1968

# Water Resources Data for Minnesota

Part 1. Surface Water Records

Part 2. Water Quality Records


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Prepared in cooperation with the Minnesota Department of Conservation, Division of Waters, Soils and Minerals; the Minnesota Department of Highways; and with other State, municipal, and Federal agencies

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

# WATER RESOURCES DATA FOR MINNESOTA

1968

## Part 1: Surface Water Records

Prepared in cooperation with

Minnesota Department of Conservation, Division of Waters, Soils and Minerals
Through the Division of Waters, Soils and Minerals
Nine Mile Creek Watershed District
City of Austin
City of Rochester
Erie Mining Company
Eveleth Taconite Company
Hanna Mining Company
United States Steel Corporation
Minnesota Department of Highways
Corps of Engineers, U.S. Army
U.S. Department of State
U.S. Department of Interior
Federal Water Pollution Control Administration
Bureau of Sport Fisheries and Wildlife

Copies of this report may be obtained from
District Chief, Water Resources Division
U.S. Geological Survey
1033 Post Office Building
St. Paul, Minnesota 55101

1970

# CALENDAR FOR WATER YEAR 1968

## OCTOBER 1967

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

## NOVEMBER 1967

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
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| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | | |

## DECEMBER 1967

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

## JANUARY 1968

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

## FEBRUARY 1968

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
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| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | | |

## MARCH 1968

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

## APRIL 1968

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

## MAY 1968

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

## JUNE 1968

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

## JULY 1968

| S | M | T | W | T | F | S |
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| | 1 | 2 | 3 | 4 | 5 | 6 |
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| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 | | | |

## AUGUST 1968

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

## SEPTEMBER 1968

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

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## ILLUSTRATIONS

# WATER RESOURCES DATA FOR MINNESOTA, 1968

## Part 1. Surface Water Records

## INTRODUCTION

The surface-water records for the 1968 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 C. R. Collier, district chief.

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

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

## COOPERATION

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

Minnesota Department of Conservation, Division of Waters, Soils and Minerals, Eugene R.Gere, Director.

Minnesota Department of Highways, N. T. Waldor, Commissioner.

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

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

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

## DEFINITION OF TERMS AND ABBREVIATIONS

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

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

Hydrologic bench-mark station is one that provides hydrologic data for a basin in which the hydrologic regimes will likely be governed solely by natural conditions. Data

collected at a bench-mark station may be used to separate effects of natural from manmade changes in other basins which have been developed and in which the physiography, climate, and geology are similar to those in the underdeveloped bench-mark basin.

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.

Gage height is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

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.

Water year in Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1964, is called the "1964 water year."

## DOWNSTREAM ORDER AND STATION NUMBERS

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

As an added means of identification, each gaging station and partial-record station has been assigned a station number. The numbers have been assigned in the same downstream order used in the annual series of water-supply papers. In assigning station numbers, no distinction is made between partial-record stations and continuous-record gaging stations, so that the station number for a 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 8-digit number for each station, such as 05-0615.00, includes the part number "05" and a 6-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 05-0615.00 would appear as 5-0615, 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 determing the daily flow. The records of stage are obtained from a water-stage recorder that gives a continuous record of fluctuations or from direct readings on a nonrecording gage. Measurements of discharge are made with a current meter by the general methods adopted by the Geological Survey on the basis of experience in stream gaging since 1888. These methods are described in Water-Supply Paper 888 and are also outlined in standard textbooks on the measurement of stream discharge.

Rating tables giving the discharge for any stage are prepared from stage-discharge relation curves defined by discharge measurements. If extensions to the rating curves are necessary to define the extremes of discharge, they are made on the basis of indirect measurements of peak discharge (such as slope-area or contracted-opening measurements, or computation of flow over dams or weirs), velocity-area studies, and logarithmic plotting. The application of the daily mean

gage height to those rating tables gives the daily mean discharge, from which the monthly and the yearly mean discharge are computed. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on individual discharge measurements and notes by engineers and observers are used in applying the gage heights to the rating tables. If the stage-discharge relation for a station is temporarily changed by the presence of aquatic growth or debris on the control, the daily mean discharge is computed by what is in effect the shifting-control method.

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

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

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

records, and comparison with other station records from the same or nearby basins.

The data in this report generally comprise a description of the station, 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 1968 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".

The daily table gives the discharge corresponding to the daily mean gage height unless there are large or rapid changes in discharge during a day. For days having large or rapid changes, discharge for the day is computed by averaging the mean discharges for several parts of a day. For digital recorders, the daily mean discharge is always the average of the discharges at each punched reading. For stations equipped with nonrecording gages, the daily discharge corresponds to once-daily readings of the gage or to the mean of twice-daily readings; but for periods of rapidly changing stage the discharge is determined from a gage-height graph based on gage readings.

In the 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. The maximum day and the minimum day for each month are shown in the line with the respective headings. Discharge for the month may be expressed in cubic feet per second per square mile (line headed "Cfsm"), or in inches (line headed "In."), or in acre-feet (line headed "Ac-ft"). Figures for cubic feet per second per square mile and runoff in inches are omitted if the drainage area includes large noncontributing areas, or if the average annual rainfall on the drainage basin is usually less than 20 inches.

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

Peak discharges and the times of their occurrence and corresponding gage heights for most stations are listed below the table of daily and monthly discharge. All independent peaks above the selected base are given. The base discharge, which is given in parentheses, is selected so that an average

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of about three peaks a year can be presented. Peak discharges are not published for any stream for which the peaks are subject to substantial control by man. Time of day is expressed in 24-hour local standard time, for example, 12:30 a.m. is 0030, 1:30 p.m. is 1330.

In a general footnote, introduced by the word "Note", certain periods are indicated for which the discharge is computed or estimated by special methods because of no gage-height record, backwater from various sources, or other unusual conditions. Periods of no gage-height record are indicated if the period is continuous for a month or more or includes the maximum discharge for the year. Periods of backwater from an unusual source, of indefinite stage-discharge relation, or of any other unusual condition at the gage are indicated only if they are a month or more in length and the accuracy of the records is affected. Days on which the stage-discharge relation is affected by ice are not indicated. The methods used in computing discharge for various unusual conditions have been explained in preceding paragraphs.

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

## ACCURACY OF FIELD DATA AND COMPUTED RESULTS

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

The station description under "Remarks" states the degree of accuracy of the records. "Excellent" means that about 95 percent of the daily discharges are within 5 percent; "good" within 10 percent; and "fair" within 15 percent. "Poor" means that daily discharges have less than "fair" accuracy.

For most gaging stations equipped with digital recorders the figures of mean daily discharge are shown to the nearest hundredth of a cfs for discharges less than 1 cfs. This has been done as a matter of uniformity in the computer program and should not be construed to indicate an accuracy greater than that used in the past.

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.

## OTHER DATA AVAILABLE

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. Most gaging-station records in the State through 1967 have been analyzed with an electronic computer to give: (1) the number of days in each year that the daily discharge was between selected limits (duration tables); (2) the lowest mean discharge for selected numbers of consecutive days in each year; and (3) the highest mean discharge for selected numbers of consecutive days in each year.

At or near some gaging stations, water-quality records also are collected. Data are obtained on the chemical quality of the stream water, on water temperature, on suspended-sediment concentration, and on the particle-size distribution of suspended sediment and bed material. These data are given in Part 2 of this report. Under the "Remarks" paragraph of the gaging-station description, reference is made to water-quality records collected on a regular basis.

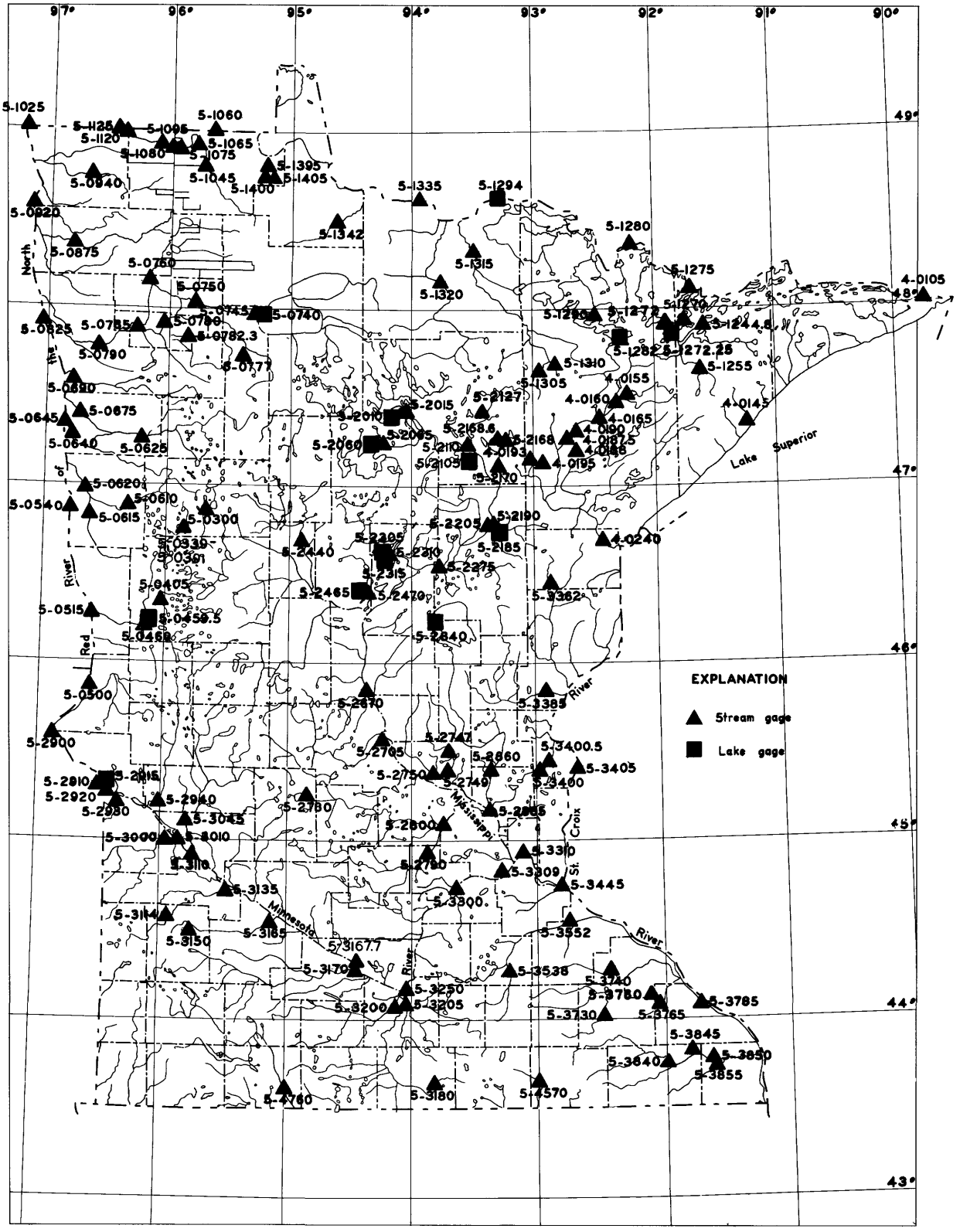


Figure 1.-- Map of Minnesota showing location of lake and stream gaging stations.

4-0105. Pigeon River at Middle Falls, near Grand Portage, 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, 2½ miles upstream from Grand Portage Port of Entry, 3½ miles upstream from mouth, and 4.7 miles northeast of village of Grand Portage.

Drainage area.--600 sq mi.

Records available.--June to October 1921, April to November 1922, March 1923 to September 1968. Published as "at International Bridge" April 1924 to September 1940; as "below International Bridge" October 1940 to September 1965. Monthly discharge only for some periods, published in WSP 1307.

Gage.--Digital 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, 5⅝ miles upstream at datum 100.24 ft higher. Oct. 1, 1940 to Aug. 13, 1968, graphic water-stage recorder at same site and datum.

Average discharge.--45 years (1923-68), 484 cfs.

Extremes.--Maximum discharge during year, 3,630 cfs July 17 (gage height, 6.71 ft); minimum daily, 30 cfs Feb. 15-22; minimum gage height, 0.12 ft Nov. 15.
1923-68: 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 winter months, which are fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 63 | 138 | 47 | 57 | 35 | 33 | 660 | 1,340 | 1,550 | 938 | 648 | 263 |
| 2 | 63 | 146 | 47 | 57 | 35 | 33 | 600 | 1,250 | 1,520 | 971 | 615 | 263 |
| 3 | 63 | 144 | 47 | 56 | 34 | 32 | 480 | 1,220 | 1,420 | 905 | 579 | 260 |
| 4 | 62 | 132 | 48 | 56 | 34 | 32 | 372 | 1,250 | 1,290 | 905 | 544 | 280 |
| 5 | 62 | 115 | 50 | 57 | 34 | 31 | 390 | 1,170 | 1,190 | 952 | 517 | 309 |
| 6 | 63 | 95 | 50 | 58 | 33 | 31 | 430 | 1,080 | 1,970 | 860 | 494 | 354 |
| 7 | 63 | 85 | 52 | 58 | 33 | 33 | 446 | 1,000 | 2,500 | 792 | 481 | 401 |
| 8 | 78 | 83 | 53 | 59 | 32 | 35 | 809 | 976 | 2,230 | 744 | 462 | 434 |
| 9 | 85 | 82 | 55 | 60 | 32 | 37 | 1,160 | 952 | 2,310 | 705 | 446 | 420 |
| 10 | 85 | 84 | 56 | 60 | 31 | 39 | 1,150 | 919 | 2,220 | 652 | 430 | 384 |
| 11 | 85 | 86 | 56 | 60 | 31 | 42 | 1,160 | 869 | 2,110 | 597 | 415 | 352 |
| 12 | 82 | 88 | 56 | 59 | 31 | 45 | 1,540 | 830 | 1,940 | 586 | 396 | 326 |
| 13 | 81 | 89 | 55 | 58 | 31 | 47 | 1,710 | 788 | 1,750 | 572 | 387 | 306 |
| 14 | 81 | 88 | 53 | 57 | 30 | 49 | 1,710 | 768 | 1,710 | 678 | 375 | 293 |
| 15 | 80 | 68 | 52 | 56 | 30 | 50 | 1,320 | 772 | 1,680 | 1,040 | 370 | 285 |
| 16 | 78 | 62 | 60 | 54 | 30 | 53 | 1,560 | 842 | 1,580 | 2,930 | 347 | 273 |
| 17 | 78 | 57 | 68 | 54 | 30 | 56 | 1,620 | 1,080 | 1,480 | 3,440 | 346 | 302 |
| 18 | 77 | 56 | 71 | 52 | 30 | 62 | 1,490 | 1,240 | 1,390 | 2,810 | 338 | 538 |
| 19 | 77 | 56 | 73 | 51 | 30 | 70 | 1,260 | 1,180 | 1,320 | 2,030 | 341 | 501 |
| 20 | 76 | 58 | 74 | 50 | 30 | 100 | 1,240 | 1,120 | 1,250 | 1,550 | 333 | 447 |
| 21 | 75 | 60 | 80 | 48 | 30 | 120 | 3,200 | 1,060 | 1,180 | 1,390 | 331 | 417 |
| 22 | 74 | 62 | 78 | 46 | 30 | 124 | 2,900 | 1,010 | 1,160 | 1,300 | 330 | 392 |
| 23 | 72 | 65 | 74 | 44 | 31 | 120 | 2,380 | 1,130 | 1,220 | 1,180 | 327 | 365 |
| 24 | 76 | 67 | 70 | 42 | 31 | 110 | 2,320 | 1,120 | 1,250 | 1,040 | 349 | 343 |
| 25 | 99 | 64 | 67 | 41 | 31 | 107 | 1,910 | 1,040 | 1,180 | 933 | 348 | 330 |
| 26 | 109 | 59 | 65 | 40 | 32 | 120 | 1,660 | 962 | 1,070 | 860 | 341 | 323 |
| 27 | 104 | 53 | 62 | 39 | 32 | 160 | 1,700 | 1,510 | 990 | 801 | 321 | 311 |
| 28 | 99 | 51 | 59 | 38 | 32 | 350 | 1,640 | 1,980 | 928 | 752 | 298 | 295 |
| 29 | 101 | 49 | 58 | 37 | 33 | 640 | 1,540 | 1,990 | 896 | 709 | 282 | 281 |
| 30 | 117 | 48 | 58 | 37 | ------ | 740 | 1,450 | 1,790 | 874 | 670 | 274 | 269 |
| 31 | 126 | ------ | 57 | 36 | ------ | 720 | ------ | 1,600 | ------ | 648 | 266 | ------ |
| Total | 2,534 | 2,390 | 1,851 | 1,577 | 918 | 4,221 | 41,807 | 35,838 | 45,158 | 34,940 | 12,331 | 10,317 |
| Mean | 81.7 | 79.7 | 59.7 | 50.9 | 31.7 | 136 | 1,394 | 1,156 | 1,505 | 1,127 | 398 | 344 |
| Max | 126 | 146 | 80 | 60 | 35 | 740 | 3,200 | 1,990 | 2,500 | 3,440 | 648 | 538 |
| Min | 62 | 48 | 47 | 36 | 30 | 31 | 372 | 768 | 874 | 572 | 266 | 260 |
| Cfsm | 0.136 | 0.133 | 0.100 | 0.085 | 0.053 | 0.227 | 2.32 | 1.93 | 2.51 | 1.88 | 0.663 | 0.573 |
| In. | 0.16 | 0.15 | 0.11 | 0.10 | 0.06 | 0.26 | 2.59 | 2.22 | 2.80 | 2.17 | 0.76 | 0.64 |

Cal yr 1967: Total 143,782 Mean 394 Max 3,740 Min 47 Cfsm 0.657 In. 8.91
Wtr yr 1968: Total 193,882 Mean 530 Max 3,440 Min 30 Cfsm 0.883 In. 12.02

Peak discharge (base 3,000 cfs)

| Date | Time | Gage height | Discharge | Date | Time | Gage height | Discharge |
|---|---|---|---|---|---|---|---|
| | about | about | about | | | | |
| 4-21 | 1200 | 6.50 | 3,420 | 7-17 | 0100 | 6.71 | 3,630 |

## 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 1968. 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.--41 years, 160 cfs.

Extremes.--Maximum discharge during year, 2,840 cfs Aug. 22 (gage height, 5.19 ft); minimum daily, 6.2 cfs Feb. 20-24.
1927-68: Maximum discharge recorded, 9,350 cfs Aug. 9, 1939 (gage height, 8.11 ft), from rating curve extended above 4,000 cfs; maximum gage height, 11.06 ft Apr. 12, 1965 (from floodmark, backwater from ice); minimum daily discharge, 0.4 cfs Jan. 5, 6, 1940.

Remarks.--Records good except those for winter months and period of backwater from bridge construction, which are fair. Records for chemical analyses and suspended sediment loads for water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 28 | 63 | 30 | 11 | 11 | 6.8 | 326 | 525 | 582 | 155 | 40 | 200 |
| 2 | 27 | 64 | 30 | 11 | 12 | 6.8 | 270 | 458 | 534 | 164 | 35 | 176 |
| 3 | 26 | 62 | 29 | 10 | 12 | 7.0 | 192 | 385 | 430 | 146 | 31 | 149 |
| 4 | 26 | 55 | 29 | 10 | 13 | 7.2 | 158 | 421 | 367 | 167 | 29 | 505 |
| 5 | 24 | 56 | 28 | 10 | 13 | 7.4 | 155 | 358 | 312 | 141 | 26 | 600 |
| 6 | 25 | 71 | 28 | 10 | 13 | 7.6 | 161 | 305 | 630 | 117 | 25 | 690 |
| 7 | 34 | 72 | 30 | 10 | 13 | 7.9 | 188 | 291 | 658 | 95 | 24 | 750 |
| 8 | 170 | 52 | 32 | 10 | 12 | 8.9 | 412 | 305 | 1,030 | 80 | 25 | 730 |
| 9 | 158 | 53 | 33 | 10 | 12 | 10 | 440 | 319 | 1,110 | 68 | 26 | 580 |
| 10 | 136 | 51 | 34 | 10 | 11 | 11 | 412 | 284 | 1,070 | 59 | 22 | 370 |
| 11 | 113 | 52 | 34 | 9.7 | 10 | 11 | 412 | 243 | 1,040 | 67 | 18 | 230 |
| 12 | 97 | 53 | 34 | 9.5 | 9.5 | 12 | 487 | 227 | 772 | 138 | 16 | 140 |
| 13 | 92 | 51 | 32 | 9.5 | 9.0 | 13 | 478 | 212 | 582 | 183 | 14 | 105 |
| 14 | 83 | 46 | 30 | 9.5 | 8.0 | 13 | 554 | 216 | 582 | 705 | 13 | 85 |
| 15 | 78 | 35 | 27 | 9.5 | 7.2 | 14 | 421 | 265 | 516 | 421 | 25 | 70 |
| 16 | 72 | 33 | 25 | 9.5 | 6.8 | 17 | 449 | 630 | 430 | 312 | 63 | 60 |
| 17 | 65 | 31 | 28 | 9.5 | 6.6 | 32 | 487 | 706 | 367 | 277 | 52 | 170 |
| 18 | 63 | 31 | 30 | 9.7 | 6.4 | 260 | 458 | 610 | 305 | 221 | 42 | 770 |
| 19 | 59 | 32 | 32 | 10 | 6.4 | 400 | 385 | 468 | 265 | 208 | 54 | 660 |
| 20 | 56 | 36 | 33 | 10 | 6.2 | 238 | 635 | 385 | 212 | 158 | 53 | 500 |
| 21 | 54 | 40 | 33 | 11 | 6.2 | 136 | 1,180 | 312 | 221 | 134 | 151 | 310 |
| 22 | 52 | 42 | 34 | 11 | 6.2 | 113 | 896 | 259 | 248 | 100 | 2,480 | 230 |
| 23 | 52 | 41 | 30 | 10 | 6.2 | 102 | 1,100 | 265 | 421 | 80 | 2,380 | 210 |
| 24 | 60 | 39 | 27 | 10 | 6.2 | 100 | 1,060 | 277 | 376 | 68 | 2,100 | 175 |
| 25 | 68 | 36 | 25 | 10 | 6.3 | 92 | 734 | 238 | 284 | 60 | 1,370 | 140 |
| 26 | 67 | 34 | 21 | 10 | 6.5 | 150 | 610 | 255 | 216 | 55 | 924 | 120 |
| 27 | 64 | 32 | 19 | 10 | 6.6 | 367 | 630 | 1,020 | 180 | 55 | 620 | 105 |
| 28 | 60 | 31 | 17 | 10 | 6.7 | 563 | 610 | 1,060 | 161 | 50 | 458 | 95 |
| 29 | 60 | 31 | 14 | 10 | 6.8 | 677 | 620 | 896 | 152 | 43 | 319 | 90 |
| 30 | 64 | 30 | 13 | 11 | ------- | 554 | 601 | 668 | 144 | 42 | 232 | 85 |
| 31 | 64 | ------ | 12 | 11 | ------- | 478 | ------ | 534 | ------- | 48 | 192 | ------ |
| Total | 2,097 | 1,355 | 853 | 312.4 | 255.8 | 4,422.6 | 15,521 | 13,397 | 14,197 | 4,617 | 11,859 | 9,100 |
| Mean | 67.6 | 45.2 | 27.5 | 10.1 | 8.82 | 143 | 517 | 432 | 473 | 149 | 383 | 303 |
| Max | 170 | 72 | 34 | 11 | 13 | 677 | 1,180 | 1,060 | 1,110 | 705 | 2,480 | 770 |
| Min | 24 | 30 | 12 | 9.5 | 6.2 | 6.8 | 155 | 212 | 144 | 42 | 13 | 60 |
| Cfsm | 0.483 | 0.323 | 0.196 | 0.072 | 0.063 | 1.02 | 3.69 | 3.09 | 3.38 | 1.06 | 2.74 | 2.16 |
| In. | 0.56 | 0.36 | 0.23 | 0.08 | 0.07 | 1.17 | 4.12 | 3.56 | 3.77 | 1.23 | 3.15 | 2.42 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 55,637 | Mean | 152 | Max | 1,980 | Min | 10 | Cfsm | 1.09 | In. | 14.78 |
| Wtr yr 1968: | Total | 77,986.8 | Mean | 213 | Max | 2,480 | Min | 6.2 | Cfsm | 1.52 | In. | 20.72 |

PEAK DISCHARGE (BASE, 1,300 CFS)

| DATE | TIME | G.HT. | DISCHARGE | DATE | TIME | G.HT. | DISCHARGE |
|---|---|---|---|---|---|---|---|
| 4-23 | 1830 | 4.55 | 1,580 | 8-22 | 0500 | 5.19 | 2,840 |

Note.--Backwater from bridge construction Sept. 5-30.

## 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 miles east of Aurora.

Drainage area.--26.3 sq mi.

Records available.--March 1955 to September 1968.

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.--13 years, 19.2 cfs.

Extremes.--Maximum discharge during year, 164 cfs about Aug. 26 (gage height, 5.23 ft, from recorded range in stage); minimum, 7.8 cfs Jan. 8, 9.
1955-68: Maximum discharge, 213 cfs Apr. 22, 1961; maximum gage height, 5.75 ft Mar. 28, 1957 (backwater from ice); minimum daily discharge, 1.5 cfs Jan. 26 to Feb. 4, 1963; minimum gage height, 3.10 ft Feb. 2, 3, 4, 1963.

Remarks.--Records good except those for winter months and those for periods of no gage-height record, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 14 | 10 | 8.6 | 10 | 9.7 | 25 | 80 | 46 | 33 | 25 | 65 |
| 2 | 16 | 12 | 10 | 8.5 | 11 | 9.8 | 21 | 75 | 46 | 35 | 25 | 54 |
| 3 | 15 | 11 | 10 | 8.5 | 11 | 10 | 20 | 71 | 44 | 37 | 24 | 50 |
| 4 | 14 | 11 | 11 | 8.4 | 12 | 10 | 19 | 63 | 39 | 36 | 23 | 48 |
| 5 | 14 | 10 | 11 | 8.4 | 12 | 10 | 19 | 54 | 37 | 35 | 24 | 46 |
| 6 | 13 | 10 | 12 | 8.4 | 11 | 11 | 20 | 47 | 39 | 33 | 27 | 48 |
| 7 | 14 | 11 | 12 | 8.4 | 11 | 11 | 30 | 45 | 41 | 31 | 32 | 51 |
| 8 | 20 | 12 | 11 | 7.8 | 11 | 13 | 42 | 42 | 55 | 29 | 40 | 55 |
| 9 | 22 | 12 | 11 | 7.8 | 11 | 15 | 48 | 40 | 60 | 28 | 38 | 57 |
| 10 | 22 | 12 | 10 | 8.4 | 11 | 16 | 47 | 38 | 65 | 28 | 36 | 59 |
| 11 | 21 | 13 | 10 | 9.0 | 11 | 16 | 42 | 36 | 73 | 28 | 34 | 58 |
| 12 | 20 | 14 | 10 | 10 | 10 | 15 | 36 | 35 | 71 | 29 | 32 | 56 |
| 13 | 19 | 14 | 10 | 11 | 10 | 14 | 31 | 34 | 67 | 31 | 32 | 52 |
| 14 | 18 | 15 | 10 | 11 | 10 | 13 | 29 | 33 | 95 | 35 | 33 | 49 |
| 15 | 18 | 16 | 9.8 | 12 | 9.7 | 12 | 30 | 32 | 92 | 40 | 35 | 47 |
| 16 | 17 | 15 | 10 | 12 | 9.6 | 12 | 44 | 32 | 89 | 42 | 36 | 46 |
| 17 | 17 | 14 | 10 | 12 | 9.5 | 16 | 47 | 34 | 80 | 42 | 35 | 45 |
| 18 | 17 | 13 | 11 | 11 | 9.5 | 24 | 45 | 33 | 70 | 47 | 33 | 45 |
| 19 | 18 | 12 | 11 | 11 | 9.4 | 30 | 40 | 32 | 60 | 49 | 32 | 44 |
| 20 | 18 | 12 | 11 | 11 | 9.4 | 32 | 37 | 30 | 50 | 44 | 32 | 44 |
| 21 | 17 | 12 | 11 | 11 | 9.3 | 33 | 39 | 28 | 43 | 41 | 58 | 47 |
| 22 | 17 | 11 | 11 | 10 | 9.3 | 30 | 45 | 27 | 40 | 39 | 75 | 48 |
| 23 | 17 | 11 | 11 | 10 | 9.3 | 24 | 55 | 27 | 42 | 38 | 85 | 47 |
| 24 | 16 | 11 | 10 | 10 | 9.3 | 20 | 52 | 27 | 48 | 36 | 110 | 45 |
| 25 | 18 | 11 | 10 | 10 | 9.3 | 20 | 45 | 26 | 53 | 34 | 125 | 41 |
| 26 | 17 | 11 | 9.8 | 10 | 9.4 | 21 | 51 | 28 | 51 | 32 | 130 | 38 |
| 27 | 16 | 11 | 9.5 | 9.8 | 9.5 | 25 | 58 | 40 | 48 | 31 | 125 | 36 |
| 28 | 14 | 10 | 9.2 | 9.8 | 9.6 | 35 | 70 | 42 | 43 | 30 | 115 | 34 |
| 29 | 13 | 10 | 9.0 | 9.8 | 9.6 | 34 | 80 | 41 | 37 | 28 | 102 | 33 |
| 30 | 14 | 10 | 8.0 | 9.9 | ------ | 31 | 82 | 41 | 34 | 27 | 90 | 32 |
| 31 | 12 | ------ | 8.8 | 10 | ------ | 29 | ------ | 40 | ------ | 26 | 80 | ------ |
| Total | 518 | 361 | 318.1 | 303.5 | 293.7 | 601.5 | 1,249 | 1,253 | 1,658 | 1,074 | 1,723 | 1,420 |
| Mean | 16.7 | 12.0 | 10.3 | 9.79 | 10.1 | 19.4 | 41.6 | 40.4 | 55.3 | 34.6 | 55.6 | 47.3 |
| Max | 22 | 16 | 12 | 12 | 12 | 35 | 82 | 80 | 95 | 49 | 130 | 65 |
| Min | 12 | 10 | 8.0 | 7.8 | 9.3 | 9.7 | 19 | 26 | 34 | 26 | 23 | 32 |
| Cfsm | 0.635 | 0.456 | 0.392 | 0.372 | 0.384 | 0.738 | 1.58 | 1.54 | 2.10 | 1.32 | 2.11 | 1.80 |
| In. | 0.73 | 0.51 | 0.45 | 0.43 | 0.42 | 0.85 | 1.77 | 1.77 | 2.34 | 1.52 | 2.44 | 2.01 |

Cal yr 1967: Total 6,975.6 Mean 19.1 Max 108 Min 7.5 Cfsm 0.726 In. 9.86
Wtr yr 1968: Total 10,772.8 Mean 29.4 Max 130 Min 7.8 Cfsm 1.12 In. 15.23

Peak discharge (base, 60 cfs)

| Date | Time | Gage height | Discharge | Date | Time | Gage height | Discharge |
|---|---|---|---|---|---|---|---|
| about 4-30 | Unkn | Unkn | about 82 | about 8-26 | Unkn | 5.23 | 164 |
| 6-14 | Unkn | 4.83 | 116 | | | | |

Note.--No gage-height record June 14 to July 15 and Aug. 22 to Sept. 19.

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 2¾ miles upstream from mouth.

Drainage area.--156 sq mi.

Records available.--August 1942 to September 1968.

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.--26 years, 122 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 1,010 cfs Aug. 27 (gage height, 5.11 ft); maximum gage height, 5.15 ft June 14; minimum discharge 12 cfs about Jan. 6 (gage height, 1.38 ft, from recorded range in stage). 1942-68: Maximum discharge, 3,230 cfs May 10, 1950 (gage height, 7.86 ft); minimum, 2.2 cfs Jan. 30, 31, 1961; minimum gage height, 0.88 ft Mar. 2, 1963.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 27 | 31 | 23 | 15 | 15 | 14 | 35 | 410 | 275 | 247 | 56 | 275 |
| 2 | 29 | 28 | 23 | 14 | 15 | 14 | 32 | 390 | 275 | 252 | 56 | 244 |
| 3 | 28 | 27 | 24 | 14 | 16 | 15 | 30 | 370 | 272 | 258 | 54 | 222 |
| 4 | 28 | 26 | 25 | 13 | 16 | 15 | 29 | 350 | 244 | 252 | 53 | 205 |
| 5 | 26 | 27 | 26 | 13 | 15 | 15 | 28 | 320 | 203 | 220 | 52 | 190 |
| 6 | 26 | 28 | 27 | 13 | 15 | 16 | 31 | 300 | 201 | 196 | 53 | 201 |
| 7 | 28 | 29 | 29 | 13 | 15 | 16 | 39 | 280 | 194 | 179 | 56 | 208 |
| 8 | 36 | 31 | 30 | 13 | 15 | 17 | 46 | 270 | 236 | 164 | 74 | 220 |
| 9 | 36 | 31 | 29 | 13 | 15 | 19 | 49 | 260 | 347 | 146 | 69 | 225 |
| 10 | 36 | 31 | 27 | 13 | 15 | 20 | 51 | 250 | 485 | 130 | 65 | 220 |
| 11 | 36 | 34 | 25 | 13 | 15 | 21 | 56 | 243 | 665 | 122 | 62 | 203 |
| 12 | 37 | 34 | 24 | 14 | 15 | 20 | 52 | 238 | 794 | 123 | 61 | 183 |
| 13 | 38 | 33 | 23 | 14 | 14 | 19 | 44 | 230 | 824 | 117 | 60 | 168 |
| 14 | 39 | 31 | 22 | 15 | 14 | 17 | 44 | 222 | 951 | 120 | 58 | 151 |
| 15 | 40 | 28 | 21 | 16 | 14 | 17 | 39 | 212 | 930 | 123 | 61 | 142 |
| 16 | 41 | 30 | 21 | 17 | 14 | 18 | 58 | 205 | 895 | 142 | 62 | 132 |
| 17 | 42 | 31 | 22 | 18 | 14 | 20 | 71 | 210 | 830 | 146 | 58 | 128 |
| 18 | 43 | 30 | 22 | 18 | 14 | 22 | 68 | 220 | 722 | 162 | 54 | 133 |
| 19 | 44 | 29 | 23 | 18 | 13 | 30 | 60 | 201 | 610 | 179 | 55 | 151 |
| 20 | 44 | 28 | 24 | 17 | 13 | 37 | 54 | 201 | 500 | 185 | 53 | 160 |
| 21 | 43 | 28 | 24 | 17 | 13 | 36 | 59 | I94 | 406 | 181 | 112 | 170 |
| 22 | 43 | 29 | 23 | 17 | 13 | 34 | 59 | 177 | 356 | 166 | 203 | 168 |
| 23 | 43 | 30 | 22 | 16 | 13 | 32 | 90 | 168 | 379 | 151 | 225 | 170 |
| 24 | 41 | 30 | 21 | 16 | 13 | 31 | 89 | 162 | 396 | 133 | 356 | 162 |
| 25 | 39 | 30 | 20 | 16 | 13 | 31 | 85 | 150 | 425 | 115 | 565 | 155 |
| 26 | 39 | 29 | 18 | 15 | 13 | 31 | 106 | 142 | 387 | 105 | 916 | 146 |
| 27 | 38 | 28 | 17 | 14 | 14 | 34 | 168 | 160 | 360 | 90 | 951 | 137 |
| 28 | 36 | 26 | 16 | 14 | 14 | 43 | 250 | 185 | 334 | 79 | 806 | 123 |
| 29 | 34 | 24 | 16 | 14 | 14 | 47 | 350 | 201 | 280 | 71 | 640 | 115 |
| 30 | 33 | 23 | 15 | 14 | ------ | 43 | 400 | 220 | 255 | 64 | 440 | 106 |
| 31 | 30 | ------ | 15 | 14 | ------ | 39 | ------ | 247 | ------ | 60 | 328 | ------ |
| Total | 1,123 | 874 | 697 | 461 | 412 | 783 | 2,572 | 7,388 | 14,031 | 4,678 | 6,714 | 5,213 |
| Mean | 36.2 | 29.1 | 22.5 | 14.9 | 14.2 | 25.3 | 85.7 | 238 | 468 | 151 | 217 | 174 |
| (≠) | +2.23 | +0.39 | +0.31 | +1.86 | -0.05 | +8.83 | +155 | +23.3 | +21.2 | +20.3 | +42.9 | +21.3 |
| Mean ≠ | 38.4 | 29.5 | 22.8 | 16.8 | 14.2 | 34.1 | 241 | 261 | 489 | 171 | 260 | 195 |
| Max | 44 | 34 | 30 | 18 | 16 | 47 | 400 | 410 | 951 | 258 | 951 | 275 |
| Min | 26 | 23 | 15 | 13 | 13 | 14 | 28 | 142 | 194 | 60 | 52 | 106 |
| Cfsm ≠ | 0.246 | 0.189 | 0.146 | 0.108 | 0.091 | 0.219 | 1.54 | 1.67 | 3.13 | 1.10 | 1.67 | 1.25 |
| In. ≠ | 0.28 | 0.21 | 0.17 | 0.12 | 0.10 | 0.25 | 1.72 | 1.93 | 3.50 | 1.27 | 1.92 | 1.40 |

Cal yr 1967: Mean 75.6 Mean ≠ 98.0 Max 525 Min 15 Cfsm 0.628 In. 8.52
Wtr yr 1968: Mean 123 Mean ≠ 148 Max 951 Min 13 Cfsm 0.949 In. 12.87

≠ 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.

## 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 1968.

Gage.--Digital 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. Aug. 26, 1944 to Sept. 27, 1967, graphic water-stage recorder at present site and datum.

Average discharge.--26 years, 237 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 1,560 cfs Aug. 26 (gage height, 4.48 ft); minimum daily, 23 cfs Feb. 20-26; minimum gage height, 0.95 ft Feb. 22-26.
1942-68: 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 winter months, which are fair. Flow regulated at times by storage in off-channel Partridge Reservoir, formerly known as Whitewater Lake. Reservoir formed from lake by levees around marsh areas and natural outlet. Available capacity 20,000 acre-ft between elevations 1,410 ft (natural lake level) and 1,440 ft. Storage began Apr. 9, 1955. Storage in reservoir obtained from Colby Lake during periods of high flow; release from storage returned to Colby Lake to maintain lake elevation during diversion for iron-ore processing. Diversion began Feb. 7, 1956. Some seepage losses from reservoir enter above station.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 47 | 58 | 52 | 41 | 31 | 25 | 130 | 1,340 | 594 | 523 | 134 | 714 |
| 2 | 49 | 58 | 53 | 40 | 31 | 26 | 132 | 1,440 | 594 | 520 | 130 | 651 |
| 3 | 50 | 54 | 54 | 40 | 30 | 26 | 125 | 1,420 | 579 | 480 | 126 | 594 |
| 4 | 49 | 51 | 55 | 39 | 30 | 27 | 118 | 1,350 | 542 | 425 | 122 | 560 |
| 5 | 45 | 48 | 56 | 38 | 30 | 27 | 112 | 1,250 | 478 | 370 | 121 | 509 |
| 6 | 43 | 47 | 56 | 38 | 29 | 28 | 110 | 1,120 | 486 | 325 | 119 | 509 |
| 7 | 46 | 46 | 55 | 38 | 28 | 29 | 115 | 1,030 | 496 | 305 | 126 | 504 |
| 8 | 60 | 47 | 53 | 39 | 27 | 31 | 137 | 956 | 651 | 290 | 154 | 532 |
| 9 | 58 | 47 | 51 | 39 | 27 | 37 | 174 | 887 | 838 | 280 | 139 | 504 |
| 10 | 58 | 48 | 48 | 39 | 26 | 41 | 196 | 800 | 992 | 270 | 132 | 482 |
| 11 | 58 | 50 | 46 | 40 | 26 | 43 | 210 | 748 | 1,200 | 255 | 124 | 444 |
| 12 | 57 | 51 | 45 | 40 | 26 | 41 | 222 | 695 | 1,320 | 245 | 122 | 409 |
| 13 | 57 | 51 | 44 | 39 | 25 | 39 | 216 | 632 | 1,340 | 248 | 121 | 378 |
| 14 | 58 | 52 | 43 | 38 | 25 | 37 | 213 | 584 | 1,500 | 242 | 114 | 359 |
| 15 | 59 | 50 | 43 | 37 | 25 | 36 | 208 | 551 | 1,460 | 240 | 117 | 344 |
| 16 | 59 | 52 | 44 | 37 | 25 | 38 | 245 | 527 | 1,410 | 242 | 122 | 322 |
| 17 | 58 | 53 | 45 | 37 | 24 | 43 | 318 | 514 | 1,330 | 242 | 110 | 311 |
| 18 | 59 | 54 | 47 | 37 | 24 | 55 | 355 | 514 | 1,200 | 255 | 105 | 333 |
| 19 | 60 | 53 | 48 | 37 | 24 | 75 | 351 | 491 | 1,060 | 286 | 109 | 333 |
| 20 | 62 | 51 | 48 | 36 | 23 | 98 | 336 | 486 | 914 | 296 | 104 | 340 |
| 21 | 60 | 52 | 48 | 36 | 23 | 102 | 363 | 469 | 816 | 296 | 232 | 344 |
| 22 | 60 | 53 | 48 | 36 | 23 | 105 | 424 | 444 | 753 | 279 | 374 | 333 |
| 23 | 60 | 53 | 49 | 36 | 23 | 100 | 594 | 424 | 784 | 255 | 716 | 336 |
| 24 | 60 | 54 | 49 | 35 | 23 | 94 | 656 | 405 | 784 | 242 | 1,130 | 318 |
| 25 | 62 | 54 | 48 | 34 | 23 | 88 | 623 | 389 | 794 | 222 | 1,370 | 300 |
| 26 | 63 | 53 | 47 | 33 | 23 | 86 | 671 | 382 | 748 | 205 | 1,540 | 286 |
| 27 | 63 | 51 | 46 | 32 | 24 | 86 | 800 | 420 | 709 | 188 | 1,480 | 265 |
| 28 | 63 | 50 | 45 | 32 | 24 | 92 | 903 | 469 | 661 | 169 | 1,300 | 251 |
| 29 | 62 | 50 | 44 | 32 | 25 | 105 | 986 | 500 | 589 | 158 | 1,130 | 238 |
| 30 | 60 | 51 | 43 | 31 | ------ | 118 | 1,140 | 514 | 556 | 149 | 920 | 220 |
| 31 | 58 | ------ | 42 | 31 | ------ | 123 | ------ | 542 | ------ | 141 | 794 | ------ |
| Total | 1,763 | 1,542 | 1,495 | 1,137 | 747 | 1,901 | 11,183 | 22,293 | 26,178 | 8,643 | 13,437 | 12,023 |
| Mean | 56.9 | 51.4 | 48.2 | 36.7 | 25.8 | 61.3 | 373 | 719 | 873 | 279 | 433 | 401 |
| (≠) | +2.23 | +0.39 | +0.31 | +1.86 | -0.05 | +8.83 | +155 | +23.3 | +21.2 | +20.3 | +42.9 | +21.3 |
| Mean ≠ | 59.1 | 51.8 | 48.5 | 38.6 | 25.8 | 70.1 | 528 | 742 | 894 | 299 | 476 | 422 |
| Max | 63 | 58 | 56 | 41 | 31 | 123 | 1,140 | 1,440 | 1,500 | 523 | 1,540 | 714 |
| Min | 43 | 46 | 42 | 31 | 23 | 25 | 110 | 382 | 478 | 141 | 104 | 220 |
| Cfsm ≠ | 0.189 | 0.166 | 0.155 | 0.124 | 0.083 | 0.225 | 1.69 | 2.38 | 2.87 | 0.958 | 1.53 | 1.35 |
| In. ≠ | 0.22 | 0.19 | 0.18 | 0.14 | 0.09 | 0.26 | 1.89 | 2.74 | 3.20 | 1.11 | 1.76 | 1.51 |

Cal yr 1967: Max 898 Min 17 Mean 156 Mean ≠ 178 Cfsm ≠ 0.571 In. ≠ 7.78
Wtr yr 1968: Max 1,540 Min 23 Mean 280 Mean ≠ 305 Cfsm ≠ 0.978 In. ≠ 13.31

≠ 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.

## 4-0187.5 St. Louis River at Forbes, Minn.

Location.--Lat 47°21'48", long 92°35'56", in NE¼SE¼ sec.3, T.56 N., R.18 W., on right bank at downstream side of highway bridge, 0.5 mile downstream from Eveleth Taconite Company dam, 0.6 mile south of Forbes, 1.8 miles upstream from Elbow Creek.

Records available.--August 1964 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 1,293.11 ft above mean sea level, datum of 1929. Prior to Oct. 28, 1964, wire-weight gage Oct. 28, 1964, to Sept. 1, 1967, graphic water-stage recorder at same site and datum.

Extremes.--Maximum discharge during year, 2,770 cfs June 18 (gage height, 12.27 ft); minimum daily, 34 cfs Feb. 18-25.

1964-68: Maximum discharge, 4,140 cfs Apr. 23, 1966 (gage height, 14.60 ft); minimum, 24 cfs Nov. 26, 1966 (gage height, 5.23 ft).

Flood of June 1964 reached a stage of about 12.3 ft, from information furnished by Eveleth Taconite Company (discharge, 2,780 cfs).

Remarks.--Records good except those for winter months, which are fair. There is some regulation at medium and low flows and diversion for iron-ore processing at Eveleth Taconite Company dam ½ mile upstream. Diversion began Dec. 5, 1965. Records of suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 89 | 98 | 67 | 50 | 38 | 37 | 490 | 2,220 | 1,030 | 1,200 | 225 | 1,220 |
| 2 | 89 | 108 | 68 | 48 | 38 | 38 | 465 | 2,310 | 1,090 | 1,130 | 198 | 1,090 |
| 3 | 91 | 112 | 70 | 47 | 38 | 40 | 430 | 2,340 | 1,070 | 1,060 | 250 | 968 |
| 4 | 91 | 100 | 72 | 45 | 37 | 43 | 400 | 2,340 | 1,040 | 1,010 | 237 | 888 |
| 5 | 89 | 88 | 74 | 44 | 37 | 47 | 390 | 2,290 | 934 | 957 | 228 | 802 |
| 6 | 87 | 86 | 74 | 44 | 37 | 53 | 360 | 2,170 | 1,020 | 881 | 219 | 794 |
| 7 | 91 | 84 | 68 | 43 | 37 | 60 | 350 | 2,030 | 1,060 | 809 | 213 | 813 |
| 8 | 115 | 82 | 42 | 43 | 36 | 64 | 385 | 1,920 | 1,200 | 614 | 222 | 820 |
| 9 | 135 | 79 | 66 | 44 | 36 | 66 | 460 | 1,820 | 1,470 | 702 | 250 | 816 |
| 10 | 129 | 74 | 42 | 45 | 36 | 63 | 515 | 1,700 | 1,620 | 636 | 231 | 791 |
| 11 | 120 | 68 | 55 | 45 | 36 | 58 | 550 | 1,560 | 1,900 | 585 | 213 | 754 |
| 12 | 117 | 76 | 65 | 44 | 36 | 54 | 543 | 1,450 | 2,070 | 512 | 204 | 713 |
| 13 | 115 | 84 | 47 | 44 | 35 | 52 | 515 | 1,280 | 2,180 | 540 | 204 | 568 |
| 14 | 87 | 86 | 58 | 43 | 35 | 51 | 504 | 1,240 | 2,480 | 529 | 198 | 605 |
| 15 | 80 | 76 | 66 | 42 | 35 | 52 | 498 | 1,070 | 2,630 | 508 | 187 | 573 |
| 16 | 98 | 72 | 50 | 41 | 35 | 56 | 592 | 1,030 | 2,700 | 508 | 143 | 530 |
| 17 | 117 | 83 | 47 | 41 | 35 | 85 | 750 | 1,010 | 2,710 | 501 | 178 | 513 |
| 18 | 117 | 92 | 63 | 41 | 34 | 150 | 794 | 976 | 2,650 | 442 | 181 | 581 |
| 19 | 120 | 90 | 72 | 41 | 34 | 250 | 776 | 953 | 2,470 | 377 | 146 | 672 |
| 20 | 103 | 83 | 55 | 41 | 34 | 290 | 765 | 907 | 2,240 | 508 | 172 | 658 |
| 21 | 123 | 79 | 62 | 41 | 34 | 300 | 816 | 794 | 2,000 | 543 | 201 | 634 |
| 22 | 123 | 82 | 68 | 40 | 34 | 285 | 888 | 854 | 1,820 | 518 | 384 | 620 |
| 23 | 123 | 84 | 53 | 40 | 34 | 260 | 1,120 | 813 | 1,770 | 512 | 709 | 648 |
| 24 | 123 | 86 | 57 | 40 | 34 | 250 | 1,360 | 783 | 1,750 | 487 | 1,350 | 651 |
| 25 | 120 | 86 | 63 | 40 | 34 | 240 | 1,440 | 742 | 1,680 | 456 | 1,650 | 611 |
| 26 | 115 | 83 | 57 | 40 | 35 | 260 | 1,570 | 706 | 1,580 | 394 | 1,720 | 573 |
| 27 | 112 | 80 | 48 | 39 | 35 | 290 | 1,760 | 761 | 1,490 | 390 | 1,800 | 458 |
| 28 | 112 | 75 | 46 | 39 | 36 | 340 | 1,980 | 846 | 1,340 | 367 | 1,820 | 519 |
| 29 | 112 | 72 | 52 | 39 | 37 | 390 | 2,110 | 892 | 1,260 | 240 | 1,750 | 606 |
| 30 | 112 | 69 | 57 | 38 | ------ | 460 | 2,140 | 907 | 1,200 | 344 | 1,580 | 313 |
| 31 | 109 | ------ | 52 | 38 | ------ | 480 | ------ | 877 | ------ | 340 | 1,360 | ------ |
| TOTAL | 3,364 | 2,517 | 1,836 | 1,310 | 1,032 | 5,164 | 25,716 | 41,591 | 51,454 | 18,600 | 18,423 | 20,802 |
| MEAN | 109 | 83.9 | 59.2 | 42.3 | 35.6 | 167 | 857 | 1,342 | 1,715 | 600 | 594 | 693 |
| MAX | 135 | 112 | 74 | 50 | 38 | 480 | 2,140 | 2,340 | 2,710 | 1,200 | 1,820 | 1,220 |
| MIN | 80 | 68 | 42 | 38 | 34 | 37 | 350 | 706 | 934 | 240 | 143 | 313 |

CAL YR 1967 TOTAL 141,229 MEAN 387 MAX 2,460 MIN 36
WTR YR 1968 TOTAL 191,809 MEAN 524 MAX 2,710 MIN 34

## 4-0189. East Two River near Iron Junction, Minn.

Location.--Lat 47°24'04", long 92°39'52", in NW¼NW¼ sec.29, T.57 N., R.18 W., on right bank downstream from bridge on State Highway 37 and 2.2 miles southwest of Iron Junction.

Drainage area.--40.0 sq mi.

Records available.--June 1966 to September 1968. Occasional low-flow measurements, water years 1957-62.

Gage.--Water-stage recorder. Altitude of gage is 1,335 ft (from topographic map).

Extremes.--Maximum discharge during year, 395 cfs Aug. 25 (gage height, 9.43 ft); minimum daily, 5.5 cfs Dec. 27, 28, 29; minimum gage height, 2.93 ft Oct. 1
1966-68: Maximum discharge, that of Aug. 25, 1968; maximum gage height, 9.48 ft Apr. 1, 1967 (backwater from ice); minimum daily discharge, that of Dec. 27, 28, 29, 1967.

Remarks.--Records good except those for winter months, which are fair.

Cooperation.--Records computed by U. S. Steel Corporation and reviewed by Geological Survey.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.8 | 10 | 8.9 | 5.6 | 7.7 | 6.4 | 89 | 90 | 36 | 33 | 7.9 | 51 |
| 2 | 6.0 | 11 | 8.7 | 5.6 | 7.8 | 6.3 | 56 | 77 | 39 | 34 | 7.5 | 48 |
| 3 | 6.3 | 13 | 8.5 | 5.7 | 7.8 | 6.3 | 55 | 62 | 37 | 31 | 7.5 | 42 |
| 4 | 6.9 | 12 | 8.3 | 5.8 | 7.8 | 6.2 | 57 | 53 | 32 | 27 | 7.7 | 38 |
| 5 | 6.7 | 12 | 8.1 | 5.9 | 7.9 | 6.1 | 58 | 48 | 28 | 25 | 7.9 | 35 |
| 6 | 6.5 | 11 | 7.9 | 6.0 | 7.8 | 6.0 | 50 | 42 | 57 | 23 | 7.9 | 38 |
| 7 | 7.7 | 11 | 7.7 | 6.1 | 7.7 | 6.0 | 42 | 43 | 90 | 20 | 8.1 | 44 |
| 8 | 11 | 11 | 7.5 | 6.2 | 7.7 | 6.1 | 65 | 42 | 127 | 18 | 11 | 50 |
| 9 | 12 | 10 | 7.3 | 6.3 | 7.7 | 8.0 | 84 | 43 | 156 | 17 | 13 | 48 |
| 10 | 12 | 10 | 7.1 | 6.4 | 7.6 | 11 | 68 | 40 | 144 | 15 | 13 | 42 |
| 11 | 12 | 10 | 6.9 | 6.4 | 7.6 | 14 | 57 | 36 | 137 | 14 | 11 | 36 |
| 12 | 11 | 10 | 6.8 | 6.5 | 7.6 | 14 | 48 | 33 | 113 | 17 | 11 | 31 |
| 13 | 11 | 10 | 6.6 | 6.6 | 7.6 | 13 | 46 | 31 | 86 | 16 | 12 | 27 |
| 14 | 10 | 11 | 6.4 | 6.6 | 7.5 | 11 | 39 | 29 | 108 | 17 | 11 | 25 |
| 15 | 10 | 11 | 6.2 | 6.8 | 7.5 | 11 | 44 | 29 | 128 | 17 | 11 | 22 |
| 16 | 10 | 11 | 6.1 | 6.8 | 7.4 | 12 | 60 | 28 | 109 | 18 | 13 | 21 |
| 17 | 9.7 | 12 | 6.0 | 6.9 | 7.4 | 17 | 72 | 27 | 83 | 20 | 13 | 26 |
| 18 | 9.7 | 12 | 5.9 | 7.0 | 7.3 | 25 | 72 | 26 | 60 | 21 | 13 | 59 |
| 19 | 9.4 | 12 | 5.8 | 7.0 | 7.2 | 36 | 70 | 26 | 43 | 21 | 13 | 88 |
| 20 | 9.4 | 11 | 5.7 | 7.1 | 7.2 | 35 | 68 | 25 | 31 | 20 | 13 | 81 |
| 21 | 8.5 | 11 | 5.7 | 7.2 | 7.1 | 33 | 62 | 23 | 31 | 18 | 23 | 65 |
| 22 | 8.8 | 11 | 5.7 | 7.2 | 7.0 | 32 | 54 | 22 | 34 | 17 | 55 | 54 |
| 23 | 9.4 | 10 | 5.7 | 7.3 | 7.0 | 31 | 70 | 20 | 66 | 15 | 119 | 57 |
| 24 | 11 | 10 | 5.7 | 7.3 | 6.9 | 30 | 80 | 19 | 76 | 13 | 281 | 52 |
| 25 | 11 | 10 | 5.6 | 7.4 | 6.8 | 32 | 84 | 17 | 61 | 11 | 388 | 45 |
| 26 | 10 | 9.8 | 5.6 | 7.4 | 6.7 | 40 | 104 | 17 | 48 | 10 | 353 | 39 |
| 27 | 9.6 | 9.6 | 5.5 | 7.5 | 6.5 | 80 | 135 | 23 | 37 | 9.4 | 288 | 35 |
| 28 | 10 | 9.4 | 5.5 | 7.6 | 6.5 | 110 | 130 | 34 | 29 | 8.3 | 196 | 34 |
| 29 | 9.6 | 9.3 | 5.5 | 7.6 | 6.4 | 127 | 116 | 34 | 24 | 7.9 | 129 | 33 |
| 30 | 10 | 9.1 | 5.6 | 7.6 | ------ | 121 | 102 | 32 | 24 | 7.7 | 71 | 29 |
| 31 | 11 | ------ | 5.6 | 7.7 | ------ | 114 | ------ | 32 | ------ | 7.7 | 52 | ------ |
| Total | 292.0 | 320.2 | 204.1 | 209.1 | 212.7 | 1,006.4 | 2,137 | 1,103 | 2,074 | 549.0 | 2,167.5 | 1,295 |
| Mean | 9.42 | 10.7 | 6.58 | 6.75 | 7.33 | 32.5 | 71.2 | 35.6 | 69.1 | 17.7 | 69.9 | 43.2 |
| Max | 12 | 13 | 8.9 | 7.7 | 7.9 | 127 | 135 | 90 | 156 | 34 | 388 | 88 |
| Min | 5.8 | 9.1 | 5.5 | 5.6 | 6.4 | 6.0 | 39 | 17 | 24 | 7.7 | 7.5 | 21 |
| Cfsm | 0.236 | 0.268 | 0.164 | 0.169 | 0.183 | 0.812 | 1.78 | 0.890 | 1.73 | 0.443 | 1.75 | 1.08 |
| In. | 0.27 | 0.30 | 0.19 | 0.19 | 0.20 | 0.94 | 1.99 | 1.03 | 1.93 | 0.51 | 2.02 | 1.20 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 9,468.3 | Mean | 25.9 | Max | 361 | Min | 5.5 | Cfsm | 0.648 | In. | 8.80 |
| Wtr yr 1968: | Total | 11,570.0 | Mean | 316 | Max | 388 | Min | 5.5 | Cfsm | 0.790 | In. | 10.76 |

## 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 37, 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 1962, October 1965 to September 1968.

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.--12 years, 44.4 cfs.

Extremes.--Maximum discharge during year, 345 cfs Aug. 26 (gage height, 7.72 ft); minimum daily, 5.2 cfs Oct. 31, Nov. 1 (gage height, 2.34 ft).
1953-62, 1966-68: 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, 2.34 ft Aug. 15-17, 24-28, 1961, Oct. 31, Nov. 1, 1967.

Remarks.--Records good except those for winter months, which are fair. Flow regulated at times by storage in West Two Rivers Reservoir for taconite processing at U. S. Steel Mountain Iron Taconite Plant. The reservoir impounds water from the upper 27.9 sq miles of the drainage area and has an available capacity of 8,500 acre-ft between elevations 1370 ft (natural inlet) and 1395 ft (crest of spillway at outlet dam). Storage began July 28, 1966. Some seepage losses from reservoir enter above station.

Cooperation.--Records for 1968 water year computed by U. S. Steel Corporation and reviewed by Geological Survey.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.3 | 5.2 | 5.8 | 5.6 | 6.1 | 6.0 | 79 | 111 | 42 | 79 | 16 | 70 |
| 2 | 5.7 | 5.5 | 5.8 | 5.6 | 6.1 | 6.1 | 72 | 84 | 45 | 138 | 16 | 69 |
| 3 | 5.5 | 5.7 | 5.8 | 5.7 | 6.2 | 6.1 | 67 | 70 | 45 | 188 | 15 | 68 |
| 4 | 5.5 | 7.1 | 5.8 | 5.8 | 6.2 | 6.2 | 63 | 59 | 39 | 187 | 14 | 64 |
| 5 | 5.5 | 6.7 | 5.8 | 5.9 | 6.2 | 6.5 | 60 | 54 | 29 | 152 | 14 | 59 |
| 6 | 6.7 | 5.9 | 5.8 | 6.0 | 6.2 | 6.8 | 60 | 48 | 82 | 110 | 14 | 65 |
| 7 | 5.9 | 6.3 | 5.7 | 6.0 | 6.2 | 7.0 | 63 | 40 | 169 | 75 | 13 | 71 |
| 8 | 9.2 | 6.3 | 5.7 | 6.0 | 6.2 | 8.5 | 69 | 44 | 245 | 58 | 14 | 79 |
| 9 | 11 | 6.7 | 5.7 | 6.0 | 6.2 | 9.5 | 86 | 49 | 299 | 42 | 16 | 76 |
| 10 | 10 | 6.3 | 5.7 | 6.0 | 6.2 | 11 | 87 | 48 | 307 | 33 | 17 | 67 |
| 11 | 9.6 | 8.0 | 5.7 | 6.0 | 6.2 | 11 | 79 | 43 | 278 | 31 | 16 | 57 |
| 12 | 8.4 | 7.5 | 5.7 | 6.0 | 6.2 | 11 | 68 | 40 | 229 | 43 | 17 | 48 |
| 13 | 8.0 | 7.1 | 5.7 | 6.0 | 6.3 | 10 | 54 | 36 | 185 | 36 | 18 | 40 |
| 14 | 18 | 6.8 | 5.7 | 6.0 | 6.3 | 10 | 53 | 33 | 201 | 38 | 18 | 35 |
| 15 | 10 | 6.6 | 5.7 | 6.0 | 6.3 | 11 | 52 | 34 | 222 | 37 | 18 | 29 |
| 16 | 7.5 | 6.4 | 5.6 | 6.0 | 6.3 | 13 | 67 | 34 | 221 | 42 | 24 | 25 |
| 17 | 6.7 | 6.1 | 5.6 | 6.0 | 6.3 | 14 | 80 | 34 | 195 | 50 | 22 | 45 |
| 18 | 6.7 | 5.9 | 5.6 | 6.0 | 6.2 | 16 | 82 | 32 | 155 | 54 | 20 | 121 |
| 19 | 6.3 | 5.9 | 5.6 | 6.0 | 6.2 | 23 | 76 | 31 | 118 | 56 | 20 | 161 |
| 20 | 5.9 | 5.9 | 5.6 | 6.0 | 6.2 | 32 | 70 | 30 | 85 | 49 | 20 | 181 |
| 21 | 6.7 | 5.9 | 5.6 | 6.0 | 6.1 | 37 | 68 | 27 | 70 | 43 | 25 | 185 |
| 22 | 6.3 | 5.8 | 5.6 | 6.0 | 6.1 | 38 | 66 | 27 | 62 | 36 | 53 | 169 |
| 23 | 6.3 | 5.8 | 5.6 | 6.0 | 6.0 | 38 | 81 | 26 | 91 | 32 | 112 | 170 |
| 24 | 5.9 | 5.8 | 5.6 | 6.0 | 6.0 | 35 | 100 | 25 | 88 | 28 | 236 | 156 |
| 25 | 5.7 | 5.8 | 5.6 | 6.0 | 6.0 | 32 | 109 | 26 | 82 | 25 | 317 | 142 |
| 26 | 5.7 | 5.8 | 5.6 | 6.0 | 6.0 | 30 | 128 | 29 | 68 | 24 | 341 | 114 |
| 27 | 5.5 | 5.8 | 5.6 | 6.0 | 6.0 | 35 | 149 | 30 | 56 | 22 | 310 | 89 |
| 28 | 5.7 | 5.8 | 5.6 | 6.1 | 6.0 | 60 | 148 | 38 | 42 | 20 | 174 | 67 |
| 29 | 5.7 | 5.8 | 5.6 | 6.1 | 6.0 | 85 | 142 | 45 | 30 | 18 | 123 | 52 |
| 30 | 5.7 | 5.8 | 5.6 | 6.1 | ------ | 83 | 138 | 50 | 34 | 18 | 100 | 40 |
| 31 | 5.2 | ------ | 5.6 | 6.1 | ------ | 80 | ------ | 39 | ------ | 18 | 72 | ------ |
| Total | 222.8 | 186.0 | 175.7 | 185.0 | 178.5 | 777.7 | 2,516 | 1,316 | 3,814 | 1,782 | 2,205 | 2,614 |
| Mean | 7.19 | 6.20 | 5.67 | 5.97 | 6.16 | 25.1 | 83.9 | 42.5 | 127 | 57.5 | 71.1 | 87.1 |
| Max | 18 | 8.0 | 5.8 | 6.1 | 6.3 | 85 | 149 | 111 | 307 | 188 | 341 | 185 |
| Min | 5.2 | 5.2 | 5.6 | 5.6 | 6.0 | 6.0 | 52 | 25 | 29 | 18 | 13 | 25 |
| Cfsm | 0.105 | 0.091 | 0.083 | 0.087 | 0.091 | 0.367 | 1.23 | 0.621 | 1.86 | 0.841 | 1.04 | 1.27 |
| In. | 0.12 | 0.10 | 0.10 | 0.10 | 0.10 | 0.42 | 1.37 | 0.72 | 2.07 | 0.97 | 1.20 | 1.42 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 9,519.7 | Mean | 26.1 | Max | 500 | Min | 5.2 | Cfsm | 0.382 | In. | 5.18 |
| Wtr yr 1968: | Total | 15,972.7 | Mean | 43.6 | Max | 341 | Min | 5.2 | Cfsm | 0.637 | In. | 8.68 |

## 4-0193. West Swan River near Silica, Minn.

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

Records available.--April 1963 to September 1968.

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

Average discharge.--5 years, 12.0 cfs.

Extremes.--Maximum discharge during year, 97 cfs July 1 (gage height, 3.12 ft); maximum gage height recorded, 5.17 ft Mar. 28 (backwater from ice); minimum daily discharge, 0.5 cfs Nov. 29, 30, Dec. 1-4; minimum gage height, 0.89 ft Aug. 14.
1963-68: Maximum discharge, 340 cfs Sept. 30, 1965 (gage height, 4.81 ft); minimum, 0.3 cfs Aug. 8, 1963.

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

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.9 | 3.6 | 0.5 | 2.6 | 3.1 | 4.6 | 28 | 14 | 22 | 87 | 1.4 | 2.5 |
| 2 | 2.0 | 3.7 | .5 | 2.5 | 3.3 | 4.9 | 23 | 9.9 | 19 | 73 | 1.3 | 2.6 |
| 3 | 2.1 | 3.5 | .5 | 2.5 | 3.4 | 5.5 | 20 | 6.8 | 15 | 46 | 1.4 | 2.3 |
| 4 | 2.2 | 3.1 | .5 | 2.5 | 3.5 | 6.2 | 18 | 5.3 | 9.9 | 16 | 1.4 | 2.3 |
| 5 | 2.0 | 2.6 | .6 | 2.5 | 3.6 | 7.2 | 16 | 4.6 | 8.6 | 5.4 | 1.4 | 2.2 |
| 6 | 1.9 | 2.2 | .7 | 2.5 | 3.6 | 8.5 | 22 | 3.9 | 34 | 3.6 | 1.4 | 2.7 |
| 7 | 2.4 | 2.1 | .8 | 2.4 | 3.6 | 10 | 40 | 4.1 | 44 | 2.8 | 1.5 | 2.9 |
| 8 | 3.3 | 2.0 | .9 | 2.4 | 3.6 | 11 | 58 | 5.3 | 41 | 2.4 | 1.4 | 2.9 |
| 9 | 3.3 | 1.9 | 2.0 | 2.4 | 3.5 | 11 | 65 | 7.1 | 38 | 2.0 | 1.5 | 2.9 |
| 10 | 3.1 | 1.9 | 6.0 | 2.4 | 3.5 | 10 | 60 | 5.7 | 30 | 1.6 | 1.4 | 2.7 |
| 11 | 3.4 | 1.9 | 6.5 | 2.4 | 3.4 | 9.0 | 51 | 5.0 | 31 | 1.6 | 1.2 | 2.3 |
| 12 | 3.3 | 1.9 | 7.0 | 2.3 | 3.3 | 8.5 | 36 | 4.6 | 23 | 1.5 | 1.1 | 2.1 |
| 13 | 3.4 | 1.8 | 6.5 | 2.3 | 3.2 | 8.0 | 20 | 4.0 | 15 | 1.5 | 1.1 | 2.0 |
| 14 | 3.4 | 1.7 | 5.0 | 2.3 | 3.2 | 8.0 | 18 | 4.4 | 46 | 2.0 | 1.0 | 2.0 |
| 15 | 3.5 | 1.6 | 4.2 | 2.2 | 3.1 | 8.5 | 26 | 6.5 | 77 | 1.9 | 1.4 | 1.8 |
| 16 | 3.3 | 1.5 | 3.7 | 2.2 | 3.1 | 11 | 38 | 6.5 | 45 | 2.3 | 2.6 | 2.0 |
| 17 | 3.1 | 1.5 | 3.5 | 2.2 | 3.0 | 15 | 45 | 7.1 | 23 | 2.3 | 2.4 | 3.4 |
| 18 | 3.0 | 1.5 | 3.3 | 2.2 | 3.0 | 25 | 39 | 12 | 13 | 2.2 | 2.2 | 13 |
| 19 | 3.1 | 1.4 | 3.1 | 2.2 | 3.0 | 32 | 24 | 9.9 | 6.8 | 1.8 | 2.8 | 29 |
| 20 | 2.8 | 1.4 | 3.0 | 2.2 | 3.0 | 30 | 16 | 7.6 | 4.4 | 1.4 | 2.4 | 34 |
| 21 | 2.8 | 1.2 | 3.0 | 2.3 | 3.0 | 17 | 25 | 7.4 | 3.7 | 1.3 | 2.5 | 22 |
| 22 | 2.9 | 1.1 | 3.0 | 2.3 | 3.1 | 12 | 22 | 5.7 | 3.5 | 1.2 | 2.6 | 22 |
| 23 | 2.9 | 1.0 | 2.9 | 2.3 | 3.1 | 9.5 | 38 | 4.4 | 7.9 | 1.2 | 3.7 | 31 |
| 24 | 3.0 | .9 | 2.8 | 2.4 | 3.2 | 9.0 | 50 | 3.9 | 6.8 | 1.1 | 6.0 | 37 |
| 25 | 3.1 | .8 | 2.8 | 2.4 | 3.4 | 8.7 | 48 | 3.6 | 4.0 | 1.2 | 6.2 | 26 |
| 26 | 2.9 | .8 | 2.7 | 2.4 | 3.7 | 10 | 59 | 3.6 | 3.1 | 1.5 | 5.4 | 16 |
| 27 | 3.1 | .7 | 2.7 | 2.5 | 3.9 | 20 | 66 | 5.1 | 2.7 | 1.5 | 4.7 | 12 |
| 28 | 3.0 | .6 | 2.6 | 2.5 | 4.0 | 33 | 56 | 7.9 | 2.0 | 1.3 | 4.0 | 8.2 |
| 29 | 3.3 | .5 | 2.6 | 2.6 | 4.2 | 35 | 35 | 7.1 | 1.8 | 1.2 | 3.6 | 5.4 |
| 30 | 3.3 | .5 | 2.6 | 2.7 | ------ | 34 | 20 | 6.2 | 16 | 1.5 | 3.1 | 4.6 |
| 31 | 3.4 | ------ | 2.6 | 3.0 | ------ | 31 | ------ | 7.9 | ------ | 1.5 | 3.1 | ------ |
| Total | 90.2 | 50.9 | 89.1 | 74.6 | 97.6 | 453.1 | 1,082 | 197.1 | 597.2 | 272.8 | 77.2 | 301.8 |
| Mean | 2.91 | 1.70 | 2.87 | 2.41 | 3.37 | 14.6 | 36.1 | 6.36 | 19.9 | 8.80 | 2.49 | 10.1 |
| Max | 3.5 | 3.7 | 7.0 | 3.0 | 4.2 | 35 | 66 | 14 | 77 | 87 | 6.2 | 37 |
| Min | 1.9 | 0.5 | 0.5 | 2.2 | 3.0 | 4.6 | 16 | 3.6 | 1.8 | 1.1 | 1.0 | 1.8 |

Cal yr 1967: Total 2,800.8 Mean 7.67 Max 290 Min 0.5
Wtr yr 1968: Total 3,383.6 Mean 9.24 Max 87 Min 0.5

Note.--No gage-height record Feb. 10 to Mar. 22.

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

Location.--Lat 47°16'55", long 92°50'05", in 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 8¾ miles upstream from St. Louis River.

Drainage area.--112 sq mi.

Records available.--September 1953 to September 1962, October 1964 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 1,260.46 ft above mean sea level, datum of 1929. Prior to Sept. 11, 1968, graphic water-stage recorder at same site and datum.

Average discharge.--13 years (1953-62, 1964-68), 90.5 cfs.

Extremes.--Maximum discharge during year, 661 cfs July 2 (gage height, 12.57 ft); minimum daily, 9.4 cfs Jan. 3-6; minimum gage height, 3.29 ft Nov. 15.
1953-62, 1964-68: 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, 12 cfs Feb. 22-26, 1965, Feb. 18-24, 1967, minimum gage height, 3.15 ft 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 winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 22 | 25 | 25 | 9.7 | 15 | 14 | 248 | 215 | 148 | 359 | 32 | 62 |
| 2 | 21 | 24 | 25 | 9.5 | 15 | 14 | 216 | 171 | 152 | 633 | 31 | 56 |
| 3 | 22 | 23 | 25 | 9.4 | 15 | 15 | 194 | 142 | 120 | 441 | 31 | 51 |
| 4 | 22 | 21 | 25 | 9.4 | 15 | 15 | 184 | 130 | 98 | 276 | 31 | 49 |
| 5 | 22 | 22 | 25 | 9.4 | 15 | 16 | 187 | 118 | 83 | 171 | 32 | 49 |
| 6 | 22 | 23 | 25 | 9.4 | 16 | 17 | 194 | 108 | 192 | 121 | 33 | 52 |
| 7 | 23 | 24 | 24 | 9.5 | 16 | 18 | 197 | 105 | 365 | 91 | 32 | 66 |
| 8 | 39 | 24 | 24 | 9.6 | 16 | 20 | 212 | 118 | 450 | 73 | 38 | 76 |
| 9 | 44 | 24 | 23 | 9.8 | 16 | 32 | 276 | 127 | 485 | 61 | 35 | 70 |
| 10 | 34 | 24 | 22 | 10 | 16 | 50 | 288 | 116 | 439 | 51 | 37 | 61 |
| 11 | 29 | 25 | 22 | 10 | 15 | 70 | 240 | 102 | 463 | 45 | 35 | 54 |
| 12 | 29 | 25 | 21 | 10 | 15 | 88 | 174 | 96 | 355 | 43 | 34 | 48 |
| 13 | 29 | 24 | 20 | 10 | 15 | 90 | 130 | 90 | 264 | 45 | 47 | 45 |
| 14 | 26 | 23 | 19 | 11 | 15 | 80 | 94 | 88 | 342 | 51 | 45 | 42 |
| 15 | 25 | 21 | 19 | 11 | 15 | 72 | 86 | 114 | 487 | 51 | 42 | 40 |
| 16 | 24 | 22 | 18 | 11 | 14 | 67 | 125 | 117 | 407 | 53 | 53 | 39 |
| 17 | 23 | 23 | 17 | 11 | 14 | 88 | 195 | 119 | 294 | 59 | 51 | 56 |
| 18 | 23 | 24 | 16 | 11 | 13 | 160 | 227 | 131 | 223 | 57 | 45 | 211 |
| 19 | 24 | 23 | 16 | 11 | 13 | 294 | 171 | 122 | 182 | 56 | 46 | 436 |
| 20 | 22 | 22 | 15 | 12 | 13 | 330 | 137 | 104 | 137 | 55 | 47 | 442 |
| 21 | 23 | 23 | 15 | 12 | 13 | 330 | 154 | 90 | 124 | 55 | 46 | 309 |
| 22 | 22 | 24 | 14 | 12 | 13 | 295 | 167 | 79 | 121 | 49 | 63 | 257 |
| 23 | 22 | 24 | 13 | 12 | 13 | 270 | 196 | 70 | 162 | 45 | 76 | 384 |
| 24 | 24 | 23 | 13 | 13 | 13 | 248 | 293 | 67 | 170 | 42 | 169 | 402 |
| 25 | 22 | 24 | 12 | 13 | 13 | 236 | 325 | 62 | 125 | 39 | 175 | 301 |
| 26 | 22 | 25 | 12 | 13 | 13 | 248 | 402 | 60 | 94 | 39 | 158 | 206 |
| 27 | 22 | 23 | 11 | 13 | 13 | 274 | 478 | 83 | 79 | 42 | 143 | 154 |
| 28 | 23 | 21 | 11 | 14 | 14 | 312 | 446 | 118 | 65 | 34 | 118 | 123 |
| 29 | 24 | 22 | 11 | 14 | 14 | 335 | 352 | 120 | 57 | 31 | 94 | 104 |
| 30 | 25 | 23 | 10 | 14 | ------ | 326 | 278 | 106 | 61 | 33 | 71 | 91 |
| 31 | 25 | ------ | 10 | 14 | ------ | 294 | ------ | 95 | ------ | 32 | 61 | ------ |
| Total | 779 | 698 | 558 | 347.7 | 416 | 4,718 | 6,866 | 3,383 | 6,744 | 3,233 | 1,951 | 4,300 |
| Mean | 25.1 | 23.3 | 18.0 | 11.2 | 14.3 | 152 | 229 | 109 | 225 | 104 | 62.9 | 143 |
| Max | 44 | 25 | 25 | 14 | 16 | 335 | 478 | 215 | 487 | 633 | 175 | 442 |
| Min | 21 | 21 | 10 | 9.4 | 13 | 14 | 86 | 60 | 57 | 31 | 31 | 39 |
| Cfsm | 0.224 | 0.208 | 0.161 | 0.100 | 0.128 | 1.36 | 2.04 | 0.973 | 2.01 | 0.929 | 0.562 | 1.28 |
| In. | 0.26 | 0.23 | 0.19 | 0.12 | 0.14 | 1.57 | 2.28 | 1.12 | 2.24 | 1.07 | 0.65 | 1.43 |

Cal yr 1967: Total 25,807 Mean 70.7 Max 1,330 Min 10 Cfsm 0.631 In. 8.57
Wtr yr 1968: Total 33,993.7 Mean 92.9 Max 633 Min 9.4 Cfsm 0.830 In. 11.29

PEAK DISCHARGE (BASE, 400 CFS)

| DATE | TIME | G.HT. | DISCHARGE | DATE | TIME | G.HT. | DISCHARGE |
|---|---|---|---|---|---|---|---|
| 3-20 | 2100 | 10.87 | 402 | 7- 2 | 0830 | 12.57 | 661 |
| 4-27 | 1200 | 10.65 | 489 | 9-20 | 0215 | 10.18 | 480 |
| 6-15 | 1600 | 10.82 | 518 | | | | |

## 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 Thomson Reservoir, and 3.2 miles upstream from Midway River.

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

Records available.--January 1908 to September 1968. Monthly discharge only for some periods published in WSP 1307. Published as "near Thomson" 1908-50.

Gage.--Digital 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. Aug. 4, 1953, to May 13, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--60 years, 2,200 cfs (unadjusted).

Extremes.--Maximum discharge during year, 11,500 cfs June 12 (gage height, 7.90 ft); minimum, 195 cfs Nov. 28 (gage height, 1.94 ft).
1908-68: Maximum daily discharge, 37,900 cfs May 9, 1950; maximum gage height, 15.8 ft, May 9, 1950, from Minnesota Highway Department (discharge uncertain); minimum discharge, 80 cfs Aug. 29, 1963; minimum daily, 109 cfs Feb. 7, 1924.

Remarks.--Records good. Diurnal fluctuation caused by powerplant upstream. Flow regulated by Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes (combined capacity, 332,160 acre-ft). Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 775 | 877 | 1,130 | 539 | 470 | 510 | 2,030 | 7,330 | 3,660 | 3,570 | 2,140 | 2,160 |
| 2 | 693 | 813 | 932 | 542 | 452 | 508 | 1,800 | 6,540 | 4,160 | 3,970 | 2,130 | 1,830 |
| 3 | 813 | 805 | 954 | 529 | 476 | 503 | 1,470 | 5,920 | 4,140 | 4,240 | 1,980 | 2,010 |
| 4 | 829 | 813 | 985 | 510 | 424 | 496 | 1,170 | 5,440 | 3,750 | 3,710 | 1,560 | 2,210 |
| 5 | 962 | 853 | 848 | 522 | 480 | 492 | 1,250 | 5,060 | 3,430 | 2,920 | 1,550 | 2,160 |
| 6 | 853 | 928 | 890 | 539 | 474 | 487 | 1,010 | 4,680 | 4,110 | 2,710 | 1,520 | 2,180 |
| 7 | 853 | 945 | 861 | 505 | 468 | 570 | 1,150 | 4,470 | 5,010 | 2,590 | 1,500 | 2,090 |
| 8 | 962 | 928 | 851 | 471 | 462 | 640 | 1,640 | 4,370 | 7,080 | 2,130 | 1,500 | 2,190 |
| 9 | 1,030 | 911 | 908 | 532 | 456 | 750 | 2,280 | 4,450 | 10,200 | 1,940 | 1,430 | 2,350 |
| 10 | 953 | 911 | 923 | 413 | 478 | 853 | 2,760 | 4,350 | 10,000 | 1,730 | 1,420 | 2,350 |
| 11 | 928 | 945 | 964 | 487 | 460 | 902 | 2,780 | 4,070 | 10,600 | 2,060 | 1,170 | 2,280 |
| 12 | 945 | 988 | 885 | 495 | 438 | 945 | 2,660 | 3,940 | 11,300 | 2,230 | 1,160 | 2,130 |
| 13 | 936 | 997 | 801 | 511 | 393 | 928 | 2,470 | 3,800 | 10,000 | 2,160 | 1,180 | 2,110 |
| 14 | 962 | 1,020 | 640 | 500 | 397 | 745 | 2,260 | 3,590 | 9,400 | 2,520 | 1,250 | 1,940 |
| 15 | 953 | 970 | 540 | 499 | 498 | 775 | 1,930 | 3,900 | 10,300 | 2,750 | 1,340 | 1,730 |
| 16 | 945 | 945 | 570 | 509 | 493 | 790 | 2,090 | 3,950 | 9,940 | 2,900 | 1,440 | 1,800 |
| 17 | 894 | 970 | 1,040 | 542 | 441 | 885 | 3,030 | 3,620 | 9,100 | 2,640 | 1,320 | 1,860 |
| 18 | 877 | 1,070 | 1,080 | 584 | 469 | 1,430 | 3,170 | 3,920 | 8,230 | 3,370 | 1,170 | 2,160 |
| 19 | 853 | 1,090 | 910 | 486 | 489 | 1,940 | 3,160 | 4,280 | 6,770 | 3,820 | 1,200 | 2,430 |
| 20 | 877 | 1,010 | 716 | 493 | 430 | 2,400 | 2,980 | 4,030 | 5,790 | 3,770 | 1,190 | 3,170 |
| 21 | 853 | 1,020 | 696 | 518 | 450 | 2,380 | 3,370 | 3,570 | 5,440 | 3,340 | 1,080 | 2,990 |
| 22 | 845 | 1,080 | 628 | 500 | 450 | 1,700 | 3,660 | 3,100 | 5,840 | 3,300 | 1,100 | 2,750 |
| 23 | 869 | 1,010 | 556 | 500 | 430 | 1,120 | 5,080 | 2,780 | 6,190 | 2,940 | 1,150 | 2,400 |
| 24 | 869 | 979 | 718 | 508 | 450 | 1,100 | 7,390 | 2,760 | 6,960 | 2,660 | 1,470 | 2,820 |
| 25 | 869 | 1,060 | 754 | 488 | 442 | 1,050 | 7,630 | 2,680 | 6,390 | 2,450 | 2,300 | 3,250 |
| 26 | 861 | 1,070 | 668 | 514 | 458 | 1,030 | 8,410 | 2,540 | 5,520 | 2,360 | 3,030 | 2,940 |
| 27 | 853 | 970 | 652 | 538 | 448 | 1,180 | 9,760 | 2,570 | 4,890 | 2,500 | 3,250 | 2,660 |
| 28 | 837 | 560 | 581 | 478 | 488 | 1,980 | 10,000 | 3,050 | 4,490 | 2,280 | 3,100 | 2,430 |
| 29 | 805 | 556 | 554 | 460 | 472 | 2,540 | 9,310 | 3,410 | 4,030 | 2,260 | 2,960 | 2,250 |
| 30 | 869 | 873 | 542 | 486 | ------ | 2,380 | 8,320 | 3,340 | 3,730 | 2,300 | 2,730 | 2,260 |
| 31 | 861 | ------ | 540 | 440 | ------ | 2,160 | ------ | 3,120 | ------ | 2,230 | 2,560 | ------ |
| Total | 27,284 | 27,967 | 24,317 | 15,638 | 13,236 | 36,169 | 116,020 | 124,630 | 200,450 | 86,350 | 53,880 | 69,880 |
| Mean | 880 | 932 | 784 | 504 | 456 | 1,167 | 3,867 | 4,020 | 6,682 | 2,785 | 1,738 | 2,329 |
| (≠) | -433 | -558 | -553 | -353 | -373 | +227 | +1,584 | +1,393 | +905 | -2 | -59 | -71 |
| Mean ≠ | 447 | 347 | 231 | 151 | 83 | 1,394 | 5,451 | 5,413 | 7,587 | 2,783 | 1,677 | 2,258 |
| Max | 1,030 | 1,090 | 1,130 | 584 | 498 | 2,540 | 10,000 | 7,330 | 11,300 | 4,240 | 3,250 | 3,250 |
| Min | 693 | 556 | 540 | 413 | 393 | 487 | 1,010 | 2,540 | 3,430 | 1,730 | 1,080 | 1,730 |
| Cfsm ≠ | .13 | .10 | .07 | .04 | .02 | .41 | 1.59 | 1.58 | 2.21 | 0.81 | 0.49 | 0.66 |
| In. ≠ | .15 | .11 | .08 | .05 | .03 | .47 | 1.77 | 1.82 | 2.47 | 0.94 | 0.56 | 0.73 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967 | Max | 14,400 | Min | 540 | Mean | 2,077 | Mean ≠ | 1,990 | Cfsm ≠ | 0.58 | In. ≠ | 7.87 |
| Wtr yr 1968 | Max | 11,300 | Min | 393 | Mean | 2,174 | Mean ≠ | 2,313 | Cfsm ≠ | 0.67 | In. ≠ | 9.18 |

≠ 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.

5-0300. Otter Tail River near Detroit Lakes, Minn.

Location.--Lat 46°50'13", long 95°41'57", 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 1968.

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

Average discharge.--31 years, 54.7 cfs (39,600 acre-ft per year).

Extremes.--Maximum discharge during year, 188 cfs May 29 (gage height, 4.18 ft); minimum, 1.5 cfs Oct. 6 (gage height, 2.67 ft).
1937-68: 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 no gage-height record and those for winter months, which are fair. Flow partly regulated by dams of Minnesota Department of Conservation on several lakes above station.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.6 | 12 | 14 | 13 | 7.4 | 2.2 | 11 | 105 | 149 | 121 | 44 | 15 |
| 2 | 1.6 | 12 | 14 | 13 | 6.8 | 2.2 | 10 | 104 | 146 | 119 | 46 | 15 |
| 3 | 1.9 | 12 | 14 | 12 | 6.2 | 2.3 | 10 | 103 | 144 | 116 | 47 | 15 |
| 4 | 2.1 | 12 | 14 | 12 | 5.6 | 2.4 | 10 | 103 | 137 | 112 | 47 | 11 |
| 5 | 1.6 | 12 | 14 | 12 | 5.1 | 2.6 | 10 | 103 | 146 | 110 | 46 | 6.2 |
| 6 | 1.5 | 12 | 14 | 12 | 4.7 | 4.7 | 11 | 105 | 151 | 106 | 47 | 6.5 |
| 7 | 2.6 | 12 | 14 | 12 | 4.3 | 6.8 | 18 | 107 | 151 | 104 | 48 | 7.2 |
| 8 | 3.0 | 13 | 14 | 12 | 3.9 | 22 | 30 | 113 | 154 | 102 | 54 | 7.5 |
| 9 | 3.0 | 13 | 14 | 12 | 3.7 | 51 | 40 | 121 | 149 | 97 | 53 | 7.2 |
| 10 | 2.8 | 14 | 14 | 12 | 3.4 | 53 | 42 | 132 | 149 | 80 | 51 | 6.8 |
| 11 | 2.3 | 14 | 17 | 13 | 3.2 | 40 | 41 | 141 | 149 | 71 | 48 | 6.5 |
| 12 | 2.1 | 13 | 20 | 13 | 3.0 | 31 | 39 | 152 | 141 | 80 | 45 | 5.9 |
| 13 | 2.1 | 13 | 21 | 13 | 2.8 | 25 | 37 | 159 | 137 | 80 | 41 | 5.9 |
| 14 | 2.3 | 13 | 21 | 13 | 2.7 | 23 | 35 | 166 | 146 | 85 | 39 | 6.5 |
| 15 | 2.3 | 13 | 21 | 13 | 2.5 | 18 | 34 | 170 | 144 | 88 | 41 | 5.9 |
| 16 | 2.3 | 14 | 21 | 13 | 2.4 | 16 | 33 | 171 | 144 | 88 | 41 | 7.5 |
| 17 | 2.1 | 14 | 21 | 14 | 2.3 | 15 | 32 | 173 | 139 | 83 | 39 | 9.3 |
| 18 | 2.1 | 14 | 22 | 14 | 2.2 | 15 | 31 | 176 | 137 | 82 | 37 | 9.3 |
| 19 | 2.1 | 15 | 22 | 14 | 2.1 | 14 | 31 | 178 | 132 | 78 | 37 | 9.3 |
| 20 | 1.9 | 15 | 22 | 14 | 2.0 | 14 | 32 | 180 | 132 | 75 | 29 | 8.9 |
| 21 | 2.3 | 15 | 21 | 14 | 2.0 | 14 | 34 | 180 | 156 | 69 | 23 | 7.8 |
| 22 | 3.0 | 15 | 21 | 14 | 2.0 | 14 | 40 | 180 | 161 | 66 | 25 | 15 |
| 23 | 4.0 | 15 | 20 | 14 | 2.1 | 14 | 51 | 181 | 156 | 65 | 26 | 18 |
| 24 | 4.7 | 15 | 19 | 14 | 2.1 | 13 | 62 | 183 | 149 | 58 | 25 | 15 |
| 25 | 5.3 | 15 | 18 | 13 | 2.1 | 13 | 76 | 178 | 141 | 52 | 24 | 14 |
| 26 | 6.5 | 14 | 18 | 12 | 2.2 | 13 | 92 | 170 | 134 | 56 | 23 | 13 |
| 27 | 7.8 | 16 | 17 | 11 | 2.2 | 13 | 107 | 160 | 129 | 58 | 22 | 12 |
| 28 | 8.6 | 17 | 16 | 11 | 2.2 | 12 | 112 | 154 | 125 | 57 | 20 | 11 |
| 29 | 10 | 15 | 15 | 9.7 | 2.2 | 12 | 110 | 172 | 119 | 57 | 18 | 9.7 |
| 30 | 11 | 15 | 15 | 8.9 | ------ | 11 | 108 | 174 | 123 | 45 | 18 | 9.3 |
| 31 | 11 | ------ | 14 | 8.1 | ------ | 11 | ------ | 156 | ------ | 42 | 17 | ------ |
| Total | 117.5 | 414 | 542 | 385.7 | 95.4 | 500.2 | 1,329 | 4,650 | 4,270 | 2,502 | 1,121 | 297.2 |
| Mean | 3.79 | 13.8 | 17.5 | 12.4 | 3.29 | 16.1 | 44.3 | 150 | 142 | 80.7 | 36.2 | 9.91 |
| Max | 11 | 17 | 22 | 14 | 7.4 | 53 | 112 | 183 | 161 | 121 | 54 | 18 |
| Min | 1.5 | 12 | 14 | 8.1 | 2.0 | 2.2 | 10 | 103 | 119 | 42 | 17 | 5.9 |
| Ac-ft | 233 | 821 | 1,080 | 765 | 189 | 992 | 2,640 | 9,220 | 8,470 | 4,960 | 2,220 | 589 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 26,359.9 | Mean | 72.2 | Max | 264 | Min | 1.0 | Ac-ft | 52,280 |
| Wtr yr 1968: | Total | 16,224 | Mean | 44.3 | Max | 183 | Min | 1.5 | Ac-ft | 32,180 |

05-0339. Pelican River at Detroit Lakes, Minn.

Location.--Lat 46°48'37", long 95°49'42", in SW¼ sec.35, T.139 N., R.41 W., on left bank 60 ft upstream from culvert, ½ mile upstream from Detroit Lake, at Detroit Lakes, Becker County.

Records available.--July to September 1968.

Gage.--Staff gage read once daily. Altitude of gage is 1,337 ft (from topographic map).

Extremes.--Maximum daily discharge during period July to September, 5.8 cfs July 23, 24; maximum gage height observed, 2.20 ft July 24; minimum daily discharge, 1.0 cfs Sept. 15.

Remarks.--Records fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

Cooperation.--Gage-height record furnished by Pelican River Watershed District.

DISCHARGE, IN CUBIC FEET PER SECOND, PERIOD JULY TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 4.6 | 1.5 |
| 2 | | | | | | | | | | | 3.5 | 1.4 |
| 3 | | | | | | | | | | | 3.2 | 1.4 |
| 4 | | | | | | | | | | | 2.7 | 1.4 |
| 5 | | | | | | | | | | | 2.4 | 1.3 |
| 6 | | | | | | | | | | | 2.2 | 1.4 |
| 7 | | | | | | | | | | | 2.5 | 1.4 |
| 8 | | | | | | | | | | | 2.6 | 1.4 |
| 9 | | | | | | | | | | | 2.6 | 1.4 |
| 10 | | | | | | | | | | | 2.2 | 1.4 |
| 11 | | | | | | | | | | | 2.2 | 1.3 |
| 12 | | | | | | | | | | | 2.0 | 1.3 |
| 13 | | | | | | | | | | | 1.9 | 1.1 |
| 14 | | | | | | | | | | | 1.8 | 1.1 |
| 15 | | | | | | | | | | | 2.6 | 1.0 |
| 16 | | | | | | | | | | | 2.2 | 1.4 |
| 17 | | | | | | | | | | | 2.1 | 1.5 |
| 18 | | | | | | | | | | | 2.6 | 1.4 |
| 19 | | | | | | | | | | | 2.2 | 1.4 |
| 20 | | | | | | | | | | | 2.2 | 1.4 |
| 21 | | | | | | | | | | | 2.1 | 1.4 |
| 22 | | | | | | | | | | | 2.1 | 1.9 |
| 23 | | | | | | | | | | 5.8 | 2.1 | 1.9 |
| 24 | | | | | | | | | | 5.8 | 2.0 | 1.7 |
| 25 | | | | | | | | | | 5.6 | 2.0 | 1.7 |
| 26 | | | | | | | | | | 5.6 | 2.0 | 1.8 |
| 27 | | | | | | | | | | 4.2 | 1.8 | 1.8 |
| 28 | | | | | | | | | | 4.1 | 1.7 | 1.9 |
| 29 | | | | | | | | | | 5.0 | 1.5 | 2.0 |
| 30 | | | | | ------ | | | | | 5.1 | 1.8 | 2.1 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 5.1 | 1.7 | ------ |
| Total | | | | | | | | | | | 71.1 | 45.1 |
| Mean | | | | | | | | | | | 2.29 | 1.50 |
| Max | | | | | | | | | | | 4.6 | 2.1 |
| Min | | | | | | | | | | | 1.5 | 1.0 |
| Ac-ft | | | | | | | | | | | 141 | 89 |

GPO 817-490-3

5-0341. Pelican River at Detroit Lake Outlet near Detroit Lakes, Minn.

Location.--Lat 46°47'22", long 95°52'00", on line between secs. 4 and 9, T.138 N., R.41 W., on left wingwall of remains of old dam at outlet of Detroit Lake, 60 ft upstream from bridge on County Highway 22 and 2½ miles southwest of Detroit Lakes.

Records available.--July to September 1968.

Gage.--Staff gage read once daily. Datum of gage is 1,330.01 ft above mean sea level, datum of 1929.

Extremes.--Maximum discharge during period July to September, 15 cfs July 23 (gage height, 4.11 ft); no flow Sept. 6, 9-16, 25, 31.

Remarks.--Records fair.

Cooperation.--Gage readings furnished by Pelican River Watershed District.

DISCHARGE, IN CUBIC FEET PER SECOND, JULY TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 9.2 | 0.5 |
| 2 | | | | | | | | | | | 8.5 | .6 |
| 3 | | | | | | | | | | | 8.5 | .4 |
| 4 | | | | | | | | | | | 7.5 | .1 |
| 5 | | | | | | | | | | | 7.5 | .1 |
| 6 | | | | | | | | | | | 7.8 | 0 |
| 7 | | | | | | | | | | | 7.8 | .1 |
| 8 | | | | | | | | | | | 8.8 | .1 |
| 9 | | | | | | | | | | | 7.8 | 0 |
| 10 | | | | | | | | | | | 7.5 | 0 |
| 11 | | | | | | | | | | | 6.2 | 0 |
| 12 | | | | | | | | | | | 4.8 | 0 |
| 13 | | | | | | | | | | | 3.8 | 0 |
| 14 | | | | | | | | | | | 4.3 | 0 |
| 15 | | | | | | | | | | | 4.8 | 0 |
| 16 | | | | | | | | | | | 4.3 | 0 |
| 17 | | | | | | | | | | | 3.8 | .1 |
| 18 | | | | | | | | | | | 4.8 | .1 |
| 19 | | | | | | | | | | | 4.0 | .1 |
| 20 | | | | | | | | | | | 3.8 | .1 |
| 21 | | | | | | | | | | | 4.0 | .2 |
| 22 | | | | | | | | | | | 3.5 | .7 |
| 23 | | | | | | | | | | 15 | 3.5 | .7 |
| 24 | | | | | | | | | | 14 | 3.5 | .1 |
| 25 | | | | | | | | | | 14 | 3.3 | 0 |
| 26 | | | | | | | | | | 13 | 3.0 | .1 |
| 27 | | | | | | | | | | 12 | 2.2 | .1 |
| 28 | | | | | | | | | | 11 | 1.5 | .1 |
| 29 | | | | | | | | | | 11 | .9 | .1 |
| 30 | | | | | ------ | | | | | 10 | .9 | 0 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 8.8 | .9 | ------ |
| Total | | | | | | | | | | | 152.7 | 4.40 |
| Mean | | | | | | | | | | | 4.92 | 0.147 |
| Max | | | | | | | | | | | 9.2 | 0.7 |
| Min | | | | | | | | | | | 0.9 | 0 |
| Ac-ft | | | | | | | | | | | 303 | 9 |

## 5-0351. Long Lake Outlet near Detroit Lakes, Minn.

Location.--Lat 46°48'33", long 95°53'26", in SE¼ sec.32, T.139 N., R.41 W., on right downstream wingwall of abandoned Minnesota Conservation Department dam, 200 ft downstream from Long Lake, 2,500 ft upstream from St. Clair Lake and 2¼ miles west of Detroit Lakes, Becker County.

Records available.--July to September 1968.

Gage.--Staff gage read once daily. Altitude of gage is 1,350 ft (from topographic map).

Extremes.--Maximum daily discharge during period, 1.2 cfs July 23-25 (gage height, 3.68 ft); no flow for several days.

Remarks.--Records fair. Flow affected by natural storage in Long Lake.

Cooperation.--Gage-height record furnished by Pelican River Watershed District.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 0.5 | 0.1 |
| 2 | | | | | | | | | | | .2 | .2 |
| 3 | | | | | | | | | | | .2 | .2 |
| 4 | | | | | | | | | | | .2 | .2 |
| 5 | | | | | | | | | | | .2 | .1 |
| 6 | | | | | | | | | | | .2 | .1 |
| 7 | | | | | | | | | | | .2 | .1 |
| 8 | | | | | | | | | | | .5 | .1 |
| 9 | | | | | | | | | | | .4 | 0 |
| 10 | | | | | | | | | | | .3 | 0 |
| 11 | | | | | | | | | | | .2 | .1 |
| 12 | | | | | | | | | | | .2 | 0 |
| 13 | | | | | | | | | | | .2 | 0 |
| 14 | | | | | | | | | | | 0 | 0 |
| 15 | | | | | | | | | | | .2 | 0 |
| 16 | | | | | | | | | | | .2 | .1 |
| 17 | | | | | | | | | | | 0 | .2 |
| 18 | | | | | | | | | | | .1 | .2 |
| 19 | | | | | | | | | | | .1 | .2 |
| 20 | | | | | | | | | | | .1 | .2 |
| 21 | | | | | | | | | | | .1 | .2 |
| 22 | | | | | | | | | | | .2 | .4 |
| 23 | | | | | | | | | | 1.2 | .2 | .5 |
| 24 | | | | | | | | | | 1.2 | .2 | .5 |
| 25 | | | | | | | | | | 1.2 | 0 | .2 |
| 26 | | | | | | | | | | 1.0 | 0 | .2 |
| 27 | | | | | | | | | | .4 | .2 | .2 |
| 28 | | | | | | | | | | .7 | .2 | .2 |
| 29 | | | | | | | | | | .6 | .1 | .1 |
| 30 | | | | | ------ | | | | | .6 | .2 | .1 |
| 31 | | ------ | | | ------ | | ------ | | ------ | .5 | .2 | ------ |
| Total | | | | | | | | | | | 5.8 | 4.7 |
| Mean | | | | | | | | | | | 0.19 | 0.16 |
| Max | | | | | | | | | | | 0.5 | 0.5 |
| Min | | | | | | | | | | | 0 | 0 |
| Ac-ft | | | | | | | | | | | 12 | 9.3 |

5-0352. West Branch County Ditch No. 14 near Detroit Lakes, Minn.

Location.--Lat 46°48'48", long 95°52'20", in NW¼ sec.33, T.139 N., R.41 W., 1,700 ft upstream from East Branch County Ditch No. 14, 1,900 ft upstream from St. Clair Lake and 1½ miles west of Detroit Lakes, Becker County.

Records available.--July to September 1968.

Gage.--Staff gage read once-daily.

Extremes.--Maximum discharge during period, 3.6 cfs Sept. 3 (gage height, 3.46 ft, backwater from aquatic growth); no flow Aug. 27-29.

Remarks.--Records poor.

Cooperation.--Gage-height record furnished by Pelican River Watershed District.

Discharge in cubic feet per second, August to September 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 0.3 | 0.1 |
| 2 | | | | | | | | | | | .3 | .3 |
| 3 | | | | | | | | | | | .3 | 1.9 |
| 4 | | | | | | | | | | | .2 | .1 |
| 5 | | | | | | | | | | | .3 | .1 |
| 6 | | | | | | | | | | | .3 | .1 |
| 7 | | | | | | | | | | | .3 | .1 |
| 8 | | | | | | | | | | | .5 | .1 |
| 9 | | | | | | | | | | | .3 | .1 |
| 10 | | | | | | | | | | | .2 | .1 |
| 11 | | | | | | | | | | | .2 | .1 |
| 12 | | | | | | | | | | | .2 | .1 |
| 13 | | | | | | | | | | | .1 | .1 |
| 14 | | | | | | | | | | | .1 | .1 |
| 15 | | | | | | | | | | | .2 | .1 |
| 16 | | | | | | | | | | | .1 | .2 |
| 17 | | | | | | | | | | | .1 | .2 |
| 18 | | | | | | | | | | | .1 | .2 |
| 19 | | | | | | | | | | | .1 | .3 |
| 20 | | | | | | | | | | | .1 | .2 |
| 21 | | | | | | | | | | | .1 | .2 |
| 22 | | | | | | | | | | | .1 | .7 |
| 23 | | | | | | | | | | 0.3 | .1 | .7 |
| 24 | | | | | | | | | | .2 | .1 | .6 |
| 25 | | | | | | | | | | .2 | .1 | .5 |
| 26 | | | | | | | | | | .3 | .1 | .4 |
| 27 | | | | | | | | | | .3 | 0 | .3 |
| 28 | | | | | | | | | | .3 | 0 | .2 |
| 29 | | | | | | | | | | .3 | 0 | .2 |
| 30 | | | | | ------ | | | | | .3 | .1 | .2 |
| 31 | | ------ | | | ------ | | ------ | | ------ | .3 | .1 | ------ |
| Total | | | | | | | | | | | 5.1 | 8.6 |
| Mean | | | | | | | | | | | 0.16 | 0.29 |
| Max | | | | | | | | | | | 0.5 | 1.9 |
| Min | | | | | | | | | | | 0 | 0.1 |
| Ac-ft | | | | | | | | | | | 10 | 17 |

5-0353. East Branch County Ditch No. 14 near Detroit Lakes, Minn.

Location.--Lat 46°48'35", long 95°52'23", in SW¼ sec.33, T.139 N., R.41 W., on left bank near downstream end of culvert on U.S. Highway 59, approximately 1,000 ft upstream from St. Clair Lake, and 1.5 miles west of city of Detroit Lakes.

Records available.--July to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 1,333.96 ft above mean sea level, datum of 1929.

Extremes.--Maximum discharge during period, 2.0 cfs July 22 (gage height, 2.87 ft); maximum gage height, 2.90 ft July 20; minimum daily discharge, 0.50 cfs Sept. 11.

Remarks.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR JULY TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 0.78 | 0.85 |
| 2 | | | | | | | | | | | .77 | .86 |
| 3 | | | | | | | | | | | .77 | .86 |
| 4 | | | | | | | | | | | .72 | .84 |
| 5 | | | | | | | | | | | .73 | .93 |
| 6 | | | | | | | | | | | .79 | .98 |
| 7 | | | | | | | | | | | .77 | .92 |
| 8 | | | | | | | | | | | .93 | .73 |
| 9 | | | | | | | | | | 1.1 | .88 | .61 |
| 10 | | | | | | | | | | 1.0 | .77 | .53 |
| 11 | | | | | | | | | | 1.0 | .68 | .5 |
| 12 | | | | | | | | | | .99 | .64 | .72 |
| 13 | | | | | | | | | | 1.0 | .63 | .82 |
| 14 | | | | | | | | | | 1.0 | .57 | .89 |
| 15 | | | | | | | | | | 1.1 | .70 | .90 |
| 16 | | | | | | | | | | 1.1 | .81 | 1.1 |
| 17 | | | | | | | | | | 1.1 | .74 | .97 |
| 18 | | | | | | | | | | 1.1 | .74 | .86 |
| 19 | | | | | | | | | | 1.1 | .84 | .78 |
| 20 | | | | | | | | | | 1.1 | .78 | .87 |
| 21 | | | | | | | | | | 1.1 | .78 | 1.2 |
| 22 | | | | | | | | | | 1.3 | .79 | 1.9 |
| 23 | | | | | | | | | | 1.1 | .79 | 1.4 |
| 24 | | | | | | | | | | .98 | .80 | .98 |
| 25 | | | | | | | | | | .94 | .75 | .84 |
| 26 | | | | | | | | | | .94 | .75 | .89 |
| 27 | | | | | | | | | | .93 | .76 | .83 |
| 28 | | | | | | | | | | .83 | .82 | .81 |
| 29 | | | | | | | | | | .80 | .84 | .80 |
| 30 | | | | | ------ | | | | | .82 | .89 | .79 |
| 31 | | ------ | | | ------ | | ------ | | ------ | .82 | .90 | ------ |
| Total | | | | | | | | | | | 23.91 | 26.96 |
| Mean | | | | | | | | | | | 0.77 | 0.90 |
| Max | | | | | | | | | | | .93 | 1.9 |
| Min | | | | | | | | | | | .57 | .50 |
| Ac-ft | | | | | | | | | | | 47 | 53 |

5-0354. St. Clair Lake near Detroit Lakes, Minn.

Location.--Lat 46°47'52", long 95°52'49", in NE¼ sec.5, T.138 N., R.41 W., at south end of lake, 2,000 ft south at St. Clair Lake outlet and 2¾ miles southwest of Detroit Lakes, Becker County.

Records available.--July to September 1968.

Gage.--Staff gage read once daily. Datum of gage is 1,330.653 ft above mean sea level, datum of 1929 (Minnesota Highway Department benchmark).

Extremes.--Maximum gage height observed during period, 4.91 ft July 23; minimum observed, 4.22 ft Sept. 15.

Remarks.--Water level subject to fluctuation caused by wind action.

Cooperation.--Gage reading furnished by Pelican River Watershed District.

Gage height, in feet, July to September 1968

| | | |
|---|---|---|
| July 31 ..... 4.66 | Aug. 31 ..... 4.37 | Sept. 30 ..... 4.66 |

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

## 5-0355. St. Clair Lake Outlet near Detroit Lakes, Minn.

Location.--Lat 46°48'03", long 95°52'37", in NW¼ sec.4, T.138 N., R.41 W. near right bank 25 ft upstream from culvert on U.S. Highway 59, 500 ft downstream from outlet of St. Clair Lake, 1 mile upstream from Pelican River and 2 miles southwest of Detroit Lakes.

Records available.--July to September 1968.

Gage.--Staff gage read once daily. Datum of gage is 1,333.35 ft above mean sea level, datum of 1929.

Extremes.--Maximum daily discharge during period July to September, 6.0 cfs July 23, 26; minimum daily, 1.3 cfs, Sept. 15.

Remarks.--Record fair.

Cooperation.--Gage reading furnished by Pelican River Watershed District.

DISCHARGE, IN CUBIC FEET PER SECOND, PERIOD JULY TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 4.3 | 2.3 |
| 2 | | | | | | | | | | | 4.1 | 2.3 |
| 3 | | | | | | | | | | | 3.8 | 2.0 |
| 4 | | | | | | | | | | | 4.1 | 2.0 |
| 5 | | | | | | | | | | | 3.6 | 2.0 |
| 6 | | | | | | | | | | | 3.6 | 2.0 |
| 7 | | | | | | | | | | | 3.4 | 2.1 |
| 8 | | | | | | | | | | | 3.8 | 2.0 |
| 9 | | | | | | | | | | | 3.8 | 1.6 |
| 10 | | | | | | | | | | | 3.6 | 1.5 |
| 11 | | | | | | | | | | | 3.5 | 1.5 |
| 12 | | | | | | | | | | | 3.3 | 1.5 |
| 13 | | | | | | | | | | | 2.6 | 1.5 |
| 14 | | | | | | | | | | | 2.4 | 1.4 |
| 15 | | | | | | | | | | | 2.5 | 1.3 |
| 16 | | | | | | | | | | | 2.7 | 1.5 |
| 17 | | | | | | | | | | | 2.5 | 1.8 |
| 18 | | | | | | | | | | | 2.5 | 1.7 |
| 19 | | | | | | | | | | | 2.7 | 1.7 |
| 20 | | | | | | | | | | | 2.7 | 1.7 |
| 21 | | | | | | | | | | | 2.6 | 1.5 |
| 22 | | | | | | | | | | | 2.6 | 2.5 |
| 23 | | | | | | | | | | 6.0 | 2.6 | 2.6 |
| 24 | | | | | | | | | | 5.6 | 2.6 | 1.8 |
| 25 | | | | | | | | | | 5.3 | 2.1 | 1.6 |
| 26 | | | | | | | | | | 6.0 | 2.2 | 1.5 |
| 27 | | | | | | | | | | 5.0 | 2.0 | 1.5 |
| 28 | | | | | | | | | | 4.6 | 2.0 | 1.5 |
| 29 | | | | | | | | | | 4.4 | 2.0 | 1.4 |
| 30 | | | | | ------ | | | | | 5.3 | 2.2 | 1.5 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 4.5 | 2.0 | ------ |
| Total | | | | | | | | | | | 90.4 | 52.8 |
| Mean | | | | | | | | | | | 2.92 | 1.76 |
| Max | | | | | | | | | | | 4.3 | 2.6 |
| Min | | | | | | | | | | | 2.0 | 1.3 |
| Ac-ft | | | | | | | | | | | 17.9 | 10.5 |

5-0356. Pelican River at Muskrat Lake Outlet near Detroit Lakes, Minn.

Location.--Lat 46°46'55", long 95°52'57", in SE¼ sec.8, T.138 N., R.41 W., on downstream side of dam between Muskrat Lake and Sallie Lake at State Fish Hatchery, 3 miles southwest of Detroit Lakes.

Records available.--July to September 1968.

Gage.--Boat lock: Staff gage read once daily. Datum of gage is 1,327.63 ft above mean sea level, datum of 1929. Spillway: Staff gage read once daily. Datum of gage is 1,328.98 ft above mean sea level, datum of 1929.

Extremes.--Maximum daily discharge during period July to September, 22 cfs July 23; no flow on many days.

Remarks.--Records fair. These records include flow in boat lock, spillway, and small bypass channel around gages.

Cooperation.--Gage readings and record of stoplog changes in dam furnished by Pelican River Watershed District.

DISCHARGE, IN CUBIC FEET PER SECOND, PERIOD JULY TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 12 | 0 |
| 2 | | | | | | | | | | | 12 | 0 |
| 3 | | | | | | | | | | | 12 | 0 |
| 4 | | | | | | | | | | | 12 | 0 |
| 5 | | | | | | | | | | | 12 | 0 |
| 6 | | | | | | | | | | | 12 | 0 |
| 7 | | | | | | | | | | | 12 | 0 |
| 8 | | | | | | | | | | | 12 | 0 |
| 9 | | | | | | | | | | | 11 | 0 |
| 10 | | | | | | | | | | | 11 | 0 |
| 11 | | | | | | | | | | | 11 | 0 |
| 12 | | | | | | | | | | | 11 | 0 |
| 13 | | | | | | | | | | | 11 | 0 |
| 14 | | | | | | | | | | | 11 | 0 |
| 15 | | | | | | | | | | | 11 | 0 |
| 16 | | | | | | | | | | | 11 | 0 |
| 17 | | | | | | | | | | | 11 | 0 |
| 18 | | | | | | | | | | | 11 | 0 |
| 19 | | | | | | | | | | | 11 | 0 |
| 20 | | | | | | | | | | | 11 | 0 |
| 21 | | | | | | | | | | | 11 | 0 |
| 22 | | | | | | | | | | | 11 | 0 |
| 23 | | | | | | | | | | 22 | 11 | .3 |
| 24 | | | | | | | | | | 19 | 13 | .3 |
| 25 | | | | | | | | | | 19 | 11 | .2 |
| 26 | | | | | | | | | | 18 | 11 | .2 |
| 27 | | | | | | | | | | 17 | 11 | .1 |
| 28 | | | | | | | | | | 14 | 11 | 0 |
| 29 | | | | | | | | | | 12 | 0 | 0 |
| 30 | | | | | ------ | | | | | 12 | 0 | 0 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 12 | 0 | ------ |
| Total | | | | | | | | | | | 318 | 1.1 |
| Mean | | | | | | | | | | | 10.3 | 0.037 |
| Max | | | | | | | | | | | 13 | 0.3 |
| Min | | | | | | | | | | | 0 | 0 |
| Ac-ft | | | | | | | | | | | 631 | 2 |

5-0371. Pelican River at Sallie Lake Outlet, near Detroit Lakes, Minn.

Location.--Lat 46°45'27", long 95°53'57", in NW¼ sec.20, T.138 N., R.41 W., Becker County, on left bank near downstream end of culvert on County Highway 22, 250 ft downstream from Sallie Lake, 800 ft upstream from Minnesota Department of Conservation dam and 5 miles southwest of city of Detroit Lakes.

Records available.--July to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 1,327.58 ft above mean sea level, datum of 1929.

Extremes.--Maximum daily discharge during period, 20 cfs July 25; minimum daily, 0.88 cfs Sept. 14.

Remarks.--Records good.

DISCHARGE, IN CUBIC FEET PER SECOND, July to September 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 11 | 2.9 |
| 2 | | | | | | | | | | | 10 | 2.5 |
| 3 | | | | | | | | | | | 10 | 2.0 |
| 4 | | | | | | | | | | | 9.8 | 1.8 |
| 5 | | | | | | | | | | | 10 | 1.5 |
| 6 | | | | | | | | | | | 11 | 1.5 |
| 7 | | | | | | | | | | | 11 | 1.5 |
| 8 | | | | | | | | | | | 14 | 1.5 |
| 9 | | | | | | | | | | | 13 | 1.5 |
| 10 | | | | | | | | | | | 12 | 1.4 |
| 11 | | | | | | | | | | | 10 | 1.3 |
| 12 | | | | | | | | | | | 8.9 | 1.2 |
| 13 | | | | | | | | | | | 8.0 | 1.0 |
| 14 | | | | | | | | | | | 7.1 | .88 |
| 15 | | | | | | | | | | | 8.2 | 1.0 |
| 16 | | | | | | | | | | | 9.2 | 1.6 |
| 17 | | | | | | | | | | | 8.5 | 2.1 |
| 18 | | | | | | | | | | | 7.5 | 2.2 |
| 19 | | | | | | | | | | | 8.3 | 2.2 |
| 20 | | | | | | | | | | | 7.5 | 2.0 |
| 21 | | | | | | | | | | | 6.7 | 2.0 |
| 22 | | | | | | | | | | | 6.5 | 3.9 |
| 23 | | | | | | | | | | | 6.6 | 4.2 |
| 24 | | | | | | | | | | | 6.6 | 3.6 |
| 25 | | | | | | | | | | 20 | 5.5 | 3.0 |
| 26 | | | | | | | | | | 19 | 4.9 | 2.6 |
| 27 | | | | | | | | | | 19 | 4.1 | 2.6 |
| 28 | | | | | | | | | | 16 | 4.0 | 2.5 |
| 29 | | | | | | | | | | 14 | 3.6 | 2.2 |
| 30 | | | | | ------ | | | | | 13 | 4.0 | 2.0 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 14 | 3.9 | ------ |
| Total | | | | | | | | | | | 251.4 | 62.18 |
| Mean | | | | | | | | | | | 8.11 | 2.07 |
| Max | | | | | | | | | | | 14 | 4.2 |
| Min | | | | | | | | | | | 3.6 | 0.88 |

5-0391. Pelican River at Lake Melissa Outlet near Detroit Lakes, Minn.

Location.--Lat 46°43'50", long 95°53'40", in NW¼ sec.32, T.138 N., R.41 W., on left bank 50 ft downstream from Lake Melissa, 400 ft upstream from culvert on county road and 6 miles southwest of Detroit Lakes.

Records available.--July to September 1968.

Gage.--Staff gage read once daily. Altitude of gage is 1,330 ft (from topographic map).

Extremes.--Maximum discharge during period July to September, 35 cfs July 23 (gage height, 1.85 ft); minimum daily, 5.0 cfs Sept. 10.

Remarks.--Records fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report. Flow affected by storage in lakes above station.

Cooperation.--Gage readings furnished by Pelican River Watershed District.

DISCHARGE, IN CUBIC FEET PER SECOND, PERIOD JULY TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | 25 | 7.2 |
| 2 | | | | | | | | | | | 24 | 6.2 |
| 3 | | | | | | | | | | | 24 | 6.0 |
| 4 | | | | | | | | | | | 23 | 5.4 |
| 5 | | | | | | | | | | | 23 | 5.7 |
| 6 | | | | | | | | | | | 22 | 5.7 |
| 7 | | | | | | | | | | | 22 | 5.7 |
| 8 | | | | | | | | | | | 24 | 5.7 |
| 9 | | | | | | | | | | | 23 | 5.4 |
| 10 | | | | | | | | | | | 20 | 5.0 |
| 11 | | | | | | | | | | | 18 | 5.4 |
| 12 | | | | | | | | | | | 15 | 5.7 |
| 13 | | | | | | | | | | | 14 | 6.0 |
| 14 | | | | | | | | | | | 13 | 6.4 |
| 15 | | | | | | | | | | | 12 | 6.2 |
| 16 | | | | | | | | | | | 13 | 8.7 |
| 17 | | | | | | | | | | | 12 | 10 |
| 18 | | | | | | | | | | | 12 | 11 |
| 19 | | | | | | | | | | | 12 | 12 |
| 20 | | | | | | | | | | | 12 | 11 |
| 21 | | | | | | | | | | | 10 | 11 |
| 22 | | | | | | | | | | | 11 | 15 |
| 23 | | | | | | | | | | 35 | 9.8 | 16 |
| 24 | | | | | | | | | | 34 | 11 | 15 |
| 25 | | | | | | | | | | 33 | 9.0 | 15 |
| 26 | | | | | | | | | | 31 | 8.2 | 14 |
| 27 | | | | | | | | | | 31 | 7.2 | 14 |
| 28 | | | | | | | | | | 33 | 7.2 | 13 |
| 29 | | | | | | | | | | 28 | 7.0 | 13 |
| 30 | | | | | ------ | | | | | 27 | 7.7 | 12 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 27 | 7.4 | ------ |
| Total | | | | | | | | | | | 458.5 | 278.4 |
| Mean | | | | | | | | | | | 14.8 | 9.28 |
| Max | | | | | | | | | | | 25 | 16 |
| Min | | | | | | | | | | | 7.0 | 5.4 |
| Ac-ft | | | | | | | | | | | - | - |

## 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 left bank 990 ft downstream from bridge on U. S. Highway 52, 3 miles northwest of Fergus Falls and 7½ miles upstream from mouth.

Drainage area.--482 sq mi.

Records available.--June 1909 to December 1912, July 1942 to September 1968.

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

Average discharge.--29 years (1909-12, 1942-68), 76.6 cfs (55,460 acre-ft per year).

Extremes.--Maximum discharge during year, 194 cfs May 15 (gage height, 4.05 ft); maximum gage height recorded, 6.88 ft Feb. 20 (backwater from ice); minimum daily discharge, 1.1 cfs Feb. 17-23.
1909-12, 1942-68: Maximum discharge, 756 cfs Mar. 29, 1943 (gage height, 8.53 ft, present datum); maximum gage height, 8.99 ft Mar. 21, 1966 (backwater from ice); no flow on many days in 1946, 1949-50.

Remarks.--Records good except those for winter months, which are fair. Records of suspended-sediment loads for water year 1968 published in Part 2 of this report. Flow affected by storage in lakes above station.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 22 | 15 | 14 | 12 | 2.1 | 1.4 | 78 | 129 | 145 | 111 | 67 | 50 |
| 2 | 21 | 15 | 14 | 11 | 2.1 | 1.5 | 73 | 126 | 138 | 108 | 67 | 50 |
| 3 | 20 | 15 | 15 | 10 | 2.1 | 1.6 | 78 | 123 | 138 | 108 | 64 | 49 |
| 4 | 20 | 14 | 16 | 8.0 | 2.0 | 1.8 | 80 | 120 | 135 | 104 | 63 | 49 |
| 5 | 19 | 14 | 17 | 6.8 | 2.0 | 2.0 | 72 | 117 | 132 | 101 | 61 | 46 |
| 6 | 19 | 14 | 19 | 6.2 | 1.9 | 2.3 | 97 | 117 | 142 | 97 | 63 | 48 |
| 7 | 19 | 14 | 21 | 5.7 | 1.8 | 2.8 | 108 | 117 | 149 | 94 | 61 | 48 |
| 8 | 19 | 14 | 20 | 5.2 | 1.7 | 3.0 | 138 | 129 | 160 | 99 | 59 | 48 |
| 9 | 19 | 15 | 20 | 4.6 | 1.6 | 2.9 | 142 | 138 | 160 | 90 | 57 | 46 |
| 10 | 19 | 15 | 19 | 4.3 | 1.6 | 2.6 | 120 | 142 | 174 | 78 | 57 | 45 |
| 11 | 20 | 15 | 19 | 4.1 | 1.5 | 2.4 | 108 | 145 | 182 | 73 | 57 | 45 |
| 12 | 19 | 15 | 18 | 3.9 | 1.4 | 2.5 | 106 | 152 | 178 | 86 | 56 | 44 |
| 13 | 18 | 15 | 18 | 3.7 | 1.3 | 3.2 | 104 | 149 | 178 | 90 | 54 | 42 |
| 14 | 18 | 14 | 19 | 3.6 | 1.3 | 4.7 | 104 | 170 | 167 | 111 | 54 | 42 |
| 15 | 18 | 14 | 20 | 3.5 | 1.2 | 6.2 | 101 | 186 | 149 | 106 | 56 | 41 |
| 16 | 18 | 14 | 24 | 3.3 | 1.2 | 8.8 | 101 | 190 | 142 | 97 | 56 | 48 |
| 17 | 17 | 14 | 26 | 3.1 | 1.1 | 11 | 101 | 186 | 135 | 94 | 54 | 46 |
| 18 | 16 | 14 | 25 | 3.0 | 1.1 | 12 | 101 | 182 | 126 | 94 | 56 | 46 |
| 19 | 16 | 15 | 25 | 2.8 | 1.1 | 10 | 99 | 163 | 120 | 92 | 56 | 48 |
| 20 | 15 | 15 | 25 | 2.7 | 1.1 | 9.0 | 106 | 156 | 117 | 92 | 56 | 49 |
| 21 | 16 | 15 | 24 | 2.6 | 1.1 | 8.0 | 120 | 152 | 132 | 97 | 53 | 49 |
| 22 | 14 | 15 | 23 | 2.5 | 1.1 | 7.2 | 132 | 145 | 145 | 94 | 53 | 67 |
| 23 | 14 | 16 | 21 | 2.4 | 1.1 | 7.0 | 160 | 142 | 142 | 92 | 53 | 78 |
| 24 | 14 | 16 | 19 | 2.3 | 1.2 | 7.6 | 174 | 138 | 135 | 90 | 52 | 73 |
| 25 | 14 | 16 | 18 | 2.3 | 1.2 | 9.5 | 163 | 138 | 129 | 88 | 51 | 70 |
| 26 | 14 | 15 | 17 | 2.2 | 1.3 | 17 | 142 | 138 | 126 | 84 | 50 | 68 |
| 27 | 14 | 15 | 16 | 2.2 | 1.3 | 40 | 132 | 142 | 120 | 82 | 48 | 64 |
| 28 | 14 | 15 | 15 | 2.2 | 1.4 | 65 | 135 | 142 | 117 | 77 | 46 | 60 |
| 29 | 14 | 14 | 14 | 2.1 | 1.4 | 78 | 135 | 145 | 111 | 73 | 46 | 56 |
| 30 | 14 | 14 | 13 | 2.1 | ------ | 82 | 129 | 142 | 114 | 72 | 51 | 52 |
| 31 | 15 | ------ | 13 | 2.1 | ------ | 80 | ------ | 149 | ------ | 68 | 50 | ------ |
| Total | 529 | 441 | 587 | 132.5 | 42.3 | 493.0 | 3,439 | 4,510 | 4,238 | 2,842 | 1,727 | 1,567 |
| Mean | 17.1 | 14.7 | 18.9 | 4.27 | 1.46 | 15.9 | 115 | 145 | 141 | 91.7 | 55.7 | 52.2 |
| Max | 22 | 16 | 26 | 12 | 2.1 | 82 | 174 | 190 | 182 | 111 | 67 | 78 |
| Min | 14 | 14 | 13 | 2.1 | 1.1 | 1.4 | 72 | 117 | 111 | 68 | 46 | 41 |
| Ac-ft | 1,050 | 875 | 1,160 | 263 | 84 | 978 | 6,820 | 8,940 | 8,410 | 5,640 | 3,420 | 3,110 |

Cal yr 1967: Total 40,230 Mean 110 Max 600 Min 13 Ac-ft 79,800
Wtr yr 1968: Total 20,547.8 Mean 56.1 Max 190 Min 1.1 Ac-ft 40,760

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 1968.

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, 14,030 acre-ft Sept. 25 (elevation, 1,069.94 ft); minimum, 985 acre-ft Mar. 23 (elevation, 1,047.90 ft).
1953-68: Maximum contents, 16,920 acre-ft June 17, 1962, May 23, 1966 (elevation, 1,072.38 ft); minimum (after initial filling), 844 acre-ft Aug. 26, 27, 1953 (elevation, 1,046.96 ft).

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

Cooperation.--Records furnished by Corps of Engineers.

Month-end elevation and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 1,069.72 | 13,790 | - |
| Oct. 31 | 1,067.93 | 11,940 | -1,850 |
| Nov. 30 | 1,065.34 | 9,670 | -2,270 |
| Dec. 31 | 1,060.07 | 5,800 | -3,870 |
| Calendar year 1967 | - | - | -1,550 |
| Jan. 31 | 1,054.26 | 2,900 | -2,900 |
| Feb. 29 | 1,052.42 | 2,200 | - 700 |
| Mar. 31 | 1,050.33 | 1,550 | - 650 |
| Apr. 30 | 1,050.72 | 1,670 | + 120 |
| May 31 | 1,050.42 | 1,580 | - 90 |
| June 30 | 1,050.95 | 1,740 | + 160 |
| July 31 | 1,055.73 | 3,530 | +1,790 |
| Aug. 31 | 1,064.57 | 9,060 | +5,530 |
| Sept. 30 | 1,069.58 | 13,640 | +4,580 |
| Water year 1967-68 | - | - | - 150 |

## 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 1968. 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.--38 years, 282 cfs (204,200 acre-ft per year).

Extremes.--Maximum discharge during year, 714 cfs May 14 (gage height, 3.37 ft); minimum, 107 cfs Sept. 9, 10, 11 (gage height, 2.32 ft).
1930-68: 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.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 173 | 201 | 168 | 149 | 133 | 161 | 322 | 507 | 599 | 536 | 300 | 173 |
| 2 | 191 | 201 | 164 | 149 | 133 | 161 | 283 | 559 | 593 | 530 | 235 | 173 |
| 3 | 201 | 196 | 163 | 149 | 133 | 161 | 272 | 553 | 593 | 530 | 240 | 153 |
| 4 | 201 | 196 | 162 | 149 | 137 | 161 | 283 | 519 | 587 | 507 | 246 | 130 |
| 5 | 205 | 196 | 161 | 145 | 137 | 161 | 283 | 496 | 553 | 440 | 251 | 133 |
| 6 | 205 | 196 | 160 | 145 | 137 | 157 | 283 | 496 | 536 | 423 | 251 | 133 |
| 7 | 205 | 196 | 160 | 145 | 137 | 182 | 278 | 457 | 542 | 446 | 251 | 133 |
| 8 | 201 | 191 | 159 | 141 | 141 | 278 | 289 | 502 | 542 | 457 | 256 | 133 |
| 9 | 201 | 187 | 159 | 141 | 141 | 322 | 289 | 587 | 547 | 457 | 261 | 123 |
| 10 | 201 | 187 | 158 | 137 | 141 | 311 | 390 | 616 | 559 | 440 | 256 | 107 |
| 11 | 201 | 187 | 158 | 137 | 141 | 306 | 440 | 616 | 627 | 395 | 256 | 107 |
| 12 | 201 | 182 | 158 | 141 | 145 | 300 | 451 | 610 | 656 | 390 | 261 | 110 |
| 13 | 201 | 182 | 157 | 141 | 145 | 300 | 446 | 616 | 662 | 390 | 261 | 110 |
| 14 | 201 | 182 | 157 | 141 | 145 | 246 | 446 | 674 | 656 | 395 | 256 | 110 |
| 15 | 201 | 182 | 157 | 137 | 149 | 240 | 395 | 709 | 645 | 401 | 261 | 110 |
| 16 | 201 | 182 | 155 | 137 | 153 | 267 | 317 | 703 | 616 | 412 | 261 | 116 |
| 17 | 205 | 178 | 155 | 137 | 153 | 294 | 300 | 697 | 553 | 423 | 261 | 120 |
| 18 | 201 | 178 | 154 | 133 | 141 | 328 | 362 | 685 | 530 | 429 | 251 | 113 |
| 19 | 201 | 178 | 153 | 133 | 141 | 350 | 401 | 674 | 542 | 440 | 251 | 113 |
| 20 | 205 | 178 | 153 | 133 | 153 | 339 | 401 | 622 | 547 | 446 | 240 | 133 |
| 21 | 205 | 178 | 153 | 133 | 157 | 334 | 423 | 593 | 553 | 451 | 224 | 161 |
| 22 | 201 | 178 | 153 | 130 | 161 | 289 | 446 | 599 | 564 | 423 | 201 | 205 |
| 23 | 205 | 178 | 153 | 126 | 161 | 256 | 451 | 604 | 559 | 418 | 205 | 219 |
| 24 | 205 | 178 | 153 | 126 | 165 | 235 | 479 | 610 | 570 | 423 | 210 | 224 |
| 25 | 205 | 178 | 153 | 126 | 165 | 251 | 547 | 610 | 587 | 429 | 214 | 261 |
| 26 | 205 | 178 | 153 | 126 | 161 | 256 | 576 | 610 | 582 | 423 | 210 | 283 |
| 27 | 205 | 177 | 153 | 126 | 161 | 267 | 564 | 610 | 547 | 434 | 191 | 283 |
| 28 | 205 | 176 | 153 | 126 | 161 | 306 | 553 | 610 | 536 | 429 | 169 | 283 |
| 29 | 205 | 174 | 149 | 130 | 161 | 322 | 496 | 604 | 530 | 372 | 165 | 283 |
| 30 | 201 | 172 | 149 | 130 | ------ | 328 | 457 | 599 | 536 | 339 | 173 | 283 |
| 31 | 201 | ------ | 153 | 133 | ------ | 339 | ------ | 593 | ------ | 345 | 173 | ------ |
| Total | 6,245 | 5,523 | 4,846 | 4,232 | 4,289 | 8,208 | 11,923 | 18,540 | 17,249 | 13,373 | 7,241 | 5,018 |
| Mean | 201 | 184 | 156 | 137 | 148 | 265 | 397 | 598 | 575 | 431 | 234 | 167 |
| Max | 205 | 201 | 168 | 149 | 165 | 350 | 576 | 709 | 662 | 536 | 300 | 283 |
| Min | 173 | 172 | 149 | 126 | 133 | 157 | 272 | 457 | 530 | 339 | 165 | 107 |
| Ac-ft | 12,390 | 10,950 | 9,610 | 8,390 | 8,510 | 16,280 | 23,650 | 36,770 | 34,210 | 26,520 | 14,360 | 9,950 |

Cal yr 1967: Total 168,858 Mean 463 Max 1,120 Min 35 Ac-ft 334,900
Wtr yr 1968: Total 106,687 Mean 291 Max 709 Min 107 Ac-ft 211,600

## 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 1968.

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

Average discharge.--27 years, 82.0 cfs (59,360 acre-ft per year).

Extremes.--Maximum discharge during year, 58 cfs Apr. 23 (gage height, 3.94 ft); no flow for many days. 1941-68: Maximum discharge, 1,620 cfs Aug. 6, 1962 (gage height, 11.41 ft, present datum); no flow at times in most years.

Remarks.--Records good except those for winter months, 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).

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.4 | 0.3 | | | | 0 | 0.1 | 8.6 | 10 | 1.9 | 0.2 | 0 |
| 2 | .4 | .2 | | | | 0 | .2 | 8.6 | 6.8 | 1.6 | .2 | 0 |
| 3 | .4 | .2 | | | | 0 | 1.3 | 7.9 | 5.6 | 1.5 | .2 | 0 |
| 4 | .3 | .1 | | | | 0 | 1.6 | 6.8 | 4.8 | 1.3 | .1 | 0 |
| 5 | .4 | .1 | | | | 0 | .9 | 5.6 | 3.6 | 1.4 | .1 | 0 |
| 6 | .4 | 0 | | | | 0 | .7 | 5.6 | 3.4 | 1.5 | 0 | 0 |
| 7 | .4 | 0 | | | | 0 | .8 | 9.4 | 3.0 | 1.3 | .1 | 0 |
| 8 | .4 | 0 | | | | 0 | 2.4 | 12 | 4.2 | 1.2 | 0 | .1 |
| 9 | .5 | 0 | | | | 0 | 12 | 12 | 5.4 | 1.0 | 0 | 0 |
| 10 | .4 | 0 | | | | 0 | 9.0 | 10 | 4.0 | .8 | .1 | 0 |
| 11 | .4 | 0 | | | | 0 | 8.3 | 9.4 | 3.8 | .7 | .2 | 0 |
| 12 | .4 | 0 | | | | 0 | 8.3 | 9.0 | 3.6 | .6 | .1 | 0 |
| 13 | .6 | 0 | | | | 0 | 4.8 | 8.3 | 3.6 | .5 | .1 | .1 |
| 14 | .6 | 0 | | | | 0 | 3.4 | 9.4 | 4.8 | .5 | .1 | 0 |
| 15 | .6 | 0 | | | | 0 | 2.4 | 9.0 | 4.0 | .4 | .1 | .1 |
| 16 | .6 | 0 | | | | 0 | 2.6 | 9.8 | 3.8 | .4 | .1 | .1 |
| 17 | .6 | 0 | | | | 0 | 2.0 | 7.9 | 3.4 | .4 | 0 | .1 |
| 18 | .4 | 0 | | | | 0 | 1.6 | 8.6 | 3.6 | .4 | .1 | .1 |
| 19 | .2 | 0 | | | | 0 | 1.3 | 8.6 | 3.0 | .4 | 0 | .1 |
| 20 | .1 | 0 | | | | 0 | 1.5 | 7.2 | 2.2 | .4 | 0 | 0 |
| 21 | .1 | 0 | | | | 0 | 2.1 | 6.4 | 2.8 | .3 | 0 | 0 |
| 22 | 0 | 0 | | | | 0 | 10 | 5.8 | 2.1 | .3 | 0 | .1 |
| 23 | 0 | 0 | | | | 0 | 38 | 5.8 | 2.0 | .2 | 0 | 0 |
| 24 | .1 | 0 | | | | 0 | 29 | 5.4 | 1.9 | .3 | 0 | .1 |
| 25 | .2 | 0 | | | | 0 | 21 | 5.1 | 2.2 | .4 | 0 | 0 |
| 26 | .3 | 0 | | | | 0 | 16 | 5.6 | 2.4 | .4 | 0 | .3 |
| 27 | .2 | 0 | | | | 0.1 | 14 | 5.6 | 1.9 | .3 | 0 | .1 |
| 28 | .2 | 0 | | | | .1 | 12 | 5.1 | 1.5 | .4 | 0 | 0 |
| 29 | .2 | 0 | | | ------ | .1 | 11 | 4.8 | 1.5 | .3 | 0 | 0 |
| 30 | .4 | 0 | | | ------ | .1 | 10 | 4.6 | 1.7 | .2 | 0 | 0 |
| 31 | .4 | ------ | | | ------ | .1 | ------- | 7.5 | ------- | .2 | 0 | ------- |
| Total | 10.6 | 0.9 | 0 | 0 | 0 | 0.5 | 228.3 | 235.4 | 106.6 | 21.5 | 1.8 | 1.3 |
| Mean | 0.34 | 0.03 | 0 | 0 | 0 | 0.02 | 7.61 | 7.59 | 3.55 | 0.69 | 0.06 | 0.04 |
| Max | 0.6 | 0.3 | 0 | 0 | 0 | 0.1 | 38 | 12 | 10 | 1.9 | 0.2 | 0.3 |
| Min | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 4.6 | 1.5 | 0.2 | 0 | 0 |
| Ac-ft | 21 | 1.8 | 0 | 0 | 0 | 1.0 | 453 | 467 | 211 | 43 | 3.6 | 2.6 |

Cal yr 1967: Total 17,420 Mean 47.7 Max 480 Min 0 Ac-ft 34,550
Wtr yr 1968: Total 606.9 Mean 1.66 Max 38 Min 0 Ac-ft 1,200

## 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 W., on left bank in Wahpeton, 800 ft downstream from confluence of Bois de Sioux and Otter Tail Rivers and at mile 548.6.

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

Records available.--April 1942 to September 1968. Gage-height records collected in this vicinity since 1917 are contained in reports of U.S. Weather Bureau.

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

Average discharge.--25 years (1943-68), 529 cfs (383,000 acre-ft per year).

Extremes.--Maximum discharge during year, 708 cfs May 18 (gage height, 4.95 ft); maximum gage height, 4.97 ft Mar. 19 (backwater from ice); minimum discharge, 39 cfs Nov. 27 (gage height, 2.29 ft).
1942-68: Maximum discharge, 7,130 cfs Apr. 12, 1952 (gage height, 14.99 ft); minimum, 8 cfs Aug. 25, 1961 (gage height, 2.26 ft); minimum gage height, 2.05 ft Sept. 17, 18, 1967.
Maximum stage known, 17.0 ft in spring of 1897.

Remarks.--Records good. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft above mean sea level, adjustment of 1912); Lake Traverse (capacity, 137,000 acre-ft), available for flood control; numerous other controlled lakes and ponds, and several powerplants.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 215 | 184 | 215 | 150 | 125 | 175 | 333 | 462 | 550 | 550 | 314 | 182 |
| 2 | 210 | 184 | 215 | 150 | 120 | 175 | 322 | 462 | 564 | 550 | 278 | 186 |
| 3 | 206 | 184 | 210 | 145 | 120 | 180 | 291 | 504 | 568 | 540 | 217 | 182 |
| 4 | 199 | 184 | 200 | 155 | 125 | 180 | 204 | 515 | 557 | 526 | 210 | 166 |
| 5 | 197 | 184 | 195 | 160 | 120 | 175 | 369 | 504 | 560 | 512 | 228 | 137 |
| 6 | 199 | 182 | 190 | 145 | 125 | 175 | 336 | 498 | 560 | 465 | 224 | 139 |
| 7 | 208 | 153 | 190 | 150 | 125 | 170 | 296 | 487 | 515 | 426 | 226 | 151 |
| 8 | 206 | 188 | 190 | 150 | 125 | 180 | 281 | 456 | 522 | 432 | 224 | 141 |
| 9 | 202 | 186 | 190 | 140 | 120 | 190 | 304 | 468 | 532 | 444 | 224 | 130 |
| 10 | 195 | 184 | 190 | 130 | 120 | 250 | 372 | 546 | 560 | 453 | 230 | 123 |
| 11 | 193 | 182 | 185 | 125 | 130 | 340 | 429 | 606 | 585 | 438 | 235 | 88 |
| 12 | 191 | 182 | 185 | 125 | 135 | 360 | 480 | 602 | 616 | 405 | 233 | 77 |
| 13 | 184 | 184 | 175 | 125 | 120 | 360 | 522 | 599 | 672 | 384 | 230 | 72 |
| 14 | 191 | 184 | 150 | 125 | 125 | 350 | 498 | 613 | 680 | 393 | 235 | 75 |
| 15 | 188 | 166 | 150 | 130 | 125 | 330 | 471 | 627 | 672 | 393 | 260 | 84 |
| 16 | 186 | 195 | 180 | 140 | 125 | 310 | 417 | 672 | 666 | 390 | 260 | 115 |
| 17 | 184 | 195 | 190 | 140 | 120 | 380 | 336 | 694 | 648 | 399 | 250 | 132 |
| 18 | 188 | 184 | 190 | 140 | 125 | 480 | 304 | 700 | 596 | 408 | 255 | 107 |
| 19 | 188 | 178 | 165 | 145 | 150 | 500 | 348 | 683 | 550 | 411 | 245 | 88 |
| 20 | 182 | 186 | 165 | 145 | 160 | 460 | 399 | 662 | 550 | 423 | 247 | 71 |
| 21 | 191 | 199 | 170 | 145 | 175 | 330 | 402 | 630 | 564 | 417 | 240 | 99 |
| 22 | 186 | 147 | 160 | 145 | 175 | 400 | 426 | 578 | 585 | 429 | 224 | 202 |
| 23 | 184 | 117 | 180 | 145 | 175 | 375 | 490 | 564 | 585 | 414 | 204 | 219 |
| 24 | 182 | 184 | 180 | 130 | 175 | 465 | 490 | 568 | 578 | 393 | 193 | 233 |
| 25 | 188 | 240 | 185 | 130 | 175 | 450 | 518 | 571 | 588 | 393 | 202 | 233 |
| 26 | 193 | 141 | 165 | 140 | 175 | 325 | 568 | 574 | 606 | 396 | 204 | 255 |
| 27 | 188 | 92 | 150 | 130 | 175 | 281 | 599 | 568 | 602 | 405 | 200 | 286 |
| 28 | 184 | 110 | 145 | 115 | 175 | 275 | 582 | 571 | 578 | 405 | 191 | 291 |
| 29 | 193 | 200 | 150 | 125 | ---170 | 309 | 550 | 574 | 546 | 402 | 174 | 291 |
| 30 | 191 | 210 | 170 | 110 | ------ | 322 | 508 | 564 | 568 | 366 | 193 | 288 |
| 31 | 186 | ------ | 140 | 125 | ------ | 325 | ------ | 568 | ------ | 309 | 188 | ------ |
| TOTAL | 5,978 | 5,289 | 5,515 | 4,255 | 4,110 | 9,577 | 12,445 | 17,690 | 17,523 | 13,271 | 7,038 | 4,843 |
| MEAN | 193 | 176 | 178 | 137 | 142 | 309 | 415 | 571 | 584 | 428 | 227 | 161 |
| MAX | 215 | 240 | 215 | 160 | 175 | 500 | 599 | 700 | 680 | 550 | 314 | 291 |
| MIN | 182 | 92 | 140 | 110 | 120 | 170 | 204 | 456 | 515 | 309 | 174 | 71 |
| AC-FT | 11,860 | 10,490 | 10,940 | 8,440 | 8,150 | 19,000 | 24,680 | 35,090 | 34,760 | 26,320 | 13,960 | 9,610 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CAL YR 1967: | TOTAL | 212,887 | MEAN | 583 | MAX | 2,470 | MIN | 15 | AC-FT | 422,300 |
| WAT YR 1968: | TOTAL | 107,534 | MEAN | 294 | MAX | 700 | MIN | 71 | AC-FT | 213,300 |

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 waterplant on 4th St. S. in Fargo, 25 miles upstream from mouth of Sheyenne River and at mile 453.0.

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

Records available.--May 1901 to September 1968. Published as "at Moorhead, Minn." 1901. Monthly discharge only for some periods, published in WSP 1308.

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

Average discharge (unadjusted).--67 years, 525 cfs (380,100 acre-ft per year); median of yearly mean discharges, 430 cfs (311,000 acre-ft per year).

Extremes.--Maximum discharge during year, 788 cfs Apr. 30 (gage height, 14.71 ft); maximum gage height, 14.77 ft May 20 (backwater from debris); minimum discharge, 88 cfs Sept. 16 (gage height, 13.52 ft).
1901-68: Maximum discharge, 16,300 cfs Apr. 15, 16, 1952; maximum gage height, 28.79 ft Apr. 16, 1952, datum then in use; no flow for many days in each year for period 1932-41.
Maximum stage known, 40.1 ft Apr. 7, 1897, site and datum in use prior to 1914 (discharge, 25,000 cfs).

Remarks.--Records good. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft above mean sea level, adjustment of 1912); 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 cities of Fargo and Moorhead. Records of chemical analyses for water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 133 | 190 | 148 | 160 | 107 | 177 | 362 | 740 | 620 | 684 | 356 | 177 |
| 2 | 141 | 190 | 169 | 152 | 101 | 177 | 362 | 700 | 620 | 644 | 299 | 177 |
| 3 | 152 | 190 | 194 | 141 | 111 | 177 | 374 | 628 | 612 | 612 | 283 | 169 |
| 4 | 141 | 186 | 203 | 152 | 114 | 208 | 380 | 612 | 605 | 582 | 272 | 165 |
| 5 | 133 | 186 | 194 | 165 | 118 | 203 | 374 | 636 | 620 | 582 | 218 | 169 |
| 6 | 141 | 186 | 190 | 165 | 122 | 203 | 304 | 644 | 628 | 545 | 194 | 173 |
| 7 | 160 | 160 | 181 | 165 | 114 | 222 | 316 | 676 | 636 | 517 | 203 | 165 |
| 8 | 165 | 129 | 181 | 165 | 114 | 251 | 398 | 644 | 636 | 456 | 236 | 144 |
| 9 | 173 | 129 | 181 | 152 | 114 | 257 | 398 | 620 | 598 | 423 | 203 | 144 |
| 10 | 169 | 186 | 186 | 156 | 114 | 257 | 392 | 590 | 590 | 404 | 199 | 148 |
| 11 | 169 | 222 | 190 | 156 | 114 | 262 | 462 | 598 | 598 | 398 | 199 | 144 |
| 12 | 165 | 190 | 190 | 152 | 114 | 277 | 552 | 628 | 636 | 410 | 199 | 137 |
| 13 | 169 | 173 | 186 | 144 | 118 | 333 | 590 | 676 | 660 | 410 | 203 | 129 |
| 14 | 173 | 160 | 177 | 141 | 125 | 392 | 620 | 740 | 700 | 398 | 213 | 107 |
| 15 | 177 | 173 | 165 | 133 | 129 | 423 | 628 | 740 | 740 | 374 | 208 | 94 |
| 16 | 177 | 177 | 141 | 125 | 129 | 430 | 617 | 724 | 756 | 380 | 232 | 98 |
| 17 | 177 | 169 | 137 | 125 | 129 | 442 | 582 | 732 | 748 | 380 | 236 | 111 |
| 18 | 173 | 177 | 144 | 129 | 141 | 468 | 517 | 756 | 732 | 362 | 251 | 114 |
| 19 | 177 | 190 | 156 | 129 | 144 | 510 | 436 | 772 | 708 | 362 | 232 | 125 |
| 20 | 169 | 181 | 160 | 125 | 137 | 482 | 416 | 772 | 660 | 374 | 232 | 129 |
| 21 | 173 | 160 | 169 | 129 | 137 | 524 | 398 | 764 | 605 | 380 | 232 | 122 |
| 22 | 169 | 169 | 148 | 125 | 148 | 545 | 442 | 740 | 598 | 386 | 222 | 144 |
| 23 | 181 | 129 | 152 | 125 | 152 | 482 | 510 | 708 | 605 | 386 | 232 | 122 |
| 24 | 190 | 125 | 144 | 125 | 173 | 416 | 524 | 668 | 612 | 398 | 213 | 148 |
| 25 | 194 | 118 | 137 | 118 | 177 | 436 | 582 | 628 | 620 | 386 | 203 | 181 |
| 26 | 190 | 133 | 148 | 114 | 186 | 496 | 620 | 620 | 605 | 374 | 190 | 208 |
| 27 | 190 | 122 | 160 | 104 | 186 | 560 | 660 | 620 | 598 | 368 | 190 | 208 |
| 28 | 208 | 101 | 152 | 104 | 181 | 575 | 716 | 636 | 598 | 374 | 190 | 222 |
| 29 | 203 | 98 | 152 | 101 | 177 | 582 | 764 | 636 | 590 | 380 | 186 | 257 |
| 30 | 194 | 133 | 144 | 98 | ------ | 449 | 780 | 628 | 660 | 380 | 199 | 272 |
| 31 | 194 | ------ | 152 | 98 | ------ | 368 | ------ | 636 | ------ | 380 | 181 | ------ |
| TOTAL | 5,320 | 4,832 | 5,131 | 4,173 | 3,926 | 11,584 | 15,076 | 20,912 | 19,194 | 13,489 | 6,906 | 4,703 |
| MEAN | 172 | 161 | 166 | 135 | 135 | 374 | 503 | 675 | 640 | 435 | 223 | 157 |
| MAX | 208 | 222 | 203 | 165 | 186 | 582 | 780 | 772 | 756 | 684 | 356 | 272 |
| MIN | 133 | 98 | 137 | 98 | 101 | 177 | 304 | 590 | 590 | 362 | 181 | 94 |
| AC-FT | 10,550 | 9,580 | 10,180 | 8,280 | 7,790 | 22,980 | 29,900 | 41,480 | 38,070 | 26,760 | 13,700 | 9,330 |
| + | 716 | 688 | 703 | 707 | 668 | 670 | 659 | 728 | 784 | 1,020 | 1,030 | 736 |

ADJUSTED FOR DIVERSION IN ACRE-FEET AT FARGO AND MOORHEAD

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEAN | 183 | 173 | 177 | 146 | 147 | 385 | 514 | 686 | 653 | 452 | 240 | 169 |
| AC-FT | 11,270 | 10,880 | 10,880 | 8,990 | 8,460 | 23,650 | 30,560 | 42,210 | 38,850 | 27,780 | 14,730 | 10,070 |

| | | OBSERVED | | | | | | | ADJUSTED | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CAL YR 1967: | TOTAL | 293,749 | MEAN | 805 | MAX | 5,760 | MIN | 26 | AC-FT | 582,600 | MEAN | 818 | AC-FT | 592,200 |
| WAT YR 1968: | TOTAL | 115,246 | MEAN | 315 | MAX | 780 | MIN | 94 | AC-FT | 228,600 | MEAN | 327 | AC-FT | 237,700 |

+ Diversion in acre-ft by the cities of Fargo and Moorhead.

## 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 1968.

Gage.--Digital 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. Jan. 29, 1953 to Aug. 29, 1968, graphic water-stage recorder at same site and datum.

Average discharge.--23 years, 72.8 cfs (52,710 acre-ft per year).

Extremes.--Maximum discharge during year, 202 cfs Mar. 28 (gage height, 4.97 ft); maximum gage height, 6.16 ft Mar. 23 (backwater from ice); minimum daily discharge, 12 cfs Jan. 18-27, Feb. 5-27.
1945-68: Maximum discharge, 1,590 cfs Aug. 5, 1955 (gage height, 9.31 ft); minimum observed, 6.8 cfs July 28, 1945; minimum gage height, 2.55 ft Sept. 5, 1961.
Maximum stage known, about 11.3 ft, present datum, spring of 1921, from information by local resident.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1967 to September 1968

| Day | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 18 | 16 | 17 | 13 | 13 | 68 | 99 | 56 | 64 | 23 | 17 |
| 2 | 17 | 18 | 16 | 16 | 13 | 14 | 59 | 91 | 54 | 69 | 22 | 17 |
| 3 | 17 | 19 | 17 | 16 | 13 | 15 | 55 | 83 | 50 | 56 | 20 | 16 |
| 4 | 18 | 19 | 17 | 16 | 13 | 16 | 40 | 78 | 48 | 47 | 20 | 16 |
| 5 | 17 | 19 | 17 | 16 | 12 | 18 | 35 | 74 | 45 | 44 | 20 | 16 |
| 6 | 16 | 19 | 17 | 16 | 12 | 21 | 41 | 71 | 45 | 47 | 20 | 16 |
| 7 | 18 | 19 | 18 | 15 | 12 | 24 | 77 | 73 | 48 | 43 | 19 | 17 |
| 8 | 19 | 20 | 18 | 15 | 12 | 25 | 116 | 78 | 59 | 37 | 23 | 17 |
| 9 | 21 | 20 | 18 | 15 | 12 | 25 | 136 | 82 | 70 | 34 | 20 | 17 |
| 10 | 21 | 20 | 19 | 14 | 12 | 24 | 132 | 80 | 82 | 32 | 20 | 17 |
| 11 | 20 | 20 | 20 | 14 | 12 | 24 | 115 | 94 | 106 | 30 | 19 | 16 |
| 12 | 19 | 20 | 20 | 14 | 12 | 25 | 102 | 114 | 98 | 29 | 20 | 15 |
| 13 | 19 | 20 | 21 | 13 | 12 | 26 | 89 | 112 | 84 | 31 | 20 | 15 |
| 14 | 18 | 20 | 21 | 13 | 12 | 30 | 79 | 121 | 84 | 41 | 18 | 15 |
| 15 | 18 | 19 | 21 | 13 | 12 | 35 | 75 | 124 | 80 | 41 | 20 | 14 |
| 16 | 17 | 19 | 21 | 13 | 12 | 38 | 72 | 107 | 75 | 51 | 19 | 33 |
| 17 | 17 | 18 | 20 | 13 | 12 | 39 | 69 | 97 | 68 | 68 | 20 | 29 |
| 18 | 17 | 18 | 20 | 12 | 12 | 40 | 64 | 93 | 60 | 59 | 20 | 25 |
| 19 | 16 | 18 | 20 | 12 | 12 | 41 | 60 | 92 | 56 | 46 | 20 | 24 |
| 20 | 16 | .8 | 20 | 12 | 12 | 40 | 62 | 87 | 51 | 46 | 19 | 23 |
| 21 | 16 | 18 | 20 | 12 | 12 | 43 | 71 | 81 | 48 | 38 | 19 | 21 |
| 22 | 17 | 18 | 20 | 12 | 12 | 50 | 79 | 78 | 50 | 35 | 18 | 34 |
| 23 | 16 | 18 | 19 | 12 | 12 | 75 | 95 | 73 | 51 | 32 | 21 | 50 |
| 24 | 17 | 18 | 19 | 12 | 12 | 125 | 116 | 69 | 52 | 30 | 20 | 50 |
| 25 | 15 | 18 | 18 | 12 | 12 | 92 | 122 | 66 | 50 | 29 | 19 | 38 |
| 26 | 15 | 17 | 18 | 12 | 12 | 104 | 116 | 65 | 46 | 28 | 18 | 31 |
| 27 | 15 | 16 | 18 | 12 | 12 | 162 | 112 | 64 | 42 | 27 | 17 | 26 |
| 28 | 15 | 16 | 17 | 13 | 13 | 189 | 118 | 62 | 39 | 26 | 16 | 24 |
| 29 | 17 | 16 | 17 | 13 | 13 | 123 | 114 | 61 | 36 | 24 | 16 | 22 |
| 30 | 17 | 16 | 17 | 13 | - - - - - | 92 | 107 | 60 | 43 | 23 | 18 | 21 |
| 31 | 18 | - - - - - | 17 | 13 | - - - - - | 78 | - - - - - | 59 | - - - - - | 23 | 19 | - - - - - |
| Total | 536 | 552 | 577 | 421 | 354 | 1,666 | 2,596 | 2,588 | 1,776 | 1,230 | 603 | 692 |
| Mean | 17.3 | 18.4 | 18.6 | 13.6 | 12.2 | 53.7 | 86.5 | 83.5 | 59.2 | 39.7 | 19.5 | 23.1 |
| Max | 21 | 20 | 21 | 17 | 13 | 189 | 136 | 124 | 106 | 69 | 23 | 50 |
| Min | 15 | 16 | 16 | 12 | 12 | 13 | 35 | 59 | 36 | 23 | 16 | 14 |
| Ac-ft | 1,060 | 1,090 | 1,140 | 906 | 714 | 3,300 | 5,150 | 5,130 | 3,520 | 2,440 | 1,200 | 1,370 |

Cal yr 1967: Total 29,593 Mean 81.1 Max 633 Min 12 Ac-ft 58,700
Wtr yr 1968: Total 13,591 Mean 37.1 Max 189 Min 12 Ac-ft 26,960

GPO 817-490-4

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 Whisky Creek and 1 mile east of Sabin.

Drainage area.--522 sq mi.

Records available.--March 1945 to September 1968.

Gage.--Wire-weight gage read once or twice daily and crest-stage gage. 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. Aug. 17, 1948, to July 26, 1965, chain gage at same site and datum.

Average discharge.--23 years, 55.6 cfs (40,250 acre-ft per year).

Extremes.--Maximum discharge during year, 230 cfs Apr. 10 (gage height, 8.25 ft, from graph based on gage readings); no flow Jan. 28 to Mar. 4.
1945-68: Maximum discharge, 6,340 cfs June 9, 1962 (gage height, 17.04 ft); no flow for many days in most years.

Remarks.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.8 | 20 | 8.5 | 0.3 | | 0 | 44 | 70 | 19 | 44 | 3.1 | 4.4 |
| 2 | .7 | 26 | 8.5 | .3 | | 0 | 39 | 60 | 17 | 33 | 2.9 | 5.0 |
| 3 | 2.8 | 25 | 8.2 | .2 | | 0 | 34 | 48 | 15 | 29 | 2.9 | 5.7 |
| 4 | 12 | 21 | 8.2 | .2 | | 0 | 29 | 39 | 14 | 25 | 3.1 | 6.5 |
| 5 | 12 | 19 | 8.0 | .2 | | .1 | 19 | 35 | 12 | 21 | 3.1 | 5.8 |
| 6 | 1.0 | 16 | 7.6 | .2 | | .2 | 6.7 | 33 | 11 | 18 | 2.9 | 5.2 |
| 7 | 1.8 | 15 | 7.2 | .2 | | .4 | 4.9 | 33 | 9.3 | 15 | 2.8 | 5.7 |
| 8 | 3.2 | 15 | 6.7 | .2 | | 1.0 | 14 | 34 | 15 | 13 | 3.4 | 5.9 |
| 9 | 4.4 | 16 | 6.2 | .2 | | 2.0 | 98 | 38 | 20 | 10 | 3.1 | 6.2 |
| 10 | 10 | 18 | 5.8 | .2 | | 4.5 | 220 | 44 | 27 | 9.5 | 4.0 | 6.4 |
| 11 | 9.3 | 19 | 5.2 | .2 | | 4.8 | 188 | 53 | 35 | 8.4 | 4.2 | 6.0 |
| 12 | 6.4 | 19 | 4.8 | .2 | | 5.0 | 136 | 56 | 65 | 7.0 | 4.4 | 5.7 |
| 13 | 11 | 19 | 4.5 | .1 | | 4.5 | 98 | 60 | 74 | 6.4 | 4.1 | 6.9 |
| 14 | 13 | 18 | 4.0 | .1 | | 4.0 | 76 | 78 | 61 | 5.8 | 3.5 | 6.7 |
| 15 | 13 | 17 | 3.5 | .1 | | 3.7 | 66 | 80 | 53 | 5.2 | 2.7 | 6.5 |
| 16 | 13 | 16 | 3.1 | .1 | | 4.0 | 54 | 78 | 50 | 15 | 3.0 | 6.4 |
| 17 | 9.8 | 15 | 2.6 | .1 | | 8.0 | 47 | 75 | 46 | 20 | 3.4 | 7.4 |
| 18 | 13 | 15 | 2.3 | .1 | | 20 | 40 | 70 | 45 | 18 | 7.5 | 7.2 |
| 19 | 12 | 15 | 2.0 | .1 | | 42 | 40 | 65 | 41 | 15 | 8.8 | 11 |
| 20 | 13 | 15 | 1.8 | .1 | | 48 | 40 | 61 | 33 | 12 | 8.6 | 17 |
| 21 | 14 | 15 | 1.5 | .1 | | 45 | 41 | 52 | 29 | 10 | 6.7 | 19 |
| 22 | 14 | 14 | 1.3 | .1 | | 42 | 41 | 49 | 26 | 7.4 | 6.0 | 20 |
| 23 | 15 | 14 | 1.1 | .1 | | 40 | 55 | 42 | 24 | 6.0 | 4.0 | 20 |
| 24 | 17 | 13 | 1.0 | .1 | | 40 | 72 | 39 | 22 | 5.7 | 5.0 | 18 |
| 25 | 18 | 13 | .9 | .1 | | 38 | 96 | 33 | 23 | 4.9 | 5.6 | 18 |
| 26 | 25 | 12 | .8 | .1 | | 52 | 86 | 30 | 20 | 4.0 | 6.2 | 22 |
| 27 | 22 | 11 | .7 | .1 | | 85 | 75 | 26 | 18 | 3.8 | 3.4 | 23 |
| 28 | 19 | 10 | .6 | 0 | | 101 | 76 | 24 | 17 | 3.7 | 3.2 | 22 |
| 29 | 20 | 9.5 | .5 | 0 | | 79 | 74 | 26 | 14 | 3.6 | 3.2 | 19 |
| 30 | 20 | 9.0 | .5 | 0 | ------ | 66 | 74 | 25 | 38 | 3.4 | 4.0 | 15 |
| 31 | 18 | ------ | .4 | 0 | ------ | 58 | ------ | 24 | ------ | 3.1 | 3.6 | ------ |
| Total | 364.2 | 479.5 | 118.0 | 4.1 | 0 | 798.2 | 1,983.6 | 1,480 | 893.3 | 385.9 | 132.4 | 333.6 |
| Mean | 11.7 | 16.0 | 3.81 | 0.13 | 0 | 25.7 | 66.1 | 47.7 | 29.8 | 12.4 | 4.27 | 11.1 |
| Max | 25 | 26 | 8.5 | 0.3 | 0 | 101 | 220 | 80 | 74 | 44 | 8.8 | 23 |
| Min | 0.7 | 9.0 | 0.4 | 0 | 0 | 0 | 4.9 | 24 | 9.3 | 3.1 | 2.7 | 4.4 |
| Ac-ft | 722 | 951 | 234 | 8.1 | 0 | 1,580 | 3,930 | 2,940 | 1,770 | 765 | 263 | 662 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 21,281.8 | Mean | 58.3 | Max | 1,080 | Min | 0.1 | Ac-ft | 42,210 |
| Wtr yr 1968: | Total | 6,972.8 | Mean | 19.1 | Max | 220 | Min | 0 | Ac-ft | 13,830 |

5-0620. Buffalo River near Dilworth, Minn.

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

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

Records available.--March 1931 to September 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 878.31 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Apr. 5, 1937, chain gage at same site and datum.

Average discharge.--37 years, 122 cfs (88,320 acre-ft per year).

Extremes.--Maximum discharge during year, 406 cfs Mar. 30 (gage height, 8.92 ft); minimum daily, 9.4 cfs Jan. 21-25; minimum gage height, 2.30 ft Sept. 15.
1931-68: Maximum discharge, 6,140 cfs June 11, 1962 (gage height, 23.56 ft); no flow at times in 1936.

Remarks.--Record fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 19 | 25 | 18 | 14 | 10 | 11 | 210 | 177 | 74 | 165 | 27 | 25 |
| 2 | 20 | 23 | 18 | 13 | 10 | 12 | 171 | 164 | 72 | 226 | 26 | 24 |
| 3 | 18 | 23 | 18 | 13 | 11 | 12 | 143 | 148 | 70 | 195 | 24 | 23 |
| 4 | 16 | 23 | 19 | 12 | 11 | 13 | 116 | 132 | 64 | 156 | 23 | 21 |
| 5 | 16 | 23 | 19 | 12 | 11 | 15 | 87 | 118 | 59 | 122 | 21 | 21 |
| 6 | 16 | 21 | 20 | 12 | 11 | 19 | 100 | 109 | 57 | 99 | 19 | 19 |
| 7 | 19 | 20 | 20 | 11 | 11 | 25 | 79 | 101 | 55 | 89 | 19 | 19 |
| 8 | 20 | 18 | 21 | 11 | 11 | 27 | 82 | 97 | 55 | 80 | 18 | 20 |
| 9 | 20 | 19 | 21 | 11 | 10 | 28 | 133 | 98 | 71 | 68 | 21 | 21 |
| 10 | 20 | 19 | 22 | 11 | 10 | 27 | 192 | 102 | 87 | 58 | 25 | 21 |
| 11 | 20 | 20 | 22 | 11 | 10 | 26 | 299 | 110 | 147 | 52 | 22 | 21 |
| 12 | 21 | 20 | 22 | 11 | 10 | 26 | 332 | 139 | 241 | 46 | 19 | 20 |
| 13 | 21 | 20 | 22 | 10 | 10 | 28 | 294 | 155 | 226 | 42 | 18 | 19 |
| 14 | 21 | 21 | 22 | 10 | 10 | 34 | 242 | 172 | 209 | 41 | 17 | 18 |
| 15 | 19 | 20 | 21 | 9.8 | 10 | 45 | 201 | 192 | 204 | 47 | 19 | 17 |
| 16 | 20 | 20 | 21 | 9.8 | 10 | 56 | 172 | 197 | 180 | 56 | 22 | 19 |
| 17 | 19 | 20 | 21 | 9.8 | 10 | 63 | 153 | 188 | 163 | 58 | 34 | 25 |
| 18 | 19 | 20 | 20 | 9.6 | 10 | 68 | 141 | 174 | 148 | 64 | 28 | 41 |
| 19 | 20 | 20 | 20 | 9.6 | 10 | 71 | 129 | 164 | 129 | 79 | 24 | 43 |
| 20 | 20 | 19 | 20 | 9.6 | 10 | 72 | 120 | 153 | 116 | 81 | 24 | 38 |
| 21 | 21 | 19 | 19 | 9.4 | 10 | 73 | 118 | 142 | 106 | 73 | 22 | 34 |
| 22 | 21 | 19 | 19 | 9.4 | 10 | 77 | 118 | 132 | 95 | 71 | 21 | 35 |
| 23 | 21 | 19 | 19 | 9.4 | 10 | 85 | 127 | 121 | 88 | 57 | 22 | 43 |
| 24 | 21 | 19 | 18 | 9.4 | 10 | 95 | 150 | 112 | 86 | 42 | 21 | 56 |
| 25 | 22 | 18 | 17 | 9.4 | 10 | 115 | 171 | 104 | 84 | 35 | 22 | 64 |
| 26 | 22 | 18 | 16 | 9.6 | 10 | 148 | 196 | 96 | 81 | 32 | 24 | 68 |
| 27 | 22 | 17 | 16 | 9.6 | 10 | 220 | 211 | 90 | 76 | 43 | 23 | 61 |
| 28 | 22 | 17 | 15 | 9.8 | 11 | 295 | 206 | 87 | 71 | 55 | 22 | 53 |
| 29 | 21 | 17 | 15 | 9.8 | 11 | 360 | 194 | 83 | 64 | 42 | 21 | 46 |
| 30 | 26 | 18 | 14 | 10 | ------ | 397 | 186 | 79 | 64 | 35 | 22 | 43 |
| 31 | 26 | ------ | 14 | 10 | ------ | 322 | ------ | 76 | ------ | 30 | 23 | ------ |
| Total | 629 | 595 | 589 | 326.0 | 298 | 2,865 | 5,073 | 4,012 | 3,242 | 2,339 | 693 | 978 |
| Mean | 20.3 | 19.8 | 19.0 | 10.5 | 10.3 | 92.4 | 169 | 129 | 108 | 75.5 | 22.4 | 32.6 |
| Max | 26 | 25 | 22 | 14 | 11 | 397 | 332 | 197 | 241 | 226 | 34 | 68 |
| Min | 16 | 17 | 14 | 9.4 | 10 | 11 | 79 | 76 | 55 | 30 | 17 | 17 |
| Ac-ft | 1,250 | 1,180 | 1,170 | 647 | 591 | 5,680 | 1,010 | 7,960 | 6,430 | 4,640 | 1,370 | 1,940 |

Cal yr 1967: Total 57,908 Mean 159 Max 1,710 Min 11 Ac-ft 114,900
Wtr yr 1968: Total 21,639.0 Mean 59.1 Max 397 Min 9.4 Ac-ft 42,940

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 small tributary.

Drainage area.--888 sq mi.

Records available.--June 1909 to September 1917, July 1930 to September 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Digital 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, graphic water-stage recorder 80 ft upstream from present site at present datum, and Aug. 3, 1950, to Aug. 14, 1967, graphic water-stage recorder at present site and datum.

Average discharge.--46 years, 164 cfs (118,700 acre-ft per year).

Extremes.--Maximum discharge during year, 594 cfs Mar. 30 (gage height, 4.33 ft); maximum gage height, 4.62 ft Mar. 28 (backwater from ice); minimum daily discharge, 13 cfs Oct. 1.
1909-17, 1930-68: Maximum discharge, 9,200 cfs July 22, 1909 (gage height, 20.0 ft, site and datum then in use), from rating curve extended above 3,300 cfs; minimum, 0.5 cfs Nov. 4, 1939.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 28 | 31 | 34 | 27 | 21 | 365 | 367 | 162 | 223 | 61 | 75 |
| 2 | 15 | 30 | 31 | 33 | 26 | 22 | 320 | 354 | 160 | 231 | 62 | 71 |
| 3 | 15 | 27 | 33 | 33 | 26 | 22 | 304 | 341 | 155 | 235 | 62 | 68 |
| 4 | 16 | 20 | 35 | 32 | 25 | 23 | 278 | 333 | 142 | 216 | 57 | 64 |
| 5 | 18 | 15 | 37 | 32 | 25 | 25 | 237 | 316 | 140 | 196 | 54 | 63 |
| 6 | 18 | 15 | 40 | 31 | 24 | 26 | 240 | 297 | 147 | 184 | 53 | 66 |
| 7 | 18 | 17 | 43 | 31 | 23 | 28 | 327 | 293 | 142 | 170 | 50 | 66 |
| 8 | 19 | 19 | 46 | 30 | 23 | 33 | 333 | 299 | 164 | 160 | 47 | 66 |
| 9 | 23 | 20 | 48 | 30 | 22 | 40 | 367 | 314 | 162 | 147 | 44 | 57 |
| 10 | 22 | 22 | 50 | 30 | 22 | 58 | 367 | 312 | 184 | 136 | 42 | 54 |
| 11 | 21 | 22 | 52 | 29 | 21 | 65 | 352 | 308 | 192 | 126 | 40 | 56 |
| 12 | 21 | 20 | 53 | 29 | 21 | 67 | 346 | 320 | 204 | 114 | 39 | 51 |
| 13 | 35 | 18 | 53 | 28 | 20 | 70 | 335 | 339 | 233 | 121 | 36 | 45 |
| 14 | 34 | 18 | 53 | 28 | 20 | 71 | 333 | 358 | 225 | 133 | 33 | 44 |
| 15 | 33 | 18 | 52 | 28 | 19 | 73 | 327 | 352 | 227 | 142 | 36 | 47 |
| 16 | 31 | 19 | 52 | 28 | 19 | 76 | 325 | 354 | 237 | 176 | 40 | 78 |
| 17 | 29 | 20 | 51 | 29 | 18 | 88 | 316 | 333 | 219 | 221 | 40 | 76 |
| 18 | 27 | 22 | 50 | 29 | 18 | 150 | 308 | 297 | 210 | 214 | 39 | 78 |
| 19 | 23 | 25 | 49 | 30 | 18 | 250 | 293 | 275 | 200 | 168 | 40 | 87 |
| 20 | 23 | 26 | 48 | 30 | 18 | 270 | 289 | 269 | 198 | 133 | 41 | 84 |
| 21 | 24 | 27 | 47 | 30 | 19 | 300 | 284 | 258 | 186 | 119 | 37 | 82 |
| 22 | 30 | 28 | 46 | 31 | 19 | 310 | 308 | 250 | 184 | 112 | 34 | 88 |
| 23 | 28 | 29 | 45 | 31 | 20 | 300 | 329 | 246 | 194 | 103 | 55 | 90 |
| 24 | 26 | 30 | 43 | 31 | 20 | 295 | 341 | 233 | 184 | 96 | 116 | 114 |
| 25 | 25 | 31 | 42 | 31 | 20 | 310 | 358 | 221 | 180 | 85 | 182 | 119 |
| 26 | 25 | 32 | 41 | 30 | 20 | 325 | 352 | 212 | 174 | 81 | 149 | 108 |
| 27 | 24 | 32 | 39 | 30 | 20 | 350 | 363 | 206 | 168 | 76 | 117 | 96 |
| 28 | 23 | 32 | 38 | 29 | 20 | 390 | 374 | 200 | 157 | 72 | 90 | 87 |
| 29 | 23 | 31 | 37 | 29 | 21 | 440 | 382 | 194 | 149 | 68 | 85 | 82 |
| 30 | 24 | 31 | 36 | 28 | ------ | 562 | 378 | 182 | 188 | 67 | 84 | 78 |
| 31 | 25 | ------ | 35 | 28 | ------ | 456 | ------ | 172 | ------ | 66 | 78 | ------ |
| TOTAL | 731 | 724 | 1,356 | 932 | 614 | 5,516 | 9,831 | 8,805 | 5,467 | 4,391 | 1,943 | 2,240 |
| MEAN | 23.6 | 24.1 | 43.7 | 30.1 | 21.2 | 178 | 328 | 284 | 182 | 142 | 62.7 | 74.7 |
| MAX | 35 | 32 | 53 | 34 | 27 | 562 | 382 | 367 | 237 | 235 | 182 | 119 |
| MIN | 13 | 15 | 31 | 28 | 18 | 21 | 237 | 172 | 140 | 66 | 33 | 44 |
| AC-FT | 1,450 | 1,440 | 2,690 | 1,850 | 1,220 | 10,940 | 19,500 | 17,460 | 10,840 | 8,710 | 3,850 | 4,440 |

| | | | | | |
|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 78,426 | MEAN 215 | MAX 1,650 | MIN 12 | AC-FT 155,600 |
| WTR YR 1968 | TOTAL 42,550 | MEAN 116 | MAX 562 | MIN 13 | AC-FT 84,400 |

Note.--No gage-height record Oct. 1 to Nov. 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 1968.

Gage.--Wire-weight gage read once or twice daily and crest stage gage. 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.--24 years, 227 cfs (164,300 acre-ft per year).

Extremes.--Maximum discharge during year, 726 cfs Mar. 29 (gage height, 11.26 ft, from graph based on gage reading, backwater from ice); minimum, 12 cfs Oct. 1.
1944-68: Maximum discharge 6,800 cfs Apr. 14, 1965; maximum gage height, 29.52 ft Apr. 15, 1965 (from floodmark, backwater from Red River of the North); no flow some days in 1948-49.

Remarks.--Records good except those for winter months, which are fair. 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. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12 | 29 | 29 | 38 | 29 | 21 | 500 | 420 | 195 | 221 | 65 | 95 |
| 2 | 17 | 32 | 31 | 37 | 28 | 22 | 427 | 396 | 188 | 304 | 65 | 86 |
| 3 | 17 | 28 | 34 | 37 | 28 | 24 | 369 | 378 | 183 | 350 | 64 | 93 |
| 4 | 17 | 22 | 37 | 36 | 28 | 25 | 360 | 357 | 180 | 321 | 66 | 84 |
| 5 | 17 | 16 | 39 | 35 | 27 | 26 | 393 | 346 | 173 | 300 | 61 | 73 |
| 6 | 19 | 15 | 43 | 35 | 26 | 27 | 305 | 333 | 182 | 275 | 55 | 72 |
| 7 | 20 | 16 | 47 | 34 | 26 | 29 | 300 | 318 | 200 | 251 | 53 | 71 |
| 8 | 20 | 18 | 50 | 34 | 25 | 30 | 330 | 308 | 230 | 224 | 56 | 71 |
| 9 | 20 | 21 | 53 | 33 | 24 | 34 | 401 | 314 | 243 | 201 | 50 | 71 |
| 10 | 26 | 23 | 55 | 33 | 24 | 50 | 400 | 324 | 267 | 183 | 44 | 66 |
| 11 | 25 | 23 | 58 | 32 | 23 | 60 | 518 | 340 | 287 | 169 | 43 | 59 |
| 12 | 26 | 22 | 60 | 32 | 22 | 78 | 495 | 360 | 314 | 156 | 42 | 56 |
| 13 | 26 | 21 | 60 | 32 | 22 | 80 | 450 | 374 | 328 | 149 | 40 | 56 |
| 14 | 41 | 20 | 60 | 32 | 21 | 78 | 398 | 390 | 337 | 170 | 38 | 50 |
| 15 | 39 | 19 | 60 | 31 | 21 | 75 | 379 | 405 | 345 | 171 | 43 | 44 |
| 16 | 38 | 19 | 59 | 31 | 20 | 105 | 372 | 410 | 333 | 177 | 46 | 47 |
| 17 | 33 | 19 | 59 | 31 | 19 | 140 | 361 | 395 | 317 | 218 | 46 | 66 |
| 18 | 31 | 21 | 59 | 31 | 19 | 175 | 347 | 369 | 291 | 244 | 54 | 110 |
| 19 | 29 | 23 | 58 | 32 | 18 | 205 | 333 | 329 | 273 | 237 | 53 | 92 |
| 20 | 26 | 25 | 57 | 32 | 18 | 230 | 334 | 303 | 260 | 200 | 44 | 93 |
| 21 | 29 | 27 | 56 | 32 | 18 | 250 | 324 | 292 | 247 | 178 | 44 | 92 |
| 22 | 26 | 29 | 54 | 32 | 17 | 280 | 323 | 280 | 230 | 168 | 46 | 97 |
| 23 | 34 | 30 | 52 | 31 | 17 | 285 | 343 | 267 | 231 | 152 | 45 | 99 |
| 24 | 30 | 30 | 50 | 31 | 17 | 320 | 373 | 275 | 232 | 141 | 50 | 115 |
| 25 | 28 | 30 | 48 | 30 | 18 | 350 | 389 | 250 | 211 | 122 | 78 | 133 |
| 26 | 26 | 30 | 47 | 30 | 18 | 420 | 401 | 238 | 211 | 109 | 166 | 141 |
| 27 | 26 | 29 | 46 | 30 | 19 | 510 | 402 | 230 | 204 | 97 | 162 | 132 |
| 28 | 25 | 29 | 44 | 29 | 19 | 570 | 407 | 225 | 207 | 91 | 152 | 123 |
| 29 | 24 | 28 | 43 | 29 | 20 | 690 | 430 | 220 | 192 | 85 | 118 | 115 |
| 30 | 24 | 28 | 41 | 29 | ------ | 675 | 450 | 214 | 185 | 79 | 109 | 110 |
| 31 | 26 | ------ | 39 | 29 | ------ | 580 | ------ | 199 | ------ | 77 | 105 | ------ |
| Total | 797 | 722 | 1,528 | 1,000 | 631 | 6,444 | 11,614 | 9,859 | 7,276 | 5,820 | 2,103 | 2,612 |
| Mean | 25.7 | 24.1 | 49.3 | 32.3 | 21.8 | 208 | 387 | 318 | 243 | 188 | 67.8 | 87.1 |
| Max | 41 | 32 | 60 | 38 | 29 | 690 | 518 | 420 | 345 | 350 | 166 | 141 |
| Min | 12 | 15 | 29 | 29 | 17 | 21 | 300 | 199 | 173 | 77 | 38 | 44 |
| Ac-ft | 1,580 | 1,430 | 3,030 | 1,980 | 1,250 | 12,780 | 23,040 | 19,560 | 14,430 | 11,540 | 4,170 | 5,180 |

Cal yr 1967: Total 108,863 Mean 298 Max 3,170 Min 12 Ac-ft 215,900
Wtr yr 1968: Total 50,406 Mean 138 Max 690 Min 12 Ac-ft 99,980

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 on upstream side of highway bridge, half a mile west of Halstad, 2½ miles downstream from Wild Rice River, and at mile 375.2

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

Records available.--April 1936 to June 1937 (no winter records), April 1942 to September 1960 (spring and summer months only), May 1961 to September 1968.

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

Average discharge.--7 years, 1,808 cfs (1,309,000 acre-ft per year).

Extremes.--Maximum discharge during year, 2,350 cfs June 19 (gage height, 7.80 ft); maximum gage height, 9.82 ft Mar. 28 (backwater from ice); minimum discharge, 215 cfs Feb. 20, 21 (gage height, 3.82 ft); minimum gage height, 2.52 ft Sept. 16

1936-37, 1942-68: Maximum discharge, 26,800 cfs Mar. 27, 1966 (gage height, 35.35 ft, backwater from ice); 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.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 255 | 325 | 290 | 280 | 240 | 250 | 1,880 | 1,650 | 1,100 | 1,340 | 616 | 378 |
| 2 | 248 | 320 | 250 | 280 | 240 | 255 | 1,640 | 1,610 | 1,090 | 1,440 | 596 | 361 |
| 3 | 244 | 322 | 255 | 275 | 240 | 255 | 1,500 | 1,550 | 1,070 | 1,540 | 576 | 358 |
| 4 | 242 | 320 | 290 | 275 | 240 | 255 | 1,380 | 1,450 | 1,050 | 1,580 | 537 | 352 |
| 5 | 246 | 312 | 305 | 275 | 245 | 260 | 1,160 | 1,370 | 1,020 | 1,520 | 498 | 341 |
| 6 | 238 | 297 | 315 | 270 | 245 | 270 | 1,130 | 1,300 | 1,000 | 1,400 | 474 | 320 |
| 7 | 233 | 300 | 315 | 270 | 245 | 285 | 1,120 | 1,300 | 1,080 | 1,290 | 438 | 312 |
| 8 | 236 | 305 | 315 | 265 | 245 | 310 | 1,070 | 1,320 | 1,290 | 1,200 | 387 | 314 |
| 9 | 253 | 305 | 315 | 265 | 245 | 350 | 1,200 | 1,330 | 1,370 | 1,110 | 355 | 307 |
| 10 | 266 | 275 | 320 | 260 | 245 | 375 | 1,420 | 1,340 | 1,400 | 1,020 | 366 | 282 |
| 11 | 273 | 275 | 320 | 260 | 240 | 415 | 1,660 | 1,350 | 1,520 | 936 | 361 | 266 |
| 12 | 280 | 280 | 325 | 260 | 240 | 430 | 1,880 | 1,360 | 1,700 | 879 | 336 | 259 |
| 13 | 280 | 300 | 335 | 255 | 235 | 480 | 2,000 | 1,400 | 1,860 | 849 | 325 | 253 |
| 14 | 285 | 305 | 290 | 255 | 235 | 540 | 2,000 | 1,480 | 2,090 | 845 | 320 | 246 |
| 15 | 300 | 285 | 280 | 250 | 235 | 620 | 1,920 | 1,580 | 2,160 | 860 | 317 | 238 |
| 16 | 310 | 265 | 275 | 250 | 235 | 750 | 1,850 | 1,680 | 2,190 | 849 | 328 | 231 |
| 17 | 317 | 250 | 270 | 250 | 230 | 890 | 1,740 | 1,700 | 2,270 | 841 | 352 | 236 |
| 18 | 312 | 275 | 280 | 250 | 230 | 990 | 1,610 | 1,680 | 2,330 | 883 | 393 | 257 |
| 19 | 307 | 265 | 270 | 245 | 225 | 1,150 | 1,480 | 1,690 | 2,340 | 902 | 393 | 294 |
| 20 | 292 | 250 | 275 | 245 | 220 | 1,260 | 1,380 | 1,680 | 2,340 | 868 | 396 | 287 |
| 21 | 287 | 260 | 280 | 240 | 220 | 1,310 | 1,290 | 1,640 | 2,340 | 830 | 387 | 292 |
| 22 | 285 | 275 | 280 | 240 | 225 | 1,300 | 1,220 | 1,580 | 2,290 | 826 | 366 | 310 |
| 23 | 285 | 260 | 285 | 240 | 225 | 1,300 | 1,180 | 1,540 | 2,140 | 857 | 366 | 314 |
| 24 | 292 | 305 | 300 | 240 | 225 | 1,330 | 1,230 | 1,480 | 1,940 | 841 | 364 | 372 |
| 25 | 290 | 310 | 300 | 240 | 225 | 1,420 | 1,300 | 1,420 | 1,780 | 798 | 360 | 375 |
| 26 | 287 | 315 | 285 | 240 | 230 | 1,560 | 1,360 | 1,360 | 1,660 | 744 | 365 | 372 |
| 27 | 282 | 315 | 270 | 240 | 230 | 1,900 | 1,440 | 1,280 | 1,550 | 704 | 380 | 414 |
| 28 | 290 | 295 | 270 | 240 | 240 | 2,200 | 1,490 | 1,240 | 1,450 | 661 | 405 | 447 |
| 29 | 290 | 290 | 280 | 240 | 250 | 2,180 | 1,580 | 1,210 | 1,380 | 633 | 366 | 453 |
| 30 | 292 | 305 | 285 | 240 | ------ | 2,100 | 1,640 | 1,180 | 1,330 | 619 | 358 | 444 |
| 31 | 325 | ------ | 285 | 240 | ------ | 2,090 | ------ | 1,140 | ------ | 623 | 364 | ------ |
| TOTAL | 8,622 | 8,761 | 9,010 | 7,875 | 6,825 | 29,080 | 44,750 | 44,890 | 50,130 | 30,288 | 12,445 | 9,685 |
| MEAN | 278 | 292 | 291 | 254 | 235 | 938 | 1,492 | 1,448 | 1,671 | 977 | 401 | 323 |
| MAX | 325 | 325 | 335 | 280 | 250 | 2,200 | 2,000 | 1,700 | 2,340 | 1,580 | 616 | 453 |
| MIN | 233 | 250 | 250 | 240 | 220 | 250 | 1,070 | 1,140 | 1,000 | 619 | 317 | 231 |
| AC-FT | 17,100 | 17,380 | 17,870 | 15,620 | 13,540 | 57,680 | 88,760 | 89,040 | 99,430 | 60,080 | 24,680 | 19,210 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CAL YR 1967: | TOTAL | 606,311 | MEAN | 1,661 | MAX | 13,700 | MIN | 134 | AC-FT | 1,203,000 |
| WAT YR 1968: | TOTAL | 262,361 | MEAN | 717 | MAX | 2,340 | MIN | 220 | AC-FT | 520,400 |

5-0675. 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, 3¾ miles southeast of Shelly and 10 miles upstream from mouth.

Drainage area.--151 sq mi.

Records available.--March 1944 to September 1968. Monthly discharge only for March 1944, published in WSP 1308.

Gage.--Wire-weight gage read once or twice daily and crest-stage gage. Datum of gage is 841.14 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Oct. 1, 1965, chain gage at datum 3.0 ft higher. Oct. 1, 1965, to June 27, 1966, chain gage at same datum.

Average discharge.--24 years, 80.4 cfs (58,210 acre-ft per year).

Extremes.--Maximum discharge during year, 221 cfs Mar. 27 (gage height, 7.35 ft); no flow for many days.
1944-68: Maximum discharge, 4,660 cfs May 11, 1950 (gage height, 18.96 ft, from floodmark); no flow for many days most years.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 0 | 24 | 3.1 | 2.6 | 2.4 | | |
| 2 | | | | | | 0 | 21 | 2.0 | 3.1 | 2.9 | | |
| 3 | | | | | | 0 | 11 | 1.9 | 3.7 | 4.0 | | |
| 4 | | | | | | 0 | 10 | 2.5 | 5.5 | 4.6 | | |
| 5 | | | | | | 0 | 9.3 | 3.6 | 8.1 | 4.5 | | |
| 6 | | | | | | 0 | 10 | 3.7 | 11 | 3.6 | | |
| 7 | | | | | | 0 | 16 | 3.6 | 25 | 2.0 | | |
| 8 | | | | | | 0 | 17 | 3.8 | 47 | 1.6 | | |
| 9 | | | | | | 0 | 22 | 4.3 | 33 | 1.1 | | |
| 10 | | | | | | 0 | 25 | 4.6 | 27 | .2 | | |
| 11 | | | | | | 0 | 27 | 6.9 | 28 | .4 | | |
| 12 | | | | | | 0 | 24 | 8.6 | 26 | .4 | | |
| 13 | | | | | | 0 | 20 | 11 | 23 | .4 | | |
| 14 | | | | | | 0 | 14 | 10 | 28 | .5 | | |
| 15 | | | | | | 0 | 12 | 10 | 31 | .6 | | |
| 16 | | | | | | 0 | 11 | 10 | 28 | .8 | | |
| 17 | | | | | | 0 | 7.7 | 9.0 | 23 | 1.0 | | |
| 18 | | | | | | .1 | 6.2 | 9.3 | 20 | .3 | | |
| 19 | | | | | | .3 | 4.5 | 8.8 | 17 | .4 | | |
| 20 | | | | | | .3 | 5.2 | 8.6 | 14 | .4 | | |
| 21 | | | | | | .5 | 5.9 | 7.3 | 12 | .2 | | |
| 22 | | | | | | 1.5 | 5.7 | 5.7 | 11 | .2 | | |
| 23 | | | | | | 5.0 | 6.9 | 4.8 | 9.6 | .2 | | |
| 24 | | | | | | 15 | 5.7 | 4.2 | 7.9 | .1 | | |
| 25 | | | | | | 35 | 7.3 | 3.0 | 7.3 | .1 | | |
| 26 | | | | | | 112 | 5.7 | 3.1 | 6.3 | 0 | | |
| 27 | | | | | | 175 | 6.1 | 2.6 | 4.3 | 0 | | |
| 28 | | | | | | 106 | 5.2 | 2.5 | 3.6 | 0 | | |
| 29 | | | | | ------ | 77 | 4.2 | 2.9 | 2.4 | 0 | | |
| 30 | | | | | ------ | 54 | 3.8 | 3.4 | 2.5 | 0 | | |
| 31 | | ------ | | | ------ | 36 | ------ | 3.3 | ------ | 0 | | ------ |
| Total | 0 | 0 | 0 | 0 | 0 | 617.7 | 353.4 | 168.1 | 470.9 | 32.9 | 0 | 0 |
| Mean | 0 | 0 | 0 | 0 | 0 | 19.9 | 11.8 | 5.42 | 15.7 | 1.06 | 0 | 0 |
| Max | 0 | 0 | 0 | 0 | 0 | 175 | 27 | 11 | 47 | 4.6 | 0 | 0 |
| Min | 0 | 0 | 0 | 0 | 0 | 0 | 3.8 | 1.9 | 2.4 | 0 | 0 | 0 |
| Ac-ft | 0 | 0 | 0 | 0 | 0 | 1,230 | 701 | 333 | 934 | 65.3 | 0 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 7,439.6 | Mean | 20.4 | Max | 738 | Min | 0 | Ac-ft | 14,760 |
| Wrt yr 1968: | Total | 1,643.0 | Mean | 4.49 | Max | 175 | Min | 0 | Ac-ft | 3,260 |

## 5-0690. Sandhill River at Climax, Minn.

Location.--Lat 47°36'43", long 96°48'52", in NE¼NE¼ sec.30, T.148 N., R.48 W., near center of span on downstream side of bridge on U.S. Highway 75 in Climax and 3.7 miles upstream from mouth.

Records available.--March 1943 to September 1968 (winter records incomplete in some years). Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage and crest-stage gage; gage read once or twice daily. Datum of gage is 820.10 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Oct. 1, 1966, chain gage at site 3.2 miles upstream at datum 12.78 ft higher.

Average discharge.--22 years (1946-68), 63.7 cfs (46,120 acre-ft per year).

Extremes.--Maximum discharge during year, 1,400 cfs June 7 (gage height, 12.71 ft); minimum daily, 7.0 cfs Feb. 21-25.
1943-68: Maximum discharge, 4,560 cfs Apr. 14, 1965 (gage height 17.81 ft, site and datum then in use); minimum not determined.

Remarks.--Records fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 14 | 11 | 10 | 9.5 | 8.5 | 135 | 35 | 35 | 71 | 17 | 13 |
| 2 | 14 | 15 | 11 | 10 | 9.4 | 9.2 | 115 | 33 | 45 | 82 | 16 | 12 |
| 3 | 14 | 14 | 12 | 10 | 9.3 | 10 | 100 | 32 | 65 | 90 | 16 | 11 |
| 4 | 14 | 13 | 12 | 9.8 | 9.2 | 13 | 85 | 31 | 160 | 100 | 16 | 12 |
| 5 | 14 | 12 | 12 | 9.5 | 9.0 | 15 | 75 | 32 | 346 | 103 | 15 | 12 |
| 6 | 15 | 11 | 13 | 9.5 | 9.0 | 19 | 95 | 33 | 652 | 100 | 15 | 12 |
| 7 | 14 | 11 | 13 | 9.5 | 9.0 | 24 | 108 | 36 | 1,320 | 97 | 14 | 12 |
| 8 | 14 | 11 | 13 | 9.5 | 8.8 | 28 | 92 | 37 | 1,080 | 90 | 13 | 12 |
| 9 | 15 | 12 | 14 | 9.8 | 8.8 | 31 | 80 | 39 | 590 | 75 | 12 | 13 |
| 10 | 15 | 13 | 14 | 10 | 8.5 | 34 | 73 | 42 | 354 | 60 | 11 | 12 |
| 11 | 15 | 14 | 15 | 10 | 8.2 | 36 | 75 | 43 | 478 | 45 | 11 | 13 |
| 12 | 15 | 14 | 15 | 10 | 8.0 | 38 | 62 | 45 | 380 | 37 | 10 | 13 |
| 13 | 14 | 13 | 15 | 10 | 7.7 | 40 | 57 | 48 | 310 | 36 | 10 | 13 |
| 14 | 13 | 12 | 14 | 10 | 7.5 | 42 | 55 | 50 | 250 | 38 | 9.5 | 14 |
| 15 | 12 | 12 | 14 | 11 | 7.3 | 43 | 54 | 48 | 230 | 40 | 9.0 | 13 |
| 16 | 12 | 12 | 14 | 11 | 7.3 | 44 | 53 | 46 | 220 | 45 | 12 | 13 |
| 17 | 12 | 12 | 14 | 11 | 7.2 | 46 | 50 | 44 | 180 | 48 | 18 | 13 |
| 18 | 12 | 13 | 14 | 11 | 7.2 | 49 | 45 | 43 | 145 | 46 | 23 | 14 |
| 19 | 12 | 13 | 14 | 11 | 7.2 | 54 | 38 | 40 | 110 | 42 | 19 | 14 |
| 20 | 13 | 13 | 14 | 11 | 7.1 | 62 | 32 | 38 | 96 | 35 | 18 | 13 |
| 21 | 13 | 14 | 14 | 11 | 7.0 | 75 | 35 | 37 | 92 | 28 | 16 | 12 |
| 22 | 13 | 14 | 14 | 11 | 7.0 | 95 | 45 | 35 | 98 | 25 | 15 | 12 |
| 23 | 14 | 14 | 13 | 11 | 7.0 | 130 | 60 | 33 | 112 | 23 | 14 | 12 |
| 24 | 13 | 14 | 13 | 11 | 7.0 | 175 | 71 | 31 | 140 | 22 | 14 | 12 |
| 25 | 13 | 14 | 13 | 11 | 7.0 | 225 | 74 | 30 | 128 | 20 | 18 | 12 |
| 26 | 13 | 14 | 12 | 10 | 7.1 | 340 | 69 | 28 | 118 | 20 | 20 | 11 |
| 27 | 13 | 13 | 12 | 10 | 7.6 | 380 | 62 | 27 | 109 | 18 | 18 | 10 |
| 28 | 12 | 12 | 12 | 10 | 7.8 | 350 | 55 | 30 | 96 | 17 | 17 | 10 |
| 29 | 13 | 12 | 11 | 9.8 | 8.2 | 300 | 47 | 38 | 76 | 18 | 16 | 10 |
| 30 | 13 | 12 | 11 | 9.5 | ------ | 230 | 39 | 42 | 64 | 17 | 17 | 10 |
| 31 | 14 | ------ | 11 | 9.5 | ------ | 180 | ------ | 41 | ------ | 17 | 14 | ------ |
| Total | 416 | 387 | 404 | 317.4 | 230.9 | 3,125.7 | 2,036 | 1,167 | 8,079 | 1,505 | 463.5 | 365 |
| Mean | 13.4 | 12.9 | 13.0 | 10.2 | 7.96 | 101 | 67.9 | 37.6 | 269 | 48.5 | 15.0 | 12.2 |
| Max | 15 | 15 | 15 | 11 | 9.5 | 380 | 135 | 50 | 1,320 | 103 | 23 | 14 |
| Min | 12 | 11 | 11 | 9.5 | 7.0 | 8.5 | 32 | 27 | 35 | 17 | 9.0 | 10 |
| Ac-ft | 825 | 768 | 801 | 630 | 458 | 6,200 | 4,040 | 2,310 | 16,020 | 2,990 | 919 | 724 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total 21,954.4 | Mean 60.1 | Max 1,080 | Min 9.8 | Ac-ft 43,550 | | | |
| Wtr yr 1968: | Total 18,496.5 | Mean 50.5 | Max 1,320 | Min 7.0 | Ac-ft 36,690 | | | |

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 1968 (published as Red Lake near Red Lake 1933-40); records on Upper Red Lake published as Red Lake at Waskish, April 1930 to September 1933, all in reports of Geological Survey. October 1921 to September 1929 gage heights at Redby and on Upper Red Lake at Waskish in files of Minnesota Department of Conservation (fragmentary).

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

Extremes.--Maximum gage height during year, 6.77 ft July 16 (affected by wind action); maximum daily, 5.92 ft July 16; minimum, 3.61 ft Nov. 15 (result of freeze-up); minimum daily, 4.05 ft Nov. 15.
1930-68: 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 1967 to September 1968

| | | |
|---|---|---|
| Oct. 31 . . . . . 4.27 | Feb. 29 . . . . . 4.34 | June 30 . . . . . 5.50 |
| Nov. 30 . . . . . 4.30 | Mar. 31 . . . . . 4.59 | July 31 . . . . . 5.60 |
| Dec. 31 . . . . . 4.31 | Apr. 30 . . . . . 4.95 | Aug. 31 . . . . . 5.29 |
| Jan. 31 . . . . . 4.40 | May 31 . . . . . 5.04 | Sept.30 . . . . . 5.22 |

Note.--Mean daily gage heights are available.

## 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 1968. 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.--35 years, 428 cfs (309,900 acre-ft per year).

Extremes.--Maximum daily discharge during year, 705 cfs July 16; maximum gage height, 6.41 ft Aug. 9 (affected by backwater from aquatic vegetation); minimum discharge, 2.3 cfs May 26, 27 (gage height, 0.79 ft).
1933-68: Maximum discharge, 3,600 cfs June 25, 1950 (gage height, 11.19 ft, affected by seiches and backwater from aquatic vegetation, present datum), from rating curve extended above 1,400 cfs; no flow at times.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 539 | 325 | 280 | 210 | 195 | 215 | 38 | 15 | 10 | 658 | 474 | 550 |
| 2 | 539 | 325 | 255 | 210 | 195 | 215 | 38 | 23 | 10 | 612 | 468 | 553 |
| 3 | 532 | 325 | 240 | 210 | 195 | 215 | 37 | 26 | 2.5 | 609 | 471 | 553 |
| 4 | 488 | 328 | 235 | 210 | 195 | 215 | 37 | 22 | 2.4 | 612 | 471 | 550 |
| 5 | 390 | 325 | 235 | 210 | 195 | 210 | 38 | 22 | 2.5 | 606 | 471 | 556 |
| 6 | 354 | 325 | 230 | 210 | 190 | 210 | 41 | 8.0 | 2.5 | 592 | 536 | 570 |
| 7 | 345 | 312 | 225 | 215 | 190 | 210 | 41 | 3.6 | 2.4 | 595 | 595 | 584 |
| 8 | 357 | 328 | 220 | 215 | 190 | 190 | 60 | 9.2 | 3.6 | 602 | 595 | 606 |
| 9 | 360 | 312 | 215 | 220 | 190 | 145 | 33 | 22 | 3.0 | 584 | 595 | 595 |
| 10 | 354 | 312 | 215 | 220 | 195 | 120 | 26 | 20 | 10 | 578 | 588 | 602 |
| 11 | 345 | 312 | 220 | 220 | 195 | 115 | 26 | 20 | 26 | 570 | 570 | 522 |
| 12 | 345 | 314 | 230 | 220 | 195 | 110 | 31 | 18 | 30 | 564 | 564 | 381 |
| 13 | 360 | 312 | 235 | 220 | 195 | 108 | 26 | 8.0 | 48 | 567 | 553 | 354 |
| 14 | 342 | 304 | 235 | 220 | 200 | 106 | 36 | 5.8 | 82 | 570 | 550 | 337 |
| 15 | 342 | 345 | 230 | 220 | 200 | 105 | 30 | 20 | 96 | 588 | 546 | 325 |
| 16 | 331 | 325 | 230 | 215 | 200 | 102 | 36 | 28 | 90 | 705 | 536 | 331 |
| 17 | 339 | 310 | 230 | 215 | 200 | 101 | 36 | 26 | 77 | 623 | 532 | 345 |
| 18 | 334 | 310 | 230 | 215 | 205 | 100 | 28 | 23 | 87 | 602 | 525 | 357 |
| 19 | 328 | 320 | 230 | 215 | 205 | 100 | 26 | 22 | 73 | 522 | 508 | 369 |
| 20 | 354 | 340 | 230 | 215 | 205 | 100 | 26 | 12 | 211 | 425 | 512 | 400 |
| 21 | 312 | 315 | 230 | 215 | 210 | 95 | 41 | 9.2 | 462 | 387 | 522 | 505 |
| 22 | 312 | 305 | 225 | 210 | 210 | 85 | 33 | 9.2 | 529 | 307 | 525 | 539 |
| 23 | 314 | 310 | 220 | 210 | 210 | 74 | 58 | 6.8 | 546 | 419 | 532 | 567 |
| 24 | 325 | 325 | 220 | 210 | 210 | 68 | 30 | 2.5 | 560 | 564 | 539 | 578 |
| 25 | 328 | 335 | 220 | 210 | 210 | 60 | 26 | 2.5 | 570 | 584 | 542 | 584 |
| 26 | 317 | 350 | 215 | 205 | 215 | 53 | 23 | 2.4 | 567 | 584 | 550 | 581 |
| 27 | 320 | 350 | 215 | 205 | 215 | 47 | 23 | 2.5 | 560 | 560 | 550 | 578 |
| 28 | 301 | 350 | 215 | 205 | 215 | 43 | 23 | 3.0 | 560 | 542 | 536 | 578 |
| 29 | 323 | 345 | 210 | 205 | 215 | 41 | 23 | 4.2 | 570 | 522 | 539 | 578 |
| 30 | 328 | 330 | 210 | 200 | ------ | 40 | 9.2 | 3.0 | 592 | 505 | 542 | 581 |
| 31 | 323 | ------ | 210 | 200 | ------ | 38 | ------ | 3.0 | ------ | 481 | 546 | ------ |
| Total | 11,181 | 9,724 | 7,040 | 6,580 | 5,840 | 3,636 | 979.2 | 401.9 | 6,384.9 | 17,239 | 16,583 | 15,109 |
| Mean | 361 | 324 | 227 | 212 | 201 | 117 | 32.6 | 13.0 | 213 | 556 | 535 | 504 |
| Max | 539 | 350 | 280 | 220 | 215 | 215 | 60 | 28 | 592 | 705 | 595 | 606 |
| Min | 301 | 304 | 210 | 200 | 190 | 38 | 9.2 | 2.4 | 2.4 | 307 | 468 | 325 |
| Ac ft | 22,180 | 19,290 | 13,960 | 13,050 | 11,580 | 7,210 | 1,940 | 797 | 12,660 | 34,190 | 32,890 | 29,970 |

Cal yr 1967: Total 252,087 Mean 691 Max 1,240 Min 82 Ac ft 500,000
Wtr yr 1968: Total 100,697.0 Mean 275 Max 705 Min 2.4 Ac ft 199,700

## 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 1968. 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.--39 years, 457 cfs (330,900 acre-ft per year).

Extremes.--Maximum discharge during year, 2,770 cfs July 18 (gage height, 11.98 ft); minimum, 16 cfs June 5 (gage height, 0.53 ft).
1929-68: Maximum discharge, 3,720 cfs May 11, 1950 (gage height, 13.42 ft); no flow during infrequent periods in 1931-34, 1936-37.

Remarks.--Records good except those for winter months, which are fair. Flow regulated by outlet dam on Lower Red Lake.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 640 | 348 | 380 | 230 | 215 | 220 | 140 | 58 | 25 | 725 | 665 | 711 |
| 2 | 645 | 352 | 350 | 225 | 210 | 225 | 110 | 51 | 20 | 776 | 629 | 709 |
| 3 | 650 | 352 | 285 | 225 | 210 | 225 | 95 | 49 | 23 | 773 | 599 | 732 |
| 4 | 640 | 345 | 260 | 220 | 210 | 228 | 90 | 48 | 22 | 755 | 575 | 746 |
| 5 | 620 | 340 | 255 | 220 | 205 | 230 | 113 | 52 | 18 | 732 | 564 | 744 |
| 6 | 540 | 330 | 255 | 220 | 205 | 235 | 104 | 51 | 34 | 707 | 554 | 746 |
| 7 | 457 | 330 | 260 | 220 | 205 | 237 | 87 | 61 | 51 | 663 | 553 | 762 |
| 8 | 420 | 325 | 270 | 220 | 205 | 245 | 99 | 51 | 106 | 646 | 572 | 778 |
| 9 | 400 | 325 | 275 | 225 | 205 | 230 | 113 | 47 | 150 | 638 | 599 | 785 |
| 10 | 385 | 330 | 280 | 227 | 200 | 195 | 111 | 48 | 153 | 640 | 617 | 783 |
| 11 | 380 | 335 | 280 | 230 | 200 | 165 | 100 | 49 | 181 | 627 | 629 | 773 |
| 12 | 385 | 335 | 280 | 230 | 200 | 155 | 91 | 38 | 182 | 629 | 638 | 755 |
| 13 | 392 | 340 | 275 | 230 | 200 | 155 | 83 | 36 | 165 | 638 | 640 | 689 |
| 14 | 390 | 340 | 270 | 230 | 200 | 155 | 81 | 39 | 181 | 646 | 636 | 613 |
| 15 | 385 | 355 | 265 | 235 | 200 | 158 | 80 | 44 | 199 | 661 | 652 | 560 |
| 16 | 382 | 370 | 262 | 235 | 200 | 165 | 78 | 53 | 192 | 2,000 | 685 | 537 |
| 17 | 376 | 350 | 260 | 235 | 200 | 200 | 77 | 52 | 180 | 2,730 | 689 | 541 |
| 18 | 372 | 330 | 255 | 235 | 200 | 245 | 78 | 59 | 169 | 2,750 | 694 | 553 |
| 19 | 374 | 325 | 255 | 230 | 202 | 320 | 79 | 62 | 152 | 2,650 | 716 | 560 |
| 20 | 354 | 345 | 255 | 230 | 202 | 285 | 81 | 51 | 142 | 2,420 | 711 | 555 |
| 21 | 361 | 375 | 252 | 230 | 205 | 265 | 98 | 47 | 190 | 1,990 | 709 | 551 |
| 22 | 367 | 355 | 250 | 225 | 205 | 255 | 108 | 44 | 450 | 1,490 | 714 | 620 |
| 23 | 356 | 350 | 250 | 225 | 205 | 250 | 110 | 37 | 611 | 1,110 | 723 | 650 |
| 24 | 352 | 370 | 250 | 220 | 210 | 265 | 107 | 35 | 657 | 904 | 730 | 663 |
| 25 | 346 | 380 | 245 | 220 | 210 | 335 | 106 | 30 | 667 | 814 | 734 | 676 |
| 26 | 352 | 385 | 245 | 220 | 210 | 420 | 96 | 27 | 663 | 797 | 732 | 685 |
| 27 | 350 | 390 | 240 | 220 | 215 | 500 | 86 | 27 | 650 | 769 | 723 | 687 |
| 28 | 354 | 400 | 235 | 215 | 218 | 450 | 75 | 25 | 640 | 727 | 720 | 678 |
| 29 | 358 | 390 | 230 | 215 | 218 | 380 | 66 | 25 | 627 | 691 | 716 | 676 |
| 30 | 352 | 385 | 230 | 215 | ------ | 260 | 59 | 26 | 644 | 687 | 716 | 665 |
| 31 | 354 | ------ | 230 | 215 | ------ | 190 | ------ | 24 | ------ | 691 | 716 | ------ |
| Total | 13,089 | 10,582 | 8,184 | 6,972 | 5,970 | 7,843 | 2,801 | 1,346 | 8,144 | 33,476 | 20,550 | 20,183 |
| Mean | 422 | 353 | 264 | 225 | 206 | 253 | 93.4 | 43.4 | 271 | 1,080 | 663 | 673 |
| Max | 650 | 400 | 380 | 235 | 218 | 500 | 140 | 62 | 667 | 2,750 | 734 | 785 |
| Min | 346 | 325 | 230 | 215 | 200 | 155 | 59 | 24 | 18 | 627 | 553 | 537 |
| Ac-ft | 25,960 | 20,990 | 16,230 | 13,830 | 11,840 | 15,560 | 5,560 | 2,670 | 16,150 | 66,400 | 40,760 | 40,030 |

Cal yr 1967: Total 310,809 Mean 852 Max 2,200 Min 230 Ac-ft 616,500
Wtr yr 1968: Total 139,140 Mean 380 Max 2,750 Min 18 Ac-ft 276,000

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 1968. Monthly discharge only for some periods, annual maximums for water years 1919, 1922, 1925, 1926, published in WSP 1308.

Gage.--Digital 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. May 4, 1939 to Aug. 20, 1968, graphic water-stage recorder at present site and datum.

Average discharge.--51 years, 149 cfs (107,900 acre-ft per year).

Extremes.--Maximum discharge during year, 1,950 cfs July 18 (gage height, 10.84 ft); no flow on many days.
1909-17, 1919-26, 1928-68: 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 winter months, which are fair. Some regulation by Thief and Mud Lakes.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 44 | 31 | 0.2 | 0 | 0.1 | 145 | 21 | 18 | 421 | 1,470 | 654 |
| 2 | 0 | 44 | 23 | .1 | 0 | .1 | 102 | 21 | 19 | 603 | 1,420 | 642 |
| 3 | 0 | 42 | 19 | .1 | 0 | .1 | 67 | 21 | 19 | 585 | 1,330 | 642 |
| 4 | 0 | 32 | 14 | .1 | 0 | .1 | 46 | 22 | 18 | 537 | 1,240 | 639 |
| 5 | 0 | 36 | 11 | .1 | 0 | .1 | 38 | 24 | 18 | 489 | 1,140 | 618 |
| 6 | 0 | 41 | 9.6 | .1 | 0 | .1 | 33 | 27 | 25 | 453 | 964 | 570 |
| 7 | 0 | 44 | 8.2 | 0 | 0 | .1 | 31 | 28 | 110 | 424 | 812 | 558 |
| 8 | 0 | 44 | 6.4 | 0 | 0 | .1 | 34 | 27 | 400 | 406 | 707 | 594 |
| 9 | 0 | 44 | 5.2 | 0 | 0 | .2 | 32 | 24 | 1,220 | 392 | 691 | 582 |
| 10 | 0 | 44 | 4.2 | 0 | 0 | .2 | 32 | 24 | 1,610 | 380 | 633 | 546 |
| 11 | 0 | 44 | 3.7 | 0 | 0 | .2 | 32 | 23 | 1,640 | 369 | 615 | 426 |
| 12 | 0 | 37 | 3.2 | 0 | .1 | .2 | 35 | 22 | 1,620 | 366 | 579 | 406 |
| 13 | 0 | 39 | 2.8 | 0 | .1 | .2 | 35 | 28 | 1,480 | 366 | 459 | 383 |
| 14 | 0 | 33 | 2.4 | 0 | .1 | .2 | 29 | 35 | 1,260 | 366 | 299 | 316 |
| 15 | 0 | 32 | 2.1 | 0 | .1 | .2 | 24 | 34 | 1,130 | 363 | 276 | 265 |
| 16 | 0 | 45 | 1.8 | 0 | .1 | .2 | 24 | 31 | 1,020 | 788 | 237 | 274 |
| 17 | 0 | 42 | 1.5 | 0 | .1 | .3 | 23 | 29 | 970 | 1,850 | 276 | 327 |
| 18 | 91 | 40 | 1.2 | 0 | .1 | .4 | 19 | 27 | 935 | 1,920 | 304 | 465 |
| 19 | 124 | 60 | 1.0 | 0 | .1 | .6 | 19 | 25 | 908 | 1,880 | 360 | 471 |
| 20 | 126 | 85 | .8 | 0 | .1 | 5.0 | 20 | 23 | 888 | 1,780 | 441 | 450 |
| 21 | 55 | 99 | .6 | 0 | .1 | 23 | 24 | 21 | 868 | 1,620 | 657 | 429 |
| 22 | 59 | 102 | .5 | 0 | .1 | 185 | 29 | 20 | 862 | 1,500 | 716 | 412 |
| 23 | 61 | 104 | .4 | 0 | .1 | 158 | 31 | 18 | 872 | 1,500 | 710 | 397 |
| 24 | 63 | 103 | .3 | 0 | .1 | 132 | 33 | 17 | 896 | 1,510 | 755 | 389 |
| 25 | 61 | 93 | .3 | 0 | .1 | 122 | 32 | 16 | 881 | 1,520 | 822 | 389 |
| 26 | 45 | 85 | .3 | 0 | .1 | 280 | 28 | 16 | 838 | 1,560 | 800 | 380 |
| 27 | 37 | 71 | .3 | 0 | .1 | 560 | 25 | 17 | 732 | 1,560 | 726 | 327 |
| 28 | 34 | 58 | .3 | 0 | .1 | 660 | 23 | 17 | 682 | 1,520 | 642 | 310 |
| 29 | 37 | 48 | .2 | 0 | .1 | 470 | 22 | 18 | 549 | 1,490 | 615 | 246 |
| 30 | 40 | 39 | .2 | 0 | ------ | 316 | 21 | 17 | 400 | 1,490 | 615 | 140 |
| 31 | 45 | ------ | .2 | 0 | ------ | 218 | ------ | 17 | ------ | 1,490 | 667 | ------ |
| Total | 878 | 1,674 | 155.7 | 0.7 | 1.8 | 3,132.7 | 1,088 | 710 | 22,888 | 31,498 | 21,978 | 13,247 |
| Mean | 28.3 | 55.8 | 5.02 | .02 | .06 | 101 | 36.3 | 22.9 | 763 | 1,016 | 709 | 442 |
| Max | 126 | 104 | 31 | 0.2 | 0.1 | 660 | 145 | 35 | 1,640 | 1,920 | 1,470 | 654 |
| Min | 0 | 32 | 0.2 | 0 | 0 | 0.1 | 19 | 16 | 18 | 363 | 237 | 140 |
| Ac-ft | 1,740 | 3,320 | 309 | 1.4 | 3.6 | 6,210 | 2,160 | 1,410 | 45,400 | 62,480 | 43,590 | 26,280 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 134,752.3 | Mean | 369 | Max | 3,080 | Min 0 | Ac-ft 267,300 |
| Wtr yr 1968: | Total | 97,251.9 | Mean | 266 | Max | 1,920 | Min 0 | Ac-ft 192,900 |

5-0777. Ruffy Brook near Gonvick, Minn.

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

Drainage area.--45.2 sq mi.

Records available.--April 1960 to September 1968. Monthly and daily figures for April 1, 1960 to June 30, 1960 published in WSP 1913.

Gage.--Wire-weight gage read once daily and crest-stage gage. 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.

Average discharge.--8 years, 14.7 cfs (10,640 acre-ft per year).

Extremes.--Maximum discharge during year, 76 cfs June 10 (gage height, 2.70 ft, from graph based on gage readings); maximum gage height, 5.65 ft Mar. 19 (from graph based on gage readings, backwater from ice); no flow Feb. 20 to Mar. 6.
1960-68: Maximum discharge, 453 cfs Mar. 30, 1967 (gage height, 6.35 ft, from graph based on gage readings); maximum gage height, 6.55 ft Mar. 29, 1967 (from graph based on gage readings, backwater from ice); no flow Feb. 20 to Mar. 6, 1968.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.3 | 1.0 | 2.0 | 4.2 | 1.3 | 0 | 17 | 17 | 6.9 | 24 | 2.2 | 1.4 |
| 2 | 1.0 | 1.4 | 2.1 | 4.1 | 1.2 | 0 | 16 | 12 | 8.8 | 17 | 2.0 | 2.0 |
| 3 | 1.8 | 1.4 | 2.3 | 4.1 | 1.1 | 0 | 15 | 9.3 | 7.6 | 17 | 2.6 | 2.6 |
| 4 | .8 | .8 | 2.8 | 4.0 | 1.0 | 0 | 14 | 8.5 | 7.4 | 11 | 2.2 | 2.4 |
| 5 | .7 | .7 | 3.5 | 3.8 | .9 | 0 | 14 | 7.1 | 9.0 | 10 | 2.0 | 2.6 |
| 6 | 1.6 | .7 | 4.0 | 3.6 | .9 | 0 | 13 | 6.9 | 14 | 9.6 | 2.0 | 2.6 |
| 7 | 2.2 | .8 | 4.5 | 3.5 | .8 | 0.1 | 22 | 9.6 | 14 | 9.3 | 1.6 | 3.4 |
| 8 | 2.6 | 1.0 | 4.8 | 3.4 | .7 | .4 | 39 | 9.6 | 33 | 7.9 | 1.6 | 3.7 |
| 9 | 3.2 | 1.0 | 5.1 | 3.3 | .6 | 1.0 | 33 | 9.0 | 32 | 6.6 | 1.6 | 2.2 |
| 10 | 2.6 | 1.2 | 5.2 | 3.2 | .6 | 2.0 | 29 | 9.3 | 58 | 5.7 | 1.4 | 1.8 |
| 11 | 2.2 | 1.6 | 5.3 | 3.1 | .5 | 2.3 | 27 | 16 | 60 | 5.2 | 1.4 | 1.6 |
| 12 | 1.8 | 2.0 | 5.3 | 3.0 | .4 | 1.7 | 26 | 18 | 43 | 5.4 | 1.4 | 1.4 |
| 13 | 1.4 | 2.0 | 5.3 | 2.9 | .4 | 1.3 | 23 | 15 | 39 | 4.8 | 1.4 | 1.2 |
| 14 | 1.2 | 1.9 | 5.3 | 2.9 | .3 | 1.1 | 20 | 18 | 45 | 6.9 | 1.4 | 1.0 |
| 15 | 1.2 | 1.8 | 5.3 | 2.8 | .2 | 1.0 | 24 | 16 | 50 | 5.2 | 1.8 | .8 |
| 16 | 1.2 | 1.8 | 5.3 | 2.7 | .2 | 1.0 | 22 | 15 | 41 | 22 | 2.2 | 2.2 |
| 17 | 1.8 | 1.9 | 5.3 | 2.6 | .1 | 2.0 | 16 | 15 | 35 | 11 | 1.8 | 3.7 |
| 18 | .8 | 2.1 | 5.3 | 2.5 | .1 | 10 | 13 | 15 | 31 | 7.9 | 1.8 | 3.2 |
| 19 | .7 | 2.2 | 5.2 | 2.5 | .1 | 35 | 13 | 16 | 22 | 5.9 | 2.6 | 3.7 |
| 20 | .6 | 2.2 | 5.2 | 2.4 | 0 | 28 | 13 | 11 | 17 | 5.2 | 1.6 | 3.0 |
| 21 | .5 | 2.3 | 5.1 | 2.3 | 0 | 24 | 31 | 9.9 | 28 | 5.2 | 1.6 | 2.6 |
| 22 | .4 | 2.3 | 5.1 | 2.3 | 0 | 21 | 22 | 8.8 | 20 | 3.7 | 2.0 | 4.1 |
| 23 | .5 | 2.3 | 5.0 | 2.2 | 0 | 20 | 27 | 7.1 | 18 | 3.4 | 2.6 | 5.2 |
| 24 | .5 | 2.3 | 5.0 | 2.1 | 0 | 20 | 29 | 6.4 | 17 | 3.2 | 2.4 | 4.1 |
| 25 | .7 | 2.2 | 4.9 | 2.1 | 0 | 45 | 39 | 5.7 | 13 | 3.0 | 2.4 | 3.4 |
| 26 | .6 | 2.2 | 4.8 | 2.0 | 0 | 55 | 27 | 5.9 | 10 | 3.9 | 2.0 | 3.2 |
| 27 | .5 | 2.1 | 4.8 | 1.9 | 0 | 50 | 22 | 5.7 | 9.6 | 3.7 | 1.6 | 3.0 |
| 28 | .5 | 2.0 | 4.7 | 1.7 | 0 | 42 | 22 | 5.9 | 8.2 | 3.4 | 1.4 | 2.4 |
| 29 | .4 | 2.0 | 4.6 | 1.6 | 0 | 32 | 21 | 6.2 | 6.9 | 3.2 | 1.2 | 2.2 |
| 30 | .5 | 2.0 | 4.5 | 1.5 | ------ | 25 | 22 | 6.2 | 13 | 3.0 | 1.2 | 1.8 |
| 31 | .7 | ------ | 4.4 | 1.4 | ------ | 20 | ------ | 6.2 | ------ | 3.0 | 1.4 | ------ |
| Total | 35.5 | 51.2 | 142.0 | 85.7 | 11.4 | 440.9 | 671 | 327.3 | 717.4 | 236.3 | 56.4 | 78.5 |
| Mean | 1.15 | 1.71 | 4.58 | 2.76 | 0.39 | 14.2 | 22.4 | 10.6 | 23.9 | 7.62 | 1.82 | 2.62 |
| Max | 3.2 | 2.3 | 5.3 | 4.2 | 1.3 | 55 | 39 | 18 | 60 | 24 | 2.6 | 5.2 |
| Min | 0.3 | 0.7 | 2.0 | 1.4 | 0 | 0 | 13 | 5.7 | 6.9 | 3.0 | 1.2 | 0.8 |
| Ac-ft | 70.4 | 102 | 282 | 170 | 22.6 | 875 | 1,330 | 649 | 1,420 | 469 | 112 | 156 |

Cal yr 1967: Total 5,479.4 Mean 15.0 Max 390 Min 0.3 Ac-ft 10,870
Wtr yr 1968: Total 2,853.6 Mean 7.80 Max 60 Min 0 Ac-ft 5,660

Peak discharge (base, 65 cfs)

| Date | Time | Gage height | Discharge |
|---|---|---|---|
| 6-10 | 2000 | 2.70 | 76 |

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 1968.

Gage.--Digital 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. Nov. 11, 1939 to Aug. 20, 1968, graphic water-stage recorder at same site and datum.

Average discharge.--29 years, 175 cfs (126,690 acre-ft per year).

Extremes.--Maximum discharge during year, 3,000 cfs July 18 (gage height, 11.00 ft); minimum, 26 cfs Nov. 5 (gage height, 2.31 ft).
1939-68: Maximum discharge, 3,640 cfs June 9, 1962 (gage height, 11.90 ft); maximum gage height, 11.97 ft Apr. 11, 1965 (backwater from ice); minimum discharge, 7.9 cfs July 8, 1940.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32 | 49 | 47 | 49 | 40 | 51 | 400 | 213 | 101 | 306 | 227 | 104 |
| 2 | 33 | 50 | 54 | 48 | 40 | 52 | 377 | 200 | 118 | 425 | 182 | 99 |
| 3 | 40 | 49 | 60 | 47 | 39 | 53 | 312 | 182 | 116 | 397 | 164 | 103 |
| 4 | 41 | 36 | 62 | 47 | 39 | 54 | 252 | 167 | 106 | 355 | 155 | 107 |
| 5 | 41 | 31 | 64 | 46 | 39 | 54 | 237 | 155 | 106 | 316 | 277 | 105 |
| 6 | 42 | 35 | 64 | 45 | 40 | 55 | 212 | 144 | 124 | 279 | 638 | 101 |
| 7 | 41 | 45 | 63 | 45 | 41 | 56 | 206 | 142 | 144 | 246 | 705 | 106 |
| 8 | 45 | 52 | 62 | 44 | 42 | 58 | 215 | 146 | 200 | 220 | 612 | 114 |
| 9 | 51 | 56 | 61 | 44 | 43 | 68 | 260 | 152 | 306 | 205 | 488 | 113 |
| 10 | 58 | 58 | 60 | 44 | 45 | 90 | 265 | 150 | 323 | 198 | 408 | 107 |
| 11 | 58 | 52 | 60 | 44 | 47 | 110 | 256 | 150 | 397 | 185 | 349 | 99 |
| 12 | 60 | 50 | 61 | 44 | 48 | 115 | 250 | 164 | 438 | 178 | 300 | 92 |
| 13 | 59 | 48 | 62 | 43 | 48 | 112 | 245 | 176 | 397 | 173 | 265 | 88 |
| 14 | 59 | 48 | 62 | 43 | 49 | 100 | 236 | 174 | 379 | 173 | 232 | 85 |
| 15 | 63 | 48 | 62 | 43 | 49 | 95 | 230 | 174 | 388 | 184 | 208 | 83 |
| 16 | 59 | 49 | 62 | 43 | 48 | 100 | 227 | 170 | 384 | 923 | 210 | 89 |
| 17 | 55 | 51 | 61 | 43 | 48 | 135 | 215 | 162 | 355 | 2,380 | 203 | 96 |
| 18 | 53 | 54 | 60 | 44 | 47 | 250 | 201 | 162 | 331 | 2,870 | 185 | 109 |
| 19 | 54 | 56 | 59 | 45 | 47 | 340 | 187 | 161 | 308 | 2,200 | 179 | 112 |
| 20 | 51 | 57 | 58 | 45 | 47 | 370 | 180 | 158 | 275 | 1,540 | 176 | 111 |
| 21 | 52 | 55 | 58 | 46 | 46 | 355 | 190 | 150 | 254 | 1,140 | 160 | 107 |
| 22 | 50 | 53 | 57 | 46 | 46 | 340 | 217 | 146 | 302 | 833 | 155 | 103 |
| 23 | 49 | 54 | 56 | 46 | 46 | 330 | 222 | 136 | 318 | 600 | 152 | 104 |
| 24 | 49 | 56 | 56 | 45 | 47 | 340 | 243 | 128 | 338 | 492 | 150 | 112 |
| 25 | 48 | 58 | 55 | 44 | 47 | 440 | 261 | 122 | 323 | 418 | 147 | 115 |
| 26 | 49 | 58 | 54 | 43 | 48 | 550 | 258 | 113 | 295 | 364 | 141 | 113 |
| 27 | 48 | 57 | 53 | 42 | 48 | 580 | 252 | 108 | 275 | 340 | 132 | 105 |
| 28 | 42 | 55 | 52 | 42 | 49 | 545 | 245 | 107 | 260 | 297 | 124 | 88 |
| 29 | 38 | 52 | 51 | 42 | 50 | 520 | 236 | 110 | 234 | 260 | 119 | 84 |
| 30 | 36 | 45 | 51 | 41 | ------ | 480 | 225 | 113 | 225 | 248 | 115 | 82 |
| 31 | 35 | ------ | 50 | 40 | ------ | 440 | ------ | 107 | ------ | 261 | 110 | ------ |
| Total | 1,491 | 1,517 | 1,797 | 1,373 | 1,313 | 7,238 | 7,312 | 4,642 | 8,120 | 19,006 | 7,668 | 3,036 |
| Mean | 48.1 | 50.6 | 58.0 | 44.3 | 45.3 | 233 | 244 | 150 | 271 | 613 | 247 | 101 |
| Max | 63 | 58 | 64 | 49 | 50 | 580 | 400 | 213 | 438 | 2,870 | 705 | 113 |
| Min | 32 | 31 | 47 | 40 | 39 | 51 | 180 | 107 | 101 | 173 | 110 | 82 |
| Ac-ft | 2,960 | 3,010 | 3,560 | 2,720 | 2,600 | 14,360 | 14,500 | 9,210 | 16,110 | 37,700 | 15,210 | 6,020 |

Cal yr 1967: Total 76,467 Mean 209 Max 2,330 Min 21 Ac-ft 151,670
Wtr yr 1968: Total 64,513 Mean 176 Max 2,870 Min 31 Ac-ft 128,000

Peak discharge (base, 500 cfs)

| Date | Time | Gage height | Discharge | Date | Time | Gage height | Discharge |
|---|---|---|---|---|---|---|---|
| 3-27 | 0300 | 7.15 | 610 | 8-7 | 1600 | 5.96 | 718 |
| 7-18 | 0430 | 11.00 | 3,000 | | | | |

## 5-0782.3 Lost River at Oklee, Minn.

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

Drainage area.--266 sq mi.

Records available.--April 1960 to September 1968. Monthly and daily figures for April 1, 1960 to June 30, 1960 published in WSP 1913.

Gage.--Wire-weight gage read once or twice daily and crest-stage gage. Datum of gage is 1,126.94 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 9, 1960, reference points at same site at datum 8.00 ft higher. September 9, 1960, to Sept. 30, 1964, wire-weight gage at same site at datum 8.00 ft higher.

Average discharge.--8 years, 75.1 cfs (54,370 acre-ft per year).

Extremes.--Maximum discharge during year, 551 cfs July 17 (gage height, 7.35 ft, from graph based on gage readings); maximum gage height, 9.05 ft Mar. 19 (from graph based on gage readings, backwater from ice); minimum daily discharge, 0.2 cfs Feb. 13 to Mar. 3; minimum gage height, 2.00 ft Oct. 1.
1960-68: Maximum discharge, 2,880 cfs Mar. 31, 1967 (gage height, 14.17 ft, from graph based on gage readings) no flow Feb. 16 to Mar. 21, 1963, Feb. 15 to Mar. 2, 1964.
Maximum stage known since at least 1897, 18.39 ft Apr. 21, 1950 (present datum), from floodmarks.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.1 | 3.2 | 3.0 | 3.4 | 0.5 | 0.2 | 188 | 69 | 32 | 264 | 12 | 7.3 |
| 2 | 1.2 | 2.4 | 3.1 | 3.2 | .4 | .2 | 152 | 65 | 38 | 300 | 11 | 7.5 |
| 3 | 2.7 | 2.0 | 3.3 | 3.0 | .4 | .2 | 150 | 57 | 40 | 226 | 7.5 | 8.1 |
| 4 | 2.7 | 1.9 | 3.5 | 2.8 | .4 | .3 | 147 | 54 | 38 | 179 | 6.8 | 16 |
| 5 | 1.2 | 1.8 | 3.7 | 2.5 | .4 | .8 | 162 | 49 | 39 | 139 | 6.4 | 16 |
| 6 | 1.2 | 2.1 | 4.2 | 2.3 | .4 | 1.7 | 127 | 51 | 42 | 107 | 5.6 | 16 |
| 7 | 1.8 | 2.4 | 4.5 | 2.1 | .4 | 3.0 | 128 | 57 | 47 | 79 | 5.1 | 14 |
| 8 | 1.5 | 2.3 | 4.7 | 1.9 | .4 | 6.0 | 127 | 59 | 70 | 71 | 4.7 | 14 |
| 9 | 4.7 | 2.4 | 4.9 | 1.7 | .4 | 13 | 133 | 60 | 128 | 61 | 4.7 | 14 |
| 10 | 2.7 | 3.3 | 5.0 | 1.4 | .3 | 19 | 123 | 54 | 129 | 54 | 4.7 | 12 |
| 11 | 2.2 | 3.7 | 5.1 | 1.3 | .3 | 18 | 112 | 69 | 153 | 49 | 4.5 | 9.6 |
| 12 | 1.6 | 3.5 | 5.1 | 1.2 | .3 | 16 | 105 | 97 | 157 | 47 | 4.2 | 10 |
| 13 | 1.4 | 2.9 | 5.0 | 1.1 | .2 | 13 | 96 | 93 | 122 | 48 | 4.1 | 8.1 |
| 14 | 2.1 | 2.8 | 5.0 | 1.1 | .2 | 11 | 87 | 95 | 169 | 49 | 3.7 | 7.5 |
| 15 | 2.2 | 2.7 | 4.9 | 1.0 | .2 | 10 | 89 | 96 | 161 | 54 | 3.6 | 9.1 |
| 16 | 2.6 | 2.9 | 4.9 | 1.0 | .2 | 10 | 104 | 86 | 117 | 327 | 6.6 | 13 |
| 17 | 3.0 | 3.1 | 4.9 | .9 | .2 | 25 | 92 | 78 | 100 | 506 | 7.3 | 14 |
| 18 | 4.1 | 3.3 | 4.8 | .9 | .2 | 190 | 81 | 67 | 92 | 383 | 7.5 | 19 |
| 19 | 3.7 | 3.4 | 4.8 | .9 | .2 | 270 | 71 | 66 | 89 | 258 | 7.9 | 26 |
| 20 | 3.3 | 3.4 | 4.8 | .8 | .2 | 350 | 68 | 55 | 61 | 173 | 7.0 | 21 |
| 21 | 2.8 | 3.5 | 4.7 | .8 | .2 | 375 | 115 | 49 | 59 | 124 | 8.8 | 21 |
| 22 | 3.0 | 3.5 | 4.6 | .8 | .2 | 310 | 140 | 44 | 79 | 88 | 9.6 | 17 |
| 23 | 3.1 | 3.5 | 4.6 | .8 | .2 | 260 | 162 | 39 | 125 | 67 | 9.6 | 16 |
| 24 | 3.0 | 3.5 | 4.5 | .8 | .2 | 240 | 167 | 38 | 131 | 49 | 9.1 | 16 |
| 25 | 2.8 | 3.4 | 4.5 | .7 | .2 | 290 | 149 | 37 | 112 | 37 | 8.4 | 14 |
| 26 | 2.8 | 3.2 | 4.4 | .7 | .2 | 350 | 132 | 36 | 91 | 32 | 7.9 | 14 |
| 27 | 2.7 | 3.1 | 4.3 | .6 | .2 | 330 | 123 | 34 | 74 | 28 | 7.9 | 11 |
| 28 | 2.6 | 3.1 | 4.1 | .6 | .2 | 300 | 104 | 33 | 63 | 19 | 7.9 | 11 |
| 29 | 2.5 | 3.0 | 3.9 | .6 | .2 | 304 | 92 | 32 | 61 | 17 | 7.0 | 10 |
| 30 | 2.5 | 3.0 | 3.7 | .5 | ------ | 238 | 78 | 31 | 134 | 13 | 6.8 | 10 |
| 31 | 2.7 | ------ | 3.6 | .5 | ------ | 192 | ------ | 31 | ------ | 13 | 6.6 | ------ |
| Total | 77.5 | 88.3 | 136.1 | 41.9 | 8.0 | 4,146.4 | 3,604 | 1,781 | 2,753 | 3,861 | 214.5 | 402.2 |
| Mean | 2.50 | 2.94 | 4.39 | 1.35 | 0.28 | 134 | 120 | 57.5 | 91.8 | 125 | 6.92 | 13.4 |
| Max | 4.7 | 3.7 | 5.1 | 3.4 | 0.5 | 375 | 188 | 97 | 169 | 506 | 12 | 26 |
| Min | 1.1 | 1.8 | 3.0 | 0.5 | 0.2 | 0.2 | 68 | 31 | 32 | 13 | 3.6 | 7.3 |
| Ac-ft | 154 | 175 | 270 | 83 | 16 | 8,220 | 7,150 | 3,530 | 5,460 | 7,660 | 425 | 798 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 24,782 | Mean | 67.9 | Max | 2,560 | Min | 0.4 | Ac-ft | 49,150 | | |
| Wat yr 1968: | Total | 17,113.9 | Mean | 46.8 | Max | 506 | Min | 0.2 | Ac-ft | 33,940 | | |

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 1968. 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.--42 years, 299 cfs (216,500 acre-ft per year).

Extremes.--Maximum discharge during year, 3,550 cfs July 18 (gage height, 7.30 ft); maximum gage height recorded, 9.36 ft Mar. 16 (backwater from ice); minimum discharge, 21 cfs Nov. 6 (gage height, 1.65 ft).
1909-17, 1934-68: 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 winter months, which are fair. Slight regulation by Clearwater Lake and several smaller lakes.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 36 | 58 | 43 | 64 | 64 | 62 | 730 | 355 | 166 | 485 | 276 | 121 |
| 2 | 36 | 64 | 46 | 63 | 64 | 64 | 610 | 335 | 159 | 935 | 233 | 117 |
| 3 | 40 | 64 | 60 | 63 | 64 | 66 | 490 | 301 | 166 | 947 | 196 | 119 |
| 4 | 40 | 58 | 72 | 62 | 65 | 68 | 426 | 273 | 164 | 769 | 181 | 119 |
| 5 | 44 | 44 | 74 | 62 | 65 | 73 | 384 | 254 | 164 | 634 | 166 | 123 |
| 6 | 46 | 30 | 75 | 62 | 66 | 81 | 400 | 239 | 176 | 538 | 478 | 132 |
| 7 | 50 | 40 | 75 | 61 | 66 | 93 | 359 | 233 | 257 | 451 | 697 | 130 |
| 8 | 55 | 71 | 75 | 61 | 67 | 110 | 363 | 236 | 590 | 380 | 702 | 130 |
| 9 | 54 | 73 | 74 | 61 | 68 | 140 | 417 | 248 | 606 | 320 | 570 | 137 |
| 10 | 62 | 78 | 73 | 61 | 69 | 164 | 455 | 248 | 644 | 294 | 472 | 137 |
| 11 | 71 | 82 | 73 | 61 | 70 | 163 | 434 | 260 | 658 | 270 | 396 | 130 |
| 12 | 71 | 80 | 74 | 61 | 70 | 159 | 413 | 276 | 732 | 251 | 335 | 119 |
| 13 | 73 | 74 | 75 | 61 | 70 | 146 | 392 | 332 | 697 | 245 | 287 | 111 |
| 14 | 73 | 72 | 76 | 61 | 69 | 140 | 380 | 355 | 649 | 251 | 254 | 106 |
| 15 | 67 | 68 | 77 | 62 | 68 | 140 | 359 | 351 | 753 | 242 | 230 | 100 |
| 16 | 71 | 68 | 77 | 62 | 68 | 158 | 372 | 347 | 687 | 649 | 219 | 111 |
| 17 | 71 | 69 | 76 | 62 | 67 | 340 | 367 | 320 | 658 | 2,120 | 219 | 117 |
| 18 | 69 | 71 | 75 | 62 | 66 | 600 | 335 | 305 | 1,030 | 2,460 | 213 | 123 |
| 19 | 65 | 73 | 75 | 63 | 64 | 740 | 312 | 294 | 658 | 3,200 | 194 | 143 |
| 20 | 67 | 76 | 74 | 64 | 63 | 760 | 308 | 283 | 520 | 2,240 | 186 | 152 |
| 21 | 65 | 82 | 72 | 64 | 62 | 710 | 312 | 276 | 434 | 1,490 | 183 | 152 |
| 22 | 62 | 75 | 71 | 65 | 61 | 665 | 392 | 260 | 434 | 1,110 | 186 | 143 |
| 23 | 64 | 66 | 70 | 65 | 60 | 680 | 434 | 242 | 498 | 822 | 176 | 137 |
| 24 | 57 | 64 | 70 | 65 | 60 | 1,100 | 451 | 222 | 542 | 639 | 169 | 130 |
| 25 | 57 | 64 | 69 | 66 | 60 | 1,350 | 502 | 208 | 538 | 542 | 164 | 132 |
| 26 | 55 | 63 | 68 | 66 | 60 | 1,490 | 498 | 194 | 489 | 459 | 162 | 130 |
| 27 | 55 | 62 | 67 | 65 | 60 | 1,500 | 472 | 183 | 434 | 413 | 152 | 130 |
| 28 | 54 | 60 | 66 | 65 | 61 | 1,330 | 451 | 176 | 392 | 367 | 143 | 123 |
| 29 | 55 | 55 | 65 | 65 | 61 | 1,220 | 409 | 174 | 347 | 316 | 132 | 119 |
| 30 | 54 | 47 | 64 | 65 | ------ | 1,080 | 384 | 176 | 332 | 287 | 132 | 108 |
| 31 | 52 | ------ | 64 | 64 | ------ | 940 | ------ | 174 | ------ | 287 | 126 | ------ |
| Total | 1,791 | 1,951 | 2,165 | 1,954 | 1,878 | 16,332 | 12,611 | 8,130 | 14,574 | 24,413 | 8,229 | 3,781 |
| Mean | 57.8 | 65.0 | 69.8 | 63.0 | 64.8 | 527 | 420 | 262 | 486 | 820 | 265 | 126 |
| Max | 73 | 82 | 77 | 66 | 70 | 1,500 | 730 | 355 | 1,030 | 3,460 | 702 | 152 |
| Min | 36 | 30 | 43 | 61 | 60 | 62 | 308 | 174 | 159 | 242 | 126 | 100 |
| Ac-ft | 3,550 | 3,870 | 4,290 | 3,880 | 3,720 | 32,390 | 25,010 | 16,130 | 28,910 | 50,410 | 16,320 | 7,500 |

Cal yr 1967: Total 139,426 Mean 382 Max 5,210 Min 23 Ac-ft 276,550
Wtr yr 1968: Total 98,809 Mean 270 Max 3,460 Min 30 Ac-ft 196,000

## 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, 0.6 mile downstream from bridge on U. S. Highway 75, and 53 miles above mouth.

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

Records available.--May 1901 to September 1968. 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.--Digital 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, graphic water-stage recorder, Oct. 1, 1919, to Sept. 30, 1930, chain gage and Oct. 1, 1930, to June 10, 1965, graphic water stage recorder, at present site and datum.

Average discharge.--67 years, 1,041 cfs (753,700 acre-ft per year).

Extremes.--Maximum discharge during year, 11,100 cfs July 19 (gage height, 17.17 ft); minimum, 75 cfs Nov. 20 (gage height, 2.69 ft).
1901-68: Maximum discharge, 27,400 cfs May 7, 1950 (gage height, 25.70 ft); maximum gage height, 25.82 ft Apr. 12, 1965 (backwater from ice); no flow for part of July 13, 1960 (caused by regulation of power plant upstream).

Remarks.--Records good except those for winter months, which are fair. Diurnal fluctuation caused by power-plant upstream. Records of chemical analyses for the water year 1968 published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 667 | 491 | 325 | 315 | 300 | 255 | 2,630 | 512 | 265 | 1,650 | 2,740 | 1,610 |
| 2 | 663 | 500 | 335 | 315 | 300 | 260 | 2,190 | 496 | 265 | 2,210 | 2,690 | 1,570 |
| 3 | 663 | 475 | 350 | 310 | 295 | 270 | 1,540 | 491 | 243 | 3,090 | 2,520 | 1,600 |
| 4 | 663 | 500 | 360 | 310 | 290 | 270 | 1,090 | 434 | 257 | 2,820 | 2,320 | 1,600 |
| 5 | 654 | 467 | 370 | 310 | 285 | 275 | 883 | 398 | 250 | 2,430 | 2,230 | 1,600 |
| 6 | 667 | 360 | 370 | 310 | 280 | 280 | 780 | 375 | 272 | 2,150 | 2,150 | 1,620 |
| 7 | 650 | 350 | 375 | 310 | 275 | 290 | 766 | 355 | 584 | 1,890 | 2,340 | 1,540 |
| 8 | 623 | 340 | 370 | 305 | 270 | 305 | 775 | 367 | 3,760 | 1,710 | 2,300 | 1,550 |
| 9 | 589 | 430 | 360 | 305 | 270 | 350 | 775 | 386 | 5,690 | 1,520 | 2,100 | 1,590 |
| 10 | 559 | 490 | 350 | 305 | 265 | 380 | 771 | 394 | 3,950 | 1,380 | 1,950 | 1,600 |
| 11 | 559 | 500 | 340 | 305 | 265 | 395 | 775 | 410 | 3,890 | 1,330 | 1,820 | 1,540 |
| 12 | 546 | 460 | 340 | 305 | 260 | 410 | 752 | 422 | 4,260 | 1,280 | 1,750 | 1,390 |
| 13 | 529 | 415 | 340 | 310 | 260 | 425 | 725 | 434 | 3,510 | 1,290 | 1,680 | 1,310 |
| 14 | 533 | 380 | 340 | 310 | 260 | 450 | 689 | 500 | 2,920 | 1,370 | 1,500 | 1,250 |
| 15 | 517 | 345 | 345 | 310 | 255 | 480 | 658 | 546 | 2,610 | 1,360 | 1,290 | 1,100 |
| 16 | 491 | 380 | 355 | 310 | 255 | 550 | 538 | 517 | 2,440 | 1,920 | 1,260 | 995 |
| 17 | 475 | 410 | 360 | 315 | 250 | 620 | 610 | 508 | 2,230 | 5,640 | 1,170 | 985 |
| 18 | 487 | 430 | 360 | 315 | 250 | 800 | 567 | 446 | 2,670 | 9,920 | 1,280 | 1,000 |
| 19 | 475 | 440 | 355 | 315 | 245 | 1,150 | 559 | 430 | 2,530 | 11,000 | 1,360 | 1,220 |
| 20 | 538 | 360 | 350 | 320 | 245 | 1,550 | 571 | 446 | 2,020 | 9,770 | 1,360 | 1,280 |
| 21 | 517 | 320 | 345 | 320 | 240 | 1,450 | 576 | 418 | 1,780 | 8,060 | 1,430 | 1,220 |
| 22 | 483 | 300 | 340 | 320 | 240 | 1,400 | 600 | 414 | 1,690 | 6,550 | 1,680 | 1,180 |
| 23 | 463 | 285 | 340 | 320 | 240 | 1,380 | 667 | 378 | 1,800 | 5,280 | 1,840 | 1,140 |
| 24 | 467 | 300 | 335 | 320 | 240 | 1,480 | 695 | 348 | 2,180 | 4,310 | 2,070 | 1,140 |
| 25 | 475 | 320 | 330 | 320 | 240 | 1,800 | 716 | 322 | 2,360 | 3,700 | 2,060 | 1,170 |
| 26 | 463 | 330 | 330 | 320 | 240 | 2,500 | 734 | 303 | 2,310 | 3,400 | 2,040 | 1,180 |
| 27 | 463 | 335 | 325 | 320 | 245 | 3,200 | 720 | 284 | 2,190 | 3,300 | 1,970 | 1,210 |
| 28 | 458 | 340 | 320 | 315 | 245 | 3,700 | 685 | 272 | 1,990 | 3,170 | 1,920 | 1,140 |
| 29 | 467 | 335 | 320 | 310 | 250 | 3,800 | 630 | 235 | 1,880 | 2,990 | 1,670 | 1,110 |
| 30 | 471 | 325 | 315 | 310 | ------ | 3,820 | 571 | 261 | 1,740 | 2,840 | 1,520 | 1,050 |
| 31 | 487 | ------ | 315 | 305 | ------ | 3,280 | ------ | 269 | ------ | 2,770 | 1,560 | ------ |
| TOTAL | 16,762 | 11,713 | 10,665 | 9,690 | 7,555 | 37,575 | 25,238 | 12,371 | 64,536 | 112,100 | 57,570 | 39,490 |
| MEAN | 541 | 390 | 344 | 313 | 261 | 1,212 | 841 | 399 | 2,151 | 3,616 | 1,857 | 1,316 |
| MAX | 667 | 500 | 375 | 320 | 300 | 3,820 | 2,630 | 546 | 5,690 | 11,000 | 2,740 | 1,620 |
| MIN | 458 | 285 | 315 | 305 | 240 | 255 | 538 | 235 | 243 | 1,280 | 1,170 | 985 |
| AC-FT | 33,250 | 23,230 | 21,150 | 19,220 | 14,990 | 74,530 | 50,060 | 24,540 | 128,000 | 222,300 | 114,200 | 78,330 |

CAL YR 1967 TOTAL 667,060 MEAN 1,828 MAX 18,000 MIN 285 AC-FT 1,323,000
WTR YR 1968 TOTAL 405,265 MEAN 1,107 MAX 11,000 MIN 235 AC-FT 803,800

GPO 817-490-5

5-0825. Red River of the North at Grand Forks, N. Dak.

Location.--Lat 47°56'34", long 97°03'10", in SW¼NE¼ sec.33, T.152 N., R.50 W., on left bank on second floor of old sewage plant in Grand Forks, 2.3 miles downstream from Red Lake River, and at mile 296.0.

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

Records available.--April 1882 to September 1968. 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 records referred to datum only half a foot higher than present datum. Oct. 16, 1926, to Nov. 2, 1933, staff gages near present site, at datum 5 ft higher than present datum but published at present datum. Nov. 3, 1933, to Apr. 13, 1965, water-stage recorder 0.3 mile upstream at present datum.

Average discharge.--86 years, 2,390 cfs (1,730,000 acre-ft per year).

Extremes.--Maximum discharge during year, 9,420 cfs June 11 (gage height, 20.03 ft); minimum, 420 cfs Nov. 24 (gage height, 3.70 ft).
about 49.7 ft, present site + datum
1882-1968: 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. Records of chemical analyses and water temperatures for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,050 | 735 | 637 | 630 | 630 | 510 | 6,250 | 2,230 | 1,350 | 3,030 | 3,090 | 1,780 |
| 2 | 952 | 763 | 770 | 630 | 620 | 520 | 5,050 | 2,200 | 1,320 | 2,900 | 3,030 | 1,790 |
| 3 | 896 | 766 | 917 | 620 | 610 | 540 | 4,200 | 2,120 | 1,270 | 3,110 | 2,970 | 1,820 |
| 4 | 819 | 770 | 952 | 610 | 610 | 540 | 3,250 | 2,060 | 1,240 | 3,860 | 2,840 | 1,820 |
| 5 | 805 | 760 | 938 | 600 | 600 | 560 | 2,820 | 1,940 | 1,230 | 4,130 | 2,640 | 1,810 |
| 6 | 794 | 735 | 914 | 590 | 600 | 580 | 2,350 | 1,820 | 1,800 | 3,890 | 2,500 | 1,820 |
| 7 | 794 | 676 | 864 | 580 | 590 | 580 | 2,070 | 1,730 | 3,250 | 3,520 | 2,380 | 1,800 |
| 8 | 802 | 573 | 812 | 580 | 580 | 630 | 2,020 | 1,700 | 5,600 | 3,200 | 2,390 | 1,760 |
| 9 | 794 | 618 | 780 | 580 | 580 | 710 | 1,950 | 1,690 | 7,930 | 2,910 | 2,390 | 1,730 |
| 10 | 774 | 721 | 756 | 580 | 580 | 760 | 1,940 | 1,700 | 9,220 | 2,620 | 2,250 | 1,720 |
| 11 | 752 | 833 | 749 | 580 | 580 | 800 | 2,060 | 1,740 | 9,310 | 2,400 | 2,100 | 1,730 |
| 12 | 738 | 868 | 746 | 580 | 570 | 810 | 2,280 | 1,770 | 7,650 | 2,250 | 2,000 | 1,680 |
| 13 | 742 | 844 | 746 | 580 | 560 | 850 | 2,470 | 1,780 | 7,200 | 2,140 | 1,940 | 1,580 |
| 14 | 756 | 805 | 756 | 570 | 550 | 940 | 2,600 | 1,820 | 6,700 | 2,110 | 1,900 | 1,500 |
| 15 | 738 | 777 | 724 | 570 | 530 | 960 | 2,630 | 1,940 | 6,350 | 2,160 | 1,820 | 1,430 |
| 16 | 742 | 735 | 662 | 570 | 520 | 990 | 2,570 | 2,060 | 5,900 | 2,470 | 1,740 | 1,350 |
| 17 | 728 | 752 | 618 | 570 | 510 | 1,100 | 2,470 | 2,160 | 5,590 | 3,120 | 1,650 | 1,300 |
| 18 | 738 | 756 | 612 | 570 | 500 | 1,200 | 2,340 | 2,220 | 5,160 | 4,850 | 1,640 | 1,220 |
| 19 | 735 | 777 | 640 | 570 | 500 | 1,450 | 2,250 | 2,200 | 5,160 | 6,980 | 1,690 | 1,180 |
| 20 | 721 | 836 | 720 | 570 | 510 | 1,600 | 2,160 | 2,130 | 5,150 | 8,540 | 1,730 | 1,280 |
| 21 | 738 | 798 | 870 | 570 | 500 | 1,900 | 2,080 | 2,100 | 4,720 | 9,200 | 1,760 | 1,420 |
| 22 | 738 | 615 | 750 | 570 | 480 | 2,500 | 1,980 | 2,060 | 4,340 | 9,160 | 1,810 | 1,450 |
| 23 | 756 | 486 | 650 | 580 | 470 | 2,700 | 1,910 | 1,970 | 4,120 | 7,250 | 1,960 | 1,410 |
| 24 | 735 | 462 | 650 | 580 | 460 | 2,700 | 1,900 | 1,900 | 3,970 | 6,350 | 2,050 | 1,370 |
| 25 | 735 | 570 | 640 | 590 | 460 | 2,600 | 1,920 | 1,820 | 3,970 | 5,300 | 2,100 | 1,380 |
| 26 | 752 | 662 | 630 | 610 | 470 | 2,700 | 2,010 | 1,760 | 3,970 | 4,600 | 2,160 | 1,430 |
| 27 | 749 | 662 | 630 | 610 | 480 | 3,350 | 2,100 | 1,670 | 3,820 | 4,030 | 2,150 | 1,460 |
| 28 | 735 | 540 | 630 | 620 | 500 | 4,500 | 2,160 | 1,590 | 3,590 | 3,740 | 2,140 | 1,520 |
| 29 | 710 | 600 | 630 | 640 | 510 | 5,500 | 2,200 | 1,510 | 3,340 | 3,570 | 2,110 | 1,470 |
| 30 | 728 | 624 | 630 | 630 | ------ | 6,350 | 2,230 | 1,460 | 3,170 | 3,380 | 2,020 | 1,480 |
| 31 | 732 | ------ | 630 | 620 | ------ | 6,750 | ------ | 1,420 | ------ | 3,220 | 1,860 | ------ |
| TOTAL | 23,978 | 21,119 | 22,653 | 18,350 | 15,660 | 58,180 | 76,220 | 58,270 | 137,390 | 129,990 | 66,810 | 46,490 |
| MEAN | 773 | 704 | 731 | 592 | 540 | 1,877 | 2,541 | 1,880 | 4,580 | 4,193 | 2,155 | 1,550 |
| MAX | 1,050 | 868 | 952 | 640 | 630 | 6,750 | 6,250 | 2,230 | 9,310 | 9,200 | 3,090 | 1,820 |
| MIN | 710 | 462 | 612 | 570 | 460 | 510 | 1,900 | 1,420 | 1,230 | 2,110 | 1,640 | 1,180 |
| AC-FT | 47,560 | 41,890 | 44,930 | 36,400 | 31,060 | 115,400 | 151,200 | 115,600 | 272,500 | 257,800 | 132,500 | 92,210 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CAL YR 1967: | TOTAL | 1,383,878 | MEAN | 3,791 | MAX | 28,000 | MIN | 462 | AC-FT | 2,745,000 |
| WAT YR 1968: | TOTAL | 675,110 | MEAN | 1,845 | MAX | 9,310 | MIN | 460 | AC-FT | 1,339,000 |

## 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, October 1950 to September 1968. Monthly discharge only for some periods, published in WSP 1728.

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.--18 years (1950-68), 41.4 cfs (29,970 acre-ft per year).

Extremes.--Maximum discharge during year, 1,120 cfs July 20 (gage height, 12.87 ft); no flow for many days. 1945; 1950-68: Maximum discharge, 2,590 cfs Apr. 12, 1965 (gage height, 15.29 ft); maximum gage height, 16.00 ft Apr. 3, 1966 (backwater from ice); no flow at times in most years.
Flood of April 1950 reached a stage of 15.25 ft, present datum, from floodmarks (discharge, 2,790 cfs).

Remarks.--Records good except those for winter months, which are fair. Records of chemical analysis and suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 2.3 | 0.9 | | 0 | 0.1 | 60 | 4.8 | 4.1 | 43 | 58 | 23 |
| 2 | 0 | 2.6 | .9 | | 0 | .1 | 40 | 4.2 | 4.6 | 41 | 54 | 23 |
| 3 | 0 | 2.4 | .9 | | 0.1 | .1 | 32 | 4.0 | 4.6 | 78 | 52 | 23 |
| 4 | 0 | 2.1 | .9 | | .1 | .2 | 35 | 3.8 | 4.6 | 196 | 46 | 20 |
| 5 | 0 | 1.8 | .8 | | .2 | .2 | 40 | 3.8 | 4.6 | 231 | 42 | 20 |
| 6 | 0 | 1.7 | .8 | | .2 | .2 | 34 | 4.5 | 5.8 | 189 | 38 | 20 |
| 7 | 0 | 1.7 | .8 | | .2 | .3 | 26 | 4.7 | 12 | 135 | 34 | 19 |
| 8 | 0 | 1.7 | .8 | | .2 | .3 | 20 | 4.3 | 28 | 98 | 32 | 21 |
| 9 | 0 | 1.8 | .8 | | .2 | .3 | 17 | 3.7 | 95 | 75 | 29 | 20 |
| 10 | 0 | 1.8 | .8 | | .1 | .3 | 15 | 4.0 | 280 | 61 | 25 | 23 |
| 11 | 0 | 1.9 | .8 | | .1 | .3 | 13 | 4.3 | 502 | 51 | 23 | 29 |
| 12 | 0 | 1.8 | .7 | | .1 | .2 | 12 | 4.6 | 655 | 45 | 21 | 28 |
| 13 | 0 | 1.7 | .7 | | .1 | .2 | 11 | 4.9 | 847 | 42 | 19 | 26 |
| 14 | 0 | 1.6 | .7 | | .1 | .2 | 11 | 4.4 | 1,060 | 38 | 17 | 25 |
| 15 | 0 | 1.5 | .7 | | .1 | .2 | 12 | 3.8 | 971 | 35 | 16 | 21 |
| 16 | 0 | 1.6 | .7 | | .1 | .2 | 14 | 4.4 | 716 | 46 | 17 | 20 |
| 17 | 0 | 1.6 | .6 | | .1 | .2 | 13 | 4.3 | 429 | 95 | 16 | 30 |
| 18 | 0 | 1.7 | .6 | | .1 | .2 | 11 | 4.3 | 281 | 316 | 16 | 33 |
| 19 | 0 | 1.7 | .6 | | .2 | .2 | 10 | 4.1 | 199 | 716 | 15 | 28 |
| 20 | 0 | 1.6 | .6 | | .2 | .2 | 10 | 4.1 | 157 | 1,080 | 16 | 36 |
| 21 | 0 | 1.6 | .6 | | .2 | .2 | 11 | 3.7 | 126 | 847 | 16 | 48 |
| 22 | 0 | 1.5 | .5 | | .2 | .3 | 13 | 3.6 | 100 | 579 | 23 | 48 |
| 23 | 0.2 | 1.4 | .5 | | .2 | .5 | 17 | 3.3 | 85 | 332 | 25 | 44 |
| 24 | 1.6 | 1.3 | .4 | | .2 | 5.0 | 20 | 3.3 | 72 | 254 | 25 | 40 |
| 25 | 1.9 | 1.3 | .4 | | .1 | 20 | 22 | 3.2 | 66 | 180 | 27 | 36 |
| 26 | 2.2 | 1.2 | .3 | | .1 | 65 | 19 | 3.6 | 64 | 138 | 30 | 32 |
| 27 | 2.3 | 1.1 | .3 | | .1 | 130 | 15 | 3.6 | 62 | 107 | 29 | 28 |
| 28 | 2.0 | 1.0 | .2 | | .1 | 160 | 10 | 3.6 | 55 | 91 | 30 | 26 |
| 29 | 2.2 | 1.0 | .1 | | .1 | 170 | 7.0 | 3.6 | 47 | 81 | 28 | 24 |
| 30 | 2.0 | 1.0 | .1 | | -------- | 150 | 5.5 | 4.3 | 43 | 71 | 28 | 22 |
| 31 | 2.2 | ------ | .1 | | -------- | 100 | ------ | 4.3 | ------ | 64 | 25 | ------ |
| Total | 16.6 | 49.0 | 18.6 | 0 | 3.8 | 805.2 | 575.5 | 125.1 | 6,980.3 | 6,355 | 872 | 836 |
| Mean | 0.54 | 1.63 | 0.60 | 0 | 0.13 | 26.0 | 19.2 | 4.04 | 233 | 205 | 28.1 | 27.9 |
| Max | 2.3 | 2.6 | 0.9 | 0 | 0.2 | 170 | 60 | 4.9 | 1,060 | 1,080 | 58 | 48 |
| Min | 0 | 1.0 | 0.1 | 0 | 0 | 0.1 | 5.5 | 3.2 | 4.1 | 35 | 15 | 19 |
| Ac-ft | 32.9 | 97.2 | 36.9 | 0 | 7.5 | 1,600 | 1,140 | 248 | 13,840 | 12,600 | 1,730 | 1,660 |

Cal yr 1967: Total 22,888.9 Mean 62.7 Max 1,270 Min 0 Ac-ft 45,400
Wtr yr 1968: Total 16,637.1 Mean 45.5 Max 1,080 Min 0 Ac-ft 33,000

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.~~ 206.7

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

Records available.--April 1936 to June 1937, April 1941 to September 1968 (fragmentary prior to April 1949).

Gage.--Water-stage recorder and concrete control. 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.--19 years (1949-68) 3,549 cfs (2,569,000 acre-ft per year); median of yearly mean discharges, 2,940 cfs (2,130,000 acre-ft per year).

Extremes.--Maximum discharge during year, 12,500 cfs July 23; maximum gage height, 20.41 ft July 23; minimum discharge, 437 cfs Nov. 28 (gage height, 9.18 ft).
1936-37, 1941-68: Maximum discharge, 86,500 cfs May 12, 1950 (gage height, 41.58 ft, former site and datum); minimum observed, 7.7 cfs Oct. 16, 1936 (gage height, 1.75 ft, former site and datum).
Maximum discharge known since 1860, that of May 12, 1950. Flood of April 1897 reached a stage of about 41 ft, at site and datum in use prior to Nov. 30, 1954.

Remarks.--Records good. Some regulation by reservoirs on tributaries. Records of water temperatures for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 850 | 814 | 535 | 580 | 530 | 500 | 6,700 | 2,580 | 1,680 | 3,810 | 4,130 | 2,330 |
| 2 | 805 | 814 | 572 | 560 | 530 | 500 | 7,000 | 2,590 | 1,640 | 3,630 | 3,840 | 2,180 |
| 3 | 814 | 814 | 595 | 550 | 540 | 520 | 6,900 | 2,550 | 1,550 | 3,390 | 3,650 | 2,140 |
| 4 | 823 | 823 | 611 | 540 | 540 | 540 | 6,450 | 2,480 | 1,480 | 3,420 | 3,510 | 2,140 |
| 5 | 880 | 823 | 667 | 530 | 540 | 560 | 5,800 | 2,370 | 1,460 | 4,010 | 3,360 | 2,120 |
| 6 | 890 | 814 | 718 | 520 | 540 | 560 | 5,200 | 2,230 | 1,470 | 4,660 | 3,190 | 2,120 |
| 7 | 890 | 814 | 752 | 510 | 540 | 600 | 4,500 | 2,120 | 1,560 | 4,740 | 3,040 | 2,120 |
| 8 | 890 | 805 | 760 | 500 | 540 | 600 | 4,000 | 2,000 | 1,780 | 4,430 | 2,870 | 2,110 |
| 9 | 880 | 787 | 760 | 500 | 540 | 610 | 3,460 | 1,970 | 3,370 | 4,010 | 2,790 | 2,100 |
| 10 | 900 | 752 | 752 | 500 | 540 | 640 | 2,740 | 1,890 | 6,610 | 3,580 | 2,770 | 2,050 |
| 11 | 890 | 692 | 734 | 530 | 540 | 660 | 2,540 | 1,860 | 9,380 | 3,230 | 2,700 | 2,000 |
| 12 | 850 | 675 | 726 | 520 | 540 | 700 | 2,510 | 1,890 | 10,800 | 2,940 | 2,550 | 1,950 |
| 13 | 841 | 692 | 718 | 510 | 540 | 750 | 2,740 | 1,910 | 10,900 | 2,740 | 2,380 | 1,900 |
| 14 | 860 | 718 | 709 | 510 | 540 | 850 | 3,150 | 1,920 | 10,600 | 2,570 | 2,270 | 1,850 |
| 15 | 850 | 734 | 692 | 510 | 540 | 1,000 | 3,160 | 1,970 | 10,500 | 2,590 | 2,180 | 1,810 |
| 16 | 850 | 800 | 684 | 510 | 550 | 1,200 | 3,110 | 2,070 | 10,000 | 2,590 | 2,100 | 1,780 |
| 17 | 850 | 823 | 675 | 520 | 540 | 1,350 | 3,020 | 2,200 | 9,400 | 3,000 | 2,010 | 1,750 |
| 18 | 850 | 805 | 667 | 520 | 540 | 1,450 | 2,940 | 2,450 | 8,750 | 4,300 | 1,910 | 1,720 |
| 19 | 850 | 814 | 651 | 520 | 540 | 1,550 | 2,800 | 2,530 | 8,080 | 6,270 | 1,850 | 1,800 |
| 20 | 832 | 787 | 635 | 520 | 540 | 1,600 | 2,750 | 2,570 | 7,320 | 8,850 | 1,820 | 1,840 |
| 21 | 823 | 778 | 635 | 530 | 540 | 1,650 | 2,710 | 2,510 | 6,720 | 11,300 | 1,840 | 1,760 |
| 22 | 814 | 760 | 625 | 530 | 540 | 1,750 | 2,600 | 2,440 | 6,090 | 12,200 | 1,880 | 1,770 |
| 23 | 814 | 720 | 620 | 530 | 540 | 2,100 | 2,480 | 2,380 | 5,460 | 12,500 | 1,920 | 1,820 |
| 24 | 814 | 680 | 620 | 520 | 540 | 2,500 | 2,400 | 2,310 | 4,970 | 11,600 | 1,980 | 1,780 |
| 25 | 814 | 640 | 620 | 530 | 540 | 2,750 | 2,310 | 2,240 | 4,680 | 10,400 | 2,190 | 1,710 |
| 26 | 814 | 595 | 620 | 530 | 530 | 2,900 | 2,270 | 2,190 | 4,560 | 9,500 | 2,330 | 1,650 |
| 27 | 805 | 478 | 620 | 520 | 510 | 3,100 | 2,310 | 2,080 | 4,500 | 8,680 | 2,510 | 1,620 |
| 28 | 805 | 450 | 620 | 520 | 500 | 3,300 | 2,400 | 2,000 | 4,380 | 7,320 | 2,570 | 1,660 |
| 29 | 796 | 506 | 620 | 530 | 500 | 4,500 | 2,460 | 1,900 | 4,160 | 6,060 | 2,550 | 1,700 |
| 30 | 796 | 535 | 620 | 530 | ------ | 5,600 | 2,530 | 1,790 | 3,960 | 5,080 | 2,510 | 1,700 |
| 31 | 814 | ------ | 605 | 530 | ------ | 6,200 | ------ | 1,740 | ------ | 4,520 | 2,480 | ------ |
| TOTAL | 26,054 | 21,742 | 20,438 | 16,260 | 15,530 | 53,090 | 105,940 | 67,730 | 167,810 | 177,920 | 79,680 | 56,980 |
| MEAN | 840 | 725 | 659 | 525 | 536 | 1,713 | 3,531 | 2,185 | 5,594 | 5,739 | 2,570 | 1,899 |
| MAX | 900 | 823 | 760 | 580 | 550 | 6,200 | 7,000 | 2,590 | 10,900 | 12,500 | 4,130 | 2,330 |
| MIN | 796 | 450 | 535 | 500 | 500 | 500 | 2,270 | 1,740 | 1,460 | 2,570 | 1,820 | 1,620 |
| AC-FT | 51,680 | 43,120 | 40,540 | 32,250 | 30,800 | 105,300 | 210,100 | 134,300 | 332,800 | 352,900 | 158,000 | 113,000 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CAL YR 1967: | TOTAL | 1,716,831 | MEAN | 4,704 | MAX | 32,200 | MIN | 450 | AC-FT | 3,405,000 |
| WAT YR 1968: | TOTAL | 809,174 | MEAN | 2,211 | MAX | 12,500 | MIN | 450 | AC-FT | 1,605,000 |

## 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 70 ft upstream from culvert 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 1968. Monthly discharge only for some periods, published in WSP 1308. Published as South Fork Two Rivers at Bronson prior to 1941.

Gage.--Digital water-stage recorder. Datum of gage is 928.46 ft above mean sea level, adjustment of 1928 (levels by Geodetic Survey of Canada). Prior to Nov. 23, 1953, chain gage at bridge 100 ft downstream at datum 2.00 ft higher. Nov. 23, 1953, to Oct. 5, 1963, graphic water-stage recorder at same site at datum 2.00 ft higher and Oct. 6, 1963 to July 19, 1967, graphic water-stage recorder at same site and datum.

Average discharge.--27 years (1928-36, 1941-43, 1945-47, 1953-68), 86.6 cfs (62,700 acre-ft per year).

Extremes.--Maximum discharge during year, 2,290 cfs July 19 (gage height, 11.08 ft); minimum daily, 1.3 cfs Feb. 10-26.
1928-37, 1941-47, 1953-68: Maximum discharge, 5,410 cfs Apr. 5, 1966 (gage height 18.23 ft); no flow at times in 1937, 1941, 1960.

Remarks.--Records good except those for period of no gage-height record and those for winter months, which are fair. Flow partly regulated since 1937 by Bronson Lake (usable capacity, 3,700 acre-ft). Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.5 | 2.0 | 2.4 | 1.8 | 1.5 | 1.4 | 221 | 15 | 4.9 | 28 | 219 | 158 |
| 2 | 2.8 | 2.3 | 2.4 | 1.7 | 1.5 | 1.5 | 39 | 14 | 4.3 | 586 | 135 | 173 |
| 3 | 2.5 | 2.0 | 2.4 | 1.7 | 1.4 | 1.5 | 237 | 9.0 | 5.2 | 732 | 68 | 227 |
| 4 | 1.8 | 2.3 | 2.3 | 1.6 | 1.4 | 1.6 | 223 | 2.0 | 5.5 | 678 | 99 | 243 |
| 5 | 2.0 | 2.3 | 2.3 | 1.6 | 1.4 | 1.6 | 159 | 2.0 | 4.9 | 605 | 101 | 219 |
| 6 | 2.3 | 2.3 | 2.3 | 1.6 | 1.4 | 1.7 | 173 | 4.9 | 11 | 385 | 110 | 217 |
| 7 | 2.8 | 2.5 | 2.2 | 1.5 | 1.4 | 1.7 | 165 | 5.9 | 19 | 219 | 229 | 217 |
| 8 | 2.5 | 2.5 | 2.2 | 1.5 | 1.4 | 1.8 | 84 | 4.9 | 249 | 158 | 273 | 267 |
| 9 | 2.3 | 2.8 | 2.2 | 1.5 | 1.4 | 1.9 | 5.0 | 4.6 | 729 | 74 | 265 | 453 |
| 10 | 1.8 | 2.8 | 2.2 | 1.5 | 1.3 | 1.9 | 30 | 5.2 | 997 | 154 | 251 | 463 |
| 11 | 2.0 | 2.8 | 2.2 | 1.5 | 1.3 | 1.8 | 201 | 5.9 | 1,350 | 175 | 154 | 311 |
| 12 | 2.0 | 3.1 | 2.3 | 1.5 | 1.3 | 1.8 | 217 | 5.9 | 1,690 | 177 | 132 | 241 |
| 13 | 2.5 | 2.8 | 2.3 | 1.5 | 1.3 | 1.7 | 53 | 6.3 | 1,890 | 110 | 277 | 196 |
| 14 | 2.3 | 2.8 | 2.3 | 1.5 | 1.3 | 1.7 | 8.5 | 6.7 | 2,080 | 146 | 257 | 201 |
| 15 | 1.6 | 3.1 | 2.4 | 1.5 | 1.3 | 1.7 | 8.5 | 5.9 | 1,850 | 463 | 158 | 201 |
| 16 | 1.5 | 3.4 | 2.4 | 1.5 | 1.3 | 1.7 | 6.3 | 5.2 | 1,270 | 473 | 42 | 201 |
| 17 | 1.5 | 3.4 | 2.4 | 1.6 | 1.3 | 1.7 | 2.3 | 4.9 | 848 | 1,130 | 91 | 292 |
| 18 | 1.5 | 3.7 | 2.5 | 1.6 | 1.3 | 1.7 | 2.0 | 5.2 | 569 | 1,600 | 213 | 349 |
| 19 | 1.5 | 3.4 | 2.5 | 1.6 | 1.3 | 1.7 | 2.0 | 4.9 | 178 | 2,070 | 277 | 351 |
| 20 | 1.8 | 3.4 | 2.5 | 1.6 | 1.3 | 1.8 | 2.3 | 5.2 | 307 | 2,220 | 28 | 353 |
| 21 | 2.0 | 3.7 | 2.4 | 1.6 | 1.3 | 1.9 | 2.0 | 5.2 | 263 | 2,240 | 25 | 349 |
| 22 | 1.8 | 3.7 | 2.3 | 1.6 | 1.3 | 3.5 | 7.1 | 5.2 | 82 | 2,030 | 27 | 338 |
| 23 | 2.0 | 3.7 | 2.3 | 1.5 | 1.3 | 10 | 21 | 5.2 | 96 | 1,510 | 173 | 255 |
| 24 | 1.6 | 3.2 | 2.2 | 1.5 | 1.3 | 150 | 36 | 4.9 | 111 | 997 | 289 | 201 |
| 25 | 1.8 | 2.4 | 2.2 | 1.5 | 1.3 | 350 | 39 | 4.0 | 108 | 895 | 327 | 199 |
| 26 | 2.3 | 1.9 | 2.1 | 1.5 | 1.3 | 450 | 34 | 3.7 | 96 | 600 | 400 | 123 |
| 27 | 2.3 | 2.2 | 2.1 | 1.5 | 1.4 | 520 | 28 | 3.7 | 134 | 342 | 314 | 63 |
| 28 | 2.0 | 2.3 | 2.0 | 1.5 | 1.4 | 558 | 24 | 4.9 | 108 | 257 | 235 | 66 |
| 29 | 2.3 | 2.4 | 2.0 | 1.5 | 1.4 | 572 | 21 | 4.0 | 11 | 322 | 277 | 86 |
| 30 | 2.3 | 2.4 | 1.9 | 1.5 | ------ | 617 | 18 | 5.2 | 12 | 320 | 314 | 178 |
| 31 | 2.3 | ------ | 1.8 | 1.5 | ------ | 617 | ------ | 5.9 | ------ | 221 | 251 | ------ |
| TOTAL | 64.2 | 83.6 | 70.0 | 48.1 | 39.1 | 3,883.3 | 2,069.9 | 175.5 | 15,082.8 | 21,917 | 6,011 | 7,191 |
| MEAN | 2.07 | 2.79 | 2.26 | 1.55 | 1.35 | 125 | 69.0 | 5.66 | 503 | 707 | 194 | 240 |
| MAX | 2.8 | 3.7 | 2.5 | 1.8 | 1.5 | 617 | 237 | 15 | 2,080 | 2,240 | 400 | 463 |
| MIN | 1.5 | 1.9 | 1.8 | 1.5 | 1.3 | 1.4 | 2.0 | 2.0 | 4.3 | 28 | 25 | 63 |
| AC-FT | 127 | 166 | 139 | 95 | 78 | 7,700 | 4,110 | 348 | 29,920 | 43,470 | 11,920 | 14,260 |

| | | | | | |
|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 60,016.40 | MEAN 164 | MAX 2,210 | MIN .90 | AC-FT 119,000 |
| WTR YR 1968 | TOTAL 56,635.5 | MEAN 155 | MAX 2,240 | MIN 1.3 | AC-FT 112,300 |

Note.--No gage-height record Feb. 18 to Mar. 23.

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

(International Gaging Station)

Location.--Lat 49°00'30", long 97°12'40", in sec.2, T.1, R.2 E., on right bank 1,500 ft downstream from Canadian National Railway bridge in Emerson, three-quarters of a mile downstream from international boundary, 3.6 miles downstream from Pembina River, and at mile 154.3

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

Records available.--March to November 1902 (gage heights only), May 1912 to September 1929 (monthly discharge only, published in WSP 1308), October 1929 to September 1968.

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

Average discharge.--56 years (1912-68) 2,970 cfs (2,150,000 acre-ft per year); median of yearly mean discharges, 2,500 cfs (1,810,000 acre-ft per year).

Extremes.--Maximum daily discharge during year, 13,900 cfs July 24, 25; maximum gage height, 64.12 ft July 25; minimum daily discharge, 404 cfs Mar. 23; minimum gage height, 47.48 ft Jan. 10.
1912-68: Maximum discharge, 95,500 cfs May 13, 1950 (gage height, 90.89 ft); minimum observed, 0.9 cfs Feb. 6-8, 1937 (gage height, 44.00 ft).

Remarks.--Records good. Discharge partially regulated by reservoirs on tributaries.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 980 | 950 | 792 | 616 | 508 | 412 | 8,240 | 2,660 | 2,020 | 4,750 | 5,260 | 3,120 |
| 2 | 872 | 960 | 772 | 620 | 508 | 404 | 8,270 | 2,670 | 1,940 | 4,760 | 4,880 | 2,980 |
| 3 | 840 | 960 | 752 | 612 | 508 | 404 | 8,630 | 2,670 | 1,900 | 4,670 | 4,590 | 2,800 |
| 4 | 824 | 975 | 748 | 588 | 520 | 412 | 8,350 | 2,660 | 1,860 | 4,640 | 4,360 | 2,790 |
| 5 | 832 | 980 | 752 | 564 | 528 | 416 | 8,560 | 2,620 | 1,790 | 4,820 | 4,190 | 2,830 |
| 6 | 880 | 995 | 744 | 544 | 536 | 436 | 8,580 | 2,570 | 1,740 | 5,250 | 4,060 | 2,880 |
| 7 | 915 | 990 | 760 | 528 | 536 | 456 | 8,080 | 2,490 | 1,730 | 5,570 | 3,930 | 3,020 |
| 8 | 930 | 965 | 788 | 500 | 528 | 472 | 7,630 | 2,400 | 1,760 | 5,530 | 3,780 | 3,280 |
| 9 | 935 | 945 | 784 | 460 | 528 | 492 | 7,400 | 2,300 | 1,890 | 5,300 | 3,680 | 3,370 |
| 10 | 930 | 930 | 796 | 436 | 520 | 512 | 6,860 | 2,260 | 3,280 | 4,940 | 3,620 | 3,300 |
| 11 | 935 | 892 | 788 | 444 | 512 | 528 | 5,710 | 2,200 | 6,370 | 4,540 | 3,550 | 3,280 |
| 12 | 935 | 844 | 772 | 460 | 504 | 552 | 4,430 | 2,210 | 9,030 | 4,230 | 3,400 | 3,240 |
| 13 | 925 | 832 | 752 | 472 | 504 | 588 | 3,680 | 2,200 | 10,300 | 3,970 | 3,180 | 3,130 |
| 14 | 915 | 876 | 728 | 476 | 504 | 636 | 3,540 | 2,180 | 11,200 | 4,060 | 2,910 | 2,960 |
| 15 | 935 | 1,010 | 704 | 464 | 508 | 688 | 3,680 | 2,280 | 11,700 | 4,070 | 2,750 | 2,760 |
| 16 | 935 | 1,120 | 664 | 456 | 516 | 776 | 3,760 | 2,500 | 12,000 | 4,040 | 2,650 | 2,770 |
| 17 | 925 | 1,120 | 632 | 448 | 516 | 884 | 3,610 | 2,530 | 11,700 | 4,270 | 2,530 | 2,980 |
| 18 | 910 | 1,040 | 604 | 444 | 516 | 985 | 3,470 | 2,600 | 11,200 | 4,780 | 2,380 | 3,040 |
| 19 | 915 | 995 | 588 | 444 | 508 | 1,060 | 3,310 | 2,750 | 10,400 | 5,880 | 2,370 | 3,050 |
| 20 | 905 | 980 | 576 | 444 | 492 | 1,100 | 3,170 | 2,850 | 9,280 | 8,070 | 2,420 | 3,130 |
| 21 | 900 | 995 | 572 | 452 | 472 | 1,120 | 3,100 | 2,880 | 8,160 | 9,650 | 2,380 | 3,190 |
| 22 | 905 | 1,000 | 564 | 448 | 460 | 1,140 | 3,020 | 2,860 | 7,260 | 11,800 | 2,260 | 3,160 |
| 23 | 905 | 995 | 556 | 452 | 452 | 1,330 | 2,920 | 2,790 | 6,540 | 13,600 | 2,130 | 3,120 |
| 24 | 896 | 1,040 | 552 | 468 | 452 | 1,480 | 2,830 | 2,720 | 5,850 | 13,900 | 2,190 | 3,090 |
| 25 | 892 | 1,030 | 564 | 468 | 448 | 1,840 | 2,710 | 2,640 | 5,260 | 13,900 | 2,500 | 3,020 |
| 26 | 905 | 940 | 576 | 468 | 444 | 2,360 | 2,600 | 2,550 | 5,130 | 12,100 | 2,890 | 2,910 |
| 27 | 910 | 900 | 584 | 480 | 436 | 2,870 | 2,550 | 2,500 | 5,120 | 10,700 | 3,310 | 2,780 |
| 28 | 896 | 940 | 584 | 488 | 428 | 3,540 | 2,560 | 2,400 | 5,020 | 8,880 | 3,630 | 2,690 |
| 29 | 892 | 884 | 592 | 492 | 416 | 4,290 | 2,600 | 2,310 | 4,900 | 8,180 | 3,610 | 2,610 |
| 30 | 892 | 816 | 604 | 496 | ------ | 5,630 | 2,640 | 2,210 | 4,790 | 6,360 | 3,420 | 2,550 |
| 31 | 915 | ------ | 616 | 504 | ------ | 6,630 | ------ | 2,110 | ------ | 5,640 | 3,240 | ------ |
| Total | 28,081 | 28,899 | 20,860 | 15,236 | 14,308 | 44,443 | 146,490 | 77,570 | 181,120 | 212,850 | 102,050 | 89,830 |
| Mean | 906 | 963 | 673 | 491 | 493 | 1,430 | 4,880 | 2,500 | 6,040 | 6,870 | 3,290 | 2,990 |
| Max | 980 | 1,120 | 792 | 620 | 536 | 6,630 | 8,630 | 2,880 | 12,000 | 13,900 | 5,260 | 3,370 |
| Min | 824 | 816 | 552 | 436 | 416 | 404 | 2,550 | 2,110 | 1,730 | 3,970 | 2,130 | 2,550 |
| Ac-ft | 55,700 | 57,320 | 41,380 | 30,200 | 28,400 | 88,200 | 291,000 | 154,000 | 359,000 | 422,000 | 202,000 | 178,000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 1,999,194 | Mean | 5,480 | Max | 33,200 | Min | 552 | Ac-ft | 3,970,000 |
| Wtr yr 1968: | Total | 961,737 | Mean | 2,630 | Max | 13,900 | Min | 404 | Ac-ft | 1,910,000 |

## 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 1968.

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

Average discharge.--22 years, 150 cfs (108,600 acre-ft per year).

Extremes.--Maximum discharge during year, 4,920 cfs July 18 (gage height,22.32 ft); minimum, 0.4 cfs Oct. 1, 2.
1946-68: Maximum discharge, that of July 18, 1968; 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 winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.4 | 3.0 | 1.0 | 1.5 | 1.3 | 0.7 | 566 | 70 | 59 | 293 | 198 | 518 |
| 2 | .5 | 3.1 | 1.2 | 1.4 | 1.2 | .7 | 238 | 68 | 78 | 596 | 174 | 414 |
| 3 | .5 | 3.2 | 1.3 | 1.3 | 1.2 | .8 | 171 | 59 | 90 | 712 | 148 | 344 |
| 4 | .5 | 3.2 | 1.5 | 1.3 | 1.1 | .8 | 116 | 52 | 98 | 692 | 139 | 317 |
| 5 | .5 | 3.0 | 1.6 | 1.2 | 1.0 | .8 | 114 | 49 | 87 | 608 | 636 | 301 |
| 6 | .6 | 2.6 | 1.8 | 1.2 | 1.0 | .8 | 103 | 46 | 120 | 462 | 882 | 278 |
| 7 | .6 | 2.1 | 1.9 | 1.2 | 1.0 | .8 | 107 | 48 | 664 | 313 | 664 | 313 |
| 8 | .8 | 1.9 | 2.1 | 1.2 | .9 | .8 | 111 | 50 | 1,590 | 221 | 436 | 512 |
| 9 | .9 | 1.7 | 2.2 | 1.2 | .9 | .8 | 126 | 61 | 3,210 | 182 | 278 | 584 |
| 10 | 1.0 | 1.5 | 2.2 | 1.2 | .9 | .8 | 128 | 70 | 3,330 | 156 | 224 | 533 |
| 11 | .9 | 1.7 | 2.4 | 1.2 | .9 | .8 | 131 | 78 | 3,390 | 380 | 187 | 459 |
| 12 | 1.0 | 1.8 | 2.6 | 1.2 | .9 | .8 | 116 | 76 | 3,100 | 305 | 158 | 352 |
| 13 | 1.4 | 1.9 | 2.7 | 1.2 | .9 | .7 | 96 | 67 | 2,620 | 297 | 139 | 278 |
| 14 | 1.9 | 1.9 | 2.8 | 1.2 | .8 | .7 | 87 | 64 | 2,140 | 592 | 122 | 234 |
| 15 | 1.9 | 2.0 | 2.8 | 1.2 | .8 | .7 | 78 | 61 | 1,680 | 340 | 111 | 198 |
| 16 | 1.9 | 2.0 | 2.8 | 1.2 | .8 | .7 | 83 | 74 | 1,290 | 696 | 107 | 184 |
| 17 | 2.6 | 2.1 | 2.8 | 1.2 | .8 | .7 | 81 | 66 | 970 | 2,730 | 131 | 234 |
| 18 | 2.6 | 2.2 | 2.8 | 1.2 | .7 | .7 | 74 | 58 | 712 | 4,820 | 137 | 425 |
| 19 | 2.3 | 2.2 | 2.7 | 1.2 | .7 | .7 | 66 | 58 | 522 | 4,440 | 190 | 484 |
| 20 | 2.2 | 2.2 | 2.6 | 1.2 | .7 | .7 | 64 | 58 | 388 | 3,220 | 368 | 428 |
| 21 | 2.3 | 2.1 | 2.6 | 1.2 | .6 | .7 | 76 | 56 | 352 | 2,550 | 399 | 352 |
| 22 | 2.6 | 2.1 | 2.6 | 1.2 | .6 | .8 | 118 | 50 | 320 | 1,900 | 407 | 297 |
| 23 | 2.8 | 2.0 | 2.6 | 1.3 | .6 | .8 | 146 | 45 | 293 | 1,380 | 364 | 259 |
| 24 | 3.0 | 2.0 | 2.5 | 1.3 | .6 | .9 | 148 | 40 | 274 | 1,020 | 812 | 227 |
| 25 | 3.0 | 2.0 | 2.5 | 1.4 | .6 | 1.2 | 142 | 36 | 263 | 730 | 1,350 | 210 |
| 26 | 3.1 | 1.8 | 2.3 | 1.4 | .6 | 4.0 | 131 | 33 | 263 | 512 | 1,840 | 195 |
| 27 | 3.1 | 1.5 | 2.1 | 1.4 | .6 | 130 | 128 | 33 | 263 | 384 | 2,140 | 176 |
| 28 | 3.1 | 1.3 | 1.9 | 1.5 | .6 | 970 | 113 | 35 | 259 | 324 | 1,860 | 158 |
| 29 | 3.0 | 1.1 | 1.8 | 1.5 | .7 | 1,350 | 96 | 40 | 256 | 263 | 1,330 | 144 |
| 30 | 2.9 | 1.0 | 1.7 | 1.4 | -------- | 1,100 | 83 | 44 | 256 | 221 | 986 | 133 |
| 31 | 2.9 | ------ | 1.6 | 1.4 | -------- | 825 | ------ | 51 | ------ | 207 | 716 | ------ |
| Total | 56.8 | 62.2 | 68.0 | 39.7 | 24.0 | 4,398.4 | 3,837 | 1,696 | 28,937 | 31,546 | 17,633 | 9,541 |
| Mean | 1.83 | 2.07 | 2.19 | 1.28 | 0.83 | 142 | 128 | 54.7 | 965 | 1,020 | 569 | 318 |
| Max | 3.1 | 3.2 | 2.8 | 1.5 | 1.3 | 1,350 | 566 | 78 | 3,390 | 4,820 | 2,140 | 584 |
| Min | 0.4 | 1.0 | 1.0 | 1.2 | 0.6 | 0.7 | 64 | 33 | 59 | 156 | 107 | 133 |
| Ac-ft | 113 | 123 | 135 | 78.7 | 47.6 | 8,720 | 7,610 | 3,360 | 57,400 | 62,570 | 34,970 | 18,920 |

Cal yr 1967: Total 60,773.4 Mean 167 Max 2,750 Min 0.3 Ac-ft 120,500
Wtr yr 1968: Total 97,839.1 Mean 267 Max 4,820 Min 0.4 Ac-ft 194,100

## 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 10½ miles (revised) 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 1968 (winter records incomplete prior to 1941). Prior to September 1951, published as Mud Creek near Sprague.

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

Average discharge.--29 years (1928-29, 1940-68), 61.3 cfs (44,380 acre-ft per year).

Extremes.--Maximum discharge during year, 861 cfs June 11 (gage height, 11.79 ft, backwater from Roseau River); minimum daily, 0.6 cfs Jan. 18 to Feb. 24.
1928-68: 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 winter months, which are fair.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.7 | 0.9 | 1.1 | 0.9 | 0.6 | 0.8 | 95 | 52 | 50 | 209 | 40 | 142 |
| 2 | .8 | .8 | 1.1 | .9 | .6 | .8 | 80 | 47 | 52 | 379 | 33 | 120 |
| 3 | 1.2 | .8 | 1.1 | .8 | .6 | .8 | 68 | 43 | 50 | 387 | 25 | 109 |
| 4 | .8 | .8 | 1.1 | .8 | .6 | .9 | 64 | 42 | 54 | 369 | 20 | 125 |
| 5 | .9 | .9 | 1.1 | .7 | .6 | 1.0 | 62 | 40 | 70 | 297 | 276 | 114 |
| 6 | .9 | .9 | 1.2 | .7 | .6 | 1.1 | 63 | 37 | 104 | 229 | 282 | 98 |
| 7 | 1.0 | 1.0 | 1.4 | .7 | .6 | 1.1 | 67 | 46 | 195 | 164 | 180 | 96 |
| 8 | 1.3 | 1.1 | 1.4 | .7 | .6 | 1.2 | 69 | 62 | 555 | 115 | 110 | 97 |
| 9 | 1.3 | 1.2 | 1.5 | .7 | .6 | 1.2 | 71 | 74 | 720 | 83 | 83 | 84 |
| 10 | 1.2 | 1.3 | 1.5 | .7 | .6 | 1.4 | 72 | 70 | 725 | 64 | 68 | 72 |
| 11 | 1.2 | 1.3 | 1.5 | .7 | .6 | 1.6 | 70 | 67 | 840 | 54 | 49 | 62 |
| 12 | 1.7 | 1.3 | 1.5 | .7 | .6 | 1.7 | 67 | 61 | 800 | 48 | 37 | 53 |
| 13 | 1.8 | 1.3 | 1.4 | .7 | .6 | 1.6 | 62 | 54 | 725 | 61 | 31 | 45 |
| 14 | 1.6 | 1.3 | 1.4 | .7 | .6 | 1.4 | 59 | 49 | 594 | 190 | 26 | 39 |
| 15 | 1.5 | 1.2 | 1.4 | .7 | .6 | 1.3 | 56 | 46 | 462 | 206 | 22 | 34 |
| 16 | 1.4 | 1.2 | 1.3 | .7 | .6 | 1.2 | 54 | 46 | 353 | 189 | 33 | 43 |
| 17 | 1.3 | 1.3 | 1.3 | .7 | .6 | 1.1 | 52 | 43 | 284 | 224 | 36 | 83 |
| 18 | 1.3 | 1.3 | 1.3 | .6 | .6 | 1.2 | 51 | 46 | 240 | 185 | 34 | 132 |
| 19 | 1.3 | 1.4 | 1.3 | .6 | .6 | 1.4 | 53 | 48 | 192 | 140 | 54 | 125 |
| 20 | 1.7 | 1.5 | 1.3 | .6 | .6 | 1.8 | 54 | 48 | 150 | 108 | 56 | 106 |
| 21 | 1.6 | 1.5 | 1.3 | .6 | .6 | 2.3 | 73 | 46 | 127 | 96 | 45 | 90 |
| 22 | 1.6 | 1.5 | 1.2 | .6 | .6 | 3.5 | 87 | 41 | 142 | 91 | 48 | 79 |
| 23 | 1.6 | 1.5 | 1.2 | .6 | .6 | 6.0 | 91 | 36 | 115 | 79 | 68 | 75 |
| 24 | 1.4 | 1.6 | 1.2 | .6 | .6 | 8.0 | 87 | 31 | 89 | 75 | 489 | 65 |
| 25 | 1.6 | 1.6 | 1.2 | .6 | .7 | 17 | 78 | 28 | 72 | 67 | 758 | 57 |
| 26 | 1.6 | 1.5 | 1.2 | .6 | .7 | 23 | 73 | 28 | 59 | 54 | 608 | 57 |
| 27 | 1.6 | 1.5 | 1.1 | .6 | .7 | 110 | 68 | 30 | 46 | 48 | 458 | 47 |
| 28 | 1.5 | 1.3 | 1.1 | .6 | .8 | 200 | 64 | 34 | 40 | 39 | 351 | 40 |
| 29 | 1.4 | 1.2 | 1.0 | .6 | .8 | 190 | 60 | 43 | 34 | 31 | 271 | 34 |
| 30 | 1.2 | 1.2 | 1.0 | .6 | ------ | 160 | 57 | 47 | 38 | 31 | 207 | 31 |
| 31 | 1.0 | ------ | 1.0 | .6 | ------ | 120 | ------ | 49 | ------ | 43 | 167 | ------ |
| Total | 41.0 | 37.2 | 38.7 | 20.9 | 18.1 | 864.4 | 2,027 | 1,434 | 7,977 | 4,355 | 4,965 | 2,354 |
| Mean | 1.32 | 1.24 | 1.25 | 0.67 | 0.62 | 27.9 | 67.6 | 46.3 | 266 | 140 | 160 | 78.5 |
| Max | 1.8 | 1.6 | 1.5 | 0.9 | 0.8 | 200 | 95 | 74 | 840 | 387 | 758 | 142 |
| Min | 0.7 | 0.8 | 1.0 | 0.6 | 0.6 | 0.8 | 51 | 28 | 34 | 31 | 20 | 31 |
| Ac-ft | 81.3 | 73.8 | 76.8 | 41.5 | 35.9 | 1,710 | 4,020 | 2,840 | 15,820 | 8,640 | 9,850 | 4,670 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 20,242.5 | Mean | 55.5 | Max | 1,060 | Min | 0.1 | Ac-ft | 40,150 |
| Wtr yr 1968: | Total | 24,132.3 | Mean | 65.9 | Max | 840 | Min | 0.6 | Ac-ft | 47,870 |

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

Location.--Lat 48°54'22", long 95°49'22", in SW¼SW¼ sec.28, T.163 N., R.40 W., near center of span on upstream side of bridge (revised) at Roseau Lake, 3½ miles upstream from Pine Creek, 3¾ miles downstream from Sprague Creek, and 7 miles northwest of Roseau.

Records available.--November 1939 to September 1968 (incomplete).

Gage.--Wire-weight gage read once daily. Datum of gage is 1,018.59 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Prior to Sept. 6, 1967, staff gage at same site and datum. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation observed during year, 1,033.68 ft June 16; minimum observed, 1,021.02 ft Oct. 5.
1939-68: Maximum elevation observed, 1,036.86 ft May 13, 1950; minimum observed, 1,019.75 ft Aug. 16, 1941.
Flood of July 1919 reached an elevation of about 1,034 ft.

Elevation, in feet, water year October 1967 to September 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 21.51 | | | | | | | 22.75 | 30.39 | | 31.47 |
| 2 | | | | | | | | 23.09 | | 30.43 | 30.24 | 31.25 |
| 3 | 21.07 | 21.49 | | | | | | | 23.16 | 30.53 | 29.85 | |
| 4 | | 21.49 | | | | | | | | 30.53 | 29.39 | 30.84 |
| 5 | 21.02 | 21.49 | | | | | | | | 30.39 | 30.84 | |
| 6 | | | | | | | | | | 30.27 | 31.50 | |
| 7 | 21.04 | | | | | | | | | 29.97 | 31.53 | 30.19 |
| 8 | | | | | | | | | | 29.63 | | 30.04 |
| 9 | | | | | | | | 24.11 | | 29.29 | 31.24 | 29.93 |
| 10 | 21.06 | | | | | | 26.38 | | | | 30.87 | 29.77 |
| 11 | | | | | | | | | | 28.82 | 30.72 | 29.59 |
| 12 | 21.17 | | | | | | 26.09 | 23.24 | | | 30.29 | 29.27 |
| 13 | | | | | | | 25.84 | | 33.33 | 28.39 | 29.94 | 29.09 |
| 14 | 21.27 | | | | | | | 22.95 | 33.51 | 28.74 | | 28.69 |
| 15 | | | | | | | 24.59 | | 33.63 | 28.59 | 29.29 | 28.39 |
| 16 | 21.33 | | | | | | | | 33.68 | 29.19 | 28.89 | 28.02 |
| 17 | | | | | | | | 22.79 | 33.65 | 30.19 | 28.67 | |
| 18 | | | | | | | 24.29 | | 33.54 | 31.19 | | 28.19 |
| 19 | | | | | | | | | 33.41 | 31.79 | | 28.26 |
| 20 | | | | | | | | 22.72 | 33.24 | 32.54 | 27.83 | 28.06 |
| 21 | | | | | | | | | 33.04 | 32.84 | 27.73 | 28.02 |
| 22 | | | | | | | 24.75 | 22.39 | 32.81 | 32.94 | 28.05 | 27.73 |
| 23 | 21.44 | | | | | | | | 32.56 | 32.99 | 28.09 | 27.39 |
| 24 | | | | | | | | | 32.34 | 32.88 | 30.04 | |
| 25 | | | | | | | 24.46 | 22.14 | 32.03 | 32.77 | 30.69 | 26.60 |
| 26 | 21.44 | | | | | | | | 31.72 | 32.57 | | |
| 27 | | | | | | | 24.09 | | 31.37 | 32.33 | 31.49 | |
| 28 | 21.49 | | | | | | 23.96 | | 30.87 | 32.05 | | 25.44 |
| 29 | | | | | ------ | | | | 30.49 | 31.45 | 31.77 | 25.06 |
| 30 | | | | | ------ | | 23.39 | | 30.44 | | 31.74 | |
| 31 | | ------ | | | ------ | | ------ | | ------ | 30.57 | 31.67 | ------ |

Note.--Add 1,000.00 ft to obtain elevation above mean sea level.

5-1075. Roseau River at Ross, Minn.

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

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

Records available.--July 1928 to September 1968.

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.--40 years, 259 cfs (187,500 acre-ft per year).

Extremes.--Maximum discharge during year, 2,370 cfs June 18 (gage height, 14.35 ft); minimum, 0.9 cfs Oct. 8, 9, 10 (gage height, 0.84 ft).
1928-68: Maximum discharge, 6,560 cfs May 12, 1950 (gage height, 18.25 ft); no flow Aug. 29, 30, 1961. Maximum stage known, about 19 ft in 1896. Other outstanding floods reached the following stages (from information by local residents): flood of July 1919, 17.5 ft; flood of 1927, about 16 ft.

Remarks.--Records good except those for winter months, which are fair. High flow regulated by natural storage in Roseau Lake. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0 | 3.5 | 1.9 | 4.8 | 5.1 | 5.1 | 1,050 | 199 | 149 | 1,400 | 1,540 | 1,710 |
| 2 | 1.0 | 3.6 | 1.9 | 4.7 | 5.0 | 5.4 | 1,000 | 182 | 160 | 1,420 | 1,440 | 1,660 |
| 3 | 1.4 | 3.2 | 2.1 | 4.5 | 5.0 | 5.7 | 950 | 169 | 165 | 1,420 | 1,360 | 1,610 |
| 4 | 5.9 | 2.7 | 2.4 | 4.2 | 4.9 | 5.9 | 870 | 158 | 178 | 1,430 | 1,270 | 1,550 |
| 5 | 2.7 | 2.2 | 2.6 | 3.9 | 4.9 | 6.0 | 800 | 149 | 193 | 1,420 | 1,480 | 1,490 |
| 6 | 1.1 | 1.9 | 2.8 | 3.6 | 4.8 | 6.1 | 736 | 140 | 233 | 1,380 | 1,600 | 1,420 |
| 7 | 1.0 | 1.8 | 3.0 | 3.3 | 4.8 | 6.2 | 648 | 143 | 473 | 1,340 | 1,680 | 1,380 |
| 8 | 1.0 | 2.0 | 3.3 | 3.2 | 4.9 | 6.4 | 619 | 158 | 1,100 | 1,280 | 1,700 | 1,340 |
| 9 | 1.0 | 2.8 | 3.6 | 3.2 | 5.0 | 6.6 | 613 | 180 | 1,270 | 1,210 | 1,660 | 1,310 |
| 10 | 1.0 | 3.3 | 4.3 | 3.1 | 5.0 | 6.7 | 582 | 194 | 1,400 | 1,130 | 1,600 | 1,280 |
| 11 | 1.0 | 3.5 | 5.0 | 3.1 | 5.0 | 7.1 | 570 | 195 | 1,380 | 1,070 | 1,530 | 1,230 |
| 12 | 1.2 | 3.5 | 5.5 | 3.2 | 5.0 | 7.6 | 552 | 192 | 1,850 | 1,030 | 1,450 | 1,180 |
| 13 | 2.0 | 3.1 | 5.8 | 3.3 | 5.0 | 8.0 | 490 | 181 | 1,980 | 980 | 1,370 | 1,120 |
| 14 | 2.1 | 2.9 | 6.0 | 3.4 | 5.0 | 8.5 | 425 | 167 | 2,160 | 1,020 | 1,290 | 1,050 |
| 15 | 2.4 | 2.8 | 6.2 | 3.4 | 5.0 | 8.8 | 388 | 157 | 2,280 | 1,020 | 1,210 | 979 |
| 16 | 2.7 | 2.8 | 6.2 | 3.5 | 5.0 | 9.1 | 360 | 152 | 2,350 | 1,040 | 1,120 | 919 |
| 17 | 2.9 | 3.1 | 6.3 | 3.6 | 5.1 | 9.4 | 347 | 156 | 2,350 | 1,210 | 1,040 | 901 |
| 18 | 2.7 | 3.3 | 6.4 | 3.6 | 5.2 | 9.7 | 319 | 153 | 2,340 | 1,380 | 980 | 927 |
| 19 | 2.4 | 3.4 | 6.4 | 3.7 | 5.3 | 10 | 278 | 147 | 2,300 | 1,540 | 909 | 931 |
| 20 | 2.7 | 3.4 | 6.4 | 3.7 | 5.3 | 11 | 236 | 145 | 2,240 | 1,700 | 880 | 919 |
| 21 | 2.7 | 3.4 | 6.3 | 3.8 | 5.2 | 11 | 264 | 142 | 2,170 | 1,810 | 850 | 889 |
| 22 | 3.1 | 3.3 | 6.2 | 4.0 | 5.1 | 11 | 302 | 136 | 2,100 | 1,970 | 867 | 846 |
| 23 | 3.3 | 3.2 | 6.1 | 4.4 | 5.0 | 11 | 343 | 124 | 2,020 | 2,070 | 911 | 787 |
| 24 | 3.3 | 3.2 | 5.9 | 5.0 | 5.0 | 12 | 356 | 110 | 1,940 | 2,090 | 1,140 | 726 |
| 25 | 3.3 | 3.1 | 5.7 | 5.4 | 4.8 | 13 | 341 | 100 | 1,860 | 2,060 | 1,300 | 659 |
| 26 | 3.3 | 2.9 | 5.5 | 5.6 | 4.8 | 16 | 314 | 93 | 1,780 | 2,000 | 1,420 | 595 |
| 27 | 3.1 | 2.7 | 5.3 | 5.4 | 4.8 | 50 | 286 | 90 | 1,690 | 1,930 | 1,540 | 536 |
| 28 | 2.9 | 2.4 | 5.2 | 5.3 | 4.8 | 250 | 269 | 104 | 1,590 | 1,860 | 1,630 | 479 |
| 29 | 2.8 | 2.1 | 5.1 | 5.2 | 5.0 | 550 | 243 | 105 | 1,500 | 1,780 | 1,700 | 423 |
| 30 | 2.8 | 2.0 | 5.1 | 5.1 | ------- | 780 | 216 | 118 | 1,430 | 1,710 | 1,730 | 375 |
| 31 | 3.1 | ------ | 5.0 | 5.1 | ------- | 960 | ------ | 129 | ------ | 1,620 | 1,730 | ------ |
| Total | 72.9 | 87.1 | 149.5 | 127.3 | 144.8 | 2,813.3 | 14,767 | 4,568 | 44,631 | 46,320 | 41,927 | 31,221 |
| Mean | 2.35 | 2.90 | 4.82 | 4.11 | 4.99 | 90.8 | 492 | 147 | 1,488 | 1,494 | 1,352 | 1,041 |
| Max | 5.9 | 3.6 | 6.4 | 5.6 | 5.3 | 960 | 1,050 | 199 | 2,350 | 2,090 | 1,730 | 1,710 |
| Min | 1.0 | 1.8 | 1.9 | 3.1 | 4.8 | 5.1 | 216 | 90 | 149 | 980 | 850 | 375 |
| Ac-ft | 145 | 173 | 297 | 252 | 287 | 5,580 | 29,290 | 9,060 | 88,520 | 91,870 | 83,160 | 61,930 |

Cal yr 1967: Total 134,362.3 Mean 368 Max 2,760 Min 0.7 Ac-ft 266,500
Wtr yr 1968: Total 186,828.9 Mean 510 Max 2,350 Min 1.0 Ac-ft 370,600

## 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 1968 (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, 1,030.11 ft about June 18 (from recorded range in stage); minimum recorded, 1,017.47 ft Nov. 8, 9.
1928-68: Maximum elevation, 1,023.65 ft May 13, 1950; minimum recorded, 1,017.42 ft Aug. 30, 1961. Maximum elevation known, about 1,034 ft in 1896.

Mean elevation, in feet, water year October 1967 to September 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 17.58 | | | | | | 21.23 | | | 27.95 | |
| 2 | | 17.57 | | | | | | 21.09 | | | 27.68 | |
| 3 | | 17.57 | | | | | | 20.87 | | | 27.40 | |
| 4 | | 17.56 | | | | | | 20.71 | | | 27.12 | |
| 5 | | 17.55 | | | | | | 20.57 | | | 28.16 | |
| 6 | | 17.51 | | | | | | 20.46 | | | 28.46 | |
| 7 | | 17.48 | | | | | | 20.38 | | | 28.64 | |
| 8 | | 17.47 | | | | | | 20.50 | | | 28.66 | |
| 9 | | 17.51 | | | | | | 20.73 | | | 28.55 | |
| 10 | | 17.64 | | | | | | 20.96 | | | 28.31 | |
| 11 | | 17.71 | | | | | 23.95 | 21.03 | | | 28.02 | |
| 12 | | 17.76 | | | | | 23.81 | 21.02 | | | | |
| 13 | | 17.76 | | | | | 23.45 | 20.95 | 29.23 | | | |
| 14 | | 17.75 | | | | | 23.03 | 20.80 | | | | |
| 15 | | 17.76 | | | | | 22.73 | | | | | |
| 16 | | 17.76 | | | | | 22.51 | | | | | 25.76 |
| 17 | | 17.74 | | | | | 22.37 | | | | | 25.68 |
| 18 | | 17.77 | | | | | 22.19 | | | | | |
| 19 | 17.53 | 17.80 | | | | | 21.95 | | | | | |
| 20 | 17.59 | 17.81 | | | | | 21.56 | | | | | 25.67 |
| 21 | 17.56 | 17.82 | | | | 19.31 | 21.51 | | | | | 25.55 |
| 22 | 17.52 | 17.81 | | | | 19.33 | 21.81 | | | | 25.38 | 25.35 |
| 23 | 17.51 | 17.79 | | | | 19.35 | 22.11 | | | | 25.57 | 25.12 |
| 24 | 17.51 | 17.80 | | | | 19.36 | 22.36 | | | 29.48 | | 24.85 |
| 25 | 17.51 | 17.79 | | | | 19.39 | 22.36 | | | 29.45 | | 24.53 |
| 26 | 17.51 | 17.79 | | | | 19.48 | 22.21 | | | 29.36 | | 24.19 |
| 27 | 17.51 | 17.80 | | | | 20.26 | 22.02 | | | 29.17 | | 23.85 |
| 28 | 17.51 | 17.83 | | | | | 21.85 | | | 28.96 | | 23.47 |
| 29 | 17.51 | 17.84 | | | ------ | | 21.70 | | | 28.76 | | 23.09 |
| 30 | 17.55 | | | | ------ | | 21.47 | | | 28.52 | | 22.74 |
| 31 | 17.59 | ------ | | | ------ | | ------ | | ------ | 28.24 | | ------ |

Note.--Add 1,000.00 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 1968 (some winter records incomplete). Published as "at Caribou", prior to April 1929; as "below Cutoff ditch, near Caribou" April 1929 to September 1936. Records published for both sites April 1929 to September 1930. Monthly discharge only for some periods, published in WSP 1308.

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

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

Extremes.--Maximum discharge during year, 1,860 cfs July 2 (gage height, 8.16 ft); maximum gage height, about 8.40 ft Apr. 7 (backwater from ice); minimum daily discharge recorded, 0.8 cfs Oct. 6, 7.
1917, 1920-68: Maximum discharge, 4,080 cfs May 19, 1950 (gage height, 11.81 ft); no flow Aug. 13, 1936. Flood of 1916 is reported to have reached a stage of about 15.5 ft at former site.

Remarks.--Records good. Occasionally, at high stages, there is some natural diversion of flow above station to headwaters of Two Rivers. Station not operated during winter period.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.4 | 4.2 | | | | | 650 | 239 | 134 | 1,830 | 1,730 | 1,460 |
| 2 | 1.4 | 4.3 | | | | | 800 | 214 | 141 | 1,860 | 1,720 | 1,490 |
| 3 | 1.5 | 4.4 | | | | | 920 | 196 | 152 | 1,840 | 1,710 | 1,530 |
| 4 | 1.2 | 4.4 | | | | | 1,000 | 184 | 173 | 1,800 | 1,700 | 1,560 |
| 5 | 1.0 | 4.4 | | | | | 1,070 | 169 | 179 | 1,770 | 1,750 | 1,570 |
| 6 | .9 | 4.2 | | | | | 1,120 | 158 | 214 | 1,740 | 1,750 | 1,580 |
| 7 | .8 | 4.1 | | | | | 1,140 | 152 | 290 | 1,710 | 1,730 | 1,620 |
| 8 | 1.0 | 3.9 | | | | | 1,160 | 150 | 546 | 1,680 | 1,710 | 1,640 |
| 9 | 1.2 | 3.8 | | | | | 1,130 | 154 | 941 | 1,640 | 1,700 | 1,630 |
| 10 | 1.4 | 3.8 | | | | | 1,090 | 162 | 1,070 | 1,610 | 1,690 | 1,620 |
| 11 | 1.6 | 3.8 | | | | | 1,040 | 177 | 1,150 | 1,620 | 1,680 | 1,600 |
| 12 | 1.6 | 3.9 | | | | | 934 | 188 | 1,190 | 1,610 | 1,670 | 1,590 |
| 13 | 1.8 | 4.0 | | | | | 840 | 192 | 1,230 | 1,610 | 1,660 | 1,570 |
| 14 | 1.8 | 4.0 | | | | | 730 | 194 | 1,270 | 1,640 | 1,640 | 1,550 |
| 15 | 1.6 | 3.8 | | | | | 640 | 192 | 1,310 | 1,600 | 1,630 | 1,530 |
| 16 | 1.5 | 3.6 | | | | | 562 | 175 | 1,360 | 1,620 | 1,620 | 1,560 |
| 17 | 2.0 | 3.5 | | | | | 497 | 167 | 1,400 | 1,670 | 1,600 | 1,570 |
| 18 | 1.6 | 3.4 | | | | | 453 | 167 | 1,470 | 1,600 | 1,580 | 1,540 |
| 19 | 1.5 | 3.3 | | | | | 408 | 173 | 1,510 | 1,580 | 1,560 | 1,510 |
| 20 | 1.5 | 3.3 | | | | 6.0 | 370 | 162 | 1,560 | 1,540 | 1,530 | 1,480 |
| 21 | 1.6 | 3.3 | | | | 6.4 | 340 | 143 | 1,630 | 1,530 | 1,480 | 1,440 |
| 22 | 1.6 | 3.4 | | | | 7.5 | 340 | 140 | 1,670 | 1,520 | 1,480 | 1,420 |
| 23 | 1.8 | 3.5 | | | | 9.0 | 365 | 132 | 1,710 | 1,530 | 1,410 | 1,390 |
| 24 | 2.2 | 3.5 | | | | 13 | 389 | 123 | 1,740 | 1,560 | 1,430 | 1,350 |
| 25 | 3.0 | 3.4 | | | | 18 | 406 | 110 | 1,750 | 1,580 | 1,400 | 1,310 |
| 26 | 3.2 | 3.2 | | | | 45 | 389 | 100 | 1,750 | 1,600 | 1,380 | 1,260 |
| 27 | 3.4 | 3.1 | | | | 100 | 360 | 94 | 1,750 | 1,630 | 1,370 | 1,190 |
| 28 | 3.3 | 3.0 | | | | 170 | 326 | 94 | 1,740 | 1,640 | 1,370 | 1,110 |
| 29 | 3.2 | 2.8 | | | ------ | 250 | 299 | 97 | 1,730 | 1,670 | 1,380 | 997 |
| 30 | 3.2 | 2.7 | | | ------ | 350 | 269 | 110 | 1,730 | 1,690 | 1,400 | 868 |
| 31 | 4.0 | ------ | | | ------ | 500 | ------ | 125 | ------ | 1,720 | 1,430 | ------ |
| Total | 58.8 | 110.0 | | | | | 20,037 | 4,833 | 34,490 | 51,240 | 48,890 | 43,535 |
| Mean | 1.90 | 3.67 | | | | | 668 | 156 | 1,150 | 1,653 | 1,577 | 1,451 |
| Max | 4.0 | 4.4 | | | | | 1,160 | 239 | 1,750 | 1,860 | 1,750 | 1,640 |
| Min | 0.8 | 2.7 | | | | | 269 | 94 | 134 | 1,520 | 1,370 | 868 |
| Ac-ft | - | - | | | | | - | - | - | - | - | - |

Cal yr 1967: Total - Mean - Max - Min - Ac-ft -
Wtr yr 1968: Total - Mean - Max - Min - Ac-ft -

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

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

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

Records available.--May 1933 to September 1968 (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, 1,006.98 ft July 4; minimum recorded, 1,002.33 ft Oct. 5-8.
1933-68: 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 1967 to September 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.43 | 2.83 | | | | | 5.73 | 3.85 | 3.67 | 6.82 | 6.72 | 6.60 |
| 2 | 2.42 | 2.85 | | | | | 5.88 | 3.77 | 3.71 | 6.84 | 6.71 | 6.61 |
| 3 | 2.43 | 2.82 | | | | | 6.11 | 3.76 | 3.71 | 6.91 | 6.70 | 6.65 |
| 4 | 2.36 | 2.78 | | | | | 6.16 | 3.71 | 3.79 | 6.94 | 6.69 | 6.68 |
| 5 | 2.35 | 2.85 | | | | | 6.16 | 3.66 | 3.82 | 6.92 | 6.69 | 6.71 |
| 6 | 2.34 | 2.83 | | | | | 6.18 | 3.66 | 3.91 | 6.91 | 6.75 | 6.71 |
| 7 | 2.33 | 2.84 | | | | | 6.21 | 3.66 | 4.04 | 6.89 | 6.78 | 6.73 |
| 8 | 2.35 | 2.84 | | | | | 6.14 | 3.64 | 4.69 | 6.86 | 6.76 | 6.73 |
| 9 | 2.48 | 2.84 | | | | | 5.87 | 3.66 | 5.53 | 6.82 | 6.74 | 6.73 |
| 10 | 2.54 | 2.86 | | | | | 5.77 | 3.68 | 5.86 | 6.81 | 6.82 | 6.73 |
| 11 | 2.53 | 2.87 | | | | | 5.59 | 3.74 | 6.04 | 6.82 | 6.87 | 6.73 |
| 12 | 2.48 | 2.96 | | | | | 5.36 | 3.75 | 6.14 | 4.80 | 6.90 | 6.73 |
| 13 | 2.54 | 3.03 | | | | | 5.13 | 3.76 | 6.24 | 4.80 | 6.92 | 6.72 |
| 14 | 2.55 | 2.94 | | | | | 4.86 | 3.75 | 6.32 | 6.82 | 6.92 | 6.71 |
| 15 | 2.48 | 3.04 | | | | | 4.66 | 3.75 | 6.36 | 6.77 | 6.93 | 6.71 |
| 16 | 2.50 | 3.09 | | | | | 4.46 | 3.73 | 6.44 | 6.78 | 6.92 | 6.73 |
| 17 | 2.61 | | | | | | 4.30 | 3.71 | 6.51 | 6.84 | 6.90 | 6.74 |
| 18 | 2.50 | | | | | | 4.21 | 3.73 | 6.57 | 6.81 | | 6.73 |
| 19 | 2.44 | | | | | | 4.14 | 3.71 | 6.65 | 6.76 | | 6.69 |
| 20 | 2.44 | | | | | | 3.99 | 3.71 | 6.70 | 6.73 | | 6.65 |
| 21 | 2.46 | | | | | | 4.00 | 3.70 | 6.78 | 6.72 | 6.61 | 6.61 |
| 22 | 2.49 | | | | | | 4.01 | 3.70 | 6.81 | 6.71 | 6.57 | 6.57 |
| 23 | 2.56 | | | | | | 4.07 | 3.69 | 6.83 | 6.73 | 6.54 | 6.54 |
| 24 | 2.55 | | | | | | 4.13 | 3.64 | 6.89 | 6.75 | 6.56 | 6.49 |
| 25 | 2.54 | | | | | | 4.15 | 3.61 | 6.89 | 6.79 | 6.53 | 6.42 |
| 26 | 2.58 | | | | | | 4.12 | 3.57 | 6.82 | 6.81 | 6.51 | 6.34 |
| 27 | 2.77 | | | | | | 4.06 | 3.56 | 6.79 | 6.82 | 6.51 | 6.25 |
| 28 | 2.75 | | | | | | 4.02 | 3.54 | 6.75 | 6.81 | 6.51 | 6.07 |
| 29 | 2.84 | 3.02 | | | ------ | 4.57 | 3.96 | 3.56 | 6.75 | 6.74 | 6.52 | 5.83 |
| 30 | 2.83 | | | | ------ | 5.18 | 3.91 | 3.60 | 6.80 | 6.73 | 6.54 | 5.51 |
| 31 | 2.85 | ------ | | | ------ | 5.55 | ------ | 3.64 | ------ | 6.71 | 6.56 | ------ |

Note.--Add 1,000.00 ft to obtain elevation above mean sea level.

## 5-1244.8 Kawishiwi River near Ely, Minn.

(Hydrologic bench-mark station)

Location.--Lat 47°55'22", long 91°32'06", in SE¼ sec.24, T.63 N., R.10 W., on left bank upstream from rapids, 2 miles upstream from South Kawishiwi River, 2¾ miles southwest of Fernberg Lookout Tower and 14 miles east of Ely.

Drainage area.--253 sq mi.

Records available.--June 1966 to September 1968.

Gage.--Water-stage recorder. Altitude of gage is 1,450 ft (from topographic map).

Extremes.--Maximum discharge during year, 1,200 cfs June 18 (gage height, 5.54 ft); minimum, 29 cfs Feb. 23-29 (gage height, 2.70 ft).
1966-68: Maximum discharge, that of June 18, 1968; minimum, 24 cfs Sept. 28, 29, 1966; minimum gage height that of Feb. 23-29, 1968.

Remarks.--Records good. Records of chemical analyses, water temperatures and suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 39 | 34 | 31 | 33 | 39 | 30 | 59 | 1,020 | 525 | 822 | 247 | 111 |
| 2 | 39 | 33 | 31 | 33 | 39 | 31 | 59 | 1,040 | 525 | 788 | 236 | 108 |
| 3 | 39 | 33 | 30 | 34 | 39 | 31 | 60 | 1,070 | 513 | 735 | 225 | 105 |
| 4 | 39 | 33 | 30 | 34 | 38 | 31 | 68 | 1,070 | 508 | 728 | 222 | 102 |
| 5 | 39 | 33 | 30 | 36 | 38 | 31 | 68 | 1,060 | 502 | 702 | 213 | 102 |
| 6 | 38 | 32 | 30 | 36 | 38 | 31 | 70 | 1,030 | 525 | 664 | 203 | 103 |
| 7 | 37 | 32 | 30 | 36 | 38 | 30 | 73 | 1,020 | 536 | 633 | 197 | 103 |
| 8 | 40 | 31 | 30 | 37 | 39 | 30 | 92 | 996 | 664 | 620 | 186 | 105 |
| 9 | 40 | 31 | 30 | 38 | 39 | 31 | 100 | 960 | 735 | 565 | 182 | 105 |
| 10 | 41 | 31 | 30 | 38 | 38 | 31 | 103 | 932 | 795 | 530 | 169 | 103 |
| 11 | 41 | 31 | 31 | 38 | 38 | 31 | 110 | 897 | 904 | 508 | 161 | 102 |
| 12 | 40 | 31 | 31 | 38 | 38 | 31 | 118 | 863 | 953 | 486 | 154 | 99 |
| 13 | 40 | 31 | 31 | 38 | 38 | 31 | 125 | 829 | 1,000 | 464 | 154 | 97 |
| 14 | 40 | 32 | 30 | 38 | 37 | 31 | 150 | 795 | 1,100 | 448 | 148 | 97 |
| 15 | 40 | 32 | 30 | 38 | 37 | 31 | 180 | 755 | 1,140 | 422 | 144 | 97 |
| 16 | 39 | 32 | 30 | 38 | 36 | 31 | 225 | 748 | 1,160 | 412 | 146 | 97 |
| 17 | 39 | 32 | 30 | 38 | 33 | 32 | 261 | 728 | 1,180 | 402 | 143 | 97 |
| 18 | 39 | 32 | 30 | 38 | 33 | 32 | 304 | 709 | 1,190 | 387 | 135 | 99 |
| 19 | 38 | 32 | 30 | 38 | 33 | 39 | 331 | 683 | 1,180 | 373 | 134 | 100 |
| 20 | 37 | 32 | 31 | 38 | 31 | 44 | 387 | 645 | 1,160 | 368 | 132 | 100 |
| 21 | 37 | 32 | 31 | 38 | 31 | 44 | 443 | 639 | 1,140 | 363 | 130 | 100 |
| 22 | 37 | 31 | 31 | 38 | 31 | 42 | 491 | 608 | 1,130 | 344 | 128 | 100 |
| 23 | 37 | 32 | 31 | 39 | 30 | 41 | 590 | 596 | 1,130 | 344 | 134 | 100 |
| 24 | 39 | 32 | 31 | 39 | 29 | 40 | 696 | 583 | 1,110 | 336 | 134 | 97 |
| 25 | 39 | 32 | 31 | 39 | 29 | 40 | 735 | 565 | 1,070 | 322 | 132 | 94 |
| 26 | 39 | 32 | 31 | 39 | 29 | 40 | 768 | 548 | 1,020 | 322 | 128 | 94 |
| 27 | 38 | 32 | 31 | 39 | 29 | 47 | 808 | 542 | 981 | 304 | 125 | 92 |
| 28 | 37 | 31 | 31 | 39 | 29 | 56 | 849 | 542 | 925 | 287 | 122 | 91 |
| 29 | 37 | 30 | 32 | 38 | 30 | 59 | 904 | 542 | 890 | 270 | 116 | 90 |
| 30 | 37 | 30 | 33 | 38 | ------ | 59 | 974 | 536 | 856 | 258 | 113 | 88 |
| 31 | 36 | ------ | 33 | 38 | ------ | 59 | ------ | 536 | ------ | 255 | 110 | ------ |
| Total | 1,197 | 954 | 952 | 1,159 | 1,006 | 1,167 | 10,201 | 24,087 | 27,047 | 14,462 | 4,903 | 2,978 |
| Mean | 38.6 | 31.8 | 30.7 | 37.4 | 34.7 | 37.6 | 340 | 777 | 902 | 467 | 158 | 99.3 |
| Max | 41 | 34 | 33 | 39 | 39 | 59 | 974 | 1,070 | 1,190 | 822 | 247 | 111 |
| Min | 36 | 30 | 30 | 33 | 29 | 30 | 59 | 536 | 502 | 255 | 110 | 88 |
| Cfsm | 0.153 | 0.126 | 0.121 | 0.148 | 0.137 | 0.149 | 1.34 | 3.07 | 3.57 | 1.85 | 0.624 | 0.392 |
| In. | 0.18 | 0.14 | 0.14 | 0.17 | 0.15 | 0.17 | 1.50 | 3.54 | 3.98 | 2.13 | 0.72 | 0.44 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 61,726 | Mean | 169 | Max | 1,080 | Min | 30 | Cfsm 0.668 | In. | 9.07 |
| Wtr yr 1968: | Total | 90,113 | Mean | 246 | Max | 1,190 | Min | 29 | Cfsm 0.972 | In. | 13.25 |

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 1968. Monthly discharge only for some periods, published in WSP 1308.

Average discharge.--49 years (1905-06, 1915-17, 1918-19, 1923-68), 979 cfs (unadjusted).

Extremes.--Maximum daily discharge during year, 8,030 cfs June 17; no flow Feb. 11.
1905-07, 1912-19, 1923-68: 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, 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 CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 348 | 368 | 438 | 206 | 174 | 174 | 523 | 5,770 | 2,950 | 4,520 | 960 | 1,760 |
| 2 | 348 | 303 | 438 | 265 | 174 | 206 | 490 | 5,980 | 2,950 | 4,050 | 928 | 1,760 |
| 3 | 348 | 303 | 438 | 206 | 103 | 206 | 523 | 6,050 | 2,950 | 3,950 | 960 | 1,750 |
| 4 | 366 | 65 | 411 | 206 | 32 | 174 | 652 | 6,000 | 2,950 | 3,340 | 960 | 1,340 |
| 5 | 344 | 161 | 470 | 206 | 303 | 238 | 555 | 5,940 | 2,930 | 3,020 | 960 | 1,220 |
| 6 | 344 | 368 | 348 | 206 | 174 | 206 | 523 | 5,910 | 2,960 | 2,490 | 960 | 1,020 |
| 7 | 376 | 336 | 382 | 206 | 205 | 238 | 620 | 5,760 | 3,040 | 3,040 | 928 | 1,140 |
| 8 | 473 | 303 | 350 | 206 | 174 | 206 | 686 | 5,610 | 3,630 | 3,010 | 895 | 1,160 |
| 9 | 408 | 336 | 172 | 206 | 174 | 271 | 801 | 5,110 | 4,090 | 2,760 | 863 | 1,220 |
| 10 | 344 | 368 | 205 | 206 | 141 | 310 | 675 | 4,700 | 5,360 | 2,030 | 799 | 1,310 |
| 11 | 311 | 129 | 318 | 206 | 0 | 271 | 443 | 4,260 | 6,490 | 1,520 | 827 | 1,400 |
| 12 | 311 | 129 | 318 | 174 | 200 | 238 | 361 | 4,140 | 6,820 | 1,630 | 797 | 1,460 |
| 13 | 280 | 369 | 315 | 118 | 103 | 174 | 297 | 3,940 | 6,990 | 1,590 | 673 | 1,370 |
| 14 | 345 | 337 | 228 | 150 | 103 | 206 | 297 | 3,520 | 7,530 | 1,860 | 673 | 1,360 |
| 15 | 280 | 368 | 261 | 206 | 103 | 271 | 496 | 3,200 | 7,650 | 1,910 | 673 | 1,320 |
| 16 | 312 | 368 | 241 | 174 | 103 | 206 | 464 | 3,190 | 7,860 | 1,870 | 570 | 1,220 |
| 17 | 312 | 368 | 176 | 131 | 168 | 206 | 525 | 2,800 | 8,030 | 2,020 | 295 | 1,220 |
| 18 | 491 | 368 | 261 | 271 | 103 | 238 | 631 | 3,200 | 7,980 | 1,720 | 226 | 1,330 |
| 19 | 281 | 534 | 149 | 174 | 103 | 421 | 857 | 2,860 | 7,920 | 1,860 | 397 | 1,400 |
| 20 | 249 | 388 | 117 | 118 | 135 | 539 | 1,320 | 2,840 | 7,920 | 1,790 | 397 | 1,220 |
| 21 | 313 | 420 | 182 | 59 | 135 | 569 | 1,800 | 2,870 | 7,470 | 1,900 | 397 | 1,060 |
| 22 | 281 | 508 | 285 | 238 | 134 | 536 | 2,060 | 2,910 | 7,240 | 1,840 | 487 | 1,020 |
| 23 | 352 | 271 | 149 | 174 | 276 | 536 | 3,320 | 3,070 | 7,180 | 1,910 | 659 | 960 |
| 24 | 337 | 420 | 124 | 206 | 71 | 536 | 3,500 | 2,980 | 6,670 | 1,910 | 831 | 992 |
| 25 | 304 | 388 | 91 | 174 | 103 | 503 | 3,640 | 3,000 | 6,320 | 1,770 | 1,020 | 1,020 |
| 26 | 337 | 355 | 221 | 206 | 206 | 536 | 4,100 | 3,000 | 6,090 | 1,800 | 1,210 | 1,020 |
| 27 | 336 | 495 | 183 | 71 | 206 | 598 | 4,530 | 3,060 | 5,280 | 1,480 | 1,150 | 992 |
| 28 | 97 | 284 | 118 | 32 | 174 | 566 | 4,970 | 2,990 | 4,850 | 1,560 | 1,120 | 960 |
| 29 | 220 | 419 | 242 | 271 | 206 | 613 | 5,180 | 2,960 | 5,090 | 1,380 | 1,480 | 960 |
| 30 | 401 | 406 | 206 | 206 | ------ | 491 | 5,370 | 2,990 | 4,640 | 1,040 | 1,600 | 960 |
| 31 | 336 | ------ | 206 | 190 | ------ | 490 | ------ | 2,920 | ------ | 1,080 | 1,570 | ------ |
| Total | 10,185 | 10,235 | 8,043 | 5,668 | 4,286 | 10,973 | 50,209 | 123,550 | 169,830 | 67,650 | 26,265 | 36,924 |
| Mean | 329 | 341 | 259 | 183 | 148 | 354 | 1,674 | 3,985 | 5,661 | 2,182 | 847 | 1,231 |
| (≠) | -87 | -48 | -8 | -23 | -29 | -133 | +460 | +65 | -47 | +91 | +26 | -69 |
| Mean ≠ | 242 | 293 | 251 | 160 | 119 | 221 | 2,134 | 4,050 | 5,614 | 2,273 | 873 | 1,162 |
| Max | 491 | 534 | 470 | 271 | 303 | 613 | 5,370 | 6,050 | 8,030 | 4,520 | 1,600 | 1,760 |
| Min | 97 | 65 | 91 | 32 | 0 | 174 | 297 | 2,800 | 2,930 | 1,040 | 226 | 960 |
| Cfsm ≠ | 0.202 | 0.244 | 0.209 | 0.133 | 0.099 | 0.184 | 1.78 | 3.38 | 4.68 | 1.89 | 0.728 | 0.968 |
| In. ≠ | 0.23 | 0.27 | 0.24 | 0.15 | 0.11 | 0.21 | 1.98 | 3.89 | 5.22 | 2.18 | 0.84 | 1.08 |

Cal yr 1967: Total 317,453 Max 4,240 Min 0 Mean 870 Mean ≠ 866 Cfsm ≠ 0.722 In. ≠ 9.80
Wtr yr 1968: Total 523,818 Max 8,030 Min 0 Mean 1,431 Mean ≠ 1,447 Cfsm ≠ 1.21 In. ≠16.42

≠ 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.

## 5-1272.05 Burntside River near Ely, Minn.

Location.--Lat 47°54'55", long 91°56'59", in NE¼NE¼ sec.26, T.63 N., R.13 W., on left bank on downstream wingwall of bridge on County Road 88, 2½ miles upstream from mouth, 4 miles northwest of Ely and 5 miles downstream from outlet on Burntside Lake.

Records available.--May 1967 to September 1968.

Gage.--Staff gage read once daily. Altitude of gage is 1,340 ft (from topographic map).

Extremes.--Maximum discharge during year, 300 cfs June 14 (gage height, 7.85 ft, from graph based on gage readings); minimum daily, 0.8 cfs Oct. 6, 7.
1967-68: Maximum discharge, that of June 14, 1968; minimum daily discharge, that of Oct. 6, 7, 1967.

Remarks.--Records good except those for winter months, which are fair.

Cooperation.--Gage readings furnished by the Federal Water Pollution Control Administration.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.6 | 1.6 | 2.9 | 2.7 | 5.2 | 3.0 | 28 | 163 | 107 | 189 | 91 | 58 |
| 2 | 1.4 | 1.4 | 2.9 | 2.7 | 5.2 | 3.0 | 26 | 164 | 106 | 180 | 84 | 57 |
| 3 | 1.4 | 1.2 | 3.0 | 2.7 | 5.2 | 3.1 | 25 | 164 | 105 | 172 | 76 | 56 |
| 4 | 1.4 | 1.2 | 3.1 | 2.7 | 5.2 | 3.1 | 22 | 162 | 101 | 178 | 76 | 54 |
| 5 | 1.4 | 1.2 | 3.2 | 2.6 | 5.1 | 3.2 | 21 | 160 | 103 | 170 | 73 | 50 |
| 6 | .8 | 1.1 | 3.2 | 2.6 | 5.0 | 3.3 | 20 | 157 | 112 | 157 | 78 | 52 |
| 7 | .8 | 1.1 | 3.2 | 2.6 | 4.8 | 3.5 | 24 | 154 | 117 | 154 | 77 | 54 |
| 8 | 5.6 | 1.2 | 3.1 | 2.5 | 4.6 | 3.8 | 30 | 150 | 199 | 167 | 78 | 55 |
| 9 | 8.0 | 1.4 | 3.0 | 2.5 | 4.3 | 4.1 | 29 | 144 | 228 | 161 | 78 | 53 |
| 10 | 9.4 | 2.0 | 2.9 | 2.5 | 4.0 | 4.1 | 28 | 143 | 251 | 150 | 70 | 49 |
| 11 | 9.0 | 2.8 | 2.9 | 2.4 | 3.8 | 4.0 | 27 | 136 | 277 | 144 | 61 | 49 |
| 12 | 8.5 | 3.1 | 2.8 | 2.4 | 3.7 | 4.0 | 25 | 130 | 277 | 140 | 57 | 48 |
| 13 | 8.5 | 3.3 | 2.8 | 2.4 | 3.6 | 3.9 | 23 | 128 | 275 | 138 | 55 | 49 |
| 14 | 8.0 | 3.4 | 2.8 | 2.4 | 3.5 | 4.1 | 33 | 126 | 298 | 134 | 55 | 50 |
| 15 | 8.0 | 3.6 | 2.7 | 2.4 | 3.5 | 5.0 | 46 | 120 | 295 | 130 | 50 | 50 |
| 16 | 8.0 | 3.6 | 2.7 | 2.4 | 3.4 | 7.0 | 49 | 127 | 289 | 127 | 53 | 43 |
| 17 | 8.0 | 3.7 | 2.7 | 2.5 | 3.4 | 9.5 | 56 | 122 | 284 | 149 | 50 | 51 |
| 18 | 7.6 | 3.7 | 2.8 | 2.5 | 3.3 | 13 | 59 | 120 | 273 | 152 | 50 | 55 |
| 19 | 7.6 | 3.7 | 2.9 | 2.6 | 3.2 | 15 | 62 | 118 | 259 | 148 | 49 | 59 |
| 20 | 7.6 | 3.6 | 3.0 | 2.7 | 3.2 | 14 | 65 | 116 | 250 | 144 | 47 | 57 |
| 21 | 7.2 | 3.6 | 3.0 | 2.9 | 3.2 | 13 | 67 | 111 | 240 | 133 | 45 | 56 |
| 22 | 6.8 | 3.5 | 3.0 | 3.3 | 3.1 | 10 | 69 | 109 | 228 | 134 | 50 | 55 |
| 23 | 6.4 | 3.5 | 3.0 | 4.0 | 3.1 | 8.0 | 65 | 109 | 232 | 121 | 61 | 57 |
| 24 | 6.0 | 3.5 | 2.9 | 4.5 | 3.1 | 6.6 | 59 | 105 | 235 | 118 | 70 | 57 |
| 25 | 4.4 | 3.4 | 2.9 | 4.7 | 3.1 | 7.0 | 54 | 101 | 230 | 111 | 74 | 53 |
| 26 | 4.0 | 3.3 | 2.8 | 4.9 | 3.1 | 9.0 | 111 | 99 | 217 | 111 | 71 | 50 |
| 27 | 3.8 | 3.3 | 2.8 | 5.0 | 3.0 | 16 | 120 | 109 | 202 | 112 | 69 | 49 |
| 28 | 3.5 | 3.2 | 2.8 | 5.0 | 3.0 | 27 | 130 | 109 | 189 | 102 | 65 | 46 |
| 29 | 3.2 | 3.1 | 2.8 | 5.1 | 3.0 | 33 | 145 | 109 | 177 | 94 | 60 | 45 |
| 30 | 3.0 | 3.0 | 2.8 | 5.2 | ------ | 32 | 157 | 108 | 177 | 97 | 59 | 43 |
| 31 | 2.6 | ------ | 2.7 | 5.2 | ------ | 30 | ------ | 107 | ------ | 94 | 58 | ------ |
| Total | 163.5 | 81.3 | 90.1 | 100.6 | 110.9 | 305.3 | 1,675 | 3,980 | 6,333 | 4,311 | 1,990 | 1,560 |
| Mean | 5.27 | 2.71 | 2.91 | 3.25 | 3.82 | 9.85 | 55.8 | 128 | 211 | 139 | 64.2 | 52.0 |
| Max | 9.4 | 3.7 | 3.2 | 5.2 | 5.2 | 33 | 157 | 164 | 298 | 189 | 91 | 59 |
| Min | 0.8 | 1.1 | 2.7 | 2.4 | 3.0 | 3.0 | 20 | 99 | 101 | 94 | 45 | 43 |
| Ac-ft | 324 | 161 | 179 | 200 | 220 | 606 | 3,320 | 7,890 | 12,560 | 8,550 | 3,950 | 3,090 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cal yr | : | Total | | Mean | | Max | | Min | | Ac-ft | |
| Wtr yr | 1968: | Total | 20,700.7 | Mean | 56.6 | Max | 298 | Min | 0.8 | Ac-ft | 41,060 |

## 5-1272.10 Armstrong Creek near Ely, Minn.

Location.--Lat 47°53'48", long 91°55'50", in SW¼NE¼ sec.36, T.63 N., R.13 W., near right bank 10 ft downstream from culvert on County Road 88, 1¼ miles upstream from mouth and 2½ miles southwest of Ely.

Records available.--May 1967 to September 1968.

Gage.--Staff gage read once daily. Altitude of gage is 1,365 ft (from topographic map).

Extremes.--Maximum discharge during year, 41 cfs June 9 (gage height 4.51 ft, from floodmark); minimum, no flow Feb. 28 to Mar. 6.
1967-68: Maximum discharge, that of June 9, 1968; minimum, that of Feb. 28 to Mar. 6, 1968.

Remarks.--Records fair.

Cooperation.--Gage readings furnished by Federal Water Pollution Control Administration.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0 | 0.8 | 0.7 | 0.4 | 0.3 | 0 | 3.5 | 23 | 8.0 | 8.5 | 1.0 | 5.0 |
| 2 | 1.0 | .8 | .7 | .4 | .3 | 0 | 3.0 | 20 | 7.3 | 9.6 | .9 | 3.7 |
| 3 | 1.3 | .9 | .7 | .4 | .3 | 0 | 2.5 | 17 | 6.8 | 8.2 | .8 | 2.7 |
| 4 | 1.2 | .9 | .8 | .4 | .3 | 0 | 3.0 | 14 | 5.6 | 7.4 | .8 | 3.1 |
| 5 | 1.1 | .9 | .8 | .3 | .3 | 0 | 3.7 | 11 | 4.8 | 6.0 | .8 | 2.7 |
| 6 | 1.0 | .9 | .8 | .3 | .2 | 0 | 4.8 | 10 | 8.8 | 3.7 | .8 | 4.9 |
| 7 | 1.2 | .8 | .8 | .3 | .2 | .1 | 6.0 | 9.1 | 9.8 | 2.6 | .8 | 9.3 |
| 8 | 2.0 | .8 | .8 | .3 | .2 | .2 | 7.5 | 8.7 | 30 | 6.2 | .9 | 10 |
| 9 | 1.8 | .8 | .8 | .3 | .2 | .2 | 10 | 9.1 | 39 | 8.0 | .9 | 7.5 |
| 10 | 1.4 | .8 | .8 | .2 | .2 | .2 | 10 | 7.0 | 32 | 4.1 | .9 | 5.5 |
| 11 | 1.1 | .8 | .8 | .2 | .2 | .2 | 10 | 7.4 | 27 | 2.6 | .9 | 4.1 |
| 12 | 1.1 | .8 | .7 | .2 | .2 | .2 | 11 | 6.8 | 23 | 2.7 | .9 | 2.9 |
| 13 | 1.0 | .8 | .7 | .2 | .1 | .2 | 7.7 | 6.2 | 18 | 2.3 | 1.0 | 2.5 |
| 14 | 1.2 | .8 | .7 | .2 | .1 | .2 | 6.6 | 5.8 | 24 | 2.0 | 1.0 | 2.1 |
| 15 | 1.1 | .8 | .7 | .2 | .1 | .2 | 5.8 | 5.7 | 24 | 1.7 | 1.0 | 2.1 |
| 16 | 1.0 | .8 | .7 | .2 | .1 | .3 | 11 | 7.7 | 18 | 2.1 | 1.2 | 2.2 |
| 17 | 1.0 | .8 | .7 | .2 | .1 | .7 | 16 | 10 | 16 | 9.1 | 1.1 | 2.5 |
| 18 | 1.0 | .8 | .6 | .2 | .1 | 1.5 | 15 | 9.4 | 13 | 7.3 | 1.2 | 5.3 |
| 19 | 1.0 | .8 | .6 | .2 | .1 | 3.7 | 12 | 9.0 | 9.1 | 5.0 | 1.3 | 8.1 |
| 20 | 1.1 | .8 | .6 | .3 | .1 | 6.0 | 13 | 8.4 | 7.4 | 3.2 | 1.3 | 6.9 |
| 21 | 1.1 | .8 | .6 | .3 | .1 | 5.0 | 12 | 7.0 | 7.3 | 2.5 | 1.2 | 5.6 |
| 22 | 1.1 | .9 | .6 | .3 | .1 | 3.2 | 11 | 6.2 | 7.2 | 1.8 | 4.0 | 5.0 |
| 23 | 1.1 | .9 | .6 | .3 | .1 | 1.8 | 12 | 6.2 | 10 | 1.5 | 7.0 | 6.7 |
| 24 | .9 | .9 | .6 | .3 | .1 | 1.1 | 14 | 5.8 | 14 | 1.3 | 12 | 6.0 |
| 25 | .7 | .9 | .6 | .3 | .1 | .5 | 16 | 5.4 | 11 | 1.4 | 10 | 5.0 |
| 26 | .6 | .8 | .6 | .3 | .1 | 1.0 | 19 | 4.8 | 5.7 | 1.7 | 6.2 | 4.0 |
| 27 | .6 | .8 | .5 | .3 | .1 | 4.0 | 19 | 9.5 | 6.2 | 1.4 | 3.6 | 3.5 |
| 28 | .6 | .8 | .5 | .3 | 0 | 6.0 | 24 | 12 | 4.6 | 1.2 | 2.5 | 3.0 |
| 29 | .6 | .8 | .5 | .3 | 0 | 6.5 | 29 | 12 | 3.6 | 1.1 | 2.2 | 2.7 |
| 30 | .6 | .7 | .5 | .3 | ------ | 5.0 | 29 | 10 | 3.6 | 1.0 | 2.4 | 2.4 |
| 31 | .6 | ------ | .5 | .3 | ------ | 4.0 | ------ | 8.8 | ------ | 4.2 | 2.7 | ------ |
| Total | 32.1 | 24.7 | 20.6 | 8.7 | 4.4 | 52.0 | 347.1 | 293.0 | 404.8 | 121.4 | 73.3 | 137.0 |
| Mean | 1.04 | 0.82 | 0.66 | 0.28 | 0.15 | 1.68 | 11.6 | 9.45 | 13.5 | 3.92 | 2.36 | 4.57 |
| Max | 2.0 | 0.9 | 0.8 | 0.4 | 0.3 | 6.5 | 29 | 23 | 39 | 9.6 | 12 | 10 |
| Min | 0.6 | 0.7 | 0.5 | 0.2 | 0 | 0 | 2.5 | 4.8 | 3.6 | 1.0 | 0.8 | 2.1 |
| Ac-ft | 64 | 49 | 41 | 17 | 8.7 | 103 | 688 | 581 | 803 | 241 | 145 | 272 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr | : | Total | | Mean | | Max | | Min | | Ac-ft |
| Wtr yr 1968: | | Total | 1,519.1 | Mean | 4.15 | Max | 39 | Min | 0 | Ac-ft 3,010 |

GPO 817-490-6

## 5-1272.15 Longstorff Creek near Ely, Minn.

Location.--Lat 47°53'33", long 91°54'55", in SE¼SW¼ sec.31, T.63 N., R.12 W., left bank on downstream side of culvert of U.S. Highway 169, 0.7 mile upstream from mouth, 1½ miles southwest of Ely and 2½ miles downstream from outlet of Mitchell Lake.

Records available.--May 1967 to September 1968.

Gage.--Staff gage read once daily. Datum of gage is 1,360.67 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department).

Extremes.--Maximum discharge during year, 111 cfs June 8 (gage height 4.34 ft, from floodmark) no flow on many days.
1967-68: Maximum discharge, that of June 8, 1968; no flow on many days in 1968.

Remarks.--Records good.

Cooperation.--Gage readings furnished by the Federal Water Pollution Control Administration.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.2 | 0.6 | 0.4 | | | 0 | 6.4 | 43 | 17 | 18 | 2.9 | 4.7 |
| 2 | .1 | .5 | .4 | | | 0 | 5.8 | 34 | 14 | 17 | 2.4 | 4.2 |
| 3 | .5 | .5 | .4 | | | 0 | 5.5 | 27 | 11 | 14 | 13 | 3.4 |
| 4 | .4 | .5 | .4 | | | 0 | 5.3 | 25 | 10 | 15 | 2.3 | 3.6 |
| 5 | 1.3 | .5 | .3 | | | 0 | 5.2 | 20 | 9.8 | 14 | 1.5 | 2.9 |
| 6 | .6 | .4 | .3 | | | 0 | 3.9 | 16 | 47 | 41 | 1.8 | 4.0 |
| 7 | 0 | .4 | .3 | | | 0 | 4.5 | 14 | 16 | 47 | 1.0 | 7.0 |
| 8 | 1.1 | .4 | .3 | | | 0 | 14 | 13 | 74 | 28 | 1.2 | 7.2 |
| 9 | 2.0 | .4 | .3 | | | 0 | 16 | 14 | 97 | 21 | 1.3 | 6.0 |
| 10 | 1.8 | .4 | .3 | | | 0 | 18 | 13 | 65 | 14 | 1.2 | 4.4 |
| 11 | 1.6 | .5 | .3 | | | 0 | 18 | 11 | 56 | 11 | 1.0 | 3.5 |
| 12 | 1.8 | .6 | .3 | | | 0 | 16 | 11 | 45 | 10 | 1.0 | 3.0 |
| 13 | 2.1 | .7 | .3 | | | 0 | 16 | 10 | 35 | 8.7 | 1.2 | 3.0 |
| 14 | 1.2 | .6 | .2 | | | 0 | 15 | 10 | 52 | 8.2 | 1.0 | 2.9 |
| 15 | 1.0 | .5 | .2 | | | 0 | 15 | 11 | 51 | 7.7 | 1.0 | 2.6 |
| 16 | .9 | .5 | .2 | | | 0.1 | 21 | 15 | 36 | 7.4 | 1.6 | 2.2 |
| 17 | .8 | .6 | .2 | | | .2 | 31 | 16 | 27 | 15 | 1.2 | 3.0 |
| 18 | .8 | .6 | .2 | | | 5.3 | 25 | 21 | 21 | 13 | 2.0 | 5.8 |
| 19 | 2.2 | .6 | .2 | | | 10 | 18 | 24 | 16 | 12 | 1.7 | 6.6 |
| 20 | .3 | .6 | .2 | | | 4.3 | 19 | 16 | 13 | 8.5 | 1.4 | 5.3 |
| 21 | .1 | .6 | .2 | | | 2.3 | 22 | 11 | 11 | 7.7 | 1.2 | 4.3 |
| 22 | .1 | .5 | .2 | | | 2.0 | 20 | 9.6 | 9.6 | 6.0 | 4.2 | 4.7 |
| 23 | 0 | .5 | .1 | | | 1.8 | 28 | 11 | 30 | 4.7 | 6.6 | 5.3 |
| 24 | 0 | .5 | .1 | | | 1.8 | 36 | 11 | 22 | 4.2 | 7.7 | 4.4 |
| 25 | .4 | .5 | .1 | | | 2.1 | 32 | 9.8 | 17 | 3.5 | 10 | 3.9 |
| 26 | 2.9 | .5 | .1 | | | 4.2 | 30 | 9.3 | 14 | 6.3 | 6.8 | 3.5 |
| 27 | .8 | .5 | .1 | | | 11 | 37 | 21 | 12 | 4.7 | 4.9 | 3.2 |
| 28 | .4 | .5 | .1 | | | 15 | 67 | 21 | 10 | 3.5 | 3.7 | 2.9 |
| 29 | .7 | .4 | .1 | | | 18 | 62 | 19 | 8.7 | 3.1 | 3.0 | 2.6 |
| 30 | .6 | .4 | .1 | | ------ | 14 | 53 | 18 | 9.6 | 2.9 | 2.8 | 2.6 |
| 31 | .6 | ------ | .1 | | ------ | 8.2 | ------ | 18 | ------ | 3.6 | 4.0 | ------ |
| Total | 27.3 | 15.3 | 7.0 | 0 | 0 | 100.3 | 665.6 | 522.7 | 856.7 | 380.7 | 96.6 | 122.7 |
| Mean | 0.88 | 0.51 | 0.23 | 0 | 0 | 3.24 | 22.2 | 16.9 | 28.6 | 12.3 | 3.12 | 4.09 |
| Max | 2.9 | 0.7 | 0.4 | 0 | 0 | 18 | 67 | 43 | 97 | 47 | 13 | 7.2 |
| Min | 0 | 0.4 | 0.1 | 0 | 0 | 0 | 3.9 | 9.3 | 8.7 | 2.9 | 1.0 | 2.2 |
| Ac-ft | 54 | 30 | 14 | 0 | 0 | 199 | 1,320 | 1,040 | 1,700 | 755 | 192 | 243 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cal yr: | Total | | Mean | | Max | | Min | | Ac-ft | |
| Wtr yr:1968 | Total | 2,794.9 | Mean | 7.64 | Max | 97 | Min | 97 | Ac-ft | 5,540 |

## 5-1272.20 Burgo Creek near Ely, Minn.

Location.--Lat 47°55'32", long 91°51'40", in SW¼NW¼ sec.22, T.63 N., R.12 W., near right bank 6 ft upstream from twin culverts on County Road 88, 0.5 mile upstream from mouth and 1½ miles north of Ely.

Records available.--May 1967 to September 1968.

Gage.--Staff gage and crest-stage gage; gage read once daily. Altitude of gage is 1,340 ft (from topographic map).

Extremes.--Maximum discharge during year, 139 cfs June 8 (gage height 9.77 ft), from rating curve extended above 35 cfs; no flow on many days.
1967-68: Maximum discharge, that of June 8, 1968; no flow at times each year.

Remarks.--Records fair.

Cooperation.--Gage readings furnished by Federal Water Pollution Control Administration.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1 | 0.3 | 0.4 | 0.1 | 0.4 | 0 | 6.3 | 21 | 4.2 | 4.7 | 0.8 | 1.9 |
| 2 | .1 | .2 | .2 | .1 | .4 | 0 | 6.0 | 16 | 3.4 | 3.6 | .6 | 1.2 |
| 3 | .1 | .2 | .3 | .1 | .4 | 0 | 5.8 | 11 | 2.8 | 2.5 | .5 | 1.0 |
| 4 | .1 | .3 | .3 | 0 | .4 | 0 | 5.2 | 9.6 | 2.4 | 2.7 | .5 | 1.1 |
| 5 | .1 | .3 | .3 | 0 | .4 | 0 | 5.0 | 8.4 | 2.7 | 2.0 | .5 | .8 |
| 6 | .1 | .3 | .3 | 0 | .4 | 0 | 7.5 | 7.2 | 6.1 | 1.5 | .6 | 2.3 |
| 7 | .1 | .2 | .5 | 0 | .3 | 0 | 7.2 | 7.2 | 6.3 | 1.8 | .5 | 2.6 |
| 8 | .5 | .2 | .3 | 0 | .3 | 0 | 15 | 6.5 | 64 | 11 | .4 | 2.4 |
| 9 | .5 | .2 | .3 | 0 | .2 | 0 | 24 | 5.5 | 38 | 9.3 | .3 | 2.0 |
| 10 | .4 | .3 | .2 | 0 | .2 | 0 | 23 | 4.7 | 24 | 5.3 | .2 | 1.6 |
| 11 | .3 | .4 | .2 | 0 | .2 | 0 | 18 | 3.9 | 26 | 1.7 | .1 | 1.4 |
| 12 | .3 | .3 | .2 | 0 | .2 | 0 | 15 | 3.7 | 20 | 3.2 | .4 | 1.1 |
| 13 | .4 | .2 | .2 | 0 | .2 | 0 | 12 | 3.4 | 18 | 2.9 | .2 | .9 |
| 14 | .7 | .2 | .2 | 0 | .2 | .1 | 11 | 3.2 | 28 | 2.8 | .1 | .8 |
| 15 | .5 | .3 | .2 | 0 | .2 | .1 | 8.9 | 2.9 | 22 | 2.7 | .1 | .7 |
| 16 | .3 | .4 | .3 | 0 | .1 | .3 | 17 | 7.4 | 15 | 4.1 | .2 | .6 |
| 17 | .5 | .5 | .3 | 0 | .1 | 1.5 | 22 | 8.0 | 11 | 17 | .1 | .7 |
| 18 | .9 | .5 | .3 | 0 | .1 | 5.0 | 18 | 13 | 8.0 | 12 | .1 | 1.1 |
| 19 | .6 | .5 | .3 | .1 | .1 | 15 | 13 | 9.0 | 5.3 | 7.6 | .2 | 1.5 |
| 20 | .6 | .5 | .5 | .1 | .1 | 11 | 10 | 5.5 | 3.2 | 2.0 | .2 | 1.1 |
| 21 | .6 | .6 | .3 | .2 | .1 | 8.5 | 10 | 3.6 | 2.8 | 3.0 | .2 | .8 |
| 22 | .5 | .8 | .3 | .3 | .1 | 6.0 | 11 | 2.9 | 2.5 | 2.3 | .3 | 1.0 |
| 23 | .5 | .8 | .3 | .4 | .1 | 4.0 | 12 | 2.7 | 2.2 | 2.0 | .9 | 1.4 |
| 24 | .5 | .8 | .3 | .4 | .1 | 2.8 | 13 | 2.2 | 4.9 | 1.6 | 1.7 | 1.2 |
| 25 | .6 | .8 | .2 | .3 | .1 | 3.0 | 14 | 2.1 | 3.3 | 1.3 | 2.1 | 1.0 |
| 26 | .4 | .8 | .1 | .3 | .1 | 9.0 | 15 | 1.8 | 2.5 | 1.7 | 1.4 | 1.0 |
| 27 | .4 | .6 | .1 | .3 | .1 | 12 | 21 | 5.5 | 2.2 | 1.2 | 1.0 | 1.0 |
| 28 | .4 | .6 | .1 | .3 | 0 | 11 | 28 | 6.7 | 1.6 | .9 | 2.8 | .9 |
| 29 | .3 | .6 | .1 | .3 | 0 | 9.0 | 39 | 7.6 | 1.6 | .8 | .7 | .6 |
| 30 | .3 | .6 | .1 | .3 | ------ | 7.5 | 29 | 6.4 | 1.8 | .6 | 1.0 | .6 |
| 31 | .3 | ------ | .1 | .4 | ------ | 7.0 | ------ | 5.1 | ------ | .9 | 1.6 | ------ |
| Total | 12.0 | 13.3 | 7.8 | 4.0 | 56 | 112.8 | 441.9 | 203.7 | 335.8 | 116.7 | 20.3 | 36.3 |
| Mean | 0.39 | 0.44 | 0.25 | 0.13 | 0.19 | 3.64 | 14.7 | 6.57 | 11.2 | 3.76 | 0.65 | 1.21 |
| Max | 0.9 | 0.8 | 0.5 | 0.4 | 0.4 | 15 | 39 | 21 | 64 | 17 | 2.8 | 2.6 |
| Min | 0.1 | 0.2 | 0.1 | 0 | 0 | 0 | 5.0 | 1.8 | 1.6 | 0.6 | 0.1 | 0.6 |
| Ac-ft | 24 | 26 | 15 | 7.9 | 11 | 224 | 876 | 404 | 666 | 231 | 40 | 72 |

| | | | | | |
|---|---|---|---|---|---|
| Cal yr : | Total | Mean | Max | Min | Ac-ft |
| Wtr yr 1968: | Total 1,310.2 | Mean 3.58 | Max 64 | Min 0 | Ac-ft 2,600 |

5-1272.25 Shagawa Lake at Ely, Minn.

Location.--Lat 47°54'18", long 91°53'00", in NE¼NE¼ sec.33, T.36 N., R.12 W., on south shore of Shagawa Lake, on east pier of dock at U.S. Forest Service Seaplane Base in Ely.

Records available.--April 1967 to September 1968. April 1962 to July 1966 (fragmentary) in files of Minnesota Department of Conservation, Division of Waters, Soils and Minerals.

Gage.--Staff gage read once daily. Datum of gage is 1,330.00 ft above mean sea level, adjustment of 1929 (levels by Minnesota Department of Conservation). Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation observed during year, 1,339.55 ft June 16; minimum observed, 1336.91 ft Feb. 26. 1967-68: Maximum elevation observed, that of June 16, 1968; minimum observed, that of Feb. 26, 1968. Maximum elevation observed April 1962 to July 1966, 1,339.95 ft April 27, 28, 1966, from Minnesota Department of Conservation, Division of Waters, Soils and Minerals.

Mean daily elevation, in feet, water year October 1967 to September 1968

| | | |
|---|---|---|
| Oct. 30 ..... 1337.09 | Mar. 26 ..... 1337.24 | July 29 ..... 1338.37 |
| Nov. 28 ..... 1337.08 | Apr. 30 ..... 1338.93 | Aug. 30 ..... 1337.89 |
| Jan. 3 ..... 1337.00 | May 31 ..... 1338.57 | Sept.30 ..... 1337.81 |
| Feb. 26 ..... 1336.91 | June 28 ..... 1339.09 | |

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

## 5-1272.30 Shagawa River at Ely, Minn.

Location.--Lat 47°55'09", long 91°50'08", in SW¼SW¼ sec.23, T.63 N., R.12 W., on right bank, 300 ft downstream from outlet of Shagawa Lake, 150 ft north of the village limits of Ely, ¾ mile upstream from County Road 88 and 3 miles upstream from Fall Lake.

Records available.--May 1967 to September 1968.

Gage.--Water-stage recorder. Altitude of gage is 1,335 ft (from topographic map). Prior to Aug. 2, 1967, staff gage at same site and datum.

Extremes.--Maximum discharge during year, 385 cfs June 15 (gage height, 6.33 ft); minimum, 6.2 cfs Mar. 4 (gage height, 3.74 ft).
1967-68: Maximum discharge, that of June 15, 1968; minimum, that of Mar. 4, 1968.

Remarks.--Records good.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 9.9 | 10 | 12 | 9.6 | 7.2 | 39 | 254 | 187 | 271 | 134 | 75 |
| 2 | 11 | 9.9 | 10 | 10 | 9.6 | 7.2 | 40 | 258 | 183 | 265 | 129 | 74 |
| 3 | 11 | 9.9 | 10 | 11 | 9.6 | 7.0 | 41 | 258 | 180 | 260 | 122 | 73 |
| 4 | 12 | 10 | 10 | 11 | 9.6 | 6.7 | 47 | 260 | 176 | 260 | 116 | 74 |
| 5 | 11 | 9.8 | 10 | 11 | 9.6 | 7.2 | 47 | 258 | 175 | 258 | 113 | 73 |
| 6 | 9.9 | 9.5 | 10 | 11 | 9.6 | 7.0 | 47 | 250 | 182 | 254 | 111 | 76 |
| 7 | 10 | 9.2 | 10 | 10 | 9.9 | 7.0 | 48 | 248 | 182 | 250 | 108 | 76 |
| 8 | 13 | 9.0 | 10 | 10 | 10 | 7.2 | 54 | 246 | 231 | 265 | 105 | 76 |
| 9 | 14 | 8.6 | 10 | 9.8 | 10 | 8.3 | 59 | 242 | 281 | 258 | 102 | 76 |
| 10 | 14 | 8.6 | 10 | 9.6 | 10 | 8.6 | 63 | 237 | 314 | 247 | 96 | 75 |
| 11 | 14 | 9.2 | 10 | 9.2 | 11 | 8.6 | 67 | 229 | 343 | 236 | 92 | 76 |
| 12 | 12 | 9.9 | 10 | 9.6 | 10 | 8.6 | 72 | 224 | 349 | 230 | 87 | 72 |
| 13 | 15 | 9.6 | 10 | 9.9 | 9.6 | 8.6 | 75 | 220 | 349 | 224 | 87 | 69 |
| 14 | 15 | 9.2 | 10 | 9.9 | 9.6 | 8.6 | 84 | 212 | 369 | 222 | 80 | 69 |
| 15 | 14 | 9.2 | 10 | 9.9 | 9.2 | 8.9 | 89 | 210 | 374 | 213 | 77 | 68 |
| 16 | 14 | 9.6 | 10 | 9.9 | 9.9 | 8.9 | 94 | 214 | 371 | 216 | 77 | 66 |
| 17 | 16 | 9.9 | 10 | 9.9 | 10 | 8.9 | 106 | 210 | 367 | 224 | 74 | 67 |
| 18 | 14 | 10 | 10 | 9.9 | 9.6 | 9.9 | 110 | 205 | 358 | 224 | 70 | 69 |
| 19 | 14 | 10 | 10 | 9.9 | 8.9 | 13 | 118 | 203 | 347 | 222 | 72 | 73 |
| 20 | 18 | 10 | 10 | 9.6 | 9.2 | 13 | 120 | 200 | 330 | 213 | 70 | 75 |
| 21 | 16 | 10 | 11 | 9.6 | 8.9 | 19 | 126 | 194 | 323 | 211 | 65 | 74 |
| 22 | 14 | 11 | 12 | 9.6 | 9.2 | 19 | 133 | 191 | 316 | 194 | 68 | 74 |
| 23 | 12 | 11 | 11 | 9.6 | 8.6 | 19 | 156 | 183 | 321 | 186 | 74 | 77 |
| 24 | 12 | 11 | 11 | 9.6 | 8.3 | 19 | 173 | 180 | 316 | 178 | 80 | 76 |
| 25 | 12 | 11 | 11 | 9.6 | 7.7 | 19 | 180 | 176 | 308 | 172 | 81 | 75 |
| 26 | 11 | 11 | 11 | 9.9 | 7.2 | 21 | 187 | 173 | 297 | 170 | 81 | 72 |
| 27 | 11 | 11 | 11 | 9.9 | 7.0 | 24 | 198 | 178 | 287 | 164 | 80 | 70 |
| 28 | 11 | 11 | 11 | 9.6 | 7.2 | 29 | 210 | 183 | 279 | 154 | 77 | 69 |
| 29 | 11 | 10 | 11 | 9.9 | 7.2 | 29 | 229 | 185 | 271 | 146 | 75 | 69 |
| 30 | 10 | 10 | 11 | 10 | ------ | 36 | 241 | 185 | 265 | 142 | 74 | 68 |
| 31 | 9.9 | ------ | 12 | 9.9 | ------ | 39 | ------ | 185 | ------ | 140 | 74 | ------ |
| Total | 392.8 | 298.0 | 323 | 310.3 | 265.8 | 443.4 | 3,253 | 6,651 | 8,631 | 6,669 | 2,751 | 2,176 |
| Mean | 12.7 | 9.93 | 10.4 | 10.0 | 9.17 | 14.3 | 108 | 215 | 288 | 215 | 88.7 | 72.5 |
| Max | 18 | 11 | 12 | 12 | 11 | 39 | 241 | 260 | 374 | 271 | 134 | 77 |
| Min | 9.9 | 8.6 | 10 | 9.2 | 7.0 | 6.7 | 39 | 173 | 175 | 140 | 65 | 66 |
| Ac-ft | 779 | 591 | 641 | 615 | 527 | 879 | 6,450 | 13,190 | 17,120 | 13,230 | 5,460 | 4,320 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr | : Total | | Mean | | Max | | Min | | Ac-ft | |
| Wtr yr 1968: | Total | 32,164.3 | Mean | 87.9 | Max | 374 | Min | 6.7 | Ac-ft | 63,800 |

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 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Digital water-stage recorder. Datum of gage is 1,296.80 ft (revised) above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Prior to June 2, 1938, staff gages at several sites on Jackfish Bay, at datum 3.0 ft higher. June 2 to Oct. 27, 1938, staff gage at Williams Island half a mile northeast of present gage at datum 3.0 ft higher. Oct. 28, 1938 to Sept. 30, 1966, graphic water-stage recorder at datum 3.0 ft higher and Oct. 1, 1966 to June 28, 1967, graphic water-stage recorder at present datum.

Average discharge.--40 years (1925-27, 1930-68), 1,330 cfs.

Extremes.--Maximum discharge during year, 9,040 cfs June 23 (gage height, 7.73 ft); minimum, 257 cfs Mar. 2, 3, 4, 5 (gage height, 2.41 ft).
1924, 1925-27, 1930-68: Maximum discharge, 15,600 cfs May 24, 1950 (gage height, 9.94 ft, present datum); 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.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 492 | 363 | 381 | 314 | 286 | 262 | 590 | 3,850 | 3,870 | 7,120 | 2,250 | 1,160 |
| 2 | 485 | 360 | 383 | 311 | 284 | 261 | 600 | 4,120 | 3,850 | 6,850 | 2,130 | 1,210 |
| 3 | 490 | 360 | 387 | 307 | 287 | 260 | 614 | 4,380 | 3,830 | 6,570 | 2,040 | 1,260 |
| 4 | 471 | 359 | 388 | 303 | 285 | 259 | 680 | 4,610 | 3,770 | 6,350 | 1,970 | 1,300 |
| 5 | 465 | 355 | 392 | 303 | 284 | 261 | 691 | 4,830 | 3,770 | 6,020 | 1,890 | 1,320 |
| 6 | 462 | 350 | 393 | 301 | 285 | 262 | 695 | 5,030 | 4,050 | 5,700 | 1,830 | 1,360 |
| 7 | 457 | 346 | 392 | 299 | 285 | 262 | 707 | 5,200 | 4,090 | 5,430 | 1,800 | 1,390 |
| 8 | 474 | 341 | 393 | 298 | 283 | 261 | 749 | 5,330 | 4,470 | 5,190 | 1,720 | 1,390 |
| 9 | 470 | 338 | 392 | 297 | 284 | 275 | 786 | 5,430 | 4,810 | 4,960 | 1,680 | 1,370 |
| 10 | 466 | 345 | 392 | 296 | 283 | 280 | 816 | 5,470 | 5,170 | 4,740 | 1,600 | 1,370 |
| 11 | 459 | 345 | 389 | 295 | 282 | 281 | 847 | 5,450 | 5,560 | 4,520 | 1,560 | 1,370 |
| 12 | 455 | 344 | 388 | 296 | 281 | 283 | 862 | 5,370 | 6,130 | 4,290 | 1,540 | 1,390 |
| 13 | 444 | 343 | 386 | 302 | 280 | 284 | 868 | 5,270 | 6,840 | 4,020 | 1,500 | 1,410 |
| 14 | 445 | 337 | 382 | 300 | 282 | 287 | 912 | 5,140 | 7,620 | 3,790 | 1,460 | 1,430 |
| 15 | 439 | 335 | 380 | 299 | 280 | 291 | 916 | 4,980 | 8,060 | 3,630 | 1,450 | 1,430 |
| 16 | 435 | 334 | 378 | 296 | 277 | 292 | 918 | 4,930 | 8,390 | 3,540 | 1,420 | 1,420 |
| 17 | 425 | 335 | 383 | 294 | 274 | 294 | 947 | 4,840 | 8,640 | 3,510 | 1,380 | 1,420 |
| 18 | 419 | 339 | 380 | 296 | 272 | 298 | 969 | 4,710 | 8,780 | 3,420 | 1,320 | 1,420 |
| 19 | 420 | 343 | 372 | 296 | 270 | 318 | 993 | 4,550 | 8,890 | 3,310 | 1,260 | 1,420 |
| 20 | 401 | 347 | 370 | 293 | 271 | 329 | 1,030 | 4,430 | 8,950 | 3,200 | 1,180 | 1,410 |
| 21 | 408 | 356 | 370 | 291 | 269 | 351 | 1,100 | 4,310 | 8,950 | 3,040 | 1,140 | 1,410 |
| 22 | 406 | 362 | 368 | 287 | 267 | 366 | 1,190 | 4,210 | 8,950 | 2,940 | 1,090 | 1,410 |
| 23 | 399 | 370 | 365 | 287 | 266 | 383 | 1,430 | 4,140 | 8,980 | 2,880 | 1,080 | 1,390 |
| 24 | 394 | 372 | 362 | 291 | 265 | 401 | 1,730 | 4,060 | 8,850 | 2,800 | 1,070 | 1,350 |
| 25 | 386 | 376 | 355 | 291 | 266 | 417 | 1,990 | 4,000 | 8,670 | 2,740 | 1,070 | 1,310 |
| 26 | 390 | 370 | 350 | 289 | 264 | 439 | 2,260 | 3,980 | 8,430 | 2,750 | 1,060 | 1,300 |
| 27 | 388 | 369 | 345 | 288 | 264 | 466 | 2,560 | 4,010 | 8,150 | 2,670 | 1,050 | 1,280 |
| 28 | 383 | 374 | 339 | 287 | 264 | 504 | 2,880 | 3,990 | 7,860 | 2,570 | 1,050 | 1,260 |
| 29 | 379 | 379 | 331 | 292 | 264 | 533 | 3,220 | 3,980 | 7,560 | 2,510 | 1,040 | 1,230 |
| 30 | 372 | 380 | 322 | 291 | ------ | 561 | 3,550 | 3,940 | 7,330 | 2,440 | 1,040 | 1,210 |
| 31 | 371 | ------ | 317 | 288 | ------ | 573 | ------ | 3,910 | ------ | 2,360 | 1,100 | ------ |
| TOTAL | 13,350 | 10,627 | 11,525 | 9,178 | 8,004 | 10,594 | 38,100 | 142,450 | 203,270 | 125,860 | 44,770 | 40,400 |
| MEAN | 431 | 354 | 372 | 296 | 276 | 342 | 1,270 | 4,595 | 6,776 | 4,060 | 1,444 | 1,347 |
| MAX | 492 | 380 | 393 | 314 | 287 | 573 | 3,550 | 5,470 | 8,980 | 7,120 | 2,250 | 1,430 |
| MIN | 371 | 334 | 317 | 287 | 264 | 259 | 590 | 3,850 | 3,770 | 2,360 | 1,040 | 1,160 |
| CFSM | .25 | .20 | .21 | .17 | .16 | .20 | .73 | 2.64 | 3.89 | 2.33 | .83 | .77 |
| IN. | .29 | .23 | .25 | .20 | .17 | .23 | .81 | 3.04 | 4.34 | 2.69 | .96 | .86 |

CAL YR 1967 TOTAL 404,059 MEAN 1,107 MAX 4,560 MIN 317 CFSM .64 IN 8.64
WTR YR 1968 TOTAL 658,128 MEAN 1,798 MAX 8,980 MIN 259 CFSM 1.03 IN 14.07

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

(International gaging station)

Location.--Lat 48°23'00", long 92°10'40" (revised), at Campbell's Camp, 2½ miles west of outlet of Lac la Croix.

Drainage area.--5,170 sq mi (revised).

Records available.--September 1921 to January 1922, April 1922 to September 1968, in reports of Geological Survey. Monthly discharge only for some periods, published in WSP 1308. August 1921 to September 1968 in reports of Inland Waters Branch, Department of Energy, Mines and Resources, Canada.

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

Average discharge.--46 years (1922-68), 3,644 cfs.

Extremes.--Maximum discharge during year, 20,000 cfs June 26 (elevation, 1,190.83 ft); minimum, 843 cfs Mar. 4, 5, 8 (elevation, 1,182.01 ft).
1921-68: Maximum discharge, 28,200 cfs May 31 to June 2, 1950 (elevation, 1,193.30 ft); minimum, 535 cfs at times in February, March and April 1924 (elevation, 1,181.50 ft).

Remarks.--Records excellent.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,980 | 1,440 | 1,140 | 1,120 | 999 | 858 | 1,150 | 5,820 | 9,890 | 19,800 | 11,600 | 5,360 |
| 2 | 1,950 | 1,410 | 1,130 | 1,110 | 999 | 850 | 1,180 | 6,190 | 9,790 | 19,700 | 11,300 | 5,290 |
| 3 | 1,980 | 1,390 | 1,130 | 1,110 | 990 | 850 | 1,200 | 6,610 | 9,760 | 19,500 | 11,100 | 5,190 |
| 4 | 1,900 | 1,380 | 1,130 | 1,100 | 982 | 843 | 1,270 | 7,030 | 9,660 | 19,400 | 10,800 | 5,110 |
| 5 | 1,870 | 1,380 | 1,120 | 1,100 | 974 | 843 | 1,310 | 7,350 | 9,610 | 19,100 | 10,500 | 5,050 |
| 6 | 1,880 | 1,370 | 1,120 | 1,100 | 982 | 850 | 1,360 | 7,690 | 9,890 | 18,800 | 10,200 | 5,050 |
| 7 | 1,870 | 1,350 | 1,110 | 1,100 | 982 | 850 | 1,440 | 7,990 | 10,100 | 18,400 | 9,810 | 4,970 |
| 8 | 1,900 | 1,300 | 1,100 | 1,100 | 974 | 843 | 1,530 | 8,290 | 10,800 | 18,000 | 9,510 | 4,870 |
| 9 | 1,880 | 1,300 | 1,100 | 1,100 | 966 | 873 | 1,630 | 8,590 | 11,700 | 17,600 | 9,140 | 4,830 |
| 10 | 1,870 | 1,310 | 1,090 | 1,100 | 958 | 888 | 1,720 | 9,000 | 12,500 | 17,200 | 8,850 | 4,770 |
| 11 | 1,860 | 1,290 | 1,100 | 1,100 | 950 | 880 | 1,800 | 9,310 | 13,100 | 16,700 | 9,000 | 4,720 |
| 12 | 1,840 | 1,250 | 1,110 | 1,100 | 950 | 873 | 1,890 | 9,590 | 13,600 | 16,300 | 8,640 | 4,680 |
| 13 | 1,800 | 1,240 | 1,100 | 1,100 | 926 | 865 | 2,000 | 9,760 | 14,100 | 15,800 | 8,520 | 4,850 |
| 14 | 1,800 | 1,240 | 1,090 | 1,100 | 918 | 873 | 2,170 | 9,990 | 14,500 | 15,300 | 8,410 | 4,810 |
| 15 | 1,770 | 1,240 | 1,090 | 1,100 | 918 | 873 | 2,280 | 10,100 | 15,200 | 15,600 | 8,290 | 4,750 |
| 16 | 1,770 | 1,220 | 1,090 | 1,110 | 918 | 873 | 2,390 | 10,200 | 15,800 | 15,700 | 8,060 | 4,720 |
| 17 | 1,720 | 1,210 | 1,120 | 1,100 | 918 | 873 | 2,520 | 10,500 | 16,400 | 15,900 | 7,830 | 4,680 |
| 18 | 1,720 | 1,190 | 1,120 | 1,090 | 910 | 880 | 2,640 | 10,600 | 16,900 | 15,700 | 7,230 | 4,660 |
| 19 | 1,740 | 1,200 | 1,110 | 1,070 | 903 | 910 | 2,770 | 10,600 | 17,500 | 15,500 | 7,000 | 4,640 |
| 20 | 1,630 | 1,200 | 1,120 | 1,050 | 895 | 934 | 2,920 | 10,600 | 18,000 | 15,100 | 6,890 | 4,590 |
| 21 | 1,690 | 1,200 | 1,140 | 1,040 | 895 | 958 | 3,060 | 10,600 | 18,500 | 14,900 | 6,730 | 4,530 |
| 22 | 1,680 | 1,190 | 1,140 | 1,040 | 895 | 958 | 3,210 | 10,600 | 19,000 | 14,700 | 6,680 | 4,480 |
| 23 | 1,640 | 1,190 | 1,150 | 1,040 | 888 | 966 | 3,500 | 10,500 | 19,400 | 14,400 | 6,540 | 4,300 |
| 24 | 1,590 | 1,180 | 1,150 | 1,040 | 880 | 966 | 3,810 | 10,400 | 19,700 | 14,100 | 6,390 | 4,240 |
| 25 | 1,540 | 1,180 | 1,150 | 1,040 | 873 | 982 | 4,020 | 10,300 | 19,900 | 13,900 | 6,230 | 4,230 |
| 26 | 1,540 | 1,150 | 1,140 | 1,030 | 865 | 982 | 4,190 | 10,200 | 19,900 | 13,600 | 6,060 | 4,230 |
| 27 | 1,530 | 1,140 | 1,140 | 1,020 | 865 | 999 | 4,440 | 10,200 | 19,900 | 13,200 | 5,930 | 4,190 |
| 28 | 1,530 | 1,150 | 1,140 | 1,020 | 865 | 1,030 | 4,740 | 10,200 | 19,700 | 13,000 | 5,760 | 4,140 |
| 29 | 1,500 | 1,140 | 1,120 | 1,020 | 873 | 1,040 | 5,050 | 10,100 | 19,600 | 12,600 | 5,610 | 4,100 |
| 30 | 1,480 | 1,140 | 1,120 | 1,020 | ------ | 1,100 | 5,440 | 10,000 | 19,900 | 12,300 | 5,520 | 4,050 |
| 31 | 1,460 | ------ | 1,120 | 999 | ------ | 1,120 | ------ | 9,960 | ------ | 12,000 | 5,460 | ------ |
| Total | 53,910 | 37,570 | 34,730 | 33,269 | 26,911 | 28,483 | 78,630 | 288,870 | 454,300 | 493,800 | 249,590 | 140,080 |
| Mean | 1,739 | 1,252 | 1,120 | 1,073 | 928 | 919 | 2,621 | 9,318 | 15,143 | 15,929 | 8,051 | 4,669 |
| Max | 1,980 | 1,440 | 1,150 | 1,120 | 999 | 1,120 | 5,440 | 10,600 | 19,900 | 19,800 | 11,600 | 5,360 |
| Min | 1,460 | 1,140 | 1,090 | 999 | 865 | 843 | 1,150 | 5,820 | 9,610 | 12,000 | 5,460 | 4,050 |
| Cfsm | 0.336 | 0.242 | 0.217 | 0.208 | 0.180 | 0.178 | 0.507 | 1.80 | 2.93 | 3.08 | 1.56 | 0.903 |
| In. | 0.39 | 0.27 | 0.25 | 0.24 | 0.19 | 0.20 | 0.57 | 2.08 | 3.27 | 3.55 | 1.80 | 1.01 |
| Ac-ft | 106,900 | 74,520 | 68,890 | 65,990 | 53,380 | 56,500 | 156,000 | 573,000 | 901,100 | 979,400 | 495,100 | 277,800 |

Cal yr 1967: Total 1,267,760 Mean 3,473 Max 12,100 Min 1,090 Cfsm 0.672 In 9.12 Ac-ft 2,515,000
Wtr yr 1968: Total 1,920,143 Mean 5,246 Max 19,900 Min 843 Cfsm 1.01 In 13.81 Ac-ft 3,809,000

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 1968 (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, 1,358.98 ft June 14 (affected by wind action); maximum daily, 1,358.81 ft June 15; minimum, 1,356.46 ft Nov. 10.
1913-15, 1941-42, 1946-68: 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).

Daily mean elevation, in feet, October 1967 to September 1968

| | | |
|---|---|---|
| Oct. 31 ..... 1,356.55 | Feb. 29 ..... 1,356.67 | June 30 ..... 1,358.69 |
| Nov. 30 ..... 1,356.55 | Mar. 31 ..... 1,357.01 | July 31 ..... 1,358.19 |
| Dec. 31 ..... 1,356.66 | Apr. 30 ..... 1,358.17 | Aug. 31 ..... 1,357.87 |
| Jan. 31 ..... 1,356.69 | May 31 ..... 1,358.17 | Sept.30 ..... 1,357.75 |

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

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 1968.

Gage.--Digital water-stage recorder. Datum of gage is 1,347.36 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, at datum 3.0 ft higher. June 26, 1928, to July 8, 1931, staff gage at datum 3.05 ft higher. Apr. 12, 1939, to Sept. 6, 1967, graphic water-stage recorder, and Sept. 7-30, 1967, digital water-stage recorder at same site, at datum 3.0 ft higher.

Average discharge.--46 years, 305 cfs.

Extremes.--Maximum discharge during year, 1,420 cfs July 1 (gage height, 6.40 ft); minimum, 1.7 cfs Nov. 12 (gage height, 1.95 ft, affected by seiche action).
1911-17, 1928-68: Maximum discharge, 2,710 cfs May 23, 1950 (gage height, 7.68 ft); no flow Oct. 25-29, 1955, caused by temporary storage behind new concrete dam at outlet of Vermilion Lake.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 5.7 | 14 | 17 | 31 | 37 | 142 | 809 | 786 | 1,260 | 714 | 512 |
| 2 | 13 | 4.8 | 13 | 17 | 31 | 37 | 142 | 811 | 779 | 1,240 | 684 | 511 |
| 3 | 16 | 4.4 | 14 | 17 | 32 | 37 | 149 | 820 | 794 | 1,240 | 667 | 516 |
| 4 | 12 | 4.0 | 14 | 17 | 32 | 38 | 166 | 846 | 776 | 1,260 | 659 | 497 |
| 5 | 7.9 | 4.2 | 14 | 18 | 32 | 38 | 178 | 872 | 782 | 1,250 | 641 | 486 |
| 6 | 12 | 4.5 | 14 | 18 | 32 | 39 | 188 | 899 | 827 | 1,230 | 617 | 488 |
| 7 | 14 | 4.7 | 14 | 18 | 33 | 39 | 196 | 920 | 835 | 1,210 | 606 | 517 |
| 8 | 16 | 4.8 | 14 | 18 | 33 | 39 | 205 | 897 | 995 | 1,180 | 579 | 497 |
| 9 | 14 | 4.3 | 14 | 19 | 34 | 41 | 222 | 863 | 1,100 | 1,140 | 551 | 478 |
| 10 | 15 | 5.7 | 13 | 19 | 34 | 43 | 238 | 876 | 1,160 | 1,150 | 510 | 484 |
| 11 | 19 | 5.0 | 14 | 19 | 35 | 47 | 249 | 871 | 1,170 | 1,090 | 495 | 477 |
| 12 | 27 | 4.1 | 14 | 20 | 35 | 50 | 258 | 872 | 1,180 | 1,090 | 491 | 476 |
| 13 | 20 | 5.4 | 14 | 20 | 35 | 51 | 267 | 874 | 1,240 | 1,060 | 444 | 480 |
| 14 | 17 | 4.4 | 14 | 21 | 36 | 54 | 314 | 871 | 1,290 | 1,040 | 436 | 467 |
| 15 | 15 | 6.5 | 14 | 21 | 36 | 55 | 334 | 852 | 1,310 | 1,010 | 457 | 482 |
| 16 | 17 | 6.3 | 15 | 22 | 36 | 58 | 344 | 815 | 1,320 | 1,040 | 437 | 464 |
| 17 | 12 | 6.5 | 17 | 23 | 37 | 60 | 359 | 838 | 1,330 | 1,090 | 419 | 463 |
| 18 | 11 | 5.4 | 17 | 23 | 37 | 72 | 378 | 843 | 1,310 | 1,080 | 435 | 488 |
| 19 | 21 | 7.2 | 16 | 24 | 37 | 102 | 398 | 816 | 1,270 | 1,070 | 425 | 495 |
| 20 | 6.3 | 8.4 | 16 | 25 | 37 | 117 | 417 | 815 | 1,310 | 1,080 | 388 | 472 |
| 21 | 12 | 9.4 | 17 | 26 | 37 | 117 | 452 | 811 | 1,250 | 1,010 | 404 | 476 |
| 22 | 18 | 10 | 16 | 26 | 37 | 112 | 475 | 794 | 1,260 | 963 | 469 | 499 |
| 23 | 12 | 12 | 17 | 27 | 37 | 105 | 540 | 781 | 1,310 | 950 | 505 | 503 |
| 24 | 6.9 | 12 | 17 | 27 | 36 | 98 | 606 | 779 | 1,290 | 910 | 524 | 478 |
| 25 | 4.4 | 12 | 17 | 28 | 37 | 97 | 650 | 766 | 1,270 | 890 | 515 | 459 |
| 26 | 6.2 | 12 | 17 | 29 | 36 | 97 | 672 | 756 | 1,250 | 874 | 529 | 458 |
| 27 | 6.2 | 12 | 17 | 29 | 37 | 102 | 693 | 787 | 1,220 | 814 | 528 | 453 |
| 28 | 9.4 | 12 | 17 | 29 | 37 | 122 | 720 | 788 | 1,210 | 773 | 532 | 445 |
| 29 | 8.8 | 12 | 17 | 30 | 36 | 140 | 736 | 788 | 1,170 | 776 | 528 | 441 |
| 30 | 6.3 | 13 | 17 | 30 | ------ | 142 | 780 | 784 | 1,200 | 763 | 520 | 435 |
| 31 | 9.6 | ------ | 17 | 31 | ------ | 142 | ------ | 795 | ------ | 718 | 519 | ------ |
| TOTAL | 405.0 | 222.7 | 475 | 708 | 1,015 | 2,328 | 11,468 | 25,709 | 33,994 | 32,251 | 16,228 | 14,397 |
| MEAN | 13.1 | 7.42 | 15.3 | 22.8 | 35.0 | 75.1 | 382 | 829 | 1,133 | 1,040 | 523 | 480 |
| MAX | 27 | 13 | 17 | 31 | 37 | 142 | 780 | 920 | 1,330 | 1,260 | 714 | 517 |
| MIN | 4.4 | 4.0 | 13 | 17 | 31 | 37 | 142 | 756 | 776 | 718 | 388 | 435 |
| CFSM | .03 | .02 | .03 | .05 | .08 | .17 | .87 | 1.89 | 2.59 | 2.38 | 1.20 | 1.10 |
| IN. | .03 | .02 | .04 | .06 | .09 | .20 | .97 | 2.18 | 2.89 | 2.74 | 1.38 | 1.22 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 76,068.7 | Mean | 208 | Max | 828 | Min | 4.0 | Cfsm | 0.475 | In. | 6.46 |
| Wtr yr 1968: | Total | 139,200.7 | Mean | 380 | Max | 1,330 | Min | 4.0 | Cfsm | 0.868 | In. | 11.82 |

Note.--Doubtful or no gage-height record Jan. 10 to Apr. 12.

## 5-1294. Rainy Lake near Fort Frances, Ontario

(International gaging station)

Location.--Lat 48°38'30", long 93°20'00", at Five Mile dock, approximately 5 miles northeast of town of Fort Frances.

Records available.--January 1910 to September 1917 and October 1934 to September 1968 in reports of Geological Survey, August 1911 to September 1968 in reports of Inland Waters Branch, Department of Energy, Mines and Resources, Canada. Prior to October 1949, published as "at Ranier, Minn.", and as "at Fort Frences, Ontario" October 1949 to September 1964.

Gage.--Water-stage recorder. Datum of gage is at mean sea level (United States and Canadian Boundary Survey). January 1910 to December 1949, staff gage 3 miles northeast at Ranier, Minn., at same datum. January 1950 to October 1964, water-stage recorder on Government dock at Pither's Point, in Fort Frances and supplementary gage in town pumping station, half a mile south, used during winter months, as same datum.

Extremes.--Maximum elevation during year 1,110.19 ft July 20; minimum, 1,105.08 ft Mar. 17.
1910-17, 1934-68: 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 1967 to September 1968

| | | |
|---|---|---|
| Oct. 31 ..... 5.98 | Feb. 29 ..... 5.19 | June 30 ..... 9.40 |
| Nov. 30 ..... 5.95 | Mar. 31 ..... 5.39 | July 31 ..... 9.62 |
| Dec. 31 ..... 6.04 | Apr. 30 ..... 6.78 | Aug. 31 ..... 8.13 |
| Jan. 31 ..... 5.78 | May 31 ..... 8.02 | Sept.30 ..... 8.09 |

Note.--Add 1,100 ft to obtain elevation above mean sea level. Elevations other than those shown are available.

## 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 1968.

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.--26 years, 120 cfs.

Extremes.--Maximum discharge during year, 599 cfs June 16 (gage height, 2.95 ft); minimum daily, 8.5 cfs Nov. 29, 30.

1942-68: Maximum discharge, 3,630 cfs May 7, 1950 (gage height, 6.41 ft), from rating curve extended above 1,600 cfs on basis of slope-area measurement of peak flow; minimum daily, 6.0 cfs Feb. 18-27, 1944; minimum gage height, 0.08 ft Jan. 28 to Feb. 1, 1963.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.5 | 11 | 9.0 | 11 | 13 | 11 | 258 | 500 | 202 | 290 | 66 | 144 |
| 2 | 9.9 | 11 | 10 | 11 | 13 | 11 | 162 | 430 | 202 | 376 | 61 | 144 |
| 3 | 11 | 10 | 11 | 12 | 14 | 10 | 110 | 362 | 193 | 446 | 56 | 134 |
| 4 | 11 | 10 | 11 | 12 | 14 | 10 | 82 | 304 | 174 | 446 | 52 | 123 |
| 5 | 12 | 9.7 | 12 | 13 | 14 | 10 | 102 | 266 | 195 | 366 | 50 | 115 |
| 6 | 12 | 9.0 | 12 | 13 | 14 | 10 | 128 | 238 | 394 | 280 | 47 | 124 |
| 7 | 14 | 9.2 | 13 | 13 | 14 | 10 | 156 | 228 | 423 | 222 | 46 | 138 |
| 8 | 24 | 9.5 | 13 | 14 | 14 | 10 | 277 | 228 | 530 | 188 | 45 | 150 |
| 9 | 24 | 10 | 12 | 14 | 14 | 11 | 369 | 233 | 595 | 174 | 55 | 150 |
| 10 | 21 | 11 | 12 | 14 | 13 | 11 | 453 | 230 | 595 | 156 | 54 | 138 |
| 11 | 19 | 12 | 12 | 14 | 13 | 11 | 473 | 220 | 562 | 144 | 49 | 124 |
| 12 | 17 | 12 | 12 | 14 | 12 | 11 | 438 | 208 | 492 | 140 | 46 | 110 |
| 13 | 17 | 11 | 12 | 14 | 12 | 11 | 369 | 198 | 430 | 152 | 45 | 106 |
| 14 | 16 | 10 | 12 | 13 | 11 | 11 | 304 | 188 | 465 | 158 | 42 | 103 |
| 15 | 15 | 10 | 11 | 13 | 11 | 12 | 260 | 188 | 522 | 154 | 44 | 98 |
| 16 | 15 | 11 | 11 | 13 | 10 | 13 | 321 | 193 | 590 | 156 | 48 | 95 |
| 17 | 14 | 12 | 12 | 13 | 10 | 14 | 369 | 195 | 571 | 186 | 48 | 119 |
| 18 | 14 | 13 | 12 | 13 | 9.8 | 17 | 380 | 198 | 461 | 215 | 50 | 198 |
| 19 | 14 | 13 | 12 | 13 | 9.5 | 40 | 362 | 198 | 366 | 225 | 53 | 280 |
| 20 | 14 | 11 | 12 | 13 | 9.5 | 30 | 331 | 190 | 287 | 212 | 52 | 372 |
| 21 | 14 | 12 | 13 | 12 | 9.5 | 37 | 314 | 176 | 271 | 193 | 62 | 423 |
| 22 | 13 | 12 | 14 | 12 | 9.5 | 39 | 294 | 165 | 266 | 167 | 79 | 387 |
| 23 | 12 | 13 | 12 | 12 | 9.5 | 37 | 294 | 156 | 341 | 144 | 153 | 334 |
| 24 | 12 | 13 | 12 | 12 | 9.5 | 35 | 280 | 148 | 352 | 126 | 260 | 294 |
| 25 | 11 | 13 | 12 | 12 | 9.5 | 35 | 304 | 142 | 317 | 112 | 408 | 280 |
| 26 | 12 | 14 | 12 | 12 | 10 | 37 | 352 | 146 | 257 | 104 | 539 | 257 |
| 27 | 11 | 11 | 12 | 12 | 10 | 56 | 430 | 165 | 212 | 95 | 496 | 220 |
| 28 | 11 | 9.5 | 12 | 12 | 10 | 88 | 509 | 202 | 181 | 85 | 362 | 193 |
| 29 | 11 | 8.5 | 11 | 12 | 11 | 136 | 557 | 220 | 165 | 78 | 243 | 169 |
| 30 | 11 | 8.5 | 11 | 12 | ------ | 210 | 553 | 215 | 176 | 72 | 176 | 154 |
| 31 | 11 | ------ | 11 | 12 | ------ | 320 | ------ | 205 | ------ | 70 | 150 | ------ |
| Total | 432.4 | 328.9 | 365.0 | 392 | 333.3 | 1,304 | 9,591 | 6,935 | 10,787 | 5,932 | 3,938 | 5,676 |
| Mean | 13.9 | 11.0 | 11.8 | 12.6 | 11.5 | 42.1 | 320 | 224 | 360 | 191 | 127 | 189 |
| Max | 24 | 14 | 14 | 14 | 14 | 320 | 557 | 500 | 595 | 446 | 539 | 423 |
| Min | 9.5 | 8.5 | 9.0 | 11 | 9.5 | 10 | 82 | 142 | 165 | 70 | 42 | 95 |
| Cfsm | 0.074 | 0.059 | 0.063 | 0.067 | 0.061 | 0.225 | 1.71 | 1.20 | 1.92 | 1.02 | 0.679 | 1.01 |
| In. | 0.09 | 0.07 | 0.07 | 0.08 | 0.07 | 0.26 | 1.91 | 1.38 | 2.14 | 1.18 | 0.78 | 1.13 |

Cal yr 1967: Total 34,059.2 Mean 93.3 Max 960 Min 8.5 Cfsm 0.499 In. 6.77
Wtr yr 1968: Total 46,014.6 Mean 126 Max 595 Min 8.5 Cfsm 0.674 In. 9.15

PEAK DISCHARGE (BASE, 500 CFS)

| DATE | TIME | G.HT. | DISCHARGE | DATE | TIME | G.HT. | DISCHARGE |
|---|---|---|---|---|---|---|---|
| 4-30 | 0100 | 2.95 | 562 | 6-16 | 2100 | 2.95 | 599 |
| 8-26 | 1600 | 2.93 | 553 | | | | |

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 12⅛ miles northeast of Chisholm.

Drainage area.--50.6 sq mi.

Records available.--August 1942 to September 1961, October 1965 to September 1968.

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.--22 years, 36.1 cfs.

Extremes.--Maximum discharge during year, 200 cfs June 8 (gage height, 3.11 ft); minimum daily, 3.0 cfs Feb. 15-23.
1942-61, 1966-68: 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.

Cooperation.--Records for 1968 water year computed by U.S. Steel Corporation and reviewed by Geological Survey.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.6 | 9.1 | 7.1 | 6.4 | 5.5 | 3.6 | 64 | 128 | 46 | 82 | 20 | 38 |
| 2 | 3.8 | 8.9 | 7.0 | 6.0 | 5.4 | 3.9 | 45 | 112 | 46 | 112 | 18 | 38 |
| 3 | 4.9 | 8.9 | 6.5 | 5.8 | 5.1 | 4.1 | 36 | 95 | 46 | 153 | 18 | 36 |
| 4 | 5.9 | 9.1 | 6.5 | 5.6 | 4.9 | 4.4 | 35 | 80 | 42 | 176 | 16 | 36 |
| 5 | 6.5 | 8.9 | 6.4 | 5.4 | 4.7 | 4.6 | 36 | 66 | 38 | 145 | 14 | 34 |
| 6 | 6.8 | 8.5 | 6.4 | 5.0 | 4.7 | 4.6 | 35 | 56 | 92 | 116 | 14 | 39 |
| 7 | 8.2 | 8.7 | 6.5 | 4.7 | 4.7 | 5.0 | 35 | 55 | 78 | 90 | 14 | 41 |
| 8 | 11 | 8.0 | 6.5 | 4.6 | 4.5 | 5.6 | 42 | 54 | 169 | 72 | 14 | 44 |
| 9 | 12 | 8.2 | 6.5 | 4.7 | 4.4 | 7.6 | 63 | 56 | 169 | 54 | 14 | 45 |
| 10 | 13 | 8.2 | 6.0 | 4.9 | 4.5 | 8.5 | 72 | 55 | 173 | 45 | 14 | 42 |
| 11 | 13 | 8.2 | 6.0 | 5.0 | 4.2 | 8.7 | 80 | 54 | 171 | 41 | 14 | 38 |
| 12 | 13 | 8.4 | 6.0 | 5.2 | 3.6 | 9.6 | 76 | 49 | 146 | 40 | 14 | 34 |
| 13 | 12 | 8.4 | 6.0 | 5.5 | 3.3 | 8.7 | 66 | 46 | 123 | 40 | 15 | 32 |
| 14 | 12 | 8.4 | 6.2 | 5.9 | 3.1 | 7.8 | 58 | 43 | 140 | 45 | 13 | 29 |
| 15 | 11 | 8.4 | 6.0 | 6.4 | 3.0 | 7.4 | 56 | 42 | 138 | 43 | 14 | 26 |
| 16 | 11 | 8.4 | 5.9 | 6.2 | 3.0 | 7.1 | 66 | 46 | 146 | 51 | 16 | 25 |
| 17 | 11 | 8.4 | 6.0 | 6.4 | 3.0 | 7.2 | 74 | 45 | 143 | 64 | 16 | 33 |
| 18 | 10 | 8.4 | 6.4 | 6.5 | 3.0 | 12 | 70 | 44 | 123 | 70 | 16 | 56 |
| 19 | 10 | 8.2 | 6.8 | 6.4 | 3.0 | 26 | 70 | 42 | 96 | 78 | 18 | 60 |
| 20 | 10 | 8.4 | 6.8 | 6.4 | 3.0 | 32 | 69 | 39 | 74 | 78 | 18 | 72 |
| 21 | 9.8 | 8.0 | 7.0 | 6.4 | 3.0 | 30 | 63 | 38 | 70 | 64 | 19 | 78 |
| 22 | 9.6 | 8.2 | 7.0 | 6.5 | 3.0 | 25 | 55 | 35 | 66 | 55 | 22 | 78 |
| 23 | 9.3 | 8.2 | 6.8 | 6.4 | 3.0 | 22 | 58 | 33 | 99 | 47 | 35 | 72 |
| 24 | 9.3 | 8.2 | 7.0 | 6.2 | 3.1 | 18 | 58 | 32 | 88 | 42 | 53 | 63 |
| 25 | 9.3 | 8.0 | 7.1 | 6.4 | 3.1 | 16 | 56 | 29 | 90 | 38 | 72 | 58 |
| 26 | 9.1 | 7.8 | 7.1 | 6.5 | 3.1 | 20 | 69 | 30 | 82 | 35 | 95 | 51 |
| 27 | 8.9 | 7.4 | 6.8 | 6.5 | 3.2 | 32 | 101 | 37 | 68 | 31 | 92 | 46 |
| 28 | 8.9 | 7.0 | 6.6 | 6.5 | 3.3 | 38 | 124 | 44 | 54 | 27 | 74 | 42 |
| 29 | 8.9 | 7.0 | 6.6 | 6.5 | 3.5 | 44 | 129 | 46 | 45 | 25 | 54 | 39 |
| 30 | 8.9 | 7.1 | 6.8 | 6.2 | ------ | 59 | 136 | 47 | 55 | 24 | 43 | 35 |
| 31 | 8.9 | ------ | 6.6 | 5.8 | ------ | 64 | ------ | 46 | ------ | 22 | 39 | ------ |
| Total | 289.6 | 247.0 | 202.9 | 182.9 | 108.9 | 546.4 | 1,997 | 1,624 | 2,916 | 2,005 | 908 | 1,360 |
| Mean | 9.34 | 8.23 | 6.55 | 5.90 | 3.76 | 17.6 | 66.6 | 52.4 | 97.2 | 64.7 | 29.3 | 45.3 |
| Max | 13 | 9.1 | 7.1 | 6.5 | 5.5 | 64 | 136 | 128 | 173 | 176 | 95 | 78 |
| Min | 3.6 | 7.0 | 5.9 | 4.6 | 3.0 | 3.6 | 35 | 29 | 38 | 22 | 13 | 25 |
| Cfsm | 0.185 | 0.163 | 0.129 | 0.117 | 0.074 | 0.348 | 1.32 | 1.04 | 1.92 | 1.28 | 0.579 | 0.895 |
| In. | 0.21 | 0.18 | 0.15 | 0.13 | 0.08 | 0.40 | 1.47 | 1.19 | 2.14 | 1.47 | 0.67 | 1.00 |

Cal yr 1967: Total 8,811.5 Mean 24.1 Max 184 Min 3.2 Cfsm 0.476 In. 6.48
Wtr yr 1968: Total 12,387.7 Mean 33.8 Max 176 Min 3.0 Cfsm 0.668 In. 9.10

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 highway bridge at town of Little Fork, 0.3 mile downstream from bridge on State Highway 217, 1½ miles upstream from Beaver Creek, and 18 miles upstream from mouth.

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

Records available.--June to November 1909, April to November 1910, April 1911 to June 1917, September 1917, October 1917 to March 1919 (gage heights only), June 1928 to September 1968.

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.--45 years (1911-16, 1928-68), 991 cfs.

Extremes.--Maximum discharge during year, 5,790 cfs June 10 (gage height, 18.51 ft, backwater from Rainy River); minimum daily discharge, 41 cfs Feb. 17-23.
1909-17, 1928-68: Maximum discharge, 25,000 cfs Apr. 18, 1916, May 11, 1950 (gage height, 37.00 ft); minimum daily, 15 cfs Feb. 9-22, 1963.

Remarks.--Records good except those for winter months or period of backwater from Rainy River, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 63 | 136 | 104 | 65 | 48 | 42 | 2500 | 3,930 | 1,460 | 1,760 | 641 | 1,040 |
| 2 | 63 | 136 | 104 | 63 | 47 | 42 | 2,200 | 3,540 | 1,620 | 3,020 | 588 | 940 |
| 3 | 66 | 134 | 105 | 62 | 47 | 42 | 1,970 | 3,150 | 1,760 | 3,560 | 550 | 904 |
| 4 | 65 | 126 | 105 | 61 | 46 | 43 | 1,700 | 2,780 | 1,720 | 3,550 | 526 | 884 |
| 5 | 68 | 128 | 106 | 60 | 46 | 44 | 1,350 | 2,460 | 1,620 | 3,530 | 498 | 864 |
| 6 | 66 | 116 | 106 | 59 | 46 | 45 | 1,030 | 2,180 | 1,940 | 3,290 | 477 | 835 |
| 7 | 65 | 106 | 106 | 57 | 46 | 46 | 1,000 | 1,970 | 2,800 | 3,010 | 434 | 868 |
| 8 | 71 | 114 | 106 | 56 | 45 | 47 | 1,600 | 1,830 | 3,900 | 2,760 | 418 | 1,020 |
| 9 | 75 | 118 | 105 | 56 | 45 | 48 | 2,000 | 1,740 | 5,100 | 3,010 | 412 | 1,220 |
| 10 | 80 | 122 | 104 | 55 | 45 | 49 | 5,000 | 1,690 | 5,750 | 2,910 | 404 | 1,290 |
| 11 | 83 | 122 | 102 | 54 | 44 | 50 | 5,070 | 1,630 | 5,680 | 2,510 | 372 | 1,210 |
| 12 | 91 | 121 | 100 | 54 | 44 | 50 | 4,550 | 1,560 | 5,180 | 1,930 | 367 | 1,080 |
| 13 | 114 | 120 | 98 | 53 | 44 | 49 | 3,750 | 1,470 | 4,470 | 1,590 | 370 | 930 |
| 14 | 132 | 117 | 96 | 53 | 44 | 50 | 3,090 | 1,380 | 4,000 | 1,430 | 370 | 803 |
| 15 | 131 | 115 | 94 | 52 | 43 | 51 | 2,660 | 1,310 | 4,280 | 1,410 | 353 | 709 |
| 16 | 126 | 114 | 93 | 52 | 42 | 54 | 2,420 | 1,280 | 4,420 | 1,810 | 355 | 647 |
| 17 | 125 | 113 | 93 | 52 | 41 | 70 | 2,860 | 1,250 | 4,040 | 2,870 | 358 | 765 |
| 18 | 121 | 112 | 92 | 52 | 41 | 220 | 3,350 | 1,210 | 3,500 | 3,680 | 362 | 1,470 |
| 19 | 116 | 111 | 91 | 52 | 41 | 650 | 3,350 | 1,200 | 3,100 | 3,380 | 355 | 2,330 |
| 20 | 114 | 110 | 89 | 52 | 41 | 590 | 3,080 | 1,180 | 2,750 | 2,950 | 375 | 2,790 |
| 21 | 114 | 109 | 86 | 52 | 41 | 1,350 | 2,860 | 1,150 | 2,500 | 2,490 | 364 | 2,860 |
| 22 | 107 | 108 | 83 | 51 | 41 | 1,740 | 2,750 | 1,080 | 2,600 | 2,250 | 401 | 2,680 |
| 23 | 107 | 107 | 80 | 51 | 41 | 1,330 | 2,720 | 1,010 | 3,460 | 1,810 | 600 | 2,770 |
| 24 | 137 | 106 | 78 | 51 | 42 | 1,050 | 2,700 | 951 | 3,650 | 1,420 | 1,000 | 3,110 |
| 25 | 148 | 106 | 75 | 51 | 42 | 950 | 2,720 | 894 | 3,900 | 1,160 | 2,130 | 3,130 |
| 26 | 143 | 105 | 73 | 51 | 42 | 900 | 2,890 | 838 | 3,330 | 1,030 | 2,360 | 2,810 |
| 27 | 139 | 104 | 71 | 50 | 42 | 920 | 3,380 | 828 | 2,650 | 964 | 2,230 | 2,410 |
| 28 | 134 | 103 | 70 | 50 | 42 | 1,020 | 4,020 | 914 | 2,120 | 883 | 2,020 | 2,040 |
| 29 | 136 | 103 | 69 | 49 | 42 | 1,600 | 4,300 | 1,150 | 1,720 | 765 | 1,790 | 1,730 |
| 30 | 136 | 104 | 67 | 49 | ------ | 2,190 | 4,230 | 1,440 | 1,370 | 684 | 1,540 | 1,480 |
| 31 | 136 | ------ | 66 | 48 | ------ | 2,240 | ------ | 1,560 | ------ | 665 | 1,250 | ------ |
| Total | 3,272 | 3,446 | 2,817 | 1,673 | 1,261 | 17,572 | 87,100 | 50,555 | 96,390 | 68,081 | 24,270 | 47,619 |
| Mean | 106 | 115 | 91 | 54 | 43 | 567 | 2,903 | 1,631 | 3,213 | 2,196 | 783 | 1,587 |
| Max | 148 | 136 | 106 | 65 | 48 | 2,240 | 5,070 | 3,930 | 5,750 | 3,680 | 2,360 | 3,130 |
| Min | 63 | 103 | 66 | 48 | 41 | 42 | 1,000 | 828 | 1,370 | 665 | 353 | 647 |
| Cfsm | 0.061 | 0.066 | 0.053 | 0.031 | 0.025 | 0.328 | 1.68 | 0.943 | 1.86 | 1.27 | 0.453 | 0.917 |
| In. | 0.07 | 0.07 | 0.06 | 0.04 | 0.03 | 0.38 | 1.87 | 1.09 | 2.07 | 1.46 | 0.52 | 1.02 |

Cal yr 1967: Total 280,887 Mean 770 Max 6,600 Min 56 Cfsm 0.445 In. 6.04
Wtr yr 1968: Total 404,056 Mean 1,104 Max 5,750 Min 41 Cfsm 0.639 In. 8.69

Note.--Backwater from Rainy River May 29 to Aug. 19.

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

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

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

Records available.--August to November 1909, April to November 1910, April 1911 to September 1912 (gage heights and discharge measurements only), June 1928 to September 1968.

Gage.--Digital 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. Dec. 18, 1937, to Sept. 6, 1967, graphic water-stage recorder at same site and datum.

Average discharge.--40 years (1928-1968), 656 cfs.

Extremes.--Maximum discharge during year, 2,620 cfs Apr. 11 (gage height, 6.33 ft); minimum daily, 54 cfs Feb. 16-24; minimum gage height, 2.75 ft Nov. 15.
1909-12, 1928-68: Maximum discharge, 14,800 cfs May 8, 9, 1950; maximum gage height, 17.08 ft May 8, 1950; minimum discharge recorded, 7 cfs Aug. 7, 1939.

Remarks.--Records good except those for period of no gage-height record and those for winter months, which are fair. Some diurnal fluctuation at low flow caused by powerplant a quarter of a mile upstream. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 129 | 198 | 165 | 111 | 72 | 59 | 616 | 1,600 | 839 | 981 | 298 | 450 |
| 2 | 132 | 201 | 166 | 109 | 71 | 60 | 552 | 1,460 | 921 | 1,890 | 282 | 410 |
| 3 | 137 | 164 | 167 | 106 | 70 | 62 | 520 | 1,320 | 981 | 2,040 | 260 | 394 |
| 4 | 138 | 214 | 168 | 104 | 69 | 64 | 480 | 1,210 | 946 | 2,010 | 248 | 383 |
| 5 | 135 | 187 | 169 | 103 | 68 | 67 | 460 | 1,120 | 878 | 1,830 | 236 | 372 |
| 6 | 134 | 169 | 170 | 101 | 66 | 71 | 445 | 1,040 | 1,060 | 1,590 | 223 | 364 |
| 7 | 139 | 167 | 172 | 99 | 65 | 74 | 512 | 998 | 1,100 | 1,320 | 213 | 400 |
| 8 | 153 | 198 | 171 | 97 | 64 | 77 | 661 | 1,000 | 1,400 | 1,100 | 200 | 470 |
| 9 | 158 | 243 | 169 | 94 | 62 | 78 | 1,050 | 1,050 | 2,170 | 935 | 196 | 542 |
| 10 | 163 | 258 | 166 | 92 | 60 | 76 | 1,640 | 1,100 | 2,060 | 791 | 193 | 563 |
| 11 | 168 | 251 | 164 | 91 | 59 | 75 | 2,150 | 1,110 | 1,790 | 680 | 184 | 524 |
| 12 | 171 | 241 | 162 | 89 | 58 | 79 | 2,010 | 1,080 | 1,560 | 622 | 175 | 441 |
| 13 | 177 | 219 | 160 | 88 | 57 | 89 | 1,480 | 1,030 | 1,370 | 558 | 174 | 415 |
| 14 | 173 | 195 | 157 | 87 | 56 | 103 | 1,360 | 991 | 1,400 | 552 | 173 | 376 |
| 15 | 172 | 130 | 156 | 86 | 55 | 113 | 1,280 | 984 | 1,720 | 564 | 170 | 349 |
| 16 | 177 | 145 | 157 | 86 | 54 | 113 | 1,310 | 970 | 1,730 | 872 | 172 | 334 |
| 17 | 214 | 160 | 156 | 85 | 54 | 121 | 1,460 | 970 | 1,570 | 1,370 | 174 | 510 |
| 18 | 199 | 168 | 154 | 84 | 54 | 147 | 1,510 | 935 | 1,380 | 1,820 | 176 | 1,190 |
| 19 | 193 | 172 | 152 | 84 | 54 | 200 | 1,460 | 893 | 1,200 | 1,670 | 173 | 2,130 |
| 20 | 175 | 172 | 148 | 84 | 54 | 360 | 1,380 | 830 | 1,050 | 1,430 | 172 | 2,290 |
| 21 | 185 | 170 | 143 | 84 | 54 | 1,300 | 1,350 | 804 | 998 | 1,260 | 170 | 2,080 |
| 22 | 186 | 169 | 138 | 83 | 54 | 1,280 | 1,340 | 772 | 1,020 | 1,110 | 176 | 1,860 |
| 23 | 191 | 167 | 135 | 82 | 54 | 1,170 | 1,370 | 726 | 1,090 | 880 | 208 | 1,900 |
| 24 | 192 | 166 | 132 | 81 | 54 | 1,020 | 1,420 | 694 | 1,180 | 690 | 460 | 2,20· |
| 25 | 186 | 165 | 128 | 80 | 55 | 878 | 1,510 | 654 | 1,190 | 560 | 1,070 | 2,230 |
| 26 | 190 | 164 | 125 | 80 | 56 | 800 | 1,690 | 616 | 1,110 | 498 | 1,200 | 2,090 |
| 27 | 200 | 164 | 123 | 79 | 57 | 748 | 1,870 | 622 | 963 | 438 | 1,110 | 1,880 |
| 28 | 204 | 163 | 120 | 78 | 57 | 728 | 1,900 | 689 | 817 | 392 | 1,000 | 1,660 |
| 29 | 201 | 163 | 117 | 77 | 58 | 724 | 1,840 | 758 | 721 | 350 | 860 | 1,470 |
| 30 | 198 | 164 | 115 | 75 | ------ | 650 | 1,720 | 790 | 680 | 321 | 720 | 1,300 |
| 31 | 204 | ------ | 113 | 74 | ------ | 638 | ------ | 791 | ------ | 310 | 560 | ------ |
| TOTAL | 5,364 | 5,507 | 4,638 | 2,753 | 1,721 | 12,024 | 38,346 | 29,607 | 36,894 | 31,434 | 11,626 | 31,577 |
| MEAN | 173 | 184 | 150 | 88.8 | 59.3 | 388 | 1,278 | 955 | 1,230 | 1,014 | 375 | 1,053 |
| MAX | 214 | 258 | 172 | 111 | 72 | 1,300 | 2,150 | 1,600 | 2,170 | 2,040 | 1,200 | 2,290 |
| MIN | 129 | 130 | 113 | 74 | 54 | 59 | 445 | 616 | 680 | 310 | 170 | 334 |
| CFSM | .12 | .13 | .10 | .06 | .04 | .27 | .88 | .65 | .84 | .69 | .26 | .72 |
| IN. | .14 | .14 | .12 | .07 | .04 | .31 | .98 | .75 | .94 | .80 | .30 | .80 |

CAL YR 1967 TOTAL 255,513 MEAN 700 MAX 4,120 MIN 106 CFSM .48 IN 6.51
WTR YR 1968 TOTAL 211,491 MEAN 578 MAX 2,290 MIN 54 CFSM .40 IN 5.39

Note.--No gage-height record July 17 to Sept. 11.

## 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 1968. 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.--Digital 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. Nov. 10, 1934, to Sept. 20, 1967, graphic water-stage recorder at present site and datum.

Average discharge.--40 years, 12,310 cfs.

Extremes.--Maximum discharge during year, 46,200 cfs July 19 (gage height, 15.78 ft); minimum daily, 3,470 cfs Mar. 4; minimum gage height, 2.06 ft Nov. 3.
1928-68: Maximum discharge, 71,600 cfs May 12, 1950 (gage height, 21.04 ft); minimum daily, 928 cfs Dec. 26, 1929.

Remarks.--Records good except those for winter months, which are fair. Diurnal fluctuation caused by power-plant at International Falls. Some regulation at low and medium flows by Rainy and Namakan Lakes. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9,710 | 4,980 | 4,500 | 4,630 | 5,340 | 5,940 | 7,110 | 13,300 | 22,500 | 37,400 | 36,200 | 14,900 |
| 2 | 9,020 | 4,940 | 5,420 | 4,460 | 5,710 | 4,970 | 8,430 | 13,100 | 22,800 | 39,500 | 35,800 | 14,300 |
| 3 | 8,720 | 4,340 | 4,680 | 4,330 | 5,860 | 4,300 | 9,850 | 12,900 | 23,000 | 42,200 | 35,400 | 12,500 |
| 4 | 8,220 | 5,240 | 4,570 | 4,570 | 5,860 | 3,470 | 9,510 | 13,000 | 23,500 | 43,200 | 35,100 | 13,400 |
| 5 | 7,560 | 6,130 | 4,570 | 4,690 | 4,970 | 4,210 | 9,040 | 12,600 | 22,800 | 43,400 | 34,800 | 13,900 |
| 6 | 8,320 | 5,690 | 4,920 | 5,270 | 6,610 | 4,270 | 8,500 | 11,900 | 22,900 | 42,900 | 34,500 | 14,000 |
| 7 | 8,640 | 4,790 | 4,620 | 5,360 | 6,300 | 3,840 | 7,580 | 12,300 | 34,700 | 42,000 | 34,200 | 14,000 |
| 8 | 9,040 | 4,420 | 4,610 | 4,780 | 6,430 | 4,670 | 7,640 | 12,600 | 37,600 | 41,100 | 33,700 | 14,200 |
| 9 | 8,360 | 4,660 | 4,460 | 5,770 | 6,880 | 4,320 | 8,720 | 14,800 | 42,700 | 40,400 | 33,300 | 14,700 |
| 10 | 7,810 | 4,620 | 4,510 | 6,120 | 7,440 | 5,340 | 10,400 | 16,900 | 43,100 | 40,200 | 32,600 | 14,900 |
| 11 | 6,740 | 4,430 | 4,650 | 6,710 | 6,870 | 3,840 | 13,400 | 18,500 | 43,800 | 39,600 | 32,000 | 14,900 |
| 12 | 7,040 | 4,660 | 4,690 | 6,540 | 5,040 | 4,620 | 14,300 | 19,900 | 43,600 | 39,200 | 31,500 | 14,600 |
| 13 | 7,720 | 4,700 | 4,580 | 6,480 | 7,370 | 4,240 | 13,700 | 18,900 | 43,400 | 38,800 | 30,300 | 14,300 |
| 14 | 8,150 | 4,940 | 4,730 | 6,060 | 5,670 | 4,970 | 12,300 | 18,700 | 42,900 | 38,500 | 29,500 | 14,000 |
| 15 | 7,750 | 5,250 | 4,770 | 5,070 | 5,110 | 4,830 | 11,600 | 18,500 | 42,100 | 38,600 | 29,000 | 13,800 |
| 16 | 7,380 | 4,940 | 4,720 | 5,340 | 5,490 | 4,800 | 10,900 | 18,500 | 42,000 | 41,300 | 26,200 | 13,500 |
| 17 | 7,670 | 4,740 | 4,690 | 5,680 | 5,850 | 4,630 | 10,700 | 18,500 | 41,500 | 44,400 | 24,200 | 14,400 |
| 18 | 8,220 | 4,740 | 4,750 | 6,110 | 5,270 | 4,180 | 11,300 | 18,400 | 40,400 | 45,500 | 23,500 | 19,400 |
| 19 | 8,570 | 4,850 | 5,410 | 6,730 | 4,360 | 5,100 | 11,700 | 18,200 | 39,400 | 46,100 | 22,800 | 23,200 |
| 20 | 8,350 | 4,720 | 4,800 | 6,080 | 6,290 | 5,690 | 12,100 | 18,200 | 38,500 | 45,300 | 18,500 | 24,800 |
| 21 | 7,690 | 4,610 | 4,560 | 5,220 | 6,610 | 5,790 | 12,000 | 18,200 | 38,000 | 43,900 | 14,500 | 24,200 |
| 22 | 7,410 | 4,790 | 4,350 | 4,400 | 6,130 | 7,650 | 12,200 | 18,200 | 38,100 | 42,400 | 13,200 | 24,500 |
| 23 | 6,760 | 4,870 | 4,810 | 5,240 | 6,200 | 8,260 | 12,700 | 18,200 | 38,900 | 41,600 | 13,300 | 26,000 |
| 24 | 7,080 | 5,050 | 4,750 | 6,580 | 6,240 | 7,260 | 12,800 | 18,000 | 39,500 | 40,300 | 15,000 | 26,200 |
| 25 | 7,040 | 5,130 | 4,270 | 6,190 | 6,160 | 6,210 | 13,200 | 17,900 | 40,300 | 39,400 | 16,300 | 25,200 |
| 26 | 6,100 | 5,130 | 4,420 | 5,530 | 4,540 | 7,020 | 12,800 | 17,700 | 39,800 | 38,900 | 17,700 | 23,400 |
| 27 | 5,130 | 4,690 | 4,510 | 6,020 | 6,810 | 7,120 | 12,700 | 17,400 | 39,200 | 38,400 | 17,800 | 21,600 |
| 28 | 5,070 | 4,710 | 4,490 | 5,580 | 5,830 | 6,030 | 12,800 | 17,400 | 38,300 | 37,900 | 17,300 | 20,200 |
| 29 | 4,950 | 4,510 | 4,490 | 4,560 | 5,460 | 5,500 | 13,500 | 17,700 | 37,500 | 37,400 | 16,600 | 18,900 |
| 30 | 4,850 | 4,680 | 4,710 | 4,780 | ------ | 7,220 | 13,600 | 19,600 | 37,100 | 36,900 | 15,900 | 17,800 |
| 31 | 4,930 | ------ | 4,430 | 5,370 | ------ | 7,640 | ------ | 20,800 | ------ | 36,400 | 15,400 | ------ |
| TOTAL | 230,000 | 145,950 | 144,440 | 170,250 | 172,700 | 167,930 | 337,080 | 519,900 | 1,099.9M | 1,263.1M | 786,100 | 535,700 |
| MEAN | 7,419 | 4,865 | 4,659 | 5,492 | 5,955 | 5,417 | 11,240 | 16,770 | 36,660 | 40,750 | 25,360 | 17,860 |
| MAX | 9,710 | 6,130 | 5,420 | 6,730 | 7,440 | 8,260 | 14,300 | 20,800 | 43,800 | 46,100 | 36,200 | 26,200 |
| MIN | 4,850 | 4,340 | 4,270 | 4,330 | 4,360 | 3,470 | 7,110 | 11,900 | 22,500 | 36,400 | 13,200 | 12,500 |
| CFSM | .38 | .25 | .24 | .28 | .31 | .28 | .58 | .86 | 1.89 | 2.10 | 1.31 | .92 |
| IN. | .44 | .28 | .28 | .33 | .33 | .32 | .65 | 1.00 | 2.11 | 2.42 | 1.51 | 1.03 |

CAL YR 1967 TOTAL 4,053,570 MEAN 11,110 MAX 33,600 MIN 3,160 CFSM .57 IN 7.77
WTR YR 1968 TOTAL 5,573,050 MEAN 15,230 MAX 46,100 MIN 3,470 CFSM .78 IN 10.68

## 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 20 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 1968.

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.--12 years, 335 cfs.

Extremes.--Maximum discharge during year, 4,310 cfs July 17 (gage height, 15.08 ft); minimum, 1.0 cfs Oct. 4. (gage height, 1.50 ft).
1956-68: Maximum discharge, 5,160 cfs (revised) May 24, 1962 (gage height, 17.13 ft); minimum, 0.1 cfs Aug. 13, 1961 (gage height, 1.18 ft).
Flood of May 11, 1950 reached a stage of 21.1 ft, from information by local residents and Minnesota Highway Department (discharge, about 7,000 cfs, revised).

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.5 | 2.9 | 3.6 | 3.3 | 2.5 | 1.9 | 310 | 244 | 392 | 572 | 622 | 464 |
| 2 | 1.5 | 2.9 | 3.7 | 3.1 | 2.4 | 2.0 | 260 | 219 | 476 | 926 | 544 | 425 |
| 3 | 1.4 | 3.0 | 3.7 | 3.0 | 2.4 | 2.0 | 220 | 200 | 446 | 916 | 495 | 422 |
| 4 | 1.2 | 3.2 | 3.7 | 2.9 | 2.3 | 2.1 | 180 | 199 | 365 | 903 | 504 | 550 |
| 5 | 1.3 | 3.2 | 3.8 | 2.8 | 2.3 | 2.2 | 155 | 228 | 305 | 967 | 461 | 516 |
| 6 | 1.6 | 3.2 | 3.8 | 2.8 | 2.3 | 3.0 | 140 | 219 | 662 | 789 | 428 | 485 |
| 7 | 1.8 | 2.8 | 3.7 | 2.7 | 2.2 | 6.0 | 135 | 264 | 1,050 | 606 | 386 | 702 |
| 8 | 2.4 | 2.8 | 3.7 | 2.7 | 2.2 | 12 | 140 | 541 | 1,330 | 498 | 350 | 970 |
| 9 | 2.6 | 3.0 | 3.6 | 2.6 | 2.1 | 14 | 180 | 603 | 1,430 | 440 | 314 | 922 |
| 10 | 2.6 | 3.0 | 3.6 | 2.6 | 2.1 | 13 | 220 | 550 | 1,450 | 362 | 268 | 798 |
| 11 | 4.2 | 3.0 | 3.6 | 2.6 | 2.1 | 10 | 214 | 476 | 1,890 | 669 | 228 | 681 |
| 12 | 3.2 | 3.4 | 3.6 | 2.5 | 2.0 | 9.0 | 211 | 446 | 1,880 | 907 | 195 | 569 |
| 13 | 2.4 | 3.4 | 3.6 | 2.5 | 2.0 | 7.5 | 187 | 422 | 1,650 | 755 | 173 | 464 |
| 14 | 1.8 | 3.2 | 3.7 | 2.5 | 1.9 | 6.3 | 175 | 374 | 1,740 | 808 | 159 | 401 |
| 15 | 1.5 | 3.1 | 3.7 | 2.5 | 1.9 | 6.0 | 195 | 336 | 1,670 | 926 | 148 | 347 |
| 16 | 1.5 | 3.3 | 3.8 | 2.5 | 1.9 | 6.5 | 246 | 311 | 1,340 | 2,270 | 194 | 324 |
| 17 | 1.8 | 3.4 | 3.8 | 2.5 | 1.8 | 11 | 252 | 282 | 1,100 | 4,530 | 248 | 588 |
| 18 | 2.0 | 3.5 | 3.9 | 2.5 | 1.8 | 17 | 234 | 264 | 973 | 4,540 | 234 | 901 |
| 19 | 2.2 | 3.5 | 4.0 | 2.6 | 1.8 | 50 | 214 | 246 | 870 | 4,100 | 236 | 882 |
| 20 | 2.4 | 3.4 | 4.0 | 2.6 | 1.8 | 40 | 211 | 225 | 730 | 3,600 | 266 | 820 |
| 21 | 2.8 | 3.3 | 3.9 | 2.7 | 1.8 | 38 | 268 | 207 | 712 | 2,970 | 240 | 718 |
| 22 | 2.7 | 3.3 | 3.8 | 2.7 | 1.8 | 34 | 350 | 202 | 995 | 2,480 | 356 | 817 |
| 23 | 2.7 | 3.2 | 3.7 | 2.8 | 1.8 | 32 | 374 | 183 | 992 | 1,920 | 736 | 1,760 |
| 24 | 2.8 | 3.2 | 3.6 | 2.8 | 1.8 | 33 | 470 | 159 | 935 | 1,490 | 986 | 1,680 |
| 25 | 2.8 | 3.2 | 3.6 | 2.8 | 1.8 | 60 | 510 | 147 | 789 | 1,220 | 1,060 | 1,430 |
| 26 | 2.8 | 3.2 | 3.5 | 2.7 | 1.8 | 150 | 455 | 132 | 643 | 1,140 | 963 | 1,120 |
| 27 | 2.9 | 3.2 | 3.5 | 2.7 | 1.8 | 350 | 404 | 129 | 519 | 1,110 | 829 | 922 |
| 28 | 3.0 | 3.3 | 3.5 | 2.7 | 1.8 | 430 | 350 | 145 | 425 | 935 | 708 | 774 |
| 29 | 2.9 | 3.4 | 3.4 | 2.6 | 1.9 | 420 | 305 | 181 | 362 | 789 | 616 | 662 |
| 30 | 2.7 | 3.5 | 3.4 | 2.6 | ------ | 405 | 278 | 242 | 330 | 696 | 538 | 584 |
| 31 | 2.5 | ------ | 3.3 | 2.5 | ------ | 360 | ------ | 278 | ------ | 681 | 488 | ------ |
| Total | 71.5 | 96.0 | 113.8 | 83.4 | 58.1 | 2,533.5 | 7,843 | 8,654 | 28,451 | 45,515 | 13,973 | 22,698 |
| Mean | 2.31 | 3.20 | 3.67 | 2.69 | 2.00 | 81.7 | 261 | 279 | 948 | 1,470 | 451 | 757 |
| Max | 4.2 | 3.5 | 4.0 | 3.3 | 2.5 | 430 | 510 | 603 | 1,890 | 4,540 | 1,060 | 1,760 |
| Min | 1.2 | 2.8 | 3.3 | 2.5 | 1.8 | 1.9 | 135 | 129 | 305 | 362 | 148 | 324 |
| Cfsm | .0043 | .0059 | .0068 | .0050 | .0037 | .150 | .481 | .514 | 1.75 | 2.71 | .831 | 1.39 |
| In. | .005 | .007 | .008 | .006 | .004 | .17 | .54 | 0.59 | 1.95 | 3.12 | 0.96 | 1.55 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 127,430.4 | Mean | 349 | Max | 3,310 | Min | 1.2 | Cfsm | 0.643 | In | 8.73 |
| Wtr yr 1968: | Total | 130,090.3 | Mean | 356 | Max | 4,540 | Min | 1.2 | Cfsm | 0.656 | In | 8.91 |

## 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 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read once daily, and crest-stage gage. 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). Prior to Sept. 6, 1967, chain gage at same site and datum.

Average discharge.--22 years, 43.6 cfs.

Extremes.--Maximum discharge during year, 1,530 cfs June 11 (gage height, 9.32 ft); no flow Oct. 1-11.
1946-68: Maximum discharge, 1,780 cfs Apr. 15, 1965 (gage height, 9.95 ft); no flow at times.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1.7 | 1.8 | 1.3 | 1.7 | 1.7 | 89 | 33 | 35 | 187 | 76 | 204 |
| 2 | 0 | 1.7 | 1.8 | 1.3 | 1.7 | 1.7 | 62 | 28 | 45 | 171 | 65 | 164 |
| 3 | 0 | 1.7 | 1.8 | 1.3 | 1.7 | 1.7 | 45 | 27 | 48 | 173 | 56 | 137 |
| 4 | 0 | 1.6 | 1.8 | 1.2 | 1.7 | 1.7 | 39 | 26 | 36 | 155 | 62 | 123 |
| 5 | 0 | 1.5 | 1.8 | 1.2 | 1.7 | 1.7 | 36 | 24 | 55 | 147 | 71 | 115 |
| 6 | 0 | 1.4 | 1.9 | 1.2 | 1.7 | 1.8 | 35 | 23 | 123 | 153 | 85 | 101 |
| 7 | 0 | 1.4 | 2.0 | 1.2 | 1.6 | 1.9 | 41 | 22 | 244 | 186 | 101 | 105 |
| 8 | 0 | 1.4 | 2.0 | 1.2 | 1.6 | 1.9 | 48 | 27 | 860 | 180 | 116 | 118 |
| 9 | 0 | 1.5 | 2.0 | 1.1 | 1.6 | 2.0 | 57 | 32 | 1,110 | 155 | 91 | 152 |
| 10 | 0 | 1.5 | 1.9 | 1.1 | 1.5 | 2.0 | 57 | 41 | 1,230 | 101 | 76 | 150 |
| 11 | 0 | 1.6 | 1.9 | 1.1 | 1.5 | 2.0 | 52 | 39 | 1,280 | 108 | 69 | 143 |
| 12 | 0.1 | 1.7 | 1.9 | 1.1 | 1.5 | 2.0 | 45 | 36 | 1,010 | 100 | 61 | 113 |
| 13 | .2 | 1.7 | 1.9 | 1.1 | 1.5 | 1.9 | 41 | 33 | 794 | 110 | 53 | 110 |
| 14 | .5 | 1.7 | 2.0 | 1.1 | 1.5 | 1.8 | 57 | 33 | 537 | 88 | 52 | 96 |
| 15 | .6 | 1.6 | 2.1 | 1.1 | 1.4 | 1.8 | 50 | 32 | 452 | 190 | 50 | 79 |
| 16 | .6 | 1.6 | 2.1 | 1.1 | 1.4 | 1.8 | 40 | 29 | 315 | 104 | 43 | 69 |
| 17 | .6 | 1.5 | 2.1 | 1.1 | 1.4 | 2.1 | 37 | 28 | 254 | 127 | 36 | 43 |
| 18 | .5 | 1.5 | 2.2 | 1.1 | 1.4 | 3.0 | 36 | 28 | 214 | 736 | 48 | 35 |
| 19 | .5 | 1.5 | 2.1 | 1.1 | 1.4 | 3.5 | 33 | 29 | 155 | 653 | 83 | 75 |
| 20 | .6 | 1.6 | 2.1 | 1.1 | 1.5 | 4.5 | 44 | 32 | 114 | 540 | 126 | 104 |
| 21 | .8 | 1.6 | 2.0 | 1.1 | 1.5 | 5.5 | 58 | 30 | 111 | 428 | 129 | 88 |
| 22 | .9 | 1.7 | 1.9 | 1.2 | 1.5 | 6.5 | 69 | 28 | 101 | 315 | 160 | 79 |
| 23 | 1.0 | 1.7 | 1.8 | 1.2 | 1.6 | 8.0 | 89 | 25 | 89 | 231 | 155 | 68 |
| 24 | 1.1 | 1.8 | 1.7 | 1.3 | 1.6 | 10 | 62 | 23 | 59 | 182 | 312 | 61 |
| 25 | 1.1 | 1.9 | 1.6 | 1.3 | 1.6 | 14 | 56 | 21 | 50 | 151 | 564 | 52 |
| 26 | 1.2 | 1.9 | 1.5 | 1.3 | 1.6 | 47 | 49 | 21 | 58 | 143 | 789 | 45 |
| 27 | 1.3 | 1.9 | 1.5 | 1.4 | 1.6 | 131 | 43 | 21 | 55 | 123 | 702 | 44 |
| 28 | 1.4 | 1.8 | 1.4 | 1.5 | 1.6 | 224 | 37 | 21 | 47 | 96 | 537 | 42 |
| 29 | 1.6 | 1.8 | 1.4 | 1.5 | 1.7 | 192 | 33 | 20 | 123 | 88 | 438 | 40 |
| 30 | 1.5 | 1.8 | 1.4 | 1.6 | ------ | 162 | 36 | 21 | 159 | 83 | 354 | 36 |
| 31 | 1.6 | ------ | 1.3 | 1.6 | ------ | 139 | ------ | 24 | ------ | 79 | 271 | ------ |
| Total | 17.7 | 49.3 | 56.7 | 38.1 | 45.3 | 981.5 | 1,476 | 857 | 9,763 | 6,283 | 5,831 | 2,791 |
| Mean | 0.57 | 1.64 | 1.83 | 1.23 | 1.56 | 31.7 | 49.2 | 27.6 | 325 | 203 | 188 | 93.0 |
| Max | 1.6 | 1.9 | 2.2 | 1.6 | 1.7 | 224 | 89 | 41 | 1,280 | 736 | 789 | 204 |
| Min | 0 | 1.4 | 1.3 | 1.1 | 1.4 | 1.7 | 33 | 20 | 35 | 79 | 36 | 35 |
| Cfsm | 0.005 | 0.015 | 0.017 | 0.011 | 0.014 | 0.288 | 0.447 | 0.251 | 2.95 | 1.85 | 1.71 | 0.845 |
| In. | 0.01 | 0.02 | 0.02 | 0.01 | 0.02 | 0.33 | 0.50 | 0.29 | 3.30 | 2.12 | 1.97 | 0.94 |

Cal yr 1967: Total 22,085.8 Mean 60.5 Max 1,490 Min 0 Cfsm 0.550 In. 7.47
Wtr yr 1968: Total 28,189.6 Mean 77.0 Max 1,280 Min 0 Cfsm 0.700 In. 9.53

GPO 817-490-7

5-1400. Bulldog Run near Warroad, Minn.

Location.--Lat 48°51'30", long 95°20'20", in SE¼ sec.7, T.162 N., R.36 W., near right bank 5 ft downstream from culvert on county highway, three-quarters of a mile upstream from mouth and 3 miles south of Warroad.

Drainage area.--14.2 sq mi.

Records available.--March 1946 to November 1951, June 1966 to September 1968.

Gage.--Staff gage read once daily. Altitude of gage is 1,090 ft (from topographic map).

Average discharge.--7 years (1946-51, 1967-68), 3.87 cfs.

Extremes.--Maximum discharge during year, 171 cfs June 8 (gage height, 6.06 ft, from floodmark); no flow for many days.
1946-51, 1966-68: Maximum discharge, 420 cfs June 10, 1947 (gage height, 6.91 ft); no flow for many days in most years.

Remarks.--Records fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 0 | 6.4 | 0.2 | 0 | 5.5 | 1.1 | 3.8 |
| 2 | | | | | | 0 | 4.5 | .1 | 0 | 24 | .9 | 2.3 |
| 3 | | | | | | 0 | 3.9 | .1 | 0 | 5.5 | .6 | .8 |
| 4 | | | | | | 0 | 3.7 | 0 | 0 | 3.2 | .8 | .6 |
| 5 | | | | | | 0 | 3.2 | 0 | 0 | 4.7 | 1.1 | .6 |
| 6 | | | | | | 0 | 2.9 | 0 | 1.8 | 3.2 | 1.3 | .6 |
| 7 | | | | | | 0 | 2.9 | 0 | 48 | 1.8 | 1.0 | .4 |
| 8 | | | | | | 0 | 3.3 | .1 | 131 | 1.2 | .6 | .4 |
| 9 | | | | | | 0 | 3.5 | .1 | 35 | 1.0 | .3 | .4 |
| 10 | | | | | | 0 | 3.0 | 0 | 52 | .7 | .1 | .2 |
| 11 | | | | | | 0 | 2.9 | 0 | 82 | .7 | 0 | .2 |
| 12 | | | | | | 0 | 2.5 | 0 | 44 | .7 | 0 | .2 |
| 13 | | | | | | 0 | 2.0 | 0 | 20 | 1.8 | 0 | .1 |
| 14 | | | | | | 0 | 2.0 | 0 | 9.5 | 1.8 | 0 | 0 |
| 15 | | | | | | 0 | 1.8 | 0 | 5.5 | 2.2 | 0 | 0 |
| 16 | | | | | | 0 | 1.7 | 0 | 4.6 | 5.7 | .1 | 0 |
| 17 | | | | | | 0 | 1.3 | 0 | 3.7 | 50 | .4 | 0 |
| 18 | | | | | | 0 | 1.2 | 0 | 2.6 | 27 | .4 | .1 |
| 19 | | | | | | 0 | 1.2 | 0 | 1.8 | 11 | .7 | .2 |
| 20 | | | | | | 0 | 1.0 | 0 | 1.1 | 8.4 | 1.6 | .2 |
| 21 | | | | | | 0 | 1.9 | 0 | 1.1 | 8.2 | 1.3 | .2 |
| 22 | | | | | | 0 | 1.7 | .1 | 1.1 | 6.8 | 1.5 | .2 |
| 23 | | | | | | 2.2 | 1.4 | .1 | 1.0 | 6.0 | 2.7 | .2 |
| 24 | | | | | | 7.2 | 1.0 | 0 | 1.0 | 5.5 | 85 | .1 |
| 25 | | | | | | 11 | .7 | 0 | 2.1 | 5.0 | 106 | .1 |
| 26 | | | | | | 18 | .5 | 0 | 1.8 | 3.5 | 41 | 0 |
| 27 | | | | | | 50 | .4 | 0 | .9 | 2.5 | 22 | 0 |
| 28 | | | | | | 61 | .3 | 0 | 1.4 | 2.0 | 10 | 0 |
| 29 | | | | | | 43 | .2 | 0 | 1.9 | 1.6 | 7.8 | 0 |
| 30 | | | | | ------ | 32 | .2 | 0 | 1.1 | 1.3 | 6.4 | 0 |
| 31 | | ------ | | | ------ | 11 | ------ | 0 | ------ | 1.2 | 4.9 | ------ |
| Total | | | | | | 235.4 | 63.2 | 0.8 | 456.0 | 203.7 | 299.6 | 11.9 |
| Mean | | | | | | 7.59 | 2.11 | 0.03 | 15.2 | 6.57 | 9.66 | 0.40 |
| Max | | | | | | 61 | 6.4 | 0.2 | 131 | 50 | 106 | 3.8 |
| Min | | | | | | 0 | 0.2 | 0 | 0 | 0.7 | 0 | 0 |
| Cfsm | | | | | | 0.535 | 0.149 | 0.0021 | 1.07 | 0.463 | 0.680 | 0.0028 |
| In. | | | | | | | 0.17 | 0.002 | 1.19 | 0.53 | 0.78 | 0.003 |

Cal yr 1967: Total 1,273 Mean 3.49 Max 305 Min 0 Cfsm 0.246 In. 3.33
Wtr yr 1968: Total 1,270.6 Mean 3.47 Max 131 Min 0 Cfsm 0.244 In. 3.33

5-1405. East Branch Warroad River near Warroad, Minn.

Location.--Lat 48°51'30", long 95°18'40", in SE¼SE¼ sec.8, T.162 N., R.36 W., near right bank on piling at upstream side of highway bridge, 2 miles upstream from mouth and 3 miles south of Warroad.

Drainage area.--102 sq mi.

Records available.--March 1946 to September 1954, June 1966 to September 1968 (fragmentary prior to April 1947).

Gage.--Staff gage read once daily. Altitude of gage is 1,080 ft (from topographic map).

Average discharge.--9 years (1947-54, 1967-68), 22.6 cfs.

Extremes.--Maximum discharge during year, 430 cfs June 11 (gage height, 8.40 ft, from graph based on gage readings); maximum gage height, 8.60 ft Aug. 25 (from graph based on gage readings, backwater from aquatic growth); no flow for many days.
1946-54, 1966-68: Maximum discharge, 1,340 cfs June 11, 1947 (gage height 9.36 ft, from floodmark); no flow at times in most years.

Remarks.--Records fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | 34 | 20 | 32 | 80 | 31 | 126 |
| 2 | | | | | | | 30 | 22 | 37 | 65 | 31 | 118 |
| 3 | | | | | | | 26 | 20 | 42 | 55 | 36 | 108 |
| 4 | | | | | | | 22 | 19 | 36 | 52 | 23 | 106 |
| 5 | | | | | | | 19 | 18 | 36 | 51 | 30 | 59 |
| 6 | | | | | | | 16 | 16 | 47 | 45 | 35 | 33 |
| 7 | | | | | | | 17 | 19 | 154 | 41 | 39 | 38 |
| 8 | | | | | | | 22 | 19 | 400 | 39 | 30 | 43 |
| 9 | | | | | | | 22 | 20 | 378 | 36 | 28 | 51 |
| 10 | | | | | | | 23 | 22 | 367 | 36 | 25 | 45 |
| 11 | | | | | | | 22 | 21 | 415 | 36 | 23 | 33 |
| 12 | | | | | | | 23 | 20 | 394 | 40 | 21 | 27 |
| 13 | | | | | | | 22 | 18 | 302 | 40 | 18 | 28 |
| 14 | | | | | | | 18 | 18 | 260 | 40 | 21 | 24 |
| 15 | | | | | | | 20 | 16 | 212 | 40 | 20 | 25 |
| 16 | | | | | | | 22 | 15 | 178 | 50 | 24 | 27 |
| 17 | | | | | | | 22 | 14 | 138 | 83 | 33 | 28 |
| 18 | | | | | | | 21 | 14 | 87 | 99 | 66 | 38 |
| 19 | | | | | | | 20 | 19 | 67 | 101 | 44 | 39 |
| 20 | | | | | | | 20 | 16 | 57 | 64 | 36 | 33 |
| 21 | | | | | | 0 | 26 | 16 | 61 | 63 | 41 | 31 |
| 22 | | | | | | 1.0 | 27 | 15 | 58 | 54 | 38 | 29 |
| 23 | | | | | | 4.0 | 33 | 13 | 57 | 51 | 54 | 28 |
| 24 | | | | | | 10 | 33 | 12 | 56 | 50 | 106 | 29 |
| 25 | | | | | | 25 | 32 | 12 | 51 | 46 | 237 | 20 |
| 26 | | | | | | 45 | 30 | 12 | 53 | 42 | 243 | 18 |
| 27 | | | | | | 61 | 29 | 11 | 52 | 40 | 191 | 14 |
| 28 | | | | | | 52 | 28 | 14 | 56 | 40 | 186 | 14 |
| 29 | | | | | ------ | 45 | 24 | 15 | 61 | 39 | 167 | 13 |
| 30 | | | | | ------ | 40 | 22 | 20 | 60 | 39 | 140 | 11 |
| 31 | | ------ | | | ------ | 37 | ------ | 31 | ------ | 33 | 124 | ------ |
| Total | 0 | 0 | 0 | 0 | 0 | 320.0 | 725 | 537 | 4,204 | 1,590 | 2,141 | 1,236 |
| Mean | 0 | 0 | 0 | 0 | 0 | 10.3 | 24.2 | 17.3 | 140 | 51.3 | 69.1 | 41.2 |
| Max | 0 | 0 | 0 | 0 | 0 | 61 | 34 | 31 | 415 | 101 | 243 | 126 |
| Min | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 11 | 32 | 33 | 18 | 11 |
| Cfsm | 0 | 0 | 0 | 0 | 0 | 0.101 | 0.237 | 0.170 | 1.37 | 0.503 | 0.677 | 0.404 |
| In. | 0 | 0 | 0 | 0 | 0 | 0.12 | 0.26 | 0.20 | 1.53 | 0.58 | 0.78 | 0.45 |

Cal yr 1967: Total 9,486.5 Mean 26.0 Max 451 Min 0 Cfsm 0.255 In. 3.46
Wtr yr 1968: Total 10,753 Mean 29.4 Max 415 Min 0 Cfsm 0.288 In. 3.92

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

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

Drainage area.--1,442 sq mi.

Records available.--April 1884 to September 1968. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to September 1956.

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

Extremes.--Maximum contents during year, 622,800 acre-ft July 1 (gage height, 10.82 ft); minimum, 437,800 acre-ft Mar. 1, 3, 4, 7, 8, 17 (gage height, 8.06 ft).
1884-1968: Maximum contents observed, 996,500 acre-ft July 30, 1905 (gage height, 14.45 ft); minimum observed, 33,680 acre-ft below zero of capacity table Oct. 20, 1931 (gage height, -0.69 ft).

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

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

Month-end gage height and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 8.79 | 485,800 | - |
| Oct. 31 | 8.35 | 456,800 | -29,000 |
| Nov. 30 | 8.24 | 449,500 | - 7,300 |
| Dec. 31 | 8.26 | 450,800 | + 1,300 |
| Calendar year 1967 | - | - | -35,200 |
| Jan. 31 | 8.20 | 446,900 | - 3,900 |
| Feb. 29 | 8.07 | 438,300 | - 8,600 |
| Mar. 31 | 8.31 | 454,200 | +15,900 |
| Apr. 30 | 8.85 | 489,500 | +35,300 |
| May 31 | 9.80 | 551,800 | +62,300 |
| June 30 | 10.60 | 607,500 | +55,700 |
| July 31 | 10.19 | 578,800 | -28,700 |
| Aug. 31 | 9.87 | 556,600 | -22,200 |
| Sept. 30 | 9.90 | 558,500 | + 1,900 |
| Water year 1967-68 | - | - | +72,700 |

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 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder on headwater and staff gage on tailwater. Tailwater gage 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.--84 years, 504 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,010 cfs July 4, 12, 25-27; minimum daily, 100 cfs Mar. 27 to Apr. 22.
1884-1968: Maximum daily discharge, 4,370 cfs Aug. 6, 1905; no flow at times in several years.

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

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 369 | 491 | 490 | 490 | 525 | 412 | 100 | 103 | 106 | 905 | 803 | 306 |
| 2 | 443 | 491 | 490 | 490 | 525 | 415 | 100 | 103 | 106 | 900 | 802 | 306 |
| 3 | 455 | 496 | 490 | 489 | 540 | 415 | 100 | 104 | 106 | 900 | 605 | 306 |
| 4 | 455 | 496 | 490 | 489 | 540 | 415 | 100 | 104 | 106 | 1,010 | 532 | 306 |
| 5 | 460 | 496 | 490 | 489 | 540 | 415 | 100 | 104 | 107 | 1,000 | 526 | 306 |
| 6 | 478 | 491 | 490 | 480 | 540 | 415 | 100 | 103 | 107 | 1,000 | 502 | 306 |
| 7 | 497 | 491 | 495 | 480 | 540 | 415 | 100 | 103 | 107 | 1,000 | 502 | 306 |
| 8 | 506 | 491 | 490 | 480 | 535 | 415 | 100 | 104 | 107 | 1,000 | 507 | 306 |
| 9 | 506 | 496 | 490 | 480 | 535 | 417 | 100 | 104 | 107 | 1,000 | 511 | 306 |
| 10 | 505 | 491 | 491 | 480 | 525 | 417 | 100 | 104 | 107 | 995 | 511 | 306 |
| 11 | 505 | 491 | 491 | 480 | 525 | 417 | 100 | 104 | 107 | 990 | 511 | 306 |
| 12 | 493 | 496 | 495 | 480 | 525 | 417 | 100 | 104 | 107 | 1,010 | 512 | 306 |
| 13 | 505 | 496 | 495 | 480 | 525 | 417 | 100 | 104 | 107 | 1,000 | 516 | 306 |
| 14 | 505 | 496 | 495 | 480 | 520 | 415 | 100 | 104 | 108 | 1,000 | 300 | 306 |
| 15 | 493 | 491 | 491 | 480 | 520 | 415 | 100 | 105 | 108 | 1,000 | 300 | 303 |
| 16 | 493 | 491 | 491 | 489 | 525 | 310 | 100 | 105 | 108 | 1,000 | 300 | 303 |
| 17 | 497 | 496 | 495 | 530 | 525 | 315 | 100 | 105 | 166 | 1,000 | 300 | 303 |
| 18 | 505 | 496 | 495 | 525 | 520 | 315 | 100 | 105 | 382 | 1,000 | 300 | 306 |
| 19 | 492 | 496 | 495 | 525 | 520 | 315 | 100 | 105 | 565 | 1,000 | 300 | 306 |
| 20 | 506 | 491 | 495 | 525 | 515 | 310 | 100 | 105 | 675 | 996 | 300 | 306 |
| 21 | 495 | 491 | 496 | 535 | 510 | 310 | 100 | 105 | 713 | 996 | 300 | 306 |
| 22 | 493 | 496 | 496 | 535 | 510 | 192 | 100 | 105 | 707 | 1,000 | 300 | 306 |
| 23 | 496 | 491 | 495 | 535 | 510 | 102 | 102 | 105 | 707 | 986 | 300 | 306 |
| 24 | 497 | 496 | 496 | 535 | 510 | 104 | 102 | 105 | 701 | 986 | 303 | 306 |
| 25 | 497 | 491 | 496 | 535 | 515 | 104 | 102 | 106 | 701 | 1,010 | 306 | 300 |
| 26 | 492 | 496 | 495 | 525 | 515 | 104 | 102 | 106 | 850 | 1,010 | 306 | 300 |
| 27 | 496 | 492 | 494 | 525 | 515 | 100 | 102 | 106 | 915 | 1,010 | 306 | 300 |
| 28 | 491 | 491 | 495 | 525 | 400 | 100 | 103 | 106 | 910 | 1,000 | 306 | 300 |
| 29 | 491 | 491 | 491 | 525 | 415 | 100 | 103 | 106 | 910 | 1,000 | 306 | 300 |
| 30 | 491 | 490 | 490 | 525 | ------ | 100 | 103 | 106 | 905 | 990 | 306 | 300 |
| 31 | 492 | ------ | 490 | 525 | ------ | 100 | ------ | 106 | ------ | 935 | 306 | ------ |
| Total | 15,099 | 14,795 | 15,278 | 15,666 | 14,965 | 9,213 | 3,019 | 3,244 | 11,518 | 30,629 | 12,785 | 9,135 |
| Mean | 487 | 493 | 493 | 505 | 516 | 297 | 101 | 105 | 384 | 988 | 412 | 304 |
| Max | 506 | 496 | 496 | 535 | 540 | 417 | 103 | 106 | 915 | 1,010 | 803 | 306 |
| Min | 369 | 490 | 490 | 480 | 400 | 100 | 100 | 103 | 106 | 900 | 300 | 300 |
| Cfsm | 0.338 | 0.342 | 0.342 | 0.350 | 0.358 | 0.206 | 0.070 | 0.073 | 0.266 | 0.685 | 0.286 | 0.211 |
| In. | 0.39 | 0.38 | 0.39 | 0.40 | 0.39 | 0.24 | 0.08 | 0.08 | 0.30 | 0.79 | 0.33 | 0.24 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 221,203 | Mean | 606 | Max | 935 | Min | 100 | Cfsm | 0.420 | In. | 5.70 |
| Wtr yr 1968: | Total | 155,346 | Mean | 424 | Max | 1,010 | Min | 100 | Cfsm | 0.294 | In. | 4.01 |

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 1968. Month-end contents only for some periods, published in WSP 1308. Prior to October 1956, published as "Leech Lake Reservoir".

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

Extremes.--Maximum contents during year, 305,200 acre-ft July 1 (gage height, 2.17 ft); minimum, 124,500 acre-ft Feb. 29 (gage height, 0.66 ft).
1884-1968: Maximum contents observed, 734,300 acre-ft June 30, 1916 (gage height, 5.18 ft); minimum observed, 72,830 acre-ft below zero of capacity table Sept. 30, Nov. 19, 1934, Jan. 9, 1935 (gage height, -1.18 ft).

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

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

Month-end gage height and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 1.08 | 170,200 | |
| Oct. 31 | .89 | 149,600 | -20,600 |
| Nov. 30 | .72 | 131,000 | -18,600 |
| Dec. 31 | .73 | 132,100 | + 1,100 |
| Calendar year 1967 | - | - | -41,500 |
| Jan. 31 | .75 | 134,300 | + 2,200 |
| Feb. 29 | .66 | 124,500 | - 9,800 |
| Mar. 31 | .87 | 147,400 | +22,900 |
| Apr. 30 | 1.41 | 209,100 | +61,700 |
| May 31 | 1.62 | 235,700 | +26,600 |
| June 30 | 2.05 | 290,000 | +54,300 |
| July 31 | 1.61 | 234,400 | -55,600 |
| Aug. 31 | 1.44 | 212,900 | -21,500 |
| Sept. 30 | 1.55 | 230,600 | +17,700 |
| Water year 1967-68 | - | - | +60,400 |

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 1968. Monthly discharge only for some periods, published in WSP 1308.

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

Average discharge.--84 years, 345 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 943 cfs July 1; minimum daily, 77 cfs Sept. 9.
1884-1968: Maximum daily discharge, 2,520 cfs June 7, 1957 (result of dam failure); no flow at times.

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

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 275 | 299 | 281 | 284 | 344 | 226 | 112 | 120 | 127 | 943 | 453 | 91 |
| 2 | 277 | 289 | 286 | 286 | 344 | 224 | 109 | 125 | 124 | 800 | 313 | 86 |
| 3 | 295 | 292 | 286 | 286 | 341 | 224 | 110 | 128 | 119 | 773 | 211 | 83 |
| 4 | 302 | 292 | 284 | 288 | 342 | 224 | 123 | 104 | 121 | 859 | 209 | 91 |
| 5 | 302 | 289 | 284 | 286 | 341 | 225 | 122 | 101 | 97 | 857 | 188 | 92 |
| 6 | 286 | 282 | 284 | 286 | 350 | 224 | 121 | 98 | 104 | 893 | 105 | 92 |
| 7 | 273 | 284 | 284 | 284 | 342 | 223 | 122 | 95 | 106 | 887 | 104 | 84 |
| 8 | 295 | 295 | 284 | 283 | 342 | 225 | 120 | 101 | 104 | 877 | 102 | 81 |
| 9 | 302 | 282 | 283 | 286 | 341 | 231 | 115 | 113 | 107 | 852 | 101 | 77 |
| 10 | 297 | 276 | 283 | 284 | 335 | 231 | 112 | 110 | 111 | 875 | 105 | 83 |
| 11 | 302 | 282 | 281 | 281 | 335 | 231 | 113 | 106 | 125 | 809 | 104 | 100 |
| 12 | 297 | 289 | 294 | 286 | 335 | 228 | 118 | 110 | 125 | 673 | 105 | 100 |
| 13 | 318 | 284 | 294 | 290 | 333 | 228 | 115 | 111 | 104 | 662 | 105 | 99 |
| 14 | 302 | 286 | 286 | 290 | 333 | 223 | 121 | 109 | 105 | 682 | 94 | 97 |
| 15 | 297 | 276 | 284 | 292 | 335 | 223 | 116 | 119 | 111 | 691 | 86 | 97 |
| 16 | 295 | 284 | 284 | 292 | 341 | 226 | 100 | 127 | 107 | 679 | 98 | 95 |
| 17 | 304 | 286 | 281 | 306 | 321 | 222 | 102 | 130 | 165 | 679 | 88 | 107 |
| 18 | 302 | 303 | 290 | 344 | 327 | 224 | 100 | 110 | 402 | 682 | 80 | 108 |
| 19 | 290 | 274 | 292 | 344 | 323 | 236 | 98 | 114 | 544 | 673 | 98 | 111 |
| 20 | 329 | 278 | 290 | 344 | 325 | 246 | 95 | 115 | 607 | 668 | 99 | 114 |
| 21 | 290 | 276 | 302 | 344 | 323 | 242 | 113 | 114 | 692 | 691 | 86 | 109 |
| 22 | 279 | 269 | 288 | 348 | 321 | 242 | 106 | 115 | 703 | 668 | 88 | 115 |
| 23 | 280 | 269 | 290 | 342 | 321 | 103 | 108 | 107 | 692 | 640 | 92 | 127 |
| 24 | 313 | 269 | 290 | 339 | 321 | 103 | 126 | 103 | 688 | 661 | 101 | 124 |
| 25 | 318 | 269 | 296 | 341 | 323 | 104 | 119 | 109 | 653 | 444 | 101 | 123 |
| 26 | 305 | 270 | 292 | 344 | 327 | 105 | 120 | 109 | 772 | 441 | 90 | 109 |
| 27 | 292 | 267 | 290 | 342 | 331 | 106 | 120 | 110 | 823 | 441 | 88 | 106 |
| 28 | 292 | 286 | 288 | 342 | 295 | 109 | 121 | 115 | 791 | 441 | 88 | 101 |
| 29 | 292 | 284 | 290 | 346 | 200 | 114 | 123 | 114 | 801 | 422 | 90 | 106 |
| 30 | 297 | 281 | 292 | 341 | ------ | 109 | 120 | 116 | 754 | 472 | 86 | 112 |
| 31 | 299 | ------ | 284 | 341 | ------ | 120 | ------ | 117 | ------ | 463 | 92 | ------ |
| Total | 9,197 | 8,462 | 8,917 | 9,692 | 9,492 | 6,001 | 3,420 | 3,475 | 10,884 | 21,298 | 3,850 | 3,020 |
| Mean | 297 | 282 | 288 | 313 | 327 | 194 | 114 | 112 | 363 | 687 | 124 | 101 |
| Max | 329 | 303 | 302 | 348 | 350 | 246 | 126 | 130 | 823 | 943 | 453 | 127 |
| Min | 273 | 267 | 281 | 281 | 200 | 103 | 95 | 95 | 97 | 422 | 80 | 77 |
| Cfsm | 0.255 | 0.242 | 0.248 | 0.269 | 0.281 | 0.167 | 0.098 | 0.096 | 0.312 | 0.591 | 0.107 | 0.087 |
| In. | 0.29 | 0.27 | 0.29 | 0.31 | 0.30 | 0.19 | 0.11 | 0.11 | 0.35 | 0.68 | 0.12 | 0.10 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 129,501 | Mean | 355 | Max | 863 | Min | 76 | Cfsm | 0.305 | In. | 4.14 |
| Wtr yr 1968: | Total | 97,708 | Mean | 267 | Max | 943 | Min | 77 | Cfsm | 0.230 | In. | 3.12 |

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 U.S. Highway 169, 4 miles south of Grand Rapids.

Drainage area.--3,265 sq mi.

Records available.--April 1884 to September 1968. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Pokegama Reservoir near Grand Rapids October 1941 to September 1956.

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

Extremes.--Maximum contents during year, 61,490 acre-ft June 11 (gage height, 9.30 ft); minimum, 27,570 acre-ft Mar. 14 (gage height, 6.74 ft).
1884-1968: Maximum contents, 121,400 acre-ft May 8, 1897 (gage height, 13.50 ft); minimum observed, 4,520 acre-ft below zero of capacity table Sept. 30, 1934 (gage height, 4.12 ft).

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

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

Month-end gage height and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 8.56 | 51,170 | |
| Oct. 31 | 7.78 | 40,860 | -10,310 |
| Nov. 30 | 7.00 | 30,940 | - 9,920 |
| Dec. 31 | 6.95 | 30,350 | - 590 |
| Calendar year 1967 | - | - | -17,850 |
| Jan. 31 | 6.86 | 29,160 | - 1,190 |
| Feb. 28 | 6.78 | 28,170 | - 990 |
| Mar. 31 | 8.19 | 46,410 | +18,240 |
| Apr. 30 | 8.85 | 55,140 | + 8,730 |
| May 31 | 9.06 | 57,920 | + 2,780 |
| June 30 | 8.80 | 54,350 | - 3,570 |
| July 31 | 9.04 | 57,720 | + 3,370 |
| Aug. 31 | 8.87 | 55,340 | - 2,380 |
| Sept. 30 | 8.94 | 56,330 | + 990 |
| Water year 1967-68 | - | - | + 5,160 |

## 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.25 W., in super-calendar room of Blandin Paper Mill in Grand Rapids, 400 ft upstream from bridge on U. S. Highway 169, 2.5 miles upstream from Prairie River, and at mile 1,182 above Onio River.

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

Records available.--October 1883 to September 1968. Monthly discharge only for some periods, published in WSP 1308. Published as "at Pokegama Dam near Grand Rapids" 1942-44.

Gage.--Digital 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. Jan. 17, 1951, to July 11, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--85 years, 1,127 cfs.

Extremes.--Maximum discharge during year, 1,880 cfs July 8 (gage height, 6.68 ft); maximum gage height, 6.75 ft June 25 (backwater from Prairie River); minimum discharge, 212 cfs May 18 (gage height, 2.61 ft), result of regulation.

1883-1968: Maximum discharge, 12,500 cfs Sept. 3, 1948 (gage height, 15.2 ft, from floodmark), caused by dam failure at gage, from rating curve extended above 4,500 cfs by logarithmic plotting; maximum daily, 5,250 cfs Sept. 5, 8, 1905; no flow at times in several years.

Remarks.--Records fair. Flow completely regulated by Pokegama Lake (see preceding page). Backwater from Prairie River occurs at times in most years. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

Cooperation.--Records furnished by Corps of Engineers, 1883-1944, 1959-64.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 754 | 1,020 | 820 | 750 | 886 | 834 | 312 | 643 | 630 | 1,810 | 1,440 | 772 |
| 2 | 721 | 998 | 814 | 754 | 886 | 822 | 305 | 584 | 734 | 1,690 | 1,500 | 606 |
| 3 | 764 | 991 | 827 | 750 | 856 | 810 | 306 | 443 | 598 | 1,760 | 1,470 | 761 |
| 4 | 735 | 964 | 827 | 750 | 854 | 787 | 360 | 499 | 510 | 1,810 | 1,410 | 702 |
| 5 | 733 | 968 | 850 | 746 | 878 | 768 | 348 | 501 | 538 | 1,760 | 1,470 | 677 |
| 6 | 700 | 957 | 836 | 742 | 877 | 764 | 299 | 504 | 552 | 1,710 | 1,460 | 687 |
| 7 | 728 | 934 | 836 | 742 | 883 | 759 | 306 | 483 | 556 | 1,820 | 1,440 | 579 |
| 8 | 734 | 953 | 818 | 742 | 871 | 727 | 508 | 516 | 573 | 1,830 | 1,400 | 554 |
| 9 | 748 | 937 | 805 | 742 | 856 | 745 | 758 | 512 | 587 | 1,800 | 1,340 | 822 |
| 10 | 756 | 1,050 | 814 | 738 | 889 | 731 | 676 | 512 | 800 | 1,790 | 1,300 | 698 |
| 11 | 915 | 1,010 | 814 | 738 | 879 | 715 | 692 | 535 | 1,260 | 1,780 | 1,220 | 578 |
| 12 | 1,070 | 1,030 | 823 | 742 | 843 | 706 | 605 | 527 | 1,460 | 1,780 | 938 | 554 |
| 13 | 1,090 | 970 | 809 | 746 | 873 | 699 | 527 | 508 | 1,570 | 1,750 | 962 | 592 |
| 14 | 1,040 | 973 | 796 | 750 | 859 | 652 | 532 | 565 | 1,590 | 1,780 | 906 | 663 |
| 15 | 992 | 936 | 809 | 730 | 854 | 568 | 731 | 536 | 1,490 | 1,810 | 906 | 592 |
| 16 | 1,000 | 938 | 762 | 754 | 864 | 622 | 844 | 542 | 1,090 | 1,790 | 986 | 582 |
| 17 | 1,040 | 944 | 792 | 742 | 896 | 566 | 812 | 534 | 718 | 1,810 | 858 | 858 |
| 18 | 1,050 | 951 | 832 | 775 | 871 | 624 | 811 | 567 | 734 | 1,830 | 846 | 603 |
| 19 | 1,100 | 951 | 779 | 827 | 848 | 571 | 785 | 538 | 854 | 1,790 | 822 | 593 |
| 20 | 1,080 | 907 | 796 | 836 | 861 | 359 | 700 | 526 | 750 | 1,780 | 649 | 709 |
| 21 | 1,060 | 905 | 809 | 832 | 841 | 393 | 758 | 570 | 955 | 1,760 | 677 | 624 |
| 22 | 1,060 | 903 | 792 | 827 | 843 | 400 | 678 | 539 | 1,080 | 1,730 | 694 | 702 |
| 23 | 1,040 | 907 | 800 | 832 | 857 | 403 | 896 | 553 | 1,400 | 1,720 | 691 | 764 |
| 24 | 1,030 | 859 | 775 | 850 | 841 | 405 | 1,280 | 587 | 1,570 | 1,700 | 694 | 795 |
| 25 | 996 | 829 | 814 | 845 | 847 | 387 | 1,510 | 697 | 1,780 | 1,690 | 720 | 670 |
| 26 | 975 | 852 | 800 | 850 | 843 | 280 | 1,250 | 683 | 1,740 | 1,720 | 691 | 822 |
| 27 | 999 | 859 | 771 | 850 | 847 | 310 | 871 | 742 | 1,710 | 1,710 | 680 | 1,040 |
| 28 | 1,110 | 793 | 766 | 854 | 847 | 302 | 807 | 644 | 1,680 | 1,670 | 735 | 998 |
| 29 | 1,050 | 785 | 758 | 854 | 852 | 297 | 708 | 754 | 1,630 | 1,630 | 673 | 926 |
| 30 | 1,040 | 795 | 758 | 872 | ------ | 278 | 591 | 623 | 1,700 | 1,500 | 572 | 958 |
| 31 | 1,040 | ------ | 754 | 863 | ------ | 300 | ------ | 707 | ------ | 1,420 | 738 | ------ |
| TOTAL | 29,150 | 27,869 | 24,856 | 24,425 | 25,002 | 17,584 | 20,566 | 17,674 | 32,839 | 53,930 | 30,888 | 21,481 |
| MEAN | 940 | 929 | 802 | 788 | 862 | 567 | 686 | 570 | 1,095 | 1,740 | 996 | 716 |
| MAX | 1,110 | 1,050 | 850 | 872 | 896 | 834 | 1,510 | 754 | 1,780 | 1,830 | 1,500 | 1,040 |
| MIN | 700 | 785 | 754 | 730 | 841 | 278 | 299 | 443 | 510 | 1,420 | 572 | 554 |

CAL YR 1967 TOTAL 488,966 MEAN 1,340 MAX 2,950 MIN 700
WTR YR 1968 TOTAL 326,264 MEAN 891 MAX 1,830 MIN 278

## 5-2127. Prairie River near Taconite, Minn.

Location.--Lat 47°23'20", long 93°22'50", in NW¼SW¼ sec.27, T.57 N., R.24 W., on left bank 125 ft upstream from highway bridge, 1½ miles downstream from outlet of Lawrence Lake and 5 miles north of Taconite.

Records available.--April 1967 to September 1968.

Gage.--Graphic water-stage recorder. Prior to Aug. 31, 1967, staff gage at site 125 ft downstream at same datum.

Extremes.--Maximum discharge during year, 836 cfs June 16 (gage height, 7.10 ft); minimum, 26 cfs Oct. 6, 7, 22; minimum gage height, 1.91 ft Oct. 22.
1967-68: Maximum discharge observed, 1,020 cfs Apr. 22, 23, 1967; maximum gage height observed, 7.96 ft Apr. 23, 1967; minimum discharge, 25 cfs Sept. 12, 13, 1967; minimum gage height, that of Oct. 22, 1967.

Remarks.--Records good except those for winter months, which are fair.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 27 | 36 | 41 | 41 | 37 | 48 | 185 | 588 | 269 | 368 | 114 | 299 |
| 2 | 28 | 38 | 38 | 40 | 37 | 48 | 190 | 586 | 280 | 379 | 109 | 282 |
| 3 | 30 | 38 | 36 | 40 | 38 | 48 | 193 | 578 | 276 | 387 | 102 | 263 |
| 4 | 30 | 38 | 34 | 39 | 38 | 49 | 202 | 566 | 272 | 404 | 95 | 248 |
| 5 | 30 | 37 | 33 | 38 | 38 | 52 | 195 | 542 | 275 | 411 | 89 | 227 |
| 6 | 26 | 36 | 33 | 38 | 38 | 56 | 190 | 512 | 320 | 416 | 89 | 220 |
| 7 | 28 | 34 | 33 | 37 | 38 | 58 | 200 | 482 | 376 | 414 | 84 | 210 |
| 8 | 33 | 32 | 33 | 36 | 37 | 59 | 257 | 458 | 460 | 408 | 83 | 206 |
| 9 | 34 | 31 | 34 | 35 | 37 | 60 | 275 | 441 | 518 | 387 | 78 | 199 |
| 10 | 33 | 31 | 35 | 34 | 36 | 60 | 296 | 411 | 576 | 355 | 76 | 190 |
| 11 | 32 | 32 | 36 | 33 | 36 | 58 | 320 | 389 | 644 | 329 | 70 | 187 |
| 12 | 29 | 33 | 37 | 33 | 35 | 57 | 358 | 371 | 682 | 299 | 67 | 182 |
| 13 | 29 | 35 | 39 | 33 | 35 | 57 | 385 | 350 | 704 | 274 | 72 | 176 |
| 14 | 32 | 35 | 42 | 32 | 35 | 58 | 423 | 352 | 777 | 260 | 68 | 170 |
| 15 | 32 | 35 | 46 | 32 | 34 | 60 | 438 | 366 | 819 | 244 | 66 | 159 |
| 16 | 30 | 34 | 50 | 32 | 34 | 63 | 475 | 366 | 832 | 239 | 68 | 155 |
| 17 | 31 | 35 | 51 | 32 | 33 | 66 | 494 | 353 | 830 | 225 | 66 | 182 |
| 18 | 33 | 37 | 52 | 32 | 33 | 75 | 498 | 352 | 826 | 218 | 63 | 211 |
| 19 | 31 | 39 | 52 | 32 | 33 | 80 | 498 | 347 | 809 | 216 | 66 | 228 |
| 20 | 32 | 41 | 51 | 32 | 33 | 84 | 510 | 335 | 781 | 210 | 66 | 248 |
| 21 | 31 | 43 | 56 | 32 | 34 | 90 | 526 | 320 | 752 | 202 | 74 | 274 |
| 22 | 29 | 44 | 49 | 32 | 35 | 96 | 530 | 304 | 708 | 193 | 81 | 310 |
| 23 | 32 | 44 | 48 | 32 | 36 | 103 | 562 | 288 | 678 | 184 | 94 | 348 |
| 24 | 34 | 46 | 47 | 33 | 37 | 109 | 590 | 272 | 630 | 173 | 110 | 368 |
| 25 | 36 | 46 | 46 | 33 | 39 | 115 | 596 | 252 | 574 | 159 | 133 | 387 |
| 26 | 33 | 46 | 46 | 33 | 41 | 123 | 600 | 241 | 520 | 156 | 167 | 401 |
| 27 | 33 | 46 | 45 | 34 | 43 | 132 | 594 | 239 | 467 | 147 | 210 | 411 |
| 28 | 30 | 45 | 45 | 34 | 45 | 145 | 586 | 237 | 416 | 139 | 248 | 414 |
| 29 | 35 | 45 | 44 | 35 | 47 | 156 | 586 | 232 | 379 | 132 | 276 | 408 |
| 30 | 35 | 43 | 43 | 36 | ------ | 167 | 588 | 230 | 355 | 127 | 290 | 396 |
| 31 | 34 | ------ | 42 | 36 | ------ | 180 | ------ | 234 | ------ | 125 | 300 | ------ |
| Total | 972 | 1,157 | 1,311 | 1,071 | 1,072 | 2,612 | 12,340 | 11,594 | 16,805 | 8,180 | 3,574 | 7,958 |
| Mean | 31.4 | 38.6 | 42.3 | 34.5 | 37.0 | 84.3 | 411 | 374 | 560 | 264 | 115 | 265 |
| Max | 36 | 46 | 52 | 41 | 47 | 180 | 600 | 588 | 832 | 416 | 300 | 414 |
| Min | 26 | 31 | 33 | 32 | 33 | 48 | 185 | 230 | 269 | 125 | 63 | 155 |

Cal yr 1968: Total 68,646 Mean 188 Max 832 Min 26

## 5-2168. O'Brien Creek near Pengilly, Minn.

Location.--Lat 47°18'56", long 93°09'26", in SE¼ sec.20, T.56 N., R.22 W., on right bank 200 ft upstream from Duluth, Missabe and Iron Range Railroad bridge, 1.0 mile upstream from mouth and 2 miles southeast of Pengilly.

Records available.--April 1963 to September 1968 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 1,337.92 ft (revised) above mean sea level, datum of 1929 (Levels by Hanna Mining Co.). Prior to July 24, 1963, reference point at same site and datum.

Average discharge.--5 years, 20.4 cfs.

Extremes.--Maximum discharge during year, 184 cfs June 8 (gage height, 3.71 ft); minimum, 1.2 cfs Oct. 1, 2, 4, 5, 6, 7.
1963-68: Maximum discharge, 265 cfs Apr. 19, 1965 (gage height, 4.29 ft); minimum, 0.9 cfs Sept. 27, 1966.

Remarks.--Records good. Flow affected by natural storage in lakes above station.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.2 | 5.9 | 6.1 | 1,6 | 2.4 | 1.6 | 17 | 27 | 19 | 53 | 3.1 | 2.6 |
| 2 | 1.2 | 6.1 | 6.1 | 1.6 | 2.4 | 1.6 | 14 | 22 | 24 | 50 | 2.8 | 2.5 |
| 3 | 1.4 | 6.1 | 5.0 | 1.6 | 2.4 | 1.5 | 11 | 19 | 25 | 33 | 2.8 | 2.4 |
| 4 | 1.4 | 6.1 | 4.2 | 1.6 | 2.3 | 1.5 | 8.2 | 18 | 20 | 23 | 2.7 | 2.5 |
| 5 | 1.2 | 6.1 | 3.4 | 1.6 | 2.3 | 1.6 | 6.5 | 19 | 16 | 16 | 2.7 | 2.5 |
| 6 | 1.2 | 5.6 | 3.1 | 1.6 | 2.3 | 1.6 | 11 | 18 | 39 | 11 | 2.8 | 3.0 |
| 7 | 1.5 | 5.2 | 2.8 | 1.6 | 2.2 | 1.6 | 25 | 17 | 118 | 9.3 | 2.7 | 4.0 |
| 8 | 2.1 | 5.2 | 2.7 | 1.6 | 2.2 | 1.9 | 51 | 19 | 178 | 8.0 | 2.8 | 5.0 |
| 9 | 4.8 | 5.6 | 2.7 | 1.6 | 2.3 | 2.6 | 75 | 20 | 127 | 7.2 | 3.0 | 5.2 |
| 10 | 5.0 | 6.1 | 2.7 | 1.6 | 2.6 | 3.5 | 62 | 20 | 71 | 6.1 | 2.7 | 4.0 |
| 11 | 4.6 | 6.4 | 2.5 | 1.6 | 3.3 | 5.0 | 50 | 18 | 55 | 5.2 | 2.5 | 3.4 |
| 12 | 4.0 | 6.4 | 2.5 | 1.6 | 2.6 | 7.5 | 38 | 16 | 46 | 5.2 | 2.3 | 3.1 |
| 13 | 3.6 | 6.1 | 2.5 | 1.7 | 2.3 | 5.0 | 28 | 14 | 36 | 5.4 | 2.1 | 2.1 |
| 14 | 4.0 | 6.1 | 2.4 | 1.7 | 2.2 | 3.8 | 23 | 15 | 75 | 5.9 | 2.1 | 1.5 |
| 15 | 4.6 | 5.9 | 2.2 | 1.7 | 2.1 | 2.8 | 18 | 16 | 119 | 6.4 | 2.4 | 1.7 |
| 16 | 4.8 | 5.9 | 2.2 | 1.8 | 2.0 | 4.5 | 35 | 19 | 86 | 7.8 | 3.8 | 1.7 |
| 17 | 4.8 | 5.9 | 2.3 | 1.8 | 2.0 | 7.0 | 52 | 18 | 46 | 8.3 | 4.6 | 1.9 |
| 18 | 5.0 | 6.4 | 2.4 | 1.8 | 2.0 | 10 | 45 | 19 | 31 | 8.0 | 3.8 | 5.9 |
| 19 | 5.0 | 6.7 | 2.1 | 1.9 | 2.0 | 14 | 33 | 20 | 23 | 7.2 | 3.6 | 13 |
| 20 | 5.0 | 6.1 | 2.1 | 2.1 | 2.0 | 19 | 26 | 19 | 17 | 5.9 | 3.8 | 17 |
| 21 | 5.2 | 5.9 | 2.1 | 2.1 | 1.9 | 20 | 31 | 16 | 13 | 5.2 | 3.6 | 14 |
| 22 | 5.0 | 6.4 | 2.1 | 2.1 | 1.7 | 16 | 31 | 14 | 12 | 4.4 | 3.3 | 13 |
| 23 | 5.2 | 8.0 | 2.0 | 2.3 | 1.6 | 12 | 35 | 12 | 18 | 3.6 | 5.9 | 17 |
| 24 | 5.0 | 8.6 | 1.9 | 2.3 | 1.6 | 9.5 | 42 | 10 | 22 | 3.3 | 18 | 21 |
| 25 | 4.8 | 8.0 | 1.9 | 2.4 | 1.6 | 9.0 | 42 | 8.3 | 17 | 2.8 | 19 | 19 |
| 26 | 4.6 | 7.8 | 1.8 | 2.3 | 1.6 | 10 | 52 | 7.8 | 13 | 3.3 | 15 | 15 |
| 27 | 4.6 | 7.0 | 1.8 | 2.3 | 1.6 | 15 | 57 | 10 | 10 | 3.4 | 11 | 11 |
| 28 | 4.8 | 6.4 | 1.7 | 2.5 | 1.6 | 20 | 54 | 14 | 8.6 | 3.3 | 7.8 | 7.5 |
| 29 | 5.2 | 5.9 | 1.7 | 2.4 | 1.6 | 23 | 44 | 15 | 7.8 | 3.3 | 5.6 | 5.4 |
| 30 | 5.6 | 6.1 | 1.7 | 2.5 | ------ | 25 | 35 | 15 | 12 | 3.4 | 3.8 | 4.4 |
| 31 | 5.6 | ------ | 1.6 | 2.5 | ------ | 21 | ------ | 14 | ------ | 3.3 | 3.0 | ------ |
| Total | 122.0 | 190.0 | 82.3 | 59.4 | 60.7 | 278.1 | 1,051.7 | 509.1 | 1,304.4 | 321.2 | 155.1 | 212.3 |
| Mean | 3.94 | 6.33 | 2.65 | 1.92 | 2.09 | 8.97 | 35.1 | 16.4 | 43.5 | 10.4 | 5.00 | 7.07 |
| Max | 5.6 | 8.6 | 6.1 | 2.5 | 3.3 | 25 | 75 | 27 | 178 | 53 | 19 | 21 |
| Min | 1.2 | 5.2 | 1.6 | 1.6 | 1.6 | 1.5 | 6.5 | 7.8 | 7.8 | 2.8 | 2.1 | 1.5 |

Cal yr 1967: Total 3,728.8 Mean 10.2 Max 241 Min 1.0
Wtr yr 1968: Total 4,346.3 Mean 11.9 Max 178 Min 1.2

5-2168.6 Swan River near Calumet, Minn.

Location.--Lat 47°17'20", long 93°13'54", in SW¼ sec.35, T.56 N., R.23 W., on left bank 1.0 mile downstream from Snowball Creek, 2.1 miles downstream from bridge on U. S. Highway 65 at outlet of Swan Lake and 3.1 miles southeast of Calumet.

Records available.--January 1964 to September 1968.

Gage.--Water-stage recorder. Datum of gage is 1,331.19 ft above mean sea level, datum of 1929. Prior to June 5, 1964, reference point at same site and datum.

Extremes.--Maximum discharge during year, 193 cfs June 17 (gage height, 5.07 ft); minimum daily, 4.9 cfs Jan. 4-6; minimum gage height, 3.50 ft Oct. 20.
1964-68: Maximum discharge 540 cfs Apr. 19, 1966 (gage height, 5.01 ft); maximum gage height, 5.11 ft Apr. 3, 1967; minimum discharge, 3.0 cfs Sept. 26, 27, 1966 (result of weir construction).

Remarks.--Records good. Flow affected by natural storage in Swan Lake.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.0 | 8.2 | 5.6 | 5.1 | 6.8 | 7.0 | 56 | 150 | 70 | 100 | 18 | 36 |
| 2 | 5.9 | 8.2 | 5.6 | 5.0 | 6.8 | 6.9 | 58 | 135 | 75 | 118 | 18 | 36 |
| 3 | 6.0 | 7.9 | 5.6 | 5.0 | 6.8 | 6.8 | 61 | 129 | 78 | 123 | 16 | 34 |
| 4 | 5.8 | 7.8 | 5.6 | 4.9 | 6.8 | 6.7 | 73 | 123 | 78 | 129 | 15 | 32 |
| 5 | 5.8 | 7.6 | 5.7 | 4.9 | 6.9 | 6.7 | 73 | 120 | 78 | 123 | 15 | 32 |
| 6 | 5.8 | 7.5 | 5.7 | 4.9 | 6.9 | 6.6 | 75 | 115 | 75 | 115 | 16 | 32 |
| 7 | 6.0 | 7.4 | 5.7 | 5.0 | 6.9 | 6.6 | 78 | 109 | 103 | 112 | 16 | 36 |
| 8 | 6.2 | 7.2 | 5.7 | 5.0 | 6.9 | 6.6 | 81 | 109 | 129 | 103 | 16 | 36 |
| 9 | 6.2 | 7.1 | 5.6 | 5.1 | 6.9 | 6.7 | 89 | 103 | 147 | 100 | 15 | 34 |
| 10 | 6.2 | 7.0 | 5.7 | 5.2 | 7.0 | 6.7 | 106 | 103 | 159 | 92 | 12 | 32 |
| 11 | 6.2 | 7.0 | 5.7 | 5.2 | 7.0 | 6.6 | 118 | 103 | 159 | 81 | 11 | 30 |
| 12 | 6.4 | 6.9 | 5.7 | 5.3 | 7.0 | 6.6 | 123 | 100 | 156 | 78 | 11 | 30 |
| 13 | 6.3 | 6.8 | 5.7 | 5.4 | 7.0 | 6.5 | 126 | 100 | 156 | 73 | 9.9 | 28 |
| 14 | 6.5 | 6.8 | 5.7 | 5.4 | 7.0 | 6.5 | 129 | 100 | 171 | 73 | 9.9 | 28 |
| 15 | 6.6 | 6.7 | 5.7 | 5.5 | 7.0 | 6.4 | 126 | 97 | 181 | 70 | 11 | 25 |
| 16 | 6.7 | 6.7 | 5.7 | 5.6 | 7.0 | 6.4 | 126 | 92 | 190 | 68 | 11 | 27 |
| 17 | 6.6 | 6.6 | 5.8 | 5.6 | 7.0 | 6.4 | 132 | 95 | 190 | 63 | 15 | 36 |
| 18 | 6.8 | 6.6 | 5.9 | 5.7 | 7.0 | 6.6 | 141 | 97 | 184 | 58 | 16 | 45 |
| 19 | 6.9 | 6.6 | 5.9 | 5.8 | 7.0 | 6.9 | 141 | 92 | 174 | 56 | 16 | 49 |
| 20 | 6.6 | 6.5 | 5.9 | 5.8 | 7.0 | 7.1 | 144 | 86 | 165 | 53 | 16 | 51 |
| 21 | 7.0 | 6.4 | 5.8 | 5.9 | 7.0 | 7.5 | 144 | 81 | 150 | 43 | 20 | 51 |
| 22 | 7.2 | 6.3 | 5.8 | 6.0 | 7.0 | 8.0 | 144 | 78 | 141 | 40 | 20 | 58 |
| 23 | 7.4 | 6.2 | 5.7 | 6.0 | 7.0 | 8.4 | 150 | 73 | 144 | 40 | 28 | 65 |
| 24 | 7.2 | 6.1 | 5.6 | 6.2 | 7.0 | 8.7 | 162 | 73 | 135 | 36 | 32 | 63 |
| 25 | 7.2 | 6.0 | 5.5 | 6.3 | 7.1 | 9.3 | 165 | 68 | 126 | 34 | 34 | 65 |
| 26 | 7.5 | 6.0 | 5.4 | 6.4 | 7.1 | 11 | 165 | 65 | 118 | 34 | 36 | 65 |
| 27 | 7.6 | 5.9 | 5.4 | 6.6 | 7.1 | 23 | 165 | 70 | 106 | 30 | 36 | 65 |
| 28 | 7.8 | 5.8 | 5.3 | 6.7 | 7.1 | 32 | 165 | 70 | 95 | 25 | 36 | 63 |
| 29 | 8.0 | 5.7 | 5.2 | 6.8 | 7.1 | 40 | 156 | 70 | 86 | 23 | 34 | 58 |
| 30 | 8.3 | 5.6 | 5.2 | 6.8 | ------ | 47 | 153 | 68 | 92 | 22 | 34 | 56 |
| 31 | 8.4 | ------ | 5.1 | 6.8 | ------ | 53 | ------ | 70 | ------ | 20 | 36 | ------ |
| Total | 209.1 | 203.1 | 174.2 | 175.9 | 202.2 | 381.2 | 3,625 | 2,944 | 3,911 | 2,135 | 629.8 | 1,298 |
| Mean | 6.75 | 6.77 | 5.62 | 5.67 | 6.97 | 12.3 | 121 | 95.0 | 130 | 68.9 | 20.3 | 43.3 |
| Max | 8.4 | 8.2 | 5.9 | 6.8 | 7.1 | 53 | 165 | 150 | 190 | 129 | 36 | 65 |
| Min | 5.8 | 5.6 | 5.1 | 4.9 | 6.8 | 6.4 | 56 | 65 | 70 | 20 | 9.9 | 25 |

Cal yr 1967: Total 11,248 Mean 30.8 Max 184 Min 5.1
Wtr yr 1968: Total 15,888.5 Mean 43.4 Max 190 Min 4.9

## 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, 3¾ miles northwest of Swan River, and 22 miles upstream from mouth.

Drainage area.--254 sq mi.

Records available.--October 1953 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 1,259.80 ft above mean sea level (Minnesota State Highway Department bench mark). Prior to Sept. 10, 1968, graphic water-stage recorder at same site and datum.

Average discharge.--15 years, 128 cfs.

Extremes.--Maximum discharge during year, 429 cfs Apr. 26 (gage height, 6.44 ft); minimum daily, 21 cfs Jan. 2-11; minimum gage height, 2.06 ft Nov. 13.

1953-68: Maximum discharge, 1,080 cfs Apr. 17, 1965 (gage height, 9.49 ft, backwater from ice); maximum gage height, 9.53 ft Apr. 16, 1965 (backwater from ice); minimum discharge, 15 cfs Sept. 4, 5, 1961 (gage height, 1.65 ft).

Flood of May 1950 reached a stage of about 11.5 ft from information by local residents.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 36 | 31 | 26 | 22 | 33 | 27 | 110 | 295 | 202 | 279 | 49 | 68 |
| 2 | 39 | 30 | 25 | 21 | 33 | 28 | 105 | 273 | 226 | 332 | 45 | 68 |
| 3 | 44 | 28 | 25 | 21 | 33 | 29 | 95 | 252 | 204 | 329 | 43 | 65 |
| 4 | 46 | 25 | 25 | 21 | 32 | 30 | 90 | 239 | 183 | 290 | 42 | 61 |
| 5 | 26 | 24 | 25 | 21 | 32 | 31 | 95 | 230 | 166 | 246 | 39 | 59 |
| 6 | 25 | 24 | 25 | 21 | 32 | 32 | 140 | 220 | 167 | 215 | 39 | 60 |
| 7 | 28 | 25 | 26 | 21 | 32 | 34 | 180 | 213 | 189 | 194 | 40 | 64 |
| 8 | 39 | 25 | 26 | 21 | 32 | 37 | 235 | 222 | 201 | 175 | 45 | 66 |
| 9 | 45 | 26 | 26 | 21 | 31 | 43 | 320 | 236 | 222 | 156 | 48 | 68 |
| 10 | 45 | 26 | 25 | 21 | 30 | 49 | 302 | 232 | 247 | 139 | 44 | 66 |
| 11 | 39 | 26 | 24 | 21 | 30 | 53 | 279 | 211 | 284 | 127 | 42 | 62 |
| 12 | 35 | 26 | 24 | 22 | 29 | 56 | 269 | 210 | 310 | 117 | 38 | 58 |
| 13 | 34 | 24 | 23 | 23 | 29 | 54 | 257 | 209 | 312 | 108 | 34 | 56 |
| 14 | 33 | 26 | 23 | 23 | 29 | 48 | 247 | 213 | 317 | 115 | 31 | 54 |
| 15 | 32 | 24 | 23 | 24 | 28 | 46 | 246 | 273 | 329 | 136 | 32 | 53 |
| 16 | 34 | 25 | 23 | 26 | 28 | 48 | 280 | 285 | 332 | 135 | 39 | 53 |
| 17 | 34 | 27 | 24 | 27 | 27 | 60 | 314 | 251 | 324 | 123 | 39 | 69 |
| 18 | 33 | 27 | 24 | 28 | 27 | 80 | 322 | 247 | 311 | 111 | 37 | 112 |
| 19 | 32 | 26 | 25 | 29 | 27 | 105 | 306 | 269 | 299 | 102 | 40 | 155 |
| 20 | 32 | 25 | 26 | 31 | 26 | 110 | 294 | 265 | 287 | 94 | 45 | 165 |
| 21 | 32 | 25 | 27 | 33 | 26 | 100 | 307 | 236 | 284 | 88 | 45 | 154 |
| 22 | 31 | 26 | 27 | 34 | 26 | 90 | 318 | 210 | 269 | 80 | 43 | 153 |
| 23 | 28 | 27 | 26 | 34 | 25 | 72 | 348 | 189 | 294 | 73 | 44 | 183 |
| 24 | 29 | 28 | 26 | 34 | 24 | 60 | 392 | 172 | 322 | 66 | 60 | 199 |
| 25 | 29 | 28 | 25 | 35 | 24 | 54 | 415 | 159 | 304 | 62 | 78 | 196 |
| 26 | 28 | 28 | 25 | 35 | 25 | 56 | 426 | 152 | 263 | 62 | 76 | 182 |
| 27 | 27 | 28 | 24 | 35 | 26 | 60 | 416 | 161 | 223 | 61 | 69 | 167 |
| 28 | 27 | 27 | 23 | 35 | 27 | 90 | 392 | 178 | 193 | 58 | 67 | 156 |
| 29 | 28 | 27 | 22 | 35 | 27 | 105 | 361 | 184 | 172 | 54 | 67 | 149 |
| 30 | 30 | 27 | 22 | 34 | ------ | 115 | 328 | 174 | 175 | 51 | 66 | 143 |
| 31 | 30 | ------ | 22 | 33 | ------ | 110 | ------ | 166 | ------ | 49 | 66 | ------ |
| Total | 1,030 | 791 | 762 | 842 | 830 | 1,912 | 8,189 | 6,826 | 7,611 | 4,227 | 1,492 | 3,164 |
| Mean | 33.2 | 26.4 | 24.6 | 27.2 | 28.6 | 61.7 | 273 | 220 | 254 | 136 | 48.1 | 105 |
| Max | 46 | 31 | 27 | 35 | 33 | 115 | 426 | 295 | 332 | 332 | 78 | 199 |
| Min | 25 | 24 | 22 | 21 | 24 | 27 | 90 | 152 | 166 | 49 | 31 | 53 |
| Cfsm | .131 | .104 | .097 | .107 | .113 | .243 | 1.07 | .866 | 1.00 | .535 | .189 | .413 |
| In. | .15 | .12 | .11 | .12 | .12 | .28 | 1.20 | 1.00 | 1.11 | .62 | .22 | .46 |

Cal yr 1967: Total 35,487 Mean 97.2 Max 730 Min 22 Cfsm .383 In. 5.20
Wtr yr 1968: Total 37,676 Mean 103 Max 426 Min 21 Cfsm .406 In. 5.52

5-2185. Sandy Lake at Libby, Minn.

Location.--Lat 46°47'20, long 93°19'10", in sec.25, T.50 N., R.24 W., on dam on Sandy River at Libby, 1.2 miles above 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 1968. Month-end contents only for some periods, published in WSP 1308. Published as Sandy Lake Reservoir at Libby October 1941 to September 1956.

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

Extremes.--Maximum contents during year, 55,640 acre-ft June 12 (gage height, 9.33 ft); minimum, 33,360 acre-ft Feb. 27 (gage height 6.80 ft).
1895-1968: Maximum contents, 167,200 acre-ft May 19, 1950 (gage height, 17.51 ft); minimum observed, 5,950 acre-ft below zero of capacity table Jan. 20, 1921 (gage height, 0.65 ft).

Remarks.--Reservoir is formed by Sandy, Flowage, Snake, and Aitkin Lakes controlled by concrete dam. Storage began in 1893; original timber crib dam completed in 1895, replaced by present structure in 1911. Capacity between gage heights 7.00 ft and 14.00 ft (minimum allowable limit to top of structure) is 73,330 acre-ft, of which 37,550 acre-ft is controlled storage between gage heights 7.00 ft and 11.00 ft (normal operating range). Contents shown herein are contents above gage height 1.72 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

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

Month-end gage height and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 8.61 | 48,990 | |
| Oct. 31 | 8.40 | 46,990 | - 2,000 |
| Nov. 30 | 7.96 | 43,080 | - 3,910 |
| Dec. 31 | 7.67 | 40,580 | - 2,500 |
| Calendar year 1967 | - | - | + 910 |
| Jan. 31 | 7.27 | 37,190 | - 3,390 |
| Feb. 29 | 6.84 | 33,680 | - 3,510 |
| Mar. 31 | 7.57 | 39,730 | + 6,050 |
| Apr. 30 | 8.92 | 51,750 | +12,020 |
| May 31 | 9.08 | 53,260 | + 1,510 |
| June 30 | 8.94 | 51,950 | - 1,310 |
| July 31 | 8.91 | 51,670 | - 280 |
| Aug. 31 | 9.08 | 53,260 | + 1,590 |
| Sept. 30 | 9.08 | 53,260 | 0 |
| Water year 1967-68 | - | - | + 4,270 |

5-2190. Sandy River at Sandy Lake Dam, at Libby, Minn.

Location.--Lat 46°47'20", long 93°19'10", in sec.25, T.50 N., R.24 W., on dam on Sandy River at Libby, 1.2 miles above mouth, and 14 miles north of McGregor.

Drainage area.--421 sq mi.

Records available.--July 1893 to March 1894, July 1894, November 1894 to March 1895, August 1895 to September 1968. 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.--73 years (1895-1968), 206 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,680 cfs June 11; minimum daily, 12 cfs many days in October, March, April, July, August and September.
1893-1968: Maximum daily discharge, 3,740 cfs July 12, 1897; no flow at times.

Remarks.--Discharge computed on basis of head over dam, using modified weir formula, head being obtained from headwater and tailwater recorder records. Flow completely regulated by Sandy Lake (see preceding page).

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12 | 83 | 81 | 76 | 71 | 21 | 12 | 1,380 | 540 | 320 | 12 | 12 |
| 2 | 12 | 83 | 80 | 76 | 69 | 21 | 12 | 645 | 535 | 315 | 12 | 12 |
| 3 | 12 | 83 | 80 | 76 | 69 | 21 | 12 | 315 | 775 | 310 | 12 | 12 |
| 4 | 12 | 83 | 80 | 76 | 69 | 21 | 12 | 74 | 755 | 310 | 12 | 12 |
| 5 | 12 | 83 | 80 | 76 | 70 | 21 | 12 | 78 | 775 | 315 | 12 | 12 |
| 6 | 12 | 83 | 80 | 76 | 69 | 21 | 12 | 216 | 848 | 75 | 12 | 12 |
| 7 | 12 | 83 | 80 | 76 | 69 | 21 | 12 | 300 | 915 | 12 | 12 | 12 |
| 8 | 12 | 83 | 79 | 76 | 69 | 20 | 12 | 331 | 910 | 12 | 12 | 12 |
| 9 | 12 | 83 | 79 | 76 | 69 | 12 | 12 | 375 | 900 | 12 | 12 | 12 |
| 10 | 12 | 83 | 79 | 76 | 70 | 12 | 12 | 370 | 1,380 | 12 | 12 | 12 |
| 11 | 12 | 83 | 80 | 76 | 71 | 12 | 12 | 375 | 1,680 | 12 | 12 | 12 |
| 12 | 12 | 82 | 80 | 75 | 71 | 12 | 12 | 375 | 1,600 | 82 | 12 | 12 |
| 13 | 12 | 82 | 80 | 75 | 70 | 12 | 12 | 375 | 1,580 | 350 | 12 | 12 |
| 14 | 12 | 81 | 80 | 75 | 70 | 12 | 12 | 440 | 1,620 | 340 | 12 | 12 |
| 15 | 12 | 82 | 80 | 75 | 70 | 12 | 12 | 535 | 1,330 | 345 | 12 | 12 |
| 16 | 12 | 82 | 80 | 74 | 69 | 12 | 12 | 520 | 1,400 | 335 | 12 | 12 |
| 17 | 12 | 82 | 80 | 74 | 69 | 12 | 12 | 520 | 1,430 | 695 | 12 | 12 |
| 18 | 12 | 82 | 79 | 74 | 69 | 12 | 12 | 525 | 1,390 | 680 | 12 | 180 |
| 19 | 12 | 82 | 79 | 74 | 69 | 12 | 12 | 745 | 1,580 | 330 | 12 | 370 |
| 20 | 12 | 82 | 79 | 72 | 69 | 12 | 12 | 730 | 1,420 | 345 | 12 | 360 |
| 21 | 84 | 82 | 79 | 72 | 68 | 12 | 12 | 875 | 1,360 | 345 | 12 | 360 |
| 22 | 84 | 82 | 79 | 71 | 68 | 12 | 12 | 875 | 640 | 345 | 12 | 246 |
| 23 | 84 | 82 | 79 | 71 | 68 | 12 | 12 | 875 | 675 | 350 | 12 | 240 |
| 24 | 84 | 81 | 80 | 71 | 68 | 12 | 320 | 410 | 670 | 355 | 12 | 240 |
| 25 | 84 | 82 | 79 | 71 | 68 | 12 | 1,030 | 465 | 655 | 355 | 12 | 160 |
| 26 | 84 | 82 | 79 | 71 | 68 | 12 | 1,280 | 465 | 635 | 360 | 12 | 160 |
| 27 | 84 | 82 | 78 | 71 | 21 | 12 | 1,190 | 470 | 630 | 360 | 12 | 160 |
| 28 | 84 | 83 | 78 | 71 | 21 | 12 | 1,200 | 465 | 635 | 360 | 12 | 80 |
| 29 | 83 | 83 | 77 | 70 | 21 | 12 | 1,260 | 445 | 517 | 360 | 12 | 80 |
| 30 | 83 | 82 | 77 | 70 | ------ | 12 | 1,320 | 455 | 315 | 190 | 12 | 80 |
| 31 | 83 | ------ | 77 | 71 | ------ | 12 | ------ | 545 | ------ | 40 | 12 | ------ |
| Total | 1,161 | 2,471 | 2,457 | 2,284 | 1,862 | 443 | 7,876 | 15,569 | 30,095 | 8,627 | 372 | 2,920 |
| Mean | 37.5 | 82.4 | 79.3 | 73.7 | 64.2 | 14.3 | 263 | 502 | 1,003 | 278 | 12.0 | 97.3 |
| Max | 84 | 83 | 81 | 76 | 71 | 21 | 1,320 | 1,380 | 1,680 | 695 | 12 | 370 |
| Min | 12 | 81 | 77 | 70 | 21 | 12 | 12 | 74 | 315 | 12 | 12 | 12 |
| Cfsm | 0.089 | 0.196 | 0.188 | 0.175 | 0.152 | 0.034 | 0.625 | 1.19 | 2.38 | 0.660 | 0.029 | 0.231 |
| In. | 0.10 | 0.22 | 0.22 | 0.20 | 0.16 | 0.04 | 0.70 | 1.38 | 2.66 | 0.76 | 0.03 | 0.26 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 75,109 | Mean | 206 | Max | 1,280 | Min | 0 | Cfsm | 0.489 | In. | 6.63 |
| Wtr yr 1968: | Total | 76,137 | Mean | 208 | Max | 1,680 | Min | 12 | Cfsm | 0.494 | In. | 6.73 |

5-2205. Mississippi River below Sandy River, near Libby, Minn.

Location.--Lat 46°47', long 93°20', in sec.25, T.50 N., R.24 W., on right bank 600 ft downstream from Sandy River, three-quarters of a mile northwest of Libby, and at mile 1,106 upstream from Ohio River.

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

Records available.--April 1930 to September 1968.

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.--38 years, 1,917 cfs.

Extremes.--Maximum discharge during year, 4,590 cfs June 15 (gage height, 10.25 ft); minimum, 772 cfs Oct. 1 (gage height, 3.12 ft).
1930-68: 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 winter months, which are fair. Flow regulated by powerplants and Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 91,93,95,101).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 777 | 1,160 | 1,090 | 875 | 1,060 | 980 | 864 | 3,380 | 2,270 | 2,970 | 1,840 | 1,130 |
| 2 | 823 | 1,150 | 1,100 | 880 | 1,070 | 980 | 864 | 2,820 | 2,380 | 3,090 | 1,770 | 1,220 |
| 3 | 864 | 1,130 | 1,100 | 900 | 1,080 | 990 | 860 | 2,410 | 2,480 | 3,120 | 1,760 | 1,280 |
| 4 | 846 | 1,120 | 1,090 | 910 | 1,090 | 1,000 | 841 | 1,980 | 2,470 | 3,060 | 1,780 | 1,260 |
| 5 | 832 | 1,140 | 1,090 | 920 | 1,100 | 1,040 | 809 | 1,820 | 2,340 | 2,980 | 1,760 | 1,290 |
| 6 | 786 | 1,110 | 1,100 | 938 | 1,080 | 1,060 | 841 | 1,890 | 2,340 | 2,740 | 1,720 | 1,270 |
| 7 | 795 | 1,100 | 1,110 | 940 | 1,080 | 1,090 | 907 | 1,960 | 2,440 | 2,590 | 1,720 | 1,200 |
| 8 | 804 | 1,090 | 1,100 | 950 | 1,060 | 1,120 | 1,060 | 2,010 | 2,510 | 2,610 | 1,730 | 1,110 |
| 9 | 827 | 1,090 | 1,100 | 965 | 1,040 | 1,190 | 1,190 | 2,060 | 2,620 | 2,630 | 1,720 | 1,040 |
| 10 | 869 | 1,110 | 1,080 | 980 | 1,000 | 1,200 | 1,530 | 2,080 | 2,890 | 2,460 | 1,690 | 1,060 |
| 11 | 1,150 | 1,120 | 1,080 | 980 | 980 | 1,200 | 1,790 | 2,040 | 3,260 | 2,420 | 1,650 | 1,170 |
| 12 | 1,170 | 1,180 | 1,070 | 980 | 970 | 1,180 | 1,790 | 2,030 | 3,640 | 2,490 | 1,610 | 1,130 |
| 13 | 1,040 | 1,190 | 1,000 | 970 | 960 | 1,150 | 1,720 | 2,040 | 4,030 | 2,650 | 1,530 | 1,050 |
| 14 | 1,120 | 1,180 | 900 | 960 | 960 | 1,110 | 1,630 | 2,130 | 4,420 | 2,680 | 1,320 | 983 |
| 15 | 1,130 | 1,140 | 840 | 960 | 940 | 1,100 | 1,510 | 2,370 | 4,570 | 2,800 | 1,260 | 1,010 |
| 16 | 1,100 | 1,130 | 890 | 950 | 935 | 1,100 | 1,610 | 2,500 | 4,550 | 2,980 | 1,250 | 1,030 |
| 17 | 1,090 | 1,110 | 925 | 940 | 927 | 1,100 | 1,920 | 2,450 | 4,490 | 3,170 | 1,250 | 1,060 |
| 18 | 1,100 | 1,120 | 1,000 | 940 | 921 | 1,110 | 2,080 | 2,460 | 4,240 | 3,080 | 1,260 | 1,250 |
| 19 | 1,120 | 1,110 | 1,040 | 935 | 920 | 1,190 | 2,080 | 2,620 | 3,970 | 2,790 | 1,200 | 1,560 |
| 20 | 1,160 | 1,090 | 1,010 | 930 | 920 | 1,220 | 2,090 | 2,650 | 3,720 | 2,700 | 1,190 | 1,580 |
| 21 | 1,250 | 1,090 | 995 | 925 | 919 | 1,150 | 2,180 | 2,690 | 3,450 | 2,690 | 1,110 | 1,530 |
| 22 | 1,210 | 1,070 | 960 | 925 | 920 | 1,000 | 2,250 | 2,620 | 3,030 | 2,650 | 987 | 1,580 |
| 23 | 1,150 | 1,090 | 940 | 930 | 920 | 870 | 2,410 | 2,480 | 3,020 | 2,580 | 963 | 1,680 |
| 24 | 1,150 | 1,100 | 920 | 950 | 920 | 850 | 2,600 | 2,090 | 3,090 | 2,510 | 983 | 1,740 |
| 25 | 1,140 | 1,050 | 910 | 970 | 930 | 860 | 2,800 | 1,970 | 3,230 | 2,460 | 1,020 | 1,700 |
| 26 | 1,140 | 1,080 | 900 | 1,000 | 940 | 860 | 3,350 | 1,940 | 3,350 | 2,410 | 1,060 | 1,730 |
| 27 | 1,140 | 1,050 | 890 | 1,010 | 980 | 860 | 3,800 | 1,980 | 3,380 | 2,420 | 1,120 | 1,720 |
| 28 | 1,130 | 926 | 880 | 1,020 | 985 | 860 | 4,000 | 2,080 | 3,310 | 2,420 | 1,130 | 1,720 |
| 29 | 1,190 | 935 | 880 | 1,030 | 990 | 880 | 3,850 | 2,170 | 3,070 | 2,360 | 1,110 | 1,840 |
| 30 | 1,210 | 1,000 | 875 | 1,040 | ------ | 893 | 3,670 | 2,170 | 2,870 | 2,170 | 1,150 | 1,880 |
| 31 | 1,170 | ------ | 875 | 1,050 | ------ | 883 | ------ | 2,210 | ------ | 1,990 | 1,160 | ------ |
| Total | 32,283 | 32,961 | 30,740 | 29,653 | 28,597 | 32,076 | 58,896 | 70,100 | 97,430 | 82,670 | 42,803 | 40,803 |
| Mean | 1,041 | 1,099 | 992 | 957 | 986 | 1,035 | 1,963 | 2,261 | 3,248 | 2,667 | 1,381 | 1,360 |
| Max | 1,250 | 1,190 | 1,110 | 1,050 | 1,100 | 1,220 | 4,000 | 3,380 | 4,570 | 3,170 | 1,840 | 1,880 |
| Min | 777 | 926 | 840 | 875 | 919 | 850 | 809 | 1,820 | 2,270 | 1,990 | 963 | 983 |
| Cfsm | 0.206 | 0.217 | 0.196 | 0.189 | 0.195 | 0.205 | 0.388 | 0.447 | 0.642 | 0.527 | 0.273 | 0.269 |
| In. | 0.24 | 0.24 | 0.23 | 0.22 | 0.21 | 0.24 | 0.43 | 0.52 | 0.72 | 0.61 | 0.31 | 0.30 |

Cal yr 1967: Total 728,230 Mean 1,995 Max 5,670 Min 736 Cfsm 0.394 In. 5.35
Wtr yr 1968: Total 579,012 Mean 1,582 Max 4,570 Min 777 Cfsm 0.313 In. 4.26

## 5-2275. Mississippi River at Aitkin, Minn.

Location.--Lat 46°32'26", long 93°42'26", in W½ sec.24, T.47 N., R.27 W., at upstream side of highway bridge at north edge of Aitkin, 1 mile downstream from Mud River and at mile 1,055.9 upstream from Ohio River.

Drainage area.--6,140 sq mi, approximately.

Records available.--March 1945 to September 1968.

Gage.--Water-stage recorder. Datum of gage is 1,182.41 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, and Mar. 15, 1961, to Sept. 30, 1967, water-stage recorder at same site at datum 3.0 ft higher. Diversion channel: Wire-weight gage. Datum of gage is 1,182.02 ft above mean sea level, datum of 1929. Apr. 9, 1955, to Apr. 10, 1956, staff gage at site 4 miles downstream at different datum. Apr. 11, 1956, to Sept. 6, 1960, staff gage, and Sept. 7, 1960, to Sept. 30, 1967, wire-weight gage at same site at datum 3.0 ft higher.

Average discharge.--23 years, 2,840 cfs.

Extremes.--Maximum discharge during year, 5,850 cfs June 17; minimum, 848 cfs Oct. 1. River gage: Maximum discharge during year, 4,160 cfs June 17 (gage height, 10.90 ft); minimum, 848 cfs Oct. 1 (gage height, 2.71 ft). Diversion gage: Maximum discharge during year, 1,690 cfs June 17 (gage height, 9.70 ft, from graph based on gage readings); no flow on many days.
1945-68: Maximum discharge, 20,000 cfs May 20, 1950 (gage height, 22.49 ft, present datum); minimum, 151 cfs Sept. 1, 1961 (gage height, 0.60 ft).

Remarks.--Records good except those for winter months, which are fair. Slight regulation by powerplants and by Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 91,93,95,101). 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. Records of chemical analyses for water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 852 | 1,300 | 1,140 | 930 | 1,100 | 1,030 | 1,150 | 4,990 | 3,180 | 4,230 | 2,310 | 1,220 |
| 2 | 866 | 1,280 | 1,170 | 930 | 1,110 | 1,030 | 1,180 | 4,800 | 3,300 | 4,180 | 2,100 | 1,210 |
| 3 | 890 | 1,260 | 1,180 | 935 | 1,120 | 1,030 | 1,230 | 4,210 | 3,380 | 4,200 | 1,970 | 1,240 |
| 4 | 929 | 1,250 | 1,200 | 940 | 1,120 | 1,030 | 1,230 | 3,660 | 3,440 | 4,210 | 1,910 | 1,290 |
| 5 | 946 | 1,220 | 1,220 | 950 | 1,130 | 1,040 | 1,160 | 3,170 | 3,440 | 4,110 | 1,900 | 1,310 |
| 6 | 929 | 1,220 | 1,220 | 955 | 1,120 | 1,060 | 1,090 | 2,860 | 3,390 | 3,950 | 1,900 | 1,330 |
| 7 | 915 | 1,210 | 1,230 | 970 | 1,120 | 1,070 | 1,180 | 2,770 | 3,300 | 3,680 | 1,850 | 1,340 |
| 8 | 922 | 1,200 | 1,230 | 980 | 1,120 | 1,120 | 1,420 | 2,780 | 3,370 | 3,440 | 1,840 | 1,300 |
| 9 | 918 | 1,200 | 1,220 | 995 | 1,110 | 1,180 | 1,650 | 2,850 | 3,670 | 3,240 | 1,830 | 1,230 |
| 10 | 926 | 1,200 | 1,210 | 1,010 | 1,100 | 1,220 | 1,840 | 2,920 | 3,920 | 3,090 | 1,810 | 1,150 |
| 11 | 954 | 1,200 | 1,180 | 1,020 | 1,090 | 1,260 | 2,070 | 2,940 | 4,390 | 2,980 | 1,770 | 1,130 |
| 12 | 996 | 1,220 | 1,160 | 1,030 | 1,080 | 1,290 | 2,340 | 2,940 | 4,710 | 2,960 | 1,720 | 1,190 |
| 13 | 1,030 | 1,240 | 1,120 | 1,030 | 1,060 | 1,300 | 2,410 | 2,940 | 4,920 | 3,030 | 1,560 | 1,200 |
| 14 | 1,090 | 1,280 | 1,050 | 1,020 | 1,040 | 1,290 | 2,420 | 2,940 | 5,280 | 3,100 | 1,470 | 1,150 |
| 15 | 1,170 | 1,270 | 950 | 1,010 | 1,030 | 1,270 | 2,330 | 3,030 | 5,630 | 3,210 | 1,490 | 1,080 |
| 16 | 1,220 | 1,250 | 900 | 1,000 | 1,020 | 1,260 | 2,270 | 3,230 | 5,810 | 3,390 | 1,400 | 1,070 |
| 17 | 1,220 | 1,250 | 880 | 990 | 1,000 | 1,270 | 2,350 | 3,360 | 5,840 | 3,600 | 1,330 | 1,150 |
| 18 | 1,210 | 1,240 | 930 | 985 | 995 | 1,300 | 2,570 | 3,400 | 5,800 | 3,780 | 1,320 | 1,200 |
| 19 | 1,200 | 1,230 | 1,000 | 980 | 980 | 1,360 | 2,720 | 3,410 | 5,580 | 3,780 | 1,320 | 1,340 |
| 20 | 1,220 | 1,200 | 1,050 | 975 | 970 | 1,430 | 2,800 | 3,470 | 5,320 | 3,580 | 1,320 | 1,620 |
| 21 | 1,240 | 1,200 | 1,060 | 975 | 965 | 1,490 | 2,850 | 3,520 | 5,170 | 3,430 | 1,250 | 1,800 |
| 22 | 1,300 | 1,200 | 1,060 | 990 | 960 | 1,510 | 2,900 | 3,540 | 5,030 | 3,340 | 1,290 | 1,920 |
| 23 | 1,320 | 1,060 | 1,040 | 1,010 | 965 | 1,500 | 3,140 | 3,440 | 4,690 | 3,290 | 1,140 | 2,060 |
| 24 | 1,300 | 1,060 | 1,020 | 1,030 | 970 | 1,430 | 3,560 | 3,280 | 4,500 | 3,190 | 1,140 | 2,140 |
| 25 | 1,270 | 1,170 | 1,000 | 1,050 | 980 | 1,330 | 4,110 | 3,020 | 4,470 | 3,090 | 1,070 | 2,170 |
| 26 | 1,250 | 1,160 | 970 | 1,060 | 990 | 1,240 | 4,720 | 2,890 | 4,510 | 3,000 | 1,070 | 2,180 |
| 27 | 1,250 | 1,120 | 960 | 1,070 | 1,000 | 1,220 | 5,140 | 2,820 | 4,580 | 2,940 | 1,090 | 2,200 |
| 28 | 1,240 | 1,080 | 950 | 1,080 | 1,020 | 1,160 | 5,330 | 2,880 | 4,600 | 2,890 | 1,140 | 2,210 |
| 29 | 1,240 | 1,080 | 940 | 1,080 | 1,030 | 1,130 | 5,350 | 2,960 | 4,540 | 2,810 | 1,130 | 2,200 |
| 30 | 1,270 | 1,120 | 935 | 1,090 | ------ | 1,130 | 5,210 | 3,030 | 4,370 | 2,730 | 1,200 | 2,250 |
| 31 | 1,300 | ------ | 930 | 1,090 | ------ | 1,140 | ------ | 3,060 | ------ | 2,570 | 1,210 | ------ |
| Total | 34,383 | 35,970 | 33,105 | 31,160 | 30,295 | 38,120 | 79,720 | 101,110 | 134,130 | 105,020 | 46,850 | 45,880 |
| Mean | 1,109 | 1,199 | 1,068 | 1,005 | 1,045 | 1,230 | 2,657 | 3,262 | 4,471 | 3,388 | 1,511 | 1,529 |
| Max | 1,320 | 1,300 | 1,230 | 1,090 | 1,130 | 1,510 | 5,350 | 4,990 | 5,840 | 4,230 | 2,310 | 2,250 |
| Min | 852 | 1,060 | 880 | 930 | 960 | 1,030 | 1,090 | 2,770 | 3,180 | 2,570 | 1,070 | 1,070 |
| Cfsm | 0.181 | 0.195 | 0.174 | 0.164 | 0.170 | 0.200 | 0.433 | 0.531 | 0.728 | 0.552 | 0.246 | 0.249 |
| In. | 0.21 | 0.22 | 0.20 | 0.19 | 0.18 | 0.23 | 0.48 | 0.61 | 0.81 | 0.64 | 0.28 | 0.28 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 920,608 | Mean | 2,522 | Max | 8,520 | Min | 852 | Cfsm | 0.411 | In. | 5.58 |
| Wtr yr 1968: | Total | 715,743 | Mean | 1,956 | Max | 5,840 | Min | 852 | Cfsm | 0.319 | In. | 4.34 |

GPO 817-490-6

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 1968. Month-end contents only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,216.32 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to May 3, 1949, staff gage at same site and datum.

Extremes.--Maximum contents during year, 102,300 acre-ft Apr. 24 (gage height, 13.29 ft); minimum, 78,900 acre-ft Mar. 13-17 (gage height, 11.55 ft).
1886-1968: Maximum contents observed, 173,600 acre-ft July 10, 1916 (gage height, 18.24 ft); minimum observed, 1,310 acre-ft below zero of capacity table Aug. 20, 1918 (gage height, 1.35 ft).

Remarks.--Reservoir is formed by Trout, Whitefish, Rush, and Cross Lakes and several other natural lakes controlled by timber crib dams; storage began in 1886; dam completed in 1886. Capacity between gage heights 10.00 ft and 18.5 ft (maximum allowable range) is 118,710 acre-ft of which 53,280 acre-ft is controlled storage between gage heights 10.00 ft and 14.00 ft (normal operating range). Contents shown herein are contents above a gage height of 2.35 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

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

Month-end gage height and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 12.25 | 88,260 | |
| Oct. 31 | 12.25 | 88,260 | 0 |
| Nov. 30 | 12.35 | 89,550 | + 1,290 |
| Dec. 31 | 12.28 | 88,460 | - 1,090 |
| Calendar year 1967 | - | - | + 390 |
| Jan. 31 | 12.06 | 85,670 | - 2,790 |
| Feb. 29 | 11.67 | 80,510 | - 5,160 |
| Mar. 31 | 12.08 | 85,940 | + 5,430 |
| Apr. 30 | 13.17 | 100,700 | +14,760 |
| May 31 | 12.80 | 95,620 | - 5,080 |
| June 30 | 12.78 | 95,350 | - 270 |
| July 30 | 12.76 | 95,090 | - 260 |
| Aug. 31 | 12.65 | 93,600 | - 1,490 |
| Sept. 30 | 12.85 | 96,300 | + 2,700 |
| Water year 1967-68 | - | - | + 8,040 |

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 1968. 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.--82 years, 211 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 710 cfs July 20, 21; minimum daily, 15 cfs Oct. 1 to Nov. 28. 1886-1968: Maximum daily discharge, 2,250 cfs in June 1896 (does not include flow bypassing dam through crevasse); no flow at times.

Remarks.--Discharge computed principally on basis of modified weir formula, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Pine River Reservoir (see preceding page).

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 15 | 120 | 140 | 190 | 200 | 45 | 465 | 235 | 197 | 155 | 50 |
| 2 | 15 | 15 | 120 | 140 | 190 | 200 | 45 | 360 | 235 | 300 | 118 | 50 |
| 3 | 15 | 15 | 120 | 140 | 190 | 200 | 45 | 355 | 230 | 300 | 95 | 50 |
| 4 | 15 | 15 | 120 | 140 | 190 | 200 | 45 | 355 | 235 | 300 | 95 | 50 |
| 5 | 15 | 15 | 120 | 140 | 190 | 200 | 45 | 350 | 235 | 283 | 95 | 50 |
| 6 | 15 | 15 | 120 | 140 | 190 | 200 | 45 | 350 | 230 | 200 | 95 | 45 |
| 7 | 15 | 15 | 130 | 140 | 190 | 200 | 45 | 350 | 230 | 195 | 95 | 45 |
| 8 | 15 | 15 | 140 | 140 | 190 | 200 | 45 | 393 | 250 | 190 | 95 | 45 |
| 9 | 15 | 15 | 140 | 140 | 190 | 200 | 45 | 470 | 290 | 190 | 95 | 40 |
| 10 | 15 | 15 | 140 | 140 | 190 | 200 | 45 | 505 | 386 | 180 | 95 | 40 |
| 11 | 15 | 15 | 140 | 140 | 190 | 200 | 45 | 680 | 592 | 160 | 95 | 40 |
| 12 | 15 | 15 | 140 | 140 | 190 | 200 | 45 | 680 | 670 | 156 | 90 | 40 |
| 13 | 15 | 15 | 140 | 140 | 190 | 185 | 45 | 633 | 654 | 130 | 90 | 40 |
| 14 | 15 | 15 | 140 | 140 | 190 | 150 | 45 | 540 | 583 | 140 | 90 | 40 |
| 15 | 15 | 15 | 140 | 140 | 190 | 150 | 61 | 540 | 670 | 227 | 90 | 40 |
| 16 | 15 | 15 | 140 | 140 | 190 | 150 | 100 | 587 | 627 | 390 | 77 | 40 |
| 17 | 15 | 15 | 140 | 140 | 190 | 150 | 100 | 665 | 515 | 424 | 45 | 43 |
| 18 | 15 | 15 | 140 | 140 | 190 | 150 | 100 | 520 | 420 | 505 | 45 | 60 |
| 19 | 15 | 15 | 140 | 155 | 190 | 123 | 106 | 520 | 456 | 582 | 45 | 70 |
| 20 | 15 | 15 | 140 | 190 | 190 | 70 | 145 | 483 | 290 | 710 | 45 | 87 |
| 21 | 15 | 15 | 140 | 190 | 190 | 70 | 145 | 410 | 353 | 710 | 45 | 115 |
| 22 | 15 | 15 | 140 | 190 | 190 | 70 | 160 | 353 | 540 | 660 | 50 | 115 |
| 23 | 15 | 15 | 140 | 190 | 190 | 70 | 226 | 240 | 500 | 489 | 55 | 150 |
| 24 | 15 | 15 | 140 | 190 | 190 | 70 | 315 | 240 | 445 | 315 | 55 | 220 |
| 25 | 15 | 15 | 140 | 190 | 200 | 70 | 390 | 240 | 540 | 310 | 55 | 220 |
| 26 | 15 | 15 | 140 | 190 | 200 | 69 | 467 | 240 | 480 | 250 | 55 | 210 |
| 27 | 15 | 15 | 140 | 190 | 200 | 45 | 620 | 240 | 336 | 250 | 50 | 210 |
| 28 | 15 | 15 | 140 | 190 | 200 | 45 | 620 | 240 | 183 | 250 | 50 | 210 |
| 29 | 15 | 54 | 140 | 190 | 200 | 45 | 620 | 240 | 155 | 231 | 50 | 210 |
| 30 | 15 | 120 | 140 | 190 | ------ | 45 | 589 | 240 | 155 | 187 | 50 | 210 |
| 31 | 15 | ------ | 140 | 190 | ------ | 45 | ------ | 240 | ------ | 165 | 50 | ------ |
| Total | 465 | 594 | 4,210 | 4,955 | 5,560 | 4,172 | 5,394 | 12,724 | 11,720 | 9,576 | 2,310 | 2,835 |
| Mean | 15.0 | 19.8 | 136 | 160 | 192 | 135 | 180 | 410 | 391 | 309 | 74.5 | 94.5 |
| Max | 15 | 120 | 140 | 190 | 200 | 200 | 620 | 680 | 670 | 710 | 155 | 220 |
| Min | 15 | 15 | 120 | 140 | 190 | 45 | 45 | 240 | 155 | 130 | 45 | 40 |
| Cfsm | 0.027 | 0.035 | 0.242 | 0.285 | 0.342 | 0.240 | 0.320 | 0.730 | 0.696 | 0.550 | 0.133 | 0.168 |
| In. | 0.03 | 0.04 | 0.28 | 0.33 | 0.37 | 0.28 | 0.36 | 0.84 | 0.78 | 0.63 | 0.15 | 0.19 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 76,079 | Mean | 208 | Max | 885 | Min | 15 | Cfsm | 0.370 | In. | 5.03 |
| Wtr yr 1968: | Total | 64,515 | Mean | 176 | Max | 710 | Min | 15 | Cfsm | 0.313 | In. | 4.27 |

5-2315. Pelican Lake near Pequot Lakes, Minn.

Location.--Lat 46°37', long 94°11', in NE¼NE¼ sec.10, T.136 N., R.28 W., on downstream side of right abutment of dam and bridge on channel between Ossawinnamakee and Pelican Lakes, 0.5 mile upstream from Pelican Lake and 6 miles east of town of Pequot Lakes.

Records available.--April 1938 to September 1968 (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, 3.70 ft June 22; minimum observed, 3.12 ft Sept. 6, 11.
1938-68: Maximum gage height observed, 4.28 ft May 23, 1966; 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 1967 to September 1968

| | | |
|---|---|---|
| May 31 ..... 3.36 | July 30 ..... 3.46 | Sept.29 ..... 3.24 |
| June 29 ..... 3.34 | Aug. 30 ..... 3.20 | |

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

5-2440. Crow Wing River at Nimrod, Minn.

Location.--Lat 46°39', long 94°53', in sec.32, T.137 N., R.33 W., on right bank 200 ft upstream from highway bridge, 0.2 mile north of 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 1968 (winter records incomplete prior to 1940).

Gage.--Digital 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. Nov. 5, 1949, to Aug. 27, 1968, graphic water-stage recorder at same site and datum.

Average discharge.--29 years (1939-68), 472 cfs.

Extremes.--Maximum discharge during year, 2,750 cfs June 9 (gage height, 6.07 ft, from recorded range-in-stage); minimum, 196 cfs Nov. 23, 24 (gage height, 2.53 ft, result of freezeup).
1910-14, 1930-68: Maximum discharge, 2,890 cfs Apr. 13, 1965 (gage height, 7.57 ft, backwater from ice); maximum gage height, 7.64 ft, backwater from ice; minimum discharge observed, 45 cfs Aug. 7, 1936.

Remarks.--Records good except those for winter months, which are fair. Flow affected by natural storage in many lakes. Records of chemical analysis and suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 300 | 397 | 370 | 290 | 265 | 260 | 649 | 912 | 610 | 955 | 592 | 419 |
| 2 | 295 | 397 | 370 | 285 | 265 | 260 | 616 | 870 | 600 | 919 | 568 | 413 |
| 3 | 300 | 397 | 380 | 280 | 265 | 265 | 610 | 857 | 598 | 870 | 544 | 421 |
| 4 | 305 | 397 | 395 | 275 | 260 | 270 | 598 | 838 | 600 | 824 | 532 | 424 |
| 5 | 305 | 393 | 410 | 270 | 260 | 270 | 630 | 824 | 610 | 805 | 508 | 418 |
| 6 | 305 | 390 | 415 | 260 | 255 | 280 | 604 | 805 | 630 | 772 | 490 | 426 |
| 7 | 331 | 385 | 420 | 260 | 250 | 290 | 649 | 818 | 792 | 746 | 484 | 435 |
| 8 | 358 | 390 | 420 | 255 | 250 | 305 | 766 | 818 | 1,040 | 727 | 502 | 441 |
| 9 | 370 | 392 | 420 | 250 | 245 | 320 | 818 | 824 | 2,650 | 688 | 490 | 441 |
| 10 | 370 | 386 | 415 | 250 | 245 | 340 | 812 | 824 | 2,620 | 668 | 484 | 437 |
| 11 | 370 | 386 | 410 | 250 | 245 | 355 | 805 | 798 | 2,380 | 642 | 472 | 422 |
| 12 | 375 | 386 | 410 | 245 | 240 | 360 | 798 | 805 | 2,020 | 884 | 466 | 408 |
| 13 | 375 | 386 | 405 | 245 | 240 | 360 | 792 | 798 | 1,880 | 844 | 454 | 397 |
| 14 | 370 | 386 | 405 | 245 | 240 | 360 | 798 | 818 | 1,850 | 827 | 442 | 393 |
| 15 | 370 | 386 | 405 | 240 | 240 | 365 | 818 | 824 | 1,760 | 1,720 | 454 | 384 |
| 16 | 364 | 380 | 410 | 240 | 240 | 370 | 792 | 824 | 1,660 | 1,550 | 478 | 400 |
| 17 | 358 | 375 | 415 | 240 | 245 | 375 | 772 | 805 | 1,560 | 1,370 | 466 | 495 |
| 18 | 358 | 375 | 425 | 240 | 245 | 385 | 766 | 798 | 1,420 | 1,270 | 472 | 497 |
| 19 | 358 | 375 | 435 | 240 | 245 | 410 | 740 | 792 | 1,290 | 1,100 | 490 | 496 |
| 20 | 358 | 386 | 440 | 240 | 245 | 425 | 805 | 760 | 1,220 | 948 | 484 | 489 |
| 21 | 358 | 380 | 440 | 245 | 250 | 420 | 940 | 746 | 1,190 | 877 | 472 | 482 |
| 22 | 358 | 375 | 430 | 245 | 250 | 415 | 970 | 714 | 1,120 | 838 | 454 | 520 |
| 23 | 358 | 256 | 410 | 250 | 250 | 410 | 1,060 | 705 | 1,050 | 792 | 454 | 567 |
| 24 | 358 | 326 | 390 | 255 | 250 | 410 | 1,170 | 727 | 978 | 753 | 454 | 566 |
| 25 | 358 | 419 | 370 | 255 | 250 | 420 | 1,150 | 670 | 962 | 714 | 448 | 561 |
| 26 | 358 | 408 | 350 | 255 | 255 | 480 | 1,120 | 642 | 926 | 682 | 454 | 554 |
| 27 | 370 | 390 | 340 | 260 | 255 | 640 | 1,060 | 640 | 891 | 682 | 430 | 543 |
| 28 | 375 | 380 | 325 | 260 | 260 | 760 | 1,020 | 642 | 850 | 636 | 412 | 537 |
| 29 | 386 | 370 | 315 | 260 | 260 | 649 | 1,000 | 600 | 831 | 616 | 404 | 525 |
| 30 | 397 | 370 | 305 | 260 | ------ | 662 | 955 | 598 | 850 | 616 | 404 | 514 |
| 31 | 397 | ------ | 295 | 260 | ------ | 649 | ------ | 600 | ------ | 616 | 419 | ------ |
| Total | 10,968 | 11,419 | 12,145 | 7,905 | 7,265 | 12,540 | 25,083 | 23,696 | 37,438 | 26,931 | 14,677 | 14,025 |
| Mean | 354 | 381 | 392 | 255 | 251 | 405 | 836 | 764 | 1,248 | 869 | 473 | 468 |
| Max | 397 | 419 | 440 | 290 | 265 | 760 | 1,170 | 912 | 2,650 | 1,720 | 592 | 567 |
| Min | 295 | 256 | 295 | 240 | 240 | 260 | 598 | 598 | 598 | 616 | 404 | 384 |
| Cfsm | 0.350 | 0.377 | 0.388 | 0.252 | 0.249 | 0.401 | 0.828 | 0.756 | 1.24 | 0.860 | 0.468 | 0.463 |
| In. | 0.40 | 0.42 | 0.45 | 0.29 | 0.27 | 0.46 | 0.92 | 0.87 | 1.38 | 0.99 | 0.54 | 0.52 |

Cal yr 1967: Total 220,151 Mean 603 Max 1,840 Min 256 Cfsm 0.597 In. 8.11
Wtr yr 1968: Total 204,092 Mean 558 Max 2,650 Min 240 Cfsm 0.552 In. 7.52

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 1968. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Gull Lake Reservoir October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,188.14 ft above mean sea level, adjustment of 1912. Prior to Aug. 10, 1949, staff gage 800 ft north of present site at same datum.

Extremes.--Maximum contents during year, 63,630 acre-ft June 23 (gage height, 6.45 ft); minimum, 46,890 acre-ft Feb. 23 (gage height, 5.16 ft).
1911-68: Maximum contents,74,800 acre-ft June 30, 1914 (gage height, 7.30 ft); minimum observed, 22,250 acre-ft Mar. 20, 1924 (gage height, 3.00 ft).

Remarks.--Reservoir is formed by Gull Lake and several other natural lakes controlled by concrete dam completed in 1913; storage began in 1912. Capacity between gage heights 5.00 ft and 7.00 ft (maximum allowable range and normal operating range) is 26,020 acre-ft. Contents shown herein are contents above gage height 1.00 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

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

Month-end gage height and contents, water year October 1967 to September 1968

| | Gage height (feet) | Contents (acre-feet) | Change in contents (acre-feet) |
|---|---|---|---|
| Sept. 30 | 5.67 | 53,550 | - |
| Oct. 31 | 5.55 | 51,940 | -1,610 |
| Nov. 30 | 5.53 | 51,680 | - 260 |
| Dec. 31 | 5.49 | 51,160 | - 520 |
| Calendar year 1967 | - | - | + 180 |
| Jan. 31 | 5.37 | 49,600 | -1,560 |
| Feb. 29 | 5.19 | 47,280 | -2,320 |
| Mar. 31 | 5.72 | 54,130 | +6,850 |
| Apr. 30 | 6.09 | 58,940 | +4,810 |
| May 31 | 6.09 | 58,940 | 0 |
| June 30 | 6.17 | 59,970 | +1,030 |
| July 31 | 6.02 | 58,020 | -1,950 |
| Aug. 31 | 5.89 | 56,320 | -1,700 |
| Sept. 30 | 5.97 | 57,370 | +1,050 |
| Water year 1967-68 | - | - | +3,820 |

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 1968. 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.--57 years, 103 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 650 cfs June 23-26; minimum daily, 3 cfs Aug. 17-19, 26-30, Sept. 2, 3, 5, 6, 13-16.
1911-68: Maximum daily discharge, 1,120 cfs May 15, 1938; no flow at times.

Remarks.--Discharge computed at dam on basis of modified weir formulas, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Gull Lake (see preceding page.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 11 | 69 | 67 | 85 | 57 | 14 | 186 | 118 | 264 | 46 | 4 |
| 2 | 15 | 11 | 69 | 66 | 84 | 56 | 14 | 116 | 118 | 257 | 44 | 3 |
| 3 | 15 | 10 | 69 | 66 | 82 | 58 | 14 | 116 | 111 | 181 | 44 | 3 |
| 4 | 15 | 11 | 68 | 65 | 82 | 60 | 17 | 116 | 111 | 183 | 44 | 4 |
| 5 | 15 | 10 | 68 | 65 | 81 | 61 | 18 | 115 | 110 | 180 | 42 | 3 |
| 6 | 15 | 10 | 68 | 65 | 81 | 61 | 36 | 111 | 110 | 175 | 44 | 3 |
| 7 | 15 | 10 | 68 | 65 | 77 | 60 | 38 | 112 | 110 | 173 | 44 | 4 |
| 8 | 15 | 10 | 68 | 65 | 77 | 61 | 69 | 188 | 142 | 105 | 46 | 5 |
| 9 | 15 | 10 | 68 | 64 | 77 | 64 | 104 | 191 | 186 | 108 | 47 | 5 |
| 10 | 15 | 10 | 67 | 64 | 76 | 66 | 105 | 191 | 287 | 52 | 45 | 4 |
| 11 | 15 | 10 | 67 | 64 | 75 | 68 | 109 | 191 | 585 | 52 | 42 | 4 |
| 12 | 15 | 10 | 68 | 65 | 73 | 69 | 115 | 191 | 571 | 101 | 38 | 4 |
| 13 | 15 | 10 | 67 | 65 | 73 | 69 | 183 | 188 | 550 | 244 | 39 | 3 |
| 14 | 15 | 10 | 66 | 65 | 72 | 21 | 191 | 191 | 559 | 246 | 38 | 3 |
| 15 | 15 | 10 | 66 | 64 | 72 | 4 | 266 | 193 | 552 | 244 | 36 | 3 |
| 16 | 15 | 10 | 66 | 64 | 71 | 5 | 257 | 196 | 541 | 239 | 37 | 3 |
| 17 | 15 | 10 | 69 | 64 | 70 | 5 | 257 | 191 | 534 | 236 | 3 | 22 |
| 18 | 15 | 11 | 74 | 92 | 69 | 6 | 253 | 186 | 524 | 100 | 3 | 52 |
| 19 | 12 | 10 | 74 | 91 | 69 | 7 | 175 | 185 | 424 | 100 | 3 | 52 |
| 20 | 12 | 10 | 74 | 88 | 68 | 8 | 188 | 109 | 339 | 91 | 5 | 52 |
| 21 | 12 | 10 | 74 | 90 | 66 | 8 | 270 | 109 | 427 | 56 | 4 | 52 |
| 22 | 11 | 10 | 74 | 90 | 65 | 9 | 270 | 109 | 600 | 56 | 5 | 53 |
| 23 | 11 | 10 | 72 | 88 | 65 | 9 | 315 | 52 | 650 | 56 | 4 | 113 |
| 24 | 12 | 10 | 72 | 88 | 65 | 10 | 375 | 52 | 650 | 56 | 5 | 184 |
| 25 | 12 | 10 | 70 | 88 | 65 | 10 | 365 | 54 | 650 | 55 | 4 | 180 |
| 26 | 11 | 10 | 69 | 88 | 64 | 11 | 365 | 55 | 650 | 54 | 3 | 175 |
| 27 | 11 | 10 | 68 | 88 | 63 | 11 | 450 | 57 | 375 | 54 | 3 | 169 |
| 28 | 11 | 10 | 68 | 86 | 61 | 12 | 443 | 57 | 333 | 53 | 3 | 165 |
| 29 | 11 | 68 | 68 | 86 | 60 | 12 | 435 | 57 | 183 | 50 | 3 | 161 |
| 30 | 11 | 69 | 68 | 85 | ------ | 13 | 343 | 57 | 191 | 47 | 3 | 156 |
| 31 | 10 | ------ | 67 | 85 | ------ | 14 | ------ | 58 | ------ | 48 | 3 | ------ |
| Total | 417 | 421 | 2143 | 2336 | 2088 | 985 | 6054 | 3980 | 11291 | 3916 | 730 | 1644 |
| Mean | 13.5 | 14.0 | 69.1 | 75.4 | 72.0 | 31.8 | 202 | 128 | 376 | 126 | 23.5 | 54.8 |
| Max | 15 | 69 | 74 | 92 | 85 | 69 | 450 | 196 | 650 | 264 | 47 | 184 |
| Min | 10 | 10 | 66 | 64 | 60 | 4 | 14 | 52 | 110 | 47 | 3 | 3 |
| Cfsm | 0.047 | 0.049 | 0.241 | 0.263 | 0.251 | 0.111 | 0.704 | 0.446 | 1.31 | 0.439 | 0.082 | 0.191 |
| In. | 0.05 | 0.05 | 0.28 | 0.30 | 0.27 | 0.13 | 0.78 | 0.52 | 1.46 | 0.51 | 0.09 | 0.21 |

Cal yr 1967: Total 32,160 Mean 88.1 Max 441 Min 10 Cfsm 0.307 In. 4.17
Wtr yr 1968: Total 36,005 Mean 98.4 Max 650 Min 3 Cfsm 0.343 In. 4.67

5-2670. Mississippi River near Royalton, Minn.

Location.--Lat 45°51'40", long 94°21'30", in lot 2, sec.20, T.39 N., R.32 W., at plant of Minnesota Power & Light Co., 4 miles northwest of Royalton, and 4.5 miles downstream from Swan River, and at mile 956 upstream from Ohio River.

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

Records available.--March 1924 to September 1968.

Average discharge.--44 years, 4,106 cfs.

Extremes.--Maximum daily discharge during year, 16,400 cfs June 14; minimum daily, 955 cfs Nov. 28.
1924-68: Maximum daily discharge, 37,700 cfs Apr. 16, 1965; minimum daily, 254 cfs Nov. 25, 1936.

Remarks.--Records fair. Discharge computed on basis of powerplant records. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy and Gull Lakes and by Pine River Reservoir (see p. 91,93, 95,105,109).

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,450 | 1,920 | 1,640 | 1,480 | 1,920 | 1,660 | 3,240 | 10,600 | 5,380 | 9,260 | 4,390 | 2,360 |
| 2 | 1,500 | 2,060 | 1,820 | 1,620 | 1,910 | 1,640 | 2,950 | 9,540 | 5,210 | 7,580 | 3,980 | 1,830 |
| 3 | 1,450 | 2,060 | 1,750 | 1,550 | 1,910 | 1,630 | 3,500 | 8,860 | 5,680 | 7,570 | 3,540 | 2,100 |
| 4 | 1,470 | 2,040 | 1,800 | 1,600 | 1,920 | 1,620 | 3,300 | 7,570 | 5,680 | 7,860 | 3,630 | 2,380 |
| 5 | 1,500 | 1,930 | 1,990 | 1,590 | 1,810 | 1,680 | 3,230 | 6,740 | 5,400 | 7,990 | 3,270 | 2,130 |
| 6 | 1,400 | 1,740 | 1,990 | 1,600 | 1,910 | 1,670 | 2,960 | 6,090 | 5,680 | 7,570 | 3,120 | 2,150 |
| 7 | 1,690 | 1,800 | 1,980 | 1,560 | 1,930 | 2,150 | 3,230 | 5,780 | 5,420 | 6,790 | 3,220 | 2,210 |
| 8 | 1,810 | 1,710 | 1,980 | 1,590 | 1,950 | 2,100 | 3,500 | 6,110 | 6,010 | 6,660 | 3,240 | 2,320 |
| 9 | 1,690 | 1,920 | 2,060 | 1,560 | 1,860 | 2,530 | 3,710 | 6,110 | 6,670 | 5,820 | 3,070 | 2,440 |
| 10 | 1,720 | 2,060 | 2,050 | 1,630 | 1,900 | 2,580 | 4,890 | 6,110 | 9,440 | 5,330 | 3,030 | 2,330 |
| 11 | 1,530 | 2,130 | 1,960 | 1,560 | 1,900 | 2,560 | 5,680 | 5,630 | 13,200 | 5,680 | 2,960 | 2,130 |
| 12 | 1,660 | 1,960 | 2,170 | 1,660 | 1,840 | 2,490 | 5,400 | 6,080 | 15,000 | 5,820 | 2,890 | 1,930 |
| 13 | 1,640 | 2,060 | 1,850 | 1,560 | 1,850 | 2,590 | 4,920 | 6,300 | 15,900 | 6,160 | 2,810 | 2,020 |
| 14 | 1,760 | 1,950 | 1,460 | 1,630 | 1,760 | 2,540 | 5,680 | 6,300 | 16,400 | 6,720 | 2,750 | 2,110 |
| 15 | 1,730 | 1,700 | 1,590 | 1,660 | 1,650 | 2,490 | 5,500 | 6,190 | 15,700 | 6,760 | 2,790 | 2,000 |
| 16 | 1,880 | 2,030 | 1,730 | 1,600 | 1,680 | 2,500 | 5,370 | 6,240 | 15,500 | 7,020 | 2,630 | 1,990 |
| 17 | 2,100 | 2,060 | 1,940 | 1,660 | 1,750 | 2,640 | 5,210 | 6,430 | 15,800 | 7,310 | 2,570 | 2,330 |
| 18 | 1,700 | 2,100 | 1,990 | 1,670 | 1,720 | 2,870 | 4,960 | 5,670 | 15,000 | 8,800 | 2,490 | 2,360 |
| 19 | 1,700 | 2,060 | 1,760 | 1,680 | 1,750 | 3,530 | 5,100 | 6,770 | 13,200 | 8,890 | 2,540 | 2,760 |
| 20 | 1,640 | 1,790 | 1,580 | 1,690 | 1,710 | 3,550 | 5,710 | 6,190 | 12,900 | 8,620 | 2,500 | 2,280 |
| 21 | 1,860 | 1,980 | 1,890 | 1,720 | 1,700 | 3,100 | 6,410 | 6,190 | 13,000 | 8,350 | 2,560 | 2,710 |
| 22 | 2,100 | 1,840 | 1,590 | 1,780 | 1,660 | 3,330 | 6,560 | 6,190 | 12,600 | 7,740 | 2,410 | 3,620 |
| 23 | 1,930 | 1,620 | 1,760 | 1,760 | 1,640 | 3,110 | 8,260 | 6,820 | 12,300 | 7,560 | 2,470 | 4,250 |
| 24 | 2,040 | 1,630 | 1,760 | 1,800 | 1,610 | 3,370 | 7,870 | 5,970 | 11,500 | 6,430 | 2,340 | 4,380 |
| 25 | 1,980 | 1,520 | 1,630 | 1,830 | 1,600 | 3,550 | 9,000 | 5,450 | 10,600 | 6,260 | 1,660 | 4,320 |
| 26 | 1,980 | 1,250 | 1,630 | 1,910 | 1,600 | 3,230 | 10,200 | 4,610 | 10,300 | 5,420 | 1,850 | 4,710 |
| 27 | 1,990 | 1,090 | 1,660 | 2,030 | 1,600 | 3,230 | 10,500 | 5,050 | 9,830 | 5,190 | 1,980 | 4,470 |
| 28 | 1,790 | 955 | 1,570 | 1,850 | 1,560 | 3,620 | 10,600 | 4,780 | 9,420 | 5,190 | 2,010 | 4,230 |
| 29 | 1,730 | 1,270 | 1,580 | 1,890 | 1,560 | 3,620 | 11,300 | 4,930 | 9,250 | 5,190 | 1,940 | 4,320 |
| 30 | 2,060 | 1,340 | 1,600 | 1,920 | ------- | 3,600 | 10,800 | 4,820 | 10,300 | 4,730 | 2,170 | 4,100 |
| 31 | 1,960 | ------- | 1,560 | 1,900 | ------- | 3,600 | ------- | 5,140 | ------- | 4,580 | 2,060 | ------- |
| TOTAL | 54,440 | 53,575 | 55,320 | 52,540 | 51,160 | 84,380 | 179,540 | 196,260 | 318,270 | 210,850 | 84,870 | 85,270 |
| MEAN | 1,756 | 1,786 | 1,785 | 1,695 | 1,764 | 2,722 | 5,985 | 6,331 | 10,610 | 6,802 | 2,738 | 2,842 |
| CFSM | 0.151 | 0.154 | 0.154 | 0.146 | 0.152 | 0.235 | 0.516 | 0.546 | 0.915 | 0.586 | 0.236 | 0.245 |
| IN. | 0.17 | 0.17 | 0.18 | 0.17 | 0.16 | 0.27 | 0.58 | 0.63 | 1.02 | 0.68 | 0.27 | 0.27 |
| MAX | 2,100 | 2,130 | 2,170 | 2,030 | 1,950 | 3,620 | 11,300 | 10,600 | 16,400 | 9,260 | 4,390 | 4,710 |
| MIN | 1,400 | 955 | 1,460 | 1,480 | 1,560 | 1,620 | 2,950 | 4,610 | 5,210 | 4,580 | 1,660 | 1,830 |

CAL YR 1967: TOTAL 1,702,295 MEAN 4,664 CFSM 0.402 IN 5.46 MAX 21,700 MIN 955
WAT YR 1968: TOTAL 1,426,475 MEAN 3,897 CFSM 0.336 IN 4.57 MAX 16,400 MIN 955

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 1968. 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.--38 years (1909-12, 1930-31, 1934-68), 249 cfs.

Extremes.--Maximum discharge during year, 443 cfs Apr. 24 (gage height, 2.47 ft); minimum, 13 cfs Nov. 27 (gage height, 0.62 ft).
1909-13, 1929-68: Maximum discharge, 9,100 cfs Apr. 13, 1965 (gage height, 10.68 ft); minimum, 0.3 cfs Nov. 25, 1936.

Remarks.--Records good except those for winter months, which are fair. Flow regulated by powerplants and reservoirs above station. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 64 | 62 | 58 | 38 | 37 | 74 | 180 | 390 | 178 | 292 | 94 | 44 |
| 2 | 62 | 62 | 58 | 38 | 37 | 83 | 167 | 377 | 181 | 257 | 92 | 43 |
| 3 | 66 | 62 | 58 | 38 | 37 | 91 | 154 | 368 | 180 | 222 | 89 | 45 |
| 4 | 70 | 62 | 57 | 37 | 38 | 102 | 186 | 346 | 175 | 199 | 86 | 55 |
| 5 | 70 | 61 | 56 | 37 | 38 | 122 | 202 | 312 | 170 | 180 | 83 | 48 |
| 6 | 70 | 60 | 56 | 37 | 38 | 167 | 199 | 289 | 167 | 172 | 98 | 44 |
| 7 | 81 | 60 | 55 | 37 | 38 | 160 | 202 | 272 | 162 | 164 | 99 | 45 |
| 8 | 79 | 60 | 54 | 37 | 38 | 160 | 260 | 295 | 160 | 157 | 94 | 54 |
| 9 | 76 | 60 | 54 | 37 | 38 | 158 | 254 | 292 | 170 | 150 | 90 | 61 |
| 10 | 76 | 60 | 54 | 37 | 38 | 147 | 254 | 251 | 216 | 138 | 86 | 55 |
| 11 | 75 | 60 | 54 | 37 | 39 | 150 | 260 | 240 | 306 | 132 | 83 | 52 |
| 12 | 75 | 58 | 54 | 37 | 39 | 152 | 257 | 228 | 320 | 125 | 81 | 52 |
| 13 | 73 | 57 | 54 | 37 | 39 | 154 | 237 | 216 | 337 | 123 | 78 | 51 |
| 14 | 75 | 58 | 54 | 37 | 40 | 157 | 277 | 214 | 371 | 127 | 76 | 51 |
| 15 | 72 | 60 | 54 | 37 | 40 | 160 | 280 | 219 | 387 | 127 | 75 | 51 |
| 16 | 68 | 61 | 54 | 37 | 40 | 162 | 277 | 222 | 374 | 125 | 73 | 61 |
| 17 | 67 | 61 | 54 | 37 | 41 | 163 | 272 | 205 | 371 | 121 | 73 | 96 |
| 18 | 67 | 61 | 54 | 37 | 42 | 164 | 257 | 199 | 352 | 119 | 72 | 78 |
| 19 | 67 | 58 | 53 | 37 | 43 | 165 | 248 | 196 | 330 | 119 | 71 | 73 |
| 20 | 67 | 61 | 52 | 37 | 45 | 166 | 274 | 191 | 320 | 112 | 70 | 72 |
| 21 | 66 | 60 | 50 | 37 | 46 | 167 | 324 | 186 | 310 | 132 | 69 | 73 |
| 22 | 64 | 60 | 48 | 37 | 47 | 170 | 298 | 180 | 295 | 121 | 68 | 83 |
| 23 | 62 | 60 | 47 | 37 | 49 | 175 | 380 | 176 | 277 | 114 | 68 | 121 |
| 24 | 66 | 58 | 46 | 37 | 51 | 180 | 436 | 173 | 254 | 117 | 64 | 119 |
| 25 | 64 | 58 | 45 | 37 | 52 | 190 | 410 | 170 | 242 | 110 | 62 | 136 |
| 26 | 62 | 49 | 44 | 37 | 56 | 205 | 407 | 167 | 242 | 110 | 62 | 134 |
| 27 | 62 | 43 | 42 | 37 | 60 | 205 | 403 | 162 | 234 | 108 | 57 | 134 |
| 28 | 62 | 54 | 41 | 37 | 63 | 216 | 403 | 159 | 225 | 101 | 44 | 129 |
| 29 | 62 | 58 | 40 | 37 | 66 | 208 | 410 | 159 | 214 | 96 | 40 | 125 |
| 30 | 64 | 58 | 40 | 37 | ------ | 199 | 407 | 165 | 263 | 94 | 41 | 125 |
| 31 | 64 | ------ | 39 | 37 | ------ | 199 | ------ | 170 | ------ | 94 | 43 | ------ |
| Total | 2118 | 1762 | 1579 | 1150 | 1275 | 4971 | 8575 | 7189 | 7783 | 4358 | 2281 | 2310 |
| Mean | 68.3 | 58.7 | 50.9 | 37.1 | 44.0 | 160 | 286 | 232 | 259 | 141 | 73.6 | 77.0 |
| Max | 81 | 62 | 58 | 38 | 66 | 216 | 436 | 390 | 387 | 292 | 99 | 136 |
| Min | 62 | 43 | 39 | 37 | 37 | 74 | 154 | 159 | 160 | 94 | 40 | 43 |
| Cfsm | 0.074 | 0.063 | 0.055 | 0.040 | 0.048 | 0.173 | 0.309 | 0.251 | 0.280 | 0.152 | 0.080 | 0.083 |
| In. | 0.09 | 0.07 | 0.06 | 0.05 | 0.05 | 0.20 | 0.34 | 0.29 | 0.31 | 0.18 | 0.09 | 0.09 |

Cal yr 1967: Total 85,654 Mean 235 Max 2,290 Min 39 Cfsm 0.254 In. 3.44
Wtr yr 1968: Total 45,351 Mean 124 Max 436 Min 37 Cfsm 0.134 In. 1.82

5-2747. St. Francis River at Santiago, Minn.

Location.--Lat 45°32'30", long 93°48'50", in NE¼ sec.10, T.35 N., R.28 W., on right bank, 0.2 mile east of Santiago and 0.4 mile upstream from bridge on county road.

Records available.--June 1965 to September 1968.

Gage.--Water-stage recorder.

Extremes.--Maximum discharge during year, 389 cfs Sept. 24 (gage height, 6.96 ft); minimum daily, 0.3 cfs Feb. 15-25; minimum gage height 3.11 ft Nov. 26.
1965-68: Maximum discharge 1,930 cfs Mar. 30, 1967 (gage height, 10.38 ft); minimum, 0.1 cfs July 10, 1966, minimum gage height, 3.11 ft Nov. 26, 1967.
Flood of Apr. 14, 1965 reached a stage of 12.17 ft, backwater from ice (discharge, 2,940 cfs).

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.6 | 2.8 | 2.9 | 1.7 | 0.5 | 1.3 | 9.8 | 32 | 17 | 152 | 4.8 | 3.3 |
| 2 | 2.6 | 3.0 | 2.9 | 1.6 | .5 | 1.5 | 8.2 | 26 | 20 | 217 | 3.8 | 3.1 |
| 3 | 2.4 | 2.8 | 2.9 | 1.5 | .5 | 1.9 | 9.1 | 21 | 18 | 196 | 3.6 | 3.0 |
| 4 | 2.6 | 2.8 | 2.8 | 1.5 | .5 | 2.4 | 11 | 18 | 15 | 166 | 3.3 | 3.0 |
| 5 | 2.4 | 2.8 | 2.8 | 1.4 | .5 | 3.0 | 10 | 16 | 12 | 115 | 3.0 | 3.0 |
| 6 | 2.3 | 2.8 | 2.8 | 1.3 | .5 | 4.0 | 12 | 14 | 9.5 | 65 | 4.2 | 2.8 |
| 7 | 2.8 | 2.8 | 2.7 | 1.2 | .5 | 5.0 | 14 | 14 | 8.2 | 36 | 6.2 | 2.8 |
| 8 | 3.3 | 2.8 | 2.6 | 1.1 | .4 | 6.0 | 24 | 15 | 13 | 22 | 23 | 3.6 |
| 9 | 3.1 | 2.8 | 2.6 | 1.1 | .4 | 7.2 | 48 | 17 | 17 | 15 | 15 | 4.4 |
| 10 | 3.0 | 2.8 | 2.6 | 1.0 | .4 | 8.8 | 55 | 17 | 24 | 10 | 10 | 3.6 |
| 11 | 3.0 | 2.8 | 2.6 | 1.0 | .4 | 11 | 42 | 16 | 53 | 7.8 | 7.8 | 3.1 |
| 12 | 3.0 | 2.8 | 2.6 | .9 | .4 | 15 | 30 | 15 | 67 | 6.4 | 6.4 | 3.0 |
| 13 | 3.0 | 2.8 | 2.6 | .9 | .4 | 17 | 23 | 13 | 62 | 5.5 | 5.0 | 2.8 |
| 14 | 3.0 | 2.8 | 2.6 | .8 | .4 | 18 | 24 | 14 | 67 | 5.0 | 5.5 | 2.8 |
| 15 | 3.0 | 2.6 | 2.6 | .8 | .3 | 19 | 30 | 16 | 58 | 4.8 | 4.6 | 2.7 |
| 16 | 3.0 | 2.8 | 2.6 | .7 | .3 | 20 | 32 | 19 | 42 | 4.6 | 4.4 | 2.8 |
| 17 | 2.8 | 2.8 | 2.7 | .7 | .3 | 20 | 26 | 20 | 30 | 5.5 | 4.2 | 5.5 |
| 18 | 2.8 | 2.8 | 2.7 | .7 | .3 | 20 | 21 | 20 | 23 | 5.8 | 4.0 | 7.5 |
| 19 | 2.8 | 2.8 | 2.6 | .7 | .3 | 20 | 18 | 24 | 16 | 4.8 | 4.0 | 6.6 |
| 20 | 2.8 | 2.8 | 2.6 | .7 | .3 | 19 | 31 | 26 | 13 | 4.0 | 3.8 | 5.5 |
| 21 | 2.7 | 2.8 | 2.5 | .7 | .3 | 17 | 90 | 24 | 16 | 4.2 | 3.6 | 4.8 |
| 22 | 2.7 | 2.7 | 2.5 | .7 | .3 | 14 | 130 | 19 | 16 | 4.4 | 3.6 | 12 |
| 23 | 2.7 | 2.7 | 2.4 | .7 | .3 | 11 | 145 | 16 | 14 | 3.6 | 3.6 | 242 |
| 24 | 2.8 | 2.7 | 2.3 | .6 | .3 | 9.1 | 248 | 14 | 12 | 3.6 | 3.3 | 375 |
| 25 | 2.8 | 2.7 | 2.2 | .6 | .3 | 8.8 | 262 | 14 | 10 | 3.3 | 3.3 | 312 |
| 26 | 2.8 | 2.7 | 2.2 | .6 | .4 | 8.2 | 182 | 15 | 9.5 | 3.3 | 3.3 | 217 |
| 27 | 2.8 | 2.8 | 2.1 | .6 | .5 | 8.8 | 115 | 16 | 8.8 | 3.3 | 3.0 | 144 |
| 28 | 2.8 | 2.9 | 2.0 | .6 | .6 | 11 | 77 | 17 | 7.2 | 3.1 | 3.0 | 97 |
| 29 | 3.0 | 2.9 | 2.0 | .6 | .6 | 13 | 54 | 16 | 6.4 | 2.8 | 2.8 | 66 |
| 30 | 3.0 | 2.9 | 1.9 | .6 | ------ | 13 | 42 | 15 | 25 | 3.0 | 2.8 | 49 |
| 31 | 2.8 | ------ | 1.8 | .6 | ------ | 13 | ------ | 15 | ------ | 6.4 | 3.3 | ------ |
| Total | 87.2 | 83.8 | 77.7 | 28.2 | 11.7 | 347.0 | 1823.1 | 554 | 709.6 | 1089.2 | 162.2 | 1593.7 |
| Mean | 2.81 | 2.79 | 2.51 | 0.910 | 0.403 | 11.2 | 60.8 | 17.9 | 23.7 | 35.1 | 5.23 | 53.1 |
| Max | 3.3 | 3.0 | 2.9 | 1.7 | 0.6 | 20 | 262 | 32 | 67 | 217 | 23 | 375 |
| Min | 2.3 | 2.6 | 1.8 | 0.6 | 0.3 | 1.3 | 8.2 | 13 | 6.4 | 2.8 | 2.8 | 2.7 |
| Ac-ft | - | - | - | - | - | - | - | - | - | - | - | - |

Cal yr 1967: Total 10,775.6 Mean 29.5 Max 1,520 Min 1.8 Ac-ft -
Wtr yr 1968: Total 6,567.4 Mean 17.9 Max 375 Min 0.3 Ac-ft -

5-2749. St. Francis River near Big Lake, Minn.

Location.--Lat 45°23'07", long 93°44'02", in NW¼NW¼ sec.5, T.33 N., R.27 W., on right bank 3.6 miles north of Big Lake and 4 miles upstream from mouth.

Records available.--May 1965 to September 1968.

Gage.--Water-stage recorder. Altitude of gage is 925 ft (from topographic map).

Extremes.--Maximum discharge during year, 309 cfs Sept. 30 (gage height, 7.54 ft); minimum daily, 20 cfs Feb. 19-22; minimum gage height, 4.71 ft Aug. 30, Sept. 15.
1965-68: Maximum discharge, 992 cfs Apr. 4, 1967 (gage height, 9.49 ft); maximum gage height, 10.15 ft about Feb. 14, 1966 (from floodmark, backwater from ice); minimum daily discharge, 20 cfs Feb. 19-22, 1968; minimum gage height, 4.67 ft Aug. 22, 1967.
Flood of Apr. 16, 1965 reached a stage of 11.34 ft, from floodmarks (discharge 2,700 cfs).

Remarks.--Records good except those for the periods of no gage-height record and those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 36 | 35 | 33 | 24 | 24 | 23 | 74 | 184 | 94 | 82 | 46 | 44 |
| 2 | 35 | 37 | 33 | 24 | 23 | 24 | 64 | 186 | 92 | 94 | 42 | 42 |
| 3 | 35 | 38 | 32 | 24 | 23 | 25 | 64 | 183 | 89 | 102 | 41 | 39 |
| 4 | 35 | 37 | 32 | 24 | 23 | 27 | 71 | 173 | 85 | 105 | 40 | 41 |
| 5 | 34 | 35 | 31 | 24 | 23 | 29 | 66 | 155 | 80 | 114 | 39 | 42 |
| 6 | 34 | 38 | 30 | 24 | 23 | 33 | 63 | 132 | 76 | 114 | 39 | 41 |
| 7 | 38 | 37 | 30 | 24 | 22 | 37 | 67 | 116 | 71 | 120 | 41 | 41 |
| 8 | 43 | 34 | 30 | 24 | 22 | 41 | 80 | 110 | 78 | 120 | 59 | 43 |
| 9 | 43 | 35 | 28 | 24 | 22 | 46 | 88 | 108 | 98 | 121 | 66 | 47 |
| 10 | 41 | 37 | 26 | 24 | 21 | 52 | 91 | 106 | 96 | 122 | 62 | 44 |
| 11 | 40 | 37 | 25 | 24 | 21 | 58 | 92 | 99 | 99 | 116 | 65 | 41 |
| 12 | 38 | 37 | 24 | 24 | 21 | 66 | 91 | 94 | 98 | 106 | 62 | 40 |
| 13 | 37 | 38 | 23 | 24 | 21 | 76 | 95 | 89 | 99 | 101 | 59 | 39 |
| 14 | 38 | 36 | 23 | 24 | 21 | 88 | 101 | 96 | 104 | 99 | 58 | 39 |
| 15 | 38 | 37 | 23 | 24 | 21 | 98 | 103 | 100 | 107 | 98 | 56 | 38 |
| 16 | 38 | 35 | 23 | 24 | 21 | 108 | 96 | 104 | 105 | 95 | 54 | 39 |
| 17 | 37 | 36 | 23 | 24 | 21 | 115 | 93 | 104 | 104 | 93 | 54 | 57 |
| 18 | 37 | 38 | 23 | 24 | 21 | 120 | 93 | 104 | 106 | 87 | 52 | 68 |
| 19 | 37 | 38 | 23 | 24 | 20 | 130 | 88 | 109 | 105 | 78 | 51 | 68 |
| 20 | 34 | 34 | 23 | 24 | 20 | 125 | 102 | 111 | 101 | 72 | 50 | 64 |
| 21 | 35 | 35 | 23 | 24 | 20 | 122 | 116 | 111 | 107 | 66 | 48 | 65 |
| 22 | 34 | 36 | 23 | 24 | 20 | 119 | 118 | 110 | 104 | 61 | 47 | 77 |
| 23 | 32 | 36 | 23 | 24 | 21 | 112 | 135 | 104 | 96 | 57 | 46 | 129 |
| 24 | 34 | 35 | 23 | 24 | 21 | 102 | 149 | 101 | 91 | 53 | 45 | 153 |
| 25 | 37 | 33 | 23 | 24 | 21 | 93 | 152 | 98 | 86 | 51 | 44 | 163 |
| 26 | 38 | 32 | 23 | 24 | 21 | 88 | 153 | 96 | 83 | 48 | 43 | 172 |
| 27 | 34 | 33 | 23 | 24 | 21 | 82 | 156 | 98 | 80 | 52 | 42 | 187 |
| 28 | 34 | 33 | 23 | 24 | 22 | 78 | 162 | 96 | 72 | 49 | 40 | 220 |
| 29 | 34 | 33 | 24 | 24 | 22 | 78 | 168 | 94 | 72 | 45 | 39 | 268 |
| 30 | 35 | 33 | 24 | 24 | ------ | 77 | 178 | 92 | 71 | 43 | 38 | 298 |
| 31 | 35 | ------ | 24 | 24 | ------ | 72 | ------ | 91 | ------ | 44 | 41 | ------ |
| Total | 1,130 | 1,068 | 794 | 744 | 623 | 2,344 | 3,169 | 3,554 | 2,749 | 2,608 | 1,509 | 2,649 |
| Mean | 36.5 | 35.6 | 25.6 | 24.0 | 21.5 | 75.6 | 106 | 115 | 91.6 | 84.1 | 48.7 | 88.3 |
| Max | 43 | 38 | 33 | 24 | 24 | 130 | 178 | 186 | 107 | 122 | 66 | 298 |
| Min | 32 | 32 | 23 | 24 | 20 | 23 | 63 | 89 | 71 | 43 | 38 | 38 |
| Ac-ft | 2,240 | 2,120 | 1,570 | 1,480 | 1,240 | 4,650 | 6,290 | 7,050 | 5,450 | 5,170 | 2,990 | 5,250 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 29,035 | Mean | 79.5 | Max | 976 | Min | 23 | Ac-ft | 57,590 |
| Wtr yr 1968: | Total | 22,941 | Mean | 62.7 | Max | 298 | Min | 20 | Ac-ft | 45,500 |

5-2750. Elk River near Big Lake, Minn.

Location.--Lat 45°20'02", long 93°40'00", in NE¼SW¼ 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 1968.

Gage.--Digital 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, Apr. 1, 1931, to July 26, 1934, chain gage, July 27, 1934, to Oct. 20, 1967 graphic water-stage recorder at same site and datum.

Average discharge.--40 years (1911-17, 1934-68), 241 cfs.

Extremes.--Maximum discharge during year, 633 cfs Mar. 18 (gage height, 2.64 ft); minimum, 25 cfs Nov. 26 (gage height, 0.54 ft, result of freezeup).
1911-17, 1931-68: Maximum discharge, 7,360 cfs Apr. 16, 1965 (gage height, 10.86 ft); minimum, 3.6 cfs July 31, 1934.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 98 | 102 | 107 | 83 | 66 | 58 | 217 | 483 | 260 | 264 | 113 | 105 |
| 2 | 96 | 103 | 107 | 83 | 65 | 59 | 203 | 455 | 257 | 271 | 105 | 99 |
| 3 | 98 | 108 | 106 | 82 | 65 | 60 | 200 | 422 | 242 | 293 | 102 | 94 |
| 4 | 98 | 106 | 105 | 81 | 64 | 61 | 214 | 390 | 235 | 325 | 99 | 99 |
| 5 | 93 | 106 | 104 | 80 | 63 | 62 | 210 | 354 | 224 | 365 | 96 | 102 |
| 6 | 91 | 91 | 102 | 79 | 62 | 63 | 200 | 314 | 214 | 375 | 96 | 99 |
| 7 | 100 | 103 | 102 | 79 | 62 | 64 | 210 | 289 | 200 | 365 | 110 | 99 |
| 8 | 125 | 103 | 101 | 79 | 61 | 66 | 260 | 282 | 203 | 332 | 142 | 105 |
| 9 | 125 | 114 | 99 | 79 | 60 | 72 | 267 | 282 | 242 | 300 | 193 | 126 |
| 10 | 114 | 112 | 96 | 78 | 60 | 78 | 275 | 275 | 249 | 278 | 182 | 122 |
| 11 | 108 | 111 | 95 | 78 | 59 | 88 | 296 | 264 | 264 | 257 | 168 | 113 |
| 12 | 103 | 114 | 90 | 78 | 58 | 105 | 303 | 264 | 260 | 239 | 165 | 108 |
| 13 | 100 | 115 | 80 | 78 | 57 | 130 | 293 | 253 | 264 | 235 | 155 | 105 |
| 14 | 100 | 109 | 80 | 78 | 57 | 165 | 300 | 271 | 303 | 235 | 148 | 99 |
| 15 | 103 | 105 | 80 | 78 | 56 | 220 | 296 | 275 | 318 | 235 | 148 | 94 |
| 16 | 100 | 108 | 82 | 77 | 56 | 257 | 282 | 278 | 318 | 217 | 155 | 96 |
| 17 | 96 | 109 | 84 | 77 | 56 | 299 | 271 | 278 | 318 | 207 | 142 | 142 |
| 18 | 100 | 111 | 86 | 76 | 55 | 447 | 264 | 278 | 325 | 200 | 138 | 168 |
| 19 | 98 | 113 | 86 | 76 | 54 | 481 | 257 | 293 | 307 | 182 | 138 | 172 |
| 20 | 93 | 106 | 86 | 75 | 54 | 354 | 293 | 293 | 293 | 172 | 135 | 168 |
| 21 | 94 | 110 | 86 | 75 | 53 | 285 | 329 | 282 | 303 | 158 | 126 | 168 |
| 22 | 99 | 112 | 86 | 74 | 53 | 264 | 329 | 275 | 300 | 145 | 119 | 200 |
| 23 | 93 | 87 | 85 | 73 | 53 | 271 | 411 | 267 | 278 | 135 | 113 | 368 |
| 24 | 93 | 116 | 85 | 72 | 54 | 242 | 494 | 257 | 260 | 129 | 108 | 458 |
| 25 | 93 | 111 | 85 | 71 | 54 | 214 | 519 | 249 | 246 | 126 | 102 | 523 |
| 26 | 89 | 87 | 84 | 70 | 55 | 210 | 516 | 246 | 239 | 119 | 99 | 563 |
| 27 | 95 | 95 | 84 | 70 | 56 | 221 | 548 | 253 | 228 | 129 | 94 | 537 |
| 28 | 92 | 100 | 84 | 69 | 57 | 231 | 573 | 246 | 210 | 129 | 88 | 498 |
| 29 | 98 | 105 | 84 | 69 | 57 | 224 | 555 | 242 | 200 | 116 | 86 | 487 |
| 30 | 98 | 107 | 84 | 68 | ------ | 224 | 516 | 242 | 217 | 110 | 84 | 498 |
| 31 | 103 | ------ | 84 | 67 | ------ | 224 | ------ | 242 | ------ | 113 | 91 | ------ |
| TOTAL | 3,096 | 3,179 | 2,809 | 2,352 | 1,682 | 5,799 | 9,901 | 9,094 | 7,777 | 6,756 | 3,840 | 6,615 |
| MEAN | 99.9 | 106 | 90.6 | 75.9 | 58.0 | 187 | 330 | 293 | 259 | 218 | 124 | 221 |
| MAX | 125 | 116 | 107 | 83 | 66 | 481 | 573 | 483 | 325 | 375 | 193 | 563 |
| MIN | 91 | 87 | 80 | 67 | 53 | 58 | 200 | 242 | 200 | 110 | 84 | 94 |
| CFSM | .16 | .17 | .15 | .12 | .09 | .30 | .54 | .48 | .42 | .35 | .20 | .36 |
| IN. | .19 | .19 | .17 | .14 | .10 | .35 | .60 | .55 | .47 | .41 | .23 | .40 |

CAL YR 1967 TOTAL 81,874 MEAN 224 MAX 2,570 MIN 78 CFSM .36 IN 4.95
WTR YR 1968 TOTAL 62,900 MEAN 172 MAX 573 MIN 53 CFSM .28 IN 3.80

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 1968.

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.--19 years, 46.9 cfs.

Extremes.--Maximum discharge during year, 90 cfs June 14 (gage height 3.31 ft); no flow Feb. 19-28.
1949-68: Maximum discharge, 408 cfs June 29, 1953; maximum gage height, 6.67 ft June 25, 1957; no flow Mar. 15-24, 1949, Feb. 26 to Mar. 26, 1960, Dec. 8, 1963, Feb. 10-21, 1965, Feb. 19-28, 1968.

Remarks.--Records good except those for periods of no gage-height record and for winter months, which are fair. Flow affected by natural storage and some regulation from lakes above station.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.0 | 1.5 | 1.0 | 0.2 | 0.2 | 0.1 | 3.2 | 9.3 | 48 | 72 | 31 | 9.3 |
| 2 | 3.6 | 1.5 | 1.0 | .2 | .2 | .1 | 2.0 | 10 | 46 | 70 | 29 | 7.8 |
| 3 | 3.8 | 1.5 | .9 | .2 | .2 | .1 | 2.3 | 14 | 42 | 64 | 28 | 7.5 |
| 4 | 3.6 | 1.5 | .9 | .2 | .2 | .2 | 2.6 | 15 | 43 | 59 | 30 | 7.8 |
| 5 | 3.4 | 1.5 | .9 | .2 | .2 | .2 | 2.1 | 12 | 43 | 56 | 30 | 7.1 |
| 6 | 3.0 | 1.5 | .9 | .2 | .2 | .2 | 1.9 | 8.6 | 44 | 54 | 30 | 6.7 |
| 7 | 3.8 | 1.5 | .9 | .2 | .2 | .3 | 3.1 | 6.7 | 42 | 52 | 30 | 5.4 |
| 8 | 4.5 | 1.4 | .8 | .2 | .2 | .4 | 3.2 | 15 | 42 | 51 | 29 | 7.5 |
| 9 | 4.5 | 1.3 | .8 | .2 | .2 | .7 | 2.7 | 20 | 37 | 48 | 28 | 9.7 |
| 10 | 3.8 | 1.4 | .7 | .2 | .2 | 1.0 | 2.3 | 15 | 56 | 43 | 26 | 7.8 |
| 11 | 3.4 | 1.4 | .7 | .2 | .1 | 1.3 | 2.1 | 16 | 65 | 41 | 23 | 6.7 |
| 12 | 3.4 | 1.2 | .6 | .2 | .1 | 1.7 | 2.0 | 17 | 61 | 40 | 21 | 6.0 |
| 13 | 3.2 | 1.3 | .6 | .2 | .1 | 2.5 | 2.1 | 12 | 62 | 41 | 19 | 5.7 |
| 14 | 3.4 | 1.2 | .6 | .2 | .1 | 3.8 | 3.4 | 13 | 89 | 46 | 17 | 5.7 |
| 15 | 3.4 | 1.3 | .5 | .2 | .1 | 5.2 | 1.9 | 18 | 86 | 46 | 16 | 4.2 |
| 16 | 3.2 | 1.3 | .5 | .2 | .1 | 7.8 | 2.4 | 21 | 82 | 44 | 18 | 4.8 |
| 17 | 3.4 | 1.3 | .5 | .2 | .1 | 11 | 2.4 | 18 | 78 | 44 | 17 | 8.6 |
| 18 | 3.2 | 1.3 | .5 | .2 | .1 | 14 | 2.1 | 18 | 81 | 44 | 14 | 10 |
| 19 | 2.8 | 1.3 | .4 | .2 | 0 | 15 | 2.1 | 17 | 79 | 38 | 15 | 7.8 |
| 20 | 3.0 | 1.2 | .4 | .2 | 0 | 14 | 4.0 | 15 | 73 | 38 | 15 | 7.5 |
| 21 | 2.6 | 1.3 | .4 | .2 | 0 | 13 | 3.6 | 14 | 75 | 38 | 13 | 7.5 |
| 22 | 2.4 | 1.3 | .4 | .2 | 0 | 12 | 3.6 | 13 | 74 | 37 | 15 | 15 |
| 23 | 2.0 | 1.2 | .4 | .2 | 0 | 11 | 9.0 | 13 | 72 | 36 | 13 | 28 |
| 24 | 2.4 | 1.3 | .4 | .2 | 0 | 11 | 7.5 | 9.3 | 70 | 39 | 15 | 26 |
| 25 | 2.4 | 1.3 | .4 | .2 | 0 | 10 | 6.4 | 12 | 69 | 37 | 13 | 25 |
| 26 | 2.0 | 1.3 | .3 | .2 | 0 | 9.2 | 6.7 | 28 | 68 | 38 | 9.3 | 22 |
| 27 | 1.9 | 1.4 | .3 | .2 | 0 | 8.5 | 6.7 | 32 | 66 | 45 | 7.8 | 20 |
| 28 | 1.6 | 1.2 | .3 | .2 | 0 | 7.6 | 7.8 | 32 | 62 | 40 | 7.5 | 19 |
| 29 | 1.7 | 1.1 | .3 | .2 | .1 | 6.8 | 9.3 | 32 | 62 | 36 | 7.1 | 17 |
| 30 | 1.6 | 1.0 | .3 | .2 | ------ | 5.4 | 10 | 32 | 62 | 35 | 7.8 | 17 |
| 31 | 1.6 | ------ | .2 | .2 | ------ | 4.1 | ------ | 38 | ------ | 36 | 9.3 | ------ |
| Total | 90.6 | 39.8 | 17.8 | 6.2 | 2.9 | 178.2 | 120.5 | 545.9 | 1,879 | 1,408 | 583.8 | 340.1 |
| Mean | 2.92 | 1.33 | 0.574 | 0.20 | 0.10 | 5.75 | 4.02 | 17.6 | 62.6 | 45.4 | 18.8 | 11.3 |
| Max | 4.5 | 1.5 | 1.0 | 0.2 | 0.2 | 15 | 10 | 38 | 89 | 72 | 31 | 28 |
| Min | 1.6 | 1.0 | 0.2 | 0.2 | 0 | 0.1 | 1.9 | 6.7 | 37 | 35 | 7.1 | 4.2 |
| Cfsm | 0.016 | 0.0074 | 0.0032 | 0.0011 | 0.00056 | 0.032 | 0.022 | 0.098 | 0.350 | 0.254 | 0.105 | 0.063 |
| In. | 0.02 | 0.008 | 0.004 | 0.001 | 0.0006 | 0.04 | 0.02 | 0.11 | 0.39 | 0.29 | 0.12 | 0.07 |

Cal yr 1967: Total 11,640.5 Mean 31.9 Max 156 Min 0.2 Cfsm 0.178 In. 2.42
Wtr yr 1968: Total 5,212.8 Mean 14.2 Max 89 Min 0 Cfsm .079 In. .108

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 1968. 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.--34 years, 228 cfs.

Extremes.--Maximum discharge during year, 1,460 cfs July 16 (gage height, 7.14 ft, from graph based on gage readings); no flow Feb. 18-23; minimum gage height, 0.72 ft Feb. 13, 14, 15, 16.
1934-68: Maximum discharge, 16,100 cfs Apr. 13, 1965 (gage height, 19.23 ft, from floodmark); no flow at times.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 6.7 | 5.8 | 1.7 | 0.1 | 0.4 | 61 | 126 | 98 | 230 | 206 | 18 |
| 2 | 9.4 | 6.7 | 6.5 | 1.4 | .1 | .7 | 58 | 104 | 118 | 209 | 194 | 18 |
| 3 | 8.4 | 6.3 | 7.4 | 1.2 | .1 | 1.4 | 57 | 90 | 106 | 179 | 185 | 17 |
| 4 | 8.4 | 6.3 | 8.2 | .9 | .1 | 2.9 | 57 | 80 | 87 | 151 | 168 | 17 |
| 5 | 20 | 5.5 | 8.7 | .7 | .1 | 5.3 | 58 | 76 | 69 | 145 | 138 | 20 |
| 6 | 12 | 5.9 | 9.1 | .6 | .1 | 9.4 | 56 | 70 | 52 | 128 | 140 | 19 |
| 7 | 13 | 6.7 | 9.2 | .5 | .1 | 16 | 44 | 67 | 46 | 110 | 126 | 16 |
| 8 | 16 | 5.9 | 9.4 | .4 | .1 | 28 | 61 | 57 | 40 | 92 | 117 | 32 |
| 9 | 16 | 5.9 | 9.5 | .3 | .1 | 50 | 60 | 64 | 40 | 80 | 102 | 51 |
| 10 | 14 | 5.9 | 9.5 | .3 | .1 | 58 | 58 | 69 | 70 | 70 | 89 | 41 |
| 11 | 11 | 7.6 | 9.6 | .2 | .1 | 59 | 51 | 65 | 115 | 66 | 77 | 35 |
| 12 | 10 | 8.4 | 9.4 | .2 | .1 | 59 | 45 | 57 | 182 | 57 | 65 | 29 |
| 13 | 9.4 | 7.6 | 9.2 | .2 | .1 | 63 | 41 | 46 | 214 | 230 | 60 | 26 |
| 14 | 8.0 | 8.4 | 9.0 | .2 | .1 | 70 | 53 | 52 | 726 | 698 | 46 | 22 |
| 15 | 8.0 | 8.4 | 8.6 | .2 | .1 | 86 | 53 | 45 | 1,050 | 1,140 | 44 | 19 |
| 16 | 7.1 | 8.4 | 8.5 | .2 | .1 | 100 | 51 | 53 | 860 | 1,430 | 43 | 17 |
| 17 | 7.1 | 9.4 | 8.5 | .2 | .1 | 109 | 42 | 53 | 670 | 1,350 | 42 | 34 |
| 18 | 6.7 | 8.9 | 8.5 | .2 | 0 | 116 | 39 | 54 | 648 | 1,190 | 36 | 87 |
| 19 | 6.3 | 8.0 | 8.5 | .2 | 0 | 111 | 38 | 50 | 747 | 1,030 | 37 | 89 |
| 20 | 5.9 | 8.0 | 8.1 | .2 | 0 | 106 | 64 | 51 | 560 | 936 | 35 | 83 |
| 21 | 5.1 | 9.4 | 7.6 | .2 | 0 | 98 | 110 | 44 | 622 | 844 | 34 | 74 |
| 22 | 5.5 | 8.9 | 6.7 | .2 | 0 | 92 | 125 | 44 | 572 | 737 | 32 | 102 |
| 23 | 5.5 | 8.9 | 6.0 | .2 | 0 | 89 | 214 | 40 | 498 | 610 | 26 | 135 |
| 24 | 5.1 | 8.4 | 5.3 | .2 | .1 | 88 | 433 | 38 | 419 | 486 | 24 | 130 |
| 25 | 10 | 9.3 | 4.6 | .1 | .1 | 88 | 381 | 44 | 362 | 383 | 23 | 118 |
| 26 | 6.3 | 5.5 | 4.0 | .1 | .1 | 92 | 305 | 43 | 346 | 336 | 21 | 123 |
| 27 | 5.5 | 4.9 | 3.6 | .1 | .1 | 100 | 247 | 81 | 358 | 312 | 21 | 107 |
| 28 | 5.1 | 4.8 | 3.2 | .1 | .2 | 109 | 201 | 102 | 330 | 280 | 21 | 90 |
| 29 | 6.3 | 5.0 | 2.7 | .1 | .2 | 87 | 179 | 81 | 296 | 238 | 19 | 81 |
| 30 | 6.7 | 5.4 | 2.3 | .1 | ------ | 80 | 153 | 80 | 252 | 216 | 17 | 73 |
| 31 | 6.7 | ------ | 1.9 | .1 | ------ | 67 | ------ | 74 | ------ | 226 | 17 | ------ |
| Total | 275.5 | 215.4 | 219.1 | 11.5 | 2.5 | 2,041.1 | 3,395 | 2,000 | 10,553 | 14,189 | 2,205 | 1,723 |
| Mean | 8.89 | 7.18 | 7.07 | 0.37 | 0.086 | 65.8 | 113 | 64.5 | 352 | 458 | 71.1 | 57.4 |
| Max | 20 | 9.4 | 9.6 | 1.7 | 0.2 | 116 | 433 | 126 | 1,050 | 1,430 | 206 | 135 |
| Min | 5.1 | 4.8 | 1.9 | 0.1 | 0 | 0.4 | 38 | 38 | 40 | 57 | 17 | 16 |
| Cfsm | 0.0076 | 0.0061 | 0.0060 | 0.00032 | 0.000074 | 0.056 | 0.097 | 0.055 | 0.301 | 0.391 | 0.061 | 0.049 |
| In. | 0.009 | 0.007 | 0.007 | 0.0004 | 0.00008 | 0.06 | 0.11 | 0.06 | 0.34 | 0.45 | 0.07 | 0.055 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 112,381.5 | Mean | 308 | Max | 3,100 | Min | 1.8 | Cfsm | 0.263 | In. | 3.57 |
| Wtr yr 1968: | Total | 36,830.1 | Mean | 101 | Max | 1,430 | Min | 0 | Cfsm | 0.086 | In. | 1.17 |

## 5-2800. Crow River at Rockford, Minn.

Location.--Lat 45°05'15", long 93°44'00", in sec.29, T.119 N., R.24 W., on right bank at Rockford, 150 ft downstream from bridge on State Highway 55 and 1 mile downstream from confluence of North and South Forks.

Drainage area.--2,520 sq mi, approximately.

Records available.--April to July 1906 (published as "near Dayton"), June 1909 to September 1917, April to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to September 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 893.65 ft above mean sea level, adjustment of 1912. Apr. 13 to July 21, 1906, staff gage at Berning Mill 14 miles downstream at different datum. June 4, 1909, to Sept. 30, 1917, staff gage at site 600 ft downstream at different datum. Apr. 23, 1929, to Aug. 21, 1934, chain gage at site 600 ft downstream at present datum.

Average discharge.--43 years (1909-17, 1930-31, 1934-68), 573 cfs.

Extremes.--Maximum discharge during year, 1,820 cfs July 18 (gage height, 5.00 ft); minimum daily, 23 cfs Jan. 15-22; minimum gage height, 1.43 ft Nov. 27.
1909-17, 1929-68: Maximum discharge, 22,400 cfs Apr. 16, 1965 (gage height, 19.27 ft, from floodmark); minimum, 1.8 cfs Nov. 15, 1936 (gage height, 1.05 ft), caused by ice jam upstream.

Remarks.--Records good except those for winter months, which are fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 51 | 51 | 40 | 32 | 26 | 28 | 220 | 450 | 350 | 805 | 487 | 88 |
| 2 | 50 | 53 | 44 | 30 | 26 | 28 | 209 | 402 | 362 | 750 | 450 | 80 |
| 3 | 50 | 53 | 46 | 30 | 26 | 28 | 218 | 374 | 362 | 712 | 406 | 80 |
| 4 | 49 | 50 | 47 | 30 | 26 | 28 | 229 | 334 | 342 | 646 | 370 | 88 |
| 5 | 68 | 50 | 47 | 30 | 26 | 28 | 229 | 316 | 302 | 586 | 342 | 134 |
| 6 | 66 | 45 | 49 | 30 | 26 | 29 | 226 | 306 | 273 | 538 | 330 | 80 |
| 7 | 63 | 48 | 51 | 28 | 27 | 32 | 232 | 302 | 248 | 482 | 312 | 73 |
| 8 | 66 | 49 | 54 | 26 | 27 | 38 | 251 | 298 | 238 | 445 | 302 | 78 |
| 9 | 68 | 54 | 58 | 26 | 27 | 48 | 257 | 292 | 229 | 392 | 279 | 82 |
| 10 | 69 | 58 | 62 | 25 | 27 | 84 | 266 | 289 | 238 | 358 | 263 | 109 |
| 11 | 66 | 60 | 64 | 25 | 27 | 114 | 266 | 292 | 266 | 338 | 241 | 113 |
| 12 | 66 | 60 | 66 | 25 | 27 | 120 | 251 | 269 | 358 | 334 | 220 | 109 |
| 13 | 64 | 60 | 70 | 25 | 27 | 130 | 235 | 257 | 445 | 397 | 203 | 96 |
| 14 | 61 | 56 | 60 | 24 | 28 | 150 | 244 | 269 | 805 | 854 | 186 | 86 |
| 15 | 58 | 54 | 58 | 23 | 28 | 164 | 248 | 266 | 1,270 | 1,320 | 175 | 74 |
| 16 | 56 | 51 | 55 | 23 | 28 | 180 | 260 | 273 | 1,440 | 1,600 | 172 | 73 |
| 17 | 54 | 54 | 55 | 23 | 28 | 194 | 263 | 273 | 1,420 | 1,770 | 162 | 94 |
| 18 | 53 | 54 | 55 | 23 | 28 | 220 | 254 | 276 | 1,370 | 1,810 | 151 | 115 |
| 19 | 51 | 56 | 54 | 23 | 28 | 285 | 241 | 285 | 1,480 | 1,690 | 146 | 183 |
| 20 | 51 | 54 | 54 | 23 | 28 | 200 | 279 | 276 | 1,490 | 1,510 | 143 | 197 |
| 21 | 49 | 54 | 54 | 23 | 28 | 175 | 316 | 269 | 1,480 | 1,390 | 141 | 200 |
| 22 | 50 | 51 | 54 | 23 | 28 | 210 | 388 | 257 | 1,500 | 1,250 | 134 | 209 |
| 23 | 50 | 44 | 51 | 24 | 28 | 215 | 509 | 238 | 1,450 | 1,110 | 124 | 241 |
| 24 | 50 | 41 | 49 | 24 | 28 | 230 | 770 | 232 | 1,360 | 973 | 117 | 276 |
| 25 | 48 | 39 | 47 | 24 | 28 | 266 | 875 | 244 | 1,240 | 847 | 100 | 312 |
| 26 | 47 | 37 | 45 | 26 | 28 | 292 | 819 | 260 | 1,180 | 750 | 98 | 326 |
| 27 | 49 | 36 | 42 | 28 | 28 | 316 | 705 | 306 | 1,120 | 712 | 96 | 312 |
| 28 | 49 | 36 | 40 | 27 | 28 | 330 | 598 | 338 | 1,040 | 646 | 96 | 285 |
| 29 | 51 | 36 | 37 | 26 | 28 | 298 | 532 | 350 | 959 | 586 | 92 | 263 |
| 30 | 51 | 38 | 35 | 25 | ------ | 279 | 487 | 334 | 882 | 532 | 86 | 248 |
| 31 | 51 | ------ | 33 | 25 | ------ | 248 | ------ | 323 | ------ | 509 | 84 | ------ |
| Total | 1,725 | 1,482 | 1,576 | 799 | 793 | 4,987 | 10,877 | 9,250 | 25,499 | 26,642 | 6,508 | 4,704 |
| Mean | 55.6 | 49.4 | 50.8 | 25.8 | 27.3 | 161 | 363 | 298 | 850 | 859 | 210 | 157 |
| Max | 69 | 60 | 70 | 32 | 28 | 330 | 875 | 450 | 1,500 | 1,810 | 487 | 326 |
| Min | 47 | 36 | 33 | 23 | 26 | 28 | 209 | 232 | 229 | 334 | 84 | 73 |
| Cfsm | 0.022 | 0.020 | 0.020 | 0.010 | 0.011 | 0.064 | 0.144 | 0.118 | 0.337 | 0.341 | 0.083 | 0.062 |
| In. | 0.03 | 0.02 | 0.02 | 0.01 | 0.01 | 0.07 | 0.16 | 0.14 | 0.38 | 0.39 | 0.10 | 0.07 |

Cal yr 1967: Total 216,204 Mean 592 Max 5,090 Min 33 Cfsm 0.235 In. 3.19
Wtr yr 1968: Total 94,842 Mean 259 Max 1,810 Min 23 Cfsm 0.103 In. 1.40

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 1968. 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 recorded during year, 1,252.99 ft June 30 (affected by wind action); maximum daily recorded, 1,252.05 ft June 30 (may have been higher during period of no gage-height record July 4 to Aug. 8); minimum recorded, 1,250.18 ft Nov. 17 (affected by wind action).
1931-68: Maximum elevation, 1,253.51 ft July 25, 1952; minimum observed, 1,245.74 ft Oct. 16-19, 1936.

Remarks.--Water level affected by fixed-crest spillway at outlet of Ogechie Lake with crest at elevation 1,250.50 ft. Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

Daily mean elevation, in feet, October 1967 to September 1968

| | | |
|---|---|---|
| Oct. 31 ..... 1,250.69 | Feb. 29 ..... 1,250.69 | May 31 ..... 1,251.39 |
| Nov. 30 ..... 1,250.53 | Mar. 31 ..... 1,250.77 | June 30 ..... 1,252.05 |
| Dec. 31 ..... 1,250.63 | Apr. 30 ..... 1,251.18 | July 3 ..... 1,252.04 |
| Jan. 31 ..... 1,250.69 | | |

5-2860. Rum River near St. Francis, Minn.

Location.--Lat 45°19'40", long 93°22'20", in SE¼ sec.19, T.33 N., R.24 W., on left bank at upstream side of highway bridge, 4 miles south of St. Francis and 15¾ miles upstream from mouth.

Drainage area.--1,360 sq mi, approximately.

Records available.--May to November 1929, March 1930 to September 1931, April to November 1932, March 1933 to September 1968.

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.--36 years (1930-31, 1933-68), 549 cfs.

Extremes.--Maximum discharge during year, 2,150 cfs Sept. 30 (gage height, 5.17 ft); maximum gage height, 5.28 ft July 8; minimum discharge, 48 cfs Nov. 26 (gage height, 2.06 ft).
1929-68: Maximum discharge, 10,100 cfs Apr. 20, 1965 (gage height, 11.57 ft); minimum, 29 cfs Aug. 18, 1934 (gage height, 1.91 ft).

Remarks.--Records good except those for winter months, which are fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 216 | 151 | 150 | 102 | 94 | 95 | 424 | 1,060 | 716 | 1,130 | 429 | 325 |
| 2 | 212 | 157 | 160 | 100 | 94 | 95 | 397 | 931 | 723 | 1,140 | 429 | 325 |
| 3 | 206 | 157 | 157 | 96 | 94 | 95 | 366 | 808 | 685 | 1,220 | 434 | 325 |
| 4 | 199 | 157 | 157 | 94 | 94 | 95 | 358 | 716 | 666 | 1,350 | 424 | 333 |
| 5 | 195 | 151 | 157 | 93 | 94 | 95 | 345 | 629 | 666 | 1,540 | 415 | 325 |
| 6 | 192 | 148 | 157 | 93 | 94 | 96 | 333 | 563 | 678 | 1,750 | 410 | 325 |
| 7 | 192 | 134 | 157 | 93 | 95 | 98 | 329 | 523 | 580 | 1,930 | 406 | 325 |
| 8 | 195 | 138 | 157 | 93 | 95 | 104 | 354 | 517 | 534 | 2,060 | 415 | 325 |
| 9 | 202 | 148 | 156 | 93 | 95 | 117 | 392 | 517 | 534 | 2,050 | 454 | 333 |
| 10 | 202 | 163 | 156 | 93 | 95 | 140 | 454 | 517 | 580 | 1,780 | 469 | 329 |
| 11 | 209 | 160 | 155 | 93 | 95 | 160 | 604 | 523 | 782 | 1,340 | 469 | 329 |
| 12 | 209 | 157 | 154 | 93 | 95 | 190 | 697 | 545 | 995 | 1,040 | 434 | 329 |
| 13 | 206 | 160 | 149 | 93 | 95 | 220 | 678 | 557 | 1,160 | 896 | 410 | 325 |
| 14 | 206 | 160 | 145 | 93 | 95 | 250 | 604 | 540 | 1,290 | 840 | 388 | 321 |
| 15 | 209 | 157 | 140 | 93 | 95 | 300 | 569 | 545 | 1,350 | 861 | 375 | 314 |
| 16 | 202 | 154 | 140 | 93 | 95 | 360 | 534 | 563 | 1,420 | 875 | 375 | 310 |
| 17 | 195 | 151 | 140 | 93 | 95 | 362 | 528 | 569 | 1,450 | 854 | 379 | 329 |
| 18 | 192 | 151 | 139 | 93 | 95 | 360 | 534 | 604 | 1,440 | 827 | 375 | 388 |
| 19 | 186 | 151 | 138 | 93 | 95 | 352 | 517 | 653 | 1,360 | 794 | 366 | 420 |
| 20 | 182 | 154 | 138 | 93 | 95 | 350 | 545 | 685 | 1,270 | 730 | 362 | 454 |
| 21 | 182 | 154 | 137 | 93 | 95 | 298 | 635 | 685 | 1,200 | 666 | 358 | 469 |
| 22 | 170 | 154 | 133 | 93 | 95 | 392 | 710 | 672 | 1,080 | 616 | 358 | 496 |
| 23 | 170 | 151 | 130 | 93 | 95 | 384 | 834 | 666 | 995 | 569 | 362 | 889 |
| 24 | 163 | 141 | 125 | 93 | 95 | 392 | 1,010 | 641 | 995 | 551 | 358 | 1,110 |
| 25 | 151 | 132 | 122 | 93 | 95 | 388 | 1,100 | 616 | 1,120 | 528 | 354 | 1,330 |
| 26 | 148 | 128 | 119 | 93 | 95 | 375 | 1,150 | 598 | 1,220 | 506 | 341 | 1,540 |
| 27 | 144 | 131 | 117 | 93 | 95 | 379 | 1,190 | 592 | 1,330 | 506 | 329 | 1,740 |
| 28 | 144 | 135 | 113 | 93 | 95 | 424 | 1,270 | 629 | 1,320 | 469 | 325 | 1,970 |
| 29 | 144 | 138 | 110 | 93 | 95 | 449 | 1,300 | 672 | 1,210 | 449 | 318 | 2,120 |
| 30 | 144 | 145 | 107 | 93 | ------ | 444 | 1,220 | 678 | 1,100 | 434 | 318 | 2,130 |
| 31 | 151 | ------ | 104 | 93 | ------ | 449 | ------ | 697 | ------ | 434 | 321 | ------ |
| Total | 5,718 | 4,468 | 4,319 | 2,903 | 2,749 | 8,308 | 19,981 | 19,711 | 30,449 | 30,735 | 11,960 | 20,583 |
| Mean | 184 | 149 | 139 | 93.6 | 94.8 | 268 | 666 | 636 | 1,015 | 991 | 386 | 686 |
| Max | 216 | 163 | 160 | 102 | 95 | 449 | 1,300 | 1,060 | 1,450 | 2,060 | 469 | 2,130 |
| Min | 144 | 128 | 104 | 93 | 94 | 95 | 329 | 517 | 534 | 434 | 318 | 310 |
| Cfsm | 0.135 | 0.110 | 0.102 | 0.069 | 0.070 | 0.197 | 0.490 | 0.468 | 0.746 | 0.729 | 0.284 | 0.504 |
| In. | 0.16 | 0.12 | 0.12 | 0.08 | 0.08 | 0.23 | 0.55 | 0.54 | 0.83 | 0.84 | 0.33 | 0.56 |

Cal yr 1967: Total 227,555 Mean 623 Max 5,290 Min 104 Cfsm 0.458 In. 6.22
Wtr yr 1968: Total 161,884 Mean 442 Max 2,130 Min 93 Cfsm 0.325 In. 4.43

GPO 817-490-9

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 1968. Prior to October 1931 published as "at Coon Rapids, near Anoka".

Gage.--Digital 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. June 14, 1932 to June 1, 1964 graphic water-stage recorder at present site and datum.

Average discharge.--37 years, 7,044 cfs.

Extremes.--Maximum discharge during year, 20,900 cfs June 16 (gage height, 7.38 ft); minimum 641 cfs Nov. 28 (gage height, 0.13 ft).
1931-68: Maximum discharge, 91,000 cfs Apr. 17, 1965 (gage height, 19.53 ft); minimum, 586 cfs Sept. 13, 1934 (gage height, 0.37 ft); minimum gage height, that of Nov. 28, 1967.

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. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2,500 | 2,370 | 2,180 | 2,000 | 2,850 | 2,220 | 5,730 | 14,300 | 8,320 | 14,700 | 6,800 | 3,010 |
| 2 | 2,480 | 3,140 | 2,400 | 2,020 | 2,800 | 2,250 | 5,520 | 13,500 | 8,330 | 13,600 | 6,630 | 3,070 |
| 3 | 2,310 | 2,980 | 2,780 | 1,700 | 2,700 | 2,300 | 5,140 | 12,800 | 8,080 | 12,500 | 6,010 | 2,690 |
| 4 | 2,560 | 3,240 | 2,940 | 2,000 | 2,650 | 2,400 | 5,330 | 11,500 | 8,510 | 12,100 | 5,260 | 2,930 |
| 5 | 2,290 | 3,140 | 2,810 | 2,080 | 2,650 | 2,600 | 6,020 | 10,400 | 8,150 | 12,200 | 5,290 | 3,240 |
| 6 | 2,290 | 2,890 | 2,840 | 2,100 | 2,750 | 2,500 | 5,150 | 9,300 | 7,880 | 12,600 | 5,440 | 3,060 |
| 7 | 2,310 | 2,920 | 3,180 | 2,150 | 2,750 | 3,000 | 5,080 | 8,940 | 8,580 | 11,900 | 5,320 | 3,080 |
| 8 | 2,560 | 2,710 | 3,090 | 2,180 | 2,800 | 3,100 | 5,620 | 8,780 | 7,460 | 11,300 | 5,510 | 2,940 |
| 9 | 2,960 | 2,330 | 3,080 | 2,200 | 2,800 | 3,400 | 6,260 | 8,610 | 8,060 | 11,300 | 5,220 | 3,200 |
| 10 | 2,950 | 2,990 | 3,000 | 2,200 | 2,900 | 4,000 | 6,490 | 8,870 | 9,280 | 10,100 | 4,990 | 3,530 |
| 11 | 2,970 | 3,260 | 3,090 | 2,220 | 2,500 | 4,700 | 7,400 | 8,660 | 12,600 | 8,900 | 4,840 | 3,410 |
| 12 | 2,610 | 2,650 | 2,880 | 2,250 | 2,700 | 4,700 | 8,300 | 8,370 | 16,000 | 8,350 | 4,460 | 3,060 |
| 13 | 2,850 | 3,230 | 2,700 | 2,280 | 3,100 | 5,000 | 8,130 | 8,790 | 18,000 | 8,940 | 4,440 | 2,760 |
| 14 | 2,490 | 3,260 | 2,520 | 2,300 | 2,600 | 5,000 | 7,860 | 9,080 | 19,700 | 9,140 | 4,230 | 2,710 |
| 15 | 2,890 | 2,980 | 2,410 | 2,300 | 2,300 | 5,000 | 8,180 | 9,110 | 20,400 | 10,800 | 4,330 | 2,540 |
| 16 | 2,760 | 2,830 | 2,120 | 2,320 | 2,100 | 5,000 | 8,060 | 9,280 | 20,600 | 11,100 | 4,240 | 2,830 |
| 17 | 2,890 | 2,690 | 2,220 | 2,380 | 2,000 | 5,500 | 8,020 | 8,940 | 20,100 | 11,300 | 4,270 | 3,300 |
| 18 | 3,050 | 2,890 | 2,700 | 2,400 | 1,900 | 5,800 | 7,640 | 8,710 | 20,300 | 11,200 | 4,090 | 3,590 |
| 19 | 3,510 | 3,100 | 2,900 | 2,420 | 2,100 | 6,190 | 7,720 | 9,250 | 19,100 | 12,400 | 3,860 | 4,130 |
| 20 | 2,810 | 3,190 | 2,900 | 2,450 | 2,050 | 6,190 | 7,740 | 9,630 | 17,700 | 12,300 | 3,590 | 4,100 |
| 21 | 2,190 | 3,080 | 2,700 | 2,500 | 2,080 | 6,380 | 8,640 | 8,970 | 17,600 | 11,800 | 3,580 | 4,160 |
| 22 | 2,630 | 2,860 | 2,000 | 2,500 | 2,080 | 5,830 | 9,110 | 8,860 | 17,400 | 11,700 | 3,660 | 3,880 |
| 23 | 2,680 | 2,910 | 1,800 | 2,550 | 2,090 | 5,380 | 10,600 | 8,840 | 17,100 | 10,600 | 3,830 | 5,500 |
| 24 | 3,450 | 2,600 | 2,100 | 2,550 | 2,100 | 6,320 | 12,400 | 9,260 | 16,800 | 10,000 | 3,580 | 7,060 |
| 25 | 3,010 | 2,630 | 2,400 | 2,600 | 2,120 | 6,580 | 12,400 | 8,800 | 16,000 | 9,130 | 3,360 | 7,340 |
| 26 | 2,840 | 2,510 | 2,900 | 2,700 | 2,150 | 6,010 | 13,600 | 8,010 | 15,100 | 8,810 | 3,150 | 7,570 |
| 27 | 2,990 | 1,810 | 2,600 | 2,700 | 2,150 | 5,980 | 14,400 | 7,460 | 14,900 | 8,410 | 2,530 | 8,130 |
| 28 | 2,750 | 1,730 | 2,400 | 2,700 | 2,150 | 5,950 | 14,700 | 7,560 | 14,100 | 7,630 | 2,480 | 7,810 |
| 29 | 2,990 | 1,400 | 2,600 | 2,800 | 2,150 | 5,920 | 15,000 | 7,610 | 13,600 | 7,480 | 2,660 | 7,780 |
| 30 | 2,960 | 1,600 | 2,400 | 2,700 | ------ | 6,030 | 15,100 | 7,620 | 13,700 | 7,140 | 2,720 | 7,840 |
| 31 | 2,820 | ------ | 2,000 | 2,900 | ------ | 5,900 | ------ | 7,600 | ------ | 6,870 | 2,810 | ------ |
| TOTAL | 85,350 | 82,580 | 80,640 | 73,150 | 70,070 | 147,130 | 261,340 | 287,410 | 423,450 | 326,300 | 133,180 | 130,250 |
| MEAN | 2,753 | 2,753 | 2,601 | 2,360 | 2,416 | 4,746 | 8,711 | 9,271 | 14,120 | 10,530 | 4,296 | 4,342 |
| MAX | 3,510 | 3,290 | 3,180 | 2,900 | 3,100 | 6,580 | 15,100 | 14,300 | 20,600 | 14,700 | 6,800 | 8,130 |
| MIN | 2,190 | 1,400 | 1,800 | 1,700 | 1,900 | 2,220 | 5,080 | 7,460 | 7,460 | 6,870 | 2,480 | 2,540 |
| CFSM | .14 | .14 | .14 | .12 | .13 | .25 | .46 | .49 | .74 | .55 | .22 | .23 |
| IN. | .17 | .16 | .16 | .14 | .14 | .29 | .51 | .56 | .82 | .64 | .26 | .25 |

CAL YR 1967 TOTAL 2,696,750 MEAN 7,388 MAX 40,600 MIN 1,400 CFSM .39 IN 5.25
WTR YR 1968 TOTAL 2,100,850 MEAN 5,740 MAX 20,600 MIN 1,400 CFSM .30 IN 4.09

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, 7⅛ miles downstream from Jorgenson River, and 8 miles upstream from Big Stone Lake.

Drainage area.--447 sq mi.

Records available.--October 1939 to September 1968.

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. April 13 to Aug. 27, 1940, staff gage at present site and datum.

Average discharge.--29 years, 45.8 cfs (33,160 acre-ft per year).

Extremes.--Maximum discharge during year, 152 cfs May 9 (gage height, 3.55 ft); no flow Jan. 3-13.
1939-68: Maximum discharge, 4,730 cfs Apr. 8, 1952 (gage height, 12.16 ft); maximum gage height, 13.35 ft Mar. 25, 1943, from floodmark (backwater from ice); no flow at times in 1940, 1942, 1950, 1954, 1957, 1959, 1963, 1968.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.4 | 1.1 | 1.1 | 0.1 | 0.7 | 0.3 | 6.1 | 56 | 24 | 5.6 | 0.4 | 0.5 |
| 2 | .4 | 1.2 | 1.1 | .1 | .7 | .3 | 5.4 | 48 | 25 | 5.6 | .4 | .5 |
| 3 | .4 | 1.2 | 1.1 | 0 | .7 | .3 | 6.6 | 41 | 20 | 8.8 | .4 | .4 |
| 4 | .4 | 1.2 | 1.1 | 0 | .7 | .3 | 5.8 | 33 | 14 | 7.6 | .4 | .4 |
| 5 | .4 | 1.1 | 1.1 | 0 | .7 | .3 | 4.6 | 28 | 11 | 6.4 | .3 | .4 |
| 6 | .4 | 1.0 | 1.1 | 0 | .7 | .3 | 4.8 | 26 | 9.2 | 5.2 | .3 | .4 |
| 7 | .5 | 1.0 | 1.1 | 0 | .7 | .3 | 6.6 | 32 | 9.2 | 4.4 | .3 | .4 |
| 8 | .6 | 1.0 | 1.1 | 0 | .7 | .3 | 12 | 86 | 28 | 3.7 | .3 | .5 |
| 9 | .7 | 1.0 | 1.1 | 0 | .7 | .3 | 25 | 134 | 44 | 2.9 | .3 | .5 |
| 10 | .8 | 1.1 | 1.0 | 0 | .7 | .3 | 37 | 145 | 41 | 2.2 | .3 | .4 |
| 11 | .7 | 1.1 | 1.0 | 0 | .6 | .3 | 26 | 131 | 32 | 1.6 | .3 | .4 |
| 12 | .7 | 1.2 | 1.0 | 0 | .6 | .3 | 20 | 112 | 22 | 1.4 | .3 | .4 |
| 13 | .8 | 1.3 | .9 | 0 | .5 | .3 | 17 | 91 | 18 | 1.1 | .3 | .4 |
| 14 | .8 | 1.4 | .8 | .1 | .5 | .4 | 16 | 77 | 16 | .9 | .3 | .4 |
| 15 | .8 | 1.4 | .7 | .1 | .4 | .5 | 13 | 66 | 14 | .7 | .7 | .3 |
| 16 | .8 | 1.4 | .7 | .1 | .4 | .6 | 13 | 58 | 14 | .5 | .8 | .8 |
| 17 | .8 | 1.4 | .6 | .2 | .3 | .7 | 13 | 50 | 12 | .6 | .5 | .9 |
| 18 | .8 | 1.4 | .5 | .3 | .3 | .8 | 12 | 44 | 12 | .5 | .5 | .8 |
| 19 | .8 | 1.3 | .5 | .4 | .3 | 1.0 | 11 | 40 | 12 | .4 | .5 | 1.0 |
| 20 | .8 | 1.3 | .4 | .6 | .3 | 1.2 | 12 | 37 | 20 | .3 | .5 | .8 |
| 21 | .8 | 1.3 | .4 | .7 | .3 | 1.5 | 15 | 34 | 13 | .3 | .4 | .9 |
| 22 | 1.0 | 1.3 | .4 | .7 | .3 | 2.0 | 36 | 32 | 9.5 | .3 | .4 | 4.1 |
| 23 | 1.0 | 1.2 | .3 | .8 | .3 | 3.0 | 78 | 30 | 8.5 | .3 | .4 | 1.5 |
| 24 | 1.1 | 1.1 | .3 | .8 | .3 | 4.5 | 91 | 26 | 7.6 | .3 | .3 | .7 |
| 25 | 1.0 | 1.1 | .3 | .8 | .3 | 6.6 | 74 | 23 | 7.9 | .3 | .3 | .4 |
| 26 | 1.0 | 1.1 | .3 | .8 | .3 | 7.2 | 72 | 20 | 7.1 | 1.7 | .4 | .4 |
| 27 | 1.0 | 1.1 | .2 | .7 | .3 | 7.8 | 72 | 17 | 7.6 | 1.2 | .4 | .4 |
| 28 | 1.1 | 1.1 | .2 | .7 | .3 | 8.4 | 71 | 17 | 8.2 | .5 | .4 | .4 |
| 29 | 1.1 | 1.1 | .2 | .7 | .3 | 9.0 | 70 | 16 | 7.1 | .4 | .5 | .4 |
| 30 | 1.1 | 1.1 | .2 | .7 | ------- | 10 | 61 | 17 | 6.6 | .4 | 1.6 | .4 |
| 31 | 1.1 | ------- | .1 | .7 | ------- | 7.6 | ------ | 24 | ------- | .4 | .8 | ------ |
| Total | 24.1 | 35.6 | 20.9 | 10.1 | 13.9 | 76.7 | 906.9 | 1,591 | 480.5 | 66.5 | 14.0 | 20.2 |
| Mean | 0.78 | 1.19 | 0.67 | 0.33 | 0.48 | 2.47 | 30.2 | 51.3 | 16.0 | 2.14 | 0.45 | 0.67 |
| Max | 1.1 | 1.4 | 1.1 | 0.8 | 0.7 | 10 | 91 | 145 | 44 | 8.8 | 1.6 | 4.1 |
| Min | 0.4 | 1.0 | 0.1 | 0 | 0.3 | 0.3 | 4.6 | 16 | 6.6 | 0.3 | 0.3 | 0.3 |
| Cfsm | 0.0017 | 0.0027 | 0.0015 | 0.00074 | 0.0011 | 0.0055 | 0.068 | 0.115 | 0.036 | 0.0048 | 0.0010 | 0.0015 |
| In. | 0.002 | 0.003 | 0.002 | 0.0008 | 0.001 | 0.006 | 0.08 | 0.13 | 0.04 | 0.006 | 0.001 | 0.002 |
| Ac-ft | 48 | 71 | 41 | 20 | 28 | 152 | 1,800 | 3,200 | 953 | 132 | 28 | 40 |

Cal yr 1967: Total 10,844.3 Mean 29.7 Max 350 Min 0.01 Cfsm 0.066 In. 0.90 Ac-ft 21,510
Wtr yr 1968: Total 3,260.4 Mean 8.91 Max 145 Min 0 Cfsm 0.020 In. 0.27 Ac-ft 6,470

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

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 1968. 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.--37 years (1931-68), 44.3 cfs (32,070 acre-ft per year).

Extremes.--Maximum discharge during year, 153 cfs Apr. 24 (gage height, 3.67 ft); maximum gage height, 4.12 ft Mar. 11 (backwater from ice); minimum daily discharge, 0.2 cfs Jan. 4-20; minimum observed gage height, 1.73 ft Jan. 9.

1910-12, 1931-68: 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 good except those for winter months, which are fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.7 | 4.4 | 5.1 | 0.3 | 1.3 | 2.9 | 6.6 | 23 | 9.2 | 5.1 | 3.4 | 2.8 |
| 2 | 1.8 | 4.4 | 5.0 | .3 | 1.6 | 3.8 | 6.6 | 21 | 7.5 | 5.4 | 3.0 | 2.8 |
| 3 | 1.8 | 4.3 | 4.9 | .3 | 1.8 | 4.5 | 8.2 | 17 | 6.4 | 4.8 | 3.0 | 2.6 |
| 4 | 1.9 | 4.4 | 4.8 | .2 | 2.0 | 5.4 | 8.2 | 15 | 5.6 | 4.4 | 2.8 | 2.2 |
| 5 | 2.0 | 4.4 | 4.5 | .2 | 2.1 | 6.6 | 11 | 15 | 5.1 | 4.1 | 2.7 | 2.2 |
| 6 | 2.2 | 4.6 | 4.4 | .2 | 2.1 | 7.7 | 9.6 | 15 | 4.6 | 3.8 | 2.6 | 2.2 |
| 7 | 2.8 | 4.6 | 4.3 | .2 | 2.2 | 8.5 | 9.9 | 18 | 4.8 | 3.5 | 2.6 | 2.0 |
| 8 | 3.0 | 4.8 | 4.2 | .2 | 2.2 | 9.1 | 12 | 21 | 34 | 3.5 | 2.3 | 2.3 |
| 9 | 3.0 | 4.8 | 4.1 | .2 | 2.3 | 9.4 | 16 | 34 | 34 | 3.2 | 2.3 | 2.7 |
| 10 | 3.2 | 4.8 | 4.0 | .2 | 2.3 | 9.7 | 21 | 34 | 20 | 3.1 | 2.3 | 2.6 |
| 11 | 3.0 | 5.1 | 3.9 | .2 | 2.3 | 9.7 | 19 | 31 | 14 | 2.8 | 2.2 | 2.6 |
| 12 | 3.0 | 5.4 | 3.8 | .2 | 2.3 | 9.8 | 16 | 27 | 11 | 3.0 | 2.2 | 2.5 |
| 13 | 3.0 | 4.9 | 3.6 | .2 | 2.3 | 10 | 14 | 23 | 9.6 | 3.0 | 2.2 | 2.2 |
| 14 | 3.5 | 5.3 | 3.5 | .2 | 2.4 | 10 | 12 | 21 | 7.5 | 3.1 | 2.2 | 2.2 |
| 15 | 3.6 | 5.6 | 3.2 | .2 | 2.4 | 11 | 9.2 | 19 | 6.4 | 3.1 | 2.5 | 2.3 |
| 16 | 3.9 | 5.4 | 3.0 | .2 | 2.4 | 12 | 7.2 | 17 | 6.0 | 2.8 | 2.8 | 3.1 |
| 17 | 4.1 | 5.3 | 2.7 | .2 | 2.5 | 12 | 6.2 | 16 | 5.4 | 3.4 | 2.3 | 3.2 |
| 18 | 4.4 | 5.4 | 2.5 | .2 | 2.5 | 12 | 5.4 | 15 | 5.3 | 3.2 | 2.1 | 3.4 |
| 19 | 4.1 | 5.8 | 2.2 | .2 | 2.5 | 13 | 4.9 | 15 | 4.9 | 2.8 | 2.3 | 3.5 |
| 20 | 3.8 | 5.4 | 2.0 | .2 | 2.5 | 12 | 5.8 | 13 | 4.9 | 2.8 | 2.1 | 3.5 |
| 21 | 4.1 | 5.6 | 1.8 | .3 | 2.5 | 12 | 6.4 | 12 | 5.4 | 2.8 | 2.0 | 3.2 |
| 22 | 4.1 | 5.4 | 1.7 | .3 | 2.5 | 12 | 20 | 9.9 | 5.8 | 2.7 | 1.8 | 3.6 |
| 23 | 4.3 | 5.4 | 1.5 | .3 | 2.5 | 12 | 73 | 9.2 | 6.0 | 2.6 | 1.8 | 3.6 |
| 24 | 4.3 | 5.3 | 1.4 | .3 | 2.5 | 13 | 140 | 8.8 | 5.3 | 2.6 | 1.6 | 3.2 |
| 25 | 4.3 | 5.1 | 1.2 | .3 | 2.6 | 15 | 94 | 6.9 | 5.8 | 2.8 | 1.7 | 3.4 |
| 26 | 4.1 | 5.3 | 1.1 | .3 | 2.6 | 16 | 56 | 8.2 | 5.8 | 18 | 1.6 | 3.1 |
| 27 | 4.3 | 5.1 | .7 | .4 | 2.7 | 17 | 41 | 7.8 | 5.8 | 12 | 1.7 | 2.8 |
| 28 | 4.3 | 5.3 | .6 | .5 | 2.7 | 18 | 32 | 9.6 | 5.3 | 5.6 | 1.7 | 2.6 |
| 29 | 4.4 | 5.2 | .5 | .7 | 2.8 | 17 | 28 | 9.2 | 4.9 | 4.1 | 1.7 | 2.0 |
| 30 | 4.6 | 5.1 | .4 | .9 | ------ | 14 | 24 | 8.5 | 5.1 | 3.8 | 3.4 | 1.8 |
| 31 | 4.3 | ------ | .3 | 1.1 | ------ | 8.5 | ------ | 9.6 | ------ | 3.6 | 3.0 | ------ |
| Total | 106.9 | 151.9 | 86.9 | 9.7 | 67.4 | 333.6 | 723.2 | 509.7 | 261.4 | 131.5 | 71.9 | 82.2 |
| Mean | 3.45 | 5.06 | 2.80 | 0.31 | 2.32 | 10.8 | 24.1 | 16.4 | 8.71 | 4.24 | 2.32 | 2.74 |
| Max | 4.6 | 5.8 | 5.1 | 1.1 | 2.8 | 18 | 140 | 34 | 34 | 18 | 3.4 | 3.6 |
| Min | 1.7 | 4.3 | 0.3 | 0.2 | 1.3 | 2.9 | 4.9 | 6.9 | 4.6 | 2.6 | 1.6 | 1.8 |
| Cfsm | 0.0089 | 0.013 | 0.0072 | 0.00080 | 0.0060 | 0.028 | 0.062 | 0.042 | 0.022 | 0.011 | 0.0060 | 0.0070 |
| In. | 0.01 | 0.01 | 0.008 | 0.0009 | 0.006 | 0.03 | 0.07 | 0.05 | 0.02 | 0.01 | 0.007 | 0.008 |
| Ac-ft | 212 | 301 | 172 | 19 | 134 | 662 | 1,430 | 1,010 | 518 | 261 | 143 | 163 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 9,353.8 | Mean | 25.6 | Max | 420 | Min | 0.3 | Cfsm | 0.066 | In. | 0.89 | Ac-ft | 18,550 |
| Wtr yr 1968: | Total | 2,536.3 | Mean | 6.93 | Max | 140 | Min | 0.2 | Cfsm | 0.018 | In. | 0.24 | Ac-ft | 5,030 |

Note.--Peak discharge (base, 200 cfs). No peak above base.

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

Location.--Lat 45°18'18", long 96°26'57", in NW¼SW¼ sec.9, T.121 N., R.46 W., at powerplant intake at west edge of Ortonville, half mile north of concrete dam at outlet, half a mile southwest of Ortonville.

Records available.--March 1937 to September 1968.

Gage.--Wire-weight gage read once a day. Datum of gage is 957.69 ft above mean sea level, datum of 1929. Prior to Sept. 17, 1947, staff gage at site ½ mile south at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site ½ mile south at same datum. Sept. 21, 1959, to June 30, 1963, supplementary wire-weight gage read once daily, at present site and datum.

Extremes.--Maximum gage height observed during year, 7.62 ft June 11; minimum observed, 6.00 ft Oct. 28.
1937-68: Maximum gage height, 12.73 ft Apr. 17, 1952; minimum observed, 2.20 ft Nov. 20, 1940.

Remarks.--Reservoir is formed by natural lake with concrete dam at outlet. Fixed crest of dam is at elevation 963.64 ft, with one 5-foot gate and two 2½-foot gates with lowest sill at elevation 958.40 ft (all elevations are referred to datum of 1929). Changes in gate openings are not made.
Silt barrier dam 700 ft upstream in outlet channel of lake completed July 7, 1958; crest elevation 963.6 ft. Supplementary wire-weight gage readings used for stages below crest of silt barrier to June 30, 1963. Water level subject to fluctuation caused by wind action.

Gage height, in feet, October 1967 to September 1968

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oct. | 31 | 6.15 | Feb. | 29 | 6.32 | June | 30 | 7.20 |
| Nov. | 30 | 6.15 | Mar. | 31 | 6.66 | July | 31 | 7.20 |
| Dec. | 31 | 6.25 | Apr. | 30 | 7.08 | Aug. | 31 | 6.32 |
| Jan. | 31 | 6.30 | May | 31 | 7.14 | Sept. | 30 | 6.16 |

Note.--Gage-height record other than that 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 1968.

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.--30 years, 111 cfs (80,360 acre-ft per year).

Extremes.--Maximum discharge during year, 248 cfs Apr. 23 (gage height, 4.91 ft); minimum, 1.2 cfs Sept. 27 (gage height, 1.14 ft).
1938-68: Maximum discharge, 3,060 cfs Apr. 13, 1952 (gage height, 12.92 ft); no flow Dec. 13, 1940.

Remarks.--Records fair. Flow affected by natural storage in Big Stone Lake (see preceding page). Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 4.6 | 5.5 | 3.3 | 3.0 | 3.4 | 11 | 12 | 35 | 42 | 26 | 14 |
| 2 | 15 | 4.6 | 5.5 | 3.2 | 3.0 | 3.6 | 8.8 | 13 | 28 | 26 | 26 | 13 |
| 3 | 13 | 4.5 | 5.6 | 3.2 | 3.0 | 3.8 | 15 | 20 | 27 | 25 | 27 | 14 |
| 4 | 13 | 4.2 | 5.6 | 3.1 | 3.0 | 4.0 | 28 | 15 | 25 | 25 | 26 | 14 |
| 5 | 12 | 4.4 | 5.6 | 3.1 | 3.0 | 4.2 | 9.4 | 12 | 23 | 25 | 26 | 13 |
| 6 | 10 | 4.5 | 5.5 | 3.0 | 3.0 | 4.6 | 11 | 11 | 23 | 25 | 25 | 13 |
| 7 | 12 | 4.3 | 5.5 | 3.0 | 3.0 | 4.7 | 18 | 14 | 23 | 25 | 25 | 13 |
| 8 | 11 | 5.2 | 5.5 | 3.0 | 3.0 | 4.9 | 29 | 25 | 25 | 27 | 24 | 20 |
| 9 | 10 | 4.9 | 5.5 | 3.0 | 3.0 | 5.1 | 14 | 20 | 23 | 25 | 23 | 18 |
| 10 | 9.1 | 5.1 | 5.5 | 3.0 | 3.0 | 5.2 | 12 | 17 | 23 | 24 | 23 | 12 |
| 11 | 8.5 | 6.1 | 5.5 | 3.0 | 3.0 | 5.2 | 12 | 19 | 31 | 23 | 22 | 9.9 |
| 12 | 8.4 | 5.7 | 5.5 | 3.0 | 3.0 | 5.1 | 17 | 19 | 24 | 22 | 23 | 7.7 |
| 13 | 8.4 | 5.4 | 5.5 | 3.0 | 3.0 | 5.1 | 14 | 21 | 26 | 22 | 24 | 8.6 |
| 14 | 7.4 | 5.4 | 5.4 | 3.0 | 3.0 | 5.6 | 15 | 30 | 27 | 22 | 21 | 6.4 |
| 15 | 7.9 | 5.4 | 5.3 | 3.0 | 3.0 | 5.7 | 13 | 39 | 21 | 22 | 21 | 3.5 |
| 16 | 7.6 | 5.8 | 5.0 | 3.0 | 3.0 | 6.1 | 15 | 69 | 23 | 23 | 24 | 5.4 |
| 17 | 8.2 | 6.5 | 5.0 | 3.0 | 3.0 | 6.5 | 15 | 31 | 23 | 26 | 26 | 6.4 |
| 18 | 6.6 | 4.7 | 5.1 | 3.0 | 3.0 | 7.0 | 13 | 47 | 23 | 26 | 25 | 7.0 |
| 19 | 6.4 | 4.3 | 5.1 | 3.0 | 3.0 | 7.6 | 11 | 49 | 22 | 25 | 23 | 5.1 |
| 20 | 7.5 | 4.4 | 5.0 | 3.0 | 3.0 | 8.5 | 16 | 31 | 22 | 23 | 18 | 4.8 |
| 21 | 5.6 | 5.4 | 4.7 | 3.0 | 3.0 | 9.1 | 16 | 30 | 27 | 27 | 18 | 3.8 |
| 22 | 6.4 | 5.1 | 4.5 | 3.0 | 3.0 | 9.8 | 31 | 29 | 21 | 25 | 19 | 4.8 |
| 23 | 6.9 | 5.1 | 4.2 | 3.0 | 3.0 | 10 | 92 | 30 | 22 | 25 | 18 | 4.4 |
| 24 | 7.8 | 5.2 | 4.2 | 3.0 | 3.0 | 11 | 22 | 30 | 21 | 25 | 25 | 5.6 |
| 25 | 6.0 | 5.2 | 4.2 | 3.0 | 3.1 | 10 | 13 | 31 | 22 | 25 | 14 | 3.4 |
| 26 | 5.0 | 5.4 | 4.0 | 3.0 | 3.2 | 10 | 13 | 32 | 22 | 28 | 13 | 2.2 |
| 27 | 5.2 | 5.5 | 3.8 | 3.0 | 3.2 | 11 | 14 | 34 | 22 | 27 | 12 | 3.1 |
| 28 | 3.8 | 5.5 | 3.6 | 3.0 | 3.2 | 11 | 14 | 35 | 21 | 25 | 12 | 5.9 |
| 29 | 4.5 | 5.5 | 3.6 | 3.0 | 3.3 | 11 | 14 | 32 | 25 | 24 | 12 | 5.8 |
| 30 | 4.4 | 5.5 | 3.6 | 3.0 | ------ | 13 | 13 | 31 | 32 | 25 | 13 | 5.3 |
| 31 | 4.4 | ------ | 3.4 | 3.0 | ------ | 19 | ------ | 30 | ------ | 27 | 14 | ------ |
| TOTAL | 255.0 | 153.4 | 151.5 | 93.9 | 88.0 | 230.8 | 539.2 | 858 | 732 | 786 | 648 | 253.1 |
| MEAN | 8.23 | 5.11 | 4.89 | 3.03 | 3.03 | 7.45 | 18.0 | 27.7 | 24.4 | 25.4 | 20.9 | 8.44 |
| MAX | 15 | 6.5 | 5.6 | 3.3 | 3.3 | 19 | 92 | 69 | 35 | 42 | 27 | 20 |
| MIN | 3.8 | 4.2 | 3.4 | 3.0 | 3.0 | 3.4 | 8.8 | 11 | 21 | 22 | 12 | 2.2 |
| AC-FT | 506 | 304 | 301 | 186 | 175 | 458 | 1,070 | 1,700 | 1,450 | 1,560 | 1,290 | 502 |

CAL YR 1967 TOTAL 26,892.9 MEAN 73.7 MAX 639 MIN 3.4 AC-FT 53,340
WTR YR 1968 TOTAL 4,788.9 MEAN 13.1 MAX 92 MIN 2.2 AC-FT 9,500

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 1968.

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.--29 years, 54.6 cfs (39,530 acre-ft per year).

Extremes.--Maximum discharge during year, 211 cfs July 26 (gage height, 3.78 ft); minimum, 0.3 cfs Jan. 6-25; minimum gage height, 1.70 ft Aug. 28, Sept. 6, 7.
1939-68: 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, Feb. 11 to Mar. 9, 1965.

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

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.8 | 3.7 | 2.7 | 0.7 | 0.5 | 0.5 | 17 | 29 | 12 | 9.8 | 13 | 1.8 |
| 2 | .8 | 3.3 | 2.7 | .7 | .5 | .5 | 14 | 26 | 11 | 8.5 | 9.8 | 1.4 |
| 3 | .9 | 3.3 | 2.6 | .6 | .5 | .5 | 11 | 22 | 10 | 7.2 | 7.8 | 1.4 |
| 4 | 1.1 | 3.3 | 2.6 | .5 | .5 | .5 | 12 | 20 | 14 | 6.8 | 7.2 | 1.4 |
| 5 | 1.0 | 3.1 | 2.5 | .4 | .5 | .5 | 14 | 18 | 13 | 6.0 | 6.2 | 1.2 |
| 6 | .9 | 3.1 | 2.5 | .3 | .5 | .5 | 17 | 18 | 11 | 5.5 | 5.5 | 1.1 |
| 7 | 1.5 | 3.1 | 2.5 | .3 | .5 | .5 | 21 | 20 | 9.8 | 5.2 | 4.8 | 1.4 |
| 8 | 2.0 | 3.3 | 2.5 | .3 | .5 | .5 | 28 | 19 | 26 | 4.8 | 4.5 | 2.4 |
| 9 | 2.5 | 3.5 | 2.5 | .3 | .5 | .5 | 40 | 19 | 16 | 4.2 | 3.8 | 2.4 |
| 10 | 2.9 | 3.7 | 2.5 | .3 | .5 | .5 | 56 | 19 | 12 | 3.8 | 3.4 | 2.0 |
| 11 | 3.1 | 3.5 | 2.5 | .3 | .5 | .6 | 46 | 22 | 11 | 3.6 | 3.2 | 1.6 |
| 12 | 3.3 | 3.3 | 2.5 | .3 | .5 | .7 | 39 | 22 | 10 | 3.8 | 2.8 | 1.2 |
| 13 | 3.5 | 3.3 | 2.4 | .3 | .5 | .7 | 33 | 23 | 11 | 3.6 | 2.6 | 1.2 |
| 14 | 3.3 | 3.3 | 2.2 | .3 | .5 | .8 | 28 | 23 | 9.3 | 3.6 | 2.4 | 1.4 |
| 15 | 3.3 | 3.3 | 2.1 | .3 | .5 | .8 | 25 | 20 | 8.5 | 3.4 | 2.6 | 1.4 |
| 16 | 3.3 | 3.7 | 2.0 | .3 | .5 | 1.0 | 19 | 18 | 7.8 | 3.0 | 2.4 | 2.4 |
| 17 | 3.3 | 3.7 | 1.9 | .3 | .5 | 1.5 | 18 | 16 | 7.5 | 3.2 | 2.0 | 2.8 |
| 18 | 3.3 | 3.7 | 1.8 | .3 | .5 | 3.0 | 17 | 16 | 7.2 | 3.4 | 2.4 | 3.0 |
| 19 | 3.1 | 3.7 | 1.7 | .3 | .5 | 6.0 | 17 | 16 | 6.8 | 3.0 | 2.4 | 3.0 |
| 20 | 3.1 | 3.7 | 1.6 | .3 | .5 | 7.6 | 19 | 15 | 6.2 | 3.6 | 2.0 | 3.0 |
| 21 | 3.3 | 3.7 | 1.5 | .3 | .5 | 10 | 20 | 15 | 8.1 | 3.2 | 2.0 | 3.0 |
| 22 | 3.3 | 3.7 | 1.5 | .3 | .5 | 11 | 25 | 14 | 7.5 | 3.2 | 1.8 | 3.0 |
| 23 | 3.5 | 3.6 | 1.4 | .3 | .5 | 12 | 41 | 13 | 7.5 | 3.8 | 1.6 | 2.6 |
| 24 | 3.5 | 3.4 | 1.4 | .3 | .5 | 12 | 62 | 13 | 7.2 | 3.6 | 1.4 | 2.2 |
| 25 | 3.5 | 3.2 | 1.3 | .3 | .5 | 12 | 93 | 12 | 7.0 | 3.8 | 1.4 | 1.6 |
| 26 | 3.5 | 3.1 | 1.3 | .4 | .5 | 12 | 86 | 11 | 7.0 | 102 | 1.4 | 1.2 |
| 27 | 3.7 | 3.0 | 1.2 | .4 | .5 | 12 | 62 | 11 | 7.2 | 27 | 1.2 | 1.2 |
| 28 | 3.7 | 2.8 | 1.1 | .4 | .5 | 12 | 49 | 11 | 7.5 | 12 | 1.1 | 1.0 |
| 29 | 3.9 | 2.8 | 1.0 | .4 | .5 | 13 | 41 | 11 | 7.8 | 38 | 1.4 | .9 |
| 30 | 3.9 | 2.8 | .9 | .4 | ------ | 16 | 35 | 11 | 9.8 | 28 | 2.8 | .7 |
| 31 | 3.9 | ------ | .8 | .4 | ------ | 23 | ------ | 11 | ------ | 18 | 2.4 | ------ |
| Total | 86.7 | 100.7 | 59.7 | 11.3 | 14.5 | 172.7 | 1,005 | 534 | 296.7 | 338.6 | 109.3 | 54.9 |
| Mean | 2.80 | 3.36 | 1.93 | 0.36 | 0.50 | 5.57 | 33.5 | 17.2 | 9.89 | 10.9 | 3.53 | 1.83 |
| Max | 3.9 | 3.7 | 2.7 | 0.7 | 0.5 | 23 | 93 | 29 | 26 | 102 | 13 | 3.0 |
| Min | 0.8 | 2.8 | 0.8 | 0.3 | 0.5 | 0.5 | 11 | 11 | 6.2 | 3.0 | 1.1 | 0.7 |
| Cfsm | 0.0070 | 0.0084 | 0.0048 | 0.00090 | 0.0013 | 0.014 | 0.084 | 0.043 | 0.025 | 0.027 | 0.0089 | 0.0046 |
| In. | 0.008 | 0.009 | 0.006 | 0.001 | 0.001 | 0.02 | 0.09 | 0.05 | 0.03 | 0.03 | 0.01 | 0.005 |
| Ac-ft | 172 | 200 | 118 | 22 | 29 | 343 | 1,990 | 1,060 | 588 | 672 | 217 | 109 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 19,634.8 | Mean | 53.8 | Max | 1,170 | Min. | 0.8 | Cfsm | 0.135 | In. | 1.83 | Ac-ft | 38,950 |
| Wtr yr 1968: | Total | 2,784.1 | Mean | 7.61 | Max | 93 | Min. | 0.3 | Cfsm | 0.019 | In. | 0.26 | Ac-ft | 5,520 |

Peak discharge (base, 300 cfs).--No peak above base.

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 1968. 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.--33 years (1935-68), 97.8 cfs (70,800 acre-ft per year).

Extremes.--Maximum discharge during year, 193 cfs June 21 (gage height, 5.40 ft); minimum daily, 2.8 cfs Jan. 11-17, minimum gage height, 3.75 ft Jan. 15.
1931-68: 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 winter months, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 21 | 25 | 18 | 4.0 | 7.0 | 8.6 | 83 | 96 | 62 | 55 | 20 | 11 |
| 2 | 20 | 24 | 18 | 3.8 | 7.4 | 8.8 | 80 | 87 | 73 | 58 | 18 | 12 |
| 3 | 19 | 24 | 18 | 3.5 | 8.0 | 9.2 | 80 | 76 | 73 | 60 | 18 | 12 |
| 4 | 20 | 24 | 18 | 3.2 | 8.4 | 10 | 83 | 73 | 68 | 58 | 18 | 12 |
| 5 | 20 | 21 | 17 | 3.1 | 8.6 | 12 | 93 | 71 | 65 | 52 | 16 | 11 |
| 6 | 19 | 20 | 17 | 3.0 | 8.9 | 14 | 91 | 71 | 62 | 48 | 21 | 9.9 |
| 7 | 23 | 19 | 17 | 3.0 | 8.9 | 20 | 83 | 70 | 62 | 46 | 18 | 11 |
| 8 | 23 | 20 | 17 | 3.0 | 8.9 | 30 | 87 | 68 | 64 | 43 | 16 | 20 |
| 9 | 28 | 25 | 17 | 2.9 | 8.8 | 29 | 100 | 70 | 71 | 41 | 15 | 24 |
| 10 | 28 | 25 | 16 | 2.9 | 8.8 | 28 | 102 | 75 | 73 | 40 | 14 | 20 |
| 11 | 28 | 24 | 16 | 2.9 | 8.6 | 26 | 91 | 80 | 67 | 40 | 13 | 18 |
| 12 | 27 | 25 | 16 | 2.8 | 8.6 | 26 | 89 | 80 | 67 | 39 | 12 | 14 |
| 13 | 27 | 24 | 15 | 2.8 | 8.6 | 26 | 91 | 76 | 65 | 36 | 12 | 12 |
| 14 | 26 | 26 | 15 | 2.8 | 8.6 | 27 | 93 | 75 | 67 | 34 | 12 | 10 |
| 15 | 25 | 24 | 14 | 2.8 | 8.4 | 28 | 93 | 78 | 68 | 33 | 14 | 9.3 |
| 16 | 24 | 23 | 14 | 2.8 | 8.4 | 29 | 91 | 76 | 67 | 32 | 13 | 12 |
| 17 | 23 | 22 | 13 | 2.8 | 8.4 | 30 | 83 | 83 | 65 | 35 | 14 | 13 |
| 18 | 24 | 24 | 12 | 2.9 | 8.2 | 35 | 82 | 85 | 67 | 37 | 17 | 14 |
| 19 | 22 | 23 | 12 | 3.0 | 8.2 | 50 | 83 | 78 | 67 | 33 | 18 | 15 |
| 20 | 24 | 25 | 12 | 3.1 | 8.2 | 40 | 100 | 76 | 65 | 31 | 18 | 16 |
| 21 | 26 | 27 | 11 | 3.3 | 8.0 | 35 | 114 | 73 | 93 | 29 | 16 | 18 |
| 22 | 25 | 23 | 10 | 3.7 | 8.0 | 50 | 131 | 68 | 70 | 28 | 16 | 18 |
| 23 | 26 | 21 | 9.0 | 4.1 | 8.0 | 80 | 148 | 65 | 70 | 28 | 14 | 20 |
| 24 | 25 | 24 | 9.0 | 4.1 | 8.0 | 90 | 173 | 64 | 70 | 28 | 11 | 25 |
| 25 | 25 | 19 | 9.0 | 4.2 | 8.2 | 120 | 148 | 61 | 68 | 28 | 13 | 22 |
| 26 | 24 | 16 | 8.0 | 4.5 | 8.2 | 105 | 126 | 60 | 70 | 28 | 12 | 20 |
| 27 | 24 | 16 | 7.2 | 5.0 | 8.4 | 99 | 114 | 58 | 67 | 19 | 11 | 17 |
| 28 | 24 | 18 | 6.5 | 6.0 | 8.5 | 98 | 111 | 60 | 62 | 24 | 10 | 15 |
| 29 | 27 | 18 | 6.0 | 6.0 | 8.5 | 93 | 111 | 60 | 60 | 24 | 9.6 | 14 |
| 30 | 26 | 18 | 5.2 | 6.0 | ------ | 87 | 104 | 60 | 58 | 22 | 13 | 14 |
| 31 | 25 | ------ | 4.5 | 6.4 | ------ | 87 | ------ | 64 | ------ | 21 | 12 | ------ |
| Total | 748 | 667 | 397.4 | 114.4 | 241.7 | 1,430.6 | 3,058 | 2,237 | 2,026 | 1,130 | 454.6 | 459.2 |
| Mean | 24.1 | 22.2 | 12.8 | 3.69 | 8.33 | 46.1 | 102 | 72.2 | 67.5 | 36.4 | 14.7 | 15.3 |
| Max | 28 | 27 | 18 | 6.4 | 8.9 | 120 | 173 | 96 | 93 | 60 | 21 | 25 |
| Min | 19 | 16 | 4.5 | 2.8 | 7.0 | 8.6 | 80 | 58 | 58 | 19 | 9.6 | 9.3 |
| Cfsm | 0.027 | 0.024 | 0.014 | 0.0041 | 0.0092 | 0.051 | 0.113 | 0.080 | 0.075 | 0.040 | 0.016 | 0.017 |
| In. | 0.03 | 0.03 | 0.02 | 0.005 | 0.001 | 0.06 | 0.12 | 0.09 | 0.08 | 0.05 | 0.02 | 0.02 |
| Ac-ft | 1,480 | 1,320 | 788 | 227 | 479 | 2,840 | 6,060 | 4,440 | 4,020 | 2,240 | 902 | 911 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr | 1967: | Total | 46,069.4 | Mean | 126 | Max | 1,010 | Min | 4.5 | Cfsm | 0.139 | In. 1.89 | Ac-ft | 91,340 |
| Wtr yr | 1968: | Total | 12,963.9 | Mean | 35.4 | Max | 173 | Min | 2.8 | Cfsm | 0.039 | In. 0.53 | Ac-ft | 25,710 |

Note.--Peak discharge (base, 200 cfs). No peak above base.

## 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 1968 (winter records incomplete prior to 1934). Published as "at Lac qui Parle", 1910-14.

Gage.--Water-stage recorder. Datum of gage is 951.98 ft above mean sea level (Minnesota Highway Department bench mark). Apr. 27, 1910, to Nov. 15, 1914, staff gage at site 2 miles downstream at different datum. Mar. 17, 1931, to Mar. 9, 1937, staff gage at site 40 ft upstream at present datum.

Average discharge.--37 years (1912-13, 1931-32, 1933-68), 113 cfs (81,810 acre-ft per year).

Extremes.--Maximum discharge during year, 241 cfs July 28 (gage height, 2.21 ft); no flow Jan. 3 to Mar. 2. 1910-14, 1931-68: Maximum discharge, 11,100 cfs Apr. 6, 1952 (gage height, 18.18 ft); maximum gage height, 19.37 ft Apr. 9, 1965, from floodmark, backwater from ice; no flow at times in several years.

Remarks.--Records fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.3 | 2.1 | 2.0 | 0.1 | | 0 | 31 | 52 | 21 | 28 | 67 | 1.8 |
| 2 | .3 | 2.1 | 2.0 | .1 | | 0 | 29 | 48 | 20 | 28 | 53 | 1.9 |
| 3 | .2 | 2.0 | 2.0 | .1 | | .1 | 27 | 44 | 20 | 27 | 44 | 1.9 |
| 4 | .2 | 1.9 | 1.9 | 0 | | .8 | 29 | 38 | 22 | 25 | 40 | 1.9 |
| 5 | .3 | 1.9 | 1.9 | 0 | | 2.0 | 31 | 35 | 21 | 22 | 36 | 1.9 |
| 6 | .1 | 2.0 | 1.8 | 0 | | 4.0 | 25 | 33 | 17 | 18 | 30 | 1.9 |
| 7 | .2 | 2.0 | 1.8 | 0 | | 6.5 | 20 | 33 | 16 | 15 | 25 | 1.9 |
| 8 | .1 | 2.0 | 1.8 | 0 | | 7.0 | 16 | 33 | 17 | 12 | 20 | 2.2 |
| 9 | .1 | 2.0 | 1.8 | 0 | | 8.5 | 18 | 33 | 18 | 9.5 | 17 | 2.7 |
| 10 | .3 | 2.0 | 1.7 | 0 | | 9.8 | 25 | 32 | 18 | 7.4 | 12 | 4.9 |
| 11 | .5 | 2.0 | 1.7 | 0 | | 10 | 35 | 32 | 20 | 5.7 | 9.5 | 4.2 |
| 12 | .7 | 2.0 | 1.7 | 0 | | 9.6 | 55 | 32 | 21 | 5.3 | 7.4 | 3.8 |
| 13 | 1.1 | 2.0 | 1.6 | 0 | | 9.4 | 50 | 32 | 28 | 6.1 | 6.1 | 3.8 |
| 14 | 1.2 | 2.0 | 1.5 | 0 | | 9.6 | 45 | 32 | 27 | 10 | 4.9 | 3.8 |
| 15 | 1.4 | 2.0 | 1.4 | 0 | | 10 | 40 | 33 | 22 | 7.9 | 4.5 | 3.6 |
| 16 | 1.5 | 2.0 | 1.3 | 0 | | 11 | 35 | 31 | 18 | 7.4 | 3.6 | 3.3 |
| 17 | 1.6 | 2.0 | 1.3 | 0 | | 13 | 30 | 28 | 15 | 6.1 | 3.0 | 3.1 |
| 18 | 1.6 | 2.0 | 1.2 | 0 | | 14 | 26 | 28 | 13 | 5.7 | 2.7 | 3.4 |
| 19 | 1.6 | 2.0 | 1.0 | 0 | | 15 | 27 | 27 | 12 | 4.9 | 2.5 | 3.4 |
| 20 | 1.7 | 1.9 | 1.0 | 0 | | 16 | 32 | 27 | 9.5 | 4.2 | 2.3 | 3.6 |
| 21 | 1.8 | 1.8 | .8 | 0 | | 16 | 40 | 24 | 19 | 4.5 | 2.1 | 3.6 |
| 22 | 1.6 | 1.9 | .6 | 0 | | 15 | 50 | 23 | 20 | 5.7 | 1.9 | 4.0 |
| 23 | 1.6 | 2.0 | .4 | 0 | | 15 | 60 | 22 | 22 | 12 | 1.8 | 4.5 |
| 24 | 1.7 | 2.0 | .4 | 0 | | 17 | 80 | 19 | 19 | 12 | 1.8 | 5.7 |
| 25 | 1.7 | 2.0 | .3 | 0 | | 19 | 95 | 18 | 22 | 12 | 1.8 | 6.1 |
| 26 | 1.7 | 2.0 | .2 | 0 | | 23 | 119 | 18 | 28 | 18 | 1.8 | 5.7 |
| 27 | 1.7 | 2.0 | .2 | 0 | | 30 | 100 | 18 | 28 | 19 | 1.8 | 5.3 |
| 28 | 1.7 | 1.9 | .1 | 0 | | 35 | 85 | 17 | 25 | 93 | 1.8 | 4.9 |
| 29 | 1.9 | 2.0 | .1 | 0 | | 37 | 70 | 18 | 26 | 185 | 1.8 | 4.2 |
| 30 | 1.9 | 2.0 | .1 | 0 | ------ | 36 | 59 | 18 | 28 | 106 | 1.8 | 4.0 |
| 31 | 2.1 | ------ | .1 | 0 | ------ | 35 | ------ | 19 | ------ | 82 | 1.8 | ------ |
| Total | 34.4 | 59.5 | 35.7 | 0.3 | 0 | 434.3 | 1,384 | 897 | 612.5 | 804.4 | 410.7 | 107.0 |
| Mean | 1.11 | 1.98 | 1.15 | 0.01 | 0 | 14.0 | 46.1 | 28.9 | 20.4 | 25.9 | 13.2 | 3.57 |
| Max | 2.1 | 2.1 | 2.0 | 0.1 | 0 | 37 | 119 | 52 | 28 | 185 | 67 | 6.1 |
| Min | 0.1 | 1.8 | 0.1 | 0 | 0 | 0 | 16 | 17 | 9.5 | 4.2 | 1.8 | 1.8 |
| Cfsm | 0.0011 | 0.0020 | 0.0012 | 0.000010 | 0 | 0.014 | 0.047 | 0.029 | 0.021 | 0.026 | 0.013 | 0.0036 |
| In. | 0.001 | 0.002 | 0.001 | 0.00001 | 0 | 0.02 | 0.05 | 0.03 | 0.02 | 0.03 | 0.02 | 0.004 |
| Ac-ft | 68 | 118 | 71 | 0.6 | 0 | 861 | 2,740 | 1,780 | 1,210 | 1,600 | 815 | 212 |

Cal yr 1967: Total 24,157.3 Mean 66.2 Max 1,240 Min 0.1 Cfsm 0.067 In. 0.91 Ac-ft 47,920
Wtr yr 1968: Total 4,779.8 Mean 13.1 Max 185 Min 0 Cfsm 0.013 In. 0.18 Ac-ft 9,480

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 1968.

Gage.--Digital water-stage recorder. Datum of gage is 900.00 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Oct. 1, 1942 to Nov. 10, 1944, graphic water-stage recorder at same site at datum 0.20 ft lower. Nov. 11, 1944 to Aug. 4, 1967, graphic water-stage recorder at same site and datum.

Average discharge.--26 years, 616 cfs (446,000 acre-ft per year).

Extremes.--Maximum discharge during year, 590 cfs Apr. 18 (gage height, 23.06 ft); minimum daily, 3.7 cfs Oct. 3.
1942-68: 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 winter months, 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.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.8 | 19 | 18 | 18 | 17 | 16 | 145 | 331 | 131 | 296 | 52 | 24 |
| 2 | 3.8 | 19 | 18 | 18 | 17 | 17 | 144 | 284 | 130 | 172 | 52 | 24 |
| 3 | 3.7 | 19 | 18 | 18 | 17 | 17 | 142 | 285 | 130 | 125 | 52 | 24 |
| 4 | 15 | 19 | 18 | 18 | 16 | 17 | 142 | 284 | 129 | 124 | 52 | 24 |
| 5 | 34 | 19 | 18 | 18 | 16 | 17 | 145 | 280 | 130 | 124 | 52 | 25 |
| 6 | 34 | 19 | 18 | 19 | 16 | 18 | 145 | 207 | 129 | 122 | 52 | 25 |
| 7 | 35 | 20 | 18 | 19 | 16 | 18 | 143 | 165 | 129 | 122 | 52 | 25 |
| 8 | 35 | 20 | 18 | 19 | 16 | 18 | 143 | 164 | 129 | 119 | 52 | 25 |
| 9 | 34 | 20 | 18 | 19 | 16 | 18 | 144 | 160 | 129 | 119 | 52 | 25 |
| 10 | 33 | 20 | 18 | 19 | 16 | 18 | 146 | 159 | 129 | 81 | 52 | 23 |
| 11 | 32 | 20 | 18 | 19 | 16 | 18 | 147 | 158 | 129 | 57 | 52 | 24 |
| 12 | 32 | 20 | 18 | 19 | 16 | 18 | 147 | 156 | 129 | 56 | 53 | 24 |
| 13 | 31 | 20 | 18 | 19 | 16 | 18 | 150 | 155 | 129 | 56 | 53 | 23 |
| 14 | 30 | 20 | 18 | 19 | 16 | 18 | 150 | 154 | 129 | 55 | 53 | 24 |
| 15 | 29 | 20 | 18 | 19 | 16 | 18 | 152 | 149 | 129 | 55 | 53 | 24 |
| 16 | 29 | 20 | 18 | 19 | 16 | 19 | 233 | 147 | 130 | 53 | 53 | 24 |
| 17 | 29 | 20 | 18 | 19 | 16 | 19 | 497 | 146 | 130 | 53 | 52 | 24 |
| 18 | 28 | 19 | 18 | 19 | 16 | 19 | 462 | 144 | 129 | 52 | 53 | 24 |
| 19 | 27 | 19 | 18 | 19 | 16 | 90 | 273 | 143 | 130 | 52 | 53 | 24 |
| 20 | 27 | 19 | 18 | 19 | 16 | 300 | 382 | 141 | 130 | 52 | 53 | 24 |
| 21 | 26 | 19 | 18 | 19 | 16 | 260 | 514 | 140 | 132 | 51 | 53 | 24 |
| 22 | 25 | 19 | 18 | 19 | 16 | 165 | 518 | 138 | 133 | 51 | 53 | 24 |
| 23 | 25 | 18 | 18 | 18 | 16 | 151 | 533 | 135 | 132 | 51 | 53 | 24 |
| 24 | 24 | 18 | 18 | 18 | 16 | 150 | 532 | 134 | 132 | 51 | 53 | 24 |
| 25 | 22 | 18 | 18 | 18 | 16 | 149 | 486 | 133 | 188 | 51 | 53 | 24 |
| 26 | 22 | 18 | 18 | 18 | 16 | 149 | 384 | 131 | 299 | 51 | 53 | 24 |
| 27 | 21 | 18 | 18 | 17 | 16 | 149 | 385 | 129 | 298 | 51 | 35 | 24 |
| 28 | 21 | 18 | 18 | 17 | 16 | 150 | 386 | 129 | 297 | 51 | 24 | 24 |
| 29 | 20 | 18 | 18 | 17 | 16 | 148 | 387 | 130 | 295 | 51 | 24 | 24 |
| 30 | 19 | 18 | 18 | 17 | ------ | 147 | 390 | 130 | 294 | 52 | 24 | 24 |
| 31 | 19 | ------ | 18 | 17 | ------ | 145 | ------ | 131 | ------ | 51 | 24 | ------ |
| TOTAL | 769.3 | 573 | 558 | 570 | 467 | 2,474 | 8,547 | 5,272 | 4,789 | 2,507 | 1,497 | 723 |
| MEAN | 24.8 | 19.1 | 18.0 | 18.4 | 16.1 | 79.8 | 285 | 170 | 160 | 80.9 | 48.3 | 24.1 |
| MAX | 35 | 20 | 18 | 19 | 17 | 300 | 533 | 331 | 299 | 296 | 53 | 25 |
| MIN | 3.7 | 18 | 18 | 17 | 16 | 16 | 142 | 129 | 129 | 51 | 24 | 23 |
| AC-FT | 1,530 | 1,140 | 1,110 | 1,130 | 926 | 4,910 | 16,950 | 10,460 | 9,500 | 4,970 | 2,970 | 1,430 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 151,193.9 | MEAN 414 | MAX 3,070 | MIN 3.7 | AC-FT 299,900 |
| WTR YR 1968 | TOTAL 28,746.3 | MEAN 78.5 | MAX 533 | MIN 3.7 | AC-FT 57,020 |

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 1968.

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.--31 years, 242 cfs (175,200 acre-ft per year).

Extremes.--Maximum discharge during year, 283 cfs Apr. 26 (gage height, 2.50 ft); maximum gage height, 3.33 ft Mar. 21 (backwater from ice); minimum daily discharge, 2.2 cfs Jan. 11-18; minimum gage height, 1.22 ft Aug. 29.
1937-68: 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 winter months, which are fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report. Flow regulated by several small lakes above gage.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32 | 40 | 29 | 3.5 | 7.5 | 10 | 134 | 228 | 138 | 125 | 39 | 23 |
| 2 | 30 | 41 | 28 | 3.2 | 9.0 | 9.8 | 127 | 213 | 136 | 123 | 35 | 23 |
| 3 | 30 | 44 | 28 | 3.0 | 11 | 9.8 | 127 | 190 | 141 | 119 | 34 | 24 |
| 4 | 30 | 42 | 28 | 3.0 | 14 | 9.6 | 141 | 180 | 134 | 115 | 39 | 25 |
| 5 | 29 | 31 | 28 | 3.0 | 15 | 9.6 | 161 | 170 | 127 | 108 | 46 | 24 |
| 6 | 30 | 31 | 27 | 2.9 | 16 | 9.6 | 168 | 168 | 117 | 100 | 61 | 21 |
| 7 | 32 | 31 | 27 | 2.8 | 16 | 10 | 183 | 168 | 117 | 91 | 55 | 21 |
| 8 | 40 | 32 | 27 | 2.8 | 16 | 11 | 213 | 166 | 130 | 83 | 49 | 36 |
| 9 | 44 | 36 | 26 | 2.5 | 16 | 17 | 234 | 170 | 134 | 76 | 43 | 47 |
| 10 | 49 | 35 | 26 | 2.3 | 16 | 25 | 225 | 161 | 138 | 71 | 38 | 49 |
| 11 | 47 | 34 | 26 | 2.2 | 15 | 26 | 219 | 156 | 213 | 64 | 33 | 45 |
| 12 | 46 | 34 | 25 | 2.2 | 15 | 30 | 210 | 159 | 202 | 61 | 30 | 38 |
| 13 | 44 | 34 | 25 | 2.2 | 14 | 35 | 199 | 156 | 186 | 60 | 26 | 34 |
| 14 | 44 | 34 | 24 | 2.2 | 13 | 40 | 196 | 156 | 170 | 60 | 25 | 32 |
| 15 | 44 | 33 | 20 | 2.2 | 12 | 42 | 193 | 154 | 193 | 60 | 26 | 30 |
| 16 | 41 | 33 | 19 | 2.2 | 12 | 44 | 188 | 150 | 234 | 60 | 24 | 28 |
| 17 | 38 | 33 | 17 | 2.2 | 12 | 48 | 178 | 145 | 237 | 66 | 25 | 32 |
| 18 | 38 | 33 | 17 | 2.2 | 12 | 65 | 166 | 147 | 231 | 94 | 29 | 34 |
| 19 | 38 | 31 | 16 | 2.5 | 11 | 90 | 161 | 147 | 213 | 92 | 38 | 36 |
| 20 | 36 | 31 | 16 | 4.0 | 11 | 110 | 180 | 145 | 196 | 73 | 46 | 41 |
| 21 | 37 | 31 | 15 | 4.0 | 11 | 180 | 196 | 143 | 196 | 61 | 39 | 41 |
| 22 | 40 | 31 | 14 | 4.3 | 11 | 155 | 219 | 138 | 188 | 61 | 33 | 41 |
| 23 | 38 | 30 | 13 | 5.0 | 11 | 150 | 237 | 136 | 183 | 55 | 33 | 47 |
| 24 | 38 | 30 | 10 | 5.5 | 10 | 165 | 252 | 127 | 173 | 49 | 26 | 46 |
| 25 | 41 | 30 | 10 | 6.0 | 10 | 200 | 274 | 125 | 143 | 46 | 24 | 46 |
| 26 | 41 | 30 | 8.5 | 6.5 | 10 | 240 | 277 | 125 | 161 | 53 | 25 | 46 |
| 27 | 41 | 29 | 7.5 | 6.5 | 10 | 196 | 264 | 121 | 156 | 56 | 21 | 45 |
| 28 | 40 | 29 | 6.0 | 7.0 | 10 | 176 | 255 | 119 | 147 | 50 | 19 | 42 |
| 29 | 37 | 29 | 5.5 | 7.0 | 10 | 168 | 252 | 119 | 143 | 47 | 19 | 41 |
| 30 | 44 | 29 | 5.2 | 7.0 | ------ | 156 | 240 | 117 | 134 | 45 | 23 | 41 |
| 31 | 41 | ------ | 4.5 | 7.0 | ------ | 145 | ------ | 127 | ------ | 43 | 24 | ------ |
| Total | 1,200 | 991 | 578.2 | 118.9 | 356.5 | 2,582.4 | 6,069 | 4,726 | 5,011 | 2,267 | 1,027 | 1,079 |
| Mean | 38.7 | 33.0 | 18.7 | 3.83 | 12.3 | 83.3 | 202 | 152 | 167 | 73.1 | 33.1 | 36.0 |
| Max | 49 | 44 | 29 | 7.0 | 16 | 240 | 277 | 228 | 237 | 125 | 61 | 49 |
| Min | 29 | 29 | 4.5 | 2.2 | 7.5 | 9.6 | 127 | 117 | 117 | 43 | 19 | 21 |
| Cfsm | 0.021 | 0.018 | 0.010 | 0.0020 | 0.0066 | 0.045 | 0.108 | 0.081 | 0.089 | 0.039 | 0.018 | 0.019 |
| In. | 0.02 | 0.02 | 0.01 | 0.002 | 0.007 | 0.05 | 0.12 | 0.09 | 0.10 | 0.05 | 0.02 | 0.02 |
| Ac-ft | 2,380 | 1,960 | 1,150 | 236 | 707 | 5,120 | 12,040 | 9,370 | 9,940 | 4,500 | 2,040 | 2,140 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 96,051.2 | Mean | 263 | Max | 2,930 | Min | 4.5 | Cfsm | 0.141 | In. | 1.91 | Ac-ft | 190,500 |
| Wtr yr 1968: | Total | 26,006 | Mean | 71.1 | Max | 277 | Min | 2.2 | Cfsm | 0.038 | In. | 0.52 | Ac-ft | 51,580 |

Peak discharge (base, 400 cfs).--No peak above base.

5-3110. Minnesota River at Montevideo, Minn.

Location.--Lat 44°56'00", long 95°44'00", in NW¼NW¼ sec.19, T.117 N., R.40 W., on right bank 100 ft upstream from bridge on U.S. Highway 212, at Montevideo, and 400 ft downstream from Chippewa River.

Drainage area.--6,180 sq mi, approximately.

Records available.--July 1909 to September 1917, October 1917 to September 1929 (no winter records), October 1929 to September 1968. 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.--47 years (1909-17, 1929-68), 635 cfs (459,700 acre-ft per year).

Extremes.--Maximum discharge during year, 829 cfs Apr. 25 (gage height, 5.10 ft); minimum, 14 cfs Oct. 5 (gage height, 1.21 ft).
1909-68: 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 winter months, which are fair. Flow regulated by Big Stone Lake since Apr. 17, 1937, Lac qui Parle Lake since January 1938 and Marsh Lake since Nov. 1, 1939.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 51 | 67 | 52 | 21 | 21 | 28 | 278 | 673 | 265 | 425 | 96 | 49 |
| 2 | 48 | 66 | 52 | 20 | 22 | 28 | 270 | 578 | 258 | 405 | 94 | 50 |
| 3 | 47 | 67 | 52 | 20 | 22 | 29 | 274 | 547 | 260 | 282 | 92 | 51 |
| 4 | 35 | 67 | 51 | 20 | 22 | 35 | 281 | 526 | 256 | 259 | 89 | 51 |
| 5 | 20 | 63 | 50 | 19 | 22 | 45 | 285 | 517 | 248 | 247 | 91 | 50 |
| 6 | 45 | 56 | 50 | 19 | 22 | 56 | 303 | 495 | 238 | 238 | 95 | 49 |
| 7 | 63 | 53 | 50 | 19 | 22 | 58 | 321 | 382 | 231 | 231 | 103 | 49 |
| 8 | 66 | 54 | 49 | 19 | 23 | 61 | 348 | 357 | 248 | 219 | 100 | 55 |
| 9 | 65 | 58 | 49 | 19 | 23 | 62 | 380 | 349 | 253 | 210 | 95 | 65 |
| 10 | 73 | 65 | 49 | 19 | 24 | 64 | 385 | 351 | 272 | 200 | 90 | 70 |
| 11 | 75 | 64 | 48 | 19 | 24 | 66 | 374 | 336 | 318 | 142 | 87 | 72 |
| 12 | 75 | 63 | 48 | 19 | 24 | 68 | 361 | 330 | 401 | 130 | 85 | 69 |
| 13 | 73 | 62 | 47 | 19 | 24 | 70 | 356 | 331 | 371 | 125 | 82 | 64 |
| 14 | 72 | 61 | 46 | 19 | 24 | 72 | 356 | 323 | 340 | 149 | 80 | 59 |
| 15 | 69 | 59 | 45 | 19 | 24 | 76 | 354 | 316 | 330 | 129 | 80 | 56 |
| 16 | 69 | 58 | 44 | 19 | 25 | 80 | 352 | 307 | 365 | 121 | 78 | 55 |
| 17 | 68 | 57 | 43 | 20 | 25 | 86 | 561 | 302 | 391 | 120 | 77 | 63 |
| 18 | 66 | 56 | 42 | 20 | 25 | 97 | 707 | 300 | 390 | 122 | 80 | 60 |
| 19 | 67 | 55 | 41 | 20 | 25 | 180 | 520 | 297 | 377 | 146 | 83 | 61 |
| 20 | 66 | 54 | 39 | 20 | 26 | 310 | 524 | 294 | 359 | 154 | 86 | 62 |
| 21 | 63 | 53 | 36 | 20 | 26 | 520 | 696 | 291 | 380 | 130 | 93 | 67 |
| 22 | 65 | 52 | 33 | 20 | 26 | 490 | 751 | 286 | 351 | 116 | 88 | 72 |
| 23 | 65 | 52 | 31 | 20 | 26 | 430 | 807 | 278 | 341 | 118 | 84 | 78 |
| 24 | 63 | 52 | 28 | 21 | 27 | 340 | 811 | 268 | 339 | 111 | 80 | 71 |
| 25 | 61 | 52 | 27 | 21 | 27 | 360 | 824 | 262 | 342 | 107 | 78 | 69 |
| 26 | 62 | 52 | 26 | 21 | 27 | 390 | 747 | 258 | 456 | 122 | 76 | 69 |
| 27 | 65 | 52 | 25 | 21 | 27 | 430 | 715 | 253 | 463 | 114 | 75 | 68 |
| 28 | 66 | 52 | 24 | 21 | 27 | 380 | 699 | 246 | 452 | 110 | 57 | 67 |
| 29 | 66 | 52 | 23 | 21 | 28 | 312 | 693 | 245 | 443 | 105 | 49 | 66 |
| 30 | 63 | 52 | 22 | 21 | ------ | 304 | 692 | 242 | 436 | 104 | 53 | 65 |
| 31 | 68 | ------ | 22 | 21 | ------ | 283 | ------ | 253 | ------ | 99 | 51 | ------ |
| TOTAL | 1,924 | 1,726 | 1,244 | 617 | 710 | 5,810 | 15,025 | 10,793 | 10,174 | 5,290 | 2,547 | 1,852 |
| MEAN | 62.1 | 57.5 | 40.1 | 19.9 | 24.5 | 187 | 501 | 348 | 339 | 171 | 82.2 | 61.7 |
| MAX | 75 | 67 | 52 | 21 | 28 | 520 | 824 | 673 | 463 | 425 | 103 | 78 |
| MIN | 20 | 52 | 22 | 19 | 21 | 28 | 270 | 242 | 231 | 99 | 49 | 49 |
| AC-FT | 3,820 | 3,420 | 2,470 | 1,220 | 1,410 | 11,520 | 29,800 | 21,410 | 20,180 | 10,490 | 5,050 | 3,670 |

CAL YR 1967 TOTAL 232,979 MEAN 638 MAX 3,980 MIN 20 AC-FT 462,100
WTR YR 1968 TOTAL 57,712 MEAN 158 MAX 824 MIN 19 AC-FT 114,500

5-3114. South Branch Yellow Medicine River at Minneota, Minn.

Location.--Lat 44°33'50", long 95°59'50", in SE¼ sec.26, T.113 N., R.43 W., on downstream side of bridge on State Highway 68, 0.5 mile northwest of Minneota, and 6 miles upstream from confluence with North Branch Yellow Medicine River.

Drainage area.--111 sq mi, approximately.

Records available.--April 1960 to September 1968. Monthly and daily discharge for the period Apr. 1, 1960 to June 30, 1960, published in WSP 1914.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,150.00 ft above mean sea level, datum of 1929. Prior to Mar. 21, 1963, staff gage at same site and datum.

Average discharge.--8 years, 19.6 cfs (14,190 acre-ft per year).

Extremes.--Maximum discharge during year, 272 cfs July 26 (gage height, 7.50 ft); no flow for many days.
1960-68: Maximum discharge, 1,830 cfs Apr. 6, 1960 (gage height, 11.10 ft); no flow at times.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0 | 0.3 | 0 | | 0 | 4.6 | 5.1 | 3.9 | 21 | 14 | 0.8 |
| 2 | | 0 | .3 | 0 | | 0 | 3.2 | 4.5 | 3.1 | 9.0 | 9.5 | .6 |
| 3 | | 0 | .2 | 0 | | 0.2 | 3.6 | 3.8 | 2.4 | 6.6 | 6.4 | .4 |
| 4 | | 0 | .2 | 0 | | .4 | 6.4 | 3.1 | 1.4 | 8.0 | 3.6 | .3 |
| 5 | | 0 | .2 | 0 | | .6 | 10 | 3.1 | 1.2 | 20 | 3.6 | .1 |
| 6 | | 0 | .2 | 0 | | .7 | 9.7 | 3.2 | 1.0 | 12 | 4.1 | 0 |
| 7 | | 0 | .2 | 0 | | .8 | 9.5 | 3.9 | .6 | 6.6 | 2.4 | 0 |
| 8 | | 0 | .2 | 0 | | .9 | 10 | 5.0 | .8 | 3.2 | 3.1 | 1.3 |
| 9 | | 0 | .1 | 0 | | 1.0 | 7.9 | 4.6 | 1.0 | 1.9 | 7.1 | 7.1 |
| 10 | | 0 | .1 | 0 | | 1.0 | 6.6 | 3.9 | 1.4 | 1.5 | 4.2 | 2.8 |
| 11 | | 0 | .1 | 0 | | 1.0 | 4.5 | 3.5 | 1.7 | 1.0 | 4.4 | 2.0 |
| 12 | | 0 | .1 | 0 | | 1.1 | 4.4 | 3.2 | 1.7 | .6 | 4.2 | 1.7 |
| 13 | | 0 | .1 | 0 | | 1.1 | 3.5 | 3.1 | 1.2 | .7 | 3.1 | 1.0 |
| 14 | | 0 | .1 | 0 | | 1.2 | 6.8 | 2.8 | .8 | .8 | 2.6 | .6 |
| 15 | | 0.1 | .1 | 0 | | 1.2 | 5.7 | 2.6 | .7 | .7 | 2.4 | .4 |
| 16 | | .2 | 0 | 0 | | 1.3 | 3.8 | 2.4 | .5 | .5 | 2.0 | .3 |
| 17 | | .3 | 0 | 0 | | 1.4 | 3.1 | 1.9 | .4 | .3 | 1.8 | .3 |
| 18 | | .4 | 0 | 0 | | 5.0 | 2.6 | 2.3 | .3 | .3 | 1.6 | 1.2 |
| 19 | | .4 | 0 | 0 | | 20 | 2.7 | 2.4 | .2 | .5 | 1.4 | 1.5 |
| 20 | | .4 | 0 | 0 | | 34 | 6.2 | 2.3 | .1 | .3 | 1.7 | 1.2 |
| 21 | | .4 | 0 | 0 | | 16 | 7.0 | 2.1 | .3 | .1 | 1.4 | 2.0 |
| 22 | | .4 | 0 | 0 | | 16 | 10 | 2.1 | .1 | 0 | 1.0 | 15 |
| 23 | | .4 | 0 | 0 | | 10 | 56 | 2.1 | .1 | 0 | .4 | 26 |
| 24 | | .4 | 0 | 0 | | 8.8 | 23 | 1.8 | .3 | 0 | .1 | 19 |
| 25 | | .4 | 0 | 0 | | 6.1 | 15 | 1.5 | .8 | 5.5 | .1 | 13 |
| 26 | | .3 | 0 | 0.2 | | 7.1 | 11 | 1.7 | 9.6 | 186 | .2 | 10 |
| 27 | | .3 | 0 | .1 | | 7.9 | 9.3 | 1.7 | 5.4 | 196 | .1 | 7.9 |
| 28 | | .3 | 0 | .2 | | 7.0 | 7.5 | 1.5 | 2.6 | 83 | .1 | 5.6 |
| 29 | | .3 | 0 | .2 | | 5.7 | 6.4 | 2.1 | 2.9 | 35 | .2 | 5.0 |
| 30 | | .3 | 0 | .2 | ------ | 5.7 | 5.9 | 1.9 | 25 | 27 | 1.0 | 4.1 |
| 31 | | ------- | 0 | .1 | ------ | 5.2 | ------- | 2.3 | ------- | 21 | 1.0 | ------ |
| Total | 0 | 5.3 | 2.5 | 1.0 | 0 | 168.4 | 265.9 | 87.5 | 71.5 | 649.1 | 88.8 | 131.2 |
| Mean | 0 | 0.18 | 0.08 | 0.03 | 0 | 5.43 | 8.86 | 2.82 | 2.38 | 20.9 | 2.86 | 4.37 |
| Max | 0 | 0.4 | 0.3 | 0.2 | 0 | 34 | 56 | 5.1 | 25 | 196 | 14 | 26 |
| Min | 0 | 0 | 0 | 0 | 0 | 0 | 2.6 | 1.5 | 0.1 | 0 | 0.1 | 0 |
| Ac-ft | 0 | 11 | 5.0 | 2.0 | 0 | 334 | 527 | 174 | 142 | 1,290 | 176 | 260 |

Cal yr 1967: Total 3,713.7 Mean 10.2 Max 578 Min 0 Ac-ft 7,370
Wtr yr 1968: Total 1,471.2 Mean 4.02 Max 196 Min 0 Ac-ft 2,920

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 1968. 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.--32 years (1935-38, 1939-68), 98.3 cfs (71,170 acre-ft per year).

Extremes.--Maximum discharge during year, 634 cfs July 29 (gage height, 4.32 ft); minimum, 1.9 cfs Oct. 2 (gage height, 2.20 ft).
1931-38, 1939-68: 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 winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.1 | 6.2 | 6.0 | 2.2 | 2.8 | 3.1 | 18 | 54 | 16 | 32 | 260 | 11 |
| 2 | 2.0 | 6.2 | 6.0 | 2.1 | 2.9 | 3.2 | 17 | 46 | 16 | 32 | 220 | 10 |
| 3 | 2.0 | 5.8 | 6.0 | 2.1 | 3.0 | 3.5 | 19 | 39 | 15 | 51 | 180 | 10 |
| 4 | 2.2 | 5.8 | 6.0 | 2.1 | 3.1 | 3.8 | 24 | 35 | 14 | 64 | 150 | 10 |
| 5 | 2.3 | 5.8 | 6.0 | 2.1 | 3.1 | 4.2 | 19 | 32 | 13 | 45 | 130 | 11 |
| 6 | 2.4 | 5.8 | 5.9 | 2.1 | 3.1 | 4.7 | 20 | 30 | 14 | 35 | 110 | 10 |
| 7 | 2.4 | 5.8 | 5.9 | 2.1 | 3.1 | 5.4 | 25 | 30 | 11 | 55 | 98 | 9.0 |
| 8 | 2.5 | 5.8 | 5.8 | 2.1 | 3.1 | 6.5 | 30 | 28 | 11 | 55 | 87 | 9.6 |
| 9 | 2.6 | 5.8 | 5.8 | 2.1 | 3.1 | 7.4 | 30 | 27 | 16 | 39 | 78 | 11 |
| 10 | 2.8 | 6.7 | 5.8 | 2.1 | 3.1 | 8.8 | 29 | 26 | 76 | 32 | 71 | 10 |
| 11 | 2.9 | 6.7 | 5.6 | 2.1 | 3.1 | 12 | 28 | 26 | 78 | 27 | 65 | 10 |
| 12 | 2.9 | 5.4 | 5.2 | 2.1 | 3.1 | 13 | 26 | 26 | 85 | 24 | 58 | 18 |
| 13 | 2.9 | 5.4 | 4.8 | 2.1 | 3.1 | 14 | 24 | 24 | 59 | 21 | 52 | 20 |
| 14 | 2.9 | 5.8 | 4.6 | 2.1 | 3.1 | 14 | 22 | 24 | 42 | 26 | 46 | 15 |
| 15 | 2.9 | 5.8 | 4.4 | 2.1 | 3.1 | 15 | 20 | 21 | 32 | 24 | 43 | 14 |
| 16 | 2.9 | 5.8 | 4.1 | 2.1 | 3.1 | 16 | 18 | 20 | 28 | 20 | 41 | 11 |
| 17 | 4.3 | 5.8 | 3.8 | 2.2 | 3.1 | 17 | 17 | 18 | 24 | 20 | 35 | 11 |
| 18 | 3.7 | 5.6 | 3.6 | 2.2 | 3.1 | 17 | 17 | 18 | 24 | 15 | 33 | 12 |
| 19 | 3.3 | 5.7 | 3.4 | 2.2 | 3.1 | 18 | 16 | 18 | 18 | 13 | 32 | 12 |
| 20 | 2.9 | 5.8 | 3.1 | 2.2 | 3.1 | 20 | 21 | 16 | 15 | 10 | 29 | 9.0 |
| 21 | 3.5 | 5.8 | 2.8 | 2.2 | 3.1 | 23 | 20 | 16 | 18 | 9.0 | 25 | 8.3 |
| 22 | 3.7 | 5.8 | 2.6 | 2.2 | 3.1 | 25 | 19 | 16 | 15 | 7.7 | 24 | 8.3 |
| 23 | 4.0 | 5.8 | 2.5 | 2.2 | 3.1 | 28 | 24 | 15 | 13 | 9.0 | 21 | 9.0 |
| 24 | 5.0 | 5.9 | 2.3 | 2.3 | 3.1 | 31 | 154 | 14 | 11 | 9.6 | 18 | 35 |
| 25 | 5.4 | 5.9 | 2.3 | 2.3 | 3.1 | 33 | 181 | 13 | 13 | 9.6 | 16 | 48 |
| 26 | 5.8 | 6.0 | 2.2 | 2.4 | 3.1 | 25 | 148 | 12 | 17 | 22 | 14 | 48 |
| 27 | 5.8 | 6.0 | 2.2 | 2.4 | 3.1 | 22 | 123 | 12 | 17 | 119 | 11 | 38 |
| 28 | 5.8 | 6.0 | 2.2 | 2.5 | 3.1 | 21 | 98 | 11 | 18 | 533 | 10 | 32 |
| 29 | 6.2 | 6.0 | 2.2 | 2.6 | 3.1 | 19 | 76 | 12 | 19 | 600 | 9.6 | 27 |
| 30 | 6.2 | 6.0 | 2.2 | 2.7 | ------ | 19 | 62 | 11 | 42 | 356 | 10 | 24 |
| 31 | 6.2 | ------ | 2.2 | 2.7 | ------ | 19 | ------ | 15 | ------ | 330 | 10 | ------ |
| Total | 112.5 | 176.7 | 127.5 | 69.0 | 89.3 | 471.6 | 1,345 | 705 | 790 | 2,644.9 | 1,986.6 | 511.2 |
| Mean | 3.63 | 5.89 | 4.11 | 2.23 | 3.08 | 15.2 | 44.8 | 22.7 | 26.3 | 85.3 | 64.1 | 17.0 |
| Max | 6.2 | 6.7 | 6.0 | 2.7 | 3.1 | 33 | 181 | 54 | 85 | 600 | 260 | 48 |
| Min | 2.0 | 5.4 | 2.2 | 2.1 | 2.8 | 3.1 | 16 | 11 | 11 | 7.7 | 9.6 | 8.3 |
| Cfsm | 0.0056 | 0.0090 | 0.0063 | 0.0034 | 0.0047 | 0.023 | 0.069 | 0.035 | 0.040 | 0.131 | 0.098 | 0.026 |
| In. | 0.006 | 0.01 | 0.007 | 0.004 | 0.005 | 0.03 | 0.08 | 0.04 | 0.04 | 0.15 | 0.11 | 0.03 |
| Ac-ft | 223 | 350 | 253 | 137 | 177 | 935 | 2,670 | 1,400 | 1,570 | 5,250 | 3,940 | 1,010 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 25,795.1 | Mean | 70.7 | Max | 1,540 | Min | 2.0 | Cfsm | 0.108 | In. | 1.47 | Ac-ft | 51,160 |
| Wtr yr 1968: | Total | 9,029.3 | Mean | 24.7 | Max | 600 | Min | 2.0 | Cfsm | 0.038 | In. | 0.51 | Ac-ft | 17,910 |

Peak discharge (base, 300 cfs)

| Date | Time | Gage height | Discharge |
|---|---|---|---|
| 7-29 | 0800 | 4.32 | 634 |

5-3150. Redwood River at Marshall, Minn.

Location.--Lat 44°27'05", long 95°47'13", in SE¼NW¼ sec.4, T.111 N., R.41 W., on downstream 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 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 1,144.88 ft above mean sea level, datum of 1929. Prior to July 12, 1966, chain gage at same site and datum. Staff gage on diversion channel. Datum of gage is 1,100.00 ft above mean sea level, datum of 1929 (levels by Corps of Engineers).

Average discharge.--28 years, 45.6 cfs (33,010 acre-ft per year).

Extremes.--Maximum discharge during year, 162 cfs Sept. 21. River channel: Maximum discharge during year, 162 cfs Sept. 21 (gage height, 1.98 ft); maximum gage height, 2.40 ft Jan. 20 (backwater from ice); minimum daily discharge 0.1 cfs Oct. 6, Jan. 3-13. Diversion channel: no flow.
1940-68: Maximum discharge, 5,370 cfs June 17, 1957 (gage height, 10.14 ft); maximum gage height, 11.05 ft Apr. 6, 1951 (from floodmark); no flow at times.

Remarks.--Records good except those for periods of no gage-height record and the winter months, which are fair. Water diverted at medium and high stages into diversion channel 3 miles above station, bypasses station and returns to river 1 mile below station. Diversion began Mar. 18, 1964. These records include flow in diversion channel. Unknown amount of natural diversion into Cottonwood River basin at extremely high stages. Records of suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.8 | 2.2 | 3.1 | 0.2 | 0.8 | 2.9 | 30 | 7.3 | 8.5 | 9.0 | 13 | 2.6 |
| 2 | .3 | 2.4 | 3.1 | .2 | .9 | 3.3 | 30 | 6.2 | 7.9 | 12 | 12 | 1.8 |
| 3 | .2 | 2.2 | 3.1 | .1 | .9 | 4.0 | 31 | 5.1 | 5.1 | 13 | 14 | 1.8 |
| 4 | .2 | 2.2 | 3.1 | .1 | .9 | 4.3 | 45 | 4.1 | 5.6 | 9.2 | 14 | 2.6 |
| 5 | .2 | 2.2 | 3.1 | .1 | 1.0 | 4.7 | 26 | 4.1 | 4.6 | 8.0 | 22 | 2.2 |
| 6 | .1 | 2.5 | 3.1 | .1 | 1.0 | 5.2 | 24 | 4.1 | 5.6 | 7.1 | 20 | 2.0 |
| 7 | .4 | 3.0 | 3.1 | .1 | 1.1 | 5.6 | 30 | 8.5 | 3.2 | 6.4 | 18 | 1.6 |
| 8 | 1.4 | 3.3 | 3.1 | .1 | 1.1 | 6.1 | 33 | 9.1 | 3.6 | 5.7 | 21 | 1.4 |
| 9 | 1.4 | 2.9 | 3.1 | .1 | 1.1 | 6.8 | 30 | 12 | 3.8 | 5.0 | 16 | 12 |
| 10 | 1.6 | 2.9 | 3.1 | .1 | 1.1 | 7.5 | 11 | 6.2 | 4.2 | 4.6 | 16 | 17 |
| 11 | 1.6 | 3.2 | 3.1 | .1 | 1.2 | 8.0 | 9.8 | 5.1 | 5.0 | 3.2 | 12 | 7.9 |
| 12 | 1.4 | 4.1 | 3.1 | .1 | 1.2 | 8.2 | 10 | 5.6 | 4.1 | 2.9 | 11 | 4.1 |
| 13 | 2.2 | 4.1 | 3.0 | .1 | 1.2 | 8.4 | 9.8 | 5.6 | 3.9 | 5.6 | 9.8 | 3.2 |
| 14 | 2.6 | 4.6 | 2.9 | .2 | 1.2 | 8.7 | 9.1 | 7.3 | 3.6 | 2.6 | 8.5 | 3.2 |
| 15 | 4.1 | 4.6 | 2.8 | .2 | 1.2 | 9.1 | 8.5 | 7.9 | 3.7 | 2.2 | 8.5 | 2.9 |
| 16 | 3.6 | 4.1 | 2.7 | .2 | 1.3 | 9.5 | 7.3 | 7.9 | 3.8 | 2.4 | 8.5 | 9.8 |
| 17 | 4.1 | 3.6 | 2.5 | .2 | 1.4 | 10 | 1.4 | 8.5 | 3.6 | 2.4 | 6.7 | 4.6 |
| 18 | 4.1 | 4.6 | 2.4 | .3 | 1.4 | 11 | 6.2 | 7.3 | 3.2 | 2.2 | 6.7 | 17 |
| 19 | 5.1 | 4.5 | 2.3 | .3 | 1.5 | 12 | 9.8 | 6.4 | 3.2 | 1.8 | 5.1 | 6.2 |
| 20 | 4.6 | 4.1 | 2.2 | .4 | 1.6 | 13 | 15 | 5.6 | 3.2 | 1.8 | 4.1 | 4.6 |
| 21 | 4.1 | 3.7 | 2.2 | .4 | 1.6 | 14 | 15 | 5.6 | 5.1 | 2.2 | 4.1 | 90 |
| 22 | 3.0 | 3.5 | 2.1 | .4 | 1.7 | 16 | 18 | 4.6 | 2.6 | 2.4 | 3.2 | 73 |
| 23 | 1.6 | 3.5 | 2.0 | .4 | 1.8 | 18 | 38 | 4.6 | 3.2 | 7.3 | 2.6 | 48 |
| 24 | 2.0 | 3.5 | 1.9 | .5 | 1.9 | 20 | 33 | 5.6 | 11 | 6.2 | 2.2 | 45 |
| 25 | 2.0 | 3.5 | 1.7 | .5 | 1.9 | 23 | 18 | 4.6 | 12 | 5.1 | 2.2 | 39 |
| 26 | 2.2 | 3.5 | 1.4 | .6 | 2.0 | 27 | 15 | 5.6 | 18 | 51 | 2.0 | 35 |
| 27 | 2.4 | 3.4 | 1.2 | .6 | 2.2 | 30 | 14 | 4.6 | 12 | 9.8 | 1.8 | 38 |
| 28 | 2.6 | 3.4 | .9 | .7 | 2.4 | 34 | 11 | 4.6 | 9.8 | 28 | 1.6 | 43 |
| 29 | 2.6 | 3.3 | .7 | .7 | 2.5 | 30 | 9.8 | 5.6 | 7.3 | 18 | 1.6 | 56 |
| 30 | 2.9 | 3.2 | .5 | .7 | ------ | 29 | 8.5 | 5.6 | 6.7 | 15 | 2.2 | 68 |
| 31 | 2.6 | ------ | .4 | .7 | ------ | 28 | ------ | 7.3 | ------ | 14 | 2.9 | ------ |
| Total | 68.0 | 101.8 | 73.0 | 9.5 | 41.1 | 417.3 | 557.2 | 192.2 | 177.1 | 266.1 | 273.3 | 643.5 |
| Mean | 2.19 | 3.39 | 2.35 | 0.31 | 1.42 | 13.5 | 18.6 | 6.20 | 5.90 | 8.58 | 8.82 | 21.4 |
| Max | 5.1 | 4.6 | 3.1 | 0.7 | 2.5 | 34 | 45 | 12 | 18 | 51 | 22 | 90 |
| Min | 0.1 | 2.2 | 0.4 | 0.1 | 0.8 | 2.9 | 1.4 | 4.1 | 2.6 | 1.8 | 1.6 | 1.4 |
| Cfsm | 0.0071 | 0.011 | 0.0076 | 0.00099 | 0.0046 | 0.044 | 0.061 | 0.020 | 0.019 | 0.028 | 0.029 | 0.070 |
| In. | 0.01 | 0.01 | 0.01 | 0.001 | 0.005 | 0.05 | 0.07 | 0.02 | 0.02 | 0.03 | 0.03 | 0.08 |
| Ac-ft | 135 | 202 | 145 | 19 | 81 | 828 | 1,105 | 381 | 351 | 528 | 542 | 1,280 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 8,511.4 | Mean | 23.3 | Max | 334 | Min | 0.1 | Cfsm | 0.076 | In. | 1.03 | Ac-ft | 16,880 |
| Wtr yr 1968: | Total | 2,820.1 | Mean | 7.71 | Max | 90 | Min | 0.1 | Cfsm | 0.025 | In. | 0.34 | Ac-ft | 5,590 |

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 1968.

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.--34 years (1911-12, 1935-68) 96.5 cfs (69,860 acre-feet per year).

Extremes.--Maximum discharge during year, 722 cfs July 27 (gage height, 3.61 ft); minimum daily, 0.7 cfs Jan. 8-17; minimum gage height, 1.37 ft Nov. 27.
1909-14, 1930-68: 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 periods of no gage-height record and those for winter months, which are fair. Records of suspended sediment loads for the water year 1968 are published in Part 2 of this report. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood and Cottonwood River basins during extreme floods.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.9 | 14 | 11 | 2.5 | 1.4 | 2.5 | 44 | 39 | 20 | 29 | 201 | 14 |
| 2 | 8.2 | 13 | 11 | 2.1 | 1.5 | 2.9 | 42 | 33 | 21 | 44 | 150 | 16 |
| 3 | 10 | 16 | 11 | 1.7 | 1.5 | 3.3 | 43 | 29 | 22 | 47 | 116 | 14 |
| 4 | 9.7 | 13 | 11 | 1.3 | 1.6 | 3.7 | 69 | 27 | 20 | 44 | 96 | 14 |
| 5 | 9.2 | 12 | 12 | 1.1 | 1.6 | 4.5 | 76 | 24 | 17 | 38 | 89 | 14 |
| 6 | 8.2 | 12 | 12 | .9 | 1.6 | 5.4 | 66 | 23 | 14 | 31 | 84 | 12 |
| 7 | 8.2 | 11 | 13 | .8 | 1.7 | 6.6 | 59 | 23 | 14 | 28 | 87 | 12 |
| 8 | 7.7 | 11 | 13 | .7 | 1.7 | 8.0 | 57 | 24 | 14 | 24 | 102 | 14 |
| 9 | 7.7 | 13 | 14 | .7 | 1.8 | 10 | 55 | 27 | 16 | 19 | 98 | 16 |
| 10 | 7.2 | 20 | 14 | .7 | 1.8 | 11 | 51 | 26 | 47 | 20 | 89 | 20 |
| 11 | 7.2 | 20 | 14 | .7 | 1.8 | 12 | 44 | 27 | 89 | 15 | 79 | 33 |
| 12 | 6.3 | 19 | 14 | .7 | 1.8 | 13 | 39 | 26 | 87 | 14 | 68 | 35 |
| 13 | 5.9 | 19 | 14 | .7 | 1.8 | 14 | 35 | 24 | 84 | 20 | 59 | 28 |
| 14 | 6.8 | 19 | 13 | .7 | 1.8 | 15 | 36 | 23 | 74 | 19 | 54 | 23 |
| 15 | 6.8 | 17 | 13 | .7 | 1.8 | 16 | 33 | 21 | 55 | 15 | 47 | 18 |
| 16 | 6.8 | 16 | 12 | .7 | 1.8 | 17 | 33 | 22 | 41 | 14 | 42 | 19 |
| 17 | 6.8 | 15 | 12 | .7 | 1.9 | 19 | 29 | 22 | 29 | 13 | 38 | 21 |
| 18 | 7.2 | 18 | 11 | .8 | 1.9 | 20 | 28 | 23 | 23 | 14 | 35 | 21 |
| 19 | 7.7 | 16 | 11 | .8 | 1.9 | 21 | 27 | 22 | 19 | 11 | 33 | 23 |
| 20 | 7.2 | 14 | 10 | .8 | 1.9 | 22 | 33 | 22 | 16 | 11 | 32 | 21 |
| 21 | 8.2 | 13 | 10 | .9 | 1.9 | 23 | 35 | 21 | 15 | 11 | 28 | 24 |
| 22 | 9.2 | 12 | 10 | .9 | 1.9 | 24 | 42 | 20 | 14 | 11 | 24 | 56 |
| 23 | 16 | 11 | 10 | 1.0 | 1.9 | 25 | 51 | 20 | 13 | 11 | 21 | 102 |
| 24 | 17 | 11 | 9.7 | 1.0 | 2.0 | 27 | 54 | 18 | 14 | 9.7 | 19 | 114 |
| 25 | 16 | 11 | 9.4 | 1.1 | 2.0 | 29 | 89 | 17 | 14 | 9.7 | 18 | 110 |
| 26 | 15 | 11 | 9.2 | 1.1 | 2.1 | 31 | 89 | 17 | 16 | 114 | 16 | 108 |
| 27 | 14 | 9.8 | 8.5 | 1.2 | 2.1 | 34 | 80 | 17 | 19 | 608 | 14 | 96 |
| 28 | 14 | 10 | 7.5 | 1.2 | 2.2 | 38 | 68 | 16 | 27 | 460 | 12 | 87 |
| 29 | 16 | 11 | 6.2 | 1.3 | 2.4 | 46 | 57 | 16 | 28 | 377 | 12 | 80 |
| 30 | 14 | 11 | 4.8 | 1.3 | ------- | 51 | 47 | 17 | 24 | 321 | 13 | 79 |
| 31 | 14 | ------ | 3.4 | 1.4 | ------- | 45 | ------ | 19 | ------ | 257 | 14 | ------ |
| Total | 304.1 | 418.8 | 334.7 | 32.2 | 53.1 | 599.9 | 1,511 | 705 | 906 | 2,659.4 | 1,790 | 1,244 |
| Mean | 9.81 | 14.0 | 10.8 | 1.04 | 1.83 | 19.4 | 50.4 | 22.7 | 30.2 | 85.8 | 57.7 | 41.5 |
| Max | 17 | 20 | 14 | 2.5 | 2.4 | 51 | 89 | 39 | 89 | 608 | 201 | 114 |
| Min | 5.9 | 9.8 | 3.4 | 0.7 | 1.4 | 2.5 | 27 | 16 | 13 | 9.7 | 12 | 12 |
| Cfsm | 0.014 | 0.020 | 0.015 | 0.0015 | 0.0026 | 0.028 | 0.072 | 0.033 | 0.043 | 0.123 | 0.083 | 0.060 |
| In. | 0.02 | 0.02 | 0.02 | 0.002 | 0.003 | 0.03 | 0.08 | 0.04 | 0.05 | 0.14 | 0.10 | 0.07 |
| Ac-ft | 603 | 831 | 664 | 64 | 105 | 1,190 | 3,000 | 1,400 | 1,800 | 5,270 | 3,550 | 2,470 |

Cal yr 1967: Total 26,796.4 Mean 73.4 Max 1,090 Min 2.7 Cfsm 0.105 In. 1.43 Ac-ft 53,150
Wtr yr 1968: Total 10,558.2 Mean 28.8 Max 608 Min 0.7 Cfsm 0.041 In. 0.56 Ac-ft 20,940

PEAK DISCHARGE (BASE, 150 CFS)

| DATE | TIME | G.HT. | DISCHARGE | DATE | TIME | G.HT. | DISCHARGE |
|---|---|---|---|---|---|---|---|
| 7-27 | 0830 | 722 | 3.61 | | | | |

Note.--No gage-height record Feb. 14 to Mar. 12, Mar. 14 to Apr. 7.

## 5-3167.7 Minnesota River at New Ulm, Minn.

Location.--Lat 44°19'29", long 94°27'09", in NE¼NE¼ sec.20, T.110 N., R.30 W., on left bank 30 ft downstream from U.S. Highway 14, at New Ulm and 6.1 miles upstream from Cottonwood River.

Drainage area.--9,536 sq mi (at mouth of Cottonwood River).

Records available.--October 1967 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 778.72 ft above mean sea level, datum of 1929.

Extremes.--Maximum discharge during year, 2,810 cfs July 28 (gage height, 14.18 ft, backwater from Cottonwood River); minimum daily discharge, 42 cfs Jan. 15, 19.

Remarks.--Records good except those for periods of no gage-height record or backwater from Cottonwood River and those for winter months, which are fair. Records of suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 128 | 148 | 110 | 64 | 56 | 60 | 551 | 934 | 428 | 704 | 2,170 | 168 |
| 2 | 128 | 148 | 121 | 62 | 58 | 60 | 512 | 914 | 467 | 714 | 1,960 | 164 |
| 3 | 128 | 148 | 123 | 59 | 59 | 60 | 449 | 892 | 527 | 742 | 1,350 | 162 |
| 4 | 128 | 148 | 125 | 57 | 60 | 60 | 464 | 850 | 527 | 732 | 930 | 160 |
| 5 | 128 | 148 | 127 | 54 | 61 | 62 | 479 | 791 | 491 | 700 | 611 | 164 |
| 6 | 128 | 149 | 125 | 53 | 62 | 66 | 563 | 710 | 452 | 644 | 506 | 162 |
| 7 | 128 | 148 | 123 | 52 | 62 | 74 | 539 | 696 | 419 | 596 | 878 | 156 |
| 8 | 128 | 146 | 128 | 51 | 64 | 90 | 509 | 693 | 417 | 524 | 1,050 | 150 |
| 9 | 130 | 142 | 134 | 49 | 64 | 110 | 494 | 650 | 410 | 461 | 1,030 | 222 |
| 10 | 130 | 141 | 136 | 48 | 64 | 140 | 539 | 635 | 533 | 437 | 728 | 292 |
| 11 | 130 | 140 | 144 | 46 | 64 | 180 | 575 | 590 | 1,040 | 410 | 672 | 275 |
| 12 | 130 | 138 | 146 | 45 | 63 | 250 | 596 | 548 | 1,170 | 395 | 503 | 240 |
| 13 | 130 | 136 | 123 | 44 | 63 | 310 | 656 | 530 | 1,110 | 458 | 440 | 226 |
| 14 | 131 | 145 | 107 | 43 | 62 | 305 | 638 | 518 | 1,120 | 605 | 353 | 212 |
| 15 | 132 | 155 | 116 | 42 | 62 | 300 | 611 | 491 | 1,070 | 840 | 295 | 188 |
| 16 | 138 | 161 | 119 | 43 | 61 | 290 | 569 | 470 | 942 | 732 | 285 | 174 |
| 17 | 139 | 160 | 128 | 44 | 60 | 330 | 578 | 464 | 822 | 686 | 258 | 344 |
| 18 | 140 | 152 | 130 | 44 | 59 | 355 | 554 | 467 | 763 | 679 | 230 | 410 |
| 19 | 160 | 154 | 130 | 42 | 57 | 363 | 542 | 458 | 728 | 696 | 234 | 392 |
| 20 | 200 | 152 | 136 | 43 | 57 | 355 | 566 | 446 | 718 | 608 | 226 | 347 |
| 21 | 160 | 150 | 136 | 43 | 57 | 355 | 728 | 437 | 686 | 521 | 206 | 431 |
| 22 | 140 | 144 | 114 | 43 | 57 | 360 | 822 | 428 | 656 | 485 | 218 | 672 |
| 23 | 138 | 142 | 109 | 44 | 57 | 365 | 875 | 422 | 653 | 506 | 198 | 950 |
| 24 | 138 | 138 | 114 | 45 | 58 | 566 | 868 | 419 | 679 | 700 | 194 | 1,250 |
| 25 | 128 | 140 | 99 | 46 | 60 | 756 | 1,010 | 410 | 710 | 728 | 174 | 1,060 |
| 26 | 132 | 142 | 84 | 47 | 60 | 794 | 1,120 | 407 | 714 | 836 | 180 | 730 |
| 27 | 138 | 92 | 68 | 48 | 60 | 707 | 1,190 | 419 | 690 | 2,010 | 174 | 467 |
| 28 | 142 | 105 | 73 | 50 | 60 | 641 | 1,210 | 416 | 700 | 2,770 | 162 | 371 |
| 29 | 143 | 112 | 68 | 51 | 60 | 629 | 1,150 | 413 | 696 | 2,540 | 168 | 270 |
| 30 | 149 | 105 | 65 | 52 | ------ | 623 | 1,050 | 392 | 710 | 1,960 | 156 | 247 |
| 31 | 150 | ------ | 64 | 54 | ------ | 569 | ------ | 404 | ------ | 2,140 | 164 | ------ |
| TOTAL | 4,272 | 4,229 | 3,525 | 1,508 | 1,747 | 10,185 | 21,007 | 17,314 | 21,048 | 27,559 | 16,703 | 11,056 |
| MEAN | 138 | 141 | 114 | 48.6 | 60.2 | 329 | 700 | 559 | 702 | 889 | 539 | 369 |
| MAX | 200 | 161 | 146 | 64 | 64 | 794 | 1,210 | 934 | 1,170 | 2,770 | 2,170 | 1,250 |
| MIN | 128 | 92 | 64 | 42 | 56 | 60 | 449 | 392 | 410 | 395 | 156 | 150 |
| AC-FT | 8,470 | 8,390 | 6,990 | 2,990 | 3,470 | 20,200 | 41,670 | 34,340 | 41,750 | 54,660 | 33,130 | 21,930 |

| | | | | |
|---|---|---|---|---|
| CAL YR 1967 | TOTAL | MEAN | MAX | MIN | AC-FT |
| WTR YR 1968 | TOTAL 140,153 | MEAN 383 | MAX 2,770 | MIN 42 | AC-FT 278,000 |

GPO 817-490-10

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 1968 (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.--34 years (1911-13, 1935-37, 1938-68), 253 cfs (183,200 acre-ft per year).

Extremes.--Maximum discharge during year, 4,550 cfs Sept. 23 (gage height, 11.98 ft); minimum 1.8 cfs May 17, (gage height, 2.17 ft).
1909-13, 1931-68: Maximum discharge, 26,000 cfs Apr. 8, 1965 (gage height, 20.86 ft, from floodmark, backwater from ice); minimum observed, 0.5 cfs Nov. 27, 1952; minimum gage height, 0.72 ft Nov. 20, 1964.

Remarks.--Records good except those for winter months, which are fair. Records of chemical analyses and suspended sediment loads for the water year 1968 are published in Part 2 of this report. Some regulation by dam at Cottonwood Lake and several other small lakes above station.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 31 | 12 | 5.0 | 6.3 | 7.7 | 46 | 83 | 32 | 60 | 2,510 | 95 |
| 2 | 20 | 29 | 12 | 4.9 | 6.5 | 7.8 | 32 | 79 | 35 | 56 | 2,400 | 92 |
| 3 | 16 | 30 | 13 | 4.9 | 6.6 | 8.2 | 11 | 72 | 35 | 54 | 1,970 | 87 |
| 4 | 18 | 30 | 13 | 4.9 | 6.8 | 8.5 | 8.5 | 58 | 34 | 52 | 1,090 | 90 |
| 5 | 24 | 28 | 13 | 4.8 | 6.8 | 9.0 | 108 | 43 | 28 | 49 | 981 | 89 |
| 6 | 17 | 25 | 13 | 4.8 | 6.9 | 9.5 | 136 | 83 | 26 | 47 | 668 | 84 |
| 7 | 37 | 22 | 13 | 4.7 | 6.9 | 10 | 20 | 30 | 23 | 44 | 743 | 79 |
| 8 | 28 | 22 | 13 | 4.7 | 7.0 | 11 | 17 | 5.0 | 29 | 42 | 1,040 | 108 |
| 9 | 21 | 27 | 13 | 4.6 | 7.0 | 14 | 16 | 3.5 | 33 | 41 | 488 | 229 |
| 10 | 26 | 27 | 13 | 4.6 | 7.0 | 19 | 32 | 3.2 | 71 | 40 | 864 | 211 |
| 11 | 27 | 29 | 13 | 4.6 | 7.1 | 30 | 127 | 3.2 | 87 | 39 | 622 | 233 |
| 12 | 28 | 29 | 12 | 4.6 | 7.2 | 50 | 195 | 3.8 | 179 | 53 | 584 | 253 |
| 13 | 28 | 30 | 12 | 4.6 | 7.2 | 80 | 185 | 4.2 | 209 | 78 | 490 | 213 |
| 14 | 26 | 30 | 12 | 4.6 | 7.2 | 90 | 119 | 3.8 | 177 | 60 | 415 | 185 |
| 15 | 26 | 28 | 12 | 4.6 | 7.2 | 88 | 89 | 3.8 | 146 | 72 | 368 | 163 |
| 16 | 23 | 28 | 12 | 4.6 | 7.3 | 90 | 117 | 3.0 | 123 | 174 | 342 | 143 |
| 17 | 42 | 26 | 12 | 4.6 | 7.4 | 95 | 92 | 2.5 | 106 | 189 | 302 | 253 |
| 18 | 331 | 25 | 12 | 4.6 | 7.5 | 114 | 70 | 4.0 | 92 | 151 | 170 | 253 |
| 19 | 210 | 26 | 12 | 4.6 | 7.7 | 127 | 68 | 2.5 | 80 | 142 | 225 | 237 |
| 20 | 61 | 28 | 12 | 4.6 | 7.7 | 106 | 73 | 3.3 | 82 | 119 | 219 | 249 |
| 21 | 41 | 26 | 11 | 4.6 | 7.7 | 101 | 74 | 14 | 63 | 96 | 199 | 555 |
| 22 | 38 | 24 | 10 | 4.7 | 7.7 | 94 | 107 | 37 | 53 | 78 | 181 | 2,340 |
| 23 | 65 | 9.5 | 9.5 | 4.7 | 7.7 | 100 | 114 | 36 | 48 | 126 | 166 | 3,430 |
| 24 | 35 | 25 | 9.0 | 4.8 | 7.7 | 98 | 108 | 18 | 54 | 443 | 148 | 4,170 |
| 25 | 32 | 25 | 7.3 | 4.9 | 7.7 | 108 | 107 | 24 | 59 | 472 | 130 | 3,240 |
| 26 | 31 | 18 | 6.4 | 5.1 | 7.7 | 96 | 108 | 34 | 64 | 1,040 | 119 | 2,310 |
| 27 | 31 | 11 | 5.8 | 5.3 | 7.7 | 94 | 102 | 43 | 62 | 3,530 | 113 | 1,740 |
| 28 | 31 | 12 | 5.4 | 5.6 | 7.7 | 88 | 99 | 87 | 60 | 3,540 | 107 | 1,470 |
| 29 | 33 | 12 | 5.2 | 5.8 | 7.7 | 82 | 95 | 50 | 66 | 2,970 | 102 | 1,300 |
| 30 | 31 | 12 | 5.1 | 6.0 | ------- | 78 | 89 | 12 | 64 | 2,000 | 104 | 1,220 |
| 31 | 31 | ------ | 5.0 | 6.1 | ------- | 74 | ------ | 25 | ------ | 2,130 | 102 | ------ |
| Total | 1,428 | 724.5 | 328.7 | 151.5 | 210.6 | 1,987.7 | 2,564.5 | 873.8 | 2,220 | 17,987 | 17,962 | 25,121 |
| Mean | 46.1 | 24.2 | 10.6 | 4.89 | 7.26 | 64.1 | 85.5 | 28.2 | 74.0 | 580 | 579 | 837 |
| Max | 331 | 31 | 13 | 6.1 | 7.7 | 127 | 195 | 87 | 209 | 3,540 | 2,510 | 4,170 |
| Min | 16 | 9.5 | 5.0 | 4.6 | 6.3 | 7.7 | 8.5 | 2.5 | 23 | 39 | 102 | 79 |
| Cfsm | 0.036 | 0.019 | 0.0083 | 0.0038 | 0.0057 | 0.050 | 0.067 | 0.022 | 0.058 | 0.453 | 0.452 | 0.654 |
| In. | 0.04 | 0.02 | 0.01 | 0.004 | 0.006 | 0.06 | 0.07 | 0.03 | 0.06 | 0.52 | 0.52 | 0.73 |
| Ac-ft | 2,830 | 1,440 | 652 | 300 | 418 | 3,940 | 5,090 | 1,730 | 4,400 | 35,680 | 35,630 | 49,830 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 64,721.8 | Mean | 177 | Max | 2,590 | Min | 3.0 | Cfsm | 0.138 | In. | 1.88 | Ac-ft | 128,400 |
| Wtr yr 1968: | Total | 71,559.3 | Mean | 196 | Max | 4,170 | Min | 2.5 | Cfsm | 0.153 | In. | 2.08 | Ac-ft | 141,900 |

## 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 1968. Prior to October 1957, published as East Fork Blue Earth River near Bricelyn.

Gage.--Wire-weight gage read twice daily. Datum of gage is 1,131.86 ft above mean sea level, datum of 1929 (Minnesota State Highway Department bench mark).

Average discharge.--17 years, 38.0 cfs (27,510 acre-ft per year).

Extremes.--Maximum discharge during year, 469 cfs July 27 (gage height, 9.47 ft); no flow on many days.
1951-68: Maximum discharge, 1,320 cfs Apr. 7, 1951 (gage height, 10.68 ft, from graph based on gage readings); maximum gage height, 11.70 ft Apr. 7, 1965; no flow on many days.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | 0 | 48 | 23 | 290 | 345 | 53 |
| 2 | | | | | | | 0 | 38 | 24 | 276 | 316 | 49 |
| 3 | | | | | | | 0 | 27 | 24 | 260 | 296 | 42 |
| 4 | | | | | | | .1 | 22 | 23 | 244 | 281 | 46 |
| 5 | | | | | | | .1 | 18 | 19 | 226 | 263 | 47 |
| 6 | | | | | | | .1 | 15 | 16 | 207 | 264 | 47 |
| 7 | | | | | | | .1 | 12 | 13 | 191 | 307 | 47 |
| 8 | | | | | | | .2 | 10 | 11 | 173 | 416 | 49 |
| 9 | | | | | | | .2 | 9.5 | 62 | 162 | 443 | 52 |
| 10 | | | | | | | .2 | 10 | 121 | 156 | 443 | 58 |
| 11 | | | | | | | .3 | 8.8 | 232 | 149 | 430 | 60 |
| 12 | | | | | | | .5 | 7.8 | 280 | 145 | 400 | 58 |
| 13 | | | | | | | .6 | 6.9 | 283 | 140 | 375 | 54 |
| 14 | | | | | | | .9 | 7.5 | 274 | 135 | 355 | 49 |
| 15 | | | | | | | 1.2 | 6.6 | 258 | 131 | 330 | 44 |
| 16 | | | | | | | 1.7 | 6.9 | 241 | 128 | 310 | 42 |
| 17 | | | | | | | 2.5 | 6.3 | 229 | 124 | 295 | 64 |
| 18 | | | | | | | 3.5 | 5.7 | 207 | 115 | 274 | 94 |
| 19 | | | | | | | 5.2 | 6.3 | 191 | 106 | 258 | 132 |
| 20 | | | | | | | 7.3 | 6.9 | 167 | 98 | 243 | 156 |
| 21 | | | | | | | 11 | 6.3 | 149 | 84 | 222 | 180 |
| 22 | | | | | | | 16 | 5.7 | 131 | 72 | 200 | 204 |
| 23 | | | | | | | 25 | 5.4 | 137 | 159 | 187 | 221 |
| 24 | | | | | | | 38 | 5.1 | 130 | 258 | 154 | 233 |
| 25 | | | | | | | 65 | 4.5 | 158 | 381 | 131 | 243 |
| 26 | | | | | | | 88 | 7.8 | 218 | 462 | 114 | 237 |
| 27 | | | | | | | 90 | 10 | 264 | 466 | 100 | 224 |
| 28 | | | | | | | 84 | 13 | 296 | 439 | 87 | 219 |
| 29 | | | | | | | 71 | 16 | 310 | 418 | 74 | 215 |
| 30 | | | | | ------ | | 58 | 18 | 299 | 395 | 64 | 211 |
| 31 | | ------ | | | ------ | | ------ | 20 | ------ | 373 | 58 | ------ |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 570.7 | 391 | 4,790 | 6,963 | 8,035 | 3,430 |
| Mean | 0 | 0 | 0 | 0 | 0 | 0 | 19.0 | 12.6 | 160 | 225 | 259 | 114 |
| Max | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 48 | 310 | 466 | 443 | 243 |
| Min | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.5 | 11 | 72 | 58 | 42 |
| Cfsm | 0 | 0 | 0 | 0 | 0 | 0 | 0.144 | 0.095 | 1.21 | 1.70 | 1.96 | 0.864 |
| In. | 0 | 0 | 0 | 0 | 0 | 0 | 0.16 | 0.11 | 1.35 | 1.96 | 2.26 | 0.97 |

Cal year 1967: Total 19,113.8 Mean 52.4 Max 722 Min 0 Cfsm 0.397 In. 5.39
Wtr year 1968: Total 24,179.7 Mean 66.1 Max 466 Min 0 Cfsm 0.501 In. 6.81

5-3200. Blue Earth River near Rapidan, Minn.

Location.--Lat 44°05'44", long 94°06'33", in SE¼SE¼ sec.6, T.107 N., R.27 W., on left bank 0.2 mile downstream from abandoned powerplant of Northern States Power Co., 2 miles west of Rapidan, 3½ miles downstream from Watonwan River, and 7¾ miles upstream from LeSueur River.

Drainage area.--2,430 sq mi, approximately.

Records available.--July 1909 to November 1910 (no winter records), October 1939 to September 1945, July 1949 to September 1968. Published as "at Rapidan Mills" 1909-10.

Gage.--Digital 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 and Nov. 15, 1939 to June 1, 1964 graphic water-stage recorder at present site and datum.

Average discharge.--25 years (1939-45, 1949-68), 778 cfs (563,200 acre-ft per year).

Extremes.--Maximum discharge during year, 3,160 cfs Sept. 25 (gage height, 5.04 ft); minimum daily, 14 cfs Jan. 8-14; minimum gage height, 1.13 ft Jan. 11.
1909-10, 1939-45, 1949-68: Maximum discharge, 43,100 cfs Apr. 9, 1965 (gage height, 21.36 ft, from floodmark); minimum, 6.9 cfs Oct. 12, 1955 (gage height, 1.04 ft).

Remarks.--Records good except those for winter months, which are fair. Flow regulated by Rapidan Reservoir. Rapidan Reservoir gates destroyed during April 1965 flood and not replaced. Capacity reduced to an undetermined figure. Regulation discontinued with closing of Northern States Power Co. plant on Dec. 31, 1966.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60 | 68 | 54 | 26 | 34 | 29 | 101 | 281 | 160 | 2,100 | 2,600 | 272 |
| 2 | 59 | 70 | 60 | 26 | 36 | 29 | 96 | 253 | 156 | 1,680 | 2,230 | 261 |
| 3 | 57 | 72 | 58 | 22 | 38 | 30 | 98 | 233 | 150 | 1,360 | 2,010 | 249 |
| 4 | 56 | 69 | 59 | 20 | 39 | 34 | 100 | 216 | 145 | 1,150 | 1,810 | 237 |
| 5 | 55 | 70 | 59 | 18 | 40 | 38 | 96 | 199 | 139 | 1,010 | 1,530 | 226 |
| 6 | 55 | 65 | 58 | 16 | 40 | 40 | 89 | 185 | 130 | 900 | 1,250 | 223 |
| 7 | 62 | 61 | 63 | 15 | 40 | 42 | 90 | 173 | 125 | 840 | 1,160 | 230 |
| 8 | 61 | 60 | 67 | 14 | 39 | 46 | 90 | 165 | 120 | 798 | 1,090 | 243 |
| 9 | 63 | 68 | 73 | 14 | 38 | 60 | 87 | 153 | 124 | 756 | 1,130 | 248 |
| 10 | 63 | 65 | 73 | 14 | 38 | 58 | 85 | 147 | 261 | 734 | 1,280 | 302 |
| 11 | 65 | 63 | 74 | 14 | 37 | 58 | 86 | 140 | 1,300 | 740 | 1,340 | 344 |
| 12 | 64 | 62 | 71 | 14 | 35 | 66 | 86 | 135 | 1,720 | 663 | 1,280 | 355 |
| 13 | 65 | 62 | 46 | 14 | 34 | 80 | 82 | 130 | 1,470 | 645 | 1,190 | 332 |
| 14 | 64 | 60 | 48 | 14 | 34 | 82 | 88 | 127 | 1,480 | 593 | 1,110 | 304 |
| 15 | 64 | 60 | 52 | 15 | 33 | 88 | 87 | 124 | 1,330 | 584 | 1,020 | 284 |
| 16 | 62 | 59 | 52 | 16 | 32 | 96 | 85 | 119 | 1,180 | 548 | 929 | 279 |
| 17 | 60 | 59 | 57 | 16 | 31 | 110 | 90 | 116 | 1,070 | 495 | 847 | 351 |
| 18 | 58 | 60 | 60 | 17 | 30 | 135 | 93 | 118 | 883 | 444 | 783 | 578 |
| 19 | 59 | 60 | 58 | 17 | 29 | 170 | 93 | 117 | 744 | 430 | 739 | 961 |
| 20 | 57 | 60 | 60 | 18 | 28 | 135 | 131 | 112 | 654 | 470 | 684 | 1,560 |
| 21 | 59 | 60 | 62 | 19 | 28 | 171 | 134 | 111 | 572 | 431 | 644 | 2,020 |
| 22 | 55 | 59 | 44 | 20 | 27 | 120 | 154 | 111 | 496 | 374 | 606 | 2,050 |
| 23 | 57 | 45 | 40 | 22 | 27 | 140 | 258 | 106 | 454 | 768 | 547 | 2,200 |
| 24 | 57 | 61 | 45 | 25 | 26 | 135 | 278 | 102 | 440 | 1,440 | 508 | 2,700 |
| 25 | 56 | 63 | 46 | 25 | 26 | 145 | 331 | 100 | 437 | 2,260 | 459 | 3,100 |
| 26 | 59 | 48 | 40 | 26 | 26 | 127 | 437 | 113 | 593 | 2,590 | 424 | 3,030 |
| 27 | 58 | 28 | 35 | 27 | 27 | 132 | 436 | 114 | 1,430 | 2,330 | 391 | 2,630 |
| 28 | 59 | 49 | 35 | 29 | 28 | 126 | 374 | 113 | 2,150 | 2,400 | 343 | 2,240 |
| 29 | 68 | 50 | 34 | 30 | 28 | 118 | 330 | 123 | 2,430 | 2,810 | 312 | 2,030 |
| 30 | 69 | 54 | 32 | 31 | ------ | 115 | 305 | 133 | 2,430 | 3,030 | 293 | 2,230 |
| 31 | 70 | ------ | 30 | 33 | ------ | 108 | ------ | 147 | ------ | 2,960 | 278 | ------ |
| TOTAL | 1,876 | 1,790 | 1,645 | 627 | 948 | 2,863 | 4,890 | 4,516 | 24,773 | 38,333 | 30,817 | 32,069 |
| MEAN | 60.5 | 59.7 | 53.1 | 20.2 | 32.7 | 92.4 | 163 | 146 | 826 | 1,237 | 994 | 1,069 |
| MAX | 70 | 72 | 74 | 33 | 40 | 171 | 437 | 281 | 2,430 | 3,030 | 2,600 | 3,100 |
| MIN | 55 | 28 | 30 | 14 | 26 | 29 | 82 | 100 | 120 | 374 | 278 | 223 |
| CFSM | .02 | .02 | .02 | .008 | .01 | .04 | .07 | .06 | .34 | .51 | .41 | .44 |
| IN. | .03 | .03 | .03 | .01 | .01 | .04 | .07 | .07 | .38 | .59 | .47 | .49 |
| AC-FT | 3,720 | 3,550 | 3,260 | 1,240 | 1,880 | 5,680 | 9,700 | 8,960 | 49,140 | 76,030 | 61,120 | 63,610 |

CAL YR 1967 TOTAL 277,719 MEAN 761 MAX 6,240 MIN 28 CFSM .31 IN 4.25 AC-FT 550,800
WTR YR 1968: TOTAL 145,147 MEAN 397 MAX 3,100 MIN 14 CFSM .16 IN 2.22 AC-FT 287,900

## 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 1968.

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.--25 years, 389 cfs (281,600 acre-ft per year).

Extremes.--Maximum discharge during year, 10,900 cfs July 26 (gage height, 13.54 ft); minimum daily, 6.4 cfs Jan. 17, 18.
1939-45, 1949-68: Maximum discharge, 24,700 cfs Apr. 8, 1965 (gage height, 22.10 ft, from floodmark); maximum gage height, 22.72 ft May 22, 1960 (from floodmark); minimum daily discharge, 1.6 cfs Feb. 9-25, 1959; minimum gage height, 1.59 ft Nov. 20, 1965.

Remarks.--Records are fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 28 | 31 | 29 | 13 | 9.0 | 9.9 | 51 | 230 | 150 | 1,410 | 2,730 | 370 |
| 2 | 32 | 34 | 29 | 12 | 9.2 | 10 | 48 | 212 | 148 | 1,220 | 2,330 | 332 |
| 3 | 29 | 34 | 29 | 12 | 9.3 | 11 | 50 | 195 | 155 | 1,030 | 2,020 | 305 |
| 4 | 28 | 34 | 29 | 11 | 9.4 | 12 | 50 | 182 | 167 | 876 | 1,770 | 297 |
| 5 | 26 | 33 | 30 | 11 | 9.5 | 13 | 45 | 174 | 164 | 732 | 1,650 | 355 |
| 6 | 28 | 31 | 31 | 10 | 9.5 | 14 | 41 | 162 | 148 | 612 | 1,510 | 380 |
| 7 | 30 | 31 | 31 | 9.5 | 9.4 | 16 | 41 | 146 | 130 | 466 | 5,790 | 395 |
| 8 | 30 | 28 | 33 | 9.0 | 9.3 | 18 | 41 | 137 | 118 | 350 | 6,120 | 509 |
| 9 | 30 | 28 | 33 | 8.5 | 9.2 | 20 | 40 | 126 | 200 | 301 | 5,800 | 1,190 |
| 10 | 28 | 31 | 32 | 8.0 | 9.2 | 22 | 37 | 120 | 254 | 285 | 7,000 | 1,310 |
| 11 | 28 | 31 | 32 | 7.6 | 9.1 | 24 | 36 | 114 | 436 | 438 | 7,050 | 1,190 |
| 12 | 27 | 31 | 30 | 7.5 | 9.1 | 25 | 35 | 110 | 816 | 522 | 5,650 | 1,040 |
| 13 | 24 | 32 | 29 | 7.2 | 9.0 | 26 | 33 | 103 | 1,040 | 588 | 4,360 | 912 |
| 14 | 23 | 32 | 29 | 6.8 | 8.8 | 30 | 37 | 100 | 1,100 | 1,500 | 3,450 | 780 |
| 15 | 24 | 31 | 28 | 6.6 | 8.7 | 35 | 36 | 96 | 1,030 | 1,880 | 2,830 | 654 |
| 16 | 24 | 32 | 28 | 6.5 | 8.6 | 40 | 36 | 103 | 954 | 2,000 | 2,480 | 558 |
| 17 | 28 | 32 | 28 | 6.4 | 8.5 | 48 | 36 | 129 | 918 | 1,700 | 2,200 | 700 |
| 18 | 24 | 31 | 27 | 6.4 | 8.4 | 60 | 37 | 265 | 768 | 1,490 | 2,000 | 1,140 |
| 19 | 23 | 31 | 26 | 6.5 | 8.2 | 70 | 38 | 230 | 582 | 1,400 | 1,800 | 1,890 |
| 20 | 22 | 31 | 25 | 6.6 | 8.2 | 75 | 64 | 192 | 460 | 1,270 | 1,720 | 2,090 |
| 21 | 22 | 33 | 24 | 6.7 | 8.2 | 77 | 70 | 174 | 370 | 1,080 | 1,700 | 2,150 |
| 22 | 22 | 33 | 22 | 6.8 | 8.2 | 76 | 96 | 155 | 305 | 870 | 1,490 | 2,200 |
| 23 | 23 | 32 | 21 | 7.0 | 8.3 | 75 | 286 | 139 | 258 | 1,820 | 1,340 | 2,670 |
| 24 | 29 | 34 | 20 | 7.2 | 8.4 | 74 | 485 | 118 | 237 | 3,430 | 1,200 | 3,320 |
| 25 | 27 | 32 | 19 | 7.4 | 8.6 | 73 | 642 | 108 | 234 | 5,910 | 1,050 | 3,450 |
| 26 | 26 | 30 | 18 | 7.6 | 8.8 | 71 | 672 | 108 | 305 | 10,000 | 894 | 3,280 |
| 27 | 28 | 31 | 17 | 7.8 | 9.0 | 70 | 522 | 108 | 758 | 9,300 | 750 | 2,800 |
| 28 | 28 | 31 | 16 | 8.0 | 9.2 | 68 | 390 | 110 | 1,310 | 7,320 | 624 | 2,480 |
| 29 | 30 | 30 | 15 | 8.2 | 9.6 | 66 | 328 | 124 | 1,580 | 5,640 | 516 | 2,270 |
| 30 | 32 | 28 | 14 | 8.4 | ------ | 56 | 265 | 143 | 1,570 | 4,210 | 444 | 2,060 |
| 31 | 32 | ------ | 13 | 8.8 | ------ | 56 | ------ | 148 | ------ | 3,360 | 395 | ------ |
| Total | 835 | 943 | 787 | 256.0 | 257.9 | 1,340.9 | 4,588 | 4,561 | 15,665 | 73,010 | 80,663 | 43,077 |
| Mean | 26.9 | 31.4 | 25.4 | 8.26 | 8.89 | 43.3 | 153 | 147 | 556 | 2,355 | 2,602 | 1,436 |
| Max | 32 | 34 | 33 | 13 | 9.6 | 75 | 672 | 265 | 1,580 | 10,000 | 7,050 | 3,450 |
| Min | 22 | 28 | 13 | 6.4 | 8.2 | 9.9 | 33 | 96 | 118 | 285 | 395 | 297 |
| Cfsm | 0.024 | 0.029 | 0.023 | 0.0075 | 0.0081 | 0.039 | 0.139 | 0.134 | 0.505 | 2.14 | 2.37 | 1.31 |
| In. | 0.03 | 0.03 | 0.03 | 0.009 | 0.009 | 0.05 | 0.16 | 0.15 | 0.56 | 2.47 | 2.73 | 1.46 |
| Ac-ft | 1,660 | 1,870 | 1,560 | 508 | 512 | 2,660 | 9,100 | 9,050 | 33,050 | 144,800 | 160,000 | 85,440 |

Cal yr 1967: Total 194,553 Mean 533 Max 8,690 Min 13 Cfsm 0.485 In. 6.58 Ac-ft 385,900
Wtr yr 1968: Total 226,983.8 Mean 620 Max 10,000 Min 6.4 Cfsm 0.564 In. 7.67 Ac-ft 450,100

Peak discharge (base, 1,300 cfs)

| Date | Time | Gage height | Discharge | Date | Time | Gage height | Discharge |
|---|---|---|---|---|---|---|---|
| 6-29 | 2200 | 5.04 | 1,610 | 8-11 | 0100 | 11.17 | 7,420 |
| 7-16 | 0800 | 5.67 | 2,030 | 9-10 | 0200 | 4.60 | 1,350 |
| 7-26 | 1030 | 13.54 | 10,900 | 9-25 | 1200 | 7.52 | 3,470 |

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 upstream from Mississippi River.

Drainage area.--14,900 sq mi, approximately.

Records available.--May 1903 to September 1968 (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.--Digital 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. Mar. 18, 1925, to Dec. 2, 1964, graphic water-stage recorder at present site and datum.

Average discharge.--47 years (1905, 1910-17, 1929-68), 2,494 cfs (1,806,000 acre-ft per year).

Extremes.--Maximum discharge during year, 15,800 cfs July 27 (gage height, 14.65 ft); minimum, 76 cfs Nov. 27 (gage height, 1.84 ft).
1903-68: Maximum discharge, 94,100 cfs Apr. 10, 1965 (gage height, 29.09 ft); 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 winter months, which are fair. Records of suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 264 | 322 | 292 | 150 | 133 | 136 | 948 | 1,730 | 874 | 4,030 | 10,800 | 1,320 |
| 2 | 260 | 325 | 295 | 140 | 135 | 140 | 843 | 1,620 | 885 | 3,490 | 9,780 | 1,240 |
| 3 | 269 | 322 | 289 | 130 | 135 | 144 | 801 | 1,540 | 927 | 3,000 | 8,560 | 1,190 |
| 4 | 256 | 325 | 313 | 120 | 138 | 150 | 811 | 1,450 | 990 | 2,680 | 7,220 | 1,180 |
| 5 | 244 | 323 | 304 | 110 | 139 | 157 | 759 | 1,340 | 990 | 2,420 | 5,840 | 1,210 |
| 6 | 240 | 318 | 308 | 102 | 139 | 163 | 822 | 1,220 | 937 | 2,210 | 5,080 | 1,230 |
| 7 | 264 | 311 | 328 | 96 | 140 | 180 | 874 | 1,160 | 874 | 2,040 | 12,000 | 1,270 |
| 8 | 274 | 310 | 334 | 89 | 140 | 198 | 811 | 1,120 | 843 | 1,890 | 12,300 | 1,510 |
| 9 | 282 | 322 | 345 | 89 | 140 | 210 | 790 | 1,080 | 937 | 1,760 | 11,200 | 1,960 |
| 10 | 269 | 327 | 350 | 88 | 139 | 225 | 769 | 1,030 | 1,290 | 1,650 | 11,500 | 2,260 |
| 11 | 266 | 327 | 355 | 87 | 138 | 240 | 811 | 969 | 2,380 | 1,760 | 11,400 | 2,280 |
| 12 | 269 | 332 | 358 | 88 | 138 | 260 | 948 | 916 | 3,610 | 1,730 | 9,450 | 2,160 |
| 13 | 271 | 330 | 303 | 91 | 137 | 300 | 1,050 | 843 | 3,680 | 1,860 | 7,640 | 1,990 |
| 14 | 275 | 327 | 236 | 96 | 135 | 330 | 1,090 | 822 | 3,680 | 2,270 | 6,330 | 1,800 |
| 15 | 279 | 323 | 250 | 100 | 135 | 355 | 990 | 811 | 3,430 | 2,680 | 5,380 | 1,620 |
| 16 | 278 | 329 | 270 | 103 | 134 | 405 | 916 | 822 | 3,060 | 3,050 | 4,730 | 1,540 |
| 17 | 285 | 342 | 285 | 108 | 132 | 480 | 948 | 759 | 2,840 | 2,930 | 4,200 | 1,980 |
| 18 | 285 | 351 | 295 | 110 | 132 | 600 | 927 | 927 | 2,570 | 2,640 | 3,740 | 2,720 |
| 19 | 362 | 345 | 290 | 112 | 131 | 700 | 874 | 958 | 2,340 | 2,540 | 3,310 | 3,740 |
| 20 | 478 | 338 | 300 | 115 | 128 | 723 | 1,000 | 885 | 2,180 | 2,460 | 3,160 | 4,380 |
| 21 | 357 | 344 | 280 | 117 | 128 | 700 | 1,040 | 822 | 2,060 | 2,180 | 2,940 | 4,920 |
| 22 | 303 | 342 | 220 | 118 | 128 | 696 | 1,220 | 801 | 1,900 | 1,870 | 2,670 | 5,860 |
| 23 | 289 | 319 | 230 | 120 | 128 | 601 | 1,760 | 769 | 1,790 | 2,640 | 2,430 | 7,980 |
| 24 | 312 | 323 | 251 | 121 | 128 | 853 | 1,850 | 738 | 1,760 | 5,260 | 2,260 | 10,200 |
| 25 | 302 | 338 | 250 | 125 | 129 | 1,050 | 1,970 | 696 | 1,760 | 8,170 | 2,080 | 11,400 |
| 26 | 286 | 313 | 230 | 125 | 129 | 1,210 | 2,180 | 738 | 1,840 | 13,000 | 1,890 | 10,800 |
| 27 | 289 | 170 | 205 | 127 | 130 | 1,240 | 2,190 | 769 | 2,590 | 15,600 | 1,730 | 9,170 |
| 28 | 286 | 269 | 190 | 129 | 130 | 1,130 | 2,130 | 769 | 3,670 | 15,200 | 1,570 | 7,590 |
| 29 | 312 | 281 | 180 | 130 | 131 | 1,060 | 2,000 | 811 | 4,260 | 14,100 | 1,460 | 6,590 |
| 30 | 330 | 291 | 170 | 131 | ------ | 1,020 | 1,860 | 822 | 4,350 | 12,500 | 1,400 | 6,110 |
| 31 | 325 | ------ | 160 | 132 | ------ | 1,010 | ------ | 822 | ------ | 11,400 | 1,350 | ------ |
| TOTAL | 9,055 | 9,539 | 8,466 | 3,499 | 3,979 | 16,666 | 35,982 | 30,559 | 65,297 | 151,010 | 175,400 | 119,200 |
| MEAN | 292 | 318 | 273 | 113 | 134 | 538 | 1,199 | 986 | 2,177 | 4,871 | 5,658 | 3,973 |
| MAX | 478 | 351 | 358 | 150 | 140 | 1,240 | 2,190 | 1,730 | 4,350 | 15,600 | 12,300 | 11,400 |
| MIN | 240 | 170 | 160 | 87 | 128 | 136 | 759 | 696 | 843 | 1,650 | 1,350 | 1,180 |
| CFSM | .02 | .02 | .02 | .008 | .009 | .04 | .08 | .07 | .15 | .33 | .38 | .27 |
| IN. | .02 | .02 | .02 | .009 | .01 | .04 | .09 | .08 | .16 | .38 | .44 | .30 |
| AC-FT | 17,960 | 18,920 | 16,790 | 6,940 | 7,690 | 33,060 | 71,370 | 60,610 | 129,500 | 299,500 | 347,900 | 236,400 |

CAL YR 1967 TOTAL 1,014,268 MEAN 2,779 MAX 18,300 MIN 160 CFSM .19 IN 2.53 AC-FT 2,012,000
WTR YR 1968: TOTAL 628,552 MEAN 1,717 MAX 15,600 MIN 87 CFSM .12 IN 1.57 AC-FT 1,247,000

5-3300. Minnesota River near Jordan, Minn.

Location.--Lat 44°41'35", long 93°38'30", in NW¼SW¼ sec.7, T.114 N., R.23 W., on left bank 1½ miles northwest of Jordan and at mile 39.4 upstream from Mississippi River.

Drainage area.--16,200 sq mi, approximately.

Records available.--September 1934 to September 1968. Prior to Oct. 1, 1966, published as "near Carver, Minn".

Gage.--Digital water-stage recorder. Datum of gage is 690.00 ft above mean sea level, datum of 1929. Auxiliary water-stage recorder 2¾ miles downstream at same datum. Prior to Oct. 1, 1966, graphic water-stage recorder 2¾ miles downstream with auxiliary chain gage at present site and same datum.

Average discharge.--34 years, 3,151 cfs (2,281,000 acre-ft per year).

Extremes.--Maximum discharge during year, 15,700 cfs Aug. 11, 12; maximum gage height, 20.03 ft Aug 11; minimum daily discharge, 185 cfs Jan. 14-17; minimum gage height, 3.89 ft Nov. 29, 30, Dec. 23, 24. 1934-68: Maximum discharge, 117,000 cfs Apr. 11, 1965; maximum gage height, 34.37 ft Apr. 12, 1965 (backwater from Mississippi River); minimum discharge, 79 cfs Nov. 17, 1955; minimum gage height, 2.66 ft Nov. 22, 1935.

Remarks.--Records fair. Records of chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 427 | 475 | 360 | 225 | 215 | 210 | 1,040 | 2,100 | 1,000 | 4,360 | 15,200 | 1,940 |
| 2 | 424 | 459 | 400 | 210 | 215 | 210 | 1,020 | 1,960 | 988 | 4,230 | 15,100 | 1,870 |
| 3 | 421 | 459 | 410 | 200 | 215 | 215 | 998 | 1,820 | 998 | 3,830 | 14,500 | 1,770 |
| 4 | 415 | 450 | 419 | 195 | 215 | 215 | 953 | 1,710 | 998 | 3,380 | 13,300 | 1,700 |
| 5 | 409 | 436 | 420 | 190 | 220 | 220 | 898 | 1,620 | 1,010 | 3,010 | 11,300 | 1,700 |
| 6 | 394 | 441 | 419 | 190 | 220 | 220 | 819 | 1,540 | 1,020 | 2,750 | 8,990 | 1,600 |
| 7 | 413 | 436 | 421 | 190 | 220 | 225 | 828 | 1,470 | 993 | 2,520 | 7,430 | 1,600 |
| 8 | 424 | 423 | 425 | 190 | 220 | 225 | 888 | 1,380 | 948 | 2,320 | 10,900 | 1,620 |
| 9 | 396 | 423 | 438 | 185 | 220 | 230 | 893 | 1,340 | 1,010 | 2,150 | 13,600 | 1,760 |
| 10 | 366 | 436 | 442 | 185 | 220 | 235 | 853 | 1,290 | 1,180 | 2,060 | 15,100 | 2,090 |
| 11 | 372 | 450 | 447 | 185 | 215 | 245 | 824 | 1,240 | 1,890 | 1,840 | 15,700 | 2,430 |
| 12 | 377 | 446 | 458 | 185 | 215 | 255 | 814 | 1,190 | 2,500 | 1,880 | 15,700 | 2,580 |
| 13 | 384 | 441 | 478 | 185 | 215 | 265 | 843 | 1,130 | 3,370 | 2,520 | 15,300 | 2,520 |
| 14 | 390 | 436 | 400 | 185 | 210 | 315 | 943 | 1,100 | 4,680 | 4,240 | 14,000 | 2,380 |
| 15 | 395 | 451 | 350 | 185 | 210 | 380 | 1,030 | 1,040 | 4,500 | 4,600 | 11,300 | 2,200 |
| 16 | 399 | 456 | 320 | 185 | 210 | 460 | 1,040 | 1,070 | 4,270 | 4,610 | 8,730 | 2,040 |
| 17 | 404 | 464 | 350 | 185 | 210 | 570 | 983 | 1,040 | 3,910 | 4,550 | 7,000 | 2,010 |
| 18 | 408 | 464 | 420 | 185 | 205 | 700 | 933 | 1,030 | 3,940 | 4,290 | 5,940 | 2,330 |
| 19 | 412 | 461 | 410 | 190 | 205 | 833 | 928 | 1,030 | 3,620 | 3,820 | 5,330 | 3,140 |
| 20 | 416 | 468 | 400 | 190 | 205 | 973 | 988 | 1,110 | 3,190 | 3,520 | 4,740 | 3,940 |
| 21 | 452 | 468 | 410 | 190 | 205 | 958 | 1,040 | 1,090 | 3,120 | 3,380 | 4,420 | 4,640 |
| 22 | 590 | 461 | 410 | 190 | 205 | 878 | 1,060 | 1,030 | 2,740 | 3,070 | 4,100 | 5,600 |
| 23 | 545 | 455 | 310 | 195 | 205 | 848 | 1,210 | 983 | 2,380 | 2,770 | 3,730 | 6,680 |
| 24 | 497 | 459 | 320 | 195 | 210 | 828 | 1,760 | 943 | 2,120 | 2,710 | 3,370 | 8,580 |
| 25 | 461 | 455 | 350 | 200 | 210 | 888 | 2,190 | 948 | 1,990 | 4,780 | 3,050 | 9,220 |
| 26 | 442 | 446 | 360 | 200 | 210 | 958 | 2,150 | 928 | 1,980 | 7,070 | 2,770 | 10,200 |
| 27 | 446 | 395 | 350 | 200 | 210 | 1,140 | 2,230 | 918 | 2,080 | 9,430 | 2,650 | 10,800 |
| 28 | 436 | 370 | 320 | 205 | 210 | 1,210 | 2,320 | 933 | 2,460 | 11,400 | 2,530 | 10,800 |
| 29 | 428 | 340 | 280 | 210 | 210 | 1,210 | 2,330 | 963 | 3,460 | 12,900 | 2,280 | 9,670 |
| 30 | 432 | 325 | 270 | 210 | ------ | 1,130 | 2,230 | 963 | 4,140 | 13,900 | 2,080 | 8,170 |
| 31 | 449 | ------ | 245 | 210 | ------ | 1,080 | ------ | 983 | ------ | 14,900 | 2,020 | ------ |
| TOTAL | 13,224 | 13,149 | 11,812 | 6,025 | 6,155 | 18,329 | 37,026 | 37,892 | 72,485 | 152,790 | 262,160 | 127,580 |
| MEAN | 427 | 438 | 381 | 194 | 212 | 591 | 1,234 | 1,222 | 2,416 | 4,929 | 8,457 | 4,253 |
| MAX | 590 | 475 | 478 | 225 | 220 | 1,210 | 2,330 | 2,100 | 4,680 | 14,900 | 15,700 | 10,800 |
| MIN | 366 | 325 | 245 | 185 | 205 | 210 | 814 | 918 | 948 | 1,840 | 2,020 | 1,600 |
| CFSM | .03 | .03 | .02 | .01 | .01 | .04 | .08 | .08 | .15 | .30 | .52 | .26 |
| IN. | .03 | .03 | .03 | .01 | .01 | .04 | .08 | .09 | .17 | .35 | .60 | .29 |
| AC-FT | 26,230 | 26,080 | 23,430 | 11,950 | 12,210 | 36,360 | 73,440 | 75,160 | 143,800 | 303,100 | 520,000 | 253,100 |

CAL YR 1967 TOTAL 1,233,981 MEAN 3,381 MAX 19,300 MIN 245 CFSM .21 IN 2.83 AC-FT 2,448,000
WTR YR 1968: TOTAL 758,627 MEAN 2,073 MAX 15,700 MIN 185 CFSM .13 IN 1.74 AC-FT 1,505,000

## 5-3309. Nine Mile Creek at Bloomington, Minn.

Location.--Lat 44°48'46", long 93°18'07", in NW¼ sec.21, T.27 N., R.24 W., on left bank between 105th and 106th Street in Bloomington, Minn., 1.2 miles downstream from bridge on Old Shakopee Road and 2.1 miles upstream from mouth.

Records available.--January 1963 to September 1968.

Gage.--Digital water-stage recorder. Altitude of gage is 731 ft (from topographic map). Prior to May 16, 1963, staff gage 30 ft upstream at datum 0.81 ft higher. May 16, 1963, to Dec. 13, 1965, graphic water-stage recorder at present site and datum.

Extremes.--Maximum discharge during year, 298 cfs June 13, July 14; maximum gage height, 3.72 ft June 13; minimum daily discharge, 1.7 cfs Feb. 16 to Mar. 4.
1963-68: Maximum discharge, 535 cfs Apr. 8, 1965 (gage height, 4.32 ft); minimum daily, 1.2 cfs Feb. 24, 1965; minimum gage height, 1.28 ft Oct. 14, 1966.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.0 | 5.0 | 4.7 | 2.3 | 1.9 | 1.7 | 9.6 | 12 | 34 | 29 | 27 | 6.4 |
| 2 | 5.4 | 4.7 | 5.1 | 2.2 | 1.9 | 1.7 | 10 | 10 | 29 | 24 | 27 | 6.5 |
| 3 | 5.1 | 4.6 | 4.7 | 2.1 | 1.9 | 1.7 | 13 | 10 | 22 | 21 | 24 | 10 |
| 4 | 5.2 | 4.5 | 4.7 | 2.1 | 1.9 | 1.7 | 24 | 8.0 | 17 | 17 | 23 | 13 |
| 5 | 5.4 | 4.4 | 4.4 | 2.1 | 1.9 | 1.8 | 19 | 7.9 | 18 | 15 | 22 | 9.2 |
| 6 | 5.3 | 4.5 | 4.4 | 2.0 | 1.9 | 1.8 | 12 | 7.0 | 14 | 14 | 22 | 7.3 |
| 7 | 17 | 4.4 | 4.5 | 2.0 | 1.9 | 1.9 | 11 | 10 | 12 | 11 | 21 | 6.3 |
| 8 | 12 | 4.7 | 4.7 | 2.0 | 1.9 | 2.0 | 14 | 15 | 14 | 9.6 | 20 | 12 |
| 9 | 9.1 | 4.6 | 4.9 | 2.0 | 1.9 | 2.0 | 13 | 12 | 18 | 8.6 | 18 | 19 |
| 10 | 5.2 | 4.7 | 4.7 | 2.0 | 1.9 | 2.1 | 11 | 8.5 | 33 | 7.6 | 16 | 20 |
| 11 | 5.1 | 4.7 | 4.7 | 2.0 | 1.9 | 2.1 | 11 | 6.7 | 97 | 9.0 | 11 | 12 |
| 12 | 5.0 | 4.7 | 5.1 | 2.0 | 1.8 | 2.2 | 12 | 6.4 | 74 | 27 | 9.4 | 9.3 |
| 13 | 5.1 | 4.5 | 4.5 | 2.0 | 1.8 | 2.2 | 12 | 6.5 | 93 | 54 | 8.8 | 7.9 |
| 14 | 5.0 | 4.5 | 4.5 | 2.0 | 1.8 | 2.3 | 21 | 11 | 123 | 104 | 8.8 | 7.0 |
| 15 | 4.9 | 4.5 | 4.4 | 1.9 | 1.8 | 2.3 | 18 | 17 | 117 | 102 | 9.6 | 7.3 |
| 16 | 5.3 | 4.9 | 4.4 | 1.9 | 1.7 | 2.4 | 11 | 40 | 111 | 118 | 10 | 7.7 |
| 17 | 5.8 | 4.9 | 4.5 | 1.9 | 1.7 | 2.4 | 9.9 | 43 | 104 | 114 | 8.8 | 23 |
| 18 | 6.1 | 5.1 | 4.6 | 1.9 | 1.7 | 23 | 9.5 | 36 | 92 | 98 | 7.9 | 45 |
| 19 | 6.4 | 4.9 | 4.6 | 1.9 | 1.7 | 37 | 9.6 | 25 | 76 | 83 | 8.8 | 40 |
| 20 | 6.9 | 4.9 | 4.6 | 1.9 | 1.7 | 25 | 43 | 17 | 65 | 69 | 7.9 | 32 |
| 21 | 6.2 | 4.9 | 4.4 | 1.9 | 1.7 | 15 | 38 | 15 | 74 | 55 | 7.9 | 24 |
| 22 | 6.9 | 4.8 | 4.1 | 1.9 | 1.7 | 15 | 22 | 13 | 69 | 47 | 7.9 | 39 |
| 23 | 9.5 | 4.7 | 4.0 | 1.9 | 1.7 | 20 | 47 | 9.5 | 67 | 50 | 7.9 | 60 |
| 24 | 9.7 | 5.2 | 3.9 | 1.9 | 1.7 | 28 | 52 | 21 | 61 | 40 | 7.9 | 58 |
| 25 | 9.5 | 5.1 | 3.8 | 1.9 | 1.7 | 31 | 40 | 36 | 53 | 35 | 7.3 | 51 |
| 26 | 5.8 | 4.5 | 3.6 | 1.9 | 1.7 | 30 | 25 | 54 | 63 | 31 | 6.8 | 40 |
| 27 | 5.0 | 4.4 | 3.4 | 1.9 | 1.7 | 30 | 17 | 60 | 55 | 30 | 6.8 | 23 |
| 28 | 4.7 | 4.4 | 3.2 | 1.9 | 1.7 | 34 | 14 | 59 | 52 | 22 | 6.8 | 16 |
| 29 | 8.3 | 4.4 | 3.0 | 1.9 | 1.7 | 27 | 13 | 47 | 45 | 19 | 6.4 | 14 |
| 30 | 7.6 | 4.2 | 2.8 | 1.9 | ------ | 16 | 14 | 30 | 36 | 23 | 6.4 | 12 |
| 31 | 6.3 | ------ | 2.6 | 1.9 | ------ | 9.5 | ------ | 29 | ------ | 26 | 6.8 | ------ |
| TOTAL | 209.8 | 140.3 | 131.5 | 61.1 | 51.9 | 374.8 | 575.6 | 682.5 | 1,738 | 1,312.8 | 389.9 | 637.9 |
| MEAN | 6.77 | 4.68 | 4.24 | 1.97 | 1.79 | 12.1 | 19.2 | 22.0 | 57.9 | 42.3 | 12.6 | 21.3 |
| MAX | 17 | 5.2 | 5.1 | 2.3 | 1.9 | 37 | 52 | 60 | 123 | 118 | 27 | 60 |
| MIN | 4.7 | 4.2 | 2.6 | 1.9 | 1.7 | 1.7 | 9.5 | 6.4 | 12 | 7.6 | 6.4 | 6.3 |
| AC-FT | 416 | 278 | 261 | 121 | 103 | 743 | 1,140 | 1,350 | 3,450 | 2,600 | 773 | 1,270 |

| | | | | | |
|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 5,815.0 | MEAN 15.9 | MAX 181 | MIN 2.6 | AC-FT 11,530 |
| WTR YR 1968 | TOTAL 6,306.1 | MEAN 17.2 | MAX 123 | MIN 1.7 | AC-FT 12,510 |

## 5-3310. Mississippi River at St. Paul, Minn.

Location.--Lat 44°56'40", long 93°05'20", in SE¼NE¼ sec.6, T.28 N., R.22 W., on left bank in St. Paul, 300 ft upstream from Robert Street Bridge, 6 miles downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.

Drainage area.--36,800 sq mi, approximately.

Records available.--Water years 1867-69, 1872-92 (annual maximum), March 1892 to September 1968 (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.--70 years (1894-95, 1896-97, 1900-1968), 10,080 cfs (adjusted for diversion).

Extremes.--Maximum discharge during year, 27,300 cfs June 16 (gage height, 5.72 ft); minimum daily, 1,220 cfs Nov. 28.

1867-69, 1872-1968: Maximum discharge, 171,000 cfs Apr. 16, 1965 (gage height, 26.01 ft, from floodmark).
1897, 1917-68: Minimum daily discharge, 632 cfs Aug. 26, 1934.
Maximum stage known since at least 1851, that of Apr. 16, 1965. Flood of Apr. 11, 1870 reached a stage of 19.4 ft (discharge, 100,000 cfs).

Remarks.--Records good. Records of water temperatures and chemical analysis for the water year 1968 are published in Part 2 of this report. Slight regulation except during extreme floods by reservoirs on headwaters and by powerplants. Beginning July 20, 1938, sewage from Minneapolis and St. Paul, which formerly entered above station, was diverted to a sewage-disposal plant, thence to river below station. Figures of daily discharge do not include this diversion.

Cooperation.--Records of Mississippi River at Twin City lock and dam computed and furnished by Ford Motor Co. Gage-height record at South St. Paul furnished by Corps of Engineers. Diversion through sewage disposal plant furnished by Minneapolis-St. Paul Sanitary District.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2650 | 3220 | 2250 | 2110 | 2940 | 2380 | 6510 | 17700 | 9570 | 19400 | 22700 | 4900 |
| 2 | 2990 | 3440 | 2570 | 2200 | 2920 | 2460 | 6540 | 16200 | 9740 | 18400 | 22200 | 5220 |
| 3 | 2240 | 3410 | 2800 | 1790 | 2820 | 2410 | 6080 | 15300 | 9500 | 17300 | 21500 | 4940 |
| 4 | 3060 | 3650 | 3150 | 2320 | 2760 | 2510 | 6140 | 14300 | 9820 | 16200 | 20300 | 4970 |
| 5 | 2630 | 3420 | 3150 | 2140 | 2840 | 2800 | 6850 | 12900 | 9500 | 15800 | 19200 | 4930 |
| 6 | 2460 | 3240 | 3110 | 2110 | 2940 | 2600 | 5930 | 11400 | 9240 | 15900 | 17000 | 4920 |
| 7 | 2540 | 3200 | 3570 | 2170 | 2810 | 3100 | 5800 | 11000 | 9630 | 14900 | 14600 | 4820 |
| 8 | 2840 | 3140 | 3470 | 2340 | 2870 | 3250 | 6170 | 10600 | 9340 | 14200 | 13100 | 4930 |
| 9 | 3560 | 2780 | 3580 | 2180 | 2900 | 4120 | 6680 | 10400 | 9000 | 13800 | 16600 | 4600 |
| 10 | 3060 | 3210 | 3310 | 2130 | 3090 | 4180 | 7170 | 10600 | 10600 | 12700 | 19100 | 5380 |
| 11 | 3400 | 3750 | 3270 | 2390 | 2450 | 4970 | 7850 | 10200 | 14000 | 11400 | 20600 | 5790 |
| 12 | 2810 | 2910 | 3390 | 2260 | 2800 | 4850 | 10100 | 9950 | 18000 | 10800 | 20800 | 5490 |
| 13 | 3040 | 3580 | 2990 | 2420 | 3210 | 4790 | 9820 | 9960 | 20900 | 11700 | 20900 | 5490 |
| 14 | 2500 | 3580 | 2920 | 2370 | 2340 | 4940 | 9300 | 10700 | 23600 | 12800 | 20200 | 5510 |
| 15 | 2950 | 3290 | 2590 | 2400 | 2260 | 5230 | 9990 | 10600 | 25500 | 15400 | 18600 | 4720 |
| 16 | 2720 | 3220 | 2190 | 2390 | 2120 | 5650 | 8940 | 10800 | 25500 | 16300 | 16300 | 5020 |
| 17 | 3430 | 3020 | 2270 | 2460 | 2160 | 6030 | 9860 | 10300 | 25000 | 16400 | 13100 | 5800 |
| 18 | 3100 | 3070 | 3380 | 2500 | 1750 | 6440 | 8440 | 9860 | 24700 | 16300 | 11400 | 6110 |
| 19 | 3730 | 3500 | 3340 | 2490 | 2300 | 6940 | 8890 | 10400 | 23600 | 17000 | 10300 | 6720 |
| 20 | 3490 | 3430 | 3280 | 2560 | 2100 | 6580 | 9130 | 10900 | 22200 | 16300 | 8670 | 7430 |
| 21 | 2150 | 3390 | 3080 | 2390 | 1980 | 6920 | 10300 | 10400 | 21400 | 15800 | 8420 | 8440 |
| 22 | 3080 | 3300 | 2030 | 2620 | 2120 | 6580 | 11600 | 10200 | 21100 | 16200 | 8090 | 9140 |
| 23 | 2970 | 3120 | 1820 | 2450 | 2160 | 6240 | 13000 | 10100 | 20500 | 14100 | 7890 | 11400 |
| 24 | 3830 | 3200 | 2310 | 2720 | 2220 | 6740 | 14800 | 10200 | 19900 | 13100 | 7680 | 15300 |
| 25 | 3570 | 2760 | 2660 | 2800 | 1920 | 7230 | 15300 | 10500 | 18800 | 12600 | 6600 | 17700 |
| 26 | 3060 | 2890 | 3180 | 2790 | 2190 | 7410 | 15900 | 9540 | 17900 | 14300 | 6420 | 18900 |
| 27 | 3260 | 1870 | 2640 | 2570 | 2490 | 6860 | 16300 | 8900 | 17300 | 16300 | 5470 | 20300 |
| 28 | 3260 | 1220 | 2580 | 2910 | 2340 | 6950 | 16600 | 8840 | 17000 | 17700 | 5070 | 20300 |
| 29 | 3480 | 1510 | 2820 | 2900 | 2210 | 7080 | 17500 | 8930 | 16600 | 19600 | 5200 | 20100 |
| 30 | 3150 | 1700 | 2660 | 2800 | ------ | 6960 | 18000 | 8850 | 17700 | 20900 | 4990 | 18500 |
| 31 | 3290 | ------ | 2170 | 3040 | ------ | 6930 | ------ | 9100 | ------ | 21900 | 5180 | ------ |
| Total | 94,300 | 91,020 | 88,530 | 75,720 | 72,010 | 162,130 | 305,490 | 339,630 | 507,140 | 485,500 | 418,180 | 267,770 |
| Mean | 3,042 | 3,034 | 2,856 | 2,442 | 2,483 | 5,230 | 10,180 | 10,960 | 16,900 | 15,660 | 13,490 | 8,926 |
| (≠) | +322 | +300 | +293 | +289 | +284 | +313 | +319 | +342 | +378 | +387 | +381 | +362 |
| Mean ≠ | 3,364 | 3,334 | 3,149 | 2,731 | 2,767 | 5,543 | 10,500 | 11,300 | 17,280 | 16,050 | 13,870 | 9,288 |
| Max | 3,830 | 3,750 | 3,580 | 3,040 | 3,210 | 7,410 | 18,000 | 17,700 | 25,500 | 21,900 | 22,700 | 20,300 |
| Min | 2,150 | 1,220 | 1,820 | 1,790 | 1,750 | 2,380 | 5,800 | 8,840 | 9,000 | 10,800 | 4,990 | 4,600 |
| Cfsm ≠ | 0.091 | 0.091 | 0.086 | 0.074 | 0.075 | 0.151 | 0.285 | 0.307 | 0.470 | 0.436 | 0.377 | 0.252 |
| In. ≠ | 0.10 | 0.10 | 0.10 | 0.09 | 0.08 | 0.17 | 0.32 | 0.35 | 0.52 | 0.50 | 0.43 | 0.28 |

Calendar year 1967: Max 52,100 Min 1,220 Mean 10,700 Mean≠ 11,030 Cfsm≠ 0.300 In.≠ 4.06
Water year 1967-68: Max 25,500 Min 1,220 Mean 7,944 Mean≠ 8,275 Cfsm≠ 0.225 In.≠ 3.04

≠ Diversion, equivalent in cubic feet per second, through sewage-disposal plant.
≠ Adjusted for diversion.

Note.--Stage-fall discharge relation affected by indefinite slope throughout the year.

5-3362. Glaisby Brook near Kettle River, Minn.

Location.--Lat 46°27'19", long 92°51'34", in SE¼NW¼ sec.22, T.46 N., R.20 W., on left bank 20 ft upstream from bridge No. 2468 on State Highways 27 and 73, 1.0 mile upstream from mouth, and 2.4 miles south of Kettle River.

Records available.--October 1959 to September 1968.

Gage.--Water-stage recorder. Altitude of gage is 1,105 ft (from topographic map).

Average discharge.--9 years, 19.5 cfs.

Extremes.--Maximum discharge during year, 270 cfs Apr. 24 (gage height, 4.75 ft); minimum daily, 0.1 cfs Feb. 4, 5, 6, 7.
1959-68: Maximum discharge, 813 cfs Apr. 18, 1965 (gage height, 8.42 ft); minimum, 0.1 cfs Aug. 3, 1960, July 9, 1961, Aug. 8, Sept. 1, 1963, July 24, 25, 26, 1964, Feb. 4, 5, 6, 7, 1968.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.2 | 0.7 | 0.4 | 0.4 | 0.2 | 0.3 | 4.6 | 54 | 71 | 29 | 29 | 2.0 |
| 2 | .2 | .7 | .4 | .3 | .2 | .3 | 2.8 | 42 | 72 | 21 | 21 | 3.8 |
| 3 | .2 | .5 | .4 | .3 | .2 | .3 | 3.3 | 35 | 63 | 15 | 14 | 2.2 |
| 4 | .2 | .4 | .4 | .3 | .1 | .4 | 3.0 | 29 | 51 | 11 | 11 | 2.6 |
| 5 | .2 | .3 | .5 | .3 | .1 | .3 | 2.6 | 25 | 42 | 8.6 | 9.7 | 2.2 |
| 6 | .2 | .3 | .5 | .3 | .1 | .4 | 4.3 | 21 | 121 | 6.8 | 8.6 | 2.6 |
| 7 | .3 | .3 | .6 | .3 | .1 | .6 | 13 | 21 | 210 | 5.4 | 8.6 | 2.6 |
| 8 | .5 | .3 | .6 | .2 | .2 | .9 | 29 | 25 | 142 | 4.0 | 13 | 6.2 |
| 9 | .3 | .3 | .6 | .2 | .2 | 2.5 | 31 | 36 | 156 | 3.0 | 16 | 8.6 |
| 10 | .3 | .4 | .7 | .3 | .2 | 1.8 | 24 | 36 | 173 | 2.1 | 14 | 7.2 |
| 11 | .3 | .4 | .7 | .3 | .3 | 1.1 | 20 | 32 | 196 | 5.4 | 10 | 5.4 |
| 12 | .3 | .5 | .7 | .3 | .3 | .8 | 17 | 52 | 178 | 103 | 10 | 4.8 |
| 13 | .4 | .5 | .7 | .3 | .2 | .6 | 14 | 65 | 128 | 61 | 8.2 | 3.0 |
| 14 | .4 | .4 | .6 | .3 | .2 | .5 | 17 | 80 | 91 | 65 | 5.4 | 1.7 |
| 15 | .4 | .4 | .6 | .3 | .2 | .7 | 22 | 90 | 64 | 107 | 6.2 | 1.7 |
| 16 | .4 | .4 | .5 | .3 | .3 | 1.0 | 25 | 84 | 50 | 88 | 6.0 | 1.7 |
| 17 | .4 | .4 | .5 | .3 | .3 | 1.5 | 25 | 70 | 41 | 59 | 5.0 | 6.3 |
| 18 | .4 | .5 | .6 | .3 | .4 | 2.3 | 21 | 69 | 35 | 92 | 5.4 | 26 |
| 19 | .5 | .4 | .5 | .3 | .3 | 3.5 | 18 | 79 | 33 | 66 | 8.2 | 38 |
| 20 | .5 | .4 | .5 | .3 | .3 | 2.6 | 25 | 79 | 34 | 39 | 9.3 | 45 |
| 21 | .5 | .4 | .5 | .3 | .4 | 1.9 | 38 | 65 | 103 | 33 | 9.0 | 40 |
| 22 | .5 | .4 | .5 | .3 | .4 | 1.4 | 39 | 52 | 89 | 26 | 6.8 | 52 |
| 23 | .5 | .4 | .4 | .3 | .4 | 1.2 | 134 | 42 | 73 | 21 | 5.6 | 102 |
| 24 | .6 | .5 | .3 | .3 | .4 | 1.0 | 228 | 50 | 52 | 19 | 6.0 | 114 |
| 25 | .6 | .5 | .4 | .3 | .4 | .7 | 222 | 56 | 38 | 18 | 6.0 | 81 |
| 26 | .6 | .5 | .4 | .3 | .4 | .8 | 180 | 59 | 28 | 15 | 4.6 | 55 |
| 27 | .6 | .5 | .4 | .3 | .3 | 4.0 | 151 | 60 | 22 | 13 | 4.0 | 39 |
| 28 | .6 | .5 | .4 | .2 | .3 | 19 | 118 | 77 | 17 | 10 | 5.1 | 29 |
| 29 | .6 | .4 | .4 | .2 | .3 | 15 | 86 | 79 | 14 | 9.0 | 3.3 | 25 |
| 30 | .6 | .4 | .4 | .2 | ------ | 8.6 | 66 | 69 | 19 | 8.6 | 2.1 | 21 |
| 31 | .7 | ------ | .4 | .2 | ------ | 6.2 | ------ | 60 | ------ | 23 | 2.6 | ------ |
| Total | 13.0 | 13.0 | 15.5 | 8.8 | 7.7 | 82.2 | 1,583.6 | 1,693 | 2,406 | 986.9 | 273.7 | 731.6 |
| Mean | 0.42 | 0.43 | 0.50 | 0.28 | 0.27 | 2.65 | 52.8 | 54.6 | 80.2 | 31.8 | 8.83 | 24.4 |
| Max | 0.7 | 0.7 | 0.7 | 0.4 | 0.4 | 19 | 228 | 90 | 210 | 107 | 29 | 114 |
| Min | 0.2 | 0.3 | 0.3 | 0.2 | 0.1 | 0.3 | 2.6 | 21 | 14 | 2.1 | 2.1 | 1.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 7,677.2 | Mean | 21.0 | Max | 718 | Min 0.2 |
| Wtr yr 1968: | Total | 7,815.0 | Mean | 21.4 | Max | 228 | Min 0.1 |

5-3367. Kettle River below Sandstone, Minn.

Location.--Lat 46°06'20", long 92°51'50", in NW¼SW¼ sec.22, T.42 N., R.20 W., Pine County, on left bank about 900 ft downstream from abandoned powerplant dam, on Sandstone Federal Correctional Institution property, 1.8 miles south of Sandstone.

Records available.--October 1967 to September 1968.

Gage.--Digital water-stage recorder. Altitude of gage is 930 ft (from topographic map).

Extremes.--Maximum discharge during year, 5,180 cfs June 22 (gage height, 8.56 ft); minimum daily, 99 cfs Feb. 19 to Mar. 1.

Remarks.--Records fair. Records of Chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 106 | 118 | 112 | 106 | 102 | 99 | 425 | 1,040 | 1,530 | 2,000 | 472 | 170 |
| 2 | 107 | 116 | 112 | 106 | 102 | 100 | 377 | 1,400 | 1,690 | 2,140 | 419 | 170 |
| 3 | 107 | 114 | 112 | 106 | 102 | 100 | 354 | 1,200 | 1,400 | 1,680 | 376 | 173 |
| 4 | 107 | 112 | 114 | 106 | 102 | 100 | 342 | 1,080 | 1,390 | 1,380 | 345 | 174 |
| 5 | 106 | 108 | 114 | 106 | 102 | 102 | 315 | 987 | 1,200 | 1,120 | 321 | 174 |
| 6 | 104 | 108 | 114 | 106 | 102 | 104 | 316 | 910 | 1,430 | 910 | 306 | 174 |
| 7 | 106 | 110 | 114 | 106 | 102 | 110 | 351 | 855 | 2,000 | 738 | 292 | 174 |
| 8 | 110 | 115 | 115 | 106 | 102 | 125 | 549 | 859 | 1,980 | 618 | 282 | 178 |
| 9 | 111 | 120 | 115 | 106 | 100 | 251 | 861 | 963 | 3,300 | 510 | 312 | 203 |
| 10 | 106 | 120 | 115 | 106 | 100 | 395 | 823 | 1,050 | 3,720 | 417 | 317 | 205 |
| 11 | 104 | 120 | 115 | 106 | 100 | 330 | 728 | 976 | 3,970 | 330 | 281 | 205 |
| 12 | 102 | 120 | 115 | 106 | 100 | 280 | 656 | 1,070 | 4,230 | 790 | 254 | 207 |
| 13 | 112 | 120 | 115 | 106 | 100 | 229 | 577 | 1,380 | 3,530 | 1,140 | 246 | 198 |
| 14 | 113 | 120 | 115 | 108 | 100 | 195 | 552 | 1,400 | 2,900 | 1,100 | 224 | 187 |
| 15 | 111 | 120 | 116 | 109 | 100 | 175 | 572 | 1,820 | 2,380 | 1,410 | 208 | 177 |
| 16 | 111 | 120 | 117 | 109 | 100 | 172 | 637 | 1,880 | 1,900 | 1,970 | 205 | 170 |
| 17 | 111 | 123 | 117 | 104 | 100 | 191 | 677 | 1,740 | 1,610 | 1,720 | 205 | 178 |
| 18 | 110 | 123 | 117 | 104 | 100 | 280 | 674 | 1,620 | 1,410 | 1,740 | 205 | 268 |
| 19 | 110 | 122 | 117 | 104 | 99 | 450 | 627 | 1,750 | 1,250 | 1,750 | 205 | 588 |
| 20 | 111 | 122 | 115 | 104 | 99 | 553 | 688 | 1,780 | 1,130 | 1,440 | 223 | 692 |
| 21 | 110 | 122 | 114 | 104 | 99 | 384 | 1,020 | 1,610 | 3,580 | 1,280 | 230 | 655 |
| 22 | 110 | 120 | 112 | 104 | 99 | 348 | 1,120 | 1,410 | 4,960 | 1,250 | 224 | 775 |
| 23 | 112 | 115 | 112 | 104 | 99 | 300 | 1,580 | 1,180 | 4,000 | 1,020 | 213 | 1,830 |
| 24 | 112 | 112 | 110 | 104 | 99 | 274 | 3,520 | 1,090 | 3,150 | 880 | 195 | 2,320 |
| 25 | 112 | 110 | 110 | 104 | 99 | 262 | 3,750 | 1,210 | 2,490 | 778 | 188 | 1,840 |
| 26 | 106 | 110 | 108 | 104 | 99 | 247 | 3,410 | 1,170 | 1,930 | 679 | 184 | 1,470 |
| 27 | 100 | 110 | 108 | 104 | 99 | 281 | 3,150 | 1,250 | 1,520 | 629 | 182 | 1,210 |
| 28 | 108 | 110 | 106 | 104 | 99 | 573 | 2,740 | 1,520 | 1,220 | 553 | 184 | 1,020 |
| 29 | 114 | 110 | 106 | 104 | 99 | 715 | 2,220 | 1,670 | 1,010 | 484 | 186 | 858 |
| 30 | 105 | 110 | 106 | 102 | ------ | 622 | 1,980 | 1,520 | 1,090 | 437 | 185 | 656 |
| 31 | 108 | ------ | 106 | 102 | ------ | 518 | ------ | 1,380 | ------ | 442 | 169 | ------ |
| TOTAL | 3,362 | 3,480 | 3,494 | 3,260 | 2,905 | 8,865 | 35,591 | 40,770 | 68,900 | 33,335 | 7,838 | 17,299 |
| MEAN | 108 | 116 | 113 | 105 | 100 | 286 | 1,186 | 1,315 | 2,297 | 1,075 | 253 | 577 |
| MAX | 114 | 123 | 117 | 109 | 102 | 715 | 3,750 | 1,880 | 4,960 | 2,140 | 472 | 2,320 |
| MIN | 100 | 108 | 106 | 102 | 99 | 99 | 315 | 855 | 1,010 | 330 | 169 | 170 |

CAL YR 1967 TOTAL MEAN MAX MIN
WTR YR 1968 TOTAL 229,099 MEAN 626 MAX 4,960 MIN 99

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 1968.

Gage.--Digital 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 and Oct. 29, 1951 to May 10, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--21 years, 556 cfs.

Extremes.--Maximum discharge during year, 3,200 cfs June 26 (gage height, 5.95 ft); minimum, 35 cfs Oct. 6 (gage height, 2.78 ft).
1913-17, 1951-68: Maximum discharge 11,500 cfs April 18, 1965 (gage height, 9.56 ft); minimum, 5.5 cfs Oct. 1, 1964 (gage height, 2.57 ft).
A discharge measurement of 12,500 cfs was made May 9, 1950.

Remarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 46 | 85 | 78 | 66 | 87 | 52 | 328 | 1,410 | 1,470 | 2,590 | 341 | 133 |
| 2 | 50 | 89 | 78 | 65 | 86 | 52 | 282 | 1,240 | 1,430 | 2,640 | 341 | 116 |
| 3 | 48 | 89 | 78 | 64 | 87 | 52 | 250 | 1,070 | 1,400 | 2,770 | 313 | 115 |
| 4 | 59 | 93 | 78 | 63 | 81 | 58 | 296 | 888 | 1,370 | 2,840 | 299 | 129 |
| 5 | 49 | 81 | 78 | 63 | 80 | 76 | 280 | 750 | 1,270 | 2,790 | 273 | 121 |
| 6 | 38 | 71 | 81 | 63 | 79 | 100 | 247 | 622 | 1,140 | 2,610 | 248 | 113 |
| 7 | 49 | 71 | 85 | 64 | 78 | 123 | 256 | 568 | 978 | 2,330 | 230 | 94 |
| 8 | 80 | 74 | 85 | 64 | 74 | 153 | 316 | 593 | 919 | 1,990 | 273 | 101 |
| 9 | 74 | 85 | 89 | 65 | 70 | 171 | 311 | 575 | 997 | 1,590 | 279 | 111 |
| 10 | 64 | 89 | 94 | 67 | 67 | 221 | 393 | 572 | 1,160 | 1,240 | 279 | 104 |
| 11 | 62 | 100 | 97 | 69 | 64 | 280 | 471 | 608 | 1,390 | 994 | 273 | 109 |
| 12 | 55 | 108 | 97 | 73 | 60 | 325 | 494 | 658 | 1,600 | 832 | 242 | 101 |
| 13 | 93 | 97 | 90 | 76 | 57 | 333 | 440 | 635 | 1,760 | 736 | 224 | 97 |
| 14 | 68 | 93 | 83 | 75 | 55 | 321 | 498 | 678 | 1,890 | 802 | 184 | 101 |
| 15 | 78 | 74 | 80 | 75 | 53 | 310 | 449 | 719 | 1,870 | 818 | 167 | 96 |
| 16 | 76 | 85 | 79 | 76 | 52 | 288 | 435 | 833 | 1,810 | 807 | 201 | 91 |
| 17 | 93 | 95 | 80 | 78 | 52 | 269 | 442 | 892 | 1,690 | 793 | 167 | 139 |
| 18 | 76 | 97 | 81 | 78 | 52 | 311 | 429 | 910 | 1,530 | 802 | 148 | 181 |
| 19 | 61 | 78 | 81 | 78 | 52 | 383 | 404 | 984 | 1,350 | 769 | 162 | 182 |
| 20 | 96 | 78 | 80 | 81 | 52 | 408 | 514 | 991 | 1,230 | 717 | 162 | 211 |
| 21 | 55 | 80 | 80 | 77 | 52 | 389 | 684 | 1,010 | 1,770 | 699 | 148 | 239 |
| 22 | 55 | 79 | 81 | 80 | 52 | 359 | 787 | 998 | 2,210 | 613 | 158 | 398 |
| 23 | 64 | 77 | 80 | 82 | 52 | 342 | 1,040 | 938 | 2,600 | 561 | 144 | 1,050 |
| 24 | 116 | 78 | 80 | 80 | 52 | 316 | 1,180 | 898 | 2,890 | 510 | 162 | 1,790 |
| 25 | 108 | 79 | 80 | 81 | 52 | 305 | 1,330 | 835 | 3,070 | 470 | 125 | 2,260 |
| 26 | 64 | 80 | 76 | 81 | 52 | 283 | 1,520 | 847 | 3,170 | 438 | 100 | 2,390 |
| 27 | 64 | 81 | 73 | 82 | 52 | 313 | 1,640 | 896 | 3,140 | 438 | 96 | 2,350 |
| 28 | 53 | 81 | 72 | 82 | 52 | 356 | 1,700 | 976 | 2,930 | 385 | 92 | 2,210 |
| 29 | 74 | 81 | 72 | 83 | 52 | 370 | 1,690 | 1,110 | 2,590 | 327 | 90 | 2,000 |
| 30 | 81 | 78 | 71 | 83 | ------ | 375 | 1,560 | 1,260 | 2,540 | 306 | 88 | 1,730 |
| 31 | 81 | ------ | 70 | 83 | ------ | 396 | ------ | 1,370 | ------ | 355 | 107 | ------ |
| TOTAL | 2,130 | 2,526 | 2,507 | 2,297 | 1,806 | 8,090 | 20,666 | 27,334 | 55,164 | 36,562 | 6,116 | 18,862 |
| MEAN | 68.7 | 84.2 | 80.9 | 74.1 | 62.3 | 261 | 689 | 882 | 1,839 | 1,179 | 197 | 629 |
| MAX | 116 | 108 | 97 | 83 | 87 | 408 | 1,700 | 1,410 | 3,170 | 2,840 | 341 | 2,390 |
| MIN | 38 | 71 | 70 | 63 | 52 | 52 | 247 | 568 | 919 | 306 | 88 | 91 |
| CFSM | .07 | .09 | .08 | .08 | .07 | .27 | .72 | .92 | 1.92 | 1.23 | .21 | .66 |
| IN. | .08 | .10 | .10 | .09 | .07 | .31 | .80 | 1.06 | 2.14 | 1.42 | .24 | .73 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 200,440 | MEAN 549 | MAX 7,600 | MIN 33 | CFSM .57 | IN 7.78 |
| WTR YR 1968 | TOTAL 184,060 | MEAN 503 | MAX 3,170 | MIN 38 | CFSM .52 | IN 7.15 |

5-3400.5 Sunrise River near Lindstrom, Minn.

Location.--Lat 45°27'00", long 92°53'10", in SW¼NE¼ sec.7, T.34 N., R.20 W., on left bank 20 ft downstream from highway bridge and 4.5 miles northwest of Lindstrom.

Records available.--July 1965 to September 1968. Records for January 1949 to July 1965 at site 6.5 miles upstream, published as "near Stacy", not equivalent owing to increased drainage area and Minnesota Game and Fish reservoir between sites.

Gage.--Water-stage recorder. Altitude of gage is 850 ft (from topographic map).

Extremes.--Maximum discharge during year, 335 cfs June 22 (gage height, 5.86 ft); minimum, 11 cfs Aug. 28-31 (gage height, 2.10 ft).
1965-68: Maximum discharge, 508 cfs Apr. 14, 1967 (gage height, 6.93 ft); minimum 7.9 cfs Sept. 11, 1965 (gage height, 2.07 ft).

Remarks.--Records good except those for winter months, which are fair. Some regulation by Minnesota Game and Fish Wildlife Refuge ponds above the station. 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 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 23 | 27 | 21 | 18 | 21 | 31 | 88 | 158 | 300 | 65 | 13 |
| 2 | 18 | 22 | 27 | 21 | 18 | 21 | 30 | 83 | 157 | 276 | 64 | 12 |
| 3 | 16 | 22 | 26 | 20 | 18 | 21 | 30 | 75 | 141 | 244 | 63 | 12 |
| 4 | 16 | 22 | 26 | 20 | 18 | 20 | 33 | 70 | 127 | 225 | 63 | 16 |
| 5 | 15 | 22 | 26 | 20 | 18 | 20 | 36 | 65 | 116 | 209 | 62 | 14 |
| 6 | 14 | 22 | 26 | 20 | 18 | 20 | 37 | 62 | 109 | 196 | 64 | 13 |
| 7 | 18 | 21 | 26 | 20 | 18 | 20 | 38 | 63 | 99 | 185 | 62 | 13 |
| 8 | 21 | 21 | 26 | 20 | 19 | 20 | 42 | 72 | 88 | 170 | 55 | 14 |
| 9 | 20 | 22 | 26 | 20 | 19 | 20 | 41 | 71 | 108 | 158 | 42 | 14 |
| 10 | 19 | 22 | 26 | 20 | 19 | 20 | 40 | 65 | 126 | 179 | 40 | 13 |
| 11 | 19 | 22 | 25 | 20 | 19 | 20 | 40 | 63 | 151 | 182 | 38 | 13 |
| 12 | 20 | 23 | 25 | 20 | 20 | 19 | 40 | 60 | 167 | 176 | 36 | 13 |
| 13 | 20 | 23 | 26 | 19 | 20 | 19 | 36 | 59 | 180 | 174 | 31 | 12 |
| 14 | 20 | 22 | 26 | 19 | 20 | 18 | 44 | 58 | 237 | 193 | 28 | 12 |
| 15 | 19 | 22 | 26 | 19 | 20 | 19 | 45 | 57 | 275 | 190 | 26 | 12 |
| 16 | 19 | 23 | 26 | 19 | 20 | 19 | 46 | 77 | 279 | 177 | 24 | 12 |
| 17 | 19 | 23 | 26 | 19 | 20 | 21 | 44 | 84 | 270 | 165 | 23 | 22 |
| 18 | 18 | 24 | 25 | 19 | 20 | 31 | 43 | 93 | 257 | 155 | 23 | 40 |
| 19 | 18 | 22 | 25 | 19 | 20 | 37 | 44 | 102 | 231 | 148 | 24 | 54 |
| 20 | 19 | 22 | 25 | 19 | 20 | 32 | 62 | 107 | 227 | 133 | 23 | 54 |
| 21 | 17 | 22 | 25 | 19 | 21 | 28 | 74 | 111 | 294 | 125 | 22 | 53 |
| 22 | 18 | 22 | 25 | 19 | 21 | 25 | 73 | 113 | 333 | 114 | 22 | 72 |
| 23 | 18 | 22 | 24 | 19 | 21 | 23 | 92 | 108 | 322 | 107 | 25 | 120 |
| 24 | 20 | 21 | 24 | 19 | 21 | 22 | 135 | 105 | 302 | 101 | 26 | 147 |
| 25 | 19 | 21 | 24 | 19 | 21 | 21 | 138 | 107 | 294 | 90 | 24 | 147 |
| 26 | 18 | 21 | 24 | 19 | 21 | 21 | 134 | 104 | 304 | 86 | 20 | 137 |
| 27 | 17 | 21 | 23 | 19 | 21 | 26 | 121 | 119 | 317 | 78 | 15 | 124 |
| 28 | 17 | 23 | 23 | 18 | 21 | 32 | 112 | 159 | 310 | 72 | 12 | 112 |
| 29 | 20 | 24 | 22 | 18 | 21 | 31 | 105 | 161 | 290 | 68 | 11 | 101 |
| 30 | 23 | 26 | 22 | 18 | ------ | 32 | 95 | 150 | 289 | 66 | 11 | 86 |
| 31 | 20 | ------ | 21 | 18 | ------ | 31 | ------ | 140 | ------ | 69 | 12 | ------ |
| Total | 573 | 668 | 774 | 599 | 571 | 730 | 1,881 | 2,851 | 6,558 | 4,811 | 1,056 | 1,477 |
| Mean | 18.5 | 22.3 | 25.0 | 19.3 | 19.7 | 23.5 | 62.7 | 92.0 | 219 | 155 | 34.1 | 49.2 |
| Max | 23 | 26 | 27 | 21 | 21 | 37 | 138 | 161 | 333 | 300 | 65 | 147 |
| Min | 14 | 21 | 21 | 18 | 18 | 18 | 30 | 57 | 88 | 66 | 11 | 12 |
| Ac-ft | 1,140 | 1,320 | 1,540 | 1,190 | 1,130 | 1,450 | 3,730 | 5,650 | 13,010 | 9,540 | 2,090 | 2,920 |

Cal yr 1967: Total 28,744 Mean 78.8 Max 500 Min 14 Ac-ft 57,010
Wtr yr 1968: Total 22,549 Mean 61.6 Max 333 Min 11 Ac-ft 44,730

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 1968 in reports of Geological Survey. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Croix Falls."

Gage.--Digital 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. Mar. 16, 1940, to Nov. 30, 1963, graphic water-stage recorder at present site and datum.

Average discharge.--66 years, 4,070 cfs.

Extremes.--Maximum discharge during year, 19,700 cfs June 23, 24 (gage height, 9.49 ft); minimum daily, 1,030 cfs Nov. 28.
1902-68: Maximum discharge, 54,900 cfs May 8, 1950 (gage height, 25.19 ft); minimum daily, 75 cfs July 17, 1910.

Remarks.--Records good except Nov. 1-7, June 30 to July 18, which are fair. Flow regulated by powerplant upstream.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,770 | 2,400 | 1,920 | 1,650 | 1,720 | 1,400 | 4,020 | 10,200 | 7,760 | 12,800 | 3,980 | 2,130 |
| 2 | 2,130 | 2,200 | 2,040 | 1,470 | 1,750 | 1,450 | 3,600 | 8,990 | 8,430 | 13,400 | 4,110 | 2,020 |
| 3 | 1,990 | 2,500 | 2,010 | 1,310 | 1,850 | 1,560 | 3,590 | 7,790 | 8,510 | 12,200 | 4,190 | 2,170 |
| 4 | 1,900 | 2,700 | 2,460 | 1,570 | 1,780 | 1,580 | 2,840 | 7,060 | 8,230 | 11,600 | 3,610 | 2,650 |
| 5 | 2,110 | 2,200 | 2,080 | 1,750 | 1,870 | 1,620 | 3,200 | 5,870 | 7,300 | 10,500 | 3,910 | 1,800 |
| 6 | 2,110 | 2,000 | 2,190 | 1,950 | 1,720 | 1,220 | 3,260 | 5,850 | 6,690 | 9,400 | 3,420 | 2,530 |
| 7 | 2,080 | 2,400 | 2,130 | 1,740 | 2,050 | 1,830 | 2,870 | 4,960 | 6,090 | 8,300 | 3,450 | 2,380 |
| 8 | 2,150 | 2,320 | 1,860 | 1,310 | 1,690 | 2,170 | 3,360 | 5,170 | 7,020 | 7,600 | 3,420 | 2,680 |
| 9 | 2,170 | 2,460 | 2,270 | 1,830 | 1,890 | 2,150 | 3,700 | 4,790 | 7,000 | 6,400 | 3,380 | 2,650 |
| 10 | 2,120 | 1,990 | 2,020 | 1,690 | 1,640 | 2,360 | 4,600 | 5,070 | 9,110 | 5,800 | 3,170 | 3,030 |
| 11 | 2,120 | 2,040 | 1,980 | 1,490 | 1,660 | 2,530 | 4,570 | 5,520 | 11,300 | 5,200 | 3,430 | 3,210 |
| 12 | 2,110 | 2,180 | 2,060 | 1,680 | 1,920 | 2,800 | 4,330 | 5,710 | 12,200 | 4,800 | 3,230 | 3,230 |
| 13 | 2,060 | 2,080 | 2,120 | 1,840 | 1,410 | 2,940 | 4,000 | 6,200 | 13,100 | 4,700 | 3,340 | 2,890 |
| 14 | 2,170 | 2,120 | 1,650 | 1,570 | 1,480 | 2,670 | 3,840 | 7,140 | 12,300 | 8,000 | 2,300 | 2,790 |
| 15 | 2,130 | 2,230 | 1,800 | 1,760 | 1,530 | 2,440 | 4,190 | 7,640 | 10,800 | 10,600 | 3,010 | 2,150 |
| 16 | 2,150 | 1,940 | 1,100 | 1,930 | 1,850 | 2,480 | 4,210 | 8,300 | 9,140 | 13,600 | 2,730 | 2,690 |
| 17 | 2,100 | 2,020 | 1,640 | 1,720 | 1,380 | 2,570 | 4,170 | 9,020 | 8,400 | 15,400 | 2,560 | 2,240 |
| 18 | 2,010 | 2,310 | 1,860 | 1,790 | 1,380 | 3,430 | 4,000 | 9,100 | 7,570 | 14,000 | 2,290 | 2,850 |
| 19 | 2,240 | 2,120 | 2,050 | 1,690 | 1,640 | 3,720 | 4,510 | 8,910 | 7,030 | 13,200 | 2,760 | 3,060 |
| 20 | 1,980 | 2,080 | 2,170 | 1,670 | 1,510 | 3,930 | 4,250 | 8,970 | 6,970 | 11,600 | 2,720 | 3,290 |
| 21 | 2,210 | 2,190 | 2,180 | 1,780 | 1,380 | 4,580 | 4,650 | 8,510 | 8,840 | 9,710 | 3,190 | 3,840 |
| 22 | 1,910 | 2,190 | 1,920 | 1,720 | 1,390 | 4,970 | 6,200 | 7,920 | 15,000 | 8,500 | 2,110 | 4,050 |
| 23 | 2,280 | 1,730 | 1,450 | 1,790 | 1,180 | 3,800 | 7,250 | 7,320 | 18,600 | 7,570 | 2,530 | 10,100 |
| 24 | 2,360 | 2,260 | 1,560 | 1,780 | 1,600 | 3,620 | 9,330 | 6,760 | 19,300 | 7,070 | 1,810 | 12,600 |
| 25 | 2,330 | 1,770 | 1,550 | 1,600 | 1,250 | 3,750 | 13,100 | 6,320 | 17,100 | 5,750 | 1,750 | 13,400 |
| 26 | 2,000 | 1,790 | 1,490 | 2,030 | 1,390 | 3,370 | 14,600 | 6,960 | 14,600 | 5,380 | 2,460 | 12,700 |
| 27 | 2,120 | 1,520 | 1,740 | 1,540 | 1,530 | 3,610 | 14,700 | 6,640 | 11,500 | 4,760 | 1,640 | 11,600 |
| 28 | 1,690 | 1,030 | 1,620 | 1,720 | 1,270 | 3,830 | 13,900 | 6,990 | 10,100 | 4,430 | 2,180 | 10,100 |
| 29 | 2,200 | 1,360 | 1,640 | 1,720 | 1,290 | 3,860 | 13,000 | 7,460 | 9,030 | 4,730 | 1,680 | 8,980 |
| 30 | 2,500 | 1,100 | 1,520 | 1,950 | ------ | 4,190 | 11,800 | 7,730 | 11,300 | 4,720 | 1,900 | 8,020 |
| 31 | 2,260 | ------ | 1,800 | 1,700 | ------ | 3,890 | ------ | 7,460 | ------ | 4,220 | 1,730 | ------ |
| Total | 65,460 | 61,230 | 57,880 | 52,740 | 46,000 | 90,320 | 185,640 | 222,330 | 310,320 | 265,940 | 87,990 | 147,830 |
| Mean | 2,112 | 2,041 | 1,867 | 1,701 | 1,586 | 2,914 | 6,188 | 7,172 | 10,340 | 8,579 | 2,838 | 4,928 |
| Max | 2,500 | 2,700 | 2,460 | 2,030 | 2,050 | 4,970 | 14,700 | 10,200 | 19,300 | 15,400 | 4,190 | 13,400 |
| Min | 1,690 | 1,030 | 1,100 | 1,310 | 1,180 | 1,220 | 2,840 | 4,790 | 6,090 | 4,220 | 1,640 | 1,800 |
| Cfsm | .36 | .34 | .31 | .29 | .27 | .49 | 1.04 | 1.21 | 1.74 | 1.45 | .48 | .83 |
| In. | .41 | .38 | .36 | .33 | .29 | .57 | 1.16 | 1.39 | 1.95 | 1.67 | .55 | .93 |

Cal yr 1967: Total 1,625,640 Mean 4,454 Max 31,500 Min 1,030 Cfsm .75 In. 10.20
Wtr yr 1968: Total 1,593,680 Mean 4,354 Max 19,300 Min 1,030 Cfsm .73 In. 9.99

## 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 1968.

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.--40 years, 15,330 cfs.

Extremes.--Maximum discharge during year, 40,200 cfs June 26 (gage height, 79.44 ft); minimum daily, 3,200 cfs Dec. 1; minimum gage height, 74.54 ft Mar. 7.
1928-68: Maximum discharge 228,000 cfs Apr. 18, 1965 (gage height, 93.11 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 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4,700 | 6,300 | 3,200 | 4,300 | 6,200 | 4,700 | 12,300 | 31,300 | 19,900 | 32,500 | 27,400 | 8,970 |
| 2 | 5,600 | 6,400 | 3,500 | 4,900 | 5,900 | 5,000 | 12,400 | 30,000 | 20,100 | 34,200 | 26,900 | 9,420 |
| 3 | 5,900 | 6,200 | 5,400 | 4,800 | 5,900 | 4,800 | 12,200 | 27,600 | 19,600 | 33,800 | 27,200 | 9,420 |
| 4 | 5,600 | 6,100 | 5,600 | 4,400 | 5,700 | 5,100 | 11,100 | 24,600 | 19,300 | 33,100 | 26,500 | 9,120 |
| 5 | 6,000 | 7,200 | 6,000 | 4,200 | 5,400 | 6,700 | 10,700 | 23,200 | 19,500 | 32,200 | 25,300 | 9,520 |
| 6 | 5,500 | 6,500 | 6,200 | 4,300 | 6,600 | 5,900 | 11,200 | 20,800 | 19,400 | 30,800 | 23,200 | 8,920 |
| 7 | 5,300 | 7,000 | 6,500 | 4,300 | 4,700 | 5,700 | 10,700 | 19,100 | 18,100 | 29,800 | 20,300 | 9,590 |
| 8 | 7,100 | 6,300 | 6,400 | 4,300 | 5,400 | 7,500 | 10,000 | 18,900 | 17,300 | 28,200 | 20,800 | 9,170 |
| 9 | 6,900 | 6,300 | 6,500 | 4,300 | 6,700 | 8,600 | 9,740 | 18,300 | 18,500 | 25,200 | 21,000 | 9,440 |
| 10 | 7,300 | 6,100 | 6,100 | 4,500 | 4,000 | 8,600 | 11,100 | 17,400 | 18,800 | 22,400 | 22,600 | 9,680 |
| 11 | 4,500 | 6,200 | 6,700 | 4,500 | 5,300 | 8,500 | 13,100 | 17,200 | 22,800 | 20,600 | 23,000 | 9,850 |
| 12 | 5,500 | 6,200 | 6,800 | 4,500 | 5,500 | 8,100 | 16,400 | 17,700 | 27,700 | 19,800 | 23,400 | 10,600 |
| 13 | 6,400 | 5,700 | 6,500 | 4,800 | 6,400 | 8,600 | 17,200 | 17,700 | 31,200 | 19,900 | 24,000 | 11,800 |
| 14 | 7,000 | 6,100 | 6,200 | 4,900 | 5,400 | 9,100 | 15,700 | 18,300 | 36,100 | 21,600 | 24,000 | 11,200 |
| 15 | 6,100 | 6,300 | 5,100 | 4,900 | 5,200 | 9,900 | 14,300 | 20,000 | 38,500 | 24,800 | 22,400 | 10,600 |
| 16 | 6,800 | 6,400 | 4,900 | 5,100 | 5,000 | 9,600 | 14,900 | 21,700 | 38,600 | 27,900 | 21,200 | 9,930 |
| 17 | 6,600 | 6,900 | 4,900 | 5,500 | 5,100 | 9,700 | 15,100 | 20,900 | 38,100 | 30,000 | 19,200 | 10,800 |
| 18 | 6,400 | 7,000 | 4,700 | 5,500 | 5,000 | 12,200 | 15,400 | 20,400 | 37,400 | 31,600 | 16,400 | 11,900 |
| 19 | 5,700 | 4,500 | 5,600 | 5,100 | 4,400 | 14,100 | 16,000 | 20,400 | 36,700 | 32,200 | 15,000 | 11,700 |
| 20 | 6,300 | 6,200 | 6,000 | 5,000 | 5,100 | 12,400 | 16,500 | 21,000 | 35,000 | 31,700 | 13,200 | 11,200 |
| 21 | 6,000 | 8,100 | 6,800 | 5,000 | 4,700 | 10,900 | 17,000 | 21,200 | 35,400 | 31,400 | 11,400 | 13,300 |
| 22 | 5,100 | 6,800 | 5,100 | 5,300 | 4,500 | 10,500 | 17,700 | 20,700 | 34,700 | 29,400 | 11,800 | 16,900 |
| 23 | 5,500 | 3,900 | 5,400 | 5,100 | 4,500 | 11,700 | 19,600 | 20,000 | 35,700 | 27,000 | 11,200 | 22,200 |
| 24 | 6,100 | 5,500 | 4,800 | 4,800 | 4,700 | 12,200 | 22,200 | 19,400 | 38,000 | 25,000 | 11,200 | 24,800 |
| 25 | 7,600 | 5,600 | 4,900 | 5,000 | 4,600 | 13,200 | 24,900 | 20,100 | 39,100 | 23,000 | 10,400 | 27,500 |
| 26 | 6,200 | 6,000 | 3,800 | 5,000 | 4,700 | 14,100 | 27,200 | 19,800 | 39,800 | 23,000 | 10,500 | 31,200 |
| 27 | 7,400 | 4,600 | 4,900 | 5,600 | 4,700 | 13,000 | 30,200 | 18,300 | 38,200 | 24,200 | 10,000 | 32,300 |
| 28 | 5,600 | 4,300 | 4,900 | 5,600 | 4,600 | 12,500 | 32,900 | 16,600 | 35,100 | 25,300 | 9,420 | 32,200 |
| 29 | 7,600 | 4,400 | 5,300 | 5,500 | 4,600 | 12,200 | 32,900 | 16,500 | 33,300 | 24,900 | 9,310 | 31,600 |
| 30 | 8,600 | 4,400 | 4,800 | 5,600 | ------ | 12,500 | 32,200 | 18,400 | 32,000 | 25,100 | 8,660 | 30,400 |
| 31 | 6,400 | ------ | 4,700 | 5,600 | ------ | 12,000 | ------ | 19,200 | ------ | 27,700 | 8,860 | ------ |
| Total | 193,300 | 179,500 | 168,200 | 152,200 | 150,500 | 299,600 | 522,840 | 636,700 | 893,900 | 848,300 | 555,750 | 465,230 |
| Mean | 6,235 | 5,983 | 5,426 | 4,910 | 5,190 | 9,665 | 17,430 | 20,540 | 29,800 | 27,360 | 17,930 | 15,510 |
| Max | 8,600 | 8,100 | 6,800 | 5,600 | 6,700 | 14,100 | 32,900 | 31,300 | 39,800 | 34,200 | 27,400 | 32,300 |
| Min | 4,500 | 3,900 | 3,200 | 4,200 | 4,000 | 4,700 | 9,740 | 16,500 | 17,300 | 19,800 | 8,660 | 8,920 |
| Cfsm | 0.139 | 0.134 | 0.121 | 0.110 | 0.116 | 0.216 | 0.389 | 0.458 | 0.665 | 0.611 | 0.400 | 0.346 |
| In. | 0.16 | 0.15 | 0.14 | 0.13 | 0.12 | 0.25 | 0.43 | 0.52 | 0.74 | 0.70 | 0.46 | 0.39 |

Cal yr 1967: Total 6,172,510 Mean 16,910 Max 86,800 Min 3,200 Cfsm 0.377 In. 5.12
Wtr yr 1968: Total 5,066,020 Mean 13,840 Max 39,800 Min 3,200 Cfsm 0.309 In. 4.21

5-3538. Straight River near Faribault, Minn.

Location.--Lat 44°15'29", long 93°13'51", in W½SE¼ sec.9, T.109 N., R.20 W., on right bank 15 ft downstream from highway bridge, 2.8 miles upstream from Falls Creek and 3.2 miles southeast of Faribault.

Records available.--October 1965 to September 1968.

Gage.--Water-stage recorder. Altitude of gage is 1,035 ft (from topographic map).

Extremes.--Maximum discharge during year, 1,930 cfs July 13 (gage height, 7.57 ft); minimum daily, 11 cfs Feb. 18 to Mar. 1; minimum gage height, 3.74 ft Nov. 27.
1965-68: Maximum discharge, 3,590 cfs June 16, 1967 (gage height 9.83 ft); minimum daily, that of Feb. 18 to Mar. 1, 1968; minimum gage height, that of Nov. 27, 1967.

Remarks.--Records good except for winter months, which are fair. Records of chemical analyses and suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 33 | 42 | 28 | 22 | 16 | 11 | 43 | 104 | 220 | 359 | 386 | 55 |
| 2 | 34 | 42 | 28 | 22 | 16 | 12 | 42 | 110 | 232 | 269 | 206 | 52 |
| 3 | 34 | 40 | 28 | 21 | 16 | 12 | 40 | 102 | 196 | 213 | 274 | 50 |
| 4 | 34 | 37 | 29 | 20 | 16 | 12 | 44 | 85 | 158 | 179 | 236 | 69 |
| 5 | 34 | 35 | 29 | 20 | 16 | 12 | 43 | 82 | 129 | 155 | 210 | 69 |
| 6 | 34 | 33 | 29 | 20 | 15 | 13 | 42 | 69 | 104 | 135 | 185 | 85 |
| 7 | 40 | 33 | 30 | 19 | 15 | 13 | 40 | 69 | 89 | 123 | 192 | 102 |
| 8 | 70 | 33 | 30 | 19 | 15 | 14 | 40 | 71 | 77 | 112 | 404 | 436 |
| 9 | 100 | 33 | 31 | 19 | 14 | 15 | 42 | 71 | 80 | 102 | 436 | 585 |
| 10 | 80 | 35 | 30 | 19 | 14 | 16 | 40 | 65 | 89 | 97 | 377 | 510 |
| 11 | 72 | 35 | 30 | 19 | 14 | 17 | 39 | 61 | 174 | 97 | 282 | 386 |
| 12 | 65 | 33 | 29 | 19 | 14 | 17 | 39 | 59 | 220 | 294 | 216 | 292 |
| 13 | 60 | 33 | 29 | 18 | 13 | 18 | 39 | 55 | 185 | 1,120 | 185 | 232 |
| 14 | 56 | 31 | 28 | 18 | 13 | 18 | 46 | 54 | 185 | 1,410 | 155 | 196 |
| 15 | 53 | 30 | 28 | 18 | 12 | 19 | 46 | 55 | 228 | 1,160 | 140 | 170 |
| 16 | 49 | 29 | 28 | 17 | 12 | 20 | 46 | 336 | 278 | 864 | 132 | 149 |
| 17 | 48 | 29 | 28 | 16 | 12 | 22 | 44 | 287 | 228 | 634 | 129 | 182 |
| 18 | 47 | 31 | 28 | 16 | 11 | 28 | 42 | 228 | 185 | 545 | 129 | 228 |
| 19 | 46 | 29 | 28 | 16 | 11 | 35 | 46 | 185 | 179 | 408 | 129 | 274 |
| 20 | 44 | 29 | 28 | 16 | 11 | 32 | 86 | 167 | 123 | 314 | 143 | 300 |
| 21 | 42 | 29 | 28 | 16 | 11 | 31 | 102 | 152 | 107 | 252 | 132 | 305 |
| 22 | 41 | 30 | 27 | 16 | 11 | 33 | 89 | 138 | 92 | 206 | 118 | 314 |
| 23 | 40 | 28 | 27 | 16 | 11 | 35 | 226 | 138 | 94 | 236 | 99 | 696 |
| 24 | 47 | 27 | 27 | 16 | 11 | 38 | 440 | 123 | 143 | 605 | 94 | 750 |
| 25 | 43 | 27 | 26 | 16 | 11 | 41 | 386 | 121 | 164 | 816 | 85 | 624 |
| 26 | 42 | 27 | 26 | 16 | 11 | 45 | 260 | 152 | 347 | 988 | 80 | 500 |
| 27 | 41 | 27 | 25 | 16 | 11 | 47 | 185 | 202 | 678 | 1,240 | 71 | 408 |
| 28 | 42 | 27 | 25 | 16 | 11 | 48 | 155 | 232 | 673 | 1,000 | 65 | 350 |
| 29 | 46 | 27 | 24 | 16 | 11 | 49 | 138 | 206 | 590 | 780 | 59 | 314 |
| 30 | 54 | 27 | 23 | 16 | ------ | 48 | 123 | 179 | 476 | 607 | 57 | 310 |
| 31 | 43 | ------ | 22 | 16 | ------ | 46 | ------ | 161 | ------ | 485 | 55 | ------ |
| Total | 1,514 | 948 | 856 | 550 | 375 | 817 | 2,993 | 4,119 | 5,723 | 15,805 | 5,461 | 8,993 |
| Mean | 48.8 | 31.6 | 27.6 | 17.7 | 12.9 | 26.4 | 99.8 | 133 | 224 | 510 | 176 | 300 |
| Max | 100 | 42 | 31 | 22 | 16 | 49 | 440 | 336 | 678 | 1,410 | 436 | 750 |
| Min | 33 | 27 | 22 | 16 | 11 | 11 | 39 | 54 | 77 | 97 | 55 | 50 |

Cal yr 1967: Total 89,675 Mean 246 Max 3,290 Min 16
Wtr yr 1968: Total 49,154 Mean 134 Max 1,410 Min 11

## 5-3552. Cannon River at Welch, Minn.

Location.--Lat 44°33'50", long 92°43'55", in NW¼SW¼ sec.27, T.113 N., R.16 W., on right bank 0.3 mile downstream from highway bridge at Welch and 1.8 miles upstream from Belle Creek.

Drainage area.--1,320 sq mi, approximately.

Records available.--June 1909 to January 1914 (no winter records 1909-11), November 1930 to September 1968.

Gage.--Digital 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, graphic water-stage recorder at site 0.3 mile upstream at present datum. Oct. 12, 1938 to May 24, 1964, graphic water-stage recorder at same site and datum.

Average discharge.--39 years (1911-13, 1931-68), 477 cfs.

Extremes.--Maximum discharge during year, 3,380 cfs July 14 (gage height, 6.75 ft); minimum daily, 75 cfs Nov. 29; minimum gage height, 1.39 ft Nov. 29.
1909-14, 1930-68: Maximum discharge, 36,100 cfs Apr. 8, 1965 (gage height, 14.01 ft); minimum, 2.5 cfs Jan. 3, 1950 (gage height, 0.06 ft, backwater from ice).
Maximum stage known, 17.1 ft, present datum, in April 1888, from floodmark at mill about 2,400 ft upstream.

Remarks.--Records good except those for winter months, which are fair. Diurnal fluctuation caused by powerplants above station to Dec. 31, 1966 when the powerplants were shut down.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 138 | 184 | 100 | 115 | 109 | 118 | 155 | 305 | 498 | 737 | 1,040 | 263 |
| 2 | 138 | 182 | 140 | 114 | 109 | 120 | 152 | 290 | 474 | 598 | 875 | 246 |
| 3 | 138 | 182 | 148 | 113 | 109 | 123 | 155 | 280 | 474 | 522 | 850 | 236 |
| 4 | 138 | 176 | 150 | 110 | 109 | 125 | 178 | 246 | 466 | 470 | 728 | 330 |
| 5 | 138 | 168 | 155 | 110 | 109 | 128 | 165 | 230 | 419 | 419 | 683 | 315 |
| 6 | 138 | 153 | 155 | 110 | 110 | 134 | 155 | 218 | 374 | 385 | 629 | 291 |
| 7 | 156 | 150 | 158 | 110 | 110 | 148 | 152 | 221 | 348 | 381 | 569 | 259 |
| 8 | 171 | 155 | 158 | 109 | 110 | 189 | 203 | 259 | 323 | 367 | 571 | 287 |
| 9 | 168 | 153 | 160 | 109 | 110 | 197 | 158 | 236 | 363 | 315 | 665 | 478 |
| 10 | 163 | 155 | 163 | 108 | 110 | 189 | 148 | 221 | 337 | 280 | 710 | 670 |
| 11 | 310 | 158 | 160 | 108 | 110 | 181 | 155 | 215 | 363 | 266 | 670 | 674 |
| 12 | 601 | 168 | 160 | 108 | 110 | 168 | 155 | 209 | 389 | 593 | 598 | 593 |
| 13 | 484 | 176 | 150 | 108 | 110 | 168 | 134 | 192 | 407 | 710 | 522 | 510 |
| 14 | 275 | 168 | 148 | 108 | 110 | 173 | 170 | 195 | 419 | 2,100 | 434 | 454 |
| 15 | 261 | 136 | 146 | 108 | 110 | 181 | 145 | 1,220 | 374 | 2,770 | 393 | 400 |
| 16 | 387 | 140 | 148 | 108 | 110 | 181 | 150 | 1,640 | 367 | 2,130 | 423 | 370 |
| 17 | 497 | 146 | 150 | 108 | 110 | 183 | 160 | 530 | 407 | 1,610 | 396 | 400 |
| 18 | 243 | 146 | 149 | 108 | 111 | 215 | 160 | 263 | 1,050 | 1,380 | 352 | 498 |
| 19 | 184 | 136 | 149 | 108 | 112 | 259 | 155 | 230 | 780 | 1,190 | 470 | 535 |
| 20 | 205 | 140 | 146 | 108 | 113 | 263 | 200 | 215 | 535 | 977 | 825 | 526 |
| 21 | 146 | 145 | 150 | 108 | 113 | 218 | 259 | 250 | 746 | 850 | 662 | 589 |
| 22 | 148 | 146 | 130 | 108 | 113 | 195 | 240 | 308 | 518 | 728 | 486 | 820 |
| 23 | 160 | 147 | 128 | 108 | 113 | 181 | 333 | 352 | 446 | 683 | 438 | 1,520 |
| 24 | 182 | 147 | 127 | 108 | 113 | 178 | 482 | 359 | 404 | 755 | 427 | 1,340 |
| 25 | 190 | 143 | 127 | 108 | 113 | 183 | 593 | 385 | 396 | 870 | 367 | 1,270 |
| 26 | 148 | 130 | 125 | 108 | 114 | 186 | 593 | 431 | 482 | 1,090 | 337 | 1,140 |
| 27 | 150 | 115 | 123 | 108 | 115 | 203 | 506 | 470 | 683 | 2,230 | 319 | 988 |
| 28 | 155 | 90 | 120 | 108 | 116 | 221 | 450 | 494 | 830 | 1,780 | 305 | 855 |
| 29 | 176 | 75 | 119 | 108 | 117 | 195 | 430 | 518 | 850 | 1,410 | 287 | 760 |
| 30 | 202 | 85 | 117 | 109 | --- | 175 | 352 | 502 | 805 | 1,230 | 277 | 697 |
| 31 | 184 | --- | 116 | 109 | --- | 183 | --- | 470 | --- | 1,220 | 273 | --- |
| TOTAL | 6,776 | 4,395 | 4,375 | 3,378 | 3,228 | 5,561 | 7,443 | 11,954 | 15,327 | 31,046 | 16,541 | 18,314 |
| MEAN | 219 | 147 | 141 | 109 | 111 | 179 | 248 | 386 | 511 | 1,001 | 534 | 610 |
| MAX | 601 | 184 | 163 | 115 | 117 | 263 | 593 | 1,640 | 1,050 | 2,770 | 1,040 | 1,520 |
| MIN | 138 | 75 | 100 | 108 | 109 | 118 | 134 | 192 | 323 | 266 | 273 | 236 |
| CFSM | .17 | .11 | .11 | .08 | .08 | .14 | .19 | .29 | .39 | .76 | .40 | .46 |
| IN. | .19 | .12 | .12 | .10 | .09 | .16 | .21 | .34 | .43 | .87 | .47 | .52 |

CAL YR 1967 TOTAL 221,936 MEAN 608 MAX 7,900 MIN 66 CFSM .46 IN 6.25
WTR YR 1968 TOTAL 128,338 MEAN 351 MAX 2,770 MIN 75 CFSM .27 IN 3.62

GPO 817-490-11

5-3730. South Fork Zumbro River near Rochester, Minn.

Location.--Lat 44°04'00", long 92°27'55", in SE¼ sec.14, T.107 N., R.14 W., on left bank 30 ft upstream from ford, a quarter of a mile downstream from sewage plant, 1.6 miles north of Rochester, 2 miles downstream from Cascade Creek, and 2½ miles downstream from Silver Lake Dam.

Drainage area.--304 sq mi.

Records available.--January 1952 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 949.56 ft above mean sea level, datum of 1929. Prior to July 31, 1967, graphic water-stage recorder at same site and datum.

Average discharge.--16 years, 117 cfs.

Extremes.--Maximum discharge during year, 1,570 cfs June 27 (gage height, 7.18 ft); minimum, 17 cfs Jan. 1, 4, 8, 9, Feb. 21 (gage height, 1.68 ft).
1952-68: Maximum discharge, 19,600 cfs Mar. 1, 1965 (gage height, 19.12 ft, from floodmark); minimum, 8.4 cfs Dec. 7, 1955.
Flood of July 21, 1951 reached a stage of about 17.5 ft, from information by sewage plant superintendent. This is the highest known stage outside the period of record since at least 1908.

Remarks.--Records good. Records of chemical analyses for the water year 1968 are published in Part 2 of this report. Slight regulation at times from Silver Lake and at very low flows from sewage-plant effluent.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30 | 42 | 32 | 22 | 44 | 28 | 51 | 65 | 119 | 303 | 96 | 54 |
| 2 | 33 | 41 | 30 | 24 | 40 | 28 | 41 | 67 | 112 | 237 | 91 | 53 |
| 3 | 32 | 39 | 28 | 25 | 36 | 25 | 39 | 63 | 98 | 184 | 87 | 56 |
| 4 | 34 | 37 | 32 | 24 | 34 | 28 | 39 | 59 | 85 | 144 | 82 | 114 |
| 5 | 32 | 35 | 31 | 25 | 35 | 30 | 37 | 55 | 75 | 120 | 83 | 88 |
| 6 | 30 | 37 | 32 | 23 | 35 | 30 | 35 | 59 | 67 | 107 | 171 | 77 |
| 7 | 81 | 36 | 36 | 21 | 33 | 32 | 34 | 58 | 62 | 109 | 202 | 80 |
| 8 | 47 | 36 | 35 | 23 | 34 | 37 | 38 | 60 | 56 | 104 | 191 | 510 |
| 9 | 49 | 36 | 34 | 23 | 32 | 40 | 36 | 56 | 63 | 90 | 117 | 751 |
| 10 | 42 | 37 | 33 | 24 | 31 | 38 | 38 | 54 | 89 | 82 | 97 | 300 |
| 11 | 40 | 36 | 35 | 25 | 27 | 38 | 37 | 52 | 89 | 77 | 88 | 154 |
| 12 | 40 | 34 | 36 | 24 | 29 | 35 | 37 | 48 | 70 | 240 | 86 | 121 |
| 13 | 38 | 36 | 35 | 23 | 28 | 35 | 36 | 50 | 69 | 473 | 83 | 107 |
| 14 | 36 | 36 | 32 | 24 | 28 | 37 | 51 | 58 | 901 | 610 | 80 | 99 |
| 15 | 34 | 35 | 32 | 26 | 28 | 36 | 41 | 59 | 594 | 259 | 81 | 93 |
| 16 | 36 | 35 | 32 | 27 | 28 | 38 | 41 | 121 | 199 | 140 | 77 | 92 |
| 17 | 36 | 35 | 34 | 27 | 26 | 40 | 40 | 88 | 131 | 131 | 74 | 126 |
| 18 | 35 | 36 | 35 | 27 | 24 | 53 | 43 | 92 | 529 | 130 | 73 | 134 |
| 19 | 34 | 34 | 33 | 28 | 26 | 57 | 41 | 87 | 367 | 105 | 80 | 137 |
| 20 | 35 | 36 | 35 | 28 | 27 | 48 | 118 | 82 | 184 | 91 | 77 | 130 |
| 21 | 33 | 37 | 35 | 27 | 26 | 42 | 71 | 77 | 128 | 83 | 73 | 120 |
| 22 | 32 | 37 | 31 | 30 | 25 | 39 | 70 | 70 | 93 | 83 | 69 | 150 |
| 23 | 36 | 33 | 29 | 29 | 25 | 35 | 302 | 67 | 90 | 639 | 67 | 139 |
| 24 | 38 | 35 | 28 | 29 | 25 | 35 | 520 | 69 | 93 | 860 | 66 | 93 |
| 25 | 35 | 35 | 28 | 28 | 24 | 39 | 218 | 71 | 132 | 349 | 60 | 83 |
| 26 | 35 | 33 | 29 | 29 | 26 | 39 | 120 | 92 | 888 | 195 | 61 | 79 |
| 27 | 35 | 30 | 29 | 32 | 27 | 44 | 95 | 91 | 1,440 | 158 | 61 | 76 |
| 28 | 34 | 34 | 28 | 31 | 27 | 42 | 88 | 96 | 877 | 125 | 58 | 74 |
| 29 | 49 | 33 | 27 | 174 | 27 | 39 | 82 | 450 | 563 | 115 | 57 | 72 |
| 30 | 47 | 33 | 26 | 60 | ------ | 38 | 76 | 377 | 394 | 105 | 56 | 73 |
| 31 | 43 | ------ | 24 | 49 | ------ | 37 | ------ | 155 | ------ | 110 | 55 | ------ |
| TOTAL | 1,191 | 1,069 | 976 | 1,011 | 857 | 1,162 | 2,515 | 2,948 | 8,657 | 6,558 | 2,699 | 4,235 |
| MEAN | 38.4 | 35.5 | 31.5 | 32.6 | 29.6 | 37.5 | 83.8 | 95.1 | 289 | 212 | 87.1 | 141 |
| MAX | 81 | 42 | 36 | 174 | 44 | 57 | 520 | 450 | 1,440 | 860 | 202 | 751 |
| MIN | 30 | 30 | 24 | 21 | 24 | 25 | 34 | 48 | 56 | 77 | 55 | 53 |
| CFSM | .13 | .12 | .10 | .11 | .10 | .12 | .28 | .31 | .95 | .70 | .29 | .46 |
| IN. | .15 | .13 | .12 | .12 | .10 | .14 | .31 | .36 | 1.06 | .80 | .33 | .52 |

CAL YR 1967 TOTAL 60,708 MEAN 166 MAX 2,930 MIN 19 CFSM .55 IN 7.43
WTR YR 1968 TOTAL 33,878 MEAN 92.6 MAX 1,440 MIN 21 CFSM .30 IN 4.14

Peak discharge (base, 1,000 cfs)

| Date | Time | Gage height | Discharge | Date | Time | Gage height | Discharge |
|---|---|---|---|---|---|---|---|
| 6-14 | 1700 | 6.45 | 1,240 | 7-23 | 0845 | 6.12 | 1,020 |
| 6-27 | 0915 | 7.18 | 1,570 | 9-8 | 1045 | 5.96 | 1,040 |

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 1968. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Digital 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. Nov. 11, 1933 to May 28, 1964, graphic water-stage recorder at present site and datum.

Average discharge.--46 years (1909-17, 1930-68), 475 cfs.

Extremes.--Maximum discharge during year, 5,320 cfs July 27 (gage height, 13.27 ft); minimum, 28 cfs Nov. 27 (gage height, 5.96 ft).
1909-17, 1929-68: Maximum discharge, 35,900 cfs July 22, 1951 (gage height, 30.80 ft, from floodmark); minimum, 27 cfs Jan. 12, 1935; minimum gage height, 5.96 ft Nov. 27, 1967.
Flood of April 1888 reached stage of about 30.5 ft at present site or 29.7 ft original site. Flood in 1859 is known to have exceeded that of 1888 (gage height, not determined).

Remarks.--Records good except those for winter months, which are fair. Diurnal fluctuation caused by power-plant above station.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82 | 176 | 382 | 67 | 230 | 177 | 84 | 355 | 559 | 981 | 789 | 120 |
| 2 | 125 | 164 | 233 | 66 | 235 | 163 | 181 | 296 | 311 | 888 | 704 | 120 |
| 3 | 152 | 176 | 121 | 110 | 140 | 78 | 248 | 206 | 425 | 734 | 636 | 306 |
| 4 | 149 | 171 | 214 | 130 | 68 | 270 | 247 | 249 | 709 | 564 | 430 | 558 |
| 5 | 136 | 84 | 274 | 152 | 78 | 434 | 151 | 157 | 330 | 472 | 456 | 391 |
| 6 | 166 | 137 | 290 | 195 | 102 | 148 | 83 | 97 | 339 | 459 | 462 | 520 |
| 7 | 190 | 329 | 283 | 94 | 100 | 87 | 78 | 196 | 336 | 408 | 472 | 352 |
| 8 | 404 | 449 | 198 | 64 | 205 | 83 | 83 | 274 | 299 | 410 | 457 | 774 |
| 9 | 160 | 399 | 134 | 121 | 200 | 84 | 134 | 181 | 193 | 399 | 586 | 1,570 |
| 10 | 136 | 198 | 88 | 128 | 150 | 80 | 138 | 242 | 345 | 242 | 298 | 1,520 |
| 11 | 136 | 121 | 112 | 136 | 71 | 77 | 150 | 184 | 282 | 350 | 252 | 1,010 |
| 12 | 119 | 39 | 193 | 143 | 66 | 138 | 136 | 94 | 259 | 1,000 | 495 | 925 |
| 13 | 227 | 111 | 203 | 122 | 178 | 103 | 131 | 203 | 427 | 2,620 | 359 | 540 |
| 14 | 135 | 221 | 202 | 108 | 140 | 92 | 83 | 251 | 719 | 4,050 | 309 | 434 |
| 15 | 81 | 137 | 186 | 71 | 136 | 79 | 95 | 260 | 802 | 2,930 | 319 | 488 |
| 16 | 82 | 140 | 140 | 176 | 143 | 134 | 163 | 1,060 | 366 | 1,610 | 353 | 473 |
| 17 | 131 | 137 | 82 | 125 | 147 | 81 | 166 | 809 | 332 | 1,220 | 246 | 398 |
| 18 | 172 | 128 | 143 | 230 | 69 | 128 | 141 | 589 | 1,050 | 1,030 | 142 | 608 |
| 19 | 221 | 83 | 194 | 137 | 68 | 271 | 238 | 275 | 1,070 | 1,010 | 398 | 708 |
| 20 | 139 | 157 | 229 | 102 | 116 | 247 | 373 | 434 | 637 | 660 | 924 | 548 |
| 21 | 134 | 200 | 184 | 73 | 135 | 385 | 210 | 482 | 623 | 451 | 476 | 650 |
| 22 | 79 | 205 | 141 | 84 | 111 | 259 | 282 | 422 | 462 | 646 | 436 | 930 |
| 23 | 193 | 168 | 112 | 182 | 105 | 224 | 382 | 283 | 336 | 596 | 459 | 1,680 |
| 24 | 263 | 124 | 67 | 184 | 262 | 91 | 561 | 268 | 373 | 737 | 253 | 1,020 |
| 25 | 159 | 178 | 61 | 179 | 71 | 178 | 382 | 199 | 437 | 958 | 138 | 678 |
| 26 | 121 | 85 | 60 | 178 | 70 | 275 | 211 | 164 | 714 | 942 | 215 | 832 |
| 27 | 120 | 164 | 61 | 113 | 199 | 431 | 132 | 589 | 2,150 | 3,640 | 265 | 761 |
| 28 | 117 | 179 | 140 | 78 | 175 | 293 | 122 | 585 | 2,430 | 2,440 | 238 | 559 |
| 29 | 84 | 300 | 190 | 160 | 176 | 280 | 232 | 636 | 1,560 | 1,260 | 278 | 267 |
| 30 | 205 | 412 | 185 | 190 | ------ | 191 | 284 | 711 | 1,230 | 1,090 | 216 | 415 |
| 31 | 210 | ------ | 138 | 230 | ------ | 92 | ------ | 529 | ------ | 793 | 169 | ------ |
| TOTAL | 4,828 | 5,632 | 5,240 | 4,128 | 3,946 | 5,653 | 5,901 | 11,280 | 20,105 | 35,590 | 12,230 | 20,155 |
| MEAN | 156 | 188 | 169 | 133 | 136 | 182 | 197 | 364 | 670 | 1,148 | 395 | 672 |
| MAX | 404 | 449 | 382 | 230 | 262 | 434 | 561 | 1,060 | 2,430 | 4,050 | 924 | 1,680 |
| MIN | 79 | 83 | 60 | 64 | 66 | 77 | 78 | 94 | 193 | 242 | 138 | 120 |
| CFSM | .14 | .17 | .15 | .12 | .12 | .16 | .17 | .32 | .59 | 1.02 | .35 | .59 |
| IN. | .16 | .19 | .17 | .14 | .13 | .19 | .19 | .37 | .66 | 1.17 | .40 | .66 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 207,819 | MEAN 569 | MAX 14,300 | MIN 60 | CFSM .50 | IN 6.84 |
| WTR YR 1968 | TOTAL 134,688 | MEAN 368 | MAX 4,050 | MIN 60 | CFSM .33 | IN 4.43 |

## 5-3760. North Fork Whitewater River near Elba, Minn.

(Hydrologic bench-mark station)

Location.--Lat 44°05'30", long 92°03'57", in sec.7, T.107 N., R.10 W., Winona County, on left bank 2.3 mile upstream from Middle Fork, 2.4 miles west of Elba, and 3.5 miles upstream from confluence with South Fork.

Drainage area.--101 sq mi.

Records available.--May 1939 to September 1941, July 1967 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 769.60 ft above mean sea level, datum of 1929. Oct. 12, 1939, to Sept. 30, 1941, graphic water-stage recorder at site 600 ft downstream at same datum. Prior to Oct. 12, 1939, nonrecording gage at site 2 miles downstream at different datum.

Extremes.--1967: Maximum discharge during period July 1 to September 30, 103 cfs Aug. 15 (gage height, 3.32 ft); minimum daily, 13 cfs July 25 to Aug. 5.
1967-68: Maximum discharge during year, 880 cfs Sept. 18 (gage height, 6.63 ft); minimum, 11 cfs Feb. 21 (gage height, 2.37 ft).
1939-41, 1967-68: Maximum discharge, 2,730 cfs July 11, 1940 (gage height, 6.13 ft), may have been exceeded Sept. 15, 1941; minimum, 11 cfs Feb. 21 (gage height, 2.37 ft).

Remarks.--Records good. Records of chemical analyses and suspended sediment loads for the water year 1967 and 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, July to September 1967

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | 21 | 13 | 14 |
| 2 | | | | | | | | | | 20 | 13 | 15 |
| 3 | | | | | | | | | | 20 | 13 | 14 |
| 4 | | | | | | | | | | 19 | 13 | 14 |
| 5 | | | | | | | | | | 19 | 13 | 14 |
| 6 | | | | | | | | | | 19 | 16 | 14 |
| 7 | | | | | | | | | | 18 | 16 | 14 |
| 8 | | | | | | | | | | 18 | 15 | 14 |
| 9 | | | | | | | | | | 18 | 15 | 14 |
| 10 | | | | | | | | | | 18 | 15 | 14 |
| 11 | | | | | | | | | | 17 | 15 | 14 |
| 12 | | | | | | | | | | 16 | 15 | 14 |
| 13 | | | | | | | | | | 16 | 14 | 15 |
| 14 | | | | | | | | | | 15 | 14 | 16 |
| 15 | | | | | | | | | | 15 | 25 | 14 |
| 16 | | | | | | | | | | 15 | 16 | 14 |
| 17 | | | | | | | | | | 15 | 15 | 13 |
| 18 | | | | | | | | | | 15 | 15 | 14 |
| 19 | | | | | | | | | | 14 | 15 | 14 |
| 20 | | | | | | | | | | 15 | 15 | 14 |
| 21 | | | | | | | | | | 15 | 15 | 14 |
| 22 | | | | | | | | | | 14 | 15 | 14 |
| 23 | | | | | | | | | | 14 | 15 | 14 |
| 24 | | | | | | | | | | 14 | 15 | 14 |
| 25 | | | | | | | | | | 13 | 15 | 14 |
| 26 | | | | | | | | | | 13 | 16 | 13 |
| 27 | | | | | | | | | | 13 | 15 | 13 |
| 28 | | | | | | | | | | 13 | 15 | 13 |
| 29 | | | | | | | | | | 13 | 15 | 14 |
| 30 | | | | | ------ | | | | | 13 | 15 | 14 |
| 31 | | ------ | | | ------ | | ------ | | ------ | 13 | 14 | ------ |
| Total | | | | | | | | | | 491 | 466 | 420 |
| Mean | | | | | | | | | | 15.8 | 15.0 | 14.0 |
| Max | | | | | | | | | | 21 | 25 | 16 |
| Min | | | | | | | | | | 13 | 13 | 13 |
| Cfsm | | | | | | | | | | 0.156 | 0.149 | 0.139 |
| In. | | | | | | | | | | 0.18 | 0.17 | 0.15 |

5-3760. North Fork Whitewater River near Elba, Minn.--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 14 | 14 | 14 | 22 | 14 | 14 | 14 | 16 | 31 | 17 | 14 |
| 2 | 14 | 14 | 14 | 14 | 18 | 14 | 14 | 14 | 16 | 27 | 17 | 13 |
| 3 | 14 | 14 | 14 | 14 | 16 | 14 | 14 | 14 | 16 | 25 | 16 | 13 |
| 4 | 14 | 14 | 14 | 14 | 15 | 14 | 14 | 14 | 16 | 24 | 16 | 52 |
| 5 | 14 | 13 | 14 | 14 | 15 | 14 | 13 | 14 | 16 | 23 | 15 | 31 |
| 6 | 14 | 14 | 14 | 13 | 15 | 14 | 13 | 14 | 15 | 22 | 23 | 19 |
| 7 | 16 | 14 | 15 | 14 | 14 | 15 | 14 | 14 | 15 | 21 | 58 | 17 |
| 8 | 16 | 14 | 14 | 14 | 14 | 15 | 14 | 14 | 16 | 21 | 25 | 290 |
| 9 | 16 | 14 | 14 | 14 | 14 | 18 | 13 | 14 | 17 | 21 | 19 | 102 |
| 10 | 15 | 14 | 14 | 13 | 14 | 17 | 13 | 14 | 18 | 20 | 17 | 36 |
| 11 | 15 | 14 | 14 | 13 | 14 | 15 | 13 | 14 | 18 | 19 | 16 | 28 |
| 12 | 15 | 14 | 14 | 13 | 14 | 14 | 14 | 14 | 17 | 21 | 16 | 25 |
| 13 | 14 | 14 | 14 | 13 | 14 | 14 | 14 | 13 | 17 | 24 | 15 | 23 |
| 14 | 14 | 14 | 14 | 13 | 14 | 14 | 14 | 14 | 20 | 117 | 15 | 22 |
| 15 | 14 | 14 | 14 | 13 | 13 | 14 | 14 | 16 | 17 | 54 | 15 | 20 |
| 16 | 14 | 14 | 14 | 14 | 13 | 14 | 14 | 21 | 17 | 26 | 15 | 20 |
| 17 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 18 | 17 | 23 | 15 | 20 |
| 18 | 14 | 14 | 14 | 14 | 14 | 16 | 13 | 18 | 122 | 22 | 16 | 23 |
| 19 | 14 | 14 | 14 | 14 | 14 | 16 | 13 | 17 | 55 | 20 | 26 | 24 |
| 20 | 14 | 14 | 14 | 14 | 13 | 15 | 17 | 17 | 27 | 19 | 30 | 22 |
| 21 | 14 | 14 | 14 | 14 | 13 | 14 | 16 | 17 | 100 | 18 | 19 | 21 |
| 22 | 14 | 15 | 13 | 14 | 13 | 14 | 16 | 16 | 30 | 17 | 16 | 29 |
| 23 | 14 | 15 | 13 | 13 | 13 | 13 | 21 | 16 | 25 | 41 | 15 | 24 |
| 24 | 15 | 15 | 14 | 13 | 14 | 14 | 20 | 16 | 23 | 46 | 14 | 24 |
| 25 | 14 | 15 | 13 | 14 | 13 | 14 | 18 | 16 | 23 | 24 | 14 | 22 |
| 26 | 14 | 14 | 13 | 14 | 13 | 14 | 17 | 17 | 118 | 24 | 14 | 21 |
| 27 | 14 | 14 | 13 | 14 | 13 | 15 | 16 | 17 | 165 | 22 | 14 | 20 |
| 28 | 14 | 14 | 13 | 14 | 13 | 15 | 15 | 17 | 71 | 20 | 13 | 20 |
| 29 | 15 | 14 | 14 | 27 | 13 | 14 | 15 | 17 | 45 | 19 | 13 | 19 |
| 30 | 15 | 14 | 14 | 25 | ------ | 14 | 15 | 17 | 36 | 18 | 13 | 19 |
| 31 | 14 | ------ | 13 | 24 | ------ | 14 | ------ | 17 | ------ | 18 | 14 | ------ |
| TOTAL | 446 | 423 | 428 | 459 | 412 | 450 | 445 | 485 | 1,124 | 847 | 561 | 1,033 |
| MEAN | 14.4 | 14.1 | 13.8 | 14.8 | 14.2 | 14.5 | 14.8 | 15.6 | 37.5 | 27.3 | 18.1 | 34.4 |
| MAX | 16 | 15 | 15 | 27 | 22 | 18 | 21 | 21 | 165 | 117 | 58 | 290 |
| MIN | 14 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 15 | 17 | 13 | 13 |
| CFSM | .14 | .14 | .14 | .15 | .14 | .14 | .15 | .15 | .37 | .27 | .18 | .34 |
| IN. | .16 | .16 | .16 | .17 | .15 | .17 | .16 | .18 | .41 | .31 | .21 | .38 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL | MEAN | MAX | MIN | CFSM | IN |
| WTR YR 1968 | TOTAL 7,113 | MEAN 19.4 | MAX 290 | MIN 13 | CFSM .19 | IN 2.62 |

## 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 1968.

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.--29 years, 27.2 cfs.

Extremes.--Maximum discharge during year, 391 cfs June 21 (gage height, 3.53 ft); minimum, 5.7 cfs Jan. 23 (gage height, 0.76 ft).
1939-68: Maximum discharge, 5,460 cfs Aug. 31, 1947 (gage height, 10.61 ft); minimum, 3.8 cfs Mar. 24, 1940; minimum gage height, 0.23 ft Mar. 12, 1965.

Remarks.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 11 | 10 | 11 | 8.5 | 11 | 10 | 14 | 23 | 54 | 50 | 23 |
| 2 | 11 | 11 | 10 | 11 | 7.6 | 9.9 | 10 | 14 | 24 | 47 | 46 | 22 |
| 3 | 11 | 11 | 10 | 11 | 7.5 | 9.0 | 11 | 13 | 22 | 45 | 51 | 25 |
| 4 | 11 | 11 | 10 | 12 | 7.2 | 8.7 | 11 | 13 | 21 | 37 | 62 | 61 |
| 5 | 11 | 11 | 10 | 12 | 7.3 | 7.3 | 11 | 12 | 20 | 34 | 64 | 28 |
| 6 | 11 | 11 | 10 | 14 | 7.1 | 7.3 | 11 | 12 | 19 | 32 | 65 | 20 |
| 7 | 13 | 11 | 11 | 15 | 7.0 | 7.7 | 11 | 12 | 18 | 32 | 40 | 18 |
| 8 | 12 | 11 | 10 | 15 | 7.2 | 8.3 | 11 | 12 | 18 | 32 | 28 | 37 |
| 9 | 12 | 11 | 10 | 16 | 7.4 | 9.1 | 11 | 12 | 25 | 28 | 22 | 32 |
| 10 | 12 | 11 | 10 | 17 | 7.6 | 8.8 | 11 | 12 | 28 | 26 | 20 | 24 |
| 11 | 12 | 11 | 10 | 16 | 8.0 | 9.0 | 11 | 12 | 28 | 25 | 18 | 19 |
| 12 | 12 | 11 | 10 | 15 | 8.4 | 9.3 | 11 | 12 | 28 | 26 | 17 | 18 |
| 13 | 11 | 11 | 10 | 14 | 8.8 | 9.5 | 11 | 13 | 26 | 32 | 17 | 17 |
| 14 | 11 | 11 | 10 | 13 | 9.2 | 9.8 | 11 | 14 | 44 | 52 | 16 | 16 |
| 15 | 11 | 11 | 10 | 12 | 9.2 | 10 | 12 | 19 | 42 | 32 | 14 | 16 |
| 16 | 11 | 11 | 10 | 12 | 8.8 | 10 | 12 | 35 | 30 | 27 | 18 | 16 |
| 17 | 11 | 11 | 10 | 12 | 9.2 | 10 | 12 | 30 | 27 | 24 | 17 | 18 |
| 18 | 11 | 11 | 11 | 11 | 10 | 12 | 12 | 21 | 108 | 22 | 17 | 21 |
| 19 | 11 | 11 | 11 | 11 | 9.8 | 12 | 12 | 20 | 65 | 19 | 18 | 23 |
| 20 | 11 | 11 | 11 | 10 | 9.8 | 10 | 16 | 20 | 39 | 17 | 20 | 21 |
| 21 | 11 | 11 | 10 | 9.8 | 10 | 9.9 | 15 | 18 | 70 | 20 | 16 | 20 |
| 22 | 11 | 11 | 10 | 9.4 | 11 | 9.6 | 15 | 17 | 34 | 32 | 14 | 23 |
| 23 | 12 | 11 | 10 | 9.0 | 13 | 9.6 | 21 | 16 | 30 | 73 | 13 | 24 |
| 24 | 12 | 11 | 10 | 9.9 | 12 | 9.6 | 32 | 16 | 49 | 63 | 28 | 22 |
| 25 | 12 | 11 | 10 | 10 | 11 | 9.6 | 23 | 16 | 38 | 36 | 30 | 21 |
| 26 | 12 | 11 | 10 | 9.1 | 11 | 9.6 | 18 | 19 | 103 | 31 | 30 | 21 |
| 27 | 12 | 11 | 10 | 8.3 | 10 | 10 | 16 | 22 | 142 | 47 | 29 | 20 |
| 28 | 11 | 11 | 10 | 7.9 | 10 | 10 | 16 | 21 | 88 | 62 | 28 | 20 |
| 29 | 12 | 11 | 11 | 18 | 10 | 10 | 15 | 24 | 71 | 52 | 27 | 19 |
| 30 | 12 | 11 | 11 | 11 | ------ | 9.9 | 14 | 28 | 61 | 50 | 25 | 19 |
| 31 | 12 | ------ | 11 | 9.5 | ------ | 9.9 | ------ | 22 | ------ | 53 | 25 | ------ |
| Total | 356 | 330 | 317 | 371.9 | 263.6 | 296.4 | 413 | 541 | 1,341 | 1,162 | 885 | 684 |
| Mean | 11.5 | 11.0 | 10.2 | 12.0 | 9.09 | 9.56 | 13.8 | 17.4 | 44.7 | 37.5 | 28.5 | 22.8 |
| Max | 13 | 11 | 11 | 18 | 13 | 12 | 32 | 35 | 142 | 73 | 65 | 61 |
| Min | 11 | 11 | 10 | 7.9 | 7.0 | 7.3 | 10 | 12 | 18 | 17 | 13 | 16 |
| Cfsm | 0.150 | 0.143 | 0.133 | 0.156 | 0.118 | 0.124 | 0.180 | 0.227 | 0.582 | 0.488 | 0.371 | 0.297 |
| In. | 0.17 | 0.16 | 0.15 | 0.18 | 0.13 | 0.14 | 0.20 | 0.26 | 0.65 | 0.56 | 0.43 | 0.33 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 11,489 | Mean | 31.5 | Max | 1,460 | Min | 9.4 | Cfsm | 0.410 | In. | 5.56 |
| Wtr yr 1968: | Total | 6,960.9 | Mean | 19.0 | Max | 142 | Min | 7.0 | Cfsm | 0.247 | In. | 3.37 |

Peak discharge (base, 400 cfs).--No peak above base.

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 1968. 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.--40 years, 24,920 cfs.

Extremes.--Maximum discharge during year, 75,000 cfs June 27 (gage height, 9.97 ft); minimum daily, 5,000 cfs Dec. 17; minimum gage height, 4.83 ft Dec. 17.
1928-68: Maximum discharge, 268,000 cfs Apr. 19, 1965 (gage height, 20.77 ft, from floodmark); minimum, 2,250 cfs Dec. 29, 1933 (gage height, -1.18 ft); minimum gage height, -3.38 ft Aug. 31, 1934.

Remarks.--Records good. Records of chemical analyses for the water year 1968 are published in Part 2 of this report. 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 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8,500 | 11,000 | 8,300 | 9,200 | 11,900 | 9,800 | 16,200 | 45,500 | 45,100 | 72,800 | 41,000 | 14,300 |
| 2 | 8,500 | 14,000 | 8,300 | 9,200 | 12,400 | 9,800 | 15,200 | 44,300 | 45,200 | 73,200 | 37,900 | 15,700 |
| 3 | 9,300 | 14,000 | 9,800 | 9,200 | 12,200 | 9,800 | 17,200 | 43,400 | 43,800 | 72,000 | 37,600 | 11,300 |
| 4 | 9,800 | 14,000 | 10,100 | 9,100 | 12,000 | 9,800 | 19,100 | 40,800 | 39,300 | 71,800 | 40,000 | 10,900 |
| 5 | 10,500 | 14,400 | 10,400 | 9,000 | 11,300 | 9,900 | 19,600 | 39,600 | 39,000 | 73,900 | 40,000 | 14,500 |
| 6 | 9,800 | 12,500 | 11,800 | 9,000 | 10,200 | 11,100 | 19,500 | 31,700 | 39,100 | 73,700 | 36,800 | 16,100 |
| 7 | 9,200 | 11,400 | 13,000 | 9,100 | 9,800 | 14,000 | 16,400 | 26,400 | 35,600 | 69,000 | 36,000 | 20,000 |
| 8 | 9,600 | 11,300 | 13,100 | 9,000 | 9,900 | 15,000 | 16,700 | 28,500 | 33,900 | 63,500 | 34,200 | 27,000 |
| 9 | 10,600 | 11,400 | 12,800 | 9,000 | 10,000 | 15,800 | 17,800 | 28,000 | 35,100 | 58,400 | 28,900 | 25,900 |
| 10 | 12,300 | 11,400 | 13,000 | 9,000 | 10,000 | 17,400 | 16,900 | 24,400 | 34,500 | 53,000 | 31,200 | 21,100 |
| 11 | 11,500 | 13,800 | 13,000 | 9,000 | 10,000 | 16,800 | 18,800 | 22,200 | 35,900 | 48,000 | 30,700 | 21,000 |
| 12 | 10,500 | 13,300 | 13,200 | 9,000 | 10,600 | 17,400 | 20,300 | 22,000 | 36,400 | 43,900 | 28,300 | 21,500 |
| 13 | 9,500 | 12,300 | 13,300 | 9,000 | 10,300 | 17,400 | 23,700 | 22,500 | 37,600 | 44,500 | 27,200 | 21,600 |
| 14 | 10,900 | 11,500 | 12,600 | 10,000 | 10,000 | 17,900 | 22,000 | 22,900 | 45,800 | 43,900 | 32,400 | 21,500 |
| 15 | 12,000 | 11,200 | 10,800 | 10,200 | 10,000 | 18,700 | 20,900 | 26,700 | 51,400 | 46,000 | 29,400 | 19,200 |
| 16 | 11,500 | 11,100 | 7,100 | 10,000 | 10,000 | 18,400 | 19,300 | 30,800 | 57,200 | 48,400 | 30,000 | 18,900 |
| 17 | 11,000 | 11,300 | 5,000 | 10,600 | 9,900 | 15,400 | 19,900 | 41,200 | 58,500 | 52,300 | 28,000 | 18,300 |
| 18 | 11,000 | 11,400 | 10,100 | 10,900 | 9,800 | 16,700 | 20,600 | 41,800 | 59,800 | 55,800 | 26,500 | 20,600 |
| 19 | 10,900 | 11,600 | 10,200 | 11,000 | 9,300 | 20,000 | 21,200 | 47,400 | 60,200 | 60,600 | 22,500 | 21,200 |
| 20 | 10,800 | 12,500 | 11,700 | 10,700 | 8,900 | 19,300 | 23,100 | 54,000 | 58,300 | 61,300 | 21,400 | 20,900 |
| 21 | 10,500 | 12,800 | 12,900 | 10,700 | 8,800 | 20,800 | 25,100 | 57,500 | 60,500 | 58,700 | 19,200 | 23,000 |
| 22 | 10,300 | 13,500 | 12,600 | 10,300 | 8,500 | 21,000 | 27,000 | 53,900 | 60,600 | 56,200 | 18,100 | 25,800 |
| 23 | 10,000 | 12,800 | 10,200 | 10,100 | 9,500 | 20,800 | 37,300 | 52,100 | 58,600 | 55,900 | 19,700 | 29,200 |
| 24 | 9,800 | 12,300 | 7,200 | 10,000 | 9,600 | 20,200 | 40,200 | 51,000 | 60,800 | 52,600 | 18,400 | 41,200 |
| 25 | 9,900 | 12,000 | 9,600 | 9,400 | 9,600 | 18,300 | 38,100 | 45,400 | 64,600 | 46,400 | 18,100 | 42,100 |
| 26 | 10,400 | 12,300 | 10,100 | 9,000 | 9,800 | 19,200 | 39,300 | 44,300 | 70,800 | 44,000 | 15,200 | 41,400 |
| 27 | 11,800 | 12,300 | 9,700 | 9,500 | 9,700 | 17,800 | 44,000 | 41,900 | 74,700 | 45,100 | 13,900 | 46,000 |
| 28 | 11,800 | 11,700 | 8,100 | 9,600 | 9,700 | 18,200 | 45,300 | 37,800 | 74,400 | 45,100 | 11,700 | 50,300 |
| 29 | 11,800 | 10,200 | 8,600 | 10,700 | 9,700 | 19,000 | 46,200 | 40,200 | 73,300 | 44,300 | 12,400 | 50,800 |
| 30 | 13,700 | 8,600 | 9,000 | 11,400 | ------ | 18,600 | 46,200 | 39,900 | 72,600 | 39,300 | 12,500 | 49,900 |
| 31 | 11,300 | ------ | 9,200 | 11,500 | ------ | 17,800 | ------ | 42,500 | ------ | 38,900 | 13,100 | ------ |
| Total | 329,000 | 363,900 | 324,800 | 303,400 | 293,400 | 512,100 | 773,100 | 1,190,600 | 1,562,600 | 1,712,500 | 812,300 | 781,200 |
| Mean | 10,600 | 12,100 | 10,500 | 9,790 | 10,100 | 16,500 | 25,800 | 38,400 | 52,100 | 55,200 | 26,200 | 26,000 |
| Max | 13,700 | 14,400 | 13,300 | 11,500 | 12,400 | 21,000 | 46,200 | 57,500 | 74,700 | 73,900 | 41,000 | 50,800 |
| Min | 8,500 | 8,600 | 5,000 | 9,000 | 8,500 | 9,800 | 15,200 | 22,000 | 33,900 | 38,900 | 11,700 | 10,900 |
| Cfsm | 0.179 | 0.204 | 0.177 | 0.165 | 0.171 | 0.279 | 0.436 | 0.649 | 0.880 | 0.932 | 0.442 | 0.439 |
| In. | 0.21 | 0.23 | 0.20 | 0.19 | 0.18 | 0.32 | 0.49 | 0.75 | 0.98 | 1.08 | 0.51 | 0.49 |

Cal yr 1967: Total 10,353,700 Mean 28,400 Max 165,000 Min 5,000 Cfsm 0.480 In. 6.50
Wtr yr 1968: Total 8,958,900 Mean 24,480 Max 74,700 Min 5,000 Cfsm 0.414 In. 5.63

5-3840. Root River near Lanesboro, Minn.

Location.--Lat 43°44'58", long 91°58'43", in sec.1, T.103 N., R.10 W., on left bank half a mile upstream from highway bridge, 1¼ miles upstream from South Branch, and 2½ miles northeast of Lanesboro.

Drainage area.--615 sq mi.

Records available.--February to November 1910, February 1911 to September 1914, July 1915 to September 1917, August 1940 to September 1968. Published as North Branch Root River near Lanesboro, 1910-17.

Gage.--Digital 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. Aug. 2, 1940 to May 19, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--33 years (1911-14, 1915-17, 1940-68), 314 cfs.

Extremes.--Maximum discharge during year, 1,790 cfs July 23 (gage height, 4.76 ft); minimum, 54 cfs Dec. 15 (gage height, 0.80 ft).
1910-17, 1940-68: Maximum discharge 22,100 cfs Mar. 29, 1962 (gage height, 16.11 ft); maximum gage height, 17.83 ft Mar. 1, 1965, from floodmark, backwater from ice; minimum discharge, 29 cfs Aug. 27, 1949 (gage height, 1.08 ft); minimum gage height, 0.80 ft Dec. 15, 1967.

Remarks.--Records good except those for winter months, which are fair. Diurnal fluctuation at times during medium and low flow caused by powerplant above station. Records of suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 84 | 99 | 93 | 80 | 190 | 88 | 107 | 140 | 237 | 417 | 204 | 90 |
| 2 | 84 | 99 | 93 | 80 | 155 | 82 | 106 | 130 | 216 | 350 | 190 | 89 |
| 3 | 84 | 97 | 92 | 80 | 145 | 115 | 108 | 123 | 194 | 306 | 178 | 89 |
| 4 | 83 | 95 | 90 | 80 | 125 | 100 | 108 | 115 | 176 | 276 | 168 | 330 |
| 5 | 83 | 93 | 90 | 80 | 110 | 90 | 108 | 110 | 162 | 251 | 160 | 250 |
| 6 | 84 | 92 | 90 | 80 | 105 | 100 | 108 | 108 | 150 | 229 | 155 | 168 |
| 7 | 94 | 92 | 92 | 80 | 100 | 115 | 108 | 108 | 139 | 221 | 155 | 144 |
| 8 | 102 | 92 | 92 | 80 | 96 | 105 | 108 | 113 | 132 | 220 | 151 | 160 |
| 9 | 106 | 93 | 91 | 80 | 92 | 110 | 110 | 114 | 143 | 207 | 147 | 166 |
| 10 | 110 | 93 | 90 | 80 | 94 | 120 | 110 | 112 | 171 | 188 | 144 | 147 |
| 11 | 102 | 93 | 89 | 80 | 100 | 137 | 109 | 112 | 170 | 175 | 138 | 132 |
| 12 | 97 | 93 | 88 | 80 | 98 | 135 | 108 | 112 | 155 | 170 | 136 | 123 |
| 13 | 95 | 91 | 86 | 80 | 115 | 128 | 109 | 112 | 144 | 185 | 130 | 124 |
| 14 | 93 | 91 | 85 | 81 | 100 | 122 | 112 | 115 | 195 | 224 | 124 | 116 |
| 15 | 91 | 93 | 85 | 82 | 85 | 120 | 118 | 165 | 221 | 219 | 119 | 108 |
| 16 | 90 | 92 | 85 | 83 | 82 | 125 | 116 | 742 | 184 | 213 | 118 | 103 |
| 17 | 88 | 93 | 83 | 84 | 80 | 130 | 116 | 526 | 184 | 194 | 117 | 106 |
| 18 | 87 | 92 | 82 | 85 | 78 | 131 | 116 | 376 | 312 | 175 | 119 | 118 |
| 19 | 87 | 91 | 81 | 86 | 77 | 148 | 116 | 295 | 361 | 160 | 116 | 123 |
| 20 | 86 | 91 | 81 | 87 | 76 | 142 | 126 | 268 | 261 | 147 | 115 | 132 |
| 21 | 87 | 91 | 80 | 88 | 76 | 123 | 211 | 240 | 202 | 148 | 113 | 127 |
| 22 | 86 | 91 | 80 | 89 | 75 | 111 | 202 | 217 | 177 | 171 | 106 | 141 |
| 23 | 87 | 89 | 80 | 89 | 75 | 105 | 288 | 196 | 168 | 743 | 102 | 147 |
| 24 | 88 | 94 | 80 | 88 | 75 | 103 | 409 | 182 | 165 | 1,170 | 101 | 137 |
| 25 | 87 | 93 | 80 | 88 | 75 | 107 | 356 | 174 | 177 | 1,100 | 100 | 128 |
| 26 | 87 | 93 | 80 | 89 | 75 | 108 | 259 | 184 | 286 | 553 | 95 | 121 |
| 27 | 88 | 93 | 80 | 88 | 75 | 109 | 214 | 202 | 1,030 | 384 | 94 | 117 |
| 28 | 88 | 93 | 80 | 86 | 78 | 113 | 188 | 218 | 1,220 | 311 | 92 | 115 |
| 29 | 93 | 93 | 80 | 200 | 80 | 111 | 167 | 241 | 759 | 266 | 89 | 117 |
| 30 | 99 | 93 | 80 | 350 | ------ | 110 | 152 | 280 | 530 | 237 | 89 | 116 |
| 31 | 98 | ------ | 80 | 230 | ------ | 110 | ------ | 260 | ------ | 218 | 90 | ------ |
| TOTAL | 2,818 | 2,788 | 2,638 | 3,113 | 2,787 | 3,553 | 4,673 | 6,390 | 8,621 | 9,828 | 3,955 | 4,084 |
| MEAN | 90.9 | 92.9 | 85.1 | 100 | 96.1 | 115 | 156 | 206 | 287 | 317 | 128 | 136 |
| MAX | 110 | 99 | 93 | 350 | 190 | 148 | 409 | 742 | 1,220 | 1,170 | 204 | 330 |
| MIN | 83 | 89 | 80 | 80 | 75 | 82 | 106 | 108 | 132 | 147 | 89 | 89 |
| CFSM | .15 | .15 | .14 | .16 | .16 | .19 | .25 | .34 | .47 | .52 | .21 | .22 |
| IN. | .17 | .17 | .16 | .19 | .17 | .21 | .28 | .39 | .52 | .59 | .24 | .25 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 113,758 | MEAN 312 | MAX 7,660 | MIN 80 | CFSM .51 | IN 6.88 | | |
| WTR YR 1968 | TOTAL 55,248 | MEAN 151 | MAX 1,220 | MIN 75 | CFSM .25 | IN 3.34 | | |

Peak discharge (base 3,500 cfs).--No peak above base.

## 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 1968.

Gage.--Wire-weight 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, Aug. 4, 1949, to June 13, 1950. June 14, 1950, to Aug. 26, 1964, chain gage at present site and datum.

Average discharge.--26 years, 53.8 cfs.

Extremes.--Maximum discharge during year, 370 cfs July 23 (gage height, 3.50 ft); minimum daily, 30 cfs Dec.14, 20-29, Mar. 3, May 10-13.

1942-68: 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, 0.93 ft June 16, 17, 18, 1965.

Flood of June 28, 29, 1942 reached a discharge of 11,000 cfs (by slope-area measurement of peak flow).

Remarks.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 36 | 34 | 34 | 32 | 48 | 32 | 41 | 36 | 37 | 47 | 41 | 34 |
| 2 | 38 | 34 | 33 | 32 | 41 | 33 | 41 | 34 | 36 | 46 | 40 | 34 |
| 3 | 41 | 34 | 32 | 32 | 39 | 30 | 42 | 32 | 34 | 43 | 40 | 34 |
| 4 | 40 | 34 | 32 | 34 | 38 | 32 | 43 | 32 | 34 | 43 | 39 | 60 |
| 5 | 41 | 34 | 32 | 34 | 38 | 32 | 42 | 32 | 34 | 43 | 39 | 40 |
| 6 | 42 | 35 | 32 | 34 | 38 | 32 | 41 | 32 | 34 | 42 | 38 | 38 |
| 7 | 51 | 34 | 34 | 34 | 38 | 33 | 43 | 32 | 33 | 43 | 55 | 39 |
| 8 | 53 | 34 | 32 | 34 | 38 | 34 | 44 | 34 | 33 | 41 | 39 | 42 |
| 9 | 50 | 34 | 32 | 34 | 40 | 32 | 44 | 31 | 37 | 41 | 38 | 38 |
| 10 | 49 | 33 | 32 | 35 | 44 | 34 | 45 | 30 | 38 | 38 | 37 | 36 |
| 11 | 49 | 33 | 32 | 35 | 55 | 33 | 44 | 30 | 37 | 38 | 36 | 34 |
| 12 | 47 | 32 | 32 | 35 | 46 | 33 | 45 | 30 | 34 | 40 | 36 | 34 |
| 13 | 47 | 33 | 32 | 36 | 52 | 32 | 46 | 30 | 34 | 39 | 36 | 34 |
| 14 | 47 | 34 | 30 | 36 | 41 | 33 | 47 | 50 | 44 | 41 | 36 | 34 |
| 15 | 45 | 34 | 31 | 35 | 34 | 33 | 44 | 106 | 34 | 45 | 37 | 34 |
| 16 | 45 | 34 | 32 | 34 | 38 | 33 | 45 | 93 | 34 | 40 | 37 | 34 |
| 17 | 44 | 34 | 31 | 32 | 38 | 33 | 45 | 85 | 34 | 40 | 37 | 34 |
| 18 | 43 | 34 | 31 | 32 | 39 | 35 | 46 | 46 | 103 | 38 | 36 | 37 |
| 19 | 43 | 34 | 31 | 32 | 35 | 36 | 45 | 43 | 51 | 37 | 36 | 36 |
| 20 | 41 | 34 | 30 | 32 | 45 | 38 | 74 | 42 | 43 | 37 | 36 | 34 |
| 21 | 40 | 34 | 30 | 32 | 43 | 38 | 54 | 40 | 44 | 70 | 36 | 34 |
| 22 | 38 | 34 | 30 | 32 | 40 | 40 | 44 | 39 | 44 | 62 | 35 | 43 |
| 23 | 38 | 34 | 30 | 33 | 37 | 41 | 64 | 38 | 44 | 291 | 35 | 37 |
| 24 | 39 | 34 | 30 | 39 | 36 | 41 | 51 | 38 | 46 | 154 | 34 | 36 |
| 25 | 38 | 34 | 30 | 34 | 33 | 42 | 45 | 38 | 46 | 52 | 34 | 35 |
| 26 | 37 | 34 | 30 | 32 | 32 | 41 | 43 | 41 | 64 | 49 | 33 | 34 |
| 27 | 36 | 34 | 30 | 32 | 32 | 41 | 40 | 38 | 56 | 50 | 34 | 34 |
| 28 | 36 | 34 | 30 | 31 | 32 | 42 | 39 | 38 | 52 | 50 | 33 | 34 |
| 29 | 36 | 34 | 30 | 110 | 37 | 40 | 38 | 38 | 48 | 52 | 33 | 34 |
| 30 | 37 | 34 | 32 | 85 | ------ | 41 | 37 | 37 | 47 | 43 | 32 | 34 |
| 31 | 34 | ------ | 32 | 58 | ------ | 41 | ------ | 37 | ------ | 43 | 34 | ------ |
| Total | 1,301 | 1,016 | 971 | 1,192 | 1,147 | 1,111 | 1,362 | 1,302 | 1,289 | 1,738 | 1,142 | 1,095 |
| Mean | 42.0 | 33.9 | 31.3 | 38.5 | 39.6 | 35.8 | 45.4 | 42.0 | 43.0 | 56.1 | 36.8 | 36.5 |
| Max | 53 | 35 | 34 | 110 | 55 | 42 | 74 | 106 | 103 | 291 | 55 | 60 |
| Min | 34 | 32 | 30 | 31 | 32 | 30 | 37 | 30 | 33 | 37 | 32 | 34 |
| Cfsm | 0.326 | 0.263 | 0.243 | 0.298 | 0.307 | 0.278 | 0.352 | 0.326 | 0.333 | 0.435 | 0.285 | 0.283 |
| In. | 0.38 | 0.29 | 0.28 | 0.34 | 0.33 | 0.32 | 0.39 | 0.38 | 0.37 | 0.50 | 0.33 | 0.32 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 21,018 | Mean | 57.6 | Max | 2,380 | Min | 27 | Cfsm | 0.447 | In. | 6.07 |
| Wtr yr 1968: | Total | 14,666 | Mean | 40.1 | Max | 110 | Min | 30 | Cfsm | 0.311 | In. | 4.22 |

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 1968. 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.--46 years (1909-17, 1930-68), 639 cfs.

Extremes.--Maximum discharge during year 3,210 cfs May 16 (gage height, 5.53 ft); minimum daily, 226 cfs Apr. 6. 1909-17, 1929-68: Maximum discharge, 37,000 cfs Apr. 1, 1952 (gage height, 13.90 ft); maximum gage height, 18.32 ft Mar. 2, 1965 (backwater from ice); minimum discharge, 65 cfs Dec. 26, 1933, Feb. 25, 1935.

Remarks.--Records good except those for winter months, which are fair. Slight diurnal fluctuation at low flows caused by powerplants above station. Records for suspended sediment loads for water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 279 | 274 | 295 | 258 | 265 | 234 | 244 | 388 | 575 | 920 | 520 | 271 |
| 2 | 278 | 274 | 297 | 258 | 263 | 234 | 238 | 366 | 525 | 815 | 480 | 273 |
| 3 | 278 | 271 | 295 | 258 | 258 | 234 | 238 | 348 | 485 | 730 | 465 | 278 |
| 4 | 280 | 274 | 293 | 257 | 252 | 235 | 241 | 334 | 456 | 670 | 438 | 282 |
| 5 | 283 | 271 | 289 | 256 | 245 | 237 | 232 | 321 | 424 | 625 | 420 | 700 |
| 6 | 284 | 271 | 285 | 256 | 241 | 240 | 226 | 309 | 402 | 575 | 420 | 490 |
| 7 | 282 | 271 | 301 | 256 | 240 | 245 | 235 | 309 | 374 | 545 | 442 | 410 |
| 8 | 305 | 278 | 305 | 256 | 240 | 250 | 235 | 313 | 352 | 520 | 406 | 495 |
| 9 | 297 | 278 | 297 | 256 | 239 | 260 | 232 | 305 | 356 | 500 | 374 | 424 |
| 10 | 297 | 278 | 293 | 256 | 239 | 275 | 238 | 297 | 456 | 465 | 374 | 392 |
| 11 | 297 | 278 | 293 | 256 | 238 | 290 | 238 | 293 | 550 | 460 | 352 | 374 |
| 12 | 289 | 278 | 289 | 256 | 238 | 305 | 235 | 289 | 442 | 428 | 343 | 352 |
| 13 | 285 | 278 | 285 | 256 | 237 | 315 | 241 | 282 | 406 | 420 | 334 | 330 |
| 14 | 285 | 278 | 280 | 256 | 237 | 316 | 313 | 313 | 410 | 420 | 330 | 313 |
| 15 | 282 | 282 | 278 | 256 | 237 | 313 | 297 | 384 | 495 | 480 | 325 | 297 |
| 16 | 274 | 285 | 280 | 256 | 237 | 309 | 289 | 1,960 | 442 | 442 | 325 | 285 |
| 17 | 268 | 278 | 290 | 256 | 236 | 317 | 285 | 1,660 | 406 | 438 | 317 | 297 |
| 18 | 271 | 289 | 313 | 256 | 236 | 330 | 282 | 1,200 | 620 | 415 | 317 | 334 |
| 19 | 268 | 282 | 297 | 256 | 236 | 334 | 293 | 1,030 | 935 | 388 | 317 | 325 |
| 20 | 264 | 282 | 293 | 256 | 235 | 330 | 370 | 915 | 655 | 374 | 321 | 325 |
| 21 | 260 | 289 | 293 | 256 | 235 | 317 | 388 | 840 | 560 | 438 | 317 | 321 |
| 22 | 264 | 289 | 293 | 256 | 234 | 301 | 415 | 780 | 475 | 545 | 297 | 510 |
| 23 | 260 | 293 | 295 | 256 | 234 | 285 | 660 | 720 | 424 | 975 | 292 | 428 |
| 24 | 271 | 285 | 290 | 256 | 234 | 278 | 640 | 665 | 424 | 1,340 | 290 | 370 |
| 25 | 271 | 293 | 280 | 256 | 234 | 274 | 675 | 630 | 460 | 1,240 | 288 | 330 |
| 26 | 268 | 290 | 275 | 256 | 234 | 274 | 600 | 620 | 650 | 1,120 | 284 | 321 |
| 27 | 264 | 289 | 270 | 257 | 234 | 301 | 515 | 600 | 995 | 890 | 281 | 301 |
| 28 | 264 | 285 | 265 | 258 | 234 | 289 | 470 | 575 | 1,450 | 775 | 278 | 293 |
| 29 | 268 | 290 | 260 | 259 | 234 | 271 | 438 | 600 | 1,290 | 665 | 268 | 285 |
| 30 | 278 | 292 | 258 | 260 | ------ | 271 | 410 | 590 | 1,060 | 610 | 268 | 285 |
| 31 | 278 | ------ | 258 | 261 | ------ | 264 | ------ | 600 | ------ | 555 | 270 | ------ |
| Total | 8,592 | 8,445 | 8,885 | 7,958 | 6,956 | 8,728 | 10,413 | 13,836 | 17,554 | 19,783 | 10,753 | 10,691 |
| Mean | 277 | 282 | 287 | 257 | 240 | 282 | 347 | 608 | 585 | 638 | 347 | 356 |
| Max | 305 | 293 | 313 | 261 | 265 | 334 | 675 | 1,960 | 1,450 | 1,340 | 520 | 700 |
| Min | 260 | 271 | 258 | 256 | 234 | 234 | 226 | 282 | 352 | 374 | 268 | 271 |
| Cfsm | 0.218 | 0.222 | 0.226 | 0.202 | 0.189 | 0.222 | 0.273 | 0.479 | 0.461 | 0.502 | 0.273 | 0.280 |
| In. | 0.25 | 0.25 | 0.26 | 0.23 | 0.20 | 0.26 | 0.30 | 0.55 | 0.51 | 0.58 | 0.32 | 0.31 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 236,969 | Mean | 649 | Max | 13,300 | Min | 258 | Cfsm | 0.511 | In. | 6.94 |
| Wtr yr 1968: | Total | 137,594 | Mean | 376 | Max | 1,960 | Min | 226 | Cfsm | 0.296 | In. | 4.03 |

Peak discharge (base, 5,000 cfs).--No peak above base.

5-3855. South Fork Root River near Houston, Minn.

Location.--Lat 43°44'19", long 91°33'50", 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 1968.

Gage.--Water-stage recorder. Datum of gage is 680.41 ft above mean sea level, datum of 1929.

Average discharge.--15 years, 120 cfs.

Extremes.--Maximum discharge during year, 768 cfs June 18 (gage height, 6.25 ft); maximum gage height, 10.86 ft Jan. 29, (from highwater mark, backwater from ice); minimum discharge 60 cfs Oct. 1 (gage height, 1.23 ft).

1953-68: Maximum discharge 8,420 cfs Mar. 29, 1962 (gage height, 13.35 ft); maximum gage height, 13.74 ft Mar. 26, 1961 (backwater from ice); minimum discharge, 11 cfs Nov. 28, 1961 (gage height, 1.47 ft); minimum gage height, 0.85 ft Aug. 17, 1967.

Remarks.--Records good except those for winter months, which are fair. Record for chemical analyses for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 65 | 72 | 69 | 64 | 250 | 69 | 68 | 74 | 77 | 130 | 79 | 71 |
| 2 | 68 | 72 | 69 | 64 | 145 | 71 | 68 | 72 | 74 | 119 | 78 | 70 |
| 3 | 69 | 72 | 68 | 64 | 110 | 73 | 69 | 71 | 73 | 110 | 77 | 69 |
| 4 | 66 | 70 | 68 | 64 | 92 | 74 | 77 | 70 | 72 | 103 | 77 | 88 |
| 5 | 67 | 70 | 68 | 64 | 83 | 74 | 72 | 70 | 69 | 101 | 76 | 86 |
| 6 | 68 | 70 | 67 | 63 | 80 | 72 | 71 | 69 | 68 | 96 | 76 | 78 |
| 7 | 78 | 70 | 68 | 63 | 76 | 72 | 68 | 70 | 68 | 96 | 86 | 77 |
| 8 | 85 | 70 | 68 | 63 | 72 | 75 | 70 | 74 | 68 | 95 | 78 | 98 |
| 9 | 78 | 70 | 68 | 63 | 71 | 83 | 68 | 71 | 71 | 92 | 77 | 85 |
| 10 | 75 | 70 | 67 | 63 | 69 | 89 | 68 | 69 | 114 | 91 | 77 | 76 |
| 11 | 74 | 70 | 68 | 63 | 68 | 79 | 68 | 68 | 82 | 89 | 72 | 73 |
| 12 | 74 | 68 | 68 | 63 | 67 | 74 | 67 | 68 | 70 | 85 | 69 | 72 |
| 13 | 76 | 68 | 66 | 63 | 67 | 72 | 68 | 65 | 68 | 91 | 68 | 71 |
| 14 | 74 | 68 | 65 | 63 | 66 | 72 | 74 | 72 | 135 | 91 | 66 | 69 |
| 15 | 68 | 68 | 64 | 63 | 65 | 71 | 72 | 74 | 87 | 90 | 68 | 69 |
| 16 | 70 | 68 | 66 | 63 | 65 | 71 | 69 | 360 | 74 | 81 | 71 | 69 |
| 17 | 71 | 68 | 67 | 63 | 64 | 71 | 70 | 149 | 72 | 101 | 70 | 75 |
| 18 | 71 | 68 | 68 | 63 | 64 | 74 | 68 | 106 | 436 | 89 | 69 | 76 |
| 19 | 71 | 68 | 68 | 63 | 63 | 78 | 67 | 100 | 212 | 83 | 71 | 75 |
| 20 | 71 | 67 | 68 | 63 | 63 | 72 | 82 | 95 | 103 | 80 | 71 | 74 |
| 21 | 67 | 68 | 68 | 64 | 63 | 72 | 84 | 91 | 87 | 86 | 70 | 70 |
| 22 | 66 | 68 | 67 | 64 | 63 | 70 | 76 | 87 | 78 | 102 | 69 | 141 |
| 23 | 66 | 68 | 66 | 64 | 63 | 70 | 119 | 84 | 146 | 249 | 68 | 262 |
| 24 | 73 | 68 | 65 | 65 | 63 | 69 | 113 | 82 | 260 | 197 | 68 | 113 |
| 25 | 75 | 68 | 65 | 65 | 63 | 70 | 97 | 81 | 439 | 112 | 68 | 91 |
| 26 | 73 | 68 | 65 | 65 | 64 | 68 | 87 | 82 | 260 | 93 | 69 | 86 |
| 27 | 73 | 67 | 65 | 66 | 65 | 72 | 81 | 81 | 248 | 91 | 69 | 82 |
| 28 | 73 | 66 | 64 | 68 | 67 | 75 | 79 | 81 | 185 | 86 | 72 | 80 |
| 29 | 74 | 67 | 64 | 300 | 68 | 70 | 78 | 95 | 157 | 83 | 69 | 79 |
| 30 | 76 | 68 | 64 | 460 | ------ | 69 | 77 | 79 | 143 | 81 | 68 | 78 |
| 31 | 73 | ------ | 64 | 370 | ------ | 72 | ------ | 77 | ------ | 81 | 70 | ------ |
| Total | 2228 | 2063 | 2065 | 2916 | 2279 | 2263 | 2295 | 2787 | 4096 | 3174 | 2236 | 2603 |
| Mean | 71.9 | 68.8 | 66.6 | 94.1 | 78.6 | 73.0 | 76.5 | 89.9 | 137 | 102 | 72.1 | 86.8 |
| Max | 85 | 72 | 69 | 460 | 250 | 89 | 119 | 360 | 439 | 249 | 86 | 262 |
| Min | 65 | 66 | 64 | 63 | 63 | 68 | 67 | 65 | 68 | 80 | 66 | 69 |
| Cfsm | 0.261 | 0.250 | 0.242 | 0.342 | 0.286 | 0.265 | 0.278 | 0.327 | 0.498 | 0.371 | 0.262 | 0.316 |
| In. | 0.30 | 0.28 | 0.28 | 0.39 | 0.31 | 0.31 | 0.31 | 0.38 | 0.55 | 0.43 | 0.30 | 0.35 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cal yr 1967: | Total | 45,715 | Mean | 125 | Max | 3,050 | Min | 60 | Cfsm | 0.455 | In. | 6.18 |
| Wtr yr 1968: | Total | 31,005 | Mean | 84.7 | Max | 460 | Min | 63 | Cfsm | 0.308 | In. | 4.19 |

5-4570. Cedar River near Austin, Minn.

Location.--Lat 43°38'10", long 92°5 '20", in NE¼SE¼ sec.15, T.102 N., R.18 W., on left bank 200 ft upstream from abandoned powerhouse, 500 ft downstream from highway bridge, 1.1 miles downstream from Turtle Creek, and 1.1 miles south of Austin.

Drainage area.--425 sq mi.

Records available.--May 1909 to September 1914, October 1944 to September 1968.

Gage.--Digital 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. October 1914 to May 18, 1964, graphic water-stage recorder at present site and datum.

Average discharge.--29 years, 171 cfs.

Extremes.--Maximum discharge during year, 2,920 cfs July 24 (gage height, 8.78 ft); minimum, 36 cfs Feb. 23 (gage height, 2.15 ft).
1909-14, 1944-68: Maximum discharge, 9,530 cfs Mar. 29, 1962 (gage height, 17.18 ft); maximum gage height, 18.87 ft Mar. 1, 1965 (from floodmark, backwater from ice); no flow for several days in 1911.

Remarks.--Records good except those for period of backwater from aquatic growth and those for winter periods, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 44 | 51 | 48 | 42 | 47 | 46 | 48 | 68 | 134 | 235 | 194 | 88 |
| 2 | 46 | 50 | 49 | 41 | 46 | 45 | 48 | 68 | 116 | 183 | 175 | 84 |
| 3 | 46 | 46 | 46 | 41 | 45 | 40 | 57 | 69 | 109 | 153 | 158 | 94 |
| 4 | 48 | 44 | 49 | 41 | 45 | 44 | 61 | 63 | 102 | 132 | 147 | 186 |
| 5 | 48 | 42 | 49 | 41 | 44 | 48 | 51 | 59 | 92 | 119 | 147 | 158 |
| 6 | 48 | 45 | 50 | 41 | 43 | 48 | 49 | 59 | 90 | 106 | 175 | 142 |
| 7 | 64 | 45 | 56 | 41 | 42 | 50 | 49 | 69 | 88 | 121 | 457 | 137 |
| 8 | 53 | 45 | 54 | 42 | 41 | 59 | 57 | 77 | 88 | 111 | 584 | 161 |
| 9 | 50 | 48 | 54 | 42 | 40 | 61 | 53 | 73 | 150 | 106 | 432 | 397 |
| 10 | 50 | 48 | 50 | 42 | 40 | 54 | 53 | 68 | 324 | 99 | 306 | 411 |
| 11 | 49 | 46 | 51 | 41 | 39 | 53 | 51 | 68 | 401 | 97 | 235 | 268 |
| 12 | 48 | 48 | 51 | 42 | 39 | 50 | 53 | 68 | 232 | 129 | 197 | 197 |
| 13 | 50 | 46 | 50 | 42 | 39 | 49 | 59 | 69 | 164 | 226 | 175 | 164 |
| 14 | 48 | 48 | 50 | 40 | 39 | 50 | 84 | 82 | 156 | 464 | 158 | 142 |
| 15 | 46 | 46 | 48 | 42 | 39 | 53 | 61 | 180 | 508 | 446 | 139 | 126 |
| 16 | 46 | 48 | 46 | 45 | 39 | 54 | 57 | 488 | 313 | 272 | 139 | 124 |
| 17 | 49 | 49 | 50 | 44 | 39 | 57 | 59 | 220 | 172 | 197 | 126 | 166 |
| 18 | 49 | 46 | 51 | 44 | 39 | 69 | 64 | 156 | 137 | 164 | 116 | 209 |
| 19 | 46 | 42 | 50 | 44 | 39 | 73 | 59 | 139 | 114 | 137 | 121 | 281 |
| 20 | 49 | 45 | 51 | 44 | 39 | 63 | 102 | 114 | 102 | 116 | 121 | 281 |
| 21 | 44 | 49 | 54 | 44 | 39 | 50 | 90 | 97 | 97 | 132 | 114 | 256 |
| 22 | 42 | 50 | 48 | 46 | 38 | 50 | 75 | 84 | 82 | 119 | 106 | 259 |
| 23 | 48 | 45 | 45 | 45 | 39 | 49 | 186 | 79 | 116 | 792 | 104 | 297 |
| 24 | 51 | 49 | 46 | 46 | 39 | 49 | 229 | 69 | 164 | 2,480 | 104 | 278 |
| 25 | 49 | 51 | 46 | 46 | 39 | 54 | 158 | 69 | 232 | 1,560 | 92 | 253 |
| 26 | 46 | 48 | 44 | 46 | 40 | 54 | 121 | 97 | 632 | 736 | 92 | 232 |
| 27 | 45 | 45 | 42 | 45 | 41 | 57 | 97 | 94 | 1,250 | 468 | 92 | 206 |
| 28 | 45 | 48 | 42 | 45 | 42 | 61 | 84 | 116 | 1,010 | 341 | 90 | 194 |
| 29 | 57 | 46 | 42 | 47 | 41 | 57 | 79 | 194 | 492 | 278 | 90 | 189 |
| 30 | 57 | 46 | 42 | 49 | ------ | 50 | 71 | 206 | 307 | 238 | 90 | 194 |
| 31 | 51 | ------ | 42 | 48 | ------ | 54 | ------ | 186 | ------ | 220 | 92 | ------ |
| TOTAL | 1,512 | 1,405 | 1,496 | 1,349 | 1,181 | 1,651 | 2,365 | 3,548 | 7,974 | 10,977 | 5,368 | 6,174 |
| MEAN | 48.8 | 46.8 | 48.3 | 43.5 | 40.7 | 53.3 | 78.8 | 114 | 266 | 354 | 173 | 206 |
| MAX | 64 | 51 | 56 | 49 | 47 | 73 | 229 | 488 | 1,250 | 2,480 | 584 | 411 |
| MIN | 42 | 42 | 42 | 40 | 38 | 40 | 48 | 59 | 82 | 97 | 90 | 84 |
| CFSM | .11 | .11 | .11 | .10 | .10 | .13 | .19 | .27 | .63 | .83 | .41 | .48 |
| IN. | .13 | .12 | .13 | .12 | .10 | .14 | .21 | .31 | .70 | .96 | .47 | .54 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CAL YR 1967 | TOTAL 74,817 | MEAN 205 | MAX 2,910 | MIN 40 | CFSM .48 | IN 6.55 |
| WTR YR 1968 | TOTAL 45,000 | MEAN 123 | MAX 2,480 | MIN 38 | CFSM .29 | IN 3.94 |

## 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 storage room of city powerplant in Jackson.

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

Records available.--May 1909 to December 1913, August 1930 to September 1968 (winter records incomplete prior to 1936). Published as Des Moines River at Jackson, 1909-13, as Des Moines River near Jackson, 1930-35, and as West Fork Des Moines River near Jackson, 1936-44.

Gage.--Water-stage recorder. Datum of gage is 1,287.75 ft above mean sea level, datum of 1929. May 31, 1909, to Dec. 20, 1913, staff gage at site 0.6 mile downstream at datum 0.99 ft lower. Aug. 22, 1930, to Sept. 30, 1944, chain gage at site 7 miles upstream at datum 17.10 ft higher. Oct. 1, 1944, to Oct. 26, 1949, wire-weight gage at site 600 ft upstream at datum 10.64 ft higher. Oct. 27, 1949 to Dec. 15, 1965, water-stage recorder 200 ft downstream at same datum.

Average discharge.--33 years (1935-68), 260 cfs.

Extremes.--Maximum discharge during year, 854 cfs July 28 (gage height, 6.57 ft) minimum, 0.2 cfs Jan. 10 (gage height, 2.47 ft).
1909-13, 1930-68: Maximum discharge 9,530 cfs Apr. 9, 1965; maximum gage height, 18.62 ft Apr. 6, 1965, (from floodmark, backwater from ice); no flow at times.

Remarks.--Records good except those for winter months, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes. Records of chemical analyses and suspended sediment loads for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 11 | 8.2 | 3.0 | 2.3 | 1.0 | 13 | 16 | 7.4 | 16 | 474 | 20 |
| 2 | 9.2 | 9.2 | 8.7 | 2.0 | 2.6 | 1.2 | 12 | 14 | 7.4 | 16 | 378 | 18 |
| 3 | 4.0 | 8.7 | 9.2 | 1.6 | 2.9 | 1.4 | 11 | 9.2 | 11 | 12 | 307 | 20 |
| 4 | 7.8 | 8.7 | 9.7 | 1.6 | 3.1 | 2.0 | 13 | 13 | 6.0 | 8.7 | 284 | 20 |
| 5 | 13 | 8.7 | 10 | 1.8 | 3.2 | 6.4 | 21 | 12 | 3.0 | 6.4 | 246 | 22 |
| 6 | 17 | 8.7 | 9.7 | 1.2 | 3.1 | 6.9 | 13 | 7.8 | 1.8 | 7.4 | 221 | 20 |
| 7 | 19 | 7.4 | 10 | .8 | 3.0 | 10 | 10 | 7.4 | 1.6 | 7.8 | 207 | 19 |
| 8 | 17 | 6.9 | 10 | .6 | 2.9 | 19 | 14 | 6.4 | 1.8 | 8.7 | 212 | 27 |
| 9 | 20 | 7.8 | 11 | .4 | 2.7 | 27 | 29 | 10 | 12 | 19 | 233 | 44 |
| 10 | 17 | 8.7 | 12 | .3 | 2.5 | 19 | 17 | 18 | 128 | 22 | 228 | 41 |
| 11 | 14 | 9.2 | 14 | .3 | 2.4 | 20 | 14 | 11 | 62 | 18 | 212 | 37 |
| 12 | 13 | 9.2 | 14 | .3 | 2.2 | 20 | 13 | 6.0 | 46 | 16 | 199 | 31 |
| 13 | 12 | 11 | 13 | .3 | 2.1 | 18 | 14 | 11 | 29 | 20 | 189 | 34 |
| 14 | 12 | 12 | 12 | .3 | 1.8 | 18 | 19 | 11 | 20 | 24 | 169 | 44 |
| 15 | 14 | 7.8 | 10 | .3 | 1.5 | 18 | 23 | 8.7 | 19 | 21 | 126 | 63 |
| 16 | 10 | 7.4 | 9.7 | .3 | 1.3 | 20 | 18 | 9.2 | 16 | 16 | 99 | 89 |
| 17 | 7.4 | 10 | 11 | .3 | 1.1 | 24 | 13 | 15 | 12 | 14 | 97 | 91 |
| 18 | 6.0 | 8.2 | 11 | .4 | 1.0 | 33 | 17 | 14 | 11 | 17 | 94 | 138 |
| 19 | 7.8 | 13 | 11 | .4 | .9 | 32 | 18 | 7.4 | 8.7 | 13 | 91 | 189 |
| 20 | 9.2 | 12 | 12 | .4 | .8 | 23 | 22 | 6.9 | 8.7 | 8.7 | 79 | 212 |
| 21 | 4.8 | 11 | 12 | .5 | .7 | 24 | 31 | 11 | 4.8 | 6.4 | 66 | 223 |
| 22 | 13 | 13 | 11 | .5 | .6 | 13 | 28 | 7.4 | 2.0 | 5.2 | 62 | 264 |
| 23 | 8.7 | 12 | 8.2 | .6 | .6 | 14 | 31 | 6.0 | 12 | 16 | 56 | 284 |
| 24 | 6.4 | 12 | 6.9 | .7 | .6 | 16 | 46 | 5.2 | 6.4 | 123 | 46 | 261 |
| 25 | 1.2 | 11 | 8.2 | .8 | .6 | 18 | 28 | 6.9 | 20 | 244 | 41 | 246 |
| 26 | 11 | 11 | 8.2 | .9 | .6 | 22 | 20 | 11 | 25 | 214 | 26 | 235 |
| 27 | 9.7 | 7.8 | 7.8 | 1.0 | .7 | 17 | 22 | 7.4 | 28 | 398 | 22 | 223 |
| 28 | 7.4 | 8.7 | 6.9 | 1.2 | .8 | 14 | 21 | 11 | 24 | 782 | 20 | 251 |
| 29 | 11 | 8.2 | 6.4 | 1.4 | .9 | 16 | 22 | 11 | 20 | 505 | 20 | 292 |
| 30 | 11 | 7.8 | 6.4 | 1.7 | ------ | 14 | 18 | 7.4 | 20 | 390 | 22 | 345 |
| 31 | 10 | ------ | 5.6 | 2.0 | ------ | 12 | ------ | 8.7 | ------ | 381 | 20 | ------ |
| Total | 334.6 | 288.1 | 303.8 | 27.9 | 49.5 | 499.9 | 591 | 307.0 | 574.6 | 3,356.3 | 4,546 | 3,803 |
| Mean | 10.8 | 9.60 | 9.80 | 0.90 | 1.71 | 16.1 | 19.7 | 9.90 | 19.2 | 108 | 147 | 127 |
| Max | 20 | 13 | 14 | 3.0 | 3.2 | 33 | 46 | 18 | 128 | 782 | 474 | 345 |
| Min | 1.2 | 6.9 | 5.6 | 0.3 | 0.6 | 1.0 | 10 | 5.2 | 1.6 | 5.2 | 20 | 18 |
| Cfsm | 0.0089 | 0.0079 | 0.0080 | 0.00074 | 0.0014 | 0.013 | 0.016 | 0.0081 | 0.016 | 0.089 | 0.120 | 0.104 |
| In. | 0.01 | 0.01 | 0.01 | 0.0009 | 0.002 | 0.02 | 0.02 | 0.01 | 0.02 | 0.10 | 0.14 | 0.12 |

Cal yr 1967: Total 67,645.4 Mean 185 Max 1,220 Min 1.2 Cfsm 0.152 In. 2.06
Wtr yr 1968: Total 14,681.7 Mean 40.1 Max 782 Min 0.3 Cfsm 0.033 In. 0.045

Peak discharge (base, 500 cfs)

| Date | Time | Gage height | Discharge | Date | Time | Gage height | Discharge |
|---|---|---|---|---|---|---|---|
| 7-28 | 0900 | 6.57 | 854 | 8-1 | 0600 | 5.51 | 505 |

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 flood-flow 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 1968

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Crow Wing River basin | | | | |
| 5-2427 | Little Sand Lake Outlet near Dorset, Minn. | NE¼ sec.36, T.141 N., R.34 W., ½ mile below Little Sand Lake and 3 miles northeast of Dorset | a74 | 1930-41≠ 1942, 1956-67 | 10-31-67 | 5.22 |
| | | | | | 11-20-67 | 10.4 |
| | | | | | 12-18-67 | 21.4 |
| | | | | | 1-22-68 | 19.7 |
| | | | | | 2-19-68 | 20.4 |
| | | | | | 3-18-68 | 30.3 |
| | | | | | 4-22-68 | 36.6 |
| | | | | | 5-20-68 | 45.2 |
| | | | | | 6-17-68 | 56.6 |
| | | | | | 7-22-68 | 52.4 |
| | | | | | 8-26-68 | 40.5 |
| | | | | | 9-30-68 | 33.2 |

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 | Little Devil 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. | 7.49 | 1961-68 | 4-26-68 | 16.56 | 92 |
| 4-0113.9 | Little Devil Track River tributary near Grand Marais, Minn. | SE¼SE¼ sec.4, T.61 N., R.1 E., at culvert on County Highway 55, 0.2 mile above mouth, and 2.8 miles north of Grand Marais. | 0.47 | 1966-68 | 6-14-68 | 10.09 | (≠) |
| 4-0131 | Lake Superior tributary near Taconite Harbor, Minn. | SW¼SE¼ sec.20, T.58 N., R.5 W., at culvert on U.S. Highway 61, 0.2 mile above mouth, and 3.7 miles southwest of Taconite Harbor. | 1.56 | 1964-68 | 4-25-68 | 7.20 | 33 |
| 4-0132 | Caribou River near Little Marais, Minn. | NW¼SE¼ sec.36, T.58 N., R.6 W., at culvert on U.S. Highway 61, 0.2 mile above mouth, and 5.2 miles northeast of Little Marais. | 22.8 | 1961-68 | 6-9-68 | 12.14 | 378 |
| 4-0151.5 | Crow Creek near Silver Creek, Minn. | SW¼SW¼ sec.23, T.54 N., R.10 W., at culvert on County Highway 3, 2.3 miles northeast of Silver Creek, and 4.0 miles above mouth. | 1.07 | 1960-68 | 4-24-68 | 9.65 | 51 |
| 4-0152 | Encampment River tributary at Silver Creek, Minn. | NE¼SE¼ sec.33, T.54 N., R.10 W., at culvert on County Highway 3, 0.3 mile north of Silver Creek, and 1.4 miles above mouth. | .96 | 1960-68 | 7-12-68 | 11.49 | 245 |
| 4-0152.5 | Silver Creek tributary near Two Harbors, Minn. | SW¼NE¼ sec.16, T.53 N., R.10 W., at culvert on County Highway 3, 1.0 mile above mouth, and 4.5 miles northeast of Two Harbors. | 3.72 | 1965-68 | 7-12-68 | 14.41 | 1,020 |
| 4-0153 | Little Stewart River near Two Harbors, Minn. | SE¼NE¼ sec.24, T.53 N., R.11 W., at culvert on county highway, 2.0 miles above mouth, and 2.7 miles north of Two Harbors. | 5.54 | 1960-68 | 9-7-64<br>4-19-65<br>10-18-65<br>6-12-67<br>4-24-68 | 12.03<br>a10.62<br>a10.34<br>10.78<br>11.80 | a260<br>a161<br>a139<br>a171<br>243 |
| 4-0153.6 | Lake Superior tributary at French River, Minn. | SW¼SE¼ sec.18, T.51 N., R.12 W., at culvert on U.S. Highway 61, 0.35 mile above mouth, and 0.7 mile west of French River. | 1.41 | 1964-68 | 4-24-68 | 19.72 | 109 |
| 4-0153.7 | Talmadge River at Duluth, Minn. | SE¼NE¼ sec.24, T.51 N., R.13 W., at culvert on U.S.Highway 61, 0.6 mile above mouth, and 0.5 mile northeast of Duluth city limits. | 5.79 | 1964-68 | 4-19-65<br>10-18-65<br>4-24-68 | 13.17<br>12.61<br>15.23 | 187<br>150<br>(≠) |
| 4-0154 | Miller Creek at Duluth, Minn. | SE¼NE¼ sec.13, T.50 N., R.15 W., at culvert on U.S. Highway 53, 0.2 mile northwest of Duluth city limits. | 4.92 | 1960-68 | 6-9-68 | 15.74 | 167 |
| 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. | .42 | 1960-68 | 4-17-61<br>8-21-68 | b9.84<br>9.73 | a27<br>27 |
| 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 | 1959-68 | 8-21-68 | 8.37 | 85 |
| 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. | 4.94 | 1961-65, 1967-68 | 6-9-68 | 24.7 | 1,110 |
| 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. | .20 | 1961-68 | 6-9-68 | 12.73 | 27 |
| 4-0242 | South Fork Nemadji River near Holyoke, Minn. | SE¼SE¼ sec.6, T.46 N., R.16 W., at culvert on State Highway 23, 1.7 miles below Clear Creek, and 2.0 miles northwest of Holyoke. | 19.4 | 1961-68 | 6-9-68 | 12.71 | 730 |

≠ Discharge not determined.
a Revised.
b 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) |
| | | Red River of the North basin | | | | | |
| 5-0476 | West Branch Mustinka River near Graceville, Minn. | NW¼NW¼ sec.22, T.125 N., R.46 W., at culverts on county highway, 4.1 miles north of Graceville. | 56.7 | 1964-68 | 1968 | (c) | <5 |
| 5-0477 | West Branch Mustinka River tributary near Graceville, Minn. | NE¼NW¼ sec.28, T.125 N., R.45 W., at culvert on county highway, 0.6 mile northeast of Graceville. | 3.37 | 1964-68 | 4-13-64<br>9-30-65<br>4-17-66<br>1968 | 8.76<br>6.99<br>7.53<br>(c) | 96<br>10<br>27<br><3 |
| 5-0492 | Eighteenmile Creek near Wheaton, Minn. | On west quarter of line between secs. 24 and 25, T.127 N., R.47 W., at culvert on County Highway 67, 1.4 miles above mouth, and 2.0 miles southwest of Wheaton. | 68.5 | 1965-68 | 4-22-68 | 4.90 | (≠) |
| 5-0608 | Buffalo River near Callaway, Minn. | SW¼SW¼ sec.17, T.141 N., R.41 W., at culvert on U.S. Highway 59, 2.7 miles north of Callaway. | 49.9 | 1960-68 | 6-30-68 | 10.06 | 81 |
| 5-0612 | Whisky Creek at Barnesville, Minn. | SE¼SW¼ sec.20, T.137 N., R.45 W., at culvert on State Highway 34, 0.7 mile above Blue Eagle Lake, and 1.0 mile northeast of Barnesville. | 25.3 | 1961-64,<br>1965-66≠,<br>1967-68 | 6-14-67<br>4-8-68 | 4.90<br>4.94 | 159<br>164 |
| 5-0614 | Hay Creek above Downer, Minn. | NW¼NW¼ sec.30, T.138 N., R.45 W., at culvert on county road, 3.1 miles east of Downer. | 5.81 | 1961-68 | 6-10-68 | 6.30 | 35 |
| 5-0622.8 | Wild Rice River tributary near Bagley, Minn. | SW¼NW¼ sec.21, T.146 N., R.37 W., at culvert on State Highway 92, 5.0 miles south of Bagley. | 3.34 | 1961-68 | 4-20-68 | 8.06 | 28 |
| 5-0624.7 | Marsh River tributary near Mahnomen, Minn. | SE¼SW¼ sec.36, T.145 N., R.43 W., at culvert on State Highway 31, a quarter mile above mouth, and 5¼ miles west of Mahnomen. | 6.57 | 1961-68 | 3-25-68 | 9.18 | 25 |
| 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. | 2.25 | 1961-68 | 3-24-68 | b13.32 | 61 |
| 5-0628 | Coon Creek near Twin Valley, Minn. | NE¼NE¼ sec.26, T.144 N., R.45 W., at bridge on County Highway 28, 1.1 miles above mouth, and 4.0 miles west of Twin Valley. | 32.1 | 1962-68 | 3-24-68 | b9.59 | 44 |
| 5-0632 | South Branch Wild Rice River near Ogema, Minn. | SE¼SE¼ sec.11, T.142 N., R.42 W., at culvert on county highway, 2 miles northwest of Ogema. | 6.50 | 1963-68 | 6-30-68 | 7.30 | 34 |
| 5-0736 | South Branch Battle River at Northome, Minn. | NE¼ sec.25, T.151 N., R.29 W., at culvert on U.S. Highway 71, three-quarters of a mile west of Northome, and 3 miles above Battle Lake. | 3.19 | 1960-68 | 4-7-68 | 13.90 | 36 |
| 5-0737.5 | South Branch Cormorant River tributary near Blackduck, Minn. | NW¼NW¼ sec.32, T.150 N., R.30 W., at culvert on County Highway 304, 3 miles above mouth, and 3¼ miles north of Blackduck. | 4.45 | 1960-68 | 4-7-68 | 12.53 | 39 |
| 5-0738 | Perry Creek near Shooks, Minn. | NW¼SW¼ sec.30, T.151 N., R.30 W., at culvert on State Highway 72, 5 miles west of Shooks. | 2.41 | 1960-68 | 6-10-68 | 6.03 | 15 |
| 5-0766 | Red Lake River tributary near Thief River Falls, Minn. | SW¼SE¼ sec.8, T.153 N., R.43 W., at culvert on County Highway 7, 0.5 mile above mouth, and 3.1 miles south of Thief River Falls. | - | 1962-68 | 6-7-68 | 5.85 | 30 |
| 5-0781 | Lost River at Gonvick, Minn. | NE¼NE¼ sec.16, T.149 N., R.38 W., at culvert on county highway, a half mile south of Gonvick, and 3 miles below Pine Lake. | 30.9 | 1960-68 | 3-28-68 | d7.14 | 60 |
| 5-0781.8 | Lost River tributary near Clearbrook, Minn. | NW¼ sec.13, T.148 N., R.38 W., at culvert on county highway, 3½ miles south of Clearbrook. | 1.79 | 1960-68 | 4-20-68 | 10.01 | 63 |
| 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, three-quarters of a mile above mouth. | 3.05 | 1960-68 | 3-28-68 | b9.99 | 30 |
| 5-0784 | Clearwater River tributary near Plummer, Minn. | SE¼SE¼ sec.22, T.151 N., R.43 W., at culvert on county highway, 1¼ miles above mouth, and 5½ miles southwest of plummer. | 1.17 | 1961-68 | 7-16-68 | e7.36 | 41 |

≠ Discharge not determined.
≠ Operated as a continuous-record gaging station.
< Less than.
b Backwater from ice.
c Peak stage did not reach bottom of gage.
d Backwater from debris.
e Backwater from aquatic growth.

Annual maximum discharge at crest-stage partial-record stations--continued

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Annual maximum | | |
|---|---|---|---|---|---|---|---|
| | | | | | Date | Gage height (feet) | Discharge (cfs) |
| | | **Lake of the Woods basin** | | | | | |
| 5-1283 | Pike River near Gilbert, Minn. | NE¼SW¼ sec.22, T.58 N., R.17 W., at culvert on State Highway 135, 1.1 miles west of Gilbert. | - | 1966-68 | 8-21-68 | 8.11 | (✓) |
| 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. | - | 1961-68 | 6-8-68 | 7.08 | 62 |
| 5-1297.1 | Johnson Creek near Britt, Minn. | NW¼NE¼ sec.28, T.60 N., R.18 W., at culvert adjacent to U.S. Highway 53, 0.6 mile below Sand Lake, and 5.9 miles west of Britt. | - | 1961-64, 1966-68 | 6-14-68 | 7.46 | 22 |
| 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 | 1959-68 | 9-18-68 | 12.02 | 132 |
| | | **Split Hand Creek basin** | | | | | |
| 5-2150 | Smith Creek near Hill City, Minn. | SE¼NW¼ sec.13, T.53 N., R.26 W., at culvert on U.S. Highway 169, 6½ miles north of Hill City. | 5.06 | 1961-68 | 4-23-68 | 3.71 | 16 |
| | | **Swan River basin** | | | | | |
| 5-2167 | O'Brien Creek near Nashwauk, Minn. | NE¼NE¼ sec.33, T.57 N., R.22 W., at culvert on U.S. Highway 169, 1.5 miles east of Nashwauk, and 3.0 miles above Welcome Creek. | 8.26 | 1959-68 | 6-6-68 | d9.76 | 94 |
| 5-2169.8 | Swan River tributary at Warba, Minn. | NW¼ sec.34, T.54 N., R.23 W., at culvert on U.S. Highway 2, three-quarters of a mile above mouth, and 1 mile southeast of Warba. | 2.36 | 1961-68 | 6-6-68 | 5.09 | 13 |
| | | **Bluff Creek basin** | | | | | |
| 5-2177 | Bluff Creek near Jacobson, Minn. | SW¼NW¼ sec.8, T.52 N., R.23 W., at culvert on State Highway 34, 1¼ miles west of Jacobson. | 2.95 | 1961-68 | 1968 | (c) | <15 |
| | | **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 3¾ miles north of Sebeka. | 9.34 | 1961-68 | 6-10-68 | 10.45 | 160 |
| 5-2442 | Cat River near Nimrod, Minn. | SW¼SW¼ sec.36, T.137 N., R.34 W., at bridge on State Highway 227, 2½ miles west of Nimrod, and 3 miles above mouth. | 44.3 | 1961-68 | 6-10-68 | 8.33 | 410 |
| | | **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. | - | 1961-68 | 6-29-68 | 8.29 | 2.8 |
| 5-2679 | Hillman Creek near Pierz, Minn. | NE¼SE¼ sec.9, T.40 N., R.30 W., at bridge on county highway, 1.1 miles above mouth, and 1.5 miles east of Pierz. | 52.6 | 1964-68 | 6-21-68 | 13.21 | 190 |
| | | **Sauk River basin** | | | | | |
| 5-2703 | Sauk River tributary at Spring Hill, Minn. | SW¼NE¼ sec.27, T.124 N., R.33 W., at culvert on State Highway 4, 1.0 mile east of Spring Hill, and 2.7 miles above mouth. | 6.42 | 1960-68 | 6-10-68 | 9.78 | 82 |
| 5-2703.1 | Sauk River tributary near St. Martin, Minn. | SE¼ sec.19, T.124 N., R.32 W., at culvert on county highway, 4½ miles northwest of St. Martin. | .23 | 1960, 1962-68 | 9-22-68 | 7.48 | 13 |

✓ Discharge not determined.
< Less than.
c Peak stage did not reach bottom of gage.
d Backwater from debris.

GPO 817-490-12

Annual maximum discharge at crest-stage partial-record stations--continued

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Annual maximum | | |
|---|---|---|---|---|---|---|---|
| | | | | | Date | Gage height (feet) | Discharge (cfs) |
| | | **Johnson Creek basin** | | | | | |
| 5-2718 | Johnson Creek tributary at Luxemburg, Minn. | NW¼NE¼ sec.30, T.123 N., R.28 W., at culverts on State Highway 15, 0.8 mile south of Luxemburg. | 2.77 | 1964-68 | 1968 | (c) | <14 |
| 5-2720 | Johnson Creek tributary near St. Augusta, Minn. | NE¼SE¼ sec.21, T.123 N., R.28 W., at culverts on county highway, 0.7 mile above mouth, and 3.1 miles southwest of St. Augusta. | - | 1964-68 | 9-22-68 | 6.41 | 38 |
| 5-2723 | Johnson Creek near St. Augusta, Minn. | NW¼SW¼ sec.13, T.123 N., R.28 W., at bridge on County Highway 7, 1.0 mile south of St. Augusta, and 3.3 miles above mouth. | - | 1964-68 | 9-22-68 | 11.96 | 105 |
| | | **Otsego Creek basin** | | | | | |
| 5-2737 | Otsego Creek near Otsego, Minn. | SW¼NE¼ sec.13, T.121 N., R.24 W., at culvert on County Highway 39, 1.3 miles above mouth, and 1.9 miles west of Otsego. | - | 1964-68 | 1968 | (c) | <22 |
| | | **Elk River basin** | | | | | |
| 5-2742 | Stony Brook tributary near Foley, Minn. | NW¼ sec.2, T.36 N., R.29 W., at culvert on State Highway 25, a quarter mile above mouth, and 1½ miles south of Foley. | 3.11 | 1960-68 | 6-30-68 | 6.88 | 9.5 |
| | | **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. | .58 | 1960-68 | 6-10-68 | 16.07 | 2.1 |
| 5-2783.5 | Fountain Creek near Montrose, Minn. | NE¼NW¼ sec.22, T.118 N., R.26 W., at culvert on County Highway 30, 3.3 miles southwest of Montrose. | 6.73 | 1962-68 | 7-14-68 | 5.51 | 36 |
| 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. | 30.2 | 1961-68 | 4-24-68 | 7.22 | 82 |
| 5-2787.5 | Otter Creek tributary near Lester Prairie, Minn. | SE¼SE¼ sec.33, T.117 N., R.27 W., at culvert on County Highway 63, 1.7 miles northwest of Lester Prairie, and 3.3 miles above mouth. | 1.54 | 1962-68 | 7-14-68 | 7.50 | 12 |
| 5-2788.5 | Buffalo Creek tributary near Brownton, Minn. | NE¼SE¼ sec.13, T.115 N., R.30 W., at culvert on State Highway 15, 0.6 mile above mouth, and 2.6 miles northwest of Brownton. | 9.45 | 1961-68 | 6-18-68 | 13.38 | 20 |
| 5-2790.3 | South Fork Crow River tributary near Mayer, Minn. | NW¼NE¼ sec.36, T.117 N., R.26 W., at culvert on State Highway 7, 0.7 mile above mouth, and 1.4 miles north of Mayer. | 6.91 | 1962-68 | 7-14-68 | 5.92 | (✓) |
| 5-2803 | School Lake Creek tributary near St. Michael, Minn. | NW¼SE¼ sec.15, T.120 N., R.24 W., at culvert on county highway, 0.2 mile above mouth, and 1.5 miles southwest of St. Michael. | 2.04 | 1964-68 | 3-7-68 | b8.20 | (✓) |
| | | **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. | - | 1961-68 | 6-20-68 | 11.60 | 48 |
| 5-2846 | Robinson Brook near Onamia, Minn. | NE¼SE¼ sec.11, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 6¾ miles south of Onamia. | 7.21 | 1960-68 | 6-30-68 | 14.34 | (✓) |
| 5-2846.2 | Rum River tributary near Onamia, Minn. | E½ sec.14, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 7¾ miles south of Onamia. | 1.84 | 1960-68 | 6-21-68 | 7.85 | 40 |

✓ Discharge not determined.
< Less than.
b Backwater from ice.
c Peak stage did not reach bottom of gage.

Annual maximum discharge at crest-stage partial-record stations--continued

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Annual maximum | | |
|---|---|---|---|---|---|---|---|
| | | | | | Date | Gage height (feet) | Discharge (cfs) |
| | | **Rum River basin--continued** | | | | | |
| 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. | 1.26 | 1961-68 | 9-23-68 | 6.51 | 41 |
| | | **Minnesota River basin** | | | | | |
| 5-2991 | Lazarus Creek tributary near Canby, Minn. | NE¼NW¼ sec.6, T.114 N., R.45 W., at culvert on State Highway 68, 2.7 miles west of Canby, and 4.2 miles above mouth. | a2.97 | 1960-68 | 1968 | (c) | < 5 |
| 5-3012 | Minnesota River tributary near Montevideo, Minn. | SW¼SE¼ sec.16, T.117 N., R.41 W., at culvert on U.S. Highway 212, 1 mile above mouth, and 3¾ miles west of Montevideo. | 0.54 | 1960-68 | 1968 | (c) | < 5 |
| 5-3029.7 | Lake Emily tributary near Starbuck, Minn. | NW¼ sec.27, T.124 N., R.39 W., at culvert on State Highway 29, 6¼ miles south of Starbuck. | .13 | 1962-68 | 1968 | (c) | < 2 |
| 5-3034.5 | Hassel Creek near Clontarf, Minn. | NW¼SE¼ sec.4, T.122 N., R.39 W., at culvert on State Highway 29, a quarter mile above Lake Hassel, and 5¼ miles east of Clontarf. | 4.03 | 1962-68 | 7-19-62<br>6-3-63<br>10-20-63<br>5-23-65<br>3-12-66<br>3-26-67<br>3-19-68 | 11.92<br>8.41<br>9.70<br>7.86<br>b8.69<br>b10.89<br>b8.26 | 177<br>44<br>81<br>30<br>38<br>56<br>28 |
| 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 | 1959-68 | 6-20-68 | 12.60 | 17 |
| 5-3112 | North Branch Yellow Medicine River near Ivanhoe, Minn. | NW¼ sec.2, T.111 N., R.46 W., at culvert on State Highway 19, 5¼ miles west of Ivanhoe. | 15.2 | 1960-68 | 4-13-60<br>7-1-62<br>7-26-63<br>4-21-64<br>4-8-65<br>3-10-66<br>6-15-67<br>7-26-68 | 13.98<br>13.66<br>14.30<br>12.60<br>b15.89<br>b14.28<br>14.17<br>12.70 | a228<br>a168<br>288<br>25<br>431<br>19<br>540<br>31 |
| 5-3112.5 | North Branch Yellow Medicine River tributary near Wilno, Minn. | SE¼NE¼ sec.33, T.113 N., R.45 W., at culvert on U.S. Highway 75, 1½ miles above mouth, and 4½ miles northwest of Wilno. | .33 | 1960-68 | 7-26-68 | 10.64 | 56 |
| 5-3113 | North Branch Yellow Medicine River tributary near Porter, Minn. | E½ sec.16, T.113 N., R.45 W., at culvert on U.S. Highway 75, 6¼ miles southwest of Porter. | 1.46 | 1960-68 | 7-26-68 | 14.23 | 64 |
| 5-3138 | Chetomba Creek tributary near Blomkest, Minn. | SW¼SW¼ sec.35, T.118 N., R.35 W., at culvert on U.S. Highway 71, 2¾ miles northwest of Blomkest. | .79 | 1959-68 | 3-18-68 | 6.76 | 33 |
| 5-3149 | Redwood River at Ruthton, Minn. | NW¼NW¼ sec.11, T.108 N., R.44 W., at culvert on State Highway 23, 0.1 mile northeast of Ruthton. | 5.90 | 1959-68 | 7-26-68 | 14.52 | 187 |
| 5-3152 | Prairie Ravine near Marshall, Minn. | SE¼NE¼ sec.20, T.112 N., R.41 W., at culvert on U.S. Highway 59, 2.7 miles north of Marshall. | 5.63 | 1959-64≠<br>1965-68 | 6-10-68 | 6.37 | 41 |
| 5-3165.5 | West Fork Beaver Creek near Olivia, Minn. | SW¼SW¼ sec.14, T.116 N., R.35 W., at culvert on U.S. Highway 71, 5½ miles northwest of Olivia. | 9.71 | 1959-68 | 7-14-68 | 3.18 | (≠) |
| 5-3166.9 | Spring Creek tributary near Sleepy Eye, Minn. | NW¼ sec.25, T.111 N., R.33 W., at culvert on county highway, 0.1 mile above mouth, and 7½ miles north of Sleepy Eye. | - | 1966-68 | 3-3-66<br>7-8-67<br>7-26-68<br>9-22-68 | b5.49<br>5.45<br>3.97<br>3.97 | 40<br>62<br>20<br>20 |
| 5-3167 | Spring Creek near Sleepy Eye, Minn. | NE¼SE¼ sec.24, T.111 N., R.33 W., at culvert on county highway, 3¾ miles above mouth, and 7½ miles north of Sleepy Eye. | 30.0 | 1959-68 | 7-26-68 | 11.89 | 241 |
| 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. | 0.50 | 1959-68 | 7-26-68 | 4.89 | 8.6 |
| 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, 1¾ miles above mouth, and 4½ miles south of Marshall. | 0.54 | 1961-68 | 7-26-68 | 13.52 | (≠) |

≠ Discharge not determined.
≠ Operated as a continuous-record gaging station.
< Less than
a Revised.
b Backwater from ice.
c Peak stage did not reach bottom of gage.

Annual maximum discharge at crest-stage partial-record stations--continued

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Annual maximum | | |
|---|---|---|---|---|---|---|---|
| | | | | | Date | Gage height (feet) | Discharge (cfs) |
| | | Minnesota River basin--continued | | | | | |
| 5-3169 | 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 | 1961-68 | 7-26-68 | 8.66 | 360 |
| 5-3169.2 | Cottonwood River tributary near Sanborn, Minn. | NW¼NW¼ sec.12, T.108 N., R.36 W., at culvert on U.S. Highway 71, 2.4 miles south of Sanborn. | - | 1966-68 | 7-26-68 | 4.58 | (✓) |
| 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. | 2.26 | 1959-68 | 6-9-68 | 7.62 | 183 |
| 5-3181 | East Branch Blue Earth River tributary near Blue Earth, Minn. | W½SE¼ sec.24, T.102 N., R.27 W., at culvert on County Highway 13, a quarter mile above mouth, and 4¼ miles east of Blue Earth. | - | 1960-68 | 6-9-68 | 9.23 | 468 |
| 5-3183 | North Fork Watonwan River near Delft, Minn. | E½ sec.11, T.106 N., R.36 W., at culvert on U.S. Highway 71, 1¾ miles northwest of Delft. | 13.1 | 1960-68 | 7-26-68 | 17.21 | (✓) |
| 5-3202 | Le Sueur 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 | 1959-68 | 8-7-68 | 24.99 | 36 |
| 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 | 1959-68 | 8-7-68 | 18.77 | 302 |
| 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 | 1959-68 | 6-8-67<br>7-23-68 | 19.67✓<br>19.81 | a381<br>284 |
| 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 | 1959-68 | 7-23-68 | 16.92 | (✓) |
| 5-3301.5 | Sand Creek tributary near Montgomery, Minn. | NE¼ sec.18, T.111 N., R.22 W., at culvert on State Highway 21, 3½ miles east of Montgomery. | 0.29 | 1961-68 | 7-13-68 | 8.97 | 31 |
| 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 | 1960-68 | 5-16-68 | 6.01 | 16 |
| 5-3303 | Sand Creek near New Prague, Minn. | NE¼NW¼ sec.1, T.112 N., R.23 W., at culvert on State Highway 13 and 19, 1.9 miles east of New Prague. | 65 | 1960-68 | 1968 | (c) | <140 |
| 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 | 1960-68 | 7-13-68 | 9.73 | 61 |
| 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 | 1960-68 | 7-13-68 | 13.31 | (✓) |
| | | St. Croix River basin | | | | | |
| 5-3363 | Moose River tributary at Moose Lake, Minn. | SE¼NE¼ sec.19, T.46 N., R.19 W., at culvert on State Highway 27, 0.9 mile above mouth, and 1.2 miles west of Moose Lake. | 0.78 | 1960-68 | 4-23-68 | 8.33 | 61 |
| 5-3365.5 | Wolf Creek tributary near Sandstone, Minn. | NE¼SE¼ sec.33, T.43 N., R.20 W., at culvert on U.S. Highway 61, 0.2 mile above mouth, and 2.2 miles north of Sandstone. | 5.46 | 1960-68 | 6-20-68 | 15.71 | 33 |
| 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. | .65 | 1960-68 | 4-4-60<br>5-15-61<br>5-23-62<br>3-24-63<br>5-6-64<br>4-15-65<br>4-4-66<br>6-14-67<br>6-20-68 | b7.26<br>6.94<br>7.45<br>b6.97<br>7.48<br>10.11<br>8.74<br>7.99<br>e7.05 | 6.7<br>6.3<br>16<br>3.1<br>17<br>84<br>45<br>28<br>6.5 |
| 5-3382 | Mission Creek near Hinckley, Minn. | SW¼SW¼ sec.25, T.41 N., R.21 W., at culvert on U.S. Highway 23, 1.2 miles south of Hinckley. | - | 1960-68 | 5-23-62<br>4-15-65<br>4-4-66<br>3-31-67<br>6-20-68 | 14.69<br>14.96<br>b15.38<br>14.15<br>13.88 | 121<br>143<br>98<br>82<br>65 |

✓ Discharge not determined.
< Less than.
a Revised.
b Backwater from ice.
c Peak stage did not reach bottom of gage.
e Backwater from aquatic growth.

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. | 14.3 | 1960-68 | 1968 | (c) | < 1 |
| | | **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. | - | 1960-68 | 7-23-68 | 16.71 | 70 |
| 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. | - | 1960-68 | 7-23-68 | 5.35 | 45 |
| 5-3551 | Little Cannon River tributary near Kenyon, Minn. | SE¼ sec.9, T.110 N., R.18 W., at culvert on State Highway 56, a quarter mile above mouth, and 5 miles north of Kenyon. | 2.02 | 1960-68 | 5-15-68 | 20.84 | 1,040 |
| 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. | 20.2 | 1960-68 | 5-15-68 | 4.92 | 412 |
| 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. | .086 | 1960-68 | 5-15-68 | 15.38 | (≠) |
| 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. | - | 1960-68 | 5-15-68 | 10.15 | 48 |
| | | **Zumbro River basin** | | | | | |
| 5-3733.5 | Zumbro River tributary near South Troy, Minn. | SE¼NE¼ sec.6, T.108 N., R.13 W., at culvert on county road, 0.8 mile above mouth, and 1.3 miles south of South Troy. | 0.16 | 1962-68 | 6-25-68 | 8.15 | 26 |
| 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 4¾ miles southwest of Wanamingo. | 9.36 | 1960-68 | 7-15-68 | 10.38 | 350 |
| 5-3739 | Trout Brook tributary near Goodhue, Minn. | SE¼ sec.4, T.110 N., R.15 W., at culvert on State Highway 58, three-quarter mile above mouth, and 3 miles south of Goodhue. | .41 | 1960-68 | 8-19-68 | 7.04 | (≠) |
| 5-3744 | Long Creek near Potsdam, Minn. | At quarter corner on north line of sec. 8, T.108 N., R.12 W., at culvert on county highway, 2.6 miles northeast of Potsdam. | - | 1966-68 | 3-4-66<br>6-15-67<br>6-25-68 | 17.39<br>19.75<br>15.96 | 228<br>408<br>137 |
| | | **East Indian Creek basin** | | | | | |
| 5-3758 | East Indian Creek tributary No. 1 near Weaver, Minn. | NW¼SE¼ sec.23, T.109 N., R.10 W., at culvert on County Highway 14, 0.3 mile above mouth, and 2.5 miles northwest of Weaver. | 0.21 | 1962-68 | 6-21-68 | 10.77 | 34 |
| | | **Garvin Brook basin** | | | | | |
| 5-3782.9 | Straight Valley Creek near Altura, Minn. | SW¼SE¼ sec.3, T.107 N., R.9 W., at culvert on State Highway 248, 2.4 miles above mouth, and 3.1 miles northeast of Altura. | - | 1966-68 | 7-14-68 | 12.55 | 373 |
| 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 | 1959-68 | 7-14-68 | 14.17 | (≠) |
| | | **Root River basin** | | | | | |
| 5-3836 | North Branch Root River tributary near Stewartville, Minn. | Near center sec.36, T.105 N., R.14 W., at culvert on State Highway 30, 2.0 miles east of Stewartville, and 2.3 miles above mouth. | .73 | 1958, 1959-64≠ 1965-68 | 6-13-68 | 5.26 | 12 |

≠ Discharge not determined.
≠ Operated as a continuous-record gaging station.
< Less than.
c Peak stage did not reach bottom of gage.

Annual maximum discharge at crest-stage partial-record stations--continued

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Annual maximum | | |
|---|---|---|---|---|---|---|---|
| | | | | | Date | Gage height (feet) | Discharge (cfs) |
| | | **Root River basin--continued** | | | | | |
| 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 | 1959-68 | 4-23-68 | 13.45 | (✓) |
| 5-3837.2 | Mill Creek near Chatfield, Minn. | SE¼NW¼ sec.23, T.105 N., R.12 W., at bridge on county highway, 3.4 miles northwest of Chatfield, and 4.8 miles above mouth. | 22.4 | 1962-68 | 6-9-63<br>3-12-64<br>3-26-67<br>6-26-68 | 12.39<br>b10.06<br>13.98<br>10.76 | 1,030<br>137<br>1,550<br>535 |
| 5-3838.5 | Bear Creek near Grand Meadow, Minn. | NE¼SE¼ sec.14, T.103 N., R.15 W., at bridge on county highway, 1½ miles northwest of Grand Meadow, and 4 miles above North Fork Bear Creek. | 13.6 | 1962-68 | 6-26-68 | 16.98 | 520 |
| 5-3841 | Trout Creek tributary near Lanesboro, Minn. | SW¼ sec.6, T.102 N., R.9 W., at culvert on county highway, three-quarter mile above mouth, and 4 miles south of Lanesboro. | 4.08 | 1959-68 | 5-15-68 | 14.68 | 236 |
| 5-3841.5 | Root River tributary near Whalan, Minn. | SW¼ sec.17, T.103 N., R.9 W., at culvert on private road, 1¼ miles southwest of Whalan. | .30 | 1959-68 | 5-15-68 | 7.15 | 24 |
| 5-3842 | Whalan Creek near Whalan, Minn. | SE¼ sec.21, T.103 N., R.9 W., at bridge on county highway, 1¾ miles southeast of Whalan, and 2¾ miles above mouth. | 7.85 | 1959-68 | 5-15-68 | 19.76 | 1,170 |
| 5-3843 | Big Springs Creek near Arendahl, Minn. | NE¼SE¼ sec.7, T.104 N., R.9 W., at culvert on State Highway 250, 2.0 miles west of Arendahl. | .14 | 1959-68 | 6-18-68 | 9.63 | 28 |
| 5-3844 | Pine Creek near Arendahl, Minn. | SE¼NE¼ sec.3, T.104 N., R.9 W., at bridge on County Highway 25, 1.3 miles northeast of Arendahl, and 4.9 miles above Hemingway Creek. | 28.1 | 1959-68 | 6-18-68 | 11.96 | 458 |
| | | **Iowa River basin** | | | | | |
| 5-4570.8 | Rose Creek tributary near Dexter, Minn. | SE¼SW¼ sec.22, T.103 N., R.16 W., at culvert on county highway, 1¾ miles above mouth, and 2¼ miles southwest of Dexter. | 1.20 | 1962-68 | 6-26-68 | 7.06 | 19 |
| 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. | - | 1960-68 | 6-23-60<br>3-25-61<br>5-11-62<br>7-18-63<br>4-6-65<br>3-31-66<br>6-8-67<br>8-6-68 | 17.77<br>b18.51<br>18.58<br>17.80<br>b20.25<br>17.90<br>18.97<br>23.17 | 20<br>33<br>40<br>21<br>58<br>23<br>50<br>158 |
| | | **Des Moines River basin** | | | | | |
| 5-4747.5 | Beaver Creek tributary near Slayton, Minn. | NW¼NW¼ sec.17, T.106 N., R.41 W., at culvert on State Highway 30, 2¾ miles west of Slayton, and 2¾ miles above mouth. | 2.67 | 1961-68 | 9-21-68 | - | f40 |
| 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. | .97 | 1961-68 | 7-30-68 | 16.87 | (✓) |
| 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 | 1960-68 | 7-26-68 | 6.93 | 104 |
| 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 | 1960-68 | 1968 | (c) | < 3 |
| 5-4759 | West Fork Des Moines River tributary near Lakefield, Minn. | SE¼SE¼ sec.32, T.103 N., R.35 W., at culvert on County Highway 19, 1½ miles above mouth, and 5¾ miles east of Lakefield. | 4.52 | 1960-68 | 1968 | (c) | <16 |
| 5-4760.1 | Nelson Creek at Jackson, Minn. | NW¼NW¼ sec.25, T.102 N., R.35 W., in flume spillway at intersection of U.S. Highways 16 and 71, at south edge of Jackson. | 6.8 | 1959, 1964-68 | 1968 | (c) | <120 |

✓ Discharge not determined.
< Less than.
b Backwater from ice.
c Peak stage did not reach bottom of gage.
f Estimated; gage height unknown.

Annual maximum discharge at crest-stage partial-record stations--continued

| Station No. | Station name | Location | Drainage area (sq mi) | Period of record | Annual maximum | | |
|---|---|---|---|---|---|---|---|
| | | | | | Date | Gage height (feet) | Discharge (cfs) |
| | | **Des Moines River basin--continued** | | | | | |
| 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. | 25.2 | 1960-68 | 1968 | (c) | <27 |
| 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 | 1960-68 | 6-10-68 | 14.55 | 690 |
| | | **Big Sioux River basin** | | | | | |
| 6-4829.5 | Mound Creek near Hardwick, Minn. | SE¼SE¼ sec.15, T.104 N., R.45 W., at culvert on county highway, 2¾ miles northwest of Hardwick. | 2.77 | 1959-68 | 1968 | (c) | <5 |
| 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, a half mile above mouth, and 1 mile southwest of Hardwick. | .23 | 1959-68 | 4-3-68 | 6.22 | (≠) |
| 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. | .20 | 1959-68 | 1968 | (c) | <22 |
| 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. | .18 | 1959-68 | 7-30-68 | 17.46 | 42 |
| 6-4832.1 | North Branch Kanaranzi Creek tributary near Wilmont, Minn. | SW¼NW¼ sec.15, T.103 N., R.42 W., at culvert on County Highway 15, 3½ miles southwest of Wilmont and 3¾ miles above mouth. | - | 1966-68 | 7-30-68 | 4.01 | (≠) |
| | | **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 | 1959-68 | 6-24-68 | 6.43 | 16 |
| 6-6035.3 | Little Sioux River near Spafford, Minn. | NE¼NE¼ sec.34, T.102 N., R.37 W., at bridge on county highway, 1.6 miles below Jackson County ditch No. 11, and 5.8 miles east of Spafford. | - | 1962-68 | 4-6-62 | b9.23 | 595 |
| | | | | | 7-18-63 | 7.66 | 118 |
| | | | | | 5-23-64 | 6.80 | 65 |
| | | | | | 4-6-65 | b11.08 | 2,700 |
| | | | | | 3-14-66 | b8.33 | 136 |
| | | | | | 6-15-67 | 8.52 | 310 |
| | | | | | 4-23-68 | 5.92 | 32 |

≠ Discharge not determined.
< Less than.
b Backwater from ice.
c Peak stage did not reach bottom of gage.

## Measurements at miscellaneous sites

Measurements of streamflow at points other than gaging stations or partial-record stations are given in the following table. Those that are measurements of base flow are designated by an asterisk (*).

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **Streams tributary to Lake Superior** | | | | | | |
| Beaver River | Lake Superior | SW¼ sec.12, T.55 N., R.7 W., Lake County, at bridge on State Highway 61 in Beaver Bay, Minn. | 126 | 1911-14≠<br>1928-31≠ | 4-10-68<br>4-25-68<br>5-8-68<br>6-7-68<br>7-18-68<br>8-14-68 | 493<br>825<br>252<br>327<br>221<br>*7.21 |
| Midway River | St. Louis River | NE¼SE¼ sec.32, T.49 N., R.16 W., Carlton County, at bridge on county road, 0.9 mile upstream from Thompson Reservoir, and 0.2 mile north of city limits of Thompson, Minn. | - | - | 9-3-68 | 15.1 |
| **Red River of the North basin** | | | | | | |
| Otter Tail River | Red River of the North | NW¼ sec.19, T.137 N., R.39 W., Otter Tail County, at bridge on county road, 1 mile north of Luce, Minn. | - | - | 10-25-67<br>6-6-68<br>8-22-68 | 28.2<br>171<br>60.3 |
| Otter Tail River | Red River of the North | S½ sec.20, T.137 N., R.39 W., Otter Tail County, at bridge on County Highway 60, 1 mile east of Luce, Minn. | - | - | 6-5-68<br>8-21-68 | 186<br>55.6 |
| Otter Tail River | Red River of the North | NW¼NW¼ sec.34, T.137 N., R.39 W., Otter Tail County, at bridge on county road, 2.2 miles southeast of Luce, Minn. | - | - | 10-25-67<br>6-5-68<br>8-21-68 | 37.6<br>220<br>40.0 |
| Toad River | Otter Tail River | S½NE¼ sec.19, T.137 N., R.38 W., Otter Tail County, at bridge on County Highway 60, 5.5 miles northeast of Perham, Minn. | - | - | 10-25-67<br>6-4-68<br>8-21-68 | 7.70<br>25.4<br>12.6 |
| Toad River | Otter Tail River | On line between secs.29 and 32, T.137 N., R.38 W., Otter Tail County, at bridge on County Road 8, 4.2 miles northeast of Perham, Minn. | - | - | 10-25-67<br>6-4-68<br>8-21-68 | 8.99<br>31.4<br>9.74 |
| Otter Tail River | Red River of the North | SE¼ sec.24, T.136 N., R.39 W., Otter Tail County, at bridge on U.S. Highway 10, 1.5 miles southeast of Perham, Minn. | - | - | 10-24-67<br>6-5-68<br>8-14-68 | 42.1<br>269<br>87.2 |
| Otter Tail River | Red River of the North | On line between secs.7 and 18, T.135 N., R.38 W., Otter Tail County, at bridge on County Highway 14, 5 miles east of Richville, Minn. | - | - | 10-24-67<br>6-5-68<br>8-14-68 | 52.3<br>299<br>97.8 |
| Willow Creek | Otter Tail River | On line between secs.15 and 16, T.135 N., R.38 W., Otter Tail County, 5 miles west of New York Mills, Minn. | - | - | 6-7-68<br>8-14-68 | 3.14<br>*.30 |
| Dead River | Otter Tail River | On line between secs.2 and 3, T.134 N., R.40 W., Otter Tail County, 1 mile southwest of Basswood, Minn. | - | - | 6-6-68<br>8-22-68 | 30.6<br>33.4 |
| Otter Tail River | Red River of the North | SW¼ sec.4, T.133N., R.40 W., Otter Tail County, at outlet of Otter Tail Lake, at bridge on County Highway 72, 4 miles south of Amor, Minn. | - | - | 6-6-68<br>8-22-68 | 370<br>218 |
| Otter Tail River | Red River of the North | E½SE¼ sec.29, T.134 N., R.41 W., Otter Tail County, at bridge on County Highway 35, 200 ft upstream from West Lost Lake, and 2 miles west of Phelps, Minn. | - | - | 6-6-68<br>8-22-68 | 398<br>182 |
| Pelican River tributary | Pelican River | Lat 46°46'52", long 95°48'01", in SE¼ sec.12, T.138 N., R.41 W., Becker County, at culvert on county road, 100 ft upstream from Detroit Lake, 0.8 mile north of Sucker Creek, and 3.2 miles southeast of Detroit Lakes, Minn. | - | - | 7-26-68<br>8-14-68<br>9-5-68<br>9-30-68 | .05<br>0<br>a.01<br>.25 |

* Base flow.
≠ Operated as a continuous-record gaging station.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| Red River of the North basin--continued | | | | | | |
| Sucker Creek | Pelican River | Lat 46°46'25", long 95°48'23", in NW¼ sec.13, T.138 N., R.41 W., Becker County, at culvert on county road, 200 ft upstream from Detroit Lake and 3.5 miles southeast of Detroit Lakes, Minn. | - | - | 7-26-68<br>8-14-68<br>9-5-68<br>9-30-68 | 2.63<br>1.14<br>.80<br>1.20 |
| Pelican River tributary | Pelican River | Lat 46°47'02", long 95°53'07", in NE¼ sec.8, T.138 N., R.41 W., Becker County, at State Fish Hatchery, on left downstream abutment of bridge over outlet from rearing ponds, 1,000 ft north of Muskrat Lake Outlet and 3 miles southwest of Detroit Lakes, Minn. | - | - | 6-12-68<br>7-26-68<br>8-15-68<br>9-6-68 | .60<br>.41<br>.24<br>.25 |
| Monson Lake Outlet | Pelican River | Lat 46°47'15", long 95°53'30", in NW¼ sec.8, T.138 N., R.41 W., Becker County, 50 ft upstream from culvert, 100 ft downstream from Monson Lake, 800 ft upstream from Lake Sallie, and 3 miles southwest of Detroit Lakes, Minn. | - | - | 6-13-68<br>7-26-68<br>8-15-68<br>9-6-68 | .35<br>.06<br>0<br>0 |
| Fox Lake Outlet | Pelican River | Lat 46°46'24", long 95°54'37", in NE¼ sec.18, T.138 N., R.41 W., Becker County, 500 ft downstream from Fox Lake, 800 ft upstream from Lake Sallie, and 4.5 miles southwest of Detroit Lakes, Minn. | - | - | 6-14-68<br>7-26-68<br>8-15-68<br>9-6-68 | 1.27<br>.36<br>.10<br>0 |
| Pelican River | Otter Tail River | NE¼SW¼ sec.31, T.138 N., R.41 W., Becker County, at highway crossing at Buck's Mill, 6.5 miles southwest of city of Detroit Lakes, Minn. | 123 | 1942-50≠ | 8-8-68<br>8-16-68<br>9-5-68 | 25.5<br>15.0<br>6.24 |
| Pelican River | Otter Tail River | NE¼NE¼ sec.1, T.137 N., R.42 W., Otter Tail County, at bridge on County Highway 20, at county line, 7.1 miles northwest of Vergas, Minn. | - | - | 7-25-68<br>8-8-68 | 47.3<br>26.1 |
| Wild Rice River | Red River of the North | On line between sec.13, T.144 N., R.46 W., and sec.18, T.144 N., R.45 W., Norman County, at bridge on County Highway 24, 0.3 mile south of State Highway 31, and 3.2 miles southeast of Ada, Minn. | - | 1945-51, 1965-67 | 4-3-68 | 139 |
| South Branch Wild Rice River | Wild Rice River | On line between secs.8 and 9, T.142 N., R.45 W., Clay County, at bridge on County Road 63, 5.5 miles northeast of Felton, Minn. | - | 1959-67 | 4-3-68<br>4-25-68 | 16.1<br>27.4 |
| State ditch No. 45 | Wild Rice River | On line between secs.15 and 16, T.141 N., R.46 W., Clay County, at culvert on State Highway 9, 3 miles south of Felton, Minn. | - | 1959-67 | 4-3-68<br>4-25-68 | 3.23<br>6.53 |
| Moose River | Thief River | NE¼SE¼ sec.36, T.158 N., R.40 W., Marshall County, at bridge on State Highway 89, about 3.5 miles northeast of Gatzke, Minn. | - | 1964-66 | 6-12-68<br>7-17-68 | 505<br>974 |
| Mud River | Thief River | At intersection of secs.13, 14, 23, and 24, T.156 N., R.40 W., Marshall County, at bridge on State Highway 89, 6 miles west of Grygla, Minn. | - | 1966 | 7-17-68 | 967 |
| Two Rivers | Red River of the North | SE¼SE¼ sec.12, T.161 N., R.49 W., Kittson County, at bridge on County Highway 3, at east edge of Hallock, and 0.2 mile downstream from South Branch. | 625 | 1911-14≠, 1929-30≠, 1941-43≠, 1967 | 6-12-68 | 1,370 |
| Roseau River | Red River of the North | SW¼ sec.13, T.162 N., R.40 W., Roseau County, at bridge on State Highway 11, at Roseau, Minn. | - | 1911-14≠, 1943, 1967 | 4-12-68<br>6-11-68<br>6-13-68 | 150<br>4,320<br>2,930 |

≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributery to | Locetion | Drainage erea (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **Lake of the Woods basin** | | | | | | |
| Isabella River | South Kawishiwi River | NW¼NE¼ sec.6, T.61 N., R.9 W., Lake County, 200 ft upstream from Bald Eagle Lake, 0.5 mile upstream from Snake River, and 14.5 miles northwest of Isabella, Minn. | 341 | 1953-61≠, 1967 | 2-2-68<br>5-28-68<br>9-24-68 | *61.9<br>892<br>*381 |
| South Kawishiwi River | Kawishiwi River | NE¼SW¼ sec.23, T.62 N., R.11 W., Lake County, 5 miles upstream from Birch Lake, and 9 miles southeast of Ely, Minn. | - | 1952-61≠, 1967 | 3-26-68 | 117 |
| Stony River | South Kawishiwi River | NW¼NW¼ sec.17, T.60 N., R.10 W., Lake County, 275 ft downstream from Slate Lake and bridge on State Highway 1, 11 miles upstream from Birch Lake, and 12.8 miles northwest of Isabella, Minn. | 180 | 1953-65≠, 1967 | 2-1-68<br>5-28-68<br>9-24-68 | *15.8<br>352<br>*226 |
| Little Fork River | Rainy River | SE¼NE¼ sec.13, T.62 N., R.19 W., St. Louis County, at bridge on U.S. Highway 53, 0.6 mile west of Cook, Minn. | - | 1950, 1958-67 | 4-9-68<br>5-16-68<br>6-11-68<br>8-15-68<br>9-19-68 | 233<br>108<br>417<br>*.47<br>125 |
| Big Fork River | Rainy River | Sec.12, T.149 N., R.47 W., Itasca County, at bridge on County Highway 29, at Dora Lake, Minn. | - | 1965-67 | 11-2-67<br>2-27-68<br>4-30-68<br>6-4-68<br>8-2-68<br>9-16-68 | 61.5<br>*10.1<br>303<br>131<br>*49.2<br>145 |
| East Branch Warroad River | Warroad River | NE¼SW¼ sec.5, T.162 N., R.36 W., Roseau County, at bridge on County Highway 5, 1.5 miles south of Warroad, Minn. | - | - | 6-13-68 | 368 |
| Warroad River | Lake of the Woods | SW¼SE¼ sec.29, T.162 N., R.36 W., Roseau County, at bridge on State Highway 11 in Warroad, Minn. | - | - | 6-13-68 | 1,740 |
| **Mississippi River main stem** | | | | | | |
| Mississippi River | Gulf of Mexico | N½ sec.13, T.155 N., R.26 W., Itasca County, at dam at outlet of Pokegama Lake, 3.5 miles northwest of Grand Rapids, Minn. | 3,265 | 1929-30, 1944-45, 1948-55, 1957-67 | 1-26-68<br>8-6-68 | 809<br>1,430 |
| **Crow Wing River basin** | | | | | | |
| Leaf River | Crow Wing River | W½ sec.22, T.134 N., R.38 W., Otter Tail County, between West and East Leaf Lakes, at culvert just upstream from State Road 108, and 4 miles east of Ottertail, Minn. | - | - | 6-7-68<br>8-14-68 | 9.96<br>2.14 |
| Oak Creek | Leaf River | SE¼SE¼ sec.26, T.134 N., R.36 W., Otter Tail County, at bridge on county road, 4 miles southwest of Wadena, Minn. | - | - | 10-18-67 | *.53 |
| Oak Creek | Leaf River | SW¼SW¼ sec.11, T.134 N., R.36 W., Otter Tail County, at bridge on County Highway 52, 3 miles west of Wadena, Minn. | - | - | 10-18-67 | *1.04 |
| Oak Creek | Leaf River | SW¼NE¼ sec.34, T.135 N., R.36 W., Otter Tail County, at bridge on U.S. Highway 10, 3.5 miles northwest of Wadena, Minn. | - | - | 10-18-67 | *1.94 |
| Leaf River | Crow Wing River | NE¼NE¼ sec.35, T.135 N., R.36 W., Otter Tail County, at bridge on County Highway 75, 2 miles northwest of Wadena, Minn. | - | - | 10-18-67 | *29.9 |
| Leaf River tributary | Leaf River | NW¼NW¼ sec.34, T.135 N., R.35 W., Wadena County, at bridge on county road, 2 miles northeast of Wadena, Minn. | - | - | 10-18-67 | *5.27 |

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Crow Wing River basin--continued | | | | |
| Leaf River | Crow Wing River | NE¼SE¼ sec.19, T.135 N., R.34 W., Wadena County, at bridge on County Highway 22, 5.5 miles north of Verndale, Minn. | - | 1964-66 | 10-17-67 | *44.3 |
| Wing River | Leaf River | SE¼SE¼ sec.16, T.133 N., R.35 W., Todd County, at bridge on State Highway 210, in Hewitt, Minn. | - | 1966-67 | 7-18-67<br>10-16-67 | *9.62<br>*17.8 |
| Wing River | Leaf River | SW¼SW¼ sec.3, T.133 N., R.35 W., Todd County, at bridge on county road, 2 miles north of Hewitt, Minn. | - | 1967 | 7-18-67<br>10-16-67 | *18.5<br>*9.90 |
| Wing River | Leaf River | SE¼NW¼ sec.26, T.134 N., R.35 W., Wadena County, 2.5 miles west of Verndale, Minn. | - | 1967 | 7-18-67<br>10-16-67 | *21.7<br>*13.1 |
| Wing River | Leaf River | SW¼NW¼ sec.19, T.134 N., R.34 W., Wadena County, at bridge on County Highway 111, 1 mile northwest of Verndale, Minn. | - | 1967 | 7-18-67<br>10-16-67 | *28.0<br>*17.9 |
| Wing River | Leaf River | N½ sec.8, T.134 N., R.34 W., Wadena County, at bridge on County Highway 4, 2 miles north of Verndale, Minn. | - | 1964-67 | 7-19 67<br>10-16-67 | *29.2<br>*21.9 |
| Wing River | Leaf River | SW¼SW¼ sec.29, T.135 N., R.35 W., Wadena County, at bridge on county road, 5 miles northeast of Verndale, Minn. | - | 1967 | 7-19-67<br>10-16-67 | *33.7<br>*22.2 |
| Redeye Piver | Leaf River | NE¼NE¼ sec.4, T.136 N., R.35 W., Wadena County, at bridge on State Highway 71 in Sebeka, Minn. | - | - | 5-27-68<br>6-18-68<br>8-26-68<br>9-30-68 | 39.1<br>96.9<br>*15.1<br>22.4 |
| Redeye River | Leaf River | On line between secs.13 and 24, T.135 N., R.34 W., Wadena County, at bridge on County Highway 7, 1.5 miles upstream from mouth and 8.5 miles north of Aldrich, Minn. | - | 1964-66 | 10-17-67 | *22.7 |
| Leaf River | Crow Wing River | SW¼SW¼ sec.34, T.135 N., R.33 W., Wadena County, at bridge on County Highway 29, 7 miles northeast of Aldrich, Minn. | - | 1965 | 10-17-67 | *109 |
| Partridge River | Crow Wing River | NE¼NW¼ sec.10, T.133 N., R.34 W., Todd County, at bridge on County Highway 118, 1.5 miles southwest of Aldrich, Minn. | - | 1967 | 7-17-67<br>10-17-67 | *2.12<br>*1.27 |
| Partridge River | Crow Wing River | NW¼SW¼ sec.35, T.134 N., R.34 W., Wadena County, at bridge on U.S. Highway 10 in Aldrich, Minn. | - | 1967 | 7-17-67<br>10-17-67 | *4.08<br>*.88 |
| Partridge River | Crow Wing River | SW¼NW¼ sec.25, T.134 N., R.34 W., Wadena County, at bridge on County Highway 2, 1 mile northeast of Aldrich, Minn. | - | 1967 | 7-17-67<br>10-17-67 | *5.27<br>*1.50 |
| Partridge River | Crow Wing River | SE¼SE¼ sec.19, T.134 N., R.33 W., Wadena County, at bridge on County Road 114, 3 miles northeast of Aldrich, Minn. | - | 1967 | 7-17-67<br>10-17-67 | *8.27<br>*3.63 |
| Partridge River | Crow Wing River | NW¼SW¼ sec.15, T.134 N., R.33 W., Wadena County, at bridge on County Highway 29, about 0.8 mile upstream from mouth, and 5.5 miles northeast of Aldrich, Minn. | - | 1964-67 | 7-17-67<br>10-17-67 | *7.11<br>*5.33 |
| | | Nokasippi River basin | | | | |
| Nokasippi River | Mississippi River | NE¼NE¼ sec.24, T.43 N., R.32 W., Crow Wing County, at bridge on County Highway 2, 3 miles northeast of Fort Ripley, Minn. | - | - | 11-15-67<br>8-28-68 | 84.1<br>33.6 |

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **Elk River basin** | | | | | | |
| Elk River | Mississippi River | NW¼NE¼ sec.6, T.129 N., R.29 W., Morrison County, at bridge on County Highway 13, 1 mile upstream from mouth, and 3 miles north of Little Falls, Minn. | - | - | 8-28-68 | *3.50 |
| **Swan River basin** | | | | | | |
| Swan River | Mississippi River | NW¼NW¼ sec.1, T.128 N., R.30 W., Morrison County, at bridge on State Highway 238, 1.5 miles upstream from mouth and 3 miles southwest of Little Falls, Minn. | - | - | 8-28-68 | *6.03 |
| **Spunk Creek basin** | | | | | | |
| Spunk Creek | Mississippi River | SE¼NW¼ sec.27, T.127 N., R.29 W., Morrison County, at bridge on County Highway 21, about 1.5 miles upstream from mouth, and 3.5 miles southwest of Royalton, Minn. | - | - | 8-28-68 | *2.83 |
| **Sauk River basin** | | | | | | |
| Ashley Creek | Sauk River | NW¼SE¼ sec.29, T.127 N., R.34 W., Todd County, at bridge on County Highway 11, 3 miles north of Sauk Centre, Minn. | - | - | 8-28-68 | *3.59 |
| Sauk River | Mississippi River | NE¼NW¼ sec.19, T.125 N., R.32 W., Stearns County, at bridge on County Highway 30, 1 mile southwest of New Munich, Minn. | - | - | 8-28-68 | *22.6 |
| **Mississippi River main stem** | | | | | | |
| Mississippi River | Gulf of Mexico | S½ sec.35, T.125 N., R.28 W., Stearns County, at bridge on State Highway 152, at St. Cloud, Minn. | - | 1967 | 7-26-68 | 6,530 |
| **Elk River basin** | | | | | | |
| Mayhew Creek | Elk River | NE¼NW¼ sec.26, T.36 N., R.30 W., Benton County, 300 ft upstream from mouth, 500 ft west of Elk River bridge on State Highway 95, and 6 miles east of St. Cloud, Minn. | - | - | 8-27-68 | *.52 |
| Elk River | Mississippi River | NE¼NW¼ sec.26, T.36 N., R.30 W., Benton County, at bridge on State Highway 95, 6 miles east of St. Cloud, Minn. | - | - | 8-27-68 | *3.04 |
| Battle Brook | St. Francis River | NW¼SW¼ sec.31, T.35 N., R.26 W., Sherburne County, at outlet of Elk Lake, 2.7 miles northwest of Zimmerman, Minn. | - | 1965-67 | 10-25-67<br>11-15-67<br>12-13-67<br>1-22-68<br>2-21-68<br>3-22-68<br>4-15-68<br>5-17-68<br>6-24-68<br>7-31-68<br>8-30-68 | 7.26<br>7.30<br>7.67<br>*7.10<br>*6.71<br>*7.94<br>9.24<br>13.1<br>7.70<br>7.86<br>5.12 |
| **Mississippi River main stem** | | | | | | |
| Mississippi River | Gulf of Mexico | SE¼ sec.34, T.33 N., R.26 W., Sherburne County, on left bank in town of Elk River, and at mile 884.6 above Ohio River. | 14,500 | 1915-56≠, 1966-67 | 6-25-68<br>9-5-68 | 13,100<br>3,300 |
| **Crow River basin** | | | | | | |
| Buffalo Creek | South Fork Crow River | Near center sec.13, T.115 N., R.28 W., McLeod County, at bridge on County Highway 75, at Glencoe, Minn. | - | 1947 | 6-14-68 | 318 |

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | **Rum River basin** | | | | |
| Rum River | Mississippi River | NE¼SE¼ sec.6, T.41 N., R.26 W., Mille Lacs County, at bridge on U.S. Highway 169, 0.5 mile south of Onamia, Minn. | - | - | 8-27-68 | *155 |
| Rum River | Mississippi River | NW¼NW¼ sec.24, T.38 N., R.27 W., Mille Lacs County, at bridge on County Highway 9, 2 miles north of Milaca, Minn. | - | - | 8-27-68 | *176 |
| West Branch Rum River | Rum River | NE¼ sec.33, T.36 N., R.26 W., Mille Lacs County, at bridge on U.S. Highway 169, 400 ft upstream from mouth, in Princeton, Minn. | - | 1961, 1965 | 8-27-68 | *11.4 |
| Rum River | Mississippi River | SE¼SE¼ sec.36, T.36 N., R.24 W., Isanti County, at bridge on State Highway 47, at West Point, 8 miles west of Cambridge, Minn. | - | 1958-62, 1965, 1967 | 3-30-67<br>3-31-67 | 696<br>1,510 |
| Stanchfield Creek | Rum River | SW¼SW¼ sec.11, T.36 N., R.24 W., Isanti County, at bridge on County Highway 32, 1.5 miles upstream from mouth, and 3 miles northeast of Walbo, Minn. | - | 1965 | 8-27-68 | *8.55 |
| Rum River | Mississippi River | W½ sec.30, T.35 N., R.23 W., Isanti County, at bridge on County Highway 5, 0.8 mile west of Isanti, Minn. | - | 1958-60, 1962, 1965, 1967 | 3-30-67<br>3-31-67 | 959<br>2,250 |
| Cedar Creek | Rum River | SW¼SW¼ sec.32, T.32 N., R.24 W., Anoka County, at bridge on county road, 0.5 mile upstream from mouth and 7 miles north of Anoka, Minn. | - | 1965 | 8-27-68 | *21.4 |
| | | **Bassett Creek basin** | | | | |
| Bassett Creek | Mississippi River | W½ sec.28, T.118 N., R.21 W., Hennepin County, at bridge on County Highway 66 in Golden Valley, Minn., and 0.2 mile west of underpass on State Highway 100. | - | 1963-67 | 10-13-67<br>11-16-67<br>3-28-68<br>5-20-68<br>6-14-68<br>9-9-68<br>9-30-68 | 3.01<br>1.10<br>6.40<br>13.8<br>60.5<br>3.52<br>4.97 |
| North Fork Bassett Creek | Bassett Creek | NW¼ sec.21, T.118 N., R.21 W., Hennepin County, at culvert on 34th Ave. North at Crystal, Minn., and 0.8 mile upstream from mouth. | - | 1963-67 | 3-28-68<br>4-17-68<br>5-20-68<br>8-1-68<br>9-9-68<br>9-30-68 | 1.98<br>.45<br>1.60<br>.92<br>.06<br>1.51 |
| South Fork Bassett Creek | Bassett Creek | Near center of W½ sec.19, T.29 N., R.24 W., Hennepin County, at culvert on Olsen Highway, Golden Valley, Minn., and 0.2 mile east of State Highway 100. | - | 1963-67 | 10-13-67<br>11-16-67<br>3-28-68<br>4-17-68<br>5-20-68<br>8-2-68<br>9-9-68<br>9-30-68 | 1.50<br>1.24<br>2.26<br>1.50<br>1.26<br>1.98<br>2.08<br>1.05 |
| Bassett Creek | Mississippi River | SE¼ sec.20, T.29 N., R.24 W., Hennepin County, at Fruen Mill, Minneapolis, Minn., and 700 feet downstream from Glenwood Ave. | - | 1952, 1954-55, 1963-67 | 3-28-68<br>4-17-68<br>5-20-68<br>6-14-68<br>8-2-68<br>9-9-68<br>9-30-68 | 16.8<br>5.44<br>15.9<br>165<br>24.5<br>11.0<br>8.44 |
| | | **Mississippi River main stem** | | | | |
| Mississippi River | Gulf of Mexico | At lower St. Anthony Falls lock and dam, Hennepin County, at Minneapolis, Minn., and 10 miles upstream from Minnesota River. | - | 1967 | 5-2-68 | 13,600 |

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **Mississippi River main stem--continued** | | | | | | |
| Mississippi River | Gulf of Mexico | At Washington Ave. and Dartmouth Ave. bridges, Hennepin County, in Minneapolis, Minn., and 9 miles upstream from Minnesota River. | | 1912, 1953-54, 1957, 1963-67 | 5-2-68<br>6-19-68 | 12,900<br>20,100 |
| Mississippi River | Gulf of Mexico | Below lock and dam No. 1, Hennepin County, between Minneapolis and St. Paul, Minn., 4 miles upstream from Minnesota River. | 19,700 | 1935, 1938-39, 1941, 1945-50, 1954, 1959, 1961-67 | 11-3-67<br>9-18-68 | 3,200<br>4,630 |
| **Minnesota River basin** | | | | | | |
| Little Minnesota River tributary | Little Minnesota River | NE¼NE¼ sec.33, T.125 N., R.49 W., Traverse County, at bridge on State Highways 7 and 28, at east edge of Browns Valley, Minn. | - | - | 4-1-68 | .23 |
| Minnesota River | Mississippi River | SE¼NW¼ sec.3, T.120 N., R.45 W., Big Stone County, about 0.3 mile downstream from Yellow Bank River, 3 miles southeast of Odessa, Minn. | - | - | 4-3-68 | 10.8 |
| Lac qui Parle River | Minnesota River | SW¼NE¼ sec.14, T.114 N., R.45 W., Yellow Medicine County, at bridge on State Highway 68, 2.4 miles southeast of Canby, Minn. | - | 1965-66 | 4-9-68 | 1.73 |
| Lac qui Parle River | Minnesota River | On line between secs.21 and 22, T.115 N., R.44 W., Yellow Medicine County, at bridge on County Highway D8, 5.7 miles northwest of St. Leo, Minn. | - | - | 5-9-68 | .91 |
| Lac qui Parle River | Minnesota River | SE¼SW¼ sec.22, T.117 N., R.43 W., Lac qui Parle County, at bridge on county road, 0.5 mile upstream from West Branch, and 0.5 mile east of Dawson, Minn. | - | - | 4-5-68 | 4.81 |
| Florida Creek | West Branch Lac qui Parle River | On line between secs.8 and 17, T.116 N., R.45 W., Lac qui Parle County, at bridge on county highway, 12 miles southwest of Dawson, Minn. | - | 1966 | 4-5-68 | 1.92 |
| West Branch Lac qui Parle River | Lac qui Parle | Near center of sec.17, T.117 N., R.44 W., Lac qui Parle County, at bridge on U. S. Highway 75, 4.5 miles south of Madison, Minn. | - | 1948-49, 1966-67 | 4-5-68<br>5-2-68 | 2.10<br>25.9 |
| West Branch Lac qui Parle River | Lac qui Parle River | S½NE¼ sec.21, T.117 N., R.43 W., Lac qui Parle County, at dam in Dawson, Minn. | - | - | 5-2-68 | 30.1 |
| Minnesota River tributary | Minnesota River | SE¼SW¼ sec.27, T.117 N., R.40 W., Chippewa County, at bridge on County Highway 15, 2.1 miles northeast of Wegdahl, Minn. | - | - | 10-17-67 | 0 |
| Minnesota River tributary | Minnesota River | SW¼NE¼ sec.34. T.116 N., R.39 W., Chippewa County, at bridge on County Highway 5 at Granite Falls, Minn. | - | - | 10-17-67 | 0 |
| Yellow Medicine River | Minnesota River | On line between secs.13 and 14, T.113 N., R.44 W., Lincoln County, at bridge on county highway, 3.5 miles southeast of Porter, Minn. | - | 1966 | 4-9-68 | 3.37 |
| Mud Creek | Yellow Medicine River | On line between secs.28 and 29, T.114 N., R.43 W., Yellow Medicine County, at bridge on County Highway 11, 3.5 miles north of Taunton, Minn. | - | 1966 | 5-8-68 | .19 |
| Yellow Medicine River | Minnesota River | On line between secs.7 and 18, T.114 N., R.41 W., Yellow Medicine County, at bridge on County Highway 18, 4.3 miles west of Hanley Falls, Minn. | - | 1965-66 | 4-9-68 | 20.9 |

GPO 817-490-13

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Minnesota River basin--continued | | | | |
| Hawk Creek | Minnesota River | NE¼SE¼ sec.18, T.119 N., R.35 W., Kandiyohi County, at bridge on County Highway 5, 2.8 miles west of Willmar, Minn. | - | - | 10-17-67 | 0 |
| Hawk Creek | Minnesota River | SW¼SE¼ sec.16, T.115 N., R.38 W., Renville County, at bridge on County Highway 52, 3.5 miles southeast of Minnesota Falls, Minn. | - | - | 10-17-67 | 4.36 |
| Minnesota River tributary | Minnesota River | NE¼SE¼ sec.1, T.114 N., R.38 W., Renville County, at bridge on County Highway 15, 6 miles south of Sacred Heart, Minn. | - | - | 10-16-67 | 0 |
| Sacred Heart Creek | Minnesota River | NW¼NW¼ sec.1, T.114 N., R.37 W., Renville County, at bridge on county road, 5.5 miles southwest of Renville, Minn. | - | - | 10-17-67 | 0 |
| Minnesota River | Mississippi River | SW¼NE¼ sec.30, T.114 N., R.36 W., Redwood County, at bridge on County Highway 6, 4 miles north of Delhi, Minn. | - | - | 5-9-68<br>8-14-68<br>9-16-68 | 470<br>176<br>79.0 |
| Redwood River | Minnesota River | On line between secs.25 and 36, T.110 N. R.43 W., Lyon County, at bridge on county highway, 1.2 miles southwest of Russell, Minn. | - | 1966-67 | 10-12-67 | .62 |
| Coon Creek | Redwood River | On line between secs.23 and 24, T.110 N. R.43 W., Lyon County, at bridge on county highway, 1 mile west of Russell, Minn. | - | 1966-67 | 10-12-67 | 0 |
| West Fork Beaver Creek | Beaver Creek | NE¼SE¼ sec.18, T.116 N., R.35 W., Renville County, at bridge on County Highway 1, 4 miles north of Danube, Minn. | - | - | 10-17-67 | 0 |
| Beaver Creek | Minnesota River | NE¼NW¼ sec.22, T.113 N., R.35 W., Renville County, at bridge on county highway in Beaver Falls, Minn. | - | 1966-67 | 10-11-67 | 7.08 |
| Little Rock Creek | Minnesota River | NW¼NW¼ sec.30, T.111 N., R.31 W., Nicollet County, at bridge on County Highway 21, 10 miles southeast of Fairfax, Minn. | - | 1966-67 | 10-11-67 | 0 |
| Eight mile Creek | Minnesota River | SE¼SW¼ sec.29, T.111 N., R.31 W., Nicollet County, at bridge on County Highway 21, 2.7 miles west of St. George, Minn. | - | - | 10-17-67 | 0 |
| Minnesota River tributary | Minnesota River | SW¼SE¼ sec.6, T.110 N., R.30 W., Nicollet County, at bridge on County Highway 21, 3 miles southwest of Klossner, Minn. | - | - | 10-17-67 | 0 |
| Cottonwood River | Minnesota River | On line between secs.11 and 12, T.110 N. R.40 W., Lyon County, 4.6 miles northeast of Amiret, Minn. | - | - | 9-4-68 | *1.51 |
| Cottonwood River | Minnesota River | On line between secs.1 and 2, T.109 N., R.38 W., Redwood County, at bridge on county road, 3.8 miles north of Revere, Minn. | - | - | 9-5-68 | *1.75 |
| Cottonwood River | Minnesota River | SE¼SE¼ sec.8, T.109 N., R.37 W., Redwood County, 2.5 miles northwest of Lamberton, Minn. | - | 1966-67 | 10-13-67<br>4-8-68<br>5-10-68<br>6-20-68<br>7-9-68<br>8-16-68<br>9-20-68 | .19<br>20.5<br>7.24<br>1.21<br>1.30<br>23.6<br>31.1 |

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Minnesota River basin--continued | | | | |
| Dutch Charley Creek | Cottonwood River | On line between sec.30, T.109 N., R.36 W., and sec.25, T.109 N., R.37 W., Redwood County, at bridge on County Highway 15, 2 miles east of Lamberton, Minn. | - | - | 9-5-68 | *7.86 |
| Cottonwood River | Minnesota River | On line between secs. 26 and 35, T.109 N., R.36 W., Redwood County, at bridge on County Highway 15, 0.5 mile west of Sanborn, Minn. | - | - | 9-5-68 | *14.1 |
| Mound Creek | Cottonwood River | NW¼NW¼ sec.4, T.108 N., R.35 W., Brown County, at bridge on County Highway 2, 5 miles southwest of Springfield, Minn. | - | - | 9-5-68 | *3.16 |
| Coal Mine Creek | Cottonwood River | On line between secs.22 and 27, T.109 N., R.35 W., Brown County, at bridge on county road, 3 miles southwest of Springfield, Minn. | - | - | 9-5-68 | *1.37 |
| Cottonwood River | Minnesota River | On line between secs.21 and 22, T.109 N., R.33 W., Brown County, at bridge on county highway, 0.2 mile north of Leavenworth, Minn. | - | 1966-67 | 10-11-67<br>4-8-68<br>5-9-68<br>7-9-68<br>8-16-68<br>9-20-68 | 5.82<br>48.6<br>31.4<br>8.51<br>162<br>131 |
| Sleepy Eye Creek | Cottonwood River | On line between secs.8 and 9, T.109 N., R.33 W., Brown County, at bridge on county highway, 1.8 miles southeast of Cobden, Minn. | - | 1966-67 | 10-11-67<br>4-8-68<br>5-9-68<br>6-7-68<br>7-9-68<br>8-16-68<br>9-20-68 | 7.87<br>19.0<br>17.4<br>6.89<br>8.84<br>66.2<br>37.1 |
| Sleepy Eye Creek | Cottonwood River | SW¼SE¼ sec.11, T.109 N., R.33 W., Brown County, at bridge on county road, 500 ft upstream from mouth, 2.2 miles northeast of Leavenworth, Minn. | - | - | 9-6-68 | *18.0 |
| Cottonwood River | Minnesota River | NE¼NW¼ sec.3, T.109 N., R.32 W., Brown County, at bridge on County Highway 10, 2.5 miles southeast of Sleepy Eye, Minn. | - | - | 9-6-68 | *66.5 |
| Little Cottonwood River | Minnesota River | On line between secs.9 and 10, T.108 N., R.33 W., Brown County, at bridge on County Highway 8, 3.8 miles south of Leavenworth, Minn. | - | - | 9-6-68 | *13.7 |
| Little Cottonwood River | Minnesota River | N½ sec.19, T.109 N., R.29 W., Blue Earth County, at bridge on County Highway 105, 2.5 miles upstream from mouth, and 2.5 miles west of Cambria, Minn. | - | - | 9-6-68 | *35.0 |
| Little Cottonwood River | Minnesota River | Near center of sec.17, T.109 N., R.29 W., Blue Earth County, at bridge on State Highway 68, 0.5 mile south of Courtland, Minn. | - | 1966 | 10-11-67<br>4-22-68<br>5-21-68<br>6-24-68<br>8-6-68<br>9-9-68 | 6.68<br>26.0<br>12.4<br>10.3<br>454<br>108 |
| Minnesota River tributary | Minnesota River | NW¼NW¼ sec.15, T.109 N., R.29 W., Nicollet County, at bridge on county road, 2.3 miles southeast of Courtland, Minn. | - | - | 10-17-67 | 0 |
| Swan Lake Outlet | Minnesota River | NW¼SW¼ sec.5, T.109 N., R.28 W., Nicollet County, at bridge on U.S. Highway 14, 2 miles west of Nicollet, Minn. | - | - | 10-17-67 | 0 |
| Swan Lake Outlet | Minnesota River | On line between secs.27 and 28, T.109 N., R.28 W., Nicollet County, at culvert on county highway, 4.5 miles south of Nicollet, Minn. | - | 1966-67 | 10-11-67 | *.59 |

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Minnesota River basin--continued | | | | |
| Minnesota River | Mississippi River | E½ sec.33, T.109 N., R.28 W., Blue Earth County, at highway bridge, a quarter of a mile northeast of Judson, Minn., and 11 miles upstream from Blue Earth River. | 11,200 | 1938-50≠, 1967 | 4-23-68<br>9-9-68 | 1,160<br>480 |
| Minnesota River tributary | Minnesota River | NW¼NW¼ sec.15, T.108 N., R.27 W., Nicollet County, at bridge on County Highway 71, 2.7 miles west of Mankato, Minn. | - | - | 10-17-67 | 0 |
| Blue Earth River | Minnesota River | Lat 43°34'22", long 94°06'08", in SW¼SW¼ sec.5, T.101 N., R.27 W., Faribault County, at bridge on County Highway 4, 4.0 miles south of Blue Earth, Minn. | - | - | 4-18-68<br>5-24-68<br>7-1-68<br>8-8-68<br>9-11-68 | *6.39<br>12.4<br>229<br>73.7<br>*6.30 |
| Center Creek | Blue Earth River | Lat 43°43'50", long 94°12'26", on line between secs.16 and 17, T.103 N., R. 28 W., Faribault County, at bridge on county road, 2 miles upstream from mouth, 1.5 miles east of Huntley, Minn. | - | - | 4-18-68<br>5-24-68<br>7-1-68<br>8-8-68<br>9-11-68 | *6.73<br>*4.98<br>32.7<br>20.0<br>13.5 |
| Elm Creek | Blue Earth River | Lat 43°45'02", long 94°12'32", in NE¼SE¼ sec.5, T.103 N., R.28 W., Faribault County, at bridge on county road, 0.7 miles upstream from mouth, 1.2 miles southwest of Winnebago, Minn. | - | - | 4-18-68<br>5-24-68<br>7-1-68<br>8-7-68<br>9-11-68 | *2.37<br>*1.75<br>21.6<br>20.4<br>3.85 |
| Watonwan River | Blue Earth River | Lat 44°03'53", long 94°35'22", on line between secs.19 and 20, T.107 N., R.31 W., Watonwan County, at bridge on County Highway 14, 0.7 mile west of La Salle, Minn. | - | - | 4-17-68<br>5-22-68<br>7-1-68<br>8-6-68<br>9-11-68 | 11.9<br>*4.72<br>10.7<br>132<br>56.9 |
| St. James Creek | Watonwan River | Lat 44°03'04", long 94°33'26", in SW¼SE¼ sec.21, T.107 N., R.31 W., Watonwan County, at bridge on County Highway 3, 100 ft downstream from Butterfield Creek, and 1.2 miles southeast of La Salle, Minn. | - | - | 4-12-68<br>5-22-68<br>7-1-68<br>8-6-68<br>9-11-68 | *5.90<br>*5.42<br>20.4<br>57.8<br>35.3 |
| South Fork Watonwan River | Watonwan River | Lat 44°02'33", long 94°27'42", in W½ sec. 29, T.107 N., R.30 W., Watonwan County, at bridge on County Highway 116, 0.4 mile upstream from mouth, and 1.6 mile west of Madelia, Minn. | - | - | 4-17-68<br>5-22-68<br>7-1-68<br>8-7-68<br>9-11-68 | *3.80<br>*2.33<br>8.18<br>50.7<br>19.2 |
| Watonwan River | Blue Earth River | Lat 44°02'45", long 94°11'38", in SW¼NE¼ sec.28, T.107 N., R.28 W., Blue Earth County, at bridge on County Highway 20, 1.5 miles west of Garden City, Minn. | 812 | 1940-45≠, 1953, 1960-61 | 4-17-68<br>5-22-68<br>6-28-68<br>8-7-68<br>9-11-68 | 32.4<br>*28.5<br>132<br>342<br>162 |
| Le Sueur River | Blue Earth River | Lat 44°00'52", long 93°31'38", in E½ sec.1, T.106 N., R.23 W., Waseca County, at bridge on County Highway 4, 0.2 mile east of Wilton, Minn. | - | - | 4-18-68<br>5-27-68<br>7-2-68<br>8-8-68<br>9-12-68 | *6.01<br>60.7<br>103<br>1,180<br>66.4 |
| Cobb River | Le Sueur River | Lat 44°02'50", long 94°00'00", SE¼NW¼ sec.30, T.107 N., R.26 W., Blue Earth County, at bridge on County Highway 16, 4.5 miles northeast of Good Thunder, Minn. | - | - | 4-12-68<br>5-23-68<br>6-28-68<br>8-7-68<br>9-10-68 | *2.19<br>15.0<br>181<br>1,400<br>384 |
| Maple River | Le Sueur River | Lat 44°03'54", long 94°01'32", on line between secs.13 and 24, T.107 N., R.27 W., Blue Earth County, at bridge on County Highway 35, 2 miles southeast of Rapidan, Minn. | - | - | 4-17-68<br>5-23-68<br>6-27-68<br>8-7-68<br>9-10-68 | *8.15<br>*15.2<br>323<br>416<br>136 |
| Warren Creek | Minnesota River | NW¼NW¼ sec.18, T.108 N., R.26 W., Blue Earth County, at culvert under railroad tracks at mouth, at Mankato, Minn. | - | - | 4-24-68 | 3.18 |

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Minnesota River basin--continued | | | | |
| Judicial ditch 1A | South Branch Rush River | NW¼NW¼ sec.19, T.111 N., R.28 W., Nicollet County, at bridge on County Highway 4, 1,000 ft upstream from County ditch No. 9, 9.5 miles above mouth, and 2 miles west of New Sweden, Minn. | - | 1964-67 | 10-11-67<br>11-13-67<br>12-11-67<br>3-18-68<br>4-22-68<br>5-21-68<br>6-24-68<br>7-11-68<br>8-6-68 | .66<br>*.28<br>*.01<br>2.49<br>1.90<br>1.07<br>2.97<br>.74<br>34.4 |
| Sand Creek | Minnesota River | SW¼SW¼ sec.29, T.115 N., R.23 W., Scott County, at bridge on county road, 1 mile upstream from mouth, and 4.5 miles north of Jordan, Minn. | - | - | 3-26-68 | 12.3 |
| Carver Creek | Minnesota River | Lat 44°45'01", long 93°39'00", in SW¼SE¼ sec.24, T.115 N., R.24 W., Carver County, at bridge on County Highway 40, 1.2 miles upstream from mouth, and 1.5 miles southwest of Carver, Minn. | - | - | 3-26-68 | 5.45 |
| Minnesota River tributary | Minnesota River | NE¼NE¼ sec.19, T.115 N., R.23 W., Carver County, at culvert on county road, 900 ft upstream from mouth, in Carver, Minn. | - | - | 3-26-68 | .29 |
| Minnesota River tributary | Minnesota River | NE¼SW¼ sec.17, T.115 N., R.23 W., Carver County, at culvert on county road, 300 ft upstream from mouth, and 0.4 mile north of Carver, Minn. | - | - | 3-26-68 | .44 |
| Minnesota River | Mississippi River | SE¼SW¼ sec.9, T.115 N., R.23 W., Carver County, 2200 ft upstream from State Highway 41 bridge at south edge of Chaska, Minn. | - | - | 3-26-68 | 921 |
| Chaska Creek | Minnesota River | NE¼NE¼ sec.8, T.115 N., R.23 W., Carver County, at bridge on U.S. Highway 212 in Chaska, Minn., and 1 mile upstream from mouth. | - | 1967 | 3-19-68<br>6-14-68 | 13.4<br>303 |
| Chaska Creek | Minnesota River | NW¼SW¼ sec.9, T.115 N., R.23 W., Carver County, at mouth, 500 ft upstream from bridge over Minnesota River on State Highway 41 in Chaska, Minn. | - | - | 3-26-68 | .67 |
| Gifford Lake Outlet | Minnesota River | NE¼SE¼ sec.9, T.115 N., R.23 W., Scott County, at mouth, 0.6 miles east of Chaska and 3 miles west of Shakopee, Minn. | - | - | 3-26-68 | .74 |
| East Chaska Creek | Minnesota River | SW¼SW¼ sec.4, T.115 N., R.23 W., Carver County, at bridge on U.S. Highway 212 at Chaska, Minn., and 1 mile upstream from mouth. | - | 1967 | 3-26-68<br>6-14-68 | *1.19<br>59.8 |
| Minnesota River tributary | Minnesota River | NW¼SW¼ sec.3, T.115 N., R.23 W., Carver County, 0.8 mile northeast of Chaska, Minn. | - | - | 3-26-68 | .36 |
| Minnesota River tributary | Minnesota River | NE¼SW¼ sec.3, T.115 N., R.23 W., Carver County, 1 mile northeast of Chaska, Minn. | - | - | 3-26-68 | 1.34 |
| Minnesota River tributary | Minnesota River | SW¼NW¼ sec.2, T.115 N., R.23 W., Carver County, 1.2 miles northwest of Shakopee, and 2.2 miles northeast of Chaska, Minn. | - | - | 3-26-68 | 3.71 |
| Nyssen Lake Outlet | Minnesota River | NW¼SE¼ sec.2, T.115 N., R.23 W., Scott County, 1.2 miles upstream from Highway 169 bridge at north edge of Shakopee, Minn. | - | - | 3-26-68 | .60 |

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| | | Minnesota River basin--continued | | | | |
| Minnesota River tributary | Minnesota River | SE¼NE¼ sec.2, T.115 N., R.23 W., Carver County, 0.7 mile upstream from U.S. Highway 169, and 3.0 miles northeast of Chaska, Minn. | - | - | 3-26-68 | 4.03 |
| Minnesota River tributary | Minnesota River | NW¼NE¼ sec.6, T.115 N., R.22 W., Scott County, 0.1 mile downstream from U.S. Highway 169, at north edge of Shakopee, Minn. | - | - | 3-26-68 | 1.71 |
| Minnesota River tributary | Minnesota River | SE¼SW¼ sec.32, T.116 N., R.22 W., Scott County, 0.9 mile east of Shakopee, Minn. | - | - | 3-26-68 | 3.24 |
| Minnesota River | Mississippi River | On line between sec.5, T.115 N., R.22 W., Scott County, and sec.32, T.116 N., R. R.22 W., Hennepin County, 2.2 miles downstream from U.S. Highway 169 bridge at north edge of Shakopee, Minn. | - | - | 3-26-68 | 954 |
| Rice Lake Outlet | Minnesota River | NE¼SE¼ sec.32, T.116 N., R.22 W., Hennepin County, 1.2 miles east of Shakopee, and 2.0 miles south of Eden Prairie, Minn. | - | - | 3-26-68 | 8.26 |
| Grass Lake Outlet | Minnesota River | SE¼SE¼ sec.32, T.116 N., R.22 W., Hennepin County, 1.5 miles east of Shakopee, and 2.2 miles south of Eden Prairie, Minn. | - | - | 3-26-68 | 3.69 |
| Minnesota River tributary | Minnesota River | NW¼NW¼ sec.3, T.115 N., R.22 W., Scott County, at mouth, 2.6 miles east of Shakopee, Minn. | -- | - | 3-26-68 | .32 |
| Minnesota River tributary | Minnesota River | NW¼NW¼ sec.3, T.115 N., R.22 W., Scott County, at mouth, 2 miles east of Shakopee, Minn. | - | - | 3-26-68 | .83 |
| Purgatory Creek | Minnesota River | NE¼SE¼ sec.36, T.116 N., R.22 W., Hennepin County, at bridge on county road, 0.4 mile upstream from mouth, and 4 miles southeast of Eden Prairie, Minn. | - | - | 3-26-68 | 6.84 |
| Fisher Lake Outlet | Minnesota River | NW¼SW¼ sec.6, T.115 N., R.21 W., Scott County, at culvert on County Highway 25, 3 miles northwest of Savage, Minn. | - | - | 3-26-68 | 6.52 |
| Eagle Creek | Minnesota River | SE¼NE¼ sec.7, T.115 N., R.22 W., Scott County, at mouth, and 1.8 miles northwest of Savage, Minn. | - | - | 3-26-68 | 11.0 |
| Minnesota River | Mississippi River | NE¼NE¼ sec.8, T.115 N., R.21 W., Scott County, 0.8 mile upstream from bridge on County Road 31, 1.2 miles northwest of Savage, Minn. | - | - | 3-27-68 | 1,140 |
| Minnesota River tributary | Minnesota River | SE¼NE¼ sec.8, T.115 N., R.21 W., Scott County, at mouth, and 1 mile northwest of Savage, Minn. | - | - | 3-27-68 | 12.6 |
| Credit River | Minnesota River | SE¼SW¼ sec.31, T.27 N., R.24 W., Scott County, at bridge on first city street south of State Highway 101 in Savage, Minn., and 0.6 mile upstream from mouth. | - | - | 3-27-68 | 6.22 |
| Credit River | Minnesota River | SW¼NE¼ sec.31, T.27 N., R.24 W., Scott County, at mouth, at Savage, Minn. | - | - | 3-27-68 | 1.05 |
| Minnesota River tributary | Minnesota River | SE¼NE¼ sec.28, T.27 N., R.24 W., Dakota County, at culvert just upstream from Interstate Highway 35W, on right bank, 1.7 miles northeast of Savage, Minn. | - | - | 3-27-68 | 11.5 |

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **Minnesota River basin--continued** | | | | | | |
| Black Dog Lake upper outlet | Minnesota River | SW¼NW¼ sec.27, T.27 N., R.20 W., Dakota County, 0.2 mile downstream from Interstate Highway 35W bridge, in Burnsville, Minn. | - | - | 3-27-68 | 314 |
| Minnesota River | Mississippi River | NW¼SE¼ sec.13, T.27 N., R.24 W., Dakota County, 400 ft upstream from State Highway 36, at northeast edge of Burnsville, Minn. | - | - | 3-27-68 | 1,460 |
| Nine Mile Creek | Minnesota River | SE¼SW¼ sec.29, T.27 N., R.24 W., Hennepin County, at mouth, at Bloomington, Minn. | - | - | 3-27-68 | b47.3 |
| **Mississippi River main stem** | | | | | | |
| Mississippi River | Gulf of Mexico | At Hastings, Dakota County, Minn. | 37,100 | 1929, 1931-39, 1945-48, 1950, 1953-57, 1959-67 | 6-27-68 | 17,500 |
| **St. Croix River basin** | | | | | | |
| Crooked Creek | St. Croix River | NE¼NE¼ sec.30, T.41 N., R.17 W., Pine County, at bridge on State Highway 48, 2.8 miles upstream from mouth, and 19 miles east of Hinckley, Minn. | - | 1966-67 | 10-19-67<br>4-16-68<br>5-14-68<br>6-16-68<br>7-24-68<br>8-26-68 | *10.6<br>67.3<br>196<br>69.0<br>*47.2<br>*17.2 |
| Sand Creek | St. Croix River | NW¼SW¼ sec.13, T.40 N., R.18 W., Pine County, at bridge on St. Croix State Park Road, 2.5 miles upstream from mouth, and 13 miles southeast of Hinckley, Minn. | - | 1966-67 | 10-23-67<br>4-16-68<br>5-14-68<br>6-18-68<br>7-24-68<br>8-26-68 | *12.9<br>83.5<br>223<br>96.9<br>*74.2<br>*25.3 |
| Kettle River | St. Croix River | NW¼NW¼ sec.16, T.45 N., R.20 W., Pine County, at bridge on County Highway 46, 2.5 miles west of Sturgeon Lake, Minn. | - | 1965-67 | 10-24-67<br>4-17-68<br>5-15-68<br>6-20-68<br>7-23-68<br>8-27-68 | *7.77<br>235<br>823<br>437<br>*263<br>*23.0 |
| Moose River | Kettle River | NW¼SW¼ sec.14, T.45 N., R.20 W., Pine County, at bridge on County Highway 46 at Sturgeon Lake, Minn., and 1.5 miles upstream from mouth. | - | 1965-67 | 10-23-67<br>4-17-68<br>5-15-68<br>6-19-68<br>7-23-68<br>8-27-68 | *13.7<br>148<br>292<br>250<br>*141<br>*37.1 |
| Kettle River | St. Croix River | NE¼NW¼ sec.26, T.41 N., R.20 W., Pine County, at bridge on State Highway 48, 4.5 miles east of Hinckley, Minn. | - | 1966-67 | 6-20-68 | 2,050 |
| Knife River | Snake River | SE¼SE¼ sec.27, T.40 N., R.24 W., Kanabec County, at bridge on County Highway 77, 2.5 miles north of Mora, Minn. | - | 1966-67 | 10-24-67<br>4-17-68<br>5-15-68<br>6-19-68<br>7-24-68<br>8-28-68 | *2.11<br>62.9<br>113<br>126<br>*25.5<br>*4.04 |
| Snake River | St. Croix River | SE¼SW¼ sec.14, T.39 N., R.24 W., Kanabec County, at bridge on State Highways 23 and 65, at Mora, Minn. | - | 1966-67 | 10-24-67<br>4-17-68<br>5-15-68<br>6-19-68<br>7-24-68<br>8-24-68 | *38.4<br>269<br>639<br>417<br>*214<br>*41.2 |
| Groundhouse River | Snake River | SW¼SE¼ sec.12, T.38 N., R.24 W., Kanabec County, at bridge on county highway at Brunswick, Minn., and 2 miles upstream from mouth. | - | 1966-67 | 10-24-67<br>4-18-68<br>5-16-68<br>6-19-68<br>7-24-68<br>8-27-68 | *7.77<br>50.3<br>105<br>87.2<br>*27.4<br>*8.66 |

* Base flow.
b May not represent total flow.

Discharge measurements made at miscellaneous sites during water year 1967

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **St. Croix River basin--continued** | | | | | | |
| Rock Creek | St. Croix River | NW¼NE¼ sec.7, T.37 N., R.20 W., Chisago County, at bridge on County Highway 3, 4.5 miles northeast of Rush City, Minn. | - | 1967 | 9-9-68 | *4.37 |
| Rush Creek | St. Croix River | NW¼NW¼ sec.31, T.37 N., R.20 W., Chisago County, at bridge on County Highway 56, 3.5 miles southeast of Rush City, Minn. | - | 1967 | 9-9-68 | *9.75 |
| North Branch Sunrise River | Sunrise River | On line between secs.18 and 19, T.35 N., R.20 W., Chisago County, at bridge on State Highway 95, 4 miles east of North Branch, Minn. | - | - | 9-9-68 | *29.5 |
| St. Croix River | Mississippi River | At Prescott, Pierce County, Wis. | 7,650 | 1928-30, 1932-39, 1946-48, 1950, 1953-57, 1959-67 | 6-27-68 | 17,600 |
| **Vermillion River basin** | | | | | | |
| Vermillion River | Mississippi River | SE¼SW¼ sec.33, T.115 N., R.17 W., Dakota County, at highway bridge in Hastings, 0.7 mile upstream from mill dam, and 3 miles upstream from Vermillion Slough. | 195 | 1942-47≠, 1966-67 | 5-16-68 | 131 |
| **Cannon River basin** | | | | | | |
| Straight River | Cannon River | SE¼ sec.9, T.107 N., R.20 W., Steele County, at bridge on West Bridge Street, in Owatonna, Minn. | - | 1966-67 | 10-31-67<br>4-30-68<br>5-27-68<br>7-2-68<br>8-5-68<br>9-12-68 | *22.0<br>57.6<br>77.9<br>123<br>79.1<br>88.3 |
| Crane Creek | Straight River | SE¼NW¼ sec.20, T.108 N., R.20 W., Steele County, at culvert on service road, 1 mile northwest of Clinton Falls, Minn. | - | 1965-67 | 10-30-67<br>11-20-67<br>12-19-67<br>1-23-68<br>2-22-68<br>3-25-68<br>5-1-68<br>5-28-68<br>7-2-68<br>8-5-68<br>9-12-68 | 2.18<br>1.16<br>2.00<br>2.75<br>1.74<br>3.17<br>18.0<br>67.5<br>52.8<br>195<br>76.6 |
| Cannon River | Mississippi River | SW¼NE¼ sec.30, T.110 N., R.20 W., Rice County, at mill dam upstream from bridge on State Highway 3, in Faribault, Minn. | - | 1965-67 | 10-30-67<br>11-20-67<br>12-19-67<br>1-22-68<br>2-22-68<br>3-25-68<br>5-1-68<br>5-28-68<br>7-3-68<br>8-2-68<br>9-12-68 | 11.7<br>3.67<br>11.9<br>*7.51<br>11.9<br>20.7<br>31.0<br>66.5<br>50.4<br>222<br>81.4 |
| Prairie Creek | Cannon River | On line between secs.21 and 28, T.112 N., R.18 W., Goodhue County, at bridge on State Highway 19, 4.5 miles southwest of Cannon Falls, Minn. | - | 1966-67 | 10-31-67<br>4-19-68<br>5-13-68<br>7-5-68<br>8-5-68<br>8-26-68 | *8.16<br>*7.37<br>*6.16<br>8.24<br>14.7<br>12.3 |
| Little Cannon River | Cannon River | SW¼ sec.25, T.112 N., R.18 W., Goodhue County, at bridge on county highway, 2.5 miles south of Cannon Falls, Minn. | - | 1966-67 | 10-31-67<br>4-19-68<br>5-13-68<br>7-5-68<br>8-8-68<br>8-26-68 | *14.5<br>*5.83<br>*11.4<br>*23.9<br>29.4<br>*21.0 |

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1968

| Stream | Tributary to | Location | Drainage area (sq mi) | Measured previously (water years) | Measurements | |
|---|---|---|---|---|---|---|
| | | | | | Date | Discharge (cfs) |
| **Cannon River basin--continued** | | | | | | |
| Belle Creek | Cannon River | SE¼ sec.4, T.112 N., R.16 W., Goodhue County, at bridge on county highway, 2 miles north of Vasa, Minn. | - | 1966-67 | 4-19-68<br>5-13-68<br>7-5-68<br>8-8-68<br>9-10-68 | 0<br>*5.54<br>13.0<br>14.7<br>19.1 |
| **Zumbro River basin** | | | | | | |
| South Fork Zumbro River | Zumbro River | NE¼NE¼ sec.18, T.106 N., R.14 W., Olmsted County, at bridge on county road, 1.2 miles above Mayowood Lake Dam, and 3.2 miles southwest of Rochester, Minn. | - | - | 3-22-68 | 13.0 |
| **Burns Valley Creek basin** | | | | | | |
| Burns Valley Creek | Mississippi River | SE¼ sec.35, T.107 N., R.7 W., Winona County, at bridge on County Highway 17, at southeast edge of Winona, Minn. | - | 1967 | 4-22-68 | 6.41 |
| **Pleasant Valley Creek basin** | | | | | | |
| Pleasant Valley Creek | Mississippi River | On line between sec.36, T.107 N., R.7 W., and sec.1, T.106 N., R.7 W., Winona County, at bridge on County Highway 15, at southeast edge of Winona, Minn. | - | 1967 | 4-22-68 | 7.59 |
| **Mississippi River main stem** | | | | | | |
| Mississippi River | Gulf of Mexico | At lock and dam No. 8, Vernon County, near Genoa, Wis. | - | 1966-67 | 7-23-68 | 61,600 |
| **Des Moines River basin** | | | | | | |
| West Fork Des Moines River | Des Moines River | Near center of sec.20, T.105 N., R.38 W., Cottonwood County, at outlet of Talcot Lake, 3.2 miles northeast of Dundee, Minn. | - | 1963-67 | 10-12-67<br>11-15-67<br>12-11-67<br>1-9-68<br>2-12-68<br>3-11-68<br>3-19-68<br>4-8-68<br>5-10-68<br>7-10-68<br>8-21-68<br>9-19-68 | 0<br>*.36<br>*.33<br>*.38<br>*.34<br>*.26<br>116<br>.78<br>.36<br>9.86<br>29.3<br>74.6 |
| **Big Sioux River basin** | | | | | | |
| Rock River | Big Sioux River | NE¼SE¼ sec.11, T.102 N., R.45 W., Rock County, at dam in Luverne, Minn. | 440 | 1911-14≠ | 10-12-67<br>9-18-68 | 5.07<br>10.6 |

* Base flow.
≠ Operated as a continuous-record gaging station.

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

# WATER RESOURCES DATA FOR MINNESOTA

1968

Part 2. Water Quality Records

Prepared in cooperation with

Minnesota Department of Conservation, Division of Waters, Soils, and Minerals
Corps of Engineers, U. S. Army

Copies of this report may be obtained from
District Chief, Water Resources Division
U.S. Geological Survey
1033 Post Office Building
St. Paul, Minnesota 55101

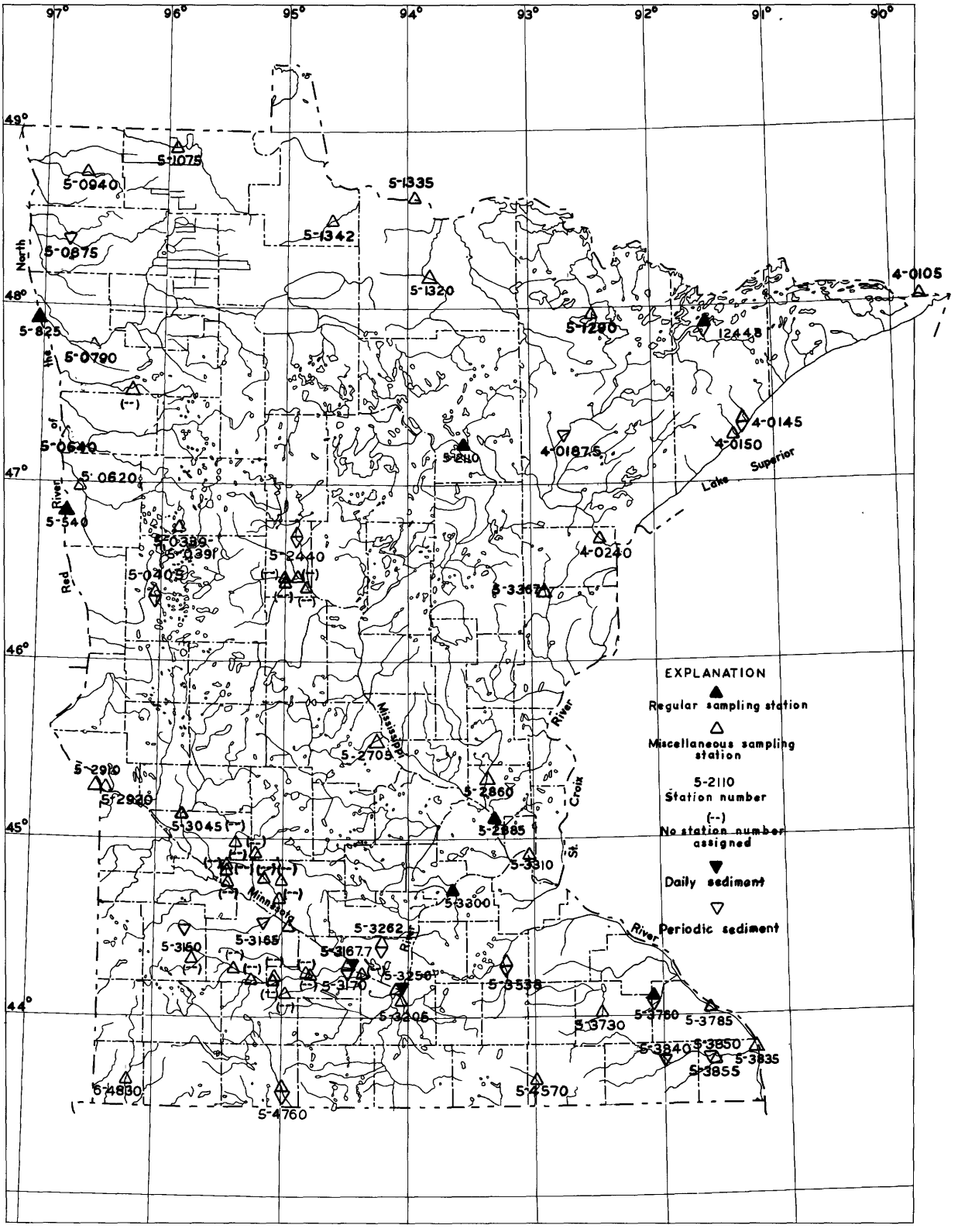


Figure 1.-- Map showing location of water-quality stations in Minnesota.

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Part 2. Water Quality Records

[*Symbols after station name designate type of data: c, chemical; t, water temperature; s, sediment*]

# ILLUSTRATIONS

# WATER RESOURCES DATA FOR MINNESOTA, 1968

## Part 2. Water Quality Records

## INTRODUCTION

Water-resources investigations of the U.S. Geological Survey include the collection of water quality data on the chemical and physical characteristics of surface- and ground-water supplies of the Nation. These data for the 1968 water year for the quality of surface waters in Minnesota are presented in this report. Data for a few water quality stations in bordering States are also included. The data were collected by the Water Resources Division of the U.S. Geological Survey under the direction of, Charles R. Collier, District Chief.

Water quality information is presented for chemical quality, water temperatures, and fluvial sediment. Chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-adsorption-ratio, specific conductance, and pH. Water-temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. Fluvial-sediment information is given for suspended-sediment discharges and concentrations and for particle-size distribution of suspended sediment and bed material.

The Geological Survey, from 1941 through 1965, published an annual series of water-supply papers, "Quality of Surface Waters of the United States," which contained the chemical quality, temperature, and suspended-sediment data of the water. Each volume covered an area whose boundaries coincided with those of certain natural drainage areas. The records for Minnesota are contained in Parts 4, 5, and 6 of the water-supply paper series. (See table 3, p. .) These publications are available in most public libraries. Beginning with the 1964 water year, water quality records for surface water obtained by the Geological Survey were published in a new series of annual releases on a state boundary basis. This report is primarily for local and immediate use, and its distribution is limited. The records will be published in Geological Survey water-supply papers.

Prior to the 1968 water year, data for chemical constituents and concentration of suspended sediment were reported

in parts per million (ppm) and water temperatures were reported in degrees Fahrenheit (°F). In October 1967 the U.S. Geological Survey began to use the metric system; data for chemical constituents and concentrations of suspended sediment are now reported in milligrams per liter (mg/l) and water temperatures are given in degrees Celsius (centigrade, °C). In waters with a density of 1.000 g/ml (grams per milliliter), parts per million and milligrams per liter can be considered equal. In waters with a density greater than 1.000 g/ml, values in parts per million should be multiplied by the density to convert to milligrams per liter. To convert temperatures in degrees Fahrenheit to degrees Celsius, subtract 32° and divide by 1.8. (See section "Definition of Terms and Abbreviations" for further information.)

## COOPERATION

Most of the records for Minnesota were obtained as a part of a cooperative program with the Minnesota Department of Conservation, Division of Waters, Soils, and Minerals, Eugene R. Gere, Director. Some records for the Red River of the North, which borders the State on the west, were obtained at the request of other Federal agencies as a part of the program of the U.S. Department of the Interior for development of the Missouri River basin.

## DEFINITION OF TERMS AND ABBREVIATIONS

The terms and abbreviations of water-quality and hydrologic data, as used in the text and tabular data of this report, are defined below:

Acre-foot (ac-ft) is a quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or 325,851 gallons.

Biochemical oxygen demand (BOD) is the amount of oxygen required by bacteria while stablizing decomposable organic matter under aerobic conditions.

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.

Chemical oxygen demand (COD) indicates the quantity of oxidizable compounds present in a water and will vary with water compositions, concentration of reagent, temperature, period of contact, and other factors.

Coliform organisms are a group of bacteria used as an indicator of the sanitary quality of the water. The number of coliform colonies per 100 milliliters is determined by the delayed incubation membrane filter method.

Cubic foot per second (cfs) is the rate of discharge through a cross-sectional area of 1 square foot of a stream at an average velocity of 1 foot per second.

Discharge, in its simplest concept, means outflow; therefore, the use of this term is not restricted as to course or location. In this report it represents the total fluids measured in the stream.

> Mean discharge is the arithmetic mean of individual daily mean discharges during a specific period.
>
> Instantaneous discharge is the discharge at time of sampling. If this discharge is reported instead of the daily mean, the heading of the discharge column is "Discharge (cfs)."

Drainage area of a stream above a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the river above the specified point.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

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

Hardness of water is the property of water attributable to the presence of alkaline earths and is expressed as equivalent calcium carbonate ($CaCO_3$). Hardness is a physical-chemical characteristic, not a substance.

Hydrologic bench-mark station is one that provides hydrologic data for a basin in which the hydrologic regimes will likely be governed solely by natural conditions. Data collected at a bench-mark station may be used to separate effects

of natural from manmade changes in other basins which have been developed and in which the physiography, climate, and geology are similar to those in the undeveloped bench-mark basin.

Methylene blue active substance (MBAS) is a measure of apparent detergents. This determination depends on the formation of a blue color when methylene blue dye reacts with synthetic detergent compounds.

Milligrams per liter (mg/l) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the weight of solute per unit volume of water. Milligrams per liter may be converted to milliequivalents per liter by multiplying by the factors in table 1, page . Concentration of suspended sediment expressed in milligrams per liter is based on the weight of sediment in a liter of water-sediment mixture. Sediment concentrations that are expressed in parts per million may be converted to milligrams per liter by using the factors in table 2, page .

Most probable number (MPN) is computed from probability analysis based on the number of positive findings of coliform group organisms resulting from multiple-dilation decimal dilutions. (Standard Methods, 12th edition, p. 604)

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

Particle size is the diameter, in millimeters (mm), of suspended sediment or bed material determined by sieve and sedimentation methods.

Particle size classification, used in this report agrees closely with recommendations made by the American Geophysical Union Subcommittee on Sediment Terminology (Lane and others, 1947, p. 937). The classification is as follows:

| | |
|---|---|
| Clay: | Smaller than 0.004 mm. |
| Silt: | Between 0.004 and 0.062 mm. |
| Sand: | Between 0.062 and 2.0 mm. |
| Gravel: | Between 2.0 and 64.0 mm. |

The particle size distributions given in this report are not necessarily representative of the particle sizes of sediment in transport in the natural stream. Most of the organic matter is removed and the sample is subjected to mechanical and

chemical dispersion before analysis of the silt and clay.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Sediment discharge is the rate at which dry weight of sediment passes a section of a stream or is the quantity of sediment, as measured by dry weight, or by volume, that is discharged in a given time.

Solute is any substance derived from the atmosphere, vegetation, soil, or rocks and is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current and is expressed in micromhos per centimeter at 25°C. Because the specific conductance is related to the number and specific chemical types of ions in solution, it can be used for approximating the dissolved-solids content in the water. Commonly, the amount of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in micromhos). This relation is not constant from stream to stream or from well to well, and it may even vary in the same source with changes in the composition of the water.

Sodium adsorption ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions with soil and is an index of sodium or alkali hazard to the soil. This ratio should be known especially for water used for irrigating farmland.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff." Streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Table 1.--Factors for conversion of chemical constituents in milligrams per liter to milliequivalents per liter

| Ion | Multiply by | Ion | Multiply by |
|---|---|---|---|
| Aluminum ($Al^{+3}$)..... | 0.11119 | Iodide ($I^{-1}$)..... | 0.00788 |
| Ammonia as $NH_4^{+1}$..... | .05544 | Iron ($Fe^{+3}$)..... | .05372 |
| Barium ($Ba^{+2}$)..... | .01456 | Lead ($Pb^{+2}$)..... | .00965 |
| Bicarbonate ($HCO_3^{-1}$) | .01639 | Lithium ($Li^{+1}$)..... | .14411 |
| Bromide ($Br^{-1}$)..... | .01251 | Magnesium ($Mg^{+2}$).. | .08226 |
| Calcium ($Ca^{+2}$)..... | .04990 | Manganese ($Mn^{+2}$).. | .03640 |
| Carbonate ($CO_3^{-2}$).... | .03333 | Nickel ($Ni^{+2}$)..... | .03406 |
| Chloride ($Cl^{-1}$)..... | .02821 | Nitrate ($NO_3^{-1}$)... | .01613 |
| Chromium ($Cr^{+6}$)..... | .11539 | Nitrite ($NO_2^{-1}$)... | .02174 |
| Cobalt ($Co^{+2}$)..... | .03394 | Phosphate ($PO_4^{-3}$). | .03159 |
| Copper ($Cu^{+2}$)..... | .03148 | Potassium ($K^{+1}$)... | .02557 |
| Cyanide ($CN^{-1}$)..... | .03844 | Sodium ($Na^{+1}$)..... | .04350 |
| Fluoride ($F^{-1}$)..... | .05264 | Strontium ($Sr^{+2}$).. | .02283 |
| Hydrogen ($H^{+1}$)..... | .99209 | Sulfate ($SO_4^{-2}$)... | .02082 |
| Hydroxide ($OH^{-1}$)..... | .05880 | Zinc ($Zn^{+2}$)..... | .03060 |

Table 2.--Factors for conversion of sediment concentration in parts per million to milligrams per liter* (All values calculated to three significant figures)

| Range of concentration (ppm) | Multiply by | Range of concentration (ppm) | Multiply by |
|---|---|---|---|
| 0 - 15,900 | 1.00 | 322,000 - 341,000 | 1.26 |
| 16,000 - 46,800 | 1.02 | 342,000 - 361,000 | 1.28 |
| 46,900 - 76,500 | 1.04 | 362,000 - 380,000 | 1.30 |
| 76,600 - 105,000 | 1.06 | 381,000 - 399,000 | 1.32 |
| 106,000 - 133,000 | 1.08 | 400,000 - 416,000 | 1.34 |
| 134,000 - 159,000 | 1.10 | 417,000 - 434,000 | 1.36 |
| 160,000 - 185,000 | 1.12 | 435,000 - 451,000 | 1.38 |
| 186,000 - 210,000 | 1.14 | 452,000 - 467,000 | 1.40 |
| 211,000 - 233,000 | 1.16 | 468,000 - 483,000 | 1.42 |
| 234,000 - 256,000 | 1.18 | 484,000 - 498,000 | 1.44 |
| 257,000 - 279,000 | 1.20 | 499,000 - 514,000 | 1.46 |
| 280,000 - 300,000 | 1.22 | 515,000 - 528,000 | 1.48 |
| 301,000 - 321,000 | 1.24 | 529,000 - 542,000 | 1.50 |

*Based on water density of 1.000 g/ml and sediment density of 2.65 g/cc.

Thermograph is a thermometer that continuously and automatically records, on a chart, the water temperature of a stream. "Temperature recorder" is the term used to indicate the location of the thermograph.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the water year.

Tons per acre-foot indicates the dry weight of dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration in milligrams per liter by 0.00136.

Tons per day is the quantity of a substance in solution or suspension that passes a stream section during a 24-hour period.

Water year in Geological Survey reports dealing with surface water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1968, is called the "1968 water year."

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

## STATION NUMBERS

A station number has been assigned as an added means of identification for each stream location where regular measurements of streamflow and determinations of water quality have been made. The numbers have been assigned to conform with the standard downstream order of listing gaging stations. The numbering system consists of 2 digits followed by a hyphen and

a 6-digit number. The notation to the left of the hyphen identifies the Part or hydrologic region used by the Geological Survey for reporting hydrologic data. The number to the right of the hyphen represents the position of the location in the standard downstream order listing the stations within each of the parts. The assigned numbers are in numerical order but are not consecutive. They are so selected from the complete 6-digit-number scale that intervening numbers will be available for future assignments to new locations. The identification number for each station in this report is printed to the left of the station name and contains only the essential digits. For example, the number is printed as 5-3310 for a station whose complete identification number is 05-3310.00.

## COLLECTION AND EXAMINATION OF SAMPLES

Water samples for analyses usually are collected at or near points on streams where gaging stations are maintained by the U.S. Geological Survey for measurement of water discharge. Discharge records for streams in Minnesota are contained in Part 1 of this report. Most of these records are used in conjunction with the computations of the chemical constituents and sediment loads in this report.

Data on the quality of surface water were collected daily at some sites and less frequently at other sites; the locations of the sites are shown on the map on page .

### Solutes

The methods of collecting and analyzing water samples for determining the kinds and concentrations of solutes are described by Rainwater and Thatcher (1960). One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge depending on the source of material and the turbulence and the mixing of the stream. Some streams must be sampled at several verticals across the channel to determine accurately the solute load.

The daily chemical quality data in this report generally represent equal-volume composites for 2- to 30-day periods; the composite periods are selected on the basis of specific conductance of the daily samples and fluctuation of water discharge.

## Temperature

Water temperatures were measured at most of the water quality stations. For daily stations, the water temperatures were taken at about the same time each day in order that the data would not reflect normal variations in water temperature. Most large streams have a small diurnal variation in water temperature; small, shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature.

At stations where thermographs are located, the records consist of maximum and minimum temperatures for each day and the monthly averages of maximum daily and minimum daily temperatures.

## Sediment

At some stations, suspended-sediment samples were collected daily with depth-integrating cable-suspended samplers from a fixed sampling point. A hand sampler was used at many stations during periods of low flow. Depth-integrated samples were collected periodically at many verticals in the cross section to determine the ratio of the cross sectional distribution of the concentration of suspended sediment to the daily sampling verticals.

During periods of high or rapidly changing flow, samples were taken twice or more often throughout the day at most stations. For periods when no samples were collected, daily loads of suspended sediment were estimated on the basis of water discharge, sediment concentrations observed immediately before and after the periods, and suspended-sediment loads for other periods of similar discharge.

At other stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow in predicting long-term sediment-discharge characteristics of the stream.

In addition to the records of the quantities of suspended sediment, records of periodic measurements of the particle size distribution of the suspended sediment and bed material are included.

## WATER-SUPPLY PAPERS

Table 3 below, shows the annual series of water-supply papers that give information on quality of surface waters in Minnesota. Data for streams in the St. Lawrence River basin (northeastern Minnesota) are given in Part 4. Those for streams in the Hudson Bay, Upper Mississippi River, and Missouri River basins are given in Parts 5 and 6.

Table 3.--Water-supply paper numbers and parts, water years, 1941-65

| Water year | Parts 1-14 | Parts 1-4 | Parts 3-4 | Parts 5-6 | Water year | Parts 1-14 | Parts 1-4 | Parts 3-4 | Parts 5-6 |
|---|---|---|---|---|---|---|---|---|---|
| 1941 | 942 | --- | --- | --- | 1954 | --- | 1350 | --- | 1351 |
| 1942 | 950 | --- | --- | --- | 1955 | --- | 1400 | --- | 1401 |
| 1943 | 970 | --- | --- | --- | 1956 | --- | 1450 | --- | 1451 |
| 1944 | 1022 | --- | --- | --- | 1957 | --- | 1520 | --- | 1521 |
| 1945 | 1030 | --- | --- | --- | 1958 | --- | 1571 | --- | 1572 |
| 1946 | 1050 | --- | --- | --- | 1959 | --- | --- | 1642 | 1643 |
| 1947 | 1102 | --- | --- | --- | 1960 | --- | --- | 1742 | 1743 |
| 1948 | --- | 1132 | --- | 1132 | 1961 | --- | --- | 1882 | 1883 |
| 1949 | --- | 1162 | --- | 1162 | 1962 | --- | --- | 1942 | 1943 |
| 1950 | --- | 1186 | --- | 1187 | 1963 | --- | --- | 1948 | 1949 |
| 1951 | --- | 1197 | --- | 1198 | 1964 | --- | --- | A1955 | A1956 |
| 1952 | --- | 1250 | --- | 1251 | 1965 | --- | --- | A1962 | A1963 |
| 1953 | --- | 1290 | --- | 1291 | | | | | |

A In preparation.

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_____ 1957, Some fundamentals of particle size analysis: Rept. 12.

_____ 1959, Federal Inter-agency sedimentation instruments and reports: Rept. AA.

_____ 1961, The single stage sampler for suspended sediment: Rept. 13.

_____ 1963, Determinations of fluvial sediment discharge: Rept. 14.

_____ 1963, A summary of the work of the Inter-agency sedimentation project: Rept. S.

## RED RIVER OF THE NORTH BASIN

### 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., Cass County, at gaging station at city waterplant 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.--Chemical analyses: October 1955 to September 1968.
Water temperatures: October 1955 to September 1968.
EXTREMES, 1967-68.--Dissolved solids: Maximum, 409 mg/l Apr. 25 to May 18; minimum, 251 mg/l Sept. 1-25.
Hardness: Maximum, 304 mg/l Feb. 1-29; minimum, 214 mg/l Dec. 1-25, Sept. 26-30.
Specific conductance: Maximum daily, 694 micromhos May 1; minimum daily, 306 micromhos Dec. 3.
Water temperatures: Maximum, 26°C on several days during July; minimum, 2°C on many days during November to March.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | MEAN DISCHARGE (CFS) | SILICA (SIO2) | TOTAL IRON (FE) | CALCIUM (CA) | MAGNESIUM (MG) | SODIUM (NA) | POTASSIUM (K) | BICARBONATE (HCO3) | CARBONATE (CO3) | SULFATE (SO4) | CHLORIDE (CL) | FLUORIDE (F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | | | |
| 01-27 | 167 | -- | -- | -- | -- | 10 | -- | 273 | 0 | 36 | -- | -- |
| 28... | 208 | 2.9 | .13 | 46 | 31 | 10 | 4.9 | 273 | 2 | 29 | 4.4 | .3 |
| 29-31 | 164 | -- | -- | -- | -- | 10 | -- | 278 | 0 | 31 | -- | -- |
| NOV. | | | | | | | | | | | | |
| 01-30 | 164 | -- | -- | -- | -- | 10 | -- | 278 | 0 | 31 | -- | -- |
| DEC. | | | | | | | | | | | | |
| 01-25 | 169 | -- | -- | -- | -- | 13 | -- | 229 | 0 | 41 | -- | -- |
| 26... | 148 | 11 | .05 | 38 | 37 | 14 | 4.9 | 262 | 9 | 48 | 5.0 | .3 |
| 27-31 | 137 | -- | -- | -- | -- | 13 | -- | 328 | 0 | 40 | -- | -- |
| JAN. | | | | | | | | | | | | |
| 01-31 | 137 | -- | -- | -- | -- | 13 | -- | 328 | 0 | 40 | -- | -- |
| FEB. | | | | | | | | | | | | |
| 01-29 | 135 | -- | -- | -- | -- | 14 | -- | 344 | 0 | 36 | -- | -- |
| MAR. | | | | | | | | | | | | |
| 01-25 | 342 | -- | -- | -- | -- | 17 | -- | 283 | 0 | 62 | -- | -- |
| 26... | 496 | 11 | .08 | 45 | 26 | 15 | 4.8 | 207 | 0 | 68 | 6.1 | .1 |
| 27-31 | 416 | -- | -- | -- | -- | 14 | -- | 216 | 0 | 65 | -- | -- |
| APR. | | | | | | | | | | | | |
| 01-11 | 416 | -- | -- | -- | -- | 14 | -- | 216 | 0 | 65 | -- | -- |
| 12-17 | 598 | -- | -- | -- | -- | 20 | -- | 220 | 0 | 101 | -- | -- |
| 18-24 | 463 | -- | -- | -- | -- | 22 | -- | 228 | 0 | 118 | -- | -- |
| 25-30 | 675 | -- | -- | -- | -- | 25 | -- | 254 | 0 | 114 | -- | -- |
| MAY | | | | | | | | | | | | |
| 01-18 | 675 | -- | -- | -- | -- | 25 | -- | 254 | 0 | 114 | -- | -- |
| 19... | 772 | 7.8 | .03 | 52 | 34 | 25 | 2.0 | 256 | 0 | 106 | 8.6 | .2 |
| 20-31 | 649 | -- | -- | -- | -- | 20 | -- | 257 | 0 | 77 | -- | -- |
| JUNE | | | | | | | | | | | | |
| 01-30 | 649 | -- | -- | -- | -- | 20 | -- | 257 | 0 | 77 | -- | -- |
| JULY | | | | | | | | | | | | |
| 01-08 | 578 | -- | -- | -- | -- | 13 | -- | 243 | 0 | 45 | -- | -- |
| 09-31 | 386 | -- | -- | -- | -- | 10 | -- | 252 | 0 | 30 | -- | -- |
| AUG. | | | | | | | | | | | | |
| 01-31 | 223 | -- | -- | -- | -- | 10 | -- | 252 | 0 | 27 | -- | -- |
| SEPT. | | | | | | | | | | | | |
| 01-25 | 141 | -- | -- | -- | -- | 8.9 | -- | 250 | 0 | 29 | -- | -- |
| 26-30 | 233 | 5.9 | -- | 41 | 27 | 10 | 4.1 | 248 | 0 | 35 | 4.0 | .1 |

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

EXTREMES, 1955-68.--Dissolved solids (1955-58, 1959-68): Maximum, 650 mg/l May 6-9, 1958; minimum, 174 mg/l Dec. 1-2, 1955.
Hardness: Maximum, 420 mg/l May 6-9, 1958; minimum, 118 mg/l Apr. 6-17, 1962.
Specific conductance: Maximum daily, 960 micromhos May 6, 1958; minimum daily, 223 micromhos Apr. 11, 1962.
Water temperatures: Maximum, 28°C on several days in 1957, 1960, and 1964; minimum, 1°C on many days in 1956 and 1959.
REMARKS.--Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Daily samples for chemical analysis composited by discharge. Water temperature, measured in waterplant, modified slightly in transit.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | NITRATE (NO3) | ORTHO PHOS-PHATE (PO4) | BORON (B) | DIS-SOLVED SOLIDS (RESI-DUE AT 180 C) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | | | |
| 01-27 | -- | -- | -- | 276 | .38 | 124 | 244 | 20 | .3 | 469 | 7.8 | -- |
| 28... | .0 | .10 | .06 | 278 | .38 | 156 | 243 | 16 | .3 | 474 | 8.3 | -- |
| 29-31 | -- | -- | -- | 276 | .38 | 122 | 240 | 11 | .3 | 467 | 7.8 | -- |
| NOV. | | | | | | | | | | | | |
| 01-30 | -- | -- | -- | 276 | .38 | 122 | 240 | 11 | .3 | 467 | 7.8 | -- |
| DEC. | | | | | | | | | | | | |
| 01-25 | -- | -- | -- | 254 | .35 | 116 | 214 | 26 | .4 | 436 | 7.9 | -- |
| 26... | .0 | -- | .59 | 316 | .43 | 126 | 245 | 15 | .4 | 523 | 8.5 | -- |
| 27-31 | -- | -- | -- | 341 | .46 | 126 | 291 | 22 | .3 | 565 | 7.7 | -- |
| JAN. | | | | | | | | | | | | |
| 01-31 | -- | -- | -- | 341 | .46 | 126 | 291 | 22 | .3 | 565 | 7.7 | -- |
| FEB. | | | | | | | | | | | | |
| 01-29 | -- | -- | -- | 357 | .49 | 130 | 304 | 22 | .3 | 586 | 7.9 | -- |
| MAR. | | | | | | | | | | | | |
| 01-25 | -- | -- | -- | 341 | .46 | 315 | 271 | 39 | .4 | 560 | 7.6 | -- |
| 26... | 1.3 | .53 | .06 | 286 | .39 | 383 | 219 | 49 | .4 | 471 | 7.8 | -- |
| 27-31 | -- | -- | -- | 291 | .40 | 327 | 222 | 44 | .4 | 472 | 7.9 | -- |
| APR. | | | | | | | | | | | | |
| 01-11 | -- | -- | -- | 291 | .40 | 327 | 222 | 44 | .4 | 472 | 7.9 | -- |
| 12-17 | -- | -- | -- | 347 | .47 | 560 | 253 | 72 | .5 | 551 | 7.7 | -- |
| 18-24 | -- | -- | -- | 381 | .52 | 476 | 276 | 88 | .6 | 599 | 7.7 | -- |
| 25-30 | -- | -- | -- | 409 | .56 | 745 | 291 | 83 | .6 | 626 | 7.6 | -- |
| MAY | | | | | | | | | | | | |
| 01-18 | -- | -- | -- | 409 | .56 | 745 | 291 | 83 | .6 | 626 | 7.6 | -- |
| 19... | .3 | .33 | .08 | 378 | .51 | 788 | 269 | 59 | .7 | 594 | 7.5 | 8 |
| 20-31 | -- | -- | -- | 346 | .47 | 606 | 262 | 51 | .5 | 549 | 7.7 | -- |
| JUNE | | | | | | | | | | | | |
| 01-30 | -- | -- | -- | 346 | .47 | 606 | 262 | 51 | .5 | 549 | 7.7 | -- |
| JULY | | | | | | | | | | | | |
| 01-08 | -- | -- | -- | 274 | .37 | 428 | 228 | 29 | .4 | 464 | 7.9 | -- |
| 09-31 | -- | -- | -- | 269 | .37 | 280 | 220 | 13 | .3 | 441 | 7.9 | -- |
| AUG. | | | | | | | | | | | | |
| 01-31 | -- | -- | -- | 252 | .34 | 152 | 217 | 11 | .3 | 426 | 7.8 | -- |
| SEPT. | | | | | | | | | | | | |
| 01-25 | -- | -- | -- | 251 | .34 | 95 | 227 | 22 | .3 | 433 | 7.7 | -- |
| 26-30 | .1 | -- | .09 | 265 | .36 | 167 | 214 | 11 | .3 | 445 | 7.8 | -- |

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

SPECIFIC CONDUCTANCE (MICROMHOS AT 25°C), WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCTOBER | NOVEMBER | DECEMBER | JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1..... | 496 | 462 | 419 | 551 | 594 | 585 | 443 | 694 | 541 | 465 | 405 | 427 |
| 2..... | 496 | 459 | 347 | 551 | 586 | 586 | 451 | 632 | 533 | 436 | 400 | 423 |
| 3..... | 489 | 459 | 306 | 556 | 577 | 588 | 449 | 678 | 528 | 464 | 398 | 425 |
| 4..... | 501 | 459 | 307 | 556 | 586 | 582 | 476 | 690 | 530 | 472 | 412 | 425 |
| 5..... | 529 | 462 | 401 | 567 | 584 | 572 | 503 | 690 | 530 | 466 | 400 | 425 |
| 6..... | 546 | 462 | 375 | 576 | 580 | 567 | 496 | 668 | 527 | 458 | 402 | 437 |
| 7..... | 527 | 460 | 396 | 567 | 576 | 551 | 471 | 680 | 525 | 454 | 401 | 427 |
| 8..... | 469 | 460 | 402 | 564 | 578 | 539 | 478 | 640 | 531 | 454 | 397 | 427 |
| 9..... | 439 | 460 | 380 | 564 | 589 | 533 | 486 | 628 | 538 | 447 | 408 | 427 |
| 10..... | 439 | 459 | 415 | 573 | 579 | 537 | 483 | 620 | 528 | 442 | 434 | 425 |
| 11..... | 443 | 454 | 440 | 568 | 563 | 578 | 479 | 614 | 528 | 438 | 438 | 419 |
| 12..... | 447 | 459 | 405 | 568 | 577 | 611 | 502 | 620 | 528 | 439 | 440 | 419 |
| 13..... | 449 | 457 | 417 | 566 | 589 | 529 | 470 | 594 | 535 | 439 | 435 | 425 |
| 14..... | 448 | 463 | 425 | 564 | 586 | 522 | 490 | 604 | 510 | 450 | 448 | 423 |
| 15..... | 449 | 466 | 428 | 564 | 588 | 498 | 578 | 595 | 580 | 433 | 465 | 421 |
| 16..... | 452 | 468 | 358 | 577 | 588 | 487 | 593 | 605 | 582 | 430 | 430 | 414 |
| 17..... | 452 | 473 | 375 | 581 | 580 | 480 | 593 | 624 | 576 | 424 | 409 | 414 |
| 18..... | 446 | 477 | 428 | 575 | 581 | 531 | 618 | 621 | 547 | 424 | 425 | 420 |
| 19..... | 446 | 477 | 420 | 576 | 578 | 568 | 602 | 610 | 561 | 442 | 422 | 428 |
| 20..... | 446 | 462 | 426 | 582 | 570 | 651 | 575 | 605 | 567 | 455 | 418 | 430 |
| 21..... | 449 | 467 | 483 | 574 | 568 | 566 | 594 | 583 | 528 | 443 | 418 | 436 |
| 22..... | 451 | 462 | 438 | 587 | 572 | 556 | 604 | 580 | 518 | 434 | 416 | 411 |
| 23..... | 455 | 474 | 482 | 580 | 565 | 564 | 576 | 604 | 507 | 434 | 409 | 416 |
| 24..... | 456 | 472 | 454 | 580 | 581 | 508 | 576 | 595 | 528 | 434 | 408 | 426 |
| 25..... | 458 | 474 | 380 | 575 | 579 | 495 | 584 | 579 | 533 | 434 | 405 | 427 |
| 26..... | 460 | 481 | 438 | 584 | 583 | 469 | 528 | 593 | 517 | 436 | 408 | 437 |
| 27..... | 461 | 483 | 426 | 587 | 588 | 451 | 538 | 606 | 503 | 428 | 418 | 444 |
| 28..... | 464 | 496 | 486 | 598 | 585 | 479 | 532 | 595 | 511 | 425 | 414 | 444 |
| 29..... | 464 | 501 | 425 | 586 | 576 | 446 | 607 | 559 | 495 | 414 | 422 | 427 |
| 30..... | 464 | 496 | 442 | 579 | -- | 419 | 666 | 556 | 453 | 409 | 414 | 426 |
| 31..... | 461 | -- | 380 | 576 | -- | 419 | -- | 547 | -- | 409 | 421 | -- |
| AVERAGE | 466 | 468 | 409 | 572 | 580 | 531 | 534 | 616 | 530 | 439 | 417 | 425 |

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| MONTH | DAY 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCTOBER.. | 14 | 15 | 15 | 16 | 15 | 14 | 14 | 14 | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 11 | 11 | 11 | 9 | 10 | 10 | 9 | 9 | 9 | 7 | 7 | 7 | 6 | 5 | 6 | 11 |
| NOVEMBER. | 6 | 6 | 6 | 6 | 6 | 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | -- | 4 |
| DECEMBER. | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| JANUARY.. | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| FEBRUARY. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | -- | -- | 2 |
| MARCH.... | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| APRIL.... | 3 | 4 | 6 | 5 | 5 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 9 | 9 | 9 | 11 | 12 | 10 | 11 | 11 | 11 | 12 | 10 | 9 | 9 | 9 | 9 | 11 | 12 | -- | | 8 |
| MAY..... | 13 | 15 | 16 | 16 | 16 | 14 | 13 | 13 | 12 | 12 | 13 | 14 | 14 | 15 | 16 | 14 | 12 | 13 | 13 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 16 | 17 | 17 | 16 | 17 | 14 |
| JUNE..... | 17 | 18 | 18 | 20 | 21 | 21 | 21 | 21 | 21 | 22 | 22 | 21 | 21 | 21 | 21 | 21 | 20 | 21 | 20 | 21 | 21 | 21 | 21 | 22 | 21 | 21 | 21 | 21 | 21 | 21 | -- | 21 |
| JULY..... | 21 | 19 | 19 | 20 | 21 | 21 | 21 | 23 | 23 | 23 | 23 | 24 | 24 | 24 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 23 | 23 | 23 | 23 |
| AUGUST... | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 24 | 24 | 23 | 23 | 23 | 23 | 21 | 21 | 21 | 20 | 19 | 20 | 21 | 21 | 22 | 22 | 23 | 22 | 21 | 21 | 20 | 21 | 21 | 20 | 22 |
| SEPTEMBER | 19 | 19 | 19 | 19 | 18 | 18 | 18 | 18 | 18 | 18 | 17 | 18 | 18 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 17 | 16 | 16 | 16 | 15 | 16 | -- | 18 |

## 5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.

LOCATION.--Lat 47°56'28", long 97°02'40", in SW¼NE¼ sec.33, T.152 N., R.50 W., Grand Forks County, at dam at Riverside Park in Grand Forks, 1,500 feet upstream from gaging station, 2 miles downstream from Red Lake River, and at mile 296.0.
DRAINAGE AREA.--30,100 sq mi, approximately.
RECORDS AVAILABLE.--Chemical analyses: September 1956 to September 1968.
Water temperatures: October 1956 to September 1968.
EXTREMES, 1967-68.--Dissolved solids: Maximum, 471 mg/l May 20-31; minimum, 259 mg/l July 18-25.
Hardness: Maximum, 328 mg/l May 20-31; minimum, 195 mg/l July 18-25.
Specific conductance: Maximum daily, 849 micromhos Mar. 16; minimum daily, 358 micromhos July 19.
Water temperatures: Maximum, 24°C July 15-17, Aug. 7; minimum, 2°C on many days during November to April.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | MEAN DISCHARGE (CFS) | SILICA (SIO2) | TOTAL IRON (FE) | CALCIUM (CA) | MAGNESIUM (MG) | SODIUM (NA) | POTASSIUM (K) | BICARBONATE (HCO3) | CARBONATE (CO3) | SULFATE (SO4) | CHLORIDE (CL) | FLUORIDE (F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | | | |
| 01-26 | 782 | -- | -- | -- | -- | 19 | -- | 241 | 0 | 45 | -- | -- |
| 27... | 749 | 13 | .10 | 51 | 24 | 15 | 3.0 | 252 | 0 | 40 | 8.6 | .2 |
| 28-31 | 707 | -- | -- | -- | -- | 18 | -- | 269 | 0 | 43 | -- | -- |
| NOV. | | | | | | | | | | | | |
| 01-30 | 707 | -- | -- | -- | -- | 18 | -- | 269 | 0 | 43 | -- | -- |
| DEC. | | | | | | | | | | | | |
| 01-31 | 718 | -- | -- | -- | -- | 28 | -- | 320 | 0 | 75 | -- | -- |
| JAN. | | | | | | | | | | | | |
| 01-31 | 592 | -- | -- | -- | -- | 28 | -- | 332 | 0 | 65 | -- | -- |
| FEB. | | | | | | | | | | | | |
| 01-29 | 540 | -- | -- | -- | -- | 25 | -- | 333 | 0 | 60 | -- | -- |
| MAR. | | | | | | | | | | | | |
| 01-18 | 754 | -- | -- | -- | -- | 31 | -- | 318 | 0 | 77 | -- | -- |
| 19-21 | 1650 | -- | -- | -- | -- | 30 | -- | 264 | 0 | 93 | -- | -- |
| 22-24 | 2630 | -- | -- | -- | -- | 22 | -- | 219 | 0 | 74 | -- | -- |
| 25... | 2600 | 12 | .02 | 47 | 21 | 19 | 7.1 | 188 | 0 | 74 | 9.0 | .2 |
| 26-31 | 2930 | -- | -- | -- | -- | 19 | -- | 200 | 0 | 84 | -- | -- |
| APR. | | | | | | | | | | | | |
| 01-30 | 2930 | -- | -- | -- | -- | 19 | -- | 200 | 0 | 84 | -- | -- |
| MAY | | | | | | | | | | | | |
| 01-18 | 1930 | -- | -- | -- | -- | 27 | -- | 276 | 0 | 124 | -- | -- |
| 19... | 2200 | 7.7 | .04 | 70 | 35 | 31 | 1.8 | 280 | 0 | 131 | 13 | .3 |
| 20-31 | 1780 | -- | -- | -- | -- | 31 | -- | 290 | 0 | 135 | -- | -- |
| JUNE | | | | | | | | | | | | |
| 01-06 | 1370 | -- | -- | -- | -- | 30 | -- | 288 | 0 | 126 | -- | -- |
| 07-08 | 4420 | -- | -- | -- | -- | 23 | -- | 276 | 0 | 104 | -- | -- |
| 09-13 | 8260 | -- | -- | -- | -- | 10 | -- | 184 | 0 | 64 | -- | -- |
| 14-20 | 5720 | -- | -- | -- | -- | 18 | -- | 220 | 0 | 115 | -- | -- |
| 21-30 | 3900 | -- | -- | -- | -- | 26 | -- | 245 | 0 | 124 | -- | -- |
| JULY | | | | | | | | | | | | |
| 01-17 | 2930 | -- | -- | -- | -- | 17 | -- | 250 | 0 | 91 | -- | -- |
| 18-25 | 7200 | -- | -- | -- | -- | 6.2 | -- | 176 | 0 | 58 | -- | -- |
| 26-31 | 3760 | -- | -- | -- | -- | 8.7 | -- | 210 | 0 | 74 | -- | -- |
| AUG. | | | | | | | | | | | | |
| 01-31 | 2160 | -- | -- | -- | -- | 11 | -- | 221 | 0 | 68 | -- | -- |
| SEPT. | | | | | | | | | | | | |
| 01... | 1780 | 8.5 | .03 | 58 | 21 | 10 | 4.3 | 225 | 0 | 62 | 11 | .3 |
| 02-30 | 1540 | -- | -- | -- | -- | 10 | -- | 221 | 0 | 61 | -- | -- |

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

EXTREMES, 1956-68.--Dissolved solids (1956-58, 1959-68): Maximum, 540 mg/l Jan. 21, 1962; minimum, 191 mg/l Mar. 24, 1966.
Hardness: Maximum, 468 mg/l Dec. 29-31, 1958; minimum, 126 mg/l Apr. 12, 1965.
Specific conductance: Maximum daily, 976 micromhos Dec. 29-31, 1958; minimum daily, 278 micromhos Mar. 26, 1966.
Water temperatures: Maximum, 28°C July 19, 1964; minimum, freezing point on many days in 1967.
REMARKS.--Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Daily samples for chemical analysis composited by discharge.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | NITRATE (NO3) | ORTHO PHOS-PHATE (PO4) | BORON (B) | DIS-SOLVED SOLIDS (RESI-DUE AT 180 C) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | | | |
| 01-26 | -- | -- | -- | 296 | .40 | 625 | 220 | 22 | .6 | 472 | 7.8 | -- |
| 27... | .3 | .48 | .07 | 288 | .39 | 582 | 224 | 17 | .4 | 478 | 7.6 | -- |
| 28-31 | -- | -- | -- | 321 | .44 | 613 | 238 | 18 | .5 | 518 | 8.0 | -- |
| NOV. | | | | | | | | | | | | |
| 01-30 | -- | -- | -- | 321 | .44 | 613 | 238 | 18 | .5 | 518 | 8.0 | -- |
| DEC. | | | | | | | | | | | | |
| 01-31 | -- | -- | -- | 429 | .58 | 832 | 315 | 53 | .7 | 669 | 8.0 | -- |
| JAN. | | | | | | | | | | | | |
| 01-31 | -- | -- | -- | 414 | .56 | 662 | 302 | 30 | .7 | 648 | 7.8 | -- |
| FEB. | | | | | | | | | | | | |
| 01-29 | -- | -- | -- | 403 | .55 | 588 | 302 | 29 | .6 | 634 | 8.0 | -- |
| MAR. | | | | | | | | | | | | |
| 01-18 | -- | -- | -- | 440 | .60 | 896 | 305 | 44 | .8 | 672 | 7.9 | -- |
| 19-21 | -- | -- | -- | 432 | .59 | 1930 | 268 | 52 | .8 | 647 | 7.8 | -- |
| 22-24 | -- | -- | -- | 337 | .46 | 2390 | 225 | 45 | .6 | 515 | 7.6 | -- |
| 25... | 3.0 | .74 | .07 | 301 | .41 | 2110 | 203 | 49 | .6 | 469 | 7.9 | 27 |
| 26-31 | -- | -- | -- | 327 | .44 | 2590 | 227 | 63 | .5 | 504 | 7.4 | -- |
| APR. | | | | | | | | | | | | |
| 01-30 | -- | -- | -- | 327 | .44 | 2590 | 227 | 63 | .5 | 504 | 7.4 | -- |
| MAY | | | | | | | | | | | | |
| 01-18 | -- | -- | -- | 449 | .61 | 2340 | 318 | 92 | .7 | 683 | 8.0 | -- |
| 19... | .3 | .49 | .10 | 461 | .63 | 2740 | 317 | 87 | .8 | 702 | 7.7 | 22 |
| 20-31 | -- | -- | -- | 471 | .64 | 2260 | 328 | 91 | .7 | 713 | 8.0 | -- |
| JUNE | | | | | | | | | | | | |
| 01-06 | -- | -- | -- | 450 | .61 | 1670 | 322 | 86 | .7 | 699 | 7.9 | -- |
| 07-08 | -- | -- | -- | 418 | .57 | 4990 | 300 | 74 | .6 | 635 | 8.0 | -- |
| 09-13 | -- | -- | -- | 274 | .37 | 6110 | 202 | 51 | .3 | 424 | 7.7 | -- |
| 14-20 | -- | -- | -- | 395 | .54 | 6100 | 279 | 99 | .5 | 576 | 7.4 | -- |
| 21-30 | -- | -- | -- | 436 | .59 | 4590 | 299 | 98 | .7 | 640 | 7.6 | -- |
| JULY | | | | | | | | | | | | |
| 01-17 | -- | -- | -- | 367 | .50 | 2900 | 269 | 64 | .5 | 552 | 7.6 | -- |
| 18-25 | -- | -- | -- | 259 | .35 | 5040 | 195 | 51 | .2 | 391 | 7.7 | -- |
| 26-31 | -- | -- | -- | 314 | .43 | 3190 | 233 | 61 | .2 | 459 | 7.7 | -- |
| AUG. | | | | | | | | | | | | |
| 01-31 | -- | -- | -- | 317 | .43 | 1850 | 235 | 53 | .3 | 474 | 7.5 | -- |
| SEPT. | | | | | | | | | | | | |
| 01... | 1.0 | -- | .16 | 372 | .51 | 1790 | 231 | 47 | .3 | 477 | 7.2 | -- |
| 02-30 | -- | -- | -- | 305 | .41 | 1270 | 240 | 59 | .3 | 476 | 7.5 | -- |

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

SPECIFIC CONDUCTANCE (MICROMHOS AT 25°C), WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCTOBER | NOVEMBER | DECEMBER | JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1..... | 409 | 511 | 567 | 654 | 620 | 670 | 385 | 664 | 724 | 609 | 490 | 420 |
| 2..... | 440 | 494 | 565 | 647 | 620 | 663 | 412 | 664 | 716 | 600 | 490 | 455 |
| 3..... | 454 | 490 | 568 | 652 | 622 | 663 | 416 | 649 | 711 | 574 | 488 | 444 |
| 4..... | 464 | 486 | 589 | 661 | 615 | 658 | 453 | 649 | 706 | 532 | 487 | 438 |
| 5..... | 459 | 499 | 624 | 657 | 618 | 659 | 453 | 652 | 702 | 542 | 496 | 434 |
| 6..... | 456 | 485 | 613 | 661 | 622 | 658 | 472 | 667 | 641 | 556 | 493 | 435 |
| 7..... | 459 | 505 | 616 | 657 | 624 | 661 | 472 | 690 | 665 | 556 | 493 | 446 |
| 8..... | 459 | 523 | 673 | 670 | 624 | 650 | 497 | 695 | 616 | 556 | 486 | 446 |
| 9..... | 462 | 507 | 684 | 678 | 636 | 648 | 502 | 690 | 382 | 545 | 490 | 441 |
| 10..... | 453 | 535 | 667 | 679 | 636 | 646 | 505 | 686 | 381 | 552 | 468 | 464 |
| 11..... | 456 | 497 | 696 | 675 | 637 | 623 | 520 | 700 | 402 | 554 | 462 | 441 |
| 12..... | 465 | 474 | 737 | 665 | 632 | 611 | 557 | 706 | 448 | 557 | 462 | 464 |
| 13..... | 480 | 471 | 706 | 674 | 636 | 609 | 549 | 695 | 475 | 554 | 463 | 478 |
| 14..... | 511 | 479 | 715 | 667 | 636 | 609 | 553 | 692 | 495 | 547 | 459 | 470 |
| 15..... | 483 | 502 | 715 | 660 | 633 | 670 | 565 | 690 | 583 | 539 | 465 | 467 |
| 16..... | 456 | 516 | 708 | 672 | 627 | 849 | 559 | 688 | 579 | 530 | 470 | 451 |
| 17..... | 465 | 538 | 703 | 662 | 627 | 743 | 553 | 676 | 594 | 482 | 473 | 470 |
| 18..... | 478 | 516 | 667 | 665 | 637 | 674 | 588 | 700 | 589 | 416 | 462 | 461 |
| 19..... | 484 | 505 | 659 | 656 | 633 | 635 | 586 | 695 | 608 | 358 | 468 | 462 |
| 20..... | 472 | 492 | 652 | 643 | 631 | 630 | 597 | 692 | 599 | 364 | 455 | 458 |
| 21..... | 477 | 492 | 659 | 633 | 642 | 629 | 611 | 704 | 606 | 369 | 455 | 455 |
| 22..... | 464 | 531 | 656 | 634 | 644 | 581 | 618 | 698 | 637 | 379 | 437 | 510 |
| 23..... | 470 | 528 | 660 | 634 | 643 | 516 | 606 | 714 | 658 | 401 | 430 | 484 |
| 24..... | 476 | 550 | 660 | 629 | 651 | 464 | 609 | 720 | 650 | 422 | 427 | 510 |
| 25..... | 478 | 520 | 664 | 623 | 655 | 469 | 616 | 720 | 656 | 434 | 427 | 531 |
| 26..... | 477 | 535 | 662 | 614 | 648 | 473 | 627 | 719 | 649 | 441 | 431 | 515 |
| 27..... | 464 | 555 | 664 | 614 | 655 | 461 | 625 | 720 | 652 | 453 | 439 | 513 |
| 28..... | 470 | 580 | 669 | 606 | 653 | 447 | 632 | 712 | 644 | 464 | 444 | 496 |
| 29..... | 471 | 538 | 680 | 605 | 659 | 403 | 642 | 708 | 634 | 464 | 456 | 500 |
| 30..... | 477 | 568 | 668 | 609 | -- | 392 | 650 | 708 | 606 | 477 | 463 | 500 |
| 31..... | 489 | -- | 650 | 636 | -- | 380 | -- | 714 | -- | 482 | 466 | -- |
| AVERAGE | 467 | 514 | 658 | 648 | 635 | 594 | 547 | 692 | 600 | 493 | 464 | 468 |

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| | DAY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | AVER- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | AGE |
| OCTOBER.. | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 10 | 9 | 8 | 8 | 8 | 8 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 5 | 4 | 4 | 9 |
| NOVEMBER. | 6 | 6 | 5 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | -- | 3 |
| DECEMBER. | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| JANUARY.. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| FEBRUARY. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | -- | -- | 2 |
| MARCH.... | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| APRIL.... | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 10 | 12 | -- | 6 |
| MAY..... | 10 | 12 | 13 | 13 | 13 | 13 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 12 | 14 | 13 | 13 | 12 | 10 | 10 | 11 | 12 | 12 | 12 | 14 | 15 | 15 | 15 | 15 | 16 | 16 | 12 |
| JUNE..... | 17 | 17 | 18 | 17 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 20 | 21 | 21 | 21 | 21 | 20 | 20 | 20 | 20 | 20 | -- | 19 |
| JULY..... | 20 | 18 | 18 | 18 | 18 | 20 | 22 | 23 | 22 | 22 | 23 | 22 | 23 | 23 | 24 | 24 | 24 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| AUGUST... | 21 | 21 | 21 | 21 | 22 | 23 | 24 | 23 | 22 | 22 | 23 | 22 | 21 | 21 | 21 | 21 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 19 | 18 | 18 | 18 | 19 | 19 | 19 | 20 |
| SEPTEMBER | 19 | 18 | 18 | 18 | 17 | 16 | 16 | 16 | 16 | 16 | 16 | 17 | 18 | 18 | 19 | 18 | 17 | 18 | 18 | 18 | 18 | 18 | 18 | 17 | 16 | 15 | 14 | 13 | 13 | 13 | -- | 17 |

## 5-1244.8 KAWISHIWI RIVER NEAR ELY, MINN.

(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'22", long 91°32'06", in SE 1/4 sec.24, T.63 N., R.10 W., Lake County, at gaging station, on left bank upstream from rapids, 2 miles upstream from South Kawishiwi River, 2.2 miles southwest of Fernberg Lookout Tower and 14 miles east of Ely.
DRAINAGE AREA.--253 sq mi.
RECORDS AVAILABLE.--Chemical analyses: October 1967 to September 1968.
Water temperatures: July 1966 to September 1968.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NOV. | | | | | | | | | | | |
| 02... | 31 | 6 | 3.5 | .13 | 3.0 | 1.0 | 1.1 | .2 | 10 | 0 | 8 |
| JAN. | | | | | | | | | | | |
| 03... | 33 | 1 | 4.0 | .14 | 4.0 | 1.5 | 1.6 | .8 | 19 | C | 16 |
| FEB. | | | | | | | | | | | |
| 01... | 37 | 1 | 4.1 | .10 | 3.8 | 1.5 | 1.3 | 1.6 | 18 | 0 | 15 |
| 27... | 29 | 1 | 4.1 | .12 | 3.8 | 1.5 | 1.5 | .8 | 18 | C | 15 |
| MAR. | | | | | | | | | | | |
| 26... | 38 | 1 | 4.0 | .08 | 3.8 | 1.5 | 1.2 | .8 | 17 | C | 14 |
| MAY | | | | | | | | | | | |
| 02... | 1030 | 7 | 3.3 | .18 | 3.2 | 1.3 | .9 | 1.0 | 13 | 0 | 11 |
| 29... | 547 | 11 | 3.4 | .20 | 3.3 | 1.4 | 1.2 | .4 | 12 | C | 10 |
| JUNE | | | | | | | | | | | |
| 19... | 1200 | 17 | 3.6 | .18 | 3.2 | 1.4 | .9 | .4 | 12 | 0 | 10 |
| JULY | | | | | | | | | | | |
| 03... | 698 | 16 | 3.5 | .19 | 3.4 | 1.4 | 1.0 | .4 | 12 | C | 10 |
| AUG. | | | | | | | | | | | |
| 06... | 204 | 22 | 2.8 | .13 | 3.7 | 1.4 | 1.0 | .6 | 14 | C | 11 |
| SEPT. | | | | | | | | | | | |
| 11... | 100 | 17 | 3.6 | .08 | 3.7 | 1.5 | 1.0 | .4 | 13 | 0 | 11 |

5-1244.8 KAWISHIWI RIVER NEAR ELY, MINN.--Continued

(Hydrologic bench-mark station)

EXTREMES, 1967-68.--Water temperatures: Maximum, 21°C July 17 to Aug. 19; minimum, freezing point on many days in February and March.
EXTREMES, 1966-68.--Water temperatures: Maximum, 24°C July 24, 25, 1966; minimum, freezing point on many days during winter months.
REMARKS.--Recorder stopped Mar. 27 to Apr. 29; range in temperature, 1°C to 6°C.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | SULFATE (SO4) | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NOV. | | | | | | | | | | | |
| 02... | 4.5 | .3 | .0 | .4 | -- | .01 | .5 | .02 | 20 | .05 | 2.87 |
| JAN. | | | | | | | | | | | |
| 03... | 5.0 | .7 | .1 | .4 | .03 | .17 | .5 | .01 | 28 | .08 | 5.26 |
| FEB. | | | | | | | | | | | |
| 01... | 6.0 | .4 | .1 | .4 | .03 | .28 | .4 | .01 | 28 | .06 | 4.69 |
| 27... | 5.5 | .3 | .1 | .5 | .03 | .20 | .5 | .00 | 27 | .07 | 3.89 |
| MAR. | | | | | | | | | | | |
| 26... | 6.0 | .2 | .0 | .5 | .07 | .17 | .4 | .00 | 27 | .06 | 4.91 |
| MAY | | | | | | | | | | | |
| 02... | 3.5 | .2 | .0 | .4 | .02 | .26 | .6 | .04 | 21 | .04 | 91.8 |
| 29... | 4.3 | .6 | .0 | .5 | .03 | .12 | .0 | .03 | 21 | .05 | 56.1 |
| JUNE | | | | | | | | | | | |
| 19... | 4.3 | .3 | .0 | .7 | .04 | 1.0 | .9 | .04 | 22 | .05 | 123 |
| JULY | | | | | | | | | | | |
| 03... | 4.3 | .3 | .0 | .7 | .59 | .31 | .8 | .03 | 22 | .06 | 77.3 |
| AUG. | | | | | | | | | | | |
| 06... | 5.0 | .8 | .1 | .6 | .07 | .24 | 1.0 | .01 | 24 | .05 | 19.8 |
| SEPT. | | | | | | | | | | | |
| 11... | 5.0 | .6 | .0 | .5 | .10 | .16 | .7 | .04 | 24 | .05 | 9.99 |

5-1244.8 KAWISHIWI RIVER NEAR ELY, MINN.--Continued

(Hydrologic bench-mark station)

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | HARDNESS (CA,MG) | NON-CARBONATE HARDNESS | SODIUM ADSORPTION RATIO | PERCENT SODIUM | SPECIFIC CONDUCTANCE (MICROMHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| NOV. | | | | | | | |
| 02... | 12 | 4 | .1 | 17 | 35 | 6.3 | 45 |
| JAN. | | | | | | | |
| 03... | 16 | 0 | .2 | 17 | 40 | 7.1 | 31 |
| FEB. | | | | | | | |
| 01... | 16 | 1 | .1 | 14 | 40 | 7.0 | 24 |
| 27... | 16 | 1 | .2 | 16 | 38 | 7.1 | 41 |
| MAR. | | | | | | | |
| 26... | 16 | 2 | .1 | 14 | 37 | 7.0 | 28 |
| MAY | | | | | | | |
| 02... | 13 | 2 | .1 | 12 | 31 | 6.6 | 50 |
| 29... | 14 | 4 | .1 | 15 | 34 | 6.4 | 40 |
| JUNE | | | | | | | |
| 19... | 14 | 4 | .1 | 12 | 31 | 6.4 | 50 |
| JULY | | | | | | | |
| 03... | 14 | 4 | .1 | 13 | 32 | 6.4 | 50 |
| AUG. | | | | | | | |
| 06... | 15 | 3 | .1 | 12 | 33 | 6.7 | 45 |
| SEPT. | | | | | | | |
| 11... | 15 | 4 | .1 | 12 | 35 | 6.7 | 40 |

RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

Units of measurement: Uranium, micrograms per liter of water; radium as radium-226, in picocuries per liter of water; gross beta radiation as strontium-90-yttrium-90, in picocuries per liter of water; gross alpha radiation, as micrograms of uranium equivalent per liter of water.

| | Dissolved | | | | | Suspended | | |
|---|---|---|---|---|---|---|---|---|
| Date of Collection | Uranium (ug/l) | Radium (pc/l) | Gross β (pc/l) | Gross α (ug U/l) | Total Dissolved Solids (mg/l) | Gross β (pc/l) | Gross α (ug U/l) | Suspended Sediments (mg/l) |
| Nov. 2, 1967... | <0.4 | <0.1 | 5.1 | 0.7 | 34 | 1.6 | 0.7 | < 1 |
| May 2, 1968... | < .4 | < .1 | 5.9 | < .4 | 34 | 2.1 | < .4 | 4 |

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) | Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|---|---|---|---|
| Jan. 3, 1968 | 33 | 1 | .09 | July 3, 1968 | 698 | 4 | 7.5 |
| May 2 | 1030 | 2 | 5.6 | Aug. 6 | 204 | 2 | 1.1 |
| May 29 | 547 | 3 | 4.4 | Sept. 11 | 100 | 2 | .54 |
| June 19 | 1200 | 4 | 13 | | | | |

GPO 817-490-15

5-1244.8 KAWISHIWI RIVER NEAR ELY, MINN.--Continued

(Hydrologic bench-mark station)

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(WATER-STAGE RECORDER WITH TEMPERATURE ATTACHMENT, CONTINUOUS ETHYL ALCOHOL-ACTUATED THERMOGRAPH)

| Month | Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| October | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 16 | 15 | 14 | 13 | 13 | 13 | 13 | 13 | 12 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 6 | 6 | 6 | 10 |
| Minimum | 15 | 14 | 13 | 13 | 13 | 13 | 13 | 12 | 11 | 10 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 6 | 6 | 6 | 6 | 10 |
| November | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | -- | 4 |
| Minimum | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | -- | 4 |
| December | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Minimum | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| January | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Minimum | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| February | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 |
| Minimum | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 |
| March | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | -- | 1 |
| Minimum | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | -- | 1 |
| April | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7 | -- | -- |
| Minimum | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6 | -- | -- |
| May | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 9 |
| Minimum | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 9 |
| June | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 11 | 11 | 12 | 13 | 14 | 14 | 14 | 15 | 16 | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | -- | 16 |
| Minimum | 11 | 11 | 11 | 12 | 13 | 14 | 14 | 14 | 15 | 16 | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 17 | 17 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | -- | 15 |
| July | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 16 | 16 | 16 | 17 | 17 | 17 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 20 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 19 |
| Minimum | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 20 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 19 |
| August | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 19 | 19 | 19 | 19 | 20 |
| Minimum | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 19 | 19 | 19 | 19 | 20 |
| September | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 17 | 17 | 17 | 17 | 17 | 16 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 16 | 16 | 16 | 15 | -- | 17 |
| Minimum | 19 | 19 | 19 | 19 | 19 | 18 | 17 | 17 | 17 | 17 | 17 | 16 | 16 | 16 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | -- | 17 |

## 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., Hennepin County, at gaging station on right bank half a mile downstream from Coon Creek, 1.5 miles downstream from hydroelectric plant of Northern States Power Co. at Coon Rapids, 6.5 miles downstream from Anoka, and at mile 864.8 upstream from Ohio River.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | STRON-TIUM (SR) | SODIUM (NA) | PO-TAS-SIUM (K) | LITHIUM (LI) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. 26... | 3090 | 6 | 3.7 | .01 | 45 | 17 | -- | 8.5 | 2.6 | -- | 222 | 0 |
| NOV. 20... | 3200 | 2 | 3.5 | .14 | 44 | 16 | .10 | 6.6 | 2.2 | .00 | 210 | 0 |
| DEC. 14... | 2420 | 0 | 9.0 | .02 | 49 | 18 | -- | 9.0 | 2.3 | -- | 236 | 0 |
| JAN. 23... | 2540 | 0 | 13 | .03 | 52 | 18 | -- | 7.7 | 2.3 | -- | 244 | 0 |
| FEB. 20... | 2300 | 0 | 14 | .04 | 50 | 17 | -- | 6.9 | 2.5 | -- | 242 | 0 |
| MAR. 25... | 5980 | 2 | 11 | .06 | 38 | 13 | -- | 5.9 | 3.6 | -- | 178 | 0 |
| APR. 15... | 8480 | 8 | 5.8 | .06 | 39 | 14 | .19 | 6.4 | 2.8 | .00 | 180 | 0 |
| MAY 21... | 9060 | 10 | 8.6 | .05 | 43 | 14 | -- | 5.8 | 2.5 | -- | 184 | 0 |
| JUNE 21... | 18400 | 18 | 13 | .17 | 39 | 12 | -- | 4.2 | 2.5 | -- | 160 | 0 |
| AUG. 01... | 7130 | 22 | 12 | .05 | 42 | 14 | -- | 5.6 | 2.4 | -- | 184 | 0 |
| SEPT. 04... | 3520 | 20 | 8.6 | .01 | 41 | 15 | -- | 5.8 | 1.6 | -- | 194 | 0 |

| DATE | TOTAL CHRO-MIUM (CR) | NICKEL (NI) | COBALT (CO) | LEAD (PB) | DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|
| OCT. 26... | -- | -- | -- | -- | 203 | .30 | 1840 |
| NOV. 20... | .00 | .00 | .00 | .01 | 193 | .27 | 1730 |
| DEC. 14... | -- | -- | -- | -- | 224 | .31 | 1500 |
| JAN. 23... | -- | -- | -- | -- | 232 | .33 | 1640 |
| FEB. 20... | -- | -- | -- | -- | 230 | .34 | 1530 |
| MAR. 25... | -- | -- | -- | -- | 182 | .26 | 3120 |
| APR. 15... | .00 | .00 | .00 | .00 | 179 | .26 | 4440 |
| MAY 21... | -- | -- | -- | -- | 191 | .28 | 5110 |
| JUNE 21... | -- | -- | -- | -- | 177 | .27 | 10000 |
| AUG. 01... | -- | -- | -- | -- | 187 | .28 | 3990 |
| SEPT. 04... | -- | -- | -- | -- | 185 | .27 | 1900 |

5-2885. MISSISSIPPI RIVER NEAR ANOKA, MINN.--Continued

DRAINAGE AREA.--19,100 sq mi, approximately.
RECORDS AVAILABLE.--Chemical analyses: August 1960 to September 1965, October 1967 to September 1968.
Water temperatures: August 1960 to September 1963.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | ALKALINITY AS CACO3 | SULFATE (SO4) | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | COPPER (CU) | ZINC (ZN) | CADMIUM (CD) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. 26... | 182 | 12 | 5.0 | .1 | .0 | .12 | .4 | .03 | -- | -- | -- |
| NOV. 20... | 172 | 12 | 4.2 | .1 | .1 | .07 | .2 | .03 | .00 | .00 | .00 |
| DEC. 14... | 193 | 14 | 5.0 | .1 | .7 | .10 | .4 | .02 | -- | -- | -- |
| JAN. 23... | 200 | 13 | 4.2 | .1 | .9 | .24 | .3 | .08 | -- | -- | -- |
| FEB. 20... | 198 | 13 | 4.6 | .1 | 1.6 | .46 | .3 | .02 | -- | -- | -- |
| MAR. 25... | 146 | 16 | 4.6 | .1 | 1.4 | .34 | .4 | .02 | -- | -- | -- |
| APR. 15... | 148 | 17 | 4.8 | .2 | .2 | .24 | .0 | .03 | .00 | .00 | .00 |
| MAY 21... | 151 | 21 | 3.9 | .2 | 1.1 | .33 | .0 | .03 | -- | -- | -- |
| JUNE 21... | 131 | 21 | 3.7 | .3 | 1.6 | .31 | .8 | .06 | -- | -- | -- |
| AUG. 01... | 151 | 14 | 4.6 | .2 | 1.3 | .36 | .8 | .02 | -- | -- | -- |
| SEPT. 04... | 159 | 13 | 3.4 | .2 | .5 | .39 | .6 | .04 | -- | -- | -- |

| DATE | HARDNESS (CA,MG) | NON-CARBONATE HARDNESS | SODIUM ADSORPTION RATIO | PERCENT SODIUM | SPECIFIC CONDUCTANCE (MICROMHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| OCT. 26... | 182 | 0 | .3 | 9 | 365 | 7.8 | 4 |
| NOV. 20... | 177 | 5 | .2 | 7 | 357 | 7.4 | 8 |
| DEC. 14... | 196 | 3 | .3 | 9 | 387 | 8.1 | 9 |
| JAN. 23... | 203 | 3 | .2 | 7 | 399 | 7.9 | 4 |
| FEB. 20... | 195 | 0 | .2 | 7 | 393 | 8.0 | 8 |
| MAR. 25... | 148 | 2 | .2 | 8 | 316 | 7.6 | 18 |
| APR. 15... | 154 | 6 | .2 | 8 | 328 | 7.7 | 8 |
| MAY 21... | 164 | 13 | .2 | 7 | 335 | 7.9 | 22 |
| JUNE 21... | 146 | 15 | .2 | 6 | 298 | 7.9 | 50 |
| AUG. 01... | 160 | 10 | .2 | 7 | 321 | 7.7 | 25 |
| SEPT. 04... | 163 | 4 | .2 | 7 | 328 | 7.5 | 4 |

## 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., Grant County, at gaging station on right bank 20 ft downstream from highway bridge, 1.5 miles west of Big Stone City, and 4.5 miles upstream from Big Stone Lake.
DRAINAGE AREA.--389 sq mi.
RECORDS AVAILABLE.--Chemical analyses: October 1967 to September 1968.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | | |
| 06... | -- | -- | 15 | .08 | 108 | 56 | 63 | 9.2 | 338 | 0 | 277 |
| 28... | 4.1 | 0 | 18 | .20 | 122 | 55 | 44 | 8.4 | 356 | 0 | 300 |
| NOV. | | | | | | | | | | | |
| 06... | 4.9 | 2 | 20 | .03 | 125 | 55 | 42 | 7.4 | 370 | 0 | 303 |
| 28... | 5.2 | 0 | 20 | .01 | 145 | 73 | 71 | 9.3 | 432 | 0 | 354 |
| JAN. | | | | | | | | | | | |
| 09... | .20 | 0 | 34 | .01 | 215 | 90 | 94 | 12 | 676 | 0 | 554 |
| FEB. | | | | | | | | | | | |
| 06... | 2.0 | 1 | 28 | .02 | 136 | 61 | 44 | 8.0 | 402 | 0 | 344 |
| MAR. | | | | | | | | | | | |
| 05... | 6.6 | 1 | 19 | .05 | 95 | 39 | 24 | 7.6 | 284 | 0 | 233 |
| 20... | 12 | 0 | 16 | .05 | 100 | 39 | 85 | 8.8 | 248 | 0 | 203 |
| APR. | | | | | | | | | | | |
| 02... | 6.9 | 6 | 7.8 | .11 | 103 | 48 | 55 | 8.2 | 252 | 0 | 207 |
| MAY | | | | | | | | | | | |
| 01... | 23 | 17 | 10 | .08 | 149 | 63 | 55 | 11 | 284 | 0 | 233 |
| 21... | 12 | 18 | 12 | .06 | 155 | 70 | 72 | 10 | 336 | 0 | 276 |
| 28... | 9.6 | 16 | 15 | .05 | 148 | 67 | 67 | 8.7 | 355 | 0 | 291 |
| JULY | | | | | | | | | | | |
| 02... | 5.4 | 17 | 18 | .02 | 116 | 55 | 69 | 8.9 | 334 | 0 | 274 |
| SEPT. | | | | | | | | | | | |
| 04... | 2.3 | -- | -- | -- | 105 | 51 | 44 | 8.7 | 341 | 0 | 280 |

| DATE | SULFATE (SO4) | CHLO-RIDE (CL) | FLUO-RIDE (F) | NITRATE (NO3) | ORTHO PHOS-PHATE (PO4) | TOTAL ALUM-INIUM (AL) | BORON (B) | DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | |
| 06... | 289 | 52 | .3 | .1 | .45 | -- | .20 | 759 | 1.11 | -- |
| 28... | 263 | 30 | .5 | .2 | .26 | -- | .16 | 722 | 1.04 | 8.47 |
| NOV. | | | | | | | | | | |
| 06... | 266 | 28 | .2 | .3 | .44 | -- | .14 | 726 | 1.05 | 10.2 |
| 28... | 372 | 42 | .2 | .1 | .29 | 1.2 | .21 | 946 | 1.36 | 14.3 |
| JAN. | | | | | | | | | | |
| 09... | 445 | 61 | .3 | .1 | .77 | .6 | .33 | 1290 | 1.84 | .73 |
| FEB. | | | | | | | | | | |
| 06... | 328 | 23 | .2 | 4.4 | .33 | .9 | .15 | 841 | 1.23 | 5.05 |
| MAR. | | | | | | | | | | |
| 05... | 204 | 12 | .2 | 1.2 | .62 | .6 | .10 | 544 | .78 | 10.3 |
| 20... | 277 | 62 | .2 | 12 | 6.1 | -- | .26 | 729 | 1.03 | 24.6 |
| APR. | | | | | | | | | | |
| 02... | 308 | 26 | .4 | .2 | .71 | .8 | .22 | 682 | 1.01 | 13.8 |
| MAY | | | | | | | | | | |
| 01... | 463 | 22 | .3 | .1 | .60 | .0 | .22 | 914 | 1.34 | 61.2 |
| 21... | 468 | 34 | .3 | .6 | .61 | -- | .28 | 988 | 1.47 | 35.0 |
| 28... | 430 | 26 | .3 | .1 | .74 | .4 | .04 | 938 | 1.37 | 26.2 |
| JULY | | | | | | | | | | |
| 02... | 318 | 42 | .3 | .1 | 1.1 | .3 | .23 | 793 | 1.14 | 12.3 |
| SEPT. | | | | | | | | | | |
| 04... | 253 | 24 | -- | .5 | -- | -- | .19 | -- | .98 | 4.50 |

## 5-3167.70. MINNESOTA RIVER AT NEW ULM, MINN.

LOCATION.--Lat 44°19'29", long 94°27'09", in NE¼NE¼ sec.20, T.110 N., R.30 W., Nicollet County, at gaging station on left bank, 30 ft downstream from bridge on U.S. Highway 14, at New Ulm, and 6.1 miles upstream from Cottonwood River.
DRAINAGE AREA.--9,536 sq mi (at mouth of Cottonwood River).
RECORDS AVAILABLE.--Water temperatures: October 1967 to September 1968.
Sediment records: October 1967 to September 1968.
EXTREMES, 1967-68.--Water temperatures: Maximum, 26°C July 15, 16, Aug. 23; minimum, freezing point on many days.
Sediment concentrations: Maximum daily, 567 mg/l June 12; minimum daily, 10 mg/l Mar. 22.
Sediment loads: Maximum daily, 2,150 tons July 28; minimum daily, 7.6 tons Jan. 15.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(ONCE-DAILY MEASUREMENT, BETWEEN 0700 AND 1200)

| | DAY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | AVER- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | AGE |
| OCTOBER.. | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| NOVEMBER. | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 0 | 0 | -- | -- | -- | -- | -- |
| DECEMBER. | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | -- | -- |
| JANUARY.. | -- | -- | -- | -- | -- | 0 | -- | -- | -- | -- | -- | -- | 0 | -- | 1 | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- |
| FEBRUARY. | -- | -- | 2 | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 0 | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- |
| MARCH.... | -- | 0 | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | 1 | -- | 3 | 1 | 1 | 0 | 1 | 1 | 1 | 3 | 6 | 7 | 6 | 8 | 9 | 8 | -- |
| APRIL.... | 7 | 8 | 9 | 5 | 6 | 7 | 7 | 6 | 6 | 7 | 9 | 12 | 12 | 8 | 8 | 10 | 12 | 10 | 12 | 12 | 12 | 13 | 11 | 6 | 8 | 9 | 10 | 11 | 12 | 13 | -- | 9 |
| MAY..... | 17 | 19 | 17 | 14 | 12 | 12 | 12 | 11 | 9 | 9 | 11 | 11 | 13 | 15 | 16 | 12 | 13 | 14 | 11 | 13 | 11 | 13 | 13 | 14 | 14 | 14 | 12 | 13 | 15 | 16 | 16 | 13 |
| JUNE..... | 15 | 18 | 18 | 21 | 23 | 24 | 25 | 25 | 24 | 24 | 23 | 20 | 20 | 21 | 19 | 19 | 19 | 20 | 20 | 21 | 22 | 21 | 18 | 21 | 19 | -- | 15 | 17 | 19 | 22 | -- | 20 |
| JULY..... | 19 | 18 | 17 | 21 | 21 | 22 | 25 | 24 | 23 | 22 | 22 | 24 | 23 | 25 | 26 | 26 | 25 | 25 | 23 | 23 | 24 | 22 | 22 | 21 | 21 | 24 | 21 | 20 | 20 | 21 | 19 | 22 |
| AUGUST... | 19 | 20 | 21 | 22 | 23 | 25 | 22 | 23 | 24 | 21 | 19 | 20 | 21 | 20 | 20 | 21 | 20 | 20 | 20 | 20 | 23 | 25 | 26 | 24 | 21 | 19 | 19 | 19 | 19 | 20 | 19 | 21 |
| SEPTEMBER | 18 | 17 | 19 | 21 | 18 | 16 | 16 | 17 | 14 | 14 | 14 | 14 | 16 | 18 | 17 | 19 | 17 | 17 | 16 | 15 | 16 | 17 | 17 | -- | 17 | 13 | 15 | 14 | 14 | 13 | -- | 16 |

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE: C. CHEMICALLY DISPERSED: N. IN NATIVE WATER: P. PIPET: S. SIEVE: V. VISUAL ACCUMULATION TUBE: W. IN DISTILLED WATER)

| Date | Time | Water Temperature (C) | Discharge (cfs) | Concentration (mg/l) | Suspended Sediment Discharge (tons/day) | Particle Size: Percent Finer than the Size (in millimeters) Indicated .002 | .004 | .008 | .016 | .031 | .062 | .125 | .250 | .500 | 1.00 | 2.00 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| June 12, 1968 | 0800 | 20 | 1170 | 638 | 2020 | 53 | 61 | 84 | 92 | 97 | 99 | | | | | | CPW |
| July 15 | 0800 | 26 | 697 | 242 | 506 | | 62 | 72 | 85 | 92 | 94 | | | | | | BCW |
| July 25 | 0800 | 21 | 756 | 230 | 449 | | 70 | 79 | 91 | 96 | 98 | | | | | | BCW |
| Aug. 7 | 0800 | 22 | 878 | 560 | 1370 | 57 | 59 | 83 | 86 | 88 | 99 | | | | | | CPW |

PARTICLE SIZE OF BED MATERIAL, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: H. HYDROMETER: O. OPTICAL ANALYZER: S. SIEVE: V. VISUAL ACCUMULATION TUBE)

| Date | Time | No. of Sampling Points | Discharge (cfs) | Particle Size: Percent Finer than the Size (in millimeters) Indicated 0.016 | 0.031 | 0.062 | 0.125 | 0.25 | 0.354 | 0.50 | 1.000 | 2.000 | 4.000 | 7.9 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July 11, 1968 | 1605 | 4 | 407 | | | 8 | 13 | 24 | 33 | | 56 | 69 | 82 | 88 | S |
| Aug. 8 | 1545 | 4 | 1060 | | | 6 | 14 | 25 | 30 | | 46 | 58 | | 82 | S |

## 5-3167.70. MINNESOTA RIVER AT NEW ULM, MINN.--Continued

SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Day | OCTOBER Mean Discharge (cfs) | OCTOBER Mean Concentration (mg/l) | OCTOBER Load (tons per day) | NOVEMBER Mean Discharge (cfs) | NOVEMBER Mean Concentration (mg/l) | NOVEMBER Load (tons per day) | DECEMBER Mean Discharge (cfs) | DECEMBER Mean Concentration (mg/l) | DECEMBER Load (tons per day) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 128 | 130 | 45 | 148 | 130 | 52 | 110 | 150 | 45 |
| 2 | 128 | 130 | 45 | 148 | 130 | 52 | 121 | 150 | 49 |
| 3 | 128 | 130 | 45 | 148 | 130 | 52 | 123 | 150 | 50 |
| 4 | 128 | 130 | 45 | 148 | 130 | 52 | 125 | 150 | 51 |
| 5 | 128 | 130 | 45 | 148 | 130 | 52 | 127 | 150 | 51 |
| 6 | 128 | 130 | 45 | 149 | 130 | 52 | 125 | 150 | 51 |
| 7 | 128 | 130 | 45 | 148 | 130 | 52 | 123 | 150 | 50 |
| 8 | 128 | 130 | 45 | 146 | 130 | 51 | 128 | 150 | 52 |
| 9 | 130 | 130 | 46 | 142 | 130 | 50 | 134 | 150 | 54 |
| 10 | 130 | 130 | 46 | 141 | 130 | 49 | 136 | 150 | 55 |
| 11 | 130 | 130 | 46 | 140 | 130 | 49 | 144 | 150 | 58 |
| 12 | 130 | 130 | 46 | 138 | 130 | 48 | 146 | 156 | 61 |
| 13 | 130 | 130 | 46 | 136 | 130 | 48 | 123 | 150 | 50 |
| 14 | 131 | 130 | 46 | 145 | 130 | 51 | 107 | 140 | 40 |
| 15 | 132 | 130 | 46 | 155 | 130 | 54 | 116 | 100 | 31 |
| 16 | 138 | 130 | 48 | 161 | 130 | 56 | 119 | 60 | 19 |
| 17 | 139 | 130 | 49 | 160 | 130 | 56 | 128 | 70 | 24 |
| 18 | 140 | 130 | 49 | 152 | 130 | 53 | 130 | 90 | 32 |
| 19 | 160 | 130 | 56 | 154 | 150 | 62 | 130 | 110 | 39 |
| 20 | 200 | 130 | 70 | 152 | 153 | 63 | 136 | 130 | 48 |
| 21 | 160 | 130 | 56 | 150 | 161 | 65 | 136 | 150 | 55 |
| 22 | 140 | 130 | 49 | 144 | 148 | 58 | 114 | 150 | 46 |
| 23 | 138 | 130 | 48 | 142 | 134 | 51 | 109 | 157 | 46 |
| 24 | 138 | 130 | 48 | 138 | 140 | 52 | 114 | 160 | 49 |
| 25 | 128 | 130 | 45 | 140 | 144 | 55 | 99 | 160 | 43 |
| 26 | 132 | 130 | 46 | 142 | 206 | 79 | 84 | 160 | 36 |
| 27 | 138 | 130 | 48 | 92 | 208 | 52 | 68 | 160 | 29 |
| 28 | 142 | 130 | 50 | 105 | 200 | 57 | 73 | 160 | 32 |
| 29 | 143 | 130 | 50 | 112 | 200 | 60 | 68 | 160 | 29 |
| 30 | 149 | 130 | 52 | 105 | 200 | 57 | 65 | 160 | 28 |
| 31 | 150 | 130 | 53 | -- | -- | -- | 64 | 160 | 28 |
| Total | | | 1499 | | | 1638 | | | 1331 |

| Day | JANUARY Mean Discharge (cfs) | JANUARY Mean Concentration (mg/l) | JANUARY Load (tons per day) | FEBRUARY Mean Discharge (cfs) | FEBRUARY Mean Concentration (mg/l) | FEBRUARY Load (tons per day) | MARCH Mean Discharge (cfs) | MARCH Mean Concentration (mg/l) | MARCH Load (tons per day) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 64 | 170 | 29 | 56 | 240 | 36 | 60 | 220 | 36 |
| 2 | 62 | 170 | 28 | 58 | 240 | 38 | 60 | 220 | 36 |
| 3 | 59 | 170 | 27 | 59 | 230 | 37 | 60 | 220 | 36 |
| 4 | 57 | 180 | 28 | 60 | 200 | 32 | 60 | 220 | 36 |
| 5 | 54 | 180 | 26 | 61 | 161 | 27 | 62 | 220 | 36 |
| 6 | 53 | 184 | 26 | 62 | 161 | 27 | 66 | 150 | 27 |
| 7 | 52 | 184 | 26 | 62 | 161 | 27 | 74 | 120 | 24 |
| 8 | 51 | 174 | 24 | 64 | 161 | 28 | 90 | 110 | 27 |
| 9 | 49 | 164 | 22 | 64 | 161 | 28 | 110 | 110 | 33 |
| 10 | 48 | 154 | 20 | 64 | 161 | 28 | 140 | 100 | 38 |
| 11 | 46 | 144 | 18 | 64 | 161 | 28 | 180 | 90 | 44 |
| 12 | 45 | 134 | 16 | 63 | 161 | 27 | 250 | 80 | 54 |
| 13 | 44 | 134 | 16 | 63 | 161 | 27 | 310 | 70 | 59 |
| 14 | 43 | 90 | 10 | 62 | 130 | 22 | 305 | 60 | 49 |
| 15 | 42 | 67 | 7.6 | 62 | 108 | 18 | 300 | 40 | 32 |
| 16 | 43 | 90 | 10 | 61 | 108 | 18 | 290 | 14 | 11 |
| 17 | 44 | 130 | 15 | 60 | 108 | 17 | 330 | 21 | 19 |
| 18 | 44 | 160 | 19 | 59 | 140 | 22 | 355 | 35 | 34 |
| 19 | 42 | 200 | 23 | 57 | 190 | 29 | 363 | 58 | 57 |
| 20 | 43 | 250 | 29 | 57 | 190 | 29 | 355 | 18 | 17 |
| 21 | 43 | 250 | 29 | 57 | 190 | 29 | 355 | 15 | 14 |
| 22 | 43 | 250 | 29 | 57 | 200 | 31 | 360 | 10 | 9.7 |
| 23 | 44 | 250 | 30 | 57 | 210 | 32 | 365 | 11 | 11 |
| 24 | 45 | 250 | 30 | 58 | 220 | 34 | 566 | 15 | 23 |
| 25 | 46 | 250 | 31 | 60 | 220 | 36 | 756 | 25 | 51 |
| 26 | 47 | 250 | 32 | 60 | 220 | 36 | 794 | 26 | 56 |
| 27 | 48 | 250 | 32 | 60 | 220 | 36 | 707 | 40 | 76 |
| 28 | 50 | 250 | 34 | 60 | 220 | 36 | 641 | 53 | 92 |
| 29 | 51 | 250 | 34 | 60 | 220 | 36 | 629 | 65 | 110 |
| 30 | 52 | 250 | 35 | -- | -- | -- | 623 | 92 | 155 |
| 31 | 54 | 250 | 36 | -- | -- | -- | 569 | 100 | 154 |
| Total | | | 771.6 | | | 831 | | | 1445.7 |

## 5-3167.70. MINNESOTA RIVER AT NEW ULM, MINN.--Continued

SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| | APRIL | | | MAY | | | JUNE | | |
|---|---|---|---|---|---|---|---|---|---|
| Day | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) |
| 1 | 551 | 102 | 152 | 934 | 193 | 487 | 428 | 178 | 206 |
| 2 | 512 | 100 | 138 | 914 | 170 | 420 | 467 | 166 | 209 |
| 3 | 449 | 93 | 113 | 892 | 176 | 424 | 527 | 150 | 213 |
| 4 | 464 | 62 | 78 | 850 | 148 | 340 | 527 | 167 | 238 |
| 5 | 479 | 35 | 45 | 791 | 118 | 252 | 491 | 207 | 274 |
| 6 | 563 | 58 | 88 | 710 | 110 | 211 | 452 | 232 | 283 |
| 7 | 539 | 65 | 95 | 696 | 110 | 207 | 419 | 208 | 235 |
| 8 | 509 | 52 | 71 | 693 | 96 | 180 | 417 | 166 | 187 |
| 9 | 494 | 95 | 127 | 650 | 82 | 144 | 410 | 155 | 172 |
| 10 | 539 | 126 | 183 | 635 | 100 | 171 | 533 | 185 | 266 |
| 11 | 575 | 163 | 253 | 590 | 85 | 135 | 1040 | 369 | 1040 |
| 12 | 596 | 139 | 224 | 548 | 65 | 96 | 1170 | 567 | 1790 |
| 13 | 656 | 135 | 239 | 530 | 94 | 135 | 1110 | 318 | 953 |
| 14 | 638 | 110 | 189 | 518 | 110 | 154 | 1120 | 284 | 859 |
| 15 | 611 | 102 | 168 | 491 | 100 | 133 | 1070 | 263 | 760 |
| 16 | 569 | 132 | 203 | 470 | 95 | 121 | 942 | 212 | 539 |
| 17 | 578 | 122 | 190 | 464 | 118 | 148 | 822 | 204 | 453 |
| 18 | 554 | 140 | 209 | 467 | 120 | 151 | 763 | 223 | 459 |
| 19 | 542 | 125 | 183 | 458 | 130 | 161 | 728 | 257 | 505 |
| 20 | 566 | 123 | 188 | 446 | 134 | 161 | 718 | 247 | 479 |
| 21 | 728 | 130 | 256 | 437 | 157 | 185 | 686 | 240 | 444 |
| 22 | 822 | 130 | 288 | 428 | 124 | 143 | 656 | 235 | 416 |
| 23 | 875 | 116 | 274 | 422 | 133 | 152 | 653 | 225 | 397 |
| 24 | 868 | 152 | 356 | 419 | 140 | 158 | 679 | 203 | 372 |
| 25 | 1010 | 168 | 458 | 410 | 147 | 163 | 710 | 197 | 378 |
| 26 | 1120 | 152 | 460 | 407 | 130 | 143 | 714 | 134 | 258 |
| 27 | 1190 | 172 | 553 | 419 | 123 | 139 | 690 | 105 | 196 |
| 28 | 1210 | 157 | 513 | 416 | 160 | 180 | 700 | 118 | 223 |
| 29 | 1150 | 192 | 596 | 413 | 151 | 168 | 696 | 114 | 214 |
| 30 | 1050 | 156 | 442 | 392 | 148 | 157 | 710 | 125 | 240 |
| 31 | -- | -- | -- | 404 | 135 | 147 | -- | -- | -- |
| Total | | | 7332 | | | 5966 | | | 13258 |

| | JULY | | | AUGUST | | | SEPTEMBER | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 704 | 138 | 262 | 2170 | 237 | 1390 | 168 | 218 | 99 |
| 2 | 714 | 120 | 231 | 1960 | 147 | 778 | 164 | 211 | 93 |
| 3 | 742 | 124 | 248 | 1350 | 112 | 408 | 162 | 269 | 118 |
| 4 | 732 | 117 | 231 | 930 | 125 | 314 | 160 | 261 | 113 |
| 5 | 700 | 133 | 251 | 611 | 133 | 219 | 164 | 257 | 114 |
| 6 | 644 | 125 | 217 | 506 | 114 | 156 | 162 | 267 | 117 |
| 7 | 596 | 102 | 164 | 878 | 495 | 1170 | 156 | 210 | 88 |
| 8 | 524 | 107 | 151 | 1050 | 275 | 1060 | 150 | 238 | 96 |
| 9 | 461 | 96 | 119 | 1030 | 200 | 584 | 222 | 230 | 138 |
| 10 | 437 | 107 | 126 | 728 | 196 | 385 | 292 | 186 | 147 |
| 11 | 410 | 98 | 108 | 672 | 195 | 354 | 275 | 158 | 117 |
| 12 | 395 | 102 | 109 | 503 | 183 | 249 | 240 | 168 | 109 |
| 13 | 458 | 93 | 115 | 440 | 184 | 219 | 226 | 190 | 116 |
| 14 | 605 | 119 | 194 | 353 | 185 | 176 | 212 | 191 | 109 |
| 15 | 840 | 230 | 522 | 295 | 182 | 145 | 188 | 168 | 85 |
| 16 | 732 | 227 | 449 | 285 | 175 | 135 | 174 | 183 | 86 |
| 17 | 686 | 245 | 454 | 258 | 155 | 108 | 344 | 136 | 126 |
| 18 | 679 | 273 | 500 | 230 | 163 | 101 | 410 | 129 | 143 |
| 19 | 696 | 305 | 573 | 234 | 148 | 94 | 392 | 130 | 138 |
| 20 | 608 | 250 | 410 | 226 | 157 | 96 | 347 | 138 | 129 |
| 21 | 521 | 220 | 309 | 206 | 170 | 95 | 431 | 140 | 163 |
| 22 | 485 | 206 | 270 | 218 | 197 | 116 | 672 | 118 | 214 |
| 23 | 506 | 272 | 371 | 198 | 207 | 111 | 950 | 98 | 251 |
| 24 | 700 | 258 | 488 | 194 | 196 | 103 | 1250 | 87 | 294 |
| 25 | 728 | 226 | 444 | 174 | 218 | 102 | 1060 | 83 | 238 |
| 26 | 836 | 189 | 427 | 180 | 242 | 118 | 730 | 112 | 221 |
| 27 | 2010 | 240 | 1300 | 174 | 221 | 104 | 467 | 167 | 211 |
| 28 | 2770 | 288 | 2150 | 162 | 250 | 109 | 371 | 217 | 217 |
| 29 | 2540 | 227 | 1560 | 168 | 259 | 117 | 270 | 205 | 149 |
| 30 | 1960 | 238 | 1260 | 156 | 220 | 93 | 247 | 195 | 130 |
| 31 | 2140 | 266 | 1540 | 164 | 262 | 116 | -- | -- | -- |
| Total | | | 15553 | | | 9325 | | | 4369 |

Total Discharge for year (cfs-days) 140153
Total Load for year (tons) 63319.3

## 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., Nicollet County, at gaging station 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 upstream from Mississippi River.
DRAINAGE AREA.--14,900 sq mi, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966.
Water temperatures: October 1967 to September 1968.
Sediment records: October 1967 to September 1968.
EXTREMES, 1967-68.--Water temperatures: Maximum, 28°C July 28; minimum, freezing point on many days.
Sediment concentrations: Maximum daily, 2,850 mg/l Aug. 7; minimum daily, 20 mg/l Mar. 23.
Sediment loads: Maximum daily, 90,200 tons Aug. 7; minimum daily, 14 tons Jan. 13, 14.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(ONCE-DAILY MEASUREMENT, BETWEEN 0700 AND 1200)

| | DAY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | AVER- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | AGE |
| OCTOBER.. | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| NOVEMBER. | -- | -- | -- | -- | -- | -- | -- | 2 | 4 | 6 | 6 | 5 | 3 | 4 | 4 | 4 | 6 | 4 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 0 | 1 | -- | -- |
| DECEMBER. | 1 | 0 | 2 | 1 | 1 | 1 | 2 | -- | -- | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | 0 | -- |
| JANUARY.. | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 0 | -- | -- | 1 | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 0 | -- | -- | -- | -- | -- |
| FEBRUARY. | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0 | -- | -- | 1 | -- | -- | -- | 0 | -- | -- | 0 | -- | -- | -- | 0 | -- | -- | -- | -- | -- | -- | -- | -- |
| MARCH.... | -- | 2 | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | 1 | -- | 1 | 1 | 2 | 6 | 5 | 8 | 7 | 9 | 9 | 9 | -- |
| APRIL.... | 7 | 8 | 9 | 7 | 4 | 6 | 7 | 7 | 7 | 8 | 10 | 13 | 11 | 10 | 8 | 11 | 11 | 11 | 13 | 12 | 12 | 14 | 12 | 8 | 7 | 9 | 11 | 11 | 12 | 13 | -- | 10 |
| MAY..... | 15 | 17 | 17 | 14 | 12 | 14 | 11 | 11 | 10 | 10 | 12 | 11 | 14 | 16 | 17 | 15 | 12 | 13 | 12 | 12 | 13 | 15 | 14 | 15 | 15 | 14 | 12 | 13 | 14 | 14 | 16 | 14 |
| JUNE..... | 15 | 17 | 19 | 22 | 24 | 24 | 25 | 25 | 24 | 24 | 23 | 20 | 20 | 20 | 19 | 18 | 18 | 20 | 20 | 20 | 22 | 21 | 23 | 21 | 20 | 16 | 14 | 17 | 17 | 20 | -- | 20 |
| JULY..... | 18 | 18 | 18 | 20 | 21 | 22 | 22 | 28 | 23 | 21 | 22 | 24 | 23 | 25 | 25 | 26 | 25 | 24 | 24 | 24 | 23 | 22 | 23 | 20 | 21 | 22 | 23 | 22 | 22 | 21 | 21 | 22 |
| AUGUST... | 20 | 20 | 21 | 22 | 23 | 25 | 23 | 25 | 25 | 24 | 21 | 21 | 21 | 21 | 20 | 21 | 21 | 20 | 20 | 20 | 24 | 25 | 26 | 24 | 20 | 18 | 19 | 19 | 19 | 20 | 18 | 21 |
| SEPTEMBER | 19 | 18 | 22 | 21 | 19 | 18 | 20 | 18 | 18 | 20 | 19 | 18 | 20 | 22 | 21 | 19 | 19 | 18 | 17 | 18 | 18 | 18 | 20 | 20 | 17 | 17 | 16 | 14 | 15 | 17 | -- | 19 |

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE: C. CHEMICALLY DISPERSED: N. IN NATIVE WATER: P. PIPET: S. SIEVE: V. VISUAL ACCUMULATION TUBE: W. IN DISTILLED WATER)

| | | | | | | Particle Size | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Water Temperature | | | Suspended Sediment | Percent Finer than the Size (in millimeters) Indicated | | | | | | | | | | | Method of Analysis |
| Date | Time | (C) | Discharge (cfs) | Concentration (mg/l) | Discharge (tons/day) | .002 | .004 | .008 | .016 | .031 | .062 | .125 | .250 | .500 | 1.00 | 2.00 | |
| June 29, 1968 | 1507 | 19 | 4310 | 560 | 6520 | 37 | 40 | 50 | 72 | 72 | 93 | 99 | 100 | | | | VPWC |
| July 25 | 1958 | 23 | 9770 | 1710 | 45100 | 28 | 35 | 42 | 51 | 63 | 83 | 95 | 100 | | | | VPWC |
| July 26 | 1055 | 22 | 13400 | 1980 | 71600 | 38 | 41 | 58 | 62 | 80 | 87 | 95 | 100 | | | | VPWC |
| Aug. 8 | 1000 | 25 | 12700 | 1080 | 37000 | | 43 | 50 | 63 | 81 | 92 | 98 | 100 | | | | VBWC |

PARTICLE SIZE OF BED MATERIAL, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: H. HYDROMETER: O. OPTICAL ANALYZER: S. SIEVE: V. VISUAL ACCUMULATION TUBE)

| | | | | Particle Size | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Percent Finer than the Size (in millimeters) Indicated | | | | | | | | | | Method of |
| Date | Time | No. of Sampling Points | Discharge (cfs) | 0.016 | 0.031 | 0.062 | 0.125 | 0.25 | 0.354 | 0.50 | 1.000 | 2.000 | 4.000 | Analysis |
| July 12, 1968 | 1510 | 5 | 1720 | | | 6 | 26 | 71 | 86 | | 97 | 99 | 100 | S |
| Aug. 8 | 1900 | 4 | 11800 | | | 1 | 4 | 49 | 78 | | 96 | 98 | 100 | S |

5-3250. MINNESOTA RIVER AT MANKATO, MINN.--Continued

SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| | OCTOBER | | | NOVEMBER | | | DECEMBER | | |
|---|---|---|---|---|---|---|---|---|---|
| Day | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) |
| 1 | 264 | 100 | 71 | 322 | 140 | 122 | 292 | 154 | 121 |
| 2 | 260 | 100 | 70 | 325 | 140 | 123 | 295 | 172 | 137 |
| 3 | 269 | 100 | 73 | 322 | 140 | 122 | 289 | 179 | 140 |
| 4 | 256 | 100 | 69 | 325 | 140 | 123 | 313 | 170 | 144 |
| 5 | 244 | 100 | 66 | 323 | 140 | 122 | 304 | 162 | 133 |
| 6 | 240 | 100 | 65 | 318 | 140 | 120 | 308 | 163 | 136 |
| 7 | 264 | 100 | 71 | 311 | 160 | 134 | 328 | 167 | 148 |
| 8 | 274 | 100 | 74 | 310 | 180 | 151 | 334 | 169 | 152 |
| 9 | 282 | 100 | 76 | 322 | 140 | 122 | 345 | 162 | 151 |
| 10 | 269 | 100 | 73 | 327 | 126 | 111 | 350 | 171 | 162 |
| 11 | 260 | 100 | 70 | 327 | 142 | 125 | 355 | 183 | 175 |
| 12 | 269 | 100 | 73 | 332 | 152 | 136 | 358 | 160 | 155 |
| 13 | 271 | 100 | 73 | 330 | 146 | 130 | 303 | 109 | 89 |
| 14 | 275 | 100 | 74 | 327 | 141 | 124 | 236 | 103 | 66 |
| 15 | 279 | 100 | 75 | 323 | 151 | 132 | 250 | 115 | 78 |
| 16 | 278 | 100 | 75 | 329 | 153 | 136 | 270 | 109 | 79 |
| 17 | 285 | 100 | 77 | 342 | 150 | 138 | 285 | 82 | 63 |
| 18 | 285 | 100 | 77 | 351 | 149 | 141 | 295 | 70 | 56 |
| 19 | 362 | 140 | 137 | 345 | 147 | 137 | 290 | 72 | 56 |
| 20 | 478 | 140 | 181 | 338 | 133 | 121 | 300 | 79 | 64 |
| 21 | 357 | 140 | 135 | 344 | 122 | 113 | 280 | 81 | 61 |
| 22 | 303 | 140 | 115 | 342 | 97 | 90 | 220 | 77 | 46 |
| 23 | 289 | 140 | 109 | 319 | 118 | 102 | 230 | 74 | 46 |
| 24 | 312 | 140 | 118 | 323 | 146 | 127 | 251 | 76 | 52 |
| 25 | 302 | 140 | 114 | 338 | 147 | 134 | 250 | 82 | 55 |
| 26 | 286 | 140 | 108 | 313 | 145 | 123 | 230 | 88 | 55 |
| 27 | 289 | 140 | 109 | 170 | 109 | 50 | 205 | 95 | 53 |
| 28 | 286 | 140 | 108 | 269 | 157 | 114 | 190 | 102 | 52 |
| 29 | 312 | 140 | 118 | 281 | 153 | 116 | 180 | 111 | 54 |
| 30 | 330 | 140 | 125 | 291 | 175 | 137 | 170 | 122 | 56 |
| 31 | 325 | 140 | 123 | -- | -- | -- | 160 | 125 | 54 |
| Total | 9055 | -- | 2902 | 9539 | -- | 3676 | 8466 | -- | 2889 |
| | JANUARY | | | FEBRUARY | | | MARCH | | |
| 1 | 150 | 120 | 49 | 133 | 107 | 38 | 136 | 72 | 26 |
| 2 | 140 | 115 | 43 | 135 | 107 | 39 | 140 | 69 | 26 |
| 3 | 130 | 110 | 39 | 135 | 107 | 39 | 144 | 63 | 24 |
| 4 | 120 | 107 | 35 | 138 | 109 | 41 | 150 | 58 | 23 |
| 5 | 110 | 105 | 31 | 139 | 109 | 41 | 157 | 53 | 22 |
| 6 | 102 | 103 | 28 | 139 | 110 | 41 | 163 | 48 | 21 |
| 7 | 96 | 97 | 25 | 140 | 110 | 42 | 180 | 44 | 21 |
| 8 | 89 | 92 | 22 | 140 | 110 | 42 | 198 | 41 | 22 |
| 9 | 89 | 85 | 20 | 140 | 110 | 42 | 210 | 41 | 23 |
| 10 | 88 | 78 | 18 | 139 | 109 | 41 | 225 | 42 | 26 |
| 11 | 87 | 71 | 17 | 138 | 104 | 39 | 240 | 42 | 27 |
| 12 | 88 | 62 | 15 | 138 | 99 | 37 | 260 | 40 | 28 |
| 13 | 91 | 55 | 14 | 137 | 93 | 34 | 300 | 40 | 32 |
| 14 | 96 | 53 | 14 | 135 | 85 | 31 | 330 | 40 | 36 |
| 15 | 100 | 54 | 15 | 135 | 77 | 28 | 355 | 38 | 36 |
| 16 | 103 | 54 | 15 | 134 | 70 | 25 | 405 | 38 | 42 |
| 17 | 108 | 57 | 17 | 132 | 66 | 24 | 480 | 40 | 52 |
| 18 | 110 | 62 | 18 | 132 | 77 | 27 | 600 | 48 | 78 |
| 19 | 112 | 65 | 20 | 131 | 97 | 34 | 700 | 57 | 108 |
| 20 | 115 | 72 | 22 | 128 | 129 | 44 | 723 | 61 | 119 |
| 21 | 117 | 77 | 24 | 128 | 124 | 43 | 700 | 47 | 89 |
| 22 | 118 | 84 | 27 | 128 | 112 | 39 | 696 | 36 | 68 |
| 23 | 120 | 92 | 30 | 128 | 112 | 39 | 601 | 20 | 32 |
| 24 | 121 | 97 | 32 | 128 | 109 | 38 | 853 | 32 | 74 |
| 25 | 125 | 102 | 34 | 129 | 103 | 36 | 1050 | 51 | 144 |
| 26 | 125 | 103 | 35 | 129 | 97 | 34 | 1210 | 111 | 363 |
| 27 | 127 | 105 | 36 | 130 | 87 | 31 | 1240 | 113 | 378 |
| 28 | 129 | 106 | 37 | 130 | 78 | 27 | 1130 | 97 | 296 |
| 29 | 130 | 107 | 38 | 131 | 74 | 26 | 1060 | 92 | 263 |
| 30 | 131 | 107 | 38 | -- | -- | -- | 1020 | 114 | 314 |
| 31 | 132 | 107 | 38 | -- | -- | -- | 1010 | 142 | 387 |
| Total | 3499 | -- | 846 | 3879 | -- | 1042 | 16666 | -- | 3200 |

5-3250. MINNESOTA RIVER AT MANKATO, MINN.--Continued

SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| | APRIL | | | MAY | | | JUNE | | |
|---|---|---|---|---|---|---|---|---|---|
| Day | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons per day) |
| 1 | 948 | 112 | 287 | 1730 | 162 | 757 | 874 | 124 | 293 |
| 2 | 843 | 96 | 219 | 1620 | 142 | 621 | 885 | 141 | 337 |
| 3 | 801 | 106 | 229 | 1540 | 165 | 686 | 927 | 137 | 343 |
| 4 | 811 | 119 | 261 | 1450 | 184 | 720 | 990 | 112 | 299 |
| 5 | 759 | 56 | 115 | 1340 | 162 | 586 | 990 | 98 | 262 |
| 6 | 822 | 69 | 153 | 1220 | 134 | 441 | 937 | 100 | 253 |
| 7 | 874 | 81 | 191 | 1160 | 123 | 385 | 874 | 101 | 238 |
| 8 | 811 | 64 | 140 | 1120 | 136 | 411 | 843 | 91 | 207 |
| 9 | 790 | 65 | 139 | 1080 | 102 | 297 | 937 | 113 | 286 |
| 10 | 769 | 67 | 139 | 1030 | 83 | 231 | 1290 | 374 | 1350 |
| 11 | 811 | 94 | 206 | 969 | 81 | 212 | 2380 | 1040 | 7030 |
| 12 | 948 | 124 | 317 | 916 | 95 | 235 | 3610 | 1090 | 10600 |
| 13 | 1050 | 130 | 368 | 843 | 96 | 219 | 3680 | 790 | 7850 |
| 14 | 1090 | 126 | 371 | 822 | 89 | 198 | 3680 | 628 | 6240 |
| 15 | 990 | 114 | 305 | 811 | 111 | 243 | 3430 | 457 | 4230 |
| 16 | 916 | 112 | 277 | 822 | 113 | 251 | 3060 | 397 | 3280 |
| 17 | 948 | 106 | 271 | 759 | 131 | 268 | 2840 | 368 | 2820 |
| 18 | 927 | 96 | 240 | 927 | 132 | 330 | 2570 | 314 | 2180 |
| 19 | 874 | 99 | 234 | 958 | 146 | 378 | 2340 | 261 | 1650 |
| 20 | 1000 | 100 | 270 | 885 | 141 | 337 | 2180 | 231 | 1360 |
| 21 | 1040 | 102 | 286 | 822 | 153 | 340 | 2060 | 225 | 1250 |
| 22 | 1220 | 151 | 497 | 801 | 164 | 355 | 1900 | 220 | 1130 |
| 23 | 1760 | 309 | 1470 | 769 | 146 | 303 | 1790 | 211 | 1020 |
| 24 | 1850 | 294 | 1470 | 738 | 94 | 187 | 1760 | 184 | 874 |
| 25 | 1970 | 241 | 1280 | 696 | 91 | 171 | 1760 | 180 | 855 |
| 26 | 2180 | 298 | 1750 | 738 | 96 | 191 | 1840 | 176 | 874 |
| 27 | 2190 | 244 | 1440 | 769 | 87 | 181 | 2590 | 314 | 2280 |
| 28 | 2130 | 178 | 1020 | 769 | 90 | 187 | 3670 | 660 | 6540 |
| 29 | 2000 | 191 | 1030 | 811 | 93 | 204 | 4260 | 555 | 6380 |
| 30 | 1860 | 167 | 839 | 822 | 117 | 260 | 4350 | 438 | 5140 |
| 31 | -- | -- | -- | 822 | 110 | 244 | -- | -- | -- |
| Total | 35982 | -- | 15814 | 30559 | -- | 10429 | 65297 | | 77451 |

| | JULY | | | AUGUST | | | SEPTEMBER | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4030 | 322 | 3500 | 10800 | 432 | 12600 | 1320 | 133 | 474 |
| 2 | 3490 | 259 | 2440 | 9780 | 418 | 11000 | 1240 | 99 | 331 |
| 3 | 3000 | 234 | 1900 | 8560 | 408 | 9430 | 1190 | 91 | 292 |
| 4 | 2680 | 203 | 1470 | 7220 | 374 | 7290 | 1180 | 87 | 277 |
| 5 | 2420 | 196 | 1280 | 5840 | 336 | 5300 | 1210 | 93 | 304 |
| 6 | 2210 | 182 | 1090 | 5080 | 369 | 5060 | 1230 | 102 | 339 |
| 7 | 2040 | 153 | 843 | 12000 | 2850 | 90200 | 1270 | 109 | 374 |
| 8 | 1890 | 176 | 898 | 12300 | 921 | 30600 | 1510 | 241 | 1000 |
| 9 | 1760 | 158 | 751 | 11200 | 569 | 17200 | 1960 | 432 | 2290 |
| 10 | 1650 | 161 | 717 | 11500 | 691 | 21500 | 2260 | 306 | 1870 |
| 11 | 1760 | 180 | 855 | 11400 | 487 | 15000 | 2280 | 206 | 1270 |
| 12 | 1730 | 201 | 939 | 9450 | 433 | 11000 | 2160 | 213 | 1240 |
| 13 | 1860 | 270 | 1360 | 7640 | 402 | 8290 | 1990 | 192 | 1030 |
| 14 | 2270 | 412 | 2530 | 6330 | 339 | 5790 | 1800 | 164 | 797 |
| 15 | 2680 | 645 | 4670 | 5380 | 252 | 3660 | 1620 | 131 | 573 |
| 16 | 3050 | 521 | 4290 | 4730 | 260 | 3320 | 1540 | 136 | 565 |
| 17 | 2930 | 330 | 2610 | 4200 | 241 | 2730 | 1980 | 232 | 1240 |
| 18 | 2640 | 293 | 2090 | 3740 | 206 | 2080 | 2720 | 319 | 2340 |
| 19 | 2540 | 274 | 1880 | 3310 | 179 | 1600 | 3740 | 430 | 4340 |
| 20 | 2460 | 232 | 1540 | 3160 | 175 | 1490 | 4380 | 397 | 4690 |
| 21 | 2180 | 200 | 1180 | 2940 | 157 | 1250 | 4920 | 390 | 5180 |
| 22 | 1870 | 172 | 868 | 2670 | 137 | 988 | 5860 | 427 | 6760 |
| 23 | 2640 | 555 | 4550 | 2430 | 134 | 879 | 7980 | 543 | 11700 |
| 24 | 5260 | 1310 | 18600 | 2260 | 149 | 909 | 10200 | 708 | 19500 |
| 25 | 8170 | 1310 | 28900 | 2080 | 127 | 713 | 11400 | 606 | 18700 |
| 26 | 13000 | 1800 | 63200 | 1890 | 129 | 658 | 10800 | 478 | 13900 |
| 27 | 15600 | 1230 | 51800 | 1730 | 129 | 603 | 9170 | 363 | 8990 |
| 28 | 15200 | 837 | 34400 | 1570 | 122 | 517 | 7590 | 270 | 5530 |
| 29 | 14100 | 686 | 26100 | 1460 | 110 | 434 | 6590 | 271 | 4820 |
| 30 | 12500 | 620 | 20900 | 1400 | 99 | 374 | 6110 | 281 | 4640 |
| 31 | 11400 | 508 | 15600 | 1350 | 107 | 390 | -- | -- | -- |
| Total | 151010 | -- | 303751 | 175400 | -- | 272855 | 119200 | | 125356 |

Total Discharge for year (cfs-days) 628552
Total Load for year (tons) 820211

5-3300. MINNESOTA RIVER NEAR JORDAN, MINN.

LOCATION.--Lat 44°41'35", long 93°38'30", in NW¼SW¼ sec.7, T.114 N., R.23 W., Carver County, at gaging station on left bank, 1.5 miles northwest of Jordan, and at mile 39.4 upstream from Mississippi River.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIC2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | STRON-TIUM (SR) | SODIUM (NA) | PO-TAS-SIUM (K) | LITHIUM (LI) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NOV. | | | | | | | | | | | | |
| 15... | 441 | 4 | 14 | .00 | 98 | 43 | -- | 48 | 5.5 | -- | 388 | 0 |
| DEC. | | | | | | | | | | | | |
| 12... | 467 | 0 | 12 | .02 | 105 | 45 | .44 | 50 | 5.6 | .00 | 398 | 0 |
| JAN. | | | | | | | | | | | | |
| 16... | 183 | 1 | 19 | .01 | 90 | 48 | -- | 63 | 6.2 | -- | 356 | 9 |
| FEB. | | | | | | | | | | | | |
| 21... | 206 | 0 | 21 | .04 | 123 | 50 | -- | 60 | 6.8 | -- | 454 | 19 |
| MAR. | | | | | | | | | | | | |
| 20... | 963 | 4 | 16 | .03 | 83 | 36 | -- | 36 | 6.4 | -- | 291 | 12 |
| APR. | | | | | | | | | | | | |
| 18... | 922 | 14 | 8.4 | .03 | 86 | 42 | .45 | 34 | 6.2 | .00 | 270 | 5 |
| MAY | | | | | | | | | | | | |
| 14... | 1070 | 16 | 8.4 | .05 | 83 | 45 | -- | 33 | 6.5 | -- | 272 | 0 |
| JUNE | | | | | | | | | | | | |
| 20... | 3190 | 16 | 23 | .06 | 84 | 29 | -- | 16 | 4.5 | -- | 248 | 0 |
| JULY | | | | | | | | | | | | |
| 31... | 14900 | 22 | 22 | .02 | 61 | 20 | -- | 7.2 | 4.8 | -- | 192 | 0 |
| SEPT. | | | | | | | | | | | | |
| 03... | 1780 | 24 | 27 | .00 | 89 | 34 | -- | 21 | 5.6 | -- | 324 | 0 |

| DATE | TOTAL CHRO-MIUM (CR) | NICKEL (NI) | COBALT (CO) | LEAD (PB) | DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|
| NOV. | | | | | | | |
| 15... | -- | -- | -- | -- | 590 | .84 | 733 |
| DEC. | | | | | | | |
| 12... | .00 | .00 | .00 | .01 | 620 | .87 | 806 |
| JAN. | | | | | | | |
| 16... | -- | -- | -- | -- | 638 | .89 | 324 |
| FEB. | | | | | | | |
| 21... | -- | -- | -- | -- | 736 | 1.05 | 429 |
| MAR. | | | | | | | |
| 20... | -- | -- | -- | -- | 513 | .74 | 1410 |
| APR. | | | | | | | |
| 18... | .00 | .00 | .00 | .00 | 545 | .79 | 1450 |
| MAY | | | | | | | |
| 14... | -- | -- | -- | -- | 537 | .78 | 1650 |
| JUNE | | | | | | | |
| 20... | -- | -- | -- | -- | 430 | .63 | 4010 |
| JULY | | | | | | | |
| 31... | -- | -- | -- | -- | 304 | .47 | 14000 |
| SEPT. | | | | | | | |
| 03... | -- | -- | -- | -- | 470 | .66 | 2350 |

5-3300. MINNESOTA RIVER NEAR JORDAN, MINN.--Continued

DRAINAGE AREA.--16,200 sq mi, approximately.
RECORDS AVAILABLE.--Chemical analyses: December 1962 to August 1966, November 1967 to September 1968.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | ALKALINITY AS CACO3 | SULFATE (SO4) | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | COPPER (CU) | ZINC (ZN) | CADMIUM (CD) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NOV. 15... | 318 | 156 | 34 | .3 | .2 | .38 | .3 | .14 | -- | -- | -- |
| DEC. 12... | 326 | 169 | 34 | .2 | .9 | .46 | .1 | .15 | .00 | .00 | .00 |
| JAN. 16... | 307 | 168 | 52 | .2 | 5.1 | .64 | .3 | .17 | -- | -- | -- |
| FEB. 21... | 404 | 179 | 46 | .3 | 5.8 | .46 | .3 | .18 | -- | -- | -- |
| MAR. 20... | 258 | 153 | 25 | .3 | 1.7 | .84 | .2 | .13 | -- | -- | -- |
| APR. 18... | 230 | 208 | 20 | .3 | .1 | .54 | .0 | .14 | .00 | .00 | .00 |
| MAY 14... | 223 | 205 | 21 | .3 | .9 | .60 | .7 | .12 | -- | -- | -- |
| JUNE 20... | 203 | 108 | 14 | .4 | 28 | .59 | .7 | .07 | -- | -- | -- |
| JULY 31... | 157 | 64 | 8.2 | .3 | 20 | .56 | .6 | .06 | -- | -- | -- |
| SEPT. 03... | 266 | 109 | 19 | .4 | 5.1 | .65 | .7 | .10 | -- | -- | -- |

| DATE | HARDNESS (CA,MG) | NONCARBONATE HARDNESS | SODIUM ADSORPTION RATIO | PERCENT SODIUM | SPECIFIC CONDUCTANCE (MICROMHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| NOV. 15... | 420 | 102 | 1.0 | 20 | 923 | 7.9 | 7 |
| DEC. 12... | 446 | 120 | 1.0 | 19 | 966 | 7.7 | 7 |
| JAN. 16... | 423 | 116 | 1.3 | 24 | 997 | 8.4 | 4 |
| FEB. 21... | 510 | 106 | 1.2 | 20 | 1140 | 8.5 | 6 |
| MAR. 20... | 352 | 93 | .8 | 18 | 796 | 8.5 | 12 |
| APR. 18... | 389 | 159 | .7 | 16 | 846 | 8.3 | 4 |
| MAY 14... | 389 | 166 | .7 | 15 | 838 | 7.8 | 9 |
| JUNE 20... | 329 | 126 | .4 | 9 | 667 | 8.1 | 28 |
| JULY 31... | 232 | 75 | .2 | 6 | 481 | 7.6 | 20 |
| SEPT. 03... | 360 | 94 | .5 | 11 | 723 | 8.0 | 15 |

## 5-3310. MISSISSIPPI RIVER AT ST. PAUL, MINN.

LOCATION.--Lat 44°56'40", long 93°05'20", temperature recorder at gaging station, on left bank in St. Paul, Ramsey County, 300 feet upstream from Robert Street Bridge, 6 miles downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.
DRAINAGE AREA.--36,800 square miles, approximately.
RECORDS AVAILABLE.--Water temperatures: October 1956 to September 1968.
EXTREMES, 1967-68.--Water temperatures: Maximum, 28°C July 18-20, Aug. 7-9; minimum, freezing point on many days during December to March.
EXTREMES, 1956-68.--Water temperatures: Maximum, 31°C July 24-28, 1964; minimum, freezing point on many days during winter months.
REMARKS.--Recorder stopped Feb. 10-13 and May 17-22.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(WATER-STAGE RECORDER WITH TEMPERATURE ATTACHMENT, CONTINUOUS ETHYL ALCOHOL-ACTUATED THERMOGRAPH)

| Month | Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| October | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 16 | 17 | 17 | 17 | 19 | 18 | 18 | 17 | 16 | 15 | 14 | 14 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 14 |
| Minimum | 16 | 16 | 17 | 17 | 17 | 17 | 17 | 16 | 15 | 13 | 12 | 12 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 12 | 12 | 11 | 11 | 9 | 8 | 7 | 8 | 13 |
| November | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 10 | 10 | 10 | 9 | 9 | 9 | 7 | 8 | 8 | 7 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | -- | 7 |
| Minimum | 7 | 7 | 7 | 7 | 6 | 4 | 3 | 4 | 4 | 6 | 6 | 6 | 6 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | -- | 4 |
| December | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 6 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| Minimum | 0 | 1 | 2 | 1 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 1 |
| January | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 5 | 5 | 6 | 6 | 6 | 6 | 5 | 4 | 3 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Minimum | 4 | 0 | 0 | 3 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 1 | 1 | 0 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 1 | 2 |
| February | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 6 | 5 | 6 | 5 | 5 | 4 | 4 | 4 | 3 | -- | -- | -- | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | -- | -- | 4 |
| Minimum | 1 | 2 | 2 | 2 | 2 | 3 | 1 | 0 | 0 | -- | -- | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | -- | -- | 1 |
| March | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 9 | 9 | 10 | 9 | 7 |
| Minimum | 2 | 2 | 2 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 2 | 1 | 2 | 2 | 3 | 4 | 3 | 4 | 6 | 3 | 3 | 2 | 3 | 2 | 4 | 4 | 6 | 6 | 8 | 7 | 9 | 4 |
| April | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 9 | 10 | 9 | 9 | 9 | 8 | 8 | 8 | 9 | 9 | 10 | 12 | 11 | 11 | 10 | 11 | 12 | 12 | 13 | 12 | 11 | 13 | 13 | 11 | 9 | 10 | 11 | 11 | 12 | 14 | -- | 11 |
| Minimum | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 9 | 9 | 9 | 10 | 10 | 11 | 12 | -- | 10 |
| May | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 14 | 16 | 16 | 16 | 15 | 14 | 14 | 13 | 13 | 13 | 14 | 14 | 16 | 17 | 18 | 17 | -- | -- | -- | -- | -- | -- | -- | 17 | 17 | 16 | 16 | 15 | 15 | 16 | 17 | 18 | 15 |
| Minimum | 12 | 13 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 13 | 14 | 14 | 14 | 16 | -- | -- | -- | -- | -- | -- | -- | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 15 | 16 | 14 |
| June | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 18 | 18 | 20 | 22 | 23 | 24 | 26 | 26 | 26 | 26 | 25 | 24 | 23 | 22 | 22 | 21 | 21 | 21 | 22 | 21 | 21 | 22 | 21 | 21 | 21 | 20 | 19 | 19 | 20 | 21 | -- | 22 |
| Minimum | 16 | 17 | 17 | 18 | 18 | 21 | 21 | 22 | 24 | 23 | 23 | 22 | 22 | 22 | 21 | 21 | 21 | 20 | 20 | 20 | 20 | 21 | 21 | 21 | 20 | 19 | 18 | 18 | 19 | 20 | -- | 20 |
| July | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 20 | 19 | 20 | 21 | 22 | 22 | 23 | 25 | 25 | 25 | 25 | 26 | 26 | 26 | 26 | 27 | 28 | 28 | 28 | 28 | 27 | 27 | 27 | 26 | 26 | 26 | 26 | 25 | 24 | 24 | 24 | 25 |
| Minimum | 19 | 19 | 19 | 19 | 19 | 21 | 19 | 21 | 22 | 22 | 22 | 23 | 23 | 25 | 25 | 24 | 25 | 26 | 26 | 27 | 26 | 24 | 24 | 25 | 25 | 24 | 24 | 24 | 24 | 23 | 23 | 23 |
| August | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 23 | 24 | 24 | 25 | 26 | 27 | 28 | 28 | 28 | 24 | 24 | 23 | 23 | 23 | 22 | 23 | 22 | 22 | 22 | 23 | 24 | 25 | 27 | 27 | 25 | 24 | 23 | 22 | 22 | 22 | 22 | 24 |
| Minimum | 23 | 23 | 23 | 23 | 24 | 24 | 25 | 25 | 24 | 24 | 23 | 23 | 23 | 22 | 22 | 22 | 22 | 22 | 22 | 21 | 22 | 23 | 23 | 24 | 23 | 23 | 22 | 22 | 22 | 22 | 21 | 22 |
| September | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 20 | 19 | 19 | 19 | 20 | 20 | 21 | 20 | 21 | 21 | 20 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 17 | 17 | 17 | -- | 20 |
| Minimum | 21 | 21 | 21 | 21 | 21 | 20 | 20 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 20 | 20 | 19 | 19 | 19 | 18 | 18 | 18 | 18 | 19 | 18 | 17 | 17 | 17 | 17 | -- | 19 |

## 5-3760. NORTH FORK WHITEWATER RIVER NEAR ELBA, MINN.
(Hydrologic bench-mark station)

LOCATION.--Lat 44°05'30", long 92°03'57", in sec.7, T.107 N., R.10 W., Winona County, at gaging station on left bank, 2.3 miles upstream from Middle Fork, 2.4 miles west of Elba, and 3.5 miles upstream from confluence with South Fork.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | STRON-TIUM (SR) | SODIUM (NA) | PO-TAS-SIUM (K) | LITHIUM (LI) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. 25... | 14 | 7 | 15 | .10 | 38 | 24 | .00 | 2.6 | 3.0 | .00 | 222 | 0 |
| NOV. 30... | 14 | 3 | 16 | .02 | 66 | 25 | -- | 2.9 | 1.5 | -- | 318 | 0 |
| DEC. 20... | 14 | 4 | 10 | .00 | 63 | 24 | -- | 3.6 | 1.3 | -- | 298 | 6 |
| JAN. 24... | 13 | 2 | 16 | .00 | 63 | 24 | -- | 3.3 | 2.1 | -- | 313 | 0 |
| FEB. 28... | 13 | 2 | 15 | .00 | 48 | 22 | -- | 2.6 | 1.2 | -- | 254 | 0 |
| MAR. 21... | 13 | 4 | 13 | .04 | 62 | 23 | .16 | 3.1 | 1.4 | .00 | 291 | 0 |
| MAY 06... | 13 | 11 | 12 | .03 | 51 | 24 | -- | 2.8 | 1.0 | -- | 266 | 0 |
| 23... | 16 | 10 | 16 | .03 | 63 | 25 | -- | 3.0 | 1.2 | -- | 308 | 0 |
| JUNE 24... | 22 | 14 | 15 | .05 | 58 | 19 | -- | 3.1 | 2.1 | -- | 260 | 0 |
| AUG. 15... | 14 | 14 | 16 | .02 | 66 | 24 | -- | 3.7 | 2.4 | -- | 312 | 0 |
| SEPT. 09... | 68 | 14 | 10 | .16 | 37 | 11 | -- | 1.9 | 5.0 | -- | 166 | 0 |

| DATE | CAD-MIUM (CD) | TOTAL CHRO-MIUM (CR) | NICKEL (NI) | COBALT (CO) | LEAD (PB) | DISS-OLVED OXYGEN | DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|
| OCT. 25... | .00 | .00 | .00 | .00 | .01 | -- | 210 | .29 | 8.40 |
| NOV. 30... | -- | -- | -- | -- | -- | -- | 289 | .39 | 10.9 |
| DEC. 20... | -- | -- | -- | -- | -- | -- | 272 | .37 | 10.2 |
| JAN. 24... | -- | -- | -- | -- | -- | 13.0 | 282 | .40 | 10.8 |
| FEB. 28... | -- | -- | -- | -- | -- | 12.7 | 232 | .32 | 8.50 |
| MAR. 21... | .00 | .00 | .00 | .00 | .00 | 13.2 | 264 | .36 | 9.48 |
| MAY 06... | -- | -- | -- | -- | -- | 14.0 | 239 | .32 | 8.45 |
| 23... | -- | -- | -- | -- | -- | 11.5 | 279 | .37 | 11.9 |
| JUNE 24... | -- | -- | -- | -- | -- | 8.9 | 250 | .35 | 15.6 |
| AUG. 15... | -- | -- | -- | -- | -- | 12.3 | 287 | .39 | 11.4 |
| SEPT. 09... | -- | -- | -- | -- | -- | 8.2 | 165 | .24 | 31.9 |

RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

Units of measurement: Uranium, micrograms per liter of water; radium as radium-226, in picocuries per liter of water; gross beta radiation as strontium-90-yttrium-90, in picocuries per liter of water; gross alpha radiation, as micrograms of uranium equivalent per liter of water.

| Date of Collection | Dissolved | | | | | Suspended | | |
|---|---|---|---|---|---|---|---|---|
| | Uranium (ug/l) | Radium (pc/l) | Gross β (pc/l) | Gross α (ug U/l) | Total Dissolved Solids (mg/l) | Gross β (pc/l) | Gross α (ug U/l) | Suspended Sediments (mg/l) |
| Oct. 25, 1967.. | 0.5 | <0.1 | 3.4 | 5.4 | 253 | 1.2 | 0.8 | 1 |
| May 6, 1968.. | .5 | .2 | 3.1 | 2.0 | 256 | .9 | <.4 | 4 |

PESTICIDE ANALYSES, IN MICROGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | ALDRIN | DDD | DDE | DDT | DIELDRIN | ENDRIN | HEPTACHLOR | LINDANE | 2,4-D | 2,4,5-T |
|---|---|---|---|---|---|---|---|---|---|---|
| OCT. 25... | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| May 6.... | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |

GPO 817-490-.

5-3760. NORTH FORK WHITEWATER RIVER NEAR ELBA, MINN.--Continued
(Hydrologic bench-mark station)

DRAINAGE AREA.--101 sq mi.
RECORDS AVAILABLE.--Chemical analyses: August 1967 to September 1968.

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | ALKALINITY AS CACO3 | SULFATE (SO4) | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | COPPER (CU) | ZINC (ZN) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | | | |
| 25... | 182 | 12 | 1.7 | .1 | 4.4 | .16 | .26 | .1 | .01 | .00 | .00 |
| NOV. | | | | | | | | | | | |
| 30... | 261 | 13 | 1.8 | .0 | 5.9 | .11 | .17 | .4 | .00 | -- | -- |
| DEC. | | | | | | | | | | | |
| 20... | 254 | 12 | 2.2 | .0 | 3.3 | .13 | .38 | .1 | .00 | -- | -- |
| JAN. | | | | | | | | | | | |
| 24... | 257 | 12 | 1.5 | .1 | 5.1 | .18 | .31 | .4 | .00 | -- | -- |
| FEB. | | | | | | | | | | | |
| 28... | 208 | 11 | 1.3 | .1 | 5.8 | .13 | .23 | .2 | .01 | -- | -- |
| MAR. | | | | | | | | | | | |
| 21... | 239 | 13 | 2.5 | .1 | 3.6 | .18 | .22 | .1 | .00 | .00 | .00 |
| MAY | | | | | | | | | | | |
| 06... | 218 | 12 | 1.7 | .2 | 2.2 | .07 | .52 | .0 | .00 | -- | -- |
| 23... | 253 | 13 | 2.0 | .2 | 4.0 | .12 | .22 | .5 | .00 | -- | -- |
| JUNE | | | | | | | | | | | |
| 24... | 213 | 13 | 2.3 | .2 | 8.5 | .56 | .71 | .6 | .00 | -- | -- |
| AUG. | | | | | | | | | | | |
| 15... | 256 | 12 | 2.6 | .2 | 5.1 | .23 | .34 | 1.8 | .00 | -- | -- |
| SEPT. | | | | | | | | | | | |
| 09... | 136 | 8.3 | 4.6 | .1 | 4.4 | 1.2 | 1.2 | .5 | .03 | -- | -- |

| DATE | HARDNESS (CA,MG) | NONCARBONATE HARDNESS | SODIUM ADSORPTION RATIO | PERCENT SODIUM | SPECIFIC CONDUCTANCE (MICROMHOS) | PH | COLOR | COLIFORM (COLONIES PER 100 ML) | BIOCHEMICAL OXYGEN DEMAND |
|---|---|---|---|---|---|---|---|---|---|
| OCT. | | | | | | | | | |
| 25... | 192 | 10 | .1 | 3 | 377 | 7.7 | 2 | -- | .6 |
| NOV. | | | | | | | | | |
| 30... | 269 | 8 | .1 | 2 | 492 | 8.0 | 2 | -- | .6 |
| DEC. | | | | | | | | | |
| 20... | 257 | 3 | .1 | 3 | 467 | 8.4 | 3 | -- | 2.6 |
| JAN. | | | | | | | | | |
| 24... | 257 | 0 | .1 | 3 | 483 | 8.0 | 1 | -- | .4 |
| FEB. | | | | | | | | | |
| 28... | 211 | 3 | .1 | 3 | 399 | 8.0 | 2 | -- | .4 |
| MAR. | | | | | | | | | |
| 21... | 247 | 8 | .1 | 3 | 600 | 7.7 | 3 | 16 | .8 |
| MAY | | | | | | | | | |
| 06... | 228 | 10 | .1 | 3 | 419 | 8.2 | 2 | 30 | 1.5 |
| 23... | 258 | 5 | .1 | 2 | 485 | 8.2 | 3 | 14 | 1.1 |
| JUNE | | | | | | | | | |
| 24... | 223 | 10 | .1 | 3 | 438 | 8.0 | 80 | 200 | 1.2 |
| AUG. | | | | | | | | | |
| 15... | 264 | 9 | .1 | 3 | 491 | 7.4 | 5 | -- | .3 |
| SEPT. | | | | | | | | | |
| 09... | 139 | 3 | .1 | 3 | 289 | 7.3 | 6 | -- | 1.7 |

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) | Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|---|---|---|---|
| Oct. 25, 1967 | 15 | 84 | 3.4 | May 22, 1968 | 16 | 23 | 1.0 |
| Nov. 30 | 14 | 113 | 4.3 | June 24 | 22 | 415 | 25 |
| Mar. 21, 1968 | 13 | 9 | .3 | Aug. 15 | 15 | 57 | 2.3 |
| Apr. 25 | 18 | 12 | .6 | Sept. 9 | 68 | 773 | 142 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 04-0105.00 - PIGEON R AT MIDDLE FALLS, NR GRAND PORTAGE, MINN (LAT 48 00 44 LONG 089 36 58) | | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | | |
| 03... | 518 | 1 | 5.3 | .30 | 7.2 | 2.5 | 1.2 | 2.4 | 28 | 0 | 23 | 8.2 |
| 25... | 1860 | 1 | 5.7 | .29 | 7.2 | 2.3 | 1.2 | 1.2 | 23 | 0 | 19 | 8.5 |
| MAY | | | | | | | | | | | | |
| 08... | 994 | 0 | 4.4 | .18 | 7.8 | 2.4 | 1.4 | .6 | 29 | 0 | 24 | 6.5 |
| JUNE | | | | | | | | | | | | |
| 06... | 2400 | 15 | 6.1 | .31 | 9.0 | 3.1 | 1.4 | 1.4 | 33 | 0 | 27 | 8.5 |
| JULY | | | | | | | | | | | | |
| 10... | 648 | 17 | 5.0 | .16 | 9.3 | 2.6 | 1.6 | .3 | 35 | 0 | 29 | 7.0 |
| AUG. | | | | | | | | | | | | |
| 13... | 397 | 15 | 8.4 | .27 | 12 | 3.6 | 3.0 | 1.0 | 48 | 0 | 39 | 7.7 |
| 04-0145.00 - BAPTISM R NEAR BEAVER BAY, MINN (LAT 47 20 15 LONG 091 12 00) | | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | | |
| 03... | 192 | 1 | 7.4 | .20 | 6.2 | 1.9 | 1.7 | 1.2 | 21 | 0 | 17 | 8.0 |
| 24... | 998 | 1 | 7.0 | .23 | 5.8 | 1.8 | 1.3 | .7 | 13 | 0 | 11 | 11 |
| MAY | | | | | | | | | | | | |
| 07... | 295 | 8 | 6.1 | .22 | 6.5 | 2.0 | 1.7 | .4 | 20 | 0 | 16 | 9.0 |
| JUNE | | | | | | | | | | | | |
| 05... | 307 | 17 | 6.5 | .21 | 7.0 | 2.2 | 1.7 | .4 | 22 | 0 | 18 | 10 |
| JULY | | | | | | | | | | | | |
| 11... | 51 | 20 | 6.7 | .28 | 11 | 3.4 | 2.2 | .3 | 41 | 0 | 34 | 9.2 |
| AUG. | | | | | | | | | | | | |
| 13... | 15 | 15 | 6.4 | .22 | 15 | 4.3 | 2.8 | 1.0 | 64 | 0 | 52 | 6.7 |
| 04-0150.00 - BEAVER RIVER AT BEAVER BAY, MINN. (LAT 47 15 37 LONG 091 17 45) | | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | | |
| 10... | 493 | 4 | 6.8 | .19 | 6.9 | 2.1 | 1.4 | 1.2 | 23 | 0 | 19 | 9.2 |
| 25... | 825 | 2 | 6.6 | .22 | 7.0 | 2.0 | 1.2 | 1.1 | 20 | 0 | 16 | 9.8 |
| MAY | | | | | | | | | | | | |
| 08... | 252 | 10 | 5.2 | .22 | 7.9 | 2.4 | 1.7 | .4 | 25 | 0 | 21 | 9.8 |
| JUNE | | | | | | | | | | | | |
| 05... | 327 | 15 | 5.3 | .41 | 8.5 | 2.4 | 1.6 | .5 | 28 | 0 | 23 | 8.8 |
| JULY | | | | | | | | | | | | |
| 18... | 221 | 20 | 8.5 | .45 | 10 | 2.8 | 1.6 | .3 | 35 | 0 | 29 | 7.5 |
| AUG. | | | | | | | | | | | | |
| 14... | 7.2 | 15 | 8.2 | .16 | 11 | 3.6 | 3.9 | 1.2 | 49 | 0 | 40 | 7.2 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 04-0105.00 - PIGEON R AT MIDDLE FALLS, NR GRAND PORTAGE, MINN (LAT 48 00 44 LONG 089 36 58) | | | | | | | |
| APR., 1968 | | | | | | | |
| 03... | 28 | 5 | .1 | 8 | 66 | 7.0 | 52 |
| 25... | 27 | 8 | .1 | 8 | 58 | 6.5 | 55 |
| MAY | | | | | | | |
| 08... | 29 | 5 | .1 | 9 | 66 | 6.7 | 40 |
| JUNE | | | | | | | |
| 06... | 35 | 8 | .1 | 8 | 70 | 6.7 | 100 |
| JULY | | | | | | | |
| 10... | 34 | 5 | .1 | 9 | 73 | 7.0 | 25 |
| AUG. | | | | | | | |
| 13... | 44 | 5 | .2 | 12 | 97 | 7.2 | 50 |
| 04-0145.00 - BAPTISM R NEAR BEAVER BAY, MINN (LAT 47 20 15 LONG 091 12 00) | | | | | | | |
| APR., 1968 | | | | | | | |
| 03... | 23 | 6 | .2 | 13 | 57 | 6.9 | 62 |
| 24... | 22 | 11 | .1 | 11 | 53 | 6.4 | 60 |
| MAY | | | | | | | |
| 07... | 24 | 8 | .1 | 13 | 56 | 7.0 | 75 |
| JUNE | | | | | | | |
| 05... | 27 | 9 | .1 | 12 | 57 | 6.6 | 60 |
| JULY | | | | | | | |
| 11... | 40 | 7 | .2 | 10 | 85 | 7.1 | 70 |
| AUG. | | | | | | | |
| 13... | 56 | 3 | .2 | 10 | 114 | 7.2 | 40 |
| 04-0150.00 - BEAVER RIVER AT BEAVER BAY, MINN. (LAT 47 15 37 LONG 091 17 45) | | | | | | | |
| APR., 1968 | | | | | | | |
| 10... | 26 | 7 | .1 | 10 | 59 | 7.0 | 58 |
| 25... | 26 | 10 | .1 | 9 | 56 | 6.5 | 100 |
| MAY | | | | | | | |
| 08... | 30 | 9 | .1 | 11 | 66 | 7.1 | 75 |
| JUNE | | | | | | | |
| 05... | 31 | 8 | .1 | 10 | 62 | 6.7 | 100 |
| JULY | | | | | | | |
| 18... | 37 | 8 | .1 | 9 | 68 | 7.5 | 100 |
| AUG. | | | | | | | |
| 14... | 43 | 3 | .3 | 16 | 97 | 7.1 | 40 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 04-0105.00 - PIGEON R AT MIDDLE FALLS, NR GRAND PORTAGE, MINN (LAT 48 00 44 LONG 089 36 58) | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | |
| 03... | 1.1 | .1 | 1.1 | .35 | -- | .6 | .03 | -- | 44 | .07 | 76.9 |
| 25... | .6 | .2 | 1.0 | .05 | -- | .9 | .13 | -- | 41 | .09 | 326 |
| MAY | | | | | | | | | | | |
| 08... | .6 | .1 | .5 | .02 | -- | .8 | .04 | -- | 40 | .07 | 137 |
| JUNE | | | | | | | | | | | |
| 06... | .5 | .1 | 1.1 | .06 | -- | 1.0 | .05 | -- | 49 | .10 | 492 |
| JULY | | | | | | | | | | | |
| 10... | 1.6 | .1 | .4 | .04 | -- | 3.3 | .00 | -- | 49 | .08 | 98.0 |
| AUG. | | | | | | | | | | | |
| 13... | 1.8 | .5 | .5 | .04 | -- | .9 | .03 | -- | 63 | .11 | 83.6 |
| 04-0145.00 - BAPTISM R NEAR BEAVER BAY, MINN (LAT 47 20 15 LONG 091 12 00) | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | |
| 03... | 1.7 | .2 | 1.3 | .25 | -- | .5 | .02 | -- | 41 | .09 | 34.2 |
| 24... | 1.3 | .3 | 1.8 | .11 | -- | .0 | .02 | -- | 37 | .08 | 162 |
| MAY | | | | | | | | | | | |
| 07... | .7 | .2 | 1.0 | .00 | -- | .8 | .03 | -- | 39 | .08 | 45.4 |
| JUNE | | | | | | | | | | | |
| 05... | .5 | .2 | 1.1 | .10 | -- | .0 | .03 | -- | 41 | .09 | 53.9 |
| JULY | | | | | | | | | | | |
| 11... | 1.4 | .4 | 1.0 | .02 | -- | .8 | .07 | -- | 56 | .10 | 10.7 |
| AUG. | | | | | | | | | | | |
| 13... | 1.7 | .2 | .4 | .03 | -- | 1.2 | .04 | -- | 72 | .12 | 3.74 |
| 04-0150.00 - BEAVER RIVER AT BEAVER BAY, MINN. (LAT 47 15 37 LONG 091 17 45) | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | |
| 10... | 1.1 | .2 | 1.1 | .14 | -- | .7 | .01 | -- | 42 | .10 | 93.2 |
| 25... | .7 | .2 | 1.1 | .06 | -- | .9 | .04 | -- | 41 | .09 | 154 |
| MAY | | | | | | | | | | | |
| 08... | 1.0 | .2 | 1.0 | .00 | -- | 1.0 | .03 | -- | 43 | .08 | 42.2 |
| JUNE | | | | | | | | | | | |
| 05... | .5 | .2 | 1.3 | .24 | -- | 1.0 | .06 | -- | 45 | .10 | 64.5 |
| JULY | | | | | | | | | | | |
| 18... | .8 | .4 | 1.5 | .03 | -- | 1.1 | .04 | -- | 53 | .12 | 51.3 |
| AUG. | | | | | | | | | | | |
| 14... | 2.4 | .3 | .6 | .02 | -- | .9 | .05 | -- | 64 | .11 | 1.56 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 04-0240.00 - ST. LOUIS RIVER AT SCANLON, MINN. (LAT 46 42 12 LONG 092 25 07) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 07... | 972 | 1 | 6.7 | .31 | 23 | 7.4 | 8.5 | 1.8 | 81 | 0 | 66 | 20 |
| APR., 1968 | | | | | | | | | | | | |
| 01... | -- | 2 | 6.9 | .30 | 18 | 6.2 | 6.3 | 4.7 | 67 | 0 | 55 | 21 |
| MAY | | | | | | | | | | | | |
| 09... | 4603 | 10 | 5.4 | .38 | 15 | 5.3 | 4.7 | 1.2 | 44 | 0 | 36 | 18 |
| 09... | 4580 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JUNE | | | | | | | | | | | | |
| 04... | 3830 | 15 | 5.0 | .47 | 16 | 5.4 | 5.1 | 1.2 | 51 | 0 | 42 | 16 |
| JULY | | | | | | | | | | | | |
| 08... | 2220 | 22 | 6.6 | .64 | 18 | 3.6 | 10 | 1.1 | 70 | 0 | 57 | 18 |
| AUG. | | | | | | | | | | | | |
| 14... | 1240 | 16 | 7.7 | .97 | 20 | 6.2 | 6.7 | 1.6 | 62 | 0 | 51 | 16 |
| SEP. | | | | | | | | | | | | |
| 16... | 1560 | 18 | 6.9 | .67 | 17 | 5.9 | 5.9 | 1.4 | 57 | 0 | 47 | 19 |
| 05-0339.00 - PELICAN RIVER AT DETRCIT LAKES, MINN. (LAT 46 48 37 LONG 095 49 42) | | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | | |
| 16... | 2.1 | 19 | 12 | .04 | 69 | 33 | 9.2 | 3.7 | 357 | 0 | 293 | 32 |
| SEP. | | | | | | | | | | | | |
| 05... | 1.2 | 13 | 6.9 | .05 | 57 | 34 | 9.2 | 4.4 | 330 | 0 | 271 | 26 |
| 30... | 2.1 | 16 | 17 | .02 | 79 | 35 | 8.1 | 4.2 | 384 | 0 | 315 | 34 |
| 05-0339.40 - PELICAN RIVER TRIBUTARY NR DETROIT LAKES, MINN. (LAT 46 46 52 LONG 095 48 01) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 30... | .25 | 13 | 27 | .04 | 75 | 34 | 6.7 | 3.2 | 382 | 0 | 313 | 13 |
| 05-0339.60 - SUCKER CREEK NEAR DETRCIT LAKES, MINN. (LAT 46 46 25 LONG 095 48 23) | | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | | |
| 14... | 1.1 | 15 | 23 | .03 | 69 | 28 | 3.6 | 2.3 | 339 | 0 | 278 | 13 |
| SEP. | | | | | | | | | | | | |
| 30... | 1.2 | 13 | 25 | .05 | 75 | 28 | 3.5 | 2.8 | 358 | 0 | 294 | 12 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 04-0240.00 - ST. LOUIS RIVER AT SCANLON, MINN. (LAT 46 42 12 LONG 092 25 07) | | | | | | | |
| DEC., 1967 | | | | | | | |
| 07... | 88 | 22 | .4 | 17 | 230 | 7.5 | 84 |
| APR., 1968 | | | | | | | |
| 01... | 71 | 16 | .3 | 15 | 181 | 7.1 | 90 |
| MAY | | | | | | | |
| 09... | 58 | 22 | .3 | 14 | 140 | 6.7 | 75 |
| JUNE | | | | | | | |
| 05... | -- | -- | -- | -- | -- | -- | -- |
| 04... | 61 | 19 | .3 | 15 | 135 | 6.6 | 175 |
| JULY | | | | | | | |
| 08... | 59 | 1 | .6 | 26 | 170 | 6.9 | 100 |
| AUG. | | | | | | | |
| 14... | 75 | 25 | .3 | 16 | 178 | 6.7 | 80 |
| SEP. | | | | | | | |
| 16... | 66 | 19 | .3 | 16 | 161 | 7.4 | 120 |
| 05-0339.00 - PELICAN RIVER AT DETROIT LAKES, MINN. (LAT 46 48 37 LONG 095 49 42) | | | | | | | |
| AUG., 1968 | | | | | | | |
| 16... | 309 | 16 | .2 | 6 | 582 | 8.0 | 10 |
| SEP. | | | | | | | |
| 05... | 283 | 12 | .2 | 7 | 544 | 8.1 | 10 |
| 30... | 340 | 25 | .2 | 5 | 622 | 7.7 | 10 |
| 05-0339.40 - PELICAN RIVER TRIBUTARY NR DETROIT LAKES, MINN. (LAT 46 46 52 LONG 095 48 01) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 30... | 328 | 15 | .2 | 4 | 591 | 7.6 | 2 |
| 05-0339.60 - SUCKER CREEK NEAR DETROIT LAKES, MINN. (LAT 46 46 25 LONG 095 48 23) | | | | | | | |
| AUG., 1968 | | | | | | | |
| 14... | 285 | 8 | .1 | 3 | 516 | 8.2 | 5 |
| SEP. | | | | | | | |
| 30... | 302 | 9 | .1 | 2 | 546 | 7.7 | 2 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 04-0240.00 - ST. LOUIS RIVER AT SCANLON, MINN. (LAT 46 42 12 LONG 092 25 07) | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | |
| 07... | 15 | .3 | 1.0 | .23 | -- | .6 | .04 | -- | 125 | .25 | 480 |
| APR., 1968 | | | | | | | | | | | |
| 01... | 9.0 | .2 | 1.4 | .06 | -- | .7 | .08 | -- | 108 | .21 | -- |
| MAY | | | | | | | | | | | |
| 09... | 7.0 | .2 | 1.2 | .09 | -- | 1.1 | .07 | -- | 81 | .16 | 1440 |
| 09... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JUNE | | | | | | | | | | | |
| 04... | 4.9 | .2 | 1.8 | .08 | -- | 1.2 | .10 | -- | 83 | .17 | 1300 |
| JULY | | | | | | | | | | | |
| 08... | 8.6 | .3 | 1.7 | .27 | -- | 1.4 | .03 | -- | 105 | .20 | 887 |
| AUG. | | | | | | | | | | | |
| 14... | 14 | .3 | 1.5 | .16 | -- | 1.1 | .05 | -- | 107 | .22 | 546 |
| SEP. | | | | | | | | | | | |
| 16... | 9.5 | .2 | 1.1 | .19 | .52 | .9 | .07 | -- | 96 | .20 | 632 |
| 05-0339.00 - PELICAN RIVER AT DETROIT LAKES, MINN. (LAT 46 48 37 LONG 095 49 42) | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | |
| 16... | 5.6 | .2 | .2 | .24 | .34 | .4 | .05 | -- | 341 | .47 | 1.98 |
| SEP. | | | | | | | | | | | |
| 05... | 6.0 | .1 | .1 | .18 | .27 | .6 | .06 | -- | 308 | .44 | 1.12 |
| 30... | 5.8 | .1 | .1 | .14 | .47 | .6 | .06 | -- | 372 | .51 | 2.17 |
| 05-0339.40 - PELICAN RIVER TRIBUTARY NR DETROIT LAKES, MINN. (LAT 46 46 52 LONG 095 48 01) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 30... | 11 | .3 | .3 | .11 | .31 | 1.3 | .06 | -- | 361 | .52 | .26 |
| 05-0339.60 - SUCKER CREEK NEAR DETROIT LAKES, MINN. (LAT 46 46 25 LONG 095 48 23) | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | |
| 14... | 3.6 | .2 | 1.2 | .12 | .17 | .4 | .01 | -- | 311 | .43 | .96 |
| SEP. | | | | | | | | | | | |
| 30... | 3.6 | .2 | .3 | .12 | .27 | .6 | .03 | -- | 327 | .45 | 1.07 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-0391.00 - PELICAN R AT L MELISSA OUTLET NR DETROIT L, MINN (LAT 46 43 50 LONG 095 53 40) | | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | | |
| 16... | 12 | 19 | 11 | .01 | 24 | 30 | 10 | 4.7 | 220 | 0 | 180 | 15 |
| SEP. | | | | | | | | | | | | |
| 05... | 5.7 | 18 | 13 | .05 | 24 | 30 | 11 | 4.5 | 218 | 0 | 179 | 15 |
| 05-0405.00 - PELICAN RIVER NEAR FERGUS FALLS, MINN. (LAT 46 20 10 LONG 096 07 00) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 25... | 13 | -- | 6.6 | .03 | 56 | 39 | 16 | 6.3 | 356 | 0 | 292 | 29 |
| 05-0620.00 - BUFFALO RIVER NEAR DILWORTH, MINN. (LAT 46 57 40 LONG 096 39 40) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 24... | 21 | -- | 17 | .05 | 89 | 48 | 21 | 6.7 | 398 | 2 | 330 | 122 |
| 05-0640.00 - WILD RICE RIVER AT HENDRUM, MINN. (LAT 47 16 05 LONG 096 47 50) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 24... | 21 | 6 | 16 | .15 | 71 | 34 | 20 | 4.7 | 348 | 5 | 294 | 54 |
| 05-0790.00 - RED LAKE RIVER AT CROOKSTON, MINN. (LAT 47 46 32 LONG 096 36 30) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 21... | 374 | 1 | 12 | .03 | 56 | 21 | 6.5 | 3.8 | 258 | 0 | 212 | 33 |
| APR., 1968 | | | | | | | | | | | | |
| 09... | 929 | 6 | 10 | .04 | 51 | 18 | 5.5 | 4.6 | 192 | 0 | 157 | 52 |
| JUNE | | | | | | | | | | | | |
| 20... | 2030 | 26 | 13 | .99 | 66 | 21 | 5.0 | 3.8 | 210 | 0 | 172 | 95 |
| 05-0875.00 - MIDDLE RIVER AT ARGYLE, MINN. (LAT 48 20 27 LONG 096 49 02) | | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | | |
| 10... | 14 | 1 | 10 | .06 | 48 | 19 | 4.3 | 3.8 | 182 | 0 | 149 | 54 |
| SEP. | | | | | | | | | | | | |
| 24... | 38 | 12 | 9.9 | .08 | 83 | 39 | 7.3 | 3.7 | 356 | 0 | 292 | 79 |
| 05-0940.00 - SOUTH BRANCH TWO RIVERS AT LAKE BRONSON, MINN. (LAT 48 43 50 LONG 096 39 50) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 18... | 1.6 | 11 | 5.7 | .06 | 60 | 28 | 7.7 | 3.8 | 294 | 0 | 241 | 35 |
| SEP., 1968 | | | | | | | | | | | | |
| 25... | 210 | 10 | 7.2 | .13 | 68 | 27 | 7.0 | 3.7 | 262 | 0 | 215 | 67 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-0391.00 - PELICAN R AT L MELISSA OUTLET NR DETROIT L, MINN (LAT 46 43 50 LONG 095 53 40) | | | | | | | |
| AUG., 1968 | | | | | | | |
| 16... | 182 | 2 | .3 | 10 | 383 | 7.9 | 5 |
| SEP. | | | | | | | |
| 05... | 181 | 2 | .4 | 11 | 377 | 7.9 | 3 |
| 05-0405.00 - PELICAN RIVER NEAR FERGUS FALLS, MINN. (LAT 46 20 10 LONG 096 07 00) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 25... | 300 | 8 | .4 | 10 | 592 | 8.1 | 17 |
| 05-0620.00 - BUFFALO RIVER NEAR DILWORTH, MINN. (LAT 46 57 40 LONG 096 39 40) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 24... | 420 | 90 | .4 | 10 | 800 | 8.4 | 20 |
| 05-0640.00 - WILD RICE RIVER AT HENDRUM, MINN. (LAT 47 16 05 LONG 096 47 50) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 24... | 317 | 23 | .5 | 12 | 633 | 8.4 | 21 |
| 05-0790.00 - RED LAKE RIVER AT CROOKSTON, MINN. (LAT 47 46 32 LONG 096 36 30) | | | | | | | |
| DEC., 1967 | | | | | | | |
| 21... | 226 | 14 | .2 | 6 | 448 | 8.0 | 13 |
| APR., 1968 | | | | | | | |
| 09... | 202 | 44 | .2 | 5 | 399 | 7.5 | 26 |
| JUNE | | | | | | | |
| 20... | 251 | 79 | .1 | 4 | 500 | 7.3 | 45 |
| 05-0875.00 - MIDDLE RIVER AT ARGYLE, MINN. (LAT 48 20 27 LONG 096 49 02) | | | | | | | |
| APR., 1968 | | | | | | | |
| 10... | 199 | 50 | .1 | 4 | 388 | 7.7 | 2 |
| SEP. | | | | | | | |
| 24... | 364 | 73 | .2 | 4 | 640 | 8.2 | 45 |
| 05-0940.00 - SOUTH BRANCH TWO RIVERS AT LAKE BRONSON, MINN. (LAT 48 43 50 LONG 096 39 50) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 18... | 264 | 23 | .2 | 6 | 505 | 7.5 | 37 |
| SEP., 1968 | | | | | | | |
| 25... | 280 | 66 | .2 | 5 | 510 | 7.7 | 50 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-0391.00 - PELICAN R AT L MELISSA OUTLET NR DETROIT L, MINN (LAT 46 43 50 LONG 095 53 40) | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | |
| 16... | 11 | .2 | .2 | .14 | .26 | .5 | .05 | -- | 214 | .30 | 7.53 |
| SEP. | | | | | | | | | | | |
| 05... | 10 | .1 | 1.0 | .16 | .26 | .6 | .05 | -- | 217 | .30 | 3.38 |
| 05-0405.00 - PELICAN RIVER NEAR FERGUS FALLS, MINN. (LAT 46 20 10 LONG 096 07 00) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 25... | 9.8 | .3 | .4 | -- | .11 | .4 | .07 | -- | 339 | .48 | 12.9 |
| 05-0620.00 - BUFFALO RIVER NEAR DILWORTH, MINN. (LAT 46 57 40 LONG 096 39 40) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 24... | 6.6 | .3 | .4 | -- | .18 | .7 | .12 | -- | 510 | .73 | 30.7 |
| 05-0640.00 - WILD RICE RIVER AT HENDRUM, MINN. (LAT 47 16 05 LONG 096 47 50) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 24... | 5.8 | .2 | .3 | -- | .16 | .7 | .10 | -- | 383 | .54 | 23.5 |
| 05-0790.00 - RED LAKE RIVER AT CROOKSTON, MINN. (LAT 47 46 32 LONG 096 36 30) | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | |
| 21... | 3.6 | .2 | .4 | .16 | -- | .4 | .03 | -- | 264 | .42 | 309 |
| APR., 1968 | | | | | | | | | | | |
| 09... | 3.2 | .1 | 1.0 | .17 | -- | .4 | .03 | -- | 241 | .37 | 675 |
| JUNE | | | | | | | | | | | |
| 20... | 1.4 | .2 | .7 | .00 | -- | .0 | .07 | -- | 311 | .52 | 2080 |
| 05-0875.00 - MIDDLE RIVER AT ARGYLE, MINN. (LAT 48 20 27 LONG 096 49 02) | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | |
| 10... | 3.3 | .2 | 1.9 | .22 | -- | .4 | .02 | -- | 235 | .34 | 10.1 |
| SEP. | | | | | | | | | | | |
| 24... | 6.2 | .2 | .0 | .20 | .73 | .4 | .06 | -- | 403 | .60 | 45.4 |
| 05-0940.00 - SOUTH BRANCH TWO RIVERS AT LAKE BRONSON, MINN. (LAT 48 43 50 LONG 096 39 50) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 18... | 5.2 | .2 | .4 | -- | .43 | .6 | .05 | -- | 292 | .43 | 1.38 |
| SEP., 1968 | | | | | | | | | | | |
| 25... | 4.8 | .2 | .2 | .12 | .44 | .4 | .13 | -- | 315 | .47 | 197 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-1075.00 - ROSEAU RIVER AT ROSS, MINN. (LAT 48 54 37 LONG 095 55 18) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 19... | 22 | 9 | 4.6 | .05 | 63 | 30 | 21 | 2.1 | 330 | 0 | 271 | 29 |
| SEP., 1968 | | | | | | | | | | | | |
| 25... | 673 | 11 | 14 | .20 | 60 | 21 | 5.6 | 2.7 | 264 | 0 | 217 | 25 |
| 05-1290.00 - VERMILION R. BL. VERMILION LAKE, NR. TOWER, MINN (LAT 47 57 41 LONG 092 28 33) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 12... | 24 | 8 | 1.7 | .03 | 7.9 | 1.9 | 1.6 | .8 | 25 | 0 | 21 | 6.5 |
| SEP., 1968 | | | | | | | | | | | | |
| 19... | 512 | 18 | .0 | .05 | 7.5 | 2.0 | 1.4 | .8 | 28 | 0 | 23 | 8.2 |
| 05-1320.00 - BIG FORK RIVER AT BIG FALLS, MINN. (LAT 48 12 00 LONG 093 48 00) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 12... | 449 | 11 | 9.7 | .52 | 24 | 7.8 | 2.2 | 1.2 | 102 | 0 | 84 | 10 |
| 05-1335.00 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47) | | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | | |
| 29... | 13860 | 9 | 4.3 | .29 | 15 | 5.3 | 1.6 | 1.5 | 58 | 0 | 48 | 13 |
| 05-1342.00 - RAPID RIVER NEAR BAUDETTE, MINN. (LAT 48 32 10 LONG 094 33 45) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 20... | 2.4 | 8 | 6.1 | .05 | 65 | 26 | 12 | 2.1 | 293 | 0 | 240 | 50 |
| SEP., 1968 | | | | | | | | | | | | |
| 26... | 1070 | 11 | 9.2 | .35 | 26 | 7.5 | .6 | 1.3 | 106 | 0 | 87 | 9.7 |
| 05-2110.00 - MISSISSIPPI RIVER AT GRAND RAPIDS, MINN. (LAT 47 13 56 LONG 093 31 48) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 06... | 700 | 12 | 7.6 | .03 | 34 | 15 | 7.0 | 2.1 | 181 | 0 | 148 | 7.2 |
| DEC. | | | | | | | | | | | | |
| 01... | 844 | 1 | 11 | .04 | 37 | 15 | 7.7 | 2.4 | 200 | 0 | 164 | 12 |
| MAY , 1968 | | | | | | | | | | | | |
| 01... | 50 | 10 | 15 | .24 | 37 | 9.6 | 23 | 3.1 | 162 | 0 | 133 | 28 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-1075.00 - ROSEAU RIVER AT ROSS, MINN. (LAT 48 54 37 LONG 095 55 18) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 19... | 280 | 9 | .5 | 14 | 572 | 7.6 | 32 |
| SEP., 1968 | | | | | | | |
| 25... | 235 | 19 | .2 | 5 | 423 | 8.1 | 47 |
| 05-1290.00 - VERMILION R. BL. VERMILION LAKE, NR. TOWER, MINN (LAT 47 57 41 LONG 092 28 33) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 12... | 28 | 7 | .1 | 11 | 63 | 6.5 | 22 |
| SEP., 1968 | | | | | | | |
| 19... | 27 | 4 | .1 | 10 | 65 | 7.2 | 7 |
| 05-1320.00 - BIG FORK RIVER AT BIG FALLS, MINN. (LAT 48 12 00 LONG 093 48 00) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 12... | 92 | 8 | .1 | 5 | 170 | 6.5 | 130 |
| 05-1335.00 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47) | | | | | | | |
| APR., 1968 | | | | | | | |
| 29... | 60 | 12 | .1 | 5 | 119 | 6.9 | 125 |
| 05-1342.00 - RAPID RIVER NEAR BAUDETTE, MINN. (LAT 48 32 10 LONG 094 33 45) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 20... | 269 | 29 | .3 | 9 | 516 | 8.2 | 34 |
| SEP., 1968 | | | | | | | |
| 26... | 96 | 8 | .0 | 1 | 168 | 7.6 | 170 |
| 05-2110.00 - MISSISSIPPI RIVER AT GRAND RAPIDS, MINN. (LAT 47 13 56 LONG 093 31 48) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 06... | 146 | 0 | .3 | 9 | 295 | 7.7 | 7 |
| DEC. | | | | | | | |
| 01... | 155 | 0 | .3 | 10 | 330 | 7.8 | 8 |
| MAY , 1968 | | | | | | | |
| 01... | 132 | 0 | .9 | 27 | 362 | 7.0 | 30 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-1075.00 - ROSEAU RIVER AT ROSS, MINN. (LAT 48 54 37 LONG 095 55 18) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 19... | 14 | .4 | .4 | -- | .10 | .5 | .06 | -- | 327 | .48 | 21.0 |
| SEP., 1968 | | | | | | | | | | | |
| 25... | 3.8 | .3 | .2 | .41 | .73 | .4 | .06 | -- | 263 | .41 | 554 |
| 05-1290.00 - VERMILION R. BL. VERMILION LAKE, NR. TOWER, MINN (LAT 47 57 41 LONG 092 28 33) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 12... | 1.2 | .1 | .5 | -- | .09 | .4 | .01 | -- | 35 | .07 | 3.67 |
| SEP., 1968 | | | | | | | | | | | |
| 19... | 1.1 | .1 | .0 | .13 | .35 | .3 | .02 | -- | 35 | .09 | 87.1 |
| 05-1320.00 - BIG FORK RIVER AT BIG FALLS, MINN. (LAT 48 12 00 LONG 093 48 00) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 12... | 1.8 | .3 | 1.9 | .10 | -- | 1.5 | .06 | -- | 111 | .22 | 193 |
| 05-1335.00 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47) | | | | | | | | | | | |
| APR., 1968 | | | | | | | | | | | |
| 29... | 1.4 | .2 | 1.5 | .11 | -- | 1.2 | .02 | -- | 74 | .15 | 4190 |
| 05-1342.00 - RAPID RIVER NEAR BAUDETTE, MINN. (LAT 48 32 10 LONG 094 33 45) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 20... | 3.0 | .3 | .3 | -- | .04 | .5 | .06 | -- | 310 | .46 | 2.20 |
| SEP., 1968 | | | | | | | | | | | |
| 26... | 1.1 | .3 | .9 | .09 | .45 | .8 | .06 | -- | 110 | .23 | 480 |
| 05-2110.00 - MISSISSIPPI RIVER AT GRAND RAPIDS, MINN. (LAT 47 13 56 LONG 093 31 48) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 06... | 1.6 | .1 | .4 | -- | .10 | .4 | .03 | -- | 165 | .24 | 335 |
| DEC. | | | | | | | | | | | |
| 01... | 2.0 | .2 | .3 | .22 | -- | .3 | .02 | -- | 187 | .29 | 488 |
| MAY , 1968 | | | | | | | | | | | |
| 01... | 15 | .2 | .4 | 1.1 | -- | .0 | .06 | -- | 212 | .30 | 30.2 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-2440.00 - CROW WING RIVER AT NIMROD, MINN. (LAT 46 39 00 LONG 094 53 00) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 31... | 389 | 4 | 8.9 | .04 | 39 | 16 | 5.2 | 1.5 | 208 | 0 | 171 | 2.2 |
| LEAF RIVER NEAR VERNDALE, MINN. (LAT 46 29 23 LONG 095 00 27) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 17... | 44 | 5 | 5.7 | .03 | 65 | 23 | 6.0 | 1.9 | 304 | 0 | 249 | 13 |
| WING RIVER NEAR VERNDALE, MINN. (LAT 46 26 18 LONG 094 59 48) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 16... | 22 | 8 | 14 | .04 | 72 | 22 | 5.2 | 1.5 | 299 | 0 | 245 | 20 |
| REDEYE RIVER NEAR ALDRICH, MINN. (LAT 46 29 55 LONG 094 54 30) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 17... | 22 | 6 | 13 | .03 | 66 | 20 | 7.0 | 1.7 | 302 | 0 | 248 | 5.2 |
| PARTRIDGE RIVER NEAR ALDRICH, MINN. (LAT 46 24 58 LONG 094 50 24) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 17... | 5.1 | 8 | 9.8 | .03 | 70 | 21 | 6.6 | 2.1 | 297 | 0 | 244 | 20 |
| 05-2705.00 - SAUK RIVER NEAR ST. CLOUD, MINN. (LAT 45 33 35 LONG 094 14 00) | | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | | |
| 29... | 39 | 19 | 9.0 | .11 | 43 | 24 | 8.3 | 4.4 | 222 | 0 | 182 | 27 |
| 05-2860.00 - RUM RIVER NEAR ST. FRANCIS, MINN. (LAT 45 19 40 LONG 093 22 20) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 05... | 327 | 19 | 9.9 | .12 | 36 | 11 | 5.0 | 1.8 | 174 | 0 | 143 | 8.5 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-2440.00 - CROW WING RIVER AT NIMROD, MINN. (LAT 46 39 00 LONG 094 53 00) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 31... | 164 | 0 | .2 | 6 | 332 | 7.7 | 24 |
| LEAF RIVER NEAR VERNDALE, MINN. (LAT 46 29 23 LONG 095 00 27) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 17... | 256 | 7 | .2 | 5 | 473 | 8.0 | 11 |
| WING RIVER NEAR VERNDALE, MINN. (LAT 46 26 18 LONG 094 59 48) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 16... | 270 | 25 | .1 | 4 | 500 | 7.8 | 11 |
| REDEYE RIVER NEAR ALDRICH, MINN. (LAT 46 29 55 LONG 094 54 30) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 17... | 246 | 0 | .2 | 6 | 462 | 7.8 | 12 |
| PARTRIDGE RIVER NEAR ALDRICH, MINN. (LAT 46 24 58 LONG 094 50 24) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 17... | 261 | 17 | .2 | 5 | 487 | 7.6 | 14 |
| 05-2705.00 - SAUK RIVER NEAR ST. CLOUD, MINN. (LAT 45 33 35 LONG 094 14 00) | | | | | | | |
| AUG., 1968 | | | | | | | |
| 29... | 204 | 22 | .3 | 8 | 428 | 7.5 | 7 |
| 05-2860.00 - RUM RIVER NEAR ST. FRANCIS, MINN. (LAT 45 19 40 LONG 093 22 20) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 05... | 137 | 0 | .2 | 7 | 292 | 7.7 | 9 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-2440.00 - CROW WING RIVER AT NIMROD, MINN. (LAT 46 39 00 LONG 094 53 00) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 31... | 3.0 | .1 | .8 | -- | .09 | .4 | .02 | -- | 179 | .26 | 204 |
| LEAF RIVER NEAR VERNDALE, MINN. (LAT 46 29 23 LONG 095 00 27) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 3.6 | .2 | .2 | -- | .02 | .7 | .03 | -- | 270 | .39 | 34.7 |
| WING RIVER NEAR VERNDALE, MINN. (LAT 46 26 18 LONG 094 59 48) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 16... | 3.6 | .1 | 8.4 | -- | .01 | .5 | .03 | -- | 294 | .40 | 17.6 |
| REDEYE RIVER NEAR ALDRICH, MINN. (LAT 46 29 55 LONG 094 54 30) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 3.0 | .1 | .2 | -- | .12 | .4 | .02 | -- | 265 | .38 | 16.8 |
| PARTRIDGE RIVER NEAR ALDRICH, MINN. (LAT 46 24 58 LONG 094 50 24) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 6.4 | .2 | 3.1 | -- | .06 | .4 | .02 | -- | 286 | .39 | 3.94 |
| 05-2705.00 - SAUK RIVER NEAR ST. CLOUD, MINN. (LAT 45 33 35 LONG 094 14 00) | | | | | | | | | | | |
| AUG., 1968 | | | | | | | | | | | |
| 29... | 8.8 | .2 | 2.5 | .29 | -- | 1.6 | .06 | -- | 238 | .34 | 26.9 |
| 05-2860.00 - RUM RIVER NEAR ST. FRANCIS, MINN. (LAT 45 19 40 LONG 093 22 20) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 05... | 3.0 | .2 | .2 | .33 | -- | .9 | .04 | -- | 163 | .24 | 158 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-2920.00 - MINNESOTA RIVER AT ORTONVILLE, MINN. (LAT 45 17 44 LONG 096 26 38) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 06... | 9.6 | 15 | 27 | .01 | 91 | 51 | 51 | 12 | 259 | 0 | 212 | 288 |
| 06... | 9.7 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 05-3045.00 - CHIPPEWA RIVER NEAR MILAN, MINN. (LAT 45 06 39 LONG 095 47 57) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 04... | 30 | 16 | 26 | .14 | 83 | 55 | 30 | 10 | 296 | 0 | 243 | 238 |
| HAWK CR., 2 MILES UPSTREAM FROM CLARA CITY, MINN (LAT 44 58 12 LONG 095 21 40) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 17... | 2.0 | -- | 14 | .42 | 115 | 86 | 27 | 5.4 | 341 | 0 | 280 | 397 |
| CHETOMBA CREEK NEAR PRINSBURG, MINN. (LAT 44 56 06 LONG 095 12 05) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 17... | .20 | -- | 5.4 | .06 | 140 | 108 | 110 | 13 | 215 | 0 | 176 | 745 |
| CHETOMBA CR., 4 MILES SOUTH OF MAYNARD, MINN. (LAT 44 51 44 LONG 095 25 37) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 17... | 1.2 | -- | 8.1 | .12 | 82 | 48 | 12 | 3.4 | 212 | 0 | 174 | 234 |
| HAWK CREEK NEAR GRANITE FALLS, MINN. (LAT 44 49 59 LONG 095 26 01) | | | | | | | | | | | | |
| JUNE, 1968 | | | | | | | | | | | | |
| 12... | -- | 21 | 19 | .08 | 73 | 32 | 9.5 | 4.4 | 195 | 0 | 160 | 150 |
| OCT., 1967 | | | | | | | | | | | | |
| 28... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JUNE, 1968 | | | | | | | | | | | | |
| 26... | -- | 17 | 17 | .10 | 75 | 44 | 23 | 8.2 | 257 | 0 | 211 | 164 |
| NOV., 1967 | | | | | | | | | | | | |
| 28... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JULY, 1968 | | | | | | | | | | | | |
| 05... | 45 | 22 | 15 | -- | 80 | 51 | 25 | 8.2 | 260 | 0 | 213 | 198 |
| FEB. | | | | | | | | | | | | |
| 06... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-2920.00 - MINNESOTA RIVER AT ORTONVILLE, MINN. (LAT 45 17 44 LONG 096 26 38) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 06... | 437 | 225 | 1.1 | 20 | 982 | 8.2 | 8 |
| 28... | -- | -- | -- | -- | -- | -- | -- |
| 05-3045.00 - CHIPPEWA RIVER NEAR MILAN, MINN. (LAT 45 06 39 LONG 095 47 57) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 04... | 431 | 188 | .6 | 13 | 877 | 7.7 | 12 |
| HAWK CR., 2 MILES UPSTREAM FROM CLARA CITY, MINN (LAT 44 58 12 LONG 095 21 40) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 17... | 640 | 360 | .5 | 8 | 1160 | 7.9 | 9 |
| CHETOMBA CREEK NEAR PRINSBURG, MINN. (LAT 44 56 06 LONG 095 12 05) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 17... | 794 | 618 | 1.7 | 23 | 1710 | 7.4 | 11 |
| CHETOMBA CR., 4 MILES SOUTH OF MAYNARD, MINN. (LAT 44 51 44 LONG 095 25 37) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 17... | 402 | 228 | .3 | 6 | 780 | 8.0 | 5 |
| HAWK CREEK NEAR GRANITE FALLS, MINN. (LAT 44 49 59 LONG 095 26 01) | | | | | | | |
| JUNE, 1968 | | | | | | | |
| 12... | 311 | 151 | .2 | 6 | 626 | 7.9 | 23 |
| 12... | -- | -- | -- | -- | 620 | -- | -- |
| 26... | 366 | 155 | .5 | 12 | 774 | .8 | 27 |
| 26... | -- | -- | -- | -- | 950 | -- | -- |
| JULY | | | | | | | |
| 05... | 409 | 196 | .5 | 11 | 840 | 7.4 | 10 |
| 05... | -- | -- | -- | -- | 830 | -- | -- |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLO-RIDE (CL) | FLUO-RIDE (F) | NITRATE (NO3) | ORTHO PHOS-PHATE (PO4) | PHOS-PHATE (PO4) | TOTAL ALUM-INIUM (AL) | BORON (B) | DISS-OLVED OXYGEN | DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) | DIS-SOLVED SOLIDS (TONS PER AC-FT) | DIS-SOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-2920.00 - MINNESOTA RIVER AT ORTONVILLE, MINN. (LAT 45 17 44 LONG 096 26 38) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 06... | 25 | .2 | 5.1 | 1.3 | -- | .6 | .26 | -- | 681 | .99 | 18.9 |
| 06... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 05-3045.00 - CHIPPEWA RIVER NEAR MILAN, MINN. (LAT 45 06 39 LONG 095 47 57) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 04... | 7.6 | .4 | 2.1 | .36 | -- | .4 | .19 | -- | 599 | .86 | 52.5 |
| HAWK CR., 2 MILES UPSTREAM FROM CLARA CITY, MINN (LAT 44 58 12 LONG 095 21 40) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 5.6 | .4 | .2 | -- | .02 | .8 | .12 | -- | 820 | 1.22 | 4.85 |
| CHETOMBA CREEK NEAR PRINSBURG, MINN. (LAT 44 56 06 LONG 095 12 05) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 26 | .7 | 22 | -- | 4.3 | .6 | .74 | -- | 1280 | 1.94 | .77 |
| CHETOMBA CR., 4 MILES SOUTH OF MAYNARD, MINN. (LAT 44 51 44 LONG 095 25 37) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 7.4 | .2 | .1 | -- | -- | .5 | .06 | -- | 500 | .77 | 1.84 |
| HAWK CREEK NEAR GRANITE FALLS, MINN. (LAT 44 49 59 LONG 095 26 01) | | | | | | | | | | | |
| JUNE, 1968 | | | | | | | | | | | |
| 12... | 7.9 | .4 | 15 | .47 | -- | .8 | .06 | -- | 408 | .59 | -- |
| OCT., 1967 | | | | | | | | | | | |
| 28... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JUNE, 1968 | | | | | | | | | | | |
| 26... | 26 | .4 | 6.8 | .59 | -- | .6 | .10 | -- | 492 | .72 | -- |
| NOV., 1967 | | | | | | | | | | | |
| 28... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JULY, 1968 | | | | | | | | | | | |
| 05... | 27 | .5 | 4.0 | -- | -- | -- | .09 | -- | 537 | .78 | 69.9 |
| FEB. | | | | | | | | | | | |
| 06... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HAWK CR., 3 MILES SOUTH OF MINNESOTA FALLS, MINN (LAT 44 45 41 LONG 095 25 43) | | | | | | | | | | | | |
| OCT., 1967 17... | 4.4 | -- | 12 | .34 | 115 | 68 | 36 | 6.9 | 307 | 0 | 252 | 358 |
| WEST FORK BEAVER CREEK NEAR DANUBE, MINN. (LAT 44 47 20 LONG 095 08 18) | | | | | | | | | | | | |
| OCT., 1967 17... | -- | -- | 21 | .20 | 115 | 52 | 14 | 3.8 | 338 | 0 | 277 | 235 |
| EAST FORK BEAVER CREEK NEAR OLIVIA, MINN. (LAT 44 47 23 LONG 094 59 43) | | | | | | | | | | | | |
| OCT., 1967 17... | 2.0 | -- | 15 | .13 | 148 | 67 | 15 | 3.8 | 330 | 0 | 271 | 364 |
| BEAVER CR, 2 MI. DWNSTRM FROM BEAVER FALLS, MINN (LAT 44 33 48 LONG 095 02 44) | | | | | | | | | | | | |
| OCT., 1967 17... | 3.2 | -- | 14 | .22 | 112 | 54 | 34 | 6.0 | 399 | 0 | 327 | 219 |
| BIRCH COULEE CREEK NEAR MORTON, MINN. (LAT 44 32 30 LONG 094 57 12) | | | | | | | | | | | | |
| OCT., 1967 17... | 1.0 | -- | 21 | .17 | 128 | 56 | 20 | 5.8 | 409 | 0 | 335 | 239 |
| COTTONWOOD RIVER NEAR AMIRET, MINN. (LAT 44 18 12 LONG 095 41 39) | | | | | | | | | | | | |
| SEP., 1968 04... | 1.5 | 20 | 20 | .04 | 205 | 77 | 50 | 9.3 | 280 | 0 | 230 | 700 |
| MAR. 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| COTTONWOOD RIVER NEAR REVERE, MINN. (LAT 44 16 45 LONG 095 22 11) | | | | | | | | | | | | |
| SEP., 1968 05... | 1.7 | 16 | 15 | .04 | 165 | 77 | 47 | 8.3 | 287 | 0 | 235 | 567 |
| MAR. 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

ANALYSES OF MISCELLANEOUS STATIONS

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| HAWK CR., 3 MILES SOUTH OF MINNESOTA FALLS, MINN (LAT 44 45 41 LONG 095 25 43) | | | | | | | |
| OCT., 1967 17... | 566 | 314 | .7 | 12 | 1100 | 7.9 | 8 |
| WEST FORK BEAVER CREEK NEAR DANUBE, MINN. (LAT 44 47 20 LONG 095 08 18) | | | | | | | |
| OCT., 1967 17... | 501 | 224 | .3 | 6 | 900 | 7.8 | 8 |
| EAST FORK BEAVER CREEK NEAR OLIVIA, MINN. (LAT 44 47 23 LONG 094 59 43) | | | | | | | |
| OCT., 1967 17... | 644 | 373 | .3 | 5 | 1100 | 7.6 | 5 |
| BEAVER CR, 2 MI. DWNSTRM FROM BEAVER FALLS, MINN (LAT 44 33 48 LONG 095 02 44) | | | | | | | |
| OCT., 1967 17... | 502 | 175 | .7 | 13 | 988 | 8.2 | 12 |
| BIRCH COULEE CREEK NEAR MORTON, MINN. (LAT 44 32 30 LONG 094 57 12) | | | | | | | |
| OCT., 1967 17... | 550 | 214 | .4 | 7 | 997 | 7.9 | 5 |
| COTTONWOOD RIVER NEAR AMIRET, MINN. (LAT 44 18 12 LONG 095 41 39) | | | | | | | |
| SEP., 1968 04... | 828 | 598 | .8 | 11 | 1520 | 7.6 | 10 |
| 04... | -- | -- | -- | -- | 1500 | -- | -- |
| COTTONWOOD RIVER NEAR REVERE, MINN. (LAT 44 16 45 LONG 095 22 11) | | | | | | | |
| SEP., 1968 05... | 728 | 493 | .8 | 12 | 1370 | 8.0 | 7 |
| 05... | -- | -- | -- | -- | 1420 | -- | -- |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HAWK CR., 3 MILES SOUTH OF MINNESOTA FALLS, MINN (LAT 44 45 41 LONG 095 25 43) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 17 | .3 | .2 | -- | .02 | .5 | .16 | -- | 766 | 1.12 | 9.81 |
| WEST FORK BEAVER CREEK NEAR DANUBE, MINN. (LAT 44 47 20 LONG 095 08 18) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 6.4 | .3 | .2 | -- | .02 | .4 | .07 | -- | 615 | .89 | -- |
| EAST FORK BEAVER CREEK NEAR OLIVIA, MINN. (LAT 44 47 23 LONG 094 59 43) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 9.2 | .4 | .4 | -- | .02 | .4 | .09 | -- | 786 | 1.15 | 4.56 |
| BEAVER CR, 2 MI. DWNSTRM FROM BEAVER FALLS, MINN (LAT 44 33 48. LONG 095 02 44) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 27 | .4 | 1.5 | -- | .71 | .5 | .14 | -- | 666 | .94 | 6.00 |
| BIRCH COULEE CREEK NEAR MORTON, MINN. (LAT 44 32 30 LONG 094 57 12) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 17... | 4.4 | .3 | .2 | -- | .08 | .4 | .14 | -- | 677 | .98 | 1.94 |
| COTTONWOOD RIVER NEAR AMIRET, MINN. (LAT 44 18 12 LONG 095 41 39) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 04... | 4.6 | .4 | .0 | .11 | .41 | .2 | .35 | 10.0 | 1210 | 1.77 | 5.26 |
| MAR. | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| COTTONWOOD RIVER NEAR REVERE, MINN. (LAT 44 16 45 LONG 095 22 11) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 05... | 9.8 | .4 | .2 | .29 | .40 | .2 | .28 | 7.1 | 1030 | 1.52 | 5.29 |
| MAR. | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUTCH CHARLEY CREEK NEAR LAMBERTON, MINN. (LAT 44 13 21 LONG 095 13 46) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 05... | 7.8 | 15 | 14 | .03 | 133 | 51 | 30 | 6.5 | 308 | 0 | 253 | 346 |
| MAR. | | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MOUND CREEK NEAR SPRINGFIELD, MINN. (LAT 44 11 40 LONG 095 03 36) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 05... | 3.2 | 19 | 17 | .08 | 103 | 37 | 10 | 3.5 | 311 | 0 | 255 | 161 |
| MAR. | | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| COAL MINE CREEK NEAR SPRINGFIELD, MINN. (LAT 44 13 28 LONG 095 01 55) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 05... | 1.3 | 18 | 24 | .03 | 133 | 64 | 19 | 7.4 | 382 | 0 | 313 | 302 |
| MAR. | | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SLEEPY EYE CREEK NEAR LEAVENWORTH, MINN. (LAT 44 15 15 LONG 094 46 26) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 18 | 14 | 19 | .02 | 128 | 67 | 29 | 6.5 | 379 | 0 | 311 | 324 |
| 05... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| COTTONWOOD RIVER NEAR SLEEPY EYE, MINN. (LAT 44 16 45 LONG 094 40 47) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 66 | 18 | 19 | .03 | 105 | 49 | 37 | 3.5 | 302 | 0 | 248 | 251 |
| 05... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| DUTCH CHARLEY CREEK NEAR LAMBERTON, MINN. (LAT 44 13 21 LONG 095 13 46) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 05... | 538 | 286 | .6 | 11 | 1070 | 7.8 | 7 |
| 05... | -- | -- | -- | -- | 1080 | -- | -- |
| MOUND CREEK NEAR SPRINGFIELD, MINN. (LAT 44 11 40 LONG 095 03 36) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 05... | 409 | 154 | .2 | 5 | 758 | 7.9 | 3 |
| 05... | -- | -- | -- | -- | 740 | -- | -- |
| COAL MINE CREEK NEAR SPRINGFIELD, MINN. (LAT 44 13 28 LONG 095 01 55) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 05... | 592 | 279 | .3 | 6 | 1080 | 7.9 | 10 |
| 05... | -- | -- | -- | -- | 1080 | -- | -- |
| SLEEPY EYE CREEK NEAR LEAVENWORTH, MINN. (LAT 44 15 15 LONG 094 46 26) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 06... | 592 | 281 | .5 | 9 | 1110 | 7.9 | 3 |
| COTTONWOOD RIVER NEAR SLEEPY EYE, MINN. (LAT 44 16 45 LONG 094 40 47) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 06... | 464 | 216 | .7 | 15 | 969 | 8.1 | 2 |
| 06... | -- | -- | -- | -- | 980 | -- | -- |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DUTCH CHARLEY CREEK NEAR LAMBERTON, MINN. (LAT 44 13 21 LONG 095 13 46) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 05... | 12 | .5 | .0 | .04 | .33 | .2 | .19 | 8.9 | 744 | 1.09 | 17.0 |
| MAR. | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MOUND CREEK NEAR SPRINGFIELD, MINN. (LAT 44 11 40 LONG 095 03 36) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 05... | 5.0 | .3 | .1 | .12 | .54 | .2 | .18 | 12.0 | 492 | .72 | 4.54 |
| MAR. | | | | | | | | | | | |
| 19... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| COAL MINE CREEK NEAR SPRINGFIELD, MINN. (LAT 44 13 28 LONG 095 01 55) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 05... | 11 | .4 | .0 | .31 | .41 | .3 | .11 | 9.2 | 748 | 1.11 | 3.01 |
| MAR. | | | | | | | | | | | |
| 19... | -- | -- | -- | | -- | -- | -- | -- | -- | -- | -- |
| SLEEPY EYE CREEK NEAR LEAVENWORTH, MINN. (LAT 44 15 15 LONG 094 46 26) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 06... | 12 | .4 | 2.0 | .07 | .20 | .2 | .14 | 8.7 | 774 | 1.14 | 40.8 |
| 05... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| COTTONWOOD RIVER NEAR SLEEPY EYE, MINN. (LAT 44 16 45 LONG 094 40 47) | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | |
| 06... | 12 | .3 | 1.9 | .20 | .29 | .2 | .13 | 12.8 | 628 | .94 | 125 |
| 05... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-3170.00 - COTTONWOOD RIVER NEAR NEW ULM, MINN. (LAT 44 17 40 LONG 094 26 40) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 13... | 18 | .2 | 5.2 | .46 | -- | .3 | .15 | -- | 653 | .92 | 22.7 | |
| MAR., 1968 | | | | | | | | | | | | |
| 19... | 11 | .3 | 5.1 | .37 | -- | .3 | .12 | -- | 385 | .56 | 134 | |
| JUNE | | | | | | | | | | | | |
| 28... | 11 | .4 | .4 | .71 | -- | .8 | .14 | -- | 563 | .81 | 93.0 | |
| LITTLE COTTONWOOD RIVER NEAR LEAVENWORTH, MINN. (LAT 44 10 19 LONG 094 47 55) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 8.4 | .3 | 3.1 | .08 | .22 | .2 | .47 | -- | 604 | .88 | 24.4 | |
| 06... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| LITTLE COTTONWOOD RIVER NEAR CAMBRIA, MINN. (LAT 44 14 13 LONG 094 21 39) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 8.4 | .3 | 3.0 | .21 | .26 | .3 | .06 | -- | 497 | .71 | 49.4 | |
| MINNEOPA CREEK NEAR MANKATO, MINN. (LAT 44 09 12 LONG 094 04 58) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 17 | .5 | 2.6 | .36 | .40 | .3 | .06 | -- | 317 | .47 | -- | |
| 05-3205.00 - LE SUEUR RIVER NEAR RAPIDAN, MINN. (LAT 44 06 40 LONG 094 02 28) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 12... | 18 | .3 | .0 | .17 | -- | .3 | .12 | -- | 504 | .69 | 35.0 | |
| 05-3262.00 - JUDICIAL DITCH 1-A NEAR NEW SWEDEN, MINN. (LAT 45 25 00 LONG 094 15 00) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 11... | 129 | .3 | 21 | .62 | -- | .3 | .13 | -- | 1280 | 1.89 | .04 | |
| MAR., 1968 | | | | | | | | | | | | |
| 18... | 105 | .4 | 1.9 | 3.3 | -- | .3 | .14 | -- | 759 | 1.09 | 5.37 | |
| JUNE | | | | | | | | | | | | |
| 24... | 25 | .5 | 6.2 | .45 | -- | .7 | .03 | -- | 491 | .71 | 4.21 | |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-3170.00 - COTTONWOOD RIVER NEAR NEW ULM, MINN. (LAT 44 17 40 LONG 094 26 40) | | | | | | | |
| DEC., 1967 | | | | | | | |
| 13... | 483 | 152 | .8 | 16 | 997 | 7.8 | 4 |
| MAR., 1968 | | | | | | | |
| 19... | 265 | 102 | .6 | 16 | 612 | 7.5 | 8 |
| JUNE | | | | | | | |
| 28... | 408 | 227 | .5 | 11 | 835 | 7.9 | 12 |
| LITTLE COTTONWOOD RIVER NEAR LEAVENWORTH, MINN. (LAT 44 10 19 LONG 094 47 55) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 06... | 497 | 217 | .2 | 5 | 884 | 7.9 | 2 |
| 06... | -- | -- | -- | -- | 900 | -- | -- |
| LITTLE COTTONWOOD RIVER NEAR CAMBRIA, MINN. (LAT 44 14 13 LONG 094 21 39) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 06... | 414 | 143 | .2 | 5 | 754 | 7.6 | 6 |
| MINNEOPA CREEK NEAR MANKATO, MINN. (LAT 44 09 12 LONG 094 04 58) | | | | | | | |
| SEP., 1968 | | | | | | | |
| 06... | 258 | 63 | .3 | 8 | 538 | 7.5 | 10 |
| 05-3205.00 - LE SUEUR RIVER NEAR RAPIDAN, MINN. (LAT 44 06 40 LONG 094 02 28) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 12... | 375 | 30 | .9 | 18 | 796 | 8.0 | 3 |
| 05-3262.00 - JUDICIAL DITCH 1-A NEAR NEW SWEDEN, MINN. (LAT 45 25 00 LONG 094 15 00) | | | | | | | |
| DEC., 1967 | | | | | | | |
| 11... | 861 | 430 | 1.7 | 22 | 1850 | 7.9 | 17 |
| MAR., 1968 | | | | | | | |
| 18... | 413 | 180 | 2.0 | 32 | 1210 | 7.9 | 27 |
| JUNE | | | | | | | |
| 24... | 401 | 152 | .4 | 9 | 781 | 8.2 | 21 |

GPO 817-490-18

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-3170.00 - COTTONWOOD RIVER NEAR NEW ULM, MINN. (LAT 44 17 40 LONG 094 26 40) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 12... | 12 | 1 | 13 | .04 | 111 | 50 | 42 | 5.4 | 403 | 0 | 331 | 209 |
| MAR., 1968 | | | | | | | | | | | | |
| 19... | 120 | 1 | 10 | .04 | 65 | 25 | 23 | 4.6 | 199 | 0 | 163 | 143 |
| JUNE | | | | | | | | | | | | |
| 28... | 57 | 21 | 17 | .09 | 94 | 42 | 23 | 6.2 | 221 | 0 | 181 | 258 |
| LITTLE COTTONWOOD RIVER NEAR LEAVENWORTH, MINN. (LAT 44 10 19 LONG 094 47 55) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 14 | 14 | 22 | .01 | 133 | 41 | 12 | 3.5 | 342 | 0 | 281 | 212 |
| 05... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| LITTLE COTTONWOOD RIVER NEAR CAMBRIA, MINN. (LAT 44 14 13 LONG 094 21 39) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | 35 | 18 | 24 | .05 | 109 | 35 | 10 | 4.1 | 331 | 0 | 271 | 140 |
| MINNEOPA CREEK NEAR MANKATO, MINN. (LAT 44 09 12 LONG 094 04 58) | | | | | | | | | | | | |
| SEP., 1968 | | | | | | | | | | | | |
| 06... | -- | 14 | 7.6 | .03 | 54 | 30 | 11 | 4.1 | 238 | 0 | 195 | 73 |
| 05-3205.00 - LE SUEUR RIVER NEAR RAPIDAN, MINN. (LAT 44 06 40 LONG 094 02 28) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 12... | 25 | 10 | 18 | .04 | 95 | 34 | 38 | 6.7 | 420 | 0 | 344 | 87 |
| 05-3262.00 - JUDICIAL DITCH 1-A NEAR NEW SWEDEN, MINN. (LAT 45 25 00 LONG 094 15 00) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 11... | .01 | 1 | 10 | .08 | 185 | 97 | 115 | 13 | 526 | 0 | 431 | 451 |
| MAR., 1968 | | | | | | | | | | | | |
| 18... | 2.4 | 7 | 17 | .10 | 95 | 43 | 92 | 12 | 284 | 0 | 233 | 248 |
| JUNE | | | | | | | | | | | | |
| 24... | 3.0 | 21 | 17 | .11 | 93 | 42 | 18 | 3.8 | 303 | 0 | 249 | 136 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-3310.00 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20) | | | | | | | | | | | | |
| NOV., 1967 | | | | | | | | | | | | |
| 06... | 2960 | 6 | -- | .02 | -- | -- | -- | -- | -- | -- | -- | -- |
| JUNE, 1968 | | | | | | | | | | | | |
| 18... | 26300 | 21 | -- | .16 | -- | -- | -- | .0 | -- | -- | -- | -- |
| 05-3367.00 - KETTLE RIVER BELOW SANDSTONE, MINN. (LAT 46 23 24 LONG 092 52 56) | | | | | | | | | | | | |
| JUNE, 1968 | | | | | | | | | | | | |
| 21... | 3030 | 19 | 8.4 | .80 | 20 | 6.8 | 2.5 | 2.0 | 86 | 0 | 71 | 7.7 |
| 05-3538.00 - STRAIGHT RIVER NEAR FARIBAULT, MINN. (LAT 44 15 29 LONG 093 13 51) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 30... | 51 | 4 | 3.5 | .00 | 85 | 28 | 30 | 5.0 | 340 | 0 | 279 | 59 |
| 05-3730.00 - SOUTH FORK ZUMBRO RIVER NEAR ROCHESTER, MINN. (LAT 44 04 00 LONG 092 27 55) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 27... | 36 | 10 | 16 | .05 | 80 | 22 | 63 | 6.7 | 279 | 0 | 229 | 48 |
| 05-3785.00 - MISSISSIPPI RIVER AT WINONA, MINN. (LAT 44 03 20 LONG 091 38 15) | | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | | |
| 18... | 10400 | 1 | 5.0 | .01 | 36 | 14 | 12 | 2.1 | 168 | 0 | 138 | 19 |
| MAR., 1968 | | | | | | | | | | | | |
| 20... | 21900 | 4 | 11 | .03 | 35 | 14 | 13 | 3.0 | 179 | 0 | 147 | 6.5 |
| APR. | | | | | | | | | | | | |
| 24... | 41400 | 8 | 8.4 | .10 | 29 | 12 | 7.6 | 2.9 | 132 | 0 | 108 | 18 |
| JULY | | | | | | | | | | | | |
| 01... | 73500 | 20 | 11 | .21 | 29 | 10 | 5.0 | 2.1 | 118 | 0 | 97 | 21 |
| SEP. | | | | | | | | | | | | |
| 20... | 20300 | 18 | 13 | .00 | 38 | 13 | 7.2 | 2.4 | 156 | 0 | 128 | 27 |
| 05-3855.00 - SOUTH FORK ROOT RIVER NEAR HOUSTON, MINN. (LAT 43 44 00 LONG 091 34 00) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 26... | 74 | 7 | 12 | .00 | 61 | 27 | 2.4 | 1.4 | 314 | 0 | 258 | 12 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-3310.00 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20) | | | | | | | |
| DEC., 1967 | | | | | | | |
| 11... | -- | -- | -- | -- | -- | -- | -- |
| MAR., 1968 | | | | | | | |
| 18... | -- | -- | -- | -- | -- | -- | -- |
| 05-3367.00 - KETTLE RIVER BELOW SANDSTONE, MINN. (LAT 46 23 24 LONG 092 52 56) | | | | | | | |
| JUNE, 1968 | | | | | | | |
| 21... | 77 | 7 | .1 | 6 | 152 | 7.9 | 100 |
| 05-3538.00 - STRAIGHT RIVER NEAR FARIBAULT, MINN. (LAT 44 15 29 LONG 093 13 51) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 30... | 328 | 49 | .7 | 16 | 676 | 8.2 | 10 |
| 05-3730.00 - SOUTH FORK ZUMBRO RIVER NEAR ROCHESTER, MINN. (LAT 44 04 00 LONG 092 27 55) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 27... | 288 | 59 | 1.6 | 31 | 833 | 8.2 | 12 |
| 05-3785.00 - MISSISSIPPI RIVER AT WINONA, MINN. (LAT 44 03 20 LONG 091 38 15) | | | | | | | |
| DEC., 1967 | | | | | | | |
| 18... | 148 | 10 | .4 | 15 | 334 | 7.5 | 13 |
| MAR., 1968 | | | | | | | |
| 20... | 143 | 0 | .5 | 16 | 348 | 7.8 | 18 |
| APR. | | | | | | | |
| 24... | 120 | 12 | .3 | 12 | 276 | 7.6 | 12 |
| JULY | | | | | | | |
| 01... | 114 | 17 | .2 | 9 | 248 | 7.9 | 55 |
| SEP. | | | | | | | |
| 20... | 148 | 19 | .3 | 9 | 324 | 7.3 | 10 |
| 05-3855.00 - SOUTH FORK ROOT RIVER NEAR HOUSTON, MINN. (LAT 43 44 00 LONG 091 34 00) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 26... | 264 | 6 | .1 | 2 | 481 | 7.8 | 5 |

GPO 817-490-17

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-3310.00 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20) | | | | | | | | | | | |
| NOV., 1967 | | | | | | | | | | | |
| 06... | -- | -- | -- | -- | -- | .1 | -- | -- | -- | -- | -- |
| JUNE, 1968 | | | | | | | | | | | |
| 18... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 05-3367.00 - KETTLE RIVER BELOW SANDSTONE, MINN. (LAT 46 23 24 LONG 092 52 56) | | | | | | | | | | | |
| JUNE, 1968 | | | | | | | | | | | |
| 21... | 1.5 | .3 | 1.4 | -- | -- | 1.3 | .04 | -- | 95 | .18 | 1090 |
| 05-3538.00 - STRAIGHT RIVER NEAR FARIBAULT, MINN. (LAT 44 15 29 LONG 093 13 51) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 30... | 37 | .3 | 1.9 | 1.9 | -- | .3 | .11 | -- | 419 | .59 | 60.6 |
| 05-3730.00 - SOUTH FORK ZUMBRO RIVER NEAR ROCHESTER, MINN. (LAT 44 04 00 LONG 092 27 55) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 27... | 81 | .8 | 52 | 11 | -- | .6 | .18 | -- | 517 | .72 | 52.0 |
| 05-3785.00 - MISSISSIPPI RIVER AT WINONA, MINN. (LAT 44 03 20 LONG 091 38 15) | | | | | | | | | | | |
| DEC., 1967 | | | | | | | | | | | |
| 18... | 9.2 | .1 | 1.0 | .42 | -- | .1 | .04 | -- | 182 | .26 | 5390 |
| MAR., 1968 | | | | | | | | | | | |
| 20... | 11 | .2 | 1.8 | .78 | -- | .3 | .03 | -- | 185 | .28 | 12100 |
| APR. | | | | | | | | | | | |
| 24... | 7.7 | .2 | 3.1 | .52 | -- | .7 | .04 | -- | 154 | .23 | 18700 |
| JULY | | | | | | | | | | | |
| 01... | 5.0 | .2 | 3.2 | .20 | -- | 1.1 | .05 | -- | 146 | .23 | 33700 |
| SEP. | | | | | | | | | | | |
| 20... | 7.4 | .2 | 1.8 | .54 | -- | .7 | .06 | -- | 188 | .28 | 11300 |
| 05-3855.00 - SOUTH FORK ROOT RIVER NEAR HOUSTON, MINN. (LAT 43 44 00 LONG 091 34 00) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 26... | 1.8 | .2 | 3.0 | .11 | -- | .0 | .00 | -- | 276 | .38 | 56.5 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | DIS-CHARGE (CFS) | TEMP-ERATURE (DEG C) | SILICA (SIO2) | TOTAL IRON (FE) | CAL-CIUM (CA) | MAG-NE-SIUM (MG) | SODIUM (NA) | PO-TAS-SIUM (K) | BICAR-BONATE (HCO3) | CAR-BONATE (CO3) | ALKA-LINITY AS CACO3 | SULFATE (SO4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-4570.00 - CEDAR RIVER NEAR AUSTIN, MINN. (LAT 43 38 10 LONG 092 58 20) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 23... | 47 | 15 | 16 | .01 | 70 | 24 | 75 | 4.6 | 286 | 1 | 236 | 37 |
| 05-4760.00 - WEST FORK DES MOINES RIVER AT JACKSON, MINN. (LAT 43 37 10 LONG 094 59 10) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 13... | 11 | 9 | 6.3 | .01 | 75 | 44 | 33 | 5.9 | 240 | 0 | 197 | 190 |
| DEC. | | | | | | | | | | | | |
| 11... | 14 | 2 | 5.5 | .00 | 111 | 55 | 44 | 5.4 | 346 | 0 | 284 | 235 |
| APR., 1968 | | | | | | | | | | | | |
| 08... | 14 | 11 | 4.3 | .05 | 51 | 34 | 48 | 4.8 | 174 | 0 | 143 | 140 |
| JULY | | | | | | | | | | | | |
| 11... | 18 | 25 | 16 | .05 | 89 | 38 | 26 | 6.3 | 245 | 0 | 201 | 182 |
| AUG. | | | | | | | | | | | | |
| 20... | 90 | 22 | 9.0 | .02 | 86 | 40 | 19 | 5.3 | 215 | 0 | 176 | 210 |
| 06-4830.00 - ROCK RIVER AT LUVERNE, MINN. (LAT 43 39 00 LONG 096 12 00) | | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | | |
| 12... | 5.0 | 9 | 12 | .01 | 65 | 31 | 13 | 3.6 | 266 | 0 | 218 | 87 |
| SEP., 1968 | | | | | | | | | | | | |
| 18... | 10 | 16 | 11 | .01 | 58 | 27 | 10 | 4.5 | 231 | 0 | 190 | 76 |

| DATE | HARD-NESS (CA,MG) | NON-CAR-BONATE HARD-NESS | SODIUM AD-SORP-TION RATIO | PERCENT SODIUM | SPECI-FIC COND-UCTANCE (MICRO-MHOS) | PH | COLOR |
|---|---|---|---|---|---|---|---|
| 05-4570.00 - CEDAR RIVER NEAR AUSTIN, MINN. (LAT 43 38 10 LONG 092 58 20) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 23... | 274 | 38 | 2.0 | 37 | 881 | 8.3 | 6 |
| 05-4760.00 - WEST FORK DES MOINES RIVER AT JACKSON, MINN. (LAT 43 37 10 LONG 094 59 10) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 13... | 369 | 172 | .7 | 16 | 809 | 7.9 | 11 |
| DEC. | | | | | | | |
| 11... | 501 | 217 | .9 | 16 | 1040 | 8.0 | 8 |
| APR., 1968 | | | | | | | |
| 08... | 266 | 123 | 1.3 | 28 | 747 | 7.5 | 5 |
| JULY | | | | | | | |
| 11... | 377 | 176 | .6 | 13 | 810 | 7.6 | 5 |
| AUG. | | | | | | | |
| 20... | 379 | 203 | .4 | 10 | 773 | 7.7 | 5 |
| 06-4830.00 - ROCK RIVER AT LUVERNE, MINN. (LAT 43 39 00 LONG 096 12 00) | | | | | | | |
| OCT., 1967 | | | | | | | |
| 12... | 290 | 72 | .3 | 9 | 579 | 7.7 | 5 |
| SEP., 1968 | | | | | | | |
| 18... | 256 | 66 | .3 | 8 | 523 | 7.8 | 5 |

CHEMICAL ANALYSES IN MILLIGRAMS PER LITER, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DATE | CHLORIDE (CL) | FLUORIDE (F) | NITRATE (NO3) | ORTHO PHOSPHATE (PO4) | PHOSPHATE (PO4) | TOTAL ALUMINIUM (AL) | BORON (B) | DISSOLVED OXYGEN | DISSOLVED SOLIDS (SUM OF CONSTITUENTS) | DISSOLVED SOLIDS (TONS PER AC-FT) | DISSOLVED SOLIDS (TONS PER DAY) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05-4570.00 - CEDAR RIVER NEAR AUSTIN, MINN. (LAT 43 38 10 LONG 092 58 20) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 23... | 106 | .3 | 2.9 | 6.5 | -- | .7 | .05 | -- | 485 | .73 | 68.6 |
| 05-4760.00 - WEST FORK DES MOINES RIVER AT JACKSON, MINN. (LAT 43 37 10 LONG 094 59 10) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 13... | 36 | .5 | .4 | .62 | -- | .5 | .10 | -- | 511 | .76 | 16.8 |
| DEC. | | | | | | | | | | | |
| 11... | 44 | .3 | 1.7 | 1.2 | -- | .3 | .12 | -- | 673 | .98 | 28.2 |
| APR., 1968 | | | | | | | | | | | |
| 08... | 60 | .3 | 1.7 | .82 | -- | .6 | .09 | -- | 431 | .63 | 18.1 |
| JLLY | | | | | | | | | | | |
| 11... | 29 | .4 | 4.7 | .68 | -- | 1.4 | .08 | -- | 514 | .76 | 27.2 |
| AUG. | | | | | | | | | | | |
| 20... | 18 | .4 | .3 | .85 | -- | .5 | .09 | -- | 495 | .71 | 127 |
| 06-4830.00 - ROCK RIVER AT LUVERNE, MINN. (LAT 43 39 00 LONG 096 12 00) | | | | | | | | | | | |
| OCT., 1967 | | | | | | | | | | | |
| 12... | 8.4 | .3 | 1.8 | .34 | -- | .2 | .04 | -- | 353 | .51 | 5.14 |
| SEP., 1968 | | | | | | | | | | | |
| 18... | 9.0 | .4 | 2.2 | .37 | -- | .6 | .06 | -- | 312 | .44 | 5.39 |

## 4-0145. BAPTISM RIVER NEAR BEAVER BAY, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 6, 1967 | 28 | 2 | .15 |
| Jan. 9, 1968 | 10 | 3 | .08 |
| Feb. 6 | 13 | 2 | .07 |
| Mar. 5 | 7.4 | 3 | .06 |
| Mar. 30 | 554 | 18 | 27 |
| Mar. 31 | 478 | 10 | 13 |
| Apr. 1 | 326 | 6 | 5.3 |
| Apr. 2 | 270 | 5 | 3.6 |
| Apr. 3 | 192 | 3 | 1.6 |
| Apr. 4 | 158 | 4 | 1.7 |
| Apr. 5 | 155 | 13 | 5.4 |
| Apr. 6 | 161 | 24 | 10 |
| Apr. 7 | 188 | 18 | 9.1 |
| Apr. 8 | 412 | 36 | 44 |
| Apr. 9 | 446 | 49 | 58 |
| Apr. 10 | 412 | 46 | 51 |
| Apr. 11 | 412 | 42 | 47 |
| Apr. 12 | 487 | 40 | 53 |
| Apr. 13 | 478 | 38 | 49 |
| Apr. 14 | 554 | 34 | 51 |
| Apr. 15 | 421 | 18 | 20 |
| Apr. 16 | 449 | 10 | 12 |
| Apr. 22 | 896 | 20 | 48 |
| Apr. 24 | 1060 | 14 | 40 |
| Apr. 25 | 734 | 8 | 16 |
| Apr. 26 | 610 | 3 | 4.9 |
| Apr. 27 | 630 | 1 | 1.7 |
| Apr. 28 | 610 | 1 | 1.6 |
| Apr. 29 | 620 | 1 | 1.7 |
| Apr. 30 | 601 | 1 | 1.6 |
| May 1 | 525 | 3 | 4.2 |
| May 2 | 458 | 3 | 3.7 |
| May 3 | 385 | 2 | 2.1 |
| May 4 | 421 | 2 | 2.3 |
| May 5 | 358 | 4 | 3.9 |
| May 6 | 305 | 3 | 2.5 |
| May 7 | 291 | 2 | 1.6 |
| May 8 | 305 | 2 | 1.6 |
| May 9 | 319 | 2 | 1.7 |
| May 10 | 284 | 1 | .77 |
| May 11 | 243 | 1 | .66 |
| May 12 | 227 | 1 | .61 |
| May 13 | 212 | 2 | 1.1 |
| May 14 | 216 | 3 | 1.7 |
| May 15 | 265 | 2 | 1.4 |
| May 16 | 630 | 10 | 17 |
| May 17 | 706 | 4 | 7.6 |
| May 18 | 610 | 2 | 3.3 |
| May 19 | 468 | 3 | 3.8 |
| May 20 | 385 | 3 | 3.1 |
| May 21 | 312 | 3 | 2.5 |
| May 22 | 259 | 2 | 1.4 |
| May 23 | 265 | 2 | 1.4 |
| May 24 | 277 | 4 | 3.0 |
| May 25 | 238 | 3 | 1.9 |
| May 26 | 255 | 4.8 | 3.3 |
| May 27 | 1030 | 44 | 122 |
| May 28 | 1060 | 13 | 3 |
| May 29 | 896 | 5 | 12 |
| May 30 | 668 | 6 | 11 |
| May 31 | 534 | 7 | 10 |
| June 1 | 582 | 9 | 14 |
| June 2 | 534 | 5 | 7.2 |
| June 3 | 430 | 3 | 3.5 |
| June 4 | 367 | 2 | 2.0 |
| June 5. 1968 | 312 | 2 | 1.7 |
| June 6 | 630 | 7 | 12 |
| June 7 | 658 | 7 | 12 |
| June 14 | 582 | 3 | 4.7 |
| June 15 | 516 | 3 | 4.2 |
| June 16 | 430 | 4 | 4.6 |
| June 17 | 367 | 4 | 4.0 |
| June 18 | 305 | 3 | 2.5 |
| June 19 | 265 | 2 | 1.4 |
| June 20 | 212 | 1 | .57 |
| June 21 | 221 | 3 | 1.8 |
| June 22 | 248 | 4 | 2.7 |
| June 23 | 421 | 5 | 5.7 |
| June 24 | 376 | 4 | 4.1 |
| June 25 | 284 | 3 | 2.3 |
| June 26 | 216 | 3 | 1.7 |
| June 27 | 180 | 2 | .97 |
| June 28 | 161 | 2 | .87 |
| June 29 | 152 | 2 | .82 |
| June 30 | 144 | 2 | .78 |
| July 1 | 155 | 2 | .84 |
| July 2 | 164 | 2 | .89 |
| July 3 | 146 | 2 | .79 |
| July 4 | 167 | 2 | .90 |
| July 11 | 67 | 5 | .90 |
| July 15 | 421 | 10 | 11 |
| July 16 | 312 | 5 | 4.2 |
| July 17 | 277 | 4 | 3.0 |
| July 18 | 221 | 4 | 2.4 |
| July 19 | 208 | 7 | 3.9 |
| Aug. 13 | 14 | 6 | .23 |
| Aug. 22 | 2480 | 59 | 416 |
| Aug. 23 | 2380 | 39 | 251 |
| Aug. 24 | 2100 | 13 | 74 |
| Aug. 25 | 1370 | 7 | 26 |
| Aug. 26 | 924 | 6 | 15 |
| Aug. 27 | 620 | 6 | 10 |
| Aug. 28 | 458 | 4 | 4.9 |
| Aug. 29 | 319 | 3 | 2.6 |
| Aug. 30 | 232 | 2 | 1.3 |
| Aug. 31 | 192 | 2 | 1.0 |
| Sept. 1 | 200 | 4 | 2.2 |
| Sept. 2 | 176 | 4 | 1.9 |
| Sept. 3 | 149 | 2 | .80 |
| Sept. 4 | 505 | 12 | 18 |
| Sept. 5 | 600 | 12 | 19 |
| Sept. 6 | 690 | 11 | 20 |
| Sept. 7 | 750 | 6 | 12 |
| Sept. 8 | 730 | 5 | 9.8 |
| Sept. 9 | 580 | 5 | 7.8 |
| Sept. 10 | 370 | 6 | 6.0 |
| Sept. 11 | 230 | 8 | 5.0 |
| Sept. 12 | 140 | 5 | 1.9 |
| Sept. 13 | 105 | 2 | .57 |
| Sept. 17 | 170 | 9 | 4.1 |
| Sept. 18 | 770 | 18 | 37 |
| Sept. 19 | 660 | 8 | 14 |
| Sept. 20 | 500 | 4 | 5.4 |
| Sept. 21 | 310 | 4 | 3.3 |
| Sept. 22 | 230 | 4 | 2.5 |
| Sept. 23 | 210 | 3 | 1.7 |
| Sept. 24 | 175 | 4 | 1.9 |
| Sept. 25 | 140 | 4 | 1.5 |
| Sept. 26 | 120 | 3 | .97 |
| Sept. 27 | 105 | 3 | .85 |
| Sept. 28 | 95 | 4 | 1.0 |
| Sept. 29 | 90 | 5 | 1.2 |
| Sept. 30 | 85 | 5 | 1.1 |

## 4-0187.5. ST. LOUIS RIVER AT FORBES, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Jan. 9, 1968 | 44 | 4 | 0.47 |
| Jan. 31 | 38 | 4 | .41 |
| Feb. 29 | 37 | 2 | .20 |
| Apr. 3 | 430 | 18 | 21 |
| Apr. 4 | 400 | 8 | 8.6 |
| Apr. 5 | 390 | 12 | 13 |
| Apr. 6 | 360 | 11 | 11 |
| Apr. 7 | 350 | 9 | 8.5 |
| Apr. 8 | 385 | 11 | 11 |
| Apr. 9 | 460 | 10 | 12 |
| Apr. 10 | 515 | 10 | 14 |
| Apr. 11 | 550 | 15 | 22 |
| Apr. 12 | 543 | 16 | 23 |
| Apr. 13 | 515 | 8 | 11 |
| Apr. 14 | 504 | 8 | 11 |
| Apr. 15 | 498 | 11 | 15 |
| Apr. 16 | 592 | 9 | 14 |
| Apr. 17 | 750 | 13 | 26 |
| Apr. 18 | 794 | 32 | 69 |
| Apr. 19 | 776 | 21 | 44 |
| Apr. 20 | 765 | 15 | 31 |
| Apr. 21 | 816 | 14 | 31 |
| Apr. 22 | 888 | 20 | 48 |
| Apr. 23 | 1120 | 32 | 97 |
| Apr. 24 | 1360 | 40 | 147 |
| Apr. 25 | 1440 | 39 | 152 |
| Apr. 26 | 1570 | 40 | 170 |
| Apr. 30 | 2140 | 50 | 288 |
| May 1 | 2220 | 85 | 509 |
| May 2 | 2310 | 72 | 449 |
| May 3 | 2340 | 82 | 518 |
| May 4 | 2340 | 55 | 347 |
| May 5 | 2290 | 45 | 278 |
| May 6 | 2170 | 39 | 228 |
| May 7 | 2030 | 31 | 170 |
| May 8 | 1920 | 24 | 124 |
| May 9 | 1820 | 22 | 108 |
| May 10 | 1700 | 70 | 321 |
| May 11 | 1560 | 68 | 286 |
| May 12 | 1450 | 20 | 78 |
| May 13 | 1280 | 13 | 45 |
| May 14 | 1240 | 14 | 47 |
| May 15 | 1070 | 8 | 23 |
| May 16 | 1030 | 9 | 25 |
| May 17 | 1010 | 12 | 33 |
| May 18 | 976 | 12 | 32 |
| May 19 | 953 | 8 | 21 |
| May 20 | 907 | 14 | 34 |
| May 21 | 794 | 8 | 17 |
| May 22 | 854 | 13 | 30 |
| May 23 | 813 | 14 | 31 |
| May 24 | 783 | 6 | 13 |
| May 25 | 742 | 6 | 12 |
| May 26 | 706 | 7 | 13 |
| May 27 | 761 | 7 | 14 |
| May 28 | 846 | 23 | 52 |
| May 29 | 892 | 16 | 38 |
| June 4 | 1040 | 11 | 31 |
| June 5 | 934 | 9 | 23 |
| June 6 | 1020 | 9 | 25 |
| June 7 | 1060 | 10 | 29 |
| June 8 | 1200 | 22 | 71 |
| June 9 | 1470 | 22 | 87 |
| June 10 | 1620 | 28 | 122 |
| June 11 | 1900 | 71 | 364 |
| June 12 | 2070 | 39 | 218 |
| June 13 | 2180 | 35 | 206 |
| June 14, 1968 | 2480 | 47 | 315 |
| June 15 | 2630 | 61 | 433 |
| June 16 | 2700 | 72 | 525 |
| June 17 | 2710 | 57 | 417 |
| June 18 | 2650 | 41 | 293 |
| June 19 | 2470 | 41 | 273 |
| June 20 | 2240 | 52 | 314 |
| June 21 | 2000 | 43 | 232 |
| June 22 | 1820 | 25 | 123 |
| June 23 | 1770 | 28 | 134 |
| June 24 | 1750 | 35 | 165 |
| June 25 | 1680 | 32 | 145 |
| June 26 | 1580 | 26 | 111 |
| June 27 | 1490 | 22 | 88 |
| June 28 | 1340 | 20 | 72 |
| June 29 | 1260 | 36 | 122 |
| June 30 | 1200 | 72 | 233 |
| July 1 | 1200 | 22 | 71 |
| July 2 | 1130 | 23 | 70 |
| July 3 | 1060 | 23 | 66 |
| July 4 | 1010 | 11 | 30 |
| July 5 | 957 | 8 | 21 |
| July 6 | 881 | 9 | 21 |
| July 7 | 809 | 13 | 28 |
| July 8 | 614 | 11 | 18 |
| July 9 | 702 | 5 | 9.5 |
| July 10 | 636 | 6 | 10 |
| July 11 | 585 | 5 | 7.9 |
| July 12 | 512 | 5 | 6.9 |
| July 13 | 540 | 6 | 8.7 |
| July 14 | 529 | 5 | 7.1 |
| July 15 | 508 | 11 | 15 |
| July 16 | 508 | 6 | 8.2 |
| July 17 | 501 | 6 | 8.1 |
| Aug. 22 | 384 | 11 | 11 |
| Aug. 23 | 709 | 38 | 73 |
| Aug. 24 | 1350 | 61 | 222 |
| Aug. 25 | 1650 | 69 | 307 |
| Aug. 26 | 1720 | 35 | 162 |
| Aug. 27 | 1800 | 50 | 243 |
| Aug. 28 | 1820 | 49 | 241 |
| Aug. 29 | 1750 | 44 | 208 |
| Aug. 30 | 1580 | 37 | 158 |
| Aug. 31 | 1360 | 31 | 114 |
| Sept. 1 | 1220 | 44 | 145 |
| Sept. 2 | 1090 | 18 | 53 |
| Sept. 3 | 968 | 14 | 37 |
| Sept. 4 | 888 | 13 | 31 |
| Sept. 7 | 813 | 12 | 26 |
| Sept. 8 | 820 | 11 | 24 |
| Sept. 9 | 816 | 9 | 20 |
| Sept. 10 | 791 | 10 | 21 |
| Sept. 11 | 754 | 9 | 18 |
| Sept. 12 | 713 | 7 | 13 |
| Sept. 13 | 568 | 6 | 9.2 |
| Sept. 14 | 605 | 6 | 9.8 |
| Sept. 15 | 573 | 9 | 14 |
| Sept. 16 | 530 | 15 | 21 |
| Sept. 17 | 513 | 12 | 17 |
| Sept. 18 | 581 | 8 | 13 |
| Sept. 19 | 672 | 7 | 13 |
| Sept. 20 | 658 | 7 | 12 |
| Sept. 21 | 634 | 6 | 10 |
| Sept. 26 | 573 | 5 | 7.8 |
| Sept. 27 | 458 | 4 | 4.9 |
| Sept. 28 | 519 | 4 | 5.6 |
| Sept. 29 | 606 | 5 | 8.2 |

## 5-0405. PELICAN RIVER NEAR FERGUS FALLS, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 19, 1967 | 25 | 62 | 4.2 |
| Feb. 1, 1968 | 2.1 | 13 | .07 |
| Feb. 20 | 1.1 | 3 | .01 |
| Mar. 19 | 10 | 7 | .19 |
| Mar. 30 | 82 | 47 | 10 |
| Apr. 6 | 97 | 31 | 8.1 |
| Apr. 7 | 108 | 36 | 10 |
| Apr. 8 | 138 | 38 | 14 |
| Apr. 9 | 142 | 26 | 10.0 |
| Apr. 10 | 120 | 16 | 5.2 |
| Apr. 11 | 108 | 18 | 5.2 |
| Apr. 12 | 106 | 17 | 4.9 |
| Apr. 13 | 104 | 16 | 4.5 |
| Apr. 14 | 104 | 13 | 3.6 |
| Apr. 15 | 101 | 14 | 3.8 |
| Apr. 20 | 106 | 13 | 3.7 |
| Apr. 21 | 120 | 13 | 4.2 |
| Apr. 22 | 132 | 17 | 6.1 |
| Apr. 23 | 160 | 20 | 8.6 |
| Apr. 24 | 174 | 17 | 8.0 |
| Apr. 25 | 163 | 19 | 8.4 |
| Apr. 26 | 142 | 18 | 6.9 |
| Apr. 27 | 132 | 15 | 5.3 |
| Apr. 28 | 135 | 14 | 5.1 |
| Apr. 29 | 135 | 14 | 5.1 |
| Apr. 30 | 129 | 18 | 6.3 |
| May 1 | 129 | 19 | 6.6 |
| May 2 | 126 | 18 | 6.1 |
| May 3 | 123 | 18 | 6.0 |
| May 4 | 120 | 14 | 4.5 |
| May 5 | 117 | 18 | 5.7 |
| May 6 | 117 | 18 | 5.7 |
| May 7 | 117 | 14 | 4.4 |
| May 8 | 129 | 15 | 5.2 |
| May 9 | 138 | 16 | 6.0 |
| May 10 | 142 | 22 | 8.4 |
| May 11 | 145 | 20 | 7.8 |
| May 12 | 152 | 19 | 7.8 |
| May 13 | 149 | 22 | 8.8 |
| May 14 | 170 | 23 | 11 |
| May 15 | 186 | 25 | 13 |
| May 22 | 145 | 17 | 6.7 |
| May 23 | 142 | 16 | 6.1 |
| May 24, 1968 | 138 | 15 | 5.6 |
| May 25 | 138 | 14 | 5.2 |
| May 26 | 138 | 13 | 4.8 |
| May 27 | 142 | 17 | 6.5 |
| May 28 | 142 | 17 | 6.5 |
| May 29 | 145 | 14 | 5.5 |
| May 30 | 142 | 14 | 5.4 |
| May 31 | 149 | 14 | 5.6 |
| June 1 | 145 | 13 | 5.1 |
| June 2 | 138 | 10 | 3.7 |
| June 3 | 138 | 14 | 5.2 |
| June 4 | 135 | 17 | 6.2 |
| June 5 | 132 | 18 | 6.4 |
| June 6 | 142 | 16 | 6.1 |
| June 7 | 149 | 20 | 8.0 |
| June 8 | 160 | 28 | 12 |
| June 9 | 160 | 29 | 13 |
| June 10 | 174 | 32 | 15 |
| June 11 | 182 | 39 | 19 |
| June 12 | 178 | 40 | 19 |
| June 13 | 178 | 34 | 16 |
| June 14 | 167 | 28 | 13 |
| June 15 | 149 | 24 | 9.7 |
| June 16 | 142 | 19 | 7.3 |
| June 17 | 135 | 16 | 5.8 |
| June 18 | 126 | 14 | 4.8 |
| June 19 | 120 | 10 | 3.2 |
| June 20 | 117 | 15 | 4.7 |
| June 21 | 132 | 21 | 7.5 |
| June 22 | 145 | 19 | 7.4 |
| June 23 | 142 | 17 | 6.5 |
| June 24 | 135 | 13 | 4.7 |
| June 25 | 129 | 12 | 4.2 |
| June 26 | 126 | 11 | 3.7 |
| June 27 | 120 | 11 | 3.6 |
| June 28 | 117 | 11 | 3.5 |
| June 29 | 111 | 10 | 3.0 |
| June 30 | 114 | 11 | 3.4 |
| July 1 | 111 | 14 | 4.2 |
| July 2 | 108 | 19 | 5.5 |
| July 3 | 108 | 12 | 3.5 |
| July 4 | 104 | 6 | 1.7 |
| July 25 | 88 | 5 | 1.2 |
| Sept. 4 | 49 | 2 | .26 |

## 5-0875. MIDDLE RIVER NEAR ARGYLE, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Mar. 25, 1968 | 20 | 10 | .54 |
| Mar. 26 | 65 | 12 | 2.1 |
| Mar. 27 | 130 | 25 | 8.8 |
| Mar. 28 | 160 | 45 | 19 |
| Mar. 29 | 170 | 46 | 21 |
| Mar. 30 | 150 | 45 | 18 |
| Mar. 31 | 100 | 40 | 11 |
| Apr. 1 | 60 | 32 | 5.2 |
| Apr. 2 | 40 | 17 | 1.8 |
| Apr. 3 | 32 | 11 | .95 |
| Apr. 4 | 35 | 8 | .76 |
| Apr. 5 | 40 | 6 | .65 |
| Apr. 6 | 34 | 7 | .64 |
| Apr. 7 | 26 | 9 | .63 |
| Apr. 8 | 20 | 13 | .70 |
| Apr. 9 | 17 | 18 | .83 |
| Apr. 10 | 15 | 23 | .93 |
| Apr. 11 | 13 | 25 | .88 |
| Apr. 12 | 12 | 19 | .62 |
| Apr. 13 | 11 | 11 | .33 |
| Apr. 14 | 11 | 15 | .45 |
| Apr. 15 | 12 | 16 | .52 |
| Apr. 16 | 14 | 10 | .38 |
| Apr. 17 | 13 | 8 | .28 |
| Apr. 18 | 11 | 8 | .24 |
| Apr. 19 | 10 | 10 | .27 |
| Apr. 20 | 10 | 12 | .32 |
| Apr. 21 | 11 | 11 | .33 |
| Apr. 22 | 13 | 8 | .28 |
| Apr. 23 | 17 | 13 | .60 |
| Apr. 24 | 20 | 22 | 1.2 |
| Apr. 25 | 22 | 15 | .89 |
| Apr. 26 | 19 | 16 | .82 |
| Apr. 27 | 15 | 18 | .73 |
| Apr. 28 | 10 | 14 | .38 |
| Apr. 29 | 7.0 | 10 | .19 |
| Apr. 30 | 5.5 | 8 | .12 |
| May 1 | 4.8 | 12 | .16 |
| May 2 | 4.2 | 13 | .15 |
| May 3 | 4.0 | 12 | .13 |
| May 4 | 3.8 | 12 | .12 |
| May 5 | 3.8 | 11 | .11 |
| May 6 | 4.5 | 11 | .13 |
| May 7 | 4.7 | 7 | .09 |
| May 8 | 4.3 | 15 | .17 |
| May 9 | 3.7 | 14 | .14 |
| May 10 | 4.0 | 16 | .17 |
| May 11 | 4.3 | 15 | .17 |
| May 12 | 4.6 | 13 | .16 |
| May 13 | 4.9 | 10 | .13 |
| May 14 | 4.4 | 12 | .14 |
| May 15 | 3.8 | 16 | .16 |
| May 16 | 4.4 | 21 | .25 |
| June 9 | 95 | 93 | 27 |
| June 10 | 280 | 120 | 91 |
| June 11 | 502 | 136 | 184 |
| June 12 | 655 | 113 | 200 |
| June 13 | 847 | 125 | 286 |
| June 14 | 1060 | 83 | 238 |
| June 15 | 971 | 62 | 162 |
| June 16 | 716 | 65 | 126 |
| June 17 | 429 | 54 | 63 |
| June 18 | 281 | 58 | 44 |
| June 19 | 199 | 36 | 19 |
| June 20 | 157 | 29 | 12 |
| June 21 | 126 | 28 | 9.5 |
| June 22 | 100 | 24 | 6.5 |
| June 23 | 85 | 21 | 4.8 |
| June 24, 1968 | 72 | 22 | 4.3 |
| June 25 | 66 | 19 | 3.4 |
| June 26 | 64 | 18 | 3.1 |
| June 27 | 62 | 19 | 3.2 |
| June 28 | 55 | 19 | 2.8 |
| June 29 | 47 | 20 | 2.5 |
| June 30 | 43 | 25 | 2.9 |
| July 1 | 43 | 22 | 2.6 |
| July 2 | 41 | 30 | 3.3 |
| July 3 | 78 | 43 | 9.1 |
| July 4 | 196 | 43 | 23 |
| July 5 | 231 | 36 | 22 |
| July 6 | 189 | 27 | 14 |
| July 7 | 135 | 24 | 8.7 |
| July 8 | 98 | 21 | 5.6 |
| July 9 | 75 | 18 | 3.6 |
| July 10 | 61 | 19 | 3.1 |
| July 11 | 51 | 19 | 2.6 |
| July 12 | 45 | 16 | 1.9 |
| July 21 | 847 | 71 | 162 |
| July 22 | 579 | 61 | 95 |
| July 23 | 332 | 54 | 48 |
| July 24 | 254 | 42 | 29 |
| July 25 | 180 | 41 | 20 |
| July 26 | 138 | 39 | 15 |
| July 27 | 107 | 31 | 9.0 |
| July 28 | 91 | 25 | 6.1 |
| July 29 | 81 | 30 | 6.6 |
| July 30 | 71 | 36 | 6.9 |
| July 31 | 64 | 30 | 5.2 |
| Aug. 1 | 58 | 33 | 5.2 |
| Aug. 2 | 54 | 32 | 4.7 |
| Aug. 3 | 52 | 29 | 4.1 |
| Aug. 4 | 46 | 29 | 3.6 |
| Aug. 5 | 42 | 31 | 3.5 |
| Aug. 6 | 38 | 28 | 2.9 |
| Aug. 7 | 34 | 31 | 2.8 |
| Aug. 8 | 32 | 39 | 3.4 |
| Aug. 9 | 29 | 37 | 2.9 |
| Aug. 10 | 25 | 53 | 3.6 |
| Aug. 11 | 23 | 38 | 2.4 |
| Aug. 12 | 21 | 46 | 2.6 |
| Aug. 13 | 19 | 47 | 2.4 |
| Aug. 20 | 16 | 39 | 1.7 |
| Aug. 26 | 30 | 68 | 5.5 |
| Aug. 27 | 29 | 59 | 4.6 |
| Aug. 28 | 30 | 59 | 4.8 |
| Aug. 29 | 28 | 51 | 3.9 |
| Aug. 30 | 28 | 45 | 3.4 |
| Aug. 31 | 25 | 42 | 2.8 |
| Sept. 1 | 23 | 41 | 2.5 |
| Sept. 2 | 23 | 41 | 2.5 |
| Sept. 3 | 23 | 40 | 2.5 |
| Sept. 4 | 20 | 43 | 2.3 |
| Sept. 5 | 20 | 50 | 2.7 |
| Sept. 6 | 20 | 42 | 2.3 |
| Sept. 7 | 19 | 36 | 1.8 |
| Sept. 8 | 21 | 33 | 1.9 |
| Sept. 9 | 20 | 31 | 1.7 |
| Sept. 10 | 23 | 39 | 2.4 |
| Sept. 11 | 29 | 36 | 2.8 |
| Sept. 12 | 28 | 36 | 2.7 |
| Sept. 13 | 26 | 33 | 2.3 |
| Sept. 14 | 25 | 35 | 2.4 |
| Sept. 15 | 21 | 38 | 2.2 |
| Sept. 16 | 20 | 31 | 1.7 |
| Sept. 24 | 40 | 54 | 5.8 |
| Sept. 25 | 36 | 70 | 6.8 |

## 5-2440. CROW WING RIVER AT NIMROD, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 18, 1967 | 425 | 20 | 23 |
| Jan. 22, 1968 | 245 | 16 | 11 |
| Feb. 19 | 245 | 3 | 2.0 |
| Mar. 18 | 385 | 3 | 3.1 |
| Mar. 26 | 480 | 19 | 25 |
| Mar. 27 | 640 | 24 | 42 |
| Mar. 28 | 760 | 26 | 53 |
| Mar. 29 | 649 | 14 | 24 |
| Mar. 30 | 662 | 14 | 25 |
| Mar. 31 | 649 | 12 | 21 |
| Apr. 1 | 644 | 13 | 23 |
| Apr. 2 | 616 | 12 | 20 |
| Apr. 3 | 610 | 8 | 13 |
| Apr. 4 | 598 | 11 | 18 |
| Apr. 5 | 630 | 15 | 26 |
| Apr. 6 | 604 | 15 | 24 |
| Apr. 7 | 649 | 14 | 25 |
| Apr. 8 | 766 | 15 | 31 |
| Apr. 9 | 818 | 18 | 40 |
| Apr. 10 | 812 | 14 | 31 |
| Apr. 11 | 805 | 16 | 35 |
| Apr. 12 | 798 | 21 | 45 |
| Apr. 13 | 792 | 16 | 34 |
| Apr. 14 | 798 | 15 | 32 |
| Apr. 15 | 818 | 20 | 44 |
| Apr. 16 | 820 | 20 | 44 |
| Apr. 17 | 810 | 16 | 35 |
| Apr. 18 | 766 | 14 | 29 |
| Apr. 19 | 740 | 15 | 30 |
| Apr. 20 | 790 | 15 | 32 |
| Apr. 21 | 900 | 16 | 39 |
| Apr. 22 | 970 | 19 | 50 |
| Apr. 23 | 1060 | 21 | 60 |
| Apr. 24 | 1170 | 24 | 76 |
| Apr. 25 | 1150 | 27 | 84 |
| Apr. 26 | 1120 | 23 | 70 |
| Apr. 27 | 1060 | 20 | 57 |
| Apr. 28 | 1020 | 20 | 55 |
| Apr. 29 | 1000 | 25 | 68 |
| Apr. 30 | 955 | 22 | 57 |
| May 1 | 912 | 21 | 52 |
| May 2 | 870 | 24 | 56 |
| May 3 | 857 | 23 | 53 |
| May 4 | 838 | 26 | 59 |
| May 5 | 824 | 18 | 40 |
| May 6 | 805 | 25 | 54 |
| May 7 | 818 | 24 | 53 |
| May 21 | 746 | 14 | 28 |
| May 22 | 714 | 18 | 35 |
| May 23 | 705 | 22 | 42 |
| May 24 | 727 | 23 | 45 |
| May 25 | 670 | 22 | 40 |
| May 26 | 642 | 21 | 36 |
| May 27 | 640 | 17 | 29 |
| May 28 | 642 | 13 | 23 |
| May 29 | 600 | 13 | 21 |
| May 30 | 598 | 17 | 27 |
| May 31 | 600 | 19 | 31 |
| June 1 | 610 | 17 | 28 |
| June 2 | 600 | 16 | 26 |
| June 3 | 598 | 17 | 27 |
| June 4 | 600 | 17 | 28 |
| June 5 | 610 | 15 | 25 |
| June 6 | 630 | 13 | 22 |
| June 7 | 792 | 17 | 36 |
| June 8 | 1040 | 31 | 87 |
| June 9 | 2650 | 24 | 172 |
| June 10 | 2620 | 18 | 127 |
| June 11 | 2380 | 17 | 109 |
| June 12 | 2020 | 15 | 82 |
| June 13 | 1880 | 17 | 86 |
| June 14 | 1850 | 21 | 105 |
| June 15 | 1760 | 27 | 128 |
| June 16, 1968 | 1660 | 27 | 121 |
| June 17 | 1560 | 26 | 110 |
| June 18 | 1420 | 26 | 100 |
| June 19 | 1290 | 21 | 73 |
| June 20 | 1220 | 22 | 72 |
| June 21 | 1190 | 26 | 84 |
| June 22 | 1120 | 25 | 76 |
| June 23 | 1050 | 20 | 57 |
| June 24 | 978 | 16 | 42 |
| June 25 | 962 | 15 | 39 |
| June 26 | 926 | 15 | 38 |
| June 27 | 891 | 15 | 36 |
| June 28 | 850 | 15 | 34 |
| June 29 | 831 | 20 | 45 |
| June 30 | 850 | 27 | 62 |
| July 1 | 955 | 19 | 49 |
| July 2 | 919 | 10 | 25 |
| July 3 | 870 | 10 | 23 |
| July 4 | 824 | 9 | 20 |
| July 5 | 805 | 9 | 20 |
| July 6 | 772 | 9 | 19 |
| July 7 | 746 | 9 | 18 |
| July 8 | 727 | 8 | 16 |
| July 9 | 688 | 10 | 19 |
| July 10 | 668 | 12 | 22 |
| July 11 | 642 | 17 | 29 |
| July 12 | 884 | 14 | 33 |
| July 13 | 844 | 9 | 20 |
| July 14 | 827 | 9 | 20 |
| July 15 | 1720 | 16 | 74 |
| July 16 | 1550 | 10 | 42 |
| July 17 | 1370 | 11 | 41 |
| July 18 | 1270 | 11 | 38 |
| July 19 | 1100 | 8 | 24 |
| July 20 | 948 | 11 | 28 |
| July 21 | 877 | 12 | 28 |
| July 22 | 838 | 9 | 20 |
| July 23 | 792 | 8 | 17 |
| July 24 | 753 | 8 | 16 |
| July 25 | 714 | 8 | 15 |
| July 26 | 682 | 9 | 17 |
| July 27 | 662 | 9 | 16 |
| July 28 | 636 | 9 | 15 |
| July 29 | 616 | 8 | 13 |
| July 30 | 616 | 7 | 12 |
| July 31 | 616 | 5 | 8.3 |
| Aug. 1 | 592 | 4 | 6.4 |
| Aug. 2 | 568 | 5 | 7.7 |
| Aug. 3 | 544 | 6 | 8.8 |
| Aug. 4 | 532 | 7 | 10 |
| Aug. 5 | 508 | 8 | 11 |
| Aug. 6 | 490 | 4 | 5.3 |
| Aug. 7 | 484 | 5 | 6.5 |
| Aug. 8 | 502 | 4 | 5.4 |
| Aug. 9 | 490 | 4 | 5.3 |
| Aug. 10 | 484 | 3 | 3.9 |
| Aug. 11 | 472 | 2 | 2.5 |
| Aug. 12 | 466 | 5 | 6.3 |
| Aug. 13 | 454 | 5 | 6.1 |
| Aug. 14 | 442 | 5 | 6.0 |
| Aug. 15 | 454 | 4 | 4.9 |
| Aug. 20 | 484 | 5 | 6.5 |
| Aug. 26 | 454 | 1 | 1.2 |
| Sept. 17 | 495 | 3 | 4.0 |
| Sept. 18 | 497 | 4 | 5.4 |
| Sept. 19 | 496 | 4 | 5.4 |
| Sept. 20 | 489 | 5 | 6.6 |
| Sept. 21 | 482 | 6 | 7.8 |
| Sept. 22 | 520 | 5 | 7.0 |
| Sept. 23 | 567 | 4 | 6.1 |
| Sept. 24 | 566 | 3 | 4.6 |
| Sept. 25 | 561 | 3 | 4.5 |
| Sept. 26 | 554 | 4 | 6.0 |
| Sept. 27 | 543 | 4 | 5.9 |
| Sept. 28 | 537 | 4 | 5.8 |
| Sept. 29 | 525 | 3 | 4.3 |
| Sept. 30 | 514 | 2 | 2.8 |

## 5-3150. REDWOOD RIVER AT MARSHALL, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) | Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|---|---|---|---|
| Jan. 9, 1968 | .1 | 30 | 0 | Aug. 7, 1968 | 18 | 100 | 4.9 |
| | | | | Aug. 8 | 21 | 98 | 5.6 |
| Feb. 13 | 1.2 | 94 | .3 | Aug. 15 | 8.5 | 58 | 1.3 |
| Mar. 12 | 8.2 | 42 | .9 | Sept. 17 | 4.6 | 47 | .6 |
| | | | | Sept. 21 | 90 | 61 | 17 |
| Apr. 10 | 11 | 31 | .9 | Sept. 22 | 73 | 93 | 20 |
| | | | | Sept. 23 | 48 | 70 | 9.1 |
| May 8 | 9.1 | 24 | .6 | Sept. 24 | 45 | 60 | 7.3 |
| | | | | Sept. 25 | 39 | 55 | 5.8 |
| June 12 | 4.1 | 29 | .3 | Sept. 26 | 35 | 50 | 4.7 |
| | | | | Sept. 27 | 38 | 45 | 4.6 |
| July 18 | 2.2 | 112 | .7 | Sept. 28 | 43 | 41 | 4.8 |
| July 29 | 16 | 91 | 4.0 | Sept. 29 | 56 | 38 | 5.7 |
| | | | | Sept. 30 | 68 | 46 | 8.4 |

## 5-3165. REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE: C. CHEMICALLY DISPERSED: N. IN NATIVE WATER: P. PIPET: S. SIEVE: V. VISUAL ACCUMULATION TUBE: W. IN DISTILLED WATER)

| Date | Time | Water Temperature (C) | Discharge (cfs) | Concentration (mg/l) | Suspended Sediment Discharge (tons/day) | Particle Size: Percent Finer than the Size (in millimeters) Indicated .002 | .004 | .008 | .016 | .031 | .062 | .125 | .250 | .500 | 1.00 | 2.00 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 12, 1968 | 1625 | 0 | 1.8 | 54 | .26 | | | | | | | | | | | | |
| Mar. 13 | 0900 | 0 | 14 | 8 | .30 | | | | | | | | | | | | |
| Mar. 27 | 1330 | 1 | 34 | 26 | 2.4 | | | | | | | | | | | | |
| Apr. 10 | 1020 | 8 | 52 | 59 | 8.3 | | | | | | | | | | | | |
| May 8 | 1240 | 9 | 26 | 46 | 3.2 | | | | | | | | | | | | |
| June 18 | 0950 | 19 | 23 | 162 | 10 | | | | | | | | | | | | |
| July 19 | 1530 | 25 | 11 | 122 | 3.6 | | | | | | | | | | | | |
| July 31 | 1045 | 20 | 268 | 245 | 177 | | | | | | | | | | | | |
| Aug. 1 | 1020 | 19 | 209 | 299 | 169 | | | | | | | | | | | | |
| Aug. 2 | 1040 | 20 | 150 | 240 | 97 | | | | | | | | | | | | |
| Aug. 13 | 1945 | 21 | 56 | 75 | 11 | | | | | | | | | | | | |
| Sept.16 | 1050 | 18 | 18 | 135 | 6.6 | 77 | 78 | 84 | 87 | 90 | | | | | | | BWC |
| Sept.27 | 1020 | 20 | 101 | 107 | 29 | | | | | | | | | | | | |

## 5-3262. JUDICIAL DITCH NO. 1-A NEAR NEW SWEDEN, MINN.

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE: C. CHEMICALLY DISPERSED: N. IN NATIVE WATER: P. PIPET: S. SIEVE: V. VISUAL ACCUMULATION TUBE: W. IN DISTILLED WATER)

| Date | Time | Water Temperature (C) | Discharge (cfs) | Concentration (mg/l) | Suspended Sediment Discharge (tons/day) | Particle Size: Percent Finer than the Size (in millimeters) Indicated .002 | .004 | .008 | .016 | .031 | .062 | .125 | .250 | .500 | 1.00 | 2.00 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar. 18, 1968 | 1425 | 7 | 2.5 | 25 | .17 | | | | | | | | | | | | |
| Apr. 22 | 1105 | 15 | 1.9 | 4 | .02 | | | | | | | | | | | | |
| May 21 | 1035 | 15 | 1.1 | 24 | .07 | | | | | | | | | | | | |
| June 10 | 1600 | 23 | 117 | 457 | 144 | | | | | | | | | | | | |
| June 11 | 1800 | 19 | 58 | 103 | 16 | | | | | | | | | | | | |
| June 12 | 0830 | 18 | 53 | 80 | 11 | | | | | | | | | | | | |
| June 24 | 1435 | 21 | 3.0 | 68 | .55 | | | | | | | | | | | | |
| July 11 | 1145 | 27 | .7 | 52 | .10 | | | | | | | | | | | | |
| July 13 | 0900 | 22 | 62 | 110 | 18 | 18 | 41 | 72 | 80 | 82 | 95 | | | | | | PWC |
| July 26 | 1500 | 20 | 122 | 120 | 40 | | | | | | | | | | | | |
| July 27 | 1000 | 19 | 406 | 210 | 230 | | | | | | | | | | | | |
| July 28 | 1100 | 21 | 337 | 280 | 255 | | | | | | | | | | | | |
| Aug. 6 | 1130 | 23 | 34 | 160 | 15 | | | | | | | | | | | | |
| Aug. 9 | 1300 | 21 | 765 | 60 | 124 | | | | | | | | | | | | |
| Aug. 10 | 1030 | 20 | 650 | 61 | 107 | | | | | | | | | | | | |
| Aug. 11 | 1700 | 22 | 606 | 27 | 44 | | | | | | | | | | | | |
| Aug. 13 | 0700 | 20 | 406 | 20 | 22 | | | | | | | | | | | | |
| Aug. 14 | 1130 | 18 | 280 | 29 | 22 | | | | | | | | | | | | |

PARTICLE SIZE OF BED MATERIAL, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHOD OF ANALYSIS: H. HYDROMETER: O. OPTICAL ANALYZER: S. SIEVE: V. VISUAL ACCUMULATION TUBE)

| Date | Time | No. of Sampling Points | Discharge (cfs) | Particle Size: Percent Finer than the Size (in millimeters) Indicated 0.016 | 0.031 | 0.062 | 0.125 | 0.25 | 0.354 | 0.50 | 1.000 | 2.000 | 4.000 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July 11, 1968 | 1145 | 2 | 0.7 | | | 11 | 19 | 30 | 36 | | 50 | 63 | | S |

## 5-3538. STRAIGHT RIVER NEAR FARIBAULT, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 19, 1967 | 28 | 39 | 2.9 |
| Jan. 22, 1968 | 16 | 1 | 0 |
| Feb. 22 | 11 | 10 | 0.3 |
| Mar. 25 | 41 | 5 | 0.6 |
| Apr. 23 | 223 | 452 | 288 |
| Apr. 24 | 440 | 328 | 390 |
| Apr. 25 | 386 | 143 | 149 |
| Apr. 26 | 260 | 102 | 72 |
| Apr. 27 | 185 | 59 | 29 |
| May 1 | 104 | 22 | 6.2 |
| May 16 | 340 | 1210 | 1110 |
| May 17 | 287 | 295 | 228 |
| May 18 | 228 | 124 | 76 |
| May 19 | 185 | 89 | 44 |
| May 20 | 167 | 100 | 45 |
| May 21 | 152 | 85 | 35 |
| May 27 | 202 | 189 | 103 |
| May 28 | 232 | 158 | 99 |
| May 29 | 206 | 198 | 110 |
| May 30 | 179 | 190 | 92 |
| May 31 | 161 | 211 | 92 |
| June 1 | 220 | 214 | 127 |
| June 2 | 232 | 188 | 118 |
| June 3 | 196 | 154 | 81 |
| June 24 | 143 | 376 | 145 |
| July 3 | 213 | 217 | 125 |
| July 12 | 294 | 864 | 857 |
| July 13 | 1120 | 694 | 4620 |
| July 14, 1968 | 1410 | 1140 | 2550 |
| July 15 | 1160 | 409 | 1280 |
| July 16 | 864 | 290 | 676 |
| July 17 | 634 | 635 | 1090 |
| July 18 | 545 | 490 | 721 |
| July 19 | 408 | 335 | 369 |
| July 20 | 314 | 243 | 206 |
| July 21 | 252 | 209 | 142 |
| Aug. 2 | 206 | 516 | 287 |
| Aug. 3 | 274 | 432 | 320 |
| Aug. 4 | 236 | 340 | 217 |
| Aug. 5 | 210 | 299 | 170 |
| Aug. 8 | 404 | 262 | 286 |
| Aug. 9 | 436 | 310 | 365 |
| Aug. 10 | 377 | 232 | 236 |
| Aug. 11 | 282 | 157 | 120 |
| Aug. 12 | 216 | 142 | 83 |
| Sept. 9 | 585 | 310 | 490 |
| Sept. 10 | 510 | 145 | 200 |
| Sept. 11 | 386 | 102 | 106 |
| Sept. 12 | 292 | 109 | 86 |
| Sept. 13 | 232 | 138 | 86 |
| Sept. 17 | 182 | 299 | 147 |
| Sept. 18 | 228 | 176 | 108 |
| Sept. 19 | 274 | 127 | 94 |
| Sept. 22 | 314 | 259 | 220 |
| Sept. 23 | 697 | 601 | 1130 |
| Sept. 24 | 754 | 327 | 666 |
| Sept. 25 | 624 | 196 | 330 |
| Sept. 26 | 500 | 157 | 212 |
| Sept. 27 | 408 | 184 | 203 |
| Sept. 28 | 350 | 260 | 246 |

## 5-3710. COTTONWOOD RIVER NEAR NEW ULM, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 13, 1967 | 12 | 86 | 2.8 |
| Dec. 16 | 12 | 156 | 5.1 |
| Dec. 23 | 9.5 | 202 | 5.2 |
| Dec. 30 | 5.1 | 218 | 3.0 |
| Jan. 6, 1968 | 4.8 | 248 | 3.2 |
| Jan. 13 | 4.6 | 137 | 1.7 |
| Jan. 16 | 4.6 | 63 | .8 |
| Jan. 20 | 4.6 | 341 | 4.2 |
| Jan. 27 | 5.3 | 192 | 2.7 |
| Feb. 3 | 6.6 | 156 | 2.8 |
| Feb. 10 | 7.0 | 105 | 2.0 |
| Feb. 17 | 7.4 | 136 | 2.7 |
| Feb. 20 | 7.7 | 127 | 2.6 |
| Feb. 24 | 7.7 | 200 | 4.2 |
| Mar. 2 | 7.8 | 190 | 4.0 |
| Mar. 9 | 14 | 88 | 3.3 |
| Mar. 16 | 90 | 16 | 3.9 |
| Mar. 19 | 127 | 76 | 26 |
| Mar. 30 | 78 | 163 | 34 |
| Apr. 20 | 73 | 85 | 17 |
| Apr. 27 | 102 | 224 | 62 |
| May 18 | 3.2 | 97 | .8 |
| May 25 | 24 | 78 | 5.0 |
| June 1 | 32 | 115 | 3.9 |
| June 8 | 29 | 115 | 9.0 |
| June 15 | 146 | 66 | 26 |
| June 21 | 53 | 32 | 4.6 |
| June 28 | 60 | 18 | 2.9 |
| June 29 | 66 | 40 | 7.1 |
| July 6 | 47 | 41 | 5.2 |
| July 25 | 472 | 46 | 59 |
| July 26 | 1040 | 148 | 437 |
| July 27 | 3530 | 272 | 2590 |
| July 28, 1968 | 3540 | 244 | 2330 |
| July 29 | 2970 | 273 | 2190 |
| July 30 | 2000 | 143 | 772 |
| July 31 | 2130 | 295 | 1700 |
| Aug. 1 | 2510 | 316 | 2140 |
| Aug. 2 | 2400 | 311 | 2020 |
| Aug. 3 | 1970 | 268 | 1430 |
| Aug. 4 | 1090 | 297 | 874 |
| Aug. 5 | 980 | 144 | 381 |
| Aug. 6 | 668 | 130 | 248 |
| Aug. 7 | 743 | 81 | 163 |
| Aug. 8 | 1040 | 119 | 334 |
| Aug. 9 | 488 | 171 | 225 |
| Aug. 10 | 864 | 349 | 814 |
| Aug. 11 | 622 | 147 | 247 |
| Aug. 12 | 584 | 169 | 266 |
| Aug. 13 | 490 | 180 | 238 |
| Aug. 14 | 415 | 125 | 140 |
| Aug. 15 | 368 | 114 | 113 |
| Aug. 16 | 342 | 121 | 112 |
| Aug. 17 | 302 | 67 | 55 |
| Aug. 18 | 170 | 45 | 21 |
| Aug. 19 | 225 | 60 | 36 |
| Aug. 20 | 219 | 47 | 28 |
| Aug. 21 | 199 | 37 | 20 |
| Aug. 22 | 181 | 35 | 17 |
| Aug. 23 | 166 | 43 | 19 |
| Aug. 24 | 148 | 54 | 22 |
| Aug. 31 | 102 | 69 | 19 |
| Sept. 4 | 90 | 20 | 4.9 |
| Sept. 7 | 79 | 96 | 20 |
| Sept. 18 | 253 | 57 | 39 |
| Sept. 25 | 3240 | 820 | 7170 |
| Sept. 26 | 2310 | 384 | 2400 |
| Sept. 27 | 1740 | 133 | 625 |
| Sept. 28 | 1470 | 98 | 389 |
| Sept. 29 | 1300 | 126 | 442 |
| Sept. 30 | 1220 | 127 | 418 |

PARTICLE SIZE OF BED MATERIAL, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHOD OF ANALYSIS: H. HYDROMETER: O. OPTICAL ANALYZER: S. SIEVE: V. VISUAL ACCUMULATION TUBE)

| Date | Time | No. of Sampling Points | Discharge (cfs) | Particle Size: Percent Finer than the Size (in millimeters) Indicated 0.016 | 0.031 | 0.062 | 0.125 | 0.25 | 0.354 | 0.50 | 1.000 | 2.000 | 4.000 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July 12, 1968 | 0935 | 4 | 39 | | | | 1 | 5 | 18 | | 86 | 96 | 100 | S |
| Aug. 8 | 1630 | 4 | 1420 | | | | -- | 1 | 6 | | 83 | 95 | 100 | S |

## 5-3840. ROOT RIVER NEAR LANESBORO, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 19, 1967 | 81 | 15 | 3.3 |
| Jan. 22, 1968 | 89 | 29 | 7.0 |
| Feb. 26 | 75 | 10 | 2.0 |
| Mar. 19 | 148 | 13 | 5.2 |
| Apr. 23 | 288 | 263 | 204 |
| Apr. 24 | 409 | 382 | 422 |
| Apr. 25 | 356 | 182 | 175 |
| May 16 | 742 | 5020 | 10100 |
| May 17 | 508 | 2290 | 3390 |
| May 18 | 376 | 700 | 711 |
| May 21 | 240 | 170 | 110 |
| June 11, 1968 | 170 | 1290 | 592 |
| June 18 | 312 | 1030 | 868 |
| June 26 | 286 | 685 | 576 |
| June 27 | 1030 | 1270 | 3530 |
| June 28 | 1220 | 578 | 1950 |
| June 29 | 759 | 400 | 820 |
| June 30 | 530 | 360 | 515 |
| July 23 | 743 | 2073 | 4560 |
| July 24 | 1170 | 2160 | 6960 |
| Aug. 13 | 130 | 102 | 36 |
| Sept. 4 | 330 | 491 | 437 |
| Sept. 10 | 147 | 98 | 39 |

## 5-3850. ROOT RIVER NEAR HOUSTON, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Dec. 18, 1967 | 313 | 53 | 45 |
| Jan. 23, 1968 | 256 | 40 | 28 |
| Feb. 27 | 234 | 21 | 13 |
| Mar. 20 | 330 | 68 | 61 |
| Mar. 21 | 317 | 123 | 105 |
| Mar. 22 | 301 | 142 | 115 |
| Mar. 23 | 285 | 118 | 91 |
| Mar. 24 | 278 | 80 | 60 |
| Mar. 25 | 274 | 57 | 42 |
| Mar. 26 | 274 | 86 | 64 |
| Mar. 27 | 301 | 142 | 115 |
| Mar. 28 | 289 | 197 | 154 |
| Apr. 23 | 660 | 640 | 1140 |
| Apr. 24 | 640 | 592 | 1020 |
| May 16, 1968 | 1960 | 16500 | 94940 |
| May 17 | 1660 | 6460 | 31000 |
| May 18 | 1200 | 1850 | 5990 |
| June 18 | 620 | 6080 | 10300 |
| June 19 | 935 | 3960 | 10200 |
| June 25 | 460 | 780 | 969 |
| June 26 | 650 | 5450 | 9560 |
| June 27 | 995 | 1120 | 3080 |
| June 28 | 1450 | 1320 | 5170 |
| June 29 | 1300 | 900 | 3200 |
| June 30 | 1060 | 450 | 1290 |
| July 1 | 920 | 420 | 1040 |
| Aug. 12 | 343 | 172 | 159 |
| Sept. 5 | 700 | 802 | 1520 |
| Sept. 13 | 352 | 136 | 1290 |
| Sept. 22 | 510 | 3240 | 4460 |

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
(METHODS OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE: C. CHEMICALLY DISPERSED: N. IN NATIVE WATER: P. PIPET: S. SIEVE: V. VISUAL ACCUMULATION TUBE: W. IN DISTILLED WATER)

| Date | Time | Water Temperature (C) | Discharge (cfs) | Concentration (mg/l) | Suspended Sediment Discharge (tons/day) | Particle Size: Percent Finer than the Size (in millimeters) Indicated .002 | .004 | .008 | .016 | .031 | .062 | .125 | .250 | .500 | 1.00 | 2.00 | Method of Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May 16, 1968 | 1715 | 0 | 2610 | 17000 | 122000 | 34 | 50 | 65 | 81 | 93 | 99 | 99 | 99 | 100 | | | BWV |

## 5-4760. WEST FORK DES MOINES RIVER AT JACKSON, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| Date | Mean Discharge (cfs) | Mean Concentration (mg/l) | Load (tons) |
|---|---|---|---|
| Jan. 9, 1968 | .4 | 40 | .04 |
| Feb. 12 | 2.2 | 21 | .12 |
| Mar. 11 | 20 | 22 | 1.2 |
| Apr. 8 | 14 | 58 | 2.2 |
| May 10 | 18 | 26 | 1.3 |
| June 6 | 1.8 | 17 | .08 |
| July 11 | 18 | 132 | 6.4 |
| July 29 | 505 | 114 | 155 |
| July 30 | 390 | 104 | 110 |
| July 31 | 381 | 97 | 100 |
| Aug. 1, 1968 | 474 | 140 | 179 |
| Aug. 2 | 378 | 121 | 123 |
| Aug. 3 | 307 | 134 | 152 |
| Aug. 4 | 284 | 150 | 115 |
| Aug. 5 | 246 | 102 | 68 |
| Aug. 6 | 221 | 74 | 44 |
| Aug. 7 | 207 | 64 | 36 |
| Aug. 8 | 212 | 61 | 35 |
| Aug. 9 | 233 | 60 | 38 |
| Aug. 20 | 79 | 77 | 16 |
| Sept. 19 | 189 | 49 | 25 |
| Sept. 23 | 284 | 42 | 32 |
| Sept. 24 | 261 | 48 | 34 |
| Sept. 30 | 345 | 52 | 48 |

Part 1. Surface Water Records

Part 2. Water-Quality Records



GPO 817-490-19