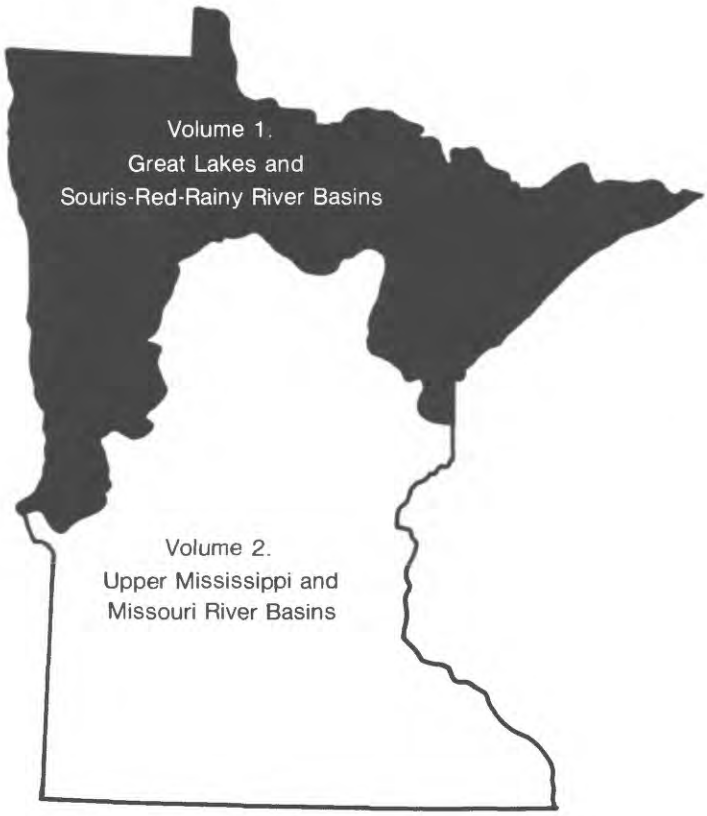
Water Resources Data Minnesota Water Year 1991

Volume 1. Great Lakes and Souris-Red-Rainy River Basins



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN–91–1
Prepared in cooperation with the Minnesota Department of Natural Resources, Division of Waters; the Minnesota Department of Transportation; and with other State, municipal, and Federal agencies

CALENDAR FOR WATER YEAR 1991

1990

OCTOBER

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1991

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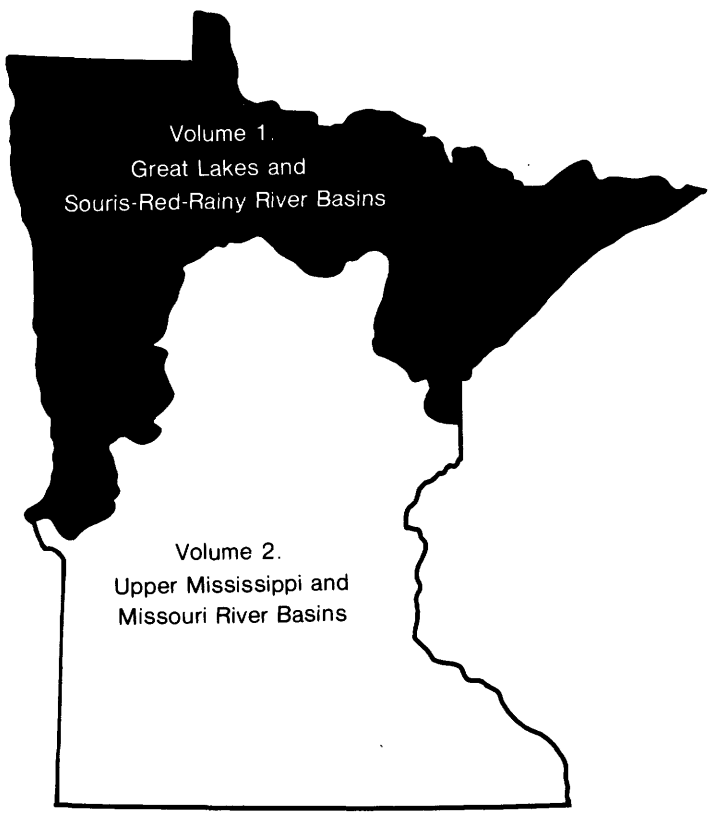
Water Resources Data Minnesota Water Year 1991

Volume 1. Great Lakes and Souris-Red-Rainy River Basins

by Kurt T. Gunard, Joseph H. Hess, and James L. Zirbel



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN–91–1
Prepared in cooperation with the Minnesota Department of Natural Resources, Division of Waters; the Minnesota Department of Transportation; and with other State,

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief, Water Resources Division
U.S. Geological Survey
2280 Woodale Drive
Mounds View, Minnesota 55112

1992

PREFACE

This volume of the annual hydrologic data report of Minnesota is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each State, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and water quality provide the hydrologic information needed by State, local, and Federal agencies, and the private sector for developing and managing our Nation's land and water resources. Hydrologic data for Minnesota are contained in two volumes:

Volume 1. Great Lakes and Souris-Red-Rainy River Basins
Volume 2. Upper Mississippi and Missouri River Basins

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following individuals contributed significantly to the preparation of this report:

Lan H. Tornes, Water-Quality Specialist, Minnesota District
Alex Brietkrietz, Ground-Water Network Project Chief, Minnesota District

Most of the data were collected, processed, and tabulated by the following individuals:

St. Paul District Office

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This report was prepared in cooperation with the State of Minnesota and with other agencies under the general supervision of George Garklavs, District Chief, Minnesota.

REPORT DOCUMENTATION PAGE	1. Report No. USGS/WRD/HD-92/307	2.	3. Recipient's Accession No.

4. Title and Subtitle Water Resources for Minnesota, Water Year 1991 Volume 1, Great Lakes and Souris-Red-Rainy River Basins	5. Report September 1992 6.
7. Author(s) Kurt T. Gunard, Joseph H. Hess and James L. Zirbel	8. Performing Organization Rept. No. USGS-WDR-91-1
9. Performing Organization Name and Address U.S. Geological Survey, Water Resources Division 2280 Woodale Drive Mounds View, MN 55112	10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Geological Survey, Water Resources Division 2280 Woodale Drive Mounds View, MN 55112	13. Type of Report & Period Covered Annual Oct. 1, 1990 Sept. 30, 1991 14.

15. Supplementary Notes

Prepared in cooperation with the State of Minnesota and with other agencies.

16. Abstract (Limit: 200 words)

Water-resources data for the 1991 water year for Minnesota consist of records of stage, discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 46 gaging stations; stage-only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 13 stream stations; and water levels for 12 observation wells. Also included are 27 high-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data together with the data in Volume 2, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota.

17. Document Analysis a. Descriptors

*Minnesota, *Hydrologic data, *Surface water, *Ground water, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Data collection

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement: No restriction on distribution. This report may be purchased from: National Technical Information Service Springfield, VA 22161	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 142
	20. Security Class (This Page) UNCLASSIFIED	22. Price

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TABLES

GAGING STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED

Note.--Data for partial-record stations and miscellaneous sites for both surface-water quantity and quality are published in separate sections of the data report. See references at the end of this list for page numbers for these sections.

[Letters after station name designates type of data: (d) discharge; (e) gage height, elevation, or contents; (c) chemical, radio-chemical, or pesticides; (b) biological or mictro-biological; (p) physical (water temperature, sediment, or specific conductance)]

SURFACE-WATER STATIONS, IN DOWNSTREAM ORDER--Continued

GROUND-WATER WELLS, BY COUNTY, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME

GROUND-WATER LEVELS

DISCONTINUED SURFACE-WATER DISCHARGE OR STAGE-ONLY STATIONS

The following continuous-record surface-water discharge or stage-only stations (gaging stations) in Minnesota have been discontinued. Daily streamflow or stage records were collected and published for the period of record, expressed in water years, shown for each station. Those stations with an asterisk (*) after the station number are currently operated as crest-stage partial-record stations. Discontinued project stations with less than 3 years of record have not been included. Information regarding these stations may be obtained from the District Office at the address given on the back side of the title page of this report.

[Letters after station name designate type of the data collected:
(d) discharge, (e) elevation (stage only)]

Station name	Station number	Drainage area (mi^2)	Period of record
STREAMS TRIBUTARY TO LAKE SUPERIOR			
Pigeon River above mouth of Arrow River, MN (d)	04010000	256	1924-27
Brule River at mouth near Hoveland, MN (e)	04011000	248	1911†
Devil Track River at mouth near Grand Marais, MN (e)	04011500	a77	1911†
Cascade River at mouth near Grand Marais, MN (e)	04012000	111	1911†
Poplar River at Lutsen, MN (d)	04012500*	114	1911†, 1912-17, 1928-47, 1952-61
Cross River at Schroeder, MN (d)	04013000	a91	1931-32
Beaver Creek (Beaver Bay Run) at Beaver Bay, MN (d)	04015000	126	1911-14, 1928-31
South Branch Partridge River near Babbitt, MN (d)	04015455	18.5	1977-80
Partridge River above Colby Lake, at Hoyt Lakes, MN (d)	04015475	106	1979-88
Second Creek near Aurora, MN (d)	04015500	29	1955-80
Partridge River near Aurora, MN (d)	04016000	161	1942-82
St. Louis River near Aurora, MN (d)	04016500	290	1942-87
Embarrass River at Embarrass, MN (d)	04017000	93.8	1942-64
Embarrass River near McKinley, MN (d)	04018000	171	1953-62
St. Louis River at Forbes, MN (d)	04018750	713	1965-90
East Two Rivers near Iron Junction, MN (d)	04018900	40.0	1966-79
West Two Rivers near Iron Junction, MN (d)	04019000	65.3	1953-62, 1965-79
West Swan River near Silica, MN (d)	04019300	16.3	1963-79
East Swan River near Toivola, MN (d)	04019500	112	1953-62, 1964-71
Swan River near Toivola, MN (d)	04020000	254	1952-61
Whiteface River below (at) Meadowlands, MN (d)	04021000	453	1909-17
Stoney Brook at Brookston, MN (d)	04021530	97.3	1983-84
Cloquet River at Independence, MN (d)	04023000	a750	1909-17
Simian Creek near Brookston, MN (d)	04023150	-	1983-84
St. Louis River near Cloquet, MN (e)	04023500	a3,400	1903†
Squaw Creek near Cloquet, MN (d)	04023600	-	1983-84
Otter Creek near Cloquet, MN (d)	04024015	-	1983-84
Elim Creek near Holyoke, MN (d)	04024090	1.06	1976-78
Skunk Creek below Elim Creek near Holyoke, MN (d)	04024093	8.83	1976-78

"See footnotes at end of table."

DISCONTINUED SURFACE-WATER DISCHARGE OR STAGE-ONLY STATIONS.--Continued

Station name	Station number	Drainage area (mi^2)	Period of record
RED RIVER OF THE NORTH BASIN			
Otter Tail River near Detroit Lakes, MN (d)	05030000	270	1937-71
Otter Tail River at German Church, near Fergus Falls, MN (d)	05030500	a1,230	1904-17
Pelican River at Detroit Lakes, MN (d)	05033900	-	1968-71, 1974-75
Pelican River at Detroit Lake outlet near Detroit Lakes, MN (d)	05034100	-	1968-71, 1972-75
Long Lake outlet near Detroit Lakes, MN (d)	05035100	-	1968-71
West Branch County Ditch No. 14 near Detroit Lakes, MN (d)	05035200	-	1968-71
East Branch County Ditch No. 14 near Detroit Lakes, MN (d)	05035300	-	1968-71
St. Clair Lake outlet near Detroit Lakes, MN (d)	05035500	-	1968-75
Pelican River at Muskrat Lake outlet near Detroit Lakes, MN (d)	05035600	-	1968-75
Pelican River at Sallie Lake outlet near Detroit Lakes, MN (d)	05037100	-	1968-75
Pelican River at Lake Melissa outlet near Detroit Lakes, MN (d)	05039100	-	1968-75
Pelican River near Detroit Lakes, MN (d)	05040000	123	1942-53
Pelican River near Fergus Falls, MN (d)	05040500	482	1909-12, 1942-80
Otter Tail River (Red River) near Fergus Falls, MN (e)	05045500	a1,690	1909-10†
Otter Tail River near Breckenridge, MN (d)	05046500	a2,040	1931-32, 1939-46†
Mustinka River (head of Bois de Sioux River) near Norcross, MN (d)	05047000	-	1940-47
Mustinka ditch above West Branch Mustinka River (Twelve Mile Creek) near Charlesville, MN (d)	05047500	-	1943-55
Mustinka ditch below West Branch Mustinka River (Twelve Mile Creek) near Charlesville, MN (d)	05048000	-	1943-55
West Branch Mustinka River (Twelve Mile Creek) below Mustinka ditch near Charlesville, MN (d)	05048500	-	1943-55
Mustinka River above (near) Wheaton, MN (d)	05049000	834	1915-24, 1930-58
Bois de Sioux River below Fairmont, ND (d)	05050500	a1,540	1919-44
Rabbit River at Cambell, MN (d)	05051000	266	1942-52
Red River of the North below Fargo, ND (d)	05054020	-	1969-78
Whiskey Creek at Barnesville, MN (d)	05061200*	25.3	1964-66
Wild Rice River near Ada, MN (d)	05063000	a1,100	1948-54
South Branch Wild Rice River near Borup, MN (d)	05063500*	254	1944-49
Marsh River below Ada, MN (d)	05067000	-	1948-52
Sand Hill River at Beltrami, MN (d)	05068000	a324	1943-58
Sand Hill ditch at Beltrami, MN (d)	05068500	-	1943-58
Thief River near Gatske, MN (d)	05075500	-	1953-56
Red Lake River at Thief River Falls, MN (d)	05076500	a3,450	1909-18, 1920-30
Clearwater River near Pinewood, MN (d)	05077000	132	1940-45
Clearwater River near Leonard, MN (d)	05077500	153	1934-47
Ruffy Brook near Gonvick, MN (d)	05077700*	45.2	1960-78

"See footnotes at end of table."

DISCONTINUED SURFACE-WATER DISCHARGE OR STAGE-ONLY STATIONS.--Continued

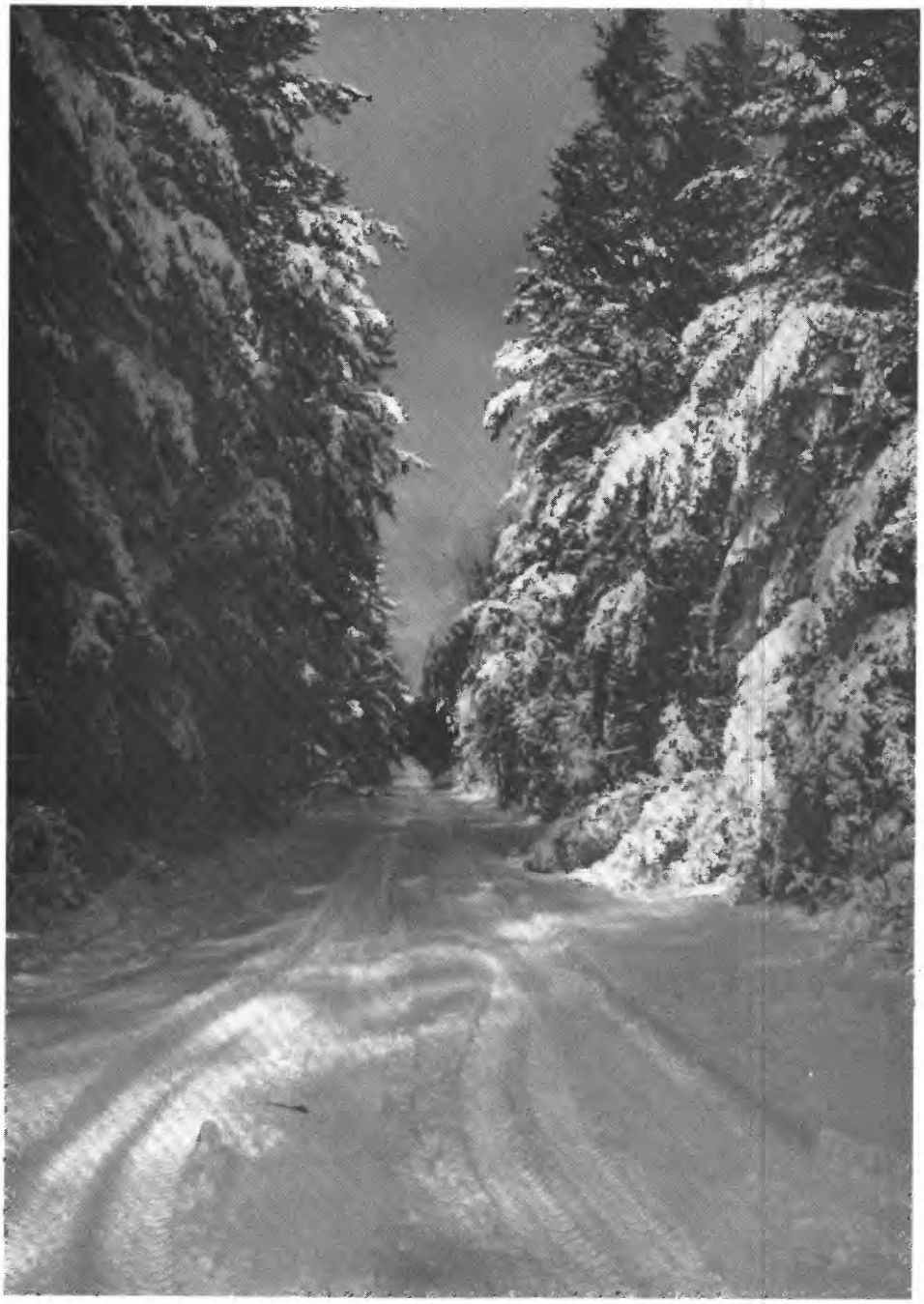
Station name	Station number	Drainage area (mi^2)	Period of record
RED RIVER OF THE NORTH BASIN--Continued			
Red River of the North at Oslo, MN (d)	05083500	331,200	1936-37, 1941-43, 1945-60, 1973-78
Snake River at Warren, MN (d)	05085500	a175	1945, 1953-56
Snake River at Alvarado, MN (d)	05086000	309	1945, 1953-56
Snake River near Argyle, MN (d)	05086500	481	1945
Middle River near Strandquist, MN (d)	05087000	-	1953-56
Tamarac River near Strandquist, MN (d)	05090500	-	1953-56
Tamarac River at Stephen, MN (d)	05091000	-	1945
Tamarac River near Stephen, MN (d)	05091500	a320	1945, 1953-55
Two Rivers (Middle Fork Two Rivers) near Hallock, MN (d)	05092500	131	1931-38
South Branch (South Fork) Two Rivers near Pelan, MN (d)	05093000	281	1928-38, 1953-56
South Branch Two Rivers (Two Rivers) at Hallock, MN (d)	05094500	-	1940-47
Two Rivers (South Branch Two Rivers) at Hallock, MN (d)	05095000		1911-14, 1929-30, 1938-39, 1941-43
Two Rivers below Hallock, MN (d)	05095500	644	1945-55
North Branch (North Fork) Two Rivers near Lancaster, MN (d)	05096000	a32	1929-38, 1941-55
State Ditch 85 near Lancaster, MN (d)	05096500	a95	1929-38, 1942-55
North Branch Two Rivers at Lancaster, MN (d)	05097000	209	1941-42, 1953-56
North Branch Two Rivers near Northcote, MN (d)	05097500	386	1941-42, 1945-51
Two Rivers below North Branch near Hallock, MN (d)	05098000	a1,060	1941-43
Roseau River (at) near Malung, MN (d)	05103000	252	1928-46
South Fork (West Branch) Roseau River near Malung, MN (d)	05104000	312	1911-14, 1928-46
Roseau River at Roseau, MN (d)	05105000	-	1940-47
Roseau River near Roseau, MN (d)	05105500	-	1930-60
Sprague Creek near Sprague, Manitoba (d)	05106000	176	1928-81
Pine Creek near Pine Creek, MN (d)	05107000	74.6	1928-53
Roseau River near Badger, MN (d)	05108000	-	1928-69
Roseau River near Duxby, MN (d)	05108500	-	1929-51, 1952-56
Badger Creek near Badger, MN (d)	05109000	a2.2	1929-30, 1931-38
Roseau River near Haug, MN (d)	05109500	-	1932-66
Roseau River at outlet of State Ditch 69 near Oak Point, MN (d)	05110000	-	1939-42
Roseau River at head of State Ditch 51 near Oak Point, MN (d)	05110500	-	1933-42
Roseau River at Oak Point, MN (d)	05111000	-	1933-39, 1941-60
Roseau River at international boundary, near Caribou, MN (d)	05112500	a1,590	1933-69

*See footnotes at end of table."

DISCONTINUED SURFACE-WATER DISCHARGE OR STAGE-ONLY STATIONS.--Continued

Station name	Station number	Drainage area (mi^2)	Period of record
LAKE OF THE WOODS BASIN			
Isabella River near Isabella, MN (d)	05124500	341	1953-61, 1976-77
Filson Creek near Ely, MN (d)	05124990	9.66	1974-85
South Kawishiwi River near Ely, MN (d)	05125000	-	1953-61, 1976-78
Stony River near Isabella, MN (d)	05125500	180	1953-64
Stony River near Babbitt, MN (d)	05125550	219	1975-80
Dunka River near Babbitt, MN (d)	05126000	53.4	1951-62, 1975-80
South Kawishiwi River above White Iron Lake near Ely, MN (d)	05126210		1975-78
Bear Island River near Ely, MN (d)	05126500	68.5	1953-62, 1975-77
Burntside River near Ely, MN (d)	05127205	-	1967-78
Bjorkman's Creek near Ely, MN (d)	05127207	1.36	1972-78
Armstrong Creek near Ely, MN (d)	05127210	5.29	1967-78
Longstorff Creek near Ely, MN (d)	05127215	8.84	1967-78
Shagawa Lake tributary at Ely, MN (d)	05127219	1.84	1971-78
Burgo Creek near Ely, MN (d)	05127220	3.04	1967-78
Shagawa River near Ely, MN (d)	05127230	99	1967-78
Vermilion Lake near Soudan, MN (e)	05128200	-	1913-15†, 1941-42†, 1946-87†
Pike River near Biwabik, MN (d)	05128340	-	1977-79
Pike River near Embarrass, MN (d)	05128500	115	1953-64, 1976-79
Vermilion River below Vermilion Lake near Tower, MN (d)	05129000	483	1911-17, 1928-81
Rainy River at International Falls, MN (d)	05129500	14,900	1905-60
Sturgeon River (Lake) at Side Lake, MN (d)	05130000	-	1938-47
Dark River near Chisholm, MN (d)	05131000	50.6	1942-61, 1965-79
Deer Lake outlet (Deer Lake) near Effie, MN (d)	05131800	-	1937-39, 1940-46
Big Fork River at Laurel, MN (d)	05132500	-	1909
Black River near Loman, MN (d)	05133000	-	1909
Rapid River near Baudette, MN (d)	05134200	543	1956-85
Warroad River near Warroad, MN (d)	05139500	162	1946-80
Bulldog Run near Warroad, MN (d)	05140000*	14.2	1946-51, 1966-77
East Branch Warroad River near Warroad, MN (d)	05140500*	102	1946-54, 1966-77

* Presently operated as high-flow partial-record station.
† Stage records only.
e Approximately.



Chippewa National Forest Road

WATER RESOURCES DATA FOR MINNESOTA, 1991

INTRODUCTION

The Water Resources Division of the U.S Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Minnesota each water year. These data, accumulated during many years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Minnesota."

Water resources data for the 1991 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume contains discharge records for 46 gaging stations; stage only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 13 stream stations; and water levels for 12 observation wells. Also included are 27 high-flow partial-record stations. These data, together with the data in Volume 2, represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota.

This series of annual reports for Minnesota began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Minnesota were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Parts 4, 5 and 6A." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply papers can be consulted in the libraries of the principal cities of the United States and may be purchased from the books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and volume number. For example, this volume is identified as the "U.S. Geological Survey Water-Data Report MN-91-1. For archiving and general distribution, the reports for 1971-1974 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. Beginning with the 1990 water year, all water-data reports will also be available on Compact Disc-Read Only Memory (CD-ROM). All data reports published for the current water year for the entire Nation, including Puerto Rico and the Trust Territories, will be reproduced on a single CD-ROM disc.

Additional information, including current prices, for ordering specific reports may be obtained from the district chief at the address given on the back of the title page or by telephone (612) 783-3101. A limited number of CD-ROM discs will be available for sale by the Books and Open-File Reports section, U.S. Geological Survey, Federal Center, Box 25425, Denver, Colorado 80225.

COOPERATION

The U.S. Geological Survey and organizations of the State of Minnesota have had cooperative agreements for the systematic collection of streamflow records since 1909, for ground-water levels since 1948, and for water-quality records since 1952. Organizations that assisted in collecting data through cooperative agreement with the Survey are:

Minnesota Department of Natural Resources, Division of Waters, Kenneth Lokkesmoe, director.

Minnesota Department of Transportation, Leonard W. Levine, commissioner.

Metropolitan Waste Control Commission of the Twin Cities Area, Louis R. Clark, chairperson.

Beltrami Soil and Water Conservation District, Floyd W. Jorgensen, chairperson.

Elm Creek Conservation Commission, Fred G. Moore, chairperson.

Leech Lake Reservation Business Committee, Daniel Brown, chairperson.

Lower Red River Watershed Management Board, Donald Ogaard, chairman.

Whitewater Joint Powers Board, Eugene Kalmes, chairman.

Assistance in the form of funds or services was given by the U.S. Army Corps of Engineers, in collecting records for 46 gaging stations and 12 water-quality stations published in this report of 2 volumes. Thirteen gaging stations in the Hudson Bay and St. Lawrence River basins were maintained by funds appropriated to the United States Department of State. Eight of these, on water adjacent to the international boundary, 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."

SUMMARY OF HYDROLOGIC CONDITIONS

PRECIPITATION

Normal annual precipitation in Minnesota ranges from about 19 in. (inches) in the northwest to more than 32 in. in the southeast. Precipitation during water year 1991 ranged from less than 20 in. in the northwest to 44 in. in several areas in southern, central, and east-central Minnesota. Precipitation ranged from more than 3 in. below normal (based on record period 1961-90) in small areas of northern, southwestern, and southeastern Minnesota to more than 12 in. above

normal in other areas of southern, central, and east-central Minnesota; precipitation in one small area in central Minnesota was more than 16 in. above normal during the water year (fig. 1).

The water year began with an 8- to 12-in. precipitation deficit in parts of northern Minnesota, and a 12- to 16-in. precipitation excess in parts of east-central and southeastern Minnesota. The following is a summary of precipitation during the 1991 water year:

October - above normal statewide except in the northwest and south where it was below normal.

November - below normal statewide.

December - near normal statewide except in parts of the south where it was considerably above normal.

January - below normal statewide.

February - below normal statewide except in the east-central, west-central, north-central, and northwest where it was above normal.

March - above normal statewide except in the northwest and northeast where it was below normal.

April - above normal statewide except in the northeast where it was below normal.

May - above normal statewide except in west-central region where it was below normal.

June - below normal statewide except in the northwest, west-central, and southwest where it was above normal.

July - above normal statewide except in the southwest where it was below normal.

August - below normal statewide except in the south-central and southeast where it was above normal.

September - above normal statewide.

Two notable rainfalls occurred during the summer of 1991. The first event was on Sunday, July 21, when approximately 6 in. of rain fell in a one-hour period in the Garvin Brook basin in southeastern Minnesota. This is about twice the 100-year one-hour rainfall for that area. The entire town of Stockton, which lies in the Garvin Brook valley, was flooded to depths as much as 5 feet. Four miles downstream from Stockton, the gage shelter for gaging station, Garvin Brook near Minnesota City (05378235) was washed away. A survey showed that Garvin Brook had risen 17 feet at the gage site.

The second event was on September 7, when more than 6 in. of rain fell Saturday evening between 2 pm and 10 pm from south of Breckenridge in west-central Minnesota near the North Dakota border to Paynesville in central Minnesota, and from Hector to Glencoe, in central Minnesota. A Soil and Water Conservation District official reported 11 in. of rain just west of Glencoe. An additional 2 or more inches of rain fell over much of Minnesota on Sunday night, September 8. As a result, flood stages or near flood stages were reached in several tributaries to the Minnesota and Mississippi Rivers during September.

STREAMFLOW

Average annual runoff in Minnesota ranges from 1 in. in the west to 14 in. in the northeast. Annual runoff in water year 1991 ranged from 0.14 in. (6 percent of average) in a small part of northwestern Minnesota to 16.90 in. (129 percent of average) in east-central Minnesota (table 1, vol. 1). In contrast to the previous year, when runoff in the western one-third of the State was considerably less than one-half the long-term average, runoff in 1991 was less than one-half the long-term average only in the northwest. Runoff in west-central and southwestern Minnesota during 1991 generally exceeded the long-term average and for some streams was almost twice the long-term average. In the remaining eastern two-thirds of the State, runoff ranged from more than one-half the long-term average in the north to greater than twice the long-term average in some areas of the south.

In 1991, runoff to the Great Lakes and Souris-Red-Rainy River Basins (Volume 1) ranged from considerably below the long-term average in most of the west to near or slightly above the long-term average in the east. Runoff ranged from a low of 6 percent of average at Thief River near Thief River Falls (05076000) in the Red River of the North basin in northwestern Minnesota to a high of 129 percent of average at Deer Creek near Holyoke (04024098) in the Lake Superior basin in east-central Minnesota.

In northwestern Minnesota, runoff for the index station, Red Lake River at Crookston (05079000), was 0.61 in. - 21 percent of the station's 90-year average (1902-1991) of 2.87 in. and the 11th lowest runoff of record indicating that the drought, which began in the late 80's, persisted in this area. In the three previous years (1988-90), runoff was the 11th, 23rd, and 6th lowest for the respective period of record.

In north-central Minnesota, runoff for the index station Little Fork River at Littlefork (05131500) was 6.42 in. - 77 percent of the 68-year average (1912-16, 1929-91) of 8.29 in. This is identical to the previous year when runoff was 77 percent of the 67-year average.

In northeastern Minnesota, runoff for the index station, Baptism River near Beaver Bay (04014500) was 14.26 in. - 87 percent of the 64-year average (1928-91) of 16.30 in. This is considerably higher than the 9.00 in. of runoff in water year 1990 and reflects the above normal precipitation in this area during the year.

Annual and monthly mean discharges for 1991 for the index stations are compared to the median of mean discharges for a 30-year base period in figure 2. Although near-record high flows occurred at a few stations, no new records were established. However, record low flows occurred at several stations. The most notable low flow, for the 2nd consecutive year, occurred in the Roseau River below State Ditch No. 51 near Caribou (65112000) in northwestern Minnesota; monthly mean flows for October, November, December, January, and February were the lowest for the period of record, which ranged from 34 years for January and February to 65 years for October.

WATER QUALITY

Boxplots for four U.S. Geological Survey National Stream-Quality Accounting Network (NASQAN) stations are used to depict variability in concentrations of dissolved solids and nitrate as nitrogen in the three major basins (figs. 3 and 4): Lake Superior, Rainy River, and Red River of the North basins.

Boxplots are a useful graphical technique because they display the central tendency, variation, and skewness of a data set, as well as the presence or absence of extreme values. A boxplot consists of a centerline (the median) dividing a rectangle defined by the 75th and 25th percentiles. Whiskers are drawn from the ends of the box (75th and 25th percentiles) to the most extreme observation within 1.5 times the interquartile range (the distance from the 25th to the 75th percentile values) beyond the ends of the box. Values more than 1.5 interquartile ranges from the box ends may indicate extreme hydrologic and chemical conditions or sampling and analytical errors. Observations from 1.5 to 3 interquartile ranges from the box in either direction are plotted individually with an asterisk. Observations greater than three interquartile ranges from the ends of the box are plotted with an open circle. Water year 1991 values are plotted with a closed circle to show where these data lie with respect to the historic distribution of data.

Dissolved-solids concentrations in 1991 were generally less than historic median in the Lake Superior basin, as evidenced by data for Baptism River near Beaver Bay and St. Louis River at Scanlon. Red Lake River at Crookston in the Red River of the North basin generally had lower concentrations of dissolved solids in the fall and higher in the winter and summer. Dissolved-solids concentrations were substantially greater than historic median in January and July

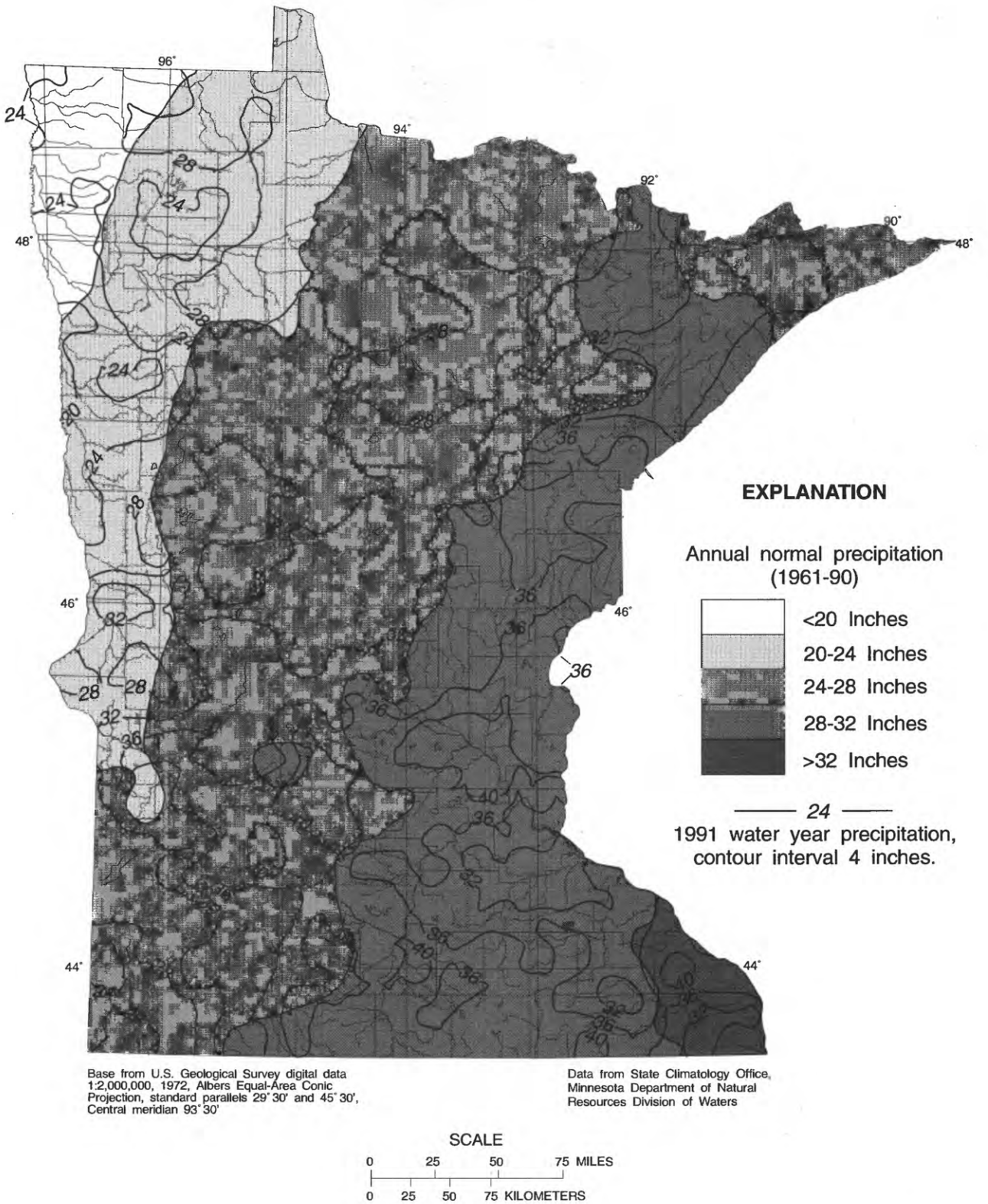


Figure 1.--Precipitation, in inches, during 1991 water year compared to normal annual precipitation in Minnesota.

Table 1.--Runoff at streamflow stations in 1991 compared with long-term average for river basins in Minnesota

[Average runoff for station is based on period of record. Maximum and minimum runoff and year of occurrence are shown. mi^2, square miles.]

Station no.	Station name	Drainage area (mi^2)	Runoff (inches)		Maximum runoff		Minimum runoff		Years of record
			1991 Water year	Average	Inches	Water year	Inches	Water year	
04010500	Pigeon River at Middle Falls near Grand Portage	600	10.30	11.38	19.01	1971	3.58	1958	68
04014500	Baptism River near Beaver Bay	140	14.26	16.30	32.50	1972	7.92	1963	64
04015330	Knife River near Two Harbors	85.6	15.31	14.17	23.32	1986	7.01	1977	17
04024000	St. Louis River at Scanlon	3,430	9.91	9.26	16.93	1972	3.74	1924	83
04024098	Deer Creek near Holyoke	7.77	16.90	13.13	33.70	1986	6.38	1980	15
05046000	Otter Tail River below Orwell Dam near Fergus Falls	1,830	2.52	2.37	6.25	1966	.15	1934	61
05050000	Bois de Sioux River near White Rock	1,160	.75	.94	3.85	1986	.004	1977	50
05051500	Red River of the North at Wahpeton	4,010	1.66	1.84	5.00	1986	.18	1977	48
05061500	South Branch Buffalo River at Sabin	522	.65	1.45	5.15	1962	.32	1977	41§
05062000	Buffalo River near Dilworth	1,040	.99	1.72	5.76	1975	.33	1934	60
05064000	Wild Rice River at Hendrum	1,600	.96	2.20	5.79	1975	.25	1977	46§
05069000	Sand Hill River at Climax	426	.88	2.25	6.50	1950	.59	1977	44§
05074500	Red Lake River near Red Lake	1,950	.45	3.30	9.00	1951	.04	1936	58
05076000	Thief River near Thief River Falls	959	.14	2.27	8.60	1966	.02	1939	73§
05078500	Clearwater River at Red Lake Falls	1,370	1.25	3.07	8.48	1950	.64	1939	64§
05079000	Red Lake River at Crookston	5,280	.61	2.87	8.05	1950	.22	1934	90
05082500	Red River of the North at Grand Forks	30,100	.53	1.16	3.42	1950	.11	1934	87

Table 1.--Runoff at streamflow stations in 1991 compared with long-term average for river basins in Minnesota--Continued

Station no.	Station name	Drainage area (mi^2)	Runoff (inches)		Maximum runoff		Minimum runoff		Years of record
			1991 Water year	Average	Inches	Water year	Inches	Water year	
05087500	Middle River at Argyle	265	.23	1.95	5.74	1966	.08	1977	40§
05102500	Red River of the North at Emerson	40,200	.45	1.12	4.09	1950	.11	1934	79
05104500	Roseau River below South Fork near Malung	573	1.19	3.13	8.18	1950	.17	1990	45
05107500	Roseau River at Ross	1,220	1.59	2.84	8.07	1950	.32	1934	63
05112000	Roseau River below State Ditch No. 51 near Caribou	1,570	1.47	2.36	5.91	1927	.31	1977	34§
05124480	Kawishiwi River near Ely	253	6.33	11.22	16.80	1971	5.07	1977	25
05127000	Kawishiwi River near Winton	1,229	7.83	11.39	21.73	1950	2.65	1924	71§
05127500	Basswood River near Winton	1,740	7.53	10.91	20.63	1950	4.35	1958	63§
05128000	Namakan River at Outlet of Lac la Croix	5,170	7.39	10.07	19.10	1950	2.53	1924	69
05130500	Sturgeon River near Chisholm	187	6.34	8.93	15.11	1950	4.58	1977	49
05131500	Little Fork River at Littlefork	1,730	6.42	8.29	15.01	1966	2.40	1931	68§
05132000	Big Fork River at Big Falls	1,460	4.49	6.74	12.67	1950	.86	1931	60§
05133500	Rainy River at Manitou Rapids	19,400	6.33	8.97	16.28	1950	4.10	1977	63

§ Noncontinuous period.

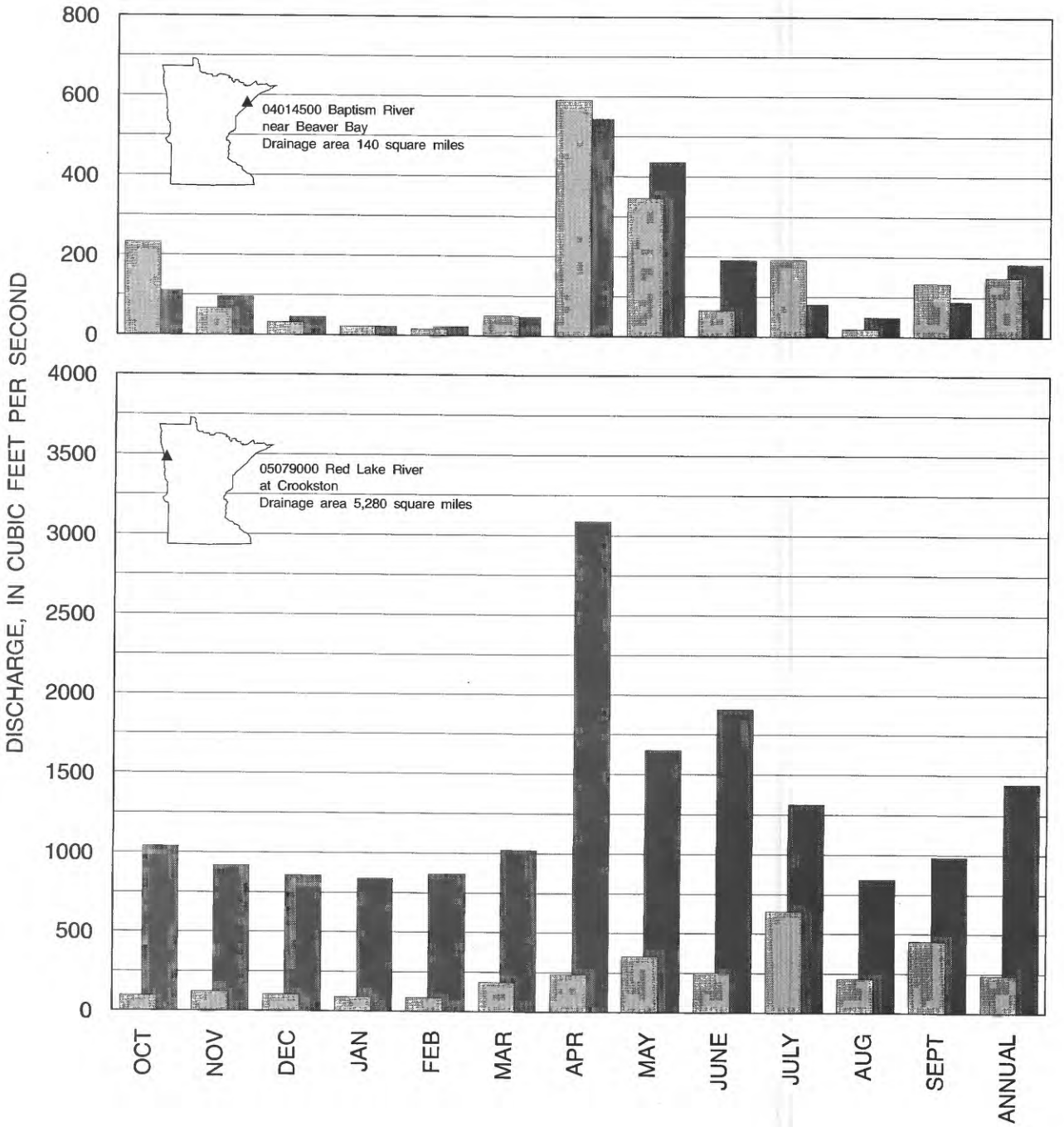
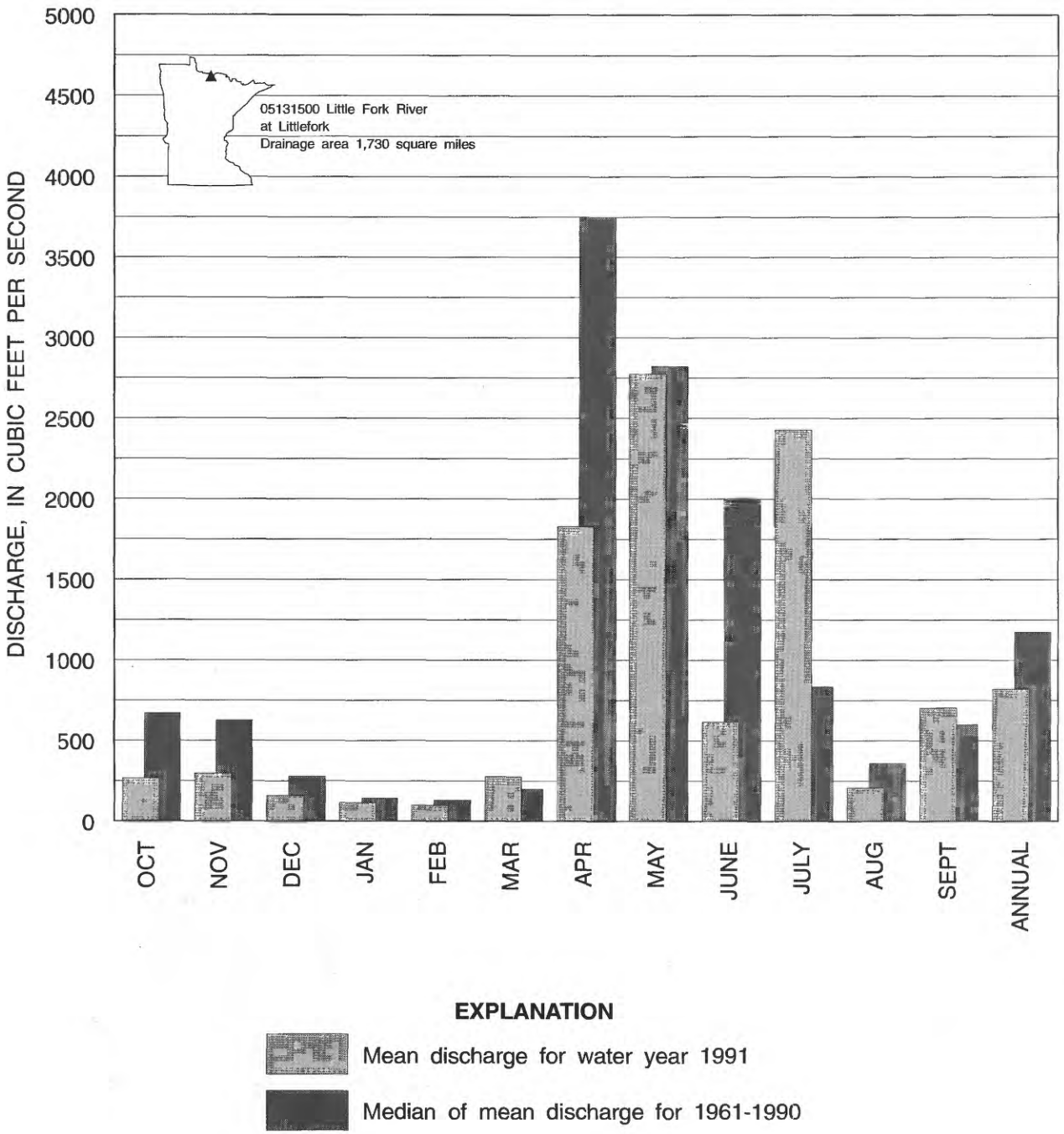


Figure 2.--Comparison of mean discharge for the 1991 water year with median



of mean discharge for 1961-90 at three long-term representative gaging stations.

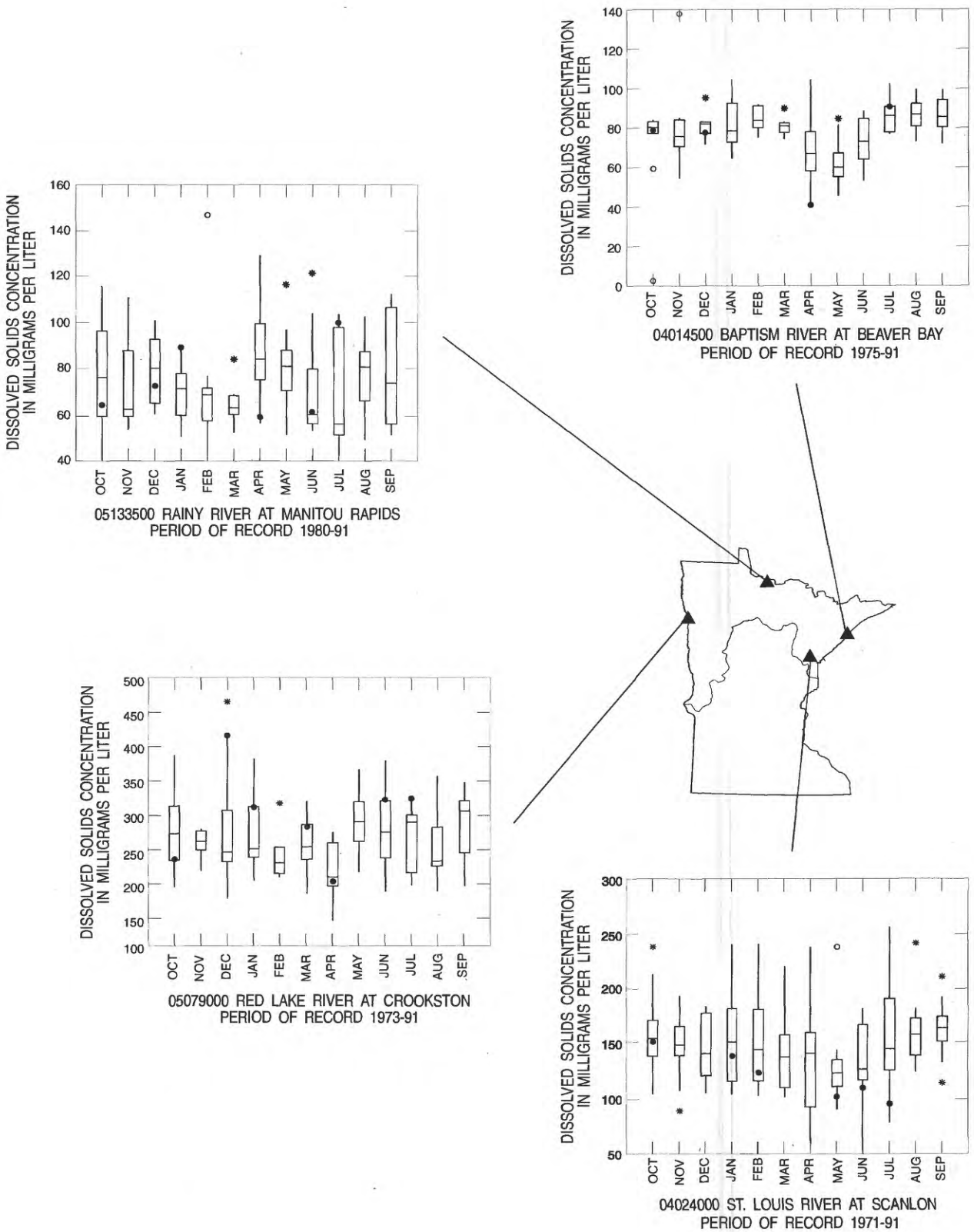


Figure 3--Comparison of dissolved-solids concentrations in water year 1991 with median for period of record at representative gaging stations.

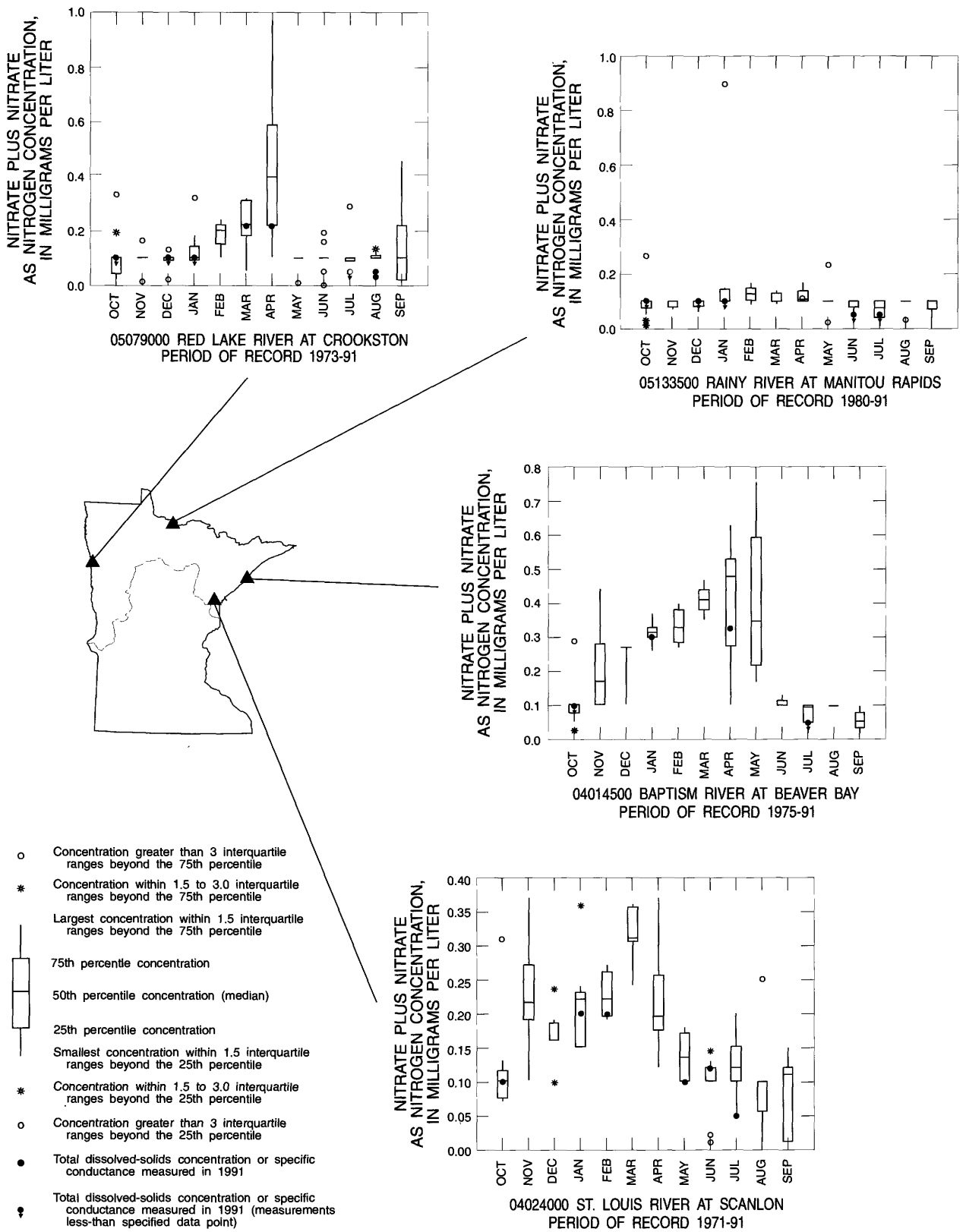


Figure 4--Comparison of nitrate plus nitrate concentrations in water year 1991 with median for period of record at representative gaging stations.

and substantially less than median in April in the Rainy River at Manitou Rapids. Dissolved-solids concentrations in samples collected in October, December, and June were within the interquartile range.

Nitrate concentrations reported as nitrogen (analyzed for nitrate plus nitrite, but nitrite concentration assumed to be negligible) were generally close to the median throughout 1991 for the four NASQAN stations. No ground-water samples were collected in the hydrologic areas described by this volume.

GROUND-WATER LEVELS

Data from six wells completed in surficial sand aquifers, five wells completed in buried sand and gravel aquifers, and one well completed in the Biwabik Iron-Formation aquifer are presented in this volume.

Surficial Sand Aquifers

Compared to the previous water year, water levels during 1991 were higher in five of six surficial sand wells, while record low levels occurred in the remaining well. Recharge to the surficial sand aquifers closely follows precipitation. For example, water level in a west-central Minnesota well (455700096314001) was 3.4 feet higher at the end of September than it was a year ago. This was in response to 11 inches of precipitation above the 22-inch average precipitation for this area. In another shallow well (463956095352601) in the same part of the State, water levels were 1.5 feet higher at the end of September compared to September 1990 (see hydrograph page). However, water levels in this well were below the monthly average from October through May, and above the monthly average from June through September. In a shallow well (474253091574101) in northeastern Minnesota, monthly water levels were above average for the entire year (fig. 5). Another well (475502091494601), in the same county, also had water levels above the monthly average for the entire year. Precipitation in this area was 5.8 inches above the annual average. Continued water-level declines were observed in one well (465237096383901) near Moorhead in northwestern Minnesota. From October through July record monthly low levels were observed in this well which has 44 years of record. This well is in an area of large ground-water withdrawals for public supply and irrigation. In contrast, a well (463854096250701) 20 miles southeast of Moorhead had an average water-level gain of 1 foot from May through September as compared to the previous year (fig. 5).

Buried Sand and Gravel Aquifer

By the end of the 1991 water year, water levels in three of the five buried sand and gravel wells were higher than they were at the end of the previous year while levels in the other two were lower. The two wells with lower water levels are near Moorhead in northwestern Minnesota. New monthly low levels were measured in one well (465328096391001) throughout the water year; in August, the lowest water level in a 30-year period of record was measured (see hydrograph page 123). In the other well (465231096415801), located 2.5 miles from the previously mentioned well, no record low water levels were measured, but water levels were below average the entire water year. Two wells (473102092345001 and 473011092524301) in northeastern Minnesota, along the Mesabi Iron Range, had water levels 1.5 feet higher at the end of the water year compared to a year ago; precipitation in this area was about 6 inches above the yearly average. Maximum recharge to these two wells was greatest from May through September causing water levels to be above average at the end of the water year. In well (455927095575505), in west central Minnesota, water levels at the end of the water year were about the same as at the close of the previous water year, even though precipitation near this well was 5 inches above the yearly average.

Bibwabik Iron-Formation Aquifer

Monthly high water levels were recorded for the entire water year as well as a record all time high in September in a well (472638092533601) in northeastern Minnesota with 36 years of record (see hydrograph page 125). This well is located on the Mesabi Iron Range. The steady rise in water level is due to a combination of above average precipitation and no dewatering of nearby mines. This type of natural phenomenon has been described at other abandoned mine sites that are now filled by ground water.

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 57 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

National Stream Quality Accounting Network (NASQAN) is a national data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of the hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water quality assessment and hydrologic research.

The National Trends Network (NTN) is a 150-station network for sampling atmospheric deposition in the United States. The purpose of the network is to determine the variability, both in location and in time, of the composition of atmospheric deposition, which includes snow, rain, dust particles, and aerosols, and gases. The core from which the NTN was built was the already-existing deposition-monitoring network of the National Atmospheric Deposition Program (NADP).

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Tritium network is a network of stations which has been established to provide baseline information on the occurrence of tritium in the Nation's surface waters. In addition to the surface-water stations in the network, tritium data are also obtained at a number of precipitation stations. The purpose of the precipitation stations is to provide an estimate sufficient for hydrologic studies of the tritium input to the United States.

EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1991 water year that began October 1, 1990, and ended September 30, 1991. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for the surface and ground water, and ground-water-level data. The locations of the stations and wells where the data were collected are shown in figures 7, 8, 9, and 10. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

STATION IDENTIFICATION NUMBERS

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The system used by the U.S.

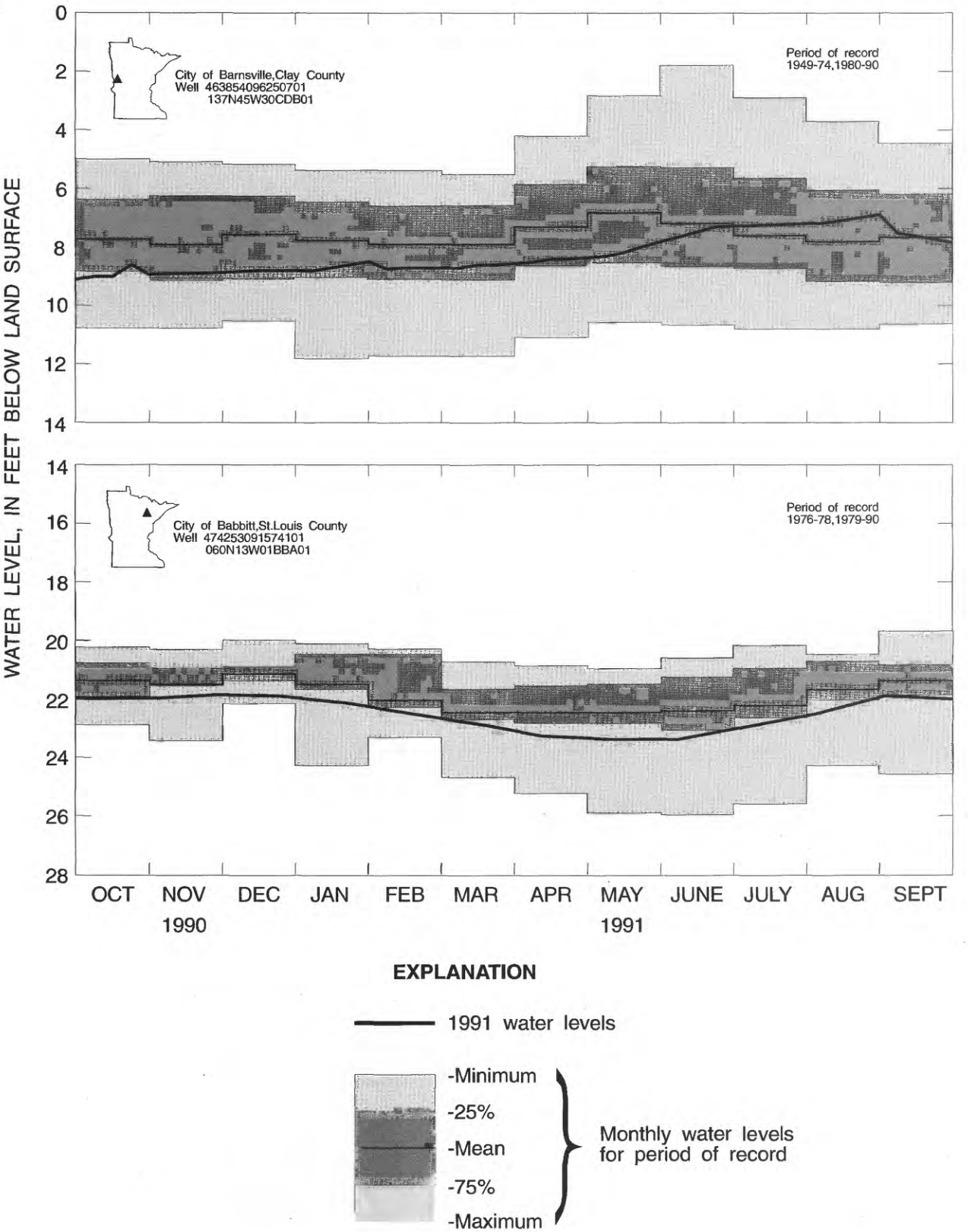


Figure 5.--Relation of water levels during 1991 to long-term levels in two representative wells in surficial sand aquifers.

Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for regular surface-water stations and the "latitude-longitude" system is used for wells and, in Minnesota, for surface-water stations where only miscellaneous measurements are made.

Downstream Order System and Station Number

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary that enters between two main-stream sections is listed between them. A similar order is followed by listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary on which a station is situated with respect to the stream to which it is immediately tributary is indicated by an indentation in a list of stations in front of the report. Each indention represents one rank. This downstream order and system of indention show which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

As an added means of identification, each hydrologic station and partial-record station has been assigned a station number. These are in the same downstream order in this report. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, 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 series of 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 05041000, which appears just to the left of the station name, includes the 2-digit part number "05" plus the 6-digit downstream order number "041000."

Latitude-Longitude System for Wells and Miscellaneous Sites

The 8-digit downstream order station numbers are not assigned to wells and miscellaneous sites where only random water-quality samples or discharge measurements are taken.

The well and miscellaneous site numbering system of the U.S. Geological Survey is based on the grid system of latitude and longitude. The system provides the geographic location of the well or miscellaneous site and a unique number for each site. The number consists of 15 digits. The first 6 digits denote the degrees, minutes, and seconds of latitude, the next 7 digits denote degrees, minutes, and seconds of longitude, and the last 2 digits (assigned sequentially) identify the wells or other sites within a 1-second grid. See figure 6. Each well site is also identified by a local well number which consists of township, range, and section numbers, three letters designating 1/4, 1/4, 1/4 section location, and a two-digit sequential number.

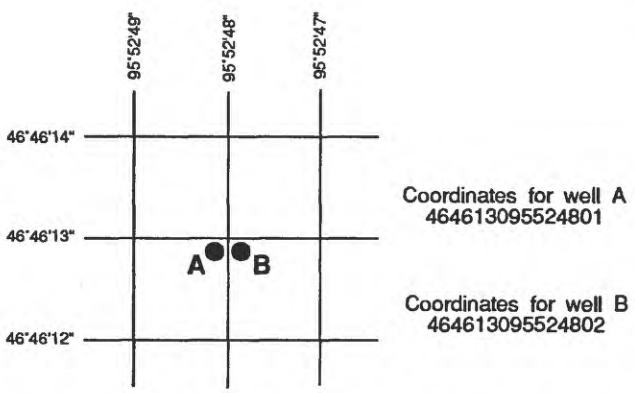


Figure 6.--Example of system for numbering wells and miscellaneous sites.

RECORDS OF STAGE AND WATER DISCHARGE

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharge may be computed for any time, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-day contents commonly are published for such stations, they are referred to as "daily stations".

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "High-flow partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record and high-flow partial-record stations for which data are given in this report are shown in figures 7 and 9.

Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with analog recorders that trace continuous graphs of stage or with digital recorders that punch stage values on paper tapes at selected time intervals. Measurements of discharge are made with current meters using methods adapted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, in Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6.

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of current-meter measurements, the curves are extended using: (1) logarithmic-plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow-over-dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the daily mean stages (gage heights) to the stage-discharge curves or tables. 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 the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby

basins for comparable periods.

At some stream-gaging stations the stage-discharge relation is affected by the 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 computing discharge. 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; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves, or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as time since the last survey increases. Discharge over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

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 daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

Data Presentation

Streamflow data in this report are presented in a new format that is considerably different from the format in data reports prior to the 1991 water year. The major changes are that statistical characteristics of discharge now appear in tabular summaries following the water-year data table and less information is provided in the text or station manuscript above the table. These changes represent the results of a pilot program to reformat the annual water-data report to meet current user needs and data preferences.

The records published for each continuous-record surface-water discharge station (gaging station) now consist of four parts, the manuscript or station description; the data table of daily mean values of discharge for the current water year with summary data; a tabular statistical summary of monthly mean flow data for a designated period, by water year; and a summary statistics table that includes statistical data of annual, daily and instantaneous flows as well as data pertaining to annual runoff, 7-day low-flow minimums, and flow duration.

Station manuscript

The manuscript provides, under various headings, descriptive information, such as station location; period of record; historical extremes outside the period of record; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement," Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA.--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time when the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS.--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all reports in which revisions have been published for the station and water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE.--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datum of previous gages are given under this heading.

REMARKS.--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. If a remarks statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES OUTSIDE PERIOD OF RECORD.--Included here is the information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

REVISIONS.--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the district office (address given on the back of title page of this report) to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and to the inclusion of a skeleton stage-capacity table when daily contents are given.

Headings for AVERAGE DISCHARGE, EXTREMES FOR PERIOD OF RECORD, AND EXTREMES FOR CURRENT YEAR have been deleted and the information contained in these paragraphs, except for the listing of secondary instantaneous peak discharges in the EXTREMES FOR CURRENT YEAR paragraph, is now presented in the tabular summaries following the discharge table or in the REMARKS paragraph, as appropriate. No changes have been made to the data presentations of lake contents.

Data table of daily mean values

The daily table of discharge records for stream-gaging stations gives mean discharge for each day of the water year. In the monthly summary for the table, the line headed "TOTAL" gives the sum of the daily figures for each month; the line headed "MEAN" gives the average flow in cubic feet per second for the month; and the lines headed "MAX" and "MIN" give the maximum and minimum daily mean discharges, respectively, for each month. Discharge for the month also is usually 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 or in acre-feet may be omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversion data or reservoir contents are given. These figure are identified by a symbol and corresponding footnote.

Statistics of monthly mean data

A tabular summary of the mean (line headed "MEAN"), maximum (line headed "MAX"), and minimum (line headed "MIN") of monthly mean flows for each month for a designated period is provided below the mean values table. The water years of the first occurrence of the maximum and minimum monthly flows are provided immediately below those figures. The designated period will be expressed as "FOR WATER YEARS 19__-19__, BY WATER YEAR (WY)," and will list the first and last water years of the range of years selected from the PERIOD OF RECORD paragraph in the station manuscript. It will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript.

Summary statistics

A table titled "SUMMARY STATISTICS" follows the statistics of monthly mean data tabulation. This table consists of four columns, with the first column containing the line headings of the statistics being reported. The table provides a statistical summary of yearly, daily, and instantaneous flows, not only for the current water year but also for the previous calendar year and for a designated period, as appropriate. The designated period selected, "WATER YEARS 19__-19__," will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript. All of the calculations for the statistical characteristics designated ANNUAL (see line headings below), except for the ANNUAL 7-DAY MINIMUM" statistic, are calculated for the designated period using complete water years. The other statistical characteristics may be calculated using partial water years.

The date or water year, as appropriate, of the first occurrence of each statistic reporting extreme values of discharge is provided adjacent to the statistic. Repeated occurrences may be noted in the REMARKS paragraph of the manuscript or in footnotes. Because the designated period may not be the same as the station period of record published in the manuscript, occasionally the dates of occurrence listed for the daily and instantaneous extremes in the designated-period column may not be within the selected water years listed in the heading. When this occurs, it will be noted in the REMARKS paragraph or in footnotes. Selected streamflow duration curve statistics and runoff data are also given. Runoff data may be omitted if there is extensive regulation or diversion of flow in the drainage basin.

The following summary statistics data, as appropriate, are provided with each continuous record of discharge. Comments to follow clarify information presented under the various line headings of the summary statistics table.

ANNUAL TOTAL.--The sum of the daily mean values of discharge for the year. At some stations the yearly mean discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by symbol and corresponding footnotes.

ANNUAL MEAN.--The arithmetic mean of the individual daily mean discharges for the year noted or for the designated period. At some stations the yearly mean discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes. At least 5 complete years of record must be available before this statistic is published for the designated period.

HIGHEST ANNUAL MEAN.--The maximum annual mean discharge occurring for the designated period.

LOWEST ANNUAL MEAN.--The minimum annual mean discharge occurring for the designated period.

HIGHEST DAILY MEAN.--The maximum daily mean discharge for the year or for the designated period.

LOWEST DAILY MEAN.--The minimum daily mean discharge for the year or for the designated period.

ANNUAL 7-DAY MINIMUM.--The lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

INSTANTANEOUS PEAK FLOW.--The maximum instantaneous discharge occurring for the water year or for the designated period. Note that secondary instantaneous peak discharges above a selected base discharge are stored in District computer files for stations meeting certain criteria. Those discharge values may be obtained by writing to the District Office. (See address on back of title page of this report.)

INSTANTANEOUS PEAK STAGE.--The maximum instantaneous stage occurring for the water year or for the designated period. If the dates of occurrence for the instantaneous peak flow and instantaneous peak stage differ, the REMARKS paragraph in the manuscript or a footnote may be used to provide further information.

INSTANTANEOUS LOW FLOW.--The minimum instantaneous discharge occurring for the water year or for the designated period.

ANNUAL RUNOFF (AC-FT).--Indicates the depth, in acre-feet, to which the drainage area would be covered if all the runoff for the year were uniformly distributed on it.

ANNUAL RUNOFF (CFSM).--Indicates 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 for the year.

ANNUAL RUNOFF (INCHES).–Indicates the depth to which the drainage area would be covered if all the runoff for the year were uniformly distributed on it.

10 PERCENT EXCEEDS.–The discharge that is exceeded by 10 percent of the flow for the designated period.

50 PERCENT EXCEEDS.–The discharge that is exceeded by 50 percent of the flow for the designated period.

90 PERCENT EXCEEDS.–The discharge that is exceeded by 90 percent of the flow for the designated period.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge 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. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. 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.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated", or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

Accuracy of the Records

The accuracy of streamflow records 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 measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of the true; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned, are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft^3/s; to the nearest tenth between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1000 ft^3/s; and to 3 significant figures for more than 1000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharges listed for partial-record stations and miscellaneous sites.

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

Other Records Available

Information of a more detailed nature than that published for most of the gaging stations such as observations of water temperatures, discharge measurements, gage-height records, and rating tables is on file in the district office. Also most gaging-station records are available in computer-usable form and many statistical analyses have been made.

Information on the availability of unpublished data or statistical analyses may be obtained from the district office.

The National Water Data Exchange, Water Resources Division, U.S. Geological Survey, National Center, Reston, VA 22092, maintains an index of all discharge measurement sites in the State as well as an index of records of discharge collected by other agencies but not published by the Geological Survey. Information on records available at specific sites can be obtained upon request.

RECORDS OF SURFACE-WATER QUALITY

Records of surface water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station, where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records" as used in this report and "continuous recordings," which refers to a continuous graph or a series of discrete values punched at short intervals on a paper tape. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figure 8.

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for partial-record stations and for miscellaneous sampling sites appear in separate tables following the table of discharge measurements at miscellaneous sites.

Onsite Measurement and Collection

In obtaining water quality data, a major concern needs to be assuring that the data obtained represents the in situ quality of water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen need to be made onsite when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed

procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for onsite measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. C2; Book 5 Chap. A1, A3, and A4. All of these references are listed on p. 17 of this report. Also, detailed information on collecting, treating, and shipping samples may be obtained from the Geological Survey district office.

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 mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. All samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals, depends on flow conditions and other factors which must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. In the rare case where an apparent inconsistency exists between a reported pH value and the relative abundance of carbon dioxide species (carbonate and bicarbonate), the inconsistency is the result of a slight uptake of carbon dioxide from the air by the sample between measurement of pH in the field and determination of carbonate and bicarbonate in the laboratory.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record. More detailed records (hourly values) may be obtained from the U.S.G.S. district office whose address is given on the back of the title page of this report.

Water Temperature

Water temperatures are measured at most of the water-quality stations. In addition, water temperatures are taken at time of discharge measurements for water-discharge stations. For stations where water temperatures are taken manually once or twice daily, the water temperatures are taken at about the same time each day. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the district office.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section, or a single sample may be obtained at a fixed point and a coefficient applied to determine the mean concentration in the cross sections.

During periods of rapidly changing flow or rapidly changing concentration, samples may have been collected more frequently (twice daily or, in some instances, hourly). The published sediment discharges for days of rapidly changing flow or concentration were computed by the subdivided-day method (time-discharge weighted average). Therefore, for those days when the published sediment discharge value differs from the value computed as the product of discharge times mean concentration times 0.0027, the reader can assume that the sediment discharge for that day was computed by the subdivided-day method. 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 and in predicting long-term sediment-discharge characteristics of the stream.

In addition to the records of suspended sediment discharge, records of the periodic measurements of the particle-size distribution of the suspended sediment and bed material are included for some stations.

Laboratory Measurements

Samples for indicator bacteria and specific conductance are analyzed locally. All other samples are analyzed in the Geological Survey laboratories in Arvada, Colo., Doraville, Ga., or Iowa City, Ia. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1. Methods used by the Geological Survey laboratories are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4.

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance, pH, water temperature, dissolved, and suspended sediment then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, when appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of stage and Water Discharge"; same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of stage and Water Discharge"; same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION.--Information on instrumentation is given only if a water-quality monitor, temperature recorder, sediment pumping sampler, or other sampling device is in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently, because the true maximums or minimums may not have been sampled. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS.--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water-quality records for partial-record stations and miscellaneous sampling sites are published in separate tables following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this report:

PRINTED OUTPUT	REMARK
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organisms count less than 0.5 percent (organisms may be observed rather than counted)
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant

RECORDS OF GROUND-WATER LEVELS

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Minnesota are shown in figure 10.

Although, in this report, records of water levels are presented for fewer than 200 wells, records are obtained through cooperative efforts of many Federal, State, and local agencies for several hundred observation wells throughout Minnesota and are placed in computer storage. Each spring, the Minnesota Department of Natural Resources, Division of Waters publishes a report for the previous water year entitled "Observation Well Data Summary, Water Year 19__." This report contains hydrographs of recorder wells, detailed maps showing the location of active observation wells, and other useful items. Information about the availability of the data in the water-level file may be obtained from the District Chief, Minnesota District. (See address on back of front page).

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well assure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level records are obtained from direct measurements with a steel tape or from the graph or punched tape of a water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If nown, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (eom).

All water-level measurements are reported to the nearest hundredth of a foot. The error of water-level measurements is normally only a hundredth or a few hundredth of a foot.

Hydrographs showing water-level fluctuations are included for 3 representative wells; 1 in a surficial-sand aquifer, 1 in a buried sand aquifer, and 1 in a bedrock aquifer.

Data Presentation

Each well consists of two parts, the station description and the data table of water levels observed during the water year. In addition a graph of water levels for the current year or other selected period is included for several representative wells. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes and seconds); a landline location designation; the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.-- This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and includes additional information such as casing breaks, collapsed screen, and other changes since construction.

INSTRUMENTATION.--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in the top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that are also water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of the publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR THE PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (eom). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level. A hydrograph for a selected period of record follows the water-level table for several representative wells.

RECORDS OF GROUND-WATER QUALITY

Records of ground-water quality in this report differ from other types of records in that for most sampling sites they consist of only one set of measurements for the water year. The quality of ground water ordinarily changes only slowly; therefore, for most general purposes one annual sampling, or only a few samples taken at infrequent intervals during the year, is sufficient. Frequent measurement of the same constituents is not necessary unless one is concerned with a particular problem, such as monitoring for trends in nitrate concentration. In the special cases where the quality of ground water may change more rapidly, more frequent measurements are made to identify the nature of the changes.

Data Collection and Computation

The records of ground-water quality in this report were obtained mostly as a part of special studies in specific areas. Consequently, a number of chemical analyses are presented for some counties but none are presented for others. As a result, the records for this year, by themselves, do not provide a balanced view of ground-water quality statewide. Such a view can be attained only by considering records for this year in context with similar records obtained for these and other counties in earlier years.

Most methods for collecting and analyzing water samples are described in the "U.S. Geological Survey Techniques of Water-Resources Investigation" manuals listed on a following page. The values reported in this report represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. All samples were obtained by trained personnel. The wells sampled were pumped long enough to assure that the water collected came directly from the aquifer and had not stood for a long time in the well casing where it would have been exposed to the atmosphere and to the material, possibly metal, comprising the casings.

Data Presentation

The records of ground-water quality are published in a section titled QUALITY OF GROUND WATER immediately following the ground-water-level records. Data for quality of ground water are listed alphabetically by County, and are identified by well number. The prime identification number for wells sampled is the 15-digit number derived from the latitude-longitude locations. No descriptive statements are given for ground-water-quality records; however, the well number, depth of well, date of sampling, and other pertinent data are given in the table containing the chemical analyses of the ground water. The REMARK codes listed for surface-water-quality records are also applicable to ground-water-quality records.

ACCESS TO WATSTORE DATA

The U.S. Geological Survey is the principal Federal water-data agency and, as such, collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage our water resources. As part of the U.S. Geological Survey's program of releasing water data to the public, a large-scale computerized system has been developed for the storage and retrieval of water data collected through its activities. The National Water Data Storage and Retrieval System (WATSTORE) was established in 1972 to provide an effective and efficient means for the processing and maintenance of water data collected through the activities of the U.S. Geological Survey and to facilitate release of the data to the public. A variety of useful products, ranging from data tables to complex statistical analyses such as Log Pearson Type III, can be produced using WATSTORE. The system resides on the central computer facilities of the U.S. Geological Survey at its National Center in Reston, Virginia, and consists of related files and data bases.

* Station Header File - Contains descriptive information on more than 440,000 sites throughout the United States and its territories where the U.S. Geological Survey collects or has collected data.

* Daily Values File - Contains more than 220 million daily values of stream flows, stages, reservoir contents, water temperature, specific conductances, sediment concentrations, sediment discharges, and ground-water levels.

* Peak Flow File - Contains approximately 500,000 maximum (peak) streamflow and gage-height values at surface-water sites.

* Water Quality File - Contains approximately 2 million analyses of water samples that describe the chemical, physical, biological, and radio-chemical characteristics of both surface and ground water.

* Ground-Water Site Inventory Data Base - Contains inventory data for more than 900,000 wells, springs, and other sources of ground water. The data includes site location, geohydrologic characteristics, well-construction history, and one-time field measurements such as water temperature.

In 1976, the U.S. Geological Survey opened WATSTORE to the public for direct access. The signing of a Memorandum of Agreement with the Survey is required to obtain direct access to WATSTORE. The system can be accessed either synchronously or asynchronously. The requester will be expected to pay all computer costs he/she incurs. Direct access may be obtained by contacting:

U.S. Geological Survey
National Water Data Exchange
421 USGS National Center
Reston, Virginia 22092

In addition to providing direct access to WATSTORE, data can be provided in various machine-readable formats on magnetic tape or 5-1/4 inch floppy disk; and, as noted in the introduction, on CD-ROM discs. Beginning with the 1990 water year, all water-data reports will also be available on Compact disc - Read Only Memory (CD-ROM). All data reports published for the current water year for the entire Nation, including Puerto Rico and the Trust Territories, will be reproduced on a single CD-ROM disc. Information about the availability of specific types of data or products, and user charges, can be obtained locally from each of the

Water Resources Division's District offices. (See address on the back of the title page.) A limited number of CD-ROM discs will be available for sale by the Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, Colorado 80225.

DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting inch-pound units to International System of units (SI) on the inside of back cover.

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Adenosine triphosphate (ATP) is the primary energy donor in cellular life process. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP, therefore, provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

Algae are mostly aquatic single-celled, colonial, or multi-celled plants, containing chlorophyll and lacking roots, stems, and leaves.

Algal growth potential (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

Aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

Bacteria are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore- forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as the organisms which produce colonies with a golden-green metallic sheet within 24 hours when incubated at 35°C ±1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal coliform bacteria are bacteria that are present in the intestine or feces of warmblooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all organisms which produce blue colonies within 24 hours when incubated at 44.5°C ±0.2°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria also found in the intestine of warmblooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C ±1.0°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Bed material is the unconsolidated material of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by microorganisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter (g/m^3), and periphyton and benthic organisms in grams per square meter (g/m^2).

Dry mass refers to the weight of residue present after drying in an oven at 60°C for zooplankton and 105°C for periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and the ash mass, and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Bottom material: See Bed Material.

Cells/volume refers to the number of cells or any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters (mL) or liters (L).

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, approximately 1.9835 acre-feet, or about 646,000 gallons or 2,447 cubic meters.

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water, and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common pigments in plants.

Color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

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.

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, an artificial structure, or a uniform cross section over a long reach of the channel.

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.

Cubic foot per second (FT^3/s, ft^3/s) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment), that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Annual 7-day minimum is the lowest mean discharge for 7 consecutive days for a calender year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

Dissolved refers to the amount of substance present in true chemical solution. In practice, however, the term includes all forms of substance that will pass through a 0.45-micrometer membrane filter, and thus may include some very small (colloidal) suspended particles. Analyses are performed on filtered samples.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Diversity index is a numerical expression of evenness of distribution of aquatic organisms. The formula for diversity index is:

$$\bar{d} = -\sum_{i=1}^{s} \frac{n_i}{n} \log_2 \frac{n_i}{n}$$

Where 'n_i' is the number of individuals per taxon, 'n' is the total number of individuals, and 's' is the total number of taxa in the sample of the community. Diversity index values range from zero, when all the organisms in the sample are the same, to some positive number, when some or all of the organisms in the sample are different.

Drainage area of a stream at 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. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

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 a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (G.H.) 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.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is attributable to the presence of alkaline earths (principally calcium and magnesium) and is expressed as equivalent calcium carbonate ($CaCO_3$).

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an 8-digit number.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

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.

Micrograms per gram (UG/G, ug/g) is a unit expressing the concentration of a chemical element as the mass (micrograms) of the element sorbed per unit mass (gram) of sediment.

Micrograms per kilogram (MG/KG, mg/kg) is a unit expressing the concentration of a chemical element as the mass (micrograms) of the element sorbed per unit mass (kilogram) of sediment.

Micrograms per liter (UG/L, ug/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (MG/L, mg/L) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represent the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in mg/L, and is based on the mass of sediment per liter of water-sediment mixture.

National Geodetic Vertical Datum of 1929 (NGVD) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Stream Quality Accounting Network (NASQAN) is a nationwide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and

other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water-quality assessment and hydrologic research.

The National Trends Network (NTN) is a 150-station network for sampling atmospheric deposition in the United States. The purpose of the network is to determine the variability, both in location and in time, of the composition of atmospheric deposition, which includes snow, rain, dust particles, aerosols, and gases, The core from which the NTN was built was the already-existing deposition-monitoring network of the National Atmospheric Deposition Program (NADP).

Organism is any living entity, such as an insect, phytoplankter, or zooplankter.

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meters (m^2), acres, or hectares. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliters (mL) or liters (L). Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Parameter code numbers are unique five-digit code numbers assigned to each parameter placed into storage. These codes are assigned by the Environmental Protection Agency and are also used to identify data exchanged among agencies.

Partial-record station is a particular site where limited streamflow and (or) water-quality 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 either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in distilled water (chemically dispersed).

Particle-size classification used in this report agrees with recommendations made by the American Geophysical Union Subcommittee on Sediment Terminology.

The classification is as follows:

Classification	Size (mm)	Method of analysis
Clay	0.00024 - 0.004	Sedimentation
Silt	.004 - .062	Sedimentation
Sand	.062 - 2.0	Sedimentation or sieve
Gravel	2.0 - 64.0	Sieve

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic material is removed and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass or volume.

Periphyton is the assemblage of microorganisms attached to and growing upon solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms. Periphyton is a useful indicator of water quality.

Pesticides are chemical compounds used to control undesirable plants and animals. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides. Insecticides and herbicides, which control insects and plants respectively, are the two categories reported.

Picocurie (PC, pCi) is one trillionth (1×10^{-12}) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields 3.7×10^{10} radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment, and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells/mL of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algal mats or floating "moss" in lakes. Their concentrations are expressed as number of cells/mL of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column, and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated by the plants (carbon method).

Milligrams of carbon per area or volume per unit time [mg $C/(m^2 \cdot$ time) for periphyton and macrophytes and mg $C/(m^3 \cdot$ time) for phytoplankton] are units for expressing primary productivity. They define the amount of carbon dioxide consumed as measured by radioactive carbon (carbon 14). The carbon 14 method is of greater sensitivity than the oxygen light and dark bottle method, and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Milligrams of oxygen per area or volume per unit time [mg $O_2/(m^2 \cdot$ time) for periphyton and macrophytes and mg $O_2/(m^3 \cdot$ time) for phytoplankton] are the units for expressing primary productivity. They define production and respiration rates as estimated from changes in the measured dissolved oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is

sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotypes. The streams that are sampled represent major drainage basins in the conterminous United States.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of only readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Runoff in inches (IN, 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.

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 precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

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.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L).

Mean concentration is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment discharge (tons/day) is the rate at which dry weight of sediment passes a section of a stream or is the quantity sediment, as measured by dry weight or volume, that passes a section in a given time. It is computed by multiplying discharge times mg/L times 0.0027.

Suspended-sediment load is quantity of suspended sediment passing a section in a specified period.

Total sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry weight or volume, that passes a section during a given time.

Total-sediment load or total load is a term which refers to the total sediment (bed load plus suspended-sediment load) that is in transport. It is not synonymous with total-sediment discharge.

7-day 10 year low flow ($7\ Q_{10}$) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance derived from the atmosphere, vegetation, soil, or rocks that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in micromhos per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration 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, and it may vary in the same source with changes in the composition of the water.

Stage-discharge relation is the relation between gage height (stage) and volume of water per unit of time, flowing in a channel.

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" as a streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Substrate is the physical surface upon which an organism lived.

Natural substrates refers to any naturally occurring emersed or submersed solid surface, such as a rock or tree, upon which an organism lived.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and miltiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest USGS topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimetered. All areas shown are those for the stage when the planimetered map was made. All areas shown are those for the stage when the planimetered map was made.

Surficial bed material is that part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of the total concentration in a water-sediment mixture. The water-sediment mixture is associated with (or sorbed on) that material retained on a 0.45 micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45 micrometer filter has been digested by a method (usually using a dilute acid solution) that

results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."

Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchical scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common.

For example, the taxonomy of a particular mayfly, Hexagenia limbata is the following:

Kingdom.....Animal
Phylum.....Arthropoda
Class.....Insects
Order.....Ephemeroptera
Family.....Ephermeridae
Genus.....Hexageria
Species.....Hexagenia limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

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 year.

Tons per acre-foot indicates the dry mass 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 substance in solution or suspension that passes a stream section during a 24-hour day.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determines all of the constituent in the sample.)

Total in bottom material is the total amount of a given constituent in a representative sample of bottom material. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total in bottom material."

Total load (tons) is the total quantity of any individual constituent, as measured by dry mass or volume, that is dissolved in a specific amount of water (discharge) during a given time. It is computed by multiplying the total discharge, times the mg/L of the constituent, times the factor 0.0027, times the number of days.

Total recoverable refers to the amount of a given constituent that is in solution after a representative water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent percent in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Tritium Network is a network of stations which has been established to provide baseline information on the occurrence of tritium in the Nation's surface waters. In addition to the surface-water stations in the network, tritium data are also obtained at a number of precipitation stations. The purpose of the precipitation stations is to provide an estimate sufficient for hydrologic studies of the tritium input to the United States.

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, 1991, is called the "1991 water year."

WDR is used as an abbreviation for "Water-Data Report" in reference to published reports beginning in 1975.

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.

WRD is used as an abbreviation for "Water-Resources Data" in the REVISED RECORDS paragraph to refer to State annual basic-data reports published before 1975.

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

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

1-D1. *Water temperature--influential factors, field measurement, and data presentation,* by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.

1-D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents,* by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.

2-D1. *Application of surface geophysics to ground-water investigations,* by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages.

2-D2. *Application of seismic-refraction techniques to hydrologic studies,* by F. P. Haeni: USGS--TWRI Book 2, Chapter D2. 1988. 86 pages.

2-E1. *Application of borehole geophysics to water-resources investigations,* by W. S. Keys and L. M. McCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages.

2-E2. *Borehole geophysics applied to ground-water investigations,* by W. Scott Keys: USGS--TWRI Book 2, Chapter E2. 1990. 150 pages.

2-F1. *Application of drilling, coring, and sampling techniques to test holes and wells,* by Eugene Shuter and Warren E. Teasdale: USGS--TWRI Book 2, Chapter F1. 1989. 97 pages.

3-A1. *General field and office procedures for indirect discharge measurements,* by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.

3-A2. *Measurement of peak discharge by the slope-area method,* by Tate Dalrymple and M. A. Benson: USGS-- TWRI Book 3, Chapter A2. 1967. 12 pages.

3-A3. *Measurement of peak discharge at culverts by indirect methods,* by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.

3-A4. *Measurement of peak discharge at width contractions by idirect methods,* by H. F. Matthai: USGS-TWRI Book 3, Chapter A4. 1967. 44 pages.

3-A5. *Measurement of peak discharge at dams by indirect methods,* by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.

3-A6. *General procedure for gaging streams,* by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.

3-A7. *Stage measurements at gaging stations,* by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3. Chapter A7. 1968. 28 pages.

3-A8. *Discharge measurements at gaging stations,* by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.

3-A9. *Measurement of time of travel in streams by dye tracing,* by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1989. 27 pages.

3-A10. *Discharge ratings at gaging stations,* by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.

3-A11. *Measurement of discharge by moving-boat method,* by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.

3-A12. *Fluorometric procedures for dye tracing,* by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS- -TWRI Book 3, Chapter A12. 1986. 41 pages.

3-A13. *Computation of continuous records of streamflow,* by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.

3-A14. *Use of flumes in measuring discharge,* by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.

3-A15. *Computation of water-surface profiles in open channels,* by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages.

3-A16. *Measurement of discharge using tracers,* by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.

3-A17. *Acoustic velocity meter systems,* by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.

3-A18. *Determination of stream reaeration coefficients by use of tracers,* by F. A. Kilpatrick, R. E. Rathburn, N. Yotsukura, G. W. Parker, and L. L. DeLong: USGS--TWRI Book 3, Chapter A18. 1989. 52 pages.

3-A19. *Levels of streamflow gaging stations,* by E.J. Kennedy: USGS--TWRI Book 3, Chapter A19. 1990. 27 pages.

3-B1. *Aquifer-test design, observation, and data analysis,* by R. W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages.

3-B2. *Introduction to ground-water hydraulics, a programmed text for self-instruction,* by G. D. Bennett: USGS-- TWRI Book 3, Chapter B2. 1976. 172 pages.

3-B3. *Type curves for selected problems of flow to wells in confined aquifers,* by J. E. Reed: USGS--TWRI Book 3, Chapter B3. 1980. 106 pages.

3-B4. *Regression modeling of ground-water flow,* by Richard L. Cooley and Richard L. Naff: USGS--TWRI Book 3, Chapter B4. 1990. 232 pages.

3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction,* by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS--TWRI Book 3, Chapter B5. 1987. 15 pages.

3-B6. *The principle of superposition and its application in ground-water hydraulics,* by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS--TWRI Book 3, Chapter B6. 1987. 28 pages.

3-C1. *Fluvial sediment concepts,* by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.

3-C2. *Field methods for measurement of fluvial sediment,* by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.

3-C3. *Computation of fluvial-sediment discharge,* by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.

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4-B1. *Low-flow investigations,* by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.

4-B2. *Storage analyses for water supply,* by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.

4-B3. *Regional analyses of streamflow characteristics,* by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.

4-D1. *Computation of rate and volume of stream depletion by wells,* by C. T. Jenkins: USGS--TWRI Book 4, Chapter D1. 1970. 17 pages.

5-A1. *Methods for determination of inorganic substances in water and fluvial sediments,* by M. J. Fishman and L. C. Friedman: USGS--TWRI Book 5, Chapter A1. 1989. 545 pages.

5-A2. *Determination of minor elements in water by emission spectroscopy,* by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.

5-A3. *Methods for the determination of organic substances in water and fluvial sediments,* edited by R. L. Wershaw, M. J. Fishman, R. R. Grabbe, and L. E. Lowe: USGS--TWRI Book 5, Chapter A3. 1987. 80 pages.

5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples,* by L. J. Britton and P. E. Greeson, editors: USGS--TWRI Book 5, Chapter A4. 1989. 363 pages.

5-A5. *Methods for determination of radioactive substances in water and fluvial sediments,* by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.

5-A6. *Quality assurance practices for the chemical and biological analyses of water and fluvial sediments,* by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.

5-C1. *Laboratory theory and methods for sediment analysis,* by H. P. Guy: USGS-TWRI Book 5, Chapter C1. 1969. 58 pages.

6-A1. *A modular three-dimensional finite-difference ground-water flow model,* by M. G. McDonald and A. W. Harbaugh: USGS--TWRI Book 6, Chapter A1. 1988. 586 pages.

7-C1. *Finite difference model for aquifer simulation in two dimensions with results of numerical experiments,* by P. C. Trescott, G. F. Pinder, and S. P. Larson: USGS--TWRI Book 7, Chapter C1. 1976. 116 pages.

7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water,* by L. F. Konikow and J. D. Bredehoeft: USGS--TWRI Book 7, Chapter C2. 1978. 90 pages.

7-C3. *A model for simulation of flow in singular and interconnected channels,* by R. W. Schaffrannek, R. A. Baltzer, and D. E. Goldberg: USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.

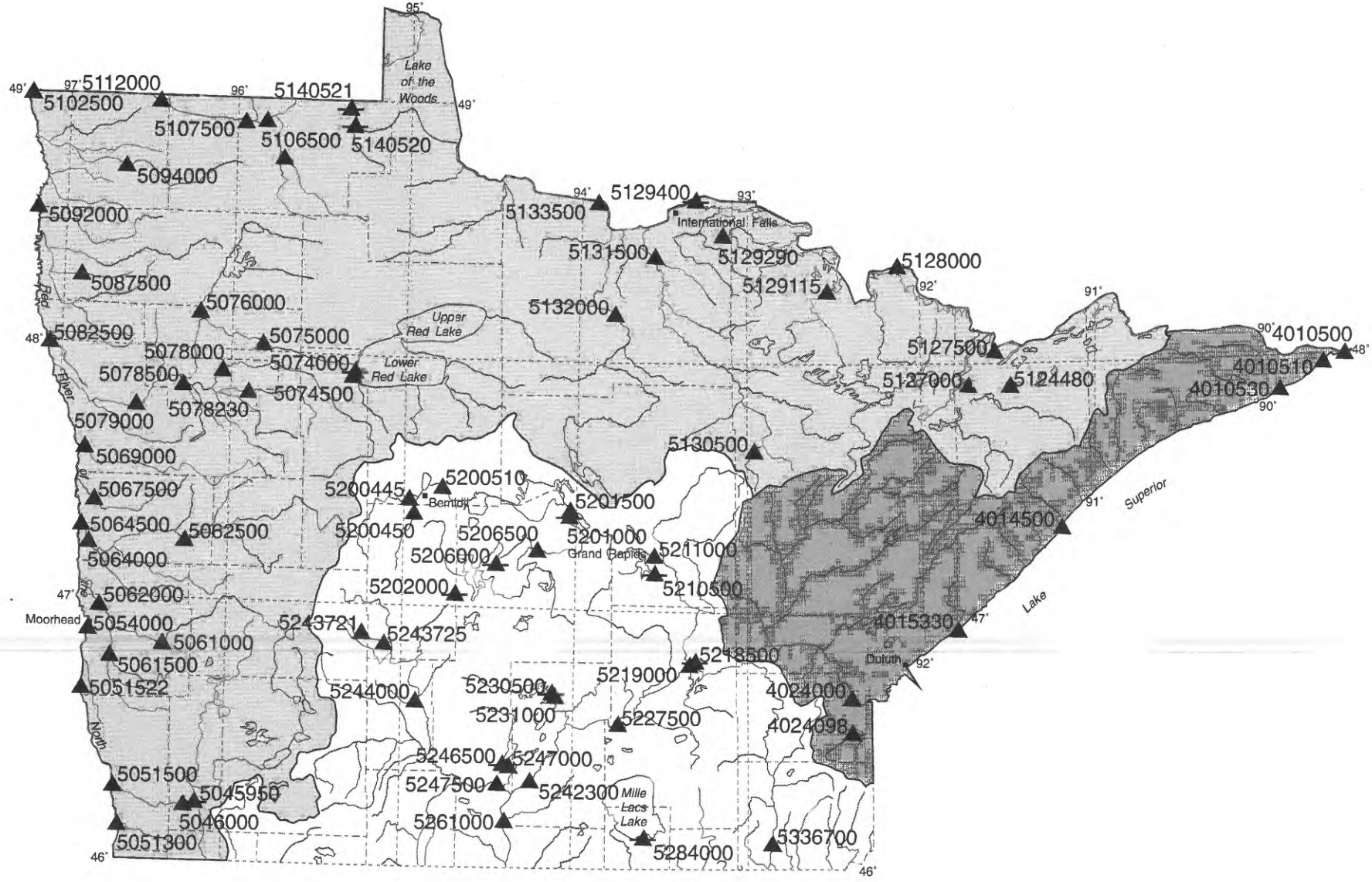
8-A1. *Methods of measuring water levels in deep wells,* by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.

8-A2. *Installation and service manual for U.S. Geological Survey manometers,* by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.

8-B2. *Calibration and maintenance of vertical-axis type current meters,* by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 15 pages.

Surface-water Station Records

Pelican River near Fergus Falls
June 16, 1960


5112000
5102500
5140521
5107500
5106500
5140520
5094000
5092000
5133500
5129400
International Falls
5131500
5129290
5128000
5087500
5129115
5076000
5132000
5082500
5075000
5078000
5074000
5078500
5074500
5078230
5079000
5069000
5067500
5064500
5062500
5064000
5062000
Moorhead
5054000
5061000
5061500
5051522
5051500
5045950
5046000
5051300
5243721
5243725
5244000
5200445
5200510
Bemidji
5200450
5206500
5201500
5201000
Grand Rapids
5206900
5211000
5202000
5210500
5230500
5231000
5219000
5227500
5218500
Duluth
5246500
5247000
5247500
5242300
5261000
5284000
5336700
Mille Lacs Lake
5130500
4010500
4010510
4010530
5127500
5127000
5124480
4014500
4015330
Superior Lake
4024000
4024098
Lake of the Woods
Upper Red Lake
Lower Red Lake
Red River
North
95°
94°
93°
92°
91°
90°
49°
48°
47°
46°
97°
96°

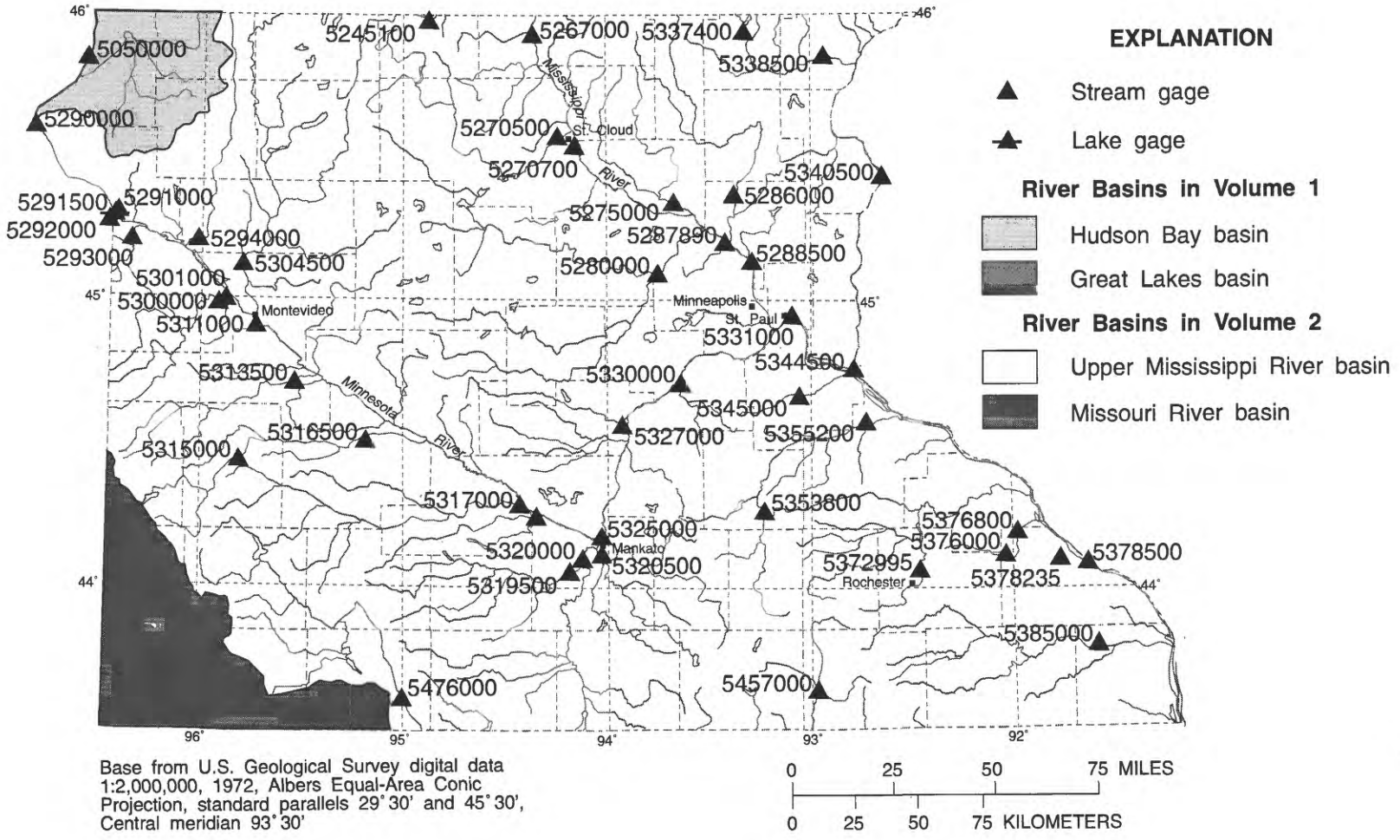
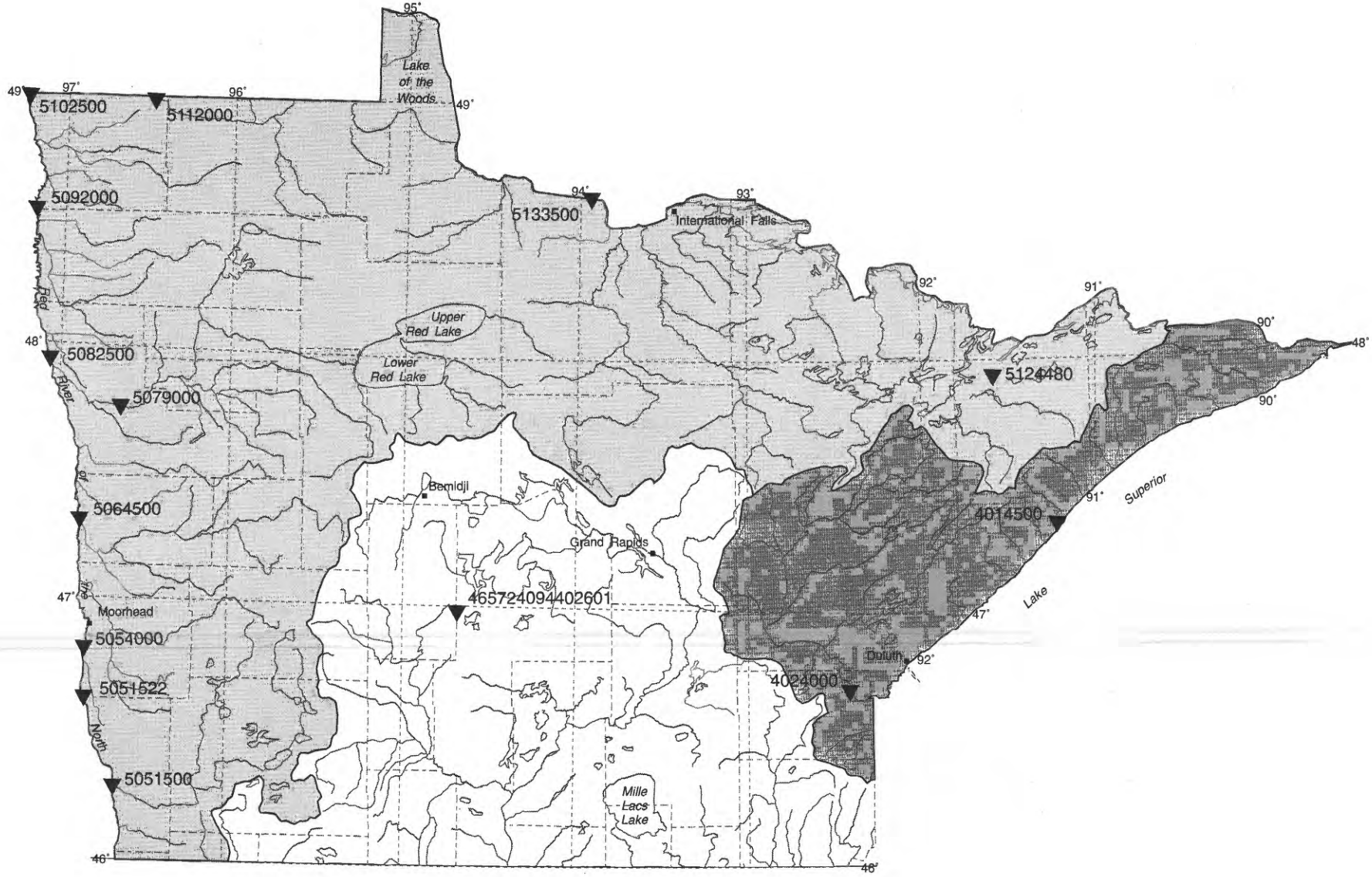


Figure 7.--Location of lake and stream-gaging stations


95°
Lake of the Woods
49°
97°
96°
5102500
5112000
5092000
94°
5133500
93°
International Falls
92°
91°
90°
48°
Red River
Upper Red Lake
Lower Red Lake
5082500
5079000
5124480
90°
48°
Bemidji
5064500
91°
Superior
4014500
Grand Rapids
47°
Moorhead
465724094402601
Lake
5054000
47°
Duluth
92°
5051522
4024000
North
5051500
Mille Lacs Lake
46°
46°

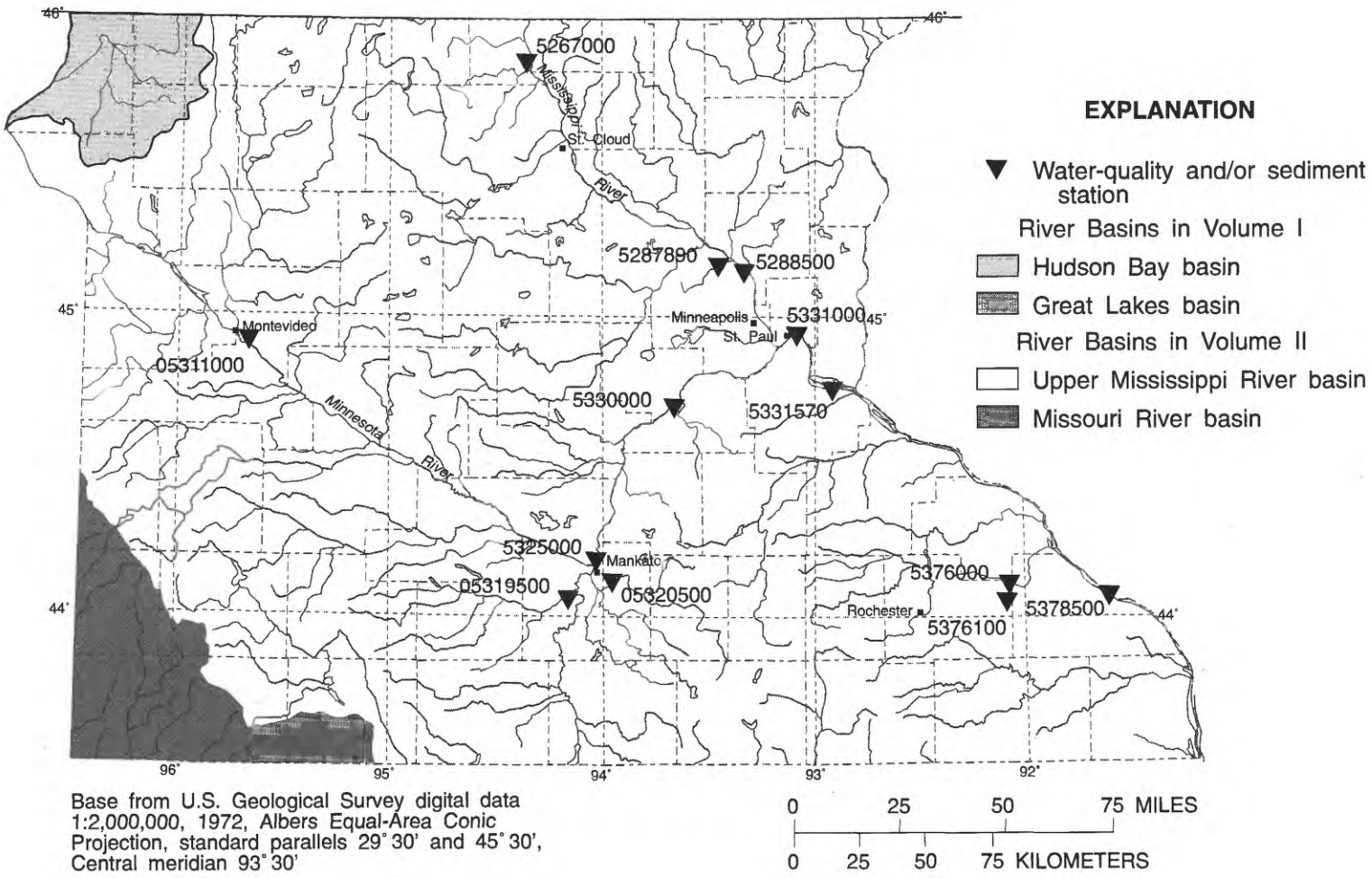


Figure 8.--Location of surface-water-quality stations

STREAMS TRIBUTARY TO LAKE SUPERIOR

04010500 PIGEON RIVER AT MIDDLE FALLS, NEAR GRAND PORTAGE, MN
(International gaging station)

LOCATION.--Lat 48°00'44", long 89°36'58", in SW¼NE¼ sec.24, T.64 N., R.6 E., Cook County, Hydrologic Unit 04010101, on the Grand Portage Indian Reservation, on right bank 400 ft upstream from Middle Falls, 2.5 mi upstream from Grand Portage Port of Entry, 3.5 mi upstream from mouth, and 4.7 mi northeast of city of Grand Portage.
DRAINAGE AREA.--600 mi^2.
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.
REVISED RECORDS.--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).
GAGE.--Water-stage recorder. Datum of gage is 787.58 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1940, nonrecording gage at International Bridge, 5.8 mi upstream at datum 102.24 ft higher. Oct. 1, 1940, to Dec. 31, 1975, at present site at datum 2.00 ft higher.
REMARKS.--Records good except those for estimated daily discharges, which are poor. Satellite telemeter at station.
COOPERATION.--This station is one of the international gaging stations maintained by the United States under agreement with Canada.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 7	2000	Ice jam	*10.38	Apr. 30	1300	*3,790	8.86
Apr. 8	1730	3,340	8.46				

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	112	437	e240	e155	e145	e135	e250	3260	823	944	95	38
2	106	410	e235	e155	e145	e135	e250	2590	728	953	89	33
3	278	386	e230	e155	e145	e135	e300	2060	662	901	85	35
4	510	365	e230	e155	e150	e135	e500	1720	603	848	84	28
5	447	343	e230	e155	e160	e135	e800	1510	549	1010	79	24
6	361	319	e225	e150	e155	e133	e1500	1680	509	942	74	21
7	295	296	e225	e150	e155	e130	e2500	2050	477	833	70	20
8	250	291	e220	e150	e150	e130	3270	1870	449	826	67	21
9	218	275	e210	e150	e150	e130	3030	1620	423	789	65	32
10	195	257	e205	e150	e145	e130	2490	1450	411	792	63	26
11	176	256	e200	e150	e145	e130	2050	1350	407	721	59	24
12	174	203	e195	e150	e140	e130	1710	1290	382	615	56	24
13	170	258	e190	e150	e140	e130	1510	1270	346	554	54	23
14	185	245	e190	e150	e140	e130	1500	1210	337	486	52	34
15	253	235	e185	e150	e140	e130	1720	1120	342	419	51	39
16	287	214	e185	e150	e140	e130	1930	1030	437	379	52	44
17	410	256	e185	e150	e140	e130	1980	962	470	314	55	46
18	713	222	e180	e150	e140	e135	2010	894	446	244	57	63
19	661	199	e180	e150	e140	e140	1960	833	417	214	53	68
20	608	222	e180	e150	e140	e150	1760	779	395	190	48	63
21	927	328	e175	e150	e140	e160	1540	738	379	178	47	58
22	1080	376	e175	e150	e140	e170	1380	708	358	168	46	53
23	985	361	e170	e150	e140	e180	1310	693	419	156	45	49
24	885	316	e170	e150	e135	e190	1280	682	453	145	44	43
25	789	287	e165	e150	e135	e210	1270	657	443	138	44	51
26	694	278	e165	e150	e135	e240	1290	1010	437	132	44	56
27	637	e265	e165	e150	e135	e280	1380	1390	456	125	43	53
28	606	e255	e160	e145	e135	e300	1840	1160	459	119	43	52
29	585	e250	e160	e145	---	e290	2210	998	798	112	43	50
30	528	e245	e160	e145	---	e280	3710	1060	1010	106	42	54
31	476	---	e155	e145	---	e260	---	941	---	100	40	---
TOTAL	14601	8650	5940	4655	4000	5223	50230	40585	14825	14453	1789	1225
MEAN	471	288	192	150	143	168	1674	1309	494	466	57.7	40.8
MAX	1080	437	240	155	160	300	3710	3260	1010	1010	95	68
MIN	106	199	155	145	135	130	250	657	337	100	40	20
AC-FT	28960	17160	11780	9230	7930	10360	99630	80500	29410	28670	3550	2430
CFSM	.78	.48	.32	.25	.24	.28	2.79	2.18	.82	.78	.10	.07
IN.	.91	.54	.37	.29	.25	.32	3.11	2.52	.92	.90	.11	.08

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1921 - 1991, BY WATER YEAR (WY)

MEAN	370	352	204	149	124	174	1212	1610	865	402	237	302
MAX	2095	1461	720	431	300	1169	2701	4016	2801	1127	1029	2985
(WY)	1978	1971	1978	1975	1969	1945	1976	1950	1947	1968	1950	1977
MIN	17.4	11.4	2.85	2.18	8.02	60.0	290	138	125	78.0	57.7	40.2
(WY)	1977	1977	1977	1977	1977	1941	1977	1977	1977	1958	1991	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1921 - 1991	
ANNUAL TOTAL	155942		166176			
ANNUAL MEAN	427		455		503	
HIGHEST ANNUAL MEAN					840	1971
LOWEST ANNUAL MEAN					158	1958
HIGHEST DAILY MEAN	2920	Apr 29	3710	Apr 30	10700	May 5 1934
LOWEST DAILY MEAN	33	Jan 1	20	Sep 7	1.0	Jan 15 1977
ANNUAL SEVEN-DAY MINIMUM	34	Jan 1	24	Sep 5	1.0	Jan 15 1977
INSTANTANEOUS PEAK FLOW	3060	Apr 29	3790	Apr 30	11000	May 5 1934
INSTANTANEOUS PEAK STAGE	8.18	Apr 29	10.38a	Apr 7	7.60b	May 5 1934
INSTANTANEOUS LOW FLOW			20	Sep 6,7,8		
ANNUAL RUNOFF (AC-FT)	309300		329600		364500	
ANNUAL RUNOFF (CFSM)	.71		.76		.84	
ANNUAL RUNOFF (INCHES)	9.67		10.30		11.39	
10 PERCENT EXCEEDS	1050		1280		1300	
50 PERCENT EXCEEDS	220		195		220	
90 PERCENT EXCEEDS	62		52		84	

a From highwater mark, backwater from ice.
b Site and datum then in use.
e Estimated.

STREAMS TRIBUTARY TO LAKE SUPERIOR

04010510 GRAND PORTAGE RIVER AT GRAND PORTAGE, MN

LOCATION.--Lat 47°57'49", long 89°41'00", in SW¼SE¼ sec.4, T.63 N., R.6 E., Cook County, Hydrologic Unit 04010101, on Grand Portage Indian Reservation, on left bank at upstream side of bridge, 600 ft upstream of mouth, at city of Grand Portage.

PERIOD OF RECORD.--May to September 1991.

GAGE.--Nonrecording gage. Elevation of gage is 615 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records fair. No estimated daily discharges.

EXTREMES FOR CURRENT PERIOD.--May to September: Maximum discharge during period, 96 ft^3/s, June 29, gage height, 2.10 ft, from graph based on gage readings; minimum daily, 0.10 ft^3/s, Aug. 12-15.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	5.6	23	.16	.24
2	---	---	---	---	---	---	---	---	4.6	20	.16	.24
3	---	---	---	---	---	---	---	---	3.9	22	.16	.30
4	---	---	---	---	---	---	---	---	3.2	21	.16	.24
5	---	---	---	---	---	---	---	---	2.9	18	.14	.24
6	---	---	---	---	---	---	---	---	2.2	8.3	.16	.30
7	---	---	---	---	---	---	---	---	2.0	3.2	.14	.58
8	---	---	---	---	---	---	---	---	1.8	4.1	.14	.85
9	---	---	---	---	---	---	---	---	1.8	3.0	.11	1.7
10	---	---	---	---	---	---	---	---	1.6	3.5	.11	1.2
11	---	---	---	---	---	---	---	---	1.3	2.3	.11	.95
12	---	---	---	---	---	---	---	---	1.1	1.8	.10	.58
13	---	---	---	---	---	---	---	8.6	1.6	1.7	.10	.43
14	---	---	---	---	---	---	---	7.3	3.7	1.3	.10	4.8
15	---	---	---	---	---	---	---	6.7	2.9	1.2	.10	8.0
16	---	---	---	---	---	---	---	6.2	1.3	.95	.20	8.6
17	---	---	---	---	---	---	---	5.6	1.2	.85	.24	6.2
18	---	---	---	---	---	---	---	4.6	1.1	.75	.20	5.1
19	---	---	---	---	---	---	---	4.3	1.1	.66	.20	3.5
20	---	---	---	---	---	---	---	3.7	.95	.66	.20	2.3
21	---	---	---	---	---	---	---	3.2	.85	.58	.20	2.0
22	---	---	---	---	---	---	---	3.9	.66	.58	.20	1.7
23	---	---	---	---	---	---	---	3.7	.58	.50	.20	1.3
24	---	---	---	---	---	---	---	3.5	.50	.36	.20	1.1
25	---	---	---	---	---	---	---	3.9	.50	.30	.24	1.1
26	---	---	---	---	---	---	---	34	3.7	.24	.24	1.1
27	---	---	---	---	---	---	---	27	4.8	.24	.30	1.3
28	---	---	---	---	---	---	---	16	6.4	.24	.24	1.6
29	---	---	---	---	---	---	---	14	53	.24	.24	2.5
30	---	---	---	---	---	---	---	12	20	.20	.24	3.0
31	---	---	---	---	---	---	---	7.6	---	.20	.24	---
TOTAL	---	---	---	---	---	---	---	---	136.84	141.95	5.53	63.05
MEAN	---	---	---	---	---	---	---	---	4.56	4.58	.18	2.10
MAX	---	---	---	---	---	---	---	---	53	23	.30	8.6
MIN	---	---	---	---	---	---	---	---	.50	.20	.10	.24
AC-FT	---	---	---	---	---	---	---	---	271	282	11	125

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1991 - 1991, BY WATER YEAR (WY)

MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
(WY)	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---
(WY)	---	---	---	---	---	---	---	---	---	---	---	---

STREAMS TRIBUTARY TO LAKE SUPERIOR

04010530 RESERVATION RIVER NEAR HOVLAND, MN

LOCATION.--Lat 46°52'38", long 89°51'45", in SE¼SW¼ sec.6, T.62 N., R.5. E., Cook County, Hydrologic Unit 04010101 on the Grand Portage Indian Reservation, on left bank at downstream side of bridge on U.S. Highway 61, 1,200 ft upstream from mouth and 5.5 miles northeast of Hovland.

PERIOD OF RECORD.--April to September 1991.

GAGE.--Water stage recorder. Elevation of gage is 660 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to May 14, 1991, nonrecording gage at same site and datum.

REMARKS.--Records good.

EXTREMES FOR CURRENT PERIOD.--April to September 1991: Maximum discharge during period, 281 ft^3/s, June 29, gage height, 2.74 ft; minimum, 0.22 ft^3/s, Sept. 1, gage height, 0.12 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	18	117	18	63	1.7	.29
2	---	---	---	---	---	---	15	88	16	56	1.5	.35
3	---	---	---	---	---	---	36	67	14	39	1.5	.48
4	---	---	---	---	---	---	88	58	12	36	1.6	.61
5	---	---	---	---	---	---	92	49	10	32	1.2	.64
6	---	---	---	---	---	---	122	140	8.9	25	1.1	.95
7	---	---	---	---	---	---	189	85	8.0	20	1.0	.67
8	---	---	---	---	---	---	158	62	7.3	20	.95	.85
9	---	---	---	---	---	---	99	53	6.8	19	.87	10
10	---	---	---	---	---	---	86	45	7.5	20	.83	4.3
11	---	---	---	---	---	---	76	39	6.0	14	.77	2.2
12	---	---	---	---	---	---	69	33	5.0	13	.65	1.5
13	---	---	---	---	---	---	82	33	4.7	12	.57	1.2
14	---	---	---	---	---	---	90	27	18	9.3	.51	12
15	---	---	---	---	---	---	110	23	11	7.6	.45	15
16	---	---	---	---	---	---	102	21	7.7	6.6	.96	9.8
17	---	---	---	---	---	---	92	18	5.7	6.2	1.3	6.7
18	---	---	---	---	---	---	90	15	4.9	5.4	.99	9.6
19	---	---	---	---	---	---	81	14	4.5	5.6	.78	6.4
20	---	---	---	---	---	---	70	13	4.0	4.6	.76	4.0
21	---	---	---	---	---	---	67	12	4.0	4.2	.67	3.0
22	---	---	---	---	---	---	58	12	3.4	4.3	.65	2.5
23	---	---	---	---	---	---	55	12	3.0	3.7	.64	2.2
24	---	---	---	---	---	---	53	12	2.6	3.3	.70	1.9
25	---	---	---	---	---	---	48	10	2.5	3.0	.73	8.8
26	---	---	---	---	---	---	50	86	8.9	2.7	.70	8.2
27	---	---	---	---	---	---	55	53	15	2.7	.71	4.7
28	---	---	---	---	---	---	73	26	8.4	2.5	.65	3.5
29	---	---	---	---	---	---	122	26	115	2.4	.55	3.0
30	---	---	---	---	---	---	166	28	39	2.1	.47	6.9
31	---	---	---	---	---	---	---	22	---	1.9	.36	---
TOTAL	---	---	---	---	---	---	2512	1299	381.8	447.1	26.82	132.24
MEAN	---	---	---	---	---	---	83.7	41.9	12.7	14.4	.87	4.41
MAX	---	---	---	---	---	---	189	140	115	63	1.7	15
MIN	---	---	---	---	---	---	15	10	2.5	1.9	.36	.29

STREAMS TRIBUTARY TO LAKE SUPERIOR
04014500 BAPTISM RIVER NEAR BEAVER BAY, MN

LOCATION.--Lat 47°20'07", long 91°12'06", in SE¼NE¼ sec.15, T.56 N., R.7 W., Lake County, Hydrologic Unit 04010101, on right bank 400 ft upstream from bridge on U.S. Highway 61, 0.3 mi upstream from mouth, 4 mi northeast of Silver Bay, and 7 mi northeast of city of Beaver Bay.
DRAINAGE AREA.--140 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1927 to current year. Monthly discharge only for some periods, published in WSP 1307.
REVISED RECORDS.--WSP 894: 1939. WSP 1337: 1933-34(M), 1935.
GAGE.--Water-stage recorder. Datum of gage is 613.65 ft above National Geodetic Vertical Datum of 1929 (U.S. Army Corps of Engineers bench mark). Prior to Oct. 5, 1934, nonrecording gage, and Oct. 5, 1934 to Nov. 22, 1978, water-stage recorder at site 370 ft downstream and at datum 3.68 ft lower.
REMARKS.--Records fair except those for estimated daily discharges, which are poor.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,300 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 6	1730	*1,720	*9.55	Apr. 30	1430	1,610	9.43

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	133	129	e39	e26	e18	e13	e100	1370	195	280	47	12
2	117	122	e38	e26	e18	e13	e110	921	150	353	38	12
3	479	115	e38	e26	e18	e13	e200	637	123	340	32	15
4	542	115	e37	e25	e19	e13	e500	516	97	365	35	15
5	382	114	e37	e25	e20	e13	1050	485	80	378	33	14
6	249	94	e36	e25	e22	e13	1440	615	67	277	28	15
7	188	84	e36	e24	e23	e13	1550	652	57	172	25	16
8	142	78	e35	e24	e24	e13	1420	548	50	156	22	164
9	112	e72	e35	e24	e25	e13	992	447	44	152	19	534
10	95	e66	e34	e24	e22	e13	672	383	50	109	18	388
11	85	e60	e34	e23	e20	e13	501	338	48	81	17	e200
12	82	e56	e34	e23	e18	e13	384	310	42	250	16	e150
13	82	e53	e33	e23	e17	e13	317	281	37	278	14	e100
14	80	e51	e33	e23	e16	e13	471	240	43	180	13	e150
15	74	e50	e33	e23	e16	e13	591	216	46	120	12	e200
16	73	e49	e32	e23	e16	e13	636	209	64	96	13	238
17	267	e48	e32	e22	e15	e13	691	257	52	504	25	e200
18	530	e47	e32	e22	e15	e13	645	200	44	360	22	e220
19	404	e47	e31	e22	e15	e15	549	154	38	281	18	e200
20	359	e47	e31	e22	e15	e18	449	133	35	e222	17	e150
21	425	e60	e30	e22	e14	e20	349	122	44	e167	16	e120
22	391	e70	e30	e21	e14	e20	298	122	43	134	15	e100
23	335	e55	e29	e21	e14	e50	273	135	35	109	14	76
24	290	e50	e29	e21	e14	e100	253	131	31	114	16	68
25	256	e48	e29	e21	e14	e200	240	120	28	86	19	90
26	227	e47	e28	e21	e13	e200	239	121	25	61	19	107
27	201	e45	e28	e20	e13	e180	282	163	46	54	18	95
28	191	e44	e28	e20	e13	e160	363	159	51	54	16	83
29	173	e42	e27	e20	---	e140	657	188	97	79	14	73
30	154	e40	e27	e19	---	e120	1560	271	102	67	13	86
31	140	---	e27	e19	---	e110	---	260	---	57	13	---
TOTAL	7258	1998	1002	700	481	1567	17782	10704	1864	5936	637	3891
MEAN	234	66.6	32.3	22.6	17.2	50.5	593	345	62.1	191	20.5	130
MAX	542	129	39	26	25	200	1560	1370	195	504	47	534
MIN	73	40	27	19	13	13	100	120	25	54	12	12
AC-FT	14400	3960	1990	1390	954	3110	35270	21230	3700	11770	1260	7720
CFSM	1.67	.48	.23	.16	.12	.36	4.23	2.47	.44	1.37	.15	.93
IN.	1.93	.53	.27	.19	.13	.42	4.72	2.84	.50	1.58	.17	1.03
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1928 - 1991, BY WATER YEAR (WY)												
MEAN	152	134	52.6	29.4	21.9	63.6	546	488	241	101	85.4	123
MAX	558	504	180	65.5	56.0	602	1083	1801	615	327	665	735
(WY)	1983	1933	1971	1969	1984	1945	1976	1950	1943	1978	1972	1977
MIN	7.01	5.20	.51	.036	.000	5.73	138	77.6	31.0	7.52	2.71	3.35
(WY)	1977	1977	1977	1977	1977	1940	1977	1977	1988	1934	1934	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1928 - 1991	
ANNUAL TOTAL	41864.0		53820			
ANNUAL MEAN	115		147		169	
HIGHEST ANNUAL MEAN					335	1972
LOWEST ANNUAL MEAN					81.6	1963
HIGHEST DAILY MEAN	2570	Apr 29	1560	Apr 30	6860	May 2 1972
LOWEST DAILY MEAN	8.0	Feb 1	12	Aug 15	.00	Jan 14 1977
ANNUAL SEVEN-DAY MINIMUM	8.0	Feb 1	13	Feb 26	.00	Jan 14 1977
INSTANTANEOUS PEAK FLOW	3300	Apr 29	1720	Apr 6	10000a	Sep 24 1977
INSTANTANEOUS PEAK STAGE	10.93	Apr 29	9.55	Apr 6	11.06b	Apr 12 1965
INSTANTANEOUS LOW FLOW			12c			
ANNUAL RUNOFF (AC-FT)	83040		106800		122700	
ANNUAL RUNOFF (CFSM)	.82		1.05		1.21	
ANNUAL RUNOFF (INCHES)	11.12		14.30		16.44	
10 PERCENT EXCEEDS	234		383		431	
50 PERCENT EXCEEDS	51		51		55	
90 PERCENT EXCEEDS	8.0		14		14	

a From rating curve extended above 4,200 ft^3/s on basis of slope-area measurement of peak flow.
b Site and datum then in use, from floodmark (backwater from ice).
c Occurred Aug. 15, 16, Aug. 31 to Sept. 3.
e Estimated.

STREAMS TRIBUTARY TO LAKE SUPERIOR

04014500 BAPTISM RIVER NEAR BEAVER BAY, MN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT												
01...	1245	134	95	98	7.7	8.3	10.0	2.9	741	11.0	38	90
JAN												
22...	1620	214	111	112	7.4	8.2	0.0	1.7	719	13.4	<1	K4
APR												
30...	1315	1580	40	51	6.5	7.0	6.0	3.2	723	12.0	K72	70
JUL												
31...	0900	67	71	87	7.6	7.7	18.0	1.5	742	8.5	23	K1000

DATE	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)
OCT											
01...	11	3.6	3.8	0.4	32	36	0	39	5.3	3.7	0.2
JAN											
22...	13	4.2	4.0	0.3	41	43	0	50	6.1	3.3	<0.1
APR											
30...	5.8	1.9	1.8	0.3	11	14	0	13	5.0	1.4	0.1
JUL											
31...	11	3.5	2.7	0.4	39	37	0	48	2.5	1.8	0.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)
OCT											
01...	9.0	79	<0.01	<0.10	<0.01	<0.01	0.60	0.03	<0.01	<0.01	<0.01
JAN											
22...	14	78	<0.01	0.30	0.04	0.04	0.20	<0.01	<0.01	<0.01	<0.01
APR											
30...	7.7	41	0.02	0.33	0.08	0.08	0.70	0.04	0.01	<0.01	<0.01
JUL											
31...	10	91	<0.01	<0.05	0.04	0.04	0.70	0.02	0.02	<0.01	<0.01

STREAMS TRIBUTARY TO LAKE SUPERIOR

04014500 BAPTISM RIVER NEAR BEAVER BAY, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	SEDIMENT, SUSPENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)
OCT											
01...	6	82	80	<1	9	<0.5	<1.0	<1	<3	3	320
JAN											
22...	2	67	40	<1	4	<0.5	<1.0	<1	<3	2	320
APR											
30...	33	60	140	<1	8	<0.5	<1.0	<1	<3	2	200
JUL											
31...	1	100	80	<1	9	<0.5	<1.0	<1	<3	3	510

DATE	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)
OCT											
01...	<1	<4	6	--	<10	<1	<1	<1.0	33	<6	17
JAN											
22...	<1	<4	3	<0.1	<10	<1	<1	<1.0	34	<6	10
APR											
30...	1	<4	7	<0.1	<10	<1	<1	<1.0	16	<6	6
JUL											
31...	<1	<4	6	<0.1	<10	1	<1	<1.0	33	<6	5

STREAMS TRIBUTARY TO LAKE SUPERIOR

04015330 KNIFE RIVER NEAR TWO HARBORS, MN

LOCATION.--Lat 46°56'49", long 91°47'32", in SW¼NW¼ sec.31, T.52 N., R.11 W., Lake County, Hydrologic Unit 04010102, on right bank 600 ft downstream from bridge on U.S. Highway 61, 0.5 mi upstream from bridge on County Highway 102, in town of Knife River, 0.8 mi upstream from Lake Superior, and 7.8 mi southwest of Two Harbors.
DRAINAGE AREA.--85.6 mi^2.
PERIOD OF RECORD.--Occasional low-flow measurements, water years 1970-71, July 1974 to current year.
GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 640 ft above National Geodetic Vertical Datum of 1929, from topographic map.
REMARKS.--Records fair except those for estimated daily discharges, which are poor.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 800 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct. 17	2245	1,740	6.34	May 6	0945	981	5.35
Mar. 26	--	1,230	Ice jam	June 29	0530	*5,440	*9.82
Apr. 4	1900	1,300	5.78	July 1	0715	1,490	6.02
Apr. 14	1845	981	5.35	Sep. 8	2200	1,640	6.22
Apr. 30	0115	1,200	5.64				

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	37	e9.0	e7.0	e5.8	e5.0	97	674	124	947	11	3.0
2	30	36	e9.0	e7.0	e5.8	e5.0	201	359	85	399	8.8	2.8
3	206	34	e8.8	e7.0	e6.0	e5.0	422	233	67	281	7.2	4.2
4	255	32	e8.8	e6.8	e6.2	e4.9	679	267	48	400	7.5	5.6
5	125	29	e8.8	e6.8	e6.4	e4.8	775	319	36	413	9.2	5.1
6	79	27	e9.5	e6.8	e6.8	e4.7	728	738	29	185	7.0	4.1
7	56	23	e10	e6.6	e7.6	e4.6	509	490	24	103	5.9	7.2
8	43	e20	e10	e6.6	e9.0	e4.6	421	300	21	176	5.5	532
9	33	e17	e9.6	e6.6	e9.6	e4.5	273	211	18	88	4.9	967
10	27	e15	e9.2	e6.4	e10	e4.5	198	168	21	52	4.4	335
11	24	e13	e8.8	e6.4	e9.2	e4.5	166	142	22	37	4.9	147
12	25	e12	e8.6	e6.4	e8.0	e4.4	125	124	20	48	5.0	83
13	29	e11	e8.6	e6.4	e7.4	e4.4	103	109	24	66	3.9	57
14	26	e11	e8.4	e6.2	e6.8	e4.4	435	94	71	45	3.3	150
15	23	e11	e8.4	e6.2	e6.4	e4.3	585	76	56	28	3.1	248
16	22	e11	e8.2	e6.2	e6.2	e4.3	502	72	47	21	3.7	191
17	618	e10	e8.0	e6.2	e5.8	e4.2	356	165	29	17	4.7	181
18	986	e10	e8.0	e6.0	e5.6	e4.5	257	112	22	15	5.7	220
19	380	e10	e7.8	e6.0	e5.6	e20	203	81	22	41	4.7	166
20	260	e10	e7.8	e6.0	e5.6	e50	149	65	19	34	4.1	108
21	335	e15	e7.8	e5.8	e5.4	e50	116	55	43	30	3.6	76
22	215	e20	e7.6	e5.8	e5.4	e50	99	48	38	22	3.5	55
23	153	e15	e7.6	e5.8	e5.4	e60	139	45	22	17	3.2	44
24	114	e12	e7.6	e5.8	e5.2	e80	157	51	15	13	5.3	36
25	89	e11	e7.4	e5.8	e5.2	e90	135	48	13	11	9.6	45
26	73	e10	e7.4	e5.6	e5.2	e450	122	60	11	10	8.7	66
27	63	e9.8	e7.4	e5.6	e5.0	e450	123	175	17	9.1	6.3	54
28	56	e9.6	e7.2	e5.6	e5.0	215	132	124	30	25	4.8	43
29	48	e9.4	e7.2	e5.6	---	130	373	293	2450	50	4.9	35
30	43	e9.2	e7.2	e5.6	---	101	1060	244	722	27	4.8	44
31	40	---	e7.2	e5.6	---	88	---	202	---	16	3.7	---
TOTAL	4498	500.0	256.9	192.2	181.6	1916.6	9640	6144	4166	3626.1	172.9	3915.0
MEAN	145	16.7	8.29	6.20	6.49	61.8	321	198	139	117	5.58	130
MAX	986	37	10	7.0	10	450	1060	738	2450	947	11	967
MIN	22	9.2	7.2	5.6	5.0	4.2	97	45	11	9.1	3.1	2.8
AC-FT	8920	992	510	381	360	3800	19120	12190	8260	7190	343	7770
CFSM	1.70	.19	.10	.07	.08	.72	3.75	2.32	1.62	1.37	.07	1.52
IN.	1.95	.22	.11	.08	.08	.83	4.19	2.67	1.81	1.58	.08	1.70
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1974 - 1991, BY WATER YEAR (WY)												
MEAN	90.0	64.4	20.0	10.3	8.50	51.2	367	169	88.1	68.1	35.9	91.6
MAX	226	189	60.6	31.4	22.2	136	631	427	240	267	163	314
(WY)	1983	1983	1983	1975	1984	1976	1982	1979	1984	1978	1988	1977
MIN	3.06	1.58	.000	.000	.000	8.65	73.6	16.0	15.5	4.87	2.95	1.43
(WY)	1977	1977	1977	1977	1977	1980	1977	1976	1988	1988	1976	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1974 - 1991	
ANNUAL TOTAL	21269.35		35209.3			
ANNUAL MEAN	58.3		96.5		89.3	
HIGHEST ANNUAL MEAN					147	1986
LOWEST ANNUAL MEAN					44.2	1977
HIGHEST DAILY MEAN	1180	Apr 28	2450	Jun 29	4480	May 10 1979
LOWEST DAILY MEAN	.50	Jan 1	2.8	Sep 2	.00	Many days in 1977
ANNUAL SEVEN-DAY MINIMUM	.59	Jan 1	4.0	Aug 28	.00	Dec 2 1976
INSTANTANEOUS PEAK FLOW	1740	Oct 17	5440	Jun 29	7440	May 10 1979
INSTANTANEOUS PEAK STAGE	6.34	Oct 17	9.82	Jun 29	11.16	May 10 1979
INSTANTANEOUS LOW FLOW			2.7	Sep 2		
ANNUAL RUNOFF (AC-FT)	42190		69840		64710	
ANNUAL RUNOFF (CFSM)	.68		1.13		1.04	
ANNUAL RUNOFF (INCHES)	9.24		15.30		14.18	
10 PERCENT EXCEEDS	112		269		220	
50 PERCENT EXCEEDS	20		20		21	
90 PERCENT EXCEEDS	.65		5.0		4.1	

e Estimated

STREAMS TRIBUTARY TO LAKE SUPERIOR
04024000 ST. LOUIS RIVER AT SCANLON, MN

LOCATION.--Lat 46°42'12", long 92°25'07", in NW¼ sec.30, T.49 N., R.16 W., Carlton County, Hydrologic Unit 04010201, on right bank 25 ft downstream from lower bridge on U.S. Highway 61 at Scanlon, 0.6 mi downstream from Minnesota Power Co. powerplant, 3 mi upstream from Thomson Reservoir, and 3.2 mi upstream from Midway River.
DRAINAGE AREA.--3,430 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1908 to current year. Monthly discharge only for some periods published in WSP 1307. Published as "near Thomson" 1908-50.
REVISED RECORDS.--WSP 1337: 1911-12.
GAGE.--Water-stage recorder. Datum of gage is 1,101.23 ft above National Geodetic Vertical Datum of 1929. Oct. 5, 1909, to Sept. 5, 1914, nonrecording gage 3 mi 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.
REMARKS.--Records good except those for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplant upstream. Flow regulated by Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes, combined capacity, 332,160 acre-ft; the water-discharge table shows the monthly change in contents (†).

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	742	3260	1670	e1200	e1100	e900	2850	5730	6350	4150	2990	498
2	594	3060	1290	e1100	e1100	e850	2700	6030	5250	4750	2420	494
3	824	2840	1560	e1050	e1100	e850	2890	5740	4480	4250	1960	685
4	2120	2870	1330	e1000	e1100	e850	3930	5670	4090	4840	1770	541
5	2800	2750	1420	e1100	e1100	e850	5250	6280	3450	6180	1550	556
6	2570	2540	1590	e1200	e1100	e850	6000	9460	2840	6040	1430	506
7	2160	2110	1650	e1200	e1100	e850	6190	11100	2490	5450	1270	1530
8	1880	2060	1630	e1200	1200	e850	6080	10500	2220	5020	1150	3220
9	1650	1920	1610	e1200	1240	e850	5930	9530	1900	4850	1040	5510
10	1500	1860	1610	e1200	1210	e850	5340	8510	1810	4500	959	5240
11	1460	1720	1480	e1200	1150	e850	4960	7540	2030	3610	868	4630
12	1420	1390	1470	e1200	1090	e850	4500	6820	2020	3430	740	3980
13	1310	1430	1350	e1200	1170	e850	4130	6050	1920	4130	723	3620
14	1320	1540	1050	e1200	1180	e900	4070	5350	1800	4610	657	3730
15	1270	1640	1320	e1200	e1100	e950	4960	4730	1700	4030	642	4070
16	1230	1750	1500	e1200	e1000	963	6160	4160	1580	3450	686	4120
17	1620	1670	1410	e1200	e1000	973	6440	3630	1440	2780	608	3940
18	4180	1650	1150	e1200	e1000	997	6160	3500	1420	2450	672	3670
19	5120	1680	1240	e1200	e1000	1090	5530	3080	1310	3250	505	3220
20	5140	1700	1280	e1200	e1000	1260	5160	2730	1290	3570	599	3030
21	6200	1790	1230	e1200	e1000	1620	4600	2420	1530	3500	581	2720
22	6610	1810	e1000	e1150	e950	1620	4130	2290	1970	3190	626	2560
23	6250	1850	e850	e1100	e950	1950	3910	2130	1930	3010	557	2330
24	5890	1670	e800	e1100	e950	2060	3710	3160	1690	2600	599	2230
25	5460	1230	e900	e1100	e950	2150	3670	3510	1400	2380	939	2160
26	4990	1480	e1100	e1100	e900	3180	3360	3370	1270	2140	852	1890
27	4690	1650	e1200	e1100	e850	5450	3370	3330	1520	1600	674	2060
28	4170	1410	e1250	e1100	e850	5360	3430	3480	2060	2340	723	2070
29	4110	1580	e1300	e1100	---	4360	3410	3730	2170	6170	699	1930
30	3670	1650	e1200	e1100	---	3740	4280	4120	3480	5340	506	2000
31	3390	---	e1200	e1100	---	3170	---	4830	---	4020	495	---
TOTAL	96340	57560	40640	35700	29440	52893	137100	162510	70410	121630	30490	78740
MEAN	3108	1919	1311	1152	1051	1706	4570	5242	2347	3924	984	2625
MAX	6610	3260	1670	1200	1240	5450	6440	11100	6350	6180	2990	5510
MIN	594	1230	800	1000	850	850	2700	2130	1270	1600	495	494
†	129	-436	-761	-669	-540	-246	968	1111	279	221	-171	183
MEAN‡	3237	1483	550	483	511	1460	5538	6353	2626	4145	813	2808
CFSM‡	.94	.43	.16	.14	.15	.43	1.61	1.85	.77	1.21	.24	.82
IN‡	1.09	.48	.18	.16	.16	.49	1.80	2.14	.85	1.39	.27	.91

CAL YR 1990 TOTAL 801243 MEAN 2195 MAX 14900 MIN 221 MEAN‡ 2241 CFSM‡ .65 IN‡ 8.87
WTR YR 1990 TOTAL 913453 MEAN 2503 MAX 11100 MIN 494 MEAN‡ 2510 CFSM‡ .73 IN‡ 9.94

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1908 - 1991, BY WATER YEAR (WY)

MEAN	1982	1625	1231	1047	1033	1402	5543	5131	3580	2229	1666	1760
MAX	7508	8518	2993	2272	2200	6026	15230	22210	16480	6798	9197	7594
(WY)	1974	1972	1972	1966	1966	1945	1948	1950	1908	1953	1953	1928
MIN	407	473	282	265	249	301	667	593	458	199	377	402
(WY)	1935	1935	1911	1911	1924	1924	1977	1977	1988	1988	1977	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1908 - 1991	
ANNUAL TOTAL	801243		913453			
ANNUAL MEAN	2195		2503		2338	
HIGHEST ANNUAL MEAN					4276	1972
LOWEST ANNUAL MEAN					945	1924
HIGHEST DAILY MEAN	14900	May 1	11100	May 7	37900	May 9 1977
LOWEST DAILY MEAN	221	Aug 17	494	Sep 2	88	Aug 24 1977
ANNUAL SEVEN-DAY MINIMUM	294	Aug 13	539	Aug 30	134	Jul 26 1988
INSTANTANEOUS PEAK FLOW	19500	Sep 6	11500	May 7	37900	May 9 1950
INSTANTANEOUS PEAK STAGE	10.33	Sep 6	8.05	May 7	15.80	May 9 1950
INSTANTANEOUS LOW FLOW	94	Aug 19	140	Nov 25		
ANNUAL RUNOFF (AC-FT)	1589000		1812000		1694000	
ANNUAL RUNOFF (CFSM)	.64		.73		.63	
ANNUAL RUNOFF (INCHES)	8.69		9.91		9.26	
10 PERCENT EXCEEDS	4460		5340		5220	
50 PERCENT EXCEEDS	1470		1690		1360	
90 PERCENT EXCEEDS	686		850		628	

† Change in contents, equivalent in cubic feet per second, in Whiteface Reservoir, and Boulder, Island, Rice and Fish Lakes; records furnished by Minnesota Power Co.
‡ Adjusted for change in reservoir contents.
e Estimated.

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024000 ST. LOUIS RIVER AT SCANLON, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1958-66, 1968 to current year.

REMARKS.--Letter K indicates non-ideal colony count. Samples collected at cableway 0.75 mi downstream from gage.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT												
09...	1245	1620	180	174	7.3	7.6	9.0	3.2	731	10.0	K17	K27
JAN												
02...	1300	1150	170	184	7.4	7.5	0.5	3.4	741	8.4	K3	K9
FEB												
12...	1215	1140	165	180	7.1	7.3	0.0	2.9	727	9.0	K14	33
MAY												
02...	0730	5740	113	122	6.7	7.5	7.5	7.1	729	11.3	K15	45
02...	1145	6070	113	--	--	--	--	--	--	--	--	--
JUN												
10...	1230	1830	123	129	7.3	7.4	23.0	3.8	732	6.1	K14	230
JUL												
31...	1530	3550	105	110	7.8	7.4	20.0	32	733	7.6	K200	660
AUG												
01...	1130	2920	100	--	7.3	--	20.5	--	732	7.8	--	--

DATE	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)
OCT											
09...	18	8.7	5.4	1.5	58	66	0	71	13	5.7	0.2
JAN											
02...	19	8.7	5.3	1.4	76	74	0	93	12	5.0	0.1
FEB											
12...	18	8.5	6.8	1.3	67	70	0	82	11	3.9	<0.1
MAY											
02...	13	5.8	4.0	1.0	43	45	0	53	7.9	3.7	0.1
02...	--	--	--	--	--	--	--	--	--	--	--
JUN											
10...	15	6.5	4.0	0.7	46	51	0	56	6.9	4.1	0.2
JUL											
31...	13	5.4	2.5	1.0	45	47	0	55	3.8	2.6	0.2
AUG											
01...	--	--	--	--	--	--	--	--	--	--	--

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)
OCT											
09...	7.6	150	<0.01	0.10	0.06	0.06	1.1	0.03	0.03	0.02	<0.01
JAN											
02...	9.2	135	<0.01	0.20	0.08	0.08	0.9	0.04	<0.01	0.01	<0.01
FEB											
12...	8.6	122	<0.01	0.20	0.08	0.06	1.0	0.06	0.01	0.02	<0.01
MAY											
02...	4.9	102	<0.01	0.10	0.06	0.06	0.9	0.05	0.02	<0.01	<0.01
02...	--	--	--	--	--	--	--	--	--	--	--
JUN											
10...	6.2	110	0.01	0.12	0.05	0.05	1.1	0.04	0.03	0.02	<0.01
JUL											
31...	8.2	96	0.01	0.05	0.04	0.04	1.1	0.06	0.04	0.02	<0.01
AUG											
01...	--	--	--	--	--	--	--	--	--	--	--

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024000 ST. LOUIS RIVER AT SCANLON, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	SEDIMENT, SUSPENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)
OCT											
09...	10	86	100	<1	20	<0.5	2.0	1	<3	<1	700
JAN											
02...	18	46	--	--	--	--	--	--	--	--	--
FEB											
12...	3	100	30	<1	11	<0.5	<1.0	2	<3	2	540
MAY											
02...	--	--	80	<1	16	<0.5	<1.0	1	<3	2	400
02...	20	90	--	--	--	--	--	--	--	--	--
JUN											
10...	4	98	--	--	--	--	--	--	--	--	--
JUL											
31...	--	--	80	<1	17	<0.5	1.0	1	<3	2	790
AUG											
01...	9	99	--	--	--	--	--	--	--	--	--

DATE	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)
OCT											
09...	1	5	60	<0.1	<10	<1	<1	<1.0	49	<6	34
JAN											
02...	--	--	--	--	--	--	--	--	--	--	--
FEB											
12...	<1	<4	37	<0.1	<10	2	<1	<1.0	52	<6	27
MAY											
02...	1	<4	25	0.1	<10	<1	<1	<1.0	38	<6	9
02...	--	--	--	--	--	--	--	--	--	--	--
JUN											
10...	--	--	--	--	--	--	--	--	--	--	--
JUL											
31...	<1	<4	57	<0.1	<10	1	<1	<1.0	37	<6	8
AUG											
01...	--	--	--	--	--	--	--	--	--	--	--

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024098 DEER CREEK NEAR HOLYOKE, MN

LOCATION.--Lat 46°31'30", long 92°23'20", in NE¼SE¼ sec.29, T.47 N., R.16 W., Carlton County, Hydrologic Unit 04010301, on left bank 179 ft west of State Highway No. 23, 0.9 mi upstream from mouth and 4.0 mi north of Holyoke.

DRAINAGE AREA.--7.77 mi^2.

PERIOD OF RECORD.--October 1976 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 786.14 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records fair except those for estimated daily discharges, which are poor.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.8	2.8	e1.8	e1.9	e1.9	1.2	8.6	26	26	128	4.2	1.8
2	1.7	2.7	e1.8	e1.9	e1.9	1.4	18	14	15	35	3.7	1.8
3	16	2.5	e1.8	e1.9	e2.0	1.3	24	9.5	9.9	30	3.8	6.2
4	8.4	2.9	e1.8	e1.9	e2.2	1.4	26	34	7.4	26	4.2	2.5
5	4.1	2.6	e1.9	e1.9	e2.5	1.2	18	65	5.9	24	3.6	2.0
6	2.8	2.3	e1.9	e1.9	e3.0	1.4	15	115	5.2	9.3	3.2	2.1
7	2.2	2.1	e1.9	e1.9	e4.0	1.5	12	52	4.7	5.5	3.1	21
8	1.9	2.0	e1.9	e1.9	e4.0	1.5	28	24	4.6	8.1	3.1	90
9	1.6	2.0	e1.9	e1.9	e3.0	1.5	12	15	5.3	4.0	3.0	52
10	1.5	2.0	e1.9	e1.9	2.4	1.4	9.3	11	9.1	3.4	2.7	18
11	1.5	2.0	e1.9	e1.9	1.8	1.6	9.7	9.3	5.1	3.9	2.8	9.3
12	1.9	1.9	e1.9	e1.9	e1.7	1.7	7.0	8.7	4.8	79	2.7	7.8
13	2.0	1.7	e1.6	e1.9	1.6	1.8	7.2	8.3	23	78	2.5	6.8
14	1.8	1.8	e1.9	e1.9	1.5	1.7	25	6.7	35	15	2.5	8.9
15	1.7	1.8	e1.9	e1.9	1.6	2.4	30	6.0	14	6.6	2.2	9.6
16	1.6	1.8	e1.9	e1.9	1.6	3.4	20	7.2	8.0	4.6	2.7	7.7
17	72	1.8	e1.9	e1.9	1.8	3.3	13	18	5.3	3.9	3.6	7.8
18	52	1.8	e1.9	e1.9	1.6	5.0	10	9.5	5.2	5.0	2.2	11
19	16	1.7	e1.9	e1.9	1.8	15	8.6	6.8	5.0	5.1	2.2	7.6
20	18	1.6	e1.9	e1.9	1.9	11	6.9	5.9	6.6	4.3	2.2	6.2
21	24	1.9	e1.9	e1.9	1.9	12	5.8	5.3	110	4.9	2.4	5.6
22	12	1.9	e1.9	e1.9	1.5	5.6	6.3	5.0	28	4.2	2.2	5.2
23	7.8	1.8	e1.9	e1.9	1.4	39	11	5.5	10	3.8	2.0	4.6
24	5.7	e1.8	e1.9	e1.9	1.6	39	8.6	11	6.1	3.6	3.0	4.6
25	4.7	e1.8	e1.9	e1.9	1.5	64	7.2	6.5	4.8	4.8	3.1	5.3
26	4.2	1.7	e1.9	e1.9	1.5	60	6.8	17	4.2	3.7	2.7	5.0
27	3.7	1.7	e1.9	e1.9	1.4	26	6.4	46	5.2	3.6	2.1	4.4
28	3.2	1.8	e1.9	e1.9	1.2	7.4	5.9	48	4.8	126	1.9	4.1
29	3.0	e1.8	e1.9	e1.9	---	3.9	23	64	6.9	38	1.9	3.8
30	3.0	e1.8	e1.9	e1.9	---	3.3	50	45	8.7	13	1.9	4.4
31	2.9	---	e1.9	e1.9	---	3.3	---	48	---	6.2	1.9	---
TOTAL	284.7	59.8	58.2	58.9	55.8	324.2	439.3	753.2	393.8	690.5	85.3	327.1
MEAN	9.18	1.99	1.88	1.90	1.99	10.5	14.6	24.3	13.1	22.3	2.75	10.9
MAX	72	2.9	1.9	1.9	4.0	64	50	115	110	128	4.2	90
MIN	1.5	1.6	1.6	1.9	1.2	1.2	5.8	5.0	4.2	3.4	1.9	1.8
AC-FT	565	119	115	117	111	643	871	1490	781	1370	169	649
CFSM	1.18	.26	.24	.24	.26	1.35	1.88	3.13	1.69	2.87	.35	1.40
IN.	1.36	.29	.28	.28	.27	1.55	2.10	3.61	1.89	3.31	.41	1.57

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1976 - 1991, BY WATER YEAR (WY)

MEAN	7.21	4.28	2.40	1.78	2.33	8.43	23.6	11.1	7.24	6.46	5.49	9.58
MAX	21.8	12.2	3.86	2.45	5.87	19.2	90.8	24.3	19.8	22.3	36.9	30.4
(WY)	1983	1983	1983	1983	1981	1985	1986	1991	1984	1991	1986	1986
MIN	1.69	1.59	1.31	.97	1.06	2.34	4.11	2.15	1.65	1.50	.89	1.69
(WY)	1988	1977	1977	1979	1979	1986	1977	1980	1982	1988	1982	1981

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1976 - 1991	
ANNUAL TOTAL	2434.69		3530.8			
ANNUAL MEAN	6.67		9.67		7.51	
HIGHEST ANNUAL MEAN					19.3	1986
LOWEST ANNUAL MEAN					3.65	1980
HIGHEST DAILY MEAN	553	Sep 6	128	Jul 1	553	Sep 6 1990
LOWEST DAILY MEAN	.69	Jul 14	1.2	Feb 28	.21	Jul 2 1976
ANNUAL SEVEN-DAY MINIMUM	.83	Jul 14	1.3	Feb 27	.47	Aug 10 1982
INSTANTANEOUS PEAK FLOW	1730	Sep 6	328	Jul 28	2000a	Sep 3 1985
INSTANTANEOUS PEAK STAGE	29.43b	Sep 6	16.10	Jul 28	32.76b	Sep 3 1985
INSTANTANEOUS LOW FLOW	.58	May 13			.20c	
ANNUAL RUNOFF (AC-FT)	4830		7000		5440	
ANNUAL RUNOFF (CFSM)	.86		1.24		.97	
ANNUAL RUNOFF (INCHES)	11.66		16.90		13.14	
10 PERCENT EXCEEDS	11		24		15	
50 PERCENT EXCEEDS	2.3		3.3		2.5	
90 PERCENT EXCEEDS	1.2		1.7		1.4	

a From rating curve extended above 1000 ft^3/s on basis of flow through culvert computations.
b From floodmarks.
c Occurred Aug. 13, 16, 1982, July 12, 1989.
e Estimated.

RED RIVER OF THE NORTH BASIN

05045950 ORWELL LAKE NEAR FERGUS FALLS, MN

LOCATION.--Lat 46°12'55", long 96°10'40", in SW¼ sec.26, T.132 N., R.44 W., Otter Tail County, Hydrologic Unit 09020103, at dam on Otter Tail River at outlet of Orwell Lake, 7 mi southwest of Fergus Falls.

DRAINAGE AREA.--1,830 mi^2, approximately.

PERIOD OF RECORD.--March 1953 to current year. Prior to October 1971, published as Orwell Reservoir.

GAGE.--Water-stage recorder. Datum of gage is adjustment of 1912.

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 is 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 were provided by U.S. Army Corps of Engineers.

EXTREMES FOR 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.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 9,580 acre-ft, May 6, elevation, 1,065.50 ft; minimum, 7,400 acre-ft, Sept. 30, elevation, 1,062.80 ft.

MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	1,063.80	8,150	
Oct. 31	1,063.90	8,220	+70
Nov. 30	1,064.20	8,470	+250
Dec. 31	1,061.13	8,410	-60
CAL YR 1990			-13,590
Jan. 31	1,064.61	8,820	+140
Feb. 28	1,064.41	8,650	-170
Mar. 31	1,064.42	8,660	+10
Apr. 30	1,064.48	8,710	+50
May 31	1,064.38	8,620	-90
June 30	1,064.69	8,890	+270
July 31	1,063.85	8,190	-700
Aug. 31	1,064.25	8,510	+320
Sept. 30	1,062.80	7,400	-1110
WTR YR 1991			-750

RED RIVER OF THE NORTH BASIN

05046000 OTTER TAIL RIVER BELOW ORWELL DAM, NEAR FERGUS FALLS, MN

LOCATION.--Lat 46°12'35", long 96°11'05", in NE¼ sec.34, T.132 N., R.44 W., Otter Tail County, Hydrologic Unit 09020103, on left bank 0.7 mi downstream from Orwell Dam, 6.1 mi downstream from Dayton Hollow Dam, 8 mi southwest of Fergus Falls, and 11.1 mi downstream from Pelican River.
DRAINAGE AREA.--1,830 mi^2, 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.
REVISED RECORDS.--WSP 785: 1934(M). WSP 1208: 1947(M). WSP 1308: 1931(M).
GAGE.--Water-stage recorder. Datum of gage is 1,029.65 ft, adjustment of 1912 (levels by U.S. Army 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 mi upstream at datum 40.30 ft higher.
REMARKS.--Records good. Flow regulated by Orwell Lake (station 05045950) beginning Mar. 21, 1953 and powerplants upstream.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	121	114	94	84	137	166	387	508	840	895	538	384
2	106	115	94	84	137	166	357	557	840	1010	464	384
3	110	115	86	84	137	166	354	604	838	908	506	329
4	128	115	80	84	137	186	341	623	840	851	507	287
5	137	104	80	84	137	211	316	623	806	815	520	324
6	137	94	80	84	137	193	316	640	780	792	529	347
7	137	94	80	84	137	167	316	676	736	788	529	347
8	138	78	80	84	137	168	335	632	693	760	489	357
9	140	71	80	84	137	161	347	636	693	713	464	354
10	137	75	77	84	137	162	347	657	669	697	464	389
11	137	75	75	84	137	188	303	663	650	633	464	411
12	136	75	78	84	154	221	278	662	656	657	446	352
13	131	75	90	84	194	231	279	666	672	691	433	316
14	131	75	99	84	191	246	279	670	693	691	433	321
15	123	75	99	84	177	251	327	731	699	645	437	324
16	115	83	98	84	173	251	519	763	691	618	434	295
17	117	89	92	84	173	251	502	764	685	618	430	273
18	128	89	89	83	173	251	446	759	682	653	426	279
19	137	89	89	82	173	236	443	759	681	674	410	277
20	137	89	91	84	173	237	445	726	685	670	380	367
21	137	95	89	84	173	237	446	717	703	670	313	426
22	137	99	94	94	173	304	446	723	715	614	274	426
23	137	104	94	107	173	331	444	723	714	578	345	355
24	137	104	94	110	173	331	440	735	735	578	384	309
25	134	104	94	112	168	291	413	735	753	561	384	311
26	131	104	94	118	166	275	398	733	655	548	384	414
27	131	e104	94	115	166	373	403	729	601	545	384	467
28	131	e95	94	115	166	426	405	752	604	545	384	465
29	117	e95	94	115	---	426	405	816	610	545	385	461
30	104	93	94	115	---	424	454	845	668	545	384	290
31	107	---	89	126	---	419	---	841	---	545	384	---
TOTAL	3986	2786	2755	2888	4446	7946	11491	21668	21287	21053	13308	10641
MEAN	129	92.9	88.9	93.2	159	256	383	699	710	679	429	355
MAX	140	115	99	126	194	426	519	845	840	1010	538	467
MIN	104	71	75	82	137	161	278	508	601	545	274	273
AC-FT	7910	5530	5460	5730	8820	15760	22790	42980	42220	41760	26400	21110
CFSM	.07	.05	.05	.05	.09	.14	.21	.38	.39	.37	.23	.19
IN.	.08	.06	.06	.06	.09	.16	.23	.44	.43	.43	.27	.22

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1991, BY WATER YEAR (WY)

MEAN	224	234	223	214	215	294	450	552	547	395	259	219
MAX	817	831	706	603	605	653	1051	1427	1425	1246	1080	904
(WY)	1986	1986	1987	1986	1987	1987	1986	1986	1986	1953	1985	1985
MIN	9.15	8.42	8.10	15.1	10.8	23.5	39.5	14.1	14.2	12.8	11.5	7.99
(WY)	1977	1977	1977	1937	1935	1937	1934	1977	1934	1936	1934	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1931 - 1991	
ANNUAL TOTAL	95807		124255			
ANNUAL MEAN	262		340		319	
HIGHEST ANNUAL MEAN					842	1986
LOWEST ANNUAL MEAN					20.4	1934
HIGHEST DAILY MEAN	644	Jun 15	1010	Jul 2	1670	Jun 20 1953
LOWEST DAILY MEAN	.71	Nov 9	71	Nov 9	1.6	Feb 7 1937
ANNUAL SEVEN-DAY MINIMUM	74	Nov 9	74	Nov 9	5.9	Sep 15 1934
INSTANTANEOUS PEAK FLOW	650	Jun 14	1050	Jul 1	1710	Jun 17 1953
INSTANTANEOUS PEAK STAGE	3.37a	Jun 14	4.00	Jul 1	5.60b	Jun 17 1953
INSTANTANEOUS LOW FLOW	66	Nov 8,9	66	Nov 8,9	.70a	Aug 5 1970
ANNUAL RUNOFF (AC-FT)	190000		246500		231300	
ANNUAL RUNOFF (CFSM)	.14		.19		.17	
ANNUAL RUNOFF (INCHES)	1.95		2.53		2.37	
10 PERCENT EXCEEDS	528		713		699	
50 PERCENT EXCEEDS	175		291		246	
90 PERCENT EXCEEDS	89		84		30	

a Result of regulation.
b Backwater from aquatic vegation.
e Estimated.

RED RIVER OF THE NORTH BASIN

05050000 BOIS DE SIOUX RIVER NEAR WHITE ROCK, SD

LOCATION.--Lat 45°51'45", long 96°34'25", in SW¼SW¼ sec.27, T.128 N., R.47 W., Roberts County, Hydrologic Unit 09020101, on Sisseton Indian Reservstion, on left bank just downstream from Big Slough Outlet, 300 ft downstream from White Rock Dam, 4 mi south of White Rock, SD and 5 mi northwest of Wheaton.

DRAINAGE AREA.--1,160 mi^2, approximately.

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

GAGE.--Water-stage recorder. Datum of gage is 960.00 ft, adjustment of 1912 (levels by U.S. Army 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.

REMARKS.--Records fair. Flow regulated by Lake Traverse-Boise de Sioux Flood Control and Water Conservation project (available capacity for flood control, 137,000 acre-ft).

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.90	2.3	e.94	e.44	e.42	e.48	7.6	31	22	569	175	6.3
2	.83	2.7	e.88	e.44	e.45	e.48	6.3	32	28	581	169	6.1
3	.88	2.6	e.84	e.44	e.47	e.48	5.6	29	34	588	170	6.1
4	.83	2.2	e.80	e.44	e.48	e.48	5.4	30	35	585	166	5.9
5	.81	2.0	e.76	e.44	e.48	e.48	5.0	33	36	600	164	5.8
6	.89	1.9	e.72	e.44	e.48	e.48	4.8	32	34	656	160	5.6
7	.81	1.9	e.70	e.42	e.48	e.49	5.3	28	31	679	157	5.5
8	.78	1.8	e.68	e.42	e.48	e.50	5.6	24	27	676	127	6.2
9	.74	1.7	e.66	e.42	e.48	e.52	5.4	21	23	656	93	11
10	.71	1.6	e.62	e.42	e.48	e.54	4.8	18	19	632	91	29
11	.75	1.5	e.60	e.42	e.48	e.62	4.4	17	16	630	89	20
12	.73	1.4	e.60	e.42	e.48	e.70	4.9	14	13	641	88	9.7
13	.69	1.4	e.58	e.42	e.48	e.82	7.3	13	9.7	624	86	8.0
14	.74	1.4	e.56	e.42	e.48	e1.0	13	11	10	605	84	8.4
15	.72	1.6	e.56	e.42	e.48	e1.2	19	10	9.4	594	73	8.6
16	.76	1.6	e.54	e.40	e.48	e1.4	22	9.2	8.1	578	66	8.2
17	2.1	1.5	e.54	e.40	e.48	e1.7	22	8.0	6.3	560	67	7.8
18	1.1	1.5	e.52	e.40	e.48	e2.2	21	6.7	5.1	544	67	7.8
19	.91	1.6	e.52	e.40	e.48	e2.9	19	5.6	4.6	502	45	28
20	1.7	1.5	e.52	e.40	e.48	e3.4	15	5.2	40	448	9.0	51
21	2.1	2.0	e.50	e.40	e.48	e4.1	13	5.0	106	437	7.6	50
22	2.5	1.7	e.50	e.40	e.48	e5.0	12	4.6	116	432	7.6	53
23	3.3	e1.6	e.50	e.40	e.48	e6.5	11	4.8	91	423	7.4	79
24	3.3	e1.5	e.48	e.40	e.48	e8.4	9.2	5.1	69	416	7.1	107
25	3.2	e1.4	e.48	e.40	e.48	e11	7.9	4.0	235	374	7.2	107
26	3.5	e1.3	e.48	e.40	e.48	19	6.8	3.1	429	314	7.2	104
27	4.0	e1.2	e.48	e.40	e.48	24	8.0	2.7	422	279	6.8	103
28	2.7	e1.1	e.46	e.40	e.48	22	9.4	2.8	435	278	6.5	102
29	2.7	e1.1	e.46	e.40	---	16	11	6.6	455	274	7.3	101
30	2.6	e1.0	e.46	e.40	---	12	20	17	481	269	7.0	101
31	2.3	---	e.46	e.40	---	9.5	---	15	---	222	6.6	---
TOTAL	50.58	49.6	18.40	12.82	13.34	158.37	311.7	448.4	3250.2	15666	2224.3	1152.0
MEAN	1.63	1.65	.59	.41	.48	5.11	10.4	14.5	108	505	71.8	38.4
MAX	4.0	2.7	.94	.44	.48	24	22	33	481	679	175	107
MIN	.69	1.0	.46	.40	.42	.48	4.4	2.7	4.6	222	6.5	5.5
AC-FT	100	98	36	25	26	314	618	889	6450	31070	4410	2280
CFSM	.00	.00	.00	.00	.00	.00	.01	.01	.09	.44	.06	.03
IN.	.00	.00	.00	.00	.00	.01	.01	.01	.10	.50	.07	.04

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1991, BY WATER YEAR (WY)

MEAN	15.5	12.0	4.92	2.51	3.26	24.8	195	249	234	148	51.1	17.9
MAX	363	258	57.5	36.0	53.0	227	1322	1310	1103	1035	1130	260
(WY)	1987	1985	1985	1987	1966	1985	1969	1969	1986	1962	1962	1962
MIN	.000	.000	.000	.000	.000	.000	.000	.23	.010	.000	.000	.000
(WY)	1942	1942	1942	1942	1942	1942	1942	1977	1977	1961	1970	1960

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1942 - 1991	
ANNUAL TOTAL	1695.77		23355.71			
ANNUAL MEAN	4.65		64.0		80.1a	
HIGHEST ANNUAL MEAN					329	1986
LOWEST ANNUAL MEAN					.38	1977
HIGHEST DAILY MEAN	77	Mar 13	679	Jul 7	3380	Apr 20 1969
LOWEST DAILY MEAN	.00	Many days	.40	Jan 16-31	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Jan 1	.40	Jan 16	.00	Oct 1 1941
INSTANTANEOUS PEAK FLOW	89b	Mar 13	685	Jul 7	3770c	
INSTANTANEOUS PEAK STAGE	4.85b	Mar 13	11.14	Jul 7	15.07cd	
ANNUAL RUNOFF (AC-FT)	3360		46330		58010	
ANNUAL RUNOFF (CFSM)	.004		.055		.069	
ANNUAL RUNOFF (INCHES)	.05		.75		.94	
10 PERCENT EXCEEDS	10		227		236	
50 PERCENT EXCEEDS	1.1		4.9		1.7	
90 PERCENT EXCEEDS	.00		.46		.00	

a Median of annual mean discharges is 54 ft^3/s.
b Due to regulation.
c Occurred during period Apr. 19-21, 1969.
d From floodmark.
e Estimated.

RED RIVER OF THE NORTH BASIN

05051300 BOIS DE SIOUX RIVER NEAR DORAN, MN

LOCATION.--Lat 46°09'08", long 96°34'44", in NE¼NE¼ sec.21, T.131 N., R.47 W., Wilkin County, Hydrologic Unit 09020101, on right bank, 10 ft downstream from bridge on County Highway 6, 3 miles downstream from Rabbit River, 4.3 mi southwest of Doran.

DRAINAGE AREA.--1,880 mi^2, approximately

PERIOD OF RECORD.--October 1989 to current year.

GAGE.--Water-stage recorder. Datum of gage is 943.90 ft above National Geodetic Vertical Datum of 1929 (elevation data obtained from Wilkin County Highway Engineer).

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow regulated by Lake Traverse-Boise de Sioux Flood Control and Water Conservation project near White Rock, SD.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.93	e1.3	e.21	e.05	e.15	134	198	565	1840	233	16
2	.00	1.3	e1.2	e.20	e.10	e.15	115	279	871	2860	193	16
3	.00	1.7	e1.2	e.19	e.11	e.15	108	214	558	2790	191	16
4	.00	1.8	e1.1	e.18	e.13	e.15	103	196	324	2230	193	13
5	.00	1.8	e1.1	e.17	e.16	e.26	94	304	209	1640	218	13
6	.00	1.6	e1.0	e.16	e.19	e.40	79	273	160	1190	203	13
7	.00	1.6	e1.0	e.15	e.20	e.50	63	187	132	997	186	14
8	.00	1.7	e.92	e.14	e.20	e.70	49	135	110	916	177	329
9	.00	1.9	e.88	e.13	e.18	e1.0	39	104	98	877	152	2020
10	.00	1.9	e.84	e.12	e.17	e1.5	31	81	87	834	121	2640
11	.00	2.0	e.78	e.12	e.16	e2.0	25	69	70	807	111	2340
12	.00	2.0	e.74	e.11	e.16	e3.0	23	57	61	1110	106	1530
13	.00	1.9	e.70	e.11	e.15	e4.3	24	51	50	1130	103	830
14	.00	1.9	e.67	e.10	e.15	e5.8	25	40	52	986	101	492
15	.00	1.9	e.64	e.10	e.15	e8.0	28	34	176	880	98	438
16	.00	2.3	e.60	e.08	e.15	e11	42	29	390	819	92	347
17	.00	2.8	e.55	e.06	e.15	e16	69	25	343	780	86	209
18	.00	3.6	e.52	e.04	e.15	e21	79	22	203	749	83	127
19	.00	3.2	e.50	e.02	e.15	e33	71	21	125	714	80	87
20	.00	3.1	e.47	e.00	e.15	e50	62	19	172	645	73	71
21	.00	2.5	e.44	e.00	e.15	e80	54	16	546	577	46	93
22	.00	2.2	e.41	e.00	e.15	e109	45	14	1090	554	28	91
23	.00	e2.1	e.38	e.00	e.15	e109	38	12	914	537	21	89
24	.00	e1.9	e.35	e.00	e.15	e100	33	11	546	519	19	101
25	.00	e1.8	e.33	e.00	e.15	e96	29	9.3	316	498	19	122
26	.00	e1.7	e.31	e.00	e.15	e90	26	8.8	241	433	18	126
27	.00	e1.6	e.29	e.00	e.15	e200	27	7.8	316	355	16	121
28	.00	e1.5	e.27	e.00	e.15	403	25	7.5	360	316	16	118
29	.00	e1.4	e.25	e.00	---	330	23	10	849	306	16	117
30	.08	e1.4	e.24	e.00	---	254	55	13	994	298	16	114
31	.72	---	e.22	e.00	---	173	---	65	---	285	17	---
TOTAL	0.80	59.03	20.20	2.39	4.21	2103.06	1618	2512.4	10928	29472	3032	12653
MEAN	.026	1.97	.65	.077	.15	67.8	53.9	81.0	364	951	97.8	422
MAX	.72	3.6	1.3	.21	.20	403	134	304	1090	2860	233	2640
MIN	.00	.93	.22	.00	.05	.15	23	7.5	50	285	16	13
AC-FT	1.6	117	40	4.7	8.4	4170	3210	4980	21680	58460	6010	25100
CFSM	.00	.00	.00	.00	.00	.04	.03	.04	.19	.51	.05	.22
IN.	.00	.00	.00	.00	.00	.04	.03	.05	.22	.58	.06	.25

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1990 - 1991, BY WATER YEAR (WY)

MEAN	10.1	5.25	4.57	.13	.075	46.7	33.3	46.4	188	478	48.9	211
MAX	20.2	8.54	8.48	.19	.15	67.8	53.9	81.0	364	951	97.8	422
(WY)	1990	1990	1990	1990	1991	1991	1991	1991	1991	1991	1991	1991
MIN	.026	1.97	.65	.077	.000	25.5	12.6	11.8	12.6	4.37	.000	.000
(WY)	1991	1991	1991	1991	1990	1990	1990	1990	1990	1990	1990	1990

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1990 - 1991	
ANNUAL TOTAL	2136.45		62405.09			
ANNUAL MEAN	5.85		171		89.9	
HIGHEST ANNUAL MEAN					171	1991
LOWEST ANNUAL MEAN					8.77	1990
HIGHEST DAILY MEAN	85	Mar 16	2860	Jul 2	2860	Jul 2 1991
LOWEST DAILY MEAN	.00	Many days	.00	Many days	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Jan 7	.00	Oct 1	.00	Jan 7 1990
INSTANTANEOUS PEAK FLOW	96	Mar 16	2980	Jul 2	2980	Jul 2 1991
INSTANTANEOUS PEAK STAGE	9.75a	Mar 16	17.89	Jul 2	17.89	Jul 2 1991
ANNUAL RUNOFF (AC-FT)	4240		123800		65110	
ANNUAL RUNOFF (CFSM)	.003		.091		.048	
ANNUAL RUNOFF (INCHES)	.04		1.23		.65	
10 PERCENT EXCEEDS	14		541		193	
50 PERCENT EXCEEDS	.63		16		5.1	
90 PERCENT EXCEEDS	.00		.00		.00	

a Due to regulation (backwater from ice).
e Estimated.

RED RIVER OF THE NORTH BASIN

05051500 RED RIVER OF THE NORTH AT WAHPETON, ND

LOCATION.--Lat 46°15'55", long 96°35'40", in NE¼ sec.8, T.132 N., R.47 W., Richland County, Hydrologic Unit 09020104, 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 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1942 to October 1942, March 1943 to current year. Gage-height records collected in this vicinity since 1917 are contained in reports of the U.S. Weather Bureau.
GAGE.--Water-stage recorder and concrete and wooden dam. Datum of gage is 942.97 ft above National Geodetic Vertical Datum of 1929. 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.
REMARKS.--Records good except those for periods of estimated daily discharges, which are fair. Flow regulated by Orwell Reservoir, capacity, 14,100 acre-ft at elevation 1,070 ft above National Geodetic Vertical Datum of 1929, adjustment of 1912; Lake Traverse, capacity, 137,000 acre-ft, available for flood control; numerous other controlled lakes and ponds, and several powerplants.
EXTREMES OUTSIDE PERIOD OF RECORD.--A stage of 17.0 ft, discharge, 10,500 ft^3/s, occurred in the spring of 1897 and has not been exceeded since.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	113	95	e82	e66	e84	e130	580	776	1050	1860	768	398
2	116	94	e86	e68	e90	e130	528	805	1600	2610	714	394
3	102	94	e90	e70	e94	e120	496	819	1530	2960	654	395
4	99	94	e98	e76	e98	e125	486	890	1220	2870	663	366
5	98	94	101	e80	e100	e130	462	920	1040	2460	678	302
6	109	91	102	e82	e100	e135	421	932	945	2030	693	311
7	109	65	102	e84	e100	e140	403	866	874	1740	731	344
8	109	68	105	e86	e100	e150	390	821	812	1620	695	638
9	109	96	105	e88	e98	e160	384	778	752	1560	657	1880
10	109	72	105	e88	e96	e175	393	718	734	1500	587	2500
11	108	74	106	e90	e94	e190	385	709	706	1450	566	2570
12	108	66	105	e90	e92	e200	361	708	670	1560	560	2220
13	109	64	103	e90	e90	e210	340	706	656	1680	541	1540
14	107	80	84	e92	e90	e240	334	690	687	1630	516	1060
15	105	81	123	e92	e90	e260	341	671	790	1540	511	932
16	108	84	137	e96	e90	e280	379	691	954	1440	688	878
17	128	85	117	e98	e90	e290	536	736	996	1350	516	687
18	119	96	e90	e96	e90	e300	609	736	881	1300	507	513
19	109	100	e80	e90	e90	e320	536	729	788	1290	504	442
20	114	103	e70	e82	e90	e360	516	724	806	1280	488	395
21	118	102	e65	e78	e92	e400	508	705	993	1210	448	437
22	131	102	e60	e76	e94	e440	500	679	1550	1180	374	532
23	149	91	e55	e76	e96	e450	495	678	1670	1120	298	542
24	134	89	e60	e74	e100	e460	490	693	1390	1050	332	507
25	143	e65	e62	e74	e105	e520	480	705	1120	1020	411	468
26	125	e60	e64	e74	e115	e600	457	702	985	968	407	474
27	122	e50	e66	e74	e125	e640	458	699	960	881	395	534
28	115	e70	e68	e74	e130	e680	443	699	914	834	393	601
29	116	e78	e66	e76	---	e720	450	725	1180	815	389	606
30	109	e80	e64	e78	---	e680	632	771	1500	805	410	600
31	97	---	e65	e80	---	623	---	830	---	794	401	---
TOTAL	3547	2483	2686	2538	2723	10258	13793	23311	30753	46407	16495	24066
MEAN	114	82.8	86.6	81.9	97.2	331	460	752	1025	1497	532	802
MAX	149	103	137	98	130	720	632	932	1670	2960	768	2570
MIN	97	50	55	66	84	120	334	671	656	794	298	302
AC-FT	7040	4930	5330	5030	5400	20350	27360	46240	61000	92050	32720	47730

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1991, BY WATER YEAR (WY)

MEAN	298	289	269	255	263	570	1203	1008	1021	727	373	298
MAX	1247	952	820	678	687	1679	4436	3085	2675	2756	1983	1434
(WY)	1987	1987	1987	1986	1987	1986	1969	1986	1962	1962	1962	1986
MIN	5.72	7.40	6.60	8.81	18.0	84.3	138	22.5	90.0	65.6	53.5	2.18
(WY)	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1942 - 1991	
ANNUAL TOTAL	100755		179060			
ANNUAL MEAN	276		491		542	
HIGHEST ANNUAL MEAN					1477	1986
LOWEST ANNUAL MEAN					54.0	1977
HIGHEST DAILY MEAN	880	Mar 18	2960	Jul 3	8940	Apr 10 1969
LOWEST DAILY MEAN	50	Nov 27	50	Nov 27	1.7	Aug 28 1976
ANNUAL SEVEN-DAY MINIMUM	62	Dec 21	62	Dec 21	1.7	Aug 28 1976
INSTANTANEOUS PEAK FLOW			2980	Jul 3	9200	Apr 10 1969
INSTANTANEOUS PEAK STAGE			9.52	Jul 3	17.95	Apr 5 1989
ANNUAL RUNOFF (AC-FT)	199800		355200		392600	
10 PERCENT EXCEEDS	532		1120		1240	
50 PERCENT EXCEEDS	198		379		350	
90 PERCENT EXCEEDS	91		78		100	

e Estimated.

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE AIR (DEG C) (00020)	TEMPER-ATURE WATER (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)
DEC												
17...	1015	109	598	--	-12.5	0.0	--	--	--	--	--	--
JAN												
08...	0940	86	600	--	-7.0	0.0	--	--	--	--	--	--
FEB												
27...	1245	128	683	--	-4.5	1.0	--	--	--	--	--	--
MAR												
a11...	1630	188	535	8.1	7.0	0.5	13.6	93	250	48	32	16
APR												
03...	1210	500	514	8.1	10.5	2.5	--	--	230	45	28	13
MAY												
03...	0850	803	767	--	5.0	5.5	--	--	--	--	--	--
JUN												
05...	0810	1060	543	--	9.5	19.0	--	--	--	--	--	--
JUL												
03...	1330	2960	355	--	18.0	22.0	--	--	--	--	--	--
12...	0835	1520	623	--	20.0	23.0	--	--	--	--	--	--
AUG												
22...	1000	401	498	8.5	23.0	22.5	--	--	230	41	32	14

DATE	SODIUM PERCENT (00932)	SODIUM AD-SORP-TION RATIO (00931)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE, FET-LAB (MG/L AS HCO3) (95440)	CAR-BONATE, FET-LAB (MG/L AS CO3) (95445)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)
MAR												
a11...	12	0.4	7.1	--	--	--	238	290	0	34	22	0.10
APR												
03...	11	0.4	6.5	220	0	180	--	--	--	64	13	0.10
AUG												
22...	11	0.4	4.9	250	3	210	--	--	--	44	12	0.10

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN,AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)
MAR												
a11...	16	304	321	0.41	154	0.410	0.020	0.430	0.210	1.1	0.060	0.060
APR												
03...	14	317	292	0.43	428	--	--	--	--	--	--	--
AUG												
22...	19	319	295	0.43	345	--	--	--	--	--	--	--

RED RIVER OF THE NORTH BASIN

05051500 RED RIVER OF THE NORTH AT WAHPETON, ND--CONTINUED

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE) (01010)	BORON, DIS-SOLVED (UG/L AS B) (01020)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR) (01030)	COBALT, DIS-SOLVED (UG/L AS CO) (01035)	COPPER, DIS-SOLVED (UG/L AS CU) (01040)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)	LITHIUM DIS-SOLVED (UG/L AS LI) (01130)
MAR											
a11...	1	76	<0.5	60	<1.0	<5	<3	<10	13	<10	18
APR											
03...	3	--	--	60	--	--	--	--	20	<1	20
AUG											
22...	4	--	--	10	--	--	--	--	10	<1	20

DATE	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	STRON-TIUM, DIS-SOLVED (UG/L AS SR) (01080)	VANA-DIUM, DIS-SOLVED (UG/L AS V) (01085)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)
MAR											
a11...	17	0.2	<10	<10	<1	<1.0	160	<6	8	8.8	0.8
APR											
03...	20	0.1	<1	--	<1	--	210	--	--	--	--
AUG											
22...	20	0.1	<1	--	<1	--	210	--	--	--	--

a Replicate sample also collected for quality-assurance purposes.

RED RIVER OF THE NORTH BASIN

05051522 RED RIVER OF THE NORTH AT HICKSON, ND

LOCATION.--Lat 46°39'35", long 96°47'44", in SW¼ sec.19, T.137 N., R.48 W., Clay County, MN, Hydrologic Unit 09020104, on right bank 60 ft downstream from bridge on township road, and 1 mi southeast of Hickson, ND.

DRAINAGE AREA.--4,300 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1975 to current year.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 877.06 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for periods of estimated daily discharges, which are fair. Flow regulated by Orwell Reservoir, capacity, 14,100 acre-ft at elevation 1,070 ft above National Geodetic Vertical Datum of 1929, adjustment of 1912; Lake Traverse, capacity, 137,000 acre-ft, available for flood control, numerous other controlled lakes and ponds, and several powerplants.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	135	123	65	e60	e66	e115	950	685	880	1650	830	409
2	130	104	66	e60	e68	e120	1010	964	949	1890	815	406
3	122	96	76	e60	e72	e125	950	997	1310	e2400	779	410
4	122	93	79	e60	e76	e140	663	994	1560	e2600	723	407
5	126	91	79	e60	e78	e150	587	1030	1420	e2800	672	398
6	114	90	76	e60	e80	173	547	1050	1200	e2700	683	364
7	113	82	73	e62	e82	186	499	1060	1060	e2500	702	328
8	119	55	69	e64	e84	203	458	1010	963	2370	719	355
9	127	59	70	67	e86	207	435	963	905	1990	717	469
10	127	69	72	65	e90	207	417	930	849	1800	703	1160
11	123	80	72	64	e94	207	411	869	807	1700	636	2070
12	125	77	72	66	e96	202	414	827	789	1620	579	2580
13	126	55	66	84	e96	211	415	814	756	1610	561	2660
14	121	50	63	74	e96	218	396	798	738	1750	546	2190
15	122	67	57	71	e96	226	379	786	745	1790	526	1440
16	118	71	56	69	e94	245	376	770	790	1700	512	1090
17	125	58	55	e66	e92	266	392	758	893	1580	505	978
18	138	53	e54	e64	e90	288	467	790	1010	1450	497	836
19	141	55	e52	e62	e88	314	629	814	990	1380	489	636
20	132	64	e52	e60	e88	329	634	815	924	1340	483	485
21	122	69	e52	e60	e86	369	589	813	880	1330	481	430
22	122	70	e52	e58	e86	442	567	804	920	1290	468	402
23	124	66	e54	e58	e86	498	550	777	1230	1240	430	459
24	132	49	e56	e58	e90	513	545	759	1630	1200	373	510
25	148	42	e58	e58	e95	502	544	758	1610	1120	343	512
26	141	25	e60	e60	e100	542	532	773	1340	1080	387	466
27	145	37	e60	e60	e105	624	532	779	1110	1050	415	447
28	137	45	e60	e60	e110	738	519	766	1040	987	410	460
29	130	50	e60	e60	---	789	508	767	1050	911	396	536
30	125	58	e61	e62	---	858	541	834	1110	873	400	585
31	127	---	e61	e64	---	951	---	936	---	853	404	---
TOTAL	3959	2003	1958	1956	2470	10958	16456	26490	31458	50554	17184	24478
MEAN	128	66.8	63.2	63.1	88.2	353	549	855	1049	1631	554	816
MAX	148	123	79	84	110	951	1010	1060	1630	2800	830	2660
MIN	113	25	52	58	66	115	376	685	738	853	343	328
AC-FT	7850	3970	3880	3880	4900	21740	32640	52540	62400	100300	34080	48550

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1975 - 1991, BY WATER YEAR (WY)

MEAN	330	296	272	257	288	704	1627	957	907	698	372	357
MAX	1312	900	817	747	745	1543	4165	3394	2485	1784	1073	1496
(WY)	1987	1987	1986	1986	1987	1986	1978	1986	1986	1986	1985	1986
MIN	2.02	.000	.000	4.95	14.0	75.9	165	22.0	86.4	73.4	35.6	12.6
(WY)	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1975 - 1991	
ANNUAL TOTAL	98198		189924			
ANNUAL MEAN	269		520		589	
HIGHEST ANNUAL MEAN					1604	1986
LOWEST ANNUAL MEAN					53.1	1977
HIGHEST DAILY MEAN	829	Apr 2	2800	Jul 5	12000	Apr 7 1989
LOWEST DAILY MEAN	25	Nov 26	25	Nov 26	.00	Oct 26 1976
ANNUAL SEVEN-DAY MINIMUM	44	Nov 24	44	Nov 24	.00	Oct 26 1976
INSTANTANEOUS PEAK FLOW					12900	Apr 7 1989
INSTANTANEOUS PEAK STAGE			16.15	Jul 5	35.81	Apr 7 1989
ANNUAL RUNOFF (AC-FT)	194800		376700		426500	
10 PERCENT EXCEEDS	566		1200		1260	
50 PERCENT EXCEEDS	179		396		336	
90 PERCENT EXCEEDS	66		60		70	

e Estimated.

RED RIVER OF THE NORTH BASIN

05051522 RED RIVER OF THE NORTH AT HICKSON, ND--CONTINUED

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1976 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE AIR (DEG C) (00020)	TEMPERATURE WATER (DEG C) (00010)	OXYGEN, DISSOLVED (MG/L) (00300)	OXYGEN, DISSOLVED (PERCENT SATURATION) (00301)	HARDNESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM, DISSOLVED (MG/L AS NA) (00930)
JAN												
09...	0940	66	552	--	4.0	0.5	--	--	--	--	--	--
MAR												
11...	1615	213	725	8.1	7.0	0.0	12.5	86	280	51	36	19
APR												
03...	1500	898	594	8.1	16.5	3.0	--	--	210	40	26	16
MAY												
07...	1040	1060	673	--	7.5	8.5	--	--	--	--	--	--
JUN												
10...	0940	865	488	--	15.0	16.5	--	--	--	--	--	--
JUL												
05...	1130	2790	373	--	20.0	20.5	--	--	--	--	--	--
17...	0955	1580	587	--	26.5	25.5	--	--	--	--	--	--
AUG												
21...	0830	492	518	8.5	23.5	21.5	--	--	240	43	32	18

DATE	SODIUM PERCENT (00932)	SODIUM ADSORPTION RATIO (00931)	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	BICARBONATE, FET-LAB (MG/L AS HCO3) (95440)	CARBONATE, FET-LAB (MG/L AS CO3) (95445)	ALKALINITY LAB (MG/L AS CACO3) (90410)	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CARBONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)
MAR											
11...	13	0.5	7.9	--	--	--	208	254	0	33	21
APR											
03...	14	0.5	6.4	200	0	160	--	--	--	68	13
AUG											
21...	14	0.5	6.3	260	0	210	--	--	--	54	12

DATE	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SILICA, DISSOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L) (70301)	SOLIDS, DISSOLVED (TONS PER AC-FT) (70303)	SOLIDS, DISSOLVED (TONS PER DAY) (70302)	NITROGEN, NITRATE DISSOLVED (MG/L AS N) (00618)	NITROGEN, NITRITE DISSOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)
MAR											
11...	0.20	16	336	312	0.46	193	0.510	0.010	0.520	0.150	1.0
APR											
03...	0.10	13	290	280	0.39	703	--	--	--	--	--
AUG											
21...	0.10	20	332	314	0.45	441	--	--	--	--	--

05051522 RED RIVER OF THE NORTH AT HICKSON, ND--CONTINUED

DATE	PHOSPHORUS DISSOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P) (00671)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BORON, DISSOLVED (UG/L AS B) (01020)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)
MAR											
11...	0.030	0.020	--	82	<0.5	--	<1.0	<5	<3	<10	17
APR											
03...	--	--	2	--	--	70	--	--	--	--	20
AUG											
21...	--	--	4	--	--	20	--	--	--	--	10

DATE	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)
MAR											
11...	<10	19	12	--	<10	<10	--	<1.0	170	<6	10
APR											
03...	<1	20	20	<0.1	2	--	1	--	200	--	--
AUG											
21...	<1	20	10	<0.1	<1	--	<1	--	210	--	--

RED RIVER OF THE NORTH BASIN

05054000 RED RIVER OF THE NORTH AT FARGO, ND

LOCATION.--Lat 46°51'40", long 96°47'00", in NW¼NE¼ sec.18, T.139 N., R.48 W., Cass County, Hydrologic Unit 09020104, at waterplant on 4th St. S. in Fargo, 25 mi upstream from mouth of Sheyenne River, and at mi 453.
DRAINAGE AREA.--6,800 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1901 to current year. Published as "at Moorhead, Minn.", 1901. Monthly discharge only for some periods, published in WSP 1308.
REVISED RECORDS.--WSP 1308: 1902-4, 1906-7, 1910-14, 1916, 1918, 1924. WSP 1388: 1905-6, 1917-20(M), 1935(M), 1938-39(M), 1943.
GAGE.--Water-stage recorder and concrete control. Datum of gage is 861.8 ft above National Geodetic Vertical Datum of 1929. Oct. 1, 1960, to Sept. 30, 1962, water-stage recorder at present site at datum 5.6 ft higher. See WSP 1728 or 1913 for history of changes prior to Oct. 1, 1960.
REMARKS.--Records good except those for periods of estimated daily discharges, which are fair. Flow regulated by Orwell Reservoir, capacity, 14,100 acre-ft at elevation 1,070 ft above National Geodetic Vertical Datum of 1929, 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 diversions to cities of Fargo and Moorhead and from Sheyenne River.
EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1897, reached a stage of 39.1 ft present datum, discharge, 25,000 ft^3/s at site 1.5 mi downstream.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	135	144	65	e65	e72	e110	e950	613	925	e1800	956	363
2	132	134	71	e65	e74	e125	e1000	872	953	e1950	943	408
3	123	123	75	e65	e76	e125	1250	1070	e1050	2100	1010	385
4	117	116	83	e65	e80	e135	1080	1190	e1530	2350	878	380
5	115	108	88	e65	e82	e140	806	1180	e1700	2530	777	369
6	118	98	89	e70	e84	e160	622	1220	e1600	2600	727	363
7	113	101	89	e70	e88	e165	563	1270	e1450	2550	745	316
8	113	97	89	e75	e90	e190	499	1260	e1200	2310	762	342
9	115	74	86	e78	e90	e210	453	1210	e1050	2020	776	348
10	123	64	85	e80	e90	e230	425	1170	e945	1840	777	578
11	122	72	82	e75	e90	e230	396	1070	890	1760	748	1410
12	123	84	82	e80	e88	e200	388	1040	854	1650	654	1880
13	128	88	80	e80	e88	e205	395	952	831	1580	596	2070
14	122	74	72	e80	e88	e200	407	875	e825	1610	572	2010
15	122	66	72	e85	e88	e205	373	860	e820	1660	551	1690
16	126	74	69	e85	e86	e220	357	852	825	1640	529	1300
17	177	76	66	e80	e86	e225	350	786	850	1580	531	1060
18	147	75	63	e80	e86	e250	366	776	1010	1500	515	952
19	146	66	e62	e80	e86	e280	464	790	1050	1430	505	798
20	143	73	e60	e75	e84	e305	581	807	970	1360	494	623
21	136	77	e60	e75	e82	e335	580	821	907	1340	478	510
22	129	79	e60	e70	e80	e365	549	821	923	1330	477	428
23	126	82	e60	e68	e84	e395	525	818	1000	1370	431	422
24	124	84	e60	e66	e88	e460	515	794	1340	1460	348	496
25	135	69	e55	e66	e90	524	506	768	1640	1380	337	527
26	148	55	e70	e66	e95	535	503	769	1540	1290	306	518
27	145	45	e70	e66	e100	582	530	785	e1300	1250	348	470
28	149	44	e70	e68	e104	658	494	790	e1150	1200	369	454
29	152	53	e70	e68	---	e840	489	784	e1050	1100	363	480
30	148	58	e70	e70	---	e860	620	809	e1300	1010	358	549
31	142	---	e70	e70	---	e900	---	929	---	972	353	---
TOTAL	4094	2453	2243	2251	2419	10364	17036	28751	33478	51522	18214	22499
MEAN	132	81.8	72.4	72.6	86.4	334	568	927	1116	1662	588	750
MAX	177	144	89	85	104	900	1250	1270	1700	2600	1010	2070
MIN	113	44	55	65	72	110	350	613	820	972	306	316
AC-FT	8120	4870	4450	4460	4800	20560	33790	57030	66400	102200	36130	44630
(+)	1258	1117	1155	1126	1002	1097	1141	1265	1313	1286	1598	1265
AC-FT*	9380	5990	5610	5590	5800	21660	34930	58300	67710	103490	37730	45900

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1901 - 1991, BY WATER YEAR (WY)

MEAN	291	262	218	198	195	636	1650	977	991	796	374	294
MAX	1435	942	800	740	778	3756	9924	4589	5122	5692	2691	1707
(WY)	1987	1907	1987	1986	1987	1966	1969	1986	1962	1962	1962	1986
MIN	.000	.000	.000	.000	.18	26.8	102	8.12	2.87	.000	.000	.000
(WY)	1935	1937	1938	1933	1933	1937	1934	1934	1936	1934	1932	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1901 - 1991	
ANNUAL TOTAL	100158		195324			
ANNUAL MEAN	274	(*295)	535	(*555)	574	
HIGHEST ANNUAL MEAN					1928	1986
LOWEST ANNUAL MEAN					17.5	1934
HIGHEST DAILY MEAN	877	Jun 2	2600	Jul 6	24800	Apr 14 1969
LOWEST DAILY MEAN	44	Nov 28	44	Nov 28	.00	Jul 25 1932
ANNUAL SEVEN-DAY MINIMUM	56	Nov 25	56	Nov 25	.00	Jul 25 1932
INSTANTANEOUS PEAK FLOW			2630	Jul 6	25300	Apr 15 1969
INSTANTANEOUS PEAK STAGE			16.99	Jul 6		
INSTANTANEOUS LOW FLOW					.00	Jul 25 1932
ANNUAL RUNOFF (AC-FT)	198700	(*213540)	387400	(*402090)	416200	
10 PERCENT EXCEEDS	565		1330		1250	
50 PERCENT EXCEEDS	180		358		290	
90 PERCENT EXCEEDS	72		70		37	

e Estimated.
+ Diversions in acre-feet to cities of Fargo and Moorehead.
* Adjusted for diversions to cities of Fargo and Moorehead.

RED RIVER OF THE NORTH BASIN

05054000 RED RIVER OF THE NORTH AT FARGO, ND--CONTINUED

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE AIR (DEG C) (00020)	TEMPER-ATURE WATER (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)
DEC												
13...	1010	90	543	--	-4.5	0.0	--	--	--	--	--	--
JAN												
09...	1220	78	505	--	-15.5	0.5	--	--	--	--	--	--
FEB												
22...	0800	80	600	--	-10.0	1.0	--	--	--	--	--	--
MAR												
12...	0905	193	620	8.0	4.0	0.5	13.1	89	K77	3200	270	50
APR												
02...	0920	980	474	8.1	3.0	1.5	--	--	--	--	200	41
MAY												
07...	1325	1300	686	--	6.5	9.0	--	--	--	--	--	--
JUN												
10...	1155	945	536	--	18.5	16.5	--	--	--	--	--	--
JUL												
03...	1410	2090	415	--	18.5	22.5	--	--	--	--	--	--
19...	1400	1430	592	--	32.5	27.5	--	--	--	--	--	--
AUG												
19...	1330	500	569	8.3	25.5	22.5	--	--	--	--	250	45

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM PERCENT (00932)	SODIUM AD-SORP-TION RATIO (00931)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE, FET-LAB (MG/L AS HCO3) (95440)	CAR-BONATE, FET-LAB (MG/L AS CO3) (95445)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
MAR												
12...	34	20	14	0.5	7.4	--	--	--	248	303	0	36
APR												
02...	24	16	14	0.5	6.8	190	0	150	--	--	--	68
AUG												
19...	33	19	14	0.5	5.8	270	0	220	--	--	--	61

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)
MAR												
12...	25	0.20	15	332	340	0.45	173	0.510	0.020	0.530	0.140	1.0
APR												
02...	12	0.10	13	283	274	0.38	749	--	--	--	--	--
AUG												
19...	12	0.10	21	354	328	0.48	478	--	--	--	--	--

RED RIVER OF THE NORTH BASIN

05054000 RED RIVER OF THE NORTH AT FARGO, ND--CONTINUED

DATE	PHOSPHORUS DISSOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P) (00671)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BORON, DISSOLVED (UG/L AS B) (01020)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)
MAR												
12...	0.060	0.060	<1	76	<0.5	60	<1.0	<5	<3	<10	13	<10
APR												
02...	--	--	2	--	--	60	--	--	--	--	30	2
AUG												
19...	--	--	5	--	--	20	--	--	--	--	10	<1

DATE	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)	CARBON, ORGANIC DISSOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUSPENDED TOTAL (MG/L AS C) (00689)
MAR												
12...	17	14	<0.1	<10	<10	<1	1.0	170	<6	9	8.4	0.6
APR												
02...	20	40	0.1	2	--	<1	--	210	--	--	--	--
AUG												
19...	20	10	<0.1	1	--	<1	--	240	--	--	--	--

RED RIVER OF THE NORTH BASIN

05061000 BUFFALO RIVER NEAR HAWLEY, MN

LOCATION.--Lat 46°51'00", long 96°19'45", in NW¼SE¼ sec.14, T.139 N., R.45 W., Clay County, Hydrologic Unit 09020106, near left downstream end of bridge on farm lane, 2 mi southwest of Hawley.
DRAINAGE AREA.--322 mi^2.
PERIOD OF RECORD.--March 1945 to current year, WY 1981 (annual maximum only), March 1982 to September 1985 (no winter records).
REVISED RECORDS.--WSP 1308: 1945-46(M), 1948(M).
GAGE.--Water-stage recorder. Datum of gage is 1,111.91 ft above National Geodetic Vertical Datum of 1929. Prior to Jan. 29, 1953, nonrecording gage at bridge 1,800 ft upstream at datum 3.17 ft lower.
REMARKS.--Records good except those for estimated daily discharges, which are fair.
EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage known, about 11.3 ft, present datum, spring of 1921, from information by local resident.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.5	17	e20	e13	e13	e14	77	188	67	169	16	15
2	9.4	16	e18	e13	e13	e14	87	189	67	168	16	16
3	11	16	e16	e13	e14	e14	96	182	65	144	41	16
4	9.5	17	e14	e13	e14	e14	103	214	59	144	36	15
5	10	17	e14	e13	e14	e15	102	239	54	134	31	14
6	11	18	e14	e13	e14	e15	90	246	52	118	24	14
7	11	18	e13	e13	e14	e15	79	237	44	105	21	13
8	11	18	e13	e13	e14	e15	73	225	36	91	19	16
9	11	18	e13	e13	e14	e15	67	201	35	86	18	14
10	11	18	e13	e13	e14	e15	60	175	96	86	16	14
11	11	18	e13	e13	e14	e15	52	146	114	79	16	15
12	11	18	e13	e13	e14	e16	47	130	87	76	15	14
13	12	18	e13	e12	e14	e17	44	124	66	70	15	17
14	12	18	e13	e12	e14	e18	44	110	63	63	14	21
15	12	18	e13	e12	e14	e20	49	100	115	53	13	18
16	13	18	e13	e12	e14	e22	54	95	133	45	13	20
17	23	32	e13	e12	e14	e25	58	90	111	40	13	19
18	20	112	e13	e12	e14	e30	54	86	92	38	12	19
19	22	105	e13	e12	e14	e40	51	78	72	35	12	18
20	20	100	e13	e12	e14	e55	48	72	67	30	11	20
21	21	94	e13	e12	e14	74	48	67	61	28	11	17
22	21	83	e13	e12	e14	135	44	65	59	28	10	15
23	25	73	e13	e12	e14	123	41	86	52	25	11	14
24	21	56	e13	e12	e14	78	41	152	46	25	13	15
25	21	e45	e13	e12	e14	85	39	157	42	24	16	16
26	20	e35	e13	e12	e14	129	37	136	38	21	13	17
27	19	e30	e13	e12	e14	158	44	116	36	19	13	22
28	18	e26	e13	e12	e14	105	54	98	42	21	12	19
29	18	e24	e13	e12	---	99	60	86	49	19	10	17
30	18	e22	e13	e12	---	91	114	77	75	18	16	15
31	18	---	e13	e12	---	87	---	71	---	17	16	---
TOTAL	479.4	1118	421	384	390	1568	1857	4238	1995	2019	513	495
MEAN	15.5	37.3	13.6	12.4	13.9	50.6	61.9	137	66.5	65.1	16.5	16.5
MAX	25	112	20	13	14	158	114	246	133	169	41	22
MIN	8.5	16	13	12	13	14	37	65	35	17	10	13
AC-FT	951	2220	835	762	774	3110	3680	8410	3960	4000	1020	982
CFSM	.05	.12	.04	.04	.04	.16	.19	.42	.21	.20	.05	.05
IN.	.06	.13	.05	.04	.05	.18	.21	.49	.23	.23	.06	.06

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 1991, BY WATER YEAR (WY)

MEAN	36.8	34.2	23.6	20.0	20.6	80.7	256	125	98.2	83.7	44.3	35.8
MAX	151	176	63.8	54.7	99.6	434	792	372	530	625	472	182
(WY)	1974	1972	1972	1981	1981	1966	1978	1985	1962	1975	1955	1957
MIN	11.6	12.2	10.6	9.94	9.87	15.0	33.3	21.5	12.7	10.1	5.87	8.52
(WY)	1979	1977	1977	1962	1949	1969	1981	1977	1977	1976	1976	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1945 - 1991	
ANNUAL TOTAL	14217.0		15477.4			
ANNUAL MEAN	39.0		42.4		71.1	
HIGHEST ANNUAL MEAN					157	1975
LOWEST ANNUAL MEAN					16.7	1977
HIGHEST DAILY MEAN	507	Mar 31	246	May 6	1970	Jul 1 1975
LOWEST DAILY MEAN	7.3	Aug 8	8.5	Oct 1	3.2	Aug 25 1976
ANNUAL SEVEN-DAY MINIMUM	7.9	Aug 3	10	Oct 1	4.3	Aug 22 1976
INSTANTANEOUS PEAK FLOW	562	Mar 31	248	May 6	2050	Jul 1 1975
INSTANTANEOUS PEAK STAGE	7.18a	Mar 31	5.90b	Mar 12	9.76	Jul 1 1975
INSTANTANEOUS LOW FLOW	6.9	Aug 8	7.3	Oct 2	2.8	Aug 26 1977
ANNUAL RUNOFF (AC-FT)	28200		30700		51510	
ANNUAL RUNOFF (CFSM)	.12		.13		.22	
ANNUAL RUNOFF (INCHES)	1.64		1.79		3.00	
10 PERCENT EXCEEDS	79		105		169	
50 PERCENT EXCEEDS	18		18		30	
90 PERCENT EXCEEDS	9.7		12		13	

a From highwater mark.
b Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN

05061500 SOUTH BRANCH BUFFALO RIVER AT SABIN, MN

LOCATION.--Lat 46°46'20", long 96°37'40", in SW¼SW¼ sec.9, T.138 N., R.47 W., Clay County, Hydrologic Unit 09020106, near center of span on downstream side of highway bridge, 0.3 mi downstream from Stony Creek and 1 mi east of Sabin.
DRAINAGE AREA.--522 mi^2.
PERIOD OF RECORD.--March 1945 to current year, WY 1981 (annual maximum only), March 1982 to September 1985 (no winter records).
REVISED RECORDS.--WSP 1308: 1949(M).
GAGE.--Water stage recorder. Datum of gage is 902.39 ft above National Geodetic Vertical Datum of 1929 (levels by Soil Conservation Service). Prior to Aug. 17, 1948, nonrecording gage at site 1 mi downstream at different datum. Aug. 17, 1948, to Oct. 4, 1989, nonrecording gage at present site and datum.
REMARKS.--Records fair.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.4	9.8	e6.8	e2.1	e1.3	e4.7	e90	113	55	102	5.5	2.7
2	1.4	9.3	e6.6	e2.0	e1.5	e4.7	e80	172	69	129	5.4	2.8
3	1.5	9.2	e6.5	e1.9	e1.7	e4.7	67	224	47	124	6.0	3.2
4	2.7	9.7	e6.4	e1.8	e1.9	e4.7	59	278	35	116	5.7	3.3
5	3.3	10	e6.3	e1.7	e2.2	e4.7	54	278	36	105	5.2	3.3
6	2.2	9.9	e6.2	e1.6	e2.7	e4.8	50	252	36	99	8.8	3.4
7	2.0	9.7	e6.2	e1.5	e3.2	e4.8	50	221	32	95	8.2	3.9
8	1.8	9.7	e6.1	e1.5	e3.8	e4.8	49	186	28	91	5.9	4.2
9	1.7	9.6	e6.0	e1.4	e4.5	e4.8	47	143	25	86	4.4	4.2
10	1.7	9.6	e6.0	e1.4	e4.7	e4.8	44	111	24	76	4.0	4.6
11	1.8	9.7	e5.9	e1.4	e4.7	e4.9	40	88	23	78	3.6	4.1
12	1.9	9.9	e5.8	e1.4	e4.7	e5.0	37	70	22	88	3.1	2.7
13	1.9	10	e5.8	e1.3	e4.7	e5.5	35	60	21	70	2.8	3.1
14	1.8	10	e5.7	e1.3	e4.7	e6.0	35	49	21	76	2.3	3.9
15	2.9	10	e5.6	e1.3	e4.7	e6.5	36	42	21	83	2.2	3.8
16	4.8	10	e5.6	e1.3	e4.7	e7.5	38	36	21	85	2.4	3.4
17	5.9	11	e5.5	e1.3	e4.7	e9.0	44	32	31	86	2.3	3.0
18	7.8	11	e5.3	e1.3	e4.7	e11	48	27	36	81	2.4	3.4
19	7.9	11	e5.1	e1.2	e4.7	e14	51	25	34	70	2.5	4.4
20	8.8	10	e4.8	e1.2	e4.7	e18	53	23	33	58	2.8	5.4
21	10	12	e4.5	e1.2	e4.7	e23	51	22	33	48	2.4	5.4
22	11	12	e4.3	e1.2	e4.7	e30	45	24	33	39	2.3	3.1
23	11	9.7	e4.1	e1.2	e4.7	e40	41	21	33	33	2.4	2.9
24	11	e8.5	e3.9	e1.2	e4.7	e60	38	19	34	28	2.7	3.0
25	11	e8.0	e3.7	e1.2	e4.7	e91	35	17	34	26	2.7	3.5
26	10	e7.4	e3.5	e1.2	e4.7	e95	34	14	34	19	1.9	4.0
27	9.3	e7.3	e3.3	e1.1	e4.7	e100	34	13	36	14	1.7	4.4
28	9.8	e7.2	e3.0	e1.1	e4.7	e100	35	14	37	11	2.2	4.4
29	9.4	e7.0	e2.7	e1.1	---	e100	37	17	56	8.1	2.5	4.6
30	9.4	e6.9	e2.5	e1.1	---	e98	65	19	60	6.9	2.4	5.4
31	9.9	---	e2.3	e1.2	---	e95	---	28	---	6.0	2.6	---
TOTAL	177.0	285.1	156.0	42.7	112.1	966.9	1422	2638	1040	2037.0	111.3	113.5
MEAN	5.71	9.50	5.03	1.38	4.00	31.2	47.4	85.1	34.7	65.7	3.59	3.78
MAX	11	12	6.8	2.1	4.7	100	90	278	69	129	8.8	5.4
MIN	1.4	6.9	2.3	1.1	1.3	4.7	34	13	21	6.0	1.7	2.7
AC-FT	351	565	309	85	222	1920	2820	5230	2060	4040	221	225
CFSM	.01	.02	.01	.00	.01	.06	.09	.16	.07	.13	.01	.01
IN.	.01	.02	.01	.00	.01	.07	.10	.19	.07	.15	.01	.01

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 1991, BY WATER YEAR (WY)

MEAN	14.3	14.3	4.80	1.46	1.40	101	260	78.5	95.0	72.0	9.27	14.2
MAX	51.1	76.7	23.5	13.1	14.0	581	928	580	1068	1112	78.8	173
(WY)	1978	1972	1978	1978	1987	1966	1969	1962	1962	1975	1962	1986
MIN	.023	2.05	.006	.000	.000	.000	27.9	8.28	1.30	.000	.000	.000
(WY)	1977	1977	1961	1946	1946	1951	1973	1980	1976	1988	1976	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1945 - 1991	
ANNUAL TOTAL	6475.93		9101.6			
ANNUAL MEAN	17.7		24.9		55.7a	
HIGHEST ANNUAL MEAN					198	1962
LOWEST ANNUAL MEAN					12.2	1977
HIGHEST DAILY MEAN	177	Apr 1	278	May 4	8200	Jul 1 1975
LOWEST DAILY MEAN	.00	Many days	1.1	Jan 27	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Aug 9	1.1	Jan 24	.00	Dec 13 1945
INSTANTANEOUS PEAK FLOW	178	Apr 1	285	May 4	8500	Jul 2 1975
INSTANTANEOUS PEAK STAGE	10.02b	Mar 16	10.30	May 4	19.90	Jul 2 1975
INSTANTANEOUS LOW FLOW			1.3	Oct 1,2		
ANNUAL RUNOFF (AC-FT)	12850		18050		40390	
ANNUAL RUNOFF (CFSM)	.034		.048		.11	
ANNUAL RUNOFF (INCHES)	.46		.65		1.45	
10 PERCENT EXCEEDS	48		76		100	
50 PERCENT EXCEEDS	6.5		6.9		6.8	
90 PERCENT EXCEEDS.	.00		1.8		.00	

a Median of annual mean discharges is 41 ft^3/s.
b Backwater from ice.

RED RIVER OF THE NORTH BASIN

05062000 BUFFALO RIVER NEAR DILWORTH, MN

LOCATION.--Lat 46°57'40", long 96°39'40", in SW¼SE¼ sec.6, T.140 N., R.47 W., Clay County, Hydrologic Unit 09020106, on left bank 4.5 mi southeast of Kragnes, 6.5 mi northeast of Dilworth, and 9 mi downstream from South Branch.
DRAINAGE AREA.--1,040 mi^2, approximately.
PERIOD OF RECORD.--March 1931 to current year. Monthly discharge only for some periods, published in WSP 1308.
REVISED RECORDS.--WSP 1308: 1931(M).
GAGE.--Water-stage recorder. Datum of gage is 878.31 ft above National Geodetic Vertical Datum of 1929 (levels by U.S Army Corps of Engineers). Prior to Apr. 5, 1937, nonrecording gage at same site and datum.
REMARKS.--Records good except those for estimated daily discharges, which are fair.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	27	e38	e18	e14	e20	e270	201	102	175	23	11
2	11	27	e36	e17	e15	e20	e260	290	104	253	20	14
3	13	26	e34	e17	e16	e20	248	349	125	299	23	16
4	14	24	e33	e17	e17	e20	221	438	140	298	28	17
5	19	23	e32	e16	e18	e20	192	538	136	280	44	17
6	21	23	e32	e16	e18	e20	179	571	123	260	44	15
7	19	24	e31	e16	e19	e20	168	573	113	234	38	13
8	18	21	e30	e16	e19	e21	155	554	107	208	29	14
9	19	22	e30	e16	e20	e21	145	515	96	191	25	15
10	19	26	e29	e16	e20	e21	137	458	84	179	25	15
11	20	27	e29	e15	e20	e21	129	387	75	174	23	16
12	20	25	e28	e15	e20	e21	120	321	112	169	20	14
13	20	24	e28	e15	e20	e22	111	280	127	179	17	13
14	20	24	e27	e15	e20	e24	105	244	117	186	15	14
15	20	30	e26	e15	e20	e26	104	209	107	169	14	15
16	20	29	e25	e15	e20	e28	103	181	116	153	14	21
17	21	30	e25	e15	e20	e30	106	165	141	141	13	19
18	23	36	e24	e14	e20	e35	111	152	141	136	13	17
19	28	43	e23	e14	e20	e40	116	142	132	132	14	21
20	28	103	e23	e14	e20	e45	118	133	127	126	13	22
21	26	119	e22	e14	e20	e60	118	124	125	116	13	20
22	25	120	e22	e13	e20	e75	117	116	121	106	12	23
23	24	117	e21	e13	e20	e90	114	109	112	92	11	24
24	24	104	e21	e13	e20	e110	106	104	105	79	12	23
25	32	77	e20	e13	e20	e136	96	116	96	67	14	18
26	38	e60	e20	e13	e20	e200	91	148	89	58	18	16
27	35	e50	e20	e13	e20	e250	88	154	81	51	19	16
28	35	e47	e19	e13	e20	e290	93	143	76	44	16	17
29	31	e44	e19	e13	---	e290	104	130	81	37	13	17
30	29	e41	e18	e13	---	e290	125	120	111	32	12	20
31	27	---	e18	e13	---	e280	---	110	---	29	12	---
TOTAL	709	1393	803	456	536	2566	4150	8075	3322	4653	607	513
MEAN	22.9	46.4	25.9	14.7	19.1	82.8	138	260	111	150	19.6	17.1
MAX	38	120	38	18	20	290	270	573	141	299	44	24
MIN	10	21	18	13	14	20	88	104	75	29	11	11
AC-FT	1410	2760	1590	904	1060	5090	8230	16020	6590	9230	1200	1020
CFSM	.02	.04	.02	.01	.02	.08	.13	.25	.11	.14	.02	.02
IN.	.03	.05	.03	.02	.02	.09	.15	.29	.12	.17	.02	.02

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1991, BY WATER YEAR (WY)

MEAN	50.6	47.7	28.4	18.5	18.5	170	540	218	197	164	59.9	52.4
MAX	186	305	97.0	53.5	61.1	1308	1984	909	2138	2814	710	517
(WY)	1958	1972	1972	1987	1984	1966	1978	1986	1962	1975	1944	1944
MIN	5.48	8.74	4.75	.87	.76	2.26	33.5	27.2	15.1	2.23	.000	.79
(WY)	1940	1937	1938	1940	1940	1940	1931	1931	1934	1936	1936	1936

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1931 - 1991	
ANNUAL TOTAL	24299.9		27783			
ANNUAL MEAN	66.6		76.1		132	
HIGHEST ANNUAL MEAN					441	1975
LOWEST ANNUAL MEAN					25.6	1934
HIGHEST DAILY MEAN	565	Apr 3	573	May 7	13500	Jul 2 1975
LOWEST DAILY MEAN	7.3	Aug 10	10	Oct 1	.00a	
ANNUAL SEVEN-DAY MINIMUM	8.1	Aug 7	13	Aug 18	.00	Jul 28 1936
INSTANTANEOUS PEAK FLOW	600	Apr 3	576	May 6,7	13600	Jul 2 1975
INSTANTANEOUS PEAK STAGE	12.40b	Apr 3	10.66	May 6,7	27.10	Jul 2 1975
INSTANTANEOUS LOW FLOW	7.2	Aug 10	9.8	Oct 1		
ANNUAL RUNOFF (AC-FT)	48200		55110		95600	
ANNUAL RUNOFF (CFSM)	.064		.073		.13	
ANNUAL RUNOFF (INCHES)	.87		.99		1.72	
10 PERCENT EXCEEDS	165		180		280	
50 PERCENT EXCEEDS	27		27		34	
90 PERCENT EXCEEDS	11		14		9.1	

a At times in 1936.
b Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN
05062500 WILD RICE RIVER AT TWIN VALLEY, MN

LOCATION.--Lat 47°16'00", long 96°14'40", in NW¼NE¼ sec.27, T.144 N., R.44., Norman County, Hydrologic Unit 09020108, on left bank 100 ft upstream from highway bridge, 0.8 mi northeast of Twin Valley, and 2 mi upstream from small tributary.
DRAINAGE AREA.--888 mi ^{2}.
PERIOD OF RECORD.--June 1909 to September 1917, July 1930 to September 1983, October 1989 to current year. Monthly discharge only for some periods, published in WSP 1308. October 1983 to September 1989, annual maximums only.
REVISED RECORDS.--WSP 955: 1941. WSP 1308: 1915(M), 1917(M).
GAGE.--Water-stage recorder. Datum of gage is 1,008.16 ft above National Geodetic Vertical Datum of 1929 (U.S. Army Corps of Engineers bench mark). June 1909 to September 1917, nonrecording gage at site 0.2 mi 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.
REMARKS.--Records good except those for estimated daily discharges, which are poor. Flow slightly regulated by Rice Lake and many other small lakes above station. Satellite telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.5	18	e16	e16	e25	e27	e170	386	147	353	19	4.9
2	4.5	20	e16	e16	e26	e27	s153	491	136	239	17	5.5
3	5.3	19	e16	e16	e27	e27	191	481	129	225	26	7.5
4	5.1	19	e16	e16	e27	e27	183	599	112	202	34	11
5	4.8	20	e16	e16	e27	e27	157	658	96	184	41	10
6	4.6	20	e16	e16	e27	e27	144	677	88	166	46	9.4
7	4.6	20	e16	e16	e27	e27	129	643	96	148	41	8.6
8	4.5	20	e16	e16	e27	e27	126	613	90	130	39	13
9	4.1	20	e16	e16	e27	e27	117	582	86	118	35	17
10	4.2	20	e16	e16	e27	e27	110	553	89	107	30	18
11	4.3	21	e16	e16	e27	e27	125	539	81	101	27	21
12	5.4	21	e16	e16	e27	e27	132	528	75	98	24	23
13	7.5	20	e16	e16	e27	e27	126	527	74	94	21	25
14	12	19	e16	e16	e27	e27	132	502	200	90	20	36
15	8.5	20	e16	e16	e27	e27	144	471	181	85	18	33
16	7.1	20	e16	e16	e27	e28	158	454	154	76	17	33
17	12	20	e16	e16	e27	e30	170	428	140	67	17	32
18	13	23	e16	e16	e27	e40	189	400	127	59	14	30
19	14	22	e16	e16	e27	e80	195	376	102	51	13	28
20	14	21	e16	e16	e27	e130	195	353	89	48	11	26
21	16	24	e16	e16	e27	e150	183	331	78	47	11	27
22	15	23	e16	e16	e27	e170	178	313	71	68	11	25
23	17	22	e16	e16	e27	e190	166	295	68	56	11	25
24	16	20	e16	e16	e27	e210	170	283	69	45	12	18
25	15	18	e16	e16	e27	e220	163	272	65	39	15	16
26	15	e17	e16	e17	e27	e230	157	260	63	34	12	20
27	18	e16	e16	e18	e27	e220	165	238	65	31	11	21
28	17	e16	e16	e20	e27	e210	178	219	62	30	8.4	18
29	16	e16	e16	e23	---	e200	205	205	123	28	7.6	22
30	15	e16	e16	e24	---	e190	283	178	135	26	6.2	18
31	15	---	e16	e24	---	e180	---	160	---	23	5.7	---
TOTAL	319.0	591	496	526	753	2883	4894	13015	3091	3068	620.9	601.9
MEAN	10.3	19.7	16.0	17.0	26.9	93.0	163	420	103	99.0	20.0	20.1
MAX	18	24	16	24	27	230	283	677	200	353	46	36
MIN	4.1	16	16	16	25	27	110	160	62	23	5.7	4.9
AC-FT	633	1170	984	1040	1490	5720	9710	25820	6130	6090	1230	1190
CFSM	.01	.02	.02	.02	.03	.10	.18	.47	.12	.11	.02	.02
IN.	.01	.02	.02	.02	.03	.12	.21	.55	.13	.13	.03	.03

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1909 - 1991, BY WATER YEAR (WY)

MEAN	86.4	74.7	49.5	37.4	34.2	123	574	419	309	218	91.0	80.4
MAX	614	488	123	100	80.0	747	1543	2259	1560	1923	960	788
(WY)	1974	1972	1972	1910	1910	1945	1979	1950	1943	1909	1909	1973
MIN	6.10	9.31	6.00	4.00	4.00	12.8	73.8	30.9	26.4	8.04	3.02	2.96
(WY)	1933	1933	1933	1933	1933	1940	1931	1977	1977	1934	1932	1936

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1909 - 1991	
ANNUAL TOTAL	31487.9		30858.8			
ANNUAL MEAN	86.3		84.5		171a	
HIGHEST ANNUAL MEAN					500	1950
LOWEST ANNUAL MEAN					22.7	1977
HIGHEST DAILY MEAN	727	Apr 1	677	May 6	9100	Jul 22 1909
LOWEST DAILY MEAN	3.6	Aug 22	4.1	Oct 9	1.1	Aug 13 1932
ANNUAL SEVEN-DAY MINIMUM	4.4	Oct 5	4.4	Oct 5	1.3	Aug 11 1932
INSTANTANEOUS PEAK FLOW	1090	Apr 3	682	May 6	9200b	Jul 22 1909
INSTANTANEOUS PEAK STAGE	6.31	Apr 3	4.96	May 6	20.00c	Jul 22 1909
INSTANTANEOUS LOW FLOW	3.5	Aug 22,23	3.2	Sep 2	.50	Nov 4 1939
ANNUAL RUNOFF (AC-FT)	62460		61210		124100	
ANNUAL RUNOFF (CFSM)	.097		.095		.19	
ANNUAL RUNOFF (INCHES)	1.32		1.29		2.62	
10 PERCENT EXCEEDS	230		210		446	
50 PERCENT EXCEEDS	22		27		62	
90 PERCENT EXCEEDS	5.5		13		14	

a Median of annual mean discharges is 150 ft^3/s.
b From rating curve extended above 3,300 ft ^{3}/s.
c Site and datum then in use.
e Estimated.

RED RIVER OF THE NORTH BASIN

05064000 WILD RICE RIVER AT HENDRUM, MN

LOCATION.--Lat 47°16'05", long 96°47'50", in SE¼SE¼ sec.19, T.144 N., R.48 W., Norman County, Hydrologic Unit 09020108, on right bank 30 ft downstream from highway bridge, 0.5 mi east of Hendrum and 4 mi upstream from mouth.
DRAINAGE AREA.--1,600 mi^2, approximately.
PERIOD OF RECORD.--March 1944 to September 1984 and May 1985 to current year. Operated as a high-flow partial-record station October 1984 to April 1985.
REVISED RECORDS.--WSP 1728: 1958.
GAGE.--Water-stage recorder. Datum of gage is 836.75 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to July 18, 1989, nonrecording gage at same site and datum.
REMARKS.--Records fair except those for estimated daily discharges, which are poor. Large part of high flow diverted into Marsh River basin at overflow section 3.5 mi east of Ada. Another diversion into the Marsh River basin formed in 1947, 1.5 mi southeast of Ada and diverted water at all stages 1947-51, after which it was closed except for a small regulated flow diverted for abatement of pollution from Ada sewage plant effluent. Amount of diversion not known.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.4	19	e18	e17	e20	e28	e350	435	197	155	32	7.9
2	3.0	18	e18	e17	e22	e28	e350	565	180	256	28	7.8
3	3.6	17	e18	e17	e23	e28	e450	648	164	401	29	8.4
4	2.9	15	e18	e17	e24	e28	e400	699	149	359	42	7.0
5	2.4	17	e18	e17	e25	e28	377	848	135	316	60	8.3
6	2.8	19	e17	e17	e26	e28	273	945	116	290	54	7.7
7	2.9	14	e17	e17	e27	e28	224	925	98	259	47	6.6
8	2.7	11	e17	e17	e28	e28	198	857	91	233	47	9.9
9	3.2	13	e17	e17	e28	e28	178	800	94	215	42	11
10	3.2	21	e17	e17	e28	e28	168	757	90	196	39	11
11	3.9	23	e17	e17	e28	e28	152	704	93	171	36	10
12	5.3	20	e17	e17	e28	e28	145	666	109	152	35	13
13	6.3	20	e17	e17	e28	e28	160	685	102	137	30	13
14	6.7	19	e17	e17	e28	e28	165	659	128	125	25	22
15	6.2	27	e17	e17	e28	e28	168	631	280	109	21	28
16	13	26	e17	e17	e28	e30	180	583	335	99	20	43
17	13	20	e17	e17	e28	e35	193	544	253	90	20	43
18	17	23	e17	e17	e28	e40	208	510	212	82	17	41
19	17	25	e17	e17	e28	e50	228	468	199	72	15	41
20	17	31	e17	e17	e28	e80	242	433	165	65	14	39
21	18	35	e17	e17	e28	e150	239	406	134	62	13	37
22	17	29	e17	e17	e28	e200	234	398	111	65	12	34
23	19	29	e17	e17	e28	e250	219	475	95	75	12	33
24	21	18	e17	e17	e28	e350	212	393	85	83	13	33
25	21	18	e17	e17	e28	e450	200	341	80	66	13	33
26	21	e18	e17	e17	e28	e500	200	317	77	53	15	32
27	24	e18	e17	e17	e28	e500	196	301	70	48	16	28
28	19	e18	e17	e17	e28	e400	198	290	66	44	16	25
29	19	e18	e17	e17	---	e370	210	262	73	40	17	25
30	20	e18	e17	e17	---	e360	276	245	83	38	13	24
31	21	---	e17	e18	---	e350	---	223	---	35	11	---
TOTAL	355.5	617	532	528	755	4535	6993	17013	4064	4391	804	682.6
MEAN	11.5	20.6	17.2	17.0	27.0	146	233	549	135	142	25.9	22.8
MAX	24	35	18	18	28	500	450	945	335	401	60	43
MIN	2.4	11	17	17	20	28	145	223	66	35	11	6.6
AC-FT	705	1220	1060	1050	1500	9000	13870	33750	8060	8710	1590	1350
CFSM	.01	.01	.01	.01	.02	.09	.15	.34	.08	.09	.02	.01
IN.	.01	.01	.01	.01	.02	.11	.16	.40	.09	.10	.02	.02
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1991, BY WATER YEAR (WY)												
MEAN	117	105	62.3	44.7	43.1	265	1098	572	419	290	108	98.7
MAX	744	784	160	121	124	1485	3261	2074	1776	3136	960	824
(WY)	1972	1972	1972	1986	1984	1966	1978	1985	1962	1975	1944	1973
MIN	.44	3.32	1.08	.092	.22	.46	106	56.1	9.15	8.82	1.07	.18
(WY)	1949	1949	1977	1977	1977	1949	1981	1977	1952	1951	1977	1948

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1944 - 1991	
ANNUAL TOTAL	42112.1		41270.1			
ANNUAL MEAN	115		113		259a	
HIGHEST ANNUAL MEAN					682	1975
LOWEST ANNUAL MEAN					28.9	1977
HIGHEST DAILY MEAN	1080	Apr 1	945	May 6	9220	Apr 10 1978
LOWEST DAILY MEAN	2.2	Sep 28	2.4	Oct 5	.00	Sep 13 1948
ANNUAL SEVEN-DAY MINIMUM	2.9	Oct 4	2.9	Oct 4	.00	Sep 27 1948
INSTANTANEOUS PEAK FLOW	1100	Apr 1	952	May 6	9350	Apr 10 1978
INSTANTANEOUS PEAK STAGE	14.26	Apr 1	10.27	May 6	32.30b	Apr 21 1979
INSTANTANEOUS LOW FLOW	2.0	Sep 28,29	2.3	Oct 5	.00c	
ANNUAL RUNOFF (AC-FT)	83530		81860		187800	
ANNUAL RUNOFF (CFSM)	.072		.071		.16	
ANNUAL RUNOFF (INCHES)	.98		.96		2.20	
10 PERCENT EXCEEDS	326		350		660	
50 PERCENT EXCEEDS	20		28		78	
90 PERCENT EXCEEDS	4.6		13		14	

a Median of annual mean discharges is 220 ft^3/s.
b Backwater from Red River of the North.
c Occurred many days during September and October, 1948.
e Estimated.

RED RIVER OF THE NORTH BASIN

05064500 RED RIVER OF THE NORTH AT HALSTAD, MN
(National stream quality accounting network station and radiochemical program station)

LOCATION.--Lat 47°21'10", long 96°50'50", on line between secs.24 and 25, T.145 N., R.49 W., Traill County, Hydrologic Unit 09020107, on left bank on upstream side of highway bridge, 0.5 mi west of Halstad, 2.5 mi downstream from Wild Rice River, and at mile 375.2.
DRAINAGE AREA.--21,800 mi^2, approximately, including 3,800 mi^2 in closed basins.

WATER-DISCHARGE RECORDS

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.
REVISED RECORDS.--WSP 1388: 1936, 1950. WSP 1728: Drainage area.
GAGE.--Water-stage recorder. Datum of gage is 826.65 ft above National Geodetic Vertical Datum of 1929. Prior to July 17, 1961, nonrecording gage at same site and datum.
REMARKS.--Records good except those for Nov. 28 to Apr. 2, which are poor; and those for July 3-9, which are fair.
EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in 1897 reached a stage of about 38.5 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	259	207	e155	e72	e140	e215	e1700	1250	1380	1800	1040	417
2	258	201	e145	e70	e140	e220	e2000	1640	1470	2510	981	403
3	250	197	e140	e72	e140	e220	2300	1790	1480	e2800	967	411
4	237	197	e150	e74	e145	e220	2150	2150	1500	e3000	1030	471
5	221	199	e155	e76	e150	e225	2080	2700	1780	e3100	1090	493
6	209	194	e160	e80	e155	e230	1780	3030	2110	e3300	964	443
7	204	185	e165	e80	e160	e235	1440	3090	2110	e3500	844	425
8	199	203	e170	e80	e160	e240	1230	3100	1920	e3600	808	423
9	193	193	e175	e80	e160	e245	1090	3060	1730	e3500	807	407
10	189	226	e180	e80	e165	e250	985	2930	1590	3390	807	424
11	183	221	e180	e82	e165	e260	890	2750	1480	3080	799	444
12	178	190	e180	e84	e170	e270	819	2560	1400	2770	778	772
13	185	192	e180	e86	e170	e280	788	2390	1340	2620	738	1580
14	186	180	e180	e90	e170	e290	788	2380	1370	2440	680	2120
15	185	186	e175	e90	e170	e300	792	2300	1510	2290	630	2330
16	179	196	e160	e90	e170	e320	791	2080	1630	2250	623	2220
17	181	208	e155	e90	e170	e340	765	1990	1540	2240	615	1850
18	183	196	e150	e92	e170	e370	737	1750	1410	2170	600	1500
19	217	205	e145	e94	e170	e450	741	1660	1400	2070	595	1270
20	249	181	e140	e100	e170	e550	780	1590	1500	1940	582	1130
21	221	188	e135	e100	e170	e750	883	1550	1550	1810	568	963
22	207	196	e125	e100	e170	e900	1010	1550	1540	1770	555	778
23	203	239	e115	e100	e175	e1000	1020	1970	1450	1720	542	641
24	198	247	e105	e105	e180	e1200	990	1940	1380	1660	534	559
25	193	237	e100	e110	e185	e1300	953	1650	1520	1580	530	535
26	185	256	e98	e115	e200	e1350	927	1480	1820	1500	500	574
27	185	246	e96	e120	e205	e1400	923	1400	1950	1410	453	595
28	197	e210	e92	e125	e210	e1450	919	1400	1860	1340	403	592
29	203	e195	e86	e125	---	e1500	963	1410	1710	1290	408	555
30	204	e175	e80	e130	---	e1550	1020	1390	1690	1200	432	524
31	207	---	e74	e135	---	e1650	---	1360	---	1110	436	---
TOTAL	6348	6146	4346	2927	4705	19780	34254	63290	48120	70760	21339	25849
MEAN	205	205	140	94.4	168	638	1142	2042	1604	2283	688	862
MAX	259	256	180	135	210	1650	2300	3100	2110	3600	1090	2330
MIN	178	175	74	70	140	215	737	1250	1340	1110	403	403
AC-FT	12590	12190	8620	5810	9330	39230	67940	125500	95450	140400	42330	51270

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1961 - 1991, BY WATER YEAR (WY)

MEAN	682	645	502	422	432	1991	6688	3114	2527	2194	753	577
MAX	2188	1771	1253	1023	1052	9429	20080	8994	10310	20060	3866	2034
(WY)	1987	1972	1987	1987	1987	1966	1969	1979	1962	1975	1962	1986
MIN	61.5	92.3	51.2	32.1	45.9	249	705	449	242	153	59.5	38.4
(WY)	1977	1977	1977	1977	1977	1962	1981	1977	1977	1988	1977	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1961 - 1991	
ANNUAL TOTAL	186581		307864			
ANNUAL MEAN	511		843		1723	
HIGHEST ANNUAL MEAN					3968	1975
LOWEST ANNUAL MEAN					214	1977
HIGHEST DAILY MEAN	2580	Jun 4	3600	Jul 8	41500	Apr 22 1979
LOWEST DAILY MEAN	74	Dec 31	70	Jan 2	10	Sep 2 1976
ANNUAL SEVEN-DAY MINIMUM	89	Dec 25	74	Dec 30	17	Aug 28 1976
INSTANTANEOUS PEAK FLOW			3700	Jul 8	42000	Apr 22 1979
INSTANTANEOUS PEAK STAGE			9.99	Jul 8	39.00	Apr 22 1979
INSTANTANEOUS LOW FLOW					5.4	Oct 8 1936
ANNUAL RUNOFF (AC-FT)	370100		610600		1248000	
10 PERCENT EXCEEDS	1240		2090		3700	
50 PERCENT EXCEEDS	249		450		684	
90 PERCENT EXCEEDS	125		123		194	

e Estimated.

RED RIVER OF THE NORTH BASIN

05064500 RED RIVER OF THE NORTH AT HALSTAD, MN--CONTINUED
(National stream quality accounting network station and radiochemical program station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1961-67, 1972 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DISCHARGE, IN CUBIC FEET PER SECOND (00060)	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE AIR (DEG C) (00020)	TEMPERATURE WATER (DEG C) (00010)	TURBIDITY (NTU) (00076)	OXYGEN, DISSOLVED (MG/L) (00300)	OXYGEN, DISSOLVED (PERCENT SATURATION) (00301)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)
OCT											
24...	1115	--	197	626	8.6	4.5	5.0	10	7.9	62	K10
DEC											
12...	1040	180	--	904	7.9	-2.0	0.0	6.6	8.7	60	K15
JAN											
11...	1045	--	82	482	--	-15.5	1.0	--	--	--	--
MAR											
12...	1610	--	269	810	7.7	1.5	0.0	5.0	8.9	59	K4
APR											
01...	1235	--	1710	509	--	11.0	3.5	--	--	--	--
09...	0955	--	1110	562	8.3	5.5	8.0	89	11.2	94	K13
MAY											
08...	1015	--	3080	704	--	9.5	8.5	--	--	--	--
30...	1020	--	1420	596	8.3	20.5	18.0	25	7.9	85	K46
JUL											
05...	1445	--	3110	426	--	22.5	21.0	--	--	--	--
18...	1325	--	2210	640	--	25.0	26.5	--	--	--	--
AUG											
14...	1040	--	691	569	8.3	27.5	24.0	83	7.5	89	K56

DATE	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARDNESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM, DISSOLVED (MG/L AS NA) (00930)	SODIUM PERCENT (00932)	SODIUM ADSORPTION RATIO (00931)	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	ALKALINITY LAB (MG/L AS CACO3) (90410)	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)
OCT											
24...	K27	260	51	31	33	21	0.9	7.1	223	202	234
DEC											
12...	K9	370	74	45	52	23	1	9.8	296	298	364
MAR											
12...	250	340	73	39	41	20	1	8.5	300	303	370
APR											
09...	K180	240	52	26	22	16	0.6	7.9	187	181	220
MAY											
30...	430	280	59	32	22	14	0.6	6.1	231	216	264
AUG											
14...	K51	280	57	34	23	15	0.6	7.6	227	205	250

DATE	CARBONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SILICA, DISSOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L) (70301)	SOLIDS, DISSOLVED (TONS PER AC-FT) (70303)	SOLIDS, DISSOLVED (TONS PER DAY) (70302)	NITROGEN, NITRATE DISSOLVED (MG/L AS N) (00618)	NITROGEN, NITRITE TOTAL (MG/L AS N) (00615)
OCT											
24...	6	87	20	<0.10	6.8	382	357	0.52	203	--	<0.010
DEC											
12...	0	130	37	0.40	10	557	542	0.76	271	0.190	0.020
MAR											
12...	0	86	33	0.20	18	462	485	0.63	336	0.610	0.010
APR											
09...	0	95	16	0.30	12	347	343	0.47	1040	0.610	0.090
MAY											
30...	0	88	14	0.20	10	367	363	0.50	1410	0.310	0.160
AUG											
14...	0	92	15	0.20	20	390	373	0.53	728	--	0.030

RED RIVER OF THE NORTH BASIN

05064500 RED RIVER OF THE NORTH AT HALSTAD, MN--CONTINUED
(National stream quality accounting network station and radiochemical program station)

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITROGEN, NITRITE DISSOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N) (00608)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITROGEN,AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOSPHORUS TOTAL (MG/L AS P) (00665)	PHOSPHORUS DISSOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P) (00671)
OCT 24...	<0.010	<0.100	<0.100	0.020	0.030	1.0	--	0.130	0.050	0.060	0.050
DEC 12...	0.010	0.300	0.200	1.70	1.60	3.1	--	0.640	0.570	0.650	0.520
MAR 12...	0.010	0.590	0.620	0.360	0.340	1.2	--	0.160	0.100	0.100	0.060
APR 09...	0.030	0.670	0.640	0.220	0.170	1.7	--	0.320	0.150	0.200	0.100
MAY 30...	0.050	0.370	0.360	0.110	0.040	1.2	--	0.600	0.150	0.270	0.150
AUG 14...	<0.010	0.059	0.056	0.030	0.030	1.0	0.80	0.260	0.170	0.170	0.130

DATE	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BORON, DISSOLVED (UG/L AS B) (01020)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)
OCT 24...	<10	3	61	<0.5	--	<1.0	<1	<3	4	8	2
MAR 12...	<10	1	82	<0.5	110	<1.0	<1	<3	1	11	<1
APR 09...	20	2	53	<0.5	--	<1.0	<1	<3	5	23	1
AUG 14...	30	<1	65	<0.5	--	<1.0	<1	<3	10	8	<1

DATE	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)	ALPHA, DISSOLVED (UG/L AS U-NAT) (80030)
OCT 24...	31	2	<0.1	<10	3	<1	<1.0	210	<6	7	--
MAR 12...	34	61	<0.1	<10	1	<1	<1.0	280	<6	7	--
APR 09...	26	3	<0.1	<10	1	<1	<1.0	190	<6	10	1.6
AUG 14...	29	3	<0.1	<10	4	<1	<1.0	230	<6	5	3.1

DATE	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DISSOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90) (80060)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L) (09511)	URANIUM NATURAL DISSOLVED (UG/L AS U) (22703)	CARBON, ORGANIC DISSOLVED (MG/L AS C) (00681)	SEDIMENT, SUSPENDED (MG/L) (80154)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 24...	--	--	--	--	--	--	--	--	20	11	21
DEC 12...	--	--	--	--	--	--	--	--	41	20	31
MAR 12...	--	--	--	--	--	--	--	7.4	17	12	54
APR 09...	12	13	3.5	10	3.2	0.08	1.3	--	214	641	79
MAY 30...	--	--	--	--	--	--	--	--	364	1400	99
AUG 14...	6.9	11	5.7	8.3	5.3	0.09	1.5	--	276	515	95

RED RIVER OF THE NORTH BASIN

05067500 MARSH RIVER NEAR SHELLY, MN

LOCATION.--Lat 47°24'45", long 96°45'50", in NE¼NW¼ sec.3, T.145 N., R.48 W., Norman County, Hydrologic Unit 09020107, near center of span on downstream truss of bridge, 3.8 mi southeast of Shelly and 10 mi upstream from mouth.
DRAINAGE AREA.--151 mi^2.
PERIOD OF RECORD.--March 1944 to September 1983 and April 1985 to current year (no winter records since 1989). Monthly discharge only for March 1944, published in WSP 1308. Operated as a high-flow partial-record station October 1983 to March 1985.
GAGE.--Water-stage recorder. Datum of gage is 841.14 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Oct.1, 1965, nonrecording gage at datum 3.0 ft higher. Oct. 1, 1965, to May 17, 1989, nonrecording gage at present site and datum.
REMARKS.--Records fair. Large part of high flow of Wild Rice River diverted into Marsh River basin at overflow section 4.6 mi east of Ada. Another diversion from Wild Rice River basin formed in 1947, 1.5 mi southeast of Ada and diverted water at all stages 1947-51, after which it was closed except for a small regulated flow diverted for abatement of pollution from Ada sewage plant effluent.
EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,120 ft^3/s, May 23, gage height, 11.88 ft; no flow for many days.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	---	---	---	---	e1.0	13	3.3	3.0	2.2	.18	.00
2	.00	---	---	---	---	e1.0	14	24	2.0	2.0	.15	.00
3	.00	---	---	---	---	e1.0	20	24	1.2	2.2	.30	.00
4	.00	---	---	---	---	e1.0	28	32	.60	4.3	.19	.00
5	.00	---	---	---	---	e1.0	22	61	.32	12	.18	.00
6	.00	---	---	---	---	e1.0	15	59	.26	12	.14	.00
7	.00	---	---	---	---	e1.0	10	45	.19	11	.06	.00
8	.00	---	---	---	---	e1.0	6.2	33	.08	8.5	.16	.00
9	.00	---	---	---	---	e1.0	3.8	21	.06	5.9	.68	.00
10	.00	---	---	---	---	e1.0	2.6	14	.08	3.9	.71	.00
11	.00	---	---	---	---	e1.0	1.8	10	.04	3.1	.35	.00
12	.00	---	---	---	---	e1.0	1.1	7.1	.02	2.6	.24	.00
13	.00	---	---	---	---	e1.0	.99	7.1	.01	1.7	.23	.00
14	.00	---	---	---	---	e1.0	1.2	8.5	113	1.1	.13	.00
15	.00	---	---	---	---	e1.0	1.1	7.4	295	.50	.03	.00
16	.00	---	---	---	---	e1.0	.92	6.7	179	.72	.02	.00
17	.00	---	---	---	---	e1.1	.78	4.8	89	3.3	.01	.00
18	.00	---	---	---	---	e2.0	.72	2.9	48	3.0	.01	.00
19	.00	---	---	---	---	e5.0	.60	2.2	30	2.1	.01	.00
20	.00	---	---	---	---	e13	.41	1.7	20	1.4	.01	.00
21	.00	---	---	---	---	e18	.29	1.3	14	1.0	.01	.00
22	.00	---	---	---	---	e22	.26	3.0	8.1	.85	.01	.00
23	.00	---	---	---	---	e25	.26	784	4.8	.72	.01	.00
24	.00	---	---	---	---	e26	.12	750	2.9	.45	.01	.00
25	.00	---	---	---	---	e26	.08	188	2.0	.32	.01	.00
26	.00	---	---	---	---	e28	.08	58	1.4	.25	.01	.00
27	.00	---	---	---	---	e28	.26	30	.78	.16	.01	.00
28	.00	---	---	---	---	e23	.29	18	.85	.15	.00	.00
29	.00	---	---	---	---	e20	.19	12	1.6	.15	.00	.00
30	.00	---	---	---	---	e17	1.8	7.9	2.3	.17	.00	.00
31	.00	---	---	---	---	e15	---	5.0	---	.19	.00	---
TOTAL	0.00	---	---	---	---	285.1	147.85	2231.9	820.59	87.93	3.86	0.00
MEAN	.000	---	---	---	---	9.20	4.93	72.0	27.4	2.84	.12	.000
MAX	.00	---	---	---	---	28	28	784	295	12	.71	.00
MIN	.00	---	---	---	---	1.0	.08	1.3	.01	.15	.00	.00
AC-FT	.00	---	---	---	---	565	293	4430	1630	174	7.7	.00
CFSM	.00	---	---	---	---	.06	.03	.48	.18	.02	.00	.00
IN.	.00	---	---	---	---	.07	.04	.55	.20	.02	.00	.00

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1991, BY WATER YEAR (WY)

MEAN	12.9	10.7	5.60	3.79	3.29	69.6	302	133	84.3	72.9	20.8	11.6
MAX	130	102	77.1	64.5	62.1	437	1537	2617	1030	820	363	144
(WY)	1952	1952	1951	1951	1951	1945	1950	1950	1950	1950	1949	1944
MIN	.000	.000	.000	.000	.000	.000	.078	.87	.000	.000	.000	.000
(WY)	1955	1956	1956	1946	1946	1964	1981	1980	1980	1961	1959	1954

SUMMARY STATISTICS	FOR 1991 WATER YEAR		WATER YEARS 1944 - 1991	
ANNUAL MEAN			63.3a	
HIGHEST ANNUAL MEAN			543	1950
LOWEST ANNUAL MEAN			1.24	1977
HIGHEST DAILY MEAN			4740	Apr 19 1979
LOWEST DAILY MEAN			.00	Sep 4 1945
ANNUAL SEVEN-DAY MINIMUM			.00	Sep 12 1945
INSTANTANEOUS PEAK FLOW	1,120	May 23	4880	Apr 19 1979
INSTANTANEOUS PEAK STAGE	11.88	May 23	23.36b	Apr 19 1979
INSTANTANEOUS LOW FLOW	.00	Many days	.00	Many days
ANNUAL RUNOFF (AC-FT)			45850	
ANNUAL RUNOFF (CFSM)			.42	
ANNUAL RUNOFF (INCHES)			5.69	
10 PERCENT EXCEEDS			108	
50 PERCENT EXCEEDS			.90	
90 PERCENT EXCEEDS			.00	

a Median of annual mean discharges is 46 ft^3/s.
b From floodmark.
e Estimated.

RED RIVER OF THE NORTH BASIN

05069000 SAND HILL RIVER AT CLIMAX, MN

LOCATION.--Lat 47°36'43", long 96°48'52", in NE¼NE¼ sec.30, T.148 N., R.48 W., Polk County, Hydrologic Unit 09020301, on left bank 25 ft upstream from bridge on U.S. Highway 75 in Climax and 3.7 mi upstream from mouth.
DRAINAGE AREA.--426 mi^2.
PERIOD OF RECORD.--March 1943 to September 1984, June 1985 to current year (winter records incomplete prior to 1947). Monthly discharge only for some periods, published in WSP 1308 and 1728. October 1984 to May 1985, operated as a high-flow partial-record station.
REVISED RECORDS.--WSP 1388: 1943(M), 1944, 1947(M). WSP 1728: 1951(M), 1960 (Average discharge).
GAGE.--Water stage recorder. Datum of gage is 820.10 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Oct. 1, 1966, nonrecording gage at site 3.2 mi upstream at datum 12.78 ft higher. Oct. 1, 1966, to Sept 5, 1989, nonrecording gage at present site and datum.
REMARKS.--Records good except those for estimated daily discharges, which are poor.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.3	12	e12	e8.0	e5.0	e12	e140	67	29	29	9.6	6.1
2	7.4	11	e12	e8.0	e5.5	e12	e135	68	27	52	10	7.1
3	7.0	11	e12	e7.5	e6.0	e12	e130	70	25	70	13	7.4
4	6.1	11	e12	e7.5	e6.5	e12	102	104	23	73	18	6.7
5	6.0	11	e12	e7.5	e7.0	e12	90	153	21	69	23	7.7
6	7.4	9.7	e12	e7.5	e8.0	e12	71	132	20	65	16	8.7
7	7.2	8.1	e12	e7.0	e9.0	e12	58	120	18	59	14	10
8	7.1	9.7	e11	e7.0	e10	e12	43	111	17	49	13	9.8
9	8.3	11	e11	e7.0	e11	e12	38	105	36	42	12	9.9
10	9.9	12	e11	e7.0	e12	e12	35	97	66	35	11	15
11	9.0	11	e11	e6.5	e13	e12	32	86	47	31	10	15
12	9.4	11	e11	e6.5	e13	e12	30	75	39	30	10	11
13	9.1	11	e11	e6.5	e13	e12	28	64	30	32	9.0	11
14	9.7	13	e11	e6.5	e13	e12	29	64	55	49	7.7	11
15	9.8	13	e11	e6.0	e13	e12	31	58	85	35	7.2	11
16	10	13	e11	e6.0	e13	e12	32	52	69	29	7.4	19
17	11	13	e10	e6.0	e13	e13	31	46	51	23	8.9	12
18	12	12	e10	e6.0	e13	e15	30	41	37	19	8.6	10
19	12	14	e10	e6.0	e13	e20	31	37	28	17	9.0	11
20	12	15	e10	e6.0	e13	e40	32	34	23	18	7.9	12
21	12	14	e9.5	e5.5	e12	e50	33	34	20	16	7.7	11
22	12	17	e9.5	e5.5	e12	e70	33	65	18	17	6.7	11
23	11	15	e9.5	e5.5	e12	e90	33	454	17	15	6.6	9.5
24	11	12	e9.0	e5.5	e12	e110	32	374	15	15	6.4	8.9
25	11	e12	e9.0	e5.5	e12	e140	30	177	13	14	7.1	8.9
26	13	e12	e9.0	e5.5	e12	e150	28	100	14	13	8.7	8.5
27	13	e12	e8.5	e5.5	e12	e150	30	66	16	12	8.3	8.8
28	13	e12	e8.5	e5.0	e12	e150	30	50	20	10	6.9	8.4
29	12	e12	e8.5	e5.0	---	e140	33	40	18	11	6.8	8.6
30	12	e12	e8.0	e5.0	---	e130	37	34	27	9.7	6.9	8.7
31	12	---	e8.0	e5.0	---	e120	---	31	---	8.7	5.7	---
TOTAL	309.7	362.5	320.0	194.5	306.0	1580	1467	3009	924	967.4	303.1	303.7
MEAN	9.99	12.1	10.3	6.27	10.9	51.0	48.9	97.1	30.8	31.2	9.78	10.1
MAX	13	17	12	8.0	13	150	140	454	85	73	23	19
MIN	6.0	8.1	8.0	5.0	5.0	12	28	31	13	8.7	5.7	6.1
AC-FT	614	719	635	386	607	3130	2910	5970	1830	1920	601	602
CFSM	.02	.03	.02	.01	.03	.12	.11	.23	.07	.07	.02	.02
IN.	.03	.03	.03	.02	.03	.14	.13	.26	.08	.08	.03	.03

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1943 - 1991, BY WATER YEAR (WY)

MEAN	32.5	27.6	16.7	12.3	12.2	75.3	351	121	96.3	58.8	29.4	23.7
MAX	223	209	48.7	30.1	46.8	385	946	1156	596	298	256	93.9
(WY)	1972	1972	1972	1986	1984	1966	1978	1950	1984	1962	1985	1985
MIN	9.43	8.64	5.11	2.02	3.55	5.81	25.3	23.7	11.5	8.95	6.30	6.49
(WY)	1977	1956	1964	1962	1962	1948	1981	1958	1980	1980	1961	1955

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1943 - 1991	
ANNUAL TOTAL	10069.9		10046.9			
ANNUAL MEAN	27.6		27.5		70.6a	
HIGHEST ANNUAL MEAN					204	1950
LOWEST ANNUAL MEAN					18.4	1977
HIGHEST DAILY MEAN	236	Jun 2	454	May 23	4360	Apr 14 1965
LOWEST DAILY MEAN	5.5	Sep 15	5.0b		1.0	Jan 17,18, 1962
ANNUAL SEVEN-DAY MINIMUM	6.0	Jan 1	5.1	Jan 26	1.1	Jan 12 1962
INSTANTANEOUS PEAK FLOW	405	Jun 2	613	May 23	4560	Apr 14 1965
INSTANTANEOUS PEAK STAGE	7.52	Jun 2	8.71	May 23	32.79c	Apr 23 1979
INSTANTANEOUS LOW FLOW	4.8	Sep 15				
ANNUAL RUNOFF (AC-FT)	19970		19930		51170	
ANNUAL RUNOFF (CFSM)	.065		.065		.17	
ANNUAL RUNOFF (INCHES)	.88		.88		2.25	
10 PERCENT EXCEEDS	63		67		140	
50 PERCENT EXCEEDS	12		12		21	
90 PERCENT EXCEEDS	7.1		7.0		8.5	

a Median of annual mean discharges is 52 ft^3/s.
b Occurred Jan. 28 to Feb. 1.
c From floodmark (backwater from Red River of the North).
e Estimated.

RED RIVER OF THE NORTH BASIN

05074000 LOWER RED LAKE NEAR RED LAKE, MN

LOCATION.--Lat 47°57'27", long 95°16'34", in SW¼NW¼ sec.28, T.152 N., R.36 W., Clearwater County, Hydrologic Unit 09020302, on Red Lake Indian Reservation, on left bank just upstream from dam at outlet, 13 mi northwest of city of Red Lake.

DRAINAGE AREA.--1,950 mi^2, approximately.

PERIOD OF RECORD.--June 1930 to November 1932 and May 1933 to current year. Published as "Red Lake at Redby" prior to May 1933 and as "Red Lake near Red Lake" May 1933 to September 1940. 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 Natural Resources (fragmentary).

GAGE.--Water-stage recorder. Datum of gage is 1,100.00 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers); gage readings have been reduced to elevations based on adjustment of 1912. May 1933 to Sept. 6, 1934, nonrecording gage and Sept. 7, 1934 to Sept. 30, 1986, recording gage at same site at datum 69.00 ft higher. Nonrecording gages at Waskish and Redby.

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

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation, 1,178.53 ft, June 25, 1950; minimum recorded, 1,169.80 ft, Nov. 20, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,173.87 ft, June 26; maximum daily, 1,173.45 ft, July 12; minimum, 1,171.60 ft, Nov. 22; minimum daily, 1,171.94 ft, Nov. 22.

MONTHEND ELEVATION, IN FEET, OCTOBER 1990 TO SEPTEMBER 1991

Oct. 31	1,172.66	Feb. 28	1,172.69	June 30	1,173.38
Nov. 30	1,172.49	Mar. 31	1,172.76	July 31	1,173.09
Dec. 31	1,172.56	Apr. 30	1,172.78	Aug. 31	1,173.15
Jan. 31	1,172.62	May 31	1,173.22	Sept. 30	1,172.79

NOTE.--Mean daily gage heights are available.

RED RIVER OF THE NORTH BASIN

05074500 RED LAKE RIVER NEAR RED LAKE, MN

LOCATION.--Lat 47°57'27", long 95°16'35", in SW¼NW¼ sec.28, T.152 N., R.36 W., Clearwater County, Hydrologic Unit 09020302, on Red Lake Indian Reservation, on left bank 50 ft downstream from dam at outlet of Lower Red Lake and 13 mi northwest of city of Red Lake.
DRAINAGE AREA.--1,950 mi^2, 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 1,100.00 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Sept. 7, 1934, nonrecording gage at site 50 ft upstream at datum 69.00 ft higher. Sept. 7, 1934, to Nov. 26, 1951, water-stage recorder at present site at datum 69.00 ft higher. Nov. 27, 1951 to Sept. 30, 1986, water-stage recorder at present site at datum 67.00 ft higher.
REMARKS.--Records poor. Flow completely regulated by outlet dam on Lower Red Lake.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	63	61	62	63	63	64	64	68	68	68	67
2	65	61	61	62	63	63	64	66	68	66	70	65
3	63	61	61	62	63	64	64	68	69	69	70	65
4	60	62	61	62	63	63	64	68	70	69	69	66
5	64	62	61	62	63	63	64	67	68	69	69	66
6	64	61	61	62	63	63	64	67	67	69	69	66
7	64	61	61	62	63	63	64	68	67	69	69	67
8	64	61	61	62	62	63	64	68	67	69	69	67
9	63	61	61	62	62	64	64	68	67	69	68	65
10	63	60	61	62	62	64	64	68	66	70	68	66
11	62	61	61	62	63	64	64	68	67	71	68	67
12	63	62	61	62	63	64	64	68	69	71	68	66
13	63	62	61	62	63	64	65	68	67	71	68	66
14	63	62	61	62	63	64	65	68	68	70	68	67
15	62	62	61	62	63	64	65	68	66	70	68	67
16	64	61	61	62	63	64	65	69	66	70	68	67
17	65	62	61	62	63	63	65	71	67	71	68	67
18	63	61	62	62	63	63	65	69	66	70	68	66
19	64	62	62	62	63	63	65	68	66	69	68	67
20	63	62	62	62	63	64	65	68	69	71	67	67
21	62	60	62	62	63	64	65	68	68	71	67	67
22	63	56	62	62	63	64	65	68	67	69	68	63
23	63	57	62	62	63	64	65	68	66	69	68	67
24	63	60	62	62	63	64	65	68	65	70	68	66
25	63	61	62	62	63	64	65	69	66	70	68	64
26	62	62	62	62	63	64	66	69	67	70	68	66
27	60	61	62	62	63	64	67	68	67	70	68	67
28	63	61	62	62	63	64	65	69	69	70	67	67
29	63	61	62	63	---	64	66	68	68	70	67	68
30	63	61	62	63	---	64	64	68	71	69	67	64
31	63	---	62	63	---	64	---	69	---	68	68	---
TOTAL	1953	1830	1905	1925	1761	1974	1941	2109	2022	2157	2112	1986
MEAN	63.0	61.0	61.5	62.1	62.9	63.7	64.7	68.0	67.4	69.6	68.1	66.2
MAX	65	63	62	63	63	64	67	71	71	71	70	68
MIN	60	56	61	62	62	63	64	64	65	66	67	63
AC-FT	3870	3630	3780	3820	3490	3920	3850	4180	4010	4280	4190	3940
CFSM	.03	.03	.03	.03	.03	.03	.03	.03	.03	.04	.03	.03
IN.	.04	.03	.04	.04	.03	.04	.04	.04	.04	.04	.04	.04

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1933 - 1991, BY WATER YEAR (WY)

MEAN	476	465	456	470	464	429	341	492	576	544	467	463
MAX	2071	1649	1498	1418	1342	1396	1199	1624	2025	1840	1464	1712
(WY)	1951	1951	1951	1951	1951	1951	1951	1950	1950	1950	1975	1950
MIN	5.10	3.57	.95	.35	.40	.60	4.00	.60	2.15	4.63	2.73	1.61
(WY)	1934	1934	1934	1934	1934	1936	1936	1933	1933	1934	1936	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1933 - 1991	
ANNUAL TOTAL	23234		23675			
ANNUAL MEAN	63.7		64.9		474	
HIGHEST ANNUAL MEAN					1292	1951
LOWEST ANNUAL MEAN					5.55	1936
HIGHEST DAILY MEAN	72	Jul 4	71	Several days	2240	Oct 6 1950
LOWEST DAILY MEAN	56	Nov 22	56	Nov 22	.00	Sep 19 1933
ANNUAL SEVEN-DAY MINIMUM	60	Sep 24	60	Nov 21	.00	Sep 1 1934
INSTANTANEOUS PEAK FLOW	72a		76	Jun 26	3600	Jun 25 1950
INSTANTANEOUS PEAK STAGE	70.22	Feb 21,Jul 10	70.19	Jun 26	78.19	Jun 25 1950
INSTANTANEOUS LOW FLOW			52	Nov 22		
ANNUAL RUNOFF (AC-FT)	46080		46960		343500	
ANNUAL RUNOFF (CFSM)	.033		.033		.24	
ANNUAL RUNOFF (INCHES)	.44		.45		3.30	
10 PERCENT EXCEEDS	67		69		1020	
50 PERCENT EXCEEDS	63		64		386	
90 PERCENT EXCEEDS	61		61		35	

a Occurred part or all of each day July 3-11.

RED RIVER OF THE NORTH BASIN

05075000 RED LAKE RIVER AT HIGH LANDING, NEAR GOODRIDGE, MN

LOCATION.--Lat 48°02'34", long 95°48'28", in NW¼NW¼ sec.28, T.153 N., R.40 W., Pennington County, Hydrologic Unit 09020303, on left bank 50 ft upstream from highway bridge at High Landing, 7 mi south of Goodridge and 33 mi upstream from Thief River.

DRAINAGE AREA.--2,300 mi^2, 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, adjustment of 1912 (levels by U.S. Army Corps of Engineers). See WSP 1308 or 1738 for history of changes prior to Oct. 1, 1949.

REMARKS.--Records fair except those for estimated daily discharges, which are poor. Flow regulated by outlet dam on Lower Red Lake.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	60	65	e62	e62	e62	e63	e88	78	70	63	89	64
2	58	64	e62	e62	e62	e63	e85	77	70	66	87	63
3	60	63	e62	e62	e62	e63	e83	74	70	70	87	63
4	61	65	e59	e62	e62	e63	e81	88	70	76	88	63
5	54	67	e55	e62	e62	e63	e79	83	69	82	88	63
6	60	e60	e66	e62	e62	e63	76	78	69	84	86	64
7	60	e50	e62	e62	e62	e63	e73	80	69	82	84	64
8	59	e65	e62	e62	e62	e63	69	77	69	80	82	64
9	59	e70	e62	e62	e62	e63	e67	74	68	79	80	64
10	59	e62	e62	e62	e62	e63	65	73	68	81	78	64
11	58	e62	e62	e62	e62	e63	e64	68	67	85	76	64
12	57	e62	e62	e62	e62	e63	e63	67	67	92	74	64
13	58	e62	e62	e62	e62	e63	62	70	67	134	73	64
14	58	e62	e62	e62	e62	e64	e66	65	67	148	72	64
15	58	e62	e62	e62	e62	e65	73	67	67	125	71	64
16	58	e62	e62	e62	e62	e67	e70	67	66	107	72	63
17	60	e62	e62	e62	e62	e71	e67	67	66	101	73	63
18	62	e62	e62	e62	e62	e79	e64	69	66	97	72	63
19	62	e62	e62	e62	e62	e88	e62	69	65	94	69	62
20	63	e62	e62	e62	e62	e96	60	70	65	94	67	62
21	60	e59	e62	e62	e62	e104	e61	70	65	97	64	63
22	59	e55	e62	e62	e62	e109	e62	71	64	103	63	63
23	60	e48	e62	e62	e62	e115	e63	71	64	112	62	64
24	58	e59	e62	e62	e62	e120	e64	71	64	109	63	64
25	60	e65	e62	e62	e63	e120	65	71	64	104	66	64
26	62	e62	e62	e62	e63	e115	64	71	64	100	66	65
27	61	e62	e62	e62	e63	e110	69	71	63	97	65	65
28	59	e62	e62	e62	e63	e105	68	71	62	95	63	65
29	67	e62	e62	e62	---	e100	65	71	63	93	63	65
30	66	e62	e62	e62	---	e95	78	71	63	93	63	65
31	64	---	e62	e62	---	e91	---	71	---	93	64	---
TOTAL	1860	1847	1916	1922	1740	2533	2076	2241	1991	2936	2270	1912
MEAN	60.0	61.6	61.8	62.0	62.1	81.7	69.2	72.3	66.4	94.7	73.2	63.7
MAX	67	70	66	62	63	120	88	88	70	148	89	65
MIN	54	48	55	62	62	63	60	65	62	63	62	62
AC-FT	3690	3660	3800	3810	3450	5020	4120	4450	3950	5820	4500	3790
CFSM	.03	.03	.03	.03	.03	.04	.03	.03	.03	.04	.03	.03
IN.	.03	.03	.03	.03	.03	.04	.03	.04	.03	.05	.04	.03
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1930 - 1991, BY WATER YEAR (WY)												
MEAN	530	502	450	448	445	479	666	671	663	567	490	511
MAX	1955	1730	1539	1424	1366	1453	1980	3179	2161	2474	1478	1733
(WY)	1951	1951	1951	1951	1951	1951	1951	1950	1950	1975	1975	1950
MIN	2.11	1.61	.000	.000	.000	.000	24.7	5.58	1.04	5.92	.026	.000
(WY)	1934	1934	1934	1934	1934	1936	1933	1933	1936	1934	1934	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1930 - 1991	
ANNUAL TOTAL	26209		25244			
ANNUAL MEAN	71.8		69.2		535	
HIGHEST ANNUAL MEAN					1407	1951
LOWEST ANNUAL MEAN					6.21	1934
HIGHEST DAILY MEAN	145	Mar 13	148	Jul 14	4040	Jul 7 1975
LOWEST DAILY MEAN	48	Nov 23	48	Nov 23	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	58	Oct 10	58	Oct 10	.00	Nov 16 1933
INSTANTANEOUS PEAK FLOW	150	Mar 13	154	Jul 13,14	4060	Jul 7 1975
INSTANTANEOUS PEAK STAGE	5.65b	Mar 13,14	5.32	Jul 13,14	13.44	Jul 3 1975
ANNUAL RUNOFF (AC-FT)	51990		50070		387700	
ANNUAL RUNOFF (CFSM)	.031		.030		.23	
ANNUAL RUNOFF (INCHES)	.42		.41		3.16	
10 PERCENT EXCEEDS	87		88		1180	
50 PERCENT EXCEEDS	71		64		415	
90 PERCENT EXCEEDS	61		62		30	

b Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN

05076000 THIEF RIVER NEAR THIEF RIVER FALLS, MN

LOCATION.--Lat 48°11'08", long 96°10'11", in NW¼SW¼ sec.3, T.154 N., R.43 W., Marshall County, Hydrologic Unit 09020304, on right bank, 0.2 mi upstream from highway bridge, 5 mi north of Thief River Falls, 7 mi upstream from mouth, and 9 mi downstream from Mud Lake National Wildlife Refuge.
DRAINAGE AREA.--959 mi^2.
PERIOD OF RECORD.--July 1909 to September 1917, April 1920 to September 1921, October 1922 to September 1924, October 1928 to September 1981, March 1982 to current year. Monthly discharge only for some periods, annual maximums for water years 1919, 1922, 1925, 1926, published in WSP 1308. October 1981 to February 1982, operated as a high-flow partial-record station.
REVISED RECORDS.--WSP 925: Drainage area. WSP 1308: 1917(M), 1924(M), 1929(M), 1931-33(M), 1935(M), 1937(M).
GAGE.--Water-stage recorder and control of grouted boulders. Datum of gage is 1,112.33 ft above National Geodetic Vertical Datum of 1929 (levels by Minnesota Department of Transportation). Prior to May 4, 1939, nonrecording gages at same site and datum.
REMARKS.--Records good except those for estimated daily discharges, which are poor. Some regulation by Thief and Mud Lakes.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	5.0	.00	.00	e.00	22	1.2	6.5	.97	1.8	1.6
2	.00	.00	3.8	.00	.00	e.00	27	3.5	4.8	5.2	1.5	1.4
3	.00	.00	3.1	.00	.00	e.00	42	4.5	3.5	24	1.9	3.0
4	.00	.00	2.2	.00	.00	e.00	60	12	2.5	28	1.7	2.3
5	.00	.00	1.7	.00	.00	e.00	45	18	1.6	24	1.2	1.7
6	.00	.00	1.3	.00	.00	e.00	32	18	1.0	20	1.2	1.2
7	.00	.00	.99	.00	.00	e.00	22	16	.70	22	1.0	1.0
8	.00	.00	.79	.00	e.00	e.00	14	16	.52	45	.72	1.0
9	.00	.00	.69	.00	e.00	e.00	7.8	16	.76	42	.54	1.4
10	.00	.00	.61	.00	e.00	e.00	4.6	13	1.0	38	.46	.89
11	.00	.00	.56	.00	e.00	e.00	2.8	10	25	41	1.0	.62
12	.00	.00	.56	.00	e.00	e.00	2.1	8.3	17	43	1.7	1.2
13	.00	.00	.57	.00	e.00	e.00	1.3	7.1	13	38	.90	1.6
14	.00	.00	.55	.00	e.00	e.00	1.9	5.6	9.4	33	.71	2.4
15	.00	98	.52	.00	e.00	e.00	2.5	4.5	8.7	35	.57	2.2
16	.00	184	.44	.00	e.00	e.00	2.2	3.4	6.5	35	.70	3.6
17	.00	167	.38	.00	e.00	e.00	2.0	2.9	4.4	30	.78	4.9
18	.00	157	.28	.00	e.00	e.00	2.1	2.3	3.0	25	.57	9.0
19	.00	134	.18	.00	e.00	e.00	2.0	1.8	2.1	19	.51	8.4
20	.00	107	e.12	.00	e.00	e.00	1.7	1.6	1.7	19	.44	8.3
21	.00	85	e.08	.00	e.00	e.05	1.4	1.3	1.2	17	.33	11
22	.00	64	e.04	.00	e.00	e30	1.3	1.3	.77	16	.22	22
23	.00	59	e.00	.00	e.00	e70	1.1	91	.52	13	.18	20
24	.00	56	e.00	.00	e.00	e70	.83	202	.39	11	.15	16
25	.00	43	e.00	.00	e.00	e55	.65	92	.30	8.7	.21	14
26	.00	28	e.00	.00	e.00	e45	.51	47	.28	6.3	1.1	11
27	.00	20	e.00	.00	e.00	e40	.51	24	.25	4.7	1.8	9.5
28	.00	17	e.00	.00	e.00	e35	.50	14	.26	4.3	1.5	8.0
29	.00	11	e.00	.00	---	e30	.44	11	.39	3.2	1.2	6.7
30	.00	7.9	e.00	.00	---	e26	1.1	12	.60	2.9	1.8	5.9
31	.00	---	.00	.00	---	24	---	10	---	2.4	2.0	---
TOTAL	0.00	1237.90	24.46	0.00	0.00	425.05	305.34	671.3	118.64	656.67	30.39	181.81
MEAN	.000	41.3	.79	.000	.000	13.7	10.2	21.7	3.95	21.2	.98	6.06
MAX	.00	184	5.0	.00	.00	70	60	202	25	45	2.0	22
MIN	.00	.00	.00	.00	.00	.00	.44	1.2	.25	.97	.15	.62
AC-FT	.00	2460	49	.00	.00	843	606	1330	235	1300	60	361
CFSM	.00	.04	.00	.00	.00	.01	.01	.02	.00	.02	.00	.01
IN.	.00	.05	.00	.00	.00	.02	.01	.03	.00	.03	.00	.01

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1909 - 1991, BY WATER YEAR (WY)

MEAN	84.7	63.2	19.6	5.66	3.58	65.8	578	464	289	194	82.6	81.6
MAX	637	844	206	100	45.0	609	2827	4274	1774	2103	842	943
(WY)	1986	1972	1945	1910	1910	1983	1966	1950	1962	1975	1985	1985
MIN	.000	.000	.000	.000	.000	.000	7.75	1.83	.032	.000	.000	.000
(WY)	1911	1911	1911	1911	1911	1930	1981	1990	1980	1932	1932	1929

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1909 - 1991	
ANNUAL TOTAL	2890.79		3651.56			
ANNUAL MEAN	7.92		10.0		160a	
HIGHEST ANNUAL MEAN					607	1966
LOWEST ANNUAL MEAN					1.28	1939
HIGHEST DAILY MEAN	184	Nov 16	202	May 24	5580	May 13 1950
LOWEST DAILY MEAN	.00	Many days	.00	Many days	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Jan 1	.00	Oct 1	.00	Oct 1 1910
INSTANTANEOUS PEAK FLOW	211	Nov 16	314	May 23	5610	May 13 1950
INSTANTANEOUS PEAK STAGE	7.08b	Mar 13	6.07	May 23	17.38	May 13 1950
ANNUAL RUNOFF (AC-FT)	5730		7240		115900	
ANNUAL RUNOFF (CFSM)	.008		.010		.17	
ANNUAL RUNOFF (INCHES)	.11		.14		2.27	
10 PERCENT EXCEEDS	20		30		505	
50 PERCENT EXCEEDS	.03		.83		6.5	
90 PERCENT EXCEEDS	.00		.00		.00	

a Median of annual mean discharges is 110 ft^3/s.
b Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN

05078000 CLEARWATER RIVER AT PLUMMER, MN

LOCATION.--Lat 47°55'24", long 96°02'46", in SE¼SW¼ sec. 4, T.151 N., R.42 W., Red Lake County, Hydrologic Unit 09020305, on right bank 200 ft downstream from Soo Line Railroad bridge, 300 ft downstream from bridge on U.S. Highway 59, 0.9 mi northwest of railroad depot in Plummer, and 8 mi upstream from Hill River.
DRAINAGE AREA.--512 mi^2.
PERIOD OF RECORD.--April 1939 to September 1979, March 1982 to current year. Annual maximums only, October 1979 to February 1982.
GAGE.--Water-stage recorder. Datum of gage is 1,098.57 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Nov. 10, 1939, nonrecording gage at site 100 ft upstream at same datum.
REMARKS.--Records and except those for estimated daily discharges, which are poor. Since 1968, undetermined amounts of water diverted for the flooding of wild rice paddies upstream.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 500 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
July 7	0200	*565	*5.39	No other peak greater than base discharge.			

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	24	30	e34	e23	e37	e36	32	21	36	213	34
2	32	26	31	e35	e13	e34	e40	31	22	109	190	34
3	32	27	31	e32	e17	e24	e46	32	26	250	157	44
4	29	27	29	e31	e23	e32	e50	44	25	324	176	95
5	26	27	31	e36	e25	e33	e55	49	25	435	204	88
6	26	26	30	e38	e30	e33	e35	33	28	530	177	73
7	25	24	30	e36	e30	e31	26	38	23	555	148	64
8	24	23	30	e33	e29	e28	24	53	19	522	122	60
9	24	25	30	e30	e29	e26	21	62	29	488	107	66
10	24	27	30	e25	e29	e31	25	31	55	431	92	146
11	23	26	30	e18	e24	e31	26	39	49	375	79	147
12	22	25	e30	e25	e28	e30	22	30	38	365	68	93
13	23	26	e27	e31	e27	e31	34	35	24	397	60	70
14	23	26	e27	e30	e29	e24	27	34	18	449	55	62
15	24	26	e24	e31	e30	e29	33	34	32	402	50	62
16	24	26	e31	e32	e31	e30	36	20	41	359	49	101
17	23	20	e32	e33	e31	e35	22	23	39	336	50	211
18	26	23	e30	e34	e34	e40	25	27	39	292	112	220
19	26	22	e31	e33	e32	e45	29	20	32	272	117	202
20	25	25	e24	e30	e23	e49	27	24	29	265	101	170
21	21	27	e30	e32	e30	e49	27	25	26	303	84	137
22	22	25	e35	e31	e35	e48	29	29	20	306	73	117
23	22	15	e38	e29	e36	e47	23	26	28	386	66	114
24	21	21	e39	e26	e35	e46	26	34	32	424	62	99
25	19	18	e39	e28	e38	e44	27	24	26	351	61	75
26	16	14	e38	e24	e38	e42	26	34	23	307	60	68
27	12	24	e39	e17	e37	e40	27	26	19	323	56	57
28	15	15	e37	e25	e37	e36	27	21	51	313	50	55
29	24	24	e38	e28	---	e34	28	22	35	302	44	55
30	23	30	e32	e28	---	e34	37	22	29	291	39	54
31	21	---	e33	e27	---	e35	---	30	---	266	35	---
TOTAL	730	714	986	922	823	1108	916	984	903	10764	2957	2873
MEAN	23.5	23.8	31.8	29.7	29.4	35.7	30.5	31.7	30.1	347	95.4	95.8
MAX	33	30	39	38	38	49	55	62	55	555	213	220
MIN	12	14	24	17	13	24	21	20	18	36	35	34
AC-FT	1450	1420	1960	1830	1630	2200	1820	1950	1790	21350	5870	5700
CFSM	.05	.05	.06	.06	.06	.07	.06	.06	.06	.68	.19	.19
IN.	.05	.05	.07	.07	.06	.08	.07	.07	.07	.78	.21	.21

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1939 - 1991, BY WATER YEAR (WY)

MEAN	117	93.3	63.9	50.9	47.1	110	533	356	257	191	115	101
MAX	483	503	140	90.1	98.4	351	1391	1974	1140	844	507	666
(WY)	1972	1972	1978	1952	1974	1945	1966	1950	1962	1975	1985	1973
MIN	21.5	23.8	24.4	18.4	19.0	22.8	26.8	7.52	30.1	16.0	13.3	14.1
(WY)	1941	1991	1990	1940	1940	1940	1977	1977	1991	1940	1940	1940

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1939 - 1991	
ANNUAL TOTAL	20343		24680			
ANNUAL MEAN	55.7		67.6		171	
HIGHEST ANNUAL MEAN					354	1950
LOWEST ANNUAL MEAN					57.0	1990
HIGHEST DAILY MEAN	384	Jun 22	555	Jul 7	3840	Apr 25 1979
LOWEST DAILY MEAN	12	Oct 27	12	Oct 27	2.6	May 16 1977
ANNUAL SEVEN-DAY MINIMUM	18	Oct 22	18	Oct 22	2.9	May 10 1977
INSTANTANEOUS PEAK FLOW	393	Jun 22	565	Jul 7	3940	Apr 25 1979
INSTANTANEOUS PEAK STAGE	6.79a	Mar 13	5.39	Jul 7	12.37a	Apr 18 1979
INSTANTANEOUS LOW FLOW					2.5	May 16,17, 1977
ANNUAL RUNOFF (AC-FT)	40350		48950		123600	
ANNUAL RUNOFF (CFSM)	.11		.13		.33	
ANNUAL RUNOFF (INCHES)	1.48		1.79		4.53	
10 PERCENT EXCEEDS	119		176		405	
50 PERCENT EXCEEDS	36		31		75	
90 PERCENT EXCEEDS	23		23		32	

a Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN

05078230 LOST RIVER AT OKLEE, MN

LOCATION.--Lat 47°50'35", long 95°51'30", in SE¼NE¼ sec.2, T.150 N., R.41 W., Red Lake County, Hydrologic Unit 09020305, on downstream side of bridge on State Highway 222 at northwest edge of Oklee, 12 mi upstream from mouth.

DRAINAGE AREA.--266 mi^2.

PERIOD OF RECORD.--April 1960 to September 1981, February 1982 to current year. Monthly and daily figures for April 1960, to June 1960, published in WSP 2113.

GAGE.--Water-stage recorder. Datum of gage is 1,126.94 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Sept. 9, 1960, reference points at same site at datum 8.00 ft higher. Sept. 9, 1960, to Sept. 30, 1964, nonrecording gage at same site at datum 8.00 ft higher. Oct. 1, 1964, to Sept. 30, 1981, and Feb. 24, 1982, to Sept. 6, 1989, nonrecording gage at same site and datum.

REMARKS.--Records poor.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	1.9	e.85	e.45	e.18	e.70	41	115	20	154	26	10
2	.04	1.9	e.80	e.40	e.18	e.70	41	116	19	168	24	11
3	.13	1.9	e.75	e.37	e.20	e.70	56	115	20	211	23	21
4	.17	1.9	e.75	e.35	e.30	e.70	53	146	18	202	23	22
5	.21	1.9	e.75	e.33	e.50	e.70	43	167	17	174	27	21
6	.32	1.9	e.80	e.31	e.80	e.70	33	140	16	177	27	20
7	.40	1.9	e.90	e.30	e.90	e.70	29	133	15	166	24	19
8	.40	1.9	e1.0	e.29	e1.0	e.70	24	120	13	146	22	20
9	.40	2.0	e1.1	e.28	e.95	e.70	21	110	19	120	21	136
10	.45	2.0	e1.3	e.27	e.90	e.70	20	94	40	98	17	215
11	.50	2.0	e1.5	e.26	e.90	e.70	18	82	45	82	13	140
12	.53	2.0	e1.6	e.25	e.80	e.70	18	89	33	76	11	90
13	.62	2.0	e1.7	e.24	e.80	e.75	16	82	22	69	8.3	58
14	.75	2.0	e1.8	e.23	e.80	e.80	19	70	19	68	7.7	46
15	.90	2.0	e1.7	e.22	e.80	e.90	25	61	16	62	7.5	81
16	1.0	2.0	e1.6	e.21	e.75	e1.0	36	51	15	53	12	212
17	1.3	2.0	e1.5	e.21	e.70	e1.2	42	42	14	43	18	192
18	1.4	2.0	e1.4	e.21	e.70	e4.0	36	38	12	38	24	156
19	1.4	2.0	e1.3	e.20	e.70	e10	30	40	11	35	25	135
20	1.6	2.0	e1.2	e.20	e.70	e25	26	42	12	35	24	98
21	1.8	2.0	e1.1	e.20	e.70	e35	25	48	10	41	23	73
22	1.7	2.0	e1.0	e.19	e.70	e45	23	53	10	57	22	51
23	1.7	e1.8	e.90	e.19	e.70	e55	24	44	11	65	21	36
24	1.7	e1.6	e.85	e.19	e.70	e70	23	42	9.7	63	17	30
25	1.7	e1.4	e.80	e.19	e.70	e70	22	39	8.1	46	16	25
26	1.7	e1.2	e.75	e.19	e.70	e70	22	45	39	36	14	23
27	1.8	e1.1	e.70	e.18	e.70	e60	23	47	125	34	13	22
28	1.8	e1.0	e.65	e.18	e.70	e45	25	34	85	31	12	21
29	1.8	e.95	e.60	e.18	---	e40	25	23	70	29	11	20
30	1.8	e.90	e.55	e.18	---	38	46	20	74	30	11	20
31	1.7	---	e.50	e.18	---	40	---	20	---	28	10	---
TOTAL	31.72	53.15	32.70	7.63	19.16	620.05	885	2268	837.8	2637	554.5	2024
MEAN	1.02	1.77	1.05	.25	.68	20.0	29.5	73.2	27.9	85.1	17.9	67.5
MAX	1.8	2.0	1.8	.45	1.0	70	56	167	125	211	27	215
MIN	.00	.90	.50	.18	.18	.70	16	20	8.1	28	7.5	10
AC-FT	63	105	65	15	38	1230	1760	4500	1660	5230	1100	4010
CFSM	.00	.01	.00	.00	.00	.08	.11	.28	.10	.32	.07	.25
IN.	.00	.01	.00	.00	.00	.09	.12	.32	.12	.37	.08	.28

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1960 - 1991, BY WATER YEAR (WY)

MEAN	47.0	30.3	12.7	7.38	7.20	66.4	313	134	83.8	67.0	36.3	34.1
MAX	470	232	56.6	19.8	25.8	242	745	622	657	442	351	330
(WY)	1972	1972	1978	1986	1984	1986	1966	1962	1962	1962	1985	1973
MIN	1.02	1.11	.050	.002	.000	.19	29.5	10.5	8.20	1.99	1.17	.000
(WY)	1991	1977	1977	1977	1977	1964	1991	1980	1980	1961	1961	1990

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1960 - 1991	
ANNUAL TOTAL	6190.60		9970.71			
ANNUAL MEAN	17.0		27.3		69.5	
HIGHEST ANNUAL MEAN					177	1962
LOWEST ANNUAL MEAN					18.2	1990
HIGHEST DAILY MEAN	133	Jun 22	215	Sep 10	3040	Apr 11 1969
LOWEST DAILY MEAN	.00	Aug 30	.00	Oct 1	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Aug 30	.18	Jan 27	.00	Feb 16 1963
INSTANTANEOUS PEAK FLOW	134	Jun 21,22	247	Sep 10	3210a	Apr 11 1969
INSTANTANEOUS PEAK STAGE	6.66b	Mar 14	6.60	Sep 10	16.72c	May 24 1962
ANNUAL RUNOFF (AC-FT)	12280		19780		50320	
ANNUAL RUNOFF (CFSM)	.064		.10		.26	
ANNUAL RUNOFF (INCHES)	.87		1.39		3.55	
10 PERCENT EXCEEDS	51		78		166	
50 PERCENT EXCEEDS	2.9		11		16	
90 PERCENT EXCEEDS	.15		.33		2.0	

a From highwater mark.
b Backwater from ice.
c Present datum.

RED RIVER OF THE NORTH BASIN

05078500 CLEARWATER RIVER AT RED LAKE FALLS, MN

LOCATION.--Lat 47°53'15", long 96°16'25", in NW¼NE¼ sec.22, T.151 N., R.44 W., Red Lake County, Hydrologic Unit 09020305, on left bank 40 ft downstream from Great Northern Railroad bridge in Red Lake Falls, 1.4 mi upstream from mouth, and 3 mi downstream from Badger Creek.
DRAINAGE AREA.--1,370 mi^2, approximately.
PERIOD OF RECORD.--June 1909 to September 1917, October 1934 to September 1981, March 1982 to current year. Monthly discharge only for October, November, 1934, published in WSP 1308. October 1981 to February 1982, operated as a high-flow partial-record station.
REVISED RECORDS.--WSP 355: 1911-12. WSP 1438: 1910-11, 1917(M). WDR MN-84-1:1983.
GAGE.--Water-stage recorder. Datum of gage is 948.94 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Sept. 12, 1911, nonrecording gage at site 0.5 mi upstream, and Sept. 12, 1911, to Sept. 30, 1917, nonrecording gage at site 40 ft upstream at different datum.
REMARKS.--Records fair.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	28	34	14	e41	e35	e43	e135	122	66	335	315	55
2	28	30	20	e40	e36	e42	139	199	63	480	273	55
3	35	37	38	e40	e30	e40	162	216	60	670	240	60
4	33	48	e35	e39	e25	e38	170	264	53	823	203	57
5	31	49	e35	e39	e24	e33	158	329	57	771	227	91
6	36	41	e35	e39	e25	e33	173	322	49	789	236	113
7	41	33	e35	e40	e28	e37	133	282	49	806	212	103
8	33	42	e35	e43	e30	e38	95	273	50	748	182	96
9	26	37	e35	e42	e33	e35	82	263	54	677	154	363
10	26	26	e35	e38	e34	e33	74	244	191	600	135	643
11	e26	35	e35	e32	e33	e31	66	199	182	515	119	603
12	e26	46	e35	e30	e32	e37	67	184	154	479	105	374
13	e25	39	e35	e29	e31	e40	60	188	234	462	93	246
14	e25	43	e35	e29	e32	e40	72	180	120	503	83	191
15	e25	41	e33	e32	e33	e40	78	164	81	504	75	172
16	e25	30	e31	e35	e35	e40	78	154	69	439	99	720
17	e25	30	e30	e36	e35	e40	96	130	68	413	82	831
18	e25	36	e35	e37	e36	e43	102	119	66	372	84	730
19	e25	21	e36	e37	e37	e50	99	116	57	340	120	639
20	25	38	e35	e38	e37	e60	93	100	58	329	140	512
21	33	42	e32	e38	e35	e80	81	95	55	329	130	375
22	31	29	e30	e37	e32	e140	76	102	60	372	114	285
23	25	16	e35	e36	e32	e165	72	136	54	381	109	227
24	27	32	e40	e35	e38	e170	67	148	48	470	94	203
25	28	30	e43	e34	e41	e170	64	131	56	452	87	179
26	27	21	e45	e32	e42	e170	62	109	53	378	82	147
27	24	21	e45	e31	e43	e165	64	101	86	348	79	135
28	19	16	e45	e30	e43	e150	65	89	154	360	76	121
29	15	12	e45	e29	---	e140	70	83	182	336	70	111
30	13	20	e45	e29	---	e130	93	70	181	321	63	105
31	34	---	e43	e32	---	e130	---	64	---	332	58	---
TOTAL	845	975	1105	1099	947	2403	2846	5176	2710	15134	4139	8542
MEAN	27.3	32.5	35.6	35.5	33.8	77.5	94.9	167	90.3	488	134	285
MAX	41	49	45	43	43	170	173	329	234	823	315	831
MIN	13	12	14	29	24	31	60	64	48	321	58	55
AC-FT	1680	1930	2190	2180	1880	4770	5650	10270	5380	30020	8210	16940
CFSM	.02	.02	.03	.03	.02	.06	.07	.12	.07	.36	.10	.21
IN.	.02	.03	.03	.03	.03	.07	.08	.14	.07	.41	.11	.23

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1909 - 1991, BY WATER YEAR (WY)

MEAN	182	136	84.9	67.4	62.3	219	1148	677	485	341	191	170
MAX	1350	1233	260	220	150	993	3458	5059	3042	1813	1686	1267
(WY)	1972	1972	1910	1910	1984	1946	1966	1950	1962	1962	1985	1973
MIN	10.0	19.0	21.4	21.4	19.1	13.6	61.0	32.2	26.5	8.34	1.49	2.92
(WY)	1935	1935	1937	1940	1937	1937	1981	1977	1980	1936	1936	1936

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1909 - 1991	
ANNUAL TOTAL	34633		45921			
ANNUAL MEAN	94.9		126		310a	
HIGHEST ANNUAL MEAN					855	1950
LOWEST ANNUAL MEAN					64.4	1939
HIGHEST DAILY MEAN	632	Jun 22	831	Sep 17	9930	Apr 25 1979
LOWEST DAILY MEAN	12	Nov 29	12	Nov 29	.10	Sep 15 1936
ANNUAL SEVEN-DAY MINIMUM	17	Sep 6	18	Nov 26	.24	Sep 12 1936
INSTANTANEOUS PEAK FLOW	652	Jun 22	1040	Sep 16	10300	Apr 25 1979
INSTANTANEOUS PEAK STAGE	5.20b	Apr. 3	4.45	Sep 16	15.85b	Mar 6 1983
INSTANTANEOUS LOW FLOW					.00c	
ANNUAL RUNOFF (AC-FT)	68690		91080		224600	
ANNUAL RUNOFF (CFSM)	.069		.092		.23	
ANNUAL RUNOFF (INCHES)	.94		1.25		3.08	
10 PERCENT EXCEEDS	200		335		777	
50 PERCENT EXCEEDS	45		57		104	
90 PERCENT EXCEEDS	26		29		36	

a Median of annual mean discharges 270 ft^3/s.
b From highwater mark, backwater from ice.
c Occurred Sept. 15, 1936, Sept. 14, 1939, and Aug. 19-22, 1940.
e Estimated.

RED RIVER OF THE NORTH BASIN

05079000 RED LAKE RIVER AT CROOKSTON, MN

LOCATION.--Lat 47°46'32", long 96°36'33", in SW¼SW¼ sec.30, T.150 N., R.46 W., Polk County, Hydrologic Unit 09020303, on right bank 100 ft upstream from Sargent Street bridge in Crookston, 0.3 mi downstream from Interstate Power Co.'s dam, 0.6 mi downstream from bridge on U.S. Highway 75, and 53 mi upstream from mouth.
DRAINAGE AREA.--5,280 mi^2, approximately.

WATER-DISCHARGE RECORDS

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.
REVISED RECORDS.--WSP 1115: 1906, 1915-16, 1919-20, 1922, 1925, 1927, 1929. WSP 1308: 1916(M), 1919(M), 1928(M), 1930(M). See also PERIOD OF RECORD.
GAGE.--Water-stage recorder. Datum of gage is 832.72 ft above National Geodetic Vertical 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.
REMARKS.--Records good except those for estimated daily discharges, which are fair. Diurnal fluctuation prior to 1975 caused by powerplant 1,000 ft upstream. Runoff from 1,950 mi^2 in the headwaters of Red Lake River is completely controlled by dam at outlet of Lower Red Lake. Flow partially affected by occasional regulation at Thief and Mud Lakes in Thief River basin (see station 05076000).

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	76	65	e104	e104	e82	e95	e320	223	185	309	398	113
2	103	95	e104	e102	e83	e95	337	273	165	472	376	131
3	79	113	e104	e102	e84	e94	413	361	167	694	376	130
4	101	84	e104	e102	e85	e94	e480	443	130	931	329	123
5	94	87	e104	e102	e86	e94	520	542	119	1130	296	126
6	118	94	e104	e100	e87	e94	e510	620	128	1060	295	148
7	88	75	e104	e100	e88	e94	e450	576	108	1030	305	189
8	128	66	e104	e100	e89	e94	314	522	96	1030	302	206
9	107	98	e104	e100	e90	e94	239	482	145	928	261	287
10	88	82	e104	e98	e91	e94	204	433	167	846	245	570
11	82	88	e104	e96	e92	e93	177	433	354	775	208	899
12	112	94	e104	e96	e93	e93	154	364	331	643	190	769
13	86	95	e104	e96	e94	e93	149	330	1300	670	174	527
14	81	97	e104	e96	e95	e93	151	341	1180	647	156	395
15	115	100	e104	e96	e95	e94	174	296	485	641	155	341
16	94	101	e104	e96	e95	e98	189	312	282	637	158	340
17	81	101	e104	e96	e95	e105	189	244	214	590	186	1010
18	98	166	e104	e96	e95	e120	197	227	181	580	181	1120
19	92	202	e104	e96	e95	e135	199	194	147	501	150	999
20	73	260	e104	e96	e95	e155	185	212	148	488	169	888
21	71	212	e104	e96	e95	e195	176	165	148	455	231	763
22	93	219	e104	e96	e95	e240	171	182	145	495	221	593
23	106	128	e104	e94	e95	e340	154	249	133	502	195	502
24	108	119	e104	e92	e95	e385	149	377	120	457	177	411
25	113	e116	e104	e90	e95	e395	138	612	110	556	167	403
26	87	e112	e104	e85	e95	e400	131	582	109	517	178	354
27	119	e110	e104	e80	e95	e390	145	375	113	451	157	318
28	91	e108	e104	e80	e95	e370	136	300	142	430	132	259
29	104	e106	e104	e80	---	e350	145	233	221	436	149	255
30	105	e105	e104	e80	---	e320	206	258	284	408	123	233
31	72	---	e104	e80	---	e315	---	205	---	391	107	---
TOTAL	2965	3498	3224	2923	2569	5721	7102	10966	7557	19700	6747	13402
MEAN	95.6	117	104	94.3	91.7	185	237	354	252	635	218	447
MAX	128	260	104	104	95	400	520	620	1300	1130	398	1120
MIN	71	65	104	80	82	93	131	165	96	309	107	113
AC-FT	5880	6940	6390	5800	5100	11350	14090	21750	14990	39070	13380	26580
CFSM	.02	.02	.02	.02	.02	.03	.04	.07	.05	.12	.04	.08
IN.	.02	.02	.02	.02	.02	.04	.05	.08	.05	.14	.05	.09
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1901 - 1991, BY WATER YEAR (WY)												
MEAN	811	670	549	495	471	934	2965	2063	1658	1247	791	782
MAX	2836	3172	1900	1663	1464	3626	10260	15290	7205	6851	3868	3009
(WY)	1972	1972	1904	1951	1951	1910	1966	1950	1962	1975	1985	1905
MIN	8.02	10.1	5.34	15.6	17.8	24.9	232	154	80.4	26.2	12.3	8.87
(WY)	1937	1937	1937	1934	1937	1936	1981	1934	1934	1936	1934	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1901 - 1991	
ANNUAL TOTAL	68422		86374			
ANNUAL MEAN	187		237		1115	
HIGHEST ANNUAL MEAN					3129	1950
LOWEST ANNUAL MEAN					83.6	1934
HIGHEST DAILY MEAN	898	Jun 23	1300	Jun 13	27100	Apr 12 1969
LOWEST DAILY MEAN	65	Sep 27	65	Nov 1	2.5	Sep 29 1936
ANNUAL SEVEN-DAY MINIMUM	74	Sep 8	81	Jan 27	3.9	Sep 28 1936
INSTANTANEOUS PEAK FLOW	916	Jun 23	2200	Jun 13	28400	Apr 12 1969
INSTANTANEOUS PEAK STAGE	7.6a	Apr 2	6.99	Jun 13	27.33	Apr 12 1969
INSTANTANEOUS LOW FLOW	51	Nov 8	51	Nov 8	.00b	Jul 13 1960
ANNUAL RUNOFF (AC-FT)	135700		171300		807900	
ANNUAL RUNOFF (CFSM)	.036		.045		.21	
ANNUAL RUNOFF (INCHES)	.48		.61		2.87	
10 PERCENT EXCEEDS	373		518		2510	
50 PERCENT EXCEEDS	116		133		652	
90 PERCENT EXCEEDS	88		91		105	

a From highwater mark, backwater from ice.
b Caused by regulation of powerplant upstream.
e Estimated.

RED RIVER OF THE NORTH BASIN

05079000 RED LAKE RIVER AT CROOKSTON, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1962, 1974-76, 1979 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT												
30...	1445	93	360	402	8.2	8.2	7.0	3.7	739	11.8	K19	170
DEC												
11...	1500	104	625	653	8.0	8.2	0.0	2.4	733	14.0	K5	K14
JAN												
29...	1615	73	625	516	7.3	7.7	0.0	2.0	739	--	K6	K13
MAR												
13...	1130	93	504	489	7.7	8.1	0.0	--	760	9.6	--	--
APR												
02...	1445	335	318	340	8.2	8.0	1.5	4.0	738	13.4	200	K10
JUN												
04...	0800	130	475	494	8.0	8.3	19.0	5.0	739	7.6	67	240
JUL												
17...	0900	576	501	490	8.7	8.5	28.0	2.3	728	7.6	69	140

DATE	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)
OCT											
30...	46	21	7.6	3.9	191	196	0	233	25	7.2	0.4
DEC											
11...	75	37	12	5.0	269	280	0	328	84	9.4	0.4
JAN											
29...	65	26	8.4	3.7	--	261	0	--	23	7.1	<0.1
MAR											
13...	59	24	10	3.7	230	--	0	281	19	9.4	<0.1
APR											
02...	41	15	5.4	3.9	128	132	0	156	39	5.8	0.2
JUN											
04...	55	25	11	5.4	177	183	0	216	63	12	0.2
JUL											
17...	63	26	8.2	4.3	210	214	<20	>207	49	10	0.2

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)
OCT											
30...	3.5	237	<0.01	<0.10	0.01	0.01	0.4	0.02	<0.01	<0.01	<0.01
DEC											
11...	10	417	<0.01	<0.10	0.05	0.04	1.4	0.05	0.05	0.02	<0.01
JAN											
29...	17	312	0.01	<0.10	0.17	0.17	1.0	0.03	0.02	0.01	0.01
MAR											
13...	15	280	<0.01	0.22	--	0.17	--	--	0.04	--	0.04
APR											
02...	7.7	203	<0.01	0.22	0.02	<0.01	0.8	0.05	<0.01	<0.01	<0.01
JUN											
04...	7.5	324	<0.01	<0.05	0.04	0.04	0.9	0.09	0.03	0.03	0.01
JUL											
17...	11	325	0.01	0.05	0.04	0.04	1.4	0.11	0.06	0.06	0.05

RED RIVER OF THE NORTH BASIN

05079000 RED LAKE RIVER AT CROOKSTON, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	SEDIMENT, SUSPENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)
OCT 30...	10	85	<10	1	51	<0.5	1.0	<1	<3	15	19
DEC 11...	44	80	--	--	--	--	--	--	--	--	--
JAN 29...	44	60	<10	1	79	<0.5	<1.0	<1	<3	2	15
MAR 13...	--	--	--	--	69	<0.5	<1.0	<5	<3	<10	13
APR 02...	4	100	<10	<1	44	<0.5	<1.0	<1	<3	1	55
JUN 04...	10	87	--	--	--	--	--	--	--	--	--
JUL 17...	12	94	<10	5	72	<0.5	<1.0	<1	<3	1	17

DATE	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)
OCT 30...	1	14	6	<0.1	<10	1	<1	<1.0	120	<6	12
DEC 11...	--	--	--	--	--	--	--	--	--	--	--
JAN 29...	<1	15	79	<0.1	<10	<1	<1	<1.0	150	<6	13
MAR 13...	<10	11	31	--	<10	<10	--	<1.0	140	<6	17
APR 02...	1	9	22	<0.1	<10	1	<1	<1.0	95	<6	14
JUN 04...	--	--	--	--	--	--	--	--	--	--	--
JUL 17...	<1	17	15	<0.1	<10	2	<2	<1.0	160	<6	5

RED RIVER OF THE NORTH BASIN

05082500 RED RIVER OF THE NORTH AT GRAND FORKS, ND

LOCATION.--Lat 47°55'38", long 97°01'34", in sec.2, T.151 N., R.50 W., Grand Forks County, Hydrologic Unit 09020301, on the right bank, 200 ft upstream from the DeMers Avenue bridge, 0.4 mi downstream from Red Lake River, and at mile 293.8.
DRAINAGE AREA.--30,100 mi^2, approximately, including 3,800 mi^2 in closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1882 to current year. Prior to January 1904 monthly discharge only, published in WSP 1308.
REVISED RECORDS.--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. WRD-ND-81-1: 1882, 1897 (M).
GAGE.--Water-stage recorder. Datum of gage is 779.00 ft above National Geodetic Vertical Datum of 1929. Oct. 1, 1983, to Sept. 30, 1986, datum of gage was 780.00 ft at same site. Apr. 14, 1965, to Sept. 30, 1983, water-stage recorder 1.9 mi downstream at a datum of 778.35 ft. Nov. 3, 1933, to Apr. 13, 1965, water-stage recorder 0.3 mi upstream at 778.35 ft datum. See WSP 1728 or 1913 for history of changes prior to Nov. 3, 1933.
REMARKS.--Records good.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	349	378	313	180	195	352	2090	1370	1760	2060	1550	625
2	383	377	270	185	207	371	2540	1500	1690	2130	1460	607
3	368	345	228	194	213	376	3180	1970	1800	2790	1470	592
4	380	337	200	200	229	379	3300	2480	1800	3600	1430	596
5	381	352	189	200	239	360	2830	2990	1720	4140	1400	618
6	360	337	189	200	239	342	2680	3720	1850	4570	1450	698
7	355	319	197	200	248	343	2450	4240	2160	4780	1360	718
8	352	252	221	193	253	350	2070	4120	2250	4850	1260	724
9	336	262	231	185	273	350	1770	4030	2170	4850	1200	710
10	341	256	236	185	291	352	1530	3940	2290	4720	1150	718
11	317	261	256	185	310	361	1350	3740	2290	4410	1130	818
12	323	323	263	185	326	367	1230	3530	2060	4020	1110	1150
13	297	306	271	185	351	367	1130	3260	2020	3600	1080	1400
14	302	323	262	185	351	373	1110	2980	2230	3350	1060	2010
15	321	341	265	180	351	395	1090	2900	2940	3190	1030	2600
16	315	326	254	180	350	427	1060	2800	2750	3020	1020	2870
17	323	304	233	185	354	462	1060	2600	2550	2910	956	2740
18	366	293	222	188	352	485	1050	2360	2170	2850	957	2620
19	329	292	223	192	350	505	1020	2170	1860	2770	988	2640
20	312	356	214	196	341	552	1030	2010	1730	2730	921	2340
21	392	454	197	215	326	625	1050	1890	1710	2500	787	2110
22	415	470	200	230	323	766	1100	1900	1760	2360	790	1840
23	364	337	179	223	326	972	1200	2790	1770	2250	834	1570
24	355	227	168	219	332	1240	1270	4100	1680	2180	824	1320
25	370	285	184	207	335	1520	1260	4090	1580	2120	799	1070
26	362	270	192	207	346	1640	1230	3190	1620	2070	771	1020
27	349	250	192	195	350	1660	1240	2640	1850	2020	763	998
28	370	275	178	192	350	1760	1200	2310	2040	1890	715	998
29	331	281	180	192	---	1840	1160	2060	2070	1770	624	962
30	373	296	183	190	---	1880	1330	1920	2070	1700	583	870
31	384	---	168	192	---	1920	---	1840	---	1650	613	---
TOTAL	10875	9485	6758	6045	8511	23692	47610	87440	60240	93850	32085	40552
MEAN	351	316	218	195	304	764	1587	2821	2008	3027	1035	1352
MAX	415	470	313	230	354	1920	3300	4240	2940	4850	1550	2870
MIN	297	227	168	180	195	342	1020	1370	1580	1650	583	592
AC-FT	21570	18810	13400	11990	16880	46990	94430	173400	119500	186200	63640	80430

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1904 - 1991, BY WATER YEAR (WY)

MEAN	1323	1151	926	790	756	2289	9147	4921	3850	3024	1536	1329
MAX	4290	5218	3073	1929	1869	10250	31480	36510	19340	25270	6564	4702
(WY)	1972	1972	1972	1951	1952	1966	1979	1950	1962	1975	1905	1985
MIN	12.1	30.5	17.8	18.8	2.87	42.1	954	373	151	88.8	30.6	20.3
(WY)	1937	1937	1937	1937	1937	1937	1938	1934	1934	1936	1934	1936

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1904 - 1991	
ANNUAL TOTAL	310538		427143			
ANNUAL MEAN	851		1170		2565	
HIGHEST ANNUAL MEAN					7580	1950
LOWEST ANNUAL MEAN					244	1934
HIGHEST DAILY MEAN	4880	Apr 4	4850	Jul 8	80900	Apr 23 1979
LOWEST DAILY MEAN	143	Jan 1	168	Dec 24	a1.8	Sep 2 1977
ANNUAL SEVEN-DAY MINIMUM	153	Jan 1	181	Dec 27	2.5	Feb 12 1937
INSTANTANEOUS PEAK FLOW			4870	Jul 8	b85000	Apr 10 1897
INSTANTANEOUS PEAK STAGE			17.63	Jul 8	c50.20	Apr 10 1897
ANNUAL RUNOFF (AC-FT)	616000		847200		1858000	
10 PERCENT EXCEEDS	1870		2790		5710	
50 PERCENT EXCEEDS	395		715		1280	
90 PERCENT EXCEEDS	207		200		255	

a Caused by unusual regulation during repair of dam at Grand Forks.
b From rating curve extended above 58,000 ft^3/s.
c Site and datum then in use.

RED RIVER OF THE NORTH BASIN

05082500 RED RIVER OF THE NORTH AT GRAND FORKS, ND--CONTINUED

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1949, 1956 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE AIR (DEG C) (00020)	TEMPER-ATURE WATER (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)
NOV												
20...	1505	377	640	--	6.0	1.5	--	--	--	--	--	--
DEC												
31...	1255	168	920	--	-15.0	0.0	--	--	--	--	--	--
JAN												
30...	1300	186	875	--	-18.0	0.0	--	--	--	--	--	--
FEB												
26...	1120	346	900	--	-3.5	0.5	--	--	--	--	--	--
MAR												
13...	1440	356	790	7.8	7.5	0.0	10.9	72	160	>1000	340	75
APR												
01...	1020	2060	460	--	5.0	1.5	--	--	--	--	--	--
04...	1205	3330	475	8.2	15.0	2.0	--	--	--	--	200	42
29...	1550	1170	560	--	13.5	12.5	--	--	--	--	--	--
MAY												
09...	1110	3870	660	--	17.0	13.5	--	--	--	--	--	--
30...	1305	1980	700	--	20.5	21.5	--	--	--	--	--	--
JUL												
01...	1210	2000	675	--	24.0	22.0	--	--	--	--	--	--
09...	1115	4830	400	--	20.0	22.0	--	--	--	--	--	--
AUG												
a01...	1220	1530	638	8.4	23.0	23.0	--	--	--	--	300	62
22...	1520	818	410	--	32.0	25.0	--	--	--	--	--	--
SEP												
03...	1520	581	640	--	24.0	24.5	--	--	--	--	--	--
16...	1540	2870	495	--	15.0	17.0	--	--	--	--	--	--

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM PERCENT (00932)	SODIUM AD-SORP-TION RATIO (00931)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE, FET-LAB (MG/L AS HCO3) (95440)	CAR-BONATE, FET-LAB (MG/L AS CO3) (95445)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
MAR												
13...	38	40	20	0.9	7.4	--	--	--	301	367	0	89
APR												
04...	22	16	15	0.5	6.1	180	0	150	--	--	--	63
AUG												
a01...	34	18	11	0.5	5.7	270	0	220	--	--	--	100

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)
MAR												
13...	32	0.20	17	475	483	0.65	457	0.580	0.010	0.590	0.290	1.3
APR												
04...	11	0.10	13	304	264	0.41	2730	--	--	--	--	--
AUG												
a01...	13	0.20	23	451	388	0.61	1860	--	--	--	--	--

RED RIVER OF THE NORTH BASIN

05082500 RED RIVER OF THE NORTH AT GRAND FORKS, ND--CONTINUED

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE) (01010)	BORON, DIS-SOLVED (UG/L AS B) (01020)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR) (01030)	COBALT, DIS-SOLVED (UG/L AS CO) (01035)	COPPER, DIS-SOLVED (UG/L AS CU) (01040)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)
MAR												
13...	0.100	0.090	1	82	<0.5	100	<1.0	<5	<3	<10	10	<10
APR												
04...	--	--	2	--	--	40	--	--	--	--	20	<1
AUG												
a01...	--	--	6	--	--	80	--	--	--	--	10	<1

DATE	LITHIUM DIS-SOLVED (UG/L AS LI) (01130)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	STRON-TIUM, DIS-SOLVED (UG/L AS SR) (01080)	VANA-DIUM, DIS-SOLVED (UG/L AS V) (01085)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)
MAR												
13...	33	42	<0.1	<10	<10	<1	<1.0	270	<6	10	8.8	0.3
APR												
04...	20	10	<0.1	2	--	<1	--	200	--	--	--	--
AUG												
a01...	30	10	0.1	2	--	<1	--	480	--	--	--	--

a Replicate sample also collected for quality-assurance purposes.

RED RIVER OF THE NORTH BASIN

05087500 MIDDLE RIVER AT ARGYLE, MN

LOCATION.--Lat 48°20'25", long 96°48'58", in NE¼NW¼ sec.15, T.156 N., R.48 W., Marshall County, Hydrologic Unit 09020309, on left bank 30 ft upstream of bridge on County Highway 4 in Argyle and 14 mi upstream from mouth.
DRAINAGE AREA.--265 mi^2.
PERIOD OF RECORD.--March to September 1945, October 1950 to September 1981, February 1982 to current year. Monthly discharge only for some periods, published in WSP 1728. October 1981 to January 1982, operated as a high-flow partial-record station.
GAGE.--Water-stage recorder. Datum of gage is 828.53 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 8, 1951, nonrecording gage and Nov. 8, 1951, to Sept. 18, 1952, water-stage recorder at site 800 ft downstream at datum 1.0 ft higher. Sept. 19, 1952, to June 28, 1982, recording gage at site 800 feet downstream at present datum. June 29, 1982, to Sept. 20, 1983, nonrecording gage at present site and datum.
REMARKS.--Records poor.
EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1950 reached a stage of 15.25 ft present datum, site then in use, from floodmarks, discharge, 2,790 ft^3/s.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.00	.28	.33	16	22	8.9	.31
2	.00	.00	.00	.00	.00	.00	.37	.19	12	26	8.3	.30
3	.00	.00	.00	.00	.00	.00	.33	.14	8.4	32	8.8	.30
4	.00	.00	.00	.00	.00	.00	.46	.18	6.1	33	8.2	.28
5	.00	.00	.00	.00	.00	.00	.31	.16	4.1	43	7.2	.27
6	.00	.00	.00	.00	.00	.00	.27	.12	2.7	59	12	.27
7	.00	.00	.00	.00	.02	.00	.24	.11	1.4	72	8.0	.28
8	.00	.00	.00	.00	.11	.00	.21	.10	.84	84	6.9	2.1
9	.00	.00	.00	.00	.09	.00	.18	.10	.53	81	5.6	1.0
10	.00	.00	.00	.00	.05	.00	.15	.10	.38	74	3.8	.47
11	.00	.00	.00	.00	.05	.00	.14	.11	.31	74	3.1	.35
12	.00	.00	.00	.00	.04	.00	.14	.11	.27	73	2.8	.33
13	.00	.00	.00	.00	.03	.00	.12	.13	.27	78	2.8	.30
14	.00	.00	.00	.00	.00	.00	.20	.09	.25	72	2.2	.30
15	.00	.00	.00	.00	.00	.09	.25	.15	.29	57	2.6	.29
16	.00	.00	.00	.00	.00	.03	.21	.14	.27	44	2.9	.67
17	.00	.00	.00	.00	.00	.04	.18	.13	.26	42	2.5	.27
18	.00	.00	.00	.00	.00	.09	.16	.13	.26	36	1.9	.27
19	.00	.00	.00	.00	.00	.09	.13	.11	.74	31	1.1	.24
20	.00	.00	.00	.00	.00	.13	.11	.10	2.4	33	1.1	.22
21	.00	.00	.00	.00	.00	.14	.10	.08	2.3	29	.42	.21
22	.00	.00	.00	.00	.00	.14	.11	.13	1.6	25	.35	.27
23	.00	.00	.00	.00	.00	.17	.10	.25	1.6	22	.57	.22
24	.00	.00	.00	.00	.00	.17	.10	.40	1.7	19	.36	.20
25	.00	.00	.00	.00	.00	.19	.10	1.2	2.2	18	.43	.19
26	.00	.00	.00	.00	.00	.23	.10	2.2	6.0	16	.38	.16
27	.00	.00	.00	.00	.00	.23	.14	9.6	3.5	15	.33	.14
28	.00	.00	.00	.00	.00	.21	.13	46	5.0	14	.31	.13
29	.00	.00	.00	.00	---	.20	.10	31	9.8	13	.31	.12
30	.00	.00	.00	.00	---	.21	.50	29	18	11	.31	.13
31	.00	---	.00	.00	---	.25	---	21	---	10	.31	---
TOTAL	0.00	0.00	0.00	0.00	0.39	2.61	5.92	143.59	109.47	1258	104.78	10.59
MEAN	.000	.000	.000	.000	.014	.084	.20	4.63	3.65	40.6	3.38	.35
MAX	.00	.00	.00	.00	.11	.25	.50	46	18	84	12	2.1
MIN	.00	.00	.00	.00	.00	.00	.10	.08	.25	10	.31	.12
AC-FT	.00	.00	.00	.00	.8	5.2	12	285	217	2500	208	21
CFSM	.00	.00	.00	.00	.00	.00	.00	.02	.01	.15	.01	.00
IN.	.00	.00	.00	.00	.00	.00	.00	.02	.02	.18	.01	.00

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 1991, BY WATER YEAR (WY)

MEAN	9.23	5.25	2.27	.98	.75	23.5	207	72.9	73.3	51.9	4.87	7.67
MAX	94.1	33.4	15.8	4.65	3.32	217	747	330	660	688	29.5	163
(WY)	1983	1957	1983	1983	1983	1983	1966	1970	1970	1975	1985	1957
MIN	.000	.000	.000	.000	.000	.000	.20	2.12	.37	.000	.000	.000
(WY)	1954	1954	1954	1953	1953	1954	1991	1981	1973	1961	1961	1952

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1945 - 1991	
ANNUAL TOTAL	993.18		1635.35			
ANNUAL MEAN	2.72		4.48		38.1a	
HIGHEST ANNUAL MEAN					112	1966
LOWEST ANNUAL MEAN					1.60	1977
HIGHEST DAILY MEAN	50	Apr 4	84	Jul 8	3790	Jul 4 1975
LOWEST DAILY MEAN	.00	Many days	.00	Many days	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Jan 1	.00	Oct 1	.00	Aug 18 1952
INSTANTANEOUS PEAK FLOW	60	Apr 4	87	Jul 8	4260	Jul 3 1975
INSTANTANEOUS PEAK STAGE	5.16b	Mar 19	5.00	Jul 12,13	16.59c	Jul 3 1975
ANNUAL RUNOFF (AC-FT)	1970		3240		27620	
ANNUAL RUNOFF (CFSM)	.010		.017		.14	
ANNUAL RUNOFF (INCHES)	.14		.23		1.96	
10 PERCENT EXCEEDS	9.0		12		75	
50 PERCENT EXCEEDS	.00		.11		1.8	
90 PERCENT EXCEEDS	.00		.00		.00	

a Median at annual mean discharge is 25 ft^3/s.
b Backwater from ice.
c Present datum.

RED RIVER OF THE NORTH BASIN

05092000 RED RIVER OF THE NORTH AT DRAYTON, ND

LOCATION.--Lat 48°34'20", long 97°08'50", in SE¼SE¼SE¼ sec.24, T.159 N., R.51 W., Pembina County, Hydrologi Unit 09020311, on downstream side of bridge on North Dakota State Highway 11, at the North Dakota-Minnesota border, 1.5 mi northeast of Drayton, and at mile 206.7.
DRAINAGE AREA.--34,800 mi^2, approximately, includes 3,800 mi^2 in closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1936 to June 1937, April 1941 to current year (fragmentary prior to April 1949).
REVISED RECORDS.--WSP 1388: 1949-50. WSP 1728: Drainage area.
GAGE.--Water-stage recorder and concrete control. Datum of gage is 755.00 ft above National Geodetic Vertical Datum of 1929 (Minnesota highway benchmark). Prior to Nov. 30, 1954, nonrecording gage at site 1.5 mi upstream at datum 1.59 ft higher.
REMARKS.--Records good. Some regulation by reservoirs on tributaries.
EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1897 reached a stage of about 41 ft, at site and datum in use prior to Nov. 30, 1954.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	322	308	e315	e166	e202	e322	2390	1300	2180	2140	1780	619
2	335	335	e315	e161	e197	e349	2620	1360	2070	2150	1690	608
3	315	362	e315	e156	e197	e376	3230	1430	2030	2180	1600	625
4	335	398	e315	e156	e191	e376	4820	1630	1960	2260	1560	643
5	348	376	e302	e161	e186	e362	4150	2000	1980	2860	1510	608
6	322	335	e270	e166	e197	e328	3420	2440	1920	3540	1530	608
7	348	322	e252	e166	e213	e322	3120	2960	1880	4040	1490	592
8	348	328	e247	e171	e224	e322	2900	3540	1920	4470	1480	651
9	335	335	e235	e181	e230	e322	2590	3860	2100	4720	1450	777
10	335	295	e235	e181	e241	e322	2270	3910	e2300	4890	1360	824
11	295	283	e241	e181	e252	e335	1960	3840	e2220	4940	1260	814
12	302	283	e247	e176	e264	e335	1690	3690	e2340	e4890	1180	795
13	302	283	e252	e171	e276	e335	1490	3540	e2300	e4760	1130	843
14	295	295	e258	e166	e295	e335	1350	3340	2190	e4450	1090	1030
15	295	322	e264	e166	e348	e335	1260	3120	e2040	3940	1070	1350
16	283	308	e270	e166	e376	e342	1180	2930	e2240	e3640	1040	2000
17	264	308	e270	e166	e405	e342	1150	2810	e2940	e3390	1000	2630
18	308	342	e264	e166	e412	e355	1090	2680	e2760	e3230	960	2860
19	308	355	e258	e176	e412	e390	1100	2500	2560	3060	901	2840
20	302	e369	e252	e186	e390	e427	1120	2300	e2180	3020	843	2800
21	315	e369	e247	e213	e348	e503	1100	2150	e1860	2950	795	2620
22	295	e376	e241	e235	e322	e575	1080	2040	e1740	2810	795	2440
23	295	e434	e230	e230	e315	e643	1090	1990	e1720	2660	777	2300
24	328	e369	e213	e224	e315	e731	1140	2120	e1760	2490	777	2100
25	342	e362	e213	e224	e322	901	1210	2950	e1780	2390	777	1810
26	322	e355	e202	e230	e328	1170	1270	3890	e1680	2300	768	1580
27	302	e328	e191	e218	e328	1490	1290	3770	1580	2230	777	1380
28	355	e322	e171	e218	e322	1770	1270	3280	1610	2180	768	1200
29	315	e322	e171	e207	---	1980	1210	2900	1810	2100	713	1130
30	322	e315	e176	e207	---	2120	1250	2560	2020	1990	686	1070
31	328	---	e171	e207	---	2270	---	2300	---	1870	660	---
TOTAL	9816	10094	7603	5798	8108	21085	56810	85130	61670	98540	34217	42147
MEAN	317	336	245	187	290	680	1894	2746	2056	3179	1104	1405
MAX	355	434	315	235	412	2270	4820	3910	2940	4940	1780	2860
MIN	264	283	171	156	186	322	1080	1300	1580	1870	660	592
AC-FT	19470	20020	15080	11500	16080	41820	112700	168900	122300	195500	67870	83600

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1949 - 1991, BY WATER YEAR (WY)

MEAN	1721	1489	1183	1041	1012	2480	13710	8379	5270	4204	1951	1617
MAX	4463	5653	3072	2065	1876	9329	38390	58890	23420	28240	7247	5392
(WY)	1972	1972	1972	1966	1952	1983	1966	1950	1962	1975	1985	1957
MIN	317	277	149	174	201	280	1275	938	676	348	243	329
(WY)	1991	1977	1977	1990	1977	1962	1981	1977	1977	1988	1977	1988

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1949 - 1991	
ANNUAL TOTAL	325368		441018			
ANNUAL MEAN	891		1208		3685	
HIGHEST ANNUAL MEAN					10510	1950
LOWEST ANNUAL MEAN					536	1977
HIGHEST DAILY MEAN	5000	Apr 7	4940	Jul 11	91000	Apr 28 1979
LOWEST DAILY MEAN	125	Jan 1	156	Jan 3	110	Dec 23 1989
ANNUAL SEVEN-DAY MINIMUM	129	Jan 1	162	Jan 1	118	Dec 28 1989
INSTANTANEOUS PEAK FLOW			4940	Jul 11	92900	Apr 28 1979
INSTANTANEOUS PEAK STAGE			13.26	Jul 11	43.66	Apr 28 1979
INSTANTANEOUS LOW FLOW					7.7	Oct 16 1936
ANNUAL RUNOFF (AC-FT)	645400		874800		2670000	
10 PERCENT EXCEEDS	1960		2910		7850	
50 PERCENT EXCEEDS	375		660		1650	
90 PERCENT EXCEEDS	220		213		440	

e Estimated.

RED RIVER OF THE NORTH BASIN

05092000 RED RIVER OF THE NORTH AT DRAYTON, ND--CONTINUED

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE AIR (DEG C) (00020)	TEMPER-ATURE WATER (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)
OCT												
15...	1635	275	1050	--	12.5	7.5	--	--	--	--	--	--
NOV												
19...	1515	341	--	--	7.0	2.5	--	--	--	--	--	--
JAN												
17...	1525	168	1100	--	-3.0	0.0	--	--	--	--	--	--
MAR												
14...	1105	336	1010	7.8	0.0	0.0	11.9	80	<2	K250	380	82
APR												
08...	1340	2900	610	8.0	11.5	6.5	--	--	--	--	220	48
MAY												
10...	1740	4120	600	--	25.5	13.0	--	--	--	--	--	--
JUN												
14...	1320	2180	702	--	24.0	24.0	--	--	--	--	--	--
JUL												
10...	1550	5100	395	--	26.0	22.0	--	--	--	--	--	--
SEP												
10...	1225	827	840	8.6	14.5	20.0	--	--	--	--	290	59

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM PERCENT (00932)	SODIUM AD-SORP-TION RATIO (00931)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE, FET-LAB (MG/L AS HCO3) (95440)	CAR-BONATE, FET-LAB (MG/L AS CO3) (95445)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
MAR												
14...	42	70	28	2	8.2	--	--	--	320	390	0	100
APR												
08...	24	37	26	1	6.7	190	0	160	--	--	--	86
SEP												
10...	35	59	30	2	12	270	7	230	--	--	--	120

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)
MAR												
14...	83	0.20	16	635	598	0.86	576	<0.010	0.770	0.230	1.1	0.110
APR												
08...	45	0.10	12	380	352	0.52	2980	--	--	--	--	--
SEP												
10...	70	0.20	16	537	509	0.73	1200	--	--	--	--	--

05092000 RED RIVER OF THE NORTH AT DRAYTON, ND--CONTINUED

DATE	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P) (00671)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BORON, DISSOLVED (UG/L AS B) (01020)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)
MAR												
14...	0.110	1	86	<0.5	140	<1.0	<5	<3	<10	11	10	43
APR												
08...	--	2	--	--	70	--	--	--	--	90	<1	30
SEP												
10...	--	8	--	--	150	--	--	--	--	20	<1	40

DATE	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)	CARBON, ORGANIC DISSOLVED (MG/L AS C) (00681)	ORGANIC SUSPENDED TOTAL (MG/L AS C) (00689)
MAR											
14...	45	<0.1	<10	<10	<1	1.0	360	<6	9	9.1	0.3
APR											
08...	<10	<0.1	2	--	<1	--	270	--	--	--	--
SEP											
10...	10	<0.1	1	--	<1	--	390	--	--	--	--

RED RIVER OF THE NORTH BASIN

05094000 SOUTH BRANCH TWO RIVERS AT LAKE BRONSON, MN

LOCATION.--Lat 48°43'50", long 96°39'50", in SW¼SW¼ sec.30, T.161 N., R.46 W., Kittson County, Hydrologic Unit 09020312, on left bank 70 ft upstream from culvert on U.S. Highway 59 at Lake Bronson and 3.4 mi downstream from dam at outlet of Bronson Lake.
DRAINAGE AREA.--444 mi^2.
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 September 1981, April 1985 to current year. Monthly discharge only for some periods, published in WSP 1308. October 1981 to March 1985, annual maximums only. Published as South Fork Two Rivers at Bronson prior to 1941.
REVISED RECORDS.--WSP 1308: 1929(M), 1931(M), 1936(M), 1944(M), 1947(M).
GAGE.--Water-stage recorder. Datum of gage is 928.53 ft above National Geodetic Vertical Datum of 1929 (Minnesota Department of Transportation bench mark). 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.
REMARKS.--Records good except those for estimated daily discharges, which are poor. Flow partly regulated since 1937 by Bronson Lake, usable capacity, 3,700 acre-ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.17	.52	e.44	e.36	e.34	e11	e1.8	.30	8.1	236	5.9	12
2	.17	.52	e.44	e.36	e.34	e11	e1.5	.16	12	611	6.2	10
3	.19	.45	e.44	e.36	e.34	e10	e1.3	.22	18	765	6.5	8.5
4	.18	.45	e.44	e.36	e.34	e10	e1.1	.65	18	814	6.7	5.2
5	.20	.39	e.44	e.36	e.34	e10	e.90	.22	16	803	7.2	3.2
6	.28	.40	e.44	e.36	e.34	e10	e.70	.20	16	645	9.4	1.1
7	.28	.45	e.44	e.36	e.34	e12	e.60	.19	15	955	8.9	.25
8	.28	.45	e.44	e.36	e.34	e14	.52	.15	12	926	8.6	1.3
9	.28	.45	e.44	e.36	e.34	e13	.39	.14	14	1010	8.3	7.5
10	.33	.45	e.44	e.36	e.34	e13	.34	.14	14	971	8.0	27
11	.29	.45	e.44	e.34	e.34	e12	.23	.14	13	890	7.8	5.4
12	.32	.47	e.44	e.34	e.36	e12	.19	.19	3.5	993	7.7	63
13	.39	.48	e.42	e.34	e.38	e11	.21	.28	.52	1920	7.9	130
14	.45	.53	e.42	e.34	e.40	e11	.58	.23	.20	1430	6.5	318
15	.45	.59	e.42	e.34	e.42	e11	.55	.22	.38	1270	6.6	169
16	.45	.59	e.42	e.34	e.45	e13	.31	.20	.26	802	25	112
17	.45	.54	e.40	e.34	e.50	e15	.35	.16	24	303	160	640
18	.47	.52	e.40	e.34	e.55	e20	.29	.16	29	211	81	957
19	.52	e.50	e.40	e.34	e.65	e16	.28	.22	26	149	60	783
20	.51	e.50	e.40	e.34	e.85	e14	.21	.39	23	148	52	647
21	.45	e.50	e.40	e.34	e1.0	e13	.19	.63	20	127	60	465
22	.51	e.50	e.40	e.34	e10	e11	.25	1.4	16	94	69	337
23	.52	e.50	e.40	e.34	e10	e9.0	.34	2.3	14	8.6	44	369
24	.52	e.50	e.38	e.34	e9.5	e7.0	.21	1.5	8.7	103	43	325
25	.52	e.50	e.38	e.34	e9.5	e6.0	.19	1.5	11	36	75	422
26	.52	e.48	e.38	e.34	e9.0	e5.0	.18	1.7	8.9	28	23	276
27	.54	e.48	e.38	e.34	e12	e4.0	.22	2.8	6.1	29	8.4	152
28	.59	e.46	e.38	e.34	e12	e3.5	.27	4.3	7.6	24	10	126
29	.54	e.46	e.38	e.34	---	e3.0	1.1	3.6	8.1	18	8.9	70
30	.52	e.45	e.38	e.34	---	e2.5	.88	3.0	39	18	3.1	74
31	.52	---	e.38	e.34	---	e2.2	---	3.2	---	13	14	---
TOTAL	12.41	14.53	12.80	10.74	81.30	315.2	16.18	30.49	402.36	16350.6	848.6	6516.45
MEAN	.40	.48	.41	.35	2.90	10.2	.54	.98	13.4	527	27.4	217
MAX	.59	.59	.44	.36	12	20	1.8	4.3	39	1920	160	957
MIN	.17	.39	.38	.34	.34	2.2	.18	.14	.20	8.6	3.1	.25
AC-FT	25	29	25	21	161	625	32	60	798	32430	1680	12930
CFSM	.00	.00	.00	.00	.01	.02	.00	.00	.03	1.19	.06	.49
IN.	.00	.00	.00	.00	.01	.03	.00	.00	.03	1.37	.07	.55

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1929 - 1991, BY WATER YEAR (WY)

MEAN	17.3	9.90	3.94	2.59	3.04	54.9	395	196	168	104	24.1	33.8
MAX	153	87.5	16.8	10.8	23.6	362	1977	1338	1336	1136	360	525
(WY)	1958	1957	1986	1966	1981	1986	1966	1970	1970	1956	1985	1957
MIN	.40	.38	.13	.12	.12	.66	.54	.98	1.43	.44	.089	.000
(WY)	1991	1990	1987	1987	1987	1934	1991	1991	1980	1988	1988	1937

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1929 - 1991	
ANNUAL TOTAL	7008.71		24611.66			
ANNUAL MEAN	19.2		67.4		84.3a	
HIGHEST ANNUAL MEAN					312	1966
LOWEST ANNUAL MEAN					2.89	1934
HIGHEST DAILY MEAN	650	Apr 1	1920	Jul 13	5290	Apr 5 1966
LOWEST DAILY MEAN	.05	Sep 15	.14	May 9	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.06	Sep 12	.16	May 6	.00	Aug 2 1937
INSTANTANEOUS PEAK FLOW	784	Apr 1	2160	Jul 13	5410	Apr 5 1966
INSTANTANEOUS PEAK STAGE	9.14b	Mar 16	11.35	Jul 13	18.23	Apr 5 1966
INSTANTANEOUS LOW FLOW	.04	Sep 17	.12	Jun 16		
ANNUAL RUNOFF (AC-FT)	13900		48820		61050	
ANNUAL RUNOFF (CFSM)	.043		.15		.19	
ANNUAL RUNOFF (INCHES)	.59		2.06		2.58	
10 PERCENT EXCEEDS	35		126		206	
50 PERCENT EXCEEDS	.50		.58		4.2	
90 PERCENT EXCEEDS	.20		.28		.80	

a Median of annual mean discharges is 53 ft^3/s.
b From highwater mark, backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER OF THE NORTH AT EMERSON, MANITOBA
(National stream-quality accounting network station)
(International gaging station)

LOCATION.--Lat 49°00'30", long 97°12'40", in sec.2, T.1, R.2 E., Hydrologic Unit 09020311, on right bank 1,500 ft downstream from Canadian National Railway bridge in Emerson, 0.8 mi downstream from international boundary, 3.6 mi downstream from Pembina River, and at mile 154.3.
DRAINAGE AREA.--40,200 mi^2, approximately, includes 3,800 mi^2 in closed basins.

WATER-DISCHARGE RECORDS

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 Geodetic Survey of Canada Datum of 1929. See WSP 1728 or 1913 for history of changes prior to Apr. 10, 1953.
COOPERATION.--This station is one of the international gaging stations maintained by Canada under agreement with the United States. Records provided by Water Survey of Canada.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	313	301	e282	e195	e184	e309	e2410	1360	2600	2150	2140	713
2	305	297	e279	e193	e183	e317	e2620	1410	2490	2390	2010	660
3	302	293	e278	e190	e180	e320	e3080	1470	2440	2720	1890	629
4	300	e299	e280	e188	e179	e320	e4100	1600	2380	3110	1770	614
5	298	e311	e281	e186	e177	e327	e4980	1770	2270	3470	1680	629
6	314	e319	e279	e184	e176	e338	4630	2060	2200	4030	1660	618
7	317	e312	e273	e181	e180	e349	3920	2450	2130	4590	1650	597
8	320	e299	e261	e180	e189	e351	3390	2920	2060	5010	1620	604
9	324	e308	e248	e181	e202	e343	2980	3420	2090	5330	1610	667
10	318	e306	e238	e180	e214	e340	2670	3780	2180	5540	1600	710
11	315	e301	e229	e181	e225	e339	2370	3880	2260	5650	1540	763
12	304	e302	e223	e181	e232	e339	2090	3880	2300	5690	1440	791
13	288	e303	e219	e181	e234	e339	1850	3810	2320	5610	1360	784
14	289	e313	e218	e180	e241	e335	1670	3640	2330	5580	1300	798
15	285	e326	e219	e177	e249	e334	1520	3440	2280	5580	1250	915
16	284	e321	e219	e175	e253	e334	1400	3290	2240	5540	1220	1320
17	287	e323	e221	e172	e261	e334	1310	3190	2470	5370	1180	1830
18	275	e318	e220	e167	e272	e339	1250	3010	3000	4980	1140	2280
19	272	e325	e218	e164	e285	e349	1210	2850	3030	4480	1120	2780
20	286	e350	e218	e162	e297	e371	1190	2680	2900	4100	1100	3200
21	288	e388	e218	e161	e306	e406	1170	2490	2670	3780	1030	3350
22	288	e374	e216	e160	e311	e459	1150	2380	2430	3600	982	3340
23	298	e322	e215	e156	e321	e533	1140	2340	2230	3410	957	3190
24	290	e261	e213	e160	e316	e590	1150	2300	2090	3200	936	2980
25	289	e292	e212	e172	e309	e678	1190	2340	2040	2980	911	2740
26	306	e325	e209	e176	e303	e791	1240	2870	2020	2800	879	2490
27	310	e340	e207	e178	e299	e971	1290	3570	1960	2690	869	2260
28	290	e327	e204	e178	e298	e1310	1320	3740	1890	2580	869	1970
29	297	e296	e202	e181	---	e1700	1310	3510	1900	2490	851	1670
30	308	e285	e199	e185	---	e2020	1300	3170	1970	2380	809	1460
31	297	---	e197	e185	---	e2240	---	2840	---	2270	763	---
TOTAL	9257	9437	7195	5490	6876	18425	62900	87460	69170	123100	40136	47352
MEAN	299	315	232	177	246	594	2097	2821	2306	3971	1295	1578
MAX	324	388	282	195	321	2240	4980	3880	3030	5690	2140	3350
MIN	272	261	197	156	176	309	1140	1360	1890	2150	763	597
AC-FT	18360	18720	14270	10890	13640	36550	124800	173500	137200	244200	79610	93920

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1912 - 1991, BY WATER YEAR (WY)

MEAN	1434	1279	940	779	739	1959	12490	8407	4924	3734	1707	1454
MAX	4533	5163	2760	2053	1914	9361	45820	72820	25430	28020	7342	6388
(WY)	1986	1972	1966	1951	1952	1983	1966	1950	1962	1975	1985	1957
MIN	28.6	23.7	33.3	7.05	1.21	2.25	1282	663	196	121	46.6	23.6
(WY)	1937	1937	1937	1937	1937	1937	1938	1934	1934	1936	1934	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1912 - 1991	
ANNUAL TOTAL	359186		486798			
ANNUAL MEAN	984		1334		3328	
HIGHEST ANNUAL MEAN					12100	1950
LOWEST ANNUAL MEAN					333	1934
HIGHEST DAILY MEAN	5470	Apr 10	5690	Jul 12	94400	May 13 1950
LOWEST DAILY MEAN	138	Jan 2	156	Jan 23	.90	Feb 6 1937
ANNUAL SEVEN-DAY MINIMUM	151	Jan 1	161	Jan 18	.97	Feb 4 1937
INSTANTANEOUS PEAK FLOW			5690	Jul 12	95500	May 13 1950
INSTANTANEOUS PEAK STAGE			756.15	Jul 12	791.19	May 1 1979
INSTANTANEOUS LOW FLOW					.90	Feb 6 1937
ANNUAL RUNOFF (AC-FT)	712400		965600		2411000	
10 PERCENT EXCEEDS	2310		3310		7240	
50 PERCENT EXCEEDS	378		667		1370	
90 PERCENT EXCEEDS	214		190		248	

e Estimated.

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER AT EMERSON, MANITOBA--CONTINUED
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.
PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1977 to current year.
WATER TEMPERATURE: October 1977 to current year.
REMARKS.--Records of daily mean values of water temperature and specific conductance are furnished by Water Survey of Canada.
EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: Maximum daily mean, 2,180 microsiemens, Dec. 8, 1989; minimum daily mean, 259 microsiemens, Apr. 14, 1989.
WATER TEMPERATURES: Maximum daily mean, 26.7C, Aug. 16, 1988; minimum daily mean, 0.0C, on many days during winter months.
EXTREMES FOR CURRENT YEAR.--
SPECIFIC CONDUCTANCE: Maximum daily mean, 1,650 microsiemens, Feb. 21; minimum daily mean, 501 microsiemens, Apr. 5.
WATER TEMPERATURES: Maximum daily mean, 26.2C, Aug. 14; minimum daily mean, 0.1C, Jan. 14, 15, 17, and 18.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DISCHARGE, IN CUBIC FEET PER SECOND (00060)	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE AIR (DEG C) (00020)	TEMPERATURE WATER (DEG C) (00010)	TURBIDITY (NTU) (00076)	OXYGEN, DISSOLVED (MG/L) (00300)	OXYGEN, DISSOLVED (PERCENT SATURATION) (00301)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 30...	1230	--	310	1020	--	9.5	5.5	--	--	--	--	--
NOV a01...	1100	301	--	935	8.7	11.0	6.5	24	13.2	109	K4	K8
DEC 11...	1015	229	--	1230	8.1	3.0	0.5	8.8	10.3	72	K4	K33
JAN 17...	1210	--	172	1180	--	--	0.0	--	--	--	--	--
MAR 14...	1450	--	337	940	7.8	5.5	0.0	4.0	11.3	76	<2	K20
APR 09...	1245	--	2980	667	8.0	8.0	4.0	130	12.4	94	K10	K100
MAY 29...	1100	3510	--	753	7.9	29.0	22.0	22	7.8	90	230	460
SEP 06...	1200	--	618	850	8.4	15.0	17.5	65	9.0	94	--	--

DATE	HARDNESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM, DISSOLVED (MG/L AS NA) (00930)	SODIUM PERCENT (00932)	SODIUM ADSORPTION RATIO (00931)	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	ALKALINITY LAB (MG/L AS CACO3) (90410)	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CARBONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	SULFATE DISSOLVED (MG/L AS SO4) (00945)
NOV a01...	280	55	34	89	40	2	9.1	222	210	228	14	100
DEC 11...	370	74	46	110	38	2	17	298	324	361	17	140
MAR 14...	380	82	42	61	25	1	8.1	324	326	398	0	110
APR 09...	200	46	21	34	26	1	7.3	156	--	--	--	73
MAY 29...	280	63	30	45	25	1	8.4	201	--	--	--	110
SEP 06...	330	68	38	62	29	1	8.1	239	216	234	14	120

DATE	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SILICA, DISSOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L) (70301)	SOLIDS, DISSOLVED (TONS PER AC-FT) (70303)	SOLIDS, DISSOLVED (TONS PER DAY) (70302)	NITROGEN, NITRATE DISSOLVED (MG/L AS N) (00618)	NITROGEN, NITRITE TOTAL (MG/L AS N) (00615)	NITROGEN, NITRITE DISSOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N) (00631)
NOV a01...	100	0.30	8.1	543	522	0.74	441	--	0.030	<0.010	<0.100	<0.100
DEC 11...	140	0.30	5.9	720	730	0.98	445	0.190	0.010	0.010	0.200	0.200
MAR 14...	66	0.20	16	589	586	0.80	536	--	0.010	<0.010	0.870	0.840
APR 09...	43	0.20	14	356	336	0.48	2860	0.390	0.130	0.040	0.430	0.430
MAY 29...	52	0.20	12	453	445	0.62	4290	0.670	0.210	0.010	0.590	0.680
SEP 06...	71	0.30	18	532	516	0.72	888	0.046	<0.010	0.010	<0.050	0.056

a Replicate sample also collected for quality-assurance purposes.

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER AT EMERSON, MANITOBA--CONTINUED
(National stream-quality accounting network station)

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOSPHORUS TOTAL (MG/L AS P) (00665)	PHOSPHORUS DISSOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P) (00671)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BORON, DISSOLVED (UG/L AS B) (01020)
NOV												
a01...	0.020	0.010	1.0	0.180	0.120	0.160	0.100	20	4	62	<0.5	--
DEC												
11...	0.190	0.190	1.3	0.440	0.380	0.430	0.350	--	--	--	--	--
MAR												
14...	0.220	0.180	0.90	0.130	0.110	0.120	0.110	<10	<1	86	<0.5	130
APR												
09...	0.170	0.080	0.90	0.420	0.160	0.370	0.070	420	2	46	<0.5	--
MAY												
29...	0.140	0.120	1.2	0.520	0.130	0.280	0.120	--	--	--	--	--
SEP												
06...	0.020	<0.010	0.90	0.280	0.130	0.100	0.100	100	6	74	<0.5	--

DATE	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY TOTAL RECOVERABLE (UG/L AS HG) (71900)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)
NOV											
a01...	<1.0	<1	<3	10	15	<1	47	11	<0.10	<0.1	<10
MAR											
14...	<1.0	<1	<3	1	7	<1	42	43	--	<0.1	<10
APR											
09...	<1.0	2	<3	17	640	6	24	34	--	0.3	<10
SEP											
06...	1.0	<1	<3	16	160	<1	49	17	--	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)	CARBON, ORGANIC DISSOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUSPENDED TOTAL (MG/L AS C) (00689)	SEDIMENT, SUSPENDED (MG/L) (80154)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV											
a01...	5	<1	<1.0	320	<6	6	--	--	51	41	74
DEC											
11...	--	--	--	--	--	--	--	--	45	28	70
MAR											
14...	1	<1	<1.0	350	<6	6	9.3	0.4	34	31	22
APR											
09...	11	<1	<1.0	210	<6	24	--	--	500	4020	95
MAY											
29...	--	--	--	--	--	--	--	--	726	6880	97
SEP											
06...	4	<1	<1.0	350	9	17	--	--	235	392	87

a Replicate sample also collected for quality-assurance purposes.

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER AT EMERSON, MANITOBA--CONTINUED
(National stream-quality accounting network station)

SPECIFIC CONDUCTANCE, MICROSIEMENS/CM AT 25 DEGREES CENTIGRADE, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	994	960	1180	1290	954	996	967	868	723	651	720	798
2	996	963	1100	1280	949	1010	831	861	757	630	713	794
3	1000	957	1020	1270	946	1110	688	871	774	649	732	798
4	1000	956	1000	1250	948	1140	560	858	788	696	752	780
5	986	908	1080	1240	951	1010	501	908	789	705	763	784
6	973	882	1110	1250	954	1040	581	985	842	687	787	801
7	963	944	1230	1270	964	997	580	1000	882	670	810	796
8	959	939	1370	1270	953	974	575	1010	912	657	788	775
9	953	1010	1470	1280	937	915	593	1040	905	655	764	749
10	942	1050	1280	1260	934	947	622	1060	879	612	760	745
11	940	995	1160	1210	925	958	652	1070	791	631	762	761
12	936	922	1090	1180	925	941	666	994	795	667	773	804
13	934	918	1020	1180	925	914	724	852	772	647	800	812
14	932	936	1000	1110	924	913	728	832	752	636	796	810
15	929	944	1050	1100	920	955	753	851	718	603	843	808
16	925	906	1080	1080	918	959	772	855	726	582	881	747
17	960	860	1160	1070	857	941	806	877	756	597	902	759
18	1090	850	1160	1070	983	946	819	895	723	624	922	784
19	1080	861	1180	1070	1250	966	822	897	629	656	893	611
20	1040	818	1220	1070	1360	1100	853	891	668	666	845	611
21	1030	1100	1240	1070	1650	1040	899	884	651	675	812	625
22	997	1300	1260	1070	1570	995	932	875	629	680	798	613
23	970	1350	1240	1060	1470	962	967	894	635	704	800	619
24	989	1360	1220	1050	1340	964	967	899	649	715	807	614
25	1080	1380	1240	1030	1150	961	947	864	672	720	814	640
26	1140	1410	1260	1030	1110	1050	936	831	647	727	839	680
27	1110	1530	1340	1020	1040	1140	925	856	622	732	810	689
28	987	1510	1360	1000	1000	1230	931	847	624	740	807	709
29	971	1320	1360	980	---	1110	928	832	625	744	799	736
30	957	1250	1370	966	---	1010	931	754	629	745	811	779
31	970	---	1370	961	---	1080	---	727	---	743	803	---
MEAN	991	1070	1200	1130	1060	1010	782	895	732	672	803	734

WATER TEMPERATURE, DEGREES CELSIUS, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10.6	5.3	1.8	.3	.9	.8	.7	11.0	24.3	22.1	23.7	23.0
2	10.5	5.2	1.7	.2	1.0	.8	1.2	10.1	23.9	21.7	23.2	22.7
3	10.5	4.1	1.6	.4	.9	.8	1.9	8.9	23.9	20.8	22.7	21.9
4	9.7	2.8	1.6	.4	.7	.8	1.8	8.4	24.3	21.2	22.7	20.8
5	9.1	1.1	1.6	.3	.7	.7	2.6	8.4	24.4	21.5	22.9	20.5
6	8.9	.5	1.5	.3	.7	.8	4.9	8.4	24.4	22.1	22.4	21.3
7	8.5	.1	1.6	.2	.8	.8	6.6	8.8	24.4	22.4	22.7	21.3
8	8.4	1.2	1.7	.2	.8	.7	7.2	9.9	24.3	22.5	23.4	21.3
9	8.1	2.3	1.4	.3	.7	.7	7.5	11.8	24.2	23.2	24.2	20.9
10	7.9	2.2	1.0	.3	.7	.7	7.8	14.0	25.0	23.6	24.8	19.8
11	7.8	2.3	1.0	.3	.8	.8	8.9	16.1	25.4	23.9	25.3	19.3
12	7.6	2.1	1.0	.4	.8	.8	9.0	17.5	24.6	23.8	26.0	19.1
13	7.6	2.2	1.0	.2	.8	.8	8.9	19.2	24.1	23.9	26.1	19.8
14	7.4	2.2	.9	.1	.8	.9	8.4	19.5	24.1	24.2	26.2	20.6
15	7.5	2.2	1.0	.1	.8	.7	8.2	18.7	24.5	24.5	26.0	20.5
16	7.0	2.1	1.0	.2	.9	.8	8.8	17.6	24.0	25.6	25.9	19.6
17	6.0	2.1	1.3	.1	.7	.8	9.6	16.9	24.0	26.1	24.6	18.6
18	5.2	1.9	1.0	.1	.9	.8	10.3	15.5	23.9	26.1	23.8	18.0
19	4.3	2.0	.9	.3	.7	.9	9.8	15.3	23.4	26.0	23.4	15.6
20	4.4	2.1	.7	.3	.8	.9	9.0	16.8	23.9	25.9	23.4	15.4
21	4.7	2.2	.8	.4	.8	.9	11.2	17.7	23.5	26.0	24.0	14.7
22	4.6	1.7	.8	.9	.7	.8	11.2	22.2	23.2	25.9	24.7	14.3
23	4.5	1.7	.7	.9	.7	.7	9.6	22.9	22.8	25.6	24.8	13.8
24	4.9	1.6	.6	.8	.7	.7	9.3	23.1	22.7	24.9	24.7	13.8
25	4.7	1.7	.5	.8	.8	.7	11.7	23.2	22.8	24.6	24.5	13.7
26	5.0	1.8	.5	.9	.8	.7	14.4	23.8	23.3	24.4	25.3	12.8
27	5.7	1.6	.4	.9	.8	.7	14.6	24.0	24.0	24.0	25.3	12.9
28	4.9	1.7	.3	.9	.9	.7	13.2	24.1	24.0	23.7	25.9	13.8
29	4.6	1.7	.3	1.0	---	.6	13.1	24.5	23.1	23.5	26.0	13.6
30	4.5	1.7	.4	.9	---	.7	13.7	24.3	22.4	23.9	25.4	13.1
31	4.5	---	.3	.9	---	.7	---	24.4	---	23.5	23.9	---
MEAN	6.8	2.1	1.0	.5	.8	.8	8.5	17.0	23.9	23.9	24.4	17.9

RED RIVER OF THE NORTH BASIN

05104500 ROSEAU RIVER BELOW SOUTH FORK NEAR MALUNG, MN

LOCATION.--Lat 48°47'30", long 95°44'40", in NW¼SW¼ sec.6, T.161 N., R.39 W., Roseau County, Hydrologic Unit 09020314, on left bank 0.3 mi downstream from South Fork and 1.5 mi northwest of Malung.
DRAINAGE AREA.--573 mi^2.
PERIOD OF RECORD.--October 1946 to current year.
REVISED RECORDS.--WSP 2113: 1948, 1950, 1951, 1956(M), 1957(M), 1962(M).
GAGE.--Water-stage recorder and concrete control. Datum of gage is 1,029.67 ft, adjustment of 1912.
REMARKS.--Records poor. Some flow bypasses the gaging station through a natural overflow channel 0.8 mi upstream and returns to river 0.5 mi downstream. Overflow begins at stage of about 13.0 ft, discharge, 1,800 ft^3/s. These records include any flow in the overflow channel.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.02	.06	.20	.20	.15	.07	2.4	8.3	30	e120	30	.37
2	.02	.06	.62	.20	.15	.06	2.8	9.5	21	e180	24	.39
3	.02	.06	.76	.19	.16	.07	3.7	9.8	14	e270	24	.43
4	.02	.07	.33	.20	.14	.06	4.7	12	10	e400	24	.46
5	.02	.07	.23	.20	.13	.06	7.7	14	7.8	e600	18	.49
6	.02	.07	.20	.20	.13	.06	6.7	19	6.9	e750	16	.60
7	.02	.07	.18	.20	.12	.05	8.9	23	5.3	e800	13	.82
8	.02	.08	.17	.20	.13	.05	11	31	5.4	e830	10	3.3
9	.02	.09	.16	.21	.13	.05	9.4	29	2.4	e860	7.4	15
10	.02	.10	.17	.21	.12	.05	9.4	38	1.8	e830	5.6	16
11	.02	.12	.17	.21	.11	.05	8.3	32	1.4	e750	3.6	42
12	.02	.12	.20	.21	.11	.05	5.8	26	1.3	e600	2.7	54
13	.02	.12	.20	.21	.10	.04	3.9	31	133	e480	2.2	41
14	.02	.17	.18	.21	.10	.04	4.6	29	795	e390	1.2	32
15	.02	.23	.18	.21	.10	.04	5.0	22	823	e310	.67	33
16	.02	.24	.18	.20	.09	.04	4.3	14	439	e250	1.1	133
17	.02	.22	.19	.20	.09	.04	5.2	12	174	198	1.6	426
18	.03	.21	.19	.20	.08	.05	7.0	8.9	101	172	8.5	449
19	.03	.21	.17	.21	.08	.06	6.0	6.8	63	149	26	378
20	.03	.21	.17	.20	.09	.09	5.2	5.6	44	129	17	274
21	.03	.23	.19	.20	.09	.14	5.0	4.3	33	114	11	208
22	.03	.24	.19	.20	.08	.16	5.0	5.3	26	108	8.8	181
23	.04	.23	.19	.18	.08	2.3	4.4	35	18	107	4.2	169
24	.04	.22	.18	.17	.08	3.2	3.9	76	14	103	2.8	187
25	.04	.23	.18	.17	.08	3.5	3.5	161	14	95	2.7	192
26	.04	.23	.18	.17	.08	4.1	3.3	182	28	84	2.8	161
27	.04	.23	.18	.17	.08	3.6	3.6	133	54	71	3.0	148
28	.05	.22	.18	.17	.07	3.4	4.3	92	52	61	2.4	143
29	.05	.20	.19	.16	---	2.7	4.6	69	52	51	.63	135
30	.05	.20	.20	.16	---	2.0	8.3	53	e90	44	.53	127
31	.06	---	.20	.16	---	2.4	---	44	---	37	.36	---
TOTAL	0.90	4.81	6.91	5.98	2.95	28.58	167.9	1235.5	3060.3	9943	275.79	3550.86
MEAN	.029	.16	.22	.19	.11	.92	5.60	39.9	102	321	8.90	118
MAX	.06	.24	.76	.21	.16	4.1	11	182	823	860	30	449
MIN	.02	.06	.16	.16	.07	.04	2.4	4.3	1.3	37	.36	.37
AC-FT	1.8	9.5	14	12	5.9	57	333	2450	6070	19720	547	7040
CFSM	.00	.00	.00	.00	.00	.00	.01	.07	.18	.56	.02	.21
IN.	.00	.00	.00	.00	.00	.00	.01	.08	.20	.65	.02	.23

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1947 - 1991, BY WATER YEAR (WY)

MEAN	67.9	43.4	14.1	6.83	5.13	49.9	589	305	231	149	58.1	69.4
MAX	351	229	51.1	21.0	14.4	345	2035	1589	1140	1152	585	710
(WY)	1983	1957	1978	1966	1986	1986	1966	1950	1968	1968	1968	1957
MIN	.029	.16	.013	.000	.000	.83	5.60	8.77	4.16	.092	.000	.025
(WY)	1991	1991	1977	1977	1977	1977	1991	1990	1980	1980	1961	1988

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1947 - 1991	
ANNUAL TOTAL	2615.89		18283.48			
ANNUAL MEAN	7.17		50.1		132a	
HIGHEST ANNUAL MEAN					304	1950
LOWEST ANNUAL MEAN					7.28	1990
HIGHEST DAILY MEAN	70	Apr 1	860	Jul 9	5670	Jul 18 1968
LOWEST DAILY MEAN	.00	Jan 16	.02	Oct 1-17	.00	Jul 23 1961
ANNUAL SEVEN-DAY MINIMUM	.00	Jan 16	.02	Oct 1	.00	Jul 23 1961
INSTANTANEOUS PEAK FLOW	78	Apr 1	898	Jun 14	5750	Jul 18 1968
INSTANTANEOUS PEAK STAGE	5.49	Apr 1	9.10	Jun 14	23.37b	Apr 3 1966
INSTANTANEOUS LOW FLOW	.00	Many days	.02	Oct 1-17,18	.00	Many days
ANNUAL RUNOFF (AC-FT)	5190		36270		95790	
ANNUAL RUNOFF (CFSM)	.013		.087		.23	
ANNUAL RUNOFF (INCHES)	.17		1.19		3.14	
10 PERCENT EXCEEDS	23		138		302	
50 PERCENT EXCEEDS	.20		.76		15	
90 PERCENT EXCEEDS	.01		.05		1.2	

a Median of annual mean discharges is 110 ft^3/s
b Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN

05106500 ROSEAU RIVER AT ROSEAU LAKE, MN

LOCATION.--Lat 48°54'22", long 95°49'55", in SW¼SW¼ sec.28, T.163 N., R.40 W., Roseau County, Hydrologic Unit 09020314, at downstream side of bridge on County Road 123 at Roseau Lake, 3.5 mi upstream from Pine Creek, 3.8 mi downstream from Sprague Creek, and 7 mi northwest of Roseau.

PERIOD OF RECORD.--November 1939 to September 1991 (incomplete, discontinued).

GAGE.--Water-stage recorder. Datum of gage is 1,018.59 ft, adjustment of 1928 (levels by Geodetic Survey of Canada); gage readings have been reduced to elevations, adjustment of 1928. Prior to Aug. 26, 1970, and Oct. 18, 1979 to Sept. 30, 1980, nonrecording gage at same site and datum.

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation observed, 1,036.86 ft, May 13, 1950; minimum observed, 1,019.75 ft, Aug. 16, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in July 1919 reached an elevation of about 1,034 ft.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,030.75 ft, July 10; minimum observed, 1,020.68 ft, Jan. 15, but may have been lower during period of no gage-height record.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	22.78	28.38	23.39	---
2	---	---	---	---	---	---	---	---	22.50	29.57	22.78	---
3	---	---	21.06	---	---	---	---	---	---	29.92	22.40	---
4	---	---	---	---	---	---	---	---	---	30.21	---	---
5	---	---	---	---	---	---	---	22.31	---	30.39	---	---
6	---	---	---	---	---	---	---	22.38	---	30.53	---	---
7	---	---	---	---	---	---	---	22.51	---	30.59	---	---
8	---	---	---	---	---	---	21.80	22.66	---	30.61	---	---
9	---	---	---	---	---	---	---	22.67	---	30.68	---	22.33
10	---	---	---	---	---	---	---	22.65	---	30.73	---	22.99
11	---	---	---	---	---	---	---	22.83	---	30.66	---	22.64
12	---	---	---	---	---	---	---	22.59	---	30.63	---	22.38
13	---	---	---	---	---	---	---	22.43	---	30.54	---	22.30
14	---	---	---	---	---	---	---	22.35	22.97	30.38	---	---
15	---	---	---	20.68	---	---	---	22.30	28.80	30.21	---	---
16	---	---	---	---	---	---	---	22.29	28.31	30.06	---	22.97
17	---	---	---	---	---	---	---	---	27.30	29.83	---	26.53
18	---	---	---	---	---	---	---	---	26.66	29.56	---	27.33
19	---	---	---	---	---	---	---	---	26.08	29.23	---	27.37
20	---	---	---	---	---	20.86	---	21.62	25.50	28.89	---	27.05
21	---	---	---	---	---	---	---	---	24.97	28.51	21.21	26.83
22	---	---	---	---	---	---	---	---	24.42	28.12	---	26.79
23	20.96	---	---	---	---	---	---	---	23.81	27.74	---	27.01
24	---	---	---	---	---	---	---	23.74	23.21	27.42	---	27.06
25	---	---	---	---	---	---	---	24.26	22.86	27.03	---	27.09
26	---	---	---	---	20.89	---	---	24.76	24.20	26.63	---	27.03
27	---	---	---	---	---	---	---	24.79	26.27	26.17	---	26.83
28	---	---	---	---	---	---	---	24.34	26.79	25.70	---	26.62
29	---	---	---	---	---	---	---	23.78	26.86	25.24	---	26.39
30	---	---	---	---	---	---	---	23.34	26.98	24.70	---	26.05
31	---	---	---	---	---	---	---	23.02	---	24.04	---	---
MEAN	---	---	---	---	---	---	---	---	---	28.80	---	---
MAX	---	---	---	---	---	---	---	---	---	30.73	---	---
MIN	---	---	---	---	---	---	---	---	---	24.04	---	---

NOTE: Add 1,000 ft to obtain elevations in adjustment of 1928. Gage height below intake elevation of 1,022.29 ft (gage height, 22.29 ft) Oct. 1-23, Mar. 20 to May 4, May 17-23, June 3-13, Aug. 4 to Sept. 8, Sept. 14, 15. No winter record.

RED RIVER OF THE NORTH BASIN
05107500 ROSEAU RIVER AT ROSS, MN

LOCATION.--Lat 48°54'37", long 95°55'18", in NE¼SE¼ sec.27, T.163 N., R.41 W., Roseau County, Hydrologic Unit 09020314, on left bank 300 ft downstream from highway bridge, 0.2 mi north of Ross, and 2.3 mi downstream from Pine Creek.
DRAINAGE AREA.--1,220 mi^2, approximately.
PERIOD OF RECORD.--July 1928 to September 1991 (discontinued).
REVISED RECORDS.--WSP 1055: 1945. WSP 1175: Drainage area. WSP 1308: 1936(M). WSP 1508: 1948-49(P).
GAGE.--Water-stage recorder. Datum of gage is 1,018.61 ft above National Geodetic Vertical Datum of 1929 (levels by Geodetic Survey of Canada). Prior to Mar. 13, 1929, nonrecording gage at same site and datum.
REMARKS.--Records good except those for estimated daily discharges, which are fair. High flow affected by natural storage in Roseau Lake.
EXTREMES OUTSIDE PERIOD OF RECORD.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.84	2.3	2.1	1.0	.80	.81	e32	31	148	734	205	2.6
2	.88	2.2	2.4	1.0	.67	e.80	e30	45	125	897	154	2.4
3	.96	2.1	2.4	1.0	.67	e.80	e45	48	103	945	115	2.3
4	.95	2.0	2.0	1.0	.67	e.80	e60	60	83	989	92	2.2
5	.88	2.0	1.9	1.0	.67	e.80	95	97	69	1040	86	2.0
6	1.0	1.9	1.7	.91	.80	e.80	107	115	58	1110	73	1.8
7	1.2	1.9	1.5	.84	.88	e.80	89	128	48	1160	63	1.6
8	1.2	1.9	1.3	.80	.88	e.80	63	144	40	1180	55	2.0
9	1.2	1.9	1.3	.85	.96	e.80	44	148	34	1200	49	97
10	1.3	1.8	1.2	.85	.96	e.80	35	144	27	1220	43	188
11	1.3	1.8	1.1	.80	1.1	e.80	29	159	20	1220	37	162
12	1.4	1.6	1.2	.80	.93	e.80	22	141	16	1230	30	134
13	1.5	1.5	1.3	.80	.96	e.80	15	123	38	1220	24	123
14	1.7	1.6	1.2	.80	e.90	e.80	14	115	458	1180	20	109
15	1.9	1.5	1.4	.80	e.85	e.80	19	108	744	1140	16	95
16	2.0	1.4	1.5	.80	e.80	e.80	22	99	721	1100	16	203
17	2.0	1.4	1.5	.80	e.80	e.80	28	83	591	1050	33	574
18	2.3	1.6	1.2	.88	e.80	e1.0	30	68	505	1000	40	706
19	3.1	1.7	1.2	.88	.73	e1.5	29	58	445	939	30	714
20	3.0	1.6	1.1	.88	.67	2.2	24	49	386	877	33	669
21	2.9	1.8	1.2	.96	.67	2.2	18	43	337	810	32	635
22	2.9	2.1	1.3	.96	.75	3.5	15	39	290	740	24	631
23	2.9	2.2	1.3	.96	.80	e7.0	13	78	239	677	18	673
24	2.7	2.1	1.3	.96	.94	e15	12	213	189	629	13	678
25	2.6	2.1	1.3	.96	.85	e30	12	262	159	568	7.2	673
26	2.5	2.0	1.2	.96	.75	e40	12	305	251	510	5.5	664
27	2.5	2.0	1.2	.96	.67	e50	9.6	314	439	458	4.7	633
28	2.5	2.0	1.2	.96	.83	e48	9.6	280	507	408	3.7	596
29	2.5	1.9	1.3	.96	---	e45	11	234	522	363	3.4	560
30	2.4	1.9	1.3	.88	---	e40	18	197	542	317	3.0	533
31	2.3	---	1.1	.88	---	e35	---	169	---	261	2.7	---
TOTAL	59.31	55.8	44.2	27.89	22.76	334.01	962.2	4097	8134	27172	1331.2	10066.9
MEAN	1.91	1.86	1.43	.90	.81	10.8	32.1	132	271	877	42.9	336
MAX	3.1	2.3	2.4	1.0	1.1	50	107	314	744	1230	205	714
MIN	.84	1.4	1.1	.80	.67	.80	9.6	31	16	261	2.7	1.6
AC-FT	118	111	88	55	45	663	1910	8130	16130	53900	2640	19970
CFSM	.00	.00	.00	.00	.00	.01	.03	.11	.22	.72	.04	.28
IN.	.00	.00	.00	.00	.00	.01	.03	.12	.25	.83	.04	.31

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1929 - 1991, BY WATER YEAR (WY)

MEAN	131	87.9	29.5	14.5	11.3	78.6	848	855	467	280	121	135
MAX	974	512	107	57.7	27.8	551	3234	4583	2258	1494	1352	1041
(WY)	1942	1957	1978	1966	1981	1946	1966	1950	1970	1968	1968	1968
MIN	1.91	1.63	.27	.001	.000	2.76	32.1	29.5	6.83	1.39	.84	.38
(WY)	1991	1977	1977	1977	1977	1989	1991	1988	1980	1980	1961	1990

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1929 - 1991	
ANNUAL TOTAL	16252.59		52307.27			
ANNUAL MEAN	44.5		143		255a	
HIGHEST ANNUAL MEAN					725	1950
LOWEST ANNUAL MEAN					28.9	1934
HIGHEST DAILY MEAN	300	Apr 1	1230	Jul 12	6510	May 12 1950
LOWEST DAILY MEAN	.04	Sep 12	.67	Feb 2	.00	Aug 29 1961
ANNUAL SEVEN-DAY MINIMUM	.09	Sep 11	.74	Jan 31	.00	Jan 3 1977
INSTANTANEOUS PEAK FLOW	310	Apr 1	1240	Jul 12	6560	May 12 1950
INSTANTANEOUS PEAK STAGE	7.15b	Apr 1	11.22	Jul 12	18.25	May 12 1950
INSTANTANEOUS LOW FLOW	.02	Sep 12	.67	Many days	.00	Many days
ANNUAL RUNOFF (AC-FT)	32240		103800		185000	
ANNUAL RUNOFF (CFSM)	.036		.12		.21	
ANNUAL RUNOFF (INCHES)	.50		1.59		2.84	
10 PERCENT EXCEEDS	150		609		829	
50 PERCENT EXCEEDS	2.0		3.4		35	
90 PERCENT EXCEEDS	.33		.80		5.5	

a Median of annual mean discharges is 230 ft^3/s.
b Backwater from ice.
e Estimated.

RED RIVER OF THE NORTH BASIN
05112000 ROSEAU RIVER BELOW STATE DITCH 51, NEAR CARIBOU, MN
(International gaging station)

LOCATION.--Lat 48°58'54", long 96°27'46", in SE¼SW¼ sec.34, T.164 N., R.45 W., Kittson County, Hydrologic Unit 09020314, on left bank 400 ft downstream from State ditch 51 (known locally as Caribou cutoff ditch) and 0.6 mi west of Caribou.
DRAINAGE AREA.--1,570 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April to October 1917, April 1920 to current year (no winter records in water years 1931, 1932, 1934-36, 1938-40, 1944-72). 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.
REVISED RECORDS.--WSP 1308: 1938(M). WSP 1508: 1917(M), 1920, 1932(M), 1934-35(M). WSP 1913: 1954(M).
GAGE.--Water-stage recorder. Datum of gage is 1,002.31 ft above National Geodetic Vertical Datum of 1929 (levels by Geodetic Survey of Canada). Prior to Apr. 1, 1929, nonrecording gage at site at Caribou 0.6 mi upstream at datum 0.95 ft lower.
REMARKS.--Records fair except those for estimated daily discharges, which are poor. Satellite telemeter at station. Occasionally, at high stages, there is some natural diversion of flow above station to headwaters of Two Rivers.
COOPERATION.--This station is one of the international gaging stations maintained by the United States under agreement with Canada.
EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of 1916 is reported to have reached a stage of about 15.5 ft at former site.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.15	.25	.45	e.25	e.06	e.06	61	38	166	798	622	8.0
2	.15	.27	.41	e.20	e.06	e.06	58	42	134	902	457	8.7
3	.15	.20	.35	e.18	e.06	e.06	56	49	110	995	327	8.7
4	.14	.16	.33	e.16	e.06	e.06	60	60	90	997	235	7.5
5	.10	.16	.34	e.14	e.06	e.06	64	63	75	1000	170	6.6
6	.15	.17	.36	e.13	e.06	e.06	85	81	62	1030	139	6.3
7	.14	.15	.37	e.12	e.06	e.06	93	96	53	1040	118	6.4
8	.10	.15	.39	e.11	e.06	e.06	87	106	46	1060	106	9.2
9	.10	.15	.41	e.10	e.06	e.06	73	117	42	1080	89	21
10	.07	.10	.45	e.09	e.06	e.06	56	121	39	1100	77	64
11	.10	.10	.52	e.08	e.06	e.06	44	119	34	1120	67	171
12	.05	.05	.63	e.07	e.06	e.06	37	125	31	1170	57	159
13	.09	.04	.66	e.07	e.06	e.06	32	119	29	1230	48	128
14	.14	.06	.71	e.06	e.06	e.06	30	104	30	1260	39	115
15	.15	.10	.75	e.06	e.06	e.06	28	99	211	1290	34	100
16	.14	.12	.80	e.06	e.06	e.06	27	94	468	1310	30	116
17	.10	.08	.63	e.06	e.06	e.06	28	87	571	1330	27	322
16	.10	.10	.79	e.06	e.06	e.07	32	78	595	1330	27	603
19	.12	.08	.75	e.06	e.06	e.50	34	67	572	1330	37	735
20	.10	.10	.76	e.06	e.06	e2.0	37	56	532	1320	35	770
21	.10	.20	.68	e.06	e.06	5.6	34	53	476	1310	32	768
22	.10	.36	.65	e.06	e.06	7.2	34	53	407	1310	32	767
23	.10	.54	.59	e.06	e.06	9.3	31	64	337	1290	31	776
24	.10	.62	.55	e.06	e.06	6.4	28	68	270	1260	26	789
25	.09	.68	.53	e.06	e.06	11	25	145	229	1230	23	792
26	.11	.62	.52	e.06	e.06	12	24	224	247	1190	21	793
27	.20	.60	.46	e.06	e.06	17	32	271	311	1140	20	776
28	.14	.57	.36	e.06	e.06	32	34	288	452	1060	16	742
29	.17	.51	.35	e.06	---	51	30	273	563	1010	15	703
30	.20	.50	.31	e.06	---	58	37	235	640	912	11	666
31	.20	---	.27	e.06	---	62	---	189	---	783	9.1	---
TOTAL	3.85	7.79	16.33	2.78	1.66	277.09	1331	3588	7822	35207	2977.1	10937.4
MEAN	.12	.26	.53	.090	.060	8.94	44.4	116	261	1136	96.0	365
MAX	.20	.68	.83	.25	.06	62	93	288	640	1330	622	793
MIN	.05	.04	.27	.06	.06	.06	24	38	29	783	9.1	6.3
AC-FT	7.6	15	32	5.5	3.3	550	2640	7120	15510	69830	5910	21690
CFSM	.00	.00	.00	.00	.00	.01	.03	.07	.17	.72	.06	.23
IN.	.00	.00	.00	.00	.00	.01	.03	.09	.19	.83	.07	.26
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1917 - 1991, BY WATER YEAR (WY)												
MEAN	162	102	41.7	23.1	18.6	98.8	780	908	572	390	140	156
MAX	1302	382	226	134	75.1	446	2167	3029	2588	1653	1577	1451
(WY)	1942	1927	1927	1927	1927	1946	1966	1950	1970	1968	1968	1968
MIN	.12	.26	.53	.090	.060	1.57	38.2	26.9	6.70	.65	2.09	.30
(WY)	1991	1991	1991	1991	1991	1989	1981	1988	1980	1980	1936	1990

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1917 - 1991	
ANNUAL TOTAL	21153.97		62172.02			
ANNUAL MEAN	58.0		170		273	
HIGHEST ANNUAL MEAN					683	1927
LOWEST ANNUAL MEAN					35.9	1977
HIGHEST DAILY MEAN	390	Apr 3	1330	Jul 17	4020	May 19 1950
LOWEST DAILY MEAN	.00	Sep 15	.04	Nov 13	.00	Sep 15 1990
ANNUAL SEVEN-DAY MINIMUM	.04	Sep 12	.06	Jan 14	.04	Sep 12 1990
INSTANTANEOUS PEAK FLOW	400	Apr 3	1340	Jul 18,19	4080	May 19 1950
INSTANTANEOUS PEAK STAGE	6.40a	Apr 3	7.35	Jul 18;19	11.81	May 19 1950
INSTANTANEOUS LOW FLOW	.00	Sep 15-17	.00b		.00c	
ANNUAL RUNOFF (AC-FT)	41960		123300		197500	
ANNUAL RUNOFF (CFSM)	.037		.11		.17	
ANNUAL RUNOFF (INCHES)	.50		1.47		2.36	
10 PERCENT EXCEEDS	199		772		1180	
50 PERCENT EXCEEDS	.71		9.2		70	
90 PERCENT EXCEEDS	.10		.06		8.0	

a Backwater from ice.
b Occurred part of each day Oct. 12, 13, and Nov. 13.
c Occurred Aug. 13, 1936, Sept. 15-17, and part of each day Oct. 12, 13, and Nov. 13, 1990.
e Estimated.

RED RIVER OF THE NORTH BASIN

05112000 ROSEAU RIVER BELOW STATE DITCH 51 NR CARIBOU, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)
OCT											
23...	1315	0.12	468	479	8.5	8.2	4.5	1.5	734	12.4	K2
JAN											
15...	0915	0.06	1150	1020	7.6	7.7	1.0	3.8	728	3.0	<1
APR											
02...	0945	63	385	419	7.8	7.7	2.0	3.0	735	7.7	240
JUL											
16...	1600	1260	377	373	6.9	7.4	25.5	2.5	722	0.8	77

DATE	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
OCT											
23...	35	48	29	10	3.0	208	220	4	245	48	9.3
JAN											
15...	1	130	61	26	7.0	526	531	0	642	72	13
APR											
02...	K13	43	20	14	5.2	163	170	0	199	27	10
JUL											
16...	K650	52	17	4.1	4.7	185	187	0	226	10	4.5

DATE	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)
OCT											
23...	0.2	0.99	280	<0.01	<0.10	0.02	<0.01	0.8	0.03	0.02	0.01
JAN											
15...	0.3	17	704	<0.01	<0.10	0.23	0.23	2.3	0.14	<0.01	<0.01
APR											
02...	0.1	8.9	250	0.04	0.47	0.19	0.17	1.3	0.10	0.03	0.03
JUL											
16...	0.1	30	287	0.01	<0.05	0.06	0.11	2.2	0.24	0.14	0.14

RED RIVER OF THE NORTH BASIN

05112000 ROSEAU RIVER BELOW STATE DITCH 51 NR CARIBOU, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)
OCT											
23...	20	1	26	<0.5	<1.0	2	<3	2	27	<1	14
JAN											
15...	10	2	130	<0.5	<1.0	<1	<3	1	69	<1	29
APR											
02...	10	<1	38	<0.5	<1.0	<1	<3	2	160	1	11
JUL											
16...	10	3	52	<0.5	<1.0	2	<3	2	320	<1	11

DATE	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)	SEDIMENT, SUSPENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT											
23...	14	<0.1	<10	1	<1	<1.0	150	<6	10	6	82
JAN											
15...	2000	<0.1	<10	2	<1	<1.0	340	<6	16	93	59
APR											
02...	110	<0.1	<10	1	<1	<1.0	120	<6	17	4	81
JUL											
16...	230	<0.1	<10	2	<2	<1.0	100	<6	17	15	83

LAKE OF THE WOODS BASIN

05124480 KAWISHIWI RIVER NEAR ELY, MN
(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'22", long 91°32'06", in SE¼SE¼ sec.24, T.63 N., R.10 W., Lake County, Hydrologic Unit 09030001, in Superior National Forest, on left bank upstream from rapids, 2 mi upstream from South Kawishiwi River, 2.2 mi southwest of Fernberg Lookout Tower and 14 mi east of Ely.
DRAINAGE AREA.--253 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1966 to current year.
GAGE.--Water-stage recorder. Elevation of gage is 1,450 ft above National Geodetic Vertical Datum of 1929, from topographic map.
REMARKS.--No estimated daily discharges. Records good.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	37	45	41	58	60	48	52	489	286	143	109	36
2	36	45	41	58	59	48	52	486	273	144	105	35
3	41	44	41	58	59	48	56	486	259	146	101	37
4	43	42	40	58	59	48	70	484	243	155	98	35
5	42	42	41	58	59	48	90	481	229	159	93	33
6	39	42	41	58	59	50	108	501	217	160	88	33
7	38	41	41	58	58	49	132	507	206	159	83	32
8	36	40	41	60	58	49	149	509	195	154	79	34
9	35	39	42	63	57	49	161	512	189	150	76	39
10	33	38	42	61	55	49	175	508	201	148	72	41
11	32	37	43	60	54	48	189	501	187	143	70	39
12	32	36	45	61	53	47	202	507	176	143	67	38
13	31	36	47	62	53	46	217	504	166	144	64	37
14	31	35	47	63	54	46	232	494	160	139	62	37
15	31	36	47	64	53	45	251	486	166	133	59	37
16	30	36	48	63	52	45	271	478	195	129	58	37
17	34	35	48	65	52	44	293	459	184	131	61	38
18	40	35	48	64	52	44	319	443	174	130	60	40
19	41	35	48	64	54	44	344	427	163	126	57	40
20	41	35	53	63	54	44	369	411	155	122	54	38
21	41	37	56	62	55	44	395	399	148	119	52	37
22	42	36	58	62	55	43	414	386	139	113	51	35
23	42	36	58	62	54	48	433	382	132	104	50	34
24	41	35	58	62	54	50	446	382	124	100	50	33
25	41	35	58	61	54	50	458	363	120	96	50	37
26	42	35	57	60	53	51	461	348	119	91	50	39
27	43	38	57	61	52	54	466	336	121	88	48	38
28	44	41	58	61	50	54	471	323	119	98	46	37
29	44	41	58	60	---	54	473	318	136	104	44	36
30	44	41	58	60	---	53	483	313	138	108	42	36
31	44	---	58	60	---	52	---	300	---	111	39	---
TOTAL	1191	1149	1519	1890	1541	1492	8232	13523	5320	3990	2038	1098
MEAN	38.4	38.3	49.0	61.0	55.0	48.1	274	436	177	129	65.7	36.6
MAX	44	45	58	65	60	54	483	512	286	160	109	41
MIN	30	35	40	58	50	43	52	300	119	88	39	32
AC-FT	2360	2280	3010	3750	3060	2960	16330	26820	10550	7910	4040	2180
CFSM	.15	.15	.19	.24	.22	.19	1.08	1.72	.70	.51	.26	.14
IN.	.18	.17	.22	.28	.23	.22	1.21	1.99	.78	.59	.30	.16

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 1991, BY WATER YEAR (WY)

MEAN	165	176	137	92.3	67.9	56.4	251	663	392	196	145	150
MAX	881	684	345	163	107	85.2	785	1133	1069	467	758	698
(WY)	1978	1971	1983	1984	1971	1969	1976	1979	1970	1968	1988	1988
MIN	12.1	9.43	7.25	5.32	4.77	5.87	8.95	13.3	115	74.5	46.7	18.5
(WY)	1977	1977	1977	1977	1977	1977	1977	1977	1977	1980	1976	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1966 - 1991	
ANNUAL TOTAL	66124		42983			
ANNUAL MEAN	181		118		209	
HIGHEST ANNUAL MEAN					313	1971
LOWEST ANNUAL MEAN					94.5	1977
HIGHEST DAILY MEAN	1240	May 3	512	May 9	1710	Apr 24 1976
LOWEST DAILY MEAN	30	Oct 16	30	Oct 16	4.5	Jan 31 1977
ANNUAL SEVEN-DAY MINIMUM	31	Oct 10	31	Oct 10	4.6	Jan 29 1977
INSTANTANEOUS PEAK FLOW	1260	May 2	512	May 8,9,10	1720	Apr 24 1976
INSTANTANEOUS PEAK STAGE	5.54	May 2	4.55	May 8,9,10	5.92	Apr 24 1976
INSTANTANEOUS LOW FLOW	30	Oct 15,16,17	30	Oct 15,16,17	4.5c	
ANNUAL RUNOFF (AC-FT)	131200		85260		151200	
ANNUAL RUNOFF (CFSM)	.72		.47		.82	
ANNUAL RUNOFF (INCHES)	9.72		6.32		11.21	
10 PERCENT EXCEEDS	417		354		530	
50 PERCENT EXCEEDS	57		58		107	
90 PERCENT EXCEEDS	35		36		36	

c Occurred all or part of each day Jan. 30 to Feb. 2, 1977.

LAKE OF THE WOODS BASIN

05124480 KAWISHIWI RIVER NEAR ELY, MN--Continued
(Hydrologic bench-mark station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)
OCT											
03...	1100	41	29	31	7.1	7.4	12.5	1.6	693	9.8	<1
JAN											
29...	1300	63	30	34	7.0	7.8	0.0	1.0	721	11.3	<1
MAY											
01...	1115	480	24	35	6.2	6.9	8.5	1.4	799	10.7	K1
JUL											
30...	1330	103	29	32	7.0	7.1	21.0	1.1	716	7.1	K6

DATE	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
OCT											
03...	230	3.2	1.5	1.1	0.4	10	11	0	12	2.5	0.5
JAN											
29...	K8	3.1	1.5	1.1	0.3	9	11	0	11	2.4	<0.1
MAY											
01...	K2	3.1	1.3	1.0	0.3	9	11	0	12	3.1	0.4
JUL											
30...	K1200	3.0	1.4	0.9	0.3	9	11	0	11	2.7	0.2

DATE	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)
OCT											
03...	0.1	3.0	37	<0.01	<0.10	<0.01	0.01	0.40	0.01	<0.01	<0.01
JAN											
29...	<0.1	2.6	21	0.01	<0.10	0.02	0.02	0.50	<0.01	<0.01	<0.01
MAY											
01...	<0.1	3.0	31	<0.01	0.06	0.02	0.02	0.50	0.03	<0.01	<0.01
JUL											
30...	<0.1	2.5	26	<0.01	<0.05	0.01	0.01	0.40	0.02	0.01	0.01

LAKE OF THE WOODS BASIN

05124480 KAWISHIWI RIVER NEAR ELY, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P) (00671)	SEDIMENT, SUSPENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)
OCT 03...	<0.01	4	71	20	<1	6	0.7	<1.0
JAN 29...	<0.01	0	100	20	<1	3	<0.5	<1.0
MAY 01...	<0.01	9	82	30	<1	8	<0.5	<1.0
JUL 30...	<0.01	2	86	20	<1	8	<0.5	<1.0

DATE	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)
OCT 03...	1	<3	5	140	<1	<4	3	<0.1
JAN 29...	<1	<3	20	210	1	<4	5	<0.1
MAY 01...	8	<3	3	150	1	<4	6	<0.1
JUL 30...	1	<3	3	110	<1	<4	3	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)
OCT 03...	<10	<1	<1	<1.0	13	<6	12
JAN 29...	<10	1	<1	<1.0	12	<6	9
MAY 01...	<10	1	<1	<1.0	11	<6	14
JUL 30...	<10	1	<1	<1.0	12	<6	4

RADIOCHEMICAL, ANALYSES, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	GROSS ALPHA, DISSOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DISSOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90) (80060)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L) (09511)	URANIUM NATURAL DISSOLVED (UG/L AS U) (22703)
OCT 03...	<0.6	<0.6	1.4	<0.6	1.4	<0.6	0.17	<0.01
JAN 29...	--	--	--	--	--	--	--	--
MAY 01...	<0.6	<0.6	1.2	0.7	1.1	0.6	0.03	0.01
JUL 30...	--	--	--	--	--	--	--	--

LAKE OF THE WOODS BASIN

05127000 KAWISHIWI RIVER NEAR WINTON, MN

LOCATION.--Lat 47°56'05", long 91°45'50", in NE¼NW¼ sec.20, T.63 N., R.11 W., Lake County, Hydrologic Unit 09030001, Superior National Forest, at powerplant of Minnesota Power Co., just upstream from Fall Lake, and 1.8 mi east of Winton.
DRAINAGE AREA.--1,229 mi^2.
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.
REVISED RECORDS.--WDR MN-77-1: Drainage area.
REMARKS.--No estimated daily discharges. Records 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 Co., under general supervision of Geological Survey, in connection with a Federal Power Commission project.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	118	958	444	444	399	397	674	2110	1310	399	795	.00
2	118	959	444	444	399	397	788	2110	1220	399	795	.00
3	321	959	444	444	399	396	787	2110	1220	428	795	232
4	476	959	444	444	398	396	786	2110	1220	443	795	283
5	481	960	444	444	398	396	670	2110	1140	680	795	233
6	482	960	444	444	398	396	475	2270	960	798	794	234
7	223	960	444	433	398	396	476	2370	959	796	794	.00
8	127	960	444	419	398	395	700	2700	960	900	648	.00
9	116	960	444	424	398	395	896	2880	960	959	631	559
10	118	959	444	423	398	395	952	2850	959	959	420	581
11	115	959	444	422	398	395	951	2840	959	959	398	582
12	190	862	576	422	398	395	952	2810	886	1570	398	574
13	.00	793	798	422	398	395	953	2740	840	2060	398	578
14	.00	793	649	422	398	395	954	2690	813	1920	348	.00
15	250	792	443	407	398	329	956	2680	795	1680	240	.00
16	400	692	443	399	398	.00	957	2560	795	1460	231	284
17	399	397	443	399	397	.00	959	2310	795	1470	.00	341
18	622	397	443	399	397	278	959	2220	795	1470	.00	280
19	797	397	443	399	397	396	959	2110	794	1470	233	273
20	827	397	444	399	397	396	960	1940	794	1470	233	398
21	883	397	444	399	397	396	1080	1490	742	1470	233	347
22	802	398	444	399	397	421	1480	1220	397	1170	232	.00
23	746	398	444	399	397	440	1480	1270	398	920	232	283
24	746	398	444	399	397	692	1180	1550	398	883	.00	399
25	703	398	444	399	397	834	961	1710	398	883	.00	398
26	694	398	444	399	397	789	1140	1550	398	830	240	399
27	839	398	444	399	397	789	1230	1470	398	795	248	399
28	839	399	444	399	397	789	1230	1470	398	795	244	398
29	913	399	444	399	---	706	1510	1470	398	849	243	398
30	958	429	444	399	---	394	1910	1470	399	883	235	399
31	957	---	444	399	---	395	---	1470	---	822	243	---
TOTAL	15260.00	20085	14450	12842	11135	13583.00	29965	64660	23498	32590	11891.00	8852.00
MEAN	492	669	466	414	398	438	999	2086	783	1051	384	295
MAX	958	960	798	444	399	834	1910	2880	1310	2060	795	582
MIN	.00	397	443	399	397	.00	475	1220	397	399	.00	.00
†	109	-22	-128	-138	-130	-151	622	-44	-80	57	-83	52
MEAN‡	601	647	338	276	268	287	1621	2042	703	1108	301	347
CFSM‡	.49	.53	.28	.22	.22	.23	1.32	1.66	.57	.90	.24	.28
IN‡	.56	.59	.32	.26	23	.27	1.47	1.92	.64	1.04	.28	.32

CAL YR 1990 TOTAL 359,018 MEAN 984 MAX 6660 MIN 0 MEAN‡ 988 CFSM‡ .80 IN‡ 10.91
WTR YR 1991 TOTAL 258,811 MEAN 709 MAX 2880 MIN 0 MEAN‡ 714 CFSM‡ .58 IN‡ 7.89

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1905 - 1991, BY WATER YEAR (WY)

MEAN	906	750	582	446	342	365	1185	3122	1963	1126	692	754
MAX	4277	3572	1422	862	770	844	5020	9278	5661	2748	3775	3149
(WY)	1947	1971	1983	1978	1927	1945	1945	1950	1968	1944	1988	1928
MIN	66.5	8.97	76.1	80.3	74.5	103	19.3	111	519	217	51.7	38.1
(WY)	1924	1924	1977	1977	1977	1924	1924	1924	1980	1961	1919	1919

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1905 - 1991	
ANNUAL TOTAL	359018.00		258811.00			
ANNUAL MEAN	984		709		1031	
HIGHEST ANNUAL MEAN					1967	1950
LOWEST ANNUAL MEAN					240	1924
HIGHEST DAILY MEAN	6660	May 5-7	2880	May 9	16000	May 18 1950
LOWEST DAILY MEAN	.00	at times	.00	At times	.00	At times
ANNUAL SEVEN-DAY MINIMUM	33	Sep 6	95	Oct 8	.00	Oct 13 1923
ANNUAL RUNOFF (AC-FT)	712100		513400		746600	
ANNUAL RUNOFF (CFSM)	.80		.58		.84	
ANNUAL RUNOFF (INCHES)	10.87		7.83		11.39	
10 PERCENT EXCEEDS	2610		1470		2450	
50 PERCENT EXCEEDS	480		444		587	
90 PERCENT EXCEEDS	97		243		186	

† Change 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 content.

LAKE OF THE WOODS BASIN

05127500 BASSWOOD RIVER NEAR WINTON, MN
(International gaging station)

LOCATION.--Lat 48°04'57", long 91°39'09", in SE¼SE¼ sec.30, T.65 N., R.10 W., Lake County, Hydrologic Unit 09030001, in Superior National Forest, on island in Jackfish Bay of Basswood Lake, used to determine discharge at outlet [lat 48°06'21", long 91°38'51", in sec.19, T.65 N., R.10 W., on international boundary 14 mi northeast of Winton].
DRAINAGE AREA.--1,740 mi^2, 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.
REVISED RECORDS.--WSP 955: Drainage area. WSP 1145: 1935, 1937.
GAGE.--Water-stage recorder. Datum of gage is 1,296.80 ft, 1928 datum, (levels by Geodetic Survey of Canada). Prior to Oct. 27, 1938, nonrecording 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.
REMARKS.--No estimated daily discharges. Records good. Satellite telemeter at station. Some regulation by powerplant on Kawishiwi River at Winton, and by many lakes located upstream from station.
COOPERATION.--This station is one of the international gaging stations maintained by the United States under agreement with Canada.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	230	592	664	648	576	546	668	1740	2320	1330	1320	415
2	229	611	658	646	572	552	672	1800	2260	1320	1310	400
3	262	632	651	642	564	548	692	1870	2210	1360	1280	385
4	270	653	642	642	560	544	730	1920	2120	1400	1240	368
5	270	675	636	642	560	549	788	1990	2050	1420	1220	361
6	271	686	629	635	555	551	854	2110	1970	1400	1190	355
7	273	703	621	634	551	552	930	2200	1900	1400	1160	353
8	275	724	617	634	544	556	992	2310	1830	1400	1130	360
9	274	729	613	634	537	560	1040	2410	1770	1410	1100	364
10	271	735	608	634	530	560	1080	2530	1750	1420	1080	355
11	266	741	609	634	529	558	1130	2650	1690	1420	1040	356
12	264	753	623	630	529	549	1170	2830	1650	1460	1000	358
13	263	770	632	627	528	544	1210	2930	1580	1500	963	365
14	257	777	642	634	528	539	1250	3000	1530	1540	926	379
15	253	782	650	633	527	536	1300	3040	1530	1600	890	379
16	250	794	653	631	524	534	1330	3120	1540	1630	861	375
17	272	802	649	627	522	522	1360	3130	1510	1670	825	374
18	301	789	644	625	519	509	1390	3090	1480	1680	784	376
19	310	775	642	618	535	496	1410	3040	1440	1670	734	369
20	321	772	673	613	543	489	1420	2990	1420	1680	691	365
21	339	774	685	609	552	482	1430	2930	1400	1680	648	361
22	362	752	702	613	560	480	1450	2850	1330	1650	613	349
23	378	723	698	605	560	517	1480	2770	1280	1600	595	344
24	399	715	690	601	560	532	1530	2770	1220	1570	575	341
25	422	700	683	600	560	542	1550	2700	1170	1530	554	353
26	442	700	681	595	557	565	1560	2620	1160	1480	535	356
27	451	695	676	593	554	589	1580	2560	1160	1450	516	355
28	483	693	667	588	550	609	1580	2500	1140	1470	498	352
29	508	691	659	587	---	631	1610	2460	1340	1450	475	355
30	533	680	659	584	---	654	1680	2420	1330	1420	453	360
31	563	---	656	576	---	661	---	2370	---	1370	437	---
TOTAL	10262	21618	20212	19214	15286	17056	36866	79650	48080	46380	26643	10938
MEAN	331	721	652	620	546	550	1229	2569	1603	1496	859	365
MAX	563	802	702	648	576	661	1680	3130	2320	1680	1320	415
MIN	229	592	608	576	519	480	668	1740	1140	1320	437	341
AC-FT	20350	42880	40090	38110	30320	33830	73120	158000	95370	91990	52850	21700
CFSM	.19	.41	.37	.36	.31	.32	.71	1.48	.92	.86	.49	.21
IN.	.22	.46	.43	.41	.33	.36	.79	1.70	1.03	.99	.57	.23

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1991, BY WATER YEAR (WY)

MEAN	1104	1011	857	711	588	562	1201	3749	2904	1770	1086	942
MAX	5320	3879	2510	1475	1229	1143	5069	9114	7332	4453	3487	5034
(WY)	1978	1971	1983	1966	1966	1966	1945	1950	1950	1944	1944	1988
MIN	1.77	1.70	1.78	1.80	1.85	2.02	2.41	2.32	3.06	3.95	3.21	5.26
(WY)	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1931 - 1991	
ANNUAL TOTAL	487982		352205			
ANNUAL MEAN	1337		965		1398	
HIGHEST ANNUAL MEAN					2643	1950
LOWEST ANNUAL MEAN					557	1958
HIGHEST DAILY MEAN	6170	May 11	3130	May 17	15200	May 24 1950
LOWEST DAILY MEAN	229	Oct 2	229	Oct 2	58	Nov 3 1976
ANNUAL SEVEN-DAY MINIMUM	235	Sep 26	258	Oct 1	58	Nov 7 1976
INSTANTANEOUS PEAK FLOW	6210	May 11	3150	May 16,17	15600	May 24 1950
INSTANTANEOUS PEAK STAGE	6.54	May 11	4.99	May 16,17	9.94b	May 24 1950
INSTANTANEOUS LOW FLOW	226a		226	Oct 1,2	55	Nov 18 1976
ANNUAL RUNOFF (AC-FT)	967900		698600		1013000	
ANNUAL RUNOFF (CFSM)	.77		.55		.80	
ANNUAL RUNOFF (INCHES)	10.43		7.53		10.92	
10 PERCENT EXCEEDS	3440		1850		3270	
50 PERCENT EXCEEDS	664		656		852	
90 PERCENT EXCEEDS	321		361		371	

a Occurred Sept. 29, Oct. 1, 2.
b Present datum.

LAKE OF THE WOODS BASIN

05128000 NAMAKAN RIVER AT OUTLET OF LAC LA CROIX, ONTARIO

(International gaging station)

LOCATION.--Lat 48°21'14", long 92°13'01", at Campbell's Camp, on Lac La Croix Lake, used to determine discharge at outlet [Lat 48°23'00", long 92°10'40", 2.5 mi east of Campbell's Camp].
DRAINAGE AREA.--5,170 mi^2.
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 Water Survey of Canada.
GAGE.--Water-stage recorder. Gage readings have been reduced to elevations, United States and Canada Boundary Survey datum. Prior to October 1933, nonrecording gages at various sites on Lac la Croix. October 1933 to Mar. 13, 1963, nonrecording gage at present site and datum.
REMARKS.--Records good. Satellite telemeter at station.
COOPERATION.--This station is one of the international stations maintained by Canada under agreement with the United States.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1580	1500	1660	1760	1660	1550	1560	5120	7030	4380	e3780	e2010
2	1590	1480	1650	1760	1660	1540	1560	5260	6920	4310	e3710	e1980
3	1670	1470	1640	1760	1650	1550	1580	5440	6890	4410	e3640	e1950
4	1640	1490	1640	1750	1640	1540	1610	5580	6750	4590	e3570	e1910
5	1670	1500	1660	1740	1630	1540	1670	5650	6600	4700	e3480	e1890
6	1640	1480	1660	1730	1630	1530	1740	5790	6460	4840	e3410	e1850
7	1630	1480	1670	1730	1620	1540	1860	5900	6360	4940	e3340	e1820
8	1620	1490	1670	1730	1610	1540	2000	6040	6220	4980	e3270	e1790
9	1600	1470	1670	1740	1600	1540	2160	6140	6140	5010	e3210	e1760
10	1570	1450	1660	1740	1590	1550	2310	6220	6110	5010	e3150	e1730
11	1540	1460	1660	1740	1580	1530	2460	6290	6000	5010	e3080	e1700
12	1530	1470	1680	1740	1580	1520	2600	6390	5930	4980	e3020	e1670
13	1510	1490	1680	1740	1570	1510	2720	6430	5760	4940	e2960	e1650
14	1490	1490	1680	1740	1560	1510	2890	6500	5620	e4870	e2900	e1610
15	1460	1490	1680	1750	1560	1510	3080	6530	5440	e4800	e2830	e1590
16	1470	1510	1680	1740	1550	1500	3230	6640	5330	e4730	e2770	e1560
17	1490	1520	1680	1740	1550	1500	3400	6750	5260	e4660	e2710	e1540
18	1520	1530	1680	1740	1540	1500	3570	6750	5120	e4590	e2660	e1510
19	1540	1530	e1700	1720	1550	1490	3710	6780	4980	e4560	e2600	1470
20	1510	1550	e1710	1720	1560	1490	3850	6780	4910	e4480	2540	1430
21	1500	1550	1720	1720	1560	1490	3990	6820	4800	e4410	e2500	1400
22	1510	1520	1760	1710	1580	1480	4130	6820	4660	e4340	e2450	1310
23	1490	1500	1770	1710	1580	1510	4270	6920	4560	e4270	e2410	1330
24	1490	1550	1770	1700	1580	1540	4380	7100	4450	4200	e2370	1320
25	1500	1550	1770	1700	1570	1540	4480	7170	4340	4100	e2330	1290
26	1490	1570	1760	1690	1560	1540	4590	7170	4410	4030	e2280	1300
27	1450	1610	1760	1690	1560	1550	4700	7170	4450	3990	e2250	1300
28	1490	1620	1760	1680	1550	1550	4730	7170	4410	4060	2210	1270
29	1490	1650	1760	1680	---	1550	4870	7130	4450	3990	2160	1280
30	1490	1670	1760	1670	---	1550	5050	7130	4380	3920	2090	1240
31	1500	---	1770	1670	---	1560	---	7100	---	e3850	e2040	---
TOTAL	47670	45640	52770	53430	44430	47340	94750	200680	164740	139950	87720	47460
MEAN	1538	1521	1702	1724	1587	1527	3158	6474	5491	4515	2830	1582
MAX	1670	1670	1770	1760	1660	1560	5050	7170	7030	5010	3780	2010
MIN	1450	1450	1640	1670	1540	1480	1560	5120	4340	3850	2040	1240
AC-FT	94550	90530	104700	106000	88130	93900	187900	398000	326800	277600	174000	94140
CFSM	.30	.29	.33	.33	.31	.30	.61	1.25	1.06	.87	.55	.31
IN.	.34	.33	.38	.38	.32	.34	.68	1.44	1.19	1.01	.63	.34

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1921 - 1991, BY WATER YEAR (WY)

MEAN	2899	2741	2370	2060	1808	1603	2542	7643	8034	6100	3992	3061
MAX	11010	8370	7166	4514	3432	2996	9071	16900	22120	15930	11200	13140
(WY)	1942	1947	1971	1947	1966	1966	1945	1938	1950	1968	1944	1988
MIN	864	732	647	583	540	535	620	1110	1475	1263	1180	1223
(WY)	1937	1937	1924	1924	1924	1924	1924	1924	1924	1924	1924	1933

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1921 - 1991	
ANNUAL TOTAL	1394330		1026580			
ANNUAL MEAN	3820		2813		3832	
HIGHEST ANNUAL MEAN					7270	1950
LOWEST ANNUAL MEAN					964	1924
HIGHEST DAILY MEAN	12700	May 19	7170	May 25	28200	May 31 1950
LOWEST DAILY MEAN	1110	Mar 9	1240	Sep 30	535	Feb 4 1924
ANNUAL SEVEN-DAY MINIMUM	1120	Mar 5	1290	Sep 24	535	Feb 4 1924
INSTANTANEOUS PEAK FLOW	12700a		7240	May 29	28200b	
INSTANTANEOUS PEAK STAGE	1188.32	May 19	1186.11	May 29	1193.30b	
INSTANTANEOUS LOW FLOW	1100	Mar. 9	1170	Sep 30	535c	
ANNUAL RUNOFF (AC-FT)	2766000		2036000		2710000	
ANNUAL RUNOFF (CFSM)	.74		.54		.72	
ANNUAL RUNOFF (INCHES)	10.03		7.39		9.83	
10 PERCENT EXCEEDS	9370		5910		8180	
50 PERCENT EXCEEDS	1710		1730		2510	
90 PERCENT EXCEEDS	1210		1490		1160	

a Occurred all or part of each day May 18-22.
b Occurred May 31 to June 2, 1950.
c Occurred at times in Feb., Mar., and Apr. 1924.
e Estimated.

LAKE OF THE WOODS BASIN

05129115 VERMILION RIVER NEAR CRANE LAKE, MN

LOCATION.--Lat 48°15'53", long 92°33'57", in NE¼NE¼ sec. 30, T.67 N., R.17 W., St. Louis County, Hydrologic Unit 09030002, in Superior National Forest, on left bank 350 ft downstream from bridge on Forest Route 491, 3.5 mi upstream from mouth, and 3.5 mi west of city of Crane Lake.

PERIOD OF RECORD.--August 1979 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,180 ft above National Geodectic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1979 reached a stage of 15.15 ft, from high-water mark, discharge, about 4,600 ft^3/s.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	82	354	e212	e174	e158	163	347	1300	1140	661	708	211
2	79	351	e210	e174	e158	165	357	1350	1100	723	671	208
3	113	343	e208	e172	e156	160	435	1360	1050	774	649	208
4	148	335	e206	e172	e156	161	720	1350	994	1000	626	186
5	150	331	e204	e172	e156	167	1130	1360	944	1200	603	174
6	158	326	e201	e172	e156	171	1380	1440	897	1290	581	169
7	159	320	e198	e170	e154	166	1540	1560	849	1260	561	164
8	162	318	e195	e170	e154	167	1620	1620	807	1250	536	186
9	163	321	e193	e170	e152	173	1590	1610	777	1200	511	219
10	161	303	e191	e170	e152	175	1420	1590	773	1160	488	238
11	162	294	e190	e168	e152	176	1250	1550	728	1110	464	256
12	161	284	e188	e168	151	175	1100	1640	691	1060	443	283
13	160	275	e186	e168	151	174	984	1750	675	1060	425	304
14	159	274	e186	e166	152	172	935	1740	661	1080	407	331
15	158	275	e184	e166	148	168	1010	1680	653	1080	392	356
16	154	280	e184	e166	145	166	1090	1610	640	1080	390	384
17	168	276	e184	e164	143	164	1120	1520	609	1060	388	399
18	211	274	e182	e164	141	165	1110	1450	592	1050	365	422
19	231	269	e182	e162	145	168	1070	1380	564	1080	351	433
20	250	271	e180	e162	151	176	1040	1320	543	1060	339	438
21	266	284	e180	e160	156	190	994	1260	531	1030	326	451
22	281	290	e180	e160	158	202	955	1210	514	998	306	457
23	296	276	e180	e158	156	215	942	1190	496	952	289	439
24	305	257	e178	e158	157	220	943	1310	480	911	279	426
25	317	e240	e178	e158	156	230	950	1420	462	883	277	430
26	330	e235	e178	e158	159	263	940	1430	488	858	272	420
27	338	e226	e176	e158	161	308	914	1410	491	833	268	414
28	339	e222	e176	e158	159	328	918	1360	457	811	264	412
29	350	e218	e176	e158	---	340	920	1300	508	788	253	409
30	352	e214	e176	e158	---	351	1120	1250	573	766	238	431
31	351	---	e174	e158	---	353	---	1190	---	746	220	---
TOTAL	6714	8536	5816	5112	4293	6372	30844	44510	20687	30814	12890	9858
MEAN	217	285	188	165	153	206	1028	1436	690	994	416	329
MAX	352	354	212	174	161	353	1620	1750	1140	1290	708	457
MIN	79	214	174	158	141	160	347	1190	457	661	220	184
AC-FT	13320	16930	11540	10140	8520	12640	61180	88290	41030	61120	25570	19550

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1979 - 1991, BY WATER YEAR (WY)

MEAN	584	497	388	268	225	268	1120	1405	1050	767	457	469
MAX	1175	1138	872	460	368	465	1641	2249	1840	1609	1612	1880
(WY)	1986	1983	1983	1984	1984	1987	1986	1982	1985	1985	1988	1988
MIN	181	152	116	97.8	94.1	89.5	627	507	205	113	60.0	103
(WY)	1980	1988	1988	1988	1988	1988	1987	1980	1980	1980	1980	1984

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1979 - 1991	
ANNUAL TOTAL	223032		186446			
ANNUAL MEAN	611		511		628	
HIGHEST ANNUAL MEAN					806	1986
LOWEST ANNUAL MEAN					326	1980
HIGHEST DAILY MEAN	2520	May 1	1750	May 13	4300	Apr 25 1985
LOWEST DAILY MEAN	78	Sep 29	79	Oct 2	38	Aug 13 1980
ANNUAL SEVEN-DAY MINIMUM	81	Sep 26	127	Oct 1	40	Aug 10 1980
INSTANTANEOUS PEAK FLOW	2530	May 1	1780	May 13	4360	Apr 25 1985
INSTANTANEOUS PEAK STAGE	12.29	May 1	10.72	May 13	15.20	Apr 25 1985
INSTANTANEOUS LOW FLOW	76	Sep 29	78	Oct 2	38	Aug 13,14, 1980
ANNUAL RUNOFF (AC-FT)	442400		369800		454900	
10 PERCENT EXCEEDS	1650		1250		1430	
50 PERCENT EXCEEDS	296		305		404	
90 PERCENT EXCEEDS	128		158		155	

e Estimated

LAKE OF THE WOODS BASIN

05129290 GOLD PORTAGE OUTLET FROM KABETOGAMA LAKE NEAR RAY, MN

LOCATION.--Lat 48°31'28", long 93°04'29", in SW¼NE¼ sec.30, T.70 N., R.21 W., St. Louis County, Hydrologic Unit 09030003, on right bank in bay at head of Gold Portage Outlet from Kabetogama Lake, 9.8 mi northeast of Ray.

PERIOD OF RECORD.--October 1982 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,100 ft, adjustment of 1912 (U.S. Army Corps of Engineers bench mark), water surface transfer.

REMARKS.--Records good. Flow completely regulated by outlet dam on Namakan Lake.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	423	289	102	45	7.9	.00	.00	.12	247	602	542	548
2	440	267	100	44	6.9	.00	.00	.62	253	611	557	548
3	433	256	98	43	5.8	.00	.00	4.8	269	620	559	525
4	411	257	95	42	4.5	.00	.00	9.2	281	651	558	520
5	425	255	93	40	3.6	.00	.00	12	290	669	563	522
6	415	236	89	38	2.8	.00	.00	16	297	679	565	521
7	416	233	88	38	1.7	.00	.00	21	309	689	564	525
8	414	234	85	38	.82	.00	.00	28	322	693	554	534
9	413	211	83	35	.23	.00	.00	34	335	697	556	515
10	411	199	80	35	.18	.00	.00	41	341	698	560	501
11	398	192	79	35	.16	.00	.00	45	358	693	563	507
12	394	191	77	34	.15	.00	.00	53	390	689	567	506
13	400	195	74	35	.13	.00	.00	57	399	677	567	500
14	383	187	75	32	.10	.00	.00	64	405	666	568	510
15	376	179	72	32	.09	.00	.00	71	414	659	569	501
16	377	171	70	31	.08	.00	.00	80	424	650	582	493
17	373	170	65	29	.03	.00	.00	89	447	651	573	499
18	371	162	63	29	.01	.00	.00	93	448	647	572	484
19	385	158	62	27	.00	.00	.00	96	451	622	577	481
20	374	161	62	24	.01	.00	.00	102	465	622	582	491
21	360	148	60	23	e.00	.00	.00	107	480	620	573	496
22	369	134	59	22	e.00	.00	.00	115	477	585	563	459
23	350	120	58	19	e.00	.00	.00	134	483	558	566	454
24	340	127	57	18	e.00	.00	.00	162	486	563	580	463
25	340	120	55	17	e.00	.00	.00	185	498	571	576	438
26	332	126	54	16	e.00	.00	.01	196	529	567	568	432
27	298	121	55	14	e.00	.00	.08	203	540	571	565	438
28	312	115	52	11	e.00	.00	.07	212	545	581	569	434
29	306	113	49	11	---	.00	.10	222	568	571	564	446
30	297	110	48	9.8	---	.00	.13	229	584	574	550	419
31	296	---	48	8.1	---	.00	---	238	---	546	555	---
TOTAL	11632	5437	2207	874.9	35.19	0.00	0.39	2919.74	12335	19492	17527	14710
MEAN	375	181	71.2	28.2	1.26	.000	.013	94.2	411	629	565	490
MAX	440	289	102	45	7.9	.00	.13	238	584	698	582	548
MIN	296	110	48	8.1	.00	.00	.00	.12	247	546	542	419
AC-FT	23070	10780	4380	1740	70	.00	.8	5790	24470	38660	34760	29180

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1983 - 1991, BY WATER YEAR (WY)

MEAN	399	191	70.8	12.5	.95	.000	.39	127	376	579	590	549
MAX	530	267	127	45.1	7.34	.002	1.66	307	583	683	686	787
(WY)	1986	1990	1990	1990	1990	1990	1985	1986	1985	1985	1988	1988
MIN	285	115	16.5	1.10	.000	.000	.000	.000	96.0	432	519	431
(WY)	1985	1988	1988	1988	1983	1983	1983	1987	1987	1987	1986	1984

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1983 - 1991	
ANNUAL TOTAL	95739.68		87170.22			
ANNUAL MEAN	262		239		243	
HIGHEST ANNUAL MEAN					280	1986
LOWEST ANNUAL MEAN					192	1987
HIGHEST DAILY MEAN	701	Jul 7	698	Jul 10	876	Sep 22 1988
LOWEST DAILY MEAN	.00	Many days	.00	Many days	.00	Many days
ANNUAL SEVEN-DAY MINIMUM	.00	Mar 2	.00	Feb 21	.00	Jan 21 1983
INSTANTANEOUS PEAK FLOW	726	Jul 7	718	Jul 9	897	Sep 21 1988
INSTANTANEOUS PEAK STAGE	18.52	Jul 7	18.58	Jul 9	19.23	Sep 21 1988
ANNUAL RUNOFF (AC-FT)	189900		172900		175800	
10 PERCENT EXCEEDS	607		570		591	
50 PERCENT EXCEEDS	199		134		148	
90 PERCENT EXCEEDS	.00		.00		.00	

e Estimated.

LAKE OF THE WOODS BASIN

05129400 RAINY LAKE NEAR FORT FRANCES, ONTARIO
(International gaging station)

LOCATION.--Lat 48°38'30", long 93°20'00", at Five Mile dock, approximately 5 mi northeast of city 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 current year, in reports of Water Survey of 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 National Geodetic Vertical Datum of 1929 (United States and Canadian Boundary Survey). January 1910 to December 1949, nonrecording gage 3 mi northeast at Ranier, Minn., at same datum. January 1950 to October 1964, water-stage recorder on Government dock at Pither's Point at Fort Frances, and supplementary gage in town pumping station, 0.5 mi south, used during winter months, at same datum.

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

EXTREMES FOR 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.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,108.06 ft, June 25, maximum daily elevation, 1,107.86 ft, July 12, 13; minimum, 1,105.48 ft, Apr. 3; minimum daily, 1,105.53 ft, Mar. 31 to Apr. 3.

MONTHEND ELEVATION, IN FEET NGVD, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Oct. 31	1,106.94	Feb. 28	1,105.68	June 30	1,107.51
Nov. 30	1,107.17	Mar. 31	1,105.53	July 31	1,107.47
Dec. 31	1,106.70	Apr. 30	1,106.51	Aug. 31	1,107.19
Jan. 31	1,106.02	May 31	1,107.51	Sept. 30	1,106.87

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

LAKE OF THE WOODS BASIN

05130500 STURGEON RIVER NEAR CHISHOLM, MN

LOCATION.--Lat 47°40'25", long 92°54'00", in NE¼NW¼ sec.20, T.60 N., R.20 W., St. Louis County, Hydrologic Unit 09030005, on left bank 1,000 ft upstream from highway bridge, 0.6 mi downstream from East Branch Sturgeon River, and 11.5 mi north of Chisholm.
DRAINAGE AREA.--187 mi^2.
PERIOD OF RECORD.--August 1942 to current year.
REVISED RECORDS.--WSP 1438: 1946.
GAGE.--Water-stage recorder. Datum of gage is 1,305.7 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 24, 1944, nonrecording gage at site 1,000 ft downstream at different datum. Aug. 25, 1944, to Sept. 30, 1975, at present site at datum 1.00 ft higher.
REMARKS.--Records good except those for estimated daily discharges, which are fair.
EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base of 500 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage Height (ft)
May 8	0900	*522	*4.01	No other peak greater than base discharge.			

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	109	e42	e25	e22	e22	124	329	117	77	43	21
2	21	103	e40	e24	e22	e22	114	343	111	80	40	21
3	67	96	e39	e24	e22	e22	136	327	103	166	39	23
4	82	90	e38	e24	e22	e21	188	305	92	298	38	22
5	82	85	e37	e24	e23	e21	243	312	84	334	36	22
6	80	80	e36	e23	25	e21	300	411	76	317	34	22
7	71	77	e35	e23	27	e21	313	490	69	289	32	23
8	61	73	e35	e23	27	e21	307	519	62	263	30	60
9	53	69	e34	e23	27	e21	277	482	58	216	29	102
10	49	73	e34	e23	e26	e21	241	411	60	179	28	120
11	49	77	e33	e22	e26	e21	210	351	53	149	26	126
12	47	70	e32	e22	e25	e21	180	307	49	148	25	120
13	43	66	e31	e22	e25	e21	160	273	45	175	25	107
14	49	62	e31	e22	e25	e21	173	241	52	152	24	94
15	38	60	e30	e22	e25	e21	226	217	53	147	23	84
16	35	61	e30	e22	e24	e21	273	196	51	150	24	92
17	57	60	e29	e22	e24	e21	298	177	45	140	25	84
18	94	58	e29	e22	e24	e22	296	159	40	128	25	86
19	101	57	e29	e22	e24	e27	277	144	35	120	24	82
20	108	56	e28	e22	e23	36	248	132	42	109	23	76
21	120	60	e28	e22	e23	44	220	123	49	100	23	70
22	130	63	e28	e22	e23	50	204	115	44	90	23	62
23	137	60	e27	e22	e23	60	198	121	39	80	22	58
24	142	e54	e27	e22	e23	67	194	144	36	72	22	52
25	144	e51	e27	e22	e23	85	190	138	33	65	23	53
26	144	e50	e27	e22	e22	134	182	133	31	58	23	54
27	143	e49	e26	e22	e22	204	199	127	31	52	23	51
28	137	e47	e26	e22	e22	206	216	119	30	49	22	48
29	130	e45	e26	e22	---	213	216	120	49	49	22	44
30	121	e44	e25	e22	---	192	281	126	49	47	22	41
31	113	---	e25	e22	---	150	---	122	---	48	22	---
TOTAL	2670	2005	964	698	669	1850	6684	7514	1688	4347	840	1920
MEAN	86.1	66.8	31.1	22.5	23.9	59.7	223	242	56.3	140	27.1	64.0
MAX	144	109	42	25	27	213	313	519	117	334	43	126
MIN	21	44	25	22	22	21	114	115	30	47	22	21
AC-FT	5300	3980	1910	1380	1330	3670	13260	14900	3350	8620	1670	3810
CFSM	.46	.36	.17	.12	.13	.32	1.19	1.30	.30	.75	.14	.34
IN.	.53	.40	.19	.14	.13	.37	1.33	1.49	.34	.86	.17	.38

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1991, BY WATER YEAR (WY)

MEAN	113	87.5	44.8	27.1	21.9	47.8	371	310	188	104	68.4	89.1
MAX	369	264	115	66.0	47.7	337	868	1451	528	483	268	424
(WY)	1974	1978	1978	1966	1984	1945	1948	1950	1944	1944	1988	1977
MIN	7.85	8.90	4.82	3.98	4.54	10.0	41.0	22.9	14.7	5.99	12.6	4.60
(WY)	1977	1977	1977	1977	1977	1957	1977	1977	1988	1988	1961	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1942 - 1991	
ANNUAL TOTAL	38441		31849			
ANNUAL MEAN	105		87.3		123	
HIGHEST ANNUAL MEAN					208	1950
LOWEST ANNUAL MEAN					63.1	1977
HIGHEST DAILY MEAN	985	Jun 5	519	May 8	3530	May 8 1950
LOWEST DAILY MEAN	16	Aug 21	21	Oct 2	2.5	Jul 30 1988
ANNUAL SEVEN-DAY MINIMUM	16	Sep 5	21	Mar 4	3.0	Jul 24 1988
INSTANTANEOUS PEAK FLOW	1010	Jun 5	522	May 8	3630a	May 7 1950
INSTANTANEOUS PEAK STAGE	4.87	Jun 5	4.01	May 8	7.41b	May 7 1950
INSTANTANEOUS LOW FLOW	14	Sep 10	20	Sep 1,2		
ANNUAL RUNOFF (AC-FT)	76250		63170		89040	
ANNUAL RUNOFF (CFSM)	.56		.47		.66	
ANNUAL RUNOFF (INCHES)	7.65		6.34		8.93	
10 PERCENT EXCEEDS	222		216		296	
50 PERCENT EXCEEDS	47		49		55	
90 PERCENT EXCEEDS	23		22		16	

a From rating curve extended above 1,600 ft^3/s, on basis of slope-area measurement of peak flow.
b Present datum.
e Estimated.

LAKE OF THE WOODS BASIN

05131500 LITTLE FORK RIVER AT LITTLEFORK, MN

LOCATION.--Lat 48°23'45", long 93°32'57", in NE¼SE¼ sec.9, T.68 N., R.25 W., Koochiching County, Hydrologic Unit 09030005, on right bank at town of Littlefork, 0.9 mi upstream from bridge on State Highway 217, 2.8 mi upstream from Beaver Creek, and 19 mi upstream from mouth.
DRAINAGE AREA.--1,730 mi^2, 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.
REVISED RECORDS.--WSP 955: Drainage area. WSP 1508: 1913, 1916, 1928-32, 1934. WRD MN-74: 1963.
GAGE.--Water-stage recorder. Datum of gage is 1,083.59 ft above National Geodetic Vertical Datum of 1929. June 23, 1909, to Mar. 4, 1917, nonrecording gage and July 21, 1937, to Oct. 23, 1979, water-stage recorder at site 1.2 mi downstream at datum 10.53 ft lower; Mar. 5 to Sept. 30, 1917, and June 22, 1928, to July 20, 1937, nonrecording gage at site 1.18 mi downstream at datum 10.53 ft lower.
REMARKS.--Records good except those for estimated daily discharges, which are fair.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	491	e195	e125	e105	e85	e950	2880	1230	914	434	100
2	61	467	e190	e125	e110	e85	e900	3420	1150	1790	423	94
3	68	444	e190	e125	e110	e85	e850	3440	1020	2090	374	92
4	75	431	e185	e120	e110	e85	e850	3220	901	3050	374	88
5	80	415	e180	e120	e110	e85	e1200	3100	833	4870	380	88
6	100	390	e180	e120	e110	e85	3200	3470	762	5460	347	88
7	139	374	e175	e120	e110	e85	2880	4460	668	4860	321	111
8	219	348	e175	e115	e105	e85	2530	4760	591	4430	294	206
9	239	328	e170	e115	e105	e85	2150	4570	526	4400	270	306
10	245	315	e170	e115	e105	e85	1910	4230	507	3870	246	395
11	233	262	e165	e115	e105	e85	1640	3840	576	3420	221	574
12	213	233	e165	e115	e100	e85	1400	3940	553	3240	205	1190
13	200	265	e160	e110	e100	e85	1200	4800	506	4270	191	1280
14	185	287	e160	e110	e100	e85	1080	4110	500	4370	174	1280
15	174	322	e160	e110	e95	e85	1310	3440	507	4020	162	1300
16	167	308	e155	e110	e95	e85	2180	2860	491	3450	155	1340
17	171	275	e155	e110	e95	e85	2860	2300	489	2770	151	1290
18	184	265	e150	e105	e90	e90	2990	1900	473	2170	148	1250
19	192	245	e150	e105	e90	e100	2800	1620	471	1810	144	1240
20	202	269	e145	e105	e90	e120	2460	1370	422	1550	135	1150
21	260	274	e145	e105	e90	e140	2120	1200	378	1360	129	1070
22	341	253	e145	e105	e90	e170	1830	1080	359	1220	126	977
23	385	259	e140	e105	e90	e200	1640	1010	354	1090	118	892
24	435	175	e140	e105	e90	e250	1550	1560	372	894	113	788
25	470	e180	e140	e105	e90	e300	1650	2810	369	728	110	711
26	495	e170	e135	e105	e85	e500	1780	2630	544	662	106	684
27	528	e190	e135	e105	e85	e700	1740	2130	924	583	106	633
28	534	e210	e135	e105	e85	e1000	1690	1720	692	512	108	608
29	524	e210	e130	e105	---	e1300	1670	1440	564	495	108	597
30	522	e200	e130	e105	---	e1200	1930	1370	717	447	112	583
31	506	---	e130	e105	---	e1000	---	1320	---	416	110	---
TOTAL	8210	8855	4880	3450	2745	8515	54940	86000	18449	75211	6395	21005
MEAN	265	295	157	111	98.0	275	1831	2774	615	2426	206	700
MAX	534	491	195	125	110	1300	3200	4800	1230	5460	434	1340
MIN	61	170	130	105	85	85	850	1010	354	416	106	88
AC-FT	16280	17560	9680	6840	5440	16890	109000	170600	36590	149200	12680	41660
CFSM	.15	.17	.09	.06	.06	.16	1.06	1.60	.36	1.40	.12	.40
IN.	.18	.19	.10	.07	.06	.18	1.18	1.85	.40	1.62	.14	.45

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1909 - 1991, BY WATER YEAR (WY)

MEAN	866	671	296	139	107	268	3186	2905	1828	927	547	735
MAX	3320	3044	972	477	270	3022	8421	12190	5490	3643	2679	5189
(WY)	1947	1972	1983	1966	1969	1945	1966	1950	1944	1944	1988	1977
MIN	43.4	60.8	52.6	43.5	42.2	50.2	292	173	182	75.4	34.3	29.2
(WY)	1977	1977	1977	1931	1963	1940	1977	1977	1988	1988	1936	1976

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1909 - 1991	
ANNUAL TOTAL	289057		298655			
ANNUAL MEAN	792		818		1056	
HIGHEST ANNUAL MEAN					1912	1966
LOWEST ANNUAL MEAN					306	1931
HIGHEST DAILY MEAN	5400	Jun 7	5460	Jul 6	25000	Apr 18 1916
LOWEST DAILY MEAN	59	Sep 18	61	Oct 2	21	Aug 26 1936
ANNUAL SEVEN-DAY MINIMUM	64	Sep 13	84	Oct 1	22	Aug 21 1936
INSTANTANEOUS PEAK FLOW	5480	Jun 6,7	5550	Jul 6	25000	a
INSTANTANEOUS PEAK STAGE	8.26	Jun 6,7	8.45	Jul 6	37.00	a
INSTANTANEOUS LOW FLOW	57	Sep 18	60	Oct 2		
ANNUAL RUNOFF (AC-FT)	573300		592400		764800	
ANNUAL RUNOFF (CFSM)	.46		.47		.61	
ANNUAL RUNOFF (INCHES)	6.22		6.42		8.29	
10 PERCENT EXCEEDS	2080		2690		2800	
50 PERCENT EXCEEDS	233		275		342	
90 PERCENT EXCEEDS	85		90		84	

a Occurred Apr. 18, 1916, May 11, 1950, site and datum then in use.
e Estimated.

LAKE OF THE WOODS BASIN

05132000 BIG FORK RIVER AT BIG FALLS, MN

LOCATION.--Lat 48°11'45", long 93°48'25", in SW¼SE¼ sec.35, T.155 N., R.25 W., Koochiching County, Hydrologic Unit 09030006, on left bank at village of Big Falls, 700 ft downstream from falls, 0.3 mi downstream from bridge on U.S. Highway 71, and 4.8 mi upstream from Sturgeon River.
DRAINAGE AREA.--1,460 mi^2, 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 September 1979. October 1979 to September 1982, annual maximums only. October 1982 to current year.
REVISED RECORDS.--WSP 1308: 1935(M).
GAGE.--Water-stage recorder. Datum of gage is 1,144.71 ft above National Geodetic Vertical Datum of 1929. Prior to June 10, 1911, nonrecording gage at railroad bridge about 0.4 mi upstream at different datum. June 10, 1911, to Sept. 30, 1912, and June 22, 1928, to Dec. 17, 1937, nonrecording gage at site 200 ft upstream at same datum.
REMARKS.--Records good except those for estimated daily discharges, which are fair. Prior to 1971, a powerplant, located 0.3 mi upstream, caused some diurnal fluctuation at low flows.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	128	256	e170	e130	e120	e130	e500	1510	991	805	312	121
2	129	255	e170	e130	e120	e130	e450	1840	909	1220	276	121
3	146	255	e170	e130	e125	e125	439	1840	809	1410	264	134
4	154	256	e165	e130	e130	e125	528	1750	713	1680	338	141
5	161	259	e165	e125	e135	e125	683	1810	617	1820	332	138
6	177	253	e165	e125	e135	e125	973	2370	545	1840	293	136
7	187	235	e160	e125	e135	e125	1190	3190	478	1650	273	141
8	191	193	e160	e125	e135	e120	889	3410	422	1870	253	171
9	186	267	e155	e125	e135	e120	684	3300	385	1550	253	225
10	182	233	e155	e125	e135	e120	615	2980	452	1520	242	288
11	180	194	e150	e125	e135	e120	556	2580	457	1340	221	300
12	175	206	e150	e125	e135	e120	506	2730	411	1300	204	297
13	172	236	e150	e125	e135	e120	458	2560	367	1370	188	300
14	172	235	e150	e120	e135	e120	473	2280	514	1150	175	327
15	173	275	e145	e120	e135	e120	583	1980	675	955	165	393
16	173	279	e145	e120	e135	e120	861	1730	707	793	166	488
17	185	276	e145	e120	e135	e120	1130	1520	622	690	164	566
18	203	242	e145	e120	e135	e118	1240	1320	566	615	158	595
19	212	256	e140	e120	e135	e117	1200	1140	497	611	150	616
20	225	263	e140	e120	e135	e117	1120	1010	415	522	145	606
21	235	283	e140	e120	e135	e117	1010	925	390	470	138	581
22	239	238	e140	e120	e135	e120	915	862	375	425	133	545
23	245	e220	e140	e120	e135	e150	888	857	385	397	127	508
24	257	e200	e140	e120	e135	e200	883	1410	368	355	125	480
25	264	e190	e135	e120	e135	e250	865	2310	334	337	123	472
26	262	e180	e135	e120	e130	e350	819	2320	350	309	123	472
27	265	e175	e135	e120	e130	e500	787	2060	329	282	127	444
28	263	e175	e130	e120	e130	e700	780	1700	283	439	127	422
29	268	e175	e130	e120	---	e800	782	1380	303	552	128	421
30	270	e170	e130	e120	---	e700	1030	1240	519	421	127	409
31	265	---	e130	e120	---	e600	---	1100	---	355	129	---
TOTAL	6344	6930	4580	3805	3720	6924	23837	59014	15188	29053	5979	10858
MEAN	205	231	148	123	133	223	795	1904	506	937	193	362
MAX	270	283	170	130	135	800	1240	3410	991	1870	338	616
MIN	128	170	130	120	120	117	439	857	283	282	123	121
AC-FT	12580	13750	9080	7550	7380	13730	47280	117100	30130	57630	11860	21540
CFSM	.14	.16	.10	.08	.09	.15	.54	1.30	.35	.64	.13	.25
IN.	.16	.18	.12	.10	.09	.18	.61	1.50	.39	.74	.15	.28

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1909 - 1991, BY WATER YEAR (WY)

MEAN	666	524	276	169	133	241	1901	2023	1194	635	394	546
MAX	2247	2034	685	399	335	1928	5186	7496	2890	2321	1799	2989
(WY)	1970	1972	1970	1969	1969	1945	1966	1950	1974	1944	1978	1937
MIN	38.3	44.5	31.6	22.2	22.9	32.9	175	138	180	46.0	26.7	22.4
(WY)	1932	1935	1935	1935	1935	1940	1931	1931	1934	1931	1934	1934

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1909 - 1991	
ANNUAL TOTAL	181815		176232			
ANNUAL MEAN	498		483		725	
HIGHEST ANNUAL MEAN					1362	1950
LOWEST ANNUAL MEAN					92.0	1931
HIGHEST DAILY MEAN	3680	Jun 23	3410	May 8	14800	May 8,19,1950
LOWEST DAILY MEAN	93	Aug 23	117	Mar 19	14	Jan 10 1940
ANNUAL SEVEN-DAY MINIMUM	95	Aug 21	118	Mar 15	18	Jan 22 1935
INSTANTANEOUS PEAK FLOW	3740	Jun 23	3420	May 8	14800	May 8 1950
INSTANTANEOUS PEAK STAGE	7.56	Jun 34	7.25	May 8	17.08	May 8 1950
INSTANTANEOUS LOW FLOW	91a		91	Nov 8	7.0	Aug 7 1939
ANNUAL RUNOFF (AC-FT)	360600		349600		525600	
ANNUAL RUNOFF (CFSM)	.34		.33		.50	
ANNUAL RUNOFF (INCHES)	4.63		4.49		6.75	
10 PERCENT EXCEEDS	1310		1240		1830	
50 PERCENT EXCEEDS	191		242		311	
90 PERCENT EXCEEDS	121		121		76	

a Occurred Aug. 22, 23, Nov. 8.
e Estimated.

LAKE OF THE WOODS BASIN
05133500 RAINY RIVER AT MANITOU RAPIDS, MN
(International gaging station)

LOCATION.--Lat 48°38'04", long 93°54'47", in NW¼SE¼ sec.36, T.160 N., R.26 W., Koochiching County, Hydrologic Unit 09030004, on left bank at Manitou Rapids, 4 mi west of Indus.
DRAINAGE AREA.--19,400 mi^2, approximately.

WATER-DISCHARGE RECORDS

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 U.S. Army Corps of Engineers Published as "near Birchdale" 1932-34.
GAGE.--Water-stage recorder. Datum of gage is 1,062.48 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 10, 1934, nonrecording gage at site near Birchdale, 7 mi. downstream at different datum.
REMARKS.--Records good except those for estimated daily discharges, which are fair. Satellite telemeter at station. Diurnal fluctuation caused by powerplant at International Falls. Some regulation at low and medium flows by Rainy and Namakan Lakes.
COOPERATION.--This station is one of the international gaging stations maintained by the United States under agreement with Canada.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5120	5060	e4850	e8200	e7000	e5000	7780	14500	17000	14200	10600	4780
2	5170	5070	e4850	e7500	e7000	e5000	8080	15900	16900	15900	9870	4720
3	5140	5190	e4900	e8000	e7000	e5000	8380	16700	16800	17200	9040	4650
4	5150	5170	e4800	e8500	e7000	e5000	8520	16700	16300	18100	8250	4780
5	5260	5120	e4500	e9000	e7000	e5000	8510	16500	15900	19400	7860	4650
6	5170	5040	e4500	e9000	e7000	e5000	8950	17700	15500	21500	6630	4650
7	4840	4600	e5600	e9000	e6000	e5000	10100	20700	14300	21700	6990	4750
8	5100	4070	e6000	e9000	e6000	e5000	10800	22900	13300	20800	7060	5160
9	5270	4090	e6000	e8500	e6000	e5000	10500	23500	13000	20800	6320	5550
10	5370	4270	e6000	e8000	e6000	e5000	9600	23100	12800	20400	6710	5810
11	5670	4050	e6000	e7500	e6000	e6000	9090	22200	12800	17900	6140	6090
12	5520	4750	e6000	e7000	e5500	e7000	8750	22000	12900	16500	5820	6300
13	5410	4370	e5700	e7000	e5000	e5000	8380	22500	12700	17600	5410	6760
14	5320	3830	e6300	e7000	e5000	e4500	8000	22600	12500	18900	4940	7190
15	5320	4230	e7550	e7000	e5000	e4500	8570	21700	12400	19400	4930	7540
16	5330	4440	e7800	e7000	e5000	e5000	10600	20600	12500	18800	5040	7900
17	5240	4450	e8050	e7000	e5000	e5000	12200	19500	12500	17900	4930	8340
18	5250	4400	e8050	e7000	e5000	e5000	13200	18500	12400	16900	4940	8570
19	5020	4380	e8000	e7000	e5000	e4500	13700	17700	12200	16100	4920	8720
20	5180	4380	e8000	e7000	e5000	e4500	14100	17000	12000	15600	4890	8740
21	5440	4370	e8100	e7000	e5000	e4500	14100	16400	11500	15100	4830	8510
22	5560	e4350	e8500	e7000	e5000	4880	13700	16000	11500	14700	4870	8180
23	5560	e4600	e9050	e7000	e5000	4910	13400	16000	11600	14500	4860	8010
24	5290	e4700	e9150	e7000	e5000	4900	13100	16200	11600	14300	4850	7690
25	5170	e4800	e8700	e7000	e5000	4890	12900	18400	11600	13900	4820	7450
26	5160	e4650	e7000	e7000	e5000	6170	13000	20100	11800	13700	4770	7410
27	5230	e4600	e7800	e7000	e5000	7160	13100	20200	12500	13600	4760	7220
28	5610	e4600	e9150	e7000	e5000	7550	13000	19400	13300	13400	4770	7080
29	5260	e4800	e9200	e7000	---	7880	13000	18400	13300	13200	4760	6920
30	5120	e4800	e9200	e7000	---	8470	13500	17800	13300	12600	4750	6740
31	5090	---	e8800	e7000	---	8190	---	17400	---	11400	4840	---
TOTAL	163340	137230	218100	232200	157500	170500	330610	588800	398700	516000	184170	200860
MEAN	5269	4574	7035	7490	5625	5500	11020	18990	13290	16650	5941	6695
MAX	5670	5190	9200	9000	7000	8470	14100	23500	17000	21700	10600	8740
MIN	4840	3830	4500	7000	5000	4500	7780	14500	11500	11400	4750	4650
AC-FT	324000	272200	432600	460600	312400	338200	655800	1168000	790800	1023000	365300	398400
CFSM	.27	.24	.36	.39	.29	.28	.57	.98	.69	.86	.31	.35
IN.	.31	.26	.42	.45	.30	.33	.63	1.13	.76	.99	.35	.39

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1929 - 1991, BY WATER YEAR (WY)

MEAN	11890	11070	10030	9077	8749	9010	15470	19580	20300	16360	11150	10870
MAX	42410	37280	27790	18430	17240	16640	38100	52880	49480	47970	33700	30620
(WY)	1942	1972	1972	1972	1969	1945	1966	1950	1950	1950	1944	1988
MIN	4728	3796	3190	2900	3129	2926	4378	4106	3676	3483	3422	4168
(WY)	1981	1977	1930	1931	1931	1931	1977	1977	1980	1980	1980	1958

SUMMARY STATISTICS	FOR 1990 CALENDAR YEAR		FOR 1991 WATER YEAR		WATER YEARS 1929 - 1991	
ANNUAL TOTAL	3957270		3298010			
ANNUAL MEAN	10840		9036		12810	
HIGHEST ANNUAL MEAN					23260	1950
LOWEST ANNUAL MEAN					4470	1931
HIGHEST DAILY MEAN	37200	Jun 8	23500	May 9	71300	May 11 1950
LOWEST DAILY MEAN	3830	Nov 14	3830	Nov 14	928	Dec 26 1929
ANNUAL SEVEN-DAY MINIMUM	4200	Nov 8	4200	Nov 8	1500	Dec 24 1929
INSTANTANEOUS PEAK FLOW	37300	Jun 8	23600	May 9	71600	May 12 1950
INSTANTANEOUS PEAK STAGE	13.76	Jun 8	10.08	May 9	21.04	May 12 1950
INSTANTANEOUS LOW FLOW	3770	Nov 14	3770	Nov 14		
ANNUAL RUNOFF (AC-FT)	7849000		6542000		9280000	
ANNUAL RUNOFF (CFSM)	.56		.47		.66	
ANNUAL RUNOFF (INCHES)	7.59		6.32		8.97	
10 PERCENT EXCEEDS	27100		17000		25400	
50 PERCENT EXCEEDS	6460		7000		10200	
90 PERCENT EXCEEDS	4760		4770		5000	

e Estimated

LAKE OF THE WOODS BASIN

05133500 RAINY RIVER AT MANITOU RAPIDS, MN--Continued
(National stream-quality network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968-70, 1978 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND (00060)	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)
OCT												
22...	1445	--	5680	93	92	7.5	7.6	6.0	5.0	724	11.2	83
DEC												
03...	1215	7680	--	--	115	7.4	7.4	0.0	6.1	740	13.1	360
JAN												
14...	1130	--	10300	--	122	6.9	7.3	1.0	4.3	724	9.0	48
APR												
01...	1130	--	7720	90	95	7.4	7.5	0.5	4.0	737	9.6	190
JUN												
03...	1230	--	16800	80	83	7.3	7.4	20.0	3.7	734	7.3	K240
JUL												
15...	1100	--	19500	79	81	7.1	7.6	22.0	14	720	7.2	K13

DATE	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)
OCT												
22...	100	9.4	2.6	4.6	0.8	30	32	0	37	4.9	5.2	<0.1
DEC												
03...	140	13	3.6	5.5	1.0	37	39	0	45	6.3	7.2	<0.1
JAN												
14...	54	12	3.3	8.0	1.2	40	44	0	49	7.0	5.0	0.2
APR												
01...	K16	9.9	2.9	4.1	1.3	31	32	0	38	5.5	5.4	<0.1
JUN												
03...	K240	9.7	3.2	2.9	0.8	29	31	0	35	3.9	1.8	<0.1
JUL												
15...	59	14	4.4	2.0	0.9	37	34	0	45	2.9	2.0	<0.1

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)
OCT											
22...	1.7	64	<0.01	<0.10	0.03	0.03	0.50	0.04	0.04	0.01	0.01
DEC											
03...	2.8	73	<0.01	<0.10	0.04	0.04	0.60	0.05	0.01	0.03	<0.01
JAN											
14...	2.9	89	<0.01	<0.10	0.06	0.06	0.50	0.91	0.03	0.02	0.02
APR											
01...	3.7	59	<0.01	0.11	0.07	0.04	0.70	0.04	0.01	<0.01	<0.01
JUN											
03...	2.9	62	<0.01	<0.05	0.02	0.02	0.70	0.03	<0.01	<0.01	<0.01
JUL											
15...	6.3	99	0.01	<0.05	0.06	0.05	0.90	0.07	0.03	0.03	0.02

LAKE OF THE WOODS BASIN

05133500 RAINY RIVER AT MANITOU RAPIDS, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	SEDIMENT, SUSPENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	IRON, DISSOLVED (UG/L AS FE) (01046)
OCT 22...	10	92	70	1	10	<0.5	<1.0	2	<3	2	110
DEC 03...	--	--	--	--	--	--	--	--	--	--	--
JAN 14...	5	91	40	<1	17	<0.5	<1.0	1	<3	3	78
APR 01...	6	95	40	<1	11	<0.5	<1.0	2	<3	3	190
JUN 03...	9	85	--	--	--	--	--	--	--	--	--
JUL 15...	28	93	160	2	21	<0.5	<1.0	<1	<3	3	610

DATE	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)
OCT 22...	1	<4	8	<0.1	<10	<1	<1	<1.0	26	<6	24
DEC 03...	--	--	--	--	--	--	--	--	--	--	--
JAN 14...	<1	<4	11	<0.1	<10	<1	<1	<1.0	30	<6	13
APR 01...	<1	<4	15	<0.1	<10	1	<1	<1.0	28	<6	24
JUN 03...	--	--	--	--	--	--	--	--	--	--	--
JUL 15...	1	<4	30	<0.1	<10	2	<2	<1.0	30	<6	10

LAKE OF THE WOODS BASIN

05140520 LAKE OF THE WOODS AT WARROAD, MN

(International gaging station)

LOCATION.--Lat 48°54'15", long 95°18'57", in SW¼SE¼ sec.29, T.163 N., R.36 W., Roseau County, Hydrologic Unit 09030009, on left bank of Warroad River in Warroad, 300 ft downstream from Canadian National railroad bridge, 1,000 ft downstream from bridge on State Highway 11, and 4,000 ft upstream from mouth of Warroad River.

DRAINAGE AREA.--27,200 mi^2.

PERIOD OF RECORD.--April to September 1978 (monthend elevations only), October 1978 to current year. Records collected prior to April 1978 are in reports of the Water Survey of Canada.

GAGE.--Water-stage recorder. Datum of gage is 1,000.00 ft, Lake of the Woods datum.

REMARKS.--Runoff conditions of the Warroad River can affect water levels obtained at this station. Water level subject to fluctuation caused by change in direction and velocity of wind and seiches.

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

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 62.38 ft, July 15, 1989; maximum daily, 61.84 ft, Sept. 12, 1978; minimum gage height recorded, 55.94 ft, Sept. 4, 1980; minimum daily recorded, 56.52 ft, Apr. 15, 1981.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 60.66 ft, July 12; maximum daily, 60.45 ft, July 12; minimum, 57.07 ft, Nov. 22; minimum daily, 57.65 ft, Nov. 22.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	58.94	58.70	58.44	58.47	58.44	58.18	57.80	57.87	59.29	59.81	60.12	59.34
2	59.01	58.51	58.45	58.47	58.41	58.17	57.81	58.14	59.41	59.76	60.25	59.21
3	58.84	58.48	58.47	58.46	58.40	58.18	57.79	58.34	59.53	60.04	60.24	59.29
4	58.51	58.68	58.46	58.47	58.38	58.16	57.79	58.35	59.47	59.99	60.11	59.26
5	59.01	58.59	58.41	58.48	58.40	58.13	57.79	58.26	59.40	59.94	60.09	59.30
6	58.94	58.52	58.40	58.48	58.37	58.10	57.79	58.41	59.35	59.93	60.11	59.20
7	58.91	58.45	58.39	58.52	58.37	58.11	57.79	58.37	59.33	60.10	60.06	59.31
8	58.85	58.36	58.40	58.51	58.34	58.12	57.80	58.39	59.25	60.08	60.01	59.36
9	58.77	58.28	58.37	58.51	58.33	58.11	57.81	58.44	59.28	60.10	59.98	59.29
10	58.61	58.42	58.41	58.55	58.31	58.13	57.81	58.39	59.28	60.19	59.97	59.32
11	58.66	58.52	58.41	58.53	58.32	58.12	57.81	58.47	59.39	60.26	59.95	59.29
12	58.84	58.58	58.38	58.54	58.32	58.07	57.82	58.58	59.46	60.45	59.92	59.18
13	58.71	58.51	58.40	58.54	58.32	58.05	57.81	58.53	59.41	60.28	59.90	59.28
14	58.79	58.49	58.41	58.52	58.28	58.03	57.85	58.64	59.54	60.20	59.82	59.39
15	58.73	58.56	58.40	58.54	58.28	58.01	57.89	58.66	59.35	60.09	59.82	59.31
16	58.87	58.47	58.41	58.50	58.28	58.00	57.86	58.80	59.32	60.26	59.87	59.48
17	59.36	58.46	58.39	58.50	58.27	57.98	57.88	58.90	59.42	60.29	59.91	59.33
18	58.92	58.47	58.43	58.51	58.25	57.94	57.91	58.82	59.39	60.27	59.85	59.66
19	58.81	58.54	58.43	58.47	58.25	57.95	57.93	58.73	59.48	60.20	59.63	59.40
20	58.71	58.54	58.43	58.50	58.26	57.95	57.94	58.69	59.59	60.35	59.62	59.32
21	58.64	58.21	58.43	58.50	58.25	57.93	57.94	58.74	59.70	60.31	59.63	59.28
22	58.64	57.65	58.43	58.47	58.23	57.92	57.94	58.79	59.56	60.10	59.67	59.35
23	58.72	58.23	58.45	58.46	58.25	57.88	57.97	59.08	59.40	60.12	59.65	59.45
24	58.75	58.46	58.46	58.46	58.21	57.87	57.99	59.17	59.33	60.33	59.54	59.27
25	58.64	58.46	58.44	58.45	58.21	57.87	57.97	59.27	59.55	60.33	59.56	59.36
26	58.62	58.51	58.47	58.45	58.19	57.86	58.06	59.21	59.47	60.26	59.71	59.59
27	58.68	58.48	58.51	58.44	58.18	57.81	58.13	59.24	59.49	60.29	59.59	59.52
28	58.71	58.45	58.45	58.43	58.20	57.81	57.91	59.28	59.71	60.27	59.45	59.64
29	58.69	58.47	58.45	58.43	---	57.81	58.08	59.28	59.72	60.18	59.41	59.59
30	58.71	58.45	58.49	58.45	---	57.81	58.03	59.28	59.87	60.09	59.58	59.25
31	58.71	---	58.49	58.44	---	57.79	---	59.34	---	59.93	59.57	---
MEAN	58.78	58.45	58.43	58.49	58.30	58.00	57.89	58.72	59.46	60.15	59.83	59.36
MAX	59.36	58.70	58.51	58.55	58.44	58.18	58.13	59.34	59.87	60.45	60.25	59.66
MIN	58.51	57.65	58.37	58.43	58.18	57.79	57.79	57.87	59.25	59.76	59.41	59.18

CAL YR 1990 MEAN 58.84 MAX 60.72 MIN 57.65
WTR YR 1991 MEAN 58.83 MAX 60.45 MIN 57.65

LAKE OF THE WOODS BASIN

05140521 LAKE OF THE WOODS AT SPRINGSTEEL ISLAND NEAR WARROAD, MN

LOCATION.--Lat 48°56'45", long 95°18'24", in SW¼SW¼ sec.9, T.163 N., R.36 W., Roseau County, Hydrologic Unit 09030009, at Springsteel Resort on Springsteel Island, 2.8 mi north of Warroad.

DRAINAGE AREA.--27,200 mi^2.

PERIOD OF RECORD.--June 1985 to current year.

GAGE.--Water-stage recorder. Datum at gage is 1,000.00 ft, Lake of the Woods datum.

REMARKS.--Satellite telemeter at station. Water level subject to fluctuation caused by changes in direction and velocity of wind and seiches.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 62.24 ft, July 5, 1989; maximum daily, 61.81 ft, July 6, 7, 1985; minimum, 57.22 ft, Nov. 22, 1990; minimum daily, 57.43 ft, Mar. 18, 19, 20, 1988.

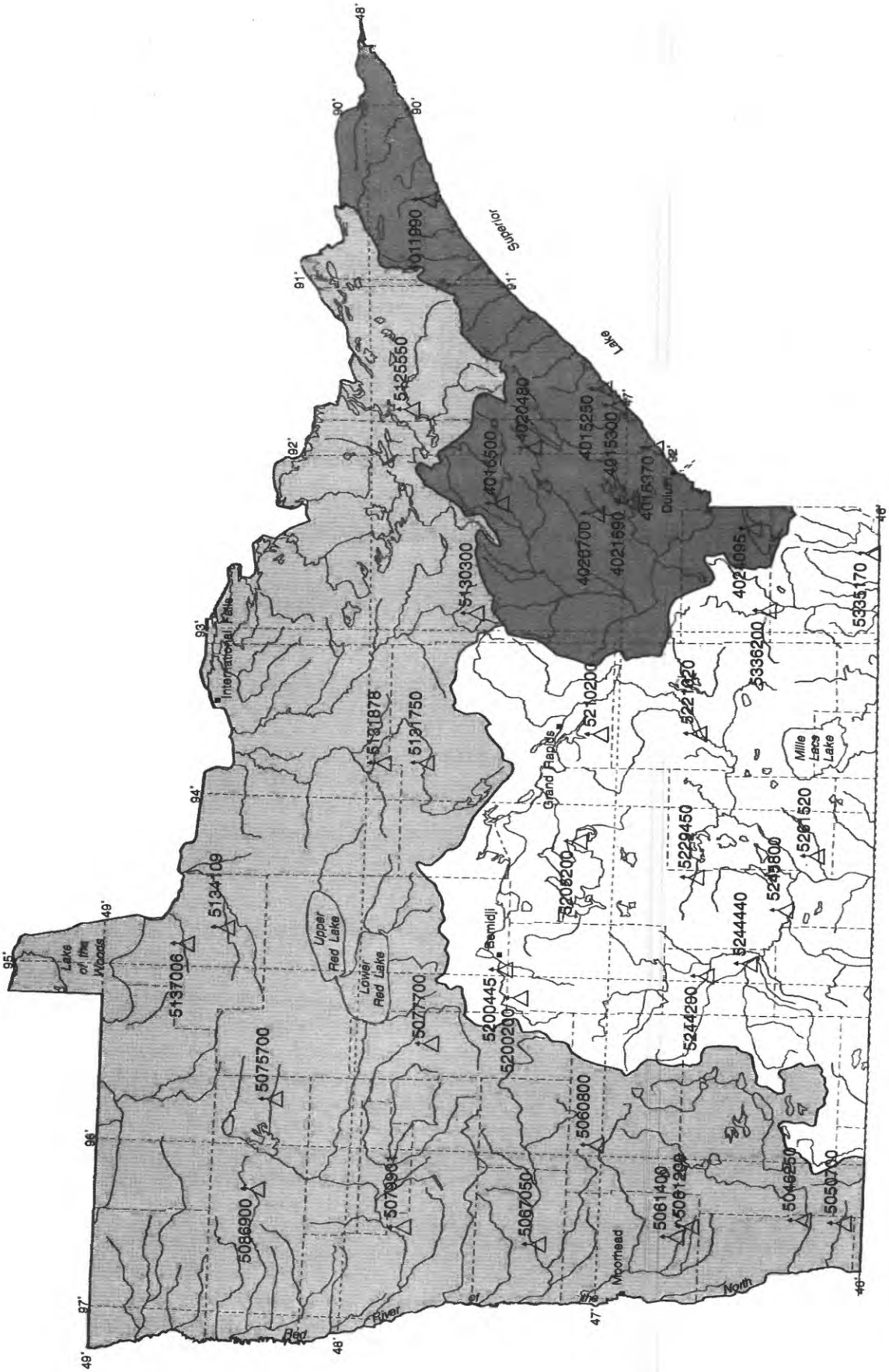
EXTREMES FOR CURRENT YEAR.--Maximum gage height, 60.54 ft, July 12, 20; maximum daily, 60.40 ft, July 12; minimum, 57.22 ft, Nov. 22; minimum daily, 57.72 ft, Nov. 22.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	58.96	58.71	58.45	58.49	58.46	58.16	57.80	57.87	59.28	59.80	60.12	59.39
2	59.07	58.52	58.46	58.49	58.42	58.14	57.80	58.10	59.37	59.75	60.24	59.29
3	58.88	58.48	58.47	58.48	58.39	58.15	57.78	58.28	59.49	59.98	60.24	59.31
4	58.57	58.68	58.47	58.49	---	58.14	57.79	58.33	59.47	59.96	60.13	59.27
5	59.01	58.60	58.44	58.50	---	58.12	57.80	58.23	59.39	59.93	60.12	59.30
6	58.92	58.52	58.43	58.49	---	58.08	57.79	58.36	59.36	59.93	60.15	59.22
7	58.90	58.47	58.43	58.55	---	58.09	57.79	58.37	59.34	60.07	60.07	59.32
8	58.89	58.38	58.43	58.54	---	58.11	57.79	58.40	59.27	60.07	60.03	59.38
9	58.81	58.28	58.42	58.52	---	58.10	57.80	58.45	59.27	60.09	60.01	59.28
10	58.69	58.41	58.45	58.56	---	58.12	57.81	58.45	59.25	60.17	60.00	59.32
11	58.69	58.50	58.45	58.55	---	58.10	57.81	58.52	59.35	60.24	59.98	59.31
12	58.82	58.57	58.41	58.56	---	58.06	57.80	58.58	59.47	60.40	59.95	59.21
13	58.75	58.53	58.44	58.57	---	58.04	57.80	58.54	59.41	60.27	59.93	59.28
14	58.80	58.52	58.45	58.54	---	58.02	57.83	58.61	59.52	60.20	59.86	59.39
15	58.73	58.56	58.45	58.56	---	58.01	57.89	58.68	59.34	60.12	59.85	59.31
16	58.87	58.47	58.45	58.53	---	58.00	57.86	58.74	59.32	60.24	59.88	59.43
17	59.21	58.48	58.44	58.52	---	57.99	57.88	58.82	59.42	60.27	59.91	59.36
18	58.93	58.46	58.46	58.54	---	57.96	57.90	58.77	59.38	60.26	59.86	---
19	58.84	58.53	58.47	58.49	---	57.95	57.91	58.72	59.44	60.19	59.68	---
20	58.72	58.55	58.46	58.50	---	57.95	57.93	58.69	59.56	60.33	59.67	---
21	58.66	58.22	58.46	58.51	---	57.93	57.96	58.74	59.64	60.32	59.66	---
22	58.69	57.72	58.46	58.50	---	57.91	57.95	58.80	59.52	60.10	59.68	---
23	58.74	58.21	58.48	58.47	---	57.88	57.94	59.06	59.40	60.12	59.66	59.47
24	58.75	58.46	58.49	58.46	---	57.87	57.99	59.14	59.33	60.30	59.62	59.29
25	58.69	58.43	58.47	58.47	58.27	57.87	58.00	59.25	59.54	60.31	59.59	59.30
26	58.67	58.50	58.49	58.46	58.18	57.86	58.04	59.20	59.45	60.26	59.70	59.55
27	58.65	58.50	58.54	58.45	58.17	57.81	58.14	59.24	59.46	60.27	59.61	59.50
28	58.73	58.46	58.48	58.44	58.18	57.80	57.99	59.26	59.65	60.26	59.52	59.60
29	58.69	58.49	58.48	58.44	---	57.80	58.09	59.25	59.67	60.20	59.46	59.60
30	58.71	58.48	58.51	58.46	---	57.80	58.01	59.24	59.84	60.12	59.58	59.25
31	58.72	---	58.52	58.45	---	57.79	---	59.30	---	59.95	59.58	---
MEAN	58.80	58.46	58.46	58.50	---	57.99	57.89	58.71	59.44	60.14	59.85	---
MAX	59.21	58.71	58.54	58.57	---	58.16	58.14	59.30	59.84	60.40	60.24	---
MIN	58.57	57.72	58.41	58.44	---	57.79	57.78	57.87	59.25	59.75	59.46	---

Partial-Record Stations

Roseau River at Ross
April 23, 1929


Lake of the Woods
Upper Red Lake
Lower Red Lake
International Falls
Bemidji
Grand Rapids
Mille Lacs Lake
Moorhead
Red River of the North
Lake Superior
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5075700
5086900
5077700
5078901
5067050
5060800
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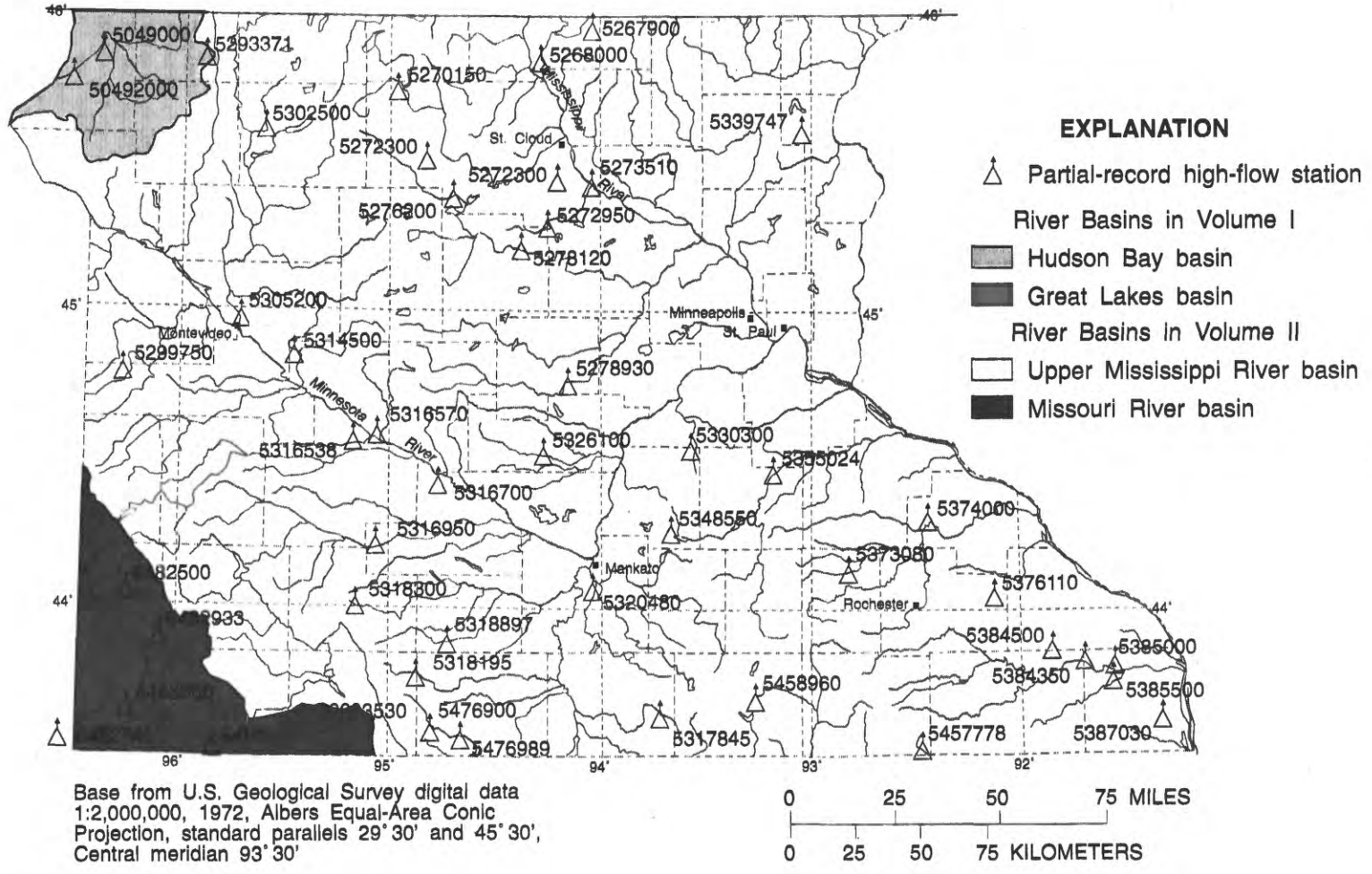


Figure 9.--Location of high-flow partial-record stations

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

High-flow partial-record stations

The following table contains annual maximum discharge for high-flow stations. A high-flow partial-record is equipped with a crest-stage gage, 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 high-flow partial-record stations during water year 1991

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			date	gage height (ft)	discharge (ft^3/s)	date	gage height (ft)	discharge (ft^3/s)
Streams tributary to Lake Superior								
Cascade River near Grand Marais, MN 04011990	Lat 47°47'24", long 90°31'35", in SE¼ sec.1, T.61 N., R.2 W., Cook County, Hydrologic Unit 04010101, at bridge on Forest Road 45, 6.6 miles upstream from mouth, 9.5 miles west of Grand Marais. Drainage area is ___ mi^2.	1985-91	4-30-91	11.52	844	4-29-90	11.95	1,210
Silver Creek tributary near Two Harbors, MN 04015250	Lat 47°04'40", long 91°36'49", in SW¼NE¼ sec.16, T.53 N., R.10 W., Lake County, Hydrologic Unit 04010102, at culvert on County Highway 3, 1.0 mile upstream from mouth, 4.5 miles northeast of Two Harbors. Drainage area is 3.72 mi^2.	1965-91	7-4-91	a4.31	205	9-20-72	17.08	1,880
Little Stewart River near Two Harbors, MN 04015300	Lat 47°03'52", long 91°40'03", in SE¼NE¼ sec.24, T.53 N., R.11 W., Lake County, Hydrologic Unit 04010102, at culvert on County Highway 2, 2.0 miles upstream from mouth, 2.7 miles north of Two Harbors. Drainage area is 5.54 mi^2.	1960-91	9-8-91	ab10.04	105	9-20-72	15.18	598
Talmadge River at Duluth, MN 04015370	Lat 46°53'20", long 91°55'21", in SE¼NE¼ sec.24, T.51 N., R.13 W., St. Louis County, Hydrologic Unit 04010102, at culvert on U.S. Highway 61, 0.6 mile upstream from mouth, 0.5 mile northeast of Duluth city limits. Drainage area is 5.79 mi^2.	1964-91	9-8-91	14.54	232	5-9-79	21.76	1,180
St. Louis River near Aurora, MN 04016500	Lat 47°29'30", long 92°14'20", in NW¼SW¼ sec.22, T.58 N., R.15 W., St. Louis County, Hydrologic Unit 04010201, on left bank at upstream side of County Highway 100 bridge, 0.8 mile downstream from Partridge River and 1.5 mile south of Aurora. Drainage area is 290 mi^2.	1942-87# 1988-91	5-8-91	3.43	928	5-14-50	8.37	5,380
North Branch Whiteface River near Fairbanks, MN 04020480	Lat 47°22'20", long 91°56'28", in NW¼NW¼ sec.1, T.56 N., R.13 W., St. Louis County, Hydrologic Unit 04010201, on right downstream wingwall of double box culvert on County Highway 16, 2 miles upstream from the mouth of Jenkins Creek, 0.7 mile west of Fairbanks. Drainage area is 17.1 mi^2.	1979-91	9-10-91	11.71	94	4-23-79	13.67	660

"See footnotes at end of the table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at high-flow partial-record stations during water year 1991--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			date	gage height (ft)	discharge (ft^3/s)	date	gage height (ft)	discharge (ft^3/s)
Streams tributary to Lake Superior--Continued								
Bug Creek at Shaw, MN 04020700	Lat 47°06'40", long 92°21'03", in SW¼SE¼ sec.34, T.54 N., R.16 W., St. Louis County, Hydrologic Unit 04010201, at left bank on downstream side of culverts on County Road 15 at Shaw, 7.5 miles upstream from mouth. Drainage area is 24.0 mi^2.	1979-91	4-7-91	12.73	130	4-23-79	15.12	590
Cloquet River near Toimi, MN 04021690	Lat 47°21'00", long 91°39'30", in NE¼SW¼ sec.7, T.56 N., R.10 W., Lake County, Hydrologic Unit 04010202, at bridge on County Highway 2, 5.8 miles southeast of Toimi, 23 miles north of Two Harbors. Drainage area is ___ mi^2.	1986-91	4-7-91	a5.87	336	4-30-90	7.51	570
Nemadji River near Holyoke, MN 04024095	Lat 46°31'04", long 92°23'22", in NE¼NE¼ sec.32, T.47 N., R.16 W., Carlton County, Hydrologic Unit 04010301, at bridge on State Highway 23, 3.5 miles north of Holyoke, 7 miles south of Wrenshall. Drainage area is 118 mi^2.	1972-91	6-22-91	a10.76	1,270	9-3-85	17.38	4,420
Red River of the North basin								
Ottertail River near Foxhome, MN 05046250	Lat 46°12'48", long 96°18'24", in SW¼SW¼ sec.26, T.132 N., R.45 W., Wilkin County, Hydrologic Unit 09020103, at bridge on County Road 19, 4 miles south of Foxhome, 10.8 miles below Orwell Dam. Drainage area is ___ mi^2.	1990-91	6-23-91	15.63	1,730	6-23-90	15.63	1,730
Mustinka River above Wheaton, MN 05049000	Lat 45°49'15", long 96°29'25", in SW¼ sec.8, T.127 N., R.46 W., Traverse County, Hydrologic Unit 09020102, at bridge on U.S. Highway 75, 1 mile upstream from Chicago, Milwaukee and St.Paul railroad bridge, 0.5 mile north of Wheaton, about 8 miles above Lake Traverse. Drainage area is 834 mi^2.	1915-24#, 1930-58#, 1985-91	7-2-91	b11.22	1,420	4-10-52	16.56	7,320
Eighteenmile Creek near Wheaton, MN 05049200	Lat 45°47'18", long 96°31'52", in NW¼NW¼ sec.25, T.127 N., R.47 W., Traverse County, Hydrologic Unit 09020102, at culvert on County Highway 7, 1.4 miles upstream from mouth, 2.0 miles southwest of Wheaton. Drainage area 68.5.	1965-91	7-2-91	7.98	370	4-9-69	---	d2,400
Rabbit River near Nashua, MN 05050700	Lat 46°04'30", long 96°18'24", in SE¼NE¼ sec. 15, T.130 N., R.45 W., Wilkin County, Hydrologic Unit 09020101, at bridge on County Road 19, 2.6 miles north of Nashua, 4.8 miles upstream from mouth of South Fork Rabbit River. Drainage area is 56.1 mi^2.	1979-91	9-8-91	b14.86	765	9-21-86	14.27	1,280

"See footnotes at end of the table."

Annual maximum discharge at high-flow partial-record stations during water year 1991--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			date	gage height (ft)	discharge (ft^3/s)	date	gage height (ft)	discharge (ft^3/s)
	Red River of the North basin--Continued							
Buffalo River near Callaway, MN 05060800	Lat 47°01'17", long 95°54'43", in SW¼SW¼ sec.17, T.141 N., R.41 W., Becker County, Hydrologic Unit 09020106, at culvert on U.S. Highway 59, 2.7 miles north of Callaway. Drainage area is 94.5 mi^2.	1960-91	5-6-91	a11.30	69	5-12-85	17.13	635
Whiskey Creek at Barnesville, MN 05061200	Lat 46°39'35", long 96°23'54", in SE¼SW¼ sec.20, T.137 N., R.45 W., Clay County, Hydrologic Unit 09020106, at culvert on State Highway 34, 0.7 mile upstream from Blue Eagle Lake, 1.0 mile northeast of Barnesville. Drainage area is 25.3 mi^2.	1961-64, 1965-66#, 1967-91	5-1-91	a4.36	112	5-31-85	7.12	660
Spring Creek above Downer, MN 05061400	Lat 46°44'37", long 96°25'12", in NW¼NW¼ sec.30, T.138 N., R.45 W., Clay County, Hydrologic Unit 09020106, at culvert on county road, 3.1 miles east of Downer. Drainage area is 5.81 mi^2.	1961-91	5-31-91	b6.68	30	6-29-75	13.52	1,460
Marsh River Ditch near Ada, MN 05067050	Lat 47°17'46", long 96°26'09", in NE¼NE¼ sec.13, T.144 N., R.46 W., Norman County, Hydrologic Unit 09020108, at bridge on County Highway 24, 3.5 miles southeast of Ada. Drainage area is ___ mi^2.	1985-91	-	-	0	4-6-89	16.74	1,070
Mud River near Grygla, MN 05075700	Lat 48°19'31", long 95°44'35", in NE¼NE¼ sec.23, T.156 N., R.40 W., Hydrologic Unit 09020304, Marshall County, at bridge on State Highway 89, 6 miles west of Grygla. Drainage area is 170 mi^2.	1979-91	5-23-91	13.44	450	4-26-79	18.49	1,480
Ruffy Brook near Gonvick, MN 05077700	Lat 47°44'50", long 95°24'45", in SE¼SE¼ sec.5, T.149 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, at culvert on County Highway 67, 4.0 miles upstream from mouth, 4.8 miles east of Gonvick. Drainage area is 45.2 mi^2.	1960-78#, 1979-85, 1986,# 1987-91	7-3-91	2.29	66	3-30-67	6.35	453
Burnham Creek near Crookston, MN 05079901	Lat 47°43'59", long 96°39'52", in SE¼SW¼ sec.10, T.149 N., R.47 W., Polk County, Hydrologic Unit 09020303, at triple box culvert on U.S. Highway 75, 0.75 mile northeast of Girard, 3 miles southwest of Crookston, 7 miles above mouth. Drainage area is c111 mi^2.	1986-91	6-11-91	b13.87	96	4-4-89	20.44	1,900
Middle River near Newfolden, MN 05086900	Lat 48°22'04", long 96°16'47", in NE¼NE¼ sec.3, T.156 N., R.44 W., Marshall County, Hydrologic Unit 09020309, at bridge on township road, 2.0 miles northeast of Newfolden. Drainage area is 91.1 mi^2.	1979-91	7-8-91	b13.27	74	4-25-79	17.10	1,000

"See footnotes at end of table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

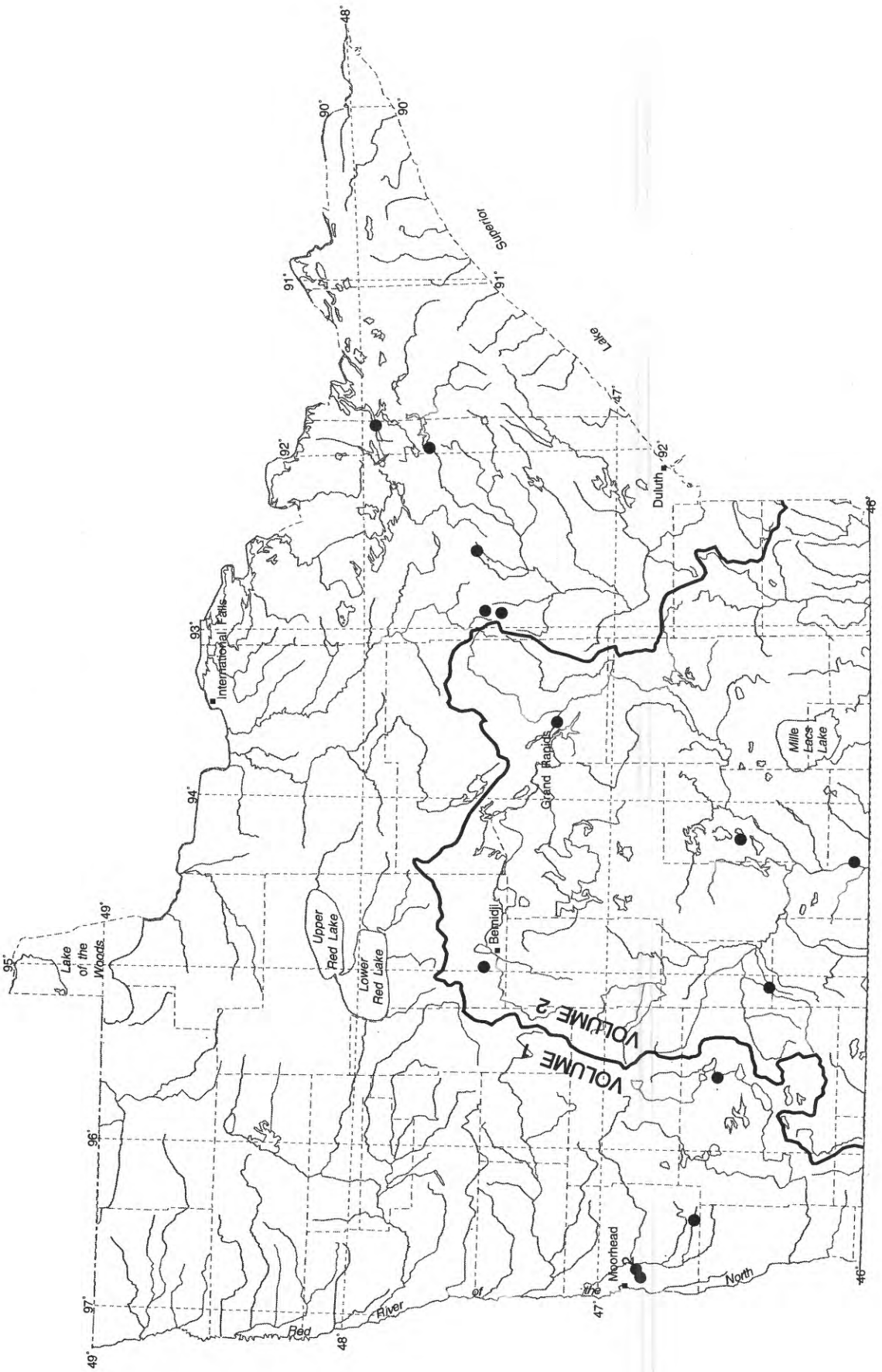
Annual maximum discharge at high-flow partial-record stations during water year 1991--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			date	gage height (ft)	discharge (ft^3/s)	date	gage height (ft)	discharge (ft^3/s)
			Lake of the Woods basin					
Stony River near Babbitt, MN 05125550	Lat 47°41'36", long 91°45'38", in SW¼SW¼ sec.8, T.60 N., R.11 W., Lake County, Hydrologic Unit 09030001, in Superior National Forest, at bridge on Forest Road 424, 4.7 miles upstream from mouth, 8.5 miles southeast of Babbitt. Drainage area is 219 mi^2.	1975-80#, 1986-91	4-10-91	5.01	457	4-19-76	8.71	2,490
Boriin Creek near Chisholm, MN 05130300	Lat 47°36'14", long 92°51'58", in SE¼SE¼ sec.9, T.59 N., R.20 W., St. Louis County, Hydrologic Unit 09030005, at culvert on State Highway 73, 1.3 miles upstream from mouth, 7.8 miles north of Chisholm. Drainage area is 13.7 mi^2.	1959-91	5-7-91	b11.33	79	4-13-69	13.40	700
Big Fork River near Bigfork, MN 05131750	Lat 47°44'56", long 93°46'31", in SW¼NE¼ sec.27, T.61 N., R.27 W., Itasca County, Hydrologic Unit 09030006, at bridge on State Highway 6, 5.5 miles west of Bigfork. Drainage area is 602 mi^2.	1973-91	5-7-91	10.90	896	4-22-79	15.48	2,830
Bowerman Brook near Craigville, MN 05131878	Lat 47°55'29", long 93°45'34", in NE¼NW¼ sec.26, T.63 N., R.27 W., Koochiching County, Hydrologic Unit 09030006, at culvert on State Highway 6, 2.4 miles upstream from mouth, 7.0 miles west of Craigville. Drainage area is 25.0 mi^2.	1979-91	5-7-91	b12.67	160	4-21-79	14.73	650
North Branch Rapid River near Baudette, MN 05134100	Lat 48°31'56", long 94°38'50", in NW¼SW¼ sec.4, T.158 N., R.31 W., Lake of the Woods County, Hydrologic Unit 09030007, at bridge on County Highway 1, 12.7 miles southwest of Baudette. Drainage area is d180 mi^2.	1986-91	7-3-91	8.24	490	3-31-86	11.16	1,000
Winter Road River near Baudette, MN 05137000	Lat 48°42'39", long 94°41'52", in NW¼NE¼ sec.1, T.160 N., R.32 W., Lake of the Woods County, Hydrologic Unit 09030008, at bridge on State Highway 11, 4.5 miles west of Baudette, 1.8 miles east of Pitt, 5 miles upstream of mouth. Drainage area is d145 mi^2.	1986-91	9-17-91	b10.22	450	3-31-86	14.30	1,400

Operated as a continuous-record gaging station.
a Not annual maximum gage height.
b Backwater from aquatic growth or debris.
c Approximate.
d Estimate

Ground Water Levels

MSEA site near Princeton
July, 1991


Lake Superior
Duluth
International Falls
Grand Rapids
Mille Lacs Lake
Bemidji
Upper Red Lake
Lower Red Lake
Lake of the Woods
Moorhead
Red River of the North
VOLUME 2
VOLUME 4
48°
90°
91°
92°
93°
94°
95°
96°
97°
47°
46°
49°

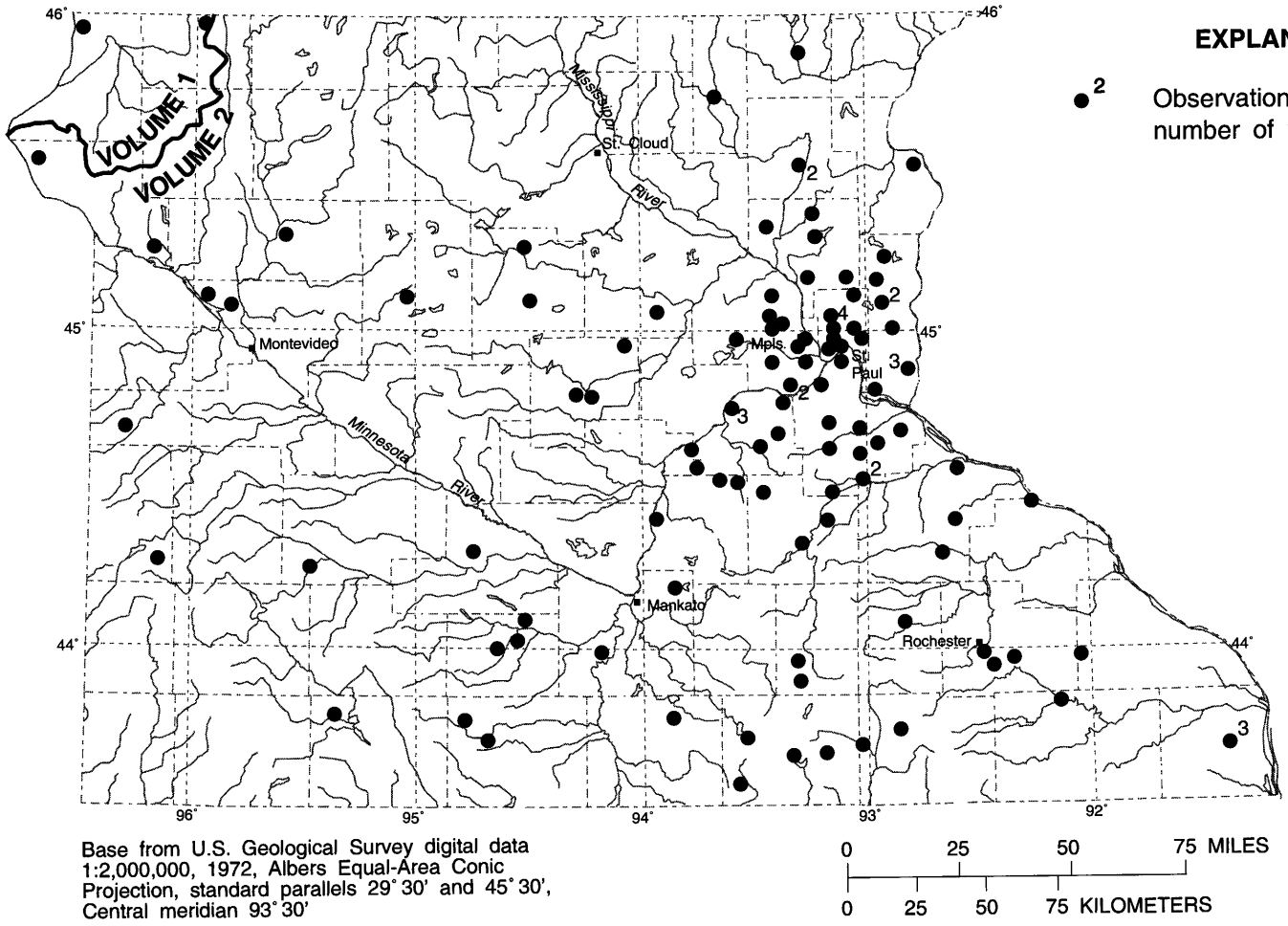


Figure 10.--Location of ground-water wells

CLAY COUNTY

463854096250701. Local number, 137N45W30CDB01.
LOCATION.--Lat 46°38'54", long 96°25'07", in NW¼SE¼SW¼ sec.30, T.137 N., R.45 W., Hydrologic Unit 09020106, in Barnesville.
Owner: City of Barnesville, well 3.
AQUIFER.--Surficial sand of Pleistocene Age.
WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 10 in., depth 73 ft.
DATUM.--Altitude of land-surface datum is 1,022 ft. Measuring point: Top of casing, 1.50 ft above land-surface datum.
PERIOD OF RECORD.--January 1949 to January 1975, May 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.86 ft below land-surface datum, June 9, 1962; lowest, 11.86 ft below land-surface datum, June 3, 1970.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct 05	9.00	Dec 07	8.80	Feb 01	8.70	Apr 05	8.40	Jul 12	7.17
12	9.00	14	8.80	08	8.70	12	8.36	Aug 02	6.90
19	8.60	28	8.80	15	8.70	19	8.30	09	7.52
26	8.94	Jan 18	8.50	22	8.70	25	8.20	15	7.60
Nov 02	8.90	25	8.74	Mar 01	8.60	May 03	7.98	30	7.85
09	8.90			08	8.60	31	7.30		
23	8.87			15	8.56				
30	8.82			22	8.50				
				29	8.40				

465237096383901. Local number, 139N47W05CDC01.
LOCATION.--Lat 46°52'37", long 96°38'39", in SW¼SE¼SW¼ sec.5, T.139 N., R.47 W., Hydrologic Unit 09020104, 2.4 mi east of Dilworth.
Owner: City of Moorhead, MS-1.
AQUIFER.--Surficial sand of Pleistocene Age.
WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 8 in., depth 131 ft, slotted 91 to 107 ft.
DATUM.--Land-surface datum is 916.7 ft National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder floor, 3.60 ft above land-surface datum.
REMARKS.--Water level affected by pumping from nearby wells.
PERIOD OF RECORD.--January 1947 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 12.19 ft below land-surface datum, July 15, 1947; lowest, 32.94 ft below land-surface datum, Aug. 24, 1988.

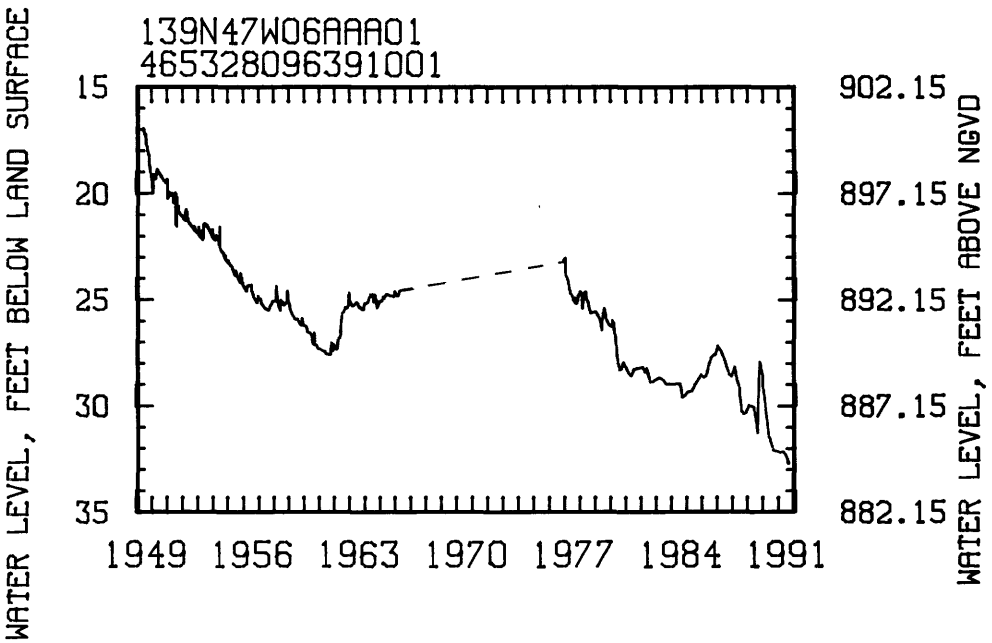
WATER LEVEL, IN FEET BELOW LAND-SURFACE DATAUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct 05	32.32	Dec 05	31.50	Feb 05	31.88	Apr 05	31.58	Jun 05	31.44	Aug 05	31.88
10	32.24	10	31.78	10	31.52	10	31.68	10	31.54	10	31.98
15	32.06	15	31.92	15	31.40	15	31.48	15	31.64	15	32.16
20	31.94	20	31.96	20	31.62	20	31.16	20	31.72	20	32.28
25	31.90	25	31.98	25	31.64	25	31.06	25	31.74	25	32.40
31	32.08	31	31.98	28	31.64	30	31.04	30	31.78	31	32.36
Nov 05	31.72	Jan 05	31.98	Mar 05	31.42	May 05	31.26	Jul 05	31.72	Sep 05	32.40
10	31.42	10	32.02	10	31.54	10	31.08	10	31.70	10	32.34
15	31.24	15	32.00	15	31.72	15	30.90	15	31.34	15	32.06
20	31.26	20	32.00	20	31.54	20	30.90	20	31.12	20	32.22
25	31.52	25	32.00	25	31.18	25	30.96	25	31.06	25	32.18
30	31.68	31	32.00	31	31.42	31	31.28	31	31.64	30	32.24

465328096391001. Local number, 139N47W06AAA01.
LOCATION.--Lat 46°53'27", long 96°39'08", in NE¼NE¼NE¼ sec.6, T.139 N., R.47 W., Hydrologic Unit 09020104, 2.7 mi northeast of Dilworth.
Owner: U.S. Geological Survey, M-80.
AQUIFER.--Buried sand and gravel of Pleistocene Age.
WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 3 in., depth 103 ft, casing slotted near bottom.
DATUM.--Altitude of land-surface datum is 915 ft. Measuring point: Top of casing, 2.50 ft above land-surface datum.
REMARKS.--Water level affected by pumping.
PERIOD OF RECORD.--July 1949 to April 1966, November 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 16.94 ft below land-surface datum, July 16, 1949; lowest, 32.70 ft below land-surface datum, Aug. 26, 1991.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec 17	32.16	Jan 28	32.20	Apr 24	32.15	Jun 24	32.33	Aug 26	32.70



465231096415801. Local number, 139N48W11ABA01.
LOCATION.--Lat 46°52'31", long 96°41'58", in NE¼NW¼NE¼ sec.11, T.139 N., R.48 W., Hydrologic Unit 09020104, at Dilworth.
Owner: City of Dilworth.
AQUIFER.--Buried sand and gravel of Pleistocene Age.
WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 8 in., depth 152 ft.
DATUM.--Altitude of land-surface datum is 908 ft. Measuring point: Top of recorder platform, 2.40 ft above land-surface datum.
REMARKS.--Water level affected by pumping.
PERIOD OF RECORD.--May 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 101.33 ft below land-surface datum, Dec. 29, 1965; lowest, 131.24 ft below land-surface datum, July 18, 1985.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec 17	125.24	Jan 28	125.32	Apr 24	125.32	Jun 24	126.64	Aug 26	128.47

GRANT COUNTY

455927095575505. Local number, 129N42W16ABB05.
LOCATION.--Lat 45°59'27", long 95°57'55", in NW¼NW¼NE¼ sec.16, T.129 N., R.42 W., Hydrologic Unit 09020102, in city of Elbow Lake.
Owner: City of Elbow Lake, well 5.
AQUIFER.--Buried sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 12 in., depth 215 ft, screened 190 to 215 ft.
DATUM.--Altitude of land-surface datum is 1,220 ft. Measuring point: Top breather pipe, 1.80 abaove land-surface datum.
PERIOD OF RECORD.--October 1989 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 74.10 ft below land-surface datum, Apr. 30, 1990; lowest, 76.50 ft below land-surface datum, Nov. 1, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

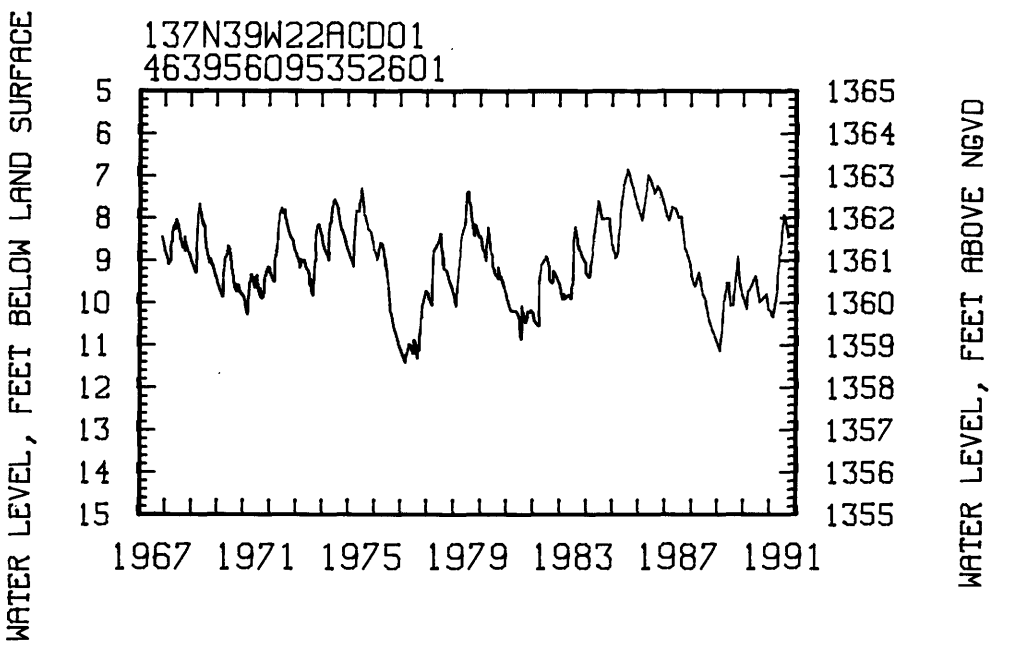
DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct 02	74.70	Dec 04	74.90	Feb 11	75.00	Apr 30	74.50	Jul 03	74.50
Nov 05	74.90	27	75.00	Mar 04	74.70	May 31	74.50	31	74.50
				29	74.80			Sep 03	74.70

OTTER TAIL COUNTY

463956095352601. Local number, 137N39W22ACD01.
LOCATION.--Lat 46°39'56", long 95°35'26", in SE¼SW¼NE¼ sec.22, T.137 N., R.39 W., Hydrologic Unit 09020103, 4.5 mi north of Perham.
Owner: U.S. Geological Survey.
AQUIFER.--Surficial sand of Pleistocene Age.
WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in., depth 24 ft, screened 21 to 24 ft.
DATUM.--Altitude of land-surface datum is 1,370 ft. Measuring point: Top of casing, 0.50 ft above land-surface datum.
PERIOD OF RECORD.--December 1967 to current year.
EXTREMES FOR PERIOD OF RECORD.--Higheest water level, 6.84 ft below land-surface datum, Aug. 12, 1985; lowest, 11.41 ft below land-surface datum, Mar. 10, 15, 1977.

WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov 21	9.79	Jan 23	10.21	Feb 20	10.35	Apr 21	9.69	Jun 20	8.52	Aug 25	8.22
Dec 20	10.16	31	10.29	Mar 22	10.04	May 22	8.87	Jul 22	7.92	Sep 24	8.45

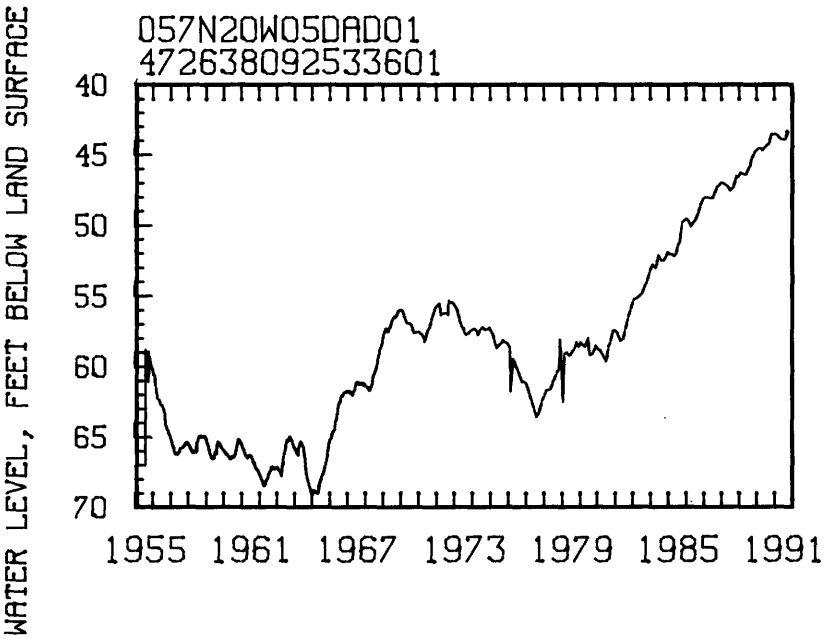


ST. LOUIS COUNTY

472638092533601. Local number, 057N20W05DAD01.
LOCATION.--Lat 47°26'38", long 92°53'36", in SE¼NE¼SE¼ sec.5, T.57 N., R.20 W., Hydrologic Unit 04010201, 2.5 mi east of Hibbing.
Owner: Burlington Northern, Inc.
AQUIFER.--Biwabik Iron Formation of Middle Precambrian Age.
WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in., depth 430 ft, cased to 315 ft.
DATUM.--Altitude of land-surface datum is 1,470 ft. Measuring point: Top of platform, 1.20 ft above land-surface datum.
PERIOD OF RECORD.--August 1955 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 43.34 ft below land-surface datum, Sept. 16, 1991; lowest, 69.07 ft below land-surface datum, Jan. 15, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct 22	43.50	Jan 15	43.50	May 09	43.88	Aug 06	43.88
Nov 27	43.58	Feb 21	43.61	Jun 25	43.92	Sep 16	43.34



473102092345001. Local number, 058N18W12CCC01.
LOCATION.--Lat 47°31'02", long 92°34'50, in SW¼SW¼SW¼ sec.12, T.58 N., R.18 W., Hydrologic Unit 04010201, 1 mi west of Virginia.
Owner: U.S. Steel Corp.
AQUIFER.--Buried sand and gravel of Pleistocene Age.
WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in., depth 97 ft, slotted casing between 67 to 97 ft.
DATUM.--Land-surface datum is 1,427.5 ft National Geodetic Vertical Datum of 1929. Measuring point: Edge of vent pipe, 1.90 ft above land-surface datum.
PERIOD OF RECORD.--December 1954 to July 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.64 ft below land-surface datum, July 20, 1957; lowest, 17.47 ft below land-surface datum, Apr. 2, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov 16	13.44	Jan 30	14.28	May 08	12.62	Aug 05	12.64
Dec 17	13.73	Mar 07	14.71	Jun 25	12.93	Sep 16	12.16

473011092524301. Local number, 058N20W16DBC01.
LOCATION.--Lat 47°30'11", long 92°52'43", in SW¼NW¼SE¼ sec.16, T.58 N., R.20 W., Hydrologic Unit 04010201, in Chisholm.
Owner: City of Chisholm.
AQUIFER.--Buried sand and gravel of Pleistocene Age.
WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in. depth 40 ft, screened 30 to 40 ft.
DATUM.--Altitude of land-surface datum is 1,500 ft. Measuring point: Top of wood platform, 1.70 ft above land-surface datum.
REMARKS.--Water level affected by pumping. Water-level subject to freezing during winter months.
PERIOD OF RECORD.--August 1953 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 0.23 ft below land-surface datum, May 10, 1954; lowest, 15.60 ft below land-surface datum, Mar. 23-24, 1957.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct 22	3.10	May 09	1.18	Aug 06	3.52
Nov 27	3.15	Jun 25	3.15	Sep 16	2.55

GROUND-WATER LEVELS

St. LOUIS COUNTY--Continued

474253091574101. Local number, 060N13W01BBA01.
LOCATION.--Lat 47°42'53", long 91°57'41", in NE¼NW¼NW¼ sec.1, T.60 N., R.13 W., Hydrologic Unit 09030001, at Babbitt water tower.
Owner: U.S. Geological Survey.
AQUIFER.--Surficial sand and gravel of Pleistocene Age.
WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in., depth 30 ft, screened 27 to 30 ft.
DATUM.--Altitude of land-surface datum is 1,485 ft. Measuring point: Top of 3 in pipe, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--October 1975 to June 1978, July 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 19.79 ft below land-surface datum, Sept. 6, 1989; lowest, 26.03 ft below land-surface datum, June 14, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct 05	20.79	Dec 03	21.08	Feb 04	21.85	Apr 02	22.33	Jul 01	21.50	Sep 03	20.92
Nov 01	20.83	Jan 02	21.46	Mar 01	22.21	May 02	22.33	Aug 05	20.83		

475502091494601. Local number, 063N12W26ABB01.
LOCATION.--Lat 47°55'02", long 91°49'46", NW¼NW¼NE¼ sec.26, T.63 N., R.12 W., Hydrologic Unit 09030001, at Ely.
Owner: U.S. Geological Survey.
AQUIFER.--Surficial sand and gravel of Pleistocene Age.
WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1¼ in., depth 9 ft, screened 7 to 9 ft.
DATUM.--Altitude of land-surface datum is 1,342 ft. Measuring point: Top of casing, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--October 1970 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.53 ft below land-surface datum, May 14, 1986; lowest, 6.87 ft below land-surface datum, Sept. 27, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov 16	4.78	Jan 29	4.80	Apr 10	2.08	Aug 07	3.69
Dec 17	4.50	Mar 06	4.86	Jun 18	3.44		

TRAVERSE COUNTY

455700096314001. Local number, 129N47W25CDC01.
LOCATION.--Lat 45°57'00", long 93°31'40", in SW¼SE¼SW¼ sec.25, T.129 N., R.47 W., Hydrologic Unit 09020101, 9 mi north of Wheaton.
Owner: U.S. Geological Survey.
AQUIFER.--Surficial sand of Pleistocene Age.
WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1¼ in., depth 39 ft, open end.
DATUM.--Altitude of land-surface datum is 1,010 ft. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--October 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.39 ft below land-surface datum, Sept. 23, 1986; lowest, 12.42 ft below land-surface datum, Dec. 2, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Jun 24	8.58	Jul 24	7.93	Sep 10	8.09

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October 1, 1978

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
	Length	
inches (in)	2.54×10^{1}	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^{0}	kilometers (km)
	Area	
acres	4.047×10^{3}	square meters (m^2)
	4.047×10^{-1}	square hectometers (hm^2)
	4.047×10^{-3}	square kilometers (km^2)
square miles (mi^2)	2.590×10^{0}	square kilometers (km^2)
	Volume	
gallons (gal)	3.785×10^{0}	liters (L)
	3.785×10^{0}	cubic decimeters (dm^3)
	3.785×10^{-3}	cubic meters (m^3)
million gallons	3.785×10^{3}	cubic meters (m^3)
	3.785×10^{-3}	cubic hectometers (hm^3)
cubic feet (ft^3)	2.832×10^{1}	cubic decimeters (dm^3)
	2.832×10^{-2}	cubic meters (m^3)
cfs-days	2.447×10^{3}	cubic meters (m^3)
	2.447×10^{-3}	cubic hectometers (hm^3)
acre-feet (acre-ft)	1.233×10^{3}	cubic meters (m^3)
	1.233×10^{-3}	cubic hectometers (hm^3)
	1.233×10^{-6}	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{1}	liters per second (L/s)
	2.832×10^{1}	cubic decimeters per second (dm^3/s)
	2.832×10^{-2}	cubic meters per second (m^3/s)
gallons per minute (gal/min)	6.309×10^{-2}	liters per second (L/s)
	6.309×10^{-2}	cubic decimeters per second (dm^3/s)
	6.309×10^{-5}	cubic meters per second (m^3/s)
million gallons per day	4.381×10^{1}	cubic decimeters per second (dm^3/s)
	4.381×10^{-2}	cubic meters per second (m^3/s)
	Mass	
tons (short)	9.072×10^{-1}	megagrams (Mg) or metric tons

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