

1969

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

CALENDAR FOR WATER YEAR 1969

OCTOBER 1968

S	M	T	W	T	F	S
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DECEMBER 1968

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JANUARY 1969

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FEBRUARY 1969

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JUNE 1969

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AUGUST 1969

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SEPTEMBER 1969

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Copies of this report may be obtained from
District Chief, Water Resources Division
U.S. Geological Survey
1033 Post Office Building
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WATER RESOURCES DATA FOR MINNESOTA, 1969

Part 1. Surface Water Records

INTRODUCTION

The surface-water records for the 1969 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 the 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 under-developed 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 indentation in the listing of gaging stations in the table of contents of this report represents one rank. This downstream order and system of indentation 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 determining the daily flow. The records of stage are obtained from a water-stage recorder that gives a continuous record of fluctuations or from direct readings on a nonrecording gage. Measurements of discharge are made with a current meter by the general methods adopted by the Geological Survey on the basis of experience in stream gaging since 1888. These methods are described in Water-Supply Paper 888 and are also outlined in standard textbooks on the measurement of stream discharge.

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

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

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

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

The data in this report generally comprise a description of the station, 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 1969 water year is shown on the inside of the cover 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 "PERIOD OF RECORD" 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 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 diversion, 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 1968 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.

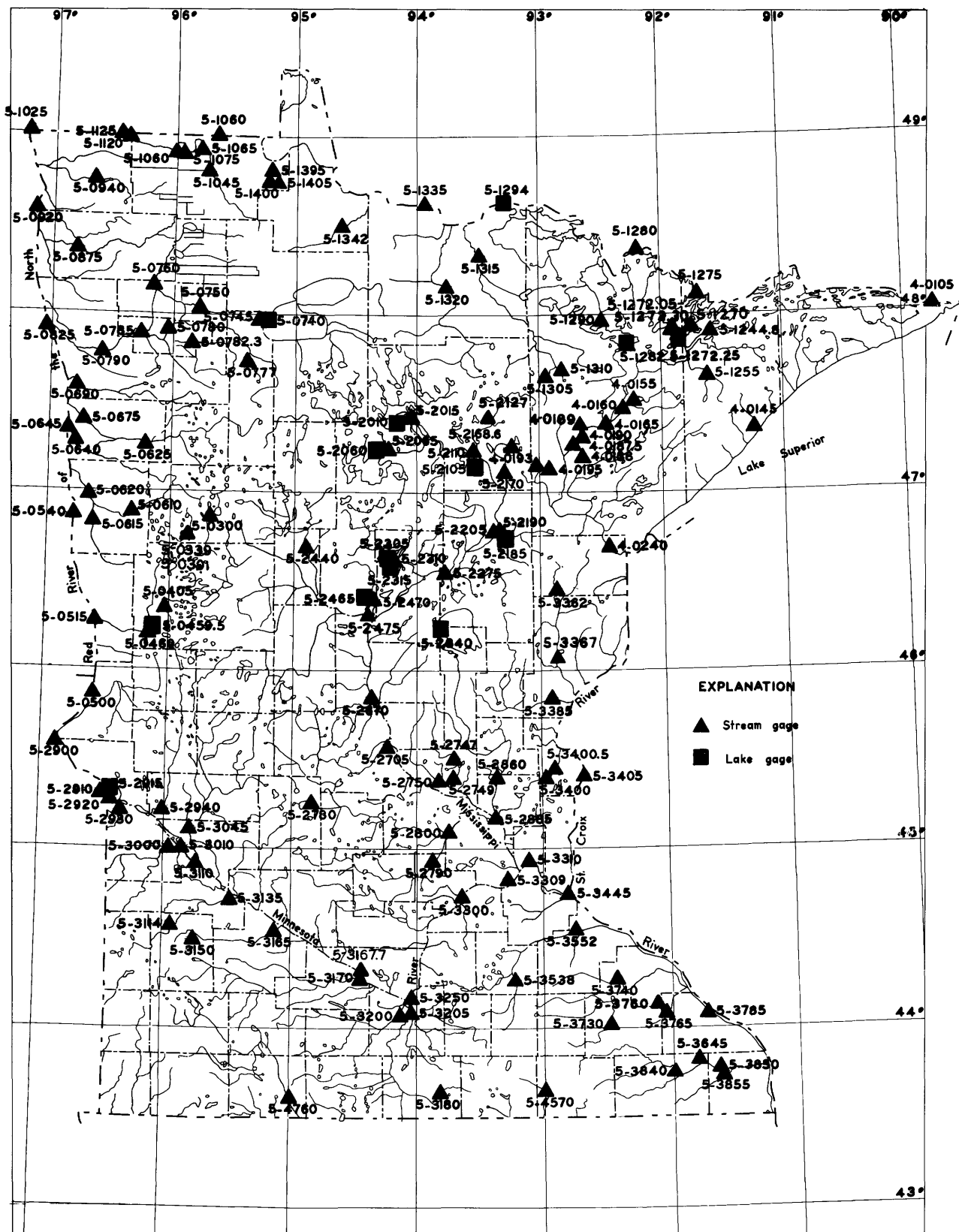


Figure 1.-- Map of Minnesota showing location of lake and stream gaging stations.

STREAMS TRIBUTARY TO LAKE SUPERIOR

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., Cook County, on right bank 400 ft upstream from Middle Falls, 2.5 miles upstream from Grand Portage Port of Entry, 3.5 miles upstream from mouth, and 4.7 miles northeast of village of Grand Portage.

DRAINAGE AREA.--600 sq mi.

PERIOD OF RECORD.--June to October 1921, April to November 1922, March 1923 to current year. 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.--Water-stage recorder. Datum of gage is 789.58 ft above mean sea level, datum of 1929. Prior to Sept. 30, 1940, nonrecording gage at International Bridge, 5.8 miles upstream at datum 100.24 ft higher.

AVERAGE DISCHARGE.--46 years (1923-69), 487 cfs (11.02 inches per year).

EXTREMES.--Current year: Maximum discharge, 4,700 cfs Apr. 22 (gage height, 7.67 ft); maximum gage height, 7.87 ft Apr. 15 (backwater from ice); minimum discharge, 63 cfs Sept. 21 (gage height, 0.42 ft).
Period of record: Maximum discharge, 11,000 cfs May 5, 1934 (gage height, 7.6 ft, site and datum then in use), from rating curve extended above 7,000 cfs; minimum, 27 cfs Nov. 4, 1945 (gage height, -0.08 ft).

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

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

REVISIONS (WATER YEARS).--WSP 744: 1927-28. WSP 804: 1934(M). WSP 974: Drainage area. WSP 1337: 1924(M), 1925, 1926-28(M), 1931(M), 1938(M), 1941(M), 1945-46(M), 1947, 1948(M), 1950(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	262	582	282	303	357	228	356	2,430	717	465	211	95
2	257	576	270	309	357	222	348	2,460	764	433	224	93
3	259	565	260	313	356	219	349	2,490	778	396	213	90
4	265	531	250	318	357	216	350	2,480	764	372	200	87
5	263	497	240	317	358	211	367	2,670	758	366	192	88
6	268	468	242	311	355	207	402	2,850	838	366	189	93
7	280	446	254	305	351	203	462	2,710	898	348	230	91
8	280	436	254	302	342	200	540	2,450	828	325	290	94
9	400	414	253	300	337	194	640	2,220	762	316	306	94
10	2,950	400	260	300	330	192	800	2,050	718	351	264	88
11	2,600	384	263	310	323	188	1,020	1,890	704	354	255	82
12	2,040	368	265	320	320	182	1,320	1,750	796	328	281	77
13	1,440	356	268	336	313	182	1,900	1,630	728	308	243	73
14	1,060	338	270	334	306	183	2,800	1,520	664	299	222	72
15	796	326	288	328	300	187	3,480	1,490	604	328	208	72
16	718	320	305	322	291	194	3,900	1,550	598	357	196	72
17	708	316	304	322	284	206	3,920	1,550	606	331	179	70
18	718	310	300	327	277	220	3,880	1,460	592	296	168	69
19	722	292	299	332	271	238	3,730	1,350	602	277	159	68
20	722	290	298	330	266	250	3,660	1,280	614	269	149	67
21	704	300	295	324	260	250	4,090	1,210	608	271	139	65
22	652	322	290	320	256	258	4,550	1,130	596	258	133	65
23	604	312	287	312	250	280	4,440	1,080	540	247	127	67
24	568	302	286	307	247	302	3,940	1,020	476	237	123	68
25	531	297	292	302	242	330	3,600	966	418	237	119	72
26	494	288	301	301	238	342	3,510	905	406	239	113	88
27	534	284	300	310	234	350	3,360	864	433	234	109	94
28	805	296	299	320	231	353	3,020	838	484	224	107	93
29	805	300	304	332	231	367	2,700	792	468	210	105	97
30	697	292	312	347	231	377	2,490	748	462	209	100	103
31	622	-----	307	353	-----	370	-----	722	-----	202	96	-----
TOTAL	24,024	11,208	8,698	9,867	8,409	7,701	69,924	50,555	19,224	9,453	5,650	2,447
MEAN	775	374	281	318	300	248	2,331	1,631	641	305	182	81.6
MAX	2,950	582	312	353	358	377	4,550	2,850	898	465	306	103
MIN	257	284	240	300	231	182	348	722	406	202	96	65
CFSM	1.29	.62	.47	.53	.50	.41	3.88	2.72	1.07	.51	.30	.14
IN.	1.49	.69	.54	.61	.52	.48	4.33	3.13	1.19	.59	.35	.15

CAL YR 1968 TOTAL 231,037 MEAN 631 MAX 3,440 MIN 30 CFSM 1.05 IN 14.32
WTR YR 1969 TOTAL 227,160 MEAN 622 MAX 4,550 MIN 65 CFSM 1.04 IN 14.08

PEAK DISCHARGE (BASE, 3,000 CFS)

NOTE.--No gage-height record Mar. 11 to Apr. 10.

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
4-22	2245	7.67	4,700				

4-0145. Baptism River near Beaver Bay, Minn.

LOCATION.--Lat 47°20'15", long 91°12'00", in SE 1/4 sec. 15, T.56 N., R.7 W., Lake County, on right bank 30 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.

PERIOD OF RECORD.--October 1927 to current year. 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, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--42 years, 161 cfs (15.62 inches per year).

EXTREMES.--Current year: Maximum discharge, 2,370 cfs Apr. 21 (gage height, 5.93 ft); minimum, 11 cfs Aug. 27, 28.

Period of record: 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 period of backwater from bridge construction, which are fair. Records for suspended sediment loads for water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	80	240	112	68	67	45	105	713	214	95	32	14
2	78	205	115	66	66	45	100	774	216	74	30	14
3	95	195	118	65	66	44	100	790	207	57	25	13
4	92	175	118	63	66	44	115	820	203	45	21	12
5	85	165	112	63	65	44	190	948	236	37	65	13
6	190	155	110	62	63	43	240	915	314	38	82	14
7	240	150	107	62	62	43	320	779	281	38	144	16
8	210	142	105	62	61	43	400	665	240	32	118	17
9	600	135	102	62	60	43	560	549	203	29	82	18
10	1,020	125	102	62	60	43	710	465	196	28	108	16
11	700	122	100	62	59	43	856	406	251	26	160	15
12	520	125	100	63	58	42	1,030	366	236	23	112	14
13	410	130	100	63	57	42	1,410	330	203	21	92	12
14	355	132	98	64	55	44	1,850	302	171	20	65	14
15	330	132	98	64	54	47	2,110	685	148	22	50	25
16	327	128	96	65	54	47	2,060	1,080	122	30	35	60
17	510	125	95	66	53	55	2,120	915	108	32	28	47
18	960	122	95	66	52	65	1,940	591	99	27	23	35
19	885	122	94	66	51	73	1,710	522	112	22	20	27
20	640	124	93	67	50	76	1,530	433	106	23	18	24
21	520	135	92	68	50	80	2,020	374	89	23	16	23
22	440	140	92	68	48	86	2,060	330	74	24	16	26
23	375	137	90	68	48	120	1,620	302	66	22	14	60
24	340	132	86	69	47	140	1,240	281	60	20	13	72
25	305	127	83	69	47	150	1,120	258	65	19	12	106
26	295	124	80	69	46	152	1,090	240	102	19	12	156
27	290	120	77	68	45	150	948	232	114	18	11	146
28	293	115	74	68	45	150	808	216	108	21	12	126
29	280	112	72	68	-----	185	757	216	99	20	14	124
30	265	110	70	68	-----	205	696	196	112	18	12	122
31	255	-----	70	67	-----	170	-----	184	-----	22	14	-----
TOTAL	11,985	4,201	2,956	2,031	1,555	2,559	31,815	15,977	4,755	945	1,446	1,381
MEAN	387	140	95.4	65.5	55.5	82.5	1,061	515	159	30.5	46.6	46.0
MAX	1,020	240	118	69	67	205	2,120	1,080	314	95	160	156
MIN	78	110	70	62	45	42	100	184	60	18	11	12
CFSM	2.76	1.00	0.68	0.47	0.40	0.59	7.57	3.68	1.13	0.22	0.33	0.33
IN.	3.18	1.12	0.79	0.54	0.41	0.68	8.45	4.25	1.26	0.25	0.38	0.37

CAL YR 1968 TOTAL 92,823.8
WTR YR 1969 TOTAL 81,606

MEAN 254
MEAN 224

MAX 2,480
MAX 2,120

MIN 6.2
MIN 11

CFSM 1.81
CFSM 1.60

IN. 24.66
IN. 21.68

PEAK DISCHARGE (BASE, 1,300 CFS)

NOTE.--Backwater from bridge construction Oct. 1 to Apr. 10.

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-9	1700	5.60	1,470	4-21	2200	5.93	2,370

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-0155. Second Creek near Aurora, Minn.

LOCATION.--Lat 47°31'25", long 92°11'35", in SW 1/4 sec.12, T.58 N., R.15 W., St. Louis County, 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.

PERIOD OF RECORD.--March 1955 to current year.

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.--14 years, 20.9 cfs (10.79 inches per year).

EXTREMES.--Current year: Maximum discharge, 130 cfs May 17 (gage height, 5.01 ft); minimum, 21 cfs Aug. 24 (gage height, 3.82 ft); minimum gage height, 3.78 ft July 30.

Period of record: 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 period of no gage-height record and those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	32	61	34	30	22	25	51	49	51	36	47	31
2	31	58	35	30	22	25	56	55	53	32	44	29
3	31	57	35	30	23	26	66	55	50	30	37	27
4	31	57	34	30	23	26	79	55	47	31	33	27
5	32	58	34	30	23	27	92	57	51	33	39	28
6	33	55	34	30	23	27	100	61	66	39	36	41
7	35	54	33	30	23	27	107	54	66	32	61	41
8	41	53	33	29	23	27	110	49	56	32	56	41
9	50	53	33	29	23	27	114	48	49	32	53	38
10	57	52	32	29	23	27	111	44	49	32	47	34
11	60	49	32	29	23	28	109	41	51	31	44	34
12	64	47	32	28	23	30	103	41	47	30	41	33
13	66	46	32	28	23	32	105	39	43	30	38	30
14	70	45	32	28	22	34	103	36	42	37	35	30
15	74	44	32	28	22	36	101	48	41	48	36	31
16	80	43	32	28	22	38	99	113	39	53	32	32
17	90	42	32	28	23	39	87	126	38	49	30	30
18	100	41	31	27	23	39	78	113	37	46	28	27
19	110	40	31	27	23	38	70	94	36	41	29	26
20	113	38	31	27	23	37	63	75	36	39	28	26
21	103	37	31	27	23	37	75	57	34	36	26	25
22	95	37	31	26	23	39	68	53	36	33	24	34
23	91	36	31	26	23	45	61	44	35	34	22	42
24	85	36	31	25	23	52	54	44	33	30	22	40
25	80	35	30	25	23	55	48	44	32	27	22	43
26	76	35	30	24	24	54	46	39	37	26	22	43
27	72	35	30	24	24	54	46	37	35	27	23	41
28	68	35	30	23	24	52	43	38	37	25	25	36
29	66	34	30	23	-----	50	45	36	41	25	30	35
30	63	34	30	23	-----	49	46	36	41	23	30	35
31	63	-----	30	23	-----	48	-----	41	-----	46	32	-----
TOTAL	2,062	1,347	988	844	642	1,150	2,336	1,722	1,309	1,065	1,072	1,010
MEAN	66.5	44.9	31.9	27.2	22.9	37.1	77.9	55.5	43.6	34.4	34.6	33.7
MAX	113	61	35	30	24	55	114	126	66	53	61	43
MIN	31	34	30	23	22	25	43	36	32	23	22	25
CFSM	2.53	1.71	1.21	1.03	0.87	1.41	2.96	2.11	1.66	1.31	1.32	1.28
IN.	2.92	1.90	1.40	1.19	0.91	1.63	3.30	2.44	1.85	1.51	1.52	1.43

CAL YR 1968: TOTAL 13,972.7 MEAN 38.2 MAX 130 MIN 7.8 CFSM 1.45 IN. 19.76
 WTR YR 1969: TOTAL 15,547 MEAN 42.6 MAX 126 MIN 22 CFSM 1.62 IN. 21.98

PEAK DISCHARGE (BASE, 60 CFS)

NOTE.--No gage-height record Dec. 6 to Jan. 7.

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
about							
10-20	Unkn	4.90	124	5-17	0300	5.01	130
4-9	0530	4.78	118	6-6	0030	4.39	68
5-6	0400	4.29	61	8-7	0530	4.44	68

STREAMS TRIBUTARY TO LAKE SUPERIOR

15

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., St. Louis County, on right bank at upstream side of highway bridge, 1,000 ft downstream from Second Creek, 2.5 miles east of Aurora, and 2.8 miles upstream from mouth.

DRAINAGE AREA.--156 sq mi.

PERIOD OF RECORD.--August 1942 to current year.

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, nonrecording gage, and Aug. 26, 1944, to July 1, 1956, water-stage recorder at site 45 ft downstream at same datum.

AVERAGE DISCHARGE (adjusted for storage and diversion).--27 years, 125 cfs (10.88 inches per year).

EXTREMES.--Current year: Maximum discharge, 1,610 cfs Apr. 17 (gage height, 5.89 ft); minimum, 46 cfs Sept. 4, 5. Period of record: 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 December and January, 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	104	208	65	55	59	63	114	379	175	87	94	51
2	101	192	65	56	59	64	109	372	185	78	93	48
3	101	179	66	56	59	66	111	369	203	73	96	48
4	98	170	64	57	59	66	125	372	212	72	96	46
5	94	164	56	57	59	66	142	392	230	72	84	49
6	104	151	55	57	59	69	164	411	286	72	77	66
7	102	146	54	57	58	70	201	420	334	71	126	65
8	102	139	54	58	58	69	212	416	344	71	123	69
9	132	132	53	58	58	68	212	392	321	71	120	68
10	198	126	53	58	58	65	233	350	236	68	122	68
11	210	120	54	58	58	63	241	312	208	65	132	70
12	228	117	54	59	58	63	289	275	210	64	118	66
13	264	114	55	59	58	62	655	244	198	66	118	64
14	308	106	55	59	58	62	1,020	212	174	80	123	63
15	324	101	56	58	58	64	930	312	185	99	123	64
16	387	97	55	58	58	70	1,430	615	178	106	115	64
17	585	93	54	58	59	74	1,600	930	165	105	104	61
18	848	92	54	57	59	80	1,500	1,180	150	105	92	59
19	1,080	87	53	57	59	88	1,320	1,230	133	102	83	59
20	1,270	85	53	57	58	89	1,120	1,080	116	94	73	59
21	1,240	82	53	56	58	89	1,010	874	102	87	63	58
22	1,070	80	53	56	59	94	930	675	99	77	56	72
23	881	82	53	56	60	105	902	515	98	76	53	76
24	686	80	53	56	61	118	860	396	96	63	52	77
25	530	80	53	56	62	118	788	334	94	61	53	87
26	406	76	54	57	62	122	692	278	92	61	53	92
27	331	73	54	57	62	128	590	241	85	64	53	70
28	296	72	54	57	62	128	515	212	84	62	53	78
29	266	68	54	58	-----	126	445	181	90	59	56	76
30	244	64	55	58	-----	123	401	164	89	57	55	70
31	225	-----	55	58	-----	118	-----	159	-----	97	53	-----
TOTAL	12,815	3,376	1,719	1,774	1,655	2,651	18,861	14,292	5,172	2,385	2,712	1,963
MEAN	413	113	55.5	57.2	59.1	85.5	629	461	172	76.9	87.5	65.4
(#)	+39.7	+26.4	+13.6	+2.15	-0.32	+5.01	+70.7	+19.4	+24.6	+13.8	+26.1	+6.22
MEAN #	453	139	69.1	59.4	58.8	90.5	700	480	197	90.7	114	71.6
MAX	1,270	208	66	59	62	128	1,600	1,230	344	106	132	92
MIN	94	64	53	55	58	62	109	159	84	57	52	46
CFSM #	2.90	0.89	0.44	0.38	0.38	0.58	4.49	3.08	1.26	0.58	0.73	0.46
IN. #	3.35	0.99	0.51	0.44	0.40	0.67	5.00	3.55	1.41	0.67	0.84	0.49

CAL YR 1968: MEAN 164 MEAN # 195 MAX 1,270 MIN 13 CFSM # 1.25 IN. # 17.16
WTR YR 1969: MEAN 190 MEAN # 211 MAX 1,600 MIN 46 CFSM # 1.35 IN. # 18.33

✓ 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.

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-0165. St. Louis River near Aurora, Minn.

LOCATION.--Lat 47°29'30", long 92°14'20", in SW¹/₄ sec.22, T.58 N., R.15 W., St. Louis County, on left bank at upstream side of highway bridge, 0.8 mile downstream from Partridge River and 1.5 miles south of Aurora.

DRAINAGE AREA.--312 sq mi.

PERIOD OF RECORD.--August 1942 to current year.

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

AVERAGE DISCHARGE (adjusted for storage and diversion).--27 years, 242 cfs (10.53 inches per year).

EXTREMES.--Current year: Maximum discharge, 2,160 cfs Apr. 17 (gage height, 5.20 ft); minimum, 74 cfs Sept. 4 (gage height, 1.18 ft).
Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	220	592	165	152	135	96	159	1,020	444	186	164	85
2	218	546	166	152	134	95	159	980	461	176	162	80
3	216	502	166	152	133	93	170	938	461	162	166	77
4	216	477	165	151	131	92	196	938	457	160	174	75
5	212	454	157	151	130	92	231	974	482	160	186	81
6	225	428	156	151	129	92	288	992	565	154	162	101
7	240	405	157	151	127	91	397	974	651	145	248	99
8	255	382	160	150	126	90	527	920	642	145	238	101
9	310	362	162	150	124	90	719	865	584	145	222	99
10	435	345	165	150	123	90	842	794	482	139	208	100
11	520	321	164	150	122	89	914	734	461	134	216	105
12	580	303	167	149	121	89	1,000	671	465	130	191	100
13	630	296	163	149	119	89	1,330	594	440	130	194	97
14	670	281	166	149	117	91	1,680	565	416	154	194	95
15	740	265	164	148	116	93	1,640	738	389	183	191	97
16	800	252	162	148	114	96	1,990	1,080	363	191	181	97
17	980	247	161	147	113	100	2,140	1,400	333	183	169	92
18	1,340	241	160	146	112	105	2,060	1,580	300	183	149	88
19	1,660	219	159	146	110	112	1,940	1,620	279	176	138	87
20	1,800	226	158	145	109	118	1,820	1,490	258	162	128	87
21	1,860	212	157	144	107	125	1,840	1,300	242	151	116	85
22	1,770	213	156	144	106	135	1,820	1,110	229	141	108	106
23	1,570	215	156	143	105	147	1,790	938	216	147	101	113
24	1,330	206	155	142	104	160	1,740	810	202	130	99	109
25	1,170	200	155	141	103	170	1,640	714	202	126	99	126
26	1,040	191	154	140	101	180	1,530	637	202	124	98	137
27	918	193	154	140	99	189	1,410	575	194	132	94	118
28	826	178	153	139	97	190	1,300	523	191	124	96	122
29	742	176	153	138	-----	186	1,180	461	196	119	99	129
30	688	186	153	137	-----	179	1,080	416	194	117	99	119
31	640	-----	153	136	-----	167	-----	397	-----	176	90	-----
TOTAL	24,821	9,114	4,942	4,531	3,267	3,731	35,532	27,748	11,001	4,685	4,780	3,007
MEAN	801	304	159	146	117	120	1,184	895	376	151	154	100
(Δ)	+39.7	+26.4	+13.6	+2.15	-.32	+5.01	+70.7	+19.4	+24.6	+13.8	+26.1	+6.22
MEAN $\neq$	841	330	173	148	117	125	1,255	914	392	165	180	106
MAX	1,860	592	167	152	135	190	2,140	1,620	651	191	248	137
MIN	212	176	153	136	97	89	159	397	191	117	90	75
CFSM $\neq$	2.70	1.06	0.55	0.47	0.38	0.40	4.02	2.93	1.26	0.53	0.58	0.34
In. $\neq$	3.11	1.18	0.64	0.55	0.39	0.46	4.49	3.38	1.40	0.61	0.67	0.38

CAL YR 1968: MAX 1,860 MIN 23 MEAN 373 MEAN $\neq$ 404 CFMS $\neq$ 1.29 IN. $\neq$ 17.62
WTR YR 1969: MAX 2,140 MIN 75 MEAN 376 MEAN $\neq$ 397 CFMS $\neq$ 1.27 IN. $\neq$ 17.25

Δ Change in contents in Partridge Reservoir and diversion to iron-ore processing plant, equivalent in cubic feet per second, furnished by Erie Mining Company.

$\neq$ Adjusted for change in contents and diversion.

STREAMS TRIBUTARY TO LAKE SUPERIOR

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

LOCATION.--Lat 47°21'48", long 92°35'56", in NE 1/4 sec. 3, T.56 N., R.18 W., St. Louis County, 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.

PERIOD OF RECORD.--August 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,293.11 ft above mean sea level, datum of 1929. Prior to Oct. 28, 1964, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--5 years, 585 cfs.

EXTREMES.--Current year: Maximum discharge, 5,180 cfs Apr. 18 (gage height, 15.77 ft); minimum, 42 cfs Aug. 24 (gage height, 5.50 ft).

Period of record: Maximum discharge, 5,180 cfs Apr. 18, 1969 (gage height, 15.77 ft); minimum, 24 cfs Nov. 26, 1966 (gage height, 5.23 ft).

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 0.5 mile upstream. Diversion began Dec. 5, 1965. Records of water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	412	1,330	362	298	228	198	205	2,270	869	368	367	223
2	403	1,230	336	295	228	198	220	2,310	794	349	332	197
3	393	1,100	328	292	226	198	225	2,130	886	225	302	181
4	381	947	332	289	226	197	245	2,080	876	327	286	172
5	366	941	334	287	225	195	275	2,160	882	335	300	179
6	376	985	332	284	225	192	320	2,220	923	327	332	239
7	397	874	330	282	225	190	380	2,150	997	308	366	276
8	405	888	328	280	218	190	560	2,030	1,050	299	440	258
9	463	782	326	277	218	188	1,100	1,880	1,040	294	428	284
10	797	770	324	274	215	186	1,850	1,790	991	288	339	242
11	1,120	672	323	271	215	185	2,730	1,650	942	207	401	463
12	1,080	596	321	268	212	183	3,160	1,500	908	277	422	387
13	1,100	591	320	266	212	182	3,760	1,160	822	270	402	372
14	1,120	669	319	263	210	182	4,250	1,300	813	206	389	357
15	1,150	521	318	261	210	182	4,780	1,360	761	313	376	293
16	1,300	589	320	259	210	183	5,040	1,630	705	368	357	282
17	1,860	548	320	256	210	185	5,120	1,920	584	337	335	322
18	2,400	441	319	254	208	190	5,170	2,140	539	312	306	315
19	2,910	450	319	252	208	198	5,070	2,350	559	330	272	291
20	3,260	380	318	250	205	208	4,780	2,490	522	337	165	273
21	3,420	382	316	248	205	215	4,540	2,540	481	269	232	260
22	3,420	398	313	246	203	225	4,250	2,460	452	313	212	275
23	3,380	393	310	244	202	238	3,980	2,050	396	249	196	330
24	3,190	378	306	242	202	250	3,710	1,910	406	301	93	368
25	2,900	362	302	240	200	270	3,580	1,690	392	222	178	379
26	2,600	362	300	238	200	285	3,440	1,530	393	271	173	422
27	2,230	348	301	237	200	298	3,160	1,370	308	271	168	435
28	1,880	324	302	234	200	290	2,870	1,230	375	264	195	404
29	1,780	400	301	233	-----	275	2,730	1,110	379	196	287	390
30	1,600	406	300	231	-----	250	2,510	961	382	238	282	396
31	1,430	-----	299	230	-----	230	-----	854	-----	325	260	-----
TOTAL	49,523	19,057	9,879	8,081	5,946	6,636	84,010	56,225	20,427	8,996	9,193	9,265
MEAN	1,598	635	319	261	212	214	2,800	1,814	681	290	297	309
MAX	3,420	1,330	362	298	228	298	5,170	2,540	1,050	368	440	463
MIN	366	324	299	230	200	182	205	854	308	196	93	172

CAL YR 1968 TOTAL 262,551 MEAN 717 MAX 3,420 MIN 34
WTR YR 1969 TOTAL 287,238 MEAN 787 MAX 5,170 MIN 93

STREAMS TRIBUTARY TO LAKE SUPERIOR

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., St. Louis County, on right bank 30 ft downstream from bridge on State Highway 37 and 2.2 miles southwest of Iron Junction.

DRAINAGE AREA.--40.0 sq mi.

PERIOD OF RECORD.--June 1966 to current year. Occasional low-flow measurements, water years 1957-62.

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

EXTREMES.--Current year: Maximum discharge, 370 cfs Apr. 10 (gage height, 9.65 ft, backwater from ice); minimum daily discharge, 10 cfs Jan. 27 to Feb. 2; minimum gage height, 3.01 ft Aug. 27, 28, 29.

Period of record: Maximum discharge, 395 cfs Aug. 25, 1968 (gage height, 9.43 ft); maximum gage height, 9.65 ft Apr. 10, 1969 (backwater from ice); minimum daily discharge, 5.5 cfs 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	31	21	16	10	15	25	44	51	17	41	61
2	25	30	21	16	10	15	26	54	58	16	38	51
3	24	29	21	16	11	15	35	63	56	16	32	40
4	23	28	21	16	11	15	60	67	54	17	27	33
5	20	27	21	15	11	15	95	92	48	17	24	31
6	22	26	21	15	11	15	140	112	47	17	22	57
7	23	26	21	15	11	15	210	95	41	16	25	61
8	22	24	21	15	12	15	275	80	38	15	23	58
9	42	24	20	14	12	15	335	68	34	15	21	49
10	69	24	20	14	12	15	360	59	32	15	20	43
11	63	25	20	14	13	15	350	53	34	15	19	39
12	57	25	20	14	13	15	336	48	30	16	18	34
13	50	25	20	14	13	15	325	44	25	16	17	29
14	46	24	20	13	13	16	313	40	21	15	16	26
15	43	24	20	13	13	17	290	86	18	22	16	25
16	62	24	20	13	14	18	266	148	17	29	15	25
17	161	24	19	13	14	20	237	191	16	33	14	24
18	206	25	19	12	14	21	196	243	16	31	14	23
19	204	26	19	12	14	22	161	208	16	26	13	21
20	182	29	19	12	14	22	131	150	15	23	13	20
21	154	28	19	12	14	22	116	106	14	20	13	19
22	118	26	19	11	14	23	107	82	14	19	13	27
23	88	25	18	11	14	24	95	62	14	18	13	42
24	71	23	18	11	15	25	82	52	14	18	13	41
25	59	22	18	11	15	25	72	46	14	19	12	53
26	52	22	18	11	15	25	64	41	16	19	12	61
27	46	22	18	10	15	26	56	36	17	20	12	58
28	43	22	17	10	15	26	52	34	18	20	12	50
29	39	21	17	10	-----	25	47	30	18	19	28	43
30	36	21	17	10	-----	25	43	27	18	18	46	40
31	33	-----	17	10	-----	25	-----	30	-----	41	63	-----
TOTAL	2,109	752	600	399	363	602	4,900	2,491	824	618	665	1,184
MEAN	68.0	25.1	19.4	12.9	13.0	19.4	163	80.4	27.5	19.9	21.5	39.5
MAX	206	31	21	16	15	26	360	243	58	41	63	61
MIN	20	21	17	10	10	15	25	27	14	15	12	19
CFSM	1.70	.63	.49	.32	.33	.49	4.08	2.01	.69	.50	.54	.99
IN.	1.96	.70	.56	.37	.34	.56	4.56	2.32	.77	.57	.62	1.10
CAL YR 1968	TOTAL 14,214	MEAN 38.8	MAX 388	MIN 5.6	CFSM .97	IN 13.22						
WAT YR 1969	TOTAL 15,507	MEAN 42.5	MAX 360	MIN 10	CFSM 1.06	IN 14.42						

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

LOCATION.--Lat 47°24'05", long 92°42'10", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.24, T.57 N., R.19 W., St. Louis County, on right bank 40 ft upstream from bridge on State Highway 37, 5 miles southwest of Iron Junction, and 9.2 miles upstream from St. Louis River.

DRAINAGE AREA.--68.4 sq mi.

PERIOD OF RECORD.--October 1953 to September 1962, October 1965 to current year.

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.--13 years, 46.0 cfs (9.13 inches per year).

EXTREMES.--Current year: Maximum discharge, 720 cfs Apr. 15 (gage height, 8.65 ft); minimum, 12 cfs Aug. 26, 27, 28 (gage height, 2.62 ft).

Period of record: 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 (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 1969 water year computed by U.S. Steel Corporation and reviewed by Geological Survey.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	35	45	25	17	29	23	30	91	87	36	46	30
2	31	41	24	17	28	23	29	107	93	34	44	29
3	26	38	24	18	28	23	29	111	89	33	41	27
4	22	38	23	18	27	23	50	119	88	32	38	27
5	24	36	23	18	27	26	80	145	88	32	35	27
6	28	34	22	18	26	28	130	156	84	30	30	36
7	29	32	22	18	26	27	200	142	78	29	30	36
8	29	30	22	19	25	26	290	124	71	29	28	38
9	48	29	21	19	25	25	360	107	63	29	28	34
10	80	28	21	20	24	24	430	94	66	29	27	29
11	100	27	21	22	24	24	560	85	69	29	26	22
12	105	26	21	22	24	23	655	77	63	28	21	19
13	96	25	20	21	23	23	685	72	58	28	20	18
14	90	24	20	20	23	23	702	68	54	28	18	16
15	78	24	20	19	23	23	708	115	51	32	18	16
16	109	24	20	19	22	24	636	169	49	32	17	17
17	213	25	20	21	23	25	560	219	46	30	16	16
18	297	27	19	23	25	26	476	246	39	29	15	14
19	360	30	19	24	27	27	361	228	43	29	14	14
20	356	35	19	24	28	30	278	183	40	27	14	14
21	303	30	19	23	28	34	244	141	39	27	13	13
22	235	25	19	22	27	33	215	114	38	26	13	18
23	186	23	19	21	26	32	190	96	36	27	12	24
24	149	22	18	21	25	32	163	87	36	27	12	23
25	119	21	18	23	24	31	138	80	36	28	12	31
26	98	33	18	25	24	31	124	75	38	27	12	38
27	86	28	18	24	23	31	116	70	36	32	12	40
28	76	27	17	24	23	31	106	67	36	30	15	41
29	64	27	17	23	-----	30	92	62	38	29	27	41
30	56	26	17	23	-----	30	84	58	39	31	27	39
31	51	-----	17	29	-----	30	-----	65	-----	54	30	-----
TOTAL	3,579	880	623	655	707	841	8,721	3,573	1,691	943	711	787
MEAN	115	29.3	20.1	21.1	25.3	27.1	291	115	56.4	30.4	22.9	26.2
MAX	360	45	25	29	29	34	708	246	93	54	46	41
MIN	22	21	17	17	22	23	29	58	36	26	12	13
CFSM	1.68	.43	.29	.31	.37	.40	4.25	1.68	.82	.44	.33	.38
IN.	1.95	.48	.34	.36	.38	.46	4.74	1.94	.92	.51	.39	.43
CAL YR 1968	TOTAL 20,470	MEAN 55.9	MAX 360	MIN 5.6	CFSM .82	IN 11.13						
WAT YR 1969	TOTAL 23,711	MEAN 65.0	MAX 708	MIN 12	CFSM .95	IN 12.90						

STREAMS TRIBUTARY TO LAKE SUPERIOR

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

LOCATION.--Lat 47°17'36", long 93°02'30", in SW¼ sec.32, T.56 N., R.21 W., St. Louis County, 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.

PERIOD OF RECORD.--April 1963 to current year.

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.--6 years, 11.5 cfs.

EXTREMES.--Current year: Maximum discharge, 399 cfs Apr. 11 (gage height, 4.92 ft); no flow Aug. 20 to Sept. 4.
Period of record: Maximum discharge, 399 cfs Apr. 11, 1969 (gage height, 4.92 ft); maximum gage height, 5.17 ft Mar. 28, 1968 (backwater from ice); no flow Aug. 20 to Sept. 4, 1969.

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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.3	4.2	1.6	.90	.80	1.0	2.1	3.2	9.9	2.0	3.5	0
2	4.1	4.1	1.7	.90	.80	1.0	2.2	17	13	1.9	2.2	0
3	3.8	3.6	1.8	.90	.80	1.0	2.3	20	10	1.5	1.7	0
4	3.5	3.6	1.8	.80	.80	1.0	2.5	23	10	1.4	1.2	0
5	3.3	3.4	1.7	.90	.80	1.0	2.9	35	11	1.4	.70	.20
6	3.7	3.1	1.7	1.0	.80	1.0	3.8	35	12	1.2	.70	.60
7	3.7	3.0	1.7	.90	.80	1.0	5.4	22	10	1.1	1.6	.50
8	4.1	3.0	1.6	.90	.80	1.0	8.6	14	6.6	1.1	1.3	.70
9	6.1	2.8	1.6	.90	.80	1.0	19	9.6	4.6	1.3	1.0	.60
10	12	2.5	1.7	.90	.70	1.0	57	8.5	4.3	1.6	.60	.50
11	13	2.4	1.7	.90	.70	.90	298	5.8	6.0	1.3	.50	.30
12	10	2.3	1.6	.90	.70	.90	291	4.3	5.6	1.0	.50	.20
13	8.8	2.3	1.6	.80	.70	.80	265	3.9	4.1	.80	.40	.20
14	7.1	2.2	1.5	.80	.70	.80	240	3.5	3.3	1.6	.40	.20
15	6.0	2.1	1.3	.90	.70	.80	168	9.7	2.9	2.2	.20	1.1
16	11	2.1	1.3	1.0	.80	.90	123	24	2.7	2.2	.20	.90
17	39	2.1	1.1	1.0	.80	.90	86	26	2.3	1.9	.10	.50
18	100	2.2	1.1	1.0	.80	.90	60	18	2.0	1.2	.10	.40
19	105	2.2	1.1	1.0	.80	.90	41	11	1.8	1.0	.10	.30
20	63	2.0	1.1	.90	.80	.90	28	7.5	1.6	.70	0	.20
21	38	2.1	1.1	.90	.70	.90	28	5.4	1.6	.50	0	.20
22	23	2.2	1.2	.90	.80	1.0	24	4.5	1.6	.50	0	.90
23	17	2.3	1.2	.90	.80	1.5	18	3.7	1.5	.50	0	1.4
24	13	2.3	1.1	.90	.90	2.2	14	3.6	1.8	.40	0	1.6
25	10	2.2	1.1	.90	.90	2.3	11	2.9	2.1	.30	0	2.0
26	8.5	2.2	1.1	.90	.90	2.3	9.0	2.7	2.4	.30	0	1.9
27	7.1	2.1	1.1	.90	1.0	2.3	8.8	2.4	2.3	1.1	0	1.6
28	5.8	1.9	1.1	.80	1.0	2.3	8.2	2.2	2.4	.70	0	1.4
29	5.4	1.8	1.1	.80	-----	2.2	7.3	1.9	2.3	.50	0	1.5
30	4.8	1.7	1.0	.80	-----	2.1	6.2	1.5	2.2	1.0	0	1.4
31	4.5	-----	1.0	.80	-----	2.1	-----	2.6	-----	5.6	0	-----
TOTAL	548.6	76.0	42.4	27.70	22.40	39.90	1,840.3	339.4	143.9	39.80	17.00	21.30
MEAN	17.7	2.53	1.37	.89	.80	1.29	61.3	10.9	4.80	1.28	.55	.71
MAX	105	4.2	1.8	1.0	1.0	2.3	298	35	13	5.6	3.5	2.0
MIN	3.3	1.7	1.0	.80	.70	.80	2.1	1.5	1.5	.30	0	0

CAL YR 1968 TOTAL 3,820.40 MEAN 10.4 MAX 105 MIN 1.0
WAT YR 1969 TOTAL 3,158.70 MEAN 8.65 MAX 298 MIN 0

STREAMS TRIBUTARY TO LAKE SUPERIOR

21

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

LOCATION.--Lat 47°16'55", long 92°50'05", in NE 1/4 sec. 2, T.55 N., R.20 W., St. Louis County, on left bank 350 ft downstream from bridge on St. Louis County Road 442, 4.8 miles upstream from confluence with West Swan River, 8 miles northwest of Toivola and 8.8 miles upstream from St. Louis River.

DRAINAGE AREA.--112 sq mi.

PERIOD OF RECORD.--September 1953 to September 1962, October 1964 to current year.

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

AVERAGE DISCHARGE.--14 years (1953-62, 1964-69), 42.3 cfs (11.19 inches per year).

EXTREMES.--Current year: Maximum discharge, 1,950 cfs Apr. 12 (gage height, 19.27 ft); maximum gage height, 19.61 ft Apr. 11 (backwater from ice); minimum daily discharge, 21 cfs Dec. 18 to Jan. 5; minimum gage height, 3.51 ft Aug. 21.
Period of record: Maximum discharge, 1,950 cfs Apr. 12, 1969 (gage height, 19.27 ft); maximum gage height, 19.61 ft Apr. 11, 1969 (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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	82	99	31	21	28	31	36	169	120	48	95	45
2	73	95	32	21	27	31	37	243	131	44	70	42
3	72	89	32	21	27	32	38	274	114	41	53	40
4	73	84	32	21	26	32	42	277	106	40	45	38
5	70	81	31	21	26	32	70	343	120	40	43	39
6	76	75	30	22	26	32	110	396	137	40	40	56
7	86	70	29	22	26	32	185	328	120	38	48	63
8	75	67	28	22	26	32	455	243	95	37	47	54
9	89	64	27	22	27	32	800	194	74	38	42	48
10	203	62	27	22	27	31	1,150	167	66	37	42	44
11	212	61	26	22	27	31	1,740	146	96	37	45	40
12	173	60	26	23	28	31	1,930	129	90	39	41	38
13	135	60	25	23	28	32	1,830	117	73	35	39	37
14	114	59	24	23	28	32	1,750	105	64	36	37	36
15	109	58	23	23	28	32	1,620	157	59	41	32	39
16	143	56	22	24	29	32	1,400	311	56	56	32	46
17	427	55	22	24	29	32	1,090	362	53	44	32	43
18	567	58	21	24	29	33	802	297	50	39	31	40
19	601	51	21	25	29	33	621	226	47	34	31	37
20	562	48	21	25	30	34	509	176	45	35	30	35
21	464	47	21	25	30	35	478	142	44	35	26	35
22	365	46	21	26	30	36	432	120	43	36	28	41
23	303	45	21	26	30	37	360	107	42	38	30	85
24	247	43	21	27	30	37	299	98	42	37	30	77
25	204	41	21	27	31	38	255	89	44	34	29	79
26	175	38	21	28	31	38	228	80	52	35	29	94
27	153	34	21	28	31	37	209	75	50	40	30	86
28	138	32	21	29	31	36	210	70	48	47	30	71
29	123	31	21	29	-----	36	194	65	45	44	50	69
30	110	31	21	29	-----	35	169	59	48	41	55	69
31	103	-----	21	28	-----	35	-----	59	-----	86	52	-----
TOTAL	6,327	1,740	761	753	795	1,039	19,049	5,624	2,174	1,272	1,264	1,566
MEAN	204	58.0	24.5	24.3	28.4	33.5	635	181	72.5	41.0	40.8	52.2
MAX	601	99	32	29	31	38	1,930	396	137	86	95	94
MIN	70	31	21	21	26	31	36	59	42	34	26	35
CFSM	1.82	.52	.22	.22	.25	.30	5.67	1.62	.65	.37	.36	.47
IN.	2.10	.58	.25	.25	.26	.35	6.33	1.87	.72	.42	.42	.52
CAL YR 1968	TOTAL 40,822.7		MEAN 112		MAX 633	MIN 9.4		CFSM 1.00	IN 13.56			
WTR YR 1969	TOTAL 42,364		MEAN 116		MAX 1,930	MIN 21		CFSM 1.04	IN 14.07			

PEAK DISCHARGE (BASE, 400 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-19	About 0400	11.70	606	5-6	0500	9.26	406
4-12	1930	19.27	1,950				

STREAMS TRIBUTARY TO LAKE SUPERIOR

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., St. Louis County, 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.

PERIOD OF RECORD.--January 1908 to current year. Monthly discharge only for some periods published in WSP 1307. Published as "near Thomson" 1908-50.

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

AVERAGE DISCHARGE (UNADJUSTED).--61 years, 2,222 cfs (8.80 inches per year).

EXTREMES.--Current year: Maximum discharge, 28,300 cfs Apr. 15 (gage height, 12.60 ft); minimum, 685 cfs Aug. 27 (gage height, 2.69 ft).

Period of record: 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 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2,190	3,870	2,160	1,690	1,890	1,930	2,180	8,160	2,330	1,820	1,360	1,280
2	1,890	3,380	2,200	1,860	1,880	1,880	1,730	7,500	2,470	1,630	1,570	1,300
3	1,990	3,210	2,320	1,900	1,820	1,920	1,870	7,720	2,530	1,750	1,570	1,240
4	2,060	2,970	2,270	1,990	1,790	1,770	1,870	7,900	2,600	1,580	1,440	1,140
5	1,980	2,720	1,680	2,000	1,860	1,740	1,850	10,100	2,810	1,520	1,370	1,130
6	2,160	2,640	1,620	1,980	1,870	1,940	2,080	11,300	2,910	1,460	1,390	1,320
7	2,230	2,930	1,950	2,040	1,860	1,940	2,580	10,800	2,910	1,550	1,400	1,180
8	2,300	2,970	1,810	2,040	1,890	1,910	4,080	9,590	2,890	1,460	1,700	1,280
9	2,700	2,840	1,880	1,950	1,890	1,900	7,240	8,350	2,690	1,500	1,620	1,380
10	3,160	2,730	2,040	1,910	1,890	2,050	11,500	7,350	2,470	1,420	1,350	1,290
11	4,070	2,600	2,270	1,860	1,840	1,880	15,800	6,570	2,600	1,430	1,280	1,130
12	4,320	2,480	2,540	1,840	1,810	1,930	20,700	5,860	2,620	1,370	1,200	1,050
13	3,900	2,450	2,030	1,870	1,790	1,730	24,000	4,900	2,600	1,300	1,100	1,140
14	3,570	2,700	1,350	1,910	1,790	2,060	27,100	4,070	2,400	1,280	1,200	1,320
15	3,350	2,770	1,450	1,930	1,790	2,070	28,100	3,590	2,150	1,310	1,120	1,320
16	3,940	2,750	1,980	1,980	1,750	2,210	27,000	4,690	2,110	1,570	1,090	1,540
17	6,750	2,710	2,090	1,950	1,710	1,890	25,500	6,100	1,830	1,570	1,070	1,490
18	12,400	2,730	1,910	1,900	1,750	2,230	23,500	6,540	1,880	1,640	1,030	1,270
19	15,200	2,580	2,220	1,880	1,760	2,140	20,800	6,260	1,690	1,540	1,080	1,080
20	16,000	2,330	2,200	1,870	1,730	2,090	17,900	5,980	1,620	1,430	1,070	940
21	15,800	2,270	2,160	1,890	1,700	2,120	16,200	5,710	1,480	1,310	1,080	1,050
22	15,500	2,540	2,160	1,910	1,700	2,040	15,200	5,510	1,560	1,370	1,060	1,120
23	15,000	2,620	1,770	2,020	1,780	2,180	13,500	5,260	1,510	1,260	934	1,390
24	13,900	2,350	1,660	1,870	1,820	2,270	12,100	4,940	1,640	1,250	979	1,390
25	12,700	2,460	1,910	1,600	1,830	2,170	10,600	4,410	1,630	1,340	1,010	1,660
26	10,700	2,520	2,180	1,650	1,820	2,260	10,000	4,030	1,830	1,180	923	1,510
27	8,950	2,100	2,200	1,730	1,840	2,350	9,650	3,460	1,790	1,250	933	1,510
28	7,100	2,140	2,170	1,910	1,820	2,400	8,790	3,180	1,780	1,270	1,030	1,590
29	5,870	1,980	2,070	1,890	-----	2,180	8,600	2,970	1,630	1,230	1,270	1,500
30	5,010	1,990	2,000	1,850	-----	2,230	8,570	2,510	1,730	1,210	1,290	1,520
31	4,470	-----	1,950	1,880	-----	2,340	-----	2,370	-----	1,290	1,270	-----
TOTAL	211,360	79,380	62,250	58,550	50,670	63,840	380,590	187,680	64,740	44,090	37,789	39,060
MEAN	6,818	2,646	2,008	1,889	1,810	2,059	12,690	6,054	2,158	1,422	1,219	1,302
(#)	+488	-537	-1,115	-1,078	-900	-1,050	+3,671	+722	-148	-575	-394	-13
MEAN #	7,306	2,109	893	811	910	1,009	16,361	6,776	2,010	847	825	1,289
MAX	16,000	3,870	2,540	2,040	1,890	2,400	28,100	11,300	2,910	1,820	1,700	1,660
MIN	1,890	1,980	1,350	1,600	1,700	1,740	1,730	2,370	1,480	1,180	923	940
CFSM #	2.13	.61	.26	.24	.27	.29	4.77	1.98	.59	.25	.24	.38
IN. #	2.46	.69	.30	.27	.28	.34	5.32	2.28	.65	.28	.28	.42
CAL YR 1968	MAX	16,000	MIN	393	MEAN	2,921	MEAN #	3,095	CFSM #	0.90	IN. #	12.28
WTR YR 1969	MAX	28,100	MIN	923	MEAN	3,507	MEAN #	3,427	CFSM #	1.00	IN. #	13.57

* 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 $46^{\circ}50'12''$, long $95^{\circ}41'57''$, in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.23, T.139 N., R.40 W., Becker County, on right bank 10 ft upstream from highway bridge, 5 miles downstream from Height of Land Lake, and 7.5 miles east of city of Detroit Lakes.

DRAINAGE AREA.--270 sq mi.

PERIOD OF RECORD.--March 1937 to current year.

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

AVERAGE DISCHARGE.--32 years, 54.6 cfs (39,560 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 207 cfs Apr. 21 (gage height, 4.30 ft); maximum gage height, 5.60 ft Mar. 1 (backwater from ice); minimum discharge, 0.82 cfs Aug. 29 (gage height, 2.62 ft).
Period of record: 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 winter months, which are fair. Flow partly regulated by dams of Minnesota Department of Conservation on several lakes above station.

REVISIONS (WATER YEAR).--WSP 1308: 1944 (M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

JAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.3	26	26	37	56	95	78	190	95	20	12	1.3
2	8.9	25	28	37	53	165	81	184	91	20	11	1.5
3	8.6	25	27	38	59	135	82	179	88	19	11	1.8
4	8.2	25	28	38	62	94	86	190	84	17	8.2	1.9
5	8.2	25	27	38	63	72	86	190	81	18	5.6	3.3
6	7.8	24	26	39	64	66	88	190	79	17	6.5	3.5
7	7.5	24	26	41	64	64	93	184	76	16	6.5	3.8
8	7.2	24	26	41	63	67	104	184	73	19	6.5	3.8
9	8.6	24	26	41	63	73	113	184	62	16	6.5	3.5
10	8.6	24	27	42	62	85	113	184	58	15	6.2	3.8
11	8.2	24	28	42	61	90	117	184	60	13	5.9	3.8
12	8.2	25	25	42	60	84	119	179	57	12	5.9	3.8
13	8.6	24	26	43	60	77	133	164	53	12	5.6	3.5
14	8.9	24	26	43	59	74	149	149	52	13	5.0	3.8
15	11	24	27	43	59	70	164	102	49	27	4.5	3.8
16	15	24	27	44	58	67	174	94	47	26	4.0	3.5
17	21	24	27	44	58	67	184	117	45	24	3.5	2.8
18	30	25	28	44	57	65	179	121	45	22	3.3	2.6
19	30	25	28	45	56	65	182	129	31	22	3.0	2.6
20	30	25	29	46	56	68	190	129	26	20	2.8	1.9
21	30	26	29	46	56	71	204	121	29	18	2.6	1.3
22	29	26	30	47	56	75	204	123	32	18	1.9	1.9
23	30	26	31	48	56	80	204	121	33	17	2.3	4.0
24	29	26	32	48	56	84	198	117	34	17	1.9	4.0
25	29	26	33	49	58	90	198	113	35	15	1.9	3.8
26	28	26	34	50	61	93	192	109	34	15	2.1	3.5
27	28	26	35	51	66	91	190	105	30	14	1.6	3.3
28	28	26	35	52	75	81	184	104	27	13	1.3	2.8
29	27	26	36	52	-----	91	184	102	27	13	1.1	2.8
30	27	26	36	53	-----	91	192	98	24	12	1.3	4.0
31	27	-----	37	54	-----	89	-----	96	-----	12	1.3	-----
TOTAL	565.8	750	906	1,378	1,682	2,579	4,465	4,436	1,557	532	142.8	91.7
MEAN	18.3	25.0	29.2	44.5	60.1	83.2	149	143	51.9	17.2	4.61	3.06
MAX	30	26	37	54	75	165	204	190	95	27	12	4.0
MIN	7.2	24	25	37	56	64	78	94	24	12	1.1	1.3
AC-FT	1,120	1,490	1,800	2,730	3,340	5,120	8,860	8,800	3,090	1,060	283	182
CAL YR 1968	TOTAL 17,372.3		MEAN 47.5		MAX 183		MIN 2.0		AC-FT 34,460			
WTR YR 1969	TOTAL 19,085.3		MEAN 52.3		MAX 204		MIN 1.1		AC-FT 37,860			

RED RIVER OF THE NORTH BASIN

5-0339. 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., Becker County, on left bank 60 ft upstream from culvert, 0.5 mile upstream from Detroit Lake, at Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

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

EXTREMES.--Current year: Maximum discharge, 167 cfs Apr. 10 (gage height, 5.31 ft, from floodmark); minimum daily, 0.3 cfs Sept. 28-30.

Period of record: Maximum discharge, 167 cfs Apr. 10, 1969 (gage height, 5.31 ft, from floodmark); minimum daily, 0.3 cfs Sept. 28-30, 1969.

REMARKS.--Records fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.0	3.5	2.2	1.4	1.7	1.8	8.7	42	15	3.6	3.1	1.6
2	1.9	3.5	2.1	1.4	1.7	1.8	8.0	41	14	3.4	2.9	.60
3	1.9	3.5	2.1	1.4	1.7	1.8	8.9	39	13	3.4	2.7	.50
4	1.8	4.0	2.1	1.4	1.7	1.8	14	43	13	3.1	2.6	.60
5	1.7	4.0	2.1	1.4	1.8	1.8	15	44	13	2.9	2.5	2.7
6	1.6	3.8	2.0	1.4	1.8	1.8	28	46	11	2.6	2.4	1.0
7	1.5	3.8	2.0	1.4	1.8	1.8	59	46	11	2.6	2.3	1.1
8	2.0	3.6	2.0	1.4	1.8	1.9	99	45	11	3.4	1.8	.90
9	2.9	3.6	2.0	1.4	1.8	1.9	134	43	11	3.4	1.3	.70
10	2.8	3.5	2.0	1.4	1.8	2.0	156	39	10	3.2	1.1	1.0
11	2.5	3.4	2.0	1.4	1.8	2.0	158	38	9.4	2.9	1.1	.80
12	2.3	3.3	2.0	1.4	1.8	2.1	152	36	8.5	2.7	1.0	.60
13	2.1	3.2	2.0	1.4	1.8	2.2	144	33	7.5	2.6	1.0	.60
14	2.1	3.1	2.0	1.4	1.8	2.2	128	31	6.9	2.6	1.0	.70
15	2.5	3.0	2.0	1.4	1.8	2.3	115	28	6.4	5.0	1.0	1.0
16	3.4	3.0	2.0	1.4	1.8	2.4	100	26	6.4	5.7	1.1	1.0
17	4.5	2.9	2.0	1.4	1.8	2.5	87	25	6.0	5.1	1.4	1.0
18	6.0	2.8	2.0	1.4	1.8	2.6	79	24	5.8	4.6	1.3	1.0
19	5.5	2.8	1.9	1.4	1.8	2.8	70	23	5.6	4.1	1.2	1.0
20	4.5	2.7	1.9	1.4	1.8	3.0	64	22	5.1	3.6	1.0	.80
21	4.2	2.7	1.9	1.5	1.8	3.2	60	20	4.7	3.4	1.0	.50
22	4.0	2.6	1.8	1.5	1.8	3.5	59	20	4.4	4.1	1.0	.70
23	4.0	2.6	1.8	1.5	1.8	4.0	54	18	4.2	3.7	.80	.60
24	3.7	2.5	1.7	1.6	1.8	4.5	52	18	4.0	3.5	.70	.60
25	3.5	2.5	1.7	1.6	1.8	5.0	50	18	3.4	3.3	.60	.70
26	3.5	2.4	1.7	1.6	1.8	6.4	48	16	4.1	3.0	.60	.80
27	4.0	2.4	1.6	1.6	1.8	7.6	46	16	4.1	3.4	.60	.60
28	4.5	2.3	1.6	1.6	1.8	7.6	45	16	3.5	3.4	.50	.30
29	4.3	2.3	1.6	1.6	-----	7.2	43	14	4.2	2.9	.40	.30
30	4.0	2.2	1.5	1.6	-----	8.3	42	14	3.7	3.1	.60	.30
31	4.0	-----	1.5	1.6	-----	8.3	-----	14	-----	3.2	1.5	-----
TOTAL	99.2	91.5	58.8	45.3	50.0	108.1	2,126.6	898	229.9	107.5	42.10	24.60
MEAN	3.20	3.05	1.90	1.46	1.79	3.49	70.9	29.0	7.66	3.47	1.36	.82
MAX	6.0	4.0	2.2	1.6	1.8	8.3	158	46	15	5.7	3.1	2.7
MIN	1.5	2.2	1.5	1.4	1.7	1.8	8.0	14	3.4	2.6	.40	.30
AC-FT	197	181	117	90	99	214	4,220	1,780	456	213	84	49

CAL YR 1968 TOTAL -- MEAN -- MAX -- MIN -- AC-FT --
 WTR YR 1969 TOTAL 3,881.60 MEAN 10.6 MAX 158 MIN .30 AC-FT 7,700

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., Becker County, on left wingwall of remains of old dam at outlet of Detroit Lake, 60 ft upstream from bridge on County Highway 22 and 2.5 miles southwest of Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

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

EXTREMES.--Current year: Maximum discharge, 111 cfs Apr. 17 (gage height, 4.55 ft); no flow Oct. 2-9, Sept. 3, 4, 8-30.
Period of record: Maximum discharge, 111 cfs Apr. 17, 1969 (gage height, 4.55 ft); no flow at times in 1968, 1969.

REMARKS.--Records fair.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.10	11	10	14	16	21	15	70	8.8	4.3	5.1	.10
2	0	11	11	14	16	20	16	62	8.5	4.5	4.8	.10
3	0	12	11	14	15	20	16	58	8.1	4.3	4.8	0
4	0	12	10	13	15	19	16	66	8.5	4.0	4.3	0
5	0	12	10	13	17	19	16	64	8.5	4.3	4.3	.10
6	0	12	11	14	18	19	22	62	8.1	4.3	4.3	.10
7	0	12	11	14	20	19	19	53	8.1	4.3	3.3	.10
8	0	12	11	15	21	19	23	54	7.8	4.8	3.0	0
9	0	11	11	15	23	19	31	53	7.5	4.8	2.8	0
10	.20	11	11	15	24	18	42	47	7.5	4.8	2.8	0
11	.50	11	10	15	25	18	46	44	7.2	4.8	2.8	0
12	.60	11	10	15	25	18	55	41	6.2	4.5	2.6	0
13	.70	11	12	15	26	18	69	40	5.1	4.3	2.6	0
14	.70	11	13	14	27	18	82	39	5.1	4.8	2.0	0
15	.80	11	13	14	27	17	95	33	5.1	10	1.6	0
16	1.6	11	13	15	27	17	103	26	5.1	10	1.3	0
17	2.0	11	13	15	27	18	110	23	4.8	9.2	1.3	0
18	3.0	11	12	15	27	16	110	21	5.1	8.8	1.0	0
19	4.0	11	12	15	26	16	108	18	4.5	7.5	1.0	0
20	5.0	11	12	15	26	17	106	17	3.5	7.5	1.0	0
21	6.0	11	12	15	24	16	108	16	3.5	7.2	.80	0
22	7.0	11	14	15	24	16	108	15	3.5	7.8	.60	0
23	7.8	11	14	15	24	16	105	15	3.3	7.8	.60	0
24	7.9	11	14	15	24	15	100	15	3.3	7.2	.50	0
25	8.0	11	13	15	23	15	98	15	5.1	7.2	.50	0
26	8.5	11	13	15	22	15	98	12	4.3	7.2	.40	0
27	9.0	11	14	16	22	15	89	10	4.3	6.2	.40	0
28	9.5	11	14	16	22	15	84	9.5	4.3	5.9	.40	0
29	10	11	14	16	-----	15	81	8.8	5.1	5.9	.40	0
30	10	10	14	17	-----	15	75	8.5	4.5	5.9	.20	0
31	11	-----	14	16	-----	15	-----	8.5	-----	5.4	.10	-----
TOTAL	113.90	335	377	460	633	534	2,046	1,029.3	174.3	189.5	61.60	0.50
MEAN	3.67	11.2	12.2	14.8	22.6	17.2	68.2	33.2	5.81	6.11	1.99	.017
MAX	11	12	14	17	27	21	110	70	8.8	10	5.1	.10
MIN	0	10	10	13	15	15	15	8.5	3.3	4.0	.10	0
AC-FT	226	664	748	912	1,260	1,060	4,060	2,040	346	376	122	1.0

CAL YR 1968 TOTAL -- MEAN -- MAX -- MIN -- AC-FT --
WTR YR 1969 TOTAL 5,954.10 MEAN 16.3 MAX 110 MIN 0 AC-FT 11,810

RED RIVER OF THE NORTH BASIN

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., Becker County, 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 2.2 miles west of Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

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

EXTREMES.--Current year: Maximum discharge, 6.9 cfs Apr. 13 (gage height, 3.97 ft); maximum gage height, 4.30 ft Jan. 8 (backwater from ice); no flow for several days.

Period of record: Maximum discharge, 6.9 cfs Apr. 13, 1969 (gage height, 3.97 ft); maximum gage height, 4.30 ft Jan. 8, 1969 (backwater from ice); no flow for several days in most years.

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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.10	.30	.50	1.2	2.6	2.3	2.1	4.3	2.4	1.2	1.3	
2	.10	.30	.60	1.3	2.6	2.3	2.1	4.3	2.6	1.2	1.3	
3	.0	.30	.90	.70	2.6	2.1	2.1	4.3	2.4	1.2	1.2	
4		.30	.90	1.0	2.6	2.3	2.1	5.2	2.4	1.3	1.2	
5	.10	.30	1.0	1.2	2.6	2.3	2.1	5.5	2.4	1.0	1.2	
6	.10	.30	.90	1.3	2.6	2.1	2.1	5.5	2.4	1.0	1.2	
7	.10	.30	.90	1.4	2.8	2.1	2.4	5.2	2.4	1.0	1.0	
8	.10	.30	.90	1.5	2.3	2.1	2.6	5.0	2.3	1.2	.70	
9	.10	.30	.90	1.7	2.3	2.1	5.0	4.8	2.3	1.0	.50	
10	.10	.30	.90	1.9	2.3	2.3	5.7	4.6	2.3	1.0	.40	
11	.20	.30	.90	2.1	2.4	2.1	6.5	4.3	2.1	1.0	.40	
12	.20	.30	.90	2.2	2.4	2.1	6.5	3.9	1.9	1.0	.40	
13	.20	.30	1.0	2.3	2.3	2.1	6.9	3.7	1.6	1.0	.40	
14	.20	.30	1.2	2.5	2.3	1.9	6.3	3.5	1.4	1.0	.20	
15	.20	.40	1.0	2.6	2.3	1.9	6.5	3.5	1.6	2.4	.20	
16	.30	.40	.90	2.6	2.6	1.9	6.3	3.5	1.6	2.1	.30	
17	.30	.40	.90	2.6	2.6	1.9	5.9	3.3	1.4	1.9	.40	
18	.30	.40	.70	2.6	2.4	1.8	5.5	3.2	1.4	1.8	.40	
19	.30	.40	.90	2.6	2.4	1.8	5.5	3.0	1.4	1.8	.30	
20	.30	.40	.90	2.6	2.3	2.3	5.5	3.0	1.2	1.8	.20	
21	.30	.40	.70	2.6	2.4	1.9	6.1	2.8	1.0	1.8	.20	
22	.30	.40	.70	2.6	2.3	2.1	6.5	2.8	1.0	1.9	.10	
23	.30	.40	.70	2.6	2.4	1.9	6.3	2.8	.90	1.8	.10	
24	.30	.40	.70	2.6	2.4	1.9	5.5	2.8	.90	1.8	.10	
25	.30	.40	1.0	2.6	2.3	1.9	5.5	2.6	1.2	1.8	.10	
26	.30	.40	1.2	2.6	2.4	1.9	5.5	2.4	1.4	1.8	0	
27	.30	.40	1.0	2.3	2.3	1.8	5.2	2.4	1.4	1.8	0	
28	.30	.50	1.0	2.5	2.3	1.8	5.0	2.4	1.4	1.4	0	
29	.30	.50	1.0	2.6	-----	1.8	4.6	2.4	1.4	1.4	0	
30	.30	.50	1.2	2.6	-----	1.8	4.5	2.4	1.3	1.4	0	
31	.30	-----	1.0	2.6	-----	2.1	-----	2.4	-----	1.3	0	-----
TOTAL	6.80	10.90	27.90	66.10	68.1	62.7	144.4	111.8	51.40	45.1	13.80	0
MEAN	.22	.36	.90	2.13	2.43	2.02	4.81	3.61	1.71	1.45	.45	0
MAX	.30	.50	1.2	2.6	2.8	2.3	6.9	5.5	2.6	2.4	1.3	0
MIN	.10	.30	.50	.70	2.3	1.8	2.1	2.4	.90	1.0	0	0
AC-FT	13	22	55	131	135	124	286	222	102	89	27	0

WAT YR 1969 TOTAL 609.00 MEAN 1.67 MAX 6.9 MIN 0 ACFT 1,210

RED RIVER OF THE NORTH BASIN

27

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., Becker County, 1,700 ft upstream from East Branch County Ditch No. 14, 1,900 ft upstream from St. Clair Lake and 1.5 miles west of Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

GAGE.--Nonrecording gage read once-daily.

EXTREMES.--Current year: Maximum discharge, 16 cfs Apr. 10 (gage height, 5.45 ft, backwater from ice); maximum gage height, 5.61 ft Apr. 9 (backwater from ice); no flow for several days.
 Period of record: Maximum discharge, 16 cfs Apr. 10, 1969 (gage height, 5.45 ft, backwater from ice); maximum gage height, 5.61 ft Apr. 9, 1969 (backwater from ice); no flow for several days during most years.

REMARKS.--Records poor.

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.20	.40	.10				0	1.2	.60	.20	.10	0
2	.20	.30	.10				0	1.2	.60	.20	.10	0
3	.20	.30	.10				0	1.2	.60	.20	.10	0
4	.20	.30	.10				0	2.8	.60	.20	.10	0
5	.20	.30	.10				.10	2.9	.60	.10	.10	0
6	.20	.30	.10				.10	2.6	.50	.10	.10	0
7	.20	.30	.10				.10	2.5	.50	.10	.10	.10
8	.50	.30	.10				.80	2.1	.40	.20	.10	.10
9	.20	.30	.10				4.5	1.8	.30	.20	.10	.10
10	.20	.30	.10				13	1.6	.30	.20	.10	.10
11	.20	.30	0				14	1.2	.30	.10	0	.10
12	.20	.30	0				11	1.1	.30	.10	0	.10
13	.20	.30	0				9.5	.90	.20	.10	0	.10
14	.20	.30	0				8.3	.90	.20	.10	0	.10
15	.20	.30	0				7.9	.80	.20	.40	0	.10
16	.20	.30	0				6.8	.70	.20	.10	0	.10
17	.50	.30	0				5.9	.70	.20	.10	0	.10
18	1.0	.30	0				5.2	.70	.20	.10	0	.10
19	.80	.30	0				4.6	.70	.20	.10	0	.10
20	.70	.20	0				4.1	.60	.20	.10	0	.10
21	.60	.20	0				4.1	.60	.20	.20	0	.10
22	.60	.20	0				3.6	.60	.20	.30	0	.10
23	.60	.20	0				3.2	.60	.20	.30	0	.20
24	.50	.20	0				2.6	.60	.20	.30	0	.20
25	.50	.20	0				2.3	.50	.20	.30	0	.20
26	.40	.20	0				1.9	.50	.20	.20	0	.20
27	.40	.20	0				1.7	.50	.20	.20	0	.20
28	.60	.20	0				1.6	.50	.20	.20	0	.30
29	.50	.20	0		-----		1.4	.40	.20	.20	0	.30
30	.40	.20	0		-----		1.2	.40	.20	.20	0	.40
31	.40	-----	0		-----		-----	.40	-----	.20	0	-----
TOTAL	12.00	8.00	1.00	0	0	0	119.50	33.80	9.20	5.60	1.00	3.60
MEAN	.39	.27	.032	0	0	0	3.98	1.09	.31	.18	.032	.12
MAX	1.0	.40	.10	0	0	0	14	2.9	.60	.40	.10	.40
MIN	.20	.20	0	0	0	0	0	.40	.20	.10	0	0
AC-FT	24	16	2.0	0	0	0	237	67	18	11	2.0	7.1

WAT YR 1969 TOTAL 193.70 MEAN .53 MAX 14 MIN 0 ACFT 384

RED RIVER OF THE NORTH BASIN

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

LOCATION.--Lat $46^{\circ}48'35''$, long $95^{\circ}52'23''$, in SW $\frac{1}{4}$ sec.33, T.139 N. R.41 W., Becker County, 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.

PERIOD OF RECORD.--July 1968 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,333.96 ft above mean sea level, datum of 1929.

EXTREMES.--Current year: Maximum discharge, 4.2 cfs Apr. 12 (gage height, 2.87 ft); no flow Aug. 21.
Period of record: Maximum discharge, 4.2 cfs Apr. 12, 1969 (gage height, 2.87 ft); maximum gage height, 2.90 ft July 20, 1968; no flow Aug. 21, 1969.

REMARKS.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.77	.76	.66	.66	.62	.73	1.4	1.3	1.0	1.1	.70	.41
2	.80	.76	.68	.66	.62	.73	1.4	1.3	.99	1.2	.69	.43
3	.81	.75	.71	.66	.62	.74	1.7	1.3	.97	1.1	.64	.42
4	.78	.75	.68	.66	.62	.74	1.9	1.7	.97	1.1	.61	.36
5	.78	.80	.71	.66	.62	.74	1.7	1.8	1.0	.99	.60	.50
6	.77	.75	.73	.66	.62	.76	2.0	1.8	.99	.92	.62	.59
7	.77	.71	.69	.66	.62	.78	2.5	1.7	.99	.90	.62	.51
8	.74	.90	.67	.66	.62	.80	3.0	1.7	.98	1.4	.56	.49
9	.98	1.3	.65	.66	.62	.81	3.5	1.6	.98	1.2	.52	.50
10	.88	1.1	.70	.66	.62	.82	3.9	1.5	.97	1.0	.46	.52
11	.83	.72	.71	.64	.62	.84	4.1	1.4	.98	.94	.41	.53
12	.92	.72	.72	.64	.64	.84	4.2	1.4	.93	.90	.39	.54
13	.85	.74	.66	.64	.65	.85	4.0	1.3	.94	.83	.34	.59
14	.86	.79	.66	.64	.66	.88	3.8	1.3	.94	.79	.30	.60
15	.90	.72	.66	.63	.68	.90	3.6	1.3	.91	1.9	.25	.61
16	1.0	.82	.66	.61	.68	.96	3.3	1.2	.92	1.6	.20	.64
17	1.6	1.1	.64	.61	.60	1.0	3.1	1.2	.93	1.2	.17	.65
18	2.3	.94	.62	.61	.69	1.1	2.8	1.2	.96	1.1	.10	.66
19	1.7	.68	.62	.61	.70	1.1	2.6	1.1	.95	.99	.10	.66
20	1.4	.67	.62	.61	.70	1.3	2.4	1.1	.93	.92	.10	.68
21	1.3	.66	.62	.61	.71	1.4	2.3	1.1	.96	.87		.68
22	1.2	.67	.62	.61	.71	1.6	2.2	1.0	.94	1.0	.10	.73
23	1.1	.65	.62	.61	.71	1.7	2.1	1.0	.94	1.1	.19	.73
24	1.0	.65	.63	.61	.72	1.7	1.9	1.0	.98	.97	.23	.75
25	.94	.66	.64	.61	.72	1.8	1.8	.98	1.1	.89	.25	.80
26	.90	.66	.65	.61	.72	1.9	1.7	.96	1.1	.86	.28	.82
27	.90	.66	.65	.61	.72	1.9	1.6	.96	1.2	.82	.29	.78
28	.98	.65	.66	.61	.73	1.9	1.5	.96	1.1	.75	.29	1.1
29	.92	.64	.66	.61	-----	1.9	1.5	.91	1.2	.73	.30	1.2
30	.85	.66	.66	.61	-----	1.7	1.4	.88	1.1	.70	.40	1.3
31	.80	-----	.66	.61	-----	1.5	-----	.93	-----	.73	.41	-----
TOTAL	31.27	23.04	20.52	19.55	18.65	36.43	74.9	38.88	29.85	31.50	11.12	19.78
MEAN	1.01	.77	.66	.63	.67	1.18	2.50	1.25	1.00	1.02	.36	.66
MAX	2.3	1.3	.73	.66	.73	1.9	4.2	1.8	1.2	1.9	.70	1.3
MIN	.77	.64	.62	.61	.62	.73	1.4	.88	.91	.70	0	.36
AC-FT	62	46	41	39	37	72	149	77	59	62	22	39
CAL YR 1968	TOTAL	--		MEAN	--		MIN	--		AC-FT	--	
WTR YR 1969	TOTAL	355.49		MEAN	.97		MAX	4.2		MIN	0	
										AC-FT	705	

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

LOCATION.--Lat $46^{\circ}47'52''$, long $95^{\circ}52'49''$, in NE $\frac{1}{4}$ sec.5, T.138 N., R.41 W., Becker County, at south end of lake, 2,000 ft south at St. Clair Lake outlet and 2.2 miles southwest of Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

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

EXTREMES.--Current year: Maximum gage height observed, 5.95 ft Apr. 17; minimum observed, 4.39 ft Sept. 21.
Period of record: Maximum gage height observed, 5.95 ft Apr. 17, 1969; minimum observed, 4.22 ft Sept. 15, 1968.

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

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

GAGE HEIGHT, IN FEET, OCTOBER 1968 TO SEPTEMBER 1969

Oct. 23.....4.94	Feb. 20.....4.95	June 30.....4.74
Nov. 30.....4.70	-	July 31.....4.99
Dec. 31.....4.94	Apr. 30.....5.20	Aug. 31.....4.49
Jan. 14.....4.73	May 31.....4.87	Sept. 30.....4.49

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

RED RIVER OF THE NORTH BASIN

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., Becker County, 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.

PERIOD OF RECORD.--July 1968 to current year.

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

EXTREMES.--Current year: Maximum discharge, 31 cfs Apr. 29 (gage height, 3.15 ft); minimum daily, 0.7 cfs, Sept. 4.

Period of record: Maximum discharge, 31 cfs Apr. 29, 1969 (gage height, 3.15 ft); minimum daily, 0.7 cfs Sept. 4, 1969.

REMARKS.--Record fair.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.5	4.0	3.4	3.1	3.5	4.9	4.5	11	6.2	3.6	3.2	.90
2	1.5	3.8	3.4	3.1	3.5	4.9	4.6	11	6.3	3.6	3.6	.90
3	1.5	3.6	3.4	3.1	3.5	4.9	4.8	11	6.0	3.6	3.8	.80
4	1.5	3.4	3.4	3.0	3.6	4.8	5.2	12	5.9	3.6	3.7	.70
5	1.5	3.5	3.4	3.0	3.7	4.8	6.0	13	6.3	3.5	3.7	1.0
6	1.5	3.6	3.4	3.0	3.8	4.7	7.7	14	6.3	3.2	3.6	1.4
7	1.5	3.8	3.3	3.0	3.9	4.7	11	14	6.3	3.0	3.6	1.5
8	1.5	3.7	3.4	3.0	4.1	4.6	16	13	6.2	3.6	3.3	1.5
9	1.5	3.7	3.3	3.0	4.3	4.6	23	12	6.2	3.6	3.1	1.4
10	1.8	3.6	3.1	3.0	4.4	4.6	29	12	6.2	3.5	3.1	1.4
11	2.5	3.6	3.0	3.0	4.6	4.5	30	11	6.0	3.3	3.0	1.5
12	3.0	3.6	3.0	3.0	4.7	4.4	31	10	5.8	3.1	2.8	1.5
13	3.5	3.6	3.0	3.0	4.8	4.4	30	9.5	5.7	2.8	2.6	1.6
14	4.0	3.6	3.0	3.0	4.9	4.3	29	9.0	5.5	2.6	2.4	1.7
15	4.0	3.6	3.0	3.0	4.9	4.3	28	8.8	5.6	4.2	2.2	1.7
16	4.0	3.6	3.1	3.0	4.9	4.3	26	8.8	5.6	4.7	2.2	1.5
17	4.5	3.6	3.1	3.0	4.9	4.2	24	8.6	5.4	4.9	2.2	1.4
18	5.0	3.5	3.1	3.0	4.8	4.3	23	8.4	5.3	4.8	2.1	1.4
19	5.5	3.5	3.2	3.0	4.9	4.3	21	8.0	5.2	4.6	1.9	1.3
20	6.0	3.5	3.2	3.0	4.9	4.3	20	7.5	4.6	4.5	1.6	1.3
21	6.2	3.5	3.2	3.0	4.9	4.3	19	7.3	4.3	4.3	1.5	1.4
22	6.3	3.4	3.2	3.0	4.9	4.3	17	7.0	4.1	4.5	1.5	1.4
23	6.4	3.4	3.2	3.0	4.9	4.3	17	6.9	3.8	4.3	1.5	1.5
24	6.4	3.4	3.2	3.1	4.9	4.4	15	6.7	3.7	4.3	1.5	1.7
25	6.3	3.4	3.2	3.1	4.9	4.4	15	6.6	4.0	4.1	1.4	1.7
26	6.2	3.4	3.2	3.2	4.9	4.5	14	6.4	4.3	3.9	1.2	1.7
27	6.1	3.4	3.2	3.2	4.9	4.5	13	6.4	4.1	3.7	1.0	1.7
28	6.0	3.4	3.2	3.3	4.9	4.4	13	6.0	3.9	3.7	.90	1.6
29	5.5	3.4	3.1	3.4	-----	4.3	12	5.9	3.9	3.6	.80	1.8
30	5.0	3.4	3.1	3.4	-----	4.3	12	5.8	3.7	3.3	.90	2.0
31	4.5	-----	3.1	3.5	-----	4.4	-----	5.7	-----	3.3	.90	-----
TOTAL	122.2	106.5	99.1	95.5	125.8	138.9	520.8	283.3	156.4	117.3	70.80	42.90
MEAN	3.94	3.55	3.20	3.08	4.49	4.48	17.4	9.14	5.21	3.78	2.28	1.43
MAX	6.4	4.0	3.4	3.5	4.9	4.9	31	14	6.3	4.9	3.8	2.0
MIN	1.5	3.4	3.0	3.0	3.5	4.2	4.5	5.7	3.7	2.6	.80	.70
AC-FT	242	211	197	189	250	276	1,030	562	310	233	140	85
CAL YR 1968	TOTAL	--	MEAN	--	MAX	--	MIN	--	AC-FT	--		
WTR YR 1969	TOTAL	1,879.50	MEAN	5.15	MAX	31	MIN	.70	AC-FT	3,730		

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., Becker County, on downstream side of dam between Muskrat Lake and Sallie Lake at State Fish Hatchery, 3 miles southwest of Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

GAGE.--Two nonrecording gages. Datum of gage in the boat lock is 1,327.63 ft above mean sea level, datum of 1929, and in the spillway the datum of gage is 1,328.98 ft above mean sea level, datum of 1929.

EXTREMES.--Current year: Maximum daily discharge, 135 cfs Apr. 15; no flow Oct. 1-15.

Period of Record: Maximum daily discharge, 135 cfs Apr. 15, 1969; no flow for several days in most years.

REMARKS.--Records fair. Some regulation by manipulation of stoplogs in controls above station.

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	14	14	17	17	35	37	71	16	6.5	7.8	.40
2	0	14	14	17	19	34	39	69	16	6.8	7.0	.20
3	0	14	14	17	23	33	39	65	16	6.8	6.3	.20
4	0	14	14	16	28	30	41	71	16	6.7	6.1	.20
5	0	14	14	16	33	28	41	74	16	6.8	5.5	.20
6	0	14	14	16	34	28	41	78	16	6.9	4.6	.20
7	0	14	14	16	34	28	41	66	16	6.9	4.0	.20
8	0	14	14	16	34	26	52	65	16	9.6	3.4	.20
9	0	14	14	16	34	26	65	64	16	8.7	3.4	.20
10	0	14	12	16	34	26	76	58	16	8.6	3.2	.20
11	0	14	13	16	34	25	79	52	16	8.0	2.6	.20
12	0	14	14	16	35	24	91	46	14	6.9	2.2	.20
13	0	14	15	16	35	24	118	44	12	6.9	2.0	.20
14	0	14	16	16	35	24	126	43	11	6.3	2.0	.20
15	0	14	16	16	35	24	135	41	11	12	1.6	.20
16	.10	14	16	16	34	23	88	42	11	13	1.3	.20
17	.10	14	16	16	34	23	88	41	11	12	1.2	.20
18	1.1	14	16	16	34	23	86	41	11	12	1.1	.20
19	3.1	14	16	16	32	23	90	37	9.5	12	1.0	.20
20	5.1	14	16	16	33	23	90	36	7.5	11	.90	.20
21	7.1	14	16	16	34	23	94	35	7.7	11	.80	.20
22	9.1	14	16	16	34	22	98	35	7.2	12	.80	.20
23	10	14	16	16	35	22	97	30	7.3	12	.70	.20
24	12	14	16	16	35	22	97	30	8.0	11	.70	.20
25	13	14	16	16	35	22	95	31	8.9	11	.70	.20
26	14	14	16	16	35	22	99	25	9.8	11	.60	.20
27	14	14	16	16	35	22	99	20	9.8	11	.60	.20
28	14	14	17	16	35	22	95	17	9.3	10	.50	.20
29	14	14	17	16	-----	22	90	20	8.2	9.5	.40	.20
30	14	14	17	16	-----	27	88	16	7.6	9.3	.40	.20
31	14	-----	16	16	-----	32	-----	16	-----	8.7	.40	-----
TOTAL	144.70	420	471	499	909	788	2,415	1,379	357.8	290.9	73.80	6.20
MEAN	4.67	14.0	15.2	16.1	32.5	25.4	80.5	44.5	11.9	9.38	2.38	.21
MAX	14	14	17	17	35	35	135	78	16	13	7.8	.40
MIN	0	14	12	16	17	22	37	16	7.2	6.3	.40	.20
AC-FT	287	833	934	990	1,800	1,560	4,790	2,740	710	577	146	12
CAL YR 1968	TOTAL	--	MEAN	--	MAX	--	MIN	--	ACFT	--		
WAT YR 1969	TOTAL	7,754.40	MEAN	21.2	MAX	135	MIN	0	ACFT	15,380		

RED RIVER OF THE NORTH BASIN

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.

PERIOD OF RECORD.--July 1968 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,327.58 ft above mean sea level, datum of 1929.

EXTREMES.--Current year: Maximum discharge, 116 cfs Apr. 21 (gage height, 1.49 ft); no flow Sept. 18-30.
Period of record: Maximum discharge, 116 cfs Apr. 21, 1969 (gage height, 1.49 ft); no flow Sept. 18-30, 1969.

REMARKS.--Records good.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.1	9.4	14	21	52	38	27	100	24	8.1	12	.31
2	2.0	8.7	16	21	48	38	27	98	22	9.2	11	.25
3	1.8	8.4	17	20	46	37	27	98	18	8.6	10	.21
4	1.4	9.3	18	19	43	37	28	105	18	9.8	9.4	.17
5	1.2	9.5	15	20	41	36	28	106	20	8.6	9.0	.25
6	1.1	10	16	22	40	36	28	106	20	7.2	9.1	.39
7	.89	10	16	23	40	36	29	102	20	6.7	7.9	.50
8	.94	11	17	24	40	35	31	99	20	9.1	6.5	.39
9	1.2	12	16	25	41	34	38	96	19	9.3	6.2	.22
10	.93	14	17	24	40	34	48	92	20	8.4	5.9	.17
11	.90	15	16	23	40	33	54	87	19	7.5	5.4	.15
12	.79	16	17	23	40	33	57	83	18	6.9	4.8	.12
13	.82	17	22	22	40	33	64	80	13	6.3	4.3	.12
14	.79	18	23	22	40	32	68	82	12	6.0	3.3	.10
15	.72	20	22	23	41	32	75	81	12	17	2.9	.12
16	1.0	22	21	22	41	31	83	78	11	20	2.5	.09
17	2.0	19	20	22	41	31	89	72	10	19	2.5	.05
18	3.4	15	19	21	39	30	95	69	10	16	2.0	0
19	3.6	15	20	21	40	30	101	66	9.8	19	1.7	0
20	4.1	13	20	21	39	31	107	65	8.0	18	1.5	0
21	5.4	13	19	20	39	29	107	68	8.0	17	1.3	0
22	6.1	12	21	20	39	29	102	67	8.0	20	1.1	0
23	6.1	12	21	22	39	29	107	66	7.3	22	1.0	0
24	6.1	12	21	22	39	29	104	65	8.0	20	.88	0
25	6.2	13	20	21	39	29	104	62	9.8	20	.80	0
26	6.7	13	22	20	38	29	105	14	9.8	20	.73	0
27	10	12	21	21	38	28	106	24	10	20	.59	0
28	7.7	14	21	22	39	28	104	24	9.8	17	.53	0
29	8.0	14	21	22	-----	28	106	22	9.8	15	.44	0
30	7.8	14	21	24	-----	27	105	20	9.8	14	.49	0
31	8.3	-----	21	61	-----	27	-----	22	-----	15	.36	-----
TOTAL	110.08	401.3	591	714	1,142	989	2,154	2,219	414.1	420.7	126.12	3.61
MEAN	3.55	13.4	19.1	23.0	40.8	31.9	71.8	71.6	13.8	13.6	4.07	.12
MAX	10	22	23	61	52	38	107	106	24	22	12	.50
MIN	.72	8.4	14	19	38	27	27	14	7.3	6.0	.36	0
AC-FT	218	796	1,170	1,420	2,270	1,960	4,270	4,400	821	834	250	7.2
CAL YR 1968	TOTAL	--	MEAN	--	MAX	--	MIN	--	AC-FT	--		
WTR YR 1969	TOTAL	9,284.91	MEAN	25.4	MAX	107	MIN	0	AC-FT	18,420		

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., Becker County, on left bank 50 ft downstream from Lake Melissa, 400 ft upstream from culvert on county road and 6 miles southwest of Detroit Lakes.

PERIOD OF RECORD.--July 1968 to current year.

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

EXTREMES.--Current year: Maximum discharge, 115 cfs May 5-11 (gage height, 2.20 ft); no flow Sept. 10-20.
Period of record: Maximum discharge, 115 cfs May 5-11, 1969 (gage height, 2.20 ft); no flow Sept. 10-20, 1969.

REMARKS.--Records fair. Records of chemical analyses for the water year 1969 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, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	14	13	29	39	44	38	96	49	6.4	12	.80
2	12	14	13	29	40	43	36	102	43	6.0	12	.80
3	11	14	14	29	41	43	36	110	40	6.4	12	.80
4	11	14	15	29	43	43	35	114	37	6.0	12	.80
5	11	13	15	29	43	42	34	115	36	6.0	11	.60
6	11	13	16	28	43	42	34	115	33	6.2	10	.50
7	11	13	17	28	43	42	34	115	32	6.2	9.5	.50
8	11	13	18	28	43	42	36	115	30	6.4	12	.50
9	11	13	20	28	43	42	36	115	30	6.7	7.7	.20
10	12	13	21	28	43	43	39	115	28	7.4	7.7	0
11	12	13	22	28	42	42	44	115	26	7.4	7.2	0
12	12	13	23	28	41	41	50	112	24	7.4	6.7	0
13	11	13	24	28	43	41	53	110	21	7.4	6.2	0
14	11	13	24	28	43	41	57	103	18	7.4	5.7	0
15	11	13	26	28	43	40	60	102	16	8.0	5.7	0
16	11	13	27	29	43	39	63	98	15	8.4	5.2	0
17	11	13	28	30	44	39	66	98	15	10	5.2	0
18	12	13	28	30	45	39	55	95	14	12	4.7	0
19	12	13	28	30	43	39	58	90	14	13	4.2	0
20	13	13	28	29	43	39	70	85	13	13	3.7	0
21	14	13	28	30	44	39	74	81	13	13	3.3	.10
22	15	13	28	31	44	39	80	80	12	13	2.5	.10
23	16	13	28	33	44	39	84	79	10	13	2.5	.10
24	16	13	28	33	44	39	89	76	9.8	13	2.2	.10
25	16	13	28	33	44	38	95	76	8.7	13	2.2	.10
26	15	13	28	34	44	39	95	74	8.2	14	1.6	.10
27	15	13	28	36	44	39	98	63	7.2	14	1.3	.10
28	15	13	28	36	44	39	102	64	6.7	13	1.1	.10
29	15	13	28	36	-----	39	105	66	6.7	13	1.1	.20
30	14	13	28	37	-----	39	105	58	6.4	13	.80	.20
31	14	-----	28	36	-----	39	-----	55	-----	13	.80	-----
TOTAL	394	394	728	948	1,203	1,254	1,861	2,892	622.7	302.7	179.80	6.70
MEAN	12.7	13.1	23.5	30.6	43.0	40.5	62.0	93.3	20.8	9.76	5.80	.22
MAX	16	14	28	37	45	44	105	115	49	14	12	.80
MIN	11	13	13	28	39	38	34	55	6.4	6.0	.80	0
AC-FT	782	782	1,440	1,880	2,390	2,490	3,690	5,740	1,240	600	357	13

WAT YR 1969 TOTAL 10,785.90 MEAN 29.6 MAX 115 MIN 0 ACFT 21,390

RED RIVER OF THE NORTH BASIN

5-0405. Pelican River near Fergus Falls, Minn.

LOCATION.--Lat 46°20'10", long 96°07'10", in NE¼ sec.17, T.133 N., R.43 W., Otter Tail County, on left bank 990 ft downstream from bridge on U. S. Highway 52, 3 miles northwest of Fergus Falls and 7.5 miles upstream from mouth.

DRAINAGE AREA.--482 sq mi.

PERIOD OF RECORD.--June 1909 to December 1912, July 1942 to current year.

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, nonrecording gage at site 1 mile downstream at different datum. July 1, 1942, to Nov. 6, 1955, nonrecording 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.--30 years (1909-12, 1942-69), 77.7 cfs (56,290 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 710 cfs Apr. 12 (gage height, 5.30 ft); maximum gage height, 7.20 ft Apr. 10 (backwater from ice); minimum daily discharge, 18 cfs Sept. 28, 29, 30.
Period of record: 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 water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

REVISIONS.--WSP 955: Drainage area.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	51	46	38	37	70	107	111	300	256	117	90	27
2	49	45	37	38	71	107	111	300	251	108	84	26
3	46	45	37	38	72	107	111	300	242	88	80	26
4	44	45	37	39	74	107	111	320	242	106	77	25
5	43	44	36	39	76	108	111	330	238	104	73	25
6	42	44	36	39	77	108	113	335	224	97	73	24
7	41	44	35	40	79	108	127	340	220	94	70	24
8	40	44	34	41	81	109	165	340	215	108	68	24
9	40	43	33	42	82	110	295	340	207	104	67	24
10	40	43	33	43	83	110	515	335	199	92	64	24
11	39	42	33	44	87	110	680	320	194	88	63	24
12	39	42	33	45	90	110	688	320	186	84	61	24
13	39	42	33	47	92	110	580	310	174	80	60	23
14	38	42	33	48	94	111	455	305	174	78	57	24
15	36	41	33	49	96	112	400	295	170	97	54	24
16	36	41	33	50	96	113	375	295	160	97	53	22
17	39	41	33	51	99	114	365	295	152	90	51	22
18	52	40	33	52	100	115	355	285	149	86	48	22
19	68	40	33	53	102	115	345	285	138	82	45	22
20	68	40	33	54	103	116	340	285	132	82	43	21
21	61	40	34	56	104	117	340	270	129	82	42	20
22	57	39	34	57	105	117	330	270	129	84	40	20
23	56	39	34	58	105	117	320	256	132	94	39	20
24	56	39	34	60	105	118	320	256	129	97	39	19
25	54	39	35	61	106	119	315	246	132	97	36	19
26	53	39	35	62	106	118	310	246	132	99	34	19
27	52	38	35	64	106	118	305	256	129	101	33	19
28	53	38	35	65	106	118	300	256	129	101	32	18
29	51	38	36	66	-----	117	300	256	126	101	30	18
30	51	38	36	67	-----	115	300	256	123	99	29	18
31	49	-----	37	68	-----	114	-----	256	-----	94	28	-----
TOTAL	1,483	1,241	1,071	1,573	2,567	3,495	9,493	9,059	5,213	2,931	1,663	667
MEAN	47.8	41.4	34.5	50.7	91.7	113	316	292	174	94.5	53.6	22.2
MAX	68	46	38	68	106	119	688	340	256	117	90	27
MIN	36	38	33	37	70	107	111	246	123	78	28	18
AC-FT	2,940	2,460	2,120	3,120	5,090	6,930	18,830	17,970	10,340	5,810	3,300	1,320
CAL YR 1968	TOTAL 22,785.8			MEAN 62.3		MAX 190	MIN 1.1	AC-FT 45,200				
WTR YR 1969	TOTAL 40,456			MEAN 111		MAX 688	MIN 18	AC-FT 80,240				

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., Otter Tail County, 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.

PERIOD OF RECORD.--March 1953 to current year.

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.--Current year: Maximum contents, 14,920 acre-ft Apr. 14 (elevation, 1,070.71 ft); minimum, 872 acre-ft Apr. 1 (elevation, 1,047.15 ft).

Period of record: 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.

MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30.....	1,069.58	13,640	-
Oct. 31.....	1,067.13	11,220	-2,420
Nov. 30.....	1,062.46	7,420	-3,800
Dec. 31.....	1,057.24	4,220	-3,200
CAL YR 1968.....	-	-	-1,580
Jan. 31.....	1,054.37	2,950	-1,270
Feb. 28.....	1,051.23	1,820	-1,130
Mar. 31.....	1,047.38	907	-913
Apr. 30.....	1,065.15	9,520	+8,610
May 31.....	1,063.25	8,000	-1,520
June 30.....	1,050.61	1,630	-6,370
July 31.....	1,057.48	4,340	+2,710
Aug. 31.....	1,063.44	8,150	+3,810
Sept.30.....	1,067.26	11,330	+3,180
WTR YR 1969.....	-	-	-2,310

RED RIVER OF THE NORTH BASIN

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., Otter Tail County, 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.

PERIOD OF RECORD.--October 1930 to current year. 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.--39 years, 286 cfs (207,200 acre-ft per year).

EXTREMES.--Current year: Maximum discharge 1,260 cfs May 31 (gage height, 4.43 ft); minimum daily, 49 cfs Sept. 10-15; minimum gage height, 2.16 ft (Sept. 5, 10-21).

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 785: 1934(M). WSP 1208: 1947(M). WSP 1308: 1931(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	278	311	306	242	260	542	420	991	1,220	599	300	113
2	283	311	300	242	260	524	395	991	1,200	582	300	110
3	283	311	300	242	260	502	406	1,040	1,190	570	300	110
4	283	311	300	242	265	490	524	1,050	1,180	564	300	75
5	283	311	300	242	270	474	582	1,050	1,140	524	306	51
6	283	311	300	240	270	474	587	1,050	1,130	468	311	51
7	283	311	300	240	390	474	738	1,090	1,110	423	271	51
8	283	306	300	240	370	468	616	1,120	1,090	423	267	51
9	283	311	294	238	365	462	95	1,120	1,060	496	267	51
10	283	311	294	234	360	457	116	1,120	1,040	530	261	49
11	283	311	294	232	360	446	126	1,120	1,020	536	261	49
12	283	311	294	232	355	434	133	1,120	998	519	230	49
13	283	311	290	231	354	434	607	1,120	978	502	210	49
14	283	311	285	228	352	434	928	1,120	953	462	210	49
15	278	311	280	228	355	423	998	1,110	915	434	210	49
16	278	311	280	228	355	418	1,000	1,110	891	406	214	53
17	283	311	275	228	357	418	1,000	1,110	879	317	210	53
18	283	306	270	228	530	412	1,000	1,100	867	306	214	53
19	283	306	265	228	515	412	991	1,110	831	283	178	51
20	278	306	260	220	479	412	991	1,110	808	283	145	51
21	278	306	255	226	446	429	991	1,110	778	306	123	51
22	283	306	255	270	412	451	991	1,110	749	311	113	55
23	283	306	255	275	412	474	991	1,110	732	311	113	55
24	283	306	255	290	401	485	991	1,110	697	328	113	55
25	278	306	255	295	401	485	984	1,110	668	328	113	55
26	283	306	250	295	401	485	984	1,100	656	328	113	60
27	283	306	250	290	418	485	984	1,110	651	328	113	60
28	283	306	250	275	502	490	991	1,120	639	334	113	60
29	283	306	250	260	-----	490	991	1,170	622	339	113	60
30	289	306	245	265	-----	475	991	1,200	610	339	113	60
31	311	-----	245	260	-----	438	-----	1,230	-----	334	113	-----
TOTAL	8,777	9,260	8,552	7,686	10,475	14,297	22,142	34,232	27,302	12,813	6,218	1,789
MEAN	283	309	276	248	374	461	738	1,104	910	413	201	59.6
MAX	311	311	306	295	530	542	1,000	1,230	1,220	599	311	113
MIN	278	306	245	220	260	412	95	991	610	283	113	49
AC-FT	17,410	18,370	16,960	15,250	20,780	28,360	43,920	67,900	54,150	25,410	12,330	3,550
CAL YR 1968	TOTAL	116,602		MEAN	319	MAX	709	MIN	107	AC-FT	231,400	
WTR YR 1969	TOTAL	163,543		MEAN	448	MAX	1,230	MIN	49	AC-FT	324,400	

RED RIVER OF THE NORTH BASIN

37

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.

PERIOD OF RECORD.--October 1941 to current year.

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, nonrecording 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.--28 years, 88.1 cfs (1.03 inches per year, 63,830 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 3,770 cfs, occurred during period Apr. 19-21 (gage height, 15.07 ft, from floodmark); no flow for many days.
Period of record: Maximum discharge, 3,770 cfs, occurred during period Apr. 19-21, 1969 (gage height, 15.07 ft, from flood mark); no flow at times in most years.

REMARKS.--Records good except those for winter period, 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	.80	.80	.20	0	0	0	1,690	1,130	40	.70	0
2	0	.70	.80	.20	0	0	0	1,670	952	42	.70	0
3	0	.60	.80	.20	0	0	0	1,630	786	40	.70	0
4	0	.60	.80	.20	0	0	0	1,640	774	40	.70	0
5	0	.60	.70	.20	0	0	1.0	1,620	765	38	.80	0
6	0	.60	.60	.20	0	0	6.0	1,600	757	34	.80	0
7	.20	.60	.50	.10	0	0	22	1,510	740	32	.80	0
8	.10	.70	.50	.10	0	0	100	1,290	721	32	.70	0
9	.10	.70	.40	.10	0	0	108	1,250	671	31	.60	0
10	0	.70	.40	.10	0	0	94	1,240	519	32	.50	0
11	0	.70	.40	.10	0	0	135	1,230	503	32	.20	0
12	0	.80	.40	.10	0	0	298	1,190	425	31	0	0
13	0	.80	.40	0	0	0	298	1,150	358	32	0	0
14	0	.80	.40	0	0	0	298	1,190	356	32	0	0
15	0	.80	.30	0	0	0	298	1,270	351	34	0	0
16	.10	.70	.30	0	0	0	1,390	1,280	346	31	0	0
17	.40	.80	.30	0	0	0	2,340	1,270	249	43	0	0
18	.40	.80	.30	0	0	0	3,110	1,260	174	24	0	0
19	.40	.90	.30	0	0	0	3,360	1,260	116	.80	0	0
20	.90	1.0	.30	0	0	0	3,380	1,250	60	.80	0	0
21	1.2	.80	.30	0	0	0	3,380	1,240	58	.70	0	0
22	1.6	.80	.30	0	0	0	3,310	1,230	49	.70	0	0
23	1.3	.80	.30	0	0	0	3,200	1,220	47	.60	0	0
24	1.1	.80	.30	0	0	0	3,000	1,220	44	.50	0	0
25	1.0	.80	.30	0	0	0	2,620	1,200	42	8.6	0	0
26	.90	.80	.30	0	0	0	2,160	1,190	42	1.0	0	0
27	1.3	.80	.20	0	0	0	1,710	1,180	49	.80	0	0
28	.80	.90	.20	0	0	0	1,680	1,180	53	.70	0	0
29	.80	.80	.20	0	-----	0	1,680	1,160	45	.60	0	0
30	.70	.80	.20	0	-----	0	1,680	1,150	44	.60	0	0
31	.70	-----	.20	0	-----	0	-----	1,150	-----	.70	0	-----
TOTAL	14.00	22.80	12.50	1.80	0	0	39,658.0	40,610	11,226	637.10	7.20	0
MEAN	.45	.76	.40	.058	0	0	1,322	1,310	374	20.6	.23	0
MAX	1.6	1.0	.80	.20	0	0	3,380	1,690	1,130	43	.80	0
MIN	0	.60	.20	0	0	0	0	1,150	42	.50	0	0
AC-FT	28	45	25	3.6	0	0	78,660	80,550	22,270	1,260	14	0
CAL YR 1968	TOTAL	644.70	MEAN	1.76	MAX	38	MIN	0	AC-FT	1,280		
WTR YR 1969	TOTAL	92,189.40	MEAN	253	MAX	3,380	MIN	0	AC-FT	182,900		

RED RIVER OF THE NORTH BASIN

5-0515. Red River of the North at Wahpeton, N. Dak.

LOCATION.--Lat $46^{\circ}15'55''$, long $96^{\circ}35'40''$, in NE $\frac{1}{4}$ sec.8, T.132 N., R.47 W., Richland County, 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.

PERIOD OF RECORD.--April 1942 to current year. 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 942.97 ft above mean sea level. Prior to Aug. 6, 1943, U.S. Weather Bureau nonrecording gage 800 ft upstream, converted to present datum. Aug. 6, 1943, to Oct. 27, 1950, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--26 years (1943-69), 544 cfs (394,100 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 9,200 cfs Apr. 10 (gage height, 16.34 ft); minimum daily discharge, 30 cfs Sept. 16 (gage height, 2.17 ft); minimum gage height, 1.76 ft Sept. 8, 9.

Period of record: Maximum discharge, 9,200 cfs Apr. 10, 1969 (gage height, 16.34 ft); minimum, 8 cfs Aug. 25, 1961 (gage height, 2.26 ft); minimum gage height, 1.76 ft Sept. 8, 9, 1969 (gates open). Maximum stage known, 17.0 ft in spring of 1897 (10,500 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; numerous other controlled lakes and ponds, and several powerplants.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	290	311	408	211	265	510	540	3,350	2,270	670	366	92
2	288	319	423	225	265	550	520	3,170	2,230	656	324	88
3	291	317	360	235	260	580	510	2,980	2,100	648	319	98
4	295	313	250	233	270	580	550	2,950	1,930	638	314	120
5	292	315	180	227	280	575	590	2,950	1,870	620	319	135
6	289	315	170	226	270	564	818	2,920	1,840	586	319	80
7	290	312	200	220	280	562	1,260	2,880	1,810	522	316	58
8	288	311	250	200	310	540	2,560	2,830	1,780	508	288	48
9	297	309	290	175	350	517	6,250	2,790	1,760	491	275	46
10	300	306	295	150	380	520	8,940	2,710	1,680	530	272	46
11	292	303	294	175	380	494	8,890	2,650	1,550	572	272	46
12	292	302	282	219	378	487	8,590	2,630	1,490	572	272	47
13	288	300	242	223	367	509	7,780	2,580	1,410	554	241	47
14	287	299	175	226	363	504	7,390	2,470	1,330	536	213	72
15	288	300	280	226	370	466	7,210	2,440	1,290	554	215	59
16	291	300	296	221	371	483	6,590	2,460	1,260	502	215	30
17	311	307	287	228	369	498	5,970	2,490	1,220	464	213	50
18	352	299	283	223	374	509	5,520	2,490	1,130	369	213	52
19	325	291	279	217	431	503	5,180	2,470	1,020	346	217	51
20	308	262	256	217	541	491	4,970	2,450	964	327	189	49
21	299	304	250	219	603	477	4,720	2,450	884	324	140	50
22	294	444	254	218	581	480	4,550	2,450	836	341	120	51
23	294	351	197	237	580	529	4,440	2,440	812	352	85	55
24	293	296	148	218	550	559	4,390	2,430	784	346	81	59
25	289	288	244	182	550	585	4,360	2,410	768	355	82	59
26	286	286	238	182	570	581	4,290	2,390	740	349	80	62
27	278	299	249	196	500	586	4,200	2,380	696	355	78	66
28	299	283	250	262	500	500	4,060	2,340	692	355	79	69
29	292	390	245	288	-----	500	3,860	2,310	688	352	63	74
30	288	312	229	262	-----	550	3,620	2,300	680	392	79	74
31	291	-----	191	265	-----	520	-----	2,280	-----	407	90	-----
TOTAL	9,157	9,344	7,995	6,806	11,258	16,309	133,068	80,790	39,514	14,593	6,349	1,933
MEAN	295	311	258	220	402	526	4,436	2,606	1,317	471	205	64.4
MAX	352	444	423	288	603	586	8,940	3,350	2,270	670	366	135
MIN	278	262	148	150	260	466	510	2,280	680	324	63	30
AC-FT	18,160	18,530	15,860	13,500	22,330	32,350	263,900	160,200	78,380	28,950	12,590	3,830
CAL YR 1968	TOTAL	117,248	MEAN	320	MAX	700	MIN	71	AC-FT	232,600		
WTR YR 1969	TOTAL	337,116	MEAN	924	MAX	8,940	MIN	30	AC-FT	668,700		

5-0540. Red River of the North at Fargo, N. Dak.

LOCATION.--Lat $46^{\circ}51'40''$, long $96^{\circ}47'00''$, in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.18, T.139 N., R.48 W., Cass County, 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.

PERIOD OF RECORD.--May 1901 to current year. 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. 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. See WSP 1728 or 1913 for history of changes prior to Oct. 1, 1960.

AVERAGE DISCHARGE (UNADJUSTED).--68 years, 539 cfs (390,500 acre-ft per year); median of yearly mean discharges, 440 cfs (319,000 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 25,300 cfs Apr. 15 (gage height, 37.34 ft); minimum, 26 cfs Sept. 28 (gage height, 13.25 ft).

Period of record: Maximum discharge, 25,300 cfs Apr. 15, 1969 (gage height, 37.34 ft); 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1308: 1902-4, 1906-7, 1910-14, 1916, 1918, 1924. WSP 1388: 1905-6, 1917-20(M), 1935(M), 1938-39(M), 1943.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	283	293	199	240	240	450	410	6,550	2,520	692	392	78
2	283	288	227	240	250	450	430	6,150	2,480	692	410	76
3	283	293	277	240	260	450	489	5,800	2,440	700	386	76
4	288	304	368	240	260	450	510	5,500	2,380	700	333	76
5	288	310	356	240	260	460	496	5,200	2,270	692	310	78
6	283	316	277	240	260	490	552	4,900	2,120	676	293	70
7	288	310	190	240	260	500	772	4,650	2,020	652	293	65
8	288	310	200	240	260	500	1,910	4,400	1,950	628	293	62
9	293	304	230	240	270	500	3,940	4,250	1,890	575	293	59
10	288	299	240	240	270	500	6,170	3,750	1,860	531	283	59
11	283	293	257	240	270	490	9,580	3,600	1,830	496	251	62
12	283	288	260	230	270	490	14,300	3,400	1,750	517	241	60
13	277	272	270	225	280	480	21,700	3,250	1,630	545	227	50
14	267	288	270	225	300	480	24,800	3,090	1,540	582	203	40
15	267	310	260	230	310	480	23,900	2,990	1,440	740	199	30
16	267	333	240	230	310	480	21,600	2,920	1,340	644	186	33
17	283	333	240	230	300	480	19,800	2,830	1,280	620	194	35
18	304	316	240	225	300	475	18,200	2,790	1,230	545	186	39
19	304	272	250	225	280	475	16,900	2,780	1,190	489	177	33
20	322	251	250	225	280	475	15,400	2,780	1,110	404	177	28
21	327	208	250	225	280	475	13,700	2,770	1,010	350	160	29
22	322	190	250	225	300	475	12,100	2,750	941	1,160	148	35
23	310	241	250	230	400	482	11,000	2,730	869	1,680	133	32
24	304	362	250	230	450	456	10,100	2,720	820	1,030	114	33
25	293	410	250	230	500	462	9,400	2,700	844	692	101	33
26	288	362	220	230	500	475	8,850	2,670	804	524	88	33
27	288	272	210	230	500	517	8,300	2,650	780	442	81	37
28	288	241	220	230	480	524	7,950	2,600	740	392	76	41
29	293	190	220	230	-----	503	7,450	2,560	716	380	78	41
30	293	186	230	230	-----	503	7,000	2,530	692	380	91	52
31	299	-----	240	230	-----	482	-----	2,520	-----	374	88	-----
TOTAL	9,027	8,645	7,686	7,205	8,900	14,909	297,709	110,780	44,486	19,524	6,485	1,475
MEAN	291	288	248	232	318	481	9,924	3,574	1,483	630	209	49.2
MAX	327	410	368	240	500	524	24,800	6,550	2,520	1,680	410	78
MIN	267	186	190	225	240	450	410	2,520	692	350	76	28
AC-FT	17,910	17,150	15,250	14,290	17,650	29,570	590,500	219,700	88,240	38,730	12,860	2,930
+	857	784	804	847	777	826	784	973	933	950	1,404	888

ADJUSTED FOR DIVERSION IN ACRE-Feet BY CITIES OF FARGO AND MOORHEAD

MEAN	305	301	261	246	332	494	9,937	3,589	1,499	645	232	64
AC-FT	18,770	17,930	16,050	15,140	18,430	30,400	591,300	220,700	89,170	39,680	14,260	3,820
OBSERVED						ADJUSTED						
CAL YR 1968	TOTAL	125,321	MEAN	342	MAX	780	MIN	94	MEAN	356	AC-FT	268,000
WTR YR 1969	TOTAL	536,831	MEAN	1,471	MAX	24,800	MIN	28	MEAN	1,486	AC-FT	1,076,000

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

RED RIVER OF THE NORTH BASIN

5-0610. Buffalo River near Hawley, Minn.

LOCATION.--Lat 46°51'00", long 96°19'45", near center of SE $\frac{1}{4}$ sec.14, T.139 N., R.45 W., Clay County, near left downstream end of bridge on farm lane, 2 miles southwest of Hawley.

DRAINAGE AREA.--322 sq mi.

PERIOD OF RECORD.--March 1945 to current year.

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

AVERAGE DISCHARGE.--24 years, 73.0 cfs (52,890 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 1,880 cfs Apr. 9 (gage height, 9.07 ft); minimum, 4.8 cfs Aug. 27 (gage height, 2.70 ft).
 Period of record: Maximum discharge, 1,880 cfs Apr. 9, 1969 (gage height, 9.07 ft); maximum gage height, 9.31 ft Aug. 5, 1955; minimum discharge, 4.8 cfs Aug. 27, 1969; 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	31	23	18	14	15	16	177	64	29	38	14
2	21	31	22	18	14	15	16	168	67	29	37	14
3	20	31	22	18	14	15	17	162	66	28	32	11
4	21	30	22	18	14	15	19	168	63	28	29	11
5	21	30	21	18	14	14	27	178	63	27	26	16
6	21	29	21	18	14	14	45	191	60	26	24	18
7	20	30	20	18	14	14	147	182	57	25	22	18
8	21	29	20	18	14	14	591	171	54	26	20	19
9	22	29	20	17	15	14	1,620	162	51	26	19	18
10	24	29	20	17	15	14	1,670	153	48	25	18	16
11	26	26	20	17	15	15	1,390	145	47	23	16	16
12	25	23	20	17	15	15	1,260	136	44	21	16	15
13	24	23	20	17	15	15	1,220	128	42	20	15	14
14	24	25	19	17	15	15	1,190	121	39	19	14	14
15	23	25	19	17	15	15	1,050	114	38	83	14	14
16	24	25	19	17	15	15	943	107	36	181	13	13
17	29	25	19	17	15	15	801	105	34	134	12	13
18	46	24	19	17	15	15	683	101	31	93	11	13
19	64	23	19	16	15	15	598	100	30	77	11	12
20	60	23	19	16	15	15	530	95	28	69	11	12
21	51	23	19	16	16	15	475	90	28	64	11	12
22	44	23	19	16	16	15	430	86	28	66	10	12
23	42	24	19	16	16	15	381	84	29	70	9.8	12
24	38	24	19	16	16	15	332	86	29	69	9.8	12
25	35	24	19	15	16	15	292	84	31	62	9.5	13
26	34	24	18	15	16	16	259	79	43	56	9.5	13
27	34	24	18	15	16	16	232	74	39	51	7.5	13
28	34	23	18	15	15	16	212	68	36	48	8.7	13
29	33	23	18	15	-----	16	197	63	32	44	8.4	13
30	32	23	18	14	-----	16	186	58	29	41	12	17
31	32	-----	18	14	-----	16	-----	58	-----	39	13	-----
TOTAL	966	776	607	513	419	465	16,829	3,694	1,286	1,599	507.2	421
MEAN	31.2	25.9	19.6	16.5	15.0	15.0	561	119	42.9	51.6	16.4	14.0
MAX	64	31	23	18	16	16	1,670	191	67	181	38	19
MIN	20	23	18	14	14	14	16	58	28	19	7.5	11
AC-FT	1,920	1,540	1,200	1,020	831	922	33,380	7,330	2,550	3,170	1,010	835
CAL YR 1968	TOTAL 14,275		MEAN 39.0		MAX 189		MIN 12		AC-FT 28,310			
WTR YR 1969	TOTAL 28,082.2		MEAN 76.9		MAX 1,670		MIN 7.5		AC-FT 55,700			

5-0615. South Branch Buffalo River at Sabin, Minn.

LOCATION.--Lat 46°46'20", long 96°37'40", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.138 N., R.47 W., Clay County, near center of span on downstream side of highway bridge, 0.3 mile downstream from Stony Creek (revised) and 1 mile east of Sabin.

DRAINAGE AREA.--522 sq mi.

PERIOD OF RECORD.--March 1945 to current year.

GAGE.--Nonrecording 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, nonrecording gage at site 1 mile downstream at different datum.

AVERAGE DISCHARGE.--24 years, 57.1 cfs (41,370 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 6,410 cfs Apr. 10 (gage height, 18.12 ft); no flow Jan. 27 to Apr. 3. Period of record: Maximum discharge, 6,410 cfs Apr. 10, 1969 (gage height, 18.12 ft); no flow for many days in most years.

REMARKS.--Records good except those for winter period, which are fair.

REVISIONS (WATER YEARS).--WSP 1308: 1949(M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

JAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	52	15	2.0			0	61	13	15	37	1.5
2	7.4	51	15	1.8			0	54	12	15	32	1.8
3	6.7	50	15	1.6			0	52	12	14	26	3.1
4	7.2	50	14	1.5			.2	52	14	12	22	3.2
5	8.1	51	13	1.4			.5	55	18	11	20	13
6	8.8	49	12	1.3			6.5	69	18	10	17	10
7	9.7	46	12	1.0			85	78	17	9.3	14	6.8
8	11	41	11	.90			850	81	15	9.3	13	4.7
9	11	37	11	.80			4,900	80	14	9.1	11	4.7
10	12	34	10	.60			6,230	74	12	9.1	9.8	3.6
11	12	31	9.8	.50			4,960	67	10	8.9	8.6	3.1
12	13	30	9.4	.40			3,360	56	8.2	8.9	7.7	2.8
13	16	29	9.0	.40			1,880	49	8.1	8.7	6.5	2.5
14	22	28	8.6	.30			1,120	44	7.6	8.6	5.8	2.6
15	24	27	8.2	.30			841	41	7.6	12	5.0	2.6
16	29	27	7.8	.30			691	40	7.2	11	3.7	2.2
17	29	26	7.2	.20			591	39	7.2	10	3.2	1.6
18	31	25	6.6	.20			482	33	7.4	9.8	2.5	1.6
19	35	24	6.2	.20			363	28	6.7	11	2.5	1.6
20	43	23	5.7	.20			277	27	6.5	13	2.3	1.7
21	55	22	5.2	.20			226	29	6.9	15	1.4	2.2
22	70	21	4.8	.10			181	28	6.4	47	.80	2.6
23	75	20	4.4	.10			157	26	6.0	58	.70	2.6
24	74	19	4.1	.10			130	25	6.0	78	.70	2.2
25	71	19	3.8	.10			111	24	6.4	100	.70	1.8
26	65	19	3.5	.10			98	23	8.2	127	.70	1.4
27	62	18	3.1	0			87	22	8.4	140	.70	1.0
28	60	17	2.8	0			76	20	8.6	150	.90	1.5
29	56	16	2.6	0	-----		69	17	10	116	.80	2.2
30	54	15	2.3	0	-----		63	16	12	80	1.0	2.1
31	54	-----	2.1	0	-----		-----	15	-----	54	1.3	-----
TOTAL	1,041.9	917	245.2	16.60	0	0	27,835.2	1,325	300.4	1,180.7	259.30	94.3
MEAN	33.6	30.6	7.91	.54	0	0	928	42.7	10.0	38.1	8.36	3.14
MAX	75	52	15	2.0	0	0	6,230	81	18	150	37	13
MIN	6.7	15	2.1	0	0	0	0	15	6.0	8.6	.70	1.0
AC-FT	2,070	1,820	486	33	0	0	55,210	2,630	596	2,340	514	187

CAL YR 1968 TOTAL 8,215.20 MEAN 22.5 MAX 220 MIN 0 ACFT 16,290
WAT YR 1969 TOTAL 33,215.60 MEAN 91.0 MAX 6,230 MIN 0 ACFT 65,880

RED RIVER OF THE NORTH BASIN

5-0620. Buffalo River near Dilworth, Minn.

LOCATION.--Lat 46°57'40", long 96°39'40", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.6, T.140 N., R.47 W., Clay County, on left bank 4.5 miles southeast of Kragnes, 6.5 miles northeast of Dilworth, and 9 miles downstream from South Branch.

DRAINAGE AREA.--1,040 sq mi, approximately.

PERIOD OF RECORD.--March 1931 to current year. 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, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--38 years, 124 cfs (89,840 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 10,400 cfs Apr. 11 (gage height, 25.55 ft); minimum, 5.9 cfs Aug. 28, 29 (gage height, 2.02 ft).

Period of record: Maximum discharge, 10,400 cfs Apr. 11, 1969 (gage height, 25.55 ft); no flow at times in 1936.

REMARKS.--Records good except those for winter months, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1308: 1931(M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY		NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	41	70	40	20	15	16	25	304	90	42	138	10
2	39	68	40	20	15	16	26	284	88	38	109	11
3	40	67	39	20	15	15	26	267	93	36	89	11
4	38	66	38	19	15	15	29	257	94	38	76	12
5	35	64	35	19	15	15	32	265	93	41	66	16
6	34	64	33	19	15	15	38	267	92	41	61	38
7	34	64	32	19	14	15	70	272	90	41	50	50
8	34	63	31	18	14	15	160	284	87	41	43	38
9	32	62	30	18	14	15	1,400	287	81	40	39	30
10	33	59	30	18	14	16	9,160	276	77	40	35	24
11	36	54	29	18	14	16	9,890	259	73	38	31	22
12	38	51	28	18	14	16	7,720	242	68	38	27	19
13	41	50	27	18	14	16	5,220	223	65	36	23	17
14	43	50	27	18	15	16	3,850	204	62	34	21	16
15	45	51	27	17	15	16	2,950	190	58	34	18	16
16	47	52	26	17	15	16	2,470	181	55	152	17	14
17	50	52	26	17	15	17	2,170	175	51	186	15	12
18	52	51	25	17	15	17	1,920	168	47	197	14	12
19	61	50	25	17	15	18	1,680	163	44	161	14	12
20	76	48	24	17	15	18	1,460	151	42	121	12	11
21	88	47	23	16	15	18	1,250	145	41	97	11	12
22	85	47	23	16	16	19	1,060	139	41	89	9.6	12
23	81	46	23	16	16	20	908	135	41	101	8.1	12
24	87	45	22	16	16	20	774	133	43	145	7.5	11
25	94	45	22	16	16	21	655	131	44	153	7.7	11
26	92	44	22	16	16	21	565	129	45	154	7.3	12
27	97	43	21	16	16	22	478	122	50	165	6.5	12
28	81	43	21	15	16	23	411	115	55	186	6.1	13
29	78	42	21	15	-----	24	360	106	55	200	6.1	14
30	76	41	20	15	-----	24	327	97	49	196	7.5	16
31	73	-----	20	15	-----	24	-----	92	-----	168	7.5	-----
TOTAL	1,771	1,599	850	536	420	555	57,084	6,063	1,914	3,049	982.9	516
MEAN	57.1	53.3	27.4	17.3	15.0	17.9	1,903	196	63.8	98.4	31.7	17.2
MAX	94	70	40	20	16	24	9,890	304	94	200	138	50
MIN	32	41	20	15	14	15	25	92	41	34	6.1	10
AC-FT	3,510	3,170	1,690	1,060	833	1,100	113,200	12,030	3,800	6,050	1,950	1,020

CAL YR 1968: TOTAL 24,046.0 MEAN 65.9 MAX 397 MIN 9.4 AC-FT 47,600
 WTR YR 1969: TOTAL 75,339.9 MEAN 206 MAX 9,890 MIN 6.1 AC-FT 149,400

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., Norman County, on left bank 100 ft upstream from highway bridge, 0.8 mile northeast of village of Twin Valley, and 2 miles upstream from small tributary.

DRAINAGE AREA.--888 sq mi.

PERIOD OF RECORD.--June 1909 to September 1917, July 1930 to current year. Monthly discharge only for some periods, published in WSP 1308.

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

AVERAGE DISCHARGE.--47 years, 165 cfs (119,500 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 4,850 cfs Apr. 10 (gage height, 11.83 ft); maximum gage height, 12.00 ft Apr. 9 (backwater from ice); minimum discharge, 16 cfs Aug. 29 (gage height, 1.06 ft).
Period of record: 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 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	75	145	61	58	52	66	69	729	352	101	72	47
2	75	149	64	57	52	66	68	693	451	101	83	41
3	32	145	64	57	52	65	67	669	495	88	72	39
4	82	135	63	57	53	65	66	646	469	87	63	32
5	78	129	60	56	53	65	66	638	426	81	59	39
6	72	131	58	56	54	64	72	625	402	76	71	46
7	74	129	56	56	54	64	150	612	378	72	77	50
8	95	126	55	56	55	63	750	589	352	72	67	58
9	104	122	55	56	55	62	2,400	562	327	67	62	51
10	100	98	56	56	56	62	4,230	540	308	66	59	43
11	104	82	58	56	56	62	3,640	526	291	72	50	37
12	103	70	60	56	57	62	3,150	509	278	71	48	32
13	93	76	61	56	58	62	2,680	483	258	63	46	29
14	98	88	62	56	59	62	2,310	451	242	75	44	27
15	95	92	62	56	59	62	2,110	422	221	158	43	26
16	101	90	62	56	60	62	1,970	424	210	112	42	25
17	101	86	62	56	60	63	1,830	433	196	101	38	23
18	114	80	61	56	61	63	1,680	465	182	85	34	23
19	133	75	61	56	62	64	1,550	420	164	82	31	22
20	166	70	60	56	63	64	1,430	391	153	75	29	20
21	178	77	60	56	64	65	1,370	374	138	71	28	19
22	174	85	60	55	64	65	1,280	352	126	74	27	22
23	172	88	60	55	65	66	1,220	339	121	72	25	23
24	166	86	59	55	66	66	1,150	333	126	72	23	24
25	153	85	59	54	66	67	1,070	320	138	75	22	26
26	153	80	59	54	66	67	989	308	168	73	20	27
27	153	69	58	54	66	67	916	291	153	68	19	29
28	151	60	58	54	66	68	855	282	153	72	18	27
29	151	56	58	53	-----	66	807	267	138	75	19	27
30	133	57	58	53	-----	66	765	250	111	73	42	26
31	135	-----	58	53	-----	67	-----	280	-----	77	42	-----
TOTAL	3,669	2,861	1,848	1,721	1,654	1,996	40,710	14,223	7,527	2,507	1,375	960
MEAN	118	95.4	59.6	55.5	59.1	64.4	1,357	459	251	80.9	44.4	32.0
MAX	178	149	64	58	66	67	4,230	729	495	158	83	58
MIN	72	56	55	53	52	62	66	250	111	63	18	19
AC-FT	7,280	5,670	3,670	3,410	3,280	3,960	80,750	28,210	14,930	4,970	2,730	1,900
CAL YR 1968	TOTAL 48,117		MEAN 131		MAX 562		MIN 18		AC-FT 95,440			
WTR YR 1969	TOTAL 81,051		MEAN 222		MAX 4,230		MIN 18		AC-FT 160,800			

RED RIVER OF THE NORTH BASIN

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., Norman County, near center of span on downstream side of highway bridge, 0.5 mile east of Hendrum and 4 miles upstream from mouth.

DRAINAGE AREA.--1,600 sq mi, approximately.

PERIOD OF RECORD.--March 1944 to current year.

GAGE.--Nonrecording gage and crest stage gage. Datum of gage is 836.75 ft above mean sea level, datum of 1929 (levels by Corps of Engineers).

AVERAGE DISCHARGE.--25 years, 232 cfs (168,100 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 8,300 cfs Apr. 15 (gage height, 31.42 ft); minimum, 19 cfs Aug. 28, 29 (gage height, 2.07 ft).
Period of record: Maximum discharge, 8,300 cfs Apr. 15, 1969 (gage height, 31.42 ft); 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 3.5 miles east of Ada. Another diversion into Marsh River basin, formed 1.5 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1728: 1958.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	95	147	60	58	55	74	84	1,000	390	154	92	40
2	89	152	65	58	54	73	86	940	480	139	93	44
3	86	155	70	58	54	73	88	890	580	143	94	41
4	88	150	70	57	54	72	90	850	587	135	84	39
5	90	147	63	56	55	72	96	800	550	131	78	58
6	93	138	60	56	55	72	108	740	478	122	75	63
7	89	133	58	56	55	71	170	700	450	114	85	68
8	83	133	57	56	55	71	370	660	412	107	86	62
9	88	134	58	56	55	70	1,600	640	379	106	80	62
10	113	135	59	56	56	70	3,060	630	354	101	64	62
11	111	120	60	56	56	68	4,500	610	337	99	53	62
12	111	99	61	56	58	68	6,640	584	318	98	46	46
13	120	98	62	56	58	67	7,640	553	302	97	48	42
14	128	101	63	56	59	67	8,120	515	283	96	50	33
15	113	107	64	56	60	66	8,140	475	265	264	52	26
16	115	109	64	56	62	66	6,200	502	246	577	46	26
17	119	110	65	56	63	66	4,620	491	237	499	39	28
18	134	104	65	56	64	66	3,120	499	223	391	39	25
19	148	90	64	56	66	67	2,630	524	207	282	40	25
20	170	75	64	56	67	68	2,140	483	190	202	42	22
21	197	74	64	56	68	68	1,880	431	176	157	38	22
22	205	78	63	55	69	70	1,730	389	171	147	34	25
23	199	86	63	55	70	70	1,670	354	182	143	27	24
24	197	91	62	55	70	71	1,620	360	163	143	30	22
25	195	90	62	55	71	72	1,550	365	197	129	26	21
26	190	82	61	55	72	74	1,480	348	186	117	26	20
27	176	70	61	55	73	75	1,390	333	200	103	20	20
28	172	60	60	55	73	76	1,290	309	211	98	19	31
29	162	58	60	55	-----	78	1,170	300	195	99	19	31
30	164	58	59	55	-----	80	1,060	291	189	103	26	35
31	166	-----	59	55	-----	82	-----	318	-----	100	32	-----
TOTAL	4,206	3,184	1,926	1,733	1,727	2,203	74,342	16,884	9,138	5,196	1,583	1,125
MEAN	136	106	62.1	55.9	61.7	71.1	2,478	545	305	168	51.1	37.5
MAX	205	155	70	58	73	82	8,140	1,000	587	577	94	68
MIN	83	58	57	55	54	66	84	291	163	96	19	20
AC-FT	8,340	6,320	3,820	3,440	3,430	4,370	147,500	33,490	18,130	10,310	3,140	2,230
CAL YR 1968	TOTAL	56,675	MEAN 155	MAX 690	MIN 17	ACFT 112,400						
WAT YR 1969	TOTAL	123,247	MEAN 338	MAX 8,140	MIN 19	ACFT 244,500						

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.14S N., R.49 W., Traill County, on left bank on upstream side of highway bridge, 0.5 mile west of Halstad, 2.5 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).

PERIOD OF RECORD.--April 1936 to June 1937 (no winter records), April 1942 to September 1960 (spring and summer months only), May 1961 to current year.

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

AVERAGE DISCHARGE.--8 years, 1,948 cfs (1,411,000 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 35,700 cfs Apr. 18 (gage height, 38.29 ft); minimum, 178 cfs Sept. 27, 28 (gage height, 2.30 ft).

Period of record: Maximum discharge, 35,700 cfs Apr. 18, 1969 (gage height, 38.29 ft); 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.

REVISIONS (WATER YEARS).--WSP 1388: 1936, 1950. WSP 1728: Drainage area.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	441	567	600	310	345	825	930	17,500	3,610	1,370	1,260	250
2	447	567	600	315	360	830	910	15,900	3,820	1,340	1,170	261
3	438	567	575	320	380	830	860	14,200	3,720	1,330	1,100	250
4	426	561	600	320	400	825	850	12,900	3,640	1,350	1,040	238
5	432	558	650	320	410	825	930	11,700	3,570	1,340	963	261
6	438	555	660	325	420	825	970	10,900	3,450	1,300	900	285
7	444	552	650	325	420	845	1,000	9,810	3,250	1,260	840	294
8	444	564	650	330	420	865	1,480	8,720	3,050	1,240	780	285
9	441	570	650	335	420	880	5,070	7,640	2,900	1,250	720	261
10	444	558	600	335	430	900	8,900	6,680	2,790	1,270	660	270
11	450	531	525	330	430	900	14,600	6,000	2,710	1,240	600	275
12	471	498	525	325	440	900	24,700	5,600	2,620	1,200	550	257
13	450	498	510	320	450	900	30,700	5,310	2,530	1,170	500	227
14	441	519	500	320	475	900	33,300	5,040	2,420	1,180	475	208
15	441	531	500	320	500	900	34,600	4,740	2,300	1,620	450	194
16	438	510	450	330	525	890	35,200	4,680	2,160	2,480	425	191
17	435	540	450	340	550	890	35,600	4,750	2,030	3,040	410	192
18	459	596	400	340	560	910	35,600	4,690	1,920	3,480	400	190
19	489	580	350	340	575	950	35,100	4,800	1,820	3,690	393	188
20	540	490	325	340	600	970	34,200	4,700	1,740	3,490	384	186
21	564	500	345	340	640	990	33,200	4,370	1,660	3,020	369	185
22	602	525	350	345	650	990	32,100	4,110	1,570	2,480	358	184
23	654	525	350	345	660	1,000	30,900	3,980	1,490	2,650	350	182
24	675	500	350	340	680	1,000	29,600	3,930	1,430	3,900	344	181
25	672	500	350	340	710	1,030	28,100	3,870	1,390	4,070	325	181
26	650	525	350	340	750	1,030	26,500	3,770	1,430	3,450	292	179
27	623	575	350	335	800	1,020	24,600	3,700	1,480	2,680	268	178
28	619	600	325	335	810	1,000	22,400	3,640	1,530	2,070	246	178
29	602	600	300	335	-----	980	20,600	3,560	1,480	1,700	231	179
30	596	600	300	340	-----	960	19,000	3,490	1,420	1,470	259	192
31	582	-----	310	345	-----	940	-----	3,470	-----	1,350	246	-----
TOTAL	15,848	16,362	14,450	10,280	14,810	28,500	602,500	208,150	70,930	64,480	17,308	6,582
MEAN	511	545	466	332	529	919	20,080	6,715	2,364	2,080	558	219
MAX	675	600	660	345	810	1,030	35,600	17,500	3,820	4,070	1,260	294
MIN	426	490	300	310	345	825	850	3,470	1,390	1,170	231	178
AC-FT	31,430	32,450	28,660	20,390	29,380	56,530	1,195M	412,900	140,700	127,900	34,330	13,060
CAL YR 1968	TOTAL	282,628	MEAN	772	MAX	2,340	MIN	220	AC-FT	560,600		
WTR YR 1969	TOTAL	1,070,200	MEAN	2,932	MAX	35,600	MIN	178	AC-FT	2,123,000		

M Expressed in thousands.

RED RIVER OF THE NORTH BASIN

5-0675. Marsh River near Shelly, Minn.

LOCATION.--Lat 47°24'45", long 96°45'50", in NE 1/4 sec. 3, T.14S N., R.48 W., Norman County, near center of span on downstream truss of bridge, 3.8 miles southeast of Shelly and 10 miles upstream from mouth.

DRAINAGE AREA.--151 sq mi.

PERIOD OF RECORD.--March 1944 to current year. Monthly discharge only for March 1944, published in WSP 1308.

GAGE.--Nonrecording 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, nonrecording gage at datum 3.0 ft higher.

AVERAGE DISCHARGE.--25 years, 79.5 cfs (57,600 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 3,910 cfs Apr. 12 (gage height, 22.28 ft); no flow for many days. Period of record: Maximum discharge, 4,660 cfs May 11, 1950 (gage height, 21.96 ft, from floodmark, present datum); no flow for many days most years.

REMARKS.--Records fair. Large part of high flow of Wild Rice River diverted into Marsh River basin at overflow section 3.5 miles east of Ada. Another diversion from Wild Rice River formed 1 mile southeast of Ada supplemented flow at all stages 1947-51, after which it was closed except for small regulated flow diverted at same point for abatement of pollution from Ada sewage plant effluent.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							0	20	38	3.1	11	.20
2							0	17	170	2.6	11	.80
3							0	17	157	2.2	10	.70
4							0	15	100	2.6	7.9	.60
5							0	17	64	2.2	6.7	3.0
6							0	19	45	1.8	6.9	2.0
7							.3	25	32	1.3	6.3	3.1
8							7.0	24	26	1.1	7.5	4.6
9							230	22	20	1.0	5.5	6.3
10							550	20	15	.60	4.8	8.8
11							1,970	19	12	.70	5.0	7.3
12							3,800	17	9.8	.40	4.6	5.7
13							3,420	16	8.1	.10	3.1	4.6
14							2,950	15	6.1	.40	2.3	3.6
15							1,900	13	4.8	167	1.6	2.9
16							950	18	4.2	283	.90	1.9
17							600	219	2.5	216	.80	1.5
18							490	138	1.6	147	.60	1.2
19							380	70	1.1	100	.40	.90
20							185	44	.80	72	.40	.80
21							150	32	.70	53	.10	.80
22							125	25	.60	48	.20	1.0
23							105	23	.50	41	.20	.80
24							92	28	.80	34	.10	1.6
25							80	24	2.5	30	.10	1.5
26							75	21	3.1	27	.10	1.1
27							67	16	3.6	23	.10	.60
28							54	13	4.3	20	.10	.80
29							48	10	3.4	17	.10	.70
30							26	7.9	3.1	16	.20	.70
31								9.0		13	.20	
TOTAL	0	0	0	0	0	0	18,254.3	973.9	740.60	1,327.10	98.80	70.10
MEAN	0	0	0	0	0	0	608	31.4	24.7	42.8	3.19	2.34
MAX	0	0	0	0	0	0	3,800	219	170	283	11	8.8
MIN	0	0	0	0	0	0	0	7.9	.50	.10	.10	.20
AC-FT	0	0	0	0	0	0	36,210	1,930	1,470	2,630	196	139
CAL YR 1968	TOTAL	1,643.00	MEAN	4.50	MAX	175	MIN	0	ACFT	3,260		
WAT YR 1969	TOTAL	21,464.80	MEAN	58.8	MAX	3,800	MIN	0	ACFT	42,580		

RED RIVER OF THE NORTH BASIN

47

5-0690. Sandhill River at Climax, Minn.

LOCATION.--Lat 47°36'43", long 96°48'52", in NE 1/4 sec. 30, T.148 N., R.48 W., Polk County, near center of span on downstream side of bridge on U.S. Highway 75 in Climax and 3.7 miles upstream from mouth.

PERIOD OF RECORD.--March 1943 to current year (winter records incomplete in some years). Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 820.10 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Oct. 1, 1966, nonrecording gage at site 3.2 miles upstream at datum 12.78 ft higher.

AVERAGE DISCHARGE.--23 years (1946-69), 64.8 cfs (46,950 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 4,180 cfs Apr 14 (result of discharge measurement); maximum gage height, 28.32 ft Apr. 17 (from floodmark, backwater from Red River of the North); minimum daily discharge, 4.5 cfs Jan. 17-28.

Period of record: Maximum discharge, 4,560 cfs Apr. 14, 1965 (gage height, 17.81 ft, site and datum then in use); maximum gage height, 28.32 ft Apr. 17, 1969 (from floodmark, backwater from Red River of the North); minimum discharge not determined.

REMARKS.--Records poor.

REVISIONS (WATER YEARS).--WSP 1388: 1943(M), 1944, 1947(M). WSP 1728: 1951(M), 1960 (Average discharge).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	24	19	5.4	4.7	7.4	8.5	136	160	85	29	28
2	12	23	19	5.2	4.7	7.5	8.6	112	185	78	28	27
3	10	23	18	5.1	4.6	7.5	8.7	95	205	74	28	25
4	10	22	18	5.1	4.6	7.4	8.8	84	210	68	28	24
5	11	22	17	5.0	4.6	7.3	9.0	88	203	58	26	28
6	11	22	17	5.0	4.6	7.2	9.3	92	180	53	30	33
7	12	21	16	4.8	4.6	7.2	10	105	160	43	33	38
8	11	21	16	4.8	4.6	7.1	20	99	140	37	32	41
9	10	20	15	4.7	4.7	7.1	120	96	125	35	31	42
10	11	19	15	4.7	4.7	7.1	520	92	110	32	30	39
11	12	18	15	4.7	4.8	7.0	700	85	97	31	27	36
12	13	18	14	4.7	4.9	7.0	1,350	75	90	28	24	33
13	14	17	14	4.6	5.0	7.0	2,420	64	82	28	23	29
14	16	17	13	4.6	5.1	7.0	3,850	58	75	26	22	25
15	18	16	13	4.6	5.3	7.1	3,050	95	70	40	21	23
16	23	16	13	4.6	5.6	7.1	2,050	180	62	125	20	21
17	28	16	12	4.5	5.9	7.2	1,650	250	56	110	18	19
18	31	17	12	4.5	6.1	7.2	1,030	240	50	90	16	18
19	34	17	12	4.5	6.3	7.3	630	225	46	70	12	17
20	35	18	12	4.5	6.5	7.4	435	215	44	55	13	17
21	36	18	11	4.5	6.6	7.6	330	205	45	47	11	18
22	35	19	11	4.5	6.8	7.8	270	190	48	42	10	20
23	33	20	10	4.5	6.9	7.8	230	175	52	39	9.7	19
24	31	20	9.5	4.5	7.0	7.9	215	160	55	37	9.4	18
25	29	20	8.7	4.5	7.0	8.0	208	140	65	35	9.4	18
26	28	20	8.0	4.5	7.2	8.0	201	128	80	33	8.7	17
27	27	20	7.3	4.5	7.2	8.1	198	118	100	32	8.4	17
28	26	19	6.8	4.5	7.4	8.2	190	108	110	30	8.1	18
29	25	19	6.4	4.6	-----	8.2	175	100	100	30	8.1	18
30	25	19	6.0	4.7	-----	8.3	166	95	92	29	30	19
31	24	-----	5.6	4.7	-----	8.4	-----	115	-----	30	28	-----
TOTAL	651	581	390.3	145.6	158.0	232.4	20,070.9	4,020	3,097	1,550	631.8	745
MEAN	21.0	19.4	12.6	4.70	5.64	7.50	669	130	103	50.0	20.4	24.8
MAX	36	24	19	5.4	7.4	8.4	3,850	250	210	125	33	42
MIN	10	16	5.6	4.5	4.6	7.0	8.5	58	44	26	8.1	17
AC-FT	1,290	1,150	774	289	313	461	39,810	7,970	6,140	3,070	1,250	1,480

CAL YR 1968 TOTAL 18,911.8 MEAN 51.8 MAX 1,320 MIN 5.6 ACFT 37,510
 WAT YR 1969 TOTAL 32,273.0 MEAN 88.4 MAX 3,850 MIN 4.5 ACFT 64,010

NOTE.--No gage-height record Dec. 12 to Jan. 10, Feb. 24 to Mar. 25, June 12 to July 11.

RED RIVER OF THE NORTH BASIN

5-0740. Lower Red Lake near Red Lake, Minn.

LOCATION.--Lat 47°57'27", long 95°16'34", in NW¼ sec.28, T.152 N., R.36 W., Clearwater County, on left bank just upstream from dam at outlet, 13 miles northwest of village of Red Lake.

DRAINAGE AREA.--1,950 sq mi, approximately.

PERIOD OF RECORD.--June 1930 to November 1932 (published as Red Lake at Redby), May 1933 to current year (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.--Current year: Maximum gage height, 7.03 ft July 30 (affected by wind action); maximum daily, 6.43 ft June 2; minimum, 4.64 ft Apr. 2; minimum daily, 4.80 ft Apr. 2.

Period of record: 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 1968 to September 1969

Oct. 31	5.38	Feb. 28	5.07	June 30	6.07
Nov. 28	5.11	Mar. 31	4.90	July 31	6.05
Dec. 31	5.18	Apr. 30	5.88	Aug. 31	5.74
Jan. 31	5.29	May 31	6.37	Sept. 30	5.40

NOTE.--Mean daily gage heights are available.

5-0745. Red Lake River near Red Lake, Minn.

LOCATION.---Lat 47°57'27", long 95°16'35", in NW 1/4 sec.28, T.152 N., R.36 W., Clearwater County, 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.

PERIOD OF RECORD.---May 1933 to current year. 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, nonrecording 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.---36 years, 441 cfs (319,500 acre-ft per year).

EXTREMES.---Current year: Maximum daily discharge, 1,200 cfs June 5, 6, 7, 8; maximum gage height, 7.36 ft Aug. 6 (affected by backwater from aquatic vegetation); minimum discharge, 114 cfs Apr. 8 (gage height, 1.76 ft).

Period of record: Maximum discharge, 3,600 cfs June 25, 1950 (gage height, 11.19 ft, affected by seiches and backwater from aquatic vegetation, present datum), from rating curve extended above 1,400 cfs; no flow at times.

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	567	655	1,020	1,000	1,150	1,130	1,110	908	1,160	1,100	756	972
2	595	277	727	1,000	1,160	1,130	1,110	930	1,180	1,100	752	980
3	592	203	180	1,010	1,160	1,130	1,110	930	1,160	1,100	748	968
4	578	186	252	1,010	1,160	1,120	1,090	934	1,180	1,100	748	984
5	567	186	960	1,020	1,160	1,120	1,100	957	1,200	1,100	752	992
6	570	184	1,040	1,020	1,170	1,120	1,090	980	1,200	1,100	767	1,000
7	567	165	1,020	1,020	1,170	1,120	298	961	1,200	1,100	748	1,020
8	564	180	1,020	1,030	1,170	1,120	124	961	1,200	1,100	752	1,020
9	581	179	1,010	1,030	1,180	1,120	130	953	1,190	1,090	756	1,020
10	556	182	1,000	1,040	1,180	1,120	135	961	1,190	1,080	752	1,020
11	550	182	1,000	1,040	1,170	1,120	126	949	1,190	1,050	752	1,020
12	532	177	990	1,040	1,170	1,120	135	946	1,180	1,030	748	1,010
13	522	212	990	1,040	1,170	1,120	148	934	1,160	1,000	752	1,020
14	412	623	980	1,040	1,170	1,120	146	949	1,130	1,000	748	1,020
15	281	730	980	1,040	1,160	1,120	152	972	1,120	988	741	1,020
16	260	815	970	1,050	1,160	1,120	165	1,010	1,120	930	734	1,020
17	260	837	970	1,060	1,160	1,120	180	1,020	1,120	911	745	1,020
18	265	848	970	1,070	1,160	1,120	180	1,020	1,120	893	745	1,020
19	260	835	970	1,080	1,150	1,120	180	1,030	1,110	882	830	1,010
20	249	805	960	1,090	1,150	1,120	184	1,030	1,110	885	848	999
21	245	790	960	1,100	1,150	1,120	196	1,040	1,110	870	856	1,010
22	247	850	960	1,100	1,150	1,120	172	1,030	1,110	867	867	1,020
23	233	878	960	1,110	1,150	1,120	165	1,040	1,110	867	874	1,020
24	225	863	970	1,110	1,140	1,110	162	1,050	1,110	837	885	1,020
25	223	848	970	1,120	1,140	1,100	206	1,050	1,110	833	896	1,010
26	227	859	970	1,130	1,140	1,100	314	1,060	1,100	815	900	1,010
27	231	845	980	1,140	1,130	1,100	323	1,060	1,100	819	911	1,020
28	229	810	980	1,140	1,130	1,100	304	1,070	1,100	815	938	999
29	507	848	990	1,150	-----	1,090	296	1,080	1,100	804	938	1,010
30	826	934	990	1,150	-----	1,080	584	1,100	1,100	796	957	1,000
31	863	-----	990	1,150	-----	1,100	-----	1,120	-----	767	957	-----
TOTAL	13,384	16,986	28,729	33,130	32,410	34,570	11,615	31,035	34,270	29,629	25,153	30,254
MEAN	432	566	927	1,069	1,158	1,115	387	1,001	1,142	956	811	1,008
MAX	863	934	1,040	1,150	1,180	1,130	1,110	1,120	1,200	1,100	957	1,020
MIN	223	165	180	1,000	1,130	1,080	124	908	1,100	767	734	968
AC-FT	26,550	33,690	56,980	65,710	64,290	68,570	23,040	61,560	67,970	58,770	49,890	60,010
CAL YR 1968	TOTAL 131,852		MEAN 361	MAX 1,040	MIN 2	ACFT 261,500						
WAT YR 1969	TOTAL 321,165		MEAN 880	MAX 1,200	MIN 124	ACFT 637,000						

RED RIVER OF THE NORTH BASIN

5-0750. Red Lake River at High Landing, near Goodridge, Minn.

LOCATION.--Lat $48^{\circ}02'34''$, long $95^{\circ}48'28''$, on line between secs. 28 and 29, T.153 N., R.40 W., Pennington County, 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.

PERIOD OF RECORD.--September 1929 to current year. 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). See WSP 1308 or 1738 for history of changes prior to Oct. 1, 1949.

AVERAGE DISCHARGE.--40 years, 472 cfs (342,000 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 2,320 cfs Apr. 10 (gage height, 10.49 ft); minimum, 394 cfs Nov. 12 (gage height, 3.82 ft, result of freeze up).

Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	648	1,050	1,190	1,070	1,180	1,150	1,100	1,040	1,210	1,120	746	1,040
2	646	1,080	1,130	1,070	1,190	1,150	1,120	1,250	1,280	1,100	732	1,040
3	644	755	880	1,070	1,190	1,150	1,140	1,320	1,310	1,090	730	1,060
4	644	539	580	1,070	1,190	1,150	1,160	1,340	1,410	1,090	725	1,070
5	646	485	405	1,070	1,190	1,150	1,180	1,370	1,410	1,090	725	1,090
6	638	464	580	1,070	1,190	1,140	1,200	1,380	1,360	1,090	757	1,120
7	629	450	1,000	1,070	1,190	1,140	920	1,360	1,340	1,090	809	1,130
8	625	441	1,080	1,070	1,180	1,140	1,350	1,340	1,300	1,070	797	1,140
9	650	436	1,070	1,070	1,170	1,140	1,950	1,320	1,260	1,050	776	1,140
10	663	430	1,070	1,070	1,160	1,140	2,170	1,290	1,250	1,010	764	1,150
11	657	427	1,070	1,060	1,160	1,140	2,220	1,270	1,270	991	757	1,150
12	650	427	1,080	1,060	1,170	1,130	2,050	1,250	1,260	967	750	1,150
13	650	510	1,080	1,060	1,170	1,130	2,080	1,230	1,250	944	760	1,160
14	636	690	1,080	1,060	1,170	1,130	2,080	1,220	1,240	932	764	1,160
15	595	1,050	1,080	1,050	1,160	1,130	1,970	1,280	1,220	919	760	1,170
16	486	1,080	1,080	1,050	1,160	1,130	1,880	1,380	1,210	904	750	1,170
17	435	1,090	1,080	1,060	1,160	1,120	1,760	1,500	1,190	886	753	1,170
18	467	1,080	1,080	1,070	1,160	1,120	1,650	1,520	1,180	879	753	1,180
19	517	910	1,080	1,070	1,160	1,120	1,530	1,480	1,170	869	762	1,200
20	522	760	1,080	1,080	1,160	1,120	1,410	1,440	1,150	855	783	1,200
21	521	900	1,080	1,080	1,160	1,110	1,290	1,410	1,150	838	812	1,210
22	510	1,080	1,080	1,090	1,150	1,110	1,190	1,380	1,150	831	833	1,240
23	497	1,120	1,070	1,100	1,150	1,110	1,090	1,340	1,160	814	850	1,240
24	486	1,120	1,070	1,100	1,150	1,110	1,010	1,310	1,160	792	867	1,240
25	477	1,100	1,070	1,110	1,150	1,110	912	1,300	1,170	778	884	1,250
26	467	1,050	1,070	1,120	1,150	1,110	926	1,290	1,200	773	904	1,240
27	450	980	1,070	1,130	1,150	1,110	949	1,250	1,180	773	916	1,240
28	453	950	1,070	1,140	1,150	1,100	897	1,210	1,160	760	926	1,240
29	445	1,060	1,070	1,150	-----	1,100	843	1,180	1,150	741	952	1,250
30	607	1,170	1,070	1,160	-----	1,100	809	1,180	1,140	730	1,000	1,250
31	889	-----	1,070	1,170	-----	1,100	-----	1,200	-----	753	1,030	-----
TOTAL	17,850	24,684	31,565	33,670	32,670	34,890	41,836	40,630	36,890	28,529	25,127	35,090
MEAN	576	823	1,018	1,086	1,167	1,125	1,395	1,311	1,230	920	811	1,170
MAX	889	1,170	1,190	1,170	1,190	1,150	2,220	1,520	1,410	1,120	1,030	1,250
MIN	435	427	405	1,050	1,150	1,100	809	1,040	1,140	730	725	1,040
AC-FT	35,410	48,960	62,610	66,780	64,800	69,200	82,980	80,590	73,170	56,590	49,840	69,600
CAL YR 1968	TOTAL 181,384		MEAN 496		MAX 2,750		MIN 18		AC-FT 359,800			
WTR YR 1969	TOTAL 383,431		MEAN 1,050		MAX 2,220		MIN 405		AC-FT 760,500			

5-0760. Thief River near Thief River Falls, Minn.

LOCATION.--Lat 48°11'08", long 96°10'11", in NW¼SW¼ sec.3, T.154 N., R.43 W., Marshall County, on right bank 0.2 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.

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

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

AVERAGE DISCHARGE.--52 years, 152 cfs (110,100 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 3,190 cfs Apr. 13 (gage height, 13.55 ft); maximum gage height, 14.99 ft Apr. 11 (backwater from ice); minimum discharge, 0.1 cfs Sept. 19, 20.

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 925: Drainage area. WSP 1308: 1917(M), 1924(M), 1929(M), 1931-33(M), 1935(M), 1937(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	130	306	203	44	39	24	11	1,560	698	29	4.5	.81
2	133	304	201	44	39	24	10	1,480	670	11	2.4	.64
3	132	303	198	43	38	23	9.8	1,410	692	25	2.4	.56
4	151	302	190	43	37	23	10	1,390	531	30	2.0	.49
5	199	336	182	43	37	22	11	1,360	384	13	.66	2.9
6	201	349	173	42	36	22	12	1,340	273	22	.42	6.6
7	200	349	160	42	36	21	14	1,270	147	22	.55	2.1
8	202	312	152	42	35	20	25	1,180	134	20	3.8	.49
9	206	276	149	42	35	20	200	1,180	111	14	4.8	.41
10	205	256	145	42	35	19	1,040	1,190	96	4.5	4.7	.77
11	205	250	143	41	34	18	2,740	1,160	96	4.0	4.6	.40
12	204	244	136	41	34	17	3,080	1,110	92	3.9	4.4	.46
13	201	240	125	41	33	16	3,170	1,130	81	4.4	5.6	.57
14	199	237	103	41	33	16	3,080	1,040	73	9.7	3.2	.55
15	200	235	85	41	32	15	3,010	1,130	68	9.1	1.9	.51
16	201	233	75	41	32	15	2,970	1,180	60	8.2	1.6	.37
17	208	231	67	42	31	14	2,920	1,230	55	8.6	.49	.25
18	216	229	61	43	31	14	2,860	1,210	47	7.6	.92	.21
19	234	227	56	44	31	14	2,820	1,190	43	6.7	.53	.17
20	251	225	53	45	30	14	2,730	1,170	38	5.5	.30	.14
21	249	223	51	45	29	14	2,540	1,160	35	4.6	.31	.16
22	270	221	50	45	28	14	2,340	1,080	35	4.1	.61	.23
23	268	220	49	45	27	14	2,190	1,030	31	3.8	.64	.26
24	259	218	48	44	26	14	2,040	1,040	16	3.3	.58	.29
25	252	217	48	44	26	15	1,900	1,030	15	2.4	.53	.31
26	246	215	47	43	25	15	1,840	975	46	2.1	.53	.28
27	239	213	46	43	24	15	1,800	930	48	.61	.48	.26
28	232	211	46	42	24	15	1,730	851	48	.61	.46	.27
29	226	209	46	42	-----	14	1,650	806	43	.96	.53	.28
30	222	207	45	41	-----	13	1,600	790	40	3.2	.46	.31
31	292	-----	45	40	-----	12	-----	777	-----	5.2	.80	-----
TOTAL	6,633	7,598	3,178	1,321	897	526	50,352.8	35,379	4,746	289.08	55.70	22.05
MEAN	214	253	103	42.6	32.0	17.0	1,678	1,141	158	9.33	1.80	.74
MAX	292	349	203	45	39	24	3,170	1,560	698	30	5.6	6.6
MIN	130	207	45	40	24	12	9.8	777	15	.61	.30	.14
AC-FT	13,160	15,070	6,300	2,620	1,780	1,040	99,870	70,170	9,410	573	110	44
CAL YR 1968	TOTAL 113,353.20			MEAN 310		MAX 1,920		MIN 0		AC-FT 224,800		
WTR YR 1969	TOTAL 110,997.63			MEAN 304		MAX 3,170		MIN .14		AC-FT 220,200		

RED RIVER OF THE NORTH BASIN

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., Clearwater County, on downstream side of bridge on County Highway 17, 4 miles upstream from mouth, and 4.8 miles east of Gonvick.

DRAINAGE AREA.--45.2 sq mi.

PERIOD OF RECORD.--April 1960 to current year. Monthly and daily figures for Apr. 1, 1960 to June 30, 1960, published in WSP 1913.

GAGE.--Nonrecording 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.--9 years, 14.5 cfs (10,510 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 232 cfs Apr. 9 (gage height, 6.62 ft, from graph based on gage readings, backwater from ice); minimum discharge, 0.7 cfs Aug. 25, 26 (gage height, 1.12 ft).
Period of record: Maximum discharge, 453 cfs Mar. 30, 1967 (gage height, 6.35 ft, from graph based on gage readings); maximum gage height, 6.62 ft Apr. 9, 1969 (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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.8	5.0	3.9	2.4	2.7	3.7	3.0	12	30	4.3	3.4	5.2
2	2.8	4.1	4.0	2.4	2.8	3.6	3.0	10	28	4.8	2.8	4.3
3	3.2	4.1	4.1	2.3	2.9	3.5	3.1	9.9	23	4.5	2.8	3.2
4	3.0	4.5	4.0	2.3	2.9	3.5	3.2	9.0	60	4.5	7.6	2.8
5	3.0	4.5	3.7	2.3	3.0	3.4	4.5	16	44	4.8	9.0	2.6
6	3.2	3.7	3.4	2.3	3.1	3.3	7.0	16	34	4.3	21	4.3
7	3.0	3.1	3.3	2.3	3.1	3.3	14	11	30	3.2	32	3.4
8	3.0	2.7	3.2	2.2	3.2	3.2	140	9.9	26	3.2	10	3.0
9	6.6	2.5	3.1	2.2	3.4	3.2	205	8.8	20	3.2	7.6	2.8
10	4.8	2.4	3.0	2.1	3.5	3.1	162	8.2	22	3.0	5.9	2.6
11	3.9	2.3	3.0	2.0	3.6	3.1	145	7.9	20	2.6	4.8	2.4
12	3.9	2.3	3.0	1.8	3.8	3.0	146	6.9	15	2.2	3.7	2.2
13	3.9	2.4	3.0	1.7	3.9	3.0	193	6.4	12	2.2	3.4	2.2
14	3.4	2.4	2.9	1.6	4.0	3.0	195	56	11	1.4	3.0	1.4
15	3.4	2.5	2.9	1.6	4.0	2.9	164	158	9.9	2.0	2.6	2.0
16	3.9	2.7	2.9	1.6	4.0	2.9	141	116	8.5	2.6	2.2	1.6
17	5.0	2.9	2.8	1.6	4.1	2.9	122	86	6.9	2.6	1.8	1.8
18	12	3.0	2.8	1.6	4.1	2.9	98	105	6.6	2.6	1.6	1.6
19	9.0	3.0	2.8	1.6	4.1	2.9	78	85	5.9	2.6	2.4	1.6
20	9.0	3.1	2.7	1.7	4.1	2.9	66	63	5.4	2.4	2.0	1.4
21	7.6	3.2	2.7	1.8	4.1	2.9	64	50	5.4	2.2	1.6	1.2
22	7.4	3.4	2.7	1.8	4.0	2.9	57	41	5.4	2.4	1.8	2.6
23	6.4	3.6	2.7	1.9	4.0	2.9	45	33	10	3.2	1.8	2.2
24	6.2	4.1	2.7	2.0	4.0	2.9	39	27	6.6	3.0	.80	2.2
25	5.9	4.4	2.6	2.1	3.9	3.0	34	22	6.2	2.2	.70	2.4
26	5.4	4.3	2.6	2.2	3.9	3.0	28	18	7.1	2.6	.70	2.4
27	5.4	4.2	2.6	2.3	3.9	3.0	21	15	5.9	13	1.4	2.6
28	5.2	4.1	2.5	2.4	3.8	3.0	17	12	6.2	6.2	1.6	2.2
29	5.9	4.0	2.5	2.5	-----	3.1	14	9.0	6.4	4.8	1.6	2.8
30	5.0	3.9	2.5	2.6	-----	3.1	12	8.2	6.4	3.4	8.8	2.8
31	5.7	-----	2.5	2.6	-----	3.0	-----	20	-----	3.9	5.9	-----
TOTAL	157.9	102.4	93.1	63.8	101.9	96.1	2,223.8	1,056.2	483.8	109.9	156.30	75.8
MEAN	5.09	3.41	3.00	2.06	3.64	3.10	74.1	34.1	16.1	3.55	5.04	2.53
MAX	12	5.0	4.1	2.6	4.1	3.7	205	158	60	13	32	5.2
MIN	1.8	2.3	2.5	1.6	2.7	2.9	3.0	6.4	5.4	1.4	.70	1.2
AC-FT	313	203	185	127	202	191	4,410	2,090	960	218	310	150
CAL YR 1968	TOTAL	2,978.30	MEAN	8.16	MAX	60	MIN	0	ACFT	5,910		
WAT YR 1969	TOTAL	4,721.00	MEAN	12.9	MAX	205	MIN	.70	ACFT	9,360		

PEAK DISCHARGE (BASE, 65 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
4-9	0300	6.62	232	5-15	1330	3.96	158

RED RIVER OF THE NORTH BASIN

53

5-0780. Clearwater River at Plummer, Minn.

LOCATION.--Lat 47°55'24", long 96°02'46", in SE 1/4 sec. 4, T.151 N., R.42 W., Red Lake County, 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.

PERIOD OF RECORD.--April 1939 to current year.

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

AVERAGE DISCHARGE.--30 years, 176 cfs (127,500 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 3,630 cfs Apr. 11 (gage height, 11.89 ft); maximum gage height, 12.31 ft Apr. 10 (backwater from ice); minimum discharge, 32 cfs Sept. 13, 14, 15.
Period of record: Maximum discharge, 3,640 cfs June 9, 1962 (gage height, 11.90 ft); maximum gage height, 12.31 ft Apr. 10, 1969 (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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	79	106	85	58	55	62	88	420	271	160	114	97
2	77	103	88	58	55	63	87	397	340	155	109	87
3	75	103	91	57	55	64	87	373	366	148	105	84
4	77	100	92	57	55	65	88	349	395	145	101	77
5	74	96	91	57	55	66	92	335	557	150	98	86
6	70	93	87	57	55	67	100	351	591	152	111	92
7	69	90	82	57	55	68	130	360	546	143	152	105
8	68	86	77	56	55	69	200	325	471	133	200	116
9	72	83	75	56	55	70	750	295	400	123	183	100
10	84	76	73	56	55	72	2,450	279	352	115	158	87
11	93	74	72	56	55	73	3,550	265	335	108	141	75
12	92	73	71	56	55	74	2,950	250	314	98	132	44
13	89	74	68	56	55	76	2,770	229	279	94	123	33
14	87	78	66	56	55	78	2,200	205	253	90	118	32
15	84	83	65	56	55	80	1,880	304	231	88	114	87
16	82	82	64	56	56	82	1,770	543	214	111	103	110
17	84	80	63	56	56	84	1,710	754	199	120	94	95
18	95	78	63	56	56	86	1,580	844	188	109	87	85
19	142	75	63	56	56	88	1,430	825	176	101	82	75
20	165	74	62	56	56	91	1,300	762	164	92	75	69
21	161	73	61	56	57	92	1,140	668	158	88	72	65
22	153	76	61	55	57	94	1,010	576	151	84	70	56
23	149	80	61	55	58	95	922	500	150	83	68	53
24	142	81	60	55	58	95	811	448	151	124	65	58
25	137	82	60	55	59	96	716	399	164	116	62	58
26	133	81	60	55	60	95	665	357	169	112	60	59
27	128	80	59	55	60	94	610	321	176	107	58	66
28	125	79	59	55	61	92	552	291	168	122	59	67
29	120	80	59	55	-----	90	495	261	166	123	56	70
30	114	82	58	55	-----	90	454	241	165	120	56	73
31	112	-----	58	55	-----	88	-----	232	-----	120	93	-----
TOTAL	3,232	2,501	2,154	1,735	1,575	2,499	32,587	12,759	8,260	3,634	3,120	2,261
MEAN	104	83.4	69.5	56.0	56.3	80.6	1,086	412	275	117	101	75.4
MAX	165	106	92	58	61	96	3,550	844	591	160	200	116
MIN	68	73	58	55	55	62	87	205	150	83	56	32
AC-FT	6,410	4,960	4,270	3,440	3,120	4,960	64,640	25,310	16,380	7,210	6,190	4,480
CAL YR 1968	TCTAL 67,555		MEAN 185		MAX 2,870		MIN 39		AC-FT 134,100			
WTR YR 1969	TCTAL 76,317		MEAN 209		MAX 3,550		MIN 32		AC-FT 151,400			

PEAK DISCHARGE (BASE, 500 CFS)

DATE	TIME	G.H.T.	DISCHARGE	DATE	TIME	G.H.T.	DISCHARGE
4-11	0800	11.89	3,630	6-6	0715	5.44	596
5-18	1045	6.35	853				

5-0785. Clearwater River at Red Lake Falls, Minn.

LOCATION.--Lat 47°53'15", long 96°16'25", in NW 1/4 sec. 22, T.151 N., R.44 W., Red Lake County, 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.

PERIOD OF RECORD.--June 1909 to September 1917, October 1934 to current year. 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, nonrecording gage at site 0.5 mile upstream and Sept. 12, 1911, to Sept. 30, 1917, nonrecording gage at site 40 ft upstream at different datum.

AVERAGE DISCHARGE.--43 years, 301 cfs (218,100 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 9,740 cfs Apr. 12 (gage height, 11.82 ft); minimum daily, 60 cfs Sept. 15.

Period of record: Maximum discharge, 9,740 cfs Apr. 12, 1969 (gage height, 11.82 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.

REVISIONS (WATER YEARS).--WSP 355: 1911-12. WSP 1438: 1910-11, 1917 (M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	102	157	90	79	71	82	100	769	529	242	188	108
2	100	152	98	79	71	82	100	722	692	236	171	119
3	98	150	119	79	71	82	100	673	784	230	152	113
4	94	150	113	79	71	83	115	630	769	222	141	104
5	96	148	100	79	72	83	160	606	900	213	130	108
6	94	146	92	79	72	84	350	616	1,010	228	194	157
7	90	141	89	78	72	85	550	649	947	213	417	137
8	88	137	88	78	72	86	1,100	620	816	205	413	134
9	92	128	86	78	72	86	3,900	560	687	181	405	141
10	92	111	85	78	73	87	6,150	524	602	178	335	130
11	102	94	85	78	73	88	9,010	498	547	174	276	119
12	121	90	84	78	73	89	8,720	472	520	152	233	106
13	121	89	84	78	74	90	6,270	430	472	134	202	84
14	119	88	83	78	74	91	4,960	392	421	113	181	65
15	117	93	83	78	75	93	4,060	838	380	115	164	60
16	113	100	82	77	76	95	3,630	1,330	343	134	157	100
17	111	108	84	77	77	96	3,400	1,990	312	171	139	120
18	128	100	83	76	78	98	3,090	2,060	280	181	121	112
19	148	87	82	76	78	99	2,770	1,770	264	171	113	103
20	216	76	82	75	79	99	2,430	1,570	245	162	106	90
21	239	85	82	75	79	100	2,120	1,390	228	152	96	85
22	236	98	82	75	79	105	1,880	1,220	219	141	86	85
23	225	103	82	74	80	108	1,690	1,070	213	132	82	74
24	210	100	82	73	81	110	1,520	923	210	121	76	71
25	199	95	81	73	81	112	1,340	806	228	174	73	81
26	191	87	81	72	81	112	1,230	717	260	171	69	80
27	181	82	81	72	81	110	1,120	639	276	169	67	77
28	174	80	80	71	82	108	1,020	579	276	152	66	83
29	171	82	80	71	-----	105	912	507	260	171	68	82
30	164	84	80	71	-----	105	828	463	251	205	82	84
31	157	-----	80	71	-----	103	-----	438	-----	210	98	-----
TOTAL	4,389	3,241	2,683	2,355	2,118	2,956	74,625	26,471	13,941	5,453	5,101	3,012
MEAN	142	108	86.5	76.0	75.6	95.4	2,488	854	465	176	165	100
MAX	239	157	119	79	82	112	9,010	2,060	1,010	242	417	157
MIN	88	76	80	71	71	82	100	392	210	113	66	60

CAL YR 1968 TOTAL 103,215
WTR YR 1969 TOTAL 146,345

MEAN 282
MEAN 401

MAX 3,460
MAX 9,010

MIN 60
MIN 60

RED RIVER OF THE NORTH BASIN

5-0790. Red Lake River at Crookston, Minn.

LOCATION.--Lat 47°46'32", long 96°36'33", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.150 N., R.46 W., Polk County, 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.

PERIOD OF RECORD.--May 1901 to current year. Monthly discharge only for some periods, published in WSP 1308. Figures of daily discharge for Apr. 3-30, 1904, published in WSP 130, have been found unreliable and should not be used.

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

AVERAGE DISCHARGE.--68 years, 1,055 cfs (764,300 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 28,400 cfs Apr. 12 (gage height, 27.33 ft); minimum, 375 cfs Aug. 13 (gage height, 3.53 ft).

Period of record: Maximum discharge, 28,400 cfs Apr. 12, 1969 (gage height, 27.33 ft); 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 1969 published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	817	1,160	1,070	1,290	1,290	1,170	1,220	3,490	2,780	1,490	975	1,040
2	388	1,540	1,130	1,280	1,290	1,170	1,270	3,470	2,900	1,490	921	1,090
3	873	1,650	1,320	1,280	1,300	1,180	1,270	3,620	3,010	1,470	874	1,080
4	836	1,520	1,460	1,270	1,300	1,190	1,260	3,700	3,130	1,450	850	1,080
5	850	1,200	1,420	1,260	1,300	1,190	1,250	3,670	3,050	1,430	845	1,190
6	907	1,020	1,040	1,250	1,300	1,200	1,240	3,630	3,100	1,430	874	1,470
7	907	995	660	1,250	1,300	1,230	1,300	3,640	2,850	1,410	1,350	1,320
8	902	956	540	1,240	1,290	1,250	1,530	3,590	2,560	1,380	1,380	1,250
9	926	946	780	1,240	1,290	1,260	4,000	3,470	2,350	1,360	1,280	1,250
10	941	869	1,180	1,240	1,280	1,270	11,000	3,370	2,200	1,340	1,180	1,230
11	946	748	1,370	1,230	1,280	1,250	22,700	3,300	2,060	1,330	1,060	1,210
12	995	667	1,370	1,230	1,270	1,240	27,100	3,200	1,980	1,280	1,010	1,210
13	975	676	1,370	1,220	1,260	1,230	22,400	3,130	1,950	1,210	841	1,200
14	1,010	685	1,360	1,210	1,240	1,230	17,700	3,080	1,860	1,180	902	1,170
15	1,000	707	1,360	1,210	1,240	1,220	14,800	3,480	1,800	1,160	893	1,170
16	980	813	1,360	1,200	1,230	1,220	12,900	4,020	1,730	1,140	874	1,160
17	956	1,310	1,360	1,190	1,230	1,220	11,600	4,570	1,650	1,110	860	1,230
18	883	1,610	1,350	1,190	1,220	1,210	10,400	5,140	1,620	1,090	836	1,230
19	845	1,380	1,350	1,210	1,220	1,210	9,330	5,020	1,570	1,080	812	1,220
20	936	1,020	1,350	1,230	1,210	1,210	8,400	4,670	1,520	1,070	808	1,240
21	1,100	980	1,340	1,230	1,200	1,210	7,640	4,420	1,460	1,040	789	1,240
22	1,130	1,140	1,340	1,240	1,200	1,210	6,890	4,190	1,450	1,040	808	1,300
23	1,100	1,440	1,340	1,240	1,190	1,220	6,160	3,970	1,440	1,010	822	1,260
24	1,080	1,870	1,330	1,250	1,180	1,220	5,590	3,760	1,440	930	831	1,260
25	1,050	1,800	1,330	1,250	1,160	1,230	5,100	3,550	1,450	931	850	1,300
26	1,010	1,670	1,330	1,260	1,150	1,240	4,640	3,450	1,520	956	855	1,280
27	985	1,250	1,320	1,270	1,150	1,250	4,400	3,300	1,560	960	850	1,290
28	935	1,170	1,310	1,270	1,160	1,260	4,270	3,090	1,600	921	869	1,290
29	946	946	1,310	1,280	-----	1,250	4,050	2,830	1,580	897	917	1,280
30	774	921	1,300	1,280	-----	1,200	3,790	2,690	1,540	902	1,020	1,300
31	907	-----	1,300	1,290	-----	1,170	-----	2,680	-----	1,100	1,050	-----
TOTAL	24,465	34,659	38,750	38,580	34,730	37,810	235,200	113,190	60,710	36,587	29,086	36,840
MEAN	950	1,155	1,250	1,245	1,240	1,220	7,840	3,651	2,024	1,180	938	1,228
MAX	1,130	1,870	1,460	1,290	1,300	1,270	27,100	5,140	3,130	1,490	1,380	1,470
MIN	794	667	540	1,190	1,150	1,170	1,220	2,680	1,440	897	789	1,040
AC-FT	58,440	68,750	76,860	76,520	68,890	75,000	466,500	224,500	120,400	72,570	57,690	73,070
CAL YR 1968	TOTAL 468,999											
WTR YR 1969	TOTAL 725,607											
	MEAN 1,281											
	MAX 11,000											
	MIN 235											
	AC-FT 930,300											
	WTR YR 1969 TOTAL 725,607											
	MEAN 1,988											
	MAX 27,100											
	MIN 540											
	AC-FT 1,439,000											

LOCATION.--Lat 47°56'34", long 97°03'10", in SW¼NE¼ sec.33, T.152 N., R.50 W., Grand Forks County, 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.

PERIOD OF RECORD.--April 1882 to current year. 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. Nov. 3, 1933, to Apr. 13, 1965, water-stage recorder 0.3 mile upstream at present datum. See WSP 1728 or 1913 for history of changes prior to Nov. 3, 1933.

EXTREMES.--Current year: Maximum discharge, 53,500 cfs Apr. 16 (gage height, 45.69 ft); minimum, 1,040 cfs Aug. 29 (gage height, 5.55 ft).

Aug. 29 (gage height, 5.55 ft).

Period of record: 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 855: 1936(M) WSP 1115: 1942. WSP 1175: 1897(M). WSP 1388: 1904, 1914-15, 1917-19, 1921-22, 1927, 1950. WSP 1728: Drainage area.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,460	1,490	1,650	1,500	1,400	1,850	2,050	29,000	6,190	3,080	2,370	1,220
2	1,360	1,570	1,690	1,500	1,400	1,900	2,050	25,900	6,350	2,980	2,240	1,250
3	1,270	1,820	1,740	1,500	1,400	1,900	2,100	24,000	6,650	2,870	2,050	1,270
4	1,290	1,990	1,790	1,500	1,400	1,950	2,150	22,200	6,840	2,800	1,940	1,280
5	1,260	2,030	1,780	1,500	1,400	1,950	2,150	20,400	6,890	2,760	1,850	1,460
6	1,240	1,890	1,750	1,500	1,400	1,950	2,150	18,800	6,690	2,700	1,800	1,620
7	1,260	1,700	1,700	1,500	1,400	2,000	2,250	17,200	6,520	2,630	1,860	1,730
8	1,320	1,590	1,600	1,500	1,400	2,000	2,860	15,600	6,200	2,560	2,020	1,740
9	1,340	1,550	1,500	1,500	1,400	2,050	5,130	14,100	5,760	2,520	2,190	1,630
10	1,350	1,540	1,400	1,500	1,400	2,050	10,100	12,500	5,400	2,470	2,080	1,560
11	1,360	1,510	1,500	1,500	1,400	2,050	18,900	11,100	5,110	2,450	1,910	1,520
12	1,380	1,360	1,600	1,500	1,450	2,100	32,400	9,900	4,790	2,420	1,750	1,500
13	1,420	1,170	1,750	1,500	1,450	2,100	42,200	9,050	4,590	2,340	1,600	1,500
14	1,460	1,190	1,800	1,500	1,450	2,100	48,800	8,400	4,440	2,250	1,460	1,480
15	1,460	1,230	1,750	1,500	1,450	2,100	52,100	7,950	4,260	2,250	1,340	1,430
16	1,460	1,220	1,700	1,500	1,450	2,100	53,400	7,700	4,040	2,500	1,310	1,390
17	1,450	1,370	1,700	1,500	1,500	2,100	53,000	7,650	3,830	3,200	1,270	1,350
18	1,480	1,600	1,650	1,500	1,500	2,150	51,400	8,600	3,610	3,910	1,260	1,350
19	1,450	1,790	1,650	1,500	1,550	2,150	49,600	9,900	3,440	4,410	1,200	1,370
20	1,380	1,670	1,600	1,500	1,550	2,200	47,500	10,100	3,280	4,680	1,140	1,340
21	1,400	1,500	1,550	1,500	1,600	2,200	45,300	9,750	3,160	4,600	1,110	1,350
22	1,560	1,520	1,500	1,500	1,650	2,200	43,300	9,200	3,060	4,220	1,070	1,380
23	1,670	1,650	1,500	1,500	1,650	2,250	41,400	8,600	2,980	3,810	1,060	1,420
24	1,720	1,900	1,500	1,500	1,700	2,250	39,600	8,100	2,920	3,560	1,060	1,430
25	1,750	2,200	1,500	1,500	1,700	2,250	38,200	7,800	2,920	4,230	1,070	1,400
26	1,740	2,240	1,500	1,500	1,750	2,250	36,400	7,450	3,130	4,810	1,070	1,410
27	1,710	2,030	1,500	1,500	1,750	2,250	35,400	7,150	3,090	4,720	1,060	1,400
28	1,680	1,750	1,500	1,500	1,800	2,300	34,400	6,900	3,100	4,090	1,060	1,390
29	1,630	1,840	1,500	1,450	-----	2,300	33,000	6,590	3,150	3,420	1,060	1,380
30	1,610	1,790	1,500	1,450	-----	2,250	31,300	6,330	3,160	2,880	1,160	1,420
31	1,480	-----	1,500	1,450	-----	2,200	-----					

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., Pembina County, on downstream end of east pier of interstate highway bridge, 1.5 miles northeast of Drayton and at mile 207.

DRAINAGE AREA.--34,800 sq mi, approximately (includes 3,800 sq mi in closed basins).

PERIOD OF RECORD.--April 1936 to June 1937, April 1941 to current year (fragmentary prior to April 1949).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 755.00 ft above mean sea level (Minnesota highway benchmark). Prior to Nov. 30, 1954, nonrecording gage at site 1.5 miles upstream at datum 1.59 ft higher.

AVERAGE DISCHARGE.--20 years (1949-69) 3,656 cfs (2,647,000 acre-ft per year); median of yearly mean discharges, 2,630 cfs (1,910,000 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 59,000 cfs Apr. 19; maximum gage height, 41.35 ft Apr. 23; minimum discharge, 1,060 cfs Aug. 30 (gage height, 9.94 ft).

Period of record: 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1388: 1949-50. WSP 1728: Drainage area.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,660	1,730	1,580	1,620	1,450	1,900	2,300	36,000	6,780	3,740	2,900	1,140
2	1,650	1,680	1,770	1,620	1,400	1,900	2,300	34,500	6,690	3,650	2,640	1,190
3	1,610	1,670	1,860	1,620	1,400	1,950	2,300	33,200	6,640	3,510	2,500	1,230
4	1,500	1,760	1,880	1,600	1,400	2,000	2,250	32,000	6,790	3,360	2,320	1,260
5	1,420	1,950	1,800	1,580	1,400	2,050	2,250	31,000	6,970	3,270	2,200	1,340
6	1,400	2,080	1,730	1,580	1,450	2,100	2,250	29,800	7,080	3,170	2,060	1,410
7	1,380	2,110	1,700	1,580	1,450	2,100	2,250	28,600	7,000	3,090	1,950	1,560
8	1,360	2,010	1,700	1,560	1,450	2,100	2,300	27,500	6,800	3,000	1,920	1,700
9	1,380	1,900	1,650	1,560	1,500	2,100	2,750	26,200	6,500	2,900	1,970	1,820
10	1,420	1,860	1,550	1,560	1,500	2,120	5,700	25,000	6,200	2,840	2,170	1,800
11	1,430	1,850	1,410	1,560	1,550	2,120	10,500	23,400	5,900	2,780	2,240	1,740
12	1,460	1,840	1,260	1,560	1,550	2,120	16,800	22,000	5,600	2,720	2,160	1,660
13	1,440	1,840	1,240	1,550	1,550	2,120	23,600	20,500	5,400	2,680	1,990	1,610
14	1,480	1,840	1,340	1,550	1,550	2,140	29,000	19,100	5,200	2,620	1,830	1,570
15	1,520	1,840	1,550	1,550	1,550	2,140	34,000	17,500	5,000	2,530	1,670	1,550
16	1,540	1,840	1,720	1,550	1,550	2,140	37,800	16,000	4,800	2,470	1,520	1,520
17	1,530	1,840	1,770	1,540	1,550	2,140	41,600	14,700	4,620	2,530	1,410	1,490
18	1,600	1,830	1,760	1,520	1,570	2,150	46,700	13,700	4,400	2,950	1,350	1,430
19	1,660	1,830	1,740	1,500	1,600	2,150	56,600	12,800	4,170	3,670	1,320	1,390
20	1,620	1,830	1,740	1,480	1,600	2,200	56,000	12,600	3,930	4,300	1,260	1,370
21	1,540	1,830	1,740	1,460	1,600	2,200	52,000	12,500	3,700	4,650	1,230	1,390
22	1,540	1,840	1,740	1,460	1,650	2,200	50,000	12,300	3,540	4,700	1,180	1,400
23	1,590	1,850	1,730	1,460	1,700	2,250	48,600	11,800	3,400	4,600	1,140	1,430
24	1,720	1,890	1,710	1,460	1,750	2,250	46,800	10,800	3,300	4,300	1,110	1,450
25	1,840	2,100	1,680	1,460	1,800	2,300	45,600	9,900	3,270	4,000	1,090	1,450
26	1,900	2,330	1,680	1,460	1,850	2,300	44,200	9,090	3,350	4,500	1,090	1,460
27	1,920	2,150	1,700	1,460	1,850	2,300	41,900	8,450	3,600	4,850	1,090	1,450
28	1,960	1,820	1,700	1,460	1,900	2,300	40,500	7,970	3,740	4,750	1,080	1,450
29	1,890	1,560	1,680	1,460	-----	2,300	39,000	7,590	3,720	4,540	1,090	1,430
30	1,840	1,460	1,680	1,460	-----	2,300	36,600	7,230	3,720	3,950	1,070	1,440
31	1,790	-----	1,670	1,450	-----	2,300	-----	6,950	-----	3,360	1,090	-----
TOTAL	49,590	55,960	51,460	47,290	44,120	66,740	824,450	580,680	151,810	109,980	51,640	44,130
MEAN	1,600	1,865	1,660	1,525	1,576	2,153	27,480	18,730	5,060	3,548	1,666	1,471
MAX	1,960	2,330	1,880	1,620	1,900	2,300	56,600	36,000	7,080	4,850	2,900	1,820
MIN	1,360	1,460	1,240	1,450	1,400	1,900	2,250	6,950	3,270	2,470	1,070	1,140
AC-FT	98,360	111,000	102,100	93,800	87,510	132,400	1,635M	1,152M	301,100	218,100	102,400	87,530

CAL YR 1968 TOTAL 897,950 MEAN 2,453 MAX 12,500 MIN 500 AC-FT 1,781,000
 WTR YR 1969 TOTAL 2,077,850 MEAN 5,693 MAX 56,600 MIN 1,070 AC-FT 4,121,000

M Expressed in thousands.

RED RIVER OF THE NORTH BASIN

5-0940. South Branch Two Rivers at Lake Bronson, Minn.

LOCATION.--Lat 48°43'50", long 96°39'50", in SW¹/₄ sec.30, T.161 N., R.46 W., Kittson County, 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.

PERIOD OF RECORD.--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 current year. Monthly discharge only for some periods, published in WSP 1308. Published as South Fork Two Rivers at Bronson prior to 1941.

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

AVERAGE DISCHARGE.--28 years (1928-36, 1941-43, 1945-47, 1953-69), 88.6 cfs (64,200 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 3,520 cfs Apr. 14 (gage height, 14.01 ft); minimum daily, 3.1 cfs Mar. 13-19.

Period of record: 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 winter months, which are fair. Flow partly regulated since 1937 by Bronson Lake (usable capacity, 3,700 acre-ft).

REVISIONS (WATER YEARS).--WSP 1308: 1929(M), 1931(M), 1936(M), 1944(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	178	52	17	6.0	5.2	3.7	3.4	255	223	24	4.5	4.1
2	84	51	16	6.0	5.2	3.6	3.6	362	224	22	4.7	4.3
3	35	50	16	5.9	5.2	3.5	4.8	389	237	20	4.7	5.0
4	43	51	15	5.8	5.2	3.5	7.8	380	240	20	4.6	4.6
5	64	39	15	5.7	5.2	3.4	14	370	337	18	4.6	6.8
6	75	17	14	5.6	5.2	3.3	29	341	299	16	4.8	6.2
7	78	32	13	5.6	5.2	3.2	66	345	218	15	4.9	5.7
8	76	35	12	5.6	5.2	3.2	170	351	215	13	5.3	5.8
9	73	36	12	5.5	5.2	3.2	520	349	135	12	4.4	6.1
10	70	35	11	5.5	5.3	3.2	1,470	344	50	11	4.0	6.6
11	71	35	11	5.5	5.3	3.2	2,160	329	125	14	4.2	6.5
12	74	32	10	5.5	5.3	3.2	2,970	272	203	13	4.3	7.0
13	73	32	10	5.4	5.3	3.1	3,450	263	129	11	4.0	5.8
14	108	28	9.6	5.4	5.3	3.1	3,480	325	73	9.1	4.1	5.5
15	176	28	9.3	5.4	5.3	3.1	3,280	338	73	8.7	4.3	6.6
16	68	33	9.0	5.3	5.3	3.1	2,900	340	52	7.8	4.3	7.1
17	24	31	8.7	5.3	5.3	3.1	2,410	408	7.3	7.1	4.4	6.2
18	25	30	8.4	5.3	5.1	3.1	1,930	440	7.0	7.4	4.5	6.3
19	34	27	8.1	5.3	4.8	3.1	1,610	415	11	7.2	4.3	7.1
20	60	27	7.9	5.3	4.5	3.2	1,290	283	18	6.7	4.2	7.2
21	157	26	7.6	5.3	4.2	3.3	1,080	215	22	6.5	4.6	6.9
22	163	26	7.4	5.2	4.1	3.4	905	294	23	7.0	4.7	7.3
23	85	26	7.2	5.2	4.0	3.4	763	277	23	6.7	4.5	7.4
24	46	26	7.0	5.2	4.0	3.5	671	267	22	6.4	4.6	7.5
25	49	25	6.9	5.2	3.9	3.5	558	261	25	5.9	4.5	6.9
26	55	23	6.7	5.2	3.9	3.5	468	218	26	6.2	4.2	6.1
27	58	22	6.6	5.2	3.8	3.5	700	144	25	6.0	4.0	6.2
28	57	20	6.5	5.2	3.8	3.4	776	149	29	5.6	3.9	6.2
29	57	19	6.3	5.2	-----	3.3	638	106	30	5.1	3.9	5.4
30	55	18	6.2	5.2	-----	3.3	420	207	27	5.1	4.4	5.5
31	52	-----	6.1	5.2	-----	3.3	-----	232	-----	4.8	4.7	-----
TOTAL	2,323	932	307.5	168.2	135.3	102.5	34,747.6	9,273	3,128.3	328.3	137.9	186.3
MEAN	74.9	31.1	9.92	5.43	4.83	3.31	1,158	299	104	10.6	4.45	6.21
MAX	178	52	17	6.0	5.3	3.7	3,480	440	337	24	5.3	7.5
MIN	24	17	6.1	5.2	3.8	3.1	3.4	106	7.0	4.8	3.5	4.1
AC-FT	4,610	1,850	610	334	268	203	68,920	18,390	6,200	651	274	370
CAL YR 1968	TOTAL 59,980.2			MEAN 164	MAX 2,240	MIN 1.3	AC-FT 119,000					
WTR YR 1969	TOTAL 51,769.9			MEAN 142	MAX 3,480	MIN 3.1	AC-FT 102,700					

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, 0.8 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).

PERIOD OF RECORD.--March to November 1902 (gage heights only), May 1912 to September 1929 (monthly discharge only, published in WSP 1308), October 1929 to current year.

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above mean sea level, datum of 1929, by Geodetic Survey of Canada. See WSP 1728 or 1913 for history of changes prior to Apr. 10, 1953.

AVERAGE DISCHARGE.--57 years (1912-69) 3,040 cfs (2,202,000 acre-ft per year); median of yearly mean discharges, 2,530 cfs (1,830,000 acre-ft per year).

EXTREMES.--Current year: Maximum daily discharge, 54,700 cfs April 26; maximum gage height, 87.59 ft April 26; minimum daily discharge, 1,310 cfs Aug. 31, Sept. 1; minimum gage height, 48.01 ft Aug. 31.
Period of record: 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2,520	2,250	2,330	1,640	1,590	1,790	2,680	51,800	9,310	4,430	3,800	1,310
2	2,500	2,200	2,360	1,630	1,570	1,800	2,730	50,100	9,130	4,420	3,340	1,340
3	2,510	2,140	2,340	1,620	1,550	1,830	2,770	48,200	9,010	4,350	3,050	1,380
4	2,470	2,090	2,340	1,630	1,520	1,850	2,770	46,300	8,980	4,230	2,880	1,440
5	2,330	2,100	2,380	1,640	1,510	1,880	2,800	44,600	8,940	4,100	2,720	1,530
6	2,190	2,210	2,380	1,650	1,510	1,920	2,860	42,600	8,950	3,960	2,580	1,560
7	2,100	2,340	2,400	1,670	1,510	1,950	2,970	40,600	8,960	3,820	2,460	1,610
8	2,060	2,400	2,380	1,690	1,520	1,990	3,380	38,700	8,900	3,710	2,330	1,710
9	2,030	2,320	2,320	1,710	1,540	2,010	4,700	37,300	8,710	3,620	2,270	1,830
10	2,010	2,180	2,240	1,740	1,560	2,030	7,800	35,900	8,440	3,540	2,290	1,940
11	2,010	2,100	2,110	1,740	1,580	2,050	13,500	34,600	8,080	3,480	2,480	1,970
12	2,010	2,010	1,920	1,750	1,600	2,080	19,300	33,100	7,600	3,420	2,530	1,970
13	2,020	1,930	1,750	1,750	1,600	2,090	25,000	31,500	7,120	3,340	2,490	1,900
14	2,020	1,900	1,660	1,760	1,610	2,110	28,300	29,900	6,720	3,280	2,340	1,860
15	2,020	1,830	1,700	1,760	1,620	2,120	31,400	28,400	6,350	3,200	2,200	1,810
16	2,050	1,710	1,800	1,770	1,620	2,140	34,500	26,800	5,990	3,100	2,050	1,770
17	2,090	1,650	1,850	1,780	1,620	2,170	37,500	25,000	5,680	3,020	1,910	1,740
18	2,120	1,630	1,880	1,770	1,610	2,190	40,400	23,100	5,370	3,050	1,780	1,700
19	2,140	1,460	1,860	1,760	1,610	2,220	43,100	21,200	5,100	3,340	1,710	1,650
20	2,150	1,470	1,830	1,730	1,610	2,240	45,700	19,500	4,830	3,870	1,650	1,590
21	2,150	1,910	1,830	1,700	1,630	2,260	48,400	17,900	4,570	4,400	1,610	1,570
22	2,120	2,130	1,820	1,700	1,650	2,290	50,800	16,600	4,340	4,750	1,560	1,590
23	2,120	2,230	1,780	1,710	1,680	2,320	52,300	15,300	4,150	4,850	1,500	1,590
24	2,170	2,280	1,740	1,710	1,710	2,360	53,400	14,200	3,980	4,770	1,450	1,600
25	2,250	2,380	1,690	1,700	1,730	2,400	51,200	13,200	3,870	4,510	1,400	1,610
26	2,320	2,530	1,680	1,670	1,750	2,440	54,700	12,200	3,840	4,300	1,360	1,630
27	2,350	2,700	1,660	1,660	1,770	2,480	52,500	11,200	3,900	4,600	1,330	1,630
28	2,390	2,780	1,660	1,650	1,780	2,510	52,300	10,800	4,100	5,090	1,330	1,630
29	2,410	2,760	1,650	1,640	-----	2,570	52,500	10,200	4,280	5,100	1,330	1,610
30	2,380	2,670	1,650	1,630	-----	2,610	52,400	9,670	4,410	4,800	1,320	1,610
31	2,320	-----	1,640	1,610	-----	2,650	-----	9,330	-----	4,260	1,310	-----
TOTAL	68,330	64,290	60,630	52,570	45,160	67,350	874,660	849,800	193,610	124,710	64,360	49,680
MEAN	2,204	2,143	1,956	1,696	1,613	2,173	29,160	27,410	6,454	4,023	2,076	1,656
MAX	2,520	2,780	2,400	1,780	1,780	2,650	54,700	51,800	9,310	5,100	3,800	1,970
MIN	2,010	1,460	1,640	1,610	1,510	1,790	2,680	9,330	3,840	3,020	1,310	1,310
AC-FT	135,500	127,500	120,300	104,300	89,570	133,600	1,735M	1,686M	384,000	247,400	127,700	98,540
CAL YR 1968	TOTAL 1,077,147		MEAN 2,943		MAX 13,900		MIN 404		AC-FT 2,136,000			
WTR YR 1969	TOTAL 2,515,150		MEAN 6,891		MAX 54,700		MIN 1,310		AC-FT 4,989,000			

M Expressed in thousands.

RED RIVER OF THE NORTH BASIN

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., Roseau County, on left bank 0.3 mile downstream from South Fork and 1.5 miles northwest of Malung.

DRAINAGE AREA.--573 sq mi.

PERIOD OF RECORD.--October 1946 to current year.

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

AVERAGE DISCHARGE.--23 years, 152 cfs (110,100 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 5,110 cfs Apr. 11 (gage height, 21.59 ft, backwater from ice); minimum, 3.2 cfs Sept. 21 (gage height, 4.54 ft).

Period of record: Maximum discharge, 5,110 cfs Apr. 11, 1969 (gage height, 21.59 ft, backwater from ice); 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. Some flow bypasses the gaging station through overflow channel 0.8 mile upstream and returns to river 0.5 mile downstream. Overflow begins at stage of about 13.0 ft, discharge, 1,800 cfs. These records include the overflow. Records prior to the 1969 water year do not include the overflow. Results of discharge measurements in overflow channel are given in table below.

RESULTS OF DISCHARGE MEASUREMENTS APRIL 1969

Date	Gage height (ft)	Discharge (cfs)	
		Main channel	Overflow channel
4-13	18.60	3,290	840
4-15	17.81	3,020	530
4-17	15.69	2,590	244
4-18	14.38	2,230	48.2

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER, 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	118	137	45	15	10	12	13	472	76	37	36	15
2	114	133	44	14	10	12	14	414	82	38	35	12
3	111	131	44	14	10	12	16	364	107	35	31	9.6
4	113	128	42	13	10	12	20	324	135	33	28	9.6
5	113	124	37	13	10	12	20	290	158	35	24	10
6	105	120	35	13	10	13	22	282	171	43	23	14
7	100	111	33	13	10	13	34	274	166	48	20	11
8	94	98	31	13	10	13	250	263	151	48	19	12
9	96	84	30	13	10	13	2,200	241	128	46	22	9.9
10	90	75	30	13	10	12	4,850	221	109	39	21	8.8
11	137	72	31	12	10	12	4,700	201	94	34	18	7.8
12	148	70	30	12	10	12	4,350	187	87	31	18	7.3
13	154	69	29	12	10	12	4,120	176	78	29	22	7.1
14	146	68	24	12	10	12	3,980	166	66	25	25	6.8
15	139	68	23	12	11	13	3,630	179	58	22	26	6.4
16	204	67	22	12	11	13	3,250	368	46	21	25	5.8
17	301	65	20	12	11	13	2,820	573	42	16	23	5.1
18	309	60	18	12	11	13	2,300	634	38	15	20	4.3
19	432	52	18	12	12	14	1,850	606	34	15	17	4.2
20	540	50	18	12	12	14	1,530	520	30	12	15	3.8
21	525	48	18	12	12	14	1,300	422	27	12	14	3.5
22	484	48	19	12	12	15	1,100	336	25	12	11	4.0
23	403	47	19	11	12	15	928	274	24	12	9.0	3.7
24	320	49	19	11	12	15	784	227	23	12	7.6	3.5
25	267	50	18	11	12	14	682	195	24	9.3	6.6	3.8
26	234	51	17	11	12	14	686	160	29	9.0	5.8	4.0
27	212	52	17	10	12	13	760	130	30	11	4.7	4.0
28	187	53	17	10	12	13	740	108	36	10	4.7	4.0
29	171	52	16	10	-----	13	662	80	38	9.3	7.3	5.1
30	156	49	16	10	-----	12	555	72	37	9.3	24	4.9
31	144	-----	15	10	-----	12	-----	74	-----	23	20	-----
TOTAL	6,667	2,281	795	372	304	402	48,166	8,833	2,149	750.9	582.7	211.0
MEAN	215	76.0	25.6	12.0	10.9	13.0	1,606	285	71.6	24.2	18.8	7.03
MAX	540	137	45	15	12	15	4,850	634	171	48	36	15
MIN	90	47	15	10	10	12	13	72	23	9.0	4.7	3.5
AC-FT	13,220	4,520	1,580	738	603	797	95,540	17,520	4,260	1,490	1,160	419
WATER YEAR 1968	TOTAL	107,395.1	MEAN	293	MAX	4,820	MIN	.60	ACFT	213,000		
WATER YEAR 1969	TOTAL	71,513.6	MEAN	196	MAX	4,850	MIN	3.5	ACFT	141,800		

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., Roseau County, on left bank 0.5 mile south of international boundary, 3.5 miles south of Sprague, Manitoba, 8 miles upstream from mouth, and 10.5 miles northeast of Roseau, Minn.

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

PERIOD OF RECORD.--September 1928 to current year (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, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--30 years (1928-29, 1940-69), 61.7 cfs (44,700 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 867 cfs Apr. 13 (gage height, 11.28 ft); minimum daily, 1.0 cfs Feb. 6-16.

Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	48	11	1.9	1.1	2.0	12	292	592	70	15	3.3
2	29	51	11	1.9	1.1	2.1	10	290	599	61	13	3.4
3	34	53	11	1.9	1.1	2.2	8.5	253	535	52	13	3.8
4	34	52	11	2.0	1.1	2.3	8.2	229	515	49	11	3.7
5	33	47	10	2.2	1.1	2.4	9.5	211	489	61	9.9	4.9
6	31	45	11	2.3	1.0	2.4	25	206	401	66	36	5.1
7	29	39	10	2.4	1.0	2.5	80	193	321	62	144	6.7
8	26	34	9.0	2.3	1.0	2.5	250	181	267	54	116	9.3
9	41	31	8.5	2.3	1.0	2.5	629	171	214	48	78	8.3
10	59	28	8.0	2.2	1.0	2.6	781	155	169	41	58	7.8
11	56	27	7.5	2.0	1.0	2.6	657	139	140	35	42	8.8
12	51	26	7.0	1.8	1.0	2.7	803	126	115	29	31	6.7
13	46	25	6.0	1.6	1.0	2.8	857	115	99	23	35	6.1
14	44	25	5.0	1.5	1.0	2.8	853	108	88	19	36	6.1
15	46	24	4.5	1.5	1.0	2.9	803	124	82	37	25	7.1
16	54	24	4.0	1.4	1.0	3.0	758	132	78	56	18	8.1
17	59	25	3.4	1.4	1.1	3.1	723	126	75	35	15	7.1
18	65	23	2.5	1.3	1.3	3.2	618	112	67	23	12	5.3
19	84	21	2.3	1.3	1.4	3.3	526	111	62	18	11	4.5
20	86	20	2.2	1.3	1.5	3.5	454	113	58	16	7.6	4.0
21	78	20	2.2	1.3	1.5	3.6	397	103	52	14	5.9	3.4
22	75	19	2.3	1.2	1.5	3.8	342	97	47	13	5.5	3.5
23	73	18	2.5	1.2	1.5	4.0	304	91	45	15	4.8	4.0
24	66	16	2.5	1.2	1.5	4.3	274	86	42	18	4.6	4.2
25	60	14	2.3	1.2	1.6	4.7	246	83	41	15	4.0	4.8
26	59	12	2.2	1.2	1.6	5.5	331	81	68	14	3.6	5.1
27	58	10	2.1	1.2	1.8	7.5	392	78	77	15	3.2	5.9
28	57	8.0	2.0	1.1	1.9	11	367	78	83	15	2.8	6.2
29	54	6.6	2.0	1.1	-----	15	345	77	82	15	2.6	7.0
30	50	8.5	1.9	1.1	-----	17	307	69	79	15	2.9	7.6
31	48	-----	1.9	1.1	-----	15	-----	349	-----	18	3.3	-----
TOTAL	1,614	800.1	168.8	49.4	34.7	144.8	12,170.2	4,569	5,582	1,022	769.7	171.8
MEAN	52.1	26.7	5.45	1.59	1.24	4.67	406	147	186	33.0	24.8	5.73
MAX	86	53	11	2.4	1.9	17	857	349	599	70	144	9.3
MIN	26	6.6	1.9	1.1	1.0	2.0	8.2	69	41	13	2.6	3.3
AC-FT	3,200	1,590	335	98	69	287	24,140	9,060	11,070	2,030	1,530	341

CAL YR 1968 TOTAL 26,598.30

MEAN 72.7

MAX 840

MIN .60

AC-FT 52,760

WTR YR 1969 TOTAL 27,096.5

MEAN 74.2

MAX 857

MIN 1.0

AC-FT 53,750

RED RIVER OF THE NORTH BASIN

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

LOCATION.--Lat 48°54'22", long 95°49'55", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.28, T.163 N., R.40 W., Roseau County, near center of span on upstream side of bridge at Roseau Lake, 3.5 miles upstream from Pine Creek, 3.8 miles downstream from Sprague Creek, and 7 miles northwest of Roseau.

PERIOD OF RECORD.--November 1939 to current year (incomplete).

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

EXTREMES.--Current year: Maximum elevation observed, 1,035.48 ft April 20; minimum observed, 1,021.24 ft Sept. 15, 21, 25.

Period of record: 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.

MEAN ELEVATION, IN FEET, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969												
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1								33.91	28.26		22.36	
2	24.33	24.43						33.77	27.66			
3		24.18						33.55		22.66		
4								33.27	27.76			21.99
5	23.88	24.03						33.10				
6	23.73		21.98					32.92	27.81	22.51		
7		23.63						32.73			24.21	21.64
8								32.31	27.59			
9	23.48						30.66	32.01		22.16		
10		23.08					31.96		26.76	22.37	23.16	
11	24.08						33.11	31.51				21.34
12	23.88						33.41		25.68			
13	24.23						34.40	30.81		21.96		
14							34.53	30.49				21.27
15	24.13						34.85	30.26	24.06			21.24
16							35.20	29.98				
17	25.63						35.33		23.56	21.81	21.96	21.27
18						22.61	35.41	29.72				
19	26.73						35.43				21.56	
20	27.18						35.48		22.81	21.66		
21	27.23							30.26				21.24
22							35.29	29.92	22.21			
23	26.88						35.15	28.56		21.81	21.31	
24							35.04					
25							34.83	28.04	22.16			21.24
26	26.08						34.75					
27	25.93						34.60	25.56		21.91	21.34	
28							34.41		22.51			21.32
29	25.25						34.24		22.86			
30	24.98							25.00				
31		-----			-----		-----		-----		22.34	-----

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 SE $\frac{1}{4}$ sec.27, T.163 N., R.41 W., Roseau County, on left bank 300 ft downstream from highway bridge, 0.2 mile north of Ross, and 2.3 miles downstream from Pine Creek.

DRAINAGE AREA---1,220 sq mi, approximately.

PERIOD OF RECORD---July 1928 to current year.

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, nonrecording gage at same site and datum.

AVERAGE DISCHARGE---41 years, 263 cfs (190,500 acre-ft per year).

EXTREMES---Current year: Maximum discharge, 3,500 cfs April 20 (gage height, 16.36 ft); minimum daily, 17 cfs December 30 to January 14; minimum gage height, 1.43 ft August 28.
Period of record: 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.

REVISIONS (WATER YEARS)---WSP 1055: 1945. WSP 1175: Drainage area. WSP 1308: 1936(M). WSP 1508: 1948-49(P).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	337	317	85	17	20	25	28	2,530	764	145	117	86
2	311	306	82	17	20	25	28	2,460	814	129	111	66
3	300	288	80	17	20	25	28	2,400	814	116	98	50
4	288	280	76	17	20	25	30	2,330	831	106	87	38
5	274	268	70	17	20	25	33	2,250	852	108	79	38
6	240	246	68	17	21	26	40	2,150	852	122	78	50
7	212	224	62	17	21	26	55	2,070	836	129	160	57
8	190	203	58	17	21	26	330	1,990	806	127	195	55
9	193	185	56	17	21	26	930	1,910	734	119	220	53
10	232	170	55	17	22	25	1,170	1,830	657	114	190	47
11	269	160	53	17	22	25	1,500	1,750	573	102	140	42
12	287	150	51	17	22	25	2,120	1,660	491	90	100	38
13	288	145	51	17	23	25	2,540	1,580	424	81	90	32
14	286	140	50	17	23	25	2,910	1,480	360	72	100	29
15	274	135	48	18	23	24	3,190	1,410	310	75	120	27
16	299	130	46	18	23	24	3,320	1,340	270	84	95	26
17	430	125	42	18	23	24	3,390	1,290	233	100	80	25
18	511	125	38	18	24	24	3,440	1,250	200	81	72	22
19	600	130	36	18	24	25	3,460	1,220	154	69	62	22
20	696	130	33	19	24	26	3,470	1,200	115	62	54	22
21	719	130	31	19	24	27	3,360	1,150	98	55	48	22
22	696	125	28	19	25	27	3,330	1,100	92	54	42	22
23	659	120	25	19	25	28	3,230	1,040	87	65	36	22
24	619	120	23	19	25	28	3,100	973	84	71	30	20
25	584	115	22	19	25	28	3,010	901	84	72	26	23
26	542	110	20	20	25	29	2,990	812	121	62	24	28
27	510	100	19	20	25	30	2,840	707	147	72	22	29
28	474	96	18	20	25	30	2,740	597	149	74	22	26
29	438	90	18	20	-----	29	2,680	506	155	65	34	24
30	400	85	17	20	-----	29	2,610	435	154	63	56	24
31	359	-----	17	20	-----	28	-----	584	-----	100	102	-----
TOTAL	12,517	4,948	1,378	562	636	814	61,902	44,905	12,261	2,784	2,690	1,065
MEAN	404	165	44.5	18.1	22.7	26.3	2,063	1,449	409	89.8	86.8	35.5
MAX	719	317	85	20	25	30	3,470	2,530	852	145	220	86
MIN	190	85	17	17	20	24	28	435	84	54	22	20
AC-FT	24,830	9,810	2,730	1,110	1,260	1,610	122,800	89,070	24,320	5,520	5,340	2,110
CAL YR 1968	TOTAL 205,362		MEAN 561	MAX 2,350	MIN 3.1	ACFT 407,300						
WAT YR 1969	TOTAL 146,462		MEAN 401	MAX 3,470	MIN 17	ACFT 290,500						

RED RIVER OF THE NORTH BASIN

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., Roseau County, on right bank 100 ft upstream from county highway bridge and 9 miles north of Badger.

PERIOD OF RECORD.--August 1928 to September 1969 (gage heights only; no winter records) (discontinued).

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.--Current year: Maximum elevation during year, 1,031.51 ft Apr. 20; minimum recorded, 1,017.98 ft Aug. 28.

Period of record: Maximum elevation, 1,032.65 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22.40						20.29	30.47			19.81	19.55
2	22.17						20.28	30.31	25.14		19.79	19.16
3	22.06						20.27	30.15	25.07		19.62	18.80
4	21.96						20.27	30.00	25.11			18.53
5	21.82						20.28	29.80	25.17			18.48
6	21.57						20.36	29.57	25.18			18.66
7	21.34						20.67	29.36	25.10		20.81	18.83
8	21.12						23.47	29.16	24.93		21.65	18.84
9	21.08							28.92	24.67	19.80	21.34	18.80
10	21.38						28.11	28.65	24.27	19.76	20.78	18.72
11	21.72							28.38	23.80	19.62	20.28	18.60
12	21.83							28.09	23.32		19.87	18.51
13	21.86							27.82	22.89		19.67	18.40
14	21.87							27.57	22.48		19.82	18.31
15	21.78							27.33	22.12		19.89	18.27
16	21.87						31.11		21.78		19.72	18.23
17	22.69						31.27		21.45			18.20
18	23.31					20.13	31.41		21.13			18.13
19	23.79					20.13	31.45		20.65			18.11
20	24.31					20.14	31.50		20.08			18.12
21	24.47					20.17	31.46		19.82		18.65	18.12
22	24.44					20.19	31.44				18.53	18.13
23	24.27					20.21	31.40				18.42	18.12
24	24.06					20.24	31.30				18.31	18.09
25	23.88					20.26	31.22				18.18	18.11
26	23.64					20.28	31.20		19.90		18.10	18.23
27	23.46					20.30	31.04		20.35		18.04	18.29
28	23.23					20.34	30.89		20.45		18.01	18.28
29	23.00					20.34	30.75				18.17	18.22
30					-----	20.33	30.63				18.65	18.18
31		-----			-----	20.32	-----		-----	19.48	19.57	-----

NOTE.--Add 1,000.00 ft to obtain elevations 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 SE 1/4 sec. 34, T.164 N., R.45 W., Kittson County, 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.

PERIOD OF RECORD.--April to October 1917, April 1920 to current year (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, nonrecording gage at site at Caribou 0.6 mile upstream at datum 0.95 ft lower.

AVERAGE DISCHARGE.--15 years (1920-30, 1932-33, 1936-43), 298 cfs (215,700 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 2,480 cfs Apr. 28 (gage height, 9.28 ft); minimum daily recorded, 41 cfs Mar. 18-23.

Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	739						49	2,450	1,180	208	125	125
2	653						49	2,430	1,210	200	156	116
3	594						50	2,400	1,210	192	162	96
4	549						52	2,390	1,210	182	152	78
5	518						58	2,380	1,200	162	143	75
6	494						78	2,360	1,180	152	132	75
7	446						120	2,340	1,160	154	123	79
8	456						200	2,300	1,140	165	200	83
9	497						415	2,270	1,100	167	310	86
10	520						900	2,240	1,050	164	330	82
11	497						1,200	2,200	964	154	297	76
12	448						1,400	2,170	855	143	215	68
13	428						1,650	2,140	730	122	169	63
14	431						1,620	2,110	632	110	147	61
15	436						1,680	2,090	546	102	149	58
16	428						1,750	2,060	460	99	152	58
17	440						1,840	2,020	395	104	143	54
18	531					41	1,920	1,960	349	123	122	54
19	632					41	2,010	1,920	304	120	112	53
20	716					41	2,080	1,860	250	112	89	51
21	793					41	2,140	1,820	188	96	80	59
22	836					41	2,190	1,780	156	93	72	63
23	843					41	2,240	1,720	141	88	67	63
24	827					42	2,290	1,670	136	89	62	61
25	793					44	2,330	1,610	129	89	58	63
26	751					46	2,420	1,560	143	91	58	62
27	702					47	2,460	1,510	165	91	63	66
28	670					49	2,470	1,450	200	89	67	68
29	634					49	2,470	1,350	204	94	64	67
30	589				-----	49	2,450	1,250	208	94	64	67
31	554	-----			-----	49	-----	1,160	-----	105	80	-----
TOTAL	18,445						42,581	60,970	18,795	3,954	4,163	2,130
MEAN	595						1,419	1,967	626	128	134	71.0
MAX	843						2,470	2,450	1,210	208	330	125
MIN	428						49	1,160	129	88	58	51
AC-FT	36,590						84,460	120,900	37,280	7,840	8,260	4,220

RED RIVER OF THE NORTH BASIN

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., Kittson County, 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 1969 (incomplete, discontinued).

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.--Current year: Maximum elevation, 1,007.10 ft Apr. 30; minimum recorded, 1,003.04 ft Mar. 18.
Period of record: 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 1968 TO SEPTEMBER 1969												
DAY	OCT	NOV	DEC	JAN	FEB	MAR.	APR	MAY	JUN	JUL	AUG	SEP
1	5.19						3.10	7.09	6.12	3.87	3.63	3.56
2	4.95						3.10	7.09	6.18	3.84	3.71	3.56
3	4.80						3.10	7.09	6.18	3.79	3.68	3.47
4	4.66						3.11	7.08	6.18	3.75	3.62	3.39
5	4.58						3.12	7.08	6.17	3.70	3.56	3.36
6	4.53						3.14	7.08	6.14	3.69	3.53	3.36
7	4.39						3.15	7.08	6.11	3.72	3.54	3.39
8	4.28						3.77	7.06	6.06	3.74	3.95	3.42
9	4.19						5.63	7.05	5.99	3.75	4.16	3.43
10	4.15						6.52	7.05	5.87	3.72	4.09	3.42
11	4.18						6.63	7.04	5.69	3.70	3.93	3.39
12	4.27						6.47	7.03	5.42	3.64	3.80	3.34
13	4.33						6.61	7.02	5.14	3.58	3.68	3.33
14	4.35						6.67	7.01	4.89	3.53	3.60	3.29
15	4.35						6.71	7.00	4.68	3.52	3.63	3.27
16	4.33						6.77	6.99	4.51	3.50	3.65	3.26
17	4.36						6.82	6.97	4.36	3.55	3.60	3.24
18	4.56					3.04	6.86	6.95	4.28	3.60	3.54	3.23
19	4.73					3.05	6.89	6.93	4.11	3.57	3.49	3.22
20	5.02					3.05	6.92	6.90	3.98	3.51	3.44	3.19
21	5.23					3.05	6.95	6.87	3.83	3.45	3.38	3.24
22	5.35					3.06	6.96	6.84	3.74	3.43	3.34	3.27
23	5.36					3.06	6.97	6.81	3.70	3.42	3.31	3.26
24	5.33					3.07	6.98	6.77	3.67	3.43	3.28	3.26
25	5.25					3.07	7.00	6.72	3.66	3.44	3.25	3.26
26	5.15					3.08	7.03	6.66	3.70	3.48	3.22	3.26
27	5.04					3.09	7.04	6.62	3.80	3.45	3.19	3.27
28	4.95					3.09	7.04	6.56	3.87	3.44	3.17	3.28
29	4.85					3.10	7.03	6.47	3.87	3.48	3.19	3.28
30	4.75					3.10	7.07	6.25	3.88	3.48	3.24	3.27
31	4.65	-----			-----	3.10	-----	6.11	-----	3.53	3.35	-----

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

LAKE OF THE WOODS BASIN

69

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., Lake County, 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.

PERIOD OF RECORD.--June 1966 to current year.

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

EXTREMES.--Current year: Maximum discharge, 1,540 cfs April 29 (gage height, 5.88 ft); minimum, 72 cfs April 2-7 (gage height, 3.12 ft).

Period of record: Maximum discharge, 1,540 cfs Apr. 29, 1969 (gage height, 5.88 ft); minimum, 24 cfs Sept. 28, 29, 1966; minimum gage height, 2.70 ft Feb. 23-29, 1968.

REMARKS.--Records good. Records of chemical analyses, water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	86	368	176	143	120	94	73	1,440	553	182	135	132
2	85	363	176	139	120	94	73	1,400	536	174	132	130
3	85	359	176	137	118	94	72	1,310	508	169	128	125
4	85	354	176	137	118	92	72	1,290	486	165	125	122
5	84	344	176	137	116	92	72	1,260	475	165	127	125
6	85	340	174	137	114	92	72	1,210	470	161	132	144
7	86	331	167	137	112	92	73	1,160	448	154	139	148
8	85	326	163	137	110	92	76	1,120	428	150	148	148
9	92	318	163	137	108	92	86	1,080	402	146	152	146
10	105	308	163	137	108	90	99	1,040	387	143	163	141
11	105	300	161	137	106	90	103	988	378	139	174	139
12	107	291	158	137	106	90	116	946	354	137	203	139
13	111	287	158	137	104	88	135	904	331	134	210	135
14	116	279	156	137	104	88	161	856	318	141	213	132
15	122	270	156	135	102	86	197	869	300	141	213	130
16	143	258	156	135	102	86	275	911	287	141	206	130
17	192	251	154	135	100	85	383	918	275	135	203	125
18	236	247	154	135	99	85	519	904	262	130	194	120
19	275	244	154	133	97	84	652	890	258	134	184	116
20	318	236	152	133	97	81	768	869	251	143	176	113
21	336	229	150	131	97	79	925	849	236	141	169	111
22	359	222	148	130	96	79	1,080	815	225	137	165	110
23	368	219	152	130	96	79	1,230	775	216	135	158	111
24	373	210	150	128	96	79	1,350	761	210	132	154	108
25	373	203	148	128	96	79	1,420	728	206	130	150	107
26	373	197	146	126	94	79	1,440	696	200	127	146	111
27	373	192	146	126	94	78	1,500	670	197	125	143	113
28	373	186	144	124	94	78	1,530	639	194	125	139	113
29	373	182	143	124	-----	76	1,540	602	192	123	137	116
30	373	182	143	122	-----	74	1,490	577	186	120	135	122
31	373	-----	143	122	-----	73	-----	559	-----	127	134	-----
TOTAL	6,650	8,096	4,882	4,123	2,924	2,640	17,582	29,036	9,769	4,406	4,987	3,762
MEAN	215	270	157	133	104	85.2	586	937	326	142	161	125
MAX	373	368	176	143	120	94	1,540	1,440	553	182	213	148
MIN	84	182	143	122	94	73	72	559	186	120	125	107
CFSM	.85	1.07	.62	.53	.41	.34	2.32	3.70	1.29	.56	.64	.49
IN.	.98	1.19	.72	.61	.43	.39	2.59	4.27	1.44	.65	.73	.55

CAL YR 1968 TOTAL 106,638 MEAN 292 MAX 1,190 MIN 29 CFSM 1.15 IN 15.68
 WAT YR 1969 TOTAL 98,857 MEAN 271 MAX 1,540 MIN 72 CFSM 1.07 IN 14.54

NOTE.--No gage-height record Jan. 17 to Feb. 17.

LAKE OF THE WOODS BASIN

5-1270. Kawishiwi River near Winton, Minn.

LOCATION.--Lat 47°56'05", long 91°45'50", in NE1/4 sec.20, T.63 N., R.11 W., Lake County, 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.

PERIOD OF RECORD.--June 1905 to June 1907, October 1912 to September 1919 (fragmentary), September 1923 to current year. Monthly discharge only for some periods, published in WSP 1308.

AVERAGE DISCHARGE (UNADJUSTED).--50 years (1905-06, 1915-17, 1918-19, 1923-69), 992 cfs (11.23 inches per year).

EXTREMES.--Current year: Maximum daily discharge, 8,620 cfs Apr. 28; minimum daily, 226 cfs July 27, Sept. 1. Period of record: Maximum daily discharge, 16,000 cfs May 18, 1950; no flow at times.

REMARKS.--Records good except those above 3,000 cfs, which are fair. 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	928	2,520	928	833	762	667	430	8,150	2,390	965	689	226
2	928	2,390	960	792	795	699	430	7,810	2,190	960	507	501
3	928	2,260	960	792	737	731	430	7,610	1,980	960	469	501
4	928	1,850	960	824	737	758	430	7,260	1,820	856	469	469
5	895	1,840	960	792	591	807	430	6,860	1,950	794	581	469
6	960	1,780	960	792	546	743	430	6,610	1,960	794	624	549
7	960	1,750	928	760	660	743	430	6,370	1,890	792	883	522
8	928	1,750	928	792	534	807	487	6,060	1,820	729	912	544
9	992	1,680	895	767	514	775	688	6,160	1,780	702	945	796
10	1,090	1,680	960	792	590	775	686	6,070	1,760	603	990	828
11	1,020	1,480	928	760	557	772	686	5,640	1,720	620	960	731
12	1,020	1,220	895	792	465	822	822	4,960	1,550	504	960	579
13	960	1,070	895	633	466	750	1,040	4,750	1,660	465	1,360	435
14	1,110	1,050	1,060	687	497	815	1,700	4,490	1,690	594	2,300	467
15	1,520	1,090	960	687	497	783	2,420	4,540	1,690	744	2,210	435
16	2,330	992	863	751	350	847	2,690	4,390	1,610	836	2,290	562
17	2,780	960	928	637	465	815	3,280	4,660	1,250	775	1,880	804
18	4,040	1,120	895	649	497	783	4,590	4,810	1,160	656	1,870	836
19	4,140	1,020	893	714	465	908	4,710	4,640	1,090	598	1,350	804
20	5,060	1,090	891	746	513	842	5,870	4,830	1,020	522	859	836
21	5,010	1,090	891	681	557	631	6,420	4,910	1,020	504	635	836
22	4,800	1,090	924	665	557	578	7,170	4,740	1,080	467	668	804
23	4,860	1,090	956	751	572	457	7,490	4,540	977	402	700	836
24	4,640	1,090	891	753	614	557	7,800	4,880	1,060	467	732	836
25	4,400	1,090	859	705	638	557	8,230	4,110	960	467	765	804
26	4,230	1,010	891	809	606	557	8,460	3,800	960	402	635	836
27	4,310	960	924	793	671	557	8,480	4,010	960	226	629	804
28	3,710	960	891	685	634	530	8,620	2,800	1,070	467	635	836
29	3,300	960	956	638	-----	430	8,600	2,480	1,020	469	700	901
30	3,070	928	924	638	-----	430	8,270	2,420	1,090	469	467	868
31	2,660	-----	924	600	-----	430	-----	2,320	-----	531	435	-----
TOTAL	78,507	40,860	28,678	22,710	16,087	21,356	112,219	157,680	44,177	19,340	30,109	20,255
MEAN	2,532	1,362	925	733	575	689	3,741	5,086	1,473	624	971	675
MAX	5,060	2,520	1,060	833	795	908	8,620	8,150	2,390	965	2,300	901
MIN	895	928	859	600	350	430	430	2,320	960	226	435	226
(+)	+22	+17	-111	-103	-97	-338	+809	-162	+24	+16	-40	-147
MEAN #	2,554	1,379	814	630	478	351	4,550	4,924	1,497	640	931	528
CFSM #	2.13	1.15	0.68	0.52	0.40	0.29	3.79	4.10	1.25	0.53	0.78	0.44
IN. #	2.45	1.28	0.78	0.60	0.41	0.34	4.23	4.73	1.39	0.60	0.89	0.49

CAL YR 1968 TOTAL 643,400 MEAN 1,758 MAX 8,030 MIN 0 MEAN # 1,780 CFMS # 1.48 IN. # 20.19
WAT YR 1969 TOTAL 591,978 MEAN 1,622 MAX 8,620 MIN 226 MEAN # 1,611 CFMS # 1.34 IN. # 18.35

+ Changes in contents, equivalent in cubic feet per second, in Camp Six, Bald Eagle, Gabbro, Little Gabbro, Birch, White Iron, Farm, South 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 NE1/4 sec.26, T.63 N., R.13 W., St. Louis County, on left bank on downstream wingwall of bridge on County Road 88, 2.5 miles upstream from mouth, 4 miles northwest of Ely and 5 miles downstream from outlet on Burntside Lake.

PERIOD OF RECORD.--May 1967 to current year.

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

EXTREMES.--Current year: Maximum discharge observed, 235 cfs May 19 (gage height, 7.49 ft); maximum gage height, 7.63 ft Apr. 22 (from graph based on gage readings); minimum daily discharge, 10 cfs Sept. 21, 22. Period of record: Maximum discharge, 300 cfs June 14, 1968 (gage height, 7.85 ft, from graph based on gage readings); minimum daily discharge, 0.8 cfs 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	UCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46	108	46	42	50	40	36	184	153	76	70	26
2	40	102	45	43	49	40	37	182	154	75	65	25
3	38	100	45	43	49	39	38	181	153	73	62	23
4	38	98	44	44	49	39	40	180	149	69	64	21
5	37	95	44	44	48	38	43	182	149	68	65	22
6	38	92	44	44	48	38	46	184	157	67	62	25
7	38	87	44	44	47	38	48	180	153	65	73	27
8	36	82	43	45	47	37	49	176	148	61	70	25
9	46	79	43	45	47	37	50	171	144	57	69	24
10	63	77	43	45	47	37	53	165	142	55	62	20
11	62	76	43	45	46	37	61	158	143	55	75	19
12	62	75	44	46	45	37	79	152	138	52	66	17
13	64	73	44	46	45	36	90	147	130	56	65	16
14	65	69	44	46	45	36	117	142	125	60	62	16
15	65	66	44	47	45	36	152	171	122	78	57	16
16	77	64	45	47	44	36	183	217	118	82	53	15
17	114	64	45	47	44	36	199	225	120	78	50	14
18	138	64	45	47	44	36	212	230	114	74	52	14
19	154	65	44	47	43	36	219	233	111	82	48	12
20	156	63	44	48	43	36	214	226	109	79	46	11
21	154	60	44	48	43	35	228	216	106	75	46	10
22	150	55	43	49	42	35	230	205	102	73	41	10
23	148	54	43	49	42	35	226	194	97	73	37	11
24	139	52	43	50	42	35	223	186	91	69	35	12
25	137	50	42	51	41	35	217	180	91	66	34	16
26	133	48	42	51	41	35	217	174	85	64	34	18
27	130	47	42	50	41	35	217	165	84	61	33	20
28	126	46	42	50	40	35	204	158	82	59	30	19
29	122	46	42	50	-----	35	194	149	80	60	28	18
30	117	46	42	50	-----	36	186	145	78	59	28	17
31	111	-----	42	50	-----	36	-----	150	-----	65	25	-----
TOTAL	2,844	2,103	1,350	1,453	1,257	1,132	4,108	5,608	3,628	2,086	1,607	539
MEAN	91.7	70.1	43.5	46.9	44.9	36.5	137	181	121	67.3	51.8	18.0
MAX	156	108	46	51	50	40	230	233	157	82	75	27
MIN	36	46	42	42	40	35	36	142	78	52	25	10
CAL YR 1968	TOTAL	26,662.8	MEAN	72.8	MAX	298	MIN	2.4				
WTR YR 1969	TOTAL	27,715	MEAN	75.9	MAX	233	MIN	10				

LAKE OF THE WOODS BASIN

5-1272.10 Armstrong Creek near Ely, Minn.

LOCATION---Lat 47°53'48", long 91°55'50", in SW 1/4 sec.36, T.63 N., R.13 W., St. Louis County, near right bank 10 ft downstream from culvert on County Road 88, 1.2 miles upstream from mouth and 2.5 miles southwest of Ely.

PERIOD OF RECORD---May 1967 to current year.

GAGE---Nonrecording gage read once daily and crest-stage gage. Altitude of gage is 1,365 ft (from topographic map).

EXTREMES---Current year: Maximum discharge, 62 cfs Apr. 15 (gage height, 4.77 ft, from graph based on gage readings); minimum, 0.8 cfs Sept. 9-13.

Period of record: Maximum discharge, 62 cfs Apr. 15, 1969 (gage height, 4.77 ft); minimum, no flow 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.3	5.6	1.5	1.3	1.0	2.4	2.2	9.0	10	2.5	6.4	1.1
2	2.4	5.1	1.5	1.3	1.0	2.4	2.1	10	12	2.3	4.0	1.0
3	3.3	4.8	1.6	1.2	1.0	2.3	2.1	10	10	2.1	2.6	1.0
4	3.3	4.7	1.7	1.2	1.0	2.2	2.1	11	8.5	2.7	4.5	1.0
5	2.8	4.2	1.6	1.2	1.0	2.2	2.1	15	9.0	3.8	3.2	1.0
6	6.1	4.0	1.6	1.2	1.0	2.2	2.1	16	13	2.5	2.7	.90
7	6.8	3.7	1.6	1.2	1.0	2.1	2.2	13	9.0	2.1	10	.90
8	5.6	3.5	1.6	1.2	.90	2.0	2.9	11	6.2	1.9	11	.90
9	8.5	3.3	1.5	1.2	.90	2.0	7.6	8.4	5.6	2.0	5.1	.80
10	22	3.2	1.5	1.2	.90	2.0	13	7.4	6.2	1.9	4.4	.80
11	19	3.1	1.5	1.2	.90	2.0	24	6.4	7.2	1.9	18	.80
12	15	3.0	1.5	1.1	.90	2.0	31	5.8	6.0	2.0	11	.80
13	12	2.8	1.5	1.1	.90	2.0	45	5.5	4.8	2.4	5.8	.80
14	9.5	2.7	1.5	1.1	.90	2.1	55	5.0	4.2	3.8	3.7	.90
15	8.5	2.5	1.5	1.1	.90	2.1	61	16	3.7	6.0	3.5	.90
16	14	2.4	1.5	1.1	.90	2.1	57	37	3.6	9.3	3.0	1.0
17	29	2.3	1.5	1.1	.90	2.1	52	32	3.6	4.5	2.1	1.0
18	36	2.2	1.4	1.0	.90	2.2	45	26	3.3	4.4	1.9	1.0
19	31	2.1	1.4	1.0	.90	2.2	40	22	4.3	6.5	1.8	1.0
20	25	2.0	1.4	1.0	1.0	2.3	38	18	3.6	4.9	1.6	1.0
21	19	2.0	1.4	1.0	1.1	2.4	39	14	3.0	3.3	1.6	1.1
22	14	1.9	1.3	1.0	1.2	2.4	35	12	2.8	2.7	1.5	1.3
23	12	1.7	1.3	1.0	1.5	2.5	28	10	2.7	2.6	1.8	1.4
24	10	1.7	1.3	1.0	1.9	2.6	24	8.0	2.5	2.3	1.6	1.4
25	8.4	1.6	1.3	1.0	2.2	2.7	19	7.0	2.7	2.2	1.4	2.2
26	7.7	1.5	1.3	1.0	2.3	2.8	17	6.4	2.7	2.1	1.3	1.8
27	7.3	1.5	1.3	1.0	2.4	2.7	15	5.8	2.4	2.3	1.2	1.6
28	7.0	1.5	1.3	1.0	2.5	2.6	13	5.0	2.2	2.2	1.2	2.3
29	6.7	1.4	1.3	1.0	-----	2.5	10	5.8	4.0	2.1	1.2	2.1
30	6.3	1.4	1.3	1.0	-----	2.5	9.0	7.0	3.0	2.0	1.2	2.0
31	6.1	-----	1.3	1.0	-----	2.4	-----	8.5	-----	5.3	1.1	-----
TOTAL	366.6	83.4	44.8	34.0	33.90	71.0	695.4	374.0	161.8	98.6	121.4	35.80
MEAN	11.8	2.78	1.45	1.10	1.21	2.29	23.2	12.1	5.39	3.18	3.92	1.19
MAX	36	5.6	1.7	1.3	2.5	2.8	61	37	13	9.3	18	2.3
MIN	2.3	1.4	1.3	1.0	.90	2.0	2.1	5.0	2.2	1.9	1.1	.80
CAL YR 1968	TOTAL 1,936.50			MEAN 5.29		MAX 39		MIN 0				
WTR YR 1969	TOTAL 2,120.70			MEAN 5.81		MAX 61		MIN .80				

5-1272.15 Longstorff Creek near Ely, Minn.

LOCATION.--Lat 47°53'33", long 91°54'55", in SE 1/4 sec.31, T.63 N., R.12 W., St. Louis County, at left bank on downstream side of culvert, 0.7 mile upstream from mouth, 1.5 miles southwest of Ely and 2.5 miles downstream from outlet of Mitchell Lake.

PERIOD OF RECORD.--May 1967 to current year.

GAGE.-- Nonrecording gage read once daily and crest-stage gage. Datum of gage is 1,360.67 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department).

EXTREMES.--Current year: Maximum discharge, 124 cfs Apr. 15 (gage height, 4.14 ft, from floodmark); no flow for part of May 7 (result of bridge construction).

Period of record: Maximum discharge, 124 cfs Apr. 15, 1969 (gage height, 4.14 ft, from floodmark); maximum gage height, 4.34 ft June 8, 1968; no flow on many days in 1968 and part of May 7, 1969 (result of bridge construction).

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

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.5	11	2.6	5.1	5.2	2.3	3.2	23	15	4.2	5.0	1.7
2	3.0	10	3.1	5.0	5.2	2.3	3.0	14	15	3.1	3.9	1.7
3	3.7	9.6	3.3	5.0	5.2	2.3	2.6	13	15	3.1	3.0	1.5
4	3.2	8.7	3.3	4.9	5.2	2.4	3.4	20	14	4.0	6.0	1.5
5	3.0	8.1	3.2	4.8	5.2	2.5	4.0	26	14	3.7	5.2	1.8
6	3.7	7.4	3.1	4.7	5.1	2.6	5.3	25	18	3.4	4.2	2.4
7	4.6	6.6	3.0	4.6	4.9	2.6	8.5	3.5	15	3.1	13	2.0
8	5.8	6.0	2.9	4.6	4.6	2.6	14	17	12	2.6	11	1.7
9	18	5.4	2.9	4.5	4.5	2.5	24	15	10	2.5	6.4	1.6
10	30	5.2	2.9	4.5	4.3	2.4	37	13	10	2.2	6.6	1.6
11	24	5.0	3.0	4.4	4.2	2.3	45	11	13	2.1	27	1.7
12	17	4.9	3.0	4.4	3.8	2.2	59	8.4	11	2.2	16	1.5
13	15	4.8	3.1	4.4	3.6	2.2	75	7.0	8.1	3.5	9.8	1.7
14	13	4.8	3.4	4.4	3.5	2.2	104	7.2	7.1	4.9	6.8	1.8
15	13	4.8	4.5	4.4	3.4	2.2	120	31	5.7	11	4.3	2.0
16	21	4.8	5.8	4.4	3.3	2.3	113	60	5.2	10	3.9	2.1
17	53	4.7	6.2	4.4	3.2	2.3	103	56	4.9	6.3	3.5	1.9
18	76	4.7	6.4	4.4	3.2	2.2	84	43	4.6	4.6	2.8	1.6
19	68	4.7	6.4	4.4	3.1	2.1	69	34	6.0	6.5	2.4	1.5
20	53	4.5	6.2	4.4	3.0	2.0	59	26	5.6	5.5	1.8	1.4
21	42	4.4	6.2	4.4	2.9	2.1	65	20	5.1	4.6	1.9	1.3
22	33	4.2	6.1	4.4	2.8	2.2	59	17	4.4	3.4	1.5	1.6
23	25	4.0	6.0	4.4	2.8	2.5	48	15	3.7	2.9	2.0	1.6
24	20	3.8	6.0	4.4	2.7	2.9	37	16	3.5	2.4	1.8	1.5
25	17	3.5	5.8	4.4	2.6	3.1	31	14	3.9	2.2	1.8	1.9
26	16	3.3	5.7	4.5	2.5	3.1	30	12	3.6	1.9	1.8	1.7
27	15	3.1	5.6	4.7	2.5	2.6	24	11	3.4	2.1	1.6	1.6
28	14	3.0	5.4	4.9	2.4	2.5	21	10	3.3	1.9	1.6	2.1
29	13	2.8	5.3	5.1	-----	2.4	20	10	4.8	1.7	1.6	1.7
30	12	2.7	5.3	5.2	-----	2.4	12	11	4.6	1.6	2.0	1.2
31	12	-----	5.2	5.2	-----	2.7	-----	17	-----	4.6	1.7	-----
TOTAL	649.5	160.5	140.9	143.3	104.9	75.0	1,283.0	606.1	249.5	117.8	161.9	50.9
MEAN	21.0	5.35	4.55	4.62	3.75	2.42	42.8	19.6	8.32	3.80	5.22	1.70
MAX	76	11	6.4	5.2	5.2	3.1	120	60	18	11	27	2.4
MIN	2.5	2.7	2.6	4.4	2.4	2.0	2.6	3.5	3.3	1.6	1.5	1.2

CAL YR 1968 TOTAL 3,696.20

WTR YR 1969 TOTAL 3,743.3

MEAN 10.1

MEAN 10.3

MAX 97

MAX 120

MIN 0

MIN 1.2

LAKE OF THE WOODS BASIN

5-1272.20 Burgo Creek near Ely, Minn.

LOCATION.--Lat 47°55'32", long 91°51'40", in SW¼ sec.22, T.63 N., R.12 W., St. Louis County, near right bank 6 ft upstream from twin culverts on County Road 88, 0.5 mile upstream from mouth and 1.5 miles north of Ely.

PERIOD OF RECORD.--May 1967 to current year.

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

EXTREMES.--Current year: Maximum discharge, 75 cfs Apr. 14 (gage height, 7.59 ft); maximum gage height, 7.65 ft Oct. 18 (from graph based on gage readings); minimum daily discharge, 0.1 cfs on several days in August and September.

Period of record: Maximum discharge, 139 cfs June 8, 1968 (gage height, 9.77 ft), from rating curve extended above 35 cfs; no flow at times in 1967, 1968.

REMARKS.--Records fair.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.60	3.3	.90	.40	.30	.60	.70	4.3	4.3	.90	1.0	.10
2	1.0	3.0	.90	.40	.30	.50	.80	5.1	4.5	.70	.50	.10
3	1.4	2.8	.80	.40	.30	.50	.90	5.8	3.7	.50	.30	.10
4	1.3	2.6	.80	.40	.30	.50	1.1	6.5	3.4	.50	.80	.10
5	1.2	2.5	.80	.40	.30	.50	1.4	9.6	3.9	.50	.60	.10
6	2.2	2.3	.80	.40	.30	.40	1.9	11	6.1	.40	.50	.20
7	1.5	2.1	.70	.30	.30	.40	2.3	9.3	5.6	.40	2.6	.20
8	1.9	2.0	.70	.30	.30	.40	10	7.2	3.2	.30	2.5	.10
9	5.5	1.9	.70	.30	.30	.40	31	5.9	1.8	.40	2.3	.10
10	19	1.8	.60	.30	.30	.40	43	4.7	1.6	.30	1.7	.10
11	13	1.7	.60	.30	.30	.40	45	3.6	1.6	.30	1.4	.10
12	9.8	1.6	.60	.30	.30	.40	55	3.0	1.8	.30	1.0	.20
13	7.2	1.4	.50	.30	.30	.40	62	2.4	1.9	.50	.80	.30
14	5.9	1.3	.50	.30	.30	.40	67	2.2	2.0	1.2	.50	.40
15	5.3	1.2	.50	.30	.30	.50	54	15	1.7	3.4	.40	.30
16	17	1.1	.50	.30	.30	.50	46	27	1.3	3.2	.40	.20
17	43	1.0	.40	.30	.30	.50	35	25	1.3	1.9	.30	.10
18	60	1.0	.40	.30	.30	.60	26	16	1.8	1.5	.20	.20
19	32	1.0	.40	.30	.30	.60	20	11	1.6	3.2	.20	.10
20	18	1.0	.40	.30	.30	.70	17	8.2	1.0	2.2	.20	.10
21	13	1.0	.40	.30	.40	.70	19	6.3	.80	1.8	.30	.10
22	11	.90	.40	.30	.40	.80	16	5.1	.60	1.3	.30	.10
23	8.2	.90	.40	.30	.40	.80	13	4.1	.50	1.2	.30	.20
24	6.3	.90	.40	.30	.50	.90	11	3.3	.40	.90	.20	.20
25	5.7	.90	.40	.30	.50	.90	8.5	2.8	.50	.70	.20	.40
26	5.3	.90	.40	.30	.60	.80	7.5	2.4	.50	.40	.20	.30
27	5.0	.90	.40	.30	.60	.80	6.7	2.2	.50	.40	.20	.20
28	4.7	.90	.40	.30	.60	.80	6.1	2.0	.40	.30	.20	.60
29	4.2	.90	.40	.30	-----	.70	5.1	1.6	.30	.20	.10	.50
30	3.9	.90	.40	.30	-----	.70	4.7	1.5	.30	.20	.20	.40
31	3.4	-----	.40	.30	-----	.70	-----	3.7	-----	.40	.10	-----
TOTAL	317.50	45.70	16.90	9.90	10.00	18.20	617.70	217.8	58.90	30.40	20.50	6.20
MEAN	10.2	1.52	.55	.32	.36	.59	20.6	7.03	1.96	.98	.66	.21
MAX	60	3.3	.90	.40	.60	.90	67	27	6.1	3.4	2.6	.60
MIN	.60	.90	.40	.30	.30	.40	.70	1.5	.30	.20	.10	.10
CAL YR 1968	TOTAL 1,657.20		MEAN 4.53		MAX 64		MIN 0					
WTR YR 1969	TOTAL 1,369.70		MEAN 3.75		MAX 67		MIN .10					

LAKE OF THE WOODS BASIN

75

5-1272.25 Shagawa Lake at Ely, Minn.

LOCATION.--Lat 47°54'18", long 91°53'00", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.33, T.63 N., R.12 W., St. Louis County, on south shore of Shagawa Lake, on east pier of dock at U. S. Forest Service Seaplane Base in Ely.

PERIOD OF RECORD.--April 1967 to current year. April 1962 to July 1966 (fragmentary) in files of Minnesota Department of Conservation, Division of Waters, Soils and Minerals.

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

EXTREMES.--Current year: Maximum elevation observed, 1,339.45 ft April 22, 23; minimum observed, 1337.27 ft Sept. 19 (affected by wind action).

Period of record: Maximum elevation observed since 1962, 1,339.95 ft Apr. 27, 28, 1966, from Minnesota Department of Conservation, Division of Waters, Soils and Minerals.

MONTH-END ELEVATION, IN FEET, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

Oct. 31	1338.63	Feb. 28	1337.71	June 30	1338.19
Nov. 25	1338.05	Mar. 27	1337.57	July 29	1337.97
Dec. 30	1337.84	Apr. 30	1339.19	Aug. 29	1337.64
Jan. 27	1337.84	May 30	1338.81	Sept.30	1337.35

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

LAKE OF THE WOODS BASIN

5-1272.30 Shagawa River at Ely, Minn.

LOCATION.--Lat 47°55'09", long 91°50'08", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.23, T.63 N., R.12 W., St. Louis County, on right bank, 300 ft downstream from outlet of Shagawa Lake, 150 ft north of the village limits of Ely, 0.8 mile upstream from County Road 88 and 3 miles upstream from Fall Lake.

PERIOD OF RECORD.--May 1967 to current year.

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

EXTREMES.--Current year: Maximum discharge, 360 cfs Apr. 22 (gage height, 6.22 ft); minimum, 22 cfs Sept. 24 (gage height, 4.20 ft).
Period of record: Maximum discharge, 385 cfs June 15, 1968 (gage height, 6.33 ft); minimum, 6.2 cfs Mar. 4, 1968 (gage height, 3.74 ft).

REMARKS.--Records good.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	65	188	77	70	80	57	45	272	228	115	85	46
2	65	182	77	69	80	56	44	268	226	113	83	44
3	65	172	77	68	80	55	43	258	222	108	81	40
4	64	166	77	67	80	54	44	258	220	107	85	41
5	62	162	76	67	77	58	44	260	220	105	87	42
6	65	154	75	67	77	59	45	260	224	102	90	45
7	65	150	74	66	75	58	47	260	222	98	101	41
8	65	144	72	67	75	58	49	253	218	95	101	38
9	73	140	69	69	73	57	62	249	213	94	98	38
10	87	133	70	68	72	55	74	247	207	92	96	35
11	91	127	69	67	72	54	86	241	205	91	99	34
12	94	122	69	67	70	54	105	239	201	87	101	34
13	96	118	75	66	70	53	142	234	190	87	101	33
14	101	116	73	65	68	53	186	234	184	94	98	32
15	102	111	73	66	68	51	241	249	176	104	92	34
16	115	107	73	70	68	51	292	281	172	107	90	33
17	150	102	72	69	68	51	327	303	166	105	88	31
18	197	105	69	69	64	50	334	321	162	104	81	29
19	226	105	69	69	65	49	341	325	162	107	76	28
20	236	104	69	70	64	49	343	319	156	105	74	27
21	241	101	68	69	64	48	347	312	148	104	69	25
22	243	95	69	69	63	47	358	303	142	101	67	25
23	239	95	75	73	62	48	358	292	138	99	63	26
24	232	92	73	78	62	48	356	286	133	94	60	23
25	226	87	73	77	60	48	349	275	127	91	58	25
26	220	86	70	76	59	46	334	264	125	88	58	28
27	216	83	72	76	58	46	310	258	125	86	58	28
28	209	82	72	80	58	47	294	251	123	85	52	27
29	203	80	70	80	-----	46	286	241	120	82	48	30
30	197	78	70	81	-----	45	277	228	120	80	52	28
31	190	-----	72	81	-----	45	-----	224	-----	86	50	-----
TOTAL	4,500	3,587	2,239	2,196	1,932	1,596	6,163	8,265	5,275	3,016	2,442	990
MEAN	145	120	72.2	70.8	69.0	51.5	205	267	176	97.3	78.8	33.0
MAX	243	188	77	81	80	59	358	325	228	115	101	46
MIN	62	78	68	65	58	45	43	224	120	80	48	23
CAL YR 1968	TOTAL 41,476		MEAN 113	MAX 374	MIN 11							
WTR YR 1969	TOTAL 42,201		MEAN 116	MAX 358	MIN 23							

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., Lake County, on island in 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).

PERIOD OF RECORD.--March to June 1924, September 1925 to March 1928, January 1930 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is 1,296.80 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Prior to Oct. 27, 1938, staff gages at several sites in vicinity of gage, at datum 3.0 ft higher. Oct. 28, 1938, to Sept. 30, 1966, water-stage recorder at datum 3.0 ft higher.

AVERAGE DISCHARGE.--41 years (1925-27, 1930-69), 1,346 cfs (10.50 inches per year).

EXTREMES.--Current year: Maximum discharge, 7,970 cfs May 5 (gage height, 7.32 ft); minimum, 732 cfs Sept. 19, 20, 21, 22 (gage height, 3.17 ft).

Period of record: 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,200	3,510	1,350	1,270	1,170	931	843	7,360	4,270	1,720	981	1,040
2	1,190	3,410	1,360	1,260	1,160	939	826	7,570	4,120	1,710	965	1,010
3	1,180	3,320	1,360	1,240	1,160	946	809	7,710	3,970	1,670	955	969
4	1,160	3,220	1,340	1,230	1,160	951	801	7,810	3,840	1,660	972	931
5	1,150	3,100	1,330	1,220	1,150	955	790	7,910	3,740	1,650	1,010	927
6	1,170	2,960	1,330	1,210	1,140	961	781	7,910	3,660	1,610	1,010	921
7	1,160	2,830	1,320	1,200	1,120	966	774	7,820	3,530	1,560	1,050	907
8	1,150	2,710	1,310	1,210	1,100	970	779	7,690	3,400	1,510	1,090	886
9	1,200	2,610	1,290	1,230	1,080	978	814	7,540	3,280	1,470	1,100	857
10	1,250	2,510	1,290	1,220	1,060	980	847	7,350	3,200	1,440	1,110	843
11	1,250	2,420	1,280	1,210	1,050	986	883	7,140	3,120	1,420	1,120	844
12	1,240	2,350	1,270	1,200	1,040	989	929	6,900	2,990	1,380	1,140	840
13	1,230	2,260	1,350	1,180	1,020	990	1,010	6,680	2,880	1,350	1,140	838
14	1,230	2,150	1,350	1,180	1,010	992	1,130	6,480	2,790	1,330	1,140	822
15	1,240	2,050	1,330	1,180	994	996	1,290	6,470	2,700	1,360	1,200	810
16	1,340	1,970	1,320	1,200	982	1,000	1,530	6,450	2,640	1,340	1,290	792
17	1,570	1,890	1,310	1,180	962	1,000	1,800	6,380	2,580	1,310	1,370	770
18	1,840	1,800	1,300	1,160	943	1,010	2,110	6,270	2,510	1,290	1,430	760
19	2,080	1,730	1,280	1,160	926	1,010	2,440	6,150	2,440	1,290	1,470	752
20	2,370	1,690	1,270	1,160	914	1,020	2,830	6,050	2,340	1,290	1,470	746
21	2,670	1,640	1,260	1,150	903	1,020	3,320	5,960	2,270	1,260	1,430	746
22	2,910	1,620	1,280	1,140	899	1,010	3,800	5,870	2,190	1,220	1,390	765
23	3,120	1,570	1,310	1,180	894	1,000	4,270	5,790	2,110	1,170	1,350	778
24	3,370	1,530	1,300	1,230	893	981	4,720	5,690	2,030	1,130	1,310	781
25	3,550	1,510	1,290	1,210	899	961	5,170	5,590	1,990	1,080	1,270	798
26	3,690	1,480	1,290	1,210	907	943	5,680	5,470	1,920	1,050	1,230	823
27	3,760	1,460	1,290	1,210	915	925	6,100	5,320	1,860	1,030	1,180	832
28	3,820	1,430	1,280	1,230	923	907	6,460	5,110	1,810	999	1,150	839
29	3,820	1,400	1,270	1,230	894	894	6,790	4,830	1,800	963	1,140	858
30	3,750	1,370	1,260	1,220	876	876	7,080	4,590	1,750	937	1,110	870
31	3,630	-----	1,270	1,190	861	861	-----	4,400	-----	973	1,070	-----
TOTAL	65,290	65,500	40,440	37,300	28,374	29,948	77,406	200,260	83,730	41,172	36,643	25,355
MEAN	2,106	2,183	1,305	1,203	1,013	966	2,580	6,460	2,791	1,328	1,182	845
MAX	3,820	3,510	1,360	1,270	1,170	1,020	7,080	7,910	4,270	1,720	1,470	1,040
MIN	1,150	1,370	1,260	1,140	893	861	774	4,400	1,750	937	955	746
CFSM	1.21	1.25	.75	.69	.58	.56	1.48	3.71	1.60	.76	.68	.49
IN.	1.40	1.40	.86	.80	.61	.64	1.65	4.28	1.79	.88	.78	.54

CAL YR 1968 TOTAL 793,856

MEAN 2,169

MAX 8,980

MIN 259

CFSM 1.25

IN 16.97

WTR YR 1969 TOTAL 731,418

MEAN 2,004

MAX 7,910

MIN 746

CFSM 1.15

IN 15.63

LAKE OF THE WOODS BASIN

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

(International gaging station)

LOCATION.--Lat 48°23'00", long 92°10'40", at Campbell's Camp, 2.5 miles west of outlet of Lac la Croix.

DRAINAGE AREA.--5,170 sq mi.

PERIOD OF RECORD.--September 1921 to January 1922, April 1922 to current year, in reports of Geological Survey.
 Monthly discharge only for some periods, published in WSP 1308. August 1921 to current year 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, nonrecording gages at various sites on Lac la
 Croix. October 1933 to March 13, 1963, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--47 years (1922-69), 3,687 cfs (9.68 inches per year).

EXTREMES.--Current year: Maximum discharge, 15,300 cfs May 15 (elevation, 1,189.24 ft); minimum daily, 2,390
 cfs Apr. 7.

Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4,000	7,790	4,890	3,570	3,580	3,030	2,490	11,700	12,300	6,930	4,830	4,030
2	3,980	7,900	4,830	3,570	3,570	2,990	2,490	12,300	12,200	6,820	4,770	3,960
3	3,950	7,950	4,750	3,600	3,540	2,980	2,450	12,800	12,000	6,680	4,720	3,880
4	3,910	8,060	4,700	3,590	3,540	2,920	2,440	13,300	11,900	6,640	4,660	3,810
5	3,880	8,150	4,620	3,590	3,500	2,890	2,430	13,700	11,700	6,590	4,620	3,760
6	3,880	8,130	4,550	3,580	3,490	2,880	2,400	14,100	11,600	6,520	4,640	3,730
7	3,850	8,080	4,460	3,580	3,470	2,860	2,390	14,300	11,500	6,410	4,720	3,710
8	3,810	8,040	4,410	3,570	3,470	2,850	2,400	14,600	11,200	6,210	4,810	3,650
9	3,850	7,950	4,350	3,570	3,440	2,840	2,440	14,800	11,000	6,060	4,810	3,580
10	3,900	7,900	4,280	3,560	3,440	2,810	2,440	14,900	10,800	5,990	4,810	3,520
11	3,950	7,740	4,210	3,550	3,440	2,780	2,480	15,000	10,600	5,930	4,770	3,460
12	3,960	7,650	4,170	3,550	3,420	2,780	2,530	15,100	10,300	5,840	4,750	3,390
13	3,950	7,580	4,260	3,540	3,390	2,780	2,610	15,100	10,100	5,800	4,720	3,340
14	4,030	7,370	4,240	3,540	3,370	2,750	2,780	15,030	9,890	5,780	4,620	3,280
15	4,120	7,260	4,210	3,530	3,350	2,710	3,050	15,000	9,660	5,900	4,590	3,240
16	4,210	7,120	4,170	3,530	3,330	2,700	3,390	15,000	9,410	5,900	4,550	3,180
17	4,460	7,000	4,120	3,520	3,310	2,680	3,810	14,900	9,210	5,840	4,510	3,120
18	4,830	6,980	4,120	3,490	3,280	2,650	4,280	14,800	9,050	5,820	4,440	3,050
19	5,050	6,960	3,960	3,470	3,260	2,640	4,740	14,600	8,830	5,800	4,420	3,000
20	5,290	6,910	3,910	3,490	3,240	2,630	5,210	14,500	8,690	5,730	4,370	2,920
21	5,570	6,190	3,900	3,470	3,220	2,600	5,730	14,300	8,500	5,650	4,330	2,860
22	5,820	6,170	3,900	3,440	3,200	2,580	6,280	14,100	8,340	5,570	4,260	2,860
23	6,100	5,930	4,020	3,470	3,170	2,570	6,840	13,800	8,130	5,420	4,230	2,890
24	6,370	5,780	4,000	3,550	3,150	2,570	7,420	13,600	7,900	5,310	4,190	2,860
25	6,540	5,670	3,980	3,580	3,130	2,540	7,990	13,500	7,810	5,210	4,170	2,820
26	6,930	5,520	3,960	3,580	3,100	2,530	8,690	13,300	7,580	5,170	4,140	2,810
27	7,030	5,360	3,950	3,580	3,070	2,540	9,290	13,000	7,370	5,110	4,080	2,770
28	7,210	5,230	3,950	3,600	3,060	2,520	9,840	12,700	7,300	5,010	4,080	2,750
29	7,420	5,110	3,950	3,580	-----	2,520	10,500	12,500	7,260	4,890	4,080	2,710
30	7,620	5,010	3,760	3,600	-----	2,510	11,000	12,300	7,050	4,790	4,080	2,670
31	7,740	-----	3,730	3,600	-----	2,510	-----	12,300	-----	4,850	4,030	-----
TOTAL	157,210	208,510	130,310	110,040	93,530	84,140	142,830	430,900	289,180	180,170	138,800	97,610
MEAN	5,071	6,950	4,204	3,550	3,340	2,714	4,761	13,900	9,639	5,812	4,477	3,254
MAX	7,740	8,150	4,890	3,600	3,580	3,030	11,000	15,100	12,300	6,930	4,830	4,030
MIN	3,810	5,010	3,730	3,440	3,060	2,510	2,390	11,700	7,050	4,790	4,030	2,670
CFSM	.98	1.34	.81	.69	.65	.53	.92	2.69	1.86	1.12	.87	.63
IN.	1.13	1.50	.94	.79	.67	.61	1.03	3.10	2.08	1.30	1.00	.70
CAL YR 1968	TOTAL 2,289,963	MEAN 6,257	MAX 19,900	MIN 843	CFSM 1.21	IN 16.48						
WAT YR 1969	TOTAL 2,063,230	MEAN 5,653	MAX 15,100	MIN 390	CFSM 1.09	IN 14.85						

5-1282. Vermilion Lake near Soudan, Minn.

LOCATION.--Lat 47°49'52", long 92°16'20", in SW 1/4 sec.20, T.62 N., R.15 W., St. Louis County, on south shore of Vermilion Lake, at McKinley Park, 2 miles northwest of Soudan.

PERIOD OF RECORD.--October 1913 to July 1915, July 1941 to November 1942, June 1946 to current year (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, nonrecording 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, nonrecording 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.--Current year: Maximum elevation, 1,359.02 ft Apr. 27; maximum daily, 1,359.01 ft Apr. 27; minimum, 1,357.14 ft Sept. 21.

Period of record: 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).

MONTHEND ELEVATION, IN FEET, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

Oct. 31	1,358.27	Feb. 28	1,357.40	June 30	1,358.15
Nov. 30	1,357.73	Mar. 31	1,357.24	July 31	1,357.85
Dec. 31	1,357.61	Apr. 30	1,358.93	Aug. 31	1,357.38
Jan. 31	1,357.60	May 31	1,358.65	Sept.30	1,357.30

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

LAKE OF THE WOODS BASIN

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

LOCATION.--Lat 47°57'41", long 92°28'33", in SE 1/4 sec. 2, T.63 N., R.17 W., St. Louis County, 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.

PERIOD OF RECORD.--May 1911 to September 1917, June 1928 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,347.36 ft above mean sea level, datum of 1929. June 26, 1928, to July 8, 1931, nonrecording gage at same site, at datum 3.05 ft higher. May 17, 1911, to Sept. 30, 1917, July 9, 1931, to Apr. 11, 1939, nonrecording gages, and Apr. 12, 1939, to Sept. 30, 1967, water-stage recorder at same site, at datum 3.00 ft higher.

AVERAGE DISCHARGE.--47 years, 310 cfs (8.72 inches per year).

EXTREMES.--Current year: Maximum discharge, 1,540 cfs Apr. 26 (gage height, 6.53 ft); minimum, 168 cfs Sept. 23 (gage height, 3.92 ft).

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 1508: 1913.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	421	784	452	385	373	262	190	1,460	1,170	655	453	247
2	410	778	457	383	365	255	190	1,430	1,130	631	447	253
3	388	778	452	378	360	255	188	1,420	1,130	625	445	245
4	391	767	457	377	352	253	191	1,420	1,120	606	437	242
5	413	762	457	377	346	252	192	1,440	1,140	593	442	232
6	400	745	457	368	335	249	194	1,400	1,150	590	466	252
7	401	729	448	366	336	246	195	1,380	1,130	567	469	250
8	382	719	444	371	328	243	204	1,350	1,120	552	466	243
9	394	709	434	366	326	241	235	1,320	1,090	517	466	235
10	408	694	430	360	320	241	258	1,280	1,090	491	471	224
11	432	674	421	354	312	241	288	1,240	1,090	491	468	223
12	437	674	412	347	309	238	336	1,210	1,020	479	469	216
13	444	679	457	342	308	235	406	1,190	1,010	485	461	222
14	439	639	452	340	305	230	510	1,180	986	520	419	218
15	453	624	444	344	305	227	651	1,310	966	577	411	208
16	474	614	435	358	302	224	789	1,340	931	574	402	207
17	537	594	430	351	299	219	906	1,400	897	565	383	201
18	673	574	421	345	298	216	1,020	1,420	878	556	364	203
19	695	559	412	344	294	214	1,130	1,400	844	562	355	202
20	730	574	403	345	291	212	1,230	1,400	825	536	346	194
21	764	529	403	339	286	212	1,320	1,410	817	538	336	189
22	753	534	398	333	282	210	1,390	1,400	799	535	328	194
23	797	519	403	356	280	205	1,430	1,390	768	491	318	183
24	813	489	412	379	277	203	1,470	1,350	748	475	309	199
25	826	499	408	376	274	201	1,470	1,340	754	468	301	207
26	841	494	408	372	270	198	1,520	1,330	737	467	302	197
27	796	489	403	372	266	197	1,480	1,280	714	460	284	191
28	816	470	373	375	265	196	1,470	1,230	685	447	271	203
29	830	466	394	372	-----	196	1,460	1,150	708	435	289	211
30	838	462	390	381	-----	193	1,450	1,150	657	437	265	204
31	816	-----	390	377	-----	193	-----	1,160	-----	452	254	-----
TOTAL	18,212	18,621	13,196	11,233	8,668	6,957	23,763	41,180	28,104	16,377	11,897	6,495
MEAN	587	621	426	362	310	224	792	1,328	937	528	384	217
MAX	841	784	457	385	373	262	1,520	1,460	1,170	655	471	253
MIN	382	462	390	333	265	193	188	1,150	657	435	254	183
CFSM	1.22	1.29	.88	.75	.64	.46	1.64	2.75	1.94	1.09	.79	.45
IN.	1.40	1.43	1.02	.86	.67	.54	1.83	3.17	2.16	1.26	.92	.50

CAL YR 1968 TOTAL 188,127 MEAN 514 MAX 1,330 MIN 17 CFSM 1.06 IN 14.49
WTR YR 1969 TOTAL 204,703 MEAN 561 MAX 1,520 MIN 183 CFSM 1.16 IN 15.76

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.

PERIOD OF RECORD.--January 1910 to September 1917 and October 1934 to current year 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 Frances, 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, nonrecording 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, at same datum.

EXTREMES.--Current year: Maximum elevation, 1,108.62 ft Aug. 6; minimum, 1,104.18 ft Apr. 7.

Period of record: 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.

MONTHEND ELEVATION, IN FEET, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

Oct. 31	8.29	Feb. 28	5.25	June 30	7.76
Nov. 30	7.22	Mar. 31	4.31	July 31	8.21
Dec. 31	6.71	Apr. 30	5.98	Aug. 31	7.98
Jan. 31	6.58	May 31	7.82	Sept. 30	7.87

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

LAKE OF THE WOODS BASIN

5-1305. Sturgeon River near Chisholm, Minn.

LOCATION.--Lat 47°40'25", long 92°54'00", in NE1/4 sec.20, T.60 N., R.20 W., St. Louis County, on left bank 1,000 ft upstream from highway bridge, 0.6 mile downstream from East Branch Sturgeon River, and 11.5 miles north of Chisholm.

DRAINAGE AREA.--187 sq mi.

PERIOD OF RECORD.--August 1942 to current year.

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

AVERAGE DISCHARGE.--27 years, 122 cfs (8.86 inches per year).

EXTREMES.--Current year: Maximum discharge, 2,200 cfs Apr. 15 (gage height, 5.55 ft); minimum, 32 cfs Aug. 27, 28 (gage height, 0.71 ft).

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

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

REVISIONS (WATER YEARS).--WSP 1438: 1946.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	144	183	88	50	49	43	65	369	321	100	121	92
2	140	178	89	50	49	43	66	380	383	92	112	82
3	140	172	92	49	48	43	68	380	390	85	94	70
4	136	167	92	49	48	43	73	390	390	84	80	62
5	128	163	60	48	48	43	85	434	362	92	72	59
6	123	153	67	48	48	42	115	438	348	86	81	92
7	119	152	70	48	47	42	167	394	314	78	181	88
8	113	148	70	48	47	42	246	352	274	72	190	84
9	126	144	69	48	47	42	380	321	243	69	181	76
10	161	140	68	48	46	47	542	290	228	66	163	71
11	183	134	66	48	46	42	861	260	230	64	124	66
12	188	112	60	47	46	41	1,260	236	225	60	103	59
13	178	121	51	47	46	41	1,740	215	208	58	92	59
14	163	124	52	47	46	41	2,080	195	195	74	82	59
15	150	121	60	47	45	41	2,160	290	181	115	75	65
16	163	117	59	47	45	40	1,940	427	167	156	67	65
17	260	117	57	49	45	40	1,580	595	154	130	62	60
18	405	117	55	48	45	41	1,280	678	146	103	56	59
19	535	115	54	48	45	41	1,050	658	138	88	52	58
20	643	110	54	48	44	42	909	544	132	79	47	55
21	619	119	54	49	44	43	856	438	124	69	44	53
22	522	117	53	49	44	45	796	358	119	64	42	72
23	430	113	52	50	44	48	743	304	112	61	39	103
24	366	110	52	50	44	52	658	271	110	58	37	119
25	321	103	51	50	44	57	571	251	107	61	35	142
26	277	92	51	51	44	60	518	235	110	57	34	148
27	246	86	51	51	44	63	465	220	106	106	32	150
28	230	86	50	51	44	66	430	210	104	117	36	150
29	215	87	50	51	-----	67	390	195	103	104	42	144
30	200	88	50	50	-----	65	358	183	103	86	67	132
31	193	-----	50	50	-----	64	-----	208	-----	115	85	-----
TOTAL	7,817	3,794	1,897	1,514	1,282	1,465	22,452	10,719	6,117	2,649	2,528	2,594
MEAN	252	126	61.2	48.8	45.8	47.3	748	346	204	85.5	81.5	86.5
MAX	643	183	92	51	49	67	2,160	678	390	156	190	150
MIN	113	86	50	47	44	40	65	183	103	57	32	53
CFSM	1.35	0.67	0.33	0.26	0.24	0.25	4.00	1.85	1.09	0.46	0.44	0.46
IN.	1.56	0.75	0.38	0.30	0.26	0.29	4.47	2.13	1.22	0.53	0.50	0.52

CAL YR 1968 TOTAL 58,395.3 MEAN 160 MAX 643 MIN 9.5 CFSM 0.86 IN. 11.62
WTR YR 1969 TOTAL 64,828 MEAN 178 MAX 2,160 MIN 32 CFSM 0.95 IN. 12.90

PEAK DISCHARGE (BASE, 500 CFS)

NOTE.--No gage-height record Feb. 14 to Mar. 13.

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-20	1900	3.15	658	5-18	2300	3.26	713
4-15	0400	5.55	2200				

LOCATION.--Lat 47°41'27", long 92°49'15", in SW 1/4 sec.12, T.60 N., R.20 W., St. Louis County, on right bank 50 ft downstream from remains of abandoned highway bridge, 3.5 miles upstream from mouth, and 12.2 miles north-east of Chisholm.

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, nonrecording gage at site 50 ft upstream at same datum.

EXTREMES.--Current year: Maximum discharge, 605 cfs Apr. 13 (gage height, 5.30 ft); minimum, 8.0 cfs Aug. 27 (gage height, 1.39 ft).
Period of record: 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.

COOPERATION.--Records for 1969 water year computed by U.S. Steel Corporation and reviewed by Geological Survey.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	53	22	17	19	16	26	79	69	22	48	20
2	34	50	22	17	19	15	27	80	79	20	46	20
3	33	48	22	17	19	15	29	79	78	18	41	19
4	32	46	23	17	19	15	31	82	79	18	35	17
5	31	44	23	17	19	15	35	90	79	22	32	17
6	32	41	24	17	18	15	42	98	76	21	32	37
7	30	40	24	17	18	15	55	89	68	19	42	31
8	30	35	22	17	18	14	80	84	61	17	37	25
9	39	35	22	17	18	14	110	76	51	17	42	23
10	45	34	22	17	18	13	180	68	48	16	43	22
11	48	33	22	17	18	13	240	60	50	15	40	20
12	53	31	21	17	18	12	422	56	47	14	36	18
13	53	30	21	17	18	12	563	51	43	12	32	17
14	48	28	21	16	17	12	582	47	38	23	28	18
15	45	27	21	16	17	12	575	96	34	46	25	21
16	58	27	21	17	17	12	527	143	30	68	23	21
17	86	27	21	17	17	12	436	174	27	57	21	19
18	108	27	21	17	17	13	336	209	24	51	19	18
19	138	27	20	16	17	14	271	182	22	45	17	17
20	163	25	20	16	17	15	234	147	20	36	16	16
21	159	26	20	16	17	16	221	117	19	30	14	15
22	142	26	19	16	17	17	190	94	17	27	12	25
23	121	26	19	15	17	19	171	79	17	25	11	33
24	108	26	19	16	17	24	151	69	16	23	10	38
25	98	25	19	17	17	26	133	60	16	25	9.8	40
26	88	25	19	18	17	28	124	54	19	22	9.3	39
27	78	25	18	18	16	27	107	46	17	53	8.7	39
28	71	24	18	18	16	26	95	40	20	44	9.1	37
29	64	23	18	18	-----	26	85	35	20	36	21	38
30	60	22	18	18	-----	25	77	31	22	32	20	36
31	56	-----	18	19	-----	25	-----	46	-----	57	21	-----
TOTAL	2,185	956	640	525	492	533	6,155	2,661	1,206	931	800.9	756
MEAN	70.5	31.9	20.6	16.9	17.6	17.2	205	85.8	40.2	30.0	25.8	25.2
MAX	163	53	24	19	19	28	582	209	79	68	48	40
MIN	30	22	18	15	16	12	26	31	16	12	8.7	15
CFSM	1.39	.63	.41	.33	.35	.34	4.05	1.70	.79	.59	.51	.50
IN.	1.61	.70	.47	.39	.36	.39	4.53	1.96	.89	.68	.59	.56
CAL YR 1968	TOTAL 15,429.2		MEAN 42.2	MAX 176	MIN 3.0	CFSM .83	IN 11.34					
WAT YR 1969	TOTAL 17,840.9		MEAN 48.9	MAX 582	MIN 8.7	CFSM .97	IN 13.12					

LAKE OF THE WOODS BASIN

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

LOCATION.--Lat 48°23'55", long 93°33'56", in NW¼ sec.9, T.68 N., R.25 W., Koochiching County, on left bank 100 ft downstream from highway bridge at town of Littlefork, 0.3 mile downstream from bridge on State Highway 217, 1.5 miles upstream from Beaver Creek, and 18 miles upstream from mouth.

DRAINAGE AREA.--1,730 sq mi, approximately.

PERIOD OF RECORD.--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 current year.

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, nonrecording gage at same site and datum. Mar. 5 to Sept. 30, 1917 and June 22, 1928, to July 20, 1937, nonrecording gage, at site 100 ft upstream at same datum. Nonrecording gage 1.2 miles upstream at datum 9.0 ft higher (used as supplementary gage during periods of backwater from Rainy River).

AVERAGE DISCHARGE.--46 years (1911-16, 1928-69), 1,009 cfs (7.92 inches per year).

EXTREMES.--Current year: Maximum discharge, 20,600 cfs Apr. 17 (gage height, 32.61 ft); minimum daily, 235 cfs Mar. 16-18.

Period of record: 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, which are fair. Records of chemical analyses for water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 955: Drainage area. WSP 1508: 1913, 1916, 1928-32, 1934.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,290	1,830	545	330	260	259	305	3,470	3,380	718	2,710	1,240
2	1,170	1,680	560	320	265	257	300	3,340	4,840	700	2,990	1,100
3	1,140	1,580	570	310	265	255	298	3,540	5,770	659	2,710	951
4	1,160	1,490	565	305	270	255	300	3,540	5,690	637	2,240	812
5	1,140	1,360	550	300	275	255	310	3,390	5,040	659	1,900	706
6	1,110	1,240	530	295	280	253	320	3,370	4,640	626	1,910	666
7	1,100	883	515	290	280	250	360	3,540	4,280	585	2,720	894
8	1,040	910	500	285	280	250	640	3,500	3,880	545	6,000	1,040
9	1,040	950	480	280	280	248	1,820	3,240	3,270	555	5,640	1,130
10	1,270	910	460	272	280	248	3,500	2,960	2,890	530	4,380	1,030
11	1,460	870	450	270	280	245	6,700	2,700	2,450	505	3,300	947
12	1,590	830	440	265	279	243	9,110	2,460	2,310	456	2,430	869
13	1,630	810	435	260	279	240	13,400	2,250	2,090	452	1,790	780
14	1,550	780	430	258	275	240	16,800	2,060	1,850	452	1,470	709
15	1,430	750	420	255	275	237	18,600	2,100	1,660	760	1,210	641
16	1,360	730	415	255	273	235	20,000	4,730	1,460	1,800	1,030	594
17	1,780	710	410	250	271	235	20,600	8,210	1,280	2,740	897	564
18	3,660	690	405	250	270	235	19,700	9,710	1,130	3,110	784	546
19	6,020	670	400	250	270	237	17,500	8,860	1,030	2,430	670	537
20	6,250	650	395	250	269	240	13,900	6,830	962	2,040	590	507
21	5,720	650	390	250	268	245	10,400	5,390	911	1,510	545	533
22	5,270	640	385	255	266	250	8,770	4,410	855	1,160	495	519
23	5,380	620	380	255	264	260	7,820	3,610	816	1,030	470	656
24	5,080	600	375	257	260	265	7,000	3,080	772	1,020	455	901
25	4,450	590	370	258	260	270	6,200	2,590	706	876	412	1,030
26	3,770	585	365	260	260	280	5,570	2,220	676	796	385	1,320
27	3,240	580	360	260	260	290	5,190	2,050	718	818	364	1,590
28	2,780	565	355	258	260	300	4,770	1,810	670	1,530	354	1,640
29	2,380	550	345	258	-----	305	4,280	1,640	682	2,560	372	1,550
30	2,180	550	340	260	-----	305	3,820	1,440	736	2,380	634	1,520
31	2,000	-----	335	260	-----	305	-----	1,600	-----	2,360	1,180	-----
TOTAL	80,440	26,253	13,475	8,381	7,574	7,992	228,283	113,640	67,444	36,999	53,037	27,522
MEAN	2,595	875	435	270	271	258	7,609	3,666	2,248	1,194	1,711	917
MAX	6,250	1,830	570	330	280	305	20,600	9,710	5,770	3,110	6,000	1,640
MIN	1,040	550	335	250	260	235	298	1,440	670	452	354	507
CFM	1.50	0.51	0.25	0.16	0.16	0.15	4.40	2.12	1.30	0.69	0.99	0.53
IN.	1.73	0.56	0.29	0.18	0.17	0.17	4.91	2.44	1.45	0.80	1.14	0.59

CAL YR 1968: TOTAL 514,689 MEAN 1,406 MAX 6,250 MIN 41 CFM 0.81 IN. 11.07
 WTR YR 1969: TOTAL 671,040 MEAN 1,838 MAX 20,600 MIN 235 CFM 1.06 IN. 14.44

NOTE.--Backwater from Rainy River Oct. 24 to Nov. 11, May 25-30, June 3 to July 27, Aug. 12-24.

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

LOCATION.--Lat 48°11'45", long 93°48'25", in sec.35, T.155 N., R.25 W., Koochiching County, on left bank at village of Big Falls, 700 ft downstream from falls, 0.3 mile downstream from bridge on U.S. Highway 71, and 4.8 miles upstream from Sturgeon River.

DRAINAGE AREA.--1,460 sq mi, approximately.

PERIOD OF RECORD.--August to November 1909, April to November 1910, April 1911 to September 1912 (gage heights and discharge measurements only), June 1928 to current year.

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

AVERAGE DISCHARGE.--41 years (1928-1969), 669 cfs (6.22 inches per year).

EXTREMES.--Current year: Maximum discharge, 13,300 cfs Apr. 16 (gage height, 15.79 ft); minimum, 231 cfs

Aug. 28 (gage height, 3.24 ft).

Period of record: 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 winter months, which are fair. Some diurnal fluctuation at low flow caused by powerplant a quarter of a mile upstream.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,160	1,410	524	400	386	286	338	2,640	2,970	488	860	890
2	1,080	1,350	522	400	382	286	333	2,580	3,470	462	813	750
3	1,060	1,310	516	400	380	284	328	2,490	3,800	455	750	637
4	1,030	1,270	502	400	376	282	325	2,410	3,660	427	704	537
5	994	1,220	488	400	372	282	330	2,370	3,340	426	599	473
6	954	1,180	480	398	368	280	340	2,350	3,020	421	540	598
7	899	1,140	468	398	364	278	400	2,280	2,630	407	656	691
8	855	1,110	458	398	360	276	540	2,190	2,200	391	950	699
9	866	1,070	450	398	356	276	760	2,100	1,810	391	980	667
10	1,020	1,050	442	398	352	274	1,270	2,000	1,590	384	905	631
11	1,110	1,000	432	396	350	274	2,010	1,890	1,570	335	788	591
12	1,130	858	424	396	344	274	3,450	1,770	1,450	338	663	544
13	1,110	834	420	396	340	274	6,100	1,680	1,290	328	569	506
14	1,060	828	416	396	334	272	10,800	1,600	1,140	323	504	472
15	1,020	838	412	396	330	272	12,500	2,250	1,040	704	452	450
16	1,010	838	414	398	326	274	13,100	4,540	942	1,710	410	433
17	1,300	806	416	398	322	274	11,800	6,140	850	2,100	375	415
18	2,370	768	418	398	320	274	10,200	6,750	788	2,080	348	406
19	3,400	726	420	400	316	276	8,540	5,790	747	1,890	325	402
20	3,930	642	416	400	312	278	7,010	4,620	702	1,480	305	396
21	3,760	578	412	400	310	280	5,940	3,740	663	1,050	290	394
22	3,550	563	410	400	306	280	5,360	3,070	626	833	276	425
23	3,370	564	408	402	304	284	4,940	2,600	584	727	268	532
24	3,010	562	406	402	300	290	4,520	2,340	574	632	259	697
25	2,670	560	404	402	298	298	4,110	2,140	517	579	251	758
26	2,360	556	402	402	296	305	3,760	1,930	473	534	244	886
27	2,110	548	402	400	292	310	3,480	1,750	474	598	235	971
28	1,900	542	402	399	288	315	3,200	1,620	474	606	264	929
29	1,730	536	402	398	-----	325	2,980	1,470	482	555	384	897
30	1,610	528	402	396	-----	335	2,780	1,320	499	522	828	859
31	1,490	-----	402	392	-----	340	-----	1,370	-----	693	1,040	-----
TOTAL	54,973	25,790	13,490	12,357	9,384	8,908	131,544	83,790	44,375	22,869	16,835	18,536
MEAN	1,773	860	435	399	335	287	4,385	2,703	1,479	738	543	618
MAX	3,930	1,410	524	402	386	340	13,100	6,750	3,800	2,100	1,040	971
MIN	.255	528	402	392	288	272	325	1,320	473	323	235	394
CFSM	1.21	.59	.30	.27	.23	.20	3.00	1.85	1.01	.51	.37	.42
IN.	1.40	.66	.34	.31	.24	.23	3.35	2.13	1.13	.58	.43	.47

CAL YR 1968 TOTAL 290,240

MEAN 793

MAX 3,930

MIN 54

CFSM .54

IN 7.39

WTR YR 1969 TOTAL 442,856

MEAN 1,213

MAX 13,100

MIN 235

CFSM .83

IN 11.28

LAKE OF THE WOODS BASIN

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., Koochiching County, on left bank at Manitou Rapids, 3.5 miles east of Manitou Post Office and 4 miles west of Indus.

DRAINAGE AREA.--19,400 sq mi, approximately.

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

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

AVERAGE DISCHARGE.--41 years, 12,510 cfs (8.76 inches per year).

EXTREMES.--Current year: Maximum discharge, 58,300 cfs Apr. 18 (gage height, 18.37 ft); minimum, 6,960 cfs Sept. 11 (gage height, 3.73 ft).

Period of record: 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 1969 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16,800	33,500	20,200	10,700	13,400	16,300	12,300	26,600	27,200	19,200	18,500	14,600
2	16,200	33,200	20,200	11,400	13,400	16,300	12,700	26,100	31,000	18,800	19,000	13,800
3	16,100	32,700	20,200	11,600	13,400	16,200	12,000	26,000	34,300	16,500	19,000	13,100
4	16,100	32,300	20,100	11,600	13,400	16,000	10,800	25,900	38,600	14,000	19,400	11,700
5	15,500	32,000	20,000	11,600	15,000	16,000	10,800	25,700	39,800	11,600	18,900	10,300
6	15,100	31,300	19,600	11,600	18,100	16,000	10,900	25,700	40,100	12,000	19,900	9,240
7	14,900	30,200	17,900	11,500	18,800	15,900	11,100	25,800	39,300	12,700	23,700	8,690
8	14,700	28,100	17,900	11,600	18,600	15,900	12,200	25,800	38,400	13,000	26,200	7,960
9	15,100	27,000	17,900	11,600	18,700	15,800	14,500	25,400	37,200	13,200	28,300	7,760
10	15,900	26,600	17,400	11,100	18,600	15,700	18,100	24,800	35,900	13,200	27,700	7,490
11	16,300	26,300	17,000	11,600	18,700	14,700	22,100	24,400	35,100	13,100	26,300	7,150
12	16,400	23,800	14,200	11,600	18,500	14,400	25,400	23,700	34,500	13,000	24,900	10,100
13	16,300	22,300	13,600	11,600	18,500	14,400	28,900	22,400	34,000	12,900	23,900	12,300
14	16,000	22,100	13,400	11,700	18,400	14,300	40,500	21,800	33,400	13,000	24,800	12,400
15	15,700	22,200	13,500	11,500	18,300	11,800	47,200	21,700	32,800	13,500	25,000	12,300
16	15,500	22,300	13,300	11,600	18,400	11,400	53,300	23,200	32,400	19,900	24,800	12,300
17	16,100	22,200	13,300	11,500	18,200	11,200	57,100	28,600	32,100	24,200	24,400	12,200
18	20,000	22,100	13,600	11,500	17,600	11,000	57,900	33,500	31,300	26,100	23,800	12,100
19	28,100	21,900	12,800	11,500	17,500	11,300	55,400	35,600	30,800	26,500	21,900	12,000
20	31,500	21,300	13,500	11,500	18,000	11,300	50,800	35,000	30,300	25,900	19,800	11,100
21	33,600	20,600	13,700	13,100	18,100	11,300	45,100	32,200	29,600	25,000	16,900	10,500
22	35,700	21,000	13,800	13,500	18,100	11,300	40,700	29,600	29,100	24,400	15,400	10,200
23	39,700	21,100	13,800	13,500	18,000	11,200	37,800	27,700	28,800	23,900	13,800	10,500
24	41,500	21,200	13,300	13,400	17,800	11,200	35,200	27,300	28,300	23,600	12,800	11,000
25	40,900	21,100	12,800	13,400	17,900	10,900	33,400	26,700	26,300	23,300	12,600	11,000
26	39,600	21,100	12,700	13,500	16,700	10,800	32,200	26,100	24,800	23,100	12,700	11,500
27	38,100	20,900	12,700	13,500	16,400	10,800	31,200	25,700	23,300	23,000	13,900	11,800
28	37,000	20,600	12,800	13,400	16,300	10,700	30,200	25,500	21,700	23,000	14,500	11,900
29	34,200	20,500	12,700	13,500	-----	11,100	28,600	19,800	19,200	22,700	14,600	11,600
30	32,800	20,400	12,700	13,500	-----	12,500	27,500	22,800	19,000	20,800	13,800	11,000
31	33,600	-----	11,200	13,500	-----	12,600	-----	25,700	-----	18,700	14,000	-----
TOTAL	755,000	741,900	471,800	377,700	482,800	410,300	905,900	816,800	938,600	583,800	615,200	329,590
MEAN	24,350	24,730	15,220	12,180	17,240	13,240	30,200	26,350	31,290	18,830	19,850	10,990
MAX	41,500	33,500	20,200	13,500	18,800	16,300	57,900	35,600	40,100	26,500	28,300	14,600
MIN	14,700	20,400	11,200	10,700	13,400	10,700	10,800	19,800	19,000	11,600	12,600	7,150
CFSM	1.26	1.27	.78	.63	.89	.68	1.56	1.36	1.61	.97	1.02	.57
IN.	1.45	1.42	.90	.72	.93	.79	1.74	1.57	1.80	1.12	1.18	.63
CAL YR 1968	TOTAL 7,021,360			MEAN 19,180		MAX 46,100	MIN 3,470	CFSM .99	IN 13.46			
WTR YR 1969	TOTAL 7,429,390			MEAN 20,350		MAX 57,900	MIN 7,150	CFSM 1.05	IN 14.24			

LAKE OF THE WOODS BASIN

87

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., Lake of the Woods County, 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.

PERIOD OF RECORD.--October 1956 to current year.

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.--13 years, 341 cfs (8.53 inches per year).

EXTREMES.--Current year: Maximum discharge, 5,500 cfs Apr. 14 (gage height, 17.86 ft); minimum, 11 cfs Sept. 22, 23; minimum gage height, 1.84 ft Aug. 28.

Period of record: Maximum discharge, 5,500 cfs Apr. 14, 1969 (gage height, 17.86 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).

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	522	467	118	35	29	35	36	1,220	290	386	171	90
2	476	449	112	35	29	35	37	1,150	476	319	147	74
3	485	419	110	34	29	35	38	1,060	581	282	121	60
4	464	395	104	33	29	34	39	1,000	541	261	93	48
5	422	377	96	33	28	34	40	976	526	401	78	47
6	383	347	90	33	28	34	43	1,040	479	479	96	48
7	347	316	86	33	28	34	55	999	407	410	252	52
8	342	290	78	32	28	35	255	926	339	336	350	51
9	777	251	72	32	28	35	1,300	857	282	280	303	47
10	1,190	224	68	32	28	35	2,440	789	242	242	232	42
11	1,100	206	68	31	28	35	3,440	715	244	195	178	39
12	926	188	68	31	28	35	4,200	634	232	170	144	35
13	780	194	66	31	28	35	5,000	572	204	154	124	30
14	696	214	65	31	28	35	5,480	526	181	132	120	28
15	674	208	64	30	28	36	5,430	696	164	118	113	24
16	693	192	63	30	28	37	5,340	1,160	146	110	93	22
17	767	180	62	30	28	38	5,060	1,330	129	97	75	21
18	1,180	170	60	30	29	38	4,600	1,290	118	81	59	17
19	1,440	160	58	30	30	38	4,080	1,180	106	84	53	14
20	1,380	155	56	30	30	38	3,600	1,080	93	82	47	15
21	1,210	155	54	30	30	39	3,180	947	83	79	40	14
22	1,120	170	52	30	31	39	2,800	832	80	70	35	11
23	1,000	184	50	30	31	40	2,470	770	74	68	32	12
24	885	190	48	30	32	39	2,220	659	76	66	27	14
25	798	180	46	30	32	40	2,000	575	82	59	22	20
26	730	170	45	30	33	40	1,840	498	113	61	18	22
27	668	158	43	29	34	39	1,710	431	207	78	15	24
28	631	144	41	29	35	39	1,580	380	401	84	35	24
29	588	130	39	29	-----	38	1,440	316	513	74	122	20
30	541	122	38	29	-----	37	1,320	268	461	70	100	18
31	498	-----	36	29	-----	36	-----	244	-----	160	103	-----
TOTAL	23,713	7,005	2,056	961	827	1,137	71,073	25,120	7,870	5,488	3,392	983
MEAN	765	234	66.3	31.0	29.5	36.7	2,369	810	262	177	109	32.8
MAX	1,440	467	118	35	35	40	5,480	1,330	581	479	350	90
MIN	342	122	36	29	28	34	36	244	74	59	15	11
CFSM	1.41	.43	.12	.057	.054	.068	4.36	1.49	.48	.33	.20	.060
IN.	1.62	.48	.14	.07	.06	.08	4.87	1.72	.54	.38	.23	.07

CAL YR 1968 TOTAL 162,583 MEAN 444 MAX 4,540 MIN 1.8 CFSM .82 IN 11.14
WAT YR 1969 TOTAL 149,625 MEAN 410 MAX 5,480 MIN 11 CFSM .76 IN 10.25

LAKE OF THE WOODS BASIN

5-1395. Warroad River near Warroad, Minn.

LOCATION.--Lat 48°52'00", long 95°21'20", in SE 1/4 sec. 12, T.162 N., R.37 W., Roseau County, on downstream hand-rail of bridge near center of span, 0.5 mile upstream from Bulldog Run and 2.5 miles south of Warroad.

DRAINAGE AREA.--110 sq mi, approximately.

PERIOD OF RECORD.--March 1946 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Nonrecording gage read 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).

AVERAGE DISCHARGE.--23 years, 44.1 cfs (5.44 inches per year).

EXTREMES.--Current year: Maximum discharge, 1,140 cfs Apr. 12 (gage height, 8.35); minimum daily, 1.0 cfs Sept. 27, 28.

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 1308: 1949 (M). WSP 1508: 1947 (M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	70	9.8	5.8	4.7	6.1	11	143	32	11	14	19
2	36	69	10	5.7	4.6	6.2	12	131	39	9.9	15	13
3	36	70	10	5.6	4.6	6.3	13	122	81	9.0	18	8.8
4	38	66	9.9	5.4	4.6	6.4	14	113	82	9.3	16	6.4
5	39	64	9.8	5.3	4.6	6.4	17	108	84	9.9	13	8.5
6	38	60	9.6	5.2	4.6	6.5	23	103	84	12	9.6	11
7	36	57	9.4	5.1	4.6	6.5	35	107	78	13	13	8.0
8	34	53	9.3	5.0	4.6	6.5	75	101	62	10	19	6.1
9	58	46	9.2	5.0	4.6	6.5	230	89	49	10	19	5.2
10	80	44	9.1	4.9	4.6	6.5	510	84	39	7.7	21	4.1
11	97	41	8.9	4.9	4.6	6.5	780	80	32	6.9	21	2.9
12	57	39	8.8	4.9	4.6	6.6	1,100	71	34	4.2	17	1.9
13	39	38	8.6	4.9	4.6	6.6	1,080	65	40	3.9	14	1.8
14	30	38	8.5	4.8	4.6	6.6	1,010	63	34	2.8	8.5	2.8
15	43	36	8.4	4.8	4.6	6.6	924	66	32	2.6	6.9	2.0
16	54	33	8.2	4.8	4.7	6.6	830	89	30	2.5	6.1	1.7
17	60	31	8.0	4.8	4.7	6.7	780	94	31	2.3	2.8	1.8
18	78	30	7.8	4.8	4.7	6.8	671	88	24	1.8	2.6	1.6
19	99	30	7.6	4.8	4.8	7.0	569	98	14	2.0	3.0	1.2
20	157	31	7.5	4.8	4.9	7.2	485	94	13	2.4	2.3	1.2
21	207	28	7.4	4.8	5.0	7.6	437	85	14	2.6	2.6	1.4
22	207	23	7.2	4.8	5.1	8.0	372	59	12	2.6	1.7	1.2
23	187	17	7.1	4.8	5.2	9.6	314	54	10	4.2	1.8	1.3
24	137	13	6.9	4.7	5.3	12	257	50	10	2.8	2.5	1.4
25	116	9.8	6.8	4.7	5.4	13	211	43	9.0	3.5	2.2	1.3
26	107	6.8	6.6	4.7	5.6	13	202	40	11	2.6	1.2	1.4
27	98	5.4	6.5	4.7	5.8	14	200	32	13	2.8	2.7	1.0
28	90	6.4	6.4	4.7	6.0	14	206	31	13	3.5	12	1.0
29	82	7.5	6.2	4.7	-----	13	182	29	13	3.4	19	1.2
30	78	9.1	6.1	4.7	-----	12	160	29	14	3.8	25	1.5
31	74	-----	6.0	4.7	-----	12	-----	30	-----	6.1	22	-----
TOTAL	2,532	1,072.0	251.6	153.3	136.3	259.3	11,710	2,391	1,033.0	171.1	334.5	121.7
MEAN	81.7	35.7	8.12	4.95	4.87	8.36	390	77.1	34.4	5.52	10.8	4.06
MAX	207	70	10	5.8	6.0	14	1,100	143	84	13	25	19
MIN	30	5.4	6.0	4.7	4.6	6.1	11	29	9.0	1.8	1.2	1.0
CFSM	.74	.32	.074	.045	.044	.076	3.55	.70	.31	.050	.098	.037
IN.	.86	.36	.09	.05	.05	.09	3.96	.81	.35	.06	.11	.04

CAL YR 1968 TOTAL 31,921.5 MEAN 87.2 MAX 1,280 MIN 1.1 CFSM .79 IN 10.80
WAT YR 1969 TOTAL 20,165.8 MEAN 55.2 MAX 1,100 MIN 1.0 CFSM .50 IN 6.82

LAKE OF THE WOODS BASIN

89

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., Roseau County, near right bank 5 ft downstream from culvert on county highway, 0.8 mile upstream from mouth and 3 miles south of Warroad.

DRAINAGE AREA.--14.2 sq mi.

PERIOD OF RECORD.--March 1946 to November 1951, June 1966 to current year.

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

AVERAGE DISCHARGE.--8 years (1946-51, 1967-69), 3.68 cfs (3.52 inches per year).

EXTREMES.--Current year: Maximum discharge, 86 cfs Apr. 11 (gage height, 5.55 ft, from graph based on gage readings); maximum gage height, 7.04 ft Apr. 9 (from floodmark, backwater from ice); no flow for many days.

Period of record: Maximum discharge, 420 cfs June 10, 1947 (gage height, 6.91 ft); maximum gage height, 7.04 ft Apr. 9, 1969 (from floodmark, backwater from ice); no flow for many days in most years.

REMARKS.--Records fair.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	1.0	.40				0	5.7	.80		0	6.5
2	0	1.0	.40				0	5.3	2.2		0	5.0
3	0	.90	.30				0	5.0	3.2		0	3.5
4	0	.80	.30				0	4.6	3.7		0	4.5
5	0	.70	.20				0	4.4	3.5		0	6.0
6	0	.60	.20				.20	4.6	3.2		0	8.0
7	0	.50	.20				2.2	4.3	2.4		0	6.8
8	1.0	.50	.20				5.0	4.0	1.6		0	4.8
9	2.0	.50	.20				35	3.6	1.0		0	1.7
10	2.2	.50	.20				50	3.1	.60		0	1.2
11	2.0	.50	.20				77	2.8	.40		0	.50
12	1.8	.50	.20				71	2.3	.30		0	0
13	1.8	.40	.20				69	1.9	.10		0	0
14	1.8	.40	.20				51	1.8	0		0	0
15	2.2	.40	.20				56	4.1	0		0	0
16	3.9	.40	.20				44	4.0	0		0	0
17	9.0	.40	.20				31	3.5	0		0	0
18	9.8	.40	.20				16	3.4	0		0	0
19	9.8	.40	.10				12	3.2	0		0	0
20	8.2	.40	.10				7.7	2.9	0		0	0
21	7.0	.40	.10				6.8	2.7	0		0	0
22	6.0	.40	.10				6.2	2.4	0		0	0
23	5.3	.40	.10				5.6	2.1	0		0	0
24	4.7	.40	.10				5.3	1.9	0		0	0
25	2.4	.30	.10				4.9	1.6	0		0	0
26	2.0	.30	.10				6.3	1.4	0		0	0
27	1.8	.30	.10				8.2	1.1	0		0	0
28	1.6	.30	0				9.6	.70	0		0	0
29	1.3	.30	0		-----		8.5	.50	0		0	0
30	1.2	.40	0		-----		6.8	.50	0		2.9	0
31	1.2	-----	0		-----		-----	.60	-----		7.6	-----
TOTAL	90.0	14.70	5.10	0	0	0	595.30	90.00	23.00	0	10.5	48.50
MEAN	2.90	.49	.16	0	0	0	19.8	2.90	.77	0	.34	1.62
MAX	9.8	1.0	.40	0	0	0	77	5.7	3.7	0	7.6	8.0
MIN	0	.30	0	0	0	0	0	.50	0	0	0	0
CFSM	.20	.035	.011	0	0	0	1.39	.20	.054	0	.024	.11
IN.	.24	.04	.01	0	0	0	1.56	.24	.06	0	.03	.13

CAL YR 1968 TOTAL 1,380.40 MEAN 3.78 MAX 131 MIN 0 CFSM .27 IN 3.62
 WAT YR 1969 TOTAL 877.10 MEAN 2.40 MAX 77 MIN 0 CFSM .17 IN 2.30

LAKE OF THE WOODS BASIN

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

LOCATION.--Lat 48°51'30", long 95°18'40", in SE¹SE⁴ sec.8, T.162 N., R.36 W., Roseau County, 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.

PERIOD OF RECORD.--March 1946 to September 1954, June 1966 to current year (fragmentary prior to April 1947).

GAGE.--Nonrecording gage. Altitude of gage is 1,080 ft (from topographic map).

AVERAGE DISCHARGE.--10 years (1947-54, 1967-69), 23.0 cfs (3.06 inches per year).

EXTREMES.--Current year: Maximum discharge, 520 cfs Apr. 13 (gage height, 8.53 ft, from floodmark); minimum daily, 0.4 cfs Feb. 7-20.

Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	29	8.6	3.0	.60	1.1	7.2	46	38	3.3	14	30
2	13	29	8.5	2.8	.60	1.2	7.5	36	39	3.3	8.8	21
3	13	27	8.3	2.7	.50	1.3	8.0	39	58	2.8	2.8	18
4	14	27	7.8	2.6	.50	1.4	9.5	39	52	2.9	3.2	16
5	14	26	7.2	2.5	.50	1.5	12	49	51	4.3	4.0	15
6	14	24	6.6	2.4	.50	1.5	18	58	50	5.4	4.0	11
7	16	23	6.4	2.4	.40	1.6	28	57	41	7.2	11	10
8	16	21	6.2	2.3	.40	1.6	50	55	24	4.0	12	9.7
9	25	20	6.0	2.2	.40	1.6	105	50	21	4.0	14	9.4
10	41	18	6.0	2.1	.40	1.7	175	47	17	4.0	14	7.0
11	36	17	5.8	2.0	.40	1.8	273	43	17	3.3	11	5.1
12	36	16	5.6	1.9	.40	1.9	427	42	16	3.0	11	4.5
13	41	16	5.6	1.8	.40	2.1	501	41	15	2.8	11	4.0
14	39	15	5.5	1.7	.40	2.2	492	41	11	2.1	15	3.2
15	39	15	5.4	1.6	.40	2.4	454	42	8.0	2.8	15	2.6
16	44	14	5.3	1.6	.40	2.6	418	50	6.1	4.8	14	2.1
17	46	14	5.3	1.5	.40	3.0	375	54	4.0	3.4	11	1.8
18	50	13	5.2	1.5	.40	3.5	348	59	3.2	3.2	3.5	1.3
19	66	12	5.1	1.4	.40	4.2	311	55	3.2	3.0	1.7	1.3
20	78	11	5.0	1.3	.40	5.0	262	54	2.2	2.8	1.7	1.4
21	80	11	4.8	1.3	.50	6.0	246	41	2.3	2.1	1.7	1.2
22	67	10	4.7	1.2	.50	6.7	202	28	3.8	5.4	1.5	1.3
23	55	10	4.5	1.1	.50	7.2	164	25	2.1	4.0	1.4	1.2
24	45	9.5	4.3	1.1	.50	7.6	147	23	2.3	4.1	1.4	1.4
25	41	9.5	4.1	1.0	.60	7.6	118	20	2.7	4.2	1.2	1.2
26	43	9.2	3.9	.90	.70	7.5	108	16	4.2	4.0	1.1	.90
27	40	9.0	3.7	.80	.80	7.2	118	15	4.8	4.0	1.2	1.3
28	36	9.0	3.5	.80	1.0	7.0	119	15	3.4	4.0	14	1.4
29	33	8.8	3.4	.70	-----	6.8	100	13	3.0	4.2	36	1.4
30	32	8.8	3.3	.70	-----	6.8	70	11	3.2	5.4	34	1.5
31	30	-----	3.1	.60	-----	7.0	-----	10	-----	5.4	36	-----
TOTAL	1,155	481.8	168.7	51.50	13.90	120.6	5,673.2	1,174	508.5	119.2	312.2	187.20
MEAN	37.3	16.1	5.44	1.66	.50	3.89	189	37.9	17.0	3.85	10.1	6.24
MAX	80	29	8.6	3.0	1.0	7.6	501	59	58	7.2	36	30
MIN	12	8.8	3.1	.60	.40	1.1	7.2	10	2.1	2.1	1.1	.90
CFSM	.37	.16	.053	.016	.005	.038	1.85	.37	.17	.038	.099	.061
IN.	.42	.18	.06	.02	.005	.04	2.07	.43	.19	.04	.11	.07
CAL YR 1968	TOTAL	12,558.50	MEAN	34.3	MAX	415	MIN	0	CFSM	.34	IN	4.58
WAT YR 1969	TOTAL	9,965.80	MEAN	27.3	MAX	501	MIN	.40	CFSM	.27	IN	3.63

UPPER MISSISSIPPI RIVER BASIN

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MISSISSIPPI RIVER MAIN STEM

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

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

DRAINAGE AREA.--1,442 sq mi.

PERIOD OF RECORD.--April 1884 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Winnibogoshish 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, nonrecording gage at same site and datum.

EXTREMES.--Current year: Maximum contents, 608,900 acre-ft June 12 (gage height, 10.62 ft); minimum, 433,800 acre-ft Apr. 6 (gage height, 8.00 ft).

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 1308: 1905(M).

MONTHEND GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30.....	9.90	558,500	-
Oct. 31.....	10.20	579,400	+20,900
Nov. 30.....	9.69	544,700	-34,700
Dec. 31.....	9.23	514,500	-30,200
CAL YR 1968.....			+63,700
Jan. 31.....	8.90	492,900	-21,600
Feb. 28.....	8.48	465,300	-27,600
Mar. 31.....	8.08	438,900	-26,400
Apr. 30.....	9.26	516,500	+77,600
May 31.....	10.24	582,200	+65,700
June 30.....	10.53	602,600	+20,400
July 31.....	10.47	598,400	-4,200
Aug. 31.....	9.87	556,600	-41,800
Sept.30.....	9.75	548,600	-8,000
WTR YR 1969.....	-	-	-9,900

LEECH LAKE RIVER BASIN

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., Cass County, at head of Leech Lake River on Waboose Bay, 5 miles southwest of town of Federal Dam.

DRAINAGE AREA.--1,163 sq mi.

PERIOD OF RECORD.--April 1884 to current year. Monthend 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, nonrecording gage 0.5 mile north of outlet to Leech Lake River at datum 5.76 ft lower. Dec. 31, 1884, to May 24, 1931, nonrecording gage half a mile north of outlet to Leech Lake River at present datum.

EXTREMES.--Current year: Maximum contents, 326,700 acre-ft June 5 (gage height, 2.34 ft); minimum, 136,500 acre-ft Apr. 4 (gage height, 0.77 ft).

Period of record: 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.

MONTHEND GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	1.58	230,600	-
Oct. 31.....	1.65	239,400	+8,800
Nov. 30.....	1.33	198,900	-40,500
Dec. 31.....	1.32	197,700	-1,200
CAL YR 1968.....			+65,600
Jan. 31.....	1.29	193,900	-3,800
Feb. 28.....	1.02	163,700	-30,200
Mar. 31.....	.79	138,700	-25,000
Apr. 30.....	1.84	263,400	+124,700
May 31.....	2.21	310,200	+46,800
June 30.....	2.00	283,600	-26,600
July 31.....	1.80	258,500	-25,100
Aug. 31.....	1.35	201,500	-57,000
Sept. 30.....	1.28	192,700	-8,800
WTR YR 1969.....	-	-	-37,900

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., Cass County, 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.

PERIOD OF RECORD.--May 1884 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder, headwater gage, and nonrecording tailwater gage. Datum of gage is 1,293.23 ft above mean sea level, adjustment of 1912. Prior to July 3, 1948, nonrecording headwater gage at same datum. May 27 to Nov. 20, 1929, nonrecording gage at site 600 ft downstream at different datum.

AVERAGE DISCHARGE.--85 years, 348 cfs, unadjusted (4.04 inches per year).

EXTREMES.--Current year: Maximum daily discharge, 979 cfs Nov. 5; minimum daily, 92 cfs May 13, 14.

Period of record: 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; six discharge measurements made and records reviewed by Geological Survey.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	111	857	824	766	917	895	862	108	611	879	565	249
2	109	871	832	811	917	900	862	115	570	592	549	239
3	121	839	885	835	917	895	852	116	562	553	549	241
4	115	828	894	820	911	890	852	115	562	553	545	227
5	107	979	813	809	906	884	862	118	647	541	533	235
6	110	853	813	825	906	884	841	94	878	526	514	254
7	109	859	840	830	911	884	641	97	860	506	561	254
8	104	853	829	820	922	868	344	97	841	510	529	244
9	113	853	808	830	911	873	116	96	860	537	529	244
10	124	832	850	841	922	890	131	95	854	541	529	249
11	114	848	843	830	933	857	111	98	835	530	525	239
12	110	837	843	809	933	852	116	97	839	522	517	251
13	111	818	808	835	906	852	120	92	863	518	533	239
14	111	848	782	852	900	846	125	92	857	514	536	235
15	111	837	829	862	890	846	117	97	826	522	501	237
16	119	805	829	900	900	836	99	346	838	534	342	243
17	115	784	818	911	906	830	115	331	837	526	248	238
18	118	794	803	906	911	863	119	336	876	514	241	233
19	139	849	851	906	906	841	121	582	863	526	225	243
20	139	824	851	900	900	868	129	521	845	526	220	241
21	147	900	862	917	895	863	124	521	863	514	220	228
22	147	889	862	911	900	841	97	542	779	514	223	235
23	423	889	862	922	906	836	97	554	799	526	223	253
24	711	884	851	961	906	841	98	542	845	532	218	233
25	897	857	829	961	900	841	98	514	797	520	213	238
26	871	862	814	900	890	836	99	510	860	541	211	256
27	920	851	829	884	890	831	95	510	891	541	218	241
28	877	846	840	895	895	860	107	554	891	549	211	233
29	855	832	840	906	-----	871	108	558	860	545	192	244
30	839	819	835	922	-----	823	107	522	891	537	256	247
31	834	-----	814	917	-----	818	-----	530	-----	570	251	-----
TOTAL	9,831	25,497	25,883	26,994	25,407	26,615	8,565	9,500	24,200	16,859	11,727	7,243
MEAN	317	850	835	871	907	859	286	306	807	544	378	241
MAX	920	979	894	961	933	900	862	582	891	879	565	256
MIN	104	784	782	766	890	818	95	92	562	506	192	227
CFSM	.27	.73	.72	.75	.78	.74	.25	.26	.69	.47	.33	.21
IN.	.31	.82	.83	.86	.81	.85	.27	.30	.77	.54	.38	.23

CAL YR 1968 TOTAL 132,343 MEAN 362 MAX 979 MIN 77 CFSM .31 IN 4.23
 WAT YR 1969 TOTAL 218,321 MEAN 598 MAX 979 MIN 92 CFSM .51 IN 6.98

MISSISSIPPI RIVER MAIN STEM

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

LOCATION.--Lat $47^{\circ}10'00''$, long $93^{\circ}33'20''$, in NW $\frac{1}{4}$ sec.17, T.54 N., R.25 W., Itasca County, at narrows on U.S. Highway 169, 4 miles south of Grand Rapids.

DRAINAGE AREA.--3,265 sq mi.

PERIOD OF RECORD.--April 1884 to current year. Prior to October 1941 monthend 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, nonrecording gage at Pooles Arm of Pokegama Lake, 5 miles northwest at same datum.

EXTREMES.--Current year: Maximum contents, 98,180 acre-ft Apr. 28 (gage height, 11.87 ft); minimum, 25,790 acre-ft Feb. 20 (gage height, 6.59 ft).

Period of record: 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.

MONTHEND GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

Date	gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	8.94	56,330	-
Oct. 31.....	8.36	48,600	-7,730
Nov. 30.....	7.60	38,680	-9,920
Dec. 31.....	7.55	37,880	-800
CAL YR 1969.....	-	-	+7,530
Jan. 31.....	7.08	31,930	-5,950
Feb. 28.....	6.63	26,180	-5,750
Mar. 31.....	7.25	34,120	+7,940
Apr. 30.....	11.72	96,000	+61,880
May 31.....	8.94	56,330	-39,670
June 30.....	8.86	55,140	-1,190
July 31.....	9.31	61,490	+6,350
Aug. 31.....	9.17	59,500	-1,990
Sept. 30.....	8.65	52,360	-7,140
WTR YR 1969.....	-	-	-3,970

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

LOCATION.--Lat 47°13'56", long 93°31'48", in SW 1/4 sec. 21, T.55 N., R.25 W., Itasca County, 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 upstream from Ohio River.

DRAINAGE AREA.--3,370 sq mi, approximately.

PERIOD OF RECORD.--October 1883 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "at Pokegama Dam near Grand Rapids" 1942-44.

GAGE.--Water-stage recorder. Datum of gage is 1,242.00 ft above mean sea level, adjustment of 1912. See WSP 1728 for history of changes prior to Jan. 17, 1951.

AVERAGE DISCHARGE.--86 years, 1,135 cfs.

EXTREMES.--Current year: Maximum daily discharge, 4,610 cfs Apr. 17; maximum gage height, 12.57 ft Apr. 17 (backwater from Prairie River); minimum discharge, 200 cfs July 5 (gage height, 2.62 ft), result of regulation).

Period of record: 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 good except those for winter months, which are fair. Flow completely regulated by Pokegama Lake (see preceding page). Backwater from Prairie River occurs at times in most years.

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

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	970	1,950	1,730	1,880	1,830	2,160	2,600	2,530	1,630	1,860	1,850	1,390
2	954	1,840	1,750	1,870	1,830	2,160	2,600	2,520	1,600	1,870	1,880	1,290
3	926	1,830	1,850	1,870	1,820	2,160	2,600	2,500	1,590	1,880	1,930	1,120
4	998	1,890	1,900	1,880	1,840	2,190	2,630	2,500	1,600	1,830	1,900	900
5	874	2,180	1,890	1,880	1,890	2,180	2,700	2,480	1,600	1,530	1,890	761
6	942	2,140	1,670	1,630	1,940	2,220	2,920	2,490	1,610	1,770	1,770	627
7	942	2,170	1,550	1,560	1,970	2,220	3,110	2,540	1,620	1,710	1,830	817
8	946	2,250	1,570	2,100	1,990	2,220	3,290	2,560	1,620	1,720	1,740	638
9	934	2,150	1,650	2,140	2,000	2,220	3,440	2,550	1,610	1,630	1,850	773
10	942	2,070	1,670	2,050	2,020	2,270	3,600	2,520	1,570	1,440	1,780	783
11	926	2,070	1,690	1,980	2,040	2,240	3,750	2,480	1,540	1,530	1,780	647
12	926	2,060	1,700	1,940	2,050	2,250	3,900	2,400	1,630	1,480	1,820	777
13	954	2,010	1,770	1,910	2,060	2,260	4,100	2,340	1,660	1,490	1,870	944
14	922	2,010	1,850	1,900	2,080	2,270	4,350	2,300	1,700	1,130	1,750	920
15	906	2,100	1,840	1,900	2,090	2,280	4,450	2,310	1,710	1,260	1,620	886
16	902	2,200	1,800	1,890	2,100	2,280	4,520	2,330	1,720	1,310	1,680	939
17	946	2,190	1,790	1,870	2,120	2,280	4,610	2,310	1,720	1,200	1,710	923
18	934	2,170	1,780	1,850	2,140	2,280	2,600	2,070	1,710	1,540	1,700	926
19	934	2,130	1,760	1,840	2,120	2,290	1,850	2,000	1,700	1,560	1,700	929
20	930	2,110	1,750	1,830	2,120	2,320	1,900	1,570	1,680	1,500	1,630	925
21	926	2,040	1,770	1,840	2,120	2,330	1,580	1,500	1,680	1,470	1,300	945
22	938	2,060	1,800	1,850	2,110	2,370	1,580	1,570	1,690	1,560	1,330	957
23	946	2,080	1,810	1,890	2,110	2,390	1,600	1,470	1,700	1,830	1,250	947
24	938	2,060	1,830	1,920	2,100	2,480	1,620	1,530	1,740	1,750	1,280	955
25	1,270	2,040	1,920	1,930	2,120	2,500	1,630	1,510	1,810	1,410	1,250	955
26	1,750	2,010	1,810	1,970	2,130	2,570	1,750	1,530	1,850	1,590	1,390	967
27	2,030	2,010	1,820	2,000	2,130	2,610	1,900	1,550	1,840	1,560	1,300	966
28	2,060	1,970	1,850	1,950	2,160	2,650	2,170	1,500	1,790	1,520	1,300	970
29	2,030	1,930	1,870	1,880	-----	2,700	2,430	1,510	1,840	1,590	1,360	964
30	2,020	1,860	1,890	1,830	-----	2,580	2,530	1,550	1,840	1,530	1,490	963
31	2,000	-----	1,890	1,810	-----	2,570	-----	1,590	-----	1,630	1,440	-----
TOTAL	35,616	61,580	55,120	58,640	57,030	72,500	84,310	64,110	50,600	48,680	50,370	27,504
MEAN	1,149	2,053	1,778	1,892	2,037	2,339	2,810	2,068	1,687	1,570	1,625	917
MAX	2,060	2,250	1,900	2,140	2,160	2,700	4,610	2,560	1,850	1,880	1,930	1,390
MIN	874	1,830	1,550	1,560	1,820	2,160	1,580	1,470	1,540	1,130	1,250	627
CAL YR 1968	TOTAL 396,705		MEAN 1,084		MAX 2,250		MIN 278					
WTR YR 1969	TOTAL 666,060		MEAN 1,825		MAX 4,610		MIN 627					

PRAIRIE RIVER BASIN

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., Itasca County, on left bank 125 ft upstream from highway bridge, 1.5 miles downstream from outlet of Lawrence Lake and 5 miles north of Taconite.

DRAINAGE AREA.--360 sq mi, approximately.

PERIOD OF RECORD.--April 1967 to current year.

GAGE.--Water-stage recorder. Prior to Aug. 31, 1967, nonrecording gage at site 125 ft downstream at same datum.

EXTREMES.--Current year: Maximum discharge, 3,260 cfs Apr. 17 (gage height, 11.81 ft); minimum, 63 cfs Aug. 28 (gage height, 2.62 ft).

Period of record: Maximum discharge, 3,260 cfs Apr. 17, 1969 (gage height, 11.81 ft); minimum, 25 cfs Sept. 12, 13, 1967; minimum gage height, 1.91 ft 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 CUBIC FEET PER SECND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	377	540	134	101	108	110	98	823	396	134	123	85
2	355	492	133	101	108	110	100	798	441	131	120	88
3	330	445	133	101	108	111	117	769	473	123	113	90
4	308	408	133	100	107	112	122	742	520	121	114	92
5	284	376	130	100	107	112	123	723	566	120	113	99
6	272	350	128	100	107	112	123	708	600	117	115	110
7	251	326	128	100	107	111	146	688	618	109	134	111
8	238	305	125	100	106	111	211	668	626	105	143	119
9	237	284	125	100	106	110	358	644	622	104	164	122
10	235	266	124	100	105	108	534	620	606	103	185	125
11	225	246	124	100	105	107	761	588	592	101	195	127
12	223	234	123	99	105	107	988	552	554	100	199	127
13	221	220	123	99	105	105	1,430	514	508	95	195	126
14	223	214	121	98	104	104	2,250	469	469	95	190	125
15	223	204	119	98	104	103	2,820	463	423	103	177	122
16	227	196	118	98	104	101	3,140	465	382	117	163	120
17	281	194	115	98	104	102	3,240	465	346	114	149	113
18	392	189	114	98	104	103	3,150	463	311	114	138	107
19	482	182	111	99	103	104	2,920	463	282	119	126	101
20	542	173	109	100	103	104	2,630	463	252	121	117	95
21	586	169	109	102	102	105	2,340	462	225	119	109	92
22	636	167	108	102	103	106	2,070	458	204	116	102	96
23	678	165	107	102	104	107	1,820	450	185	114	93	103
24	708	163	106	103	106	107	1,620	443	172	111	86	100
25	731	156	105	105	107	108	1,440	418	160	108	81	102
26	737	155	104	106	108	108	1,290	397	159	105	76	108
27	733	159	104	107	109	107	1,160	376	152	109	69	110
28	710	143	103	108	110	104	1,060	350	149	107	67	112
29	674	137	102	108	-----	101	958	328	143	102	68	114
30	632	137	102	108	-----	99	857	299	141	99	80	125
31	586	-----	101	109	-----	98	-----	302	-----	122	83	-----
TOTAL	13,337	7,395	3,621	3,150	2,959	3,297	39,876	16,371	11,277	3,458	3,887	3,266
MEAN	430	247	117	102	106	106	1,329	528	376	112	125	109
MAX	737	540	134	109	110	112	3,240	823	626	134	199	127
MIN	221	137	101	98	102	98	98	299	141	95	67	85
CFSM	1.19	.69	.33	.28	.29	.29	3.69	1.47	1.04	.31	.35	.30
IN.	1.38	.76	.37	.33	.31	.34	4.12	1.69	1.17	.36	.40	.34
CAL YR 1968	TOTAL	89,559	MEAN	245	MAX	832	MIN	32	CFSM	.68	IN	9.25
WAT YR 1969	TOTAL	111,894	MEAN	307	MAX	3,240	MIN	67	CFSM	.85	IN	11.56

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., Itasca County, 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.

PERIOD OF RECORD.---January 1964 to current year.

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.

AVERAGE DISCHARGE.---5 years, 64.7 cfs.

EXTREMES.---Current year: Maximum discharge, 773 cfs Apr. 15 (gage height, 5.83 ft); minimum, 6.2 cfs Aug. 27 (gage height, 4.38 ft).

Period of record: Maximum discharge, 773 cfs Apr. 15, 1969 (gage height, 5.83 ft); minimum, 3.0 cfs Sept. 26, 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	UCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	54	94	31	31	41	38	45	156	70	43	50	9.4
2	52	91	38	31	38	38	45	151	84	45	52	9.4
3	48	84	38	29	38	38	45	156	94	43	50	9.4
4	52	81	41	29	38	38	50	164	102	41	48	9.4
5	50	81	38	29	38	38	54	169	109	41	48	9.4
6	48	73	36	29	38	36	62	169	113	41	43	12
7	43	70	36	29	38	36	76	164	113	36	34	14
8	45	65	36	29	38	36	98	164	113	31	36	12
9	48	65	34	29	38	36	146	151	94	29	34	12
10	48	59	34	29	38	36	215	138	98	29	29	11
11	48	54	34	26	38	36	317	128	98	34	26	12
12	50	52	34	26	36	34	421	120	84	34	24	12
13	48	50	50	26	36	34	534	109	81	34	22	11
14	50	48	48	24	36	31	640	102	76	43	20	12
15	50	48	45	26	38	31	730	117	70	52	16	12
16	59	50	43	31	38	31	700	124	62	57	16	16
17	79	54	41	29	38	31	670	133	59	54	14	15
18	109	54	41	29	38	31	595	128	52	52	12	15
19	124	48	38	29	38	31	510	120	48	48	12	12
20	146	48	36	31	38	34	442	117	43	45	12	11
21	156	45	36	31	38	34	400	109	41	41	11	10
22	156	48	41	31	38	34	374	98	41	34	9.4	12
23	160	45	41	38	36	36	329	91	36	31	8.8	18
24	151	43	41	43	36	36	299	84	34	29	8.8	20
25	146	43	38	43	38	36	275	81	43	26	8.8	22
26	142	41	36	43	38	38	248	73	45	31	8.2	22
27	128	38	36	41	38	38	220	70	45	38	6.7	22
28	124	38	36	41	38	38	194	62	48	36	7.7	24
29	120	36	36	43	-----	41	169	57	48	31	8.2	22
30	113	31	36	43	-----	41	160	57	43	34	8.8	26
31	102	-----	34	41	-----	43	-----	62	-----	48	10	-----
TOTAL	2,749	1,677	1,183	1,009	1,057	1,109	9,063	3,624	2,087	1,211	694.4	434.0
MEAN	88.7	55.9	38.2	32.5	37.8	35.8	302	117	69.6	39.1	22.4	14.5
MAX	160	94	50	43	41	43	730	169	113	57	52	26
MIN	43	31	31	24	36	31	45	57	34	26	6.7	9.4

CAL YR 1968 TOTAL 20,911.1 MEAN 57.1 MAX 190 MIN 4.9
WAT YR 1969 TOTAL 25,897.4 MEAN 71.0 MAX 730 MIN 6.7

SWAN RIVER BASIN

5-2170. Swan River near Warba, Minn.

LOCATION.---Lat 47°06'40", long 93°15'50", in SE $\frac{1}{4}$ sec.33, T.54 N., R.23 W., Itasca County, on left bank 75 ft upstream from highway bridge, 1.2 miles south of Warba, 3.8 miles northwest of Swan River, and 22 miles upstream from mouth.

DRAINAGE AREA.---254 sq mi.

PERIOD OF RECORD.---October 1953 to September 1969 (discontinued).

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

AVERAGE DISCHARGE.---16 years, 130 cfs (6.95 inches per year).

EXTREMES.---Current year: Maximum discharge, 1,360 cfs Apr. 15 (gage height, 9.33 ft); maximum gage height, 9.74 ft Apr. 12 (backwater from ice); minimum discharge, 27 cfs Aug. 28 (gage height, 2.27 ft).
Period of record: Maximum discharge, 1,360 cfs Apr. 15, 1969 (gage height, 9.33 ft); maximum gage height, 9.74 ft Apr. 12, 1969 (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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	136	208	62	55	79	67	90	479	163	121	114	40
2	129	191	61	54	80	67	89	449	199	116	108	38
3	126	175	63	54	80	66	91	432	202	114	103	37
4	122	163	68	53	80	66	103	432	209	107	97	34
5	113	156	67	53	79	65	120	442	222	101	91	36
6	108	150	63	52	78	65	150	450	224	100	87	43
7	106	143	61	52	78	65	180	446	216	93	86	46
8	103	135	59	51	77	64	260	428	205	91	83	44
9	107	129	58	51	77	64	400	401	192	88	77	43
10	126	123	57	51	76	64	540	370	183	83	70	42
11	134	117	56	52	76	64	780	339	185	77	67	40
12	127	108	56	53	75	63	1,130	306	184	75	65	37
13	119	102	55	54	74	63	1,280	271	178	73	61	34
14	115	95	55	57	73	63	1,300	243	166	72	58	34
15	115	91	58	59	73	63	1,340	246	153	86	55	36
16	125	90	68	60	72	64	1,340	275	143	110	50	48
17	194	89	65	60	72	66	1,270	303	132	114	47	52
18	311	91	63	61	71	68	1,180	298	122	106	46	48
19	380	98	61	61	71	71	1,090	279	116	97	43	45
20	405	96	60	62	70	73	1,030	255	108	92	40	43
21	402	93	60	63	70	79	986	234	102	85	37	40
22	385	88	59	63	70	83	933	216	97	79	36	45
23	368	84	59	63	69	87	866	202	96	76	34	64
24	352	80	58	64	69	90	803	189	94	74	32	71
25	338	77	58	64	68	92	748	176	94	71	30	73
26	322	74	58	65	68	93	697	164	113	67	29	78
27	305	72	57	67	68	94	653	156	129	71	28	78
28	287	71	57	72	67	94	612	146	123	76	29	74
29	294	69	56	76	-----	93	569	135	121	76	38	75
30	253	65	56	78	-----	92	522	124	125	74	42	80
31	225	-----	55	79	-----	91	-----	122	-----	93	44	-----
TOTAL	6,732	3,323	1,849	1,859	2,060	2,299	21,152	9,008	4,596	2,758	1,827	1,498
MEAN	217	111	59.6	60.0	73.6	74.2	705	291	153	89.0	58.9	49.9
MAX	405	208	68	79	80	94	1,340	479	224	121	114	80
MIN	103	65	55	51	67	63	89	122	94	67	28	34
CFSM	.85	.44	.23	.24	.29	.29	2.78	1.15	.60	.35	.23	.20
IN.	.99	.49	.27	.27	.30	.34	3.10	1.32	.67	.40	.27	.22
CAL YR 1968	TOTAL 46,997	MEAN 128	MAX 426	MIN 21	CFSM .50	IN 6.88						
WAT YR 1969	TOTAL 58,961	MEAN 162	MAX 1,340	MIN 28	CFSM .64	IN 8.64						

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., Aitkin County, on dam on Sandy River at Libby, 1.2 miles above mouth, and 14 miles north of McGregor.

DRAINAGE AREA.--421 sq mi.

PERIOD OF RECORD.--July to December 1893, October to December 1894, July 1895 to current year. Monthend 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, nonrecording gage at same site and datum.

EXTREMES.--Current year: Maximum contents, 114,400 acre-ft Apr. 25 (gage height, 14.44 ft)· minimum, 27,770 acre-ft Mar. 31 (gage height, 6.10 ft).

Period of record: 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.

MONTHEND GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30.....	9.08	53,260	-
Oct. 31.....	9.06	53,160	-100
Nov. 30.....	8.57	48,600	-4,560
Dec. 31.....	8.12	44,430	-4,170
CAL YR 1968.....	-	-	+3,850
Jan. 31.....	7.76	41,260	-3,170
Feb. 28.....	7.21	36,690	-4,570
Mar. 31.....	6.10	27,770	-8,920
Apr. 30.....	14.00	108,300	+80,530
May 31.....	8.86	51,170	-57,130
June 30.....	9.16	53,950	+2,780
July 31.....	9.15	53,950	0
Aug. 31.....	8.77	50,380	-3,570
Sept.30.....	8.92	51,770	+1,390
WTR YR 1968-69.....	-	-	-1,490

SANDY RIVER BASIN

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.

PERIOD OF RECORD.--July 1893 to March 1894, July 1894, November 1894 to March 1895, August 1895 to current year. 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, nonrecording gages at same site and datum

AVERAGE DISCHARGE (UNADJUSTED).--74 years (1895-1969), 208 cfs (6.71 inches per year).

EXTREMES.--Current year: Maximum daily discharge, 1,940 cfs May 8; no flow Apr. 1-3, 10-20.
Period of record: 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 CUBIC FEET PER SECCND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	80	615	196	144	176	130	0	1,590	13	150	365	10
2	80	610	194	144	172	129	0	1,730	13	148	360	10
3	80	615	198	146	170	126	0	1,880	13	148	148	10
4	80	625	202	148	168	275	10	1,840	13	148	150	10
5	81	270	194	150	170	245	535	1,840	13	148	150	10
6	81	280	180	148	170	230	460	1,730	13	150	10	10
7	82	278	184	148	170	225	400	1,800	72	154	10	10
8	83	276	188	148	168	220	295	1,940	72	152	10	10
9	83	276	188	152	168	220	160	1,860	72	150	10	10
10	84	276	186	152	166	230	0	1,840	138	10	10	10
11	84	276	184	148	162	225	0	1,790	136	10	10	10
12	83	280	182	144	162	235	0	1,770	136	10	10	10
13	84	282	184	142	160	220	0	1,780	134	10	10	10
14	86	200	170	142	160	210	0	1,760	134	10	10	10
15	86	200	170	144	160	200	0	1,750	134	10	10	10
16	86	200	176	144	156	195	0	1,700	134	385	10	10
17	193	200	174	142	154	185	0	1,690	136	375	10	10
18	940	198	168	142	150	180	0	1,610	69	317	10	10
19	1,550	196	162	140	146	175	0	1,570	70	79	10	10
20	1,450	196	156	140	146	175	0	1,540	13	78	10	10
21	1,470	198	154	140	142	175	100	1,540	13	78	10	10
22	1,460	198	152	192	140	180	74	1,580	13	78	10	10
23	1,450	196	152	188	140	180	110	1,570	13	79	10	10
24	1,410	196	148	186	140	165	133	1,520	13	10	10	10
25	1,380	196	146	184	136	135	394	1,480	13	10	10	10
26	1,360	198	144	182	134	130	1,260	1,330	13	10	10	10
27	1,300	198	148	186	132	155	1,330	290	13	10	10	10
28	1,280	200	148	186	132	180	1,460	320	13	10	10	10
29	570	198	146	182	-----	215	1,560	137	13	10	10	10
30	610	196	146	182	-----	225	1,590	13	13	10	10	10
31	610	-----	144	180	-----	85	-----	13	-----	109	10	-----
TOTAL	18,356	8,323	5,264	4,896	4,350	5,855	9,871	44,803	1,658	3,056	1,433	300
MEAN	592	277	170	158	155	189	329	1,445	55.3	98.6	46.2	10.0
MAX	1,550	625	202	192	176	275	1,590	1,940	138	385	365	10
MIN	80	196	144	140	132	85	0	13	13	10	10	10
CFSM	1.41	.66	.40	.38	.37	.45	.78	3.43	.13	.23	.11	.024
IN.	1.62	.74	.47	.43	.38	.52	.87	3.96	.15	.27	.13	.03
CAL YR 1968	TOTAL 101,991	MEAN 279	MAX 1,680	MIN 12	CFSM .66	IN 9.01						
WAT YR 1969	TOTAL 108,165	MEAN 296	MAX 1,940	MIN 0	CFSM .70	IN 9.56						

MISSISSIPPI RIVER MAIN STEM

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

LOCATION.--Lat 46°47'23", long 93°19'43", in ~~SENECA~~ sec.25, T.50 N., R.24 W., Aitkin County, on right bank 600 ft downstream from Sandy River, 0.8 mile northwest of Libby, and at mile 1.106 upstream from Ohio River.

DRAINAGE AREA.--5,060 sq mi, approximately.

PERIOD OF RECORD.--April 1930 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,204.55 ft above mean sea level, adjustment of 1912. Prior to July 28, 1931, nonrecording gage at site 600 ft upstream at datum 3.16 ft higher.

AVERAGE DISCHARGE.--39 years, 1,939 cfs (5.20 inches per year).

EXTREMES.--Current year: Maximum discharge, 9,080 cfs Apr. 20 (gage height, 16.46 ft); minimum, 888 cfs Sept. 13 (gage height, 3.37 ft).

Period of record: 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. 91,92,94,99).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

JAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,820	3,570	2,510	2,140	2,120	2,530	2,810	6,660	2,150	2,220	2,170	1,440
2	1,790	3,530	2,560	2,120	2,110	2,560	2,920	6,600	2,270	2,240	2,160	1,480
3	1,770	3,470	2,540	2,110	2,100	2,660	3,010	6,600	2,410	2,240	2,040	1,420
4	1,760	3,310	2,470	2,100	2,080	2,780	3,210	6,580	2,520	2,250	2,040	1,360
5	1,750	2,990	2,420	2,090	2,070	2,790	3,480	6,640	2,600	2,220	2,030	1,270
6	1,730	2,960	2,380	2,040	2,070	2,780	3,660	6,620	2,620	2,090	1,920	1,140
7	1,630	3,030	2,350	1,980	2,080	2,770	3,730	6,560	2,670	1,990	1,940	1,010
8	1,580	3,060	2,330	1,970	2,100	2,740	3,960	6,580	2,660	2,060	1,940	926
9	1,560	3,090	2,330	2,000	2,120	2,700	4,230	6,490	2,650	2,040	1,880	959
10	1,550	3,080	2,360	2,040	2,150	2,650	4,510	6,350	2,680	1,920	1,840	916
11	1,580	3,000	2,410	2,080	2,170	2,610	4,860	6,200	2,690	1,840	1,840	921
12	1,580	2,950	2,450	2,100	2,190	2,580	5,260	6,060	2,700	1,740	1,810	930
13	1,470	2,900	2,500	2,120	2,200	2,580	5,760	5,870	2,720	1,720	1,800	902
14	1,390	2,830	2,500	2,100	2,200	2,590	6,360	5,700	2,740	1,720	1,800	954
15	1,440	2,800	2,480	2,090	2,200	2,600	7,050	5,550	2,750	1,770	1,810	1,040
16	1,540	2,790	2,450	2,070	2,210	2,600	7,640	5,430	2,710	2,000	1,770	1,110
17	2,120	2,780	2,430	2,060	2,220	2,610	8,080	5,320	2,630	2,010	1,700	1,090
18	2,980	2,790	2,410	2,060	2,240	2,630	8,500	5,230	2,510	1,930	1,670	1,130
19	3,540	2,800	2,400	2,030	2,250	2,670	8,880	5,120	2,440	1,750	1,660	1,160
20	3,720	2,800	2,380	2,010	2,270	2,710	9,040	4,970	2,340	1,810	1,620	1,150
21	3,720	2,800	2,350	1,980	2,280	2,650	9,040	4,780	2,280	1,830	1,600	1,130
22	3,720	2,790	2,320	1,970	2,300	2,690	8,900	4,520	2,190	1,800	1,510	1,140
23	3,710	2,790	2,300	2,000	2,310	2,730	8,660	4,330	2,140	1,790	1,430	1,200
24	3,780	2,790	2,280	2,050	2,320	2,790	8,340	4,220	2,100	1,780	1,390	1,200
25	3,940	2,760	2,260	2,120	2,350	2,820	8,050	4,100	2,050	1,860	1,370	1,210
26	3,830	2,740	2,240	2,140	2,400	2,850	7,930	3,800	2,080	1,820	1,370	1,220
27	3,910	2,670	2,220	2,150	2,450	2,890	7,640	3,000	2,120	1,730	1,360	1,210
28	3,910	2,530	2,200	2,150	2,500	2,900	7,300	2,800	2,120	1,740	1,370	1,200
29	3,640	2,450	2,180	2,140	-----	2,880	7,000	2,540	2,110	1,750	1,380	1,220
30	3,610	2,470	2,160	2,130	-----	2,810	6,800	2,290	2,120	1,730	1,410	1,230
31	3,590	-----	2,150	2,130	-----	2,800	-----	2,190	-----	1,980	1,440	-----
TOTAL	79,560	87,320	73,320	64,270	62,060	83,950	186,610	159,700	72,770	59,370	53,070	34,268
MEAN	2,566	2,911	2,365	2,073	2,216	2,708	6,220	5,152	2,426	1,915	1,712	1,142
MAX	3,910	3,570	2,560	2,150	2,500	2,900	9,040	6,660	2,750	2,250	2,170	1,480
MIN	1,390	2,450	2,150	1,970	2,070	2,530	2,810	2,190	2,050	1,720	1,360	902
CFSM	.51	.58	.47	.41	.44	.54	1.23	1.02	.48	.38	.34	.23
IN.	.58	.64	.54	.47	.46	.62	1.37	1.17	.53	.44	.39	.25

CAL YR 1968 TOTAL 723,228 MEAN 1,981 MAX 4,570 MIN 809 CFSM .39 IN 5.32
WAT YR 1969 TOTAL 1,016,268 MEAN 2,784 MAX 9,040 MIN 902 CFSM .55 IN 7.47

MISSISSIPPI RIVER MAIN STEM

5-2275. Mississippi River at Aitkin, Minn.

LOCATION.--Lat 46°32'26", long 93°42'26", in W $\frac{1}{2}$ sec.24, T.47 N., R.27 W., Aitkin County, 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.

PERIOD OF RECORD.--March 1945 to current year.

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 Mar. 14, 1961, nonrecording gage, and Mar. 15, 1961, to Sept. 30, 1967, water-stage recorder at same site at datum 3.0 ft higher. Diversion channel: nonrecording gage. Datum of gage is 1,182.02 ft above mean sea level, datum of 1929. Apr. 9, 1955, to Apr. 10, 1956, nonrecording gage at site 4 miles downstream at different datum. Apr. 11, 1956, to Sept. 30, 1967, nonrecording gage at same site at datum 3.0 ft higher.

AVERAGE DISCHARGE.--24 years, 2,875 cfs (6.36 inches per year).

EXTREMES.--Current year: Maximum discharge, 14,400 cfs Apr. 23; minimum, 1,100 cfs Sept. 12-15. River gage: Maximum discharge, 7,740 cfs Apr. 23 (gage height, 17.32 ft); minimum, 1,100 cfs Sept. 12-15; minimum gage height, 3.17 ft Sept. 14. Diversion gage: Maximum discharge, 6,640 cfs Apr. 23 (gage height, 17.59 ft); no flow on many days.

Period of record: 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, 92, 94, 99). Water diverted at medium and high stages into Aitkin diversion channel 6.5 miles above station, bypasses station and returns to river 15.5 miles below station. Diversion began Apr. 2, 1955. These records include flow in diversion channel. Records of chemical analyses for water year 1969 are published in Part 2 of this report.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

JAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2,380	4,820	2,640	2,570	2,38C	3,180	3,810	10,600	2,840	2,430	2,510	1,570
2	2,390	4,640	2,710	2,540	2,38C	3,270	3,530	10,300	2,760	2,470	2,700	1,610
3	2,310	4,490	2,760	2,520	2,360	3,390	3,530	9,790	2,830	2,520	2,720	1,620
4	2,210	4,340	2,760	2,510	2,360	3,520	3,980	9,690	3,000	2,560	2,600	1,600
5	2,100	4,130	2,760	2,510	2,37C	3,600	4,550	9,660	3,170	2,540	2,500	1,560
6	2,080	4,060	2,660	2,490	2,39C	3,680	5,430	9,770	3,230	2,520	2,420	1,500
7	2,050	3,990	2,550	2,460	2,400	3,740	6,510	9,720	3,270	2,360	2,330	1,400
8	1,970	3,930	2,530	2,440	2,42C	3,770	7,030	9,560	3,330	2,250	2,250	1,260
9	1,920	3,660	2,550	2,420	2,440	3,800	7,080	9,410	3,330	2,250	2,230	1,150
10	1,900	3,630	2,560	2,420	2,460	3,810	7,820	9,160	3,290	2,220	2,170	1,140
11	1,900	3,590	2,540	2,410	2,460	3,810	8,990	8,970	3,290	2,150	2,100	1,120
12	1,910	3,510	2,560	2,410	2,450	3,800	9,850	8,720	3,260	2,050	2,070	1,110
13	1,930	3,420	2,660	2,400	2,430	3,760	10,600	8,410	3,250	1,970	2,030	1,100
14	1,880	3,330	2,700	2,400	2,430	3,770	11,200	8,060	3,220	1,900	2,01C	1,100
15	1,810	3,240	2,720	2,400	2,440	3,770	11,600	7,740	3,200	1,990	2,00C	1,130
16	1,860	3,160	2,690	2,400	2,460	3,780	12,000	7,430	3,160	2,000	2,000	1,220
17	2,140	3,090	2,680	2,400	2,480	3,790	12,400	7,150	3,110	2,190	1,980	1,300
18	3,110	3,180	2,670	2,390	2,500	3,800	12,800	6,870	2,990	2,260	1,910	1,310
19	4,000	3,230	2,720	2,390	2,520	3,820	13,200	6,710	2,850	2,220	1,87C	1,330
20	5,090	3,170	2,770	2,390	2,560	3,850	13,600	6,470	2,760	2,040	1,840	1,370
21	5,470	3,190	2,740	2,380	2,590	3,870	14,000	6,300	2,660	2,010	1,810	1,370
22	5,710	3,190	2,720	2,370	2,640	3,890	14,300	6,010	2,550	2,010	1,770	1,380
23	5,830	3,220	2,720	2,380	2,700	3,920	14,400	5,630	2,480	2,020	1,730	1,400
24	5,970	3,240	2,700	2,400	2,790	3,960	14,300	5,390	2,450	1,990	1,640	1,420
25	5,880	3,180	2,660	2,420	2,860	4,030	14,000	5,130	2,390	1,970	1,580	1,470
26	5,890	3,170	2,610	2,440	2,940	4,100	13,600	4,900	2,380	2,000	1,56C	1,490
27	5,770	2,980	2,600	2,440	3,000	4,160	13,000	4,550	2,390	2,060	1,540	1,510
28	5,740	2,800	2,590	2,440	3,07C	4,230	12,600	3,930	2,400	2,020	1,530	1,520
29	5,580	2,660	2,600	2,420	-----	4,310	12,000	3,510	2,420	1,990	1,520	1,520
30	5,300	2,620	2,580	2,410	-----	4,350	11,400	3,200	2,430	1,980	1,530	1,530
31	4,970	-----	2,590	2,390	-----	4,180	-----	2,960	-----	2,090	1,540	-----
TOTAL	109,050	104,860	82,300	75,360	71,280	118,710	303,110	225,900	86,690	67,030	61,990	41,110
MEAN	3,518	3,495	2,655	2,431	2,546	3,829	10,100	7,287	2,890	2,162	2,000	1,370
MAX	5,970	4,820	2,770	2,570	3,07C	4,350	14,400	10,800	3,330	2,560	2,720	1,620
MIN	1,810	2,620	2,530	2,370	2,360	3,180	3,530	2,960	2,380	1,900	1,520	1,100
CFSM	.57	.57	.43	.40	.41	.62	1.65	1.19	.47	.35	.33	.22
IN.	.66	.64	.50	.46	.43	.72	1.84	1.37	.53	.41	.38	.25

CAL YR 1968 TOTAL 908,495 MEAN 2,489 MAX 5,970 MIN 930 CFSM .41 IN 5.50
WAT YR 1969 TOTAL 1,347,390 MEAN 3,691 MAX 14,400 MIN 100 CFSM .60 IN 8.16

5-2305. Pine River Reservoir at Cross Lake, Minn.

LOCATION.--Lat 46°40'09", long 94°06'44", in SW $\frac{1}{4}$ sec.21, T.137 N., R.27 W., Crow Wing County at dam on Pine River, at outlet of Cross Lake at village of Cross Lake.

DRAINAGE AREA.--562 sq mi.

PERIOD OF RECORD.--March 1886 to current year. Monthend 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, nonrecording gage at same site and datum.

EXTREMES.--Current year: Maximum contents, 99,770 acre-ft Oct. 22 (gage height, 13.11 ft); minimum, 65,060 acre-ft Apr. 3 (gage height, 10.48).

Period of record: 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 (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.

MONTHEND GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30.....	12.85	96,300	-
Oct. 31.....	12.87	96,600	+300
Nov. 30.....	12.19	87,470	-9,130
Dec. 31.....	11.79	82,120	-5,350
CAL YR 1968.....	-	-	-6,340
Jan. 31.....	11.45	77,550	-4,570
Feb. 28.....	11.02	72,000	-5,550
Mar. 31.....	10.52	65,460	6,540
Apr. 30.....	12.85	96,300	+30,840
May 31.....	12.74	94,810	-1,490
June 30.....	12.84	96,200	+1,390
July 31.....	12.86	96,400	+200
Aug. 31.....	12.46	91,040	-5,360
Sept.30.....	12.48	91,240	+200
WTR YR 1969.....	-	-	-5,060

PINE RIVER BASIN

5-2310. Pine River at Cross Lake Dam, at Cross Lake, Minn.

LOCATION.--Lat 46°40'09", long 94°06'44", in SW 1/4 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.

PERIOD OF RECORD.--April 1886 to current year. 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 nonrecording 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, nonrecording gages on headwater and tailwater at same sites and datum. June 1 to Nov. 30, 1929, nonrecording gage in tailwater at datum 1.60 ft lower. Dec. 1, 1929, to May 2, 1949, nonrecording gage on headwater and Dec. 1, 1929, to August 1949, nonrecording gage on tailwater at present sites and datum.

AVERAGE DISCHARGE (unadjusted).--83 years, 212 cfs (5.12 inches per year).

EXTREMES.--Current year: Maximum daily discharge, 940 cfs May 5; minimum daily, 40 cfs Aug. 26 to Sept. 22. Period of record: Maximum daily discharge, 2,250 cfs in June 1896 (does not include flow bypassing dam through crevasse); no flow at times.

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

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	210	340	335	320	315	315	300	725	250	135	210	40
2	210	340	335	320	315	315	300	785	240	135	210	40
3	205	340	330	320	315	315	300	930	232	135	210	40
4	186	340	330	320	315	315	300	930	190	135	197	40
5	150	340	330	320	315	315	300	940	190	135	165	40
6	75	340	325	320	315	315	300	935	190	135	147	40
7	75	340	325	320	315	305	300	930	190	123	115	40
8	75	340	325	320	315	305	300	930	190	95	115	40
9	75	340	325	320	315	305	300	930	190	95	120	40
10	75	340	320	320	315	305	300	920	190	100	120	40
11	75	340	320	320	315	305	300	802	190	135	116	40
12	75	340	320	315	315	305	310	540	190	135	95	40
13	75	340	320	315	315	305	310	535	190	135	95	40
14	75	340	320	315	310	305	315	488	190	135	95	40
15	75	340	320	315	310	305	315	360	190	146	95	40
16	107	340	320	315	310	305	320	407	169	210	95	40
17	198	340	320	315	310	305	320	485	135	210	95	40
18	298	340	320	315	310	300	340	485	135	210	95	40
19	360	340	320	315	315	300	485	480	135	210	95	40
20	360	340	320	315	315	300	485	480	128	210	95	40
21	355	340	320	315	315	305	495	459	95	210	95	40
22	355	340	320	315	315	300	450	360	95	195	95	40
23	355	340	320	315	315	305	387	350	95	180	95	51
24	350	340	320	315	315	305	500	300	95	210	95	70
25	350	340	320	315	315	305	533	300	95	210	78	70
26	350	340	320	315	315	300	600	272	95	210	40	70
27	350	340	320	315	315	300	600	205	95	210	40	70
28	340	340	320	315	315	300	640	200	95	210	40	70
29	340	340	320	315	-----	300	730	250	95	210	40	70
30	340	340	320	315	-----	300	730	275	110	210	40	70
31	340	-----	320	315	-----	300	-----	275	-----	210	40	-----
TOTAL	6,859	10,200	10,000	9,820	8,795	9,465	12,165	17,263	4,669	5,224	3,278	1,421
MEAN	221	340	323	317	314	305	406	557	156	169	106	47.4
MAX	360	340	335	320	315	315	730	940	250	210	210	70
MIN	75	340	320	315	310	300	300	200	95	95	40	40
CFSM	.39	.61	.57	.56	.56	.54	.72	.99	.28	.30	.19	.084
IN.	.45	.68	.66	.65	.58	.63	.81	1.14	.31	.35	.22	.09
CAL YR 1968	TOTAL 86,305	MEAN 236	MAX 710	MIN 40	CFSM .42	IN 5.71						
WAT YR 1969	TOTAL 99,159	MEAN 272	MAX 940	MIN 40	CFSM .48	IN 6.56						

5-2315. Pelican Lake near Pequot Lakes, Minn.

LOCATION.--Lat 46°37', long 94°11', in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.10, T.136 N., R.28 W. Crow Wing County, 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.

PERIOD OF RECORD.--April 1938 to July 1969 (fragmentary, discontinued). Prior to October 1956, published as Pelican Lake diversion near Pequot Lakes.

GAGE.--Nonrecording 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 period October 1968 to July 1969, 3.98 ft May 7; minimum observed, 3.16 ft Oct. 7, 9, 14. Period of record: 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 1968 TO JULY 1969

Oct. 31	3.24	Feb. 28	3.64	May 30	3.84
Nov. 30	3.20	Mar. 31	3.64	June 29	3.70
Dec. 31	3.38	Apr. 28	3.80	July 31	3.68
Jan. 31	3.62				

NOTE.--Gage readings other than those shown are available.

CROW WING RIVER BASIN

5-2440. Crow Wing River at Nimrod, Minn.

LOCATION.--Lat 46°38'25", long 94°52'44", in SE 1/4 sec.32, T.137 N., R.33 W., Wadena County, 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.

PERIOD OF RECORD.--April 1910 to September 1914, July 1930 to current year (winter records incomplete prior to 1940).

GAGE.--Water-stage recorder. Datum of gage is 1,313.27 ft above mean sea level, datum of 1929 (levels by Wadena County Highway Department from Minnesota Highway Department bench mark). Apr. 15, 1910, to Sept. 30, 1914, nonrecording gage at same site, at datum 2.2 ft lower. July 28, 1930, to Nov. 4, 1949, nonrecording gages at same site and datum.

AVERAGE DISCHARGE.--30 years (1939-69), 474 cfs (6.37 inches per year).

EXTREMES.--Current year: Maximum discharge, 2,200 cfs Apr. 15 (gage height, 5.26 ft); minimum, 98 cfs Dec. 6 (gage height, 2.26 ft, result of freezeup).
Period of record: Maximum discharge, 2,890 cfs Apr. 13, 1965 (gage height, 7.57 ft, backwater from ice); maximum gage height, 7.64 ft Apr. 20, 1950, backwater from ice; minimum discharge observed, 45 cfs Aug. 7, 1936.

REMARKS.--Records good except those for winter months, which are fair. Flow affected by natural storage in many lakes. Records of chemical analysis, water temperatures, and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1508: 1910-11, 1913-14, 1937, 1942(M), 1944(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	592	589	440	329	334	398	380	1,200	688	535	503	284
2	584	561	436	329	334	393	400	1,200	708	544	494	275
3	581	534	418	330	335	389	420	1,160	720	531	494	269
4	587	520	380	331	335	384	440	1,190	713	514	494	268
5	587	518	225	332	336	380	470	1,220	702	492	491	313
6	584	520	180	333	338	374	550	1,180	685	476	475	342
7	568	520	435	334	340	370	810	1,130	662	463	450	360
8	559	518	450	335	341	363	1,230	1,090	632	495	430	364
9	596	514	440	335	342	358	1,650	1,060	606	496	415	364
10	619	508	425	336	346	351	1,920	1,040	588	487	396	361
11	609	508	400	336	349	347	2,140	1,010	578	479	387	354
12	602	508	375	336	350	339	2,140	993	563	455	391	344
13	606	493	360	336	351	330	2,130	970	548	425	399	330
14	615	487	350	338	352	322	2,130	943	530	439	404	337
15	622	482	360	340	355	318	2,180	904	529	474	393	348
16	644	478	365	341	358	313	2,170	896	520	518	372	354
17	741	486	362	341	360	311	2,080	874	512	511	345	341
18	952	489	358	341	362	310	1,940	843	496	506	326	333
19	978	482	354	341	366	310	1,800	824	472	497	317	326
20	929	450	352	340	370	311	1,710	803	457	485	313	315
21	884	442	349	340	374	313	1,660	774	451	484	310	304
22	858	440	345	339	380	315	1,580	744	451	518	304	316
23	836	440	341	339	386	316	1,510	723	454	550	297	341
24	815	439	340	338	394	320	1,440	698	478	547	288	364
25	798	438	338	338	403	330	1,390	678	477	541	285	370
26	774	434	337	337	403	350	1,340	668	499	524	283	363
27	735	431	335	337	401	365	1,330	664	480	515	280	358
28	695	429	334	336	400	400	1,320	639	478	516	277	353
29	652	424	332	335	-----	400	1,270	609	491	510	274	370
30	628	422	331	335	-----	390	1,220	594	521	509	278	380
31	608	-----	330	334	-----	380	-----	626	-----	514	285	-----
TOTAL	21,438	14,504	11,177	10,422	10,095	10,850	42,750	27,947	16,689	15,550	11,450	10,101
MEAN	692	483	361	336	361	350	1,425	902	556	502	369	337
MAX	978	589	450	341	403	400	2,180	1,220	720	550	503	380
MIN	559	422	180	329	334	310	380	594	451	425	274	268
CFSM	.68	.48	.36	.33	.36	.35	1.41	.89	.55	.50	.37	.33
IN.	.79	.53	.41	.38	.37	.40	1.57	1.03	.61	.57	.42	.37
CAL YR 1968	TOTAL 216,679		MEAN 592		MAX 2,650		MIN 180		CFSM .59		IN 7.98	
WTR YR 1969	TOTAL 202,973		MEAN 556		MAX 2,180		MIN 180		CFSM .55		IN 7.47	

5-2465. Gull Lake near Brainerd, Minn.

LOCATION.--Lat $46^{\circ}24'40''$, long $94^{\circ}21'26''$, in N $\frac{1}{2}$ sec.20, T.134 N., R.29 W., Cass County, 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.

PERIOD OF RECORD.--August 1911 to current year. Prior to October 1941 monthend 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, nonrecording gage 800 ft north of present site at same datum.

EXTREMES.--Current year: Maximum contents, 60,300 acre-ft May 7 (gage height, 6.20 ft); minimum, 45,220 acre-ft Mar. 30 (gage height, 5.03 ft).

Period of record: 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.

MONTHEND GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30.....	5.97	57,370	-
Oct. 31.....	5.85	55,740	-1,630
Nov. 30.....	5.29	48,600	-7,140
Dec. 31.....	5.22	47,600	-1,000
CAL YR 1968.....			-3,560
Jan. 31.....	5.24	48,000	+400
Feb. 28.....	5.13	46,410	-1,590
Mar. 31.....	5.03	45,220	-1,190
Apr. 30.....	5.96	57,320	+12,100
May 31.....	6.01	57,920	+600
June 30.....	6.07	58,710	+790
July 31.....	6.10	59,110	+400
Aug. 31.....	5.77	54,740	-4,370
Sept.30.....	5.84	55,740	+1,000
WTR YR 1969.....	-	-	-1,630

CROW WING RIVER BASIN

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.

PERIOD OF RECORD.--August 1911 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "at Gull Lake Reservoir" 1929.

GAGE.--Water-stage recorder on headwater and nonrecording 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 nonrecording gages at same site and datum. May 24 to Nov. 30, 1929, nonrecording gage 500 ft downstream at different datum.

AVERAGE DISCHARGE (UNADJUSTED).--58 years, 104 cfs (4.92 inches per year).

EXTREMES.--Current year: Maximum daily discharge, 660 cfs Apr. 16-20; minimum daily, 3 cfs Oct. 7, 8. Period of record: 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 CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	92	206	129	114	119	107	92	323	56	172	54	10
2	95	203	132	112	119	107	92	325	76	101	53	10
3	93	196	134	111	118	105	92	325	107	104	49	10
4	41	193	151	108	116	105	93	335	107	104	10	10
5	40	189	119	109	115	104	97	345	107	103	10	10
6	40	186	115	112	115	103	100	446	104	100	10	10
7	3.0	183	114	112	115	101	107	450	53	97	11	10
8	3.0	180	114	112	114	100	118	545	52	50	10	10
9	6.0	175	116	113	112	100	204	538	51	53	10	10
10	6.0	172	119	112	112	100	306	531	50	53	10	10
11	6.0	169	119	112	112	97	510	522	51	53	10	10
12	6.0	165	121	111	111	97	530	510	50	53	10	10
13	6.0	161	125	112	108	96	540	325	47	51	10	10
14	7.0	159	123	112	108	96	550	169	10	51	10	10
15	8.0	158	123	112	110	96	640	54	10	80	10	10
16	25	154	122	115	111	95	660	83	10	112	10	10
17	112	154	122	115	111	95	660	268	10	111	10	10
18	219	154	121	115	111	95	660	262	10	108	10	10
19	343	151	121	113	111	93	660	185	10	61	10	10
20	339	148	119	114	108	95	660	186	10	58	10	10
21	333	147	118	114	110	95	660	183	10	56	10	10
22	333	145	121	114	111	93	555	181	10	54	10	10
23	327	144	122	114	111	92	500	108	10	56	10	10
24	319	144	121	118	110	92	323	109	10	56	10	10
25	308	139	119	116	110	92	317	107	10	55	10	10
26	230	138	119	116	108	91	319	105	57	53	10	10
27	232	135	121	116	107	91	323	53	75	55	10	10
28	225	136	119	118	107	92	325	54	181	54	10	10
29	216	134	118	116	-----	92	323	55	177	54	10	10
30	211	129	118	119	-----	92	321	54	177	52	10	10
31	208	-----	114	116	-----	92	-----	54	-----	54	10	-----
TOTAL	4,432.0	4,847	3,769	3,523	3,130	3,001	11,337	7,790	1,698	2,274	437	300
MEAN	143	162	122	114	112	96.8	378	251	56.6	73.4	14.1	10.0
MAX	343	206	151	119	119	107	660	545	181	172	54	10
MIN	3.0	129	114	108	107	91	92	53	10	50	10	10
CFSM	.50	.56	.43	.40	.39	.34	1.32	.87	.20	.26	.049	.035
IN.	.57	.63	.49	.46	.41	.39	1.47	1.01	.22	.29	.06	.04

CAL YR 1968 TOTAL 46,072.0 MEAN 126 MAX 650 MIN 3.0 CFSM .44 IN 5.97
 WAT YR 1969 TOTAL 46,538.0 MEAN 128 MAX 660 MIN 3.0 CFSM .45 IN 6.03

MISSISSIPPI RIVER MAIN STEM

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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.

PERIOD OF RECORD.--March 1924 to current year.

AVERAGE DISCHARGE.--45 years, 4,106 cfs (4.87 inches per year).

EXTREMES.--Current year: Maximum daily discharge, 32,400 cfs Apr. 14; minimum daily, 1,630 cfs Sept. 13.
Period of record: Maximum daily discharge, 37,700 cfs Apr. 16, 1965; minimum daily, 254 cfs Nov. 25, 1936.

REMARKS.--Records good. 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. 91,92, 94,99,103,107).

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4,030	8,670	3,580	4,030	3,650	4,100	5,010	20,000	5,820	4,030	3,530	2,060
2	4,030	7,560	4,570	4,030	3,630	4,230	6,900	19,500	5,440	4,030	3,430	1,840
3	3,900	7,560	4,640	4,030	3,770	4,230	5,910	19,000	5,550	3,960	3,900	1,940
4	4,300	7,560	5,400	3,970	3,710	4,230	7,470	18,500	5,120	4,160	4,220	2,060
5	4,050	7,300	3,940	4,030	3,950	4,390	7,560	18,500	5,670	4,110	4,000	2,250
6	3,740	6,760	2,780	4,030	3,990	4,230	9,430	18,500	5,480	4,030	3,760	2,320
7	3,630	6,590	2,420	4,100	3,880	4,390	13,600	18,500	6,000	3,910	3,600	2,360
8	3,570	6,110	2,690	4,040	3,830	4,710	16,800	18,900	6,040	3,850	3,430	2,240
9	3,760	6,110	2,770	4,020	4,000	4,710	20,400	18,500	5,410	3,830	3,430	2,030
10	3,580	6,110	3,750	3,950	4,030	4,610	26,300	17,900	5,210	3,460	3,230	1,800
11	3,300	6,110	3,660	3,820	3,910	4,470	29,500	17,100	5,210	3,710	3,130	1,700
12	3,460	6,110	4,110	3,630	4,030	4,470	31,100	16,500	5,210	3,510	3,060	1,730
13	3,580	5,810	2,950	3,710	4,030	4,470	32,100	15,600	5,050	3,290	2,890	1,630
14	3,420	5,640	2,270	3,780	4,030	4,470	32,400	14,800	4,710	3,210	2,900	1,690
15	4,250	5,210	2,940	3,760	4,030	4,470	31,600	13,600	5,130	3,380	2,820	1,800
16	3,890	5,210	3,460	3,950	4,030	4,470	30,300	13,600	4,680	3,670	2,590	1,720
17	3,940	5,210	3,680	3,830	4,030	4,760	29,400	12,800	4,470	3,450	2,700	1,820
18	6,700	5,210	3,730	3,730	4,020	4,710	28,100	12,300	4,600	3,430	2,680	1,680
19	8,190	5,210	3,630	3,630	4,020	4,830	27,000	11,600	4,590	4,000	2,750	1,910
20	9,870	5,110	3,630	3,810	4,070	4,950	26,200	11,300	4,160	3,970	2,530	1,970
21	11,000	5,150	3,780	4,030	4,080	4,950	25,500	12,100	3,880	3,600	2,210	1,960
22	12,000	5,050	3,900	3,910	4,010	4,950	24,700	10,300	3,930	3,550	2,400	2,180
23	11,500	5,400	4,110	3,970	3,960	5,190	23,900	9,340	3,900	3,200	2,430	2,710
24	11,200	5,610	3,830	4,030	4,100	5,190	23,000	9,100	3,600	3,510	2,260	2,060
25	11,200	5,200	3,760	3,700	4,170	5,130	21,800	8,570	4,020	3,600	2,300	2,050
26	10,600	5,210	3,930	3,830	4,100	5,220	21,600	8,440	3,770	3,520	2,140	2,320
27	10,400	4,860	3,990	3,830	4,130	5,580	21,800	7,920	4,190	3,720	2,020	2,180
28	10,400	4,600	4,070	3,830	4,190	5,820	21,400	7,250	4,130	3,660	2,070	2,160
29	9,570	4,450	4,030	3,890	-----	5,150	21,000	6,470	4,080	3,440	2,000	2,410
30	9,260	4,020	4,030	3,650	-----	5,010	20,500	5,750	4,000	3,440	2,040	2,570
31	9,130	-----	4,030	3,800	-----	5,140	-----	5,690	-----	3,710	2,020	-----
TOTAL	205,450	174,710	114,060	120,350	111,380	147,230	642,280	417,930	143,050	113,940	88,470	61,150
MEAN	6,627	5,824	3,679	3,882	3,978	4,749	21,410	13,480	4,768	3,675	2,854	2,038
MAX	12,000	8,670	5,400	4,100	4,190	5,820	32,400	20,000	6,040	4,160	4,220	2,710
MIN	3,300	4,020	2,270	3,630	3,630	4,100	5,010	5,690	3,600	3,200	2,000	1,630
CFSM	.57	.50	.32	.33	.34	.41	1.85	1.16	.41	.32	.25	.18
IN.	.66	.56	.37	.39	.36	.47	2.06	1.34	.46	.37	.28	.20
CAL YR 1968	TOTAL 1,757,360	MEAN 4,802	MAX 16,400	MIN 1,480	CFSM .41	IN 5.64						
WAT YR 1969	TOTAL 2,340,000	MEAN 6,411	MAX 32,400	MIN 1,630	CFSM .55	IN 7.50						

SAUK RIVER BASIN

5-2705. Sauk River near St. Cloud, Minn.

LOCATION.--Lat 45°33'35", long 94°14'00", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.8, T.124 N., R.28 W., Stearns County, on right bank 0.5 mile northwest of Waite Park, 3 miles west of St. Cloud, and 5 miles upstream from mouth.

DRAINAGE AREA.--925 sq mi.

PERIOD OF RECORD.--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 current year. 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, nonrecording gage on highway bridge 1 mile downstream at datum 6.77 ft lower.

AVERAGE DISCHARGE.--39 years (1909-12, 1930-31, 1934-69), 255 cfs (3.74 inches per year).

EXTREMES.--Current year: Maximum discharge, 5,300 cfs Apr. 11 (gage height, 7.96 ft); minimum, 41 cfs Aug. 30 (gage height, 0.86 ft).

Period of record: 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 895: Drainage area. WSP 1308: 1912(M), 1932(M), WSP 1508: 1937(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	126	398	190	95	115	138	250	1,860	840	367	193	52
2	125	377	188	94	115	139	265	1,820	695	384	177	50
3	129	350	190	94	115	139	290	1,760	225	388	168	51
4	120	334	188	94	115	140	350	1,680	258	387	164	52
5	114	318	176	93	115	141	480	1,660	310	395	160	61
6	120	308	170	93	115	142	700	1,640	345	360	167	69
7	121	309	166	94	115	142	1,100	1,590	359	331	176	68
8	127	303	164	94	115	143	1,940	1,540	366	339	162	63
9	154	287	160	95	115	145	4,000	1,490	364	349	142	64
10	162	280	157	95	115	148	4,890	1,430	359	340	134	63
11	148	276	150	95	119	148	5,240	1,390	384	325	131	62
12	141	265	142	95	120	149	5,250	1,360	371	310	123	61
13	137	261	140	95	121	150	5,100	1,350	363	296	122	61
14	139	253	135	95	121	151	4,870	1,330	357	283	119	58
15	139	247	130	96	122	151	4,650	1,320	348	290	109	60
16	210	242	128	100	123	158	4,350	1,310	347	289	105	57
17	384	247	124	100	124	160	4,000	1,270	331	265	101	51
18	519	252	120	102	125	165	3,660	1,380	317	253	96	50
19	622	247	118	103	126	172	3,330	1,460	307	253	93	50
20	641	241	112	104	128	178	3,010	1,420	287	250	88	48
21	677	231	110	104	128	184	2,750	1,340	274	234	72	47
22	706	229	109	104	130	193	2,500	1,280	262	230	57	64
23	661	231	105	105	131	200	2,270	1,230	265	227	54	70
24	632	233	105	105	131	205	2,100	1,180	265	219	49	64
25	604	225	103	108	134	209	1,970	1,100	272	216	47	61
26	569	229	102	108	134	213	1,850	1,050	321	207	47	64
27	560	220	100	109	135	220	1,990	1,020	338	215	46	61
28	500	214	99	110	138	222	2,050	1,000	337	200	46	57
29	451	205	97	110	-----	228	1,990	940	322	197	45	55
30	418	200	96	115	-----	232	1,910	877	359	202	56	61
31	398	-----	95	115	-----	240	-----	851	-----	223	62	-----
TOTAL	10,554	8,012	4,169	3,119	3,440	5,345	79,105	41,928	10,548	8,824	3,311	1,755
MEAN	340	267	134	101	123	172	2,637	1,353	352	285	107	58.5
MAX	706	398	190	115	138	240	5,250	1,860	840	395	193	70
MIN	114	200	95	93	115	138	250	851	225	197	45	47
CFSM	.37	.29	.15	.11	.13	.19	2.85	1.46	.38	.31	.12	.06
IN.	.42	.32	.17	.13	.14	.21	3.18	1.69	.42	.35	.13	.07

CAL YR 1968	TOTAL	62,627	MEAN	171	MAX	706	MIN	37	CFSM	.19	IN	2.52
WTR YR 1969	TOTAL	180,110	MEAN	493	MAX	5,250	MIN	45	CFSM	.53	IN	7.24

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., Sherburne County, on right bank, 0.2 mile east of Santiago and 0.4 mile upstream from bridge on county road.

PERIOD OF RECORD.--June 1965 to current year.

GAGE.--Water-stage recorder.

EXTREMES.--Current year: Maximum discharge, 2,970 cfs Apr. 7 (gage height, 11.42 ft); minimum, 2.3 cfs Sept. 21, 22; minimum gage height, 3.38 ft Mar. 11, Sept. 21, 22.

Period of record: Maximum discharge, 2,970 cfs Apr. 7, 1969 (gage height, 11.42 ft); minimum, 0.1 cfs July 10, 1966, minimum gage height 3.22 ft Sept. 12, 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 periods, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	32	15	9.4	6.1	5.5	50	332	36	14	9.8	6.6
2	32	30	14	9.6	6.0	5.6	56	237	32	15	8.8	5.0
3	28	29	14	9.6	5.9	5.8	96	166	39	13	8.2	4.4
4	25	27	14	9.8	5.6	5.9	375	127	36	12	6.9	4.4
5	24	25	13	9.8	5.5	6.1	1,060	102	18	11	6.4	5.0
6	26	24	12	10	5.4	6.3	2,070	97	16	10	6.6	5.0
7	28	22	12	10	5.2	6.5	2,600	107	15	8.8	6.9	4.8
8	32	22	11	10	5.1	6.6	2,130	109	14	8.5	6.9	4.6
9	58	20	11	10	5.0	7.0	1,650	85	13	8.5	6.9	4.4
10	114	20	11	10	4.9	7.3	1,050	66	12	8.5	6.1	3.8
11	135	18	11	10	4.8	7.6	659	52	13	7.8	6.1	3.4
12	136	18	10	10	4.7	7.8	482	44	14	6.9	5.5	3.3
13	104	16	10	9.7	4.7	8.2	345	37	13	6.9	5.5	3.0
14	83	16	9.9	9.4	4.8	8.5	266	31	13	10	4.6	3.0
15	68	16	9.8	9.2	4.8	8.9	238	26	12	12	5.0	2.8
16	89	15	9.7	9.2	4.8	9.3	262	56	11	19	4.2	2.8
17	257	16	9.5	8.9	4.8	9.8	228	131	11	16	4.4	2.6
18	744	17	9.5	8.7	4.9	10	170	128	9.5	16	4.4	2.6
19	747	16	9.6	8.4	4.9	10	120	100	8.8	13	4.2	2.6
20	561	15	9.5	8.4	4.9	11	89	72	8.2	11	4.4	2.6
21	401	15	9.4	8.1	4.9	12	110	51	7.5	9.1	4.4	2.4
22	275	15	9.4	8.0	4.9	13	58	36	7.8	8.2	3.8	4.2
23	212	15	9.4	7.9	5.1	15	48	32	8.2	7.5	4.0	5.0
24	165	15	9.2	7.7	5.1	18	41	32	8.2	7.2	4.6	4.2
25	123	15	9.2	7.5	5.1	22	37	31	12	8.5	4.6	3.4
26	94	15	9.2	7.4	5.2	28	34	29	15	7.5	3.8	3.3
27	72	15	9.2	7.2	5.3	35	164	28	18	11	3.6	3.3
28	57	15	9.4	7.0	5.4	40	874	26	18	14	3.1	3.1
29	49	15	9.4	6.8	-----	45	694	21	17	12	3.1	3.3
30	41	15	9.4	6.4	-----	46	496	17	15	9.8	4.4	3.3
31	35	-----	9.4	6.4	-----	50	-----	20	-----	11	7.5	-----
TOTAL	4,855	564	328.1	270.5	143.8	477.7	16,552	2,428	471.2	333.7	168.7	112.2
MEAN	157	18.8	10.6	8.73	5.14	15.4	552	78.3	15.7	10.8	5.44	3.74
MAX	747	32	15	10	6.1	50	2,600	332	39	19	9.8	6.6
MIN	24	15	9.2	6.4	4.7	5.5	34	17	7.5	6.9	3.1	2.4

CAL YR 1968 TOTAL 12,065.8 MEAN 33.0 MAX 747 MIN .30
 WAT YR 1969 TOTAL 26,704.9 MEAN 73.2 MAX 2,600 MIN 2.4

ELK RIVER BASIN

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., Sherburne County, on right bank 3.6 miles north of Big Lake and 4 miles upstream from mouth.

PERIOD OF RECORD.--

GAGE.--Water-stage recorder. Altitude of gage is 925 ft (from topographic map).

EXTREMES.--Current year: Maximum discharge, 2,110 cfs Apr. 10 (gage height, 10.47 ft); minimum, 32 cfs Aug. 30 (gage height, 4.37 ft).

Period of record: Maximum discharge, 2,110 Apr. 10, 1969; (gage height, 10.47 ft); minimum daily discharge, 20 cfs Feb. 19-22; minimum gage height, 4.37 ft Aug. 30, 1969. Flood of Apr. 16, 1965 reached a stage of 11.34 ft, from floodmarks (discharge 2,700 cfs).

REMARKS.--Records good except those for winter periods, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	314	342	143	80	76	78	154	365	108	78	68	42
2	311	306	143	80	76	78	160	651	104	79	65	41
3	299	276	143	80	76	78	175	682	101	76	62	39
4	282	248	142	80	76	79	186	624	104	71	60	38
5	264	231	137	79	76	79	199	557	103	69	57	38
6	246	217	123	79	76	79	212	495	100	66	57	38
7	225	204	115	78	76	80	238	424	98	62	55	38
8	208	192	109	78	76	80	618	379	92	72	53	37
9	207	181	100	78	76	80	1,900	350	84	79	51	36
10	200	176	93	78	76	80	2,100	328	76	71	49	37
11	194	176	89	78	76	80	2,030	304	82	67	48	37
12	184	173	88	78	76	80	1,820	285	87	67	48	38
13	181	167	88	78	76	80	1,600	267	80	68	46	36
14	180	158	87	78	76	80	1,380	251	75	57	45	36
15	187	150	87	78	76	80	1,190	235	74	58	44	36
16	205	144	86	78	76	80	1,030	227	71	69	43	36
17	230	143	86	78	76	81	846	211	72	63	42	36
18	260	141	86	78	76	81	656	198	78	62	41	35
19	270	141	86	78	76	83	563	182	71	60	40	35
20	288	139	85	78	76	86	547	168	65	63	39	35
21	331	138	85	78	77	90	492	159	65	63	39	34
22	426	138	84	78	77	95	444	155	71	62	38	37
23	644	138	84	78	77	102	408	157	68	60	38	49
24	810	140	84	78	78	107	378	169	67	57	37	51
25	804	143	83	77	78	112	350	169	82	60	36	47
26	735	145	82	77	78	119	328	163	101	59	35	45
27	664	145	82	77	78	124	333	155	93	73	35	45
28	609	144	82	77	78	131	325	146	87	81	34	44
29	526	144	82	76	-----	136	311	133	86	72	33	44
30	446	144	81	76	-----	140	304	123	83	66	32	43
31	381	-----	81	76	-----	146	-----	109	-----	68	42	-----
TOTAL	11,111	5,324	3,026	2,418	2,141	2,904	21,277	8,821	2,528	2,078	1,412	1,183
MEAN	358	177	97.6	78.0	76.5	93.7	709	285	84.3	67.0	45.5	39.4
MAX	810	342	143	80	78	146	2,100	682	108	81	68	51
MIN	180	138	81	76	76	78	154	109	65	57	32	34
CAL YR 1968	TOTAL 39,410		MEAN 108		MAX 810		MIN 20					
WTR YR 1969	TOTAL 64,223		MEAN 176		MAX 2,100		MIN 32					

5-2750. Elk River near Big Lake, Minn.

LOCATION.--Lat 45°20'02", long 93°40'00", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.23, T.33 N., R.27 W., Sherburne County, 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.

PERIOD OF RECORD.--April 1911 to September 1917, April to September 1931, April to November 1932, March to November 1933, March 1934 to current year.

GAGE.--Water-stage recorder. Datum of gage is 899.60 ft above mean sea level, datum of 1929. April 1911 to Sept. 30, 1917, Apr. 1, 1931, to July 26, 1934, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--41 years (1911-17, 1934-69), 251 cfs (5.54 inches per year).

EXTREMES.--Current year: Maximum discharge, 5,980 cfs Apr. 10 (gage height, 10.08 ft); minimum, 80 cfs Aug. 29, 30 (gage height, 0.81 ft).
Period of record: 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 periods, which are fair.

REVISIONS (WATER YEARS).--WSP 895: 1939. WSP 1308: 1912(M), 1915-17(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
1	505	823	305	175	180	200	386	1,090	323	238	198	124	
2	498	746	298	175	180	205	440	1,340	326	257	187	117	
3	480	678	296	175	180	210	451	1,510	312	246	178	112	
4	451	624	296	175	180	215	569	1,410	305	230	165	112	
5	422	577	256	175	180	220	679	1,280	298	219	159	125	
6	411	537	250	175	180	230	818	1,170	288	210	154	129	
7	390	501	245	175	180	235	1,030	1,050	284	202	147	127	
8	383	473	245	175	180	240	1,670	948	274	222	139	123	
9	419	444	245	175	180	245	4,140	869	260	238	133	121	
10	437	422	245	175	180	250	5,720	801	246	222	128	118	
11	433	408	245	175	180	250	5,800	729	260	207	126	116	
12	411	393	230	175	180	255	5,050	659	263	197	120	114	
13	393	383	210	175	180	255	4,050	603	253	204	113	110	
14	383	365	200	175	180	255	3,280	554	246	202	109	106	
15	379	350	185	175	185	260	2,710	512	242	194	105	104	
16	451	336	180	175	185	260	2,290	484	232	218	102	105	
17	581	336	175	175	185	265	1,970	463	228	216	100	103	
18	689	336	175	175	185	270	1,690	456	232	207	99	99	
19	771	329	175	175	190	270	1,460	459	225	199	95	96	
20	849	308	175	175	190	275	1,330	456	211	195	94	93	
21	982	314	175	175	190	285	1,220	435	204	191	94	91	
22	1,170	327	175	175	190	300	1,100	417	218	182	92	98	
23	1,340	325	175	175	190	310	999	400	218	177	91	133	
24	1,560	323	175	175	190	347	901	421	214	170	90	137	
25	1,600	322	175	175	190	354	815	442	246	173	90	131	
26	1,510	325	175	175	190	357	739	442	291	168	89	126	
27	1,380	325	175	175	190	375	772	424	274	228	87	123	
28	1,260	325	175	180	195	379	833	396	260	246	85	121	
29	1,160	332	175	180	-----	332	876	365	256	223	84	117	
30	1,030	323	175	180	-----	307	916	337	253	203	87	116	
31	919	-----	175	180	-----	329	-----	319	-----	201	117	-----	
TOTAL	23,647	12,610	6,556	5,445	5,165	8,540	54,704	21,241	7,742	6,485	3,661	3,447	
MEAN	763	420	211	176	184	275	1,823	685	258	209	118	115	
MAX	1,600	823	305	180	195	379	5,800	1,510	326	257	198	137	
MIN	379	308	175	175	180	200	386	319	204	168	84	91	
CFSM	1.24	.68	.34	.29	.30	.45	2.96	1.11	.42	.34	.19	.19	
IN.	1.43	.76	.40	.33	.31	.52	3.31	1.28	.47	.39	.22	.21	
CAL YR 1968	TOTAL	96,629		MEAN	264	MAX	1,600	MIN	53	CFSM	.43	IN	5.84
WTR YR 1969	TOTAL	159,243		MEAN	436	MAX	5,800	MIN	84	CFSM	.71	IN	9.63

CROW RIVER BASIN

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., Kandiyohi County, on right bank 75 ft upstream from highway bridge, 1.5 miles downstream from Lake Calhoun, 3 miles downstream from Green Lake, and 6.8 miles northeast of Spicer.

DRAINAGE AREA.--179 sq mi,

PERIOD OF RECORD.--March 1949 to current year.

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, nonrecording gage at bridge 75 ft downstream at same datum.

AVERAGE DISCHARGE.--20 years, 49.4 cfs (3.75 inches per year).

EXTREMES.--Current year: Maximum discharge, 376 cfs Apr. 28 (gage height, 537 ft); minimum, 5.0 cfs Sept. 30 (gage height, 2.16 ft).

Period of record: 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 winter period, which are fair. Flow affected by natural storage and some regulation from lakes above station.

REVISIONS (WATER YEARS).--WSP 1508: 1949(M), 1950.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	58	89	46	49	61	86	344	215	76	63	21
2	20	58	88	45	50	61	89	352	207	80	61	19
3	16	58	83	45	51	62	98	350	194	76	57	19
4	14	58	80	44	52	62	114	346	185	74	53	18
5	10	60	76	44	53	62	137	347	182	71	47	18
6	13	62	70	43	54	62	192	352	178	67	43	18
7	10	78	65	42	55	62	230	346	178	64	39	18
8	11	90	60	42	56	61	257	342	176	70	39	16
9	18	94	57	41	57	60	270	335	167	74	36	14
10	18	97	55	41	59	61	257	329	158	74	34	13
11	18	99	55	41	59	66	246	319	157	72	32	12
12	15	98	56	41	59	72	236	310	145	70	30	12
13	15	97	58	41	59	72	240	300	134	64	28	11
14	15	97	61	41	59	75	253	292	131	64	28	10
15	16	97	62	41	59	76	268	293	126	72	26	12
16	39	94	58	41	59	74	280	330	121	74	25	11
17	69	96	56	42	59	74	290	335	113	71	25	9.2
18	89	97	56	42	59	76	300	314	108	67	23	8.2
19	92	94	56	43	59	77	310	299	102	64	22	7.4
20	85	92	55	43	59	83	312	289	97	62	20	6.6
21	79	90	55	43	59	97	310	279	92	58	19	5.6
22	80	89	54	44	60	80	300	275	90	57	19	11
23	76	86	53	44	58	83	293	268	88	60	19	12
24	73	83	52	44	57	84	303	264	86	57	18	9.2
25	71	83	51	45	58	86	313	253	85	57	18	8.7
26	71	85	50	45	59	86	320	242	92	58	17	8.2
27	74	85	49	45	59	87	353	237	91	60	16	7.8
28	65	88	48	46	60	89	374	234	89	59	15	7.0
29	58	88	48	47	-----	89	360	232	82	58	13	6.3
30	54	89	47	47	-----	89	346	224	80	59	19	5.6
31	54	-----	46	48	-----	89	-----	214	-----	61	23	-----
TOTAL	1,360	2,540	1,849	1,347	1,596	2,318	7,737	9,246	3,949	2,050	927	354.8
MEAN	43.9	84.7	59.6	43.5	57.0	74.8	258	298	132	66.1	29.9	11.8
MAX	92	99	89	48	60	97	374	352	215	80	63	21
MIN	10	58	46	41	49	60	86	214	80	57	13	5.6
CFSM	.25	.47	.33	.24	.32	.42	1.44	1.67	.74	.37	.17	.07
IN.	.28	.53	.38	.28	.33	.48	1.61	1.92	.82	.43	.19	.07
CAL YR 1968	TOTAL 10,813.60		MEAN 29.5		MAX 99		MIN 0		CFSM .17		IN 2.25	
WTR YR 1969	TOTAL 35,273.8		MEAN 96.6		MAX 374		MIN 5.6		CFSM .54		IN 7.33	

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., Carver County, 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.

PERIOD OF RECORD.--April 1934 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Nonrecording gage read once or twice daily. Datum of gage is 925.78 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department).

AVERAGE DISCHARGE.--35 years, 240 cfs (2.79 inches per year).

EXTREMES.--Current year: Maximum discharge, 9,770 cfs Apr. 11 (gage height, 16.48 ft, from floodmark); minimum, 7.2 cfs Spet. 30 (gage height, 0.76 ft).
Period of record: 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 periods, which are fair.

REVISIONS (WATER YEARS).--WSP 1508: 1935-36.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	73	953	218	43	37	38	1,400	1,790	172	372	93	8.7
2	70	839	220	43	37	38	1,500	1,750	179	316	86	9.1
3	69	742	220	42	37	38	1,800	1,720	197	274	74	9.1
4	55	660	200	42	37	38	2,600	1,680	197	235	62	9.1
5	49	610	148	41	37	39	3,800	1,620	194	211	58	9.5
6	49	572	150	41	37	40	5,020	1,550	197	190	53	15
7	49	525	158	41	37	40	5,900	1,470	197	162	50	16
8	55	488	168	41	37	40	6,650	1,420	187	168	48	16
9	170	459	170	41	37	40	8,120	1,370	184	184	46	13
10	394	433	170	40	37	41	9,370	1,310	253	182	37	10
11	402	411	170	40	37	41	9,660	1,190	214	177	31	9.1
12	340	396	170	40	37	41	9,040	1,140	136	167	31	8.7
13	296	356	168	39	37	42	8,050	1,040	101	156	27	7.9
14	255	338	162	39	37	42	6,820	945	83	140	23	18
15	226	334	152	39	37	44	5,980	886	77	136	23	19
16	307	332	142	38	37	47	5,430	821	69	133	23	21
17	850	332	132	38	37	51	4,960	757	81	126	21	21
18	1,460	328	128	38	37	55	4,560	680	92	114	18	21
19	1,760	322	125	38	37	60	4,140	644	89	102	16	21
20	1,960	276	125	38	37	80	3,650	620	90	101	15	21
21	2,160	285	121	38	37	100	3,280	576	86	96	16	18
22	2,560	290	120	38	37	120	2,950	555	87	95	16	16
23	2,890	290	119	37	37	180	2,630	528	128	90	13	12
24	2,840	289	110	37	37	250	2,380	509	146	89	13	9.1
25	2,630	294	96	37	37	450	2,210	502	253	89	12	7.9
26	2,320	290	76	37	37	800	2,050	466	572	84	11	7.9
27	2,080	274	56	37	37	1,100	2,000	430	629	86	11	7.9
28	1,760	250	46	37	37	1,250	1,950	375	567	87	10	7.6
29	1,550	222	44	37	-----	1,350	1,920	326	495	79	9.5	7.6
30	1,330	215	43	37	-----	1,400	1,850	233	435	76	8.7	7.2
31	1,070	-----	43	37	-----	1,400	-----	182	-----	77	9.5	-----
TOTAL	32,079	12,405	4,170	1,211	1,036	9,295	131,670	29,085	6,387	4,594	964.7	384.4
MEAN	1,035	414	135	39.1	37.0	300	4,389	938	213	148	31.1	12.8
MAX	2,890	953	220	43	37	1,400	9,660	1,790	629	372	93	21
MIN	49	215	43	37	37	38	1,400	182	69	76	8.7	7.2
CFSM	.88	.35	.11	.03	.03	.26	3.75	.80	.18	.13	.03	.01
IN.	1.02	.39	.13	.04	.03	.30	4.19	.92	.20	.15	.03	.01

CAL YR 1968 TOTAL 84,774.10 MEAN 232 MAX 2,890 MIN 0 CFSM .20 IN 2.69
WTR YR 1969 TOTAL 233,281.1 MEAN 639 MAX 9,660 MIN 7.2 CFSM .55 IN 7.42

CROW RIVER BASIN

5-2800. Crow River at Rockford, Minn.

LOCATION.--Lat 45°05'12", long 93°44'02" (revised), in sec.29, T.119 N., R.24 W., Hennepin County 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.

PERIOD OF RECORD.--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 current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is 893.08 ft above mean sea level, datum of 1929. Apr. 13 to July 21, 1906, nonrecording gage at Berning Mill 14 miles downstream at different datum. June 4, 1909, to Sept. 30, 1917, at site 600 ft downstream at different datum. Apr. 23, 1929, to Aug. 21, 1934, at site 600 ft downstream at present datum.

AVERAGE DISCHARGE.--44 years (1909-17, 1930-31, 1934-69, 593 cfs (3.20 inches per year).

EXTREMES.--Current year: Maximum discharge, 15,100 cfs Apr. 13 (gage height, 16.51 ft); minimum, 61 cfs Sept. 24 (gage height, 1.78 ft).

Period of record: 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 period, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1115: 1932. WSP 1508: 1933.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	241	2,240	660	280	192	210	2,100	5,080	1,490	938	282	80
2	232	2,040	700	280	195	210	2,350	4,950	1,460	854	282	80
3	220	1,870	635	275	200	210	2,850	4,810	1,450	777	269	82
4	206	1,720	500	275	205	215	3,500	4,680	1,420	718	254	84
5	203	1,620	422	270	210	220	4,480	4,580	1,400	672	238	84
6	206	1,520	380	260	210	225	5,700	4,530	1,360	634	229	84
7	203	1,440	370	250	210	230	7,020	4,300	1,320	598	223	84
8	212	1,360	370	240	212	235	8,340	4,120	1,260	598	215	88
9	292	1,290	370	230	215	240	9,780	3,950	1,230	672	209	88
10	492	1,230	365	220	215	245	11,500	3,780	1,240	660	200	86
11	634	1,170	360	210	220	250	13,200	3,610	1,230	610	192	82
12	622	1,120	360	205	220	260	14,400	3,440	1,050	562	178	76
13	568	1,080	350	200	220	265	15,000	3,270	945	538	167	73
14	509	1,030	350	200	225	269	14,800	3,090	882	514	156	69
15	465	995	340	197	225	270	14,100	2,920	833	509	146	68
16	544	959	335	195	225	280	13,100	2,760	784	492	143	63
17	924	945	330	195	225	285	12,200	2,630	744	465	138	69
18	1,510	931	325	195	225	290	11,400	2,510	718	460	134	71
19	2,040	924	320	195	225	300	10,700	2,390	686	440	126	71
20	2,370	903	320	195	225	310	10,000	2,270	646	420	117	71
21	2,600	868	318	198	222	330	9,400	2,190	610	410	115	69
22	2,800	868	315	198	222	370	8,770	2,120	604	388	111	68
23	3,100	861	310	195	222	450	8,160	2,050	616	374	106	64
24	3,390	861	305	200	220	620	7,530	1,990	634	354	102	63
25	3,560	854	305	202	220	890	6,940	1,940	731	354	96	66
26	3,560	840	300	202	214	1,180	6,420	1,870	988	338	96	64
27	3,440	812	300	202	214	1,620	6,120	1,800	1,150	338	92	64
28	3,220	754	295	200	210	1,800	5,900	1,770	1,120	323	90	63
29	2,970	720	290	195	-----	1,900	5,620	1,760	1,080	312	82	63
30	2,760	680	284	192	-----	1,950	5,320	1,600	1,010	292	76	63
31	2,500	-----	280	191	-----	2,050	-----	1,530	-----	289	76	-----
TOTAL	46,593	34,505	11,464	6,742	6,043	18,179	256,700	94,290	30,691	15,903	4,940	2,200
MEAN	1,503	1,150	370	217	216	586	8,557	3,042	1,023	513	159	73.3
MAX	3,560	2,240	700	280	225	2,050	15,000	5,080	1,490	938	282	88
MIN	203	680	280	191	192	210	2,100	1,530	604	289	76	63
CFSM	.60	.46	.15	.09	.09	.23	3.40	1.21	.41	.20	.06	.03
IN.	.69	.51	.17	.10	.09	.27	3.79	1.39	.45	.23	.07	.03
CAL YR 1968	TOTAL 182,621			MEAN 499		MAX 3,560	MIN 23	CFSM .20	IN 2.70			
WTR YR 1969	TOTAL 528,250			MEAN 1,447		MAX 15,000	MIN 63	CFSM .57	IN 7.80			

5-2840. Mille Lacs Lake at Garrison, Minn.

LOCATION.---Lat 46°18'05", long 93°49'05" in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.12, T.44 N., R.28 W., Crow Wing County, at pumphouse of Minnesota Division of Game and Fish, 0.2 mile southwest of Borden Lake Outlet and 0.8 mile northeast of Garrison.

PERIOD OF RECORD.---June 1931 to current year. 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, nonrecording 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.---Current year: Maximum elevation recorded, 1,252.73 ft June 22 (affected by wind action); maximum daily recorded, 1,252.40 ft May 5 (may have been higher during period of no gage-height record May 14 to June 17); minimum recorded, 1,250.90 ft Sept. 24 (affected by wind action).
Period of record: 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 1968 TO SEPTEMBER 1969

Oct. 31	1,252.02	Feb. 27	1,251.99	June 30	1,252.04
Nov. 30	1,251.83	Mar. 31	1,251.93	July 31	1,251.95
Dec. 28	1,251.87	Apr. 30	1,252.37	Aug. 31	1,251.53
Jan. 31	1,252.07	May 13	1,252.35	Sept. 30	1,251.15

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

RUM RIVER BASIN

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., Anoka County, on left bank at upstream side of highway bridge, 4 miles south of St. Francis and 15.8 miles upstream from mouth.

DRAINAGE AREA.--1,360 sq mi, approximately.

PERIOD OF RECORD.--May to November 1929, March 1930 to September 1931, April to November 1932, March 1933 to current year.

GAGE.--Water-stage recorder. Datum of gage is 861.12 ft above mean sea level, adjustment of 1912. Prior to Nov. 9, 1933, nonrecording gage at site 50 ft downstream at same datum.

AVERAGE DISCHARGE.--37 years (1930-31, 1933-69), 564 cfs (5.63 inches per year).

EXTREMES.--Current year: Maximum discharge, 10,100 cfs Apr. 13 (gage height, 11.63 ft); minimum, 195 cfs Sept. 23, 24, (gage height, 2.57 ft).

Period of record: Maximum discharge, 10,100 cfs Apr. 20, 1965, Apr. 13, 1969; maximum gage height 11.63 ft Apr. 13, 1969; minimum discharge, 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 1969 are published in Part 2 of this report. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

REVISIONS (WATER YEAR).--WSP 1308: 1930 (M), 1932 (M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,940	2,080	678	540	500	505	880	2,370	840	545	449	250
2	1,600	1,790	670	535	500	505	950	2,850	827	623	434	265
3	1,290	1,570	665	535	500	505	1,020	3,310	814	598	444	261
4	1,080	1,410	660	530	500	505	1,210	3,610	801	580	429	254
5	938	1,280	655	530	500	505	1,490	3,580	794	551	415	250
6	861	1,190	650	530	500	510	1,840	3,390	782	512	392	247
7	845	1,120	645	525	500	510	2,300	3,130	762	490	362	247
8	935	1,060	640	525	500	515	2,770	2,810	742	501	341	250
9	1,030	1,010	630	520	500	515	3,390	2,520	723	523	337	254
10	1,120	973	620	520	500	515	5,090	2,300	704	545	329	247
11	1,240	938	610	520	500	520	7,370	2,110	697	551	337	247
12	1,380	903	602	520	500	525	9,320	1,910	691	517	379	244
13	1,500	868	600	520	500	530	10,000	1,730	678	479	329	244
14	1,580	847	595	520	500	535	9,960	1,550	672	464	314	240
15	1,630	820	590	520	500	540	9,360	1,410	660	444	302	236
16	1,650	808	585	520	500	560	8,440	1,300	635	449	294	230
17	1,870	794	580	515	500	580	7,440	1,200	623	449	291	223
18	2,130	794	580	515	500	600	6,450	1,130	610	479	283	219
19	2,350	794	575	515	500	640	5,540	1,130	592	534	280	212
20	2,480	782	570	510	500	670	4,800	1,190	557	534	276	206
21	2,730	756	570	510	505	690	4,260	1,250	551	506	268	202
22	3,320	749	565	510	505	735	3,840	1,270	545	512	265	199
23	4,430	730	565	510	505	760	3,460	1,280	545	523	261	199
24	4,990	720	560	510	505	794	3,100	1,260	528	499	254	209
25	5,070	715	560	510	505	834	2,750	1,180	528	479	254	223
26	4,690	710	555	505	505	861	2,390	1,100	569	459	250	230
27	4,240	700	555	505	505	924	2,210	1,030	616	512	240	230
28	3,800	695	550	505	505	980	2,140	980	616	464	236	223
29	3,310	690	545	505	-----	900	2,130	938	574	464	230	223
30	2,840	685	545	505	-----	820	2,160	875	545	479	223	219
31	2,430	-----	540	500	-----	780	-----	827	-----	479	244	-----
TOTAL	71,299	28,981	18,510	16,040	14,040	19,868	128,060	56,520	19,821	15,744	9,742	6,983
MEAN	2,300	966	597	517	501	641	4,269	1,823	661	508	314	233
MAX	5,070	2,080	678	540	505	980	10,000	3,610	840	623	449	265
MIN	845	685	540	500	500	505	880	827	528	444	223	199
CFSM	1.69	.71	.44	.38	.37	.47	3.14	1.34	.49	.37	.23	.17
IN.	1.95	.79	.51	.44	.38	.54	3.50	1.55	.54	.43	.27	.19
CAL YR 1968	TOTAL 266,169		MEAN 727		MAX 5,070	MIN 93		CFSM .53		IN 7.28		
WTR YR 1969	TOTAL 405,608		MEAN 1,111		MAX 10,000	MIN 199		CFSM .82		IN 11.09		

LOCATION.--Lat 45°07'36", long 93°17'48", in SW¼ sec.12, T.119 N., R.21 W., Hennepin County on right bank 0.5 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.

PERIOD OF RECORD.--June 1931 to current year. Prior to October 1931 published as "at Coon Rapids, near Anoka."

AVERAGE DISCHARGE.--38 years, 7,156 cfs (5.09 inches per year).

EXTREMES.--Current year: Maximum discharge, 72,500 cfs Apr. 14 (gage height, 16.84 ft); minimum, 1,930 cfs Sept. 16 (gage height, 1.44 ft).
Period of record: 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 0.13 ft 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. Coon Rapids hydroelectric plant discontinued operation Dec. 31, 1968. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7,380	16,900	7,630	5,800	5,500	7,100	11,000	34,000	10,600	7,150	6,110	2,760
2	7,410	15,500	7,460	5,800	5,500	7,200	11,400	33,400	10,300	7,060	5,150	2,630
3	7,090	14,200	7,320	5,700	5,500	7,300	13,300	33,200	9,860	7,250	5,440	2,640
4	6,420	13,800	8,220	5,800	5,500	7,400	15,000	32,400	9,450	6,790	5,610	2,940
5	6,400	13,500	7,980	5,800	5,500	7,500	18,000	31,600	9,130	6,790	5,820	2,770
6	6,300	12,900	5,400	5,700	5,600	7,600	21,600	31,300	9,730	6,940	6,180	2,790
7	5,610	12,000	4,000	5,700	5,600	7,600	26,000	30,600	9,670	6,470	5,420	3,020
8	6,170	11,300	4,100	5,700	5,700	7,600	35,600	29,700	9,440	6,760	5,250	3,520
9	6,350	10,900	4,200	5,700	5,800	7,600	45,700	29,100	8,970	6,660	5,220	3,480
10	7,280	10,800	4,800	5,700	5,900	7,600	56,200	27,800	8,520	6,710	5,010	2,570
11	7,310	10,700	5,700	5,800	6,000	7,600	63,900	26,800	8,990	6,560	4,870	2,910
12	6,950	10,100	7,000	5,800	6,000	7,500	69,000	25,000	8,820	6,100	4,310	2,660
13	6,730	10,000	6,500	5,800	6,100	7,500	71,900	24,000	8,550	6,000	4,220	2,430
14	7,070	9,790	5,500	5,800	6,200	7,500	72,300	23,200	8,190	5,800	4,280	2,250
15	7,440	9,570	4,700	5,700	6,200	7,400	71,200	22,100	7,880	5,890	4,280	2,330
16	8,210	9,250	4,500	5,700	6,100	7,400	68,300	21,100	7,870	5,820	4,410	2,220
17	9,350	9,330	4,800	5,600	6,000	7,500	64,000	20,600	7,720	5,690	3,830	2,320
18	11,900	9,370	5,200	5,600	6,000	7,700	59,300	19,400	7,270	5,830	3,470	2,510
19	15,200	9,050	5,500	5,700	5,800	8,000	55,100	19,100	7,130	5,790	3,960	2,610
20	17,400	8,860	5,600	5,800	5,400	8,300	51,200	18,400	7,250	6,190	3,930	2,540
21	19,800	8,420	5,600	5,800	5,300	8,500	47,900	17,900	6,860	5,750	3,490	2,540
22	21,300	8,630	5,600	5,800	5,300	8,800	45,000	18,300	6,670	5,870	3,390	2,730
23	23,100	8,650	5,600	5,900	5,400	9,200	42,100	16,400	6,510	5,570	3,210	3,090
24	24,100	8,980	5,600	5,900	5,500	9,500	39,800	15,700	6,620	5,470	3,260	3,990
25	24,700	9,180	5,600	5,900	5,900	10,000	37,600	15,200	6,970	5,370	3,350	3,450
26	23,900	8,920	5,600	5,900	6,200	10,500	35,800	14,600	6,980	5,640	3,070	2,820
27	22,800	8,870	5,600	5,800	6,500	10,800	35,300	14,500	7,390	5,640	2,740	2,580
28	21,700	8,290	5,700	5,800	6,900	11,200	35,600	13,500	7,600	6,080	2,750	3,250
29	20,100	7,880	5,800	5,700	-----	10,900	35,400	12,600	7,720	5,780	2,610	3,180
30	19,000	7,700	5,900	5,600	-----	10,600	34,600	11,700	7,300	5,480	2,710	3,090

MINNESOTA RIVER BASIN

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., Roberts County, on right bank, 2 miles northwest of town of Browns Valley, Minn., 3.2 miles upstream from proposed Lake Traverse diversion, 5.3 miles northeast of Peever, 7.2 miles downstream from Jorgenson River, and 8 miles upstream from Big Stone Lake.

DRAINAGE AREA.--447 sq mi.

PERIOD OF RECORD.--October 1939 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 1,000 ft (from topographic map). Oct. 1, 1939, to Mar. 20, 1940, nonrecording gage at site 4.5 miles downstream at different datum. Mar. 21 to Apr. 12, 1940, nonrecording gage at site 100 ft downstream at present datum. April 13 to Aug. 27, 1940, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--30 years, 47.3 cfs (1.44 inches per year, 34,270 acre-ft per year).

EXTREMES.--Current year: Maximum discharge 3,270 cfs Apr. 6 (gage height, 11.31 ft); minimum daily, 0.3 cfs Sept. 23-30; minimum gage height, 1.98 ft Oct. 1.
Period of record: 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, 1959, 1963, 1968.

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

REVISIONS (WATER YEARS).--WSP 1308: 1943 (M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.40	4.3	2.6	1.6	1.1	.90	.9	133	42	9.9	3.5	.50
2	.40	4.3	2.6	1.6	1.1	.90	2.9	122	39	9.2	3.1	.50
3	.40	3.9	2.6	1.5	1.1	.90	47	116	36	9.9	2.9	.50
4	.50	3.8	2.7	1.5	1.0	.90	1,090	136	36	11	2.9	.40
5	.50	3.8	2.7	1.5	1.0	.90	1,370	176	34	12	2.7	.40
6	.50	3.7	2.7	1.5	1.0	.90	2,100	147	30	12	2.6	.40
7	.50	3.7	2.8	1.5	1.0	.90	2,690	138	26	11	2.2	.50
8	.50	3.5	2.8	1.5	1.0	.90	2,880	122	24	11	1.7	.50
9	.60	3.5	2.8	1.5	1.0	.90	2,910	116	21	12	1.5	.50
10	.60	3.5	2.8	1.5	1.0	.90	2,480	108	19	23	1.4	.40
11	.50	3.4	2.8	1.5	1.0	.90	1,980	100	17	21	1.2	.40
12	.50	3.3	2.7	1.5	1.0	.90	1,640	93	16	14	1.0	.40
13	.50	3.1	2.6	1.5	1.0	.90	1,380	84	14	10	.80	.40
14	.50	3.0	2.6	1.5	1.0	.90	1,240	74	14	9.5	.80	.40
15	.50	2.9	2.5	1.5	1.0	.90	1,010	66	13	8.2	.80	.40
16	.60	2.8	2.3	1.5	.90	.90	830	263	13	7.4	.80	.50
17	1.5	2.7	2.2	1.4	.90	.90	688	500	12	6.1	.70	.50
18	2.4	2.7	2.1	1.4	.90	.90	574	254	11	5.6	.70	.50
19	1.5	2.7	2.0	1.4	.90	.80	480	218	9.9	5.2	.70	.50
20	1.8	2.6	1.9	1.4	.90	.80	407	180	9.5	5.2	.70	.50
21	6.6	2.6	1.8	1.4	.90	.80	376	154	9.5	4.6	.60	.40
22	5.4	2.6	1.7	1.4	.90	.80	337	133	9.2	4.4	.60	.40
23	5.2	2.6	1.7	1.3	.90	.70	295	120	11	4.6	.60	.30
24	4.1	2.6	1.6	1.3	.90	.70	251	106	11	5.4	.60	.30
25	3.5	2.6	1.6	1.3	.90	.70	208	91	12	5.2	.60	.30
26	3.3	2.6	1.6	1.2	.90	.70	173	80	15	4.6	.50	.30
27	3.3	2.6	1.6	1.2	.90	.70	161	71	28	4.3	.50	.30
28	4.4	2.6	1.6	1.2	.90	.70	176	62	22	3.9	.50	.30
29	4.3	2.5	1.6	1.1	-----	.80	168	54	15	3.5	.50	.30
30	3.9	2.5	1.6	1.1	-----	.80	147	47	12	3.3	.50	.30
31	4.1	-----	1.6	1.1	-----	.80	-----	43	-----	3.9	.50	-----
TOTAL	63.30	93.0	68.8	43.4	27.00	26.00	28,091.8	4,107	581.1	260.9	38.70	12.30
MEAN	2.04	3.10	2.22	1.40	.96	.84	936	132	19.4	8.42	1.25	.41
MAX	6.6	4.3	2.8	1.6	1.1	.90	2,910	500	42	23	3.5	.50
MIN	.40	2.5	1.6	1.1	.90	.70	.90	43	9.2	3.3	.50	.30
CFSM	.005	.007	.005	.003	.002	.002	2.09	.30	.043	.019	.003	.0009
IN.	.005	.007	.005	.003	.002	.002	2.34	.34	.05	.02	.003	.001
AC-FT	126	184	136	86	54	52	55,720	8,150	1,150	518	77	24

CAL YR 1968 TOTAL 3,404.90 MEAN 9.30 MAX 145 MIN 0 CFSM .02 IN .28 ACFT 6,750
WAT YR 1969 TOTAL 33,413.30 MEAN 91.5 MAX 2,910 MIN .30 CFSM .20 IN 2.78 ACFT 66,280

PEAK DISCHARGE (BASE, 450 CFS).--Apr. 6 (2200) 3,270 cfs (11.31 ft); May 17 (0100) 880 cfs (6.01 ft).

5-2910. Whetstone River near Big Stone City, S. Dak.

LOCATION.--Lat 45°17'32", long 96°29'14", in SE 1/4 sec.18, T.121 N., R.46 W., Grant County, 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.

PERIOD OF RECORD.--March 1910 to November 1912 (no winter records) and March 1931 to current year. 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, nonrecording gage 2 miles downstream at different datum. Mar. 18, 1931, to May 3, 1939, nonrecording 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.--38 years (1931-69), 45.8 cfs (1.60 inches per year, 33,180 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 6,870 cfs Apr. 8 (gage height, 14.32 ft, from floodmark); minimum daily, 0.8 cfs Oct. 8; minimum gage height, 1.52 ft Sept. 21.

Period of record: Maximum discharge, 6,870 cfs Apr. 8, 1969 (gage height, 14.32 ft, from floodmark); 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 periods, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 895: Drainage area. WSP 1308: 1932 (M), 1935 (M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.6	4.8	5.0	5.0	2.4	1.7	2.2	134	45	19	15	3.9
2	1.3	4.3	5.1	4.9	2.4	1.8	2.2	132	42	22	14	3.9
3	1.2	3.8	5.2	4.9	2.3	2.0	2.5	132	39	24	13	3.7
4	1.3	3.4	5.2	4.9	2.3	2.1	3.5	172	38	29	11	3.7
5	1.4	3.9	5.2	4.8	2.2	2.2	50	288	37	68	10	4.9
6	1.0	4.3	5.2	4.8	2.1	2.4	1,200	246	34	108	10	4.3
7	.90	3.9	5.1	4.8	2.1	2.6	4,710	170	31	59	9.9	4.6
8	.80	4.3	5.1	4.8	2.0	2.8	6,090	133	31	46	9.5	4.1
9	1.4	4.4	5.1	4.8	1.9	2.9	4,550	111	28	40	9.5	3.7
10	1.2	4.3	5.1	4.8	1.9	3.0	2,820	104	27	40	8.6	3.7
11	1.0	4.4	4.9	4.7	1.8	3.2	1,970	94	27	39	7.9	3.7
12	1.1	4.6	4.8	4.7	1.8	3.4	1,550	92	25	39	7.9	3.5
13	1.1	4.4	4.6	4.7	1.8	3.7	1,270	76	22	28	7.6	3.5
14	1.1	4.6	4.6	4.7	1.7	3.8	1,090	71	22	25	6.4	3.7
15	.90	4.6	4.7	4.7	1.7	4.0	862	65	22	25	6.4	3.4
16	1.9	4.6	4.7	4.7	1.7	4.2	595	145	22	24	6.4	3.2
17	4.4	4.6	4.8	4.7	1.7	4.3	460	855	20	25	5.5	3.2
18	4.9	4.6	4.8	4.6	1.6	4.3	387	552	19	24	5.5	3.2
19	6.2	4.6	4.8	4.5	1.6	4.2	337	262	18	22	5.2	3.2
20	5.1	4.6	4.8	4.5	1.6	3.8	288	179	18	20	5.5	3.2
21	5.8	4.6	4.8	4.1	1.6	3.5	277	148	18	20	5.5	3.2
22	3.4	4.6	4.8	3.9	1.6	3.0	243	133	18	20	5.5	4.3
23	3.0	4.7	4.8	3.7	1.6	2.5	201	122	20	18	5.2	4.3
24	2.7	4.7	4.9	3.6	1.6	2.2	174	112	22	18	4.9	4.1
25	2.6	4.8	5.0	3.5	1.6	2.1	161	98	23	18	4.9	3.7
26	2.6	4.8	5.0	3.4	1.7	2.1	141	88	25	18	5.2	3.5
27	2.7	4.9	5.0	3.3	1.7	2.1	142	77	24	16	5.5	3.4
28	3.0	4.9	5.0	3.2	1.7	2.1	152	65	21	15	4.9	3.7
29	3.2	4.9	5.0	3.0	-----	2.1	151	59	20	15	4.3	3.7
30	3.1	5.0	5.0	2.8	-----	2.1	137	50	18	15	3.5	3.7
31	3.1	-----	5.0	2.6	-----	2.2	-----	46	-----	15	3.9	-----
TOTAL	75.00	134.9	153.1	132.1	51.7	88.4	30,018.4	5,011	776	914	228.1	111.9
MEAN	2.42	4.50	4.94	4.26	1.85	2.85	1,001	162	25.9	29.5	7.36	3.73
MAX	6.2	5.0	5.2	5.0	2.4	4.3	6,090	855	45	108	15	4.9
MIN	.80	3.4	4.6	2.6	1.6	1.7	2.2	46	18	15	3.5	3.2
CFSM	.006	.012	.013	.011	.005	.007	2.57	.42	.067	.076	.019	.010
IN.	.007	.01	.01	.01	.004	.008	2.87	.48	.07	.09	.02	.01
AC-FT	149	288	304	262	103	175	59,540	9,940	1,540	1,810	452	222

CAL YR 1968 TOTAL 2,553.60 MEAN 6.9 MAX 140 MIN .20 CFSM .01 IN .24 ACFT 5,070
WAT YR 1969 TOTAL 37,694.60 MEAN 103 MAX 6,090 MIN .80 CFSM .26 IN 3.60 ACFT 74,770

PEAK DISCHARGE (BASE, 200 CFS)

DATE	TIME	G.H.	DISCHARGE	DATE	TIME	G.H.	DISCHARGE
4-8	0400	14.32	6,870	5-17	1300	6.71	1,040
5-5	1700	4.30	331				

MINNESOTA RIVER BASIN

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., Big Stone County at powerplant intake at west edge of Ortonville, 0.5 mile north of concrete dam at outlet, 0.5 mile southwest of Ortonville.

PERIOD OF RECORD.--March 1937 to current year.

GAGE.--Nonrecording gage read once a day. Datum of gage is 957.69 ft above mean sea level, datum of 1929. Prior to Sept. 17, 1947, nonrecording gage at site 0.5 mile south at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site 0.5 mile south at same datum. Sept. 21, 1959, to June 30, 1963, supplementary nonrecording gage read once daily, at present site and datum.

EXTREMES.--Current year: Maximum gage height observed, 12.47 ft Apr. 15; minimum observed, 5.49 ft Sept. 21. Period of record: 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 and two 2.5-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 nonrecording 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 1968 TO SEPTEMBER 1969

Oct. 31.....6.31	Feb. 28.....6.80	June 30.....7.48
Nov. 30.....6.27	Mar. 31.....6.37	July 31.....7.16
Dec. 30.....6.57	Apr. 30.....9.93	Aug. 31.....6.28
Jan. 31.....6.64	May 31.....8.40	Sept. 30.....5.85

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

MINNESOTA RIVER BASIN

123

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., Big Stone County, 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.

PERIOD OF RECORD.--February 1938 to current year.

GAGE.--Water-stage recorder. Datum of gage is 956.38 ft above mean sea level, datum of 1929. Prior to Mar. 31, 1939, nonrecording gage on downstream side of dam 1,300 ft upstream at datum 1.31 ft higher.

AVERAGE DISCHARGE.--31 years, 115 cfs (83,320 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 2,550 cfs Apr. 13 (gage height, 12.09 ft); minimum, 0.28 cfs Oct. 12, (gage height, 1.15 ft); minimum gage height, 1.04 ft Nov. 13.
Period of record: Maximum discharge, 3,060 cfs Apr. 13, 1952 (gage height, 12.92 ft); no flow Dec. 13, 1940.

REMARKS.--Records good except those for winter periods, which are fair. Flow affected by natural storage in Big Stone Lake (see preceding page). Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 895: 1939. WSP 1508: 1942 (yearly mean).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	CCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.3	5.7	5.2	12	15	15	109	1,400	572	55	42	33
2	15	3.0	5.4	12	15	13	103	1,350	507	57	41	31
3	8.7	1.8	5.9	12	15	13	99	1,260	417	56	40	28
4	2.7	3.2	6.9	12	15	13	111	1,230	418	65	41	27
5	.92	4.4	7.7	12	15	64	123	1,190	397	59	43	31
6	.91	5.5	8.0	12	15	157	344	1,160	347	56	48	31
7	.49	5.5	8.0	13	15	147	759	1,110	290	54	48	31
8	1.0	4.6	8.0	13	15	136	1,200	1,070	287	61	47	31
9	2.0	1.9	8.0	13	15	132	1,700	968	265	74	43	29
10	.38	4.5	7.9	14	15	129	2,030	973	261	57	38	28
11	.35	3.8	8.0	14	15	119	2,300	894	253	74	37	29
12	.29	1.7	8.0	14	15	115	2,440	812	254	61	36	27
13	.87	2.3	8.0	14	15	116	2,540	774	209	62	39	25
14	1.7	3.6	8.0	14	15	110	2,530	695	198	53	34	26
15	1.3	3.6	8.0	14	15	106	2,450	693	190	51	34	30
16	3.1	2.9	8.1	14	16	102	2,290	883	181	51	33	25
17	14	7.8	8.2	14	17	122	2,150	807	198	49	35	23
18	9.1	13	8.4	14	18	154	2,070	802	254	48	38	17
19	4.7	9.6	8.6	14	19	154	1,980	830	223	49	47	12
20	7.7	4.8	8.8	14	19	161	1,970	790	93	47	44	11
21	13	4.8	8.9	14	19	147	1,950	750	52	46	43	10
22	16	4.8	9.0	14	19	145	1,840	713	53	46	41	22
23	12	5.0	9.2	14	19	147	1,870	698	53	48	39	23
24	8.5	5.1	9.6	14	19	150	1,940	690	53	46	39	16
25	8.2	5.1	10	14	19	145	1,830	642	50	46	38	21
26	9.8	5.1	11	15	19	132	1,760	630	53	47	32	16
27	22	5.1	11	15	19	130	1,750	610	73	48	32	16
28	5.3	5.1	11	15	18	144	1,650	607	54	44	33	13
29	1.4	5.1	11	15	-----	120	1,500	583	58	43	30	17
30	.98	5.1	11	15	-----	118	1,370	517	60	43	36	14
31	2.8	-----	11	15	-----	113	-----	536	-----	44	33	-----
TOTAL	152.49	143.5	265.8	425	465	3,569	46,758	26,667	6,373	1,680	1,204	653
MEAN	6.21	4.78	8.57	13.7	16.6	115	1,559	860	212	54.2	38.8	23.1
MAX	32	13	11	15	19	161	2,540	1,400	572	57	48	33
MIN	.29	1.7	5.2	12	15	13	99	517	50	43	30	10
AC-FT	382	285	527	843	922	7,080	92,740	52,890	12,640	3,330	2,390	1,370
CAL YR 1968	TOTAL	4,830.79	MEAN	13.2	MAX	92	MIN	.29	AC-FT	9,580		
WTR YR 1969	TOTAL	88,435.79	MEAN	242	MAX	2,540	MIN	.29	AC-FT	175,400		

MINNESOTA RIVER BASIN

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., Lac qui Parle County, on left bank 150 ft downstream from highway bridge, 2.5 miles southwest of Odessa, and 4.5 miles upstream from mouth.

DRAINAGE AREA.--398 sq mi.

PERIOD OF RECORD.--October 1939 to current year.

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, nonrecording gage at site 150 ft upstream at same datum.

AVERAGE DISCHARGE.--30 years, 57.0 cfs (1.94 inches per year, 41,300 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 6,970 cfs Apr. 9 (gage height, 19.07 ft from floodmark); minimum, 0.2 cfs Oct. 5; minimum gage height, 1.73 ft Sept. 19-22.

Period of record: Maximum discharge, 6,970 cfs Apr. 9, 1969 (gage height, 19.07 ft from floodmark); 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 for winter periods, which are fair.

REVISIONS (WATER YEARS).--WSP 1388: 1947(M), 1950.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.70	2.2	9.2	2.6	2.2	3.1	10	191	67	29	19	3.8
2	.80	2.0	9.2	2.6	2.2	3.1	13	182	64	30	18	3.6
3	.70	3.0	9.2	2.5	2.2	3.2	16	175	62	32	16	3.5
4	.40	2.8	9.1	2.5	2.2	3.2	20	341	60	74	15	3.3
5	.20	2.8	8.9	2.4	2.2	3.2	30	752	57	102	14	3.2
6	.90	3.2	8.4	2.4	2.3	3.2	40	678	53	181	14	3.1
7	1.1	3.2	7.7	2.4	2.3	3.3	100	421	50	182	15	3.1
8	1.1	3.0	7.1	2.4	2.3	3.3	2,500	310	46	149	16	3.1
9	2.6	3.2	6.4	2.3	2.4	3.4	6,640	244	43	117	18	2.9
10	2.0	3.4	5.8	2.3	2.4	3.4	5,810	211	41	101	23	2.9
11	1.6	4.0	5.4	2.3	2.4	3.5	4,820	185	42	100	19	2.6
12	1.4	4.0	5.1	2.3	2.5	3.6	2,910	166	40	84	17	2.6
13	1.6	4.8	4.8	2.2	2.5	3.8	2,080	150	39	72	16	2.4
14	1.6	4.8	4.5	2.2	2.5	4.0	1,800	136	42	61	13	2.3
15	1.1	4.8	4.3	2.2	2.6	4.2	1,510	121	41	56	12	2.0
16	2.0	5.0	4.1	2.2	2.6	4.4	1,100	151	38	49	10	2.0
17	2.4	5.2	3.9	2.2	2.7	4.5	870	233	37	47	9.7	2.0
18	2.2	6.0	3.7	2.2	2.7	4.5	725	340	35	44	8.6	2.0
19	1.6	7.5	3.6	2.2	2.7	4.4	638	229	33	41	8.0	1.9
20	.80	8.1	3.5	2.2	2.8	4.3	535	174	31	37	7.2	1.9
21	5.4	8.9	3.4	2.2	2.8	4.2	495	145	31	35	6.9	1.9
22	6.2	9.3	3.3	2.2	2.8	4.0	445	130	31	33	6.4	3.2
23	4.0	9.8	3.2	2.2	2.9	3.9	374	119	32	31	6.2	3.4
24	2.8	9.3	3.1	2.2	2.9	3.8	338	112	33	28	5.7	3.2
25	2.4	9.3	3.0	2.2	3.0	3.7	304	107	35	27	5.2	2.8
26	1.8	9.3	2.9	2.2	3.0	3.6	274	100	35	26	5.1	2.7
27	1.4	9.0	2.8	2.2	3.1	3.6	254	94	34	25	4.7	2.7
28	1.4	8.8	2.8	2.2	3.1	3.6	244	87	33	23	4.5	2.7
29	1.6	8.4	2.7	2.2	-----	3.5	234	80	34	21	4.1	2.7
30	1.8	9.0	2.7	2.2	-----	3.6	220	75	32	21	4.1	2.5
31	1.8	-----	2.6	2.2	-----	7.0	-----	71	-----	21	4.1	-----
TOTAL	57.40	174.1	156.4	70.8	72.3	118.1	35,349	6,510	1,251	1,879	345.5	82.0
MEAN	1.85	5.80	5.05	2.28	2.58	3.81	1,178	210	41.7	60.6	11.1	2.73
MAX	6.2	9.8	9.2	2.6	3.1	7.0	6,640	752	67	182	23	3.8
MIN	.20	2.0	2.6	2.2	2.2	3.1	10	71	31	21	4.1	1.9
CFSM	.005	.01	.01	.006	.006	.01	2.96	.53	.10	.15	.03	.007
IN.	.005	.02	.01	.007	.007	.01	3.30	.61	.12	.18	.03	.008
AC-FT	114	345	310	140	143	234	70,110	12,910	2,480	3,730	685	163

CAL YR 1968 TOTAL 2,924.90 MEAN 7.99 MAX 93 MIN .20 CFSM .02 IN .27 AC-FT 5,800
WTR YR 1969: TOTAL 46,065.60 MEAN 126 MAX 6,640 MIN .20 CFSM .32 IN 4.30 AC-FT 91,370

PEAK DISCHARGE (BASE, 300 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
4-9	1200	19.07	6,970	5-18	0045	4.57	421
5-5	1830	6.79	987				

5-2940. Pomme de Terre River at Appleton, Minn.

LOCATION.--Lat 45°12'10", long 96°01'20", in SW¼ sec.14, T.120 N., R.43 W., Swift County, on left bank 60 ft upstream from bridge on U.S. Highway 59 and State Highway 119 at Appleton and 8 miles upstream from mouth.

DRAINAGE AREA.--905 sq mi, approximately.

PERIOD OF RECORD.--March 1931 to September 1935 (no winter records), October 1935 to current year. 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, nonrecording gage at site 4 miles upstream at datum 25.17 ft higher.

AVERAGE DISCHARGE.--34 years (1935-69), 102 cfs (1.53 inches per year, 73,900 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 5,520 cfs Apr. 11 (gage height, 13.78 ft); maximum gage height, 14.58 ft Apr. 9 (backwater from ice); minimum daily discharge, 1.2 cfs Feb. 10-21; minimum gage height, 3.66 ft Feb. 23.

Period of record: Maximum discharge, 5,520 cfs Apr. 11, 1969 (gage height, 13.78 ft); maximum gage height, 14.58 ft Apr. 9, 1969 (backwater from ice); no flow for several periods.

REMARKS.--Records good except those for winter periods, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

REVISIONS (WATER YEARS).--WSP 1308: 1931(M), 1937(M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	30	28	2.8	1.5	1.5	3.3	808	380	144	85	31
2	10	28	28	2.8	1.5	1.6	3.8	720	372	119	80	30
3	11	28	27	2.8	1.4	1.6	5.4	693	352	146	73	28
4	12	30	25	2.8	1.4	1.6	6.5	704	340	141	67	28
5	12	32	12	2.8	1.4	1.6	7.7	704	313	136	65	32
6	12	31	25	2.8	1.4	1.6	11	710	306	131	62	29
7	12	31	28	2.8	1.4	1.7	15	688	292	126	61	30
8	13	33	28	2.8	1.3	1.7	43	649	278	138	61	29
9	21	33	27	2.8	1.3	1.7	2,310	588	260	141	57	29
10	18	35	27	2.6	1.2	1.7	4,940	566	254	128	55	29
11	20	32	27	2.6	1.2	1.8	5,210	534	257	123	54	30
12	21	23	20	2.6	1.2	1.8	3,840	485	243	114	52	30
13	21	24	14	2.6	1.2	1.8	3,650	445	226	110	50	30
14	17	28	10	2.6	1.2	1.9	3,390	414	222	105	47	29
15	15	30	7.0	2.6	1.2	2.0	3,000	392	215	112	45	29
16	23	30	5.8	2.6	1.2	2.1	2,580	1,130	202	114	43	28
17	31	28	5.2	2.6	1.2	2.2	2,210	3,260	199	116	43	28
18	42	22	5.0	2.5	1.2	2.3	1,870	2,170	189	112	35	31
19	51	16	4.6	2.5	1.2	2.4	1,670	1,640	186	105	14	32
20	48	20	4.4	2.4	1.2	2.4	1,580	1,330	183	99	34	31
21	41	25	4.2	2.4	1.2	2.4	1,520	1,130	177	95	37	29
22	38	28	4.0	2.3	1.3	2.3	1,410	1,000	171	91	36	40
23	36	28	3.8	2.2	1.3	2.3	1,280	896	168	76	35	45
24	33	27	3.6	2.1	1.3	2.2	1,160	803	168	75	35	43
25	33	27	3.4	2.0	1.3	2.2	1,100	720	168	71	34	39
26	31	27	3.2	1.8	1.4	2.2	1,040	654	166	73	34	39
27	29	25	3.2	1.7	1.4	2.2	1,020	578	157	68	32	47
28	31	25	3.0	1.6	1.5	2.2	974	517	146	67	32	41
29	35	23	3.0	1.6	-----	2.4	930	465	144	62	32	39
30	37	27	3.0	1.5	-----	2.8	842	422	146	65	31	37
31	34	-----	2.8	1.5	-----	3.0	-----	396	-----	73	31	-----
TOTAL	801	826	395.2	74.1	36.5	63.2	47,621.7	26,211	6,880	3,276	1,452	992
MEAN	25.8	27.5	12.7	2.39	1.30	2.04	1,587	846	229	106	46.8	33.1
MAX	51	35	28	2.8	1.5	3.0	5,210	3,260	380	146	85	47
MIN	10	16	2.8	1.5	1.2	1.5	3.3	392	144	62	14	28
CFSM	.029	.030	.014	.003	.001	.002	1.75	.93	.25	.12	.052	.037
IN.	.03	.03	.02	.003	.001	.002	1.96	1.08	.28	.13	.06	.04
AC-FT	1,590	1,640	784	147	72	125	94,460	51,990	13,650	6,500	2,880	1,970

CAL YR 1968 TOTAL 13,173.7 MEAN 36.1 MAX 173 MIN 2.8 CFSM .04 IN .54 ACFT 26,130
WAT YR 1969 TOTAL 88,628.7 MEAN 243 MAX 5,210 MIN 1.2 CFSM .27 IN 3.64 ACFT 175,800

PEAK DISCHARGE (BASE, 200 CFS)

DATE	TIME	G.H.T.	DISCHARGE	DATE	TIME	G.H.T.	DISCHARGE
4-11	1300	13.78	5,520	5-17	0400	11.80	3,950

MINNESOTA RIVER BASIN

5-3000. Lac qui Parle River near Lac qui Parle, Minn.

LOCATION.--Lat 44°59'42", long 95°55'09", in SW¹/₄SW¹/₄ sec.27, T.118 N., R.42 W., Lac qui Parle County, on right bank 40 ft downstream from highway bridge and 0.5 mile southwest of village of Lac qui Parle.

DRAINAGE AREA.--983 sq mi.

PERIOD OF RECORD.--April 1910 to November 1914; March 1931 to current year (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, nonrecording gage at site 2 miles downstream at different datum. Mar. 17, 1931, to Mar. 9, 1937, nonrecording gage at site 40 ft upstream at present datum.

AVERAGE DISCHARGE.--38 years (1912-13, 1931-32, 1933-69), 119 cfs (1.64 inches per year, 86,220 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 17,100 cfs Apr. 10 (gage height, 18.94 ft from floodmark); no flow Jan. 20, 21.

Period of record: Maximum discharge, 7,100 cfs Apr. 10, 1969 (gage height, 18.94 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.

REVISIONS (WATER YEARS).--WSP 1308: 1912(M), 1935(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.8	60	33	1.0	1.3	1.0	7	692	113	58	88	16
2	3.6	57	33	.80	1.3	1.0	8	634	105	62	84	15
3	3.6	55	32	.70	1.3	1.0	15	591	97	65	81	14
4	3.4	52	32	.60	1.3	1.0	20	570	95	103	78	12
5	3.3	51	31	.50	1.3	1.0	35	589	92	265	72	12
6	3.0	51	31	.40	1.3	1.0	60	651	88	229	84	12
7	2.9	50	30	.40	1.3	.90	250	617	85	196	119	11
8	2.8	49	30	.40	1.3	.80	850	576	79	214	94	9.9
9	3.1	48	30	.30	1.3	.80	9,960	539	75	183	119	9.3
10	3.3	48	29	.30	1.3	.80	16,000	499	75	168	140	8.7
11	3.6	48	28	.20	1.2	.80	14,200	454	85	182	118	7.7
12	3.4	48	26	.20	1.1	.80	11,800	417	77	182	108	7.3
13	3.4	48	22	.20	1.0	.80	9,400	385	79	150	95	6.8
14	3.0	48	19	.20	1.0	.80	7,600	347	86	126	81	6.0
15	2.6	48	16	.20	1.0	.80	6,220	309	84	119	72	6.0
16	4.9	49	15	.10	1.0	.80	5,100	282	81	107	64	5.8
17	30	49	14	.10	1.0	.80	4,300	258	77	101	57	5.9
18	52	48	13	.10	1.0	.80	3,550	243	74	108	50	5.3
19	70	45	12	.10	1.0	.80	2,910	230	70	136	46	4.6
20	142	40	11	0	1.0	1.0	2,450	214	65	203	42	4.4
21	206	42	9.2	0	1.0	1.2	2,110	203	65	270	39	4.1
22	190	48	7.5	.10	1.0	1.4	1,850	198	66	249	37	9.2
23	159	48	6.1	.10	1.0	1.8	1,610	190	65	182	34	12
24	133	47	5.0	.20	1.0	2.2	1,400	185	65	147	32	13
25	110	47	4.0	.20	1.0	2.7	1,190	180	70	128	30	7.8
26	96	47	3.3	.30	1.0	3.3	1,020	173	69	121	28	6.9
27	87	43	2.7	.40	1.0	3.7	930	162	66	110	26	7.3
28	77	38	2.3	.60	1.0	4.3	892	150	64	101	23	5.6
29	73	36	1.8	.70	-----	4.8	830	136	64	94	21	4.9
30	68	33	1.5	1.0	-----	5.4	762	126	62	95	19	6.0
31	64	-----	1.3	1.3	-----	6.0	-----	117	-----	97	19	-----
TOTAL	1,610.7	1,421	531.7	11.70	31.3	54.30	107,329	10,917	2,338	4,551	2,000	256.5
MEAN	52.0	47.4	17.2	.38	1.12	1.75	3,578	352	77.9	147	64.5	8.55
MAX	206	60	33	1.3	1.3	6.0	16,000	692	113	270	140	16
MIN	2.6	33	1.3	0	1.0	.80	7.0	117	62	58	19	4.1
CFSM	.05	.05	.02	.0003	.001	.002	3.64	.36	.08	.15	.07	.009
IN.	.06	.05	.02	.0004	.001	.002	4.06	.41	.09	.17	.08	.01
AC-FT	3,190	2,820	1,050	23	62	108	212,900	21,650	4,640	9,030	3,970	509
CAL YR 1968 TOTAL	8,213.60			MEAN 22.4		MAX 206		MIN 0		CFSM .02	IN .31	AC-FT 16,290
WTR YR 1969: TOTAL	131,052.20			MEAN 359		MAX 16,000		MIN 0		CFSM .37	IN 4.96	AC-FT 259,900

5-3010. Minnesota River near Lac qui Parle, Minn.

LOCATION.--Lat 45°01'17", long 95°52'05", in NW 1/4 sec. 24, T.118 N., R.42 W., Chippewa County, 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.

PERIOD OF RECORD.--October 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Nov. 10, 1944, at datum 0.20 ft lower.

AVERAGE DISCHARGE.--27 years, 646 cfs (468,000 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 29,400 cfs Apr. 12 (gage height, 39.75 ft); minimum daily, 19 cfs Dec. 7 to Jan. 9; minimum gage height, 20.32 ft Dec. 9.

Period of record: Maximum discharge, 29,400 cfs Apr. 12, 1969 (gage height, 39.75 ft); no flow Nov. 17, 1942, Sept. 29, 1947, Oct. 19 to Nov. 18, 1951, Nov. 24, 1952.

REMARKS.--Records good except those for winter periods, 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	22	20	19	240	160	60	6,480	3,080	1,260	283	24
2	24	22	20	19	240	120	60	5,830	3,010	1,050	281	25
3	23	21	20	19	240	92	60	5,230	2,850	955	279	25
4	24	22	20	19	240	92	60	5,150	2,740	753	188	25
5	23	22	20	19	240	92	60	5,050	2,630	744	134	25
6	22	21	20	19	240	92	150	5,020	2,520	655	133	25
7	22	21	19	19	240	92	400	5,010	2,420	454	134	25
8	23	22	19	19	250	92	1,390	4,990	2,330	403	133	25
9	22	22	19	19	250	92	2,700	4,870	1,930	639	132	25
10	22	22	19	30	250	92	6,720	4,800	1,480	760	132	25
11	22	21	19	50	250	92	21,000	4,650	1,560	762	132	26
12	22	21	19	66	250	92	28,700	4,450	1,670	759	133	26
13	22	21	19	120	250	92	28,000	4,230	1,710	750	133	26
14	22	21	19	360	250	92	25,100	3,740	1,740	745	133	26
15	22	21	19	350	240	92	22,500	2,860	1,680	742	132	25
16	22	21	19	340	230	88	19,900	1,720	1,800	699	132	26
17	21	21	19	320	220	80	17,700	1,770	1,810	564	132	26
18	21	21	19	310	220	110	15,700	2,000	1,700	508	118	26
19	21	21	19	280	210	76	13,900	2,600	1,660	410	63	26
20	21	21	19	260	200	60	12,900	3,140	1,620	410	42	25
21	21	21	19	240	190	60	12,200	3,350	1,580	410	28	26
22	21	21	19	230	190	60	11,600	3,520	1,560	410	28	26
23	21	21	19	230	180	60	10,800	3,600	1,540	409	29	25
24	21	21	19	230	170	60	10,000	3,650	1,520	406	29	25
25	21	21	19	230	170	60	9,280	3,610	1,500	404	29	24
26	21	20	19	230	170	60	8,680	3,560	1,490	399	29	25
27	21	20	19	230	170	60	8,230	3,500	1,480	401	28	25
28	21	20	19	240	160	60	7,710	3,430	1,440	397	28	24
29	21	20	19	240	-----	60	7,210	3,330	1,410	394	29	24
30	21	20	19	240	-----	60	6,670	3,180	1,390	329	29	24
31	22	-----	19	240	-----	60	-----	3,110	-----	285	27	-----
TOTAL	677	632	595	5,237	6,150	2,550	309,440	121,430	56,850	18,266	3,292	755
MEAN	21.8	21.1	19.2	169	220	82.3	10,310	3,917	1,895	589	106	25.2
MAX	24	22	20	360	250	160	28,700	6,480	3,080	1,260	283	26
MIN	21	20	19	19	160	60	60	1,720	1,390	285	27	24
AC-FT	1,340	1,250	1,180	10,390	12,200	5,060	613,800	240,900	112,800	36,230	6,530	1,500
CAL YR 1968	TOTAL	28,750	MEAN	78.6	MAX	533	MIN	16	AC-FT	57,020		
WTR YR 1969	TOTAL	525,874	MEAN	1,441	MAX	28,700	MIN	19	AC-FT	1,043,000		

MINNESOTA RIVER BASIN

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., Chippewa County, on right bank bank 800 ft upstream from bridge on State Highway 40, 2.0 miles upstream from small tributary, and 5.5 miles east of Milan.

DRAINAGE AREA.--1,870 sq mi, approximately.

PERIOD OF RECORD.--March 1937 to current year.

GAGE.--Water-stage recorder. Datum of gage is 959.69 ft above mean sea level, datum of 1929. Prior to June 15, 1942, nonrecording gage on bridge 800 ft downstream at same datum.

AVERAGE DISCHARGE.--32 years, 251 cfs (1.82 inches per year, 181,800 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 11,400 cfs Apr. 9 (gage height, 15.45 ft); minimum daily, 21 cfs Jan. 17 to Feb. 19; minimum gage height, 1.38 ft Sept. 20-22.

Period of Record: Maximum discharge, 11,400 cfs Apr. 9, 1969 (gage height, 15.45 ft); no flow at times during 1940.

REMARKS.--Records good except those for winter periods, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report. Flow regulated by several small lakes above gage.

REVISIONS (WATER YEARS).--WSP 1145: Drainage area.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	43	161	68	30	21	24	55	1,750	830	305	176	61
2	42	152	66	28	21	24	61	1,770	776	309	173	60
3	39	143	66	27	21	24	66	1,700	712	312	166	60
4	38	136	65	26	21	25	73	1,650	690	305	156	56
5	38	132	64	25	21	25	80	1,710	658	289	154	55
6	36	130	62	25	21	25	150	1,750	620	280	156	55
7	36	127	62	25	21	25	780	1,680	599	277	147	56
8	38	123	60	24	21	25	3,600	1,560	562	293	138	55
9	46	119	57	23	21	25	8,750	1,470	525	326	132	53
10	52	117	56	23	21	25	10,100	1,420	504	343	130	52
11	53	115	56	23	21	25	9,840	1,370	504	322	121	50
12	58	102	56	23	21	25	9,400	1,290	479	315	117	49
13	56	112	54	22	21	26	7,680	1,240	460	309	112	47
14	55	114	54	22	21	26	6,720	1,200	451	299	108	45
15	53	110	52	22	21	26	6,010	1,150	441	296	102	43
16	69	110	48	22	21	27	5,200	1,700	415	293	98	45
17	102	96	47	21	21	27	4,610	2,500	398	286	96	42
18	159	80	46	21	21	28	3,970	2,100	377	274	94	39
19	216	64	45	21	21	29	3,340	1,900	362	264	91	38
20	249	90	44	21	22	29	2,910	1,800	346	246	89	35
21	246	96	43	21	23	30	2,570	1,700	340	234	85	35
22	231	92	42	21	24	31	2,310	1,600	336	222	83	56
23	219	90	41	21	24	32	2,120	1,500	329	216	80	98
24	213	90	40	21	24	32	1,980	1,400	329	208	76	106
25	205	86	40	21	24	33	1,850	1,300	332	202	74	96
26	202	84	36	21	24	34	1,750	1,250	329	190	73	89
27	196	80	34	21	24	35	1,750	1,180	322	186	71	81
28	188	78	34	21	24	37	1,990	1,120	332	178	69	73
29	186	74	33	21	-----	40	1,950	1,050	326	170	66	69
30	178	70	32	21	-----	44	1,820	995	315	170	63	68
31	170	-----	30	21	-----	50	-----	912	-----	180	66	-----
TOTAL	3,712	3,173	1,533	705	612	913	103,485	46,717	13,999	8,099	3,362	1,767
MEAN	120	106	49.5	22.7	21.9	29.5	3,450	1,507	467	261	108	58.9
MAX	249	161	68	30	24	50	10,100	2,500	830	343	176	106
MIN	36	64	30	21	21	24	55	912	315	170	63	35
CFSM	.06	.06	.03	.01	.01	.02	1.84	.81	.25	.14	.06	.03
IN.	.07	.06	.03	.01	.01	.02	2.06	.93	.28	.16	.07	.04
AC-FT	7,360	6,290	3,040	1,400	1,210	1,810	205,300	92,660	27,770	16,060	6,670	3,500
CAL YR 1968 TOTAL	31,654.8			MEAN 86.5		MAX 277	MIN 2.2	CFSM .05	IN .63	AC-FT 62,790		
WTR YR 1969: TOTAL	188,077			MEAN 515		MAX 10,100	MIN 21	CFSM .28	IN 3.74	AC-FT 373,000		

PEAK DISCHARGE (BASE, 400 CFS).--Apr. 9 (2230) 11,400 cfs (15.45 ft), May 17 (Time Unknown) 3,160 cfs (7.41 ft).

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., Lac qui Parle County, 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.

PERIOD OF RECORD.--July 1909 to September 1917, October 1917 to September 1929 (no winter records), October 1929 to current year. 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 909.12 ft above mean sea level, datum of 1929. July 22, 1909, to Feb. 4, 1932, nonrecording gage at bridge 600 ft downstream at present datum. Feb. 5, 1932, to Nov. 26, 1934, nonrecording gage at bridge 100 ft downstream at present datum.

AVERAGE DISCHARGE.--48 years (1909-17, 1929-69), 660 cfs (1.45 inches per year, 478,200 acre-ft per year).

EXTREMES.--Current year: Maximum discharge 35,100 cfs Apr. 12 (gage height, 21.68 ft from high-water mark; minimum daily, 31 cfs Sept. 20.
Period of record: Maximum discharge, 35,100 cfs Apr. 12, 1969 (gage height, 21.68 ft, from high-water mark; 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.

REVISIONS (WATER YEARS).--WSP 1035: 1919 (M). WSP 1085: 1935-36. WSP 1508: 1912, 1925 (M), 1929 (M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	186	82	127	234	235	145	7,810	3,950	1,530	499	73
2	64	174	85	128	234	235	160	7,450	3,850	1,320	491	65
3	61	167	88	128	234	230	175	6,540	3,720	1,260	482	65
4	60	158	88	128	235	210	200	6,220	3,550	1,060	460	65
5	60	154	90	127	240	200	250	6,090	3,400	952	344	61
6	59	149	92	125	240	190	400	6,050	3,250	949	327	60
7	58	143	93	125	240	180	1,600	5,930	3,100	803	331	60
8	58	140	93	125	240	170	3,850	5,900	2,960	715	315	61
9	70	139	93	125	240	155	6,140	5,820	2,710	840	309	60
10	67	136	93	122	240	145	9,970	5,730	2,000	1,020	301	58
11	67	134	93	122	240	132	18,900	5,570	1,940	1,040	293	57
12	68	124	93	122	240	125	32,900	5,380	2,030	1,030	287	56
13	69	110	93	125	240	120	34,400	5,160	2,020	1,010	279	55
14	68	108	93	130	240	115	31,600	4,890	2,060	997	270	53
15	68	103	93	140	240	110	28,600	4,530	2,000	1,010	264	51
16	100	100	93	160	240	108	25,600	3,570	1,990	950	258	48
17	120	95	93	190	240	104	22,500	3,090	2,120	886	252	51
18	153	89	93	234	240	102	19,700	3,320	1,970	821	248	48
19	196	83	94	234	240	98	17,100	3,500	1,900	717	220	45
20	244	76	96	234	240	98	14,900	3,760	1,840	675	188	44
21	267	72	98	234	240	98	13,900	3,920	1,800	658	111	35
22	258	72	100	234	240	98	12,900	4,100	1,770	642	93	31
23	246	72	102	234	240	100	11,900	4,290	1,750	631	91	47
24	237	72	105	234	240	103	11,200	4,390	1,730	620	84	73
25	229	72	108	234	240	105	10,500	4,430	1,720	615	75	81
26	225	74	110	234	240	108	9,900	4,420	1,690	603	68	62
27	216	76	114	234	240	110	9,810	4,380	1,670	554	67	53
28	211	78	118	234	235	115	9,340	4,340	1,640	586	67	53
29	207	78	120	234	-----	120	8,810	4,290	1,630	574	65	51
30	207	80	125	234	-----	130	8,220	4,180	1,590	558	75	51
31	197	-----	125	234	-----	135	-----	4,050	-----	519	72	-----
TOTAL	4,273	3,314	3,056	5,525	6,692	4,284	375,570	153,100	69,350	26,265	7,266	1,673
MEAN	138	110	98.6	178	239	138	12,520	4,939	2,312	847	234	55.8
MAX	267	186	125	234	240	235	34,400	7,810	3,950	1,530	499	81
MIN	58	72	82	122	234	98	145	3,090	1,590	519	65	31
AC-FT	8,480	6,570	6,060	10,960	13,270	8,500	744,900	303,700	137,600	52,100	14,410	3,320
CAL YR 1968	TOTAL 63,461		MEAN 173		MAX 824	MIN 19		AC-FT 125,900				
WTR YR 1969	TOTAL 660,368		MEAN 1,809		MAX 34,400	MIN 31		AC-FT 1,310,000				

MINNESOTA RIVER BASIN

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., Lyon County, 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.

PERIOD OF RECORD.--April 1960 to current year. Monthly and daily discharge for the period Apr. 1, 1960 to June 30, 1960, published in WSP 1914.

GAGE.--Nonrecording gage read once daily. Datum of gage is 1,150.00 ft above mean sea level, datum of 1929. Prior to Mar. 21, 1963, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--9 years, 25.5 cfs (18,470 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 4,430 cfs Apr. 8 (gage height, 13.41 ft); minimum daily, 1.0 cfs Sept. 15; minimum gage height, 3.05 ft Oct. 5, 6, 7, 8.
Period of record: Maximum discharge, 4,430 cfs Apr. 8, 1969 (gage height, 13.41 ft); no flow at times.

REMARKS.--Records good except those for winter periods, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.9	30	13	4.7	2.9	1.3	5.0	61	20	31	9.4	6.2
2	3.4	26	17	4.7	2.7	1.3	7.0	61	19	429	8.1	3.6
3	2.5	24	16	4.7	2.6	1.4	9.0	58	17	66	6.6	2.8
4	2.4	22	15	4.7	2.4	1.4	15	67	17	1,020	5.4	2.4
5	2.2	25	14	4.7	2.3	1.4	250	64	16	416	5.2	2.8
6	2.2	30	13	4.7	2.2	1.4	800	114	15	141	6.6	2.0
7	2.2	28	12	4.7	2.1	1.4	1,700	136	15	100	41	1.7
8	2.2	26	11	4.6	2.0	1.4	3,500	98	14	79	26	1.4
9	5.0	26	10	4.6	2.0	1.4	3,240	73	13	73	17	1.6
10	10	23	10	4.5	1.9	1.4	2,010	74	13	53	13	1.6
11	7.5	22	9.0	4.4	1.9	1.4	1,350	63	15	43	11	1.4
12	6.2	22	8.5	4.4	1.8	1.4	968	55	14	37	8.9	1.4
13	5.6	20	7.5	4.4	1.8	1.4	818	49	13	31	6.6	1.3
14	4.6	20	7.0	4.4	1.7	1.4	716	44	13	26	5.0	1.2
15	4.6	20	6.4	4.4	1.7	1.4	596	42	12	23	4.1	1.0
16	37	20	5.8	4.4	1.6	1.5	436	39	12	20	3.2	1.7
17	170	24	5.2	4.4	1.6	1.6	332	36	9.9	16	2.2	1.4
18	316	22	4.6	4.4	1.6	1.8	267	35	9.4	64	1.7	1.3
19	251	19	4.5	4.4	1.6	1.9	204	33	8.4	51	1.8	1.3
20	187	30	4.5	4.4	1.5	2.0	158	39	7.9	46	2.8	1.2
21	131	21	4.5	4.4	1.5	2.1	136	38	7.4	36	2.6	1.3
22	100	22	4.5	4.4	1.5	2.4	111	38	7.1	34	2.2	8.4
23	80	24	4.5	4.4	1.4	3.0	99	38	11	29	2.0	15
24	68	24	4.5	4.3	1.4	4.0	87	36	11	24	1.8	8.9
25	56	25	4.5	4.3	1.4	6.0	79	32	11	19	1.6	5.7
26	52	24	4.6	4.1	1.4	10	74	31	19	16	1.4	2.6
27	50	20	4.6	3.8	1.4	12	72	29	14	15	1.4	2.0
28	42	22	4.6	3.7	1.3	8.0	71	27	13	15	1.4	2.0
29	40	24	4.6	3.4	-----	6.0	68	24	13	14	1.2	2.0
30	36	13	4.6	3.2	-----	5.0	62	22	12	12	1.1	1.4
31	32	-----	4.6	3.0	-----	5.0	-----	21	-----	10	7.9	-----
TOTAL	1,712.5	698	244.1	133.6	51.2	93.1	18,240.0	1,577	392.1	2,989	210.2	88.6
MEAN	55.2	23.3	7.87	4.31	1.83	3.00	608	50.9	13.1	96.4	6.78	2.95
MAX	316	30	17	4.7	2.9	12	3,500	136	20	1,020	41	15
MIN	2.2	13	4.5	3.0	1.3	1.3	5.0	21	7.1	10	1.1	1.0
AC-FT	3,400	1,380	484	265	102	185	36,180	3,130	778	5,930	417	176
CAL YR 1968	TOTAL	4,118.00	MEAN	11.3	MAX	316	MIN	0	AC-FT	8,170		
WTR YR 1969	TOTAL	26,429.4	MEAN	72.4	MAX	3,500	MIN	1.0	AC-FT	52,420		

5-3135. Yellow Medicine River near Granite Falls, Minn.

LOCATION.--Lat 44°43'18" long 95°31'07", in SW¼ sec.35, T.115 N., R.39 W., Yellow Medicine County, 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.

PERIOD OF RECORD.--March 1931 to September 1935 (no winter records), October 1935 to September 1938, October 1939 to current year. 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 19, 1936, and June 11, 1936, to June 13, 1938, nonrecording gage, on bridge 50 ft upstream at same datum. Oct. 12, 1939, to Nov. 30, 1952, nonrecording gage 500 ft downstream at same datum.

AVERAGE DISCHARGE.--33 years (1935-38, 1939-69), 107 cfs (2.23 inches per year, 77,520 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 17,200 cfs Apr. 10 (gage height, 14.90 ft); minimum, 4.3 cfs Sept. 22 (gage height, 2.24 ft).

Period of record: Maximum discharge, 17,200 cfs Apr. 10, 1969 (gage height, 14.90 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 periods, which are fair.

REVISIONS (WATER YEARS).--WSP 1508: 1931, 1934(M), 1937(M), 1946(M), 1950(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	19	155	71	14	6.8	19	31	646	109	55	83	18		
2	17	148	72	13	6.8	19	32	590	103	55	76	18		
3	15	139	72	13	6.8	19	35	555	95	92	72	20		
4	14	130	72	13	6.8	20	40	535	90	572	63	20		
5	13	126	71	12	6.9	20	46	520	85	535	60	18		
6	13	120	69	12	7.0	21	70	540	80	876	63	17		
7	12	123	65	12	7.2	21	280	610	74	1,170	57	16		
8	12	130	60	11	7.3	22	1,300	694	69	967	54	15		
9	16	130	56	11	7.5	22	11,900	595	63	658	123	12		
10	15	123	54	11	7.6	22	16,400	525	62	570	106	12		
11	12	120	50	11	7.8	22	12,900	486	67	505	83	9.6		
12	13	111	48	10	7.9	23	9,630	466	62	414	65	8.3		
13	16	106	45	10	8.2	23	7,730	414	62	335	57	7.7		
14	25	98	42	10	8.6	24	6,190	360	65	270	48	7.7		
15	22	100	39	10	9.0	24	5,060	326	62	233	42	7.7		
16	35	95	37	9.8	9.3	24	4,280	285	60	202	38	9.6		
17	43	95	35	9.6	9.6	25	3,620	258	59	192	33	9.0		
18	152	95	32	9.4	10	25	3,070	236	57	198	30	7.7		
19	640	83	30	9.1	11	26	2,650	222	55	205	28	7.7		
20	850	69	28	9.0	11	26	2,240	209	51	262	26	6.2		
21	754	72	27	8.6	12	26	1,930	205	49	274	25	5.4		
22	595	75	25	8.4	12	26	1,660	209	51	244	25	5.4		
23	490	79	23	8.4	13	26	1,440	202	49	209	22	5.4		
24	405	80	22	8.2	14	27	1,260	195	49	188	22	5.8		
25	330	80	21	8.0	15	28	1,090	181	57	165	20	9.0		
26	289	78	19	7.8	16	28	941	171	62	148	19	14		
27	251	77	18	7.6	17	29	876	158	60	133	17	12		
28	222	74	18	7.4	18	29	844	148	65	120	16	9.6		
29	198	72	17	7.2	-----	30	802	136	62	106	14	7.2		
30	185	70	17	7.2	-----	30	724	123	57	100	17	7.2		
31	171	-----	16	7.0	-----	31	-----	114	-----	92	20	-----		
TOTAL	5,844	3,053	1,271	305.7	280.1	757	99,071	10,914	1,991	10,145	1,424	328.2		
MEAN	189	102	41.0	9.86	10.0	24.4	3,302	352	66.4	327	45.9	10.9		
MAX	850	155	72	14	18	31	16,400	694	109	1,170	123	20		
MIN	12	69	16	7.0	6.8	19	31	114	49	55	14	5.4		
CFSM	.29	.16	.06	.02	.02	.04	5.06	.54	.10	.50	.07	.02		
IN.	.33	.17	.07	.02	.02	.04	5.64	.62	.11	.58	.08	.02		
AC-FT	11,590	6,060	2,520	606	556	1,500	196,500	21,650	3,950	20,120	2,820	651		
CAL YR 1968	TOTAL	18,780.6	MEAN	51.3	MAX	850	MIN	2.1	CFSM	.08	IN	1.07	AC-FT	37,250
WTR YR 1969:	TOTAL	135,384.0	MEAN	371	MAX	16,400	MIN	5.4	CFSM	.57	IN	7.71	AC-FT	268,500

PEAK DISCHARGE (BASE, 300 CFS)

DATE	TIME	G.H.T.	DISCHARGE	DATE	TIME	G.H.T.	DISCHARGE
10-20	1500	4.68	870	7-7	1300	5.05	1,210
4-10	0500	14.90	17,200				

MINNESOTA RIVER BASIN

5-3150. Redwood River at Marshall, Minn.

LOCATION.--Lat 44°27'05", long 95°47'13", in SE¼ sec.4, T.111 N., R.41 W., Lyon County, on downstream side of highway bridge on Fourth Street in Marshall and 10 miles upstream from Threemile Creek.

DRAINAGE AREA.--307 sq mi.

PERIOD OF RECORD.--March 1940 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 1,144.88 ft above mean sea level, datum of 1929. Nonrecording gage and crest-stage 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.--29 years, 49.3 cfs (2.18 inches per year, 35,720 acre-ft per year).

EXTREMES (Combined flow).--Current year: Maximum discharge, 5,590 cfs Apr. 10; minimum daily, 4.1 cfs Sept. 14.

Period of record: Maximum discharge, 5,590 cfs Apr. 10, 1969; no flow at times.

(River only).--Current year: Maximum discharge, 1,610 cfs Apr. 9 (gage height, 7.62 ft); minimum, 3.6 cfs Sept. 14.

Period of record: Maximum discharge, 5,370 cfs June 17, 1957; maximum gage height, 11.05 ft Apr. 6, 1957 (from floodmark); no flow at times.

(Diversion only).--Current year: Maximum discharge, 4,440 cfs Apr. 10 (gage height, 78.45 ft); no flow on many days.

Period of record: Maximum discharge, 4,440 cfs Apr. 10, 1969 (gage height, 78.45 ft); no flow on many days.

REMARKS.--Records good except those for periods of no gage-height record, 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 water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	66	106	42	17	14	13	23	343	65	93	29	5.6
2	69	96	43	17	14	13	20	336	62	413	28	5.6
3	62	83	43	17	14	13	23	307	57	166	26	5.1
4	58	79	45	17	14	13	53	302	57	335	28	5.1
5	57	77	47	17	14	13	240	347	51	207	29	6.2
6	51	79	47	17	14	13	519	314	48	167	39	6.2
7	48	80	47	17	14	13	1,240	303	50	121	24	5.6
8	45	77	47	16	14	13	2,780	252	46	134	21	5.1
9	48	66	45	16	14	13	4,760	220	43	118	21	5.1
10	45	57	43	16	14	13	4,530	222	41	101	18	5.1
11	41	49	38	16	13	13	2,950	193	47	84	18	5.1
12	41	48	36	16	13	13	2,440	182	47	76	16	5.1
13	41	45	33	16	13	13	2,160	170	48	68	11	4.6
14	41	47	31	15	13	13	1,870	152	43	60	12	4.1
15	40	54	28	15	13	14	1,590	144	41	57	11	8.5
16	99	52	26	15	13	14	1,350	144	35	50	10	7.3
17	273	50	23	15	13	14	1,170	123	35	57	12	5.1
18	437	47	20	15	13	14	930	109	33	79	13	5.1
19	1,010	44	19	15	13	14	799	115	31	76	11	5.1
20	1,060	38	19	15	13	14	676	106	30	63	14	5.1
21	805	35	19	15	13	14	598	111	29	56	12	5.1
22	610	31	18	15	13	14	534	119	30	50	9.8	9.1
23	452	38	18	14	13	15	490	118	41	45	9.8	16
24	265	39	18	14	13	15	454	115	41	43	8.5	12
25	222	35	18	14	13	15	443	113	46	40	7.9	7.9
26	195	23	18	14	13	16	414	101	50	38	6.7	7.9
27	184	32	18	14	13	16	410	94	46	36	5.6	7.9
28	155	33	18	14	13	16	397	86	51	34	5.6	6.7
29	134	38	17	14	-----	17	367	76	90	31	4.6	6.2
30	127	65	17	14	-----	19	332	69	190	28	5.6	6.2
31	116	-----	17	14	-----	26	-----	66	-----	29	7.3	-----
TOTAL	6,897	1,648	918	476	374	449	34,562	5,452	1,524	2,949	474.4	194.8
MEAN	222	54.9	29.6	15.4	13.4	14.5	1,152	176	50.8	95.1	15.3	6.49
MAX	1,060	106	47	17	14	26	4,760	347	190	413	39	16
MIN	40	23	17	14	13	13	20	66	29	28	4.6	4.1
CFSM	.72	.18	.096	.050	.044	.047	3.75	.57	.17	.31	.050	.021
IN.	.84	.20	.11	.06	.05	.05	4.19	.66	.18	.36	.06	.02
AC-FT	13,680	3,270	1,820	944	742	891	68,550	10,810	3,020	5,850	941	386

CAL YR 1968 TOTAL 12,040.3 MEAN 32.9 MAX 1,060 MIN .10 CFSM .11 IN 1.46 ACFT 23,880
WAT YR 1969 TOTAL 55,918.2 MEAN 153 MAX 4,760 MIN 4.1 CFSM .50 IN 6.78 ACFT 110,900

NOTE.--No gage-height record at river gage Dec. 19 to Jan. 20, Jan. 22 to Feb. 26, Feb. 27 to Mar. 17.

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., Redwood County, 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.

PERIOD OF RECORD.--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 current year.

GAGE.--Water-stage recorder. Datum of gage is 972.33 ft above mean sea level. July 1909 to September 1914, nonrecording gage at bridge 20 ft downstream at datum 0.22 ft lower. August 1930, to Oct. 25, 1949, nonrecording gage, at bridge 20 ft downstream at present datum.

AVERAGE DISCHARGE.--35 years (1911-12, 1935-69), 105 cfs (2.05 inches per year, 76,070 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 14,100 cfs Apr. 9 (gage height, 14.58 ft); minimum daily, 3.8 cfs Jan. 27-30; minimum gage height, 1.64 ft Jan. 27.

Period of Record: 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 winter periods, which are fair. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood, and Cottonwood River basins during extreme floods. Records of water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	82	273	100	18	3.9	20	100	650	154	225	84	29
2	82	249	100	17	4.0	21	120	602	147	273	82	24
3	78	233	100	16	4.1	23	160	568	138	470	79	20
4	77	217	97	15	4.2	24	280	557	132	530	74	18
5	75	209	95	14	4.2	25	600	562	126	1,110	72	18
6	72	201	88	13	4.4	26	1,200	568	120	1,130	72	18
7	70	197	84	12	4.6	27	2,500	557	118	1,100	75	18
8	67	189	78	11	4.8	29	5,000	574	114	1,200	75	19
9	77	185	74	10	5.1	31	13,200	562	108	1,270	72	18
10	77	178	70	10	5.4	33	11,200	525	106	1,180	65	17
11	77	171	66	9.0	5.7	34	8,720	495	112	800	59	17
12	74	168	65	8.0	6.0	36	6,450	455	118	568	54	18
13	70	160	63	7.0	6.3	37	4,960	426	116	455	49	16
14	65	154	61	6.0	6.6	39	4,270	390	114	368	46	16
15	63	150	60	5.6	7.0	42	3,860	358	112	313	42	18
16	108	147	58	5.3	7.4	44	3,380	329	108	281	38	19
17	636	147	56	5.0	8.0	45	2,960	305	102	253	35	19
18	1,180	147	55	4.7	8.5	47	2,540	285	96	241	32	17
19	1,140	141	54	4.5	9.2	51	2,200	273	93	257	31	17
20	1,000	108	52	4.3	10	52	1,910	265	89	233	31	17
21	988	120	49	4.2	11	53	1,710	265	86	205	32	16
22	1,020	144	47	4.2	12	56	1,490	265	84	174	31	16
23	1,010	140	43	4.2	13	59	1,300	269	91	154	31	16
24	890	140	27	4.0	14	61	1,140	265	96	135	28	18
25	656	140	24	4.0	15	64	1,000	253	106	118	27	19
26	525	140	23	3.9	16	65	878	241	198	110	26	17
27	445	140	22	3.8	17	66	858	225	229	104	23	17
28	386	120	21	3.8	19	69	897	209	171	100	21	17
29	345	102	21	3.8	-----	72	806	189	154	96	20	17
30	317	100	20	3.8	-----	79	722	174	201	93	20	17
31	293	-----	19	3.9	-----	87	-----	164	-----	89	26	-----
TOTAL	12,046	4,910	1,792	239.0	236.4	1,417	86,411	11,825	3,739	13,635	1,452	543
MEAN	389	164	57.8	7.71	8.44	45.7	2,880	381	125	440	46.8	18.1
MAX	1,180	273	100	18	19	87	13,200	650	229	1,270	84	29
MIN	63	100	19	3.8	3.9	20	100	164	84	89	20	16
CFSM	.56	.23	.08	.01	.01	.07	4.13	.55	.18	.63	.07	.03
IN.	.64	.26	.10	.01	.01	.08	4.61	.63	.20	.73	.08	.03
AC-FT	23,890	9,740	3,550	474	469	2,810	171,400	23,450	7,420	27,050	2,880	1,080

CAL YR 1968: TOTAL 28,248.60 MEAN 77.2 MAX 1,180 MIN .70 CFSM .11 IN 1.51 AC-FT 56,030
WTR YR 1969: TOTAL 138,245.4 MEAN 379 MAX 13,200 MIN 3.8 CFSM .54 IN 7.38 AC-FT 274,200

PEAK DISCHARGE (BASE, 150 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-18	1900	4.52	1,250	6-26	2200	2.74	281
4-9	1200	14.58	14,100	7-9	1700	4.49	1,290

MINNESOTA RIVER BASIN

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., Nicollet County, on left bank 30 ft downstream from U.S. Highway 14, at New Ulm and 6.1 miles upstream from Cottonwood River.

DRAINAGE AREA.--9,530 sq mi,

PERIOD OF RECORD.--October 1967 to current year.

GAGE.--Water-stage recorder. Datum of gage is 778.72 ft above mean sea level, datum of 1929.

EXTREMES.--Current year: Maximum discharge, 58,000, 2,810 cfs Apr. 15 (gage height, 30.65 ft); minimum daily discharge, 127 cfs Oct. 8.

Period of record: Maximum discharge, 58,000 cfs Apr. 15, 1969 (gage height, 30.65 ft); minimum daily discharge, 42 cfs Jan. 15, 19, 1968.

REMARKS.--Records good except those for periods of backwater from Cottonwood River and those for winter periods, which are fair. Records of water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	226	2,020	1,050	205	402	402	2,100	13,600	5,020	2,730	1,120	214
2	222	1,800	1,040	205	402	402	2,250	13,000	4,930	2,740	1,050	204
3	196	1,670	1,110	205	402	402	2,500	12,200	4,850	2,690	1,070	192
4	154	1,550	1,020	205	402	402	2,900	11,400	4,750	2,750	1,020	202
5	160	1,490	990	205	402	402	3,220	10,800	4,620	2,950	966	220
6	156	1,400	930	205	402	402	4,150	10,200	4,490	3,070	922	212
7	136	1,330	870	205	402	399	5,510	9,810	4,360	3,160	879	204
8	127	1,300	830	205	402	395	7,700	9,340	4,200	3,210	826	204
9	130	1,240	770	205	402	392	11,000	8,910	4,020	3,280	777	204
10	374	1,230	730	205	402	390	21,500	8,630	3,820	3,350	735	194
11	467	1,190	670	205	402	390	38,900	8,370	3,660	3,360	700	192
12	512	1,140	600	205	402	390	49,100	8,150	3,450	3,290	676	192
13	416	1,150	550	205	402	390	51,500	7,940	3,190	3,060	662	192
14	325	1,100	510	205	402	390	53,200	7,650	2,990	2,750	625	192
15	275	1,090	465	205	402	390	56,900	7,390	2,890	2,510	556	190
16	569	1,050	445	205	402	395	55,600	7,180	2,820	2,280	512	184
17	1,620	1,070	415	208	402	400	50,400	6,970	2,770	2,130	545	178
18	3,000	1,050	390	211	402	405	44,400	6,750	2,710	2,040	505	180
19	2,540	1,080	370	230	402	410	38,600	6,500	2,670	2,110	482	182
20	4,050	1,060	345	250	402	420	34,200	6,230	2,630	2,400	473	188
21	5,900	1,050	330	275	402	435	30,500	5,890	2,570	2,250	464	190
22	6,800	998	310	310	402	450	27,300	5,600	2,510	2,060	455	190
23	6,840	1,060	295	330	402	470	24,400	5,350	2,490	1,870	431	186
24	6,610	1,090	285	360	402	510	22,100	5,190	2,480	1,710	398	180
25	5,850	1,100	275	390	402	600	20,300	5,090	2,670	1,610	368	180
26	5,200	1,140	260	402	402	720	18,600	5,040	2,920	1,510	341	180
27	4,530	1,130	250	402	402	850	17,100	5,050	2,890	1,410	320	194
28	3,950	1,140	235	402	402	1,300	15,800	5,150	2,830	1,340	295	212
29	3,310	1,110	225	402	-----	1,600	14,700	5,180	2,840	1,270	268	220
30	2,760	1,060	210	402	-----	1,800	14,100	5,150	2,820	1,200	240	226
31	2,370	-----	205	402	-----	1,900	-----	5,090	-----	1,150	224	-----
TOTAL	69,775	36,888	16,980	8,256	11,256	18,603	740,530	238,800	101,860	73,360	19,053	5,878
MEAN	2,251	1,230	548	266	402	600	24,680	7,703	3,395	2,366	615	196
MAX	6,840	2,020	1,110	402	402	1,900	56,900	13,600	5,020	3,360	1,120	226
MIN	127	998	205	205	402	390	2,100	5,040	2,480	1,150	224	178
CFSM	.24	.13	.06	.03	.04	.06	2.59	.81	.36	.25	.06	.02
IN.	.27	.14	.07	.03	.04	.07	2.89	.93	.40	.29	.07	.02
AC-FT	138,400	73,170	33,680	16,380	22,330	36,900	1,469M	473,700	202,000	145,500	27,750	11,660
CAL YR 1968 TOTAL	251,770			688		6,840		42		.07	.58	
WTR YR 1969: TOTAL	1,341,239			3,675		56,900		127		.39	5.23	
AC-FT	499,400					2,660,000						

NOTE.--Backwater from Cottonwood River Oct. 1 to Dec. 3, Apr. 5-12.

M Expressed in thousands.

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., Brown County, 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 Current year (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, nonrecording gage at site 2.7 miles upstream at different datum. Mar. 15, 1931, to Mar. 31, 1938, nonrecording gage 2.2 miles upstream at datum 11.41 ft higher. Aug. 23, 1938, to June 25, 1948, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--35 years (1911-13, 1935-37, 1938-69, 280 cfs (2.97 inches per year, 202900 acre-ft per year).

EXTREMES.--Current year: Maximum discharge during year, 28,700 cfs Apr. 10 (gage height, 19.15 ft); minimum 40 cfs, Sept. 29, 30 (gage height, 2.62 ft); minimum gage height, 2.28 ft Mar. 9.
Period of record: 1909-13, 1931-69: Maximum discharge, 28,700 cfs Apr. 10, 1969 (gage height, 19.15 ft); maximum gage height, 20.86 ft Apr. 8, 1965 (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 periods, which are fair. Some regulation by dam at Cottonwood Lake and several other small lakes above station. Records of chemical analyses, water temperatures, and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS) --WSP 355: 1912.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,240	1,410	426	135	155	150	850	1,570	402	863	312	71
2	1,150	1,310	444	135	155	150	1,200	1,510	370	1,020	287	70
3	1,060	1,230	450	135	155	150	2,090	1,430	352	1,040	263	70
4	1,050	1,180	441	135	155	150	4,300	1,340	335	1,540	242	76
5	972	1,120	382	140	155	150	6,350	1,280	322	1,820	222	77
6	864	1,080	200	140	155	150	9,660	1,360	306	1,750	207	78
7	797	1,060	200	140	155	150	13,600	1,390	292	1,480	193	77
8	766	1,030	210	140	155	150	22,000	1,280	283	1,390	179	73
9	874	996	230	140	155	150	27,100	1,160	270	1,350	166	64
10	1,220	958	260	140	155	150	24,200	1,100	261	1,240	160	60
11	1,600	916	250	140	155	150	18,200	1,110	270	1,060	156	56
12	1,520	874	235	145	155	150	13,600	1,070	263	890	150	56
13	1,250	836	190	145	155	150	10,000	953	257	768	138	54
14	1,090	800	155	145	155	150	7,910	886	261	645	127	53
15	1,010	734	178	147	155	150	6,900	804	257	564	118	50
16	1,420	720	335	150	155	160	6,240	752	248	498	111	50
17	4,620	705	340	150	155	170	5,440	696	242	465	103	51
18	8,910	702	308	150	155	180	4,600	645	232	441	97	50
19	13,000	690	268	150	155	202	3,980	624	222	1,000	103	49
20	12,300	642	242	150	155	275	3,480	638	207	1,170	108	47
21	9,360	564	230	150	155	340	3,040	662	198	890	108	47
22	7,380	624	220	150	150	380	2,660	670	191	740	113	50
23	5,740	633	180	150	150	430	2,340	688	195	628	116	53
24	4,250	642	167	150	150	500	2,070	688	197	540	110	53
25	3,420	630	184	150	150	660	1,880	673	311	662	103	54
26	2,890	615	176	145	150	750	1,700	631	537	554	97	47
27	2,470	573	153	145	150	880	1,630	582	495	471	94	45
28	2,140	537	143	150	150	910	1,730	534	504	414	89	44
29	1,870	495	140	150	-----	880	1,800	492	492	382	83	41
30	1,680	444	138	150	-----	860	1,690	444	708	355	78	41
31	1,530	-----	135	150	-----	840	-----	420	-----	328	78	-----
TOTAL	99,443	24,750	7,610	4,492	4,305	10,667	212,240	28,082	9,480	26,958	4,511	1,707
MEAN	3,208	825	245	145	154	344	7,075	906	316	870	146	56.9
MAX	13,000	1,410	450	150	155	910	27,100	1,570	708	1,820	312	78
MIN	766	444	135	135	150	150	850	420	191	328	78	41
CFSM	2.51	.64	.19	.11	.12	.27	5.53	.71	.25	.68	.11	.045
IN.	2.89	.72	.22	.13	.13	.31	6.17	.82	.28	.78	.13	.05
AC-FT	197,200	49,090	15,090	8,910	8,540	21,160	421,000	55,700	18,800	53,470	8,950	3,390
CAL YR 1968	TOTAL 200,881	MEAN 550	MAX 13,000	MIN 2.5	CFSM .43	IN 5.84	ACFT 398,400					
WAT YR 1969	TOTAL 434,245	MEAN 1,190	MAX 27,100	MIN 41	CFSM .93	IN 12.62	ACFT 861,300					

MINNESOTA RIVER BASIN

5-3180. East Branch Blue Earth River near Bricelyn, Minn.

LOCATION.--Lat 43°37'50", long 93°47'25", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.23, T.102 N., R.25 W., Faribault County, 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.

PERIOD OF RECORD.--March 1951 to current year. Prior to October 1957, published as East Fork Blue Earth River near Bricelyn.

GAGE.--Nonrecording 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.--18 years, 42.1 cfs (4.33 inches per year, 30,500 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 792 cfs Mar. 26 (gage height, 10.62 ft, backwater from ice); maximum gage height, 10.78 ft Mar. 26 (backwater from ice); minimum discharge, 0.03 cfs Aug. 30 (gage height, 3.61 ft).

Period of record: 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 in most years.

REMARKS.--Records good except those for winter periods, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	203	286	58	25	11	7.6	520	100	40	244	54	2.5
2	188	263	56	24	11	7.8	504	96	36	285	46	3.6
3	176	239	52	24	11	7.8	495	90	31	290	40	4.2
4	159	221	51	23	11	7.8	490	87	25	279	34	4.8
5	147	201	50	22	10	8.0	485	84	20	256	29	7.8
6	147	188	50	22	10	8.0	478	94	16	243	25	7.8
7	139	174	50	21	10	8.0	445	102	13	224	21	6.9
8	132	159	48	21	9.8	8.0	400	96	16	226	19	5.4
9	163	144	47	20	9.6	8.0	386	96	14	264	16	3.6
10	201	128	45	20	9.4	8.0	364	107	12	279	15	2.9
11	229	114	43	19	9.2	8.5	337	104	18	283	12	2.6
12	260	104	41	19	9.0	8.5	310	101	25	278	10	2.0
13	262	94	40	18	8.8	8.5	281	98	22	251	7.5	1.8
14	256	86	39	18	8.6	8.5	253	94	20	220	6.3	1.4
15	248	79	38	17	8.4	9.0	247	88	19	205	4.8	.92
16	288	75	38	17	8.3	10	244	84	18	186	3.6	1.2
17	450	75	37	16	8.2	14	245	108	17	163	2.8	.80
18	694	84	37	16	8.0	20	243	115	16	147	2.8	.42
19	722	82	36	16	7.8	30	233	127	14	130	2.8	.34
20	700	80	36	15	7.7	80	220	134	11	116	2.8	.30
21	669	78	35	15	7.6	150	213	136	9.1	106	2.6	.26
22	627	78	34	15	7.5	250	201	136	7.5	91	2.3	.26
23	572	77	33	14	7.4	400	185	133	8.1	78	2.0	.38
24	526	76	32	14	7.4	450	172	123	7.8	68	1.3	.38
25	478	74	31	14	7.3	510	150	114	12	62	1.1	.30
26	437	70	30	13	7.3	720	137	102	20	64	.56	.30
27	404	68	29	13	7.4	773	129	89	28	78	.38	.42
28	378	66	28	12	7.5	740	123	76	36	75	.22	.48
29	346	62	28	12	-----	680	114	65	100	71	.14	.48
30	324	60	27	12	-----	620	107	57	158	65	.04	.68
31	306	-----	26	12	-----	560	-----	47	-----	60	1.8	-----
TOTAL	10,831	3,585	1,225	539	246.2	6,129.0	8,711	3,083	789.5	5,387	366.84	65.22
MEAN	349	120	39.5	17.4	8.79	198	290	99.5	26.3	174	11.8	2.17
MAX	722	286	58	25	11	773	520	136	158	290	54	7.8
MIN	132	60	26	12	7.3	7.6	107	47	7.5	60	.04	.26
CFSM	2.65	.91	.30	.13	.07	1.50	2.20	.75	.20	1.32	.09	.02
IN.	3.05	1.01	.35	.15	.07	1.73	2.45	.87	.22	1.52	.10	.02

CAL YR 1968 TOTAL 39,820.70 MEAN 109 MAX 722 MIN 0 CFSM .82 IN 11.22
WTR YR 1969 TOTAL 40,957.76 MEAN 112 MAX 773 MIN .04 CFSM .85 IN 11.54

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., Blue Earth County, on left bank 0.2 mile downstream from abandoned powerplant of Northern States Power Co., 2 miles west of Rapidan, 3.5 miles downstream from Watonwan River, and 7.8 miles upstream from LeSueur River.

DRAINAGE AREA.--2,430 sq mi, approximately.

PERIOD OF RECORD.--July 1909 to November 1910 (no winter records), October 1939 to September 1945, July 1949 to current year. Published as "at Rapidan Mills" 1909-10.

GAGE.--Water-stage recorder. Datum of gage is 808.80 ft above mean sea level, adjustment of 1912. July 20, 1909, to Apr. 28, 1910, nonrecording gage at site 0.2 mile upstream at different datum. Apr. 29 to Nov. 12, 1910, nonrecording gage at site 800 ft upstream at different datum. Oct. 4 to Nov. 14, 1939, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--26 years (1939-45, 1949-69), 839 cfs (4.68 inches per year, 607,900 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 21,100 cfs Apr. 10 (gage height, 13.54 ft); minimum, 105 cfs Sept. 28 (gage height, 1.60 ft).
Period of record: 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 periods, 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.

REVISIONS (WATER YEARS).--WSP 895: Drainage area. WSP 1508: 1910.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2,710	3,720	1,160	470	254	250	7,720	3,090	1,490	4,660	1,630	155
2	2,750	3,410	1,170	470	254	255	7,600	2,880	1,470	4,900	1,460	218
3	2,450	3,140	1,160	460	254	255	7,950	2,730	1,420	5,220	1,300	254
4	2,180	2,940	1,170	450	254	255	8,980	2,590	1,320	5,820	1,160	253
5	1,940	2,780	900	440	254	260	10,900	2,480	1,230	5,700	1,030	238
6	1,800	2,640	650	430	254	260	12,600	2,470	1,160	5,210	926	212
7	1,730	2,500	594	420	252	260	14,500	2,480	1,100	4,760	844	197
8	1,860	2,370	613	410	252	260	17,000	2,500	1,040	4,160	737	189
9	2,210	2,270	720	400	252	260	20,100	2,410	979	3,830	669	182
10	2,880	2,170	850	390	252	260	20,900	2,310	925	3,920	605	173
11	3,600	2,080	870	370	252	260	19,700	2,320	935	4,280	549	166
12	3,950	1,970	860	340	250	265	16,600	2,420	951	4,740	493	159
13	3,950	1,870	800	325	250	270	13,700	2,380	1,020	4,960	441	153
14	3,600	1,790	680	320	250	290	11,500	2,230	1,210	4,770	405	146
15	3,160	1,730	660	315	250	300	10,200	2,010	1,430	4,120	372	140
16	2,970	1,670	680	315	250	310	9,310	1,870	1,350	3,340	343	136
17	3,840	1,620	690	315	250	320	8,770	1,830	1,260	2,890	316	132
18	6,040	1,590	690	310	250	330	8,410	2,190	1,180	2,890	254	130
19	8,330	1,550	690	310	250	350	7,880	2,750	1,110	2,940	298	126
20	10,900	1,470	685	305	250	400	7,180	2,800	1,040	2,960	255	123
21	12,000	1,390	685	300	250	500	6,400	2,640	970	3,140	256	120
22	11,800	1,420	680	300	250	800	5,620	2,510	907	2,990	250	117
23	10,700	1,400	670	290	250	1,600	4,950	2,510	887	2,560	255	116
24	9,520	1,380	660	285	250	3,020	4,410	2,600	901	2,170	271	114
25	8,490	1,360	650	280	249	4,320	3,970	2,520	1,370	2,450	256	114
26	7,500	1,330	580	265	250	5,210	3,620	2,330	2,700	2,710	243	113
27	6,580	1,300	520	260	250	6,980	3,430	2,160	3,740	2,650	224	111
28	5,750	1,280	490	258	250	9,300	3,430	1,990	4,000	2,560	212	110
29	5,040	1,240	480	256	-----	9,190	3,460	1,840	4,460	2,350	155	108
30	4,490	1,200	480	256	-----	8,670	3,300	1,710	4,550	2,100	155	109
31	4,060	-----	480	254	-----	7,930	-----	1,580	-----	1,850	269	-----
TOTAL	158,760	58,580	22,667	10,569	7,033	63,190	284,090	73,130	48,105	113,560	14,841	4,654
MEAN	5,121	1,953	731	341	251	2,038	9,470	2,359	1,604	3,664	543	155
MAX	12,000	3,720	1,170	470	254	9,300	20,900	3,090	4,550	5,820	1,630	254
*IN	1,730	1,200	480	254	249	250	3,300	1,580	887	1,850	155	108
CFSM	2.11	.80	.30	.14	.10	.84	3.90	.97	.66	1.51	.22	.06
IN.	2.43	.90	.35	.16	.11	.97	4.35	1.12	.74	1.74	.26	.07
AC-FT	314,900	116,200	44,960	20,960	13,950	125,300	563,500	145,100	95,410	225,300	33,460	9,230
CAL YR 1968	TOTAL 379,843			MEAN 1,038	MAX 12,000	MIN 14	CFSM .43	IN 5.61	AC-FT 753,400			
WTR YR 1969:	TOTAL 861,209			MEAN 2,359	MAX 20,900	MIN 108	CFSM .97	IN 13.18	AC-FT 1,708,000			

MINNESOTA RIVER BASIN

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., Blue Earth County 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.

PERIOD OF RECORD.--October 1939 to September 1945, July 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 775.76 ft above mean sea level, datum of 1929. Prior to Nov. 15, 1939, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--26 years, 416 cfs (5.13 inches per year, 301,400 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 10,900 cfs Mar. 27 (gage height, 12.75 ft); minimum, 17 cfs Sept. 22 (gage height, 1.32 ft).

Period of record: 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, 1.32 ft Sept. 22, 1969.

REMARKS.--Records good except those for winter periods, which are fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

OAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,960	1,620	422	280	190	140	4,180	1,030	438	2,020	206	52
2	1,870	1,510	433	270	190	140	4,410	996	400	2,280	189	50
3	1,700	1,410	433	270	190	140	5,310	984	360	2,180	186	60
4	1,570	1,320	433	260	190	140	6,940	990	323	2,020	169	60
5	1,460	1,250	360	250	188	140	7,630	990	297	1,740	135	54
6	1,420	1,180	172	250	188	140	7,410	1,060	265	1,450	130	52
7	1,430	1,120	177	240	185	140	6,460	1,060	244	1,220	126	50
8	1,430	1,060	190	230	180	140	5,760	1,070	234	1,060	112	43
9	2,200	1,010	222	230	180	140	5,510	1,060	215	953	112	40
10	3,030	972	280	220	180	140	5,470	1,040	200	884	121	39
11	3,120	924	269	216	180	140	5,170	996	209	868	110	36
12	3,230	876	250	210	175	139	4,560	954	218	805	98	34
13	3,070	828	230	210	170	139	3,860	930	237	720	89	32
14	2,740	792	250	210	165	139	3,250	882	301	635	83	30
15	2,470	768	280	210	162	139	3,230	810	346	540	77	27
16	2,420	738	310	208	160	139	3,320	762	328	471	67	27
17	4,130	726	323	205	160	139	3,280	774	293	410	63	24
18	6,450	714	350	202	160	139	2,960	882	265	385	61	22
19	9,200	690	360	200	159	160	2,680	1,230	244	365	63	21
20	9,750	612	350	200	157	200	2,410	1,340	218	385	65	20
21	7,670	588	340	200	157	500	2,140	1,290	203	333	65	18
22	5,850	612	330	198	155	1,050	1,920	1,210	192	287	61	18
23	4,630	600	320	195	155	2,000	1,730	1,120	192	281	60	19
24	3,660	588	310	192	150	5,180	1,560	1,040	192	266	56	19
25	3,030	558	305	192	147	8,840	1,420	984	258	257	50	21
26	2,640	546	300	190	142	10,400	1,300	900	540	272	48	22
27	2,390	534	300	190	142	10,700	1,280	816	708	266	43	22
28	2,190	499	280	190	140	10,300	1,250	732	678	263	37	20
29	2,000	482	280	190	-----	7,590	1,170	648	978	266	36	19
30	1,850	433	280	190	-----	6,100	1,090	564	1,510	255	32	18
31	1,730	-----	280	190	-----	5,640	-----	488	-----	229	50	-----
TOTAL	102,290	25,565	9,419	6,688	4,697	71,173	108,660	29,632	11,086	24,366	2,800	969
MEAN	3,300	852	304	216	168	2,296	3,622	956	370	786	90.3	32.3
MAX	9,750	1,620	433	280	190	10,700	7,630	1,340	1,510	2,280	206	60
MIN	1,420	438	172	190	140	139	1,090	488	192	229	32	18
CFSM	3.00	.77	.28	.20	.15	2.09	3.29	.87	.34	.71	.08	.03
IN.	3.46	.86	.32	.23	.16	2.41	3.67	1.00	.37	.82	.09	.03
AC-FT	202,900	50,710	18,680	13,270	9,320	141,200	215,500	58,780	21,990	48,330	5,550	1,920
CAL YR 1968	TOTAL 361,692.8		MEAN 988		MAX 10,000	MIN 6.4	CFSM .90	IN 12.23	AC-FT 717,400			
WTR YR 1969:	TOTAL 397,345		MEAN 1,089		MAX 10,700	MIN 18	CFSM .99	IN 13.43	AC-FT 788,100			

PEAK DISCHARGE (BASE, 1,300 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-12	1200	7.30	3,560	4-5	0500	10.56	7,680
10-19	2100	13.36	10,600	5-20	0900	4.62	1,350
3-27	1300	12.75	10,900	7-2	0900	5.87	2,300

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, 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.

PERIOD OF RECORD.--May 1903 to current year (no winter records 1904, 1906-10, 1918-29). Monthly discharge only for some periods, published in WSP 1308. Published as "near Mankato" 1903-21.

GAGE.--Water-stage recorder. Datum of gage is 747.92 ft above mean sea level, datum of 1929. Prior to Oct. 19, 1921, nonrecording gage, at site 1.8 miles upstream at datum 6.4 ft higher. Mar. 15, 1922, to Nov. 30, 1924, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--48 years (1905, 1910-17, 1929-69), 2,623 cfs (2.39 inches per year, 1,900,000 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 76,700 cfs Apr. 12 (gage height, 29.09 ft); minimum observed, Sept. 28 (gage height, 2.48 ft).
Period of record: 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 periods, which are fair. Records of water temperatures and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 875: 1917. WSP 955: Drainage area. WSP 1085: 1929. WSP 1238: 1903, 1908, 1919. WSP 1508: 1916 (M), 1918 (M), 1926 (M), 1928, 1930, 1932 (M), 1938 (M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6,200	9,690	3,390	1,320	915	1,120	15,200	19,400	8,370	10,500	3,610	657
2	6,180	8,700	3,360	1,280	915	1,120	15,800	18,700	8,220	11,100	3,350	695
3	5,690	7,960	3,320	1,220	915	1,110	17,200	18,100	8,040	11,360	3,100	730
4	5,100	7,400	3,280	1,180	915	1,130	20,800	17,300	7,800	11,600	2,850	742
5	4,690	7,020	3,200	1,120	915	1,120	25,800	16,500	7,560	11,800	2,620	752
6	4,460	6,710	2,530	1,100	915	1,120	30,800	16,100	7,310	11,400	2,420	726
7	4,270	6,310	3,000	1,060	915	1,120	36,400	15,600	7,060	10,800	2,270	688
8	4,240	6,160	3,020	1,040	915	1,110	45,700	15,200	6,820	10,000	2,070	652
9	5,890	5,940	3,040	1,020	915	1,110	61,000	14,600	6,550	9,520	1,910	628
10	7,890	5,760	3,100	1,000	915	1,110	70,000	14,100	6,260	9,470	1,760	596
11	9,180	5,570	3,120	980	915	1,100	74,200	13,600	6,120	9,750	1,650	569
12	9,940	5,370	2,800	960	915	1,100	76,200	13,300	5,930	10,100	1,510	547
13	9,560	5,160	2,300	940	915	1,100	75,400	13,000	5,680	10,200	1,420	525
14	8,650	5,000	2,000	920	920	1,100	73,000	12,600	5,530	9,640	1,370	500
15	7,680	4,840	1,980	915	920	1,110	74,400	12,100	5,600	8,620	1,260	484
16	7,650	4,670	2,000	915	920	1,110	75,500	11,700	5,410	7,440	1,210	480
17	12,500	4,570	2,050	915	920	1,120	72,700	11,500	5,180	6,580	1,150	459
18	18,400	4,530	2,100	915	920	1,180	67,100	11,400	4,970	6,240	1,120	429
19	25,800	4,450	1,980	915	920	1,340	60,600	11,900	4,780	6,260	1,100	427
20	35,200	4,240	1,840	915	930	1,970	53,900	12,000	4,610	6,820	1,060	413
21	39,200	4,050	1,800	915	950	3,110	48,200	11,500	4,430	7,090	1,070	400
22	37,900	3,970	1,780	915	980	4,630	42,400	11,000	4,270	6,740	1,030	404
23	33,400	4,000	1,740	915	1,000	6,400	36,600	10,500	4,190	6,040	1,060	414
24	28,300	3,980	1,700	915	1,020	9,800	32,100	10,300	4,170	5,360	972	397
25	23,800	3,960	1,620	915	1,050	14,400	28,200	10,000	4,910	5,170	921	401
26	20,400	3,950	1,560	915	1,080	17,900	25,600	9,630	7,040	5,480	879	388
27	17,900	3,870	1,520	915	1,100	20,800	24,100	9,300	8,440	5,270	825	389
28	15,700	3,810	1,500	915	1,120	24,000	22,700	9,050	8,670	5,040	777	379
29	13,800	3,690	1,480	915	-----	21,900	21,500	8,910	9,160	4,720	730	389
30	12,300	3,500	1,460	915	-----	17,700	20,300	8,740	10,200	4,360	691	368
31	10,800	-----	1,380	915	-----	16,400	-----	8,520	-----	4,000	761	-----
TOTAL	452,690	158,830	70,950	30,695	26,645	180,440	1,343,400	396,150	193,280	248,350	48,546	15,698
MEAN	14,600	5,294	2,289	990	952	5,821	44,780	12,780	6,443	8,011	1,566	523
MAX	39,200	9,690	3,390	1,320	1,120	24,000	76,200	19,400	10,200	11,800	3,630	752
MIN	4,240	3,500	1,380	915	915	1,100	15,200	8,520	4,170	4,000	651	379
CFSM	.98	.36	.15	.07	.06	.39	3.01	.86	.43	.54	.11	.04
IN.	1.13	.40	.18	.08	.07	.45	3.35	.99	.48	.62	.12	.04
AC-FT	897,900	315,000	140,700	60,880	52,850	357,900	2,665,000	785,800	383,400	492,600	56,260	21,140
CAL YR 1968	TOTAL 1,283,962	MEAN 3,508	MAX 39,200	MIN 87	CFSM .24	IN 3.20	AC-FT 2,547,000					
WTR YR 1969:	TOTAL 3,165,674	MEAN 8,673	MAX 76,200	MIN 379	CFSM .58	IN 7.90	AC-FT 6,279,000					

MINNESOTA RIVER BASIN

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, on left bank 1.5 miles northwest of Jordan and at mile 39.4 upstream from Mississippi River.

DRAINAGE AREA.--16,200 sq mi, approximately.

PERIOD OF RECORD.--September 1934 to current year. Prior to Oct. 1, 1966, published as "near Carver, Minn".

GAGE.--Water-stage recorder. Datum of gage is 690.00 ft above mean sea level, datum of 1929. Auxiliary water-stage recorder 2.8 miles downstream at same datum. Prior to Oct. 1, 1966, water-stage recorder 2.8 miles downstream with auxiliary chain gage at present site and same datum.

AVERAGE DISCHARGE.--35 years, 3,336 cfs (2.80 inches per year, 2,417,000 acre-ft).

EXTREMES.--Current year: Maximum discharge, 84,600 cfs Apr. 14 (gage height, 32.85 ft); minimum daily, 495 cfs Sept. 30; minimum gage height, 4.54 ft Sept. 30.

Period of record: 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 955: Drainage area. WSP 1508: 1935.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7,130	17,900	4,420	1,440	1,340	1,440	24,500	23,100	9,120	9,710	4,240	888
2	6,800	17,000	4,320	1,380	1,360	1,440	23,100	22,300	8,880	10,200	3,940	888
3	6,680	15,200	4,240	1,330	1,380	1,440	23,000	21,400	8,560	10,600	3,680	838
4	6,340	13,400	4,220	1,300	1,380	1,440	23,700	20,700	8,350	10,900	3,460	806
5	5,840	11,600	4,160	1,280	1,380	1,440	25,000	20,000	8,020	11,200	3,240	848
6	5,460	10,300	3,800	1,260	1,380	1,440	27,200	19,400	7,690	11,400	3,020	843
7	5,180	9,260	3,020	1,240	1,380	1,440	30,400	18,800	7,400	11,500	2,830	828
8	4,980	8,610	2,850	1,220	1,380	1,440	33,600	18,400	7,110	11,400	2,670	806
9	5,180	8,110	2,800	1,210	1,380	1,440	38,300	17,800	6,790	11,000	2,480	774
10	6,930	7,690	2,940	1,200	1,380	1,440	48,300	17,300	6,530	10,300	2,330	738
11	8,890	7,280	3,310	1,190	1,380	1,440	64,000	16,900	6,310	9,720	2,190	716
12	9,740	7,100	3,400	1,180	1,380	1,440	76,000	16,400	6,130	9,580	2,070	702
13	10,400	6,680	3,480	1,170	1,380	1,450	82,300	15,900	5,900	9,790	1,920	684
14	10,700	6,370	3,420	1,170	1,380	1,480	84,500	15,500	5,680	10,000	1,820	675
15	10,500	6,120	3,350	1,170	1,380	1,490	83,500	15,100	5,520	10,100	1,700	648
16	10,200	5,910	3,120	1,170	1,380	1,510	82,100	14,700	5,510	9,470	1,630	612
17	11,100	5,760	3,040	1,170	1,380	1,520	81,600	14,100	5,410	8,190	1,560	603
18	13,300	5,630	3,000	1,170	1,380	1,540	79,400	13,700	5,220	7,050	1,480	594
19	15,000	5,500	2,900	1,170	1,380	1,650	74,900	13,100	5,030	6,390	1,420	558
20	17,300	5,350	2,850	1,170	1,380	1,850	68,900	12,900	4,820	6,200	1,360	558
21	22,900	5,220	2,820	1,170	1,380	2,550	61,600	12,900	4,690	6,430	1,310	549
22	31,700	5,060	2,780	1,170	1,380	4,000	53,500	12,800	4,550	6,770	1,280	549
23	36,400	4,960	2,660	1,180	1,400	6,330	46,300	12,700	4,490	6,620	1,250	531
24	37,200	4,920	2,530	1,180	1,420	8,840	40,100	12,300	4,420	6,020	1,230	513
25	35,800	4,870	2,400	1,190	1,430	11,100	35,200	11,700	4,640	5,440	1,210	531
26	33,200	4,840	2,250	1,200	1,440	12,800	31,200	11,300	5,690	5,080	1,150	531
27	30,200	4,790	2,050	1,220	1,440	14,400	28,600	10,800	7,330	5,310	1,100	521
28	27,000	4,710	1,850	1,250	1,440	16,400	26,500	10,400	8,290	5,240	1,060	513
29	24,000	4,630	1,660	1,280	-----	19,800	25,000	10,200	8,730	5,040	998	504
30	21,500	4,510	1,580	1,300	-----	23,400	23,900	9,860	8,960	4,790	948	495
31	19,300	-----	1,500	1,330	-----	25,000	-----	9,560	-----	4,620	908	-----
TOTAL	496,850	229,280	92,720	38,060	38,870	174,390	1,446,2M	472,020	195,770	256,060	61,484	19,844
MEAN	16,030	7,643	2,991	1,228	1,388	5,625	48,210	15,230	6,526	8,260	1,983	661
MAX	37,200	17,900	4,420	1,440	1,440	25,000	84,500	23,100	9,120	11,500	4,240	888
MIN	4,980	4,510	1,500	1,170	1,340	1,440	23,000	9,560	4,420	4,620	908	495
CFSM	.99	.47	.18	.08	.09	.35	2.98	.94	.40	.51	.12	.04
IN.	1.14	.53	.21	.09	.10	.40	3.32	1.08	.45	.59	.14	.05
AC-FT	985,500	454,800	183,900	75,490	77,100	345,900	2,869M	936,300	388,300	507,900	122,000	39,360
CAL YR 1968	TOTAL 1,539,292			MEAN 4,217	MAX 37,200	MIN 185	CFSM .26	IN 3.53	AC-FT 3,053,000			
WTR YR 1969	TOTAL 3,521,548			MEAN 9,648	MAX 84,500	MIN 495	CFSM .60	IN 8.08	AC-FT 6,985,000			

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., Hennepin County, 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 current year.

GAGE.--Water-stage recorder. Altitude of gage is 731 ft (from topographic map). Prior to May 16, 1963, non-recording gage 30 ft upstream at datum 0.81 ft higher.

AVERAGE DISCHARGE.--6 years, 18.0 cfs (13,040 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 181 cfs Oct. 17 (gage height, 3.17 ft); minimum discharge, 3.0 cfs Jan. 23, 24 (gage height, 1.40 ft).
Period of record: 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 periods, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	30	17	7.3	6.0	9.0	41	26	9.4	16	9.8	5.2
2	11	27	18	7.4	6.1	9.0	40	27	10	13	9.5	5.0
3	10	25	19	7.5	6.4	9.0	44	21	11	12	6.7	5.0
4	9.6	25	19	7.5	6.7	9.0	45	19	9.1	10	11	5.2
5	11	26	15	7.5	6.9	9.0	44	26	8.9	7.1	8.8	5.6
6	15	25	17	7.5	7.3	8.7	41	33	8.7	6.1	13	5.3
7	16	24	16	7.6	7.5	8.3	38	27	8.9	8.8	17	4.9
8	19	20	15	7.6	7.7	8.0	41	26	9.1	27	17	4.9
9	65	17	11	7.6	7.8	7.7	43	25	8.1	33	13	5.0
10	68	17	9.0	7.6	7.9	7.5	42	21	7.1	27	9.3	5.0
11	64	15	8.7	7.4	7.9	7.5	39	18	8.1	16	7.4	4.9
12	63	15	8.6	7.1	8.0	7.5	34	17	9.2	12	6.5	5.0
13	57	15	8.5	6.0	8.1	7.5	29	17	6.8	46	6.5	5.2
14	46	15	8.4	5.7	8.2	7.5	28	16	6.9	49	6.4	5.0
15	35	15	8.3	6.4	8.3	7.5	34	15	9.0	56	6.0	4.7
16	60	15	8.1	6.2	8.3	8.0	35	17	8.8	67	5.8	4.6
17	112	18	8.0	5.8	8.3	30	30	16	7.2	65	5.6	4.8
18	104	18	7.9	5.6	8.3	28	25	13	8.9	61	5.4	4.8
19	107	18	7.8	5.6	8.4	42	21	16	13	54	5.2	4.8
20	109	16	7.7	5.5	8.4	63	20	16	11	43	5.4	4.9
21	103	16	7.7	5.4	8.5	62	22	17	9.1	29	5.3	4.5
22	92	16	7.7	5.8	8.6	82	19	18	17	19	5.3	5.4
23	77	17	7.6	5.6	8.7	100	17	17	18	13	5.3	5.1
24	61	17	7.6	5.6	8.8	96	16	19	20	9.9	5.2	6.0
25	48	16	7.7	5.7	9.0	85	15	17	38	11	4.9	6.0
26	40	17	7.8	5.8	9.0	70	15	13	36	8.0	5.1	5.1
27	38	18	7.7	5.8	9.0	60	32	12	38	6.3	5.6	5.1
28	37	17	7.6	5.8	9.0	55	36	12	33	5.2	5.5	4.6
29	35	16	7.4	5.8	-----	50	30	11	29	5.1	5.2	4.7
30	34	15	7.3	5.8	-----	47	22	9.0	22	6.2	7.0	4.6
31	32	-----	7.2	5.9	-----	44	-----	8.6	-----	9.0	5.3	-----
TOTAL	1,589.6	561	321.3	199.4	223.1	1,044.7	938	565.6	439.3	750.7	235.0	150.9
MEAN	51.3	18.7	10.4	6.43	7.97	33.7	31.3	18.2	14.6	24.2	7.58	5.03
MAX	112	30	19	7.6	9.0	100	45	33	38	67	17	6.0
MIN	9.6	15	7.2	5.4	6.0	7.5	15	8.6	6.8	5.1	4.5	4.5
AC-FT	3,150	1,110	637	396	443	2,070	1,860	1,120	871	1,490	466	299

CAL YR 1968 TOTAL 8,296.4
WTR YR 1969 TOTAL 7,018.6

MEAN 22.7
MEAN 19.2

MAX 123
MAX 112

MIN 1.7
MIN 4.5

AC-FT 16,460
AC-FT 13,920

5-3310. Mississippi River at St. Paul, Minn.

LOCATION.--Lat 44°56'40", long 93°05'20", in SE 1/4 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.

PERIOD OF RECORD.--Water years 1867-69, 1872-92 (annual maximum), March 1892 to current year (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, nonrecording 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, nonrecording gage, at present site and datum. Since September 1938, auxiliary water-stage recorder 5.4 miles downstream.

AVERAGE DISCHARGE (ADJUSTED FOR DIVERSION).--70 years (1894-95, 1896-97, 1900-1969), 10,080 cfs (3.78 inches per year).

EXTREMES.--Current year: Maximum discharge, 156,000 cfs Apr. 15 (gage height, 24.52 ft, from floodmark): minimum daily, 2,650 cfs Oct. 13.

Period of record (1867-69, 1872-1969): Maximum discharge, 171,000 cfs Apr. 16, 1965 (gage height, 26.01 ft, from floodmark).

Period of record (1897, 1917-69): 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 analyses for the water year 1969 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15,800	42,600	13,200	7,440	7,100	8,410	32,300	65,400	22,700	18,600	10,500	3,600
2	14,800	38,800	12,900	7,460	6,780	8,570	32,900	63,300	21,700	16,500	9,360	3,540
3	14,500	35,500	12,400	7,290	6,770	8,490	34,300	61,400	21,600	16,800	9,120	3,550
4	14,100	32,700	13,300	8,540	7,050	8,700	37,000	59,600	20,200	17,100	9,180	3,820
5	13,400	30,000	12,700	7,530	7,030	8,660	39,700	58,000	18,700	17,700	9,110	3,670
6	12,900	27,400	9,690	7,320	7,460	8,690	45,000	56,500	18,800	18,500	9,130	3,580
7	11,800	24,800	7,590	7,290	7,270	9,030	49,700	55,000	18,400	18,200	8,890	3,740
8	12,300	22,600	7,030	7,260	7,160	8,650	57,200	53,400	17,800	19,400	7,810	4,000
9	13,700	21,200	6,860	7,160	7,160	8,470	68,200	52,200	17,400	18,700	7,650	4,440
10	14,800	20,200	7,400	7,120	7,470	8,870	82,100	50,600	16,900	18,200	7,100	3,280
11	17,700	19,800	8,830	6,910	8,000	8,470	99,400	48,900	15,700	17,300	6,920	3,530
12	19,300	19,000	10,900	6,860	7,640	8,790	119,000	47,100	15,700	16,700	6,110	3,470
13	19,200	18,300	10,700	6,900	7,620	8,940	137,000	45,100	14,900	16,600	5,930	2,650
14	19,400	17,900	8,530	6,740	7,340	8,960	148,000	43,600	14,600	16,700	5,940	2,790
15	20,100	17,200	8,150	7,000	7,390	8,640	154,000	42,000	14,400	17,500	5,830	3,110
16	21,700	16,800	7,580	6,950	7,890	8,820	153,000	40,000	13,500	17,200	5,660	2,860
17	23,800	16,400	8,020	7,020	7,590	9,160	148,000	38,400	13,000	15,700	5,330	2,870
18	25,500	16,200	8,930	7,170	7,840	9,170	144,000	36,900	12,500	14,200	4,600	2,690
19	28,000	15,800	9,120	7,430	7,870	9,700	138,000	35,700	11,800	13,000	5,050	3,130
20	31,700	15,600	8,900	6,910	7,230	10,000	131,000	34,600	11,600	12,500	5,560	2,850
21	35,800	15,000	8,950	6,910	6,690	10,200	122,000	33,900	11,500	12,200	4,730	2,910
22	39,400	14,700	8,880	7,060	7,000	11,500	113,000	33,600	11,600	12,600	4,530	3,070
23	44,200	14,700	8,480	7,090	6,850	14,100	104,000	32,900	10,200	12,500	3,870	3,320
24	50,600	14,800	8,280	6,870	7,130	17,400	96,500	31,500	10,300	12,100	4,380	4,100
25	54,700	15,000	8,100	6,940	7,900	21,000	89,400	30,400	12,200	11,600	4,480	4,230
26	58,100	14,900	8,040	7,030	8,340	23,500	83,300	29,500	11,600	10,900	4,200	3,100
27	58,200	14,700	7,760	6,880	7,840	25,800	78,200	28,700	13,300	10,800	3,810	3,050
28	56,300	14,200	8,620	6,790	8,190	27,400	73,500	27,400	14,600	11,400	3,740	3,350
29	53,600	13,800	8,820	7,230	-----	28,500	70,600	26,100	16,400	11,000	3,740	3,550
30	50,200	12,600	7,990	7,190	-----	30,100	67,900	25,300	15,500	10,400	3,470	3,210
31	46,400	-----	7,660	7,220	-----	31,200	-----	23,700	-----	10,000	3,540	-----
TOTAL	912,000	613,200	284,310	221,510	207,600	417,890	2,748.2M	1,310.7M	459,100	462,600	189,270	101,060
MEAN	29,420	20,440	9,171	7,145	7,414	13,480	91,610	42,280	15,300	14,920	6,105	3,369
MAX	58,200	42,600	13,300	8,540	8,340	31,200	154,000	65,400	22,700	19,400	10,500	4,440
MIN	11,800	12,600	6,860	6,740	6,690	8,410	32,300	23,700	10,200	10,000	3,470	2,650
(#)	+398	+322	+308	+299	+307	+365	+356	+376	+376	+385	+377	+346
MEAN #	29,818	20,762	9,479	7,444	7,721	13,845	91,966	42,656	15,676	15,305	6,582	3,715
CFSM #	0.81	0.56	0.26	0.20	0.21	0.38	2.50	1.16	0.43	0.42	0.18	0.10
IN. #	0.93	0.65	0.30	0.23	0.24	0.44	2.88	1.34	0.48	0.48	0.21	0.11
CAL YR 1968 TOTAL	4,443,080			MEAN 12,140		MAX 58,200	MIN 1,750	MEAN # 12,480	CFSM # 0.34	IN. # 4.62		
WAT YR 1969 TOTAL	7,927,440			MEAN 21,720		MAX 154,000	MIN 2,650	MEAN # 22,072	CFSM # 0.60	IN. # 8.29		

Diversion, equivalent in cubic feet per second, through sewage disposal plant.

Adjusted for diversion.

M Expressed in thousands.

NOTE.--Stage-fall-discharge relation indefinite July 20 to Sept. 30.

ST. CROIX RIVER BASIN

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5-3362. Glaisby Brook near Kettle River, Minn.

LOCATION---Lat 46°27'19", long 92°51'34", in SE 1/4 sec. 22, T.46 N., R.20 W., Carlton County, 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.

DRAINAGE AREA---24.2 sq mi.

PERIOD OF RECORD---October 1959 to current year.

GAGE---Water-stage recorder. Altitude of gage is 1,105 ft (from topographic map).

AVERAGE DISCHARGE---10 years, 20.4 cfs (11.45 inches per year).

EXTREMES---Current year: Maximum discharge, 614 cfs Apr. 13 (gage height, 7.21 ft); minimum, 0.2 cfs Aug. 19-25, Sept. 21, 22.

Period of record: Maximum discharge, 813 cfs Apr. 18, 1965 (gage height, 8.42 ft); minimum, 0.1 cfs at times in 1961, 1963, 1964, 1968.

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

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	22	4.5	2.1	2.7	2.7	16	88	2.0	8.2	36	.40
2	18	20	4.3	2.1	2.8	2.7	15	89	2.2	8.2	28	.40
3	18	18	4.2	2.1	3.1	2.8	17	82	2.2	8.6	15	.40
4	16	17	4.2	2.1	3.3	2.8	24	70	6.2	7.6	9.0	.50
5	14	16	4.0	2.1	3.3	2.9	31	56	14	6.0	6.0	1.0
6	21	15	3.8	2.1	3.3	3.0	50	50	16	5.0	4.3	.50
7	25	14	3.4	2.1	3.3	3.1	104	43	13	4.0	3.3	.50
8	25	13	3.1	2.0	3.3	3.3	173	37	9.3	4.8	2.2	.50
9	72	12	3.0	2.0	3.2	3.4	221	31	6.6	5.0	1.6	.50
10	165	11	3.0	2.0	3.1	3.5	248	26	5.0	4.8	1.3	.60
11	178	10	2.9	2.0	3.1	3.5	152	22	4.0	2.6	1.3	.60
12	120	9.0	2.8	2.0	3.0	3.5	391	19	3.8	1.8	1.2	.60
13	85	8.6	2.7	2.0	3.0	3.5	590	16	3.0	1.5	1.0	.60
14	68	8.2	2.7	2.0	2.9	3.5	471	14	2.2	1.5	.80	.50
15	56	7.9	2.6	2.1	2.8	3.6	393	12	2.0	2.4	.60	.60
16	178	7.6	2.5	2.1	2.7	3.7	303	22	1.6	2.4	.60	.60
17	435	7.9	2.5	2.1	2.7	5.0	231	25	1.2	1.7	.50	.40
18	498	8.5	2.4	2.1	2.6	5.6	180	20	1.0	1.5	.40	.40
19	402	8.0	2.4	2.1	2.6	6.0	134	15	.80	1.5	.20	.40
20	286	7.2	2.3	2.1	2.6	6.2	102	12	.60	1.1	.20	.30
21	191	7.6	2.3	2.1	2.6	6.6	84	9.7	.70	.80	.20	.20
22	134	8.9	2.3	2.2	2.6	7.6	71	8.2	.70	.60	.20	.80
23	98	9.4	2.2	2.2	2.6	9.0	60	6.8	.70	.60	.20	.60
24	72	9.6	2.2	2.3	2.6	11	50	6.2	1.3	.50	.20	.60
25	59	9.3	2.2	2.3	2.6	12	41	5.0	4.5	.40	.20	.60
26	48	9.0	2.2	2.4	2.6	13	33	4.6	18	.60	.30	.50
27	41	7.2	2.2	2.4	2.6	14	72	4.0	23	2.1	.30	.40
28	35	6.0	2.2	2.5	2.7	16	124	3.3	18	2.4	.30	.30
29	30	5.4	2.2	2.5	-----	21	146	2.6	13	1.2	.40	.60
30	26	4.6	2.1	2.6	-----	17	116	2.0	10	1.4	.80	.60
31	24	-----	2.1	2.6	-----	16	-----	1.7	-----	21	.60	-----
TOTAL	3,457	317.9	87.5	67.4	80.3	217.5	4,643	803.1	186.60	111.80	117.20	15.50
MEAN	112	10.6	2.82	2.17	2.87	7.02	155	25.9	6.22	3.61	3.78	.52
MAX	498	22	4.5	2.6	3.3	21	590	89	23	21	36	1.0
MIN	14	4.6	2.1	2.0	2.6	2.7	15	1.7	.60	.40	.20	.20
CFSM	4.63	.44	.12	.090	.12	.29	6.41	1.07	.26	.15	.16	.022
IN.	5.31	.49	.13	.10	.12	.33	7.14	1.23	.29	.17	.18	.02

CAL YR 1968 TOTAL 11,635.90 MEAN 31.9 MAX 498 MIN .10 CFSM 1.32 IN 17.89
 WAT YR 1969 TOTAL 10,104.80 MEAN 27.7 MAX 590 MIN .20 CFSM 1.14 IN 15.53

ST. CROIX RIVER BASIN

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.

PERIOD OF RECORD.--October 1967 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 930 ft (from topographic map).

EXTREMES.--Current year: Maximum discharge 11,300 cfs Apr. 14 (gage height, 11.84 ft); minimum, 107 cfs Sept. 4, 5, 20, 21, 22 (gage height, 3.92 ft).

Period of record: Maximum discharge, 11,300 cfs Apr. 14, 1969 (gage height, 11.84 ft); minimum daily, 99 cfs Feb. 19 to Mar. 1, 1968.

Flood in April 1965 reached a stage of 12.96 ft, from floodmark (discharge, 13,400 cfs).

REMARKS.--Records fair. Records of chemical analyses for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	560	997	335	237	274	241	400	3,293	306	277	435	142
2	502	933	330	237	278	241	502	3,120	321	259	515	130
3	459	845	328	237	280	241	502	3,000	331	241	515	125
4	429	792	295	237	285	232	619	2,540	331	241	471	112
5	396	733	265	237	288	241	808	2,240	424	237	424	107
6	396	660	265	236	292	237	1,260	2,200	477	224	379	112
7	465	639	255	236	298	246	2,610	2,020	471	212	326	122
8	515	606	252	236	303	237	5,170	1,740	435	212	282	125
9	901	567	250	236	306	232	6,600	1,500	390	216	255	125
10	2,730	528	248	236	309	237	7,830	1,320	358	216	237	125
11	3,070	489	246	236	310	220	9,790	1,160	342	212	212	125
12	2,510	459	244	238	311	220	10,700	1,040	326	192	196	122
13	2,120	429	242	239	312	220	11,000	941	306	182	185	120
14	1,830	429	241	239	314	220	11,000	861	292	175	164	117
15	1,610	401	241	240	311	220	9,990	800	277	212	157	117
16	2,300	401	240	241	302	225	8,900	830	264	224	148	115
17	6,240	401	240	242	293	237	7,630	933	232	220	142	112
18	8,920	401	240	243	280	246	6,310	893	228	216	136	112
19	9,070	379	240	245	270	255	5,150	800	237	189	130	112
20	7,680	374	240	246	260	264	4,190	718	237	192	125	110
21	6,000	370	240	247	250	259	3,400	639	228	185	122	107
22	4,680	370	239	248	241	282	2,920	586	224	178	120	127
23	3,750	380	239	250	237	331	2,510	547	220	175	120	145
24	3,270	385	239	251	237	363	2,170	508	220	175	117	148
25	2,650	380	239	253	241	379	1,830	465	250	175	107	148
26	2,160	360	238	257	241	396	1,580	435	306	168	110	148
27	1,790	345	238	260	241	453	2,060	424	363	189	115	145
28	1,550	340	238	262	241	489	4,060	407	347	232	115	142
29	1,360	340	238	264	-----	420	4,270	374	326	237	112	151
30	1,210	340	238	267	-----	400	3,820	337	302	224	125	161
31	1,080	-----	237	270	-----	360	-----	311	-----	246	145	-----
TOTAL	82,203	15,073	7,860	7,603	7,805	8,844	139,581	36,979	9,371	6,533	6,742	3,809
MEAN	2,652	502	254	245	279	285	4,653	1,193	312	211	217	127
MAX	9,070	997	335	270	314	489	11,000	3,290	477	277	515	161
MIN	396	340	237	236	237	220	400	311	220	168	107	107
CAL YR 1968	TOTAL 323,899		MEAN 885		MAX 9,070	MIN 99						
WTR YR 1969	TOTAL 332,403		MEAN 911		MAX 11,000	MIN 107						

ST. CROIX RIVER BASIN

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5-3385. Snake River near Pine City, Minn.

LOCATION.--Lat 45°50'30", long 92°56'00", in SE 1/4 sec. 26, T.39 N., R.21 W., Pine County, on left bank at site of former powerplant and dam, 0.5 mile downstream from Cross Lake and 1.5 miles northeast of Pine City.

DRAINAGE AREA.--958 sq mi.

RECORDS AVAILABLE.--June 1913 to September 1917, July 1951 to current year.

GAGE.--Water-stage recorder. Datum of gage is 919.00 ft above mean sea level, datum of 1929. June 25, 1913, to Sept. 30, 1917, nonrecording gage at site 500 ft downstream at different datum. July 1 to Oct. 28, 1951 nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--22 years, 576 cfs (8.17 inches per year).

EXTREMES.--Current year: Maximum discharge, 10,200 cfs Apr. 12 (gage height, 9.08 ft); minimum, 49 cfs Sept. 22 (gage height, 2.86 ft).

Period of record: 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 periods, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,460	1,800	383	290	290	341	607	3,880	378	253	196	146
2	1,230	1,500	392	290	290	343	646	4,260	341	236	183	134
3	1,030	1,250	389	290	290	348	682	4,200	313	214	173	115
4	815	1,070	387	290	292	348	816	3,890	327	219	162	103
5	670	913	355	290	292	348	1,100	3,510	341	195	193	112
6	625	822	327	290	292	348	1,770	3,090	334	171	215	112
7	565	731	313	290	292	348	3,110	2,700	320	163	253	98
8	564	663	307	290	292	348	5,190	2,380	313	203	206	83
9	828	600	313	288	294	348	7,090	2,090	313	246	174	78
10	1,270	559	313	288	294	348	8,600	1,810	292	247	161	73
11	1,790	526	313	288	294	350	9,580	1,550	313	234	144	72
12	2,150	490	320	287	294	350	10,100	1,310	306	212	137	78
13	2,300	451	325	287	296	341	10,100	1,110	285	193	130	67
14	2,310	440	320	287	296	341	9,780	948	273	186	130	67
15	2,220	417	318	287	296	354	9,270	826	267	191	101	77
16	2,390	391	316	287	296	341	8,570	752	261	203	90	76
17	3,210	409	314	287	296	334	7,700	680	236	191	94	67
18	4,210	419	310	287	296	327	6,790	757	230	190	85	59
19	5,060	408	305	287	298	327	5,920	809	213	203	66	60
20	5,920	372	302	287	300	320	5,120	887	190	202	60	60
21	6,900	372	300	287	305	320	4,400	887	184	186	64	55
22	7,590	362	298	287	310	327	3,620	867	190	187	67	97
23	7,510	390	296	287	315	341	2,980	790	200	195	66	111
24	6,970	398	294	287	320	385	2,500	732	202	185	64	88
25	6,160	400	292	287	325	430	2,100	631	216	177	61	107
26	5,340	431	290	287	330	475	1,770	578	280	158	61	108
27	4,570	422	290	290	330	518	1,780	544	314	192	59	102
28	3,730	407	290	290	335	576	2,110	502	273	185	61	84
29	3,030	403	290	290	-----	590	2,640	446	257	183	58	110
30	2,500	378	290	290	-----	587	3,260	378	286	178	95	97
31	2,110	-----	290	290	-----	593	-----	355	-----	231	142	-----
TOTAL	97,027	18,194	9,842	8,939	8,450	11,995	139,701	48,149	8,248	6,209	3,751	2,696
MEAN	3,130	606	317	288	302	387	4,657	1,553	275	200	121	89.9
MAX	7,590	1,800	392	290	335	593	10,100	4,260	378	253	253	146
MIN	564	362	290	287	290	320	607	355	184	158	58	55
CFSM	3.27	.63	.33	.30	.32	.40	4.86	1.62	.29	.21	.13	.09
IN.	3.77	.71	.38	.35	.33	.47	5.42	1.87	.32	.24	.15	.10

CAL YR 1968 TOTAL 301,960

MEAN 825

MAX 7,590

MIN 52

CFSM .86

IN 11.72

WTR YR 1969 TOTAL 363,201

MEAN 995

MAX 10,100

MIN 55

CFSM 1.04

IN 14.10

ST. CROIX RIVER BASIN

5-3400.5 Sunrise River near Lindstrom, Minn.

LOCATION.--Lat 45 27'00", long 92 53'10", in SW 1/4 sec. 7, T.34 N., R.20 W., Chisago County, on left bank 20 ft downstream from highway bridge and 4.5 miles northwest of Lindstrom.

PERIOD OF RECORD.--July 1965 to current year. 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.--Current year: Maximum discharge, 704 cfs Apr. 11 (gage height, 7.28 ft); minimum, 5.7 cfs Sept. 22 (gage height, 2.03 ft).
Period of record: Maximum discharge, 704 cfs Apr. 11, 1969 (gage height, 7.28 ft); minimum 5.7 cfs Sept. 22, 1969 (gage height, 2.03 ft).

REMARKS.--Records good except those for periods of no gage-height record and those for winter period, 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	82	263	113	76	80	94	174	288	44	38	30	11
2	79	232	111	76	80	94	167	280	43	38	29	11
3	78	203	100	75	81	95	178	268	42	37	28	10
4	69	158	99	75	82	96	229	262	42	37	28	9.6
5	58	111	99	75	82	96	263	260	41	36	38	9.6
6	60	95	95	75	82	97	293	259	40	35	36	9.3
7	59	95	90	75	82	98	326	254	40	35	37	9.3
8	62	100	84	75	82	99	460	245	40	42	34	8.4
9	110	119	78	75	83	100	601	234	38	44	33	8.1
10	179	139	72	74	84	100	676	225	34	41	30	7.8
11	182	121	70	74	84	99	693	216	34	39	29	7.8
12	193	114	77	74	84	99	688	207	34	37	27	7.6
13	186	113	77	74	84	99	660	196	34	36	26	7.8
14	196	113	77	74	85	100	629	186	34	35	26	7.3
15	223	113	76	74	86	100	601	171	34	36	23	7.3
16	257	112	76	75	86	102	576	73	34	41	22	7.3
17	318	115	76	75	87	102	536	51	33	38	21	6.8
18	414	116	76	76	88	103	497	48	32	36	20	7.3
19	434	114	76	76	88	105	475	48	32	35	19	6.8
20	408	112	76	76	89	108	442	48	30	34	17	6.4
21	394	112	76	76	90	109	420	48	29	32	16	7.1
22	392	112	76	77	90	108	394	44	31	32	16	6.2
23	380	111	76	77	90	108	366	35	30	31	15	7.1
24	366	110	76	78	91	114	342	40	29	30	14	6.6
25	360	112	76	78	92	120	325	42	36	30	14	7.1
26	352	133	76	78	92	125	302	46	42	30	14	6.6
27	352	134	76	78	92	131	322	49	41	35	13	6.4
28	340	127	76	79	93	142	335	51	40	32	12	6.2
29	316	122	76	79	-----	177	323	49	39	31	12	7.6
30	298	117	76	80	-----	174	302	44	40	30	12	6.6
31	284	-----	76	80	-----	174	-----	44	-----	33	14	-----
TOTAL	7,481	3,848	2,534	2,359	2,409	3,468	12,595	4,311	1,092	1,096	705	234.0
MEAN	241	128	81.7	76.1	86.0	112	420	139	36.4	35.4	22.7	7.80
MAX	434	263	113	80	93	177	693	288	44	44	38	11
MIN	58	95	70	74	80	94	167	35	29	30	12	6.2
AC-FT	14,840	7,630	5,030	4,680	4,780	6,880	24,980	8,550	2,170	2,170	1,400	464

CAL YR 1968 TOTAL 34,397 MEAN 94.0 MAX 434 MIN 11 AC-FT 68,230
WAT YR 1969 TOTAL 42,132.0 MEAN 115 MAX 693 MIN 6.2 AC-FT 83,570

NOTE.--No gage-height record Dec. 14 to Jan. 13, Feb. 2 to Mar. 19.

5-3405. St. Croix River at St. Croix Falls, Wis.

LOCATION.--Lat 45°24'25", long 92°38'49", in NW¼ sec.30, T.34 N., R.18 W., Polk County, 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.

PERIOD OF RECORD.--January 1902 to current year. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Croix Falls."

GAGE.--Water-stage recorder. Datum of gage is 690.47 ft above mean sea level, adjustment of 1912. Prior to July 1905, gage heights and discharge measurements were used by Loweth and Wolff, consulting engineers of St. Paul, Minn., to determine the flow. July 1905 to February 1940, records were computed from power generation at the St. Croix Falls powerplant.

AVERAGE DISCHARGE.--67 years, 4,098 cfs (9.38 inches per year).

EXTREMES.--Current year: Maximum discharge, 41,600 cfs Apr. 13 (gage height, 19.19 ft); minimum daily, 1,400 cfs Aug. 27.

Period of record: Maximum discharge, 54,900 cfs May 8, 1950 (gage height, 25.19 ft); minimum daily, 75 cfs July 17, 1910.

REMARKS.--Records are good. Flow regulated by St. Croix Falls powerplant 1,800 ft upstream. Reservoir has a usable capacity of 221 million cu ft.

REVISIONS (WATER YEARS).--WSP 1115: 1929.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7,240	8,420	3,740	3,670	3,320	3,460	5,520	19,000	2,700	2,350	2,510	1,920
2	6,590	7,520	4,100	4,140	3,450	3,590	5,660	18,500	3,150	2,750	2,000	2,160
3	6,110	7,090	3,900	3,800	3,420	3,810	5,600	17,300	2,810	2,900	2,630	1,760
4	5,590	6,710	3,850	3,720	3,670	3,690	6,770	15,900	3,090	2,110	2,310	2,160
5	5,390	6,260	3,510	4,030	3,370	3,680	8,340	14,400	3,060	2,460	2,830	1,620
6	4,210	5,630	1,930	3,640	3,550	3,520	13,000	12,900	2,770	2,190	2,650	1,660
7	4,580	5,010	1,680	3,380	3,640	3,560	17,000	11,900	3,100	2,040	2,080	1,660
8	4,860	5,040	2,050	3,650	3,520	3,250	23,000	11,200	3,530	2,850	2,560	2,120
9	6,160	5,020	2,190	3,570	3,180	3,500	29,500	9,930	3,380	2,770	2,120	1,650
10	10,900	4,590	2,680	3,440	3,780	3,390	33,400	9,000	2,670	1,620	2,360	1,660
11	14,600	4,760	2,830	3,330	3,020	3,270	36,400	8,060	3,130	3,200	1,580	1,890
12	16,500	4,160	3,550	3,230	3,700	3,150	38,900	7,300	2,760	1,900	2,010	1,920
13	16,500	4,220	4,140	3,320	3,050	3,230	40,500	6,790	2,920	2,560	2,070	1,640
14	15,200	4,050	4,540	3,190	3,670	3,110	40,000	5,610	2,920	2,590	1,800	1,640
15	13,600	4,060	3,890	3,400	3,300	3,260	39,200	5,580	2,200	2,050	2,450	1,640
16	12,700	3,960	4,110	3,290	3,330	3,120	37,600	5,200	2,870	3,720	1,620	1,940
17	16,000	4,140	4,110	3,540	3,090	3,380	35,100	5,170	2,310	2,320	1,580	1,650
18	23,800	3,880	4,090	3,280	3,250	3,240	31,400	5,040	2,660	3,670	1,600	2,150
19	28,300	4,530	3,950	3,490	3,300	3,480	27,600	4,910	2,020	3,540	1,620	2,000
20	29,800	3,780	3,900	3,360	3,030	3,570	24,100	4,950	2,330	3,280	1,620	1,650
21	28,800	3,710	3,810	3,200	3,630	3,570	20,700	4,570	2,030	2,880	1,600	1,940
22	26,800	3,860	3,980	3,470	3,340	3,520	17,600	4,390	2,180	2,760	1,600	1,970
23	24,100	3,900	3,890	3,170	3,400	3,530	15,100	4,120	2,700	2,670	1,560	2,210
24	21,400	4,140	3,620	3,510	3,250	5,020	13,100	3,630	1,960	1,920	1,580	2,170
25	18,800	4,130	3,860	3,360	3,310	4,180	12,100	3,940	1,850	2,500	1,800	2,330
26	16,600	4,100	3,980	3,320	3,350	4,390	8,880	3,660	3,750	1,850	1,420	2,190
27	14,400	3,960	3,940	3,590	3,520	4,530	8,820	3,880	2,760	2,480	1,400	1,950
28	12,700	3,530	3,780	3,490	3,700	4,730	14,000	3,400	2,990	2,440	1,460	1,860
29	12,300	3,630	3,660	3,220	-----	4,580	17,200	3,130	2,850	2,070	1,560	1,870
30	9,650	3,410	3,820	3,740	-----	5,500	18,800	2,870	2,420	2,380	1,520	1,950
31	9,310	-----	3,960	3,460	-----	5,500	-----	3,470	-----	2,200	1,600	-----
TOTAL	442,490	141,200	111,040	108,000	95,140	117,310	644,890	239,700	81,870	79,020	59,100	56,930
MEAN	14,270	4,707	3,582	3,484	3,398	3,784	21,500	7,732	2,729	2,549	1,906	1,898
MAX	29,800	8,420	4,540	4,140	3,780	5,500	40,500	19,000	3,750	3,720	2,830	2,330
MIN	4,210	3,410	1,680	3,170	3,020	3,110	5,520	2,870	1,850	1,620	1,400	1,620
CFSM	2.41	.79	.60	.59	.57	.64	3.63	1.30	.46	.43	.32	.32
IN.	2.78	.89	.70	.68	.60	.74	4.04	1.50	.51	.50	.37	.36
CAL YR 1968	TOTAL 2,103,840		MEAN 5,748		MAX 29,800	MIN 1,180	CFSM .97	IN 13.19				
WTR YR 1969	TOTAL 2,176,690		MEAN 5,964		MAX 40,500	MIN 1,400	CFSM 1.01	IN 13.65				

MISSISSIPPI RIVER MAIN STEM

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., Pierce County, 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.

PERIOD OF RECORD.--June 1928 to current year.

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, nonrecording 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.--41 years, 15,660 cfs (4.75 inches per year).

EXTREMES.--Current year: Maximum discharge, 199,000 cfs Apr. 16 (gage height, 91.48 ft); minimum daily, 3,920 cfs Sept. 16; minimum gage height, 74.49 ft Mar. 17.
Period of record: 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.

REVISIONS (WATER YEARS).--WSP 1508: 1941.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	27,600	58,800	19,200	12,300	11,400	13,600	36,800	82,500	27,600	22,500	13,100	7,140
2	24,800	54,300	20,100	12,600	11,800	14,000	39,400	80,800	26,300	20,900	13,100	6,430
3	23,600	49,700	17,800	11,200	11,300	15,500	40,200	78,500	23,800	21,400	12,800	6,120
4	23,100	45,800	18,800	11,400	11,500	15,400	42,300	76,100	23,600	21,500	12,200	6,100
5	22,000	42,700	18,500	11,700	11,200	13,800	45,400	73,600	23,700	22,000	11,800	6,300
6	21,600	39,200	13,100	12,500	11,500	11,800	50,500	71,300	23,300	21,700	11,700	5,590
7	20,300	36,200	7,800	12,100	11,700	12,900	59,200	68,700	22,800	21,800	12,200	5,800
8	18,300	33,100	7,100	12,100	11,700	12,500	67,800	66,500	23,200	22,600	12,100	5,970
9	19,900	30,200	10,800	11,900	11,300	12,800	78,700	64,000	22,700	23,800	10,500	6,400
10	22,400	28,400	10,600	11,900	11,800	10,900	94,300	62,300	21,900	23,700	9,150	7,220
11	24,400	27,200	11,900	11,700	11,200	10,600	112,000	59,900	21,100	21,800	8,540	6,730
12	28,600	26,300	16,700	11,400	12,600	11,700	133,000	57,100	20,500	20,900	8,830	5,950
13	33,200	25,000	12,100	10,700	11,800	11,800	157,000	54,900	20,700	19,700	9,110	5,780
14	35,600	24,700	12,200	10,700	11,700	11,700	177,000	52,500	20,400	19,600	7,870	5,950
15	36,000	24,000	12,500	11,100	11,800	11,700	190,000	50,200	19,500	20,100	7,620	4,440
16	36,500	23,100	11,500	11,300	12,000	11,800	197,000	48,900	17,500	21,900	7,380	3,920
17	37,000	22,300	11,100	11,400	11,200	14,800	196,000	47,300	16,700	21,900	7,260	4,380
18	38,700	22,200	13,800	11,200	11,200	15,000	190,000	44,900	16,000	20,000	7,340	5,310
19	44,200	21,300	15,400	11,500	11,300	16,000	183,000	43,200	16,200	18,700	6,920	5,650
20	45,500	21,000	14,400	12,200	10,800	17,000	173,000	42,100	15,000	16,700	6,910	6,570
21	61,600	20,400	13,200	11,700	11,500	17,500	163,000	40,700	15,200	15,700	6,590	7,140
22	68,800	20,200	13,400	11,400	11,100	19,000	150,000	39,700	15,400	15,400	6,370	6,640
23	70,700	20,500	12,000	10,500	11,200	22,000	136,000	38,800	15,800	16,100	6,320	5,680
24	72,700	20,700	11,600	10,800	11,000	24,000	124,000	38,200	15,700	16,700	6,500	6,960
25	75,300	21,700	11,300	10,400	11,600	25,000	113,000	36,900	15,000	15,300	6,320	7,810
26	76,800	21,600	11,900	10,900	11,600	28,000	103,000	35,400	16,500	14,500	6,320	7,770
27	77,100	21,600	12,200	11,800	13,000	29,100	94,600	34,300	17,400	14,300	6,640	6,800
28	75,400	20,700	12,300	11,800	14,000	31,200	87,300	33,400	19,700	13,700	6,000	6,500
29	71,600	17,900	12,500	11,500	-----	31,900	84,600	32,200	21,700	13,200	5,930	5,080
30	68,500	17,600	13,200	12,300	-----	32,100	83,500	30,300	23,500	12,700	5,340	6,260
31	63,700	-----	13,000	11,500	-----	33,600	-----	28,800	-----	13,200	6,750	-----
TOTAL	1,365.5M	858,400	412,000	357,500	325,800	558,700	3,401.6M	1,614.0M	598,400	584,000	265,510	184,990
MEAN	44,050	28,610	13,290	11,530	11,640	18,020	113,400	52,060	19,950	18,840	8,565	6,166
MAX	77,100	58,800	20,100	12,600	14,000	33,600	197,000	82,500	27,600	23,800	13,100	7,810
MIN	18,300	17,600	7,100	10,400	10,800	10,600	36,800	28,800	15,000	12,700	5,340	3,920
CFSM	.98	.64	.30	.26	.26	.40	2.53	1.16	.45	.42	.19	.14
IN.	1.13	.71	.34	.30	.27	.46	2.82	1.34	.50	.48	.22	.15
CAL YR 1968	TOTAL	7,160,920	MEAN	19,570	MAX	77,100	MIN	4,000	CFSM	.44	IN	5.94
WTR YR 1969	TOTAL	10,526,400	MEAN	28,840	MAX	197,000	MIN	3,920	CFSM	.64	IN	8.74

M expressed in thousands.

CANNON RIVER BASIN

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5-3538. Straight River near Faribault, Minn.

LOCATION.--Lat 44°15'29", long 93°13'51", in W¹SE⁴ sec.9, T.109 N., R.20 W1, Rice County, on right bank 15 ft downstream from highway bridge, 2.8 miles upstream from Falls Creek and 3.2 miles southeast of Faribault.

PERIOD OF RECORD.--October 1965 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 1,035 ft (from topographic map).

EXTREMES.--Current year: Maximum discharge, 3,970 cfs Mar. 25 (gage height, 9.86 ft); minimum daily, 31 cfs Sept. 30.

Period of record: Maximum discharge, 3,970 cfs Mar. 25, 1969 (gage height 9.86 ft); minimum daily, 11 cfs Feb. 18 to Mar. 1, 1968.

REMARKS.--Records good except for winter period, which are fair. Records of chemical analyses, water temperatures, and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

JAY	UCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	310	426	182	108	96	82	1,000	252	248	470	92	50
2	252	390	185	108	95	82	1,350	467	404	490	89	49
3	228	359	185	108	95	82	2,240	404	350	500	85	46
4	232	354	196	108	94	82	3,380	354	269	460	82	43
5	228	328	162	107	93	82	3,120	359	220	380	77	46
6	240	310	159	106	92	82	2,530	1,180	213	310	75	43
7	269	323	157	106	92	82	2,200	943	192	250	102	43
8	282	318	153	105	91	82	2,120	712	179	230	129	40
9	729	314	150	105	91	82	1,980	550	164	220	123	39
10	1,360	310	149	105	90	83	1,650	449	155	220	99	38
11	1,350	292	144	105	90	83	1,430	382	196	220	89	38
12	1,160	278	140	105	89	84	1,180	336	269	240	80	37
13	924	264	136	105	89	84	995	296	305	320	69	37
14	762	220	132	104	88	85	864	256	292	510	57	36
15	662	206	126	104	88	90	1,030	232	252	607	49	35
16	804	199	122	104	88	95	1,130	224	220	462	48	36
17	1,990	313	119	104	87	140	1,070	359	199	336	48	35
18	2,080	264	117	103	87	200	912	476	182	248	48	34
19	1,910	244	114	103	86	450	774	449	173	196	49	34
20	1,660	216	112	103	86	1,000	651	426	158	188	49	33
21	1,380	220	112	103	85	2,100	560	400	149	152	52	34
22	1,140	220	111	103	85	2,300	480	377	146	129	48	34
23	918	224	110	102	84	2,650	426	354	146	126	44	37
24	810	220	110	100	83	3,810	382	336	143	149	44	32
25	739	213	109	99	83	3,680	350	323	202	135	40	32
26	684	213	109	98	82	3,060	310	323	323	135	39	32
27	618	210	109	98	82	3,140	296	305	368	123	39	32
28	565	202	108	97	82	2,730	296	269	318	112	38	32
29	525	196	108	96	-----	1,890	282	244	400	99	38	32
30	485	185	108	96	-----	1,460	256	228	450	102	37	31
31	458	-----	108	96	-----	1,210	-----	220	-----	92	59	-----
TOTAL	25,754	8,031	4,142	3,194	2,473	31,162	35,244	12,485	7,285	8,211	2,017	1,120
MEAN	831	268	134	103	88.3	1,005	1,175	403	243	265	65.1	37.3
MAX	2,080	426	196	108	96	3,810	3,380	1,180	450	607	129	50
MIN	228	185	108	96	82	82	256	220	143	92	37	31
CAL YR 1968	TOTAL	83,763	MEAN	229	MAX	2,080	MIN	11				
WTR YR 1969	TOTAL	141,118	MEAN	387	MAX	3,810	MIN	31				

PEAK DISCHARGE (BASE, 1,500 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-17	2100	8.24	2,430	4-4	2100	9.43	3,540
3-25	0100	9.86	3,970	5-6	1000	7.03	1,550

CANNON RIVER BASIN

5-3552. Cannon River at Welch, Minn.

LOCATION.--Lat 44°33'50", long 92°43'55", in NW 1/4 sec. 27, T.113 N., R.16 W., Goodhue County, 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.

PERIOD OF RECORD.--June 1909 to January 1914 (no winter records 1909-11), November 1930 to current year.

GAGE.--Water-stage recorder. Datum of gage is 699.16 ft above mean sea level, datum of 1929. Prior to Nov. 11, 1930, nonrecording gage on highway bridge at site 0.3 mile upstream at datum 3.00 ft lower. Nov. 11, 1930, to Oct. 11, 1938, water-stage recorder at site 0.3 mile upstream at present datum.

AVERAGE DISCHARGE.--40 years (1911-13, 1931-69), 491 cfs (5.05 inches per year).

EXTREMES.--Current year: Maximum discharge, 9,370 cfs Apr. 15 (gage height, 1029 ft); minimum, 162 cfs Sept. 28, 29 (gage height, 1.67 ft).

Period of record: 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 periods, which are fair. Diurnal fluctuation caused by powerplants above station to Dec. 31, 1966 when the powerplants were shut down.

REVISIONS (WATER YEARS).--WSP 1308: 1912(M). WSP 1508: 1933. WSP 1914: 1960.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	665	1,520	624	385	315	377	3,000	1,460	689	942	450	212
2	661	1,410	624	380	315	369	3,260	1,450	635	954	397	222
3	589	1,330	700	375	315	385	5,190	1,540	565	865	365	212
4	494	1,250	750	375	310	393	8,040	1,440	219	793	343	203
5	490	1,190	480	370	310	414	9,070	1,390	225	700	321	203
6	539	1,110	300	365	310	432	8,170	1,550	302	570	312	203
7	544	1,060	400	360	310	423	7,060	2,300	432	480	321	194
8	557	1,060	425	354	310	393	6,420	2,020	446	605	292	188
9	977	1,030	430	350	315	381	6,210	1,680	432	635	298	185
10	2,000	1,010	410	350	315	410	5,640	1,460	405	575	305	182
11	2,150	977	410	345	320	385	4,920	1,330	414	550	285	179
12	2,060	944	430	345	325	369	4,370	1,230	423	485	269	182
13	1,900	911	450	345	335	397	3,880	1,150	446	545	257	176
14	1,650	890	450	340	340	393	3,520	1,070	485	1,250	247	176
15	1,450	993	450	340	350	354	3,440	996	490	1,250	228	176
16	1,430	1,040	445	335	360	373	3,600	960	460	1,080	222	176
17	2,290	916	445	335	365	381	3,580	954	410	936	222	170
18	3,770	890	440	330	370	405	3,330	996	405	984	216	170
19	3,670	840	440	330	380	490	3,090	1,100	365	1,080	206	170
20	3,450	755	435	325	390	972	2,840	1,070	335	1,070	206	170
21	3,170	670	430	325	400	1,890	2,610	978	315	870	206	167
22	2,870	755	425	325	400	2,660	2,300	942	315	711	206	170
23	2,660	933	420	325	390	3,320	2,080	859	335	672	206	170
24	2,470	785	415	320	380	5,040	1,950	848	321	590	203	167
25	2,280	719	410	320	373	6,800	1,840	826	381	560	197	173
26	2,150	683	405	320	373	6,870	1,760	799	450	525	194	167
27	2,070	670	405	320	377	6,240	1,710	810	505	525	191	165
28	1,920	661	400	315	389	5,000	1,630	793	510	500	191	162
29	1,790	652	395	315	-----	4,000	1,570	722	585	470	185	167
30	1,690	634	390	315	-----	3,500	1,490	650	788	446	188	170
31	1,590	-----	385	315	-----	3,200	-----	630	-----	525	206	-----
TOTAL	55,996	28,288	14,018	10,549	9,742	57,016	117,570	36,003	13,088	22,743	7,935	5,427
MEAN	1,806	943	452	340	348	1,839	3,919	1,161	436	734	256	181
MAX	3,770	1,520	750	385	400	6,870	9,070	2,300	788	1,250	450	222
MIN	490	634	300	315	310	354	1,490	630	219	446	185	162
CFSM	1.37	.71	.34	.26	.26	1.39	2.97	.88	.33	.56	.19	.14
IN.	1.58	.80	.39	.30	.27	1.61	3.31	1.01	.37	.64	.22	.15

CAL YR 1968 TOTAL 211,094 MEAN 577 MAX 3,770 MIN 108 CFSM .44 IN 5.95
 WTR YR 1969 TOTAL 378,375 MEAN 1,037 MAX 9,070 MIN 162 CFSM .79 IN 10.66

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., Olmsted County, 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 2.5 miles downstream from Silver Lake Dam.

DRAINAGE AREA.--304 sq mi.

PERIOD OF RECORD.--January 1952 to current year.

GAGE.--Water-stage recorder. Datum of gage is 949.56 ft above mean sea level, datum of 1929.

AVERAGE DISCHARGE.--17 years, 120 cfs (5.36 inches per year).

EXTREMES.--Current year: Maximum discharge, 5,060 cfs Apr. 4 (gage height, 11.17 ft); minimum, 38 cfs Aug. 24 (gage height, 2.12 ft); minimum gage, 1.60 ft June 2.

Period of record: 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 1969 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 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	72	95	80	57	57	56	188	218	127	368	96	53
2	73	92	81	58	56	55	305	235	127	227	92	53
3	69	91	80	58	57	56	1,650	220	123	178	98	53
4	68	92	80	57	56	55	4,160	193	120	151	87	59
5	68	93	76	56	56	55	2,650	184	117	135	84	55
6	77	95	70	57	56	54	1,390	263	114	128	83	52
7	75	95	72	58	57	53	985	268	112	124	242	49
8	75	96	69	59	56	49	846	231	110	155	333	48
9	198	95	68	57	55	49	850	207	109	164	150	48
10	578	94	68	57	56	49	674	194	106	147	116	47
11	257	94	68	56	56	47	501	179	132	126	109	48
12	114	94	77	54	54	46	404	163	175	114	102	51
13	100	93	76	55	54	46	353	146	170	109	97	50
14	95	94	66	56	54	44	332	138	141	153	91	49
15	95	93	66	58	54	43	424	129	124	185	75	49
16	100	92	67	61	54	43	522	149	119	140	68	49
17	149	93	66	61	55	53	442	291	113	133	66	48
18	672	93	64	59	56	58	395	325	110	627	76	48
19	349	91	64	58	55	76	317	223	107	511	51	49
20	167	88	62	59	53	742	275	191	104	177	47	48
21	120	88	62	60	54	975	260	179	103	133	48	46
22	106	89	61	61	54	1,180	240	169	102	116	46	56
23	104	89	61	63	54	1,420	216	165	107	109	43	54
24	101	87	58	57	56	1,660	201	157	105	104	42	50
25	101	88	57	59	56	1,620	194	151	126	109	44	63
26	99	89	57	57	55	838	188	152	200	118	46	54
27	98	86	99	58	54	702	222	152	404	272	44	51
28	98	84	60	58	56	610	216	143	238	154	43	49
29	97	83	58	59	-----	350	196	134	410	112	46	71
30	95	80	60	59	-----	258	181	129	828	103	51	52
31	95	-----	58	58	-----	198	-----	134	-----	101	54	-----
TOTAL	4,565	2,726	2,071	1,800	1,546	11,540	19,777	5,812	5,083	5,483	2,660	1,551
MEAN	147	90.9	66.8	58.1	55.2	372	659	187	169	177	85.8	51.7
MAX	672	96	81	63	57	1,660	4,160	325	828	627	333	71
MIN	68	80	57	54	53	43	181	129	102	101	42	46
CFSM	.48	.30	.22	.19	.18	1.22	2.17	.62	.56	.58	.28	.17
IN.	.56	.33	.25	.22	.19	1.41	2.42	.71	.62	.67	.33	.19

CAL YR 1968 TOTAL 40,004 MEAN 109 MAX 1,440 MIN 21 CFSM .36 IN 4.89
WTR YR 1969 TOTAL 64,614 MEAN 177 MAX 4,160 MIN 42 CFSM .58 IN 7.90

PEAK DISCHARGE (BASE, 1,000 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
3-25	0115	7.33	1,810	4-4	1230	11.17	5,060

ZUMBRO RIVER BASIN

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., Wabasha County, on left bank in Zumbro Falls, 1,000 ft downstream from Cold 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.

PERIOD OF RECORD.--June 1909 to September 1917, April to November 1929, March 1930 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is 811.26 ft above mean sea level, datum of 1929. Prior to Nov. 11, 1933, nonrecording gage on bridge 800 ft downstream at same datum.

AVERAGE DISCHARGE.--47 years (1909-17, 1930-69), 481 cfs (5.78-inches per year).

EXTREMES.--Current year: Maximum discharge, 12,900 cfs Apr. 5 (gage height, 20.07 ft); minimum 70 cfs Feb. 13 (gage height, 6.37 ft).

Period of record: 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 periods, which are fair. Diurnal fluctuation caused by power-plant above station.

REVISIONS (WATER YEAR).--WSP 355: 1912. WSP 895: Drainage area. WSP 1508: 1911, 1917, 1930-31(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	453	656	230	166	152	208	1,410	565	580	1,550	457	128
2	367	612	435	230	121	179	1,500	1,030	460	1,040	434	269
3	357	373	495	231	350	320	3,820	792	530	912	232	317
4	379	498	457	241	460	247	9,270	690	485	870	428	300
5	277	807	432	270	480	201	11,600	816	535	732	518	271
6	364	595	403	210	480	268	7,430	1,420	430	586	393	202
7	397	575	278	229	470	417	5,280	1,910	560	550	405	114
8	384	585	244	286	239	195	4,530	1,630	280	580	718	247
9	1,020	453	357	286	400	120	4,080	1,230	417	682	358	259
10	2,630	326	455	315	440	354	3,370	1,070	465	584	275	225
11	2,490	514	255	151	251	187	2,580	976	485	499	457	301
12	1,560	582	313	128	136	209	2,130	930	591	510	486	140
13	1,170	569	403	205	239	228	1,900	668	608	499	482	183
14	1,040	483	273	320	218	208	1,720	624	555	763	206	107
15	979	586	205	320	128	191	1,800	619	412	1,410	345	228
16	869	309	250	380	98	103	2,310	591	485	1,360	236	243
17	1,550	208	330	255	191	335	2,080	696	440	958	187	244
18	3,910	439	360	221	240	485	1,830	888	445	999	263	243
19	2,620	380	680	147	160	510	1,580	1,020	804	1,660	244	301
20	1,710	466	720	250	190	1,140	1,360	963	550	1,100	350	172
21	1,430	278	550	320	210	1,530	1,180	930	186	944	305	107
22	1,180	445	520	360	160	1,550	1,080	912	165	874	269	103
23	1,050	573	540	311	107	3,150	995	912	162	690	200	99
24	1,010	253	560	221	250	4,520	937	828	159	578	199	107
25	986	457	900	218	720	4,750	912	515	394	600	255	174
26	966	514	920	114	490	3,580	906	591	505	577	292	204
27	512	556	920	230	520	2,960	900	690	720	618	254	209
28	685	518	600	210	363	2,780	894	646	912	817	284	208
29	692	303	233	330	-----	2,220	888	646	882	683	348	250
30	678	296	300	320	-----	1,750	624	525	1,260	595	193	257
31	653	-----	400	194	-----	1,580	-----	430	-----	603	159	-----
TOTAL	34,368	14,209	14,018	7,669	8,263	36,475	80,896	26,753	15,462	25,423	10,232	6,212
MEAN	1,109	474	452	247	295	1,177	2,697	863	515	820	330	207
MAX	3,910	807	920	380	720	4,750	11,600	1,910	1,260	1,660	718	317
MIN	277	208	205	114	98	103	624	430	159	499	159	99
CFSM	.98	.42	.40	.22	.26	1.04	2.39	.76	.46	.73	.29	.18
IN.	1.13	.47	.46	.25	.27	1.20	2.66	.88	.51	.84	.34	.20

CAL YR 1968 TOTAL 181,583
WTR YR 1969 TOTAL 279,980

MEAN 496
MEAN 767

MAX 4,050
MAX 11,600

MIN 64
MIN 98

CFSM .44
CFSM .68

IN 5.98
IN 9.21

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.

PERIOD OF RECORD.--May 1939 to September 1941, July 1967 to current year.

GAGE.--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.--Current year: Maximum discharge, 1,940 cfs Apr. 3 (gage height, 7.73 ft); minimum daily, 14 cfs Feb. 19, 20.

Period of record: 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.

Flood of June 15, 1967 reached a stage of 8.56 ft from highwater mark in well (discharge, 2,850 cfs).

REMARKS.--Records good. Records of chemical analyses and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	20	18	17	15	15	23	34	26	40	25	19
2	19	20	18	17	15	15	38	41	26	36	24	10
3	19	20	18	16	15	15	380	39	26	35	24	19
4	18	20	18	16	15	15	1,020	35	26	34	23	19
5	19	20	18	16	15	15	386	34	25	33	23	19
6	20	20	17	16	15	15	238	35	25	32	23	19
7	20	20	17	16	15	15	191	35	25	30	23	19
8	21	20	16	16	15	15	161	34	25	34	23	19
9	50	20	16	16	15	15	141	34	24	36	23	19
10	61	20	16	16	15	15	103	33	24	33	22	18
11	32	19	17	16	15	15	74	33	26	31	22	19
12	28	19	17	16	15	15	61	32	29	29	21	18
13	25	19	17	16	15	15	53	31	29	28	21	18
14	24	19	17	16	14	15	48	31	28	46	21	18
15	24	19	17	16	15	15	48	30	25	45	21	18
16	23	19	48	16	15	15	46	31	25	146	21	18
17	28	19	17	16	15	15	45	36	24	52	21	18
18	28	19	17	16	15	16	42	38	24	52	23	18
19	25	19	17	16	14	17	39	34	24	39	22	18
20	24	19	17	16	14	89	37	33	24	33	21	19
21	23	18	16	16	15	74	36	32	23	29	21	18
22	23	19	17	15	15	51	35	31	24	29	20	19
23	22	19	17	16	15	59	34	31	25	42	19	19
24	22	19	16	16	15	164	33	30	24	33	19	19
25	22	19	16	15	15	120	34	29	27	28	19	20
26	22	19	17	15	15	45	34	29	43	29	19	19
27	22	19	17	15	15	35	35	29	84	29	19	19
28	22	19	17	15	15	34	35	28	39	27	19	19
29	22	19	16	15	-----	26	34	26	42	25	19	23
30	21	18	15	15	-----	25	33	26	60	25	19	22
31	21	-----	16	15	-----	25	-----	26	-----	25	19	-----
TOTAL	769	577	553	490	417	1,035	3,517	1,000	901	1,155	659	567
MEAN	24.8	19.2	17.8	15.8	14.9	33.4	117	32.3	30.0	37.6	21.3	18.9
MAX	61	20	43	17	15	164	1,020	41	34	146	25	23
MIN	18	19	15	15	14	15	23	26	23	25	19	18
CFSM	.25	.19	.18	.16	.15	.33	1.16	.32	.30	.37	.21	.19
IN.	.23	.21	.20	.18	.15	.33	1.30	.37	.33	.43	.24	.21
CAL YR 1968	TOTAL	7,715	MEAN	21.1	MAX	290	MIN	13	CFSM	.21	IN	2.84
WTR YR 1969	TOTAL	11,650	MEAN	31.9	MAX	1,020	MIN	14	CFSM	.32	IN	4.29

WHITEWATER RIVER BASIN

5-3765. South Fork Whitewater River near Altura, Minn.

LOCATION.--Lat $44^{\circ}04'10''$, long $91^{\circ}58'49''$, in SE $\frac{1}{4}$ sec.14, T.107 N., R.10 W., Winona County, 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.

PERIOD OF RECORD.--October 1939 to current year

GAGE.--Water-stage recorder. Datum of gage is 761.80 ft (232.20 m) above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

AVERAGE DISCHARGE.--30 years, 27.3 cfs.

EXTREMES.--Current year: Maximum discharge, 971 cfs Apr. 3 (gage height, 4.77 ft); minimum daily, 10 cfs Jan. 11-15.

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 1278: 1940(M), 1942(M), 1945(M), 1947(M), 1949(M), 1950(P). WSP 1508: 1950(M).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	20	14	12	11	12	28	30	26	54	24	16
2	19	20	14	11	11	12	40	32	26	47	22	15
3	19	19	14	11	11	12	372	28	25	43	21	14
4	19	19	14	11	11	12	716	27	25	40	19	14
5	19	19	14	11	11	13	388	26	23	38	19	15
6	21	19	14	11	11	13	193	40	23	42	19	16
7	22	19	13	11	11	13	142	43	23	40	24	14
8	22	19	14	11	11	13	118	34	22	48	24	14
9	33	18	14	11	11	13	100	32	22	77	20	14
10	57	18	13	11	11	12	79	30	22	53	19	13
11	37	18	12	10	11	13	61	30	26	44	18	13
12	33	17	12	10	11	13	54	28	36	40	18	13
13	30	17	14	10	11	12	45	27	40	36	17	13
14	28	17	16	10	11	13	43	28	30	49	17	13
15	28	17	14	10	12	13	43	27	27	55	16	14
16	28	17	13	11	12	12	43	30	26	78	16	16
17	30	16	12	11	12	13	46	54	26	58	16	17
18	32	17	12	11	12	13	43	46	26	50	17	18
19	29	16	14	11	12	13	36	37	26	47	21	18
20	27	15	13	11	13	17	32	35	24	50	19	17
21	26	16	13	11	13	17	31	34	23	36	17	17
22	25	16	13	12	12	54	28	34	24	34	16	19
23	24	16	13	12	12	82	27	32	26	53	15	20
24	24	16	13	12	12	123	27	31	26	32	15	20
25	24	15	13	11	12	76	27	28	32	32	15	21
26	23	15	12	11	12	57	28	28	62	37	14	20
27	23	15	12	11	12	50	35	27	80	37	14	19
28	23	14	12	11	12	47	33	27	54	30	14	19
29	22	15	12	11	-----	34	30	26	63	27	14	22
30	21	14	12	11	-----	34	29	26	82	26	14	21
31	21	-----	12	11	-----	36	-----	25	-----	26	15	-----
TOTAL	808	509	407	340	324	867	2,917	982	996	1,359	549	495
MEAN	26.1	17.0	13.1	11.0	11.6	28.0	97.2	31.7	33.2	43.8	17.7	16.5
MAX	57	20	16	12	13	123	716	54	82	78	24	22
MIN	19	14	12	10	11	12	27	25	22	26	14	13
CFSM	.34	.22	.17	.14	.15	.36	1.27	.41	.43	.57	.23	.21
IN.	.39	.25	.20	.16	.16	.42	1.41	.48	.48	.66	.27	.24

CAL YR 1968 TOTAL 7,681 MEAN 21.0 MAX 142 MIN 7.0 CFSM .27 IN 3.72
 WAT YR 1969 TOTAL 10,553 MEAN 28.9 MAX 716 MIN 10 CFSM .38 IN 5.11

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., Winona County, on right bank at Winona pumping station in Winona, 9.5 miles upstream from Trempealeau River and at mile 725.7 upstream from the Ohio River.

DRAINAGE AREA.--59,200 sq mi, approximately.

PERIOD OF RECORD.--June 1928 to current year. 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, nonrecording 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, nonrecording 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.--41 years, 25,340 cfs (5.81 inches per year).

EXTREMES.--Current year: Maximum discharge, 218,000 cfs Apr. 19 (gage height, 19.44 ft); minimum daily, 8,600 cfs Aug. 21.

Period of record: 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 1969 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.

REVISIONS (WATER YEARS).--WSP 700: Drainage area.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	48,900	81,000	27,000	20,000	24,000	25,000	54,900	111,000	42,000	41,000	22,900	11,000
2	47,800	79,000	26,900	20,000	24,000	26,000	55,800	108,000	39,000	39,000	23,000	11,500
3	45,400	76,000	27,900	21,000	24,000	30,000	56,800	106,000	36,000	37,000	21,700	11,000
4	41,800	74,000	28,000	21,000	24,000	28,000	59,300	104,000	34,000	35,000	21,500	10,000
5	37,700	70,000	27,500	21,000	24,000	28,000	64,500	101,000	36,000	37,000	21,600	10,000
6	33,000	68,000	25,600	23,000	25,000	29,000	69,900	99,300	34,000	32,000	21,100	10,000
7	35,000	66,000	20,000	23,000	25,000	29,000	75,100	96,900	32,000	30,000	19,000	10,000
8	34,000	62,000	14,000	23,000	25,000	29,000	79,600	94,000	31,000	31,000	20,700	10,000
9	36,000	57,000	14,000	23,000	25,000	28,000	86,700	90,200	30,000	37,000	21,100	10,000
10	40,000	52,000	17,000	23,000	25,000	28,000	95,600	86,300	28,000	35,000	17,500	10,500
11	45,000	48,000	21,000	23,000	26,000	26,000	113,000	82,500	28,400	30,600	13,600	12,100
12	50,000	45,000	24,000	23,000	26,000	26,000	134,000	79,400	30,600	30,200	18,300	11,100
13	52,000	43,000	23,000	22,000	26,000	26,000	152,000	75,300	32,600	31,000	15,900	11,100
14	56,000	42,000	19,000	22,000	26,000	26,000	168,000	72,400	29,400	26,300	14,900	11,200
15	58,000	42,000	17,000	22,000	26,000	27,000	184,000	70,000	29,300	25,400	15,600	10,600
16	60,000	40,000	19,000	23,000	25,000	27,000	198,000	68,000	28,500	34,200	14,800	11,800
17	61,000	39,000	24,000	23,000	25,000	26,000	207,000	67,600	26,100	38,900	14,500	10,100
18	62,000	40,000	28,000	23,000	25,000	26,800	216,000	64,800	24,500	40,400	13,300	10,700
19	63,000	37,000	29,000	23,000	25,000	26,400	218,000	61,500	24,500	33,100	13,400	9,680
20	66,000	32,000	29,000	23,000	25,000	28,900	212,000	61,000	24,600	32,900	11,400	9,100
21	69,000	31,100	28,000	23,000	25,000	32,800	206,000	60,100	24,900	33,300	8,600	9,150
22	72,000	31,800	27,000	23,000	26,000	33,800	198,000	59,200	24,400	22,700	8,800	9,290
23	75,000	31,900	27,000	23,000	27,000	36,700	187,000	57,900	23,700	25,700	9,200	9,890
24	78,000	30,700	26,000	23,000	27,000	39,000	176,000	55,500	21,700	26,500	9,600	11,100
25	81,000	28,800	21,000	22,000	26,000	44,900	164,000	54,600	23,100	27,200	9,600	11,500
26	83,000	29,200	21,000	20,000	25,000	49,000	153,000	52,400	25,300	26,800	9,800	12,000
27	85,000	30,600	22,000	21,000	25,000	50,800	143,000	50,300	27,200	26,700	10,500	11,400
28	87,000	31,300	22,000	22,000	25,000	53,900	134,000	50,000	33,500	24,400	10,500	11,400
29	88,000	30,700	23,000	23,000	-----	54,600	125,000	50,000	39,200	19,600	10,000	12,000
30	86,000	28,500	23,000	24,000	-----	54,900	117,000	48,400	42,300	20,800	10,000	11,900
31	83,000	-----	22,000	24,000	-----	55,400	-----	44,400	-----	21,200	11,000	-----
TOTAL	1,859.6M	1,397.6M	722,900	693,000	706,000	1,051.9M	4,103.2M	2,282.4M	905,800	951,900	463,400	321,110
MEAN	59,990	46,590	23,320	22,350	25,210	33,930	136,800	73,630	30,190	30,710	14,950	10,700
MAX	88,000	81,000	29,000	24,000	27,000	55,400	218,000	111,000	42,300	41,900	23,000	12,100
MIN	33,000	28,500	14,000	20,000	24,000	25,000	54,900	44,400	21,700	19,600	8,600	9,100
CFSM	1.01	.79	.39	.38	.43	.57	2.31	1.24	.51	.52	.25	.18
IN.	1.17	.88	.45	.44	.44	.66	2.58	1.43	.57	.60	.29	.20

CAL YR 1968 TOTAL 11,921,300 MEAN 32,570 MAX 88,000 MIN 8,500 CFSM .55 IN 7.49
WTR YR 1969 TOTAL 15,458,810 MEAN 42,350 MAX 218,000 MIN 8,600 CFSM .72 IN 9.71

M expressed in thousands.

ROOT RIVER BASIN

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., Fillmore County, on left bank half a mile upstream from highway bridge, 1.2 miles upstream from South Branch, and 2.5 miles northeast of Lanesboro.

DRAINAGE AREA.--615 sq mi.

PERIOD OF RECORD.--February to November 1910, February 1911 to September 1914, July 1915 to September 1917, August 1940 to current year.

GAGE.--Water-stage recorder. Datum of gage is 791.84 ft above mean sea level, adjustment of 1912. Prior to Oct. 1, 1917, nonrecording gage at site half a mile downstream at datum about 1.5 ft higher.

AVERAGE DISCHARGE.--34 years (1911-14, 1915-17, 1940-69), 316 cfs (6.98 inches per year)

EXTREMES.--Current year: Maximum discharge, 7,340 cfs Apr. 4 (gage height, 10.24 ft); minimum, 48 cfs Dec. 6 (gage height, 0.74 ft).

Period of record: 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 periods, 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 355: 1912. WSP 1308: 1911(M).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	113	152	116	109	115	118	534	324	315	1,650	300	190
2	111	147	118	110	115	115	546	341	288	935	282	185
3	107	144	120	110	115	110	1,730	330	264	730	267	173
4	103	138	118	110	115	112	5,760	321	247	613	256	168
5	103	137	101	111	115	114	5,400	309	233	490	244	185
6	116	139	94	111	115	112	2,410	337	224	446	238	187
7	121	137	112	112	115	111	1,640	494	219	414	785	175
8	121	135	118	113	115	110	1,460	514	210	414	577	165
9	146	134	116	114	115	112	1,420	442	203	494	344	159
10	234	134	113	115	115	120	1,330	400	195	534	285	154
11	295	132	112	115	115	119	1,070	369	200	482	258	154
12	315	129	113	115	115	118	840	341	250	400	241	152
13	267	128	114	115	115	117	699	318	321	355	227	150
14	225	125	108	115	115	109	622	300	386	334	216	148
15	201	124	103	115	115	108	591	285	376	369	205	145
16	184	124	102	115	115	111	740	276	312	446	200	143
17	184	126	101	115	115	118	780	334	273	449	195	141
18	191	126	101	115	115	120	755	421	250	3,840	197	139
19	313	124	101	115	115	253	672	428	233	1,240	210	139
20	341	120	101	115	115	1,110	538	393	219	735	203	139
21	270	120	101	115	115	1,340	467	351	205	577	195	139
22	234	122	101	115	115	1,150	421	330	205	482	187	141
23	212	123	101	115	115	2,400	386	318	216	428	182	145
24	195	120	102	115	114	3,210	348	303	224	386	177	143
25	184	120	104	115	114	3,080	327	297	267	358	173	145
26	176	124	105	115	115	1,870	318	294	609	573	170	145
27	172	124	106	115	117	1,340	348	288	2,450	699	168	143
28	170	122	107	115	119	1,160	351	279	2,440	518	165	139
29	165	118	108	115	-----	835	330	267	1,240	397	161	145
30	160	118	108	115	-----	649	318	253	2,710	348	159	150
31	156	-----	108	115	-----	649	-----	303	-----	324	168	-----
TOTAL	5,885	3,866	3,333	3,530	3,224	21,100	33,151	10,560	15,784	20,460	7,635	4,626
MEAN	190	129	108	114	115	681	1,105	341	526	660	246	154
MAX	341	152	120	115	119	3,210	5,760	514	2,710	3,840	785	190
MIN	103	118	94	109	114	108	318	253	195	324	159	139
CFSM	.31	.21	.17	.19	.19	1.11	1.80	.55	.86	1.07	.40	.25
IN.	.36	.23	.20	.21	.19	1.28	2.00	.64	.95	1.24	.46	.28
CAL YR 1968	TOTAL 60,088			MEAN 164		MAX 1,220	MIN 75		CFSM .27		IN 3.63	
WTR YR 1969	TOTAL 133,154			MEAN 365		MAX 5,760	MIN 94		CFSM .59		IN 8.05	

PEAK DISCHARGE (BASE, 3,500 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
3-24	2200	6.91	3,510	6-27	2245	7.97	4,560
4-04	1900	10.24	7,340	7-18	1245	9.15	5,760

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LOCATION.--Lat 43°50'00", long 91°46'40", on line between secs. 3 and 10, T.104 N., R.8 W., Fillmore County, on downstream side near Center of span of highway bridge, 1.5 miles northwest of Rushford and 3 miles upstream from mouth.

PERIOD OF RECORD.--August 1942 to current year.

GAGE.--Nonrecording 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.

EXTREMES.--Current year: Maximum discharge, 620 cfs Apr. 4 (gage height, 4.11 ft, from highwater mark); maximum gage height, 4.23 ft Oct. 10; minimum daily discharge, 32 cfs Nov. 20, Dec. 8-11, 16-19; minimum gage height, 1.02 ft June 10.

Period of record: 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).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	34	33	34	35	34	46	43	38	58	38	36
2	34	34	33	33	35	34	46	41	37	52	37	36
3	34	34	33	33	35	34	74	41	37	49	37	34
4	34	34	33	33	36	34	309	38	37	49	37	34
5	34	34	33	33	36	35	106	40	36	48	37	36
6	37	34	33	33	36	35	69	42	36	47	37	35
7	36	34	33	33	36	34	60	40	36	46	47	35
8	34	34	32	33	36	34	54	39	36	49	37	34
9	66	34	32	33	36	34	52	39	36	46	37	34
10	240	34	32	33	36	34	50	40	35	45	35	34
11	39	34	32	33	36	34	49	40	38	44	34	34
12	38	34	34	33	36	34	47	38	44	43	34	34
13	37	34	35	33	36	34	46	38	41	45	34	34
14	37	34	34	33	36	34	65	38	38	47	34	34
15	37	34	33	35	36	34	245	38	38	47	34	34
16	36	34	32	34	36	34	190	38	41	55	34	34
17	37	34	32	34	36	35	140	45	37	47	33	34
18	36	34	32	34	36	35	90	40	38	92	35	34
19	36	34	32	34	36	37	60	38	37	52	35	34
20	36	32	33	34	37	47	65	38	37	49	33	34
21	35	33	33	34	36	53	50	38	37	47	33	34
22	35	33	33	34	36	54	46	38	37	46	33	35
23	34	33	33	34	35	96	43	38	40	67	33	35
24	34	33	33	34	35	84	40	38	38	44	33	34
25	34	33	33	35	35	56	39	38	60	44	33	35
26	34	33	33	35	34	51	41	38	60	52	33	34
27	36	33	33	35	34	46	44	38	62	46	33	34
28	34	35	33	35	34	41	41	38	50	41	33	34
29	34	33	33	35	-----	43	40	38	82	40	33	42
30	34	33	33	35	-----	43	40	37	73	39	33	35
31	34	-----	33	35	-----	45	-----	37	-----	40	39	-----
TOTAL	1,330	1,010	1,019	1,049	997	1,312	2,287	1,210	1,292	1,516	1,088	1,040
MEAN	42.9	33.7	32.9	33.8	35.6	42.3	76.2	39.0	43.1	48.9	35.1	34.7
MAX	240	35	35	35	37	96	309	45	82	92	47	42
MIN	34	32	32	33	34	34	39	37	35	39	33	34
CFSM	.33	.26	.26	.26	.28	.33	.59	.30	.33	.38	.27	.27
IN.	.38	.29	.29	.30	.29	.38	.66	.35	.37	.44	.31	.30
CAL YR 1968	TOTAL	14,737	MEAN	40.3	MAX	291	MIN	30	CFSM	.31	IN	4.25
WAT YR 1969	TOTAL	15,150	MEAN	41.5	MAX	309	MIN	32	CFSM	.32	IN	4.37

5-3850. Root River near Houston, Minn.

LOCATION.--Lat $43^{\circ}46'05''$, long $91^{\circ}35'11''$, in sec.32, T.104 N., R.6 W., Houston County, on right bank 1 mile west of Houston and 2.5 miles upstream from South Fork.

DRAINAGE AREA.--1,270 sq mi, approximately.

PERIOD OF RECORD.--May 1909 to September 1917, May to November 1929, March 1930 to current year. 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, nonrecording gage at site 1.5 miles downstream at different datum. May 4, 1929, to Sept. 27, 1933, nonrecording gage at present site and datum.

AVERAGE DISCHARGE.--47 years (1909-17, 1930-69), 639 cfs (6.83 inches per year).

EXTREMES.--Current year: Maximum discharge, 8,280 cfs Apr. 5 (gage height, 9.25 ft); minimum daily, 240 cfs Dec. 19-28.

Period of record: 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 periods, which are fair. Slight diurnal fluctuation at low flows caused by powerplants above station. Records for water temperatures and suspended sediment loads for water year 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 895: Drainage area. WSP 1508: 1911-12. WSP 1628: 1948(P).

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	293	352	330	275	290	320	1,180	655	535	3,040	785	451
2	289	348	338	270	285	330	1,150	660	535	1,890	740	438
3	278	338	338	270	285	330	1,420	645	510	1,540	725	410
4	278	325	338	270	285	343	4,520	640	475	1,360	675	397
5	278	317	352	270	285	325	7,800	625	456	1,210	660	406
6	297	309	317	270	285	325	4,020	645	446	1,100	620	424
7	301	317	317	270	285	321	2,580	680	442	1,020	675	415
8	309	317	312	270	285	313	2,160	795	433	960	1,060	397
9	415	325	305	270	285	305	1,940	780	424	990	810	379
10	451	325	295	270	285	309	1,910	725	406	1,000	690	374
11	456	325	285	270	285	309	1,700	685	420	1,020	655	366
12	475	330	280	270	285	301	1,460	655	470	945	630	356
13	525	317	275	270	285	301	1,270	640	525	870	555	352
14	490	317	265	270	285	297	1,160	620	575	855	510	352
15	451	321	255	270	290	293	1,090	595	625	900	485	352
16	424	330	250	270	285	293	1,060	575	600	920	475	352
17	415	334	250	275	280	309	1,200	610	565	920	460	343
18	397	334	247	290	280	334	1,160	650	535	3,520	460	338
19	397	330	240	300	280	370	1,140	680	505	2,930	470	334
20	485	330	240	305	280	864	1,020	685	465	1,550	465	330
21	530	309	240	308	285	1,920	905	650	428	1,290	446	321
22	480	309	240	305	290	1,620	825	620	424	1,130	433	330
23	442	313	240	305	295	2,650	780	600	438	1,060	420	352
24	420	313	240	305	300	4,070	730	590	442	1,040	420	348
25	392	317	240	305	305	4,080	695	575	545	945	415	352
26	384	334	240	290	310	3,020	675	560	1,070	965	406	352
27	384	338	240	300	312	2,240	695	550	2,660	1,190	402	356
28	379	338	240	300	320	1,910	685	530	3,830	1,100	397	343
29	366	330	250	300	-----	1,650	670	535	2,390	965	397	410
30	366	338	265	300	-----	1,360	645	505	3,390	875	392	374
31	348	-----	280	300	-----	1,240	-----	500	-----	840	410	-----
TOTAL	12,195	9,780	8,544	8,813	8,107	32,652	48,245	19,460	25,564	39,940	17,143	11,104
MEAN	393	326	276	284	290	1,053	1,608	628	852	1,288	553	370
MAX	530	352	352	308	320	4,080	7,800	795	3,830	3,520	1,060	451
MIN	278	309	240	270	280	293	645	500	406	840	392	321
CFSM	.31	.26	.22	.22	.23	.83	1.27	.49	.67	1.01	.44	.29
IN.	.36	.29	.25	.26	.24	.96	1.41	.57	.75	1.17	.50	.33

CAL YR 1968 TOTAL 142,191 MEAN 389 MAX 1,960 MIN 226 CFSM .31 IN 4.16
WAT YR 1969 TOTAL 241,547 MEAN 662 MAX 7,800 MIN 240 CFSM .52 IN 7.08

PEAK DISCHARGE (BASE, 5,000 CFS).--Apr. 5 (0930) 8,280 cfs (9.25 ft).

5-3855. South Fork Root River near Houston, Mihn.

LOCATION.--Lat 43°44'19", long 91°33'50", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.103 N., R.6 W., Houston County, on left bank 50 ft downstream from bridge on State Highway 76, half a mile upstream from Badger Creek and 1.5 miles south of Houston.

DRAINAGE AREA.--275 sq mi.

PERIOD OF RECORD.--January 1953 to current year.

GAGE.--Water-stage recorder. Datum of gage is 680.41 ft above mean sea level, datum of 1929.

AVERAGE DISCHARGE.--16 years, 120 cfs (5.93 inches per year).

EXTREMES.--Current year: Maximum discharge, 2,670 cfs July 18 (gage height, 11.07 ft); minimum 54 cfs Dec. 6 (gage height, 1.21 ft).

Period of record: 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 1969 are published in Part 2 of this report.

REVISIONS (WATER YEARS).--WSP 1388: 1953.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	76	73	68	71	80	76	124	107	84	242	131	168
2	75	72	68	72	80	76	126	108	84	203	126	122
3	75	72	69	72	80	77	155	103	84	184	122	97
4	75	73	68	72	80	76	328	101	82	171	120	93
5	76	73	69	73	80	77	370	99	81	157	117	94
6	80	72	68	74	80	77	234	103	80	143	115	92
7	81	73	68	74	79	76	205	103	81	133	128	90
8	75	72	68	74	79	78	189	100	81	136	155	87
9	103	72	67	75	79	77	177	98	79	147	118	86
10	134	72	67	76	78	77	165	97	78	131	113	86
11	109	71	66	76	78	77	151	96	82	175	109	87
12	95	71	66	77	78	76	141	96	92	153	106	88
13	90	71	66	78	78	77	134	93	90	131	104	87
14	87	70	66	79	77	76	129	92	83	135	102	95
15	85	70	65	80	77	75	130	90	81	187	101	92
16	82	71	65	80	77	75	130	90	79	160	100	88
17	83	70	64	80	76	76	131	93	78	176	99	87
18	81	71	64	81	76	80	131	93	79	1,260	98	85
19	81	71	64	82	76	86	126	92	79	853	97	86
20	80	70	64	83	76	125	121	92	78	361	97	85
21	78	69	65	84	76	210	120	89	77	278	95	85
22	78	69	66	83	76	177	118	90	79	233	93	86
23	78	69	66	83	75	434	116	88	87	197	92	87
24	78	68	66	82	75	448	112	88	89	232	91	86
25	77	69	67	82	75	285	110	86	100	185	90	88
26	77	70	68	82	75	212	110	86	183	182	89	87
27	77	68	68	82	74	178	116	85	547	170	88	85
28	77	68	69	82	76	162	112	84	238	158	88	84
29	76	68	69	81	-----	143	108	82	293	148	86	90
30	75	68	70	81	-----	130	106	81	417	141	86	88
31	74	-----	70	81	-----	125	-----	82	-----	138	91	-----
TOTAL	2,568	2,116	2,074	2,432	2,166	4,094	4,525	2,887	3,745	7,300	3,247	2,761
MEAN	82.8	70.5	66.9	78.5	77.4	132	151	93.1	125	235	105	92.0
MAX	134	73	70	84	80	448	370	108	547	1,260	155	168
MIN	74	68	64	71	74	75	106	81	77	131	86	84
CFSM	.30	.26	.24	.29	.28	.48	.55	.34	.45	.86	.38	.33
IN.	.35	.29	.28	.33	.29	.55	.61	.39	.51	.99	.44	.37

CAL YR 1968 TOTAL 31,407 MEAN 85.8 MAX 460 MIN 63 CFSM .31 IN 4.25
 WTR YR 1969 TOTAL 39,915 MEAN 109 MAX 1,260 MIN 64 CFSM .40 IN 5.40

PEAK DISCHARGE (BASE, 900 CFS)

DATE	TIME	G.H.T.	DISCHARGE	DATE	TIME	G.H.T.	DISCHARGE
7-18	2330	11.07	2,670				

5-4570. Cedar River near Austin, Minn.

LOCATION.--Lat 43°38'10", long 92°58'20", in NE 1/4 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.

PERIOD OF RECORD.--May 1909 to September 1914, October 1944 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,162.10 ft above mean sea level, datum of 1929. May 1909 to April 1912, nonrecording gage in tailwater of powerplant 200 ft downstream at datum 3.1 ft lower. May 1912 to September 1914, chain gage on highway bridge 500 ft downstream at datum 1.1 ft lower.

AVERAGE DISCHARGE.--30 years, 175 cfs (5.59 inches per year).

EXTREMES.--Current year: Maximum discharge, 3,830 cfs Apr. 4 (gage height, 10.05 ft); minimum, 54 cfs Dec. 5 (gage height, 2.30 ft).

Period of record: 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.

REVISIONS (WATER YEARS).--WSP 1145: 1945, 1948.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	191	191	116	92	75	82	422	183	214	1,670	111	73
2	183	177	119	90	77	84	508	189	200	950	99	78
3	169	169	121	84	79	88	1,460	183	175	640	92	78
4	158	166	121	84	77	90	3,270	177	158	484	92	78
5	153	166	84	77	77	88	2,520	175	145	394	90	78
6	183	166	97	77	77	88	1,420	247	134	327	86	79
7	197	161	100	75	77	88	1,120	281	129	290	86	79
8	197	158	90	75	75	82	1,080	253	126	383	84	80
9	313	153	90	78	73	86	1,150	229	116	592	97	80
10	692	153	92	73	77	88	977	220	109	488	88	82
11	808	150	94	66	75	84	728	214	150	359	82	82
12	480	147	100	66	73	86	540	194	194	287	77	84
13	348	142	100	69	73	84	460	180	220	397	75	84
14	300	142	94	73	73	82	439	166	223	905	73	84
15	272	139	100	77	71	79	708	161	186	936	68	90
16	397	137	100	86	71	88	918	180	164	508	68	97
17	840	137	100	82	73	109	716	290	153	359	66	111
18	1,280	142	94	79	75	145	600	422	137	359	86	102
19	896	139	97	79	73	262	443	345	129	584	77	94
20	552	114	88	82	73	624	338	275	119	352	77	90
21	418	139	90	84	75	824	307	244	104	238	75	86
22	359	132	90	86	73	1,330	272	235	109	200	73	94
23	313	132	79	82	75	2,270	244	223	126	183	68	99
24	281	126	77	84	79	3,060	223	220	111	164	66	90
25	259	124	73	83	82	2,860	206	217	397	153	66	97
26	241	132	82	81	79	1,880	200	220	1,000	150	68	92
27	241	126	86	77	79	1,650	214	209	1,530	147	66	90
28	226	121	86	77	82	1,360	203	186	824	147	68	82
29	214	119	79	79	-----	752	189	172	2,360	137	68	86
30	203	109	86	79	-----	664	175	214	2,860	124	66	82
31	200	-----	91	77	-----	508	-----	200	-----	124	73	-----
TOTAL	11,564	4,309	2,916	2,453	2,118	19,665	22,050	6,904	12,602	13,031	2,431	2,601
MEAN	373	144	94.1	79.1	75.6	634	735	223	420	420	78.4	86.7
MAX	1,280	191	121	92	82	3,060	3,270	422	2,860	1,670	111	111
MIN	153	109	73	66	71	79	175	161	104	124	66	73
CFSM	.88	.34	.22	.19	.18	1.49	1.73	.52	.99	.99	.18	.20
IN.	1.01	.38	.26	.21	.19	1.72	1.93	.60	1.10	1.14	.21	.23

CAL YR 1968 TOTAL 59,376 MEAN 162 MAX 2,480 MIN 38 CFSM .38 IN 5.20
WTR YR 1969 TOTAL 102,644 MEAN 281 MAX 3,270 MIN 66 CFSM .66 IN 8.98

PEAK DISCHARGE (BASE, 1,400 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
3-25	0015	9.43	3.360	6-27	1145	6.59	1.640
4-4	1845	10.05	3.830	6-30	0015	9.73	3.500

NOTE.--Backwater from aquatic vegetation May 6 to June 29, Aug. 2 to Sept. 30.

5-4760. West Fork Des Moines River at Jackson, Minn.

LOCATION.--Lat 43°37'10", long 94°59'10", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.24, T.102 N., R.35 W., Jackson County, on right bank in storage room of city powerplant in Jackson.

DRAINAGE AREA.--1,220 sq mi, approximately.

PERIOD OF RECORD.--May 1909 to December 1913, August 1930 to current year (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, nonrecording gage at site 0.6 mile downstream at datum 0.99 ft lower. Aug. 22, 1930, to Sept. 30, 1944, nonrecording gage at site 7 miles upstream at datum 17.10 ft higher. Oct. 1, 1944, to Oct. 26, 1949, nonrecording 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.--34 years (1935-69), 284 cfs (3.15 inches per year).

EXTREMES.--Current year: Maximum discharge, 15,700 cfs Apr. 11 (gage height, 19.45 ft) minimum daily 29 cfs Sept. 30 caused by temporary dam construction.

Period of record: Maximum discharge 15,700 cfs Apr. 11, 1969; no flow at times.

REMARKS.--Records good except those for winter periods, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes. Records of chemical analyses, water temperatures, and suspended sediment loads for the water year 1969 are published in Part 2 of this report.

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	362	1,710	689	160	42	130	420	2,390	486	1,510	643	157
2	342	1,620	739	150	43	130	470	2,260	465	1,730	567	169
3	337	1,520	653	140	44	130	540	2,130	406	2,950	512	193
4	316	1,480	493	130	45	130	1,300	2,010	359	3,970	462	226
5	305	1,420	329	120	46	130	1,750	1,900	342	4,250	412	161
6	313	1,370	221	110	47	130	2,700	1,830	318	4,080	387	106
7	318	1,310	240	100	48	130	4,800	1,720	294	3,740	356	94
8	318	1,230	265	92	49	130	7,810	1,620	276	3,590	332	87
9	362	1,200	375	84	50	130	11,700	1,500	271	3,220	302	96
10	409	1,180	360	76	51	130	14,100	1,430	266	2,930	281	82
11	444	1,130	320	68	52	130	15,500	1,350	297	2,690	268	65
12	438	1,080	250	62	53	130	15,100	1,270	324	2,430	254	61
13	426	1,030	215	58	54	130	13,400	1,180	321	2,200	240	51
14	426	999	185	54	55	132	11,400	1,100	310	2,030	233	47
15	429	946	165	50	56	135	9,970	1,020	373	1,890	214	47
16	521	907	180	47	58	135	8,800	963	268	1,770	203	58
17	1,150	894	191	44	60	140	7,760	933	242	1,650	195	72
18	1,880	900	205	42	62	160	6,860	874	244	1,580	169	92
19	2,460	851	210	40	64	210	6,140	841	233	1,490	171	86
20	2,250	679	200	39	66	350	5,580	838	226	1,410	226	70
21	2,130	663	190	38	68	450	5,120	818	212	1,330	248	62
22	2,440	943	190	38	69	500	4,570	818	210	1,240	226	59
23	2,780	818	185	39	70	560	3,980	811	210	1,180	223	54
24	2,760	801	185	39	71	600	3,680	778	210	1,110	214	41
25	2,600	772	185	40	72	640	3,480	745	432	1,050	205	40
26	2,430	729	185	40	110	560	3,250	702	590	1,010	193	43
27	2,300	564	180	40	150	520	3,080	676	547	970	185	44
28	2,160	518	180	41	140	500	2,880	633	511	900	189	51
29	1,990	554	175	41	-----	480	2,680	587	2,800	808	179	32
30	1,860	607	170	41	-----	460	2,520	534	1,610	748	165	29
31	1,780	-----	170	42	-----	440	-----	496	-----	709	167	-----
TOTAL	39,036	30,425	8,480	2,105	1,795	8,662	181,340	36,757	13,653	62,165	8,621	2,475
MEAN	1,259	1,014	274	67.9	64.1	279	6,045	1,186	455	2,005	278	82.5
MAX	2,780	1,710	739	160	150	640	15,500	2,390	2,800	4,250	643	226
MIN	305	518	165	38	42	130	420	496	210	709	165	29
CFSM	1.03	.83	.22	.056	.053	.23	4.95	.97	.37	1.64	.23	.068
IN.	1.19	.93	.26	.06	.05	.26	5.53	1.12	.42	1.90	.26	.08

CAL YR 1968 TOTAL 91,696 MEAN 251 MAX 2,780 MIN .30 CFSM .21 IN 2.80
WAT YR 1969 TOTAL 395,514 MEAN 1,084 MAX 15,500 MIN 29 CFSM .89 IN 12.06

PEAK DISCHARGE (BASE, 500 CFS)

DATE	TIME	G.HT.	DISCHARGE	DATE	TIME	G.HT.	DISCHARGE
10-23	2200	11.85	2,820	6-29	0500	14.06	4,170
4-11	1600	19.45	15,700	7-51	1200	14.06	4,260

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

Measurements 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 when 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 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Lake of the Woods basin						
5-1316	Bowstring River near Talmoon, Minn.	On line between secs.23 and 24, T.147 N., R.25 W., Itasca County, at bridge on State Highway 6, 0.4 mile south of Bowstring and 4.5 miles southwest of Talmoon.	-	1969	9-10-69	41.8
5-1317.6	Rice River near Bigfork, Minn.	On line between secs.16 and 21, T.60 N., R.26 W., Itasca County, at bridge on County Highway 254, 5 miles south of Bigfork.	-	1969	9-10-69	39.0
5-1317.7	Gale Brook near Bigfork, Minn.	NE&NW& sec.4, T.60 N., R.26 W., Itasca County, at culvert on County Highway 7, 1.5 miles south of Bigfork.	-	1969	9-10-69	9.21
5-1319	Caldwell Brook near Effie, Minn.	SW&NW& sec.29, T.152 N., R.25 W., Koochiching County, at bridge on Caldwell Trail, 11.6 miles north of Effie.	-	1969	9-10-69	5.72
5-1324	Bear River near Littlefork, Minn.	On line between secs.4 and 9, T.68 N., R.26 W., Koochiching County, at bridge on County Highway 1, 5.5 miles west of Littlefork.	-	1969	9-12-69	76.4
5-1332	West Branch Black River near Loman, Minn.	SE&SW& sec.3, T.158 N., R.25 W., Koochiching County, at bridge on County Highway 82, 1.6 miles northwest of Loman.	-	1969	9-12-69	23.6
5-1341	North Branch Rapid River near Baudette, Minn.	NW&SW& sec.4, T.158 N., R.31 W., Lake of the Woods County, at bridge on County Highway 1, 12.7 miles southwest of Baudette.	-	1969	9-11-69	18.6
5-1351	Rapid River at Clementson, Minn.	NE&SE& sec.12, T.160 N., R.30 W., Lake of the Woods County, at bridge on State Highway 11 at Clementson.	-	1969	9-11-69	74.0
5-1360	Baudette River at Baudette, Minn.	On line between secs.22 and 27, T.160 N., R.31 W., Lake of the Woods County, at bridge on county road, 4 miles southwest of Baudette.	-	1969	9-11-69	1.15
5-1370	Winter Road River near Baudette, Minn.	SE&SE& sec.36, T.161 N., R.32 W., Lake of the Woods County, at bridge on Old State Highway 11, 4.5 miles west of Baudette.	-	1969	9-11-69	8.49
5-1380	County ditch No. 1 near Williams, Minn.	NE&NE& sec.24, T.162 N., R.34 W., Lake of the Woods County, at triple box culvert on County Highway 2, 5.2 miles north of Williams.	-	1969	9-11-69	3.02
Crow Wing River basin						
5-2443.6	Lea River near Verndale, Minn.	On line between secs.19 and 20, T.135 N., R.34 W., Wadena County, at County Highway 22, 6.4 miles north of Verndale.	-	1964-66, 1968-69	8-29-69	21.3

Discharge measurements made at low-flow partial-record stations during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Crow Wing River basin--Continued						
5-2443.7	Wing River near Hewitt, Minn.	On line between secs.3 and 4, T.133 N., R.35 W., Todd County, at bridge on county road, 2 miles north of Hewitt.	-	1967-69	8-28-69	1.21
5-2443.8	Wing River near Verndale, Minn.	SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.26, T.134 N., R.35 W., Wadena County, at County Highway 1, 2.5 miles west of Verndale.	-	1967-69	8-28-69	3.21
5-2443.9	Wing River at Verndale, Minn.	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.19, T.134 N., R.34 W., Wadena County, at bridge on County Highway 111, 1 mile northwest of Verndale.	-	1967-69	8-28-69	8.24
5-2444	Wing River below Verndale, Minn.	On line between secs.5 and 8, T.134 N., R.34 W., Wadena County, at County Highway 4, 2.5 miles north of Verndale.	-	1964-69	8-28-69	10.3
5-2444.03	Wing River near Wadena, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.135 N., R.35 W., Wadena County, at bridge on county road, 1 mile upstream from mouth, 5 miles north of Verndale and 7 miles northeast of Wadena.	-	1967-69	8-28-69	11.2
5-2444.1	Redeye River at Sebek, Minn.	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.4, T.136 N., R.35 W., Wadena County, at bridge on U.S. Highway 71, in Sebek.	-	1968-69	6- 9-69 8-18-69	25.9 10.0
5-2444.2	Redeye River near Aldrich, Minn.	On line between secs.13 and 24, T.135 N., R.34 W., Wadena County, at County Highway 7, 1.5 miles upstream from mouth, 3.5 miles north of Central, and 8.5 miles north of Aldrich.	-	1964-66, 1968-69	8-29-69	9.49
5-2444.7	Partridge River near Aldrich, Minn.	NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.15, T.134 N., R.33 W., Wadena County, on County Highway 29, about 0.8 mile upstream from mouth, and 5.5 miles northeast of Aldrich.	-	1964-66, 1969	8-29-69	3.02
Nokasippi River basin						
5-2615.2	Nokasippi River near Fort Ripley, Minn.	On line between secs.13 and 24, T.43 N., R.32 W., Crow Wing County, at bridge on County Highway 2, 3 miles northeast of Fort Ripley.	-	1968-69	9-11-69	21.2
Elk River basin						
5-2630	Elk River near Little Falls, Minn.	NW $\frac{1}{4}$ NE $\frac{1}{4}$ 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.	-	1968-69	11-15-68 9-11-69	38.8 12.5
Swan River basin						
5-2657	Swan River near Little Falls, Minn.	NW $\frac{1}{4}$ NW $\frac{1}{4}$ 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.	-	1968-69	11-15-68 9-11-69	38.8 12.5
Spunk Creek basin						
5-2675.8	Spunk Creek near Royalton, Minn.	SE $\frac{1}{4}$ NW $\frac{1}{4}$ 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.	-	1968-69	11-15-68 9-11-69	17.6 2.32
Sauk River basin						
5-2701.5	Ashley Creek near Sauk Centre, Minn.	NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.127 N., R.34 W., Todd County, at bridge on County Highway 11, 3 miles north of Sauk Centre.	-	1968-69	9-10-69	8.92
5-2702.3	Sauk River at New Munich, Minn.	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.19, T.125 N., R.32 W., Stearns County, at bridge on County Highway 30, 1 mile southwest of New Munich.	-	1968-69	9-10-69	30.3

Discharge measurements made at low-flow partial-record stations during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Elk River basin						
5-2740	Elk River near St. Cloud, Minn.	NE¼NW¼ sec.26, T.36 N., R.30 W., Benton County, at bridge on State Highway 95, 6 miles east of St. Cloud.	-	1968-69	9-10-69	5.18
Crow River basin						
5-2760	North Fork Crow River near Regal, Minn.	Lat 45°22'45", long 94°47'40", in S¼ sec.11, T.122 N., R.33 W., Kandiyohi County, at bridge on county road, 3 miles southeast of Regal.	215	1943-54, 1955, 1969	9- 4-69	2.15
5-2770.5	Grove Creek near Manannah, Minn.	Lat 45°14'23", long 94°36'26", on line between sec.6, T.120 N., R.31 W., and sec.32, T.121 N., R.31 W., Meeker County, at County Highway 46, 1.1 miles southeast of Manannah.	-	1969	8-16-69 9-17-69	.93 .59
5-2783.4	North Fork Crow River near Delano, Minn.	Lat 45°05'22", long 93°52'07", on line between secs.29 and 30, T.119 N., R.25 W., Wright County, at State Highway 25, 5 miles upstream from mouth, and 5 miles northwest of Delano.	-	1969	8-16-69 9-17-69	112 69.3
5-2785	South Fork Crow River at Cosmos, Minn.	Lat 44°56'05", long 94°40'20", in SW¼ sec.14, T.117 N., R.32 W., Meeker County, at bridge on State Highway 7, 1 mile east of Cosmos.	221	1945-64, 1965, 1969	9-10-69	0
5-2785.9	South Fork Crow River at Biscay, Minn.	SE¼SW¼ sec.23, T.116 N., R.29 W., McLeod County, at State Highway 22, 1 mile northwest of Biscay.	-	1969	9-10-69	4.74
5-2788.3	Buffalo Creek near Buffalo Lake, Minn.	Lat 44°46'05", long 94°32'55", at center of sec.15, T.115 N., R.31 W., Renville County, at bridge on County Highway 25, upstream from right bank tributary and 2 miles northwest of Buffalo Lake.	-	1969	8- 8-69 9-10-69 9-17-69	3.96 1.27 .68
5-2788.35	Buffalo Creek tributary near Buffalo Lake, Minn.	Lat 44°46'05", long 94°32'55", at center of sec.15, T.115 N., R.31 W., Renville County, at mouth, downstream from County Highway 25 bridge over Buffalo Creek, and 2 miles northeast of Buffalo Lake.	-	1969	8- 8-69 9-10-69 9-17-69	2.99 1.98 0
5-2789.5	Buffalo Creek near Plato, Minn.	Lat 44°48'03", long 94°02'24", at center of N¼ sec.2, T.115 N., R.27 W., McLeod County, at bridge on County Highway 9, 1.9 miles north of Plato.	-	1969	8- 8-69 9-10-69 9-17-69	12.6 1.49 1.50
Rum River basin						
5-2845	Rum River at Onamia, Minn.	On line between secs.5 and 6, T.41 N., R.26 W., Mille Lacs County, at bridge on U.S. Highway 169, 0.8 mile south of Onamia.	-	1911-13, 1953, 1965, 1968-69	11-14-68 9- 9-69	254 110
5-2846.6	Rum River near Milaca, Minn.	On line between secs.23 and 24, T.38 N., R.27 W., Mille Lacs County, at bridge on County Highway 9, 1.8 miles north of Milaca.	-	1968-69	11-14-68 9- 9-69	349 123
5-2847.1	West Branch Rum River at Princeton, Minn.	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.	-	1961, 1965, 1968-69	11-14-68 9- 9-69	67.0 10.1
5-2849.5	Stanchfield Creek at Springvale, Minn.	On line between secs.11 and 14, T.36 N., R.24 W., Isanti County, at bridge on County Highway 32, 1.5 miles upstream from mouth, and 1 mile south of Springvale.	-	1965, 1968-69	11-15-68 9- 9-69	51.7 5.47
5-2863	Cedar Creek near Anoka, Minn.	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.	-	1965, 1968-69	10-14-68 9- 9-69	108 19.2

* Operated as a continuous-record gaging station.

Discharge measurements made at low-flow partial-record stations during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Minnesota River basin						
5-3146	Boiling Springs Creek near Belview, Minn.	On line between secs.20 and 21, T.114 N., R.37 W., Redwood County, at bridge on county road, 1 mile upstream from mouth, and 3.6 miles north of Belview.	-	1969	9-23-69	.62
5-3146.5	Echo Creek near Belview, Minn.	On line between secs.34 and 35, T.114 N., R.36 W., Redwood County, at bridge on county road, 2.2 miles northeast of Belview.	-	1969	9-23-69	0
5-3147	Sacred Heart Creek near Delhi, Minn.	NW¼NE¼ sec.24, T.114 N., R.37 W., Renville County, at bridge on County Highway 15, 4.8 miles northeast of Delhi, and 8.4 miles south of Renville.	-	1969	9-23-69	.30
5-3147.5	Middle Creek near Delhi, Minn.	SE¼NE¼ sec.3, T.113 N., R.36 W., Renville County, at bridge on County Highway 15, 0.3 mile upstream from mouth, 2.8 miles northeast of Delhi, and 9.1 miles northwest of Morton.	-	1969	9-23-69	.19
5-3148	Smith Creek near North Redwood, Minn.	NE¼SE¼ sec.12, T.113 N., R.36 W., Renville County, at bridge on County Highway 15, 0.6 mile upstream from mouth, 3 miles northwest of North Redwood, and 7.7 miles northwest of Morton.	-	1969	9-23-69	.70
5-3163	Clear Creek at Seaforth, Minn.	On line between secs.29 and 32, T.112 N., R.37 W., Redwood County, at bridge on county road, 0.8 mile southeast of Seaforth, and 1 mile upstream from mouth.	-	1958-63, 1969	9-22-69	1.39
5-3165.4	Ramsey Creek near Redwood Falls, Minn.	N¼ sec.35, T.113 N., R.36 W., Redwood County, at bridge on County Highway 17, 1.5 miles upstream from mouth, and 1.8 miles northwest of Redwood Falls.	-	1958-63, 1969	9-22-69	1.21
5-3165.7	Beaver Creek at Beaver Falls, Minn.	NE¼NW¼ sec.22, T.113 N., R.35 W., Renville County, at bridge on County Highway 2, at Beaver Falls, and 3.8 miles northwest of Morton.	-	1966-69	9-23-69	4.15
5-3165.9	Birch Coulee Creek near Morton, Minn.	At intersection of secs.32 and 33, T.113 N., R.34 W., and sec.5, T.112 N., R.34 W., Renville County, at bridge on State Highway 19, 1.6 miles southeast of Morton.	-	1969	9-23-69	.53
5-3166.3	Wabasha Creek near Morton, Minn.	NE¼NE¼ sec.22, T.122 N., R.34 W., Redwood County, at bridge on county road, 5.4 miles southeast of Morton, and 5.7 miles north of Morgan.	-	1969	9-22-69	.59
5-3166.8	Ridgely Creek at Fort Ridgely State Memorial Park, Minn.	NW¼SW¼ sec.5, T.111 N., R.32 W., Nicollet County, at culvert on County Highway 29, in Fort Ridgely State Memorial Park, and 10.2 miles northwest of St. George.	-	1969	9-23-69	.56
5-3167.4	Little Rock Creek near Fairfax, Minn.	NW¼NW¼ sec.30, T.111 N., R.31 W., Nicollet County, at bridge on County Highway 21, 0.7 mile upstream from mouth, and 10 miles southeast of Fairfax.	-	1966-69	9-23-69	0
5-3168.79	Pell Creek near Lamberton, Minn.	E½ sec.18, T.109 N., R.37 W., Redwood County, at bridge on county road, 3.4 miles west of Lamberton.	-	1969	9-22-69	.30
5-3168.9	Dutch Charley Creek near Lamberton, Minn.	On line between secs.26 and 27, T.109 N., R.37 W., Redwood County, at bridge on County Highway 6, 1.2 miles south of Lamberton.	-	1969	9-22-69	.65
5-3168.95	Highwater Creek near Lamberton, Minn.	On line between secs.25 and 36, T.109 N., R.37 W., Redwood County, at bridge on county road, 1.9 miles southeast of Lamberton.	-	1969	9-22-69	3.18

Discharge measurements made at low-flow partial-record stations during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
5-3169.1	Dry Creek at Sanborn, Minn.	On line between sec.2, T.108 N., R.36 W., and sec.35, T.109 N., R.36 W., Redwood County, at bridge on County Highway 41, 1.5 miles upstream from mouth, and at southwest limits of Sanborn.	-	1969	9-22-69	.61
5-3169.4	Mound Creek near Springfield, Minn.	NW¼NW¼ sec.4, T.108 N., R.35 W., Brown County, at bridge on County Highway 2, 0.9 miles upstream from mouth, and 5 miles southwest of Springfield.	-	1968-69	9-24-69	2.27
5-3169.6	Coal Mine Creek near Springfield, Minn.	On line between secs.22 and 27, T.109 N., R.35 W., Brown County, at bridge on county road, 1.2 miles upstream from mouth, and 3 miles southwest of Springfield.	-	1968-69	9-24-69	.02
5-3173	Morgan Creek at Cambria, Minn.	S¼SW¼ sec.16, T.109 N., R.29 W., Blue Earth County, at culvert on State Highway 68, 0.5 mile upstream from mouth, and 0.6 mile northwest of Cambria.	-	1969	9-22-69	1.28
5-3174	Swan Lake Outlet near Nicollet, Minn.	SE¼SE¼ sec.28, T.109 N., R.28 W., Nicollet County, at culvert on County Highway 62, 0.8 mile upstream from mouth, and 4.5 miles south of Nicollet.	-	1966-69	9-22-69	1.10
5-3178.18	Blue Earth River near Blue Earth, Minn.	Lat 43°34'22", long 94°06'08", on line between secs.5 and 8, T.101 N., R.27 W., Faribault County, at bridge on County Highway 4, 4.8 miles south of Blue Earth.	-	1968-69	11-20-68 7-30-69 8-27-69	160 241 17.5
5-3181.9	Center Creek near Huntley, Minn.	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, and 1.5 miles east of Huntley.	-	1968-69	11-20-68 7-30-69 8-27-69	79.0 125 10.4
5-3182.5	Elm Creek near Winnebago, Minn.	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 mile upstream from mouth, and 2.5 miles southwest of Winnebago.	-	1968-69	11-20-68 7-30-69 8-27-69	120 169 20.2
5-3187	Watonwan River at La Salle, Minn.	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, 1 mile southwest of La Salle.	-	1968-69	11-13-68 8-6-69 8-28-69	144 80.0 20.3
5-3188	St. James Creek near La Salle, Minn.	Lat 44°03'04", long 94°33'26", on line between secs.21 and 28, T.107 N., R.30 W., Watonwan County, at bridge on county road, 100 ft downstream from Butterfield Creek, and 1.4 miles south-east of La Salle.	-	1968-69	11-13-68 8-6-69 8-28-69	90.4 50.2 9.40
5-3191	South Fork Watonwan River near Madelia, Minn.	Lat 44°02'33", long 94°27'42", NE¼SW¼ sec.29, T.107 N., R.30 W., Watonwan County, at bridge on County Highway 116, 0.4 mile upstream from mouth, and 2.2 miles west of Madelia.	-	1968-69	11-13-68 8-6-69 8-28-69	129 54.1 8.36
5-3194.9	Watonwan River near Garden City, Minn.	SE¼SE¼ sec.31, T.107 N., R.28 W., Blue Earth County, at bridge on County Highway 20, 0.5 mile upstream from right bank tributary, and 3.7 miles southwest of Garden City.	-	1968-69	11-15-68 8-6-69 8-28-69	582 295 71.7
5-3200.7	Le Sueur River at Wilton, Minn.	Lat 44°00'52", long 93°31'38", in NE¼SE¼ sec.1, T.106 N., R.23 W., Waseca County, at bridge on County Highway 4, 0.2 mile east of Wilton.	-	1968-69	8-4-69 8-26-69	13.1 39.9
5-3203.3	Cobb River near Good Thunder, Minn.	Lat 44°02'50", long 94°00'00", in 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.	-	1968-69	10-15-68 8-6-69 8-29-69	758 28.5 2.46

Discharge measurements made at low-flow partial-record stations during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
5-3204.8	Maple River near Rapidan, Minn.	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, 3 miles southeast of Rapidan.	-	1968-69	10-15-68 8-6-69 8-28-69	666 61.3 14.8
St. Croix River basin						
5-3351.7	Crooked Creek near Hinckley, Minn.	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.	-	1966-69	10- 2-68 11- 8-68	56.2 50.8
5-3359	Sand Creek near Hinckley, Minn.	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.	-	1966-69	10- 2-68 11- 8-68	62.6 74.5
5-3362.4	Kettle River near Sturgeon Lake, Minn.	On line between secs.9 and 16, T.45 N., R.20 W., Pine County, at bridge on County Highway 46, 2.5 miles west of Sturgeon Lake.	-	1965-69	10- 2-68 11- 7-68	102 172
5-3363.2	Moose River at Sturgeon Lake, Minn.	NW¼SW¼ sec.14, T.45 N., R.20 W., Pine County, at bridge on County Highway 46 at Sturgeon Lake, and 1.5 miles upstream from mouth.	-	1965-69	10- 2-68 11- 7-68	85.5 112
5-3374	Knife River near Mora, Minn.	SE¼SE¼ sec.27, T.40 N., R.24 W., Kanabec County, at bridge on County Highway 77, 2.5 miles north of Mora.	-	1966-69	11- 8-68 8-27-69	57.7 2.14
5-3375	Snake River at Mora, Minn.	SE¼SW¼ sec.14, T.39 N., R.24 W., Kanabec County, at bridge on State Highways 23 and 65, at Mora.	-	1909-13 1966-69	11- 8-68 8-26-69	240 38.8
5-3377	Groundhouse River at Brunswick, Minn.	SW¼SE¼ sec.12, T.38 N., R.24 W., Kanabec County, at bridge on county highway at Brunswick, and 2 miles upstream from mouth.	-	1966-69	11- 8-68 8-26-69	65.1 7.81
5-3394.9	Rock Creek near Rush City, Minn.	On line between secs.6 and 7, T.37 N., R.20 W., Chisago County, at bridge on County Highway 3, 4.5 miles northeast of Rush City.	-	1967-69	10- 1-68 11- 6-68 8-22-69	26.2 12.3 2.42
5-3397.2	Rush Creek near Rush City, Minn.	On line between sec.31, T.37 N., R.20 W., and sec.36, T.37 N., R.21 W., Chisago County, at bridge on County Highway 56, 3.5 miles southeast of Rush City.	-	1967-69	10- 1-68 11- 6-68 8-21-69	60.5 102 2.03
5-3401.7	North Branch Sunrise River near North Branch, Minn.	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.	-	1967-69	10- 1-68 11- 5-68 8-20-69	70.0 84.8 20.7
Cannon River basin						
5-3550.8	Prairie Creek near Cannon Falls, Minn.	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.	-	1966-69	11- 6-68 9-15-69	27.7 11.1
5-3351.4	Little Cannon River near Cannon Falls, Minn.	SW¼ sec.25, T.112 N., R.18 W., Goodhue County, at bridge on county highway, 2.5 miles south of Cannon Falls.	-	1966-69	11- 6-68 9-15-69	48.2 14.2
5-3552.15	Belle Creek near Vasa, Minn.	SE¼ sec.4, T.112 N., R.16 W., Goodhue County, at bridge on county highway, 2 miles north of Vasa.	-	1966-69	11- 5-68 9-15-69	24.0 10.0
Winnebago Creek basin						
5-3872	Winnebago Creek near New Albin, Iowa	SE¼SW¼ sec.27, T.101 N., R.3 W., Houston County, Minn., at bridge on County Highway 5, 1.3 miles northwest of New Albin.	-	1969	9-24-69	25.7

* Operated as a continuous-record gaging station.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at low-flow partial-record stations during water year 1969

Discharge measurements made at low-flow partial-record stations during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Des Moines River basin						
5-4747.7	Beaver Creek near Currie, Minn.	At center of W $\frac{1}{2}$ sec.24, T.107 N., R.41 W., Murray County, at bridge on county road, 2.8 miles southwest of Currie.	-	1969	9-23-69	1.72
5-4748	Lime Creek near Avoca, Minn.	Near intersection of secs.27, 28, 33, and 34, T.106 N., R.39 W., Murray County, at bridge on County Highway 6, 0.6 mile upstream from mouth, and 6.2 miles east of Avoca.	-	1969	9-23-69	.49
5-4749.2	Okabena Creek at Okabena, Minn.	On line between secs.7 and 8, T.103 N., R.37 W., Jackson County, at bridge on County Highway 9, 0.3 mile north of Okabena.	-	1969	9-22-69	3.61
5-4749.8	Jack Creek near Heron Lake, Minn.	On line between secs.31 and 32, T.104 N., R.37 W., Murray County, at bridge on County Highway 9, 1.8 miles south of Heron Lake.	-	1969	9-22-69	1.83

Crest-stage partial-record stations

The following table contains annual maximum discharge for crest-stage stations. A crest-stage 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, and discharge measurements may have been made for purposes of establishing the stage-discharge relation, but these are 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 during water year 1969

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Streams tributary to Lake Superior							
4-0113.7	Little Devil Track River near Grand Marais, Minn.	Lat 47°47'09", long 90°19'44", in NE¼NW¼ sec.9, T.61 N., R.1 E., Cook County, at culvert on County Highway 12, 1.6 miles above mouth, and 2.5 miles north of Grand Marais.	7.49	1961-69	10-9-68	20.62	341
4-0113.9	Little Devil Track River tributary near Grand Marais, Minn.	Lat 47°47'17", long 90°19'20", in SE¼SE¼ sec.4, T.61 N., R.1 E., Cook County, at culvert on County Highway 55, 0.2 mile above mouth, and 2.8 miles north of Grand Marais.	.47	1966-69	10-9-68	16.02	(/)
4-0131	Lake Superior tributary near Taconite Harbor, Minn.	Lat 47°29'14", long 90°59'19", in SW¼SE¼ sec.20, T.58 N., R.5 W., Cook County, at culvert on U.S. Highway 61, 0.2 mile above mouth, and 3.7 miles southwest of Taconite Harbor.	1.56	1964-69	10-9-68	9.62	102
4-0132	Caribou River near Little Marais, Minn.	Lat 47°27'51", long 91°01'50", in NW¼SE¼ sec.36, T.58 N., R.6 W., Lake County, at culvert on U.S. Highway 61, 0.2 mile above mouth, and 5.2 miles northeast of Little Marais.	22.7	1961-69	10-9-68	13.64	608
4-0151.5	Crow Creek near Silver Creek, Minn.	Lat 47°08'30", long 91°34'38", in SW¼SW¼ sec.23, T.54 N., R.10 W., Lake County, at culvert on County Highway 3, 2.3 miles northeast of Silver Creek, and 4.0 miles above mouth.	1.07	1960-69	4-13-69	8.83	32
4-0152	Encampment River tributary at Silver Creek, Minn.	Lat 47°07'01", long 91°36'04", in NE¼SE¼ sec.33, T.54 N., R.10 W., Lake County, at culvert on County Highway 3, 0.3 mile north of Silver Creek, and 1.4 miles above mouth.	.96	1960-69	8- 6-69	7.73	46
4-0152.5	Silver Creek tributary near Two Harbors, Minn.	Lat 47°04'40", long 91°36'49", in SW¼NE¼ sec.16, T.53 N., R.10 W., Lake County, at culvert on County Highway 3, 1.0 mile above mouth, and 4.5 miles northeast of Two Harbors.	3.72	1965-69	9-30-65 10-18-65 6-12-67 8- 6-69	4.06 4.47 4.66 5.22	a130 a155 a168 208
4-0153	Little Stewart River near Two Harbors, Minn.	Lat 47°03'52", long 91°40'03", in SE¼NE¼ sec.24, T.53 N., R.11 W., Lake County, at culvert on county highway, 2.0 miles above mouth, and 2.7 miles north of Two Harbors.	5.54	1960-69	4-13-69	10.85	176
4-0153.6	Lake Superior tributary No. 2 at French River, Minn.	Lat 46°53'43", long 91°54'31", in SW¼SE¼ sec.18, T.51 N., R.12 W., St. Louis County, at culvert on U.S. Highway 61, 0.35 mile above mouth, and 0.7 mile west of French River.	1.41	1964-69	4-13-69	18.48	75
4-0153.7	Talmadge River at Duluth, Minn.	Lat 46°53'20", long 91°55'21", in SE¼NE¼ sec.24, T.51 N., R.13 W., St. Louis County, at culvert on U.S. Highway 61, 0.6 mile above mouth, and 0.5 mile northeast of Duluth city limits.	5.79	1964-69	6-13-67 4-24-68 4-14-69	15.55 15.23 13.85	a371 a335 224
4-0154	Miller Creek at Duluth, Minn.	Lat 46°49'01", long 92°10'42", in SE¼NE¼ sec.13, T.50 N., R.15 W., St. Louis County, at culvert on U.S. Highway 53, 0.2 mile northwest of Duluth city limits.	4.92	1960-69	4-11-69	15.67	164
4-0177	McKinley Lake tributary at McKinley, Minn.	Lat 47°30'41", long 92°25'11", in SW¼NE¼ sec.18, T.58 N., R.16 W., St. Louis County, at culvert on State Highway 135 at west edge of McKinley.	.42	1960-69	9- 6-69	9.35	25
4-0188	East Two River tributary at Virginia, Minn.	Lat 47°31'54", long 92°33'51", in NE¼NE¼ sec.12, T.58 N., R.18 W., St. Louis County, at culvert on U.S. Highway 169, 0.2 mile west of Virginia city limits, and 1.1 miles above mouth.	4.26	1959-69	8-29-69	8.93	b100

/ Discharge not determined.

a Not previously published.

b Estimated.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Streams tributary to Lake Superior--Continued							
4-0241	Rock Creek near Blackhoof, Minn.	Lat 46°32'10", long 92°22'12", in SW¼SE¼ sec.21, T.47 N., R.16 W., Carlton County, at culvert on State Highway 23, 4.0 miles above mouth, and 4.4 miles east of Blackhoof.	4.94	1961-65, 1967-69	7-31-69	16.03	360
4-0241.1	Rock Creek tributary near Blackhoof, Minn.	Lat 46°32'14", long 92°22'05", in NE¼SE¼ sec.21, T.47 N., R.16 W., Carlton County, at culvert on State Highway 23, 0.1 mile above mouth, and 4.5 miles east of Blackhoof.	.20	1961-69	7-31-69	15.21	31
4-0242	South Fork Nemadji River near Holyoke, Minn.	Lat 46°29'38", long 92°24'36", in SE¼SE¼ sec.6, T.46 N., R.16 W., Carlton County, at culvert on State Highway 23, 1.7 miles below Clear Creek, and 2.0 miles northwest of Holyoke.	19.4	1961-69	7-31-69	16.29	1,590
Red River of the North basin							
5-0476	West Branch Mus-tinka River near Graceville, Minn.	Lat 45°37'43", long 96°26'35", in NW¼NW¼ sec.22, T.125 N., R.46 W., Traverse County, at culverts on county highway, 4.1 miles north of Graceville.	56.7	1964-69	4- 9-69	12.50	686
5-0477	West Branch Mus-tinka River tributary near Graceville, Minn.	Lat 45°36'53", long 96°19'47", in NE¼NW¼ sec.28, T.125 N., R.45 W., Traverse County, at culvert on county highway, 0.6 mile northeast of Graceville.	3.37	1964-69	4- 9-69	10.56	418
5-0608	Buffalo River near Callaway, Minn.	Lat 47°01'15", long 95°54'50", in SW¼SW¼ sec.17, T.141 N., R.41 W., Becker County, at culvert on U.S. Highway 59, 2.7 miles north of Callaway.	49.9	1960-69	4-10-69	c15.11	446
5-0612	Whisky Creek at Barnesville, Minn.	Lat 46°39'35", long 96°23'54", in SE¼SW¼ sec.20, T.137 N., R.45 W., Clay County, at culvert on State Highway 34, 0.7 mile above Blue Eagle Lake, and 1.0 mile northeast of Barnesville.	25.3	1961-64, 1965-66, 1967-69	4- 9-69	6.85	570
5-0614	Hay Creek above Downer, Minn.	Lat 46°44'37", long 96°25'12", in NW¼NW¼ sec.30, T.138 N., R.45 W., Clay County, at culvert on county road, 3.1 miles east of Downer.	5.81	1961-69	4- 9-69	8.08	117
5-0622.8	Wild Rice River tributary near Bagley, Minn.	Lat 47°27'00", long 95°23'00", in SW¼NW¼ sec.21, T.146 N., R.37 W., Clearwater County, at culvert on State Highway 92, 5.0 miles south of Bagley.	3.34	1961-69	4-10-69	9.24	57
5-0624.7	Marsh River tributary near Mahnomen, Minn.	Lat 47°19'35", long 96°04'40", in SE¼SW¼ sec.36, T.145 N., R.43 W., Norman County, at culvert on State Highway 31, a quarter mile above mouth, and 5¼ miles west of Mahnomen.	6.57	1961-69	4-11-69	13.76	436
5-0627	Wild Rice River tributary near Twin Valley, Minn.	Lat 47°17'50", long 96°19'40", in SW¼SE¼ sec.12, T.144 N., R.45 W., Norman County, at culvert on State Highway 31, 1.2 miles above mouth, and ¼ miles northwest of Twin Valley.	2.25	1961-69	4- 9-69	13.83	236
5-0628	Coon Creek near Twin Valley, Minn.	Lat 47°15'55", long 96°20'35", in NE¼NE¼ sec.26, T.144 N., R.45 W., Norman County, at bridge on County Highway 28, 1.1 miles above mouth, and 4.0 miles west of Twin Valley.	32.1	1962-69	4- 9-69	c13.42	1,520
5-0632	South Branch Wild Rice River near Ogema, Minn.	Lat 47°07'20", long 95°57'35", in SE¼SE¼ sec.11, T.142 N., R.42 W., Becker County, at culvert on county highway, 2 miles northwest of Ogema.	6.50	1963-69	4- 9-69	8.68	(#)
5-0736	South Branch Battle River at Northome, Minn.	Lat 47°52'20", long 94°17'50", in NE¼ sec.25, T.151 N., R.29 W., Koochiching County, at culvert on U.S. Highway 71, 0.8 mile west of Northome, and 3 miles above Battle Lake.	3.19	1960-69	4-13-69	c16.43	109
5-0737.5	South Branch Cormorant River tributary near Blackduck, Minn.	Lat 47°46'20", long 94°31'20", in NW¼NW¼ sec.32, T.150 N., R.30 W., Beltrami County, at culvert on County Highway 304, 3 miles above mouth, and ¾ miles north of Blackduck.	4.45	1960-69	4-13-69	16.16	235
5-0738	Perry Creek near Shooks, Minn.	Lat 47°52'00", long 94°32'50", in NW¼SW¼ sec.30, T.151 N., R.30 W., Beltrami County, at culvert on State Highway 72, 5 miles west of Shooks.	2.41	1960-69	4-13-69	d8.05	76

Discharge not determined.

Operated as a continuous-record gaging station.

c Backwater from ice.

d Backwater from debris.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Red River of the North basin--Continued							
5-0766	Red Lake River tributary near Thief River Falls, Minn.	Lat 48°04'44", long 96°12'15", in SW¼SE¼ sec.8, T.153 N., R.43 W., Pennington County, at culvert on County Highway 7, 0.5 mile above mouth, and 3.1 miles south of Thief River Falls.	-	1962-69	4- 9-69	7.22	200
5-0781	Lost River at Gonvick, Minn.	Lat 47°43'55", long 95°31'10", in NE¼NE¼ sec.16, T.149 N., R.38 W., Clearwater County, at culvert on county highway, 0.5 mile south of Gonvick, and 3 miles below Pine Lake.	30.9	1960-69	4- 8-69	c13.33	(A)
5-0781.8	Lost River tributary near Clearbrook, Minn.	Lat 47°38'40", long 95°26'40", in NW¼ sec.13, T.148 N., R.38 W., Clearwater County, at culvert on county highway, 3.5 miles south of Clearbrook.	1.79	1960-69	4-10-69	9.54	56
5-0782	Lost River tributary at Clearbrook, Minn.	Lat 47°41'50", long 95°25'45", in SW¼NW¼ sec.29, T.149 N., R.37 W., Clearwater County, at culvert on county highway at north edge of Clearbrook, three-quarters of a mile above mouth.	3.05	1960-69	4- 9-69	12.74	93
5-0784	Clearwater River tributary near Plummer, Minn.	Lat 47°52'35", long 96°08'25", in SE¼SE¼ sec.22, T.151 N., R.43 W., Red Lake County, at culvert on county highway, 1.2 miles above mouth, and 5½ miles southwest of Plummer.	1.17	1961-69	4-10-69	9.97	153
Lake of the Woods basin							
5-1283	Pike River near Gilbert, Minn.	Lat 47°29'34", long 92°29'15", in NE¼SW¼ sec.22, T.58 N., R.17 W., St. Louis County, at culvert on State Highway 135, 1.1 miles west of Gilbert.	-	1966-69	4-15-66 3-31-67 8-21-68 10-17-68	7.13 7.17 8.11 7.67	a13 a14 a34 24
5-1287	Pike River tributary near Wahlsten, Minn.	Lat 47°43'04", long 92°17'12", in SW¼SW¼ sec.32, T.61 N., R.15 W., St. Louis County, at culvert on State Highway 135, 1.2 miles south of Wahlsten, and 2.7 miles above mouth.	1.93	1961-69	4-13-69	7.29	80
5-1297.1	Johnson Creek near Britt, Minn.	Lat 47°39'40", long 92°38'03", in NW¼NE¼ sec.28, T.60 N., R.18 W., St. Louis County, at culvert adjacent to U.S. Highway 53, 0.6 mile below Sand Lake, and 5.9 miles west of Britt.	6.92	1961-64, 1966-69	4-13-69	7.86	31
5-1303	Borin Creek near Chisholm, Minn.	Lat 47°36'14", long 92°51'58", in SE¼SE¼ sec.9, T.59 N., R.20 W., St. Louis County, at culvert on State Highway 73, 1.2 miles above mouth, and 7.8 miles north of Chisholm.	13.7	1959-69	9- 6-59 4-13-60 4-23-61 6-11-62 5- 6-64 9-30-65 4-16-66 3-31-67 9-18-68 4-13-69	12.58 12.23 13.01 11.79 12.21 12.18 12.26 c12.63 12.02 13.40	e305 e206 e485 e124 e202 e191 e211 e182 e159 700
Split Hand Creek basin							
5-2150	Smith Creek near Hill City, Minn.	Lat 47°05'05", long 93°35'05", in SE¼NW¼ sec.13, T.53 N., R.26 W., Itasca County, at culvert on U.S. Highway 169, 6.5 miles north of Hill City.	5.06	1961-69	4-13-69	6.04	248
Swan River basin							
5-2167	O'Brien Creek near Nashwauk, Minn.	Lat 47°22'59", long 93°08'08", in NE¼NE¼ sec.33, T.57 N., R.22 W., Itasca County, at culvert on U.S. Highway 169, 1.5 miles east of Nashwauk, and 3.0 miles above Welcome Creek.	8.26	1959-69	4-12-69	c8.31	25
5-2169.8	Swan River tributary at Warba, Minn.	Lat 47°07'15", long 93°15'00", in NW¼ sec.34, T.54 N., R.23 W., Itasca County, at culvert on U.S. Highway 2, three-quarters of a mile above mouth, and 1 mile southeast of Warba.	2.36	1961-69	4-13-69	5.98	44

A Discharge not determined.
 a Not previously published.
 c Backwater from ice.
 e Revised.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Bluff Creek basin							
5-2177	Bluff Creek near Jacobson, Minn.	Lat 47°00'20", long 93°17'40", in SW¼NW¼ sec.8, T.52 N., R.23 W., Aitkin County, at culvert on State Highway 34, 1¼ miles west of Jacobson.	2.95	1961-69	4-13-69	8.33	59
Crow Wing River basin							
5-2441	Kitten Creek near Sebek, Minn.	Lat 46°40'30", long 95°04'40", in SE¼SE¼ sec.15, T.137 N., R.35 W., Wadena County, at culvert on county highway, ¾ miles above mouth, and ¾ miles north of Sebek.	9.34	1961-69	4-12-69	10.77	227
5-2442	Cat River near Nimrod, Minn.	Lat 46°37'50", long 94°55'40", in SW¼SW¼ sec.36, T.137 N., R.34 W., Wadena County, at bridge on State Highway 227, 2½ miles west of Nimrod, and 3 miles above mouth.	44.3	1961-69	4-12-69	8.33	410
Platte River basin							
5-2678	Big Mink Creek tributary near Lastrup, Minn.	Lat 46°01'58", long 94°06'13", in NW¼SW¼ sec.14, T.41 N., R.30 W., Morrison County, at culvert on State Highway 25, 1.4 miles above mouth, and 2.1 miles west of Lastrup.	-	1961-69	4- 8-69	11.76	35
5-2679	Hillman Creek near Pierz, Minn.	Lat 45°58'27", long 94°04'21", in NE¼SE¼ sec.9, T.40 N., R.30 W., Morrison County, at bridge on county highway, 1.1 miles above mouth, and 1.5 miles east of Pierz.	52.6	1964-69	4- 9-69	15.48	(A)
Sauk-River basin							
5-2703	Sauk River tributary at Spring Hill, Minn.	Lat 45°31'22", long 94°48'31", in SW¼NE¼ sec.27, T.124 N., R.33 W., Stearns County, at culvert on State Highway 4, 1.0 mile east of Spring Hill, and 2.7 miles above mouth.	6.42	1960-69	4- 7-69	13.09	364
5-2703.1	Sauk River tributary near St. Martin, Minn.	Lat 45°31'45", long 94°44'45", in SE¼ sec.19, T.124 N., R.32 W., Stearns County, at culvert on county highway, ¼ miles northwest of St. Martin.	.23	1960, 1962-69	4- 8-69	7.34	11
Johnson Creek basin							
5-2718	Johnson Creek tributary at Luxemburg, Minn.	Lat 45°26'30", long 94°14'46", in NW¼NE¼ sec.30, T.123 N., R.28 W., Stearns County, at culverts on State Highway 15, 0.8 mile south of Luxemburg.	2.77	1964-69	4- 8-69	c8.25	52
5-2720	Johnson Creek tributary near St. Augusta, Minn.	Lat 45°26'52", long 94°12'00", in NE¼SE¼ sec.21, T.123 N., R.28 W., Stearns County, at culverts on county highway, 0.7 mile above mouth, and 3.1 miles southwest of St. Augusta.	-	1964-69	4- 8-69	9.09	196
5-2723	Johnson Creek near St. Augusta, Minn.	Lat 45°27'49", long 94°09'19", in NW¼SW¼ sec.13, T.123 N., R.28 W., Stearns County, at bridge on County Highway 7, 1.0 mile south of St. Augusta, and 3.3 miles above mouth.	-	1964-69	4- 8-69	14.23	532
Otsego Creek basin							
5-2737	Otsego Creek near Otsego, Minn.	Lat 45°17'19", long 93°38'59", in SW¼NE¼ sec.13, T.121 N., R.24 W., Wright County, at culvert on County Highway 39, 1.3 miles above mouth, and 1.9 miles west of Otsego.	-	1964-69	4- 7-69	7.00	171
Elk River basin							
5-2742	Stony Brook tributary near Foley, Minn.	Lat 45°38'40", long 93°54'50", in NW¼ sec.2, T.36 N., R.29 W., Benton County, at culvert on State Highway 25, a quarter mile above mouth, and 1½ miles south of Foley.	3.11	1960-69	4- 7-69	c10.20	78

A Discharge not determined.
 c Backwater from ice.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Crow River basin							
5-2761	North Fork Crow River tributary near Paynesville, Minn.	Lat 45°23'20", long 94°46'50", in NW¼ sec.12, T.122 N., R.33 W., Kandiyohi County, at culvert on county highway, 1 mile above mouth, and 3 miles west of Paynesville.	.58	1960-69	4- 7-69	17.04	15
5-2783.5	Fountain Creek near Montrose, Minn.	Lat 45°01'20", long 93°56'29", in NE¼NW¼ sec.22, T.118 N., R.26 W., Wright County, at culvert on County Highway 30, 3.3 miles southwest of Montrose.	6.73	1962-69	4- 7-69	6.37	63
5-2787	Otter Creek near Lester Prairie, Minn.	Lat 44°54'23", long 94°04'24", in SE¼SE¼ sec.28, T.117 N., R.27 W., McLeod County, at culvert on State Highway 7, 2.1 miles northwest of Lester Prairie, and 4.4 miles above mouth.	30.2	1961-69	4- 9-69	9.02	365
5-2787.5	Otter Creek tributary near Lester Prairie, Minn.	Lat 44°53'34", long 94°04'24", in SE¼SE¼ sec.33, T.117 N., R.27 W., McLeod County, at culvert on County Highway 63, 1.7 miles northwest of Lester Prairie, and 3.3 miles above mouth.	1.54	1962-69	4- 7-69	8.42	31
5-2788.5	Buffalo Creek tributary near Brown-ton, Minn.	Lat 44°04'55", long 94°22'33", in NE¼SE¼ sec.13, T.115 N., R.30 W., McLeod County, at culvert on State Highway 15, 0.6 mile above mouth, and 2.6 miles northwest of Brown-ton.	9.45	1961-69	4- 6-69	14.57	64
5-2790.3	South Fork Crow River tributary near Mayer, Minn.	Lat 44°54'21", long 93°53'51", in NW¼NE¼ sec.36, T.117 N., R.26 W., Carver County, at culvert on State Highway 7, 0.7 mile above mouth, and 1.4 miles north of Mayer.	e7.74	1962-69	4- 7-69	6.04	(#)
5-2803	School Lake Creek tributary near St. Michael, Minn.	Lat 45°12'09", long 93°41'31", in NW¼SE¼ sec.15, T.120 N., R.24 W., Wright County, at culvert on county highway, 0.2 mile above mouth, and 1.5 miles southwest of St. Michael.	2.04	1964-69	4- 7-69	9.23	(#)
Rum River basin							
5-2841	Mille Lacs Lake tributary near Wealthwood, Minn.	Lat 46°21'25", long 93°41'40", in NW¼NE¼ sec.25, T.45 N., R.27 W., Aitkin County, at culvert on State Highway 18, 0.2 mile above mouth, and 2.0 miles west of Wealthwood.	-	1961-69	4- 7-69	9.41	23
5-2846	Robinson Brook near Onamia, Minn.	Lat 45°58'20", long 93°39'30", in NE¼SE¼ sec.11, T.40 N., R.27 W., Mille Lacs County, at culvert on U.S. Highway 169, a quarter mile above mouth, and 6 3/4 miles south of Onamia.	7.21	1960-69	6-30-68 10-17-68	14.34 15.43	62 138
5-2846.2	Rum River tributary near Onamia, Minn.	Lat 45°57'20", long 93°39'30", in E¼ sec.14, T.40 N., R.27 W., Mille Lacs County, at culvert on U.S. Highway 169, a quarter mile above mouth, and 7 3/4 miles south of Onamia.	1.84	1960-69	4- 7-69	10.32	98
5-2849.2	Stanchfield Creek tributary near Day, Minn.	Lat 45°41'29", long 93°23'45", in NW¼SE¼ sec.13, T.37 N., R.25 W., Isanti County, at culvert on County Highway 60, 0.5 mile above mouth, and 1.5 miles southwest of Day.	1.26	1961-69	4- 7-69	6.73	47
Minnesota River basin							
5-2991	Lazarus Creek tributary near Canby, Minn.	Lat 44°43'04", long 96°19'42", in NE¼NW¼ sec.6, T.114 N., R.45 W., Yellow Medi-cine County, at culvert on State High-way 68, 2.7 miles west of Canby, and 4.2 miles above mouth.	2.97	1960-69	3-29-60 7- 1-61 7- 4-62 7-26-63 4-13-64 5-21-65 3-10-66 6-18-67 4- 7-69 4- 7-69	11.67 10.80 13.64 18.49 10.75 12.19 c11.44 11.00 13.17 c14.40	a139 a55 a387 1,000 a51 a204 a74 a71 330 30
5-3012	Minnesota River tributary near Montevideo, Minn.	Lat 44°56'10", long 95°48'10", in SW¼SE¼ sec.16, T.117 N., R.41 W., Lac qui Parle County, at culvert on U.S. High-way 212, 1 mile above mouth, and 3 3/4 miles west of Montevideo.	.54	1960-69	4- 7-69	c14.40	30

Discharge not determined.
a Not previously published.
c Backwater from ice.
e Revised.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Minnesota River basin--Continued							
5-3029.7	Lake Emily tributary near Starbuck, Minn.	Lat 45°31'30", long 95°33'40", in NW¼ sec.27, T.124 N., R.39 W., Pope County, at culvert on State Highway 29, 6¼ miles south of Starbuck.	.13	1962-69	7-19-62 4- 5-64 8- 6-65 10-18-65 6-16-67 4- 7-69	10.30 c7.26 8.00 7.29 7.08 7.70	a59 a3.3 a17 a7.3 a4.6 13
5-3034.5	Hassel Creek near Clontarf, Minn.	Lat 45°24'05", long 95°34'15", in NW¼SE¼ sec.4, T.122 N., R.39 W., Swift County, at culvert on State Highway 29, a quarter mile above Lake Hassel, and 5¼ miles east of Clontarf.	4.03	1962-69	5-16-69	14.41	313
5-3052	Spring Creek near Montevideo, Minn.	Lat 44°58'40", long 95°43'00", in SW¼SW¼ sec.32, T.118 N., R.40 W., Chippewa County, at culvert on State Highway 29, 1¼ miles above mouth, and 2¼ miles north of Montevideo.	16.3	1959-69	4- 7-69	17.94	463
5-3112	North Branch Yellow Medicine River near Ivanhoe, Minn.	Lat 44°27'32", long 96°21'27", in NE¼NW¼ sec.2, T.111 N., R.46 W., Lincoln County, at culvert on State Highway 19, 5.3 miles west of Ivanhoe.	e14.8	1960-69	4- 7-69	18.70	940
5-3112.5	North Branch Yellow Medicine River tributary near Wilno, Minn.	Lat 44°33'12", long 96°16'33", in SE¼NE¼ sec.33, T.113 N., R.45 W., Lincoln County, at culvert on U.S. Highway 75, 2.1 miles above mouth, and 4.3 miles northwest of Wilno.	.33	1960-69	4- 4-69	10.47	54
5-3113	North Branch Yellow Medicine River tributary No. 2 near Porter, Minn.	Lat 44°35'39", long 96°16'34", in SE¼NE¼ sec.16, T.113 N., R.45 W., Lincoln County, at culvert on U.S. Highway 75, 6¼ miles southwest of Porter.	e3.70	1960-69	4- 7-69	16.57	212
5-3138	Chetomba Creek tributary near Blomkest, Minn.	Lat 44°58'40", long 95°02'20", in SW¼SW¼ sec.35, T.118 N., R.35 W., Kandiyohi County, at culvert on U.S. Highway 71, 2 3/4 miles northwest of Blomkest.	.79	1959-69	4- 7-69	8.02	34
5-3149	Redwood River at Ruthton, Minn.	Lat 44°10'53", long 96°06'07", in NW¼NW¼ sec.11, T.108 N., R.44 W., Pipestone County, at culvert on State Highway 23, 0.3 mile north of Ruthton.	5.90	1959-69	4- 8-69	18.19	728
5-3152	Prairie Ravine near Marshall, Minn.	Lat 44°29'44", long 95°47'48", in SE¼NE¼ sec.20, T.112 N., R.41 W., Lyon County, at culvert on U.S. Highway 59, 2.7 miles north of Marshall.	5.63	1959-64 ^a , 1965-69	4- 7-69	9.96	221
5-3165.5	West Fork Beaver Creek near Olivia, Minn.	Lat 44°50'55", long 95°02'05", in SW¼SW¼ sec.14, T.116 N., R.35 W., Renville County, at culvert on U.S. Highway 71, 5¼ miles northwest of Olivia.	9.71	1959-69	7-14-68 4- 7-69	3.18 7.7	a20 269
5-3166.9	Spring Creek tributary near Sleepy Eye, Minn.	Lat 44°23'54", long 94°45'35", in NW¼ sec.25, T.111 N., R.33 W., Brown County, at culvert on county highway, 0.1 mile above mouth, and 7½ miles north of Sleepy Eye.	-	1966-69	4- 6-69	7.14	117
5-3167	Spring Creek near Sleepy Eye, Minn.	Lat 44°24'15", long 94°44'55", in NE¼SE¼ sec.24, T.111 N., R.33 W., Brown County, at culvert on county highway, 3 3/4 miles above mouth, and 7½ miles north of Sleepy Eye.	30.0	1959-69	4- 6-69	15.93	683
5-3168	Cottonwood River tributary near Balaton, Minn.	Lat 44°14'20", long 95°57'20", in NW¼NW¼ sec.19, T.109 N., R.42 W., Lyon County, at culvert on U.S. Highway 14, 4¼ miles west of Balaton.	.50	1959-69	4- 6-69	c7.74	106
5-3168.5	Meadow Creek tributary near Marshall, Minn.	Lat 44°22'42", long 95°45'20", in SE¼NE¼ sec.34, T.111 N., R.41 W., Lyon County, at culvert on U.S. Highway 59, 1.2 miles above mouth, and 4.5 miles south of Marshall.	.54	1961-69	3-19-61 5-22-62 7-19-63 6-30-64 4- 9-65 3-14-66 4-30-67 7-26-68 7- 4-69 10-17-68	c14.18 13.49 13.94 14.02 14.00 c14.78 14.63 13.52 14.81 9.36	a5.0 a1.4 a17 a24 a22 a8.6 a76 a1.8 90 435
5-3169	Dry Creek near Jeffers, Minn.	Lat 44°07'21", long 95°12'13", in NE¼NE¼ sec.31, T.108 N., R.36 W., Cottonwood County, at culvert on County Highway 10, 4.5 miles north of Jeffers.	e3.13	1961-69	10-17-68	9.36	435
5-3169.2	Cottonwood River tributary near Sanborn, Minn.	Lat 44°10'34", long 95°07'15", in SW¼NW¼ sec.12, T.108 N., R.36 W., Cottonwood County, at culvert on U.S. Highway 71, 2.4 miles south of Sanborn.	.42	1966-69	4-19-66 4- 2-67 7-26-68 10-17-68	6.06 4.43 4.58 4.82	a72 a21 a25 31

* Operated as a continuous-record gaging station.

a Not previously published.

c Backwater from ice.

e Revised.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Minnesota River basin--Continued							
5-3178.5	Foster Creek near Alden, Minn.	Lat 43°39'31", long 93°35'30", in NE¼NE¼ sec.9, T.102 N., R.23 W., Freeborn County, at culvert on U.S. Highway 16, 1.2 miles southwest of Alden.	2.26	1959-69	10-16-68	7.30	123
5-3181	East Branch Blue Earth River tributary near Blue Earth, Minn.	Lat 43°37'09", long 94°01'03", in SW¼SE¼ sec.24, T.102 N., R.27 W., Faribault County, at culvert on County Highway 13, a quarter mile above mouth, and 4¼ miles east of Blue Earth.	9.20	1960-69	6-29-69	d6.65	203
5-3183	North Fork Watonwan River near Delft, Minn.	Lat 44°00'00", long 95°07'20", in E¼ sec.11, T.106 N., R.36 W., Cottonwood County, at culvert on U.S. Highway 71, 1 3/4 miles northwest of Delft.	13.1	1960-69	7-26-68 4- 6-69	17.21 17.72	a565 865
5-3202	Le Sueur River tributary near Mankato, Minn.	Lat 44°07'29", long 93°57'33", in SE¼SW¼ sec.28, T.108 N., R.26 W., Blue Earth County, at culvert on State Highway 22, 0.2 mile above mouth, and 1.5 miles southeast of Mankato Airport.	.073	1959-69	10-17-68	19.48	8.6
5-3203	Cobb River tributary near Mapleton, Minn.	Lat 44°01'05", long 93°57'30", in SW¼NE¼ sec.4, T.106 N., R.26 W., Blue Earth County, at culvert on State Highway 22, 1.0 mile above mouth, and 6.3 miles north of Mapleton.	7.25	1959-69	10-17-68	16.35	162
5-3204	Maple River tributary near Mapleton, Minn.	Lat 43°55'18", long 94°01'17", in SE¼SW¼ sec.1, T.105 N., R.27 W., Blue Earth County, at culvert on State Highway 30, 0.9 mile above mouth and 3.3 miles west of Mapleton.	e6.22	1959-69	10-17-68	18.28	191
5-3204.4	Judicial ditch No. 49 near Amboy, Minn.	Lat 43°53'17", long 94°07'38", in NW¼ sec.19, T.105 N., R.27 W., Blue Earth County, at culvert on State Highway 30, 1.6 miles east of Amboy.	e18.0	1959-69	10-17-68	15.83	(#)
5-3301.5	Sand Creek tributary near Montgomery, Minn.	Lat 44°25'41", long 93°30'31", in NE¼NE¼ sec.18, T.111 N., R.22 W., Rice County, at culvert on State Highway 21, 3¼ miles east of Montgomery.	e.36	1961-69	4- 3-69	8.61	23
5-3302	Rice Lake tributary near Montgomery, Minn.	Lat 44°25'42", long 93°32'10", in NE¼NW¼ sec.13, T.111 N., R.23 W., Le Sueur County, at culvert on State Highway 21, 1.8 miles above Rice Lake, and 2.5 miles east of Montgomery.	e3.16	1960-69	4- 3-69	7.60	65
5-3303	Sand Creek near New Prague, Minn.	Lat 44°32'37", long 93°32'16", in NE¼NW¼ sec.1, T.112 N., R.23 W., Le Sueur County, at culvert on State Highway 13 and 19, 1.9 miles east of New Prague.	e62.4	1960-69	4- 3-69	12.26	540
5-3305.5	Raven Stream tributary near New Prague, Minn.	Lat 44°34'21", long 93°35'58", in NW¼ sec.28, T.113 N., R.23 W., Scott County, at culvert on county road, 1.6 miles above mouth, and 2.3 miles northwest of New Prague.	e22.1	1960-69	4- 3-69	13.06	325
5-3306	Sand Creek tributary No. 2 near Jordan, Minn.	Lat 44°37'45", long 93°36'33", in NW¼NE¼ sec.5, T.113 N., R.23 W., Scott County, at culvert on State Highway 21, 0.8 mile above mouth, and 2.8 miles south of Jordan.	2.62	1960-69	3-23-69	13.17	(#)
St. Croix River basin							
5-3363	Moose River tributary at Moose Lake, Minn.	Lat 46°27'17", long 92°47'14", in SE¼NE¼ sec.19, T.46 N., R.19 W., Carlton County at culvert on State Highway 27, 0.9 mile above mouth, and 1.2 miles west of Moose Lake.	e1.23	1960-69	10-17-68	8.89	83
5-3365.5	Wolf Creek tributary near Sandstone, Minn.	Lat 46°09'45", long 92°51'58", in NE¼SE¼ sec.33, T.43 N., R.20 W., Pine County, at culvert on U.S. Highway 61, 0.2 mile above mouth, and 2.2 miles north of Sandstone.	5.46	1960-69	10-17-68	17.87	125
5-3366	Kettle River tributary at Sandstone, Minn.	Lat 46°08'46", long 92°51'57", in SE¼SE¼ sec.4, T.42 N., R.20 W., Pine County, at culvert on U.S. Highway 61 at Sandstone, and 0.2 mile above mouth.	.65	1960-69	4- 9-69	8.22	32
5-3382	Mission Creek near Hinckley, Minn.	Lat 45°59'52", long 92°56'44", in SW¼SW¼ sec.25, T.41 N., R.21 W., Pine County, at culvert on U.S. Highway 23, 1.2 miles south of Hinckley.	-	1960-69	4- 9-69	15.03	146

* Discharge not determined.
 a Not previously published.
 d Backwater from debris.
 e Revised.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Vermillion River basin							
5-3459	Vermillion River tributary near Hastings, Minn.	Lat 44°43'19", long 92°56'03", in NE¼SE¼ sec.35, T.115 N., R.18 W., Dakota County, at culvert on county highway, 2.0 miles above mouth, and 4.1 miles west of Hastings.	14.3	1960-69	4- 3-69	16.15	44
Cannon River basin							
5-3527	Turtle Creek tributary No. 2 near Pratt, Minn.	Lat 44°00'02", long 93°08'30", in NW¼SW¼ sec.8, T.106 N., R.19 W., Steele County, at culvert on U.S. Highway 218, 1 mile above mouth, and 1.7 miles southeast of Pratt.	1.28	1960-69	6-29-69	16.42	57
5-3528	Turtle Creek tributary near Steele Center, Minn.	Lat 44°00'26", long 93°12'20", in NW¼NW¼ sec.11, T.106 N., R.20 W., Steele County, at culvert on township road, 1.3 miles above mouth, and 1.6 miles northeast of Steele Center.	5.01	1960-69	6-29-69	5.73	58
5-3551	Little Cannon River tributary near Kenyon, Minn.	Lat 44°20'50", long 92°58'50", in SE¼ sec.9, T.110 N., R.18 W., Goodhue County, at culvert on State Highway 56, a quarter mile above mouth, and 5 miles north of Kenyon.	2.02	1960-69	10-17-68	13.95	217
5-3551.5	Pine Creek near Cannon Falls, Minn.	Lat 44°32'27", long 92°53'40", in NE¼NE¼ sec.6, T.112 N., R.17 W., Goodhue County, at culvert on State Highway 20, 2.0 miles above mouth, and 2.1 miles north of Cannon Falls.	20.2	1960-69	4- 3-69	3.24	187
5-3552.3	Cannon River tributary near Welch, Minn.	Lat 44°36'04", long 92°42'34", in SW¼SW¼ sec.11, T.113 N., R.16 W., Goodhue County, at culvert on U.S. Highway 61, 1.2 miles above mouth, and 2.7 miles northeast of Welch.	.05	1960-69	4- 3-69	8.24	13
Zumbro River basin							
5-3733.5	Zumbro River tributary near South Troy, Minn.	Lat 44°11'16", long 92°25'22", in SE¼NE¼ sec.6, T.108 N., R.13 W., Olmsted County, at culvert on county road, 0.8 mile above mouth, and 1.3 miles south of South Troy.	.16	1962-69	4- 3-69	8.18	20
5-3737	North Fork Zumbro River tributary near Wanamingo, Minn.	Lat 44°17'10", long 92°52'20", in SE¼SE¼ sec.32, T.110 N., R.17 W., Goodhue County, at culvert on County Highway 1, 3¼ miles above mouth, and 4¼ miles southwest of Wanamingo.	9.36	1960-69	10-17-68	11.55	620
5-3739	Trout Brook tributary near Goodhue, Minn.	Lat 44°21'40", long 92°37'00", in SE¼ sec.4, T.110 N., R.15 W., Goodhue County, at culvert on State Highway 58, three-quarter mile above mouth, and 3 miles south of Goodhue.	.41	1960-69	6-29-60 4-15-61 8-31-62 7-17-63 4-21-64 7-13-65 3- 3-66 3-24-67 8-19-68 4- 2-69 4- 3-69	6.27 6.50 6.77 8.50 5.76 7.81 8.83 8.74 7.04 6.24 15.24	a55 a64 a75 163 a37 a126 a181 a54 a88 33 97
5-3744	Long Creek near Potsdam, Minn.	Lat 44°10'48", long 92°17'23", at quarter corner on north line of sec.8, T.108 N., R.12, W., Wabasha County, at culvert on county highway, 2.6 miles northeast of Potsdam.	-	1966-69	4- 3-69		
East Indian Creek basin							
5-3758	East Indian Creek tributary near Weaver, Minn.	Lat 44°13'41", long 91°58'35", in NW¼SE¼ sec.23, T.109 N., R.10 W., Wabasha County, at culvert on County Highway 14, 0.3 mile above mouth, and 2.5 miles northwest of Weaver.	.21	1962-69	7-17-69	8.48	3.4
Garvin Brook basin							
5-3782.9	Straight Valley Creek near Altura, Minn.	Lat 44°05'39", long 91°53'07", in SW¼SE¼ sec.3, T.107 N., R.9 W., Winona County, at culvert on State Highway 248, 2.4 miles above mouth, and 3.1 miles northeast of Altura.	-	1966-69	6-26-69	12.13	(*)

* Discharge not determined.
a Not previously published.
c Backwater from ice.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis- charge (cfs)
Garvin Brook basin--Continued							
5-3783	Straight Valley Creek near Rol- lingstone, Minn.	Lat 44°05'09", long 91°50'34", in SE¼NE¼ sec.12, T.107 N., R.9 W., Winona County, at bridge on county highway, 0.2 mile above mouth, and 1.5 miles southwest of Rollingstone.	5.16	1959-69	6-26-69	11.27	(#)
Root River basin							
5-3836	North Branch Root River tributary near Stewartville, Minn.	Lat 43°51'20", long 92°26'50", near center sec.36, T.105 N., R.14 W., Olmsted County, at culvert on State Highway 30, 2.0 miles east of Stewart- ville, and 2.3 miles above mouth.	.73	1958, 1959-64, 1965-69	7-17-69	9.93	172
5-3837	Mill Creek tributary near Chatfield, Minn.	Lat 43°53'57", long 92°14'16", in SW¼NW¼ sec.14, T.105 N., R.12 W., Olmsted County, at culvert on county highway, 0.8 mile above mouth, and 4.5 miles northwest of Chatfield.	2.36	1959-69	8- 7-69	14.10	(#)
5-3837.2	Mill Creek near Chatfield, Minn.	Lat 43°53'01", long 92°13'46", in SE¼NW¼ sec.23, T.105 N., R.12 W., Olmsted County, at bridge on county highway, 3.4 miles northwest of Chatfield, and 4.8 miles above mouth.	22.4	1962-69	8- 7-69	11.38	721
5-3838.5	Bear Creek near Grand Meadow, Minn.	Lat 43°43'25", long 92°35'20", in NE¼SE¼ sec.14, T.103 N., R.15 W., Mower County, at bridge on county highway, 1½ miles northwest of Grand Meadow, and 4 miles above North Fork Bear Creek.	13.6	1962-69	6-26-69	18.96	1,140
5-3841	Duschee Creek near Lanesboro, Minn.	Lat 43°39'40", long 91°58'10", in SW¼SW¼ sec.6, T.102 N., R.9 W., Fillmore County, at culvert on county highway, 7.4 miles above mouth, and 4 miles south of Lanesboro.	e3.85	1959-69	7-17-69	20.39	1,680
5-3841.5	Root River tributary near Whalan, Minn.	Lat 43°43'03", long 91°56'39", in SE¼SW¼ sec.17, T.103 N., R.9 W., Fillmore County, at culvert on private road, 1.3 miles southwest of Whalan.	e.08	1959-69	5-17-69	4.78	4.8
5-3842	Gribben Creek near Whalan, Minn.	Lat 43°42'26", long 91°54'50", in NE¼SE¼ sec.21, T.103 N., R.9 W., Fillmore County, at bridge on county highway, 1 3/4 miles southeast of Whalan, and 2½ miles above mouth.	e7.80	1959-69	7-17-69	16.73	543
5-3843	Big Springs Creek near Arendahl, Minn.	Lat 43°49'26", long 91°57'00", in NE¼SE¼ sec.7, T.104 N., R.9 W., Fillmore County, at culvert on State Highway 250, 2.0 miles west of Arendahl.	.14	1959-69	7-17-69	9.49	26
5-3844	Pine Creek near Arendahl, Minn.	Lat 43°50'27", long 91°53'39", in SE¼NE¼ sec.3, T.104 N., R.9 W., Fillmore County, at bridge on County Highway 25, 1.3 miles northeast of Arendahl, and 4.9 miles above Hemingway Creek.	28.1	1959-69	4- 3-69	11.77	392
Iowa River basin							
5-4570.8	Rose Creek tributary near Dexter, Minn.	Lat 43°42'10", long 92°44'30", in SE¼SW¼ sec.22, T.103 N., R.16 W., Mower County, at culvert on county highway, 1 3/4 miles above mouth, and 2½ miles southwest of Dexter.	1.20	1962-69	6-26-69	10.21	194
Des Moines River basin							
5-4747.5	Beaver Creek tribu- tary No. 2 near Slayton, Minn.	Lat 43°59'35", long 95°48'01", in NW¼NW¼ sec.17, T.106 N., R.41 W., Murray County, at culvert on State Highway 30, 2.4 miles west of Slayton, and 3.2 miles above mouth.	e4.25	1961-69	4- 6-69	19.38	182
5-4747.6	Beaver Creek tribu- tary above Slay- ton, Minn.	Lat 43°59'35", long 95°47'12", in NE¼NE¼ sec.17, T.106 N., R.41 W., Murray County, at culvert on State Highway 30, 0.9 mile above mouth, and 1.7 miles west of Slayton.	e2.20	1961-69	4- 7-69	20.14	(#)

$\neq$ Discharge not determined.

$\neq$ Operated as a continuous-record gaging station.

e Revised.

Annual maximum discharge at crest-stage partial-record stations during water year 1969--Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Des Moines River basin--Continued							
5-4754	Warren Lake tributary near Windom, Minn.	Lat 43°54'05", long 95°07'20", in SE¼NE¼ sec.14, T.105 N., R.36 W., Cottonwood County, at culvert on U.S. Highway 71, a quarter mile above Warren Lake, and 2.4 miles north of Windom.	1.38	1960-69	4- 7-69	5.88	63
5-4758	West Fork Des Moines River tributary near Jackson, Minn.	Lat 43°41'40", long 95°01'30", in NW¼SE¼ sec.27, T.103 N., R.35 W., Jackson County, at culvert on county highway, three-quarter mile above mouth, and 5½ miles north of Jackson.	1.42	1960-69	6-29-69	16.99	134
5-4759	West Fork Des Moines River tributary No. 2 near Lakefield, Minn.	Lat 43°40'30", long 95°03'20", in SE¼SE¼ sec.32, T.103 N., R.35 W., Jackson County, at culvert on County Highway 19, 1½ miles above mouth, and 5 3/4 miles east of Lakefield.	4.52	1960-69	6-29-69	10.44	271
5-4760.1	Nelson Creek at Jackson, Minn.	Lat 43°36'55", long 94°59'35", in NW¼NW¼ sec.25, T.102 N., R.35 W., Jackson County, in flume spillway at intersection of U.S. Highways 16 and 71, at south edge of Jackson.	6.8	1959, 1964-69	6-29-69	16.67	1,480
5-4761	Story Brook near Petersburg, Minn.	Lat 43°32'20", long 94°59'40", in SW¼NW¼ sec.24, T.101 N., R.35 W., Jackson County, at bridge on U.S. Highway 71, 3 miles above mouth, and 4 miles west of Petersburg.	25.2	1960-69	6-29-69	13.73	2,500
5-4769	East Fork Des Moines River tributary near Dunnell, Minn.	Lat 43°35'00", long 94°46'25", in SW¼NW¼ sec.2, T.101 N., R.33 W., Martin County, at bridge on State Highway 4, a half mile above mouth, and 1½ miles north of Dunnell.	7.88	1960-69	6-29-69	15.53	1,420
Big Sioux River basin							
6-4829.5	Mound Creek near Hardwick, Minn.	Lat 43°48'18", long 96°12'47", in SE¼SE¼ sec.15, T.104 N., R.45 W., Rock County, at culvert on county highway, 2.2 miles northwest of Hardwick.	e2.47	1959-69	6-29-69	11.48	433
6-4829.6	Mound Creek tributary at Hardwick, Minn.	Lat 43°46'05", long 96°12'44", in NE¼SE¼ sec.34, T.104 N., R.45 W., Rock County, at culvert on U.S. Highway 75, 0.7 mile above mouth, and 0.9 mile southwest of Hardwick.	e.19	1959-69	6-29-69	11.08	382
6-4830.5	Rock River tributary near Luverne, Minn.	Lat 43°34'15", long 96°12'45", in NE¼NE¼ sec.10, T.101 N., R.45 W., Rock County, at culvert on U.S. Highway 75, 5.8 miles south of Luverne.	e.21	1959-69	4- 6-69	13.3	(#)
6-4832	Kanaranzi Creek tributary near Lismore, Minn.	Lat 43°45'41", long 95°55'56", in SW¼SW¼ sec.31, T.104 N., R.42 W., Nobles County, at culvert on county highway adjacent to State Highway 91, 60 ft above mouth, and 1.2 miles northeast of Lismore.	e.14	1959-69	6-29-69	21.32	256
6-4832.1	Kanaranzi Creek tributary No. 2 near Wilmont, Minn.	Lat 43°43'32", long 95°52'20", in SW¼NW¼ sec.15, T.103 N., R.42 W., Nobles County, at culvert on County Highway 15, 3.5 miles southwest of Wilmont, and 3.7 miles above mouth.	2.14	1966-69	8-14-66 4- 2-67 7-30-68 6-29-69	4.89 5.49 d4.01 12.03	a70 all2 al.4 1,230
Little Sioux River basin							
6-6035.2	Judicial ditch 28 tributary near Spafford, Minn.	Lat 43°36'58", long 95°22'58", in NW¼NE¼ sec.27, T.102 N., R.38 W., Jackson County, at culvert on U.S. Highway 16, 0.4 mile west of Spafford, and 0.6 mile above mouth.	4.06	1959-69	6-29-69	11.58	400
6-6035.3	Little Sioux River near Spafford, Minn.	Lat 43°36'08", long 95°15'27", in NE¼NE¼ sec.34, T.102 N., R.37 W., Jackson County, at bridge on county highway, 1.6 miles below Jackson County ditch No. 11, and 5.8 miles east of Spafford.	-	1962-69	6-29-69	12.06	4,500

Discharge not determined.
 a Not previously published.
 d Backwater from debris.
 e Revised.

Discharge measurements at miscellaneous sites

Measurements of streamflow at points other than gaging stations are given in the following table. Those that are measurements of base flow are designated by an asterisk (*); measurements of peak flow by a dagger (†).

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Red River of the North basin						
Campbell Creek	Pelican River	Lat 46°53'29", long 95°51'57", on line between sec.4, T.139 N., R.41 W., and sec.33, T.140 N., R.41 W., Becker County, at upstream side of 36-inch corrugated metal pipe culvert on county road, 5.3 miles north of Detroit Lakes, Minn.	-	-	7- 1-69 7-29-69 9- 4-69	.16 .11 0
Floyd Lake Outlet	Pelican River	Lat 46°52'42", long 95°50'23", in SE¼SE¼ sec.3, T.139 N., R.41 W., Becker County, on upstream side of concrete box culvert on County Highway 21, 3.7 miles northeast of Detroit Lakes, Minn.	-	-	3-26-69 4-11-69 4-30-69 5-28-69 7- 1-69 7-29-69 9- 4-69	2.07 13.0 20.3 6.94 5.30 1.17 0
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.	-	1968	11- 6-68 12-10-68 1-14-69 2-18-69 3-26-69 4-11-69 4-29-69 5-27-69 7- 1-69 8-29-69 9- 4-69	.53 .32 .46 .64 1.59 8.54 .80 .36 .06 .07 0
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.	-	1968	11- 6-68 12-10-68 1-14-69 2-18-69 3-26-69 4-11-69 4-29-69 5-27-69 7- 1-69 7-29-69 9- 4-69	3.46 1.55 1.89 1.89 2.12 12.1 3.00 2.04 1.83 1.17 .61
Oxidation Pond Outlet	St. Clair Lake	SE¼NE¼ sec.32, T.139 N., R.41 W., Becker County, at outlet of Oxidation Pond, 1.8 miles west of Detroit Lakes, Minn.	-	1968	9- 6-68 10- 1-68 12-11-68 12-16-68 1-15-69 1-21-69 2-18-69 3-25-69 4-12-69 4-30-69 5-28-69 7- 3-69 7-30-69 9- 5-69	1.70 .70 1.02 1.05 1.14 1.04 1.05 .99 1.60 .82 .99 .86 1.23 1.31
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.	-	1968	10- 1-68 11- 7-68 12-11-68 1-15-69 2-19-69 3-26-69 4-12-69 4-29-69 5-28-69 7- 2-69 7-30-69 9- 4-69	.38 .33 .10 .12 .16 .15 .37 a.01 .47 .56 .39 .22

a Estimated.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Red River of the North basin--Continued						
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.	-	1968	10- 1-68 11- 7-68 12-11-68 1-15-69 2-19-69 3-26-69 4-12-69 4-29-69 5-28-69 7- 2-69 7-30-69 9- 4-69	.01 .01 .06 0 .28 .22 1.37 .88 .31 .04 .03 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.	-	1968	10- 1-68 11- 7-68 11-11-68 1-15-69 2-18-69 3-25-69 4-12-69 4-29-69 5-28-69 7-30-69 9- 4-69	.34 .01 .92 0 3.20 .91 1.76 1.29 .94 .43 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 1968	10- 1-68 11- 8-68 12-11-68 1-16-69 2- 4-69 2-12-69 2-19-69 3-25-69 4-12-69 4-29-69 5-27-69 7- 3-69 7-28-69 9- 9-69	13.6 14.7 25.0 33.2 43.4 45.6 45.8 37.8 92.7 125 66.2 5.29 18.0 .24
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, 1965-68	4- 9-69 4-14-69 4-22-69	2,760 2,610 1,330
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.	-	1959-68	4-11-69 4-24-69	1,400 83.6
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.	-	1959-68	4-11-69	48.0
Marsh River (ditch)	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, 0.1 mile south of State Highway 31, and 3 miles east of Ada, Minn.	-	1945-51, 1965, 1967	4- 9-69 4-14-69	676 190
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, 1968	4-12-69 4-14-69 4-22-69	938 1,080 183
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, 1967-68	4-11-69 4-14-69	5,440 4,120

* Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1969

Discharge measurements made at miscellaneous sites during water year 1959						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Lake of the Woods basin						
Shagawa Lake tributary	Shagawa Lake	NE¼SW¼ sec.28, T.63 N., R.12 W., St. Louis County, downstream from sewage disposal plant at Ely, Minn.	-	-	4- 8-69 4-10-69	2.18 2.76
Shagawa Lake tributary	Shagawa Lake	NW¼SE¼ sec.20, T.63 N., R.12 W., St. Louis County, on County Highway 88, 2 miles northwest of Ely, Minn.	-	-	5- 6-69 5-13-69 6- 3-69 6-17-69 7-23-69 8-14-69	2.82 *1.21 2.27 *.54 *.59 *.16
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, 1958-68	4-14-69 4-16-69 4-20-69	785 906 417
Big Fork River	Rainy River	Sec.12, T.149 N., R.27 W., Itasca County, at bridge on County Highway 29, at Dora Lake, Minn.	-	1965-68	10-16-68 4-19-69 5-14-69 6-23-69 7-29-69 8-28-69	288 1,020 956 500 141 *133
County ditch No. 6	Warroad River	SW¼SE¼ sec.31, T.162 N., R.36 W., Roseau County, at bridge at mouth, 1 mile southwest of Warroad, Minn.	-	1967	4-12-69 4-15-69	40.7 20.4
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.	-	1968	4-15-69	2,310
Mississippi River main stem						
Mississippi River	Gulf of Mexico	N¼ 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, 1957-68	2- 5-69 2- 7-69 4-18-69 4-22-69 4-28-69 4-29-69 4-30-69 5- 8-69	1,840 1,970 1,740 1,490 2,180 2,160 2,450 2,510
Crow Wing River basin						
Little Sand Lake Outlet	Crow Wing River	NE¼ sec.36, T.141 N., R.34 W., Hubbard County, 0.5 mile downstream from Little Sand Lake, and 3 miles northeast of Dorset.	a74	1930-41, 1942, 1956-68	11-14-68 12- 9-68 1-13-69 2-25-69 3-24-69 4-19-69 5- 5-69 6- 9-69 7-14-69 8-18-69 9-22-69	32.1 25.3 33.1 38.3 32.7 37.4 51.3 49.5 46.3 35.6 29.7
Mississippi River main stem						
Mississippi River	Gulf of Mexico	S¼ sec.35, T.125 N., R.28 W., Stearns County, at bridge on State Highway 152, at St. Cloud, Minn.	-	1967-68	4-10-69 4-14-69	39,600 41,800
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.	-	1968	10-11-68 11-18-68	4.77 2.76

* Base flow.

≠ Operated as a continuous-record gaging station.

a Estimated.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Elk River basin--Continued						
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.	-	1965-68	10- 7-68 11-14-68 12-11-68 1- 7-69 2-12-69 3-18-69 3-27-69 4- 5-69 4-29-69 5-23-69 6-24-69 8- 5-69 9-10-69	20.0 *22.1 15.0 17.0 14.4 14.7 18.8 26.0 42.5 15.8 17.0 12.8 7.11
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 upstream from Ohio River.	14,500	1915-56 1966-68	10-23-68 4- 4-69 4-10-69 4-13-69 4-17-69	16,100 9,360 42,900 47,300 42,900
Crow River basin						
North Fork Crow River	Crow River	S½N½ sec.4, T.123 N., R.34 W., Stearns County, at U.S. Highway 71, 3.6 miles northeast of Belgrade, Minn.	-	-	9- 4-69	*1.24
North Fork Crow River	Crow River	NW¼NE¼ sec.17, T.120 N., R.30 W., Meeker County, at County Highway 2, 0.1 mile north of Forest City, Minn.	-	-	9- 5-69	52.6
Washington Creek	North Fork Crow River	On line between secs.27 and 34, T.120 N., R.29 W., Meeker County, at County Highway 21, 2.1 miles south of Kingston, Minn.	-	-	9- 5-69	.29
Twelvemile Creek	North Fork Crow River	On line between secs.20 and 29, T.119 N., R.26 W., Wright County, at County Highway 107, 2 miles north of Waverly, Minn.	-	1942-44	9- 5-69	0
South Fork Crow River	Crow River	Lat 44°53'44", long 94°22'08", SE¼SW¼ sec.31, T.117 N., R.29 W., McLeod County, at bridge on State Highways 15 and 22, in Hutchinson, Minn.	-	1947, 1965, 1967	4- 2-69 4- 7-69 4-12-69	352 2,720 2,550
Buffalo Creek	South Fork Crow River	At center of sec.13, T.115 N., R.28 W., McLeod County, at bridge on County Highway 75 (Pleasant Avenue), in Glencoe, Minn.	-	1947, 1968	3-26-69 4- 4-69 4- 7-69 4-11-69	217 1,290 2,380 3,700
South Fork Crow River	Crow River	NE¼SE¼ sec.11, T.118 N., R.25 W., Wright County, at bridge on Bridge Avenue, in Delano, Minn.	-	1962-63, 1966-67	10-23-68 4- 3-69 4- 8-69 4-11-69	2,410 1,870 6,390 9,680
Rum River basin						
Rum River	Mississippi River	N½ sec.30, T.36 N., R.23 W., Isanti County, at County Highway 64, in Cambridge, Minn.	-	1965	10-22-68 4- 4-69 4-11-69 4-15-69	4,230 797 8,700 3,800
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	10-22-68 4- 7-69 4-11-69 4-15-69	5,050 2,560 8,220 8,040
Elm Creek basin						
Elm Creek	Mississippi River	Lat 45°11'04", long 93°24'06", on line between sec.19, T.120 N., R.21 W., and sec.24, T.120 N., R.22 W., Hennepin County, at bridge on Cartway Road, at south edge of Champlin, Minn.	-	-	3-18-69 4- 4-69 4-10-69 4-18-69 6- 6-69 7-23-69	12.9 386 613 250 *4.53 *4.09

* Base flow.

/ Peak flow.

Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Coon Creek basin						
Coon Creek	Mississippi River	Lat 45°09'00", long 93°17'49", in NW¼NE¼ sec.26, T.31 N., R.24 W., Anoka County, at bridge on Coon Rapids Boulevard, at southeast edge of Coon Rapids, Minn.	-	1956	3-18-69 3-25-69 4-10-69 6- 6-69 7-23-69	64.3 162 318 *33.7 *24.3
Rice Creek basin						
Rice Creek	Mississippi River	Lat 45°05'30", long 93°15'47", on line between secs.14 and 15, T.30 N., R.24 W., Anoka County, at culvert on State Highway 47 (University Avenue), at north edge of Fridley, Minn.	-	-	3-18-69 3-25-69 4-10-69 6- 6-69 7-23-69	63.1 136 205 *30.8 *11.3
Shingle Creek basin						
Shingle Creek	Mississippi River	Lat 45°04'45", long 93°18'55", in NE¼NW¼ sec.35, T.119 N., R.21 W., Hennepin County, at bridge on 69th Avenue North in Brooklyn Center, Minn.	-	-	3-18-69 3-25-69 4- 4-69 6- 6-69 7-23-69	25.6 66.5 58.0 *10.8 *9.17
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.	-	1963-68	10-17-68 11-12-68 3-19-69 3-25-69 4-25-69 6- 2-69 7- 8-69 8-20-69 9-18-69	116 *13.2 26.1 42.2 *20.7 7.17 20.0 5.26 5.17
North Fork Bassett Creek	Bassett Creek	NW¼ sec.21, T.118 N., R.21 W., Hennepin County, at culvert on 34th Avenue North at Crystal, Minn., and 0.8 mile upstream from mouth.	-	1963-68	11-12-68 4-25-69 6- 2-69 7- 8-69 8-20-69 9-18-69	*.38 *.33 .05 3.94 0 0
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.	-	1963-68	11-12-68 3-18-69 4-25-69 6- 2-69 7- 8-69	*1.72 9.59 1.33 1.12 9.95
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 Avenue.	-	1952, 1954-55, 1963-68	10-17-68 11-12-68 3-19-69 3-25-69 4-25-69 6- 2-69 7- 8-69 8-20-69 9-18-69	234 *18.8 66.9 60.6 *29.0 8.88 48.2 8.65 4.07
Mississippi River main stem						
Mississippi River	Gulf of Mexico	SW¼ sec.30, T.29 N., R.23 W., Hennepin County, at Dartmouth Avenue bridge (I-94), at Minneapolis, Minn.	-	1965-68	10-25-68	26,100
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	1924, 1935, 1938-39, 1941, 1943, 1945-50, 1954, 1957, 1959, 1961-62, 1964-68	9-30-69	3,140

* Base flow.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin						
Mud Creek	Pomme de Terre River	On line between secs.22 and 23, T.124 N., R.42 W., Stevens County, at concrete culvert on U.S. Highway 59, 1 mile upstream from mouth, and 3 miles south of Morris, Minn.	-	-	9-23-69	.17
Lac qui Parle River	Minnesota River	SW $\frac{1}{4}$ NE $\frac{1}{4}$ 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, 1968	4- 8-69	1,830
Lac qui Parle River	Minnesota River	On line between secs.3 and 10, T.115 N., R.44 W., Yellow Medicine County, at bridge on State Highway 67, 0.5 mile upstream from Lazarus Creek, and 8 miles northeast of Canby, Minn.	-	1963-66	4- 9-69 9-25-69	608 0
Lac qui Parle River	Minnesota River	SE $\frac{1}{4}$ SW $\frac{1}{4}$ 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.	-	1968	4- 9-69	6,190
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, 1968	4-11-69	775
West Branch Lac qui Parle River	Lac qui Parle River	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, 1966-68	4- 9-69	8,600
West Branch Lac qui Parle River	Lac qui Parle River	S $\frac{1}{2}$ NE $\frac{1}{4}$ sec.21, T.117 N., R.43 W., Lac qui Parle County, at dam in Dawson, Minn.	-	1968	4- 9-69	7,640
Chippewa River	Minnesota River	On line between secs.17 and 18, T.125 N., R.40 W., Pope County, at bridge on County Highway 3, 1.2 miles north of Cyrus, Minn.	-	1963-66	9-23-69	.57
Little Chippewa River	Chippewa River	On line between secs.34 and 35, T.125 N., R.40 W., Pope County, at bridge on County Highway 73, 3.2 miles southeast of Cyrus, Minn.	-	-	9-23-69	.02
Emily Lake Outlet	Chippewa River	S $\frac{1}{4}$ S $\frac{1}{4}$ sec.28, T.124 N., R.40 W., Pope County, at bridge on county road, 5 miles east of Hancock, Minn.	-	-	9-23-69	9.41
East Branch Chippewa River	Chippewa River	Near center of W $\frac{1}{4}$ sec.14, T.122 N., R.38 W., Swift County, at bridge on County Highway 28, 1.7 miles southeast of Swift Falls, Minn.	-	-	9-24-69	12.4
Mud Creek	East Branch Chippewa River	W $\frac{1}{4}$ NW $\frac{1}{4}$ sec.19, T.122 N., R.37 W., Swift County, at bridge on County Highway 87, 3.4 miles southeast of Swift Falls, Minn.	-	-	9-24-69	13.3
Mud Creek	East Branch Chippewa River	On line between secs.2 and 3, T.121 N., R.39 W., Swift County, at bridge on county road, 2.9 miles east of Benson, Minn.	-	-	9-24-69	4.99
East Branch Chippewa River	Chippewa River	SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.29, T.122 N., R.39 W., Swift County, at bridge on county road, 2.2 miles north of Benson, Minn.	-	1963-66	9-24-69	35.7
Shakopee Creek	Chippewa River	On line between sec.13, T.120 N., R.40 W., and sec.18, T.120 N., R.39 W., Swift County, at bridge on county road, 7.8 miles south of Benson, Minn.	352	1949-54 [#]	9-24-69	8.04

[#] Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Dry Weather Creek	Chippewa River	N $\frac{1}{2}$ sec.11, T.118 N., R.41 W., Chippewa County, at bridge on county road, 0.8 mile upstream from mouth, and 7.4 miles northwest of Montevideo, Minn.	-	-	9-24-69	6.38
Chippewa River diversion	Minnesota River	On line between secs.15 and 16, T.118 N., R.41 W., Chippewa County, at weir at bridge on county road, 1 mile north of Watson, Minn.	-	1943-58, 1960-67	12- 9-68 1-26-69 3-18-69 4- 7-69 4-11-69 4-12-69 4-14-69 4-22-69 4-30-69 6- 3-69 7-10-69 8-12-69 9-17-69	0 0 0 1,060 5,200 5,520 3,980 1,700 1,300 94.7 0 0 19.8
Chippewa River	Minnesota River	On line between secs.15 and 22, T.118 N., R.41 W., Chippewa County, downstream from diversion channel, at culvert and spillway at bridge on County Highway 13, 1 mile northeast of Watson, Minn.	-	1943-58, 1960-67	1-17-69 4- 7-69 4- 8-69 4-11-69 4-12-69 4-14-69 4-22-69 4-30-69 6- 3-69 9-17-69	15.0 408 2,500 5,200 3,810 3,760 724 714 669 24.1
Palmer Creek	Minnesota River	On line between secs.16 and 21, T.116 N., R.39 W., Chippewa County, at bridge on county road, 1 mile upstream from mouth, and 2.5 miles north of Granite Falls, Minn.	-	-	9-22-69	2.06
Minnesota River	Mississippi River	SW $\frac{1}{4}$ sec.32, T.116 N., R.39 W., Chippewa-Yellow Medicine County line, at bridge on U.S. Highway 212, at Granite Falls, Minn.	-	-	4- 9-69 4-13-69 4-18-69 4-25-69	6,960 43,400 23,400 10,400
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.	-	1965-66, 1968	4- 5-69 4- 7-69	166 743
Yellow Medicine River	Minnesota River	On line between secs.2 and 3, T.113 N., R.43 W., Lyon County, at bridge on county road, 3.4 miles northeast of Taunton, Minn.	-	-	4-11-69	1,330
Yellow Medicine River	Minnesota River	At center of line between secs.1 and 2, T.113 N., R.43 W., Lyon County, at bridge on County Highway 3, 0.5 mile upstream from Mud Creek, 3 miles upstream from South Branch Yellow Medicine River, and 4.4 miles north of Minneota, Minn.	-	1963-66	9-23-69	6.75
Mud Creek	Yellow Medicine River	On line between secs.21 and 22, T.114 N., R.44 W., Yellow Medicine County, at bridge on County Highway 12, 2.7 miles north of Porter, Minn.	-	1966	3-10-69 4- 5-69 4- 7-69	0 447 1,080
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, 1968	4- 7-69	2,190
Yellow Medicine River	Minnesota River	On line between sec.6, T.113 N., R.42 W., and sec.1, T.113 N., R.43 W., Lyon County, at bridge on County Highway 57, 1.5 miles downstream from Mud Creek, and 4.4 miles northeast of Minneota, Minn.	-	-	4- 7-69	2,930

/ Peak flow.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Yellow Medicine River	Minnesota River	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.114 N., R.41 W., Yellow Medicine County, at bridge on U.S. Highway 59 at Normania, 5.4 miles southeast of Spring Creek, Minn.	-	1946	4- 8-69	7,450
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, 4.6 miles west of Hanley Falls, Minn.	-	1948, 1965-66, 1968	4- 8-69	2,940
Spring Creek	Yellow Medicine River	On line between sec.6, T.114 N., R.41 W., and sec.1, T.114 N., R.42 W., Yellow Medicine County, at bridge on County Highway 35, at Spring Creek, Minn.	-	1966	4- 8-69	7,210
Yellow Medicine River	Minnesota River	On line between secs.11 and 12, T.114 N., R.40 W., Yellow Medicine County, at bridge on State Highway 23, at northwest corner of Hanley Falls, Minn.	-	-	4- 8-69	1,210
Hawk Creek	Minnesota River	On line between sec.31, T.118 N., R.37 W., and sec.6, T.117 N., R.37 W., Chippewa County, at bridge on county road, 1.5 miles north of Clara City, Minn.	-	-	9-23-69	5.24
Spring Creek	Hawk Creek	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.16, T.116 N., R.38 W., Renville County, at culvert on farm road, 75 ft upstream from mouth, and 3.5 miles southeast of Maynard, Minn.	-	-	9-23-69	3.01
Hawk Creek	Minnesota River	Lat 44°49'59", long 95°26'01", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.21, T.116 N., R.38 W., Renville County, at bridge on county road, 1.5 miles downstream from Spring Creek, and 6 miles northeast of Granite Falls, Minn.	-	1968	9-23-69	8.14
Minnesota River	Mississippi River	SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.30, T.114 N., R.36 W., Redwood County, at bridge on County Highway 6, 4 miles north of Delhi, Minn.	-	1968	10-23-68	1,490
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.	-	1966-68	9-23-69	6.82
Coon Creek	Redwood River	On line between secs.23 and 24, T.110 N., R.43 W., Lyon County, at bridge on county highway, 1.3 miles west of Russell, Minn.	-	1966-68	9-23-69	1.96
Three Mile Creek	Redwood River	On line between sec.7, T.112 N., R.41 W., and sec.12, T.112 N., R.42 W., Lyon County, at bridge on County Highway 65, 2.9 miles northeast of Ghent, Minn.	-	-	9-23-69	11.1
Three Mile Creek	Redwood River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.2, T.112 N., R.41 W., Lyon County, at culvert on State Highway 23, 0.8 mile north of Green Valley, Minn.	-	1958-63	9-23-69	15.3
Minnesota River	Mississippi River	SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.8, T.111 N., R.32 W., Nicollet County, at bridge on State Highway 4, 0.6 mile south of Fort Ridgely State Memorial Park, and 6 miles south of Fairfax, Minn.	-	-	4-19-69 4-25-69	32,700 17,700
Cottonwood River	Minnesota River	On line between secs.11 and 12, T.110 N., R.40 W., Lyon County, at culvert on County Highway 11, 4.6 miles northeast of Amiret, Minn.	-	1968	9-23-69	2.47
Meadow Creek	Cottonwood River	On N $\frac{1}{2}$ of line between secs.11 and 12, T.110 N., R.40 W., Lyon County, at bridge on County Highway 11, 4.8 miles northeast of Amiret, Minn.	-	-	9-23-69	0

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Plum Creek	Cottonwood River	On line between secs.4 and 9, T.109 N., R.38 W., Redwood County, at bridge on county road, 3.8 miles northwest of Walnut Grove, Minn.	-	-	9-22-69	.76
Cottonwood River	Minnesota River	On line between sec.7, T.109 N., R.37 W., and sec.12, T.109 N., R.38 W., Redwood County, at bridge on County Highway 7, 3 miles north of Revere, Minn.	-	-	10-31-68	300
Cottonwood River	Minnesota River	SE½SE½ sec.8, T.109 N., R.37 W., Redwood County, 2.5 miles northwest of Lamberton, Minn.	-	1966-68	9-22-69	4.00
Cottonwood River	Minnesota River	On line between secs.14 and 15, T.109 N., R.37 W., Redwood County, at bridge on County Highway 6, 0.8 mile north of Lamberton, Minn.	-	-	4- 5-69 4- 7-69 4-13-69	2,450 8,720 2,720
Cottonwood River	Minnesota River	NW¼NE¼ sec.19, T.109 N., R.34 W., Brown County, at bridge on County Highway 5, in Springfield, Minn.	-	-	4- 5-69 4- 8-69 4-13-69	7,060 18,300 5,340
Cottonwood River	Minnesota River	On line between secs.21 and 22, T.109 N., R.33 W., Brown County, at bridge on County Highway 8, 0.2 mile north of Leavenworth, Minn.	-	1966-68	10-31-68 9-24-69	972 18.8
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.	-	1966-68	10-31-68 9-24-69	220 *6.23
Cottonwood River	Minnesota River	NW¼ sec.31, T.110 N., R.30 W., Brown County, at bridge on County Highway 13, 0.6 mile upstream from Lake Cottonwood, and 1.7 miles southeast of New Ulm, Minn.	-	-	4-12-69	14,100
Little Cottonwood River	Minnesota River	NE¼NE¼ sec.21, T.109 N., R.30 W., Brown County, at bridge on State Highway 15, 0.7 mile north of Searles, Minn.	-	-	4- 4-69 4- 7-69 4-10-69	953 2,310 2,100
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, 1.5 miles south of Courtland, Minn.	-	1966-68	10-16-68 11-13-68 7- 1-69 9-22-69	680 155 165 *7.53
Minnesota River	Mississippi River	E½ sec.33, T.109 N., R.28 W., Blue Earth County, at highway bridge, 0.2 mile northeast of Judson, Minn., and 11 miles upstream from Blue Earth River.	11,200	1938-50* 1967-68	10-18-68 3-28-69 4- 9-69 4-16-69 4-22-69 7- 1-69	8,920 4,030 36,900 61,600 32,100 3,800
West Branch Blue Earth River	Blue Earth River	NW¼NW¼ sec.8, T.101 N., R.27 W., Faribault County, at mouth, upstream from County Highway 4, 4.8 miles south of Blue Earth, Minn.	-	-	9- 4-69	17.4
Coon Creek	Blue Earth River	On line between secs.20 and 29, T.102 N., R.27 W., Faribault County, at bridge on county road, 0.5 mile upstream from mouth, and 1.8 miles south of Blue Earth, Minn.	-	-	9- 4-69	7.89
Badger Creek	Blue Earth River	N½ sec.13, T.102 N., R.28 W., Faribault County, at bridge on county road, 1.3 miles upstream from mouth, and 1.8 miles west of Blue Earth, Minn.	-	-	9- 4-69	6.69
East Branch Blue Earth River	Blue Earth River	Lat 43°38'58", long 94°06'10", in NE¼SW¼ sec.8, T.102 N., R.27 W., Faribault County, at bridge on U.S. Highway 169 in Blue Earth, Minn.	-	-	9- 5-69	23.1

* Base flow.

/ Peak flow.

/ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Blue Earth River	Minnesota River	On line between sec.31, T.103 N., R.27 W., and sec.6, T.102 N., R.27 W., Faribault County, at bridge on County Highway 8, 2.3 miles northwest of Blue Earth, Minn.	-	-	9- 4-69	101
South Creek	Blue Earth River	At intersection of secs.17, 18, 19, and 20, T.102 N., R.29 W., Martin County, at bridge on County Highway 9, 6 miles southeast of Fairmont, Minn.	-	-	9- 3-69	5.43
South Creek	Blue Earth River	S½ of sec.19, T.103 N., R.28 W., Faribault County, at bridge on County Highway 1, 1.8 miles south of Huntley, Minn.	-	-	9- 4-69	6.70
South Creek	Blue Earth River	Lat 43°42'33", long 94°10'38", in center of sec.22, T.103 N., R.28 W., Faribault County, at bridge on County Highway 5, 4.1 miles south of Winnebago, Minn.	-	-	9- 4-69	8.22
George Lake Outlet	Center Creek	NW¼SW¼ sec.6, T.102 N., R.30 W., Martin County, at Fairmont, Minn.	-	-	9- 4-69	0
Center Creek	Blue Earth River	N¼NW¼ sec.5, T.102 N., R.30 W., Martin County, at bridge on County Highway 59 continued, in Fairmont, Minn.	-	-	9- 4-69	3.20
Center Creek	Blue Earth River	At center of NW¼ of sec.26, T.103 N., R.29 W., Martin County, at bridge on County Highway 27, 3.3 miles east of Granada, Minn.	-	-	9- 3-69	9.18
Elm Creek	Blue Earth River	On line between secs.2 and 3, T.103 N., R.32 W., Martin County, at bridge on county road at junction with County Highway 52, 1 mile upstream from Creek Lake, and 3 miles east of Trimont, Minn.	-	-	9- 3-69	2.42
Cedar Run Creek	Elm Creek	On line between secs.34 and 35, T.104 N., R.32 W., Martin County, at bridge on County Highway 52, 1.3 miles upstream from Creek Lake, and 3 miles east of Trimont, Minn.	-	-	9- 3-69	2.45
Elm Creek	Blue Earth River	On line between sec.6, T.103 N., R.31 W., and sec.1, T.103 N., R.32 W., Martin County, at bridge on County Highway 7, 0.8 mile downstream from Creek Lake, and 5.1 miles east of Trimont, Minn.	-	-	9- 3-69	5.69
Elm Creek	Blue Earth River	On line between sec.6, T.103 N., R.30 W., and sec.1, T.103 N., R.31 W., Martin County, at bridge on County Highway 14, 3.1 miles northwest of Northrop, Minn.	-	-	9- 3-69	7.31
Martin Lake Outlet	Elm Creek	On line between sec.5, T.103 N., R.30 W., and sec.32, T.104 N., R.30 W., Martin County, at County Highway 59, 2.1 miles northwest of Northrop, Minn.	-	-	9- 3-69	0
Elm Creek	Blue Earth River	On line between sec.6, T.103 N., R.29 W., and sec.31, T.104 N., R.29 W., Martin County, at bridge on county road, 4.3 miles northeast of Northrop, Minn.	-	-	9- 3-69	9.43
Blue Earth River	Minnesota River	Lat 43°46'10", long 94°11'42", in SW¼NE¼ sec.33, T.104 N., R.28 W., Faribault County, at bridge on County Highway 12, 1.5 miles west of Winnebago, Minn.	-	-	9- 4-69	136
Blue Earth River	Minnesota River	E½E½ sec.27, T.106 N., R.28 W., Blue Earth County, at bridge on U.S. Highway 169, at south edge of Vernon Center, Minn.	-	-	9- 5-69	162

Discharge measurements made at miscellaneous sites during water year 1969

Discharge measurements made at miscellaneous sites during water year 1969						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Watonwan River	Blue Earth River	On line between secs.33 and 34, T.107 N., R.33 W., Watonwan County, at bridge on County Highway 5, 2.8 miles southeast of Darfur, Minn.	-	-	9- 4-69	5.72
North Fork Watonwan River	Watonwan River	At intersection of secs.7, 8, 17, and 18, T.107 N., R.33 W., Watonwan County, at bridge on County Highway 4, 1.9 miles north of Darfur, Minn.	-	-	9- 4-69	3.09
St. James Creek	Watonwan River	At the intersection of secs.6 and 7, T.105 N., R.32 W., and secs.1 and 12, T.105 N., R.33 W., Watonwan County, at County Highway 19, 3.8 miles north of Odin, Minn.	-	-	9- 4-69	0
St. James Creek	Watonwan River	On line between secs.7 and 8, T.106 N., R.31 W., Watonwan County, at bridge on County Highway 14, 2.7 miles northeast of St. James, Minn.	-	-	9- 5-69	3.21
South Fork Watonwan River	Watonwan River	NW¼SE¼ sec.21, T.105 N., R.32 W., Watonwan County, at bridge on State Highway 4, 2.5 miles north of Ormsby, Minn.	-	-	9- 4-69	4.14
Spring Branch Creek	Perch Creek	On line between secs.21 and 22, T.106 N., R.30 W., Watonwan County, at State Highways 15 and 30, 3.5 miles north of Lewisville, Minn.	-	-	9- 4-69	0
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 13, 1.5 miles west of Garden City, Minn.	812	1940-45, 1953, 1960-61	3-27-69 4- 5-69 4-10-69 9- 5-69	1,990 4,070 10,400 69.9
Le Sueur River	Blue Earth River	At center of N½ sec.34, T.106 N., R.22 W., Waseca County, at bridge on County Highway 56, 4.2 miles northeast of New Richland, Minn.	-	-	9- 3-69	1.88
Le Sueur River	Blue Earth River	At center of NE¼ sec.32, T.106 N., R.22 W., Waseca County, at State Highway 13, 3.8 miles north of New Richland, Minn.	-	-	9- 3-69	1.56
Boot Creek	Blue Earth River	On line between sec.6, T.105 N., R.22 W., and sec.31, T.106 N., R.22 W., Waseca County, at bridge on county road, 0.5 mile upstream from mouth, and 3.2 miles northwest of New Richland, Minn.	-	-	9- 3-69	1.07
Little Le Sueur River	Blue Earth River	SE¼NE¼ sec.7, T.106 N., R.22 W., Waseca County, at bridge on County Highway 51, 0.3 mile upstream from mouth, and 1.5 miles southeast of Wilton, Minn.	-	-	9- 3-69	1.21
Blue Earth River	Minnesota River	SE¼ sec.14, T.108 N., R.27 W., Blue Earth County, at bridge on U.S. Highway 169, at Le Hillier, 0.6 mile upstream from mouth, and 1.7 miles west of Mankato, Minn.	-	1909, 1967	3-23-69 3-28-69	4,980 19,300
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.	-	1968	10-17-68	7.47
Cherry Creek	Minnesota River	On line between secs.1 and 12, T.110 N., R.26 W., Le Sueur County, at bridge on County Highway 20, 2.3 miles southeast of Ottawa, Minn.	-	-	9-11-69	0
Minnesota River	Mississippi River	NE¼SW¼ sec.35, T.112 N., R.26 W., Le Sueur County, at bridge on State Highway 93, at Le Sueur, Minn.	-	-	9-18-69	*496

* Base flow.

* Operated as a continuous-record gaging station.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at miscellaneous sites during water year 1969

Discharge measurements made at miscellaneous sites during water year 1969						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Le Sueur Creek	Minnesota River	On line between secs.20 and 29, T.111 N., R.25 W., Le Sueur County, at county road, 4.1 miles northeast of Ottawa, Minn.	-	-	9-11-69	0
Rush River	Minnesota River	On line between secs.16 and 17, T.112 N., R.27 W., Sibley County, at bridge on County Highway 9, 2.2 miles south of New Rome, Minn.	-	-	9-12-69	0
High Island Creek	Minnesota River	On line between secs.4 and 5, T.113 N., R.27 W., Sibley County, at County Highway 9, 1.2 miles northwest of Arlington, Minn.	-	-	9-12-69	0
Buffalo Creek	High Island Creek	On line between secs.26 and 27, T.113 N., R.27 W., Sibley County, at County Highway 17, 2.4 miles northeast of New Rome, Minn.	-	-	9-12-69	0
Minnesota River	Mississippi River	SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.4, T.113 N., R.25 W., Scott County, next to County Highway 6, 1 mile northeast of Blakely, Minn.	-	-	9-18-69	*580
Bevens Creek	Minnesota River	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.11, T.114 N., R.24 W., Carver County, at mouth, 1.8 miles south of East Union, Minn.	-	-	9-12-69	*1.91
Raven Stream	Sand Creek	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.16, T.113 N., R.23 W., Scott County, at State Highway 21, 1.1 miles northeast of St. Benedict, Minn.	-	-	9-15-69	0
Porter Creek	Sand Creek	On line between secs.34 and 35, T.114 N., R.23 W., Scott County, at County Highway 13, 3.6 miles southeast of Jordan, Minn.	-	-	9-15-69	0
Sand Creek	Minnesota River	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.19, T.114 N., R.23 W., Scott County, at bridge on U.S. Highway 169, in Jordan, Minn.	-	1936, 1960, 1966	10-21-68	889
Carver Creek	Minnesota River	Lat 44°45'01", long 93°39'00", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.24, T.115 N., R.24 W., Carver County, at bridge on County Highway 40, 1.6 miles upstream from mouth, and 1.5 miles southwest of Carver, Minn.	-	1968	3-19-69 3-26-69 4- 2-69 4-16-69 6- 3-69 7-23-69 9-12-69	47.5 244 203 237 16.2 *13.3 *4.14
Chaska Creek	Minnesota River	NE $\frac{1}{4}$ NE $\frac{1}{4}$ 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.	-	1967-68	10-17-68 3-26-69 4- 8-69	127 145 68.3
Minnesota River	Mississippi River	NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.115 N., R.23 W., Carver County, at State Highway 41, at Chaska, Minn.	-	1962	10-21-68 4- 8-69	21,600 33,400
East Chaska Creek	Minnesota River	SW $\frac{1}{4}$ SW $\frac{1}{4}$ 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.	-	1967-68	10-17-68 3-19-69 3-26-69	44.3 27.2 40.5
Minnesota River	Mississippi River	SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.1, T.115 N., R.23 W., Scott County, at U.S. Highway 169 bridge, at Shakopee, Minn.	-	1962, 1966	2-28-69 9-12-69	1,440 *761
Riley Creek	Minnesota River	Lat 44°49'23", long 93°28'48", on line between secs.28 and 29, T.116 N., R.22 W., Hennepin County, at culvert on County Highway 4, 2.2 miles south of Eden Prairie, Minn.	-	-	3-19-69 3-26-69 4- 2-69 4-16-69 5-27-69 7-23-69	2.53 17.3 *20.7 17.3 *2.31 .94
Minnesota River tributary	Minnesota River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.3, T.115 N., R.22 W., Scott County, at mouth, 2 miles east of Shakopee, Minn.	-	1968	9-15-69	.63

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1969

Discharge measurements made at miscellaneous sites during water year 1969						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin--Continued						
Purgatory Creek	Minnesota River	Lat 44°49'38", long 93°25'20", in SE¼NE¼ sec.26, T.116 N., R.22 W., Hennepin County, at culvert on County Highway 1, at Eden Prairie, Minn.	-	1968	3-19-69 3-26-69 4- 2-69 4-16-69 5-27-69 7-23-69 9-15-69	22.0 53.8 *47.5 45.5 *9.65 *8.86 2.66
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.	-	1968	9-15-69	1.34
Nine Mile Creek	Minnesota River	SE¼SW¼ sec.29, T.27 N., R.24 W., Hennepin County, at mouth, at Bloomington, Minn.	-	1968	9-15-69	5.90
Mississippi River main stem						
Mississippi River	Gulf of Mexico	At Hastings, Dakota County, Minn.	37,100	1929, 1931-39, 1945-48, 1950, 1953-57, 1959-68	10-28-68 4- 1-69 4-11-69 4-16-69 4-24-69 4-29-69	55,500 34,200 27,100 155,200 94,500 72,200
St. Croix River basin						
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.	-	1966-68	10-23-68 4-10-69 4-17-69	4,500 8,760 7,810
Snake River	St. Croix River	On line between secs.15 and 22, T.41 N., R.23 W., Kanabec County, at bridge on County Highway 3, 0.4 mile east of bridge over Snowshoe Brook, 0.4 mile upstream from Snowshoe Brook, and 3.2 miles southeast of Warman, Minn.	-	1967	8-27-69	*15.4
Knife River	Snake River	On line between secs.9 and 10, T.40 N., R.24 W., Kanabec County, at County Highway 8, 0.7 mile upstream from Knife Lake, and 6 miles southwest of Warman, Minn.	-	-	8-27-69	*2.06
Spring Creek	Snake River	NW¼SW¼ sec.24, T.39 N., R.24 W., Kanabec County, at culvert on County Highway 62, 0.1 mile upstream from mouth, and 1.7 miles south of Mora, Minn.	-	-	8-26-69	*2.50
Ann River	Snake River	SW¼NE¼ sec.21, T.39 N., R.24 W., Kanabec County, at bridge on State Highway 23, 2.5 miles southwest of Mora, Minn.	-	1967	8-26-69	*5.10
Ann River	Snake River	SE¼SE¼ sec.23, T.39 N., R.24 W., Kanabec County, at Fish Lake outlet, 0.3 mile upstream from Snake River, and 2.2 miles south of Mora, Minn.	-	-	8-26-69	*7.64
Groundhouse River	Snake River	On line between secs.1 and 12, T.38 N., R.25 W., Kanabec County, at bridge on county road, 2.3 miles southeast of Ogilvie, Minn.	-	1967	8-26-69	*2.63
South Fork Groundhouse River	Groundhouse River	On line between secs.12 and 13, T.38 N., R.25 W., Kanabec County, at bridge on county road, 0.6 mile upstream from mouth, and 3.2 miles southeast of Ogilvie, Minn.	-	1967	8-26-69	*1.68
Snake River	St. Croix River	SW¼SE¼ sec.12, T.38 N., R.23 W., Kanabec County, at bridge on State Highway 70, near south boundary of Grasston, Minn.	-	1967	8-27-69	*61.9

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
St. Croix River basin--Continued						
Snake River	St. Croix River	SW¼SE¼ sec.35, T.39 N., R.20 W., Pine County, next to County Highway 18, 8.2 miles east of Pine City, Minn.	-	-	8-25-69	*63.9
Rush Creek	St. Croix River	SE¼NW¼ sec.9, T.37 N., R.21 W., Chisago County, at county road, 2.2 miles west of Rush City, Minn.	-	-	8-21-69	*.62
Goose Creek	St. Croix River	NW¼NE¼ sec.14, T.36 N., R.21 W., Chisago County, at bridge on County Highway 57, 3 miles northeast of Harris, Minn.	-	1967	8-21-69	*2.28
Sunrise River	St. Croix River	SW¼NW¼ sec.22, T.33 N., R.21 W., Chisago County, at bridge on State Highway 98, 2.2 miles west of Wyoming, Minn.	-	1967	8-21-69	*.99
West Branch Sunrise River	Sunrise River	On line between secs.31 and 32, T.34 N., R.21 W., Chisago County, at county road, at southwest edge of Stacy, Minn.	-	1967	8-21-69	*5.27
Sunrise River tributary	Sunrise River	On line between sec.6, T.34 N., R.20 W., and sec.1, T.34 N., R.21 W., Chisago County, at culvert on County Highway 15, 0.6 mile upstream from mouth, and 5.5 miles northwest of Lindstrom, Minn.	-	-	8-20-69	*1.73
North Branch Sunrise River	Sunrise River	On line between secs.23 and 26, T.35 N., R.22 W., Isanti County, at bridge on County Highway 5, 3.8 miles northeast of Weber, Minn.	-	-	8-21-69	*4.04
North Branch Sunrise River	Sunrise River	On line between secs.16 and 17, T.35 N., R.21 W., Chisago County, at culvert on U.S. Highway 61, in North Branch, Minn.	-	-	8-20-69	*15.1
Sunrise River	St. Croix River	NW¼SW¼ sec.4, T.35 N., R.20 W., Chisago County, at bridge on County Highway 9, at Sunrise, Minn.	-	1967	8-20-69	*50.5
Lawrence Creek	St. Croix River	SE¼SE¼ sec.3, T.33 N., R.19 W., Chisago County, at bridge on county road in Franconia, 2.9 miles southeast of Shafer, Minn.	-	-	8-22-69	*2.21
Browns Creek	St. Croix River	NE¼NE¼ sec.21, T.30 N., R.20 W., Washington County, at culvert on State Highway 95, in northeast corner of Stillwater, Minn.	-	-	8-22-69	*2.00
Valley Branch	St. Croix River	Lat 44°54'40", long 92°46'48", in NW¼SW¼ sec.14, T.28 N., R.20 W., Washington County, at bridge on State Highway 95, 0.3 mile upstream from mouth, and 0.6 mile north of Afton, Minn.	-	1967	3-20-69 5-26-69 7-23-69 8-22-69	12.7 9.13 8.38 *8.44
Trout Brook	St. Croix River	On line between secs.33 and 34, T.28 N., R.20 W., Washington County, at County Highway 21, 2.1 miles southwest of Afton, Minn.	-	-	8-22-69	*.26
St. Croix River	Mississippi River	At Prescott, Pierce County, Wis.	7,650	1928-30, 1932-39, 1946-48, 1950, 1953-57, 1959-68	10-28-68 4-1-69 4-11-69 4-16-69 4-24-69 4-29-69	15,200 2,920 27,100 38,400 19,100 16,500
Vermillion River basin						
Vermillion River	Mississippi River	Lat 44°40'00", long 93°03'17", on line between secs.23 and 24, T.114 N., R.19 W., Dakota County, at bridge on County Highway 79, 3.7 miles southwest of Coates, Minn.	-	-	9-21-69	*16.1

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Vermillion River basin--Continued						
Vermillion River	Mississippi River	Lat 44°43'12", long 92°51'57", in SE¼SW¼ sec.33, T.115 N., R.17 W., Dakota County, at bridge on County Highway 47 in Hastings, 0.7 mile upstream from mill dam, and 3 miles upstream from Vermillion Slough.	195	1942-47, 1966-68	10-17-68 3-20-69 3-24-69 3-25-69 4-13-69 9-21-69	130 110 495 720 186 *23.2
Cannon River basin						
Cannon River	Mississippi River	SW¼NE¼ sec.30, T.110 N., R.20 W., Rice County, at mill dam, 0.1 mile upstream from State Highway 3, 0.3 mile upstream from Straight River, in Faribault, Minn.	-	1965-68	10- 8-68 11-18-68 12-19-68 1-20-69 2-27-69 3-25-69 3-27-69 4- 3-69 4-17-69 5-22-69 6-23-69 8- 4-69 8-25-69	91.5 290 *138 *86.9 *75.1 658 751 917 1,040 *178 *15.2 *56.2 *27.6
Turtle Creek	Straight River	On line between secs.32 and 33, T.107 N., R.20 W., Steele County, at bridge on county road, 0.7 mile upstream from mouth, and 3.7 miles south of Owatonna, Minn.	-	1961	9-25-69	.57
Straight River	Cannon River	At center of SE¼ sec.9, T.107 N., R.20 W., Steele County, at bridge on West Bridge Street in Owatonna, Minn.	-	1961, 1966-68	10- 9-68 10-17-68 11-19-68 3-25-69 3-27-69 4- 3-69 6-24-69 8- 4-69 8-26-69	229 682 102 1,620 1,340 744 63.4 *44.7 *22.9
Maple Creek	Straight River	NW¼NW¼ sec.10, T.107 N., R.20 W., Steele County, at Elm Street bridge in Owatonna, Minn.	-	-	9-25-69	1.89
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.	-	1965-68	10- 8-68 11-18-68 12-19-68 1-21-69 2-26-69 3-25-69 3-27-69 4- 3-69 4-17-69 5-23-69 6-24-69 8- 4-69 8-25-69	113 79.5 *17.5 *17.8 *11.4 834 1,090 723 265 *62.4 25.4 *9.50 *4.46
Wolf Creek	Cannon River	On line between secs.21 and 22, T.111 N., R.20 W., Rice County, at bridge on County Highway 8, 1.5 miles southwest of Dundas, Minn.	-	-	9-25-69	1.07
Heath Creek	Cannon River	NW¼SE¼ sec.2, T.111 N., R.20 W., Rice County, at bridge on County Highway 78, 0.1 mile upstream from mouth, in Northfield, Minn.	-	1965	9-24-69	.24
Chub Creek	Cannon River	N¼ sec.7, T.112 N., R.18 W., Dakota County, at bridge on County Highway 9½ at west boundary of Randolph, Minn.	-	1965	9-22-69	5.95
Spring Creek basin						
Spring Creek	Mississippi River	On line between secs.27 and 28, T.113 N., R.15 W., Goodhue County, at bridge on County Highway 53, 4 miles west of Red Wing, Minn.	-	-	9-24-69	3.07

* Base flow.

Operated as a continuous-record gaging station.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at miscellaneous sites during water year 1969

Discharge measurements made at miscellaneous sites during water year 1969						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Hay Creek basin						
Hay Creek	Mississippi River	SE½NW¼ sec.36, T.113 N., R.15 W., Goodhue County, at bridge on county road, in Red Wing, Minn.	-	-	9-24-69	15.0
Wells Creek basin						
Wells Creek	Mississippi River	NE½NW¼ sec.13, T.112 N., R.14 W., Goodhue County, at bridge on county road leading to Old Frontenac, 1.2 miles south of Old Frontenac, and 1.6 miles east of Frontenac, Minn.	-	-	9-24-69	17.9
Miller Creek basin						
Miller Creek	Mississippi River	NW¼SE¼ sec.8, T.111 N., R.12 W., Wabasha County, at bridge on County Highway 9, 1.3 miles south of Lake City, Minn.	-	-	9-24-69	2.06
Mississippi River main stem						
Mississippi River	Gulf of Mexico	At lock and dam No. 4, Buffalo County, at Alma, Wis., 4 miles northeast of Kellogg, Minn.	-	1965	4-19-69	201,000
Zumbro River basin						
South Fork Zumbro River	Zumbro River	SE½NE¼ sec.18, T.106 N., R.14 W., Olmsted County, at bridge on county road, 1.4 miles upstream from Mayowood Lake dam, and 4.4 miles southwest of Rochester, Minn.	-	1968	3-19-69 3-21-69 3-25-69	48.0 555 826
South Fork Zumbro River	Zumbro River	Lat 44°00'26", long 92°28'19", on line between secs.2 and 11, T.106 N., R.14 W., Olmsted County, at bridge on U.S. Highways 14 and 52, at Rochester, Minn., and 1.5 miles upstream from Bear Creek.	155	1965, 1968	10-11-68 11-15-68 3-19-69 3-25-69 4-23-69 5-27-69 7- 1-69	130 38.7 46.3 933 104 76.5 181
Bear Creek	South Fork Zumbro River	Lat 44°00'29", long 92°26'44", in SW¼SE¼ sec.1, T.106 N., R.14 W., Olmsted County, at bridge on U.S. Highways 14 and 52, in Rochester, Minn., and 1.2 miles upstream from mouth.	80.0	1965, 1968	3-20-69 3-25-69 4-23-69 7- 1-69	185 270 66.9 75.3
Silver Creek	South Fork Zumbro River	Lat 44°01'44" long 92°25'44", near center of sec.31, T.107 N., R.13 W., Olmsted County, at bridge on county road at east edge of Rochester, Minn., and 1.7 miles upstream from mouth.	17.3	1968	3-25-69 7- 1-69	51.6 9.79
Cascade Creek	South Fork Zumbro River	Lat 44°01'51", long 92°28'18", in SE½NW¼ sec.35, T.107 N., R.14 W., Olmsted County, at bridge on 7th Street N.W., at Rochester, Minn., and 0.6 mile upstream from mouth.	37.0	1965, 1967-68	10-11-68 3-20-69 3-25-69 7- 1-69	20.3 72.3 130 21.5
Middle Fork Zumbro River	Zumbro River	At center of SW¼ of sec.12, T.109 N., R.15 W., Olmsted County, at bridge on County Highway 31, 2 miles west of Oronoco, Minn.	-	-	9-23-69	19.3
South Branch Middle Fork Zumbro River	Middle Fork Zumbro River	NW¼SW¼ sec.23, T.108 N., R.14 W., Olmsted County, at bridge on County Highway 3, 3.5 miles southwest of Oronoco, Minn.	-	-	9-23-69	18.8
North Fork Zumbro River	Zumbro River	NW¼NW¼ sec.7, T.109 N., R.14 W., Wabasha County, at bridge on County Highway 1, at southwest edge of Mazeppa, Minn.	-	-	9-23-69	33.8
Trout Brook	North Fork Zumbro River	Near center of sec.5, T.109 N., R.14 W., Wabasha County, at bridge on State Highway 60, 1.3 miles east of Mazeppa, Minn.	-	-	9-23-69	8.56

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Zumbro River basin--Continued						
Cold Creek	Zumbro River	SE¼NE¼ sec.36, T.109 N., R.14 W., Wabasha County, at triple box culvert on State Highway 60, 0.2 mile upstream from mouth, and 0.6 mile northwest of Zumbro Falls, Minn.	-	-	9-23-69	6.43
Spring Creek	Zumbro River	N½SW¼ sec.27, T.110 N., R.12 W., Wabasha County, at bridge on County Highway 11, 0.8 mile upstream from mouth, and 2.2 miles east of West Albany, Minn.	-	-	9-23-69	8.20
Trout Brook	Zumbro River	SW¼NE¼ sec.10, T.110 N., R.11 W., Wabasha County, at bridge on State Highway 60, 0.3 mile east of Dumfries, Minn.	-	-	9-23-69	0
Gorman Creek basin						
Gorman Creek	Mississippi River	On line between secs.34 and 35, T.110 N., R.10 W., Wabasha County, at bridge on U.S. Highway 61, 1.1 miles south of Kellogg, Minn.	-	-	9-24-69	.81
Whitewater River basin						
Middle Fork Whitewater River	Whitewater River	SW¼SE¼ sec.9, T.107 N., R.10 W., Winona County, at bridge on State Highway 74, at Elba, Minn.	-	-	9-22-69	16.2
Garvin Brook basin						
Garvin Brook	Mississippi River	On line between secs.10 and 11, T.107 N., R.8 W., Winona County, at bridge on one lane road, 0.6 mile southwest of Minnesota City, Minn.	-	-	9-23-69	9.29
Rollingstone Creek	Garvin Brook	NW¼SW¼ sec.3, T.107 N., R.8 W., Winona County, at bridge on county road, 1.4 miles west of Minnesota City, Minn.	-	-	9-23-69	17.8
Burns Valley Creek basin						
Burns Valley Creek	Mississippi River	On line between secs.35 and 36, T.107 N., R.7 W., Winona County, at bridge on County Highway 17, in southeast Winona Minn.	-	1967-68	3-28-69 9-23-69	9.08 5.29
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.	-	1967-68	3-28-69 9-22-69	7.87 4.77
Mississippi River main stem						
Mississippi River	Gulf of Mexico	At U.S. Highways 14, 16, and 61, La Crosse County, at La Crosse, Wis., 2 miles southeast of La Crescent, Minn.	62,800	1929-55½, 1965, 1967	4-18-69 4-30-69	211,000 126,000
Root River basin						
North Branch Root River	Root River	SE¼SE¼ sec.8, T.104 N., R.11 W., Fillmore County, at bridge on County Highway 5, 1.6 miles upstream from Middle Branch Root River, and 1.7 miles southeast of Chatfield, Minn.	-	-	9-22-69	36.6
Middle Branch Root River	Root River	On line between secs.17 and 18, T.104 N., R.11 W., Fillmore County, at bridge on County Highway 7, 1 mile upstream from North Branch Root River, and 2.7 miles south of Chatfield, Minn.	-	-	9-22-69	44.7
Willow Creek	South Branch Root River	On line between secs.1 and 12, T.102 N., R.11 W., Fillmore County, at bridge on County Highway 12, 0.5 mile upstream from mouth, and 1 mile southwest of Preston, Minn.	-	-	3-26-69	31.4

$\frac{1}{2}$ Operated as a continuous-record gaging station.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at miscellaneous sites during water year 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Root River basin--Continued						
South Branch Root River	Root River	NW¼SW¼ sec.6, T.102 N., R.10 W., Fillmore County, at bridge on County Highway 17, at south edge of Preston, Minn.	-	1965-68	3-21-69 3-26-69	380 346
South Branch Root River	Root River	At center of E¼ sec.21, T.103 N., R.10 W., Fillmore County, at bridge on county road, 3.7 miles northeast of Preston, Minn.	-	-	9-24-69	66.0
South Branch Root River	Root River	NE¼SW¼ sec.13, T.103 N., R.10 W., Fillmore County, at bridge on road to ball park (bridge closed), in Lanesboro, Minn.	-	1915, 1940-42, 1950, 1965-67	3-21-69 3-26-69	507 497
Money Creek	Root River	NE¼SE¼ sec.19, T.104 N., R.6 W., Houston County, at bridge on State Highway 76, 2.4 miles northwest of Houston, Minn.	-	-	9-23-69	23.3
Upper Iowa River basin						
Little Iowa River	Upper Iowa River	At center of S¼ sec.21, T.101 N., R.14 W., Mower County, at bridge on county road in Lake Louise State Park, 1.7 miles northwest of Le Roy, Minn.	-	-	9-25-69	1.63
Iowa River basin						
Roberts Creek	Cedar River	On line between secs.1 and 2, T.103 N., R.18 W., Mower County, at bridge on county road, 0.2 mile upstream from mouth, and 1.4 miles northeast of Lansing, Minn.	-	-	9-25-69	1.37
Wolf Creek	Cedar River	SW¼SE¼ sec.26, T.103 N., R.19 W., Mower County, at bridge on County Highway 25, at Todd Park, 0.3 mile upstream from mouth, and 1.7 miles north of Austin, Minn.	-	-	9-24-69	.02
Turtle Creek	Cedar River	Lat 43°41'05", long 93°02'15", at center of N¼ sec.31, T.103 N., R.18 W., Mower County, at bridge on county road, 3.5 miles northwest of Austin, Minn., and 5.6 miles upstream from mouth.	144	1946, 1947-51	9-25-69	14.5
Rose Creek	Cedar River	On line between secs.26 and 27, T.102 N., R.18 W., Mower County, at bridge on County Highway 29, 0.3 mile upstream from mouth, and 3.8 miles south of Austin, Minn.	-	-	9-25-69	6.40
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.	-	1963-68	10-28-68 11-24-68 12-17-68 1-21-69 2-26-69 3-26-69 4- 2-69 4- 8-69 4- 9-69 4-12-69 4-15-69 4-16-69 4-24-69 5-20-69 6-24-69 7-28-69 9-13-69	975 290 0 0 42.3 128 125 6,360 8,730 13,200 9,310 3,240 1,450 280 40.5 79.8 .34
Big Sioux River basin						
Split Rock Creek	Big Sioux River	On line between secs.26 and 35, T.104 N., R.47 W., Rock County, at bridge on county road, 5.4 miles southwest of Jasper, Minn.	-	-	9-24-69	3.76

* Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1969

Discharge measurements made at miscellaneous sites during water year 1969						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Big Sioux River basin--Continued						
Beaver Creek	Big Sioux River	On line between secs.2 and 11, T.102 N., R.46 W., Rock County, at bridge on County Highway 5, 5.4 miles west of Luverne, Minn.	-	-	9-24-69	.39
Beaver Creek tributary	Beaver Creek	On line between secs.6 and 7, T.102 N., R.45 W., Rock County, at bridge on County Highway 5, 3.8 miles west of Luverne, Minn.	-	-	9-24-69	<.10
Beaver Creek	Big Sioux River	On line between secs.35 and 36, T.102 N., R.47 W., Rock County, at bridge on State Highway 23, 3.8 miles southwest of Beaver Creek, Minn.	-	-	9-24-69	2.80
Rock River	Big Sioux River	SW $\frac{1}{4}$ sec.28, T.105 N., R.44 W., Pipestone County, at bridge on County Highway 10, at west edge of Edgerton, Minn., and about 1.7 miles upstream from Chanarambie Creek.	-	-	9-23-69	3.31
Chanarambie Creek	Rock River	W $\frac{1}{2}$ sec.27, T.105 N., R.44 W., Pipestone County, at bridge on County Highway 1, in Edgerton, Minn., and 1 mile upstream from Rock River.	-	-	9-23-69	2.12
Rock River	Big Sioux River	On line between secs.18 and 19, T.103 N., R.44 W., Rock County, at bridge on County Highway 8, 4.3 miles southeast of Hardwick, Minn.	-	-	9-23-69	13.3
Champepadan Creek	Rock River	On line between secs.20 and 21, T.103 N., R.44 W., Rock County, at bridge on County Highway 9, 1.2 miles upstream from mouth, and 5.8 miles southeast of Hardwick, Minn.	-	-	9-23-69	.67
Rock River	Big Sioux River	NE $\frac{1}{4}$ sec.11, T.102 N., R.45 W., Rock County, at dam in Luverne, Minn.	-	1911-14 [#] 1967-68	4-7-69 4-10-69	13,900 3,600
Elk Creek	Rock River	On line between sec.30, T.102 N., R.44 W., and sec.25, T.102 N., R.45 W., Rock County, at bridge on County Highway 9, 4 miles southeast of Luverne, Minn.	-	-	9-23-69	.48
Ash Creek	Rock River	NE $\frac{1}{4}$ sec.14, T.101 N., R.45 W., Rock County, at bridge on county road, 0.7 mile north of Ash Creek, Minn.	-	-	9-24-69	0
Kanaranzi Creek	Rock River	On line between sec.4, T.100 N., R.44 W., and sec.33, T.101 N., R.44 W., Rock County, at Iowa-Minnesota border, at bridge on county road, 5.3 miles southwest of Kanaranzi, Minn.	-	-	9-23-69	5.02
Mud Creek	Rock River	On line between secs.27 and 34, T.101 N., R.46 W., Rock County, at bridge on county road, 1.2 miles southeast of Hills, Minn.	-	-	9-23-69	<.01
Little Sioux River basin						
Little Sioux River	Missouri River	On line between secs.3 and 10, T.101 N., R.37 W., Jackson County, at bridge on county road, 6.7 miles southeast of Spafford, Minn.	-	-	9-22-69	.22

[#] Operated as a continuous-record station.

< Less than.

Low-flow investigations in the Mississippi-Sauk watershed

Two series of discharge measurements were made during the 1969 water year, on Nov. 4-7, 1968 and Aug. 20-22, 1969, on many streams in the Mississippi-Sauk watershed to study base-flow yields from various parts of the watershed. No measurable precipitation was reported in the area from Oct. 28 to Nov. 4, prior to the first series of measurements, although some scattered precipitation ranging from .05 inch to .13 inch was reported during the period Nov. 5-7. Prior to the second series of measurements, no measurable precipitation was reported in the area from Aug. 8-22, with the exception of two sites which recorded .02 inch and .05 inch of precipitation on Aug. 17. These measurements should represent base flow.

Discharge measurements made in the Mississippi-Sauk watershed, Minn., Nov. 4-7, 1968, Aug. 20-22, 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Nokasippi River	Mississippi River	NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.27, T.44 N., R.30 W., Crow Wing County, at State Highway 25, 7.8 miles southeast of Brainerd, Minn.	-	-	8-20-69	10.2
Daggett Brook	Nokasippi River	On line between secs.3 and 10, T.43 N., R.30 W., Crow Wing County, at county road, 9.1 miles southeast of Crow Wing, Minn.	-	-	8-20-69	.42
Nokasippi River	Mississippi River	On line between secs.13 and 24, T.43 N., R.32 W., Crow Wing County, at bridge on County Highway 2, 3 miles northeast of Fort Ripley, Minn.	-	1968	*8-20-69	19.7
Fletcher Creek	Mississippi River	At center of W $\frac{1}{2}$ sec.1, T.41 N., R.32 W., Morrison County, at box culvert on U.S. Highway 371, 0.2 mile upstream from mouth, and 0.6 mile south of Camp Ripley Junction, Minn.	-	-	8-20-69	a.1
Mississippi River tributary	Mississippi River	On line between secs.29 and 30, T.130 N., R.29 W., Morrison County, at box culvert on County Highway 13, 1.9 miles northwest of Belle Prairie, Minn.	-	-	11- 4-68 8-20-69	a4.4 0
Elk River	Mississippi River	On line between secs.26 and 35, T.130 N., R.30 W., Morrison County, at bridge on county road, 4.1 miles west of Belle Prairie, Minn.	-	-	11- 4-68 8-20-69	34.6 4.13
Elk River tributary	Elk River	On line between secs.25 and 36, T.130 N., R.30 W., Morrison County, at culvert on county road, 4.4 miles northwest of Little Falls, Minn.	-	-	11- 4-68 8-20-69	a.3 0
Elk River	Mississippi River	NW $\frac{1}{4}$ NE $\frac{1}{4}$ 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.	-	1968	*11- 4-68 8-20-69	39.3 4.85
Swan River	Mississippi River	SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.33, T.129 N., R.31 W., Morrison County, at bridge on county road, 2.8 miles southwest of Flensburg, Minn.	-	-	8-20-69	11.0
Swan River	Mississippi River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ 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.	-	1968	*11- 7-68 8-20-69	46.2 14.2
North Branch Two Rivers	Mississippi River	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.8, T.127 N., R.29 W., Morrison County, at bridge on County Highway 224, 0.3 mile upstream from mouth, and 2.2 miles northeast of Bowlus, Minn.	-	-	11- 7-68 8-20-69	5.31 1.69
Two Rivers	Mississippi River	On line between secs.14 and 15, T.127 N., R.30 W., Morrison County, at county road, 1.5 miles southwest of Bowlus, Minn.	-	-	8-21-69	a.1
Two Rivers	Mississippi River	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.8, T.127 N., R.29 W., Morrison County, at bridge on County Highway 25, 0.3 mile upstream from mouth, and 2 miles east of Bowlus, Minn.	-	-	11- 7-68 8-20-69	41.7 1.04

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

a Estimated.

Discharge measurements made in the Mississippi-Sauk watershed, Minn., Nov. 4-7, 1968, Aug. 20-22, 1969--Continued

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
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.	-	1968	*11- 7-68 8-21-69	23.1 2.70
Platte River	Mississippi River	On line between secs.26 and 27, T.42 N., R.30 W., Morrison County, at triple box culvert on State Highway 25, 3.5 miles southeast of Harding, Minn.	-	-	11- 6-68 8-22-69	79.5 .66
Big Mink Creek	Platte River	On line between secs.29 and 30, T.41 N., R.30 W., Morrison County, at bridge on county road, 2.6 miles northwest of Pierz, Minn.	-	-	11- 5-68 8-20-69	a6.2 .86
Platte River	Mississippi River	On line between sec.30, T.41 N., R.30 W., and sec.25, T.41 N., R.31 W., Morrison County, at bridge on county road, 3.7 miles south of Freedhem, Minn.	-	-	11- 5-68 8-21-69	103 2.45
Little Mink Creek	Platte River	On line between sec.31, T.41 N., R.30 W., and sec.36, T.41 N., R.31 W., Morrison County, at bridge on County Highway 255, 4.1 miles west of Pierz, Minn.	-	-	11- 4-68 8-21-69	3.46 .02
Pierz Lake Outlet	Platte River	NW¼SE¼ sec.14, T.40 N., R.31 W., Morrison County, at twin culverts on County Highway 36, at Pierz Lake Outlet, 3 miles southwest of Pierz, Minn.	-	-	11- 5-68 8-21-69	a1.2 1.05
Platte River	Mississippi River	On line between secs.16 and 21, T.40 N., R.31 W., Morrison County, at bridge on county road, 4.4 miles west of Genola, Minn.	-	-	11- 5-68	107
Skunk River	Platte River	On line between secs.20 and 21, T.41 N., R.29 W., Morrison County, at double box culvert on County Highway 267, 2.6 miles southeast of Lastrup, Minn.	-	-	11- 6-68 8-20-69	17.0 1.03
Skunk River	Platte River	On line between sec.9, T.40 N., R.30 W., and sec.36, T.41 N., R.30 W., Morrison County, at double box culvert on County Highway 39, 1.1 miles east of Pierz, Minn.	-	-	11- 6-68 8-20-69	25.0 5.87
Hillman Creek	Skunk River	NE¼NE¼ sec.8, T.40 N., R.29 W., Morrison County, at double box culvert on County Highway 39, 4.6 miles southwest of Hillman, Minn.	-	-	11- 6-68 8-20-69	4.14 .01
✓Hillman Creek	Skunk River	NE¼SE¼ sec.9, T.40 N., R.29 W., Morrison County, at bridge on county road, 1.1 miles upstream from mouth, and 1.5 miles east of Pierz, Minn.	52.6	1964-68	11- 6-68 8-20-69	11.7 .22
Skunk River tributary	Skunk River	On line between secs.17 and 20, T.40 N., R.30 W., Morrison County, at box culvert on County Highway 38, 0.6 mile south of Genola, Minn.	-	-	11- 7-68 8-20-69	.20 0
Skunk River tributary	Skunk River	On line between secs.20 and 21, T.40 N., R.30 W., Morrison County, at County Highway 239, 1.5 miles southwest of Genola, Minn.	-	-	11- 7-68 8-20-69	2.59 .07
Skunk River	Platte River	On line between secs.29 and 30, T.40 N., R.30 W., Morrison County, at culvert on State Highway 25, 1.6 miles south of Genola, Minn.	-	-	11- 7-68 8-20-69	43.0 8.07
Skunk River	Platte River	On line between secs.26 and 27, T.40 N., R.31 W., Morrison County, at bridge on county road, 4.6 miles northwest of Buckman, Minn.	-	-	11- 4-68 8-22-69	54.8 10.0

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

✓ Crest-stage partial-record station.

a Estimated.

Discharge measurements made in the Mississippi-Sauk watershed, Minn., Nov. 4-7, 1968, Aug. 20-22, 1969--Continued

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Buckman Creek	Skunk River	On line between sec.4, T.39 N., R.31 W., and sec.33, T.40 N., R.31 W., Morrison County, at bridge on county road, 4.2 miles northwest of Buckman, Minn.	-	-	11- 4-68 8-21-69	11.5 .70
Rice Creek	Platte River	On line between secs.17 and 20, T.40 N., R.31 W., Morrison County, at triple culvert on county road, 0.7 mile upstream from Rice Lake, and 6.1 miles east of Little Falls, Minn.	-	-	11- 4-68 8-21-69	16.2 3.69
Platte River tributary	Platte River	On N½ line between sec.19, T.40 N., R.31 W., and sec.24, T.40 N., R.32 W., Morrison County, at County Highway 256, 5 miles southeast of Little Falls, Minn.	-	-	11- 4-68 8-21-69	a0.2 0
Platte River tributary	Platte River	On center of line between sec.19, T.40 N., R.31 W., and sec.24, T.40 N., R.32 W., Morrison County, at County Highway 256, 5 miles southeast of Little Falls, Minn.	-	-	8-21-69	0
Platte River	Mississippi River	NW¼NW¼ sec.31, T.40 N., R.31 W., Morrison County, at bridge on County Highway 35, downstream from Rice Lake, and 6 miles southeast of Little Falls, Minn.	-	1938, 1963-65	11- 5-68 8-21-69	258 50.2
Platte River	Mississippi River	NE¼NW¼ sec.12, T.39 N., R.32 W., Morrison County, at bridge on County Highway 34, 4.7 miles north of Royalton, Minn.	-	-	11- 5-68 8-21-69	282 41.6
Platte River	Mississippi River	Lat 45°49'50", long 94°17'12", in E½ sec.35, T.39 N., R.32 W., Morrison County, at County Highway 26, in Royalton, Minn.	336	1929-36#	11- 5-68 8-21-69	265 49.0
Little Rock Creek	Mississippi River	SE¼NE¼ sec.33, T.39 N., R.31 W., Benton County, at triple box culvert on County Highway 26, 4.5 miles east of Royalton, Minn.	-	-	11- 7-68 8-21-69	14.2 4.18
Little Rock Creek	Mississippi River	NE¼NW¼ sec.28, T.38 N., R.31 W., Morrison County, at County Highway 12, 2 miles upstream from Little Rock Lake, and at northeast corner of Rice, Minn.	-	-	8-21-69	15.4
Watab River	Mississippi River	NE¼SE¼ sec.20, T.125 N., R.28 W., Stearns County, at bridge on county road, 1.1 miles west of Sartell, Minn.	-	-	8-22-69	5.38
Sauk River	Mississippi River	On line between sec.2, T.127 N., R.34 W., and sec.35, T.128 N., R.34 W., Todd County, at bridge on county road, 1.1 miles south of Little Sauk, Minn.	-	-	8-20-69	17.2
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.	-	1968	*8-20-69	9.24
Sauk River	Mississippi River	NW¼NE¼ sec.15, T.126 N., R.34 W., Stearns County, at bridge on county road, about 1 mile downstream from Sauk Lake, in Sauk Centre, Minn.	-	1941	8-20-69	19.5
Sauk River tributary	Sauk River	NE¼NE¼ sec.2, T.125 N., R.34 W., Stearns County, at culvert on County Highway 29, 3.6 miles northwest of Meire Grove, Minn.	-	-	8-20-69	0
Adley Creek	Sauk River	NE¼NE¼ sec.36, T.126 N., R.33 W., Stearns County, at culvert on County Highway 168, 2.2 miles east of Melrose, Minn.	-	-	8-20-69	4.81

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

Operated as a continuous-record gaging station.

a Estimated.

Discharge measurements made in the Mississippi-Sauk watershed, Minn., Nov. 4-7, 1968, Aug. 20-22, 1969--Continued

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
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.	-	1968	*8-20-69	33.0
Sauk River tributary	Sauk River	On line between sec.31, T.125 N., R.32 W., and sec.36, T.125 N., R.33 W., Stearns County, at bridge on county road, 0.4 mile upstream from mouth, and 2.3 miles southwest of New Munich, Minn.	-	-	8-21-69	.22
Getchell Creek	Sauk River	NE¼SE¼ sec.1, T.124 N., R.33 W., Stearns County, at bridge on County Highway 12, 0.3 mile upstream from mouth, and 4 miles south of New Munich, Minn.	-	-	8-21-69	.39
Stony Creek	Sauk River	SE¼NE¼ sec.23, T.124 N., R.33 W., Stearns County, at culvert on county road, 0.2 mile upstream from mouth, and 2.2 miles northeast of Spring Hill, Minn.	-	-	8-21-69	0
Sauk River	Mississippi River	On W¼ line between sec.6, T.123 N., R.31 W., and sec.31, T.124 N., R.31 W., Stearns County, at bridge on county road, 1.9 miles southeast of Farming, Minn.	-	-	8-21-69	43.8
Sauk River tributary	Sauk River	On E¼ line between sec.6, T.123 N., R.31 W., and sec.31, T.124 N., R.31 W., Stearns County, at culvert on County Highway 23, 1.5 miles southwest of Farming, Minn.	-	-	8-21-69	0
Sauk River tributary	Sauk River	NE¼SW¼ sec.2, T.122 N., R.31 W., Stearns County, at county road, just below confluence with Mud Lake outlet, 0.2 mile upstream from Long Lake, and 3.4 miles southwest of Richmond, Minn.	-	-	8-21-69	0
Sauk River tributary	Sauk River	SW¼SW¼ sec.9, T.123 N., R.29 W., Stearns County, at bridge on State Highway 23, 0.1 mile upstream from mouth, in Rockville, Minn.	-	-	8-21-69	3.52
Johnson Creek	Mississippi River	NW¼SW¼ sec.13, T.123 N., R.28 W., Stearns County, at bridge on County Highway 7, 1.1 miles south of St. Augusta, Minn.	-	1964-68	8-21-69	5.17
Plum Creek	Mississippi River	NE¼NE¼ sec.33, T.123 N., R.27 W., Stearns County, at culvert on State Highway 152, 1.7 miles northwest of Clearwater, Minn.	-	-	8-22-69	2.28
Clearwater River	Mississippi River	SW¼SW¼ sec.7, T.121 N., R.28 W., Stearns County, at bridge on State Highway 55, 0.1 mile upstream from Lake Louisa, and 2.1 miles southeast of Kimball Prairie, Minn.	-	-	8-22-69	1.07
Clearwater River	Mississippi River	Lat 45°24'40", long 94°03'44", in NW¼NE¼ sec.3, T.122 N., R.27 W., Stearns County, at bridge on county road, at southwest corner of Clearwater, Minn.	-	-	8-22-69	4.10
Silver Creek	Mississippi River	SE¼NW¼ sec.15, T.122 N., R.26 W., Wright County, at county road, 1.6 miles northeast of Hasty, Minn.	-	-	8-22-69	2.20
Mayhew Creek	Elk River	NE¼NW¼ sec.26, T.36 N., R.30 W., Benton County, 300 ft upstream from mouth, 500 ft northwest of Elk River bridge on State Highway 95, and 6 miles east of St. Cloud, Minn.	-	1968	b8-22-69	.71

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

/ Crest-stage partial-record station.

b 1969 water year measurements other than those shown are listed under miscellaneous measurements.

LOW-FLOW INVESTIGATIONS

Discharge measurements made in the Mississippi-Sauk watershed, Minn., Nov. 4-7, 1968, Aug. 20-22, 1969--Continued

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Elk River	Mississippi River	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.26, T.36 N., R.30 W., Benton County, at bridge on State Highway 95, 6 miles east of St. Cloud, Minn.	-	1968	*8-22-69	4.36
Rice Creek	Elk River	At center of N $\frac{1}{2}$ sec.29, T.35 N., R.29 W., Sherburne County, at bridge on County Highway 61, 3.8 miles northeast of Clear Lake, Minn.	-	-	8-22-69	4.63
Elk River	Mississippi River	On line between secs.13 and 14, T.34 N., R.29 W., Sherburne County, at bridge on State Highway 25, 2.2 miles northwest of Becker, Minn.	-	-	8-22-69	40.1
Snake River	Elk River	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.36, T.34 N., R.28 W., Sherburne County, at culvert on County Highway 73, 4.1 miles northwest of Big Lake, Minn.	-	-	8-22-69	9.74
St. Francis River	Elk River	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.27, T.35 N., R.27 W., Sherburne County, at County Highway 9, about 1 mile upstream from Rice Lake, and 4.2 miles northeast of Orrock, Minn.	-	-	8-22-69	4.50
St. Francis River tributary	St. Francis River	On line between secs.2 and 3, T.34 N., R.27 W., Sherburne County, at culvert on County Highway 43, 0.4 mile upstream from mouth, and 3.5 miles northeast of Orrock, Minn.	-	-	8-22-69	1.06
Battle Brook	St. Francis River	On line between secs.19 and 30, T.35 N., R.26 W., Sherburne County, at culvert on County Highway 9, 0.5 mile upstream from Elk Lake, and 4.4 miles northwest of Lake Fremont, Minn.	-	-	8-22-69	3.44

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

LOW-FLOW INVESTIGATIONS

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Low-flow investigations in the Rum River basin

On August 20-22, 1969, a series of discharge measurements were made on the Rum River and its tributaries to study base-flow yields from various parts of the basin.

No rain fell in the 6 days preceding this period and the measurements should represent base flow.

Discharge measurements made in the Rum River basin, Minn., Aug. 20-22, 1969

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Rum River	Mississippi River	SW $\frac{1}{4}$ sec.33, T.43 N., R.27 W., Mille Lacs County, at bridge on U.S. Highway 169, at Mille Lacs Lake outlet, at Vine-land, Minn.	-	1909-10, 1946-47, 1952-53, 1965-69	8-20-69	121
Rum River	Mississippi River	On line between secs.5 and 6, T.41 N., R.26 W., Mille Lacs County, at bridge on U.S. Highway 169, 0.8 mile south of Onamia, Minn.	-	1911-13 [*] , 1953, 1965, 1968	*8-20-69	130
Bradbury Brook	Rum River	On line between secs.29 and 30, T.41 N., R.26 W., Mille Lacs County, at bridge on U.S. Highway 169, 0.15 mile up-stream from mouth, and 5 miles south of Onamia, Minn.	-	-	8-20-69	0
Rum River	Mississippi River	On line between secs.13 and 24, T.38 N., R.27 W., Mille Lacs County, at bridge on County Highway 9, 1.8 miles north of Milaca, Minn.	-	1968	*8-20-69	141
Bogus Brook	Rum River	On line between secs.23 and 26, T.37 N., R.26 W., Mille Lacs County, at County Highway 1, 0.2 mile upstream from mouth, and 1.6 miles east of Woodward Brook, Minn.	-	-	8-20-69	<.01
West Branch Rum River	Rum River	NE $\frac{1}{4}$ 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, 1968	*8-20-69	7.82
Spencer Brook	Rum River	NW $\frac{1}{4}$ sec.15, T.35 N., R.25 W., Isanti County, at County Highway 40, 0.3 mile upstream from mouth, and 0.3 mile north of Spencer Brook, Minn.	-	1965	8-21-69	5.88
Green Lake Brook	Rum River	On line between sec.31, T.36 N., R.24 W., and sec.36, T.36 N., R.25 W., Isanti County, 0.2 mile upstream from mouth, and 0.5 mile north of West Point, Minn.	-	1965	8-21-69	2.86
Stanchfield Creek	Rum River	On line between secs.11 and 14, T.36 N., R.24 W., Isanti County, at bridge on County Highway 32, 1.5 miles upstream from mouth, and 1 mile south of Springvale, Minn.	-	1965, 1968	*8-22-69	2.97
Lower Stanchfield Creek	Rum River	On line between secs.5 and 8, T.136 N., R.23 W., Isanti County, at County Highway 6 at Little Stanchfield Lake outlet, and 1.9 miles southwest of Grandy, Minn.	-	-	8-22-69	2.26
Rum River *	Mississippi River	N $\frac{1}{2}$ sec.30, T.36 N., R.23 W., Isanti County, at County Highway 64, in Cambridge, Minn.	-	1965	*8-22-69	202
Isanti Brook	Rum River	At center of S $\frac{1}{2}$ sec.17, T.135 N., R.23 W., Isanti County, at U.S. Highway 65, 2.1 miles northeast of Isanti, Minn.	-	-	8-21-69	0
Long Lake Outlet	Rum River	On line between secs.10 and 15, T.34 N., R.24 W., Isanti County, at county road, 4 miles north of St. Francis, and 5.3 miles southwest of Isanti, Minn.	-	1965	8-21-69	2.12

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

^{*} 1969 water year measurements other than those shown are listed under miscellaneous measurements.

^{*} Operated as a continuous-record gaging station.

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LOW-FLOW INVESTIGATIONS

Discharge measurements made in the Rum River basin, Minn., Aug. 20-22, 1969--Continued

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Seelye Creek	Rum River	SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.7, T.33 N., R.24 W., Anoka County, at bridge on County Highway 55 1.6 miles south of St. Francis, Minn.	-	1965	8-21-69	2.39
Cedar Creek	Rum River	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.32, T.33 N., R.24 W., Anoka County, at county road, 0.5 mile upstream from mouth, 4.3 miles southwest of Cedar, and 7 miles north of Anoka, Minn.	-	1965, 1968	*8-21-69	24.2
Trott Brook	Rum River	NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.2, T.32 N., R.25 W., Anoka County, at State Highway 47, 0.8 mile upstream from mouth, and 3.9 miles southeast of Nowthen, Minn.	-	1965	8-21-69	5.12

* 1969 water year measurements other than those shown are listed under measurements made at low-flow partial-record stations.

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

WATER RESOURCES DATA
FOR
MINNESOTA

1969

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
Federal Water Quality Administration, U.S. Department of
Interior
Atomic Energy Commission

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)*

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WATER RESOURCES DATA FOR MINNESOTA, 1969

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 1969 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. 218.) 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 stabilizing 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 millequivalents per liter by multiplying by the factors in table 1, page 214. 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 214.

Most probable number (MPN) is computed from probability analysis based on the number of positive findings of coliform group organisms resulting from multiple-dilution 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	Multi- ply by	Ion	Multi- ply 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)	Multi- ply by	Range of concentration (ppm)	Multi- ply 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 206.

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.

SELECTED REFERENCES

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- Love, S. K., and Benedict, P. C., 1948, Discharge and sediment loads in the Boise River drainage basin, Idaho, 1939-40: U.S. Geol. Survey Water-Supply Paper 1048, 150 p.
- Rainwater, F. H., and Thatcher, L. L., 1960, Methods for collection and analysis of water samples: U.S. Geol. Survey Water-Supply Paper 1454, 301 p.
- U.S. Inter-Agency Committee on Water Resources, Subcommittee on Sedimentation, A study of methods used in measurement and analysis of sediment loads in streams. Published by the St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minn.
- _____ 1957, The development and calibration of visual accumulation tube: Rept. 11.
- _____ 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.

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-0153.8 LAKE SUPERIOR AT DULUTH, MINN.

LOCATION.--Lat 46°51'33", long 91°57'20", in NE¼ sec.35, T.51 N., R.13 W., St. Louis County, at intake of City of Duluth Lakewood Pumping Plant, 3.8 miles northeast of the Lester River and 10 miles northeast of Duluth post office.

PERIOD OF RECORD.--Chemical analyses: August to September 1969.

REMARKS.--Some analyses furnished by City of Duluth, Water, Gas, and Sewage Treatment Department and Federal Water Quality Administration, Cincinnati, Ohio.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	ALKA- LITY AS CACO ₃ (MG/L)	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	ORGANIC NITRO- GEN (N) (MG/L)	NITRITE (N) (MG/L)	NITRITE (NO ₂) (MG/L)	AMMONIA NITRO- GEN (N) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	TOTAL PHOS- PHORUS (P) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	HARD- NESS (CA, MG) (MG/L)
AUG.												
04...	44	2.0	1.5	--	--	--	--	--	--	--	--	45
04-05	--	--	--	--	--	--	--	--	--	--	--	--
11...	43	3.6	1.5	--	--	--	--	--	--	--	--	44
18...	43	3.7	1.5	--	--	--	--	--	--	--	--	44
25...	43	3.2	1.5	--	--	--	--	--	--	--	--	44
SEPT.												
01-03	--	--	--	--	--	--	--	--	--	--	--	--
02...	43	4.3	1.5	--	--	--	--	--	--	--	--	44
03...	--	--	--	.10	.00	.00	.00	.40	1.8	.36	.01	--
29...	--	--	--	--	.00	.03	.05	.30	1.2	.32	.06	--
29...	--	--	--	--	--	--	--	--	--	--	--	--

DATE	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)	TUR- BID- ITY (JTU)	DISS- OLVED OXYGEN (MG/L)	BIO- CHEM- ICAL OXYGEN DEMAND (MG/L)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	SAMPLE SIZE (GALS)	TOTAL CARBON EX- TRACT ABLES (UG/L)	CARBON ALCOHOL EX- TRACT ABLES (UG/L)
AUG.											
04...	--	7.7	5	0	1.1	12.4	.1	--	--	--	--
04-05	--	--	--	--	--	--	--	--	1170	150	131
11...	--	7.9	6	0	2.0	12.7	.6	--	--	--	--
18...	--	7.8	5	0	2.0	12.4	.5	--	--	--	--
25...	--	7.8	5	0	2.0	12.6	.5	--	--	--	--
SEPT.											
01-03	--	--	--	--	--	--	--	--	1103	231	203
02...	--	7.9	7	0	1.0	11.8	.5	--	--	--	--
03...	--	--	--	--	--	--	--	.01	--	--	--
29...	--	--	13	--	--	--	--	--	--	--	--
29...	427	8.8	13	--	--	7.6	--	--	--	--	--

DATE	CARBON CHLORO- FORM EX- TRACT ABLES (UG/L)
AUG.	
04-05	19
SEPT.	
01-03	28

5-0338.1 FLOYD LAKE OUTLET NEAR DETROIT LAKES, MINN.

LOCATION.--Lat 46°52'42", Long 95°50'23", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.3, T.139 N., R.41 W., Becker County, at culvert on county highway between Floyd Lake and Little Floyd Lake and 4 miles north of city of Detroit Lakes.
 PERIOD OF RECORD.--Chemical analyses: March to September 1969.
 REMARKS.--No flow Sept. 4, 1969.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG)	PH (UNITS)	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
MAR. 26...	2.0	40	28	8.1	212	.2	900	11	8	.01	439	0
APR. 30...	20	60	29	7.4	194	.2	800	23	9	.09	402	0
MAY 28...	6.9	130	30	7.7	187	.4	300	29	10	.00	402	0
JULY 01...	2.7	42	31	7.9	181	.3	204	21	10	.00	385	0
26...	1.1	0	30	7.7	148	.2	331	22	16	.01	339	0

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SIO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO3) (MG/L)
MAR. 26...	4.0	0	32	.0	50	.1	284	.01	24	43	5.3	258
APR. 30...	2.5	0	35	.4	10	.1	271	.03	19	40	4.7	237
MAY 28...	2.6	0	35	.1	70	.1	248	.00	13	38	4.8	228
JULY 01...	2.6	0	33	.4	35	.1	229	.08	14	30	4.4	221
26...	2.4	0	29	.6	32	.1	223	.01	17	20	5.8	180

DATE	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)
MAR. 26...	2.9	.00	223	2	268
APR. 30...	2.5	.10	217	8	250
MAY 28...	3.0	.00	216	24	239
JULY 01...	2.7	.10	202	18	226
26...	3.4	.14	170	25	197

RED RIVER OF THE NORTH BASIN

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., Becker County, at gaging station on left bank 50 ft downstream from Lake Melissa, 400 ft upstream from culvert on county road and 6 miles southwest of city of Detroit Lakes.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO2) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO3) (MG/L)	CAR- BONATE (CO3) (MG/L)	ALKA- LINITY AS CaCO3 (MG/L)
OCT.												
01...	12	15	500	--	0	25	29	11	4.0	213	0	174
NOV.												
07...	13	15	200	--	50	25	29	11	4.6	221	0	181
DEC.												
11...	27	15	0	--	0	27	31	12	4.7	232	0	190
JAN.												
15...	28	15	200	--	10	30	31	13	5.1	245	0	201
FEB.												
19...	43	16	1300	30	0	29	31	15	7.1	256	0	210
MAR.												
25...	37	15	700	170	0	31	33	13	5.1	257	0	211
APR.												
29...	104	13	700	60	0	28	30	12	4.5	233	0	191
MAY												
27...	60	12	0	0	0	31	28	11	4.9	235	0	193
JULY												
03...	6.6	8.9	261	73	10	26	30	12	4.4	229	0	188
28...	13	9.9	201	15	0	20	29	12	5.6	206	0	169
SEPT.												
09...	.20	14	238	40	32	27	31	13	7.5	240	0	196

DATE	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	SPEC I- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)
OCT.									
01...	7.42	183	8	11	.4	384	7.6	17	2
NOV.									
07...	8.49	182	0	11	.4	397	7.5	3	4
DEC.									
11...	14.6	195	5	11	.4	417	7.8	0	4
JAN.									
15...	19.9	204	3	12	.4	439	7.9	1	6
15...	--	--	--	--	--	370	--	--	--
FEB.									
19...	29.4	201	0	14	.5	437	8.3	1	7
MAR.									
25...	27.1	213	2	11	.4	445	8.1	2	8
APR.									
29...	64.0	191	0	12	.4	401	7.9	10	7
MAY									
27...	42.0	193	0	11	.3	405	8.1	18	4
JULY									
03...	4.02	186	0	12	.4	397	7.9	21	7
28...	8.00	167	0	13	.4	370	7.7	25	12
SEPT.									
09...	.14	195	0	12	.4	420	7.7	16	45

RED RIVER OF THE NORTH BASIN

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5-0391. PELICAN RIVER AT LAKE MELISSA OUTLET NEAR DETROIT LAKES, MINN.--Continued

PERIOD OF RECORD.--Chemical analyses: August 1968 to September 1969.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	PHOS- PHATE (PO ₄) (MG/L)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)
OCT. 01...	17	11	.2	--	.1	.22	.17	--	60	227	218	.31
NOV. 07...	18	12	.2	--	.2	.18	.10	--	50	242	224	.33
DEC. 11...	19	12	.1	--	.7	--	.04	.03	60	242	237	.33
JAN. 15...	20	12	.2	--	.2	--	.07	.04	70	259	248	.35
FEB. 19...	16	13	.2	.00	.1	--	.01	.06	40	253	254	.34
MAR. 25...	19	13	.3	.10	.7	--	.04	.02	30	270	258	.37
APR. 29...	18	11	.1	.00	.2	--	.01	.01	60	228	231	.31
MAY 27...	18	12	.2	.00	.1	-	.01	.01	0	251	234	.34
JULY 03...	16	12	.2	.00	.1	--	.02	.01	49	224	223	.30
28...	15	9.4	.3	.00	.0	--	.01	.02	40	228	202	.31
SEPT. 09...	13	11	.2	.71	3.1	--	.07	.04	54	259	238	.35

RED RIVER OF THE NORTH BASIN

05-0540.00 RED RIVER OF THE NORTH AT FARGO, N. DAK.

LOCATION.--Lat 46°51'40", long 96°47'00", in NW¹/₄NE¹/₄ 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 1969.

Water temperatures: October 1955 to September 1969.

EXTREMES, 1968-69.--Dissolved solids: Maximum, 411 mg/l June 1-30; minimum, 226 mg/l Apr. 1-30.

Hardness: Maximum, 297 mg/l June 1-30; minimum, 148 mg/l Apr. 1-30.

Specific conductance: Maximum daily, 677 micromhos June 6; minimum daily, 238 micromhos Apr. 13.

Water temperatures: Maximum, 26°C on several days during July and August; minimum, 1°C Dec. 7-10.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)
OCT.												
01-31	291	--	--	--	--	--	14	--	279	43	--	--
NOV.												
01-30	288	--	--	--	--	--	14	--	291	47	--	--
DEC.												
01-31	248	--	--	--	--	--	16	--	308	49	--	--
JAN.												
01-31	232	--	--	--	--	--	12	--	310	36	--	--
FEB.												
01-28	318	--	--	--	--	--	9.0	--	303	27	--	--
MAR.												
01-31	481	--	--	--	--	--	9.0	--	281	23	--	--
APR.												
01-30	9920	--	--	--	--	--	9.1	--	138	67	--	--
MAY												
01-31	3570	--	--	--	--	--	22	--	232	138	--	--
JUNE												
01-30	1480	--	--	--	--	--	25	--	244	--	--	--
JULY												
01-31	630	--	--	--	--	--	17	--	231	--	--	--
AUG.												
01-31	209	--	--	--	--	--	20	--	268	--	--	--
SEPT.												
01-30	49	--	--	--	--	--	20	--	286	--	--	--

ANALYSES OF ADDITIONAL SAMPLES

OCT.												
26...	288	13	60	--	38	29	10	4.1	242	36	6.4	.2
NOV.												
13...	277	11	30	--	43	31	11	4.4	268	35	5.8	.3
DEC.												
11...	257	12	210	0	41	35	18	5.1	269	61	9.4	.2
JAN.												
08...	240	15	0	0	45	32	11	4.1	290	33	6.0	.3
FEB.												
14...	300	20	50	10	45	34	10	5.4	308	32	5.4	.3
MAR.												
04...	450	18	20	0	43	30	10	5.3	284	23	4.8	.2
APR.												
15...	24300	9.4	--	--	27	10	6.0	5.6	76	52	2.6	.1
MAY												
06...	5000	16	--	--	53	25	21	8.0	187	124	7.8	.2
06...	4950	17	20	100	49	26	21	7.5	190	122	6.8	.5
26...	2670	11	30	0	65	34	24	6.7	240	157	6.8	.2
JUNE												
25...	836	12	0	10	50	33	18	5.4	251	83	6.0	.2
JULY												
24...	1080	13	55	0	33	13	7.6	5.2	149	33	4.0	.8
AUG.												
21...	160	17	59	0	49	34	22	5.7	274	72	8.8	.3
SEPT.												
15...	30	15	18	0	50	36	20	5.5	274	75	7.8	.3

DATE	DIS- SOLVED ALUM- INUM (AL) (UG/L)	TOTAL DIS- SOLVED CHRO- MIUM (CR) (UG/L)	NICKEL (NI) (UG/L)	COPPER (CU) (UG/L)	LEAD (PB) (UG/L)	ZINC (ZN) (UG/L)	COBALT (CO) (UG/L)	ARSENIC (AS) (UG/L)
MAY								
26...	200	0	0	0	0	0	0	0

ANALYSES OF ADDITIONAL SAMPLES

MAY								
26...	200	0	0	0	0	0	0	0

05-0540.00 RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

EXTREMES, 1955-69.--Dissolved solids (1955-58, 1959-69): 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, 110 mg/l Apr. 15.

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 during winter months.

REMARKS.--Daily samples for chemical analysis composited by discharge. Maximum observed during water year: Dissolved solids, 441 mg/l May 26; hardness, 303 mg/l May 26. Minimum observed during water year: Dissolved solids, 208 mg/l Apr. 15; hardness, 110 mg/l Apr. 15. Water temperature, measured in waterplant, modified slightly in transit.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	NITRATE (NO3) (MG/L)	ORTHO PHOS- PHATE (PO4) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (TONS PER (CA, MG) (MG/L)	HARD- NESS (CA, MG) (MG/L)	ALKA- LINITY AS CACO3 (MG/L)	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	COLOR (PLATI- NUM- COBALT UNITS)
OCT.											
01-31	--	--	--	294	231	245	229	.4	482	7.5	--
NOV.											
01-30	--	--	--	310	241	247	239	.4	518	7.6	--
DEC.											
01-31	--	--	--	356	238	273	253	.4	545	7.7	--
JAN.											
01-31	--	--	--	316	198	268	254	.3	522	7.8	--
FEB.											
01-29	--	--	--	295	253	253	249	.2	483	7.6	--
MAR.											
01-31	--	--	--	269	349	233	231	.3	452	7.7	--
APR.											
01-30	--	--	--	226	6050	148	113	.3	343	7.3	--
MAY											
01-31	--	--	--	403	3890	275	191	.6	599	7.4	--
JUNE											
01-30	--	--	--	411	1640	297	200	.6	635	8.2	--
JULY											
01-31	--	--	--	306	521	236	189	.5	491	7.9	--
AUG.											
01-31	--	--	--	341	192	261	220	.5	548	7.8	--
SEPT.											
01-30	--	--	--	347	45.9	262	235	.5	562	7.7	--

ANALYSES OF ADDITIONAL SAMPLES

OCT.											
26...	1.1	.26	50	275	214	214	199	.3	431	8.5	--
NOV.											
13...	.0	--	50	277	207	233	219	.3	471	7.9	5
DEC.											
11...	.1	--	180	330	229	244	221	.5	528	8.1	5
JAN.											
08...	.0	--	60	298	193	243	238	.3	498	8.0	6
FEB.											
14...	.1	1.5	110	307	249	252	252	.3	490	8.1	1
MAR.											
04...	.1	--	90	275	334	232	233	.3	460	8.0	2
APR.											
15...	13	--	30	208	13600	110	62	.3	266	8.1	25
MAY											
06...	.0	--	90	345	4660	234	153	.6	538	7.8	20
06...	.0	--	70	387	5170	227	156	.6	537	7.8	16
26...	1.0	.20	90	441	3180	303	197	.6	645	7.9	17
JUNE											
25...	.1	--	70	365	824	258	206	.5	543	8.1	--
JULY											
24...	2.4	--	62	213	621	136	122	.3	299	7.3	11
AUG.											
21...	.2	--	109	342	148	263	225	.6	577	7.8	7
SEPT.											
15...	.0	--	101	342	27.7	271	225	.5	566	7.8	6

DATE	SELE- NIUM (SE) (UG/L)	CAD- MIUM (CD) (UG/L)	STRON- TIUM (SR) (UG/L)	BARIUM (BA) (UG/L)	LITHIUM (LI) (UG/L)	MOLY- BDENUM (MO) (UG/L)	VANA- DIUM (V) (UG/L)
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ANALYSES OF ADDITIONAL SAMPLES

MAY							
26...	0	0	370	0	40	1	1

RED RIVER OF THE NORTH BASIN

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

SPECIFIC CONDUCTANCE (MICROMHOS AT 25°C), WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
1.....	449	533	490	500	509	454	448	503	669	520	548	565
2.....	434	530	470	506	509	455	452	509	675	529	552	567
3.....	451	536	493	531	509	452	448	524	668	523	547	574
4.....	464	525	528	516	505	451	437	522	671	532	515	574
5.....	444	509	528	508	496	447	469	522	676	533	510	516
6.....	458	556	545	510	496	446	460	537	677	533	522	539
7.....	503	500	566	508	494	434	435	556	676	528	515	545
8.....	503	490	558	506	497	434	376	566	664	509	506	540
9.....	486	473	574	513	497	439	278	601	664	524	510	540
10.....	506	468	565	522	498	440	272	639	659	526	523	543
11.....	512	467	565	527	498	444	261	632	656	537	536	553
12.....	502	463	543	526	498	444	245	636	657	534	550	554
13.....	502	459	538	530	497	444	238	637	656	548	533	552
14.....	488	459	534	530	492	438	247	636	660	545	529	553
15.....	473	471	608	530	488	445	253	645	628	496	543	562
16.....	468	489	651	530	478	439	266	625	617	526	546	561
17.....	454	492	575	529	474	449	284	620	609	523	550	560
18.....	438	487	534	525	479	448	256	610	592	515	542	560
19.....	440	491	508	522	480	456	324	604	586	524	541	553
20.....	440	508	488	525	483	451	352	611	586	504	559	552
21.....	453	488	478	525	482	456	376	643	586	529	568	552
22.....	448	488	508	516	481	456	412	624	591	452	558	524
23.....	457	486	528	515	477	452	445	624	564	404	554	543
24.....	441	483	582	512	477	454	458	660	548	283	548	531
25.....	429	481	525	509	467	452	481	645	544	320	547	538
26.....	449	466	524	509	455	451	479	653	522	377	545	535
27.....	490	480	510	510	454	450	480	659	506	430	543	534
28.....	512	505	493	505	452	447	494	672	502	488	543	526
29.....	554	513	490	505	--	449	505	666	498	517	547	524
30.....	557	510	500	504	--	436	497	658	506	534	552	517
31.....	546	--	496	504	--	443	--	670	--	540	549	--
AVERAGE	475	493	532	516	486	446	380	609	610	496	539	546

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	DAY																															AVER- AGE	
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		
OCTOBER..	16	16	14	13	12	12	13	13	13	12	12	12	12	13	13	13	12	11	11	10	11	11	11	9	8	9	8	8	8	7	7	11	
NOVEMBER.	8	8	7	7	7	7	4	4	4	4	4	4	4	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	--	4	
DECEMBER.	2	2	2	3	2	2	1	1	1	1	2	2	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	
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	2	2	3	3	3	3	5	7	8	10	11	11	12	12	12	12	12	12	13	12	13	12	13	13	--	7	
MAY.....	13	13	13	13	14	15	16	16	16	16	16	14	14	14	16	18	16	16	16	16	16	16	16	16	16	16	17	19	20	21	19	16	
JUNE.....	19	19	18	18	17	18	18	18	19	19	19	18	18	18	19	18	18	19	18	18	18	18	18	18	18	18	18	18	19	19	19	--	18
JULY.....	19	20	21	21	21	20	21	20	21	22	23	23	24	26	26	26	26	26	26	26	26	26	24	24	22	23	23	24	23	23	24	23	23
AUGUST...	23	23	23	24	24	24	24	24	24	26	24	25	25	24	24	24	24	24	23	23	23	23	24	24	24	24	24	24	24	25	25	24	24
SEPTEMBER	23	23	23	23	22	22	22	21	21	20	19	19	19	20	21	20	19	18	18	18	18	18	18	17	16	16	16	14	14	14	14	--	19

5-0822. RED LAKE RIVER AT EAST GRAND FORKS, MINN.

LOCATION.--Lat 47°55'24", long 97°00'59", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.1, T.151 N., R.50 W., Polk County, at bridge on State Highway 220 at south edge of East Grand Forks and 0.2 mile upstream from mouth.

DRAINAGE AREA.--5,655 sq mi, approximately.

PERIOD OF RECORD.--Chemical analyses: August to September 1969.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	OIS- CHARGE (CFS)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKA- LITY AS CACO ₃ (MG/L)	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	ORGANIC NITRO- GEN (N) (MG/L)	TOTAL NITRO- GEN (N) (MG/L)	NITRITE (N) (MG/L)	NITRITE (NO ₂) (MG/L)	AMMONIA NITRO- GEN (N) (MG/L)	NITRATE (N) (MG/L)
AUG.												
01...	1900	226	0	185	15	12	.78	1.1	.00	.10	.10	.20
01...	1900	--	--	--	--	--	--	--	--	--	--	--
SEPT.												
05...	1150	200	0	164	18	2.4	--	--	.00	.04	.05	.10
05...	1150	--	--	--	--	--	--	--	--	--	--	--

DATE	NITRATE (NO ₃) (MG/L)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	TOTAL PHOS- PHORUS (P) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	TEMP- ERATURE (DEG C)	TUR- BID- ITY (JTU)	BIO- CHEM- ICAL OXYGEN DEMAND (MG/L)
AUG.												
01...	.8	.07	.05	.05	221	188	2	--	7.3	22	45	3.6
01...	--	--	--	--	--	--	--	345	8.4	22	--	--
SEPT.												
05...	.2	--	.20	.00	217	168	4	--	7.6	22	37	1.6
05...	--	--	--	--	--	--	--	320	9.6	22	--	--

DATE	COLI- FORM (COL- ONIES PER 100 ML)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	AIR TEMP- ERATURE (DEG C)
AUG.			
01...	--	.00	--
01...	1100	--	22
SEPT.			
05...	--	.03	--
05...	1000	--	21

RED RIVER OF THE NORTH BASIN

05-0825.00 RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.

LOCATION.--Lat 47°56'28", long 97°02'40", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.33, T.152 N., R.50 W., Grand Forks County, at dam at Riverside Park in Grand Forks, 1,500 ft 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 1969.

Water temperatures: October 1956 to September 1969.

EXTREMES, 1968-69.--Dissolved solids: Maximum, 384 mg/l June 1-30; minimum, 243 mg/l Apr. 1-30.

Hardness: Maximum, 285 mg/l June 1-30; minimum, 165 mg/l Apr. 1-30.

Specific conductance: Maximum daily, 628 micromhos June 11; minimum daily, 321 micromhos Apr. 13.

Water temperatures: Maximum, 25°C July 15-17; minimum, freezing point Dec 8.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED IRON (Fe) (MG/L)	DIS- SOLVED MAN- GANESE (Mn) (MG/L)	CAL- CIUM (Ca) (MG/L)	MAG- NE- SIUM (Mg) (MG/L)	SODIUM (Na) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (Cl) (MG/L)	FLUO- RIDE (F) (MG/L)
OCT.												
01-31	1460	--	--	--	--	--	14	--	252	60	--	--
NOV.												
01-30	1660	--	--	--	--	--	16	--	259	64	--	--
DEC.												
01-31	1600	--	--	--	--	--	15	--	296	54	--	--
JAN.												
01-31	1500	--	--	--	--	--	9.8	--	266	33	--	--
FEB.												
01-28	1510	--	--	--	--	--	14	--	266	37	--	--
MAR.												
01-31	2110	--	--	--	--	--	19	--	268	45	--	--
APR.												
01-30	28700	--	--	--	--	--	8.8	--	148	65	--	--
MAY												
01-31	12000	--	--	--	--	--	20	--	215	109	--	--
JUNE												
01-30	4520	--	--	--	--	--	20	--	259	108	--	--
JULY												
01-31	3300	--	--	--	--	--	21	--	262	76	--	--
AUG.												
01-31	1490	--	--	--	--	--	19	--	226	--	--	--
SEPT.												
01-30	1430	--	--	--	--	--	14	--	213	--	--	--

ANALYSES OF ADDITIONAL SAMPLES

OCT.												
26...	1740	12	50	--	60	28	18	4.4	272	72	13	.3
NOV.												
25...	2240	14	10	--	55	23	11	3.5	253	49	7.2	.2
DEC.												
27...	1500	18	50	--	60	24	11	3.2	275	44	6.8	.2
JAN.												
24...	1500	19	80	0	53	21	11	3.9	260	33	5.2	.3
FEB.												
24...	1700	19	60	0	53	23	18	4.2	270	44	8.0	.4
MAR.												
25...	2250	18	60	0	52	24	20	4.7	267	46	7.4	.3
APR.												
09...	5600	15	50	210	50	20	14	3.5	219	48	6.8	.4
13...	40800	12	--	--	36	12	6.9	6.0	136	39	6.8	.1
20...	47500	14	--	--	36	14	7.5	14	132	54	4.4	.2
MAY												
04...	22400	15	--	--	54	20	18	20	192	101	7.2	--
AUG.												
25...	1060	14	59	0	50	22	17	4.3	234	51	9.4	.2
SEPT.												
25...	1400	6.6	15	0	45	19	15	4.0	210	42	11	.3

DATE	SELE- NIUM (Se) (UG/L)	CAD- MIUM (Cd) (UG/L)	STRON- TIUM (Sr) (UG/L)	BARIIUM (Ba) (UG/L)	LITHIUM (Li) (UG/L)	MOLY- BDENUM (Mo) (UG/L)	VANA- DIUM (V) (UG/L)
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ANALYSES OF ADDITIONAL SAMPLES

MAY							
20...	10	0	310	0	10	4	1

05-0825.00 RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

EXTREMES, 1956-69.--Dissolved solids (1956-58, 1959-69): 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 during winter months.

REMARKS.--Daily samples for chemical analysis composited by discharge. Maximum observed during water year:

Dissolved solids, 394 mg/l May 20. Minimum observed during water year: Dissolved solids, 208 mg/l Apr 13; hardness, 140 mg/l Apr. 13.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	NITRATE (NO3) (MG/L)	ORTHO PHOS- PHATE (PO4) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA, MG) (MG/L)	ALKA- LITY AS CACO3 (MG/L)	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	COLOR (PLATI- NUM- COBALT UNITS)
OCT. 01-31	--	--	--	328	1290	256	206	.4	519	7.6	--
NOV. 01-30	--	--	--	337	1510	266	213	.4	529	7.6	--
DEC. 01-31	--	--	--	348	1500	267	242	.4	542	7.6	--
JAN. 01-31	--	--	--	299	1210	233	218	.3	466	7.6	--
FEB. 01-28	--	--	--	301	1230	234	218	.4	466	7.8	--
MAR. 01-31	--	--	--	317	1810	234	220	.5	489	7.7	--
APR. 01-30	--	--	--	243	18800	165	121	.3	371	7.6	--
MAY 01-31	--	--	--	357	11600	257	176	.5	541	7.4	--
JUNE 01-30	--	--	--	384	4690	285	212	.5	589	7.5	--
JULY 01-31	--	--	--	334	2980	237	214	.6	519	7.6	--
AUG. 01-31	--	--	--	311	1250	245	186	.5	488	7.4	--
SEPT. 01-30	--	--	--	253	977	206	175	.4	419	7.7	--

ANALYSES OF ADDITIONAL SAMPLES

OCT. 26...	.1	.51	70	360	1690	266	223	.5	554	7.8	5
NOV. 25...	.0	--	60	310	1880	232	207	.3	476	7.7	5
DEC. 27...	.2	--	40	316	1280	246	226	.3	518	7.7	5
JAN. 24...	.6	--	60	292	1180	220	213	.3	449	7.8	3
FEB. 24...	.5	--	110	305	1400	228	222	.5	503	7.9	1
MAR. 25...	.2	--	70	322	1960	227	219	.6	487	8.3	3
APR. 09...	6.6	--	60	287	4340	207	180	.4	440	7.6	8
13...	8.9	--	60	208	22900	140	112	.3	321	8.0	24
20...	4.5	--	0	229	29400	146	108	.3	338	7.8	21
MAY 04...	2.6	--	--	322	19500	216	157	.5	514	--	20
AUG. 25...	.1	--	79	297	850	216	192	.5	475	7.8	9
SEPT. 25...	.0	--	63	245	926	191	172	.5	427	8.0	6

DATE	DIS- SOLVED ALUM- INUM (AL) (UG/L)	TOTAL DIS- SOLVED CHRO- MIUM (CR) (UG/L)	NICKEL (NI) (UG/L)	COPPER (CU) (UG/L)	LEAD (PB) (UG/L)	ZINC (ZN) (UG/L)	COBALT (CO) (UG/L)	ARSENIC (AS) (UG/L)
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ANALYSES OF ADDITIONAL SAMPLES

MAY 20...	200	0	0	0	0	10	0	0
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RED RIVER OF THE NORTH BASIN

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

SPECIFIC CONDUCTANCE (MICROMHOS AT 25°C), WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
1.....	509	564	520	498	453	502	503	508	588	567	442	420
2.....	511	557	530	463	451	499	499	502	610	590	456	417
3.....	509	545	531	463	448	496	492	516	586	581	508	409
4.....	523	522	544	460	444	489	492	501	570	594	487	412
5.....	501	502	534	455	451	484	486	517	571	578	513	380
6.....	501	489	542	455	454	484	479	517	614	562	536	419
7.....	495	497	547	460	456	495	476	516	584	562	531	375
8.....	487	508	572	466	454	479	473	513	598	569	491	397
9.....	480	532	578	472	453	478	453	516	618	568	453	406
10.....	481	553	591	468	453	483	378	543	625	563	445	410
11.....	482	558	582	459	454	481	365	556	628	573	449	416
12.....	478	572	529	454	454	482	331	561	623	560	478	422
13.....	477	566	562	454	460	481	321	574	614	558	498	409
14.....	460	576	573	452	460	481	323	583	606	563	508	421
15.....	476	583	542	450	460	481	323	578	605	562	524	414
16.....	476	577	541	447	460	477	326	558	600	583	513	422
17.....	502	577	530	446	462	475	340	552	597	627	505	415
18.....	495	561	543	446	465	475	333	546	590	526	505	408
19.....	497	551	545	447	467	478	333	574	595	482	502	396
20.....	509	547	545	447	465	476	333	578	590	482	490	396
21.....	501	510	535	448	473	481	337	596	576	428	483	407
22.....	525	490	520	448	473	482	342	580	570	429	482	388
23.....	521	488	516	446	482	481	351	542	564	435	487	390
24.....	525	495	514	444	489	483	362	556	549	445	474	404
25.....	533	476	527	443	489	489	404	566	545	478	472	412
26.....	559	483	522	442	488	489	387	568	538	526	471	410
27.....	564	502	510	441	487	501	434	560	536	441	461	410
28.....	564	480	490	440	497	500	452	574	536	413	456	403
29.....	561	504	492	439	---	496	462	584	545	397	450	390
30.....	556	506	496	437	---	496	484	582	556	401	440	398
31.....	563	---	496	436	---	494	---	589	---	436	417	---
AVERAGE	510	529	535	452	464	486	402	551	584	518	481	405

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

	DAY																															AVER- AGE
MDNTH	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	
OCTOBER..	14	14	13	13	12	12	12	12	12	10	11	10	11	12	12	12	12	10	9	8	9	8	9	7	7	7	7	6	6	5	6	10
NOVEMBER.	6	6	6	5	6	5	4	4	4	3	3	3	2	2	2	2	2	1	1	1	2	1	1	1	1	1	1	1	1	1	--	2
DECEMBER.	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
JANUARY..	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.	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	--	--	--	
MARCH....	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	
APRIL....	1	1	1	1	1	1	1	2	2	1	1	3	3	3	3	3	5	7	9	11	11	11	10	10	11	11	10	11	11	12	--	
MAY.....	12	12	12	12	13	13	13	12	12	12	12	12	13	13	13	13	13	14	14	14	13	13	13	14	14	14	14	16	18	19	19	19
JUNE.....	19	19	17	17	17	18	18	18	18	19	18	18	18	18	18	18	18	18	18	18	18	18	18	18	17	17	17	17	17	17	17	--
JULY.....	18	18	19	20	20	20	20	20	20	21	22	23	24	24	25	25	25	24	21	23	24	23	23	23	23	24	23	23	23	23	23	22
AUGUST...	23	23	23	24	24	24	24	23	23	23	23	24	24	24	24	23	24	23	23	22	22	23	23	23	24	24	24	24	24	24	23	23
SEPTEMBER	23	22	22	22	22	21	20	20	17	18	18	18	18	19	19	18	18	18	17	17	17	17	16	15	14	13	13	12	12	12	--	18

05082500 1969 W YR

MAXIMUM VALUE = 24.9 MINIMUM VALUE = 0.0

05-0920.00 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., Pembina County, temperature recorder at gaging station at interstate highway bridge, 1.5 miles northeast of Drayton and at mile 207.

DRAINAGE AREA.--34,800 sq mi, approximately.

RECORDS AVAILABLE.--Chemical analyses: June 1954 to September 1955.

Water temperatures: December 1956 to September 1961, October 1965 to September 1966, October 1967 to September 1969.

EXTREMES, 1968-69.--Water temperatures: Minimum, freezing point on many days during December to April. EXTREMES, 1956-61, 1965-66, 1967-69.--Water temperatures: Maximum (1956-58, 1959-61, 1965-66, 1967-68), 28°C July 20-23, 1960; minimum, freezing point on many days during winter months.

REMARKS.--Recorder stopped or pen malfunctioned June 7-15, July 4-29, Aug. 28 to Sept. 24.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(RECORDER WITH TEMPERATURE ATTACHMENT, CONTINUOUS ETHYL ALCOHOL-ACTUATED THERMOGRAPH)

		DAY																															AVER- AGE
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	
OCTOBER																																	
MAXIMUM		14	14	13	12	12	11	11	11	11	11	10	10	11	11	11	11	11	9	8	8	7	7	7	7	7	7	7	6	6	5	5	9
MINIMUM		14	13	12	12	11	11	11	11	11	10	10	9	9	11	11	11	9	8	8	7	7	7	7	7	7	7	6	6	5	5	5	9
NOVEMBER																																	
MAXIMUM		5	5	5	5	4	4	3	3	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	--	2	
MINIMUM		5	5	5	4	4	3	3	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	--	2	
DECEMBER																																	
MAXIMUM		1	3	1	1	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	
MINIMUM		1	1	1	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	
JANUARY																																	
MAXIMUM		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	0	
MINIMUM		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	0	
FEBRUARY																																	
MAXIMUM		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		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	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		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	0	
APRIL																																	
MAXIMUM		0	0	0	0	0	1	1	1	1	1	1	1	2	4	6	7	7	8	9	11	11	11	11	12	12	12	13	12	12	11	--	
MINIMUM		0	0	0	0	0	1	1	1	1	1	1	1	2	4	6	7	7	8	9	11	11	11	11	12	12	12	12	12	11	--		
MAY																																	
MAXIMUM		12	13	13	13	13	13	13	13	13	13	12	12	12	13	13	13	13	13	13	13	13	13	14	14	14	14	16	17	18	19	19	14
MINIMUM		11	12	13	13	13	13	13	13	13	13	12	12	12	12	13	13	13	13	13	13	13	13	14	14	14	14	16	17	16	18	19	14
JUNE																																	
MAXIMUM		19	17	17	18	18	18	--	--	--	--	--	--	--	--	--	18	18	18	18	18	17	17	17	17	17	17	17	17	18	18	--	
MINIMUM		17	17	17	17	18	18	--	--	--	--	--	--	--	--	--	18	18	18	18	17	17	17	17	17	17	17	17	17	17	18	--	
JULY																																	
MAXIMUM		18	19	19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	24	24	--
MINIMUM		18	18	19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	24	23	--
AUGUST																																	
MAXIMUM		23	24	24	24	24	24	24	24	24	24	25	25	25	25	25	24	24	24	24	24	24	24	23	24	24	25	25	25	--	--	--	24
MINIMUM		23	23	24	24	24	24	24	24	24	24	25	25	25	25	24	24	24	24	24	24	24	23	23	23	24	24	25	25	25	--	--	24
SEPTEMBER																																	
MAXIMUM		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14	13	13	13	13	--	--
MINIMUM		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13	13	13	13	13	12	--

LAKE OF THE WOODS BASIN

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., 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.

PERIOD OF RECORD.--Chemical analyses: October 1967 to September 1969.

Water temperatures: July 1966 to September 1969.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKA- LITY AS CaCO ₃ (MG/L)
OCT.												
23...	373	1.9	800	--	20	3.1	1.4	1.0	.6	14	0	11
DEC.												
30...	139	3.9	--	70	0	3.5	1.6	1.1	.2	15	0	12
APR.												
29...	1540	6.9	600	200	0	3.1	1.6	1.0	.6	13	0	11
MAY												
06...	1230	7.1	600	290	0	3.4	1.6	.6	.5	12	0	10
JUNE												
17...	256	6.1	500	570	0	2.8	1.4	1.0	.8	12	0	10
JULY												
24...	143	3.5	426	243	0	3.0	1.4	1.0	.5	12	0	10
AUG.												
27...	143	3.6	417	732	34	3.5	1.4	1.1	.3	13	0	10
SEPT.												
30...	121	3.3	406	180	0	3.1	1.3	1.1	.3	12	0	10

DATE	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA, MG) (MG/L)	NDN- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)
OCT.									
23...	35.2	13	2	13	.1	34	7.7	9	45
DEC.									
30...	19.5	15	3	13	.1	35	7.0	0	45
APR.									
29...	150	14	3	13	.1	36	7.1	5	35
MAY									
06...	120	15	5	8	.1	31	7.1	14	37
JUNE									
17...	27.0	13	3	14	.1	30	7.0	14	30
JULY									
24...	13.5	13	3	14	.1	31	6.9	21	35
AUG.									
27...	13.5	14	4	14	.1	38	6.8	22	11
SEPT.									
30...	11.8	13	3	15	.1	32	7.0	13	31

5-1244.8 KAWISHIWI RIVER NEAR ELY, MINN.--Continued

(Hydrologic bench-mark station)

EXTREMES, 1968-69.--Water temperatures: Maximum, 23°C August 28 to September 2; minimum, freezing point on many days during winter months.

EXTREMES, 1966-69.--Water temperatures: Maximum, 24°C July 24, 25, 1966; minimum, freezing point on many days during winter months.

REMARKS.--Recorder stopped November 19 to December 19; range in temperature, 1°C to 3°C.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	SULFATE (SO ₄) (MG/L)	CHLORIDE (CL) (MG/L)	FLUORIDE (F) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	PHOSPHATE (PO ₄) (MG/L)	ORTHO PHOSPHATE (PO ₄) (MG/L)	DIS- SOLVED- PHOSPHORUS (P) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)
OCT. 23...	6.0	.3	.0	--	.0	1.3	.88	--	0	35	22	.05
DEC. 30...	4.8	.4	.5	.10	.3	--	.08	.27	40	52	24	.07
APR. 29...	5.8	.6	.1	.10	.3	--	.03	.07	70	36	27	.05
MAY 06...	6.0	1.0	.1	.00	.2	--	.24	.08	20	36	28	.05
JUNE 17...	5.5	.8	.1	.00	.2	--	.00	.06	30	39	26	.05
JULY 24...	5.5	.4	.1	.10	.3	--	.05	.02	31	35	22	.05
AUG. 27...	5.8	.6	.5	.01	.1	--	.12	.04	28	35	24	.05
SEPT. 30...	5.8	.5	.1	.02	.1	--	.09	.03	28	36	22	.05

RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

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. A picocurie is one millionth of the amount of radioactivity represented by a microcurie, which is the quantity of radiation represented by one millionth of a gram of radium-226. A picocurie of radium results in 2.22 disintegrations per minute.

DATE	DISSOLVED				DISSOLVED SOLIDS mg/l	SUSPENDED		SUSPENDED SOLIDS mg/l
	URANIUM µg/l	RADIUM pc/l	GROSS α µg/l	GROSS β pc/l		GROSS α µg/l	GROSS β pc/l	
SEPT. 30...	<.01	.03	.6	5.2	39	<.4	.5	1

LAKE OF THE WOODS BASIN

5-1244.8 KAWISHIWI RIVER NEAR ELY, MINN.--Continued

(Hydrologic bench-mark station)

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(WATER-STAGE RECORDER WITH TEMPERATURE ATTACHMENT, CONTINUOUS ETHYL ALCOHOL-ACTUATED THERMOGRAPH)

DAY	OCT		NOV		DEC		JAN		FEB		MAR	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	14.0	14.0	7.0	7.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
2	14.0	14.0	7.0	6.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
3	14.0	13.0	6.0	6.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
4	13.0	13.0	6.0	6.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
5	13.0	12.0	6.0	6.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
6	12.0	12.0	6.0	6.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
7	12.0	12.0	6.0	5.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
8	12.0	12.0	5.0	4.0	--	--	0.0	0.0	0.0	0.0	1.0	0.0
9	12.0	12.0	4.0	4.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
10	12.0	11.0	4.0	4.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
11	11.0	11.0	4.0	4.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
12	11.0	11.0	4.0	4.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
13	11.0	11.0	4.0	3.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
14	11.0	11.0	3.0	3.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
15	11.0	11.0	3.0	3.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
16	11.0	11.0	3.0	3.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
17	11.0	11.0	3.0	3.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
18	11.0	11.0	3.0	3.0	--	--	0.0	0.0	0.0	0.0	1.0	1.0
19	11.0	11.0	3.0	3.0	--	1.0	0.0	0.0	0.0	0.0	1.0	1.0
20	11.0	11.0	3.0	--	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0
21	11.0	11.0	--	--	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0
22	11.0	10.0	--	--	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0
23	10.0	9.0	--	--	1.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
24	9.0	9.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
25	9.0	9.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
26	9.0	8.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
27	8.0	8.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
28	8.0	7.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
29	7.0	7.0	--	--	0.0	0.0	0.0	0.0	--	--	1.0	1.0
30	7.0	7.0	--	--	0.0	0.0	0.0	0.0	--	--	1.0	1.0
31	7.0	7.0	--	--	0.0	0.0	0.0	0.0	--	--	1.0	1.0
AVG	10.7	10.5	--	--	--	--	0.0	0.0	0.0	0.0	0.7	0.7
DAY	APR		MAY		JUN		JUL		AUG		SEP	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	1.0	1.0	5.0	5.0	14.0	14.0	14.0	14.0	21.0	21.0	23.0	23.0
2	1.0	1.0	5.0	5.0	14.0	14.0	16.0	14.0	21.0	21.0	23.0	22.0
3	1.0	1.0	6.0	5.0	14.0	14.0	16.0	16.0	21.0	21.0	22.0	22.0
4	1.0	1.0	6.0	6.0	14.0	14.0	16.0	16.0	21.0	21.0	22.0	22.0
5	1.0	1.0	6.0	6.0	14.0	14.0	16.0	16.0	21.0	21.0	22.0	22.0
6	1.0	1.0	7.0	6.0	14.0	14.0	16.0	16.0	21.0	21.0	22.0	22.0
7	1.0	1.0	7.0	7.0	14.0	14.0	16.0	16.0	21.0	21.0	22.0	22.0
8	1.0	1.0	8.0	7.0	14.0	14.0	16.0	16.0	21.0	21.0	22.0	21.0
9	1.0	1.0	8.0	8.0	14.0	14.0	16.0	16.0	21.0	21.0	21.0	21.0
10	1.0	1.0	8.0	8.0	14.0	14.0	16.0	16.0	21.0	21.0	21.0	20.0
11	1.0	1.0	8.0	8.0	14.0	14.0	18.0	16.0	21.0	21.0	20.0	19.0
12	2.0	1.0	8.0	8.0	14.0	14.0	19.0	18.0	21.0	21.0	19.0	19.0
13	2.0	2.0	8.0	8.0	14.0	14.0	19.0	19.0	21.0	21.0	19.0	19.0
14	2.0	2.0	8.0	8.0	14.0	14.0	21.0	19.0	21.0	21.0	19.0	18.0
15	2.0	2.0	9.0	8.0	14.0	14.0	21.0	21.0	21.0	21.0	18.0	18.0
16	2.0	2.0	9.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	18.0	18.0
17	2.0	2.0	9.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	18.0	18.0
18	2.0	2.0	9.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	18.0	18.0
19	2.0	2.0	9.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	18.0	18.0
20	2.0	2.0	9.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	18.0	17.0
21	2.0	2.0	9.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	17.0	17.0
22	2.0	2.0	10.0	9.0	14.0	14.0	21.0	21.0	21.0	21.0	17.0	17.0
23	3.0	2.0	10.0	10.0	14.0	14.0	21.0	21.0	21.0	21.0	17.0	16.0
24	3.0	3.0	11.0	10.0	14.0	14.0	21.0	21.0	22.0	21.0	16.0	15.0
25	4.0	3.0	11.0	11.0	14.0	14.0	21.0	21.0	22.0	22.0	15.0	14.0
26	4.0	4.0	11.0	11.0	14.0	14.0	21.0	21.0	22.0	22.0	14.0	14.0
27	4.0	4.0	12.0	11.0	14.0	14.0	21.0	21.0	22.0	22.0	14.0	14.0
28	4.0	4.0	12.0	12.0	14.0	14.0	21.0	21.0	23.0	22.0	14.0	13.0
29	4.0	4.0	13.0	12.0	14.0	14.0	21.0	21.0	23.0	23.0	13.0	13.0
30	5.0	4.0	14.0	13.0	14.0	14.0	21.0	21.0	23.0	23.0	13.0	13.0
31	--	--	14.0	14.0	--	--	21.0	21.0	23.0	23.0	--	--
AVG	2.1	2.0	9.0	8.7	14.0	14.0	19.0	18.8	21.3	21.3	18.5	18.1

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INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(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)

[illegible]

MISSISSIPPI RIVER MAIN STEM

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 0.5 mile downstream from Coon Creek, 1.5 mile 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, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKÁ- LINITY AS CaCO ₃ (MG/L)
OCT.												
01...	7630	9.8	100	--	0	37	13	5.9	2.6	170	0	139
NOV.												
12...	9930	13	400	--	100	50	18	6.6	3.6	208	0	170
DEC.												
12...	7080	12	200	--	0	58	22	8.3	3.9	244	0	200
JAN.												
07...	5700	14	200	--	20	56	21	9.1	3.4	260	0	213
FEB.												
11...	6000	14	700	110	30	47	18	9.0	2.8	239	0	196
APR.												
01...	11800	13	900	120	70	50	17	7.5	5.1	215	0	177
10...	54700	12	300	160	0	32	9.4	4.6	3.5	132	0	108
13...	72100	9.5	--	--	--	32	12	3.2	3.7	126	0	103
JUNE												
06...	9860	10	500	60	10	47	16	5.8	2.8	209	0	171
JULY												
09...	5920	9.3	228	94	10	44	17	6.1	2.3	210	0	172

DATE	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	PHOS- PHATE (PO ₄) (MG/L)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)
OCT.												
01...	17	5.1	.3	--	.3	.41	.23	--	40	186	175	.25
NOV.												
12...	38	7.2	.3	--	3.4	.25	.25	--	40	270	242	.37
DEC.												
12...	39	7.4	.2	--	3.6	--	.17	.08	50	291	275	.40
JAN.												
07...	27	7.2	.2	--	1.3	--	.19	.08	50	285	268	.39
FEB.												
11...	19	7.8	.2	.00	.2	--	.13	.06	70	246	237	.33
APR.												
01...	27	9.6	.2	1.9	8.2	--	.40	.23	0	261	245	.35
10...	14	4.0	.1	1.4	6.4	--	.13	.08	40	158	152	.21
13...	20	4.1	.1	.90	4.0	--	.03	.02	40	180	150	.24
JUNE												
06...	19	5.5	.3	.50	2.1	--	.07	.03	30	219	212	.30
JULY												
09...	21	5.2	.3	.00	.1	--	.12	.08	54	212	208	.29

PERIOD OF RECORD.--Chemical analyses: August 1960 to September 1965, October 1967 to July 1969 (discontinued).

DATE	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)	ARSENIC (AS) (UG/L)	CAD- MIUM (CD) (UG/L)
OCT. 01...	3830	146	6	8	.2	310	7.3	16	22	0	0
NOV. 12...	7240	200	29	7	.2	407	7.8	2	33	--	--
DEC. 12...	5560	235	35	7	.2	468	8.1	1	18	--	--
JAN. 07...	4390	227	14	8	.3	457	8.1	0	15	--	--
FEB. 11...	3990	191	0	9	.3	399	7.6	0	7	--	--
APR. 01...	8320	195	18	7	.2	394	8.3	1	17	--	--
10...	23300	119	10	8	.2	251	8.0	5	13	--	--
13...	35000	127	24	5	.1	246	7.4	7	16	--	--
JUNE 06...	5830	185	14	6	.2	360	7.7	19	15	0	0
JULY 09...	3390	179	7	7	.2	364	7.7	21	15	--	--

[illegible]

MINNESOTA RIVER BASIN

5-2910. WHETSTONE RIVER NEAR BIG STONE CITY, S. DAK.

LOCATION.--Lat 45°17'32", long 96°29'14", in SE 1/4 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.

PERIOD OF RECORD.--Chemical analyses: October 1967 to June 1969 (discontinued).

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS-CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKA- LITY AS CaCO ₃ (MG/L)	SULFATE (SO ₄) (MG/L)
OCT. 03...	1.3	--	--	--	113	53	65	9.8	344	0	282	282
NOV. 08...	3.9	--	--	--	115	54	65	5.0	353	0	289	285
DEC. 03...	3.8	--	--	--	115	57	62	9.4	328	7	282	330
JAN. 07...	4.8	--	--	--	151	66	65	8.0	423	0	347	375
MAR. 05...	2.0	--	--	--	135	55	56	6.8	389	0	319	302
APR. 02...	2.2	--	--	--	120	50	57	7.8	348	0	285	280
MAY 02...	132	5.5	--	90	120	47	34	7.3	304	0	249	314
JUNE 04...	37	9.9	10	120	115	48	31	7.9	338	0	277	278

DATE	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	NITRATE (N) (MG/L)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER DAY)	DIS- SOLVED SOLIDS (TONS PER AC-FT)	HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM
OCT. 03...	50	--	.00	--	--	799	--	2.80	1.09	499	216	22
NOV. 08...	42	--	.00	--	190	803	--	8.46	1.09	507	218	22
DEC. 03...	37	--	.00	--	180	849	--	8.71	1.15	521	240	20
JAN. 07...	37	--	1.0	--	210	1020	--	13.2	1.39	649	302	18
MAR. 05...	33	--	2.2	--	200	875	--	4.72	1.19	563	244	18
APR. 02...	33	--	3.4	--	180	842	--	5.00	1.15	503	218	19
MAY 02...	13	.3	.00	.35	110	753	691	268	1.02	491	242	13
JUNE 04...	11	.3	.10	.18	180	716	668	71.5	.97	484	208	12

DATE	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)	TEMP- ERATURE (DEG C)
OCT. 03...	1.3	1140	8.0	12
NOV. 08...	1.3	1130	8.1	1
DEC. 03...	1.2	1170	8.4	2
JAN. 07...	1.1	1340	8.0	0
MAR. 05...	1.0	1200	7.7	1
APR. 02...	1.1	1110	7.4	1
MAY 02...	.7	1000	8.0	5
JUNE 04...	.6	963	8.1	15

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., 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).

PERIOD OF RECORD.--Water temperatures: October 1967 to September 1969.

Sediment records: October 1967 to September 1969.

EXTREMES, 1968-69.--Water temperatures: Maximum, 26°C July 15, 16; minimum, freezing point on many days during winter period.

Sediment concentrations: Maximum daily, 426 mg/l June 26; minimum daily, 19 mg/l May 5.

Sediment loads: Maximum daily, 34,200 tons Apr. 13; minimum daily, 25 tons Feb. 24.

EXTREMES, 1967-69.--Water temperatures: Maximum, 26°C July 15, 16, Aug. 23, 1968, July 15, 16, 1969; minimum, freezing point on many days during winter period.

Sediment concentrations: Maximum daily, 567 mg/l June 12, 1968; minimum daily, 10 mg/l Mar. 22, 1968.

Sediment loads: Maximum daily, 34,200 tons Apr. 13, 1969; minimum daily, 7.6 tons Jan. 15, 1968.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(ONCE DAILY MEASUREMENT, BETWEEN 0700 AND 1200)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	14.0	6.0	0.0	--	1.0	0.0	0.0	11.0	17.0	17.0	21.0	20.0
2	15.0	6.0	0.0	--	--	--	0.0	12.0	14.0	19.5	20.0	20.0
3	12.0	5.0	0.0	--	--	--	0.0	12.0	13.0	19.0	21.0	19.0
4	8.0	6.0	0.0	1.0	--	--	0.0	12.0	16.0	18.0	21.0	22.0
5	10.0	6.0	0.0	--	--	--	0.0	15.0	17.0	19.0	22.0	20.0
6	10.0	5.0	0.0	--	--	--	0.0	16.0	17.0	19.0	24.0	21.0
7	10.0	5.0	0.0	--	--	--	3.0	16.0	16.0	19.0	24.0	19.0
8	11.0	3.0	--	--	1.0	0.0	4.0	15.0	17.0	19.0	21.0	19.0
9	11.0	3.0	--	--	--	--	4.0	12.0	17.0	20.0	22.0	18.0
10	9.0	3.0	--	--	--	--	4.0	12.0	18.0	20.0	23.0	19.0
11	11.0	3.0	--	1.0	--	--	5.5	11.0	18.0	21.0	23.0	19.0
12	6.0	3.5	--	--	--	--	4.5	10.0	17.0	22.0	24.0	18.0
13	14.0	1.0	--	--	--	--	7.0	12.0	15.0	24.0	24.0	19.0
14	14.0	2.0	0.0	0.0	--	--	7.5	16.0	15.0	25.0	24.0	19.0
15	17.0	1.0	--	--	1.0	0.0	5.0	15.0	15.0	26.0	22.0	20.0
16	15.0	2.0	0.0	--	--	--	7.0	17.0	15.0	26.0	25.0	18.0
17	12.0	1.0	--	--	--	--	7.0	14.0	16.0	25.0	23.0	16.0
18	9.0	1.0	--	1.0	--	--	7.0	14.0	17.0	23.0	22.0	17.0
19	8.0	1.0	--	--	--	--	9.0	15.0	17.0	25.0	21.0	17.0
20	6.0	1.0	--	--	--	--	9.0	12.0	15.0	24.0	21.0	15.0
21	7.5	2.0	1.0	--	--	--	9.0	14.0	17.0	22.0	22.0	17.0
22	8.0	1.0	--	0.0	--	0.0	9.0	12.0	16.0	23.0	22.0	17.0
23	8.0	2.0	--	--	--	--	11.0	12.0	15.0	23.0	22.0	17.0
24	6.0	1.0	--	--	0.0	--	10.0	13.0	15.0	22.0	21.0	13.0
25	6.0	1.0	--	1.0	--	--	10.0	14.0	17.0	23.0	22.0	13.0
26	6.0	1.0	--	--	--	--	13.0	15.0	18.0	23.0	21.0	13.0
27	6.0	1.0	--	--	--	0.0	11.0	19.0	17.0	21.0	22.0	14.0
28	5.0	0.0	1.0	--	--	0.0	9.0	20.5	17.0	21.0	22.0	13.0
29	5.0	0.0	--	--	--	0.0	11.0	20.0	18.0	22.0	23.0	14.0
30	6.0	0.0	--	--	--	0.0	11.0	20.0	18.0	23.0	23.0	12.0
31	5.0	--	--	--	--	0.0	--	20.0	--	23.0	20.0	--
AVG	9.3	2.4	--	--	--	--	6.2	14.4	16.3	21.8	22.1	17.2

MINNESOTA RIVER BASIN

5-3167.7 MINNESOTA RIVER AT NEW ULM, MINN.--Continued

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCTOBER			NOVEMBER			DECEMBER		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	226	200	122	2020	147	802	1050	112	318
2	222	205	123	1800	177	860	1040	121	340
3	196	200	106	1670	170	767	1110	121	363
4	154	195	81	1550	155	649	1020	112	308
5	160	170	73	1490	176	708	990	123	329
6	156	138	58	1400	146	552	930	128	321
7	136	155	57	1330	115	413	870	200	470
8	127	145	50	1300	110	386	830	198	444
9	130	140	49	1240	69	231	770	191	397
10	374	102	103	1230	102	339	730	183	361
11	467	182	229	1190	105	337	670	178	322
12	512	170	235	1140	98	302	600	173	280
13	416	170	191	1150	90	279	550	165	245
14	325	149	131	1100	90	267	510	155	213
15	275	200	148	1090	110	324	465	132	166
16	569	199	306	1050	130	368	445	109	131
17	1620	172	752	1070	144	416	415	140	157
18	3000	162	1310	1050	160	454	390	190	200
19	2540	112	768	1080	178	519	370	209	209
20	4050	50	547	1060	170	486	345	222	207
21	5900	58	924	1050	160	454	330	242	216
22	6800	60	1100	998	158	426	310	238	199
23	6840	53	979	1060	167	478	295	221	176
24	6610	46	821	1090	169	497	285	222	171
25	5850	49	774	1100	158	469	275	225	167
26	5200	50	702	1140	130	400	260	225	158
27	4530	57	697	1130	152	464	250	220	148
28	3950	65	693	1140	148	456	235	212	134
29	3310	72	643	1110	132	396	225	200	122
30	2760	104	775	1060	102	292	210	182	103
31	2370	110	704	--	--	--	205	168	93
TOTAL	69775	--	14251	36888	--	13791	16980	--	7468
DAY	JANUARY			FEBRUARY			MARCH		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	205	150	83	402	117	127	402	95	103
2	205	136	75	402	98	106	402	105	114
3	205	125	69	402	80	87	402	115	125
4	205	120	66	402	63	68	402	117	127
5	205	127	70	402	60	65	402	112	122
6	205	129	71	402	56	61	402	115	125
7	205	131	72	402	55	60	399	118	127
8	205	132	73	402	55	60	395	115	123
9	205	138	76	402	55	60	392	112	118
10	205	138	76	402	58	63	390	107	113
11	205	138	76	402	58	63	390	95	100
12	205	130	72	402	58	63	390	85	90
13	205	125	69	402	59	64	390	75	79
14	205	117	65	402	60	65	390	68	72
15	205	114	63	402	60	65	390	70	74
16	205	115	64	402	60	65	395	88	94
17	208	120	67	402	60	65	400	92	99
18	211	125	71	402	58	63	405	99	108
19	230	115	71	402	58	63	410	100	111
20	250	120	81	402	60	65	420	100	113
21	275	120	89	402	70	76	435	116	136
22	310	120	100	402	70	76	450	141	171
23	330	125	111	402	38	41	470	143	181
24	360	143	139	402	23	25	510	152	209
25	390	185	195	402	28	30	600	150	243
26	402	190	206	402	40	43	720	152	296
27	402	185	201	402	55	60	850	140	321
28	402	180	195	402	70	76	1300	42	147
29	402	172	187	--	--	--	1600	40	173
30	402	150	163	--	--	--	1800	45	219
31	402	130	141	--	--	--	1900	41	210
TOTAL	8256	--	3157	11256	--	1825	18603	--	4443

5-3167.7 MINNESOTA RIVER AT NEW ULM, MINN.--Continued

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	APRIL			MAY			JUNE		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	2100	41	232	13600	25	918	5020	198	2680
2	2250	63	383	13000	24	842	4930	158	2100
3	2500	123	830	12200	22	725	4850	118	1540
4	2900	355	2780	11400	22	677	4750	144	1850
5	3220	256	2230	10800	19	554	4620	138	1720
6	4150	170	1900	10200	28	771	4490	140	1700
7	5510	110	1640	9810	38	1010	4360	122	1440
8	7700	92	1910	9340	42	1060	4200	135	1530
9	11000	81	2410	8910	46	1110	4020	150	1630
10	21500	122	7080	8630	47	1100	3820	148	1530
11	38900	195	20500	8370	45	1020	3660	176	1740
12	49100	220	29200	8150	42	924	3450	190	1770
13	51500	246	34200	7940	32	686	3190	173	1490
14	53200	194	27900	7650	37	764	2990	183	1480
15	56900	186	28600	7390	37	738	2890	198	1540
16	55600	186	27900	7180	35	678	2820	200	1520
17	50400	119	16200	6970	27	508	2770	163	1220
18	44400	88	10500	6750	48	874	2710	200	1460
19	38600	65	6770	6500	58	1020	2670	160	1150
20	34200	47	4340	6230	65	1090	2630	182	1290
21	30500	38	3130	5890	70	1110	2570	188	1300
22	27300	32	2360	5600	83	1250	2510	185	1250
23	24400	32	2110	5350	81	1170	2490	157	1060
24	22100	26	1550	5190	84	1180	2480	162	1080
25	20300	25	1370	5090	97	1330	2670	307	2210
26	18600	33	1660	5040	108	1470	2920	426	3360
27	17100	42	1940	5050	84	1150	2890	262	2040
28	15800	45	1920	5150	145	2020	2830	230	1760
29	14700	37	1470	5180	133	1860	2840	207	1590
30	14100	28	1070	5150	144	2000	2820	260	1980
31	--	--	--	5090	169	2320	--	--	--
TOTAL	740530	--	246085	238800	--	33929	101860	--	50010
DAY	JULY			AUGUST			SEPTEMBER		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	2730	252	1860	1140	201	619	222	206	123
2	2740	260	1920	1110	222	665	212	160	92
3	2690	251	1820	1080	240	700	201	142	77
4	2790	242	1820	1040	228	640	211	189	108
5	2950	242	1930	982	242	642	226	176	107
6	3080	210	1750	937	260	658	221	172	103
7	3160	238	2030	892	245	590	210	197	112
8	3210	174	1510	840	250	567	213	191	100
9	3280	175	1550	790	230	491	210	142	81
10	3350	166	1500	750	218	441	200	145	78
11	3380	186	1700	713	223	429	197	147	78
12	3290	305	2710	688	222	412	198	145	78
13	3070	268	2220	674	230	419	196	142	75
14	2790	302	2270	640	222	384	198	162	87
15	2520	315	2140	609	210	345	194	169	89
16	2280	300	1850	585	180	284	190	153	78
17	2140	325	1880	557	200	301	183	192	95
18	2050	306	1690	521	215	302	181	158	77
19	2120	283	1620	495	185	247	186	174	87
20	2410	285	1850	485	177	232	190	180	92
21	2300	267	1660	477	159	205	194	162	85
22	2080	205	1150	468	180	227	193	180	94
23	1880	270	1120	444	175	200	187	191	96
24	1730	205	957	410	199	220	183	182	90
25	1620	230	1010	381	200	206	182	134	66
26	1520	235	964	353	162	154	181	138	67
27	1430	235	907	329	206	183	196	100	53
28	1350	215	784	306	145	120	211	114	65
29	1280	215	743	277	195	146	222	102	61
30	1210	200	653	249	167	112	225	160	97
31	1140	205	631	233	163	103	--	--	--
TOTAL	73570	--	48199	19455	--	11244	6013	--	2591

TOTAL DISCHARGE FOR YEAR (CFS-DAYS)
TOTAL LOAD FOR YEAR (TONS)

1341239
436993

MINNESOTA RIVER BASIN

5-3167.7 MINNESOTA RIVER AT NEW ULM, MINN.--Continued

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
 (METHODS OF ANALYSIS: R, 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 TEMP- PERA- TURE (C)	DISCHARGE (CFS)	CONCEN- TRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE											METHOD OF ANALY- SIS
						PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED											
						.002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	
OCT 16, 1968	0800	15.0	365	277	273	--	70	77	88	92	96	--	--	--	--	--	SBWC

PARTICLE SIZE OF BED MATERIAL, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
 (METHOD OF ANALYSIS: H, HYDROMETER; O, OPTICAL ANALYZER; S, SIEVE; V, VISUAL ACCUMULATION TUBE)

DATE	TIME	WATER TEMP- PERA- TURE (C)	NUMBER OF SAM- PLING POINTS	DISCHARGE (CFS)	PARTICLE SIZE											METHOD OF ANALY- SIS
					PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED											
					.062	.125	.250	.500	1.00	2.00	4.00	8.00	16.0	32.0	64.0	
APR 8, 1969	1130	5.0		7300	39	42	55	--	81	89	100	--	--	--	--	S

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., at gaging station on left bank at downstream side of Main Street bridge at 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.

PERIOD OF RECORD.--Chemical analyses: October 1963 to August 1966.

Water temperatures: October 1967 to September 1969.

Sediment records: October 1967 to September 1969.

EXTREMES, 1968-69.--Water temperatures: Maximum, 29°C July 15, 16; minimum, freezing point on many days during winter period.

Sediment concentrations: Maximum daily, 1,500 mg/l Apr. 9; minimum daily, 32 mg/l Feb. 7.

Sediment loads: Maximum daily, 247,000 tons Apr. 9; minimum daily, 79 tons Feb. 7.

EXTREMES, 1967-69.--Water temperatures: Maximum, 29°C July 15, 16, 1969; minimum, freezing point on many days during winter period.

Sediment concentrations: Maximum daily, 2,850 mg/l Aug. 7, 1968; minimum daily, 20 mg/l Mar. 23, 1968.

Sediment loads: Maximum daily, 247,000 tons Apr. 9, 1969; minimum daily, 14 tons Jan. 13, 14, 1968.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(ONCE-DAILY MEASUREMENT, BETWEEN 0700 AND 1200)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18.0	10.0	1.0	--	--	--	1.0	13.0	18.0	21.0	25.0	25.0
2	15.0	8.0	1.0	0.0	--	--	2.0	17.0	16.0	19.0	25.0	21.0
3	13.0	8.0	2.0	--	--	--	1.5	15.0	17.0	22.0	23.0	21.0
4	13.0	8.0	2.0	--	--	--	2.5	16.0	20.0	23.0	25.0	21.0
5	11.0	8.0	0.0	--	--	--	2.0	17.0	22.0	23.0	23.0	21.0
6	12.0	7.0	0.0	--	--	--	3.5	19.0	20.0	22.0	27.0	22.0
7	12.0	6.0	0.0	--	0.0	0.0	3.5	19.0	18.0	21.0	25.0	23.0
8	12.0	5.0	0.0	--	--	--	6.5	18.0	20.0	23.0	27.0	20.0
9	12.0	4.0	--	--	--	--	6.5	16.0	21.0	24.0	25.0	18.0
10	13.0	4.0	--	--	--	--	7.0	15.0	21.0	25.0	24.0	17.0
11	13.0	4.0	--	--	--	--	7.5	14.0	19.0	27.0	27.0	18.0
12	12.0	4.0	--	--	--	--	8.0	13.5	19.0	28.0	27.0	18.0
13	15.0	4.0	--	0.0	--	0.0	8.5	16.0	16.0	27.0	26.0	20.0
14	17.0	3.0	0.0	--	--	--	9.0	18.0	16.0	28.0	25.0	21.0
15	17.0	3.0	--	--	0.0	--	9.5	20.0	16.0	29.0	26.0	21.0
16	18.0	3.0	--	0.0	--	--	9.0	18.0	17.0	29.0	25.0	20.0
17	14.5	3.0	--	--	--	--	9.0	16.0	18.0	26.0	27.0	18.0
18	11.5	3.0	--	0.0	--	1.0	8.0	17.0	18.0	26.0	26.0	18.0
19	10.0	1.0	--	--	--	--	9.0	16.0	19.0	27.0	23.0	16.0
20	9.0	1.0	0.0	--	--	--	10.0	16.0	17.0	26.0	24.0	16.0
21	10.0	4.0	--	--	0.0	0.0	11.0	15.0	18.0	26.0	25.0	18.0
22	9.0	3.0	--	--	--	1.0	10.0	14.0	17.0	26.0	24.0	17.0
23	10.0	4.0	--	--	--	1.5	10.0	15.0	16.0	27.0	23.0	16.0
24	9.0	5.0	--	--	--	1.0	11.0	17.0	16.0	26.0	25.0	16.0
25	7.0	3.0	--	--	--	1.0	12.0	17.0	19.0	27.0	23.0	14.0
26	8.0	3.0	--	--	--	1.0	13.0	19.0	20.0	25.0	26.0	14.0
27	8.0	3.0	0.0	0.0	--	.5	11.0	21.0	21.0	24.0	24.0	14.0
28	7.0	2.0	--	--	1.0	0.0	11.0	23.0	20.0	25.0	25.0	17.0
29	6.0	1.0	--	--	--	0.0	11.0	22.0	19.0	26.0	26.0	15.0
30	9.0	3.0	--	--	--	0.0	11.0	24.0	18.0	25.0	25.0	15.0
31	8.0	--	--	0.0	--	1.0	--	22.0	--	23.0	23.0	--
AVG	11.5	4.2	--	--	--	--	7.8	17.3	18.4	25.0	24.9	18.3

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

(METHODS OF ANALYSIS: B, BOTTOM WITHDRAWAL TUBE; C, CHEMICALLY DISPERSED; N, IN NATIVE WATER; P, PIPET; S, SIFVE; V, VISUAL ACCUMULATION TUBE; W, IN DISTILLED WATER)

DATE	TIME	WATER TEMP- PERA- TURE (C)	DISCHARGE (CFS)	CONCEN- TRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE												METHOD OF ANALY- SIS
						PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED												
						.002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00		
OCT 21, 1968	1800		39600	930	99400	14	23	24	26	32	37	45	78	99	100	--	VPWC	
APR 9, 1969	1830	6.0	63200	600	102000	--	51	58	67	--	76	--	--	--	--	--	RCW	

PARTICLE SIZE OF RED MATERIAL, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

(METHOD OF ANALYSIS: H, HYDROMETER; O, OPTICAL ANALYZER; S, SIEVE; V, VISUAL ACCUMULATION TUBE)

DATE	TIME	WATER TEM- PERA- TURE (C)	NUMBER OF SAM- PLING POINTS	DISCHARGE (CFS)	PARTICLE SIZE												METHOD OF ANALY- SIS
					PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED												
					.062	.125	.250	.500	1.00	2.00	4.00	8.00	16.0	32.0	64.0		
APR 9, 1969	1700	6.0	5	63200	2	4	10	--	83	98	100	--	--	--	--	S	

5-3250. MINNESOTA RIVER AT MANKATO, MINN.--Continued

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCTOBER			NOVEMBER			DECEMBER		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	6200	370	6190	9690	291	7610	3390	150	1370
2	6180	290	4840	8700	230	5400	3360	135	1220
3	5690	242	3720	7960	240	5160	3320	150	1340
4	5100	189	2600	7400	245	4900	3280	155	1370
5	4690	200	2530	7020	235	4450	3200	167	1440
6	4460	206	2480	6710	212	3840	2530	180	1230
7	4270	165	1900	6310	195	3320	3000	308	2490
8	4240	160	1830	6160	167	2780	3020	230	1880
9	5890	417	6630	5940	143	2290	3040	190	1560
10	7890	482	10300	5760	141	2190	3100	190	1590
11	9180	508	12600	5570	152	2290	3120	185	1560
12	9940	640	17200	5370	155	2250	2800	180	1360
13	9580	490	12700	5160	168	2340	2300	180	1120
14	8650	411	9600	5000	168	2270	2000	178	961
15	7680	350	7260	4840	189	2470	1980	175	936
16	7650	366	7560	4670	159	2000	2000	175	945
17	12500	1070	36100	4570	140	1730	2050	178	985
18	18400	910	45200	4530	158	1930	2100	178	1010
19	25800	908	63300	4450	164	1970	1980	166	887
20	35200	993	94400	4240	142	1630	1840	160	795
21	39200	680	72000	4050	150	1640	1800	152	739
22	37900	488	49900	3970	123	1320	1780	140	673
23	33400	508	45800	4000	132	1430	1740	128	601
24	28300	500	38200	3980	110	1180	1700	115	528
25	23800	523	33600	3960	128	1370	1620	90	394
26	20400	340	18700	3950	170	1810	1560	48	202
27	17900	280	13500	3870	158	1650	1520	33	135
28	15700	265	11200	3810	100	1030	1500	39	158
29	13800	255	9500	3690	115	1150	1480	40	160
30	12300	282	9370	3500	160	1510	1460	45	177
31	10800	278	8110	--	--	--	1380	48	179
TOTAL	452690	--	658820	158830	--	76910	70950	--	29995
DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969									
DAY	JANUARY			FEBRUARY			MARCH		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	1320	50	178	915	60	148	1120	41	124
2	1280	50	173	915	55	136	1120	39	118
3	1220	55	181	915	51	126	1110	40	120
4	1180	55	175	915	50	124	1130	39	119
5	1120	55	166	915	42	104	1120	40	121
6	1100	52	154	915	38	94	1120	52	157
7	1060	50	143	915	32	79	1120	55	166
8	1040	50	140	915	36	89	1110	60	180
9	1020	48	132	915	38	94	1110	62	186
10	1000	47	127	915	40	99	1110	66	198
11	980	46	122	915	41	101	1100	65	193
12	960	45	117	915	41	101	1100	68	202
13	940	44	112	915	42	104	1100	72	214
14	920	43	107	920	43	107	1100	70	208
15	915	55	136	920	45	112	1110	66	198
16	915	142	351	920	45	112	1110	65	195
17	915	63	156	920	42	104	1120	69	209
18	915	51	126	920	40	99	1180	85	271
19	915	50	124	920	40	99	1340	150	543
20	915	48	119	930	38	95	1970	185	984
21	915	48	119	950	33	85	3110	808	6890
22	915	47	116	980	37	98	4630	505	6310
23	915	44	109	1000	39	105	6400	868	15000
24	915	42	104	1020	40	110	9800	1330	35200
25	915	41	101	1050	41	116	14400	1190	46300
26	915	40	99	1080	40	117	17900	832	40200
27	915	39	96	1100	42	125	20800	850	47700
28	915	40	99	1120	42	127	24000	790	51200
29	915	42	104	--	--	--	21900	604	35700
30	915	49	121	--	--	--	17700	557	26600
31	915	56	138	--	--	--	16400	563	24900
TOTAL	30695	--	4245	26645	--	3010	180440	--	340706

5-3250. MINNESOTA RIVER AT MANKATO, MINN.--Continued

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	APRIL			MAY			JUNE		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	15200	447	18300	19400	105	5500	8370	184	4160
2	15800	545	23200	18700	141	7120	8220	224	4970
3	17200	682	31700	18100	153	7480	8040	196	4250
4	20800	835	46900	17300	150	7010	7800	153	3220
5	25800	845	58900	16500	123	5480	7560	156	3180
6	30800	807	67100	16100	107	4650	7310	155	3060
7	36400	960	94300	15600	110	4630	7060	165	3150
8	45700	1440	178000	15200	115	4720	6820	158	2910
9	61000	1500	247000	14600	150	5910	6550	168	2970
10	70000	972	184000	14100	130	4950	6260	176	2970
11	74200	865	173000	13600	142	5210	6120	189	3120
12	76200	645	133000	13300	121	4350	5930	220	3520
13	75400	678	138000	13000	103	3620	5680	183	2810
14	73000	620	122000	12600	102	3470	5530	193	2880
15	74400	432	86800	12100	112	3660	5600	188	2840
16	75500	364	74200	11700	105	3320	5410	202	2950
17	72700	285	55900	11500	112	3480	5180	194	2710
18	67100	218	39500	11400	128	3940	4970	188	2520
19	60600	190	31100	11900	128	4110	4780	232	2990
20	53900	185	26900	12000	130	4210	4610	169	2100
21	48200	180	23400	11500	113	3510	4430	186	2220
22	42400	265	30300	11000	121	3590	4270	170	1960
23	36600	162	16000	10500	140	3970	4190	164	1860
24	32100	115	9970	10300	167	4640	4170	185	2080
25	28200	128	9750	10000	155	4190	4910	435	5770
26	25600	144	9950	9630	158	4110	7040	604	11500
27	24100	132	8590	9300	136	3410	8440	550	12500
28	22700	118	7230	9050	194	4740	8670	480	11200
29	21500	106	6150	8910	223	5360	9160	473	11700
30	20300	109	5970	8740	206	4860	10200	530	14600
31	--	--	--	8520	183	4210	--	--	--
TOTAL	1343400	--	1957110	396150	--	143410	193280	--	138670

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	JULY			AUGUST			SEPTEMBER		
	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
1	10500	510	14500	3630	242	2370	697	63	119
2	11100	410	12300	3350	243	2200	695	73	137
3	11300	370	11300	3100	262	2190	730	108	213
4	11600	361	11300	2850	298	2290	742	108	216
5	11800	352	11200	2620	222	1570	752	120	244
6	11400	357	11000	2420	230	1500	726	100	196
7	10800	347	10100	2270	213	1310	688	69	128
8	10000	320	8640	2070	205	1150	652	52	92
9	9520	308	7920	1910	192	990	628	80	136
10	9470	301	7700	1780	180	865	596	85	137
11	9750	275	7240	1650	160	713	569	84	129
12	10100	260	7090	1510	148	603	547	80	118
13	10200	280	7710	1420	162	621	525	90	128
14	9640	290	7550	1370	140	518	500	90	122
15	8620	302	7030	1280	112	387	484	95	124
16	7440	316	6350	1210	101	330	480	98	127
17	6580	332	5900	1150	98	304	459	81	100
18	6240	358	6030	1120	91	275	439	108	128
19	6260	405	6850	1100	81	241	427	106	122
20	6820	411	7570	1080	72	210	413	95	106
21	7090	368	7040	1070	53	153	400	105	113
22	6740	318	5790	1030	75	209	404	115	125
23	6040	315	5140	1000	62	167	414	120	134
24	5300	332	4750	972	71	186	397	97	104
25	5170	312	4360	921	78	194	401	77	83
26	5480	320	4730	879	70	166	388	84	88
27	5270	300	4270	825	82	183	389	78	82
28	5040	325	4420	777	92	193	379	78	80
29	4720	291	3710	730	89	175	389	82	86
30	4360	242	2850	691	80	149	388	81	85
31	4000	238	2570	761	62	127	--	--	--
TOTAL	248350	--	224910	48546	--	22539	15698	--	3802

TOTAL DISCHARGE FOR YEAR (CFS-DAYS)

3165674

TOTAL LOAD FOR YEAR (TONS)

3604127

MINNESOTA RIVER BASIN

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, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKA- LITY AS CaCO ₃ (MG/L)
OCT. 03...	6920	26	200	0	0	109	37	14	4.6	327	0	268
NOV. 13...	6420	23	300	50	100	118	44	17	4.1	359	0	294
DEC. 11...	3310	21	200	50	120	81	50	21	4.3	253	0	207
JAN. 06...	1160	21	100	60	210	113	44	24	4.3	385	0	316
FEB. 28...	1460	23	1900	110	400	109	47	28	3.7	385	0	316
MAR. 19...	19400	15	700	60	0	53	14	6.1	5.7	154	0	126
APR. 14...	83800	15	2200	20	0	48	13	4.9	4.9	145	0	119
MAY 12...	16000	8.1	400	40	30	78	35	14	5.4	238	0	195
JULY 10...	10500	23	472	94	20	104	40	17	4.4	299	0	245

DATE	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHCS)	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)	ARSENIC (AS) (UG/L)	CAD- MIUM (CD) (UG/L)
OCT. 03...	10200	419	152	7	.3	803	7.6	14	17	0	0
NOV. 13...	11000	472	178	7	.3	888	8.1	3	11	--	--
DEC. 11...	5150	406	199	10	.5	818	8.0	1	3	--	--
JAN. 06...	1940	460	144	10	.5	909	8.1	0	4	--	--
FEB. 28...	2600	464	149	11	.6	946	7.8	1	3	--	--
MAR. 19...	16600	191	65	6	.2	360	8.1	1	12	--	--
APR. 14...	61800	173	54	6	.2	367	7.9	9	18	--	--
MAY 12...	19500	337	142	8	.3	671	7.7	14	12	0	0
JULY 10...	16100	424	179	8	.4	807	7.7	22	15	--	--

PERIOD OF RECORD.--Chemical analyses: December 1962 to August 1966, November 1967 to July 1969 (discontinued).

DATE	SULFATE (SO4) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO3) (MG/L)	PHOS- PHATE (PO4) (MG/L)	ORTHO PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	BDRON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)
OCT. 03...	140	15	.5	--	27	.64	.60	--	70	546	532	.74
NOV. 13...	177	17	.5	--	25	.57	.41	--	60	635	601	.86
DEC. 11...	195	19	.3	--	25	--	.34	.12	90	576	541	.78
JAN. 06...	156	28	.3	--	16	--	.27	.09	100	620	596	.84
FEB. 28...	190	24	.4	.10	.4	--	.15	.07	160	660	618	.90
MAR. 19...	63	7.8	.4	3.8	17	--	.34	.15	60	316	259	.43
APR. 14...	48	6.9	.3	3.5	15	--	.19	.06	0	273	230	.37
MAY 12...	155	11	.5	2.2	9.8	--	.02	.02	70	451	434	.61
JULY 10...	182	14	.7	4.7	21	--	.36	.13	121	568	554	.77

[illegible]

MISSISSIPPI RIVER MAIN STEM

5-3310. MISSISSIPPI RIVER AT ST. PAUL, MINN.

LOCATION.--Lat 44°56'40", long 93°05'20", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.6, T.28 N., R.22 W., Ramsey County, temperature recorder at gaging station 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.

PERIOD OF RECORD.--Water temperatures: October 1956 to September 1969.

EXTREMES, 1968-69.--Water temperatures: Maximum, 28°C Aug. 12, 13, 18, 29, 30; minimum, freezing point on several days during winter period.

EXTREMES, 1956-69.--Water temperatures: Maximum, 31°C July 24-28, 1964; minimum, freezing point on many days during winter period.

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(WATER-STAGE RECORDER WITH TEMPERATURE ATTACHMENT, CONTINUOUS ETHYL ALCOHOL-ACTUATED THERMOGRAPH)

DAY	OCT		NOV		DEC		JAN		FEB		MAR	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	17.0	17.0	9.0	9.0	6.0	.5	6.5	4.0	6.5	1.5	7.0	3.0
2	17.0	17.0	9.0	8.5	6.0	1.5	7.0	1.0	6.5	1.5	6.5	3.0
3	17.0	16.5	8.5	8.5	6.5	2.0	7.0	.5	7.0	3.5	7.0	3.0
4	16.5	16.0	9.0	8.5	7.0	1.5	6.0	.5	7.0	2.0	8.0	3.0
5	16.5	15.5	8.5	8.5	6.5	1.5	6.0	1.0	6.5	.5	8.0	2.0
6	16.0	15.0	8.5	8.0	7.0	0.0	6.0	0.0	6.5	1.0	8.0	2.0
7	16.0	15.0	8.5	7.0	6.5	0.0	6.0	.5	6.5	2.0	7.0	2.0
8	16.0	14.5	8.0	6.5	7.0	0.0	6.0	.5	6.0	3.5	7.0	3.0
9	15.5	14.5	8.0	6.5	6.0	0.0	6.5	.5	7.0	1.5	7.0	1.5
10	15.5	14.5	8.5	5.5	7.0	.5	7.0	1.5	7.0	1.5	6.5	1.5
11	15.0	14.5	8.5	4.5	7.0	1.0	8.0	1.0	6.5	1.5	6.5	2.0
12	15.0	14.5	8.0	4.5	6.5	1.0	8.0	4.0	7.0	1.5	6.0	1.5
13	15.0	14.5	8.0	3.5	6.5	1.0	8.0	1.5	7.0	1.5	6.0	1.5
14	15.5	15.0	8.0	3.5	7.0	1.0	7.0	1.0	7.0	3.0	6.5	2.0
15	16.5	15.0	7.0	3.5	7.0	0.0	6.0	.5	7.0	1.5	6.5	3.0
16	16.5	16.5	7.0	4.0	8.0	2.0	7.0	1.5	5.0	1.5	5.5	2.0
17	16.5	16.0	8.0	4.0	8.0	.5	7.0	1.0	7.0	3.0	6.0	1.5
18	16.5	15.5	6.5	3.0	8.0	.5	7.0	1.0	6.5	2.0	6.0	3.0
19	15.5	14.0	7.0	3.0	6.5	.5	6.5	1.0	7.0	2.0	6.0	3.0
20	14.5	14.0	6.5	1.5	6.5	.5	7.0	1.0	7.0	3.0	5.5	.5
21	14.5	13.5	7.0	1.5	7.0	.5	8.0	3.0	7.0	1.5	4.5	0.0
22	13.5	12.0	6.5	2.0	7.0	1.0	7.0	1.0	6.0	2.0	4.0	.5
23	12.0	11.5	6.5	3.0	6.5	0.0	8.0	2.0	7.0	3.5	4.0	1.0
24	11.5	10.0	7.0	3.5	6.0	.5	6.5	1.5	7.0	3.0	3.5	.5
25	10.0	10.0	7.0	3.0	6.5	1.5	5.5	.5	7.0	3.5	3.0	.5
26	10.0	10.0	6.5	2.0	6.5	0.0	6.0	2.0	6.5	3.0	2.0	.5
27	10.0	9.5	7.0	1.5	7.0	.5	6.5	1.0	6.5	2.0	2.0	.5
28	9.5	9.0	6.0	1.0	6.0	0.0	7.0	1.5	7.0	3.0	2.0	.5
29	9.0	9.0	6.0	1.5	6.5	0.0	6.0	1.5	--	--	1.5	.5
30	9.0	9.0	6.0	1.0	6.5	0.0	6.0	1.0	--	--	2.0	1.0
31	9.0	9.0	--	--	6.0	1.0	6.0	1.0	--	--	2.0	.5
AVG	14.1	13.4	7.5	4.3	6.7	0.6	6.7	1.2	6.6	2.1	5.2	1.6

5-3310. MISSISSIPPI RIVER AT ST. PAUL, MINN.--Continued

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(WATER-STAGE RECORDER WITH TEMPERATURE ATTACHMENT, CONTINUOUS ETHYL ALCOHOL-ACTUATED THERMOGRAPH)

DAY	APR		MAY		JUN		JUL		AUG		SEP	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	3.5	.5	11.0	10.5	16.5	15.0	18.5	16.0	25.0	23.0	26.0	25.0
2	3.0	1.0	11.5	11.0	15.5	14.0	19.0	16.0	25.0	23.0	26.0	25.0
3	2.0	2.0	12.0	11.0	14.0	13.5	19.5	16.5	25.0	23.0	26.0	24.5
4	3.0	2.0	12.0	12.0	14.0	13.0	19.5	16.5	25.0	23.0	24.5	24.0
5	3.0	2.0	14.0	12.0	14.5	13.5	20.5	18.0	26.5	24.0	24.5	23.5
6	3.0	2.0	15.0	14.0	14.5	13.5	20.0	17.0	27.0	24.5	24.5	23.5
7	4.0	2.0	15.5	15.0	14.5	13.5	19.5	18.0	26.5	24.5	24.5	23.5
8	5.0	4.0	15.5	15.5	15.0	14.0	19.0	18.0	26.5	24.5	23.5	23.0
9	5.5	5.0	15.5	14.5	16.0	14.0	20.0	17.0	26.5	24.5	23.0	21.5
10	6.0	5.5	14.5	14.0	16.5	14.5	21.0	18.5	26.5	24.5	22.0	21.0
11	6.5	6.0	14.0	13.0	16.5	14.5	23.0	19.5	27.0	24.5	21.5	21.0
12	8.0	6.5	13.0	12.0	15.5	14.5	24.0	19.5	28.0	25.0	21.0	20.5
13	8.5	8.0	12.0	12.0	15.5	14.0	24.0	20.5	28.0	25.5	21.0	21.0
14	10.0	8.5	14.0	12.0	15.0	14.0	25.0	21.0	27.0	25.5	21.5	21.0
15	10.0	9.5	14.0	13.5	15.5	14.0	25.5	22.0	27.0	25.5	23.0	21.5
16	10.0	9.5	15.0	14.5	16.0	14.0	26.5	22.0	27.0	25.5	23.0	21.5
17	10.0	10.0	14.5	13.5	16.5	15.0	26.0	23.5	27.0	25.5	22.0	21.0
18	10.0	10.0	13.5	13.5	17.0	15.0	26.5	23.5	28.0	25.5	22.0	21.0
19	10.5	10.0	14.0	13.5	16.5	15.0	26.5	23.5	26.5	25.0	21.5	21.0
20	10.0	10.0	14.0	13.5	16.5	14.5	25.5	23.5	26.5	25.0	21.0	20.5
21	10.0	10.0	13.5	13.5	16.5	14.5	25.5	23.5	26.0	25.0	20.5	19.5
22	10.0	10.0	13.5	13.0	16.0	14.5	25.0	23.5	26.0	24.5	20.0	19.5
23	10.5	10.0	13.5	12.0	15.0	14.0	25.0	23.5	26.0	24.5	19.5	19.0
24	11.0	10.5	13.5	12.0	15.0	14.0	25.5	23.5	26.0	24.5	19.0	18.5
25	11.5	11.0	14.0	13.0	16.0	14.5	25.5	23.0	26.5	24.5	18.5	18.5
26	12.0	11.0	14.5	13.0	17.0	15.0	26.0	24.0	26.5	25.0	18.5	18.0
27	12.0	11.5	16.0	13.5	17.0	15.5	25.0	23.5	27.0	25.0	18.5	18.0
28	12.0	10.5	17.0	14.5	18.0	15.5	24.0	23.0	27.0	25.0	18.5	17.0
29	10.5	10.5	18.5	15.0	18.0	16.0	25.0	23.0	28.0	25.5	18.0	18.0
30	10.5	10.5	18.5	16.0	18.0	16.0	25.5	23.5	28.0	25.5	18.0	17.0
31	--	--	17.0	15.5	--	--	25.5	23.5	26.0	25.0	--	--
AVG	8.0	7.3	14.3	13.2	15.9	14.4	23.4	20.8	26.5	24.6	21.7	20.9

MISSISSIPPI RIVER MAIN STEM

5-3449.8 MISSISSIPPI RIVER AT LOCK AND DAM 3, NEAR RED WING, MINN.

LOCATION.--Lat 44°36'36", long 92°36'36", in SW 1/4 sec.10, T.113 N., R.15 W., Goodhue County, on right bank on downstream side of dam, 5 miles northwest of Red Wing and at mile 796.7 upstream from Ohio River.

DRAINAGE AREA.--46,600 sq mi, approximately.

PERIOD OF RECORD.--Chemical analyses: July to September 1969.

Water temperatures: August to September 1969.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	ALKA- LITY AS CaCO3 (MG/L)	SULFATE (SO4) (MG/L)	CHLO- RIDE (CL) (MG/L)	ORGANIC NITRO- GEN (N) (MG/L)	TOTAL NITRO- GEN (N) (MG/L)	NITRITE (N) (MG/L)	NITRITE (NO2) (MG/L)	AMMONIA NITRO- GEN (N) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO3) (MG/L)	ORTHO PHOS- PHATE (PO4) (MG/L)
JULY												
29...	13800	--	--	--	.80	2.9	.00	.14	.38	1.7	7.4	.45
29...	13800	--	--	--	--	--	--	--	--	--	--	--
AUG.												
07...	14300	--	--	--	--	--	--	--	--	--	--	--
13...	9500	177	49	12	--	--	--	--	--	--	--	--
20...	7500	168	45	13	--	--	--	--	--	--	--	--
21...	6500	--	--	--	.68	--	.00	.10	.18	.20	.8	--
28...	6300	160	41	14	--	--	--	--	--	--	--	--
SEPT.												
04...	6300	159	41	15	--	--	--	--	--	--	--	--
10...	6600	162	36	15	--	--	--	--	--	--	--	--
15...	5200	--	--	--	1.2	--	.00	.08	.24	.20	.7	--
17...	4500	160	34	15	--	--	--	--	--	--	--	--
24...	6900	160	31	16	--	--	--	--	--	--	--	--

DATE	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	SAMPLE SIZE (GALS)	TOTAL CARBON EX- TRACT ABLES (UG/L)	CARBON ALCOHOL EX- TRACT ABLES (UG/L)	CARBON CHLORO- FORM EX- TRACT ABLES (UG/L)	AIR TEMP- ERATURE (DEG C)
JULY						
01-07	--	3329	203	136	67	--
29...	.02	--	--	--	--	--
29...	--	--	--	--	--	25
AUG.						
05-10	--	2016	274	183	91	--
21...	.08	--	--	--	--	--
SEPT.						
15...	.04	--	--	--	--	--

5-3449.8 MISSISSIPPI RIVER AT LOCK AND DAM 3, NEAR RED WING, MINN.--Continued

EXTREMES, August to September.--Water temperatures: Maximum, 26.5°C Aug. 11-14, 17, 18; minimum, 17.0°C Sept. 23, 27, 28, 30.

REMARKS.--Some analyses furnished by Minneapolis-St. Paul Sanitary District and Federal Water Quality Administration, Cincinnati, Ohio.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	TOTAL PHOS- PHORUS (P) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	HARD- NESS (CA, MG) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHQS)	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)	TUR- BID- ITY (JTU)	DISS- OLVED OXYGEN (MG/L)	BIO- CHEM- ICAL OXYGEN DEMAND (MG/L)	COLI- FORM (COL- ONIES PER 100 ML)	COLI- FORM (COL- ONIES PER 100 ML)
JULY												
29...	.05	.18	--	--	--	24	--	--	--	--	--	--
29...	--	--	--	525	7.8	24	--	--	8.1	--	--	--
AUG.												
07...	--	--	--	--	--	--	--	--	--	--	2500	--
13...	--	--	228	--	7.9	25	25	40	7.1	4.8	--	3300
20...	--	--	202	--	8.4	24	25	40	7.8	3.9	--	4
21...	.39	.14	--	--	--	24	--	--	--	4.4	--	--
28...	--	--	192	--	8.2	25	25	55	7.7	5.4	--	200
SEPT.												
04...	--	--	200	--	8.6	23	25	60	8.3	5.2	--	490
10...	--	--	204	--	7.9	20	25	35	7.7	3.8	--	330
15...	.27	.17	--	--	--	23	--	--	--	--	--	--
17...	--	--	180	--	8.1	21	25	20	8.5	4.5	--	110
24...	--	--	176	--	7.9	18	25	30	6.6	3.6	--	790

TEMPERATURE (°C) OF WATER, AUGUST TO SEPTEMBER 1969

DAY	APR		MAY		JUN		JUL		AUG		SEP	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	--	--	--	--	--	--	--	--	--	--	25.0	24.5
2	--	--	--	--	--	--	--	--	--	--	25.0	24.0
3	--	--	--	--	--	--	--	--	--	--	24.5	24.0
4	--	--	--	--	--	--	--	--	--	--	24.5	24.0
5	--	--	--	--	--	--	--	--	--	--	24.5	24.0
6	--	--	--	--	--	--	--	--	25.5	25.0	25.0	24.0
7	--	--	--	--	--	--	--	--	25.5	24.5	24.5	24.0
8	--	--	--	--	--	--	--	--	25.0	24.0	24.0	22.5
9	--	--	--	--	--	--	--	--	25.5	24.5	22.5	21.5
10	--	--	--	--	--	--	--	--	26.0	25.0	22.0	21.0
11	--	--	--	--	--	--	--	--	26.5	25.5	21.5	21.0
12	--	--	--	--	--	--	--	--	26.5	26.0	22.0	21.0
13	--	--	--	--	--	--	--	--	26.5	25.5	22.0	21.5
14	--	--	--	--	--	--	--	--	26.5	25.5	22.0	21.5
15	--	--	--	--	--	--	--	--	26.0	25.0	22.5	22.0
16	--	--	--	--	--	--	--	--	26.0	25.0	22.5	22.0
17	--	--	--	--	--	--	--	--	26.5	25.0	22.5	22.0
18	--	--	--	--	--	--	--	--	26.5	25.5	22.0	21.0
19	--	--	--	--	--	--	--	--	26.0	25.0	21.0	20.5
20	--	--	--	--	--	--	--	--	25.0	24.5	20.5	20.0
21	--	--	--	--	--	--	--	--	25.0	24.0	20.0	19.5
22	--	--	--	--	--	--	--	--	25.0	24.0	19.5	19.0
23	--	--	--	--	--	--	--	--	25.0	24.5	19.0	17.0
24	--	--	--	--	--	--	--	--	25.5	24.5	18.0	17.5
25	--	--	--	--	--	--	--	--	26.0	25.0	18.0	17.5
26	--	--	--	--	--	--	--	--	26.0	25.0	17.5	17.5
27	--	--	--	--	--	--	--	--	26.0	25.0	17.5	17.0
28	--	--	--	--	--	--	--	--	25.5	25.0	18.0	17.0
29	--	--	--	--	--	--	--	--	26.0	25.5	18.0	17.5
30	--	--	--	--	--	--	--	--	26.0	25.0	17.5	17.0
31	--	--	--	--	--	--	--	--	25.5	24.5	--	--
AVG	--	--	--	--	--	--	--	--	25.8	24.9	21.4	20.7

WHITewater RIVER BASIN

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, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKA- LITY AS CaCO ₃ (MG/L)
OCT.												
10...	68	13	600	40	70	61	19	6.0	6.8	267	0	219
NOV.												
14...	19	11	0	10	20	68	25	4.3	1.5	319	0	261
DEC.												
20...	16	15	100	30	0	73	25	4.3	1.4	321	0	263
JAN.												
22...	15	15	100	0	10	68	25	4.0	1.4	316	0	259
FEB.												
26...	14	14	--	30	20	67	25	4.2	1.2	324	0	266
MAR.												
24...	164	8.8	--	70	90	28	9.7	2.5	6.8	112	0	92
APR.												
29...	33	6.4	--	70	30	68	24	5.2	1.8	316	0	259
MAY												
26...	28	12	100	10	80	75	25	4.9	1.6	340	0	278
JUNE												
30...	53	.8	--	240	0	54	18	4.3	4.7	246	0	202
AUG.												
12...	22	11	274	657	37	71	22	4.8	2.4	322	0	264
12...	22	--	--	--	--	--	--	--	--	--	--	--
SEPT.												
17...	18	12	167	13	75	40	25	3.6	2.0	232	0	190

DATE	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH (UNITS)
OCT.							
10...	50.9	230	12	5	.2	473	7.5
10...	--	--	--	--	--	480	7.7
NOV.							
14...	15.0	270	9	3	.1	525	7.7
DEC.							
20...	13.5	286	23	3	.1	510	8.2
20...	--	--	--	--	--	510	78.0
JAN.							
22...	12.7	269	10	3	.1	503	7.7
22...	--	--	--	--	--	530	7.8
FEB.							
26...	11.6	271	5	3	.1	490	7.9
26...	--	--	--	--	--	470	8.2
MAR.							
24...	66.4	110	18	4	.1	243	7.6
24...	--	--	--	--	--	270	7.6
APR.							
29...	26.0	268	10	4	.1	483	8.0
29...	--	--	--	--	--	551	8.4
MAY							
26...	24.3	289	10	4	.1	532	8.0
26...	--	--	--	--	--	530	8.3
JUNE							
30...	33.0	209	7	4	.1	400	7.5
30...	--	--	--	--	--	469	--
AUG.							
12...	18.5	268	4	4	.1	507	7.7
12...	--	--	--	--	--	536	8.3
SEPT.							
17...	11.2	202	11	4	.1	380	8.0
17...	--	--	--	--	--	500	8.3

5-3760. NORTH FORK WHITEWATER RIVER NEAR ELBA, MINN.--Continued

(Hydrologic bench-mark station)

DRAINAGE AREA.--101 sq mi.

PERIOD OF RECORD.--Chemical analyses: August 1967 to September 1969.

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	SULFATE (SO ₄) (MG/L)	CHLORIDE (CL) (MG/L)	FLUORIDE (F) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	PHOSPHATE (PO ₄) (MG/L)	ORTHO PHOSPHATE (PO ₄) (MG/L)	DIS- SOLVED PHOSPHORUS (P) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)
OCT.												
10...	20	9.2	.2	--	6.9	1.8	1.5	--	30	277	274	.38
NOV.												
14...	17	4.2	.2	--	.7	.07	.04	--	10	293	288	.40
DEC.												
20...	15	3.3	.1	--	6.4	--	.19	.09	10	299	302	.41
JAN.												
22...	15	3.5	.1	--	5.6	--	.53	.19	10	295	293	.40
FEB.												
26...	11	3.2	.2	--	--	--	.83	.14	20	293	287	.40
MAR.												
24...	12	5.4	.2	4.7	21	--	2.8	.45	30	150	152	.20
APR.												
29...	18	5.6	.2	.80	3.8	--	.57	.13	20	287	289	.39
MAY												
26...	16	5.2	.2	1.3	5.7	--	.90	.28	30	313	314	.43
JUNE												
30...	16	6.0	.1	.10	.4	--	1.6	.28	30	229	227	.31
AUG.												
12...	16	4.0	.3	.65	2.9	--	.15	.07	17	309	294	.42
12...	--	--	--	--	--	--	--	--	--	--	--	--
SEPT.												
17...	14	3.6	.1	.79	3.5	--	.09	.06	18	230	219	.31

DATE	TEMP- ERATURE (DEG C)	COLOR (PLATINUM- COBALT UNITS)	DISS- OLVED OXYGEN (MG/L)	BIO- CHEM- ICAL OXYGEN DEMAND (MG/L)	COLI- FORM (COL- ONIES PER 100 ML)	COLI- FORM (COL- ONIES PER 100 ML)
OCT.						
10...	9	15	10.5	3.1	40000	--
10...	--	--	--	--	--	--
NOV.						
14...	5	1	15.2	.6	8	--
DEC.						
20...	2	7	14.0	.7	--	12
20...	--	--	--	--	--	--
JAN.						
22...	3	1	12.0	.6	--	896
22...	--	--	--	--	--	--
FEB.						
26...	4	1	14.0	.8	--	150
26...	--	--	--	--	--	--
MAR.						
24...	2	10	--	1.0	--	8600
24...	--	--	--	--	--	--
APR.						
29...	8	5	13.2	1.0	--	9
29...	--	--	--	--	--	--
MAY						
26...	14	2	10.2	1.2	--	226
26...	--	--	--	--	--	--
JUNE						
30...	19	10	7.9	3.2	--	6300
30...	--	--	--	--	--	--
AUG.						
12...	19	1	--	1.2	--	--
12...	--	--	11.6	--	--	425
SEPT.						
17...	13	18	--	6.0	--	--
17...	--	--	11.5	--	--	100

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	ALDRIN (UG/L)	ALDRIN IN BOTTOM DE- POSITS (UG/KG)	DDD (UG/L)	DDD IN BOTTOM DE- POSITS (UG/KG)	DDE (UG/L)	DDE IN BOTTOM DE- POSITS (UG/KG)	DDT (UG/L)	DDT IN BOTTOM DE- POSITS (UG/KG)	DI- ELDRIN (UG/L)	DI- ELDRIN IN BOTTOM DE- POSITS (UG/KG)
OCT. 10...	.00	.00	.00	1.0	.00	.00	.00	2.0	.00	.00
MAR. 24...	.00	--	.00	--	.00	--	.00	--	.01	--

[illegible]

5-3760. NORTH FORK WHITEWATER RIVER NEAR ELBA, MINN.--Continued

CHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MOLY- BDENUM (MO) (UG/L)	NICKEL (NI) (UG/L)	SELF- NIUM (SE) (UG/L)	STRON- TIUM (SR) (UG/L)	VANA- DIUM (V) (UG/L)	ZINC (ZN) (UG/L)
NOV. 14...	5	0	0	130	1	0
MAY 26...	1	0	0	220	1	0

TOTAL DISSOLVED							
DATE	ARSENIC (AS) (UG/L)	CAD- MIUM (CD) (UG/L)	CHRO- MIUM (CR) (UG/L)	COBALT (CO) (UG/L)	COPPER (CU) (UG/L)	LEAD (PB) (UG/L)	LITHIUM (LI) (UG/L)
NOV. 14...	0	0	0	0	0	0	0
MAY 26...	10	0	0	0	0	0	0

RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

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. A picocurie is one millionth of the amount of radioactivity represented by a microcurie, which is the quantity of radiation represented by one millionth of a gram of radium-226. A picocurie of radium results in 2.22 disintegrations per minute.

DATE	DISSOLVED				DISSOLVED SOLIDS mg/l	SUSPENDED		SUSPENDED SOLIDS mg/l
	URANIUM μg/l	RADIUM pc/l	GROSS α μg/l	GROSS β pc/l		GROSS α μg/l	GROSS β pc/l	
SEPT. 17...	.7	.06	3.3	4.2	300	<.4	.9	3

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LINITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM- (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
04024000 - ST. LOUIS RIVER AT SCANLON, MINN. (LAT 46 42 12 LONG 092 25 07)												
MAR., 1969												
10... 1840		810	6.8	7.4	59	.3	600	17	100	--	176	50
JUNE												
23... 1530		610	5.9	7.2	43	.2	700	21	90	.05	152	30

05033800 - CAMPBELL CREEK NEAR DETROIT LAKES, MINN. (LAT 46 53 29 LONG 095 51 57)												
JULY, 1969												
01...	.16	77	38	8.3	267	.4	375	27	23	.09	505	10
29...	.11	115	35	7.8	284	.4	419	20	50	.06	538	62

05033900 - PELICAN RIVER AT DETROIT LAKES, MINN. (LAT 46 48 37 LONG 095 49 42)												
NOV., 1968												
06...	3.7	--	37	7.8	328	.3	200	32	14	.09	657	130
DEC.												
10...	2.0	--	38	8.1	269	.2	100	22	4	.07	553	400
JAN., 1969												
14...	1.4	--	35	7.6	323	.3	200	26	5	.08	650	260
FEB.												
18...	1.8	70	38	8.2	295	.3	1500	22	4	.06	653	240

05033940 - PELICAN RIVER TRIBUTARY NEAR DETROIT LAKES, MINN. (LAT 46 46 52 LONG 095 48 01)												
DEC., 1968												
10...	.32	--	39	7.9	398	.2	100	15	12	.08	734	1200
MAR., 1969												
26...	1.5	160	40	8.0	329	.2	2700	39	8	.04	714	200
JULY												
01...	.06	62	33	8.0	285	.3	339	0	27	.08	517	0

DATE	8 CAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA, MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)
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04024000 - ST. LOUIS RIVER AT SCANLON, MINN. (LAT 46 42 12 LONG 092 25 07)

MAR., 1969						
10...	72	10	.10	76	2	112
JUNE						
23...	53	10	.10	64	2	92

05033800 - CAMPBELL CREEK NEAR DETROIT LAKES, MINN. (LAT 46 53 29 LONG 095 51 57)

JULY, 1969						
01...	326	1.8	.50	294	11	310
29...	346	1.6	.00	304	17	323

05033900 - PELICAN RIVER AT DETROIT LAKES, MINN. (LAT 46 48 37 LONG 095 49 42)

NOV., 1968						
06...	400	6.0	--	360	4	402
DEC.						
10...	328	4.7	--	291	0	339
JAN., 1969						
14...	394	5.7	--	349	1	397
FEB.						
18...	360	7.2	.50	317	1	383

05033940 - PELICAN RIVER TRIBUTARY NEAR DETROIT LAKES, MINN. (LAT 46 46 52 LONG 095 48 01)

DEC., 1968						
10...	485	6.6	--	413	1	446
MAR., 1969						
26...	401	14	.10	368	1	406
JULY						
01...	348	7.2	.00	283	17	289

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SDRP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SIO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
04024000 - ST. LOUIS RIVER AT SCANLON, MINN. (LAT 46 42 12 LONG 092 25 07)												
MAR., 1969												
10...	6.3	0	19	.4	80	.3	138	--	--	11	19	1.6
JUNE												
23...	5.6	0	19	.5	100	.3	121	--	.02	5.8	16	1.2
05033800 - CAMPBELL CREEK NEAR DETROIT LAKES, MINN. (LAT 46 53 29 LONG 095 51 57)												
JULY, 1969												
01...	2.0	0	36	2.0	43	.1	327	--	.03	12	56	2.0
29...	1.6	0	25	.0	69	.0	373	--	.04	23	65	1.9
05033900 - PELICAN RIVER AT DETROIT LAKES, MINN. (LAT 46 48 37 LONG 095 49 42)												
NOV., 1968												
06...	7.5	0	44	.3	50	.2	422	.16	--	23	84	4.4
DEC.												
10...	8.5	0	37	2.3	50	.2	350	--	.03	28	55	3.8
JAN., 1969												
14...	9.0	0	39	2.1	80	.2	408	--	.03	25	83	3.9
FEB.												
18...	13	0	46	2.3	30	.3	418	--	.04	28	65	4.9
05033940 - PELICAN RIVER TRIBUTARY NEAR DETROIT LAKES, MINN. (LAT 46 46 52 LONG 095 48 01)												
DEC., 1968												
10...	5.8	0	22	.0	50	.1	461	--	.03	28	102	3.0
MAR., 1969												
26...	8.2	0	31	.3	30	.2	423	--	.03	26	82	3.7
JULY												
01...	5.8	0	7.2	.2	49	.1	311	--	.03	3.2	60	1.6

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG)	PH (UNITS)	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
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05033960 - SUCKER CREEK NEAR DETROIT LAKES, MINN. (LAT 46 46 25 LONG 095 48 23)

DEC., 1968												
10...	1.5	--	29	8.1	306	.1	100	1	3	.05	564	150
MAR., 1969												
26...	2.1	130	31	8.1	283	.2	700	14	5	.00	589	130
JULY												
01...	1.8	77	29	8.0	292	.2	203	0	3	.01	534	60

05062000 - BUFFALO RIVER NEAR OILWORTH, MINN. (LAT 46 57 40 LONG 096 39 40)

OCT., 1968												
01...	41	--	42	7.9	293	.2	200	86	10	.38	724	20

05064000 - WILD RICE RIVER AT HENDRUM, MINN. (LAT 47 16 05 LONG 096 47 50)

NOV., 1968												
06...	139	210	29	8.1	260	.3	1600	0	10	.01	508	0

05079000 - RED LAKE RIVER AT CROOKSTON, MINN. (LAT 47 46 32 LONG 096 36 30)

OCT., 1968												
03...	905	--	19	8.1	178	.1	300	24	20	.18	402	20

05131500 - LITTLE FORK RIVER AT LITTLEFORK, MINN. (LAT 48 24 00 LONG 093 34 00)

OCT., 1968												
14...	1510	--	5.6	7.6	59	.3	1500	4	170	.09	122	10

DATE	BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (NI) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTIT- TUENTS) (MG/L)
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05033960 - SUCKER CREEK NEAR DETROIT LAKES, MINN. (LAT 46 46 25 LONG 095 48 23)

DEC., 1968						
10...	374	3.7	--	307	0	339
MAR., 1969						
26...	345	7.1	.20	297	0	319
JULY						
01...	356	4.2	.00	292	13	318

05062000 - BUFFALO RIVER NEAR OILWORTH, MINN. (LAT 46 57 40 LONG 096 39 40)

OCT., 1968						
01...	357	6.4	--	379	13	465

05064000 - WILD RICE RIVER AT HENDRUM, MINN. (LAT 47 16 05 LONG 096 47 50)

NOV., 1968						
06...	317	1.4	.10	258	4	301

05079000 - RED LAKE RIVER AT CROOKSTON, MINN. (LAT 47 46 32 LONG 096 36 30)

OCT., 1968						
03...	217	2.8	--	202	12	240

05131500 - LITTLE FORK RIVER AT LITTLEFORK, MINN. (LAT 48 24 00 LONG 093 34 00)

OCT., 1968						
14...	72	1.6	--	63	12	85

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

259

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05033960 - SUCKER CREEK NEAR DETROIT LAKES, MINN. (LAT 46 46 25 LONG 095 48 23)												
DEC., 1968												
10...	3.7	0	14	1.7	30	.1	341	--	.02	25	75	2.8
MAR., 1969												
26...	4.3	0	8.0	.7	10	.1	349	--	.01	26	68	3.1
JULY												
01...	4.6	0	11	.1	29	.1	363	--	.05	22	70	2.4
05062000 - BUFFALO RIVER NEAR DILWDRTH, MINN. (LAT 46 57 40 LONG 096 39 40)												
OCT., 1968												
01...	18	0	115	.0	120	.4	482	.57	--	18	83	7.4
05064000 - WILD RICE RIVER AT HENDRUM, MINN. (LAT 47 16 05 LONG 096 47 50)												
NOV., 1968												
06...	10	0	28	.3	70	.3	314	--	.02	15	56	3.7
05079000 - RED LAKE RIVER AT CROOKSTON, MINN. (LAT 47 46 32 LONG 096 36 30)												
OCT., 1968												
03...	5.9	0	41	.0	50	.2	269	.97	--	8.4	50	5.7
05131500 - LITTLE FORK RIVER AT LITTLEFORK, MINN. (LAT 48 24 00 LONG 093 34 00)												
OCT., 1968												
14...	1.9	0	12	1.7	90	.1	147	.33	--	7.7	16	1.4

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS-CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS-SOLVED ALUMINUM (AL) (UG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	BICARBONATE (HCO ₃) (MG/L)	CARBONATE (CO ₃) (MG/L)	ALKALINITY AS CaCO ₃ (MG/L)
05133500 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47)												
OCT. 15...	15300	4.8	1100	380	30	13	5.0	1.5	1.0	61	0	50
JUNE 23...	29600	2.4	600	280	0	8.8	3.8	1.5	.9	40	0	33
JULY 31...	18500	--	--	--	--	--	--	--	--	61	0	50
31...	18500	--	--	--	--	--	--	--	--	--	--	--
SEPT. 04...	11600	--	--	--	--	--	--	--	--	92	0	75
04...	11600	--	--	--	--	--	--	--	--	--	--	--

DATE	BORON (B) (UG/L)	DIS-SOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	DIS-SOLVED SOLIDS (TONS PER AC-FT)	DIS-SOLVED SOLIDS (TONS PER DAY)	HARDNESS (CA, MG) (MG/L)	NON-CARBONATE HARDNESS (MG/L)	PERCENT SODIUM	SODIUM AD-SORPTION RATIO	SPECIFIC CONDUCTANCE (MICROMHOS)
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05133500 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47)										
OCT., 1968 15...	50	101	69	.14	4170	53	3	6	.1	104
JUNE, 1969 23...	30	58	46	.08	4640	38	5	8	.1	71
JULY 31...	--	97	--	.13	4850	53	3	--	--	96
31...	--	--	--	--	--	--	--	--	--	102
SEP. 04...	--	113	--	.15	3540	54	0	--	--	--
04...	--	--	--	--	--	--	--	--	--	95

DATE	DIS-CHARGE (CFS)	DIS-SOLVED IRON (FE) (UG/L)	MAGNESIUM (MG) (MG/L)	PH (UNITS)	ALKALINITY AS CaCO ₃ (MG/L)	FLUORIDE (F) (MG/L)	DIS-SOLVED ALUMINUM (AL) (UG/L)	NON-CARBONATE HARDNESS (MG/L)	COLOR (PLATINUM-COBALT) UNITS	ORTHO PHOSPHATE (PO ₄) (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	DIS-SOLVED MANGANESE (MN) (UG/L)
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05227500 - MISSISSIPPI RIVER AT AITKIN, MINN. (LAT 46 32 26 LONG 093 42 26)												
OCT., 1968 15...	1750	0	9.8	7.5	114	.1	0	9	45	.59	231	0

05244000 - CROW WING RIVER AT NIMROD, MINN. (LAT 46 39 00 LONG 094 53 00)												
NOV., 1968 04...	536	410	14	7.9	169	.1	600	31	8	.01	317	30

DATE	SODIUM (NA) (MG/L)	CARBONATE (CO ₃) (MG/L)	SULFATE (SO ₄) (MG/L)	NITRATE (NO ₃) (MG/L)	BORON (B) (UG/L)	SODIUM AD-SORPTION RATIO	DIS-SOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	PHOSPHATE (PO ₄) (MG/L)	DIS-SOLVED PHOSPHORUS (P) (MG/L)	SILICA (SiO ₂) (MG/L)	CALCIUM (CA) (MG/L)	POTASSIUM (K) (MG/L)
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05227500 - MISSISSIPPI RIVER AT AITKIN, MINN. (LAT 46 32 26 LONG 093 42 26)												
OCT., 1968 15...	4.4	0	13	.0	0	.2	170	.90	--	7.6	33	1.7

05244000 - CROW WING RIVER AT NIMROD, MINN. (LAT 46 39 00 LONG 094 53 00)												
NOV., 1968 04...	5.8	0	40	.8	50	.2	289	--	.02	11	57	2.0

DATE	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	ORGANIC NITRO- GEN (N) (MG/L)	TOTAL NITRO- GEN (N) (MG/L)	NITRITE (N) (MG/L)	NITRITE (NO ₂) (MG/L)	AMMONIA NITRO- GEN (N) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	TOTAL PHOS- PHORUS (P) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)
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05133500 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47)

OCT., 1968												
15...	9.5	1.1	.2	--	--	--	--	--	--	.9	--	--
JUNE, 1969												
23...	6.5	1.0	.2	--	--	--	--	--	.10	.3	--	--
JULY												
31...	6.2	.8	--	1.3	1.5	.00	.04	.02	.10	.6	.04	.02
31...	--	--	--	--	--	--	--	--	--	--	--	--
SEP.												
04...	10	2.0	--	.69	--	.00	.02	.02	.20	.7	.15	.02
04...	--	--	--	--	--	--	--	--	--	--	--	--

DATE	PH (UNITS)	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)	TUR- BID- ITY (JTU)	DISS- OLVED OXYGEN (MG/L)	BIO- CHEM- ICAL OXYGEN DEMAND (MG/L)	COLI- FORM (COL- ONIES PER 100 ML)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	AIR TEMP- ERATURE (DEG C)
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05133500 - RAINY RIVER AT MANITOU RAPIDS, MINN. (LAT 48 38 04 LONG 093 54 47)

OCT., 1968									
15...	7.5	10	5	--	--	--	--	--	--
JUNE, 1969									
23...	7.1	11	30	--	--	--	--	--	--
JULY									
31...	7.6	19	--	13	--	1.5	--	.02	--
31...	8.6	20	--	--	7.9	--	750	--	19
SEP.									
04...	7.1	21	--	7.5	--	1.6	--	.04	--
04...	8.2	21	--	--	7.2	--	950	--	24

DATE	BICAR- BONATE (HCO ₃) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA, MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)
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05227500 - MISSISSIPPI RIVER AT AITKIN, MINN. (LAT 46 32 26 LONG 093 42 26)

OCT., 1968						
15...	139	1.9	--	123	13	140

05244000 - CROW WING RIVER AT NIMROD, MINN. (LAT 46 39 00 LONG 094 53 00)

NOV., 1968						
04...	206	2.5	.20	200	5	236

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LINITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC CONO- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05261500 - NOKASIPPI RIVER NEAR FORT RIPLEY, MINN. (LAT 46 12 02 LONG 094 19 03)												
AUG., 1969 20...	20	35	9.6	8.1	128	.1	291	0	9	.01	249	27
05263000 - ELK RIVER NEAR LITTLE FALLS, MINN. (LAT 46 01 13 LONG 094 22 38)												
AUG., 1969 20...	4.8	77	16	8.0	208	.2	412	4	20	.07	414	166
05265500 - SWAN RIVER NEAR SWANVILLE, MINN. (LAT 45 56 03 LONG 094 34 50)												
AUG., 1969 20...	11	11	18	7.9	184	.3	296	6	1	.01	379	32
05265700 - SWAN RIVER NEAR LITTLE FALLS, MINN. (LAT 45 56 00 LONG 094 24 34)												
AUG., 1969 20...	14	0	19	8.0	207	.2	265	1	0	.03	404	48

DATE	BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)
05261500 - NOKASIPPI RIVER NEAR FORT RIPLEY, MINN. (LAT 46 12 02 LONG 094 19 03)						
AUG., 1969 20...	156	1.8	.00	127	18	147
05263000 - ELK RIVER NEAR LITTLE FALLS, MINN. (LAT 46 01 13 LONG 094 22 38)						
AUG., 1969 20...	254	6.8	.10	212	19	244
05265500 - SWAN RIVER NEAR SWANVILLE, MINN. (LAT 45 56 03 LONG 094 34 50)						
AUG., 1969 20...	224	4.6	.00	190	22	215
05265700 - SWAN RIVER NEAR LITTLE FALLS, MINN. (LAT 45 56 00 LONG 094 24 34)						
AUG., 1969 20...	252	4.0	.00	208	25	235

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SIO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05261500 - NOKASIPPI RIVER NEAR FORT RIPLEY, MINN. (LAT 46 12 02 LONG 094 19 03)												
AUG., 1969 20...	3.6	0	6.5	.0	17	.1	160	--	.01	13	35	9.6
05263000 - ELK RIVER NEAR LITTLE FALLS, MINN. (LAT 46 01 13 LONG 094 22 38)												
AUG., 1969 20...	9.6	0	13	.5	78	.3	266	--	.03	13	58	1.6
05265500 - SWAN RIVER NEAR SWANVILLE, MINN. (LAT 45 56 03 LONG 094 34 50)												
AUG., 1969 20...	7.2	0	15	.2	55	.2	217	--	.01	11	46	2.1
05265700 - SWAN RIVER NEAR LITTLE FALLS, MINN. (LAT 45 56 00 LONG 094 24 34)												
AUG., 1969 20...	6.9	0	15	.1	39	.2	276	--	.01	11	52	1.9

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT (PO4) (MG/L)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
PLATTE RIVER NEAR PIERZ, MINN. (LAT 46 00 17 LONG 094 11 16)												
AUG., 1969 21...	2.2	75	12	7.6	147	.2	340	0	30	.00	276	124
05267580 - SPUNK CREEK NEAR ROYALTON, MINN. (LAT 45 47 04 LONG 094 18 54)												
AUG., 1969 21...	2.7	0	23	7.7	230	.2	255	8	6	.02	452	62
05268000 - PLATTE RIVER AT ROYALTON, MINN. (LAT 45 49 50 LONG 094 17 12)												
AUG., 1969 21...	49	44	11	8.0	133	.1	324	0	10	.04	263	50
05269800 - WATAB RIVER NEAR SARTELL, MINN. (LAT 45 37 09 LONG 094 13 38)												
AUG., 1969 22...	5.4	8	21	8.0	199	.2	306	12	4	.01	415	74
05270150 - ASHLEY CREEK NEAR SAUK CENTRE, MINN. (LAT 45 46 46 LONG 094 58 52)												
AUG., 1969 20...	9.2	146	26	7.8	243	.1	460	13	7	.01	503	107
05270210 - ADLEY CREEK NR MELROSE, MINN. (LAT 45 41 00 LONG 094 46 13)												
AUG., 1969 20...	4.8	33	21	8.1	192	.1	309	3	5	.06	378	27

DATE	BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)
PLATTE RIVER NEAR PIERZ, MINN. (LAT 46 00 17 LONG 094 11 16)						
AUG., 1969 21...	179	3.8	.03	140	18	166
05267580 - SPUNK CREEK NEAR ROYALTON, MINN. (LAT 45 47 04 LONG 094 18 54)						
AUG., 1969 21...	280	5.0	.50	237	24	269
05268000 - PLATTE RIVER AT ROYALTON, MINN. (LAT 45 49 50 LONG 094 17 12)						
AUG., 1969 21...	162	2.6	.10	129	21	148
05269800 - WATAB RIVER NEAR SARTELL, MINN. (LAT 45 37 09 LONG 094 13 38)						
AUG., 1969 22...	243	6.4	.00	211	24	237
05270150 - ASHLEY CREEK NEAR SAUK CENTRE, MINN. (LAT 45 46 46 LONG 094 58 52)						
AUG., 1969 20...	296	3.6	.50	256	18	299
05270210 - ADLEY CREEK NR MELROSE, MINN. (LAT 45 41 00 LONG 094 46 13)						
AUG., 1969 20...	234	3.0	.30	195	24	209

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
PLATTE RIVER NEAR PIERZ, MINN. (LAT 46 00 17 LONG 094 11 16)												
AUG., 1969 21...	5.6	0	6.0	.1	42	.2	190	--	.00	10	37	2.3
05267580 - SPUNK CREEK NEAR ROYALTON, MINN. (LAT 45 47 04 LONG 094 18 54)												
AUG., 1969 21...	6.5	0	22	2.1	58	.2	282	--	.02	12	58	2.6
05268000 - PLATTE RIVER AT ROYALTON, MINN. (LAT 45 49 50 LONG 094 17 12)												
AUG., 1969 21...	4.9	0	7.0	.5	19	.2	162	--	.02	7.1	34	1.0
05269800 - WATAB RIVER NEAR SARTELL, MINN. (LAT 45 37 09 LONG 094 13 38)												
AUG., 1969 22...	7.9	0	22	.0	42	.2	247	--	.01	7.2	50	2.1
05270150 - ASHLEY CREEK NEAR SAUK CENTRE MINN. (LAT 45 46 46 LONG 094 58 52)												
AUG., 1969 20...	5.1	0	29	2.1	30	.1	306	--	.01	25	60	26
05270210 - ADLEY CREEK NR MELROSE, MINN. (LAT 45 41 00 LONG 094 46 13)												
AUG., 1969 20...	4.9	0	13	1.4	41	.2	230	--	.02	4.4	43	21

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG)	PH	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05270230 - SAUK RIVER AT NEW MUNICH, MINN. (LAT 45 37 32 LONG 094 45 39)												
AUG., 1969 20...	33	46	25	8.0	225	.2	246	7	12	1.0	488	29
05270280 - GETCHELL CREEK NEAR NEW MUNICH, MINN. (LAT 45 34 36 LONG 094 45 55)												
AUG., 1969 21...	.39	22	21	8.1	210	.0	900	30	4	.03	467	81
05270350 - SAUK RIVER NEAR FARMING, MINN. (LAT 45 29 56 LONG 094 37 44)												
AUG., 1969 21...	44	0	26	7.3	230	.2	266	17	8	.89	481	34
05270500 - SAUK RIVER NEAR ST. CLOUD, MINN. (LAT 45 33 35 LONG 094 14 00)												
DEC., 1968 10...	157	--	26	7.8	219	.1	100	30	6	.22	495	0
JUNE, 1969 23...	267	160	25	7.6	217	.3	600	25	15	.13	456	30
AUG. 21...	58	18	23	7.9	176	.2	304	17	8	.23	415	38
DATE		BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTIT- UENTS) (MG/L)					
05270230 - SAUK RIVER AT NEW MUNICH, MINN. (LAT 45 37 32 LONG 094 45 39)												
AUG., 1969 20...		275	14	.30	233	24	289					
05270280 - GETCHELL CREEK NEAR NEW MUNICH, MINN. (LAT 45 34 36 LONG 094 45 55)												
AUG., 1969 21...		256	3.2	4.9	240	16	283					
05270350 - SAUK RIVER NEAR FARMING, MINN. (LAT 45 29 56 LONG 094 37 44)												
AUG., 1969 21...		281	13	.50	247	23	293					
05270500 - SAUK RIVER NEAR ST. CLOUD, MINN. (LAT 45 33 35 LONG 094 14 00)												
DEC., 1968 10...		267	8.7	--	249	1	283					
JUNE, 1969 23...		265	8.0	.30	242	16	263					
AUG. 21...		215	9.0	.80	193	26	222					

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

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DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05270230 - SAUK RIVER AT NEW MUNICH, MINN. (LAT 45 37 32 LONG 094 45 39)												
AUG., 1969 20...	13	0	28	1.3	44	.4	297	--	.33	16	52	25
05270280 - GETCHELL CREEK NEAR NEW MUNICH, MINN. (LAT 45 34 36 LONG 094 45 55)												
AUG., 1969 21...	4.0	0	25	22	30	.1	319	--	.01	19	62	21
05270350 - SAUK RIVER NEAR FARMING, MINN. (LAT 45 29 56 LONG 094 37 44)												
AUG., 1969 21...	11	0	26	2.4	38	.3	307	--	.30	14	57	26
05270500 - SAUK RIVER NEAR ST. CLOUD, MINN. (LAT 45 33 35 LONG 094 14 00)												
DEC., 1968 10...	7.8	0	39	1.7	40	.2	295	--	.09	6.8	58	3.9
JUNE, 1969 23...	7.2	0	27	1.2	30	.2	262	--	.05	3.3	56	3.6
AUG. 21...	7.4	0	25	3.4	45	.2	239	--	.09	4.6	40	3.6

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LINITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05273000 - CLEARWATER RIVER NEAR KIMBALL, MINN. (LAT 45 17 54 LONG 094 15 38)												
AUG., 1969 22...	1.1	6	27	8.2	250	.1	330	6	6	.12	472	29
05273498 - CLEARWATER RIVER NEAR CLEARWATER, MINN. (LAT 45 24 40 LONG 094 03 40)												
AUG., 1969 22...	4.1	0	25	8.1	214	.1	245	24	3	.00	450	85
05273600 - SILVER CREEK NEAR HASTY, MINN. (LAT 45 22 37 LONG 093 56 31)												
AUG., 1969 22...	2.2	117	20	7.4	171	.1	286	8	11	.01	342	32
05274100 - ELK RIVER NEAR ST. CLOUD, MINN. (LAT 45 35 14 LONG 094 02 25)												
AUG., 1969 22...	4.4	0	16	8.1	174	.2	236	17	7	.04	366	62
05274700 - ST. FRANCIS RIVER AT SANTIAGO, MINN. (LAT 45 32 30 LONG 093 48 50)												
AUG., 1969 22...	3.6	0	12	8.0	122	.2	327	20	7	.33	309	83
05274900 - ST. FRANCIS RIVER NEAR BIG LAKE, MINN. (LAT 45 23 07 LONG 093 44 02)												
AUG., 1969 22...	34	0	10	8.0	123	.1	306	7	11	.07	255	34

DATE	BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)
05273000 - CLEARWATER RIVER NEAR KIMBALL, MINN. (LAT 45 17 54 LONG 094 15 38)						
AUG., 1969 22...	305	5.4	.40	256	17	283
05273498 - CLEARWATER RIVER NEAR CLEARWATER, MINN. (LAT 45 24 40 LONG 094 03 40)						
AUG., 1969 22...	260	3.2	.00	238	17	264
05273600 - SILVER CREEK NEAR HASTY, MINN. (LAT 45 22 37 LONG 093 56 31)						
AUG., 1969 22...	209	6.8	.40	179	19	200
05274100 - ELK RIVER NEAR ST. CLOUD, MINN. (LAT 45 35 14 LONG 094 02 25)						
AUG., 1969 22...	213	4.8	.90	192	21	218
05274700 - ST. FRANCIS RIVER AT SANTIAGO, MINN. (LAT 45 32 30 LONG 093 48 50)						
AUG., 1969 22...	149	5.0	.80	142	18	174
05274900 - ST. FRANCIS RIVER NEAR BIG LAKE, MINN. (LAT 45 23 07 LONG 093 44 02)						
AUG., 1969 22...	150	1.8	.40	129	24	151

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SDRP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PD- TAS- SIUM (K) (MG/L)
05273000 - CLEARWATER RIVER NEAR KIMBALL, MINN. (LAT 45 17 54 LONG 094 15 38)												
AUG., 1969 22...	4.5	0	17	1.9	35	.1	289	--	.05	14	59	27
05273498 - CLEARWATER RIVER NEAR CLEARWATER, MINN. (LAT 45 24 40 LONG 094 03 40)												
AUG., 1969 22...	4.4	0	29	.1	30	.1	270	--	.01	17	55	25
05273600 - SILVER CREEK NEAR HASTY, MINN. (LAT 45 22 37 LONG 093 56 31)												
AUG., 1969 22...	3.8	0	14	1.9	43	.1	223	--	.01	6.5	39	20
05274100 - ELK RIVER NEAR ST. CLOUD, MINN. (LAT 45 35 14 LONG 094 02 25)												
AUG., 1969 22...	6.2	0	15	4.0	29	.2	235	--	.02	15	50	16
05274700 - ST. FRANCIS RIVER AT SANTIAGO, MINN. (LAT 45 32 30 LONG 093 48 50)												
AUG., 1969 22...	5.1	0	20	3.3	19	.2	190	--	.11	16	38	1.3
05274900 - ST. FRANCIS RIVER NEAR BIG LAKE, MINN. (LAT 45 23 07 LONG 093 44 02)												
AUG., 1969 22...	3.2	0	9.0	1.7	25	.1	160	--	.02	15	35	.7

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LINITY AS CACO3 (MG/L)	FLUD- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLAT1- INUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05275000 - ELK RIVER NEAR BIG LAKE, MINN. (LAT 45 20 02 LONG 093 40 00)												
AUG., 1969												
22...	93	0	13	7.9	144	.1	187	11	7	.06	303	39
SEP.												
11...	116	32	14	7.6	148	.2	304	3	2	.02	308	32
05278340 - NORTH FORK CROW RIVER NEAR DELANO, MINN. (LAT 45 05 22 LONG 093 52 07)												
SEP., 1969												
05...	65	46	29	7.5	247	.2	265	14	35	.24	534	46
05278836 - BUFFALO CREEK NEAR BUFFALO LAKE, MINN. (LAT 44 46 05 LONG 094 32 55)												
SEP., 1969												
10...	3.2	55	72	8.1	276	.5	245	347	50	.54	1180	124
05278950 - BUFFALO CREEK NEAR PLATO, MINN. (LAT 44 48 03 LONG 094 02 24)												
SEP., 1969												
10...	1.5	1660	70	7.7	587	.5	940	0	50	17	5950	860
05280000 - CROW RIVER AT ROCKFORD, MINN. (LAT 45 05 15 LONG 093 44 00)												
OCT., 1968												
01...	23	--	31	7.5	251	.1	1300	65	5	.79	645	150
JUNE, 1969												
26...	960	70	27	7.8	217	.5	300	51	12	.53	567	0
05284001 - RUM RIVER AT VINELAND, MINN. (LAT 46 09 36 LONG 093 46 00)												
AUG., 1969												
20...	121	11	8.4	7.6	99	.2	318	0	12	.00	204	27
		DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)										
		8ICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)						
05275000 - ELK RIVER NEAR BIG LAKE, MINN. (LAT 45 20 02 LONG 093 40 00)												
AUG., 1969												
22...		176	2.0	.50	155	19	173					
SEP.												
11...		181	2.6	.10	151	15	174					
05278340 - NORTH FORK CROW RIVER NEAR DELANO, MINN. (LAT 45 05 22 LONG 093 52 07)												
SEP., 1969												
05...		301	8.6	.00	261	17	322					
05278836 - BUFFALO CREEK NEAR BUFFALO LAKE, MINN. (LAT 44 46 05 LONG 094 32 55)												
SEP., 1969												
10...		336	20	.00	623	15	839					
05278950 - BUFFALO CREEK NEAR PLATO, MINN. (LAT 44 48 03 LONG 094 02 24)												
SEP., 1969												
10...		716	1760	8.6	575	15	3620					
05280000 - CROW RIVER AT ROCKFORD, MINN. (LAT 45 05 15 LONG 093 44 00)												
DCT., 1968												
01...		306	15	--	316	17	399					
JUNE, 1969												
26...		264	17	.30	268	20	346					
05284001 - RUM RIVER AT VINELAND, MINN. (LAT 46 09 36 LONG 093 46 00)												
AUG., 1969												
20...		120	3.0	.00	97	20	119					

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MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LINIT- AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- INUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05284710 - WEST BRANCH RUM RIVER AT PRINCETON, MINN. (LAT 45 34 24 LONG 093 34 47)												
AUG., 1969 20...	7.8	71	13	7.6	144	.2	245	6	25	.03	312	66
05284950 - STANCHFIELD CREEK AT SPRINGVALE, MINN. (LAT 45 36 59 LONG 093 18 06)												
AUG., 1969 22...	3.0	60	23	7.8	240	.2	231	0	21	.39	452	68
05285000 - RUM RIVER AT CAMBRIDGE, MINN. (LAT 45 34 17 LONG 093 14 07)												
AUG., 1969 22...	202	18	11	7.5	120	.2	239	0	10	.06	247	31
05285800 - SEELYE CREEK NEAR ST. FRANCIS, MINN. (LAT 45 21 58 LONG 093 22 20)												
AUG., 1969 21...	2.4	8	15	7.6	170	.2	189	10	28	.05	358	164
05286000 - RUM RIVER NEAR ST. FRANCIS, MINN. (LAT 45 19 40 LONG 093 22 20)												
DEC., 1968 12...	602	--	14	7.7	154	.2	200	7	7	.13	321	60
JUNE, 1969 27...	619	220	11	7.5	126	.2	200	0	8	.08	258	30
05286300 - CEDAR CREEK NEAR ANOKA, MINN. (LAT 45 15 57 LONG 093 21 59)												
AUG., 1969 21...	24	13	12	7.8	167	.1	179	4	22	.04	340	63
DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS)												
DATE BICAR- BONATE (HCO3) (MG/L) CHLO- RIDE (CL) (MG/L) NITRATE (N) (MG/L) HARD- NESS (CA, MG) (MG/L) TEMP- ERATURE (DEG C) (MG/L)												
05284710 - WEST BRANCH RUM RIVER AT PRINCETON, MINN. (LAT 45 34 24 LONG 093 34 47)												
AUG., 1969 20...				176	5.8	.45	151	21	181			
05284950 - STANCHFIELD CREEK AT SPRINGVALE, MINN. (LAT 45 36 59 LONG 093 18 06)												
AUG., 1969 22...				293	7.4	.00	228	19	261			
05285000 - RUM RIVER AT CAMBRIDGE, MINN. (LAT 45 34 17 LONG 093 14 07)												
AUG., 1969 22...				146	3.6	.00	118	22	141			
05285800 - SEELYE CREEK NEAR ST. FRANCIS, MINN. (LAT 45 21 58 LONG 093 22 20)												
AUG., 1969 21...				208	6.2	.24	180	16	206			
05286000 - RUM RIVER NEAR ST. FRANCIS, MINN. (LAT 45 19 40 LONG 093 22 20)												
DEC., 1968 12...				188	3.6	--	161	2	185			
JUNE, 1969 27...				154	3.2	.00	124	19	144			
05286300 - CEDAR CREEK NEAR ANOKA, MINN. (LAT 45 15 57 LONG 093 21 59)												
AUG., 1969 21...				203	3.6	.00	171	20	198			

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SIO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05284710 - WEST BRANCH RUM RIVER AT PRINCETON, MINN. (LAT 45 34 24 LONG 093 34 47)												
AUG., 1969 20...	5.2	0	12	2.0	21	.2	202	--	.02	15	39	2.5
05284950 - STANCHFIELD CREEK AT SPRINGVALE, MINN. (LAT 45 36 59 LONG 093 18 06)												
AUG., 1969 22...	12	0	5.3	.0	48	.3	276	--	.14	12	53	3.4
05285000 - RUM RIVER AT CAMBRIDGE, MINN. (LAT 45 34 17 LONG 093 14 07)												
AUG., 1969 22...	5.2	0	6.3	.0	24	.2	164	--	.03	12	29	2.0
05285800 - SEELYE CREEK NEAR ST. FRANCIS, MINN. (LAT 45 21 58 LONG 093 22 20)												
AUG., 1969 21...	5.2	0	15	1.1	13	.2	227	--	.03	13	47	1.5
05286000 - RUM RIVER NEAR ST. FRANCIS, MINN. (LAT 45 19 40 LONG 093 22 20)												
DEC., 1968 12...	4.9	0	12	.5	30	.2	197	--	.05	13	42	2.0
JUNE, 1969 27...	4.3	0	8.7	.2	30	.2	148	--	.08	6.7	32	1.6
05286300 - CEDAR CREEK NEAR ANOKA, MINN. (LAT 45 15 57 LONG 093 21 59)												
AUG., 1969 21...	4.5	0	11	.0	10	.1	215	--	.02	16	48	2.3

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LITY AS CACO3 (MG/L)	FLUD- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT (PO4) (MG/L)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05286800 - TROTT BROOK NEAR NOWTHEN, MINN. (LAT 45 17 16 LONG 093 25 08)												
AUG., 1969 21...	5.1	8	21	7.6	233	.2	177	0	23	.00	437	128
05292000 - MINNESOTA RIVER AT ORTONVILLE, MINN. (LAT 45 17 44 LONG 096 26 38)												
DEC., 1968 10...	8.0	70	72	7.9	329	.3	200	335	4	1.7	1490	0
05304500 - CHIPPEWA RIVER NEAR MILAN, MINN. (LAT 45 06 39 LONG 095 47 57)												
DEC., 1968 09...	56	380	60	8.0	394	.3	100	146	9	.30	1020	120
05317000 - COTTONWOOD RIVER NEAR NEW ULM, MINN. (LAT 44 17 40 LONG 094 26 40)												
OCT., 1968 16...	1250	180	42	7.4	217	.5	300	240	9	.63	902	150
05317818 - BLUE EARTH R. 4 MILES SOUTH OF BLUE EARTH, MINN (LAT 43 34 22 LONG 094 06 08)												
SEP., 1969 04...	28	19	36	7.9	307	.5	264	102	3	.05	841	103
05318120 - EAST BRANCH BLUE EARTH R. AT BLUE EARTH, MINN. (LAT 43 38 58 LONG 094 06 10)												
SEP., 1969 05...	23	15	30	7.9	276	.4	357	56	4	.56	686	172

DATE	BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA, MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)
05286800 - TROTT BROOK NEAR NOWTHEN , MINN. (LAT 45 17 16 LONG 093 25 08)						
AUG., 1969 21...	284	2.4	.30	230	17	258
05292000 - MINNESOTA RIVER AT ORTONVILLE, MINN. (LAT 45 17 44 LONG 096 26 38)						
DEC., 1968 10...	401	71	--	664	1	1040
05304500 - CHIPPEWA RIVER NEAR MILAN, MINN. (LAT 45 06 39 LONG 095 47 57)						
DEC., 1968 09...	480	8.7	--	540	0	665
05317000 - COTTONWOOD RIVER NEAR NEW ULM, MINN. (LAT 44 17 40 LONG 094 26 40)						
OCT., 1968 16...	265	11	--	458	16	611
05317818 - BLUE EARTH R. 4 MILES SOUTH OF BLUE EARTH, MINN (LAT 43 34 22 LONG 094 06 08)						
SEP., 1969 04...	374	22	4.3	409	21	542
05318120 - EAST BRANCH BLUE EARTH R. AT BLUE EARTH, MINN. (LAT 43 38 58 LONG 094 06 10)						
SEP., 1969 05...	336	21	1.5	332	19	425

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

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DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05286800 - TROTT BROOK NEAR NOWTHEN, MINN. (LAT 45 17 16 LONG 093 25 08)												
AUG., 1969 21...	5.4	0	8.2	1.3	27	.2	277	--	.00	19	57	2.5
05292000 - MINNESOTA RIVER AT ORTONVILLE, MINN. (LAT 45 17 44 LONG 096 26 38)												
DEC., 1968 10...	93	0	415	6.9	300	1.6	1110	--	.57	23	148	11
05304500 - CHIPPEWA RIVER NEAR MILAN, MINN. (LAT 45 06 39 LONG 095 47 57)												
DEC., 1968 09...	22	0	192	.6	130	.4	704	--	.12	20	118	7.1
05317000 - COTTONWOOD RIVER NEAR NEW ULM, MINN. (LAT 44 17 40 LONG 094 26 40)												
OCT., 1968 16...	16	0	256	14	90	.3	661	.87	--	20	115	6.2
05317818 - BLUE EARTH R. 4 MILES SOUTH OF BLUE EARTH, MINN (LAT 43 34 22 LONG 094 06 08)												
SEP., 1969 04...	28	0	117	19	96	.6	553	--	.04	25	104	5.8
05318120 - EAST BRANCH BLUE EARTH R. AT BLUE EARTH, MINN. (LAT 43 38 58 LONG 094 06 10)												
SEP., 1969 05...	24	0	67	6.8	87	.6	435	--	.20	21	83	5.4

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC CONDO- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05318140 - SOUTH CREEK NEAR WINNEBAGO, MINN. (LAT 43 42 33 LONG 094 10 38)												
SEP., 1969 04...	8.2	0	32	7.7	220	.3	167	80	10	.37	601	95
05318190 - CENTER CREEK NEAR HUNTLEY, MINN. (LAT 43 43 50 LONG 094 12 26)												
SEP., 1969 04...	11	0	39	7.8	310	.6	84	140	6	3.8	972	664
05318250 - ELM CREEK NEAR WINNEBAGO, MINN. (LAT 43 45 02 LONG 094 12 32)												
SEP., 1969 04...	14	0	36	7.7	239	.5	105	96	10	.16	679	68
BLUE EARTH RIVER NEAR WINNEBAGO, MINN. (LAT 43 46 10 LONG 094 11 42)												
SEP., 1969 04...	136	0	34	8.1	272	.4	152	101	11	.36	776	168
05318700 - WATONWAN RIVER AT LA SALLE, MINN. (LAT 44 03 53 LONG 094 35 22)												
SEP., 1969 05...	7.8	8	40	7.9	246	.5	240	177	2	.00	813	103
BUTTERFIELD CREEK NEAR LA SALLE, MINN. (LAT 44 03 03 LONG 094 33 28)												
SEP., 1969 04...	2.1	0	39	7.8	241	.4	70	136	4	.09	740	130
DATE			BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA, MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)				
05318140 - SOUTH CREEK NEAR WINNEBAGO, MINN. (LAT 43 42 33 LONG 094 10 38)												
SEP., 1969 04...		268	15	1.8	300	22	389					
05318190 - CENTER CREEK NEAR HUNTLEY, MINN. (LAT 43 43 50 LONG 094 12 26)												
SEP., 1969 04...		378	47	.80	450	19	648					
05318250 - ELM CREEK NEAR WINNEBAGO, MINN. (LAT 43 45 02 LONG 094 12 32)												
SEP., 1969 04...		291	18	1.3	335	20	437					
BLUE EARTH RIVER NEAR WINNEBAGO, MINN. (LAT 43 46 10 LONG 094 11 42)												
SEP., 1969 04...		332	27	2.2	373	20	514					
05318700 - WATONWAN RIVER AT LA SALLE, MINN. (LAT 44 03 53 LONG 094 35 22)												
SEP., 1969 05...		300	15	.34	423	21	554					
BUTTERFIELD CREEK NEAR LA SALLE, MINN. (LAT 44 03 03 LONG 094 33 28)												
SEP., 1969 04...		294	16	.30	377	23	483					

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AN- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05318140 - SDUTH CREEK NEAR WINNEBAGO, MINN. (LAT 43 42 33 LONG 094 10 38)												
SEP., 1969 04... 15		0	86	8.2	81	.4	402	--	.14	29	67	4.3
05318190 - CENTER CREEK NEAR HUNTLEY, MINN. (LAT 43 43 50 LONG 094 12 26)												
SEP., 1969 04... 48		0	174	3.5	161	1.0	657	--	1.3	23	116	6.3
05318250 - ELM CREEK NEAR WINNEBAGO, MINN. (LAT 43 45 02 LONG 094 12 32)												
SEP., 1969 04... 16		0	109	5.7	90	.4	449	--	.07	30	75	36
BLUE EARTH RIVER NEAR WINNEBAGO, MINN. (LAT 43 46 10 LONG 094 11 42)												
SEP., 1969 04... 29		0	124	9.6	100	.7	528	--	.13	28	93	34
05318700 - WATONWAN RIVER AT LA SALLE, MINN. (LAT 44 03 53 LONG 094 35 22)												
SEP., 1969 05... 20		0	199	1.5	92	.4	568	--	.02	23	103	3.8
BUTTERFIELD CREEK NEAR LA SALLE, MINN. (LAT 44 03 03 LONG 094 33 28)												
SEP., 1969 04... 18		0	150	1.2	88	.4	486	--	.04	24	87	3.5

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05318800 - ST. JAMES CREEK NEAR LA SALLE, MINN. (LAT 44 03 03 LONG 094 33 25)												
SEP., 1969 04...	3.5	0	57	7.7	266	.5	144	326	5	2.4	1370	210
05319100 - SOUTH FORK WATONWAN RIVER NEAR MADELIA, MINN. (LAT 44 02 33 LONG 094 27 42)												
SEP., 1969 05...	8.4	15	44	7.9	207	.5	232	187	2	.20	758	62
05319500 - WATONWAN RIVER AT GARDEN CITY, MINN. (LAT 44 02 45 LONG 094 11 38)												
SEP., 1969 05...	70	0	36	7.7	225	.4	145	146	7	.26	784	37
05320070 - LE SUEUR RIVER AT WILTON, MINN. (LAT 44 00 52 LONG 093 31 38)												
SEP., 1969 03...	5.0	28	30	8.0	277	.3	226	47	3	.18	641	116
05320330 - COBB RIVER NEAR GOOD THUNDER, MINN. (LAT 44 02 50 LONG 094 00 00)												
SEP., 1969 05...	7.0	17	31	7.8	276	.5	146	54	7	.08	683	9
05320480 - MAPLE RIVER NEAR RAPIDAN, MINN. (LAT 44 03 54 LONG 094 01 32)												
SEP., 1969 05...	26	0	27	8.0	250	.4	0	57	14	.23	635	26

DATE	BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)
05318800 - ST. JAMES CREEK NEAR LA SALLE, MINN. (LAT 44 03 03 LONG 094 33 25)						
SEP., 1969 04...	324	36	3.5	592	23	1010
05319100 - SOUTH FORK WATONWAN RIVER NEAR MADELIA, MINN. (LAT 44 02 33 LONG 094 27 42)						
SEP., 1969 05...	253	12	.73	395	23	513
05319500 - WATONWAN RIVER AT GARDEN CITY, MINN. (LAT 44 02 45 LONG 094 11 38)						
SEP., 1969 05...	274	30	.80	371	21	523
05320070 - LE SUEUR RIVER AT WILTON, MINN. (LAT 44 00 52 LONG 093 31 38)						
SEP., 1969 03...	338	13	.02	324	18	393
05320330 - COBB RIVER NEAR GOOD THUNDER, MINN. (LAT 44 02 50 LONG 094 00 00)						
SEP., 1969 05...	336	15	.00	330	24	443
05320480 - MAPLE RIVER NEAR RAPIDAN, MINN. (LAT 44 03 54 LONG 094 01 32)						
SEP., 1969 05...	305	19	.20	307	25	410

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AQ- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05318800 - ST. JAMES CREEK NEAR LA SALLE, MINN. (LAT 44 03 03 LONG 094 33 25)												
SEP., 1969 04... 106		0	462	16	233	1.9	1070	--	.82	21	144	57
05319100 - SOUTH FORK WATONWAN RIVER NEAR WADELIA, MINN. (LAT 44 02 33 LONG 094 27 42)												
SEP., 1969 05... 15		0	201	3.2	93	.3	536	--	.08	21	86	4.4
05319500 - WATONWAN RIVER AT GARDEN CITY, MINN. (LAT 44 02 45 LONG 094 11 38)												
SEP., 1969 05... 30		0	170	3.5	147	.7	538	--	.10	24	89	36
05320070 - LE SUEUR RIVER AT WILTON, MINN. (LAT 44 00 52 LONG 093 31 38)												
SEP., 1969 03... 16		0	58	.1	69	.4	425	--	.07	23	81	4.5
05320330 - COBB RIVER NEAR GOOD THUNDER, MINN. (LAT 44 02 50 LONG 094 00 00)												
SEP., 1969 05... 25		0	92	.2	120	.6	456	--	.05	28	82	31
05320480 - MAPLE RIVER NEAR RAPIDAN, MINN. (LAT 44 03 54 LONG 094 01 32)												
SEP., 1969 05... 23		0	82	.7	106	.6	417	--	.09	24	78	27

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC CONO- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05320500 - LE SUEUR RIVER NEAR RAPIDAN, MINN. (LAT 44 06 40 LONG 094 02 28)												
OCT., 1968												
17...	5230	580	18	7.4	190	.4	400	45	23	.83	485	100
SEP., 1969												
05...	52	0	30	8.0	231	.4	106	35	10	.02	605	10
LE SUEUR CREEK AT LE SUEUR, MINN. (LAT 44 28 48 LONG 093 53 47)												
SEP., 1969												
12...	1.9	17	27	8.0	298	.2	33	37	3	.08	630	373
RUSH R. 3 MI. N. OF RUSH R. ON CO. RD. 17, MINN 0 (LAT 44 27 58 LONG 094 02 56)												
SEP., 1969												
12...	.50	6	60	8.1	284	.6	275	223	13	.13	1120	69
SOUTH BRANCH RUSH RIVER AT RUSH RIVER, MINN. (LAT 44 30 53 LONG 094 02 58)												
SEP., 1969												
12...	.24	242	56	7.5	221	.5	329	229	19	.02	864	180
05327000 - HIGH ISLAND CREEK NEAR HENDERSON, MINN. (LAT 44 34 18 LONG 093 55 22)												
SEP., 1969												
12...	1.1	4	47	8.0	380	.3	0	53	6	.11	929	245
05329900 - BEVENS CREEK 3 MILES NORTHWEST OF JORDAN, MINN. 0 (LAT 44 41 28 LONG 093 40 39)												
SEP., 1969												
12...	1.9	0	31	7.8	283	.2	0	50	4	.01	650	75
					BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIOS (SUM OF CONSTI- TUENTS) (MG/L)		
05320500 - LE SUEUR RIVER NEAR RAPIDAN, MINN. (LAT 44 06 40 LONG 094 02 28)												
OCT., 1968												
17...		232	10	--			235	15	302			
SEP., 1969												
05...		282	18	.16			266	25	387			
LE SUEUR CREEK AT LE SUEUR, MINN. (LAT 44 28 48 LONG 093 53 47)												
SEP., 1969												
12...		363	7.8	.02			335	19	404			
RUSH R. 3 MI. N. OF RUSH R. ON CO. RD. 17, MINN 0 (LAT 44 27 58 LONG 094 02 56)												
SEP., 1969												
12...		346	68	.04			507	20	770			
SOUTH BRANCH RUSH RIVER AT RUSH RIVER, MINN. (LAT 44 30 53 LONG 094 02 58)												
SEP., 1969												
12...		270	36	.06			450	23	574			
05327000 - HIGH ISLAND CREEK NEAR HENDERSON, MINN. (LAT 44 34 18 LONG 093 55 22)												
SEP., 1969												
12...		464	3.8	.78			434	22	606			
05329900 - BEVENS CREEK 3 MILES NORTHWEST OF JORDAN, MINN. 0 (LAT 44 41 28 LONG 093 40 39)												
SEP., 1969												
12...		345	7.8	.84			333	17	415			

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05320500 - LE SUEUR RIVER NEAR RAPIDAN, MINN. (LAT 44 06 40 LONG 094 02 28)												
OCT., 1968 17...	6.0	0	41	19	50	.2	324	.93	--	23	64	4.6
SEP., 1969 05...	28	0	83	.7	119	.7	389	--	.01	26	58	30
LE SUEUR CREEK AT LE SUEUR, MINN. (LAT 44 28 48 LONG 093 53 47)												
SEP., 1969 12...	11	0	59	.1	55	.3	403	--	.04	26	90	27
RUSH R. 3 MI. N. OF RUSH R. ON CO. RD. 17, MINN O (LAT 44 27 58 LONG 094 02 56)												
SEP., 1969 12...	68	0	258	.2	185	1.3	807	--	.06	32	105	60
SOUTH BRANCH RUSH RIVER AT RUSH RIVER, MINN. (LAT 44 30 53 LONG 094 02 58)												
SEP., 1969 12...	21	0	204	.3	94	.4	597	--	.02	28	89	5.9
05327000 - HIGH ISLAND CREEK NEAR HENDERSON, MINN. (LAT 44 34 18 LONG 093 55 22)												
SEP., 1969 12...	52	0	144	3.5	289	1.1	605	--	.04	26	96	47
05329900 - BEVENS CREEK 3 MILES NORTHWEST OF JORDAN, MINN. O (LAT 44 41 28 LONG 093 40 39)												
SEP., 1969 12...	12	0	76	3.7	76	.3	416	--	.01	27	82	31

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LITY AS CACO ₃ (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLD- R (PLATI- INUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
SAND CREEK AT MOUTH, 1 MILE SE OF CARVER, MINN. 0 (LAT 44 44 52 LONG 093 36 54)												
SEP., 1969 12...	4.0	0	34	7.9	314	.2	79	31	3	.38	670	372
CARVER CREEK AT CARVER, MINN. (LAT 44 45 34 LONG 093 37 27)												
SEP., 1969 12...	4.1	17	32	7.5	294	.2	88	26	2	.04	638	83
PURGATORY CREEK AT MOUTH NEAR EDEN PRAIRIE, MINN 0 (LAT 44 48 27 LONG 093 24 34)												
SEP., 1969 15...	2.7	30	29	7.8	281	.2	81	14	4	.02	561	89
CREDIT RIVER AT SAVAGE, MINN. (LAT 44 47 14 LONG 093 20 32)												
SEP., 1969 15...	1.2	0	29	7.9	256	.2	51	30	2	1.3	552	48
NINE MILE CREEK NR. BLOOMINGTON, AT MOUTH, MINN 0 (LAT 44 47 37 LONG 093 19 21)												
SEP., 1969 15...	5.9	4	30	7.6	269	.2	81	37	5	.06	639	86

DATE	BICAR- BONATE (HCO ₃) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA, MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)
SAND CREEK AT MOUTH, 1 MILE SE OF CARVER, MINN. 0 (LAT 44 44 52 LONG 093 36 54)						
SEP., 1969 12...	383	9.8	2.1	345	20	412
CARVER CREEK AT CARVER, MINN. (LAT 44 45 34 LONG 093 37 27)						
SEP., 1969 12...	359	10	.35	320	24	401
PURGATORY CREEK AT MOUTH NEAR EDEN PRAIRIE, MINN 0 (LAT 44 48 27 LONG 093 24 34)						
SEP., 1969 15...	343	7.0	.41	295	18	333
CREDIT RIVER AT SAVAGE, MINN. (LAT 44 47 14 LONG 093 20 32)						
SEP., 1969 15...	312	10	1.6	286	23	331
NINE MILE CREEK NR. BLOOMINGTON, AT MOUTH, MINN 0 (LAT 44 47 37 LONG 093 19 21)						
SEP., 1969 15...	328	36	1.3	306	24	383

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

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DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
SAND CREEK AT MOUTH, 1 MILE SE OF CARVER, MINN. 0 (LAT 44 44 52 LONG 093 36 54)												
SEP., 1969 12... 13		0	47	9.4	74	.3	410	--	.15	24	82	34
CARVER CREEK AT CARVER, MINN. (LAT 44 45 34 LONG 093 37 27)												
SEP., 1969 12... 17		0	55	1.5	94	.4	403	--	.03	28	76	32
PURGATORY CREEK AT MOUTH NEAR EDEN PRAIRIE, MINN 0 (LAT 44 48 27 LONG 093 24 34)												
SEP., 1969 15... 5.5		0	23	1.8	35	.1	339	--	.01	25	70	2.7
CREDIT RIVER AT SAVAGE, MINN. (LAT 44 47 14 LONG 093 20 32)												
SEP., 1969 15... 6.5		0	30	6.9	33	.2	331	--	.44	22	67	4.7
NINE MILE CREEK NR. BLOOMINGTON, AT MOUTH, MINN 0 (LAT 44 47 37 LONG 093 19 21)												
SEP., 1969 15... 19		0	29	5.6	50	.5	408	--	.03	24	73	30

DATE	DIS- CHARGE (CFS)	SILICA (SiO ₂) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	DIS- SOLVED IRON (FE) (UG/L)	DIS- SOLVED MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAG- NE- SIUM (MG)	SODIUM (NA) (MG/L)	PO- TAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO ₃) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	ALKA- LITY AS CACO ₃ (MG/L)
05331000 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20)												
NOV., 1968												
12... 14800		15	200	100	20	70	24	9.3	3.4	239	0	196
JUNE, 1969												
04... 18900		14	400	70	20	67	27	12	4.0	248	0	203

DATE	DIS- SOLVED SOLIDS (TONS PER DAY)	HARD- NESS (CA,MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	PH	TEMP- ERATURE (DEG C)	COLOR (PLATI- NUM- COBALT UNITS)	ARSENIC (AS) (UG/L)	CAD- MIUM (CO) (UG/L)
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05331000 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20)

NOV., 1968											
12... 13900		274	78	7	.2	531	7.4	4	23	0	0
JUNE, 1969											
04... 19000		278	75	8	.3	557	7.8	18	17	10	0

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG)	PH	ALKA- LITY AS CACO ₃ (MG/L)	FLUD- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
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05336700 - KETTLE RIVER BELOW SANDSTONE, MINN. (LAT 46 23 24 LONG 092 52 56)

OCT., 1968												
03...	486	1300	5.3	--	53	.2	1200	8	100	.15	128	110

05338500 - SNAKE RIVER NEAR PINE CITY, MINN. (LAT 45 50 30 LONG 092 56 00)

OCT., 1968													
18...	4390	540	5.4	7.3	55	.3	100	-	9	90	.27	129	100

05353800 - STRAIGHT RIVER NEAR FARIBAULT, MINN. (LAT 44 15 29 LONG 093 13 51)

OCT., 1968												
08...	264	50	31	7.6	291	.4	300	73	18	.86	694	130

DATE	BICAR- BONATE (HCO ₃) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARD- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTIT- UENTS) (MG/L)
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05336700 - KETTLE RIVER BELOW SANDSTONE, MINN. (LAT 46 23 24 LONG 092 52 56)

OCT., 1968						
03... 65	3.0	--	61	19	83	

05338500 - SNAKE RIVER NEAR PINE CITY, MINN. (LAT 45 50 30 LONG 092 56 00)

OCT., 1968						
18... 67	2.7	--	64	13	82	

05353800 - STRAIGHT RIVER NEAR FARIBAULT, MINN. (LAT 44 15 29 LONG 093 13 51)

OCT., 1968						
08... 354	18	--	363	11	430	

DATE	SULFATE (SO ₄) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	NITRATE (N) (MG/L)	NITRATE (NO ₃) (MG/L)	PHOS- PHATE (PO ₄) (MG/L)	ORTHO PHOS- PHATE (PO ₄) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	BORON (B) (UG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)
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05331000 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20)

NOV., 1968												
12...	74	9.2	.7	--	8.9	.29	.28	--	60	347	334	.47
JUNE, 1969												
04...	90	9.8	.5	1.0	4.6	--	.19	.07	60	373	352	.51

TOTAL
DISSOLVED
CHRO-

DATE	MIUM (CR) (UG/L)	COBALT (CO) (UG/L)	COPPER (CU) (UG/L)	LEAD (PB) (UG/L)	LITHIUM (LI) (UG/L)	MOLY- BDENUM (MO) (UG/L)	NICKEL (NI) (UG/L)	SELE- NIUM (SE) (UG/L)	STRON- TIUM (SR) (UG/L)	VANA- DIUM (V) (UG/L)	ZINC (ZN) (UG/L)
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05331000 - MISSISSIPPI RIVER AT ST. PAUL, MINN. (LAT 44 56 40 LONG 093 05 20)

NOV., 1968											
12...	0	0	0	0	0	8	0	0	280	2	0
JUNE, 1969											
04...	0	0	10	0	30	0	0	10	340	1	10

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO ₃) (MG/L)	SULFATE (SO ₄) (MG/L)	NITRATE (NO ₃) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO ₄) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO ₂) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
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05336700 - KETTLE RIVER BELOW SANDSTONE, MINN. (LAT 46 23 24 LONG 092 52 56)

OCT., 1968												
03...	3.0	0	7.7	1.1	40	.2	112	1.4	--	11	16	1.8

05338500 - SNAKE RIVER NEAR PINE CITY, MINN. (LAT 45 50 30 LONG 092 56 00)

OCT., 1968												
18...	2.4	0	9.0	1.2	50	.1	115	.33	--	8.3	17	2.5

05353800 - STRAIGHT RIVER NEAR FARIBAULT, MINN. (LAT 44 15 29 LONG 093 13 51)

OCT., 1968												
08...	9.1	0	61	15	50	.2	463	.99	--	23	95	3.4

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

DATE	DIS- CHARGE (CFS)	DIS- SOLVED IRON (FE) (UG/L)	MAG- NE- SIUM (MG) (MG/L)	PH (UNITS)	ALKA- LITY AS CACO3 (MG/L)	FLUO- RIDE (F) (MG/L)	DIS- SOLVED ALUM- INUM (AL) (UG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	COLOR (PLATI- NUM- COBALT UNITS)	ORTHO PHOS- PHATE (PO4) (MG/L)	SPECI- FIC COND- UCTANCE (MICRO- MHOS)	DIS- SOLVED MAN- GANESE (MN) (UG/L)
05373000 - SOUTH FORK ZUMBRO RIVER NEAR ROCHESTER, MINN. (LAT 44 04 00 LONG 092 27 55)												
OCT., 1968 11...	259	50	16	7.4	168	.1	800	51	15	1.8	515	20
05378500 - MISSISSIPPI RIVER AT WINONA, MINN. (LAT 44 03 20 LONG 091 38 15)												
APR., 1969 19...	215000	140	13	7.5	119	.2	900	32	10	.12	299	30
05395500 - SOUTH FORK ROOT RIVER NEAR HOUSTON, MINN. (LAT 43 44 00 LONG 091 34 00)												
OCT., 1968 08...	76	10	27	7.6	259	.1	700	8	2	.19	491	50
05457000 - CEDAR RIVER NEAR AUSTIN, MINN. (LAT 43 38 10 LONG 092 58 20)												
OCT., 1968 10...	676	110	25	7.5	223	.3	300	92	9	1.2	676	130
05476000 - WEST FORK DES MOINES RIVER AT JACKSON, MINN. (LAT 43 37 10 LONG 094 59 10)												
NOV., 1968 23...	782	20	54	8.0	253	.6	200	277	8	.31	1010	100
APR., 1969 25...	3360	10	25	8.3	147	.5	100	139	13	.12	543	0
JUNE 24...	205	90	48	7.7	242	.7	200	228	10	.11	878	60
DATE		BICAR- BONATE (HCO3) (MG/L)	CHLO- RIDE (CL) (MG/L)	NITRATE (N) (MG/L)	HARO- NESS (CA,MG) (MG/L)	TEMP- ERATURE (DEG C)	DIS- SOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)					
05373000 - SOUTH FORK ZUMBRO RIVER NEAR ROCHESTER, MINN. (LAT 44 04 00 LONG 092 27 55)												
OCT., 1968 11...		205	31	--	218	11	301					
05378500 - MISSISSIPPI RIVER AT WINONA, MINN. (LAT 44 03 20 LONG 091 38 15)												
APR., 1969 18...		145	6.1	.20	151	9	179					
05385500 - SOUTH FORK ROOT RIVER NEAR HOUSTON, MINN. (LAT 43 44 00 LONG 091 34 00)												
OCT., 1968 08...		316	2.3	--	267	11	280					
05457000 - CEDAR RIVER NEAR AUSTIN, MINN. (LAT 43 38 10 LONG 092 58 20)												
OCT., 1968 10...		272	31	--	315	10	411					
05476000 - WEST FORK DES MOINES RIVER AT JACKSON, MINN. (LAT 43 37 10 LONG 094 59 10)												
NOV., 1968 23...		309	21	--	529	3	699					
APR., 1969 25...		180	8.8	2.2	286	12	362					
JUNE 24...		295	16	1.0	470	17	600					

DATE	SODIUM (NA) (MG/L)	CAR- BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	NITRATE (NO3) (MG/L)	BORON (B) (UG/L)	SODIUM AD- SORP- TION RATIO	DIS- SOLVED SOLIDS (RESI- DUE AT 180 C) (MG/L)	PHOS- PHATE (PO4) (MG/L)	DIS- SOL- VED- PHOS- PHORUS (P) (MG/L)	SILICA (SiO2) (MG/L)	CAL- CIUM (CA) (MG/L)	PO- TAS- SIUM (K) (MG/L)
05373000 - SOUTH FORK ZUMBRO RIVER NEAR ROCHESTER, MINN. (LAT 44 04 00 LONG 092 27 55)												
OCT., 1968 11... 19		0	40	15	50	.6	324	1.8	--	12	61	5.0
05378500 - MISSISSIPPI RIVER AT WINONA, MINN. (LAT 44 03 20 LONG 091 38 15)												
APR., 1969 18... 4.4		0	29	1.1	50	.2	207	--	.09	9.2	40	3.7
05385500 - SOUTH FORK ROOT RIVER NEAR HOUSTON, MINN. (LAT 43 44 00 LONG 091 34 00)												
OCT., 1968 08... 2.3		0	12	3.0	0	.1	277	.24	--	12	63	1.6
05457000 - CEDAR RIVER NEAR AUSTIN, MINN. (LAT 43 38 10 LONG 092 58 20)												
OCT., 1968 10... 16		0	69	27	30	.4	454	1.3	--	19	85	4.4
05476000 - WEST FORK DES MOINES RIVER AT JACKSON, MINN. (LAT 43 37 10 LONG 094 59 10)												
NOV., 1968 23... 21		0	286	18	70	.4	747	.35	--	18	124	5.6
APR., 1969 25... 7.9		0	129	9.6	60	.2	403	--	.07	13	73	4.9
JUNE 24... 19		0	236	4.4	90	.4	624	--	.04	17	110	3.2

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-2860. RUM RIVER NEAR ST. FRANCIS, MINN.

SPECIFIC CONDUCTANCE (MICROMHOS AT 25°C), MARCH TO SEPTEMBER 1969

DAY	FEBRUARY			MARCH			APRIL			MAY		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
1.....	--	--	--	--	--	--	315	315	315	220	200	210
2.....	--	--	--	--	--	--	325	315	325	205	185	190
3.....	--	--	--	--	--	--	325	325	325	195	185	190
4.....	--	--	--	--	--	--	325	300	320	205	195	200
5.....	--	--	--	--	--	--	300	290	300	205	195	200
6.....	--	--	--	--	--	--	290	270	280	200	200	200
7.....	--	--	--	270	270	270	270	245	260	200	200	200
8.....	--	--	--	290	195	280	245	220	235	200	200	200
9.....	--	--	--	290	290	290	270	200	210	210	200	205
10.....	--	--	--	290	290	290	200	180	190	220	210	210
11.....	--	--	--	290	270	280	180	165	170	245	220	225
12.....	--	--	--	300	300	300	170	165	170	245	245	245
13.....	--	--	--	300	300	300	180	170	177	265	245	260
14.....	--	--	--	300	300	300	180	170	177	275	260	270
15.....	--	--	--	300	245	285	200	170	185	290	275	280
16.....	--	--	--	300	300	300	215	200	210	315	285	295
17.....	--	--	--	300	300	300	255	215	240	300	280	285
18.....	--	--	--	305	265	295	255	255	255	305	270	285
19.....	--	--	--	--	--	--	275	255	270	270	260	265
20.....	--	--	--	--	--	--	275	245	265	270	245	255
21.....	--	--	--	--	--	--	245	235	245	290	205	255
22.....	--	--	--	--	--	--	235	235	235	205	205	205
23.....	--	--	--	--	--	--	235	235	235	210	205	205
24.....	--	--	--	--	--	--	235	235	235	210	210	210
25.....	--	--	--	--	--	--	235	235	235	210	210	210
26.....	--	--	--	--	--	--	200	200	200	245	210	230
27.....	--	--	--	--	--	--	220	200	210	245	235	240
28.....	--	--	--	--	--	--	230	210	220	235	225	230
29.....	--	--	--	--	--	--	240	230	235	225	225	225
30.....	--	--	--	--	--	--	230	215	220	230	225	230
31.....	--	--	--	--	--	--	--	--	--	240	230	240
AVERAGE	--	--	--	--	--	--	243	230	238	238	223	230
DAY	JUNE			JULY			AUGUST			SEPTEMBER		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
1.....	235	220	230	340	325	335	--	--	--	--	--	--
2.....	245	220	225	335	335	335	--	--	--	--	--	--
3.....	290	245	260	335	295	310	--	--	--	--	--	--
4.....	280	235	260	295	250	270	--	--	--	--	--	--
5.....	235	215	230	260	230	245	--	--	--	--	--	--
6.....	260	225	240	230	230	230	325	300	305	--	--	--
7.....	240	210	230	230	230	230	300	290	295	--	--	--
8.....	210	210	210	245	220	235	290	280	280	--	--	--
9.....	210	210	210	275	245	255	280	280	280	--	--	--
10.....	210	210	210	275	267	275	290	280	280	--	--	--
11.....	210	210	210	320	267	290	290	290	290	--	--	--
12.....	210	210	210	350	315	325	290	290	290	--	--	--
13.....	235	210	215	350	350	350	290	290	290	--	--	--
14.....	245	235	240	370	350	365	290	290	290	--	--	--
15.....	245	220	240	400	350	375	290	280	280	--	--	--
16.....	230	220	225	425	380	395	280	265	280	--	--	--
17.....	230	210	215	380	380	380	265	255	255	--	--	--
18.....	245	210	225	390	355	380	260	255	260	--	--	--
19.....	260	220	245	375	350	355	265	250	265	--	--	--
20.....	220	205	215	350	310	325	325	250	315	280	280	280
21.....	205	205	205	315	315	315	285	265	280	280	280	280
22.....	205	205	205	325	300	315	275	265	270	290	280	280
23.....	205	205	205	325	300	305	285	265	280	290	290	290
24.....	205	205	205	300	300	300	285	285	285	290	290	290
25.....	205	200	200	--	--	--	--	--	--	295	290	290
26.....	200	195	200	--	--	--	--	--	--	295	290	295
27.....	195	195	195	--	--	--	--	--	--	290	290	290
28.....	265	195	255	--	--	--	--	--	--	290	290	290
29.....	300	265	285	--	--	--	--	--	--	290	290	290
30.....	325	300	315	--	--	--	--	--	--	300	290	300
31.....	--	--	--	--	--	--	--	--	--	--	--	--
AVERAGE	235	217	227	324	302	312	--	--	--	--	--	--

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

4-0187.5 ST. LOUIS RIVER AT FORBES, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	5.0	--	--	--	--	--	8.0	20.0	--	--	--
2	--	4.0	--	--	--	--	--	10.0	17.0	--	--	--
3	--	5.0	--	--	--	1.0	1.0	10.0	16.0	--	--	--
4	--	--	--	--	--	--	--	10.0	16.0	--	--	--
5	--	--	--	--	--	--	--	11.0	16.0	--	--	--
6	--	--	--	--	--	--	--	10.0	17.0	--	--	--
7	--	2.0	--	--	--	--	--	10.0	17.0	--	--	--
8	--	2.0	--	--	--	--	0.0	11.0	17.0	--	--	--
9	10.0	2.0	--	--	--	--	0.0	11.0	17.0	--	--	--
10	9.0	1.0	--	--	--	--	0.0	11.0	17.0	--	--	--
11	9.0	1.0	--	--	--	--	1.0	--	--	--	--	17.0
12	9.0	2.0	--	--	--	--	1.0	--	--	--	--	--
13	13.0	1.0	--	--	--	--	2.0	11.0	--	--	--	--
14	12.0	0.0	--	--	--	--	6.0	--	--	--	--	--
15	16.0	0.0	--	--	--	--	4.0	15.0	--	--	--	--
16	13.0	1.0	--	--	--	--	3.0	14.0	15.0	--	--	--
17	11.0	0.0	--	--	--	--	3.0	12.0	17.0	--	--	--
18	9.0	0.0	--	--	--	--	3.0	12.0	18.0	--	--	--
19	9.0	--	--	--	--	--	4.0	12.0	17.0	--	--	--
20	--	0.0	--	--	--	--	3.0	13.0	17.0	--	--	--
21	7.0	--	--	--	--	--	3.0	12.0	16.0	--	--	--
22	7.0	--	--	--	--	--	2.0	12.0	15.0	--	--	--
23	6.0	--	--	--	--	--	2.0	13.0	19.0	--	--	--
24	5.0	--	--	--	--	--	3.0	15.0	19.0	--	--	--
25	6.0	--	--	--	--	--	3.0	15.0	--	--	--	--
26	7.0	--	--	--	--	--	8.0	15.0	--	--	--	--
27	6.0	--	1.0	--	--	--	7.0	18.0	--	--	--	13.0
28	5.0	--	--	1.0	--	--	8.0	19.0	--	--	--	--
29	--	--	--	--	--	--	9.0	21.0	--	--	--	--
30	6.0	--	--	--	--	--	8.0	21.0	--	--	--	11.0
31	7.0	--	--	--	--	--	--	20.0	--	--	--	--
AVG	--	--	--	--	--	--	3.5	13.2	--	--	--	--

MAXIMUM VALUE = 21.0

MINIMUM VALUE = 0.0

5-0405. PELICAN RIVER NEAR FERGUS FALLS, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	--	--	--	--	--	--	14.0	12.0	20.0	--	--
2	12.0	--	--	--	--	--	--	15.0	13.0	22.0	--	--
3	--	--	--	--	--	--	--	13.0	16.0	--	--	--
4	--	--	--	--	--	--	--	14.0	17.0	20.0	--	--
5	--	--	--	--	--	--	--	16.0	18.0	--	--	--
6	--	--	--	--	--	--	--	18.0	18.0	--	--	--
7	--	--	--	--	--	--	--	16.0	17.0	--	--	--
8	--	1.0	--	--	--	--	--	14.0	19.0	19.0	--	--
9	--	--	0.0	--	--	--	1.0	13.0	22.0	--	--	--
10	--	--	--	--	--	--	2.0	12.0	19.0	--	--	14.0
11	--	--	--	--	--	--	4.0	12.0	18.0	--	--	--
12	--	--	--	--	--	--	3.0	13.0	--	--	--	--
13	--	--	--	0.0	--	--	8.0	16.0	--	--	--	--
14	--	--	--	--	--	--	12.0	19.0	18.0	--	--	--
15	--	--	--	--	--	--	10.0	19.0	17.0	--	--	--
16	--	--	--	--	--	--	10.0	14.0	20.0	--	--	--
17	--	--	--	--	1.0	--	11.0	13.0	21.0	--	--	--
18	--	--	--	--	--	--	11.0	13.0	19.0	--	--	--
19	--	--	--	--	--	--	10.0	14.0	19.0	--	--	--
20	--	--	--	--	--	--	12.0	15.0	18.0	--	--	--
21	--	--	--	--	--	--	12.0	13.0	15.0	--	--	--
22	--	--	--	--	--	--	12.0	13.0	14.0	--	--	--
23	--	--	--	--	--	--	13.0	15.0	16.0	--	--	--
24	--	--	--	--	--	--	14.0	16.0	18.0	--	--	--
25	--	--	--	--	--	--	15.0	16.0	17.0	--	--	--
26	--	--	--	--	--	--	16.0	20.0	23.0	--	--	--
27	--	--	--	--	--	--	10.0	24.0	19.0	--	--	--
28	--	--	--	--	--	--	12.0	24.0	21.0	24.0	--	--
29	--	--	--	--	--	--	11.0	20.0	20.0	--	--	--
30	--	--	--	--	--	--	12.0	19.0	19.0	--	--	--
31	--	--	--	--	--	--	--	18.0	--	--	--	--
AVG	--	--	--	--	--	--	10.0	15.8	17.9	--	--	--

MAXIMUM VALUE = 24.0

MINIMUM VALUE = 0.0

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

5-0875. MIDDLE RIVER AT ARGYLE, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	--	--	--	--	--	--	15.0	18.0	19.0	--	--
2	--	--	--	--	--	--	--	15.0	19.0	19.0	--	--
3	--	--	--	--	--	--	--	16.0	19.0	20.0	--	--
4	--	--	--	--	--	--	--	16.0	20.0	19.0	--	--
5	--	--	0.0	--	--	--	--	16.0	19.0	20.0	--	--
6	--	--	--	--	--	--	--	--	19.0	20.0	--	--
7	--	--	--	--	--	--	--	16.0	19.0	20.0	--	--
8	--	--	--	--	--	--	3.0	14.0	20.0	20.0	--	--
9	--	--	--	--	--	--	4.0	15.0	19.0	20.0	--	--
10	--	--	--	--	--	--	2.0	15.0	19.0	--	--	--
11	--	--	--	--	--	--	2.0	15.0	19.0	--	--	--
12	--	--	--	--	--	--	2.0	16.0	17.0	--	--	--
13	--	--	--	--	--	--	3.0	17.0	17.0	--	--	--
14	--	--	--	--	--	--	3.0	20.0	19.0	--	--	--
15	--	--	--	--	--	--	3.0	17.0	19.0	--	--	--
16	--	--	--	--	--	--	3.0	16.0	18.0	--	--	--
17	--	--	--	--	--	--	3.0	17.0	19.0	--	--	--
18	--	--	--	--	--	--	4.0	17.0	18.0	--	--	--
19	--	--	--	--	--	1.0	5.0	16.0	19.0	--	--	--
20	--	--	--	--	--	--	3.0	17.0	17.0	--	--	--
21	--	--	--	--	--	--	3.0	17.0	18.0	--	--	--
22	--	--	--	--	--	--	5.0	18.0	--	--	--	--
23	--	--	--	--	--	--	11.0	18.0	--	--	--	--
24	--	--	--	--	--	--	12.0	16.0	--	--	--	--
25	--	--	--	--	--	--	11.0	17.0	--	--	--	--
26	--	--	--	--	--	--	12.0	19.0	20.0	--	--	--
27	--	--	--	--	--	--	11.0	20.0	19.0	--	--	--
28	--	--	--	--	--	--	12.0	18.0	19.0	--	--	--
29	--	--	--	--	--	--	13.0	18.0	20.0	--	--	--
30	--	--	--	--	--	--	13.0	17.0	20.0	--	--	--
31	6.0	--	--	--	--	--	--	19.0	--	--	--	--
AVG	--	--	--	--	--	--	6.2	16.7	18.8	--	--	--

MAXIMUM VALUE =20.0

MINIMUM VALUE = 0.0

5-2440. CROW WING RIVER AT NIMROD, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	--	--	--	--	--	--	13.0	--	--	--	--
2	13.0	6.0	--	--	--	--	--	13.0	14.0	--	--	25.0
3	--	--	--	--	--	--	--	15.0	--	--	--	--
4	12.0	6.0	--	--	--	--	--	11.0	19.0	23.0	--	--
5	--	5.0	--	--	--	--	3.0	15.0	--	--	--	--
6	12.0	--	--	--	--	--	2.0	14.0	21.0	18.0	25.0	--
7	--	3.0	--	--	--	--	7.0	15.0	--	--	--	--
8	13.0	--	--	--	--	--	5.0	14.0	21.0	21.0	--	--
9	--	2.0	--	--	--	--	3.0	15.0	17.0	--	--	--
10	12.0	--	--	--	--	--	7.0	13.0	18.0	27.0	--	--
11	--	2.0	--	--	--	--	9.0	11.0	--	--	--	--
12	--	--	--	--	--	--	9.0	14.0	18.0	--	--	--
13	--	1.0	--	0.0	--	--	12.0	17.0	--	--	--	--
14	16.0	--	--	--	--	--	11.0	20.0	--	--	27.0	--
15	--	--	--	--	--	--	8.0	19.0	--	26.0	--	--
16	12.0	--	--	--	--	--	9.0	12.0	--	--	--	--
17	--	--	--	--	--	--	10.0	16.0	--	24.0	--	--
18	9.0	--	1.0	--	--	--	11.0	18.0	--	--	19.0	--
19	--	--	--	--	--	--	12.0	17.0	--	24.0	--	--
20	8.0	--	--	--	--	--	10.0	14.0	--	--	--	--
21	--	--	--	--	--	--	11.0	--	--	25.0	--	--
22	9.0	--	--	--	--	--	12.0	--	--	--	--	16.0
23	--	--	--	--	--	--	14.0	18.0	--	24.0	--	--
24	5.0	--	--	--	--	1.0	15.0	--	--	--	--	--
25	--	--	--	--	1.0	--	14.0	18.0	17.0	26.0	--	--
26	9.0	--	--	--	--	--	17.0	--	23.0	--	--	--
27	--	--	--	--	--	--	11.0	25.0	--	22.0	--	--
28	8.0	--	--	--	--	--	12.0	--	23.0	--	--	--
29	--	--	--	--	--	--	14.0	25.0	23.0	26.0	--	--
30	7.0	--	--	--	--	--	13.0	--	--	--	--	--
31	--	--	--	--	--	--	--	18.0	--	23.0	--	--
AVG	--	--	--	--	--	--	10.0	16.0	--	--	--	--

MAXIMUM VALUE =27.0

MINIMUM VALUE = 0.0

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

291

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

5-3150. REDWOOD RIVER AT MARSHALL, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16.0	8.0	--	--	--	--	--	--	--	17.0	22.0	--
2	--	--	--	--	--	--	--	--	16.0	13.0	21.0	--
3	--	--	--	--	--	--	--	--	12.0	21.0	--	--
4	--	--	--	--	--	--	1.0	--	21.0	13.0	22.0	--
5	--	--	--	--	--	--	2.0	--	22.0	15.0	22.0	--
6	--	--	--	--	--	--	--	--	18.0	--	28.0	20.0
7	--	--	--	--	--	--	3.0	--	19.0	18.0	25.0	--
8	--	--	--	--	--	--	2.0	--	--	17.0	21.0	--
9	--	--	--	--	--	--	3.0	--	19.0	20.0	--	--
10	--	--	--	--	--	--	3.0	--	18.0	22.0	--	--
11	--	--	--	--	--	--	4.0	--	15.0	22.0	24.0	--
12	--	1.0	--	--	--	--	7.0	--	13.0	--	23.0	--
13	--	1.0	--	--	--	--	8.0	--	13.0	--	22.0	--
14	--	--	--	--	--	--	10.0	--	13.0	29.0	25.0	--
15	--	--	--	--	--	--	10.0	--	--	25.0	21.0	--
16	10.0	--	--	--	--	--	11.0	--	20.0	27.0	--	--
17	10.0	--	--	--	--	--	8.0	--	21.0	22.0	--	--
18	7.0	--	1.0	--	--	--	8.0	--	18.0	25.0	--	--
19	7.0	--	--	--	--	--	9.0	--	19.0	--	--	--
20	--	--	--	--	--	--	9.0	--	19.0	--	--	--
21	8.0	--	--	--	--	--	10.0	11.0	19.0	--	--	--
22	9.0	--	--	--	--	--	10.0	12.0	--	--	--	--
23	9.0	--	--	--	--	--	10.0	15.0	15.0	--	--	--
24	14.0	--	--	--	--	--	10.0	12.0	--	--	--	11.0
25	6.0	--	--	--	--	3.0	11.0	--	22.0	--	--	13.0
26	--	--	--	--	--	--	12.0	--	18.0	--	--	13.0
27	--	--	--	--	2.0	--	11.0	--	19.0	--	--	--
28	5.0	--	--	--	--	--	9.0	--	18.0	--	--	--
29	4.0	--	--	--	--	--	10.0	19.0	18.0	--	--	15.0
30	7.0	1.0	--	--	--	--	11.0	--	18.0	22.0	--	13.0
31	8.0	--	--	--	--	--	--	--	--	21.0	--	--
AVG	--	--	--	--	--	--	7.7	--	17.7	--	--	--

MAXIMUM VALUE = 29.0

MINIMUM VALUE = 1.0

5-3165. REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	--	--	--	--	--	--	12.0	--	--	--	--
2	--	--	--	--	--	--	4.0	14.0	--	22.0	--	--
3	--	--	--	--	--	--	--	12.0	--	21.0	--	--
4	--	--	--	--	--	--	--	14.0	--	--	--	--
5	--	--	--	--	--	--	1.0	16.0	--	22.0	--	--
6	--	--	--	--	--	--	1.0	15.0	22.0	19.0	--	21.5
7	--	--	--	--	--	--	3.0	11.0	--	18.0	--	--
8	--	--	--	--	--	--	3.0	14.0	--	20.0	--	--
9	--	--	--	--	--	--	2.0	13.0	--	23.0	--	--
10	--	--	--	--	--	--	2.0	16.0	--	23.0	--	--
11	--	--	--	--	--	--	4.0	16.0	--	23.0	--	--
12	--	--	--	--	--	--	6.0	16.0	16.0	--	--	--
13	--	--	--	--	--	--	8.0	17.0	14.0	--	--	--
14	--	--	--	--	--	--	8.0	17.0	--	26.0	--	--
15	--	--	--	--	--	--	7.0	16.0	16.0	26.0	--	--
16	--	--	--	--	--	--	8.0	16.0	16.0	26.0	--	--
17	--	--	--	--	--	--	7.0	--	17.0	--	--	--
18	--	--	1.0	--	--	--	8.0	--	18.0	--	--	--
19	--	--	--	--	--	--	10.0	--	17.0	--	--	--
20	--	--	--	--	--	--	9.0	--	18.0	--	--	--
21	--	--	--	--	--	--	7.0	14.0	16.0	--	--	--
22	--	--	--	--	--	--	8.0	13.0	14.0	--	--	--
23	15.0	--	--	--	--	--	11.0	--	14.0	--	--	--
24	--	--	--	--	--	--	11.0	15.0	--	--	--	--
25	--	--	--	--	--	--	12.0	--	18.0	26.0	--	--
26	--	--	--	--	--	4.0	11.0	21.0	21.0	--	--	--
27	--	--	--	--	1.0	--	8.0	--	18.0	--	--	--
28	--	--	--	--	--	--	9.0	--	18.0	22.0	--	--
29	--	.5	--	--	--	--	11.0	--	--	--	--	--
30	--	--	--	--	--	--	9.0	--	21.0	--	--	--
31	--	--	--	--	--	--	--	--	--	--	--	--
AVG	--	--	--	--	--	--	6.9	--	--	--	--	--

MAXIMUM VALUE = 26.0

MINIMUM VALUE = 0.5

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

5-3170. COTTONWOOD RIVER NEAR NEW ULM, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16.0	6.0	0.0	--	1.0	0.0	0.0	10.0	15.0	16.0	21.0	--
2	15.0	6.0	0.0	--	--	--	0.0	11.0	11.0	18.0	18.0	--
3	14.0	5.0	1.0	--	--	--	0.0	11.0	10.0	18.0	19.0	25.0
4	11.0	6.0	0.0	1.0	--	--	0.0	12.0	14.0	18.0	20.0	--
5	10.0	7.0	0.0	--	--	--	0.0	14.0	16.0	18.0	--	--
6	10.0	5.0	0.0	--	--	--	0.0	15.0	17.0	18.0	--	18.0
7	10.0	5.0	0.0	--	--	--	1.0	15.0	15.0	18.0	--	--
8	11.0	4.0	--	--	1.0	0.0	3.0	14.0	15.0	18.0	--	--
9	11.0	3.0	--	--	--	--	4.0	12.0	15.0	20.0	21.0	--
10	10.0	3.0	--	--	--	--	4.0	11.0	16.0	20.0	--	--
11	16.0	3.0	--	1.0	--	--	5.0	10.0	--	21.0	--	--
12	16.0	3.0	--	--	--	--	7.0	9.0	--	22.0	--	--
13	16.0	1.0	--	--	--	--	10.0	10.0	--	24.0	--	16.0
14	16.0	2.0	--	--	--	--	10.0	13.0	12.0	24.0	--	--
15	12.0	2.0	--	0.0	1.0	0.0	10.0	15.0	--	25.0	--	--
16	16.0	2.0	0.0	--	--	--	11.0	17.0	--	25.0	25.0	--
17	12.0	3.0	--	--	--	--	10.0	12.0	--	24.0	--	--
18	9.0	2.0	--	1.0	--	--	9.0	12.0	--	22.0	--	--
19	7.0	2.0	--	--	--	--	8.0	14.0	--	24.0	--	--
20	5.0	0.0	--	--	--	--	9.0	11.0	--	24.0	--	13.0
21	7.0	2.0	1.0	--	--	--	10.0	12.0	15.0	21.0	--	--
22	7.0	3.0	--	--	0.0	0.0	9.0	10.0	--	21.0	--	--
23	8.0	3.0	--	--	--	--	10.0	10.0	--	22.0	19.0	--
24	7.0	3.0	--	--	0.0	--	10.0	13.0	--	20.0	--	--
25	6.0	3.0	--	1.0	--	--	11.0	13.0	--	22.0	--	--
26	6.0	2.0	--	--	--	--	11.0	14.0	21.0	22.0	--	--
27	6.0	1.0	--	--	--	0.0	11.0	18.0	18.0	20.0	--	9.0
28	4.0	0.0	1.0	--	--	0.0	10.0	20.0	18.0	19.0	--	--
29	4.0	0.0	--	--	--	0.0	10.0	20.0	17.0	20.0	--	--
30	4.0	0.0	--	--	--	0.0	10.0	19.0	17.0	21.0	21.0	--
31	6.0	--	--	--	--	0.0	--	19.0	--	19.0	--	--
AVG	9.9	2.9	--	--	--	--	6.7	13.4	--	20.7	--	--

MAXIMUM VALUE = 25.0

MINIMUM VALUE = 0.0

5-3538. STRAIGHT RIVER NEAR FARIBAULT, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	--	--	--	--	--	1.0	13.0	15.0	23.0	--	--
2	--	--	--	--	--	--	3.0	17.0	--	25.0	--	--
3	--	--	--	--	--	--	3.0	15.0	--	25.0	--	--
4	--	--	--	--	--	--	5.0	--	--	26.0	--	--
5	--	--	--	--	--	--	5.0	15.0	--	--	--	--
6	--	--	--	--	--	--	5.0	--	21.0	--	--	--
7	12.0	--	--	--	--	--	6.0	--	19.0	24.0	--	--
8	11.5	--	--	--	--	--	8.0	--	--	23.0	--	--
9	11.0	--	--	--	--	--	9.0	--	--	28.0	--	--
10	13.0	--	--	--	--	--	5.0	--	--	27.0	--	--
11	11.0	--	--	--	--	--	8.0	--	--	--	--	--
12	--	--	--	--	--	--	11.0	14.0	19.0	--	--	--
13	16.0	--	--	--	--	--	13.0	17.0	--	--	--	--
14	12.0	--	--	--	--	--	--	--	--	27.0	--	--
15	--	--	--	--	--	--	--	--	--	--	--	--
16	18.0	--	--	--	--	--	8.0	--	--	--	--	--
17	14.0	--	--	--	--	--	8.0	--	--	--	--	--
18	14.0	--	--	--	--	--	7.0	18.0	--	--	--	--
19	10.0	--	0.0	--	--	--	10.0	--	--	--	--	--
20	11.0	--	--	--	--	--	16.0	--	--	--	--	--
21	--	--	--	0.0	--	--	8.0	--	--	--	--	--
22	--	--	--	--	--	3.0	12.0	--	--	--	22.0	--
23	10.0	--	--	--	--	1.0	8.0	19.0	16.0	--	--	--
24	--	--	--	--	--	3.0	--	--	--	--	--	--
25	--	--	--	--	--	2.0	--	--	23.0	--	25.0	--
26	--	--	--	--	--	0.0	16.0	18.0	25.0	--	--	--
27	--	--	--	--	0.0	1.0	--	--	--	--	--	--
28	3.0	--	--	--	0.0	2.0	9.0	24.0	25.0	--	--	--
29	--	--	--	--	--	1.0	13.0	--	--	--	--	--
30	6.0	--	--	--	--	--	13.0	--	--	--	--	--
31	9.0	--	--	--	--	1.0	--	--	--	--	--	--
AVG	--	--	--	--	--	--	8.4	--	--	--	--	--

MAXIMUM VALUE = 28.0

MINIMUM VALUE = 0.0

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

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TEMPERATURE (°C) OF WATER, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

5-3850. ROOT RIVER NEAR HOUSTON, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	--	--	--	--	--	--	1.0	--	--	20.0	--	--
2	--	--	--	--	--	--	3.0	--	--	20.0	--	--
3	--	--	--	--	--	--	6.0	--	--	20.0	--	--
4	--	--	--	--	--	--	6.0	--	--	--	--	--
5	--	--	--	--	--	--	4.0	--	--	20.0	--	--
6	--	--	--	--	--	--	5.0	--	--	19.0	--	--
7	--	--	--	--	--	--	8.0	--	--	18.0	--	--
8	--	--	--	--	--	--	10.0	15.0	--	17.0	--	--
9	12.0	--	--	--	--	--	9.0	13.0	--	18.0	--	--
10	--	--	--	--	--	--	9.0	--	--	20.0	--	--
11	--	--	--	--	--	--	11.0	--	--	23.0	--	17.0
12	--	--	--	--	--	--	12.0	--	--	25.0	--	--
13	--	3.0	--	--	--	--	12.0	--	--	23.0	--	--
14	--	--	--	--	--	--	12.0	--	--	22.0	--	--
15	--	--	--	--	--	--	12.0	--	18.0	25.0	--	--
16	--	--	--	--	--	--	11.0	--	--	25.0	--	--
17	--	--	0.0	--	--	--	10.0	--	--	24.0	--	--
18	--	--	0.0	--	--	--	10.0	--	--	23.0	--	--
19	--	--	--	--	--	--	11.0	--	--	23.0	--	--
20	--	--	--	--	--	0.0	11.0	--	--	23.0	--	--
21	--	--	--	1.0	--	0.0	--	--	--	22.0	--	--
22	--	--	--	--	--	0.0	11.0	--	--	22.0	--	--
23	--	--	--	--	--	0.0	12.0	--	--	22.0	--	--
24	--	--	--	--	--	2.0	12.0	--	--	--	--	--
25	--	--	--	--	--	2.0	14.0	25.0	17.0	--	--	--
26	--	--	--	--	--	2.0	--	--	18.0	--	--	--
27	--	--	--	--	1.0	3.0	--	--	19.0	--	--	--
28	--	--	--	--	--	2.0	--	--	20.0	--	--	--
29	--	--	--	--	--	1.0	--	--	18.0	--	--	--
30	--	--	--	--	--	0.0	--	--	18.0	--	--	--
31	--	--	--	--	--	0.0	--	--	--	--	--	--
AVG	--	--	--	--	--	--	9.2	--	--	--	--	--

MAXIMUM VALUE = 25.0

MINIMUM VALUE = 0.0

5-4760. WEST FORK DES MOINES RIVER AT JACKSON, MINN.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19.0	8.0	--	--	--	--	--	13.0	--	19.0	22.0	--
2	14.0	7.0	0.0	--	--	--	0.0	15.0	--	--	--	23.0
3	11.0	7.0	--	--	--	--	0.0	15.0	--	21.0	--	--
4	10.0	7.0	0.0	--	--	--	0.0	17.0	17.0	23.0	26.0	--
5	9.0	7.0	--	--	--	--	1.0	17.0	--	22.0	--	23.0
6	9.0	6.0	0.0	--	--	--	2.0	18.0	20.0	22.0	25.0	--
7	11.0	4.0	--	--	--	--	2.0	19.0	--	20.0	--	23.0
8	12.0	3.0	--	--	--	--	3.0	--	--	21.0	24.0	--
9	10.0	1.0	0.0	--	--	--	3.0	15.0	18.0	22.0	--	--
10	11.0	1.0	--	--	--	--	5.0	14.0	--	24.0	--	--
11	11.0	1.0	1.0	--	--	--	5.0	13.0	19.0	26.0	25.0	--
12	11.0	1.0	--	--	--	--	6.0	12.0	--	26.0	--	--
13	7.0	1.0	0.0	--	--	--	8.0	14.0	--	--	25.0	--
14	16.0	1.0	--	--	--	--	--	18.0	--	28.0	--	--
15	17.0	2.0	--	--	--	--	10.0	18.0	--	29.0	--	--
16	16.0	1.0	--	--	--	--	9.0	19.0	--	29.0	--	--
17	12.0	1.0	2.0	--	--	--	9.0	15.0	20.0	27.0	--	--
18	9.0	1.0	--	--	--	--	9.0	15.0	--	25.0	--	--
19	6.0	0.0	--	--	--	--	10.0	14.0	19.0	26.0	--	--
20	8.0	1.0	--	--	--	--	11.0	14.0	--	--	--	--
21	8.0	1.0	--	--	--	--	11.0	--	18.0	25.0	--	--
22	9.0	1.0	--	--	--	--	12.0	13.0	--	25.0	--	--
23	9.0	3.0	--	--	--	--	12.0	--	16.0	25.0	--	--
24	8.0	1.0	--	--	--	0.0	16.0	16.0	17.0	25.0	--	--
25	7.0	--	--	--	2.0	0.0	12.0	--	19.0	26.0	24.0	--
26	7.0	1.0	--	--	--	0.0	14.0	19.0	20.0	26.0	--	--
27	8.0	--	--	--	--	0.0	12.0	--	--	--	--	--
28	6.0	1.0	--	--	--	0.0	11.0	23.0	19.0	22.0	26.0	--
29	5.0	--	--	--	--	0.0	12.0	--	19.0	24.0	--	--
30	4.0	1.0	--	--	--	--	12.0	23.0	18.0	24.0	--	--
31	6.0	--	--	--	--	0.0	--	--	--	--	--	--
AVG	9.8	2.5	--	--	--	--	7.7	16.2	--	24.3	--	--

MAXIMUM VALUE = 29.0

MINIMUM VALUE = 0.0

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

4-0145. BAPTISM RIVER NEAR BEAVER BAY, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 7, 1968..	240	4	2.6	NOV 1.....	240	2	1.3
OCT 8.....	210	3	1.7	NOV 2.....	205	1	.55
OCT 9.....	712	33	56	NOV 3.....	195	1	.53
OCT 10.....	1020	3	8.3	NOV 4.....	175	1	.47
OCT 11.....	700	2	3.8	NOV 5.....	165	2	.89
OCT 12.....	520	3	4.2	NOV 6.....	155	3	1.3
OCT 13.....	410	4	4.4	NOV 7.....	150	3	1.2
OCT 14.....	355	4	3.8	NOV 26.....	124	2	.67
OCT 15.....	330	3	2.7	APR 5, 1969..	190	25	13
OCT 16.....	327	2	1.8	APR 6.....	240	19	12
OCT 17.....	538	32	48	APR 7.....	320	23	20
OCT 18.....	964	16	41	APR 8.....	400	13	14
OCT 19.....	885	5	12	APR 9.....	498	105	141
OCT 20.....	640	3	5.2	APR 10.....	710	42	81
OCT 21.....	520	2	2.8	APR 11.....	856	25	58
OCT 22.....	440	1	1.2	APR 12.....	1030	24	72
OCT 23.....	375	1	1.0	APR 13.....	1410	28	107
OCT 24.....	340	2	1.8	APR 14.....	1850	29	145
OCT 25.....	305	2	1.6	APR 15.....	2110	35	199
OCT 26.....	295	2	1.6	APR 16.....	2060	33	184
OCT 27.....	290	2	1.6	APR 17.....	2120	42	240
OCT 28.....	293	2	1.6	APR 18.....	1940	33	173
OCT 29.....	280	2	1.5	APR 19.....	1710	21	97
OCT 30.....	265	2	1.4	APR 20.....	1530	15	62
OCT 31.....	255	2	1.4	APR 21.....	2020	41	224
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
APR 22.....	2060	36	200	MAY 8.....	665	4	7.2
APR 23.....	1620	18	79	MAY 9.....	549	4	5.9
APR 24.....	1240	14	47	MAY 10.....	465	3	3.8
APR 25.....	1120	10	30	MAY 11.....	406	3	3.3
APR 26.....	1090	7	21	MAY 12.....	366	3	3.0
APR 27.....	948	6	15	MAY 13.....	330	4	3.6
APR 28.....	808	7	15	MAY 14.....	302	5	4.1
APR 29.....	757	6	12	MAY 15.....	685	20	41
APR 30.....	696	6	11	MAY 16.....	1080	14	41
MAY 1.....	713	7	13	MAY 17.....	915	9	22
MAY 2.....	774	14	29	MAY 18.....	691	6	11
MAY 3.....	790	11	23	MAY 19.....	522	5	7.0
MAY 4.....	820	8	18	MAY 20.....	433	4	4.7
MAY 5.....	948	14	36	MAY 21.....	374	3	3.0
MAY 6.....	915	6	15	MAY 22.....	330	1	.89
MAY 7.....	779	4	8.4	AUG 6.....	195	4	2.1

4-0187.5 ST. LOUIS RIVER AT FORBES, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 9, 1968..	463	4	5.0	NOV 3.....	1100	40	119
OCT 10.....	797	11	24	NOV 8.....	888	7	17
OCT 11.....	1120	21	64	NOV 9.....	782	8	17
OCT 12.....	1080	18	52	NOV 10.....	770	6	12
OCT 13.....	1100	24	71	NOV 11.....	672	9	16
OCT 14.....	1120	25	76	NOV 12.....	596	28	45
OCT 15.....	1150	15	46	NOV 13.....	591	9	14
OCT 16.....	1300	22	77	NOV 14.....	669	7	13
OCT 17.....	1860	50	251	NOV 15.....	521	11	15
OCT 18.....	2400	70	454	NOV 16.....	589	9	14
OCT 19.....	2910	89	699	NOV 17.....	548	13	19
OCT 20.....	3260	92	810	NOV 18.....	441	9	11
OCT 21.....	3420	115	1060	NOV 19.....	450	6	7.3
OCT 22.....	3420	95	877	NOV 20.....	380	3	3.1
OCT 23.....	3380	94	858	DEC 27.....	301	2	1.6
OCT 24.....	3190	87	749	JAN 28, 1969..	234	3	1.9
OCT 25.....	2900	50	392	MAR 3.....	198	3	1.6
OCT 26.....	2600	31	218	APR 3.....	225	3	1.8
OCT 27.....	2230	30	181	APR 8.....	560	43	65
OCT 28.....	1880	24	122	APR 9.....	1100	52	154
OCT 29.....	1780	21	101	APR 10.....	1850	53	265
OCT 30.....	1600	23	99	APR 13.....	3760	138	1400
OCT 31.....	1430	18	69	APR 14.....	4250	86	987
NOV 1.....	1330	14	50	APR 15.....	4780	171	2210
NOV 2.....	1230	25	83	APR 16.....	5040	192	2610
APR 17.....	5120	221	3060	MAY 18.....	2140	30	173
APR 18.....	5170	155	2160	MAY 19.....	2350	33	209
APR 19.....	5070	118	1620	MAY 20.....	2490	37	249
APR 20.....	4780	65	839	MAY 21.....	2540	42	288
APR 21.....	4540	41	502	MAY 22.....	2460	31	206
APR 22.....	4250	71	815	MAY 23.....	2050	28	155
APR 23.....	3980	63	677	MAY 24.....	1910	17	88
APR 24.....	3710	56	561	MAY 25.....	1690	26	119
APR 25.....	3580	47	454	MAY 26.....	1530	17	70
APR 26.....	3440	45	418	MAY 27.....	1370	16	59
APR 27.....	3160	51	435	MAY 28.....	1230	15	50
APR 28.....	2870	64	496	MAY 29.....	1110	7	21
APR 29.....	2730	43	317	MAY 30.....	961	10	26
APR 30.....	2510	109	739	MAY 31.....	854	10	23
MAY 1.....	2270	57	349	JUN 1.....	869	28	66
MAY 2.....	2310	35	218	JUN 2.....	794	13	28
MAY 6.....	2220	29	174	JUN 3.....	886	10	24
MAY 7.....	2150	54	313	JUN 4.....	876	9	21
MAY 8.....	2030	25	137	JUN 5.....	882	10	24
MAY 9.....	1880	60	304	JUN 6.....	923	12	30
MAY 13.....	1160	11	34	JUN 7.....	997	11	30
MAY 14.....	1300	11	39	JUN 8.....	1050	10	28
MAY 15.....	1360	12	44	JUN 9.....	1040	10	28
MAY 16.....	1630	30	132	JUN 10.....	991	8	21
MAY 17.....	1920	30	156	JUN 16.....	705	8	15
JUN 17.....	584	7	11	JUN 21.....	481	7	9.1
JUN 18.....	539	7	10	JUN 22.....	452	7	8.5
JUN 19.....	559	11	17	JUL 24.....	301	6	4.9
JUN 20.....	522	8	11				

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-0405. PELICAN RIVER NEAR FERGUS FALLS, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 2, 1968..	49	6	.80	APR 29.....	300	13	10
NOV 8.....	44	7	.80	APR 30.....	300	14	11
DEC 9.....	33	27	2.4	MAY 1.....	300	12	10
JAN 13, 1969..	47	103	13	MAY 2.....	300	13	10
FEB 7.....	79	7	1.5	MAY 3.....	300	15	12
APR 9.....	295	36	29	MAY 4.....	320	17	15
APR 10.....	515	116	161	MAY 5.....	330	15	13
APR 11.....	680	208	382	MAY 6.....	335	15	14
APR 12.....	688	76	141	MAY 7.....	340	15	14
APR 13.....	580	57	89	MAY 8.....	340	14	13
APR 14.....	455	53	65	MAY 9.....	340	13	12
APR 15.....	400	39	42	MAY 10.....	335	13	12
APR 16.....	375	31	31	MAY 11.....	320	12	10
APR 17.....	365	24	24	MAY 12.....	320	13	11
APR 18.....	355	24	23	MAY 13.....	310	12	10
APR 19.....	345	27	25	MAY 14.....	305	14	12
APR 20.....	340	26	24	MAY 15.....	295	15	12
APR 21.....	340	27	25	MAY 16.....	295	15	12
APR 22.....	330	25	22	MAY 17.....	295	13	10
APR 23.....	320	27	23	MAY 18.....	285	15	12
APR 24.....	320	24	21	MAY 19.....	285	15	12
APR 25.....	315	20	17	MAY 20.....	285	14	11
APR 26.....	310	17	14	MAY 21.....	270	10	7.3
APR 27.....	305	17	14	MAY 22.....	270	10	7.3
APR 28.....	300	20	16	MAY 23.....	256	9	6.2

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
MAY 24.....	256	10	6.9	JUN 16.....	160	24	10
MAY 25.....	246	9	6.0	JUN 17.....	152	20	8.2
MAY 26.....	246	11	7.3	JUN 18.....	149	22	8.8
MAY 27.....	256	26	18	JUN 19.....	138	28	10
MAY 28.....	256	32	22	JUN 20.....	132	22	7.8
MAY 29.....	256	25	17	JUN 21.....	129	16	5.6
MAY 30.....	256	22	15	JUN 22.....	129	17	5.9
MAY 31.....	256	19	13	JUN 23.....	132	17	6.0
JUN 1.....	256	15	10	JUN 24.....	129	15	5.2
JUN 2.....	251	16	11	JUN 25.....	132	17	6.0
JUN 3.....	242	18	12	JUN 26.....	132	15	5.3
JUN 4.....	242	19	12	JUN 27.....	129	13	4.5
JUN 5.....	238	17	11	JUN 28.....	129	15	5.2
JUN 6.....	224	19	11	JUN 29.....	126	14	4.8
JUN 7.....	220	18	11	JUN 30.....	123	13	4.3
JUN 8.....	215	16	9.3	JUL 1.....	117	12	3.8
JUN 9.....	207	20	11	JUL 2.....	108	13	3.8
JUN 10.....	199	28	15	JUL 3.....	88	14	3.3
JUN 11.....	194	17	8.9	JUL 4.....	106	15	4.3
JUN 12.....	186	15	7.5	JUL 8.....	108	14	4.1
JUN 13.....	174	19	8.9	JUL 28.....	101	10	2.7
JUN 14.....	174	30	14	SEP 10.....	24	4	.30
JUN 15.....	170	25	11				

5-0875. MIDDLE RIVER AT ARGYLE, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 31, 1968..	20	40	2.2	APR 30.....	94	16	4.1
DEC 5.....	9.4	82	2.1	MAY 1.....	84	16	3.6
MAR 19, 1969..	3.7	54	.50	MAY 2.....	77	16	3.3
APR 8.....	135	35	13	MAY 3.....	71	22	4.2
APR 9.....	360	59	57	MAY 4.....	65	26	4.6
APR 10.....	670	85	154	MAY 5.....	62	28	4.7
APR 11.....	1790	112	541	MAY 6.....	59	32	5.1
APR 12.....	2300	112	696	MAY 7.....	51	37	5.1
APR 13.....	1800	93	454	MAY 8.....	49	27	3.6
APR 14.....	1570	47	199	MAY 9.....	47	37	4.7
APR 15.....	1540	46	191	MAY 10.....	45	52	6.3
APR 16.....	1240	74	248	MAY 11.....	42	53	6.0
APR 17.....	973	38	100	MAY 12.....	37	43	4.3
APR 18.....	796	74	159	MAY 13.....	37	42	4.2
APR 19.....	647	105	183	MAY 14.....	36	66	6.4
APR 20.....	530	70	100	MAY 15.....	35	55	5.2
APR 21.....	432	83	97	MAY 16.....	32	46	4.0
APR 22.....	349	61	57	MAY 17.....	35	18	1.7
APR 23.....	287	54	42	MAY 18.....	86	16	3.7
APR 24.....	238	49	31	MAY 19.....	153	16	6.6
APR 25.....	198	42	22	MAY 20.....	150	14	5.7
APR 26.....	165	36	16	MAY 21.....	121	13	4.2
APR 27.....	138	28	10	MAY 22.....	102	12	3.3
APR 28.....	118	21	6.7	MAY 23.....	87	18	4.2
APR 29.....	104	18	5.0	MAY 24.....	73	14	2.8
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
MAY 25.....	63	20	3.4	JUN 16.....	32	43	3.7
MAY 26.....	56	16	2.4	JUN 17.....	28	40	3.0
MAY 27.....	49	20	2.6	JUN 18.....	25	41	2.8
MAY 28.....	44	29	3.4	JUN 19.....	22	45	2.7
MAY 29.....	40	36	3.9	JUN 20.....	19	32	1.6
MAY 30.....	36	30	2.9	JUN 21.....	16	65	2.8
MAY 31.....	34	34	3.1	JUN 26.....	17	31	1.4
JUN 1.....	33	36	3.2	JUN 27.....	16	44	1.9
JUN 2.....	31	34	2.8	JUN 28.....	14	46	1.7
JUN 3.....	42	36	4.1	JUN 29.....	15	58	2.3
JUN 4.....	58	38	6.0	JUN 30.....	24	70	4.5
JUN 5.....	72	40	7.8	JUL 1.....	27	78	5.7
JUN 6.....	138	43	16	JUL 2.....	24	84	5.4
JUN 7.....	158	36	15	JUL 3.....	23	89	5.5
JUN 8.....	139	24	9.0	JUL 4.....	21	80	4.5
JUN 9.....	110	34	10	JUL 5.....	21	79	4.5
JUN 10.....	90	34	8.3	JUL 6.....	18	68	3.3
JUN 11.....	70	34	6.4	JUL 7.....	16	66	2.8
JUN 12.....	56	39	5.9	JUL 8.....	14	64	2.4
JUN 13.....	49	32	4.2	JUL 9.....	13	54	1.9
JUN 14.....	42	32	3.6	AUG 14.....	1.1	82	.20
JUN 15.....	38	47	4.8				

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-2440. CROW WING RIVER AT NIMROD, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 1, 1968..	592	6	9.6	OCT 26.....	774	6	12
OCT 2.....	584	9	14	OCT 27.....	735	8	18
OCT 3.....	581	12	19	OCT 28.....	695	5	9.4
OCT 4.....	587	46	73	OCT 29.....	652	4	7.0
OCT 5.....	587	36	57	OCT 30.....	628	4	6.8
OCT 6.....	584	25	39	OCT 31.....	608	4	6.6
OCT 7.....	568	18	28	NOV 1.....	589	5	8.0
OCT 8.....	559	6	9.0	NOV 2.....	561	5	7.6
OCT 9.....	596	3	4.8	NOV 3.....	534	5	7.2
OCT 10.....	619	3	5.0	NOV 4.....	520	6	8.4
OCT 11.....	609	3	4.9	NOV 5.....	518	2	2.8
OCT 12.....	602	3	4.9	NOV 11.....	508	3	4.1
OCT 13.....	606	3	4.9	NOV 12.....	508	2	2.7
OCT 14.....	615	3	5.0	NOV 13.....	493	1	1.3
OCT 15.....	622	3	5.0	DEC 18.....	358	21	20
OCT 16.....	644	3	5.2	JAN 13, 1969..	336	66	60
OCT 17.....	741	4	8.0	FEB 25.....	403	15	16
OCT 18.....	952	7	18	MAR 24.....	320	10	8.6
OCT 19.....	978	7	21	APR 6.....	450	17	25
OCT 20.....	929	5	13	APR 7.....	810	25	55
OCT 21.....	884	4	9.5	APR 8.....	1230	29	96
OCT 22.....	858	5	12	APR 9.....	1650	21	94
OCT 23.....	836	6	14	APR 10.....	1920	20	104
OCT 24.....	815	5	11	APR 11.....	2140	23	133
OCT 25.....	798	4	8.6	APR 12.....	2140	16	92
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
APR 13.....	2130	14	80	MAY 8.....	1090	13	38
APR 14.....	2130	13	75	MAY 9.....	1060	11	31
APR 15.....	2180	13	76	MAY 10.....	1040	11	31
APR 16.....	2170	20	117	MAY 11.....	1010	9	24
APR 17.....	2080	15	84	MAY 12.....	993	12	32
APR 18.....	1940	12	63	MAY 13.....	970	13	34
APR 19.....	1800	16	78	MAY 14.....	943	16	41
APR 20.....	1710	13	60	MAY 15.....	904	17	41
APR 21.....	1660	13	58	MAY 16.....	896	18	44
APR 22.....	1580	13	55	MAY 17.....	874	13	31
APR 23.....	1510	13	53	MAY 18.....	843	13	30
APR 24.....	1440	22	86	MAY 19.....	824	15	33
APR 25.....	1390	12	45	MAY 20.....	803	12	26
APR 26.....	1340	9	32	MAY 21.....	774	11	23
APR 27.....	1330	10	36	MAY 22.....	744	11	22
APR 28.....	1320	16	57	MAY 23.....	723	12	23
APR 29.....	1270	16	55	MAY 24.....	698	11	21
APR 30.....	1220	14	46	MAY 25.....	678	9	16
MAY 1.....	1200	10	32	MAY 26.....	668	7	13
MAY 2.....	1200	12	39	MAY 27.....	664	7	12
MAY 3.....	1160	17	53	MAY 28.....	639	20	34
MAY 4.....	1190	12	38	MAY 29.....	609	49	80
MAY 5.....	1220	19	62	MAY 30.....	594	56	90
MAY 6.....	1180	18	57	MAY 31.....	626	55	93
MAY 7.....	1130	12	37	JUN 1.....	688	42	78

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

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5-2440. CROW WING RIVER AT NIMROD, MINN.--Continued

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
JUN 2.....	708	21	40	JUL 10.....	487	4	5.2
JUN 3.....	720	18	35	JUL 15.....	474	8	10
JUN 4.....	713	18	35	JUL 16.....	518	10	14
JUN 5.....	702	10	19	JUL 17.....	511	10	14
JUN 6.....	685	7	13	JUL 18.....	506	9	12
JUN 7.....	662	7	12	JUL 19.....	497	7	9.4
JUN 8.....	632	7	12	JUL 20.....	485	6	7.8
JUN 9.....	606	6	9.8	JUL 21.....	484	5	6.5
JUN 10.....	588	9	14	JUL 22.....	518	8	11
JUN 11.....	578	9	14	JUL 23.....	550	6	8.9
JUN 12.....	563	5	7.6	JUL 24.....	547	5	7.4
JUN 25.....	477	40	52	JUL 25.....	541	4	5.8
JUN 26.....	499	18	24	JUL 26.....	524	3	4.2
JUN 27.....	480	10	13	JUL 27.....	515	3	4.2
JUN 28.....	478	11	14	JUL 28.....	516	3	4.2
JUN 29.....	491	16	21	JUL 29.....	510	3	4.1
JUL 4.....	514	20	28	JUL 30.....	509	3	4.1
JUL 5.....	492	14	18	JUL 31.....	514	3	4.2
JUL 6.....	476	7	9.0	AUG 6.....	475	16	20
JUL 7.....	463	7	8.8	AUG 14.....	404	6	6.5
JUL 8.....	495	9	12	AUG 18.....	326	5	4.4
JUL 9.....	496	7	9.4	SEP 22.....	316	3	2.6

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-3150. REDWOOD RIVER AT MARSHALL, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)
OCT 1, 1968..	66	41	7.3	APR 6.....	519	1890	2650
OCT 16.....	99	448	120	APR 7.....	1240	2600	8700
OCT 17.....	273	400	295	APR 8.....	2780	2600	19500
OCT 18.....	437	615	731	APR 9.....	4760	1880	24200
OCT 19.....	1010	473	1290	APR 10.....	4530	1710	20900
OCT 20.....	1060	388	1110	APR 11.....	2950	1540	12300
OCT 21.....	805	302	656	APR 12.....	2440	1500	9880
OCT 22.....	610	213	351	APR 13.....	2160	1260	7350
OCT 23.....	452	160	195	APR 14.....	1870	1070	5400
OCT 24.....	265	131	94	APR 15.....	1590	848	3640
OCT 25.....	222	148	89	APR 16.....	1350	795	2900
OCT 28.....	155	133	56	APR 17.....	1170	618	1950
OCT 29.....	134	138	50	APR 18.....	930	700	1760
OCT 30.....	127	150	51	APR 19.....	799	685	1480
OCT 31.....	116	151	47	APR 20.....	676	642	1170
NOV 1.....	106	142	41	APR 21.....	598	510	823
NOV 12.....	48	132	17	APR 22.....	534	422	608
NOV 13.....	45	135	16	APR 23.....	490	296	392
NOV 30.....	65	166	29	APR 24.....	454	260	319
DEC 18.....	20	138	7.4	APR 25.....	443	230	275
JAN 21, 1969..	15	75	3.0	APR 26.....	414	200	224
FEB 27.....	13	136	4.8	APR 27.....	410	225	249
MAR 25.....	15	82	3.3	APR 28.....	397	170	182
APR 4.....	53	66	9.4	APR 29.....	367	140	139
APR 5.....	240	244	158	APR 30.....	332	124	111
DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)
MAY 21.....	111	85	25	JUN 22.....	30	98	7.9
MAY 22.....	119	55	18	JUN 23.....	41	102	11
MAY 23.....	118	92	29	JUN 24.....	41	115	13
MAY 24.....	115	132	41	JUN 25.....	46	156	19
MAY 29.....	76	95	19	JUN 26.....	50	191	26
JUN 2.....	62	90	15	JUN 27.....	46	188	23
JUN 3.....	57	91	14	JUN 28.....	51	183	25
JUN 4.....	57	89	14	JUN 29.....	90	160	39
JUN 5.....	51	90	12	JUN 30.....	190	298	153
JUN 6.....	48	102	13	JUL 1.....	93	255	64
JUN 7.....	50	113	15	JUL 2.....	413	2010	2420
JUN 8.....	46	118	15	JUL 3.....	166	430	193
JUN 9.....	43	112	13	JUL 4.....	335	1840	1760
JUN 10.....	41	113	12	JUL 5.....	207	258	144
JUN 11.....	47	100	13	JUL 6.....	162	242	106
JUN 12.....	47	108	14	JUL 7.....	120	277	90
JUN 13.....	48	95	12	JUL 8.....	134	234	85
JUN 14.....	43	91	11	JUL 9.....	118	248	79
JUN 15.....	41	90	10	JUL 10.....	101	225	61
JUN 16.....	35	80	7.6	JUL 11.....	84	212	48
JUN 17.....	35	91	8.6	JUL 14.....	60	130	21
JUN 18.....	33	105	9.4	JUL 15.....	57	190	29
JUN 19.....	31	95	7.9	JUL 16.....	50	160	22
JUN 20.....	30	83	6.7	JUL 17.....	57	210	32
JUN 21.....	29	90	7.0	JUL 18.....	79	280	60
DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)
JUL 30.....	28	170	13	AUG 12.....	16	168	7.2
JUL 31.....	29	175	14	AUG 13.....	11	152	4.5
AUG 1.....	29	220	17	AUG 14.....	12	142	4.6
AUG 2.....	28	245	18	AUG 15.....	11	160	4.8
AUG 3.....	26	234	16	SEP 24.....	12	195	6.3
AUG 4.....	28	195	15	SEP 25.....	7.9	150	3.2
AUG 5.....	29	182	14	SEP 26.....	7.9	115	2.4
AUG 6.....	39	151	16	SEP 27.....	7.9	118	2.5
AUG 7.....	24	150	9.7	SEP 28.....	6.7	121	2.2
AUG 8.....	21	178	10	SEP 29.....	6.2	121	2.0
AUG 11.....	18	185	9.0	SEP 30.....	6.2	120	2.0

5-3165. REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 23, 1968..	1010	167	455	APR 23.....	1300	160	562
NOV 29.....	102	83	23	APR 24.....	1140	202	622
DEC 18.....	55	162	24	APR 25.....	1000	198	535
JAN 10, 1969..	10	163	4.4	APR 26.....	878	158	375
JAN 27.....	3.8	114	1.2	APR 27.....	858	142	329
FEB 27.....	17	20	.90	APR 28.....	897	160	388
MAR 26.....	65	12	2.1	APR 29.....	806	117	255
APR 2.....	120	34	11	APR 30.....	722	108	211
APR 6.....	1200	380	1230	MAY 1.....	650	140	246
APR 7.....	2500	262	1770	MAY 2.....	602	118	192
APR 8.....	5000	558	7630	MAY 3.....	568	115	176
APR 9.....	13200	340	12100	MAY 4.....	557	100	150
APR 10.....	11200	498	15100	MAY 5.....	562	93	141
APR 11.....	8720	448	10500	MAY 6.....	568	104	159
APR 12.....	6450	545	9490	MAY 7.....	557	85	128
APR 13.....	4960	185	2480	MAY 8.....	574	114	177
APR 14.....	4270	138	1590	MAY 9.....	562	140	212
APR 15.....	3860	112	1170	MAY 10.....	525	144	204
APR 16.....	3380	72	657	MAY 11.....	495	160	214
APR 17.....	2960	138	1100	MAY 12.....	455	165	203
APR 18.....	2540	85	583	MAY 13.....	426	122	140
APR 19.....	2200	63	374	MAY 14.....	390	94	99
APR 20.....	1910	110	567	MAY 15.....	358	106	102
APR 21.....	1710	462	2130	MAY 16.....	329	129	115
APR 22.....	1490	189	760	MAY 17.....	305	123	101
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
MAY 18.....	285	118	91	JUN 30.....	201	300	163
MAY 22.....	265	78	56	JUL 1.....	225	412	190
MAY 25.....	253	230	157	JUL 2.....	273	329	242
MAY 26.....	241	200	130	JUL 3.....	470	898	1190
MAY 27.....	225	150	91	JUL 4.....	530	900	1290
MAY 30.....	174	84	39	JUL 5.....	1110	530	1580
JUN 6.....	120	94	30	JUL 6.....	1130	282	860
JUN 12.....	118	94	30	JUL 7.....	1100	190	564
JUN 13.....	116	95	30	JUL 8.....	1200	172	557
JUN 14.....	114	100	31	JUL 9.....	1270	145	497
JUN 15.....	112	80	24	JUL 10.....	1180	140	446
JUN 16.....	108	80	23	JUL 14.....	368	323	321
JUN 17.....	102	78	21	JUL 15.....	313	328	277
JUN 18.....	96	60	16	JUL 16.....	281	342	259
JUN 19.....	93	55	14	JUL 17.....	253	380	260
JUN 20.....	89	60	14	JUL 18.....	241	418	272
JUN 21.....	86	40	9.3	JUL 19.....	257	413	287
JUN 22.....	84	45	10	JUL 20.....	233	345	217
JUN 23.....	91	98	24	JUL 21.....	205	400	221
JUN 24.....	96	138	36	JUL 22.....	174	385	181
JUN 25.....	106	125	36	JUL 23.....	154	400	166
JUN 26.....	198	172	92	JUL 24.....	135	365	133
JUN 27.....	229	268	166	JUL 25.....	118	285	91
JUN 28.....	171	259	120	JUL 26.....	110	268	80
JUN 29.....	154	272	113	JUL 27.....	104	270	76
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
JUL 28.....	100	297	80	SEP 5.....	18	372	18

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-3710. COTTONWOOD RIVER NEAR NEW ULM, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT. 1.....	1240	139	465	DEC. 5.....	382	160	186
OCT. 2.....	1150	150	466	DEC. 6.....	200	181	98
OCT. 3.....	1060	160	457	DEC. 7.....	200	158	85
OCT. 4.....	1050	187	530	DEC. 16.....	335	150	136
OCT. 5.....	972	191	501	JAN. 3.....	135	143	59
OCT. 6.....	864	188	439	JAN. 11.....	140	100	38
OCT. 7.....	797	185	398	JAN. 15.....	147	163	65
OCT. 8.....	766	173	358	JAN. 18.....	150	124	50
OCT. 9.....	874	161	380	JAN. 25.....	150	113	46
OCT. 10.....	1220	191	629	FEB. 1.....	155	153	64
OCT. 11.....	1600	206	890	FEB. 8.....	155	138	58
OCT. 12.....	1520	160	657	FEB. 15.....	155	110	46
OCT. 13.....	1250	201	678	FEB. 22.....	150	183	74
OCT. 14.....	1090	215	633	FEB. 24.....	150	146	59
OCT. 15.....	1010	206	562	MAR. 1.....	150	255	103
OCT. 16.....	1420	264	1010	MAR. 8.....	150	140	57
OCT. 17.....	4620	915	13100	MAR. 15.....	150	150	61
OCT. 18.....	8910	1275	30700	MAR. 22.....	380	54	55
OCT. 19.....	13000	886	31000	MAR. 27.....	880	252	599
OCT. 20.....	12300	652	21600	MAR. 28.....	910	171	420
OCT. 21.....	9360	468	11800	MAR. 29.....	880	137	326
OCT. 22.....	7380	395	7870	MAR. 30.....	860	140	325
OCT. 23.....	5740	370	5730	MAR. 31.....	840	116	263
OCT. 24.....	4250	361	4140	APR. 1.....	850	120	275
OCT. 25.....	3420	362	3340	APR. 2.....	1200	240	778
OCT. 26.....	2890	522	4070	APR. 3.....	2090	598	3760
OCT. 27.....	2470	483	3220	APR. 4.....	4300	1120	13000
OCT. 28.....	2140	440	2540	APR. 5.....	6350	920	15800
OCT. 29.....	1870	425	2150	APR. 6.....	9660	935	24400
OCT. 30.....	1680	423	1920	APR. 7.....	13600	864	32400
OCT. 31.....	1530	423	1750	APR. 8.....	22000	1210	71900
NOV. 1.....	1410	206	784	APR. 9.....	27100	1350	98000
NOV. 2.....	1310	171	605	APR. 10.....	24200	1070	69900
NOV. 3.....	1230	169	561	APR. 11.....	18200	977	48000
NOV. 4.....	1180	155	494	APR. 12.....	13600	817	30000
NOV. 5.....	1120	163	493	APR. 13.....	10000	684	18500
NOV. 6.....	1080	203	591	APR. 14.....	7910	650	13900
NOV. 7.....	1060	233	667	APR. 15.....	6900	584	10900
NOV. 8.....	1030	230	640	APR. 16.....	6240	500	8420
NOV. 9.....	996	231	621	APR. 17.....	5440	448	7170
NOV. 10.....	958	203	525	APR. 18.....	4600	454	5640
NOV. 11.....	916	184	455	APR. 19.....	3980	458	4920
NOV. 12.....	874	182	429	APR. 20.....	3480	510	4790
NOV. 13.....	836	181	409	APR. 21.....	3040	682	5600
NOV. 14.....	800	168	363	APR. 22.....	2660	680	4880
NOV. 15.....	734	157	311	APR. 23.....	2340	495	3130
NOV. 16.....	720	135	262	APR. 24.....	2070	394	2200
NOV. 17.....	705	131	249	APR. 25.....	1880	302	1530
NOV. 18.....	702	174	330	APR. 26.....	1700	350	1610
NOV. 19.....	690	181	337	APR. 27.....	1630	340	1500
NOV. 20.....	642	181	314	APR. 28.....	1730	335	1560
NOV. 21.....	564	176	268	APR. 29.....	1800	300	1460
NOV. 22.....	624	168	283	APR. 30.....	1690	326	1490
NOV. 23.....	633	158	270	MAY 1.....	1570	436	1850
NOV. 24.....	642	186	322	MAY 2.....	1510	394	1610
NOV. 25.....	630	162	276	MAY 3.....	1430	307	1190
NOV. 26.....	615	165	274	MAY 4.....	1340	282	1020
NOV. 27.....	573	160	248	MAY 5.....	1280	240	829
NOV. 28.....	537	151	219	MAY 6.....	1360	243	892
NOV. 29.....	495	173	231	MAY 7.....	1390	252	946
NOV. 30.....	444	134	161	MAY 8.....	1280	238	822
DEC. 1.....	426	134	154	MAY 9.....	1160	269	842
DEC. 2.....	444	134	161	MAY 10.....	1100	205	609
DEC. 3.....	450	148	180	MAY 11.....	1110	224	671
DEC. 4.....	441	153	182	MAY 12.....	1070	208	601

5-3710. COTTONWOOD RIVER NEAR NEW ULM, MINN.--Continued

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE		MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE		MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
MAY	13.....	953	234	602	JULY	4.....	1540	461	1920
MAY	14.....	886	194	464	JULY	5.....	1820	497	2440
MAY	15.....	804	196	425	JULY	6.....	1750	538	2540
MAY	16.....	752	196	398	JULY	7.....	1480	466	1860
MAY	17.....	696	182	342	JULY	8.....	1390	329	1230
MAY	18.....	645	167	291	JULY	9.....	1350	354	1290
MAY	19.....	624	182	307	JULY	10.....	1240	446	1490
MAY	20.....	638	192	331	JULY	11.....	1060	438	1250
MAY	21.....	662	144	257	JULY	12.....	890	301	723
MAY	22.....	670	70	127	JULY	13.....	768	282	585
MAY	23.....	688	132	245	JULY	14.....	645	271	472
MAY	24.....	688	151	280	JULY	15.....	564	312	475
MAY	25.....	673	126	229	JULY	16.....	498	300	403
MAY	26.....	631	142	242	JULY	17.....	465	356	447
MAY	27.....	582	175	275	JULY	18.....	441	254	302
MAY	28.....	534	142	205	JULY	19.....	1000	376	1020
MAY	29.....	492	150	199	JULY	20.....	1170	365	1150
MAY	30.....	444	157	188	JULY	21.....	890	276	663
MAY	31.....	420	160	181	JULY	22.....	740	247	494
JUNE	1.....	402	145	157	JULY	23.....	628	238	404
JUNE	2.....	370	151	151	JULY	24.....	540	254	370
JUNE	3.....	352	252	240	JULY	25.....	662	301	538
JUNE	4.....	335	324	293	JULY	26.....	554	336	503
JUNE	5.....	322	158	137	JULY	27.....	471	270	343
JUNE	6.....	306	162	134	JULY	28.....	414	244	273
JUNE	7.....	292	362	285	JULY	29.....	382	230	237
JUNE	8.....	283	188	144	JULY	30.....	355	216	207
JUNE	9.....	270	185	135	JULY	31.....	328	202	179
JUNE	10.....	261	185	130	AUG.	1.....	312	265	223
JUNE	11.....	270	183	133	AUG.	2.....	287	247	191
JUNE	12.....	263	184	131	AUG.	3.....	263	213	151
JUNE	13.....	257	186	129	AUG.	4.....	242	224	146
JUNE	14.....	261	174	123	AUG.	9.....	166	125	56
JUNE	27.....	495	627	838	AUG.	16.....	111	163	49
JUNE	28.....	504	374	509	AUG.	23.....	116	169	53
JUNE	29.....	492	348	462	AUG.	30.....	78	112	24
JUNE	30.....	708	364	696	SEP.	6.....	78	103	22
JULY	1.....	863	452	1050	SEP.	13.....	54	83	12
JULY	2.....	1020	532	1460	SEP.	20.....	47	69	8.8
JULY	3.....	1040	527	1480	SEP.	27.....	45	82	10

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-3538. STRAIGHT RIVER NEAR FARIBAULT, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 7, 1968..	269	124	90	MAR 22.....	2300	538	3340
OCT 8.....	282	219	167	MAR 23.....	2650	908	6500
OCT 9.....	729	1330	1490	MAR 24.....	3810	823	8470
OCT 10.....	1360	574	2110	MAR 25.....	3680	436	4330
OCT 11.....	1350	343	1250	MAR 26.....	3060	366	3020
OCT 12.....	1160	232	727	MAR 27.....	3140	399	3380
OCT 13.....	924	163	407	MAR 28.....	2730	400	2950
OCT 14.....	762	161	331	MAR 29.....	1890	239	1250
OCT 15.....	662	164	293	MAR 30.....	1460	166	654
OCT 16.....	804	203	441	MAR 31.....	1210	159	519
OCT 17.....	1990	803	4560	APR 1.....	1000	189	510
OCT 18.....	2080	353	2020	APR 2.....	1350	384	1400
OCT 19.....	1910	198	1020	APR 3.....	2240	476	2880
OCT 20.....	1660	221	990	APR 4.....	3380	498	4540
OCT 21.....	1380	205	764	APR 5.....	3120	320	2700
OCT 22.....	1140	171	526	APR 6.....	2530	221	1510
OCT 23.....	918	135	335	APR 7.....	2200	360	2390
OCT 28.....	565	102	156	APR 8.....	2120	688	4340
OCT 29.....	525	124	176	APR 9.....	1980	203	1090
OCT 30.....	485	95	124	APR 10.....	1650	151	673
OCT 31.....	458	90	111	APR 11.....	1430	156	602
NOV 18.....	264	78	56	APR 12.....	1180	120	382
DEC 19.....	114	141	43	APR 13.....	995	86	231
JAN 21, 1969..	103	184	51	APR 14.....	864	112	261
FEB 28.....	82	38	8.4	APR 15.....	1030	141	392
APR 16.....	1130	103	314	MAY 27.....	305	114	94
APR 17.....	1070	105	303	MAY 28.....	269	112	81
APR 18.....	912	120	295	JUN 1.....	248	104	70
APR 19.....	774	380	794	JUN 6.....	213	95	55
APR 20.....	651	144	253	JUN 7.....	192	124	64
APR 21.....	560	116	175	JUN 12.....	269	202	147
APR 22.....	480	103	133	JUN 23.....	146	152	60
APR 23.....	426	101	116	JUN 24.....	143	152	58
APR 24.....	382	108	111	JUN 25.....	202	203	111
APR 25.....	350	92	87	JUN 26.....	323	256	223
APR 26.....	310	95	80	JUN 27.....	368	211	210
APR 27.....	296	95	76	JUN 28.....	318	232	199
APR 28.....	296	76	61	JUL 1.....	470	257	326
APR 29.....	282	77	59	JUL 2.....	490	266	352
APR 30.....	256	73	50	JUL 3.....	500	233	315
MAY 1.....	252	67	46	JUL 4.....	460	294	365
MAY 2.....	467	304	383	JUL 7.....	250	200	135
MAY 3.....	404	154	168	JUL 8.....	230	173	107
MAY 4.....	354	122	117	JUL 9.....	220	172	102
MAY 5.....	359	86	83	JUL 10.....	220	131	78
MAY 12.....	336	67	61	JUL 11.....	220	114	68
MAY 13.....	296	104	83	JUL 12.....	240	122	79
MAY 14.....	256	103	71	JUL 13.....	320	129	111
MAY 22.....	377	72	73	JUL 14.....	510	156	215
MAY 26.....	323	99	86	AUG 5.....	77	66	14
				AUG 25.....	40	50	5.4

5-3840. ROOT RIVER NEAR LANESBORO, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 8, 1968..	121	21	6.8	APR 24.....	348	71	67
NOV 19.....	124	16	5.3	MAY 28.....	279	48	36
JAN 20, 1969..	115	76	24	JUN 26.....	609	548	1100
FEB 28.....	119	49	16	JUN 27.....	2450	2110	14700
MAR 21.....	1340	620	2240	JUN 28.....	2440	1190	8230
MAR 22.....	1150	338	1050	JUN 29.....	1240	571	1910
MAR 23.....	2400	1040	6740	JUN 30.....	2710	820	6000
MAR 24.....	3210	1700	10400	JUL 1.....	1650	459	2040
MAR 25.....	3080	726	6040	JUL 2.....	935	274	692
MAR 26.....	1870	345	1740	JUL 16.....	446	265	319
APR 4.....	5760	2260	36900	JUL 17.....	449	1920	2830
APR 5.....	5400	1430	20800	JUL 18.....	3840	4570	48300
APR 6.....	2410	490	3190	JUL 19.....	1240	937	3420
APR 7.....	1640	231	1020	AUG 13.....	227	85	52
APR 8.....	1460	172	678	SEP 12.....	152	30	12

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

(METHODS OF ANALYSIS: R, 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 TEMP- ERATURE (C)	DISCHARGE (CFS)	CONCEN- TRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE												METHOD OF ANALY- SIS
						PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED												
						.002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00		
APR 4, 1969	1100	3.0	6230	2980	50100	28	34	40	50	62	77	81	89	99	100	--	VPWC	
JUN 27.....	2030		4350	2460	28900	41	62	70	74	89	96	--	--	--	--	--	SPWC	
JUL 18.....	0900		4760	6130	78800	46	57	70	84	97	99	--	--	--	--	--	SPWC	

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-3850. ROOT RIVER NEAR HOUSTON, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)
NOV 13, 1968..	317	21	18	APR 10.....	1910	446	2300
DEC 17.....	250	101	68	APR 11.....	1700	443	2030
DEC 18.....	247	35	23	APR 12.....	1460	345	1350
JAN 21, 1969..	308	130	108	APR 13.....	1270	280	960
FEB 27.....	312	70	59	APR 14.....	1160	250	783
MAR 21.....	1920	2760	14300	APR 15.....	1090	250	736
MAR 22.....	1620	1100	4810	APR 16.....	1060	305	873
MAR 23.....	2650	1620	12900	APR 17.....	1200	280	907
MAR 24.....	4070	3090	34000	APR 18.....	1160	230	720
MAR 25.....	4080	1620	17800	APR 19.....	1140	300	1110
MAR 26.....	3020	1070	8720	APR 20.....	1020	350	964
MAR 27.....	2240	860	5200	APR 21.....	905	240	586
MAR 28.....	1910	430	2220	APR 22.....	825	450	1000
MAR 29.....	1650	360	1600	APR 23.....	780	480	1010
MAR 30.....	1360	400	1470	APR 24.....	730	300	591
MAR 31.....	1240	330	1100	APR 25.....	695	165	310
APR 1.....	1180	175	558	MAY 28.....	530	65	93
APR 2.....	1150	170	528	JUN 21.....	428	137	158
APR 3.....	1420	336	1430	JUN 25.....	545	330	486
APR 4.....	4520	1930	27400	JUN 26.....	1070	1050	3320
APR 5.....	7800	3560	7500	JUN 27.....	2660	3620	27000
APR 6.....	4020	1290	14500	JUN 28.....	3830	4670	48300
APR 7.....	2580	770	5360	JUN 29.....	2390	1820	11700
APR 8.....	2160	530	3090	JUN 30.....	3390	2280	20900
APR 9.....	1940	450	2360	JUL 1.....	3040	1780	14600

DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCENTRATION (MG/L)	LOAD (TONS)
JUL 2.....	1890	1160	5920	JUL 14.....	855	240	554
JUL 3.....	1540	600	2490	JUL 15.....	900	300	729
JUL 4.....	1360	420	1540	JUL 16.....	920	330	820
JUL 5.....	1210	380	1240	JUL 17.....	920	270	670
JUL 6.....	1100	260	772	JUL 18.....	3520	3920	47100
JUL 7.....	1020	1450	3990	JUL 19.....	2930	2360	22300
JUL 8.....	960	1180	3060	JUL 20.....	1550	480	2010
JUL 9.....	990	350	936	JUL 21.....	1290	370	1290
JUL 10.....	1000	260	702	JUL 22.....	1130	320	976
JUL 11.....	1020	260	716	JUL 23.....	1040	350	983
JUL 12.....	945	235	600	AUG 14.....	510	112	154
JUL 13.....	870	235	552	SEP 11.....	366	61	60

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

(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 TEMP- PERA- TURE (C)	DISCHARGE (CFS)	CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE											METHOD OF ANALY- SIS
						PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED											
						.002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	
APR 4, 1969	1740	6.0	5660	2560	39100	21	28	40	57	78	93	--	--	--	--	--	SPWC
JUN 27.....	1830	19.0	1910	4250	21900	41	54	69	81	93	96	97	98	--	--	--	VPWC

5-4760. WEST FORK DES MOINES RIVER AT JACKSON, MINN.

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
OCT 1, 1968..	362	51	50	OCT 26.....	2430	84	551
OCT 2.....	342	58	54	OCT 27.....	2300	64	397
OCT 3.....	337	55	50	OCT 28.....	2160	52	303
OCT 4.....	316	38	32	OCT 29.....	1990	47	252
OCT 5.....	305	31	26	OCT 30.....	1860	33	166
OCT 6.....	313	26	22	OCT 31.....	1780	33	158
OCT 7.....	318	26	22	NOV 1.....	1710	32	148
OCT 8.....	318	43	37	NOV 2.....	1620	44	192
OCT 9.....	362	47	46	NOV 3.....	1520	96	393
OCT 10.....	409	41	45	NOV 4.....	1480	45	180
OCT 11.....	444	44	53	NOV 5.....	1420	28	107
OCT 12.....	438	40	47	NOV 6.....	1370	28	104
OCT 13.....	426	71	82	NOV 7.....	1310	41	145
OCT 14.....	426	55	63	NOV 8.....	1230	58	193
OCT 15.....	429	56	65	NOV 9.....	1200	35	113
OCT 16.....	521	80	112	NOV 10.....	1180	19	60
OCT 17.....	1150	309	959	NOV 11.....	1130	20	61
OCT 18.....	1880	463	2350	NOV 12.....	1080	30	87
OCT 19.....	2460	333	2210	NOV 13.....	1030	44	122
OCT 20.....	2250	139	844	NOV 14.....	999	26	70
OCT 21.....	2130	127	730	NOV 15.....	946	23	59
OCT 22.....	2440	176	1150	NOV 16.....	907	18	44
OCT 23.....	2780	135	1010	NOV 17.....	894	21	51
OCT 24.....	2760	140	1040	NOV 18.....	900	20	49
OCT 25.....	2600	106	744	NOV 19.....	851	27	62
NOV 20.....	679	35	64	MAR 23.....	550	45	67
NOV 21.....	663	68	122	MAR 24.....	600	37	60
NOV 22.....	943	93	237	MAR 25.....	640	25	43
NOV 23.....	818	39	86	MAR 26.....	560	16	24
NOV 24.....	801	61	132	MAR 27.....	520	11	15
NOV 25.....	772	70	146	MAR 28.....	500	38	51
NOV 26.....	729	71	140	MAR 29.....	480	43	56
NOV 27.....	564	66	100	MAR 30.....	460	13	16
NOV 28.....	518	61	85	MAR 31.....	440	17	20
NOV 29.....	554	68	102	APR 1.....	420	25	28
NOV 30.....	607	80	131	APR 2.....	470	20	25
DEC 1.....	689	82	152	APR 3.....	540	39	57
DEC 2.....	739	80	160	APR 4.....	1300	149	523
DEC 3.....	653	87	153	APR 5.....	1750	118	558
DEC 4.....	493	95	126	APR 6.....	2700	225	1640
DEC 5.....	329	78	69	APR 7.....	4800	453	6230
DEC 6.....	221	68	40	APR 8.....	7810	372	7840
DEC 7.....	240	72	47	APR 9.....	11700	458	14500
DEC 8.....	265	84	60	APR 10.....	14100	431	16400
DEC 9.....	375	90	91	APR 11.....	15500	416	17400
DEC 10.....	360	85	83	APR 12.....	15100	391	15900
DEC 11.....	320	90	78	APR 13.....	13400	251	9080
DEC 17.....	199	113	61	APR 14.....	11400	188	5790
JAN 20, 1969..	39	133	14	APR 15.....	9970	158	4250
FEB 25.....	72	30	5.8	APR 16.....	8800	98	2330

MISCELLANEOUS ANALYSES OF STREAMS IN MINNESOTA

5-4760. WEST FORK DES MOINES RIVER AT JACKSON, MINN.--Continued

PERIODIC DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
APR 17.....	7760	102	2140	MAY 12.....	1270	67	230
APR 18.....	6860	76	1410	MAY 13.....	1180	66	210
APR 19.....	6140	93	1540	MAY 14.....	1100	39	116
APR 20.....	5580	70	1050	MAY 15.....	1020	44	121
APR 21.....	5120	121	1670	MAY 16.....	963	46	120
APR 22.....	4570	74	913	MAY 17.....	933	41	103
APR 23.....	3980	110	1180	MAY 18.....	874	37	87
APR 24.....	3680	81	805	MAY 19.....	841	44	100
APR 25.....	3480	95	893	MAY 20.....	838	87	197
APR 26.....	3250	83	728	MAY 21.....	818	80	177
APR 27.....	3080	54	449	MAY 22.....	818	70	155
APR 28.....	2880	68	529	MAY 23.....	811	66	144
APR 29.....	2680	102	738	MAY 24.....	778	63	132
APR 30.....	2520	153	1040	MAY 25.....	745	64	129
MAY 1.....	2390	130	839	MAY 26.....	702	62	118
MAY 2.....	2260	117	714	MAY 27.....	676	59	108
MAY 3.....	2130	142	817	MAY 28.....	633	55	94
MAY 4.....	2010	94	510	MAY 29.....	587	57	90
MAY 5.....	1900	76	390	MAY 30.....	534	62	89
MAY 6.....	1830	64	316	MAY 31.....	496	66	88
MAY 7.....	1720	108	502	JUN 1.....	486	75	98
MAY 8.....	1620	122	534	JUN 2.....	465	88	108
MAY 9.....	1500	131	530	JUN 3.....	406	96	105
MAY 10.....	1430	83	320	JUN 4.....	359	107	104
MAY 11.....	1340	64	232	JUN 5.....	342	105	97
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
JUN 6.....	318	103	88	JUL 10.....	2930	98	775
JUN 11.....	297	43	34	JUL 11.....	2690	122	886
JUN 17.....	242	35	23	JUL 12.....	2430	52	341
JUN 18.....	244	42	28	JUL 13.....	2200	44	261
JUN 19.....	233	46	29	JUL 14.....	2030	49	268
JUN 20.....	226	49	30	JUL 15.....	1890	50	252
JUN 21.....	212	48	27	JUL 16.....	1770	53	253
JUN 22.....	210	43	24	JUL 17.....	1650	55	245
JUN 23.....	210	41	23	JUL 18.....	1580	60	256
JUN 24.....	210	44	25	JUL 19.....	1490	50	201
JUN 25.....	432	98	114	JUL 20.....	1410	47	179
JUN 26.....	590	112	178	JUL 21.....	1330	49	176
JUN 27.....	547	129	190	JUL 22.....	1240	48	161
JUN 28.....	511	151	208	JUL 23.....	1180	45	143
JUN 29.....	2800	918	8100	JUL 24.....	1110	56	168
JUN 30.....	1610	262	1140	JUL 25.....	1050	134	380
JUL 1.....	1510	179	730	JUL 26.....	1010	87	237
JUL 2.....	1730	191	892	JUL 27.....	970	74	194
JUL 3.....	2950	240	1910	JUL 28.....	900	57	138
JUL 4.....	3970	178	1910	JUL 29.....	808	62	135
JUL 5.....	4250	92	1060	JUL 30.....	748	90	182
JUL 6.....	4080	81	892	JUL 31.....	709	144	276
JUL 7.....	3740	64	646	AUG 1.....	643	176	306
JUL 8.....	3590	40	872	AUG 2.....	567	153	234
JUL 9.....	3220	62	539	AUG 3.....	512	109	151
DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)	DATE	MEAN DISCHARGE (CFS)	MEAN CONCEN- TRATION (MG/L)	LOAD (TONS)
AUG 4.....	462	65	81	AUG 9.....	302	76	62
AUG 5.....	412	76	84	AUG 10.....	281	101	76
AUG 6.....	387	138	144	AUG 11.....	268	146	106
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