1961

Surface Water Records of Minnesota

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UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Prepared in cooperation with the State of Minnesota and other agencies

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

SURFACE WATER RECORDS OF MINNESOTA 1961

Prepared under the direction of L. R. Sawyer, District Engineer, Surface Water Branch, in cooperation with the State of Minnesota and other agencies

Copies of this report may be obtained from
District Engineer, Surface Water Branch
U. S. Geological Survey
1610 Post Office Building
St. Paul 1, Minnesota

CALENDAR FOR WATER YEAR 1961

OCTOBER 1960

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
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NOVEMBER 1960

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JANUARY 1961

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FEBRUARY 1961

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MARCH 1961

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APRIL 1961

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JUNE 1961

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JULY 1961

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AUGUST 1961

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SEPTEMBER 1961

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SURFACE WATER RECORDS OF MINNESOTA, 1961

INTRODUCTION

The surface-water records for the 1961 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 L. R. Sawyer, district engineer, Surface Water Branch.

This report marks the beginning of a new method of presenting, annually, basic data on surface-water records by States. 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 Minnsota 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. These 5-year water-supply papers will show daily discharge and will be compiled on the same geographical areas previously used for the annual series; however, some of the 14 parts of conterminous United States will be further subdivided.

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, L. P. Zimmerman, Commissioner, succeeded by James C. Marshall.

Minnesota State Iron Range Resources and Rehabilitation Commission, Kaarlo J. Otava, Commissioner, succeeded by A. M. De Yoannes.

Hennepin County Board of Commissioners, G. W. Matthews, chairman.

Assistance in the form of funds or services was given by Corps of Engineers, Department of the 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 date, 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

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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 silimar 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 partial-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.

EXPLANATION OF DATA

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 either 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 1961 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 available. 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.

For stations equipped with water-stage recorders, except those on streams subject to sudden or rapid fluctuation, the daily table gives the discharge corresponding to the daily mean gage height. For stations subject to such a fluctuation, the daily mean gage height may not indicate the true daily mean discharge, which must be obtained by averaging the discharge for parts of the day or by using the discharge integrator, which is an instrument for obtaining the daily mean discharge from a continuous gage-height graph and containing, as an essential element, a curve representing the stage-discharge relation at the station. For stations equipped with nonrecording gages, the table of daily discharge gives the discharge corresponding to once-daily readings of the gage, or to the mean of twice-daily readings, or to the mean gage height determined from gage-height graphs based on gage readings. For periods of rapidly changing stage, the daily mean discharge is determined from gage-height graphs based on gage readings, the frequency of which is stated in the station description.

In the table of daily discharge, the figures for the maximum day and the minimum day for each month are underlined. If the figure is repeated, it is 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.

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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.

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 following footnotes and their corresponding symbols have been standardized for use throughout this report. The methods used in computing data for such footnoted periods have been explained in preceding paragraphs.

* Discharge measurements made on this day. Used to indicate days on which discharge measurements were made at a gaging station unless they were made at frequent regular intervals, two or more times monthly, in which instance the general frequency of discharge measurements is given under "Remarks" in the station description.

** Field estimate made on this day. Used to indicate days on which an estimate of the flow was made at the gaging station.

a No gage-height record. Used to indicate periods when there was no gage-height record or the available record was such that it could not be used to compute the daily discharge. No mention is made of periods of no gage-height record if they are few and of short duration, no more than 4 days in succession and notmore than

12 days distributed throughout the water year, and if the degree of accuracy of records for those days is not changed.

b Stage-discharge relation affected by ice. Used to indicate periods when the stage-discharge relation is affected by ice forming on stream, control, or streambed. No mention is made of occasional days of ice effect if the degree of accuracy of daily records is not changed.

c Backwater from aquatic growth (or debris or other conditions). Used only when records for the periods affected are rated down in accuracy.

e Shifting-control method used. Used only when records for the periods affected are rated down in accuracy.

g Computed from once-daily (twice-daily, etc.) staff (or chain, wire-weight, etc.) gage readings. Used only for recording stations for periods when the water-stage recorder graph was not used but readings of a nonrecording gage were used. The symbol is not used for periods of short duration if the degree of accuracy of records for the periods involved are not changed.

k Computed by using rate of change in stage as a factor. Used only when records for the periods involved are rated down in accuracy.

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. 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." Information on the availability

of unpublished data, or quality of water records may generally be obtained from the district office.

4-0105. 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 5 3/4 miles downstream from International Bridge.

Drainage area.--600 sq mi.

Records available.--June to October 1921, April to November 1922, March 1923 to September 1961. 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, 5 3/4 miles upstream at datum 100.24 ft higher.

Average discharge.--38 years (1923-61), 485 cfs.

Extremes.--Maximum discharge during year, 3,540 cfs Apr. 21 (gage height, 6.69 ft); minimum daily, 76 cfs Jan. 30, 31; minimum gage height, 0.59 ft Oct. 12.
1923-61: 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 periods of ice effect, 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 1960-61, except periods of ice effect (gage height, in feet, and discharge in cubic feet per second)
(Shifting-control method used July 4 to Aug. 2)

0.6	78	3.0	775
.7	90	4.0	1,260
1.0	137	5.0	1,940
2.0	414	7.0	3,910

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	99	374	230	110	77	80	150	1,200	658	353	294	131
2	99	530	250	115	78	83	146	1,220	1,490	350	286	131
3	99	417	250	110	78	85	146	1,200	2,260	350	277	129
4	98	326	245	105	79	83	140	1,140	1,810	344	280	126
5	96	280	270	110	78	81	155	1,090	1,330	359	277	122
6	94	247	255	115	80	81	180	1,100	1,080	359	269	128
7	88	210	235	112	80	81	200	1,690	946	347	263	124
8	84	200	225	110	81	81	210	1,940	860	338	242	*126
9	82	195	215	108	81	81	215	1,860	833	332	217	118
10	80	190	210	105	81	81	230	1,460	838	338	209	174
11	79	180	200	*103	82	81	270	1,190	780	332	204	666
12	80	180	195	103	83	81	300	1,080	727	*320	204	670
13	86	168	*192	107	*85	84	350	1,020	697	317	196	524
14	95	160	190	105	84	85	450	1,130	646	317	189	639
15	102	155	190	105	84	83	540	1,800	613	311	*178	793
16	96	236	180	107	83	82	760	1,740	578	311	178	624
17	90	400	170	105	83	83	1,350	1,410	547	383	173	448
18	85	365	160	102	83	83	1,600	1,160	530	383	170	392
19	*86	315	155	98	82	83	*1,670	1,070	503	371	168	350
20	85	285	150	93	82	82	1,640	996	487	368	168	317
21	82	258	140	89	82	82	2,980	946	467	353	165	294
22	86	*255	135	86	82	80	3,260	892	448	341	155	311
23	103	235	138	83	81	*80	2,680	842	*439	332	151	266
24	110	225	139	81	81	82	1,970	*802	433	356	144	250
25	114	215	133	78	81	86	1,560	771	430	365	142	234
26	112	205	135	78	80	100	1,310	740	417	347	139	217
27	110	195	123	77	80	120	1,120	706	389	356	137	220
28	110	160	125	77	80	145	1,000	666	405	374	131	217
29	108	155	126	77	-	180	919	632	414	350	128	223
30	106	180	120	76	---------	160	991	606	359	326	131	212
31	148	---------	114	76	---------	155	---------	585	---------	308	129	---------
Total	2,992	7,496	5,595	3,006	2,271	2,914	28,492	34,684	22,414	10,691	5,994	9,176
Mean	96.5	250	180	97.0	81.1	94.0	950	1,120	747	345	193	306
Cfsm	0.161	0.417	0.300	0.162	0.135	0.157	1.58	1.87	1.24	0.575	0.322	0.510
In.	0.19	0.46	0.35	0.19	0.14	0.18	1.77	2.15	1.39	0.66	0.37	0.57

Calendar year 1960: Max 2,960 Min 79 Mean 339 Cfsm 0.565 In. 7.70
Water year 1960-61: Max 3,260 Min 76 Mean 372 Cfsm 0.620 In. 8.42

Peak discharge (base, 3,000 cfs).--Apr. 21 (7-8 p.m.) 3,540 cfs (6.69 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Oct. 24, Nov. 7-12, 17-20, Nov. 23 to Apr. 18.

4-0125. Poplar River at Lutsen, Minn.

Location.--Lat 47°38'23", long 90°42'31", in SW¼NE¼ sec. 33, T. 60 N., R. 3 W., on right bank 350 ft upstream from concrete bridge on U. S. Highway 61 at Lutsen and 1,650 ft upstream from mouth.

Drainage area.--114 sq mi.

Records available.--May to November 1911 and August to September 1912 (gage height only, published as "at mouth"), October 1912 to September 1917, July 1928 to September 1947, August 1952 to September 1961 (discontinued). Monthly discharge only for some periods, published in WSP 1307.

Gage.--Water-stage recorder and concrete control. Datum of gage is 697.89 ft above mean sea level. May 6 to Nov. 4, 1911, staff gage at site 1,250 ft downstream and Aug. 22, 1912, to Sept. 30, 1917, at site 900 ft downstream at different datum. July 17, 1928, to Mar. 30, 1937, chain gage at site 150 ft downstream at datum 6.90 ft lower.

Average discharge.--33 years (1912-17, 1928-47, 1952-61), 103 cfs.

Extremes.--Maximum discharge during year, 1,300 cfs Apr. 21 (gage height, 5.56 ft); maximum gage height, 5.68 ft Jan. 21 (backwater from ice); minimum discharge, 6.8 cfs Aug. 20 (gage height, 1.99 ft).
1912-17, 1928-47, 1952-61: Maximum discharge, 1,880 cfs May 1, 1954 (gage height, 6.23 ft); minimum 2.3 cfs Dec. 3, 1939 (gage height, 1.73 ft).

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.0	7.0	3.5	152
2.2	12	4.0	276
2.5	26	4.5	512
2.8	46	5.0	870
3.1	81	5.5	1,250

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	280	100	33	9.0	11	30	219	186	36	18	16
2	20	217	120	32	8.8	11	31	212	214	33	20	17
3	20	146	150	32	8.7	12	34	197	202	32	20	16
4	18	113	173	32	8.5	12	36	186	173	30	18	13
5	18	93	180	31	8.5	12	39	180	144	29	16	12
6	16	87	169	31	8.6	12	42	195	132	30	14	29
7	16	82	140	31	8.6	12	45	419	122	28	14	*28
8	15	80	110	30	8.6	13	49	383	115	25	12	21
9	14	77	91	30	8.7	13	54	369	111	24	11	18
10	14	74	80	30	8.7	13	58	290	108	23	11	57
11	13	71	65	*30	8.8	13	64	249	99	*22	10	356
12	14	68	56	29	8.9	13	*72	230	94	22	10	209
13	64	64	*51	29	*9.0	14	80	224	90	24	8.8	162
14	61	62	48	28	9.1	14	92	286	82	29	* 8.5	152
15	43	58	47	26	9.2	14	117	655	77	28	7.9	134
16	36	55	45	25	9.4	14	*128	585	73	26	7.4	104
17	31	53	44	24	9.5	15	160	383	72	26	7.2	86
18	*28	51	43	23	9.6	15	195	294	69	24	7.7	69
19	25	49	41	20	9.7	16	*230	261	69	22	7.4	60
20	23	47	40	18	9.8	16	323	249	67	20	7.2	53
21	22	45	39	17	10	16	1,160	224	67	20	7.4	58
22	24	*45	38	15	10	17	1,040	207	*63	22	7.7	67
23	32	43	38	15	10	*17	634	177	60	22	8.1	61
24	30	42	37	14	11	18	440	188	55	25	8.3	51
25	30	40	36	12	11	19	347	*191	57	25	9.0	46
26	29	38	36	11	11	20	300	184	50	22	15	43
27	29	38	35	11	11	21	280	175	52	23	16	41
28	28	39	35	10	11	22	255	169	46	23	14	37
29	27	45	34	10	-	23	241	160	42	20	14	34
30	56	64	33	9.6	--------	25	232	152	38	20	19	36
31	331	--------	33	9.3	--------	28	--------	144	--------	18	19	--------
Total	1,147	2,266	2,187	697.9	264.7	491	6,808	8,037	2,829	773	373.6	2,086
Mean	37.0	75.5	70.5	22.5	9.45	15.8	227	259	94.3	24.9	12.1	69.6
Cfsm	0.325	0.662	0.618	0.197	0.083	0.139	1.99	2.27	0.827	0.218	0.106	0.610
In.	0.37	0.74	0.71	0.23	0.09	0.16	2.22	2.62	0.92	0.25	0.12	0.68

Calender year 1960: Max 983 Min 11 Mean 105 Cfsm 0.921 In. 12.58
Water year 1960-61: Max 1,160 Min 7.2 Mean 76.6 Cfsm 0.672 In. 9.11

Peak discharge (base, 500 cfs).--Apr. 21 (3:30 p.m.) 1,300 cfs (5.56 ft); May 15 (5:30 p.m.) 751 cfs (4.84 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Oct. 23, 24, Nov. 23-26, Nov. 29 to Dec. 3, Dec. 8 to Apr. 13, Apr. 16-19.

4-0145. 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 1961. 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.--34 years, 159 cfs.

Extremes.--Maximum discharge during year, 2,980 cfs Apr. 21 (gage height, 5.26 ft); minimum, 2.8 cfs Aug. 21 (gage height, 1.42 ft).
1927-61: 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 or no gage-height record, which are fair.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet and discharge, in cubic feet per second)

1.4	2.7	2.0	15	3.5	374
1.5	3.2	2.3	32	4.0	875
1.6	4.2	2.6	58	4.5	1,490
1.7	5.5	2.9	98	5.2	2,860
1.8	7.6	3.1	155		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16	500	230	32	9.1	18	430	259	98	13	5.5	5.9
2	16	422	170	31	8.8	18	451	237	98	9.8	5.7	5.5
3	15	283	100	30	8.5	18	432	218	96	8.8	6.8	5.9
4	15	209	70	30	8.4	18	374	214	86	8.5	6.6	4.7
5	15	163	400	29	8.3	18	359	209	73	8.2	7.4	6.1
6	13	129	710	28	8.5	18	330	337	65	8.8	5.4	40
7	13	96	600	27	8.8	17	283	680	60	8.2	4.8	*28
8	13	86	400	26	9.3	17	233	710	55	7.0	4.7	16
9	13	76	290	25	9.7	17	200	600	52	6.8	4.3	22
10	13	62	192	24	10	17	195	480	50	7.0	4.2	57
11	13	61	120	23	11	17	187	367	46	*7.6	3.9	330
12	14	59	90	*23	11	17	*191	322	53	6.6	3.7	191
13	44	58	78	22	12	17	195	307	62	7.0	4.5	200
14	37	54	*73	21	*13	17	171	580	57	14	*3.4	195
15	34	58	62	20	15	17	195	1,050	50	12	3.1	163
16	29	68	53	20	15	17	*283	970	41	10	3.0	122
17	27	65	45	19	16	17	550	710	34	9.5	3.0	90
18	*27	64	40	18	17	16	620	560	29	8.2	3.0	68
19	25	64	35	17	16	16	600	441	24	7.2	3.0	56
20	24	60	31	16	17	17	802	344	21	8.2	2.9	44
21	22	57	30	15	17	18	2,740	277	20	7.0	2.8	50
22	24	54	28	15	17	*19	2,080	237	*18	8.2	3.0	61
23	26	*34	26	14	18	20	1,280	209	17	11	9.2	52
24	25	38	25	13	18	22	875	179	18	24	9.2	46
25	26	40	24	12	18	29	700	*167	18	16	5.7	39
26	27	38	27	12	18	39	560	155	16	11	5.4	34
27	27	31	31	11	18	58	460	148	18	9.5	5.1	32
28	27	25	32	11	18	130	374	129	18	7.9	5.1	27
29	27	45	33	10	-	220	315	110	14	7.0	6.3	26
30	122	200	33	9.8	--------	310	307	98	13	7.2	7.0	29
31	520	--------	33	9.2	--------	370	--------	90	--------	7.2	7.0	--------
Total	1,289	3,199	4,111	613.0	374.4	1,579	16,772	11,394	1,320	292.4	154.7	2,046.1
Mean	41.6	107	133	19.8	13.4	50.9	559	368	44.0	9.43	4.99	68.2
Cfsm	0.297	0.764	0.950	0.141	0.096	0.364	3.99	2.63	0.314	0.067	0.036	0.487
In.	0.34	0.85	1.09	0.16	0.10	0.42	4.46	3.03	0.35	0.08	0.04	0.54

Calendar year 1960: Max 2,260 Min 9.2 Mean 136 Cfsm 0.971 In. 13.19
Water year 1960-61: Max 2,740 Min 2.8 Mean 118 Cfsm 0.843 In. 11.46

Peak discharge (base, 1,300 cfs).--Apr. 21 (2 p.m.) 2,980 cfs (5.26 ft).

* Discharge measurement made on this day

Note.--Stage-discharge relation affected by ice Oct. 22-25, Nov. 8-12, 16-18, Nov. 23 to Jan. 22, Mar. 22 to Apr. 1. No gage-height record Jan. 23 to Feb. 13, Mar. 19-21; discharge estimated on the basis of recorded range in stage, weather records and records for Poplar River at Lutsen.

4-0155. 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 mile east of Aurora.

Drainage area.--26.3 sq mi.

Records available.--March 1955 to September 1961.

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.--6 years, 16.7 cfs.

Extremes.--Maximum discharge during year, 213 cfs Apr. 22 (gage height, 5.64 ft); minimum daily, 2.2 cfs Dec. 23-28; minimum gage height, 3.12 ft Dec. 24.
1955-61: Maximum discharge, that of Apr. 22, 1961; maximum gage height, 5.75 ft Mar. 28, 1957 (backwater from ice); minimum discharge, 1.9 cfs Aug. 3, 1956 (gage height, 3.18 ft).

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.2	3.2	4.0	36
3.4	7.6	4.5	81
3.6	14	5.0	136
3.8	24	5.6	208

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	12	12	7.9	2.4	2.4	3.7	33	33	24	6.6	9.2	8.2
2	11	12	8.2	2.4	2.4	3.8	32	30	30	5.9	11	14
3	10	10	8.6	2.5	2.5	3.9	30	27	33	7.6	12	10
4	9.8	12	9.3	2.5	2.5	3.9	28	25	30	7.1	11	9.8
5	12	14	10	2.5	2.6	3.9	26	22	27	5.0	9.2	8.8
6	12	12	10	2.5	2.6	3.8	24	28	24	4.8	8.8	12
7	10	10	9.4	2.6	2.8	3.8	22	34	21	6.4	7.1	14
8	9.8	9.8	8.7	2.6	2.8	3.7	20	38	21	7.1	6.9	14
9	6.6	8.2	9.5	2.6	2.9	3.7	18	38	20	6.4	7.9	16
10	4.8	7.6	9.7	2.6	2.9	3.7	17	37	19	9.2	7.6	48
11	4.0	9.2	9.0	2.7	2.9	3.7	16	35	14	15	6.4	100
12	4.2	9.5	8.8	2.7	2.9	3.7	16	31	14	14	*5.7	82
13	6.4	9.2	8.8	2.7	2.9	3.8	16	32	17	13	5.0	96
14	7.1	9.2	8.8	2.7	2.8	4.2	17	49	16	13	4.0	93
15	6.4	9.8	8.0	2.7	2.8	4.6	18	95	14	14	3.6	86
16	4.8	10	6.8	2.7	2.8	5.0	20	100	13	15	3.6	73
17	4.4	9.2	5.5	2.7	2.8	5.4	22	93	13	11	3.8	60
18	5.9	7.9	4.6	2.6	2.9	6.2	31	75	11	*12	4.0	48
19	5.9	7.4	3.6	2.6	3.1	7.0	56	59	*8.5	22	3.6	41
20	5.2	*6.7	3.0	2.6	3.3	8.0	97	*48	9.2	17	4.2	34
21	*4.2	7.6	2.6	2.6	3.6	9.2	192	40	10	14	3.6	33
22	7.1	7.4	*2.4	2.5	*3.8	11	198	34	9.8	14	3.2	30
23	7.9	7.0	2.2	2.5	4.0	13	155	30	9.5	14	5.7	27
24	7.4	6.4	2.2	2.4	4.0	17	119	30	9.8	18	6.6	24
25	7.9	6.4	2.2	*2.4	4.0	22	92	30	8.5	18	5.9	22
26	8.5	7.4	2.2	2.3	3.9	27	73	26	7.6	18	5.0	21
27	7.6	8.5	2.2	2.3	3.8	30	59	25	7.6	15	4.8	20
28	7.6	8.7	2.2	2.3	3.7	34	49	21	8.2	14	5.2	18
29	8.2	8.5	2.3	2.3	-	35	42	18	8.2	12	6.4	17
30	12	7.9	2.3	2.3	--------	36	37	17	7.1	11	6.6	17
31	12	--------	2.4	2.3	--------	*35	--------	16	--------	9.2	5.9	-------
Total	242.7	271.5	183.4	78.1	86.4	358.7	1,575	1,216	465.0	369.3	193.5	1,096.8
Mean	7.83	9.05	5.92	2.52	3.09	11.6	52.5	39.2	15.5	11.9	6.24	36.6
Cfsm	0.298	0.344	0.225	0.096	0.117	0.441	2.00	1.49	0.589	0.452	0.237	1.39
In.	0.34	0.38	0.26	0.11	0.12	0.51	2.23	1.72	0.66	0.52	0.27	1.55

Calendar year 1960: Max 123 Min 2.2 Mean 17.3 Cfsm 0.658 In. 8.93
Water year 1960-61: Max 198 Min 2.2 Mean 16.8 Cfsm 0.639 In. 8.67

Peak discharge, base, 60 cfs).--Apr. 22 (3 a.m.) 213 cfs (5.64 ft); May 16 (1-4 p.m.) 103 cfs (4.72 ft); Sept. 11 (6 a.m.) 120 cfs (4.87 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 17, 20, 23, Nov. 28 to Apr. 17.

4-0160. 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 2 3/4 miles upstream from mouth.

Drainage area.--156 sq mi.

Records available.--August 1942 to September 1961.

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.--19 years 124 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 694 cfs May 18 (gage height, 4.59 ft); minimum, 2.2 cfs Jan. 30, 31 (gage height, 1.45 ft).
1942-61: Maximum discharge, 3,230 cfs May 10, 1950 (gage height, 7.86 ft); minimum, that of Jan. 30, 31, 1961.

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 elevation 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 elevation during diversion for iron-ore processing. Diversion began Feb. 7, 1956. Some seepage losses from reservoir bypass station.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.0	2.0	1.7	19	3.5	238
1.2	4.1	2.0	29	4.0	407
1.3	5.9	2.5	54	4.5	640
1.4	8.7	3.0	120	5.0	970

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16	27	19	5.5	2.3	3.8	36	a138	92	22	22	12
2	16	27	18	5.3	2.3	4.6	32	a122	105	19	24	27
3	15	27	17	5.1	2.4	4.9	30	a110	130	19	26	20
4	15	28	17	5.0	2.4	3.7	29	a102	115	18	24	18
5	17	30	17	5.0	2.4	3.7	29	a 97	112	14	22	17
6	18	29	16	5.0	2.4	3.7	28	a102	113	12	20	23
7	16	29	15	4.7	2.5	3.7	28	a145	100	13	18	25
8	15	30	14	4.5	2.5	3.8	27	a180	92	13	17	26
9	10	29	14	4.2	2.5	4.4	26	a195	82	11	19	28
10	6.4	29	14	4.2	2.5	4.4	26	205	72	17	19	74
11	4.9	29	14	4.2	2.5	3.2	23	202	60	26	18	154
12	5.7	30	13	4.0	2.4	2.9	24	192	56	24	*16	130
13	14	29	12	3.8	2.3	3.0	24	189	54	26	15	144
14	15	28	11	3.8	2.6	4.4	26	238	51	25	13	*136
15	13	27	11	3.8	2.7	5.7	*30	368	50	25	11	128
16	10	27	11	3.8	2.7	6.6	32	504	48	27	9.4	118
17	8.7	26	10	3.6	2.7	7.2	32	615	45	23	8.7	96
18	11	25	9.5	3.4	3.0	5.9	40	682	40	*22	10	80
19	12	25	9.2	3.2	3.0	8.7	63	670	*35	33	7.5	79
20	11	*24	8.7	3.1	3.1	11	115	*576	34	28	7.8	63
21	*9.4	24	8.3	3.0	3.2	16	300	495	36	27	6.9	65
22	15	23	*7.7	2.8	*5.3	18	294	411	35	25	6.2	57
23	17	22	a7.5	2.7	8.1	21	189	319	34	26	9.0	53
24	15	22	a7.2	2.6	8.1	25	*136	263	32	30	11	49
25	18	21	7.0	*2.5	8.2	34	*103	221	30	30	9.7	49
26	20	21	6.7	2.4	8.1	42	a103	174	28	30	7.5	46
27	18	21	6.5	2.4	7.8	48	a130	150	28	27	6.4	45
28	18	21	6.3	2.3	6.9	45	a165	120	26	26	9.4	43
29	20	21	6.0	2.3	-	49	a170	105	25	26	13	41
30	25	20	5.8	2.3	--------	45	a160	96	23	25	13	42
31	27	--------	5.7	2.3	--------	*40	--------	88	--------	23	11	---------
Total	452.1	771	345.1	112.8	106.9	482.3	2,450	8,074	1,783	712	430.5	1,888
Mean	14.6	25.7	11.1	3.64	3.82	15.6	81.7	260	59.4	23.0	13.9	62.9
(✓)	-0.2	-0.2	-0.2	+0.36	+0.70	+11.8	+180.9	+30	+19.2	+0.2	+0	+87.1
Mean≠	14.4	25.5	10.9	4.00	4.52	27.4	263	290	78.6	23.2	13.9	150
Cfsm≠	0.092	0.163	0.070	0.026	0.029	0.176	1.69	1.87	0.492	0.149	0.089	0.962
In.≠	0.11	0.18	0.08	0.03	0.03	0.20	1.89	2.16	0.55	0.17	0.10	1.07

Calendar year 1960:	Max	809	Min	4.9	Mean	67.2	Mean≠	82.3	Cfsm≠	0.528	In.≠	7.17
Water year 1960-61:	Max	682	Min	2.3	Mean	48.2	Mean≠	75.5	Cfsm≠	0.484	In.≠	6.58

* 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.
a No gage-height record.
Note.--Stage discharge relation affected by ice Nov. 11 to Dec. 22, Dec. 25 to Jan. 24, Jan. 26-69, Feb. 1-4, 7-12, 19, 20, 25, 26.

4-0165. 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 1961.

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.--19 years 239 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 1,070 cfs Apr. 22 (gage height, 3.80 ft, from graph based on gage readings); minimum daily, 10 cfs Jan. 26 to Feb. 3; minimum gage height, 0.56 ft, Aug. 28.
1942-61: 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 elevation 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 table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.5	15	2.0	228
.7	25	3.0	643
1.0	48	4.0	1,200
1.5	110		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	34	43	43	17	10	19	165	595	279	54	38	25
2	33	43	42	17	10	18	147	539	279	49	40	37
3	32	43	42	17	10	18	131	445	293	46	45	29
4	32	44	41	16	11	17	115	420	275	44	42	25
5	32	48	41	16	11	17	105	408	251	42	37	25
6	32	49	40	16	11	17	102	416	238	38	34	34
7	31	49	39	15	11	16	99	450	216	37	31	33
8	30	51	38	15	11	16	101	462	201	35	29	32
9	28	53	37	15	12	16	98	462	184	34	32	34
10	25	52	36	15	12	16	93	462	169	38	53	109
11	23	55	35	15	12	16	89	462	149	48	*34	210
12	24	56	33	15	12	16	89	445	166	46	30	147
13	34	56	32	14	12	17	90	441	193	52	26	*176
14	32	56	31	14	12	18	92	530	241	49	24	169
15	32	56	29	14	12	19	*99	773	225	52	23	159
16	28	57	28	14	13	21	113	926	193	56	21	147
17	27	56	27	13	13	22	117	1,000	164	48	21	135
18	26	58	26	13	13	24	159	1,030	141	44	22	127
19	28	56	25	13	14	27	312	993	120	*65	20	122
20	28	*55	24	12	14	29	498	898	107	52	19	110
21	27	55	*23	12	15	32	845	810	*104	48	19	113
22	28	54	22	11	*16	36	*1,030	*727	98	44	18	104
23	32	52	21	11	17	41	803	633	90	43	19	98
24	30	51	21	*11	18	48	624	572	86	50	20	92
25	32	50	20	11	19	62	530	511	78	49	20	88
26	35	48	20	10	20	85	489	458	74	47	19	85
27	34	47	20	10	20	*132	534	412	69	45	18	80
28	*33	45	19	10	19	170	668	367	65	42	19	76
29	33	44	19	10	-	195	692	331	61	40	24	75
30	40	43	18	10	--------	205	633	305	57	42	23	74
31	43	--------	18	10	--------	190	--------	279	--------	41	22	--------
Total	958	1,525	910	412	380	1,575	9,662	17,562	4,866	1,420	842	2,770
Mean	30.9	50.8	29.4	13.3	13.6	50.8	322	567	162	45.8	27.2	92.3
(✓)	-0.2	-0.2	-0.2	+0.4	+0.7	+11.8	+181	+30.5	+19.2	+0.2	0	+87.1
Mean,≠	30.7	50.6	29.2	13.7	14.3	62.6	503	598	181	46.0	27.2	179
Cfsm,≠	0.098	0.162	0.094	0.044	0.046	0.201	1.61	1.92	0.580	0.147	0.087	0.574
In.≠	0.11	0.18	0.11	0.05	0.05	0.23	1.80	2.21	0.65	0.17	0.10	0.64

Calendar year 1960: Max 1,330 Min 18 Mean 157 Mean,≠ 172 Cfsm,≠ 0.551 In.≠ 7.54
Water year 1960-61: Max 1,030 Min 10 Mean 117 Mean,≠ 144 Cfsm,≠ 0.462 In.≠ 6.30

* 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. 26 to Apr. 1.

4-0170. 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 1961.

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.--19 years, 66.9 cfs.

Extremes.--Maximum discharge during year, 724 cfs Apr. 23 (gage height, 9.01 ft); minimum, 1.8 cfs Aug. 16, 17, 18; minimum gage height, 0.66 ft Aug. 17.
1942-61: Maximum discharge, 1,740 cfs May 8, 9, 1950; maximum gage height, 10.92 ft May 9, 1950; minimum discharge, that of Aug. 16, 17, 18, 1961; minimum gage height, that of Aug. 17, 1961.

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

Rating table, water year 1960-61, except periods of ice effect,
(gage height, in feet, and discharge, in cubic feet per second)
(Backwater from inflow below control Apr. 18-21)

0.6	1.8	1.5	38
.7	2.5	2.0	74
.8	4.0	3.0	137
.9	6.0	5.0	266
1.0	9.3	7.0	428
1.2	19	9.0	722

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.2	12	6.4	3.5	2.8	3.2	61	182	95	6.3	3.6	3.6
2	4.0	14	6.3	3.5	2.8	3.3	51	156	122	5.6	3.6	5.2
3	3.3	14	6.2	3.6	2.9	3.3	44	134	124	5.6	3.6	5.4
4	2.8	13	6.2	3.7	3.0	3.3	37	114	118	5.2	3.5	5.0
5	3.3	13	6.4	3.7	3.0	3.3	34	99	108	5.2	3.0	4.6
6	3.0	12	6.7	3.7	3.1	3.3	33	97	89	4.6	2.8	5.8
7	3.1	12	6.8	3.8	3.1	3.4	33	120	70	4.2	2.7	7.3
8	3.5	12	6.8	3.8	3.1	3.4	34	130	55	4.2	2.5	7.3
9	3.6	12	6.6	3.8	3.2	3.4	31	129	48	3.8	2.4	6.3
10	3.8	12	6.4	3.8	3.2	3.5	28	121	42	3.6	2.3	14
11	3.8	12	6.1	3.8	3.2	3.5	26	114	38	3.8	*2.3	68
12	4.0	12	5.9	3.8	3.1	3.6	24	108	34	4.6	2.2	*102
13	7.3	13	5.7	3.9	3.1	3.6	30	125	37	6.0	2.1	113
14	11	12	5.5	3.9	3.0	3.6	*35	171	33	6.7	2.0	138
15	8.3	13	5.2	3.9	3.0	3.6	36	260	29	6.7	2.0	156
16	7.3	14	4.8	3.9	2.9	3.6	39	321	*25	6.0	1.9	160
17	6.7	14	4.6	3.8	2.9	3.7	48	388	22	5.6	1.8	153
18	6.3	13	4.3	3.8	2.9	3.8	75	315	19	5.4	1.9	133
19	6.0	*13	4.0	*3.8	2.9	3.9	141	*364	16	*5.4	2.0	107
20	5.8	12	3.8	3.7	2.9	4.1	210	320	*12	5.6	2.0	78
21	5.6	12	*3.7	3.6	3.0	4.3	*300	274	11	5.6	2.0	64
22	5.8	12	3.6	3.6	3.0	4.6	*564	230	10	5.6	2.0	64
23	6.7	9.7	3.6	3.5	*3.0	5.2	*715	189	10	5.6	2.0	57
24	6.3	9.1	3.5	3.4	3.1	6.0	630	161	9.7	6.3	1.9	48
25	6.3	8.8	3.5	3.3	3.1	7.7	509	136	9.7	7.0	2.0	42
26	*6.7	8.6	3.4	3.2	3.2	12	413	118	9.3	7.0	2.0	38
27	7.3	7.6	3.4	3.1	3.2	29	*351	100	8.3	6.3	2.0	34
28	7.3	7.4	3.4	3.0	3.2	75	297	84	8.3	6.3	2.0	32
29	7.6	6.7	3.4	3.0	-	82	253	72	8.0	6.3	2.1	30
30	8.6	6.6	3.4	2.9	--------	*76	212	63	7.3	5.2	2.6	31
31	12	--------	3.5	2.8	--------	70	--------	57	--------	4.0	3.3	--------
Total	181.3	342.5	153.1	110.6	84.9	442.2	5,294	5,252	1,227.6	169.3	74.1	1,712.5
Mean	5.85	11.4	4.94	3.57	3.03	14.3	176	169	40.9	5.46	2.39	57.1
Cfsm	0.062	0.122	0.053	0.038	0.032	0.152	1.88	1.80	0.436	0.058	0.025	0.609
In.	0.07	0.14	0.06	0.04	0.03	0.18	2.10	2.08	0.49	0.07	0.03	0.68

Calendar year 1960: Max 371 Min 2.5 Mean 40.8 Cfsm 0.435 In. 5.94
Water year 1960-61: Max 715 Min 1.8 Mean 41.2 Cfsm 0.439 In. 5.97

* Discharge measurement made on this day.
Note.--Stage discharge relation affected by ice Nov. 17, Nov. 24 to Apr. 11 (no gage-height record Jan. 22 to Feb. 22).

4-0180. Embarrass River near McKinley, Minn.

Location.--Lat 47°27'10", long 92°23'00" in NW¼ sec. 4, T. 57 N., R. 16 W., on left bank 40 ft upstream from highway bridge, 0.9 mile downstream from outlet of Esquagama Lake, and 4½ miles southeast of McKinley.

Drainage area.--171 sq mi.

Records available.--October 1953 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,338.65 ft above mean sea level, datum of 1929.

Average discharge.--8 years, 108 cfs.

Extremes.--Maximum discharge during year, 842 cfs Apr. 27 (gage height, 9.76 ft); minimum, 18 cfs Aug. 25-28; minimum gage height, 2.78 ft Aug. 28.
1953-61: Maximum discharge, 1,690 cfs Apr. 20, 1954 (gage height, 11.72 ft); minimum, 11 cfs Sept. 7, 1955; minimum gage height, 2.66 ft June 26, 1959.

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

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used May 14-30)

Oct. 1 to Apr. 23				Apr. 24 to Sept. 30			
3.0	24	6.0	308	2.8	18	8.0	530
3.4	52	8.0	528	3.2	42	9.0	670
4.0	103	9.0	672	4.0	110	10.0	925
				6.0	307		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	30	240	38	27	21	29	121	654	250	48	35	25
2	28	159	40	27	21	29	122	597	233	46	36	30
3	28	114	39	26	21	29	123	538	218	44	38	28
4	28	85	39	26	21	29	121	487	212	43	37	26
5	30	68	38	26	22	29	119	442	120	42	36	26
6	29	58	37	26	22	28	116	407	41	41	34	27
7	27	50	37	26	23	28	112	382	142	40	32	26
8	26	51	36	25	23	28	105	359	193	38	32	26
9	26	49	36	25	24	28	98	338	199	36	30	27
10	26	46	35	25	24	28	92	322	183	32	32	46
11	28	46	35	25	24	28	89	309	163	47	28	*76
12	29	46	34	25	25	28	90	302	180	48	*27	67
13	35	45	34	25	25	28	89	298	206	50	26	88
14	34	44	33	25	25	28	*92	304	148	48	24	103
15	33	44	33	25	25	28	110	353	123	50	24	122
16	32	*42	33	*24	25	27	122	384	108	53	23	144
17	29	42	33	24	25	27	129	402	97	54	22	167
18	28	41	33	24	25	26	136	419	90	52	24	191
19	28	39	32	23	26	25	172	*439	81	68	23	206
20	29	38	*32	23	28	24	248	464	*74	*64	22	217
21	28	38	31	23	*30	25	384	484	70	62	21	232
22	32	37	31	22	30	26	490	492	66	56	20	221
23	33	38	30	22	31	29	556	526	62	50	20	200
24	32	37	30	22	30	31	629	468	60	50	19	180
25	32	37	29	22	30	35	*713	442	56	47	19	163
26	32	37	29	21	30	42	797	412	52	43	18	148
27	31	36	28	21	29	62	*839	374	50	45	18	133
28	30	32	28	21	29	79	823	346	49	41	19	120
29	*31	35	28	21	-	98	771	316	49	40	20	112
30	38	37	27	21	--------	116	713	289	48	40	21	106
31	162	--------	27	21	--------	*120	--------	269	--------	38	21	--------
Total	1,064	1,711	1,025	739	714	1,217	9,121	12,618	3,623	1,456	801	3,283
Mean	34.3	57.0	33.1	23.8	25.5	39.3	304	407	121	47.0	25.8	109
Cfsm	0.201	0.333	0.194	0.139	0.149	0.230	1.78	2.38	0.708	0.275	0.151	0.637
In.	0.23	0.37	0.22	0.16	0.16	0.26	1.98	2.74	0.79	0.32	0.17	0.71

Calendar year 1960: Max 576 Min 25 Mean 106 Cfsm 0.620 In. 8.40
Water year 1960-61: Max 839 Min 18 Mean 102 Cfsm 0.596 In. 8.11

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 27 to Mar. 25, Mar. 29.

4-0190. West Two River near Iron Junction, Minn.

Location.--Lat 47°24'05", long 92°42'10", in SW¼SW¼ sec. 24, T. 57 N., R. 19 W., on right bank 40 ft upstream from bridge on State Highway 216, 5 miles southwest of Iron Junction, and 9¼ miles upstream from St. Louis River.

Drainage area.--68.4 sq mi.

Records available.--October 1953 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,322.05 ft above mean sea level, datum of 1929 (Minnesota Highway Department bench mark).

Average discharge.--8 years 44.3 cfs.

Extremes.--Maximum discharge during year, 856 cfs Apr. 22 (gage height, 9.61 ft); minimum daily, 4.4 cfs Jan. 28 to Feb. 2; minimum gage height, 2.34 ft Aug. 15-17, 24-28.
1953-61: Maximum discharge, 916 cfs Apr. 17, 1954 (gage height, 9.85 ft); minimum daily, 3.0 cfs Jan. 22 to Feb. 6, 1957; minimum gage height, that of Aug. 15-17, 24-28, 1961.

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

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 7		Apr. 8 to Sept. 30			
2.4	6.0	2.3	3.8	4.0	111
2.6	16	2.4	7.2	6.0	277
3.0	42	2.5	13	8.0	530
		3.0	42	9.6	853

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	12	30	*10	7.2	4.4	9.3	125	82	24	9.4	7.7	8.3
2	12	30	9.8	7.2	4.4	9.4	95	67	27	8.3	7.7	7.7
3	11	27	10	7.2	4.5	9.5	80	57	27	7.2	8.8	7.2
4	10	26	10	7.2	4.6	9.6	70	52	25	7.2	7.7	7.2
5	12	23	10	*7.2	4.7	9.6	58	49	22	7.2	7.7	6.5
6	11	23	10	7.1	4.8	9.7	50	66	21	6.9	7.2	7.7
7	10	21	9.7	7.0	5.0	9.8	42	125	18	6.9	7.2	7.7
8	9.9	21	9.4	7.0	*5.2	9.9	39	160	18	6.2	6.9	7.2
9	9.9	20	9.2	6.9	5.4	9.9	34	144	17	5.5	6.5	8.3
10	9.9	20	9.1	6.8	5.7	10	30	111	16	5.5	6.9	14
11	9.4	19	9.0	6.8	6.0	10	27	92	15	6.9	6.5	28
12	10	18	8.9	6.7	6.1	10	27	82	57	*8.8	6.2	41
13	15	17	8.8	6.7	6.2	10	27	110	*123	9.9	6.2	47
14	18	16	8.8	6.6	6.2	10	33	204	58	9.9	5.8	45
15	18	16	8.7	6.6	6.3	10	52	367	39	11	5.5	50
16	15	16	8.5	6.5	6.4	10	56	498	28	13	5.2	49
17	14	16	8.3	6.4	6.5	10	50	482	21	11	5.2	39
18	*13	16	8.2	6.2	6.6	11	74	*314	18	9.9	6.5	33
19	12	16	8.1	6.0	6.8	12	*235	199	16	9.4	6.2	23
20	11	16	7.9	5.8	7.1	13	397	139	14	8.3	5.8	19
21	10	16	7.7	5.6	*7.8	16	671	99	13	7.7	5.8	20
22	10	15	7.6	5.4	8.5	21	836	77	12	7.2	5.8	18
23	9.9	15	7.5	5.1	8.8	28	767	63	10	7.7	5.5	18
24	9.4	15	7.4	5.0	8.9	*36	586	52	9.9	8.8	5.5	17
25	9.4	14	7.3	4.8	9.0	50	*349	47	9.9	8.3	5.2	16
26	9.4	14	7.2	4.6	9.0	85	254	43	9.9	8.8	5.2	14
27	9.0	13	7.2	4.5	9.1	130	209	39	9.4	9.9	5.2	13
28	10	12	7.2	4.4	9.2	180	166	34	8.8	9.4	5.5	13
29	12	11	7.2	4.4	-	200	129	30	8.3	8.8	5.5	12
30	16	10	7.2	4.4	--------	180	102	27	8.3	8.8	5.5	12
31	24	--------	7.2	4.4	--------	150	--------	25	--------	7.7	6.5	--------
Total	372.2	542	263.1	187.7	183.2	1,278.7	5,670	3,936	703.5	261.5	194.6	608.8
Mean	12.0	18.1	8.49	6.05	6.54	41.2	189	127	23.4	8.44	6.28	20.3
Cfsm	0.175	0.265	0.124	0.088	0.096	0.602	2.76	1.86	0.342	0.123	0.092	0.297
In.	0.20	0.29	0.14	0.10	0.10	0.70	3.08	2.14	0.38	0.14	0.11	0.33

Calendar year 1960: Max 514 Min. 5.1 Mean 37.4 Cfsm 0.547 In. 7.43
Water year 1960-61: Max 836 Min. 4.4 Mean 38.9 Cfsm 0.569 In. 7.71

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 9 to Apr. 7.

4-0195. East Swan River near Toivola, Minn.

Location.--Lat 47°16'55", long 92°50'05", NE¼NE¼ sec. 2, T. 55 N., R. 20 W., on left bank, 350 ft downstream from bridge on St. Louis County Road 442, 4.8 miles upstream from confluence with West Swan River, 8 miles northwest of Toivola, and 8 3/4 miles upstream from St. Louis River.

Drainage area.--112 sq mi.

Records available.--September 1953 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,260.46 ft above mean sea level, datum of 1929.

Average discharge.--8 years, 87.2 cfs.

Extremes.--Maximum discharge during year, 1,150 cfs Apr. 21 (gage height, 15.67 ft); minimum, 14 cfs, Aug. 24 (gage height, 3.15 ft).

1953-61: Maximum discharge, 1,690 cfs Apr. 15, 1956 (gage height, 17.94 ft); maximum gage height, 18.45 ft Apr. 12, 1954 (backwater from ice); minimum daily discharge, 13 cfs Jan. 28 to Feb. 3, 1955; minimum gage height, that of Aug. 24, 1961.

Flood in May 1950 reached a stage of about 20.0 ft, from information by local residents.

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

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge in cubic feet per second)
(Shifting-control method used Oct. 1-29, May 15-22)

Oct. 1 to Apr. 20				Apr. 21 to Sept. 30			
3.5	27	3.2	14	4.5	64	8.0	304
3.7	32	3.5	23	5.0	89	12.0	680
4.0	43	4.0	42	6.0	146	16.0	1,210
5.0	88						

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	37	57	*28	18	15	24	150	179	65	26	19	18
2	35	50	28	18	15	24	130	150	76	30	20	21
3	33	44	29	18	15	24	120	133	76	25	20	21
4	32	41	29	18	15	24	110	125	65	21	26	21
5	32	39	28	19	15	24	100	115	57	19	22	18
6	34	39	27	19	16	24	94	130	53	18	23	*21
7	37	37	27	19	16	25	90	246	53	16	21	18
8	37	40	26	19	16	25	85	256	38	17	20	19
9	33	47	25	19	17	25	80	213	38	21	18	16
10	32	43	24	19	17	25	76	174	38	21	21	31
11	30	43	24	18	17	25	74	171	36	19	*20	88
12	30	42	23	18	17	25	74	153	34	*18	17	75
13	39	41	23	18	17	25	76	198	*58	19	17	71
14	45	39	23	18	18	25	78	360	104	30	19	74
15	43	39	23	18	18	26	85	774	62	28	17	72
16	39	39	23	17	18	26	96	849	50	32	15	58
17	34	39	23	17	18	27	115	577	40	27	15	48
18	*33	38	22	17	19	28	170	*403	37	21	20	42
19	32	37	22	16	20	29	*390	304	34	18	22	39
20	33	36	22	16	21	31	800	239	29	19	18	35
21	32	35	22	16	*21	35	1,090	188	28	21	15	32
22	30	34	21	15	22	40	992	170	27	22	15	44
23	32	32	21	15	23	50	742	150	27	23	16	44
24	32	33	21	15	23	*73	494	132	27	25	14	40
25	31	33	21	15	23	100	436	116	29	23	15	34
26	31	32	20	15	23	140	413	106	28	21	17	31
27	31	30	20	15	24	190	369	96	25	22	18	28
28	31	27	20	15	24	255	308	88	22	22	16	29
29	31	25	19	15	-	220	250	80	21	22	14	30
30	35	27	19	15	--------	190	213	72	22	23	14	29
31	63	--------	19	15	--------	165	--------	67	--------	23	15	--------
Total	1,079	1,138	722	525	523	1,969	8,300	7,014	1,299	692	559	1,147
Mean	34.8	37.9	23.3	16.9	18.7	63.5	277	226	43.3	22.3	18.0	38.2
Cfsm	0.311	0.338	0.208	0.151	0.167	0.567	2.47	2.02	0.387	0.199	0.161	0.341
In.	0.36	0.38	0.24	0.17	0.17	0.65	2.76	2.33	0.43	0.23	0.19	0.38

Calendar year 1960: Max 871 Min 19 Mean 84.7 Cfsm 0.756 In. 10.30
Water year 1960-61: Max 1,090 Min 14 Mean 68.4 Cfsm 0.611 In. 8.29

Peak discharge (base, 400 cfs).--Apr. 21 (10:30 a.m.) 1,150 cfs (15.67 ft); May 16 (11.15 a.m.) 894 cfs (14.25 ft).

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 11 to Apr. 20 (no gage-height record Mar. 4-23; discharge estimated on the basis of weather records and records for West Two River near Iron Junction).

4-0200. Swan River near Toivola, Minn.

Location.--Lat 47°15'02", long 92°48'36", in NE¼NE¼ sec. 13, T. 55 N., R. 20 W., on left bank at upstream side of bridge on St. Louis County Highway 5, 0.4 mile downstream from confluence of East Swan and West Swan Rivers, 3½ miles upstream from mouth, and 5 3/4 miles north of Toivola.

Drainage area.--254 sq mi.

Records available.--October 1952 to September 1961 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 1,251.78 ft above mean sea level, datum of 1929.

Average discharge.--9 years, 168 cfs.

Extremes.--Maximum discharge during year, 1,800 cfs Apr. 21 (gage height, 12.61 ft); minimum, 20 cfs Aug. 30 (gage height, 2.26 ft).
1952-61: Maximum discharge, 2,980 cfs Apr. 13, 1954 (gage height, 17.17 ft; backwater from ice); minimum, 20 cfs Nov. 13, 1952, Jan. 5 to Feb. 5, 1957, Aug. 30, 1961; minimum gage height, that of Aug. 30, 1961.

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

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.2	18	4.0	180
2.4	27	6.0	440
2.6	40	9.0	985
3.0	71	13.0	1,900

Discharge in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	48	77	*42	24	21	32	175	391	126	28	31	24
2	46	66	43	24	21	32	155	340	137	34	28	26
3	45	60	43	23	21	32	140	302	143	31	29	26
4	43	58	43	23	21	32	130	280	123	26	32	26
5	42	60	43	*23	21	32	120	258	108	24	32	26
6	45	56	43	23	22	32	110	267	96	24	31	27
7	48	56	42	24	23	33	106	416	84	22	31	27
8	49	58	42	24	*23	33	100	467	78	22	29	26
9	45	67	41	24	24	34	96	425	68	21	28	25
10	44	54	40	24	24	34	91	362	66	24	28	28
11	41	55	39	24	24	34	88	345	63	22	*28	74
12	41	56	38	24	24	35	86	327	60	*22	28	91
13	45	56	37	24	24	35	86	358	*71	24	26	82
14	58	56	36	24	25	36	88	587	132	29	26	89
15	53	55	35	24	25	37	91	1,310	93	39	26	89
16	52	54	34	24	25	38	97	1,540	70	39	24	77
17	46	51	33	23	26	39	108	1,330	62	38	24	64
18	44	47	32	23	27	40	180	*1,070	55	34	24	56
19	42	49	31	23	27	41	*485	849	41	33	29	50
20	42	50	30	22	28	43	1,000	636	41	26	26	46
21	42	51	29	22	29	45	1,550	480	39	26	24	42
22	40	47	28	22	30	50	1,730	392	36	29	24	47
23	41	42	28	22	30	*56	1,530	339	36	29	24	53
24	42	43	27	21	31	82	1,120	297	35	33	23	50
25	40	45	26	21	31	114	*903	261	36	33	23	46
26	39	46	26	21	31	160	805	235	36	30	24	41
27	41	40	25	21	31	230	703	210	32	31	24	39
28	41	34	25	21	32	325	604	187	29	32	25	36
29	41	29	25	21	-	280	519	164	28	34	22	38
30	44	37	24	21	--------	240	458	149	28	32	20	38
31	72	--------	24	21	--------	200	--------	134	--------	33	22	--------
Total	1,402	1,555	1,054	705	721	2,486	13,454	14,708	2,052	904	815	1,409
Mean	45.2	51.8	34.0	22.7	25.8	80.2	448	474	68.4	29.2	26.3	47.0
Cfsm	0.178	0.204	0.134	0.089	0.102	0.316	1.76	1.87	0.269	0.115	0.104	0.185
In.	0.21	0.23	0.15	0.10	0.11	0.36	1.97	2.15	0.30	0.13	0.12	0.21

Calendar year 1960: Max 1,540 Min 24 Mean 149 Cfsm 0.587 In. 8.02
Water year 1960-61: Max 1,730 Min 20 Mean 113 Cfsm 0.445 In. 6.04

Peak discharge (base, 900 cfs).--Apr. 21 (9 p.m.) 1,800 cfs (12.61 ft); May 16 (11 a.m. to 2 p.m.) 1,560 cfs (11.61 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 11 to Apr. 21 (no gage-height record Jan. 3 to Mar. 22; discharge estimated on the basis of weather records and records for East Swan River near Toivola and West Two River near Iron Junction).

4-0240. 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 Thompson Reservoir and 3.2 miles upstream from Midway River.

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

Records available.--January 1908 to September 1961. Monthly discharge only for some periods, published in WSP 1307. Published as "near Thompson" 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.--53 years, 2,192 cfs (unadjusted).

Extremes.--Maximum discharge during year, 19,300 cfs Apr. 21 (gage height, 10.20 ft from graph based on gage reading); minimum, 452 cfs Dec. 1 (gage height, 2.32 ft).
1908-61: 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 daily discharge, 109 cfs Feb. 7, 1924.

Remarks.--Records excellent except those computed from Scanlon powerplant tailwater gage readings, which are 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 table, water year 1960-61 except periods of ice effect, (gage height, in feet, and discharge, in cubic feet per second)

2.5	560	5.0	3,850
3.0	935	6.0	5,940
3.5	1,450	8.0	11,800
4.0	2,190	10.0	18,600

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	710	901	718	810	620	901	1,870	5,260	1,840	1,020	755	762
2	748	971	*1,370	790	640	953	1,690	4,210	1,890	842	810	695
3	762	1,100	1,500	755	610	989	1,390	3,560	1,950	867	834	762
4	702	1,220	1,530	802	620	1,140	1,230	3,920	1,810	725	786	748
5	755	1,220	1,690	732	620	1,030	1,170	4,340	1,570	842	770	732
6	755	1,460	1,640	826	620	1,070	1,200	4,450	1,540	802	748	794
7	702	1,240	1,260	786	630	1,030	1,020	4,080	1,450	688	778	786
8	652	1,370	1,380	826	630	1,080	962	4,320	1,390	732	718	786
9	748	1,430	1,100	810	640	1,200	980	4,410	1,220	732	740	702
10	688	1,460	1,480	810	640	1,240	930	4,190	1,460	718	794	802
11	786	1,490	1,410	810	650	1,220	*864	4,210	1,380	632	802	971
12	794	1,410	1,160	786	660	1,200	830	4,170	1,370	688	778	1,020
13	944	1,390	1,260	818	660	1,150	810	3,920	1,370	710	695	876
14	892	1,520	1,320	802	660	1,160	850	4,640	1,540	786	725	1,220
15	884	1,530	1,340	818	660	1,080	1,200	9,640	1,720	725	725	1,130
16	892	1,540	1,300	794	670	1,020	1,090	12,600	1,750	688	695	*1,060
17	989	1,440	1,240	794	680	1,080	1,280	11,800	1,540	794	653	1,080
18	918	1,440	1,160	748	720	1,130	1,690	10,600	1,380	755	748	1,010
19	971	1,480	1,100	755	720	1,080	2,370	9,490	1,380	632	826	953
20	926	1,380	1,050	755	680	1,040	9,240	8,200	1,370	*586	810	918
21	953	1,450	1,020	755	700	1,100	g17,200	6,830	1,380	695	802	762
22	962	1,590	970	667	680	1,090	g17,500	5,860	1,200	884	842	826
23	834	1,320	930	599	750	962	g16,500	5,060	1,130	1,280	802	850
24	718	1,350	*881	590	800	1,010	g14,100	4,490	*1,110	1,250	810	826
25	755	1,260	830	620	780	1,190	11,700	4,080	1,030	1,200	794	826
26	818	1,330	850	*670	800	1,460	10,200	3,700	1,020	962	802	850
27	748	1,460	900	720	*818	2,030	8,860	*3,240	1,030	998	755	639
28	826	1,250	940	640	818	2,610	7,570	3,000	1,010	962	748	802
29	786	980	830	620	-	2,800	6,560	2,700	962	826	778	681
30	926	667	810	600	-------	2,540	5,840	2,300	962	834	748	681
31	*953	-------	810	630	-------	2,270	-------	2,190	-------	826	667	-------
Total	25,497	39,649	35,779	22,938	19,176	40,855	148,696	165,460	41,754	25,681	23,738	25,550
Mean	822	1,322	1,154	740	685	1,318	4,957	5,337	1,392	828	766	852
(✓)	-327	-602	-765	-551	-482	-348	+1,959	+1,596	-399	-441	-594	-2
Mean≠	495	720	389	189	203	970	6,916	6,933	993	387	172	850
Cfsm≠	0.144	0.210	0.113	0.055	0.059	0.283	2.02	2.02	0.290	0.113	0.050	0.248
In.≠	0.17	0.23	0.13	0.06	0.06	0.33	2.25	2.33	0.32	0.13	0.06	0.28

Calendar year 1960: Max 15,600 Min 652 Mean 2,096 Mean≠ 2,049 Cfsm≠ 0.597 In.≠ 8.12
Water year 1960-61: Max 17,500 Min 586 Mean 1,684 Mean≠ 1,604 Cfsm≠ 0.468 In.≠ 6.35

* 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.
g Computed from hourly tailwater gage readings from Scanlon power plant, furnished by Minnesota Power and Light Co.
* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 18 to Jan. 2, Jan. 26 to Feb. 26, Apr. 10-12.

GPO 823486-3

5-0300. 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 1961.

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

Average discharge.--24 years, 52.3 cfs (37,860 acre-ft per year).

Extremes.--Maximum discharge during year, 151 cfs May 15 (gage height, 4.12 ft); minimum, 3.3 cfs Nov. 29 (gage height, 2.75 ft).

1937-61: 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, or no gage-height record, which are fair. Flow partly regulated by dams of Minnesota Department of Conservation on several lakes above station.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.7	2.1	3.5	50
2.9	7.3	4.0	124
3.1	16	4.5	261
3.3	28		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	61	26	12	35	43	34	26	77	137	39	21	8.1
2	58	26	15	35	44	33	26	79	137	46	18	7.3
3	56	26	16	36	44	32	26	80	128	46	15	6.2
4	53	25	17	36	44	31	28	80	124	47	14	5.3
5	50	25	17	36	44	29	31	83	120	50	10	5.9
6	47	25	18	36	44	28	30	88	117	44	7.7	5.9
7	45	24	18	37	44	27	29	89	111	40	5.9	5.3
8	41	23	19	37	44	26	28	88	108	28	4.5	12
9	39	23	20	37	44	25	28	88	105	16	4.0	18
10	38	24	20	37	44	24	28	94	105	18	38	21
11	37	23	21	37	43	23	28	92	108	20	3.5	19
12	35	23	21	37	43	23	28	94	105	20	3.8	18
13	34	23	21	*37	43	22	28	103	100	21	4.2	21
14	*32	23	22	37	42	21	31	115	97	26	4.2	19
15	30	23	23	37	42	21	33	142	90	25	4.2	16
16	27	23	23	37	42	21	31	137	94	24	4.2	14
17	27	23	24	38	41	20	31	133	100	22	6.4	12
18	21	*22	25	38	*41	20	32	133	77	21	19	12
19	19	21	25	38	41	20	32	133	62	19	20	10
20	19	21	26	39	40	20	35	133	64	19	20	10
21	19	21	27	40	40	20	39	139	64	21	20	11
22	19	21	28	40	39	20	*45	139	*66	21	*18	10
23	19	21	*29	41	39	21	53	139	70	*23	17	10
24	19	21	30	41	38	21	65	139	66	39	15	9.2
25	19	21	31	41	37	23	66	142	64	57	14	8.8
26	19	20	31	41	37	23	66	142	61	76	13	8.4
27	19	20	32	42	36	25	69	139	58	77	13	9.6
28	19	16	33	42	35	25	73	139	56	51	12	*8.8
29	20	8.1	34	43	-	*26	74	139	53	35	11	9.6
30	26	9.4	34	43	--------	26	76	*137	49	34	10	9.2
31	26	--------	35	43	--------	26	--------	137	--------	28	8.8	--------
Total	993	650.5	747	1,194	1,158	755	1,215	3,592	2,696	1,053	345.2	340.6
Mean	32.0	21.7	24.1	38.5	41.4	24.4	40.5	116	89.9	34.0	11.1	11.4
Ac-ft	1,970	1,290	1,480	2,370	2,300	1,500	2,410	7,120	5,350	2,090	685	676

Calendar year 1960: Max 203 Min. 8.1 Mean 60.6 Ac-ft 43,980
Water year 1960-61: Max 142 Min. 3.5 Mean 40.4 Ac-ft 29,240

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 30 to Mar. 23. No gage-height record Jan. 19 to Feb. 17, Feb. 19 to Mar. 23.

5-0405. 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 right bank 90 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 1961.

Gage.--Water-stage recorder. Datum of gage is 1,179.98 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 at present site and datum.

Average discharge.--21 years (1910-12, 1942-61) 68.4 cfs (49,520 acre-ft per year).

Extremes.--Maximum discharge during year, 135 cfs Apr. 24 (gage height, 2.33 ft); maximum gage height, 4.28 ft Feb. 24 (backwater from ice); minimum daily discharge, 6.4 cfs Dec. 12-19.
1909-12, 1942-61: Maximum discharge observed, 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 Mar. 1-20, which are poor. Flow affected by storage in lakes above station.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 15-23)

1.2	8.0
1.4	16
1.7	35
2.0	70
2.5	153

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	34	24	7.1	11	18	24	55	80	90	36	28	8.7
2	32	23	7.1	12	18	24	53	76	87	38	27	8.7
3	31	23	7.0	12	19	25	52	74	84	41	23	8.7
4	30	23	7.0	13	19	25	52	70	76	42	20	8.7
5	29	22	7.0	14	19	27	52	69	72	41	20	9.4
6	27	21	7.0	15	20	33	54	84	64	39	19	9.7
7	26	21	7.0	15	20	40	56	92	61	39	18	9.0
8	26	20	6.8	16	20	42	57	96	57	39	18	11
9	26	18	6.7	17	21	43	57	95	60	37	16	23
10	26	17	6.6	17	21	44	57	93	53	36	16	34
11	26	15	6.5	18	21	44	57	84	52	36	16	30
12	26	14	6.4	*18	22	44	59	87	51	34	15	28
13	*26	13	6.4	19	22	44	62	93	50	34	15	24
14	26	13	6.4	19	22	45	68	112	49	34	15	23
15	26	13	6.4	19	22	45	74	126	47	31	14	21
16	27	12	6.4	19	22	45	73	129	45	29	12	19
17	27	11	6.4	19	*22	45	90	126	44	29	11	19
18	27	*10	6.4	19	22	46	81	117	43	27	13	18
19	27	9.7	6.4	19	22	46	74	113	42	26	15	18
20	26	9.4	6.5	19	22	46	87	110	42	26	17	17
21	26	9.2	6.5	19	22	47	95	107	42	25	15	15
22	26	9.0	6.5	19	23	48	*92	105	*42	24	*14	15
23	26	8.9	*6.6	19	23	51	96	105	41	*25	14	14
24	26	8.7	6.8	19	23	54	129	105	38	24	14	14
25	26	8.6	7.1	19	23	55	124	105	36	21	14	13
26	27	8.4	7.5	18	23	56	112	*105	35	21	12	15
27	27	8.1	7.8	18	23	57	98	105	32	20	12	*14
28	28	8.0	8.3	18	24	58	92	101	30	21	12	14
29	28	7.6	8.8	18	-	77	90	98	32	23	11	12
30	28	7.4	9.5	18	---------	*65	83	96	33	33	9.7	12
31	27	---------	10	18	---------	62	---------	93	---------	30	9.0	---------
Total	846	416.0	218.9	533	598	1,407	2,281	3,051	1,530	961	484.7	485.9
Mean	27.3	13.9	7.06	17.2	21.4	45.4	76.0	98.4	51.0	31.0	15.6	16.2
Ac-ft	1,680	825	434	1,060	1,190	2,790	4,520	6,050	3,030	1,910	961	964

Calendar year 1960: Max 204 Min 6.4 Mean 69.9 Ac-ft 50,770
Water year 1960-61: Max 129 Min 6.4 Mean 35.1 Ac-ft 25,420

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 16 to Mar. 26 (no gage-height record Nov. 19, 21, 26, 27, Jan. 31 to Feb. 3). No gage-height record Oct. 8-12, 14-29, Nov. 2-15, Mar. 27, 31, Apr. 2-6, 8-14, 18, June 11-21. Computed from once daily staff-gage readings June 22 to Sept. 30.

5-0459.5. 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 1961.

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, 12,350 acre-ft Nov. 8 (elevation, 1,068.35 ft); minimum, 4,480 acre-ft June 19 (elevation, 1,057.75 ft).

1953-61: Maximum contents, 15,290 acre-ft June 17, 1953 (elevation, 1,071.03 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, 1,075 ft (maximum operating stage) is 20,400 acre-ft of which 19,400 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 1960 to September 1961

Date	Elevation (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	1,065.62	9,900	
Oct. 31	1,068.20	12,200	+2,300
Nov. 30	1,068.12	12,120	-80
Dec. 31	1,067.00	11,100	-1,020
Calendar year 1960	-	-	+80
Jan. 31	1,065.94	10,150	-950
Feb. 28	1,063.45	8,160	-1,990
Mar. 31	1,060.00	5,750	-2,410
Apr. 30	1,060.07	5,800	+50
May 31	1,058.90	5,100	-700
June 30	1,058.30	4,760	-340
July 31	1,059.70	5,570	+810
Aug. 31	1,064.20	8,760	+3,190
Sept. 30	1,065.90	10,120	+1,360
Water year 1960-61	-	-	+220

/ Elevation at 12 p.m.

5-0460. 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 1961. 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.--31 years, 250 cfs (181,000 acre-ft per year).

Extremes.--Maximum discharge during year, 664 cfs May 23 (gage height, 3.44 ft); minimum, 45 cfs Sept. 6 (gage height, 2.06 ft).

1930-61: 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. Flow regulated by Orwell Reservoir beginning Mar. 21, 1953 (see preceding page) and powerplants upstream.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Dec. 3 June 3 to Sept. 30		Dec. 4 to June 2	
2.0	35	2.3	120
2.2	69	2.4	154
2.5	169	2.6	229
3.0	407	3.0	407
4.0	1,040	3.5	700

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	87	133	136	137	172	199	269	352	402	169	149	53
2	87	129	136	137	172	198	269	347	468	203	153	55
3	90	133	136	137	172	195	253	342	503	226	153	56
4	90	129	134	137	171	195	249	342	491	226	153	56
5	90	129	132	137	170	195	245	342	479	221	153	56
6	90	129	133	138	168	198	245	338	474	221	149	55
7	90	126	134	139	160	215	245	334	468	221	149	46
8	85	129	134	139	155	250	245	316	468	226	137	46
9	85	129	130	140	152	243	249	307	468	221	119	46
10	85	129	132	153	150	240	257	307	462	221	112	49
11	82	129	133	170	149	238	273	307	468	212	115	49
12	82	129	132	*176	149	236	273	307	462	203	119	49
13	85	129	131	174	149	235	265	307	456	203	119	49
14	85	129	135	170	150	234	265	307	446	203	105	72
15	85	129	136	169	152	233	265	307	402	199	90	112
16	85	133	137	168	*154	233	257	307	381	182	87	105
17	85	*133	138	167	154	233	261	316	386	169	79	105
18	85	133	138	168	152	235	269	338	381	169	69	98
19	85	133	139	170	151	233	269	342	350	169	69	98
20	105	133	140	170	150	232	273	342	248	169	65	102
21	129	133	142	172	160	231	282	342	248	169	60	105
22	129	133	*144	174	200	228	*277	356	*295	169	*55	105
23	133	133	143	175	200	245	286	387	360	*173	55	105
24	129	133	141	175	200	256	307	382	381	178	55	105
25	129	129	138	175	200	262	320	387	365	178	56	105
26	133	129	136	174	200	263	352	*392	305	165	55	105
27	129	129	136	174	200	263	356	392	234	149	53	*109
28	133	132	136	173	200	265	356	397	182	149	51	109
29	133	135	136	173	-	*269	356	397	165	149	53	105
30	133	135	137	173	---------	269	352	397	165	149	53	109
31	133	---------	137	172	---------	269	---------	397	---------	149	55	---------
Total	3,186	3,926	4,222	5,006	4,712	7,290	8,440	10,733	11,363	5,810	2,945	2,419
Mean	103	131	136	161	168	235	281	346	379	187	95.0	80.6
Ac-ft	6,320	7,790	8,370	9,930	9,350	14,460	16,740	21,290	22,540	11,520	5,840	4,800

Calendar year 1960: Max 804 Min 82 Mean 315 Ac-ft 22,860
Water year 1960-61: Max 503 Min 46 Mean 192 Ac-ft 13,900

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 28 to Dec. 22. No gage-height record Dec. 23 to Jan. 11, Jan. 13 to Feb. 15, Feb. 17 to Mar. 28.

5-0500. 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 1961.

Gage.--Water-stage recorder. Datum of gage is 959.89 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Jan. 14, 1943, staff gage at same site and datum.

Average discharge.--20 years, 70.7 cfs (51,180 acre-ft per year).

Extremes.--Maximum discharge during year, 125 cfs Sept. 14 (gage height, 5.16 ft); no flow on many days.. 1941-61: Maximum discharge, 1,410 cfs June 3, 1952 (gage height, 10.36 ft); no flow at times in most years.

Remarks.--Records good except those for periods of ice effect or no gage-height record, 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 17-30)

Oct. 1 to Mar. 23		Mar. 24 to Sept. 30	
2.8	0	2.9	0
2.9	.4	3.0	0.1
3.0	1.9	3.1	1.0
		3.5	9.0
		4.0	27

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.1					0	5.2	1.5	1.5		0	0
2	0					0	8.3	1.7	1.0		0	0
3	0					0	6.4	1.9	1.5		0	0
4	0					0	9.5	2.9	1.4		0	0
5	0					0	4.6	2.9	1.5		0	0
6	0					0	2.6	5.6	2.1		0	0
7	.2					0	7.2	8.6	1.5		0	0
8	0					0	9.2	5.6	1.2		0	0
9	0					0	6.8	5.2	.8		0	0
10	0					0	5.6	6.2	.5		0	0
11	0					0	.6	6.6	.6		0	0
12	0					0	3.7	4.2	.5		0	3.3
13	*.2					0	11	8.6	.6		0	1.5
14	.4					0	3.5	12	1.2		0	16
15	.2					0	2.6	14	3.7		0	9.5
16	.1					0	4.4	12	2.3		0	7.0
17	0	(*)				0	2.1	8.3	1.5		0	4.4
18	0					0	6.2	10	.7		0	3.3
19	0					0	18	10	.5		0	2.4
20	0					a.2	7.7	9.5	.3		0	2.6
21	0					a1.0	*7.2	7.9	*.1		.1	1.4
22	0					a2.5	3.3	7.5	.1	(*)	.6	1.4
23	0					a3.5	1.0	7.7	0		*.2	.7
24	.1					*b4.6	2.3	6.6	0		.5	.7
25	0					b4.8	4.8	*3.7	0		0	.5
26	0					b4.7	4.6	4.0	0		0	.1
27	0					b4.4	4.4	5.4			0	*.1
28	0					b4.2	2.3	4.8	0		0	.4
29	0				-	b4.3	3.8	3.3	0		0	.4
30	0				---------	b4.5	2.1	6.2	0		0	0
31	0	---------			---------	b4.7	---------	3.3	---------		0	---------
Total	1.3	0	0	0	0	43.4	161.0	197.7	25.1	0	1.4	55.7
Mean	0.04	0	0	0	0	1.40	5.37	6.38	0.84	0	0.05	1.86
Ac-ft	2.6	0	0	0	0	86	319	392	50	0	2.8	110

Calendar year 1960: Max 123 Min 0 Mean 15.2 Ac-ft 11,030
Water year 1960-61: Max 18 Min 0 Mean 1.33 Ac-ft 962

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

5-0515. 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 N., 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 1961. 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, 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.--18 years (1943-61), 489 cfs (354,000 acre-ft per year).

Extremes.--Maximum discharge during year, 548 cfs June 8 (gage height, 4.72 ft); minimum, 8 cfs Aug. 25 (gage height, 2.26 ft).

1942-61: Maximum discharge, 7,130 cfs Apr. 12, 1952 (gage height, 14.99 ft); minimum, that of Aug. 25, 1961.

Maximum stage known, 17.0 ft in spring of 1897.

Remarks.--Records good, except those for periods of ice effect and those below 40 cfs, which are fair. Flow regulated by Owell Reservoir (capacity, 28,400 acre-ft), Lake Traverse (capacity, 137,000 acre-ft available for flood control), numerous other controlled lakes and ponds, and several powerplants.

Rating table,, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Aug. 31 to Sept. 20)

2.3	6	3.6	184
2.4	11	4.0	296
2.6	24	5.0	636
2.8	40	6.0	1,040
3.2	93		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	75	146	140	130	185	*235	269	396	403	168	141	43
2	76	*144	*180	125	180	235	275	396	416	161	146	46
3	75	141	175	135	180	255	266	393	446	192	*144	47
4	75	136	175	140	185	260	252	*384	501	227	139	51
5	73	136	175	*140	175	295	232	377	512	232	141	54
6	76	136	170	140	160	315	232	400	515	232	141	56
7	78	136	160	140	180	325	241	393	515	232	136	*55
8	78	130	155	130	170	325	238	371	519	232	141	44
9	78	88	155	125	155	325	230	368	537	227	130	39
10	81	101	155	150	160	330	*227	358	530	227	125	49
11	*81	141	150	170	160	330	235	342	522	230	101	52
12	83	153	150	160	165	330	263	345	522	218	97	54
13	84	163	150	165	160	325	269	355	519	205	99	60
14	84	153	150	140	155	325	249	371	508	202	99	50
15	84	156	145	145	155	325	205	374	497	207	95	60
16	83	141	140	160	150	*320	125	374	466	205	68	101
17	83	102	150	160	155	315	308	380	425	192	68	99
18	83	88	150	155	140	315	361	390	419	*171	95	99
19	83	134	145	150	155	315	*305	403	419	168	63	97
20	86	181	140	145	190	310	290	406	*400	176	43	101
21	91	156	135	140	190	300	317	406	308	179	36	116
22	125	139	130	170	200	*295	342	396	269	171	30	108
23	134	125	150	170	220	296	355	393	311	168	21	106
24	134	127	150	160	220	*302	358	*419	384	168	15	108
25	130	148	155	*150	210	296	355	416	432	168	10	110
26	132	136	150	190	230	290	345	422	432	166	10	112
27	132	91	140	200	235	281	374	416	380	163	13	119
28	132	56	125	190	235	216	406	409	281	161	14	123
29	144	38	140	185	-	*355	403	409	216	146	13	110
30	161	23	140	180	--------	287	396	406	166	153	32	101
31	148	--------	135	185	--------	272	--------	390	--------	146	39	--------
Total	3,062	3,745	4,660	4,825	5,055	9,300	8,723	12,058	12,770	5,893	2,445	2,370
Mean	98.8	125	150	156	181	300	291	389	426	190	78.9	79.0
Ac-ft	6,070	7,430	9,240	9,570	10,030	18,450	17,300	23,920	25,330	11,690	4,850	4,700

Calendar year 1960: Max 2,200 Min 14 Mean 377 Ac-ft 273,500
Water year 1960-61: Max 537 Min 10 Mean 205 Ac-ft 148,600

* Discharge measurement made on this date.
Note.--Stage-discharge relation affected by ice Dec. 1 to Mar. 22.

5-0540. 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 1961. Published as "at Moorhead, Minn." 1901.

Gage.--Water-stage recorder and concrete control. Datum of gage is 867.4 ft above mean sea level, datum of 1929. Prior to Sept. 1, 1914, staff gage at site 3½ miles downstream at datum 6.65 ft lower. Sept. 1, 1914, to July 31, 1928, staff gage at site 3 miles downstream at datum 3.70 ft higher. Aug. 1, 1928, to Apr. 12, 1959, staff gage at site 1 mile downstream at present datum. Aug. 13, 1959, to June 21, 1960, water-stage recorder at site 2 miles upstream at present datum.

Average discharge.--60 years, 483 cfs (349,700 acre-ft per year, unadjusted); median of yearly mean discharges, 410 cfs (297,000 acre-ft per year, unadjusted).

Extremes.--Maximum discharge during year, 1,020 cfs June 9 (gage height, 9.24 ft); minimum, 10 cfs Sept. 1 (gage height, 7.42 ft).
1901-61: Maximum discharge, 16,300 cfs Apr. 15, 16, 1952; maximum gage height, 28.79 ft Apr. 16, 1952; no flow for many days in each year for periods 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, 28,400 acre-ft), 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.

Rating table, water year 1960-61 (gage height, in feet, and discharge in cubic feet per second)
(Shifting-control method used Jan. 19 to Mar. 11)

7.4	7.5	8.2	288
7.5	19	8.6	540
7.7	65	9.2	1,000
7.9	136		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	60	150	45	140	176	*232	348	423	373	232	145	14
2	80	150	48	132	181	282	330	*416	373	172	145	13
3	90	*145	*65	132	181	336	306	410	373	154	132	12
4	80	136	80	128	181	354	330	404	354	140	124	13
5	68	132	158	124	181	442	336	404	373	145	120	*17
6	68	132	196	*128	186	488	318	430	410	154	116	23
7	68	136	196	132	191	501	300	430	430	172	108	27
8	65	128	176	132	186	508	282	430	494	181	100	32
9	62	128	163	128	181	*482	277	430	928	191	*104	36
10	62	120	154	124	176	470	*271	416	638	196	104	74
11	65	87	150	120	168	460	254	398	527	201	108	42
12	*65	77	145	124	163	450	254	404	514	201	104	42
13	65	100	132	136	158	440	249	456	488	212	96	48
14	65	128	132	150	158	*436	266	456	475	212	84	50
15	65	150	136	154	154	423	288	534	468	201	74	48
16	65	172	132	145	150	423	288	520	456	196	71	45
17	62	168	124	140	150	423	266	482	449	186	84	40
18	60	140	124	154	140	430	*201	456	430	181	87	42
19	62	116	128	158	120	442	249	436	391	*168	80	60
20	62	96	132	154	124	442	330	436	379	163	84	74
21	62	108	128	163	132	*456	342	436	*385	163	84	80
22	60	150	120	140	158	456	324	430	404	163	74	77
23	65	176	108	120	172	449	342	423	354	172	55	80
24	74	172	108	132	176	430	391	416	282	168	48	87
25	90	140	112	145	181	449	410	*398	266	163	40	84
26	108	140	116	*136	191	494	423	410	306	154	36	84
27	120	136	124	154	206	462	430	404	360	154	32	84
28	120	136	124	136	222	*423	423	404	379	150	27	87
29	124	96	124	168	-	367	410	404	385	172	23	80
30	154	62	128	172	---------	312	416	398	312	196	19	84
31	145	---------	136	176	---------	330	---------	385	---------	181	18	---------
Total	2,461	3,907	3,944	4,377	4,743	13,092	9,654	13,279	12,756	5,494	2,526	1,579
Mean	79.4	130	127	141	169	422	322	428	425	177	81.5	52.6
Ac-ft	4,880	7,750	7,820	8,680	9,410	25,970	19,150	26,340	25,300	10,900	5,010	3,130
(✓)	466	386	401	408	355	373	368	484	738	654	771	434
Mean≠	87.0	137	134	148	176	428	328	436	438	188	94.0	59.9
Ac-ft≠	5,350	8,140	8,220	9,090	9,760	26,340	19,520	26,820	26,040	11,550	5,780	3,570

Calendar year 1960:	Max	3,700	Min	45	Mean	431	Ac-ft	312,600	Mean≠	439	Ac-ft≠	318,400
Water year 1960-61:	Max	928	Min	12	Mean	213	Ac-ft	154,300	Mean≠	221	Ac-ft≠	160,200

* Discharge measurement made on this day.
✓ Diversion in acre-feet, by city of Fargo.
≠ Adjusted for diversion

5-0610. 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 1961.

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.--16 years, 69.6 cfs (50,390 acre-ft per year).

Extremes.--Maximum discharge during year, 246 cfs May 16 (gage height, 5.28 ft); maximum gage height, 5.60 ft Mar. 4 (backwater from ice); minimum discharge, 7.9 cfs Sept. 5 (gage height, 2.55 ft).
1945-61: Maximum discharge, 1,590 cfs Aug. 5, 1955 (gage height, 9.31 ft); minimum observed, 6.8 cfs July 28, 1945; minimum gage height, that of 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 7, July 13 to Sept. 30)

2.3	6.2	4.0	99
2.5	11	5.0	212
3.0	26	6.0	348
3.5	54		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	22	34	12	14	14	30	56	97	61	22	17	8.3
2	22	31	14	14	14	50	43	87	58	21	15	8.3
3	22	28	16	14	14	80	52	80	55	20	14	8.5
4	21	26	20	14	14	110	53	74	51	20	13	8.5
5	21	25	24	14	15	130	56	68	47	21	12	9.0
6	20	25	*24	14	15	120	49	74	44	18	12	10
7	20	25	24	14	15	*70	52	86	42	17	11	10
8	19	25	24	14	15	50	49	101	39	16	10	9.7
9	19	24	22	14	15	74	53	94	39	15	10	10
10	20	22	22	14	15	66	57	88	41	15	10	14
11	20	20	20	15	15	69	60	89	39	15	10	15
12	20	20	20	15	16	66	51	94	40	16	9.7	17
13	20	20	18	15	16	57	47	123	39	20	9.3	20
14	21	22	18	15	15	*54	50	162	36	18	9.3	21
15	21	24	18	14	16	55	42	194	34	18	8.8	21
16	21	22	18	14	16	53	34	238	30	20	8.5	18
17	21	20	16	14	15	47	36	232	29	19	8.8	16
18	20	18	16	14	16	47	49	219	27	17	10	15
19	20	20	16	14	16	47	92	214	26	16	10	14
20	20	22	14	14	17	48	145	204	25	16	11	15
21	20	24	14	14	17	57	154	184	24	16	12	15
22	20	22	*14	14	17	61	153	161	25	16	12	16
23	20	20	14	14	18	62	145	142	26	17	11	18
24	20	20	13	14	18	59	143	128	26	*18	11	17
25	20	22	13	14	18	74	*144	113	24	16	10	16
26	20	24	13	*13	20	94	141	101	22	15	10	15
27	*21	20	13	13	*25	104	134	91	*21	15	9.7	15
28	23	16	13	13	25	79	126	83	21	14	*9.7	*16
29	22	14	14	13	-	71	117	75	20	17	9.5	17
30	26	12	15	13	--------	*73	107	69	23	18	8.5	15
31	31	--------	15	14	--------	74	--------	*64	--------	18	8.5	---------
Total	653	667	527	433	462	2,131	2,490	3,829	1,034	540	331.3	428.3
Mean	21.1	22.2	17.0	14.0	16.5	68.7	83.0	124	34.5	17.4	10.7	14.3
Ac-ft	1,300	1,320	1,050	859	916	4,230	4,940	7,590	2,050	1,070	657	850

Calendar year 1960: Max 633 Min 12 Mean 73.5 Ac-ft 53,390
Water year 1960-61: Max 238 Min 8.3 Mean 37.1 Ac-ft 26,830

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 8 to Mar. 8 (no gage-height record Nov. 8 to Dec. 5).

5-0615. 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 1961.

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.--16 years, 45.9 cfs (33,230 acre-ft per year).

Extremes.--Maximum discharge during year, 248 cfs May 18 (gage height, 9.09 ft); no flow Dec. 2 to Feb. 20.
1945-61: Maximum discharge, 3,410 cfs May 31, 1953 (gage height, 15.38 ft); no flow for many days in most years.

Remarks.--Records fair.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 4 to Nov. 8, Apr. 8 to May 31, July 18-31, Sept. 27-30)

2.7	0	4.0	19
2.8	.3	5.0	44
2.9	.8	6.0	83
3.0	1.6	8.0	210
3.2	3.7	9.0	298
3.5	8.6		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.3	9.8	0.2		0	30	68	86	*14	2.9	3.6	0.5
2	.8	9.7	0		0	40	61	67	12	2.8	4.0	.4
3	3.1	9.5	0		0	60	54	60	12	2.3	3.7	.6
4	5.2	12	0		0	90	49	48	12	2.0	3.7	.8
5	2.0	11	0		0	100	43	44	11	1.7	3.7	.7
6	2.7	10	*0		0	120	38	43	9.8	1.5	4.3	.5
7	4.0	8.4	0		0	120	38	49	8.8	1.4	4.7	.7
8	4.3	7.6	0		0	*100	41	55	7.9	1.2	4.9	1.0
9	4.3	6.5	0		0	85	43	63	7.0	1.0	5.2	1.1
10	3.5	5.0	0		0	70	37	73	5.8	.9	4.7	1.6
11	4.1	4.5	0		0	60	35	70	4.7	1.3	3.5	1.6
12	4.1	4.5	0		0	55	34	67	4.6	.6	2.9	2.5
13	4.1	4.5	0		0	50	33	70	4.6	1.6	2.3	3.2
14	4.6	5.0	0		0	*40	33	93	4.1	1.2	1.4	4.4
15	5.7	5.0	0		0	35	33	122	4.0	.8	1.0	5.7
16	5.7	4.5	0		0	35	31	157	3.6	1.7	.8	8.9
17	5.0	4.0	0		0	40	30	216	3.6	2.9	.9	10
18	4.6	4.0	0		0	50	50	229	3.6	1.7	.7	11
19	5.2	4.0	0		0	55	56	184	3.6	1.2	1.1	11
20	5.7	4.5	0		0	60	60	138	3.4	1.6	1.1	11
21	5.7	5.0	0		.1	70	61	105	2.4	1.6	.8	11
22	4.7	4.5	0		.5	*78	64	79	2.6	1.5	.6	10
23	4.0	4.5	*0		.1	80	73	64	2.5	2.1	.5	9.3
24	4.6	4.5	0		.1	100	84	53	2.5	3.2	.3	8.4
25	4.6	4.5	0		.2	125	98	43	2.3	*3.2	.5	7.9
26	4.6	4.0	0	(*)	4.0	128	*117	35	2.3	2.7	.5	7.4
27	5.7	3.0	0		*10	111	146	29	*2.8	2.3	.5	6.9
28	*4.9	2.0	0		15	88	139	25	2.9	2.5	*.8	*6.5
29	5.3	1.0	0		-	88	146	22	3.1	3.5	.7	6.2
30	8.2	.5	0		--------	*72	160	20	3.0	3.2	.9	5.7
31	9.7	--------	0		--------	88	--------	16	--------	3.1	.7	--------
Total	142.0	167.5	0.2	0	30.0	2,323	1,955	2,425	166.5	61.2	65.0	156.5
Mean	4.58	5.58	0.01	0	1.07	74.9	65.2	78.2	5.55	1.97	2.10	5.22
Ac-ft	282	332	0.4	0	60	4,610	3,880	4,810	330	121	129	310

Calendar year 1960: Max 960 Min 0 Mean 49.0 Ac-ft 35,570
Water year 1960-61: Max 229 Min 0 Mean 20.5 Ac-ft 14,860

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 9 to Mar. 24 (no gage-height record Nov. 28, Dec. 31, Feb. 15-21, 23-25).

5-0620. Buffalo River near Dilworth, Minn.

Location.--Lat 46°57'40", long 96°39'40", in SE¼SW¼ 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 1961. 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.--30 years, 107 cfs, (77,460 acre-ft per year).

Extremes.--Maximum discharge during year, 480 cfs May 19 (gage height, 9.90 ft); minimum, 5.1 cfs Aug. 17 (gage height, 1.67 ft).
1931-61: Maximum discharge, 4,530 cfs Apr. 2, 1943 (gage height, 22.60 ft, from floodmark); no flow at times in 1936.

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

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 9, July 31 to Sept. 30)

1.4	4.2	6.0	192
2.0	16	8.0	317
3.0	45	10.0	490
4.0	84		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	27	40	12	18	15	20	160	238	*105	21	21	6.0
2	27	46	10	18	15	25	162	214	97	24	19	6.4
3	27	49	18	18	15	50	137	195	89	26	18	6.0
4	27	49	28	18	15	100	118	174	83	23	16	6.9
5	28	44	28	18	15	150	125	156	78	20	14	7.3
6	27	41	27	18	16	180	134	148	74	19	12	8.8
7	27	40	*29	18	16	190	124	161	68	20	11	9.0
8	27	39	29	18	16	*190	112	166	64	17	11	10
9	27	36	29	18	16	180	110	168	64	17	8.8	12
10	28	26	30	18	16	170	110	181	59	16	8.4	14
11	28	28	28	18	16	160	112	189	58	16	8.6	14
12	28	24	26	18	16	150	113	190	59	15	8.2	17
13	28	36	24	18	16	140	113	221	57	16	7.8	18
14	29	34	22	18	16	*140	106	290	56	16	7.8	18
15	30	34	22	18	16	140	105	334	54	23	7.4	20
16	28	30	20	18	16	130	96	386	50	20	5.8	21
17	28	36	20	19	17	130	105	400	45	20	5.8	21
18	28	24	20	19	17	135	101	456	41	21	6.2	19
19	26	22	20	19	17	140	102	477	38	21	5.8	18
20	26	26	20	18	17	140	122	448	35	20	6.0	18
21	27	30	18	18	17	140	181	394	32	19	6.2	18
22	26	30	*16	18	17	150	224	342	33	21	6.5	19
23	26	24	16	17	18	*150	235	298	33	21	6.2	21
24	25	22	16	17	18	150	247	262	31	19	6.5	21
25	25	20	16	16	18	170	*265	232	29	*19	6.9	23
26	25	28	16	16	18	170	266	205	29	18	6.7	23
27	25	20	16	*16	18	170	271	184	26	18	6.4	23
28	*25	18	16	16	*19	170	280	164	*25	17	6.4	22
29	25	16	16	16	-	170	281	147	23	17	*6.5	*22
30	32	14	17	15	--------	*160	264	128	23	19	6.7	23
31	37	--------	18	15	--------	160	--------	114	--------	22	6.0	--------
Total	849	926	643	543	462	4,420	4,881	7,662	1,558	601	279.6	485.4
Mean	27.4	30.9	20.7	17.5	16.5	143	163	247	51.9	19.4	9.02	16.2
Ac-ft	1,680	1,840	1,280	1,080	916	8,770	9,680	15,200	3,090	1,190	555	963

Calendar year 1960: Max 1,380 Min 10 Mean 142 Ac-ft 103,100
Water year 1960-61: Max 477 Min 5.8 Mean 63.9 Ac-ft 46,240

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 10 to Apr. 1.

5-0625. 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 1961. 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.--39 years, 155 cfs (112,200 acre-ft per year).

Extremes.--Maximum discharge during year, 847 cfs May 17 (gage height, 5.29 ft); minimum, 8.6 cfs about Aug. 17 (gage height, 0.82 ft).
1909-17, 1930-61: 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 periods of ice effect or no gage-height record, 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-3)

0.9	8.6	2.0	114
1.0	13	3.0	294
1.2	26	4.0	514
1.5	54	6.0	1,060

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	68	80	45	42	32	44	166	382	320	38	31	18
2	65	88	55	42	32	75	142	367	314	39	30	16
3	68	85	55	42	32	120	158	346	302	47	29	14
4	82	75	60	42	32	125	158	335	276	55	27	13
5	104	68	65	42	32	150	152	318	248	56	27	15
6	111	68	*65	42	32	150	135	329	224	55	21	12
7	117	72	65	42	32	*150	134	329	208	58	17	14
8	115	68	70	40	32	140	134	335	190	58	23	12
9	113	62	68	40	32	135	150	318	188	54	14	20
10	113	40	68	38	32	135	153	314	170	49	12	40
11	107	48	66	38	32	125	150	294	155	50	14	38
12	107	55	70	38	32	115	142	308	148	51	12	35
13	100	60	65	38	32	110	139	371	145	51	12	42
14	97	70	62	36	32	*100	147	467	129	46	11	40
15	94	60	62	34	32	90	145	664	120	45	11	38
16	88	50	62	36	32	85	124	763	107	44	10	36
17	91	45	60	34	34	90	121	839	95	53	10	36
18	81	50	58	34	34	100	139	825	88	50	25	38
19	74	65	56	34	36	95	218	784	83	46	32	40
20	61	75	54	34	36	125	274	742	75	38	30	42
21	59	70	52	34	36	*128	331	708	73	56	28	40
22	61	65	*52	32	37	142	365	677	74	46	27	38
23	56	50	50	34	40	148	371	646	70	47	27	36
24	61	65	48	32	40	175	360	615	66	*52	28	36
25	57	65	48	32	40	186	*356	579	59	42	28	35
26	59	60	48	*32	42	218	393	545	55	39	26	35
27	*56	55	46	32	*42	224	411	509	*47	36	25	36
28	56	55	44	32	42	165	411	465	43	30	*30	*38
29	58	50	44	32	-	136	404	415	40	35	29	50
30	68	50	42	32	--------	190	396	378	39	29	22	47
31	77	--------	42	32	--------	*206	--------	*348	--------	35	20	--------
Total	2,524	1,869	1,747	1,124	971	4,177	6,879	15,315	4,151	1,430	688	950
Mean	81.4	62.3	56.4	36.3	34.7	135	229	494	138	46.1	22.2	31.7
Ac-ft	5,010	3,710	3,470	2,230	1,930	8,280	13,640	30,380	8,230	2,840	1,360	1,880

Calendar year 1960: Max 635 Min 28 Mean 153 Ac-ft 111,300
Water year 1960-61: Max 839 Min 10 Mean 115 Ac-ft 82,960

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 10 to Mar. 20. No gage-height record Aug. 9-27, Aug. 30 to Sept. 27.

5-0640. 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 1961.

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.--17 years, 198 cfs (143,300 acre-ft per year).

Extremes.--Maximum discharge during year, 1,080 cfs May 17 (gage height, 10.66 ft); minimum observed, 12 cfs Aug. 18, Sept. 8, 9; minimum gage height observed, 0.82 ft Sept. 9.

1944-61: 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 good except those for period of ice effect, 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 table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 8, Sept. 29-30)

0.8	11	3.0	115
1.0	16	5.0	290
1.5	34	8.0	653
2.0	57	11.0	1,150

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	97	97	35	44	34	50	330	413	*391	55	36	23
2	92	105	45	44	34	55	310	458	362	50	34	20
3	91	106	45	44	34	75	290	437	347	50	38	19
4	88	109	50	44	34	95	276	411	343	49	39	17
5	85	109	60	44	34	120	243	391	317	48	38	16
6	101	106	65	44	34	200	220	388	296	58	33	15
7	117	103	*70	44	34	240	213	417	262	55	24	15
8	117	99	70	44	34	270	a210	440	252	54	24	12
9	118	90	70	42	34	280	a204	442	238	a58	17	12
10	128	85	70	42	34	260	*201	420	230	62	17	21
11	135	80	70	42	34	250	206	410	215	65	14	50
12	132	78	70	42	34	210	203	397	198	71	14	44
13	129	75	70	42	34	190	206	402	186	70	14	46
14	127	75	70	42	34	200	195	490	180	68	15	52
15	123	90	a70	40	35	220	133	678	168	65	15	52
16	114	90	a65	40	35	190	150	956	152	60	14	49
17	111	80	a65	40	35	*175	212	1,080	139	56	13	44
18	a106	75	a60	40	36	165	212	1,050	131	56	12	42
19	103	a75	a60	40	36	160	195	1,030	119	54	21	38
20	93	80	a55	40	38	180	250	961	112	54	a26	38
21	91	85	a55	38	38	200	326	865	107	55	30	45
22	77	90	a50	38	40	210	391	808	104	60	27	37
23	71	80	*50	36	40	220	431	822	101	60	30	42
24	68	70	50	36	40	220	462	743	98	54	35	42
25	64	65	50	36	40	250	487	667	91	*49	34	41
26	65	65	48	36	40	280	506	572	88	46	30	40
27	69	60	48	*35	40	330	520	540	77	43	a28	42
28	*69	50	46	35	*44	320	*527	542	*70	42	27	42
29	72	45	46	35	-	260	517	503	60	42	*25	*42
30	74	30	44	35	--------	260	501	460	57	39	18	46
31	89	--------	44	35	--------	*315	--------	418	--------	38	27	---------
Total	3,016	2,447	1,766	1,239	1,013	6,450	9,127	18,611	5,491	1,686	769	1,044
Mean	97.3	81.6	57.0	40.0	36.2	208	304	600	183	54.4	24.8	34.8
Ac-ft	5,980	4,850	3,500	2,460	2,010	12,790	18,100	36,910	10,890	3,340	1,530	2,070

Calendar year 1960: Max 1,550 Min 30 Mean 220 Ac-ft 159,500
Water year 1960-61: Max 1,080 Min 12 Mean 144 Ac-ft 104,400

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 9 to Apr. 3.

5-0645. 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 at 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 (revised) in closed basins.

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

Gage.--Water-stage recorder and wire-weight gage. 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 observed during period, 1,900 cfs May 22 (gage height, 6.96 ft); minimum, 133 cfs Sept. 7 (gage height, 1.91 ft).

1936-37, 1942-61: 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. Some regulation by many controlled lakes and reservoirs on tributaries.

Rating table, May 22 to Sept. 30, 1961 (gage height, in feet, and discharge, in cubic feet per second)

1.9	132	3.0	344
2.0	144	5.0	1,020
2.5	225	7.0	1,920

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1								-	1,050	510	*[illegible]2	145
2								-	1,000	474	[illegible]	143
3								-	948	408	278	139
4								-	906	352	257	139
5								-	876	297	246	134
6								-	849	275	231	134
7								-	819	268	217	133
8								-	816	268	217	134
9								-	834	282	210	140
10								-	864	297	201	155
11								-	1,160	302	196	184
12								-	1,050	304	192	248
13								-	906	347	189	229
14								-	845	339	186	192
15								-	*801	336	183	198
16								-	758	344	[illegible]	196
17								-	729	317	[illegible]	187
18								-	704	302	168	179
19								-	682	297	178	181
20								-	654	292	194	186
21								-	616	*294	179	196
22								*1,880	596	302	176	*219
23								1,770	585	304	178	231
24								1,660	599	287	*178	227
25								1,540	567	282	168	221
26								1,450	510	282	162	221
27								1,360	453	275	160	225
28								1,290	447	264	154	223
29					-			1,230	477	259	151	214
30					--------			1,160	498	264	148	212
31		--------			--------			1,100	--------	292	145	--------
Total									22,599	9,716	6,102	5,565
Mean									753	313	197	186
Ac-ft									44,820	19,270	12,100	11,040

* Discharge measurement made on this day.

05-0675. 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, 3-3/4 miles southeast of Shelly and 10 miles upstream from mouth.

Drainage area.--151 sq mi.

Records available.--March 1944 to September 1961. Monthly discharge only for some periods, 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.--17 years, 99.2 cfs (71,820 acre-ft per year).

Extremes.--Maximum discharge during year, 100 cfs Mar. 9 (gage height, 3.51 ft, backwater from ice); no flow for many days.
1944-61: Maximum discharge, 4,660 cfs May 11, 1950 (gage height, 18.96 ft, from floodmark); no flow for many days.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are 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 divered at same point for abatement of pollution from Ada sewage plant effluent.

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 17		Mar. 18 to Sept. 30			
-0.3	0	-0.2	0	0.2	3.8
- .2	.2	- .1	.4	.5	11
- .1	.9	0.0	1.0	1.0	26
		.1	2.0	1.7	48

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		0				0.1	20	a20	15			0
2		0				.1	16	18	12			0
3		0				.2	a13	16	11			0
4		0				10	12	15	10			0
5		0				20	11	14	7.9	(*)		0
6		0				35	12	14	6.6			0
7		0	(*)			40	9.0	a15	5.9			0
8		0				*65	9.0	21	a5.0			0
9		a.1				85	a8.5	24	a4.0			0
10		a.1				70	*7.9	27	3.1			a.2
11		a.1				50	7.7	a26	2.4			a.1
12		.1				a45	7.1	23	a2.0			0
13		.2				*42	6.9	22	1.7			a.1
14		.2				40	6.9	20	1.2			0
15		.2				40	6.6	21	*.9			0
16		a.2				36	a6.0	22	.9			0
17		.2				36	5.4	28	.5			0
18		.2				35	8.4	*37	.3			0
19	(*)	.2				34	9.0	a38	.2			0
20		a.2				34	12	39	.1			0
21		.2				*40	13	43	.1			0
22		a.2				45	15	a40	.1			*0
23		a.2	(*)			43	17	37	0			0
24		a.2				39	17	34	0		(*)	0
25		.2				43	16	a30	0			0
26		a.2				46	20	a28	0			0
27		.1		(*)		38	23	25	0			0
28		a.1			(*)	29	*25	a22	0	(*)		0
29		a.1			--	22	25	20	0			0
30		0			--------	21	22	18	0			0
31		--------			--------	*20	--------	17	--------			--------
Total	0	3.5	0	0	0	1,103.4	387.4	774	90.9	0	0	0.4
Mean	0	0.12	0	0	0	35.6	12.9	25.0	3.03	0	0	0.01
Ac-ft	0	6.9	0	0	0	2,190	768	1,540	180	0	0	0.8

Calendar year 1960: Max 477 Min 0 Mean 13.9 Ac-ft 10,080
Water year 1960-61: Max 85 Min 0 Mean 6.46 Ac-ft 4,690

* Discharge measurement or observation of no flow made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 12 to Mar. 17.

36.167
60
43
47.603 96.794

5-0690. 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 1961 (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.--13 years (1946-50, 1952-61) 57.0 cfs (41,270 acre-ft per year).

Extremes.--Maximum discharge during year, 140 cfs Mar. 25 (gage height, 4.86 ft, backwater from ice); minimum observed, 4.1 cfs Sept. 5 (gage height, 0.46 ft).
1943-61: Maximum discharge, 3,040 cfs Apr. 22, 1950 (gage height, 16.31 ft, from floodmark); minimum not determined.

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

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to June 22		June 23 to Sept. 30	
0.6	3.4	0.4	3.4
1.0	13	0.7	7.5
2.0	50	1.0	13
3.0	105	2.0	50
4.0	188		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9.8	28	10	6.4	6.8	20	80	56	19	9.4	8.5	4.9
2	9.8	27	10	6.4	6.8	25	55	49	19	9.4	8.2	4.9
3	8.8	21	12	6.4	6.8	30	40	47	20	9.0	7.8	4.3
4	8.8	20	12	6.4	6.8	45	50	44	21	9.0	7.5	4.3
5	8.3	21	11	6.4	6.8	45	45	39	19	*8.5	6.9	4.1
6	8.8	23	11	6.6	6.6	40	60	44	19	8.8	6.6	4.3
7	8.8	*17	*11	6.6	6.6	40	55	61	18	8.5	6.6	4.6
8	8.3	16	10	6.6	6.4	*42	35	52	17	7.5	6.3	4.9
9	8.8	10	10	6.4	6.4	40	38	48	17	6.9	6.6	5.2
10	9.6	12	9.5	6.4	6.4	38	*40	46	16	9.6	6.0	5.2
11	9.0	16	9.5	6.4	6.4	36	48	46	15	9.2	6.6	17
12	10	16	9.0	6.4	6.4	50	26	47	14	11	6.3	20
13	11	15	9.0	6.6	6.2	*64	27	45	13	13	6.0	16
14	11	16	8.5	6.6	6.2	65	36	45	13	15	5.4	12
15	11	16	8.5	6.6	6.0	65	26	47	*11	15	5.4	11
16	10	15	8.0	6.6	6.0	60	35	49	10	13	5.2	10
17	11	15	8.0	6.8	5.8	65	61	47	10	12	6.0	10
18	12	14	7.5	6.8	5.8	70	45	*53	10	10	6.9	11
19	*10	12	7.5	6.8	5.6	70	57	52	9.3	9.2	6.6	12
20	9.3	18	7.0	6.8	5.6	75	52	50	9.8	9.2	6.3	15
21	11	16	7.0	7.0	5.6	*85	53	46	10	9.9	6.0	11
22	14	16	6.5	7.0	5.4	86	57	43	12	12	6.0	*22
23	13	16	*6.4	7.0	5.4	*88	62	34	11	12	6.3	15
24	14	16	6.4	7.0	5.4	110	74	33	10	12	*6.0	13
25	16	15	6.4	7.0	5.6	125	80	29	10	12	6.0	12
26	12	15	6.4	7.0	10	110	81	27	9.7	9.9	6.0	9.9
27	13	14	6.2	*7.0	20	95	75	24	9.7	9.6	5.7	8.8
28	13	8	6.2	7.0	*20	90	*67	23	9.4	*8.8	5.4	7.8
29	16	12	6.4	7.0	-	70	64	23	9.0	9.2	5.7	7.2
30	21	11	6.4	7.0	---------	65	61	22	9.4	8.8	5.4	7.5
31	29	---------	6.4	7.0	---------	*85	---------	21	---------	8.5	5.2	---------
Total	366.1	487	259.7	208.0	203.8	1,994	1,585	1,292	400.3	315.9	195.4	294.9
Mean	11.8	16.2	8.38	6.71	7.28	64.3	52.8	41.7	13.3	10.2	6.30	9.83
Ac-ft	726	966	515	413	404	3,960	3,140	2,560	794	627	388	585

Calendar year 1960: Max 440 Min 6.2 Mean 32.8 Ac-ft 23,800
Water year 1960-61: Max 125 Min 4.1 Mean 20.8 Ac-ft 15,080

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 8 to Apr. 11.

5-0740. 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 1961 (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, 5.83 ft May 25 (affected by wind action); minimum, 3.60 ft Sept. 3 (affected by wind action).
1930-61: 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 1960 to September 1961

Oct. 31..... 4.40	Jan. 31..... 4.55	Apr. 30..... 4.98	July 31..... 4.77
Nov. 30..... 4.41	Feb. 28..... 4.56	May 31..... 5.27	Aug. 31..... 4.55
Dec. 19..... 4.50	Mar. 31..... 4.62	June 30..... 4.91	Sept. 30..... 4.43

Note.--Mean daily gage heights are available.

GPO 823486-4

5-0745. 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 1961. 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.--28 years, 386 cfs (279,500 acre-ft per year).

Extremes.--Maximum daily discharge during year, 240 cfs June 24-25; maximum gage height, 3.41 ft June 26 (backwater from aquatic vegetation); minimum daily discharge, 13 cfs June 7-15; minimum gage height, 0.65 ft May 10-11.

1933-61: Maximum discharge, 3,600 cfs June 25, 1950 (gage height, 9.19 ft, affected by seiches and backwater from aquatic vegetation), from rating curve extended above 1,400 cfs; no flow at times.

Remarks.--Records good above 30 cfs and fair below. Flow completely regulated by outlet dam on Lower Red Lake.

Revisions (water years).--WSP 1308: 1934(M), 1943(M). WSP 1438: 1950(M).

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	32	130	35	35	35	35	35	30	16	50	*46	30
2	32	130	35	35	35	35	35	30	16	50	46	30
3	31	130	35	35	35	35	35	29	14	48	46	30
4	31	130	35	35	35	35	*35	28	14	48	46	28
5	*31	130	35	35	35	35	35	28	14	48	44	28
6	31	130	35	35	35	35	35	27	14	48	44	28
7	30	128	35	35	35	35	35	27	13	*48	42	*28
8	30	128	35	35	35	35	35	27	13	48	40	41
9	30	128	35	35	35	35	35	26	13	48	40	50
10	76	128	35	35	35	35	35	*25	13	46	40	50
11	136	128	35	35	35	35	35	25	13	46	40	48
12	136	128	35	35	35	35	35	24	13	46	38	48
13	136	128	35	35	35	35	35	24	13	46	38	46
14	136	128	35	35	35	35	35	22	13	48	38	46
15	136	128	35	35	35	*35	35	22	13	50	38	93
16	136	*127	35	35	35	35	35	22	29	50	*38	130
17	134	126	35	35	*35	35	35	20	36	48	38	130
18	134	126	35	35	35	35	35	20	34	48	38	130
19	*134	126	35	*35	35	35	35	20	32	*48	36	*129
20	134	126	35	35	35	35	*35	20	30	48	36	128
21	134	126	35	35	35	35	35	18	*29	48	36	128
22	134	126	35	35	35	35	35	18	28	48	36	128
23	134	126	35	35	35	35	34	18	*169	48	34	128
24	132	126	35	35	35	35	34	18	240	48	34	128
25	132	88	35	35	35	35	33	18	240	48	34	128
26	132	35	35	35	35	35	33	18	117	48	34	128
27	132	35	35	35	35	35	33	16	50	48	32	128
28	132	35	35	35	35	35	32	16	50	46	32	126
29	130	35	35	35	-	35	32	16	50	46	32	126
30	130	35	35	35	--------	35	30	16	50	46	32	126
31	130	--------	35	35	--------	35	--------	*16	--------	46	30	--------
Total	3,158	3,330	1,085	1,085	980	1,085	1,031	684	1,389	1,480	1,178	2,545
Mean	102	111	35.0	35.0	35.0	35.0	34.4	22.1	46.3	47.7	38.0	84.8
Ac-ft	6,260	6,600	2,150	2,150	1,940	2,150	2,040	1,360	2,760	2,940	2,340	5,050

Calendar year 1960: Max 136 Min 5.6 Mean 68.1 Ac-ft 49,460
Water year 1960-61: Max 240 Min 13 Mean 52.1 Ac-ft 37,740

* Discharge measurement made on this day.

Note.--Stage-discharge relation indefinite Oct. 1 to Nov. 9, Apr. 2 to Sept. 30. Stage-discharge relation affected by ice Nov. 10 to Apr. 1.

5-0750. 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 1961. 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.--32 years 400 cfs (289,600 acre-ft per year).

Extremes.--Maximum discharge during year, 282 cfs Apr. 20 (gage height, 2.92 ft); maximum gage height, 4.49 ft Mar. 25 (backwater from ice); minimum daily discharge, 4.2 cfs Oct. 1.
1929-61: 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 fair. Flow regulated by outlet dam on Lower Red Lake.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.2	119	38	38	33	33	75	63	16	66	50	23
2	8.5	117	32	38	33	33	68	51	15	53	44	23
3	22	117	34	38	33	33	62	45	16	45	42	22
4	36	116	34	38	33	33	65	45	14	47	41	21
5	37	116	38	38	32	33	*60	44	12	47	41	20
6	31	115	40	38	32	33	60	46	10	46	39	20
7	31	118	32	38	32	34	64	52	10	43	36	20
8	31	115	30	38	32	35	64	54	10	44	33	21
9	31	76	32	37	32	35	62	*44	10	44	33	22
10	28	100	32	37	32	35	56	47	10	43	35	30
11	31	150	32	37	32	35	*48	49	15	44	32	48
12	66	145	32	37	32	35	42	33	17	46	31	54
13	111	138	42	37	32	36	55	30	17	47	30	53
14	118	138	*42	37	32	*36	68	34	17	49	32	50
15	116	*139	40	37	32	36	70	40	18	53	*31	43
16	116	125	40	37	*32	36	42	30	19	54	30	34
17	116	80	40	37	32	36	42	29	19	45	32	47
18	*118	125	40	*37	32	37	73	28	22	*40	41	*108
19	109	130	40	37	32	40	191	25	23	42	43	138
20	118	125	40	36	32	50	*264	24	*23	42	41	139
21	118	120	40	36	32	65	249	29	22	47	34	142
22	116	110	39	36	32	80	188	28	22	65	28	146
23	116	90	39	36	32	85	148	22	21	57	25	141
24	117	90	39	36	33	100	133	21	17	55	25	139
25	118	95	39	35	33	160	136	19	80	54	25	134
26	114	100	39	35	33	170	127	19	197	51	25	132
27	115	70	38	35	33	160	103	18	217	47	24	132
28	112	65	38	34	33	*135	105	19	165	47	24	132
29	112	60	39	34	-	100	87	17	103	47	23	137
30	129	48	38	34	---------	85	69	17	74	51	23	132
31	128	---------	38	34	---------	80	---------	16	---------	53	24	---------
Total	2,573.7	3,252	1,155	1,132	905	1,934	2,876	1,040	1,231	1,514	1,017	2,303
Mean	83.0	108	37.3	36.5	32.3	62.4	95.9	33.5	41.0	48.8	32.8	76.8
Ac-ft	5,100	6,450	2,290	2,250	1,800	3,840	5,700	2,060	2,440	3,000	2,020	4,570

Calendar year 1960: Max 510 Min 4.2 Mean 87.0 Ac-ft 63,130
Water year 1960-61: Max 264 Min 4.2 Mean 57.3 Ac-ft 41,520

* Discharge measurement made on this day.

Note.--Discharge computed from once-daily wire-weight gage readings Oct. 1-17, Dec. 31 to Mar. 19, Apr. 7-18, May 1 to June 24, Aug. 22 to Sept. 11. Stage-discharge relation affected by ice Nov. 10 to Apr. 7.

5-0760. 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 1961. 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.--44 years, 115 cfs (83,260 acre-ft per year).

Extremes.--Maximum discharge during year, 441 cfs Mar. 24 (gage height, 7.49 ft, backwater from ice); no flow for many days.

1909-17, 1919-26, 1928-61: 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 fair. Some regulation by Thief and Mud Lakes.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.7	0	4.4	2.9	5.0	61
3.8	.1	4.5	5.6	6.0	324
4.0	.2	4.6	9.5	7.0	618
4.2	.6	4.7	17		
4.3	1.2	4.8	29		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.2	6.0	0.4			0	70	88	10	0	0.1	0
2	.1	5.0	.3			0	75	83	9.1	0	0	0
3	.1	3.9	.3			0	71	79	8.3	0	0	0
4	.1	3.2	.3			0	54	75	7.6	0	0	.4
5	0	6.0	.2			0	*34	69	7.2	0	0	.5
6	0	5.3	.2			0	27	69	6.0	0	0	.5
7	0	2.9	.2			0	31	71	5.3	0	0	.4
8	0	1.9	.2			0	31	73	5.3	0	0	6.0
9	0	1.4	.1			0	27	*73	4.2	0	0	12
10	0	1.2	.1			0	25	71	3.9	0	0	13
11	0	1.5	.1			0	20	67	3.2	0	0	34
12	0	1.8	.1			0	*22	97	2.4	0	0	36
13	0	1.8	0			0	22	102	1.9	0	0	35
14	0	1.8	*0			*0	22	102	1.2	0	0	31
15	0	*1.8	0			0	14	99	.8	0	*0	24
16	0	1.8	0		(*)	0	9.1	109	.5	0	0	15
17	0	1.8	0			0	12	112	.3	0	0	12
18	*0	1.6	0	(*)		0	24	112	.2	*0	0	*9.1
19	0	1.6	0			0	61	106	.2	0	0	7.9
20	0	1.4	0			.1	*95	75	*.1	0	0	13
21	1.5	1.4	0			*50	119	73	.1	0	.4	24
22	2.4	1.4	0			110	119	69	.1	0	.7	34
23	3.9	1.2	0			180	102	61	0	0	.5	32
24	1.6	1.2	0			400	102	59	0	0	.3	29
25	.8	1.2	0			350	106	58	0	.9	.3	20
26	.5	1.0	0			230	102	56	0	.8	.2	15
27	.4	.8	0			130	99	54	0	.6	.2	12
28	.3	.6	0			*60	97	52	0	.4	.2	11
29	.3	.6	0		-	50	95	32	0	.3	.1	8.7
30	1.4	.6	0		--------	60	92	13	0	.2	0	7.6
31	5.6	--------	0		--------	70	--------	10	--------	.2	0	--------
Total	19.2	63.7	2.5	0	0	1,690.1	1,779.1	2,269	77.9	3.4	3.0	443.1
Mean	0.62	2.12	0.08	0	0	54.5	59.3	73.2	2.60	0.11	0.10	14.8
Acft	38	126	5.0	0	0	3,350	3,530	4,500	155	6.7	6.0	879

Calendar year 1960: Max 1,010 Min 0 Mean 104 Ac-ft 75,650
Water year 1960-61: Max 400 Min 0 Mean 17.4 Ac-ft 12,600

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 15 to Apr. 2.

5-0780. 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 1961.

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.--22 years, 162 cfs (117,300 acre-ft per year).

Extremes.--Maximum discharge during year, 461 cfs Apr. 25 (gage height, 4.88 ft); minimum, 14 cfs Aug. 17 (gage height, 2.20 ft).
1939-61: Maximum discharge, 3,630 cfs May 6, 1950 (gage height, 11.33 ft); maximum gage height, 11.84 ft June 27, 1957; minimum discharge, 7.9 ft July 8, 1940.

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 22 to May 3)

2.2	14
2.5	36
3.0	94
4.0	271
5.0	523

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	34	57	30	40	24	34	150	328	98	21	41	30
2	33	60	54	38	24	36	135	295	95	20	38	30
3	32	61	54	38	24	36	125	269	92	21	36	29
4	31	60	54	38	24	36	*120	246	87	24	34	30
5	31	57	54	38	24	38	115	220	80	23	30	30
6	31	55	52	38	25	38	115	213	72	21	30	29
7	31	53	52	38	25	38	115	222	69	19	26	26
8	30	55	52	36	25	40	120	209	66	18	25	30
9	30	36	50	36	25	40	120	*205	58	18	23	34
10	31	44	50	36	25	40	111	190	54	18	23	50
11	31	56	48	36	25	40	*92	179	53	20	20	81
12	36	40	48	36	26	40	90	174	50	25	20	86
13	40	60	48	36	26	42	86	167	45	25	22	90
14	46	56	*48	34	26	*42	90	202	42	30	21	98
15	50	*56	48	32	26	42	80	230	41	53	*18	134
16	50	75	48	32	*26	44	68	273	40	81	17	129
17	50	75	48	32	26	44	66	293	37	83	17	112
18	*47	65	48	*33	26	46	170	304	34	*75	20	*101
19	44	40	48	33	26	55	*154	302	30	68	18	95
20	43	50	46	28	26	70	202	291	*30	64	34	92
21	41	55	44	28	28	95	323	278	30	62	44	95
22	39	54	44	28	28	110	390	256	28	62	43	107
23	39	54	44	28	28	125	380	234	25	56	40	122
24	39	52	44	26	28	140	372	209	25	51	38	117
25	38	50	44	26	28	160	421	187	25	53	36	102
26	37	48	44	26	30	190	450	170	23	50	35	91
27	37	48	42	24	30	*210	442	151	22	45	33	84
28	36	40	40	24	32	200	429	137	21	42	31	80
29	39	35	38	24	-	200	403	125	21	44	30	83
30	48	35	40	24	--------	170	370	116	20	40	30	78
31	50	--------	40	24	--------	155	-------	105	--------	41	29	--------
Total	1,194	1,582	1,444	990	736	2,596	6,304	6,780	1,413	1,273	902	2,295
Mean	38.5	52.7	46.6	31.9	26.3	83.7	210	219	47.1	41.1	29.1	76.5
Ac-ft	2,370	3,140	2,860	1.960	1.460	5,150	12,500	13,450	2,800	2,520	1,790	4,550

Calendar year 1960: Max 620 Min 21 Mean 85.3 Ac-ft 61,960
Water year 1960-61: Max 450 Min 17 Mean 75.4 Ac-ft 54,550

Peak discharge (base, 500 cfs).--No peak above base.

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 10 to Apr. 9, Apr. 15-17.

5-0777. Ruffy Brook near Gonvick, Minn.

Location.--Lat 47°44'50", long 95°24'45", on line between sec. 5 and 8, T. 149 N., R. 37 W., on downstream side of bridge on County Highway 17, 4 miles upstream from mouth, and 4 3/4 miles east of Gonvick.

Records available.--July 1960 to September 1961.

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.--1960: Maximum discharge observed during period July to September, 22 cfs July 1 (gage height, 1.96 ft); minimum, 1.0 cfs Aug. 1 (gage height, 1.28 ft).
1960-61: Maximum discharge during water year, 66 cfs Apr. 20 (gage height, 3.74 ft, from floodmarks, backwater from ice); maximum gage height, 5.82 ft Mar. 11 (backwater from ice); minimum discharge, 0.6 cfs Sept. 5 (gage height, 1.29 ft).

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

Rating tables, July 1, 1960 to Sept. 30, 1961, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 10-31, Apr. 23-27)

July 1, 1960 to Apr. 22, 1961				Apr. 23 to Sept. 30, 1961			
1.2	0.4	1.6	7.2	1.29	0.6	1.6	6.4
1.3	1.2	2.0	23	1.3	.7	2.0	22
1.4	2.4	3.0	64	1.4	1.8	3.0	64
1.5	4.3			1.5	3.6		

Discharge, in cubic feet per second, July to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1										22	*1.2	5.9
2									✓11	19	1.2	8.8
3										12	1.2	4.3
4										11	1.6	3.8
5							✓18			11	1.2	3.0
6										7.2	1.2	2.5
7							✓62			6.5	1.9	*2.5
8										4.1	1.8	2.5
9										3.4	1.6	2.5
10										3.0	1.4	2.1
11										2.5	1.3	1.9
12							✓31			2.5	1.2	1.8
13										2.5	1.1	1.7
14	✓2.6									2.2	1.1	1.4
15										2.2	1.1	1.3
16										1.1	1.1	1.8
17										3.4	1.1	1.8
18								✓6.9		2.5	1.2	1.9
19										4.6	1.6	1.4
20							✓26			3.0	1.8	1.4
21										2.5	1.4	1.4
22										2.2	1.2	1.2
23										2.1	1.2	1.2
24										1.8	2.5	1.3
25										2.5	9.5	1.3
26										2.2	13	1.3
27										2.1	16	1.3
28										1.8	13	1.3
29									✓23	1.2	9.5	1.3
30					---------	✓20				1.2	4.1	1.6
31		---------			---------		---------		---------	1.4	3.4	---------
Total										146.7	101.7	67.5
Mean										4.73	3.28	2.25
Ac-ft										291	202	134

Calendar year :	Max	Min	Mean	Cfsm	In.	Ac-ft
Water year	Max	Min	Mean	Cfsm	In.	Ac-ft

* Discharge measurement made on this day.
✓ Result of discharge measurement.

5-0777. Ruffy Brook near Gonvick, Minn.--Continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.6	3.2	2.2	1.2	0.8	1.2	11	28	7.1	0.8	*1.3	0.9
2	1.6	3.0	2.2	1.2	.8	1.2	10	24	7.1	.8	3.4	.9
3	1.6	2.7	2.2	1.2	.8	1.2	9.0	22	6.7	.9	2.6	.7
4	1.2	2.5	2.2	1.2	.8	1.2	*8.7	19	3.8	.8	1.7	.7
5	*1.2	2.5	2.2	1.2	.8	1.4	8.0	19	3.2	.9	.9	.6
6	1.4	2.5	2.0	1.2	.8	1.6	6.0	39	3.2	.9	.9	.7
7	1.6	2.5	2.0	1.2	.8	2.0	7.0	56	3.4	*.8	.7	*.8
8	1.8	2.5	2.0	1.0	.8	2.0	7.0	53	2.8	1.0	1.0	1.4
9	1.7	2.5	2.0	1.0	.8	2.0	6.0	17	2.6	.9	1.0	1.8
10	1.7	2.4	2.0	1.0	.8	3.8	5.0	*11	2.1	.8	1.0	3.2
11	1.8	2.4	2.0	.9	.8	4.0	*5.0	11	1.9	.9	1.0	3.6
12	1.8	2.4	1.8	.9	.8	4.0	6.0	13	1.8	1.8	1.0	3.6
13	1.7	2.4	1.8	.9	.8	4.5	7.0	31	1.7	1.8	.9	17
14	1.8	2.5	1.8	.9	.8	4.5	7.0	32	1.3	11	.7	17
15	1.9	2.5	*1.8	.9	.8	*4.7	8.0	45	1.3	6.7	.7	12
16	1.7	*2.6	1.8	.9	.8	4.5	10	49	1.5	4.3	.7	7.1
17	1.6	2.6	1.8	.9	*.8	4.5	20	46	1.5	3.4	.7	6.1
18	1.3	2.6	1.8	.8	.8	4.8	30	43	1.4	2.6	1.3	4.0
19	*1.3	2.4	1.6	*.8	.8	5.5	50	40	1.4	2.6	2.1	3.4
20	1.3	2.4	1.6	.8	.8	5.0	*60	37	1.3	1.9	1.4	2.6
21	1.2	2.4	1.6	.8	.8	6.0	60	31	1.2	1.9	1.4	3.4
22	1.1	2.4	1.6	.8	1.5	8.0	60	27	1.3	1.8	1.3	3.8
23	1.2	2.2	1.4	.8	1.0	10	57	25	1.3	1.9	1.3	4.3
24	1.3	2.4	1.4	.8	1.0	12	53	23	1.2	1.7	1.1	4.3
25	1.3	2.5	1.4	.8	1.0	14	61	20	1.3	1.7	.9	3.4
26	1.3	2.4	1.4	.8	1.2	15	57	17	1.3	1.2	.9	3.4
27	1.3	2.4	1.4	.8	1.2	16	47	14	1.2	1.3	.9	2.8
28	1.3	2.2	1.4	.8	1.2	16	43	11	1.1	1.0	1.0	2.8
29	1.2	2.2	1.4	.8	-	*13	38	10	.8	2.6	.9	3.4
30	2.4	1.8	1.2	.8	---	14	33	9.8	.8	2.6	.7	3.4
31	4.3	---	1.2	.8	---	12	---	*8.6	---	1.9	.8	---
Total	49.5	74.0	54.2	28.9	24.9	199.6	789.7	831.4	68.6	65.2	36.2	123.1
Mean	1.60	2.47	1.75	0.93	0.89	6.44	26.3	26.8	2.29	2.10	1.17	4.10
Ac-ft	98	147	108	57	49	396	1,570	1,650	136	129	72	244

Calendar year 1960: Max - Min - Mean - Ac-ft -
Water year 1960-61: Max 61 Min 0.6 Mean 6.43 Ac-ft 4,660

Discharge (base, 65 cfs).--Apr. 20 (4 a.m.) 66 cfs (3.74 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 16 to Apr. 22.

5-0782. 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.

Records available.--July 1960 to September 1961.

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.--1960: Maximum discharge during period July to September, 460 cfs July 2 (gage height, 6.13 ft, from graph based on gage readings); minimum, 0.1 cfs Aug. 7, 20-24, Sept. 26, 27.
1960-61: Maximum discharge during year, 279 cfs Apr. 22, 23 (gage height, 4.34 ft); minimum, 0.1 cfs July 7-13, 15-17, Aug. 14-17, Aug. 29 to Sept. 9; minimum gage height, 1.29 ft Aug. 30 to Sept. 8.
Maximum stage known since at least 1897, 10.39 ft Apr. 21, 1950, from floodmarks (discharge, 2,790 cfs).

Remarks.--Records fair.

Discharge, in cubic feet per second, July to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							✓145		✓190	366	*4.7	0.6
2										436	3.6	.6
3										400	3.1	.6
4										225	1.8	.6
5							✓199			144	.9	.6
6										41	.3	1.1
7							✓434			84	.1	*2.6
8										68	.9	1.5
9										57	2.2	4.1
10										49	2.6	3.6
11										43	6.0	4.1
12										40	6.6	3.6
13										36	3.6	2.6
14							✓195			33	2.6	2.2
15										32	3.1	2.2
16										32	2.6	1.5
17										33	2.2	1.5
18								✓39		36	1.1	1.5
19										38	.4	1.5
20							✓103			33	.1	1.5
21										32	.1	1.1
22										29	.1	*2.6
23										28	.1	1.5
24										26	.1	.6
25										24	1.1	.3
26										19	1.8	.1
27										18	1.1	.1
28										16	1.5	.3
29									✓399	15	1.1	.6
30					---					14	1.1	.3
31	✓16	---			---		---		---	8.6	.6	---
Total										2,455.6	57.2	45.6
Mean										79.2	1.85	1.52
Ac-ft										4,870	113	90

* Discharge measurement made on this day.
✓ Result of discharge measurement.

5-0782. Lost River at Oklee, Minn.--Continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.3	11	8.4	4.5	0.5	0.5	50	113	29	0.6	2.6	0.1
2	.3	11	8.2	4.0	.5	.5	43	93	28	.6	*2.2	.1
3	.4	12	8.0	4.0	.5	.6	40	78	27	.6	2.6	.1
4	.4	11	7.8	3.5	.5	1.0	*32	72	25	.6	9.3	.1
5	.4	11	7.8	3.0	.5	5.0	32	64	20	.4	1.8	.1
6	.4	11	8.0	3.0	.4	8.0	32	66	18	.3	1.5	.1
7	.3	10	8.0	3.0	.4	7.5	31	89	17	.1	1.8	.1
8	.3	10	8.0	2.5	.4	7.0	30	97	17	.1	2.2	.1
9	.3	7.3	8.0	2.5	.4	7.5	30	*90	18	.1	2.2	.1
10	.3	6.0	8.0	2.5	.4	8.0	29	74	19	.1	1.8	.3
11	.3	6.0	8.0	2.5	.3	8.5	*28	76	18	.1	1.5	6.0
12	.3	6.6	8.0	2.0	.3	9.0	28	72	12	.1	.9	16
13	.3	6.6	8.0	2.0	.3	10	28	70	9.3	.1	.3	24
14	.4	7.3	*8.0	2.0	.3	*10	32	79	8.6	.6	.1	32
15	1.6	*8.6	8.0	1.5	.3	12	35	92	8.6	.1	*.1	41
16	1.1	7.9	8.0	1.5	*.3	18	44	92	7.9	.1	.1	42
17	1.1	7.9	8.0	1.2	.3	20	106	93	6.6	.1	.1	35
18	*.9	7.9	7.8	*1.1	.3	22	66	95	5.3	*2.2	1.1	*26
19	4.7	7.9	7.8	1.0	.3	28	*92	88	3.6	1.5	.6	22
20	4.7	8.6	7.8	1.0	.3	*28	182	74	*1.8	1.5	.4	18
21	4.7	8.6	7.5	1.0	.3	32	253	67	3.1	1.8	.4	19
22	4.7	8.6	7.5	1.0	.4	38	276	53	2.6	4.1	.4	27
23	4.7	8.6	7.0	.8	.4	55	277	48	2.6	6.0	.4	32
24	4.7	9.3	6.5	.8	.4	65	263	48	2.2	6.6	.4	33
25	4.7	9.3	6.5	.8	.4	80	243	43	1.8	6.6	.3	28
26	6.0	9.3	6.0	.8	.5	90	244	38	1.5	6.6	.3	25
27	7.3	9.0	5.5	.6	.5	110	232	34	1.5	5.3	.3	22
28	7.3	9.0	5.5	.6	.5	100	200	32	1.1	4.1	.3	19
29	8.6	8.8	5.0	.5	-	*100	170	30	.9	4.1	.1	16
30	9.3	8.6	5.0	.5	--------	70	140	28	.9	3.1	.1	14
31	10	--------	5.0	.5	--------	55	--------	28	--------	3.6	.1	--------
Total	90.8	264.7	226.6	56.2	10.9	1,006.1	3,288	2,116	317.9	61.8	36.3	498.2
Mean	2.93	8.82	7.31	1.81	0.39	32.5	110	68.3	10.6	1.99	1.17	16.6
Ac-ft	180	525	449	111	22	2,000	6,520	4,200	631	123	72	988

Calendar year 1960: Max
Water year 1960-61: Max 277 Min. 0.1 Mean 21.8 Ac-ft 15,820

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 27 to Mar. 31.

5-0785. 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 1961. 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.--35 years, 272 cfs (196,900 acre-ft per year).

Extremes.--Maximum discharge during year, 884 cfs Apr. 26 (gage height, 3.97 ft); minimum, 3.1 cfs June 10 (gage height, 1.41 ft).

1909-17, 1934-61: 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 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.5	9.2	2.5	200
1.7	30	3.0	368
2.0	80	4.0	902

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	38	87	45	40	25	34	332	654	164	27	44	29
2	38	93	35	40	25	36	344	534	156	24	43	31
3	38	100	25	40	25	40	278	479	152	22	40	30
4	37	100	45	40	25	40	*249	426	144	20	36	29
5	38	95	65	40	25	45	243	390	135	21	33	28
6	36	89	70	38	25	45	215	381	125	22	29	29
7	36	*87	70	38	25	45	215	408	114	21	27	31
8	36	84	65	38	25	50	210	431	109	20	27	36
9	36	72	65	38	25	45	214	403	107	18	27	46
10	34	70	65	38	25	48	222	399	82	19	28	68
11	34	60	65	36	26	50	*170	368	95	19	23	82
12	38	75	62	34	26	50	169	340	87	24	20	104
13	44	70	*64	36	26	55	166	324	58	27	19	116
14	44	75	60	36	26	60	166	317	*60	29	17	123
15	47	80	55	34	26	70	150	360	60	30	*17	137
16	50	72	55	34	26	*90	110	403	57	36	17	174
17	54	72	60	32	26	100	116	450	54	72	19	169
18	54	80	60	30	26	110	184	*464	50	82	24	*154
19	*55	82	60	30	26	140	*302	464	46	*78	21	149
20	55	75	55	*30	26	160	421	445	43	74	19	142
21	54	76	50	28	*26	170	632	421	40	76	19	139
22	50	85	45	26	28	190	766	386	38	80	30	139
23	50	76	40	28	30	220	783	348	34	68	37	149
24	49	80	42	28	30	250	772	317	33	60	37	164
25	43	78	45	26	30	300	812	288	33	54	37	159
26	41	60	50	26	32	386	878	265	30	52	36	152
27	44	70	45	26	32	*440	842	240	29	50	34	139
28	43	68	45	26	34	421	801	217	27	49	33	125
29	49	64	40	25	-	399	754	203	26	44	31	118
30	68	60	38	25	--------	454	670	184	26	44	30	118
31	76	--------	35	25	--------	364	--------	174	--------	44	29	--------
Total	1,409	2,335	1,621	1,011	752	4,907	12,186	11,483	2,214	1,306	883	3,109
Mean	45.5	77.8	52.3	32.6	26.9	158	406	370	73.8	42.1	28.5	104
Ac-ft	2,790	4,630	3,220	2,010	1,490	9,730	24,170	22,780	4,390	2,590	1,750	6,170

Calendar year 1960: Max 1,600 Min 24 Mean 177 Ac-ft 128,500
Water year 1960-61: Max 878 Min 17 Mean 118 Ac-ft 85,720

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 9 to Mar. 25, Apr. 6-8, 11, 15, 16 (no gage-height record Jan. 26 to Feb. 20, Feb. 22 to Mar. 7, Mar. 10, 11).

5-0790. 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 1961. 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.--60 years, 964 cfs (697,900 acre-ft per year).

Extremes.--Maximum discharge during year, 1,450 cfs Mar. 27 (gage height, 5.67 ft); minimum, 28 cfs Aug. 17 (gage height, 2.50 ft).
1901-61: 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 period of ice effect, which are fair. Diurnal fluctuation caused by powerplant upstream).

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 2 to May 23)

2.5	25	4.0	567
2.8	109	5.0	1,030
3.0	177	6.0	1,620

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	50	243	125	45	74	60	757	926	254	90	72	48
2	50	224	75	45	74	75	676	831	202	142	70	45
3	50	224	70	55	72	75	784	752	195	109	70	42
4	48	224	50	60	72	75	*614	685	170	81	61	45
5	48	217	70	55	74	90	462	606	163	61	56	48
6	48	213	140	55	74	110	390	601	152	50	53	53
7	48	*206	100	65	76	120	406	597	129	42	45	53
8	45	209	90	65	74	130	430	628	119	42	42	50
9	61	174	100	55	74	140	390	619	119	38	38	67
10	64	109	85	65	74	150	390	623	119	35	48	135
11	72	142	85	70	72	150	379	597	109	40	50	213
12	70	156	95	70	72	150	333	567	94	58	40	191
13	72	156	*84	65	70	160	310	533	94	78	38	213
14	87	156	70	60	70	160	257	550	*87	109	35	239
15	78	213	70	65	70	190	291	538	64	78	35	232
16	90	184	65	65	70	200	246	563	61	70	30	235
17	163	126	64	65	70	228	265	606	61	87	35	272
18	170	156	64	65	68	239	213	*672	61	106	35	246
19	*174	202	64	65	70	250	287	680	53	129	42	235
20	166	174	75	*65	72	*268	446	667	50	122	40	217
21	166	163	75	66	*70	287	*827	650	50	142	45	209
22	166	166	65	68	65	340	1,230	588	56	129	58	283
23	166	146	50	72	64	517	1,300	538	45	122	56	336
24	163	166	45	70	62	698	1,240	504	45	116	*56	317
25	163	184	45	70	54	897	1,170	471	42	103	64	*321
26	160	199	40	70	52	1,170	1,210	394	40	112	67	254
27	163	142	70	72	52	*1,310	1,230	394	38	122	67	265
28	163	152	55	72	52	1,110	1,180	371	38	*109	81	246
29	174	116	45	72	-	1,010	1,110	336	38	109	81	224
30	228	65	45	74	---------	1,090	1,020	306	*40	81	67	209
31	217	---------	45	74	---------	1,120	---------	265	---------	70	58	---------
Total	3,583	5,207	2,221	2,000	1,913	12,569	19,843	17,658	2,788	2,782	1,635	5,543
Mean	116	174	71.6	64.5	68.3	405	661	570	92.9	89.7	52.7	185
Ac-ft	7,110	10,330	4,410	3,970	3,790	24,930	39,360	35,020	5,530	5,520	3,240	10,990

Calendar year 1960: Max 5,050 Min 35 Mean 453 Ac-ft 328,600
Water year 1960-61: Max 1,310 Min 30 Mean 213 Ac-ft 154,200

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 30 to Mar. 16.

5-0825. 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 (revised) in closed basins.

Records available.--April 1882 to September 1961. 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 at 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.--79 years, 2,267 cfs (1,641,000 acre-ft per year).

Extremes.--Maximum discharge during year, 3,400 cfs Mar. 28 (gage height, 9.75 ft); minimum, 110 cfs Sept. 8 (gage height, 1.50 ft).

1882-1961: 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. Flow regulated by many lakes and reservoirs on tributaries.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second

1.5	106	6.0	1,560
2.2	225	8.0	2,500
3.0	425	10.0	3,540
4.0	750		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	322	560	260	280	280	*420	2,660	2,520	*1,470	518	348	156
2	315	*560	*260	290	280	450	2,200	2,400	1,380	518	350	146
3	312	596	270	290	280	500	*2,020	2,300	1,280	518	352	135
4	302	589	300	290	280	530	1,950	2,160	1,190	503	335	135
5	275	592	360	290	290	560	1,870	2,020	1,120	464	318	119
6	270	603	360	290	290	630	1,680	1,950	1,070	392	290	122
7	278	603	300	300	290	770	1,560	1,880	1,030	338	261	119
8	272	572	280	300	290	970	1,440	1,840	999	305	253	123
9	278	560	290	300	300	1,180	1,380	1,840	975	275	241	119
10	280	430	310	300	300	*1,360	1,350	1,870	967	298	229	145
11	298	380	350	310	300	1,500	1,300	1,880	991	345	215	199
12	308	390	380	310	310	1,600	1,260	1,880	1,170	362	209	233
13	310	440	380	320	320	*1,650	1,210	1,860	1,180	365	201	350
14	308	*470	370	320	330	1,650	1,160	1,790	1,060	407	197	458
15	310	500	370	310	340	1,620	1,120	1,780	967	440	194	446
16	308	470	360	310	340	1,600	1,060	1,920	891	437	190	407
17	315	420	350	310	340	1,580	1,070	2,200	830	428	190	392
18	312	380	340	300	340	1,660	1,060	2,600	785	401	*201	401
19	358	420	340	300	340	1,740	1,050	2,840	760	377	194	434
20	383	480	340	310	340	*1,760	1,020	2,880	729	380	181	458
21	392	500	340	310	350	1,800	1,100	2,840	712	419	182	467
22	392	490	330	310	350	1,900	1,310	2,750	701	437	182	449
23	392	*420	320	300	360	2,000	1,840	2,620	666	437	173	461
24	401	360	310	300	370	2,100	2,240	2,460	638	434	165	503
25	377	380	300	290	350	2,300	2,390	2,300	631	416	156	542
26	389	440	290	290	370	2,800	2,420	2,140	614	383	158	536
27	380	420	290	280	390	*3,240	2,480	2,010	563	362	153	533
28	374	420	270	270	400	3,320	*2,580	1,870	497	360	155	503
29	395	410	270	270	-	3,050	2,610	1,760	467	383	165	479
30	494	300	*270	280	--------	2,940	2,600	1,660	*488	368	161	*467
31	*539	--------	270	*280	--------	2,810	--------	1,560	--------	*358	*163	--------
Total	10,639	14,155	9,830	9,210	9,120	51,990	50,990	66,380	26,821	12,428	6,762	10,037
Mean	343	472	317	297	326	1,677	1,700	2,141	894	401	218	335
Ac-ft	21,100	28,080	19,500	18,270	18,090	103,100	101,100	131,700	53,200	24,650	13,410	19,910

Calendar year 1960: Max 17,000 Min 230 Mean 1,654 Ac-ft 1,201,000
Water year 1960-61: Max 3,320 Min 119 Mean 763 Ac-ft 548,500

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 10 to Mar. 26.

5-0875. 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 1961.

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.--10 years (1951-61) 24.4 cfs (17,660 acre-ft per year).

Extremes.--Maximum discharge during year, 135 cfs Mar. 27 (gage height, 6.77 ft, backwater from ice); no flow June 19 to Sept. 25.

1945, 1950-61: Maximum discharge, 1,390 cfs July 11, 1956 (gage height, 13.18 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 poor.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 9)

Oct. 1 to Apr. 13		Apr. 14 to Sept. 30			
0.8	0	0.8	0	1.5	6.0
.9	.2	.9	.1	1.7	9.5
1.0	.7	1.0	.4	2.0	18
1.1	1.5	1.1	1.1	3.0	59
1.2	2.7	1.2	2.1		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.1	1.1	0.5	0.5	0.1	0.3	80	18	3.6			0
2	.1	.8	*.5	.5	*.1	.3	70	17	3.3			0
3	.1	.6	.5	.4	.1	.3	60	17	3.2			0
4	.1	.5	.5	.4	.1	.3	50	16	2.9			0
5	.1	.4	.6	.4	.1	.3	40	14	2.2			0
6	.1	.4	.6	.4	.1	.3	30	14	1.8			0
7	.1	.3	.6	.4	.1	.4	*28	13	1.4			0
8	.1	.1	.6	.4	.1	.4	28	12	1.1			0
9	.1	.2	.6	.4	.1	.4	24	11	1.0			0
10	.1	.2	.6	.4	.2	.4	22	16	.8			0
11	.1	.2	.6	.4	.2	.4	20	17	.6			0
12	.1	.2	.6	.4	.2	.4	18	16	.4			0
13	.2	.2	.6	.4	.2	.5	20	15	.3			0
14	.2	.3	.6	.4	.2	.5	*18	14	.2			0
15	.2	.4	.7	.4	.2	.5	18	13	.1			0
16	.2	.4	.7	.4	.2	.5	15	11	.1			0
17	.2	.3	.7	.4	.2	.6	15	11	.1			0
18	.2	.2	.6	.3	.2	.8	14	10	.1			0
19	.2	.2	.6	.3	.2	1.0	13	9.5	0			0
20	.3	.3	.6	.3	.2	1.2	13	8.7	0			0
21	.3	.4	.6	.3	.2	1.5	13	7.9	0			0
22	.5	.4	.6	.2	.3	6.0	19	7.1	0			0
23	.5	.3	.6	.2	*.3	10	24	6.6	0			0
24	.5	.4	.6	.2	.3	*12	28	6.1	0			0
25	.2	.6	.5	.2	.3	50	28	5.5	0	(*)		0
26	*.2	1.2	.5	.2	.3	100	*27	5.5	0			9.5
27	.3	.6	.5	.2	.3	130	24	5.0	*0			11
28	.3	.5	.5	.2	.3	110	22	4.6	0		(*)	*9.5
29	.5	.5	.5	.2	-	100	20	4.3	0			7.4
30	2.2	.5	*.5	.2	---	*95	18	4.1	0			6.6
31	1.4	---	.5	.1	---	90	---	*3.8	---			---
Total	9.8	12.7	17.8	10.1	5.4	714.3	819	333.7	23.2	0	0	44.0
Mean	0.32	0.42	0.57	0.33	0.19	23.0	27.3	10.8	0.77	0	0	1.47
Ac-ft	19	25	35	20	11	1,420	1,620	662	46	0	0	87

Calendar year 1960: Max 830 Min 0 Mean 34.9 Ac-ft 25,350
Water year 1960-61: Max 130 Min 0 Mean 5.45 Ac-ft 3,940

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 10 to Apr. 13, Apr. 15, 16 (no gage-height record Jan. 9-30, Apr. 1).

5-0920. 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, revised, in closed basins).

Records available.--April 1936 to June 1937, April 1941 to September 1961 (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.--12 years (1949-61), 3,018 cfs (2,185,000 acre-ft per year); median of yearly mean discharges, 2,360 cfs (1,710,000 acre-ft per year).

Extremes.--Maximum discharge during year, 3,600 cfs Mar. 31 (gage height, 33.71 ft, backwater from ice); minimum, 124 cfs, Sept. 5 (gage height, 3.26 ft).
1936-37, 1941-61: Maximum discharge, 86,500 cfs May 12, 1950 (gage height, 41.58 ft, site and datum then in use); minimum observed, 7.7 cfs Oct. 16, 1936 (gage height, 1.75 ft, site and datum then in use.
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 periods of ice effect or no gage-height record, which are poor. Some regulation by reservoirs on tributaries.

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 12		Apr. 13 to Sept. 30	
3.6	272	3.2	104
4.0	512	3.5	215
5.0	1,170	4.0	471
8.0	3,150	5.0	1,110
9.0	3,860	8.0	3,180

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	392	472	*360	330	300	400	3,400	2,790	1,800	557	436	a155
2	386	504	360	320	300	410	3,300	2,770	1,700	538	430	a155
3	*369	526	370	310	a300	*420	3,100	2,690	1,590	557	419	a145
4	351	556	340	310	a300	420	*2,900	2,580	1,500	564	396	a135
5	345	582	320	320	300	450	2,800	2,460	1,410	570	396	124
6	340	601	310	330	300	490	2,700	2,360	1,320	557	386	a125
7	317	601	330	340	310	540	2,550	2,230	1,230	526	369	a140
8	289	608	350	340	310	600	2,400	2,140	1,190	483	348	*175
9	278	590	370	340	320	650	2,250	*2,040	1,150	419	327	164
10	283	580	370	340	320	760	*2,100	1,980	1,110	386	296	153
11	289	560	350	340	320	940	1,700	1,990	1,070	386	*282	179
12	294	550	330	350	330	1,100	1,650	2,010	1,050	369	272	171
13	308	540	340	360	330	1,400	*1,570	2,030	*1,070	380	245	179
14	317	a530	370	360	330	1,600	1,520	2,020	1,190	*448	236	236
15	a310	a520	390	370	330	*1,650	1,460	1,990	1,230	459	228	317
16	a310	520	*400	380	340	1,700	1,370	1,950	1,150	454	215	471
17	a310	500	390	*380	340	1,700	1,280	1,980	1,050	477	211	538
18	*317	500	380	380	340	1,750	1,250	2,170	989	489	a210	538
19	306	450	380	370	350	1,800	1,270	2,480	918	483	a220	520
20	306	420	380	370	350	*1,850	1,310	2,800	861	465	a210	538
21	306	400	380	360	360	2,000	1,330	3,000	829	448	a205	545
22	357	*380	370	350	360	2,100	1,340	3,050	810	454	a200	570
23	386	380	360	340	370	*2,200	1,420	3,020	784	465	a190	576
24	380	400	360	a330	370	2,300	1,650	2,930	765	477	a185	557
25	380	400	350	a320	370	2,500	2,100	2,800	734	477	a180	545
26	392	400	340	310	380	2,900	2,450	2,630	702	477	a175	557
27	392	420	340	a300	390	3,200	2,580	2,460	683	483	a170	620
28	392	420	340	a300	400	3,400	2,650	2,300	671	459	a165	639
29	392	400	340	a300	-	*3,450	2,710	2,100	639	442	a160	645
30	441	380	340	a300	---------	3,450	2,790	1,990	595	442	a160	633
31	466	---------	340	300	---------	3,550	---------	1,890	---------	442	156	---------
Total	10,701	14,690	11,050	10,450	9,420	51,680	62,900	73,630	31,790	14,633	8,078	11,045
Mean	345	490	356	337	336	1,667	2,097	2,375	1,060	472	261	368
Ac-ft	21,230	29,140	21,920	20,730	18,680	102,500	124,800	146,000	63,050	29,020	16,020	21,910

Calendar year 1960:	Max	24,600	Min	278	Mean	2,181	Ac-ft	1,583,000
Water year 1960-61:	Max	3,550	Min	124	Mean	849	Ac-ft	615,000

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 9 to Apr. 12.

5-0940. 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 1961. 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 930.46 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 same datum.

Average discharge.--20 years (1928-36, 1941-43, 1945-47, 1953-61), 62.7 cfs (45,390 acre-ft per year).

Extremes.--Maximum discharge during year, 451 cfs Mar. 26 (gage height, 4.86 ft, backwater from ice); minimum, 0.1 cfs Sept. 1 (gage height, 1.58 ft).
1928-37, 1941-47, 1953-61: Maximum discharge, 2,650 cfs Apr. 24, 1956 (gage height, 10.79 ft); no flow at times during 1937, 1941, 1960.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are poor. Flow partly regulated since 1937 by Bronson Lake (usable capacity, 3,700 acre-ft).

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 8, Sept. 20-30)

Oct. 1 to Mar. 15				Mar. 16 to Sept. 30			
1.6	0.9	2.1	8.5	1.6	0.2	2.2	11
1.7	1.4	2.3	19	1.7	.4	2.4	23
1.8	2.1	2.6	46	1.8	.8	2.7	50
1.9	3.1			1.9	1.7	3.0	93
2.0	4.8			2.0	3.6	3.5	188
				2.1	6.4		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.2	1.9	*2.1	1.5	1.4	14	6.1	29	4.9	0.9	1.2	0.3
2	1.2	1.7	2.0	1.5	1.4	12	6.4	28	5.8	.6	1.0	.6
3	1.2	1.8	2.0	1.5	1.4	10	11	27	5.5	.8	1.0	.7
4	1.2	1.7	1.8	1.5	1.4	9.0	20	25	5.5	.9	1.0	.6
5	1.2	1.7	2.0	1.5	1.4	8.0	24	23	5.5	.7	.7	.5
6	1.4	1.9	1.8	1.5	1.4	7.0	25	23	4.9	.6	.7	.7
7	15	1.7	1.8	1.5	1.4	6.0	26	21	4.4	.8	.8	.7
8	23	1.4	1.8	1.5	1.4	5.5	26	20	4.7	.7	.7	1.5
9	1.0	1.4	1.8	1.5	1.4	4.5	26	19	4.4	.5	.8	.8
10	1.2	1.4	1.7	1.5	1.4	4.0	26	19	4.1	.5	.9	1.0
11	1.6	2.2	1.7	1.5	6.0	3.5	26	19	3.6	114	1.0	1.2
12	1.8	2.2	1.7	1.5	35	3.0	21	18	3.6	1.6	1.0	.8
13	1.9	2.2	1.7	1.4	28	2.5	19	16	2.8	.9	.9	.8
14	1.9	2.3	1.6	1.4	22	2.5	*20	16	2.2	.8	.7	.6
15	1.9	2.4	1.6	1.4	16	2.0	19	14	2.0	.8	56	.5
16	1.9	2.4	1.6	1.4	10	a2.0	17	13	1.4	.6	4.5	.6
17	1.9	2.2	1.6	1.4	5.5	a1.8	16	13	2.2	.6	1.3	.6
18	1.9	2.2	1.6	1.4	3.0	a1.8	16	11	2.0	.6	1.0	.6
19	1.8	2.2	1.6	1.4	2.5	a1.6	17	11	2.2	.5	.8	.8
20	1.8	2.2	1.6	1.4	10	a1.6	21	9.1	1.7	.5	.6	.9
21	1.8	2.2	1.6	1.4	40	a1.5	26	8.7	2.2	.6	a.6	.8
22	1.9	2.2	1.5	1.4	38	*1.4	30	7.9	1.3	1.0	a.6	.8
23	1.7	2.2	1.5	1.4	*35	a1.4	35	7.5	1.0	1.0	a.6	.7
24	1.8	2.2	1.5	1.4	32	1.2	*33	6.7	.7	*.6	a.5	.9
25	1.7	2.2	1.5	1.4	28	a1.2	32	5.8	.6	.5	a.5	.6
26	*1.6	2.2	1.5	1.4	20	160	32	4.9	.4	.5	a.4	.7
27	1.7	2.2	1.5	1.4	18	300	31	4.7	*.4	.5	a.4	*.7
28	1.6	2.2	1.5	1.4	15	170	29	4.1	.7	.4	*.4	.8
29	1.9	2.1	1.5	1.4	-	75	29	3.6	.7	.6	.5	.9
30	2.4	2.1	*1.5	1.4	--------	*6.7	29	3.6	.7	4.4	.4	1.0
31	1.9	--------	1.5	*1.4	--------	6.4	--------	*3.9	--------	1.4	.5	--------
Total	86.0	60.9	51.7	44.6	378.0	827.1	694.5	435.5	82.1	139.4	82.0	22.7
Mean	2.77	2.03	1.67	1.44	13.5	26.7	23.2	14.0	2.74	4.50	2.65	0.76
Ac-ft	171	121	103	88	750	1,640	1,380	864	163	276	163	45

Calendar year 1960: Max 1,230 Min 0 Mean 56.1 Ac-ft 40,770
Water year 1960-61: Max 300 Min 0.3 Mean 7.96 Ac-ft 5,760

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 9 to Mar. 15, Mar. 26-29.

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 1961.

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

Average discharge.--15 years, 119 cfs (86,150 acre-ft per year).

Extremes.--Maximum discharge during year, 610 cfs Mar. 25 (gage height, 8.43 ft, backwater from ice); no flow July 23 to Sept. 8.

1946-61: 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 shifting control, which are fair, and those for periods of ice effect, no gage-height record, or indefinite stage discharge relation, which are poor.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.8	4.4	3.4	4.6	2.3	4.4	113	174	*30	0.4		0
2	.8	4.4	*3.3	4.4	2.2	4.6	115	152	34	.4		0
3	.8	4.4	3.2	4.4	2.2	4.6	120	134	35	.3		0
4	.8	4.2	3.2	4.4	2.2	4.4	95	122	28	.3		0
5	.8	4.4	3.8	4.4	2.2	4.6	*70	113	23	.2		0
6	.9	3.9	4.0	4.6	2.2	4.8	56	109	20	.2		0
7	.9	3.7	4.2	4.6	2.2	4.8	61	116	18	.1		0
8	.9	3.4	4.2	4.8	2.4	5.0	60	162	14	.1		0
9	1.0	3.1	4.4	4.8	2.4	5.0	58	158	11	.1		.5
10	1.0	2.8	4.4	4.8	2.4	5.2	58	155	10	.1		2.0
11	1.1	2.8	4.4	4.6	2.4	5.2	45	152	10	.1		5.0
12	1.3	3.0	4.4	4.6	2.4	5.2	*49	144	8.5	.1		12
13	2.1	3.2	4.6	4.6	2.4	5.4	50	139	6.4	.1		40
14	2.4	3.4	4.8	4.4	2.4	5.4	54	124	5.4	.1		45
15	2.6	3.6	5.0	4.4	2.4	5.4	27	122	4.6	.1		50
16	3.0	3.7	5.0	4.4	2.4	5.4	32	113	4.8	.1		60
17	3.0	3.6	5.0	4.2	2.6	5.6	50	102	4.2	.1		75
18	3.0	3.6	5.0	4.2	2.6	5.8	66	88	3.9	.1		70
19	3.1	3.7	4.8	4.0	2.8	6.0	116	84	2.8	.1		65
20	3.2	3.9	4.8	4.0	3.0	6.2	211	82	2.1	.2		60
21	3.2	4.1	4.8	3.8	3.2	6.8	308	74	1.6	.1		65
22	3.2	3.9	4.8	3.6	3.4	100	350	66	1.2	.1		70
23	3.1	3.9	4.8	3.4	3.6	*280	354	56	.7	0		85
24	3.1	3.9	4.8	3.0	*3.8	400	328	51	.5	0		95
25	*4.7	4.2	4.8	2.8	4.0	580	*292	45	.4	*0		85
26	3.2	4.4	4.8	2.6	4.2	550	258	40	.5	0		80
27	3.1	4.2	4.7	2.6	4.2	380	243	35	.4	0		75
28	3.1	4.1	*4.7	2.6	4.2	*232	215	36	*.5	0		*75
29	3.2	3.9	4.6	2.5	-	265	211	34	.5	0	(*)	70
30	4.1	3.6	4.6	2.4	--------	211	191	33	.4	0		68
31	4.2	--------	4.6	*2.3	--------	139	--------	30	--------	0		--------
Total	71.7	113.4	137.9	120.8	78.7	3,246.8	4,256	3,045	282.4	3.5	0	1,252.5
Mean	2.31	3.78	4.45	3.90	2.81	105	142	98.2	9.41	0.11	0	41.8
Ac-ft	142	225	274	240	156	6,440	8,440	6,040	560	6.9	0	2,480

Calendar year 1960: Max 960 Min 0.6 Mean 69.1 Ac-ft 50,170
Water year 1960-61: Max 580 Min 0 Mean 34.5 Ac-ft 25,000

* Discharge measurement or observation of no flow made on this day.

Note.--Shifting-control method used Oct. 1 to Nov. 29, May 21 to June 1, June 23-28. Stage-discharge relation affected by ice Nov. 29 to Mar. 27. No gage-height record Apr. 2, June 29 to July 24. Stage-discharge relation indefinite July 25 to Sept. 30.

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 1961 (winter records incomplete prior to 1941). Monthly discharge only for some periods, published in WSP 1308. 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.--22 years (1928-29, 1940-61) 56.4 cfs (40,830 acre-ft per year).

Extremes.--Maximum discharge during year, 115 cfs Mar. 24 (gage height, 5.71 ft, backwater from ice); no flow Aug. 8 to Sept. 1.
1928-61: 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 State under agreement with Canada.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Nov. 30		Dec. 1 to Sept. 30			
2.3	1.6	1.7	0	2.6	6.9
2.5	3.7	1.8	0.1	2.9	16
2.7	7.4	2.0	.3	3.2	28
3.0	17	2.1	.7	3.5	52
3.2	28	2.2	1.3	4.0	86
		2.4	3.4	5.0	146

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.8	28	*4.6	1.8	0.8	1.9	20	62	23	0.8	0.3	0
2	1.8	27	3.9	1.6	.8	1.9	17	57	*26	.6	.2	.2
3	1.6	24	4.4	1.5	.8	1.9	16	54	31	.5	.1	.3
4	1.7	23	4.2	1.4	.7	1.9	17	54	28	.4	.8	.2
5	5.3	21	4.0	1.4	.7	1.9	15	54	23	.4	1.1	.1
6	2.1	21	4.0	1.5	.8	2.0	*14	58	22	.4	.3	.5
7	1.9	21	4.0	1.5	.8	2.0	14	70	21	.3	.1	.4
8	1.8	20	4.0	1.5	.9	2.0	15	77	17	.2	0	.5
9	1.8	18	3.8	1.5	1.0	2.0	17	79	15	.1	0	.4
10	1.7	17	3.6	1.5	1.1	2.0	18	77	14	.2	0	1.2
11	1.7	14	3.2	1.4	1.2	2.1	17	75	12	.1	0	2.4
12	3.2	13	3.0	1.4	1.3	2.1	*16	73	11	.3	0	2.1
13	3.6	13	2.8	1.4	1.4	2.1	16	70	9.6	.6	0	1.7
14	2.8	13	2.8	1.4	1.4	2.2	16	68	7.9	1.0	0	1.3
15	2.8	13	2.8	1.3	1.5	2.2	16	65	7.4	1.3	0	1.7
16	3.2	14	2.8	1.3	1.5	2.6	18	61	6.3	1.1	0	.9
17	2.8	12	2.6	1.4	1.5	3.4	20	58	5.3	.9	0	.7
18	2.5	12	2.6	1.3	1.6	2.5	34	54	4.9	2.6	0	.6
19	2.6	12	2.6	1.2	1.6	2.5	47	50	3.7	.8	0	.8
20	2.6	9.7	2.4	1.1	1.6	4.5	52	47	3.2	.5	0	1.1
21	3.0	10	2.2	1.0	1.7	15	65	46	3.1	.4	0	3.1
22	4.5	8.4	2.2	1.0	1.8	20	68	43	2.6	.5	0	3.6
23	5.7	8.4	2.0	1.0	1.9	*40	61	40	3.3	2.7	0	2.7
24	6.1	8.4	2.0	.9	*1.9	80	57	38	3.1	*2.3	0	2.4
25	*5.9	7.6	2.0	.9	1.9	90	*55	34	1.8	1.3	0	1.9
26	5.3	7.4	2.0	.9	1.9	100	56	31	1.4	1.0	0	1.4
27	5.7	6.6	*2.0	.8	1.9	35	61	28	1.1	.6	0	1.2
28	5.3	5.5	1.9	.8	1.9	30	68	26	*1.0	.6	0	*.9
29	5.1	4.9	1.9	.8	-	*35	73	24	.9	.2	*0	.9
30	13	4.8	1.8	*.8	--------	25	68	23	.9	.1	0	.8
31	28	--------	1.8	.8	--------	25	--------	22	--------	.1	0	--------
Total	136.9	417.7	89.9	38.1	37.9	540.7	1,047	1,618	310.5	22.9	2.9	36.0
Mean	4.42	13.9	2.90	1.23	1.35	17.4	34.9	52.2	10.4	0.74	0.09	1.20
Ac-ft	272	828	178	76	75	1,070	2,080	3,210	616	45	5.8	71

Calendar year 1960: Max 696 Min 1.4 Mean 41.5 Ac-ft 30,150
Water year 1960-61: Max 100 Min 0 Mean 11.8 Ac-ft 8,530

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Dec. 1 to Mar. 5, Mar. 20 to Apr. 1.

GPO 823486-5

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, 3 3/4 miles downstream from Sprague Creek, and 7 miles northwest of Roseau.

Records available.--November 1939 to September 1961 (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, 1,028.43 ft Mar. 25; minimum observed, 1,019.97 ft Aug. 30.
1939-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	60.69					-	25.38	24.16	21.49	20.31	20.51	19.99
2	20.73					-	25.25	23.87	21.69	20.29	20.47	20.05
3	20.75					-	25.03	23.62	21.61	20.23	20.45	20.19
4	20.77					-	24.48	23.43	21.57	20.37	20.43	20.29
5	20.77					-	23.62	23.24	21.52	30.43	20.41	20.45
6	20.81					-	23.18	23.17	21.33	20.41	20.39	20.59
7	20.85					-	22.92	23.27	21.23	20.35	20.37	20.69
8	20.83					-	22.93	23.58	21.09	20.33	20.37	20.81
9	20.81					-	22.60	23.89	21.01	20.27	20.35	20.83
10	20.85					-	22.49	23.89	20.89	20.25	20.33	20.89
11	20.85					-	22.21	23.81	20.79	20.19	20.31	20.93
12	20.87					-	22.13	23.74	20.75	20.21	20.27	20.95
13	20.99					-	22.06	23.65	20.71	20.27	20.23	21.17
14	21.09					-	22.03	23.57	20.63	20.27	20.19	21.63
15	21.15					-	22.10	23.46	20.59	20.29	20.17	21.91
16	21.07					-	22.20	23.32	20.57	20.39	20.13	21.97
17	21.07					-	22.09	23.11	20.53	20.37	20.11	22.01
18	21.05					-	22.19	22.92	20.55	20.37	20.09	22.35
19	21.01					-	22.93	22.74	20.57	20.41	20.01	22.37
20	20.99					-	23.93	22.60	20.57	20.45	20.05	22.27
21	20.99					-	24.81	22.49	20.55	20.45	20.03	22.17
22	21.07					-	25.41	22.39	20.55	20.45	20.03	22.11
23	21.19					24.21	25.58	22.29	20.53	20.47	20.01	22.25
24	21.21					27.28	25.47	22.18	20.53	20.57	19.99	22.73
25	21.17					28.40	25.14	22.09	20.53	20.65	19.99	23.05
26	21.13					28.37	24.92	21.94	20.51	20.67	19.99	22.97
27	21.07					27.99	24.68	21.78	20.45	20.75	19.99	22.82
28	21.01					27.34	24.52	21.69	20.41	20.67	19.99	22.63
29	20.95				-	26.72	24.44	21.61	20.37	20.65	19.99	22.43
30	20.99				---------	26.33	24.37	21.55	20.31	20.63	19.97	22.35
31	21.39	---------			---------	25.91	---------	21.49	---------	20.57	19.99	---------

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 two-thirds mile downstream from Pine Creek.

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

Records available.--July 1928 to September 1961.

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.--33 years, 222 cfs (160,700 acre-ft per year).

Extremes.--Maximum discharge during year, 570 cfs Mar. 25 (gage height, 8.91 ft, backwater from ice); no flow Aug. 29, 30.

1928-61: Maximum discharge, 6,560 cfs May 12, 1950 (gage height, 18.25 ft); minimum, that of 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 fair prior to Apr. 5, good thereafter. High flow regulated by natural storage in Roseau Lake.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting control method used Oct. 4 to Nov. 8, June 6 to July 6, Sept. 25-30)

0.04	0	0.7	9.5	3.0	111
.1	.2	1.0	17	5.0	308
.2	1.4	1.5	32	7.0	576
.4	4.2	2.0	53		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.0	37	*15	9.4	5.2	8.4	340	300	*75	0.9	3.0	0.4
2	1.1	39	14	9.4	5.0	8.6	320	272	81	.5	2.2	1.3
3	1.4	38	13	9.4	5.0	8.6	310	242	81	.4	1.8	1.4
4	2.0	36	12	9.2	4.8	8.6	280	221	83	.4	2.0	1.6
5	2.4	34	12	9.2	4.8	8.8	240	205	76	1.4	1.3	2.7
6	2.7	34	12	9.2	4.8	9.0	*204	197	65	1.4	1.3	4.4
7	3.3	35	12	9.2	4.8	9.2	178	206	60	.7	1.4	4.4
8	3.4	38	12	9.0	4.8	9.5	180	231	52	.4	1.3	4.2
9	2.7	36	13	9.0	4.8	9.5	152	270	45	.3	1.4	6.6
10	2.8	36	13	9.0	5.0	10	142	271	40	.3	1.4	7.1
11	2.7	36	13	9.0	5.0	11	118	262	33	.3	1.3	8.9
12	2.8	34	12	9.0	5.0	12	111	256	31	.6	.6	10
13	2.8	32	12	9.0	5.4	12	*107	248	30	.4	.4	19
14	4.4	32	12	9.0	5.6	12	105	234	27	.2	.9	46
15	6.7	32	13	9.0	6.0	12	92	219	23	.3	.7	67
16	7.1	32	13	9.2	6.0	12	100	210	19	.4	.6	73
17	6.4	30	12	9.2	6.2	13	108	194	16	.3	.7	79
18	6.0	28	12	9.2	6.2	13	114	173	14	.5	.7	93
19	5.5	28	12	9.2	6.4	14	171	155	11	.6	.7	97
20	5.0	26	12	9.0	6.6	15	263	144	8.9	.9	.5	92
21	4.9	26	12	9.0	7.0	18	369	136	*7.2	1.3	.5	89
22	5.8	24	12	8.8	7.2	26	446	130	8.2	1.4	.3	87
23	8.4	24	11	8.6	*7.6	120	473	123	7.2	1.6	.2	93
24	*12	24	11	8.0	7.8	*410	459	112	7.1	*2.3	.1	117
25	13	24	11	7.0	7.8	540	427	103	6.0	2.7	.1	136
26	16	22	11	6.5	7.8	560	*392	96	5.2	4.4	.1	135
27	17	20	10	6.2	8.0	520	367	89	*3.8	5.8	.1	124
28	18	16	*9.7	6.0	8.0	460	349	83	2.6	5.2	*.1	*110
29	18	12	9.4	5.6	-	*405	340	79	1.9	3.6	0	98
30	21	14	9.4	*5.5	---------	390	344	74	1.1	3.0	0	92
31	28	---------	9.4	5.4	---------	370	---------	71	---------	2.7	.3	---------
Total	234.3	879	366.9	259.4	168.6	4,035.2	7,601	5,606	921.2	45.2	26.0	1,700.0
Mean	7.56	29.3	11.8	8.37	6.02	130	253	181	30.7	1.46	0.84	56.7
Ac-ft	465	1,740	728	515	334	8,000	15,080	11,120	1,830	90	52	3,370

Calendar year 1960: Max 1,560 Min 1.0 Mean 161 Ac-ft 117,100
Water year 1960-61: Max 560 Min 0 Mean 59.8 Ac-ft 43,320

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 9 to Apr. 5.

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 1961 (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, 1,026.00 ft Mar. 26; minimum recorded, 1,017.42 ft Aug. 30.
1928-61: Maximum elevation, 1,032.65 ft May 13, 1950; minimum recorded, that of Aug. 30, 1961.

Mean elevation, in feet, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	17.83					-	-	22.13	19.30	17.94	17.98	17.48
2	17.77					-	23.63	21.90	19.45	17.92	17.96	17.50
3	17.68					-	23.44	21.66	19.45	17.89	17.92	17.51
4	17.66					-	22.65	21.45	19.50	17.87	17.92	17.49
5	17.66					-	21.91	21.27	19.42	17.89	17.87	17.53
6	17.63					-	21.31	21.17	19.22	17.93	17.83	17.63
7	17.63					-	20.95	21.24	19.12	17.91	17.80	17.72
8	17.63					-	20.95	21.47	18.98	17.88	17.77	17.84
9	17.63					-	20.68	21.83	18.80	17.84	17.76	17.90
10	17.62					-	20.50	21.87	18.68	17.82	17.76	17.89
11	17.61					-	20.13	21.80	18.58	17.82	17.75	17.92
12	17.59					-	19.98	21.76	18.48	17.86	17.71	17.93
13	17.60					-	19.94	21.70	18.38	17.86	17.69	18.09
14	17.62					-	19.87	21.58	18.28	17.82	17.66	18.73
15	17.74					-	19.82	21.45	18.18	17.79	17.64	19.28
16	17.86					-	19.85	21.35	18.13	17.77	17.62	19.49
17	17.86					-	19.98	21.18	19.10	17.75	17.60	19.59
18	17.87					-	19.98	20.98	18.07	17.75	17.58	19.84
19	17.83					-	20.67	29.77	18.04	17.75	17.56	19.99
20	17.78					-	21.64	20.62	18.02	17.75	17.55	19.93
21	17.77					-	22.46	20.51	17.98	17.77	17.53	19.79
22	17.78					19.23	23.10	20.40	17.96	17.82	17.52	19.69
23	17.83					20.90	23.33	20.31	17.96	17.87	17.50	19.71
24	17.93					24.24	23.28	20.16	17.96	17.88	17.49	20.16
25	-					25.60	23.07	20.00	17.96	17.89	17.49	20.61
	-											
26	-					25.95	22.82	19.85	17.97	17.93	17.47	20.68
27	-					25.76	22.63	19.70	17.97	18.02	17.46	20.56
28	-					-	22.48	19.54	17.96	18.11	17.45	20.37
29	-				-	24.83	22.40	19.43	17.95	18.11	17.44	20.15
30	-				---------	24.55	22.33	19.34	17.94	18.05	17.44	20.00
31	-	---------			---------	24.35	---------	19.26	---------	18.00	17.47	---------

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 1961 (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, 1,022.78 ft occurred during period Mar. 27 to Apr. 23, from high-water marks in gage well; minimum recorded, 1,014.75 ft Sept. 4.
1932-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	15.62					-	-	18.60	16.18	15.15	15.40	14.91
2	15.59					-	-	18.43	16.24	15.09	15.37	14.91
3	15.56					-	-	18.21	16.26	15.10	15.35	14.82
4	15.54					-	-	18.00	16.34	15.09	15.38	14.85
5	15.50					-	-	17.83	16.37	15.08	15.35	14.84
6	15.47					-	-	17.73	16.26	15.11	15.30	14.84
7	15.44					-	-	17.70	16.12	15.14	15.24	14.81
8	15.40					-	-	17.84	16.09	15.16	15.21	14.89
9	15.36					-	-	18.31	15.92	15.17	15.21	14.93
10	15.33					-	-	18.51	15.84	15.17	15.20	15.07
11	15.32					-	-	18.44	15.74	15.18	15.18	15.17
12	15.31					-	-	18.39	15.65	15.33	15.17	15.11
13	15.31					-	-	18.35	15.54	15.35	15.17	15.11
14	15.31					-	-	18.27	15.46	15.36	15.14	15.19
15	15.31					-	-	18.18	15.38	15.34	15.12	15.73
16	15.30					-	-	18.08	15.31	15.31	15.11	16.23
17	15.30					-	-	17.99	15.28	15.26	15.09	16.42
18	15.29					-	-	17.86	15.29	15.22	15.10	16.53
19	15.29					-	-	17.68	15.20	15.22	15.08	16.75
20	15.28					-	-	17.49	15.15	15.20	15.04	16.85
21	15.27					-	-	17.24	15.10	15.20	15.03	16.77
22	15.28					16.69	-	17.13	15.10	15.25	15.02	16.66
23	15.29					17.09	-	17.04	15.04	15.30	15.01	16.58
24	15.29					18.41	19.44	16.93	15.00	15.30	15.01	16.69
25	-					20.29	19.36	16.77	14.98	15.28	14.99	17.06
	-											
26	-					21.16	19.18	16.65	14.97	15.27	14.95	17.31
27	-					-	19.05	16.53	14.99	15.27	14.94	17.36
28						-	18.87	16.43	15.00	15.32	14.92	17.27
29	-				-	-	18.76	16.30	15.01	15.45	14.90	17.10
30	-					-	18.71	16.22	15.06	15.45	14.91	16.95
31	-					- -		16.19		15.45	14.93	

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 1961 (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, of 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, 611 cfs Mar. 29 (gage height, 5.96 ft from floodmarks, backwater from ice); minimum discharge, 1.7 cfs Aug. 17.
1917, 1920-61: Maximum discharge, 4,080 cfs May 19, 1950 (gage height, 11.81 ft); no flow Aug. 13, 1936.

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

Revisions (water years).--WSP 1308: 1938(M). WSP 1508: 1917(M), 1920, 1932(M), 1934-35(M).

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.3					-	540	398	83	7.3	5.8	2.4
2	7.3					-	500	370	78	6.8	5.6	2.7
3	6.6					-	460	336	80	6.0	5.8	2.7
4	6.2					-	480	303	77	5.8	6.0	2.4
5	6.4					-	460	281	83	5.8	5.4	2.1
6	6.4					-	400	267	78	5.8	5.2	2.0
7	5.6					-	*320	255	62	5.2	4.8	1.9
8	5.0					-	200	261	57	5.2	4.0	2.5
9	4.4					-	190	316	49	5.6	3.4	3.4
10	4.4					-	160	365	40	6.0	3.0	4.0
11	4.6					-	140	363	37	6.2	2.9	5.2
12	5.8					-	130	352	33	6.4	2.8	6.4
13	6.4					-	125	340	29	8.2	2.4	8.2
14	6.8					-	*125	331	25	8.8	2.2	9.4
15	6.8					-	101	314	23	8.5	2.2	9.7
16	6.6					-	89	299	22	7.9	2.0	29
17	6.6					-	137	289	19	6.4	2.1	46
18	6.8					-	135	273	19	5.6	2.4	48
19	7.0					-	146	251	18	5.0	2.5	54
20	7.9					-	219	231	14	4.8	2.4	69
21	8.2					-	312	201	12	5.6	2.3	71
22	8.8					*14	409	178	12	5.8	2.2	68
23	9.1					20	492	171	11	6.6	2.1	64
24	*7.9					40	*529	162	9.4	*6.2	2.0	62
25	-					150	529	146	8.5	5.2	2.2	80
26	-					350	492	127	7.0	4.6	2.5	108
27	-					500	472	116	*6.6	4.2	2.7	*116
28	-					560	442	106	6.6	5.0	*2.6	113
29	-				-	590	423	94	6.6	6.6	2.3	105
30	-				--------	*600	411	86	6.6	6.4	2.2	86
31	-	--------			--------	580	--------	*80	--------	6.4	2.3	--------
Total						-	9,568	7,662	1,012.3	189.9	98.3	1,184.0
Mean							319	247	33.7	6.13	3.17	39.5
Ac-ft							18,980	15,200	2,010	377	195	2,350

Calendar year	Max	Min	Mean	In.	Ac-ft
Water year	Max	Min	Mean	In.	Ac-ft

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Mar. 22 to Apr. 14 (no gage-height record Mar. 29, Apr. 1-6). Shifting-control method used Oct. 1-24, May 22 to Sept. 30.

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 last international boundary crossing and 3 miles northwest of Caribou.

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

Records available.--May 1933 to September 1961 (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, 1,005.24 ft during period Mar. 28 to Apr. 6, from high-water marks in gage well; minimum recorded, 1,002.44 ft Aug. 28.
1933-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.94					-	-	4.12	3.38	2.80	2.68	-
2	2.94					-	-	4.07	3.37	2.80	2.68	-
3	2.93					-	-	3.99	3.38	2.80	2.67	-
4	2.92					-	4.28	3.91	3.37	2.79	2.68	-
5	2.91					-	-	3.86	3.40	2.77	2.68	-
6	2.91					-	-	3.82	3.38	2.76	2.67	-
7	2.90					-	4.11	3.81	3.32	2.76	2.66	-
8	2.90					-	3.88	3.81	3.29	2.75	2.67	-
9	2.89					-	2.79	3.92	3.26	2.75	2.66	-
10	2.89					-	3.72	4.04	3.21	2.73	2.66	-
11	2.88					-	3.66	4.06	3.16	2.74	2.66	-
12	2.87					-	3.54	4.02	3.13	2.73	2.65	-
13	2.86					-	3.52	4.01	3.08	2.73	2.64	-
14	2.85					-	3.53	4.00	3.03	3.73	2.63	-
15	2.84					-	3.38	3.97	2.99	2.73	2.62	-
16	2.83					-	3.27	3.93	2.94	2.73	2.61	2.84
17	2.82					-	3.41	3.91	2.92	2.72	2.62	3.19
18	2.81					-	3.46	3.88	2.91	2.71	2.62	3.25
19	2.81					-	3.51	3.83	2.91	2.71	-	3.30
20	2.80					-	3.70	3.78	2.86	2.71	-	3.37
21	2.79					-	3.94	3.73	2.84	2.71	-	3.37
22	2.79					-	4.16	3.67	2.82	2.71	-	3.35
23	2.78					-	4.31	3.65	2.82	2.70	-	3.32
24	2.78					-	4.41	3.63	2.83	2.69	-	3.30
25	-					-	4.42	3.59	2.83	2.69	-	3.36
26	-					3.00	4.35	3.53	2.82	2.69	-	3.49
27	-					3.74	4.30	3.50	2.82	2.68	-	3.54
28	-					-	4.23	3.47	2.82	2.68	2.44	3.53
29	-				-	-	4.18	3.43	2.81	2.68	-	3.49
30	-				---------	4.19	4.16	3.39	2.80	2.67	-	3.44
31	-	---------			---------	-		3.37	---------	2.68	-	---------

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

5-1245. Isabella River near Isabella, Minn.

Location.--Lat 47°48'00", long 91°31'15", in NW¼NE¼ sec. 6, T. 61 N., R. 9 W., on left bank 200 ft upstream from Bald Eagle Lake, half a mile upstream from Snake River and 14½ miles northwest of Isabella.

Drainage area.--341 sq mi.

Records available.--October 1952 to September 1961 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 1,453.10 ft above mean sea level, datum of 1929.

Average discharge.--9 years, 280 cfs.

Extremes.--Maximum discharge during year, 1,370 cfs Apr. 25 (gage height, 7.03 ft,from flood mark); minimum, 24 cfs Aug. 21, 22; minimum gage height, 2.86 ft Aug. 22.
1952-61: Maximum discharge, 3,550 cfs May 4, 1954 (gage height, 9.31 ft); minimum, that of Aug. 21, 22, 1960; minimum gage height, that of Aug. 22, 1960.

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

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 24 to Nov. 11)

Oct. 1 to Mar. 26		Mar. 27 to Sept. 30			
3.1	40	2.8	22	4.4	213
3.5	68	3.0	29	5.0	415
4.0	135	3.2	40	6.0	770
		3.6	70	7.0	1,360
		4.0	120		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	46	71	83	64	38	43	468	750	523	88	49	59
2	46	86	85	62	37	43	454	706	632	80	48	62
3	46	94	90	61	37	43	443	670	702	77	47	63
4	46	110	95	60	37	43	450	632	738	76	45	59
5	47	127	105	60	36	43	485	600	726	72	44	57
6	46	133	113	59	36	43	520	572	688	69	42	66
7	45	126	125	60	36	43	530	572	636	66	41	79
8	45	124	133	62	36	43	530	590	583	64	*39	77
9	45	114	138	63	36	43	580	618	534	60	38	75
10	45	102	140	64	37	43	625	642	492	57	37	118
11	45	100	140	63	37	43	636	642	457	56	36	366
12	45	96	140	63	37	43	653	625	432	56	35	520
13	47	93	140	62	38	42	a678	628	412	55	33	639
14	52	91	140	62	39	42	a692	674	*376	56	32	730
15	51	91	140	60	40	42	a723	830	345	59	30	806
16	50	101	138	60	40	43	a762	994	314	61	29	802
17	48	102	135	59	41	43	a792	1,100	283	60	27	754
18	47	110	130	*59	41	42	a797	1,150	254	58	27	716
19	47	118	122	58	41	42	a835	1,090	225	59	26	597
20	47	122	115	57	41	42	a910	982	202	60	25	516
21	45	*127	110	55	42	43	a1,020	870	186	59	24	464
22	49	122	105	54	42	44	a1,130	779	168	56	27	422
23	50	114	97	53	42	45	a1,230	720	151	55	43	380
24	50	118	91	52	42	47	a1,330	670	142	60	45	342
25	49	110	87	50	42	53	a1,360	632	129	64	43	307
26	50	107	82	48	42	80	a1,300	600	120	61	42	276
27	*50	98	76	47	43	263	a1,180	569	112	59	41	254
28	50	87	72	45	43	471	*1,030	541	108	56	43	228
29	50	83	68	44	-	450	895	506	100	55	47	219
30	52	83	66	42	---------	454	815	478	95	52	50	213
31	57	---------	65	40	---------	474	---------	454	---------	51	57	---------
Total	1,488	3,160	3,366	1,748	1,099	3,278	23,853	21,886	10,865	1,917	1,192	10,266
Mean	48.0	105	109	56.4	39.2	106	795	706	362	61.8	38.5	342
Cfsm	0.141	0.308	0.320	0.165	0.115	0.311	2.33	2.07	1.06	0.181	0.113	1.00
In.	0.16	0.34	0.34	0.19	0.12	0.36	2.60	2.39	1.18	0.21	0.13	1.12

Calendar year 1960: Max 2,160 Min 43 Mean 253 Cfsm 0.742 In. 10.09
Water year 1960-61: Max 1,360 Min 24 Mean 230 Cfsm 0.674 In. 9.17

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 26.

5-1250. South Kawishiwi River near Ely, Minn.

Location.--Lat 47°50'24", long 91°41'43", in NE¼SW¼ sec. 23, T. 62 N., R. 11 W., on left bank 5 miles upstream from Birch Lake and 9 miles southeast of Ely.

Records available.--October 1951 to September 1961 (discontinued).

Gage.--Water-stage recorder. Altitude of gage is 1,430 ft (from topographic map prepared by Minnesota Power & Light Co.).

Average discharge.--10 years, 437 cfs.

Extremes.--Maximum discharge during year, 1,740 cfs Apr. 27 (gage height, 4.99 ft); minimum, 25 cfs Oct. 12 (gage height, 1.42 ft).
1951-61: Maximum discharge, 5,130 cfs May 4, 1954 (gage height, 7.25 ft); minimum, that of Oct. 12, 1961.

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

Rating table, water year 1960-61 except periods of ice effect (gage height in feet, and discharge, in cubic feet per second)

1.4	23	3.0	324
1.7	58	3.5	530
2.0	97	4.0	830
2.5	194	5.0	1,750

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	39	56	111	80	52	58	117	1,400	795	255	118	58
2	38	60	111	79	51	58	120	1,310	795	245	122	68
3	36	60	110	77	51	58	122	1,240	802	232	120	64
4	35	60	109	76	50	58	127	1,180	838	222	115	58
5	34	62	110	74	50	59	133	1,130	882	212	113	58
6	32	64	111	73	50	59	141	1,100	921	210	107	*60
7	31	65	111	72	50	59	145	1,070	929	203	100	59
8	30	73	112	72	50	59	145	1,040	905	199	99	59
9	28	76	113	71	51	59	145	1,000	875	190	94	60
10	27	80	113	71	51	60	145	994	830	187	*94	100
11	27	87	114	72	52	60	147	1,000	788	183	90	170
12	28	93	116	73	53	60	153	1,010	740	179	87	192
13	39	97	118	74	55	60	*155	1,040	702	*181	83	217
14	40	103	119	74	56	60	159	1,100	653	183	80	276
15	40	108	*119	75	*57	59	174	1,300	*618	174	78	350
16	40	111	118	76	57	59	194	*1,410	575	166	75	448
17	39	113	117	*76	58	59	203	1,540	555	162	71	591
18	36	115	114	76	58	59	220	1,620	535	157	74	721
19	36	117	110	75	57	60	268	1,680	510	155	70	781
20	*34	117	106	74	57	62	337	1,670	490	155	68	760
21	33	*117	104	73	57	62	728	1,610	476	151	64	721
22	34	118	100	71	57	63	728	1,530	462	143	63	665
23	36	118	97	69	57	64	*882	1,430	448	141	64	608
24	36	120	94	67	57	68	1,230	1,300	444	151	60	560
25	36	120	92	64	58	73	1,530	1,210	423	145	58	525
26	39	122	91	61	58	89	*1,700	1,120	402	137	57	490
27	40	122	89	59	58	100	1,730	1,040	354	135	53	462
28	40	118	87	57	58	106	1,690	977	298	131	54	435
29	41	116	85	55	-	*110	1,600	913	276	129	56	423
30	45	112	83	53	---------	113	1,510	845	263	127	58	419
31	48	---------	81	52	---------	115	---------	795	---------	122	57	---------
Total	1,117	2,900	3,265	2,171	1,526	2,148	16,678	37,604	18,584	5,362	2,502	10,458
Mean	36.0	96.7	105	70.0	54.5	69.3	556	1,213	619	173	80.7	349
Cfsm	-	-	-	-	-	-	-	-	-	-	-	-
In.	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1960: Max 2,660 Min 27 Mean 368 Cfsm - In. -
Water year 1960-61: Max 1,730 Min 27 Mean 286 Cfsm - In. -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 28 to Dec. 7, Dec. 15-18, Dec. 26 to Jan. 21, Feb. 15 to Mar. 18. No gage-height record Dec. 8-14, 19-25, Jan. 22 to Feb. 14, Mar. 27-29; discharge estimated on the basis of weather records and records for other stations on nearby streams.

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 12 3/4 miles northwest of Isabella.

Drainage area.--180 sq mi.

Records available.--October 1952 to September 1961. 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.--9 years, 130 cfs.

Extremes.--Maximum discharge during year, 665 cfs Apr. 26 (gage height, 9.10 ft); minimum, 5.6 cfs Aug. 22 (gage height, 7.32 ft).
1952-61: Maximum discharge, 2,040 cfs Apr. 27, 1957 (gage height, 10.60 ft); minimum, that of Aug. 22, 1961.

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

7.3	5.0	7.9	96
7.4	10	8.1	160
7.5	18	8.5	335
7.6	32	9.1	665
7.7	49		

Discharge, in cubic feet per second, water year 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10	16	37	13	7.3	9.3	44	415	168	34	15	9.3
2	10	16	37	13	7.1	9.3	44	365	160	29	14	9.3
3	10	18	35	12	7.0	9.4	46	320	150	27	14	8.6
4	10	18	34	12	6.9	9.4	46	285	146	27	14	8.0
5	10	20	35	12	6.8	9.5	46	262	140	26	13	8.0
6	9.3	22	39	12	6.7	9.5	49	240	126	23	11	10
7	9.3	26	39	12	6.7	9.5	49	227	120	23	10	10
8	9.3	32	39	12	6.7	9.6	49	227	111	22	11	9.3
9	9.3	37	39	12	6.8	9.7	49	232	102	20	*10	11
10	9.3	40	39	12	6.9	9.8	49	244	96	20	11	16
11	8.6	42	39	12	7.0	9.9	53	258	86	20	10	26
12	8.6	44	39	*12	7.2	10	55	267	83	20	9.3	27
13	11	44	37	12	7.4	10	*57	272	*80	*20	8.6	37
14	11	44	*37	11	7.8	10	60	290	73	21	8.0	64
15	11	44	37	11	*8.2	10	66	330	70	23	8.0	*102
16	9.3	44	37	11	8.6	10	73	390	68	23	7.4	143
17	9.3	44	37	11	8.7	10	78	*457	66	22	6.9	171
18	9.3	44	35	11	8.8	10	80	506	66	21	6.9	187
19	9.3	44	34	11	8.8	11	88	518	62	23	6.9	183
20	*8.6	42	32	10	8.9	11	105	518	60	22	6.9	175
21	8.6	*42	29	10	9.0	11	187	479	55	22	6.9	171
22	10	42	27	10	9.0	11	305	474	51	21	6.4	160
23	10	40	24	9.8	9.0	11	*457	395	49	21	6.9	143
24	10	40	22	9.4	9.1	12	569	355	47	24	6.9	133
25	11	40	20	9.1	9.1	15	647	310	44	24	6.9	117
26	11	40	18	8.9	9.1	20	*653	262	40	21	6.9	111
27	11	39	18	8.6	9.2	27	*629	236	40	22	6.4	102
28	11	39	16	8.3	9.3	37	581	211	39	18	6.9	93
29	11	39	16	8.0	-	*35	528	183	37	18	6.9	91
30	12	37	14	7.8	--------	40	474	164	35	18	9.3	83
31	13	--------	13	7.6	--------	42	--------	164	--------	16	9.3	--------
Total	311.1	1,079	954	331.5	223.1	457.9	6,216	9,856	2,470	691	281.6	2,418.5
Mean	10.0	36.0	30.8	10.7	7.97	14.8	207	318	82.3	22.3	9.08	80.6
Cfsm	0.056	0.200	0.171	0.059	0.044	0.082	1.15	1.77	0.457	0.124	0.050	0.448
In.	0.06	0.22	0.20	0.07	0.05	0.09	1.28	2.04	0.51	0.14	0.06	0.50

Calendar year 1960: Max 972 Min 8.6 Mean 97.4 Cfsm 0.541 In. 7.36
Water year 1960-61: Max 653 Min 6.4 Mean 69.3 Cfsm 0.385 In. 5.22

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28, Dec. 31 to Mar. 22.

5-1260. Dunka River near Babbitt, Minn.

Location.--Lat 47°41'55", long 91°52'05", in NW¼NE¼ sec. 9, T. 60 N., R. 12 W., on left bank 1.8 miles upstream from Birch Lake and 2½ miles northeast of Babbitt.

Drainage area.--53.0 sq mi.

Records available.--October 1951 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,488.98 ft above mean sea level, datum of 1929.

Average discharge.--10 years, 36.6 cfs.

Extremes.--Maximum discharge during year, 487 cfs Apr. 22 (gage height, 7.33 ft); minimum, 0.6 cfs Aug. 20, 21, 22; minimum gage height, 3.64 ft Aug. 21.
1951-61: Maximum discharge, 691 cfs Apr. 16, 1954 (gage height, 7.84 ft); minimum, that of Aug. 20, 21, 22, 1961.

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

Rating table, water year 1960-61 (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 21 to May 20)

3.7	0.7	4.9	40
3.8	1.1	5.4	91
3.9	1.7	6.0	196
4.0	2.6	7.0	430
4.3	7.4	7.5	586
4.6	20		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.5	8.3	4.3	1.8	0.7	1.1	26	87	70	3.2	2.2	7.2
2	2.1	13	4.6	1.7	.7	1.2	21	80	116	2.7	3.7	47
3	8.0	12	5.0	1.6	.7	1.2	20	72	126	2.5	6.0	47
4	6.8	10	5.4	1.5	.7	1.3	18	73	108	2.2	7.6	34
5	5.6	9.7	6.1	1.6	.7	1.4	17	57	89	2.0	2.2	27
6	4.9	9.1	6.2	1.7	.7	1.4	16	56	75	1.9	1.7	*24
7	4.0	8.5	5.9	1.7	.8	1.4	15	70	60	1.7	4.3	22
8	8.0	7.0	5.4	1.7	.8	1.4	14	78	49	1.6	5.1	24
9	5.1	7.5	5.1	1.7	.8	1.4	14	82	45	1.5	4.4	24
10	4.6	8.0	5.0	1.6	.8	1.4	13	75	40	1.5	*5.1	59
11	3.5	8.1	5.0	1.7	.8	1.3	13	66	35	1.5	4.8	166
12	2.5	8.0	5.0	1.7	.8	1.3	12	58	34	1.6	3.5	231
13	3.1	8.1	5.4	*1.6	.8	1.3	*12	66	*36	2.1	1.9	231
14	4.9	8.3	5.6	1.5	.8	1.4	13	85	34	*2.6	1.8	223
15	6.4	8.6	5.1	1.6	.8	1.4	14	158	31	3.0	2.6	219
16	9.7	8.4	*4.5	1.6	.8	1.4	16	249	25	2.7	1.1	204
17	10	8.1	4.2	1.6	.8	1.5	20	*257	22	2.4	1.2	166
18	7.0	8.0	4.0	1.5	.8	1.6	28	228	19	2.3	1.0	132
19	5.5	*7.8	3.6	1.5	.8	1.7	52	190	15	3.0	.9	107
20	5.2	7.4	3.3	1.4	.9	1.8	105	154	13	2.3	.7	74
21	5.1	6.8	3.0	1.2	1.1	2.2	281	132	11	2.1	.7	65
22	5.0	6.0	2.4	1.1	1.2	3.0	*454	107	8.8	2.1	3.2	61
23	5.0	6.0	2.2	1.0	*1.3	4.7	407	88	8.0	2.2	6.0	54
24	4.9	5.6	2.0	1.0	1.5	5.4	315	74	7.2	4.0	6.6	48
25	4.9	5.4	1.8	.9	1.4	6.3	*278	69	6.6	4.3	1.4	41
26	*4.9	5.3	1.7	.8	1.3	8.4	211	68	6.2	5.3	.9	39
27	5.4	5.0	1.6	.8	1.2	13	177	59	6.0	7.6	.8	35
28	4.9	4.7	1.6	.8	1.2	28	148	50	4.9	6.2	.8	34
29	4.8	4.5	1.6	.8	-	42	123	44	4.2	5.3	1.3	32
30	5.1	4.4	1.7	.7	--------	*38	104	38	3.6	2.7	6.8	29
31	5.6	--------	1.8	.7	--------	30	--------	35	--------	2.4	3.9	--------
Total	164.0	227.6	120.1	42.1	25.7	208.9	2,957	3,005	1,108.5	88.5	94.2	2,506.2
Mean	5.29	7.59	3.87	1.36	0.91	6.74	98.6	96.9	37.0	2.85	3.04	83.5
Cfsm	0.100	0.143	0.073	0.026	0.017	0.127	1.86	1.83	0.698	0.054	0.057	1.58
Ins.	0.12	0.16	0.08	0.03	0.02	0.15	2.07	2.11	0.78	0.06	0.07	1.76

Calendar year 1960:	Max	332	Min	0.9	Mean	26.9	Cfsm	0.508	In.	6.90
Water year 1960-61:	Max	454	Min	0.7	Mean	28.9	Cfsm	0.545	In.	7.41

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 27-30, Dec. 14-19, Dec. 23 to Apr. 16. No gage-height record Oct. 3, 4, 19-25, Nov. 7-18, Dec. 1-13.

5-1265. Bear Island River near Ely, Minn.

Location.--Lat 47°49'50", long 91°50'20", in SW¼ sec. 23, T. 62 N., R. 12 W., on right bank 10 ft downstream from State Highway 1 and 6 miles southeast of Ely.

Drainage area.--68.5 sq mi.

Records available.--October 1952 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,388.86 ft above mean sea level, datum of 1929.

Average discharge.--9 years, 40.2 cfs.

Extremes.--Maximum discharge during year, 242 cfs Apr. 24, 25 (gage height, 7.20 ft); minimum discharge, 0.3 cfs Oct. 11, 12; minimum gage height, 4.45 ft Aug. 27-29.
1952-61: Maximum discharge, 423 cfs May 3, 1954; maximum gage height, that of Apr. 24, 25, 1961; minimum discharge, that of Oct. 11, 12, 1961; minimum gage height, 4.33 ft Sept. 15, 16, 1955.

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Nov. 6-28, Apr. 7-20)

Oct. 1 to Apr. 6		Apr. 7 to Sept. 30			
4.5	0.3	4.4	0.7	5.8	20
4.7	1.4	4.5	1.2	6.1	42
4.9	3.2	4.7	2.6	6.5	109
5.1	5.1	5.0	5.4	7.2	242
		5.5	12		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.2	1.9	4.0	7.7	7.0	7.2	14	204	122	14	5.2	1.6
2	1.2	2.3	4.3	7.7	7.0	7.2	15	194	122	14	5.0	1.8
3	1.1	2.3	4.6	7.7	7.0	7.3	17	187	118	13	4.8	1.5
4	1.0	2.2	4.8	7.8	7.1	7.3	19	179	115	12	4.5	1.4
5	1.0	2.2	5.1	7.8	7.2	7.4	23	172	107	11	4.2	1.4
6	.8	2.0	5.4	7.8	7.3	7.5	26	170	101	10	4.0	*2.0
7	.7	1.9	5.7	7.9	7.4	7.6	28	170	94	9.6	3.9	1.8
8	.6	2.4	5.9	7.9	7.4	7.6	28	168	88	9.2	3.6	1.7
9	.5	2.5	6.1	8.0	7.5	7.7	29	162	83	8.7	3.3	1.7
10	.4	2.3	6.3	8.0	7.5	7.8	29	156	78	8.1	*3.4	9.1
11	.3	2.5	6.5	8.1	7.4	7.8	29	155	71	7.8	3.0	19
12	.5	2.6	6.6	8.1	7.4	7.9	29	147	66	7.4	2.9	17
13	1.6	2.7	6.7	8.1	7.3	8.0	30	155	59	*7.7	2.4	19
14	1.0	2.7	6.8	8.2	7.2	8.1	*31	164	55	7.6	2.1	26
15	.9	2.8	*6.9	8.2	7.1	8.2	35	189	*52	7.2	1.9	31
16	.8	3.2	7.0	8.2	7.0	8.3	46	194	48	6.8	1.7	37
17	.8	3.2	7.1	*8.2	6.9	8.4	64	198	42	6.5	1.7	42
18	.8	3.2	7.1	8.2	6.8	8.5	78	*200	39	6.0	2.0	49
19	.8	3.1	7.1	8.2	6.8	8.6	107	198	34	7.7	1.7	56
20	*.6	3.1	7.2	8.1	6.8	8.7	149	193	31	7.2	1.6	63
21	.6	*3.2	7.2	8.1	6.8	8.9	215	189	27	6.7	1.5	68
22	.9	3.4	7.3	8.0	6.9	9.1	*232	183	24	6.6	1.4	68
23	.9	3.2	7.3	7.9	6.9	9.2	240	177	23	6.7	1.4	68
24	.8	3.2	7.4	7.8	7.0	9.3	240	170	20	7.2	1.2	64
25	.9	3.2	7.4	7.7	7.0	9.6	240	162	20	7.0	1.2	64
26	1.0	3.3	7.5	7.6	7.0	9.9	236	155	19	7.0	1.0	61
27	1.0	3.3	7.5	7.5	7.1	10	231	147	18	7.0	1.0	59
28	1.0	2.9	7.6	7.4	7.1	*11	225	141	16	6.6	1.2	58
29	.9	3.2	7.6	7.3	-	11	219	134	16	6.4	1.0	56
30	1.3	3.6	7.7	7.2	--------	12	214	128	15	6.0	1.6	55
31	1.5	--------	7.7	7.1	--------	13	--------	122	--------	5.6	1.2	--------
Total	27.4	83.6	203.4	243.5	198.9	270.1	3,118	5,263	1,723	254.3	76.6	1,004.0
Mean	0.88	2.79	6.56	7.85	7.10	8.71	104	170	57.4	8.20	2.47	33.5
Cfsm	0.013	0.041	0.096	0.115	0.104	0.127	1.52	2.48	0.838	0.120	0.036	0.489
In.	0.01	0.05	0.11	0.13	0.11	0.15	1.69	2.86	0.94	0.14	0.04	0.55

Calendar year 1960: Max 225 Min 0.3 Mean 32.8 Cfsm 0.479 In. 6.52
Water year 1960-61: Max 240 Min 0.3 Mean 34.2 Cfsm 0.499 In. 6.77

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Apr. 6. (no gage-height record Dec. 23-26, Jan. 9-12, Jan. 21 to Feb. 16, Feb. 19 to Mar. 27; discharge estimated on the basis of weather records and records for South Kawishiwi River near Ely and Stony River near Isabella).

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 1961. Monthly discharge only for some periods, published in WSP 1308.

Average discharge.--42 years (1905-6, 1915-17, 1918-19, 1923-61), 961 cfs (unadjusted).

Extremes.--Maximum daily discharge during year, 4,300 cfs May 21; no flow for many days.
1905-07, 1912-19, 1923-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	65	165	0	133	100	216	391	3,580	1,620	250	125	190
2	65	165	0	101	100	329	359	3,640	2,010	250	222	157
3	101	165	0	133	100	420	262	3,100	2,180	218	93	125
4	165	68	0	66	100	471	332	2,430	2,140	250	190	88
5	101	68	129	98	100	501	448	1,900	2,270	153	93	28
6	133	32	108	66	115	468	391	1,590	1,990	250	190	157
7	165	133	464	262	100	499	310	1,650	1,640	185	93	125
8	133	101	367	101	100	483	326	2,010	1,410	218	28	125
9	133	133	367	133	100	562	326	2,060	1,080	0	*157	125
10	101	68	302	133	100	465	390	2,540	1,170	125	125	1,820
11	133	133	270	165	100	592	293	2,570	1,090	125	157	1,470
12	212	165	133	101	100	528	390	2,440	1,250	125	125	952
13	733	101	133	133	100	463	358	2,360	1,240	190	125	885
14	508	68	198	133	100	558	358	2,680	1,240	222	125	918
15	254	68	165	133	100	331	492	2,290	1,180	125	93	1,180
16	49	4	133	101	68	457	487	*3,320	998	93	125	1,240
17	65	107	101	100	100	458	439	4,070	956	60	125	1,180
18	0	0	133	100	100	426	522	4,110	859	190	157	1,200
19	65	0	198	100	68	297	684	4,290	762	157	125	1,420
20	32	97	204	132	68	265	724	4,240	789	254	93	1,550
21	65	32	168	100	100	198	1,780	4,300	683	279	93	1,670
22	97	0	200	100	68	424	1,770	3,730	667	441	190	1,630
23	32	0	216	132	35	327	1,720	3,770	558	376	125	1,530
24	101	0	168	100	99	327	2,000	2,860	370	441	93	1,340
25	165	65	200	100	67	392	2,500	2,390	390	344	93	1,250
26	133	0	168	100	67	364	2,640	2,790	410	344	125	862
27	101	0	200	100	132	262	2,680	2,800	282	311	125	631
28	133	0	200	100	166	456	3,190	2,890	315	261	190	711
29	101	97	168	100	-	326	3,410	2,740	347	250	125	692
30	133	65	116	132	--------	407	3,420	2,080	282	153	190	692
31	101	--------	133	100	--------	351	--------	1,440	--------	93	125	---------
Total	4,375	2,100	5,342	3,588	2,653	12,623	33,392	88,660	32,178	6,733	4,040	25,943
Mean	141	70.0	172	116	94.8	407	1,113	2,860	1,073	217	130	865
(†)	-85.3	+144	+24	+8	+5.8	-270	+312	+288	+23	-35	-84.3	+88
Mean‡	55.7	214	196	124	101	137	1,425	3,148	1,096	182	45.7	953
Cfsm‡	0.046	0.178	0.163	0.103	0.084	0.114	1.19	2.62	0.913	0.152	0.038	0.794
In.‡	0.05	0.20	0.19	0.12	0.09	0.13	1.33	3.02	1.02	0.18	0.04	0.89

Calendar year 1960: Max 5,780 Min 0 Mean 743 Mean‡ 732 Cfsm‡ 0.610 In.‡ 8.33
Water year 1960-61: Max 4,300 Min 0 Mean 607 Mean‡ 642 Cfsm‡ 0.535 In.‡ 7.26

* 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 1961. 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 gage at several sites on Jackfish Bay, at present datum. June 2 to Oct. 27, 1938, staff gage at Williams Island half mile northeast of present gage at same datum.

Average discharge.--33 years (1925-27, 1930-61), 1,314 cfs.

Extremes.--Maximum discharge during year, 4,030 cfs May 22 (gage height, 2.48 ft); minimum, 206 cfs Dec. 4 (gage height, -0.78 ft).
1924, 1925-27, 1930-61: 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 1960-61 (gage height, in feet, and discharge, in cubic feet per second)

-0.8	201	0.5	1,060	2.0	3,160
- .5	287	1.0	1,640	3.0	5,040
0.0	580	1.5	2,330		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	287	248	216	216	226	232	507	a2,350	3,200	1,000	468	299
2	284	248	214	216	226	229	507	a2,450	3,110	920	474	344
3	284	246	214	216	226	229	500	a2,600	3,020	880	462	320
4	274	243	214	218	226	229	507	a2,700	2,990	860	455	316
5	264	246	221	218	226	232	507	a2,740	2,960	810	436	316
6	261	243	218	221	224	237	507	a2,760	2,900	770	423	320
7	257	243	218	226	224	246	500	a2,780	2,820	741	392	320
8	254	243	218	229	224	254	500	a2,800	2,740	712	*380	316
9	248	240	216	229	224	267	500	a2,780	2,620	665	370	320
10	246	237	214	229	224	280	494	a2,740	2,470	648	354	462
11	243	237	214	226	226	291	494	*2,680	2,330	631	328	640
12	248	240	214	226	229	308	500	2,680	2,300	622	320	770
13	270	234	214	226	229	324	507	2,740	2,210	622	312	890
14	267	234	214	226	229	338	507	2,790	*2,100	597	299	970
15	270	232	214	226	229	354	522	3,040	2,030	589	291	1,040
16	264	226	214	226	229	370	580	3,250	1,960	551	284	1,090
17	261	*226	214	226	229	386	622	3,430	1,890	544	277	1,130
18	254	224	214	*226	229	386	640	3,590	1,820	529	284	1,180
19	251	224	211	226	229	392	656	3,720	1,740	529	277	1,210
20	248	221	211	226	229	399	694	3,830	1,680	522	274	1,260
21	246	221	211	224	226	405	920	3,920	1,620	507	270	1,340
22	248	216	211	224	229	411	1,090	3,990	1,570	488	267	1,420
23	243	214	214	221	226	411	1,220	4,010	1,500	481	267	1,470
24	246	214	214	221	229	417	1,380	3,900	1,440	507	257	1,520
25	248	214	211	224	229	423	1,520	3,770	1,360	507	264	1,520
26	243	211	211	221	229	423	1,680	3,700	1,300	507	261	1,480
27	240	211	211	224	232	468	1,810	3,680	1,250	544	257	1,460
28	*234	218	214	224	232	514	1,960	3,680	1,180	529	254	1,410
29	234	216	214	224	-	514	2,100	3,650	1,130	514	254	1,420
30	237	216	216	224	--------	522	a2,200	3,520	*1,070	507	261	1,400
31	240	--------	216	226	--------	514	--------	3,320	--------	494	257	--------
Total	7,894	6,886	6,640	6,935	6,369	11,005	26,631	99,590	62,310	19,327	10,029	27,953
Mean	255	230	214	224	227	355	888	3,213	2,077	623	324	932
Cfsm	0.147	0.132	0.123	0.129	0.130	0.204	0.510	1.85	1.19	0.358	0.186	0.536
In.	0.17	0.15	0.14	0.15	0.14	0.24	0.57	2.13	1.33	0.41	0.21	0.60

Calendar year 1960: Max 4,820 Min 211 Mean 954 Cfsm 0.548 In. 7.45
Water year 1960-61: Max 4,010 Min 211 Mean 799 Cfsm 0.459 In. 6.24

* Discharge measurement made on this day.
a No gage-height record; discharge estimated on the basis of weather records and recorded change in stage.

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 1961, in reports of Geological Survey. Monthly discharge only for some periods, published in WSP 1308. August 1921 to September 1961 in reports of Water Resources Branch, Department of Northern Affairs and National Resources, Canada.

Gage.--Staff gage read twice daily. 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.

Average discharge.--39 years (1922-61), 3,536 cfs.

Extremes.--Maximum discharge during year, 10,400 cfs May 25-29; maximum elevation, 1,187.44 ft May 25, 26; minimum, 918 cfs Mar. 26, 27 (elevation, 1,182.11 ft).
1921-61: Maximum discharge, 28,200 cfs May 31 to June 2, 1950 (elevation, 1,193.50 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 1960-61 (gage height, in feet, and discharge, in cubic feet per second)

1,182.0	835	1,185.0	4,830
1,182.5	1,280	1,187.0	9,310
1,183.0	1,820	1,188.0	11,900
1,184.0	3,130		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,800	1,300	1,320	1,490	1,330	1,100	1,040	5,780	10,100	4,740	2,630	1,840
2	1,790	1,290	1,340	1,480	1,330	1,090	1,060	5,900	10,000	4,680	2,570	1,960
3	1,780	1,290	1,370	1,480	1,330	1,080	1,080	6,120	9,860	4,600	2,490	2,080
4	1,760	1,280	1,420	1,470	1,330	1,070	1,120	6,340	9,760	4,440	2,430	2,180
5	1,750	1,280	1,450	1,460	1,330	1,060	1,160	6,570	9,660	4,350	2,360	2,180
6	1,730	1,270	1,490	1,450	1,330	1,060	1,200	6,800	9,510	4,240	2,280	2,180
7	1,710	1,270	1,510	1,440	1,320	1,050	1,240	7,030	9,260	4,070	2,230	2,310
8	1,690	1,270	1,530	1,420	1,320	1,050	1,260	7,260	9,210	3,910	2,160	2,310
9	1,660	1,260	1,540	1,420	1,300	1,040	1,280	7,440	9,020	3,830	2,130	2,380
10	1,630	1,260	1,560	1,420	1,290	1,040	1,310	7,580	8,930	3,740	2,100	2,410
11	1,630	1,260	1,570	1,410	1,280	1,030	1,380	7,720	8,780	3,660	2,050	2,470
12	1,620	1,260	1,580	1,400	1,270	1,020	1,470	7,990	8,540	3,580	2,010	2,530
13	1,600	1,250	1,580	1,400	1,260	1,020	1,560	8,130	8,310	3,500	1,980	2,680
14	1,580	1,250	1,590	1,390	1,250	1,020	1,630	8,270	8,220	3,410	1,930	2,790
15	1,560	1,260	1,590	1,390	1,240	1,010	1,700	8,430	7,990	3,340	1,890	2,790
16	1,530	1,260	1,590	1,390	1,230	1,000	1,720	8,710	7,720	3,280	1,860	2,930
17	1,510	1,260	1,600	1,380	1,220	1,000	1,840	8,950	7,510	3,250	1,820	3,020
18	1,490	1,260	1,600	1,380	1,210	982	1,960	9,340	7,350	3,220	1,800	3,070
19	1,470	1,260	1,600	1,370	1,200	982	2,080	9,480	7,160	3,160	1,760	3,130
20	1,440	1,260	1,590	1,370	1,200	982	2,310	9,660	6,930	3,120	1,730	3,220
21	1,400	1,260	1,590	1,360	1,200	974	2,740	9,960	6,700	3,070	1,710	3,310
22	1,380	1,260	1,590	1,360	1,190	958	3,050	10,100	6,480	3,050	1,710	3,380
23	1,360	1,270	1,580	1,360	1,180	942	3,380	10,200	6,260	3,020	1,700	3,460
24	1,340	1,270	1,570	1,350	1,170	934	3,760	10,300	5,760	2,990	1,690	3,540
25	1,320	1,280	1,560	1,350	1,160	926	4,100	10,400	5,400	2,930	1,680	3,620
26	1,320	1,280	1,540	1,350	1,150	918	4,420	10,400	5,190	2,890	1,680	3,700
27	1,320	1,280	1,530	1,340	1,140	918	4,790	10,400	5,030	2,850	1,670	3,780
28	1,300	1,290	1,520	1,330	1,130	942	5,270	10,400	4,930	2,820	1,640	3,860
29	1,290	1,300	1,510	1,330	-	974	5,480	10,400	4,870	2,780	1,620	3,960
30	1,290	1,310	1,500	1,330	--------	990	5,690	10,300	4,830	2,740	1,600	4,030
31	1,300	--------	1,490	1,330	--------	1,010	--------	10,300	--------	2,710	1,620	--------
Total	47,350	38,150	47,400	43,200	34,890	31,172	72,080	266,660	229,270	107,970	60,530	87,100
Mean	1,530	1,270	1,530	1,390	1,250	1,010	2,400	8,600	7,640	3,480	1,950	2,900
Cfsm	0.30	0.25	0.30	0.27	0.24	0.20	0.46	1.67	1.48	0.67	0.38	0.56
In.	0.35	0.28	0.35	0.31	0.25	0.23	0.51	1.92	1.65	0.77	0.44	0.62

Calendar year 1960:	Max	9,050	Min	1,250	Mean	2,770	Cfsm	0.54	In.	7.33
Water year 1960-61:	Max	10,400	Min	918	Mean	2,920	Cfsm	0.57	In.	7.68

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 1961 (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, 1,358.64 ft May 20; minimum, 1,356.59 ft Oct. 27, 29.
1913-15, 1941-42, 1946-61: 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 1960 to September 1961

Oct. 31..... 1,356.76	Jan. 31..... 1,356.87	Apr. 30..... 1,358.33	July 31..... 1,357.05
Nov. 30..... 1,356.83	Feb. 28..... 1,356.92	May 31..... 1,358.31	Aug. 31..... 1,356.76
Dec. 31.....a1,356.88	Mar. 31..... 1,357.43	June 30..... 1,357.40	Sept.30.....a1,357.27

a No gage reading, elevation estimated.

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 1961.

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

Average discharge.--8 years, 77.0 cfs.

Extremes.--Maximum discharge during year, 1,130 cfs Apr. 23 (gage height, 9.43 ft); minimum 3.3 cfs Aug. 25-28 (gage height, 3.08 ft).

1953-61: Maximum discharge, 1.750 cfs Apr. 17, 1954 (gage height, 10.28 ft); minimum daily, 3.2 cfs Feb. 24-26, 1955; minimum gage height, that of 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 periods of ice effect, which are fair.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 21, 23-25)

3.0	2.6	3.5	12	7.0	351
3.1	3.5	4.0	38	8.0	580
3.2	4.8	4.5	72	9.0	1,000
3.3	6.8	5.0	112	10.0	1,580
3.4	9.3	6.0	215		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10	42	15	6.8	4.2	5.4	187	368	100	8.8	9.0	4.2
2	10	47	15	6.4	4.2	5.5	158	323	105	8.3	8.8	4.5
3	10	48	14	6.1	4.2	5.5	122	286	110	7.8	9.9	4.1
4	9.9	48	14	5.9	4.3	5.4	95	249	106	7.6	8.3	4.0
5	9.9	45	14	5.7	4.5	5.4	83	216	96	6.8	7.3	4.0
6	9.6	43	14	5.6	4.6	5.3	75	196	82	6.3	6.8	5.1
7	9.6	40	13	5.5	4.7	5.2	71	202	70	5.7	6.1	5.1
8	9.3	40	13	5.4	4.8	5.2	68	218	60	5.5	5.9	5.1
9	8.8	39	12	5.4	4.9	5.3	66	228	52	5.1	5.5	5.0
10	8.8	36	11	5.3	4.9	5.4	61	229	49	5.7	5.5	13
11	8.8	34	11	5.3	4.9	5.6	57	223	43	5.3	*5.0	66
12	9.6	35	11	5.3	4.8	5.7	54	215	40	5.5	4.5	*94
13	16	36	10	5.3	4.8	5.8	54	223	38	6.3	4.2	112
14	18	34	10	5.4	4.7	5.9	*63	259	37	7.3	4.1	136
15	21	34	10	5.5	4.7	6.0	83	353	*37	8.6	3.8	151
16	22	37	9.8	5.5	4.7	6.0	80	466	35	12	3.6	156
17	22	36	9.5	5.4	4.6	6.0	74	542	31	13	3.5	150
18	22	35	9.3	5.2	4.6	6.2	78	539	28	13	3.8	137
19	20	*35	9.2	*5.0	4.6	7.1	127	491	24	*13	3.8	117
20	19	31	*9.0	4.9	4.6	9.5	255	433	22	14	3.7	100
21	17	30	8.8	4.8	4.6	16	*638	375	20	14	3.6	93
22	17	29	8.6	4.7	4.7	21	1,100	*329	18	13	3.5	92
23	18	27	8.4	4.6	4.8	26	*1,110	296	16	12	3.5	86
24	18	26	8.2	4.6	*4.8	29	*990	251	15	17	3.5	78
25	18	24	8.0	4.5	4.9	33	870	219	14	18	3.4	67
26	*19	22	7.7	4.4	5.0	42	*784	190	12	17	3.4	59
27	19	20	7.5	4.3	5.1	60	663	165	11	16	3.3	52
28	19	18	7.3	4.3	5.2	100	559	144	11	14	3.6	47
29	19	17	7.2	4.2	-	155	481	126	9.3	12	4.0	44
30	22	16	7.1	4.2	--------	*190	418	112	8.8	12	4.5	45
31	31	--------	7.0	4.2	--------	200	--------	100	--------	10	4.1	--------
Total	491.3	1,004	319.6	159.7	131.4	989.4	9,524	8,566	1,300.1	320.6	153.5	1,936.1
Mean	15.8	33.5	10.3	5.15	4.69	31.9	317	276	43.3	10.3	4.95	64.5
Cfsm	0.137	0.291	0.090	0.045	0.041	0.277	2.76	2.40	0.377	0.090	0.043	0.561
In.	0.16	0.32	0.10	0.05	0.04	0.32	3.08	2.77	0.42	0.10	0.05	0.63

Calendar year 1960: Max 568 Min 6.3 Mean 71.3 Cfsm 0.620 In. 8.42
Water year 1960-61: Max 1,110 Min 3.3 Mean 68.2 Cfsm 0.593 In. 8.04

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 9-12, 18, 22, 23, Nov. 26 to Apr. 8, Apr. 16, 17.

GPO 823486-6

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 1961.

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.--39 years, 300 cfs.

Extremes.--Maximum discharge during year, 1,160 cfs May 21 (gage height, 3.08 ft); minimum, 0.4 cfs Oct. 23 (gage height, -1.42 ft).
1911-17, 1928-61: Maximum discharge, 2,710ccfs 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 periods of no gage-height record, which are fair.

Rating table, water year 1960-61 (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 18-30)

-1.0	2.5	-0.2	23	1.5	314
- .8	4.4	0.0	36	2.0	534
- .6	7.6	.5	93	3.0	1,100
- .4	14	1.0	174	4.0	2,000

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	26	6.7	32	48	50	61	105	811	862	268	120	41
2	12	7.8	30	47	50	62	109	822	838	218	120	57
3	18	7.4	31	48	50	62	112	828	816	221	119	35
4	24	8.8	32	48	50	62	115	828	806	221	109	37
5	12	12	40	48	49	63	119	828	794	208	104	31
6	10	9.6	45	50	49	63	119	833	772	194	106	33
7	14	18	45	59	48	64	120	833	767	192	92	*30
8	15	13	46	60	47	64	120	811	734	180	82	36
9	12	11	46	62	47	64	120	794	704	172	82	32
10	8.8	17	46	59	48	64	120	822	689	167	67	86
11	9.1	15	47	59	48	64	123	844	669	166	59	125
12	13	21	47	60	49	64	*136	811	649	169	*45	131
13	16	18	48	58	49	64	136	856	624	*169	54	141
14	16	21	*50	58	49	65	141	904	*599	164	40	149
15	16	19	48	59	50	65	170	979	564	159	34	157
16	12	11	48	59	51	65	199	1,050	539	157	40	167
17	7.1	*17	48	*57	52	65	226	1,080	524	155	38	174
18	7.4	20	48	57	53	66	232	1,090	484	160	35	174
19	5.4	21	48	56	53	66	243	1,090	444	152	31	182
20	*6.2	20	47	55	54	66	282	*1,080	430	149	30	180
21	7.1	21	47	56	55	66	403	1,120	430	152	30	180
22	7.2	14	46	55	56	67	504	1,120	394	143	26	169
23	2.9	18	46	54	57	68	564	1,100	374	136	27	167
24	7.2	18	47	53	58	69	639	1,060	350	139	25	164
25	7.4	20	44	53	59	71	699	1,020	346	146	18	164
26	5.2	17	43	52	60	74	740	1,000	342	151	16	160
27	7.8	15	45	53	61	78	778	979	314	152	16	144
28	5.2	21	45	52	*61	82	794	941	303	147	17	139
29	6.9	27	45	52	-	86	811	923	289	139	17	160
30	7.8	30	45	52	---------	92	811	904	300	138	30	144
31	7.6	---------	48	50	---------	100	---------	874	---------	133	30	---------
Total	332.3	495.3	1,373	1,689	1,463	2,132	9,790	29,035	16,750	5,217	1,659	3,589
Mean	10.7	16.5	44.3	54.5	52.2	68.8	326	937	558	168	53.5	120
Cfsm	0.022	0.034	0.092	0.113	0.108	0.142	0.675	1.94	1.16	0.348	0.111	0.248
In.	0.03	0.04	0.11	0.13	0.11	0.16	0.75	2.24	1.29	0.40	0.13	0.28

Calendar year 1960:	Max	923	Min	2.9	Mean	217	Cfsm	0.449	In.	6.14
Water year 1960-61:	Max	1,120	Min	2.9	Mean	201	Cfsm	0.416	In.	5.67

* Discharge measurement made on this day.
Note.--No gage-height record Feb. 10-27, Mar. 1 to Apr. 1.

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 1961 in reports of Geological Survey; August 1911 to September 1961 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.--1910-17, 1934-61: 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 1960 to September 1961

Oct. 31	6.42	Apr. 30	6.28
Nov. 30	6.48	May 31	8.08
Dec. 31	6.65	June 30	8.15
Jan. 31	6.66	July 31	8.03
Feb. 28	6.16	Aug. 31	7.11
Mar. 31	5.46	Sept.30	7.80

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 1961.

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.--19 years, 118 cfs.

Extremes.--Maximum discharge during year, 1,380 cfs Apr. 22 (gage height, 4.43 ft); minimum, 7.8 cfs Dec. 28, Feb. 4-6; minimum gage height, 0.12 ft Aug. 28.
1942-61: 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, that of Aug. 28, 1961.

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

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 2				Apr. 3 to Sept. 30			
0.1	6.1	1.0	50	0.1	8.8	1.6	132
.2	8.5	1.3	80	.3	14	2.0	213
.4	14	1.6	130	.6	26	2.5	360
.7	29			.9	44	3.0	560
				1.2	72	4.3	1,290

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	23	37	16	11	8.3	14	82	289	163	24	17	10
2	22	39	16	12	8.0	14	70	254	167	22	17	11
3	22	39	17	12	8.0	14	68	233	165	20	17	12
4	21	38	19	12	7.8	14	60	216	156	18	17	11
5	21	37	23	12	7.8	14	54	199	141	18	17	11
6	20	36	33	12	7.8	14	53	206	132	17	16	*11
7	20	34	38	14	8.0	14	50	252	122	16	16	10
8	18	33	38	14	8.3	14	50	283	112	16	15	10
9	18	32	35	14	8.5	14	50	289	106	15	14	11
10	17	32	32	15	9.0	14	48	271	100	14	*14	59
11	16	31	29	15	9.6	14	46	255	94	14	14	112
12	18	31	27	15	9.8	14	*48	244	*88	*15	13	92
13	21	34	26	16	10	14	50	350	81	19	13	95
14	21	33	*25	16	10	14	60	463	75	19	12	109
15	23	35	23	16	10	14	78	800	69	18	11	113
16	23	*39	21	16	11	14	72	964	65	18	11	94
17	23	35	19	*16	12	13	81	*964	59	18	10	89
18	22	37	18	16	12	13	92	800	53	17	12	78
19	*20	35	16	16	12	14	146	628	48	16	11	69
20	19	33	15	16	12	14	353	503	44	16	11	64
21	18	32	14	16	12	15	811	415	41	15	11	66
22	18	31	12	16	13	16	1,280	353	38	15	11	67
23	18	26	10	14	13	18	1,250	307	37	16	11	67
24	18	28	9.3	14	13	20	916	274	35	17	10	65
25	17	26	9.8	13	13	22	*680	246	32	16	9.9	61
26	17	26	9.8	11	13	26	547	230	30	16	9.9	59
27	17	24	8.5	11	14	35	475	213	28	20	9.5	58
28	17	18	7.8	10	*14	50	423	197	26	20	9.9	58
29	17	16	8.5	9.6	-	70	378	188	24	19	9.7	58
30	23	16	9.6	9.0	--------	90	325	177	23	19	9.9	58
31	30	--------	11	8.5	--------	87	--------	167	--------	17	9.9	--------
Total	618	943	596.3	418.1	294.9	727	8,696	11,230	2,354	540	389.7	1,688
Mean	19.9	31.4	19.2	13.5	10.5	23.5	290	362	78.5	17.4	12.6	56.3
Cfsm	0.106	0.168	0.103	0.072	0.056	0.126	1.55	1.94	0.420	0.093	0.067	0.301
In.	0.12	0.19	0.12	0.08	0.06	0.14	1.73	2.23	0.47	0.11	0.08	0.34

Calendar year 1960: Max 705 Min 7.8 Mean 93.8 Cfsm 0.502 In. 6.82
Water year 1960-61: Max 1,280 Min 7.8 Mean 78.1 Cfsm 0.418 In. 5.67

Peak discharge (base, 500 cfs).--Apr. 22 (8-10 p.m.) 1,380 cfs (4.43 ft); May 17 (1 a.m.) 1,000 cfs (3.85 ft)

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Oct. 20, 24-26, Nov. 8-11, Nov. 29 to Dec. 23, Mar. 20 to Apr. 2.

5-1310. Dark River near Chisholm, Minn.

Location.--Lat 47°41'27", long 92°49'15", in SW¼SW¼ sec. 12, T. 60 N., R. 20 W., on right bank 50 ft downstream from remains of abandoned highway bridge, 3½ miles upstream from mouth, and 12¼ miles northeast of Chisholm.

Drainage area.--50.6 sq mi.

Records available.--August 1942 to September 1961 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 1,316.8 ft above mean sea level, datum of 1929 (surveyed by Topographic Division). Prior to Aug. 24, 1944, staff gage at site 50 ft upstream at same datum.

Average discharge.--19 years, 35.9 cfs.

Extremes.--Maximum discharge during year, 515 cfs Apr. 22 (gage height, 4.93 ft); minimum, 3.2 cfs Aug. 16, 17 (gage height, 0.87 ft).
1942-61: Maximum discharge, 1,170 cfs May 7, 1950 (gage height, 7.10 ft); minimum, 0.3 cfs Aug. 3, 1956; minimum gage height, 0.87 ft Mar. 22, 23, 1949, Aug. 16, 17, 1961.

Remarks.--Records good except those for periods of ice effect or backwater from leaves and debris, which are fair.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9.1	13	b10	6.2	6.2	5.2	b28	102	36	8.2	4.9	4.0
2	8.7	14	b10	6.4	6.1	5.3	b30	88	37	7.2	4.6	4.6
3	8.4	14	b11	6.5	6.1	5.3	b30	74	37	6.2	5.2	4.8
4	8.4	15	11	6.5	6.1	5.4	b28	65	36	6.1	5.0	4.3
5	8.5	15	14	6.5	6.1	5.4	27	58	35	5.7	4.9	*4.2
6	8.7	15	14	6.5	5.9	5.4	27	61	32	5.5	4.8	4.8
7	8.9	15	17	6.5	5.9	5.4	25	69	30	5.3	4.6	4.8
8	8.9	16	22	6.5	5.9	5.4	24	71	28	5.0	4.4	4.8
9	10	16	22	6.5	5.9	5.4	24	76	27	4.8	4.4	4.6
10	8.2	16	15	6.4	5.8	5.4	24	77	26	4.6	*4.3	35
11	10	16	14	6.4	5.8	5.4	23	76	24	*3.8	4.0	46
12	8.7	16	13	6.4	5.7	5.5	*24	74	*23	4.2	3.8	35
13	9.6	16	13	6.4	5.7	5.5	24	110	23	4.6	3.7	39
14	9.1	16	*11	6.4	5.6	5.5	27	130	21	4.6	3.6	42
15	10	16	11	6.4	5.6	5.5	29	230	19	5.0	3.6	42
16	10	*17	10	6.3	5.6	5.6	36	257	18	6.0	3.5	42
17	9.8	b17	10	*6.3	5.6	5.6	40	*278	18	6.1	3.5	41
18	9.3	b17	10	6.3	5.6	5.6	39	230	16	6.1	3.9	38
19	*9.1	16	9.8	6.3	5.6	5.6	54	177	15	6.1	3.9	35
20	8.9	b15	9.1	6.3	5.6	5.7	99	142	14	5.8	3.7	31
21	8.9	15	8.5	6.3	5.4	5.7	209	118	13	6.0	3.6	29
22	9.1	14	8.5	6.2	5.4	5.8	454	95	12	6.1	3.6	28
23	9.1	b14	8.2	6.2	5.4	5.9	461	77	11	6.1	3.6	26
24	9.1	13	7.9	6.2	5.4	5.9	366	65	11	6.4	3.6	25
25	8.9	13	6.0	6.2	5.3	6.0	263	58	9.7	6.1	3.5	23
26	8.9	13	6.0	6.2	5.3	6.1	*219	51	9.3	6.0	3.5	21
27	8.7	12	5.6	6.1	5.2	6.2	184	47	8.2	8.1	3.4	21
28	8.7	11	5.4	6.1	*5.2	6.5	156	44	8.0	6.5	3.7	19
29	8.7	b10	5.4	6.2	-	6.9	136	40	7.5	5.7	3.8	18
30	11	b10	5.7	6.2	---------	b8.0	115	37	7.2	5.4	3.9	18
31	12	---------	5.9	6.2	---------	b21	---------	35	---------	4.6	3.9	---------
Total	285.4	436	330.0	196.1	159.0	193.1	3,225	3,112	611.9	177.9	124.4	694.9
Mean	9.21	14.5	10.6	6.33	5.68	6.23	108	100	20.4	5.74	4.01	23.2
Cfsm	0.182	0.287	0.209	0.125	0.112	0.123	2.13	1.98	0.403	0.113	0.079	0.458
In.	0.21	0.32	0.24	0.14	0.12	0.14	2.37	2.29	0.45	0.13	0.09	0.51

Calendar year 1960: Max 198 Min 5.4 Mean 31.4 Cfsm 0.621 In. 8.42
Water year 1960-61: Max 461 Min 3.4 Mean 26.2 Cfsm 0.518 In. 7.01

* Discharge measurement made on this day.
b Stage-discharge relation affected by ice.
Note.--Backwater from leaves and debris Oct. 1 to Apr. 18.

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.

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 1961.

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.--38 years (1911-16, 1928-61), 954 cfs.

Extremes.--Maximum discharge during year, 9,120 cfs Apr. 23 (gage height, 22.00 ft); minimum, 73 cfs Aug. 30 (gage height, 4.80 ft).
1909-17, 1928-61: 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 tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 22				Apr. 23 to Sept. 30			
5.1	112	8.0	909	4.8	72	9.0	1,200
5.3	143	10.0	1,730	5.0	95	12.0	2,600
5.6	198	15.0	4,380	5.5	170	16.0	4,820
6.0	290	21.0	8,520	6.0	265	22.0	9,120
7.0	557			7.0	528		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	148	222	228	126	68	*75	1,350	3,180	1,150	203	99	105
2	147	256	233	124	67	76	1,200	2,810	1,160	189	118	132
3	143	268	239	122	66	78	1,040	2,500	1,130	185	145	121
4	140	290	246	121	66	80	880	2,240	1,130	167	158	114
5	141	298	252	119	65	80	760	2,050	1,080	163	162	109
6	138	308	260	118	65	81	660	1,930	1,010	168	148	105
7	129	310	265	117	66	82	570	2,060	937	162	137	*107
8	126	315	268	115	66	82	520	2,510	851	143	132	107
9	120	315	270	114	66	83	470	2,750	838	119	121	112
10	114	310	268	112	67	84	440	2,680	884	94	118	126
11	114	300	265	110	68	85	420	2,510	845	88	119	168
12	114	290	260	109	69	86	391	2,350	796	83	118	220
13	116	280	252	106	69	88	*383	2,440	758	81	*108	1,430
14	143	270	244	105	68	90	365	3,870	734	*82	104	1,610
15	150	265	*236	104	68	92	409	5,150	*681	90	100	1,720
16	155	260	226	101	68	95	536	7,970	607	95	98	2,000
17	157	*257	214	97	68	98	616	9,060	555	103	94	1,860
18	158	252	206	*95	68	102	838	8,400	513	104	104	1,620
19	160	250	200	93	68	106	985	6,880	469	125	103	1,360
20	*164	248	188	91	68	112	2,360	5,490	429	124	95	1,140
21	157	248	178	88	68	124	5,460	4,480	385	114	91	996
22	162	248	172	85	68	140	8,520	3,710	359	112	93	884
23	165	248	166	84	69	170	9,080	3,110	329	111	94	806
24	167	249	158	81	69	205	8,510	2,660	308	108	90	774
25	171	249	152	79	70	270	7,580	2,330	285	104	89	734
26	167	245	145	77	71	340	6,870	*2,050	265	98	88	675
27	167	240	140	75	72	430	5,870	1,810	254	98	84	625
28	165	232	134	73	73	600	4,970	1,630	242	98	80	585
29	165	230	131	72	-	1,090	4,270	1,480	224	104	78	576
30	176	228	130	71	---------	1,400	3,660	1,330	218	108	74	585
31	182	---------	128	69	---------	1,500	---------	1,220	---------	102	83	---------
Total	4,621	7,981	6,454	3,053	1,904	8,024	79,983	104,640	19,426	3,725	3,325	21,506
Mean	149	266	208	98.5	68.0	259	2,666	3,375	648	120	107	717
Cfsm	0.086	0.154	0.120	0.057	0.039	0.150	1.54	1.95	0.375	0.069	0.062	0.414
In.	0.10	0.17	0.14	0.07	0.04	0.17	1.72	2.25	0.42	0.08	0.07	0.46

Calendar year 1960: Max 8,250 Min 47 Mean 670 Cfsm 0.387 In. 5.28
Water year 1960-61: Max 9,080 Min 65 Mean 725 Cfsm 0.419 In. 5.69

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 11 to Apr. 11.

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 4 3/4 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 1961.

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.--33 years (1928-1961), 627 cfs.

Extremes.--Maximum discharge during year, 4,290 cfs May 17 (gage height, 8.02 ft); minimum, 54 cfs Aug. 11, 27 (gage height, 2.70 ft).
1909-12, 1928-61: Maximum discharge, 14,800 cfs May 8, 9, 1950; maximum gage height, 17.08 ft May 8, 1950; minimum recorded, 7 cfs Aug. 7, 1939.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair. Some diurnal fluctuation at low flow caused by powerplant a quarter of a mile upstream.

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.7	54	5.0	1,340
3.0	134	6.0	2,190
3.5	349	8.0	4,270
4.0	635		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	265	316	250	165	78	*72	370	1,550	837	138	243	89
2	256	321	250	160	76	72	340	1,400	900	128	206	102
3	248	344	260	155	75	74	330	1,280	956	118	172	94
4	243	340	270	150	75	74	321	1,180	921	112	145	89
5	239	340	275	148	75	75	316	1,120	830	99	131	89
6	243	330	280	145	76	76	311	1,100	746	92	118	89
7	235	321	280	142	77	77	340	1,220	648	86	105	89
8	243	316	275	140	78	77	349	1,320	570	76	94	*89
9	248	316	270	140	79	78	359	1,360	546	74	84	92
10	243	265	260	140	79	80	364	1,350	515	74	89	97
11	243	201	250	140	79	81	394	1,280	463	74	84	124
12	243	243	245	140	78	82	326	1,200	426	72	79	128
13	252	270	240	140	77	82	*340	1,500	410	72	*76	142
14	256	316	230	135	77	84	369	2,330	379	*74	72	197
15	256	369	*228	130	77	89	311	3,200	*354	76	74	222
16	261	354	220	130	76	91	316	4,150	326	84	72	222
17	270	*330	215	125	77	92	420	4,240	297	92	74	302
18	293	256	210	*117	78	94	426	3,950	274	102	84	297
19	284	243	205	113	79	92	364	3,430	256	118	84	279
20	274	316	200	110	80	92	778	2,900	239	105	81	256
21	*279	321	195	105	80	92	1,720	2,480	235	99	79	252
22	279	354	190	102	80	93	2,220	2,160	231	97	81	256
23	279	316	185	98	78	100	2,140	1,900	231	94	84	265
24	279	239	180	95	76	105	2,010	1,680	227	97	86	307
25	274	261	180	92	74	115	2,070	1,520	227	94	84	307
26	270	307	180	90	73	130	2,100	*1,380	222	92	81	297
27	265	293	175	86	72	190	2,070	1,240	193	94	69	288
28	261	270	175	85	72	300	2,000	1,110	176	99	89	284
29	261	260	170	83	-	390	1,880	1,020	172	265	76	279
30	270	250	170	81	--------	405	1,700	935	153	359	79	288
31	293	--------	170	79	--------	390	--------	865	--------	274	76	--------
Total	8,105	8,978	6,883	3,761	2,151	3,944	27,354	57,350	12,960	3,530	3,051	5,911
Mean	261	299	222	121	76.8	127	912	1,850	432	114	98.4	197
Cfsm	0.179	0.205	0.152	0.083	0.053	0.087	0.625	1.27	0.296	0.078	0.067	0.135
In.	0.21	0.23	0.18	0.10	0.05	0.10	0.70	1.46	0.33	0.09	0.08	0.15

Calendar year 1960: Max 3,040 Min 110 Mean 416 Cfsm 0.285 In. 3.90
Water year 1960-61: Max 4,240 Min 69 Mean 394 Cfsm 0.270 In. 3.68

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Apr. 3 (no gage-height record Feb. 22-28).

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 1961. 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.--33 years, 11,630 cfs.

Extremes.--Maximum discharge during year, 25,400 cfs May 18 (gage height, 10.65 ft); minimum daily, 2,830 cfs Jan. 16.
1928-61: Maximum discharge, 71,600 cfs May 12, 1950 (gage height, 21.04 ft); minimum daily, 928 cfs Dec. 26, 1929.

Remarks.--Records good. 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.7	2,760	3.0	5,620	7.0	14,700
1.0	3,030	4.0	7,500	10.0	23,300
2.0	4,130	5.0	9,660		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	8,530	6,530	6,250	5,600	6,400	7,150	9,780	16,700	13,100	8,350	7,940	7,440
2	8,160	6,140	5,990	5,180	7,220	6,540	9,430	15,000	15,600	5,760	8,080	8,120
3	5,160	5,250	5,980	6,500	7,790	6,500	9,330	14,200	19,300	5,060	8,660	5,810
4	6,050	5,030	4,000	6,120	7,200	6,770	8,930	14,600	20,500	4,100	8,750	4,180
5	7,940	5,480	3,450	6,250	6,300	7,990	8,510	14,400	20,600	3,900	8,840	3,710
6	8,530	4,500	6,500	6,450	7,150	6,310	8,160	14,000	20,400	6,380	7,860	6,770
7	8,290	4,310	7,700	6,650	7,660	6,940	8,200	14,100	20,000	8,160	5,840	7,120
8	8,040	6,490	7,400	4,180	7,790	6,290	8,440	14,700	19,600	8,180	5,350	*7,680
9	6,030	7,160	6,800	4,400	7,470	6,320	8,100	15,500	19,400	7,160	7,500	7,780
10	4,100	7,000	6,700	5,500	7,460	7,320	8,350	15,800	19,500	4,740	8,490	7,680
11	5,700	6,590	4,800	6,190	7,750	7,130	8,510	15,500	19,500	4,500	8,750	5,330
12	6,720	6,570	3,960	6,180	7,160	5,630	8,750	15,300	19,400	6,720	8,570	5,570
13	7,200	4,840	6,300	6,110	6,740	7,280	*8,710	15,400	19,100	7,920	8,000	8,730
14	7,280	4,210	7,180	6,220	7,650	7,230	8,530	16,200	19,200	*8,000	7,020	10,900
15	6,590	4,290	6,780	4,000	7,470	6,810	8,490	18,500	19,000	7,300	7,960	11,600
16	4,780	5,720	7,120	2,830	7,810	6,850	9,360	21,200	18,900	7,200	8,660	12,000
17	4,460	6,100	6,790	6,700	7,940	6,670	9,940	24,300	18,100	5,570	8,330	11,500
18	6,280	*5,670	4,000	6,850	7,530	6,810	10,600	25,300	13,200	5,300	8,880	8,100
19	7,740	5,760	3,000	6,300	7,390	7,560	11,400	24,300	10,600	7,800	8,950	6,960
20	7,700	5,690	5,300	5,900	6,500	7,810	12,000	22,500	10,100	8,790	8,550	9,500
21	8,350	4,580	6,120	6,690	7,100	7,580	14,700	20,700	10,400	8,930	7,080	10,600
22	8,330	5,840	5,070	5,320	6,330	7,210	18,800	19,300	9,660	9,080	5,060	11,100
23	5,790	6,700	6,040	7,820	7,580	6,970	20,600	18,100	8,950	9,180	6,960	11,000
24	4,160	6,300	6,400	7,000	7,670	8,250	19,100	16,900	8,790	9,430	7,860	10,500
25	5,860	4,720	5,210	6,070	6,930	8,770	20,700	*16,100	8,060	8,060	8,310	8,270
26	7,460	4,720	4,700	6,200	6,680	9,640	20,900	16,800	6,140	8,310	8,270	8,620
27	7,920	4,260	5,100	6,500	6,390	10,700	20,600	16,700	7,000	9,080	7,900	9,980
28	7,940	4,450	6,400	7,600	7,090	10,400	19,800	16,200	7,940	8,930	5,880	10,600
29	7,760	5,960	7,030	5,440	-	10,600	18,700	15,700	8,770	8,900	4,360	10,700
30	5,960	6,800	6,190	5,100	--------	10,400	17,700	14,200	8,950	8,970	6,640	11,000
31	4,420	--------	6,810	7,000	--------	10,300	--------	12,800	--------	9,500	7,100	--------
Total	209,230	167,660	181,070	184,850	202,150	238,730	375,120	531,000	439,760	229,260	236,400	258,850
Mean	6,749	5,589	5,841	5,963	7,220	7,701	12,500	17,130	14,660	7,395	7,626	8,628
Cfsm	0.348	0.288	0.301	0.307	0.372	0.397	0.644	0.883	0.756	0.381	0.393	0.445
In.	0.40	0.32	0.35	0.35	0.39	0.46	0.72	1.02	0.84	0.44	0.45	0.50

Calendar year 1960: Max 22,400 Min 3,000 Mean 8,953 Cfsm 0.461 In. 6.27
Water year 1960-61: Max 25,300 Min 2,830 Mean 8,915 Cfsm 0.460 In. 6.24

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 30 to Mar. 23.

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 1961.

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.--5 years, 174 cfs.

Extremes.--Maximum discharge during year, 1,340 cfs Apr. 21 (gage height, 7.44 ft); maximum gage height, 7.82 ft Mar. 27 (backwater from ice); minimum discharge, 0.1 cfs Aug. 13 (gage height, 1.18 ft).
1956-61: Maximum discharge, 4,080 cfs Apr. 21, 1957 (gage height, 14.58 ft); minimum that of Aug. 13, 1961.

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.2	0.2	1.9	18	4.0	360
1.3	1.2	2.1	30	5.0	630
1.4	2.9	2.5	68	6.0	909
1.5	4.9	2.8	106	7.0	1,200
1.7	10	3.5	237	8.0	1,530

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	86	112	58	41	7.7	*7.4	640	544	102	3.1	4.1	0.3
2	82	154	61	40	7.4	7.3	540	495	111	2.7	3.5	1.1
3	77	170	65	39	7.2	7.3	450	454	109	2.7	2.5	.8
4	72	177	72	38	7.2	7.3	400	419	95	2.7	2.2	.4
5	66	178	78	37	7.1	7.2	350	403	83	2.5	1.7	.3
6	63	174	87	36	7.1	7.2	320	387	73	2.4	1.0	.2
7	57	168	92	35	7.0	7.2	290	495	63	2.0	1.0	.3
8	53	158	90	35	7.0	7.2	270	565	58	1.7	1.2	2.0
9	52	148	87	34	7.0	7.2	270	579	48	1.6	2.4	*2.0
10	48	141	84	33	7.1	7.2	270	554	49	1.6	2.0	2.7
11	44	141	82	33	7.2	7.2	250	546	40	1.6	1.6	5.8
12	46	142	80	32	7.2	7.3	225	490	33	1.4	.6	5.8
13	49	143	78	31	7.3	7.3	205	476	28	1.7	*.5	16
14	56	145	77	30	7.4	7.3	*190	479	26	*2.2	.6	24
15	58	149	75	29	7.4	7.5	170	460	20	2.0	.6	34
16	60	150	*74	28	7.5	7.6	155	436	*18	2.7	.5	38
17	60	150	71	26	7.5	7.8	202	400	16	4.1	.8	42
18	54	*149	68	24	7.4	8.3	261	360	12	4.3	1.8	45
19	52	118	66	*22	7.4	8.8	622	328	10	5.4	1.4	35
20	49	106	64	20	7.4	9.5	1,060	304	9.2	3.8	1.0	32
21	*46	106	61	18	7.4	12	1,310	287	8.3	3.7	.9	36
22	45	88	59	16	7.4	20	1,290	266	7.2	5.1	1.1	58
23	45	82	56	15	7.4	40	1,140	248	6.5	4.5	.9	88
24	45	76	54	13	7.4	100	987	226	6.5	4.5	.8	42
25	45	70	51	12	7.4	200	876	*206	6.5	4.7	.5	41
26	45	64	49	11	7.4	500	803	182	5.1	5.8	.3	36
27	45	61	47	10	7.4	1,180	745	163	4.5	4.5	.2	83
28	46	60	46	9.5	7.4	1,130	692	148	3.8	3.7	.2	81
29	48	59	44	9.0	-	1,050	654	130	3.3	3.3	.2	85
30	55	58	43	8.5	--------	940	595	122	3.1	2.5	.2	73
31	78	--------	42	8.0	--------	800	--------	108	--------	2.2	.2	
Total	1,727	3,697	2,061	773.0	204.7	6,123.1	16,232	11,260	1,058.0	96.7	36.5	910.7
Mean	55.7	123	66.5	24.9	7.31	198	541	363	35.3	3.12	1.18	30.4
Cfsm	0.103	0.227	0.122	0.046	0.013	0.365	0.996	0.669	0.065	0.0057	0.0022	0.056
In.	0.12	0.25	0.14	0.05	0.01	0.42	1.11	0.77	0.07	0.007	0.002	0.06

Calendar year 1960: Max 820 Min 3.3 Mean 145 Cfsm 0.267 In. 3.64
Water year 1960-61: Max 1,310 Min 0.2 Mean 121 Cfsm 0.223 In. 3.01

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 18, 19, Nov. 23 to Apr. 15. No gage-height record Oct. 22 to Nov. 17, Dec. 19-22, Dec. 29 to Jan. 7, Jan. 23-27, Feb. 17-28.

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 1961. 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.--15 years, 32.1 cfs.

Extremes.--Maximum discharge during year, 93 cfs Apr. 22 (gage height, 4.58 ft, backwater from ice); no flow June 25 to Sept. 2.

1946-61: Maximum discharge, 1,410 cfs June 11, 1947 (gage height, 9.50 ft); 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 period of ice effect, which are fair.

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 4-12)

Oct. 1 to Apr. 26		Apr. 27 to Sept. 30			
1.8	0.3	1.5	0	2.1	3.2
1.9	.7	1.6	.1	2.3	6.4
2.0	1.2	1.7	.3	2.6	13
2.2	2.9	1.8	.7	3.0	26
		1.9	1.3	3.5	47
		2.0	2.1	4.0	76

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.3	2.1	1.5	0.9	0.7	0.5	20	57	*7.8			0
2	.4	2.2	*1.5	.9	.6	.5	18	51	8.6			0
3	.3	2.1	1.5	.9	.6	.5	16	46	8.2			.1
4	.6	2.0	1.5	.9	.6	.5	14	42	7.2			.9
5	.6	1.9	1.4	.9	.6	.5	14	37	6.0			.5
6	.7	1.8	1.4	1.0	.6	.5	*13	38	5.2			.1
7	.7	1.8	1.4	1.0	.6	.5	13	40	3.9			.1
8	.8	1.4	1.2	1.0	.6	.5	14	42	3.8			.2
9	.9	1.4	1.2	1.0	.6	.5	16	41	3.0			1.2
10	1.0	1.4	1.2	1.0	.6	.5	14	38	2.7			1.9
11	1.0	1.4	1.2	1.0	.6	.5	13	35	2.4			2.1
12	1.4	1.6	1.2	1.0	.6	.5	12	31	1.8			3.2
13	1.3	1.6	1.2	1.0	.6	.5	12	29	1.6			5.9
14	1.2	1.8	1.3	1.0	.6	.5	*12	25	1.5			5.5
15	1.8	1.8	1.3	1.0	.5	.5	12	24	1.2			3.1
16	1.7	1.8	1.3	1.0	.5	.5	13	24	1.0			3.3
17	1.5	1.8	1.2	1.0	.5	.5	13	22	.6			6.2
18	1.2	1.8	1.2	1.0	.5	.6	14	20	.6			8.6
19	1.2	1.8	1.0	1.0	.5	.6	20	17	.3			7.6
20	1.0	1.8	1.0	1.0	.5	1.5	40	16	.2			5.2
21	1.1	1.8	1.0	.9	.5	3.0	70	16	.1			2.3
22	1.5	2.0	.9	.9	.5	10	90	14	.1			4.8
23	2.0	2.0	.9	.9	.5	*14	80	12	*.2			12
24	2.1	2.0	.9	.9	*.5	30	70	11	.1			12
25	*1.9	2.0	.9	.9	.5	35	*65	9.4	0	(*)		9.9
26	2.0	2.0	.9	.9	.5	35	60	9.2	0			8.4
27	1.7	1.8	.9	.9	.5	35	63	6.4	*0			*6.4
28	1.3	1.8	*.9	.8	.5	25	66	6.0	0			*4.5
29	1.4	1.6	.9	.7	-	*30	65	5.5	0		(*)	3.9
30	1.5	1.6	.9	*.7	--------	25	62	5.3	0			4.6
31	2.8	--------	.9	.7	--------	22	--------	5.0	--------			--------
Total	38.9	53.9	35.7	28.7	15.5	275.2	1,004	774.8	68.1	0	0	124.5
Mean	1.25	1.80	1.15	0.93	0.55	8.88	33.5	25.0	2.27	0	0	4.15
Cfsm	0.011	0.016	0.010	0.008	0.005	0.081	0.305	0.227	0.021	0	0	0.038
In.	0.01	0.02	0.01	0.01	0.005	0.09	0.34	0.26	0.02	0	0	0.04

Calendar year 1960: Max 224 Min 0 Mean 12.6 Cfsm 0.115 In. 1.56
Water year 1960-61: Max 90 Min 0 Mean 6.63 Cfsm 0.060 In. 0.80

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 9 to Apr. 26 (no gage-height record Dec. 1, Jan. 28, 29, Jan. 31 to Feb. 23, Feb. 25 to Mar. 12).

5-2010. Winnigiboshish 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 1961. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to October 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, (543,370 acre-ft) July 1 (gage height, 9.67 ft); minimum, (465,260 acre-ft) Nov. 28 (gage height, 8.48 ft).

1884-1961: 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 height 0.00 ft and gage height 14.2 ft (maximum operating stage) is 967,930 acre-ft, of which 653,570 acre-ft is controlled storage above gage height 6.00 ft (minimum allowable stage). 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 1960 to September 1961

Date	Gage height (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	8.82	487,580	-
Oct. 31	8.81	486,920	-660
Nov. 30	8.62	474,450	-12,470
Dec. 31	8.70	479,700	+5,250
Calendar year 1960	-	-	-38,080
Jan. 31	8.66	477,080	-2,620
Feb. 28	8.63	475,100	-1,980
Mar. 31	8.61	473,790	-1,310
Apr. 30	8.96	496,780	+22,990
May 31	9.36	523,040	+26,260
June 30	9.40	525,660	+2,620
July 31	9.25	515,820	-9,840
Aug. 31	9.05	502,690	-13,130
Sept. 30	9.14	508,580	+5,890
Water year 1960-61	-	-	+21,000

/ Gage height at 12 p.m.

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 1961. 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.--77 years, 498 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 321 cfs Oct. 2; minimum daily, 42 cfs July 4, 5, Aug. 13.
1884-61: 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.--Four discharge measurements and 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	309	296	271	284	278	273	270	56	54	47	51	50
2	321	292	271	284	276	273	267	55	55	52	51	51
3	*308	283	271	284	276	273	265	55	55	47	50	56
4	*283	282	271	283	275	273	265	55	55	42	50	50
5	285	277	282	281	275	271	267	53	55	42	50	48
6	293	271	286	283	275	271	251	53	54	54	48	48
7	275	264	285	285	273	271	203	57	55	51	49	48
8	273	269	285	283	275	271	167	60	56	51	48	47
9	273	278	285	283	275	273	127	63	56	51	46	48
10	275	275	285	281	273	270	92	56	56	51	49	53
11	*273	269	285	283	273	271	57	55	56	51	49	58
12	268	265	284	281	273	270	53	58	58	51	48	55
13	275	264	284	283	273	270	53	62	60	52	42	55
14	287	264	284	283	273	270	50	63	48	55	43	62
15	311	271	286	281	273	271	55	65	49	58	47	62
16	316	288	284	281	273	269	55	57	50	57	52	58
17	*313	277	284	283	275	267	56	50	50	56	52	58
18	305	271	285	281	273	267	56	50	50	55	58	58
19	305	270	285	283	273	267	56	52	51	56	56	58
20	285	270	285	281	271	267	*56	53	51	55	56	58
21	283	269	285	283	271	267	60	52	48	54	55	60
22	290	281	285	280	273	267	60	53	48	53	55	64
23	300	270	283	281	271	267	60	54	48	55	54	61
24	275	270	284	281	275	267	58	54	47	56	54	60
25	269	265	283	278	273	267	53	54	46	55	54	60
26	273	269	283	280	275	269	53	54	45	55	53	58
27	269	264	281	278	273	275	54	53	44	55	52	64
28	271	259	281	280	273	275	55	53	45	54	52	64
29	267	280	281	278	-	273	55	53	44	53	52	56
30	269	275	281	278	---------	271	55	52	43	52	52	61
31	284	---------	283	278	---------	271	---------	52	---------	50	51	---------
Total	8,883	8,198	8,748	8,726	7,665	8,377	3,284	1,712	1,532	1,626	1,579	1,689
Mean	287	273	282	281	274	270	109	55.2	51.1	52.5	50.9	56.3
(≠)	-10.6	-210	+85.5	-42.6	-35.7	-21.3	+386	+427	+44.0	-160	-214	+99.0
Mean≠	276	63	368	238	238	249	495	482	95.1	-108	-163	155
Cfsm≠	191	0.044	0.255	0.165	0.165	0.173	0.343	0.334	0.066	-0.075	-0.113	0.107
In.≠	0.22	0.05	0.29	0.19	0.17	0.20	0.38	0.38	0.07	-0.09	-0.13	0.12

Calendar year 1960:	Max 896	Min 49	Mean 305	Mean≠ 252	Cfsm≠ 0.175	In.≠ 2.39
Water year 1960-61:	Max 321	Min 42	Mean 170	Mean≠ 199	Cfsm≠ 0.138	In.≠ 1.85

* Discharge measurement made on this day.
≠ Change in contents, equivalent in cubic feet per second, in Winnibigoshish Lake.
≠ Adjusted for change in contents
Note.--Negative figures of adjusted discharge and runoff indicate that evaporation and seepage from reservoir exceeded inflow.

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 1961. Monthly 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.

Extremes.--Maximum contents during year, 239,440 acre-ft Sept. 22 (gage height, 1,65 ft); minimum, 133,230 acre-ft Jan. 31 (gage height, 0.74 ft).

1884-1961: 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 -0.50 ft, and gage height 5.24 ft (maximum operating stage) is 743,330 acre-ft, of which 689,780 acre-ft is controlled storage above gage height 0.00 ft (minimum allowable stage). 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 1960 to September 1961

Date	Gage height (feet)≠	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	1.63	236,930	
Oct. 31	1.30	195,210	-41,720
Nov. 30	1.16	178,910	-16,300
Dec. 31	1.14	176,750	-2,160
Calendar year 1960	-	-	-67,760
Jan. 31	0.90	150,620	-26,130
Feb. 28	0.95	156,060	+5,440
Mar. 31	0.85	145,190	-10,870
Apr. 30	1.23	186,530	+41,340
May 31	1.49	219,230	+32,700
June 30	1.19	182,180	-37,050
July 31	1.25	188,890	+6,710
Aug. 31	1.02	163,700	-25,190
Sept.30	1.52	223.020	+59,320
Water year 1960-61	-	-	-13,910

≠ Gage height at 12 p.m.

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 1961. 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 gages 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.--77 years (1884-1961) 336 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 459 cfs Nov. 1, 2; minimum daily, 36 cfs Aug. 13.
1884-1961: Maximum daily discharge, 2,520 cfs June 7, 1977 (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 Enginers; three discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	401	459	326	321	367	370	398	77	111	114	47	51
2	398	459	326	319	364	*376	383	100	105	116	47	54
3	380	450	326	319	364	376	376	100	106	110	48	65
4	380	445	323	319	364	364	370	154	107	103	47	51
5	393	445	337	316	364	364	378	149	101	105	45	49
6	378	421	344	319	364	364	369	150	98	106	45	48
7	373	442	341	316	362	364	322	164	100	100	47	49
8	370	442	339	314	362	367	261	178	101	47	44	47
9	370	438	339	316	*364	364	200	171	101	47	41	48
10	374	347	339	319	362	362	141	154	96	46	43	62
11	403	347	337	319	364	364	101	156	97	46	45	44
12	403	339	337	319	362	358	52	165	99	47	39	42
13	408	342	337	330	364	356	51	169	96	48	36	56
14	408	339	337	378	367	362	51	164	91	52	54	*49
15	411	342	344	378	359	373	70	170	99	56	51	53
16	424	360	337	375	353	358	68	151	100	52	50	51
17	408	357	334	388	367	344	66	147	102	51	51	52
18	421	337	334	378	362	370	49	151	96	51	54	51
19	401	344	332	375	359	373	44	157	95	52	54	52
20	388	344	332	370	356	373	45	161	93	50	54	52
21	393	339	329	364	356	367	56	153	89	49	54	54
22	388	349	329	362	356	370	57	156	86	50	55	58
23	393	344	321	359	353	370	54	158	106	51	51	54
24	365	337	323	356	359	370	56	159	104	52	52	54
25	362	329	323	350	373	356	61	142	104	51	51	55
26	362	329	326	350	389	367	63	104	103	52	50	53
27	379	311	323	347	378	395	64	106	102	51	49	57
28	434	286	321	350	370	406	66	103	106	49	49	54
29	422	332	321	344	-	389	64	102	100	48	49	50
30	429	329	321	349	---------	378	65	102	95	46	51	53
31	450	---------	321	364	---------	392	---------	102	---------	45	49	---------
Total	12,269	11,084	10,259	10,683	10,184	11,462	4,401	4,375	2,989	1,943	1,502	1,568
Mean	396	369	331	345	364	370	147	141	99.6	62.7	48.4	52.3
(≠)	-678	-274	-35.2	-425	+97.8	-177	+695	+532	-623	+10.9	-410	+997
Mean≠	-282	95.0	296	-80.0	462	193	842	673	-523	73.6	-362	1,049
Cfsm≠	-0.242	0.082	0.255	-0.069	0.397	0.166	0.724	0.579	-0.450	0.063	-0.311	0.902
In.≠	-0.28	0.09	0.29	-0.08	0.41	0.19	0.81	0.67	-0.50	0.07	-0.36	1.01

Calendar year 1960:	Max 780	Min 45	Mean 277	Mean≠ 184	Cfsm≠ 0.158	In.≠ 2.14
Water year 1960-61:	Max 459	Min 36	Mean 227	Mean≠ 208	Cfsm≠ 0.179	In.≠ 2.32

* Discharge measurement made on this day.
≠ Change in contents, equivalent in cubic feet per second, in Leech Lake.
≠ Adjusted for change in contents.
Note.--Negative figures of adjusted discharge and runoff indicate that evaporation and seepage from lake exceeded inflow.

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 1961. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Pokegama Reservoir near Grand Rapids October 1941 to October 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, 64,520 acre-ft May 15 (gage height, 9.22 ft); minimum, 47,250 acre-ft Mar. 10, 11 (gage height, 8.09 ft).
1884-1961: Maximum contents, 155,000 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 height 4.50 ft and gage height 12.00 ft (maximum operating stage) is 120,750 acre-ft, of which 102,390 acre-ft is controlled storage above gage height 6,00 ft (minimum allowable stage). Contents shown herein are contents above gage height 4.50 ft. Water is used to benefit nqvigation 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 1960 to September 1961

	Gage height (feet)✓	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	8.98	60,540	-
Oct. 31	8.85	58,590	-1,950
Nov. 30	8.59	54,720	-3,870
Dec. 31	8.49	53,240	-1,480
Calendar year 1960	-	-	-
Jan. 31	8.37	51,450	-1,790
Feb. 28	8.11	47,560	-3,890
Mar. 31	8.35	51,130	+3,570
Apr. 30	9.04	61,510	+10,380
May 31	8.98	60,540	-970
June 30	8.62	55,180	-5,360
July 31	8.70	56,350	+1,170
Aug. 31	8.34	51,000	-5,350
Sept. 30	8.89	59,190	+8,190
Water year 1960-61	-	-	-1,350

✓ Gage height 12 p.m.

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 machine room of Blandin Paper Mill in Grand Rapids, 400 ft upstream from bridge on State Highway 169, and 2.5 miles upstream from Prairie River, and at mile 1,182 upstream from Ohio River.

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

Records available.--October 1883 to September 1961. 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.--78 years, 1,102 cfs.

Extremes.--Maximum discharge during year, 1,340 cfs May 15, computation of peak flow through Pokegama Dam (furnished by Corps of Engineers); minimum daily, 83 cfs Aug. 26-28.
1941-61: 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.--Daily discharge 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, 1959-61.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	845	725	580	565	671	640	803	520	329	143	105	180
2	830	725	580	560	650	645	797	511	335	143	103	178
3	825	732	570	555	645	635	797	511	338	136	95	172
4	830	*725	570	555	640	624	797	504	340	136	100	166
5	825	725	588	555	640	630	809	495	338	136	100	164
6	810	725	600	*570	635	630	828	487	338	136	99	180
7	810	739	592	570	635	624	728	507	335	131	97	210
8	810	739	596	560	630	624	728	515	335	131	95	204
9	795	732	596	560	630	630	643	511	335	129	95	199
10	790	739	600	560	630	618	652	507	326	127	96	196
11	775	732	600	565	630	630	557	515	324	128	95	187
12	767	725	596	565	630	624	566	515	324	129	92	185
13	788	732	596	570	635	624	430	625	315	131	91	196
14	781	732	596	600	719	635	339	736	307	136	90	*209
15	775	732	612	600	707	*640	368	1,070	301	137	*88	179
16	767	732	596	600	701	635	380	1,320	204	140	87	185
17	753	725	592	650	701	645	384	1,320	*202	141	86	193
18	760	719	596	635	671	655	384	1,320	196	141	89	199
19	732	*713	588	630	655	679	380	1,320	193	140	88	206
20	739	707	584	624	650	701	392	1,290	187	128	88	210
21	739	701	584	618	650	896	433	1,270	182	*102	87	214
22	739	695	580	612	645	908	457	1,210	180	105	87	220
23	725	679	575	606	645	921	464	951	178	105	86	217
24	725	671	570	596	650	933	479	*943	175	106	85	222
25	719	663	565	592	645	926	495	808	172	106	85	224
26	713	655	565	588	655	939	511	575	167	107	83	226
27	719	645	560	584	645	953	520	585	143	109	83	209
28	713	635	560	584	635	966	520	580	143	108	83	176
29	707	600	560	580	-	912	520	570	140	106	119	179
30	719	584	560	580	--------	797	520	566	139	106	187	179
31	732	--------	560	580	--------	803	--------	566	--------	106	182	--------
Total	23,757	21,083	18,067	18,169	18,275	22,722	16,681	23,723	7,521	3,865	3,046	5,864
Mean	766	703	583	586	653	733	556	756	251	125	98.3	195
Cfsm	-	-	-	-	-	-	-	-	-	-	-	-
In.	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1960: Max 1,780 Min 216 Mean 804 Cfsm 0.239 In. 3.25
Water year 1960-61: Max 1,320 Min 83 Mean 501 Cfsm 0.149 In. 2.02

* Discharge measurement made on this day.

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, 1¼ miles south of Warba, 3 3/4 miles northwest of Swan River, and 22 miles upstream from mouth.

Drainage area.--254 sq mi.

Records available.--October 1953 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,259.80 ft above mean sea level (Minnesota State Highway Department bench mark).

Average discharge.--8 years, 126 cfs.

Extremes.--Maximum discharge during year, 570 cfs May 17 (gage height, 7.36 ft); minimum, 15 cfs Sept. 4,5 (gage height, 1.65 ft).
1953-61: 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, that of Sept. 4, 5, 1961.
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 tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Nov. 1-7)

Oct. 1 to Mar. 28		Mar. 29 to Sept. 30			
2.1	38	1.6	13	4.0	175
2.3	48	1.9	26	6.0	378
2.6	67	2.4	54	8.0	698
3.0	95	3.0	95		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	55	74	57	45	36	45	118	276	158	41	25	17
2	52	68	57	45	36	45	91	258	157	44	24	17
3	56	64	57	45	36	45	101	241	152	38	23	16
4	49	*60	57	45	37	46	91	227	141	34	22	15
5	49	59	57	45	37	46	80	216	126	33	22	16
6	49	59	58	*46	38	46	75	213	113	30	21	17
7	47	59	57	46	38	46	66	237	101	28	21	19
8	47	65	56	46	39	47	65	241	91	26	20	19
9	48	64	56	47	39	47	64	226	82	25	20	18
10	48	65	55	47	40	47	62	211	77	24	22	19
11	46	70	54	47	40	47	62	212	71	24	24	29
12	45	74	53	47	40	47	62	218	78	24	24	43
13	58	73	53	47	40	47	65	256	85	24	22	40
14	63	70	52	47	41	47	68	336	73	25	*21	*47
15	64	70	51	48	41	*47	86	482	65	*26	21	52
16	59	69	50	48	41	48	95	545	60	32	20	46
17	59	65	49	48	41	49	94	568	*58	32	18	38
18	56	56	49	47	41	50	119	556	58	30	20	34
19	55	*78	48	46	42	51	*199	523	58	27	22	32
20	53	80	47	45	*42	52	334	494	61	26	24	32
21	51	76	47	44	42	54	412	462	54	27	23	32
22	51	70	47	43	43	57	406	431	52	32	22	36
23	51	68	47	42	44	61	352	401	50	34	20	37
24	50	66	46	41	44	68	320	*372	48	33	19	35
25	49	67	46	40	44	85	330	339	45	30	19	32
26	49	64	46	39	45	110	*350	302	44	28	18	30
27	49	62	46	38	45	130	350	265	42	34	18	32
28	49	60	46	37	45	145	333	233	40	34	18	31
29	49	59	46	36	-	141	311	206	40	30	18	28
30	55	58	46	36	--------	131	293	186	38	30	18	29
31	73	--------	46	36	--------	131	--------	169	--------	27	17	--------
Total	1,634	1,992	1,582	1,359	1,137	2,058	5,454	9,902	2,318	932	646	888
Mean	52.7	66.4	51.0	43.8	40.6	66.4	182	319	77.3	30.1	20.8	29.6
Cfsm	0.207	0.261	0.201	0.172	0.160	0.261	0.717	1.26	0.304	0.119	0.082	0.117
In.	0.24	0.29	0.23	0.20	0.17	0.30	0.80	1.45	0.34	0.14	0.09	0.13

Calendar year 1960: Max 716 Min 45 Mean 126 Cfsm 0.496 In. 6.79
Water year 1960-61: Max 568 Min 15 Mean 81.9 Cfsm 0.322 In. 4.38

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 11 to Mar. 28.

GPO 823406-7

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., at Libby, 1 mile upstream from dam on Sandy River, 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 1961. Monthly contents only for some periods, published in WSP 1308. Published as Sandy Lake Reservoir at Libby October 1941 to October 1956.

Gage.--Water-stage recorder. Datum of gage is 1,207.71 ft above mean seal level, adjustment of 1912. Prior to Sept. 23, 1949, float gage at same site and datum.

Extremes.--Maximum contents during year, 55,080 acre-ft Apr. 17 (gage height, 9,27 ft); minimum, 37,780 acre-ft Mar. 18 (gage height, 7.34 ft).

1895-1961: 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 height 1.72 ft and gage height 11.0 ft (maximum operating stage) is 72,500 acre-ft, of which 37,540 acre-ft is controlled storage above gage height 7.0 ft (minimum allowable stage). 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-ft by Geological Survey.

Month-end gage height and contents, water year October 1960 to September 1961

Date	Gage height (feet)✓	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	8.85	51,110	
Oct. 31	8.79	50,560	-550
Nov. 30	8.65	49,270	-1,290
Dec. 31	8.33	46,370	-2,900
Calendar year 1960	-	-	+7,740
Jan. 31	7.81	41,770	-4,600
Feb. 28	7.44	38,620	-3,150
Mar. 31	7.55	39,550	+930
Apr. 30	8.78	50,480	+10,930
May 31	8.98	52,320	+1,840
June 30	9.00	52,500	+180
July 31	8.85	51,110	-1,390
Aug. 31	8.55	48,360	-2,750
Sept.30	8.66	49,370	+1,010
Water year 1960-61	-	-	-1,780

✓ Gage height at 12 p.m.

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 1.4 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 1961. 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.--66 years (1895-1961), 201 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,390 cfs May 18; minimum daily, 2 cfs Oct. 1 to Nov. 10. 1893-1961: Maximum daily discharge, 3,738 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.--One discharge measurement made and records reviewed by Geological Survey. Daily discharge furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2	2	68	82	77	38	40	425	42	3	3	3
2	2	2	68	82	78	38	40	340	26	3	3	3
3	2	2	67	82	77	37	40	270	26	3	3	3
4	2	2	66	83	76	37	40	140	27	3	3	3
5	2	2	66	82	76	37	41	140	27	3	3	3
6	2	2	66	82	76	38	41	145	54	3	3	3
7	2	2	67	82	76	38	24	150	54	3	3	3
8	2	2	86	81	75	39	24	150	54	3	3	3
9	2	2	85	82	74	39	24	150	81	3	3	3
10	2	2	85	82	73	38	24	150	81	3	3	3
11	2	11	84	82	73	38	25	150	84	3	3	3
12	2	11	83	82	73	38	25	155	84	3	3	3
13	2	11	84	82	73	38	25	155	84	3	3	3
14	2	11	85	82	73	39	25	155	84	3	3	*3
15	2	69	84	81	73	39	25	433	3	3	3	3
16	2	68	84	80	72	39	26	832	3	3	3	3
17	2	68	84	80	71	39	26	880	3	3	3	3
18	2	68	85	80	71	40	26	1,390	3	3	3	3
19	2	68	84	79	37	40	26	1,100	3	3	3	3
20	2	68	83	79	38	40	25	1,060	3	3	3	3
21	2	68	84	78	39	40	48	1,100	3	3	3	3
22	2	68	84	79	38	40	355	1,100	3	3	3	3
23	2	68	83	79	38	39	350	540	3	3	3	3
24	2	69	82	79	38	38	355	585	3	3	3	3
25	2	69	82	79	38	38	360	590	3	3	3	3
26	2	69	82	78	38	38	360	290	3	3	3	3
27	2	69	83	77	37	39	340	315	3	3	3	3
28	2	69	84	77	37	39	345	285	3	3	3	3
29	2	69	84	77	-	39	380	345	3	3	3	3
30	2	69	83	76	--------	39	430	190	3	3	3	3
31	2	--------	83	76	--------	39	--------	120	--------	3	3	--------
Total	62	1,160	2,478	2,482	1,715	1,197	3,915	13,830	856	93	93	90
Mean	2.0	38.7	79.9	80.1	61.2	38.6	130	446	28.5	3.0	3.0	3.0
(†)	-9.0	-21.7	-47.1	-74.8	-56.8	+15.2	+184	+30.0	+3.0	-22.6	-44.8	+17.0
Mean≠	-7.03	17.0	32.8	5.3	4.4	53.8	314	476	31.5	-19.6	-41.8	20.0
Cfsm≠	-0.017	0.040	0.078	0.013	0.010	0.128	0.746	1.13	0.075	-0.047	-0.099	0.048
In.≠	-0.02	0.05	0.09	0.01	0.01	0.15	0.86	1.30	0.08	-0.05	-0.11	0.05

Calendar year 1960:	Max 1,758	Min 2	Mean 174	Mean≠ 185	Cfsm≠ 0.439	In.≠ 5.96
Water year 1960-61:	Max 1,390	Min 2	Mean 76.6	Mean≠ 74.2	Cfsm≠ 0.176	In.≠ 2.42

* Discharge measurement made on this day.
† Change in contents, equivalent in cubic feet per second, in Sandy Lake.
≠ Adjusted for change in contents.
Note.--Negative figures of adjusted discharge and runoff indicate that evaporation and seepage exceeded inflow.

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 and three-quarters of a mile northwest of Libby.

Drainage area.--5,060 sq mi, approximately.

Records available.--April 1930 to September 1961.

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.--31 years, 1,825 cfs.

Extremes.--Maximum discharge during year, 4,450 cfs May 19 (gage height, 9.91 ft); minimum, 155 cfs Aug. 30 (gage height, 1.54 ft).
1930-61: 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, or no gage-height record, which are fair. Flow regulated by powerplants and Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 82, 84, 86, 89).

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 26		Mar. 27 to June 25		June 26 to Sept. 30	
3.4	898	2.4	459	1.5	146
4.0	1,210	3.0	738	1.7	190
4.4	1,420	4.0	1,240	2.0	278
		7.0	2,830	2.5	458
		10.0	4,500	3.0	690
				3.5	950

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,040	960	660	900	860	960	1,310	2,570	1,650	415	304	342
2	1,080	981	680	900	880	970	1,340	2,480	1,460	400	272	345
3	1,030	*950	780	890	880	980	1,210	2,360	1,370	380	275	345
4	981	981	860	*860	890	970	1,150	2,140	1,300	366	300	317
5	971	992	870	860	900	960	1,190	2,080	1,260	294	338	307
6	1,040	1,020	850	880	900	960	1,250	1,970	1,240	259	362	291
7	1,120	1,010	840	880	*880	950	1,250	1,900	1,190	252	307	288
8	1,130	1,030	820	880	900	940	1,210	1,920	1,180	288	284	338
9	1,160	1,040	840	860	910	950	1,160	1,910	1,160	294	265	359
10	1,160	1,040	860	840	920	960	1,130	1,880	1,060	291	284	366
11	1,110	976	880	840	930	970	1,010	1,840	938	284	314	380
12	1,040	992	870	840	930	970	998	1,800	793	272	310	407
13	971	1,050	860	840	940	970	973	1,760	733	281	304	*471
14	929	1,090	840	840	940	*970	968	1,950	763	281	304	518
15	950	1,130	860	850	940	960	953	2,770	778	307	*294	540
16	950	1,140	860	860	950	980	938	3,530	748	334	240	567
17	940	1,140	860	870	980	980	963	3,940	733	356	214	562
18	955	1,130	840	870	980	970	*863	4,310	698	348	240	576
19	986	1,110	880	870	960	970	888	4,430	639	317	246	518
20	1,020	1,110	870	860	920	990	1,260	4,430	*536	*300	243	454
21	1,020	1,110	850	860	920	1,040	1,760	4,360	459	291	262	531
22	1,020	1,100	860	860	920	1,070	2,100	4,240	536	320	243	640
23	1,020	1,050	900	860	940	1,200	2,150	*3,850	545	324	204	737
24	1,010	1,020	920	860	960	1,320	2,110	3,740	577	342	217	747
25	992	1,010	940	860	970	1,400	2,090	3,600	601	331	237	655
26	971	1,010	910	880	980	1,420	2,150	3,320	458	294	229	466
27	940	1,020	890	900	980	1,410	2,300	3,040	400	304	220	483
28	903	1,000	880	900	960	1,370	2,440	2,720	366	307	190	660
29	976	760	870	900	-	1,370	2,550	2,440	373	304	164	585
30	986	*640	860	890	---------	1,410	2,610	2,100	366	297	157	558
31	955	---------	880	880	---------	1,350		1,870	---------	297	186	---------
Total	31,356	30,592	26,440	26,940	26,020	33,690	44,274	87,250	24,910	9,730	8,009	14,353
Mean	1,011	1,020	853	869	929	1,087	1,476	2,815	830	314	258	478
Cfsm	0.200	0.202	0.168	0.172	0.184	0.215	0.292	0.556	0.164	0.062	0.051	0.094
In.	0.23	0.22	0.19	0.20	0.19	0.25	0.33	0.64	0.18	0.07	0.06	0.10

Calendar year 1960:	Max	5,640	Min	418	Mean	1,592	Cfsm	0.315	In.	4.26
Water year 1960-61:	Max	4,430	Min	157	Mean	996	Cfsm	0.197	In.	2.66

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 26 (no gage-height record Jan. 22 to Feb. 2).

5-2275. Mississppi River at Aitkin, Minn.

Location.--Lat 46°32'26", long 93°42'26", in W½ sec. 24, T. 47 N., R. 27 W., on 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 1961.

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.--16 years, 2,785 cfs.

Extremes.--Maximum discharge during year, 5,980 cfs May 20; maximum gage height, 7.54 ft May 21; minimum, discharge, 151 cfs Sept. 1 (gage height, -2.40 ft).
1945-61: Maximum discharge observed, 20,000 cfs May 20, 1950 (gage height, 19.49 ft); minimum, that of Sept. 1, 1961.

Remarks.--Records good except those for period of ice effect, which are fair. Slight regulation by powerplants and Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 82, 84, 86, 89). 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.

Cooperation.--Gage-height Oct. 1 to Mar. 14, furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,030	1,020	750	930	940	1,050	1,770	3,410	2,330	454	293	153
2	1,050	1,010	680	920	940	1,040	1,550	3,350	2,120	461	303	242
3	1,090	1,020	690	920	940	1,050	1,450	3,220	1,920	464	293	329
4	1,110	*1,040	750	920	950	1,070	1,360	3,040	1,770	451	272	342
5	1,050	1,030	840	910	960	1,080	1,300	2,820	1,660	425	284	332
6	1,020	1,020	900	910	970	1,080	1,290	2,680	1,590	382	316	322
7	1,040	1,010	910	910	960	1,080	1,320	2,560	1,530	313	372	297
8	1,050	1,020	890	910	960	1,070	1,340	2,480	1,470	268	359	281
9	1,080	1,030	890	930	970	1,070	1,330	2,470	1,420	272	316	300
10	1,150	1,050	900	*920	*980	1,070	1,270	2,480	1,370	290	290	355
11	1,190	1,060	910	910	990	1,070	1,230	2,470	1,270	293	281	388
12	1,200	1,070	920	900	1,000	1,070	1,160	2,500	1,160	313	313	405
13	1,130	1,080	930	900	1,010	1,070	1,100	2,380	1,040	300	326	*494
14	1,120	1,070	930	900	1,020	1,070	1,090	2,470	948	303	326	563
15	1,100	1,120	930	890	1,010	1,070	1,120	2,940	937	306	319	609
16	1,060	1,130	920	890	1,010	*1,070	1,090	3,760	934	313	*313	643
17	1,030	1,180	920	900	1,020	1,060	1,090	4,580	898	329	287	668
18	993	1,200	910	910	1,030	1,060	1,100	5,210	867	362	284	696
19	996	1,190	910	920	1,040	1,050	1,150	5,710	832	375	262	688
20	993	1,160	905	930	1,040	1,050	1,360	5,920	*776	*362	253	660
21	1,010	1,160	930	920	1,030	1,050	*1,900	5,970	688	345	247	606
22	1,030	1,160	940	920	1,030	1,080	2,430	5,860	609	326	250	606
23	1,030	1,140	940	940	1,020	1,170	2,900	*5,700	593	336	253	660
24	1,050	1,160	930	940	1,020	1,300	3,040	5,270	616	352	227	755
25	1,060	1,150	930	930	1,020	1,550	3,070	4,940	619	365	216	800
26	1,060	1,120	920	910	1,030	1,860	3,070	4,590	647	375	222	780
27	1,070	1,120	920	900	1,040	2,120	3,100	4,190	586	339	224	657
28	1,010	1,110	940	920	1,060	2,280	3,220	3,770	500	313	222	570
29	996	1,100	970	940	-	2,290	3,300	3,360	444	309	205	647
30	1,000	1,000	970	940	---------	2,130	3,390	2,980	435	319	182	692
31	1,010	---------	960	940	---------	1,980	---------	2,610	---------	303	156	---------
Total	32,808	32,730	27,735	28,430	27,990	40,110	54,890	115,690	32,579	10,718	8,466	15,540
Mean	1,058	1,091	895	917	1,000	1,294	1,830	3,732	1,086	346	273	518
Cfsm	0.172	0.178	0.146	0.149	0.163	0.211	0.298	0.608	0.177	0.056	0.044	0.084
In.	0.20	0.20	0.17	0.17	0.17	0.24	0.33	0.70	0.20	0.06	0.05	0.09

Calendar year 1960: Max 8,630 Min 563 Mean 2,012 Cfsm 0.328 In. 4.47
Water year 1960-61: Max 5,970 Min 153 Mean 1,172 Cfsm 0.191 In. 2.58

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 27.

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 1961. Monthly 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, 98,620 acre-ft May 20 (gage height, 13.02 ft); minimum, 80,910 acre-ft Mar. 3 (gage height, 11.70 ft).
1886-1961: 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 height 2.35 ft and gage height 18.5 ft (maximum operating stage) is 177,520 acre-ft, of which 131,310 acre-ft is controlled storage above gave height 9.0 ft (minimum allowable stage). Contents shown herein are contents above gage height 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 1960 to September 1961

Date	Gage height (feet)✓	Contents (acre-feet	Change in contents (acre-feet)
Sept.30	12.36	89,690	
Oct. 31	12.32	89,160	-530
Nov. 30	12.27	88,480	-680
Dec. 31	12.27	88,480	0
Calendar year 1960	-	-	+1,740
Jan. 31	11.99	84,730	-3,750
Feb. 28	11.72	81,160	-3,570
Mar. 31	11.83	82,610	+1,450
Apr. 30	12.52	91,830	+9,220
May 31	12.82	95,900	+4,070
June 30	12.50	91,560	-4,340
July 31	12.75	94,950	+3,390
Aug. 31	12.47	91,160	-3,790
Sept.30	12.57	92,510	+1,350
Water year 1960-61	-	-	+2,820

✓ Gage height at 12 p.m.

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 1961. 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.--75 years, 206 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 350 cfs May 23-28; minimum daily, 30 cfs Nov. 3-14.
1886-1961: Maximum daily discharge, 2,246 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.--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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	45	35	60	100	115	115	115	50	195	50	60	50
2	45	35	60	100	115	115	115	50	195	45	60	50
3	45	30	60	101	115	115	115	50	195	40	60	50
4	45	30	60	115	115	115	115	50	190	40	60	45
5	45	30	60	115	115	115	115	50	175	40	60	45
6	45	30	60	115	115	115	115	50	150	40	60	45
7	45	30	60	115	115	115	93	50	150	35	55	45
8	45	30	60	115	115	115	50	50	120	35	45	45
9	45	30	60	115	115	115	50	50	70	35	45	45
10	45	30	60	115	115	115	50	50	65	35	50	45
11	45	30	60	115	115	115	50	51	70	40	50	50
12	45	30	60	115	115	115	50	*58	65	40	50	45
13	45	30	60	115	115	115	50	58	65	40	50	45
14	45	30	60	115	115	115	50	58	65	40	45	45
15	45	39	60	115	115	115	50	88	64	40	45	45
16	40	60	60	115	115	115	50	155	55	40	45	45
17	40	60	60	115	115	115	50	155	55	40	45	45
18	40	60	60	115	115	115	50	155	55	40	45	45
19	40	60	72	115	115	115	50	183	55	40	45	45
20	35	60	100	115	115	115	50	240	50	40	45	45
21	35	60	100	115	115	115	50	240	50	45	45	45
22	35	60	100	115	115	115	50	277	50	45	50	45
23	35	60	100	115	115	115	50	350	55	45	50	45
24	35	60	100	115	115	115	50	350	55	45	50	45
25	35	60	100	115	115	115	50	350	45	46	50	45
26	35	60	100	115	115	115	50	350	45	60	50	45
27	35	60	100	115	115	115	50	350	45	56	50	45
28	35	60	100	115	115	115	50	350	45	45	50	45
29	35	60	100	115	-	115	50	312	45	45	45	45
30	35	60	100	115	---------	115	50	220	45	45	45	45
31	35	---------	100	115	---------	115	---------	212	---------	48	45	---------
Total	1,255	1,369	2,352	3,521	3,220	3,565	1,933	5,062	2,584	1,320	1,550	1,370
Mean	40.5	45.6	75.9	114	115	115	64.4	163	86.1	42.6	50.0	45.7
(✓)	-8.7	-11.3	0	-61.0	-64.3	+23.5	+155	+66.1	-73.0	+55.2	-61.1	+22.7
Mean≠	31.8	34.3	75.9	53.0	50.7	138	219	229	13.1	97.8	-11.6	68.4
Cfsm≠	0.057	0.061	0.135	0.094	0.090	0.246	0.390	0.407	0.023	0.174	-0.021	0.122
In.≠	0.07	0.07	0.16	0.11	0.09	0.28	0.44	0.47	0.03	0.20	-0.02	0.14

Calendar year 1960: Max 555 Min 30 Mean 147 Mean≠ 149 Cfsm≠ 0.265 In.≠ 363
Water year 1960-61: Max 350 Min 30 Mean 79.7 Mean≠ 83.6 Cfsm≠ 0.149 In.≠ 2.04

* Discharge measurement made on this day.
✓ Change in contents, equivalent in cubic feet per second, in Pine River Reservoir.
≠ Adjusted for change in contents.
Note.--Negative figures of adjusted discharge and runoff indicate that evaporation and seepage from reservoir exceeded inflow.

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 (revised) and Pelican Lakes, 0.5 miles upstream from Pelican Lake and 6 miles east of town of Pequot Lakes.

Records available.--April 1938 to September 1961 (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, 2.20 ft May 24; minimum observed, 1.62 ft Sept. 9.
1938-61: 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 1960 to September 1961

Oct. 31	1.86	May 31	2.08	July 31	1.98
Nov. 26	1.78	June 28	1.80	Aug. 29	1.76
May 12	2.04			Sept. 29	1.66

Note.--Gage readings other than those shown above are available.

5-2415. Rabbit River near Crosby, Minn.

Location.--Lat 46°30'55", long 93°57'35", in NE¼ sec. 35, T. 47 N., R. 29 W., on right bank a third of a mile downstream from Clinker Lake control dam and 2 miles north of Crosby.

Drainage area.--8.38 sq mi.

Records available.--August 1945 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 1,190.00 ft above mean sea level, adjustment of 1912.

Average discharge.--16 years, 5.91 cfs.

Extremes.--Maximum discharge during year, 18 cfs May 7 (gage height, 6.04 ft); minimum daily, 0.1 cfs many days during October, November, and December; minimum gage height, 4.59 ft Oct. 23, 26.
1945-61: Maximum discharge, 94 cfs June 27, 1946 (gage height, 7.54 ft) from rating curve extended above 30 cfs (release from log jam); no flow at times.

Remarks.--Records fair. Some regulation by Clinker Lake. Flow affected by pumping from Rabbit Lake and underground mine.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.1	0.2	0.1	2.3	1.8	2.2	0.7	7.4	5.4	1.9	1.3	0.4
2	.1	.2	*.2	2.2	1.8	2.0	.6	5.3	5.3	1.8	1.2	.4
3	.1	.2	.2	2.3	1.9	1.7	.5	4.6	5.0	1.6	1.2	.3
4	.1	*.2	.2	2.6	2.0	1.6	1.0	4.1	4.9	1.3	1.2	.2
5	.1	.2	.2	3.1	2.1	1.5	2.1	3.7	4.8	1.2	1.0	.2
6	.1	.1	.2	3.3	2.2	1.5	2.0	3.9	4.5	1.2	1.0	.2
7	.1	.2	.2	3.4	2.3	1.5	1.8	6.8	4.4	1.0	1.0	.2
8	.1	.1	.2	3.1	2.4	1.4	2.6	15	4.3	.8	1.0	.3
9	.1	.1	.2	2.8	*2.6	1.4	3.2	14	4.2	.6	1.0	.3
10	.1	.2	.2	*2.5	2.6	1.4	3.3	14	4.0	.5	.9	.4
11	.1	.2	.2	2.3	2.7	1.4	3.4	14	3.9	.6	.8	.5
12	.1	.2	.2	2.2	2.7	1.4	3.6	*13	3.9	.8	.7	*.6
13	.1	.1	.3	2.1	2.8	1.4	3.5	12	3.7	1.2	.6	1.2
14	.1	.1	.5	2.0	3.3	1.4	3.4	15	3.2	1.6	.6	1.4
15	.1	.1	.6	2.0	3.2	1.3	3.8	16	2.8	1.4	.5	1.4
16	.1	.1	.6	2.0	3.0	*1.2	3.7	14	2.6	1.2	*.5	1.2
17	.1	.2	.6	2.0	2.7	1.1	3.7	14	2.3	1.0	.5	1.1
18	.1	.2	.5	1.8	3.0	.8	3.6	13	2.2	1.0	.5	1.0
19	.1	.2	.5	1.7	3.2	.7	3.6	13	1.9	1.0	.6	.9
20	.1	.2	.5	1.7	3.1	.7	2.3	12	1.9	1.1	.5	.9
21	.1	.2	.5	1.6	2.8	.6	*1.7	12	1.9	1.4	.5	1.4
22	.1	.2	.5	1.6	2.7	.8	1.6	12	2.0	1.9	.5	1.4
23	.1	.2	.6	1.6	2.6	1.1	1.8	11	1.9	2.0	.5	1.4
24	.1	.2	.8	1.6	2.7	.9	2.2	11	1.7	1.8	.5	1.4
25	.1	.2	1.0	1.6	2.8	.8	2.2	10	1.5	1.6	.5	1.3
26	.1	.2	1.0	1.6	2.4	.9	3.0	9.4	1.3	1.6	.5	1.3
27	.1	.2	1.3	1.6	2.3	1.3	9.9	9.1	1.2	1.4	.5	1.2
28	.1	.2	1.5	1.6	2.2	1.3	9.4	8.4	1.0	1.4	.5	1.1
29	.1	.1	1.8	1.6	-	1.2	9.1	8.1	1.0	1.4	.5	1.0
30	.2	.1	2.1	1.7	--------	1.1	8.2	6.9	1.1	1.4	.5	1.0
31	.2	--------	2.3	1.7	--------	.7	--------	5.4	--------	1.4	.4	--------
Total	3.3	5.1	19.8	65.2	71.9	38.3	101.5	318.1	89.8	40.1	22.0	25.6
Mean	0.11	0.17	0.64	2.10	2.57	1.24	3.38	10.3	2.99	1.29	0.71	0.85
Cfsm	0.013	0.020	0.076	0.251	0.307	0.148	0.403	1.23	0.357	0.154	0.085	0.101
In.	0.01	0.02	0.09	0.29	0.32	0.17	0.45	1.41	0.40	0.18	0.10	0.11

Calendar year 1960: Max 15 Min 0 Mean 2.27 Cfsm 0.271 In. 3.68
Water year 1960-61: Max 16 Min 0.1 Mean 2.19 Cfsm 0.261 In. 3.55

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Jan. 17. No gage-height record Jan. 18 to Feb. 9.

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 Nimrod, 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 1961.(winter records incomplete prior to 1940). Monthly discharge only for some periods, published in WSP 1308.

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.--22 years (1939-61), 451 cfs.

Extremes.--Maximum discharge during year, 839 cfs May 15 (gage height, 3.82 ft); maximum gage height, 4.35 ft Mar. 15 (backwater from ice); minimum discharge, 168 cfs Aug. 17.
1910-14, 1930-61: Maximum discharge, 2,330 cfs Apr. 7, 1943 and Aug. 9, 1944; 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 periods of ice effect, which are fair. Flow affected by natural storage in many lakes.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	388	338	248	265	246	309	333	532	543	338	203	189
2	382	350	249	268	252	311	322	492	543	360	189	189
3	382	350	251	270	259	313	316	448	571	360	185	176
4	377	355	252	273	265	315	311	416	498	350	189	172
5	372	355	254	278	275	318	322	399	487	322	185	180
6	355	355	249	280	281	320	328	421	470	278	180	194
7	350	360	233	284	292	323	333	438	454	252	180	194
8	350	360	235	289	300	328	333	432	448	242	185	185
9	344	363	241	295	309	330	333	432	443	226	194	176
10	333	360	250	299	311	331	338	432	421	217	203	217
11	328	365	251	302	312	333	344	438	382	226	194	226
12	322	370	253	308	310	341	344	448	388	231	189	231
13	322	372	252	311	310	343	338	492	372	252	180	273
14	333	377	251	*323	304	348	350	616	338	289	172	294
15	*338	377	251	330	301	349	333	821	338	284	176	289
16	344	382	251	336	292	349	350	821	355	278	172	278
17	344	377	251	338	286	350	366	790	344	257	176	268
18	344	394	251	337	285	353	388	796	306	242	208	268
19	333	*448	250	332	*288	355	421	802	289	236	198	257
20	322	377	249	320	290	360	465	808	273	231	194	257
21	322	311	248	308	301	361	504	784	268	242	*189	311
22	311	306	246	291	317	364	509	802	273	231	189	316
23	300	300	245	270	324	370	504	790	*262	231	189	333
24	289	322	*244	255	322	371	543	767	262	*231	194	366
25	284	316	244	245	313	373	*565	750	236	221	189	377
26	278	289	245	242	309	375	571	722	231	212	189	394
27	278	275	247	240	309	372	571	683	226	208	185	394
28	273	263	251	238	309	*366	554	655	217	208	189	*388
29	289	255	254	236	-	366	548	*616	212	208	185	366
30	322	248	255	236	---------	355	543	593	217	212	172	338
31	338	---------	257	239	---------	355	---------	571	---------	203	172	---------
Total	10,247	10,270	7,708	8,838	8,272	10,707	12,380	19,007	10,667	7,878	5,794	8,096
Mean	331	342	249	285	295	345	413	613	356	254	187	270
Cfsm	0.328	0.339	0.247	0.282	0.292	0.342	0.409	0.607	0.352	0.251	0.185	0.267
In.	0.38	0.38	0.28	0.33	0.30	0.39	0.46	0.70	0.39	0.29	0.21	0.30

Calendar year 1960: Max 1,220 Min 203 Mean 431 Cfsm 0.427 In. 5.81
Water year 1960-61: Max 821 Min 172 Mean 328 Cfsm 0.325 In. 4.41

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 6-12, Nov. 27 to Mar. 26.

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 1961. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Gull Lake Reservoir October 1941 to October 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, 60,220 acre-ft May 14 (gage height, 6.19 ft); minimum, 49,730 acre-ft Mar. 20 (gage height, 5.38 ft).
1911-61: 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 height 1.00 ft and gage height 7.00 ft (maximum operating stage) is 70,830 acre-ft, of which 26,020 acre-ft is controlled storage above gage height 5.00 ft (minimum allowable stage). 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 1960 to September 1961

Date	Gage height (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	5.89	56,320	-
Oct. 31	5.76	54,640	-1,680
Nov. 30	5.72	54,130	-510
Dec. 31	5.72	54,130	0
Calendar year 1960	-	-	+1,930
Jan. 31	5.53	51,690	-2,440
Feb. 28	5.43	50,380	-1,310
Mar. 31	5.44	50,500	+120
Apr. 30	5.94	56,970	+6,470
May 31	5.96	57,240	+270
June 30	5.95	57,100	-140
July 31	6.04	58,270	+1,170
Aug. 31	5.94	56,970	-1,300
Sept.30	5.98	57,500	+530
Water year 1960-61	-	-	+1,180

/ Gage height at 12 p.m.

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 1961. 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.--50 years, 100 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 268 cfs May 15; minimum daily, 15 cfs Oct. 1 to Nov. 14, May 31 to Sept. 30.
1911-61: Maximum daily discharge, 1,123 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	15	15	44	40	54	44	46	52	15	15	15	15
2	15	15	44	39	54	*45	45	32	15	15	15	15
3	15	15	44	46	53	44	45	31	15	15	15	15
4	15	15	45	72	53	43	45	52	15	15	15	15
5	15	15	47	70	53	44	50	52	15	15	15	15
6	15	15	47	70	53	45	50	58	15	15	15	15
7	15	15	47	70	50	44	49	75	15	15	15	15
8	15	15	46	70	51	44	38	80	15	15	15	15
9	15	15	46	69	52	44	30	91	15	15	15	15
10	15	15	47	68	50	44	25	76	15	15	15	15
11	15	15	46	67	49	44	26	76	15	15	15	15
12	15	15	46	67	48	44	26	82	15	15	15	15
13	15	15	45	66	47	43	27	99	15	15	15	15
14	15	15	46	65	47	43	29	109	15	15	15	15
15	15	42	46	65	47	44	31	268	15	15	15	15
16	15	40	46	64	47	42	34	235	15	15	15	15
17	15	38	45	64	47	42	35	187	15	15	15	15
18	15	47	44	62	47	42	36	188	15	15	15	15
19	15	46	44	61	46	42	36	188	15	15	15	15
20	15	45	44	61	46	42	38	188	15	15	15	15
21	15	45	43	60	46	42	41	185	15	15	15	15
22	15	44	43	60	46	44	44	145	15	15	15	15
23	15	42	43	59	46	43	45	144	15	15	15	15
24	15	40	43	58	46	43	49	118	15	15	15	15
25	15	40	43	58	46	43	50	86	15	15	15	15
26	15	41	43	57	45	45	51	85	15	15	15	15
27	15	40	43	56	45	47	52	63	15	15	15	15
28	15	48	40	56	44	47	52	22	15	15	15	15
29	15	47	40	56	-	46	53	22	15	15	15	15
30	15	45	40	55	---------	46	54	22	15	15	15	15
31	15	---------	40	54	---------	46	---------	15	---------	15	15	---------
Total	465	900	1,370	1,885	1,358	1,361	1,232	3,126	450	465	465	450
Mean	15.0	30.0	44.2	60.8	48.5	43.9	41.1	101	15.0	15.0	15.0	15.0
†	-27.4	-8.7	0	-39.7	-23.6	+1.9	+109	+4.5	-2.3	+19.0	-21.3	+9.0
Mean≠	-12.4	21.3	44.2	21.1	24.9	45.8	150	106	12.7	34.0	-6.3	24.0
Cfsm≠	-0.043	0.074	0.154	0.074	0.087	0.160	0.523	0.369	0.044	0.118	-0.022	0.084
In.≠	-0.05	0.08	0.18	0.09	0.09	0.18	0.58	0.43	0.05	0.14	-0.03	0.09

Calendar year 1960: Max 512 Min 15 Mean 73.8 Mean≠ 76.4 Cfsm≠ 0.266 In.≠ 3.62
Water year 1960-61: Max 268 Min 15 Mean 37.1 Mean≠ 38.7 Cfsm≠ 0.135 In.≠ 183

* Discharge measurement made on this day.
† Change in contents, equivalent in cubic feet per second, in Gull Lake.
≠ Adjusted for change in contents.
Note.--Negative figures of adjusted discharge and runoff indicate that evaporation and seepage exceeded inflow.

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.

Drainage area.--11,600 sq mi, approximately.

Records available.--March 1924 to September 1961.

Average discharge.--37 years, 3,841 cfs.

Extremes.--Maximum daily discharge during year, 9,140 cfs May 21; minimum daily, 502 cfs Sept. 3.
1924-61: 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 elsewhere in this report).

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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,610	1,720	696	1,370	1,360	1,640	2,920	4,790	4,510	1,260	1,030	725
2	1,620	1,760	1,120	1,360	1,340	1,670	2,370	4,890	4,150	1,180	999	660
3	1,760	1,740	1,410	1,340	1,340	1,720	2,330	4,670	3,670	1,260	1,050	502
4	1,760	1,760	1,540	1,380	1,320	1,770	2,700	4,710	3,280	1,100	1,020	563
5	1,880	1,660	1,850	1,460	1,220	1,720	2,620	4,420	3,310	1,020	851	658
6	1,780	1,730	1,870	1,520	1,240	1,660	2,220	4,100	3,280	1,120	915	758
7	1,730	1,630	1,800	1,420	1,320	1,720	2,340	4,080	2,780	954	725	794
8	1,620	1,760	1,830	1,460	1,430	1,790	2,170	3,800	2,780	1,080	758	792
9	1,520	1,840	1,840	1,490	1,240	1,800	2,320	3,700	2,790	958	918	825
10	1,840	1,770	1,800	1,490	1,330	1,750	2,440	3,700	2,760	655	792	992
11	1,890	1,600	1,620	1,510	1,420	1,720	2,140	3,880	2,540	958	899	969
12	1,780	1,610	1,580	1,510	1,400	1,820	2,180	3,800	2,400	1,160	744	915
13	1,740	1,810	1,620	1,520	1,380	1,950	2,120	3,890	2,380	1,390	773	1,330
14	1,850	1,920	1,680	1,470	1,470	1,740	2,240	4,350	2,150	1,050	744	1,320
15	1,740	1,880	1,600	1,500	1,510	1,870	2,190	4,750	1,890	1,010	751	1,220
16	1,640	1,920	1,530	1,360	1,570	1,980	2,510	5,570	1,550	1,110	706	1,270
17	1,440	1,790	1,560	1,460	1,470	2,020	2,060	7,040	1,670	1,110	719	1,290
18	1,670	1,760	1,580	*1,420	1,480	1,880	2,410	7,650	1,850	1,210	970	1,240
19	1,610	1,660	1,410	1,480	1,550	2,490	2,340	8,400	1,720	1,150	825	1,320
20	1,490	1,830	1,420	1,490	1,530	2,080	2,590	8,750	1,450	1,270	825	1,340
21	1,580	1,910	1,430	1,460	1,560	1,920	3,110	9,140	1,430	1,180	932	1,540
22	1,650	*2,110	1,310	1,520	1,620	2,140	3,560	9,000	1,820	1,360	761	1,420
23	1,660	2,020	1,300	1,460	1,590	2,260	4,260	8,820	1,610	1,320	748	1,400
24	1,570	1,610	1,370	1,320	1,500	2,090	4,890	8,500	1,360	*1,140	731	1,350
25	1,660	1,840	1,380	1,350	1,540	2,260	4,700	8,240	1,420	966	702	1,280
26	1,780	1,730	1,280	1,350	1,530	2,670	4,700	7,670	1,270	1,040	715	1,500
27	1,590	1,890	1,460	1,230	1,570	3,340	4,700	6,910	1,250	1,060	710	1,570
28	1,700	2,000	1,420	1,260	1,640	3,200	4,870	6,550	1,290	1,040	651	1,540
29	1,560	1,210	1,500	1,230	-	3,220	4,960	6,230	1,180	1,160	681	*1,460
30	1,790	590	1,410	1,250	--------	3,020	5,200	5,440	1,210	1,270	692	1,150
31	1,760	--------	1,420	1,320	--------	*3,100	--------	*5,250	--------	944	585	--------
Total	52,270	52,060	46,636	43,760	40,470	66,010	92,160	182,690	66,750	34,485	24,922	33,693
Mean	1,686	1,735	1,504	1,412	1,445	2,129	3,072	5,893	2,225	1,112	804	1,123
Cfsm	0.145	0.150	0.130	0.122	0.125	0.184	0.265	0.508	0.192	0.096	0.069	0.097
In.	0.17	0.17	0.15	0.14	0.13	0.21	0.30	0.59	0.21	0.11	0.80	0.11

Calendar year 1960:	Max	14,900	Min	590	Mean	3,425	Cfsm	0.295	In.	4.01
Water year 1960-61:	Max	9,140	Min	502	Mean	2,016	Cfsm	0.174	In.	2.37

* 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 1961. 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.--31 years (1909-12, 1930-31, 1934-61), 242 cfs.

Extremes.--Maximum discharge during year, 275 cfs May 21 (gage height, 1.78 ft); maximum gage height, 2.74 ft Feb. 12 (backwater from ice); minimum, 14 cfs Nov. 10 (gage height, 0.43 ft) result of freeze-up.
1909-13: 1929-61: 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 periods of ice effect or no gage-height record, which are fair. Flow regulated by powerplants and reservoirs above station.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	55	38	38	35	34	66	66	*138	129	51	48	44
2	51	40	41	35	34	67	66	136	117	47	48	45
3	47	38	44	35	35	67	62	129	106	40	52	41
4	51	40	45	35	36	67	66	117	96	38	52	38
5	51	37	46	35	36	66	70	110	89	36	52	43
6	47	38	45	35	37	65	76	119	86	36	50	58
7	47	43	43	35	38	64	75	134	78	34	47	51
8	47	48	42	35	38	63	73	143	78	34	48	45
9	44	a45	40	35	39	63	70	147	81	33	52	47
10	40	40	a39	35	40	63	67	129	78	33	57	52
11	45	a43	38	35	41	62	75	132	67	34	52	47
12	45	51	a38	35	42	62	78	134	72	38	48	47
13	47	48	a38	35	44	62	76	110	70	41	47	61
14	47	45	a37	36	45	63	78	157	60	40	43	58
15	45	47	a37	36	47	64	99	202	55	38	44	51
16	44	48	a36	36	49	64	104	222	54	38	45	47
17	40	50	*36	37	50	64	106	231	51	34	45	43
18	*43	48	35	*38	51	63	101	258	48	37	57	38
19	43	44	35	38	50	62	110	268	43	41	58	41
20	44	48	34	38	50	61	114	272	43	40	51	45
21	43	38	33	37	51	61	132	261	41	55	*47	55
22	44	45	33	37	*56	61	140	231	50	48	48	52
23	40	*48	32	37	57	61	132	228	45	42	48	48
24	34	44	32	36	58	61	132	219	*44	38	50	44
25	40	44	32	35	60	61	152	202	44	*37	48	41
26	40	44	32	34	62	62	162	180	40	37	48	44
27	40	41	32	34	63	62	170	172	41	40	48	47
28	38	47	32	33	65	a62	172	160	41	51	45	43
29	38	41	33	33	-	a62	157	140	41	47	45	43
30	45	38	33	33	---	a62	145	132	43	47	43	45
31	36	---	34	33	---	*62	---	*123	---	45	44	---
Total	1,361	1,309	1,145	1,096	1,308	1,955	3,126	5,336	1,931	1,250	1,510	1,404
Mean	43.9	43.6	36.9	35.4	46.7	63.1	104	172	64.4	40.3	48.7	46.8
Cfsm	0.047	0.047	0.040	0.038	0.050	0.068	0.112	0.186	0.070	0.044	0.053	0.051
In.	0.05	0.05	0.05	0.04	0.05	0.08	0.13	0.21	0.08	0.05	0.06	0.06

Calendar year 1960: Max 1,430 Min 32 Mean 128 Cfsm 0.138 In. 1.89
Water year 1960-61: Max 272 Min 32 Mean 62.2 Cfsm 0.067 In. 0.91

* Discharge eeasurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 30 to Dec. 9, Dec. 11, Dec. 17 to Mar. 27.

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 1961.

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.--33 years (1911-17, 1934-61), 242 cfs.

Extremes.--Maximum discharge during year, 486 cfs May 19 (gage height, 2.01 ft); minimum discharge, 52 cfs Nov. 30 (gage height, 0.72 ft, result of freezeup).
1911-17, 1931-61: 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 table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.8	66
0.9	87
1.1	142
1.3	212
1.6	322
2.0	482

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	127	110	94	78	58	90	160	180	188	121	127	66
2	121	112	96	76	58	92	142	174	180	124	127	72
3	118	107	100	76	58	93	136	166	170	110	142	107
4	115	104	109	76	58	94	133	160	160	102	160	94
5	110	102	117	75	58	95	133	152	149	100	139	90
6	107	102	114	74	59	95	133	170	139	94	124	104
7	107	100	108	74	59	95	127	205	149	87	118	100
8	104	102	100	73	59	96	121	212	156	85	115	92
9	102	97	95	72	60	97	112	205	149	81	115	90
10	100	92	90	72	61	97	110	198	139	79	124	90
11	100	102	86	71	62	97	107	188	136	76	124	107
12	100	104	84	71	63	98	110	177	136	92	110	107
13	100	97	83	70	65	100	112	170	156	115	104	121
14	100	97	82	70	66	101	118	270	174	112	94	130
15	100	100	81	*70	67	103	166	374	166	112	90	121
16	100	100	80	70	68	104	212	394	152	115	85	107
17	94	100	*80	68	69	105	149	394	146	124	81	121
18	*94	97	78	67	70	106	194	450	139	127	87	118
19	92	97	78	65	71	108	226	478	133	170	102	104
20	92	97	77	64	72	118	226	458	130	202	94	102
21	92	*100	77	62	73	133	219	438	127	198	*85	100
22	92	*100	76	60	74	130	226	426	146	208	83	133
23	92	94	76	60	*75	133	244	402	142	194	81	136
24	92	94	76	60	77	139	255	366	130	188	76	127
25	92	104	75	59	79	133	255	342	124	*170	72	118
26	90	104	75	58	81	152	241	311	*118	160	72	110
27	90	100	75	58	84	160	226	289	115	156	81	107
28	92	97	75	58	88	177	*212	259	112	160	85	102
29	92	96	76	58	-	191	202	237	104	160	81	*100
30	102	94	76	58	--------	177	198	219	104	142	74	100
31	110	--------	78	58	--------	174	--------	*198	--------	136	70	--------
Total	3,119	3,002	2,667	2,081	1,892	3,683	5,205	8,662	4,269	4,100	3,122	3,176
Mean	101	100	86.0	67.1	67.5	119	174	279	142	132	101	106
Cfsm	0.164	0.163	0.139	0.109	0.110	0.193	0.283	0.454	0.231	0.215	0.164	0.172
In.	0.19	0.18	0.16	0.13	0.11	0.22	0.31	0.52	0.26	0.25	0.19	0.19

Calendar year 1960: Max 1,120 Min. 40 Mean 155 Cfsm 0.252 In. 3.42
Water year 1960-61: Max 478 Min 58 Mean 123 Cfsm 0.200 In. 2.71

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 20.

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 1961.

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.--12 years, 51.0 cfs.

Extremes.--Maximum discharge during year, 73 cfs May 25 (gage height, 3.42 ft); minimum daily, 1.1 cfs Jan. 19 to Feb. 7.

1949-61: 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.

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 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used July 28 to Sept. 30)

1.5	0.6	2.2	13
1.6	1.2	2.5	27
1.7	2.6	3.0	50
1.8	4.4	3.5	79
2.0	8.0		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.2	1.9	1.7	1.3	1.1	1.3	9.0	18	59	25	7.8	2.1
2	2.6	1.7	1.7	1.3	1.1	1.3	g8.8	16	54	23	8.2	2.1
3	2.1	1.6	1.7	1.3	1.1	1.3	g8.8	13	48	18	9.0	2.2
4	1.9	1.6	1.8	1.3	1.1	1.4	g8.8	11	50	15	8.6	1.4
5	2.2	1.7	1.9	1.3	1.1	1.4	g15	10	54	13	7.8	2.1
6	2.1	1.7	1.9	1.3	1.1	1.4	g15	18	53	12	7.6	1.9
7	1.7	1.7	1.9	1.2	1.1	1.4	g9.6	25	51	12	7.5	1.6
8	1.6	1.6	1.8	1.2	1.2	1.4	9.0	31	51	11	7.1	1.6
9	1.6	1.6	1.8	1.2	1.2	1.4	g8.4	28	55	10	6.7	1.6
10	1.6	1.6	1.8	1.2	1.2	1.5	g8.4	22	52	9.8	6.6	1.9
11	1.6	1.6	1.8	1.2	1.2	1.5	g8.8	24	50	9.4	6.0	2.4
12	1.7	1.6	1.7	1.2	1.2	1.6	12	24	47	9.4	5.5	2.1
13	1.7	1.6	1.7	1.2	1.2	1.7	9.6	24	45	9.6	5.1	3.3
14	2.1	1.6	1.7	1.2	1.2	1.8	g10	39	39	9.6	4.9	3.0
15	1.9	1.7	1.7	1.2	1.2	2.0	25	46	34	9.4	4.9	2.1
16	1.4	1.6	*1.7	1.2	1.2	2.2	41	45	36	8.8	4.4	2.1
17	1.7	1.4	1.6	*g1.2	1.2	2.5	26	48	35	8.0	3.9	1.7
18	2.6	1.6	1.6	1.2	1.2	2.9	16	56	35	8.8	6.0	1.6
19	*1.9	1.6	1.5	1.1	1.2	3.3	12	60	35	13	5.8	1.6
20	1.4	1.6	1.5	1.1	1.2	4.0	12	65	*32	12	4.9	1.7
21	1.4	1.6	1.5	1.1	g1.2	g5.2	15	69	29	*12	4.6	2.2
22	1.4	1.6	1.5	1.1	*g1.2	*g6.4	16	67	30	11	4.6	2.4
23	1.6	*1.6	1.4	1.1	1.2	g7.6	15	*66	27	10	4.4	1.9
24	1.4	1.9	1.4	1.1	1.2	g8.4	16	67	25	10	*3.7	1.9
25	1.6	1.9	1.4	1.1	1.2	g8.8	19	71	22	9.4	3.9	2.1
26	1.4	1.9	1.4	1.1	1.2	g9.2	23	69	20	8.8	3.1	1.9
27	1.4	2.1	1.3	1.1	1.3	g11	*24	69	20	8.4	2.8	2.2
28	1.6	1.9	1.3	1.1	1.3	g19	25	70	19	8.4	2.4	1.9
29	1.6	1.8	1.3	1.1	-	g11	21	66	18	8.4	2.2	1.9
30	2.1	1.7	1.3	1.1	--------	g9.2	20	62	18	8.4	2.1	2.6
31	1.9	--------	1.3	1.1	--------	g9.2	--------	60	--------	7.8	2.1	--------
Total	55.0	50.6	49.6	36.5	33.1	142.3	467.2	1,359	1,143	349.4	164.2	61.1
Mean	1.77	1.69	1.60	1.18	1.18	4.59	15.6	43.8	38.1	11.3	5.30	2.04
Cfsm	0.0099	0.0094	0.0089	0.0066	0.0066	0.026	0.087	0.245	0.213	0.063	0.030	0.011
In.	0.01	0.01	0.01	0.008	0.007	0.03	0.10	0.28	0.24	0.07	0.03	0.01

Calendar year 1960: Max 73 Min 0 Mean 10.8 Cfsm 0.060 In. 0.83
Water year 1960-61: Max 71 Min 1.1 Mean 10.7 Cfsm 0.060 In. 0.80

* Discharge measurement made on this day.
g Computed from once daily chain-gage readings.
Note.--Stage-discharge relation affected by ice Nov. 9, Nov. 29 to Dec. 20, Jan. 17, Feb. 21, 22, Mar. 21, 22. No gage-height record Dec. 21 to Jan. 16, Jan. 18 to Feb. 20, Feb. 23 to Mar. 20, Apr. 1, 8.

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 1961.

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). March 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.--16 years, 44.6 cfs.

Extremes.--Maximum discharge during year, 86 cfs May 17 (gage height, 4.75 ft, from graph based on gage readings); no flow on many days.
1945-61: Maximum discharge, 1,890 cfs June 17, 1957 (gage height, 9.62 ft, from graph based on gage readings); no flow on many days.

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

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 18-29)

Oct. 1 to Mar. 23		Mar. 24 to Sept. 30			
2.2	0	2.3	0	2.7	4.9
2.3	.7	2.35	.1	2.8	7.1
2.4	1.5	2.4	.5	3.0	13
2.5	2.5	2.45	1.0	3.5	28
2.6	3.9	2.5	1.6	4.0	46
2.8	7.8	2.6	3.0	4.5	72

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.2	1.5	1.5	0.1	0	1.0	5.1	3.7	5.5	5.3	1.8	0
2	6.6	1.5	1.6	.1		1.1	4.9	2.9	5.5	4.3	1.6	0
3	5.8	1.4	1.8	.1	0	1.2	4.9	2.1	5.1	2.6	.8	0
4	5.2	1.6	2.3	.1	0	1.3	4.5	1.8	4.7	2.1	.3	0
5	4.2	1.4	5.0	.1	0	1.3	4.9	2.8	4.5	1.6	.2	0
6	3.7	1.4	2.8	.1	0	1.4	4.5	27	4.5	1.3	0	.3
7	3.3	1.3	2.1	.1	0	1.4	4.1	22	7.1	1.1	0	.2
8	2.9	1.2	2.0	.1	0	1.5	3.9	24	6.6	.7	0	0
9	2.6	1.2	1.8	*.1	0	1.6	3.6	16	5.7	.7	0	0
10	*2.8	1.1	1.8	.1	0	1.7	3.0	11	10	.6	0	0
11	2.4	1.1	1.7	.1	0	1.8	3.4	8.4	13	.5	0	0
12	2.2	1.2	1.6	.1	0	1.9	3.7	8.7	12	.7	0	0
13	2.2	1.2	1.6	.1	0	2.0	7.6	13	10	1.0	0	1.1
14	2.2	1.3	1.5	.1	0	2.2	9.2	47	7.4	1.1	0	1.6
15	2.2	*1.7	1.4	.1	0	2.3	7.6	33	5.1	.8	0	.7
16	2.1	1.5	*1.2	.1	0	2.6	6.4	21	3.9	.8	0	.3
17	2.1	1.4	.8	.1	0	2.9	4.1	34	3.4	.7	0	.2
18	2.0	1.2	.7	.1	0	3.4	*8.4	64	2.4	.8	0	0
19	2.0	1.3	.6	0	0	3.9	35	41	2.6	.8	1.6	0
20	2.0	1.4	.5	0	0	4.6	32	32	2.1	.7	2.0	0
21	2.1	1.6	.4	0	*0	*5.4	21	26	1.8	*.5	1.8	0
22	2.1	1.8	.3	0	0	8.0	14	22	2.1	.4	1.3	.1
23	2.1	1.8	.2	0	0	11	13	*18	2.4	.7	.7	.2
24	2.1	2.0	.2	0	.1	17	10	16	1.6	.8	*.1	.3
25	1.8	2.0	.2	0	.1	15	9.0	15	1.0	.7	0	*.8
26	1.6	1.8	.2	0	.2	11	7.4	13	.7	.7	0	.3
27	1.6	1.7	.2	0	.6	9.2	6.1	9.8	.5	.6	0	.2
28	1.6	1.6	.1	0	.8	7.9	5.3	8.7	.3	.5	0	0
29	1.5	1.5	.1	0	-	7.4	4.9	8.1	.3	.5	0	0
30	1.6	1.5	.1	0	---------	7.1	4.1	6.6	5.3	2.7	0	0
31	1.5	---------	.1	0	---------	7.4	---------	5.3	---------	3.2	0	---------
Total	85.3	44.2	36.4	1.8	1.8	147.5	255.6	563.9	137.1	39.5	12.2	6.3
Mean	2.75	1.47	1.17	0.06	0.06	4.76	8.52	18.2	4.57	1.27	0.39	0.21
Cfsm	0.012	0.0067	0.0053	0.00027	0.00027	0.022	0.039	0.082	0.021	0.0057	0.0018	0.00095
In.	0.01	0.007	0.006	0.0003	0.0003	0.02	0.04	0.09	0.02	0.007	0.002	0.001

Calendar year 1960: Max 589 Min 0 Mean 22.8 Cfsm 0.103 In. 1.40
Water year 1960-61: Max 64 Min 0 Mean 3.65 Cfsm 0.017 In. 0.20

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 9-18, Nov. 27 to Mar. 23 (no gage-height record Nov. 16, 17, Dec. 31, Jan. 31 to Feb. 11, Mar. 15).

GPO 823480-8

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 1961. 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.--27 years, 214 cfs.

Extremes.--Maximum discharge during year, 457 cfs May 19 (gage height, 3.71 ft); minimum daily, 1.1 cfs Jan. 30 to Feb. 7.
1934-61: 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 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 24		Mar. 25 to Sept. 30			
0.8	0.6	0.8	2.9	1.6	62
.9	2.4	.9	4.4	2.0	120
1.0	5.8	1.0	6.6	3.0	286
1.1	12	1.1	12	4.0	543
1.3	32	1.3	29		
1.7	85				

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	67	20	17	2.4	1.1	17	49	66	81	114	24	3.4
2	61	22	17	2.4	1.1	19	42	62	72	213	18	3.0
3	53	22	18	2.5	1.1	20	41	54	66	176	25	3.0
4	49	23	20	2.5	1.1	22	36	49	60	125	34	3.0
5	45	22	24	2.6	1.1	23	37	39	50	88	22	3.4
6	37	18	30	2.7	1.1	24	32	50	43	66	16	5.5
7	36	16	33	2.7	1.1	24	29	86	44	48	12	6.2
8	33	14	33	2.9	1.2	25	31	130	41	37	8.2	11
9	31	12	31	*3.1	1.2	26	30	157	41	27	7.1	11
10	*28	8.8	27	3.2	1.2	27	27	168	40	22	7.7	8.2
11	25	11	22	3.3	1.2	29	25	147	34	17	6.6	6.6
12	23	13	19	3.3	1.2	31	26	128	14	18	5.7	6.6
13	23	15	17	3.3	1.3	35	27	117	27	60	5.1	8.2
14	23	*16	17	3.2	1.3	38	32	100	40	42	5.1	8.2
15	23	16	*17	3.2	1.3	42	47	149	57	34	4.2	6.6
16	20	15	16	3.1	1.4	47	60	205	49	25	4.1	7.7
17	21	14	15	3.0	1.4	52	*74	253	41	24	3.8	9.8
18	15	15	13	2.9	1.5	58	92	378	25	20	3.8	8.8
19	27	16	12	2.7	1.6	63	125	457	*33	18	4.1	6.6
20	23	17	10	2.5	1.7	*72	128	426	26	*24	4.4	5.1
21	20	22	9.0	2.3	*1.8	80	162	399	26	20	4.4	8.8
22	17	22	7.7	2.1	2.0	95	154	*345	20	25	5.5	8.2
23	15	15	6.5	2.0	2.3	110	168	288	21	32	4.8	9.3
24	13	17	5.8	1.7	2.6	125	189	251	22	26	*4.1	9.3
25	14	17	4.6	1.5	3.4	133	171	218	18	24	4.0	*9.3
26	16	19	3.0	1.4	4.5	141	152	194	16	20	3.8	6.6
27	14	19	2.8	1.3	7.0	128	136	162	14	17	3.2	5.7
28	12	18	2.7	1.2	15	115	131	142	11	15	3.5	5.5
29	14	17	2.6	1.2	-	109	109	123	8.2	15	3.6	5.9
30	17	17	2.5	1.1	--------	96	79	102	20	11	3.6	5.5
31	17	--------	2.4	1.1	--------	67	--------	88	--------	19	3.6	--------
Total	832	508.8	457.6	74.4	63.8	1,893	2,441	5,533	1,060.2	1,422	265.0	206.0
Mean	26.8	17.0	14.8	2.40	2.28	61.1	81.4	178	35.3	45.9	8.55	6.87
Cfsm	0.022	0.015	0.013	0.0021	0.0019	0.052	0.070	0.152	0.030	0.039	0.0073	0.0059
In.	0.03	0.02	0.01	0.002	0.002	0.06	0.08	0.18	0.03	0.05	0.008	0.007

Calendar year 1960:	Max	3,500	Min.	2.0	Mean	162	Cfsm	0.138	In.	1.90
Water year 1960-61:	Max	457	Min	1.1	Mean	40.4	Cfsm	0.035	In.	0.48

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 8, 9, 11-13, 18, 19, Nov. 28 to Dec. 23, Dec. 27-31, Jan. 8 to Feb. 9, Feb. 11 to Mar. 24.

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. 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 1961. Monthly discharge only for some periods, published in WSP 1308. Published as "near Dayton" April to July 1906.

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.--36 years (1909-17, 1930-31, 1934-61) 554 cfs.

Extremes.--Maximum discharge during year, 1,200 cfs May 20 (gage height, 4.25 ft); minimum daily, 21 cfs Feb. 1-5; minimum gage height, 1.57 ft Sept. 2.
1909-17, 1929-61: 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.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 27)

1.6	38	2.5	220	4.0	1,010
1.8	57	3.0	401	5.0	1,760
2.0	89	3.5	662	6.0	2,540
2.2	136				

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	187	74	*70	40	*21	*48	*199	286	*484	179	129	36
2	168	74	69	39	21	50	184	266	456	424	134	38
3	154	74	69	38	21	52	176	247	419	541	131	42
4	144	74	75	39	21	56	168	232	392	494	129	38
5	*136	74	110	39	21	59	168	220	358	380	129	42
6	119	72	104	40	22	62	162	238	334	300	117	51
7	112	72	95	41	22	64	154	282	311	250	103	51
8	103	70	92	41	22	66	152	342	304	211	91	56
9	96	66	82	41	23	68	152	401	289	182	83	65
10	91	54	77	41	25	71	149	428	282	157	81	67
11	85	58	75	41	26	74	146	419	286	141	76	66
12	83	66	71	42	27	78	144	375	296	168	70	66
13	80	69	66	42	*29	82	139	342	307	196	66	69
14	81	*72	63	42	29	90	152	350	293	226	62	70
15	81	74	*60	*42	30	*97	202	484	269	211	57	69
16	80	70	58	42	31	112	226	707	250	190	54	66
17	*80	67	56	42	31	124	*229	842	229	170	51	61
18	80	67	53	41	32	134	266	1,040	208	157	53	57
19	74	67	50	40	33	146	334	1,170	196	157	57	53
20	74	69	47	38	34	156	414	1,190	182	157	57	51
21	76	80	44	36	35	164	465	1,160	173	220	56	57
22	74	81	42	34	37	170	465	1,090	179	241	56	61
23	72	85	41	32	39	174	456	1,000	168	229	55	60
24	69	81	40	30	41	178	460	906	159	226	52	60
25	70	81	39	28	42	220	465	821	146	199	*54	60
26	66	89	39	26	43	265	446	760	136	176	46	58
27	66	96	38	25	45	310	410	694	126	159	45	55
28	64	110	38	24	46	330	*367	638	117	159	44	53
29	62	74	*38	23	-	266	338	585	*110	139	42	*51
30	69	72	39	22	--------	247	318	536	110	131	41	51
31	*72	--------	39	22	--------	226	--------	536	--------	*129	38	--------
Total	2,868	2,232	1,879	1,113	849	4,239	8,106	18,587	7,569	6,899	2,259	1,680
Mean	92.5	74.4	60.6	35.9	30.3	137	270	600	252	223	72.8	56.0
Cfsm	0.037	0.030	0.024	0.014	0.012	0.054	0.107	0.238	0.100	0.088	0.029	0.022
In.	0.04	0.03	0.03	0.02	0.01	0.06	0.12	0.27	0.11	0.10	0.03	0.02

Calendar year 1960:	Max	4,770	Min	29	Mean	391	Cfsm	1.55	In.	2.10
Water year 1960-61:	Max	1,190	Min	21	Mean	160	Cfsm	0.63	In.	0.84

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 27.

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 1961. 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, 1,250.42 ft June 30 (affected by wind action); minimum, 1,249.08 ft Nov. 29 (affected by wind action).
1931-61: 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 Ogeechie 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 1960 to September 1961

Oct. 31..... 1,249.41	Jan. 31..... 1,249.42	Apr. 30..... 1,249.76	July 31..... 1,249.89
Nov. 30..... 1,249.37	Feb. 28..... 1,249.45	May 31..... 1,249.92	Aug. 31..... 1,249.47
Dec. 31..... 1,249.45	Mar. 31..... 1,249.52	June 30..... 1,249.85	Sept.30..... 1,249.24

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 1961.

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.--1960 maximum observed discharge during period July to September 1960, 449 cfs July 1 (gage height, 3.44 ft); minimum observed, 29 cfs Aug. 24 (gage height, 0.52 ft).
1960-61: Maximum discharge, 730 cfs May 17, computed from graph based on gage readings; minimum daily, 14 cfs Jan. 27 to Feb. 3; minimum gage height, 0.50 ft Sept. 2, 3.

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

Rating tables, July 1, 1960 to Sept. 30, 1961, except for period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

July 1, 1960 to Mar. 22, 1961 May 21 to Sept. 30, 1961		Mar. 23 to May 20, 1961	
0.4	22	0.9	54
0.6	35	1.0	62
1.0	70	1.5	115
2.0	195	2.0	185
3.0	362	3.0	362
5.0	787	5.0	787

Discharge, in cubic feet per second, July to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1										449	45	120
2										360	55	115
3										281	55	103
4										231	56	91
5										198	50	83
6										189	55	77
7										169	52	70
8										148	49	72
9										130	47	66
10										116	43	64
11										105	*39	60
12										122	40	57
13										121	38	56
14										104	37	55
15										94	36	51
16										93	34	50
17										88	33	49
18										86	32	48
19										89	33	49
20										85	32	48
21										80	32	48
22										73	31	49
23										68	30	49
24								✓593		62	29	60
25										59	31	62
26										60	47	62
27										55	54	59
28										54	152	57
29										50	228	*54
30										48	173	54
31										46	142	---------
Total										3,913	1,810	1,938
Mean										126	58.4	64.6
Cfsm										-	-	-
In.										-	-	-

* Discharge measurement made on this day.
✓ Result of discharge measurement.

5-2847.5. Rum River at Spencer Brook, Minn.--Continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	53	47	42	23	14	32	94	118	115	80	62	*26
2	52	47	42	23	14	33	79	*108	105	77	58	25
3	50	47	44	22	14	34	73	103	97	74	58	25
4	50	46	48	21	15	35	72	92	91	68	60	26
5	48	46	56	21	15	36	70	86	88	66	64	51
6	47	45	58	20	15	37	68	92	82	60	60	55
7	46	46	53	19	15	38	68	103	79	57	56	40
8	45	47	48	19	15	39	69	113	79	55	50	32
9	45	46	46	18	15	40	67	124	78	49	48	32
10	44	46	45	18	16	41	66	119	74	48	45	34
11	42	45	43	18	16	42	64	114	70	48	43	36
12	42	45	41	18	17	43	64	107	75	47	42	36
13	43	45	39	17	18	45	62	93	104	48	41	43
14	42	44	38	17	19	47	65	131	102	84	39	48
15	42	46	37	17	20	50	81	228	99	100	37	50
16	40	48	*36	17	21	52	107	490	89	86	36	52
17	40	42	36	17	21	56	120	690	80	80	35	49
18	41	42	35	17	21	60	118	715	75	81	34	47
19	40	42	34	16	21	63	145	650	71	83	34	44
20	39	42	35	15	23	64	223	560	67	81	34	42
21	39	42	35	15	24	64	349	487	66	*79	36	43
22	38	42	34	15	25	65	337	*405	73	102	34	48
23	39	42	33	*15	27	*67	279	346	*119	105	34	47
24	*38	41	32	15	*28	68	249	279	171	110	34	46
25	40	*41	31	15	29	73	223	231	200	106	32	45
26	40	41	30	15	30	96	188	207	165	104	32	44
27	42	41	29	14	31	127	173	184	133	99	31	43
28	41	48	28	14	31	113	160	173	114	91	31	42
29	40	47	27	14	-	103	144	146	100	81	29	42
30	45	43	26	14	--------	105	136	136	85	75	27	41
31	45	--------	24	14	--------	96	--------	119	--------	68	26	---------
Total	1,338	1,332	1,185	533	570	1,864	4,013	7,549	2,946	2,392	1,282	1,234
Mean	43.2	44.4	38.2	17.2	20.4	60.1	134	244	98.2	77.2	41.4	41.1
Cfsm	-	-	-	-	-	-	-	-	-	-	-	-
In.	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1960: Max - Min - Mean - Cfsm - In. -
Water year 1960-61: Max 715 Min 14 Mean 71.9 Cfsm - In. -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 22. No gage-height record Dec. 12, 13, 15, 18, 20, 22, 24-26, 28, Dec. 30 to Jan. 22, Jan. 24-26, May 16-20, June 16-20.

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 15 3/4 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 1960. Monthly discharge only for some periods, published in WSP 1308.

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.--29 years (1930-31, 1933-61), 537 cfs.

Extremes.--Maximum discharge during year, 1,270 cfs May 19 (gage height, 4.23 ft); minimum daily, 86 cfs Jan. 27-30; minimum gage height, 2.16 ft Sept. 2.
1929-61: 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.1	73
2.5	192
3.0	390
4.0	1,060
5.0	1,980

Discharge, in cubic feet per second, water year 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	170	157	136	110	87	137	290	367	336	244	173	92
2	170	160	136	110	88	138	263	*344	310	233	166	*92
3	166	157	140	110	88	139	244	323	290	223	160	97
4	160	154	148	110	89	141	226	306	279	206	154	92
5	154	148	160	110	90	142	226	290	263	195	154	97
6	154	144	168	109	91	144	233	294	252	182	154	109
7	151	138	163	109	93	144	241	331	248	179	144	114
8	144	138	153	108	95	144	237	405	248	166	138	112
9	138	144	146	108	96	144	233	440	241	157	*129	109
10	138	144	140	107	100	144	226	445	237	148	129	117
11	141	129	137	107	102	145	219	415	226	*144	123	148
12	141	148	134	107	106	146	219	400	*226	154	120	154
13	138	154	133	107	110	148	226	376	256	176	114	170
14	138	148	132	106	112	150	233	466	275	186	106	176
15	138	144	131	106	112	152	279	715	282	182	103	176
16	135	148	*130	106	113	154	331	932	279	189	100	173
17	135	151	128	106	115	157	331	1,040	256	199	95	160
18	135	144	125	106	118	160	344	1,190	237	199	103	144
19	129	141	122	104	120	161	440	1,250	230	202	117	141
20	129	141	118	100	122	175	527	1,180	212	209	114	138
21	129	141	116	97	124	195	592	1,100	206	219	112	138
22	129	141	114	94	128	206	655	999	237	209	106	141
23	129	141	112	*90	129	*209	674	883	319	216	106	144
24	*129	138	111	90	*130	216	642	785	390	237	103	138
25	129	*138	110	88	131	230	592	674	425	226	103	135
26	129	135	109	87	132	263	533	574	430	223	100	132
27	129	141	108	86	133	298	493	504	385	219	103	129
28	132	163	108	86	135	358	466	451	331	219	112	123
29	135	150	109	86	-	381	425	410	290	206	106	117
30	144	140	110	86	---------	353	400	376	259	199	106	120
31	154	---------	110	87	---------	319	---------	353	---------	186	100	---------
Total	4,372	4,360	3,997	3,123	3,089	5,993	11,040	18,618	8,455	6,132	3,753	3,928
Mean	141	145	129	101	110	193	368	601	282	198	121	131
Cfsm	0.104	0.107	0.095	0.074	0.081	0.142	0.271	0.442	0.207	0.146	0.089	0.096
In.	0.12	0.12	0.11	0.09	0.08	0.16	0.30	0.51	0.23	0.17	0.10	0.11

Calendar year 1960: Max 2,510 Min 85 Mean 295 Cfsm 0.217 In. 2.96
Water year 1960-61: Max 1,250 Min 86 Mean 211 Cfsm 0.155 In. 2.10

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 20.

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 1961. Prior to October 1931 published as "at Coon Rapids, near Anoka." Monthly discharge only for some periods, published in WSP 1308.

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.--30 years, 6,733 cfs.

Extremes.--Maximum discharge during year, 16,400 cfs May 23 (gage height, 5.88 ft); minimum, 982 cfs Sept. 8, 9 (gage height, 0.66 ft), but may have been less during period of no gage-height record.
1931-61: Maximum discharge, 75,900 cfs Apr. 14, 1952 (gage height, 17.51 ft); minimum, 586 cfs Sept. 13, 1934 (gage height, 0.37 ft).

Minimum daily = 602 cfs

Remarks.--Records good. Flow slightly regulated by six reservoirs on headwaters; total usable capacity, 1,640,600 acre-ft. Diurnal regulation caused by powerplant above station.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used May 17-26)

Oct. 1 to Mar. 25				Mar. 26 to Sept. 30			
1.0	1,400	2.0	3,090	0.7	1,030	3.0	5,600
1.2	1,670	2.5	4,190	1.0	1,460	4.0	8,250
1.5	2,140			1.5	2,320	6.0	15,100
				2.0	3,300		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,840	2,290	1,480	2,130	1,740	2,330	4,560	7,060	*7,570	2,240	2,500	a1,110
2	2,760	3,200	1,820	1,960	1,860	2,470	4,790	6,460	8,670	2,250	2,110	a1,200
3	2,600	2,260	1,730	2,030	1,700	2,540	3,890	6,570	5,920	2,600	2,450	a1,250
4	2,760	2,740	1,790	1,930	2,000	2,500	3,370	6,100	5,460	2,750	2,370	a1,270
5	2,570	2,570	2,840	1,920	1,760	2,450	3,940	6,360	5,240	2,830	2,000	a1,200
6	2,600	2,170	2,100	2,000	1,840	2,780	4,330	6,230	4,330	2,270	1,700	a1,180
7	2,580	2,350	2,300	2,100	1,900	2,580	4,030	5,980	4,490	1,680	1,630	1,350
8	2,600	2,400	2,300	1,950	1,810	2,420	3,650	6,130	4,830	1,750	1,660	1,150
9	2,600	2,280	2,400	2,000	1,710	2,520	a3,250	6,020	4,560	1,940	1,770	1,330
10	2,330	2,660	2,750	1,900	1,800	2,350	a3,500	6,260	4,260	1,660	1,380	1,490
11	2,330	2,580	2,550	2,060	1,840	2,500	3,670	5,460	4,240	1,820	1,600	1,700
12	2,600	2,440	2,600	2,150	1,940	2,400	3,810	5,900	4,650	1,830	1,600	2,090
13	2,620	2,400	2,100	2,150	1,950	3,000	3,450	6,020	4,010	2,210	1,320	a2,050
14	2,680	2,350	2,480	2,050	2,040	2,650	3,370	6,720	3,810	2,020	1,600	a1,850
15	2,620	2,510	2,650	2,100	2,000	2,800	3,890	7,540	3,740	2,430	1,400	a2,350
16	2,420	2,570	2,140	2,100	1,980	2,580	4,010	9,100	3,740	2,370	1,320	a2,200
17	*2,580	2,880	2,200	2,120	2,050	2,700	a4,300	9,380	3,340	1,990	1,070	a2,050
18	2,170	2,940	2,200	2,050	2,100	2,550	a4,200	13,100	2,500	1,900	1,230	a1,750
19	2,090	2,760	2,100	1,960	2,000	2,560	a4,150	13,900	2,710	2,230	1,400	1,780
20	2,350	2,310	2,000	2,060	2,130	3,200	a4,400	14,300	2,890	2,270	2,000	2,240
21	2,220	*2,420	1,960	1,940	2,280	a3,500	a4,600	14,900	3,200	2,750	1,360	2,460
22	2,110	2,550	1,750	1,920	2,380	a3,200	a5,600	15,100	2,670	2,610	1,110	2,480
23	2,470	2,820	1,770	2,000	2,200	a2,650	a6,200	14,300	3,050	2,670	1,240	2,390
24	2,260	2,620	1,800	1,750	2,120	3,250	a7,000	14,000	3,110	2,850	1,200	2,360
25	2,260	2,800	1,900	1,900	2,100	4,000	*7,540	12,600	2,910	2,240	*1,270	a2,300
26	2,240	2,900	2,040	1,950	2,150	a3,450	7,630	12,300	*2,600	*2,270	1,400	a2,200
27	2,720	2,400	1,850	1,850	2,300	*a4,800	7,460	9,980	2,460	2,160	1,300	a2,000
28	2,900	3,030	1,900	1,650	2,260	6,020	6,780	9,440	2,730	2,230	1,330	a2,100
29	1,760	2,680	1,840	1,550	-	4,830	6,670	9,160	2,140	2,060	1,190	a2,300
30	2,740	2,280	2,030	1,540	--------	5,240	6,700	8,220	2,280	2,060	1,120	a2,350
31	2,570	--------	2,140	1,720	--------	4,670	--------	7,410	--------	2,000	a1,100	--------
Total	76,950	77,160	65,510	60,490	55,940	97,490	144,740	282,000	118,110	68,940	47,730	55,530
Mean	2,482	2,572	2,113	1,951	1,998	3,145	4,825	9,097	3,937	2,224	1,540	1,851
Cfsm	0.130	0.135	0.111	0.102	0.105	0.165	0.253	0.476	0.206	0.116	0.081	0.097
In.	0.15	0.15	0.13	0.12	0.11	0.19	0.28	0.55	0.23	0.13	0.09	0.11

Calendar year 1960: Max 21,900 Min 1,480 Mean 5,262 Cfsm 0.275 In. 3.77
Water year 1960-61: Max 15,100 Min 1,070 Mean 3,152 Cfsm 0.165 In. 2.24

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Dec. 6 to Mar. 7, Mar. 9-25.

05-2890. 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 1961, (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, 929.15 ft June 11; minimum, 927.97 ft Nov. 28.
1938-61: 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 1960 to September 1961

Oct. 31.....928.23	Feb. 28.....928.11	June 30.....928.87
Nov. 30.....928.12	Mar. 31.....928.39	July 31.....928.83
Dec. 31.....928.10	Apr. 30.....928.70	Aug. 31.....928.49
Jan. 31.....928.07	May 31.....929.09	Sept.30.....928.34

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 1961.

Gage.--Water-stage recorder. Datum of gage is 916.11 ft above mean sea level, datum of 1929.

Average discharge.--8 years, 10.2 cfs.

Extremes.--Maximum discharge during year, 15 cfs May 20 (gage height, 5.20 ft); maximum gage height during year, 5.84 ft Dec. 20 (backwater from ice); no flow on many days.
1953-61: Maximum discharge, 198 cfs July 4, 1957; maximum gage height, 6.78 ft Dec. 12, 1957 (backwater from ice); no flow for many days each year.

Remarks.--Records fair. Discharge affected by storage in Minnetonka Lake controlled by fixed-crest dam.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

4.35	0	4.8	3.3
4.4	.1	4.9	5.8
4.5	.3	5.0	8.2
4.6	.7	5.2	15
4.7	1.6		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.2	0.7	0.4			0	5.9	2.4	8.5	1.1	0.2	
2	1.3	.6	.4			0	5.0	2.0	9.4	1.0	.1	
3	*1.2	*.6	.4			0	4.8	1.7	8.0	1.5	.1	
4	1.0	.6	.5			0	4.3	1.6	7.0	1.6	.1	
5	1.0	.6	.7			0	*5.0	*1.3	6.5	1.3	0	
6	1.0	.6	.8			0	4.8	2.2	5.5	1.0	00	(*)
7	.9	.5	.9			0	3.8	3.3	*5.3	.8	0	
8	.8	.5	.7			0	3.3	4.1	4.8	.7	0	
9	.8	.5	*.8			0	2.7	3.3	4.5	.6	0	
10	.8	.5	.7			0	2.4	2.4	4.8	.5	0	
11	.8	.4	.7	(*)	(*)	.1	1.9	2.0	5.0	.5	0	
12	.7	.4	.6			.1	2.0	2.2	5.0	.5	0	
13	.7	.4	.6			.1	1.5	2.6	4.8	.4	0	
14	.7	.4	.5			.1	2.0	3.6	3.8	*.4	0	
15	.6	.4	.5			.1	4.5	8.0	3.1	.4	0	
16	.6	.4	.5			.1	3.8	8.0	2.6	.3	0	
17	.5	.4	.5			.1	3.8	9.1	2.2	.3	0	
18	.5	.4	.5			.1	*5.0	*14	2.2	.3	0	
19	.5	.4	.5			.2	5.5	14	2.4	.4	0	
20	.5	.4	.5			.2	5.5	15	1.7	.4	0	
21	.4	.4	.4			.2	6.2	14	1.7	.4	0	
22	.4	.4	.4			.2	5.3	13	1.6	.4	0	
23	.5	.4	.4			.3	4.5	12	1.5	.3	0	
24	.4	.4	.3			.8	4.5	12	1.3	.2	0	
25	.4	.4	.3			2.8	4.1	12	1.1	.2	0	
26	.4	.4	.2			5.3	3.8	11	.9	.2	0	
27	.4	.4	.2			9.2	3.3	10	.8	.2	0	
28	.4	.4	.2			8.7	2.9	9.4	.7	.2	0	
29	.4	.4	.1		-	*8.0	2.6	8.5	.7	.1	0	
30	.5	.4	.1		---------	7.4	2.6	7.5	.6	.2	0	
31	.5	---------	0		---------	6.6	---------	7.5	---------	*.3		---------
Total	20.8	13.7	14.3	0	0	50.7	117.3	219.7	108.0	16.7	0.5	0
Mean	0.67	0.46	0.46	0	0	1.64	3.91	7.09	3.60	0.54	0.02	0
Cfsm	0.0052	0.0035	0.0035	0	0	0.013	0.030	0.055	0.028	0.0042	0.00015	0
In.	0.006	0.004	0.004	0	0	0.01	0.03	0.06	0.03	0.005	0.0001	0

Calendar year 1960:	Max	29	Min	0	Mean	1.33	Cfsm	0.010	In.	0.14		
Water year 1960-61:	Max	15	Min	0	Mean	1.54	Cfsm	0.012	In.	0.15		

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Dec. 23. No gage-height record Dec. 24-30, Mar. 11-28, Mar. 30 to Apr. 1.

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 1961.

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.--22 years, 45.5 cfs (32,940 acre-ft per year).

Extremes.--Maximum discharge during year, 64 cfs May 19 (gage height, 3.10 ft); maximum gage height, 3.93 ft Mar. 4 (backwater from ice); minimum daily discharge, 0.1 cfs many days.
1939-61: 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.

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

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.7	0.1	2.4	6.8
1.9	.4	2.5	10
2.0	.8	2.6	16
2.1	1.4	2.8	33
2.2	2.4	3.0	52
2.3	4.2	3.5	124

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.6	1.0	0.8	0.3	0.1	9.8	11	5.6	7.4	8.4	0.5	0.1
2	.6	1.0	.8	.3	.1	15	10	4.9	6.8	17	.4	.1
3	.6	1.0	.8	.3	.1	21	9.4	4.0	5.6	5.9	.4	.1
4	.6	1.0	.8	.3	.1	31	7.6	3.6	5.2	3.2	.4	.1
5	.6	1.0	1.0	.4	.1	32	9.4	3.8	4.2	1.8	.3	.1
6	.6	1.0	1.0	.4	.1	31	9.4	7.6	3.8	1.2	.2	.2
7	.6	1.0	1.0	.4	.1	30	7.4	14	3.2	.7	.2	.2
8	.6	1.0	.8	.4	.2	27	7.6	36	4.4	.6	.3	.1
9	.6	.9	.7	.4	.2	24	7.4	26	3.2	.4	.2	.1
10	.7	.9	.7	.5	.2	23	7.0	19	2.6	.6	.2	.2
11	.7	.9	.6	*.6	.2	22	5.9	14	2.0	.6	.2	.4
12	*.7	.9	.5	.6	.2	21	6.2	12	1.6	.5	.1	.4
13	.7	1.0	.4	.6	.2	21	5.9	11	1.3	.4	.1	.8
14	.7	1.0	.4	.6	.2	20	7.4	18	3.4	.4	.1	.5
15	.7	1.0	.4	.6	*.2	20	8.2	28	2.9	.4	.1	.4
16	.7	1.1	.3	.5	.3	19	7.4	41	2.2	.3	.1	.3
17	.7	*1.0	.2	.5	.4	19	8.2	39	1.8	.2	.1	.2
18	.7	1.0	.2	.5	.4	19	9.4	39	1.4	.2	.9	.2
19	.7	1.1	.1	.4	.4	18	9.4	59	1.2	.3	.5	.2
20	.8	1.1	.1	.3	.5	18	*8.0	52	1.1	.3	.2	.2
21	.8	1.0	.1	.2	.7	18	8.0	41	*1.0	.4	.2	.7
22	.9	1.0	*.1	.2	1.0	18	8.0	38	.7	*.4	.1	.5
23	.8	1.0	.1	.1	1.2	17	8.6	34	.5	.3	*.1	.4
24	.8	1.0	.1	.1	1.6	*16	9.8	29	.5	.2	.1	.4
25	.9	1.0	.1	.1	2.0	16	12	*27	.6	.2	.1	.4
26	.9	1.0	.2	.1	2.6	15	16	23	.6	.2	.1	.3
27	.9	1.0	.2	.1	3.5	15	14	22	.5	.3	.1	*.3
28	.9	.9	.2	.1	5.8	14	9.8	19	.3	.4	.1	.3
29	1.0	.9	.3	.1	-	14	8.2	15	.4	.6	.1	.3
30	1.4	.8	.3	.1	---------	13	6.8	11	.6	.8	.1	.3
31	1.0	---------	.3	.1	---------	12	---------	8.6	---------	.6	.1	---------
Total	23.5	29.5	13.5	10.2	22.7	608.8	263.4	705.1	71.0	47.8	6.7	8.8
Mean	0.76	0.98	0.44	0.33	0.81	19.6	8.78	22.7	2.37	1.54	0.22	0.29
Cfsm	0.0017	0.0022	0.00098	0.00074	0.0018	0.044	0.020	0.051	0.0053	0.0034	0.00049	0.00065
In.	0.002	0.002	0.001	0.0008	0.002	0.05	0.02	0.06	0.006	0.004	0.0006	0.0007
Ac-ft	47	59	27	20	45	1,210	524	1,400	141	95	13	17

Calendar year 1960:	Max	774	Min	0.1	Mean	35.0	Cfsm	0.078	In.	1.07	Ac-ft	25,440
Water year 1960-61:	Max	59	Min	0.1	Mean	4.96	Cfsm	0.011	In.	0.15	Ac-ft	3,600

Peak discharge (base, 450 cfs).--No peak above base.

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Apr. 2.

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 1961. 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.--30 years (1931-61), 42.9 cfs (31,060 acre-ft per year).

Extremes.--Maximum discharge during year, 300 cfs May 19 (gage height, 4.26 ft); maximum gage height, 4.68 ft Feb. 22 (backwater from ice); minimum discharge, 0.1 cfs July 27-29, Aug. 3-15.

1910-12, 1931-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	a3.8	a8.5	a4.2	a2.1	a2.5	30	16	10	22	2.8	0.3	0.6
2	a3.6	a9.1	a4.2	2.2	a2.5	40	15	9.7	21	3.0	.2	.5
3	a3.2	a9.4	a4.3	a2.3	a2.5	39	13	8.7	18	3.1	.1	.4
4	3.0	a9.4	4.5	a2.4	a2.5	38	13	8.2	16	3.6	.1	.4
5	a2.0	a9.4	a4.5	a2.5	a2.5	36	12	8.7	13	4.9	.1	.9
6	1.4	a9.4	a4.5	a2.6	a2.5	35	13	14	11	2.4	.1	1.2
7	a1.6	9.2	a4.4	a2.7	2.5	33	13	19	9.7	1.9	.1	1.5
8	1.7	a8.5	a4.3	2.8	a2.5	32	13	26	8.0	2.2	.1	1.1
9	1.8	a7.7	a4.1	a3.0	a2.5	30	14	33	6.5	2.4	.1	1.2
10	a1.8	a7.1	4.0	a3.1	a2.5	29	15	31	6.3	2.8	.1	1.3
11	a1.9	a6.3	a3.7	*3.1	a2.5	28	14	28	6.3	5.6	.1	1.5
12	*2.0	a5.5	a3.4	a3.1	2.5	27	14	25	5.9	5.8	.1	1.6
13	a2.6	a5.0	a3.1	a3.1	2.5	26	13	19	5.4	6.7	.1	1.2
14	3.1	a4.8	a2.7	a3.2	*2.5	25	13	22	5.1	6.5	.1	1.0
15	3.1	a4.7	a2.3	a3.2	2.6	25	13	*26	4.7	6.3	.1	.8
16	3.1	*4.6	a2.1	3.2	2.6	24	18	32	4.4	6.3	.2	.7
17	3.1	a4.4	a1.8	a3.2	2.7	24	23	50	3.9	5.9	.3	.4
18	3.1	a4.4	a1.7	a3.2	2.8	24	17	54	3.6	5.4	2.4	.2
19	3.2	a4.4	a1.6	a3.1	3.0	24	*17	218	3.7	4.9	3.4	.2
20	3.7	4.4	1.6	a3.0	3.1	25	16	192	3.4	3.7	3.9	.2
21	a3.8	a4.4	*1.6	a2.9	3.3	25	16	106	*3.4	3.7	3.0	.4
22	a4.0	a4.4	a1.6	a2.8	3.7	24	15	79	3.1	*1.6	2.4	.7
23	a4.0	a4.3	a1.6	a2.8	4.3	*23	15	61	2.6	.6	*1.8	.9
24	a4.1	a4.3	a1.6	a2.7	5.0	22	15	52	2.4	.4	1.5	1.9
25	4.2	a4.3	a1.7	a2.7	6.5	22	14	*51	2.4	.3	1.4	1.9
26	a4.2	a4.3	1.7	2.7	9.5	22	14	44	2.2	.2	1.4	*1.7
27	a4.4	a4.3	a1.8	a2.6	15	23	14	41	2.2	.1	1.3	1.9
28	a4.5	a4.3	a1.8	a2.6	21	24	13	39	2.2	.1	1.3	2.0
29	a4.6	a4.2	a1.9	a2.6	-	27	12	35	2.6	.1	1.2	2.4
30	a5.4	4.2	a2.0	2.6	--------	21	11	30	2.6	.3	1.0	1.9
31	7.4	--------	a2.0	a2.5	--------	17	--------	26	--------	.4	.8	--------
Total	103.4	179.2	86.3	86.6	120.1	844	434	1,398.3	203.6	94.0	29.1	32.6
Mean	3.34	5.97	2.78	2.79	4.29	27.2	14.5	45.1	6.79	3.03	0.94	1.09
Cfsm	0.0086	0.015	0.0071	0.0072	0.011	0.070	0.037	0.12	0.017	0.0078	0.0024	0.0028
In.	0.009	0.02	0.008	0.008	0.01	0.08	0.04	0.13	0.02	0.009	0.003	0.003
Ac-ft	205	355	171	172	238	1,670	861	2,770	404	186	58	65

Calendar year 1960:	Max	1,340	Min	0.4	Mean	33.4	Cfsm	0.086	In.	1.16	Ac-ft	24,280
Water year 1960-61:	Max	218	Min	0.1	Mean	9.87	Cfsm	0.025	In.	0.34	Ac-ft	7,160

Peak discharge (base, 200 cfs).--May 19 (5 p.m.) 300 cfs (4.26 ft).

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 30 to Mar. 29.

5-2915. Big Stone Lake at Ortonville, Minn.

Location.--Lat 45°17'50", long 96°26'54", in NW¼NW¼ sec. 16, T. 121 N., R. 46 W., in dike on left bank at end of concrete dam at outlet, half a mile southwest of Ortonville.

Records available.--March 1937 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 957.69 ft above mean sea level, datum of 1929. Prior to Sept. 17, 1947, staff gage at same site and datum. Since Sept. 21, 1959, supplementary wire-weight gage read once daily, at site ½ mile north at power plant intake.

Extremes.--Maximum gage height during year, 8.18 ft Apr. 14; minimum, 5.93 Sept. 29.
1937-61: 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). Ordinarily 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. Water level subject to fluctuation caused by wind action.

Daily mean gage height, in feet, October 1960 to September 1961

Oct. 31	6.86	Feb. 28	6.60	June 30	6.89
Nov. 30	6.46	Mar. 31	6.90	July 31	6.69
Dec. 31	6.52	Apr. 30	6.91	Aug. 31	6.32
Jan. 31	6.46	May 31	7.05	Sept. 30	6.53

Note.--Gage-height record other than shown above is available.

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 1961.

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.--23 years, 109 cfs (78,910 acre-ft per year).

Extremes.--Maximum discharge during year, 230 cfs Apr. 16 (gage height, 5.27 ft); minimum daily, 1.0 cfs Apr. 13, May 4, 22.
1938-61: Maximum discharge, 3,060 cfs Apr. 13, 1952 (gage height, 12.92 ft); no flow Dec. 13, 1940.

Remarks.--Records fair. Some regulation by Big Stone Lake (see preceding page).

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	22	22	12	10	7.2	7.7	137	12	35	11	26	7.7
2	20	21	11	11	7.0	8.7	73	11	37	15	27	9.2
3	14	19	11	11	7.0	8.2	13	20	15	9.7	21	9.7
4	15	18	12	11	7.1	7.2	21	1.0	8.7	11	23	8.2
5	11	15	13	11	7.2	6.7	37	5.0	23	17	23	7.7
6	9.0	14	14	11	7.3	6.7	20	18	9.7	15	17	8.2
7	8.0	5.7	13	11	7.7	7.2	18	28	7.2	15	10	7.7
8	7.3	17	12	11	8.2	8.2	23	35	9.7	9.7	11	6.7
9	7.8	15	11	11	8.7	9.2	63	2.5	15	10	10	6.2
10	9.0	8.2	11	11	9.4	8.7	10	1.8	7.2	18	10	10
11	10	7.2	10	*11	10	7.2	4.5	1.6	8.7	24	11	9.7
12	*8.7	6.2	10	11	11	7.7	1.6	1.2	12	22	9.2	7.7
13	8.2	7.2	10	11	12	8.7	1.0	1.6	29	12	9.2	9.7
14	6.2	7.7	10	11	*13	10	41	95	12	12	9.2	9.7
15	2.2	9.7	10	11	10	11	100	26	8.2	12	8.7	9.2
16	2.9	*15	9.8	11	8.7	10	143	22	8.2	13	8.2	8.2
17	6.2	53	9.5	11	8.6	10	130	1.2	8.7	15	5.3	7.2
18	11	8.2	9.3	11	8.5	11	27	1.8	8.7	14	9.7	7.7
19	24	5.3	*9.2	11	8.2	12	9.2	22	11	13	8.7	8.2
20	6.2	4.9	9.1	11	8.2	12	26	70	9.7	11	7.7	10
21	3.3	5.7	9.0	11	8.0	13	12	3.7	*20	*11	7.7	11
22	3.3	5.7	9.0	10	8.3	*14	26	1.0	21	12	7.7	11
23	5.3	5.4	9.0	10	9.3	12	22	49	8.2	15	*10	8.7
24	2.9	6.5	9.0	10	10	7.7	21	*55	11	23	9.2	8.7
25	3.7	8.5	9.0	9.5	10	9.2	20	*53	12	18	11	8.2
26	7.2	10	9.1	9.3	9.2	11	44	7.2	7.2	15	12	*8.2
27	5.3	9.5	9.2	8.7	8.2	54	60	7.2	10	16	11	8.2
28	6.2	10	9.3	8.2	8.2	20	8.7	4.1	12	16	12	6.7
29	6.2	11	9.7	7.8	-	40	7.7	2.2	10	15	10	6.2
30	17	12	10	7.5	--------	53	*5.2	12	11	17	8.2	7.2
31	26	--------	10	7.3	--------	115	--------	36	--------	24	7.2	--------
Total	295.1	363.6	319.2	318.3	246.2	527.0	1,124.9	607.1	406.1	461.4	370.9	252.7
Mean	9.52	12.1	10.3	10.3	8.80	17.0	37.5	19.6	13.5	14.9	12.0	8.42
Ac-ft	585	721	633	631	488	1,045	2,230	1,200	805	915	736	500

Calendar year 1960: Max 470 Min 2.2 Mean 62.4 Ac-ft 45,280
Water year 1960-61: Max 143 Min 1.0 Mean 14.5 Ac-ft 10,490

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 19 to Feb. 15, Feb. 17-19, 21-23. No gage-height record Oct. 1-11, Nov. 23 to Dec. 18, Jan. 17-19, Jan. 26 to Feb. 13, Mar. 18-21, Apr. 26, 27, 30, May 1, 4-7.

5-2925. Minnesota River near Odessa, Minn.

Location.--Lat 45°15'22", long 96°20'20", in SW¼SW¼ sec. 29, T. 121 N., R. 45 W., near center of span on upstream side of highway bridge, 0.6 mile southwest of Odessa and 5.0 miles upstream from Yellow Bank River.

Drainage area.--1,340 sq mi, approximately.

Records available.--July 1909 to December 1912 (no winter records), May 1944 to September 1961. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read once daily. Datum of gage is 940.76 ft above mean sea level, datum of 1929. July 4, 1909, to Dec. 31, 1912, chain gage at site 250 ft upstream at datum 0.45 ft lower. May 5, 1944, to July 18, 1948, chain gage at site 250 ft upstream at present datum.

Average discharge.--17 years (1944-61), 114 cfs (82,530 acre-ft per year).

Extremes.--Maximum discharge during year, 139 cfs Apr. 17 (gage height, 6.24 ft); minimum observed, 2.8 cfs Aug. 10 (gage height, 2.90 ft).
1909-12, 1944-61: Maximum discharge, 3,070 cfs Apr. 13, 1952 (gage height, 14.06 ft, from graph based on gage readings); no flow at times during 1950, 1951, 1954, 1959, 1960.

Remarks.--Records fair. Some regulation by Big Stone Lake (see p. 116).

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14	23	13	11	10	14	109	20	46	22	31	4.3
2	22	23	12	12	10	14	94	21	57	21	33	4.8
3	20	22	12	13	10	14	36	31	44	28	31	6.6
4	16	21	12	14	10	14	31	24	41	20	23	8.1
5	17	20	14	15	10	14	41	23	24	20	22	9.8
6	10	19	15	15	10	14	24	33	38	34	21	8.9
7	8.9	13	15	15	10	13	22	37	26	37	11	7.1
8	7.5	10	14	15	10	13	24	32	21	36	3.2	7.1
9	7.1	11	13	15	11	14	59	36	24	24	3.3	6.6
10	7.5	10	12	*15	11	15	27	23	24	38	2.8	7.1
11	*8.9	9.0	12	16	12	15	15	21	23	44	2.9	7.7
12	12	7.5	11	16	13	15	13	21	22	45	3.1	7.7
13	12	6.8	11	16	14	15	12	24	22	47	3.3	7.7
14	11	6.0	11	15	14	15	15	102	26	25	3.4	6.6
15	11	*4.6	11	15	*15	16	75	63	20	22	3.9	6.6
16	9.6	5.0	10	15	15	17	78	55	16	19	4.4	6.2
17	8.9	8.6	10	15	15	18	119	52	14	17	5.6	5.8
18	12	33	9.2	15	15	18	68	60	13	20	6.4	4.1
19	14	14	8.8	15	15	17	*33	51	12	20	5.8	5.6
20	13	13	*8.2	15	14	18	22	48	*14	16	5.1	5.3
21	11	13	8.0	14	14	19	59	80	12	13	4.8	6.6
22	9.6	13	8.0	14	14	20	24	60	35	*10	5.6	6.2
23	9.3	11	7.9	14	14	*21	36	42	17	9.6	*7.3	5.3
24	9.3	9.8	8.0	14	15	20	31	*74	12	14	6.2	4.3
25	8.9	9.6	8.0	13	15	18	32	77	12	28	6.0	4.0
26	8.4	11	8.2	13	16	17	41	65	17	20	6.2	*5.8
27	9.1	10	8.5	12	15	20	40	39	9.8	16	5.8	7.1
28	8.6	11	8.8	12	15	28	42	36	19	21	5.5	6.2
29	7.9	13	9.2	11	-	35	20	35	19	18	6.2	5.5
30	18	14	9.8	11	---------	50	19	31	19	18	4.8	5.6
31	22	---------	10	11	---------	85	---------	40	---------	24	5.1	---------
Total	364.5	394.9	328.6	431	362	636	1,261	1,356	698.8	746.6	288.7	190.3
Mean	11.8	13.2	10.6	13.9	12.9	20.5	42.0	43.7	23.3	24.1	9.31	6.34
Ac-ft	723	783	652	855	718	1,260	2,500	2,690	1,390	1,480	573	377

Calendar year 1960: Max 540 Min 3.4 Mean 66.4 Ac-ft 48,160
Water year 1960-61: Max 119 Min 2.8 Mean 19.3 Ac-ft 14,000

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 10, 11, Nov. 27 to Mar. 30.

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 1961.

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.--22 years, 55.6 cfs (40,250 acre-ft per year).

Extremes.--Maximum discharge during year, 209 cfs May 20 (gage height, 3.77 ft); maximum gage height, 4.35 ft Feb. 24 (backwater from ice); minimum discharge, 0.1 cfs Aug. 13-17, 21,22, Aug. 30 to Sept. 2; minimum gage height, 1.53 ft Aug. 17.

1939-61: 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 periods of ice effect, which are fair.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second) (Shifting-control method used Oct. 1 to Nov. 17, Nov. 20-28 Sept. 22-30)

1.5	0.1	2.0	7.3	3.0	94
1.6	0.3	2.2	14	4.0	250
1.7	1.3	2.3	19		
1.8	2.5	2.5	35		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.0	3.7	2.5	1.1	0.7	48	19	16	24	3.7	1.0	0.1
2	1.0	3.7	2.5	1.1	.7	48	18	14	21	3.1	1.2	.2
3	.9	3.3	2.8	1.1	.7	45	20	12	19	2.9	.9	.3
4	.9	2.7	3.2	1.1	.7	43	18	12	17	2.5	.9	.4
5	.9	2.5	3.5	1.1	.7	42	18	12	16	2.3	.7	1.0
6	.8	2.3	3.6	1.1	.8	40	16	17	14	2.3	.5	1.3
7	.7	2.5	3.5	1.1	.8	40	15	18	14	2.1	.4	1.2
8	.6	2.9	3.3	1.1	.8	40	15	18	13	1.9	.3	1.0
9	.6	2.5	3.1	1.1	.8	40	15	24	13	1.7	.2	1.1
10	.6	2.3	2.8	*1.1	.9	39	14	28	12	1.7	.2	1.9
11	*.8	2.3	2.7	1.1	.9	38	13	27	11	1.9	.2	2.3
12	1.2	2.9	2.6	1.1	.9	37	13	23	11	2.0	.2	2.0
13	1.4	2.9	2.4	1.1	.9	37	13	20	17	1.9	.1	2.7
14	1.4	2.7	2.4	1.1	*1.0	36	14	25	16	2.0	.1	2.1
15	1.5	2.9	2.3	1.1	1.1	36	16	*30	13	1.8	.1	2.0
16	1.7	*2.9	2.1	1.1	1.1	36	15	31	11	1.6	.1	1.6
17	1.6	2.9	1.9	1.1	1.2	36	16	75	11	1.6	.1	1.6
18	1.6	2.7	1.7	1.1	1.3	35	15	98	9.9	1.5	1.0	1.5
19	1.7	2.7	1.4	1.0	1.4	36	19	133	9.8	1.6	.3	1.5
20	1.7	3.1	*1.1	1.0	1.5	36	*26	200	*8.9	1.6	.2	1.6
21	1.7	3.1	1.1	1.0	1.7	35	30	160	8.6	1.8	.1	2.0
22	1.8	2.9	1.0	.9	2.0	33	25	120	7.3	*1.5	.2	1.7
23	1.9	2.7	1.0	.9	6.5	*32	23	98	6.4	1.4	*1.2	1.4
24	1.8	3.1	1.0	.8	9.0	31	23	*81	5.9	1.2	.7	1.1
25	1.8	3.1	1.0	.8	10	28	23	76	6.7	1.0	.4	1.0
26	1.8	3.1	1.0	.8	11	26	20	65	6.2	1.4	.3	*1.0
27	1.8	3.1	1.0	.8	17	23	19	57	5.4	1.6	.2	1.2
28	1.8	3.5	1.0	.8	40	24	20	47	4.6	1.4	.2	1.1
29	2.0	3.0	1.0	.7	-	22	18	40	4.4	1.2	.2	1.0
30	3.1	2.6	1.1	.7	--------	21	17	33	3.7	1.1	.2	1.1
31	3.5	--------	1.1	.7	--------	20	--------	28	--------	1.0	.1	--------
Total	45.6	86.6	62.7	30.7	116.1	1,083	546	1,638	340.8	56.3	12.5	40.0
Mean	1.47	2.89	2.02	0.99	4.15	34.9	18.2	52.8	11.4	1.82	0.40	1.33
Cfsm	0.0037	0.0073	0.0051	0.0025	0.010	0.088	0.045	0.133	0.029	0.0046	0.0010	0.0033
In.	0.004	0.008	0.006	0.003	0.01	0.10	0.05	0.15	0.03	0.005	0.001	0.004
Ac-ft	90	172	124	61	230	2,150	1,080	3,250	676	112	25	79

Calendar year 1960:	Max	1,380	Min	0.6	Mean	46.1	Cfsm	0.116	In.	1.58	Ac-ft	33,490
Water year 1960-61:	Max	200	Min.	0.1	Mean	11.1	Cfsm	0.028	In.	0.37	Ac-ft	8,050

Peak discharge (base, 300 cfs).--No peaks above base.

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 18, 19, Nov. 29 to Apr. 1.

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 1961. 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.--26 years (1935-61) 87.0 cfs (62,990 acre-ft per year).

Extremes.--Maximum discharge during year, 148 cfs Apr. 20 (gage height, 5.22 ft); minimum, 4.4 cfs Aug. 17; minimum gage height, 3.69 ft Feb. 4.

1931-61: 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 or no gage-height record, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Feb. 16		Feb. 17 to Sept. 30	
3.8	9.5	3.9	4.3
4.1	14	4.1	7.7
4.3	20	4.3	15
4.5	30	4.5	26
4.7	56	4.7	50
5.0	115	5.0	113
		5.5	237

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	42	63	23	23	6.3	28	72	91	58	28	*13	9.9
2	44	56	27	22	6.1	31	70	87	56	28	12	16
3	42	54	27	*22	6.0	32	72	85	58	28	10	20
4	42	48	30	21	6.0	37	72	76	54	26	10	17
5	41	44	36	22	6.1	46	72	76	52	*22	11	23
6	41	40	33	22	*6.2	50	76	87	48	20	9.9	21
7	41	39	39	22	6.4	50	74	104	47	18	9.6	20
8	40	39	36	22	6.6	48	70	106	47	16	9.0	20
9	38	34	38	22	7.0	50	66	102	46	14	9.9	20
10	33	26	36	21	7.4	56	64	98	43	14	9.9	26
11	30	39	35	21	8.0	56	66	a94	40	17	9.3	24
12	29	48	32	22	8.9	50	66	a90	52	22	8.3	26
13	32	50	30	22	10.0	*56	66	a88	44	21	7.3	30
14	34	50	29	23	11	58	72	a108	37	18	6.9	31
15	38	48	28	22	12	60	62	128	34	18	6.3	32
16	39	47	27	22	13	62	32	a129	32	18	5.7	31
17	40	45	26	22	13	66	54	a116	29	18	5.3	28
18	38	31	25	22	13	66	91	a107	28	17	12	22
19	35	44	24	22	14	70	128	a100	25	16	13	20
20	35	44	23	22	14	70	132	a106	25	18	18	22
21	39	47	23	20	15	80	128	a98	25	18	21	25
22	36	44	22	18	17	78	113	a91	25	16	21	26
23	34	38	22	17	17	80	113	a84	27	14	21	28
24	*31	40	22	14	18	89	*111	a78	25	13	21	31
25	31	42	22	12	19	113	119	*83	24	12	22	32
26	34	42	23	10	22	117	117	87	23	11	20	31
27	30	41	23	9.0	32	89	113	78	22	11	18	28
28	33	*32	22	8.3	31	76	111	74	22	11	*18	28
29	40	16	22	7.5	-	80	106	68	21	13	13	28
30	44	20	22	6.8	--------	85	102	66	24	13	7.1	30
31	56	--------	23	6.5	--------	*74	--------	62	--------	13	8.0	--------
Total	1,162	1,251	850	567.1	352.0	2,003	2,610	2,847	1,093	542	386.5	745.9
Mean	37.5	41.7	27.4	19.3	12.6	64.6	87.0	91.8	36.4	17.5	12.5	24.9
Cfsm	0.041	0.046	0.030	0.020	0.014	0.071	0.096	0.101	0.040	0.019	0.014	0.028
In.	0.05	0.05	0.03	0.02	0.01	0.08	0.11	0.12	0.04	0.02	0.02	0.03
Ac-ft	2,300	2,480	1,690	1,120	698	3,970	5,180	5,650	2,170	1,080	767	1,480

Calendar year 1960:	Max	1,200	Min	9.0	Mean	84.7	Cfsm	0.094	In.	1.27	Ac-ft	61,480
Water year 1960-61:	Max	132	Min	5.3	Mean	39.4	Cfsm	0.044	In.	0.58	Ac-ft	28,580

Peak discharge (base, 200 cfs).--No peak above the base.

* Discharge measurement made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Dec. 14-22, Jan. 26 to Feb. 12.

GPO 823486-9

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 1961 (winter records incomplete prior to 1934). Monthly discharge only for some periods, published in WSP 1308. 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.--30 years (1912-13, 1931-32, 1933-61), 112 cfs (81,080 acre-ft per year).

Extremes.--Maximum discharge during year, 413 cfs May 20 (gage height, 2.84 ft); no flow Feb. 4-10.
1910-14, 1931-61: 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 prior to Mar. 31, good thereafter.

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 7 to Nov. 27, Aug. 26-69, Sept. 15-30)

Oct. 1 to Mar. 31		Apr. 1 to Sept. 30			
0.3	0.5	0.2	0.4	0.9	21
.4	1.4	.3	1.1	1.2	50
.5	2.6	.4	1.9	1.5	95
.6	5.0	.5	2.8	2.0	189
.7	11	.6	4.5	3.0	460
		.7	7.9		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.4	6.6	8.5	3.2	0.4	60	47	42	86	29	5.1	4.5
2	3.2	7.2	8.2	3.0	.2	70	43	39	74	25	*4.8	3.3
3	2.9	7.8	8.6	2.8	.1	72	39	38	64	23	4.5	2.7
4	2.8	7.8	10	*2.6	0	72	*35	37	56	21	3.8	2.4
5	2.6	8.4	11	2.6	0	68	32	35	50	105	3.6	2.5
6	2.5	8.4	12	2.5	0	62	30	41	50	*100	3.3	2.5
7	2.5	8.4	12	2.5	*0	58	29	49	54	83	3.6	2.4
8	2.6	7.8	10	2.5	0	53	27	54	48	66	6.3	2.3
9	2.5	7.2	9	2.5	0	50	26	75	50	50	8.8	2.2
10	2.6	6.6	8.6	2.5	0	47	25	78	56	40	6.7	2.4
11	2.5	7.2	8.2	2.4	.1	45	24	78	50	35	5.1	2.4
12	2.5	7.2	7.9	2.4	.1	43	24	72	55	28	4.0	2.3
13	2.4	7.8	7.6	2.3	.2	42	22	66	62	24	3.4	2.6
14	2.4	7.8	7.3	2.3	.4	41	23	68	56	22	3.0	2.4
15	2.4	7.8	7.0	2.3	.6	*41	30	*68	63	18	2.7	2.1
16	2.1	9.1	6.7	2.3	1.0	42	35	80	66	15	2.4	1.6
17	2.0	9.8	6.4	2.2	1.3	44	28	126	70	13	2.1	1.3
18	2.0	10	5.8	2.2	1.4	50	41	149	66	11	3.0	1.2
19	1.9	11	5.2	2.2	1.4	64	50	224	59	9.9	3.0	.9
20	1.7	11	4.6	2.2	1.6	75	60	389	56	14	2.8	.9
21	1.6	10	4.0	2.1	1.8	82	64	386	50	11	2.5	1.6
22	1.5	10	3.6	1.9	2.8	84	56	337	60	9.3	2.7	1.6
23	1.4	9.8	3.1	1.8	4.0	83	54	280	62	7.5	2.7	1.6
24	*1.4	10	3.1	1.6	7.5	78	*51	230	58	7.1	2.5	1.6
25	1.4	10	3.2	1.4	11	71	53	200	50	6.3	2.2	1.6
26	1.4	10	3.3	1.2	18	66	53	*171	43	6.3	48	1.6
27	1.3	10	3.4	1.0	30	62	53	153	37	6.3	39	1.8
28	1.4	10	3.4	.9	45	59	51	138	34	6.3	23	1.6
29	1.6	*11	3.3	.8	-	56	49	124	35	6.3	*16	1.6
30	2.6	9	3.3	.7	--------	53	46	112	37	5.7	11	1.6
31	4.0	--------	3.3	.6	--------	50	--------	97	--------	5.7	6.3	--------
Total	69.1	264.7	201.6	63.5	128.9	1,843	1,200	4,036	1,657	809.7	237.9	61.1
Mean	2.23	8.82	6.50	2.05	4.60	59.5	40.0	130	55.2	26.1	7.67	2.04
Cfsm	0.0023	0.0090	0.0066	0.0021	0.0047	0.061	0.041	0.132	0.056	0.027	0.0078	0.0021
In.	0.003	0.01	0.008	0.002	0.005	0.07	0.05	0.15	0.06	0.03	0.009	0.002
Ac-ft	137	525	400	126	256	3,660	2,380	8,010	3,290	1,610	472	121

Calendar year 1960:	Max	2,900	Min	0	Mean	128	Cfsm	0.130	In.	1.83	Ac-ft	93,060
Water year 1960-61:	Max	389	Min	0	Mean	29.0	Cfsm	0.030	In.	0.47	Ac-ft	20,990

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 31 (no gage-height record Mar. 6-14).

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 1961.

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.--19 years, 638 cfs (461,900 acre-ft per year).

Extremes.--Maximum discharge during year, 950 cfs May 25 (gage height, 25.55 ft); minimum observed, 19 cfs July 7-26; minimum gage height observed, 20.40 ft July 7-20, 22-26.
1942-61: 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 period 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 7 to Nov. 28)

20.4	19	22.0	243
20.6	32	24.0	612
20.8	54	26.0	1,060
21.3	131		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	131	37	37	65	62	120	125	293	379	21	20	21
2	131	37	37	65	62	120	125	311	375	20	*20	21
3	131	37	37	65	62	120	125	313	375	20	20	21
4	131	37	37	*65	62	120	*125	310	373	20	20	21
5	131	37	37	65	62	120	125	310	187	20	20	21
6	69	36	37	65	62	122	125	310	46	*20	20	21
7	37	37	37	65	*62	125	123	306	46	19	20	21
8	37	37	37	65	62	200	123	308	45	19	20	21
9	37	37	37	65	62	270	123	305	45	19	20	21
10	37	37	37	64	62	308	123	305	46	19	20	21
11	37	36	37	65	62	308	123	305	46	19	20	21
12	37	37	37	65	62	308	123	301	46	19	20	21
13	37	36	37	65	62	308	123	298	90	19	20	21
14	37	37	44	65	62	*316	123	301	126	19	20	21
15	37	37	65	65	62	316	125	303	154	19	20	21
16	37	37	65	65	62	259	125	298	251	19	20	21
17	37	37	65	65	62	128	123	301	253	19	20	21
18	37	37	65	65	62	126	123	330	254	19	21	21
19	37	37	65	65	62	126	125	360	256	19	21	21
20	37	37	65	65	62	125	125	364	257	19	21	21
21	37	37	65	62	70	125	125	354	257	19	21	21
22	37	37	65	62	78	125	123	373	254	19	21	21
23	37	37	65	62	105	125	123	646	192	19	21	21
24	37	37	65	62	120	125	185	919	101	19	21	21
25	*37	37	65	62	120	126	*248	*933	99	19	21	20
26	37	37	65	62	120	126	248	936	45	19	21	20
27	37	37	65	62	120	125	249	921	21	20	21	21
28	37	37	65	62	120	133	246	919	21	20	*21	21
29	37	*37	65	62		126	246	749	21	20	21	21
30	37	37	65	62	--------	125	246	604	21	20	21	21
31	37	--------	65	62	--------	125	--------	512	--------	20	21	--------
Total	1,649	1,107	1,630	1,982	2,093	5,331	4,519	14,098	4,682	601	634	628
Mean	53.2	36.9	52.6	63.9	74.8	172	151	455	156	19.4	28.5	20.9
Ac-ft	3,270	2,200	3,230	3,930	4,150	10,570	8,960	27,960	9,290	1,190	1,260	1,250

Calendar year 1960: Max 5,220 Min 36 Mean 42.1 Ac-ft 305,700
Water year 1960-61: Max 936 Min 19 Mean 107 Ac-ft 77,260

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 9. Gage heights computed from outside staff-gage readings Dec. 22 to Mar. 14, July 7 to Aug. 1.

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 1961.

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.--24 years, 231 cfs (167,200 acre-ft per year).

Extremes.--Maximum discharge during year, 320 cfs May 19 (gage height, 2.64 ft); minimum daily, 4.7 cfs Feb. 5-6. 1937-61: 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 periods of ice effect, or no gage-height record, which are fair. Flow regulated by several small lakes above gage.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to May 6		May 7 to Sept. 30			
1.3	18	1.1	6.5	2.0	125
1.5	40	1.2	12	2.3	205
1.7	74	1.4	28	2.7	344
2.0	144	1.6	51		
2.3	231	1.8	84		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	48	65	44	27	5.9	18	98	161	132	31	*20	10
2	62	69	50	26	5.4	19	92	155	118	31	17	9.0
3	63	71	54	*26	4.9	21	*81	144	103	30	20	8.5
4	60	71	57	27	4.8	22	77	136	95	28	28	8.5
5	56	69	60	27	4.7	24	79	132	88	*27	33	12
6	56	77	61	27	*4.7	25	74	152	81	26	23	18
7	56	77	62	27	4.8	27	74	185	77	24	18	23
8	43	71	62	26	4.8	28	71	205	74	22	16	20
9	40	65	62	25	5.0	29	67	199	70	21	16	15
10	40	51	60	25	5.1	30	69	191	65	20	13	15
11	40	60	58	25	5.5	31	69	185	63	22	12	21
12	38	67	57	24	5.8	31	71	185	72	23	12	30
13	34	60	55	24	6.4	*32	69	177	67	23	11	27
14	33	73	53	24	6.8	33	74	194	60	21	10	29
15	38	65	51	24	7.5	36	87	*234	54	23	9.6	26
16	33	65	49	23	8.0	39	63	270	51	25	9.0	25
17	30	62	47	22	8.3	42	94	285	48	24	9.0	26
18	31	44	45	21	8.5	45	83	300	45	22	16	24
19	27	62	41	20	8.8	52	108	316	40	21	20	24
20	27	58	39	19	9.1	58	181	312	37	22	22	23
21	27	71	37	18	9.6	67	207	304	37	33	16	32
22	27	62	34	16	10	77	219	293	39	31	13	42
23	25	54	33	15	11	91	219	281	41	28	14	36
24	*26	49	31	13	12	115	*219	260	39	25	16	32
25	25	65	30	12	13	130	222	*256	36	24	15	34
26	24	58	29	11	14	120	216	237	33	22	12	31
27	26	60	28	10	15	115	204	222	30	21	12	30
28	24	52	28	9.2	16	112	189	202	29	21	*12	30
29	33	*45	28	8.0	-	114	178	180	30	20	11	33
30	48	38	28	7.2	--------	110	169	158	31	18	11	33
31	62	--------	27	6.5	--------	105	--------	145	--------	18	10	--------
Total	1,202	1,856	1,400	614.9	225.4	1,798	3,723	6,656	1,785	747	476.6	727.0
Mean	38.8	61.9	45.2	19.8	8.05	58.0	124	215	59.5	24.1	15.4	24.2
Cfsm	0.021	0.033	0.024	0.011	0.0043	0.031	0.066	0.115	0.032	0.013	0.0082	0.013
In.	0.02	0.04	0.03	0.01	0.004	0.04	0.07	0.13	0.04	0.01	0.009	0.01
Ac-ft	2,380	3,680	2,780	1,220	447	3,570	7,380	13,200	3,540	1,480	945	1,440

Calendar year 1960:	Max	2,100	Min	7.1	Mean	138	Cfsm	0.074	In.	1.00	Ac-ft	100,100
Water year 1960-61:	Max	316	Min	4.7	Mean	58.1	Cfsm	0.031	In.	0.41	Ac-ft	42,060

Peak discharge (base, 400 cfs).--No peak above base.

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 11, Nov. 28 to Mar. 27. No gage-height record June 10-15, 17-22, 24-29, July 1-4, Sept. 27, 28, 30

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, across from 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 1961. 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.--40 years (1909-17, 1929-61), 604 cfs (437,300 acre-ft per year).

Extremes.--Maximum discharge during year, 1,170 cfs May 25, 26 (gage height, 6.73 ft); minimum, 27 cfs Aug. 11, 12 (gage height, 1.54 ft).
1909-61: 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 period of ice effect or no gage-height record, 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 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 20-24)

Oct. 1 to June 25		June 26 to Sept. 30	
2.0	71	1.5	24
2.5	139	1.7	39
3.0	225	2.0	70
4.0	440	2.4	124
5.0	680		
7.0	1,250		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	186	102	103	92	77	215	241	464	632	51	40	30
2	189	109	102	91	77	220	241	502	572	51	39	29
3	203	112	105	90	76	225	229	512	555	57	*39	28
4	206	110	110	*89	76	230	*223	502	538	53	39	28
5	201	110	115	89	76	235	216	498	490	51	45	37
6	192	109	110	88	76	250	214	514	237	*50	53	39
7	121	116	105	88	*76	270	212	522	196	49	45	37
8	98	115	100	88	76	310	210	553	155	47	52	41
9	90	109	97	88	76	370	206	572	110	44	68	41
10	88	91	95	88	76	370	201	567	124	44	42	44
11	85	95	92	88	76	365	204	555	155	50	28	37
12	85	105	91	87	76	360	206	550	158	48	28	41
13	85	109	90	87	76	355	210	550	157	48	28	57
14	82	108	90	87	77	*341	214	606	214	48	28	50
15	81	110	98	86	77	300	219	608	221	45	29	48
16	84	106	110	86	77	250	223	630	310	44	31	48
17	82	106	112	85	78	210	217	685	340	45	33	45
18	79	98	110	85	80	186	233	724	338	49	36	45
19	78	96	109	84	82	191	245	758	333	48	35	44
20	78	101	107	83	85	199	273	774	329	52	34	46
21	78	108	106	82	94	210	327	766	325	49	33	63
22	77	110	105	81	140	219	359	742	319	53	33	53
23	77	103	103	80	180	237	374	784	304	53	35	57
24	77	101	102	79	190	248	372	1,100	177	50	40	56
25	*76	98	101	78	200	291	481	1,170	145	46	37	52
26	76	105	100	78	205	350	514	1,160	141	44	34	53
27	73	102	98	78	208	319	510	1,140	79	43	33	53
28	73	103	96	77	212	279	500	1,120	59	41	33	52
29	85	104	95	77	-	263	486	1,060	57	40	*33	53
30	102	*105	95	77	--------	255	471	855	54	44	33	52
31	95	--------	94	77	--------	247	--------	787	--------	42	30	--------
Total	3,282	3,156	3,146	2,613	2,975	8,370	8,831	22,330	7,824	1,479	1,146	1,359
Mean	106	105	101	84.3	106	270	294	720	261	47.7	37.0	45.3
Ac-ft	6,510	6,260	6,240	5,180	5,900	16,600	17,520	44,290	15,520	2,930	2,270	2,700

Calendar year 1960: Max 5,980 Min 54 Mean 549 Ac-ft 398,600
Water year 1960-61: Max 1,170 Min 28 Mean 182 Ac-ft 131,900

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 17. No gage-height record Aug. 16, 17, 20-28.

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 left upstream wingwall of bridge on State Highway 68, 0.5 mile northwest of Minneota, and 6 miles upstream from confluence with North Branch Yellow Medicine River.

Records available.--July 1960 to September 1961.

Gage.--Staff gage read once daily. Datum of gage is 1,150.00 ft above mean sea level, datum of 1929.

Extremes.--1959: Maximum discharge during period July to September, 11 cfs June 12 (gage height, 4.05 ft, from graph based on gage readings); no flow at times.
1959-60: Maximum discharge during water year, 135 cfs Mar. 15 (gage height, 6.52 ft, from graph based on gage readings); maximum gage height, 7.20 ft Feb. 23, from graph based on gage readings, (backwater from ice); no flow at times.

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

Rating table, July 1, 1960 to Sept. 30, 1961, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.2	0	4.0	9.3
3.3	.4	4.5	24
3.4	1.0	5.0	40
3.6	2.9	6.0	95
3.8	5.4		

Discharge, in cubic feet per second, April to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1										a0.9	0	0.4
2										a1.3	0	.3
3										a1.6	.2	.2
4										a1.6	*0	0
5										a1.4	0	0
6							≠1,260			a1.3	0	0
7										a1.3	0	0
8										*1.2	0	.7
9										1.1	0	.3
10									≠6.0	.8	0	.9
11										4.9	0	.3
12										5.0	0	.2
13										6.3	0	.2
14										4.2	0	.2
15										3.6	0	.2
16										2.0	0	.1
17										1.5	0	.1
18										1.5	0	.1
19										5.0	0	.2
20										2.0	0	.1
21										1.1	0	0
22										.9	0	.2
23										.5	0	.2
24										.8	0	.4
25										.5	.6	.4
26										.2	0	.3
27										.2	.1	.2
28							≠19			0	2.1	.2
29										0	3.1	*.1
30					---					0	1.8	0
31		---			---				---	0	*.7	---
Total										52.7	8.6	6.5
Mean										1.70	0.28	0.22
Ac-ft										105	17	13

* Discharge measurement made on this day.
≠ Result of discharge measurement.
a No gage-height record.

5-3114. South Branch Yellow Medicine River at Minneota, Minn.--continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0	1.7	0.8	0.7	0	43	4.5	2.8	6.8	6.5	8.9	0
2	0	1.1	.8	.7	0	34	4.4	2.5	5.6	7.6	6.0	0
3	0	1.1	.8	.7	0	28	4.4	2.6	4.8	3.0	8.2	0
4	0	.9	.9	.8	0	24	4.4	3.0	4.5	2.1	5.0	0
5	0	.9	8.4	.8	0	22	4.8	3.2	4.1	1.5	2.1	0
6	0	.8	8.7	.8	0	22	4.9	9.8	4.0	1.4	1.4	0
7	0	.8	4.4	.8	0	21	4.4	11	4.4	1.0	.6	0
8	0	.7	2.7	.7	.1	18	4.1	7.0	4.5	.9	.4	0
9	0	.5	1.9	.8	.3	15	4.1	5.6	4.2	.6	.2	.2
10	0	.6	1.6	.8	.4	13	4.0	5.0	4.5	.5	.1	.1
11	0	.7	1.4	.8	.4	12	3.8	4.6	5.3	.4	0	0
12	0	.9	1.3	.8	.5	12	4.0	3.7	5.8	.8	0	0
13	0	1.4	1.2	.8	.5	11	4.1	3.7	6.5	.6	0	.1
14	0	1.4	1.1	.8	.6	12	4.4	7.6	8.0	.7	0	.1
15	0	1.5	1.1	.8	.7	15	4.5	14	11	.7	0	0
16	0	1.6	1.0	.8	.7	54	5.2	8.2	5.0	.5	0	0
17	0	1.5	.9	.7	.7	*77	6.3	20	3.5	.4	0	0
18	0	1.4	.8	.6	.7	58	6.5	44	2.6	.2	.1	0
19	0	1.5	.8	.5	.7	40	6.8	56	4.5	.3	.1	0
20	0	1.5	.8	.5	.7	23	7.8	50	4.4	.3	0	0
21	0	1.6	.7	.4	.8	15	6.0	36	2.9	.2	0	.1
22	0	1.4	.7	.3	.8	13	5.3	28	2.6	.2	0	.1
23	0	1.3	.7	.3	.9	12	4.5	23	2.1	.2	0	0
24	0	1.1	.6	.2	1.3	6.6	5.2	19	1.6	.1	0	0
25	0	1.4	.6	.2	2.0	11	4.9	16	1.3	.1	0	0
26	0	1.4	.6	.1	40	8.6	4.6	14	1.1	.1	0	.1
27	0	1.4	.6	.1	60	8	*3.8	12	.8	.1	0	.1
28	0	3.0	.6	.1	50	6.6	3.4	*11	1.1	.1	0	0
29	0	1.8	.6	.1	-	6.5	3.1	9.3	1.5	0	0	0
30	2.8	1.2	.6	0	--------	*5.4	2.9	8.7	1.1	0	*0	.1
31	2.6	--------	.6	0	--------	4.6	--------	7.4	--------	10	0	--------
Total	5.4	38.1	48.3	16.5	162.8	651.4	141.1	448.7	120.1	41.1	33.1	1.0
Mean	0.17	1.27	1.56	0.53	5.81	21.0	4.70	14.5	4.00	1.33	1.07	0.03
Ac-ft	11	76	96	33	323	1,290	280	890	238	82	66	2.0

Calendar year:	Max	-	Min	-	Mean	-	Cfsm	-	In.	-	Ac-ft	-
Water year 1960-61:	Max	77	Min	0	Mean	4.68	Cfsm	-	In.	-	Ac-ft	3,390

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 29 to Dec. 4, Dec. 8 to Mar. 15.

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 1961. 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.--25 years (1935-38, 1939-61) 96.8 cfs (70,080 acre-ft per year).

Extremes.--Maximum discharge during year, 374 cfs May 20 (gage height, 3.69 ft); minimum, 1.9 cfs Sept. 20, 26, 27; minimum gage height, 2.03 ft Sept. 3.

1931-38, 1939-61: 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 period of ice effect, which are fair.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 12 to Nov. 28, Sept. 19-30)

2.0	1.9	2.6	46
2.1	3.1	2.8	87
2.2	6.2	3.0	145
2.3	11	3.3	247
2.4	19	3.7	414

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.1	6.6	7.6	6.3	3.2	60	30	30	74	21	12	2.6
2	7.1	6.2	8.0	6.2	3.1	60	26	27	65	20	12	2.5
3	7.1	6.2	8.5	6.0	3.1	45	26	25	63	17	26	2.4
4	7.1	6.6	9.1	5.9	3.0	35	*25	23	54	92	67	2.5
5	6.6	7.1	13	*5.8	3.0	30	24	24	48	87	48	2.9
6	6.2	8.1	13	5.8	3.0	26	24	31	44	54	44	2.9
7	6.2	8.1	13	5.6	3.0	28	21	32	42	*43	34	2.9
8	5.8	7.6	12	5.5	3.0	31	20	32	42	36	*27	2.8
9	5.4	8.1	12	5.4	3.0	29	20	50	40	27	19	2.8
10	5.4	7.6	12	5.4	3.1	26	20	54	38	23	15	2.9
11	5.4	7.1	11	5.3	3.2	23	20	52	40	23	12	2.9
12	5.0	8.6	11	5.3	3.3	22	19	48	38	20	10	3.3
13	5.0	9.1	10	5.3	3.3	21	19	43	67	16	8.1	3.5
14	5.0	8.6	10	5.3	3.3	21	20	50	63	14	6.6	3.3
15	5.8	8.1	10	5.2	3.2	*21	23	*52	52	13	6.2	3.1
16	5.8	8.6	9.6	5.2	3.4	21	19	56	50	11	5.0	2.6
17	5.4	8.6	9.2	5.2	3.5	23	24	139	50	11	4.3	2.4
18	5.4	8.6	9.0	5.2	3.3	45	21	175	54	9.6	4.6	2.1
19	5.4	8.6	9.0	5.1	3.1	140	32	255	56	11	4.3	2.0
20	5.4	8.6	8.6	5.0	3.5	155	37	365	50	20	4.0	2.0
21	5.0	8.6	8.3	4.8	3.6	130	54	339	57	34	4.0	2.4
22	5.0	9.1	8.0	4.6	3.7	85	56	310	56	18	3.7	2.4
23	4.6	9.1	7.8	4.5	3.8	72	50	262	50	15	3.7	2.4
24	4.0	11	7.6	4.3	4.0	57	44	209	43	12	3.5	2.4
25	*3.7	9.6	7.4	4.1	4.5	63	*42	181	40	10	3.3	2.2
26	4.0	7.6	7.2	3.9	5.0	59	40	*152	38	8.6	3.1	1.9
27	3.7	8.1	7.0	3.7	7.0	52	38	136	34	7.6	2.9	1.9
28	3.7	11	6.8	3.6	40	46	38	120	30	7.1	2.9	2.0
29	4.6	8.6	6.6	3.5	-	43	36	106	26	6.2	*3.1	2.0
30	7.1	8.0	6.5	3.4	---	38	32	92	23	7.1	2.9	2.0
31	6.6	---	6.3	3.3	---	34	---	83	---	9.6	2.8	---
Total	169.6	247.4	285.1	153.7	135.2	1,541	900	3,553	1,427	703.8	405.0	76.0
Mean	5.47	8.25	9.20	4.96	4.83	49.7	30.0	115	47.6	22.7	13.1	2.53
Cfsm	0.0084	0.013	0.014	0.0076	0.0074	0.076	0.046	0.176	0.073	0.035	0.020	0.0039
In.	0.01	0.01	0.02	0.009	0.008	0.09	0.05	0.20	0.08	0.04	0.02	0.004
Ac-ft	336	491	566	305	268	3,060	1,780	7,050	2,830	1,400	803	151

Calendar year 1960:	Max	3,210	Min	3.2	Mean	130	Cfsm	0.199	In.	2.71	Ac-ft	93,440
Water year 1960-61:	Max	365	Min	1.9	Mean	26.3	Cfsm	0.040	In.	0.54	Ac-ft	19,000

Peak discharge (base, 100 cfs).--Mar. 19 (12 p.m.) 165 cfs (3.18 ft); May 20 (3 p.m.) 374 cfs (3.69 ft); July 4 (4 p.m.) 136 cfs (2.97 ft).

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 20.

5-3150. Redwood River at Marshall, Minn.

Location.--Lat 44°27', long 95°47', in NW¼ 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 1961. 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.--21 years, 46.3 cfs (33,520 acre-ft per year).

Extremes.--Maximum daily discharge during year, 190 cfs May 19; minimum daily, 0.6 cfs Aug. 30 to Sept. 5, Sept. 7, 9, 10, 12.
1940-61: 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 fair except those for periods of ice effect or no gage-height record, which are poor. Unknown amount of natural diversion into Cottonwood River basin at extremely high stages.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Aug. 11 to Sept. 30)

Oct. 1 to Mar. 23				Mar. 24 to Sept. 30			
0.6	1.0	1.2	38	0.5	0.3	1.2	26
.7	2.2	1.5	85	.6	1.0	1.4	52
.8	4.0	2.0	170	.7	2.2	1.8	124
.9	8.2			.8	4.0	2.2	202
1.0	15			1.0	13		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.0	7.0	1.8	3.3	1.5	46	32	18	35	11	17	0.6
2	3.6	8.2	*5.2	3.4	1.4	50	30	17	30	13	25	.6
3	3.2	7.0	3.6	3.5	1.3	50	28	17	26	12	24	.6
4	3.2	7.0	12	3.8	1.3	47	26	20	24	12	*20	.6
5	3.6	8.2	14	*5.4	1.2	45	25	27	22	11	13	.6
6	2.8	8.2	12	5.2	1.2	44	23	37	19	12	12	.7
7	2.5	7.0	9.4	4.7	1.2	43	22	50	22	12	10	.6
8	2.2	6.5	7.6	4.5	*1.1	42	22	54	22	*12	8.0	.8
9	2.2	6.0	6.6	4.4	1.1	42	20	58	17	12	7.5	.6
10	2.5	5.2	5.6	4.3	1.1	43	19	46	17	12	5.0	.6
11	7.0	4.6	5.1	4.2	1.3	44	19	41	19	14	4.3	.8
12	12	4.0	4.8	4.2	1.4	48	19	35	14	13	2.5	.6
13	7.0	3.6	4.7	4.1	1.5	58	19	32	14	12	2.8	.9
14	5.2	3.6	4.5	4.1	1.7	70	20	38	15	17	2.2	1.4
15	4.0	3.2	4.2	4.0	1.7	95	21	45	21	10	1.6	1.2
16	4.0	3.6	3.8	3.9	1.8	*122	22	60	18	9.5	1.6	1.0
17	3.6	3.6	3.4	3.8	1.9	130	25	157	17	8.0	.7	.8
18	3.6	2.8	3.2	3.7	2.1	130	27	182	16	10	1.2	.8
19	3.2	2.5	3.1	3.7	2.3	110	30	190	18	8.5	1.1	.8
20	2.8	2.8	3.1	3.6	2.5	100	34	160	15	8.0	.8	.8
21	3.0	2.5	3.0	3.5	2.9	87	34	145	14	7.0	.8	1.4
22	2.8	2.2	2.9	3.3	3.2	73	31	130	13	6.2	.8	1.6
23	2.8	2.8	3.1	3.1	3.9	62	29	110	12	12	1.0	1.0
24	2.5	2.2	3.2	2.9	5.0	54	28	100	10	12	1.0	1.3
25	2.4	2.5	3.2	2.7	8.0	48	26	86	10	10	.8	1.3
26	*6.5	1.9	3.2	2.5	14	44	*26	77	10	8.0	1.0	1.2
27	7.0	2.2	3.0	2.3	25	40	24	*70	9.5	10	.9	1.1
28	8.2	1.9	3.0	2.1	37	38	23	*63	8.0	8.5	1.2	1.1
29	8.2	1.8	3.0	1.9	-	37	21	57	8.0	7.5	1.0	1.3
30	8.2	1.7	3.4	1.8	--------	35	19	47	8.0	12	.6	3.2
31	7.6	--------	3.3	1.7	--------	*36	--------	41	--------	18	.6	--------
Total	141.4	126.3	152.0	109.6	129.6	1,913	744	2,210	503.5	341.2	170.0	29.9
Mean	4.56	4.21	4.90	3.54	4.63	61.7	24.8	71.3	16.8	11.0	5.48	1.00
Cfsm	0.015	0.014	0.016	0.012	0.015	0.201	0.081	0.232	0.055	0.036	0.018	0.0033
In.	0.02	0.02	0.02	0.01	0.02	0.23	0.09	0.27	0.06	0.04	0.02	0.004
Ac-ft	280	250	301	217	257	3,790	1,480	4,380	999	677	377	59

Calendar year 1960:	Max	1,320	Min	1.7	Mean	53.0	Cfsm	0.173	In.	2.36	Ac-ft	38,500
Water year 1960-61:	Max	190	Min	0.6	Mean	18.0	Cfsm	0.059	In.	0.80	Ac-ft	13,030

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29, Dec. 1, Dec. 7-30, Jan. 1-7, Feb. 8, Mar. 16. No gage-height record Nov. 30, Dec. 31, Jan. 8 to Feb. 7, Feb. 9 to Mar. 15, Mar. 17-30, Apr. 1-25, Apr. 27 to May 26, May 29 to June 1.

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 1961. Monthly discharge only for some periods, published in WSP 1308.

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.--27 years (1911-12, 1935-61) 93.8 cfs (67,910 acre-feet per year).

Extremes.--Maximum discharge during year, 400 cfs May 20 (gage height, 3.02 ft); minimum, 2.9 cfs Sept. 3, 4, 5 (gage height, 1.36 ft).
1909-14, 1930-61: 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 tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to May 5		May 6 to Sept. 30			
1.6	15	1.3	1.6	1.8	35
1.8	34	1.4	4.6	2.0	70
2.0	63	1.5	9.7	2.5	201
2.2	100	1.6	16	3.0	390
2.6	220				

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	37	38	*20	11	4.3	100	62	45	116	32	153	4.1
2	36	36	22	11	4.0	110	56	43	106	41	134	3.7
3	34	36	24	11	3.8	112	53	40	96	68	111	3.3
4	31	34	25	11	3.7	110	51	38	87	66	114	3.3
5	31	34	27	*11	3.5	106	*51	40	80	56	85	3.7
6	34	33	28	11	3.3	103	50	56	76	47	65	4.1
7	32	34	28	11	3.2	102	47	83	76	*42	*54	3.7
8	31	32	27	10	*3.1	100	45	94	78	37	43	5.1
9	30	29	25	10	3.1	98	44	137	74	34	35	5.1
10	29	22	24	10	3.1	98	43	108	70	30	30	4.6
11	29	22	24	10	3.1	100	43	96	65	32	26	4.1
12	29	27	23	10	3.3	104	43	87	70	33	23	3.1
13	29	29	23	10	3.5	108	43	76	83	37	20	7.1
14	29	28	23	9.8	3.7	115	45	76	72	32	17	3.1
15	26	26	22	9.4	4.0	128	48	91	63	28	16	6.6
16	26	26	22	9.7	4.4	*149	30	*98	59	41	14	7.1
17	25	26	21	9.7	4.8	162	56	124	57	56	13	6.1
18	23	25	20	9.2	5.2	172	56	273	56	42	13	6.1
19	23	24	18	9.0	5.2	172	68	345	59	35	12	4.1
20	21	27	17	8.4	5.2	168	86	386	68	46	12	4.1
21	21	26	17	7.9	6.0	160	88	390	76	42	10	6.6
22	22	25	16	7.5	7.0	150	82	350	68	37	9.7	7.1
23	22	23	15	7.2	8.2	127	74	313	59	33	9.2	6.1
24	26	22	15	6.7	10	102	68	276	48	24	9.2	7.6
25	24	23	14	6.3	20	94	67	244	40	20	8.6	7.1
26	*25	26	13	6.0	40	92	*62	221	35	20	8.1	7.1
27	23	24	13	5.6	65	88	64	198	32	21	7.6	5.6
28	24	31	12	5.3	85	82	57	186	32	20	7.1	5.1
29	25	21	12	5.0	-	77	53	162	31	18	*6.6	5.1
30	22	18	12	4.7	--------	72	50	145	30	36	*5.6	5.6
31	26	--------	11	4.6	--------	65	--------	132	--------	94	4.6	--------
Total	845	827	613	269.0	318.7	3,526	1,685	4,953	1,962	1,200	1,076.3	162.2
Mean	27.3	27.6	19.8	8.68	11.4	114	56.2	160	65.4	38.7	34.7	5.41
Cfsm	0.039	0.040	0.028	0.012	0.016	0.164	0.081	0.230	0.094	0.056	0.050	0.0078
In.	0.04	0.04	0.03	0.01	0.02	0.19	0.09	0.26	0.10	0.06	0.06	0.009
Ac-ft	1,680	1,640	1,220	534	632	6,990	3,340	9,820	3,890	2,380	2,140	322

Calendar year 1960:	Max	6,300	Min	2.2	Mean	162	Cfsm	0.232	In.	3.15	Ac-ft	117,600
Water year 1960-61:	Max	390	Min	3.1	Mean	47.8	Cfsm	0.069	In.	0.91	Ac-ft	34,590

Peak discharge (base, 75 cfs).--Mar. 20 (1 a.m.) 174 cfs (2.63 ft); Apr. 21 (11 a.m.) 9.00 cfs (2.15 ft); May 9 (9 a.m.) 116 cfs (2.20 ft); May 20 (12 p.m.) 400 cfs (3.02 ft); June 13 (2 a.m.) 87 cfs (2.08 ft); June 20 (12 p.m.) 83 cfs [illegible] ft); July 20 (4.30 p.m.) 189 cfs (2.46 ft); July 31 (12 p.m.) 162 cfs (2.37 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Mar. 23.

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 1961 (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.--27 years (1911-13, 1935-37, 1938-61) 236 cfs (170,900 acre-ft per year).

Extremes.--Maximum discharge during year, 1,300 cfs Feb. 28 (gage height, 5.79 ft); minimum, 10 cfs Feb. 21, 22, 23 (gage height, 1.03 ft).

1909-13, 1931-61: Maximum discharge, 13,800 cfs July 9, 1947 (gage height, 16.94 ft, from floodmark), from rating curve extended above 9,000 cfs, result of dam failure; minimum observed, 0.5 cfs Nov. 27, 1952 (gage height, 0.77 ft).

Remarks.--Records good except those for periods of ice effect, which are fair. Some regulation by dam at Cottonwood Lake and several other small lakes above station.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.0	10	1.4	34	3.0	346
1.1	13	1.8	86	4.0	645
1.2	18	2.2	151	5.0	990

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	167	71	48	32	17	510	193	133	248	82	279	*48
2	155	73	63	30	17	432	175	123	*253	77	228	46
3	146	71	70	29	17	346	169	*119	250	67	235	43
4	137	71	79	29	16	240	167	112	240	71	279	42
5	*128	71	92	29	16	207	*159	112	123	79	253	42
6	122	68	67	29	16	238	167	127	111	76	221	40
7	112	68	68	*30	16	243	138	142	171	71	155	39
8	104	67	68	31	15	157	133	184	173	64	140	39
9	98	66	*71	31	15	119	128	258	200	58	151	34
10	94	50	71	30	*14	104	122	314	163	59	169	30
11	89	62	64	29	14	92	119	308	191	62	142	28
12	90	63	58	30	13	84	120	276	195	64	122	27
13	83	63	54	31	13	80	119	243	175	60	109	28
14	79	62	54	31	13	79	127	226	165	58	100	27
15	76	62	51	31	12	86	130	276	155	100	88	24
16	71	62	47	31	12	100	128	372	151	131	80	22
17	68	63	46	31	12	122	133	453	89	127	*76	21
18	67	64	44	30	12	171	125	570	109	130	79	18
19	64	63	39	29	11	303	149	826	128	117	74	20
20	64	63	35	27	11	642	200	972	125	149	71	24
21	63	63	31	26	11	689	261	902	123	103	68	26
22	62	63	29	25	11	552	256	846	120	83	68	25
23	62	60	28	24	12	480	230	752	111	86	68	26
24	62	59	28	23	13	*429	216	639	104	79	68	27
25	62	58	28	22	14	402	204	567	96	68	68	27
26	62	58	29	21	288	408	195	495	92	64	62	27
27	60	56	32	20	824	365	184	471	86	62	56	24
28	62	76	31	19	920	332	171	420	79	60	54	21
29	63	38	30	19	-	274	155	217	74	59	52	20
30	63	37	31	18	--------	238	144	105	*68	68	51	26
31	*70	--------	32	18	--------	216	--------	457	--------	147	51	--------
Total	2,705	1,871	1,518	835	2,375	8,740	4,917	12,017	4,368	2,581	3,717	891
Mean	87.3	62.4	49.0	27.0	84.8	282	164	388	146	83.3	120	29.7
Cfsm	0.068	0.049	0.038	0.021	0.066	0.220	0.128	0.303	0.114	0.065	0.094	0.023
In.	0.08	0.05	0.04	0.02	0.07	0.25	0.14	0.35	0.13	0.07	0.11	0.03
Ac-ft	5,370	3,710	3,010	1,660	4,710	17,340	9,750	23,840	8,660	5,120	7,370	1,770

Calendar year 1960:	Max	5,550	Min	25	Mean	305	Cfsm	0.238	In.	3.22	Ac-ft	221,300
Water year 1960-61:	Max	972	Min	11	Mean	127	Cfsm	0.099	In.	1.34	Ac-ft	92,310

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 10, 23, Dec. 7 to Jan. 28.

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 1961. 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 (revised) above mean sea level, datum of 1929 (Minnesota State Highway Department bench mark).

Average discharge.--10 years, 28.1 cfs (20,340 acre-ft per year).

Extremes.--Maximum discharge during year, 502 cfs Mar. 28 (gage height, 9.08 ft); no flow for many days.
1951-61: 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 periods of ice effect or no gage-height record, which are fair.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 1, July 28 to Sept. 30)

3.9	0	4.4	3.4	5.5	69
4.0	.1	4.5	4.9	6.0	109
4.1	.6	4.6	7.7	7.0	191
4.2	1.3	4.8	18	8.0	300
4.3	2.2	5.0	31	9.0	482

Discharge, in cubic feet per second, water year 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.2					0	375	64	*32	6.0	99	26
2	a.2	(*)				0	342	*59	28	9.4	150	*17
3	a.2					0	319	51	26	20	180	11
4	a.1					0	290	45	22	32	196	7.4
5	a.1					a.5	269	44	18	39	170	6.0
6	*.1		(*)	(*)		a1.0	245	39	18	39	141	6.0
7	a.1					a1.1	216	35	20	34	111	5.5
8	a.1					a1.2	196	37	20	30	a106	9.0
9	0				(*)	a1.2	172	40	18	23	98	12
10	0					a1.3	157	39	16	16	91	a16
11	0					a1.4	143	a35	14	12	82	a22
12	0					a2.0	131	31	21	8.5	74	a32
13	0					b2.4	120	27	43	6.9	66	a41
14	0					b3.0	115	28	59	5.5	56	a56
15	0					b3.5	110	30	71	5.5	*49	a82
16	0					b4.3	109	34	74	4.8	42	a105
17	0					b5.4	101	39	69	4.3	41	125
18	0					b6.5	97	51	62	3.6	45	122
19	0					b7.8	102	67	56	4.3	55	116
20	0					b9.2	112	83	51	4.0	56	112
21	0					b12	124	91	44	4.3	58	107
22	0					*b16	126	90	38	5.7	59	101
23	0					27	120	85	33	23	58	95
24	0					47	119	81	28	45	57	87
25	0					125	112	78	23	62	55	79
26	0					243	107	72	18	69	51	71
27	0					404	98	67	12	67	50	62
28	0					*497	91	61	*9.4	60	55	53
29	0				-	494	82	55	6.6	51	50	45
30	0				---	460	72	46	4.6	52	43	42
31	0	---			---	408	---	39	---	66	35	---
Total	1.1	0	0	0	0	2,784.8	4,772	1,643	954.6	812.8	2,479	1,670.9
Mean	0.04	0	0	0	0	89.8	159	53.0	31.8	26.2	80.0	55.7
Cfsm	0.00030	0	0	0	0	0.680	1.20	0.402	0.241	0.198	0.606	0.422
In.	0.0003	0	0	0	0	0.78	1.34	0.46	0.27	0.23	0.70	0.47

Calendar year 1960: Max 871 Min 0 Mean 57.1 Cfsm 0.433 In. 5.87
Water year 1960-61: Max 497 Min 0 Mean 41.4 Cfsm 0.314 In. 4.25

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

5-3200. Blue Earth River near Rapidan, Minn.

Location.--Lat 44°05'44", long 94°06'35", 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 7-3/4 miles upstream from the 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 1961. 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.--18 years (1939-45, 1949-61), 718 cfs (519,800 acre-ft per year).

Extremes.--Maximum discharge during year, 11,200 cfs Mar. 28 (gage height, 9.35 ft); minimum, 15 cfs Feb. 10-23; minimum gage height, 1.21 ft Oct. 13.

1909-10, 1939-45, 1949-61: 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 1960-61 (gage height, in feet, and discharge in cubic feet per second)

1.1	11	2.0	267	5.0	2,880
1.2	21	2.4	475	6.0	4,380
1.4	57	3.0	907	7.0	6,190
1.6	112	4.0	1,800	9.0	10,400

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	915	*224	96	79	34	300	8,080	1,200	973	355	845	84
2	891	216	141	69	33	385	6,800	1,090	891	214	1,130	*231
3	712	227	174	67	32	488	5,640	990	827	356	1,450	29
4	728	232	113	99	33	1,320	4,640	*948	728	198	1,500	29
5	*640	234	210	103	16	1,350	3,590	875	690	266	1,160	146
6	551	19	136	102	32	1,530	3,360	883	*626	274	1,300	171
7	525	251	159	67	32	1,110	2,830	875	625	302	1,400	172
8	488	205	*142	20	35	827	2,500	998	578	463	1,180	172
9	452	186	200	*93	35	705	2,310	998	598	365	932	206
10	446	150	231	93	*33	705	2,110	1,010	598	339	1,050	36
11	406	155	96	89	54	513	1,980	982	592	332	899	283
12	401	171	198	93	16	446	*1,890	859	572	*316	765	417
13	305	67	164	93	35	434	1,880	851	532	261	661	488
14	390	190	156	19	52	434	1,920	812	1,140	262	532	673
15	295	190	156	19	56	440	1,890	819	1,830	330	513	1,160
16	196	187	133	93	57	440	1,850	804	1,940	143	*488	1,120
17	337	198	97	92	57	458	1,860	948	1,460	259	475	907
18	282	193	66	91	59	506	1,590	1,300	1,070	237	481	750
19	294	198	97	91	16	558	1,800	1,950	915	240	481	572
20	264	21	99	93	60	619	2,180	2,430	796	440	488	538
21	264	193	97	47	58	675	2,300	2,440	705	532	488	519
22	254	193	98	19	90	640	2,210	2,160	633	752	488	481
23	19	154	100	86	113	804	1,860	1,940	592	728	500	463
24	224	65	62	94	59	1,240	1,870	1,780	551	592	500	446
25	223	162	61	64	138	3,350	1,790	1,640	494	605	494	348
26	219	168	64	41	212	6,190	1,800	1,590	446	532	488	401
27	230	68	66	17	349	7,780	1,740	1,470	364	494	481	401
28	186	213	66	17	375	9,940	1,550	1,410	394	488	475	380
29	166	162	67	17		*10,400	1,460	1,250	388	406	390	339
30	101	127	76	34	---------	10,100	1,280	1,160	341	150	263	326
31	168	---------	76	33	---------	9,330	---------	1,080	---------	636	165	- - - - -
Total	11,572	5,019	3,697	2,034	2,171	74,017	78,560	39,542	22,889	11,867	22,462	12,288
Mean	373	167	119	65.6	77.5	2,388	2,619	1,276	763	383	725	410
Cfsm	0.153	0.069	0.049	0.027	0.032	0.983	1.08	0.525	0.314	0.158	0.298	0.169
In.	0.17	0.08	0.06	0.03	0.03	1.13	1.20	0.61	0.35	0.18	0.34	0.19
Ac-ft	22,950	9,960	7,330	4,030	4,310	146,800	155,800	78,430	45,400	23,540	44,550	24,370

Calendar year 1960:	Max	14,800	Min	19	Mean	1,053	Cfsm	0.433	In.	5.90	Ac-ft	764,400
Water year 1960-61:	Max	10,400	Min	16	Mean	784	Cfsm	0.323	In.	4.37	Ac-ft	567,500

* Discharge measurement made on this day.

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 1961.

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.--18 years, 333 cfs (241,100 acre-ft per year).

Extremes.--Maximum discharge during year, 6,600 cfs Mar. 28 (gage height, 12.20 ft, from graph based on gage readings); minimum daily, 8.2 cfs Feb. 1-5.
1939-45, 1949-61: 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, 1.85 ft Aug. 22, 23, 1955.

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

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Mar. 25-27)

Oct. 1 to Mar. 27				Mar. 28 to Sept. 30			
2.6	28	5.0	610	2.1	26	4.0	430
3.0	71	8.0	2,450	2.3	46	6.0	1,500
3.5	135	11.0	5,040	2.6	94	9.0	3,600
4.0	245			3.0	181	12.0	6,400

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	76	35	35	21	8.2	50	2,700	466	1,990	98	1,630	*90
2	71	35	36	21	8.2	70	2,140	416	1,990	146	1,720	83
3	67	33	38	21	8.2	100	1,790	380	1,450	139	1,700	69
4	*64	31	42	21	8.2	443	1,510	*358	1,110	135	1,610	61
5	58	30	51	21	8.2	770	1,300	335	865	128	1,390	58
6	53	30	47	21	8.3	960	1,130	341	*705	109	1,200	63
7	49	52	44	*20	8.3	730	960	355	630	88	1,000	58
8	48	55	*42	20	8.4	745	855	367	564	75	800	73
9	43	45	40	20	8.4	680	770	364	514	64	650	102
10	43	38	38	20	*8.5	640	705	350	450	54	555	107
11	41	40	37	19	8.5	615	*660	335	395	47	474	207
12	37	37	36	19	8.5	475	620	313	364	*44	406	271
13	36	37	35	19	8.5	423	610	298	335	42	341	256
14	32	36	33	19	8.6	370	630	282	313	37	295	269
15	30	34	31	19	8.7	316	680	326	370	35	258	302
16	30	33	30	18	8.8	278	715	370	412	34	*218	333
17	29	32	30	17	8.9	253	640	605	350	33	183	326
18	28	33	29	17	9.0	189	600	1,190	306	31	177	291
19	29	34	28	16	9.2	126	948	1,430	278	43	218	247
20	29	35	27	15	9.5	114	1,330	1,580	251	137	273	214
21	29	36	25	15	9.7	122	1,360	1,440	225	227	370	190
22	29	33	24	14	10	127	1,270	1,270	210	300	341	163
23	31	33	24	13	12	*170	1,160	1,100	192	304	300	146
24	32	32	23	12	18	482	1,050	918	172	300	260	135
25	31	32	23	11	21	2,010	954	850	150	284	225	124
26	28	32	23	11	22	3,400	855	760	130	262	196	111
27	29	31	22	10	24	5,010	775	690	117	216	172	100
28	33	48	22	9.5	28	6,200	680	620	102	172	152	88
29	30	36	22	9.0	-	6,080	596	560	88	139	135	79
30	32	33	22	8.5	--------	4,860	528	498	75	183	117	77
31	*31	--------	22	8.3	--------	3,560	--------	906	--------	462	102	--------
Total	1,228	1,081	981	505.3	315.8	40,368	30,521	20,073	15,103	4,368	17,468	4,693
Mean	39.6	36.0	31.6	16.3	11.3	1,302	1,017	648	503	141	563	156
Cfsm	0.036	0.033	0.029	0.015	0.010	1.18	0.925	0.589	0.457	0.128	0.512	0.142
In.	0.04	0.04	0.03	0.02	0.01	1.36	1.03	0.68	0.51	0.15	0.59	0.16
Ac-ft	2,440	2,140	1,950	1,000	626	80,070	60,540	39,810	29,960	8,660	34,650	9,310

Calendar year 1960:	Max	19,200	Min	22	Mean	664	Cfsm	0.604	In.	8.23	Ac-ft	482,300
Water year 1960-61:	Max	6,200	Min	8.2	Mean	375	Cfsm	0.341	In.	4.62	Ac-ft	271,200

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Jan. 7. No gage-height record Jan. 8 to Feb. 9, Feb. 11 to Mar. 3.

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 Septmmber 1961. (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.--40 years (1905, 1910-17, 1929-61), 2,335 cfs (1,690,000 acre-ft per year).

Extremes.--Maximum discharge during year, 17,600 cfs Mar. 29 (gage height, 15.61 ft); minimum daily, 179 cfs Feb. 4-8; minimum gage height, 1.14 ft Feb. 8 (from graph based on gage readings).
1903-61: 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 period of ice effect, which are fair. Some diurnal fluctuation at low and medium stages caused by powerplants on Blue Earth River.

Rating table, water year 1960-61, except period of ice effect (gage height, in feet, and discharge in cubic feet per second)
(Shifting-control method used Oct. 16 to Dec. 5)

1.3	255	5.0	2,810
1.5	300	8.0	6,120
2.0	480	12.0	11,200
3.0	1,060	16.0	18,500
4.0	1,820		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,840	*498	392	310	180	1,010	12,400	2,770	5,020	1,020	3,280	*419
2	1,680	480	419	305	180	1,050	10,500	2,600	4,960	906	3,880	383
3	1,640	512	453	300	180	1,230	8,950	2,400	*4,200	953	4,100	386
4	*1,480	520	494	290	179	1,640	7,670	*2,260	3,570	771	4,070	266
5	1,430	550	680	285	179	2,100	6,350	2,180	3,150	828	3,460	274
6	1,320	476	512	280	179	2,390	5,660	2,210	2,680	789	3,114	354
7	1,220	471	*411	275	179	2,190	5,090	2,280	2,660	759	3,090	381
8	1,180	520	420	270	179	1,830	4,600	2,460	2,420	912	2,770	453
9	1,110	516	465	*265	181	1,820	4,120	2,570	2,390	847	2,320	453
10	1,060	476	550	260	184	1,720	3,810	2,600	2,310	741	2,160	403
11	1,020	453	570	257	*190	1,440	*3,550	2,610	2,110	696	2,020	394
12	974	476	555	253	194	1,300	3,420	2,520	1,990	*702	1,740	783
13	840	435	535	250	200	1,300	3,300	2,500	1,860	630	1,520	880
14	892	471	510	248	206	1,210	3,360	2,430	1,970	605	1,340	1,040
15	765	520	480	246	210	1,280	3,530	2,800	2,880	625	1,200	1,320
16	664	516	450	240	216	1,380	3,510	2,750	3,200	575	1,120	1,550
17	642	502	430	236	222	1,500	3,320	3,110	2,810	585	*1,020	1,390
18	647	530	415	230	235	1,750	3,050	4,470	2,180	674	1,010	1,210
19	625	530	400	224	250	2,190	3,520	5,330	2,000	630	1,140	995
20	620	498	390	216	272	2,450	4,350	6,700	1,790	906	1,110	886
21	560	484	380	210	325	2,590	4,740	7,020	1,720	1,240	1,160	886
22	560	550	370	202	357	2,610	4,680	6,780	1,680	1,720	1,140	828
23	530	520	365	198	419	2,590	4,430	6,380	1,600	1,890	1,060	783
24	516	458	360	190	476	*3,440	4,180	5,920	1,530	1,780	988	759
25	507	415	350	188	431	6,070	4,000	5,550	1,440	1,640	939	610
26	489	502	345	186	448	10,300	3,880	5,200	1,380	1,460	912	669
27	476	462	345	184	630	12,900	3,740	4,870	1,200	1,270	873	664
28	494	570	340	182	988	16,600	3,440	4,670	1,160	1,140	840	652
29	462	512	330	181	-	17,500	3,200	4,440	1,090	967	789	605
30	458	388	325	180	---------	16,300	3,000	3,990	967	912	625	555
31	453	---------	320	180	---------	14,500	---------	4,260	---------	1,510	423	---------
Total	27,154	14,811	13,361	7,321	8,069	138,180	143,350	118,630	69,917	30,683	55,213	21,231
Mean	876	494	431	236	288	4,457	4,778	3,827	2,331	990	1,781	708
Cfsm	0.059	0.037	0.029	0.016	0.019	0.299	0.321	0.257	0.156	0.066	0.120	0.048
In.	0.07	0.04	0.03	0.02	0.02	0.34	0.36	0.30	0.17	0.08	0.14	0.05
Ac-ft	53,860	29,380	26,500	14,520	16,000	274,100	284,300	235,300	138,700	60,860	109,500	42,110

Calendar year 1960: Max 33,800 Min 249 Mean 3,461 Cfsm 0.232 In. 3.17 Ac-ft 2,513,000
Water year 1960-61: Max 17,500 Min 179 Mean 1,775 Cfsm 0.119 In. 1.62 Ac-ft 1,285,000

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 8 to Feb. 19. Discharge computed from once daily outside gage readidngs Dec. 16 to Mar. 24.

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 1961.

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 2 3/4 miles upstream at same datum read twice daily.

Average discharge.--27 years, 2,947 cfs (2,134,000 acre-ft per year).

Extremes.--Maximum discharge during year, 15,700 cfs Apr. 1; maximum gage height, 18.57 ft Apr. 2 (backwater from Mississippi River); minimum daily, 380 cfs Feb. 2-10; minimum gage height, 3.38 ft Feb. 18.
1934-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,330	785	652	480	385	850	15,200	3,770	5,150	1,890	2,250	821
2	2,180	775	607	470	380	*970	15,600	3,560	5,540	1,820	3,620	717
3	*2,000	*805	660	460	380	1,550	14,800	3,360	5,640	1,610	4,310	685
4	1,930	836	740	460	380	1,720	12,800	2,970	4,800	1,440	4,450	637
5	1,850	846	920	465	380	2,000	9,760	*2,800	4,340	1,420	4,530	629
6	1,700	868	890	465	380	2,500	7,830	2,770	3,750	1,290	4,380	*557
7	1,620	878	800	465	380	3,190	6,860	2,820	*3,360	1,250	3,900	541
8	1,520	836	690	470	380	3,890	6,190	2,910	3,180	1,210	3,540	605
9	1,440	795	680	470	380	3,730	5,610	2,960	3,040	1,170	3,690	661
10	1,370	846	710	*470	380	3,310	5,010	3,020	3,000	1,250	3,390	645
11	1,320	846	760	470	385	3,050	4,700	3,020	3,200	1,190	2,900	637
12	1,280	805	*820	470	390	2,940	4,430	3,000	3,070	1,130	2,730	597
13	1,240	775	805	470	390	2,700	4,210	2,930	2,780	*1,100	2,510	637
14	1,190	785	770	470	395	2,460	4,100	2,900	2,610	1,080	2,270	845
15	1,100	775	710	470	400	2,240	4,060	4,000	2,500	1,040	2,070	901
16	1,100	765	*650	465	400	2,030	4,210	5,630	2,930	994	1,850	1,040
17	1,040	795	620	460	405	1,960	4,270	4,870	3,320	994	1,660	1,360
18	952	805	605	455	410	1,830	4,290	6,300	3,290	952	*1,580	1,400
19	930	805	590	450	425	1,950	4,420	7,320	2,890	1,080	1,590	1,260
20	930	805	565	445	450	2,350	4,700	7,490	2,660	1,130	1,660	1,110
21	920	805	545	440	465	2,760	5,620	8,230	2,510	1,350	1,590	976
22	920	765	530	435	500	3,070	5,690	9,050	2,420	2,810	1,520	933
23	899	715	520	430	540	3,390	5,570	8,370	2,330	3,290	1,500	893
24	888	785	520	420	590	4,000	5,380	7,730	2,230	3,260	1,410	861
25	826	785	515	415	670	*4,570	4,920	7,190	2,140	3,210	1,320	829
26	775	755	515	410	710	6,160	4,900	6,590	2,040	2,920	1,220	797
27	846	715	510	400	740	8,270	4,720	6,130	1,940	2,650	1,160	741
28	846	815	505	395	770	10,200	4,650	5,870	1,820	2,390	1,110	741
29	846	846	500	390	-	11,400	4,430	5,520	1,700	2,120	1,040	733
30	857	735	495	390	---------	12,600	3,990	5,160	1,620	1,910	1,000	749
31	836	---------	490	385	---------	*14,300	---------	4,950	---------	1,840	917	---------
Total	38,481	23,952	19,889	13,810	12,840	127,940	192,920	153,190	91,800	52,790	72,667	24,538
Mean	1,241	798	642	445	459	4,127	6,431	4,942	3,060	1,703	2,344	818
Cfsm	0.077	0.049	0.040	0.027	0.028	0.254	0.397	0.305	0.189	0.105	0.145	0.050
In.	0.09	0.05	0.05	0.03	0.03	0.29	0.44	0.35	0.21	0.12	0.17	0.06
Ac-ft	76,330	47,510	39,450	27,390	25,470	253,800	382,700	303,800	182,100	104,700	144,100	48,670

Calendar year 1960:	Max	35,100	Min	450	Mean	4,031	Cfsm	0.249	In.	3.40	Ac-ft	2,927,000
Water year 1960-61:	Max	15,600	Min	380	Mean	2,260	Cfsm	0.140	In.	1.89	Ac-ft	1,636,000

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 1-4, Dec. 6 to Mar. 6.

5-3310. Mississippi River at St. Paul, Minn.

Location.--Lat 44°56'40", long 93°05'20", in NE¼NE¼ 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 1961 (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.--63 years (1894-95, 1896-97, 1900-1961), 9,768 cfs (adjusted for diversion).

Extremes.--Maximum discharge during year, 22,600 cfs May 22 (gage height, 5.50 ft); minimum daily, 1,540 cfs Sept. 4.

1892-1961: Maximum discharge, 125,000 cfs Apr. 16, 1952 (gage height, 22.02 ft); minimum daily, 632 cfs Aug. 26, 1934.

Maximum stage known 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 power-plants. 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,620	3,160	2,320	2,680	2,020	3,130	17,700	11,000	13,660	4,050	4,210	1,780
2	5,220	3,750	2,320	2,390	2,220	3,420	18,800	11,100	15,100	3,840	4,320	1,730
3	5,210	2,980	2,560	2,460	2,100	3,270	19,000	10,500	14,360	4,240	5,970	1,860
4	4,560	3,640	2,700	2,450	2,210	4,240	18,000	10,400	12,100	4,180	6,700	1,540
5	*4,650	3,550	3,620	2,310	2,050	4,270	*17,300	10,400	10,700	3,940	6,460	1,750
6	4,500	2,890	3,110	2,400	2,200	4,730	15,900	10,200	8,980	3,580	6,340	1,670
7	4,280	2,980	3,010	2,570	2,260	5,140	13,700	9,870	8,910	2,680	5,930	1,840
8	4,250	3,270	3,160	2,390	2,230	5,740	12,300	9,510	8,750	2,680	5,510	1,680
9	3,940	3,060	3,130	2,530	1,990	6,390	10,900	8,750	8,280	3,040	5,220	1,790
10	3,780	3,230	3,590	2,470	2,200	6,560	9,480	11,000	7,590	2,600	5,140	1,840
11	3,730	3,320	3,520	2,420	2,100	6,150	8,610	11,200	7,730	2,760	4,750	2,180
12	3,880	3,310	3,510	2,720	2,240	5,780	7,640	10,000	8,230	2,700	4,300	2,640
13	3,990	2,900	2,870	2,570	2,390	5,820	7,780	9,700	7,720	3,120	3,990	2,520
14	3,840	3,060	3,460	2,510	2,400	5,580	7,670	10,700	7,210	2,920	3,790	2,210
15	4,130	3,130	3,550	2,400	2,370	5,680	6,950	11,400	6,220	2,910	3,640	3,050
16	3,600	*3,360	2,840	2,670	2,370	5,370	6,080	13,500	6,150	3,350	2,980	3,140
17	3,680	3,480	2,790	2,630	2,460	6,410	7,470	15,600	5,980	2,640	2,760	2,900
18	3,080	3,790	2,880	2,610	2,640	5,490	8,990	17,800	5,790	2,770	2,800	2,900
19	2,820	3,540	2,870	2,290	2,210	5,420	9,090	19,900	5,880	2,860	2,680	*3,010
20	3,340	3,100	2,590	2,400	2,570	6,120	9,500	20,900	5,580	3,050	3,410	2,430
21	3,200	2,960	2,520	2,420	2,750	7,530	9,920	21,400	*5,780	3,700	*2,930	3,440
22	2,980	3,450	2,210	2,280	3,020	6,330	11,700	22,300	5,300	3,930	2,590	3,260
23	3,370	3,460	2,360	2,350	2,750	6,780	12,900	22,100	5,490	5,420	2,450	3,230
24	3,010	3,310	2,330	2,100	2,770	7,750	12,900	21,700	5,290	*6,120	2,410	2,950
25	3,130	3,470	2,460	2,140	2,820	10,100	13,100	20,400	4,900	5,460	2,470	2,960
26	2,980	3,640	2,550	2,240	2,830	10,100	14,000	19,700	4,620	5,420	2,560	2,920
27	*3,350	3,200	2,370	2,360	3,060	12,400	13,000	18,400	4,300	4,860	2,230	2,560
28	3,750	3,790	2,380	1,890	3,060	15,000	11,800	17,000	4,310	4,710	2,270	2,440
29	2,350	3,550	2,400	1,870	-	16,300	11,700	16,900	3,810	4,390	2,120	3,100
30	3,530	2,450	2,420	1,910	---------	17,000	11,200	16,200	3,840	4,270	1,920	2,990
31	3,490	---------	2,600	2,100	---------	17,700	---------	*15,400	---------	3,790	1,800	---------
Total	117,240	98,780	87,000	73,530	68,290	231,700	355,080	454,930	222,560	115,980	116,650	74,310
Mean	3,782	3,293	2,806	2,372	2,439	7,474	11,840	14,680	7,419	3,741	3,736	2,477
(†)	250	231	225	212	220	247	263	288	307	300	312	283
Mean≠	4,032	3,524	3,031	2,584	2,659	7,721	12,100	14,970	7,726	4,041	4,075	2,760
Cfsm≠	0.11	0.096	0.082	0.070	0.072	0.210	0.329	0.407	0.210	0.110	0.111	0.075
In.≠	0.12	0.11	0.09	0.08	0.07	0.24	0.37	0.47	0.23	0.13	0.13	0.08

Calendar year 1960:	Max 43,200	Min 1,950	Mean 9,280	Mean≠ 9,536	Cfsm≠ 0.259	In.≠ 3.53
Water year 1960-61:	Max 22,300	Min 1,540	Mean 5,523	Mean≠ 5,785	Cfsm≠ 0.157	In.≠ 2.12

* Discharge measurement made on this day.

† 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. 16, May 16-18, June 16 to Sept. 30.

GPO 823486-10

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 1961.

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.--14 years, 540 cfs.

Extremes.--Maximum discharge during year, 2,290 cfs May 20 (gage height, 5.33 ft); minimum, 12 cfs Nov. 29, 30 (gage height, 2.72 ft), result of freezeup.

1913-17, 1951-61: Maximum discharge, 7,710 cfs May 4, 1954; maximum gage height, 8.30 ft Apr. 12, 13, 1952; minimum discharge, that of 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, or no gage-height record, which are fair.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 23						Apr. 24 to Sept. 30					
2.9	24	3.3	158	4.0	730	2.9	34	3.5	301	5.0	1,870
3.0	40	3.6	368	5.0	1,870	3.0	56	4.0	729	6.0	3,290
3.1	67					3.2	133				

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	80	101	110	45	32	60	271	582	465	143	76	44
2	86	101	*111	43	32	60	243	*526	400	138	73	*42
3	85	*97	110	43	32	60	222	465	355	124	73	51
4	84	90	106	45	32	60	209	416	321	116	70	44
5	81	86	108	45	32	61	209	362	289	112	66	48
6	80	86	120	45	32	63	209	362	251	107	59	59
7	78	82	114	46	33	64	209	377	233	94	56	59
8	76	86	110	46	33	66	216	400	222	90	53	66
9	75	86	106	45	33	68	209	400	*205	90	51	70
10	73	71	102	45	34	71	203	377	193	87	51	76
11	72	67	98	45	35	74	196	369	183	83	48	90
12	70	67	93	45	36	78	203	362	183	80	44	87
13	70	67	90	45	37	82	196	349	183	83	44	107
14	69	67	87	45	39	86	190	416	168	87	42	112
15	68	67	85	45	41	91	243	679	163	94	42	112
16	67	71	82	46	42	94	285	1,060	158	94	40	107
17	67	67	*75	46	44	94	307	1,480	148	94	38	102
18	66	64	73	46	46	93	345	1,900	133	94	42	112
19	66	64	70	45	48	92	417	2,180	124	99	44	112
20	64	64	67	44	50	92	547	2,250	116	103	44	112
21	63	64	64	43	51	94	750	2,220	107	*103	42	120
22	63	71	58	41	52	97	906	2,160	133	112	44	124
23	62	71	53	40	53	*105	1,010	2,000	148	112	44	116
24	62	67	48	*39	54	110	1,050	1,760	168	112	44	112
25	*64	71	45	38	55	126	1,030	1,470	178	112	42	103
26	67	71	40	36	56	147	961	1,240	178	99	42	99
27	67	71	42	35	*57	203	908	1,040	178	99	42	107
28	67	78	43	35	59	250	834	855	173	94	42	99
29	64	78	40	34	-	243	740	699	158	90	44	87
30	86	80	40	33	--------	264	659	601	143	87	44	94
31	97	--------	40	33	--------	278	--------	526	--------	76	44	--------
Total	2,239	2,273	2,430	1,307	1,180	3,426	13,977	29,883	6,057	3,108	1,530	2,673
Mean	72.2	75.8	78.4	42.2	42.1	111	466	964	202	100	49.4	89.1
Cfsm	0.075	0.079	0.082	0.044	0.044	0.116	0.486	1.01	0.211	0.104	0.052	0.093
In.	0.09	0.09	0.09	0.05	0.05	0.13	0.54	1.16	0.24	0.12	0.06	0.10

Calendar year 1960:	Max	1,980	Min	33	Mean	270	Cfsm	0.282	In. 3.82
Water year 1960-61:	Max	2,250	Min	32	Mean	192	Cfsm	0.200	In. 2.71

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 28 to Dec. 24, Dec. 27, Jan. 7, 8, Jan. 13 to Mar. 9. No gage-height record Oct. 1-23, Mar. 10-20.

5-3400. Sunrise River near Stacy, Minn.

Location (revised).--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, and 3 miles downstream from West Branch Sunrise River.

Drainage area.-- 167 sq mi (revised).

Records available.--January 1949 to September 1961.

Gage.--Water-stage recorder. Altitude of gage is 855 ft (from topographic map). Prior to Nov. 10, 1949, chain gage at same site and datum.

Average discharge.--12 years, 65.1 cfs.

Extremes.--Maximum discharge during year, 326 cfs May 20 (gage height, 6.77 ft); minimum, 10 cfs Sept. 2 (gage height, 2.52 ft).
1949-61: 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 good except those for period of ice effect, which are fair. 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	86	42	52	14	12	20	121	136	145	54	31	*11
2	83	39	49	15	12	21	112	126	137	55	30	11
3	76	38	48	15	12	21	105	118	128	50	29	13
4	69	35	47	15	12	22	97	114	118	48	28	13
5	64	34	50	15	12	23	114	111	110	45	27	14
6	60	34	53	15	12	25	124	111	103	43	25	18
7	57	33	58	15	13	27	116	133	103	38	23	17
8	54	33	53	15	13	29	113	*156	108	35	22	16
9	52	32	50	15	13	30	124	166	*106	33	*21	17
10	50	31	46	15	13	31	120	172	100	30	22	17
11	49	32	45	15	13	32	109	172	99	*28	21	21
12	48	30	43	15	14	32	113	160	115	28	19	22
13	47	30	40	15	14	33	110	142	149	34	18	27
14	47	30	38	15	15	36	106	146	127	34	17	29
15	47	32	36	15	15	38	154	196	105	36	16	26
16	45	32	35	15	15	42	166	243	92	37	15	24
17	44	33	*32	15	16	45	162	261	83	34	14	21
18	43	34	29	15	16	45	177	294	76	32	16	19
19	42	35	27	14	16	44	200	312	73	33	19	19
20	41	34	25	14	16	44	216	322	69	37	18	18
21	41	35	23	14	16	44	222	322	66	48	16	19
22	41	35	21	13	17	45	214	314	81	47	16	21
23	41	33	19	13	17	47	207	301	74	45	15	22
24	39	33	17	*12	18	*51	208	286	69	48	14	21
25	*38	*32	16	12	18	60	209	265	66	44	14	19
26	37	34	15	12	19	72	205	243	61	40	14	19
27	36	34	14	12	*20	94	193	222	58	38	15	18
28	36	38	14	12	20	148	178	200	55	36	16	18
29	35	45	14	12	-	167	161	186	52	35	15	18
30	41	56	14	12	--------	159	147	170	50	33	14	18
31	44	--------	14	12	--------	139	--------	156	--------	32	12	--------
Total	1,533	1,048	1,037	433	419	1,666	4,603	6,256	2,778	1,210	592	566
Mean	49.5	34.9	33.5	14.0	15.0	53.7	153	202	92.6	39.0	19.1	18.9
Cfsm	0.296	0.209	0.201	0.084	0.090	0.322	0.916	1.21	0.554	0.234	0.114	0.113
In.	0.34	0.23	0.23	0.10	0.09	0.37	1.03	1.39	0.62	0.27	0.13	0.13

Calendar year 1960: Max 321 Min 10 Mean 64.3 Cfsm 0.385 In. 5.23
Water year 1960-61: Max 322 Min 11 Mean 60.7 Cfsm 0.363 In. 4.93

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 18.

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 1960 in report 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.--59 years (1902-61) 4,040 cfs.

Extremes.--Maximum discharge during year, 27,500 cfs May 18 (gage height, 12.95 ft); minimum, 142 cfs many days during November, December, January, February, March (gage height, 0.99 ft); minimum daily, 1,200 cfs Jan. 29.
1902-61: 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 (gage height, in feet, and discharge, in cubic feet per second)

1.9	1,170	6.0	11,900
2.5	2,410	7.0	14,100
3.0	3,710	9.0	18,600
4.0	6,950	11.0	23,100
5.0	9,500	13.0	27,600

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,870	2,450	2,000	1,950	1,390	1,880	5,230	8,000	5,180	2,390	1,700	1,460
2	2,800	2,740	1,910	1,860	1,470	1,940	5,440	7,440	4,600	2,150	1,830	1,460
3	2,760	2,900	2,140	1,970	1,430	1,880	5,040	6,560	4,680	2,080	1,680	1,440
4	2,720	3,090	2,280	1,890	1,500	1,820	4,480	5,830	3,700	2,210	1,850	1,430
5	2,600	3,080	3,470	1,770	1,320	1,920	4,600	5,700	3,970	2,110	1,780	1,410
6	2,410	2,690	3,030	1,850	1,470	2,180	4,700	5,100	3,580	2,160	1,740	1,620
7	2,650	2,800	2,520	1,880	1,450	1,960	4,370	5,560	3,380	2,080	1,680	1,600
8	2,260	2,930	2,620	1,800	1,500	2,120	4,270	6,850	3,610	1,860	1,640	1,680
9	2,220	2,410	2,220	1,760	1,520	1,950	3,970	7,660	3,380	1,860	1,680	1,760
10	2,390	3,100	2,500	1,780	1,620	2,150	3,800	8,120	3,160	1,700	1,660	1,780
11	2,000	2,840	2,510	1,750	1,560	2,230	3,460	8,000	2,710	1,680	1,640	2,040
12	2,040	2,800	2,520	1,890	1,460	1,990	3,880	8,000	3,070	1,680	1,600	2,160
13	2,230	2,770	2,860	1,970	1,630	2,260	3,490	8,000	2,900	2,090	1,400	2,260
14	2,450	2,600	3,170	1,660	1,530	2,200	3,760	9,240	3,240	1,910	1,390	2,410
15	2,420	2,520	3,130	1,760	1,780	2,210	3,800	14,500	3,010	1,990	1,430	2,400
16	2,540	2,700	3,240	1,640	1,630	2,390	4,660	18,300	2,890	2,100	1,430	2,230
17	2,450	2,860	3,180	1,900	1,780	2,410	5,100	24,800	3,060	2,160	1,390	2,260
18	2,390	2,620	2,080	1,580	1,780	2,440	5,130	27,300	2,300	1,980	1,480	1,800
19	2,530	2,820	2,650	1,950	1,630	2,430	6,340	25,100	2,390	2,100	1,440	2,020
20	2,160	2,440	2,060	1,770	1,840	2,390	7,790	22,500	2,460	2,280	1,460	2,360
21	2,220	2,340	2,100	1,780	1,710	2,800	9,640	20,200	2,720	2,030	1,520	1,820
22	2,240	2,610	1,990	1,610	1,730	2,470	12,000	17,900	2,830	2,000	1,440	2,100
23	2,210	2,810	1,920	1,670	1,810	2,590	14,100	15,400	2,630	2,080	1,430	2,060
24	2,240	2,240	1,770	1,610	1,980	2,700	14,800	14,700	2,730	2,170	1,440	1,800
25	2,220	2,480	1,720	1,450	1,950	3,150	13,800	11,100	2,500	2,090	1,560	1,880
26	2,140	2,280	1,910	1,500	1,970	3,940	12,600	8,300	2,700	2,300	1,540	1,830
27	2,360	2,480	1,840	1,330	1,740	4,220	11,800	8,370	2,270	2,080	1,460	1,990
28	2,430	2,590	1,820	1,580	1,950	5,650	11,000	7,660	2,600	1,980	1,580	2,000
29	2,310	2,530	1,750	1,200	-	5,490	9,810	6,690	2,520	1,760	1,500	1,890
30	2,600	1,720	1,990	1,520	--------	6,650	9,090	6,160	1,950	2,160	1,480	2,170
31	2,700	--------	1,890	1,370	--------	6,460	--------	5,300	--------	1,970	1,500	--------
Total	74,560	79,240	72,790	53,000	46,130	88,870	211,950	354,340	92,720	63,190	48,390	57,120
Mean	2,405	2,641	2,348	1,710	1,648	2,867	7,065	11,430	3,091	2,038	1,561	1,904
Cfsm	0.406	0.445	0.396	0.288	0.278	0.483	1.19	1.93	0.521	0.344	0.263	0.321
In.	0.47	0.50	0.46	0.33	0.29	0.56	1.33	2.22	0.58	0.40	0.30	0.36

Calendar year 1960: Max 12,400 Min 1,520 Mean 3,736 Cfsm 0.630 In. 8.59
Water year 1960-61: Max 27,300 Min 1,200 Mean 3,404 Cfsm 0.574 In. 7.80

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 1961.

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.--33 years, 14,660 cfs.

Extremes.--Maximum discharge during year, 46,300 cfs May 20 (gage height, 80.54 ft); minimum daily, 3,470 cfs Sept. 27; minimum gage height, 74.45 ft Mar. 13.
1928-61: 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11,100	6,460	5,820	5,020	4,120	5,710	25,000	20,700	*20,400	7,490	7,060	5,070
2	10,300	5,340	4,850	5,270	4,130	6,980	24,500	19,700	18,700	6,970	6,570	5,580
3	9,900	6,140	5,080	4,970	4,140	7,230	24,700	18,700	18,900	6,670	7,590	e4,330
4	9,780	7,950	5,940	5,020	4,080	7,500	24,300	*17,500	17,700	6,980	9,670	3,890
5	8,550	8,100	6,660	4,910	4,080	7,610	23,300	17,000	16,200	7,020	9,380	3,930
6	*7,930	8,000	7,200	4,820	4,220	7,210	22,200	17,100	14,700	6,250	9,040	5,140
7	8,410	9,120	6,910	5,290	4,170	7,750	19,200	16,900	13,100	6,830	7,270	5,230
8	8,700	6,410	6,260	5,030	4,200	7,580	17,100	16,200	13,300	5,340	7,410	5,630
9	8,270	5,340	6,330	4,860	4,230	7,240	17,000	16,500	12,900	4,220	7,530	6,420
10	7,890	7,860	6,660	4,820	4,230	8,200	15,800	17,200	12,300	4,800	7,760	6,100
11	8,070	7,860	7,000	4,930	4,290	7,660	14,500	17,800	12,400	5,080	6,790	4,090
12	7,960	10,300	6,920	4,910	4,260	8,190	15,100	18,000	12,800	4,910	6,120	5,300
13	7,230	8,830	7,120	5,070	4,430	7,650	15,000	17,800	13,400	5,430	6,130	6,790
14	6,410	7,230	7,370	5,250	4,230	7,560	14,800	17,900	12,000	5,200	5,180	5,200
15	6,600	6,400	7,080	5,340	4,650	7,690	16,400	20,300	10,500	5,150	3,940	4,120
16	6,600	5,160	7,280	5,450	4,780	7,880	14,100	23,600	11,100	5,130	4,510	5,050
17	6,280	8,470	7,290	5,430	5,410	9,580	14,800	29,900	10,900	5,140	4,560	7,630
18	5,910	*8,410	7,180	5,540	5,440	9,100	17,500	37,000	10,700	5,600	5,420	7,560
19	4,400	8,340	6,490	5,300	5,240	9,450	17,400	43,900	10,800	4,760	6,930	7,370
20	6,400	7,810	5,970	5,340	5,210	9,850	17,400	45,900	10,400	5,880	5,540	*7,670
21	6,340	6,820	5,720	5,000	5,620	10,900	18,800	45,800	10,300	6,950	5,440	7,450
22	3,910	6,900	5,180	4,930	5,950	12,200	22,400	44,700	*10,600	7,050	*4,990	6,720
23	3,550	6,630	4,810	4,620	6,090	11,400	22,000	43,700	10,000	8,890	4,820	7,060
24	6,960	5,930	4,420	4,200	5,820	10,800	24,800	41,100	9,540	9,440	*5,070	5,470
25	7,270	7,240	4,520	3,800	5,280	13,500	26,500	38,700	9,190	10,200	5,140	5,290
26	5,870	7,130	4,560	4,520	5,020	16,200	26,500	35,300	9,230	9,720	4,750	6,230
27	7,860	7,020	4,530	4,330	4,940	16,700	26,000	31,400	8,450	*9,210	5,050	3,470
28	*7,580	8,070	4,340	3,960	5,370	19,800	24,900	27,500	7,790	8,010	5,480	4,940
29	9,090	7,510	4,800	4,290	-	22,600	22,300	24,700	7,520	6,550	5,350	6,480
30	8,610	7,330	4,620	4,120	---------	24,000	22,000	23,200	7,570	6,110	5,300	4,310
31	4,870	---------	5,210	4,150	---------	24,700	---------	22,100	---------	7,880	4,820	---------
Total	228,600	220,110	184,120	150,490	133,630	340,420	606,300	827,800	363,390	204,860	190,610	169,520
Mean	7,374	7,337	5,939	4,855	4,772	10,980	20,210	26,700	12,110	6,608	6,149	5,651
Cfsm	0.165	0.164	0.133	0.108	0.107	0.245	0.451	0.596	0.270	0.148	0.137	0.126
In.	0.19	0.18	0.15	0.12	0.11	0.28	0.50	0.69	0.30	0.17	0.16	0.14

Calendar year 1960: Max 53,700 Min 3,500 Mean 14,210 Cfsm 0.317 In. 4.31
Water year 1960-61: Max 45,900 Min 3,470 Mean 9,917 Cfsm 0.221 In. 2.99

* Discharge measurement made on this day.
e Indefinite stage-fall-discharge relation.
Note.--Stage-fall-discharge relation affected by ice Nov. 21 to Mar. 15.

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, November 1930 to September 1961.

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.--32 years (1911-13, 1931-61), 465 cfs.

Extremes.--Maximum discharge during year, 5,020 cfs Mar. 26 (gage height, 7.47 ft); minimum, 39 cfs Jan. 21 (gage height, 1.24 ft).

1909-14, 1930-61: 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).

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Diurnal fluctuation caused by powerplants above station.

Rating tables, water year 1960-61, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Feb. 23				Feb. 24 to Sept. 30			
1.5	72	2.5	374	1.4	67	4.0	1,360
1.7	108	3.0	630	1.6	103	5.0	2,260
2.0	182			2.0	220	7.0	4,460
				3.0	691		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	195	195	123	90	130	436	1,670	791	1,230	1,010	312	174
2	100	198	123	150	130	780	1,400	791	2,460	670	325	158
3	275	213	125	280	120	769	1,200	521	1,910	596	443	86
4	238	218	90	120	120	579	1,090	461	1,440	578	508	81
5	227	104	280	120	90	524	1,050	502	1,180	528	395	231
6	225	89	180	160	135	708	1,010	520	1,030	345	293	*250
7	223	188	130	90	130	478	954	566	916	284	292	195
8	110	235	130	90	120	452	903	566	840	221	401	214
9	89	237	200	150	130	459	859	767	803	110	481	192
10	223	172	110	320	130	491	834	767	791	261	522	99
11	227	156	90	300	130	464	821	549	916	253	434	178
12	216	102	*250	135	90	360	580	553	791	*255	383	204
13	189	72	255	135	130	376	425	542	767	251	377	440
14	176	122	250	135	120	409	558	466	767	254	*301	450
15	168	*219	140	90	120	266	668	633	*492	105	302	390
16	91	164	130	220	130	289	522	1,240	453	94	232	286
17	167	152	90	145	130	326	680	1,620	443	209	212	112
18	174	206	90	145	120	301	877	2,500	217	240	243	249
19	174	176	220	145	90	392	1,110	2,950	390	251	310	269
20	175	104	200	*145	215	572	1,490	2,810	513	293	167	295
21	175	167	200	110	360	664	1,550	2,560	507	274	310	320
22	91	161	190	90	360	578	1,400	2,210	454	203	256	294
23	84	211	185	140	370	679	1,230	1,880	300	99	245	115
24	158	104	190	180	372	1,310	1,110	1,630	231	185	244	94
25	175	132	90	130	302	2,940	1,050	1,450	117	192	244	202
26	*175	173	90	140	159	4,220	1,010	1,330	255	195	164	210
27	178	130	115	130	182	3,760	954	1,230	316	195	97	220
28	192	255	120	130	*415	*3,630	903	1,140	312	194	220	210
29	106	200	120	90	-	3,320	*840	987	301	101	221	209
30	95	120	115	130	---------	2,630	809	877	170	92	210	107
31	188	---------	120	135	---------	2,120	---------	840	---------	300	179	---------
Total	5,279	4,975	4,741	4,570	5,030	35,282	29,557	36,249	21,312	8,838	9,323	6,534
Mean	170	166	153	147	180	1,138	985	1,169	710	285	301	218
Cfsm	0.129	0.126	0.116	0.111	0.136	0.862	0.746	0.886	0.538	0.216	0.228	0.165
In.	0.15	0.14	0.13	0.13	0.14	0.99	0.83	0.02	0.60	0.25	0.26	0.18

Calendar year 1960: Max 8,130 Min 72 Mean 655 Cfsm 0.496 In. 6.76
Water year 1960-61: Max 4,220 Min 72 Mean 470 Cfsm 0.355 In. 4.82

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 29 to Jan. 26. No gage-height record Jan. 27 to Feb. 23.

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.

Records available.--January 1952 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 951.0 ft above mean sea level, datum of 1929 (levels by City of Rochester Sewage Department).

Average discharge.--9 years, 107 cfs.

Extremes.--Maximum discharge during year, 10,900 cfs Mar. 26 (gage height, 15.43 ft); minimum, 24 cfs Jan. 29 (gage height, 1.66 ft).
1952-61: Maximum discharge, that of Mar. 26, 1961; minimum, 8.4 cfs Dec. 7, 1955.
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.

Rating table, water year 1960-61 (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 27 to May 1)

1.6	19	5.0	913
1.8	38	7.0	1,690
2.0	73	10.0	3,340
3.0	314	13.0	6,900

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	67	80	48	36	31	228	228	98	734	257	170	53
2	59	67	48	36	30	518	199	94	309	226	*134	57
3	57	59	46	36	30	481	187	84	228	132	137	127
4	55	53	59	36	30	194	175	82	192	115	139	71
5	55	49	101	36	28	122	168	82	173	98	206	59
6	51	48	75	36	30	110	161	82	156	89	113	61
7	49	49	61	37	31	91	151	103	*151	82	96	55
8	48	53	55	34	31	65	137	197	154	75	139	61
9	46	48	49	37	31	63	130	173	151	69	125	55
10	48	48	49	36	31	61	127	137	175	69	120	55
11	48	48	46	36	32	63	125	118	366	65	115	57
12	48	48	44	36	33	57	137	106	187	80	96	69
13	48	46	43	36	35	63	149	98	178	73	84	87
14	46	48	44	36	35	61	151	151	144	65	80	73
15	44	51	*43	35	35	61	190	314	122	63	73	67
16	41	49	38	37	36	59	197	240	113	59	71	57
17	43	51	39	37	37	59	158	216	108	59	137	49
18	43	51	38	37	36	59	163	373	101	55	96	49
19	43	49	38	*35	33	61	228	332	125	61	82	49
20	43	46	38	34	36	67	257	264	113	57	75	48
21	*43	48	36	33	37	80	230	233	103	61	75	44
22	43	46	35	32	*39	80	204	204	101	55	71	46
23	42	46	34	33	57	103	182	180	91	57	71	46
24	43	44	33	31	44	583	187	163	87	67	71	44
25	43	46	34	30	42	3,180	185	158	80	57	63	46
26	43	46	35	31	49	*6,430	166	144	78	51	65	44
27	43	44	36	31	59	1,960	144	137	73	49	65	*42
28	43	75	36	31	91	1,190	*130	127	71	48	*65	42
29	44	*59	36	27	-	426	118	120	*69	48	61	42
30	65	42	36	30	--------	322	108	110	65	464	59	75
31	67	--------	36	31	--------	269	--------	1,280	--------	242	59	--------
Total	1,501	1,537	1,389	1,059	1,069	17,166	5,072	6,200	4,798	3,048	3,013	1,730
Mean	48.4	51.2	44.8	34.2	38.2	554	169	200	160	98.3	97.2	57.7
Cfsm	-	-	-	-	-	-	-	-	-	-	-	-
In.	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1960: Max 2,820 Min 33 Mean 136 Cfsm - In. -
Water year 1960-61: Max 6,430 Min 27 Mean 130 Cfsm - In. -

Peak discharge (base, 1,000 cfs).--Mar. 26 (4 a.m.) 10,900 cfs (15.43 ft); May 31 (5.30 p.m.) 2,720 cfs (9.05 ft).

* 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 1961. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. 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.--39 years (1909-17, 1930-61), 477 cfs.

Extremes.--Maximum discharge during year, 15,400 cfs Mar. 26 (gage height, 21.69 ft); minimum, 34 cfs Feb. 18 (gage height, 6.06 ft).

1909-17, 1929-61: Maximum discharge, 30,700 cfs July 22, 1951 (gage height, 30.80 ft, from floodmark); minimum, 27 cfs Jan. 12, 1935 (gage height, 6.30 ft).

Flood of April 1888 reached stage of about 30.5 ft at present site or 29.7 ft, original site. Flood of 1859 is known to have exceeded that of 1888 (gage height, not determined).

Remarks.--Records good.

Rating tables, water year 1960-61 (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Dec. 10				Dec. 11 to Sept. 30			
6.5	80	7.0	204	6.2	47	8.0	734
6.6	100	7.5	413	6.4	75	9.0	1,380
6.8	146	8.0	685	6.7	140	12.0	3,650
				7.0	227	16.0	7,540
				7.5	449	21.0	14,300

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	266	281	185	103	88	959	1,020	*313	1,380	688	211	210
2	141	271	237	92	320	1,430	978	297	1,430	1,750	118	129
3	243	283	113	107	642	1,510	952	276	1,040	1,040	313	90
4	289	280	107	192	138	1,260	685	409	901	920	515	242
5	242	166	167	188	107	946	618	361	*882	717	228	*235
6	194	96	295	193	349	913	596	227	360	244	114	261
7	305	241	267	157	282	807	584	156	387	254	391	239
8	230	288	265	79	107	619	275	466	460	195	556	231
9	118	438	285	191	101	574	172	491	572	130	869	140
10	231	258	229	201	98	437	290	370	269	421	856	101
11	334	297	110	179	96	263	438	572	297	510	837	124
12	292	172	168	181	94	130	449	573	745	800	825	299
13	156	104	243	185	96	238	459	282	894	813	813	302
14	230	106	258	121	90	312	460	305	862	813	776	326
15	161	160	*224	101	90	338	360	937	413	819	693	302
16	102	212	268	161	90	199	262	1,370	417	813	710	192
17	122	121	217	212	90	233	680	1,080	207	626	517	116
18	186	316	107	202	47	192	907	1,650	140	326	385	260
19	173	234	170	*197	79	135	857	2,060	414	145	333	301
20	164	107	220	195	96	404	1,070	1,600	303	128	334	271
21	*158	226	310	260	92	702	1,260	1,460	212	118	294	248
22	107	243	265	133	375	644	1,150	1,100	316	109	217	234
23	94	306	248	160	*644	1,260	1,030	985	266	105	273	152
24	111	173	184	192	677	3,040	998	946	138	105	245	103
25	169	161	101	183	311	8,550	985	920	126	*101	208	193
26	174	178	103	180	163	13,200	959	901	*238	98	153	242
27	173	98	240	124	252	7,000	940	364	192	94	105	*207
28	175	*215	218	88	577	*5,020	920	195	185	92	237	196
29	154	250	221	84	-	2,190	331	221	215	90	246	189
30	100	170	142	124	---------	1,400	189	253	356	90	235	133
31	209	---------	154	126	---------	1,120	---------	514	---------	194	219	---------
Total	5,803	6,451	6,321	4,891	6,191	56,025	20,874	21,654	14,617	13,348	12,826	6,268
Mean	187	215	204	158	221	1,807	696	699	487	431	414	209
Cfsm	0.165	0.190	0.181	0.140	0.196	1.60	0.616	0.619	0.431	0.381	0.366	0.185
In.	0.19	0.21	0.21	0.16	0.20	1.84	0.69	0.71	0.48	0.44	0.42	0.21

Calendar year 1960: Max 12,800 Min 71 Mean 545 Cfsm 0.482 In. 6.57
Water year 1960-61: Max 13,200 Min 47 Mean 480 Cfsm 0.425 In. 5.76

* Discharge measurement made on this day.

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 1961.

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.--22 years, 27.9 cfs.

Extremes.--Maximum discharge during year, 4,530 cfs Mar. 25 (gage height, 9.65 ft); minimum, 7.2 cfs Jan. 8 (gage height, 0.96 ft).
1939-61: 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 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second) (Shifting-control method used Mar. 30, 31, June 1, July 19 to Sept. 30)

1.1	11	2.5	188
1.2	16	3.0	302
1.4	35	5.0	1,070
1.6	58	7.0	2,160
2.0	111		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14	16	13	12	10	40	28	15	38	16	15	13
2	14	18	13	12	10	100	23	15	22	14	14	15
3	14	15	13	12	10	65	23	15	19	14	13	24
4	14	14	13	12	10	35	21	15	17	15	19	14
5	14	14	14	12	10	25	21	14	16	14	22	14
6	14	14	14	12	10	22	20	15	15	14	20	13
7	13	14	14	12	10	18	20	14	15	14	15	12
8	13	14	14	12	10	16	18	15	15	14	17	12
9	13	14	14	14	11	15	17	16	15	14	16	12
10	13	14	14	13	11	14	16	15	16	14	15	12
11	13	13	14	13	11	14	15	14	16	15	16	12
12	13	13	13	13	11	13	16	14	18	15	14	13
13	13	13	14	12	11	13	17	14	18	16	13	13
14	13	13	*14	12	11	13	16	15	16	16	12	13
15	13	13	13	12	11	13	17	17	15	15	12	13
16	13	13	15	12	12	13	20	19	14	15	11	12
17	13	13	14	12	12	14	17	19	13	14	11	12
18	13	13	15	*12	13	14	16	21	13	14	12	12
19	13	13	14	11	12	14	23	25	14	14	12	12
20	*13	13	14	10	13	14	31	25	13	14	12	12
21	13	13	14	9.6	12	15	27	24	14	14	12	12
22	13	13	14	9.6	*12	15	23	20	14	14	11	12
23	13	13	14	9.6	13	33	22	19	14	14	11	12
24	13	13	14	9.6	15	404	22	*17	14	13	11	12
25	13	13	14	9.6	15	2,130	22	18	14	13	11	12
26	13	13	13	9.7	15	1,850	*20	17	15	*12	11	12
27	13	13	13	9.8	17	562	20	16	15	12	12	12
28	13	14	13	10	25	188	17	16	15	12	12	*12
29	13	14	13	10	-	54	16	15	14	12	*12	13
30	14	*13	13	10	--------	42	16	15	14	13	12	13
31	14	--------	13	10	--------	*33	--------	20	--------	18	12	15
Total	411	409	424	349.5	343	5,811	600	529	481	438	418	389
Mean	13.3	13.6	13.7	11.3	12.2	187	20.0	17.1	16.0	14.1	13.5	13.0
Cfsm	0.173	0.177	0.178	0.147	0.159	2.43	0.260	0.223	0.208	0.184	0.176	0.169
In.	0.20	0.20	0.21	0.17	0.17	2.81	0.29	0.26	0.23	0.21	0.20	0.19

Calendar year 1960:	Max	579	Min	12	Mean	24.9	Cfsm	0.324	In.	5.12	
Water year 1960-61:	Max	2,130	Min	9.6	Mean	29.0	Cfsm	0.378	In.	5.14	

Peak discharge (base 200 cfs).--Mar. 25 (7 p.m.) 4,530 cfs (9.65 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 30 to Dec. 3, Dec. 7, 8, Dec. 19 to Jan. 7, Jan. 19 to Feb. 11, Feb. 27 to Mar. 9.

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 1961. 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.--33 years, 24,240 cfs.

Extremes.--Maximum discharge during year, 67,600 cfs May 23 (gage height, 9.22 ft); minimum daily, 5,700 cfs Sept. 27; minimum gage height, 4.72 ft, Dec. 11.
1928-61: 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. 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 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	19,900	14,300	14,700	8,390	7,450	12,300	57,500	39,300	39,300	14,500	13,600	10,700
2	19,400	*16,300	14,600	8,450	7,380	13,300	53,600	34,800	37,800	14,700	13,300	10,800
3	18,800	20,300	14,000	8,450	7,380	18,400	51,300	36,700	33,700	15,400	14,000	6,900
4	18,000	25,300	14,300	8,450	7,350	20,600	48,500	35,000	32,000	16,300	11,500	6,910
5	15,800	25,900	15,500	8,550	7,350	23,800	45,500	*30,700	28,100	15,600	13,800	8,030
6	13,400	25,300	15,900	9,280	7,350	20,800	44,400	28,000	27,800	13,700	11,600	6,990
7	*13,800	22,700	15,600	10,900	8,040	19,400	*41,300	29,600	25,900	13,200	11,600	6,930
8	14,300	21,400	15,300	10,900	8,490	15,900	35,300	29,900	23,800	12,800	9,930	7,940
9	14,400	20,600	14,900	10,700	8,750	16,100	34,500	28,000	21,800	13,500	12,300	12,400
10	16,000	20,000	12,100	10,600	8,750	16,000	31,400	29,000	21,000	7,010	9,910	9,020
11	13,200	17,100	7,650	10,500	8,740	16,800	31,100	32,000	23,000	10,600	8,060	11,700
12	12,600	18,100	6,050	10,400	8,780	17,700	26,600	32,900	19,500	7,770	9,120	13,400
13	11,800	16,600	9,370	10,400	8,830	16,800	27,900	32,900	22,000	6,770	11,500	12,500
14	12,300	17,300	14,900	10,400	8,830	15,400	26,300	31,800	24,000	6,840	8,950	10,500
15	13,300	17,200	17,900	10,600	8,830	14,900	23,700	35,000	22,400	9,020	6,970	9,890
16	13,600	15,400	18,000	10,700	8,720	14,400	22,900	38,500	20,200	9,080	8,030	9,010
17	13,500	14,400	18,500	10,600	8,690	14,700	28,000	40,400	18,800	9,180	5,800	10,200
18	14,400	14,200	18,600	11,000	8,590	15,500	32,400	47,800	16,900	10,200	5,800	10,200
19	14,100	14,100	18,700	10,900	8,700	16,800	30,100	52,500	20,000	11,700	8,160	10,900
20	14,000	14,200	18,600	10,900	9,140	20,700	34,100	58,600	18,300	13,200	5,730	10,800
21	13,800	*14,300	15,800	10,900	10,400	21,600	39,900	62,700	16,600	13,900	5,780	8,840
22	14,100	14,600	13,600	10,900	10,400	24,800	39,800	66,200	17,800	14,000	5,830	8,930
23	13,600	15,700	12,400	10,700	10,800	26,300	39,800	67,400	17,600	13,900	5,870	13,300
24	12,800	15,300	11,500	10,000	11,200	27,900	42,700	66,900	18,100	11,400	8,190	13,300
25	11,400	14,700	11,500	8,950	11,600	37,200	45,800	*64,600	16,700	13,100	*8,170	12,940
26	12,600	13,200	11,600	8,660	12,400	55,500	47,000	62,300	16,200	*14,500	9,200	9,120
27	12,800	12,900	10,500	8,180	12,800	60,900	47,000	59,900	*15,500	12,200	9,290	5,700
28	11,600	13,800	9,200	8,180	12,500	59,300	46,800	56,800	13,600	12,700	10,200	8,890
29	12,200	15,900	8,620	8,180	-	55,700	46,000	51,800	14,000	11,900	10,100	9,930
30	11,500	15,200	8,240	8,190	--------	52,000	44,200	47,600	13,600	12,000	10,800	10,100
31	11,500	--------	8,370	7,780	--------	56,000	--------	43,600	--------	14,800	11,600	---------
Total	434,500	516,300	416,500	301,690	258,240	817,500	1,165,400	1,373,200	656,000	375,470	294,690	296,770
Mean	14,020	17,210	13,440	9,732	9,223	26,370	38,850	44,300	21,870	12,110	9,506	9,892
Cfsm	0.237	0.291	0.227	0.164	0.156	0.445	0.656	0.748	0.369	0.205	0.161	0.167
In.	0.27	0.32	0.26	0.19	0.16	0.51	0.73	0.86	0.41	0.24	0.19	0.19

Calendar year 1960: Max 69,700 Min 6,050 Mean 25,040 Cfsm 0.423 In. 5.76
Water year 1960-61: Max 67,400 Min 5,700 Mean 18,920 Cfsm 0.320 In. 4.33

**Discharge measurement made on this day.
Note.--Fall-stage-discharge relation affected by ice Nov. 17 to Mar. 20.

5-3790. Gilmore Creek at Winona, Minn.

Location.--Lat 44°02'40", long 91°41'25", sec. 29, T. 107 N., R. 7 W., on left bank at west edge of Winona, 1,500 ft upstream from bridge on U.S. Highway 14, 2¼ miles upstream from Lake Winona, and 6½ miles upstream from mouth.

Drainage area.--8.95 sq mi.

Records available.--October 1939 to September 1961.

Gage.--Water-stage recorder. Datum of gage is 672.92 ft above mean sea level, adjustment of 1912. Prior to Nov. 4, 1939, staff gage at same site and datum.

Average discharge.--22 years, 3.68 cfs.

Extremes.--Maximum discharge during year, 425 cfs Mar. 25 (gage height, 2.59 ft); minimum, 1.0 cfs Nov. 26; minimum gage height, 0.05 ft Nov. 26, Aug. 10.

1939-61: Maximum discharge, 5,360 cfs July 21, 1951 (gage height, 9.47 ft), from rating curve extended above 260 cfs on basis of slope-area measurement at gage height 6.74 ft and logarithmic plotting; minimum, 0.4 cfs several days in July and August 1941.

Remarks.--Records poor. Some regulation at low flow by swimming pool three-quarters of a mile above station. Water diverted above station at times since May 1961 to maintain water level in pond. Records include diversion.

Rating table, water year 1959-60, except periods of ice effect (gage height, in feet, and discharge in cubic feet per second)

0.05	1.4	0.4	13
.1	2.1	.6	28
.2	4.2	1.0	66
.3	7.8	1.5	145

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.7	4.5	3.2	2.3	1.7	15	4.2	3.5	3.5	3.5	2.7	2.7
2	2.7	4.2	3.1	2.3	1.7	31	4.2	3.1	3.3	2.7	2.5	2.9
3	2.7	4.0	2.9	2.3	1.7	7.0	4.2	3.3	3.3	2.7	2.5	3.1
4	2.7	3.7	2.9	2.3	1.7	11	4.0	3.3	3.3	2.7	2.5	2.9
5	2.5	3.7	3.1	2.4	1.7	12	4.0	3.3	2.7	2.7	2.7	4.8
6	2.5	3.7	3.1	2.5	1.8	4.8	4.0	3.7	2.3	2.7	2.5	2.9
7	2.5	3.7	3.1	2.5	1.8	3.5	3.7	3.5	2.5	3.1	2.5	2.7
8	2.5	4.2	2.9	2.6	1.9	3.5	3.7	3.5	2.7	2.9	3.5	2.7
9	2.5	3.5	2.3	2.6	2.1	3.5	3.7	3.5	3.1	2.9	2.9	2.7
10	2.5	2.5	2.0	2.6	2.3	3.5	3.7	3.3	3.3	3.3	2.5	2.3
11	2.5	2.5	1.8	2.6	2.4	3.5	3.7	3.3	3.3	3.3	2.9	2.5
12	2.5	2.5	1.8	2.7	2.6	3.5	3.7	3.3	3.7	3.3	2.7	3.5
13	2.5	2.5	2.1	2.7	2.8	3.5	3.7	2.9	3.7	2.9	2.5	3.3
14	2.9	2.5	*2.1	2.8	2.9	3.5	3.7	3.5	3.5	2.7	2.3	2.9
15	2.9	2.5	2.1	2.9	3.0	3.5	3.7	3.7	2.7	2.7	2.3	2.9
16	2.9	2.5	2.1	2.9	3.1	3.5	3.7	3.7	2.3	2.5	2.3	3.1
17	2.9	2.5	2.1	2.9	3.1	3.5	4.0	3.7	2.1	2.5	2.5	3.1
18	2.9	2.5	2.1	*2.9	3.1	3.5	4.0	4.0	2.3	2.5	2.5	2.7
19	2.9	2.5	2.1	2.9	3.1	3.7	4.0	4.0	2.5	2.5	2.9	2.7
20	*3.1	2.5	2.1	2.8	3.2	4.0	4.2	4.2	2.5	2.5	2.7	2.5
21	3.1	2.5	2.0	2.7	3.2	*4.5	4.2	3.7	2.5	2.5	2.7	2.5
22	3.3	2.5	2.0	2.6	*3.3	5.4	4.0	3.3	2.5	2.5	2.7	2.5
23	3.3	2.3	1.9	2.5	3.4	13	4.0	3.3	2.5	2.5	2.7	2.5
24	3.3	2.5	1.9	2.3	3.6	47	4.0	*3.3	2.5	2.5	2.7	2.7
25	3.3	2.5	1.9	2.2	3.8	138	4.0	3.3	2.5	2.5	2.7	2.7
26	3.3	2.3	1.9	2.1	4.4	74	*3.5	3.5	2.7	*2.3	2.3	2.5
27	3.3	2.7	2.0	2.0	5.5	41	3.5	2.7	*2.7	2.3	2.7	2.5
28	3.3	3.1	2.0	1.9	7.5	5.8	3.5	2.5	2.5	2.3	2.5	*2.7
29	3.1	3.5	2.1	1.8	-	4.8	3.5	2.5	2.5	2.3	*2.7	2.7
30	3.7	*3.3	2.3	1.8	--------	*4.2	3.5	2.5	2.5	2.5	2.7	3.1
31	4.5	--------	2.3	1.7	--------	4.2	--------	3.7	--------	2.9	2.7	--------
Total	91.3	89.9	71.3	76.1	82.4	472.4	115.5	104.6	84.0	83.7	81.5	85.3
Mean	2.95	3.00	2.30	2.45	2.94	15.2	3.85	3.37	2.80	2.70	2.63	2.84
Cfsm	0.330	0.335	0.257	0.274	0.328	1.70	0.430	0.377	0.313	0.302	0.294	0.317
In.	0.38	0.37	0.30	0.32	0.34	1.96	0.48	0.43	0.35	0.35	0.34	0.35

Calendar year 1960:	Max	27	Min	1.8	Mean	3.11	Cfsm	0.347	In.	4.74		
Water year 1960-61:	Max	138	Min	1.7	Mean	3.94	Cfsm	0.440	In.	5.97		

Peak discharge (base, 60 cfs).--Mar. 2 (4 p.m.) 199 cfs (1.75 ft); Mar. 4 (7 p.m.) 69 cfs (1.00 ft); Mar. 25 (2 p.m.) 425 cfs (2.59 ft).

* Discharge measurement made on this day.

Note.--No gage-height record Dec. 22 to Jan. 17, Jan. 19 to Feb. 21, Feb. 23 to Mar. 1.

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 1961.

Gage.--Water-stage recorder. Altitude of gage is 1,205 ft (from topographic map).

Extremes.--1959: Maximum discharge during period March to September, 164 cfs June 25 (gage height, 9.78 ft); no flow most of year.
1959-60: Maximum discharge during year, 328 cfs July 2 (gage height, 13.47 ft); no flow most of year.
1960-61: Maximum discharge during year, 90 cfs Mar. 25 (gage height, 7.97 ft); no flow most of year.

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

Rating table, Mar. 1, 1959 to Sept. 30, 1961, except periods of ice effect or indefinite stage-discharge relation (gage height, in feet, and discharge in cubic feet per second)

4.4	0	5.1	1.8
4.5	.1	5.2	4.6
4.6	.2	5.3	13
4.7	.2	5.4	15
4.8	.2	5.7	20
4.9	.6	6.0	26
5.0	1.2	6.5	41

Discharge, in cubic feet per second, water year March to September 1959

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1						0	14		0	1.9	0	1.7
2						0	*4.6		0	.4	0	2.1
3						0	1.6		0	.2	.2	.3
4						0	.7		0	.2	0	.2
5						0	0		0	.2	0	.2
6						0	0		0	.2	0	.2
7						0	0		0	.2	0	.2
8						0	0		0	5.5	0	.2
9						0	0		0	.7	0	.1
10						*0	0		0	.2	0	.1
11						0	0		0	.2	0	*0
12						0	0		*0	.2	0	0
13						0	0		0	.2	0	0
14						0	0		0	.2	0	0
15						0	0	*	0	.2	0	0
16						0	0		0	.2	0	0
17						*0	.2		0	.2	0	0
18						0	.2		0	.1	*0	0
19						0	.1		0	0	0	0
20						*0	0		0	0	0	0
21						0	0		0	0	*15	0
22						0	0		0	0	14	5.1
23						*0	0		0	0	14	.2
24						b4.0	0		0	0	**.8	.2
25						*b14	0		*30	0	.3	.4
26						b7.0	0		2.1	0	.2	10
27						b4.0	0		1.3	0	1.3	1.3
28						b10	0		2.1	0	.2	.4
29						b15	0		**.6	0	.2	.3
30						17	0		3.3	0	.2	.2
31						*17	---------		---------	0	.2	---------
Total						88.0	21.4	0	39.4	11.2	46.6	23.4
Mean						2.84	0.71	0	1.31	0.36	1.50	0.78
Cfsm						3.89	0.973	0	1.79	0.493	2.05	1.07
In.						4.48	1.09	0	2.01	0.57	2.37	1.19

Peak discharge (base, 30 cfs).--June 25 (7.50 p.m.) 164 cfs (9.78 ft); Aug. 21 (10:10 p.m.) 81 cfs (7.74 ft).

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

5-3836. North Branch Root River tributary near Stewartville, Minn.--continued

Discharge, in cubic feet per second, water year October 1959 to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.2	0.7	0			0	e0	0.2	0.2	0.1		
2	.7	.3	0			0	e.1	.2	.2	*35	*	
3	1.1	.3	a.1			0	e.3	.2	.2	1.0		
4	.4	8.3	a.3			0	e2.0	.2	.2	.2		
5	.3	1.6	a.2			0	e.7	11	.2	.2		
6	.2	1.3	a.1			0	.3	17	.2	.2		
7	.2	1.5	0			0	.2	1.4	.2	.1		
8	.3	1.5	0			0	.2	.4	.2	**.1		
9	.2	1.6	0			0	.2	.2	.1	.1		
10	.2	8.8	0			0	.2	**.3	.2	.1		
11	.2	3.3	0			0	.2	.2	.1	.1		
12	.2	a.9	0			0	1.3	.2	.1	.1		
13	*.2	a.2	0			0	4.4	.2	.1	.1		
14	.2	a.2	0			0	.2	.2	.1	.1		
15	.2	a.2	*0			0	.2	.2	.1	.1		
16	.2	a.1	0			0	.3	.7	*6.0	.1		
17	.2	a.1	0			0	.3	.3	.2	.1		
18	.2	0	0			0	.2	.2	.2	.1		
19	.2	0	0			0	.2	*.2	.1	.1		
20	.2	0	0			0	.2	2.4	.1	0		
21	.2	0	0			0	.2	13	.1	0		
22	.2	0	0	*	*	0	.1	1.2	.2	0		*
23	1.5	0	0			0	.1	.3	4.9	0		
24	4.8	0	0			*0	.1	.2	.2	0		
25	.4	0	a.1			a.1	.4	.2	.2	0		
26	3.7	0	a.2			a.1	.3	.2	.1	0		
27	1.5	0	a.5			a.2	.2	.2	.4	0		
28	.8	0	a.3			b3.0	**.3	.2	.2	0		
29	.4	0	a.1		-	b1.0	1.6	.2	.2	0		
30	.4	0	0		--------	e.2	.6	.2	.1	0		
31	1.3	--------	0		--------	*e0	--------	.2	--------	0		--------
Total	21.0	30.9	1.9	0	0	4.6	15.6	52.0	15.6	38.0	0	0
Mean	0.68	1.03	0.06	0	0	0.15	0.52	1.68	0.52	1.23	0	0
Cfsm	0.932	1.41	0.082	0	0	0.205	0.712	2.30	0.712	1.68	0	0
In.	1.07	1.57	0.10	0	0	0.23	0.79	2.65	0.79	1.94	0	0

Calendar year		Max	-	Min	-	Mean	-	Cfsm	-	In.	-	
Water year 1959-60:		Max	35	Min	0	Mean	0.49	Cfsm	0.671	In.	9.14	

Peak discharge (base, 30 cfs).--May 5 (7 p.m.) 65 cfs (7.29 ft); July 2 (3,40 p.m.) 328 cfs (13.47 ft).

* Discharge measurement or observation of no flow made on this day.
** Field estimate made on this day.
a No gage-height record.
b Stage-discharge relation affected by ice.
e Indefinite stage-discharge relation.

5-3836. North Branch Root River tributary near Stewartville, Minn.--continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1						b0.5		0	0	0		0
2						b1.6		0	0	0	*	1.1
3						b.2		0	0	0		1.8
4						b.1		0	0	0		0
5						b.1		0	0	0		0
6						a.1		0	0	0		*0
7						0		0	*0	0		*0
8						0		.1	0	0		0
9						0		.1	0	0		0
10						0		0	.1	0		0
11						0		0	0	0		0
12						0		0	0	0		0
13						0		0	0	0		0
14			*			0		8.0	0	0		0
15						*0		.2	0	0	*	0
16						0		.1	0	0		0
17						0		.3	0	0		0
18				*		0		.1	0	0		0
19						0		.1	0	0		0
20	*					0		.1	0	0		0
21						0		.1	0	0		0
22					*	0		.1	0	0		0
23						0		.1	0	0		0
24						0		0	0	0		0
25						25		0	0	0		0
26						**14		*0	0	0		0
27						6.9		0	0	0		0
28						.2	*	0	0	0	*	0
29		*			-	0		0	0	0		*0
30					--------	0		0	0	.2		0
31		--------			--------	0	--------	.1	--------	0		--------
Total	0	0	0	0	0	48.7	0	9.5	0.1	0.2	0	2.9
Mean	0	0	0	0	0	1.57	0	0.31	0.003	0.01	0	0.10
Cfsm	0	0	0	0	0	2.15	0	0.425	0.0041	0.014	0	0.14
Ins.	0	0	0	0	0	2.48	0	0.48	0.005	0.01	0	0.15

Calendar year 1960: Max 35 Min 0 Mean 0.34 Cfsm 0.466 In. 6.40
Water year 1960-61: Max 25 Min 0 Mean 0.17 Cfsm 0.233 In. 3.12

Peak discharge (base, 30 cfs).--Mar. 25 (4 p.m.) 90 cfs (7.97 ft); Mar. 27 (10:30 a.m.) 36 cfs (6.35 ft); May 14 (11:50 a.m.) 66 cfs (7.32 ft).

* Discharge measurement or observation of no flow made on this day.
** Field estimate made on this day.
a No gage-height record.
b Stage-discharge relation affected by ice.

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.--March 1910 to September 1917 (published as North Branch Root River near Lanesboro), August 1940 to September 1961.

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.--26 years (1911-14, 1915-17, 1940-61) 324 cfs.

Extremes.--Maximum discharge during year, 19,500 cfs Mar. 26 (gage height, 15.26 ft); minimum daily, 100 cfs Jan. 30, 31; minimum gage height, 2.06 ft Nov. 30.
1910-17, 1940-61: Maximum discharge, 20,500 cfs Mar. 27, 1950 (gage height, 15.55 ft); minimum, 29 cfs Aug. 27, 1949 (gage height, 1.08 ft).

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Diurnal fluctuation at times during medium and low flow caused by power plant above station.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Mar. 27, 28)

Oct. 1 to Mar. 26

2.1	113	5.0	1,770
2.4	198	6.0	2,610
2.7	315	8.0	4,900
3.0	447	10.0	7,850
4.0	1,000	15.0	19,000

Mar. 27 to Sept. 30

2.1	91
2.4	172
3.0	418
4.0	1,000

Note.--Same as preceding table above 4.0 ft.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	195	185	128	125	101	540	476	238	a300	176	207	107
2	188	195	132	124	102	1,100	400	226	a250	254	238	117
3	179	182	141	122	102	1,870	356	215	a210	250	271	125
4	172	166	154	122	103	1,010	321	207	a190	242	*242	275
5	166	155	166	121	103	714	304	196	a181	204	356	179
6	166	152	182	120	104	498	287	196	*179	179	226	163
7	160	146	176	120	105	345	275	196	176	163	182	150
8	158	146	168	119	106	238	258	204	176	156	176	141
9	155	144	158	118	108	190	242	204	172	147	176	133
10	152	133	152	118	109	208	234	196	169	141	166	130
11	152	138	150	118	109	209	230	190	376	138	160	130
12	152	138	148	118	110	172	234	190	250	136	147	136
13	152	138	*146	118	111	160	246	186	204	138	138	153
14	149	138	146	118	112	152	258	190	182	147	133	153
15	146	138	145	117	115	146	275	561	166	150	128	153
16	144	138	143	*116	119	146	334	604	156	147	125	141
17	144	136	140	115	123	146	326	409	153	141	122	136
18	*141	133	139	112	135	141	287	383	153	138	130	130
19	138	133	138	109	150	136	300	545	166	138	200	125
20	136	130	136	108	*148	138	431	462	166	133	136	122
21	136	130	135	108	138	141	555	374	163	136	122	119
22	138	128	132	106	132	149	480	326	160	133	119	117
23	138	*128	131	105	136	198	414	287	153	136	117	117
24	136	128	130	104	150	1,040	378	266	150	141	114	119
25	136	126	129	103	180	5,650	*383	254	147	141	112	117
26	136	126	129	103	170	17,800	370	242	141	163	109	117
27	136	128	129	102	240	15,600	330	230	138	156	109	117
28	136	138	127	101	340	*6,550	296	a218	136	141	109	114
29	136	139	126	101	-	1,300	266	a209	*136	136	109	*109
30	149	132	126	100	---	*730	254	a200	133	222	*109	130
31	166	---	126	100	---	566	---	a190	---	254	105	---
Total	4,688	4,267	4,408	3,491	3,761	57,983	9,800	8,594	5,432	5,077	4,893	4,075
Mean	151	142	142	113	134	1,870	327	277	181	164	158	136
Cfsm	0.246	0.231	0.231	0.184	0.218	3.04	0.532	0.450	0.294	0.267	0.257	0.221
In.	0.28	0.26	0.27	0.21	0.23	3.51	0.59	0.52	0.33	0.31	0.30	0.25

Calendar year 1960: Max 6,580 Min 113 Mean 323 Cfsm 0.525 In. 7.15
Water year 1960-61: Max 17,800 Min 100 Mean 319 Cfsm 0.519 In. 7.06

Peak discharge (base, 3,500 cfs).--Mar. 2 (10:30 p.m.) 4,820 cfs (7.94 ft); Mar. 26 (7 p.m.) 19,500 cfs (15.26 ft).

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 29 to Dec. 4, Dec. 7 to Mar. 2, Mar. 8-10.

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 1961.

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.--19 years, 54.9 cfs.

Extremes.--Maximum discharge during year, 4,920 cfs Mar. 25 (gage height, 10.26 ft from graph based on gage readings); minimum, 31 cfs Jan. 19; minimum gage height, 2.68 ft Sept. 29.

1942-61: 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, that of Sept. 29, 1961.

Flood of June 28, 29, 1942, reached a discharge of 11,000 cfs (by slope-area measurement of peak flow).

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

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet and discharge, in cubic feet per second)
(Shifting-control method used Feb. 17-26, Mar. 28 to Apr. 6)

Oct. 1 to Mar. 25				Mar. 26 to Sept. 30			
3.0	30	5.5	473	2.7	36	5.5	473
3.2	39	6.0	643	3.0	48	6.0	643
3.4	51	6.5	925	3.5	78	6.5	925
3.6	72	7.0	1,380	4.0	126	7.0	1,380
4.0	126	8.0	2,380	4.5	221	8.0	2,380
4.5	221	9.0	3,400	5.0	339	10.0	4,580
5.0	339						

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	39	52	b38	34	b33	233	63	41	38	44	41	37
2	38	49	39	b34	b33	252	64	41	38	39	39	38
3	37	44	39	b34	b33	483	61	41	38	38	*38	38
4	38	44	40	b34	b33	99	56	41	36	39	48	37
5	38	43	42	b34	b33	46	53	41	37	39	64	53
6	38	43	40	34	b33	70	50	40	37	38	39	40
7	38	43	40	34	33	46	48	40	37	38	38	39
8	38	42	40	b35	36	59	46	41	36	38	39	39
9	38	42	41	b34	34	38	46	41	38	37	39	39
10	38	40	39	33	33	37	44	39	38	37	38	38
11	37	41	38	33	33	36	44	39	47	38	38	38
12	37	41	39	33	33	36	46	39	48	37	38	38
13	37	39	43	33	34	35	44	40	46	36	37	40
14	37	39	*36	33	34	35	47	41	42	37	38	39
15	37	39	b37	32	34	35	46	42	40	38	38	38
16	37	39	b38	33	34	36	46	40	40	37	37	38
17	37	40	b38	33	35	36	46	41	40	36	37	38
18	*37	39	b39	*33	38	36	46	43	40	36	38	38
19	37	39	b39	32	42	36	46	41	43	37	41	37
20	37	39	b39	b33	*41	36	46	42	40	37	38	37
21	38	39	b38	b33	37	36	45	41	40	38	37	37
22	38	39	b38	b33	39	39	45	40	40	37	36	37
23	38	38	b37	b34	49	548	45	40	40	37	36	38
24	39	38	37	b33	54	1,970	46	40	40	38	36	38
25	39	39	37	b34	43	2,970	*45	*41	39	37	36	37
26	39	39	37	b33	45	3,530	43	40	39	37	37	36
27	39	39	38	b34	58	2,670	42	40	39	37	36	36
28	38	42	37	b33	66	430	42	39	39	36	36	36
29	39	*39	36	b33	-	72	41	39	39	36	*36	*36
30	46	b38	34	b33	--------	*66	42	39	*38	62	36	40
31	44	--------	34	b33	--------	62	--------	39	--------	43	36	--------
Total	1,187	1,227	1,187	1,034	1,083	14,113	1,424	1,252	1,192	1,194	1,201	1,150
Mean	38.3	40.9	38.3	33.4	38.7	455	47.5	40.4	39.7	38.5	38.7	38.3
Cfsm	0.297	0.136	0.297	0.259	0.300	3.53	0.368	0.313	0.308	0.298	0.300	0.297
In.	0.34	0.35	0.34	0.30	0.31	4.07	0.41	0.36	0.34	0.34	0.35	0.33

Calendar year 1960:	Max	1,260	Min	30	Mean	50.6	Cfsm	0.392	In.	5.33	
Water year 1960-61:	Max	3,530	Min	32	Mean	74.6	Cfsm	0.578	In.	7.84	

* Discharge measurement made on this day.
b Stage-discharge relation affected by ice.
Note.--Shifting-control method used Feb. 17-26, Mar. 28 to Apr. 6.

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 1961. 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.--39 years (1909-17, 1930-61) 648 cfs.

Extremes.--Maximum discharge during year, 31,400 cfs Mar. 27 (gage height, 15.10 ft); minimum daily, 270 cfs Dec. 9.
1909-17, 1929-61: Maximum discharge, 37,000 cfs Apr. 1, 1952 (gage height, 13.90 ft); maximum gage height, 14.9 ft Mar. 11, 1936 (backwater from ice); minimum discharge, 65 cfs Dec. 26, 1933, Feb. 25, 1935.

Remarks.--Records fair. Slight diurnal fluctuation at low flows caused by powerplants above station.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	474	501	328	315	300	650	1,340	571	453	410	514	298
2	457	457	364	320	303	1,700	1,100	528	487	424	420	309
3	436	440	402	315	308	3,600	922	496	448	456	*484	313
4	428	424	405	305	310	2,000	809	492	432	492	514	318
5	424	424	432	300	318	2,200	736	457	417	472	820	380
6	406	398	*403	295	320	1,300	689	457	*409	428	646	374
7	389	388	375	300	325	900	628	453	428	405	500	338
8	378	388	305	305	330	700	585	466	424	388	450	328
9	374	384	270	310	330	660	552	453	417	374	418	320
10	376	380	285	315	335	620	515	444	417	361	402	309
11	375	380	295	315	340	580	501	436	492	346	388	302
12	374	377	305	315	345	540	505	428	664	342	360	313
13	375	370	315	315	345	500	496	421	762	338	341	370
14	372	370	320	315	350	*461	510	432	571	324	330	343
15	366	380	325	315	345	444	533	483	501	332	320	335
16	362	377	330	312	340	432	556	1,040	470	336	307	328
17	358	374	330	*310	330	428	664	867	448	323	300	320
18	355	370	330	308	325	421	638	741	436	326	297	311
19	*361	370	325	304	320	409	599	757	457	313	345	307
20	352	367	320	300	320	409	664	894	433	304	355	300
21	349	364	315	290	*326	417	916	741	405	304	325	290
22	352	361	300	280	330	428	956	654	382	319	300	294
23	346	352	290	275	350	604	877	599	356	308	292	286
24	343	355	290	275	390	1,840	804	556	366	294	285	294
25	343	352	290	275	420	8,040	793	490	337	310	285	279
26	343	358	295	280	435	21,700	788	461	336	305	284	280
27	340	355	300	280	450	*29,800	*747	449	325	314	286	275
28	338	380	302	280	480	19,000	695	445	325	310	284	*290
29	340	380	*308	285	-	*4,330	638	436	310	302	288	280
30	398	358	310	290	---------	2,110	609	428	*353	427	*293	345
31	417	---------	314	290	---------	1,650	---------	432	---------	523	295	---------
Total	11,701	11,534	10,078	9,289	9,720	108,873	21,365	17,007	13,061	11,210	11,728	9,429
Mean	377	385	325	300	347	3,512	712	549	435	361	378	314
Cfsm	0.297	0.303	0.256	0.236	0.273	2.77	0.561	0.432	0.343	0.284	0.298	0.247
In.	0.34	0.34	0.30	0.27	0.28	3.19	0.63	0.50	0.39	0.33	0.34	0.28

Calendar year 1960: Max 6,530 Min 256 Mean 647 Cfsm 0.509 In. 6.94
Water year 1950-61: Max 29,800 Min 270 Mean 671 Cfsm 0.528 In. 7.19

Peak discharge (base, 5,000 cfs).--Mar. 27 (12 M) 31,400 cfs (15.10 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 6 to Mar. 3. No gage-height record Oct. 5-18, Mar. 4-13, May 24-28, June 20 to Aug. 31, Sept. 20-27, 29, 30.

GPO 823486-11

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 1961.

Gage.--Water-stage recorder. Datum of gage is 680.41 ft above mean sea level, datum of 1929.

Average discharge.--8 years, 122 cfs.

Extremes.--Maximum discharge during year, 6,980 cfs Mar. 26 (gage height, 12.87 ft); maximum gage height, 13.74 ft Mar. 26 (backwater from ice); minimum discharge, 64 cfs July 18; minimum gage height, 2.68 ft June 5.
1953-61: Maximum discharge, that of Mar. 26, 1961; maximum gage height, that of Mar. 26, 1961; minimum discharge, 55 cfs Aug. 16, 17, 1958 (gage height, 2.62 ft).

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second) (Shifting-control method used Mar. 28 to June 12, July 1, 2, Aug. 20 to Sept. 30)

2.6	62	9.0	992
2.8	70	10.0	1,320
3.1	85	11.0	2,150
3.5	111	11.5	2,930
4.0	166	12.0	4,370
6.0	446	12.5	5,870

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	97	128	79	88	79	462	186	105	94	119	94	71
2	95	116	86	88	80	481	167	104	92	109	88	74
3	94	103	91	86	81	410	154	102	90	89	*84	76
4	93	100	90	86	81	333	148	102	90	90	89	76
5	92	99	94	87	81	752	149	100	90	88	143	74
6	93	98	*92	88	82	324	147	101	*92	82	93	86
7	90	97	91	88	82	150	138	101	97	80	87	77
8	88	97	84	84	84	140	130	101	97	77	84	77
9	90	96	76	83	84	128	122	98	93	76	83	81
10	90	95	74	83	85	106	123	96	93	74	83	76
11	89	95	84	84	86	105	124	93	95	74	82	75
12	89	95	92	85	86	100	126	92	109	73	79	80
13	88	95	99	86	86	100	126	92	146	72	78	95
14	87	95	*106	87	86	*100	125	99	82	72	78	86
15	87	95	90	86	86	98	127	119	73	74	78	80
16	87	94	88	85	86	96	125	102	72	74	78	78
17	88	93	85	*84	86	96	130	102	71	78	78	76
18	88	93	84	84	89	95	130	109	70	66	77	75
19	*87	93	83	86	92	95	130	104	81	70	83	74
20	88	92	82	85	94	95	130	102	87	70	79	74
21	88	92	83	84	*94	98	133	101	96	70	76	74
22	89	92	82	82	87	101	133	98	102	73	76	74
23	88	91	82	80	267	129	117	96	99	70	76	76
24	87	92	83	79	400	500	125	95	95	76	75	81
25	87	92	84	79	236	1,200	124	96	94	82	74	79
26	89	92	84	78	158	6,200	121	95	92	74	74	76
27	88	91	84	78	381	*5,210	*116	94	90	69	74	75
28	87	95	85	77	494	1,520	111	93	89	68	75	*74
29	87	94	86	78	-	*286	109	92	87	68	74	77
30	97	90	87	78	--------	210	108	92	*85	165	*72	109
31	104	--------	88	79	--------	198	--------	95	--------	97	71	--------
Total	2,791	2,890	2,678	2,585	3,813	19,918	3,934	3,071	2,743	2,519	2,535	2,356
Mean	90.0	96.3	86.4	83.4	136	643	131	99.1	91.4	81.3	81.8	78.5
Cfsm	0.327	0.350	0.314	0.303	0.495	2.34	0.476	0.360	0.332	0.296	0.297	0.285
In.	0.38	0.39	0.36	0.35	0.52	2.69	0.53	0.42	0.37	0.34	0.34	0.32

Calendar year 1960: Max 2,800 Min 57 Mean 120 Cfsm 0.436 In. 5.95
Water year 1960-61: Max 6,200 Min 66 Mean 142 Cfsm 0.516 In. 7.01

Peak discharge (base, 900 cfs).--Mar. 5 (3.45 a.m.) 947 cfs (8.82 ft); Mar. 26 (5-6 p.m.) 6,980 cfs (12.87 ft).

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 30 to Dec. 2, Dec. 8-14, Dec. 16 to Jan. 14, Jan. 20 to Feb. 12, Feb. 18-21, 24, Mar. 8-10, 24-26.

5-3860. Root River below South Fork near Houston, Minn.

Location.--Lat 43°46'13", long 91°32'03", in SE¼NE¼ sec. 34, T. 104 N., R. 6 W., on right bank 600 ft downstream from South Fork and 1½ miles northeast of Houston.

Drainage area.--1,560 sq mi, approximately.

Records available.--March 1938 to September 1961 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 660.00 ft above mean sea level, adjustment of 1912. Prior to Oct. 1, 1938, chain gage and high-water staff gage at present site at datum 60.00 ft lower. Oct. 1, 1938, to Oct. 2, 1950, chain gage and high-water staff gage at present site and datum.

Average discharge.--23 years, 803 cfs.

Extremes.--Maximum discharge during year, 38,200 cfs Mar. 27 (gage height, 17.75 ft); minimum, 322 cfs Dec. 9 (gage height, 5.44 ft).
1938-61: Maximum discharge, 38,700 cfs Apr. 1, 1952 (gage height, 17.58 ft), from rating table extended above 13,000 cfs; minimum, 197 cfs Nov. 23, 1950.

Remarks.--Records good except those for period of ice effect, which are fair. Slight diurnal fluctuation at low flows caused by powerplants above station.

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	587	668	378	420	380	1,220	1,810	698	598	532	614	365
2	565	614	460	425	385	2,300	1,460	662	638	548	521	388
3	538	570	521	410	395	4,300	1,250	632	576	548	*570	406
4	526	543	505	400	400	a2,600	1,090	614	543	582	609	420
5	521	526	548	400	405	a3,400	1,030	592	521	560	977	526
6	505	510	*500	405	410	a1,900	990	582	*516	510	746	538
7	485	495	470	415	415	a1,200	912	582	526	485	592	465
8	470	500	396	425	420	a910	860	587	526	465	538	440
9	470	495	353	435	425	a840	824	570	516	450	510	440
10	470	495	375	435	430	a770	788	543	516	435	495	415
11	470	490	400	435	435	a720	764	543	620	420	480	401
12	470	485	420	435	440	a660	770	521	775	415	450	425
13	470	475	435	435	445	a610	764	526	977	410	430	532
14	465	475	440	435	450	*560	788	543	764	396	415	470
15	460	490	445	430	455	554	812	609	614	406	406	450
16	455	475	450	425	450	538	836	1,150	576	410	388	430
17	450	470	450	*415	445	532	938	1,010	548	401	378	410
18	445	470	445	410	440	510	932	892	521	392	374	396
19	*450	470	440	400	430	505	892	886	548	383	450	383
20	450	470	430	390	430	505	938	1,030	526	374	460	378
21	435	465	420	385	435	526	1,160	880	505	374	401	365
22	445	455	410	380	470	560	1,180	788	490	392	374	370
23	435	445	400	375	670	768	1,080	710	460	378	370	365
24	425	450	395	370	820	2,420	1,000	656	465	370	357	378
25	430	440	395	365	700	9,330	958	592	435	392	361	361
26	445	450	390	365	650	28,400	938	560	430	378	353	361
27	435	440	395	365	880	*35,100	*880	548	420	383	357	353
28	435	490	403	365	1,040	20,600	824	543	420	378	357	*357
29	435	485	*408	370	-	*4,980	770	543	401	370	361	361
30	526	430	410	370	---------	2,330	728	521	*440	592	*353	460
31	560	---------	415	375	---------	1,990	---------	548	---------	620	357	---------
Total	14,728	14,736	13,302	12,465	14,150	132,138	28,966	20,661	16,411	13,749	14,404	12,409
Mean	475	491	429	402	505	4,263	966	666	547	444	465	414
Cfsm	0.304	0.315	0.275	0.258	0.324	2.73	0.619	0.427	0.351	0.285	0.298	0.265
In.	0.35	0.35	0.32	0.30	0.34	3.15	0.69	0.49	0.39	0.33	0.34	0.30

Calendar year 1960: Max 7,820 Min 339 Mean 773 Cfsm 0.496 In. 6.76
Water year 1960-61: Max 35,100 Min 353 Mean 844 Cfsm 0.541 In. 7.35

Peak discharge (base, 8,500 cfs).--Mar. 27 (10 a.m.) 38,200 cfs (17.75 ft).

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 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 (revised) 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 1961. Monthly discharge only for some periods, published in WSP 1308.

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.--22 years, 165 cfs.

Extremes.--Maximum discharge during year, 8,290 cfs Mar. 26 (gage height, 17.03 ft); minimum daily, 36 cfs Jan. 25; minimum gage height, 2.19 ft Feb. 5.
1909-14, 1944-61: Maximum discharge, 8,800 cfs Mar. 26, 1950 (gage height, 17.81 ft); no flow for several days in 1911.

Remarks.--Records good.

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Dec. 20, June 10 to Sept. 30)

2.1	36	3.5	390
2.2	44	4.0	565
2.5	87	7.0	1,900
2.8	169	10.0	3,650
3.1	262	16.0	7,570

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	49	52	48	42	b40	216	316	119	470	49	701	50
2	45	52	49	42	b40	617	250	110	262	44	649	51
3	46	51	46	44	b41	889	225	105	139	44	394	57
4	46	51	56	44	41	425	209	96	101	45	*310	44
5	46	50	73	43	41	194	200	94	89	44	284	50
6	48	51	60	43	42	119	181	96	87	44	203	55
7	45	51	b52	43	42	108	163	98	*89	43	145	52
8	43	50	b50	42	43	73	151	122	89	42	119	63
9	42	52	49	43	42	72	139	124	87	41	119	57
10	44	49	48	42	43	64	139	110	84	42	105	55
11	44	50	46	42	49	62	139	96	80	42	101	62
12	45	50	46	43	49	59	157	89	78	42	87	73
13	46	50	*45	44	50	62	163	84	82	43	77	84
14	49	51	45	43	50	63	188	84	84	43	70	87
15	46	52	48	42	50	64	272	154	77	43	69	85
16	46	54	45	*44	49	64	253	216	72	42	64	75
17	*50	52	43	45	49	64	191	203	69	43	64	70
18	50	52	43	45	48	66	200	307	66	42	64	70
19	49	51	45	45	45	64	304	355	67	45	66	67
20	49	50	44	45	*43	66	404	278	66	43	62	66
21	49	51	44	42	46	70	339	219	64	46	62	66
22	50	51	b42	42	54	72	262	184	62	44	62	66
23	49	*50	41	b41	77	77	225	148	59	63	59	64
24	50	48	39	b38	66	160	*237	127	54	55	59	62
25	50	50	39	b36	64	244	231	130	50	62	56	62
26	51	50	40	b37	64	7,230	209	119	51	54	54	62
27	49	50	42	b38	70	*3,730	178	105	60	49	54	60
28	50	63	42	b37	92	2,660	154	98	46	48	56	57
29	52	52	42	b37	-	953	133	96	43	46	54	57
30	57	48	43	b38	--------	558	124	85	*42	60	51	77
31	55	--------	42	b39	--------	414	--------	96	--------	304	*50	--------
Total	1,490	1,534	1,437	1,291	1,430	19,579	6,336	4,347	2,769	1,697	4,370	1,906
Mean	48.1	51.1	46.4	41.6	51.1	632	211	140	92.3	54.7	141	63.5
Cfsm	0.113	0.120	0.109	0.098	0.120	1.49	0.496	0.329	0.217	0.129	0.332	0.149
In.	0.13	0.13	0.13	0.11	0.13	1.71	0.55	0.38	0.24	0.15	0.38	0.17

Calendar year 1960:	Max	3,560	Min	39	Mean	156	Cfsm	0.367	In.	5.01
Water year 1960-61:	Max	7,230	Min.	36	Mean	132	Cfsm	0.311	In.	4.21

Peak discharge (base, 1,400 cfs).--Mar. 26 (4:30 a.m.) 8,290 cfs (17.03 ft).

* Discharge measurement made on this day.
b Stage-discharge relation affected by ice.

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 1961.(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. 27, 1949, wire-weight gage at site 600 ft upstream at datum 10.64 ft higher.

Average discharge.--26 years (1935-61), 253 cfs.

Extremes.--Maximum discharge during year, 2,140 cfs Mar. 24 (gage height, 10.78 ft); minimum daily, 14 cfs Jan. 28 to Feb. 7; minimum gage height, 3.15 ft Sept. 19, 20.
1909-13, 1930-61: 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.

Rating tables, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-12)

Oct. 1 to Feb. 26		Feb. 27 to Sept. 30			
3.4	41	3.1	13	5.0	316
3.6	68	3.2	21	6.0	564
4.0	132	3.5	61	8.0	1,170
6.0	521	4.0	134	10.0	1,840

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	412	129	58	45	14	507	668	253	384	81	107	26
2	399	118	80	44	14	507	607	*242	*350	89	100	26
3	378	120	88	43	14	452	572	229	309	84	103	25
4	362	115	97	43	14	374	543	213	281	79	110	25
5	344	117	122	43	14	310	530	216	265	128	134	21
6	*324	104	*77	*42	14	280	491	247	251	172	153	22
7	300	93	78	42	14	250	448	309	244	140	153	19
8	275	94	83	41	15	230	418	362	245	137	137	31
9	258	102	94	41	*15	220	400	420	247	137	122	29
10	244	65	82	40	16	210	388	420	242	137	113	34
11	242	77	75	40	16	202	386	408	232	139	*101	29
12	235	107	70	40	16	230	379	415	242	144	91	30
13	228	110	67	40	17	229	364	410	230	126	82	27
14	222	94	62	40	18	240	362	381	209	124	74	30
15	205	99	59	41	19	251	386	355	197	137	67	26
16	190	105	56	41	19	280	350	309	187	130	60	21
17	188	93	54	41	20	300	318	353	182	125	52	20
18	186	94	51	40	20	335	312	496	174	118	50	18
19	180	96	48	37	21	430	323	626	164	112	65	17
20	140	127	45	35	21	522	346	654	152	104	62	19
21	134	129	41	31	22	*663	362	674	139	94	49	41
22	147	120	40	29	23	734	362	705	137	88	54	38
23	144	107	41	27	33	880	346	714	130	103	50	38
24	127	102	42	24	180	1,520	350	702	116	98	45	35
25	122	105	43	20	190	1,580	362	682	106	91	41	34
26	130	93	44	17	200	1,160	357	635	98	84	37	29
27	118	91	44	15	281	1,010	332	578	95	78	34	25
28	*117	110	44	14	422	880	314	530	94	74	31	25
29	117	54	44	14	-	*781	292	*481	*84	70	30	22
30	130	50	45	14	- - - -	748	263	430	81	81	30	18
31	139	- - - -	45	14	- - - -	716	- - - -	403	- - - -	84	*27	- - - -
Total	6,737	3,020	1,919	1,038	1,682	17,031	11,931	13,852	5,867	3,388	2,364	800
Mean	217	101	61.9	33.5	60.1	549	398	447	196	109	76.3	26.7
Cfsm	0.178	0.083	0.051	0.027	0.049	0.450	0.326	0.366	0.161	0.089	0.063	0.022
In.	0.21	0.09	0.06	0.03	0.05	0.52	0.36	0.42	0.18	0.10	0.07	0.02

Calendar year 1960:	Max	3,730	Min	13	Mean	396	Cfsm	0.325	In.	4.46
Water year 1960-61:	Max	1,580	Min	14	Mean	191	Cfsm	0.157	In.	2.11

Peak discharge (base, 500 cfs).--Mar. 2 (6 p.m.) 580 cfs (6.06 ft); Mar. 24 (10 p.m.) 2,140 cfs (10.78 ft); May 23 (9 a.m.) 716 cfs (6.55 ft).

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29 to Dec. 2, Dec. 6 to Feb. 26, Mar. 5-12, 16-18.

6-6030. Little Sioux River near Lakefield, Minn.

Location.--Lat 43°37'10", long 95°16'30", in SE¼ sec. 21, T. 102 N., R. 37 W., on left bank at upstream side of highway bridge, a quarter of a mile upstream from Jackson County ditch 11 and 6.7 miles southwest of Lakefield.

Drainage area.--17.1 sq mi.

Records available.--July 1948 to September 1961.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,405.28 ft above mean sea level, datum of 1929.

Average discharge.--13 years, 3.58 cfs (2,590 acre-ft per year).

Extremes.--Maximum discharge during year, 79 cfs Mar. 24 (gage height, 4.58 ft); maximum gage height, 4.69 ft Mar. 28 (backwater from ice); no flow on many days.

1948-61: Maximum discharge, 2,550 cfs June 7, 1953 (gage height, 10.20 ft) from rating curve extended above 170 cfs on basis of contracted opening determination of combined flow of Little Sioux River and Jackson County ditch; no flow on many days each year.

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

Rating tables, water year 1960-61 (gage height, in feet, and discharge, in cubic feet per second)

2.9	0	2.4	0	3.0	0.7	4.0	34
3.0	.2	2.5	.1	3.1	1.5	4.2	45
3.1	.5	2.6	.1	3.2	3.2	4.4	62
3.2	1.1	2.7	.2	3.4	7.8	4.6	85
3.3	3.0	2.8	.3	3.6	16		
3.4	6.7	2.9	.4	3.8	25		
3.6	16						

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	12	2.2	1.1	0.3	0	6.5	15	5.1	5.1	1.3	0.1	
2	11	2.0	1.2	.3	0	8.0	12	*4.7	4.7	1.0	.1	
3	9.8	2.0	*1.2	.3	0	6.5	11	4.5	4.2	.7	0	
4	8.5	2.0	1.4	.3	0	5.0	10	4.0	3.8	.6	0	
5	7.6	1.7	1.7	.3	0	3.8	10	4.0	3.4	.6	0	
6	7.1	1.7	1.4	*.2	0	3.0	9.5	5.1	3.6	.5	0	
7	6.3	1 7	1.3	.2	0	2.7	8.8	5.8	4.2	.4	0	
8	5.9	1.5	1.4	.2	0	2.3	8.1	7.6	4.0	.4	0	
9	5.1	1.5	1.3	.2	*0	2.0	7.6	9.2	3.8	.3	0	
10	4.3	1.4	1.1	.2	0	1.9	7.3	7.6	3.2	.3	*0	
11	4.0	1.4	1.1	.2	0	2.0	7.3	6.3	3.2	.3	0	
12	3.6	1.4	1.0	.2	0	2.1	7.8	6.0	8.6	.3	0	
13	3.3	1.4	1.0	.2	0	2.4	7.8	6.0	8.8	.3	0	
14	3.0	1.4	.9	.2	0	2.7	8.5	5.8	5.6	.3	0	
15	2.7	1.5	.8	.2	0	3.0	10	5.3	4.9	.3	0	
16	2.4	1.5	.8	.2	0	3.3	10	5.1	4.7	.2	0	
17	2.2	1.5	.7	.2	0	3.7	9.2	7.3	4.2	.2	0	
18	2.2	1.5	.7	.1	0	4.4	8.1	9.5	3.8	.2	0	
19	2.0	1.5	.6	.1	0	5.2	7.3	12	3.4	.1	0	
20	1.7	1.5	.6	.1	0	7.5	6.8	12	3.2	.1	0	
21	1.7	1.4	.5	.1	0	*10	6.8	11	2.4	.1	0	
22	1.7	1.4	.5	0	.3	13	6.8	9.5	2.1	.1	0	
23	1.5	1.2	.4	0	.7	29	7.3	8.8	1.8	.1	0	
24	1.5	1.4	.4	0	2.0	76	7.6	7.8	1.6	.1	0	
25	1.4	1.4	.4	0	1.7	58	7.6	8.5	1.8	0	0	
26	1.4	1.4	.3	0	1.5	39	7.0	7.6	1.6	0	0	
27	1.4	1.4	.3	0	3.5	35	6.8	7.0	1.5	0	0	
28	*1.2	1.2	.3	0	5.0	28	6.0	6.6	1.3	0	0	
29	1.5	1.1	.3	0	-	*22	5.8	*5.8	*.9	0	0	
30	2.0	1.1	.3	0	--------	18	5.3	5.6	.7	0	0	
31	2.0	--------	.3	0	--------	16	--------	5.3	--------	0	*0	--------
Total	122.0	45.3	25.3	4.3	14.7	422.0	249.1	216.4	106.1	8.8	0.2	0
Mean	3.94	1.51	0.82	0.14	0.52	13.6	8.30	6.98	3.54	0.28	0.006	0
Ac-ft	242	90	50	8.5	29	837	494	429	210	17	0.4	0

Calendar year 1960: Max 111 Min 0 Mean 7.64 Ac-ft 5,530
Water year 1960-61: Max 76 Min 0 Mean 3.33 Ac-ft 2,410

Peak discharge (base, 30 cfs).--Mar. 24 (9 a.m.) 79 cfs (4.58 ft).

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 28 to Mar. 24, Mar. 28. No gage-height record Jan. 26 to Feb. 21, Feb. 25, 26, Mar. 5-20, Aug. 6 to Sept. 30.

6B-6035. Jackson County ditch 11 near Lakefield, Minn.

Location.--Lat 43°37'10", long 95°16'10", in SW¼ sec. 22, T. 102 N., R. 37 W., on left bank 600 ft upstream from mouth and 6.5 miles southwest of Lakefield.

Drainage area.--7.69 sq mi.

Records available.--July 1948 to Mar. 31, 1961 (discontinued).

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,404.47 ft above mean sea level, datum of 1929.

Average discharge.--12 years (1948-60), 1.80 cfs (1,300 acre-ft per year).

Extremes.--Maximum discharge during period October to March, 39 cfs Mar. 24 (gage height, 5.06 ft); maximum gage height, 5.38 ft Mar. 23; no flow on many days.
1948-61: Maximum discharge, 1,150 cfs June 7, 1953 (gage height, 10.91 ft from floodmark), from rating curve extended above 120 cfs on basis of contracted-opening measurement of combined flow of Jackson County ditch and Little Sioux River; no flow on many days each year.

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

Rating table, water year 1960-61, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Jan. 5-17)

3.7	0.1	4.3	3.7
3.8	.2	4.4	5.8
3.9	.5	4.6	12
4.0	1.0	4.8	22
4.1	1.6	5.2	48
4.2	2.4		

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.4	1.2	0.9	0.3	0	1.5						
2	3.2	1.1	1.0	.3	0	2.0						
3	2.8	.9	*1.2	.3	0	.9						
4	2.7	.9	1.4	.2	0	.5						
5	2.6	1.1	1.6	.2	0	.3						
6	2.3	1.1	1.4	*.3	0	.2						
7	1.9	1.1	1.2	.3	0	.2						
8	1.8	1.3	1.1	.3	0	.2						
9	1.5	.9	.9	.3	*0	**.2						
10	1.5	.9	.9	.3	0	.2						
11	1.5	1.0	.8	.2	0	.2						
12	1.4	1.0	.6	.2	0	.2						
13	1.6	1.0	.5	.2	0	.2						
14	1.8	1.6	.6	.2	0	.3						
15	.8	1.3	.5	.2	0	.3						
16	1.0	1.2	.5	.2	0	.4						
17	1.3	1.1	.4	.2	0	.4						
18	1.8	1.0	.4	.1	0	.5						
19	.7	.8	.3	.1	0	.7						
20	.8	.5	.3	0	0	.9						
21	1.1	.6	.3	0	.1	1.2						
22	1.3	.7	.3	0	.2	2.0						
23	1.5	.7	.3	0	.3	4.1						
24	1.6	.8	.3	0	.7	30						
25	1.1	.8	.3	0	.6	22						
26	1.1	.8	.3	0	.6	10						
27	.6	.8	.3	0	.8	6.4						
28	*.8	.8	.3	0	1.1	3.9						
29	1.1	.8	.3	0	-	2.0						
30	1.2	.8	.3	0	---------	1.4						
31	1.2	---------	.3	0	---------	1.1	---------		---------			---------
Total	49.0	28.6	19.8	4.4	4.4	94.4	-	-	-	-	-	-
Mean	1.58	0.95	0.64	0.14	0.16	3.05	-	-	-	-	-	-
Ac-ft	97	57	39	8.7	8.7	187	-	-	-	-	-	-

Calendar year 1960: Max 44 Min 0 Mean 2.60 Ac-ft 1,980
Water year 1960-61: Max - Min - Mean - Ac-ft -

Peak discharge, (base, 40 cfs).--Mar. 24 (7 p.m.) 39 cfs (5.06 ft).

* Discharge measurement made on this day.
** Field estimate made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Dec. 2, Jan. 18 to Mar. 24.

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 1961

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
		Stream tributary to Lake Superior				
4-0189	East Two Rivers near Iron Junction, Minn.	At common corner of secs. 19, 20, 29, 30, T. 57 N., R. 18 W., at culvert on State Highway 216, 2.2 miles southwest of Iron Junction, Minn.	34.5	1957-61	10-19-60	9.18
					5-19-61	116
					6-13-61	33.2
					7-12-61	9.47
					8-11-61	9.50
					9- 6-61	11.1
		Crow Wing River basin				
5-2435	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, Minn.	a74	1930-41≠, 1942, 1956-61	10-14-60	14.1
					11-18-60	11.3
					12-24-60	14.6
					1-13-61	18.2
					2-19-61	19.6
					3-28-61	20.7
					4-23-61	26.3
					5-30-61	30.6
					6-24-61	20.5
					7-23-61	18.8
					8-22-61	10.6
					9-28-61	12.2

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	4-20-61	17.50	(✓)
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	4-20-61	9.82	(✓)
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.	-	1961	4-20-61	15.97	1,130
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.	-	1960-61	4-20-61	11.08	(✓)
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.	-	1960-61	4-20-61	9.17	85
4-0153	Little Stewart River near Two Harbors, Minn.	SE¼NE¼ sec.24, T.53 N., R.11 W., at culvert on county road, 2.0 miles above mouth and 2.7 miles north of Two Harbors.	-	1960-61	4-20-61	11.76	200
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.	-	1960-61	4-20-61	18.85	424
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.	-	1960-61	4-17-61	a9.84	31
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.	-	1960-61	5-14-61	7.45	(✓)
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	1959-61	6-11-59 7-16-60 4-20-61	6.11 b6.59 8.16	44 46 54
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	4-20-61	15.13	(✓)

✓ Discharge not determined.
a Backwater from ice.
b 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)
		Streams tributary to Lake Superior--continued					
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	4-20-61	9.44	(✓)
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	5-14-61	11.44	(✓)
		Red River of the North basin					
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.	-	1960-61	4- 4-61	a13.57	127
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.	-	1961	3-13-61	a5.75	40
5-0613.9	Hay Creek near Downer, Minn.	NW¼SW¼ sec.28, T.138 N., R.45 W., at culvert on county highway, 4.9 miles east of Downer.	-	1961	5-14-61	8.22	(✓)
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.	-	1961	3- 3-61	6.96	21
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.	-	1961	4-18-61	a7.12	5
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.	-	1961	3-17-61	a10.55	6
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, 1¼ miles above mouth, and 4¼ miles northwest of Twin Valley.	-	1961	5-14-61	10.63	(✓)
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, 3/4 mile west of Northome, and 3 miles above Battle Lake.	-	1960-61	5-14-61	14.83	(✓)
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.	-	1960-61	5-14-61	13.24	51
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.	-	1960-61	5-14-61	6.54	(✓)
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.	-	1960-61	4-16-61	b7.52	(✓)
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.	-	1960-61	4- 6-60 3-26-61	8.56 a7.79	42 54
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 3/4 mile above mouth.	-	1960-61	4- 6-60 4-26-61	a8.60 8.40	18 20

✓ Discharge not determined.
a Backwater from ice.
b 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)
		Red River of the North basin--continued					
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.	-	1961	3-24-61	6.10	(✓)
		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	4-15-61	a8.06	60
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	4-21-61	7.60	28
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	1959-61	4-23-61	13.21	223
		Split Hand Creek basin					
5-2150	Split Hand Creek tributary 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.	-	1961	5-14-61	5.15	(✓)
		Swan River basin					
5-2166	O'Brien Creek tributary near Keewatin, Minn.	SW¼SW¼ sec.27, T.57 N., R.22 W., at culvert on U.S. Highway 169, 0.2 mile above mouth, and 2.6 miles southwest of Keewatin.	-	1959-61	5-14-61	17.52	(✓)
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.	-	1959-61	5-14-61	8.35	85
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-quarter mile above mouth, and 1 mile southeast of Warba.	-	1961	4-21-61	5.63	(✓)
		Mississippi River basin					
5-2177	Mississippi River tributary near Jacobson, Minn.	SW¼NW¼ sec.8, T.52 N., R.23 W., at culvert on State Highway 34, 1¼ miles west of Jacobson.	-	1961	5-14-61	6.94	(✓)
		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, 3¼ miles above mouth, and 3¼ miles north of Sebeka	-	1961	5-14-61	9.81	(✓)
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.	-	1961	4-24-61	6.56	(✓)

✓ Discharge not determined.
a Backwater from ice.

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)
		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	-	c	<0.2
		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.	-	1960-61	4-14-61	a12.33	(✓)
		Elk River basin					
5-2739	Mayhew Creek at Silver Corners, Minn.	SW¼SW¼ sec.28, T.38 N., R.30 W., at culvert on State Highway 25 at Silver Corners, 3.7 miles above Mayhew Lake.	-	1961	5-14-61	12.66	(✓)
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.	-	1960-61	6-28-60 4-14-61	6.90 7.89	9.8 29
		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.	-	1960-61	4-14-61	a17.94	(✓)
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	5-18-61	6.08	(✓)
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 miles above mouth, and 2.6 miles northwest of Brownton.	-	1961	-	c	<9
		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	4-18-61	7.34	0.5
5-2846	Robinson Brook near Onamia, Minn.	NE¼SW¼ sec.11, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 6 3/4 miles south of Onamia.	-	1960-61	7-16-60 4-18-61	14.36 -	43 d10
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 7 3/4 miles south of Onamia.	-	1960-61	4- 3-60 4-18-61	6.92 a7.68	19 27
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	5-14-61	6.38	(✓)
		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.	-	1960-61	7- 1-61	10.80	(✓)

✓ Discharge not determined.
a Backwater from ice.
c Peak stage did not reach bottom of gage.
d 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)
		Minnesota River basin--continued					
5-3012	Minnesota River tributary near Montevideo, Minn.	NE¼NE¼ sec.21, T.117 N., R.41 W., at culvert on U.S. Highway 212, 1 mile above mouth, and 3 3/4 miles west of Montevideo.	-	1960-61	3-25-61	a8.16	<0.8
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	1959-61	3-13-61	12.74	21
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.	-	1960-61	4-13-60 7-31-61	13.98 12.10	360 3.6
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.	-	1960-61	4-13-60 7- 1-61	8.63 10.27	19 50
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.	-	1960-61	7- 1-61	14.30	(✓)
5-3138	Chetomba Creek tributary near Blomkest, Minn.	SW¼SW¼ sec.35, T.118 N., R.35 W., at culvert on U.S. Highway 71, 2 3/4 miles northwest of Blomkest.	-	1959-61	5- 5-61	5.86	(✓)
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.	-	1959-61	3-10-59 4- 2-60 7- 5-61	a12.79 14.37 13.23	19 228 71
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.	-	1959-61	4-26-61	4.52	13
5-3167	Spring Creek near Sleepy Eye, Minn.	NE¼SE¼ sec.24, T.111 N., R.33 W., at culvert on county highway, 3 3/4 miles above mouth, and 7½ miles north of Sleepy Eye.	30.0	1959-61	8- 1-61	10.66	139
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.	-	1959-61	3-14-61	5.24	(✓)
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	3-19-61	a14.18	(✓)
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	3-14-61	a5.12	(✓)
5-3178.2	Coon Creek near Frost, Minn.	E½NE¼ sec.22, T.101 N., R.26 W., at bridge on State Highway 254, 3.2 miles south of Frost.	-	1960-61	3-25-61	a10.94	(✓)
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.	-	1959-61	7-21-61	b7.55	(✓)
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, ¼ mile above mouth, and 4¼ miles east of Blue Earth.	-	1960-61	6-12-61	6.42	222
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, 1 3/4 miles northwest of Delft.	13.1	1960-61	3-25-61	a14.91	32

✓ Discharge not determined.
a Backwater from ice.
b 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)
		Minnesota River basin--continued					
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	1959-61	5-18-61	22.29	32
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	1959-61	3-25-61	16.61	176
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	1959-61	3-25-61	19.58	218
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	1959-61	3-30-59 3-26-61	a12.26 14.06	56 206
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	5-18-61	8.08	(≠)
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.	-	1961	3-25-61	8.21	(≠)
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	1960-61	5-21-60 5-18-61	13.72 6.67	279 (≠)
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 mile east of New Prague.	65	1960-61	5-21-60 3-25-61	14.84 a10.39	1,100 204
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	1960-61	5-21-60 5-18-61	17.34 11.05	929 161
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	1960-61	5-21-60 7- 1-61	19.66 13.27	558 (≠)
		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 mile west of Moose Lake.	-	1960-61	5-15-61	8.60	(≠)
5-3364.8	Kettle River tributary near Sandstone, Minn.	NE¼SE¼ sec.33, T.43 N., R.20 W., at culvert on U.S. Highway 61, 1.3 miles above mouth, and 2.2 miles north of Sandstone.	-	1960-61	5-14-61	15.56	(≠)
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.	-	1960-61	5-15-61	6.94	(≠)
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.	-	1960-61	3-29-60 5-15-61	a14.28 13.13	45 28

≠ Discharge not determined.
a Backwater from ice.

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)
		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	-	1960-61	3-25-61	15.62	(✓)
		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.	-	1960-61	5-31-61	19.79	220
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.	-	1960-61	5-21-60 5-31-61	9.10 12.20	206 369
5-3551	Little Cannon River tributary near Kenyon, Minn.	SE¼ sec.9, T.110 N., R.18 W., at culvert on State Highway 56, ¼ mile above mouth, and 5 miles north of Kenyon.	-	1960-61	3-27-61	13.28	162
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.	-	1960-61	3-20-61	1.65	(✓)
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, and 6.3 miles east of Hampton.	-	1960-61	3-25-61	13.77	(✓)
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.	-	1960-61	4-15-61	8.13	(✓)
		Zumbro River basin					
5-3729	Marion Creek at Marion, Minn.	W½SE¼ sec.35, T.106 N., R.13 W., at culvert on U.S. Highway 52, 0.3 mile south of Marion.	-	1959-61	3-25-61	15.25	(✓)
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, 3¼ miles above mouth, and 4¼ miles southwest of Wanamingo.	-	1960-61	3-27-61	10.29	(✓)
5-3739	Trout Brook tributary near Goodhue, Minn.	SE¼ sec.4, T.110 N., R.15 W., at culvert on State Highway 58, 3/4 mile above mouth, and 3 miles south of Goodhue.	.41	1960-61	4-15-61	6.50	(✓)
		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	1959-61	3-25-61	15.30	(✓)
		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	1959-61	4-15-61	13.37	(✓)

✓ Discharge not determined.

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)
		Root River basin--continued					
5-3838	Deer Creek near Grand Meadow, Minn.	SW¼SW¼ sec.30, T.103 N., R.14 W., at bridge on county highway, 1 mile south of Grand Meadow.	-	1959-61	3-25-61	a16.47	(✓)
5-3841	Trout Creek tributary near Lanesboro, Minn.	SW¼ sec.6, T.102 N., R.9 W., at culvert on county highway, 3/4 mile above mouth, and 4 miles south of Lanesboro.	4.08	1959-61	3-25-61	15.41	307
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.	0.30	1959-61	8-18-61	5.45	11
5-3842	Whalan Creek near Whalan, Minn.	SE¼ sec.21, T.103 N., R.9 W., at bridge on county highway, 1 3/4 miles southeast of Whalan, and 2¼ miles above mouth.	7.85	1959-61	6-25-59 3-25-61	16.52 16.83	647 770
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.	0.14	1959-61	6-25-59 3-25-61	8.32 8.85	9.0 18
5-3844	Pine Creek near Arendahl, Minn.	SE¼NE¼ sec.3, T.104 N., R.9 W., at bridge on county highway, 1.3 miles northeast of Arendahl, and 4.9 miles above Hemingway Creek.	28.1	1959-61	3-25-61	14.42	2,020
		Iowa River basin					
5-4571	Rose Creek tributary near Elkton, Minn.	SW¼ sec.34, T.103 N., R.16 W., at bridge on U.S. Highway 16, 3/4 mile above mouth, and 2¼ miles northwest of Elkton.	-	1959-61	3-25-61	14.86	(✓)
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.	-	1960-61	3-25-61	a18.51	(✓)
		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 47, 2¼ miles west of Slayton, and 2 3/4 miles above mouth.	-	1961	5-17-61	16.74	(✓)
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-quarter mile above mouth, and 1½ miles west of Slayton.	-	1961	5-17-61	17.52	(✓)
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	1960-61	3-25-61	4.63	(✓)
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-quarter mile above mouth, and 5½ miles north of Jackson.	1.42	1960-61	3-22-61	a13.77	(✓)
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 5 3/4 miles east of Lakefield.	4.52	1960-61	3-25-61	a6.90	(✓)
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.	-	1960-61	3-29-60 3-25-61	11.03 11.06	745 750

✓ Discharge not determined.
a Backwater from ice.

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--continued					
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	1960-61	5-21-60 3-25-61	14.58 14.69	448 464
		Big Sioux River basin					
6-4829.2	Rock River tributary near Hatfield, Minn.	NE¼NE¼ sec.1, T.105 N., R.45 W., at culvert on County Highway 16, 1 3/4 miles south of Hatfield, and 3¼ miles above mouth.	-	1961	12-5-60	a15.60	(✓)
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	1959-61	3-14-61	a7.83	14
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	1959-61	7- 1-61	6.72	(✓)
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.	-	1959-61	3-14-61	a13.50	(✓)
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.	-	1959-61	3-28-60 6-26-61	a9.66 9.84	45 67
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.	-	1959-61	6-26-61	19.61	184
		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	1959-61	3-27-61	a7.28	39

✓ Discharge not determined.
a Backwater from ice.

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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 (*); measurements of peak flow by a dagger (†).

Discharge measurements made at miscellaneous sites during water year 1961

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Stream tributary to Lake Superior						
Elbow Creek..	St. Louis River	SW¼SE¼ sec. 22, T. 57 N., R. 18 W., at culvert on State Highway 216, 1¼ miles south of Iron Junction	-	1958-60	10-19-60	*2.10
					5-19-61	33.6
					6-13-61	8.04
					7-12-61	*2.76
					8-11-61	*1.21
					9- 6-61	*2.16
Red River of the North basin						
South Branch Wild Rice River	Wild Rice River	On line between sec. 8 and 9, T. 142 N., R. 45 W., at bridge on County Road 63, and 5½ miles northeast of Felton, Minn.	-	1959-60	10-27-60	*5.99
					3-31-61	39.2
					4-26-61	76.2
					6- 1-61	17.5
					6-28-61	*3.01
					7-25-61	*2.02
					8-29-61	*1.12
					9-29-61	*2.18
State Ditch No. 45	..do.....	On line between sec. 15 and 16 T. 141 N., R. 46 W., at culvert on State Highway 9 and 3 miles south of Felton, Minn.	-	1959-60	10-27-61	*1.89
					3-14-61	a4.0
					3-31-61	4.24
					4-26-61	15.6
					6- 1-61	*2.45
					6-28-61	*3.83
					7-25-61	*.84
					8-29-61	*.56
					9-29-61	*1.05
Tamarack River	Upper Red Lake	SW¼ sec. 15, T. 145 N., R. 30 W., 1 mile southeast of Waskish	-		9-15-61	228
Lake of the Woods basin						
Sand River	Pike River....	NW¼ sec. 6, T. 59 N., R. 17 W., at bridge on U.S. Highway 53, 1.3 miles southwest of Britt, Minn.	-	1958-60	10-29-60	*4.39
					11-16-60	*8.94
					12-22-60	*.39
					1-23-61	*.37
					2-21-61	*.54
					5-23-61	61.0
					6-21-61	*4.99
					7-17-61	1.34
					8-14-61	*.38
					9-13-61	23.7
Rice River	South Branch Little Fork River	SW¼ sec. 4, T. 60 N., R. 18 W., at bridge on U.S. Highway 53, 5.1 miles south of Angora, Minn.	-	1958-60	10-20-60	*9.55
					11-16-60	*21.7
					5-19-61	154
					6-14-61	*46.5
					7-13-61	*7.56
					8-12-61	*5.06
					9- 7-61	*4.91
South Branch Little Fork River	Little Fork River	NE¼SE¼ sec. 31, T. 62 N., R. 18 W., at bridge on U.S. Highway 53, 3.1 miles south of Cook, Minn.	-	1958-60	10-20-60	*17.4
					5-19-61	478
					6-14-61	*78.7
					7-13-61	*9.64
					8-12-61	*8.57
					9- 7-61	*8.56
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, 1958-60	10-20-60	a*1.0
					5-20-61	201
					6-14-61	*38.2
					7-13-61	*.91
					8-12-61	*.32
					9- 7-61	*.85
Rum River basin						
Rum River	Mississippi River	Sec. 28 T. 36 N., R. 26 W., at bridge on State Highway 95 at Princeton, Minn., and ¼ mile upstream from West Branch Rum River	-		5-23-61	231

* Base flow.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1961

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Rum River basin continued				
Rum River...	Mississippi River	SE¼SE¼ sec. 36, T. 36 N., R. 24 W., at bridge on State Highway 56 at West Point, 8 miles west of Cambridge, Minn.	-	1958-60	5-23-61	372
		Mississippi River main stem				
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	7-31-61	2,070
		Minnesota River basin				
Threemile Creek	Redwood River	NW¼ sec. 2, T. 112 N., R. 41 W., at bridge on State Highway 23, 1 mile north of Green Valley, Minn.	-	1958-60	10-26-60 4-26-61 5-27-61 7- 8-61 8- 3-61 8-30-61	*1.33 10.6 23.9 *3.06 *5.26 0
Clear Creek..	Redwood River	SE¼ sec. 29, T. 112 N., R. 37 W., at County highway bridge, 3/4 mile southeast of Seaforth, Minn., and 1 mile above mouth	-	1958-60	10-26-60 4-26-61 5-27-61 7- 8-61 8- 7-61 8-30-61	*2.82 6.39 20.9 *5.68 *9.65 *1.68
Ramsey Creek	Redwood River	Near center of N½ sec. 35, T. 113 N., R. 36 W., at bridge, 1 3/4 miles northwest of Redwood Falls, Minn., and 2¼ miles above mouth	-	1958-60	10-26-60 4-26-61 5-27-61 7- 8-61 8- 4-61 8-30-61	*2.14 7.69 14.4 *3.39 *8.01 *.86
Watonwan River	Blue Earth River	SW¼NE¼ sec. 28, T. 107 N., R. 28 W., at highway bridge 1.5 miles west of Garden City, Minn.	812	1940-45≠	8-16-61	*113
		Mississippi River main stem				
Mississippi River	Gulf of Mexico	At Hastings, Minn.	37,100	1929 1931-39, 1945-48, 1950, 1953-57, 1959-60	6- 1-61	11,800
		St. Croix River basin				
St. Croix River	Mississippi River	At Prescott, Wis.	7,650	1939, 1946-48, 1950, 1953-56	6- 1-61	10,300
		Cannon River basin				
Turtle Creek	Straight River	On west line of sec. 34, T. 107 N., R. 20 W., at bridge on U.S. Highway 65, 2½ miles above mouth, and 3 miles south of city limits of Owatonna, Minn.	-		5-31-61	✓2,930
Straight River	Cannon River	SE¼NW¼ sec. 16, T. 107 N., R. 20 W., ¼ mile below Crane Creek at Owatonna, Minn.	-		5-31-61	✓2,080
		Zumbro River basin				
Zumbro River	Mississippi River	NW¼SW¼ sec. 31, T. 110 N., R. 11 W., at highway bridge at Thielman, Minn.	b1,320	1938-56≠, 1957, 1958,1960	10-21-60 11-28-60 5- 1-61 6- 5-61 6-26-61 7-25-61 9- 5-61	314 194 281 931 199 173 344
		Root River basin				
Root River...	Mississippi River	SE¼NW¼ sec. 21, T. 104 N., R. 8 W., at bridge on U.S. Highway 16, 2.8 miles west of Rushford, Minn.	-	1959-60	4-26-61 8- 3-61	649 414

* Base flow
✓ Peak flow
b Approximately
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1961

Stream	Tributary	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Iowa River basin						
Rose Creek	Cedar River	NE¼NE¼ sec. 6, T. 102 N., R. 16 W., at highway bridge on County Road 20, 4¼ miles west of Elkton, Minn.	-		3-25-61	✓2,470
Des Moines River basin						
West Fork River	Des Moines River	NW¼ sec. 36, T. 105 N., R. 36 W., at highway bridge at Windom, Minn.	-		5-16-61	304

✓ Peak flow

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