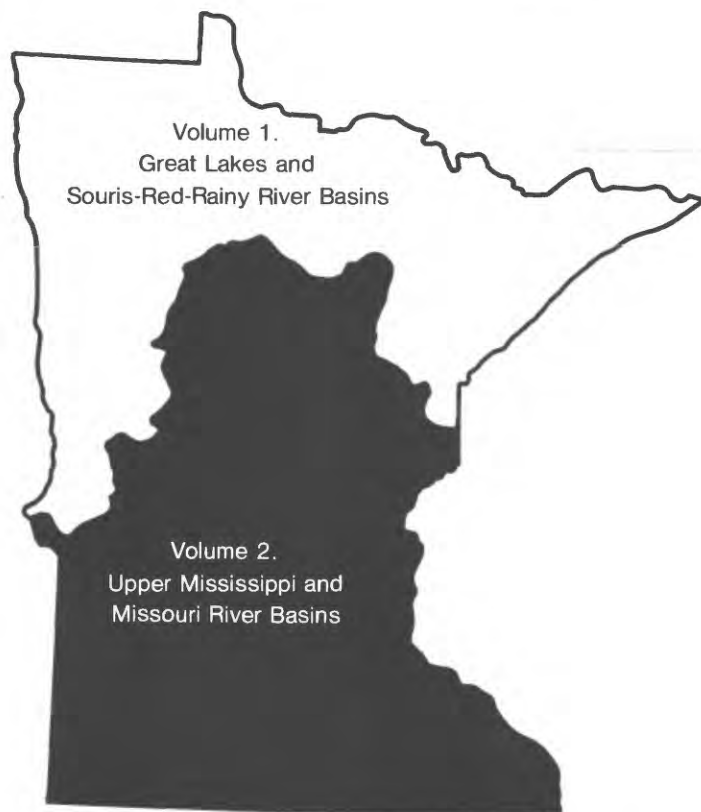




# Water Resources Data Minnesota Water Year 1986

## Volume 2. Upper Mississippi and Missouri River Basins



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN-86-2  
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 1986

1985

OCTOBER

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

NOVEMBER

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

DECEMBER

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

1986

JANUARY

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

FEBRUARY

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

MARCH

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

APRIL

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

MAY

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

JUNE

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

JULY

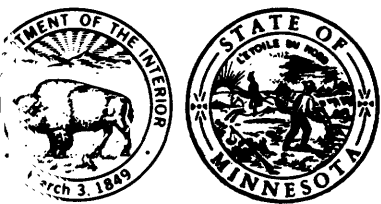
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

AUGUST

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

SEPTEMBER

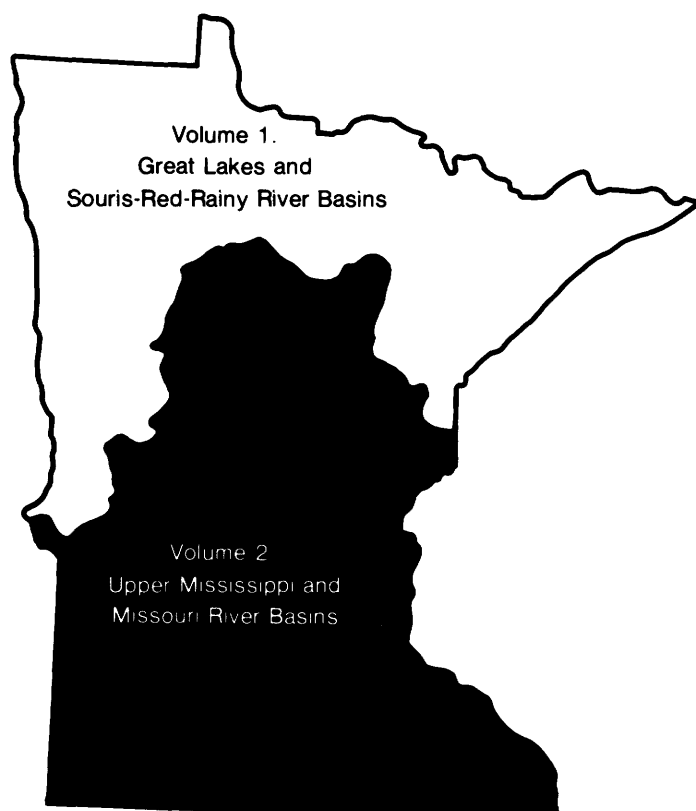
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				



# Water Resources Data Minnesota Water Year 1986

## Volume 2. Upper Mississippi and Missouri River Basins

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



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN-86-2  
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

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief, Water Resources Division  
U.S. Geological Survey  
702 Post Office Building  
St. Paul, Minnesota 55101

## 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:

Mark R. Have, Water-Quality Specialist, Minnesota District  
Henry W. Anderson, Jr., Ground-Water Project Chief, Minnesota District

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

Allan D. Arntson	Wallace W. Larson
Howard D. Braden	Gregory R. Melhus
Alex Brietkrietz	Rebecca A. Miller
Paul E. Felsheim	Gregory B. Mitton
Kenneth D. Fossum	Charles J. Smith
William A. Gothard	Gregory W. Stratton
Joan M. Helms	Sandra J. Surratt
Roderick L. Johnson	Lan H. Tornes
	Duane A. Wicklund

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

<b>REPORT DOCUMENTATION PAGE</b>	<b>1. REPORT NO.</b> USGS/WRD/HD-88/275	<b>2.</b>	<b>3. Recipient's Accession No.</b>
<b>4. Title and Subtitle</b> Water Resources for Minnesota, Water Year 1986 Volume 2, Upper Mississippi and Missouri River Basin		<b>5. Report Date</b> August 1988	
<b>7. Author(s)</b> Kurt T. Gunard, Joseph H. Hess, James L. Zirbel, and Charles E. Cornelius		<b>8. Performing Organization Rept. No.</b> USGS-WDR-MN-86-2	
<b>9. Performing Organization Name and Address</b> U. S. Geological Survey, Water Resources Division 702 Post Office Building St. Paul, Minnesota 55101		<b>10. Project/Task/Work Unit No.</b>	
<b>12. Sponsoring Organization Name and Address</b> U. S. Geological Survey, Water Resources Division 702 Post Office Building St. Paul, Minnesota 55101		<b>11. Contract(C) or Grant(G) No.</b>  (C)  (G)	
		<b>13. Type of Report &amp; Period Covered</b> Annual Oct. 1, 1985 to Sept. 30, 1986	
<b>15. Supplementary Notes</b>  Prepared in cooperation with the State of Minnesota and with other agencies.		<b>14.</b>	
<b>16. Abstract (Limit: 200 words)</b>  Water-resources data for the 1986 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 53 gaging stations; stage and contents for 8 lakes and reservoirs; water quality for 14 stream stations, 8 partial-record stations, 1 lake station, 1 precipitation station, and 87 wells; and water levels for 136 observation wells. Also included are 78 high-flow partial-record stations and 1 low-flow partial-record station. Additional water data were collected at various sites, not part of the systematic data collection program and are published as miscellaneous measurements or low-flow investigations. These data, together with the data in Volume 1, represent that part of the National Water Data System operated by the U. S. Geological Survey and cooperating State and Federal Agencies in Minnesota.			
<b>17. Document Analysis a. Descriptors</b>  *Minnesota, *Hydrologic data, *Surface water, *Ground water, *Water quality, flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Precipitation, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Data collection  <b>b. Identifiers/Open-Ended Terms</b>          <b>c. COSATI Field/Group</b>			
<b>18. Availability Statement:</b> No restriction on distribution This report may be purchased from: National Technical Information Service Springfield, VA 22161		<b>19. Security Class (This Report)</b> UNCLASSIFIED	<b>21. No. of Pages</b> 305
		<b>20. Security Class (This Page)</b> UNCLASSIFIED	<b>22. Price</b>

## CONTENTS

	Page
Preface .....	iii
List of gaging stations, in downstream order, for which records are published.....	vi
List of ground-water wells, by county, for which records are published.....	viii
Introduction.....	1
Cooperation.....	1
Summary of hydrologic conditions.....	2
Precipitation.....	2
Streamflow.....	2
Water quality.....	2
Ground-water levels.....	5
Special networks and programs.....	12
Explanation of the records.....	12
Station identification numbers.....	12
Downstream order system and station number.....	12
Latitude-longitude system for wells and miscellaneous sites.....	12
Records of stage and water-discharge.....	13
Data collection and computation.....	13
Data presentation.....	14
Identifying estimated daily discharge.....	15
Accuracy of the records.....	15
Other records available.....	16
Records of surface water-quality.....	16
Classification of records.....	16
Arrangement of records.....	16
On-site measurement and collection.....	16
Water temperature.....	17
Sediment.....	17
Laboratory measurements.....	17
Data presentation.....	17
Remark codes.....	18
Records of ground-water levels.....	18
Data collection and computation.....	18
Data presentation.....	18
Records of ground-water quality.....	19
Data collection and computation.....	19
Data presentation.....	19
Access to WATSTORE data.....	19
Definition of terms.....	20
Publications on techniques of water-resources investigations.....	26
Discontinued gaging stations.....	28
Station records, surface water.....	36
Discharge at partial-record stations and miscellaneous sites.....	168
Low-flow partial-record stations.....	168
High-flow partial-record stations.....	169
Miscellaneous sites.....	182
Low-flow investigations in the Crow and Chippewa River basins.....	183
Analyses of samples collected at water-quality partial-record stations.....	191
Miscellaneous water quality data collected continuous-record stations.....	196
Station records, ground water.....	204
Ground-water levels.....	206
Quality of ground-water.....	276
Chemical quality of precipitation.....	288
Index.....	291

## ILLUSTRATIONS

Figure 1. Map showing precipitation, in inches, during 1986 water year compared with normal annual precipitation for Minnesota.....	3
2. Graph showing comparison of discharge at four long-term representative gaging stations for the 1986 water year with median discharges for water years 1951-80.....	6
3. Graph showing comparison of dissolved solids concentrations for the 1986 water year with median monthly values for the period of record.....	8
4. Graph showing comparison of nitrate concentrations for the 1986 water year with median monthly values for the period of record.....	9
5. Map showing relation of seasonal water-table levels to long-term mean levels.....	10

6. Map showing relation of seasonal water levels in confined aquifers to long-term mean levels.....	11
7. Diagram showing system for numbering wells and miscellaneous sites.....	13
8. Map showing location of lake and stream-gaging stations.....	32
9. Map showing location of surface-water-quality stations.....	34
10. Map showing location of high-flow partial-record stations.....	170
11. Map showing location of ground-water wells.....	204

---

TABLES

---

Table 1. Runoff at streamflow stations in representative basins in Minnesota.....	4
---	---

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 micro-biological; (p) physical (water temperature, sediment, or specific conductance)]

UPPER MISSISSIPPI RIVER BASIN

Mississippi River:		
Winnibigoshish Lake near Deer River.....	(- e - - -)	36
Mississippi River at Winnibigoshish Dam, near Deer River.....	(d - - - -)	37
<u>LEECH LAKE RIVER BASIN</u>		
Williams Lake near Akeley.....	(- - c b p)	38
Leech Lake at Federal Dam.....	(- e - - -)	43
Leech Lake River at Federal Dam.....	(d - - - -)	44
Pokegama Lake near Grand Rapids.....	(- e - - -)	45
Mississippi River at Grand Rapids.....	(d - - - p)	46,196
<u>SWAN RIVER BASIN</u>		
Swan River near Calumet.....	(d - - - p)	47,196
<u>SANDY RIVER BASIN</u>		
Sandy Lake at Libby.....	(- e - - -)	48
Sandy River at Sandy Lake Dam, at Libby.....	(d - - - -)	49
Mississippi River below Sandy River, near Libby.....	(d - - - -)	50
Mississippi River at Aitkin.....	(d - - - p)	51,196
<u>PINE RIVER BASIN</u>		
Pine River Reservoir at Cross Lake.....	(- e - - -)	52
Pine River at Cross Lake Dam, at Cross Lake.....	(d - - - -)	53
<u>CROW WING RIVER BASIN</u>		
Long Prairie River at Long Prairie.....	(d - - - p)	54,196
Gull River:		
Gull Lake near Brainerd.....	(- e - - -)	55
Gull River at Gull Lake Dam, near Brainerd.....	(d - - - -)	56
Crow Wing River near Pillager.....	(d - - - p)	57,196
Mississippi River near Royalton.....	(d - c b p)	58,197
<u>ELK RIVER BASIN</u>		
Elk River near Big Lake.....	(d - - - p)	61,197
<u>CROW RIVER BASIN</u>		
North Fork Crow River:		
Middle Fork Crow River near Spicer.....	(d - - - p)	62,197
Crow River at Rockford.....	(d - - - p)	63,197
<u>RUM RIVER BASIN</u>		
Mille Lacs Lake (head of Rum River) at Garrison.....	(- e - - -)	64
Rum River near St. Francis.....	(d - - - p)	65,197
<u>ELM CREEK BASIN</u>		
Elm Creek near Champlin.....	(d - - - p)	66,197
Mississippi River near Anoka.....	(d - c - p)	67,197
Mississippi River at Fridley.....	(- - c - p)	71
<u>MINNESOTA RIVER BASIN</u>		
Whetstone River near Big Stone City, SD.....	(d - - - p)	78,198
Big Stone Lake at Ortonville.....	(- e - - -)	82

## UPPER MISSISSIPPI RIVER BASIN--Continued

MINNESOTA RIVER BASIN--Continued	
Minnesota River at Ortonville.....	(d - - - p)... 83,198
Yellow Bank River near Odessa.....	(d - - - p)... 84,198
Pomme de Terre River at Appleton.....	(d - - - p)... 88,198
Lac qui Parle River near Lac qui Parle.....	(d - - - p)... 89,198
Minnesota River near Lac qui Parle.....	(d - - - p)... 90,199
Chippewa River near Milan.....	(d - - - p)... 91,199
Minnesota River at Montevideo.....	(d - - - p)... 92,199
Yellow Medicine River:	
South Branch Yellow Medicine River at Minneota.....	(d - - - -)... 93
Yellow Medicine River near Granite Falls.....	(d - - - p)... 94,199
Redwood River near Marshall.....	(d - - - p)... 95,199
Redwood River near Redwood Falls.....	(d - - - p)... 96,200
Cottonwood River near New Ulm.....	(d - - - p)... 97,200
Little Cottonwood River near Courtland.....	(d - - - p)... 98,200
Blue Earth River:	
Watonwan River near Garden City.....	(d - - - p)... 99,200
Blue Earth River near Rapidan.....	(d - - - p)... 100,200
Le Sueur River near Rapidan.....	(d - - - p)... 101,200
Minnesota River at Mankato.....	(d - - - p)... 102,201
High Island Creek near Henderson.....	(d - - - p)... 106,201
Minnesota River near Jordan.....	(d - c b p)... 107,201
Mississippi River at St. Paul.....	(d - - - p)... 117,201
Mississippi River at Fifth Street at Newport.....	(- - c - p)... 120
Mississippi River at Grey Cloud Island near Cottage Grove.....	(- - c - p)... 127
Mississippi River at Nininger.....	(- - c b p)... 134
Mississippi River at lock and dam 2, at Hastings.....	(- - c - p)... 136
ST. CROIX RIVER BASIN	
St. Croix River:	
Kettle River below Sandstone.....	(d - - - p)... 141,201
Snake River:	
Knife River near Mora.....	(d - - - p)... 142,201
St. Croix River at St. Croix Falls, WI.....	(d - c b p)... 143
Mississippi River at Prescott, WI.....	(d - - - p)... 146,202
VERMILLION RIVER BASIN	
Vermillion River near Empire.....	(d - c - p)... 147,202
CANNON RIVER BASIN	
Cannon River:	
Straight River near Faribault.....	(d - - - p)... 155,202
ZUMBRO RIVER BASIN	
South Fork Zumbro River at Rochester.....	(d - - - p)... 156,202
Zumbro River at Kellogg.....	(d - - - p)... 157,202
WHITEWATER RIVER BASIN	
North Fork Whitewater River near Elba.....	(d - c b p)... 158,202
GARVIN BROOK BASIN	
Garvin Brook near Minnesota City.....	(d - - - p)... 161,203
Mississippi River at Winona.....	(d - c b p)... 162-203
IOWA RIVER BASIN	
Iowa River:	
Cedar River near Austin.....	(d - - - p)... 166,203
DES MOINES RIVER BASIN	
Des Moines River at Jackson.....	(d - - - p)... 167,203

\* \* \* \* \*

Discharge at partial-record stations and miscellaneous sites.....	168
Low-flow partial-record stations.....	168
High-flow partial-record stations.....	169
Miscellaneous sites.....	182
Low-flow investigations in the Crow and Chippewa River basins.....	183
Analysis of samples collected at water-quality partial-record stations.....	191
Miscellaneous water quality data collected at continuous-record stations.....	196

## Page

5	ANOKA	Well	450927093033802	Local	number	031N22W23CBC02	206
		Well	451210093170201	Local	number	031N24W01CBB01	206
		Well	451742093122102	Local	number	032N23W04AAD02	207
		Well	452305093141501	Local	number	033N23W05BAB01	207
		Well	451938093223101	Local	number	033N24W30ABB01	208
1	BELTRAMI	Well	473023094570901	Local	number	147N34W35ADC01	209
2	BIG STONE	Well	451517096104501	Local	number	121N44W27CCC01	209
		Well	453330096420201	Local	number	124N48W17AAA01	210
2	BLUE EARTH	Well	440050094102801	Local	number	106N28W03DBA01	210
		Well	441134093505301	Local	number	108N25W04BBC01	211
2	BROWN	Well	441030094254501	Local	number	108N30W09ADD01	211
		Well	441800094434301	Local	number	110N32W30DDB01	212
1	CARVER	Well	445155093320101	Local	number	116N23W12CDB01	213
2	CHIPPEWA	Well	450447095490101	Local	number	119N41W29DDD01	213
		Well	450631095562201	Local	number	119N42W17DDD01	213
1	CHISAGO	Well	453125092445401	Local	number	035N19W17BDB01	215
2	CROW WING	Well	463006094131201	Local	number	135N28W16CCD01	216
13	DAKOTA	Well	445044093102401	Local	number	027N23W09ABD01	216
		Well	445330093054301	Local	number	028N22W19DCC02	217
		Well	443146093002201	Local	number	112N18W08ABA01	217
		Well	443134093010601	Local	number	112N18W08BBC01	218
		Well	442830093085201	Local	number	112N19W30DBD01	219
		Well	443645093014701	Local	number	113N18W07BAC01	219
		Well	444205092500001	Local	number	114N17W10AAA01	219
		Well	444047092521901	Local	number	114N17W16CBB01	220
		Well	443827092521801	Local	number	114N17W33BBC01	221
		Well	444117092595701	Local	number	114N18W17AAB01	221
		Well	443801092571301	Local	number	114N18W35CCB01	222
		Well	444220093055001	Local	number	114N19W04DAC01	222
		Well	443934093043201	Local	number	114N19W22DDD01	223
2	DODGE	Well	435336092553201	Local	number	105N18W13DDD01	223
		Well	440448092485501	Local	number	107N17W13BBA01	224
3	FARIBAULT	Well	434237094082901	Local	number	103N28W24BDC01	225
		Well	434558093540001	Local	number	104N26W36CAC01	225
		Well	434902094042901	Local	number	104N27W16ABA01	225
4	FREEBORN	Well	433434093331201	Local	number	101N23W02DAC01	226
		Well	433846093220601	Local	number	102N21W09CCB01	226
		Well	434032093111801	Local	number	103N20W36CCB01	226
		Well	434308093322001	Local	number	103N23W13CDA01	227
3	GOODHUE	Well	441737092400501	Local	number	110N15W31BBD01	227
		Well	442401092372501	Local	number	111N15W21CDA01	227
		Well	443012092362201	Local	number	113N15W27BAB01	228
17	HENNEPIN	Well	444815093194901	Local	number	027N24W30AAA01	229
		Well	444801093202801	Local	number	027N24W30BDA01	229
		Well	445356093145301	Local	number	028N24W23ADD01	230
		Well	450116093205301	Local	number	029N24W06CCC01	230
		Well	445849093155802	Local	number	029N24W23CCB02	230
		Well	445833093154301	Local	number	029N24W26BAB01	231
		Well	445829093162901	Local	number	029N24W27ABD01	231
		Well	445158093225101	Local	number	116N21W07DAD01	232
		Well	445615093212301	Local	number	117N21W16CCA01	232
		Well	445618093211801	Local	number	117N21W16CDB01	232
		Well	445347093213901	Local	number	117N21W32DAD01	233
		Well	445740093333001	Local	number	117N23W11BBD01	233
		Well	450223093231801	Local	number	118N21W07DCB01	234
		Well	445905093224401	Local	number	118N21W32CBB01	234
		Well	445857093223101	Local	number	118N21W32CBD01	234
		Well	450854093212801	Local	number	119N21W04BBA01	235
		Well	450519093281401	Local	number	119N22W28ACC01	235

## GROUND-WATER WELLS, BY COUNTY, FOR WHICH RECORDS ARE PUBLISHED--Continued

ix  
Page

3	<u>HOUSTON</u>								
	Well 433953091251801	Local number	102N50W03DCC01						236
	Well 433935091252001	Local number	102N05W03DCC02						236
	Well 443935091252901	Local number	102N05W03DCC03						236
1	<u>HUBBARD</u>								
	Well 465142094433201	Local number	139N32W16AAA01						237
3	<u>ISANTI</u>								
	Well 453125093181101	Local number	035N24W14BCD01						237
	Well 453058093175901	Local number	035N24W14CDC01						238
	Well 453410093140001	Local number	036N23W32ACB01						238
1	<u>ITASCA</u>								
	Well 471450093322001	Local number	055N25W17ACD01						339
1	<u>JACKSON</u>								
	Well 434742095191501	Local number	104N37W19DBD01						239
i	<u>KANABEC</u>								
	Well 455236093172301	Local number	039N24W11DDC01						240
1	<u>KANDIYOHI</u>								
	Well 450730095014801	Local number	119N35W14ABB01						240
3	<u>LE SUEUR</u>								
	Well 442522093543901	Local number	111N26W14ADA01						241
	Well 443234093333501	Local number	112N23W02BAB01						241
	Well 443147093374501	Local number	112N23W06DD01						242
1	<u>LINCOLN</u>								
	Well 441705096084501	Local number	110N44W33DCD01						242
2	<u>MARTIN</u>								
	Well 434359094422201	Local number	103N32W08CCD01						243
	Well 434725094483001	Local number	104N33W28BAB01						243
4	<u>MC LEOD</u>								
	Well 444758094132101	Local number	115N28W05ACC01						243
	Well 444704094090801	Local number	115N28W11ADD01						244
	Well 444819094164701	Local number	116N29W35DDC01						244
	Well 445721094031201	Local number	117N27W10DAA01						245
2	<u>MEEKER</u>								
	Well 450632094290801	Local number	119N30W19AAB01						245
	Well 451542094322301	Local number	121N31W26BDC01						246
1	<u>MILLE LACS</u>								
	Well 454450093395701	Local number	038N27W35ABC01						247
1	<u>MORRISON</u>								
	Well 460444094212501	Local number	130N29W08DCC01						247
2	<u>MOWER</u>								
	Well 434010093010801	Local number	102N18W05ACB01						248
	Well 434417093521001	Local number	103N17W09DAA01						248
1	<u>OLMSTED</u>								
	Well 435920092273801	Local number	106N14W14ADB01						249
1	<u>PINE</u>								
	Well 462112092495801	Local number	045N20W26DEB01						250
12	<u>RAMSEY</u>								
	Well 445955093011001	Local number	029N22W14CAB01						251
	Well 445955093011002	Local number	029N22W14CAB02						251
	Well 445955093011003	Local number	029N22W14CAB03						251
	Well 450001093024701	Local number	029N22W16ADD01						252
	Well 445918092590901	Local number	029N22W24ADA01						252
	Well 445700093051001	Local number	029N22W31DD01						253
	Well 450026093084201	Local number	029N23W11CCC01						253
	Well 445751093072301	Local number	029N23W25CCD01						254
	Well 445739093081201	Local number	029N23W35BAD01						255
	Well 450414093012701	Local number	030N22W23CBB01						255
	Well 450723093071801	Local number	030N23W01BAB01						255
	Well 450238093082501	Local number	030N23W35BDC01						256
3	<u>REDWOOD</u>								
	Well 441323095280701	Local number	109N38W30BBD01						257
	Well 443051095074201	Local number	112N36W14AAA01						257
	Well 442906095064101	Local number	112N36W24DDC01						258
1	<u>RENVILLE</u>								
	Well 444437094425001	Local number	115N32W29AAC01						258
3	<u>RICE</u>								
	Well 441912093162901	Local number	110N20W19BDC01						259
	Well 442543093113701	Local number	111N20W11CDC01						259
	Well 442751093240701	Local number	112N21W31CBB01						260
10	<u>SCOTT</u>								
	Well 443732093460301	Local number	113N24W06ECB01						260
	Well 443352093423001	Local number	113N24W28DAA01						261
	Well 443352093423002	Local number	113N24W28DAA02						261
	Well 443715093480801	Local number	113N25W02CAC01						261
	Well 444025093220801	Local number	114N21W20BAA01						262
	Well 443752093254401	Local number	114N22W35DCC01						262
	Well 444633093212901	Local number	115N21W09CCC01						263
	Well 444427093353901	Local number	115N23W28BDD01						264
	Well 444427093353902	Local number	115N23W28BDD02						264
	Well 444427093353903	Local number	115N23W28BDD03						264

x

## GROUND-WATER WELLS, BY COUNTY, FOR WHICH RECORDS ARE PUBLISHED--Continued

Page

1	<u>SHERBURNE</u>			
	Well 452938093432701	Local number 035N27W29DBB02	265	
1	<u>STEELE</u>			
	Well 435742093164001	Local number 106N20W30BAD01	266	
1	<u>SWIFT</u>			
	Well 451913095370201	Local number 121N39W06BDB01	266	
1	<u>WABASHA</u>			
	Well 442708092155401	Local number 111N12W04BBD01	266	
1	<u>WADENA</u>			
	Well 462415095003001	Local number 134N34W19ADD01	267	
1	<u>WASHINGTON</u>			
	Well 445125092464001	Local number 027N20W02BCC01	268	
	Well 445125092464002	Local number 027N20W02BCC02	268	
	Well 445125092464003	Local number 027N20W02BCC03	268	
	Well 444751092563101	Local number 027N21W28BCC01	269	
	Well 445536092462401	Local number 028N20W11CAA01	269	
	Well 445220092465901	Local number 028N20W34ADA01	269	
	Well 450134092583101	Local number 029N21W06CAD01	270	
	Well 450027092552101	Local number 029N21W10CCC01	270	
	Well 445858092523901	Local number 029N21W13CAB01	271	
	Well 450858092575001	Local number 031N21W28ABD01	271	
	Well 451355092532601	Local number 032N20W30BCD01	272	
3	<u>WATONWAN</u>			
	Well 440037194372601	Local number 106N32W01DDB01	272	
	Well 440409094304901	Local number 107N31W14DAC01	273	
	Well 440133094312501	Local number 107N31W35CAC01	273	
1	<u>WINONA</u>			
	Well 435746092034202	Local number 106N10W19DDA02	273	
2	<u>WRIGHT</u>			
	Well 450318094040603	Local number 118N27W03CAC03	274	
	Well 450403093544501	Local number 119N26W35DDA01	274	
1	<u>YELLOW MEDICINE</u>			
	Well 444219096165501	Local number 114N45W04DCD01	275	

## COUNTIES WITH QUALITY OF GROUND WATER RECORDS

<u>ANOKA</u>	276
<u>CHISAGO</u>	278
<u>ISANTI</u>	278
<u>KANDIYOHI</u>	279
<u>POPE</u>	279
<u>RAMSEY</u>	280
<u>SHERBURNE</u>	283
<u>STEARNS</u>	284

## PRECIPITATION SITES, FOR WHICH CHEMICAL QUALITY RECORDS ARE PUBLISHED

Precipitation Station at Camp Ripley	288
--------------------------------------	-----

## WATER RESOURCES DATA FOR MINNESOTA, 1986

### 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 1986 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 53 gaging stations; stage and contents for 8 lakes and reservoirs; water quality for 14 stream stations, 8 partial-record stations, 1 lake station, 1 precipitation station, and 87 wells; and water levels for 136 observation wells. Also included are 78 high-flow partial-record stations and 1 low-flow partial-record station. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements or low-flow investigations. These data, together with the data in Volume 1, 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 Distribution Branch, Text Products Section, U.S. Geological Survey, 604 Pickett Street, Alexandria, VA 22304.

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-86-2. 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.

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) 229 2600.

### 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, Lawrence D. Seymour, director.

Minnesota Department of Transportation, Richard P. Braun, commissioner.

Minnesota Pollution Control Agency, Thomas J. Kalitowski, executive director.

Metropolitan Waste Control Commission of the Twin Cities Area, Peter E. Meintsman, chairperson

Metropolitan Council of the Twin Cities Area, Sandra Gardebring, chairperson.

Elm Creek Conservation Commission, Gerald E. Butcher, chairperson.

Red Lake Watershed District, Truman Sandland, president.

Red Lake Reservation Business Committee, Roger Jourdain, chairperson.

Middle River-Snake River Watershed District, Donald Rivard, chairperson.

White Earth Reservation Business Committee, Darrell Wadena, chairperson.

Assistance in the form of funds or services was given by the Corps of Engineers, U.S. Army, in collecting records for 48 gaging stations and 12 water-quality stations published in this report. 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

Precipitation during the 1986 water year varied from slightly below normal in a small area in extreme northwestern and north-central Minnesota, bordering Canada, to 22 in. (inches) above normal in small parts of central and east-central Minnesota (fig. 1). Normal annual precipitation in Minnesota ranges from 19 in. in the northwest to 32 in. in the southeast. Precipitation during water year 1986 ranged from 18 in. in parts of the northwest to greater than 48 in. in small parts of central and east-central Minnesota.

Precipitation was normal at the beginning of the 1st quarter, above normal in midquarter and below normal toward the end of the 1st quarter. Precipitation during the 2nd quarter continued in the below-normal range, except during February, when it was normal to slightly above in the northern two thirds of the State. In the 3rd quarter, precipitation was above normal except during May when it was below normal statewide. Precipitation during the final quarter was considerably above normal over the entire State, except during August when it was below normal in the north and in parts of south and central Minnesota.

Annual precipitation was considerably above normal for most of the State; new 12-month precipitation records were set at several places in central and south-central Minnesota. The most noteworthy new record was 49.39 in. at New London, in central Minnesota; annual precipitation of this magnitude is extremely rare in this part of the State, usually occurring only in the southeasternmost part. The 30-year (1951-80) annual normal precipitation for New London is slightly greater than 27 in.

Water year 1986 was a continuation of a long-term, extremely wet period as indicated by a new 10-year precipitation record set at Caledonia in extreme southeastern Minnesota--383.31 in.; this is the greatest 10-year precipitation total ever observed in Minnesota.

## STREAMFLOW

Average annual runoff in Minnesota ranges from 1 in. in the west to 14 in. in the northeast. Annual runoff in 1986 ranged from 2.5 in. along the northwestern border to 21 in. in east-central Minnesota [33.7 in. of runoff were recorded on an extremely small area of 7.77 square miles in east-central Minnesota (table 1)]. Runoff varied from 95 percent of average in parts of the north to more than 400 percent of average in parts of the south. West-central and part of central Minnesota had the greatest area of much-above-average runoff, ranging from 300 to 415 percent of the long-term average. The lowest average runoff, ranging from 95 to 150 percent of the long-term average, occurred in the northeast "arrow-head" region and parts of the northwest, north-central, and southeast regions. Runoff in the remaining area of the State ranged from 150 to 280 percent of the long-term average.... a most unusual year, with above-average runoff recorded over almost the entire State. Runoff to the Mississippi River at St. Paul reflects this situation. At St. Paul, the Mississippi River drains 40 percent of the State and, in 1986, broke an 88-year period of record with a mean annual flow of 29,580 cubic feet per second--a rate 1.4 times greater than the previous maximum set in 1983.

During 1986, records for stations in central and southern Minnesota generally indicate that annual runoff was considerably above average. Runoff in the Mississippi River at Aitkin, in east-central Minnesota, was 10.26 in. or 156 percent of the 41-year average annual runoff of 6.57 in.--the 3rd highest of record. Runoff in the Crow River at Rockford, in the southern part of central Minnesota, was 14.84 in., an amount 3.7 times the average annual runoff of 3.98 in. and the highest in 61 years of record. Water year 1986 is the 4th consecutive year of record, or near-record, runoff in the Crow River basin. Runoff in 1983 was 9.84 in., which broke the previous record of 9.14 in. set in 1972. Another new record of 11.01 in. was set in 1984 followed by 9.64 in. in 1985. In west-central Minnesota, runoff in the Chippewa River near Milan was 9.49 in., more than 4 times the average annual runoff of 2.29 in. and the highest in 49 years of record. The previous record of 7.26 in. was set in 1985, preceded by the 5th highest runoff of record, 5.43 in. in 1984. Runoff to the Des Moines River at Jackson, in southwestern Minnesota, was 10.36 in.--an amount 2.8 times the average annual runoff of 3.66 in. and the 4th highest in 51 years of record. Annual and monthly mean discharges for these stations are compared to median discharges for a 30-year base period in figure 2.

Although record-breaking monthly and annual runoff volumes were recorded at a number of gaging stations, no peaks of record were exceeded during water year 1986 at any stations on streams for which records are published in this volume.

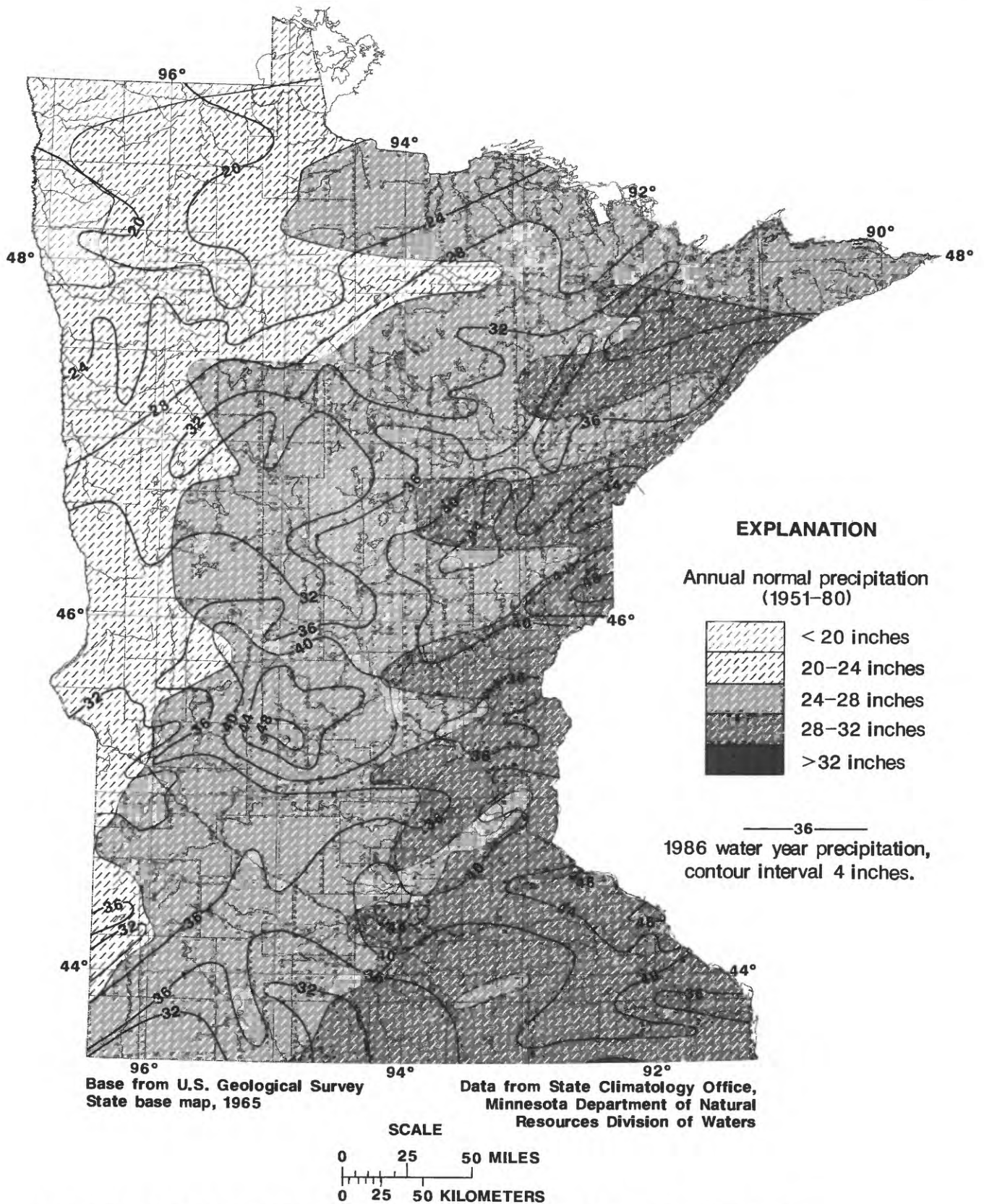
The combined storage in the six Mississippi River Headwater Reservoirs (Winnibigoshish, Leech, Pokegama, Pine, Sandy, and Gull), located in northern and central Minnesota, was 1,591,015 acre-feet at the end of the 1986 water year--an increase of 196,599 acre-feet from the corresponding date the previous year.

## WATER QUALITY

Three U.S. Geological Survey National Stream-Quality Accounting Network (NASQAN) stations and one bench-mark station are used to depict variability in concentrations of dissolved solids and nitrate as nitrogen in the Upper Mississippi River basin (figs. 3 and 4); there are no water-quality stations in the Missouri River basin in Minnesota.

Dissolved-solids concentrations generally were near the monthly medians at Mississippi River near Royalton, higher than the monthly medians at Minnesota River near Jordan, and near the medians to slightly higher at North Fork Whitewater River near Elba. Dissolved-solids concentrations at Mississippi River at Nininger varied from the monthly medians with high concentrations in fall, normal in winter, and low in summer. Nitrate concentrations tended to vary the same as dissolved solids at each of the three stations.

Water samples were collected from 87 wells. Nitrate concentrations are above the primary drinking-water standard of 10 mg/L (Minnesota Pollution Control Agency, 1988) in 20 samples. Twenty seven samples are above the iron standard of 300 ug/L, and 29 samples are above the manganese standard of 50 ug/L. Trace-element concentrations were not above the primary drinking-water standards in any of the samples.



**Figure 1.--Precipitation, in inches, during 1986 water year compared to normal annual precipitation for Minnesota**

Table 1.--Runoff at streamflow stations in 1986 compared with long-term average for river basins in Minnesota

[Average runoff for station is based on period of record. Previous or present maximum runoff and year of occurrence are shown. mi<sup>2</sup>, square miles.]

Station No.	Station name	Drainage Area (mi <sup>2</sup> )	Runoff (inches)			
			1986 Water year	Average	Maximum	
					Inches	Water year
05201500	Mississippi River at Winnibigoshish Dam near Deer River	1,442	7.98	4.92	11.61	1898*
05206500	Leech Lake River at Federal Dam	1,163	7.54	4.33	9.52	1899*
05211000	Mississippi River at Grand Rapids	3,370	8.26	4.80	9.78	1906
05216860	Swan River near Calumet	114	9.60	7.93	12.75	1966
05219000	Sandy River at Sandy Lake Dam at Libby	421	17.43	7.23	16.35	1953
05227500	Mississippi River at Aitkin	6,140	10.26	6.57	11.03	1966
05231000	Pine River at Cross Lake Dam at Cross Lake	562	11.28	5.34	13.48	1905*
05245100	Long Prairie River at Long Prairie	432	10.15	5.25	11.51	1972
05247000	Gull River at Gull Lake Dam near Brainerd	287	10.45	5.20	10.79	1972
05247500	Crow Wing River near Pillager	3,300	10.38	5.67	10.55	1972
05267000	Mississippi River near Royalton	11,600	10.44	5.43	9.05	1985
05275000	Elk River near Big Lake	615	14.77	6.07	11.64	1984
05278000	Middle Fork Crow River near Spicer	179	18.23	4.97	12.29	1984
05280000	Crow River at Rockford	2,520	14.84	3.98	11.04	1984
05286000	Rum River near St. Francis	1,360	15.10	6.37	12.42	1984
05287890	Elm Creek near Champlin	84.9	12.01	6.17	8.80	1985
05288500	Mississippi River near Anoka	19,100	12.62	5.70	9.74	1985
05291000	Whetstone River near Big Stone City	389	6.32	1.77	5.52	1962
05292000	Minnesota River at Ortonville	1,160	4.26	1.31	4.04	1962
05293000	Yellow Bank River near Odessa	398	7.68	2.08	6.45	1972
05294000	Pomme de Terre River at Appleton	905	5.45	1.71	4.40	1985
05300000	Lac qui Parle River near Lac qui Parle	983	6.42	1.87	5.44	1984
05301000	Minnesota River near Lac qui Parle	4,050	8.41	2.34	5.60	1952
05304500	Chippewa River near Milan	1,870	9.49	2.29	7.46	1984
05311000	Minnesota River at Montevideo	6,180	6.51	1.65	4.82	1952
05313500	Yellow Medicine River near Granite Falls	653	9.37	2.58	9.98	1984
05315000	Redwood River near Redwood Falls	697	9.04	2.45	9.22	1983
05317000	Cottonwood River near New Ulm	1,280	12.32	3.43	12.63	1969
05317200	Little Cottonwood River near Courtland	230	7.93	3.65	9.45	1983

\* Calendar year

Table 1.--Runoff at streamflow stations in 1986 compared with long-term average for river basins in Minnesota.--  
Continued

Station No.	Station name	Drainage Area (mi <sup>2</sup> )	Runoff (inches)			
			1986 Water year	Average	Maximum	
					Inches	Water year
05319500	Watsonwan River near Garden City	812	10.29	5.97	13.83	1983
05320000	Blue Earth River near Rapidan	2,430	10.26	5.25	16.08	1983
05320500	Le Sueur River near Rapidan	1,100	10.85	5.88	16.53	1983
05325000	Minnesota River at Mankato	14,900	8.44	2.75	7.90	1969
05327000	High Island Creek near Henderson	237	13.54	5.66	11.00	1984
05330000	Minnesota River near Jordan	16,200	8.94	3.20	8.09	1969
05331000	Mississippi River at St. Paul	36,800	11.05	4.15	8.16	1983
05336700	Kettle River below Sandstone	863	21.28	12.04	21.87	1972
05337400	Knife River near Mora	102	17.97	9.40	12.94	1985
05340500	St. Croix River at St. Croix Falls	6,240	18.65	9.46	15.71	1972
05344500	Mississippi River at Prescott	44,800	11.68	5.27	9.19	1952
05345000	Vermillion River near Empire	110	13.72	7.01	12.05	1983
05353800	Straight River near Fairbault	442	12.95	8.36	18.59	1983
05374900	Zumbro River at Kellogg	1,400	12.80	8.76	14.93	1983
05376000	North Fork Whitewater River near Elba	101	7.96	6.44	12.54	1974
05378500	Mississippi River at Winona	59,200	13.04	6.42	10.86	1983
05457000	Cedar River near Austin	425	11.51	6.74	18.15	1983
05476000	Des Moines River at Jackson	1,220	10.36	3.66	13.35	1983

#### GROUND-WATER LEVELS

Water levels in unconfined (water-table) aquifers generally were above normal in more than half the observation wells throughout the 1986 water year. Figure 5 shows how water levels relate seasonally to normal levels, based on water-level fluctuations in 25 wells in unconfined aquifers. Levels during the 1986 water year are compared to the long-term normal for each month and grouped by seasons. Water levels generally declined seasonally from November through March, rose in spring, and declined during summer. Water levels rose again in late summer in 11 of the 25 observation wells. During fall 1985 (October through December), water levels were above normal in 72 percent of the 25 observation wells, and new record-high monthly levels were recorded in 36 percent of the wells. During winter 1986 (January through March), water levels were above normal in 56 percent of the 25 observation wells, and new record-high monthly levels were recorded in 20 percent of the wells. During spring and summer 1986 (April through September), water levels were above normal in 80 percent of the 25 observation wells. In spring, new record-high monthly levels were recorded in 44 percent of the wells and during summer new record-high monthly levels were recorded in 64 percent of the wells. One observation well in south-central Minnesota had below-normal levels from fall 1985 through spring 1986. Water levels in the well returned to normal in summer 1986. Water levels in central and much of eastern Minnesota were consistently above normal throughout the 1986 water year, similar to water levels in the adjacent area of Wisconsin. Water levels in northwestern and southwestern Minnesota generally were in the normal range during the 1986 water year.

In much of Minnesota, water levels in confined drift and bedrock aquifers generally were above normal throughout the 1986 water year (fig. 6). Water levels in many wells were steady or declined slightly during fall and winter and rose to the high level for the year in spring or summer 1986. Water levels in 58 observation wells producing from confined drift or the first bedrock aquifer were compared seasonally to long-term normal levels. In fall 1985 (October through December), at the beginning of the 1986 water year, water levels in 72 percent of the 58 wells were above normal (fig. 6), 16 percent were in the normal range, and 12 percent were below-normal. New monthly record-high water levels were recorded in 48 percent of the wells during fall. During summer 1986 (July through September), at the end of the 1986 water year, water levels in 76 percent of the 58 wells were above normal, 15 percent were in the normal range, and 9 percent were below normal. New monthly record-high water levels were recorded in 53 percent of the wells during summer. The cones of depression that develop in the St. Paul and Minneapolis areas continued below-normal levels throughout the 1986 water year as indicated in figure 6. Two or three other areas of below-normal levels were observed in southern and western Minnesota. Levels in the Mount Simon-Hinckley aquifer in the Twin Cities basin were consistently below normal, and new seasonal record-low-water levels were recorded.

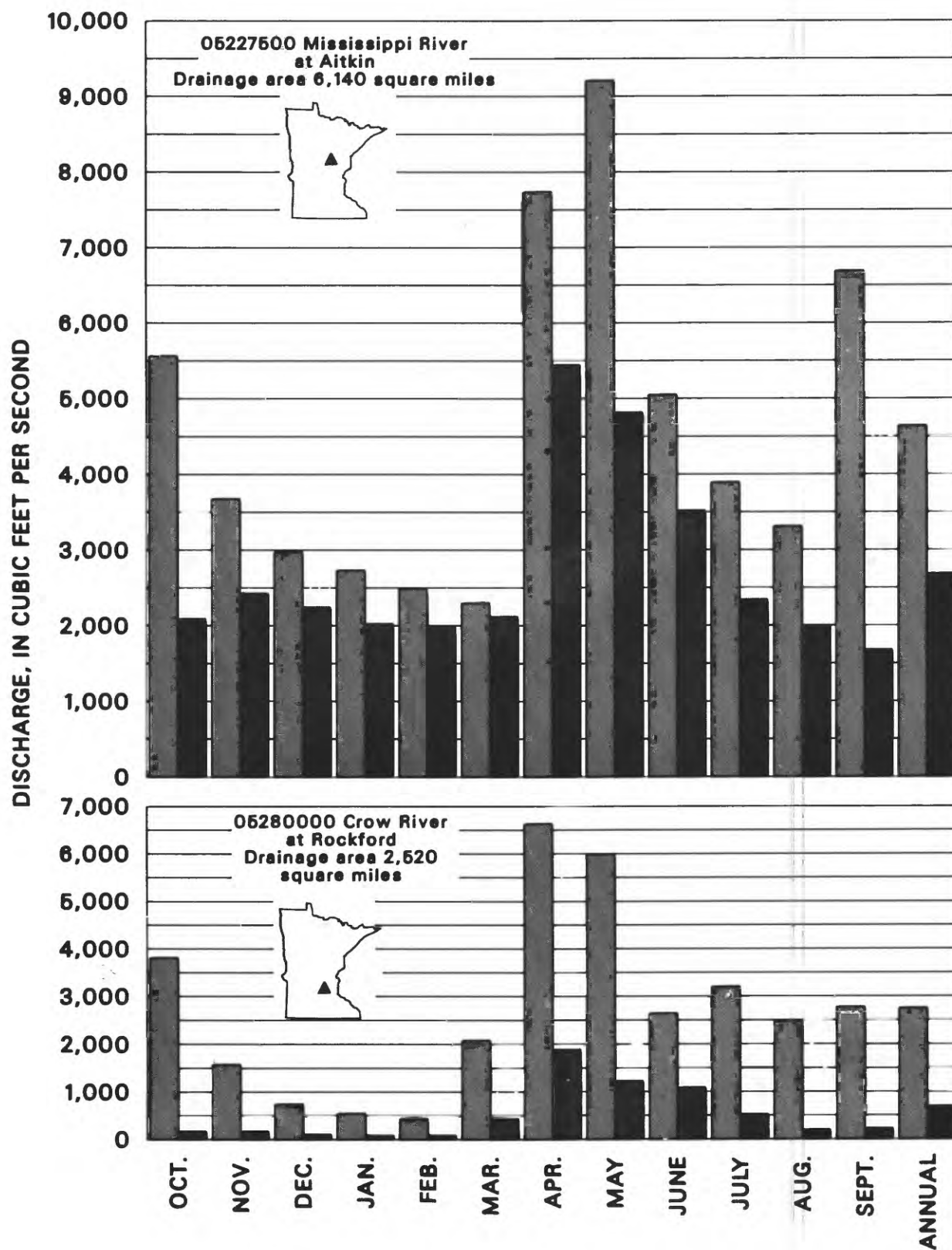
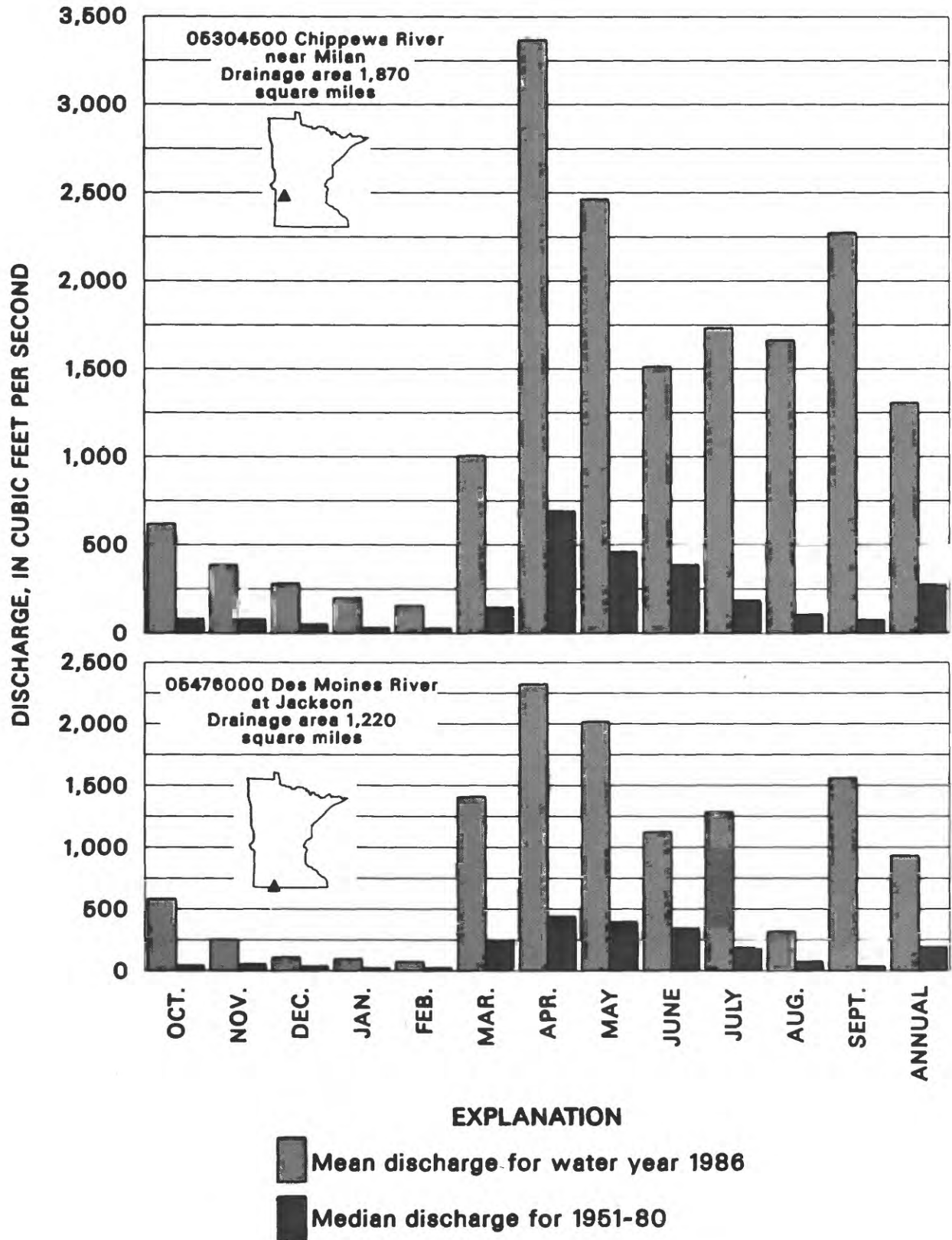


Figure 2.--Comparison of mean discharge for the 1986 water year with median



discharge for 1951-80 at four long-term representative gaging stations

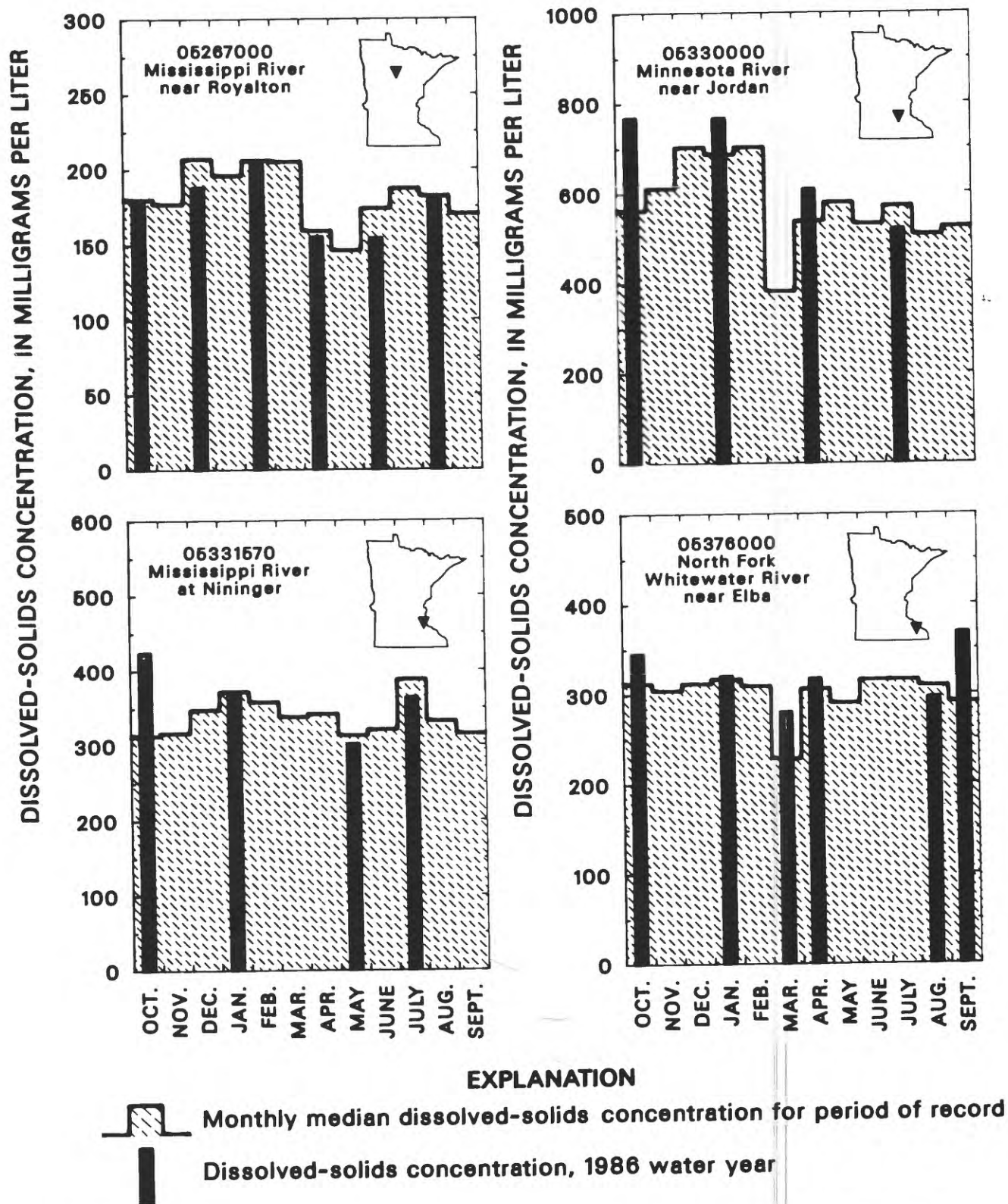


Figure 3.--Comparisons between the monthly median for the period of record and the single samples of dissolved-solids concentrations collected during the 1986 water year

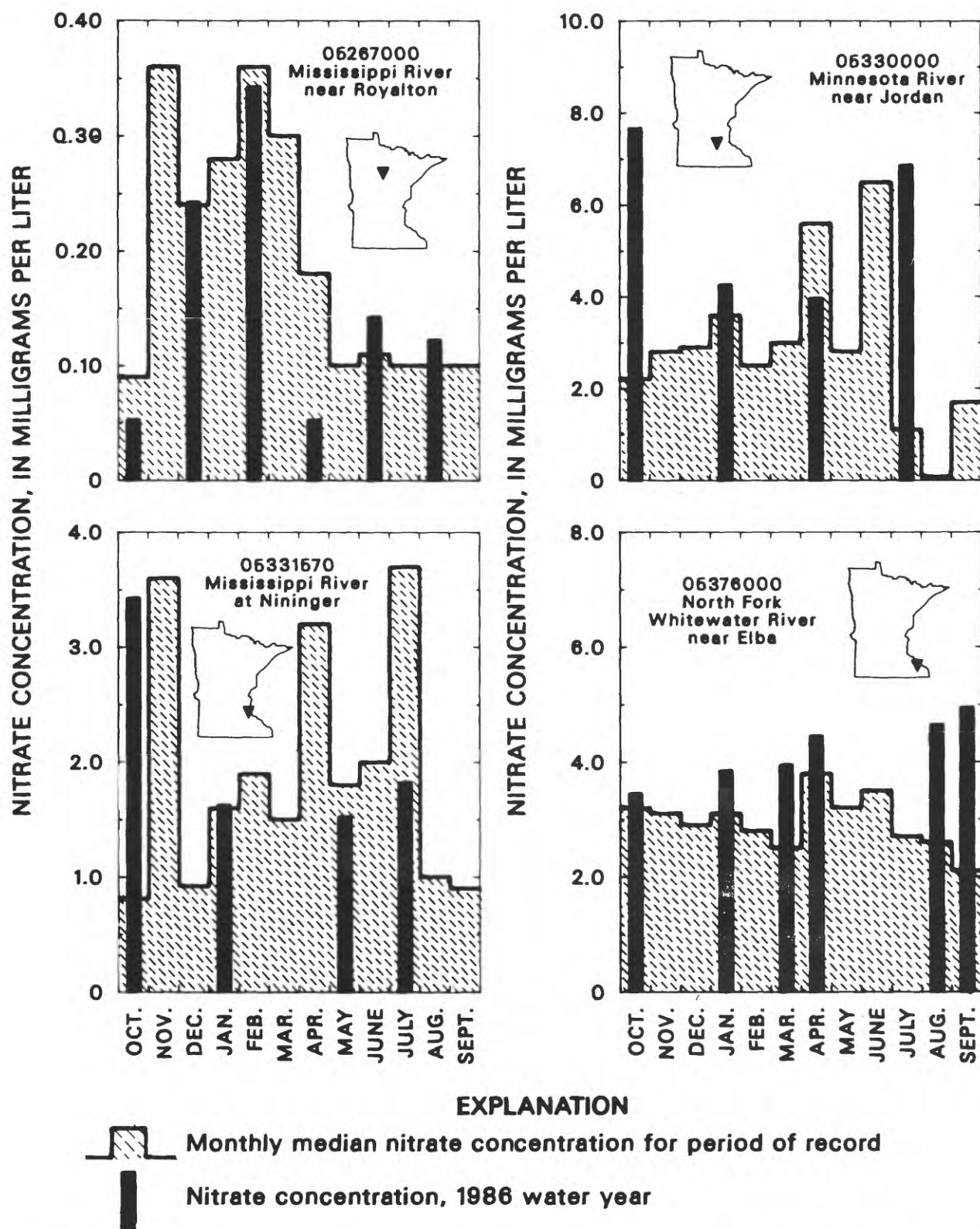
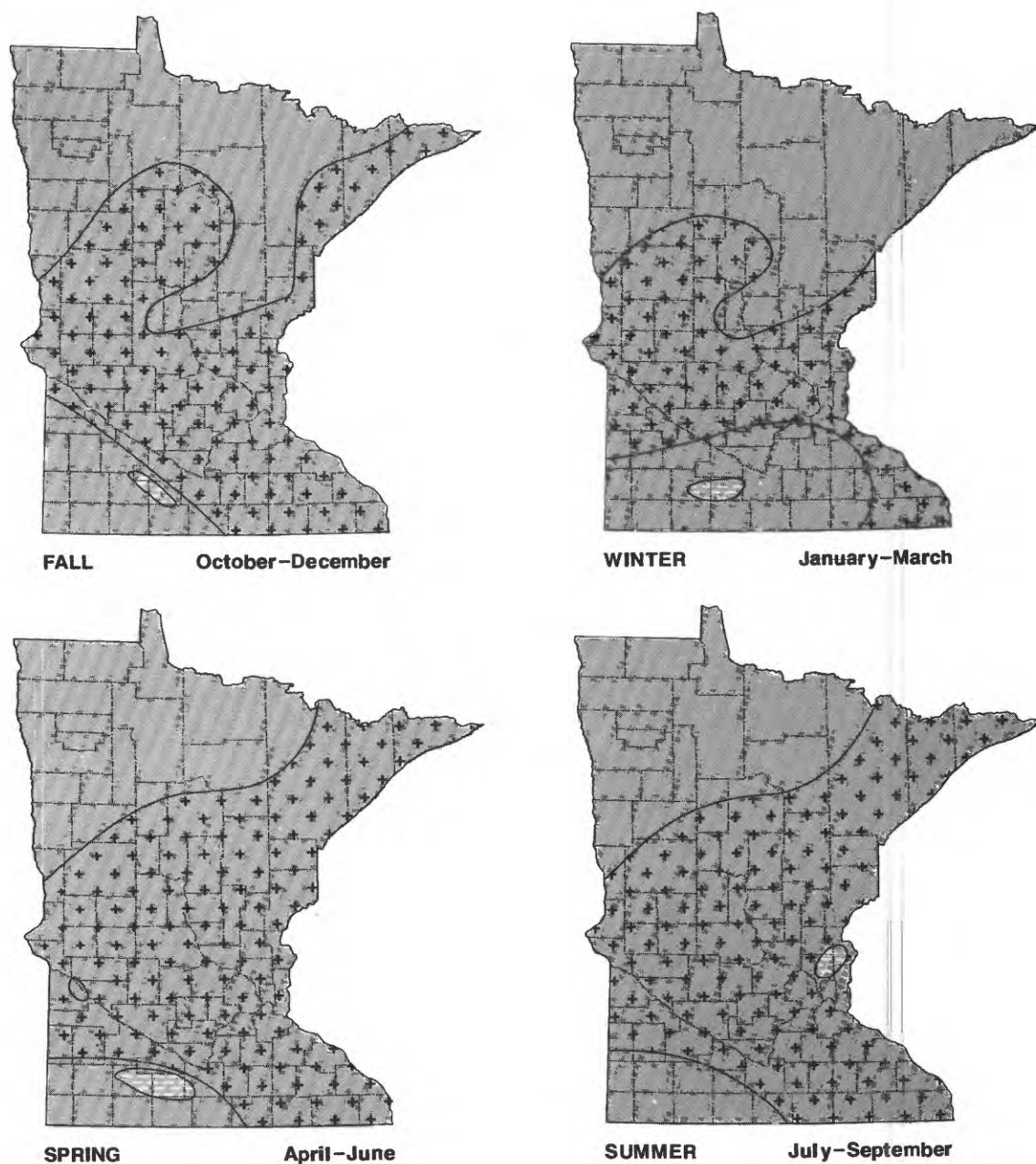


Figure 4.--Comparisons between the monthly median for the period of record and the single samples of nitrate concentrations collected during the 1986 water year

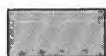


### EXPLANATION

#### WATER-TABLE LEVELS



**Above normal**      Water levels are within the highest 25% of record for the season

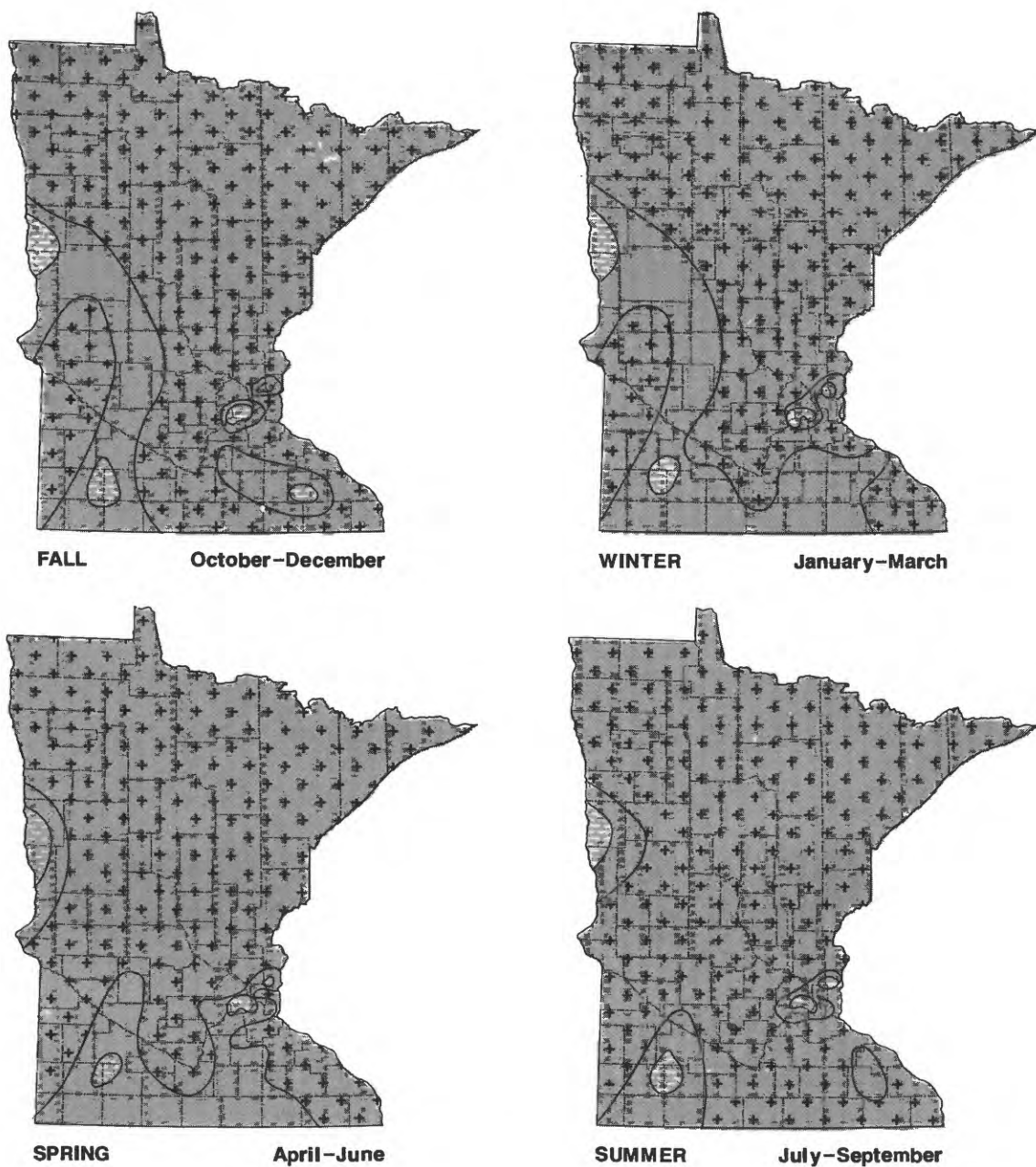


**Normal**



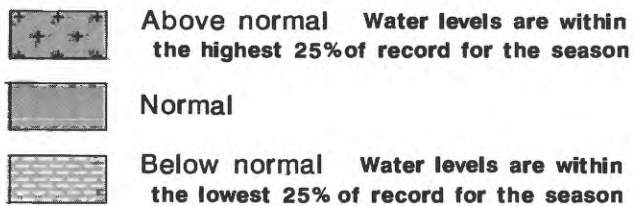
**Below normal**      Water levels are within the lowest 25% of record for the season

**Figure 5.--Relation of seasonal water-table levels to long-term mean levels**



### EXPLANATION

#### CONFINED-AQUIFER WATER LEVELS



**Figure 6.--Relation of seasonal water levels in confined aquifers to long-term mean levels**

## 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 1986 water year that began October 1, 1985, and ended September 30, 1986. 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 8, 9, 10, and 11. 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. 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

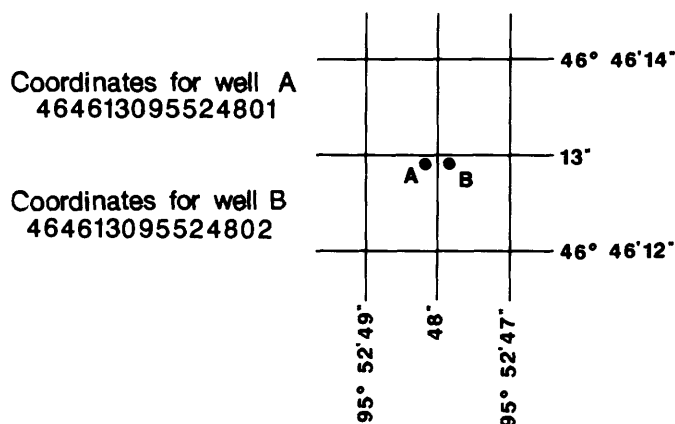
Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary that enters between two main-stream 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 indentation represents one rank. This downstream order and system of indentation 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 7 on following page. 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 7.--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 8 and 10.

#### 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

The records published for each gaging station consist of two parts, the manuscript or station description and the data table for the current water year. The manuscript provides, under various headings, descriptive information, such as station location; period of record; average discharge; historical extremes; 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 datums 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.

**AVERAGE DISCHARGE.**--The discharge value given is the arithmetic mean of the water-year mean discharges. It is computed only for stations having at least 5 water years of complete record, and only water years of complete record are included in the computation. It is not computed for stations where diversions, storage, or other water-use practices cause the value to be meaningless. If water developments significantly altering flow at a station are put into use after the station has been in operation for a period of years, a new average is computed as soon as 5 water years of record have accumulated following the development. The median of yearly mean discharges also is given under this heading for stations having 10 or more water years of record, if the median differs from the average given by more than 10 percent.

**EXTREMES FOR PERIOD OF RECORD.**--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the manner as the maximum.

**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.

**EXTREMES FOR THE CURRENT YEAR.**--Extremes given here are similar to those for the period of record, except the peak discharge listing which may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

**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 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.

For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. For some reservoirs a table showing daily contents or stage is given.

The daily table for stream-gaging stations gives mean discharge for each day and is followed by monthly and yearly summaries. In the monthly summary below the daily table, the line headed "TOTAL" gives the sum of the daily figures. The line headed "MEAN" gives the average flow in cubic feet per second during the month. The lines headed "MAX" and "MIN" give the maximum and minimum daily discharges, respectively, for the 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 are omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. In the yearly summary below the monthly summary, the figures shown are the appropriate discharges for the calendar and water years. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversions or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

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<sup>3</sup>/s; to the nearest tenth between 1.0 and 10 ft<sup>3</sup>/s; to whole numbers between 10 and 1000 ft<sup>3</sup>/s; and to 3 significant figures for more than 1000 ft<sup>3</sup>/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 10.

##### 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.

##### On-Site 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.

RECORD 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:

<u>PRINTED OUTPUT</u>	<u>REMARK</u>
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 acceptable 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 11.

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 known, 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).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error in determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given only to a tenth of a foot or a larger unit.

Hydrographs showing water-level fluctuations are included for 64 representative wells; 34 bedrock, 18 surficial-sand, and 12 buried-sand wells.

#### Data Presentation

Each well consists of two parts, the station description and the data table of water levels observed during the water year. 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.

**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.

#### 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 National WATER Data STORAGE and RETRIEVAL System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from each of the Water Resources Division's district offices (see address given on back of the title page).

General inquiries about WATSTORE may be directed to:

Chief Hydrologist  
U.S. Geological Survey  
437 National Center  
Reston, Virginia 22092

#### 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 sheen within 24 hours when incubated at 35°C  $\pm$  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  $\pm$  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  $\pm$  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<sup>3</sup>), and periphyton and benthic organisms in grams per square meter (g/m<sup>2</sup>).

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<sup>3</sup>/s, ft<sup>3</sup>/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.

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<sub>i</sub>' 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<sub>3</sub>).

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<sup>2</sup>), 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 milliliters (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 ( $1 \times 10^{-12}$ ) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields  $3.7 \times 10^{10}$  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 [ $\text{mg C}/(\text{m}^2 \cdot \text{time})$  for periphyton and macrophytes and  $\text{mg C}/(\text{m}^3 \cdot \text{time})$  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 [ $\text{mg O}_2/(\text{m}^2 \cdot \text{time})$  for periphyton and macrophytes and  $\text{mg O}_2/(\text{m}^3 \cdot \text{time})$  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 radioisotopes. 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 quantity and intensity of 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 of 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<sub>10</sub>) 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 emerged 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 multiple 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 um membrane 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.....Ephemeridae  
Genus.....Hexagenia  
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, 1980, is called the "1980 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-E1. *Application of borehole geophysics to water-resources investigations*, by W. S. Keys and L. M. MacCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 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 indirect 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 and dispersion in streams by dye tracing*, by E. F. Hubbard, F. A. Kilpatrick, L. A. Martens, and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1982. 44 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-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-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 programed 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.

## PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS--Continued

- 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.
- 4-A1. *Some statistical tools in hydrology*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.
- 4-A2. *Frequency curves*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.
- 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. W. Skougstad and others, editors: USGS--TWRI Book 5, Chapter A1. 1979. 626 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 analysis of organic substances in water*. by D. F. Goerlitz and Eugene Brown: USGS--TWRI Book 5, Chapter A3. 1972. 40 pages.
- 5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*. edited by P. E. Greenson, T. A. Ehlke, G. A. Irwin, B. W. Lium, and K. V. Slack: USGS--TWRI Book 5, Chapter A4. 1977. 332 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.
- 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. Schaffranek, 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.

## DISCONTINUED GAGING STATIONS

The following continuous-record streamflow or stage stations in Minnesota have been discontinued or converted to partial-record stations. Daily streamflow or stage records were collected and published for the period of record shown for each station.

Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Upper Mississippi River basin			
05210000	Mississippi River near Deer River, MN	a3,190	1945-50
05212700	Prairie River near Taconite, MN	a360	1967-83
*05213000	Prairie River near Grand Rapids, MN	485	1909 <del>W</del> , 1925-49
05216800	O'Brien Creek near Pengilly, MN	-	1963-68
05216820	Initial tailings basin outflow near Keewatin, MN	2.5	1982-85
05217000	Swan River near Warba, MN	254	1954-69
05217500	Swan River near Swan River, MN	a290	1929
05218000	Mississippi River above Sandy River near Libby (above Sandy River), MN	4,560	1895-1915, 1925-29
05221000	Willow River near Palisade, MN	442	1929
05226200	Ripple (Mud) River near Wealthwood, MN	-	1937-39
05232000	Pelican Brook (Long Lake) near Pequot Lakes, MN	-	1938-42, 1943-47
05241500	Rabbit River near Crosby, MN	8.38	1945-63
05242700	Little Sand Lake outlet (Sand Lake outlet) near Dorset, MN	a74	1930-41
*05244000	Crow Wing River at Nimrod, MN	a1,010	1910-14, 1930-81
05244500	Crow Wing River at Motley, MN	a2,140	1909 <del>W</del> , 1913-17, 1930-31
05244980	Diversion from Long Prairie River near Osakis, MN	-	1939-47
05245000	Long Prairie River near Osakis, MN	-	1949-54
05245500	Long Prairie River near Motley, MN	973	1909-17, 1930-31
05246000	Crow Wing River at Pillager, MN	a3,230	1903 <del>W</del> , 1909-13, 1925-50
*05261000	Mississippi River near Fort Ripley, MN	a11,010	1906, 1909-10, 1929
05261500	Nokasippi River near Fort Ripley, MN	210	1929
*05268000	Platte (Platt) River at Royalton, MN	338	1929-36
05269000	Mississippi River near Sauk Rapids, MN	a12,400	1903-06
05270000	Mississippi River at Sartell, MN	a12,450	1929, 1943-47 <del>W</del>
05270500	Sauk River near St. Cloud, MN	925	1909-12, 1913, 1929, 1930, 1931, 1932, 1933, 1934-81
05273500	Clearwater River at Clearwater, MN	-	1937, 1940-42
05274500	Elk River above St. Francis River near Big Lake, MN	384	1929
05274700	St. Francis River at Santiago, MN	-	1965-70, 1980-81
05274750	St. Francis River above Zimmerman, MN	-	1980-84
05274900	St. Francis River near Big Lake, MN	-	1965-70

\*See footnotes at end of table."

## DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Upper Mississippi River basin--Continued			
05275500	Mississippi River at Elk River, MN	a14,500	1915-56
05276000	North Fork Crow River near Regal, MN	215	1943-54
05277000	Middle Fork Crow River at New London, MN	-	1939-42, 1943-47
05277500	Middle Fork Crow River (Calhoun Lake Diversion) near Spicer, MN	-	1939, 1940-46
05278400	North Fork Crow River near Rockford, MN	-	1909-10
05278500	South Fork Crow River at Cosmos, MN	221	1945-64
05278930	Buffalo River near Glencoe, MN	374	1972-80
*05279000	South Fork Crow River near Mayer, MN	a1,170	1934-79
05279500	South Fork Crow River near Rockford, MN	a1,250	1909-12
05283500	Mississippi River at Anoka, MN	a17,100	1897, 1905-13
05284500	Rum River at Onamia, MN	414	1910-12
05284750	Rum River at Spencer Brook MN	-	1960-64
05285000	Rum River at Cambridge, MN	a1,160	1909-14
05285500	Rum River at St. Francis, MN	-	1903
05286500	Rum River near Anoka, MN	1,430	1905-06, 1909
05289000	Minnetonka Lake (head of Minnehaha Creek) near Wayzata (at Excelsior), MN	-	1938-64
05289500	Minnehaha Creek at Minnetonka Mills, MN	130	1953-64
Minnesota River basin			
05290000	Little Minnesota River near Peever, SD	447	1939-81
05292500	Minnesota River near Odessa, MN	a1,340	1909-12, 1944-63
05293500	Pomme de Terre River near Morris, MN	-	1937-39, 1940-47
05299500	Canby Creek at Canby, MN	-	1938-39, 1940-46
05300500	Ten Mile Creek near Boyd, MN	82.8	1949-51
05302000	Little Chippewa River near Lowry, MN	a54	1941
*05302500	Little Chippewa River near Starbuck, MN	111	1938-39
05303000	Chippewa River at diversion dam near Hancock, MN	-	1930-39, 1940-46
05303500	Chippewa River at Benson, MN	a1,270	1949-51
05304000	Shakopee Creek near Benson, MN	352	1949-54
05305000	Chippewa River near Watson, MN	a2,050	1910-17, 1931-36
05311500	Yellow Medicine River near Cottonwood, MN	465	1945-46
05312000	Spring Creek near Clarkfield, MN	a89	1945-46
05312500	Spring Creek near Hazel Run, MN	101	1945-48
05313000	Yellow Medicine River near Hanley Falls, MN	606	1945-47
05313521	Hawk Creek at outlet of Eagle Lake near Willmar, MN	-	1972-73
05313560	Eagle Lake tributary No. 7 near Willmar, MN	-	1972-73
05313570	Eagle Lake tributary No. 8 near Willmar, MN	-	1972-73
05314000	Chetomba Creek near Maynard, MN	a200	1949-51

\*See footnotes at end of table."

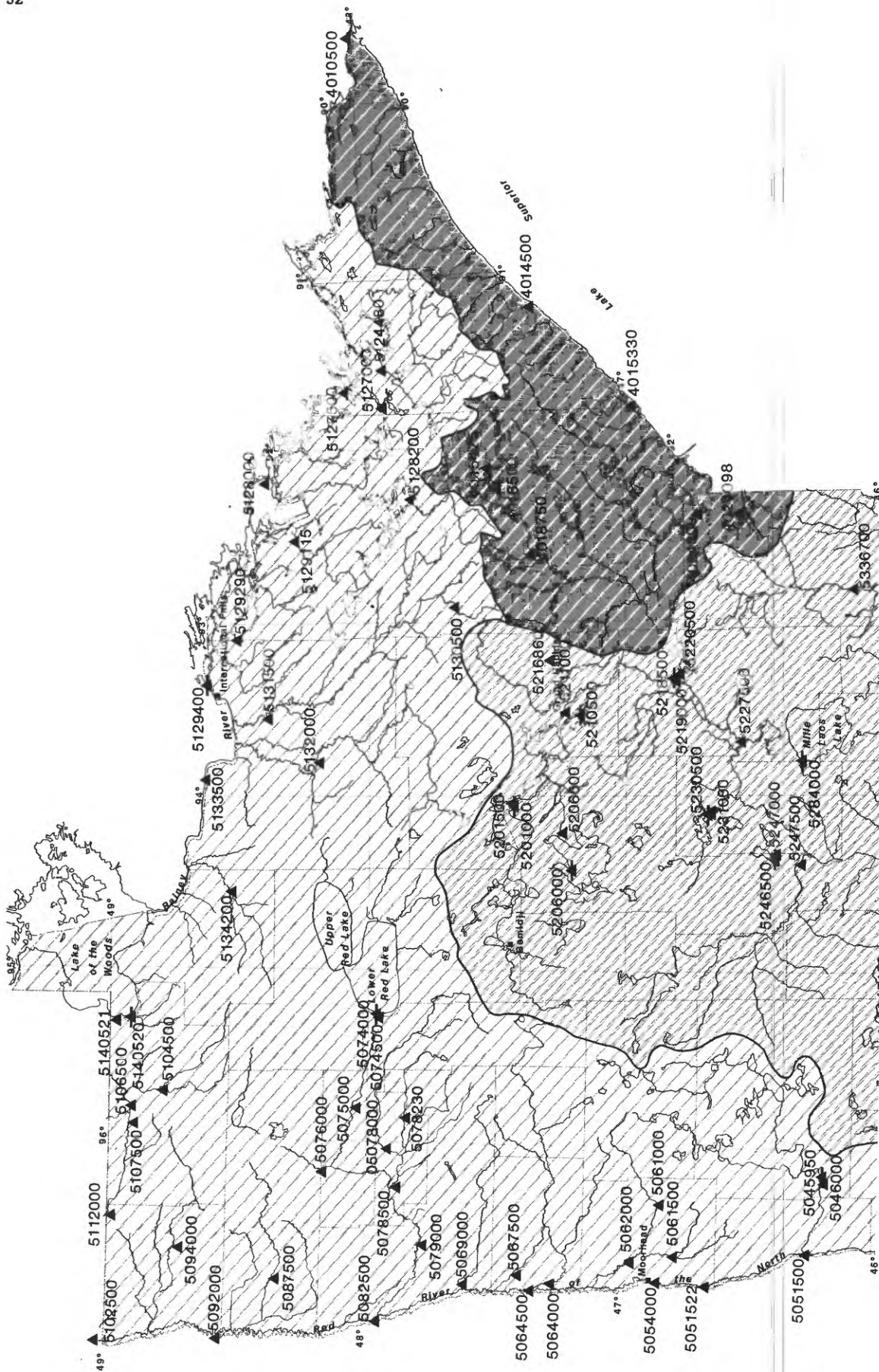
## DISCONTINUED GAGING STATIONS

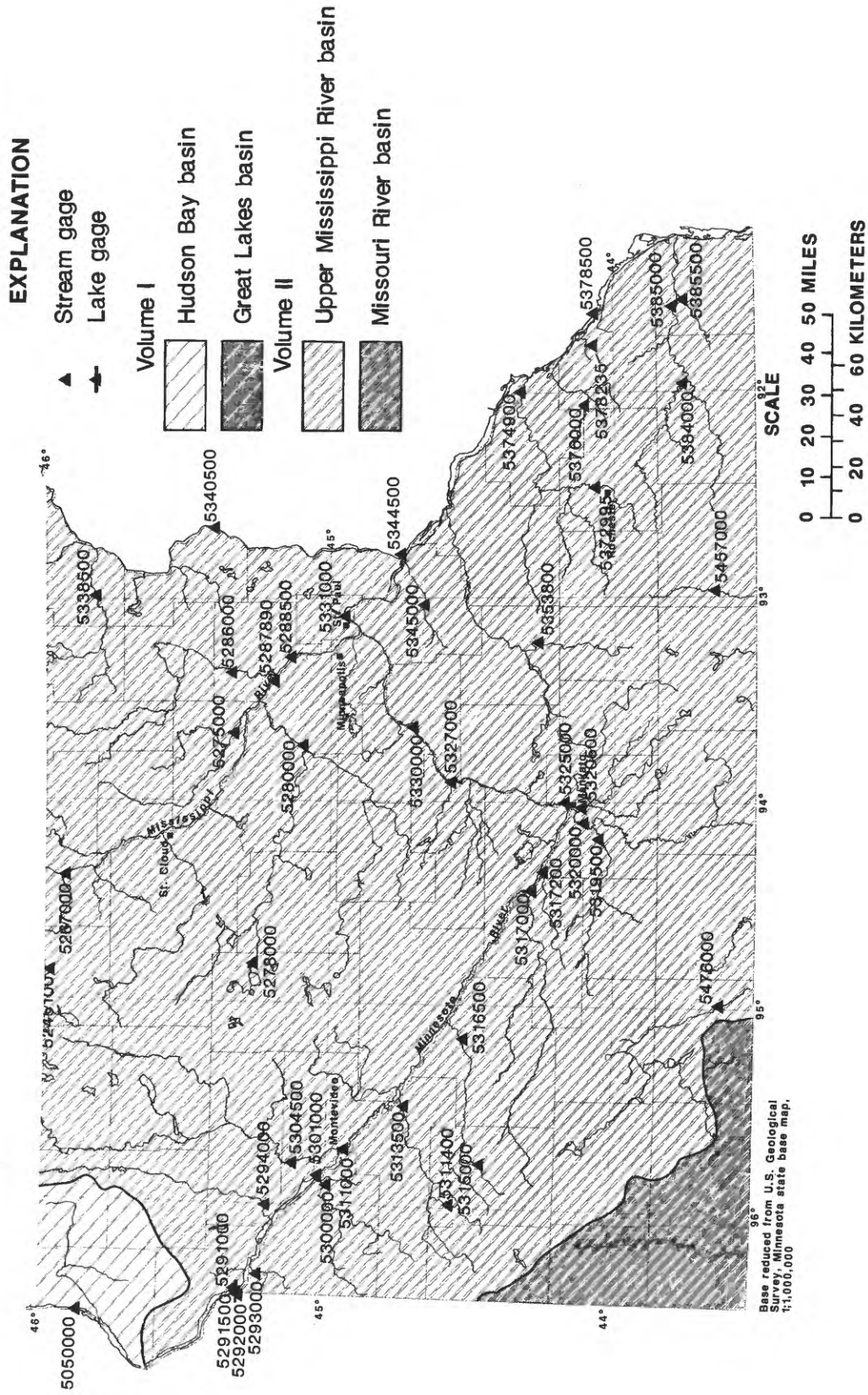
Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Minnesota River basin--Continued			
*05314500	Hawk Creek near Maynard, MN	474	1949-54
*05315200	Prairie Ravine near Marshall, MN	5.63	1959-64
05315500	Redwood River near Green Valley, MN	436	1945-57
05316000	Redwood River near Seaforth, MN	573	1945-46
05316770	Minnesota River at New Ulm, MN	9,536	1968-76
05316900	Dry Creek near Jeffers, MN	3.13	1982-85
05317500	Minnesota River at Judson, MN	a11,200	1938-50
*05318000	East Branch (East Fork) Blue Earth River near Bricelyn, MN	132	1951-70
05319000	South Fork Watonwan River at diversion dam near St. James, MN	-	1939, 1940-46
05321000	Blue Earth River at Mankato, MN	a3,550	1938-39, 1940-42
05330400	Sand Creek at diversion dam near Jordan, MN	-	1938-39, 1940-46
05330800	Purgatory Creek at Eden Prairie, MN	-	1975-80
05330900	Nine Mile Creek at Bloomington, MN	-	1963-73
St. Croix River basin			
*05336200	Glaisby Brook near Kettle River, MN	24.2	1959-70
05336500	Kettle River near Sandstone, MN	825	1908-16
05337000	Grindstone River at Hinckley, MN	-	1940-47
05337500	Snake River at Mora, MN	422	1909-13
05338000	Snake River at Sanatorium Bridge near Pine City, MN	-	1937-38
*05338500	Snake River near Pine City, MN	958	1913-17, 1951-81
05339500	St. Croix River near Rush City, MN	a5,120	1923-61
05340000	Sunrise River near Stacy, MN	167	1949-65
05340050	Sunrise River near Lindstrom	231	1965-85
Lower Mississippi River basin			
05345500	Vermillion River at Empire (Empire City), MN	124	1942-44
05346000	Vermillion River at Hastings, MN	195	1942-47
*05355200	Cannon River at Welch, MN	a1,320	1909-14, 1930-71
05371500	Mississippi River at Wabasha, MN	a56,600	1934
*05372800	South Fork Zumbro River on Belt Line at Rochester, MN	155	1981
*05372930	Bear Creek at Rochester, MN	80.0	1981
*05372950	Silver Creek at Rochester, MN	17.3	1981
*05372990	Cascade Creek at Rochester, MN	35.8	1981
05373000	South Fork Zumbro River near Rochester, MN	304	1952-81
05373500	Zumbro River (South Branch) near Zumbro Falls, MN	821	1911-17
05374000	Zumbro River at Zumbro Falls, MN	-	1909-17, 1929-80
05374500	Zumbro River at Theilman, MN	a1,320	1938-56
*05376500	South Fork Whitewater River near Altura, MN	76.8	1939-71
05376800	Whitewater River near Beaver, MN	271	1975-85
05377000	Beaver Creek at Beaver, MN	15.4	1939-40

"See footnotes at end of table."

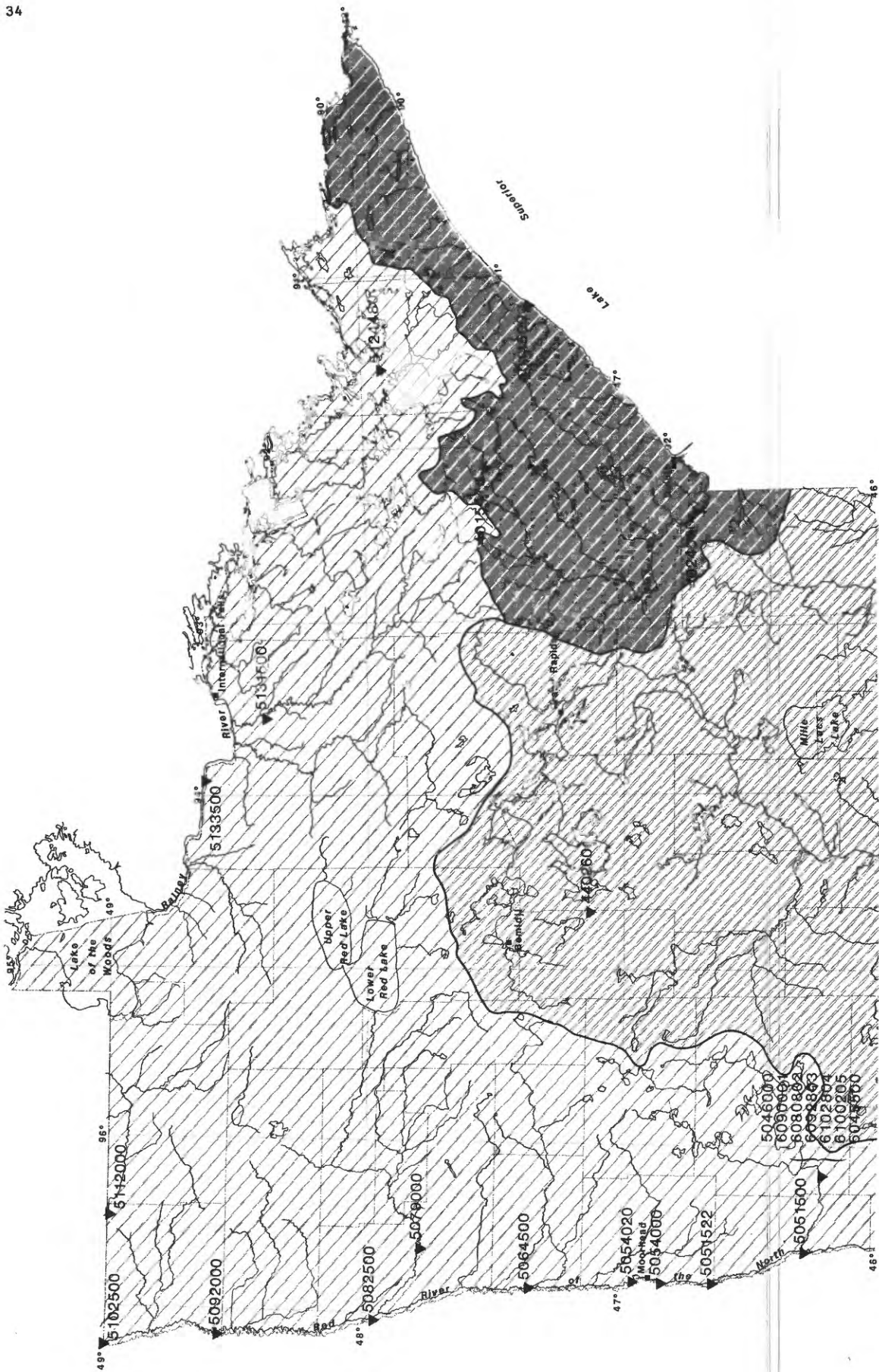
## DISCONTINUED GAGING STATIONS

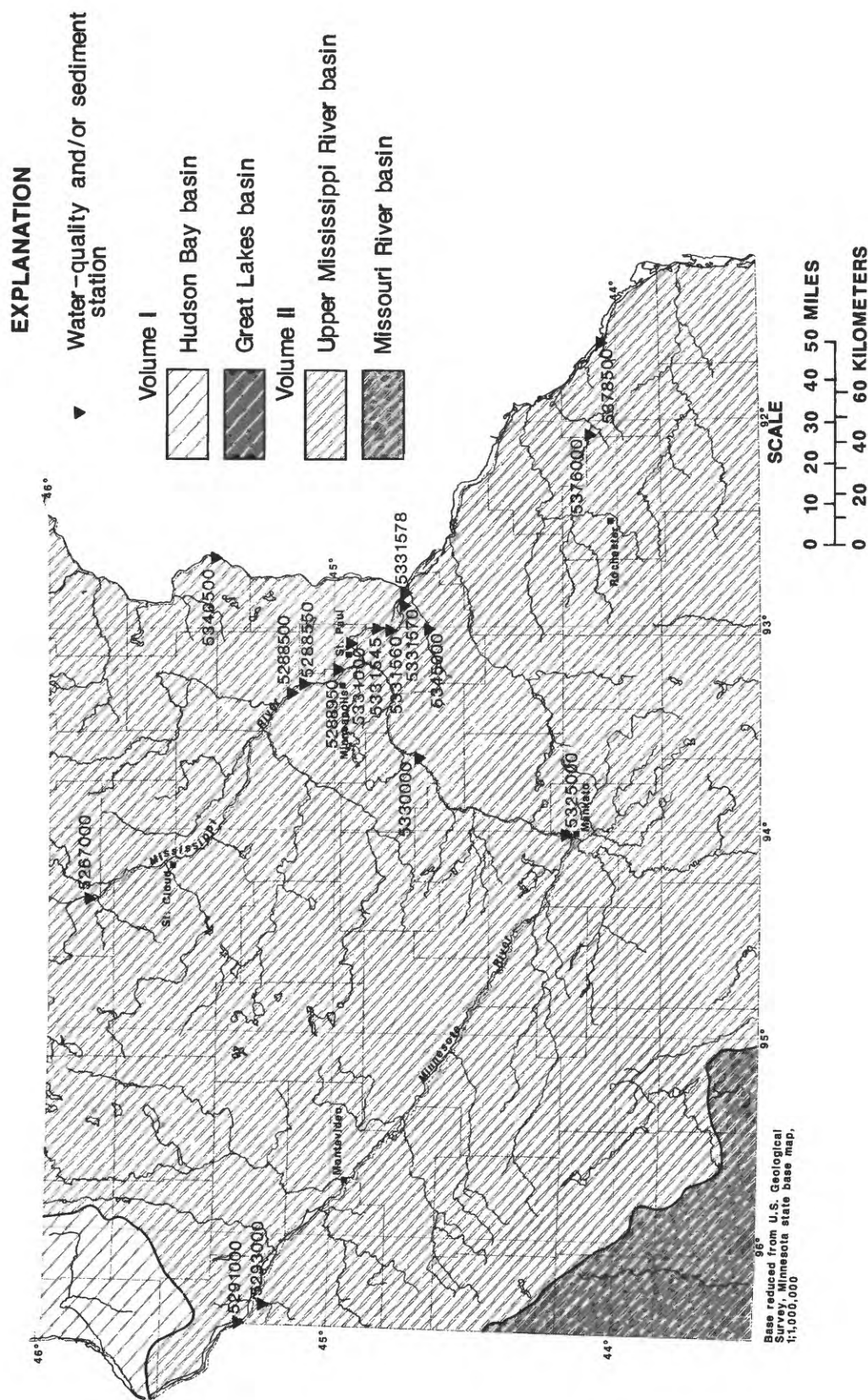
Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Lower Mississippi River basin--Continued			
05377500	Whitewater River at Beaver, MN	288	1936-38 1939-56
05378230	Stockton Valley Creek at Stockton	-	1982-85
05378300	Straight Valley Creek near Rollingstone	5.16	1970-85
05379000	Gilmore Creek at Winona, MN	8.95	1939-63
05380500	Mississippi River at Lamoile, MN	a60,000	1930-31
05383500	Mississippi River at LaCrosse, WI	-	1929-55
05383600	North Branch Root River tributary near Stewartville, MN	0.73	1959-64
*05384500	Rush Creek near Rushford, MN	129	1942-79
b05385000	Root River near Houston, MN	a1,270	1909-17 1929 1930-83
b05385500	South Fork Root River near Houston, MN	275	1953-83
05386000	Root River below South Fork near Houston, MN	a1,560	1938-61
05456500	Turtle Creek near Austin, MN	144	1947-51
05475000	Heron Lake outlet near Heron Lake, MN	-	1930-43
Big Sioux River basin			
*06483000	Rock River at Luverne, MN	440	1911-14
06603000	Little Sioux River near Lakefield, MN	17.1	1948-63
06603500	Jackson County ditch No. 11 near Lakefield, MN	7.69	1948-61
* Presently operated as a high-flow partial-record station. ‡ Stage records only. a Approximately. b Discharge measurements made to maintain a current rating.			





**Figure 8.--Location of lake and stream-gaging stations**





**Figure 9.--Location of surface-water-quality stations**

## UPPER MISSISSIPPI RIVER BASIN

## MISSISSIPPI RIVER MAIN STEM

05201000 WINNIBIGOSHISH LAKE NEAR DEER RIVER, MN

LOCATION.--Lat 47°25'42", long 94°03'00", in sec.25, T.146 N., R.27 W., Itasca County, Hydrologic Unit 07010101, on Leech Lake Indian Reservation, at dam on Mississippi River, 1 mi northwest of Little Winnibigoshish Lake, 14 mi northwest of town of Deer River, and at mile 1,248 upstream from Ohio River.

DRAINAGE AREA.--1,442 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1884 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to September 1956.

REVISED RECORDS.--WSP 1308: 1905(M).

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to July 8, 1949, nonrecording gage at same site, and July 9, 1949, to July 10, 1973, water-stage recorder at same site and at datum of 1,288.94 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Reservoir is formed by Winnibigoshish Lake and several other natural lakes controlled by a concrete and timber dam, completed in 1884; storage began in 1884. Capacity between elevations 1,294.94 ft and 1,303.14 ft (maximum allowable range) is 668,737 acre-ft of which 439,636 acre-ft is controlled storage between elevations 1,294.94 ft and 1,300.94 ft (normal operating range). Contents shown herein are contents above elevation 1,286.00 ft. Prior to September 1978, published contents as contents above elevation 1,288.94 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents observed, 996,500 acre-ft, capacity table then in use, July 30, 1905, elevation, 1,303.39 ft; minimum observed, 33,680 acre-ft, below zero of capacity table then in use, Oct. 20, 1931, elevation, 1,288.25 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 766,920 acre-ft, June 7, elevation, 1,299.19 ft; minimum, 608,810 acre-ft, Feb. 13, elevation, 1,296.80 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,298.33	709,000	
Oct. 31 .....	1,297.92	682,090	-26,910
Nov. 30 .....	1,297.59	660,420	-21,670
Dec. 31 .....	1,297.23	636,800	-23,620
CAL YR 1985 .....			* -17,710
Jan. 31 .....	1,296.88	613,880	-22,920
Feb. 28 .....	1,296.93	617,120	+3,240
Mar. 31 .....	1,297.50	654,510	+37,390
Apr. 30 .....	1,298.48	718,850	+64,340
May 31 .....	1,299.11	761,310	+42,460
June 30 .....	1,298.90	746,620	-14,690
July 31 .....	1,298.89	745,930	-690
Aug. 31 .....	1,298.03	689,300	-56,630
Sept. 30 .....	1,297.61	661,730	-27,570
WTR YR 1986 .....			-47,270

\*Due to revision of elevation-contents table, this value is not compatible with previous year-end value.

## MISSISSIPPI RIVER MAIN STEM

05201500 MISSISSIPPI RIVER AT WINNIBIGOSHISH DAM NEAR DEER RIVER, MN

LOCATION.--Lat 47°25'42", long 94°03'00", in SW $\frac{1}{4}$  sec.25, T.146 N., R.27 W., Itasca County, Hydrologic Unit 07010101, on Leech Lake Indian Reservation, at dam 1 mi northwest of Little Winnibigoshish Lake, 14 mi northwest of town of Deer River, and at mile 1,248 upstream from Ohio River.

DRAINAGE AREA.--1,442 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder on headwater and nonrecording gage on tailwater. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U. S. Army Corps of Engineers). Prior to June 30, 1973, gages at same sites with datum at 1,289.47 ft, adjustment of 1912. Prior to July 8, 1949, nonrecording headwater gage at same site and datum in use.

REMARKS.--Daily discharge is computed on the basis of modified weir formula and corrected to conform with discharge measurements, the head being determined from readings of headwater and tailwater gages. Flow completely regulated by Winnibigoshish Lake (station 05201000).

COOPERATION.--Daily discharge computed by U. S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--102 years, 522 ft<sup>3</sup>/s, 4.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 4,370 ft<sup>3</sup>/s, Aug. 6, 1905; no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,270 ft<sup>3</sup>/s, Oct. 1-23; minimum daily, 101 ft<sup>3</sup>/s, Mar. 7, 11, Apr. 2-25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1270	1110	1100	1090	743	201	102	705	609	1080	1080	1060		
2	1270	1110	1100	1090	743	202	101	703	608	1080	1080	1060		
3	1270	1110	1100	1090	743	202	101	702	707	1080	1080	1060		
4	1270	1110	1100	1090	749	202	101	702	804	1080	1070	1060		
5	1270	1110	1100	1090	630	102	101	702	905	1080	1070	1060		
6	1270	1110	1100	1090	631	102	101	702	897	1080	1070	1060		
7	1270	1110	1100	1090	631	101	101	703	994	1080	1070	1060		
8	1270	1110	1100	999	631	102	101	798	994	1080	1070	1060		
9	1270	1110	1100	999	631	102	101	797	989	1080	1070	1060		
10	1270	1110	1100	1000	631	102	101	797	1080	1080	1070	1060		
11	1270	1110	1100	1000	631	101	101	798	1080	1080	1070	1060		
12	1270	1110	1100	1000	631	102	101	798	1080	1080	1070	1060		
13	1270	1110	1100	1000	513	102	101	895	1080	1080	1070	1060		
14	1270	1110	1100	1000	513	102	101	990	1080	1080	1070	1060		
15	1270	1110	1100	1000	513	102	101	990	1080	1080	1070	1060		
16	1270	1110	1100	1000	514	102	101	990	1080	837	1070	1060		
17	1270	1110	1100	1000	515	102	101	990	1080	1080	1070	1060		
18	1270	1110	1100	862	515	102	101	990	1080	1080	1070	1060		
19	1270	1110	1100	862	515	102	101	990	1080	1080	1070	1060		
20	1270	1110	1100	862	515	102	101	988	1080	1080	1070	1060		
21	1270	1110	1100	862	515	102	101	893	1080	1080	1070	1080		
22	1270	1110	1100	862	395	102	101	798	1080	1080	1070	1060		
23	1270	1110	1100	859	395	102	101	703	1080	1080	1070	1060		
24	1180	1100	1100	859	395	102	101	605	1080	1080	1070	1060		
25	1110	1110	1100	740	395	102	101	606	1080	1080	1070	1060		
26	1110	1110	1100	740	298	102	255	607	1080	1070	1070	1060		
27	1110	1110	1100	740	298	102	255	607	1080	1080	1070	1060		
28	1110	1100	1100	740	299	102	255	409	1080	1080	1060	1060		
29	1110	1100	1100	742	---	102	550	508	1080	1080	1060	1060		
30	1110	1100	1100	743	---	102	691	409	1080	1080	1060	1060		
31	1110	---	1100	743	---	102	---	509	---	1080	1060	---		
TOTAL	38160	33260	34100	28844	15128	3559	4532	23384	30187	33227	33160	31820		
MEAN	1231	1109	1100	930	540	115	151	754	1006	1072	1070	1061		
MAX	1270	1110	1100	1090	749	202	691	990	1080	1080	1080	1080		
MIN	1110	1100	1100	740	298	101	101	409	608	837	1060	1060		
CFSM	.85	.77	.76	.65	.37	.08	.11	.52	.70	.74	.74	.74		
IN	.98	.86	.88	.74	.39	.09	.12	.60	.78	.86	.86	.82		
AC-FT	75690	65970	67640	57210	30010	7060	8990	46380	59880	65910	65770	63110		
CAL YR 1985	TOTAL	332560	MEAN	911	MAX	1410	MIN	100	CFSM	.63	IN	8.58	AC-FT	659600
WTR YR 1986	TOTAL	309361	MEAN	848	MAX	1270	MIN	101	CFSM	.59	IN	7.98	AC-FT	613600

## LEECH LAKE RIVER BASIN

465724094402601 WILLIAMS LAKE NEAR AKELEY, MN

LOCATION.--Lat 46°57'24", long 94°40'26", in SE¼NW¼ sec.12, T.140 N., R.32 W., Hubbard County, Hydrologic Unit 07010102. Samples are collected near center of lake at the deepest point.

DRAINAGE AREA.--0.875 mi<sup>2</sup> (2.27 km<sup>2</sup>).

PERIOD OF RECORD.--Water years 1977 to current year.

REMARKS.--Some meteorological and additional lake data are available by contacting the District office.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAM- PLING DEPTH (M) (000098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (000095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (900095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE OF WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)
OCT										
23...	1030	--	153	--	8.30	--	9.5	--	11.1	--
23...	1040	--	153	--	8.30	--	9.5	--	11.0	--
23...	1100	--	--	--	--	--	--	--	--	--
DEC										
04...	1210	--	143	--	--	--	1.5	731	11.9	--
04...	1220	--	142	173	8.00	7.80	3.5	731	10.8	23
04...	1230	--	139	--	7.90	--	4.0	731	10.6	--
04...	1235	--	140	--	7.80	--	4.0	731	9.9	--
04...	1240	--	144	--	7.70	--	4.0	731	8.8	--
04...	1315	--	--	--	--	--	--	731	--	--
JAN										
09...	1115	--	161	--	7.50	--	1.0	723	10.9	--
09...	1120	--	158	184	7.50	8.00	4.0	723	9.6	24
09...	1130	--	157	--	7.60	--	4.0	723	9.0	--
09...	1135	--	161	--	7.40	--	4.5	723	6.0	--
09...	1140	--	167	--	7.20	--	5.0	723	3.9	--
09...	1145	--	173	--	7.10	--	5.0	723	1.6	--
09...	1155	--	176	194	7.10	7.60	5.0	723	1.6	26
09...	1215	--	--	--	--	--	--	731	--	--
FEB										
04...	1125	1.0	163	193	7.50	8.00	3.5	735	8.1	24
04...	1135	2.0	162	--	7.50	--	4.0	735	6.8	--
04...	1140	4.0	165	--	7.40	--	4.5	735	4.5	--
04...	1145	6.0	171	--	7.20	--	4.5	735	2.0	--
04...	1150	8.0	174	--	7.20	--	4.5	735	1.3	--
04...	1155	8.7	176	195	7.20	7.70	5.0	735	1.3	27
04...	1400	--	--	--	--	--	--	735	--	--
MAR										
04...	1100	0.0	168	--	7.30	--	0.5	732	7.8	--
04...	1105	1.0	167	199	7.40	7.90	2.5	732	6.8	26
04...	1115	2.0	167	--	7.30	--	4.0	732	4.8	--
04...	1125	4.0	172	--	7.30	--	4.5	732	2.6	--
04...	1140	6.0	175	--	7.20	--	4.5	732	1.4	--
04...	1150	8.0	176	--	7.20	--	4.5	732	1.3	--
04...	1200	8.9	178	202	7.20	7.60	4.5	732	1.1	25
04...	1410	--	--	--	--	--	--	732	--	--
25...	1000	0.0	164	--	7.20	--	0.5	719	6.5	--
25...	1005	1.0	171	199	7.20	7.60	4.0	719	3.1	26
25...	1015	2.0	172	--	7.20	--	4.0	719	2.8	--
25...	1020	4.0	172	--	7.20	--	4.0	719	2.6	--
25...	1025	6.0	174	--	7.20	--	4.5	719	2.4	--
25...	1030	8.0	176	--	7.10	--	4.5	719	--	--
25...	1040	8.9	181	203	7.10	7.70	4.5	719	--	26
25...	1400	--	--	--	--	--	--	719	--	--
25...	1400	--	--	--	--	--	--	719	--	--
APR										
27...	1000	--	164	--	8.20	--	9.5	759	11.5	--
27...	1015	--	164	181	8.20	8.20	9.5	759	11.4	23
27...	1020	--	164	--	8.20	--	9.0	759	11.5	--
27...	1030	--	164	--	8.20	--	9.0	759	11.3	--
27...	1040	--	163	--	8.20	--	8.5	759	11.1	--
27...	1055	--	163	183	7.90	8.00	8.5	759	9.8	23
27...	1100	--	--	--	--	--	--	759	--	--
27...	1130	--	--	--	6.60	--	--	759	--	--

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

[illegible]

## LEECH LAKE RIVER BASIN

465724094402601 WILLIAMS LAKE NEAR AKELEY, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	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 TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
OCT									
23...	--	--	--	0.011	--	--	--	--	--
23...	--	--	--	0.012	--	--	--	--	--
23...	<0.010	0.009	0.60	0.013	--	--	--	4.90	0.100
DEC									
04...	--	--	--	0.015	--	--	--	--	--
04...	--	--	--	--	--	24	2	--	--
04...	--	--	--	0.009	--	--	--	--	--
04...	--	--	--	0.009	--	--	--	--	--
04...	--	--	--	0.008	--	--	--	--	--
04...	<0.010	0.073	0.60	0.013	0.002	--	--	0.700	<0.100
JAN									
09...	--	--	--	0.014	--	--	--	--	--
09...	--	--	--	--	--	23	2	--	--
09...	--	--	--	0.011	--	--	--	--	--
09...	--	--	--	0.011	--	--	--	--	--
09...	--	--	--	0.012	--	--	--	--	--
09...	--	--	--	0.023	--	--	--	--	--
09...	--	--	--	--	--	230	82	--	--
09...	0.011	0.210	0.70	0.014	0.006	--	--	0.800	<0.100
FEB									
04...	--	--	--	--	--	15	2	--	--
04...	--	--	--	0.005	--	--	--	--	--
04...	--	--	--	0.004	--	--	--	--	--
04...	--	--	--	0.020	--	--	--	--	--
04...	--	--	--	0.021	--	--	--	--	--
04...	--	--	--	--	--	140	50	--	--
04...	0.021	0.250	0.70	0.015	0.010	--	--	0.900	<0.100
MAR									
04...	--	--	--	0.010	--	--	--	--	--
04...	--	--	--	--	--	41	4	--	--
04...	--	--	--	0.009	--	--	--	--	--
04...	--	--	--	0.008	--	--	--	--	--
04...	--	--	--	0.008	--	--	--	--	--
04...	--	--	--	0.008	--	--	--	--	--
04...	--	--	--	--	--	23	1	--	--
04...	0.097	0.236	1.0	0.010	0.005	--	--	1.20	<0.100
25...	--	--	--	0.007	--	--	--	--	--
25...	--	--	--	--	--	21	<1	--	--
25...	--	--	--	0.007	--	--	--	--	--
25...	--	--	--	0.007	--	--	--	--	--
25...	--	--	--	0.005	--	--	--	--	--
25...	--	--	--	0.007	--	--	--	--	--
25...	--	--	--	--	--	20	<1	--	--
25...	--	--	--	--	--	--	--	0.600	<0.100
25...	0.156	0.124	0.60	0.007	0.002	--	--	--	--
APR									
27...	--	--	--	0.009	--	--	--	--	--
27...	--	--	--	--	--	8	1	--	--
27...	--	--	--	0.009	--	--	--	--	--
27...	--	--	--	0.013	--	--	--	--	--
27...	--	--	--	0.005	--	--	--	--	--
27...	--	--	--	0.007	--	41	3	--	--
27...	0.113	0.047	0.30	0.011	0.001	--	--	8.60	0.500
27...	--	--	--	0.007	--	--	--	--	--

## LEECH LAKE RIVER BASIN

465724094402601 WILLIAMS LAKE NEAR AKELEY, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	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)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)
MAY									
11...	1100	159	--	8.80	--	12.0	759	13.5	--
11...	1105	159	180	8.80	8.60	12.0	759	12.6	25
11...	1120	158	--	8.70	--	12.0	759	12.8	--
11...	1130	157	--	8.60	--	11.5	759	11.8	--
11...	1140	156	--	8.60	--	11.0	759	11.4	--
11...	1155	158	183	8.20	8.40	10.0	759	11.4	25
11...	1200	--	--	--	--	--	759	--	--
11...	1230	--	--	--	--	--	759	--	--
25...	1100	161	--	8.60	--	17.0	767	10.7	--
25...	1105	161	177	8.60	8.60	17.0	767	10.6	24
25...	1120	160	--	8.60	--	17.0	767	10.6	--
25...	1130	160	--	8.60	--	16.0	767	10.4	--
25...	1140	158	--	8.80	--	13.0	767	12.6	--
25...	1155	160	183	8.30	8.40	11.0	767	10.6	25
25...	1200	--	--	--	--	--	767	--	--
25...	1230	--	--	--	--	--	767	--	--
25...	1330	--	--	--	--	--	767	--	--
JUN									
08...	1155	168	180	8.40	8.00	13.0	765	8.2	24
08...	1200	164	--	8.60	--	21.0	765	9.6	--
08...	1205	163	171	8.70	8.60	21.0	765	9.5	23
08...	1220	163	--	8.70	--	20.5	765	9.4	--
08...	1230	163	--	8.80	--	20.5	765	9.2	--
08...	1240	165	--	9.00	--	15.0	765	11.5	--
08...	1300	--	--	--	--	--	765	--	--
08...	1330	--	--	--	--	--	765	--	--
SEP									
01...	1300	--	--	--	--	--	765	--	--

DATE	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 LAB (MG/L AS CAO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
MAY								
11...	--	--	--	--	--	--	--	--
11...	6.8	1.3	1.0	93	1.6	0.60	0.3	--
11...	--	--	--	--	--	--	--	--
11...	--	--	--	--	--	--	--	--
11...	6.7	1.3	1.0	93	1.6	0.60	0.2	--
11...	--	--	--	--	--	--	--	0.017
11...	--	--	--	--	--	--	0.1	--
25...	6.9	1.3	0.90	91	1.5	0.50	0.2	--
25...	--	--	--	--	--	--	--	--
25...	--	--	--	--	--	--	--	--
25...	6.9	1.2	1.0	94	1.3	0.50	0.1	--
25...	--	--	--	--	--	--	--	<0.010
25...	--	--	--	--	--	--	--	--
JUN								
08...	6.8	1.2	1.1	94	1.6	0.80	0.1	--
08...	--	--	--	--	--	--	--	--
08...	6.8	1.4	1.0	89	1.6	0.60	0.4	--
08...	--	--	--	--	--	--	--	--
08...	--	--	--	--	--	--	--	--
08...	--	--	--	--	--	--	--	0.010
08...	--	--	--	--	--	--	--	0.359
SEP								
01...	--	--	--	--	--	--	--	--

## LEECH LAKE RIVER BASIN

465724094402601 WILLIAMS LAKE NEAR AKELEY, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, ORTHOPHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHOPHOS- PHORUS, TOTAL (MG/L AS P) (00671)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
MAY								
11...	--	--	0.005	--	--	--	--	--
11...	--	--	--	--	3	<1	--	--
11...	--	--	0.007	--	--	--	--	--
11...	--	--	<0.008	--	--	--	--	--
11...	--	--	<0.005	--	--	--	--	--
11...	--	--	--	--	110	1	--	--
11...	0.027	0.60	0.010	0.002	--	--	6.20	0.200
11...	--	--	--	--	--	--	--	--
25...	--	--	0.007	--	--	--	--	--
25...	--	--	--	--	15	1	--	--
25...	--	--	0.006	--	--	--	--	--
25...	--	--	0.010	--	--	--	--	--
25...	--	--	0.007	--	--	--	--	--
25...	--	--	0.024	--	13	<1	--	--
25...	0.021	0.60	0.010	0.001	--	--	--	--
25...	--	--	0.020	--	--	--	--	--
25...	--	--	--	--	--	--	5.90	0.200
JUN								
08...	--	--	0.008	--	19	8	--	--
08...	--	--	0.005	--	--	--	--	--
08...	--	--	--	--	16	4	--	--
08...	--	--	0.006	--	--	--	--	--
08...	--	--	0.007	--	--	--	--	--
08...	--	--	0.006	--	--	--	--	--
08...	0.027	0.60	0.010	<0.001	--	--	3.60	0.300
08...	0.540	--	0.008	0.003	--	--	--	--
SEP								
01...	--	--	--	--	--	--	11.0	0.500

## LEECH LAKE RIVER BASIN

05206000 LEECH LAKE AT FEDERAL DAM, MN

LOCATION.--Lat 47°12'23", long 94°18'31", in lot 2, sec.14, T.143 N., R.29 W., Cass County, Hydrologic Unit 07010102, on Leech Lake Indian Reservation, at head of Leech Lake River on Waboose Bay, 5 mi southwest of town of Federal Dam.

DRAINAGE AREA.--1,163 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1884 to current year. Monthend contents only for some periods, published in WSP 1308. Prior to October 1956, published as "Leech Lake Reservoir."

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Dec. 31, 1884, nonrecording gage 0.5 mi north of outlet to Leech Lake River at datum 98.47 ft higher. Dec. 31, 1884, to May 24, 1931, nonrecording gage 0.5 mi north of outlet to Leech Lake River and May 25, 1931, to July 10, 1973, water-stage recorder at same site and at datum 92.70 ft higher.

REMARKS.--Reservoir is formed by Leech Lake and several other natural lakes controlled by concrete and timber dam; storage began in 1884; original timber structure completed in 1884, replaced by present dam in 1902. Capacity between elevation 1,292.70 ft and 1,297.94 ft (maximum allowable range) is 688,985 acre-ft of which 352,637 acre-ft is controlled storage between elevations 1,292.70 ft and 1,295.70 ft (normal operating range). Contents shown herein are contents above elevation 1,290.00 ft. Prior to September 1978, published contents as contents above elevation 1,292.20 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents observed, 734,300 acre-ft, capacity table then in use, June 30, 1916, elevation, 1,297.88 ft; minimum, 51,380 acre-ft, capacity table then in use, Dec. 8, 24, 1976, elevation, 1,292.69 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 961,570 acre-ft, Sept. 11, elevation, 1,294.70 ft; minimum, 473,470 acre-ft, Mar. 21, elevation, 1,293.81 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 to SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,294.73	587,500	
Oct. 31 .....	1,294.67	579,910	-7,590
Nov. 30 .....	1,294.57	567,270	-12,640
Dec. 31 .....	1,294.33	536,930	-30,340
CAL YR 1985 .....			* +47,690
Jan. 31 .....	1,294.11	509,120	-27,810
Feb. 28 .....	1,293.91	484,460	-24,660
Mar. 31 .....	1,293.89	482,180	-2,280
Apr. 30 .....	1,294.89	607,730	+125,550
May 31 .....	1,295.24	651,970	+44,240
June 30 .....	1,294.97	617,840	-34,130
July 31 .....	1,294.94	614,050	-3,790
Aug. 31 .....	1,294.63	574,850	-39,200
Sept. 30 .....	1,294.84	601,410	+26,560
WTR YR 1986 .....			+13,910

\* Due to revised elevation-contents table, this value is not compatible with previous year-end value.

## LEECH LAKE RIVER BASIN

05206500 LEECH LAKE RIVER AT FEDERAL DAM, MN

LOCATION.--Lat 47°14'45", long 94°13'12", in sec.34, T.144 N., R.28 W., Cass County, Hydrologic Unit 07010102, on Leech Lake Indian Reservation, on right bank at dam on Leech Lake River at town of Federal Dam, 2 mi downstream from natural outlet of Leech Lake.

DRAINAGE AREA.--1,163 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder, headwater gage, and nonrecording tailwater gage. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U. S. Army Corps of Engineers). Prior to June 30, 1973, gages (nonrecording headwater gage prior to July 3, 1948) at same sites with datum at 1,293.23 ft, adjustment of 1912. May 27 to Nov. 30, 1929, nonrecording gage at site 600 ft downstream at different datum.

REMARKS.--Discharge computed on basis of modified weir formula, the head being obtained from readings on tailwater gage and mean gage height from recording headwater gage. Flow completely regulated by Leech Lake (station 05206000).

COOPERATION.--Computations of daily discharge were provided by U.S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--102 years, 371 ft<sup>3</sup>/s, 4.33 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 2,520 ft<sup>3</sup>/s, June 7, 1957 (result of dam failure); no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 962 ft<sup>3</sup>/s, June 12; minimum daily, 112 ft<sup>3</sup>/s, Apr. 5, 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	612	420	892	792	810	887	319	644	791	728	796	477
2	396	420	867	766	807	890	319	633	791	728	796	477
3	397	420	858	794	805	890	318	633	741	728	796	495
4	587	420	862	797	847	889	216	644	775	729	777	495
5	860	420	867	802	850	834	112	633	775	729	697	495
6	840	420	880	760	849	769	112	679	775	729	682	477
7	840	443	884	797	899	714	122	633	874	729	681	477
8	840	420	906	790	823	673	122	610	855	713	681	477
9	840	413	909	814	786	680	122	633	855	728	682	477
10	840	413	911	897	797	683	122	644	960	637	682	477
11	840	413	889	822	818	697	122	679	950	550	682	477
12	840	420	909	900	817	624	122	644	962	448	600	495
13	840	413	790	823	816	560	122	674	956	342	585	486
14	840	420	896	844	786	540	122	674	952	237	585	486
15	840	546	868	844	813	494	128	679	952	237	585	477
16	840	696	780	844	812	494	128	679	958	277	585	561
17	840	696	812	844	810	494	128	679	948	462	585	572
18	840	696	836	864	856	494	128	679	944	650	585	561
19	840	880	769	866	845	429	138	679	836	814	486	550
20	840	840	790	833	818	368	138	679	744	796	495	561
21	840	840	808	883	889	330	138	594	744	796	486	572
22	840	820	834	854	830	307	138	504	759	796	486	583
23	860	820	830	882	849	325	138	395	744	796	486	583
24	638	780	747	850	850	306	144	594	744	795	486	572
25	420	780	740	812	867	307	132	594	744	777	486	561
26	420	924	792	664	872	319	154	594	744	777	486	572
27	420	904	798	798	872	307	144	594	744	777	486	583
28	420	898	804	773	889	307	158	594	729	777	486	572
29	420	867	797	742	---	307	429	594	729	777	486	572
30	443	930	798	758	---	307	429	594	729	796	477	583
31	420	---	767	783	---	307	---	704	---	792	477	---
TOTAL	21593	18792	25890	25292	23382	16532	5164	19486	24804	20647	18371	15803
MEAN	697	626	835	816	835	533	172	629	827	666	593	527
MAX	860	930	911	900	899	890	429	704	962	814	796	583
MIN	396	413	740	664	786	306	112	395	729	237	477	477
CFSM	.60	.54	.72	.70	.72	.46	.15	.54	.71	.57	.51	.45
IN.	.69	.60	.83	.81	.75	.53	.17	.62	.79	.66	.59	.51
AC-FT	42830	37270	51350	50170	46380	32790	10240	38650	49200	40950	36440	31350
CAL YR 1985 TOTAL	248101		MEAN 680	MAX 1060	MIN 128	CFSM .59	IN 7.94	AC-FT 492100				
WTR YR 1986 TOTAL	235756		MEAN 646	MAX 962	MIN 112	CFSM .56	IN 7.54	AC-FT 467600				

## MISSISSIPPI RIVER MAIN STEM

05210500 POKEGAMA LAKE NEAR GRAND RAPIDS, MN

LOCATION.--Lat 47°10'00", long 93°33'20", in NW¼ sec.17, T.54 N., R.25 W., Itasca County, Hydrologic Unit 07010101, at narrows on U.S. Highway 169, 4 mi south of Grand Rapids and at mile 1,184 upstream from Ohio River.

DRAINAGE AREA.--3,265 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1884 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Pokegama Reservoir near Grand Rapids, October 1941 to September 1956.

REVISED RECORDS.--WSP 1914: 1897(M).

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to May 30, 1949, nonrecording gage at Pooles Arm of Pokegama Lake 5 mi northwest, and May 31, 1949, to July 12, 1973, water-stage recorder at same site and at datum 64.42 ft higher.

REMARKS.--Reservoir is formed by Pokegama Lake and several other natural lakes controlled by concrete dam; storage began in 1884; original timber dam completed in 1884, replaced by present structure in 1888-89. Capacity between elevation 1,270.42 ft and 1,276.42 ft (maximum allowable range) is 80,126 acre-ft of which 52,483 acre-ft is controlled storage between elevations 1,270.42 ft and 1,274.42 ft (normal operating range). Contents shown herein are contents above elevation 1,267.00 ft. Prior to September 1978, published contents as contents above elevation 1,268.92 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 132,160 acre-ft, May 23, 1986, elevation, 1,275.28 ft; maximum elevation, 1,277.92 ft, May 8, 1897; minimum contents observed, 4,520 acre-ft, below zero of capacity table then in use, Sept. 30, 1934, elevation, 1,268.54 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 132,160 acre-ft, May 23, elevation, 1,275.28 ft; minimum, 61,220 acre-ft, Mar. 24, elevation, 1,270.86 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,273.35	96,790	
Oct. 31 .....	1,272.85	89,340	-7,450
Nov. 30 .....	1,271.67	72,240	-17,100
Dec. 31 .....	1,271.98	76,660	+4,420
CAL YR 1985 .....			* +12,500
Jan. 31 .....	1,271.98	76,660	0
Feb. 28 .....	1,271.40	68,410	-8,250
Mar. 31 .....	1,271.33	67,480	-930
Apr. 30 .....	1,273.55	100,020	+32,540
May 31 .....	1,274.73	120,920	+20,900
June 30 .....	1,273.80	104,210	-16,710
July 31 .....	1,273.63	101,360	-2,850
Aug. 31 .....	1,273.48	98,840	-2,520
Sept. 30 .....	1,273.24	95,160	-3,680
WTR YR 1986 .....			-1,630

\* Due to revision of elevation-contents table, this value is not compatible with previous year-end value.

## MISSISSIPPI RIVER MAIN STEM

05211000 MISSISSIPPI RIVER AT GRAND RAPIDS, MN

LOCATION.--Lat 47°13'56", long 93°31'48", in SW 1/4 sec. 21, T.55 N., R.25 W., Itasca County, Hydrologic Unit 07010103, on left bank, in super-calendar room of Blandin Paper Mill in Grand Rapids, 400 ft downstream from Blandin Dam, 400 ft upstream from bridge on U.S. Highway 169, 2.5 mi upstream from Prairie River, and at mile 1,182 upstream from Ohio River.

DRAINAGE AREA.--3,370 mi<sup>2</sup>, approximately.

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

GAGE.--Water-stage recorder. Datum of gage is 1,242.03 ft above National Geodetic Vertical Datum of 1929. See WSP 1914 for history of changes prior to Jan. 17, 1951.

REMARKS.--Estimated daily discharges: Nov. 25 to Mar. 14. Records fair. Flow regulated by Winnibigoshish Lake (station 05201000), Leech Lake (station 05206000), Pokegama Lake (station 05210500) and occasionally at low flow by powerplant at Blandin Dam. Backwater from Prairie River occurs at times in most years.

AVERAGE DISCHARGE.--103 years, 1,192 ft<sup>3</sup>/s; median of yearly mean discharges, 1,070 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,500 ft<sup>3</sup>/s, Sept. 3, 1948, gage height, 15.2 ft, from floodmark, caused by dam failure at gage, from rating curve extended above 4,500 ft<sup>3</sup>/s; maximum daily, 5,250 ft<sup>3</sup>/s, Sept. 5, 8, 1905; no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,040 ft<sup>3</sup>/s, Oct. 17, 18, 19, gage height, 8.75 ft; minimum daily, 468 ft<sup>3</sup>/s, July 15; minimum gage height, 2.78 ft, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2980	2510	1700	2000	2100	1700	1150	2130	2850	2180	2080	2070
2	2910	2460	1700	2000	2100	1700	1210	2040	2820	2170	1770	2180
3	2850	2430	1700	2100	2100	1650	1120	2120	2670	2160	1800	2380
4	2860	2410	1700	2100	2100	1650	1210	2060	2640	2280	1790	2400
5	2800	2370	1700	2100	2100	1600	1580	2100	2610	2260	1780	2390
6	2780	2350	1700	2100	2100	1600	2130	2140	2340	2230	1780	2350
7	2810	2290	1700	2100	2000	1600	2500	2100	2200	2150	1820	2320
8	2890	2220	1800	2200	2000	1600	2610	2170	2080	2180	2080	2260
9	2880	2200	1800	2200	2000	1600	2690	2080	2030	2080	2260	2100
10	2880	2190	1800	2200	1950	1550	2590	1960	1820	2040	2190	2140
11	2880	2170	1800	2200	1950	1500	2400	2060	1890	1560	1990	2160
12	2920	2170	1800	2200	1950	1500	2470	2070	1910	1190	1640	2130
13	2930	2170	1800	2200	1950	1500	2460	2040	1980	1220	1820	2160
14	2950	2160	1800	2200	1950	1500	2230	2020	2090	856	2110	2110
15	2990	2090	1800	2200	1950	1480	1800	1780	2090	468	2350	2190
16	3000	2050	1800	2200	1950	1480	1640	1390	2100	1350	2440	2290
17	2990	2090	1800	2200	1950	1470	1280	1250	2030	2240	2390	2340
18	3000	2060	1800	2200	1950	1470	1200	1080	2040	2870	2390	2300
19	3010	2080	1800	2200	1950	1370	1100	1020	2170	2860	2360	2310
20	2980	2080	1800	2200	1950	1360	1050	1250	2080	2820	2130	2380
21	2970	1890	1900	2200	1900	1390	1250	1590	2070	2720	1920	2380
22	2950	1640	1900	2200	1900	1400	1460	1790	2050	2640	1970	2410
23	2920	1560	1900	2200	1850	1380	1510	2010	2030	2580	1940	2350
24	2860	1640	1900	2200	1850	1070	1450	2190	2020	2580	1940	2370
25	2800	1700	1900	2200	1800	848	1180	2350	2000	2530	2070	2410
26	2760	1700	1900	2200	1800	840	878	2380	2020	2490	2120	2480
27	2720	1700	2000	2200	1750	833	864	2330	2160	2470	2150	2410
28	2700	1700	2000	2200	1750	831	1460	2350	2230	2440	2180	2400
29	2660	1700	2000	2100	---	856	2110	2380	2190	2380	2170	2440
30	2610	1700	2000	2100	---	941	2240	2570	2250	2340	2180	2590
31	2580	---	2000	2100	---	1030	---	2800	---	2270	2130	---
TOTAL	88820	61480	56700	67000	54650	42299	50822	61600	65460	66604	63740	69200
MEAN	2865	2049	1829	2161	1952	1364	1694	1987	2182	2149	2056	2307
MAX	3010	2510	2000	2200	2100	1700	2690	2800	2850	2870	2440	2590
MIN	2580	1560	1700	2000	1750	831	864	1020	1820	468	1640	2070
CFSM	.85	.61	.54	.64	.58	.41	.50	.59	.65	.64	.61	.69
IN.	.98	.68	.63	.74	.60	.47	.56	.68	.72	.74	.70	.76
AC-FT	176200	121900	112500	132900	108400	83900	100800	122200	129800	132100	126400	137300

CAL YR 1985 TOTAL 746221 MEAN 2044 MAX 3010 MIN 665 CFSM .61 IN 8.24 AC-FT 1480000  
WTR YR 1986 TOTAL 748375 MEAN 2050 MAX 3010 MIN 468 CFSM .61 IN 8.26 AC-FT 1484000

## SWAN RIVER BASIN

05216860 SWAN RIVER NEAR CALUMET, MN

LOCATION.--Lat 47°17'20", long 93°13'54", in NW 1/4 sec.35, T.56 N., R.23 W., Itasca County, Hydrologic Unit 07010103, on left bank 1.0 mi downstream from Snowball Creek, 2.1 mi downstream from bridge on U.S. Highway 65 outlet of Swan Lake and 3.1 mi southeast of Calumet.

DRAINAGE AREA.--114 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder. Datum of gage is 1,331.19 ft above National Geodetic Vertical Datum of 1929. Prior to June 5, 1964, reference point at present site and datum.

REMARKS.--No estimated daily discharges. Records fair. Natural flow of stream affected by continually changing iron-mining activities that include diversions for iron-ore processing, storage in tailing ponds and Swan Lake, and mine pit dewatering.

AVERAGE DISCHARGE.--22 years, 66.6 ft<sup>3</sup>/s, 7.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 773 ft<sup>3</sup>/s Apr. 15, 1969, gage height, 5.83 ft; maximum gage height, 5.96 ft, Apr. 23, 1979; minimum discharge, 0.38 ft<sup>3</sup>/s, Oct. 14, 1976, gage height, 4.16 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 382 ft<sup>3</sup>/s, May 13, 14, 15, gage height, 4.97 ft; minimum, 18 ft<sup>3</sup>/s, Mar. 8, 9, gage height, 4.06 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46	52	50	32	26	22	108	317	120	91	59	38
2	50	50	50	32	27	22	166	318	110	82	54	41
3	52	49	49	33	26	22	211	306	103	70	51	43
4	81	47	50	33	26	21	235	287	104	83	49	42
5	57	47	50	32	25	22	242	269	97	85	47	40
6	57	47	49	30	25	21	241	243	89	78	45	40
7	57	47	48	30	25	19	235	240	92	77	43	37
8	69	48	48	28	24	19	228	239	91	81	43	36
9	111	49	48	28	24	20	216	235	86	82	42	37
10	128	47	47	28	24	22	203	239	93	77	41	40
11	125	44	46	27	22	21	192	288	104	80	39	47
12	129	44	44	25	23	21	174	327	90	87	39	45
13	125	44	43	25	23	21	164	370	82	93	41	45
14	118	42	41	24	22	21	166	382	82	96	44	45
15	112	42	40	24	22	21	168	351	84	96	43	44
16	107	45	39	24	22	21	171	319	83	96	42	42
17	98	47	38	24	21	21	176	303	83	91	41	52
18	92	51	37	23	22	22	184	284	80	86	38	56
19	89	52	35	22	22	21	183	265	106	88	34	63
20	85	50	35	22	24	21	193	248	107	90	32	73
21	82	49	34	26	24	21	193	233	103	83	32	79
22	79	50	34	27	24	21	181	206	102	79	35	81
23	75	50	35	26	23	22	176	166	105	78	37	81
24	71	50	35	28	22	22	173	156	106	83	37	83
25	71	49	34	29	22	22	181	148	103	87	36	91
26	65	51	35	28	24	24	173	147	103	82	35	89
27	64	50	35	27	24	25	183	142	109	84	35	82
28	62	50	34	26	22	29	226	135	107	79	34	82
29	57	48	34	25	---	36	275	128	104	76	33	84
30	58	49	33	25	---	47	303	121	100	69	33	79
31	55	---	32	25	---	67	---	122	---	63	33	---
TOTAL	2527	1440	1262	838	660	757	5920	7534	2928	2572	1247	1737
MEAN	81.5	48.0	40.7	27.0	23.6	24.4	197	243	97.6	83.0	40.2	57.9
MAX	129	52	50	33	27	67	303	382	120	96	59	91
MIN	46	42	32	22	21	19	108	121	80	63	32	36
CFSM	.72	.42	.36	.24	.21	.21	1.73	2.13	.86	.73	.35	.51
IN.	.82	.47	.41	.27	.22	.25	1.93	2.46	.96	.84	.41	.57
AC-FT	5010	2860	2500	1660	1310	1500	11740	14940	5810	5100	2470	3450
CAL YR 1985	TOTAL	27247	MEAN	74.6	MAX	413	MIN	15	CFSM	.65	IN	8.89
WTR YR 1986	TOTAL	29422	MEAN	80.6	MAX	382	MIN	19	CFSM	.71	IN	9.60
									AC-FT	54040		
									AC-FT	58360		

## SANDY RIVER BASIN

05218500 SANDY LAKE AT LIBBY, MN

LOCATION.--Lat 46°47'20", long 93°19'10", in sec.25, T.50 N., R.24 W., Aitkin County, Hydrologic Unit 07010103, on dam on Sandy River at Libby, 1.2 mi upstream from mouth, and 14 mi north of McGregor.

DRAINAGE AREA.--421 mi<sup>2</sup>.

PERIOD OF RECORD.--July to December 1893, October to December 1894, July 1895 to current year. Monthend contents only for some periods, published in WSP 1308. Published as Sandy Lake Reservoir at Libby, October 1941 to September 1956.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Sept. 23, 1949, nonrecording gage and Sept. 24, 1949, to Nov. 28, 1962, water-stage recorder at site 1 mi upstream at datum 1,207.71 ft, adjustment of 1912. Nov. 29, 1962, to June 30, 1973, water-stage recorder at present site at datum 1,207.71 ft, adjustment of 1912.

REMARKS.--Lake is formed by concrete dam which controls Sandy, Flowage, Snake, and Aitkin Lakes. Storage began in 1893; original timber crib dam completed in 1895, replaced by present structure in 1911. Capacity between elevation 1,214.31 ft and 1,221.31 ft (top of structure) is 73,037 acre-ft, of which 37,539 acre-ft is controlled storage between elevations 1,214.31 ft and 1,218.31 ft (normal operating range). Contents shown herein are contents above elevation 1,207.00 ft. Prior to September 1978, published contents as contents above elevation 1,209.03 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 167,200 acre-ft, capacity table then in use, May 19, 1950, elevation, 1,224.82 ft; minimum observed, 5,950 acre-ft, below zero of capacity table then in use, Jan. 20, 1921, elevation, 1,207.96 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 94,890 acre-ft, May 18, elevation, 1,219.48 ft; minimum, 43,880 acre-ft, Mar. 18, elevation, 1,214.25 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	1,216.34	62,190	
Oct. 31.....	1,215.73	56,570	-5,620
Nov. 30.....	1,215.49	54,420	-2,150
Dec. 31.....	1,214.80	48,430	-5,990
CAL YR 1985.....			* -1,390
Jan. 31.....	1,214.55	46,350	-2,080
Feb. 28.....	1,214.41	45,180	-1,170
Mar. 31.....	1,214.71	47,700	+2,520
Apr. 30.....	1,217.27	71,190	+23,490
May 31.....	1,217.05	69,030	-2,160
June 30.....	1,216.25	61,340	-7,690
July 31.....	1,216.34	62,190	+850
Aug. 31.....	1,216.30	61,810	-380
Sept. 30.....	1,217.27	71,190	+9,380
WTR YR 1986.....			+9,000

\* Due to revised elevation-contents table, this value is not compatible with previous year-end value.

## SANDY RIVER BASIN

05219000 SANDY RIVER AT SANDY LAKE DAM, AT LIBBY, MN

LOCATION.--Lat 46°47'20", long 93°19'10", in sec.25, T.50 N., R.24 W., Aitkin County, Hydrologic Unit 07010103, at dam at outlet of Sandy Lake, at Libby, 1.2 mi above mouth, and 14 mi north of McGregor.

DRAINAGE AREA.--421 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1893 to March 1894, July 1894, November 1894 to March 1895, August 1895 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "below Sandy Lake Reservoir" 1893-1916.

GAGE.--Water-stage recorders on headwater and tailwater. Datum of gages is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to June 30, 1973, gages (nonrecording gages prior to June 20, 1949) at same site with datum at 1,207.71 ft, adjustment of 1912.

REMARKS.--Discharge computed on basis of head over dam, using modified weir formula, head being obtained from headwater and tailwater recorder records. Flow completely regulated by Sandy Lake (station 05218500).

COOPERATION.--Computations of daily discharge were provided by U.S. Army Corps of Engineers; discharge measurements made and records reviewed by Geological Survey.

AVERAGE DISCHARGE (unadjusted).--91 years (water years 1896-1986), 224 ft<sup>3</sup>/s, 7.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 3,740 ft<sup>3</sup>/s, July 12, 1897; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 2,040 ft<sup>3</sup>/s, May 21; minimum daily, 51 ft<sup>3</sup>/s, Apr. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	488	432	165	245	98	102	51	1060	1470	370	193	1680
2	480	432	159	240	96	102	756	1060	1380	380	195	1270
3	880	432	156	240	96	102	738	1280	1010	380	198	1250
4	784	440	245	147	92	104	792	1330	588	389	208	1220
5	784	236	245	147	90	104	828	1450	636	292	103	1180
6	784	248	245	147	90	104	882	1450	244	289	106	972
7	784	248	245	147	90	104	882	1450	264	285	107	1040
8	784	248	240	145	90	106	882	1450	276	211	400	1060
9	768	252	240	144	90	110	864	1420	292	213	202	640
10	736	256	240	144	92	112	1110	1330	308	219	200	680
11	736	264	230	74	92	112	1050	1280	864	221	196	690
12	720	268	230	77	96	110	1030	1210	1040	740	193	680
13	704	268	230	77	96	108	1050	1140	1240	680	196	670
14	652	268	240	77	96	108	1100	1290	1220	700	308	680
15	672	268	245	102	96	108	1090	1380	1240	390	516	680
16	672	268	255	98	96	108	1090	1550	1220	425	498	690
17	672	268	255	98	96	110	1120	1740	1220	460	480	690
18	672	268	260	98	96	110	1200	1770	1220	455	462	1320
19	672	204	260	98	96	56	1220	1880	1200	336	195	1100
20	672	204	260	98	96	56	1250	1910	1200	308	200	1100
21	672	204	260	98	96	58	1270	2040	683	284	57	1100
22	450	198	260	96	96	61	1300	2030	714	402	59	1100
23	490	180	260	93	96	62	1320	2030	693	396	61	1100
24	490	180	260	96	98	61	1250	1960	582	268	62	1150
25	510	183	260	96	98	61	1230	1930	704	175	63	1270
26	510	186	260	96	98	52	814	1880	735	175	225	1300
27	510	192	255	96	98	66	928	1750	725	183	352	1300
28	520	189	245	98	98	70	944	1690	560	188	470	1300
29	520	183	245	104	---	72	1250	1580	576	185	465	1320
30	530	177	254	102	---	69	1100	1560	576	188	459	1320
31	424	---	245	98	---	62	---	1540	---	190	459	---
TOTAL	19742	7644	7449	3716	2658	2730	30391	48420	24680	10377	7888	31552
MEAN	637	255	240	120	94.9	88.1	1013	1562	823	335	254	1052
MAX	880	440	260	245	98	112	1320	2040	1470	740	516	1680
MIN	424	177	156	74	90	52	51	1060	244	175	57	640
CFSM	1.51	.61	.57	.29	.23	.21	2.41	3.71	1.96	.80	.60	2.50
IN.	1.74	.68	.66	.33	.23	.24	2.69	4.28	2.18	.92	.70	2.79
AC-FT	39160	15160	14780	7370	5270	5410	60280	96040	48950	20580	15650	62580
CAL YR 1985 TOTAL	136510.00			MEAN 374	MAX 1320	MIN .00	CFSM .89	IN 12.06	AC-FT 270800			
WTR YR 1986 TOTAL	197247.00			MEAN 540	MAX 2040	MIN 51	CFSM 1.28	IN 17.43	AC-FT 391200			

## MISSISSIPPI RIVER MAIN STEM

05220500 MISSISSIPPI RIVER BELOW SANDY RIVER, NEAR LIBBY, MN

LOCATION.--Lat 46°47'23", long 93°19'43", in SE¼NE¼ sec.25, T.50 N., R.24 W., Aitkin County, Hydrologic Unit 07010103, on right bank 600 ft downstream from Sandy River, 0.8 mi northwest of Libby, and at mile 1,106 upstream from Ohio River.

DRAINAGE AREA.--5,060 mi<sup>2</sup>, approximately.

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

REVISED RECORDS.--WSP 1914: 1958.

GAGE.--Water-stage recorder. Datum of gage is 1,204.06 ft above National Geodetic Vertical Datum of 1929. Prior to July 28, 1931, nonrecording gage at site 600 ft upstream at datum 3.16 ft higher.

REMARKS.--Estimated daily discharges: Nov. 13 to Mar. 31. Records good except those for period with ice effect, Nov. 13 to Mar. 31, which are fair. Flow regulated by Winnibigoshish Lake (station 05201000), Leech Lake (station 05206000), Pokegama Lake (station 05210500), and Sandy Lake (station 05218500).

AVERAGE DISCHARGE.--56 years, 2,099 ft<sup>3</sup>/s, 5.63 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,000 ft<sup>3</sup>/s, May 17, 1950, gage height, 20.02 ft; minimum, 83 ft<sup>3</sup>/s, Nov. 16, 1936, gage height, 1.44 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,170 ft<sup>3</sup>/s, May 16, 17, gage height, 14.07 ft; minimum daily, 1,900 ft<sup>3</sup>/s, Mar. 28-30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4110	4000	2550	2600	2450	2150	4310	5610	5090	3140	3100	4270
2	4330	3950	2550	2600	2450	2150	4500	5830	4940	3120	3030	4400
3	4590	3900	2550	2600	2400	2150	4590	6010	4660	3030	2860	4480
4	4620	3770	2550	2600	2400	2100	4670	6060	4480	3010	2620	4540
5	4600	3570	2550	2600	2400	2100	4750	6080	4180	3080	2480	4370
6	4580	3540	2550	2600	2400	2100	4820	6070	3800	3150	2400	4140
7	4540	3530	2550	2600	2400	2100	4970	6050	3640	3110	2460	4040
8	4590	3490	2550	2600	2350	2100	5150	6090	3460	3040	2530	3790
9	4660	3430	2550	2600	2350	2100	5380	6220	3220	2960	2480	3520
10	4670	3310	2550	2600	2350	2100	5570	6330	3190	2910	2620	3480
11	4680	3230	2600	2550	2350	2100	5640	6570	3730	3100	2730	3480
12	4750	3220	2600	2550	2350	2100	5630	6760	3780	3600	2720	3560
13	4850	3000	2600	2550	2300	2100	5550	6890	3930	3500	2590	3580
14	4870	2900	2600	2550	2300	2100	5500	6990	3930	3120	2540	3550
15	4850	2800	2600	2550	2300	2100	5510	7060	3930	2690	2720	3510
16	4820	2750	2600	2550	2300	2100	5460	7130	3900	2310	2880	3470
17	4820	2700	2600	2550	2250	2100	5300	7160	3850	2070	3020	4090
18	4810	2650	2600	2500	2250	2100	5080	7060	3900	2470	3030	4640
19	4780	2600	2600	2500	2250	2100	4910	6880	3940	2980	2910	4690
20	4750	2600	2600	2500	2250	2100	4780	6670	3800	3410	2850	4850
21	4660	2550	2600	2500	2200	2050	4630	6420	3530	3630	2720	4910
22	4490	2550	2600	2500	2200	2050	4520	6220	3670	3770	2580	4950
23	4440	2550	2600	2500	2200	2050	4520	6080	3810	3710	2460	4950
24	4400	2550	2600	2500	2200	2050	4520	5980	3710	3550	2410	4910
25	4360	2550	2600	2500	2200	2000	4420	5900	3600	3430	2420	4900
26	4320	2550	2600	2500	2150	1950	4190	5830	3520	3360	2510	4890
27	4270	2550	2600	2500	2150	1950	4150	5750	3500	3350	2660	4890
28	4210	2550	2600	2450	2150	1900	4580	5640	3400	3330	2800	4870
29	4160	2550	2600	2450	---	1900	5110	5490	3360	3290	2810	4850
30	4110	2550	2600	2450	---	1900	5360	5340	3280	3230	2810	4810
31	4050	---	2600	2450	---	3000	---	5200	---	3170	2930	---
TOTAL	140740	90440	80100	78650	64300	64950	148070	193370	114730	97620	83680	129380
MEAN	4540	3015	2584	2537	2296	2095	4936	6238	3824	3149	2699	4313
MAX	4870	4000	2600	2600	2450	3000	5640	7160	5090	3770	3100	4950
MIN	4050	2550	2550	2450	2150	1900	4150	5200	3190	2070	2400	3470
CFSM	.90	.60	.51	.50	.45	.41	.98	1.23	.76	.62	.53	.85
IN.	1.03	.66	.59	.58	.47	.48	1.09	1.42	.84	.72	.62	.95
AC-FT	279200	179400	158900	156000	127500	128800	293700	383500	227600	193600	166000	256600
CAL YR 1985	TOTAL	1222010	MEAN	3348	MAX	6250	MIN	1470	CFSM	.66	IN	8.98
WTR YR 1986	TOTAL	1286030	MEAN	3523	MAX	7160	MIN	1900	CFSM	.70	IN	9.45
									AC-FT	2424000	AC-FT	2551000

## MISSISSIPPI RIVER MAIN STEM

05227500 MISSISSIPPI RIVER AT AITKIN, MN

LOCATION.--Lat 46°32'26", long 93°42'26", in SW 1/4 sec.24, T.47 N., R.27 W., Aitkin County, Hydrologic Unit 07010104, on right bank upstream side of highway bridge at north edge of Aitkin, 1 mi downstream from Ripple River and at mile 1,055.9 upstream from Ohio River.

DRAINAGE AREA.--6,140 mi<sup>2</sup>, approximately.

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

GAGE.--Water-stage recorder. Datum of gage is 1,182.41 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Mar. 1, 1945, to Mar. 14, 1961, nonrecording gage, and Mar. 15, 1961, to Sept. 30, 1967, water-stage recorder at same site at datum 3.0 ft higher. Diversion channel: Non-recording gage. Datum of gage is 1,182.02 ft above National Geodetic Vertical Datum of 1929. Apr. 9, 1955, to Apr. 10, 1956, nonrecording gage at site 4 mi downstream at different datum. Apr. 11, 1956, to Sept. 30, 1967, non-recording gage at same site at datum 3.0 ft higher.

REMARKS.--Estimated daily discharges: Nov. 13 to Apr. 1. Records good except those for period with ice effect, Nov. 13 to Apr. 1, which are fair. Flow regulated by Winnibigoshish Lake (sta 05201000), Leech Lake (sta 05206000), Pokegama Lake (sta 05210500), and Sandy Lake (sta 05218500). Water diverted at medium and high stages into Aitkin diversion channel 6.5 mi above station, bypasses station and returns to river 15.5 mi below station. Diversion began Apr. 2, 1955. These records include flow in diversion channel.

AVERAGE DISCHARGE.--41 years, 2,971 ft<sup>3</sup>/s, 6.57 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,000 ft<sup>3</sup>/s, May 20, 1950, gage height, 22.49 ft, present datum; minimum, 151 ft<sup>3</sup>/s, Sept. 1, 1961, gage height, 0.60 ft.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 10,700 ft<sup>3</sup>/s, May 16-18; minimum daily, 2,170 ft<sup>3</sup>/s, Mar. 18-27. River gage: Maximum discharge, 5,980 ft<sup>3</sup>/s, May 17, gage height, 15.05 ft; Diversion channel: Maximum discharge, 4,980 ft<sup>3</sup>/s, May 17, gage height, 14.85 ft, from graph based on gage readings.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	4900	4800	3100	2850	2600	2350	6000	8550	6260	4030	3790	5200		
2	5030	4730	3100	2850	2600	2350	8290	8740	5930	3860	3680	6980		
3	5270	4650	3100	2850	2600	2300	8910	8900	5820	3760	3570	7180		
4	5480	4580	3100	2800	2600	2300	8800	9120	5520	3720	3450	7220		
5	5500	4450	3100	2800	2600	2300	8730	9160	5430	3660	3530	6960		
6	5470	4340	3050	2800	2550	2300	8780	9090	5150	3680	3290	6500		
7	5450	4280	3050	2800	2550	2300	8770	9060	4800	3680	3090	6050		
8	5530	4230	3050	2800	2550	2300	8760	9040	4520	3600	3070	5690		
9	5610	4200	3050	2800	2550	2250	8720	9290	4200	3500	3100	5310		
10	5680	4060	3050	2800	2550	2250	8690	9480	4040	3350	3150	5100		
11	5720	3800	3000	2800	2550	2250	8650	9610	4560	3410	3230	5010		
12	5820	3770	3000	2750	2500	2250	8520	9970	5130	3850	3250	5040		
13	6020	3550	3000	2750	2500	2250	8360	10300	5360	4260	3210	5210		
14	6140	3500	3000	2750	2500	2200	8170	10500	5490	4470	3150	5180		
15	6180	3450	3000	2750	2500	2200	8050	10600	5560	4260	3210	5050		
16	6120	3400	2950	2750	2500	2200	7960	10700	5600	3850	3410	4940		
17	6080	3350	2950	2700	2500	2180	7700	10700	5560	3410	3470	5430		
18	6030	3300	2950	2700	2450	2170	7430	10700	5430	3120	3530	6540		
19	5990	3300	2950	2700	2450	2170	7300	10600	5370	3410	3500	7140		
20	5940	3240	2950	2700	2450	2170	7130	10400	5210	3830	3420	7650		
21	5870	3200	2900	2700	2450	2170	6910	10100	5010	4100	3340	7980		
22	5740	3150	2900	2700	2400	2170	6670	9720	4770	4310	3280	8330		
23	5590	3150	2900	2700	2400	2170	6470	9380	4800	4390	3310	8480		
24	5490	3150	2900	2650	2400	2170	6320	8990	4970	4390	3210	8410		
25	5380	3150	2900	2650	2400	2170	6380	8600	4910	4230	3120	8300		
26	5300	3150	2900	2650	2350	2170	6260	8290	4750	4050	3080	8210		
27	5200	3100	2900	2650	2350	2170	6200	7810	4540	4260	3090	8100		
28	5100	3100	2850	2650	2350	2200	6960	7450	4390	4260	3190	7960		
29	5010	3100	2850	2650	---	2250	7960	7140	4270	4140	3330	7840		
30	4940	3100	2850	2600	---	2500	8310	6870	4190	4020	3340	7670		
31	4860	---	2850	2600	---	4000	---	6590	---	3910	3350	---		
TOTAL	172440	110330	92200	84700	69750	71180	232160	285450	151540	120770	102740	200660		
MEAN	5563	3678	2974	2732	2491	2296	7739	9208	5051	3896	3314	6689		
MAX	6180	4800	3100	2850	2600	4000	8910	10700	6260	4470	3790	8480		
MIN	4860	3100	2850	2600	2350	2170	6000	6590	4040	3120	3070	4940		
CFSM	.91	.60	.48	.45	.41	.37	1.26	1.50	.82	.64	.54	1.09		
IN.	1.04	.67	.56	.51	.42	.43	1.41	1.73	.92	.73	.62	1.22		
AC-FT	342000	218800	182900	168000	138300	141200	460500	566200	300600	239500	203800	398000		
CAL YR 1985	TOTAL	1513670	MEAN	4147	MAX	9370	MIN	1530	CFSM	.68	IN	9.17	AC-FT	3002000
WTR YR 1986	TOTAL	1693920	MEAN	4641	MAX	10700	MIN	2170	CFSM	.76	IN	10.26	AC-FT	3360000

## PINE RIVER BASIN

05230500 PINE RIVER RESERVOIR AT CROSS LAKE, MN

LOCATION.--Lat 46°40'09", long 94°06'44", in SW 1/4 sec. 21, T.137 N., R.27 W., Crow Wing County, Hydrologic Unit 07010105, at dam on Pine River, at outlet of Cross Lake at village of Cross Lake.

DRAINAGE AREA.--562 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1886 to current year. Monthend contents only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to May 3, 1949, nonrecording gage at same site and datum.

REMARKS.--Reservoir is formed by Trout, Whitefish, Rush, and Cross Lakes and several other natural lakes controlled by timber crib dams; storage began in 1886; dam completed in 1886. Capacity between elevations 1,226.32 ft and 1,234.82 ft (maximum allowable range) is 118,703 acre-ft of which 53,272 acre-ft is controlled storage between elevations 1,226.32 ft and 1,230.32 ft (normal operating range). Contents shown herein are contents above an elevation 1,216.00 ft. Prior to September 1978, published contents as contents above elevation 1,218.67 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents observed, 173,600 acre-ft, capacity table then in use, July 10, 1916, elevation, 1,234.56 ft; minimum observed, 1,310 acre-ft, below zero of capacity table then in use, Aug. 20, 1918, elevation, 1,217.67 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 103,920 acre-ft, May 1, elevation, 1,229.51 ft; minimum, 75,750 acre-ft, Mar. 8, elevation, 1,227.40 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,229.23	100,110	
Oct. 31 .....	1,229.09	98,220	-1,890
Nov. 30 .....	1,228.83	94,700	-3,520
Dec. 31 .....	1,228.10	84,960	-9,740
CAL YR 1985 .....			-4,020
Jan. 31 .....	1,227.52	77,320	-7,640
Feb. 28 .....	1,227.45	76,400	-920
Mar. 31 .....	1,227.92	82,580	+6,180
Apr. 30 .....	1,229.41	102,570	+19,990
May 31 .....	1,229.33	101,480	-1,090
June 30 .....	1,229.25	100,380	-1,100
July 31 .....	1,229.43	102,840	+2,460
Aug. 31 .....	1,229.30	101,070	-1,770
Sept. 30 .....	1,229.25	100,380	-690
WTR YR 1986 .....			+270

## PINE RIVER BASIN

05231000 PINE RIVER AT CROSS LAKE DAM, AT CROSS LAKE, MN

LOCATION.--Lat 46°40'09", long 94°06'44", in SW 1/4 sec. 21, T.137 N., R.27 W., Crow Wing County, Hydrologic Unit 07010105, at dam at outlet of Cross Lake at Village of Cross Lake.

DRAINAGE AREA.--562 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1886 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "below Pine River Reservoir" 1895-1916, 1929, and as "at Pine River Dam, at Cross Lake" 1941-56.

GAGE.--Water-stage recorder, headwater gage, and nonrecording tailwater gage. Datum of gages is 1,216.32 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Mar. 26, 1886, to May 31, 1929, nonrecording gages on headwater and tail water at same sites and datum. June 1 to Nov. 30, 1929, nonrecording gage in tailwater at datum 1.60 ft (0.49 m) lower. Dec. 1, 1929, to May 2, 1949, nonrecording gage on headwater and Dec. 1, 1929, to August 1949, nonrecording gage on tailwater at present sites and datum.

REMARKS.--Discharge computed principally on basis of modified weir formula, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Pine River Reservoir (station 05230500).

COOPERATION.--Computations of daily discharge were provided by U. S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--100 years, 221 ft<sup>3</sup>/s, 5.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 2,250 ft<sup>3</sup>/s, in June 1896 (does not include flow bypassing dam through crevasse); no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,550 ft<sup>3</sup>/s, May 3-19; minimum daily, 30 ft<sup>3</sup>/s, Aug. 6, 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	355	355	450	550	340	340	170	1200	550	350	200	300
2	355	355	450	550	340	340	170	1360	550	350	200	300
3	355	355	450	550	340	340	170	1550	468	350	200	300
4	355	355	500	550	340	340	335	1550	410	269	200	442
5	355	355	550	550	340	340	480	1550	410	200	108	567
6	355	355	550	550	340	340	480	1550	410	200	30	600
7	355	355	550	550	340	340	480	1550	315	200	30	600
8	355	355	550	550	340	340	638	1550	200	138	131	600
9	355	355	550	550	340	340	750	1550	200	50	300	425
10	355	355	550	550	340	340	750	1550	220	50	300	300
11	355	355	550	550	340	340	750	1550	404	50	300	350
12	355	355	550	550	340	340	750	1550	850	50	300	400
13	355	355	550	550	340	340	750	1550	633	50	300	400
14	355	355	550	550	340	340	750	1550	460	50	213	400
15	355	355	550	550	340	340	750	1550	460	135	188	400
16	355	355	550	550	340	340	750	1550	460	250	300	400
17	355	355	550	550	340	340	622	1550	460	400	300	400
18	355	355	550	467	340	340	530	1550	460	300	300	546
19	355	355	550	450	340	340	530	1550	460	250	183	650
20	355	355	550	450	340	340	530	1280	460	357	100	650
21	355	410	550	450	340	340	530	1040	405	317	100	650
22	355	450	550	450	340	255	530	819	350	317	100	650
23	355	450	550	450	340	170	530	740	350	400	194	704
24	355	450	550	450	340	170	447	661	350	317	250	750
25	355	450	550	386	340	170	488	551	350	200	250	750
26	355	450	550	340	345	170	530	550	350	200	250	750
27	355	450	550	340	340	170	623	550	480	200	313	750
28	355	450	550	340	340	170	670	550	590	200	350	750
29	355	450	550	340	---	170	839	550	590	200	350	750
30	355	450	550	340	---	170	1090	550	435	200	320	653
31	355	---	550	340	---	170	---	550	---	200	320	---
TOTAL	11005	11560	16700	14943	9525	8925	17412	37301	13090	6800	6980	16187
MEAN	355	385	539	482	340	288	580	1203	436	219	225	540
MAX	355	450	550	550	345	340	1090	1550	850	400	350	750
MIN	355	355	450	340	340	170	170	550	200	50	30	300
CFSM	.63	.69	.96	.86	.61	.51	1.03	2.14	.78	.39	.40	.96
IN.	.73	.77	1.11	.99	.63	.59	1.15	2.47	.87	.45	.46	1.07
AC-FT	21830	22930	33120	29640	18890	17700	34540	73990	25960	13490	13840	32110
CAL YR 1985 TOTAL	164861			MEAN 452	MAX 2150	MIN 30	CFSM .80	IN 10.91	AC-FT 327000			
WTR YR 1986 TOTAL	170428			MEAN 467	MAX 1550	MIN 30	CFSM .83	IN 11.28	AC-FT 338000			

## CROW WING RIVER BASIN

05245100 LONG PRAIRIE RIVER AT LONG PRAIRIE, MN

LOCATION.--Lat 45°58'30", long 94°51'56", in NE1/4 sec.20, T.129 N., R.33 W., Todd County, Hydrologic Unit 07010108, on right bank 90 ft upstream from bridge on First Avenue at Long Prairie and 400 ft downstream from Venewitz Creek.

DRAINAGE AREA.--432 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1971 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,281.74 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 9 to Mar. 29. Records good except those for period with ice effect, Nov. 9 to Mar. 29, which are fair.

AVERAGE DISCHARGE.--15 years, 167 ft<sup>3</sup>/s, 5.25 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,270 ft<sup>3</sup>/s, July 22, 1972, gage height, 9.37 ft; minimum daily, 0.84 ft<sup>3</sup>/s, Jan. 12-18, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,570 ft<sup>3</sup>/s, Apr. 1, gage height, 7.10 ft; minimum, 39 ft<sup>3</sup>/s, Nov. 20, gage height, 1.51 ft (backwater from ice).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	179	127	81	94	89	98	1500	864	380	360	325	411
2	165	128	86	94	88	98	1330	891	368	348	317	399
3	164	129	88	94	88	99	1130	852	351	336	309	396
4	163	129	91	94	88	99	992	787	343	345	301	387
5	162	124	93	94	88	100	923	717	331	344	293	388
6	162	128	94	94	87	100	844	658	319	341	288	413
7	161	129	94	94	87	94	783	611	317	327	294	447
8	160	122	94	93	87	98	730	629	311	320	290	468
9	157	93	94	93	87	102	682	770	303	316	298	478
10	152	53	94	93	87	105	637	772	332	313	319	485
11	148	56	94	93	86	107	592	797	430	319	325	473
12	177	91	94	92	86	107	549	869	486	322	334	458
13	181	94	94	91	86	108	509	867	464	323	343	444
14	187	98	94	91	86	108	531	803	455	323	378	434
15	198	84	94	90	86	109	631	759	454	351	388	445
16	204	101	94	90	85	109	638	735	440	441	393	449
17	204	101	94	90	85	110	641	693	406	515	389	496
18	197	101	94	90	85	106	666	663	377	480	374	533
19	187	90	94	90	85	116	714	634	354	521	363	549
20	181	43	94	90	85	123	702	605	338	567	360	564
21	176	77	94	90	85	126	671	577	335	568	355	627
22	168	102	94	90	85	124	666	546	354	538	383	847
23	170	96	94	90	86	123	652	518	390	500	402	955
24	166	82	94	90	87	121	633	500	394	477	410	916
25	167	73	94	90	88	121	599	479	389	444	412	996
26	166	71	94	90	90	132	627	474	409	414	416	1050
27	156	70	94	90	94	163	605	463	422	391	431	1030
28	150	71	94	90	96	218	652	449	412	367	446	958
29	142	74	94	90	---	370	806	435	391	356	446	890
30	135	76	94	90	---	1070	795	417	372	346	441	826
31	132	---	94	89	---	1090	---	399	---	334	424	---
TOTAL	5217	2813	2883	2833	2442	5754	22430	20233	11427	12247	11247	18212
MEAN	168	93.8	93.0	91.4	87.2	186	748	653	381	395	363	607
MAX	204	129	94	94	96	1090	1500	891	486	568	446	1050
MIN	132	43	81	89	85	94	509	399	303	313	288	387
CFSM	.39	.22	.22	.21	.20	.43	1.73	1.51	.88	.91	.84	1.41
IN.	.45	.24	.25	.24	.21	.50	1.93	1.74	.98	1.05	.97	1.57
AC-FT	10350	5580	5720	5620	4840	11410	44490	40130	22670	24290	22310	36120
CAL YR 1985	TOTAL	91177	MEAN 250	MAX	996	MIN 43	CFSM .58	IN 7.85	AC-FT	180800		
WTR YR 1986	TOTAL	117738	MEAN 323	MAX	1500	MIN 43	CFSM .75	IN 10.14	AC-FT	233500		

## CROW WING RIVER BASIN

05246500 GULL LAKE NEAR BRAINERD, MN

LOCATION.--Lat 46°24'40", long 94°21'26", in NF sec.20, T.134 N., R.29 W., Cass County, Hydrologic Unit 07010106, in pool of dam on Gull River, 800 ft south of outlet of Gull Lake, 0.2 mi upstream from Gull Lake Dam, and 8 mi northwest of Brainerd.

DRAINAGE AREA.--287 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1911 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Gull Lake Reservoir October 1941 to September 1956.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Aug. 10, 1949, nonrecording gage 800 ft north of present site at same datum. Aug. 11, 1949, to June 30, 1973, water-stage recorder at present site and at datum 1,188.14 ft, adjustment of 1912.

REMARKS.--Reservoir is formed by Gull Lake and several other natural lakes controlled by concrete dam completed in 1913; storage began in 1912. Capacity between elevation 1,192.75 ft and 1,194.75 ft (maximum allowable range and normal operating range) is 26,008 acre-ft. Contents shown herein are contents above elevation 1,188.00 ft. Prior to September 1978, published contents as contents above elevation 1,188.75 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 74,800 acre-ft, capacity table then in use, June 30, 1914, elevation, 1,195.05 ft; minimum observed, 22,250 acre-ft, capacity table then in use, Mar. 20, 1924, elevation, 1,190.75 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 65,590 acre-ft, Apr. 30, elevation, 1,194.35 ft; minimum, 43,790 acre-ft, Mar. 11, elevation, 1,192.66 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	1,193.93	60,100	
Oct. 31.....	1,193.80	58,420	-1,680
Nov. 30.....	1,193.76	57,890	-530
Dec. 31.....	1,193.73	57,500	-390
CAL YR 1985.....			* -130
Jan. 31.....	1,193.33	52,320	-5,180
Feb. 28.....	1,192.78	45,200	-7,120
Mar. 31.....	1,193.05	48,690	+3,490
Apr. 30.....	1,194.35	65,590	+16,900
May 31.....	1,194.04	61,540	-4,050
June 30.....	1,193.94	60,230	-1,310
July 31.....	1,193.95	60,360	+130
Aug. 31.....	1,193.89	59,590	-770
Sept. 30.....	1,194.01	61,150	+1,560
WTR YR 1986.....			+1,050

\* Due to revised elevation-contents table, this value is not compatible with previous year-end value.

## CROW WING RIVER BASIN

05247000 GULL RIVER AT GULL LAKE DAM, NEAR BRAINERD, MN

LOCATION.--Lat 46°24'40", long 94°21'12", in sec.20, T.134 N., R.29 W., Cass County, Hydrologic Unit 07010106, in headwater and tailwater of dam at outlet of Gull Lake, 8 mi northwest of Brainerd.

DRAINAGE AREA.--287 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder on headwater and nonrecording gage on tailwater. Datum of gages is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). August 1911 to May 23, 1929, and Dec. 1, 1929, to Aug 1, 1949, both gages were nonrecording gages at same site and datum in use. May 24 to Nov. 30, 1929, non-recording gage 500 ft downstream at different datum. Aug. 2, 1949, to June 30, 1973, at present sites with datum of gage at 1,188.14 ft, adjustment of 1912.

REMARKS.--Discharge computed at dam on basis of modified weir formulas, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Gull Lake (station 05246500).

COOPERATION.--Computations of daily discharge were provided by U.S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--75 years, 110 ft<sup>3</sup>/s, 5.20 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 1,120 ft<sup>3</sup>/s, May 15, 1938; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 672 ft<sup>3</sup>/s, May 16; minimum daily, 21 ft<sup>3</sup>/s, Aug.5-7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	103	181	118	121	262	242	118	600	243	56	150	172
2	103	180	118	121	262	242	120	630	243	56	52	172
3	103	180	118	120	262	242	122	623	148	56	52	280
4	103	179	122	197	262	235	124	612	149	56	51	280
5	103	118	122	197	262	166	384	612	149	56	21	280
6	103	118	122	197	262	166	384	590	149	56	21	370
7	103	118	122	197	262	166	384	569	81	56	21	365
8	103	188	122	197	257	166	384	569	81	56	160	365
9	103	118	122	197	257	166	384	590	81	56	273	365
10	103	118	124	197	257	166	384	590	81	56	273	365
11	103	118	124	197	257	166	384	590	83	56	273	365
12	105	118	124	197	257	109	161	590	299	56	149	360
13	105	118	124	197	257	109	161	590	299	56	149	375
14	105	118	124	197	257	109	196	612	375	56	53	375
15	105	118	124	197	257	109	196	612	401	265	53	385
16	62	118	124	197	257	109	196	672	401	323	53	375
17	134	118	122	195	257	109	280	590	391	319	53	375
18	134	118	120	195	257	109	280	590	391	319	53	397
19	134	118	120	195	257	105	286	590	391	319	53	398
20	134	113	120	196	257	109	289	319	387	315	53	420
21	134	111	120	195	257	109	285	319	387	311	53	443
22	182	118	121	195	250	109	387	247	387	155	53	443
23	182	118	121	191	245	109	387	247	283	153	228	422
24	182	118	120	197	242	109	289	247	291	153	347	430
25	182	118	120	270	242	109	289	287	287	153	347	492
26	182	118	121	270	242	109	289	287	103	152	347	490
27	182	118	121	270	242	109	289	287	103	152	347	462
28	182	118	121	270	242	109	292	250	103	152	338	462
29	180	118	121	270	---	110	525	250	101	152	338	462
30	179	118	121	270	---	110	600	248	101	150	172	462
31	181	---	121	270	---	114	---	245	---	150	172	---
TOTAL	4099	3846	3764	6372	7137	4306	8849	14654	6969	4477	4758	11407
MEAN	132	128	121	206	255	139	295	473	232	144	153	380
MAX	182	188	124	270	262	242	600	672	401	323	347	492
MIN	62	111	118	120	242	105	118	245	81	56	21	172
CFSM	.46	.45	.42	.72	.89	.48	1.03	1.65	.81	.50	.53	1.32
IN.	.53	.50	.49	.83	.93	.56	1.15	1.90	.90	.58	.62	1.48
AC-FT	8130	7630	7470	12640	14160	8540	17550	29070	13820	8880	9440	22630
CAL YR 1985	TOTAL	61080	MEAN 167	MAX 600	MIN 16	CFSM .58	IN 7.92	AC-FT 121200				
WTR YR 1986	TOTAL	80638	MEAN 221	MAX 672	MIN 21	CFSM .77	IN 10.45	AC-FT 159900				

## CROW WING RIVER BASIN

05247500 CROW WING RIVER NEAR PILLAGER, MN

LOCATION.--Lat 46°18'18", long 94°22'38", in SW 1/4 sec.30, T.133 N., R.29 W., Cass County, Hydrologic Unit 07010106, at Sylvan dam powerplant of Minnesota Power Co., 3.6 mi above mouth and 4.9 mi southeast of Pillager.

PERIOD OF RECORD.--October 1968 to current year. Records for August 1924 to September 1968 available in files of the Minnesota District Office.

REMARKS.--Records fair. Discharge computed on basis of powerplant records. Records for Oct. 1, 1968 to Sept. 30, 1975, were adjusted for storage change in the Sylvan dam reservoir. Flow partly regulated by powerplants and Gull Lake (station 05246500).

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

AVERAGE DISCHARGE.--18 years, 1,382 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16,600 ft<sup>3</sup>/s, Apr. 12, 13, 1969; minimum daily, 60 ft<sup>3</sup>/s, Aug. 10, 11, 13, 14, 1976.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum daily discharge since 1924, 18,300 ft<sup>3</sup>/s, Apr. 14, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 10,800 ft<sup>3</sup>/s, Apr. 4; minimum daily, 802 ft<sup>3</sup>/s, Nov. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1990	1510	1300	1080	1140	1240	10000	7310	2300	1470	1970	1860
2	1950	1770	1300	1080	1130	1240	9340	7910	2030	1470	1880	1970
3	1920	1800	1300	1140	1100	996	9270	8070	1810	1530	1710	2180
4	1930	1690	1300	1190	1060	977	10800	7870	1820	1490	1480	2740
5	1880	1600	1300	1190	1110	1050	10700	7300	1830	1800	1330	2470
6	1880	1600	1300	1190	1320	1130	10400	6410	1620	1850	1440	2310
7	1790	1610	1300	1190	1180	1080	9970	6040	1620	1710	1780	2320
8	1710	1610	1300	1190	1240	973	8380	5940	1890	1710	1870	2200
9	1830	1610	1410	1190	1240	973	6750	6310	1770	1660	1790	2140
10	1820	1340	1520	1270	1280	973	6330	6550	1780	1470	1710	2250
11	1850	960	1460	1290	1430	973	5850	6800	2540	1660	1870	2420
12	1880	1370	1440	1290	1250	923	5580	6880	2840	1910	2010	2400
13	2100	1530	1400	1250	1060	992	5370	6880	2610	2000	1580	2450
14	2220	1590	1390	1200	1020	1150	4850	6600	2530	2260	1550	2500
15	2180	1240	1390	1160	1060	1250	4810	6730	2930	2370	1820	2540
16	2180	1220	1330	1160	1060	1210	4920	6690	2760	2150	1810	2710
17	2180	1420	1300	1190	1050	1170	5060	6490	2520	2030	1620	2900
18	2180	1660	1300	1200	1100	1170	5340	6310	2460	2070	1150	3220
19	2180	1540	1300	1200	1170	1240	5530	6080	2430	2330	1180	3460
20	2100	1480	1300	1220	1100	1560	5610	5440	2300	2460	1350	3730
21	1910	802	1230	1240	925	1570	6050	5070	2440	2440	1450	4060
22	2040	948	1180	1230	899	1600	5960	4840	2460	2220	1690	4590
23	2000	1190	1210	1220	1070	1600	5800	4490	2530	2040	2040	4900
24	2000	1240	1210	1270	1090	1600	5670	4360	2420	2130	2150	4970
25	1900	1130	1200	1320	1060	1930	5140	4300	2190	2180	2000	5000
26	1870	1080	989	1280	1060	1730	5220	4130	2140	2050	1940	5030
27	1920	1150	1020	1220	1120	2210	5160	4070	2020	2200	1880	5000
28	1890	1310	1080	1070	1180	3160	5660	2810	1830	2130	1800	5020
29	1870	1300	1080	983	---	3740	6090	2240	1650	1930	1810	5000
30	1860	1300	1080	1080	---	4950	6750	2560	1530	1940	1860	4920
31	1570	---	1080	1040	---	7890	---	2310	---	2010	1860	---
TOTAL	60580	41600	39299	36823	31504	54250	202360	175790	65600	60670	53380	99260
MEAN	1954	1387	1268	1188	1125	1750	6745	5671	2187	1957	1722	3309
MAX	2220	1800	1520	1320	1430	7890	10800	8070	2930	2460	2150	5030
MIN	1570	802	989	983	899	923	4810	2240	1530	1470	1150	1860
CFSM	.59	.42	.38	.36	.34	.53	2.04	1.72	.66	.59	.52	1.00
IN.	.68	.47	.44	.42	.36	.61	2.28	1.98	.74	.68	.60	1.12
AC-FT	120200	82510	77950	73040	62490	107600	401400	348700	130100	120300	105900	196900
CAL YR 1985 TOTAL	790315			2165	MAX 5650	MIN 398	CFSM .66	IN 8.91	AC-FT 1568000			
WTR YR 1986 TOTAL	921116			2524	MAX 10800	MIN 802	CFSM .77	IN 10.38	AC-FT 1827000			

## MISSISSIPPI RIVER MAIN STEM

05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN

LOCATION.--Lat 45°51'41", long 94°21'33", in lot 2, sec.20, T.39 N., R.32 W., Morrison County, Hydrologic Unit 07010104, at plant of Minnesota Power Co., 4 mi northwest of Royalton, 4.5 mi downstream from Swan River, and at mile 956 upstream from Ohio River.

DRAINAGE AREA.--11,600 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

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

REMARKS.--Estimated daily discharges: Nov. 21 to Dec. 7. Records good except those for period Nov. 21 to Dec. 7, which are fair. Discharge computed using average tailwater readings furnished by powerplant. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see stations 05201000, 05206000, 05210500, 05218500, 05230500, 05246500).

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

AVERAGE DISCHARGE.--62 years, 4,638 ft<sup>3</sup>/s, 5.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 37,700 ft<sup>3</sup>/s, Apr. 16, 1965; minimum daily, 254 ft<sup>3</sup>/s, Nov. 25, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 23,500 ft<sup>3</sup>/s, Apr. 5; minimum daily, 2,760 ft<sup>3</sup>/s, Feb. 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8190	7220	4600	4710	3570	4040	20300	22500	11700	7460	7460	7220
2	8440	7460	4400	4500	3410	3980	22100	22100	11400	7220	6520	8440
3	8440	7700	4500	4230	3830	3980	22800	18700	10400	6980	6750	11400
4	8440	6980	5000	4720	3700	3950	23400	18300	9850	7220	6520	11700
5	8190	6980	4700	4490	3550	4080	23500	18300	9560	6980	6300	12300
6	8190	6980	5300	4490	3910	4120	22200	19400	9260	6980	7220	11700
7	8190	6980	5200	4300	3610	4220	21600	19200	8980	6750	6750	11400
8	8440	6980	4870	4320	3430	3980	21500	19900	8700	6750	6520	10800
9	8440	6520	5510	4430	3540	4200	20300	19800	7940	6520	6300	9850
10	8440	6520	6220	4450	3800	4120	19400	19200	8700	6300	6520	10200
11	8440	6090	6200	4610	3630	3920	19400	19600	10800	6300	6300	9560
12	8700	5480	6110	4460	3750	4040	18800	20100	11400	6520	6750	9260
13	8980	5680	5750	4480	3500	3760	18000	20300	12000	6750	7220	9560
14	9260	5880	5490	4370	2760	3660	17600	20600	12300	7700	6090	9850
15	9850	5880	5370	4300	2830	3960	17200	19900	11700	8440	6090	9850
16	9850	5680	5110	4300	2970	4220	17200	19300	11700	8440	6980	9850
17	9850	5680	5060	4280	3200	4220	17600	19000	11400	7700	6090	10800
18	10200	6090	6090	4430	3610	4160	17600	19500	11400	6980	6750	11700
19	10200	6520	5870	4430	3300	4440	17600	19300	11100	7220	6090	13300
20	9850	5680	5860	4290	3790	4640	17600	18800	10800	7220	6300	14400
21	9850	4280	5420	4160	4050	4510	18000	19300	10200	7940	6090	15800
22	9260	4100	5030	4040	3830	4740	16900	18800	10800	7940	6520	17200
23	9560	4000	5170	3960	3780	4230	16900	18000	9850	8190	7220	18000
24	9560	3300	5020	4360	4090	4580	16500	17200	9560	8190	7460	18000
25	8980	3700	4830	4320	4520	4850	15400	16500	9560	8440	7220	18800
26	8700	3400	4750	4410	4100	5450	15400	15800	9260	7700	6980	18000
27	8190	3800	4720	4030	4050	6330	16100	15000	8980	7940	6750	18000
28	8440	3700	4890	4270	4080	5700	18000	14700	8190	7940	6300	17600
29	8190	3600	4300	3870	---	8100	19400	12000	8190	7940	6300	17200
30	7940	4100	4960	3480	---	10600	19900	13000	7700	7460	6750	16500
31	7940	---	5120	3660	---	15000	---	12300	---	7220	6520	---
TOTAL	275190	166960	161420	133150	102190	155780	568200	566400	303380	229330	205630	388240
MEAN	8877	5565	5207	4295	3650	5025	18940	18270	10110	7398	6633	12940
MAX	10200	7700	6220	4720	4520	15000	23500	22500	12300	8440	7460	18800
MIN	7940	3300	4300	3480	2760	3660	15400	12000	7700	6300	6090	7220
CFSM	.77	.48	.45	.37	.32	.43	1.63	1.58	.87	.64	.57	1.12
IN.	.88	.54	.52	.43	.33	.50	1.82	1.82	.97	.74	.66	1.25
AC-FT	545800	331200	320200	264100	202700	309000	1127000	1123000	601800	454900	407900	770100
CAL YR 1985	TOTAL	2889350	MEAN	7916	MAX	18400	MIN	2310	CFSM	.68	IN	9.27
WTR YR 1986	TOTAL	3255870	MEAN	8920	MAX	23500	MIN	2760	CFSM	.77	IN	10.44
										AC-FT	5731000	
										AC-FT	6458000	

## MISSISSIPPI RIVER MAIN STEM

05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1963-66, 1975 to current year.

REMARKS.--Letter K indicates non-ideal colony count. Letter E indicates estimated value.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, MEAN DAILY (CFS) (00060)	STREAM- FLOW, INSTAN- TANEOUS (CFS) (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, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)
OCT										
16...	1145	--	10200	255	258	8.0	7.7	7.5	7.0	4.5
DEC										
19...	0945	6600	--	235	322	7.5	7.5	-23.0	0.5	2.3
FEB										
26...	1025	5280	--	310	356	7.6	7.7	1.0	0.0	2.5
APR										
30...	1200	--	20000	215	235	8.1	8.3	15.0	12.0	3.5
JUN										
23...	1050	--	9190	250	245	8.2	8.2	21.5	21.5	12
AUG										
11...	1135	--	6160	250	279	8.1	8.3	23.5	22.5	12

DATE	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)	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)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
OCT										
16...	763	13.4	K13	36	35	12	4.2	1.5	158	0
DEC										
19...	765	10.8	K36	K15	42	14	5.1	1.8	188	0
FEB										
26...	746	8.9	100	E38	44	15	6.0	1.8	205	0
APR										
30...	750	10.8	27	40	31	9.1	3.5	1.6	129	0
JUN										
23...	757	--	K29	350	32	10	3.8	1.1	138	0
AUG										
11...	744	7.5	55	200	38	12	4.7	1.5	176	0

DATE	ALKA- LITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA- LITY, FIXED ENDPT, FIELD (MG/L AS CAC03) (00410)	ALKA- LITY LAB (MG/L AS CAC03) (90410)	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)	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)
OCT									
16...	130	129	129	6.3	3.6	<0.1	7.4	175	<0.01
DEC									
19...	154	152	152	11	3.6	0.1	10	186	<0.01
FEB									
26...	168	168	172	9.2	3.8	0.1	11	201	<0.01
APR									
30...	106	106	112	10	3.7	0.1	5.8	153	<0.01
JUN									
23...	113	114	120	9.8	3.4	0.1	7.3	152	<0.01
AUG									
11...	144	143	140	9.5	3.7	0.1	12	180	<0.01

## MISSISSIPPI RIVER MAIN STEM

05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	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)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 16...	0.10	<0.01	<0.01	0.7	0.04	0.03	0.02	20	96
DEC 19...	0.24	0.13	0.12	0.8	0.03	0.02	0.01	4	--
FEB 26...	0.34	0.15	0.14	0.8	0.02	0.01	<0.01	1	100
APR 30...	<0.10	0.03	0.03	1.2	0.04	0.02	<0.01	9	100
JUN 23...	0.14	0.04	0.04	0.9	0.07	0.03	0.02	19	99
AUG 11...	0.12	0.04	0.04	0.8	0.05	0.02	0.02	13	96

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	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)	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)
OCT 16...	1145	<10	<1	36	0.8	<1	<1	<3	2	190	3
FEB 26...	1025	<10	<1	49	<0.5	<1	<1	<3	1	140	<1
AUG 11...	1135	20	1	42	<0.5	<1	<1	<3	1	120	<5

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)
OCT 16...	7	19	<0.1	<10	3	<1	<1	67	<6	<3
FEB 26...	7	46	<0.1	<10	1	<1	<1	91	<6	12
AUG 11...	<4	11	0.5	<10	2	<1	<1	75	<6	8

## ELK RIVER BASIN

05275000 ELK RIVER NEAR BIG LAKE, MN

LOCATION.--Lat 45°20'02", long 93°40'00", in NE¼SW¼ sec.23, T.33 N., R.27 W., Sherburne County, Hydrologic Unit 07010203, on right bank at upstream side of highway bridge, 4 mi east of Big Lake and 4 mi downstream from St. Francis River.

DRAINAGE AREA.--615 mi<sup>2</sup>.

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

REVISED RECORDS.--WSP 895: 1939. WSP 1308: 1912(M), 1915-17(M).

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

REMARKS.--Estimated daily discharges: Nov. 23 to Mar. 22. Records good except those for periods with ice effect, Nov. 23 to Mar. 22, which are fair.

AVERAGE DISCHARGE.--58 years (water years 1912-17, 1935-86), 275 ft<sup>3</sup>/s, 6.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,360 ft<sup>3</sup>/s, Apr. 16, 1965, gage height, 10.86 ft; minimum, 3.6 ft<sup>3</sup>/s, July 31, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,990 ft<sup>3</sup>/s, May 14, gage height, 7.38 ft; minimum daily discharge, 213 ft<sup>3</sup>/s, Mar. 9; minimum gage height, 1.29 ft, Nov. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	900	483	255	230	223	223	1640	1740	497	443	916	540
2	870	471	250	229	223	220	2000	2040	476	467	831	522
3	836	459	245	229	222	218	2280	2180	452	444	740	541
4	817	431	240	229	222	217	2570	2220	428	410	660	545
5	806	396	235	229	222	216	2700	2070	413	380	583	520
6	783	380	235	229	222	215	2540	1740	404	388	568	486
7	745	371	235	228	222	214	2240	1490	398	379	698	474
8	729	357	235	228	221	214	2030	1360	389	359	586	466
9	726	345	234	228	221	213	1850	1310	379	359	549	448
10	710	335	234	228	221	218	1680	1220	367	351	654	538
11	685	322	234	227	221	218	1560	1600	371	360	785	515
12	724	321	234	227	220	220	1450	2430	358	388	933	457
13	738	320	234	227	220	222	1280	2840	349	407	981	421
14	737	318	233	227	220	230	1190	2980	346	403	988	397
15	727	314	233	227	220	240	1190	2920	346	397	974	456
16	741	314	233	226	220	242	1150	2680	333	403	960	486
17	768	314	233	226	220	255	1080	2410	318	392	942	612
18	766	316	232	226	220	290	1120	2140	314	373	892	720
19	751	332	232	226	220	305	1220	1880	315	468	807	833
20	732	300	232	225	220	300	1240	1650	311	474	739	920
21	704	280	232	225	220	295	1220	1460	330	474	704	1150
22	675	316	231	225	220	315	1190	1270	417	512	642	1400
23	654	310	231	225	222	376	1170	1070	465	622	603	1660
24	631	300	231	225	228	428	1160	917	469	734	568	2000
25	608	290	231	224	230	495	1150	814	481	795	569	2350
26	590	280	231	224	230	589	1100	758	526	845	608	2580
27	569	275	230	224	230	657	1250	693	573	889	672	2560
28	545	270	230	224	228	779	1340	639	551	946	691	2450
29	525	265	230	223	---	913	1370	599	496	1000	652	2300
30	507	260	230	223	---	1080	1430	572	463	1020	598	2140
31	494	---	230	223	---	1280	---	536	---	988	563	---
TOTAL	21793	10045	7265	7016	6228	11897	46390	50228	12335	16870	22656	31497
MEAN	703	335	234	226	222	384	1546	1620	411	544	731	1050
MAX	900	483	255	230	230	1280	2700	2980	573	1020	988	2580
MIN	494	260	230	223	220	213	1080	536	311	351	549	397
CFSM	1.14	.55	.38	.37	.36	.62	2.51	2.63	.67	.89	1.19	1.71
IN.	1.32	.61	.44	.42	.38	.72	2.81	3.04	.75	1.02	1.37	1.91
AC-FT	43230	19920	14410	13920	12350	23600	92010	99630	24470	33460	44940	62470

CAL YR 1985 TOTAL 173689 MEAN 476 MAX 2510 MIN 152 CFSM .77 IN 10.51 AC-FT 344500  
WTR YR 1986 TOTAL 244220 MEAN 669 MAX 2980 MIN 213 CFSM 1.09 IN 14.77 AC-FT 484400

LOCATION.--Lat 45°15'45", long 94°48'10", in NE¼ sec.27, T.121 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, on right bank 75 ft upstream from highway bridge, 1.5 mi downstream from Lake Calhoun, 3 mi downstream from Green Lake, and 6.8 mi northeast of Spicer.

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

GAGE.--Water-stage recorder and concrete and steel sharp-crested V-notch weir. Datum of gage is 1,147.93 ft above National Geodetic Vertical Datum of 1929 (Kandiyohi County Highway Department bench mark). Prior to July 20, 1950, nonrecording gage at bridge 75 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 18, 19, 22-24, 27, Dec. 1-4, 7-14, 16-31, Jan. 4-8, 12-14, Jan. 21 to Feb. 2, 8-12, 14, 16, 20, 21, 24, 28, Mar. 6-8, and 18-20. Records good except those for periods with ice effect, Nov. 18, 19, 22-24, 27, Dec. 1-4, 7-14, 16-31, Jan. 4-8, 12-14, Jan. 21 to Feb. 2, 8-12, 14, 16, 20, 21, 24, 28, Mar. 6-8, and 18-20, which are fair.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 571 ft<sup>3</sup>/s, July 28, 1986, gage height, 6.47 ft; maximum gage height, 6.67 ft, June 25, 1957; no flow Mar. 15-24, 1949, Feb. 26 to Mar. 26, 1960, Dec. 8, 1963, Feb. 10-21, 1965, Feb. 19-28, 1968, Jan. 11-30, 1975.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 571 ft<sup>3</sup>/s, July 28, gage height, 6.47 ft; minimum discharge, 56 ft<sup>3</sup>/s, Feb. 19, gage height, 2.95 ft.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	174	142	86	77	76	71	194	436	383	303	534	317
2	172	141	86	77	74	71	190	417	362	317	517	307
3	168	138	86	77	75	72	201	397	340	318	497	308
4	177	136	86	77	76	73	215	382	325	314	480	306
5	178	133	86	76	76	74	253	369	307	319	463	298
6	173	136	87	76	76	75	273	367	290	335	451	287
7	169	135	87	75	76	75	277	366	281	338	474	276
8	170	133	87	75	76	73	276	401	268	340	486	267
9	170	129	87	74	75	72	273	429	250	339	492	262
10	168	122	87	75	74	73	274	430	244	335	549	267
11	167	114	87	76	72	74	283	421	255	355	553	263
12	176	123	86	76	70	73	287	412	247	396	526	256
13	178	123	85	77	69	76	301	421	237	444	498	249
14	176	122	84	77	69	76	332	423	229	438	539	242
15	175	121	83	77	69	76	377	468	219	418	551	251
16	171	124	84	78	69	77	383	505	211	403	525	254
17	166	123	84	78	68	78	372	497	204	387	491	314
18	162	120	84	78	68	81	369	483	263	378	461	340
19	158	116	84	79	68	86	391	468	272	447	438	352
20	155	113	84	80	75	86	400	459	266	471	441	366
21	152	109	84	81	73	87	391	454	297	459	460	380
22	151	107	84	82	70	96	372	452	331	435	455	396
23	153	104	83	82	69	112	362	450	335	415	446	399
24	155	102	83	82	69	128	368	459	317	479	430	396
25	154	101	82	82	69	146	365	461	298	515	422	400
26	154	99	81	81	69	165	358	460	290	496	412	411
27	152	95	80	80	70	159	377	453	289	543	395	414
28	150	92	80	80	70	169	447	439	286	569	377	414
29	149	89	79	79	---	181	471	425	282	559	361	413
30	147	86	78	78	---	192	455	412	296	549	344	414
31	144	---	76	77	---	193	---	398	---	539	330	---
TOTAL	5064	3528	2600	2419	2010	3140	9887	13414	8474	12953	14398	9819
MEAN	163	118	83.9	78.0	71.8	101	330	433	282	418	464	327
MAX	178	142	87	82	76	193	471	505	383	569	553	414
MIN	144	86	76	74	68	71	190	366	204	303	330	242
CFSM	.91	.66	.47	.44	.40	.56	1.84	2.42	1.58	2.34	2.59	1.83
IN.	1.05	.73	.54	.50	.42	.65	2.05	2.79	1.76	2.69	2.99	2.04
AC-FT	10040	7000	5160	4800	3990	6230	19610	26610	16810	25690	28560	19480
CAL YR 1985	TOTAL	48123	MEAN 132	MAX 318	MIN 53	CFSM	.74	IN 10.00	AC-FT	95450		
WTR YR 1986	TOTAL	87706	MEAN 240	MAX 569	MIN 68	CFSM	1.34	IN 18.23	AC-FT	174000		

## CROW RIVER BASIN

05280000 CROW RIVER AT ROCKFORD, MN

LOCATION.--Lat 45°05'12", long 93°44'02", in sec.29, T.119 N., R.24 W., Hennepin County, Hydrologic Unit 07010204, on right bank at Rockford, 150 ft downstream from bridge on State Highway 55 and 1 mi downstream from confluence of North and South Forks.

DRAINAGE AREA.--2,520 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--April to July 1906 (published as "near Dayton"), June 1909 to September 1917, April to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1115: 1932. WSP 1508: 1933. WDR MN-77-2: 1972 (M)(m).

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

REMARKS.--Estimated daily discharges: Nov. 25 to Mar. 24 and May 14-27. Records good except those for period with ice effect, Nov. 25 to Mar. 24, and period of no gage-height record, May 14-27, which are fair.

AVERAGE DISCHARGE.--61 years (water years 1910-17, 1931, 1935-86), 739 ft<sup>3</sup>/s, 3.98 in/yr; median of yearly mean discharges, 535 ft<sup>3</sup>/s, 2.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,400 ft<sup>3</sup>/s, Apr. 16, 1965, gage height, 19.27 ft, from floodmark; minimum, 1.8 ft<sup>3</sup>/s, Nov. 15, 1936, gage height, 1.05 ft, caused by ice jam upstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,800 ft<sup>3</sup>/s, May 5, gage height, 12.44 ft; minimum daily discharge, 390 ft<sup>3</sup>/s, Feb. 27, 28, minimum gage height, 3.33 ft Mar. 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3110	2510	890	610	480	393	7460	7520	3340	4360	2780	2150
2	3140	2410	870	600	480	396	7280	7850	3180	4170	2860	2090
3	3140	2350	860	595	480	399	7080	8320	3010	3940	2920	2100
4	3360	2220	840	590	480	400	6900	8720	2860	3700	2960	2110
5	3550	2130	820	580	475	400	6790	8750	2740	3540	2960	2100
6	3750	2070	810	575	475	401	6700	8360	2610	3500	2910	2060
7	3980	2010	800	570	475	402	6640	7800	2480	3370	2860	1980
8	4230	1960	790	565	470	403	6640	7290	2360	3270	2800	1910
9	4380	1900	780	560	460	404	6650	6770	2250	3180	2700	1850
10	4480	1840	770	555	455	405	6730	6330	2130	3100	2660	1810
11	4550	1740	760	550	450	406	6770	6110	2070	3050	2620	1760
12	4620	1690	760	545	445	407	6670	5900	1990	3030	2490	1720
13	4630	1650	750	540	440	408	6310	5960	1920	3010	2380	1680
14	4580	1600	750	540	435	418	6280	6000	1840	3000	2300	1670
15	4510	1560	740	540	425	450	6300	6300	1770	3000	2240	1700
16	4460	1540	730	540	420	490	6360	6450	1710	3000	2200	1700
17	4370	1510	730	540	415	505	6440	6420	1670	3010	2200	1800
18	4280	1500	720	540	410	620	6520	6300	1730	3060	2180	1870
19	4190	1500	720	540	410	900	6600	6000	1840	3150	2160	2040
20	4100	1370	710	540	400	1240	6730	5600	1980	3210	2180	2250
21	4010	1180	710	537	400	1500	6840	5300	2090	3270	2230	2590
22	3900	1120	705	537	400	1880	6830	5000	2360	3320	2290	3000
23	3810	1030	704	537	400	2350	6620	4700	2660	3300	2310	3500
24	3640	922	695	530	395	2680	6410	4500	2960	3210	2320	3980
25	3480	1050	690	525	391	3990	6240	4250	3290	3050	2350	4530
26	3330	1080	670	515	391	5350	6060	4100	3600	2900	2350	4980
27	3210	1030	660	510	390	6880	6140	4000	3870	2800	2340	5350
28	3030	1000	650	500	390	7500	6280	4060	4160	2730	2320	5570
29	2900	960	635	490	---	7540	6600	3870	4360	2680	2290	5700
30	2750	920	630	480	---	7510	7110	3700	4480	2670	2250	5700
31	2620	---	620	480	---	7510	---	3520	---	2700	2200	---
TOTAL	118090	47352	22969	16856	12137	64537	198980	185750	79310	99280	76610	83250
MEAN	3809	1578	741	544	433	2082	6633	5992	2644	3203	2471	2775
MAX	4630	2510	890	610	480	7540	7460	8750	4480	4360	2960	5700
MIN	2620	920	620	480	390	393	6060	3520	1670	2670	2160	1670
CFSM	1.51	.63	.29	.22	.17	.83	2.63	2.38	1.05	1.27	.98	1.10
IN.	1.74	.70	.34	.25	.18	.95	2.94	2.74	1.17	1.47	1.13	1.23
AC-FT	234200	93920	45560	33430	24070	128000	394700	368400	157300	196900	152000	165100

CAL YR 1985 TOTAL 719390 MEAN 1971 MAX 6790 MIN 226 CFSM .78 IN 10.62 AC-FT 1427000  
WTR YR 1986 TOTAL 1005121 MEAN 2754 MAX 8750 MIN 390 CFSM 1.09 IN 14.84 AC-FT 1994000

## RUM RIVER BASIN

05284000 MILLE LACS LAKE AT GARRISON, MN

LOCATION.--Lat 46°18'05", long 93°49'05", in SW¼SE¼ sec.12, T.44 N., R.28 W., Crow Wing County, Hydrologic Unit 07010207, at pumphouse of Minnesota Division of Game and Fish, 0.2 mi southwest of Borden Lake outlet and 0.8 mi northeast of Garrison.

PERIOD OF RECORD.--June 1931 to current year. Monthend records for the period October 1939 to September 1953 published in WSP 1278 (fragmentary 1940-41). Prior to October 1939, published as "at Wealthwood."

GAGE.--Water-stage recorder. Datum of gage is 1,240.40 ft above National Geodetic Vertical Datum of 1929. Gage readings have been reduced to elevations NGVD. Prior to Oct. 1, 1941, nonrecording gage at Wealthwood, 8.3 mi northeast of present site, at various datums; gage readings have been reduced to elevations, adjustment of 1912. October 1, 1941, to Sept. 30, 1958, water-stage recorder at datum 1,240.50 ft, adjustment of 1912. To convert these records to National Geodetic Vertical Datum of 1929, subtract 0.10 ft.

REMARKS.--Water level affected by fixed-crest spillway constructed in 1953 at outlet of Ogechie Lake, 2.7 mi downstream from outlet of Mille Lacs Lake, with crest at elevation 1,250.50 ft. Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation, 1,253.87 ft, Aug. 14, 1972, affected by wind action and seiche action; maximum daily, 1,253.43 ft, Aug. 22, 1972; minimum observed, 1,245.74 ft, Oct. 16-19, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,253.49 ft, June 21, affected by wind action and seiche action; maximum daily, 1,253.10 ft, Sept. 25; minimum, 1,251.49 ft, Nov. 20, affected by wind action and seiche action; minimum daily, 1,251.56 ft, Nov. 20.

## MONTHEND ELEVATION, IN FEET NGVD, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Oct. 31 .....	1,251.80	Feb. 28 .....	1,251.70	June 30 .....	1,252.84
Nov. 30 .....	1,251.66	Mar. 31 .....	1,251.80	July 31 .....	1,252.94
Dec. 31 .....	1,251.68	Apr. 30 .....	1,252.35	Aug. 31 .....	1,252.85
Jan. 31 .....	1,251.70	May 31 .....	1,252.70	Sept. 30 .....	1,253.03

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

## RUM RIVER BASIN

05286000 RUM RIVER NEAR ST. FRANCIS, MN

LOCATION--Lat 45°19'40", long 93°22'20", in SE¼ sec.19, T.33 N., R.24 W., Anoka County, Hydrologic Unit 07010207, on left bank at upstream side of highway bridge, 4 mi south of St. Francis and 15.8 mi upstream from mouth.

DRAINAGE AREA.--1,360 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.-- May to November 1929, March 1930 to September 1931, April to November 1932, March 1933 to current year.

REVISED RECORDS.--WSP 1308: 1930(M), 1932(M).

GAGE.--Water-stage recorder. Datum of gage is 860.74 ft above National Geodetic Vertical Datum of 1929 (levels by Anoka County Highway Department). Prior to Nov. 9, 1933, nonrecording gage at site 50 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 24 to Mar. 14, 16-22, and 24. Records good except those for periods with ice effect, Nov. 24 to Mar. 14, 16-22, and 24 (includes periods of no gage-height record, Dec. 3, and Feb. 17 to Mar. 5), which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

AVERAGE DISCHARGE.--54 years (water years 1931, 1934-86), 638 ft<sup>3</sup>/s, 6.37 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,100 ft<sup>3</sup>/s, Apr. 20, 1965, Apr. 13, 1969; maximum gage height, 11.63 ft, Apr. 13, 1969; minimum discharge, 29 ft<sup>3</sup>/s, Aug. 18, 1934, gage height, 1.91 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,000 ft<sup>3</sup>/s, Apr. 6, 7, gage height, 9.24 ft; minimum daily discharge, 350 ft<sup>3</sup>/s, Jan. 27 to Feb. 15; minimum gage height, 2.98 ft, Nov. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1710	863	560	388	350	390	2880	3140	1410	1320	1280	1700		
2	1650	848	550	386	350	395	3140	3570	1380	1220	1260	1480		
3	1570	830	540	383	350	405	3830	4420	1350	1110	1210	1370		
4	1540	812	530	380	350	410	5190	5060	1300	1080	1150	1340		
5	1520	795	520	376	350	415	6430	5090	1220	1090	1140	1290		
6	1520	786	510	373	350	421	6930	4680	1130	1110	1100	1260		
7	1480	783	500	371	350	435	6870	4150	1080	1100	1160	1290		
8	1440	775	495	370	350	445	6470	3630	1070	1100	1310	1340		
9	1370	762	490	368	350	450	5960	3210	1040	1100	1400	1370		
10	1310	743	485	366	350	460	5410	2980	1040	1100	1520	1350		
11	1280	707	480	365	350	475	4860	2940	1030	1100	1680	1290		
12	1350	662	475	364	350	485	4340	3250	1010	1090	1880	1220		
13	1410	652	470	363	350	500	3850	4540	1020	1070	2030	1190		
14	1460	662	460	362	350	520	3470	6080	1110	1060	2150	1180		
15	1480	679	455	360	350	537	3140	6770	1260	1050	2190	1250		
16	1530	689	450	360	351	550	2880	6890	1420	1060	2130	1320		
17	1620	664	445	360	352	575	2640	6710	1520	1040	1980	1460		
18	1700	657	440	359	353	600	2470	6280	1530	1040	1780	1640		
19	1730	673	435	358	354	625	2450	5620	1440	1100	1630	1820		
20	1680	684	430	357	355	650	2510	4880	1280	1160	1580	1970		
21	1550	532	425	356	358	680	2540	4220	1220	1210	1540	2250		
22	1410	573	422	355	360	710	2480	3650	1370	1300	1490	2710		
23	1310	677	420	354	365	742	2380	3180	1450	1410	1480	3260		
24	1220	650	415	353	368	810	2360	2770	1490	1510	1470	3890		
25	1150	630	410	352	370	854	2380	2410	1520	1570	1480	4450		
26	1080	620	408	351	375	959	2330	2170	1570	1530	1550	4960		
27	1030	600	405	350	380	1060	2340	1960	1620	1480	1670	5400		
28	986	590	402	350	385	1360	2530	1820	1630	1390	1830	5530		
29	953	580	400	350	---	1760	2820	1740	1550	1330	1950	5330		
30	919	570	395	350	---	2210	3000	1590	1440	1290	1980	4960		
31	891	---	390	350	---	2620	---	1470	---	1280	1890	---		
TOTAL	42849	20748	14212	11240	9976	23508	110880	120870	39500	37400	49890	70870		
MEAN	1382	692	458	363	356	758	3696	3899	1317	1206	1609	2362		
MAX	1730	863	560	388	385	2620	6930	6890	1630	1570	2190	5530		
MIN	891	532	390	350	350	390	2330	1470	1010	1040	1100	1180		
CFSM	1.02	.51	.34	.27	.26	.56	2.72	2.87	.97	.89	1.18	1.74		
IN.	1.17	.57	.39	.31	.27	.64	3.03	3.31	1.08	1.02	1.36	1.94		
AC-FT	84990	41150	28190	22290	19790	46630	219900	239700	78350	74180	98960	140600		
CAL YR 1985	TOTAL	385866	MEAN	1057	MAX	6380	MIN	304	CFSM	.78	IN	10.55	AC-FT	765400
WTR YR 1986	TOTAL	551943	MEAN	1512	MAX	6930	MIN	350	CFSM	1.11	IN	15.10	AC-FT	1095000

## ELM CREEK BASIN

05287890 ELM CREEK NEAR CHAMPLIN, MN

LOCATION.--Lat 45°09'48", long 93°26'11", in NE¼NW¼ sec.35, T.120 N., R.22 W., Hennepin County, Hydrologic Unit 07010206, on left bank, 33 ft downstream from bridge on Elm Creek Road, 2.5 mi southwest of Champlin.

DRAINAGE AREA.--84.9 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1978 to current year.

GAGE.--Water-stage recorder. Datum of gage is 850.71 ft above National Geodetic Vertical Datum of 1929. Prior to March 15, 1979, nonrecording gage at present site and datum.

REMARKS.-- Estimated daily discharges; Nov. 23, 24, 26, 27, 30, Dec. 1-8, Dec. 10 to Jan. 9, 23, Jan. 26 to Feb. 1, 9-17, 24, 28, Mar. 7, 20, 21. Records good except those for periods with ice effect, Nov. 23, 24, 26, 27, 30, Dec. 1-8, Dec. 10 to Jan. 9, 23, Jan. 26 to Feb. 1, 9-17, 24, 28, Mar. 7, 20, 21, which are fair.

AVERAGE DISCHARGE.--8 years, 38.6 ft<sup>3</sup>/s, 6.17 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 597 ft<sup>3</sup>/s, Mar. 27, 1986, gage height, 9.93 ft; minimum daily, 1.3 ft<sup>3</sup>/s, Feb. 5-20, 1982; minimum gage height, 2.86 ft, Feb. 24, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 597 ft<sup>3</sup>/s, Mar. 27, gage height, 9.93 ft; minimum daily discharge, 5.0 ft<sup>3</sup>/s, Jan. 15, gage height, 3.63 ft; minimum gage height, 3.63 ft, Jan. 14, 15, 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	153	90	16	6.9	6.2	6.7	444	381	36	35	17	10
2	147	88	16	6.7	6.1	6.5	402	345	28	30	15	9.9
3	141	71	15	6.5	6.1	6.8	362	306	25	28	13	12
4	203	63	15	6.3	6.1	6.4	329	264	23	26	12	12
5	322	58	15	6.1	6.1	6.4	312	220	21	26	10	9.7
6	339	55	14	5.9	6.1	6.4	292	190	20	28	10	8.7
7	381	50	14	5.7	6.0	6.4	272	165	19	27	12	8.3
8	432	44	14	5.6	6.1	6.4	244	144	17	25	12	8.1
9	432	40	14	5.5	6.1	6.5	226	124	16	25	13	8.7
10	400	39	13	5.3	6.1	7.0	209	111	15	24	17	10
11	372	35	13	5.3	6.1	7.0	193	111	15	25	14	9.8
12	366	37	13	5.5	6.1	7.3	176	122	15	28	14	9.4
13	348	33	12	5.3	6.2	7.5	158	146	14	35	12	9.0
14	319	30	12	5.1	6.2	7.8	142	169	13	37	14	9.3
15	291	27	12	5.0	6.2	8.7	156	184	12	38	14	13
16	269	27	11	5.1	6.2	10	164	189	11	39	14	15
17	245	27	11	5.1	6.2	14	166	184	10	38	15	20
18	222	26	11	5.1	6.2	20	169	170	11	37	13	20
19	205	25	11	5.2	6.2	28	176	151	10	43	13	22
20	188	24	10	5.5	6.4	40	179	130	10	40	14	26
21	174	23	10	6.0	6.5	56	171	111	10	38	15	56
22	162	21	9.7	6.0	6.3	61	158	95	21	37	14	100
23	150	20	9.3	6.2	6.2	102	147	81	26	35	14	117
24	136	19	9.1	6.2	6.2	187	134	68	28	34	13	123
25	122	19	8.7	6.3	6.2	254	129	59	33	34	13	144
26	111	18	8.4	6.4	6.4	438	120	57	40	32	13	157
27	100	18	8.1	6.4	6.4	545	126	53	44	32	13	160
28	91	17	7.9	6.4	6.4	503	183	49	45	30	12	152
29	84	17	7.5	6.3	---	506	294	45	41	28	11	141
30	93	16	7.3	6.2	---	493	384	40	39	26	11	127
31	89	---	7.1	6.2	---	475	---	34	---	21	10	---
TOTAL	7087	1077	355.1	181.3	173.6	3835.8	6617	4498	668	981	407	1527.9
MEAN	229	35.9	11.5	5.85	6.20	124	221	145	22.3	31.6	13.1	50.9
MAX	432	90	16	6.9	6.5	545	444	381	45	43	17	160
MIN	84	16	7.1	5.0	6.0	6.4	120	34	10	21	10	8.1
CFSM	2.70	.42	.14	.07	.07	1.46	2.60	1.71	.26	.37	.15	.60
IN.	3.11	.47	.16	.08	.08	1.68	2.90	1.97	.29	.43	.18	.67
AC-FT	14060	2140	704	360	344	7610	13120	8920	1320	1950	807	3030

CAL YR 1985 TOTAL 25199.4 MEAN 69.0 MAX 465 MIN 3.7 CFSM .81 IN 11.04 AC-FT 49980  
WTR YR 1986 TOTAL 27408.7 MEAN 75.1 MAX 545 MIN 5.0 CFSM .89 IN 12.01 AC-FT 54370

## MISSISSIPPI RIVER MAIN STEM

05288500 MISSISSIPPI RIVER NEAR ANOKA, MN

LOCATION.--Lat 45°07'36", long 93°17'48", in SW $\frac{1}{4}$  sec.12, T.119 N., R.21 W., Hennepin County, Hydrologic Unit 07010206, on right bank 0.4 mi downstream from Coon Creek, 1.3 mi downstream from Coon Rapids dam at Coon Rapids, 6.5 mi downstream from Anoka, and at mile 864.8 upstream from Ohio River.

DRAINAGE AREA.--19,100 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1931 to current year. Prior to October 1931 published as "at Coon Rapids, near Anoka."

GAGE.--Water-stage recorder. Datum of gage is 804.53 ft above National Geodetic Vertical Datum of 1929. Prior to June 14, 1932, at site 1.2 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Flow slightly regulated by six reservoirs on headwaters; total usable capacity, 1,640,600 acre-ft. Diurnal regulation caused by dam above station.

AVERAGE DISCHARGE.--55 years, 8,019 ft<sup>3</sup>/s, 5.70 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 91,000 ft<sup>3</sup>/s, Apr. 17, 1965, gage height, 19.53 ft; minimum, 529 ft<sup>3</sup>/s, Aug. 29, 1976, gage height, 0.04 ft, result of regulation; minimum daily, 602 cfs, Sept. 10, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 50,300 ft<sup>3</sup>/s, Apr. 6, gage height, 13.19 ft; minimum discharge, 4,910 ft<sup>3</sup>/s, Mar. 7, gage height, 2.76 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	17700	14500	6700	9320	7900	6840	38300	41800	20900	17700	14300	13900		
2	17000	13700	6470	9480	8570	6990	43200	44000	19500	17100	14300	13900		
3	17000	13500	6350	9300	8090	7180	45600	45100	18800	16300	13400	15100		
4	17900	13500	9080	9050	7830	6600	47500	46600	17800	15500	13500	17700		
5	18200	13500	10200	8640	8160	6560	49300	46300	16800	15400	13200	17800		
6	17900	12400	9610	8470	7820	6380	50100	44700	16100	15300	12800	18100		
7	18300	12900	9660	8360	7500	6130	48800	41800	15700	14800	14600	17200		
8	18700	12500	9950	8500	7560	7950	46800	39600	15200	14200	14700	16800		
9	18800	12000	10100	9340	6570	7210	44700	40800	14400	14200	14700	16300		
10	18700	11600	10200	9420	5770	6440	42500	42500	14000	13400	14900	15900		
11	18900	11400	10200	8970	6890	6460	40100	43600	15400	13400	15100	15900		
12	19300	10900	9510	8770	7170	6430	38700	44700	16700	13500	15000	15500		
13	19700	10500	9080	8580	7480	6510	36500	47000	17300	13700	15100	14900		
14	19900	10500	8960	8440	7480	6430	35400	48900	18000	13600	15600	15000		
15	20200	10800	9020	8280	8010	6190	35600	49900	18300	14400	14800	15800		
16	20100	10800	9730	8310	7150	6520	34300	49800	17800	15100	14700	16300		
17	20000	10300	9160	8410	7450	6830	33800	49200	17800	15000	15100	17100		
18	19900	10400	8470	8210	7780	7470	33600	47600	17400	14300	14000	19400		
19	19600	10800	8840	8200	7730	7600	33900	45500	17300	14900	14100	21300		
20	19400	10900	9560	8430	7160	7590	34100	43100	17200	15300	13500	24000		
21	18900	8670	9570	8220	5840	8230	33900	40400	17400	15500	14100	26700		
22	18500	7760	9460	7410	7480	9100	33700	37900	18700	16400	13500	30500		
23	17600	8200	10400	7860	7100	9930	32300	35500	20200	16400	14600	34900		
24	17600	6730	9440	7880	6630	10800	31700	32800	20600	16700	15400	37400		
25	17300	6340	8270	7830	6890	12300	31100	30800	20700	17000	15600	39200		
26	16400	6860	9330	6600	7290	14200	29900	29400	20400	16800	15200	40800		
27	16200	7650	9850	5740	6910	16700	30500	27800	20300	15800	14900	41000		
28	15800	6960	8820	7100	6710	19700	33100	26100	19600	15700	14800	40700		
29	15300	7130	8720	7750	---	21700	36800	25300	18700	15500	14500	40100		
30	15100	5770	9280	8160	---	26800	39700	22200	18400	15300	14200	38000		
31	14500	---	8870	8390	---	32100	---	22000	---	14700	14400	---		
TOTAL	560400	309470	282860	257420	204920	317870	1145500	1232700	537400	472900	448600	707200		
MEAN	18080	10320	9125	8304	7319	10250	38180	39760	17910	15250	14470	23570		
MAX	20200	14500	10400	9480	8570	32100	50100	49900	20900	17700	15600	41000		
MIN	14500	5770	6350	5740	5770	6130	29900	22000	14000	13400	12800	13900		
CFSM	.95	.54	.48	.44	.38	.54	2.00	2.08	.94	.80	.76	1.23		
IN	1.09	.60	.55	.50	.40	.62	2.23	2.40	1.05	.92	.87	1.38		
AC-FT	1112000	613800	561100	510600	406500	630500	2272000	2445000	1066000	938000	889800	1403000		
CAL YR 1985	TOTAL	5107710	MEAN	13990	MAX	38100	MIN	4440	CFSM	.73	IN	9.95	AC-FT	10130000
WTR YR 1986	TOTAL	6477240	MEAN	17750	MAX	50100	MIN	5740	CFSM	.93	IN	12.62	AC-FT	12850000

## MISSISSIPPI RIVER MAIN STEM

05288500 MISSISSIPPI RIVER NEAR ANOKA, MN--Continued

## WATER-QUALITY RECORDS

LOCATION.--Sediment samples collected at Camden Avenue bridge, in Minneapolis, 7.0 mi downstream from gage.  
Tritium samples collected at gage near right bank. Prior to October 1, 1978, sediment samples collected at Lowry Avenue bridge.

DRAINAGE AREA.--19,600 mi<sup>2</sup> (50,800 km<sup>2</sup>), approximately.

PERIOD OF RECORD.--Water years 1963-67, 1975 to current year.

## PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1975 to current year.

SUSPENDED SEDIMENT DISCHARGE: August 1975 to current year.

REMARKS.--During the winter period, daily suspended-sediment load was estimated on the basis of water records and monthly sediment samples. Water temperature was obtained once-daily for most of the open water period and occasionally for the winter period.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES (water years 1976-77, 1979-80, 1982-86): Maximum daily, 31.0°C, Aug. 25, 26, 1976, July 19, 1977; minimum daily, 0.0°C several days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 210 mg/L, Apr. 3, 1982; minimum daily mean, 1 mg/L on several days in 1978, 1980, 1981, 1982, and 1984.

SEDIMENT LOADS: Maximum daily, 17,400 tons, Apr. 20, 1982; minimum daily, 3.9 tons, Feb. 2, 1981.

## EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURES: Maximum daily, 29.0°C, July 18; minimum daily, 0.0°C several days during winter period.

SEDIMENT CONCENTRATION: Maximum daily mean, 130 mg/L, May. 13; minimum daily mean, 5 mg/L, Nov. 25 to Mar. 2.

SEDIMENT LOADS: Maximum daily, 16,500 tons, May 13; minimum daily, 77 tons, Jan. 27.

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
ONCE-DAILY

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10.0	---				---	---	12.0	23.0	22.0	26.0	20.0
2	11.0	8.0				---	---	12.0	22.0	23.0	23.0	22.0
3	11.0	8.0				---	5.0	12.0	24.0	24.0	25.0	22.0
4	11.0	7.0				---	6.0	16.0	22.0	25.0	25.0	21.0
5	10.0	8.0				---	6.0	17.0	22.0	26.0	23.0	19.5
6	11.0	8.0				---	7.0	16.0	21.0	25.0	24.0	18.0
7	10.0	6.0				---	9.0	15.0	21.0	26.0	24.0	19.0
8	10.0	3.0				---	8.0	14.0	22.0	25.0	25.0	19.0
9	8.0	---				---	9.0	14.0	23.0	26.0	24.0	17.0
10	11.0	---				---	10.0	---	23.0	25.0	23.0	17.0
11	9.0	2.0				---	12.0	---	18.0	24.0	23.0	15.0
12	9.0	1.0				---	10.0	---	21.0	23.0	22.0	16.0
13	---	3.0				---	11.0	15.0	21.0	23.0	21.0	14.0
14	---	3.0				---	8.0	17.0	19.0	24.0	22.0	14.0
15	---	3.0				---	9.0	17.0	23.0	25.0	24.0	14.0
16	8.0	2.0				---	10.0	17.0	22.0	26.0	24.0	14.0
17	---	4.0				---	---	16.0	23.0	27.0	25.0	14.0
18	---	3.0				---	---	16.0	24.0	29.0	25.0	15.0
19	9.0	.0				---	10.0	17.0	26.0	27.0	24.0	15.0
20	11.0	---				---	11.0	17.0	26.0	26.0	22.0	15.0
21	10.0	---				---	10.0	17.0	26.0	26.0	22.0	15.0
22	12.0	---				4.0	11.0	19.0	24.0	27.0	21.0	16.0
23	12.0	---				4.0	13.0	18.0	24.0	27.0	20.0	17.0
24	11.0	---				3.0	13.0	17.0	24.0	26.0	19.0	17.0
25	---	---				4.0	13.0	17.0	24.0	26.0	22.0	16.5
26	---	---				2.0	13.0	18.0	25.0	25.0	20.0	19.0
27	---	---				4.0	15.0	21.0	26.0	26.0	19.0	19.0
28	10.0	---				6.0	12.0	22.0	24.0	26.0	19.0	17.0
29	10.0	---				6.0	---	23.0	25.0	27.0	19.0	17.0
30	9.0	---				---	14.0	25.0	24.0	27.0	20.0	17.0
31	9.0	---				---	---	26.0	---	26.0	22.0	---
MEAN	---	---				---	---	---	23.0	25.5	22.5	17.0
MAX	12.0	8.0				6.0	15.0	26.0	26.0	29.0	26.0	22.0
MIN	---	.0				---	---	12.0	18.0	22.0	19.0	14.0
WTR YR 1986	MAX	29.0		MIN	.0							

## SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)
OCTOBER			NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
1	14	669	9	352	5	90	5	126	5	107	5	92
2	10	459	11	407	5	87	5	128	5	116	5	94
3	17	780	14	510	5	86	5	126	5	109	8	155
4	36	1740	14	510	5	123	5	122	5	106	8	143
5	56	2750	12	437	5	138	5	117	5	110	8	142
6	23	1110	10	335	5	130	5	114	5	106	8	138
7	20	988	8	279	5	130	5	113	5	101	8	132
8	17	858	14	472	5	134	5	115	5	102	8	172
9	17	863	20	648	5	136	5	126	5	89	8	156
10	15	757	21	658	5	138	5	127	5	78	8	139
11	26	1330	18	554	5	138	5	121	5	93	8	140
12	19	990	12	353	5	128	5	118	5	97	8	139
13	15	798	8	227	5	123	5	116	5	101	8	141
14	14	752	6	170	5	121	5	114	5	101	9	156
15	14	764	7	204	5	122	5	112	5	108	10	167
16	14	760	8	233	5	131	5	112	5	97	11	194
17	13	702	17	473	5	124	5	114	5	101	12	221
18	14	752	10	281	5	114	5	111	5	105	14	282
19	16	847	16	467	5	119	5	111	5	104	16	328
20	19	995	21	618	5	129	5	114	5	97	18	369
21	21	1070	21	492	5	129	5	111	5	79	20	444
22	20	999	20	419	5	128	5	100	5	101	23	565
23	14	665	8	177	5	140	5	106	5	96	26	697
24	15	713	6	109	5	127	5	106	5	90	32	933
25	15	701	5	86	5	112	5	106	5	93	43	1430
26	14	620	5	93	5	126	5	89	5	98	55	2110
27	13	569	5	103	5	133	5	77	5	93	66	2980
28	12	512	5	94	5	119	5	96	5	91	77	4100
29	14	578	5	96	5	118	5	105	---	---	89	5210
30	14	571	5	78	5	125	5	110	---	---	100	7240
31	10	391	---	---	5	120	5	113	---	---	110	9530
TOTAL	---	27053	---	9935	---	3818	---	3476	---	2769	---	38739
APRIL			MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1	116	12000	65	7340	57	3220	28	1340	45	1740	19	713
2	119	13900	73	8670	46	2420	47	2170	42	1620	17	638
3	115	14200	75	9130	59	2990	75	3300	40	1450	18	734
4	97	12400	72	9060	74	3560	68	2850	38	1390	50	2390
5	78	10400	76	9500	62	2810	33	1370	41	1460	41	1970
6	67	9060	82	9900	34	1480	28	1160	45	1560	26	1270
7	51	6720	61	6880	47	1990	28	1120	40	1580	22	1020
8	45	5690	56	5990	55	2260	27	1040	41	1630	23	1040
9	49	5910	68	7490	48	1870	26	997	33	1310	21	924
10	44	5050	78	8950	30	1130	23	832	28	1130	19	816
11	42	4550	90	10600	45	1870	24	868	32	1300	22	944
12	41	4280	110	13300	69	3110	28	1020	36	1460	19	795
13	38	3740	130	16500	69	3220	26	962	38	1550	14	563
14	30	2870	112	14800	68	3300	22	808	40	1680	16	648
15	29	2790	73	9840	57	2820	22	855	36	1440	20	853
16	32	2960	69	9280	70	3360	26	1060	38	1510	19	836
17	32	2920	72	9560	56	2690	24	972	35	1430	19	877
18	31	2810	67	8610	56	2630	34	1310	30	1130	27	1410
19	29	2650	64	7860	66	3080	38	1530	25	952	43	2470
20	29	2670	51	5930	63	2930	31	1280	23	838	59	3820
21	27	2470	46	5020	60	2820	28	1170	24	914	72	5190
22	27	2460	46	4710	83	4190	24	1060	35	1280	70	5760
23	32	2790	53	5080	89	4850	24	1060	24	946	62	5840
24	31	2650	58	5140	72	4000	24	1080	24	998	49	4950
25	37	3110	47	3910	72	4020	24	1100	25	1050	42	4450
26	35	2830	39	3100	67	3690	25	1130	25	1030	42	4630
27	47	3870	39	2930	78	4280	26	1110	25	1010	46	5090
28	57	5090	45	3170	66	3490	31	1310	23	919	42	4620
29	61	6060	42	2870	41	2070	43	1800	23	900	36	3900
30	63	6750	42	2520	30	1490	45	1860	23	882	29	2980
31	---	---	32	1900	---	---	43	1710	22	855	---	---
TOTAL	---	165650	---	229540	---	87640	---	41234	---	38944	---	72141
TOTAL LOAD FOR YEAR:			720939		TONS.							

## MISSISSIPPI RIVER MAIN STEM

05288500 MISSISSIPPI RIVER NEAR ANOKA, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
MAR			
26...	1140	14200	69
JUL			
25...	1155	17600	85
SEP			
25...	1311	36900	38

## PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	NUMBER OF SAM- PLING POINTS (00063)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM (80164)	BED MAT. SIEVE DIAM. % FINER THAN .125 MM (80165)	BED MAT. SIEVE DIAM. % FINER THAN .250 MM (80166)	BED MAT. SIEVE DIAM. % FINER THAN .500 MM (80167)
MAR							
26...	1100	14200	2	<1	2	24	52
SEP							
25...	1258	36900	3	--	<1	3	24

DATE	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM (80168)	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM (80169)	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM (80170)	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM (80171)	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM (80172)	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM (80173)
MAR						
26...	64	70	75	81	91	100
SEP						
25...	59	76	84	92	100	--

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN

LOCATION.--Lat 45°06'12", long 93°16'37", in SW¼NE¼ sec.10, T.30 N., R.24 W., Anoka County, Hydrologic Unit 07010206, on left bank at St. Paul Pumping Station in Fridley, 0.9 mi upstream from Rice Creek, and 3.4 mi downstream from Coon Rapids Dam, and at mile 862.8 upstream from Ohio River.

PERIOD OF RECORD.--Water years 1975 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: November 1974 to current year.

pH: November 1974 to current year.

WATER TEMPERATURES: November 1974 to current year.

DISSOLVED OXYGEN: November 1974 to current year.

INSTRUMENTATION.--Water-quality monitor since November 1974.

REMARKS.--Extremes are published for years with 80 percent or more daily record.

COOPERATION.--Water-quality monitor is operated by the Metropolitan Waste Control Commission, St. Paul, MN.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water year 1981, 1983-86): Maximum, 473 microsiemens Sept. 30, 1981; minimum,

202 microsiemens Nov. 12, 17, 1982.

pH (water year 1981-86): Maximum, 8.7 units Apr. 16, 18-20, 1981; minimum, 6.8 units June 17, 1984.

WATER TEMPERATURES (water year 1981-86): Maximum, 29.5°C July 6, 1981, Aug. 7, 1983; minimum, 0.0°C several days during winter period.

DISSOLVED OXYGEN (water year 1981-86): Maximum, 17.6 mg/L Mar. 7, 8, 1981; minimum, 2.9 mg/L July 27, 1981.

EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 378 microsiemens Mar. 1; minimum, 211 microsiemens Sep. 24-25.

pH: Maximum, 8.4 units Oct. 24, 25, 31, Nov. 1, 2, Aug. 27; minimum, 7.2 units Aug. 22.

WATER TEMPERATURES: Maximum, 27.5°C July 18-19; minimum, 0.0°C several days during winter period.

DISSOLVED OXYGEN: Maximum, 15.7 mg/L Mar. 21; minimum, 6.1 mg/L Aug. 16-17, 26.

## SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	224	219	221	318	314	316	296	291	293	293	288	29
2	238	222	223	323	313	314	296	291	294	294	287	28
3	228	223	226	315	311	313	297	293	294	294	289	28
4	228	212	219	313	309	310	295	286	291	291	289	29
5	222	218	219	310	279	292	289	285	286	292	289	29
6	222	219	220	317	283	286	295	286	287	294	291	29
7	222	220	221	311	279	283	289	286	287	294	291	29
8	224	219	221	283	278	279	287	283	284	295	291	29
9	223	218	220	278	275	276	292	283	287	295	290	29
10	222	219	221	276	271	272	291	287	290	292	289	29
11	223	219	221	272	268	270	291	289	290	302	294	29
12	224	218	221	280	270	272	291	288	289	304	299	30
13	235	229	232	---	---	---	291	289	290	311	309	31
14	252	247	249	---	---	---	293	290	291	322	320	32
15	273	268	270	---	---	---	293	289	291	342	329	33
16	288	286	287	---	---	---	291	287	289	346	339	34
17	317	315	316	---	---	---	291	289	289	345	290	34
18	315	311	313	282	280	281	293	290	291	346	340	34
19	316	309	312	286	278	282	293	290	291	344	340	34
20	317	310	313	281	275	277	292	288	290	343	340	34
21	320	314	316	282	278	280	292	288	289	343	290	34
22	324	317	320	285	280	282	293	289	290	344	341	34
23	330	321	325	285	281	282	290	285	287	344	341	34
24	329	325	327	288	279	286	290	286	287	344	340	34
25	329	322	324	291	279	288	295	290	292	345	342	34
26	330	323	326	292	280	289	295	290	292	348	343	34
27	329	322	324	296	289	292	293	288	290	348	346	34
28	324	320	321	298	289	294	294	286	292	348	344	34
29	323	319	321	296	291	293	295	293	293	347	342	34
30	321	316	317	295	291	293	295	292	293	346	343	34
31	327	314	315	---	---	---	294	291	292	346	342	34
MONTH	330	212	274	---	---	---	297	283	290	348	287	32

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	348	343	343	378	356	362	316	268	292	272	268	270
2	345	340	341	375	360	364	268	265	266	272	265	268
3	345	340	342	377	364	367	---	---	---	271	265	267
4	---	---	---	371	363	366	---	---	---	284	264	266
5	---	---	---	367	363	364	---	---	---	271	266	268
6	350	348	349	363	344	360	---	---	---	275	266	268
7	351	349	349	363	359	360	---	---	---	273	270	271
8	352	348	349	363	357	360	260	256	258	273	271	272
9	353	350	351	367	355	359	---	---	---	272	270	271
10	354	351	352	370	348	364	---	---	---	271	265	267
11	355	350	352	366	362	363	---	---	---	267	264	265
12	354	352	352	365	360	362	---	---	---	271	266	268
13	355	352	353	363	358	361	---	---	---	272	270	270
14	355	352	352	367	363	364	---	---	---	272	270	270
15	352	350	351	371	364	367	---	---	---	272	270	270
16	353	350	351	371	366	367	---	---	---	272	270	271
17	352	350	351	370	365	367	---	---	---	272	270	271
18	353	349	351	367	358	360	---	---	---	272	270	271
19	360	350	354	363	354	359	---	---	---	272	271	271
20	360	356	358	366	356	358	---	---	---	272	271	271
21	---	---	---	366	360	362	---	---	---	278	271	274
22	---	---	---	364	360	362	265	260	264	280	275	277
23	---	---	---	363	358	360	288	261	277	282	272	279
24	360	357	358	359	356	356	288	284	286	281	266	274
25	362	357	360	359	355	357	288	283	285	275	272	274
26	364	357	359	355	342	346	291	285	287	274	268	271
27	365	360	360	348	341	344	292	287	288	277	268	273
28	361	359	360	349	344	346	291	286	288	272	268	270
29	---	---	---	348	344	346	287	282	284	284	274	276
30	---	---	---	346	336	340	287	271	276	289	280	283
31	---	---	---	337	331	333	---	---	---	291	286	288
MONTH	---	---	---	378	331	358	---	---	---	291	264	272

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	290	285	286	298	290	293	---	---	---	---	---	---
2	291	281	286	302	296	298	307	301	303	308	302	304
3	300	290	293	306	295	300	304	300	301	308	280	298
4	303	288	296	308	291	306	307	299	304	298	292	294
5	306	297	300	308	297	305	307	256	294	292	286	288
6	306	284	299	304	298	301	306	248	284	286	279	282
7	299	246	294	308	301	303	---	---	---	279	272	274
8	301	293	296	310	306	308	---	---	---	275	270	272
9	306	298	301	308	302	304	---	---	---	291	260	268
10	306	299	302	309	306	307	---	---	---	286	264	265
11	300	290	294	308	288	303	---	---	---	270	268	268
12	295	285	290	309	297	302	---	---	---	272	268	270
13	299	294	296	299	295	297	---	---	---	274	270	272
14	296	293	294	306	298	301	---	---	---	---	---	---
15	295	292	293	305	300	301	---	---	---	268	262	266
16	293	289	290	313	298	304	---	---	---	272	266	269
17	290	283	286	318	313	315	---	---	---	271	268	268
18	302	285	293	322	299	317	---	---	---	283	265	273
19	306	294	301	321	298	313	308	304	306	283	278	281
20	313	304	308	316	310	312	---	---	---	282	280	281
21	---	---	---	317	307	311	279	274	276	270	255	263
22	310	297	304	319	312	315	279	263	276	255	247	251
23	---	---	---	318	306	312	279	273	275	242	221	231
24	---	---	---	311	303	308	277	269	272	240	211	226
25	---	---	---	308	299	303	275	267	270	234	211	225
26	---	---	---	308	301	303	276	272	273	233	213	225
27	---	---	---	306	299	302	295	268	282	269	228	231
28	298	287	293	308	304	306	294	271	291	232	230	230
29	298	294	295	313	304	308	295	289	291	235	222	230
30	294	288	290	313	306	309	295	289	292	237	218	226
31	---	---	---	---	---	---	301	295	296	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	8.0	7.9	8.0	8.4	8.3	8.3	8.0	7.9	7.9	7.8	7.7	7.8
2	8.0	7.9	8.0	8.4	8.3	8.4	7.9	7.8	7.9	7.9	7.7	7.8
3	8.1	8.0	8.0	8.3	8.2	8.3	7.8	7.8	7.8	7.8	7.8	7.8
4	8.1	7.9	8.0	8.3	8.2	8.3	7.8	7.7	7.8	7.8	7.8	7.8
5	8.0	7.8	7.9	8.2	8.1	8.1	7.8	7.7	7.7	7.8	7.8	7.8
6	8.0	7.7	7.8	8.3	8.2	8.2	7.9	7.7	7.7	7.8	7.8	7.8
7	8.0	7.7	7.7	8.3	8.2	8.2	7.7	7.7	7.7	7.8	7.7	7.8
8	8.0	7.9	7.9	8.2	8.2	8.2	7.7	7.6	7.7	7.8	7.7	7.8
9	7.9	7.9	7.9	8.2	8.2	8.2	7.8	7.6	7.7	7.8	7.8	7.8
10	8.0	7.9	7.9	8.2	8.2	8.2	7.8	7.7	7.8	7.8	7.8	7.8
11	8.0	7.9	8.0	8.2	8.2	8.2	7.9	7.8	7.8	7.9	7.8	7.8
12	8.1	8.0	8.0	8.2	8.2	8.2	7.9	7.8	7.9	7.9	7.8	7.8
13	8.0	7.9	8.0	---	---	---	7.8	7.8	7.8	7.9	7.8	7.9
14	8.1	8.0	8.0	---	---	---	7.8	7.8	7.8	7.9	7.8	7.9
15	8.1	8.0	8.1	---	---	---	7.8	7.7	7.8	7.9	7.8	7.9
16	8.2	8.1	8.1	---	---	---	7.9	7.7	7.8	7.9	7.8	7.9
17	8.2	8.2	8.2	---	---	---	7.8	7.7	7.7	7.9	7.8	7.9
18	8.2	8.2	8.2	8.2	8.1	8.2	7.8	7.7	7.7	7.9	7.8	7.9
19	8.2	8.1	8.2	8.1	8.1	8.1	7.8	7.7	7.8	7.9	7.9	7.9
20	8.2	8.2	8.2	8.1	8.1	8.1	7.8	7.7	7.7	8.0	7.9	7.9
21	8.3	8.2	8.2	8.1	8.1	8.1	7.8	7.7	7.8	8.0	7.9	7.9
22	8.3	8.2	8.2	8.2	8.1	8.1	7.8	7.7	7.7	7.9	7.9	7.9
23	8.3	8.2	8.2	8.1	8.1	8.1	7.8	7.7	7.8	8.0	7.8	7.9
24	8.3	8.2	8.3	8.1	8.0	8.1	7.8	7.7	7.7	8.0	7.9	8.0
25	8.4	8.2	8.3	8.1	8.0	8.0	7.8	7.7	7.7	8.0	7.9	8.0
26	8.4	8.3	8.3	8.1	7.9	8.0	7.8	7.7	7.8	8.0	7.9	7.9
27	8.3	8.3	8.3	8.0	8.0	8.0	7.8	7.7	7.7	7.9	7.9	7.9
28	8.3	8.3	8.3	8.0	7.9	8.0	7.8	7.7	7.7	7.9	7.8	7.9
29	8.3	8.3	8.3	7.9	7.9	7.9	7.8	7.7	7.7	8.0	7.8	7.8
30	8.3	8.3	8.3	7.9	7.8	7.9	7.8	7.7	7.8	7.9	7.8	7.8
31	8.4	8.3	8.3	---	---	---	7.8	7.7	7.8	7.9	7.8	7.8
MONTH	8.4	7.7	8.1	---	---	---	8.0	7.6	7.8	8.0	7.7	7.9
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	7.9	7.8	7.8	8.1	8.0	8.0	8.0	7.7	7.7	7.9	7.8	7.9
2	8.0	7.8	7.8	8.1	7.9	8.0	7.7	7.7	7.7	8.0	7.8	7.8
3	7.9	7.8	7.9	8.1	7.9	8.0	---	---	---	7.9	7.8	7.8
4	---	---	---	8.1	8.0	8.0	---	---	---	8.0	7.8	7.8
5	---	---	---	8.1	8.0	8.1	---	---	---	8.0	7.8	7.8
6	7.9	7.9	7.9	8.1	8.0	8.1	---	---	---	7.9	7.7	7.7
7	8.0	7.9	8.0	8.1	8.0	8.0	---	---	---	7.9	7.8	7.8
8	8.0	7.9	8.0	8.2	8.0	8.1	7.7	7.7	7.7	7.8	7.8	7.8
9	8.0	7.9	7.9	8.1	8.0	8.1	---	---	---	7.9	7.8	7.8
10	7.9	7.8	7.9	8.1	8.0	8.1	---	---	---	7.8	7.7	7.8
11	8.0	7.8	7.9	8.0	7.9	8.0	---	---	---	7.8	7.8	7.8
12	7.9	7.8	7.9	8.0	7.8	7.9	---	---	---	7.9	7.7	7.8
13	7.9	7.8	7.9	8.1	7.9	7.9	---	---	---	7.8	7.8	7.8
14	7.9	7.8	7.8	8.0	7.9	7.9	---	---	---	7.8	7.8	7.8
15	7.9	7.8	7.8	8.0	7.9	7.9	---	---	---	7.8	7.8	7.8
16	7.9	7.8	7.9	8.1	7.9	8.0	---	---	---	7.8	7.8	7.8
17	7.9	7.8	7.9	8.0	7.9	8.0	---	---	---	7.9	7.8	7.8
18	7.9	7.8	7.9	8.1	7.9	7.9	---	---	---	7.9	7.9	7.9
19	7.9	7.8	7.9	8.0	7.9	7.9	---	---	---	8.0	7.9	7.9
20	8.0	7.8	7.9	8.0	7.8	7.9	---	---	---	8.0	7.8	7.9
21	---	---	---	8.0	7.9	7.9	---	---	---	8.0	7.8	7.9
22	---	---	---	8.0	7.8	7.9	8.3	8.2	8.3	7.8	7.8	7.8
23	---	---	---	7.9	7.8	7.9	8.3	8.1	8.2	8.1	7.8	7.9
24	8.0	7.9	7.9	7.9	7.8	7.9	8.3	8.2	8.2	8.1	7.8	8.0
25	8.0	7.9	7.9	8.0	7.8	7.9	8.3	8.1	8.2	8.1	8.0	8.1
26	8.0	7.9	7.9	7.9	7.8	7.9	8.3	8.1	8.2	8.1	8.1	8.1
27	8.0	7.9	7.9	8.0	7.8	7.9	8.2	8.1	8.1	8.1	8.0	8.1
28	8.0	7.9	8.0	8.1	7.9	8.0	8.1	8.0	8.0	8.1	8.0	8.0
29	---	---	---	8.0	7.9	7.9	8.0	7.9	8.0	8.0	8.0	8.0
30	---	---	---	7.9	7.8	7.8	8.0	7.8	7.9	8.1	8.0	8.0
31	---	---	---	7.8	7.8	7.8	---	---	---	8.1	8.0	8.1
MONTH	---	---	---	8.2	7.8	8.0	---	---	---	8.1	7.7	7.9

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	8.1	7.9	8.0	8.0	7.9	8.0	---	---	---	---	---	---
2	7.9	7.9	7.9	8.1	8.0	8.0	8.1	8.1	8.1	8.2	7.8	8.0
3	7.9	7.8	7.9	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.0	8.1
4	8.0	7.6	7.9	8.1	8.0	8.1	8.2	7.9	8.1	8.1	8.0	8.0
5	8.0	7.9	8.0	8.1	8.0	8.1	8.2	7.8	8.1	8.1	7.9	8.0
6	8.0	7.9	8.0	8.1	8.0	8.0	8.1	7.8	8.0	8.0	8.0	8.0
7	8.0	7.9	8.0	8.1	8.0	8.1	---	---	---	8.0	7.9	8.0
8	8.1	7.9	8.0	8.1	8.0	8.1	---	---	---	8.0	7.9	8.0
9	8.1	8.0	8.0	8.1	8.0	8.0	---	---	---	8.0	7.9	7.9
10	8.1	8.0	8.0	8.1	8.0	8.0	---	---	---	8.0	7.9	7.9
11	8.0	7.9	7.9	8.0	8.0	8.0	---	---	---	7.9	7.9	7.9
12	8.0	7.9	7.9	8.1	7.9	8.0	---	---	---	8.0	7.9	7.9
13	8.0	7.9	7.9	8.0	8.0	8.0	---	---	---	8.0	7.9	8.0
14	8.0	7.9	7.9	8.0	8.0	8.0	---	---	---	---	---	---
15	8.2	8.0	8.1	8.0	8.0	8.0	---	---	---	8.0	7.9	8.0
16	8.3	8.1	8.2	8.0	7.9	8.0	---	---	---	8.0	8.0	8.0
17	8.2	8.1	8.1	8.1	8.0	8.0	---	---	---	8.0	7.9	8.0
18	8.1	7.9	8.0	8.1	8.0	8.0	---	---	---	8.0	7.9	7.9
19	8.2	7.9	7.9	8.1	8.0	8.0	8.2	8.0	8.1	7.9	7.9	7.9
20	7.9	7.8	7.9	8.1	8.0	8.0	8.1	7.9	7.9	7.9	7.9	7.9
21	---	---	---	8.1	8.0	8.1	8.0	7.9	7.9	7.9	7.8	7.9
22	7.8	7.8	7.8	8.1	8.0	8.1	8.0	7.2	7.9	8.0	7.8	7.8
23	---	---	---	8.1	7.9	8.0	8.0	7.9	7.9	7.8	7.7	7.8
24	---	---	---	8.1	7.9	8.0	8.0	7.9	7.9	7.9	7.7	7.7
25	---	---	---	8.0	7.9	7.9	7.9	7.9	7.9	7.7	7.7	7.7
26	---	---	---	8.0	7.9	7.9	8.0	7.9	7.9	7.7	7.6	7.6
27	---	---	---	7.9	7.9	7.9	8.4	7.9	8.0	7.8	7.6	7.6
28	8.1	8.0	8.0	8.0	7.9	7.9	8.1	7.9	8.1	7.6	7.6	7.6
29	8.1	8.0	8.0	8.0	7.9	8.0	8.1	8.0	8.1	7.7	7.6	7.6
30	8.0	8.0	8.0	8.1	8.0	8.0	8.1	8.1	8.1	7.7	7.6	7.6
31	---	---	---	---	---	---	8.1	8.0	8.1	---	---	---

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	9.5	9.0	9.0	8.0	7.5	8.0	.0	.0	.0	.0	.0	.0
2	9.5	8.5	9.0	8.0	7.0	7.5	.0	.0	.0	.0	.0	.0
3	10.0	9.5	9.5	7.0	6.0	6.5	.5	.0	.0	.0	.0	.0
4	10.0	9.5	10.0	6.5	5.5	6.0	.5	.5	.5	.0	.0	.0
5	10.5	10.0	10.0	6.5	5.0	6.0	.5	.5	.5	.0	.0	.0
6	10.5	10.5	10.5	7.5	6.5	6.5	.5	.0	.5	.0	.0	.0
7	10.5	10.0	10.5	6.5	5.5	6.0	.5	.5	.5	.0	.0	.0
8	10.5	10.0	10.5	5.5	4.0	5.0	.5	.5	.5	.0	.0	.0
9	10.0	9.0	9.5	4.0	3.0	3.5	.5	.5	.5	.0	.0	.0
10	9.0	8.5	8.5	3.0	2.0	2.5	1.0	.5	.5	.0	.0	.0
11	9.0	8.0	8.5	2.0	1.5	1.5	.5	.5	.5	.0	.0	.0
12	9.0	8.5	9.0	2.0	1.5	1.5	.5	.5	.5	.0	.0	.0
13	9.0	8.5	8.5	---	---	---	.5	.0	.5	.0	.0	.0
14	9.5	7.5	8.5	---	---	---	.5	.5	.5	.0	.0	.0
15	9.5	7.0	9.0	---	---	---	.5	.5	.5	.5	.0	.0
16	8.5	8.0	8.5	---	---	---	.5	.0	.5	.5	.5	.5
17	8.5	7.5	8.0	---	---	---	.5	.0	.5	.5	.0	.5
18	8.5	8.0	8.0	3.5	3.0	3.5	.5	.5	.5	.5	.0	.5
19	8.5	7.5	8.0	3.5	1.5	2.5	.5	.0	.5	.5	.5	.5
20	8.5	7.5	8.0	1.5	.0	.5	.5	.5	.5	.5	.5	.5
21	9.0	8.5	8.5	.0	.0	.0	.5	.5	.5	.5	.0	.5
22	10.0	9.0	9.0	.0	.0	.0	.5	.5	.5	.5	.5	.5
23	11.5	10.0	10.5	.0	.0	.0	.5	.5	.5	.5	.5	.5
24	11.5	10.5	11.0	1.0	.0	.0	.5	.5	.5	.5	.5	.5
25	11.0	10.0	10.5	.0	.0	.0	.5	.5	.5	.5	.0	.5
26	11.0	10.5	10.5	.0	.0	.0	.5	.5	.5	.5	.0	.5
27	11.0	9.5	10.0	.0	.0	.0	.5	.0	.0	.5	.0	.5
28	10.0	9.0	9.5	.0	.0	.0	.5	.0	.0	.5	.0	.0
29	9.5	9.0	9.0	.0	.0	.0	.0	.0	.0	.5	.0	.0
30	9.0	8.0	8.5	.0	.0	.0	.0	.0	.0	.5	.0	.5
31	8.0	7.5	8.0	---	---	---	.0	.0	.0	.5	.0	.5
MONTH	11.5	7.0	9.0	---	---	---	1.0	.0	.5	.5	.0	.0

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	FEBRUARY			MARCH			APRIL			MAY		
1	.5	.0	.5	.5	.0	.0	5.5	5.0	5.0	13.5	12.5	13.0
2	.5	.0	.0	1.0	.0	.5	6.0	4.5	5.0	12.5	11.5	12.0
3	.5	.0	.5	1.5	1.0	1.5	---	---	---	13.0	11.5	12.5
4	---	---	---	2.0	1.5	1.5	---	---	---	15.0	12.5	13.5
5	---	---	---	2.0	1.5	1.5	---	---	---	15.0	14.5	14.5
6	.5	.5	.5	1.5	.0	1.0	---	---	---	16.0	14.0	14.5
7	.5	.0	.5	.5	.0	.5	---	---	---	15.5	14.5	14.5
8	.5	.0	.5	.5	.0	.0	8.0	7.0	7.5	15.0	13.5	14.0
9	.5	.0	.5	1.5	.0	1.0	---	---	---	13.5	13.0	13.0
10	.5	.0	.5	2.0	1.5	1.5	---	---	---	13.0	12.5	12.5
11	.5	.0	.5	2.5	1.5	2.0	---	---	---	13.0	12.5	12.5
12	.5	.0	.5	2.0	.5	2.0	---	---	---	13.0	13.0	13.0
13	.5	.0	.5	1.5	1.0	1.0	---	---	---	13.0	13.0	13.0
14	.5	.0	.5	2.0	1.0	1.5	---	---	---	13.0	12.5	13.0
15	.5	.0	.5	4.0	2.0	2.5	---	---	---	12.5	12.5	12.5
16	.5	.0	.5	3.0	2.5	2.5	---	---	---	12.5	12.5	12.5
17	.5	.5	.5	3.5	2.0	3.0	---	---	---	12.5	12.5	12.5
18	.5	.5	.5	3.0	1.5	2.0	---	---	---	12.5	12.5	12.5
19	.5	.0	.5	2.0	1.0	1.5	---	---	---	13.5	13.5	13.5
20	.5	.0	.0	2.5	.0	1.0	---	---	---	14.5	14.0	14.0
21	---	---	---	2.5	1.0	1.5	---	---	---	17.0	15.0	16.0
22	---	---	---	3.0	2.0	2.5	10.0	9.0	9.5	17.0	15.5	16.5
23	---	---	---	3.0	2.0	2.5	12.5	9.5	10.5	17.5	16.0	16.5
24	.0	.0	.0	2.0	1.5	1.5	12.5	12.0	12.0	18.0	16.5	17.0
25	.0	.0	.0	2.5	1.5	2.0	13.0	12.0	12.5	18.0	17.0	17.5
26	.0	.0	.0	2.0	1.5	1.5	14.0	12.5	13.0	18.5	17.0	17.5
27	.0	.0	.0	2.5	1.0	1.5	14.5	14.0	14.0	20.0	18.0	19.0
28	.0	.0	.0	3.5	2.0	3.0	15.0	13.5	14.5	20.5	19.0	20.0
29	---	---	---	4.5	3.0	4.0	14.5	13.0	13.5	22.0	20.5	21.0
30	---	---	---	4.5	1.5	4.0	14.0	13.0	14.0	22.5	21.5	22.0
31	---	---	---	5.5	3.0	4.0	---	---	---	24.0	22.0	23.0
MONTH	---	---	---	5.5	.0	2.0	---	---	---	24.0	11.5	15.0
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	---	---	---	22.0	21.0	21.5	---	---	---	---	---	---
2	---	---	---	22.5	20.5	21.5	24.5	23.5	24.0	21.5	20.5	21.0
3	---	---	---	23.5	21.5	22.5	23.5	22.5	23.0	21.5	20.5	21.0
4	21.5	20.0	21.0	24.5	23.0	23.5	23.5	21.5	23.0	21.0	20.0	20.5
5	20.0	18.5	19.5	25.0	24.5	24.5	24.0	23.0	23.5	20.5	19.5	19.5
6	20.0	19.0	19.5	25.0	23.5	24.5	23.5	22.0	22.5	19.5	18.5	19.0
7	20.0	19.0	19.5	25.5	22.5	24.5	---	---	---	18.5	17.5	18.0
8	20.5	19.0	19.5	25.5	23.5	25.0	---	---	---	18.0	17.0	17.5
9	20.5	19.5	20.0	25.0	23.5	24.5	---	---	---	17.5	15.5	17.0
10	20.5	19.5	20.0	25.0	24.5	24.5	23.5	21.5	22.5	17.0	15.5	16.0
11	20.5	17.5	19.0	24.5	23.0	23.5	---	---	---	16.0	14.5	15.5
12	19.0	17.0	17.5	25.5	23.0	23.5	---	---	---	17.5	13.5	14.5
13	19.0	17.5	18.0	23.0	22.0	22.5	---	---	---	14.5	13.5	14.0
14	19.0	17.5	18.0	23.5	22.5	23.0	---	---	---	---	---	---
15	19.5	18.0	19.0	24.0	23.0	23.5	---	---	---	12.5	11.5	12.0
16	20.0	19.0	19.5	25.5	23.5	24.0	---	---	---	13.5	13.0	13.5
17	20.5	19.0	20.0	27.0	25.0	26.0	---	---	---	13.5	13.0	13.0
18	22.0	20.0	21.0	27.5	26.5	27.0	---	---	---	14.5	13.0	14.0
19	---	---	---	27.5	26.0	26.5	23.5	23.0	23.5	12.5	12.0	12.5
20	24.5	23.5	24.0	27.0	25.5	26.0	23.5	22.0	23.0	13.0	12.0	12.5
21	---	---	---	26.0	25.0	25.5	22.0	21.0	21.5	13.5	12.5	13.0
22	24.0	22.5	23.5	26.5	25.0	26.0	22.0	20.5	21.0	14.5	12.0	13.0
23	---	---	---	26.5	25.5	26.0	21.0	19.5	20.5	13.0	11.5	12.5
24	---	---	---	26.5	26.0	26.0	21.0	19.5	20.5	16.0	12.0	13.0
25	---	---	---	26.5	25.0	25.5	21.0	19.0	20.0	18.0	15.5	16.5
26	---	---	---	26.5	24.5	25.5	21.0	20.0	20.5	18.5	16.0	17.5
27	---	---	---	25.5	24.0	24.5	20.0	19.0	19.5	18.5	11.5	18.0
28	25.5	24.0	25.0	26.0	24.5	25.5	19.0	18.0	18.5	18.5	18.0	18.0
29	25.5	23.5	24.5	26.0	24.5	25.5	19.0	18.0	18.5	18.0	16.5	17.5
30	23.5	21.5	22.0	26.5	25.0	26.0	19.0	18.0	18.5	17.0	16.0	16.5
31	---	---	---	---	---	---	20.5	19.0	19.5	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	11.5	10.6	11.0	12.4	12.2	12.3	13.4	12.7	13.0	13.0	12.5	12.8
2	11.4	10.0	11.0	12.1	11.3	11.7	13.1	13.0	13.1	13.2	12.6	12.8
3	11.0	10.6	10.8	12.6	11.8	12.2	13.1	12.9	13.0	13.0	12.7	12.8
4	11.0	9.9	10.4	12.6	12.3	12.5	13.0	12.6	12.8	13.0	12.7	12.8
5	9.9	8.8	9.4	12.4	12.0	12.2	12.9	12.5	12.8	13.1	12.7	13.0
6	8.8	8.2	8.6	12.2	11.9	12.0	13.0	12.5	12.6	13.2	12.8	13.0
7	8.2	7.3	8.0	12.7	12.0	12.4	12.8	12.5	12.6	13.3	12.8	13.1
8	10.8	10.2	10.5	13.0	12.6	12.8	12.8	12.3	12.6	13.2	12.7	13.0
9	11.3	10.0	10.7	13.4	13.0	13.2	13.0	11.2	12.2	13.1	12.3	12.6
10	11.5	11.0	11.3	13.7	13.3	13.5	---	---	---	12.8	12.2	12.4
11	12.4	11.8	12.1	13.9	13.7	13.8	---	---	---	12.7	12.0	12.4
12	12.0	11.6	11.8	13.8	13.5	13.6	---	---	---	12.8	12.0	12.5
13	11.8	11.6	11.7	---	---	---	13.7	13.3	13.6	12.8	12.4	12.6
14	11.7	11.0	11.5	---	---	---	13.6	13.3	13.4	12.7	12.4	12.5
15	11.0	10.7	10.8	---	---	---	13.3	13.0	13.1	13.0	12.3	12.7
16	11.1	10.6	10.9	---	---	---	13.2	12.9	13.0	13.0	12.5	12.7
17	11.2	10.8	11.0	---	---	---	13.4	12.8	13.1	12.9	12.5	12.7
18	11.0	10.5	10.8	13.4	13.1	13.2	13.3	12.9	13.1	13.1	12.5	12.9
19	10.7	9.9	10.4	13.6	13.0	13.3	13.3	12.8	13.0	13.0	12.5	12.7
20	11.9	10.0	10.9	14.4	13.6	14.0	13.2	12.8	13.0	12.7	12.5	12.6
21	11.7	11.3	11.5	14.8	14.2	14.3	13.2	12.8	13.0	12.6	12.4	12.5
22	11.6	11.4	11.5	14.9	13.9	14.1	13.1	12.8	13.0	12.7	12.5	12.6
23	11.0	10.5	10.8	14.1	13.9	14.0	13.0	12.6	12.8	13.0	12.5	12.9
24	11.1	10.5	10.8	14.2	13.7	14.1	13.1	12.6	12.9	13.0	12.3	12.7
25	11.0	10.7	10.9	14.3	13.5	13.9	13.4	13.0	13.2	13.1	12.4	12.6
26	10.9	10.6	10.8	14.2	13.4	13.5	13.1	12.7	12.9	13.4	12.9	13.2
27	11.7	10.7	11.3	13.7	13.3	13.5	13.1	12.6	12.9	13.2	12.7	13.1
28	11.6	11.2	11.4	13.8	13.1	13.5	13.3	12.9	13.1	13.0	12.7	12.8
29	12.0	11.2	11.6	13.3	12.9	13.1	13.2	12.6	12.9	13.5	12.5	13.0
30	12.2	11.7	12.0	13.0	12.7	12.8	13.3	12.7	13.0	13.7	13.0	13.4
31	12.7	12.0	12.3	---	---	---	13.2	12.6	12.9	13.9	13.4	13.6
MONTH	12.7	7.3	10.9	---	---	---	---	---	---	13.9	12.0	12.8
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	13.5	12.7	13.4	14.1	13.1	13.6	13.7	13.1	13.4	10.6	9.7	10.2
2	13.5	12.5	13.0	14.0	13.1	13.4	14.2	13.1	13.6	10.2	9.4	9.6
3	13.6	13.0	13.4	14.4	13.5	14.0	---	---	---	9.9	9.5	9.7
4	---	---	---	14.1	13.2	13.7	---	---	---	9.9	8.2	9.0
5	---	---	---	13.9	13.4	13.7	---	---	---	10.2	8.1	9.1
6	13.7	13.4	13.5	14.7	13.7	14.1	---	---	---	10.0	8.5	9.3
7	13.7	13.2	13.5	14.7	13.8	14.2	---	---	---	10.9	10.0	10.5
8	13.7	13.3	13.5	14.4	13.5	13.9	13.6	13.2	13.4	10.7	9.5	10.1
9	14.2	13.6	13.9	13.9	13.1	13.5	---	---	---	11.2	10.2	10.8
10	14.3	13.6	14.1	13.6	13.1	13.3	---	---	---	11.3	10.9	11.2
11	14.4	13.5	14.1	13.7	13.2	13.5	---	---	---	11.1	10.2	10.8
12	14.0	13.3	13.7	13.9	13.2	13.5	---	---	---	10.2	9.5	9.7
13	14.0	13.3	13.7	14.1	13.3	13.7	---	---	---	9.5	8.7	9.1
14	13.7	13.2	13.5	14.1	13.5	13.8	---	---	---	8.7	7.6	8.2
15	13.8	13.0	13.4	14.1	13.4	13.8	---	---	---	7.6	6.4	7.0
16	13.7	12.9	13.3	14.3	13.9	14.1	---	---	---	---	---	---
17	13.5	12.8	13.1	14.8	13.8	14.3	---	---	---	---	---	---
18	13.3	12.7	13.1	14.5	13.7	14.1	---	---	---	---	---	---
19	13.3	12.7	13.0	15.2	14.4	14.8	---	---	---	---	---	---
20	14.2	13.2	13.7	15.6	14.0	15.2	---	---	---	---	---	---
21	---	---	---	15.7	14.2	15.2	---	---	---	9.9	9.2	9.6
22	---	---	---	15.2	14.2	14.7	11.8	11.2	11.5	10.0	9.7	9.9
23	---	---	---	15.2	13.6	14.7	11.5	10.8	11.2	10.3	9.3	9.8
24	14.6	13.9	14.1	15.4	14.4	14.8	10.9	10.5	10.7	10.3	9.8	10.0
25	14.6	13.8	14.1	14.9	14.1	14.5	11.3	10.3	10.8	10.4	9.8	10.1
26	14.2	12.8	13.5	15.0	13.6	14.1	11.0	10.2	10.7	10.2	9.5	10.0
27	13.7	12.8	13.2	14.3	13.7	14.0	10.4	9.9	10.2	9.9	9.2	9.5
28	14.1	13.6	13.8	14.0	13.3	13.5	10.0	9.3	9.5	10.2	9.0	9.6
29	---	---	---	13.6	12.9	13.3	10.3	9.8	10.1	10.1	9.2	9.6
30	---	---	---	13.6	12.9	13.0	11.0	9.8	10.4	10.0	8.8	9.4
31	---	---	---	13.6	12.8	13.3	---	---	---	9.5	8.5	9.1
MONTH	---	---	---	15.7	12.8	14.0	---	---	---	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05288550 MISSISSIPPI RIVER AT FRIDLEY, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	8.9	8.0	8.3	8.3	7.9	8.2	---	---	---	---	---	---
2	8.4	6.6	7.5	8.9	7.8	8.4	8.3	7.7	7.9	9.2	8.7	9.0
3	---	---	---	8.5	8.0	8.3	8.0	7.1	7.5	9.4	9.0	9.2
4	9.1	8.0	8.6	8.1	7.1	7.8	---	---	---	8.2	7.7	8.0
5	9.3	8.7	8.9	7.7	7.1	7.4	8.5	7.4	8.1	10.0	7.6	9.2
6	9.1	8.1	8.8	7.6	7.0	7.3	8.2	6.5	7.3	9.4	9.2	9.2
7	9.1	8.6	8.8	8.7	7.1	7.9	---	---	---	9.4	8.6	9.2
8	9.1	8.5	8.8	8.3	7.6	8.0	7.9	6.5	6.9	10.0	8.5	9.3
9	9.3	8.5	8.8	8.3	7.6	8.0	---	---	---	10.0	8.8	9.3
10	8.8	8.3	8.6	8.0	7.4	7.7	8.0	6.3	7.0	9.3	8.6	8.9
11	8.6	8.2	8.4	7.6	6.8	7.2	---	---	---	9.9	9.2	9.4
12	9.2	8.6	8.8	7.5	6.7	6.9	---	---	---	10.1	8.5	9.9
13	9.9	8.7	9.2	7.3	6.7	7.1	---	---	---	10.4	9.8	10.0
14	9.4	8.7	9.1	7.4	6.7	7.2	---	---	---	---	---	---
15	9.0	8.0	8.6	7.4	6.6	7.1	---	---	---	10.1	9.7	9.9
16	10.4	7.9	9.3	8.5	6.6	7.6	8.1	6.1	6.8	11.3	9.9	10.9
17	10.1	9.2	9.7	8.1	7.0	7.7	7.1	6.1	6.6	10.9	10.5	10.7
18	9.6	8.7	9.2	7.7	6.9	7.4	---	---	---	10.7	9.9	10.3
19	9.1	8.4	8.9	7.9	7.2	7.6	8.4	7.2	7.8	10.2	9.7	9.9
20	8.5	8.1	8.3	8.2	7.3	7.7	7.8	6.9	7.2	9.9	9.5	9.7
21	---	---	---	8.9	7.4	8.2	7.9	7.2	7.5	9.5	8.3	8.8
22	8.1	7.8	8.0	9.0	7.2	8.1	7.4	6.8	7.2	10.5	9.0	9.4
23	---	---	---	8.6	7.9	8.3	7.4	7.0	7.2	9.7	9.3	9.5
24	---	---	---	7.8	7.5	7.6	7.0	6.8	7.0	9.8	9.5	9.7
25	---	---	---	8.6	7.4	7.9	6.9	6.3	6.7	9.5	8.5	9.0
26	---	---	---	8.3	7.9	8.1	8.0	6.1	7.3	9.8	8.2	9.1
27	---	---	---	8.2	7.7	7.9	8.3	7.2	8.1	9.4	9.0	9.3
28	8.1	7.6	7.9	8.8	7.3	8.2	8.4	7.8	8.1	10.0	9.0	9.6
29	7.6	7.1	7.4	8.6	8.1	8.3	9.4	7.6	8.2	10.0	9.3	9.6
30	8.7	7.0	7.9	8.7	7.8	8.3	8.8	8.1	8.4	9.5	9.3	9.4
31	---	---	---	---	---	---	8.3	7.5	8.0	---	---	---

## MINNESOTA RIVER BASIN

05291000 WHETSTONE RIVER NEAR BIG STONE CITY, SD

LOCATION.--Lat 45°17'32", long 96°29'14", in SE¼ sec.18, T.121 N., R.46 W., Grant County, Hydrologic Unit 07020001, on right bank 20 ft downstream from former highway bridge site, 1.5 mi west of Big Stone City, and 4.5 mi upstream from Big Stone Lake.

DRAINAGE AREA.--389 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March 1910 to November 1912 (no winter records), and March 1931 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 895: Drainage area. WSP 1308: 1932(M), 1935(M).

GAGE.--Water-stage recorder. Datum of gage is 996.96 ft adjustment of 1912. Mar. 8, 1910, to Nov. 30, 1912, nonrecording gage 2 mi downstream at different datum. Mar. 18, 1931, to May 3, 1939, nonrecording gage, at site 20 ft upstream at present datum. May 4, 1939, to Nov. 8, 1952, water-stage recorder at site 80 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 9 to Mar. 23 and June 30. Records good except those for period with ice effect, Nov. 9 to Mar. 23, which are fair.

AVERAGE DISCHARGE.--55 years (water years 1932-86), 50.7 ft<sup>3</sup>/s, 1.77 in/yr, 36,730 acre-ft/yr; median of yearly mean discharges, 35 ft<sup>3</sup>/s, 1.22 in/yr, 25,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,870 ft<sup>3</sup>/s, Apr. 8, 1969, gage height, 14.32 ft from flood-mark; no flow at times in most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage known, about 26 ft in June 1919, present site and datum, from information by local resident, discharge 29,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharge above base of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 9	1930	296	a4.96	Apr. 19	1515	2,350	9.13
Mar. 18	2200	575	a6.17	Apr. 29	1230	593	5.32
Mar. 24	0015	3,260	10.46	May 10	0400	2,380	9.18
Mar. 29	2145	1,840	8.27	May 27	1430	274	4.03
Apr. 5	2230	1,210	7.00	June 12	0845	1,440	7.49
Apr. 15	1120	*4,730	*11.89	July 18	0300	234	3.80

a - Backwater from ice

Minimum, 0.86 ft<sup>3</sup>/s, Nov. 10; gage height, 1.15 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.9	8.1	8.8	10	9.4	9.3	843	345	141	50	57	22
2	5.6	8.8	9.7	10	9.4	13	717	296	126	49	58	21
3	4.6	7.8	10	10	9.4	18	575	263	117	46	53	38
4	6.1	6.9	11	10	9.4	26	824	241	110	42	47	53
5	6.1	6.9	12	10	9.4	32	1020	225	101	37	44	49
6	7.5	7.2	12	10	9.4	48	1020	202	101	33	40	45
7	8.4	8.1	12	10	9.4	46	669	183	105	30	52	38
8	7.8	6.6	12	10	9.4	42	486	269	105	29	49	31
9	6.9	6.1	12	10	9.4	160	397	1460	104	33	50	27
10	6.4	7.5	12	9.9	9.4	195	336	1980	104	36	58	27
11	6.4	7.2	11	9.8	9.4	188	292	1040	237	100	51	25
12	13	7.2	11	9.8	9.3	188	256	697	1170	104	49	25
13	13	6.6	11	9.8	9.3	179	249	461	629	93	46	25
14	21	6.6	11	9.7	9.3	149	581	359	416	85	46	25
15	16	6.1	11	9.7	9.3	131	3800	300	278	72	47	26
16	16	6.6	11	9.7	9.3	150	1880	269	206	162	46	29
17	15	6.6	11	9.6	9.3	213	1120	228	178	208	41	42
18	13	6.4	11	9.6	9.3	454	808	205	149	220	36	52
19	13	6.9	11	9.6	9.3	404	1850	188	130	142	34	60
20	12	6.4	11	9.6	9.3	413	1390	173	115	92	35	89
21	12	5.6	11	9.6	9.3	284	757	159	106	72	37	134
22	10	6.1	11	9.5	9.3	460	549	146	108	63	36	154
23	9.1	6.1	11	9.5	9.3	2250	440	137	141	57	38	136
24	8.8	6.4	11	9.5	9.3	2530	396	145	107	60	41	123
25	8.8	6.6	11	9.5	9.3	1750	364	178	89	58	41	112
26	8.8	6.9	10	9.5	9.3	1460	371	225	80	56	39	111
27	8.4	6.9	10	9.5	9.3	1350	392	270	74	55	61	127
28	8.4	7.2	10	9.5	9.3	1020	449	258	68	53	48	126
29	8.4	7.5	10	9.4	---	1490	556	214	63	50	37	99
30	8.1	7.8	10	9.4	---	1490	435	181	55	63	29	84
31	8.1	---	10	9.4	---	1140	---	159	---	61	24	---
TOTAL	303.6	207.7	336.5	301.1	261.5	18282.3	23822	11456	5513	2311	1370	1955
MEAN	9.79	6.92	10.9	9.71	9.34	590	794	370	184	74.5	44.2	65.2
MAX	21	8.8	12	10	9.4	2530	3800	1980	1170	220	61	154
MIN	4.6	5.6	8.8	9.4	9.3	9.3	249	137	55	29	24	21
CFSM	.03	.02	.03	.03	.02	1.52	2.04	.95	.47	.19	.11	.17
IN	.03	.02	.03	.03	.03	1.75	2.28	1.10	.53	.22	.13	.19
AC-FT	602	412	667	597	519	36260	47250	22720	10940	4580	2720	3880

CAL YR 1985	TOTAL	22219.8	MEAN	60.9	MAX	3340	MIN	2.7	CFSM	.16	IN	2.12	AC-FT	44070
WTR YR 1986	TOTAL	66119.7	MEAN	181	MAX	3800	MIN	4.6	CFSM	.47	IN	6.32	AC-FT	131100

## MINNESOTA RIVER BASIN

05291000 WHETSTONE RIVER NEAR BIG STONE CITY, SD--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1960-62, 1967 to 69, 1974 to current year.

PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1973 to September 1981, March to August each year, 1982 to current year.

SUSPENDED-SEDIMENT DISCHARGE: October 1973 to September 1981, March to August each year, 1982 to current year.

REMARKS.--Daily sediment concentrations were estimated on the basis of water records and daily sediment samples.

Water temperature was obtained when sediment samples were collected.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum daily, 34.0°C July 7, 1974; minimum daily, 0.0°C many days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 2,540 mg/L, Mar. 27, 1979; minimum daily mean, 0 mg/L, July 30, 31, Aug. 1-7, 24-26, 1976.

SEDIMENT LOADS: Maximum daily, 5,700 tons, Mar. 31, 1982; minimum daily, 0 ton, July 30, 31, Aug. 1-7, 24-26, 1976.

EXTREMES FOR CURRENT PERIOD.--March to August 1986:

WATER TEMPERATURES: Maximum daily, 33.0°C, July 17; minimum daily, 0.0°C, many days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 489 mg/L, Apr. 15; minimum daily mean, 12 mg/L, Aug. 1, 2.

SEDIMENT LOADS: Maximum daily, 5,020 tons, Apr. 15; minimum daily, 1.7 ton, Mar. 8, Aug. 19, 20.

TEMPERATURE, WATER, DEGREES CENTIGRADE, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
ONCE DAILY VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	8.0	12.0	26.0	23.0	27.0	---
2	---	---	---	---	---	9.0	9.0	15.0	25.0	28.0	27.0	---
3	---	---	---	---	---	---	---	---	26.0	29.0	27.0	---
4	---	---	---	---	---	---	6.0	20.0	23.0	31.0	29.0	---
5	---	---	---	---	---	---	6.0	20.0	26.0	25.0	27.0	---
6	---	---	---	---	---	---	10.0	15.0	23.0	29.0	27.0	---
7	---	---	---	---	---	---	10.0	14.0	23.0	28.0	26.0	---
8	---	---	---	---	---	2.0	13.0	12.0	25.0	25.0	28.0	---
9	---	---	---	---	---	2.0	13.0	13.0	27.0	28.0	26.0	---
10	---	---	---	---	---	2.0	15.0	16.0	20.0	21.0	22.0	---
11	---	---	---	---	---	1.0	15.0	22.0	19.0	25.0	24.0	---
12	---	---	---	---	---	2.0	12.0	22.0	18.0	24.0	26.0	---
13	---	---	---	---	---	2.0	9.0	23.0	24.0	21.0	24.0	---
14	---	---	---	---	---	3.0	6.0	23.0	25.0	30.0	26.0	---
15	---	---	---	---	---	2.0	4.0	20.0	26.0	29.0	28.0	---
16	---	---	---	---	---	2.0	4.0	18.0	24.0	32.0	29.0	---
17	---	---	---	---	---	2.0	9.0	18.0	25.0	33.0	26.0	---
18	---	---	---	---	---	3.0	9.0	19.0	28.0	28.0	26.0	---
19	---	---	---	---	---	1.0	9.0	20.0	30.0	25.0	29.0	---
20	---	---	---	---	---	2.0	10.0	20.0	25.0	19.0	26.0	---
21	---	---	---	---	---	4.0	10.0	20.0	30.0	27.0	23.0	---
22	---	---	---	---	---	3.0	13.0	20.0	25.0	29.0	20.0	---
23	---	---	---	---	---	2.0	15.0	15.0	25.0	31.0	24.0	---
24	---	---	---	---	---	4.0	16.0	16.0	27.0	28.0	20.0	---
25	---	---	---	---	---	5.0	12.0	16.0	28.0	28.0	24.0	---
26	---	---	---	---	---	5.0	11.0	19.0	27.0	29.0	21.0	---
27	---	---	---	---	---	4.0	9.0	24.0	29.0	27.0	22.0	---
28	---	---	---	---	---	5.0	11.0	25.0	27.0	30.0	21.0	---
29	---	---	---	---	---	9.0	15.0	27.0	21.0	26.0	20.0	---
30	---	---	---	---	---	9.0	15.0	28.0	20.0	27.0	24.0	---
31	---	---	---	---	---	9.0	---	28.0	---	26.0	25.0	---
MEAN	---	---	---	---	---	---	---	---	24.9	27.1	25.0	---
MAX	---	---	---	---	---	---	---	---	30.0	33.0	29.0	---
MIN	---	---	---	---	---	---	---	---	18.0	19.0	20.0	---

## MINNESOTA RIVER BASIN

05291000 WHETSTONE RIVER NEAR BIG STONE CITY, SD--Continued

SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MEAN CONCENTRATION (MG/L)		MEAN CONCENTRATION (MG/L)		MEAN CONCENTRATION (MG/L)		MEAN CONCENTRATION (MG/L)		MEAN CONCENTRATION (MG/L)		MEAN CONCENTRATION (MG/L)	
	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	LOADS (T/DAY)	
OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		
1										117	2.9	
2										115	4.0	
3										88	4.3	
4										71	5.0	
5										51	4.4	
6												
7										36	4.7	
8										21	2.6	
9										15	1.7	
10										73	32	
11										87	46	
12												
13										27	14	
14										33	17	
15										26	13	
16										32	13	
17										17	6.0	
18												
19										20	8.1	
20										38	22	
21										117	143	
22										73	80	
23										68	76	
24												
25										75	58	
26										174	216	
27										373	2270	
28										185	1260	
29										178	841	
30												
31										151	595	
TOTAL										182	663	
										98	270	
										171	688	
										195	784	
										127	391	
										---	8535.7	
APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		
1	85	193	46	43	37	14	90	12	12	1.8		
2	117	227	39	31	29	9.9	67	8.9	12	1.9		
3	96	149	30	21	51	16	56	7.0	13	1.9		
4	101	225	17	11	90	27	89	10	29	3.7		
5	90	248	17	10	62	17	91	9.1	28	3.3		
6	89	245	30	16	50	14	45	4.0	31	3.3		
7	97	175	48	24	91	26	40	3.2	21	2.9		
8	59	77	42	31	93	26	46	3.6	15	2.0		
9	44	47	328	1290	72	20	39	3.5	19	2.6		
10	93	84	248	1330	72	20	68	6.6	18	2.8		
11	67	53	116	326	65	42	113	31	17	2.3		
12	23	16	49	92	148	468	34	9.5	15	2.0		
13	55	37	48	60	53	90	23	5.8	15	1.9		
14	133	209	35	34	33	37	29	6.7	20	2.5		
15	489	5020	24	19	53	40	30	5.8	16	2.0		
16	223	1130	35	25	60	33	44	19	20	2.5		
17	97	293	44	27	48	23	32	18	25	2.8		
18	75	164	56	31	45	18	45	27	21	2.0		
19	270	1350	63	32	72	25	47	18	18	1.7		
20	143	537	60	28	72	22	37	9.2	18	1.7		
21	77	157	46	20	92	26	54	10	26	2.6		
22	44	65	39	15	83	24	69	12	30	2.9		
23	32	38	41	15	54	21	86	13	30	3.1		
24	35	37	36	14	33	9.5	51	8.3	32	3.5		
25	37	36	64	31	84	20	35	5.5	33	3.7		
26	32	32	79	48	102	22	31	4.7	36	3.8		
27	48	51	80	58	96	19	24	3.6	105	17		
28	63	76	71	49	102	19	26	3.7	77	10		
29	63	95	58	34	99	17	35	4.7	44	4.4		
30	64	75	58	28	98	15	26	4.4	53	4.1		
31	---	---	44	19	---	---	15	2.5	73	4.7		
TOTAL	---	11141	---	3812	---	1180.4	---	290.3	---	107.4		
TOTAL LOAD FOR PERIOD.--MARCH TO AUGUST:					25066.8	TONS.						

## MINNESOTA RIVER BASIN

05291000 WHETSTONE RIVER NEAR BIG STONE CITY, SD--Continued

## PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	TEMPER- ATURE WATER (DEG C) (00010)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM (70337)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM (70338)	SED. SUSP. FALL DIAM. % FINER THAN .016 MM (70340)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM (70342)	SED. SUSP. FALL DIAM. % FINER THAN .125 MM (70343)	SED. SUSP. FALL DIAM. % FINER THAN .250 MM (70344)	SED. SUSP. FALL DIAM. % FINER THAN .500 MM (70345)
APR 15...	1345	4570	3.0	537	53	62	76	88	91	99	100

## MINNESOTA RIVER BASIN

05291500 BIG STONE LAKE AT ORTONVILLE, MN

LOCATION.--Lat 45°18'18", long 96°26'57", in NW¼SW¼ sec.9, T.121 N., R.46 W., Big Stone County, Hydrologic Unit 07020001, at powerplant intake at west edge of Ortonville, 0.5 mi north of concrete dam at outlet, 0.5 mi southwest of Ortonville.

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

GAGE.--Nonrecording gage read once a day. Datum of gage is 957.69 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 17, 1947, nonrecording gage at site 0.5 mi south at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site 0.5 mi south at same datum. Sept. 21, 1959, to June 30, 1963, supplementary nonrecording gage read once daily, at present site and datum.

REMARKS.--Natural lake with concrete dam at outlet. Fixed crest of dam is at 5.95 ft, with one 5 ft and two 2.5 ft gates with lowest sill at 0.71 ft. Silt barrier dam 700 ft upstream in outlet channel of lake completed July 7, 1958; crest at 5.9 ft. Supplementary nonrecording gage readings used for stages below crest of silt barrier to June 30, 1963. Water level subject to fluctuation caused by wind action.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 12.73 ft, Apr. 17, 1952; minimum observed, 3.53 ft, Mar. 2, 1957 (strong upstream wind in channel). Minimum observations of 3.10 ft, Mar. 2, 1940, and 2.20 ft, Nov. 20, 1940, at spillway site are the result of blockage of channel to spillway by ice and snow and do not represent lake elevations.

EXTREMES FOR CURRENT YEAR.--Maximum gage height observed, 8.90 ft, Mar. 30; minimum observed, 6.80 ft, Oct. 2, 7, Nov. 5 (respective upstream wind velocities of 8, 12, and 20 mph).

## GAGE HEIGHT, IN FEET, OCTOBER 1985 TO SEPTEMBER 1986

Oct. 31 .....	6.90	Feb. 28 .....	6.90	June 30 .....	7.20
Nov. 30 .....	7.20	Mar. 31 .....	8.88	July 31 .....	7.60
Dec. 31 .....	7.30	Apr. 30 .....	7.70	Aug. 31 .....	7.25
Jan. 31 .....	7.10	May 31 .....	7.40	Sept. 30 .....	7.66

NOTE.--Gage-height record other than that shown above is available in the District office.

## MINNESOTA RIVER BASIN

05292000 MINNESOTA RIVER AT ORTONVILLE, MN

LOCATION.--Lat 45°17'44", long 96°26'38", in NE¼ sec.16, T.121 N., R.46 W., Big Stone County, Hydrologic Unit 07020001, on left bank 400 ft downstream from bridge on U.S. Highway 12 and 1,300 ft downstream from dam at outlet of Big Stone Lake, at Ortonville.

DRAINAGE AREA.--1,160 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--February 1938 to current year.

REVISED RECORDS.--WSP 895: 1939. WSP 1508: 1942 (yearly mean).

GAGE.--Water-stage recorder. Datum of gage is 956.38 ft above National Geodetic Vertical Datum of 1929. Prior to Mar. 31, 1939, nonrecording gage on downstream side of dam 1,300 ft upstream at datum 1.31 ft higher.

REMARKS.--Estimated daily discharges: Nov. 19 to Mar. 11. Records good except those for period with ice effect, Nov. 19 to Mar. 11, which are fair. Some regulation by Big Stone Lake (station 05291500).

AVERAGE DISCHARGE.--48 years, 112 ft<sup>3</sup>/s, 81,140 acre-ft/yr; median of yearly mean discharges, 86 ft<sup>3</sup>/s, 62,300 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,060 ft<sup>3</sup>/s, Apr. 13, 1952, gage height, 12.92 ft; no flow Dec. 13, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,570 ft<sup>3</sup>/s, Apr. 19, gage height, 9.28 ft; minimum, 0.14 ft<sup>3</sup>/s, Oct. 1, gage height, 0.98 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.57	4.2	2.8	10	112	38	2290	1760	238	176	172	66
2	.69	3.4	3.1	9.0	112	38	2220	1510	232	171	170	66
3	.92	3.8	3.3	8.2	112	38	2170	1300	195	143	167	66
4	3.8	3.4	2.9	7.5	112	38	2150	1240	141	125	166	65
5	2.5	3.4	2.8	7.0	110	38	2170	1290	140	124	99	60
6	2.3	3.4	2.8	6.8	105	40	2160	1410	139	124	32	57
7	2.5	3.0	2.5	6.8	87	49	2100	975	141	90	76	51
8	3.4	3.0	2.5	6.8	87	40	2090	616	138	56	127	46
9	4.6	3.0	2.5	32	87	39	1880	911	134	55	127	45
10	4.6	3.0	2.5	134	87	39	1740	1590	136	53	127	44
11	4.6	3.0	2.7	85	87	120	1620	1680	182	49	125	40
12	7.7	3.0	3.0	57	87	272	1700	1680	231	49	104	38
13	.47	3.0	3.0	48	87	270	1280	1620	311	48	78	35
14	13	3.0	2.3	42	87	270	1520	1490	385	46	85	33
15	9.8	3.0	2.2	41	87	270	1900	1460	384	46	90	33
16	5.5	3.0	1.6	40	87	270	1480	1450	385	100	87	32
17	3.8	3.0	1.9	40	87	272	1810	1340	375	183	86	56
18	1.0	3.0	2.0	40	87	278	2060	1180	354	184	85	94
19	.76	3.0	2.0	70	84	512	2360	667	355	184	82	130
20	.57	3.0	2.0	168	82	685	2410	255	353	183	80	161
21	.42	2.8	2.0	132	84	812	2330	204	353	181	78	176
22	.42	3.0	2.1	122	87	855	2150	160	357	180	77	211
23	1.0	2.8	2.4	118	87	1150	2060	159	355	178	76	211
24	1.3	2.8	3.2	113	87	1650	2100	159	348	178	75	209
25	1.1	2.8	10	112	87	2070	1930	159	344	177	75	210
26	1.1	2.8	9.9	112	87	1910	1870	158	344	176	74	212
27	1.8	2.8	9.6	114	66	1790	1880	158	283	176	72	213
28	6.6	2.8	9.8	142	38	1710	1880	191	224	175	68	253
29	6.0	2.8	10	132	---	2370	1700	241	220	173	66	328
30	5.5	2.8	12	130	---	2370	1790	241	199	174	66	390
31	4.2	---	11	128	---	2350	---	240	---	174	67	---
TOTAL	102.52	91.8	132.4	2214.1	2496	22653	58800	27494	7976	4131	2959	3631
MEAN	3.31	3.06	4.27	71.4	89.1	731	1960	887	266	133	95.5	121
MAX	13	4.2	12	168	112	2370	2410	1760	385	184	172	390
MIN	.42	2.8	1.6	6.8	38	38	1280	158	134	46	32	32
CFSM	.003	.003	.004	.06	.08	.63	1.69	.77	.23	.12	.08	.10
IN.	.00	.00	.00	.07	.08	.73	1.89	.88	.26	.13	.09	.12
AC-FT	203	182	263	4390	4950	44930	116600	54530	15820	8190	5870	7200

CAL YR 1985 TOTAL 36526.32 MEAN 100 MAX 1810 MIN .18 CFSM .09 IN 1.17 AC-FT 72450  
WTR YR 1986 TOTAL 132680.82 MEAN 364 MAX 2410 MIN .42 CFSM .31 IN 4.25 AC-FT 263200

## MINNESOTA RIVER BASIN

05293000 YELLOW BANK RIVER NEAR ODESSA, MN

LOCATION.--Lat 45°13'35", long 96°21'12", in SE¼SE¼ sec.1, T.120 N., R.46 W., Lac qui Parle County, Hydrologic Unit 07020001, on left bank 150 ft downstream from highway bridge, 2.5 mi southwest of Odessa, and 4.5 mi upstream from mouth.

DRAINAGE AREA.--398 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

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

REVISED RECORDS.--WSP 1388: 1947(M), 1950.

GAGE.--Water-stage recorder. Datum of gage is 953.34 ft above National Geodetic Vertical Datum of 1929 (U.S. Army Corps of Engineers bench mark). Prior to Aug. 28, 1940, nonrecording gage at site 150 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 10 to Mar. 26. Records good except those for period with ice effect, Nov. 10 to Mar. 26, which are fair.

AVERAGE DISCHARGE.--47 years, 61.0 ft<sup>3</sup>/s, 2.08 in/yr, 44,190 acre-ft/yr; median of yearly mean discharges, 49 ft<sup>3</sup>/s, 1.67 in/yr, 35,500 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,970 ft<sup>3</sup>/s, Apr. 9, 1969, gage height, 19.07 ft, from floodmark; no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 24	1645	3,100	a13.23	Apr. 20	0115	2,020	9.89
Mar. 30	0545	1,700	9.79	May 10	1615	2,340	10.79
Apr. 6	0715	1,990	10.35	July 11	2315	322	4.76
Apr. 16	0245	*4,070	*14.44	July 20	0115	479	5.44

a-Backwater from ice.

Minimum discharge, 18 ft<sup>3</sup>/s, Dec. 5-22; minimum gage height, 2.43 ft, Nov. 15.DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	60	23	19	20	25	1250	436	119	52	170	33
2	56	58	21	19	20	27	1080	373	106	51	175	32
3	55	56	20	19	20	30	920	322	97	49	139	32
4	55	54	19	19	20	31	1130	284	87	46	121	32
5	60	54	18	19	20	32	1550	254	81	43	105	31
6	67	57	18	19	20	31	1870	222	77	41	89	30
7	73	55	18	19	20	30	1390	195	84	39	84	29
8	73	52	18	19	20	39	972	281	81	39	73	28
9	81	49	18	19	19	58	700	822	81	39	67	27
10	73	45	18	20	19	110	550	2040	81	38	62	27
11	68	42	18	20	19	135	467	1700	124	139	56	27
12	78	43	18	20	19	115	403	1190	168	234	56	27
13	88	43	18	20	19	84	359	859	203	148	52	29
14	107	43	18	20	19	78	545	629	159	121	52	29
15	120	38	18	20	19	83	2340	485	143	125	48	29
16	121	41	18	20	19	100	3240	393	126	156	45	30
17	109	35	18	20	19	135	1840	332	112	132	41	41
18	99	35	18	20	19	315	1320	291	101	109	40	65
19	92	36	18	20	19	610	1520	260	91	276	39	90
20	85	36	18	20	19	565	1810	233	82	439	41	126
21	81	35	18	20	19	780	1260	209	75	406	44	153
22	79	33	18	20	19	845	920	188	70	257	44	182
23	77	32	19	20	19	2120	701	170	65	176	46	170
24	76	31	19	20	19	2840	580	167	62	150	45	158
25	73	30	19	20	19	2080	537	176	60	144	43	147
26	71	29	19	20	20	1580	543	196	56	132	41	142
27	68	27	19	20	21	1600	502	204	53	119	41	132
28	66	26	19	20	23	1270	506	197	51	109	39	128
29	63	25	19	20	---	1450	600	177	49	97	37	105
30	61	24	19	20	---	1570	556	156	50	101	36	92
31	61	---	19	20	---	1470	---	136	---	119	35	---
TOTAL	2393	1224	578	611	547	20238	31961	13577	2794	4126	2006	2203
MEAN	77.2	40.8	18.6	19.7	19.5	653	1065	438	93.1	133	64.7	73.4
MAX	121	60	23	20	23	2840	3240	2040	203	439	175	182
MIN	55	24	18	19	19	25	359	136	49	38	35	27
CFSM	.19	.10	.05	.05	.05	1.64	2.68	1.10	.23	.33	.16	.18
IN.	.22	.11	.05	.06	.05	1.89	2.99	1.27	.26	.39	.19	.21
AC-FT	4750	2430	1150	1210	1080	40140	63390	26930	5540	8180	3980	4370

CAL YR 1985 TOTAL 41218.4 MEAN 113 MAX 2470 MIN 3.4 CFSM .28 IN 3.85 AC-FT 81760  
WTR YR 1986 TOTAL 82258.0 MEAN 225 MAX 3240 MIN 18 CFSM .57 IN 7.69 AC-FT 163200

## MINNESOTA RIVER BASIN

05293000 YELLOW BANK RIVER NEAR ODESSA, MN--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1961-62, 1974 to 1981, March to August each year, 1982 to current year.

PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1973 to September 1981, March to August each year, 1982 to current year.

SUSPENDED-SEDIMENT DISCHARGE: October 1973 to September 1981, March to August each year, 1982 to current year.

REMARKS.--Daily sediment concentrations were estimated on the basis of water records and daily sediment samples.  
Water temperature was obtained when sediment samples were collected.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum daily, 29.0°C, July 10, 1974, July 17, 1975; minimum daily, 0.0°C on many days during winter periods.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 906 mg/L, Apr. 15, 1986; minimum daily mean, no flow for several days during 1976, 1977, 1980.

SEDIMENT LOADS: Maximum daily, 5,720 tons, Apr. 15, 1986; minimum daily, no flow for several days during 1976, 1977, 1980.

EXTREMES FOR CURRENT PERIOD.--March to August 1986:

WATER TEMPERATURES: Maximum daily, 28.5°C, Aug. 20; minimum daily, 0.0°C on several days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 906 mg/L, Apr. 15; minimum daily mean, 9 mg/L, Mar. 9.

SEDIMENT LOADS: Maximum daily, 5,720 tons, Apr. 15; minimum daily, 1.4 tons, Mar. 9.

TEMPERATURE, WATER, DEGREES CENTIGRADE, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
INSTANTANEOUS VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	10.0	11.0	22.0	19.0	22.0	---
2	---	---	---	---	---	---	10.0	9.0	20.0	24.5	21.0	---
3	---	---	.0	---	---	2.0	8.0	12.0	20.0	21.5	21.0	---
4	---	---	---	---	---	---	6.0	16.0	18.0	21.0	21.0	---
5	---	---	---	---	---	---	7.0	18.0	21.0	27.0	22.0	---
6	---	---	---	---	---	---	9.0	15.0	---	24.5	23.0	---
7	---	---	---	---	---	---	11.0	12.0	20.0	23.0	22.0	---
8	---	---	---	---	---	---	11.0	12.0	21.0	23.0	21.5	---
9	---	---	---	---	---	3.0	10.0	13.0	19.0	21.5	21.0	---
10	---	---	---	---	---	2.0	9.0	17.0	21.0	24.0	22.0	---
11	---	---	---	---	---	1.0	11.0	19.0	19.0	20.5	18.0	---
12	---	---	---	---	---	2.0	9.0	20.0	18.0	20.0	20.0	---
13	---	---	---	---	---	2.0	8.0	18.0	18.0	20.0	21.0	---
14	---	---	---	---	---	3.0	8.0	18.0	19.0	20.5	23.5	---
15	---	---	---	---	---	3.0	5.0	17.0	24.0	24.0	24.0	---
16	---	---	---	---	---	2.0	5.5	16.0	20.0	26.0	23.0	---
17	---	---	---	---	---	2.0	8.0	15.0	19.0	27.0	26.0	---
18	---	---	---	---	---	1.0	9.0	15.0	21.0	28.0	22.0	---
19	---	---	---	---	---	2.0	9.0	14.0	26.0	25.0	22.0	---
20	---	---	---	---	---	1.0	11.0	15.0	26.0	24.0	28.5	---
21	---	---	---	---	---	1.0	9.0	15.0	25.0	24.0	19.0	---
22	---	---	---	---	---	2.0	8.0	15.0	25.0	24.0	20.0	---
23	---	---	---	---	---	1.0	10.0	17.0	23.0	25.0	17.0	---
24	---	---	---	---	.0	3.0	13.0	---	19.0	25.0	18.0	---
25	---	---	---	---	---	3.0	13.0	---	21.5	24.0	18.0	---
26	---	---	---	---	---	2.0	11.0	---	24.5	24.0	20.0	---
27	---	---	---	---	---	2.0	10.0	20.0	24.0	25.0	16.0	---
28	---	---	---	---	---	6.0	8.0	19.0	22.0	24.0	17.0	---
29	---	---	---	---	---	7.0	9.0	20.0	23.0	24.5	---	---
30	---	---	---	---	---	10.0	11.0	21.0	19.0	23.0	---	---
31	---	---	---	---	---	12.0	---	23.0	---	23.0	---	---
MEAN	---	---	---	---	---	---	9.22	---	---	23.5	---	---
MAX	---	---	---	---	---	---	13.0	---	---	28.0	---	---
MIN	---	---	---	---	---	---	5.0	---	---	19.0	---	---

## MINNESOTA RIVER BASIN

05293000 YELLOW BANK RIVER NEAR ODESSA, MN--Continued

SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)
	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
1											30	2.0
2											34	2.5
3											53	4.3
4											57	4.8
5											53	4.6
6											46	3.9
7											28	2.3
8											15	1.6
9											9	1.4
10											28	8.3
11											106	39
12											83	26
13											28	6.4
14											30	6.3
15											52	12
16											48	13
17											55	20
18											78	66
19											67	110
20											22	34
21											72	152
22											525	1200
23											663	3800
24											640	4910
25											513	2880
26											380	1620
27											313	1350
28											288	988
29											313	1230
30											303	1280
31											282	1120
TOTAL											---	20898.4

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1	263	888	66	78	95	31	152	21	113	52		
2	260	758	79	80	66	19	178	25	78	37		
3	348	864	48	42	78	20	138	18	60	23		
4	208	635	18	14	47	11	150	19	77	25		
5	242	1010	27	19	60	13	150	17	92	26		
6	283	1430	52	31	80	17	115	13	80	19		
7	182	683	83	44	80	18	109	11	118	27		
8	140	367	133	101	63	14	102	11	115	23		
9	150	283	534	1190	102	22	147	15	108	20		
10	121	180	612	3370	92	20	168	17	75	13		
11	116	146	205	941	132	44	408	153	92	14		
12	142	155	163	524	105	48	357	226	89	13		
13	114	111	127	295	100	55	116	46	78	11		
14	248	365	111	189	90	39	97	32	79	11		
15	906	5720	115	151	133	51	120	40	76	9.8		
16	502	4390	83	88	97	33	158	67	57	6.9		
17	352	1750	162	145	105	32	111	40	61	6.8		
18	322	1150	151	119	98	27	98	29	58	6.3		
19	336	1380	160	112	48	12	281	209	30	3.2		
20	305	1490	148	93	80	18	289	343	29	3.2		
21	142	483	132	74	62	13	173	190	60	7.1		
22	131	325	110	56	77	15	152	105	77	9.1		
23	140	265	110	50	93	16	132	63	47	5.8		
24	191	299	104	47	116	19	109	44	48	5.8		
25	143	207	98	47	102	17	83	32	58	6.7		
26	106	155	96	51	107	16	90	32	60	6.6		
27	84	114	91	50	115	16	67	22	73	8.1		
28	71	97	73	39	102	14	100	29	61	6.4		
29	118	191	75	36	115	15	110	29	58	5.8		
30	124	186	108	45	113	15	137	37	55	5.3		
31	---	---	98	36	---	---	139	45	53	5.0		
TOTAL	---	26077	---	8157	---	700	---	1980	---	421.9		

TOTAL LOAD FOR CURRENT PERIOD.--MARCH TO AUGUST: 58234.3 TONS

## MINNESOTA RIVER BASIN

05293000 YELLOW BANK RIVER NEAR ODESSA, MN--Continued

## PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	TEMPER- ATURE WATER (DEG C) (00010)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM (70337)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM (70338)	SED. SUSP. FALL DIAM. % FINER THAN .016 MM (70340)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM (70342)	SED. SUSP. FALL DIAM. % FINER THAN .125 MM (70343)	SED. SUSP. FALL DIAM. % FINER THAN .250 MM (70344)	SED. SUSP. FALL DIAM. % FINER THAN .500 MM (70345)
APR 15...	1615	3190	5.0	930	37	44	59	78	88	97	100

## MINNESOTA RIVER BASIN

## 05294000 POMME DE TERRE RIVER AT APPLETON, MN

LOCATION.--Lat 45°12'10", long 96°01'20", in SW 1/4 sec.14, T.120 N., R.43 W., Swift County, Hydrologic Unit 07020002, on left bank 60 ft upstream from bridge on U.S. Highway 59 and State Highway 119 at Appleton and 8 mi upstream from mouth.

DRAINAGE AREA.--905 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1931 to September 1935 (no winter records), October 1935 to current year. Prior to October 1953, published as "near Appleton."

REVISED RECORDS.--WSP 1308: 1931(M), 1937(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 978.00 ft above National Geodetic Vertical Datum of 1929. Prior to Dec. 22, 1952, nonrecording gage at site 4 mi upstream at datum 25.17 ft higher.

REMARKS.--Estimated daily discharges: Nov. 9 to Mar. 10. Records good except those for period with ice effect, Nov. 9 to Mar. 10, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

AVERAGE DISCHARGE.--51 years (water years 1936-86), 114 ft<sup>3</sup>/s, 1.71 in/yr, 82,590 acre-ft/yr; median of yearly mean discharge, 94 ft<sup>3</sup>/s, 1.41 in/yr, 68,100 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,520 ft<sup>3</sup>/s, Apr. 11, 1969, gage height, 13.78 ft; maximum gage height, 14.58 ft, Apr. 9, 1969 (backwater from ice); no flow for several periods.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 28	1800	*1,920	*8.51	July 18	2215	467	6.09
Apr. 16	0715	1,630	7.79	July 31	0600	541	6.22
Apr. 20	1130	1,630	7.84	Aug. 11	0915	405	5.94
May 10	1700	1,390	7.48	Aug. 24	1100	370	5.86
June 13	0015	654	6.47	Sept. 21	1415	536	6.20
June 23	2030	457	6.11				

Minimum discharge, 2.7 ft<sup>3</sup>/s, Nov. 10, gage height, 3.52 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	123	115	88	79	63	60	1710	980	416	294	481	276
2	123	113	79	79	64	62	1610	944	397	276	429	268
3	119	111	68	78	64	62	1580	879	373	256	385	275
4	123	108	78	78	64	64	1600	807	354	241	339	277
5	123	102	89	77	64	65	1730	736	335	226	304	272
6	125	102	94	76	64	67	1810	674	322	214	287	266
7	119	101	94	74	64	71	1700	633	319	205	296	258
8	111	102	93	71	64	75	1550	670	319	203	346	251
9	110	83	93	67	64	77	1480	861	306	209	374	248
10	110	34	90	66	62	82	1430	1300	313	206	382	246
11	113	56	88	65	61	84	1360	1300	396	240	396	246
12	121	89	87	64	60	86	1260	1160	585	309	368	242
13	150	104	87	64	60	88	1190	1060	620	313	346	235
14	152	99	86	64	60	88	1270	1020	536	308	340	231
15	148	86	86	63	60	88	1410	1030	473	305	344	235
16	148	97	86	63	60	90	1600	1010	417	337	336	262
17	146	94	85	63	60	92	1530	936	397	391	313	293
18	141	94	84	63	60	102	1480	848	381	405	294	327
19	137	65	84	63	60	108	1490	753	366	390	275	354
20	137	46	83	63	60	112	1590	679	355	360	288	384
21	133	77	82	63	60	121	1540	619	344	332	291	504
22	133	93	82	63	60	139	1460	571	357	302	289	502
23	131	94	82	63	60	200	1400	539	431	277	318	502
24	131	93	82	63	60	250	1320	528	430	278	362	483
25	129	95	87	63	60	418	1220	527	364	311	352	444
26	129	95	86	63	60	666	1130	525	324	309	358	430
27	125	95	83	63	60	1330	1030	519	302	278	350	424
28	123	94	81	63	61	1690	969	500	288	347	331	409
29	121	95	80	63	---	1680	960	471	276	441	314	401
30	119	93	80	63	---	1870	986	448	275	512	302	399
31	117	---	80	63	---	1760	---	428	---	525	289	---
TOTAL	3970	2725	2627	2073	1719	11747	42395	23955	11371	9600	10479	9944
MEAN	128	90.8	84.7	66.9	61.4	379	1413	773	379	310	338	331
MAX	152	115	94	79	64	1870	1810	1300	620	525	481	504
MIN	110	34	68	63	60	60	960	428	275	203	275	231
CFSM	.14	.10	.09	.07	.07	.42	1.56	.85	.42	.34	.37	.37
IN.	.16	.11	.11	.09	.07	.48	1.74	.98	.47	.39	.43	.41
AC-FT	7870	5410	5210	4110	3410	23300	84090	47510	22550	19040	20790	19720
CAL YR 1985 TOTAL	86289			MEAN 236	MAX 1670	MIN 34	CFSM .26	IN 3.55	AC-FT 171200			
WTR YR 1986 TOTAL	132605			MEAN 363	MAX 1870	MIN 34	CFSM .40	IN 5.45	AC-FT 263000			

## MINNESOTA RIVER BASIN

05300000 LAC QUI PARLE RIVER NEAR LAC QUI PARLE, MN

LOCATION.--Lat 44°59'42, long 95°55'09" in SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.27, T.118 N., R.42 W., Lac qui Parle County, Hydrologic Unit 07020003, on right bank 40 ft downstream from highway bridge and 0.5 mi southwest of village of Lac qui Parle.

DRAINAGE AREA.--983 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1910 to November 1914; March 1931 to current year (winter records incomplete prior to 1934). Published as "at Lac qui Parle," 1910-14.

REVISED RECORDS.--WSP 1308: 1912(M), 1935(M).

GAGE.--Water-stage recorder. Datum of gage is 951.98 ft above National Geodetic Vertical Datum of 1929 (Minnesota Department of Transportation benchmark). Apr. 27, 1910, to Nov. 15, 1914, nonrecording gage at site 2 mi downstream at different datum. Mar. 17, 1931, to Mar. 9, 1937, non recording gage at site 40 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 10 to Mar. 25. Records good except those for period with ice effect, Nov. 10 to Mar. 25, which are fair.

AVERAGE DISCHARGE.--55 years (water years 1913, 1932, 1934-86), 135 ft<sup>3</sup>/s, 1.87 in/yr, 97,810 acre-ft/yr; median of yearly mean discharges, 113 ft<sup>3</sup>/s, 1.56 in/yr, 81,900 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,100 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 18.94 ft, from floodmark; maximum gage height, 19.37 ft, Apr. 9, 1965, from floodmark (backwater from ice); no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,700 ft<sup>3</sup>/s, Mar. 26, gage height, 10.45 ft; maximum gage height, 10.83 ft, Mar. 24 (backwater from ice); minimum discharge, 25 ft<sup>3</sup>/s, Sept. 10, gage height, 0.74 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	171	115	57	32	34	33	2980	853	456	164	403	84
2	171	113	54	32	34	33	2980	776	426	161	575	72
3	171	112	50	32	34	33	2830	713	401	149	537	61
4	171	107	48	32	34	33	2720	665	370	139	424	58
5	176	104	45	32	34	33	2960	630	346	123	342	54
6	182	101	42	32	34	33	2980	581	328	110	287	57
7	182	99	39	32	34	33	3000	545	308	98	247	52
8	187	99	37	32	34	33	2890	526	290	90	215	39
9	175	97	34	33	34	200	2610	547	268	88	192	32
10	166	87	32	36	34	300	2260	919	266	90	192	25
11	164	68	32	38	33	370	1920	1420	370	118	167	28
12	176	84	32	40	33	390	1640	1550	451	178	152	28
13	191	84	32	41	33	410	1420	1570	483	299	141	28
14	206	83	32	40	33	420	1600	1440	391	386	134	28
15	218	84	32	40	33	430	1840	1290	365	362	126	30
16	218	72	32	39	33	450	2110	1150	337	436	120	31
17	208	68	32	39	33	500	2290	1000	316	323	117	143
18	195	65	32	39	33	662	2290	872	281	268	114	262
19	186	65	32	38	33	953	2330	772	250	603	109	453
20	176	65	32	37	33	1050	2230	704	232	894	106	727
21	171	65	32	37	33	1220	2160	647	232	1030	106	795
22	162	65	32	36	33	1790	1930	607	218	945	104	917
23	159	65	32	35	33	2900	1650	564	254	681	110	960
24	155	65	32	35	33	2940	1430	542	260	515	118	945
25	145	65	32	34	33	2840	1300	534	260	440	118	908
26	142	65	32	34	33	3480	1170	528	214	399	112	865
27	137	64	32	34	33	3370	1050	528	186	361	98	816
28	134	62	32	34	33	3360	987	553	162	336	97	737
29	129	61	32	34	---	2790	970	556	147	313	94	642
30	121	59	32	34	---	2740	919	523	144	337	91	563
31	115	---	32	34	---	2840	---	483	---	338	86	---
TOTAL	5260	2408	1110	1097	934	36669	61446	24588	9012	10774	5834	10440
MEAN	170	80.3	35.8	35.4	33.4	1183	2048	793	300	348	188	348
MAX	218	115	57	41	34	3480	3000	1570	483	1030	575	960
MIN	115	59	32	32	33	33	919	483	144	88	86	25
CFSM	.17	.08	.04	.04	.03	1.20	2.08	.81	.31	.35	.19	.35
IN.	.20	.09	.04	.04	.04	1.39	2.33	.93	.34	.41	.22	.40
AC-FT	10430	4780	2200	2180	1850	72730	121900	48770	17880	21370	11570	20710

CAL YR 1985 TOTAL 109091.2 MEAN 299 MAX 4700 MIN 3.4 CFSM .30 IN 4.13 AC-FT 216400  
WTR YR 1986 TOTAL 169572.0 MEAN 465 MAX 3480 MIN 25 CFSM .47 IN 6.42 AC-FT 336300

## MINNESOTA RIVER BASIN

05301000 MINNESOTA RIVER NEAR LAC QUI PARLE, MN

LOCATION.--Lat 45°01'17", long 95°52'05", in NW¼NE¼ sec.24, T.118 N., R.42 W., Chippewa County, Hydrologic Unit 07020004, on left bank 200 ft downstream from dam at Lac qui Parle Outlet, 2.4 mi northwest of village of Lac qui Parle, and 3.5 mi west of Watson.

DRAINAGE AREA.--4,050 mi<sup>2</sup>, approximately.

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

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Nov. 10, 1944, at datum 0.20 ft lower.

REMARKS.--Estimated daily discharges: Nov. 19 to Dec. 9, 12-15, 18-21, Dec. 24 to Jan. 1, 6-9, 26-30, Feb. 8-17, 20-25, and Mar. 7-12. Records good. Part of flow from 2,050 mi<sup>2</sup>, of Chippewa River basin at times diverted into Minnesota River above station. Some regulation by Big Stone Lake since Apr. 17, 1937, Lac qui Parle since January 1938, Marsh Lake since Nov. 1, 1939, and Odessa Dam since May 1974.

AVERAGE DISCHARGE.--44 years, 697 ft<sup>3</sup>/s, 505,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 29,400 ft<sup>3</sup>/s, Apr. 12, 1969, gage height, 39.75 ft; no flow Nov. 17, 1942, Sept. 29, 1947, Oct. 19 to Nov. 18, 1951, Nov. 24, 1952, Dec. 9-11, 1976, Feb. 28 to Mar. 5, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 13,200 ft<sup>3</sup>/s, Apr. 8, gage height, 36.80 ft; minimum discharge, 54 ft<sup>3</sup>/s, Oct. 29, gage height, 20.66 ft, due to regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1150	322	635	365	372	417	10100	7980	3290	1790	2920	1960
2	1070	447	630	360	368	410	10500	6850	2990	1810	2920	1920
3	1100	448	630	365	369	409	10800	6460	2680	1750	2880	1880
4	1290	412	628	398	366	432	11100	6440	2590	1740	2860	1850
5	1230	337	625	397	340	526	11500	6400	2420	1690	2830	1800
6	1140	331	620	399	285	640	12100	6390	1840	1630	2800	1790
7	1170	330	610	420	280	685	12500	6200	1580	1580	2770	1750
8	1270	330	600	407	290	650	12800	6030	1550	1570	2720	1700
9	1220	328	585	395	290	625	12300	5950	1520	1560	2680	1670
10	1210	328	419	394	290	620	11900	6100	1560	1520	2690	1670
11	1260	330	217	387	290	620	11400	6300	1640	1550	2610	1650
12	1300	329	265	374	290	620	11000	6470	1740	1630	2530	1620
13	1260	328	300	417	290	620	10100	6600	1830	1770	2470	1600
14	1250	328	305	455	290	651	9750	6680	1890	1870	2460	1580
15	1240	328	310	457	290	705	10100	6740	1930	2010	2430	1580
16	1230	328	310	454	290	705	10200	6740	1980	2140	2400	1550
17	1100	328	311	451	290	707	10500	6690	1950	2240	2320	1680
18	788	328	312	449	289	716	10700	6580	1870	2320	2250	1880
19	544	328	315	458	277	697	11300	6460	1650	2420	2190	2160
20	452	328	315	457	390	843	11500	6300	1600	2550	2210	2390
21	61	328	315	449	450	1030	11600	6120	1580	2660	2190	2600
22	61	333	308	455	442	1220	11400	5400	1650	2780	2190	3180
23	58	345	284	455	436	1470	11000	4760	1610	2820	2180	3950
24	273	352	300	452	436	2460	10700	4680	1440	2880	2140	4140
25	804	440	410	444	434	3880	10200	4600	1490	2890	2120	4260
26	1150	605	395	440	423	4950	9700	4490	1570	2860	2120	4370
27	1150	625	390	440	416	6060	9290	4180	1700	2840	2080	4150
28	584	640	380	420	417	7030	9070	3710	1820	2840	2030	3530
29	55	638	380	400	---	8330	8570	3630	1800	2840	1970	3120
30	55	636	378	390	---	9300	8730	3540	1770	2890	1960	3090
31	155	---	372	381	---	9860	---	3440	---	2920	1960	---
TOTAL	26680	11838	12854	12985	9690	67888	322410	178910	56530	68360	74880	72070
MEAN	861	395	415	419	346	2190	10750	5771	1884	2205	2415	2402
MAX	1300	640	635	458	450	9860	12800	7980	3290	2920	2920	4370
MIN	55	322	217	360	277	409	8570	3440	1440	1520	1960	1550
CFSM	.21	.10	.10	.10	.09	.54	2.65	1.43	.47	.54	.60	.59
IN.	.25	.11	.12	.12	.09	.62	2.96	1.64	.52	.63	.69	.66
AC-FT	52920	23480	25500	25760	19220	134700	639500	354900	112100	135600	148500	143000

CAL YR 1985 TOTAL 444015 MEAN 1216 MAX 9360 MIN 55 CFSM .30 IN 4.08 AC-FT 880700  
WTR YR 1986 TOTAL 915095 MEAN 2507 MAX 12800 MIN 55 CFSM .62 IN 8.41 AC-FT 1815000

## MINNESOTA RIVER BASIN

05304500 CHIPPEWA RIVER NEAR MILAN, MN

LOCATION.--Lat 45°06'39", long 95°47'57", in SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.16, T.119 N., R.41 W., Chippewa County, Hydrologic Unit 07020005, on right bank 800 ft upstream from bridge on State Highway 40, 2.0 mi upstream from small tributary, and 5.5 mi east of Milan.

DRAINAGE AREA.--1,870 mi<sup>2</sup>, approximately.

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

REVISED RECORDS.--WSP 1145: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 959.69 ft above National Geodetic Vertical Datum of 1929. Prior to June 15, 1942, nonrecording gage on bridge 800 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 8 to Mar. 28. Records good except those for period with ice effect, Nov. 8 to Mar. 28, which are fair. Flow regulated by several small lakes upstream from gage.

AVERAGE DISCHARGE.--49 years, 315 ft<sup>3</sup>/s, 2.29 in/yr, 228,200 acre-ft/yr; median of yearly mean discharges, 233 ft<sup>3</sup>/s, 1.69 in/yr, 169,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,400 ft<sup>3</sup>/s, Apr. 9, 1969, gage height, 15.45 ft; no flow at times during 1940.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s, and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 18	0215	727	3.45	June 11	1600	2,330	6.25
Nov. 22	0345	471	a3.80	June 23	0330	2,040	5.79
Mar. 27	0145	Ice jam	*10.78	July 13	0200	2,270	6.16
Mar. 29	1100	*5,280	10.14	July 20	2030	2,890	7.09
Apr. 15	1930	4,080	8.69	July 28	2345	2,140	5.90
Apr. 29	1715	3,720	8.22	Aug. 21	2015	1,990	5.57
May 9	2115	3,570	8.02	Sept. 23	0645	4,430	9.13

a Backwater from ice.

Minimum discharge, 85 ft<sup>3</sup>/s, Nov. 20, gage height, 1.76 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	500	508	340	230	165	155	3840	3350	1610	1370	1950	1460		
2	522	496	335	225	165	155	3650	3040	1540	1280	1880	1420		
3	522	478	330	225	165	158	3630	2840	1480	1230	1830	1410		
4	545	466	325	220	165	160	3810	2690	1410	1220	1750	1570		
5	628	458	320	215	165	160	4220	2540	1350	1170	1660	1530		
6	653	459	315	215	165	160	4330	2360	1300	1120	1570	1440		
7	628	447	310	210	165	155	4110	2210	1250	1080	1570	1380		
8	623	443	310	210	160	160	3700	2370	1210	1050	1700	1340		
9	613	405	305	210	160	165	3250	3400	1160	1070	1630	1310		
10	598	338	300	210	160	175	2900	3450	1230	1110	1730	1350		
11	593	292	300	205	160	185	2670	3170	2200	1440	1720	1360		
12	638	338	295	205	158	191	2460	3000	2120	2130	1640	1370		
13	726	375	290	205	155	195	2280	2910	1820	2250	1620	1320		
14	729	361	290	205	152	200	2700	2840	1670	2050	1670	1290		
15	716	352	285	200	150	205	3900	2750	1570	1910	1680	1300		
16	729	347	280	200	150	210	3950	2690	1490	1900	1640	1400		
17	747	355	275	200	150	215	3560	2630	1420	1780	1570	2170		
18	742	350	270	200	150	220	3360	2500	1360	1680	1510	3070		
19	711	355	265	200	150	230	3930	2380	1290	2120	1440	3140		
20	679	173	260	200	150	240	3980	2270	1230	2810	1460	3280		
21	656	365	260	200	150	245	3680	2180	1230	2790	1860	3410		
22	651	450	260	195	145	525	3300	2090	1590	2360	1910	4220		
23	642	420	260	190	145	1090	3020	2000	1970	1910	1770	4410		
24	611	405	255	190	145	1560	2820	1950	1750	1690	1690	4170		
25	581	380	250	185	145	2110	2680	1910	1650	1700	1670	3810		
26	576	370	245	175	150	2610	2690	1900	1590	1630	1650	3450		
27	547	360	240	172	150	2740	2610	1890	1540	1600	1620	3070		
28	528	355	240	170	150	3200	2700	1840	1490	2010	1580	2770		
29	510	350	240	170	---	4800	3590	1780	1440	2110	1540	2570		
30	502	345	235	170	---	4520	3640	1730	1400	2070	1520	2410		
31	505	---	235	168	---	4070	---	1670	---	2040	1490	---		
TOTAL	19151	11596	8720	6175	4340	31164	100960	76330	45360	53680	51520	68200		
MEAN	618	387	281	199	155	1005	3365	2462	1512	1732	1662	2273		
MAX	747	508	340	230	165	4800	4330	3450	2200	2810	1950	4410		
MIN	500	173	235	168	145	155	2280	1670	1160	1050	1440	1290		
CFSM	.33	.21	.15	.11	.08	.54	1.80	1.32	.81	.93	.89	1.22		
IN.	.38	.23	.17	.12	.09	.62	2.01	1.52	.90	1.07	1.02	1.36		
AC-FT	37990	23000	17300	12250	8610	61810	200300	151400	89970	106500	102200	135300		
CAL YR 1985	TOTAL	282634	MEAN	774	MAX	5170	MIN	165	CFSM	.41	IN	5.62	AC-FT	560600
WTR YR 1986	TOTAL	477196	MEAN	1307	MAX	4800	MIN	145	CFSM	.70	IN	9.49	AC-FT	946500

## MINNESOTA RIVER BASIN

## 05311000 MINNESOTA RIVER AT MONTEVIDEO, MN

LOCATION.--Lat 44°56'00", long 95°44'00", in NW1/4 sec.19, T.117 N., R.40 W., Yellow Medicine County, Hydrologic Unit 07020004, on right bank 100 ft upstream from bridge on U.S. Highway 212, at Montevideo, and 400 ft downstream from Chippewa River.

DRAINAGE AREA.--6,180 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1909 to September 1917, October 1917 to September 1929 (no winter records), October 1929 to current year. Prior to October 1939, published as "near Montevideo." Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1035: 1919(M). WSP 1085: 1935-36. WSP 1508: 1912, 1925(M), 1929(M).

GAGE.--Water-stage recorder. Datum of gage is 909.12 ft above National Geodetic Vertical Datum of 1929. July 22, 1909, to Feb. 4, 1932, nonrecording gage at bridge 600 ft downstream at present datum. Feb. 5, 1932, to Nov. 26, 1934, nonrecording gage at bridge 100 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 11 to Mar. 21. Records good except those for periods with ice effect, Nov. 11-16, Nov. 18 to Mar. 21, which are fair. Flow regulated by Big Stone Lake since April 17, 1937, Lac qui Parle since January 1938, and Marsh Lake since Nov. 1, 1939.

AVERAGE DISCHARGE.--65 years (water years 1910-17, 1930-86), 751 ft<sup>3</sup>/s, 544,100 acre-ft/yr; median of yearly mean discharges, 575 ft<sup>3</sup>/s, 417,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 35,100 ft<sup>3</sup>/s, Apr. 12, 1969, gage height, 21.68 ft, from high-water mark; no flow for several days in 1933-34, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 13,990 ft<sup>3</sup>/s, Apr. 8, gage height, 17.26 ft; minimum, 264 ft<sup>3</sup>/s, Dec. 24, gage height, 4.04 ft (backwater from ice).

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1940	781	730	490	540	630	10900	9630	4100	2050	3050	2210
2	1900	943	710	490	540	625	11100	9000	3910	1980	3050	2160
3	1880	971	700	500	530	620	11400	8480	3620	1940	3050	2110
4	2070	960	685	560	525	680	11800	8370	3380	1890	3040	2070
5	2090	881	680	570	480	740	12500	8320	3220	1860	3020	2020
6	2010	839	670	570	430	805	13100	8180	2900	1810	3000	1990
7	1950	830	665	570	420	890	13500	7980	2450	1750	2970	1950
8	1990	823	660	575	420	910	13800	7850	2300	1720	2940	1900
9	1940	826	655	575	420	815	13500	7730	2230	1730	2910	1850
10	1840	785	635	575	420	778	12700	7690	2280	1700	2910	1840
11	1850	680	425	575	420	780	12100	7740	2420	1740	2880	1820
12	1940	680	370	575	420	780	11500	7940	2590	1780	2830	1780
13	1970	730	400	575	420	790	10800	8140	2630	1870	2760	1750
14	2020	760	415	630	420	810	10600	8270	2630	1960	2710	1710
15	2010	750	420	640	420	870	10600	8310	2630	2100	2680	1700
16	1990	775	425	645	425	890	10800	8300	2630	2230	2650	1680
17	1960	774	425	645	425	895	10900	8260	2610	2280	2630	1870
18	1730	770	425	645	425	970	11200	8120	2620	2320	2570	1990
19	1400	685	425	640	425	1000	11900	7960	2420	2430	2510	2150
20	1300	585	425	630	390	1080	12300	7780	2370	2510	2490	2360
21	1010	590	425	635	595	1220	12500	7580	2430	2580	2470	2480
22	822	590	430	630	620	1670	12200	7300	2510	2670	2460	2710
23	792	630	430	630	620	2080	12000	6510	2560	2760	2500	3290
24	789	630	360	630	620	2490	11700	6050	2410	2840	2490	3890
25	1150	635	430	630	623	3190	11200	5870	2360	2910	2460	4460
26	1640	725	470	620	630	3790	10700	5690	2350	2950	2450	4770
27	1710	775	475	615	635	5650	10300	5450	2390	2980	2430	4930
28	1520	790	480	610	635	6990	10200	5000	2490	2980	2390	4780
29	794	780	480	555	---	8910	9990	4620	2490	2970	2340	4300
30	641	750	485	540	---	10000	9780	4410	2420	3000	2300	3860
31	628	---	490	540	---	10800	---	4250	---	3020	2260	---
TOTAL	49276	22723	15900	18310	13893	73148	347570	226780	80350	71310	83200	78380
MEAN	1590	757	513	591	496	2360	11590	7315	2678	2300	2684	2613
MAX	2090	971	730	645	635	10800	13800	9630	4100	3020	3050	4930
MIN	628	585	360	490	390	620	9780	4250	2230	1700	2260	1680
CFSM	.26	.12	.08	.10	.08	.38	1.88	1.18	.43	.37	.43	.42
IN	.30	.14	.10	.11	.08	.44	2.09	1.37	.48	.43	.50	.47
AC-FT	97740	45070	31540	36320	27560	145100	689400	449800	159400	141400	165000	155500
CAL YR 1985 TOTAL		615422	MEAN 1686		MAX 11000	MIN 243	CFSM .27	IN 3.70	AC-FT 1221000			
WTR YR 1986 TOTAL		1080840	MEAN 2961		MAX 13800	MIN 360	CFSM .48	IN 6.51	AC-FT 2144000			

## MINNESOTA RIVER BASIN

05311400 SOUTH BRANCH YELLOW MEDICINE RIVER AT MINNEOTA, MN

LOCATION.--Lat 44°33'50", long 95°59'50", in SE¼ sec.26, T.113 N., R.43 W., Lyon County, Hydrologic Unit 07020004, on downstream side of bridge on State Highway 68, 0.5 mi northwest of Minneota and 6 mi upstream from mouth.

DRAINAGE AREA.--111 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--April 1960 to September 1981 and October 1982 to current year. Monthly and daily discharge for the period Apr. 1, 1960, to June 30, 1960, published in WSP 1914. Operated as high-flow partial-record station October 1981 to September 1982.

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 1,150.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 10 to Mar. 28. Records good except those for periods with ice effect, Nov. 10-30, and Dec. 2 to Mar. 28, and period of no gage-height record, Dec. 1, which are fair.

AVERAGE DISCHARGE.--25 years (water years 1961-1981, 1983-1986), 28.7 ft<sup>3</sup>/s, 3.51 in/yr, 20,790 acre-ft/yr; median of yearly mean discharges, 19 ft<sup>3</sup>/s, 2.32 in/yr, 13,800 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,430 ft<sup>3</sup>/s, Apr. 8, 1969, gage height, 13.41 ft; no flow at times.

EXTREMES FOR CURRENT YEAR.--Peak discharge above base of 82 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 19	1100	310	a9.57	May 10	0700	147	4.85
Mar. 26	1000	1,130	a10.31	June 12	1830	686	7.45
Apr. 5	1100	695	8.12	July 12	0800	164	4.85
Apr. 15	1200	404	6.82	July 27	1000	92	4.14
Apr. 19	0700	273	6.09	July 30	1600	144	4.65
May 1	1700	246	5.69	Sept. 17	1230	*1,900	*11.16
				Sept. 19	930	716	8.62

a Backwater from ice.

Minimum daily discharge, 12 ft<sup>3</sup>/s, Sept. 8-10, 14; minimum gage height, 2.69 ft, Sept. 8, 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	25	19	18	15	14	348	246	44	55	48	14
2	32	24	19	18	15	15	285	176	39	47	38	13
3	30	23	19	18	15	16	264	91	38	42	33	14
4	33	21	19	18	15	18	285	121	33	35	31	16
5	41	22	19	18	15	20	600	107	32	31	28	14
6	46	22	19	17	15	21	494	93	32	29	25	13
7	41	23	19	16	15	22	371	81	30	27	24	13
8	37	22	19	16	15	23	363	76	32	25	22	12
9	33	21	19	16	15	28	212	102	31	23	21	12
10	31	18	19	17	14	61	177	147	36	22	24	12
11	28	18	19	19	14	47	153	135	124	27	21	14
12	35	19	18	21	14	37	142	118	380	121	20	13
13	47	20	17	21	14	39	150	110	211	38	20	13
14	58	20	17	21	14	45	172	97	152	29	20	12
15	52	22	17	21	14	43	369	85	117	28	19	18
16	48	22	17	21	14	49	269	82	90	27	20	20
17	42	21	17	21	14	71	206	76	70	24	18	931
18	37	22	17	21	14	170	206	70	58	22	16	325
19	34	22	17	20	14	295	259	62	47	23	15	581
20	32	22	17	19	14	223	237	55	40	21	14	413
21	29	22	18	18	14	194	185	52	41	20	21	315
22	28	22	19	17	14	266	147	48	68	19	17	246
23	28	22	19	16	14	460	124	43	47	18	15	228
24	28	22	18	16	14	410	109	49	39	16	15	214
25	27	22	18	16	14	560	104	52	36	16	16	225
26	29	22	18	15	13	1030	96	59	32	19	16	192
27	28	21	18	15	13	1010	88	82	30	70	16	149
28	26	21	18	15	13	870	83	74	30	48	16	115
29	25	20	18	15	---	725	198	63	68	36	14	100
30	26	20	18	15	---	552	228	55	60	75	14	82
31	28	---	18	15	---	441	---	50	---	74	14	---
TOTAL	1068	643	563	550	398	7775	6924	2757	2087	1107	651	4339
MEAN	34.5	21.4	18.2	17.7	14.2	251	231	88.9	69.6	35.7	21.0	145
MAX	58	25	19	21	15	1030	600	246	380	121	48	931
MIN	25	18	17	15	13	14	83	43	30	16	14	12
CFSM	.31	.19	.16	.16	.13	2.26	2.08	.80	.63	.32	.19	1.31
IN.	.36	.22	.19	.18	.13	2.61	2.32	.92	.70	.37	.22	1.45
AC-FT	2120	1280	1120	1090	789	15420	13730	5470	4140	2200	1290	8610

CAL YR 1985	TOTAL	19614.1	MEAN 53.7	MAX 1240	MIN 1.5	CFSM .48	IN 6.57	AC-FT 38900
WTR YR 1986	TOTAL	28862.0	MEAN 79.1	MAX 1030	MIN 12	CFSM .71	IN 9.67	AC-FT 57250

## MINNESOTA RIVER BASIN

05313500 YELLOW MEDICINE RIVER NEAR GRANITE FALLS, MN

LOCATION.--Lat 44°43'18", long 95°31'07", in SW¼ sec.35, T.115 N., R.39 W., Yellow Medicine County, Hydrologic Unit 07020004, on right bank 50 ft downstream from highway bridge, 6 mi upstream from mouth, and 8 mi south of town of Granite Falls.

DRAINAGE AREA.--653 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1931 to September 1935 (no winter records), October 1935 to September 1938, October 1939 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1508: 1931, 1934(M), 1937(M), 1946(M), 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 960.64 ft above National Geodetic Vertical Datum of 1929.

Mar. 16, 1931, to June 13, 1938, nonrecording gage, on bridge 50 ft upstream at present datum. Oct. 12, 1939, to Nov. 30, 1952, nonrecording gage 500 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 8 to Mar. 25. Records good except those for period with ice effect, Nov. 8 to Mar. 25, which are fair.

AVERAGE DISCHARGE.--50 years (water years 1936-38, 1940-86), 124 ft<sup>3</sup>/s, 2.58 in/yr, 89,840 acre-ft/yr; median of yearly mean discharges, 82 ft<sup>3</sup>/s, 1.71 in/yr, 59,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,200 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 14.90 ft; no flow at times in 1931, 1933, 1948, 1959.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in June 1919 reached a stage of 17.5 ft, from information by local residents, discharge, 25,200 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 7	1715	316	3.51	May 28	0430	618	4.14
Oct. 15	0015	333	3.56	June 13	2230	936	4.74
Mar. 26	0230	3,130	7.23	June 24	1100	520	3.96
Apr. 18	1845	1,280	5.27	July 14	0815	618	4.14
Apr. 30	0830	1,030	4.89	July 21	1200	509	3.94
May 15	1100	731	4.37	Aug. 2	1215	1,320	5.33
				Sept. 23	0115	*3,650	*7.65

Minimum daily discharge, 35 ft<sup>3</sup>/s, Mar. 1; minimum gage height, 2.63 ft, Nov. 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	148	162	85	50	50	35	2370	974	409	317	1080	104
2	172	158	74	49	50	36	2010	897	370	305	1300	94
3	188	152	57	49	50	37	1760	811	341	277	1130	87
4	235	145	56	49	50	38	1630	720	317	243	848	83
5	264	139	53	48	49	41	1740	646	293	203	685	78
6	296	136	50	48	49	42	1820	579	275	173	554	76
7	312	132	54	48	47	51	2000	514	268	148	438	70
8	306	132	62	47	47	108	2030	481	254	132	367	66
9	275	127	64	47	47	113	1840	474	233	119	322	63
10	254	124	69	47	46	165	1530	512	255	108	289	64
11	240	103	69	47	46	217	1280	621	312	109	273	60
12	254	121	69	47	46	217	1090	643	533	118	263	60
13	275	124	68	47	46	188	951	612	874	364	229	60
14	319	113	66	47	45	165	958	644	917	591	201	63
15	333	108	65	47	44	136	1030	714	828	480	177	63
16	326	110	64	47	43	148	1180	646	712	412	157	79
17	312	105	63	47	42	217	1250	586	594	343	160	507
18	296	105	62	47	40	414	1250	530	492	309	153	1130
19	286	87	61	47	39	520	1230	476	414	308	169	1790
20	264	53	60	47	38	661	1220	426	363	344	175	2340
21	249	96	59	47	38	849	1210	391	335	482	165	2900
22	240	100	58	47	38	1140	1100	361	351	423	166	3500
23	235	89	58	47	38	1580	958	341	374	350	169	3550
24	221	84	57	47	37	1790	842	325	498	297	155	3100
25	204	87	57	47	36	2330	754	325	459	256	142	2580
26	196	91	56	47	36	3040	693	391	397	218	139	2110
27	188	101	55	47	36	3000	643	511	338	205	141	1760
28	184	100	54	47	36	2980	740	616	291	275	145	1460
29	176	98	53	48	---	3030	978	581	264	744	138	1220
30	169	92	52	49	---	2930	1020	512	292	835	128	1040
31	165	---	51	50	---	2720	---	449	---	796	116	---
TOTAL	7582	3374	1881	1475	1209	28938	39107	17309	12653	10284	10574	30157
MEAN	245	112	60.7	47.6	43.2	933	1304	558	422	332	341	1005
MAX	333	162	85	50	50	3040	2370	974	917	835	1300	3550
MIN	148	53	50	47	36	35	643	325	233	108	116	60
CFSM	.38	.17	.09	.07	.07	1.43	2.00	.86	.65	.51	.52	1.54
IN.	.43	.19	.11	.08	.07	1.65	2.23	.99	.72	.59	.60	1.72
AC-FT	15040	6690	3730	2930	2400	57400	77570	34330	25100	20400	20970	59820

CAL YR 1985 TOTAL 85916.8 MEAN 235 MAX 3110 MIN 9.8 CFSM .36 IN 4.89 AC-FT 170400  
WTR YR 1986 TOTAL 164543.0 MEAN 451 MAX 3550 MIN 35 CFSM .69 IN 9.37 AC-FT 326400

## MINNESOTA RIVER BASIN

05315000 REDWOOD RIVER NEAR MARSHALL, MN

LOCATION.--Lat 44°25'49", long 95°50'43", in SE¼SW¼ sec.12, T.111 N., R.42 W., Lyon County, Hydrologic Unit 07020006, on right bank 2.0 mi upstream from Redwood River diversion structure on southwest edge of town of Marshall, MN. Prior to Apr. 10, 1980, at site 5 mi downstream.

DRAINAGE AREA.--303 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1940 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is 1,188.23 ft above National Geodetic Vertical Datum of 1929. March 1940 to April 9, 1980, nonrecording gage 5.0 mi downstream from present site at datum 43.35 ft lower (crest-stage gage added June 12, 1968). Since March 1964, nonrecording gage and crest-stage gage on diversion channel 1.5 mi downstream at datum 1,100.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 10 to Apr. 1, 14, 15, 17, 20, 21, 26, 27, May 1-4, June 1-4, June 12 to July 14, 21-28, Aug. 1-4, 6, 7, Aug. 15 to Sept. 18. Records good except those for periods of no gage-height record, Nov. 25, Jan. 24 to Mar. 9, Mar. 27 to Apr. 1, 14, 15, 17, 20, 21, 26, 27, May 1-4, June 1-4, June 12 to July 14, 21-28, Aug. 1-4, 6, 7, Aug. 15 to Sept. 18, and periods with ice effect, Nov. 10-24, Nov. 26 to Jan. 23, and Mar. 10-26, which are poor. Water diverted at medium and high stages into diversion channel 2.0 mi below station. Diversion began Mar. 18, 1964. Unknown amount of natural diversion into Cottonwood River basin occurs at extremely high stages 0.8 mi below station.

AVERAGE DISCHARGE.--46 years, 56.9 ft<sup>3</sup>/s, 2.55 in/yr, 41,220 acre-ft/yr; median of yearly mean discharges, 42 ft<sup>3</sup>/s, 1.88 in/yr, 30,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--River only, maximum discharge, 5,370 ft<sup>3</sup>/s, June 17, 1957, gage height, 10.14 ft; maximum gage height, 11.05 ft, Apr. 6, 1951, from floodmark; no flow at times.

Diversion only, maximum discharge, 4,440 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 78.45 ft; no flow on many days.

Combined flow, maximum discharge, 5,590 ft<sup>3</sup>/s, Apr. 10, 1969; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,350 ft<sup>3</sup>/s, Mar. 26, gage height, 14.43 ft; minimum daily, 18 ft<sup>3</sup>/s, Sept. 11, 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	122	91	54	30	30	35	793	1050	195	167	42	20
2	118	89	52	30	30	40	693	970	180	159	38	19
3	116	86	51	30	30	50	686	850	160	152	34	19
4	129	84	50	30	30	55	957	600	144	148	32	21
5	133	84	49	30	30	56	1200	387	130	145	30	20
6	128	85	48	30	30	56	1150	345	126	138	29	19
7	124	85	47	30	30	61	1080	299	125	135	28	19
8	121	83	47	30	30	69	952	280	120	131	26	19
9	112	77	46	30	30	81	829	359	113	128	27	19
10	109	76	44	30	30	147	758	424	133	125	28	19
11	108	76	42	30	29	154	667	402	188	138	25	18
12	128	75	40	30	29	163	584	376	190	162	25	18
13	135	75	37	30	29	174	570	362	182	210	23	19
14	138	74	34	30	29	174	510	321	175	142	23	22
15	137	74	33	30	29	182	460	291	164	101	23	28
16	131	72	32	30	29	216	404	294	155	95	24	70
17	128	70	32	30	29	314	500	283	147	85	30	760
18	121	66	31	30	29	678	624	256	143	75	24	720
19	117	66	31	30	29	624	790	232	142	75	23	644
20	114	65	30	30	29	644	640	215	142	67	23	630
21	111	62	30	30	29	762	520	199	150	63	22	645
22	111	60	30	30	29	809	466	203	178	59	22	688
23	108	60	30	30	30	762	450	256	190	57	22	727
24	116	60	30	30	30	895	613	263	180	54	22	680
25	113	60	30	30	30	1490	564	251	158	52	24	626
26	107	60	30	30	31	1840	504	236	147	66	30	556
27	101	59	30	30	32	1360	466	263	144	86	28	487
28	99	58	30	30	34	1110	495	271	163	55	25	428
29	96	57	30	30	---	986	737	242	183	37	23	405
30	92	55	30	30	---	933	1260	222	177	45	21	393
31	92	---	30	30	---	905	---	210	---	44	20	---
TOTAL	3615	2144	1160	930	835	15825	20922	11212	4724	3196	816	8758
MEAN	117	71.5	37.4	30.0	29.8	510	697	362	157	103	26.3	292
MAX	138	91	54	30	34	1840	1260	1050	195	210	42	760
MIN	92	55	30	30	29	35	404	199	113	37	20	18
CFSM	.39	.24	.12	.10	.10	1.68	2.30	1.20	.52	.34	.09	.96
IN.	.44	.26	.14	.11	.10	1.94	2.57	1.38	.58	.39	.10	1.08
AC-FT	7170	4250	2300	1840	1660	31390	41500	22240	9370	6340	1620	17370

CAL YR 1985 TOTAL 42787.2 MEAN 117 MAX 1210 MIN 6.4 CFSM .39 IN 5.25 AC-FT 84870  
WTR YR 1986 TOTAL 74137.0 MEAN 203 MAX 1840 MIN 18 CFSM .67 IN 9.10 AC-FT 147100

## MINNESOTA RIVER BASIN

05316500 REDWOOD RIVER NEAR REDWOOD FALLS, MN

LOCATION.--Lat 44°31'25", long 95°10'20", in SE¼NE¼ sec.9, T.112 N., R.36 W., Redwood County, Hydrologic Unit 07020006, on right bank 4 ft upstream from highway bridge, 3 mi west of town of Redwood Falls, and 8.5 mi upstream from mouth.

DRAINAGE AREA.--697 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1909 to September 1914 (no winter records except 1911-12). August 1930 to September 1935 (no winter records), October 1935 to current year.

GAGE.--Water-stage recorder. Datum of gage is 972.33 ft above National Geodetic Vertical Datum of 1929. July 1909 to September 1914, nonrecording gage at bridge 20 ft downstream at datum 0.22 ft lower. August 1930 to Oct. 25, 1949, nonrecording gage, at bridge 20 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 8 to Mar. 24. Records good except those for periods with ice effect, Nov. 8 to Mar. 24 (includes periods of no gage-height record, Mar. 16 and 20), which are fair. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood, and Cottonwood River basins during extreme floods.

AVERAGE DISCHARGE.--52 years (water years 1912, 1936-86), 126 ft<sup>3</sup>/s, 2.45 in/yr, 91,290 acre-ft/yr; median of yearly mean discharges, 84 ft<sup>3</sup>/s, 1.64 in/yr, 60,900 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,700 ft<sup>3</sup>/s, June 18, 1957, gage height, 15.92 ft, from floodmark; no flow for several days in January 1940 and for part of each day Aug. 19, 20, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 5	0600	565	3.43	Apr. 19	0630	1,470	4.98
Mar. 7	about 1300	435	a4.08	Apr. 29	0800	2,150	5.85
Mar. 23	0100	*4,630	a11.35	May 26	0900	690	3.68
Mar. 23	1600	Ice jam	*a11.62	July 16	0245	592	3.47
Mar. 28	1430	3,110	7.38	July 31	1030	555	3.40
Apr. 5	0930	2,330	6.20	Sept. 25	0815	1,690	5.11

a Backwater from ice.

Minimum discharge, 44 ft<sup>3</sup>/s, Sept. 9, 13, 14, gage height, 1.86 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	356	235	136	76	65	78	1680	1740	463	266	453	74
2	369	226	115	74	65	90	1480	1710	424	268	427	66
3	352	220	97	74	65	140	1460	1830	392	248	333	61
4	478	212	97	73	65	270	1580	1670	370	229	258	60
5	555	209	102	73	65	257	2240	1360	345	217	209	59
6	503	212	110	72	65	230	2020	1080	331	244	175	53
7	449	208	112	72	65	377	2040	868	322	217	151	47
8	426	198	110	71	64	412	2080	741	305	204	130	47
9	386	192	109	70	64	386	1830	715	289	211	114	46
10	362	177	108	70	62	364	1520	749	279	184	104	48
11	347	158	106	69	60	356	1260	788	306	170	107	49
12	407	158	104	68	60	340	1080	802	344	187	95	47
13	437	158	102	68	58	320	934	785	351	312	88	45
14	444	158	100	67	58	304	1020	735	347	258	82	51
15	436	158	98	67	58	360	1150	692	334	341	76	62
16	419	153	96	66	58	625	1180	715	317	542	71	139
17	398	153	94	66	57	730	1270	674	290	370	84	704
18	375	153	92	66	57	1360	1360	624	271	262	78	1040
19	350	150	90	66	58	1360	1450	569	252	218	70	1370
20	334	135	88	65	58	1380	1330	524	234	192	88	1430
21	322	166	87	65	58	1390	1270	489	237	166	93	1520
22	312	166	85	65	59	2910	1210	457	291	146	94	1670
23	305	166	84	65	60	4400	1060	429	298	131	84	1650
24	293	166	82	65	62	2810	921	417	273	118	78	1650
25	288	164	81	65	63	2100	810	478	252	110	75	1680
26	287	158	80	65	66	2220	755	669	226	108	83	1620
27	272	154	80	65	68	2560	828	642	206	229	100	1490
28	259	150	78	65	72	3040	1430	599	193	188	104	1310
29	251	147	78	65	---	2780	2060	580	205	178	107	1140
30	242	142	77	65	---	2240	1940	550	242	311	99	966
31	236	---	76	65	---	1880	---	502	---	524	88	---
TOTAL	11250	5202	2954	2108	1735	38069	42248	25183	8989	7349	4198	20194
MEAN	363	173	95.3	68.0	62.0	1228	1408	812	300	237	135	673
MAX	555	235	136	76	72	4400	2240	1830	463	542	453	1680
MIN	236	135	76	65	57	78	755	417	193	108	70	45
CFSM	.52	.25	.14	.10	.09	1.76	2.02	1.17	.43	.34	.19	.97
IN.	.60	.28	.16	.11	.09	2.03	2.25	1.34	.48	.39	.22	1.08
AC-FT	22310	10320	5860	4180	3440	75510	83800	49950	17830	14580	8330	40050
CAL YR 1985 TOTAL	104061			MEAN 285	MAX 3100	MIN 12	CFSM .41	IN 5.55	AC-FT 206400			
WTR YR 1986 TOTAL	169479			MEAN 464	MAX 4400	MIN 45	CFSM .67	IN 9.05	AC-FT 336200			

## MINNESOTA RIVER BASIN

05317000 COTTONWOOD RIVER NEAR NEW ULM, MN

LOCATION.--Lat 44°17'29", long 94°26'24", in SW¼NE¼ sec.33, T.110 N., R.30 W., Brown County, Hydrologic Unit 07020008, on left bank 600 ft upstream from highway bridge, 1.8 mi south of New Ulm, and 3.2 mi upstream from mouth.

DRAINAGE AREA.--1,280 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1909 to December 1913, March 1931 to March 1938, August 1938 to current year (winter records incomplete prior to 1936).

REVISED RECORDS.--WSP 355: 1912.

GAGE.--Water-stage recorder. Datum of gage is 796.83 ft above National Geodetic Vertical Datum of 1929. July 1, 1909, to Dec. 13, 1913, nonrecording gage at site 2.7 mi upstream at different datum. Mar. 15, 1931, to Mar. 31, 1938, nonrecording gage 2.2 mi upstream at datum 11.41 ft higher. Aug. 23, 1938, to June 25, 1948, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 25 to Mar. 20. Records good except those for the period with ice effect, Nov. 25 to Mar. 20 (includes periods of no gage-height record, Mar. 7-13, 17-20), which are fair.

AVERAGE DISCHARGE.--52 years (water years 1912-13, 1936-37, 1939-86), 323 ft<sup>3</sup>/s, 3.43 in/yr, 234,000 acre-ft/yr; median of yearly mean discharges, 227 ft<sup>3</sup>/s, 2.41 in/yr, 164,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 28,700 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 19.15 ft; maximum gage height, 20.86 ft, Apr. 8, 1965, from floodmark (backwater from ice); minimum discharge observed, 0.5 ft<sup>3</sup>/s, Nov. 27, 1952; minimum gage height, 0.72 ft, Nov. 20, 1964.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 6	1100	2,030	7.29	May 27	1030	1,910	7.27
Mar. 25	0400	5,850	12.33	July 17	0930	1,920	7.19
Apr. 6	1900	5,200	11.78	July 31	1930	2,540	8.26
Apr. 17	0300	2,200	7.78	Sept. 23	2130	7,180	13.26
May 1	0300	*10,100	*14.48				

Minimum daily discharge, 158 ft<sup>3</sup>/s, Feb. 7-15; minimum gage height, 2.46 ft, Nov. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	699	532	360	182	163	170	2470	9520	1320	563	2180	306
2	977	521	350	180	159	183	2190	7530	1200	620	1580	277
3	1100	503	335	178	159	200	1980	6280	1080	675	1330	256
4	1250	483	320	176	159	240	2070	4760	992	616	1020	241
5	1700	466	310	174	159	330	3180	3680	956	555	795	228
6	1990	468	295	173	159	400	4920	2880	929	516	661	213
7	1750	460	285	172	158	460	4920	2360	878	484	562	200
8	1490	452	270	171	158	520	4240	2000	831	477	486	188
9	1330	448	260	170	158	510	3430	1770	780	593	428	179
10	1200	432	250	170	158	480	2720	1690	737	941	397	305
11	1080	417	238	170	158	440	2230	1770	725	876	354	531
12	1050	415	232	170	158	400	1930	1760	712	767	331	859
13	1160	429	230	172	158	370	1710	1670	712	1100	327	1030
14	1280	438	228	174	158	370	1630	1570	721	1220	327	838
15	1240	427	222	175	158	440	1830	1500	708	1080	308	866
16	1160	433	220	175	160	550	2150	1420	672	1360	282	1020
17	1070	436	216	175	162	700	2180	1370	624	1870	262	1470
18	993	441	212	176	164	1300	2110	1320	611	1510	241	3460
19	927	445	209	176	165	2500	2030	1250	549	1170	231	4890
20	868	301	206	176	166	5200	2120	1170	530	1070	294	5920
21	817	235	210	175	166	4970	2090	1090	549	1020	297	6390
22	785	257	212	174	165	4750	1880	1020	741	920	277	6640
23	756	419	214	173	164	4900	1690	965	856	780	284	7030
24	729	440	209	172	163	5490	1540	925	918	662	290	6930
25	697	435	205	170	162	5710	1440	962	812	562	275	5970
26	664	415	200	170	160	5480	1400	1390	712	490	279	4940
27	627	400	195	169	160	4980	1950	1880	634	505	312	3960
28	592	390	192	169	164	4200	4390	1810	574	560	474	3170
29	567	380	190	167	---	3540	7300	1670	525	516	472	2600
30	550	370	188	165	---	3120	9350	1520	512	1030	405	2230
31	539	---	184	164	---	2770	---	1390	---	2230	347	---
TOTAL	31637	12688	7447	5353	4501	65673	85070	71892	23100	27338	16108	73137
MEAN	1021	423	240	173	161	2118	2836	2319	770	882	520	2438
MAX	1990	532	360	182	166	5710	9350	9520	1320	2230	2180	7030
MIN	539	235	184	164	158	170	1400	925	512	477	231	179
CFSM	.80	.33	.19	.14	.13	1.66	2.22	1.81	.60	.69	.41	1.91
IN.	.92	.37	.22	.16	.13	1.91	2.47	2.09	.67	.79	.47	2.13
AC-FT	62750	25170	14770	10620	8930	130300	168700	142600	45820	54220	31950	145100

CAL YR 1985	TOTAL	239545	MEAN	656	MAX	6570	MIN	52	CFSM	.51	IN	6.96	AC-FT	475100
WTR YR 1986	TOTAL	423944	MEAN	1161	MAX	9520	MIN	158	CFSM	.91	IN	12.32	AC-FT	840900

## MINNESOTA RIVER BASIN

05317200 LITTLE COTTONWOOD RIVER NEAR COURTLAND, MN

LOCATION.--Lat 44°14'47", long 94°20'19", in SW 1/4 sec. 17, T. 109 N., R. 29 W., Blue Earth County, Hydrologic Unit 07020007, on right bank 30 ft downstream from bridge on State Highway 68, 0.7 mi above mouth, 1.5 mi south of Courtland.

DRAINAGE AREA.--230 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1973 to current year. September 1969 to September 1973, operated as a low-flow station only.

GAGE.--Water-stage recorder. Datum of gage is 788.25 ft above National Geodetic Vertical Datum of 1929.

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

AVERAGE DISCHARGE.--13 years, 61.8 ft<sup>3</sup>/s, 3.65 in/yr, 44,770 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,340 ft<sup>3</sup>/s, Mar. 16, 1985, gage height, 8.96 ft; minimum discharge, 0.01 ft<sup>3</sup>/s, Sept. 17, 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 180 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 5	0600	187	4.06	June 22	0645	485	6.49
Mar. 22	1915	*1,060	*8.56	July 31	0045	283	5.20
Apr. 8	1530	491	6.38	Sept. 10	2400	898	8.06
May 1	0730	961	8.28	Sept. 19	0900	448	6.16
May 29	1630	190	4.61				

Minimum discharge, 12 ft<sup>3</sup>/s, Feb. 13, 14; gage height, 2.22 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	66	67	29	17	21	14	216	942	170	74	178	26
2	73	66	20	17	20	15	199	872	163	70	146	24
3	81	63	16	17	20	33	197	688	153	67	127	26
4	145	61	18	18	20	84	209	574	152	67	113	24
5	179	60	21	18	19	110	313	476	161	62	99	22
6	157	61	18	18	19	54	317	398	142	58	85	21
7	151	59	17	18	17	32	367	340	135	51	72	20
8	156	57	17	17	17	54	464	299	124	53	60	19
9	161	46	19	17	16	68	465	267	117	60	53	18
10	160	51	21	16	16	75	388	249	110	77	50	337
11	153	51	21	17	15	96	329	241	106	106	44	686
12	157	64	20	18	13	114	280	229	104	112	40	443
13	156	57	20	18	12	105	246	219	94	115	38	313
14	145	57	20	18	13	123	257	207	89	119	55	295
15	137	56	21	18	13	157	266	199	83	132	49	337
16	131	58	22	18	13	229	250	193	74	150	40	296
17	129	57	20	19	13	229	233	184	69	137	35	261
18	125	59	18	19	13	470	234	175	92	134	30	255
19	120	56	17	19	13	530	254	166	104	146	28	433
20	115	18	17	19	13	396	237	159	88	143	36	370
21	110	35	18	20	13	401	224	158	103	133	48	347
22	103	55	18	20	13	766	208	157	372	115	46	363
23	96	49	19	22	13	737	198	148	285	98	41	369
24	93	46	20	22	13	483	200	143	190	82	35	381
25	88	44	18	22	13	373	199	146	145	76	33	427
26	86	44	17	22	13	330	192	156	119	72	35	414
27	80	39	18	23	13	327	493	159	104	82	34	385
28	76	36	18	23	14	311	534	166	92	74	33	330
29	73	35	18	22	---	290	496	175	84	62	33	322
30	69	33	17	22	---	261	738	177	77	185	30	292
31	68	---	17	21	---	236	---	175	---	249	29	---
TOTAL	3639	1540	590	595	421	7503	9203	8837	3901	3161	1775	7856
MEAN	117	51.3	19.0	19.2	15.0	242	307	285	130	102	57.3	262
MAX	179	67	29	23	21	766	738	942	372	249	178	686
MIN	66	18	16	16	12	14	192	143	69	51	28	18
CFSM	.51	.22	.08	.08	.07	1.05	1.34	1.24	.57	.44	.25	1.14
IN.	.59	.25	.10	.10	.07	1.21	1.49	1.43	.63	.51	.29	1.27
AC-FT	7220	3050	1170	1180	835	14880	18250	17530	7740	6270	3520	15580

CAL YR 1985	TOTAL	27354.2	MEAN	74.9	MAX	1110	MIN	3.3	CFSM	.33	IN	4.42	AC-FT	54260
WTR YR 1986	TOTAL	49021.0	MEAN	134	MAX	942	MIN	12	CFSM	.58	IN	7.93	AC-FT	97230

## 05319500 WATONWAN RIVER NEAR GARDEN CITY, MN

LOCATION.--Lat 44°02'47", long 94°11'43", in SW¼NE¼ sec.28, T.107 N., R.28 W., Blue Earth County, Hydrologic Unit 07020010, on left bank 25 ft downstream from bridge on County Highway 13, 1.5 miles west of Garden City, 7.3 mi upstream from mouth, and 9.2 mi downstream from Perch Creek.

DRAINAGE AREA.-- 812 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1940 to September 1945, 1953, 1960, 1961, 1969, one or more discharge measurements each year, September 1976 to current year.

REVISED RECORDS.--WDR MN-78-2: 1977.

GAGE.--Water-stage recorder. Datum of gage is 905.05 ft above National Geodetic Vertical Datum of 1929. Prior to September 30, 1945, nonrecording gage at site 200 ft upstream and at datum 0.17 ft higher.

REMARKS.--Estimated daily discharge: Oct. 1 to Mar. 24, Apr. 3, 4, 6-8, and Apr. 22-28. Records good except those for period with ice effect (also no gage-height record), Nov. 25 to Mar. 19, which are fair and periods of no gage-height record, Oct. 1 to Nov. 24, Mar. 20-25, April 3, 4, 6-8, 22-28, which are poor.

AVERAGE DISCHARGE.--15 years (water years 1941-45, 1977-86), 357 ft<sup>3</sup>/s, 5.97 in/yr, 258,600 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,620 ft<sup>3</sup>/s, May 21, 1944, gage height 9.84 ft, datum then in use; minimum daily, 1.9 ft<sup>3</sup>/s, Jan. 20 to Feb. 8, 1977; minimum gage height, 0.27 ft, July 23, 1940, datum then in use.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1965, reached a stage of 18.89 ft at datum 0.17 ft higher, from floodmarks, discharge, 19,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
a	--	>980	Unknown	May 14	1430	1,160	4.27
Mar. 19	--	Ice jam	*8.32	June 22	1400	2,680	7.10
b	--	*>2,900	--	July 14	1130	1,390	4.75
Apr. 8	--	2,680	7.10	Sept. 25	1500	1,720	5.41
May 1	2330	2,360	6.57				

> Greater than.

a Some time during period Oct. 4-9.

b Some time during period Mar. 20-24.

Minimum daily discharge, 71 ft<sup>3</sup>/s, Feb. 22-24; minimum gage height observed, 1.17 ft, Sept. 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	400	335	205	105	85	77	1240	2320	650	816	436	137
2	440	320	200	105	84	82	1170	2320	604	749	379	124
3	500	310	200	100	83	98	1120	2080	552	703	322	117
4	590	300	195	99	82	130	1170	1760	526	650	276	121
5	770	290	190	98	81	160	1610	1510	531	577	242	115
6	980	280	185	97	80	250	2130	1290	567	517	215	103
7	950	275	180	96	80	290	2510	1100	566	469	195	96
8	890	265	175	95	79	285	2650	961	542	465	183	89
9	830	260	170	94	78	280	2390	851	496	786	165	94
10	790	250	170	93	77	290	2020	804	456	1040	161	191
11	730	245	165	93	76	320	1680	849	443	1010	153	369
12	720	235	160	92	74	370	1440	921	432	1010	136	408
13	730	225	155	92	74	420	1270	1030	424	1260	151	385
14	780	220	150	92	73	500	1210	1150	404	1370	173	376
15	760	215	150	93	72	560	1330	1150	385	1280	161	462
16	720	215	145	94	72	660	1350	1130	363	1200	142	518
17	680	210	140	94	72	780	1290	1080	343	1250	130	506
18	650	210	140	95	72	1100	1190	978	414	1150	120	501
19	630	210	135	95	72	2000	1200	867	553	997	109	881
20	590	215	135	95	72	2750	1250	774	458	899	108	1200
21	560	215	130	95	72	2800	1200	707	1260	833	119	1360
22	535	215	125	94	71	2900	1110	644	2580	725	123	1510
23	510	215	125	93	71	2850	989	589	2530	623	113	1460
24	490	215	120	92	71	2780	892	554	2240	537	108	1650
25	460	215	120	91	72	2620	816	570	2030	484	102	1690
26	440	215	120	90	72	2450	808	635	1800	452	133	1640
27	420	215	115	90	72	2290	924	649	1540	412	205	1510
28	400	215	115	89	73	1970	1230	675	1250	364	224	1240
29	380	210	110	88	---	1680	1660	703	1030	323	196	1160
30	360	210	110	87	---	1490	2080	680	897	340	173	1020
31	345	---	105	86	---	1340	---	659	---	416	154	---
TOTAL	19030	7225	4640	2912	2112	36572	42929	31990	26866	23707	5607	21033
MEAN	614	241	150	93.9	75.4	1180	1431	1032	896	765	181	701
MAX	980	335	205	105	85	2900	2650	2320	2580	1370	436	1690
MIN	345	210	105	86	71	77	808	554	343	323	102	89
CFSM	.76	.30	.19	.12	.09	1.45	1.76	1.27	1.10	.94	.22	.86
IN.	.87	.33	.21	.13	.10	1.68	1.97	1.47	1.23	1.09	.26	.96
AC-FT	37750	14330	9200	5780	4190	72540	85150	63450	53290	47020	11120	41720
CAL YR 1985 TOTAL	130813			MEAN 358	MAX 3210	MIN 20	CFSM .44	IN 5.99	AC-FT 259500			
WTR YR 1986 TOTAL	224623			MEAN 615	MAX 2900	MIN 71	CFSM .76	IN 10.29	AC-FT 445500			

## MINNESOTA RIVER BASIN

05320000 BLUE EARTH RIVER NEAR RAPIDAN, MN

LOCATION.--Lat 44°05'44", long 94°06'33", in SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.6, T.107 N., R.27 W., Blue Earth County, Hydrologic Unit 07020009, on left bank 0.2 mi downstream from powerplant (reactivated in 1984) operated by Rapidan Redevelopment Limited Partnership, 2 mi west of Rapidan, 3.5 mi downstream from Watonwan River, and 7.8 mi upstream from Le Sueur River.

DRAINAGE AREA.--2,430 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1909 to November 1910 (published as "at Rapidan Mills," no winter records), October 1939 to September 1945, July 1949 to current year.

REVISED RECORDS.--WSP 895: Drainage area. WSP 1508: 1910.

GAGE.--Water-stage recorder. Datum of gage is 807.83 ft above National Geodetic Vertical Datum of 1929. July 20, 1909, to Apr. 28, 1910, nonrecording gage at site 0.2 mi upstream at different datum. Apr. 29 to Nov. 12, 1910, nonrecording gage at site 800 ft upstream at different datum. Oct. 4 to Nov. 14, 1939, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 21 to Jan. 17, Jan. 20-29, and Jan. 31 to Mar. 16. Records good except those for periods of no gage-height record, Nov. 28 to Dec. 9, Dec. 11 and part of Dec. 12, and periods with ice effect, Nov. 21-27, Dec. 10, Dec. 12 to Jan. 17, Jan. 20-29, and Jan. 31 to Mar. 16, which are fair.

AVERAGE DISCHARGE.--43 years (water years 1940-45, 1950-86), 939 ft<sup>3</sup>/s, 5.25 in/yr, 680,300 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 43,100 ft<sup>3</sup>/s, Apr. 9, 1965, gage height, 21.36 ft, from floodmark; minimum, 6.9 ft<sup>3</sup>/s, Oct. 12, 1955, gage height, 1.04 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 15,200 ft<sup>3</sup>/s, Mar. 23, gage height, 11.17 ft; minimum, 24 ft<sup>3</sup>/s, Feb. 18, gage height, 1.19 ft, due to regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	856	1080	650	700	350	159	3790	5260	2980	2560	940	361
2	1810	1050	540	680	315	203	3860	5120	2650	2340	763	441
3	2000	1040	470	670	285	187	3590	4590	2380	2190	627	275
4	2140	967	410	650	275	270	3420	4050	2210	2050	449	314
5	2670	928	362	635	280	420	4530	3690	2310	1880	706	305
6	2950	895	350	605	266	670	6080	3330	3000	1780	425	143
7	3000	899	340	590	271	1000	6910	3060	3260	1570	521	168
8	2780	875	362	570	261	950	7230	2620	3130	1620	454	307
9	2510	881	426	550	256	890	7160	2590	2780	2010	217	328
10	2300	767	500	530	280	820	6010	2380	2560	2310	312	206
11	2150	783	600	500	252	830	5090	2450	2470	2280	534	513
12	2030	787	716	480	275	940	4520	2830	2430	2880	193	731
13	2110	811	800	455	203	1000	4040	3440	2330	3320	253	380
14	2360	816	790	420	212	1000	3780	3900	2220	3380	436	456
15	2480	824	820	390	199	1000	3820	3890	2110	2880	534	662
16	2190	839	900	370	195	1800	4080	4010	2000	2620	270	649
17	1780	857	940	350	187	3030	3950	4100	1840	2720	217	652
18	1950	900	960	331	212	4090	3700	3790	1820	2600	217	672
19	1810	985	980	319	171	5280	3480	3370	2130	1970	229	1080
20	1700	938	1010	315	191	7060	3550	3120	2360	2060	221	1530
21	1610	1250	1030	300	167	8050	3560	3180	3660	1770	265	1760
22	1540	1400	1020	285	171	12600	3350	2650	6030	1560	270	1930
23	1500	1280	950	278	171	13000	2960	2450	5830	1310	264	2090
24	1470	1130	980	265	183	9470	2700	2280	5500	1180	182	2370
25	1420	1050	1020	255	153	8100	2580	2210	5390	1110	296	2380
26	1350	960	1000	250	157	7500	2510	2600	4930	913	201	2410
27	1280	900	900	245	167	6660	2470	2860	4120	873	227	2520
28	1230	840	830	235	155	5910	3230	3190	3530	1000	518	2310
29	1180	800	770	230	---	5110	4220	3380	3070	726	556	1990
30	1140	740	735	220	---	4550	4990	3480	2780	844	374	1800
31	1100	---	705	290	---	4300	---	3320	---	654	337	---
TOTAL	58396	28272	22866	12963	6260	116849	125160	103190	93810	58960	12008	31733
MEAN	1884	942	738	418	224	3769	4172	3329	3127	1902	387	1058
MAX	3000	1400	1030	700	350	13000	7230	5260	6030	3380	940	2520
MIN	856	740	340	220	153	159	2470	2210	1820	654	182	143
CFSM	.78	.39	.30	.17	.09	1.55	1.72	1.37	1.29	.78	.16	.44
IN.	.89	.43	.35	.20	.10	1.79	1.92	1.58	1.44	.90	.18	.49
AC-FT	115800	56080	45350	25710	12420	231800	248300	204700	186100	116900	23820	62940

CAL YR 1985 TOTAL 387861 MEAN 1063 MAX 7940 MIN 60 CFSM .44 IN 5.94 AC-FT 769300  
WTR YR 1986 TOTAL 670467 MEAN 1837 MAX 13000 MIN 143 CFSM .76 IN 10.26 AC-FT 1330000

## MINNESOTA RIVER BASIN

05320500 LE SUEUR RIVER NEAR RAPIDAN, MN

LOCATION.--Lat 44°06'40", long 94°02'28", in SW $\frac{1}{4}$  sec.35, T.108 N., R.27 W., Blue Earth County, Hydrologic Unit 07020011, on right bank 600 ft downstream from highway bridge, 1.8 mi northeast of Rapidan, and 2.3 mi upstream from mouth.

DRAINAGE AREA.--1,100 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1939 to September 1945, July 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 775.76 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 15, 1939, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 22 to Mar. 18, Aug. 7 to Sept. 16, 22-30. Records good except those for period with ice effect, Nov. 22 to Mar. 18 (includes periods of no gage-height record Dec. 3, 6, 12 and Jan. 8-14), which are fair, and periods of no gage height record, Aug. 7 to Sept. 16, 22-30, which are poor.

AVERAGE DISCHARGE.--43 years (water years 1940-45, 1950-86), 476 ft<sup>3</sup>/s, 5.88 in/yr, 344,900 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 24,700 ft<sup>3</sup>/s, Apr. 8, 1965, gage height, 22.10 ft, from floodmark; maximum gage height, 22.72 ft, May 22, 1960, from floodmark; minimum daily discharge, 1.6 ft<sup>3</sup>/s, Feb. 9-25, 1959; minimum gage height, 0.65 ft, Sept. 7-13, 1976.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 5	1300	1,530	4.38	May 16	0430	2,450	5.53
Mar. 22	0715	7,890	10.48	June 25	0500	*8,410	*10.69
Apr. 6	2230	2,460	5.55	July 12	1900	2,250	5.13
Apr. 30	0515	1,950	4.92				

a Backwater from ice.

Minimum daily discharge, 60 ft<sup>3</sup>/s, Aug. 20, Sept. 8; minimum gage height recorded, 1.59 ft, Aug. 7, but may have been lower during period of no gage-height record Aug. 7 to Sept. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	361	326	300	144	104	73	1640	1760	1160	2310	283	95
2	535	309	295	141	102	74	1530	1630	1010	2040	266	86
3	610	295	285	139	100	76	1470	1510	872	1770	236	74
4	1030	289	280	137	98	95	1530	1460	789	1540	215	66
5	1470	270	275	135	96	170	2060	1330	795	1350	192	63
6	1450	270	270	133	94	290	2380	1090	922	1190	173	65
7	1360	266	265	131	92	305	2400	972	1070	1070	163	62
8	1220	253	255	128	89	310	2230	883	1040	1090	152	60
9	1100	252	250	126	87	325	2000	831	918	1380	145	74
10	979	240	245	125	84	375	1760	819	802	1480	134	121
11	868	224	240	124	81	415	1560	1020	736	1510	123	158
12	889	229	235	123	79	450	1410	1650	696	1770	113	186
13	951	246	230	122	77	500	1270	1910	695	2130	106	152
14	969	247	225	121	76	560	1210	2220	725	1880	106	127
15	935	243	220	120	76	570	1200	2390	693	1620	100	147
16	866	264	215	120	75	840	1180	2400	703	1660	95	255
17	789	282	208	120	74	1340	1140	2240	704	1600	86	243
18	732	278	200	120	73	3300	1090	2050	1060	1390	83	243
19	688	314	195	120	72	5900	1090	1860	1630	1190	78	633
20	648	281	190	120	71	6600	1090	1660	1620	1010	60	726
21	610	347	185	119	70	6920	1060	1480	3180	858	65	729
22	577	370	180	118	70	7410	1000	1320	5180	736	78	787
23	540	360	175	117	70	6380	921	1180	5990	646	71	845
24	510	355	170	116	70	4830	845	1080	7340	572	65	905
25	475	345	167	115	70	3640	791	1000	8070	507	65	966
26	449	340	163	114	70	3010	744	1090	6820	452	63	997
27	417	335	160	112	71	2610	905	1130	5360	406	65	1020
28	384	330	156	111	72	2320	1460	1070	4050	373	86	1000
29	366	320	152	110	---	2110	1850	1030	3210	337	97	893
30	344	310	150	108	---	1940	1900	1010	2680	369	104	781
31	330	---	147	106	---	1770	---	1120	---	328	102	---
TOTAL	23452	8790	6683	3795	2263	65508	42716	44195	70520	36564	3770	12559
MEAN	757	293	216	122	80.8	2113	1424	1426	2351	1179	122	419
MAX	1470	370	300	144	104	7410	2400	2400	8070	2310	283	1020
MIN	330	224	147	106	70	73	744	819	693	328	60	60
CFSM	.69	.27	.20	.11	.07	1.92	1.30	1.30	2.14	1.07	.11	.38
IN.	.79	.30	.23	.13	.08	2.22	1.44	1.49	2.38	1.24	.13	.42
AC-FT	46520	17430	13260	7530	4490	129900	84730	87660	139900	72520	7480	24910
CAL YR 1985	TOTAL	152387	MEAN 417	MAX 5400	MIN 19	CFSM .38	IN 5.15	AC-FT 302300				
WTR YR 1986	TOTAL	320815	MEAN 879	MAX 8070	MIN 60	CFSM .80	IN 10.85	AC-FT 636300				

## MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN

LOCATION.--Lat 44°09'58", long 94°00'57", in NW 1/4 sec.13, T.108 N., R.27 W., Nicollet County, Hydrologic Unit 07020007, on left bank 12 ft downstream from bridge on U.S. Highway 169 in North Mankato, 1.1 mi downstream from Blue Earth River and at mile 107.1 upstream from Mississippi River.

DRAINAGE AREA.--14,900 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1903 to current year (no winter records 1904, 1906-10, 1918-29). Monthly discharge only for some periods, published in WSP 1308. Published as "near Mankato": 1903-21.

REVISED RECORDS.--WSP 875: 1917. WSP 955: Drainage area. WSP 1085: 1929. WSP 1238: 1903, 1908, 1919. WSP 1508: 1916(M), 1918(M), 1926(M), 1928, 1930, 1932(M), 1938(M). WDR-MN-76-1: 1881(M).

GAGE.--Water-stage recorder. Datum of gage is 747.92 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 19, 1921, nonrecording gage, at site 1.1 mi upstream at datum 6.4 ft higher. Mar. 15, 1922, to Nov. 30, 1924, nonrecording gage, and Dec. 1, 1924 to May 24, 1971, recorder at site 0.5 mi downstream at present datum. May 25, 1971 to Aug. 14, 1977, recorder at site 0.2 mi downstream at present datum. Aug. 14, 1977 to July 27, 1978, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 21 to Mar. 17. Records good except for periods with ice effect, Nov. 21 to Mar. 17 (includes period of no gage height record, Dec. 3), which are fair.

AVERAGE DISCHARGE.--65 years (water years 1905, 1911-17, 1930-86), 3,019 ft<sup>3</sup>/s, 2.75 in/yr, 2,187,000 acre-ft/yr; median of yearly mean discharges, 2,560 ft<sup>3</sup>/s, 2.33 in/yr, 1,850,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 94,100 ft<sup>3</sup>/s, Apr. 10, 1965, gage height, 29.09 ft; minimum observed, 26 ft<sup>3</sup>/s, Aug. 4, 1934.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage since Apr. 26, 1881, 29.9 ft, present site and datum, from floodmark, discharge, 110,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 36,300 ft<sup>3</sup>/s, May 2, gage height, 22.65 ft; minimum daily, 1,260 ft<sup>3</sup>/s, Feb. 26; minimum gage height, 4.88 ft, Feb. 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
1	4700	4740	2500	1750	1600	1270	23200	34700	13900	11100	8920	4400	
2	5700	4330	2400	1720	1590	1270	22700	35900	13100	10300	9380	4310	
3	6440	4070	2350	1700	1520	1270	22300	33900	12200	9500	9410	4060	
4	7880	3930	2300	1680	1500	1300	22500	30800	11600	8890	8940	4000	
5	9300	3790	2200	1650	1490	1800	24500	27400	11100	8220	8750	3990	
6	9970	3820	2100	1620	1470	2180	28100	24500	11500	7630	8230	3870	
7	10300	3790	2050	1600	1430	2500	31200	22200	11700	7090	7810	3710	
8	10200	3710	2000	1590	1420	3000	33200	20100	11200	7050	7380	3640	
9	9740	3650	2080	1580	1410	3300	33600	18600	10400	7760	6770	3640	
10	9370	3500	2120	1560	1400	3550	32700	17500	9690	8370	6390	4100	
11	9050	3370	2220	1550	1390	3750	30900	17100	9220	8430	6250	5900	
12	8830	3300	2270	1540	1380	3950	29100	17200	8840	8920	5710	5830	
13	8770	3290	2280	1530	1370	4200	27500	17800	8480	9630	5440	5330	
14	8940	3270	2290	1520	1360	4450	26100	18200	8300	9750	5500	5090	
15	9150	3220	2280	1510	1350	4750	25400	18200	8240	9080	5440	5520	
16	8680	3260	2250	1500	1340	5150	25000	18100	8350	9110	5070	5490	
17	8320	3300	2220	1500	1330	8000	24600	18000	8330	9790	4790	5450	
18	8140	3350	2180	1500	1320	12900	24100	17600	8910	10000	4560	6250	
19	7990	3470	2140	1500	1310	18100	24300	17100	9640	9670	4480	8700	
20	7770	3370	2110	1500	1310	21300	24100	16800	9780	9400	4560	10700	
21	7490	3420	2080	1500	1300	22200	24000	16500	13500	8930	4890	12500	
22	7170	3400	2030	1500	1300	26700	23300	16000	19300	8430	4950	14600	
23	6810	3400	2000	1500	1290	32500	22600	15200	19600	7870	5020	17200	
24	6420	3300	1980	1510	1280	30300	22100	14600	19900	7380	5000	19600	
25	5960	3200	1940	1530	1270	27200	21600	14200	20600	7060	5010	21000	
26	5550	3100	1900	1590	1260	26300	21300	14400	19900	6520	4930	21400	
27	5230	3000	1880	1620	1270	25900	21100	14700	18000	6390	4770	21200	
28	5060	2900	1840	1620	1270	25800	22700	15000	15900	6270	4860	20300	
29	5070	2800	1810	1610	---	25300	26400	15000	13900	6190	5060	18900	
30	5100	2650	1790	1600	---	24500	31100	14800	12300	6980	4810	17600	
31	5030	---	1770	1570	---	23800	---	14500	---	7890	4580	---	
TOTAL	234130	103700	65360	48750	38530	398490	771300	606600	377380	259600	187660	288280	
MEAN	7553	3457	2108	1573	1376	12850	25710	19570	12580	8374	6054	9609	
MAX	10300	4740	2500	1750	1600	32500	33600	35900	20600	11100	9410	21400	
MIN	4700	2650	1770	1500	1260	1270	21100	14200	8240	6190	4480	3640	
CFSM	.51	.23	.14	.11	.09	.86	1.73	1.31	.84	.56	.41	.65	
IN.	.58	.26	.16	.12	.10	.99	1.93	1.51	.94	.65	.47	.72	
AC-FT	464400	205700	129600	96700	76420	790400	1530000	1203000	748500	514900	372200	571800	
CAL YR 1985 TOTAL	1962736	MEAN	5377	MAX	28800	MIN	740	CFSM	.36	IN	4.90	AC-FT	3893000
WTR YR 1986 TOTAL	3379780	MEAN	9260	MAX	35900	MIN	1260	CFSM	.62	IN	8.44	AC-FT	6704000

## MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1963-66, 1968 to current year.

PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1967 to September 30, 1981, October 1982 to September 30, 1983.

SUSPENDED-SEDIMENT DISCHARGE: October 1967 to current year.

REMARKS.--During the winter period, daily suspended-sediment samples were collected monthly and daily sediment load was estimated on the basis of water records and these sediment samples. Water temperature was obtained once-daily during open water period and occasionally for the winter period. Temperature records are considered fair.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum daily, 30.5°C July 15, 1980; minimum daily, 0.0°C on many days each year.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 2,850 mg/L, Aug. 7, 1968; minimum daily mean, 13 mg/L, Nov. 24, 1974, Feb. 18, 19, 1979.

SEDIMENT LOADS: Maximum daily, 247,000 tons, Apr. 9, 1969; minimum daily, 5.2 tons, Nov. 6, 1976.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURES: Maximum daily, 26.0°C, July 19, 20; minimum daily, 0.0°C on many days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 1960 mg/L, June 21; minimum daily mean, 48 mg/L, Mar. 13.

SEDIMENT LOADS: Maximum daily, 80,200 tons, June 22; minimum daily, 191 tons, Feb. 26.

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
ONCE-DAILY

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.0	8.0			---	---	9.0	10.5	21.5	20.5	22.5	19.0
2	9.0	6.5			---	---	9.5	11.5	20.5	20.5	22.0	20.0
3	9.5	6.0			---	.5	9.0	11.0	20.0	24.0	21.5	20.5
4	9.5	5.0			---	1.0	8.5	13.0	20.5	23.0	22.5	21.0
5	8.5	5.0			---	.0	8.5	15.0	20.0	25.0	22.0	20.0
6	8.5	6.0			---	.0	8.0	14.5	21.0	24.0	22.5	18.5
7	9.0	5.0			---	.0	8.5	14.0	20.5	24.0	23.0	17.0
8	10.0	4.0			---	1.0	8.5	14.5	21.5	25.0	23.0	17.0
9	8.5	2.5			---	.5	9.0	15.0	20.0	24.0	23.5	17.5
10	7.5	2.0			---	.0	9.0	16.0	21.0	24.0	23.0	18.0
11	7.5	1.5			.0	.5	11.0	18.0	21.0	23.0	21.5	17.0
12	9.0	1.5			---	.0	9.5	15.5	19.5	22.5	22.0	15.5
13	8.0	1.5			---	.0	8.5	17.0	19.5	22.0	22.0	16.0
14	8.5	1.5			---	.0	8.0	15.5	20.0	22.0	21.5	16.0
15	8.0	1.0			---	1.0	7.0	17.0	20.0	24.0	21.5	15.0
16	8.0	1.0			---	1.0	6.5	17.0	20.5	23.5	23.0	14.0
17	9.0	1.5			---	.5	8.5	15.5	20.5	24.5	23.5	14.0
18	9.0	2.0			---	.0	8.0	15.5	21.0	25.5	23.5	14.5
19	8.5	1.0			---	.0	8.0	14.5	23.0	26.0	23.5	15.0
20	8.5	---			---	.0	9.0	14.5	24.5	26.0	24.0	14.5
21	9.5	---			---	1.0	8.0	15.0	23.5	24.5	21.0	16.0
22	10.0	---			---	1.5	7.5	15.5	21.5	24.0	21.0	16.5
23	11.0	---			---	.5	9.0	16.5	22.0	25.0	20.0	16.0
24	10.5	---			---	2.5	11.5	16.0	20.0	25.5	20.0	16.0
25	10.0	---			---	1.5	11.0	16.5	22.5	25.5	20.0	17.5
26	11.0	---			---	2.0	12.0	16.0	23.0	25.0	20.5	18.0
27	10.0	---			---	4.5	13.0	16.5	23.5	24.5	19.0	18.0
28	10.0	---			---	3.5	12.0	17.0	24.0	25.0	18.0	17.0
29	9.5	---			---	8.5	13.0	18.5	24.0	25.0	18.0	17.0
30	8.0	---			---	8.0	13.0	19.0	22.0	25.0	18.5	16.5
31	7.5	---			---	8.0	---	21.0	---	23.0	19.0	---
MEAN	9.0	---			---	---	9.5	15.5	21.5	24.0	21.5	17.0
MAX	11.0	8.0			---	8.5	13.0	21.0	24.5	26.0	24.0	21.0
MIN	7.5	---			.0	.0	6.5	10.5	19.5	20.5	18.0	14.0
WTR YR 1986	MAX	26.0		MIN	.0							

SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)
	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
1	230	2920	100	1280	56	378	56	265	56	242	60	206
2	242	3720	102	1190	56	363	56	260	56	240	70	240
3	288	5010	103	1130	56	355	56	257	56	230	92	315
4	330	7020	104	1100	56	348	56	254	56	227	75	263
5	362	9090	105	1070	56	333	56	249	56	225	52	253
6	326	8780	98	1010	56	318	56	245	56	222	61	359
7	295	8200	81	829	56	310	56	242	56	216	70	472
8	282	7770	80	801	56	302	56	240	56	215	62	502
9	260	6840	80	788	56	314	56	239	56	213	52	463
10	240	6070	80	756	56	321	56	236	56	212	50	479
11	214	5230	80	728	56	336	56	234	56	210	50	506
12	197	4700	77	686	56	343	56	233	56	209	50	533
13	193	4570	72	640	56	345	56	231	56	207	48	544
14	200	4830	67	592	56	346	56	230	56	206	49	589
15	208	5140	62	539	56	345	56	228	56	204	67	859
16	212	4970	55	484	56	340	56	227	56	203	200	2780
17	222	4990	53	472	56	336	56	227	56	201	226	4880
18	220	4840	51	461	56	330	56	227	56	200	785	27300
19	158	3410	50	468	56	324	56	227	56	198	824	40300
20	133	2790	50	455	56	319	56	227	56	198	675	38800
21	142	2870	50	462	56	314	56	227	56	197	617	37000
22	160	3100	50	459	56	307	56	227	56	197	700	50500
23	201	3700	50	459	56	302	56	227	56	195	496	43500
24	209	3620	50	445	56	299	56	228	56	194	325	26600
25	198	3190	50	432	56	293	56	231	56	192	230	16900
26	166	2490	51	427	56	287	56	240	56	191	202	14300
27	141	1990	52	421	56	284	56	245	56	192	184	12900
28	131	1790	53	415	56	278	56	245	56	192	169	11800
29	129	1770	54	408	56	274	56	243	---	---	150	10200
30	113	1560	55	394	56	271	56	242	---	---	138	9130
31	96	1300	---	---	56	268	56	237	---	---	131	8420
TOTAL	---	138270	---	19801	---	9883	---	7370	---	5828	---	361893

	APRIL			MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1	125	7830	335	31400	150	5630	242	7250	355	8550	222	2640	
2	119	7290	214	20700	169	5980	305	8480	280	7090	244	2840	
3	113	6800	141	12900	178	5860	332	8520	245	6220	262	2870	
4	116	7050	90	7480	174	5450	320	7680	250	6030	274	2960	
5	215	14200	107	7920	171	5120	306	6790	195	4610	281	3030	
6	237	18000	119	7870	171	5310	295	6080	222	4930	275	2870	
7	179	15100	113	6770	179	5650	290	5550	265	5590	264	2640	
8	148	13300	119	6460	200	6050	325	6190	290	5780	260	2560	
9	126	11400	135	6780	214	6010	388	8130	280	5120	263	2580	
10	104	9180	143	6760	220	5760	358	8090	248	4280	267	2960	
11	84	7010	152	7020	221	5500	317	7220	230	3880	274	4360	
12	71	5580	163	7570	220	5250	300	7230	264	4070	278	4380	
13	66	4900	165	7930	220	5040	350	9100	274	4020	284	4090	
14	66	4650	163	8010	220	4930	320	8420	252	3740	290	3990	
15	68	4660	162	7960	220	4890	284	6960	252	3700	294	4380	
16	67	4520	147	7180	220	4960	308	7580	223	3050	300	4450	
17	65	4320	147	7140	221	4970	304	8040	241	3120	318	4680	
18	64	4160	147	6990	216	5200	289	7800	250	3080	419	7070	
19	63	4130	147	6790	189	4920	228	5950	254	3070	513	12100	
20	60	3900	140	6350	172	4540	248	6290	258	3180	462	13300	
21	60	3890	132	5880	1960	71400	276	6650	259	3420	420	14200	
22	61	3840	132	5700	1540	80200	250	5690	248	3310	382	15100	
23	62	3780	131	5380	620	32800	202	4290	233	3160	322	15000	
24	63	3760	137	5400	410	22000	232	4620	225	3040	289	15300	
25	60	3500	104	3990	350	19500	263	5010	215	2910	244	13800	
26	61	3510	120	4670	260	14000	236	4150	205	2730	213	12300	
27	85	4840	123	4880	219	10600	257	4430	188	2420	183	10500	
28	110	6740	177	7170	220	9440	275	4660	167	2190	144	7890	
29	169	12000	163	6600	200	7510	290	4850	149	2040	119	6070	
30	310	26000	148	5910	191	6340	324	6110	170	2210	103	4890	
31	---	---	127	4970	---	---	367	7820	194	2400	---	---	
TOTAL	---	229840	---	248530	---	380810	---	205630	---	122940	---	205800	

TOTAL LOAD FOR YEAR: 1936595 TONS.

## MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN--Continued

## PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SED. SUSP. SIEVE DIAM. % FINER THAN (70331) .062 MM	SED. SUSP. FALL DIAM. % FINER THAN (70337) .002 MM	SED. SUSP. FALL DIAM. % FINER THAN (70338) .004 MM	SED. SUSP. FALL DIAM. % FINER THAN (70340) .016 MM	SED. SUSP. FALL DIAM. % FINER THAN (70342) .062 MM	SED. SUSP. FALL DIAM. % FINER THAN (70343) .125 MM	SED. SUSP. FALL DIAM. % FINER THAN (70344) .250 MM	SED. SUSP. FALL DIAM. % FINER THAN (70345) .500 MM	SED. SUSP. FALL DIAM. % FINER THAN (70346) 1.00 MM
APR											
09...	0900	33500	55	--	--	--	--	--	--	--	--
29...	1316	25900	--	46	56	70	78	79	83	89	100
MAY											
02...	1030	37400	82	--	--	--	--	--	--	--	--
JUN											
17...	1645	8620	89	--	--	--	--	--	--	--	--

## PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	NUMBER OF SAM- PLING POINTS (00063)	BED MAT. SIEVE DIAM. % FINER THAN (80165) .125 MM	BED MAT. SIEVE DIAM. % FINER THAN (80166) .250 MM	BED MAT. SIEVE DIAM. % FINER THAN (80167) .500 MM	BED MAT. SIEVE DIAM. % FINER THAN (80168) 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN (80169) 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN (80170) 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN (80171) 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN (80172) 16.0 MM
APR											
29...	1232	25900	5	<1	1	26	64	78	88	96	100
SEP											
24...	1225	19700	3	<1	7	30	61	80	92	97	100

## MINNESOTA RIVER BASIN

05327000 HIGH ISLAND CREEK NEAR HENDERSON, MN

LOCATION.--Lat 44°34'19", long 93°55'18", in NE¼NW¼ sec.26, T.113 N., R.26 W., Sibley County, Hydrologic Unit 07020012, on left bank 20 ft downstream from bridge on County Road 6, 1.6 mi upstream from mouth, and 3.1 mi north of Henderson.

DRAINAGE AREA.--237 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1973 to current year. May 1970 to September 1973, operated as a low-flow station only.

GAGE.--Water-stage recorder. Datum of gage is 728.56 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 24, Dec. 2 to Feb. 18, 21-22, 28, and Mar. 6-8. Records good except those for periods with ice effect, Nov. 24, Dec. 2 to Feb. 18, 21-22, 28, and Mar. 6-8, which are fair.

AVERAGE DISCHARGE.--13 years, 98.7 ft<sup>3</sup>/s, 5.66 in/yr, 71,510 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,760 ft<sup>3</sup>/s, Aug. 25, 1981, gage height, 9.09 ft; minimum discharge, 0.20 ft<sup>3</sup>/s, Jan. 4, 1981, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 4	1930	917	5.55	June 18	1915	486	3.47
Mar. 18	2345	562	3.79	June 22	0845	*1,670	*8.59
Mar. 25	1615	1,010	5.87	July 16	0045	732	4.76
Apr. 14	1930	767	4.94	July 27	1745	314	2.88
Apr. 28	1245	890	5.60	Sept. 21	1730	937	5.71
May 3	1815	876	5.54				

Minimum discharge, 6.3 ft<sup>3</sup>/s, Mar. 6, gage height, 0.87 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	157	124	52	16	11	9.2	620	699	117	651	168	52
2	157	122	50	15	11	9.5	579	784	108	578	130	45
3	167	121	47	14	11	9.5	572	862	103	478	105	59
4	623	116	44	14	11	9.7	573	852	94	372	86	74
5	724	111	38	14	11	9.9	672	794	87	281	73	69
6	502	108	38	14	11	10	606	721	75	240	63	68
7	412	112	37	14	11	10	553	646	68	207	55	69
8	445	109	35	14	11	9.6	552	588	64	181	47	67
9	426	105	34	13	11	10	577	515	60	170	42	63
10	406	90	33	13	11	11	597	453	56	151	40	75
11	394	84	33	13	11	12	578	434	58	165	33	84
12	461	95	33	13	11	14	551	390	64	189	27	72
13	435	100	33	13	10	14	488	367	56	238	23	58
14	385	95	32	12	9.2	16	616	329	52	198	40	83
15	350	89	31	12	9.0	18	663	306	49	354	30	103
16	330	92	30	12	8.8	21	549	294	45	612	28	96
17	315	91	30	12	8.8	43	504	287	44	482	36	108
18	296	91	30	12	8.8	33.5	529	266	289	445	25	173
19	278	92	29	12	8.8	51.9	622	247	376	448	21	401
20	252	58	28	12	8.7	41.7	595	227	307	463	72	476
21	222	53	26	12	8.7	45.4	560	211	665	482	244	706
22	193	85	25	12	8.7	66.0	526	206	1580	492	235	838
23	175	79	24	12	8.5	85.0	488	180	1320	461	257	693
24	162	78	23	12	8.5	84.0	464	182	929	384	257	638
25	154	76	23	12	8.2	97.7	421	156	805	291	246	673
26	151	74	22	11	8.5	92.2	382	156	748	184	207	672
27	141	74	21	11	8.8	84.0	537	147	735	263	162	663
28	132	64	20	11	9.0	82.0	810	139	732	237	130	652
29	128	67	18	11	---	79.0	677	132	722	196	105	637
30	129	60	17	11	---	72.4	689	126	696	235	85	616
31	125	---	16	11	---	67.1	---	128	---	200	65	---
TOTAL	9227	2715	952	390	273.0	10055.4	17150	11824	11104	10328	3137	9083
MEAN	298	90.5	30.7	12.6	9.75	32.4	572	381	370	333	101	303
MAX	724	124	52	16	11	97.7	810	862	1580	651	257	838
MIN	125	53	16	11	8.2	9.2	382	126	44	151	21	45
CFSM	1.26	.38	.13	.05	.04	1.37	2.41	1.61	1.56	1.41	.43	1.28
IN.	1.45	.43	.15	.06	.04	1.58	2.69	1.86	1.74	1.62	.49	1.43
AC-FT	18300	5390	1890	774	541	19940	34020	23450	22020	20490	6220	18020

CAL YR 1985	TOTAL	49501.4	MEAN	136	MAX	818	MIN	3.8	CFSM	.57	IN	7.77	AC-FT	98190
WTR YR 1986	TOTAL	86238.4	MEAN	236	MAX	1580	MIN	8.2	CFSM	1.00	IN	13.54	AC-FT	171100

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN

LOCATION.--Lat 44°41'35", long 93°38'30", in NW¼SW¼ sec.7, T.114 N., R.23 W., Carver County, Hydrologic Unit 07020012, on pier at center downstream side of bridge, 1.5 mi northwest of Jordan, and at mile 39.4 upstream from Mississippi River.

DRAINAGE AREA.--16,200 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1934 to current year. Prior to Oct. 1, 1966, published as "near Carver, Minn".

REVISED RECORDS.--WSP 955: Drainage area. WSP 1508: 1935.

GAGE.--Water-stage recorder. Datum of gage is 690.00 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1966, water-stage recorder 2.8 mi downstream with auxiliary nonrecording gage at present site and present datum.

REMARKS.--Estimated daily discharges: Nov. 22 to Mar. 26, Aug. 13, 14. Records good except those for period with ice effect, Nov. 22 to Mar. 26, and period of no gage-height record, Aug. 13, 14, which are fair.

AVERAGE DISCHARGE.--52 years, 3,814 ft<sup>3</sup>/s, 3.20 in/yr, 2,763,000 acre-ft/yr; median of yearly mean discharges, 3,300 ft<sup>3</sup>/s, 2.77 in/yr, 2,390,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 117,000 ft<sup>3</sup>/s, Apr. 11, 1965; maximum gage height, 35.07 ft, Apr. 12, 1965 (backwater from Mississippi River); minimum discharge, 79 ft<sup>3</sup>/s, Nov. 17, 1955; minimum gage height, 2.66 ft, Nov. 22, 1935.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 36,700 ft<sup>3</sup>/s, May 4, gage height, 26.30 ft; maximum gage height, 26.58 ft, Mar. 25 (backwater from ice); minimum daily, 1,370 ft<sup>3</sup>/s, Feb. 20-23; minimum gage height, 7.35 ft, Feb. 19, 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	5780	5630	3250	1940	1890	1440	29000	30100	15600	20300	9060	5140		
2	5940	5420	3150	1900	1930	1460	28100	32700	15300	18500	9520	4910		
3	6480	5090	3050	1870	2000	1480	27500	35200	15000	16600	9890	4810		
4	8060	4800	2950	1850	2030	1510	27100	36600	14400	14500	10000	4790		
5	10800	4620	2850	1820	1980	1570	27200	36100	13600	12500	9800	4910		
6	12200	4500	2750	1800	1950	1730	27800	34000	12900	10900	9460	4920		
7	12700	4470	2700	1780	1880	2100	29300	31300	12300	9790	9020	4700		
8	12900	4430	2700	1780	1780	2600	31300	29100	12100	8910	8470	4440		
9	12800	4420	2700	1790	1720	3200	33600	27000	11900	8510	7990	4330		
10	12500	4340	2700	1790	1670	4000	35300	24900	11500	9030	7460	4420		
11	11900	4180	2700	1800	1620	4700	36000	23300	10900	9560	6920	5970		
12	11500	4090	2740	1800	1570	5100	35300	21800	10200	9760	6620	7830		
13	11400	4000	2750	1800	1530	5600	33400	20800	9630	10000	6590	7980		
14	11200	3950	2700	1800	1470	5900	32100	20400	9180	10700	6380	7380		
15	11000	3900	2650	1810	1440	6400	31400	20300	8860	11200	6020	7210		
16	10900	3880	2600	1810	1420	6800	30400	20300	9050	11900	5910	7540		
17	10700	3900	2570	1820	1400	7200	29200	20400	9230	12500	5860	7490		
18	10200	3930	2520	1840	1390	7900	28300	20300	9730	12600	5530	7330		
19	9730	3970	2470	1900	1380	9700	28000	20100	10800	12400	5210	8300		
20	9390	3980	2420	1940	1370	11500	27800	19800	11500	12200	5150	10500		
21	9070	3470	2400	2000	1370	14300	27400	19400	12000	11600	5990	12400		
22	8710	3900	2360	2000	1370	17800	27000	18900	13900	11000	6850	13900		
23	8350	3850	2320	1990	1370	21000	26800	18500	17000	10200	6820	15200		
24	7900	3800	2270	1990	1380	26600	26300	18100	22800	9500	6540	16800		
25	7410	3750	2220	1980	1380	31200	25800	17600	25300	8840	6300	18400		
26	6940	3700	2200	1970	1400	33600	25200	17000	26200	7970	6110	20200		
27	6440	3620	2150	1960	1410	34800	25000	16500	26300	7790	5940	22400		
28	6020	3550	2100	1940	1420	32700	25800	16000	25400	7620	5660	23900		
29	5790	3450	2060	1930	---	31400	26600	15800	23500	7270	5550	24400		
30	5690	3350	2020	1910	---	30600	28100	15800	21100	7280	5630	24200		
31	5680	---	1980	1900	---	29800	---	15700	---	8340	5430	---		
TOTAL	286080	123940	79000	58210	44520	395690	872100	713800	447180	339770	217680	316700		
MEAN	9228	4131	2548	1878	1590	12760	29070	23030	14910	10960	7022	10560		
MAX	12900	5630	3250	2000	2030	34800	36000	36600	26300	20300	10000	24400		
MIN	5680	3350	1980	1780	1370	1440	25000	15700	8860	7270	5150	4330		
CFSM	.57	.26	.16	.12	.10	.79	1.79	1.42	.92	.68	.43	.65		
IN.	.66	.28	.18	.13	.10	.91	2.00	1.64	1.03	.78	.50	.73		
AC-FT	567400	245800	156700	115500	88310	784900	1730000	1416000	887000	673900	431800	628200		
CAL YR 1985	TOTAL	2318881	MEAN	6353	MAX	31900	MIN	925	CFSM	.39	IN	5.32	AC-FT	4599000
WTR YR 1986	TOTAL	3894670	MEAN	10670	MAX	36600	MIN	1370	CFSM	.66	IN	8.94	AC-FT	7725000

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1952, 1963-69, 1972 to current year.

## PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: July 1973 to current year.

pH: January 1974 to current year.

WATER TEMPERATURES: July 1973 to current year.

DISSOLVED OXYGEN: July 1973 to current year.

INSTRUMENTATION.--Water-quality monitor since July 1973.

REMARKS.--Extremes are for years with 80 percent or more daily record. Letter K indicates non-ideal colony count. Letter E indicates estimated value. Water is pumped to a monitor that is inside a heated shelter; therefore, water temperature during the winter period may be affected.

COOPERATION.--Water-quality monitor is operated by the Metropolitan Waste Control Commission, St. Paul, MN.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1978, 1980-86): Maximum, 1,330 microsiemens Jan. 8, 1986; minimum, 324 microsiemens June 3, 1980.

pH (water years 1978, 1980-82, 1984-86): Maximum, 8.9 units May 4, Sept. 15, 1982; minimum, 6.4 units Aug. 11, 1982.

WATER TEMPERATURES (water years 1978-86): Maximum, 30.0°C July 15, 1980; minimum, 0.0°C several days during winter period.

DISSOLVED OXYGEN (water years 1978-85): Maximum, 19.6 mg/L Oct. 19, 1978; minimum, 2.5 mg/L Sept. 5, 1978.

## EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 1,330 microsiemens Jan. 8; minimum, 357 microsiemens Sep. 13.

pH: Maximum, 8.6 units Oct. 19-23, Nov. 2; minimum, 7.6 units Dec. 6-10.

WATER TEMPERATURES: Maximum, 27.0°C July 18-20; minimum, 0.0° several days during winter period.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (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, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT										
23...	1430	8730	1050	1070	8.2	8.1	16.0	11.5	17	760
JAN										
16...	1115	1810	1000	1120	7.6	7.8	2.0	0.0	3.5	761
APR										
28...	1225	25000	880	858	8.4	8.4	8.0	14.0	14	754
JUL										
15...	1130	11100	810	732	8.3	8.2	23.0	22.5	82	754

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI 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)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
OCT									
23...	10.0	41	130	130	60	24	4.2	390	0
JAN									
16...	10.4	K8200	400	130	58	30	4.8	443	0
APR									
28...	10.5	270	K2500	100	46	17	5.5	287	3
JUL									
15...	6.7	470	760	94	37	14	3.6	283	0

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	ALKA-LINITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA-LINITY, FIXED ENDPT, FIELD (MG/L AS CAC03) (00410)	ALKA-LINITY, LAB (MG/L AS CAC03) (90410)	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)	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)
OCT 23...	320	320	381	240	29	0.5	23	761	0.05
JAN 16...	363	362	397	230	36	0.4	22	760	0.03
APR 28...	235	235	239	230	18	0.3	10	602	0.02
JUL 15...	232	232	253	120	19	0.4	24	513	0.03

DATE	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)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 23...	7.6	0.09	0.05	1.2	0.17	0.09	0.09	278	86
JAN 16...	4.2	0.50	0.49	1.8	0.13	0.10	0.09	27	--
APR 28...	3.9	0.07	0.05	1.0	0.12	0.05	0.03	75	60
JUL 15...	6.8	0.08	0.07	1.4	0.26	0.15	0.13	307	92

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	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)	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 PE) (01049)
OCT 23...	1430	10	3	91	3	<1	<1	<3	3	6	<1
JAN 16...	1115	<10	2	81	<0.5	<1	<1	<3	1	12	1
JUL 15...	1130	<10	4	78	<0.5	<1	<1	<3	2	5	<5

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

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)
OCT 23...	54	5	0.1	<10	2	4	<1	470	<6	9
JAN 16...	48	74	<0.1	<10	4	3	<1	500	<6	16
JUL 15...	35	<1	0.2	<10	3	2	<1	310	<6	9

## RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)
JUL 15...	1130	6.5	4.5	9.4	8.6	7.1	8.0	0.08

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	954	921	939	1190	1150	1170	---	---	---	---	---	---
2	935	907	918	1200	1120	1170	1320	1210	1260	---	---	---
3	964	908	937	1130	1080	1100	1320	1270	1300	---	---	---
4	910	714	827	1090	1080	1080	1290	1260	1280	---	---	---
5	712	612	658	1150	1090	1100	1250	1090	1170	---	---	---
6	714	628	660	1130	1110	1120	1240	1090	1120	1260	1240	1240
7	820	717	811	1140	1110	1130	1260	1100	1150	1290	1240	1240
8	846	795	828	1150	1010	1070	---	---	---	1330	1230	1240
9	917	844	870	1000	978	995	1090	1060	1070	1250	1110	1220
10	1030	907	1000	1010	977	996	1210	1000	1070	1160	1120	1140
11	1070	1030	1050	1000	975	991	---	---	---	1150	1110	1140
12	1170	1070	1080	975	951	962	---	---	---	1160	1060	1110
13	1090	1070	1080	990	952	967	1000	929	984	1190	1120	1160
14	1090	1080	1080	981	962	972	961	932	947	1240	1100	1160
15	1090	1040	1080	982	965	974	1040	961	998	1150	1110	1130
16	1110	1090	1090	979	952	964	1020	990	1000	1160	1060	1080
17	1120	1090	1110	965	946	957	1060	1030	1040	---	---	---
18	1180	1110	1150	980	955	970	---	---	---	1090	1050	1080
19	1240	1180	1210	1000	963	970	1120	1100	1110	1060	1050	1040
20	1250	1210	1230	980	959	970	1130	1110	1120	1060	1040	1050
21	1260	1240	1250	1080	966	1010	1240	1120	1180	---	---	---
22	1260	1250	1260	1110	1010	1070	1210	1150	1190	---	---	---
23	1260	1250	1260	1140	1110	1130	1220	1180	1200	1030	971	1000
24	1260	1180	1220	1150	1040	1100	1280	1220	1250	1020	979	1000
25	1200	1180	1190	1040	1000	1020	1290	1190	1240	1010	981	998
26	1190	1180	1180	---	---	---	1270	1240	1250	---	---	---
27	1190	1170	1180	---	---	---	1280	1240	1250	1060	1000	1020
28	1210	1180	1190	1140	1010	1070	---	---	---	1060	983	1020
29	1240	1180	1220	1160	1130	1140	---	---	---	---	---	---
30	1210	1180	1190	1150	1140	1150	1300	1250	1300	---	---	---
31	1220	1180	1220	---	---	---	1290	1250	1260	1160	1060	1120
MONTH	1260	612	1060	---	---	---	---	---	---	---	---	---
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	1190	1080	1120	1160	1060	1110	---	---	---	805	703	751
2	1090	1000	1030	1140	1090	1110	630	589	610	752	684	710
3	1110	1090	1100	1110	1090	1100	---	---	---	683	661	668
4	---	---	---	1100	1070	1080	---	---	---	736	661	677
5	---	---	---	1100	1060	1080	---	---	---	744	697	719
6	1010	992	1000	1090	1050	1070	---	---	---	810	744	774
7	1030	993	1020	1070	1010	1040	---	---	---	832	760	796
8	1060	1020	1030	---	---	---	977	962	970	801	784	793
9	1040	1020	1030	884	667	776	991	976	983	825	804	815
10	---	---	---	668	627	647	1010	990	1000	826	817	822
11	---	---	---	702	628	665	1040	1010	1020	816	800	806
12	1100	1080	1090	658	649	654	1090	1040	1060	801	793	797
13	1170	1090	1120	---	---	---	1080	1040	1060	793	778	787
14	---	---	---	---	---	---	1030	1020	1030	778	758	768
15	1160	1110	1130	---	---	---	972	968	970	793	755	775
16	1180	1110	1140	806	785	790	914	911	913	789	784	785
17	1140	1110	1120	808	744	778	852	849	850	793	785	788
18	1130	1110	1120	---	---	---	852	844	847	798	793	795
19	---	---	---	741	498	640	847	843	844	793	785	789
20	1150	1110	1130	469	463	466	857	845	850	794	755	775
21	---	---	---	435	358	390	887	857	869	791	773	782
22	---	---	---	---	---	---	891	855	873	775	767	771
23	---	---	---	---	---	---	899	862	879	796	770	776
24	---	---	---	---	---	---	884	785	834	790	781	787
25	1140	1010	1130	---	---	---	822	800	812	792	783	788
26	1190	1100	1120	---	---	---	890	822	831	783	775	779
27	1110	1090	1100	---	---	---	832	823	828	775	756	767
28	1100	1080	1090	---	---	---	824	793	810	756	736	743
29	---	---	---	---	---	---	793	740	765	813	732	783
30	---	---	---	---	---	---	740	717	726	830	810	818
31	---	---	---	---	---	---	---	---	---	857	828	843
MONTH	---	---	---	---	---	---	---	---	---	857	661	775

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN. MN--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	876	856	864	704	635	670	---	---	---	---	---	---
2	893	876	883	747	700	724	551	529	541	849	827	839
3	930	893	913	---	---	---	645	544	587	833	807	822
4	957	928	943	---	---	---	745	647	703	845	800	817
5	967	858	956	---	---	---	827	741	780	815	784	802
6	964	958	961	837	810	821	833	537	685	815	770	794
7	959	914	939	854	835	843	816	757	787	816	795	806
8	913	875	890	867	853	861	906	864	879	814	788	801
9	872	855	864	873	863	868	922	893	907	819	801	810
10	868	852	860	863	760	803	925	885	905	829	802	810
11	852	838	845	771	736	754	898	888	893	803	507	704
12	830	819	824	745	713	728	884	858	871	503	380	459
13	823	810	814	715	701	705	840	792	816	486	357	416
14	823	810	815	703	667	680	796	747	772	---	---	---
15	906	810	818	693	664	686	753	730	739	641	586	630
16	810	785	793	---	---	---	736	693	722	694	634	661
17	808	772	786	810	757	783	702	666	685	730	694	705
18	840	808	820	818	749	770	704	680	695	789	730	765
19	819	789	798	818	747	782	718	685	708	799	707	760
20	---	---	---	785	752	768	732	665	700	731	627	686
21	---	---	---	---	---	---	687	597	644	625	559	574
22	---	---	---	---	---	---	691	557	580	579	529	554
23	---	---	---	---	---	---	631	567	591	603	567	585
24	---	---	---	850	840	845	664	630	640	675	623	649
25	---	---	---	850	816	833	669	635	653	736	694	715
26	---	---	---	874	824	843	711	670	692	769	734	749
27	---	---	---	883	823	858	716	704	712	816	770	785
28	---	---	---	830	818	823	733	707	717	921	864	892
29	770	682	724	838	819	826	810	729	773	996	922	959
30	852	769	809	823	777	802	803	788	796	1070	996	1030
31	---	---	---	---	---	---	818	800	809	---	---	---

PH (STANDARD UNITS). WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN		MAX	MIN	MEAN		MAX	MIN	MEAN		MAX	MIN	MEAN
	OCTOBER				NOVEMBER				DECEMBER				JANUARY		
1	8.3	8.3	8.3		8.4	8.3	8.3		8.1	7.8	7.9		---	---	---
2	8.4	8.3	8.3		8.6	8.3	8.3		8.1	7.7	7.8		---	---	---
3	8.3	7.9	8.1		8.5	8.3	8.4		7.8	7.7	7.7		---	---	---
4	7.9	7.8	7.9		8.3	8.3	8.3		7.9	7.7	7.7		---	---	---
5	7.8	7.7	7.7		8.4	8.3	8.3		7.8	7.7	7.7		---	---	---
6	7.7	7.7	7.7		8.3	8.3	8.3		7.9	7.6	7.7		7.9	7.9	7.9
7	7.8	7.7	7.7		8.4	8.3	8.4		8.0	7.6	7.8		7.9	7.8	7.9
8	7.7	7.7	7.7		8.4	8.1	8.3		7.7	7.6	7.7		8.0	7.8	7.9
9	8.2	7.7	7.7		8.2	8.2	8.2		7.7	7.6	7.7		8.1	7.9	8.0
10	8.1	7.8	7.8		8.3	8.2	8.2		8.0	7.6	7.6		8.0	7.9	7.9
11	7.9	7.7	7.8		8.3	8.2	8.2		7.9	7.8	7.8		8.0	7.9	8.0
12	7.8	7.8	7.8		8.3	8.2	8.3		---	---	---		7.9	7.9	7.9
13	7.8	7.8	7.8		8.3	8.2	8.3		8.0	7.8	7.9		8.1	7.9	8.0
14	8.0	7.8	7.8		8.3	8.3	8.3		7.9	7.8	7.9		8.2	7.9	8.0
15	8.2	8.0	8.0		8.3	8.0	8.1		7.9	7.8	7.9		8.2	7.9	8.0
16	8.2	8.2	8.2		8.0	8.0	8.0		8.0	7.8	7.9		8.2	8.0	8.0
17	8.4	8.2	8.2		8.0	8.0	8.0		8.0	7.7	7.8		---	---	---
18	8.5	8.2	8.4		8.2	8.0	8.0		8.1	7.8	7.9		8.1	8.0	8.0
19	8.6	8.5	8.5		8.0	7.9	8.0		8.1	7.9	8.0		8.0	7.9	7.9
20	8.6	8.5	8.5		8.1	8.0	8.1		8.0	8.0	8.0		8.0	8.0	8.0
21	8.6	8.5	8.5		8.0	7.9	8.0		8.3	7.8	8.0		---	---	---
22	8.6	8.5	8.5		8.0	7.9	7.9		8.3	8.1	8.1		---	---	---
23	8.6	8.5	8.5		7.9	7.9	7.9		8.3	8.0	8.2		8.1	7.9	8.0
24	8.5	8.2	8.4		8.0	7.9	7.9		8.3	7.9	8.0		8.0	8.0	8.0
25	8.2	8.2	8.2		7.9	7.9	7.9		8.0	7.9	8.0		8.0	8.0	8.0
26	8.3	8.2	8.2		---	---	---		8.1	8.0	8.0		8.3	7.9	8.1
27	8.4	8.2	8.2		---	---	---		8.2	8.0	8.1		7.9	7.9	7.9
28	8.3	8.2	8.3		7.9	7.8	7.8		---	---	---		8.2	7.9	8.0
29	8.3	8.3	8.3		7.8	7.8	7.8		8.2	8.0	8.0		8.1	7.9	7.9
30	8.4	8.3	8.3		8.2	7.8	7.9		8.3	7.9	8.0		---	---	---
31	8.3	8.3	8.3		---	---	---		8.3	7.9	8.1		8.2	7.9	8.0
MONTH	8.6	7.7	8.1		---	---	---		---	---	---		---	---	---

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	8.2	8.0	8.1	8.1	8.0	8.1	---	---	---	8.1	8.0	8.1
2	8.0	8.0	8.0	8.1	8.1	8.1	7.8	7.8	7.8	8.0	8.0	8.0
3	---	---	---	8.2	8.1	8.1	---	---	---	8.0	7.9	7.9
4	---	---	---	8.2	8.1	8.1	---	---	---	8.2	7.9	7.9
5	---	---	---	8.2	8.1	8.1	---	---	---	7.9	7.9	7.9
6	8.1	8.0	8.0	8.1	8.0	8.0	---	---	---	8.0	7.9	7.9
7	8.1	8.0	8.0	8.2	8.0	8.1	---	---	---	8.0	8.0	8.0
8	8.1	8.0	8.0	8.1	7.9	8.1	8.0	7.9	8.0	8.1	8.0	8.0
9	8.0	8.0	8.0	8.1	8.0	8.1	8.2	8.2	8.2	8.1	8.0	8.1
10	---	---	---	8.1	8.0	8.0	8.2	7.9	8.0	8.1	8.0	8.1
11	8.0	7.9	8.0	8.1	8.0	8.0	8.2	8.2	8.2	8.1	8.1	8.1
12	8.2	7.9	8.0	8.1	8.0	8.0	8.2	8.2	8.2	8.1	8.1	8.1
13	8.1	7.9	8.0	---	---	---	8.3	8.2	8.2	8.1	8.1	8.1
14	8.0	7.9	8.0	---	---	---	8.3	8.1	8.2	8.1	8.1	8.1
15	8.1	7.9	8.0	---	---	---	8.3	8.3	8.3	8.2	8.1	8.2
16	8.2	7.9	8.0	8.1	8.0	8.0	8.3	8.2	8.2	8.2	8.2	8.2
17	8.1	8.0	8.0	8.1	8.1	8.1	8.3	8.0	8.1	8.2	8.2	8.2
18	8.3	8.0	8.0	8.1	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.2
19	8.2	8.0	8.0	8.2	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.2
20	8.0	8.0	8.0	8.1	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.2
21	---	---	---	8.0	8.0	8.0	8.3	8.2	8.2	8.2	8.2	8.2
22	---	---	---	---	---	---	8.3	8.2	8.3	8.2	8.1	8.2
23	---	---	---	---	---	---	8.4	8.3	8.3	8.2	8.1	8.1
24	---	---	---	---	---	---	8.3	8.3	8.3	8.1	8.1	8.1
25	8.2	8.1	8.1	---	---	---	8.4	8.3	8.3	8.1	8.1	8.1
26	8.4	8.1	8.2	---	---	---	8.4	8.2	8.3	8.1	8.0	8.1
27	8.2	8.1	8.1	---	---	---	8.4	8.3	8.3	8.1	8.0	8.0
28	8.1	8.0	8.0	---	---	---	8.3	8.2	8.2	8.0	8.0	8.0
29	---	---	---	---	---	---	8.2	8.2	8.2	8.1	8.0	8.0
30	---	---	---	---	---	---	8.2	8.1	8.1	8.0	7.9	8.0
31	---	---	---	---	---	---	---	---	---	8.0	7.9	8.0
MONTH	---	---	---	---	---	---	---	---	---	8.2	7.9	8.1
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	8.0	7.9	8.0	8.1	8.1	8.1	---	---	---	---	---	---
2	7.9	7.9	7.9	8.2	8.1	8.1	8.3	8.2	8.2	8.3	8.2	8.2
3	8.0	7.8	8.0	---	---	---	8.3	8.3	8.3	8.3	8.2	8.2
4	8.0	7.9	8.0	---	---	---	8.3	8.2	8.3	8.3	8.2	8.2
5	8.1	7.9	8.0	---	---	---	8.3	8.3	8.3	8.3	8.2	8.2
6	8.0	8.0	8.0	8.2	8.2	8.2	8.4	8.2	8.3	8.3	8.2	8.3
7	8.0	8.0	8.0	8.2	8.2	8.2	8.4	8.2	8.3	8.3	8.2	8.2
8	8.0	8.0	8.0	8.2	8.2	8.2	8.3	8.2	8.2	8.2	8.2	8.2
9	8.0	8.0	8.0	8.3	8.2	8.2	8.3	8.2	8.2	8.2	8.2	8.2
10	8.0	8.0	8.0	8.3	8.2	8.2	8.3	8.2	8.2	8.2	8.2	8.2
11	8.0	7.9	8.0	8.2	8.2	8.2	8.3	8.3	8.3	8.2	8.0	8.1
12	8.0	8.0	8.0	8.2	8.2	8.2	8.3	8.2	8.3	8.0	8.0	8.0
13	8.0	8.0	8.0	8.3	8.2	8.2	8.3	8.2	8.2	8.1	8.0	8.0
14	8.0	8.0	8.0	8.3	8.2	8.2	8.2	8.2	8.2	---	---	---
15	8.0	8.0	8.0	8.2	7.9	8.2	8.2	8.2	8.2	8.2	8.1	8.2
16	8.0	8.0	8.0	---	---	---	8.2	8.2	8.2	8.2	8.1	8.2
17	8.0	8.0	8.0	8.2	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2
18	8.0	8.0	8.0	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
19	8.1	8.0	8.0	8.2	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8.2
20	8.1	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8.1
21	---	---	---	---	---	---	8.2	8.0	8.1	8.1	8.0	8.0
22	8.0	7.9	8.0	---	---	---	8.2	8.0	8.0	8.0	7.9	7.9
23	---	---	---	---	---	---	8.0	8.0	8.0	7.9	7.9	7.9
24	---	---	---	8.3	8.2	8.3	8.1	8.0	8.0	7.9	7.9	7.9
25	---	---	---	8.3	8.3	8.3	8.1	8.1	8.1	7.9	7.8	7.9
26	---	---	---	8.3	8.3	8.3	8.1	8.1	8.1	7.9	7.9	7.9
27	---	---	---	8.3	8.3	8.3	8.1	8.1	8.1	7.9	7.8	7.9
28	---	---	---	8.3	8.3	8.3	8.2	8.1	8.1	7.9	7.9	7.9
29	8.1	8.0	8.0	8.3	8.3	8.3	8.2	8.1	8.2	7.9	7.9	7.9
30	8.1	8.1	8.1	8.3	8.3	8.3	8.3	8.2	8.2	8.0	7.9	8.0
31	---	---	---	---	---	---	8.3	8.2	8.3	---	---	---

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	9.5	9.0	9.5	9.0	8.5	9.0	---	---	---	---	---	---
2	11.5	8.5	9.0	8.5	7.5	8.5	.5	.0	.5	---	---	---
3	10.0	9.0	9.5	7.5	7.0	7.5	.5	.5	.5	---	---	---
4	9.5	9.5	9.5	7.0	6.5	6.5	.5	.5	.5	---	---	---
5	9.5	9.0	9.5	6.5	6.0	6.5	.5	.0	.5	---	---	---
6	9.0	9.0	9.0	6.5	6.5	6.5	.0	.0	.0	.0	.0	.0
7	9.0	9.0	9.0	6.5	6.0	6.5	.5	.0	.5	.0	.0	.0
8	9.5	9.0	9.0	6.5	5.0	6.5	.0	.0	.0	.5	.0	.0
9	9.0	8.5	9.0	5.0	3.5	4.0	.0	.0	.0	1.0	.0	.5
10	8.5	8.0	8.5	3.5	2.5	3.0	.5	.0	.0	.0	.0	.0
11	8.0	7.5	7.5	2.5	2.0	2.0	.0	.0	.0	.0	.0	.0
12	8.0	7.5	8.0	2.5	2.0	2.5	---	---	---	.0	.0	.0
13	8.5	8.0	8.5	2.5	2.5	2.5	---	---	---	.5	.0	.0
14	8.5	8.0	8.5	2.5	2.5	2.5	.0	.0	.0	1.0	.0	.0
15	8.5	8.0	8.0	2.5	2.0	2.5	.0	.0	.0	---	---	---
16	8.0	7.5	8.0	2.5	2.5	2.5	.5	.0	.0	1.0	.0	.5
17	8.5	8.0	8.0	3.0	2.5	2.5	.5	.0	.0	---	---	---
18	8.5	8.0	8.5	3.5	3.0	3.0	.5	.0	.5	---	---	---
19	9.0	8.0	8.5	3.5	2.0	3.0	.5	.0	.5	1.0	.5	1.0
20	9.0	8.5	8.5	2.5	.5	1.0	.5	.0	.5	1.0	.5	.5
21	9.5	9.0	9.0	.5	.0	.5	.5	.0	.0	---	---	---
22	10.0	9.5	10.0	1.0	.5	.5	.5	.0	.5	---	---	---
23	11.0	10.0	10.5	1.0	.5	.5	.5	.0	.0	.5	.0	.0
24	12.0	11.0	11.5	.5	.5	.5	.0	.0	.0	.5	.0	.5
25	12.0	11.5	11.5	.5	.5	.5	.0	.0	.0	.5	.0	.0
26	12.0	11.5	11.5	---	---	---	.5	.0	.0	.0	.0	.0
27	11.5	11.0	11.5	---	---	---	.0	.0	.0	.0	.0	.0
28	11.0	10.5	11.0	.5	.5	.5	---	---	---	.0	.0	.0
29	11.0	10.0	11.0	.5	.0	.5	---	---	---	---	---	---
30	10.0	9.0	9.5	1.0	.5	.5	.5	.0	.0	---	---	---
31	9.0	9.0	9.0	---	---	---	.5	.0	.0	.5	.0	.0
MONTH	12.0	7.5	9.5	---	---	---	---	---	---	---	---	---
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	.5	.0	.5	1.0	.5	.5	---	---	---	14.0	12.5	13.0
2	.5	.5	.5	1.5	.5	1.0	10.5	9.5	10.0	12.5	12.0	12.5
3	---	---	---	1.5	1.0	1.0	---	---	---	13.0	12.0	12.5
4	---	---	---	2.0	1.0	1.0	---	---	---	14.5	12.5	13.5
5	---	---	---	1.0	.5	.5	---	---	---	16.0	14.5	15.0
6	1.0	.5	1.0	.5	.0	.5	---	---	---	16.0	15.5	15.5
7	1.0	1.0	1.0	.5	.0	.0	---	---	---	16.0	15.5	15.5
8	1.0	.5	.5	.5	.0	.5	9.5	9.0	9.5	15.5	15.0	15.5
9	.5	.5	.5	1.0	.5	.5	10.0	9.0	9.5	16.0	15.5	15.5
10	---	---	---	.5	.0	.5	10.0	9.0	9.5	16.5	16.0	16.5
11	.5	.0	.5	.5	.5	.5	10.5	9.5	10.0	17.0	16.0	16.5
12	.5	.0	.5	.5	.5	.5	10.5	10.0	10.5	17.5	17.0	17.0
13	1.0	.0	.5	---	---	---	10.0	9.5	10.0	17.5	17.0	17.5
14	1.0	.5	1.0	---	---	---	9.5	8.5	9.0	18.0	17.0	17.5
15	1.0	.5	1.0	---	---	---	8.5	8.0	8.5	18.5	18.0	18.0
16	1.5	.5	1.0	.5	.5	.5	9.0	7.5	8.0	18.0	17.5	18.0
17	2.0	1.0	1.0	.5	.5	.5	10.0	8.5	9.0	17.5	17.0	17.0
18	1.5	1.0	1.5	.5	.5	.5	9.0	9.0	9.0	17.0	16.5	16.5
19	1.5	1.0	1.5	.5	.5	.5	10.0	9.0	9.5	17.0	16.5	16.5
20	1.0	.5	1.0	1.5	.5	1.0	10.5	9.5	10.0	18.0	16.5	16.5
21	---	---	---	1.5	1.0	1.0	10.0	9.5	10.0	17.0	16.5	17.0
22	---	---	---	---	---	---	10.5	9.5	10.0	17.5	17.0	17.0
23	---	---	---	---	---	---	11.5	10.0	10.5	17.5	16.5	17.5
24	---	---	---	---	---	---	12.0	11.5	11.5	17.5	17.0	17.5
25	1.0	.5	1.0	---	---	---	13.0	12.0	12.5	17.5	17.0	17.5
26	1.0	1.0	1.0	---	---	---	14.0	12.5	13.0	17.5	17.0	17.0
27	1.0	.5	1.0	---	---	---	14.5	14.0	14.0	18.0	17.0	17.5
28	.5	.0	.5	---	---	---	14.5	13.5	14.5	18.5	18.0	18.0
29	---	---	---	---	---	---	14.0	13.0	13.5	19.5	18.5	19.0
30	---	---	---	---	---	---	14.0	13.5	13.5	20.5	19.5	20.0
31	---	---	---	---	---	---	---	---	---	21.5	20.5	21.0
MONTH	---	---	---	---	---	---	---	---	---	21.5	12.0	16.5



## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	13.7	12.0	13.1	12.5	11.7	12.1	---	---	---	9.6	9.3	9.4
2	12.8	12.5	12.6	12.6	12.2	12.4	12.0	10.6	11.3	8.9	8.5	8.7
3	12.5	12.1	12.3	12.7	12.3	12.5	---	---	---	8.5	7.9	8.2
4	---	---	---	12.8	12.2	12.5	---	---	---	8.0	7.1	7.4
5	---	---	---	12.8	12.5	12.6	---	---	---	---	---	---
6	12.3	11.9	12.0	12.7	12.0	12.4	---	---	---	---	---	---
7	12.0	11.7	11.9	12.1	11.6	11.8	---	---	---	---	---	---
8	11.6	10.6	11.2	11.6	11.0	11.4	14.5	14.0	14.2	9.9	8.5	9.2
9	11.4	10.0	10.6	11.9	11.3	11.5	14.4	13.4	13.9	7.8	7.2	7.4
10	---	---	---	12.2	11.3	11.6	13.7	11.4	12.4	7.8	7.4	7.6
11	11.5	10.7	11.1	11.9	11.5	11.7	12.1	10.5	11.3	7.9	7.7	7.8
12	12.0	11.4	11.7	11.9	11.6	11.7	11.5	10.7	11.1	8.6	8.2	8.4
13	12.4	11.7	12.1	---	---	---	10.5	9.5	10.0	9.3	9.0	9.2
14	13.7	11.4	12.0	---	---	---	10.5	8.3	9.4	9.3	9.0	9.2
15	11.8	11.3	11.6	---	---	---	11.0	9.5	10.2	9.8	9.2	9.5
16	12.0	11.3	11.5	11.7	11.3	11.5	10.3	9.9	10.1	9.4	8.6	9.0
17	11.8	11.5	11.7	11.6	11.4	11.5	9.9	9.7	9.8	9.2	8.5	8.9
18	12.1	11.7	11.9	11.9	11.1	11.5	10.3	9.7	10.0	8.8	8.3	8.6
19	12.7	12.0	12.4	12.5	10.5	11.5	9.9	9.7	9.8	8.5	8.0	8.3
20	12.7	12.5	12.6	12.5	12.2	12.4	9.8	9.6	9.7	10.1	8.0	9.5
21	---	---	---	12.2	11.3	11.7	10.7	10.1	10.2	10.0	9.4	9.6
22	---	---	---	---	---	---	10.7	10.3	10.5	9.9	8.5	9.4
23	---	---	---	---	---	---	10.7	10.4	10.5	9.8	8.2	8.9
24	---	---	---	---	---	---	10.8	10.7	10.7	8.5	7.9	8.1
25	11.1	11.0	11.1	---	---	---	10.6	10.1	10.3	7.9	7.1	7.4
26	12.1	11.2	11.7	---	---	---	10.1	9.4	9.8	7.5	6.8	7.1
27	13.1	11.1	12.1	---	---	---	9.5	8.8	9.1	7.5	7.0	7.3
28	12.7	12.5	12.6	---	---	---	8.8	8.3	8.5	8.0	7.3	7.7
29	---	---	---	---	---	---	8.3	8.0	8.2	8.8	8.1	8.5
30	---	---	---	---	---	---	8.0	7.5	7.8	8.3	7.7	7.9
31	---	---	---	---	---	---	---	---	---	7.8	7.4	7.5

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	7.3	6.8	7.0	8.3	7.9	8.1	---	---	---	---	---	---
2	7.1	6.2	6.7	8.3	8.0	8.1	7.2	6.8	7.0	8.0	6.3	7.4
3	7.9	6.1	7.0	---	---	---	7.0	6.3	6.8	8.3	7.2	7.8
4	7.8	6.9	7.4	---	---	---	7.2	6.3	6.7	9.1	8.0	8.6
5	8.6	6.7	7.7	---	---	---	7.5	6.8	7.2	8.3	7.5	7.9
6	8.7	7.7	8.0	---	---	---	---	---	---	7.6	7.0	7.3
7	8.6	7.5	8.0	---	---	---	8.3	7.2	7.8	7.0	5.8	6.2
8	7.9	7.1	7.5	---	---	---	7.9	7.0	7.5	---	---	---
9	8.4	7.5	8.0	---	---	---	7.5	6.5	6.9	---	---	---
10	8.1	7.0	7.6	7.2	6.6	6.9	6.6	5.5	6.0	---	---	---
11	7.9	7.1	7.5	7.6	6.9	7.2	---	---	---	8.3	7.9	8.1
12	8.3	7.3	7.8	7.7	7.2	7.4	7.5	6.5	7.1	6.9	6.0	6.6
13	7.7	6.6	7.2	8.0	7.7	7.8	7.5	6.6	7.1	7.1	6.7	6.9
14	7.2	6.0	6.6	8.1	7.7	8.0	8.5	7.5	8.0	---	---	---
15	6.9	5.9	6.4	8.1	7.6	7.8	8.0	6.0	6.9	7.8	7.4	7.6
16	7.1	6.4	6.8	---	---	---	7.7	7.0	7.4	8.1	7.5	7.8
17	8.5	7.1	7.8	8.0	7.1	7.4	---	---	---	8.6	8.4	8.5
18	8.3	7.4	7.9	7.4	6.5	7.0	---	---	---	9.0	8.8	8.9
19	8.3	8.1	8.2	6.7	6.2	6.5	8.1	7.3	7.7	9.4	9.2	9.3
20	8.9	6.8	8.3	6.4	6.1	6.3	7.9	7.2	7.6	8.3	7.4	7.8
21	---	---	---	---	---	---	8.4	7.8	8.1	8.0	7.4	7.6
22	8.8	6.4	8.5	---	---	---	7.9	7.0	7.4	7.5	6.8	7.1
23	---	---	---	---	---	---	7.2	6.9	7.1	7.3	7.0	7.1
24	---	---	---	7.3	7.0	7.1	7.1	6.8	7.0	7.2	7.0	7.1
25	---	---	---	7.0	6.1	6.6	7.4	6.5	7.0	7.4	7.2	7.3
26	---	---	---	6.3	5.9	6.1	---	---	---	7.5	7.0	7.2
27	---	---	---	6.2	5.8	6.0	---	---	---	7.2	6.7	7.0
28	---	---	---	6.3	5.6	6.0	---	---	---	7.1	6.9	7.0
29	7.6	7.1	7.4	7.5	6.1	6.8	8.8	7.7	8.3	7.1	7.0	7.0
30	7.9	7.4	7.6	7.0	6.5	6.7	8.3	7.5	8.0	7.1	6.5	6.8
31	---	---	---	---	---	---	8.1	7.6	7.9	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331000 MISSISSIPPI RIVER AT ST. PAUL, MN

LOCATION.--Lat 44°56'40", long 93°05'20", in SE¼NE¼ sec. 6, T.28 N., R.22 W., Ramsey County, Hydrologic Unit 07010206, on left bank in St. Paul, 300 ft upstream from Robert Street Bridge, 6 mi downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.

DRAINAGE AREA.--36,800 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--Water year 1867-69, 1872-92 (annual maximums), March 1892 to current year (prior to 1901, fragmentary during some winters). Records prior to March 1892, published in the 19th Annual Report, Part 4, have been found to be unreliable and should not be used. Monthly discharge only for some periods, published in WSP 1308. Gage-height records (winter records incomplete) collected at same site since 1866 are contained in reports of U.S. Weather Bureau, War Department and Mississippi River Commission.

REVISED RECORDS.--WSP 285: 1892-96. WSP 715: Drainage area. WSP 875: 1938. WSP 895: 1939. WSP 1308: 1867(M). WSP 1508: 1897, 1898(M), 1903(M), 1917-18(M), 1928(M), 1929. WRD MN-74: 1973.

GAGE.--Water-stage recorder. Datum of gage is 683.62 ft above National Geodetic Vertical Datum of 1929. Prior to Mar. 18, 1925, nonrecording gage at several sites within 300 ft of present site at present datum. Mar. 18, 1925, to Mar. 10, 1933, water-stage recorder and Mar. 11, 1933, to Sept. 14, 1939, nonrecording gage, at present site and datum. Since September 1938, auxiliary water-stage recorder 5.6 mi downstream.

REMARKS.--No estimated daily discharges. Records good. Slight regulation except during extreme floods by reservoirs on headwaters and by power plants. Beginning July 20, 1938, sewage from Minneapolis and St. Paul, which formerly entered above station, was diverted to a sewage-disposal plant, thence to river below station. Figures of daily discharge do not include this diversion.

COOPERATION.--Records of Mississippi River at Twin City lock and dam computed and furnished by Ford Motor Co. Diversion through sewage disposal plant furnished by Metropolitan Waste Control Commission.

AVERAGE DISCHARGE (ADJUSTED FOR DIVERSION).--88 years (water years 1895, 1897, 1901-86), 11,233 ft<sup>3</sup>/s, 4.15 in/yr; median of yearly mean discharges, 10,053 ft<sup>3</sup>/s, 3.71 in/yr.

EXTREMES FOR PERIOD OF RECORD (1867-70, 1872-1986).--Maximum discharge, 171,000 ft<sup>3</sup>/s, Apr. 16, 1965, gage height, 26.01 ft, from floodmark. Maximum flood known since at least 1851, that of 1965. Flood of Apr. 11, 1870 reached a stage of 19.4 ft, discharge, 100,000 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD (1897, 1917-85).--Minimum daily discharge, 632 ft<sup>3</sup>/s, Aug. 26, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 83,300 ft<sup>3</sup>/s, May 6, gage height, 16.10 ft; minimum daily, 7,140 ft<sup>3</sup>/s, Mar. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24500	20800	10300	11500	9930	8290	64700	68700	40600	43900	24300	20400
2	24500	20400	9990	11600	10600	8460	68400	72000	39600	41700	23900	19800
3	24600	19700	9760	11400	10100	8670	70900	75900	38000	39600	24000	20900
4	27300	19600	12400	11100	9810	8650	72700	79900	36500	36400	24000	23300
5	29300	19100	13400	10600	10200	8580	74600	82600	34900	33900	24000	23600
6	30600	17700	12700	10400	9930	8450	75800	83000	32700	30700	23700	23400
7	31900	18500	12700	10300	9630	7140	76200	80400	31500	28100	24100	23200
8	32800	17600	12800	10400	9640	7940	76000	76900	29800	25800	25200	22500
9	32400	16900	12900	11200	8620	10100	76100	74100	28400	24400	23900	22300
10	32500	16600	13000	11300	7740	9770	77000	72900	27800	24100	23900	22600
11	32500	16200	13000	10800	8760	10600	77100	72700	28100	24800	22900	22000
12	33400	15900	12300	10600	8980	11800	77100	71200	28600	24800	22600	23700
13	32700	15400	11900	10500	9230	12700	75900	71300	28700	24900	22700	24700
14	32800	15000	11800	10300	9180	13200	74400	71500	28900	24800	23200	24600
15	33000	15400	11900	10200	9660	13200	72800	71700	28900	25700	22800	24700
16	33000	15500	12600	10200	8760	13800	71000	71900	28000	27500	21500	25400
17	33100	15100	11900	10300	8990	14900	69100	71400	28100	28600	22800	26100
18	32400	14900	11200	10100	9290	16300	67600	70600	28500	28400	21800	27600
19	31500	15300	11500	10100	9230	16600	66600	69200	29100	28700	20400	30100
20	30900	15400	12200	10300	8650	17900	65700	67400	29600	28800	20400	34000
21	30100	13000	12200	10200	7310	20700	64800	65000	32200	28400	21000	41700
22	29500	11900	12000	9400	8940	24800	64500	62600	36400	28700	21400	45000
23	28800	11800	12900	9900	8550	28400	63800	60200	36600	28700	22600	49200
24	27500	10800	11900	9980	8070	32400	62500	57500	39200	27600	22900	52600
25	27400	10400	10700	9930	8330	40400	61700	55000	41700	27400	23100	55600
26	26000	10800	11700	8690	8730	47200	60500	53000	42900	26900	22400	57500
27	24600	11600	12200	7830	8350	51300	60700	50700	44900	26200	21700	59000
28	23900	10800	11100	9180	8160	54400	62300	48400	46700	24500	21500	60600
29	22100	10900	11000	9820	---	56500	63600	46700	46100	23800	21200	62300
30	21800	9500	11500	10200	---	58100	66500	44000	45600	24700	21300	63100
31	21100	---	11100	10400	---	61700	---	42300	---	24300	21200	---
TOTAL	898500	452500	368550	318730	253370	703350	2080600	2060700	1038600	886800	702400	1031500
MEAN	28980	15080	11890	10280	9049	22690	69350	66470	34620	28610	22660	34380
MAX	33400	20800	13400	11600	10600	61700	77100	83000	46700	43900	25200	63100
MIN	21100	9500	9760	7830	7310	7140	60500	42300	27800	23800	20400	19800
CFSM	.79	.41	.32	.28	.25	.62	1.89	1.81	.94	.78	.62	.93
IN.	.91	.46	.37	.32	.26	.71	2.10	2.08	1.05	.90	.71	1.04
\$	405	318	285	288	282	383	436	456	380	381	352	394
MEAN†	29,380	15,400	12,180	10,570	9,330	23,070	69,790	66,930	35,000	28,990	23,010	34,770
CFSM†	.80	.42	.33	.29	.25	.63	1.90	1.82	.95	.79	.63	.94
IN.†	.92	.47	.38	.33	.26	.72	2.12	2.10	1.06	.91	.72	1.05

CAL YR 1985 TOTAL 7,613,540 MEAN 20,860 MAX 55,400 MIN 5,470 MEAN ‡ 21,200 CFSM ‡ .58 IN ‡ 7.82  
WTR YR 1986 TOTAL 10,795,600 MEAN 29,580 MAX 83,000 MIN 7,140 MEAN ‡ 29,950 CFSM ‡ .81 IN ‡ 11.05

\$ Diversion equivalent in cubic feet per second, through sewage disposal plant.

† Adjusted for diversion.

## MISSISSIPPI RIVER BASIN

05331000 MISSISSIPPI RIVER AT ST. PAUL, MN--Continued

## WATER-QUALITY RECORDS

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

PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1956 to current year.

INSTRUMENTATION.--Temperature recorder since October 1956.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum 31.0°C July 24-28, 1964, July 31, 1975, July 19, 21, 1977; minimum, 0.0°C many days during winter periods.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURES: Maximum 28.0°C, July 18; minimum, 0.0°C many days during winter period.

## TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	10.0	9.5	9.5	8.0	8.0	8.0	.0	.0	.0	.5	.5	.5
2	9.5	9.0	9.5	8.0	7.5	7.5	.5	.0	.0	.5	.0	.0
3	10.5	9.5	10.0	7.5	6.5	7.0	.5	.0	.5	.0	.0	.0
4	10.0	9.5	10.0	7.0	6.5	6.5	.5	.0	.0	.5	.0	.5
5	9.5	9.5	9.5	6.5	6.0	6.5	.5	.0	.0	.5	.5	.5
6	9.5	9.0	9.0	6.5	6.0	6.5	.0	.0	.0	.5	.0	.5
7	9.5	9.0	9.0	6.5	5.5	6.0	.0	.0	.0	.5	.0	.5
8	9.5	9.0	9.5	5.5	4.5	5.0	.0	.0	.0	1.0	.5	.5
9	9.5	8.5	9.0	4.5	3.5	4.0	.0	.0	.0	1.0	.5	.5
10	8.5	8.0	8.0	3.5	2.5	3.0	.0	.0	.0	1.0	.5	.5
11	8.0	7.5	8.0	2.5	2.0	2.5	.0	.0	.0	1.0	.5	.5
12	8.0	8.0	8.0	2.5	2.0	2.0	.0	.0	.0	.0	.0	.0
13	8.0	8.0	8.0	2.5	2.0	2.5	.0	.0	.0	.5	.0	.0
14	8.5	7.5	8.0	3.5	2.5	3.0	.5	.0	.0	.5	.0	.0
15	8.5	8.0	8.0	3.0	2.0	2.5	.5	.0	.0	1.0	.5	.5
16	8.0	8.0	8.0	2.0	1.5	2.0	.5	.0	.0	.5	.0	.0
17	8.0	7.5	8.0	2.0	1.5	2.0	.5	.0	.0	.5	.0	.0
18	8.5	8.0	8.0	3.5	2.0	3.0	1.0	.5	.5	.5	.0	.0
19	8.0	8.0	8.0	3.5	3.0	3.5	1.0	.5	.5	.5	.0	.0
20	8.5	8.0	8.0	2.5	1.0	2.0	.5	.0	.0	.5	.0	.0
21	9.0	8.5	8.5	1.0	.5	.5	.5	.5	.5	.5	.0	.0
22	9.5	9.0	9.0	.5	.0	.5	.5	.0	.5	.5	.0	.0
23	11.0	9.5	10.5	.0	.0	.0	.5	.0	.0	.5	.0	.0
24	11.0	10.5	11.0	.0	.0	.0	.0	.0	.0	.5	.0	.0
25	11.0	10.5	10.5	.0	.0	.0	1.0	.5	.0	.5	.0	.0
26	10.5	10.0	10.5	.5	.0	.0	1.0	.5	.0	.5	.0	.0
27	10.5	10.0	10.5	.5	.0	.0	.5	.0	.0	1.0	.5	.5
28	10.0	9.5	9.5	.5	.0	.0	1.0	.5	.5	1.0	.5	.5
29	9.5	9.0	9.0	.5	.0	.0	1.0	.5	.5	1.0	.5	.5
30	9.0	8.5	8.5	.5	.0	.0	.5	.0	.5	1.0	.5	.5
31	8.5	8.0	8.0	---	---	---	.5	.0	.5	1.0	.5	.5
MONTH	11.0	7.5	9.0	8.0	.0	3.0	1.0	.0	.0	1.0	.0	.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	FEBRUARY			MARCH			APRIL			MAY		
1	1.0	.5	.5	1.5	.5	1.0	7.5	7.0	7.5	14.0	13.0	13.5
2	1.0	.5	.5	1.0	.5	1.0	7.5	6.5	7.0	13.0	12.5	13.0
3	1.0	.5	.5	1.0	.0	1.0	7.5	7.0	7.0	13.5	12.5	13.0
4	.0	.0	.0	1.0	.5	1.0	7.0	6.5	6.5	14.5	13.5	14.0
5	.0	.0	.0	1.5	1.0	1.0	6.5	6.5	6.5	16.0	15.0	15.5
6	1.0	.5	.5	3.0	1.5	2.0	7.0	6.5	6.5	16.5	16.0	16.0
7	1.0	.5	.5	3.0	1.5	2.0	8.0	7.0	7.5	16.5	15.5	16.0
8	.5	.0	.0	3.0	1.5	2.0	8.5	8.0	8.5	15.5	15.0	15.0
9	.5	.0	.5	2.0	1.0	1.5	9.5	8.5	9.0	15.0	14.5	14.5
10	1.0	.0	.5	1.5	.5	1.0	10.0	9.0	9.5	14.5	14.0	14.0
11	1.0	.0	.5	1.5	.5	1.0	11.0	10.0	10.5	14.5	13.5	14.0
12	.5	.0	.0	1.5	1.0	1.5	11.0	11.0	11.0	16.0	14.5	15.0
13	.0	.0	.0	1.5	1.0	1.5	11.5	11.0	11.0	16.0	15.5	15.5
14	.0	.0	.0	1.5	1.0	1.0	11.0	10.0	10.5	16.5	15.5	16.0
15	.0	.0	.0	2.0	1.0	1.5	10.0	9.5	9.5	17.5	16.5	17.0
16	.0	.0	.0	2.0	1.5	2.0	10.0	9.0	9.5	17.5	17.0	17.5
17	.0	.0	.0	2.0	1.5	2.0	10.5	10.0	10.0	17.5	16.5	17.0
18	.0	.0	.0	3.0	1.5	1.5	10.5	10.0	10.0	17.0	16.5	17.0
19	.0	.0	.0	2.0	1.5	1.5	10.5	10.0	10.0	17.0	16.5	17.0
20	.0	.0	.0	2.0	1.5	1.5	11.0	10.5	10.5	17.0	16.5	17.0
21	.5	.0	.0	2.0	1.0	1.5	11.0	10.5	10.5	17.5	17.0	17.0
22	1.0	.0	.5	1.0	.5	1.0	11.0	10.5	10.5	17.5	17.0	17.5
23	.5	.0	.0	2.5	1.0	1.0	11.5	10.5	11.0	17.5	17.5	17.5
24	.5	.0	.5	2.0	.5	1.0	12.5	12.0	12.5	18.0	17.5	17.5
25	.5	.5	.5	2.0	1.0	1.5	13.0	12.5	12.5	18.0	17.5	18.0
26	.5	.0	.5	3.0	1.5	2.5	14.0	13.0	13.0	18.0	17.5	18.0
27	.5	.0	.5	3.0	2.0	2.5	15.0	14.0	14.5	19.5	18.0	18.5
28	1.0	.5	1.0	4.5	3.0	3.5	15.0	14.5	14.5	20.5	19.5	20.0
29	---	---	---	5.5	4.0	5.0	14.0	13.5	14.0	21.5	20.5	21.0
30	---	---	---	6.0	5.5	6.0	14.5	14.0	14.0	22.5	21.5	22.0
31	---	---	---	7.0	5.5	6.5	---	---	---	23.5	22.0	22.5
MONTH	1.0	.0	.5	7.0	.0	2.0	15.0	6.5	10.0	23.5	12.5	16.5

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	23.5	23.0	23.0	23.0	22.5	22.5	26.5	25.5	26.0	22.0	20.5	21.0
2	23.0	22.5	22.5	23.0	22.5	22.5	25.5	24.5	25.0	22.5	21.5	22.0
3	22.5	21.5	22.0	24.0	23.0	23.5	24.5	23.5	24.0	22.5	22.0	22.0
4	22.5	22.0	22.5	25.0	23.5	24.5	24.0	23.5	24.0	22.0	21.0	21.5
5	22.0	21.5	22.0	26.0	25.0	25.5	25.0	24.0	24.5	21.5	20.5	21.0
6	22.0	21.5	21.5	26.0	25.5	26.0	25.0	23.5	24.5	20.5	19.5	19.5
7	21.5	21.0	21.5	26.5	25.5	26.0	25.0	24.0	24.5	19.5	18.5	19.0
8	22.0	21.5	21.5	26.5	26.0	26.5	25.0	24.0	24.0	19.0	18.0	18.5
9	22.5	21.5	22.0	26.5	25.5	26.0	25.0	24.0	24.5	18.5	17.5	18.0
10	22.5	21.5	22.0	26.0	25.0	25.5	24.5	23.5	24.0	17.5	16.5	17.0
11	22.0	20.5	21.5	26.0	24.5	25.0	23.5	22.5	23.0	17.0	16.5	16.5
12	20.5	19.5	20.0	25.0	24.0	24.5	23.0	22.0	22.5	16.5	16.0	16.5
13	21.5	20.5	21.0	24.5	23.5	24.0	22.5	21.5	22.0	16.5	16.0	16.0
14	21.5	20.5	21.0	24.5	23.0	24.0	22.0	21.0	21.5	16.0	15.0	15.5
15	22.5	21.5	22.0	25.0	24.0	24.5	23.5	21.5	22.5	15.0	14.0	14.5
16	23.0	22.0	22.5	25.5	24.0	25.0	24.5	23.0	23.5	14.5	14.0	14.5
17	23.0	22.0	22.5	27.0	25.5	26.0	25.0	24.0	24.5	14.5	14.0	14.0
18	23.5	22.5	23.0	28.0	26.5	27.0	24.5	24.0	24.5	14.5	14.0	14.5
19	25.0	23.5	24.0	27.5	27.0	27.5	24.5	23.5	24.0	14.5	14.5	14.5
20	26.0	25.0	25.5	27.0	26.5	27.0	24.0	23.0	23.5	15.0	14.0	14.5
21	26.0	25.5	25.5	27.0	26.0	26.5	23.0	22.5	22.5	15.0	14.5	15.0
22	25.5	25.0	25.5	27.0	26.0	26.5	22.5	21.5	22.0	15.5	15.0	15.0
23	25.5	24.5	25.0	27.5	26.5	27.0	21.5	20.5	21.0	16.0	15.0	15.5
24	24.5	23.5	24.0	27.0	27.0	27.0	21.0	20.5	21.0	16.5	16.0	16.0
25	24.0	23.5	24.0	27.0	26.5	26.5	21.0	20.0	20.5	17.5	16.0	17.0
26	25.0	24.0	24.5	26.5	26.0	26.5	21.5	21.0	21.0	18.0	17.0	17.5
27	26.0	25.0	25.0	26.0	25.0	25.5	21.0	20.0	20.5	18.0	17.5	18.0
28	26.0	25.5	26.0	26.5	25.5	26.0	20.0	19.5	19.5	18.0	17.5	17.5
29	26.0	25.0	25.5	27.0	26.0	26.5	19.5	19.0	19.5	17.5	17.0	17.5
30	25.0	23.0	24.0	27.0	26.0	26.5	19.5	19.0	19.0	17.0	16.5	17.0
31	---	---	---	27.0	26.0	26.5	20.5	19.0	20.0	---	---	---
MONTH YEAR	26.0 28.0	19.5 .0	23.0 11.0	28.0	22.5	25.5	26.5	19.0	22.5	22.5	14.0	17.0

## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°51'37", long 93°00'24", in NE¼NE¼ sec.2, T.27 N., R.22 W., Washington County, Hydrologic Unit 07010206, on left bank at the end of Fifth Street, and at mile 830.6 upstream from Ohio River.

PERIOD OF RECORD.--December 1978 to current year.

## PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: December 1978 to current year.

pH: December 1978 to current year.

WATER TEMPERATURES: December 1978 to current year.

DISSOLVED OXYGEN: December 1978 to current year.

INSTRUMENTATION.--Water-quality monitor since December 1978.

REMARKS.--Water is pumped to a monitor that is inside a heated shelter. Extremes are published for those years with 80 percent or more daily record.

COOPERATION.--Water-quality monitor is operated by the Metropolitan Waste Control Commission, St. Paul, Minn.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water year 1981, 1983-86): Maximum, 821 microsiemens Nov. 15, 1982, minimum, 201 microsiemens Mar. 22, 1985.

pH (water year 1981, 1983-86): Maximum, 8.6 units Apr. 18, 1981, Sept. 17-18, 1984, Feb. 11, 1986; minimum, 7.2 units Sep. 25, 1984.

WATER TEMPERATURES (water year 1981, 1983-86): Maximum, 27.5°C July 10, 1981; minimum, 0.0°C on many days during winter period.

DISSOLVED OXYGEN (water year 1981, 1983-85): Maximum, 15.7 mg/L Mar. 25, 1981; minimum, 3.4 mg/L June 6, 1984.

## EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 755 microsiemens Jan. 8; minimum, 344 microsiemens May 15.

pH: Maximum, 8.6 units Feb. 11; minimum, 7.3 units Mar. 15, June 8.

WATER TEMPERATURES: Maximum, 27.0° July 21; minimum, 0.5°C several days during winter.

## SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	488	460	473	616	534	560	612	519	597	561	512	527
2	556	476	527	576	542	555	644	575	591	598	497	520
3	604	500	571	553	519	532	678	580	606	526	463	489
4	576	461	522	553	478	537	692	614	626	533	473	509
5	576	528	553	566	523	533	709	576	642	505	469	482
6	575	541	558	609	542	589	651	586	618	638	493	519
7	580	542	560	618	523	562	612	575	585	564	540	552
8	570	550	560	547	503	518	589	570	577	755	553	654
9	570	561	565	590	520	542	620	555	567	721	483	579
10	588	553	571	618	520	570	627	557	571	615	543	556
11	594	549	571	556	489	547	641	560	595	668	518	569
12	598	516	557	550	502	517	628	561	576	601	575	585
13	562	493	528	594	544	566	628	572	585	582	537	552
14	540	492	516	621	560	590	599	576	586	548	529	538
15	563	535	550	609	549	572	619	568	580	611	529	547
16	637	528	542	603	568	585	581	549	563	542	522	531
17	659	543	561	715	584	650	585	527	543	563	518	535
18	561	535	549	639	602	621	624	572	587	563	527	546
19	587	527	538	644	536	590	730	572	609	573	548	557
20	568	537	552	674	498	533	704	588	626	653	554	594
21	690	550	591	583	475	517	626	580	603	623	574	594
22	637	591	609	579	507	547	716	620	661	731	585	610
23	639	602	620	508	455	495	735	632	663	637	531	585
24	731	553	673	521	462	483	736	534	607	709	554	605
25	678	630	651	550	457	489	618	524	548	697	561	594
26	670	615	643	555	498	512	574	523	537	---	---	---
27	652	574	616	578	517	542	571	488	511	---	---	---
28	637	554	573	577	550	563	596	477	495	---	---	---
29	666	545	574	576	555	566	561	480	505	---	---	---
30	620	578	598	605	554	572	533	504	513	---	---	---
31	611	529	548	---	---	---	584	508	518	---	---	---
MONTH	731	460	568	674	389	525	736	477	580	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	615	508	582	637	544	568	---	---	---	461	410	435
2	623	570	587	601	566	583	---	---	---	475	429	452
3	590	531	568	593	559	574	---	---	---	470	442	452
4	---	---	---	613	567	594	---	---	---	499	394	446
5	---	---	---	639	589	610	---	---	---	499	411	455
6	583	570	574	678	589	631	---	---	---	546	424	446
7	591	565	573	636	582	603	---	---	---	563	455	497
8	616	452	535	685	556	620	523	514	516	552	484	507
9	563	467	515	672	590	631	---	---	---	540	425	509
10	585	565	575	686	638	662	---	---	---	554	406	459
11	594	553	573	654	564	599	---	---	---	546	462	497
12	602	552	572	590	539	563	---	---	---	500	445	473
13	618	553	581	590	551	565	---	---	---	593	471	504
14	624	551	580	616	582	597	523	507	514	552	464	483
15	574	529	550	712	572	607	552	496	519	481	344	368
16	586	527	556	693	588	624	576	524	554	417	370	394
17	540	519	529	701	544	589	539	507	523	503	387	445
18	535	503	520	586	526	556	497	471	484	452	362	407
19	603	518	555	564	495	531	513	465	493	452	386	419
20	599	574	588	568	489	529	518	480	498	493	373	454
21	---	---	---	538	516	527	570	496	524	540	446	478
22	---	---	---	538	494	503	570	522	546	657	457	519
23	---	---	---	501	459	477	517	506	511	566	455	507
24	597	563	585	476	456	464	551	451	501	496	451	470
25	585	525	556	465	446	455	556	505	530	516	490	501
26	593	539	554	466	439	446	613	499	549	513	487	496
27	595	548	567	528	452	474	611	504	557	547	498	522
28	607	559	578	525	463	478	511	399	455	656	509	565
29	---	---	---	518	468	488	543	443	493	654	500	596
30	---	---	---	526	443	502	444	401	423	637	558	583
31	---	---	---	---	---	---	---	---	---	666	571	613
MONTH	---	---	---	---	---	---	---	---	---	666	344	480
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	---	---	---	592	526	545	---	---	---	---	---	---
2	565	471	518	548	544	546	512	441	460	485	443	466
3	565	488	526	585	548	565	596	428	448	488	453	470
4	567	528	548	668	574	649	546	428	471	506	406	447
5	557	497	529	663	642	653	565	495	538	476	416	446
6	533	485	511	630	579	605	633	525	604	449	413	430
7	534	499	510	559	448	503	642	507	561	440	404	422
8	565	515	533	577	447	470	611	472	516	438	403	420
9	---	---	---	577	436	469	582	496	539	508	413	461
10	602	499	521	505	449	477	584	500	531	529	459	494
11	561	505	535	588	423	513	528	478	498	522	468	480
12	608	499	532	554	512	533	520	474	496	475	472	474
13	580	495	537	523	492	508	599	465	506	505	450	479
14	582	485	545	512	496	504	554	476	507	479	394	445
15	500	469	486	498	461	478	591	459	498	496	434	452
16	554	482	512	610	481	546	558	484	519	497	379	422
17	526	457	486	609	498	509	584	491	546	509	424	454
18	526	476	504	625	494	555	561	459	510	511	443	468
19	556	473	529	626	524	576	522	470	493	452	415	433
20	569	499	530	577	516	539	584	456	511	472	431	449
21	---	---	---	582	506	528	544	451	497	481	393	437
22	559	448	514	---	---	---	478	409	444	470	424	449
23	---	---	---	---	---	---	---	---	---	477	425	444
24	---	---	---	566	525	536	---	---	---	448	410	418
25	---	---	---	555	516	537	520	452	480	438	411	425
26	---	---	---	563	534	549	549	455	502	474	435	455
27	---	---	---	620	518	569	517	436	476	529	449	473
28	566	521	543	588	540	564	531	426	466	470	417	455
29	585	513	527	588	541	564	476	440	457	478	436	456
30	529	510	518	550	490	520	452	434	444	495	455	473
31	---	---	---	---	---	---	511	417	444	---	---	---



## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	8.1	7.5	7.8	7.8	7.8	7.8	---	---	---	---	---	---
2	8.1	7.6	7.9	7.8	7.8	7.8	8.0	7.9	7.9	8.1	8.0	8.1
3	---	---	---	7.9	7.8	7.8	7.9	7.8	7.9	8.1	7.9	8.0
4	8.0	7.9	8.0	7.9	7.9	7.9	8.0	7.9	7.9	8.1	8.0	8.1
5	8.1	8.0	8.1	8.0	7.9	7.9	8.0	8.0	8.0	8.1	8.0	8.1
6	8.1	7.9	8.0	8.0	7.9	7.9	8.0	7.9	8.0	8.2	8.0	8.1
7	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0
8	8.0	7.3	7.9	8.0	7.9	7.9	8.0	7.9	8.0	8.1	8.0	8.0
9	8.0	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0	7.8	7.9
10	8.0	7.9	7.9	8.0	7.9	7.9	8.0	8.0	8.0	7.9	7.8	7.9
11	8.0	7.9	8.0	8.0	7.9	8.0	8.1	8.0	8.0	7.9	7.8	7.9
12	8.0	7.9	8.0	8.0	7.9	7.9	8.1	8.0	8.1	8.0	7.9	7.9
13	8.0	7.9	8.0	8.0	7.9	8.0	8.1	8.0	8.0	8.0	7.9	7.9
14	8.0	7.9	7.9	8.0	7.9	8.0	8.0	7.9	8.0	7.9	7.9	7.9
15	8.0	7.9	7.9	8.0	7.9	8.0	8.1	8.0	8.0	8.0	7.9	8.0
16	8.1	8.0	8.0	8.0	7.9	8.0	8.1	8.0	8.0	8.1	8.0	8.1
17	8.0	7.9	7.9	8.0	7.9	8.0	7.9	7.8	7.9	8.1	8.1	8.1
18	7.9	7.8	7.9	8.0	7.9	8.0	7.8	7.8	7.8	8.1	8.1	8.1
19	7.9	7.8	7.8	8.1	7.9	8.0	7.8	7.8	7.8	8.1	8.1	8.1
20	8.0	7.8	7.8	8.1	8.0	8.0	7.9	7.8	7.8	8.2	8.1	8.1
21	---	---	---	8.3	7.8	8.0	7.9	7.8	7.8	8.1	8.0	8.1
22	7.8	7.7	7.8	---	---	---	8.0	7.8	7.9	8.0	7.8	8.0
23	---	---	---	---	---	---	8.0	7.9	7.9	8.0	8.0	8.0
24	---	---	---	8.0	7.9	8.0	8.1	8.0	8.0	8.1	7.9	7.9
25	---	---	---	8.0	8.0	8.0	8.1	8.1	8.1	8.0	7.9	7.9
26	---	---	---	7.9	7.9	7.9	8.2	8.1	8.1	8.0	7.9	7.9
27	---	---	---	7.9	7.8	7.9	8.2	8.1	8.1	8.0	7.8	7.9
28	7.8	7.7	7.8	7.9	7.8	7.9	8.2	8.1	8.1	8.0	7.9	7.9
29	7.8	7.8	7.8	7.9	7.8	7.8	8.2	8.2	8.2	7.9	7.9	7.9
30	7.9	7.8	7.8	7.9	7.8	7.9	8.3	8.1	8.2	7.9	7.9	7.9
31	---	---	---	---	---	---	8.4	8.2	8.3	---	---	---

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	10.5	10.5	10.5	9.5	9.5	9.5	2.0	1.0	1.0	.5	.5	.5
2	11.0	10.5	10.5	9.5	9.0	9.5	1.0	1.0	1.0	.5	.5	.5
3	11.0	10.5	10.5	9.0	9.0	9.0	1.0	1.0	1.0	.5	.5	.5
4	11.0	10.5	10.5	8.5	8.5	8.5	1.0	1.0	1.0	.5	.5	.5
5	10.5	10.5	10.5	8.0	7.5	8.0	.5	.5	.5	.5	.5	.5
6	10.5	10.0	10.5	8.0	7.0	7.5	.5	.5	.5	.5	.5	.5
7	10.5	10.0	10.0	9.0	7.0	7.0	1.0	.5	.5	.5	.5	.5
8	10.5	10.0	10.5	7.0	6.5	6.5	.5	.5	.5	.5	.5	.5
9	10.0	10.0	10.0	6.5	6.0	6.0	.5	.5	.5	.5	.5	.5
10	10.5	9.5	9.5	6.0	5.5	5.5	.5	.5	.5	.5	.5	.5
11	9.5	9.5	9.5	5.5	5.0	5.0	.5	.5	.5	1.0	.5	.5
12	10.0	9.5	9.5	5.0	4.5	5.0	.5	.5	.5	.5	.5	.5
13	9.5	9.5	9.5	5.0	4.5	5.0	.5	.5	.5	.5	.5	.5
14	9.5	9.5	9.5	5.0	5.0	5.0	.5	.5	.5	1.0	.5	.5
15	9.5	9.5	9.5	5.0	5.0	5.0	.5	.5	.5	1.0	.5	.5
16	9.5	9.5	9.5	5.0	4.5	5.0	.5	.5	.5	1.0	.5	.5
17	9.5	9.5	9.5	5.0	4.5	5.0	.5	.5	.5	1.0	.5	1.0
18	9.5	9.5	9.5	5.5	5.0	5.0	.5	.5	.5	1.0	.5	.5
19	10.0	9.5	9.5	5.5	3.5	4.5	.5	.5	.5	.5	.5	.5
20	10.0	9.5	9.5	3.5	2.5	3.0	.5	.5	.5	1.0	.5	.5
21	10.0	9.5	10.0	4.0	2.5	2.5	.5	.5	.5	1.0	.5	.5
22	10.5	10.0	10.0	2.5	2.0	2.5	.5	.5	.5	.5	.5	.5
23	11.0	10.5	10.5	3.5	2.0	2.0	.5	.5	.5	.5	.5	.5
24	11.5	11.0	11.0	3.5	2.0	2.0	.5	.5	.5	.5	.5	.5
25	11.0	11.0	11.0	2.5	2.0	2.0	.5	.5	.5	.5	.5	.5
26	11.0	11.0	11.0	2.5	2.0	2.0	.5	.5	.5	---	---	---
27	11.0	10.5	11.0	2.0	1.0	1.5	.5	.5	.5	---	---	---
28	11.0	10.5	10.5	1.0	1.0	1.0	.5	.5	.5	---	---	---
29	11.0	10.0	10.5	1.0	1.0	1.0	.5	.5	.5	---	---	---
30	10.0	10.0	10.0	1.0	1.0	1.0	.5	.5	.5	---	---	---
31	10.0	9.5	9.5	---	---	---	.5	.5	.5	---	---	---
MONTH	11.5	9.5	10.0	9.5	1.0	4.5	2.0	.5	.5	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	.5	.5	.5	1.0	1.0	1.0	---	---	---	13.0	12.5	13.0
2	1.0	1.0	1.0	1.0	1.0	1.0	---	---	---	12.5	12.5	12.5
3	1.0	1.0	1.0	1.0	1.0	1.0	---	---	---	12.5	12.0	12.5
4	---	---	---	1.5	1.0	1.0	---	---	---	14.0	13.0	13.5
5	---	---	---	1.5	1.0	1.0	---	---	---	15.0	14.5	14.5
6	1.5	1.0	1.0	1.0	.5	1.0	---	---	---	15.0	15.0	15.0
7	1.0	1.0	1.0	1.0	.5	1.0	---	---	---	15.0	14.5	15.0
8	1.0	1.0	1.0	1.0	1.0	1.0	5.0	4.5	5.0	15.5	15.0	15.0
9	.5	.5	.5	1.0	1.0	1.0	---	---	---	15.5	15.0	15.5
10	.5	.5	.5	1.0	1.0	1.0	---	---	---	15.5	15.0	15.5
11	1.5	.5	.5	1.5	1.0	1.0	10.5	10.0	10.5	15.5	15.0	15.5
12	1.0	.5	.5	2.0	1.5	2.0	10.5	10.5	10.5	16.0	15.5	15.5
13	.5	.5	.5	2.0	2.0	2.0	---	---	---	16.0	16.0	16.0
14	1.0	.5	.5	2.0	2.0	2.0	10.5	10.0	10.5	16.5	16.0	16.0
15	1.0	.5	.5	2.5	1.5	2.0	10.0	9.5	10.0	16.5	16.0	16.5
16	1.0	.5	.5	2.5	2.5	2.5	10.0	9.5	10.0	17.0	16.5	17.0
17	1.0	1.0	1.0	3.0	2.5	3.0	10.5	10.0	10.0	17.0	16.5	16.5
18	1.0	1.0	1.0	3.0	3.0	3.0	10.5	10.0	10.0	16.5	16.5	16.5
19	1.0	1.0	1.0	3.0	2.0	2.5	10.5	10.0	10.0	16.5	16.5	16.5
20	1.0	.5	.5	2.0	2.0	2.0	10.5	10.0	10.5	17.0	16.5	16.5
21	---	---	---	2.5	2.0	2.0	10.5	10.5	10.5	17.0	16.5	16.5
22	---	---	---	2.5	2.0	2.5	10.5	10.0	10.5	17.0	16.5	17.0
23	---	---	---	2.5	2.0	2.5	11.0	10.5	10.5	17.0	17.0	17.0
24	1.0	.5	.5	2.5	2.0	2.0	11.5	11.0	11.0	17.5	16.5	17.0
25	1.0	.5	.5	2.5	2.0	2.0	12.5	11.5	12.0	17.0	17.0	17.0
26	1.0	.5	.5	2.0	2.0	2.0	13.0	12.0	12.5	17.5	17.0	17.0
27	1.0	.5	1.0	2.5	2.0	2.0	13.5	12.5	13.0	18.0	17.0	17.5
28	1.0	.5	1.0	3.0	2.5	3.0	13.5	13.0	13.5	18.5	17.5	18.0
29	---	---	---	4.0	3.0	3.5	13.0	13.0	13.0	19.5	18.5	19.0
30	---	---	---	4.5	2.0	4.0	13.5	13.0	13.0	20.5	20.0	20.5
31	---	---	---	---	---	---	---	---	---	21.0	20.0	20.5
MONTH	---	---	---	---	---	---	---	---	---	21.0	12.0	16.0
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	22.0	21.5	21.5	23.0	22.5	22.5	---	---	---	---	---	---
2	22.0	19.0	20.5	23.0	22.5	22.5	26.0	25.0	25.5	21.5	20.5	21.5
3	22.0	21.5	21.5	23.5	22.5	23.0	26.5	25.0	25.0	22.0	21.5	21.5
4	22.0	21.5	22.0	24.0	23.0	23.5	26.5	24.0	24.5	21.5	21.5	21.5
5	22.0	21.5	21.5	24.5	24.0	24.0	24.5	24.0	24.0	21.5	21.0	21.0
6	22.0	21.5	21.5	24.5	24.0	24.5	24.5	24.0	24.0	21.0	20.0	20.5
7	22.0	21.5	21.5	25.0	24.0	24.5	24.5	24.0	24.0	20.0	20.0	20.0
8	22.0	21.0	21.5	25.0	24.5	24.5	24.5	24.0	24.0	20.0	19.5	20.0
9	22.0	21.0	21.5	25.0	24.5	24.5	24.5	24.0	24.5	19.5	19.5	19.5
10	22.0	21.5	21.5	24.5	24.5	24.5	24.5	24.0	24.0	19.5	19.0	19.0
11	21.5	20.5	21.0	24.5	24.0	24.0	24.0	23.5	23.5	19.0	18.5	19.0
12	21.0	20.5	20.5	24.0	23.5	24.0	23.5	23.0	23.5	18.5	17.0	18.0
13	21.5	20.5	21.0	24.0	23.5	23.5	23.5	22.0	22.5	17.5	17.0	17.0
14	21.5	21.0	21.0	24.0	23.5	23.5	22.5	22.0	22.0	17.0	17.0	17.0
15	22.0	21.0	21.5	24.0	23.5	24.0	23.0	22.0	22.5	17.0	16.0	16.5
16	22.0	21.5	21.5	25.0	24.0	24.0	23.5	23.0	23.0	16.0	15.5	15.5
17	22.0	21.5	22.0	25.5	24.5	25.0	23.5	22.0	23.5	16.0	15.5	15.5
18	22.5	21.5	22.0	26.0	25.0	25.5	24.5	23.5	24.0	15.5	14.5	15.0
19	23.0	21.0	22.5	26.0	25.5	25.5	24.5	24.0	24.0	15.0	14.5	14.5
20	23.5	22.0	23.5	26.0	25.0	25.5	24.0	23.5	24.0	15.0	14.5	14.5
21	---	---	---	27.0	25.0	26.0	23.5	23.5	23.5	15.0	14.5	15.0
22	23.5	23.0	23.5	---	---	---	23.5	23.0	23.0	16.0	15.0	15.0
23	---	---	---	---	---	---	24.0	22.5	23.0	15.5	15.0	15.5
24	---	---	---	26.5	26.5	26.5	23.0	22.5	22.5	16.0	14.5	15.5
25	---	---	---	26.5	26.0	26.5	26.0	21.0	22.0	16.0	15.5	16.0
26	---	---	---	26.5	26.0	26.5	21.0	21.0	21.0	16.5	16.0	16.5
27	---	---	---	26.0	25.5	26.0	21.0	20.5	21.0	17.0	16.5	16.5
28	24.0	23.5	24.0	26.5	25.5	26.0	20.5	20.5	20.5	16.5	15.5	16.5
29	24.0	23.5	23.5	26.5	26.0	26.5	20.5	20.0	20.0	16.5	16.5	16.5
30	23.5	23.0	23.5	26.5	26.0	26.5	20.5	20.0	20.0	16.5	16.0	16.0
31	---	---	---	---	---	---	21.0	20.0	20.5	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	11.0	10.6	10.8	11.3	10.7	11.1	11.8	11.2	11.4	12.0	11.6	11.8
2	---	---	---	11.5	10.8	11.1	12.0	11.0	11.6	12.0	11.7	11.8
3	---	---	---	11.7	11.1	11.4	11.8	11.1	11.5	12.2	11.0	11.5
4	---	---	---	12.0	11.2	11.7	11.5	11.0	11.2	11.4	11.0	11.2
5	---	---	---	11.9	11.6	11.7	11.3	10.9	11.1	11.3	11.0	11.1
6	---	---	---	11.8	10.9	11.6	11.7	11.2	11.4	12.3	11.1	11.5
7	---	---	---	11.9	11.1	11.7	11.7	11.2	11.5	12.8	11.4	11.9
8	10.3	9.3	10.0	12.0	11.5	11.7	11.5	11.2	11.3	12.5	11.0	11.3
9	---	---	---	12.1	11.6	11.9	11.4	11.0	11.3	11.4	11.0	11.3
10	---	---	---	12.5	11.9	12.2	11.6	11.4	11.5	11.6	11.0	11.4
11	10.9	10.1	10.5	12.4	11.5	12.0	11.5	11.0	11.1	11.6	11.3	11.5
12	---	---	---	11.8	11.6	11.7	11.1	10.7	10.9	11.6	11.2	11.4
13	---	---	---	12.1	11.2	11.3	11.2	10.5	10.8	11.7	11.2	11.4
14	---	---	---	11.3	11.0	11.2	11.3	10.4	10.7	11.7	11.3	11.6
15	---	---	---	11.4	10.9	11.1	10.4	10.2	10.4	11.4	11.3	11.3
16	11.0	9.4	10.8	11.4	10.9	11.1	11.3	10.2	10.8	11.4	11.0	11.2
17	---	---	---	11.4	10.9	11.0	12.3	11.1	11.6	11.3	10.8	11.1
18	---	---	---	12.0	10.7	10.9	12.1	10.9	11.4	11.6	11.0	11.1
19	10.0	9.0	10.9	11.7	11.2	11.4	11.9	10.8	11.4	11.2	10.9	11.0
20	---	---	---	11.6	11.1	11.4	11.7	10.4	10.9	11.1	10.9	11.0
21	---	---	---	11.9	10.9	11.6	12.0	10.4	10.8	11.0	10.8	10.9
22	---	---	---	12.2	11.4	11.6	11.4	10.5	10.9	11.4	10.8	11.1
23	---	---	---	12.0	11.6	11.8	12.0	10.2	10.9	11.2	11.0	11.1
24	---	---	---	12.1	11.5	11.9	11.7	11.3	11.5	11.1	11.0	11.1
25	---	---	---	12.1	11.5	11.8	11.7	10.4	11.4	11.0	10.7	10.8
26	---	---	---	11.9	11.4	11.8	11.6	10.5	10.9	---	---	---
27	11.0	10.5	10.6	12.1	11.5	11.7	11.1	10.5	10.8	---	---	---
28	10.9	10.5	10.5	11.6	11.2	11.5	11.5	10.5	10.7	---	---	---
29	11.2	10.3	10.8	12.1	11.1	11.6	11.4	11.2	11.3	---	---	---
30	11.1	10.7	10.9	12.1	11.6	11.8	11.8	11.6	11.7	---	---	---
31	11.2	10.9	11.0	---	---	---	12.2	10.5	11.9	---	---	---
MONTH	---	---	---	12.5	10.7	11.5	12.3	10.2	11.2	---	---	---
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	11.8	9.0	11.1	12.7	12.6	12.6	---	---	---	10.2	9.7	10.0
2	12.1	11.8	11.9	12.6	12.5	12.6	---	---	---	10.2	9.9	10.1
3	12.5	12.1	12.3	12.8	12.6	12.7	---	---	---	10.1	8.7	9.5
4	---	---	---	13.2	12.6	12.8	---	---	---	11.3	8.5	9.5
5	---	---	---	13.0	12.7	12.8	---	---	---	10.9	9.0	10.0
6	12.5	11.9	12.5	13.2	12.7	12.9	---	---	---	10.8	9.7	10.1
7	12.7	12.4	12.6	13.5	12.3	13.0	---	---	---	10.2	9.8	10.1
8	12.7	12.4	12.7	13.3	12.6	13.0	---	---	---	10.8	8.9	9.9
9	12.8	12.5	12.7	13.2	13.1	13.2	---	---	---	9.2	9.0	9.1
10	13.4	12.5	12.9	13.5	13.1	13.3	---	---	---	9.3	9.1	9.2
11	13.8	12.7	13.0	13.2	12.8	13.0	12.1	11.4	11.7	10.3	9.1	9.7
12	---	---	---	13.3	12.7	13.0	12.9	11.3	12.2	10.5	9.4	9.9
13	12.5	12.3	12.4	13.3	13.1	13.2	---	---	---	10.8	8.3	9.6
14	12.4	11.9	12.3	13.2	12.9	13.1	---	---	---	8.8	8.7	8.8
15	12.2	12.0	12.2	13.2	12.9	13.1	---	---	---	9.0	8.8	8.9
16	12.2	12.0	12.1	13.0	12.9	13.0	---	---	---	9.4	8.6	9.0
17	12.5	11.9	12.1	12.9	12.0	12.4	11.1	10.9	11.0	9.2	9.1	9.2
18	12.2	12.1	12.1	12.1	11.9	12.0	11.1	10.9	11.0	9.2	9.0	9.1
19	12.8	11.9	12.1	12.5	12.1	12.3	11.0	10.6	10.8	9.3	9.0	9.2
20	12.1	11.6	12.1	12.5	12.2	12.4	10.6	10.1	10.3	9.2	8.2	9.1
21	---	---	---	12.4	12.0	12.2	10.1	9.8	10.0	9.1	8.9	9.0
22	---	---	---	12.5	12.4	12.4	10.7	10.4	10.5	9.0	8.7	8.8
23	---	---	---	13.0	12.8	12.9	11.7	11.3	11.5	9.3	8.7	9.0
24	11.9	11.8	11.8	13.1	12.9	13.0	11.4	10.1	10.9	9.2	9.0	9.1
25	11.8	10.8	11.6	12.9	12.7	12.7	10.9	10.8	10.9	9.0	8.8	8.9
26	11.8	11.5	11.6	13.0	12.7	12.9	10.7	9.4	10.3	8.9	8.6	8.8
27	11.8	11.6	11.7	13.0	12.4	12.6	10.6	10.1	10.3	8.8	8.5	8.6
28	11.7	11.7	11.7	13.6	12.2	12.9	11.4	9.9	10.7	9.8	8.5	8.8
29	---	---	---	13.5	13.2	13.4	11.5	9.1	10.0	9.2	7.7	8.4
30	---	---	---	13.4	12.9	13.3	10.0	9.2	9.5	8.2	8.1	8.1
31	---	---	---	---	---	---	---	---	---	9.7	7.9	8.5
MONTH	---	---	---	---	---	---	---	---	---	11.3	7.7	9.2



## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°48'13", long 93°00'43", in NW¼NE¼ sec.26, T.27 N., R.22 W., Washington County, Hydrologic Unit 07010206, on left bank at the J. L. Shiely Co. loading dock, and at mile 826.2 upstream from Ohio River.

PERIOD OF RECORD.--February 1977 to current year.

## PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: September 1977 to current year.

pH: September 1977 to current year.

WATER TEMPERATURES: September 1977 to current year.

DISSOLVED OXYGEN: September 1977 to current year.

INSTRUMENTATION.--Water-quality monitor since September 1977.

REMARKS.--Water discharge computed on the basis of discharge for Mississippi River at St. Paul (station 05331000) adjusted for inflow and travel time. Extremes are published for years with 80 percent or more daily record.

COOPERATION.--Samples collected and water-quality monitor operated by the Metropolitan Waste Control Commission, St. Paul, MN.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water year 1981-86): Maximum, 773 microsiemens Feb. 23, 1985; minimum, 243 microsiemens Mar. 19, 1985.

pH (water year 1981,1984-86): Maximum, 8.7 units May 13, Sept. 6, 7, 9, 13, 1981, Mar. 16, 17, 1984; minimum, 7.0 units Oct. 10, 1983, Aug. 15, 1985.

WATER TEMPERATURES (water year 1981-86): Maximum, 29.0°C Aug. 7, 1982; minimum, 0.0°C several days during winter period.

DISSOLVED OXYGEN (water year 1981-82, 1984-86): Maximum, 16.0 mg/L Jan. 18, 1985; minimum, 1.1 mg/L June 30, 1986.

## EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 685 microsiemens Nov. 27; minimum, 361 microsiemens Apr. 30.

pH: Maximum, 8.4 units Mar. 20, Sep. 18; minimum, 7.4 units many days during the water year.

WATER TEMPERATURES: Maximum, 28.5°C July 19-20; minimum, 0.5°C several days during winter period.

DISSOLVED OXYGEN: Maximum, 13.9 mg/L Nov. 15; minimum, 1.1 mg/L June 30.

## SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	511	497	503	612	582	598	668	632	651	615	601	606
2	539	512	523	612	598	603	661	616	650	607	580	592
3	537	527	531	612	592	602	654	631	641	613	571	576
4	543	488	522	608	584	595	665	652	659	581	571	577
5	548	500	535	595	564	579	664	620	644	590	577	585
6	548	526	538	597	566	582	656	589	608	598	582	591
7	531	519	524	605	570	584	638	597	604	607	595	601
8	539	528	535	581	563	572	606	591	597	609	575	590
9	577	522	562	582	562	572	660	577	584	585	576	580
10	583	573	577	591	567	580	612	575	578	583	570	573
11	597	580	589	584	573	577	579	572	576	575	562	568
12	600	582	589	580	569	573	---	---	---	576	560	570
13	598	589	593	585	576	581	---	---	---	588	553	573
14	602	585	592	588	578	582	602	577	594	561	543	552
15	599	555	573	587	574	581	597	589	592	561	544	552
16	560	547	554	591	564	575	595	574	584	559	546	551
17	564	549	557	593	572	584	574	551	559	562	546	552
18	566	552	558	593	570	581	586	552	567	567	550	561
19	559	549	554	592	577	585	595	568	578	564	544	555
20	567	554	558	593	584	587	581	566	573	552	539	543
21	569	558	564	593	575	583	570	550	560	---	---	---
22	581	561	573	635	592	614	565	551	558	558	538	549
23	587	572	578	625	584	601	577	561	567	580	554	561
24	592	577	584	611	577	597	576	551	564	578	548	564
25	585	567	577	610	591	599	593	572	577	574	557	563
26	584	571	579	653	607	635	619	593	610	579	563	574
27	599	576	588	685	616	655	624	576	598	594	562	573
28	592	573	580	628	612	618	583	566	579	611	594	605
29	594	574	584	636	610	625	609	578	600	607	570	596
30	603	583	591	640	616	625	615	598	609	581	553	570
31	608	580	589	---	---	---	619	606	611	577	553	568
MONTH	608	488	563	685	562	594	---	---	---	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	611	567	576	601	580	591	425	409	416	481	460	468
2	589	566	580	607	585	594	409	391	397	485	452	471
3	582	548	564	603	558	578	---	---	---	479	384	471
4	---	---	---	587	557	571	---	---	---	480	378	473
5	---	---	---	588	553	568	---	---	---	485	467	475
6	583	568	575	606	554	581	---	---	---	474	470	471
7	577	552	564	569	561	564	---	---	---	474	468	469
8	562	547	554	626	569	586	425	390	405	470	459	466
9	553	542	547	625	608	618	435	415	422	495	457	474
10	585	547	560	616	605	610	462	434	446	474	456	464
11	596	585	590	619	570	597	470	442	456	457	450	453
12	600	580	591	572	552	560	473	454	464	488	450	472
13	582	574	578	555	546	550	487	470	478	488	470	479
14	588	553	581	574	555	564	515	487	504	470	461	464
15	582	573	578	578	558	568	---	---	---	465	459	461
16	575	542	557	572	560	566	---	---	---	461	458	459
17	574	551	569	577	561	571	---	---	---	459	455	457
18	575	557	569	584	565	577	---	---	---	459	455	457
19	581	552	568	570	551	564	---	---	---	458	425	442
20	593	577	585	551	497	527	---	---	---	485	429	457
21	---	---	---	523	473	499	---	---	---	483	474	479
22	---	---	---	505	470	486	---	---	---	491	479	485
23	---	---	---	474	449	460	---	---	---	492	456	471
24	574	567	570	452	447	450	---	---	---	469	425	463
25	587	521	576	440	433	436	---	---	---	473	467	469
26	591	577	584	442	366	430	---	---	---	472	467	470
27	601	580	591	462	365	417	---	---	---	485	471	478
28	607	588	599	473	461	465	492	460	473	541	485	514
29	---	---	---	485	468	473	468	379	412	548	538	540
30	---	---	---	483	433	476	489	361	433	566	546	552
31	---	---	---	477	423	444	---	---	---	574	566	570
MONTH	---	---	---	626	365	534	---	---	---	574	378	474
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	579	574	576	525	503	512	---	---	---	---	---	---
2	577	540	554	533	507	527	524	488	500	503	484	498
3	554	545	548	546	530	537	490	481	485	505	468	482
4	555	550	553	562	545	552	498	486	491	472	433	454
5	563	555	558	561	555	557	521	494	507	447	434	441
6	566	555	562	557	525	551	528	512	518	435	421	430
7	564	556	559	---	---	---	536	528	532	426	417	421
8	559	551	555	550	542	546	539	519	531	417	407	411
9	557	547	552	---	---	---	543	533	537	412	383	400
10	554	544	551	534	524	525	---	---	---	464	392	414
11	556	531	542	556	534	546	535	505	516	456	442	443
12	531	513	518	---	---	---	505	492	498	488	446	462
13	514	505	509	545	523	530	535	493	508	478	455	467
14	512	501	507	531	519	524	517	505	509	---	---	---
15	500	495	497	542	527	534	517	499	506	438	434	436
16	505	495	500	534	527	529	525	515	521	---	---	---
17	504	498	500	542	529	535	---	---	---	456	449	452
18	507	493	499	552	533	541	---	---	---	469	447	453
19	522	497	508	558	547	552	444	438	441	456	444	449
20	537	522	529	556	542	550	523	436	438	463	450	455
21	---	---	---	542	528	535	437	427	432	---	---	---
22	---	---	---	557	549	553	480	432	459	456	450	453
23	---	---	---	593	577	585	---	---	---	451	442	445
24	---	---	---	599	590	592	---	---	---	454	399	419
25	---	---	---	596	587	591	459	425	447	410	401	405
26	---	---	---	589	579	584	451	442	446	419	408	413
27	---	---	---	---	---	---	483	447	463	443	418	421
28	495	483	489	---	---	---	485	457	482	439	429	433
29	508	493	500	---	---	---	485	479	481	455	426	434
30	509	503	505	---	---	---	484	479	480	453	434	442
31	---	---	---	---	---	---	---	---	---	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	---	---	---	7.8	7.7	7.7	7.7	7.5	7.5	7.7	7.7	7.7
2	---	---	---	7.8	7.7	7.8	7.6	7.5	7.5	7.7	7.7	7.7
3	7.8	7.7	7.8	7.8	7.8	7.8	7.5	7.5	7.5	7.7	7.7	7.7
4	7.7	7.6	7.7	7.8	7.8	7.8	7.5	7.5	7.5	7.7	7.7	7.7
5	7.7	7.6	7.6	7.8	7.8	7.8	7.5	7.4	7.4	7.7	7.7	7.7
6	7.6	7.5	7.6	7.8	7.7	7.8	7.5	7.4	7.4	7.7	7.7	7.7
7	7.5	7.5	7.5	7.8	7.7	7.7	7.6	7.4	7.4	7.7	7.7	7.7
8	7.5	7.4	7.5	7.8	7.8	7.8	7.4	7.4	7.4	7.7	7.6	7.7
9	7.8	7.4	7.6	7.8	7.8	7.8	7.5	7.4	7.4	7.7	7.6	7.6
10	7.8	7.8	7.8	7.8	7.8	7.8	7.5	7.4	7.5	7.7	7.7	7.7
11	7.9	7.8	7.8	7.9	7.8	7.8	7.7	7.5	7.6	7.7	7.6	7.7
12	7.8	7.8	7.8	7.8	7.8	7.8	---	---	---	7.8	7.7	7.7
13	7.8	7.8	7.8	7.8	7.8	7.8	---	---	---	7.8	7.7	7.7
14	7.8	7.8	7.8	7.8	7.7	7.8	7.6	7.4	7.6	7.7	7.7	7.7
15	7.8	7.7	7.8	7.8	7.7	7.8	7.6	7.6	7.6	7.7	7.7	7.7
16	7.8	7.7	7.8	7.8	7.7	7.7	7.6	7.5	7.6	7.7	7.7	7.7
17	7.8	7.7	7.7	7.8	7.7	7.7	7.6	7.5	7.5	7.7	7.7	7.7
18	7.7	7.7	7.7	7.8	7.7	7.7	7.6	7.5	7.5	7.7	7.7	7.7
19	7.7	7.6	7.7	7.8	7.7	7.7	7.5	7.5	7.5	7.7	7.7	7.7
20	7.7	7.6	7.6	7.8	7.7	7.7	7.5	7.5	7.5	7.8	7.7	7.7
21	7.6	7.6	7.6	7.8	7.7	7.8	7.5	7.4	7.5	---	---	---
22	7.7	7.6	7.6	7.8	7.7	7.7	7.5	7.4	7.5	7.9	7.8	7.8
23	7.7	7.6	7.7	7.7	7.7	7.7	7.5	7.4	7.5	7.8	7.8	7.8
24	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.5	7.6	7.9	7.8	7.8
25	7.7	7.7	7.7	7.7	7.6	7.6	7.8	7.7	7.7	7.9	7.8	7.8
26	7.7	7.7	7.7	7.7	7.6	7.6	7.7	7.7	7.7	7.9	7.8	7.9
27	7.7	7.7	7.7	7.7	7.6	7.6	7.7	7.7	7.7	7.9	7.8	7.9
28	7.7	7.7	7.7	7.6	7.6	7.6	7.8	7.7	7.7	7.9	7.9	7.9
29	7.7	7.7	7.7	7.6	7.6	7.6	7.7	7.7	7.7	7.9	7.8	7.9
30	7.7	7.7	7.7	7.6	7.6	7.6	7.7	7.7	7.7	7.9	7.9	7.9
31	7.7	7.7	7.7	---	---	---	7.7	7.7	7.7	7.9	7.9	7.9
MONTH	---	---	---	7.9	7.6	7.7	---	---	---	---	---	---

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	7.9	7.9	7.9	8.0	8.0	8.0	7.9	7.9	7.9	8.1	8.1	8.1
2	7.9	7.8	7.9	8.1	8.0	8.0	7.9	7.9	7.9	8.1	8.1	8.1
3	7.9	7.9	7.9	8.1	8.0	8.0	---	---	---	---	---	---
4	---	---	---	8.0	7.9	8.0	---	---	---	---	---	---
5	---	---	---	8.1	7.9	8.0	---	---	---	8.1	8.1	8.1
6	7.9	7.9	7.9	8.1	8.0	8.0	---	---	---	8.1	8.1	8.1
7	7.9	7.9	7.9	8.1	8.1	8.1	---	---	---	8.1	8.1	8.1
8	7.9	7.9	7.9	8.1	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1
9	7.9	7.9	7.9	8.0	8.0	8.0	8.0	7.9	7.9	8.1	8.1	8.1
10	8.0	7.9	7.9	8.1	8.0	8.1	7.9	7.9	7.9	8.1	8.1	8.1
11	8.0	8.0	8.0	8.1	8.0	8.0	8.0	7.9	7.9	8.1	8.1	8.1
12	8.0	7.9	8.0	8.0	7.9	8.0	7.9	7.9	7.9	8.1	8.1	8.1
13	8.0	7.9	8.0	8.0	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1
14	8.0	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.1
15	7.9	7.9	7.9	8.1	8.0	8.0	---	---	---	8.1	8.0	8.1
16	7.9	7.9	7.9	8.0	8.0	8.0	---	---	---	8.0	8.0	8.0
17	7.9	7.9	7.9	8.1	8.0	8.0	---	---	---	8.0	8.0	8.0
18	7.9	7.9	7.9	8.1	8.1	8.1	---	---	---	8.0	8.0	8.0
19	7.9	7.9	7.9	8.2	8.1	8.1	---	---	---	8.0	8.0	8.0
20	8.1	8.0	8.1	8.4	8.1	8.1	---	---	---	8.0	8.0	8.0
21	---	---	---	8.1	8.0	8.0	---	---	---	8.1	8.0	8.0
22	---	---	---	8.0	7.9	8.0	---	---	---	8.0	8.0	8.0
23	---	---	---	7.9	7.9	7.9	---	---	---	8.0	8.0	8.0
24	8.0	7.8	7.9	7.9	7.9	7.9	---	---	---	8.0	8.0	8.0
25	8.0	8.0	8.0	7.9	7.9	7.9	---	---	---	8.0	7.9	8.0
26	8.0	8.0	8.0	8.0	7.9	7.9	---	---	---	8.0	7.9	7.9
27	8.1	8.0	8.0	8.0	8.0	8.0	---	---	---	8.0	7.9	7.9
28	8.1	8.0	8.0	8.0	7.9	8.0	---	---	---	8.1	7.9	8.0
29	---	---	---	8.0	7.9	8.0	---	---	---	8.0	8.0	8.0
30	---	---	---	8.0	8.0	8.0	8.1	8.1	8.1	8.0	8.0	8.0
31	---	---	---	8.0	7.9	8.0	---	---	---	8.0	8.0	8.0
MONTH	---	---	---	8.4	7.9	8.0	---	---	---	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	8.0	8.0	8.0	7.9	7.7	7.9	---	---	---	---	---	---
2	8.0	7.9	8.0	7.9	7.7	7.8	8.1	8.0	8.1	8.2	8.1	8.2
3	7.9	7.9	7.9	7.9	7.9	7.9	8.1	8.0	8.0	8.2	8.1	8.1
4	8.0	7.9	7.9	8.0	7.9	7.9	8.1	8.0	8.0	8.2	8.1	8.1
5	8.0	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.2	8.1	8.1
6	8.0	7.9	8.0	8.0	7.7	8.0	8.1	8.0	8.1	8.2	8.1	8.1
7	8.0	7.9	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.1	8.0	8.1
8	8.0	7.9	8.0	8.0	7.9	7.9	8.1	8.1	8.1	8.1	8.0	8.1
9	8.0	7.9	8.0	---	---	---	8.1	8.1	8.1	8.1	8.1	8.1
10	8.0	7.9	7.9	8.0	7.9	7.9	---	---	---	8.2	8.2	8.2
11	8.0	7.9	7.9	8.1	8.0	8.0	8.2	7.9	8.1	8.3	8.2	8.2
12	8.0	7.9	7.9	---	---	---	8.2	8.1	8.2	8.2	8.0	8.2
13	7.9	7.9	7.9	8.1	7.7	8.0	8.2	8.1	8.2	8.2	8.1	8.1
14	7.9	7.9	7.9	8.1	8.0	8.0	8.2	8.1	8.1	---	---	---
15	7.9	7.9	7.9	8.1	8.0	8.0	8.1	8.1	8.1	8.2	8.1	8.1
16	8.1	7.9	8.0	8.1	8.0	8.1	8.1	8.0	8.1	8.2	8.2	8.2
17	8.1	8.0	8.0	8.1	8.0	8.0	---	---	---	8.2	8.2	8.2
18	8.0	7.9	8.0	8.1	7.4	7.9	---	---	---	8.4	8.1	8.2
19	7.9	7.9	7.9	8.1	7.8	7.9	8.1	8.1	8.1	8.2	8.1	8.1
20	7.9	7.9	7.9	8.0	7.8	7.9	8.1	8.0	8.1	8.1	8.1	8.1
21	---	---	---	8.1	7.7	8.0	8.1	8.0	8.0	---	---	---
22	---	---	---	8.1	8.1	8.1	8.1	8.0	8.1	8.0	8.0	8.0
23	---	---	---	8.2	8.1	8.1	---	---	---	8.1	7.9	8.1
24	---	---	---	8.2	8.1	8.1	---	---	---	8.1	7.9	8.0
25	---	---	---	8.1	8.0	8.1	8.1	7.9	8.0	8.0	7.9	7.9
26	---	---	---	8.1	8.0	8.0	8.1	8.1	8.1	7.9	7.9	7.9
27	---	---	---	---	---	---	8.1	8.1	8.1	8.1	7.9	7.9
28	8.0	8.0	8.0	---	---	---	8.1	8.1	8.1	8.0	7.9	7.9
29	8.0	7.9	8.0	---	---	---	8.2	8.1	8.2	7.9	7.9	7.9
30	8.0	7.9	7.9	---	---	---	8.2	8.1	8.2	8.0	7.9	7.9
31	---	---	---	---	---	---	---	---	---	---	---	---

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	10.5	10.0	10.5	9.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	1.0
2	10.5	9.5	10.5	9.0	8.5	8.5	1.0	1.0	1.0	1.0	.5	1.0
3	11.0	10.5	10.5	8.5	8.0	8.0	1.0	1.0	1.0	1.0	.5	1.0
4	11.0	10.5	11.0	8.0	7.5	7.5	1.0	1.0	1.0	1.0	.5	1.0
5	10.5	10.5	10.5	7.5	7.0	7.5	1.0	1.0	1.0	1.0	.5	1.0
6	10.5	10.0	10.0	7.5	7.0	7.5	1.0	1.0	1.0	1.0	.5	1.0
7	10.5	10.0	10.0	8.0	7.0	7.0	1.0	1.0	1.0	1.0	.5	1.0
8	10.5	10.0	10.5	7.0	6.0	6.5	1.0	1.0	1.0	1.5	.5	1.0
9	10.5	9.5	10.0	6.0	5.0	5.5	1.0	1.0	1.0	1.5	1.0	1.0
10	9.5	9.0	9.5	5.0	4.0	4.5	1.0	1.0	1.0	1.5	.5	1.0
11	9.0	8.5	9.0	4.0	3.5	3.5	1.0	1.0	1.0	1.5	1.0	1.0
12	9.0	9.0	9.0	3.5	3.0	3.5	---	---	---	1.5	1.0	1.0
13	9.0	9.0	9.0	3.0	3.0	3.0	---	---	---	1.5	1.0	1.0
14	9.5	8.5	9.0	3.5	3.0	3.5	1.0	.5	1.0	1.5	1.0	1.0
15	9.0	8.5	9.0	3.5	3.5	3.5	1.0	1.0	1.0	1.0	1.0	1.0
16	9.0	8.5	9.0	3.5	3.0	3.5	1.0	1.0	1.0	1.5	1.0	1.0
17	9.0	8.5	9.0	3.5	3.0	3.5	1.0	1.0	1.0	1.5	1.0	1.5
18	9.0	8.5	9.0	4.0	3.0	3.5	1.0	1.0	1.0	1.5	1.0	1.5
19	9.5	9.0	9.0	4.0	3.5	4.0	1.0	.5	1.0	1.5	1.5	1.5
20	9.5	9.0	9.0	3.5	2.0	2.5	1.0	.5	1.0	1.5	1.5	1.5
21	10.0	9.5	9.5	2.0	1.0	1.5	1.0	.5	1.0	---	---	---
22	10.5	10.0	10.0	1.5	1.0	1.0	1.0	1.0	1.0	1.5	1.0	1.0
23	11.5	10.5	11.0	1.0	1.0	1.0	1.0	.5	1.0	1.5	1.0	1.0
24	12.0	11.0	11.5	1.0	1.0	1.0	1.0	.5	.5	1.5	1.0	1.0
25	12.0	11.0	11.5	1.0	1.0	1.0	1.0	.5	.5	1.5	1.0	1.0
26	12.0	11.0	11.5	1.0	1.0	1.0	1.0	.5	1.0	1.0	1.0	1.0
27	11.5	11.0	11.5	1.0	1.0	1.0	1.0	.5	.5	1.0	1.0	1.0
28	11.0	10.5	10.5	1.0	1.0	1.0	1.0	.5	1.0	1.5	1.0	1.0
29	10.5	10.0	10.0	1.0	1.0	1.0	1.0	.5	1.0	1.5	1.0	1.0
30	10.0	9.5	10.0	1.0	1.0	1.0	1.0	.5	1.0	1.5	1.0	1.0
31	9.5	9.0	9.0	---	---	---	1.0	.5	1.0	1.0	.5	1.0
MONTH	12.0	8.5	10.0	9.0	1.0	4.0	---	---	---	---	---	---

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	FEBRUARY			MARCH			APRIL			MAY		
1	1.0	.5	.5	2.0	1.0	1.5	8.5	7.5	8.0	14.0	13.0	13.5
2	1.0	.5	.5	2.0	1.5	1.5	8.0	7.0	7.5	13.0	12.5	13.0
3	1.0	.5	.5	1.5	1.0	1.5	---	---	---	14.0	12.5	13.0
4	---	---	---	1.5	1.0	1.5	---	---	---	14.0	13.0	13.5
5	---	---	---	1.5	.5	1.0	---	---	---	15.5	14.0	15.0
6	1.0	.5	1.0	1.0	.5	1.0	---	---	---	16.0	15.5	15.5
7	1.5	.5	1.0	1.0	.5	.5	---	---	---	15.5	15.5	15.5
8	1.5	1.0	1.5	1.0	.5	.5	9.5	9.0	9.5	15.0	15.0	15.0
9	1.5	1.0	1.0	1.5	.5	1.0	10.0	9.5	9.5	15.0	14.5	14.5
10	1.5	.5	1.0	2.0	1.0	1.5	10.5	9.5	10.0	14.5	14.0	14.5
11	1.0	1.0	1.0	2.0	1.0	1.5	11.0	10.0	10.5	14.5	14.0	14.0
12	1.0	1.0	1.0	2.5	2.0	2.0	11.0	10.5	11.0	15.5	14.5	15.0
13	1.0	1.0	1.0	2.5	2.0	2.5	11.5	11.0	11.0	15.5	15.0	15.5
14	1.5	1.0	1.0	2.5	2.0	2.5	11.0	10.0	10.5	16.0	15.0	15.5
15	1.5	1.0	1.0	3.0	2.0	2.5	---	---	---	16.5	15.5	16.0
16	1.5	1.0	1.0	3.5	3.0	3.0	---	---	---	17.0	16.5	16.5
17	1.5	1.0	1.0	4.0	3.0	3.5	---	---	---	16.5	16.0	16.5
18	1.5	1.0	1.5	3.5	3.0	3.5	---	---	---	16.5	16.0	16.0
19	1.5	1.0	1.5	3.0	2.0	2.5	---	---	---	16.5	16.0	16.0
20	1.5	1.0	1.0	2.0	1.5	1.5	---	---	---	17.0	16.0	16.0
21	---	---	---	2.5	1.5	2.0	---	---	---	17.0	16.0	16.5
22	---	---	---	3.0	2.0	2.5	---	---	---	17.5	16.5	17.0
23	---	---	---	3.0	2.0	2.5	---	---	---	17.0	16.0	17.0
24	1.5	1.0	1.5	2.5	2.5	2.5	---	---	---	17.5	16.5	17.0
25	1.5	1.0	1.5	3.0	2.5	3.0	---	---	---	17.5	17.0	17.0
26	1.5	1.0	1.5	3.0	2.5	2.5	---	---	---	17.5	16.5	17.0
27	1.5	1.0	1.0	3.5	2.5	3.0	---	---	---	19.0	17.0	18.0
28	1.5	1.0	1.0	4.0	2.5	3.5	14.5	14.0	14.5	19.5	18.5	19.0
29	---	---	---	5.5	4.0	4.5	14.0	13.5	14.0	21.0	19.5	20.0
30	---	---	---	6.5	3.5	6.0	14.5	13.5	14.0	21.5	20.0	21.0
31	---	---	---	8.5	6.0	7.0	---	---	---	22.5	21.0	21.5
MONTH	---	---	---	8.5	.5	2.5	---	---	---	22.5	12.5	16.0
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	22.5	22.0	22.5	23.5	22.5	23.0	---	---	---	---	---	---
2	22.0	21.5	21.5	23.5	21.5	23.0	25.0	24.0	24.5	22.0	19.5	21.5
3	21.5	20.5	21.0	23.5	22.0	23.0	24.5	24.0	24.0	22.0	22.0	22.0
4	21.5	21.0	21.0	24.5	23.0	23.5	24.0	23.0	23.5	22.0	21.0	21.5
5	21.5	20.5	21.0	25.5	24.5	25.0	24.5	23.5	24.0	21.5	20.5	21.0
6	21.0	20.5	21.0	26.0	23.5	25.5	25.0	24.0	24.0	20.5	19.5	20.0
7	21.5	20.5	21.0	25.5	22.5	24.5	24.5	24.0	24.0	20.0	18.0	19.5
8	21.5	20.5	21.0	24.5	24.5	24.5	24.5	23.0	24.0	19.0	18.5	19.0
9	21.5	20.5	21.0	---	---	---	25.0	23.5	24.0	18.5	17.5	18.0
10	21.5	20.5	21.0	24.5	23.5	24.0	---	---	---	17.5	17.0	17.5
11	21.0	19.5	20.5	24.0	23.5	23.5	24.5	22.5	23.5	17.0	16.5	16.5
12	20.5	19.5	19.5	---	---	---	22.5	22.0	22.5	16.5	16.0	16.5
13	20.5	19.5	20.0	24.5	22.5	23.5	24.0	20.5	21.5	16.5	16.0	16.5
14	21.5	20.0	20.5	24.0	22.0	23.0	21.0	20.5	20.5	---	---	---
15	21.5	20.5	21.0	25.0	23.0	24.0	22.0	20.5	21.0	15.5	14.5	15.5
16	22.0	21.0	21.5	24.5	23.0	23.5	23.5	22.0	22.5	---	---	---
17	22.5	21.0	21.5	25.5	24.0	24.0	---	---	---	14.5	14.5	14.5
18	22.5	21.5	22.0	27.0	25.5	26.5	---	---	---	15.0	14.0	14.5
19	23.5	20.5	22.5	28.5	26.5	27.5	24.5	23.5	24.0	15.0	14.5	15.0
20	25.0	23.5	24.0	28.5	26.5	27.5	24.0	22.5	23.5	15.0	14.5	15.0
21	---	---	---	27.0	25.5	26.5	24.0	22.5	23.0	---	---	---
22	---	---	---	26.5	25.5	26.0	23.5	22.0	22.5	---	---	---
23	---	---	---	26.5	25.5	26.0	---	---	---	16.0	15.0	15.5
24	---	---	---	26.0	25.5	26.0	---	---	---	16.5	15.0	16.0
25	---	---	---	27.0	25.5	26.0	23.0	20.5	21.0	17.0	16.0	16.5
26	---	---	---	26.0	25.5	26.0	21.5	20.5	21.0	---	---	---
27	---	---	---	---	---	---	21.0	20.0	21.0	---	---	---
28	26.0	25.0	25.5	---	---	---	20.5	19.5	20.0	18.0	16.0	16.5
29	---	---	---	---	---	---	20.0	19.5	19.5	18.0	17.0	17.5
30	23.5	21.0	23.0	---	---	---	20.0	19.0	19.5	17.0	17.0	17.0
31	---	---	---	---	---	---	---	---	---	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	11.1	10.7	10.9	10.7	9.8	10.1	13.1	12.4	12.9	12.9	12.7	12.8
2	11.0	10.7	10.8	10.9	10.1	10.4	13.2	12.6	12.9	12.9	12.3	12.5
3	11.0	10.7	10.8	10.7	10.1	10.4	13.1	12.7	12.9	12.3	10.1	12.2
4	11.0	10.1	10.6	12.0	10.4	11.1	12.7	12.2	12.5	12.1	11.9	12.0
5	11.1	10.4	10.8	12.2	11.3	11.7	12.3	11.9	12.1	12.2	11.9	12.0
6	10.5	9.8	10.1	11.6	11.2	11.5	12.2	12.0	12.1	12.1	11.8	11.9
7	10.9	9.9	10.3	11.6	10.1	11.3	13.3	11.8	12.0	12.0	10.2	12.0
8	10.6	10.0	10.3	12.2	11.1	11.6	11.9	11.7	11.8	12.0	11.5	11.7
9	10.7	10.3	10.5	12.7	10.0	11.9	12.8	11.7	11.8	11.7	11.4	11.5
10	10.9	10.7	10.8	10.9	10.2	10.6	12.8	11.8	11.9	11.9	11.5	11.6
11	11.1	10.7	10.9	13.3	10.7	11.4	12.0	11.7	11.9	11.7	11.5	11.5
12	11.0	10.4	10.7	13.6	13.2	13.4	---	---	---	12.4	11.4	11.9
13	10.7	10.4	10.5	13.5	12.6	13.2	---	---	---	12.3	11.8	12.0
14	11.4	10.3	10.8	13.5	12.9	13.2	12.0	11.5	11.7	12.4	11.8	12.1
15	11.0	10.6	10.8	13.9	12.9	13.4	11.7	11.4	11.5	12.4	12.1	12.2
16	11.0	10.6	10.8	13.7	13.3	13.4	11.7	11.2	11.4	12.8	12.2	12.5
17	11.0	10.5	10.6	13.6	13.1	13.3	11.8	11.4	11.6	12.7	11.9	12.1
18	11.2	10.2	10.8	13.5	12.7	13.1	11.7	11.3	11.5	12.3	11.9	12.1
19	11.2	10.8	11.0	12.8	12.3	12.5	11.4	11.3	11.3	12.2	11.8	12.0
20	11.0	10.7	10.9	12.5	12.3	12.4	11.5	11.2	11.3	12.4	12.0	12.2
21	11.4	10.5	10.8	13.0	12.4	12.7	11.5	11.3	11.4	---	---	---
22	11.3	10.4	10.8	12.8	12.5	12.7	11.3	11.0	11.1	12.7	11.9	12.3
23	10.5	9.8	10.1	13.0	12.7	12.8	11.4	10.4	10.9	12.2	11.9	12.0
24	9.8	9.5	9.6	12.9	12.7	12.8	11.1	10.9	11.0	12.3	11.9	12.1
25	10.2	9.3	9.7	13.0	12.6	12.8	10.9	10.4	10.6	12.4	12.1	12.2
26	10.2	9.7	9.9	13.2	12.8	13.0	10.6	10.1	10.4	12.3	12.1	12.2
27	10.0	9.6	9.8	13.1	12.8	13.0	11.2	10.7	11.0	12.2	11.9	12.1
28	10.8	9.7	10.3	12.9	12.6	12.7	12.0	11.3	11.7	12.1	11.6	11.7
29	10.6	10.0	10.3	13.2	12.4	12.7	11.9	11.7	11.8	12.1	11.5	11.8
30	10.1	9.8	10.0	13.3	13.0	13.2	12.7	12.0	12.4	12.2	11.9	12.0
31	10.1	9.9	10.0	---	---	---	13.0	10.1	12.8	12.8	12.1	12.5
MONTH	11.4	9.3	10.5	13.9	9.8	12.3	---	---	---	---	---	---
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	12.7	12.5	12.6	12.7	12.0	12.2	13.1	12.2	12.6	10.5	10.1	10.3
2	12.7	12.4	12.6	12.2	11.9	12.0	13.0	12.4	12.7	12.5	10.3	11.5
3	13.0	12.0	12.8	12.2	11.8	12.0	---	---	---	12.4	11.1	12.1
4	---	---	---	12.2	11.6	11.8	---	---	---	11.8	11.0	11.4
5	---	---	---	12.0	11.5	11.8	---	---	---	11.1	9.9	10.4
6	13.3	13.0	13.2	11.9	11.2	11.6	---	---	---	10.3	9.6	9.9
7	13.3	12.5	12.9	12.1	11.6	11.8	---	---	---	10.5	9.9	10.2
8	12.7	12.4	12.5	12.3	11.7	12.0	12.2	11.8	12.0	10.4	9.9	10.0
9	12.7	12.4	12.5	12.3	11.7	12.0	12.1	11.7	11.9	10.2	9.8	10.0
10	12.7	12.3	12.5	13.1	11.7	12.4	11.8	11.3	11.6	10.1	9.9	10.1
11	12.5	12.1	12.2	12.8	11.9	12.2	11.3	10.8	11.0	10.0	9.8	9.9
12	12.8	12.0	12.3	12.4	11.6	12.0	11.0	10.3	10.6	10.3	9.8	10.0
13	12.8	12.4	12.5	12.4	12.0	12.2	10.6	10.3	10.5	9.9	9.5	9.7
14	12.6	12.1	12.4	12.8	12.0	12.4	10.5	10.0	10.2	10.0	9.2	9.6
15	12.5	12.2	12.3	12.9	12.1	12.6	---	---	---	10.0	9.3	9.7
16	12.3	12.1	12.2	12.7	12.2	12.5	---	---	---	10.3	9.8	10.1
17	12.4	12.1	12.2	12.6	11.8	12.2	---	---	---	10.0	9.6	9.8
18	12.3	12.0	12.1	12.2	11.9	12.1	---	---	---	9.9	9.4	9.6
19	12.3	12.0	12.2	12.7	12.0	12.3	---	---	---	11.0	9.6	10.3
20	12.5	12.1	12.3	12.9	12.4	12.6	---	---	---	10.2	9.0	9.6
21	---	---	---	13.0	12.6	12.8	---	---	---	10.0	9.6	9.8
22	---	---	---	12.7	12.0	12.4	---	---	---	10.5	9.8	10.1
23	---	---	---	12.1	9.8	11.2	---	---	---	10.2	9.5	9.9
24	12.9	12.6	12.8	10.6	9.9	10.2	---	---	---	9.8	9.3	9.5
25	12.8	12.6	12.7	12.7	12.3	12.5	---	---	---	9.4	8.8	9.2
26	12.8	11.5	12.4	12.9	12.8	12.8	---	---	---	9.0	8.6	8.8
27	12.4	12.0	12.2	13.0	12.4	12.7	---	---	---	9.6	8.4	9.1
28	12.3	11.8	12.1	12.9	12.1	12.7	11.1	10.9	11.0	9.7	8.6	9.3
29	---	---	---	12.8	12.0	12.4	11.5	10.9	11.2	9.6	8.8	9.2
30	---	---	---	12.9	11.8	12.1	11.0	10.3	10.7	9.1	8.7	8.9
31	---	---	---	13.4	11.8	12.6	---	---	---	8.7	8.3	8.5
MONTH	---	---	---	13.4	9.8	12.2	---	---	---	12.5	8.3	9.9

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

[illegible]

## MISSISSIPPI RIVER MAIN STEM

05331570 MISSISSIPPI RIVER AT NININGER, MN  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°46'22", long 92°54'07", in NW¼NE¼ sec.18, T.115 N., R.17 W., Dakota County, Hydrologic Unit 07010206, on right bank at the end of Jason Avenue, and at mile 817.8 upstream from Ohio River.

DRAINAGE AREA.--37,000 mi<sup>2</sup> (95,800 km<sup>2</sup>), approximately.

PERIOD OF RECORD.--January 1977 to current year.

REMARKS.--Water-discharge computed on the basis of discharge for Mississippi River at St. Paul (station 05331000) adjusted for inflow and travel time. Letter K indicates non-ideal colony count.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, MEAN DAILY (CFS) (00060)	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, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT										
22...	1230	31200	625	641	8.2	8.0	11.0	10.0	15	763
JAN										
17...	1030	10700	560	620	7.7	8.0	1.0	0.0	2.4	764
MAY										
15...	1200	73300	500	486	8.3	8.2	25.5	16.5	17	764
JUL										
28...	1210	22500	470	530	8.4	8.2	21.5	25.0	32	766

DATE	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)	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)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
OCT									
22...	10.2	360	83	73	31	13	3.2	274	0
JAN									
17...	14.4	1300	190	69	27	19	3.3	273	0
MAY									
15...	10.3	K130	140	58	21	9.3	3.3	187	0
JUL									
28...	6.4	1600	250	65	26	12	3.1	234	1

## MISSISSIPPI RIVER MAIN STEM

05331570 MISSISSIPPI RIVER AT NININGER, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	ALKA-LINITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA-LINITY, FIXED ENDPT, FIELD (MG/L AS CAC03) (00410)	ALKA-LINITY LAB (MG/L AS CAC03) (90410)	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)	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)
OCT 22...	225	223	222	89	19	0.2	14	420	0.01
JAN 17...	224	223	228	65	22	0.3	15	365	0.02
MAY 15...	153	159	166	73	13	0.2	6.2	298	0.03
JUL 28...	194	191	194	66	13	0.2	17	360	0.04

DATE	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, DIS- SOLVED 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)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 22...	3.40	0.11	0.05	1.2	0.15	0.10	0.08	85	100
JAN 17...	1.60	1.10	1.10	1.7	0.16	0.13	0.12	3	--
MAY 15...	1.50	0.13	0.08	1.2	0.15	0.06	0.04	41	93
JUL 28...	1.80	0.11	0.08	1.2	0.17	0.13	0.12	58	99

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	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)	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)
OCT 22...	1230	<10	2	62	2	2	<1	<3	3	29	<1
JAN 17...	1030	<10	1	58	<0.5	<1	<1	<3	<1	18	2
JUL 28...	1210	<10	3	63	<0.5	<1	<1	<3	3	13	<5

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)
OCT 22...	21	14	1.0	<10	6	2	<1	220	<6	28
JAN 17...	18	67	<0.1	<10	4	<1	<1	190	<6	12
JUL 28...	<20	41	0.4	<10	3	1	<1	180	<6	5





## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	---	---	---	7.8	7.4	7.7	---	---	---	---	---	---
2	---	---	---	7.8	7.7	7.8	8.2	8.1	8.1	8.1	8.0	8.1
3	---	---	---	7.9	7.7	7.8	8.1	8.0	8.0	8.2	8.0	8.1
4	---	---	---	8.0	7.9	7.9	8.1	7.9	8.0	8.3	8.0	8.2
5	---	---	---	8.0	7.9	7.9	8.1	7.9	8.0	8.3	8.1	8.2
6	---	---	---	8.0	7.9	8.0	8.1	7.9	7.9	8.3	8.2	8.2
7	---	---	---	8.1	7.9	8.0	8.0	7.8	7.9	8.3	8.2	8.2
8	---	---	---	8.0	7.9	7.9	8.1	7.9	8.0	8.2	8.1	8.2
9	---	---	---	8.1	7.8	7.9	8.1	7.9	8.0	8.2	7.9	8.0
10	---	---	---	8.0	7.9	7.9	8.2	8.0	8.1	8.0	7.7	7.8
11	7.9	7.8	7.9	8.1	7.9	8.0	8.3	8.1	8.1	7.8	7.7	7.7
12	8.0	7.9	7.9	8.0	7.8	7.9	8.2	8.0	8.1	7.9	7.8	7.8
13	7.9	7.8	7.8	8.0	7.9	7.9	8.1	8.0	8.1	7.9	7.8	7.8
14	7.9	7.7	7.8	8.0	7.9	7.9	8.1	8.0	8.0	7.9	7.7	7.8
15	7.9	7.8	7.8	8.0	7.9	7.9	8.0	7.8	7.9	7.8	7.7	7.7
16	---	---	---	7.9	7.9	7.9	8.0	7.8	7.9	8.4	7.7	7.9
17	8.1	7.9	8.0	7.9	7.9	7.9	8.0	7.9	7.9	8.1	7.8	8.0
18	8.0	7.8	7.9	7.9	7.9	7.9	8.0	7.8	7.9	8.0	7.9	8.0
19	7.9	7.7	7.8	8.0	7.9	7.9	8.1	7.8	7.9	8.1	8.0	8.0
20	---	---	---	8.0	7.9	8.0	8.1	7.9	7.9	8.0	7.8	7.9
21	---	---	---	8.1	7.9	8.0	8.1	7.9	8.0	8.1	8.0	8.0
22	7.9	7.8	7.9	8.1	7.9	8.0	8.0	7.9	8.0	8.0	7.8	7.9
23	---	---	---	8.2	8.0	8.1	8.1	8.0	8.0	7.8	7.8	7.8
24	---	---	---	8.2	8.0	8.1	8.0	7.9	7.9	7.9	7.7	7.7
25	---	---	---	8.2	7.9	8.1	8.0	7.8	7.9	7.8	7.7	7.7
26	---	---	---	8.1	8.0	8.0	8.1	7.9	7.9	7.7	7.6	7.7
27	---	---	---	8.0	7.9	8.0	8.2	8.0	8.1	7.8	7.6	7.6
28	7.7	7.5	7.6	8.0	7.8	7.9	8.1	8.1	8.1	7.6	7.6	7.6
29	7.7	7.6	7.6	8.1	7.8	7.9	8.1	7.9	8.1	7.7	7.6	7.6
30	7.8	7.7	7.8	8.0	7.9	8.0	8.1	8.0	8.1	7.7	7.6	7.6
31	---	---	---	---	---	---	8.2	8.0	8.1	---	---	---

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

[illegible]



## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	---	---	---	5.8	5.8	6.5	---	---	---	---	---	---
2	---	---	---	8.1	6.8	7.5	7.7	6.9	7.3	---	---	---
3	---	---	---	8.3	7.6	7.9	8.7	6.2	7.5	8.4	6.7	7.8
4	---	---	---	8.1	7.4	7.7	8.0	7.2	7.6	7.9	7.2	7.5
5	---	---	---	7.6	7.0	7.3	7.2	7.2	7.7	7.6	6.7	7.2
6	---	---	---	7.2	6.6	6.9	6.9	6.9	7.2	7.2	6.6	6.8
7	---	---	---	---	---	---	6.3	6.3	6.6	7.0	6.5	6.7
8	---	---	---	8.1	6.7	7.4	7.0	6.2	6.6	8.5	6.4	7.6
9	---	---	---	8.1	6.3	7.1	---	---	---	8.3	7.5	7.9
10	---	---	---	7.7	7.0	7.3	---	---	---	7.9	7.2	7.5
11	8.5	8.1	8.3	8.1	7.2	7.6	---	---	---	7.6	7.2	7.4
12	9.1	8.3	8.7	7.9	6.7	7.1	7.4	7.4	6.5	8.0	7.3	7.6
13	8.7	8.1	8.4	7.7	6.9	7.3	8.3	7.9	8.1	7.9	7.7	7.8
14	8.5	7.7	8.1	7.6	7.1	7.2	8.1	7.8	8.0	8.2	7.6	7.9
15	8.5	7.9	8.2	7.8	7.0	7.3	7.9	7.5	7.6	8.4	8.0	8.2
16	---	---	---	7.2	6.7	7.0	8.2	7.4	7.7	8.5	8.5	8.6
17	9.0	7.8	8.7	6.9	6.3	6.6	8.1	7.3	7.6	8.8	7.5	8.5
18	---	---	---	7.3	5.8	6.5	7.7	7.2	7.5	8.8	8.0	8.5
19	9.2	6.5	8.4	7.5	6.3	6.6	7.9	7.1	7.5	8.7	8.1	8.5
20	---	---	---	7.2	5.8	6.2	8.4	7.5	7.8	8.1	7.4	7.8
21	---	---	---	7.6	5.9	6.7	8.5	7.5	8.0	7.9	7.5	7.8
22	---	---	---	7.4	6.8	7.1	8.3	7.6	8.1	8.0	7.5	7.7
23	---	---	---	7.4	6.7	7.1	---	---	---	7.8	7.8	7.8
24	---	---	---	7.0	5.7	6.2	---	---	---	7.8	7.3	7.6
25	---	---	---	7.2	5.2	6.2	---	---	---	7.6	7.2	7.4
26	---	---	---	7.5	6.7	7.1	6.8	5.5	6.2	7.4	7.0	7.2
27	---	---	---	7.5	6.7	7.1	---	---	---	7.3	6.6	7.1
28	6.2	5.8	5.9	---	---	---	---	---	---	7.3	6.4	7.2
29	6.3	5.5	5.7	6.8	6.8	7.5	8.0	7.7	7.9	7.5	6.1	7.3
30	6.5	5.7	6.2	7.8	7.0	7.4	8.0	7.3	7.7	7.5	6.2	7.5
31	---	---	---	---	---	---	7.6	7.1	7.4	---	---	---

## ST. CROIX RIVER BASIN

05336700 KETTLE RIVER BELOW SANDSTONE, MN

LOCATION.--Lat 46°06'20", long 92°51'50", in NW¼SW¼ sec.22, T.42 N., R.20 W., Pine County, Hydrologic Unit 07030003, on Sandstone Federal Correctional Institution property, on left bank about 900 ft downstream from abandoned powerplant dam, 1.8 mi south of Sandstone.

DRAINAGE AREA.--863 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 931.50 ft above National Geodetic Vertical Datum of 1929. (Minnesota Department of Transportation bench mark).

REMARKS.--Estimated daily discharges: Nov. 19 to Mar. 9, 18-23, Apr. 5-16, 18-21. Records good except those for periods of no gage-height record, Mar. 18, Apr. 5-16, 18-21, and periods with ice effect, Nov. 19 to Mar. 9, 19-23, which are fair.

AVERAGE DISCHARGE.--19 years, 765 ft<sup>3</sup>/s, 12.04 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,200 ft<sup>3</sup>/s, July 23, 1972, gage height, 15.38 ft; minimum, 25 ft<sup>3</sup>/s, Nov. 11, 12, 1977, gage height, 3.37 ft, result of freezeup.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in April 1965 reached a stage of 12.96 ft, from flood marks, discharge, 13,400 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,600 ft<sup>3</sup>/s and maximum (\*)

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Apr. 2	0730	*9,380	*11.09	June 12	1730	5,610	8.84
Apr. 29	1715	8,940	10.83	Sept. 23	0630	6,720	9.52
May 12	1500	8,000	10.28				

Minimum daily discharge, 180 ft<sup>3</sup>/s, Feb. 17-22; minimum gage height, 4.22 ft, Mar. 10-13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1740	565	326	245	184	182	7900	6590	460	548	791	1590		
2	2250	558	322	236	184	182	9230	5410	407	543	679	2840		
3	2190	542	319	226	184	183	8600	4360	326	518	591	2700		
4	1970	518	313	217	183	183	7540	3410	432	516	526	3360		
5	1720	485	308	207	183	183	6800	2730	575	535	502	3260		
6	1490	472	303	200	183	183	5900	2260	614	579	462	2570		
7	1290	490	297	190	183	183	5100	1860	759	569	557	2000		
8	1520	499	293	190	183	183	4400	1870	917	521	1090	1580		
9	2030	457	290	190	182	183	3500	3670	928	482	1050	1290		
10	1780	385	286	190	182	182	3000	4940	1020	446	1140	1220		
11	1500	351	281	190	182	181	2400	5860	3470	433	1190	1350		
12	1490	413	278	189	182	181	1950	7720	5450	547	1130	1350		
13	2070	382	273	189	182	182	1600	7540	4980	730	1060	1290		
14	2050	359	270	188	181	184	1420	6670	4050	798	1050	1220		
15	1780	329	266	188	181	184	1510	5640	3270	850	1040	1180		
16	1520	366	262	188	181	186	1720	4750	2640	1330	1050	1300		
17	1320	383	260	188	180	192	1940	3940	2100	1430	948	2650		
18	1170	375	260	187	180	200	2250	3210	1650	1170	836	5220		
19	1060	372	259	187	180	205	2200	2620	1300	1050	735	4960		
20	954	370	258	187	180	210	2030	2180	1070	1290	654	4780		
21	865	365	257	187	180	220	1900	1800	1280	1120	707	4940		
22	801	362	256	187	180	230	1760	1510	1590	952	869	5500		
23	760	359	255	186	181	240	1530	1290	1690	822	1380	6540		
24	736	355	254	186	181	250	1430	1130	1590	713	1470	5530		
25	686	352	253	186	181	266	1810	1010	1420	660	1260	4690		
26	653	347	252	186	182	288	2040	912	1250	603	1100	4440		
27	621	343	251	185	182	288	2590	823	1060	1540	936	3930		
28	580	340	250	185	182	355	5660	732	903	1760	813	3270		
29	550	337	250	185	---	513	8520	658	757	1520	705	2870		
30	545	332	250	185	---	1530	7920	593	656	1170	619	2530		
31	565	---	250	185	---	4560	---	519	---	953	557	---		
TOTAL	40256	12163	8502	6015	5089	124,2	116150	98207	48614	26698	27497	91950		
MEAN	1299	405	274	194	182	402	3872	3168	1620	861	887	3065		
MAX	2250	565	326	245	184	4560	9230	7720	5450	1760	1470	6540		
MIN	545	329	250	185	180	181	1420	519	326	433	462	1180		
CFSM	1.51	.47	.32	.23	.21	.47	4.49	3.67	1.88	1.00	1.03	3.55		
IN.	1.74	.52	.37	.26	.22	.54	5.01	4.23	2.10	1.15	1.19	3.96		
AC-FT	79850	24130	16860	11930	10090	24740	230400	194800	96430	52960	54540	182400		
CAL YR 1985	TOTAL	319085	MEAN	874	MAX	8290	MIN	144	CFSM	1.01	IN	13.75	AC-FT	632900
WTR YR 1986	TOTAL	493613	MEAN	1352	MAX	9230	MIN	180	CFSM	1.57	IN	21.28	AC-FT	979100

## ST. CROIX RIVER BASIN

05337400 KNIFE RIVER NEAR MORA, MN

LOCATION.--Lat 45°55'12", long 93°18'26", in SW¼SW¼S sec.26, T.40 N., R.24 W., Kanabec County, Hydrologic Unit 07030004, on left bank 400 ft upstream from bridge on County Highway 77, 1.1 mi upstream from mouth and 2.5 mi north of Mora.

DRAINAGE AREA.--102 mi<sup>2</sup>.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1969-74; July 1974 to current year.

GAGE.--Water-stage recorder. Datum of gage is 991.20 ft above National Geodetic Vertical Datum of 1929. (Kanabec County bench mark).

REMARKS.--Estimated daily discharges: Nov. 24, Nov. 27 to Dec. 10, and Dec. 12 to Mar. 29. Records good except those for periods with ice effect, Nov. 24, Nov. 27 to Dec. 10, and Dec. 12 to Mar. 29, which are fair.

AVERAGE DISCHARGE.--12 years, 70.6 ft<sup>3</sup>/s, 9.40 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,840 ft<sup>3</sup>/s, May 10, 1979, gage height, 6.31 ft; maximum gage height, 6.69 ft, Nov. 24, 1977, from floodmark (backwater from ice); minimum daily discharge, 1.1 ft<sup>3</sup>/s, Jan. 12 to Feb. 9, 1977.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of July 26, 1972, reached a stage of 14.0 ft, from information by local resident (discharge not determined). Result of dam failure and backwater from collapsed bridge.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
April 1	2030	*1,780	*6.22	May 12	2245	1,060	5.32
April 29	1030	988	5.21	Sept. 22	1430	759	4.82

Minimum discharge, 8.2 ft<sup>3</sup>/s, Oct. 28, 29, gage height, 1.72 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	137	36	37	21	15	14	1610	590	39	26	171	46
2	144	40	37	21	15	14	1530	427	28	26	125	45
3	144	41	36	20	15	14	1170	317	23	21	92	71
4	144	41	36	20	15	14	922	246	28	27	77	124
5	125	45	35	19	15	14	758	212	25	32	90	122
6	111	51	35	19	15	14	626	174	24	43	97	104
7	107	46	35	18	15	14	515	164	28	39	116	82
8	123	47	35	18	15	14	427	230	28	39	178	67
9	148	49	34	18	15	14	348	561	25	32	223	61
10	153	43	34	18	15	14	293	695	35	27	223	63
11	146	24	34	18	15	14	255	854	63	29	181	62
12	171	43	34	18	15	14	223	940	104	29	143	57
13	217	42	34	18	14	15	192	1030	148	33	117	63
14	219	39	33	17	14	16	194	904	165	33	125	63
15	201	37	33	17	14	17	219	683	142	42	146	86
16	170	41	32	17	14	17	219	509	125	43	141	91
17	152	40	32	17	14	17	210	377	97	41	119	378
18	137	44	31	17	14	18	199	290	80	43	96	707
19	127	57	31	17	14	19	211	228	70	50	78	640
20	111	59	30	17	14	21	245	177	61	41	70	630
21	106	60	29	16	14	22	234	143	75	33	65	612
22	95	60	28	16	14	24	198	120	73	29	90	712
23	87	57	27	16	14	25	170	99	65	25	159	668
24	83	55	27	16	14	27	181	88	53	28	164	516
25	78	51	26	16	14	29	197	81	41	30	150	410
26	78	47	25	16	14	30	189	76	37	24	127	356
27	65	44	25	16	14	35	256	67	46	123	98	286
28	8.6	41	24	16	14	55	630	59	39	409	78	238
29	11	39	23	16	---	114	951	52	34	430	63	191
30	19	38	23	16	---	392	785	46	29	349	57	162
31	26	---	22	15	---	997	---	40	---	248	48	---
TOTAL	3643.6	1357	957	540	404	2058	14157	10479	1830	2424	3707	7713
MEAN	118	45.2	30.9	17.4	14.4	66.4	472	338	61.0	78.2	120	257
MAX	219	60	37	21	15	997	1610	1030	165	430	223	712
MIN	8.6	24	22	15	14	14	170	40	23	21	48	45
CFSM	1.16	.44	.30	.17	.14	.65	4.63	3.31	.60	.77	1.18	2.52
IN.	1.33	.49	.35	.20	.15	.75	5.16	3.82	.67	.88	1.35	2.81
AC-FT	7230	2690	1900	1070	801	4080	28080	20790	3630	4810	7350	15300

CAL YR 1985	TOTAL	30779.6	MEAN	84.3	MAX	1350	MIN	8.6	CFSM	.83	IN	11.23	AC-FT	61050
WTR YR 1986	TOTAL	49269.6	MEAN	135	MAX	1610	MIN	8.6	CFSM	1.32	IN	17.97	AC-FT	97730

## ST. CROIX RIVER BASIN

05340500 ST. CROIX RIVER AT ST. CROIX FALLS, WI  
(National stream-quality accounting network station)

LOCATION.--Lat 45°24'25", long 92°38'49", in SW 1/4 sec.30, T.34 N., R.18 W., Polk County, Hydrologic Unit 07030005, St. Croix National Scenic Riverway, on left bank, 1,500 ft downstream from powerplant of Northern States Power Co., in St. Croix Falls, and at mile 52.2.

DRAINAGE AREA.--6,240 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1902 to current year. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Croix Falls."

REVISED RECORDS.--WSP 1115: 1929. WDR WI-82-1: Drainage area.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 689.94 ft above National Geodetic Vertical Datum of 1929. Prior to July 1905, gage heights and discharge measurements were used by Loweth and Wolff, consulting engineers of St. Paul, Minn., to determine the flow. July 1905 to February 1940, records were computed from power generation at the St. Croix Falls Powerplant. February 1940 to Sept. 30, 1979, water-stage recorder at site 300 ft downstream at same datum.

REMARKS.--No estimated daily discharges. Records are good. Diurnal fluctuation caused by St. Croix Falls Powerplant 1,500 ft upstream. Satellite telemeter at station.

AVERAGE DISCHARGE.--84 years, 4,346 ft<sup>3</sup>/s, 9.46 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 54,900 ft<sup>3</sup>/s, May 8, 1950, gage height, 25.19 ft; minimum daily, 75 ft<sup>3</sup>/s, July 17, 1910.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 37,000 ft<sup>3</sup>/s, May 14, gage height, 17.17 ft; minimum daily, 1,460 ft<sup>3</sup>/s, Feb. 13.

RATING TABLE (gage height, in feet, and discharge, in cubic feet per second).

2.5	1,400	9.0	18,200
3.0	2,350	12.0	25,400
4.0	4,950	14.0	29,900
6.0	10,700	16.0	34,400
		18.0	38,900

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9880	6020	3450	3380	2590	2720	23900	32800	5400	4480	7730	5350
2	10600	5650	3720	3420	3170	2860	29300	30000	5450	4140	7330	5470
3	11400	5770	3270	3270	2900	3150	34100	26200	4810	3820	6750	7190
4	12600	5630	3930	3360	2560	3320	36000	22200	4730	4000	5930	8840
5	11300	5680	4210	3430	2620	3060	36000	18900	4870	4250	5640	9010
6	10400	5550	3980	3460	2200	3160	34700	16000	5140	4530	5520	8970
7	9240	5530	4220	3420	2810	3290	32400	14100	5650	5160	6000	7530
8	9850	5560	4390	3600	2510	3350	29600	12300	5460	4540	7060	7120
9	10100	5450	4330	3370	2510	3140	27000	14700	6450	4630	9020	6660
10	10800	5290	4360	3490	1870	3250	24000	17800	5770	3940	10300	6500
11	10900	4860	4460	3330	2390	3190	21000	22500	6310	4090	10700	6270
12	11000	4910	4680	3210	1960	3430	18700	27400	8170	4560	10200	6470
13	11300	4620	4170	3140	1460	3480	16700	32200	11200	5620	9090	6460
14	12100	4880	4190	3280	1870	3500	14800	36700	11700	6320	7400	6450
15	12500	4560	4100	3500	2240	3320	13600	36300	10300	6180	7310	6390
16	11800	4890	3700	3300	2220	3610	13200	35200	8840	6500	9110	6990
17	10700	4640	3900	3360	3080	3760	12800	32400	8140	7730	9710	7710
18	10100	4450	3930	3280	2690	4630	12300	28400	7340	8610	8620	10200
19	9650	4810	3800	3300	2520	4070	12100	24500	7060	9380	7340	14400
20	9100	4830	3740	3210	2780	4430	12100	20700	5700	9550	6790	16300
21	8210	4300	3600	3340	2790	4890	12500	17900	5560	8670	6710	17800
22	7790	3630	3350	3180	2260	4160	12100	15100	6480	8290	7200	21000
23	7460	4010	3570	3140	2470	4700	9630	12700	7150	7320	9480	22900
24	7250	2380	3610	3480	2350	4780	10100	11200	7740	6750	10800	24900
25	7190	3450	3620	3230	2780	5060	10200	9920	7260	6190	11500	24900
26	6770	3220	3580	3380	2900	5790	10600	9250	7210	6290	10600	23400
27	6690	3600	3500	2480	3010	6520	12600	9130	6170	6110	8830	21800
28	6470	3020	3550	2940	3000	7260	19200	8450	5680	9590	7570	20600
29	6150	3600	3470	2850	---	10500	28100	7010	5280	12100	6830	18800
30	6020	3460	3460	2500	---	14800	32000	5900	4580	12400	6560	16400
31	5520	---	3430	2670	---	17000	---	5670	---	10100	5540	---
TOTAL	290840	138250	119270	100300	70510	154180	611330	613530	201600	205840	249170	372780
MEAN	9382	4608	3847	3235	2518	4974	20380	19790	6720	6640	8038	12430
MAX	12600	6020	4680	3600	3170	17000	36000	36700	11700	12400	11500	24900
MIN	5520	2380	3270	2480	1460	2720	9630	5670	4580	3820	5520	5350
CFSM	1.50	.74	.62	.52	.40	.80	3.27	3.17	1.08	1.06	1.29	1.99
IN.	1.73	.82	.71	.60	.42	.92	3.64	3.66	1.20	1.23	1.49	2.22

CAL YR 1985 TOTAL 2327470 MEAN 6377 MAX 27200 MIN 1960 CFSM 1.02 IN 13.88  
WTR YR 1986 TOTAL 3127600 MEAN 8569 MAX 36700 MIN 1460 CFSM 1.37 IN 18.65

## ST. CROIX RIVER BASIN

05340500 ST. CROIX RIVER AT ST. CROIX FALLS, WI--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967-68, 1974 to September 1986 (discontinued).

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

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUC- TANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT								
07...	1220	7870	129	7.3	8.5	2.7	10.8	748
JAN								
07...	1030	5150	193	7.3	.5	2.9	9.7	771
FEB								
24...	1200	1800	211	7.5	.0	2.7	9.4	757
APR								
04...	1110	36000	85	7.2	3.5	--	12.4	755

DATE	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCHI 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)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)
OCT							
07...	40	320	16	5.2	2.4	1.0	65
JAN							
07...	K6	K9	25	7.8	3.3	1.0	99
FEB							
24...	K5	K4	25	8.2	3.6	1.0	110
APR							
04...	K67	110	--	--	--	--	37

DATE	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)	ALKA- LITY, IT-FLD (MG/L AS CAC03) (99430)	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)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)
OCT							
07...	0	52	9.2	3.2	<.10	10	99
JAN							
07...	0	80	9.9	3.5	<.10	17	121
FEB							
24...	0	88	8.5	3.3	<.10	17	117
APR							
04...	0	30	--	--	--	--	--

DATE	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 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						
07...	.11	.02	.30	.05	.03	<.01
JAN						
07...	.37	.09	.40	.02	.01	<.01
FEB						
24...	.45	.07	.40	.03	.01	<.01
APR						
04...	.24	.12	.90	.09	.02	<.01

## ST. CROIX RIVER BASIN

05340500 ST. CROIX RIVER AT ST. CROIX FALLS, WI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	ALUM- INUM, DIS- SOLVED (UG/L) AS AL) (01106)	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)	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)
OCT										
07...	1220	7870	30	<1	20	<.5	<1	6	<3	1
JAN										
07...	1030	5150	10	<1	25	<.5	<1	<1	<3	2
FEB										
24...	1200	1800	<10	<1	23	<.5	<1	<1	<3	<1

DATE	IRON, DIS- SOLVED (UG/L) AS FE) (01046)	LEAD, DIS- SOLVED (UG/L) AS PB) (01049)	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)	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)
OCT											
07...	430	6	<4	20	<.1	<10	11	<1	33	<6	<3
JAN											
07...	460	<1	<4	29	<.1	<10	1	<1	48	<6	9
FEB											
24...	350	<1	4	27	<.1	<10	1	<1	49	<6	<3

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUC- TANCE (US/CM) (00095)	TEMPER- ATURE (DEG C) (00010)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT							
01...	1040	9710	138	9.0	--	--	--
07...	1220	7870	129	8.5	7	149	73
NOV							
26...	1110	4860	192	.0	--	--	--
JAN							
07...	1030	5150	193	.5	4	56	66
FEB							
24...	1200	1800	211	.0	3	15	70
APR							
04...	1110	36000	85	3.5	26	2530	90
JUN							
13...	1050	11000	120	17.5	--	--	--
JUL							
23...	1105	6980	116	25.0	--	--	--

## MISSISSIPPI RIVER MAIN STEM

05344500 MISSISSIPPI RIVER AT PRESCOTT, WI

LOCATION.--Lat 44°44'45", long 92°48'00", in sec.9, T.26 N., R.20 W., Pierce County, Hydrologic Unit 07040001, on left bank at Prescott, 200 ft downstream from St. Croix River, 300 ft south of Chicago, Burlington & Quincy Railroad bridge, 800 ft south of bridge on U.S. Highway 10, and at mile 811.4 upstream from Ohio River.

DRAINAGE AREA.--44,800 mi<sup>2</sup>, approximately.

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

REVISED RECORDS.--WSP 1508: 1941. WRD MN-74: 1973.

GAGE.--Water-stage recorder. Datum of gage is 649.50 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 2, 1932, nonrecording gage at railroad bridge 300 ft upstream at following datums: June 3, 1928, to Sept. 30, 1929, 19.27 ft higher; Oct. 1, 1929, to Sept. 30, 1930, 17.68 ft higher; Oct. 1, 1930, to Aug. 1, 1932, 19.28 ft higher. Aug. 2, 1932, to Oct. 30, 1938, water-stage recorder at present site at datum 19.28 ft higher; Nov. 1, 1938, to Sept. 7, 1971, water-stage recorder at present site at datum 50.00 ft lower. Auxiliary water-stage recorder 10.7 mi downstream from base gage.

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

AVERAGE DISCHARGE.--58 years, 17,370 ft<sup>3</sup>/s, 5.27 in/yr; median of yearly mean discharges, 16,500 ft<sup>3</sup>/s, 5.00 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 228,000 ft<sup>3</sup>/s, Apr. 18, 1965, gage height, 43.11 ft; minimum daily, 1,380 ft<sup>3</sup>/s, July 13, 1940; minimum gage height, 15.08 ft, Aug. 29, 1934, present datum.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 116,000 ft<sup>3</sup>/s, Apr. 6, 7; maximum recorded gage height, 36.37 ft, Apr. 8, but was known to be higher during period of recorder malfunction, Apr. 1-7; minimum daily, 10,600 ft<sup>3</sup>/s, Feb. 11; minimum gage height, 24.90 ft, Mar. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	32000	27300	14000	15700	14200	12200	82800	104000	47800	48600	34800	26800		
2	32400	27100	14900	16100	13700	12200	93200	107000	44600	46800	33400	26100		
3	33300	26400	14800	16300	15000	12500	103000	107000	43000	43700	32200	25400		
4	35700	26000	14200	15900	14200	13100	111000	107000	41600	41100	31300	27300		
5	38200	25700	17600	15600	13600	13100	114000	107000	39500	38800	30700	30000		
6	39300	25500	19000	15200	14000	12800	116000	106000	37900	37100	30300	31000		
7	40600	24500	18000	15000	13300	12800	116000	103000	36600	34400	29400	31200		
8	42200	24100	18200	14800	13600	11400	109000	98900	35800	32400	29900	30500		
9	43100	23800	18600	15200	13200	12300	109000	93600	35400	30500	30500	29600		
10	43000	23300	18700	15800	12100	14500	106000	93300	35200	28900	31400	30000		
11	43600	23000	18700	16000	10600	14300	102000	95200	34300	28700	32100	29900		
12	44400	22600	18800	15300	12200	15000	98700	99700	33100	29100	31900	29300		
13	44700	21900	18300	15000	12000	16500	95100	103000	34200	29500	31800	30400		
14	44400	21100	17300	14800	11700	17600	93300	108000	36100	30000	32000	31100		
15	44800	21400	17200	14700	12100	18100	90200	113000	37400	30600	31200	31300		
16	45200	21700	17200	14900	13300	17900	86100	113000	37500	31800	30100	31300		
17	44800	21900	17600	14700	12000	18800	82600	112000	35900	32900	30100	31700		
18	44200	21600	17100	14800	13200	20100	80400	103000	34800	34300	30900	33000		
19	42700	21000	16300	14500	13100	22300	79000	98100	34300	35800	30200	36100		
20	40800	21000	16500	14500	12900	23500	77400	92600	34500	36600	28700	41200		
21	39300	21200	17100	14700	12500	24300	75800	86600	34400	36900	28200	50400		
22	37800	19500	17100	14700	11100	25700	75000	80800	38300	36700	27500	60200		
23	36600	17000	16600	13700	12200	29800	73900	75800	40800	36200	27900	68400		
24	35000	15700	17800	14200	12100	33500	72400	71300	41500	35800	29900	76000		
25	33700	14300	16700	14600	11500	38000	70700	67900	44000	35000	31400	81800		
26	33100	15100	15500	14300	12200	44800	70300	65000	46600	33400	32600	84500		
27	31900	15200	16500	13200	12800	51800	70300	61900	48600	33100	31900	85700		
28	30400	16500	16900	11300	12500	58200	73900	59400	49600	32600	30600	85900		
29	29700	14900	15800	13200	---	63100	79400	56500	50100	32100	29300	86500		
30	28900	15700	15700	13800	---	67600	88400	53600	49400	33300	28100	86000		
31	28000	---	16100	13900	---	73100	---	50000	---	35000	27400	---		
TOTAL	1183800	636000	524800	456400	356900	820900	2694900	2793200	1192900	1081700	947700	1378600		
MEAN	38190	21200	16930	14720	12750	26480	89830	90100	39760	34890	30570	45950		
MAX	45200	27300	19000	16300	15000	73100	116000	113000	50100	48600	34800	86500		
MIN	28000	14300	14000	11300	10600	11400	70300	50000	33100	28700	27400	25400		
CFSM	.85	.47	.38	.33	.29	.59	2.01	2.01	.89	.78	.68	1.03		
IN.	.98	.53	.44	.38	.30	.68	2.24	2.32	.99	.90	.79	1.14		
AC-FT	2348000	1262000	1041000	905300	707900	1628000	5345000	5540000	2366000	2146000	1880000	2734000		
CAL YR 1985	TOTAL	10018470	MEAN	27450	MAX	73000	MIN	8390	CFSM	.61	IN	8.32	AC-FT	19870000
WTR YR 1986	TOTAL	14067800	MEAN	38540	MAX	116000	MIN	10600	CFSM	.86	IN	11.68	AC-FT	27900000

## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN

LOCATION.--Lat 44°40'00", long 93°03'17", in SW¼NW¼ sec.24, T.114 N., R.19 W., Dakota County, Hydrologic Unit 07040001, on right bank and just downstream from County Road 79, 2 mi west of Empire and 4 mi northeast of Farmington.

DRAINAGE AREA.--110 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1942 to June 1945 (no record during July, August, and September 1944), September 1969 to September 1973 (discharge measurements only), October 1973 to current year. Prior to October 1975 published as "near Empire City".

GAGE.--Water-stage recorder. Datum of gage is 851.99 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). April 12, 1942, to June 30, 1944, and October 1, 1944, to July 7, 1945, nonrecording gage at same site and present datum.

REMARKS.--Estimated daily discharges: Nov. 28, 29, Dec. 2, 3, 13-22, 24-30, Jan. 6-9, 23, 24, 26-30, Feb. 8-15, 21, 22, and Mar. 7, 8. Records good. Some regulation at low flow by sewage plant upstream.

AVERAGE DISCHARGE.--14 years (water years 1943, 1974-86), 56.8 ft<sup>3</sup>/s, 7.01 in/yr, 41,150 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,030 ft<sup>3</sup>/s, Sept. 18, 1942; maximum gage height, 8.30 ft, Sept. 22, 1986; minimum daily discharge, 8.4 ft<sup>3</sup>/s, Jan. 15, 1975; minimum gage height, 1.63 ft, Oct. 14, 1976.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in April 1965, reached a stage of 7.5 ft, from information by local resident, discharge 6,200 ft<sup>3</sup>/s, from rating extended above 2,100 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 5	1615	220	5.47	May 14	1630	496	6.29
Mar. 26	1730	614	6.53	June 23	1400	552	6.43
Apr. 6	0315	241	5.31	July 17	0815	317	5.66
Apr. 16	0530	236	5.28	Sept. 11	2200	209	5.14
Apr. 29	0100	706	6.77	Sept. 22	0800	*1,660	*8.30

Minimum discharge, 26 ft<sup>3</sup>/s, Feb. 28, gage height, 2.28 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	67	62	45	35	34	31	237	403	99	115	78	56
2	61	61	45	36	34	32	197	330	94	106	69	56
3	55	59	45	35	34	33	180	267	92	96	65	56
4	106	57	44	36	34	33	184	224	93	90	63	61
5	203	57	42	36	34	33	217	189	94	85	60	57
6	185	58	41	36	35	33	240	168	92	94	60	54
7	128	57	40	35	34	32	220	148	91	92	59	53
8	116	55	41	35	34	32	180	139	86	85	57	53
9	105	53	41	35	34	32	151	153	82	85	55	57
10	93	52	41	35	34	36	132	168	82	81	56	93
11	85	53	41	35	33	35	123	271	85	84	55	178
12	97	53	41	36	33	36	115	434	84	91	53	185
13	106	53	40	37	33	38	108	416	80	111	52	123
14	98	52	38	36	33	37	126	468	77	101	76	102
15	90	51	36	35	33	39	204	465	75	109	76	116
16	90	52	34	35	33	44	225	358	70	224	67	113
17	87	53	34	35	33	49	181	286	68	292	71	102
18	83	53	33	35	33	96	153	242	92	147	69	99
19	77	53	33	36	32	149	152	202	99	107	64	146
20	74	50	32	36	32	170	149	173	84	95	67	203
21	73	47	32	37	32	167	136	157	105	88	90	299
22	73	47	32	36	32	208	121	144	299	82	87	1230
23	73	47	38	36	32	319	111	137	495	77	74	647
24	70	44	38	36	32	431	105	130	342	79	66	442
25	67	47	38	36	32	499	112	127	162	92	66	379
26	65	46	37	36	32	556	118	137	128	78	66	339
27	62	44	37	35	32	495	153	134	127	84	63	303
28	60	44	36	35	31	406	417	123	122	91	60	262
29	59	44	36	34	---	354	625	115	107	84	58	236
30	59	44	35	34	---	314	473	109	112	87	59	208
31	58	---	35	34	---	275	---	104	---	94	58	---
TOTAL	2725	1548	1181	1099	924	5044	5845	6921	3718	3226	2019	6308
MEAN	87.9	51.6	38.1	35.5	33.0	163	195	223	124	104	65.1	210
MAX	203	62	45	37	35	556	625	468	495	292	90	1230
MIN	55	44	32	34	31	31	105	104	68	77	52	53
CFSM	.80	.47	.35	.32	.30	1.48	1.77	2.03	1.13	.95	.59	1.91
IN.	.92	.52	.40	.37	.31	1.71	1.98	2.34	1.26	1.09	.68	2.13
AC-FT	5410	3070	2340	2180	1830	10000	11590	13730	7370	6400	4000	12510
CAL YR 1985 TOTAL	24148			66.2	485	25	CFSM .60	IN 8.17	AC-FT 47900			
WTR YR 1986 TOTAL	40558			MEAN 111	MAX 1230	MIN 31	CFSM 1.01	IN 13.72	AC-FT 80450			

## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1973 to current year.

## PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: February 1974 to current year.

pH: February 1974 to current year.

WATER TEMPERATURES: February 1974 to current year.

DISSOLVED OXYGEN: February 1974 to current year.

INSTRUMENTATION.--Water quality monitor since February 1974.

REMARKS.--Water is pumped to a monitor that is inside a heated shelter; water temperature during the winter may be affected. Extremes are for those years with 80 percent or more record.

COOPERATION.--Water-quality monitor is operated by the Metropolitan Waste Control Commission, St. Paul, MN.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1979-82, 1984-86): Maximum, 997 microsiemens Jan. 7, 1982; minimum, 236 microsiemens June 8, 1980.

pH (water years 1979-82, 1986): Maximum, 9.3 units Nov. 11, 1978; minimum, 6.7 units Mar. 20, 1980.

WATER TEMPERATURES (water years 1979-82, 1984-86): Maximum, 30.0°C July 13, 1984; minimum 0.0°C many days during winter.

DISSOLVED OXYGEN (water years 1979-82, 1984-85): Maximum, 16.0 mg/L Apr. 18, 1985; minimum, 1.5 mg/L Nov. 14, 1979.

## EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 864 microsiemens Mar. 2; minimum, 308 microsiemens Sep. 23.

pH: Maximum, 8.9 units Jan. 17; minimum, 7.2 units Oct. 21, Apr. 28, May 14-15, Sep. 23.

WATER TEMPERATURES: Maximum, 26.0°C July 17; minimum, 0.0°C several days during winter period.

## SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	736	635	662	736	640	662	680	587	634	675	572	605
2	705	639	668	703	618	647	734	627	680	672	548	619
3	772	681	734	681	616	639	708	654	681	691	588	636
4	770	548	641	683	617	645	713	683	698	694	566	619
5	616	534	585	689	630	660	734	659	699	649	557	604
6	661	616	632	729	651	677	717	665	699	644	582	606
7	675	649	661	739	639	668	734	687	704	644	518	603
8	---	---	---	715	620	653	747	686	720	634	580	606
9	---	---	---	685	605	633	759	698	736	649	572	604
10	---	---	---	713	616	643	750	708	745	665	578	617
11	---	---	---	698	634	657	757	686	725	673	583	619
12	---	---	---	755	643	678	743	691	717	679	579	624
13	---	---	---	751	615	680	760	704	724	642	586	613
14	---	---	---	758	640	672	763	696	728	635	565	600
15	---	---	---	695	616	652	760	689	720	657	565	607
16	675	654	662	701	618	645	740	683	711	708	591	632
17	713	649	671	708	639	663	738	685	712	766	597	650
18	697	661	682	706	641	678	785	691	714	711	605	653
19	733	681	699	681	603	647	780	683	709	697	610	651
20	771	707	730	654	591	615	726	669	705	691	608	652
21	800	670	751	654	597	626	732	673	705	696	593	641
22	814	766	798	690	596	629	743	681	720	630	580	608
23	853	714	744	653	597	623	741	660	712	656	572	614
24	---	---	---	705	597	631	745	692	715	643	576	619
25	764	676	712	690	600	637	730	658	702	644	571	612
26	773	703	733	672	620	639	684	600	642	739	600	670
27	786	694	730	738	605	630	670	538	604	721	558	640
28	778	687	726	667	604	634	734	523	564	748	727	737
29	755	704	735	643	587	621	609	535	572	774	692	731
30	749	696	726	701	592	617	621	553	584	793	724	754
31	743	652	673	---	---	---	616	557	583	802	712	756
MONTH	---	---	---	758	587	647	785	523	686	802	518	639

## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	784	623	751	841	740	782	512	500	506	455	429	439
2	802	714	752	864	751	795	510	486	496	488	430	451
3	804	735	775	843	778	814	---	---	---	512	455	482
4	---	---	---	845	720	783	---	---	---	541	415	512
5	---	---	---	767	698	739	---	---	---	557	527	539
6	838	768	806	739	688	718	---	---	---	584	532	561
7	847	769	801	800	654	711	---	---	---	593	535	558
8	815	748	782	712	665	688	584	520	558	---	---	---
9	820	744	784	776	664	717	590	553	568	---	---	---
10	813	747	783	744	685	714	605	555	585	---	---	---
11	830	762	788	810	676	733	623	506	581	---	---	---
12	833	766	796	781	712	753	592	558	572	---	---	---
13	817	763	790	774	703	743	605	567	580	496	455	472
14	819	752	786	796	720	764	582	496	543	477	416	445
15	813	764	781	795	714	755	543	487	520	496	466	475
16	825	760	792	731	660	696	599	535	559	505	480	495
17	840	763	801	706	640	678	613	582	591	515	456	499
18	860	783	818	640	532	586	601	584	593	535	506	521
19	846	781	817	532	488	503	614	582	598	574	552	563
20	---	---	---	535	485	505	615	589	602	602	570	586
21	---	---	---	---	---	---	600	575	586	618	577	595
22	---	---	---	---	---	---	620	577	596	624	510	611
23	---	---	---	---	---	---	669	600	624	625	603	614
24	---	---	---	---	---	---	691	638	657	637	602	619
25	---	---	---	520	463	492	668	628	650	632	602	613
26	818	760	782	485	451	468	---	---	---	645	604	622
27	810	753	778	506	448	473	509	485	497	665	638	649
28	800	736	762	547	485	513	485	365	425	671	632	651
29	---	---	---	571	519	544	364	357	360	661	635	648
30	---	---	---	574	402	546	455	413	433	673	650	660
31	---	---	---	571	382	536	---	---	---	706	653	675
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	705	654	676	624	600	612	---	---	---	---	---	---
2	673	622	650	655	615	632	715	653	692	728	676	700
3	694	624	661	684	634	656	709	665	687	735	669	696
4	689	646	666	728	669	691	714	655	691	691	603	654
5	682	628	659	740	723	730	721	682	698	663	600	628
6	680	634	655	590	568	580	720	680	702	705	622	653
7	679	630	653	612	569	590	730	694	710	694	635	659
8	691	642	667	632	589	613	737	702	714	700	610	658
9	723	659	682	728	605	641	755	685	718	691	620	660
10	692	655	677	716	677	698	741	666	709	---	---	---
11	686	598	641	---	---	---	718	671	694	537	488	501
12	647	593	619	---	---	---	734	673	699	557	511	530
13	647	599	625	---	---	---	725	689	708	602	541	559
14	666	600	627	---	---	---	---	---	---	607	566	583
15	669	607	645	---	---	---	667	640	653	587	543	565
16	703	650	678	518	479	500	---	---	---	620	574	598
17	681	613	655	---	---	---	714	698	705	631	603	618
18	660	538	617	673	622	646	688	659	673	---	---	---
19	704	608	665	---	---	---	736	670	697	---	---	---
20	710	663	690	686	636	655	728	615	682	605	581	591
21	---	---	---	652	611	643	660	585	624	---	---	---
22	---	---	---	713	649	679	621	569	594	---	---	---
23	---	---	---	709	658	682	702	609	641	371	308	341
24	---	---	---	---	---	---	725	656	679	419	367	396
25	---	---	---	---	---	---	734	667	701	477	419	448
26	---	---	---	695	634	664	707	652	677	500	470	483
27	---	---	---	680	616	646	669	625	653	518	500	505
28	---	---	---	655	617	641	670	635	651	518	506	512
29	---	---	---	699	646	670	705	629	664	531	516	522
30	---	---	---	696	616	667	719	651	685	566	516	543
31	---	---	---	---	---	---	726	660	689	---	---	---

## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	8.3	8.2	8.2	8.5	8.2	8.3	8.7	8.0	8.1	8.1	7.8	7.9
2	8.4	8.2	8.3	8.4	8.3	8.3	8.2	7.9	8.0	8.5	7.8	7.9
3	8.3	8.2	8.3	8.4	8.2	8.3	8.0	7.9	7.9	8.1	7.7	7.9
4	8.2	7.7	8.0	8.4	8.2	8.3	8.2	7.9	7.9	8.1	7.8	7.9
5	7.9	7.7	7.8	8.3	8.2	8.3	8.2	7.9	8.0	8.0	7.8	7.9
6	8.0	7.8	7.8	8.4	8.2	8.2	8.1	8.0	8.0	7.9	7.8	7.9
7	7.9	7.8	7.8	8.4	8.2	8.3	8.1	8.0	8.0	7.9	7.7	7.8
8	---	---	---	8.6	8.2	8.3	8.2	7.9	8.0	7.9	7.7	7.8
9	---	---	---	8.6	8.3	8.4	8.8	8.0	8.1	8.0	7.7	7.8
10	---	---	---	8.4	8.3	8.4	8.2	8.0	8.1	8.0	7.7	7.8
11	---	---	---	8.4	8.3	8.4	8.2	8.0	8.1	8.1	7.8	7.9
12	---	---	---	8.4	8.0	8.2	8.1	8.0	8.1	8.2	7.8	8.0
13	---	---	---	8.4	7.9	8.0	8.4	7.9	8.0	8.2	7.9	7.9
14	---	---	---	8.5	7.9	8.1	8.2	7.9	7.9	8.0	7.8	7.9
15	---	---	---	8.1	8.0	8.1	8.1	7.8	7.9	8.0	7.8	7.9
16	8.1	8.0	8.0	8.2	8.0	8.1	8.2	7.9	8.0	8.3	7.8	7.9
17	8.3	8.0	8.0	8.4	8.0	8.1	8.0	7.9	8.0	8.9	7.8	8.0
18	8.1	7.9	8.0	8.1	8.0	8.0	8.2	7.9	7.9	8.7	7.8	8.0
19	8.0	7.9	8.0	8.3	8.0	8.1	8.4	7.8	7.9	8.3	7.8	7.9
20	8.4	7.9	8.0	8.2	8.0	8.2	8.0	7.8	7.9	8.8	7.8	7.9
21	8.6	7.2	8.0	8.4	8.1	8.1	8.0	7.8	7.9	8.6	7.8	7.9
22	7.8	7.8	7.8	8.2	8.1	8.1	8.1	7.8	7.9	8.5	7.8	7.9
23	8.1	7.8	8.0	8.3	8.1	8.1	8.4	7.9	8.0	8.5	7.8	7.9
24	---	---	---	8.4	8.0	8.1	8.3	7.9	8.0	8.0	7.8	7.9
25	8.2	8.1	8.2	8.4	8.0	8.1	8.3	7.9	8.0	8.1	7.8	7.9
26	8.2	8.1	8.2	8.4	7.9	8.0	8.3	7.9	8.0	8.2	7.7	7.8
27	8.4	8.1	8.2	---	---	---	8.3	7.7	8.0	8.1	7.6	7.6
28	8.4	8.2	8.2	8.2	8.0	8.1	8.3	7.7	7.8	7.9	7.6	7.7
29	8.3	8.2	8.2	8.2	8.0	8.1	7.9	7.7	7.8	8.1	7.8	7.9
30	8.3	8.1	8.2	8.1	8.0	8.1	7.9	7.7	7.8	8.3	7.9	8.0
31	8.4	8.2	8.3	---	---	---	8.0	7.7	7.9	8.3	7.9	8.0
MONTH	---	---	---	8.6	7.9	8.2	8.8	7.7	8.0	8.9	7.6	7.9
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	8.1	7.6	7.9	8.3	8.0	8.1	8.0	7.8	7.9	8.0	7.6	7.8
2	8.8	7.8	8.0	8.4	7.9	8.1	8.0	7.9	8.0	8.1	7.8	8.0
3	8.2	7.9	8.0	8.4	7.9	8.1	---	---	---	8.1	7.8	7.9
4	---	---	---	8.3	7.8	8.0	---	---	---	8.0	7.4	7.9
5	---	---	---	8.2	7.8	8.0	---	---	---	8.0	7.7	7.9
6	8.2	8.0	8.1	8.2	7.9	8.0	---	---	---	8.1	7.8	7.9
7	8.2	8.0	8.1	8.1	7.8	7.9	---	---	---	8.1	7.9	8.0
8	8.3	8.0	8.1	8.0	7.9	8.0	8.0	7.9	8.0	---	---	---
9	8.2	8.0	8.1	8.1	7.9	8.0	8.1	7.9	8.0	---	---	---
10	8.1	7.9	8.0	8.1	7.8	7.9	8.1	7.9	8.0	---	---	---
11	8.1	7.9	8.0	8.1	7.8	7.9	8.1	7.9	8.0	---	---	---
12	8.1	8.0	8.0	8.1	7.8	8.0	---	---	---	---	---	---
13	8.1	7.9	8.0	8.1	7.9	8.0	---	---	---	---	---	---
14	8.1	7.9	8.0	8.0	7.8	7.9	---	---	---	7.6	7.2	7.4
15	8.2	8.0	8.1	8.1	7.8	7.9	8.0	8.0	8.0	7.6	7.2	7.4
16	8.3	8.0	8.1	8.0	7.8	7.9	8.1	8.0	8.1	7.7	7.3	7.5
17	8.3	8.0	8.1	7.9	7.8	7.8	8.2	7.9	8.1	7.8	7.4	7.6
18	8.3	8.0	8.1	7.9	7.6	7.7	8.0	7.9	8.0	7.8	7.6	7.7
19	8.4	8.0	8.2	7.6	7.5	7.5	8.1	7.8	7.9	7.9	7.7	7.8
20	---	---	---	7.6	7.5	7.5	8.0	7.8	7.9	8.0	7.8	7.9
21	---	---	---	---	---	---	7.9	7.7	7.8	7.9	7.8	7.9
22	---	---	---	---	---	---	7.9	7.7	7.8	7.9	7.7	7.9
23	---	---	---	---	---	---	7.9	7.8	7.8	7.9	7.8	7.9
24	---	---	---	---	---	---	7.9	7.7	7.8	8.0	7.9	7.9
25	---	---	---	7.7	7.3	7.5	7.9	7.7	7.8	7.9	7.9	7.9
26	8.3	7.9	8.1	7.8	7.6	7.7	---	---	---	7.9	7.8	7.9
27	8.3	8.0	8.1	7.8	7.7	7.8	7.6	7.4	7.5	8.0	7.8	7.9
28	8.3	8.0	8.1	7.8	7.7	7.7	7.4	7.2	7.3	8.0	7.8	7.9
29	---	---	---	7.7	7.7	7.7	7.6	7.3	7.4	8.0	7.8	7.9
30	---	---	---	7.8	7.7	7.8	7.7	7.4	7.5	7.9	7.9	7.9
31	---	---	---	7.9	7.7	7.8	---	---	---	8.0	7.9	7.9

## VERMILLION RIVER BASIN

151

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	8.1	7.9	8.0	8.0	7.9	8.0	---	---	---	---	---	---
2	8.1	8.0	8.1	8.1	7.9	8.0	8.2	8.1	8.2	8.1	7.9	8.0
3	8.1	7.9	8.1	8.0	8.0	8.0	8.2	8.1	8.2	8.1	8.0	8.0
4	8.0	7.9	8.0	8.0	7.9	8.0	8.2	7.9	8.1	8.1	7.9	8.0
5	8.1	8.0	8.0	7.9	7.8	7.9	8.2	8.1	8.2	8.1	8.0	8.0
6	8.0	7.9	8.0	8.1	8.0	8.1	8.2	8.1	8.1	8.1	7.9	8.0
7	8.1	8.0	8.0	8.1	8.0	8.0	8.2	8.1	8.1	8.1	8.0	8.0
8	8.1	8.0	8.1	8.1	8.0	8.0	8.2	8.1	8.2	8.1	7.9	8.0
9	8.1	8.0	8.1	8.1	8.0	8.1	8.2	8.1	8.1	8.0	7.9	8.0
10	8.0	8.0	8.0	8.1	8.0	8.1	8.2	8.1	8.1	---	---	---
11	8.1	7.9	8.0	---	---	---	8.2	8.1	8.2	7.8	7.5	7.5
12	8.2	8.1	8.1	---	---	---	8.2	8.1	8.1	7.7	7.5	7.6
13	8.1	8.1	8.1	---	---	---	8.2	8.0	8.1	7.9	7.6	7.7
14	8.2	7.8	8.1	---	---	---	---	---	---	7.9	7.8	7.9
15	8.1	8.1	8.1	---	---	---	8.1	8.0	8.0	7.9	7.8	7.8
16	8.2	8.1	8.1	8.0	7.4	7.5	---	---	---	8.0	7.9	7.9
17	8.1	8.1	8.1	7.7	7.4	7.4	8.0	8.0	8.0	7.3	7.9	7.9
18	8.1	7.9	8.0	8.0	7.7	7.9	8.2	8.0	8.1	---	---	---
19	8.1	7.8	7.9	---	---	---	8.2	8.1	8.1	---	---	---
20	8.1	7.9	8.0	8.1	8.0	8.1	8.2	7.9	8.1	7.7	7.7	7.7
21	---	---	---	8.1	8.1	8.1	8.1	7.9	8.0	---	---	---
22	---	---	---	8.2	8.1	8.1	8.0	8.0	8.0	---	---	---
23	---	---	---	8.1	8.1	8.1	8.2	8.0	8.1	7.4	7.2	7.2
24	---	---	---	---	---	---	8.1	8.0	8.1	7.5	7.3	7.4
25	---	---	---	---	---	---	8.1	8.0	8.1	7.5	7.4	7.5
26	---	---	---	8.1	8.0	8.1	8.1	8.0	8.0	7.6	7.5	7.5
27	---	---	---	8.1	8.0	8.1	8.1	8.1	8.1	7.6	7.5	7.5
28	---	---	---	8.1	7.9	8.0	8.1	8.1	8.1	7.7	7.6	7.6
29	---	---	---	8.1	8.0	8.0	8.2	8.0	8.1	7.8	7.6	7.7
30	---	---	---	8.1	8.0	8.0	8.2	8.0	8.1	7.9	7.8	7.8
31	---	---	---	---	---	---	8.2	8.0	8.1	---	---	---

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	10.5	8.0	9.5	10.0	8.0	9.0	.5	.0	.0	2.5	.5	1.5
2	12.5	8.0	10.0	8.5	7.0	8.0	.5	.5	.5	2.5	1.0	1.5
3	12.5	10.5	11.5	8.5	5.5	6.5	.5	.5	.5	3.5	1.0	3.0
4	12.0	10.0	11.0	8.0	5.0	6.0	3.0	1.0	2.0	4.0	1.0	2.5
5	11.5	9.0	10.5	7.5	6.0	6.5	3.0	1.0	2.0	2.0	.0	.5
6	12.0	10.5	11.5	8.0	7.0	7.5	2.0	.0	1.0	1.0	.0	.5
7	14.0	12.0	13.0	7.5	5.0	6.5	3.5	1.0	2.0	.5	.5	.5
8	---	---	---	6.5	4.0	5.0	4.0	2.5	3.0	1.0	.5	.5
9	---	---	---	4.0	3.0	3.5	4.5	3.5	4.0	3.5	1.0	2.5
10	---	---	---	4.0	3.0	3.5	4.5	3.5	4.0	5.5	2.0	4.0
11	---	---	---	4.5	3.0	4.0	3.5	1.0	2.5	5.5	.5	4.5
12	---	---	---	6.5	4.5	5.5	1.5	.5	.5	4.5	2.0	3.5
13	---	---	---	6.5	5.5	6.0	.5	.5	.5	3.5	1.0	2.0
14	---	---	---	6.5	5.0	5.5	1.0	.5	.5	3.5	1.5	2.5
15	---	---	---	5.5	4.0	4.5	1.5	.5	1.0	4.5	1.5	2.5
16	9.5	8.5	9.0	6.0	4.5	5.0	1.5	.5	1.0	5.0	2.5	4.0
17	10.5	8.5	9.5	6.5	5.0	6.0	1.0	1.0	1.0	6.0	4.0	4.5
18	11.0	9.5	10.0	8.5	6.5	7.5	1.0	1.0	1.0	6.0	5.5	5.5
19	12.5	9.5	11.0	8.0	2.0	5.0	1.0	1.0	1.0	6.0	5.0	5.5
20	14.5	11.0	12.5	4.5	.5	1.0	1.0	1.0	1.0	6.0	5.0	5.5
21	16.0	11.5	14.5	2.0	.5	1.0	1.5	1.0	1.0	6.0	3.0	5.0
22	---	---	---	3.0	1.0	2.0	4.0	1.5	3.0	3.5	1.0	2.0
23	16.0	14.5	15.0	2.0	.5	1.5	4.0	2.0	3.5	3.5	.5	1.5
24	---	---	---	1.5	.0	.5	2.0	.5	1.0	3.5	2.0	2.5
25	12.5	10.0	11.5	3.0	1.0	1.5	1.0	1.0	1.0	3.0	.5	1.5
26	14.5	11.5	13.0	3.5	1.0	2.5	1.5	1.0	1.0	.5	.5	.5
27	13.0	10.5	11.5	1.5	.0	1.0	1.5	.0	.5	1.0	.5	.5
28	13.5	8.0	9.5	1.5	.0	1.0	1.0	.0	.5	1.0	.5	.5
29	10.5	8.5	9.5	.5	.0	.0	1.0	.0	.5	1.0	.5	.5
30	12.0	8.5	9.5	3.0	.0	.5	2.5	.5	1.5	3.0	.5	1.5
31	9.0	7.5	8.5	---	---	---	1.5	.5	1.0	2.0	1.5	2.0
MONTH	---	---	---	10.0	.0	4.0	4.5	.0	1.5	6.0	.0	2.5

## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	4.0	1.5	2.5	7.0	2.5	4.5	14.5	11.5	13.0	15.5	11.5	13.0
2	4.0	2.5	3.0	7.0	4.5	5.5	11.5	9.0	10.5	14.5	9.0	11.5
3	5.5	3.0	4.5	8.0	5.0	6.5	---	---	---	15.0	11.0	13.0
4	---	---	---	7.0	2.0	4.5	---	---	---	18.5	13.5	15.5
5	---	---	---	6.0	3.5	5.0	---	---	---	19.0	16.0	17.5
6	5.0	4.0	5.0	4.0	.5	3.0	---	---	---	17.5	14.5	16.0
7	5.0	3.0	4.0	3.5	.0	1.0	---	---	---	15.0	13.0	14.0
8	4.0	1.0	2.5	3.5	.0	.5	10.0	8.5	9.0	---	---	---
9	1.5	.5	1.0	5.5	4.0	5.0	10.0	6.5	8.5	---	---	---
10	2.0	.5	1.0	6.0	4.0	4.5	11.0	7.0	9.0	---	---	---
11	2.0	.5	1.0	7.5	3.0	5.0	12.5	8.0	10.0	---	---	---
12	2.0	.5	1.0	5.5	4.0	5.0	11.0	9.0	10.0	---	---	---
13	1.0	.5	.5	5.0	2.5	4.0	10.0	8.0	9.0	17.5	14.5	16.0
14	3.0	.5	1.0	6.5	4.5	5.5	10.0	6.0	8.0	20.0	12.5	16.0
15	2.5	.5	1.0	9.5	5.0	7.0	7.0	5.5	6.5	19.0	16.5	17.5
16	4.0	1.0	2.0	7.5	4.0	6.0	11.0	5.5	8.5	17.0	15.0	16.0
17	5.0	2.5	4.0	8.0	5.5	6.5	11.0	9.0	10.0	15.5	13.0	14.5
18	6.0	5.0	5.5	6.0	2.0	4.0	10.5	9.5	9.5	15.5	12.0	13.5
19	6.5	4.5	5.5	3.5	1.0	2.0	12.0	8.5	10.0	15.0	12.5	13.5
20	---	---	---	2.5	.5	1.5	12.0	9.5	11.0	16.5	11.5	13.5
21	---	---	---	---	---	---	10.0	7.5	9.0	15.0	11.5	13.5
22	---	---	---	---	---	---	11.0	7.0	9.0	15.5	12.0	14.0
23	---	---	---	---	---	---	13.5	8.5	11.0	14.5	13.0	14.0
24	---	---	---	---	---	---	13.0	11.5	12.5	15.0	12.0	14.0
25	---	---	---	5.5	2.0	4.0	13.5	11.0	12.5	14.5	12.5	13.0
26	7.0	4.5	5.5	4.5	2.0	3.0	---	---	---	16.0	12.5	14.0
27	6.5	3.0	4.5	7.0	.5	3.5	16.5	14.0	15.5	18.5	14.5	16.5
28	5.0	1.0	3.0	11.5	5.0	8.0	16.5	13.0	15.5	19.0	15.5	17.0
29	---	---	---	14.0	8.5	11.0	17.0	11.0	14.0	20.0	16.0	18.0
30	---	---	---	13.5	10.0	11.5	18.0	14.5	16.0	20.0	17.0	18.5
31	---	---	---	16.0	10.0	12.5	---	---	---	21.0	16.5	19.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
JUNE			JULY			AUGUST			SEPTEMBER			
1	---	---	---	16.0	14.0	15.0	---	---	---	---	---	---
2	17.5	13.5	15.5	19.0	14.5	16.5	19.0	15.5	17.5	19.0	15.5	17.5
3	18.5	13.0	16.0	21.0	16.0	18.5	19.0	14.5	17.0	19.0	16.5	17.5
4	17.5	15.0	16.5	26.0	19.0	22.0	20.0	15.0	17.5	18.0	15.5	16.5
5	18.0	13.5	15.5	---	---	---	20.0	16.5	18.5	17.0	13.0	15.0
6	16.5	15.5	16.0	21.0	19.5	20.5	20.5	16.5	18.0	17.5	13.0	14.0
7	18.5	15.0	16.5	21.5	17.5	19.5	19.5	17.0	18.0	15.0	11.5	13.5
8	18.5	14.5	16.5	20.0	18.0	19.0	20.5	16.0	18.0	16.0	11.0	13.5
9	19.0	14.0	16.5	21.0	17.0	19.0	21.0	16.5	18.5	13.5	12.5	13.0
10	19.0	16.0	17.5	19.0	17.5	18.0	19.5	16.5	18.0	---	---	---
11	18.0	13.0	15.5	---	---	---	18.0	14.0	16.0	14.5	13.5	14.0
12	17.5	12.0	14.5	---	---	---	18.5	14.0	16.0	16.5	12.0	14.0
13	16.5	14.5	15.5	---	---	---	16.5	15.5	16.0	16.5	13.5	14.5
14	17.5	13.5	15.0	---	---	---	---	---	---	13.0	11.5	12.0
15	20.0	14.5	17.0	---	---	---	21.0	17.5	20.0	12.0	11.5	12.0
16	20.0	16.0	18.0	24.5	21.0	23.5	---	---	---	13.0	10.5	12.0
17	20.0	14.0	17.0	26.0	23.5	24.5	20.5	19.5	20.0	12.5	12.0	12.0
18	21.5	16.5	18.5	25.0	22.0	23.5	18.5	17.0	18.0	---	---	---
19	---	---	---	---	---	---	20.0	15.5	17.5	---	---	---
20	---	---	---	21.5	19.0	20.0	18.0	16.0	16.5	15.5	15.5	15.5
21	---	---	---	21.0	17.5	19.0	17.5	14.5	16.0	---	---	---
22	---	---	---	21.5	17.5	19.5	16.5	15.0	16.0	---	---	---
23	---	---	---	23.0	18.5	20.0	18.5	15.0	16.5	17.0	15.0	16.5
24	---	---	---	---	---	---	16.0	14.0	14.5	16.0	14.5	15.5
25	---	---	---	---	---	---	18.5	14.0	16.0	18.5	15.5	17.0
26	---	---	---	20.0	17.5	19.0	18.5	16.0	17.0	19.0	16.5	17.5
27	---	---	---	20.0	17.5	18.5	16.0	13.0	14.5	18.5	15.5	17.5
28	---	---	---	20.5	18.0	19.0	16.0	12.0	14.0	17.0	14.5	15.0
29	---	---	---	22.0	18.0	20.0	16.0	12.0	14.0	15.0	14.0	14.5
30	---	---	---	22.0	18.0	20.0	17.5	13.5	15.5	14.0	12.5	13.5
31	---	---	---	---	---	---	19.5	14.5	17.0	---	---	---

## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER			NOVEMBER			DECEMBER			JANUARY			
1	12.1	10.3	11.1	---	---	---	14.4	11.9	13.1	13.5	10.7	11.8
2	12.1	9.8	11.0	---	---	---	13.5	11.0	12.2	13.6	10.9	11.9
3	11.1	9.1	10.0	---	---	---	13.2	11.2	11.9	13.3	10.7	11.6
4	9.2	7.0	8.3	11.9	10.1	11.1	13.5	11.2	12.0	13.9	10.4	11.7
5	10.0	7.2	8.4	11.7	9.4	10.5	14.2	11.2	12.4	13.8	11.0	11.9
6	10.0	8.1	9.0	10.8	8.9	9.8	14.7	11.4	12.9	13.6	11.0	11.9
7	8.5	6.9	7.7	11.7	9.6	10.3	14.3	11.6	12.6	13.9	11.2	11.9
8	---	---	---	12.2	9.6	10.8	14.6	11.4	12.4	13.4	10.4	11.5
9	---	---	---	14.0	10.8	11.8	14.5	11.1	12.1	13.2	10.5	11.5
10	---	---	---	13.6	11.4	12.4	14.9	10.8	12.3	13.2	9.9	11.2
11	---	---	---	13.6	11.6	12.4	15.3	11.4	12.9	13.0	9.8	10.9
12	---	---	---	12.9	10.9	11.6	14.9	11.9	13.1	13.5	10.1	11.6
13	---	---	---	12.6	10.4	11.2	14.5	11.6	12.8	14.4	11.2	12.3
14	---	---	---	13.0	10.4	11.5	14.8	10.9	12.2	14.2	11.0	12.1
15	---	---	---	13.1	11.0	11.8	14.2	11.0	12.4	14.6	9.9	12.1
16	12.7	10.9	11.8	12.5	10.4	11.2	14.5	11.5	12.7	13.9	10.5	11.7
17	10.9	9.3	10.3	12.5	10.0	11.0	14.3	11.7	12.7	13.9	10.2	11.4
18	11.8	9.0	10.0	11.4	9.3	10.1	13.9	11.6	12.4	13.6	9.8	11.1
19	10.6	8.3	9.6	12.7	9.2	11.0	13.5	11.2	12.0	14.0	9.9	11.3
20	10.9	7.2	9.3	14.7	10.8	13.0	13.8	11.3	12.2	13.9	10.0	11.3
21	10.2	7.5	8.3	14.4	12.5	13.2	13.8	11.4	12.3	13.0	9.6	11.1
22	---	---	---	14.0	11.9	12.8	13.8	10.8	11.9	15.3	11.7	13.2
23	9.5	8.1	8.9	14.5	11.9	13.0	13.5	10.9	11.8	15.2	12.2	13.5
24	---	---	---	14.7	11.8	13.2	14.7	11.6	12.7	14.3	11.7	12.7
25	11.1	9.4	10.3	13.9	11.5	12.6	14.5	11.5	12.3	15.2	11.6	13.1
26	10.1	9.0	9.4	13.9	11.0	12.3	13.4	10.8	11.9	13.9	10.7	12.2
27	11.3	9.0	10.1	14.9	11.8	12.9	---	---	---	13.3	11.1	12.2
28	11.8	8.2	10.6	14.6	11.6	12.9	13.0	10.9	12.0	13.6	10.7	12.2
29	11.2	9.1	10.0	14.8	12.2	13.1	13.3	10.7	12.0	14.8	11.7	13.1
30	11.8	8.9	10.2	14.5	11.5	13.1	12.9	10.5	11.7	15.2	12.5	13.6
31	11.7	10.2	10.5	---	---	---	12.2	11.2	11.7	15.4	12.6	13.7
MONTH	---	---	---	---	---	---	---	---	---	15.4	9.6	12.0
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	15.7	10.0	13.5	16.6	10.6	13.1	---	---	---	15.0	10.2	10.4
2	15.5	11.5	13.5	16.9	9.7	12.5	---	---	---	17.0	8.9	12.5
3	15.2	11.4	13.3	17.4	9.6	12.5	---	---	---	16.5	8.5	13.2
4	---	---	---	16.4	9.1	11.9	---	---	---	14.4	8.2	11.7
5	---	---	---	15.9	9.3	11.9	---	---	---	13.3	8.2	11.1
6	15.6	11.7	13.6	15.5	10.4	12.6	---	---	---	14.9	8.0	12.1
7	16.3	11.6	13.3	14.6	11.4	12.8	---	---	---	15.6	8.2	11.6
8	16.5	11.7	13.7	14.7	12.2	12.9	12.7	9.8	11.4	---	---	---
9	16.0	12.4	13.9	13.7	9.8	12.2	12.9	9.2	10.9	---	---	---
10	15.4	12.7	13.8	14.4	10.1	11.8	13.5	9.2	11.0	---	---	---
11	15.1	12.3	13.5	15.5	10.2	12.4	12.4	8.9	10.6	---	---	---
12	15.1	12.1	13.2	15.1	10.4	12.3	11.9	8.1	9.6	---	---	---
13	15.0	11.5	12.9	14.9	11.0	12.5	---	---	---	---	---	---
14	15.0	11.9	13.2	14.3	10.2	11.9	---	---	---	---	---	---
15	15.4	12.1	13.4	14.1	9.9	11.6	10.8	10.0	10.4	---	---	---
16	15.6	12.0	13.3	14.1	11.5	12.8	10.1	7.6	8.8	---	---	---
17	15.3	11.1	12.8	14.7	11.3	13.0	9.9	6.5	8.1	---	---	---
18	15.6	10.5	12.3	14.1	11.5	11.9	8.4	6.6	7.5	---	5.3	---
19	16.2	10.8	12.7	14.5	12.3	13.1	9.8	7.0	8.4	10.7	8.3	11.2
20	---	---	---	13.6	11.8	12.8	10.2	7.2	8.7	10.1	6.8	9.9
21	---	---	---	---	---	---	12.0	8.7	10.4	10.3	6.2	8.2
22	---	---	---	---	---	---	12.5	9.5	11.0	10.1	6.7	8.3
23	---	---	---	---	---	---	11.5	8.7	10.0	9.9	6.8	8.3
24	---	---	---	---	---	---	10.6	7.7	9.0	8.8	6.3	7.8
25	---	---	---	12.9	11.1	12.0	10.2	7.2	8.7	---	---	---
26	16.0	10.0	12.1	13.3	11.0	12.3	---	---	---	---	---	---
27	16.6	9.9	12.8	13.6	10.7	12.7	---	---	9.4	10.7	8.1	8.0
28	16.9	11.5	13.5	10.7	7.0	9.4	---	---	---	10.3	6.9	8.4
29	---	---	---	---	---	---	10.5	8.9	8.2	10.4	8.3	9.3
30	---	---	---	---	---	---	10.7	6.0	8.4	8.8	7.3	7.9
31	---	---	---	---	---	---	---	---	---	7.6	6.1	6.9

VERMILLION RIVER BASIN  
05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

OXYGEN, DISSOLVED (DO), MG/L, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	---	---	---	8.9	8.1	8.5	---	---	---	---	---	---
2	9.5	7.5	8.5	8.1	7.2	7.7	9.5	8.1	8.8	10.1	7.2	8.5
3	9.7	8.3	9.0	---	---	---	10.2	8.6	9.4	9.2	7.0	8.0
4	8.1	6.7	7.2	---	---	---	9.7	6.8	8.3	10.1	6.9	8.5
5	9.7	7.5	8.7	---	---	---	9.2	7.4	8.5	11.2	8.1	9.9
6	8.9	7.5	8.1	8.7	8.0	8.5	9.0	7.1	8.0	10.8	7.3	9.1
7	---	---	---	9.2	7.8	8.5	9.0	7.1	7.9	11.6	8.6	10.1
8	9.5	7.6	8.6	9.1	7.6	8.4	9.0	7.1	7.9	11.4	8.7	10.1
9	9.2	8.0	8.6	9.7	7.9	9.0	8.6	6.7	7.5	8.5	8.2	8.4
10	8.7	7.9	8.3	10.2	8.2	9.1	9.2	6.7	7.8	---	---	---
11	10.4	6.9	8.3	---	---	---	10.5	7.8	9.1	---	---	---
12	11.1	9.0	10.6	---	---	---	10.0	8.0	9.1	---	---	---
13	9.8	8.5	9.1	---	---	---	9.4	7.1	8.1	---	---	---
14	10.5	9.0	9.7	---	---	---	---	---	---	9.4	8.4	9.0
15	9.8	7.6	9.0	---	---	---	8.0	6.2	7.3	9.3	8.5	8.8
16	9.2	7.3	8.2	---	---	---	---	---	---	9.8	8.7	9.3
17	9.5	7.9	8.9	---	---	---	6.2	5.9	6.0	8.7	8.2	8.4
18	8.0	6.0	7.0	---	---	---	8.9	7.2	8.3	---	---	---
19	---	---	---	---	---	---	8.9	7.0	8.0	---	---	---
20	---	---	---	---	---	---	8.7	6.8	7.2	6.6	5.5	6.2
21	---	---	---	---	---	---	8.8	7.3	8.1	---	---	---
22	---	---	---	8.4	7.2	8.0	7.9	7.3	7.6	---	---	---
23	---	---	---	7.3	6.6	6.9	8.9	7.4	8.1	7.4	5.1	6.4
24	---	---	---	---	---	---	9.7	8.1	8.8	6.8	4.9	5.7
25	---	---	---	---	---	---	8.9	7.3	8.4	5.1	3.3	4.4
26	---	---	---	8.6	6.8	7.9	8.9	6.9	7.8	5.2	3.2	4.0
27	---	---	---	8.3	7.0	7.7	10.8	8.1	9.6	5.4	3.0	4.2
28	---	---	---	8.3	7.2	7.8	11.5	9.6	10.5	7.2	4.2	5.7
29	---	---	---	---	---	---	11.5	9.5	10.4	7.3	5.6	6.5
30	---	---	---	8.1	6.9	7.5	10.6	8.5	9.6	7.6	7.5	7.5
31	---	---	---	---	---	---	10.2	8.3	9.2	---	---	---

## CANNON RIVER BASIN

05353800 STRAIGHT RIVER NEAR FARIBAULT, MN

LOCATION.--Lat 44°15'29", long 93°13'51", in W&SE¼ sec.9, T.109 N., R.20 W., Rice County, Hydrologic Unit 07040002, on right bank 15 ft downstream from highway bridge, 2.8 mi upstream from Falls Creek and 3.2 mi southeast of Faribault.

DRAINAGE AREA.--442 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder. Datum of gage is 1,034.58 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 21 to Mar. 15 and Mar. 19-21. Records good except those for periods with ice effect, Nov. 21 to Mar. 15, and period of no gage-height record, Mar. 19-21, which are fair.

AVERAGE DISCHARGE.--21 years, 272 ft<sup>3</sup>/s, 8.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,990 ft<sup>3</sup>/s, May 1, 1973, gage height, 11.20 ft; maximum gage height, 12.74 ft, Mar. 5, 1974 (backwater from ice); minimum discharge, 10 ft<sup>3</sup>/s, Oct. 27, 1976; minimum gage height, 3.66 ft, Nov. 27, 1976.

EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base discharge of 1,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 19	-	4,240	10.01	June 22	1930	*4,630	*10.30
May 14	0430	1,670	7.20	July 15	2130	1,540	7.02

Minimum daily discharge, 48 ft<sup>3</sup>/s, Mar. 7; minimum gage height, 4.02 ft, Sept. 7-9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	592	171	134	82	59	52	869	938	305	629	254	70
2	549	164	129	82	58	53	783	716	271	560	206	65
3	436	155	124	82	58	54	796	617	251	493	173	69
4	658	147	120	82	57	55	902	543	266	440	153	85
5	1150	146	116	81	57	56	1130	486	252	394	142	73
6	1050	112	112	79	56	51	1180	423	236	399	132	66
7	832	141	108	77	56	48	1040	365	220	367	122	60
8	696	135	105	75	55	57	826	346	205	339	114	57
9	590	131	102	73	55	70	670	354	190	328	103	58
10	507	123	99	72	54	80	574	388	179	309	101	184
11	444	123	97	72	54	95	510	757	185	351	91	445
12	458	130	94	72	54	110	458	1100	176	355	87	295
13	457	130	92	72	53	130	411	1240	165	464	78	215
14	423	130	89	72	53	150	584	1600	154	427	88	198
15	382	141	88	72	53	190	767	1510	144	697	84	302
16	343	169	86	72	53	295	724	1350	143	1100	78	302
17	315	169	85	72	52	536	614	1070	131	776	70	256
18	295	185	83	72	52	1640	545	829	172	552	64	232
19	275	232	82	72	52	3800	532	674	178	453	62	675
20	258	218	82	72	52	3260	525	578	174	364	62	717
21	247	207	81	72	52	2870	475	513	1320	314	65	1120
22	241	198	81	72	52	2850	420	461	3660	275	64	1390
23	237	190	81	71	52	3140	378	418	4400	243	71	1290
24	226	182	81	69	52	2790	348	385	3320	217	61	1030
25	210	175	82	67	52	2440	327	369	2250	201	60	1320
26	201	166	82	65	52	2160	308	367	1560	183	112	1240
27	194	158	82	64	52	1630	393	373	1300	212	123	945
28	181	152	82	63	52	1380	1280	364	1020	195	143	693
29	176	146	82	62	---	1230	1410	344	827	181	103	658
30	171	140	82	61	---	1070	1260	338	704	558	91	544
31	170	---	82	60	---	926	---	333	---	355	85	---
TOTAL	12964	4766	2925	2231	1509	33268	21039	20149	24358	12731	3242	14654
MEAN	418	159	94.4	72.0	53.9	1073	701	650	812	411	105	488
MAX	1150	232	134	82	59	3800	1410	1600	4400	1100	254	1390
MIN	170	112	81	60	52	48	308	333	131	181	60	57
CFSM	.95	.36	.21	.16	.12	2.43	1.59	1.47	1.84	.93	.24	1.10
IN.	1.09	.40	.25	.19	.13	2.80	1.77	1.70	2.05	1.07	.27	1.23
AC-FT	25710	9450	5800	4430	2990	65990	41730	39970	48310	25250	6430	29070
CAL YR 1985 TOTAL	76489	MEAN 210	MAX 2470	MIN 24	CFSM .48	IN 6.44	AC-FT 151700					
WTR YR 1986 TOTAL	153836	MEAN 421	MAX 4400	MIN 48	CFSM .95	IN 12.95	AC-FT 305100					

## ZUMBRO RIVER BASIN

05372995 SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN

LOCATION.--Lat 44°03'42", long 92°27'58", in NW¼ sec.23, T.107 N., R.14 W., Olmsted County, Hydrologic Unit 07040004, on left bank 50 ft downstream from 37th Street bridge, 0.2 mi upstream from sewer plant, and 2.0 mi downstream from Silver Lake Dam.

DRAINAGE AREA.--303 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1981 to current year.

GAGE.--Water-stage recorder. Datum of gage is 950.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharge. Records good. Slight regulation at times from Silver Lake.

AVERAGE DISCHARGE.--5 years (water years 1982-86), 262 ft<sup>3</sup>/s, 11.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,450 ft<sup>3</sup>/s, July 1, 1983, gage height, 14.93 ft; minimum discharge, 10 ft<sup>3</sup>/s, Oct. 23, 1981, result of regulation; minimum gage height, 2.76 ft, July 21, 1985.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of July 6, 1978, reached a stage of about 28.0 ft, on upstream side of bridge, discharge 30,500 ft<sup>3</sup>/s. This is the highest known stage since at least 1908.

EXTREMES FOR CURRENT PERIOD.--Peak discharges greater than base discharge of 1,300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 19	1430	3,080	11.11	Sept. 11	1145	1,310	7.23
Mar. 23	1000	1,850	8.51	Sept. 21	1645	*10,000	*20.77
June 22	2300	1,710	8.30	Sept. 25	1700	2,600	9.72

Minimum discharge, 21 ft<sup>3</sup>/s, July 21, gage height, 2.76 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	617	156	134	81	75	65	570	466	194	239	218	111
2	417	142	104	80	76	68	526	398	179	223	191	106
3	345	130	103	82	77	71	470	344	170	206	173	113
4	362	122	118	82	80	77	564	313	176	187	160	123
5	675	120	124	77	80	71	763	291	176	208	151	105
6	582	118	122	77	78	64	797	265	158	550	146	99
7	404	116	123	75	77	50	559	240	155	569	139	95
8	360	114	124	71	73	64	459	227	146	322	133	93
9	323	116	123	70	56	74	397	271	142	267	127	97
10	285	115	123	73	68	76	360	313	138	232	138	330
11	259	111	121	75	64	78	332	498	145	218	120	968
12	247	115	109	77	59	77	309	513	144	248	114	409
13	242	115	110	75	56	94	287	558	128	285	112	254
14	228	117	105	77	57	94	379	769	125	238	166	298
15	212	120	105	74	53	117	478	578	125	260	133	547
16	199	141	105	79	54	136	410	440	116	771	118	413
17	187	143	103	80	55	249	345	393	113	449	108	314
18	181	188	99	82	60	1230	314	342	143	314	103	324
19	175	312	96	84	64	2720	322	324	129	272	100	809
20	168	258	94	84	60	1610	308	283	115	225	99	790
21	162	183	92	87	57	1050	284	258	231	194	98	7710
22	158	205	92	74	63	1040	261	239	1060	176	99	5620
23	167	180	98	73	59	1680	246	224	1200	163	96	2540
24	154	153	94	87	60	1390	231	219	522	152	90	1630
25	145	168	88	81	61	1100	220	259	398	187	98	2180
26	141	175	87	66	65	1240	225	355	355	151	242	1720
27	135	134	87	85	63	806	390	308	495	317	212	1350
28	130	149	85	71	54	678	817	259	343	472	149	1170
29	125	132	85	72	---	667	944	235	274	269	130	1020
30	124	136	84	73	---	579	574	224	254	321	123	904
31	123	---	83	74	---	520	---	211	---	298	117	---
TOTAL	8032	4484	3220	2398	1804	17835	13141	10617	8049	8983	4203	32242
MEAN	259	149	104	77.4	64.4	575	438	342	268	290	136	1075
MAX	675	312	134	87	80	2720	944	769	1200	771	242	7710
MIN	123	111	83	66	53	50	220	211	113	151	90	93
CFSM	.86	.49	.34	.26	.21	1.90	1.45	1.13	.88	.96	.45	3.55
IN.	.99	.55	.40	.29	.22	2.19	1.61	1.30	.99	1.10	.52	3.96
AC-FT	15930	8890	6390	4760	3580	35380	26070	21060	15970	17820	8340	63950
CAL YR 1985	TOTAL	57220	MEAN 157	MAX 1580	MIN 22	CFSM .52	IN 7.03	AC-FT 113500				
WTR YR 1986	TOTAL	115008	MEAN 315	MAX 7710	MIN 50	CFSM 1.04	IN 14.12	AC-FT 228100				

## ZUMBRO RIVER BASIN

05374900 ZUMBRO RIVER AT KELLOGG, MN

LOCATION.--Lat 44°18'43", long 92°00'14", in SW¼ sec.22, T.110 N., R.10 W., Wabasha County, Hydrologic Unit 07040004, on right bank at downstream side of bridge on U.S. Highway 61, and 4 mi above mouth.

DRAINAGE AREA.--1,400 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder. Datum of gage is 669.47 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 24 to Mar. 11. Records good except those for period with ice effect, Nov. 24 to Mar. 11, which are fair. Some regulation by powerplant upstream from station.

AVERAGE DISCHARGE.--11 years, 903 ft<sup>3</sup>/s, 8.76 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,300 ft<sup>3</sup>/s, Sept. 23, 1986, gage height, 16.07 ft; minimum daily, 140 ft<sup>3</sup>/s, Dec. 3, 1980; minimum gage height, 1.69 ft, Dec. 2, 1980, result of freezeup.

EXTREMES OUTSIDE PERIOD OF RECORD.--A discharge of 33,000 ft<sup>3</sup>/s, occurred on July 22, 1951, at station 05374500, 20 mi upstream; this was the greatest since 1938.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 27	1745	7,000	9.69	Aug. 1	0015	3,660	6.95
June 24	2015	4,780	8.04	Sept. 23	1130	*22,300	*16.07

Minimum discharge, 410 ft<sup>3</sup>/s, Jan.27; minimum gage height, 2.92 ft, Nov. 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	926	767	600	465	435	570	2550	2320	1090	1530	3250	791		
2	1470	709	590	465	440	580	2340	2010	1090	1370	2100	717		
3	1540	710	570	465	445	590	2180	1770	971	1300	1660	697		
4	1420	684	560	460	450	600	2110	1640	927	1210	1430	716		
5	1350	649	550	460	455	580	2290	1490	925	1090	1310	800		
6	1750	625	540	460	460	540	2800	1380	891	1400	1120	731		
7	2160	662	530	460	465	560	2940	1150	896	1360	995	682		
8	1880	607	522	460	460	580	2430	1140	879	1540	1250	647		
9	1580	641	521	460	445	600	2100	1150	782	1400	941	668		
10	1460	637	520	460	430	620	1880	1090	848	1250	843	746		
11	1340	626	510	460	420	630	1710	1290	870	1190	794	1290		
12	1250	584	510	465	420	634	1580	1500	867	1080	793	2110		
13	1190	566	510	470	425	633	1460	2010	812	1230	728	1840		
14	1160	556	510	470	430	641	1420	2100	709	1190	719	1500		
15	1140	571	500	465	440	642	1450	2760	672	1220	786	1510		
16	1120	592	490	460	450	653	1780	2730	661	1200	764	1530		
17	1100	595	490	460	465	664	1790	2320	700	1800	735	1640		
18	1090	598	485	470	475	841	1660	2010	739	2050	701	1560		
19	1060	611	480	480	485	1220	1530	1840	737	1730	712	1600		
20	1060	717	480	480	490	3340	1490	1640	807	1460	679	2230		
21	1060	883	480	470	500	4120	1440	1470	683	1340	701	4790		
22	1050	862	475	460	510	3630	1370	1400	700	1200	699	9930		
23	945	801	475	460	520	3650	1300	1300	2430	1100	708	19900		
24	954	760	475	440	520	4980	1250	1250	4530	903	672	13700		
25	848	730	470	430	530	5800	1200	1310	3760	942	677	7240		
26	816	700	470	420	540	5830	1180	1260	2660	840	700	5520		
27	807	680	470	410	550	6510	1190	1310	2120	903	878	5770		
28	765	650	465	415	560	4990	1270	1380	2060	926	903	4260		
29	754	630	465	420	---	3510	1730	1300	1860	1200	916	3480		
30	740	610	465	425	---	3210	2660	1230	1670	1760	843	3050		
31	689	---	465	430	---	2880	---	1170	---	3050	748	---		
TOTAL	36474	20013	15643	14075	13215	64828	54080	49720	39346	41764	30755	101645		
MEAN	1177	667	505	454	472	2091	1803	1604	1312	1347	992	3383		
MAX	2160	883	600	480	560	6510	2940	2760	4530	3050	3250	19900		
MIN	689	556	465	410	420	540	1180	1090	661	840	672	647		
CFSM	.84	.48	.36	.32	.34	1.49	1.29	1.15	.94	.96	.71	2.42		
IN.	.97	.53	.42	.37	.35	1.72	1.44	1.32	1.05	1.11	.82	2.70		
AC-FT	72350	39700	31030	27920	26210	128600	107300	98620	78040	82840	61000	201600		
CAL YR 1985	TOTAL	312652	MEAN	857	MAX	7550	MIN	340	CFSM	.61	IN	8.31	AC-FT	620100
WTR YR 1986	TOTAL	481558	MEAN	1319	MAX	19900	MIN	410	CFSM	.94	IN	12.80	AC-FT	955200

# WHITEWATER RIVER BASIN

05376000 NORTH FORK WHITEWATER RIVER NEAR ELBA, MN  
(Hydrologic bench-mark station)

LOCATION.--Lat 44°05'30", long 92°03'57", in sec.7, T.107 N., R.10 W., Winona County, Hydrologic Unit 07040003, on left bank 2.3 mi upstream from Middle Fork, 2.4 mi west of Elba, and 3.5 mi upstream from confluence with South Fork.

DRAINAGE AREA.--101 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1939 to September 1941, July 1967 to current year.

REVISED RECORDS.--WRD MN-74: 1967(M), 1969(M), 1971(M), 1972(M), 1973(M). WRD MN-80-2: 1978.

GAGE.--Water-stage recorder. Datum of gage is 769.60 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 12, 1939, nonrecording gage at site 2 mi downstream at different datum. Oct. 12, 1939, to Sept. 30, 1941, water-stage recorder at site 600 ft downstream at present datum. Prior to July 6, 1978, water-stage recorder at same site and present datum (gage destroyed by flood of July 1978), July 6 to Oct. 30, 1978, nonrecording gage at same site and present datum.

REMARKS.--Estimated daily discharges: Dec. 17-22, 24, Jan. 8-14, 26-30, Feb. 13, 14-17, Mar. 7, and Sept. 21-23. Records good except those for periods with ice effect, Dec. 17-22, 24, Jan. 26-30, Feb. 14-17, Mar. 7, and periods of no gage height record, Jan. 8-14, Feb. 13, Sept. 21-23, which are fair.

AVERAGE DISCHARGE.--21 years (water years 1940-41, 1968-86), 47.9 ft<sup>3</sup>/s, 6.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,100 ft<sup>3</sup>/s, June 21, 1974, gage height, 16.32 ft, from floodmark; minimum, 11 ft<sup>3</sup>/s, Feb. 21, 1968.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 600 ft<sup>3</sup>/s and maximum (\*).

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
June 22	1015	706	5.98	Sept. 21	----	*2,720	*8.22
July 28	0115	738	6.04				

Minimum daily discharge, 16 cfs, Jan. 8; minimum recorded gage height, 3.79 ft, Jan. 6, 7.

## DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986 MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42	35	34	17	21	30	66	57	45	71	99	44
2	37	34	36	17	20	30	63	53	43	68	86	44
3	34	34	34	17	20	29	56	52	43	63	77	43
4	34	33	34	17	20	29	56	50	43	60	68	48
5	34	32	35	17	20	29	54	50	44	67	65	46
6	34	33	35	17	20	29	55	48	44	150	62	43
7	33	33	34	17	20	29	50	47	44	95	61	42
8	33	33	34	16	20	29	49	45	44	73	60	42
9	33	34	34	18	18	29	47	46	41	68	58	42
10	33	34	34	24	21	29	45	49	42	63	59	75
11	32	34	35	40	20	29	46	52	56	60	58	223
12	33	35	33	60	20	29	45	50	68	66	56	71
13	32	35	33	45	20	30	44	51	50	80	54	51
14	31	35	33	32	20	30	50	54	45	67	56	46
15	31	36	33	19	20	30	60	55	44	71	58	59
16	30	37	33	18	21	30	55	51	43	78	55	55
17	29	37	32	18	25	28	52	49	43	64	53	49
18	30	38	31	18	30	49	50	48	43	57	49	49
19	30	40	30	19	30	115	49	45	44	108	49	122
20	30	40	30	19	30	95	49	45	44	78	48	92
21	30	37	29	19	28	68	47	44	74	60	48	1520
22	30	36	29	18	29	61	46	44	290	56	47	858
23	30	37	27	18	28	135	44	43	201	52	47	319
24	31	35	25	18	28	140	44	43	96	51	47	222
25	30	35	25	19	28	179	43	68	80	56	48	359
26	31	35	22	19	29	229	43	71	74	58	52	233
27	32	34	20	19	30	112	47	70	143	138	56	228
28	30	33	20	19	28	94	67	55	99	253	48	192
29	30	34	20	19	---	91	77	49	75	104	45	158
30	31	34	19	19	---	79	64	48	71	220	45	143
31	31	---	17	21	---	67	---	47	---	199	45	---
TOTAL	991	1052	920	673	664	2012	1563	1579	2116	2754	1759	5518
MEAN	32.0	35.1	29.7	21.7	23.7	64.9	52.1	50.9	70.5	88.8	56.7	184
MAX	42	40	36	60	30	229	77	71	290	253	99	1520
MIN	29	32	17	16	18	28	43	43	41	51	45	42
CFSM	.32	.35	.29	.22	.24	.64	.52	.50	.70	.88	.56	1.82
IN.	.36	.39	.34	.25	.24	.74	.58	.58	.78	1.01	.65	2.03
AC-FT	1970	2090	1820	1330	1320	3990	3100	3130	4200	5460	3490	10940
CAL YR 1985	TOTAL	19930	MEAN 54.6	MAX 789	MIN 17	CFSM .54	IN 7.34	AC-FT 39530				
WTR YR 1986	TOTAL	21601	MEAN 59.2	MAX 1520	MIN 16	CFSM .59	IN 7.96	AC-FT 42850				

# WHITWATER RIVER BASIN

05376000 NORTH FORK WHITWATER RIVER NEAR ELBA, MN--Continued  
(Hydrologic bench-mark station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967 to current year.

REMARKS.--Letter K indicates non-ideal colony count. Letter E indicates estimated value.

### WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (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, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT 01...	1230	44	585	557	8.1	8.0	13.5	8.0	1.0	765
JAN 14...	1120	32	510	574	8.1	7.8	-6.0	1.0	1.0	769
MAR 19...	1350	132	425	484	8.0	7.8	-2.0	4.0	25	764
APR 16...	1420	54	530	542	8.6	8.6	14.5	10.0	2.1	770
AUG 20...	1135	49	450	576	8.4	8.3	18.5	16.0	2.1	769
SEP 23...	1400	296	520	517	8.1	8.0	21.0	15.5	40	760

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI 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)	BICAR- BONATE IT-FLD AS HCO3) (99440)	CAR- BONATE IT-FLD AS CO3) (99445)
OCT 01...	13.4	420	230	--	--	--	--	310	0
JAN 14...	17.4	K12	K14	74	28	6.5	1.6	326	0
MAR 19...	12.1	K6000	>3000	56	19	7.3	9.4	234	0
APR 16...	15.0	380	220	74	24	7.5	2.5	--	--
AUG 20...	10.8	170	350	82	28	6.3	1.7	323	0
SEP 23...	--	3700	6900	80	20	4.8	4.3	299	0

DATE	ALKA- LITY, FIXED ENDPT, IT-FLD (MG/L AS CAC03) (99430)	ALKA- LITY, LAB (MG/L AS CAC03) (90410)	ALKA- LITY, LAB (MG/L AS CAC03) (90410)	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)	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)
OCT 01...	254	248	260	17	15	0.2	--	342	0.50
JAN 14...	267	266	264	24	10	0.2	16	317	0.02
MAR 19...	192	191	181	16	17	0.2	12	277	0.04
APR 16...	250	247	249	15	15	0.2	12	314	0.03
AUG 20...	265	264	--	22	13	0.3	13	293	0.01
SEP 23...	245	248	237	18	11	0.1	19	365	0.03

## WHITEWATER RIVER BASIN

05376000 NORTH FORK WHITEWATER RIVER NEAR ELBA, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	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)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. Z FINER THAN .062 MM (70331)
OCT 01...	3.4	1.70	1.60	2.6	0.97	0.97	0.34	17	91
JAN 14...	3.8	0.25	0.12	0.4	0.16	0.16	0.16	E61	--
MAR 19...	3.9	1.80	1.80	6.2	0.94	0.70	0.60	152	99
APR 16...	4.4	0.06	0.06	0.9	0.23	0.20	0.17	6	100
AUG 20...	4.6	0.04	0.02	0.7	0.11	0.09	0.09	29	40
SEP 23...	4.9	0.12	0.11	1.5	0.46	0.21	0.15	177	96

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	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)	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)
OCT 01...	1230	10	<1	--	--	--	<1	--	1	--	6
MAR 19...	1350	<10	1	57	<0.5	<1	<1	<3	<1	46	1
APR 16...	1420	10	<1	57	<0.5	<1	<1	<3	2	3	<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)
OCT 01...	--	--	0.2	--	1	<1	<1	--	--	--
MAR 19...	7	110	0.1	<10	<1	<1	<1	69	<6	10
APR 16...	8	15	0.3	<10	<1	<1	<1	79	<6	5

## RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)
SEP 23...	1400	0.8	<0.4	4.9	1.6	3.7	1.5	0.08

## GARVIN BROOK BASIN

05378235 GARVIN BROOK NEAR MINNESOTA CITY, MN

LOCATION.--Lat 44°04'16", long 91°45'51", in SE 1/4 sec. 15, T.107 N., R.8 W., Winona County, Hydrologic Unit 07040003, on left bank, 20 ft downstream from County 23 bridge, 1.8 mi south of Minnesota City, and 2.3 mi upstream from Rollingstone Creek.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March 1982 to November 1983, January 1984 to current year (partial winter records in 1984).

GAGE.--Water stage recorder and broad-crested weir.

REMARKS.--Estimated daily discharges: Nov. 21, 24, 25, Nov. 27 to Dec. 8, Dec. 12 to Jan 13, 15, 16, 23, Jan. 26 to Feb. 2, 9-18, 21, 23-25, 28, and Mar. 7, 8. Records good except those for periods with ice effect, all estimated daily record listed above, which are fair.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge 1,580 ft<sup>3</sup>/s, Sept. 21, 1986, gage height, 6.63 ft; minimum, 15 ft<sup>3</sup>/s, Mar. 9, 1982, gage height, 0.75 ft, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,580 ft<sup>3</sup>/s, Sept. 21, gage height, 6.63 ft; minimum discharge, 16 ft<sup>3</sup>/s, Jan. 27, gage height, 0.90 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	36	40	30	38	29	27	38	35	31	36	37	31
2	33	36	30	38	29	27	36	33	31	36	36	31
3	34	34	30	39	29	28	38	34	31	35	36	31
4	34	33	32	39	29	28	38	35	33	34	35	35
5	35	32	33	39	28	29	39	35	33	33	34	32
6	34	33	33	38	28	28	37	33	32	37	35	31
7	33	32	33	33	28	28	36	32	32	35	37	32
8	34	31	33	33	27	27	36	32	31	32	38	32
9	32	33	31	33	27	27	36	33	31	35	35	33
10	33	33	30	33	27	29	36	35	34	33	35	125
11	32	32	30	32	27	28	36	34	36	35	35	212
12	35	34	30	32	28	29	36	33	35	36	34	49
13	33	33	30	32	28	30	35	36	32	37	34	45
14	33	33	30	32	28	31	43	39	31	34	34	47
15	32	33	30	31	28	31	40	35	32	36	35	58
16	32	36	30	31	30	32	38	39	32	38	34	46
17	33	35	30	31	33	34	37	35	31	34	33	45
18	34	35	30	31	32	73	36	34	33	33	33	46
19	33	36	30	30	27	54	36	33	32	37	33	55
20	33	34	30	30	27	43	36	32	31	34	33	47
21	33	34	31	31	27	41	36	32	33	33	32	477
22	33	33	35	30	27	44	36	31	50	32	31	82
23	34	31	37	30	27	44	36	31	37	31	31	54
24	34	31	35	30	27	42	36	31	35	31	31	51
25	33	31	34	29	27	43	36	36	34	33	33	60
26	33	31	34	28	27	42	36	33	35	31	37	48
27	32	31	35	30	27	40	36	32	54	49	34	47
28	32	31	35	30	27	40	40	32	37	57	31	44
29	32	31	36	29	---	39	35	31	36	35	31	44
30	32	31	37	29	---	38	36	31	37	60	31	43
31	32	---	37	29	---	37	---	31	---	43	31	---
TOTAL	1028	993	1001	1000	785	1113	1106	1038	1032	1135	1049	2013
MEAN	33.2	33.1	32.3	32.3	28.0	35.9	36.9	33.5	34.4	36.6	33.8	67.1
MAX	36	40	37	39	33	73	43	39	54	60	38	477
MIN	32	31	30	28	27	27	35	31	31	31	31	31
AC-FT	2040	1970	1990	1980	1560	2210	2190	2060	2050	2250	2080	3990
CAL YR 1985	TOTAL	14589	MEAN 40.0	MAX 478	MIN 21	AC-FT 28940						
WTR YR 1986	TOTAL	13293	MEAN 36.4	MAX 477	MIN 27	AC-FT 26370						

## MISSISSIPPI RIVER MAIN STEM

05378500 MISSISSIPPI RIVER AT WINONA, MN

LOCATION.--Lat 44°03'21", long 91°38'16", in sec.23, T.107 N., R.7 W., Winona County, Hydrologic Unit 07040003, on right bank at Winona pumping station in Winona, 9.5 mi upstream from Trempealeau River, and at mile 725.7 upstream from the Ohio River.

DRAINAGE AREA.--59,200 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1928 to current year. Gage-height records collected in this vicinity since 1878 are contained in reports of Mississippi River Commission.

GAGE.--Water-stage recorder. Datum of gage is 639.64 ft above National Geodetic Vertical Datum of 1929. June 10, 1928, to Apr. 15, 1931, nonrecording gage at site 800 ft upstream. Prior to Oct. 1, 1929, at datum 0.20 ft higher and Oct. 1, 1929, to Apr. 15, 1931, at datum 0.12 ft lower. Apr. 16, 1931, to Nov. 12, 1934, nonrecording gage at present site and datum. Since Mar. 31, 1937, auxiliary water-stage recorder 2.7 mi upstream at tailwater of navigation dam 5A.

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

AVERAGE DISCHARGE.--58 years, 27,980 ft<sup>3</sup>/s, 6.42 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 268,000 ft<sup>3</sup>/s, Apr. 19, 1965, gage height, 20.77 ft, from floodmark; minimum, 1,940 ft<sup>3</sup>/s, Dec. 12, 1980, gage height, 3.96 ft, result of ice jam; minimum gage height, -3.38 ft, Aug. 31, 1934 (prior to dam construction in 1936); minimum gage height since 1938, after completion of dam, 1.95 ft, Jan. 27, 1944.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of June 18, 1880, reached an elevation of 657.14 ft, discharge, 172,000 ft<sup>3</sup>/s, from information by U.S. Army Corps of Engineers.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 167,000 ft<sup>3</sup>/s, Apr. 7, gage height, 16.60 ft; minimum daily discharge, 15,000 ft<sup>3</sup>/s, Nov. 30; minimum gage height, 5.16 ft, Nov. 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	57100	50000	22300	28700	22600	19800	97800	100000	71800	66700	57500	42000		
2	54200	47800	26800	28500	22700	19800	111000	107000	66400	66500	57600	38800		
3	56800	44100	25800	28500	23900	19900	126000	115000	62500	65700	55600	37900		
4	62300	44100	24300	28400	24000	20300	139000	120000	60800	62900	51400	38000		
5	65200	45800	23200	28400	24100	20900	153000	122000	60700	61000	49000	38900		
6	66400	47200	23100	28300	24100	21000	163000	124000	57600	60700	48800	38800		
7	69100	48200	26400	27500	24100	20200	166000	124000	54300	61300	48200	39900		
8	75700	47000	28500	25700	24400	18900	165000	123000	52500	59700	48300	40600		
9	84700	46000	30100	23700	24400	20000	161000	121000	49200	55800	47600	40900		
10	91100	43800	31700	23600	24200	20200	155000	118000	45900	51400	48000	43300		
11	92100	41300	31600	25200	22700	22500	148000	116000	47000	49100	48200	48400		
12	89900	38900	32200	25800	21000	22500	142000	114000	48000	48600	48400	50800		
13	85200	38100	32100	25900	19600	24500	137000	114000	48600	48000	48300	54000		
14	81000	37800	31500	26000	18200	26500	132000	115000	48900	47200	48600	56800		
15	78700	36600	29400	26100	18400	27800	128000	117000	48200	47400	49000	57700		
16	76800	35500	27900	25800	18600	28300	125000	122000	47100	49000	49400	57200		
17	75400	34900	28600	25500	19800	28100	121000	126000	47200	50200	50400	55700		
18	74000	34400	28300	25000	20100	28500	116000	128000	48000	51000	53300	55600		
19	72500	34500	28300	25200	20300	33100	112000	129000	48400	53000	54000	57700		
20	71300	35000	28300	25200	20800	38800	111000	128000	47800	54500	52700	59500		
21	68500	34800	28200	27300	20900	41000	109000	124000	47800	56800	50600	63900		
22	65400	34300	28300	24700	21100	45700	106000	119000	50000	58100	47000	75000		
23	63200	35300	28400	24600	21100	47200	102000	113000	52100	57500	44100	88400		
24	61200	32200	29400	24600	21100	51800	99600	107000	54500	55700	43000	105000		
25	61200	24500	28500	23900	20700	60200	98200	102000	58800	55600	42700	120000		
26	57200	18600	26900	23900	20600	63500	96400	95800	61400	55100	44500	133000		
27	55700	19700	26800	23500	20700	66300	94500	89700	63100	55500	46200	138000		
28	53500	20800	27600	20100	20300	68800	92600	84600	64000	56300	47200	138000		
29	49500	18000	28600	18800	---	78100	91800	82100	66000	56100	45700	136000		
30	47500	15000	28700	19700	---	83500	94400	79300	67600	56400	43600	135000		
31	49400	---	28700	21000	---	89600	---	76000	---	56600	43400	---		
TOTAL	2111800	1084200	870500	779100	604500	1177300	3693300	3455500	1646200	1729400	1512300	2084800		
MEAN	68120	36140	28080	25130	21590	37980	123100	111500	54870	55790	48780	69490		
MAX	92100	50000	32200	28700	24400	89600	166000	129000	71800	66700	57600	138000		
MIN	47500	15000	22300	18800	18200	18900	91800	76000	45900	47200	42700	37900		
CFSM	1.15	.61	.47	.42	.37	.64	2.08	1.88	.93	.94	.82	1.17		
IN.	1.33	.68	.55	.49	.38	.74	2.32	2.17	1.03	1.09	.95	1.31		
AC-FT	4189000	2151000	1727000	1545000	1199000	2335000	7326000	6854000	3265000	3430000	3000000	4135000		
CAL YR 1985	TOTAL	16011400	MEAN	43870	MAX	101000	MIN	15000	CFSM	.74	IN	10.06	AC-FT	31760000
WTR YR 1986	TOTAL	20748900	MEAN	56850	MAX	166000	MIN	15000	CFSM	.96	IN	13.04	AC-FT	41160000

## MISSISSIPPI RIVER MAIN STEM

05378500 MISSISSIPPI RIVER AT WINONA, MN--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1963 to current year.

## PERIOD OF DAILY RECORD.--

CHEMICAL DATA: April 1963 to August 1986 (discontinued).

SPECIFIC CONDUCTANCE: May 1980 to September 1984 (discontinued).

WATER TEMPERATURES: October 1975 to current year.

SUSPENDED-SEDIMENT DISCHARGE: September 1975 to current year.

REMARKS.--Daily sediment concentrations and loads were estimated on the basis of water records and sediment samples that were collected weekly during April 1 to September 30. No samples were collected October 1 to May 31. Water temperature was measured at the time of sample collection. Letter K indicates non-ideal colony count.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: Maximum daily, 550 microsiemens, July 17, 1984; minimum daily, 180 microsiemens, Sept. 24, 1980, May 9, 1981.

WATER TEMPERATURES: Maximum daily, 29.0°C, July 10, 1976; minimum daily, 0.0°C on many days each year.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 393 mg/L, July 2, 1978; minimum daily mean, 1 mg/L many days during several years.

SEDIMENT LOADS: Maximum daily, 65,300 tons, July 2, 1978; minimum daily, 19 tons, Dec. 12, 1980.

## EXTREMES FOR CURRENT PERIOD.--April to September 1986:

WATER TEMPERATURES: Maximum daily, 28.0°C, July 18; minimum daily, 0.0°C on many days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 83 mg/L, Apr. 6; minimum daily mean, 12 mg/L, July 21,

Aug. 24-26, Sept. 2.

SEDIMENT LOADS: Maximum daily, 36,500 tons, Apr. 6; minimum daily, 1,260 tons, Sept. 2.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, MEAN DAILY (CFS) (00060)	STREAM- FLOW, INSTAN- TANEOUS (CFS) (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, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)
NOV 25...	1050	--	24100	390	395	8.30	7.70	-1.5	1.0	4.0
JAN 14...	1315	26000	--	400	446	7.70	7.70	-4.0	0.0	2.6
APR 09...	1500	--	160000	370	350	7.90	7.80	12.0	8.0	4.5
AUG 20...	1345	--	52600	340	358	8.20	8.20	25.5	23.5	6.6

DATE	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)	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)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
NOV 25...	766	14.9	K11	K9	48	19	9.1	2.0	183	0
JAN 14...	773	13.4	K19	K8	51	20	11	2.5	222	0
APR 09...	770	11.0	K20	K24	41	13	5.8	3.7	152	0
AUG 20...	772	7.4	83	510	41	17	7.5	2.6	157	0

DATE	ALKA- LINITY, FIXED ENDPT, (MG/L AS CACO3) (99430)	ALKA- LINITY, FIXED FIELD (MG/L AS CACO3) (00410)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	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)	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)
NOV 25...	150	148	146	39	14	0.2	10	245	0.01
JAN 14...	182	182	166	34	16	0.2	15	264	0.02
APR 09...	125	124	123	29	8.9	0.2	12	216	0.03
AUG 20...	129	128	136	39	9.1	0.2	13	228	0.04

## MISSISSIPPI RIVER MAIN STEM

05378500 MISSISSIPPI RIVER AT WINONA, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	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)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. 7 FINER THAN .062 MM (70331)
NOV 25...	1.50	0.06	0.05	0.8	0.13	0.04	0.03	--	--
JAN 14...	1.60	0.46	0.45	1.1	0.09	0.07	0.07	--	--
APR 09...	2.20	0.21	0.20	0.9	0.14	0.08	0.06	--	--
AUG 20...	0.75	0.09	0.02	0.9	0.14	0.09	0.08	16	99

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	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)	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)
NOV 25...	1050	20	<1	38	2	<1	<1	<3	2	100	3
JAN 14...	1315	10	<1	44	0.6	<1	<1	<3	<1	110	4
AUG 20...	1345	<10	2	43	<0.5	<1	<1	<3	1	43	30

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)
NOV 25...	<4	26	<0.1	<10	2	<1	<1	120	<6	62
JAN 14...	11	88	3.0	<10	3	<1	<1	130	<6	4
AUG 20...	12	3	<0.1	<10	2	<1	<1	110	<6	42

## PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	NUMBER OF SAM- PLING POINTS (00063)	BED MAT. SIEVE DIAM. 7 FINER THAN .062 MM (80164)	BED MAT. SIEVE DIAM. 7 FINER THAN .125 MM (80165)	BED MAT. SIEVE DIAM. 7 FINER THAN .250 MM (80166)	BED MAT. SIEVE DIAM. 7 FINER THAN .500 MM (80167)	BED MAT. SIEVE DIAM. 7 FINER THAN 1.00 MM (80168)	BED MAT. SIEVE DIAM. 7 FINER THAN 2.00 MM (80169)	BED MAT. SIEVE DIAM. 7 FINER THAN 4.00 MM (80170)	BED MAT. SIEVE DIAM. 7 FINER THAN 8.00 MM (80171)	BED MAT. SIEVE DIAM. 7 FINER THAN 16.0 MM (80172)
APR 09...	4	<1	<1	3	49	88	95	97	99	100

## MISSISSIPPI RIVER MAIN STEM

05378500 MISSISSIPPI RIVER AT WINONA, MN--Continued

## SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)	MEAN CONCEN- TRATION (MG/L)	LOADS (T/DAY)
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1	56	14800	25	6750	18	3490	17	3060	19	2950	13	1470
2	63	18900	23	6640	18	3230	17	3050	20	3110	12	1260
3	68	23100	22	6830	17	2870	17	3020	21	3150	13	1330
4	72	27000	20	6480	17	2790	18	3060	21	2910	16	1640
5	77	31800	18	5930	16	2620	18	2960	21	2780	18	1890
6	83	36500	17	5690	17	2640	19	3110	21	2770	20	2100
7	80	35900	17	5690	17	2490	19	3140	21	2730	23	2480
8	60	26700	16	5310	16	2270	19	3060	21	2740	24	2630
9	39	17000	17	5550	15	1990	19	2860	22	2830	26	2870
10	22	9210	17	5420	14	1740	19	2640	20	2590	27	3160
11	20	7990	16	5010	13	1650	19	2520	19	2470	28	3660
12	20	7670	16	4920	13	1680	19	2490	18	2350	29	3980
13	19	7030	16	4920	14	1840	19	2460	17	2220	29	4230
14	18	6420	15	4660	15	1980	19	2420	15	1970	30	4600
15	17	5880	16	5050	15	1950	18	2300	14	1850	31	4830
16	16	5400	16	5270	15	1910	18	2380	13	1730	31	4790
17	16	5230	16	5440	15	1910	18	2440	17	2310	32	4810
18	17	5320	16	5530	14	1810	17	2340	18	2590	32	4800
19	16	4840	16	5570	14	1830	16	2290	17	2480	32	4990
20	16	4800	16	5530	15	1940	14	2060	16	2280	33	5300
21	16	4710	16	5360	16	2060	12	1840	15	2050	33	5690
22	15	4290	16	5140	16	2160	15	2350	14	1780	39	7900
23	14	3860	16	4880	16	2250	17	2640	13	1550	44	10500
24	15	4030	16	4620	16	2350	18	2710	12	1390	50	14200
25	15	3980	16	4410	19	3020	18	2700	12	1380	42	13600
26	15	3900	16	4140	19	3150	19	2830	12	1440	35	12600
27	20	5100	15	3630	18	3070	19	2850	13	1620	30	11200
28	29	7250	16	3650	18	3110	19	2890	13	1660	29	10800
29	27	6690	17	3770	18	3210	19	2880	13	1600	29	10600
30	26	6630	17	3640	18	3290	19	2890	13	1530	29	10600
31	---	---	18	3690	---	---	18	2750	13	1520	---	---
TOTAL	---	351930	---	159120	---	72300	---	82990	---	68330	---	174510

TOTAL LOAD FOR CURRENT PERIOD--April to September: 909180 TONS.

## IOWA RIVER BASIN

05457000 CEDAR RIVER NEAR AUSTIN, MN

LOCATION.--Lat 43°38'11", long 92°58'26", in NE¼SE¼ sec.15, T.102 N., R.18 W., Mower County, Hydrologic Unit 07080201, on left bank 200 ft upstream from abandoned powerhouse, 500 ft downstream from highway bridge, 1.1 mi downstream from Turtle Creek, and 1.1 mi south of Austin.

DRAINAGE AREA.--425 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1909 to September 1914, October 1944 to current year.

REVISED RECORDS.--WSP 1145: 1945, 1948.

GAGE.--Water-stage recorder. Datum of gage is 1,162.10 ft above National Geodetic Vertical Datum of 1929. May 1909 to April 1912, nonrecording gage in tailwater of powerplant 200 ft downstream at datum 3.1 ft lower. May 1912 to September 1914, nonrecording gage on highway bridge 500 ft downstream at datum 1.1 ft lower.

REMARKS.--Estimated daily discharges: Nov. 20, to Jan. 18, 23, Jan. 26 to Feb. 27, and Mar. 7, 8, 18-20. Records good except those for periods with ice effect, Nov. 20 to Jan 18, 23, Jan. 26 to Feb. 27, Mar. 7, 8, and period of no gage height record, Mar. 18-20, which are fair.

AVERAGE DISCHARGE.--47 years (water years 1910-14, 1945-86), 211 ft<sup>3</sup>/s, 6.74 in/yr; median of yearly mean discharges, 199 ft<sup>3</sup>/s, 6.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,400 ft<sup>3</sup>/s, July 17, 1978, gage height, 20.35 ft, from floodmark in well; no flow for several days in 1911.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 19	0100	*4,440	*11.22	May 14	1300	3,070	9.00
Mar. 24	0045	2,220	7.49	July 6	1800	1,720	6.53
Apr. 5	2230	1,570	6.22	Sept. 23	0230	1,860	6.80
Apr. 29	0030	1,820	6.72				

Minimum discharge, 47 ft<sup>3</sup>/s, Mar. 7, gage height, 2.26 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	767	156	120	89	81	77	743	789	289	237	122	116
2	683	150	115	91	81	78	772	605	262	222	124	108
3	454	144	110	92	81	80	702	495	242	202	105	111
4	384	136	106	94	80	87	977	431	293	184	101	134
5	547	130	104	93	78	90	1330	392	406	218	97	121
6	903	134	100	90	74	88	1390	350	336	1400	97	108
7	702	133	97	88	70	87	1020	305	292	1260	94	98
8	475	135	94	88	66	86	742	280	262	858	92	95
9	391	128	93	88	63	89	582	349	234	599	86	97
10	336	123	91	91	61	97	485	371	219	490	90	103
11	295	127	88	94	60	109	423	661	213	420	83	130
12	287	131	88	96	60	128	380	1070	207	352	80	142
13	280	140	87	98	61	158	338	1640	192	350	82	138
14	279	143	86	99	61	165	417	2920	179	362	242	143
15	266	144	85	100	62	198	616	2140	173	313	125	180
16	249	162	85	101	63	399	581	1340	190	329	99	229
17	231	172	84	102	64	759	485	1060	176	369	88	209
18	227	220	84	102	66	3050	447	830	194	288	82	188
19	216	486	84	99	66	3900	482	665	267	238	81	372
20	203	400	83	98	64	2700	471	552	217	202	78	654
21	196	258	83	99	62	2180	418	482	217	180	78	1590
22	190	215	84	93	61	1760	358	426	987	165	75	1790
23	191	190	84	96	64	2000	316	383	1220	150	75	1700
24	184	175	85	95	66	1980	298	347	882	140	71	1060
25	173	160	85	93	68	1470	279	344	562	185	73	1120
26	166	150	86	89	71	1430	279	415	426	152	870	1200
27	160	145	86	85	73	1120	381	466	355	142	579	944
28	153	140	87	81	76	801	1250	425	308	135	272	732
29	149	133	87	80	---	763	1590	376	272	128	181	608
30	145	128	88	81	---	747	1110	345	250	127	148	485
31	146	---	88	81	---	657	---	316	---	120	129	---
TOTAL	10028	5188	2827	2866	1903	27333	19662	21570	10322	10517	4599	14705
MEAN	323	173	91.2	92.5	68.0	882	655	696	344	339	148	490
MAX	903	486	120	102	81	3900	1590	2920	1220	1400	870	1790
MIN	145	123	83	80	60	77	279	280	173	120	71	95
CFSM	.76	.41	.22	.22	.16	2.08	1.54	1.64	.81	.80	.35	1.15
IN.	.88	.45	.25	.25	.17	2.39	1.72	1.89	.90	.92	.40	1.29
AC-FT	19890	10290	5610	5680	3770	54210	39000	42780	20470	20860	9120	29170
CAL YR 1985	TOTAL	69367	MEAN 190	MAX 2060	MIN 39	CFSM .45	IN 6.07	AC-FT	137600			
WTR YR 1986	TOTAL	131520	MEAN 360	MAX 3900	MIN 60	CFSM .85	IN 11.51	AC-FT	260900			

## DES MOINES RIVER BASIN

05476000 DES MOINES RIVER AT JACKSON, MN

LOCATION.--Lat 43°37'10", long 94°59'10", in SE¼SW¼ sec.24, T.102 N., R.35 W., Jackson County, Hydrologic Unit 07100001, on right bank in storage room of city powerplant in Jackson.

DRAINAGE AREA.--1,220 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--May 1909 to December 1913, August 1930 to current year (winter record incomplete prior to 1936). Published as Des Moines River near Jackson, 1930-35, as West Fork Des Moines River near Jackson, 1936-44, and as West Fork Des Moines River at Jackson, 1945-69.

REVISED RECORDS.--WSP 1115: 1942. WSP 1175: Drainage area. WSP 1238: 1950. WSP 1308: 1938(M).

GAGE.--Water-stage recorder. Datum of gage is 1,287.75 ft above National Geodetic Vertical Datum of 1929. May 31, 1909, to Dec. 20, 1913, nonrecording gage at site 0.6 mi downstream at datum 0.99 ft lower. Aug. 22, 1930, to Sept. 30, 1944, nonrecording gage at site 7 mi upstream at datum 17.10 ft higher. Oct. 1, 1944, to Oct. 26, 1949, nonrecording gage at site 600 ft upstream at datum 10.64 ft higher. Oct. 27, 1949, to Dec. 15, 1965, water-stage recorder 200 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 9 to Mar. 26, July 11-15, 20-23, Aug. 30, 31, and Sept. 21. Records good except those for periods with ice effect, Nov. 9 to Feb. 11, Feb. 27 to Mar. 26, and periods of no gage-height record, Feb. 12-26, July 11-15, 20-23, and Aug. 30, 31, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes.

AVERAGE DISCHARGE.--51 years (water years 1936-86), 329 ft<sup>3</sup>/s, 3.66 in/yr; median of yearly mean discharges, 245 ft<sup>3</sup>/s, 2.73 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,700 ft<sup>3</sup>/s, Apr. 11, 1969, gage height, 19.45 ft; no flow at times.

EXTREMES FOR CURRENT YEAR.--Peak discharge above base of 900 ft<sup>3</sup>/s (revised) and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 26	1800	4,110	13.68	June 22	1100	1,330	7.92
Apr. 30	0445	3,240	12.79	July 6	1800	2,030	9.84
June 4	1300	2,360	10.78	Sept. 28	about 1800	*4,980	*a14.14

a From graph based on gage readings.

Minimum discharge, 13 ft<sup>3</sup>/s, Sept. 11, gage height, 2.83 ft, gate closed in dam.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	493	424	147	100	78	85	2970	2780	1350	1430	521	251		
2	518	408	140	100	75	108	2790	2650	1270	1560	537	243		
3	528	389	134	100	73	347	2660	2630	1190	1640	541	243		
4	563	382	128	100	73	388	2680	2610	1770	1740	503	242		
5	634	367	122	100	73	563	3000	2560	1560	1860	468	235		
6	651	338	118	100	74	575	3280	2440	1440	2000	440	213		
7	652	336	115	100	74	518	3140	2240	1330	1990	410	198		
8	655	357	112	100	74	484	2940	2030	1250	1890	376	218		
9	640	291	108	100	74	475	2830	1920	1160	1780	347	170		
10	610	172	105	99	74	493	2760	1940	1100	1670	335	179		
11	591	180	105	99	75	510	2650	1970	1070	1650	292	171		
12	601	239	105	98	76	515	2500	2010	1030	1600	261	286		
13	630	292	105	98	77	557	2310	2160	1000	1560	257	315		
14	635	285	104	98	76	569	2160	2090	1010	1500	257	407		
15	653	250	104	98	74	566	2060	2100	993	1460	234	506		
16	652	266	103	97	69	566	1940	2120	945	1430	212	541		
17	656	291	102	96	67	625	1820	2140	869	1340	211	598		
18	650	295	101	96	65	1460	1800	2100	810	1230	201	789		
19	633	218	101	95	64	1660	1850	2050	775	1150	198	1110		
20	613	141	101	95	64	1840	1890	2010	735	1090	251	1470		
21	599	150	100	94	63	1830	1840	1960	972	1020	292	1700		
22	590	170	100	92	62	1630	1760	1880	1210	960	259	2010		
23	581	170	100	90	61	1620	1740	1780	1160	880	231	2580		
24	576	170	100	90	61	2150	1740	1670	1080	842	208	3620		
25	550	170	100	88	63	3070	1690	1600	1010	795	161	4500		
26	535	168	100	87	65	3960	1610	1540	987	729	242	4810		
27	512	165	100	87	69	3760	1580	1530	984	683	357	4910		
28	478	162	100	86	76	3360	1850	1550	1080	634	297	4970		
29	465	157	100	84	---	3170	2690	1520	1190	586	257	4800		
30	454	150	100	83	---	3120	3110	1480	1320	566	255	4490		
31	429	---	100	81	---	3080	---	1430	---	525	253	---		
TOTAL	18057	7553	3360	2931	1969	43654	69640	62490	33650	39790	9664	46775		
MEAN	582	252	108	94.5	70.3	1408	2321	2016	1122	1284	312	1559		
MAX	652	424	147	100	78	3960	3280	2780	1770	2000	541	4970		
MIN	429	141	100	81	61	85	1580	1430	735	525	161	170		
CFSM	.48	.21	.09	.08	.06	1.15	1.90	1.65	.92	1.05	.26	1.28		
IN.	.55	.23	.10	.09	.06	1.33	2.12	1.91	1.03	1.21	.29	1.43		
AC-FT	35820	14980	6660	5810	3910	86590	138100	123900	66740	78920	19170	92780		
CAL YR 1985	TOTAL	189294	MEAN	519	MAX	2380	MIN	22	CFSM	.43	IN	5.77	AC-FT	375500
WTR YR 1986	TOTAL	339533	MEAN	930	MAX	4970	MIN	61	CFSM	.76	IN	10.35	AC-FT	673500

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or flood-flow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations and the second is a table of annual maximum stage and discharge at crest-stage stations. Discharge measurements made at miscellaneous sites for both low flow and high flow are given in a third table.

## Low-flow partial-record stations

Measurements of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. These measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream when continuous records are available, will give a picture of the low-flow potentiality of a stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same site.

Discharge measurements made at low-flow partial-record stations during water year 1986

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Date	Discharge (ft <sup>3</sup> /s)
Iowa River basin						
05458960	Bancroft Creek at Bancroft, MN	Lat 43°42'09", long 93°21'23", in SW¼SE¼ sec.21, T.103 N., R.21 W., Freeborn County, Hydrologic Unit 07080202, at bridge on County road 14, 1.6 miles northeast of Fountain Lake, 1 mile north of Interstate 90.	a29	1985, 1986 §	4- 3-86 7-31-86 9-23-86	45.9 8.93 49.2

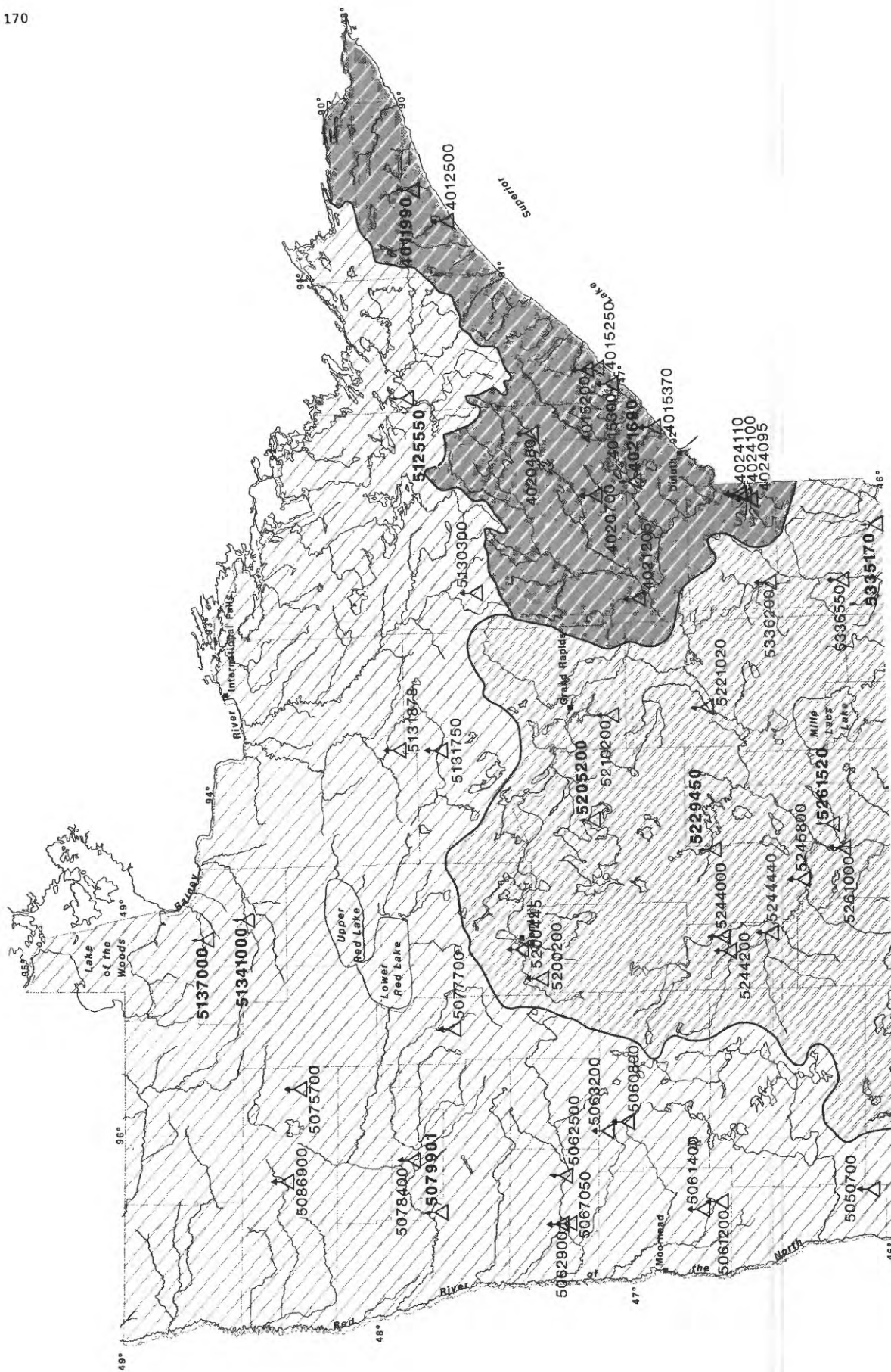
§ - Operated as a high-flow partial record station.

a - approximately.

### High-Flow Partial Record Stations



Roseau River near Haug, Minnesota  
Photo by U.S. Geological Survey  
circa 1929



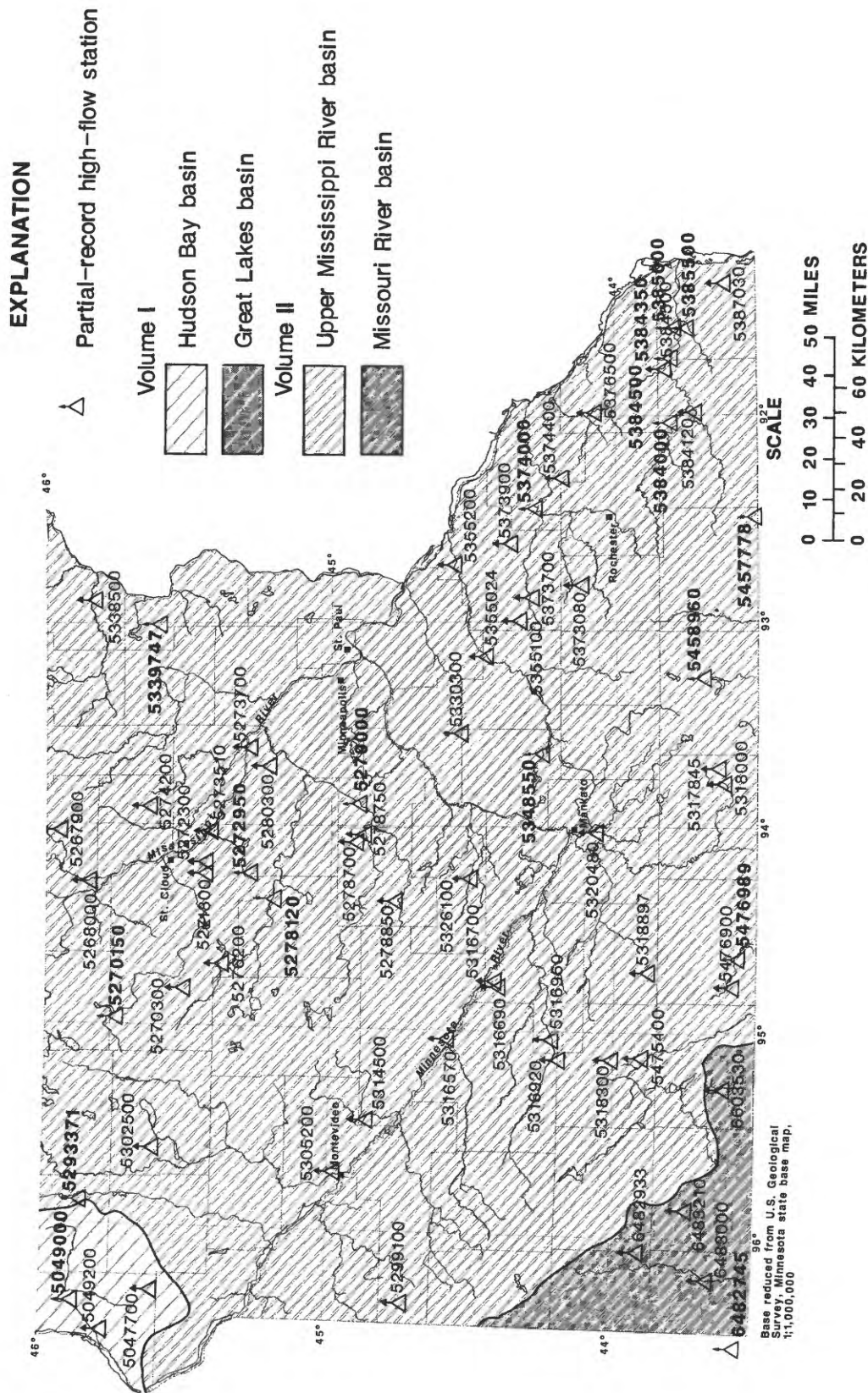


Figure 10. -- Location of high-flow partial-record stations

## 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 station 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 1986

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum	
						Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Mississippi River main stem							
05200200	Hennepin Creek near Becida, MN	Lat 47°23'52", long 95°05'12", in NW¼NE¼ sec.11, T.145 N., R.35 W., Hubbard County, Hydrologic Unit 07010101, gages upstream and downstream from culvert on Stumphges Rapids Trail approximately 0.5 mile west of Hubbard County Road 3, 3 miles north of Becida, 1.5 miles upstream from mouth.	41.4	1979-86	4- 3-86	12.24	105
05200445	Mississippi River at Bemidji, MN	Lat 47°27'04", long 94°54'23", in NW¼NW¼ sec.20, T.146 N., R.33 W., Beltrami County, Hydrologic Unit 07010101, at bridge on County Highway 11, 1.5 miles southwest of intersection of U.S. Highway 2 and County Highway 7 in Bemidji.	400	1973-86	4- 6-86	11.87	620
Leech Lake River basin							
05205200	Boy River near Remer, MN	Lat 47°04'51", long 94°05'54", in SE¼SE¼ sec.28 T.142 N., R.27 W., Cass County, Hydrologic Unit 07010102, at bridge on County Highway 53, 1.9 miles upstream from Boy Lake and 9 miles northwest of Remer.	310	1986	4- 3-86	10.92	530
Smith Creek basin							
05210200	Smith Creek near Hill City, MN	Lat 47°04'58", long 93°34'59", in SE¼NW¼ sec.13, T.53 N., R.26 W., Itasca County, Hydrologic Unit 07010101, at culvert on U.S. Highway 169, 6.2 miles north of Hill City.	8.00	1961-86	4-28-86	5.43	84
Willow River basin							
05221020	Willow River below Palisade, MN	Lat 46°42'36", long 93°33'21", in NW¼NE¼ sec.30, T.49 N., R.25 W., Aitkin County, Hydrologic Unit 07010103, at bridge on County Highway 3, 3.2 miles west of Palisade.	445	1972-86	4-30-86	13.42	1,870
Pine River basin							
05229450	Pine River near Pine River, MN	Lat 46°41'39", long 94°22'11", in NE¼SE¼ sec.8., T.137 N., R.29 W., Cass County, Hydrologic Unit 07010105, at bridge 2.3 miles southeast of Pine River, on U.S. Highway 371, 4.9 miles upstream of upper Whitefish Lake.	285	1986	3-28-86	4.35	1,150

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Crow Wing River basin							
05244000	Crow Wing River at Nimrod, MN	Lat 46°38'25", long 94°52'44", in SE¼NW¼ sec.32, T.137 N., R.33 W., Wadena County, Hydrologic Unit 07010106, 200 ft upstream from bridge on County Highway 121, 0.2 mile north of Nimrod, 0.7 mile upstream of Cat River.	1,010	1910-14#, 1931-81#, 1982-86	4-30-86	4.91	1,720
05244200	Cat River near Nimrod, MN	Lat 46°37'49", long 94°55'51", in SW¼SW¼ sec.36, T.137 N., R.34 W., Wadena County, Hydrologic Unit 07010106, at bridge on State Highway 227, 2.5 miles west of Nimrod, 3.0 miles upstream from mouth.	49.2	1961-86	4-29-86	6.46	205
05244440	Leaf River near Aldrich, MN	Lat 46°27'25", long 94°50'29", in SW¼SW¼ sec.34, T.135 N., R.33 W., Wadena County, Hydrologic Unit 07010107, at bridge on County Highway 29, 3.3 miles upstream from mouth, 7.0 miles northeast of Aldrich.	860	1972-86	4-30-86	14.89	3,260
05245800	Sevenmile Creek near Pillager, MN	Lat 46°20'32", long 94°32'56", in SW¼SE¼ sec.11, T.133 N., R.31 W., Cass County, Hydrologic Unit 07010106, at downstream wing wall of bridge on township road, 3.5 miles northwest of Pillager, 3.2 miles upstream from mouth.	18.3	1979-86	4- 1-86	12.20	108
Mississippi River main stem							
05261000	Mississippi River near Fort Ripley, MN	Lat 46°10'50", long 94°21'56", in SE¼NW¼ sec.27, T.43 N., R.32 W., Crow Wing County, Hydrologic Unit 07010104, on left bank 600 ft upstream from Nokasippi River, 1.0 mile north of Fort Ripley.	11,010	1929#, 1972-86	4- 5-86	1,145.54	21,600
Nokasippi River basin							
05261520	Nokasippi River near Fort Ripley, MN	Lat 46°12'02", long 94°19'03" on line between secs.13 and 24, T.43 N., R.32 W., Crow Wing County, Hydrologic Unit 07010104, at bridge on County Highway 2, 3 miles northeast of Fort Ripley.	178	1967-70, 1974, 1976, 1986	4- 4-86	13.90	828
Platte River basin							
05267900	Hillman Creek near Pierz,	Lat 45°58'27", long 94°04'21", in NE¼SE¼ sec.9, T.40 N., R.30 W., Morrison County, Hydrologic Unit 07010201, at bridge on county highway, 1.1 miles upstream from mouth, 1.5 miles east of Pierz.	46.7	1964-86	4- 4-86	13.96	680
05268000	Platte River above Royalton, MN	Lat 45°50'43", long 94°17'40", in SE¼NW¼ sec.26, T.39 N., R.32 W., Morrison County, Hydrologic Unit 07010201, at bridge on County Highway 27, 0.6 mile north of Royalton, 6.6 miles upstream from mouth.	335	1929-36#, 1972-86	5-13-86	12.85	2,390
Sauk River basin							
05270150	Ashley Creek near Sauk Centre, MN	Lat 45°46'46", long 94°58'52", in NW¼SE¼ sec.29, T.127 N., R.34, Todd County, Hydrologic Unit 07010202, at bridge on County Highway 11, 3 miles north of Sauk Centre.	113	1968-70, 1974, 1976, 1986	9-25-86	16.52	600

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Sauk River basin--Continued							
05270300	Sauk River tributary at Spring Hill, MN	Lat 45°31'22", long 94°48'31", in SW¼NE¼ sec.27, T.124 N., R.33 W., Stearns County, Hydrologic Unit 07010202, at culvert on State Highway 4, 1.0 mile east of Spring Hill, 2.7 miles upstream from mouth.	7.06	1960-86	7-18-86	15.51	700
Johnson Creek basin							
05271800	Johnson Creek tributary at Luxemburg, MN	Lat 45°26'30", long 94°14'46", in NW¼NE¼ sec.30, T.123 N., R.28 W., Stearns County, Hydrologic Unit 07010203, at culverts on State Highway 15, 0.8 mile south of Luxemburg.	3.82	1964-86	9-16-86	7.33	32
05272300	Johnson Creek near St. Augusta, MN	Lat 45°27'49", long 94°09'19", in NW¼SW¼ sec.13, T.123 N., R.28 W., Stearns County, Hydrologic Unit 07010203, at bridge on County Highway 7, 1.0 mile south of St. Augusta, 3.3 miles upstream from mouth.	46.7	1964-86	4-28-86	13.46	305
Clearwater River basin							
05272950	Clearwater River near South Haven, MN	Lat 45°16'45", long 94°15'04", in NE¼NW¼ in sec.19, T.121 N., R.28 W., Wright County, Hydrologic Unit 07010203 at culverts 3.4 miles southeast of Kimball, 0.25 mile downstream of Scott Lake Outlet, 2.0 miles southeast of South Haven.	-	1985-86	9- 9-85 9-22-86	17.11 15.78	f1,040 490
Mississippi River main stem							
05273510	Mississippi River at Clearwater, MN	Lat 45°25'15", long 94°02'37", in NW¼SW¼ sec.23, T.34 N., R.30 W., Sherburne County, Hydrologic Unit 07010203, on left bank 700 ft upstream from bridge, on State Highway 24 at Clearwater.	-	1972-86	4- 6-86	17.07	28,800
Otsego Creek basin							
05273700	Otsego Creek near Otsego, MN	Lat 45°17'19", long 93°38'59", in SW¼NE¼ sec.13, T.131 N., R.24 W., Wright County, Hydrologic Unit 07010203, at culvert on County Highway 39, 1.3 miles upstream from mouth, 1.9 miles west of Otsego.	3.11	1964-86	4-28-86	4.54	100
Elk River basin							
05274200	Stony Brook tributary near Foley, MN	Lat 45°38'42", long 93°54'54", in NE¼NW¼ sec.2, T.36 N., R.29 W., Benton County, Hydrologic Unit 07010203, at culvert on State Highway 25, 0.3 mile upstream from mouth, 1.5 miles south of Foley.	2.26	1960-86	5-10-86	13.08	180
Crow River basin							
05276200	North Fork Crow River at Paynesville, MN	Lat 45°23'09", long 94°42'41", in SW¼SE¼ sec.9, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at bridge on county road at northeast edge of Paynesville city limits.	236	1973-86	9-22-86	6.68	1,370

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Crow River basin--Continued							
05278120	North Fork Crow River near Kingston, MN	Lat 45°12'13", long 94°23'16", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec 13, T.120 N., Meeker County, Hydrologic Unit 07010204, at bridge on State Highway 24, 3.7 miles west of Kingston, 3.9 miles east of Forest City.	-	1986	5- 1-86	17.82	4,850
05278700	Otter Creek near Lester Prairie, MN	Lat 44°54'23", long 94°04'24", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.28, T.117 N., R.27 W., McLeod County, Hydrologic Unit 07010205, at culvert on State Highway 7, 2.1 miles northwest of Lester Prairie, 4.4 miles upstream from mouth.	30.2	1961-86	3-23-86	18.12	200
05278750	Otter Creek tributary near Lester Prairie, MN	Lat 44°53'34", long 94°04'24", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.33, T.117 N., R.27 W., McLeod County, Hydrologic Unit 07010205, at culvert on County Highway 63, 1.7 miles northwest of Lester Prairie, 3.3 miles upstream from mouth.	1.54	1962-86	4-14-86	8.88	5
05278850	Buffalo Creek tributary near Brownton, MN	Lat 44°45'55", long 94°22'33", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.13, T.115 N., R.30 W., McLeod County, Hydrologic Unit 07010205, at culvert on State Highway 15, 0.6 mile upstream from mouth, 2.6 miles northwest of Brownton.	9.45	1961-86	6-22-86	14.18	48
05279000	South Fork Crow River near Mayer, MN	Lat 44°54'20", long 93°53'05", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.117 N., R.25 W., Carver County, Hydrologic Unit 07010205, near center of span on downstream side of bridge on State Highway 7, 1.3 miles north of Mayer, 4.3 miles southwest of Watertown, 16 miles upstream from confluence with North Fork.	1,170	1934-79#, 1980-84, 1986	5- 4-86	13.93	5,980
05280300	School Lake Creek tributary near St. Michael, MN	Lat 45°12'09", long 93°41'31", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.15, T.120 N., R.24 W., Wright County, Hydrologic Unit 07010204, at culvert on county highway, 0.2 mile upstream from mouth, 1.5 miles southwest of St. Michael.	2.04	1964-86	4-28-86	8.47	44
Minnesota River basin							
05293371	Pomme de terre River near Elbow Lake, MN	Lat 46°57'47", long 95°53'07", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.19, T.129 N., R.41 W., Grant County, Hydrologic Unit 07020002, at bridge on County Road 47, 4 miles southeast of Elbow Lake, 2.5 miles south of the outlet of Pomme de Terre Lake, in a national water fowl production area.	340	1986	6-23-86	4.87	159
05299100	Lazarus Creek tributary near Canby, MN	Lat 44°43'04", long 96°19'42", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.6, T.114 N., R.45 W., Yellow Medicine County, Hydrologic Unit 07020003, at culvert on State Highway 68, 2.7 miles west of Canby, 4.2 miles upstream from mouth.	2.97	1960-86	7-19-86	12.10	190
05302500	Little Chippewa River near Starbuck, MN	Lat 45°36'52", long 95°37'12", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.30, T.125 N., R.39 W., Pope County, Hydrologic Unit 07020005, at downstream wing wall on triple box culvert on State Highway 28, 4.4 miles west of Starbuck.	69.6	1979-86	8- 9-86	12.57	140

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Minnesota River basin--Continued							
05305200	Spring Creek near Montevideo, MN	Lat 44°58'41", long 95°42'57", in NW¼NW¼ sec.5, T.117 N., R.40 W., Chippewa County, Hydrologic Unit 07020005, at culvert on State Highway 29, 1.2 miles upstream from mouth, 2.0 miles north of Montevideo.	16.0	1959-86	3-23-86	15.21	172
05314500	Hawk Creek near Maynard, MN	Lat 44°52'10", long 95°28'58", in SW¼NW¼ sec.7, T.116 N., R.38 W., at Renville and Chippewa County line, Hydrologic Unit 07020004, at right downstream side of bridge on State Highway 23, 3.0 miles southwest of Maynard.	474	1949-54#, 1981-86	7-28-86	17.46	2,070
05316570	Beaver Creek at Beaver Falls, MN	Lat 44°35'03", long 95°02'49", in NE¼NW¼ sec.22, T.113 N., R.35 W., Renville County, Hydrologic Unit 07020004, at bridge on County Highway 2 in Beaver Falls, 2.2 miles upstream from mouth, 3.8 miles northwest of Morton.	194	1972-86	3-23-86	c11.29	1,060
05316690	Spring Creek tributary near Sleepy Eye, MN	Lat 44°23'54", long 94°45'35", in NW¼ sec.25, T.111 N., R.33 W., Brown County, Hydrologic Unit 07020007, at culvert on county highway, 0.1 mile upstream from mouth, 7.5 miles north of Sleepy Eye.	3.69	1966-86	4-28-86	5.42	60
05316700	Spring Creek near Sleepy Eye, MN	Lat 44°24'12", long 94°44'41", in NE¼SE¼ sec.24, T.111 N., R.33 W., Brown County, Hydrologic Unit 07020007, at culvert on county highway, 4.3 miles upstream from mouth, 7.5 miles north of Sleepy Eye.	31.3	1959-86	4-28-86	13.78	428
05316920	Cottonwood River tributary No. 2 near Sanborn, MN	Lat 44°10'34", long 95°07'15", in SW¼NW¼ sec.12, T.108 N., R.36 W., Cottonwood County, Hydrologic Unit 07020008, at culvert on U.S. Highway 71, 2.4 miles south of Sanborn.	.42	1966-86	7-30-86	5.79	61
05316950	Cottonwood River near Springfield, MN	Lat 44°12'12", long 95°02'53", on line between secs.33 and 34, T.109 N., R.35 W., Brown County, Hydrologic Unit 07020008, at bridge on County Highway 2, 1.3 miles downstream from Mound Creek, 1.0 mile upstream from Coal Mine Creek, 3.5 miles southwest of Springfield.	773	1973-86	9-22-86	d26.82	8,200
05317845	East Branch Blue Earth River near Walters, MN	Lat 43°37'58", long 93°42'28", in SE¼SE¼ sec.16, T.102 N., R.24 W., Faribault County, Hydrologic Unit 07020009, at left downstream wing wall of box culvert on State Highway 22, 2.5 miles northwest of Walters.	29.6	1979-86	3-18-86	c17.72	425
05318000	East Branch Blue Earth River near Bricelyn, MN	Lat 43°37'50", long 93°47'25", in NE¼NE¼ sec.23, T.102 N., R.25 W., Faribault County, Hydrologic Unit 07020009, at bridge on county highway, 2.0 miles upstream from Brush Creek, 3.0 miles downstream from South Walnut Lake, 5.0 miles northeast of Bricelyn.	132	1973-86	3-18-86	10.33	580

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Minnesota River basin--Continued							
05318300	Watonwan River near Delft, MN	Lat 43°59'55", long 95°07'11", in NE¼SE¼ sec.11, T.106 N., R.36 W., Cottonwood County, Hydrologic Unit 07020010, at culvert on U.S. Highway 71, 1.7 miles northwest of Delft.	13.0	1960-86	4-29-86	e16.54	340
05318897	South Fork Watonwan River near Ormsby, MN	Lat 43°53'08", long 94°41'27", in SE¼NW¼ sec.21, T.105 N., R.32 W., Watonwan County, Hydrologic Unit 07020010, at right downstream wing wall of bridge on township road, 2.6 miles north of Ormsby, 5.0 miles upstream from mouth at Willow Creek.	109	1979-86	3-18-86	c16.15	670
05320480	Maple River near Rapidan, MN	Lat 44°03'54", long 94°01'32", in SW¼ sec.13, T.107 N., R.27 W., Blue Earth County, Hydrologic Unit 07020011, at bridge on County Highway 35, 3.0 miles southeast of Rapidan, 3.3 miles upstream from mouth.	343	1972-86	6-21-86	10.60	2,300
05326100	Middle Branch Rush River near Gaylord, MN	Lat 44°30'27", long 94°15'00", in SW¼NW¼ sec.18, T.112 N., on line between R.28 W. and R.29 W., Sibley County, Hydrologic Unit 07020012, at downstream side of bridge on township road, 3.0 miles southwest of Gaylord, 10.5 miles upstream from the main branch of Rush River.	68.5	1979-86	8- 5-84 3-15-85 6-22-86	17.43 16.65 18.03	f810 f700 900
05330300	Sand Creek near New Prague, MN	Lat 44°32'37", long 93°32'16", in NE¼NW¼ sec.1, T.112 N., R.23 W., Le Sueur County, Hydrologic Unit 07020012, at culvert on State Highway 13 and 19, 1.9 miles east of New Prague.	62.4	1960-86	9-21-86	11.22	350
St. Croix River basin							
05335170	Crooked Creek near Hinckley, MN	Lat 46°00'42", long 92°31'45", in NE¼NE¼ sec.30, T.41 N., R.17 W., Pine County, Hydrologic Unit 07030001, at triple box culvert on State Highway 48, 2.7 miles upstream from mouth, 8 miles south of Duxbury, 19 miles east of Hinckley.	93	1966-70, 1974-76, 1979-80, 1986	4- 2-86	14.16	1,080
05336200	Glaishy Brook near Kettle River, MN	Lat 46°27'19", long 92°51'34", in SE¼NW¼ sec.22, T.46 N., R.20 W., Carlton County, Hydrologic Unit 07030003, at bridge on State Highways 27 and 73, 1.0 mile upstream from mouth, 2.4 miles south of Kettle River.	27.5	1960-70#, 1971-86	4-28-86	6.64	580
05336550	Wolf Creek tributary near Sandstone, MN	Lat 46°09'45", long 92°51'58", in NE¼SE¼ sec.33, T.43 N., R.20 W., Pine County, Hydrologic Unit 07030003, at culvert on U.S. Highway 61, 0.2 mile upstream from mouth, 2.2 miles north of Sandstone.	5.46	1960-86	4-28-86	18.69	170
05338500	Snake River near Pine City, MN	Lat 45°50'30", long 92°56'00", in SE¼NW¼ sec.26, T.39 N., R.21 W., Pine County, Hydrologic Unit 07030004, on left bank at site of former powerplant and dam, 0.5 mile downstream from Cross Lake and 1.5 miles northeast of Pine City.	958	1913-17, 1951-81#, 1982-86	4- 6-86	8.33	8,140

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
St. Croix River basin--Continued							
05339747	Goose Creek at Harris, MN	Lat 45°35'11", long 92°58'39", in SW¼SW¼ sec.21, T.36 N., R.21 W., Chisago County, Hydrologic Unit 07030005, at culverts on County Highway 9, 0.15 mile east of County Highway 30 in Harris, 8 miles above mouth.	a60	1986	5-12-86	7.09	235
Cannon River basin							
05348550	Cannon River below Sabre Lake near Kilkenny, MN	Lat 44°17'50", long 93°37'44", in NE¼NE¼ sec. 31, T.110 N., R.23 W., LeSueur County, Hydrologic Unit 07040002, at right downstream side of bridge, on township road, 0.25 mile downstream of Sabre Lake, 3 miles southeast of Kilkenny.	-	1985-86	9-22-86	13.36	400
05355024	Cannon River at Northfield, MN	Lat 44°27'19", long 93°09'46", in NE¼NE¼ sec.1, T.111 N., R.20 W., Rice County, Hydrologic Unit 07040002, on left bank at downstream side of Fifth Street bridge in Northfield.	934	1980-86	6-24-86	904.19	5,400
05355100	Little Cannon River tributary near Kenyon, MN	Lat 44°20'45", long 92°58'47", in NE¼SE¼ sec.9, T.110 N., R.18 W., Goodhue County, Hydrologic Unit 07040002, at culvert on State Highway 56, 0.3 mile upstream from mouth, 5.3 miles north of Kenyon.	2.20	1960-86	9-21-86	20.74	1,030
05355200	Cannon River at Welch, MN	Lat 44°33'50", long 92°43'55", in NW¼SW¼ sec.27, T.113 N., R.16 W., Goodhue County, Hydrologic Unit 07040002, on right bank 0.3 mile downstream from highway bridge at Welch, 1.8 miles upstream from Belle Creek.	1,320	1909-14#, 1930-71#, 1973-86	9-22-86	13.80	33,700
Zumbro River basin							
05373080	Milliken Creek near Concord, MN	Lat 44°07'13", long 92°49'08", in NW¼NW¼ sec.36, T.108 N., R.17 W., Dodge County, Hydrologic Unit 07040004, at bridge on County Road 9, 8.0 miles upstream from mouth, 2.1 miles southeast of Concord.	22.2	1979-86	6-22-86	e13.60	480
05373700	Spring Creek near Wanamingo, MN	Lat 44°17'13", long 92°52'17", in SE¼SE¼ sec.32, T.110 N., R.17 W., Goodhue County, Hydrologic Unit 07040004, at culvert on County Highway 1, 3.5 miles upstream from mouth, 4.2 miles southwest of Wanamingo.	9.93	1960-86	9-21-86	16.08	2,050
05373900	Trout Brook tributary near Goodhue, MN	Lat 44°21'30", long 92°36'58", in NE¼SE¼ sec.4, T.110 N., R.15 W., Goodhue County, Hydrologic Unit 07040004, at culvert on State Highway 58, 0.8 mile upstream from mouth, 3.0 miles south of Goodhue.	.40	1960-86	9-21-86	9.68	225
05374000	Zumbro River at Zumbro Falls, MN	Lat 44°17'12", long 92°25'56", in sec.36, T.110 N., R.14 W., Wabasha County, Hydrologic Unit 07040004, on left bank in Zumbro Falls, 1,000 ft downstream from Cold Creek, 0.7 mile upstream from bridge on U.S. Highway 63, 6.3 miles downstream from North North Fork Zumbro River.	1,130	1909-17, 1929, 1930-80#, 1985-86	f3-11-85 9-22-86	e15.17 e25.49	8,250 24,400

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Zumbro River basin--Continued							
05374400	Long Creek near Potsdam, MN	Lat 44°10'48", long 92°17'23", at quarter corner on north line of sec.8, T.108 N., R.12 W., Wabasha County, Hydrologic Unit 07040004, at culvert on county highway, 2.6 miles northeast of Potsdam.	4.46	1966-86	7-30-86	18.09	310
Whitewater River basin							
05376500	South Fork White-water River near Altura, MN	Lat 44°04'10", long 91°58'49", in SE¼ sec.14, T.107 N., R.10 W., Winona County, Hydrologic Unit 07040003, on left bank 500 ft upstream from highway bridge, 2.0 miles west of Altura, 2.4 miles upstream from Keefer Creek.	76.8	1939-71#, 1973-86	9-21-86	9.54	4,380
Root River basin							
05384000	Root River near Lanesboro, MN	Lat 43°44'58", long 91°58'43", in sec.1, T.103 N., R.10 W., Fillmore County, Hydrologic Unit 07040008, on left bank 0.5 mile upstream from highway bridge, 1.2 mile upstream from South Branch, 2.5 miles northeast of Lanesboro.	615	1910-14, 1915-17, 1940-85#, 1986	9-21-86	12.82	10,700
05384120	South Branch Root River at Lanesboro, MN	Lat 43°43'19", long 91°58'43", in NW¼SE¼ sec.13, T.103 N., R.10 W., Fillmore County, Hydrologic Unit 07040008, at bridge to ball park in Lanesboro, 2.5 miles upstream from mouth.	297	1973-86	9-23-86	8.30	3,000
05384350	Root River at Rushford, MN	Lat 43°48'11", long 91°45'10", in NE¼NE¼ sec.23, T.104 N., R.8 W., Fillmore County, Hydrologic Unit 07040008, on right downstream side of U.S. Highway 16 bridge on south side of Rushford.	-	1985-86	f3-11-85 9-21-86	21.40 25.26	\$ \$
05384500	Rush Creek near Rushford, MN	Lat 43°50'00", long 91°46'40", on line between secs.3 and 10, T.104 N., R.8 W., Fillmore County, Hydrologic Unit 07040008, on downstream side near center of span of highway bridge, 1.5 miles northwest of Rushford, 3.0 miles upstream from mouth.	129	1942-79#, 1980-86	9-21-86	5.24	1,320
05385000	Root River near Houston, MN	Lat 43°46'07", long 91°34'11", in SW¼NW¼ sec.33, T.104 N., R.6 W., Houston County, Hydrologic Unit 07040008, on right bank 0.2 mile north of Houston, 1.6 miles upstream of South Fork Root River, 18.2 miles upstream from mouth.	1,270	1909-17, 1929, 1930-84#, 1985-86	f3-11-85 9-23-86	e12.42 e14.73	8,780 13,600
05385500	South Fork Root River near Houston, MN	Lat 43°44'19", long 91°33'50", in NE¼SW¼ sec.9, T.103 N., R.6 W., Houston County, Hydrologic Unit 07040008, on left bank, 50 feet downstream from State Highway 76 bridge, 0.5 mile upstream from Badger Creek, 1.5 mile south of Houston.	275	1953-83#, 1985-86	f3-11-85 8-26-86	e11.32 e6.64	5,280 1,010

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Crooked Creek basin							
05387030	Crooked Creek at Freeburg, MN	Lat 43°36'37", long 91°21'39", in SW¼NE¼ sec.30, T.102 N., R.4 W., Houston County, Hydrologic Unit 07060001, on right downstream wing wall of bridge on State Highway 249 at Freeburg, 6.5 miles upstream from mouth.	44.2	1979-86	3-19-86	9.06	150
Iowa River basin							
05457778	Little Cedar River near Johnsbury, MN	Lat 43°30'52", long 92°45'19", in NW¼NE¼ sec.33, T.101 N., R.16 W., Mower County, Hydrologic Unit 07080201, at bridge on County Road 6, 1 mile northeast of Johnsbury, 1 mile north Minnesota-Iowa border.	a46	1986	9- 9-86	14.66	\$
05458960	Bancroft Creek at Bancroft, MN	Lat 43°42'09", long 93°21'23", in SW¼SE¼ sec.21, T.103 N., R.21 W., Freeborn County, Hydrologic Unit 07080202, at bridge on County Road 14, 1.6 miles northeast of Fountain Lake, 1 mile north of Interstate 90.	a29	1985, 1986	7- 6-86	4.95	160
Des Moines River basin							
05475400	Warren Lake tributary near Windom, MN	Lat 43°54'02", long 95°07'13", in SE¼NE¼ sec.14, T.105 N., R.36 W., Cottonwood County, Hydrologic Unit 07100001, at culvert on U.S. Highway 71, 0.2 mile up stream from Warren Lake, 2.4 miles north of Windom.	1.39	1960-86	7-10-86	d4.99	24
05476900	Fourmile Creek near Dunnell, MN	Lat 43°34'57", long 94°46'26", in SW¼NW¼ sec.2, T.101 N., R.33 W., Martin County, Hydrologic Unit 07100003, at bridge on State Highway 4, 0.6 mile upstream from mouth, 1.6 miles north of Dunnell.	14.0	1960-86	5-11-86	d13.10	250
05476989	East Fork Des Moines River near Ceylon, MN	Lat 43°33'53", long 94°39'15", in NW¼SW¼ sec.11, T.101 N., R.32 W., Martin County, Hydrologic Unit 07010003, at bridge on County Road 23, 2.4 miles northwest of Ceylon.	a154	1986	3-28-86	c20.90	820
Big Sioux River basin							
06482745	Beaver Creek at Valley Springs, S.D.	Lat 43°35'10", long 96°28'20", in NW¼NW¼ sec.3, T.101 N., R.47 W., Minnehaha County, South Dakota Hydrologic Unit 10170203, at bridge on County Road 103 (Valley Drive), 1 mile west of South Dakota-Minnesota border, 2.5 miles south of interstate 90.	a104	1986	9-24-86	22.07	1,060
06482933	Chanarambi Creek near Edgerton, MN	Lat 43°53'59", long 96°03'39", in NW¼SW¼ sec.18, T.105 N., R.43 W., near Murray and Pipestone County line, Hydrologic Unit 10170204, at right downstream wing wall of bridge on township road, 3.8 miles northeast of Edgerton, 7.4 miles upstream from mouth.	56.1	1979-86	9-19-86	18.09	580

"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 1986--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft <sup>3</sup> /s)
Big Sioux River basin--Continued							
06483000	Rock River at Luverne, MN	Lat 43°39'15", long 96°12'03", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.11, T.102 N., R.45 W., Rock County, Hydrologic Unit 10170204, at bridge on Main Street (County Highway 4) in Luverne.	425	1911-14#, 1972-86	9-22-86	11.11	6,400
06483210	Kanaranzi Creek tributary No. 2 near Wilmont, MN	Lat 43°43'32", long 95°52'20", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.15, T.103 N., R.42 W., Nobles County, Hydrologic Unit 10170204, at culvert on County Highway 15, 3.5 miles southwest of Wilmont, 3.7 miles upstream from mouth.	2.14	1966-86	9-19-86	7.28	268
Little Sioux River basin							
06603530	Little Sioux River near Spafford, MN	Lat 43°36'08", long 95°15'27", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.34, T.102 N., R.37 W., Jackson County, Hydrologic Unit 10230003, at bridge on county highway, 1.6 miles downstream from Jackson County ditch No. 11, 5.8 miles east of Spafford.	41.1	1962-86	6-30-86	9.93	1,775

# Operated as a continuous-record gaging station.

\$ Discharge not determined.

a Approximately.

b Datum changed.

c Backwater from ice.

d Backwater from aquatic growth or debris.

e Affected by shifting control.

f Not previously published.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

## Discharge measurements at miscellaneous sites

Measurements of streamflow points other than gaging stations are given in the following table. The measurements of base flow are designated by an asterisk (\*); measurements of peak flow by a dagger (§).

Discharge measurements made at miscellaneous sites during water year 1986

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements Date	Discharge (ft <sup>3</sup> /s)
Elm Creek basin						
Elm Creek	Mississippi River	Lat 45°10'55", long 93°23'30", in SE¼SW¼ sec.19, T.120 N., R.21 W., Hennepin County, Hydrologic Unit 07010206, at bridge on U.S. Highway 52, 0.3 mile south of Champlin, at downstream end of Mill Pond, 0.3 miles above mouth.	-	-	4-30-86	\$421
Mississippi River main stem						
Mississippi River	Gulf of Mexico	Lat 44°58'46", long 93°14'50", in SE¼SE¼ sec.23, T.29 N., R.24 W., Hennepin County, Hydrologic Unit 07010206, at lower St. Anthony Falls lock and dam in Minneapolis, MN at River Mile 853.3 upstream from Ohio River. (Discharge measurements made between Hennepin Avenue and Franklin Avenue bridges over the Mississippi River are included). (05288920)	a19,700	1912, 1938-39, 1941, 1943, 1953-54, 1957, 1963-85	5-29-86	26,200
Minnesota River basin						
Chippewa River diversion	Minnesota River	Lat 45°01'30", long 95°48'00", in SE¼ sec.16, T.118 N., R.41 W., Chippewa County, Hydrologic Unit 07020005, 1 mile north of Watson, MN.	-	1945-85	4- 9-86 7-21-86	2,560 2,820
Chippewa River below diversion	Minnesota River	Lat 45°01'10", long 95°47'30", in NW¼ NW¼ sec.22, T.118 N., R.41 W., Chippewa County, Hydrologic Unit 07020005, 1.4 miles northeast of Watson, MN.	-	1945-85	4- 9-86 5-23-86 7-21-86 9- 3-86	930 821 156 153
Vadnais Lake basin						
Lamberts Creek	Vadnais Lake	Lat 45°03'22", long 93°04'03", in SE¼NE¼ sec.29, T.30 N., R.22 W., Ramsey County, Hydrologic Unit 07010206, 1 mile upstream of Vadnais Lake, in Vadnais Heights, 100 ft from end of Stockdale Road.	6.41	1984-85	6-23-86 6-27-86 7-23-86	10.6 6.5 1.5
Mississippi River main stem						
Mississippi River	Gulf of Mexico	Lat 44°44'48", long 93°51'08", between secs.21 and 22, T.115 N., Washington County line, Hydrologic Unit 07010206, a bridge on U.S. Highway 61, at Hastings, MN, 2.5 miles upstream from St. Croix River (05331580).	a37,100	1928, 1931-39, 1941-52, 1959-85	4- 8-86	75,800
St. Croix River	Mississippi River	Lat 44°44'57", long 92°48'16", in SE¼SE¼ sec.9, T.26 N., R.20 W., Pierce County, Hydrologic Unit 07030005, at bridge in Prescott, WI, 0.1 mile upstream from mouth. (05344490)	a7,650	1928-30, 1932-39, 1947-48, 1950, 1953-57, 1959-85	4- 8-86	34,900

a Approximately

## Low-flow investigations in the Crow and Chippewa River Basins

Discharge measurements made for the Brooten-Belgrade ground water study to determine base flow variations which will facilitate modeling of ground-surface water relations. Base-flow conditions were poor and measurements are not considered base flow. Total precipitation measured by the New London, Melrose and Litchfield U.S. Weather Bureau observers for 10 days preceding the measurements and including August 27 are 2.14 inches, 2.50 inches, and 1.80 inches respectively. Daily rainfalls greater than 0.5 inch were measured at New London on August 20, at Litchfield on August 21, and at Melrose on August 22 and 23.

## Discharge measurements made in Crow and Chippewa River basins, August 25-27, 1986

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin						
North Fork Crow River	Crow River	Lat 45°36'06", long 95°10'13", in SW¼SE¼ sec.26, T.125 N., R.36 W., Pope County, Hydrologic Unit 07010204, at culvert on County Road 39, below Grove Lake outlet, 4 miles northeast of Sedan.	-	1985	8-27-86	32.3
Intermittent Ditch	North Fork Crow River	Lat 45°36'25", long 95°09'45", in NW¼SE¼ sec.28, T.125 N., R.36 W., Pope County, Hydrologic Unit 07010204, at culvert under field road, 0.2 mile east of Grove Lake Church, 0.6 mile southwest of Grove Lake Village, 1.1 miles west of Pope-Stearns County line.	-	-	8-27-86	0.25
Intermittent Ditch	North Fork Crow River	Lat 45°35'23", long 95°10'14", in NW¼SE¼ sec.35, T.125 N., R.36 W., Pope County, Hydrologic Unit 07010204, at culvert on County Road 39, 1 mile south of Grove Lake.	-	1985	8-27-86	1.4
North Fork Crow River	Crow River	Lat 45°35'20", long 95°06'30", in SW¼SE¼ sec.32, T.125 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at bridge on County Road 18, 6 miles east of Sedan.	-	1985	8-27-86	41.4
Judicial Ditch No. 1	North Fork Crow River	Lat 45°35'29", long 95°05'16", in NE¼SE¼ sec.33, T.125 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at culvert under township road, 2.2 miles southwest of Padua, 6.5 miles northeast of Brooten.	-	1985	8-27-86 8-27-86	0.04 12.7
North Fork Crow River	Crow River	Lat 45°32'57", long 95°04'28", in NE¼SE¼ sec.16, T.124 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at bridge on township road, 3 miles northeast of Brooten.	-	1985	8-27-86	61.6
County Ditch No. 32	North Fork Crow River	Lat 45°32'40", long 95°03'17", in SW¼SE¼ sec.15, T.124 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at county ditch near township road, 4.5 miles northeast of Brooten, 5.2 miles southwest of Elrosa.	-	-	8-27-86	19.6
Sedan Brook	North Fork Crow River	Lat 45°31'49", long 95°03'46", in SE¼SW¼ sec.22, T.124 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at culverts on County Road 27, 2.5 miles northeast of Brooten.	-	1985	8-27-86	29.8
Intermittant Stream	North Fork Crow River	Lat 45°31'30", long 95°01'06", in NW¼NE¼ sec.25, T.124 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at stream beside township road, 4.6 miles northeast of Brooten, 4.4 miles southwest of Elrosa.	-	-	8-27-86	0.47
North Fork Crow River	Crow River	Lat 45°31'12", long 95°00'29", in NW¼SW¼ sec.30, T.124 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at bridge on County Road 13, 4.5 miles north of Belgrade.	-	1985	8-27-86	141

\*See footnote at end of the table."

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued						
County Ditch No. 7	North Fork Crow River	Lat 45°30'59", long 95°00'29", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.25, T.124 N., R.35 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 13, 6.0 miles northeast of Brooten.	-	1985	8-27-86	10.5
Intermittent Creek	North Fork Crow River	Lat 45°31'14", long 94°59'55", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.124 N., R.34 W., Stearns County, Hydrologic Unit 07010204, on east-west township road, 3 miles southwest of Elrosa.	-	1985	8-27-86	trace
Intermittent Creek	North Fork Crow River	Lat 45°31'14", long 94°59'14", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.29, T.124 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on township road, 5.2 miles east of Brooten, 3.4 miles southwest of Elrosa.	-	-	8-27-86	0.42
Intermittent Creek	North Fork Crow River	Lat 45°31'14", long 94°58'40", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.124 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on east-west township road, 3 miles southwest of Elrosa.	-	1985	8-27-86	8.99
Intermittent Creek	North Fork Crow River	Lat 45°30'03", long 94°59'40", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.31, T.124 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert under field road, 4.8 miles southwest of Elrosa, 6.2 east of Brooten.	-	-	8-27-86	1.08
Intermittent Creek	North Fork Crow River	Lat 45°30'17", long 94°58'11", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.32., T.124 N., R.34 W., Stearns County, Hydrologic Unit 07010204, in creek 0.1 mile west of township road, 4 miles south of Elrosa, 7.3 miles east of Brooten.	-	-	8-27-86	2.82
North Fork Crow River	Crow River	Lat 45°29'57", long 94°58'14", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.5, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on east-west township road, 3 miles northeast of Belgrade.	-	1985	8-27-86	164
Skunk River	North Fork Crow River	Lat 45°29'12", long 94°57'30", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.4, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on U.S. Highway 71, 3 miles northeast of Belgrade.	-	1985	8-27-86	54.8
Intermittent Creek	North Fork Crow River	Lat 45°29'57", long 94°55'53", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.3, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 175, 5 miles northeast of Belgrade.	-	1985	8-27-86	61.6
Intermittent Channel	North Fork Crow River	Lat 45°29'23", long 94°55'47", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.3, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert in driveway, 4.2 miles northeast of Belgrade, 4.2 miles north of Georgeville.	-	-	8-27-86	0.81
North Fork Crow River	Crow River	Lat 45°29'06", long 94°55'37", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.3, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204 at bridge on County Highway 32, 2 miles east of U.S. Highway 71 and 4 miles north of of Georgeville (05275970).	166	1969-73, 1976, 1985	8-27-86	253
Intermittent Creek	North Fork Crow River	Lat 45°29'06", long 94°55'34", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.11, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 32, 4.5 miles northeast of Belgrade.	-	1985	8-27-86	3.48

"See footnote at end of the table."

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued						
Intermittent Creek	North Fork Crow River	Lat 45°28'48", long 94°55'34", in NE&SE& sec.10, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 196, 4 miles northeast of Belgrade.	-	1985	8-27-86	0.0
Intermittent Creek	North Fork Crow River	Lat 45°28'37", long 94°54'22", in NW&SW& sec.12, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on township road.	-	1985	8-27-86	0.5
Intermittent Creek	North Fork Crow River	Lat 45°27'29", long 94°53'31", in SW&SE& sec.13, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on township road, 5.8 miles east of Belgrade.	-	1986	8-27-86	a1.0
Intermittent Creek	North Fork Crow River	Lat 45°27'22", long 94°53'31", in NW&NE& sec.24, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert under township road, 3 miles north of Stearns- Kandiyohi County line, 2.5 miles northeast of Georgeville.	-	-	8-27-86	a0.3
North Fork Crow River	Crow River	Lat 45°26'56", long 94°53'32", in NE&SE& sec.24, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at bridge on County Road 19, 0.5 miles east of Belgrade.	-	1985	8-26-86	290
Intermittent Creek	North Fork Crow River	Lat 45°26'58", long 94°54'11", in SW&NW& sec.24, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on State Highway 19, 1.7 miles northeast of Georgeville, 4.7 miles east of Belgrade.	-	-	8-26-86	1.63
Intermittent Creek	North Fork Crow River	Lat 45°26'45", long 94°54'23", in NW&SW& sec.24, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on township road, 1.4 miles northeast of Georgeville, 4.5 miles east of Belgrade.	-	-	8-26-86	3.0
Intermittent Creek	North Fork Crow River	Lat 45°26'18", long 94°54'22", in SW&NW& sec.25, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on township road, 5 miles southeast of Belgrade, 1 mile northeast of Georgeville.	-	1985	8-26-86	3.4
Intermittent Creek	North Fork Crow River	Lat 45°26'14", long 94°52'35", in SE&NW& sec.30, T.123 N., R.33 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 178, 2.5 miles northeast of Georgeville.	-	1985	8-26-86	3.8
Intermittent Creek	North Fork Crow River	Lat 45°25'13", long 94°53'49", in SW&NE& T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on State Highway 55, 0.2 mile north of Stearns-Kandiyohi County line, 1.6 mile southeast of Georgeville.	-	-	8-26-86	3.55
Intermittent Creek	North Fork Crow River	Lat 45°25'18", long 94°51'58", in SE&NE& sec.31, T.123 N., R.33 W., Stearns County, Hydrologic Unit 07010204, at culvert on north-south township road, 1.5 miles northwest of Regal.	-	1985	8-26-86	1.8
North Fork Crow River	Crow River	Lat 45°24'38", long 94°52'03", in NE&NE& sec.6, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on State Highway 55, 8 miles northwest of Paynesville.	-	1985	8-26-86	355

"See footnote at end of the table."

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued						
Intermittent Creek	North Fork Crow River	Lat 45°24'30", long 94°51'45", in SW¼NW¼ sec.5, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on State Highway 55, 0.3 mile south of Kandiyohi-Stearns County line, 0.9 mile west of Regal.	-	-	8-26-86	0.65
Intermittent Creek	North Fork Crow River	Lat 45°23'55", long 94°50'44", in SE¼SE¼ sec.5, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, in channel northwest of junction County Highway 2 and township road 0.6 mile south of Regal.	-	-	8-26-86	1.51
North Fork Crow River	Crow River	Lat 45°24'02", long 94°50'42", in SW¼SW¼ sec.4, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on township road, 6 miles northwest of Paynesville.	-	1985	8-26-86	329
Intermittent Creek	North Fork Crow River	Lat 45°24'21", long 94°49'29", in NE¼SE¼ sec.4, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on State Highway 55 at junction with township road, 1 mile west of Regal.	-	-	8-27-86	1.25
Intermittent Creek	North Fork Crow River	Lat 45°23'57", long 94°48'39", in SW¼SE¼ sec.3 T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert under State Highway 55, 2.4 miles west of Kandiyohi-Stearns County line, 1.7 miles southeast of Regal.	-	1985	8-26-85 8-26-86	0.05 0.94
Intermittent Creek	North Fork Crow River	Lat 45°23'48", long 94°48'29", in NE¼NE¼ sec.10, T.122 N., R. 33 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert under State Highway 55, 2.2 miles west of Kandiyohi-Stearns County line, 1.9 miles southeast of Regal.	-	1985	8-26-85 8-26-86	0.05 0.57
North Fork Crow River	Crow River	Lat 45°23'04", long 94°47'38", in SE¼SW¼ sec.11, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on County Road 6, 3.5 miles west of Paynesville, 3 miles southeast of Regal (05276000).	-	1985	8-26-86	331
Intermittent Creek	North Fork Crow River	Lat 45°23'09", long 94°47'37", in SE¼SW¼ sec.11, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on township road, 1.5 miles west of Kandiyohi-Stearns County line, 300 ft north of gaging site 05276000.	-	-	8-26-86	1.4
Intermittent Creek	North Fork Crow River	Lat 45°22'38", long 94°47'09", in SE¼NE¼ sec.14, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at mouth of creek, 1.1 mile west of Kandiyohi-Stearns County line, 2.5 miles west of Paynesville airport.	-	-	8-25-86	38.4
Intermittent Ditch	North Fork Crow River	Lat 45°22'36", long 94°46'04", in NE¼SE¼ sec.13, T.122 N., R.33 W., Kandiyohi County, at culvert on township road, 0.2 mile west of Kandiyohi-Stearns County line, 1.6 miles west of Paynesville airport.	-	-	8-25-86	5.4

"See footnote at end of the table."

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued						
Intermittent Creek	North Fork Crow River	Lat 45°23'17", long 94°46'54", in NW¼SW¼ sec.12, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on State Highway 55, near junction with State Highway 4, 0.2 mile below high flow site 05276100, 0.9 mile west of Kandiyohi-Stearns County line, 2.4 miles northwest of Paynesville airport.	-	-	8-26-86	0.63
Intermittent Creek	North Fork Crow River	Lat 45°23'28", long 94°45'55", in SE¼NE¼ sec.12, T.122 N., R.33 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on County Road 39, 4 miles southeast of Regal.	-	1985	8-25-86	3.58
Intermittent Creek	North Fork Crow River	Lat 45°22'49", long 94°43'47", in SW¼NE¼ sec.17, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at culvert on upstream side of State Highway 55 bridge at Paynesville.	-	1985	8-25-86	0.66
North Fork Crow River	Crow River	Lat 45°22'56", long 94°43'18", in NW¼NW¼ sec.16, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at the end of Oak Park Avenue in Paynesville.	-	1985	8-25-86	368
Intermittent Creek	North Fork Crow River	Lat 45°23'07", long 94°43'45", in SW¼SE¼ sec.8, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at culverts on County Road 130, 0.5 mile north of Paynesville.	-	1985	8-25-86	2.13
Intermittent Creek	North Fork Crow River	Lat 45°23'22", long 94°42'42", in NE¼SW¼ sec.9, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 123, 0.5 mile north of Paynesville.	-	1985	8-26-86	16.2
Intermittent Culvert	North Fork Crow River	Lat 45°23'04", long 94°41'45", in SE¼SW¼ sec.10, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at outlet to culvert under State Highway 23, 0.8 mile northwest of Paynesville.	-	1985	8-26-85 8-25-86	0.07 0.08
Intermittent Ditch	North Fork Crow River	Lat 45°23'03", long 94°41'43", in SE¼SW¼ sec.10, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, in ditch at right downstream side of Highway 23 bridge 0.8 mile northwest of Paynesville.	-	1985	8-26-85 8-25-86	0.01 0.09
North Fork Crow River	Crow River	Lat 45°21'52", long 94°39'18", in SE¼NW¼ sec.24, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at bridge on township road, 3.5 miles east of Paynesville, 0.6 mile upstream of Rice Lake.	-	1985	8-25-86	377
County Ditch <sup>b</sup>	Middle Fork Crow River	Lat 45°26'28", long 95°00'13", in SE¼SE¼ sec.19, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert under County Road 197, 0.6 mile south of Belgrade, 2 miles north of Stearns- Kandiyohi County line.	-	1985	8-26-85 8-26-86	0.97 4.4
Drainage Ditch	Middle Fork Crow River	Lat 45°25'59", long 95°00'14", in NW¼SW¼ sec.30, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert under County Road 197, 1.1 miles south of Belgrade, 1.4 miles north of Stearns- Kandiyohi County line.	-	1985	8-26-85 8-26-86	0.1 10.4

<sup>b</sup>See footnote at end of the table.

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued						
Middle Fork Crow River	Crow River	Lat 45°25'19", long 94°58'20", in SE&NE¼ sec.32, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on township road, 2.25 miles southeast of Belgrade.	-	1985	8-26-86	14.4
County Ditch	Middle Fork Crow River	Lat 45°25'06", long 94°57'28", in NW&SE¼ sec.33, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at culvert on County Road 126, 3 miles southeast of Belgrade.	-	1985	8-26-86	11.3
County Ditch No. B5	Middle Fork Crow River	Lat 45°24'28", long 94°57'28", in SW&NE¼ sec.4, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on County Road 126, 3.5 miles southeast of Belgrade.	-	1985	8-26-86	3.3
Middle Fork Crow River	Crow River	Lat 45°23'54", long 94°58'46", in SE&SW¼ sec.5, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on County Road 35, 3.75 miles southeast of Belgrade.	-	1985	8-26-86	33.5
Middle Fork Crow River	Crow River	Lat 45°22'18", long 94°57'37", in SE&SW¼ sec.16, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on County Road 128, 2 miles north of Mud Lake.	-	1985	8-26-86	105
Intermittent Stream (wetland area)	Middle Fork Crow River	Lat 45°22'20", long 94°56'51", in SW&SW¼ sec.15, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on township road, 4.7 miles north of New London, 2.8 miles south of Kandiyohi-Stearns County line.	-	-	8-26-86	1.22
County Ditch No. 37	Middle Fork Crow River	Lat 45°21'14", long 94°58'05", in NW&NW¼ sec.28, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on County Road 128, 3 miles northwest of New London.	-	1985	8-26-86	17.7
Middle Fork Crow River	Crow River	Lat 45°20'57", long 94°57'05", in SE&NE¼ sec.28, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on County Road 33, 3 miles north of New London, at inlet to Mud Lake.	-	1985	8-26-86	115
Intermittent Creek (wetland area)	Middle Fork Crow River	Lat 45°20'17", long 94°58'24", in NE&NE¼ sec.32, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on County Road 33, 3 miles northwest of New London, 0.25 mile east of Mud Lake.	-	1985	8-26-86	4.85
Intermittent Creek (wetland area)	Middle Fork Crow River	Lat 45°19'45", long 94°58'03", in SW&SW¼ sec.33, T.122 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at culvert on County Road 33, 2 miles northwest of New London, 2.25 miles west of Mud Lake.	-	1985	8-26-86	1.96
Middle Fork Crow River	Crow River	Lat 45°18'00", long 94°56'25", in NE&SW¼ sec.10, T.121 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on County Road 9, at New London, (05277000).	-	1985	8-27-86	196

"See footnote at end of the table."

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued						
Middle Fork Crow River	Crow River	Lat 45°16'38", long 94°57'20", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.21, T.121 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on township road, 1.25 miles southwest of New London.	-	1985	8-27-86	217
Middle Fork Crow River	Crow River	Lat 45°16'07", long 94°57'54", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.21, T.121 N., R.34 W., Kandiyohi County, Hydrologic Unit 07010204, at bridge on township road, at inlet to Nest Lake.	-	1985	8-27-86	212
Minnesota River basin						
East Branch Chippewa River	Chippewa River	Lat 45°39'37", long 95°18'07", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.2, T.125 N., R.37 W., Pope County, Hydrologic Unit 07020005, at bridge on State Highway 28, 3.2 miles northeast of Glenwood.	-	1985	8-25-86	22.5
East Branch Chippewa River	Chippewa River	Lat 45°39'02", long 95°18'02", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.11, T.125 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on County Road 22, 3 miles east of Glenwood.	-	1985	8-25-86	73.1
East Branch Chippewa River	Chippewa River	Lat 45°38'10", long 95°17'57", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.14, T.125 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on east-west township road, 3.5 miles southeast of Glenwood.	-	1985	8-25-86	68.4
East Branch Chippewa River	Chippewa River	Lat 45°36'23", long 95°17'09", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.26, T.125 N., R.37 W., Pope County, Hydrologic Unit 07020005, at bridge on east-west township road, 0.2 mile below Marles Lake outlet, 2.8 miles northwest of Sedan.	-	1985	8-25-86	93.2
East Branch Chippewa River	Chippewa River	Lat 45°35'23", Long 95°17'35", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.35, T.125 N., R.32 W., Pope County, Hydrologic Unit 07020005, at culvert on State Highway 55, 2.5 miles northwest of Sedan.	-	1985	8-26-86	87.7
East Branch Chippewa River	Chippewa River	Lat 45°33'50", long 95°18'27", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.10, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at bridge on County Road 21, 3 miles southwest of Sedan.	-	1985	8-26-86	99.7
East Branch Chippewa River	Chippewa River	Lat 45°33'14", long 95°18'03", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.15, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on County 23, 3 miles southwest of Sedan.	-	1985	8-26-86	94.3
East Branch Chippewa River	Chippewa River	Lat 45°32'40", long 95°17'35", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.14, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at bridge on east-west township road, 3 miles northeast of Terrace.	-	1985	8-26-86	85.2
Intermittent Creek	East Branch Chippewa River	Lat 45°32'32", long 95°16'27", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.24, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on east-west township road, 0.5 mile south of Round Lake, 3 miles northeast of Terrace.	-	1985	8-26-86	13.0

"See footnote at end of table.

## LOW-FLOW INVESTIGATIONS

## Low-flow investigations in the Crow and Chippewa River Basins--Continued

Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Date	Discharge (ft <sup>3</sup> /s)
Minnesota River basin--Continued						
East Branch Chippewa River	Chippewa River	Lat 45°31'14", long 95°17'34", in NW¼SW¼ sec.26, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at bridge on township road, 1.5 miles northeast of Terrace.	-	1985	8-26-86	115
Intermittent Creek	East Branch Chippewa River	Lat 45°30'57", long 95°17'08", in SW¼SE¼ sec.26, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on County Road 26, 1.5 miles northeast of Terrace.	-	1985	8-27-86	5.83
Intermittent Creek	East Branch Chippewa River	Lat 45°30'24", long 95°17'50", in NE¼SE¼ sec.34, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on State Highway 104, 1 mile southeast of Terrace.	-	1985	8-27-86	3.53
East Branch Chippewa River	Chippewa River	Lat 45°30'42", long 95°19'15", in NE¼NE¼ sec.33, T.124 N., R.37 W., Pope County, Lat 45°30'42", long 95°19'15", in NE¼NE¼ Hydrologic Unit 07020005, at bridge on County Road 21, at Terrace.	-	1985	8-27-86	135
Intermittent Creek	East Branch Chippewa River	Lat 45°30'49", long 95°20'58", in SE¼SW¼ sec.29, T.124 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on State Highway 104, 1.25 miles west of Terrace.	-	1985	8-27-86	1.16
Intermittent Creek	East Branch Chippewa River	Lat 45°29'24", long 95°20'55", in NE¼SW¼ sec.5, T.123 N., R.37 W., Pope County, Hydrologic Unit 07020005, site adjacent to field road, 0.4 mile east of Lake Linka.	-	1985	8-27-86	2.0
East Branch Chippewa River	Chippewa River	Lat 45°28'57", long 95°21'40", in NE¼NE¼ sec.7, T.123 N., R.37 W., Pope County, Hydrologic Unit 07020005, at bridge on County Road 20, 0.5 mile east of Gilchrist Lake.	-	1985	8-27-86	122
East Branch Chippewa River	Chippewa River	Lat 45°27'52", long 95°21'19", in SW¼NW¼ sec.17, T.123 N., R.37 W., Pope County, Hydrologic Unit 07020005, at culvert on County Road 82, 0.1 mile below Gilchrist Lake.	-	1985	8-27-86	138
East Branch Chippewa River	Chippewa River	Lat 45°26'36", long 95°24'28", in SW¼SE¼ sec.23, T.123 N., R.38 W., Pope County, Hydrologic Unit 07020005, at culvert on County Road 19, 3.3 miles northeast of Swift Falls.	-	1985	8-27-86	128

a Estimated

b Revised location was previously called County Ditch No. B6

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

Water-quality partial record stations are particular sites where chemical-quality, biological and (or) sediment data are collected systematically over a period of years for use in hydrologic analyses.

453405094192301 STORM SEWER INFLOW TO WETLAND AT ST. JOSEPH, MN

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

BEGIN DATE	BEGIN TIME	END DATE	END TIME	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)
APR 18	1315	APR 18	1415	996	1.8	0.17
APR 26	2215	APR 28	0200	280	2.2	0.36
MAY 08	0245	MAY 08	0624	690	0.8	0.11
MAY 09	1015	MAY 09	1300	839	1.8	0.21
JUN 10	0700	JUN 10	1430	791	1.8	0.34

453407094192101 BULK DEPOSITION NEAR WASTE WATER TREATMENT PLANT AT ST. JOSEPH, MN

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

BEGIN DATE	BEGIN TIME	END DATE	END TIME	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)
OCT 08...	1200	SEP 04...	1000	294	33	0.40

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

453408094192401 WASTE WATER TREATMENT PLANT EFFLUENT DISCHARGE AT FLUME AT ST. JOSEPH, MN

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	SOLIDS, VOLA- TILE ON IGNI- TION, TOTAL (MG/L) (00505)	NITRO- GEN, NO2+NO3 TOTAL (MG/L) AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED TOTAL (MG/L) AS N) (00631)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L) AS N) (00625)	NITRO- GEN,AM- MONIA + ORGANIC DIS. TOTAL (MG/L) AS N) (00623)	PHOS- PHORUS, TOTAL (MG/L) AS P) (00665)	PHOS- PHORUS, DIS- SOLVED TOTAL (MG/L) AS P) (00666)
NOV											
07...	0930	--	--	874	210	1.2	1.2	28	25	4.2	3.4
15...	1500	--	--	703	106	1.0	0.81	33	32	3.9	3.3
22...	1000	1810	7.7	950	168	2.5	2.4	31	25	4.7	3.9
26...	1400	--	--	742	84	1.4	1.4	28	E25	3.8	3.1
FEB											
03...	1112	1500	7.7	770	83	0.80	--	37	--	4.3	--
13...	1000	--	--	906	135	0.70	--	37	--	6.3	--
20...	1010	--	--	841	92	0.90	--	34	--	4.5	--
27...	0935	--	--	891	134	0.50	--	34	--	4.8	--
MAR											
06...	0950	--	--	894	174	0.60	--	36	--	5.1	--
13...	0925	--	--	938	180	0.50	--	36	--	4.7	--
20...	0940	--	--	853	172	0.70	--	35	--	4.2	--
27...	0940	--	--	884	112	1.5	--	21	--	2.9	--
APR											
03...	0930	--	--	867	--	--	--	35	--	4.5	--
17...	0946	--	--	940	--	--	--	36	--	5.1	--
MAY											
01...	1040	--	--	827	--	--	--	32	--	4.3	--
14...	1353	--	--	666	--	--	--	1.6	--	3.5	--
29...	1040	--	--	914	--	--	--	18	--	2.5	--
JUN											
13...	0930	--	--	898	--	--	--	18	--	0.18	--
25...	0820	--	--	677	--	--	--	18	--	0.16	--
JUL											
10...	0805	--	--	687	--	--	--	15	--	2.4	--
24...	0840	--	--	733	--	--	--	11	--	2.9	--
AUG											
07...	0900	--	--	661	--	--	--	7.4	--	2.2	--
21...	1157	--	--	905	--	--	--	12	--	3.0	--
SEP											
04...	0845	--	--	825	--	--	--	16	--	0.09	--

E--estimated.

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

453410094192801 WETLAND OUTLET 1 FROM WASTE WATER TREATMENT PLANT AT ST JOSEPH, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	SOLIDS, VOLA- TILE ON IGNI- TION, TOTAL (MG/L) (00505)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)
FEB								
03...	1121	923	7.7	521	105	0.70	8.5	0.78
13...	1010	--	--	608	92	0.40	21	2.6
20...	1030	--	--	612	83	0.40	20	3.1
27...	0945	--	--	598	149	0.30	21	3.0
MAR								
06...	1005	--	--	662	102	0.20	22	0.07
13...	0935	--	--	597	136	0.30	21	2.8
20...	0950	--	--	541	127	0.30	17	2.3
27...	0950	--	--	515	117	0.30	12	1.5
APR								
03...	0940	--	--	539	--	--	13	1.7
17...	1005	--	--	486	--	--	16	2.2
MAY								
01...	1026	--	--	512	--	--	15	1.9
14...	1402	--	--	461	--	--	1.8	0.86
29...	1100	--	--	511	--	--	2.0	0.29
JUN								
13...	0945	--	--	717	--	--	1.7	0.35
25...	0830	--	--	517	--	--	3.5	0.63
JUL								
10...	0813	--	--	5110	--	--	1.7	0.22
24...	0850	--	--	299	--	--	2.7	0.39
AUG								
07...	0920	--	--	242	--	--	1.7	0.25
21...	1210	--	--	547	--	--	2.4	0.49
SEP								
04...	0900	--	--	503	--	--	3.3	0.38

453418094194501 WATAB RIVER DOWNSTREAM OF WASTE WATER TREATMENT PLANT AT ST JOSEPH, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	SOLIDS, VOLA- TILE ON IGNI- TION, TOTAL (MG/L) (00505)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)
FEB						
27...	1140	325	105	0.50	2.4	0.32
MAR						
06...	1150	333	97	0.50	2.5	0.27
13...	1120	319	125	0.50	1.9	0.23
20...	1130	307	126	0.60	2.3	0.30
27...	1130	199	67	0.50	1.8	0.18

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

453421094193701 WETLAND OUTLET 2 FROM WASTE WATER TREATMENT PLANT AT ST JOSEPH, MN

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	SOLIDS, VOLA- TILE ON IGNI- TION, TOTAL (MG/L) (00505)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	CARBON, ORGANIC TOTAL (MG/L AS C) (00680)
FEB									
03...	1300	889	7.70	508	110	0.60	6.7	0.65	--
13...	1120	--	--	613	135	0.20	11	2.7	--
20...	1100	--	--	586	96	0.30	20	2.7	1.6
27...	1115	--	--	591	108	0.20	21	3.0	--
MAR									
06...	1130	--	--	631	92	0.20	20	2.7	--
13...	1015	--	--	554	135	0.20	18	2.3	--
20...	1100	--	--	527	129	0.20	1.6	2.2	--
27...	1110	--	--	487	124	0.30	9.9	1.3	--
APR									
03...	1050	--	--	499	--	--	12	1.5	--
17...	1125	--	--	438	--	--	12	1.5	--
MAY									
01...	1005	--	--	474	--	--	12	1.5	--
14...	1057	--	--	418	--	--	4.7	0.59	--
29...	1145	--	--	497	--	--	2.5	0.42	--
JUN									
13...	1100	--	--	513	--	--	2.1	0.43	--
25...	0900	--	--	514	--	--	2.7	0.59	--
JUL									
10...	0845	--	--	522	--	--	1.8	0.29	--
24...	0815	--	--	382	--	--	3.4	0.54	--
AUG									
07...	1027	--	--	228	--	--	1.6	0.22	--
21...	1315	--	--	510	--	--	1.2	0.31	--
SEP									
04...	0915	--	--	496	--	--	3.1	0.44	--

453431094194301 WATAB RIVER UPSTREAM OF WASTE WATER TREATMENT PLANT AT ST JOSEPH, MN

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	SOLIDS, VOLA- TILE ON IGNI- TION, TOTAL (MG/L) (00505)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)
FEB						
27...	1045	331	103	0.50	0.4	0.02
MAR						
06...	1045	297	72	0.60	1.3	0.03
13...	1015	291	124	0.60	0.6	0.02
20...	1025	299	124	0.70	1.6	0.20
27...	1050	206	80	0.50	1.7	0.17

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

470800095233001 LAKE OF THE VALLEY NEAR PONSFORD, MN

## WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- PLING DEPTH (FEET) (00003)	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)
AUG									
07...	1400	--	10	234	8.6	5	28	11	133
07...	1445	55.0	--	268	7.8	5	33	12	144

DATE	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L AS P) (70507)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)
AUG									
07...	<0.01	0.10	<0.01	0.01	<1	59	<10	<1	4
07...	0.02	<0.10	0.35	0.01	<1	68	<10	<1	4

DATE	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
AUG								
07...	2	<3	<5	0.2	1	<1	<1	<0.01
07...	28	13	8	0.3	1	<1	<1	<0.01

## MISCELLANEOUS WATER QUALITY DATA COLLECTED AT CONTINUOUS-RECORD STATIONS

## WATER QUALITY DATA AT STREAMFLOW STATIONS

Field determinations of water temperature and specific conductance are made at many streamflow stations in addition to those that are also regular water-quality stations. These data are usually collected at regular intervals during routine visits to the station. Additional data for each station are published elsewhere in this report.

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05211000 MISSISSIPPI RIVER AT GRAND RAPIDS, MN							
OCT. 09, 1985.....	2,870	---	---	APR. 18.....	1,190	10	200
NOV. 19.....	2,100	2.0	290	MAY 14.....	2,000	---	---
JAN. 09, 1986.....	2,170	.0	---	JUNE 11.....	1,850	22	260
FEB. 19.....	1,940	.0	---	JULY 23.....	2,580	---	---
MAR. 21.....	1,400	3.0	325	AUG. 29.....	2,160	---	---
05216860 SWAN RIVER NEAR CALUMET, MN							
OCT. 10, 1985.....	127	6.0	320	APR. 11.....	201	---	---
NOV. 18.....	47	2.0	385	MAY 16.....	325	---	---
JAN. 08, 1986.....	29	.0	340	JUNE 11.....	98	---	---
JAN. 15.....	24	.5	260	JULY 23.....	79	24.5	275
FEB. 18.....	23	.0	340	AUG. 29.....	30	19	270
MAR. 21.....	21	1.0	320				
05227500 MISSISSIPPI RIVER AT AITKIN, MN							
OCT. 07, 1985.....	5,410	8.0	248	APR. 15.....	8,080	---	---
NOV. 20.....	3,240	.5	255	JUNE 12.....	5,290	18.5	220
JAN. 02, 1986.....	2,850	.0	---	JULY 25.....	4,290	---	---
FEB. 10.....	2,530	.0	---	SEPT. 03.....	7,140	---	---
MAR. 18.....	2,170	.0	---				
05245100 LONG PRAIRIE RIVER AT LONG PRAIRIE, MN							
OCT. 09, 1985.....	159	5.0	510	MAY 19.....	627	13.0	550
DEC. 06.....	94	.0	530	JULY 23.....	500	26.0	460
FEB. 20, 1986.....	85	.0	530	SEPT. 04.....	388	19.5	490
MAR. 31.....	1,050	7.0	295				
05247500 CROW WING RIVER NEAR PILLAGER, MN							
OCT. 31, 1985.....	1,390	7.0	360	APR. 04.....	10,100	5.0	240
JAN. 08, 1986.....	1,170	---	---	JUNE 25.....	2,110	24.5	360
FEB. 20.....	1,160	---	290	SEPT. 04.....	2,200	---	---

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN							
OCT. 16, 1985.....	10,200	7.0	255	JUNE 23.....	9,190	21.5	250
APR. 30, 1986.....	20,000	12.0	215	AUG. 11.....	6,160	22.5	250
05275000 ELK RIVER NEAR BIG LAKE, MN							
OCT. 08, 1985.....	730	9.0	---	MAR. 25.....	489	3.0	340
NOV. 27.....	275	.0	---	JULY 16.....	402	23.0	320
MAR. 03, 1986.....	218	.5	370	SEPT. 24.....	1,970	15.5	---
05278000 MIDDLE FORK CROW RIVER NEAR SPICER, MN							
OCT. 09, 1985.....	171	---	---	MAY 19.....	468	15.0	440
DEC. 06.....	88	.0	450	JULY 23.....	417	25.0	400
FEB. 20, 1986.....	75	.0	470	SEPT. 04.....	306	20.0	440
MAR. 31.....	196	6.0	410				
05280000 CROW RIVER AT ROCKFORD, MN							
OCT. 28, 1985.....	3,070	12.0	690	APR. 28.....	6,300	8.0	640
DEC. 23.....	704	.0	---	MAY 28.....	4,060	20.0	590
JAN. 23, 1986.....	537	.0	---	JUNE 23.....	2,660	23.0	480
FEB. 26.....	391	.0	730	JULY 29.....	2,680	25.0	450
MAR. 24.....	2,680	.0	400	AUG. 28.....	2,340	17.5	400
MAR. 28.....	7,480	1.5	410	SEPT. 25.....	4,540	---	---
05286000 RUM RIVER NEAR ST. FRANCIS, MN							
OCT. 08, 1985.....	1,430	9.0	---	MAY 20.....	4,780	15.5	180
DEC. 30.....	395	---	---	JULY 17.....	998	24.5	250
MAR. 06, 1986.....	930	.5	320	SEPT. 29.....	5,110	---	---
05287890 ELM CREEK NEAR CHAPLIN, MN							
OCT. 02, 1985.....	147	8.0	---	APR. 30.....	386	14.0	510
NOV. 12.....	38	1.0	490	JUNE 03.....	25.8	17.0	480
JAN. 22, 1986.....	5.82	.0	---	JULY 22.....	36.6	22.5	---
MAR. 04.....	6.23	4.0	625	SEPT. 05.....	10.0	15.5	---
MAR. 25.....	219	1.5	400				
05288500 MISSISSIPPI RIVER NEAR ANOKA, MN							
OCT. 16, 1985.....	20,200	8.0	480	JULY 25.....	17,600	25.5	380
MAR. 26, 1986.....	14,200	1.5	360	SEPT. 25.....	36,900	16.5	270

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05291000 WHETSTONE RIVER NEAR BIG STONE CITY, SOUTH DAKOTA							
DEC. 04, 1985.....	11	.0	1,230	APR. 15.....	4,660	3.0	420
FEB. 24, 1986.....	9.3	.0	1,325	MAY 16.....	251	11.0	1,350
MAR. 10.....	185	.0	780	JULY 01.....	48	23.0	1,070
MAR. 25.....	1,730	3.0	410	AUG. 28.....	48	19.0	950
05292000 MINNESOTA RIVER AT ORTONVILLE, MN							
DEC. 04, 1985.....	2.9	.0	---	APR. 16.....	1,360	5.0	680
JAN. 14, 1986.....	42	1.0	1,330	MAY 09.....	349	13.0	940
FEB. 07.....	87	1.0	1,320	MAY 16.....	1,320	---	---
MAR. 21.....	805	4.0	990	JULY 02.....	165	23.0	950
MAR. 25.....	2,120	3.0	410	AUG. 28.....	69	19.5	990
APR. 02.....	2,210	6.5	980				
05293000 YELLOW BANK RIVER NEAR ODESSA, MN							
DEC. 03, 1985.....	20	.0	1,280	APR. 15.....	3,290	5.0	710
FEB. 24, 1986.....	19	.0	1,040	MAY 16.....	384	16.0	950
MAR. 10.....	110	.0	830	JULY 02.....	50	24.0	930
MAR. 25.....	1,910	3.0	410	AUG. 28.....	40	17.0	910
APR. 02.....	1,070	10.0	630				
05294000 POMME DE TERRE RIVER AT APPLETON, MN							
NOV. 25, 1985.....	95	0.5	1,040	APR. 01.....	1,730	10.0	600
JAN. 28, 1986.....	63	0.5	800	APR. 16.....	1,610	8.0	840
MAR. 20.....	111	.0	830	APR. 30.....	978	12.0	890
MAR. 26.....	723	1.0	560	JUNE 13.....	649	15.0	990
MAR. 31.....	1,750	---	---	AUG. 06.....	282	25.0	880
0530000 LAC QUI PARLE RIVER NEAR LAC QUI PARLE, MN							
OCT. 03, 1985.....	165	10.0	1,190	JUNE 12.....	437	18.0	1,050
DEC. 11.....	34	.0	1,430	JULY 17.....	298	29.0	1,190
FEB. 19, 1986.....	33	.0	1,850	AUG. 29.....	88	20.0	1,190
MAR. 26.....	3,590	---	520	SEPT. 29.....	643	15.0	1,140
APR. 30.....	925	10.5	1,140				

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05301000 MINNESOTA RIVER NEAR LAC QUI PARLE, MN							
OCT. 03, 1985.....	1,010	10.0	850	APR. 11.....	10,900	21.5	680
OCT. 10.....	1,190	---	---	MAY 23.....	4,560	16.0	810
OCT. 21.....	59	10.0	1,450	JULY 18.....	2,190	28.0	810
DEC. 11.....	224	.0	1,045	JULY 22.....	2,770	---	---
FEB. 18, 1986.....	290	1.0	1,570	AUG. 29.....	1,960	---	760
FEB. 19.....	286	1.0	1,540	SEPT. 02.....	1,930	---	---
MAR. 31.....	9,870	4.5	710	SEPT. 29.....	3,130	15.5	820
APR. 01.....	10,100	---	---				
05304500 CHIPPEWA RIVER NEAR MILAN, MN							
NOV. 25, 1985.....	381	.0	1,040	APR. 09.....	3,320	10.0	750
JAN. 28, 1986.....	170	.0	790	MAY 23.....	2,070	16.0	810
MAR. 12.....	191	.0	860	JULY 21.....	2,920	24.0	600
MAR. 26.....	2,610	0.5	470	SEPT. 03.....	1,400	21.5	670
MAR. 31.....	4,090	7.0	630	SEPT. 22.....	4,330	16.5	600
05311000 MINNESOTA RIVER AT MONTEVIDEO, MN							
OCT. 03, 1985.....	1,860	---	---	APR. 07.....	14,220	9.0	750
OCT. 10.....	1,810	---	---	APR. 21.....	12,530	6.0	970
DEC. 09.....	655	.0	---	MAY 29.....	4,380	20.0	970
FEB. 25, 1986.....	623	.0	1,260	JUNE 12.....	2,680	20.0	990
MAR. 10.....	778	---	---	AUG. 01.....	3,160	24.0	820
MAR. 26.....	4,210	---	---	AUG. 29.....	2,330	19.0	750
APR. 04.....	11,820	5.0	650	SEPT. 29.....	4,220	16.0	880
05313500 YELLOW MEDICINE RIVER NEAR GRANITE FALLS, MN							
NOV. 27, 1985.....	101	.0	1,890	MAY. 08.....	465	14.0	1,520
JAN. 27, 1986.....	45	.0	1,180	JULY 03.....	271	20.0	1,530
MAR. 11.....	225	1.0	940	SEPT. 02.....	94	22.0	1,540
MAR. 25.....	2,300	---	---				
05315000 REDWOOD RIVER NEAR MARSHALL, MN							
NOV. 26, 1985.....	60	.0	1,420	MAY 08.....	277	11.0	950
JAN. 23, 1986.....	30	.0	1,360	JUNE 05.....	130	20.0	990
MAR. 10.....	147	.0	1,075	JULY 15.....	102	---	---
MAR. 24.....	815	1.5	640	JULY 30.....	45	27.0	950
APR. 02.....	683	10.0	850	SEPT. 19.....	654	16.0	730

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05316500 REDWOOD RIVER NEAR REDWOOD FALLS, MN							
NOV. 27, 1985.....	154	.0	---	APR. 03.....	1,480	---	---
JAN. 27, 1986.....	65	.0	1,350	MAY 08.....	732	13.0	1,375
MAR. 11.....	340	.0	1,040	JUNE 18.....	259	23.0	1,390
MAR. 24.....	2,320	1.0	780	JULY 29.....	180	23.0	790
MAR. 27.....	2,720	5.0	750	SEPT. 12.....	47	17.0	1,310
05317000 COTTONWOOD RIVER NEAR NEW ULM, MN							
OCT. 22, 1985.....	786	10.5	---	MAY 01.....	9,130	---	---
DEC. 11.....	238	---	---	JUNE 17.....	615	21.5	1,210
FEB. 10, 1986.....	158	.0	1,030	JULY 29.....	515	24.5	1,060
MAR. 21.....	4,970	---	---	SEPT. 15.....	858	---	---
05317200 LITTLE COTTONWOOD RIVER NEAR COURTLAND, MN							
OCT. 22, 1985.....	102	12.8	---	MAY 01.....	962	12.0	520
DEC. 10.....	21.1	---	---	JUNE 17.....	65.2	22.5	880
FEB. 23, 1986.....	15.5	.0	1,120	JULY 29.....	61.1	---	---
MAR. 21.....	374	1.0	470	SEPT. 02.....	25.4	21.0	---
05319500 WATONWAN RIVER NEAR GARDEN CITY, MN							
OCT. 22, 1985.....	534	---	---	MAY 08.....	989	13.5	810
DEC. 17.....	142	.0	---	JUNE 18.....	408	21.0	820
FEB. 12, 1986.....	74.0	.0	680	JULY 30.....	321	22.0	760
MAR. 20.....	2,740	---	---	SEPT. 23.....	1,660	---	---
05320000 BLUE EARTH NEAR RAPIDAN, MN							
OCT. 23, 1985.....	1,500	13.0	---	MAY 07.....	3,020	15.5	750
DEC. 12.....	716	---	---	JUNE 18.....	1,850	22.5	750
FEB. 12, 1986.....	293	.0	---	AUG. 07.....	824	23.5	660
MAR. 19.....	6,130	1.0	280	SEPT. 16.....	668	---	---
05320500 LE SUEUR RIVER NEAR RAPIDAN, MN							
OCT. 25, 1985.....	498	10.0	---	MAY 07.....	1,010	14.0	640
DEC. 17.....	208	---	---	JUNE 18.....	1,190	23.5	630
FEB. 13, 1986.....	77.0	---	---	AUG. 07.....	160	21.5	670
MAR. 20.....	6,700	---	---	SEPT. 16.....	262	---	---

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

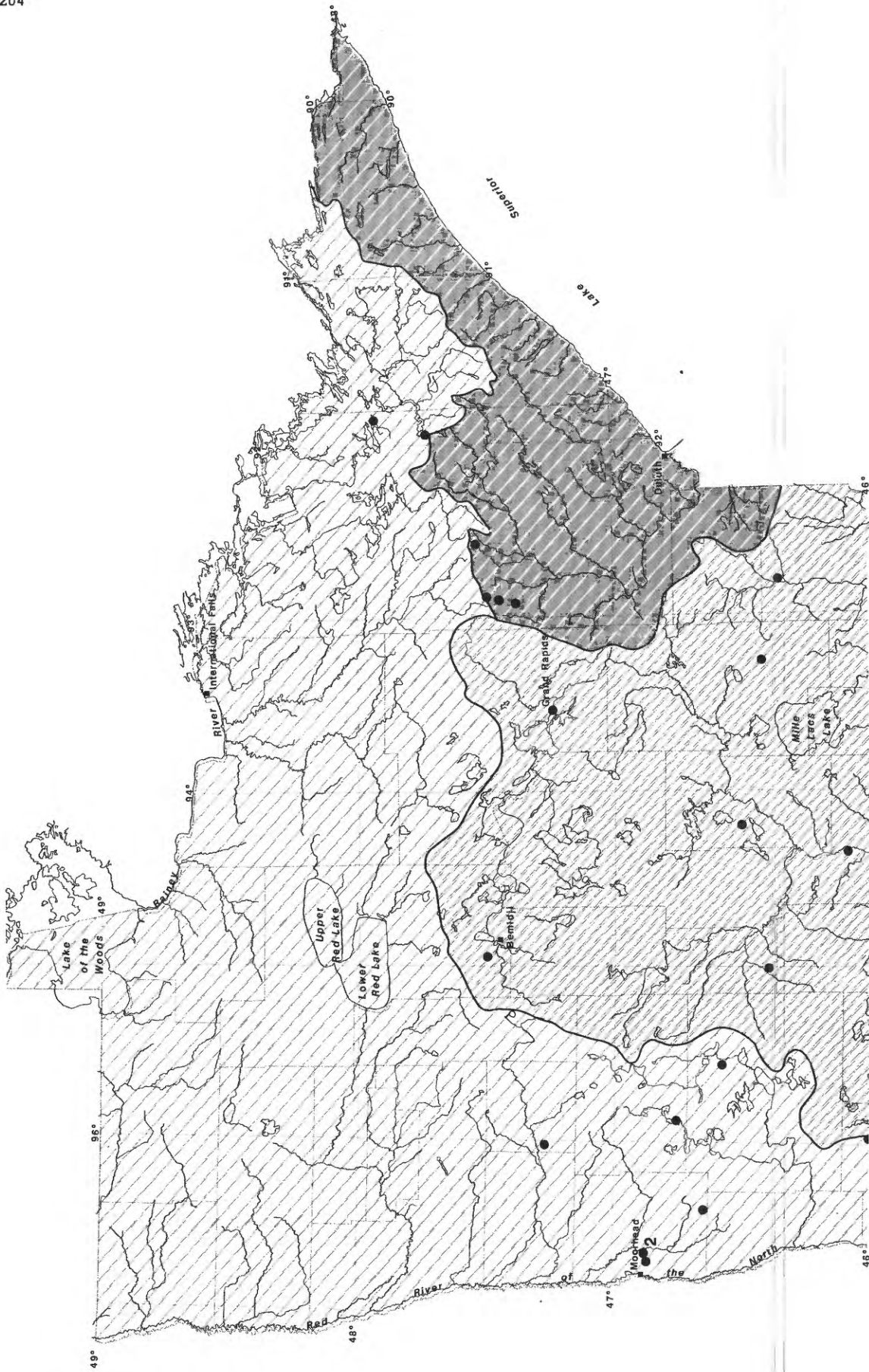
DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05325000 MINNESOTA RIVER AT MANKATO, MN							
OCT. 24, 1985.....	6,330	11.5	---	APR. 29.....	25,900	13	930
DEC. 18.....	2,180	---	---	MAY 02.....	37,400	---	---
FEB. 11, 1986.....	1,390	.0	900	JUNE 17.....	8,620	22.5	980
MAR. 19.....	16,850	1.0	500	AUG. 06.....	8,400	---	---
MAR. 21.....	25,900	---	---	SEPT. 24.....	19,400	---	---
05327000 HIGH ISLAND CREEK NEAR HENDERSON, MN							
OCT. 04, 1985.....	745	10.0	540	MAY 01.....	691	11.0	610
OCT. 07.....	404	---	---	JUNE 06.....	73.0	19.0	---
OCT. 21.....	229	10.0	---	AUG. 04.....	80.4	21.0	750
DEC. 10.....	36.5	---	---	AUG. 26.....	211	21.5	---
FEB. 10, 1986.....	13.6	.0	1,010	SEPT. 10.....	87.3	---	---
MAR. 19.....	527	1.0	320	SEPT. 24.....	633	---	---
05330000 MINNESOTA RIVER NEAR JORDAN, MN							
OCT. 23, 1985.....	8,730	11.5	1,050	MAR. 27.....	35,900	2	530
NOV. 27.....	3,620	.5	940	APR. 28.....	25,000	14.5	880
DEC. 23.....	2,320	.0	1,090	MAY 28.....	16,300	17.5	920
JAN. 16, 1986.....	1,810	.0	1,000	JUNE 24.....	22,800	21.5	550
JAN. 29.....	1,930	.0	1,010	JULY 15.....	11,100	22.5	810
FEB. 25.....	1,380	.0	990	AUG. 28.....	5,930	19.5	590
MAR. 11.....	4,670	.5	640	SEPT. 29.....	24,600	18.0	810
MAR. 21.....	14,300	---	---				
05331000 MISSISSIPPI RIVER AT ST. PAUL, MN							
APR. 07, 1986.....	13,300	19	410				
05336700 KETTLE RIVER BELOW SANDSTONE, MN							
OCT. 29, 1985.....	538	6.5	100	MAY 14.....	6,580	---	---
JAN. 07, 1986.....	190	---	---	JUNE 24.....	1,530	20.0	80
FEB. 19.....	180	1.0	---	AUG. 20.....	668	20.0	---
APR. 02.....	9,460	3.5	100				
05337400 KNIFE RIVER NEAR MORA, MN							
NOV. 01, 1985.....	34.6	6.5	110	APR. 02.....	1,530	---	---
JAN. 06, 1986.....	18.6	---	---	MAY 21.....	150	17.0	100
FEB. 18.....	13.9	.0	230	JUNE 24.....	54.3	20.5	130
APR. 01.....	1,660	4.0	110	AUG. 19.....	75.5	24.0	150

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05344500 MISSISSIPPI RIVER AT PRESCOTT, WISCONSIN							
APR. 08, 1986.....	111,000	8.5	395				
05345000 VERMILLION RIVER NEAR EMPIRE, MN							
OCT. 16, 1985.....	89	7.0	690	APR. 29.....	654	14	370
NOV. 19.....	52	4.5	730	APR. 29.....	628	---	---
DEC. 19.....	33	0.5	---	JUNE 06.....	90	16.0	650
JAN. 16, 1986.....	35	1.5	---	JUNE 25.....	156	18	595
FEB. 19.....	31	---	---	AUG. 05.....	58	18.5	540
MAR. 25.....	511	2.5	370	SEPT. 18.....	96	14	470
APR. 04.....	183	6.5	540	SEPT. 22.....	1,390	17	210
05353800 STRAIGHT RIVER NEAR FARIBULT, MN							
OCT. 04, 1985.....	471	10.0	630	APR. 03.....	866	8.0	600
NOV. 20.....	222	.5	530	MAY 15.....	1,560	15	610
JAN. 09, 1986.....	73	.0	770	JULY 18.....	535	25	---
FEB. 21.....	52	.0	---	SEPT. 05.....	75	15.5	440
05372995 SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN							
OCT. 02, 1985.....	399	9.0	540	MAY 14.....	848	15.5	490
NOV. 20.....	231	2.5	460	JULY 16.....	973	23.5	360
JAN. 08, 1986.....	71	2.5	460	SEPT. 04.....	110	24.5	460
FEB. 20.....	57	5.0	---	SEPT. 11.....	1,240	18	230
MAR. 21.....	1,000	1.0	380	SEPT. 22.....	5,840	17.5	270
APR. 03.....	464	9.5	520				
05374900 ZUMBRO RIVER AT KELLOGG, MN							
OCT. 02, 1985.....	1,540	9.5	580	MAY 12.....	1,490	16.0	550
NOV. 18.....	606	.9	530	JULY 08.....	1,440	24.0	560
JAN. 06, 1986.....	461	.0	530	SEPT. 04.....	655	19.0	410
FEB. 18.....	475	.0	540	SEPT. 22.....	10,300	17.5	280
MAR. 31.....	2,890	9.5	460	SEPT. 23.....	22,300	17.0	250
05376000 NORTH FORK WHITEWATER RIVER NEAR ELBA, MN							
OCT. 01, 1985.....	44	8	585	APR. 16.....	54	10	530
NOV. 19.....	38	5.5	495	MAY 12.....	50	17.5	530
JAN. 14, 1986.....	32	1.0	510	AUG. 20.....	48	16	450
FEB. 19.....	30	4.0	510	SEPT. 11.....	178	15.5	250
MAR. 19.....	132	4.0	420	SEPT. 23.....	296	15.5	520

## WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)	DATE	MEASURED DISCHARGE (ft <sup>3</sup> /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- MHOS)
05378235 GARVIN BROOK NEAR MINNESOTA CITY, MN							
OCT. 01, 1985.....	36	9.0	470	MAR. 31.....	39	17	470
NOV. 18.....	36	7.5	450	MAY 14.....	40	13.0	500
JAN. 06, 1986.....	38	.0	425	JULY 11.....	34	16.0	---
FEB. 18.....	32	3.5	470	SEPT. 04.....	37	14.5	370
05378500 MISSISSIPPI RIVER AT WINONA, MN							
OCT. 02, 1985.....	52,500	11.0	430	AUG. 21, 1986.....	50,300	---	---
05385000 ROOT RIVER NEAR HOUSTON, MN							
OCT. 01, 1985.....	781	8.0	530	APR. 01.....	1,650	12.5	515
NOV. 19.....	734	3.5	480	MAY 13.....	1,580	17.0	540
JAN. 07, 1986.....	458	0.0	500	JULY 10.....	940	21.5	520
FEB. 19.....	530	0.0	510	SEPT. 03.....	747	19.0	430
05385500 SOUTH FORK ROOT RIVER NEAR HOUSTON, MN							
OCT. 01, 1985.....	220	8.0	530	APR. 01.....	235	12.5	505
NOV. 19.....	213	7.0	460	MAY 13.....	191	16.5	500
JAN. 07, 1986.....	151	0.0	490	JULY 10.....	172	18.0	520
FEB. 19.....	155	3.0	490	SEPT. 03.....	173	16.0	425
05457000 CEDAR RIVER NEAR AUSTIN, MN							
OCT. 03, 1985.....	484	9.5	560	APR. 03.....	667	9.5	520
NOV. 21.....	258	.0	390	MAY 15.....	2,200	14.0	500
JAN. 09, 1986.....	88	.0	570	JULY 18.....	312	24.0	---
FEB. 21.....	62	.5	---	SEPT. 05.....	128	17	370
MAR. 20.....	2,760	.5	280				
05476000 DES MOINES RIVER AT JACKSON, MN							
NOV. 08, 1985.....	357	3.0	1,130	JUNE 18.....	785	21.0	940
JAN. 17, 1986.....	96	.0	1,240	JULY 16.....	1,450	26.5	820
FEB. 27.....	69	.0	1,330	JULY 24.....	853	---	---
MAR. 19.....	1,660	0.5	550	SEPT. 11.....	194	17.0	820
MAR. 27.....	3,890	2.0	660	SEPT. 24.....	3,660	18.5	640
MAY 21.....	1,980	---	---				



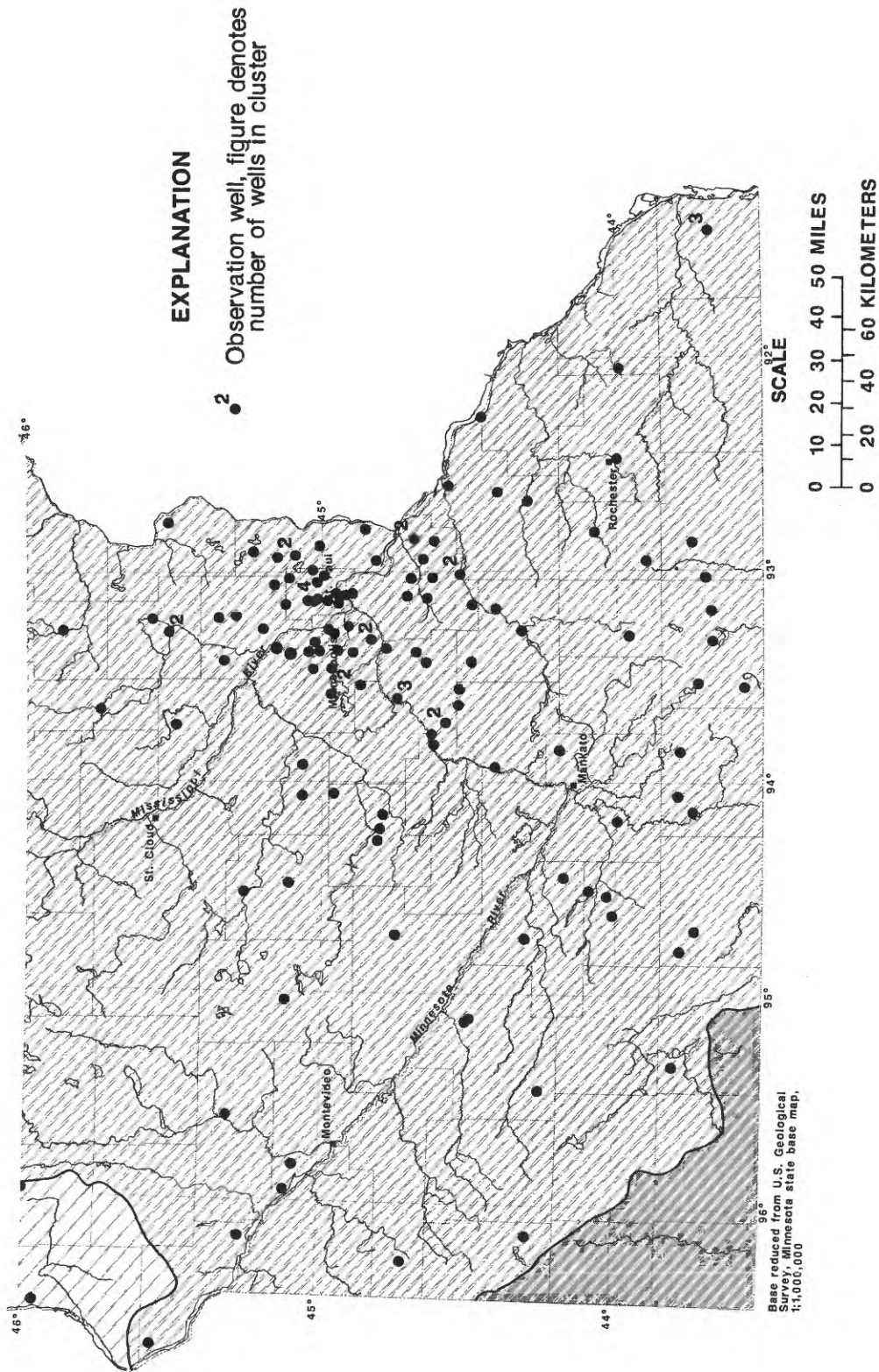


Figure 11.--Location of ground-water wells

## GROUND-WATER LEVELS

## ANOKA COUNTY

450927093033802. Local number, 031N22W23C8C02.

LOCATION.--Lat 45°09'27", long 93°03'38", in SW¼NW¼SW¼ sec.23, T.31 N., R.22 W., Hydrologic Unit 07010206, at city of Centerville.

Owner: U.S. Geological Survey.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 277 ft (84.4 m), screened 272 to 277 ft (82.9 to 84.4 m).

DATUM.--Land-surface datum is 901.6 ft (274.8 m) National Geodetic Vertical Datum of 1929. Measuring point:

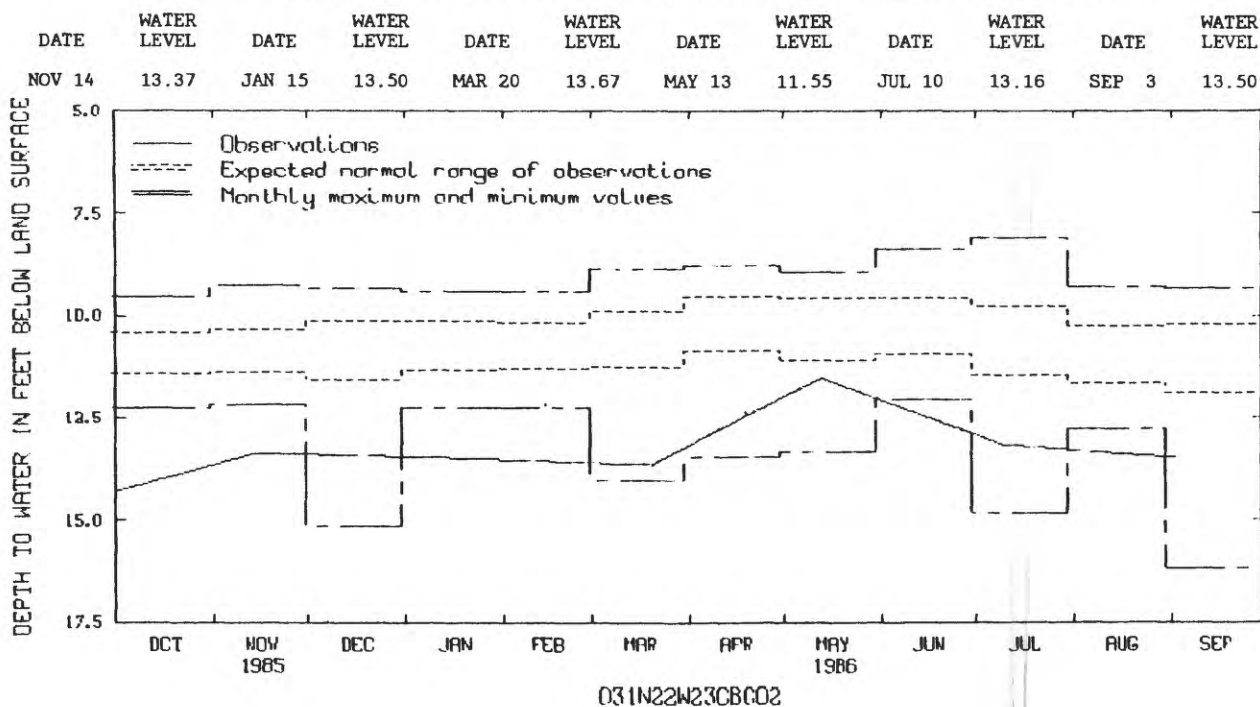
Top of recorder platform, 2.20 ft (0.67 m) above land-surface datum.

REMARKS.--Water level affected by nearby flowing wells.

PERIOD OF RECORD.--February 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 8.10 ft (2.47 m) below land-surface datum, July 5, 1975; lowest, 16.20 ft (4.94 m) below land-surface datum, Sept. 15, 1976.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



451210093170201. Local number, 031N24W01C8B01.

LOCATION.--Lat 45°12'10", long 93°17'02", in NW¼NW¼SW¼ sec.1, T.31 N., R.24 W., Hydrologic Unit 07010206, at Golf Course.

Owner: City of Coon Rapids.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 193 ft (58.8 m), screened 163 to 193 ft (49.7 to 58.8 m).

DATUM.--Altitude of land-surface datum is 897 ft (273 m). Measuring point: Top of breather pipe, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--December 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.43 ft (5.61 m) below land-surface datum, May 13, 1986; lowest, 31.30 ft (9.54 m) below land-surface datum, July 13, 1983.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 12	18.80	JAN 15	19.70	MAR 14	19.93	MAY 13	18.43	JUL 10	26.77	SEP 3	27.63

## GROUND-WATER LEVELS

## ANOKA COUNTY--Continued

451742093122102. Local number, 032N23W04AAD02.

LOCATION.--Lat 45°17'42", long 93°12'21", in SE¼NE¼NE¼ sec.4, T.32 N., R.23 W., Hydrologic Unit 07030005, 1.5 mi (2.4 km) east of Soderville.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

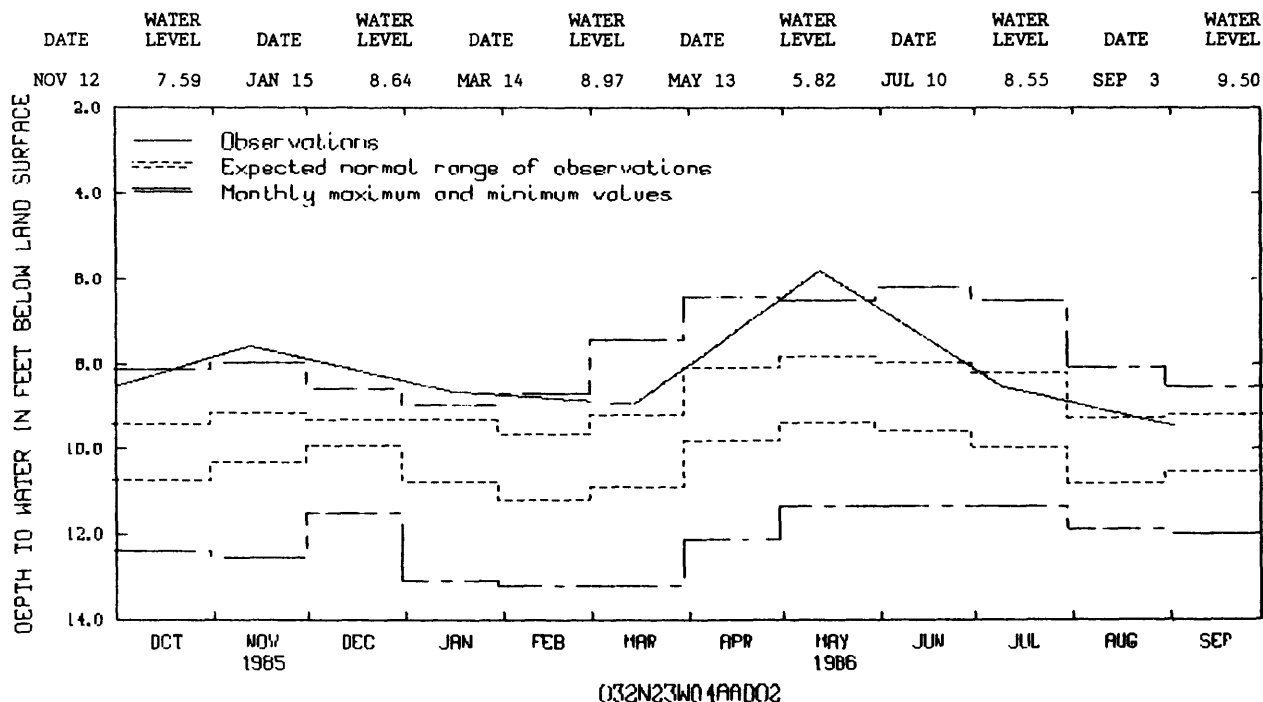
WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in (0.05 m), depth 21 ft (6.4 m), screened 19 to 21 ft (5.8 to 6.4 m).

DATUM.--Altitude of land-surface datum is 916 ft (279 m). Measuring point: Top of casing, 3.50 ft (1.07 m) above land-surface datum.

PERIOD OF RECORD.--August 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.82 ft (1.77 m) below land-surface datum, May 13, 1986; lowest, 13.22 ft (4.03 m) below land-surface datum, Mar. 5-9, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



452305093141501. Local number, 033N23W05BAB01.

LOCATION.--Lat 45°23'05", long 93°14'15", in NW¼NE¼NW¼ sec.5, T.33 N., R.23 W., Hydrologic Unit 07010207, at 1300 229th Ave. NE, Bethel.

Owner: Friendship Baptist Church.

AQUIFER.--Franconian Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 141 ft (43.0 m), cased to 126 ft (38.4 m).

DATUM.--Altitude of land-surface datum is 923 ft (281 m). Measuring point: Top of well cap, 0.80 ft (0.24 m) above land-surface datum.

PERIOD OF RECORD.--April 1980 to current year.

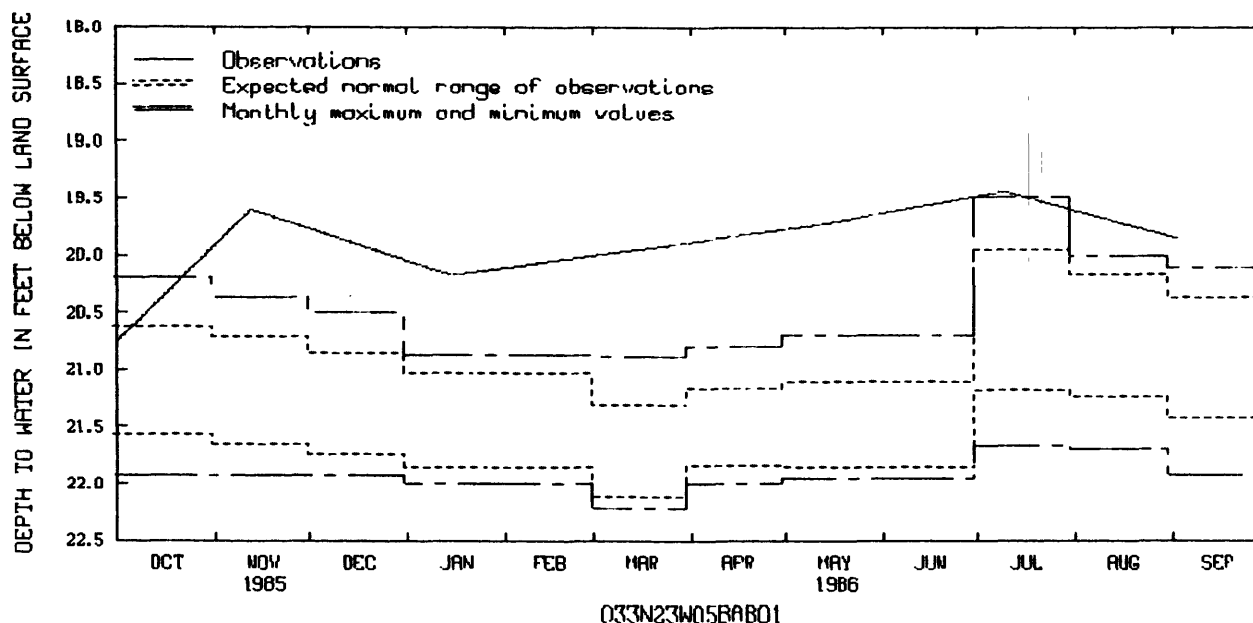
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 19.48 ft (5.94 m) below land-surface datum, July 12, 1984; lowest, 22.22 ft (6.77 m) below land-surface datum, Mar. 3, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 12	19.60	JAN 15	20.18	MAY 13	19.73	JUL 10	19.45	SEP 3	19.86

## GROUND-WATER LEVELS

ANOKA COUNTY--Continued



451938093223101. Local number, 033N24W30ABB01.

LOCATION.--Lat 45°19'38", long 93°22'31", in NW¼NW¼NE¼ sec.30, T.33 N., R.24 W., Hydrologic Unit 07010207, at 4324 Viking Blvd.

Owner: Northwestern Bell Telephone Co.

AQUIFER.--Iron-ton-Galesville Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 280 ft (85.3 m), cased to 223 ft (68.0 m).

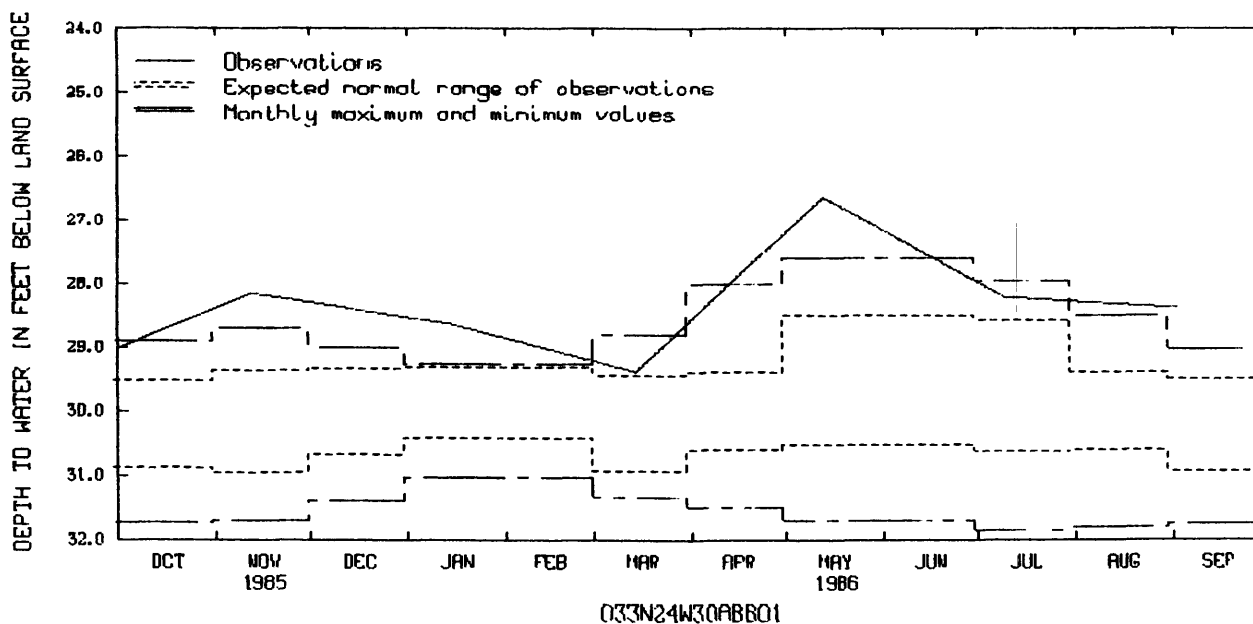
DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Top of casing, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 26.64 ft (8.11 m) below land-surface datum, May 13, 1986; lowest, 31.84 ft (9.70 m) below land-surface datum, July 11, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 12	28.15	JAN 15	28.65	MAR 14	29.40	MAY 13	26.64	JUL 10	28.20	SEP 3	28.38



## GROUND-WATER LEVELS

## BELTRAMI COUNTY

473023094570901. Local number, 147N34W35ADC01.

LOCATION.--Lat 47°30'23", long 94°57'09", in SW¼SE¼ sec.35, T.147 N., R.34 W., Hydrologic Unit 07010101, on Clarence Hart farm.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 20 ft (6.1 m), screened 18 to 20 ft (5.5 to 6.1 m).

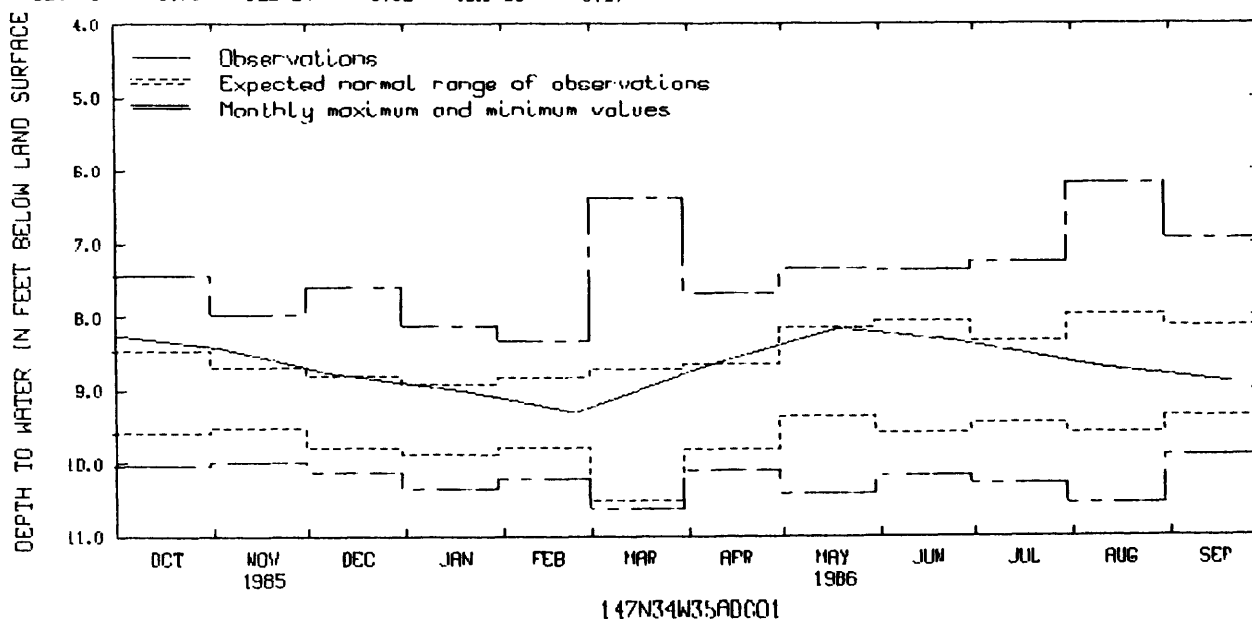
DATUM.--Altitude of land-surface datum is 1,383 ft (421 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--October 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 6.17 ft (1.88 m) below land-surface datum, Aug. 1, 1975; lowest, 10.63 ft (3.22 m) below land-surface datum, Mar. 16, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 4	8.44	JAN 21	9.04	APR 4	8.72	JUN 26	8.36	AUG 11	8.72	SEP 22	8.92
DEC 9	8.78	FEB 24	9.32	MAY 19	8.17						



147N34W35ADC01

## BIG STONE COUNTY

451517096104501. Local number, 121N44W27CCC01.

LOCATION.--Lat 45°15'17", long 96°10'45", in SW¼SW¼ sec.27, T.121 N., R.44 W., Hydrologic Unit 07010001, north of Correll.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 16 ft (4.9 m), screened 14 to 16 ft (4.3 to 4.9 m).

DATUM.--Altitude of land-surface datum is 1,018 ft (310 m). Measuring point: Top of casing, 3.10 ft (0.94 m) above land-surface datum.

PERIOD OF RECORD.--September 1972 to February 1974, August 1976 to current year.

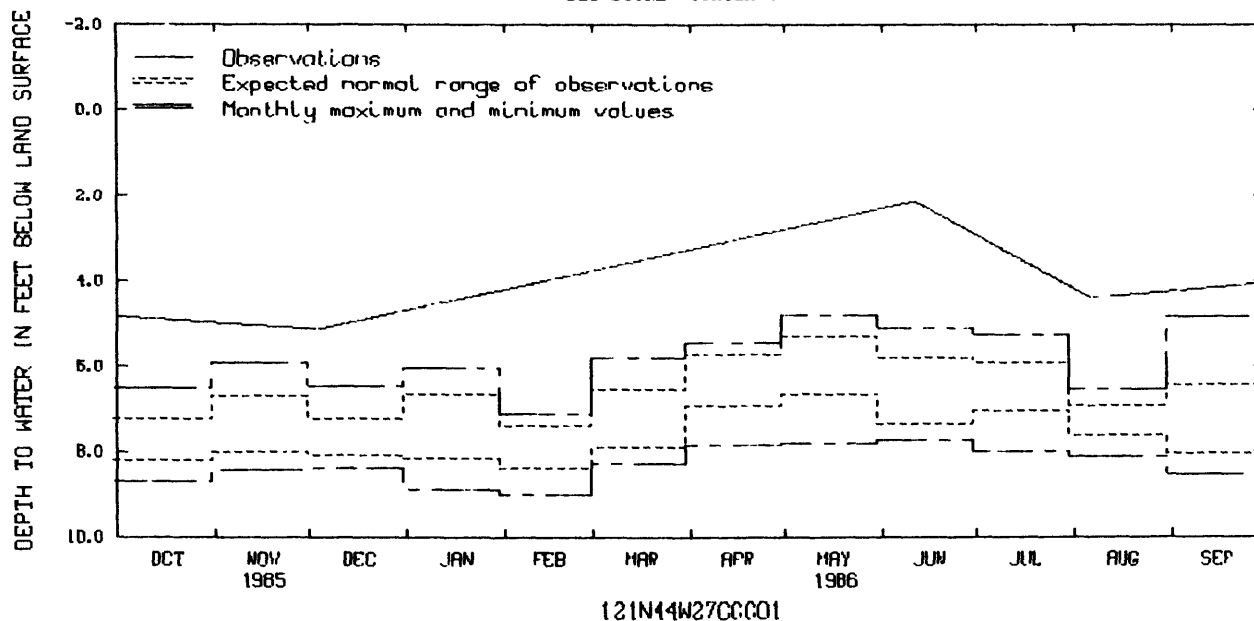
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.16 ft (0.65m) below land-surface datum, June 12, 1986; lowest, 8.99 ft (2.74 m) below land-surface datum, Feb. 8, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 3	5.15	JUN 12	2.16	AUG 7	4.43

## GROUND-WATER LEVELS

## BIG STONE--Continued



453330096420201. Local number, 124N48W17AAA01.

LOCATION.--Lat 45°33'30", long 96°42'02", in NE~~1~~NE~~1~~NE~~1~~ sec.17, T.124 N., R.48 W., Hydrologic Unit 07020001, 0.5 mi (0.8 km) east of Beardsley.

Owner: U.S. Geological Survey.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in (0.05 m), depth 282 ft (86.0 m), screened 242 to 282 ft (73.8 to 86.0 m).

DATUM.--Altitude of land-surface datum is 1,086.8 ft (331.3 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 3.60 ft (1.10 m) above land-surface datum.

PERIOD OF RECORD.--November 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.90 ft (3.32 m) below land-surface datum, Apr. 11, 1979; lowest, 21.75 ft (6.63 m) below land-surface datum, Aug. 25, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JAN 9	15.40	FEB 13	15.39	APR 10	14.56	AUG 14	13.34

## BLUE EARTH COUNTY

440050094102801. Local number, 106N28W03DBA01.

LOCATION.--Lat 44°00'50", long 94°10'28", in NE~~1~~NW~~1~~SE~~1~~ sec.3, T.106 N., R.28 W., Hydrologic Unit 07020010, at Farmland Industries Ammonia Plant, 3.2 mi (5.2 km) north of Vernon Center.

Owner: Farmland Industries.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in (0.41 m), depth 390 ft (119 m), cased to 150 ft (45.7 m).

DATUM.--Altitude of land-surface datum is 1,005 ft (306 m). Measuring point: Top of recorder floor, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--October 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 71.81 ft (21.89 m) below land-surface datum, Apr. 26, 1983; lowest, 76.17 ft (23.22 m) below land-surface datum, Aug. 17, 1977.

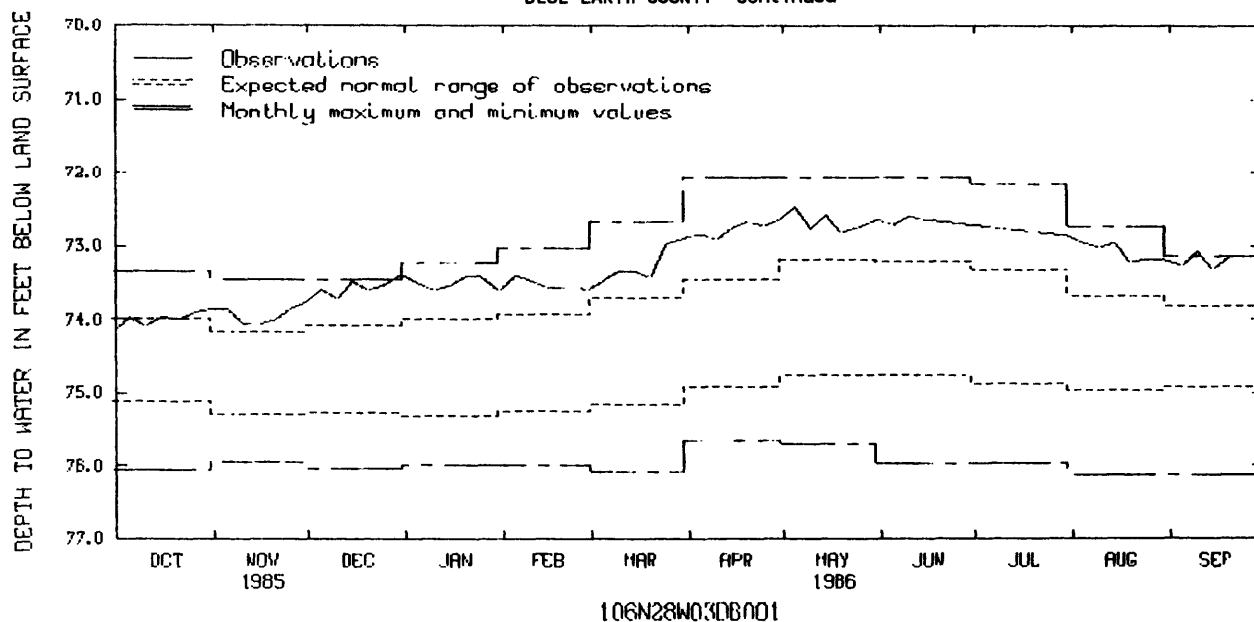
WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	73.97	73.87	73.60	73.53	73.41	73.48	72.84	72.46	72.71	.....	72.96	73.27
10	74.10	74.07	73.73	73.62	73.49	73.35	72.91	72.75	72.60	.....	73.03	73.08
15	73.98	74.08	73.49	73.55	73.58	73.34	72.77	72.59	72.64	.....	72.96	73.32
20	74.03	74.02	73.61	73.41	73.58	73.44	72.67	72.83	.....	.....	73.23	73.17
25	73.92	73.86	73.55	73.44	73.58	72.98	72.73	72.75	.....	.....	73.18	.....
EOM	73.86	73.77	73.39	73.61	73.61	72.90	72.66	72.64	.....	72.88	73.20	.....

WTR YEAR 1986 HIGHEST 72.33 MAY 5, 1986 LOWEST 74.18 OCT 1, 1985

## GROUND-WATER LEVELS

## BLUE EARTH COUNTY--Continued



441134093505301. Local number, 108N25W04BBC01.

LOCATION.--Lat 44°11'34", long 93°50'53", in SW¼NW¼NW¼ sec.4, T.108 N., R.25 W., Hydrologic Unit 07020011, at 1.3 mi (2.1 km) west of Madison Lake at waste treatment plant.

Owner: City of Madison Lake.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 6 in (0.15 m), depth 313 ft (95.4 m), cased to 296 ft (90.2 m).

DATUM.--Altitude of land-surface datum is 1,036 ft (316 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--May 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 92.52 ft (28.20 m) below land-surface datum, July 17, 1986; lowest, 95.42 ft (29.08 m) below land-surface datum, July 16, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	93.23	MAY 15	92.66	JUL 17	92.52	SEP 18	92.70
MAR 27	93.20						

## BROWN COUNTY

441030094254501. Local number, 108N30W09ADD01.

LOCATION.--Lat 44°10'30", long 94°25'45", in SE¼SE¼NE¼ sec.9, T.108 N., R.30 W., Hydrologic Unit 07020007, 3.7 mi (6.0 km) northeast of Hanska.

Owner: Erwin Kjelshus.

AQUIFER.--Deposits of Pleistocene Age.

WELL CHARACTERISTICS.--Bored unused water-table well, diameter 16 in (0.41 m), depth 32 ft (9.8 m), cased to 32 ft (9.8 m), open end.

DATUM.--Altitude of land-surface datum is 1,003 ft (306 m). Measuring point: Top of concrete cover, at land-surface datum.

REMARKS.--Measured by Erwin Kjelshus. Water level used in monthly Water Resources Review.

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

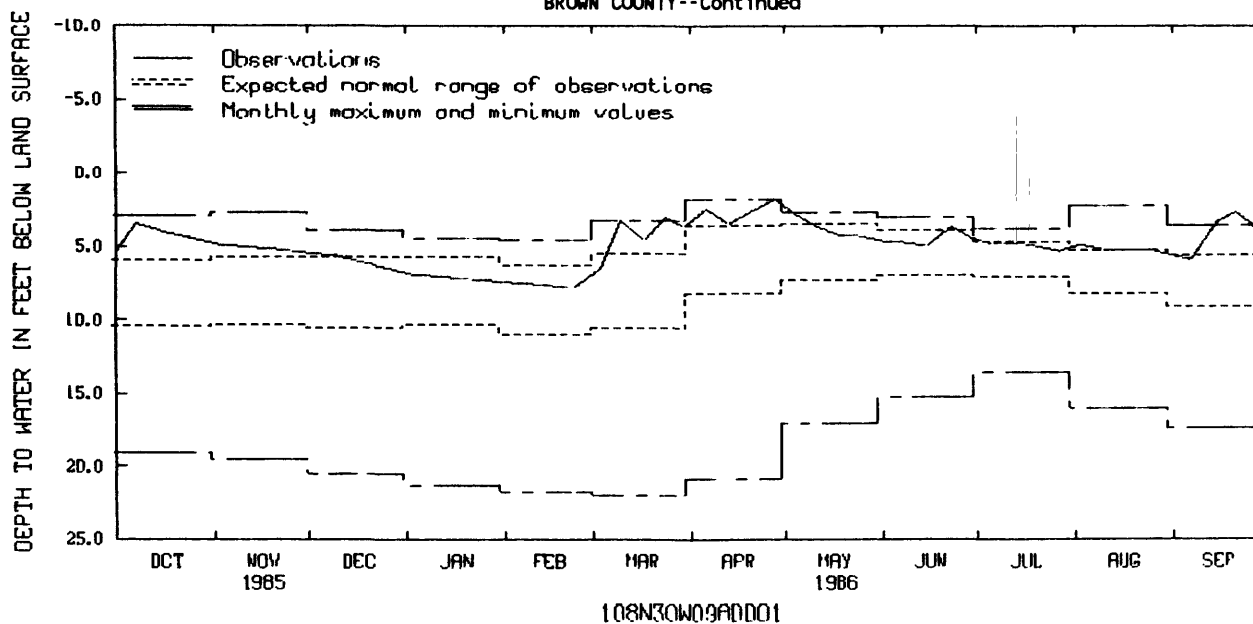
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.82 ft (0.55 m) below land-surface datum, Apr. 28, 1986; lowest, 22.00 ft (6.71 m) below land-surface datum, Mar. 2, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	3.52	MAR 3	6.60	APR 20	2.67	JUN 1	4.75	JUL 13	4.83	AUG 24	5.29
15	4.00	10	3.23	28	1.82	8	4.84	20	5.07	31	5.55
NOV 2	4.93	17	4.54	MAY 4	2.85	15	5.05	27	5.40	SEP 7	5.90
21	5.22	24	3.07	11	3.71	23	3.67	AUG 3	4.98	15	3.35
DEC 10	5.67	30	3.68	18	4.20	29	4.46	10	5.31	21	2.65
JAN 3	7.00	APR 6	2.46	25	4.35	JUL 6	4.95	15	5.30	29	3.90
FEB 23	7.82	13	3.46								

## GROUND-WATER LEVELS

## BROWN COUNTY--Continued



441800094434301. Local number, 110N32W30DD801.

LOCATION.--Lat 44°18'00", long 94°43'43", in NW¼SE¼ sec.30, T.110 N., R.32 W., Hydrologic Unit 07020008, in Sleepy Eye at hospital.

Owner: City of Sleepy Eye.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in (0.05 m), depth 176 ft (53.6 m).

DATUM.--Altitude of land-surface datum is 1,030 ft (314 m). Measuring point: Top of casing, 1.30 ft (0.40 m) above land-surface datum.

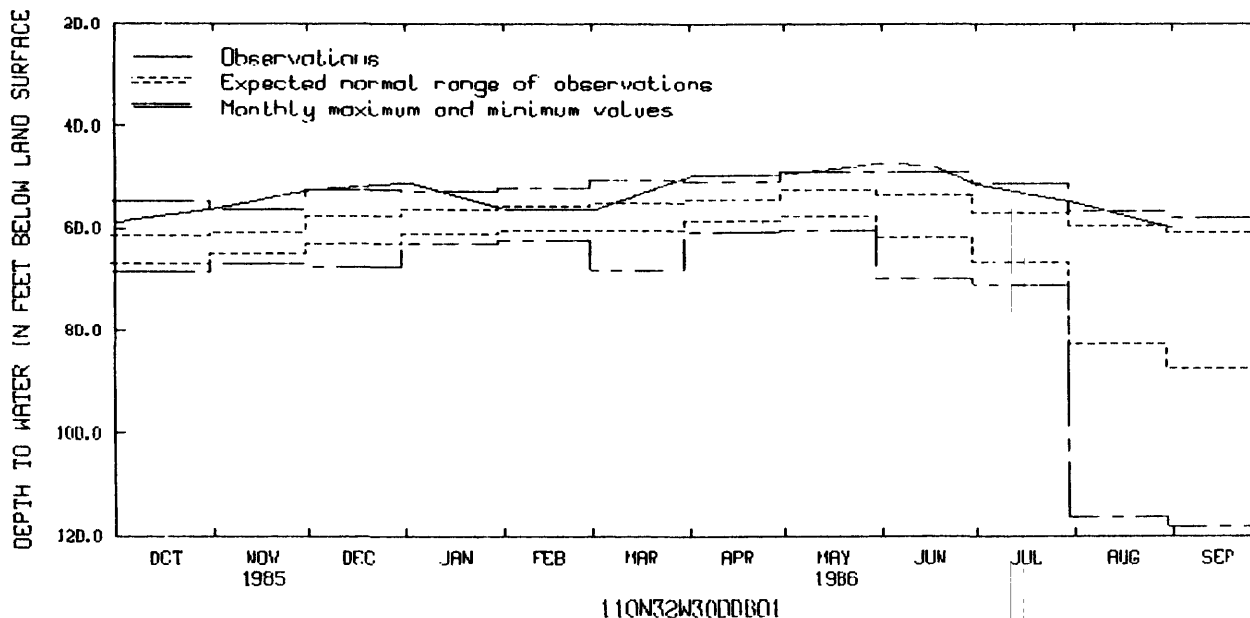
REMARKS.--Water level affected by pumping from nearby wells.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 47.40 ft (14.44 m) below land-surface datum, June 2, 1986; lowest, 118.1 ft (36.00 m) below land-surface datum, Sept. 15, 1976.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	58.50	JAN 2	51.00	MAR 3	56.30	MAY 1	49.40	JUN 18	47.95	AUG 1	55.10
NOV 1	56.20	FEB 1	56.20	APR 1	49.70	JUN 2	47.40	JUL 1	51.40	SEP 2	60.20
DEC 1	56.60										



## GROUND-WATER LEVELS

## CARVER COUNTY

445155093320101. Local number, 116N23W12CDB01.

LOCATION.--Lat 44°51'55", long 93°32'01", in NW¼SE¼SW¼ sec.12, T.116 N., R.23 W., Hydrologic Unit 07020012, Chanhassen water tower.

Owner: City of Chanhassen, well 1.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 10 in (0.25 m), depth 518 ft (158 m), cased to 424 ft (129 m).

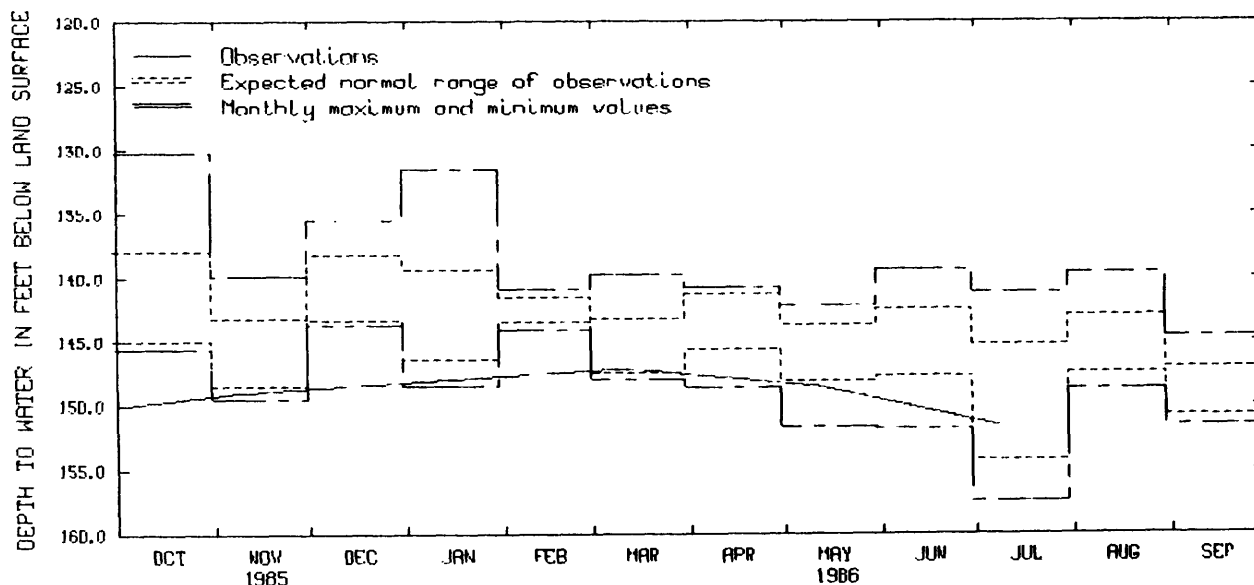
DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Edge of vent pipe, 2.40 ft (0.73 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 130.3 ft (39.72 m) below land-surface datum, Oct. 13, 1965; lowest, 157.5 ft (48.00 m) below land-surface datum, July 16, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 6	149.06	JAN 10	148.08	MAR 12	147.20	MAY 12	148.65	JUL 9	151.66		WELL DESTROYED



116N23W12CDB01

## CHIPPEWA COUNTY

450447095490101. Local number, 119N41W29DD01.

LOCATION.--Lat 45°04'47", long 95°40'01", in SE¼SE¼SE¼ sec.29, T.119 N., R.41 W., Hydrologic Unit 07020005, 5 mi (8.1 km) north of Watson.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 19 ft (5.8 m), screened 17 to 19 ft (5.2 to 5.8 m).

DATUM.--Altitude of land-surface datum is 992 ft (302 m). Measuring point: Top of casing, 3.75 ft (1.14 m) above land-surface datum.

PERIOD OF RECORD.--September 1972 to February 1974, January 1977 to current year.

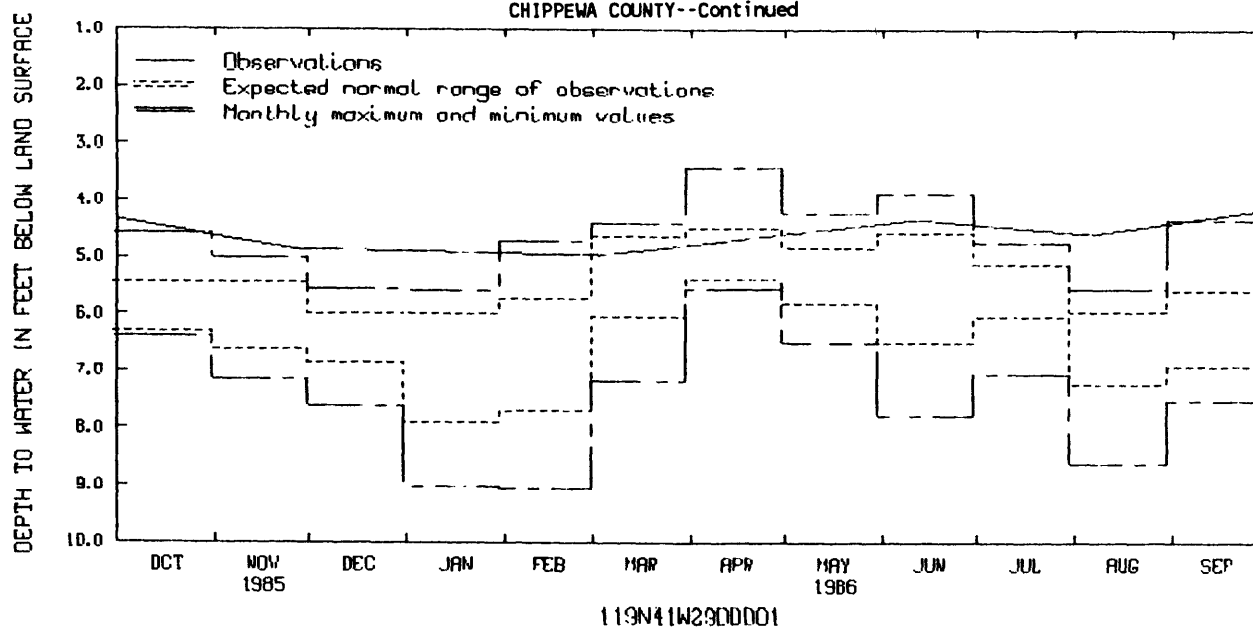
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 3.43 ft (1.05 m) below land-surface datum, Apr. 10, 1984; lowest, 9.06 ft (2.76 m) below land-surface datum, Feb. 8, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 25	4.88	MAR 3	4.97	JUN 12	4.36	AUG 6	4.61

## GROUND WATER LEVELS

## CHIPPEWA COUNTY--Continued



450631095562201. Local number, 119N42W17DDD01.

LOCATION.--Lat 45°06'31", long 95°56'22", in SE¼SE¼SE¼ sec.17, T.119 N., R.42 W., Hydrologic Unit 07020001, west of Milan.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial silt of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 19 ft (5.8 m), screened 17 to 19 ft (5.2 to 5.8 m).

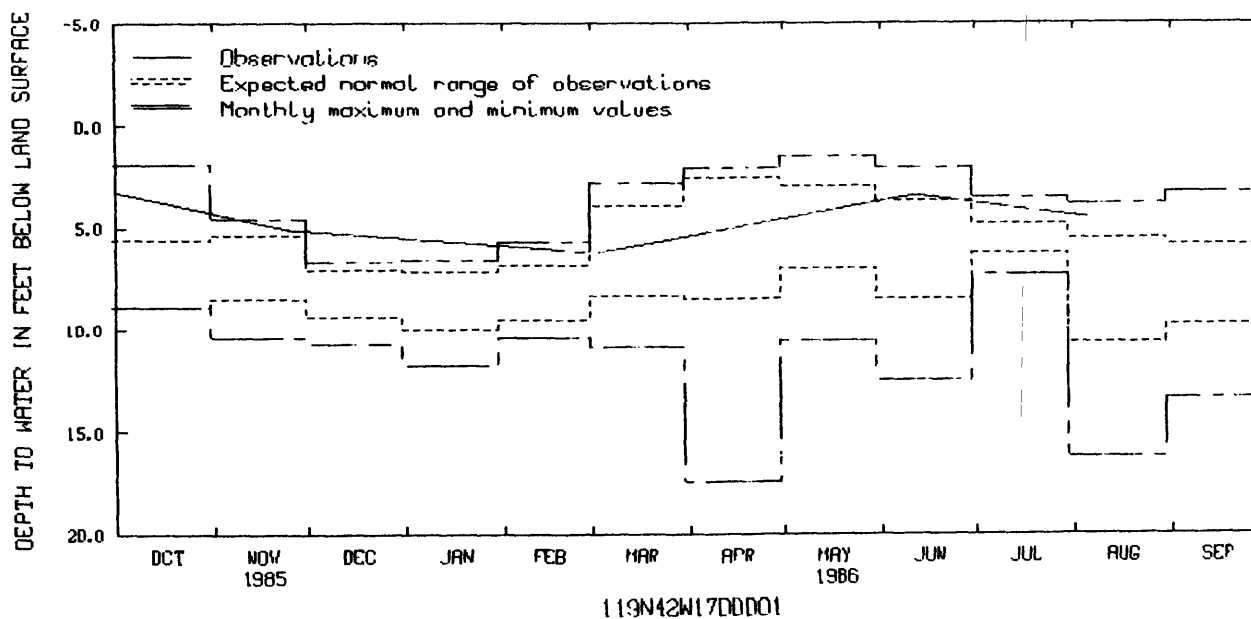
DATUM.--Altitude of land-surface datum is 1,027 ft (313 m). Measuring point: Top of casing, 4.50 ft (1.37 m) above land-surface datum.

PERIOD OF RECORD.--September 1972 to October 1973, April 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.50 ft (0.46 m) below land-surface datum, May 7, 1973; lowest, 17.46 ft (5.32 m) below land-surface datum, Apr. 1, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 25	5.08	MAR 3	6.24	JUN 12	3.42	AUG 6	4.51



## GROUND-WATER LEVELS

## CHISAGO COUNTY

453125092445401. Local number, 035N19W17BD01.

LOCATION.--Lat 45°31'25", long 92°44'54", in NW¼SE¼NW¼ sec.17, T.35 N., R.19 W., Hydrologic Unit 07030005, at Wild River State Park.

Owner: State of Minnesota.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 6 in (0.15 m), depth 270 ft (82.3 m), cased 230 ft (70.1 m).

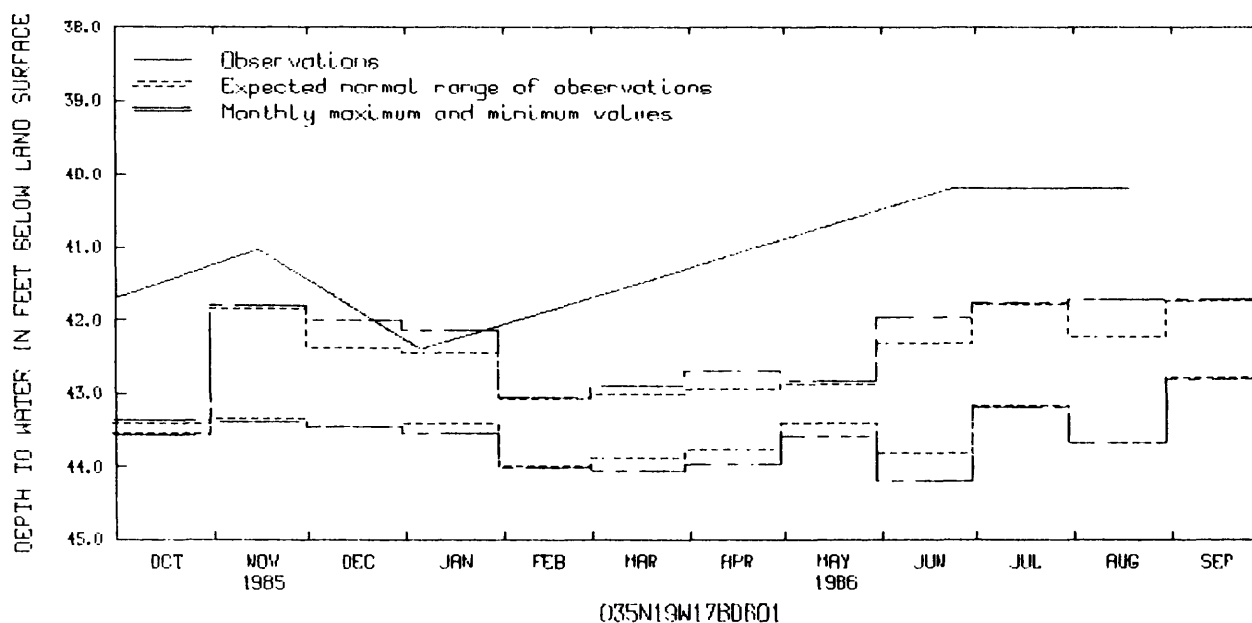
DATUM.--Altitude of land-surface datum is 820 ft (250 m). Measuring point: Top of casing, 0.70 ft (0.21 m) above land-surface datum.

PERIOD OF RECORD.--October 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 40.17 ft (12.24 m) below land-surface datum, June 24, 1986; lowest, 44.19 ft (13.47 m) below land-surface datum, June 8, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 15	41.04	JAN 6	42.40	JUN 24	40.17	AUG 19	40.17



## GROUND-WATER LEVELS

## CROW WING COUNTY

463006094131201. Local number, 135N28W16CCD01.

LOCATION.--Lat 46°30'06", long 94°13'12", in SE~~SW~~SW~~SE~~ sec.16, T.135 N., R.28 W., Hydrologic Unit 07010106, northwest of Merrifield.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 18 ft (5.5 m), screened 16 to 18 ft (4.9 to 5.5 m).

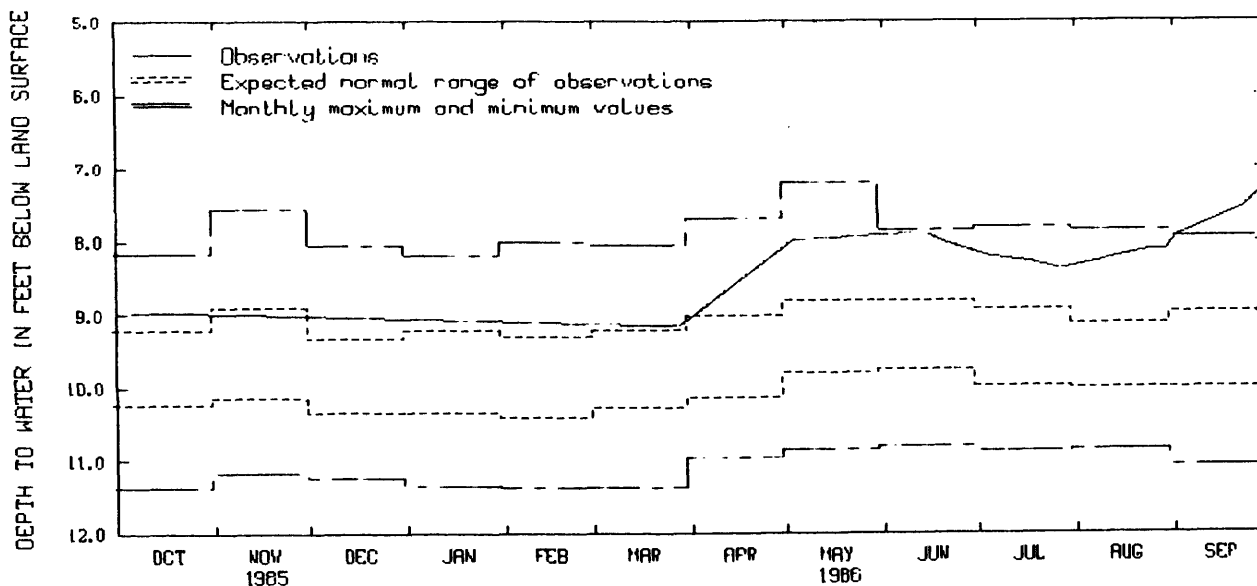
DATUM.--Altitude of land-surface datum is 1,212 ft (369 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--October 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 7.20 ft (2.19 m) below land-surface datum, May 1, 1982; lowest, 11.38 ft (3.47 m) below land-surface datum, Oct. 16, 1970, Mar. 11, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	8.99	MAY 3	8.00	JUN 21	8.04	JUL 27	8.38	AUG 30	8.12	SEP 23	7.57
12	8.97	10	7.99	JUL 5	8.20	AUG 23	8.14	SEP 2	7.95	28	7.35
MAR 28	9.17	JUN 14	7.89	19	8.30						



135N28W16CCD01

## DAKOTA COUNTY

445044093102401. Local number, 027N23W09ABD01.

LOCATION.--Lat 44°50'44", long 93°10'24", in SE~~NW~~NE~~SE~~ sec.9, T.27 N., R.23 W., Hydrologic Unit 07020012, at Eagan.

Owner: City of Eagan, Timberline Addition.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 10 in (0.25 m), depth 503 ft (153 m), cased to 401 ft (122 m).

DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Hole in well cap, 2.60 ft (0.79 m) above land-surface datum.

REMARKS.--Water-level affected by pumping.

PERIOD OF RECORD.--December 1965, April 1966, December 1966, March 1967, December 1970, August 1971, August 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 141.4 ft (43.10 m) below land-surface datum, Apr. 5, 1966; lowest, 164.7 ft (50.20 m) below land-surface datum, Sept. 9, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 8	160.27	JAN 10	161.36	MAR 12	160.74	MAY 5	161.50	JUL 7	164.52	SEP 5	162.60

## GROUND-WATER LEVELS

## DAKOTA COUNTY--Continued

445330093054301. Local number, 028N22W19DCC02.

LOCATION.--Lat 44°53'30", long 93°05'43", in SW¼SW¼SE¼ sec.19, T.28 N., R.22 W., Hydrologic Unit 07010206, in West St. Paul.

Owner: U.S. Geological Survey, 2-N.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in (0.15 m), depth 539 ft (164 m), cased to 407 ft (124 m).

DATUM.--Land-surface datum is 1,036 ft (316.0 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.60 ft (0.79 m) above land-surface datum.

REMARKS.--Water-level affected by regional pumping.

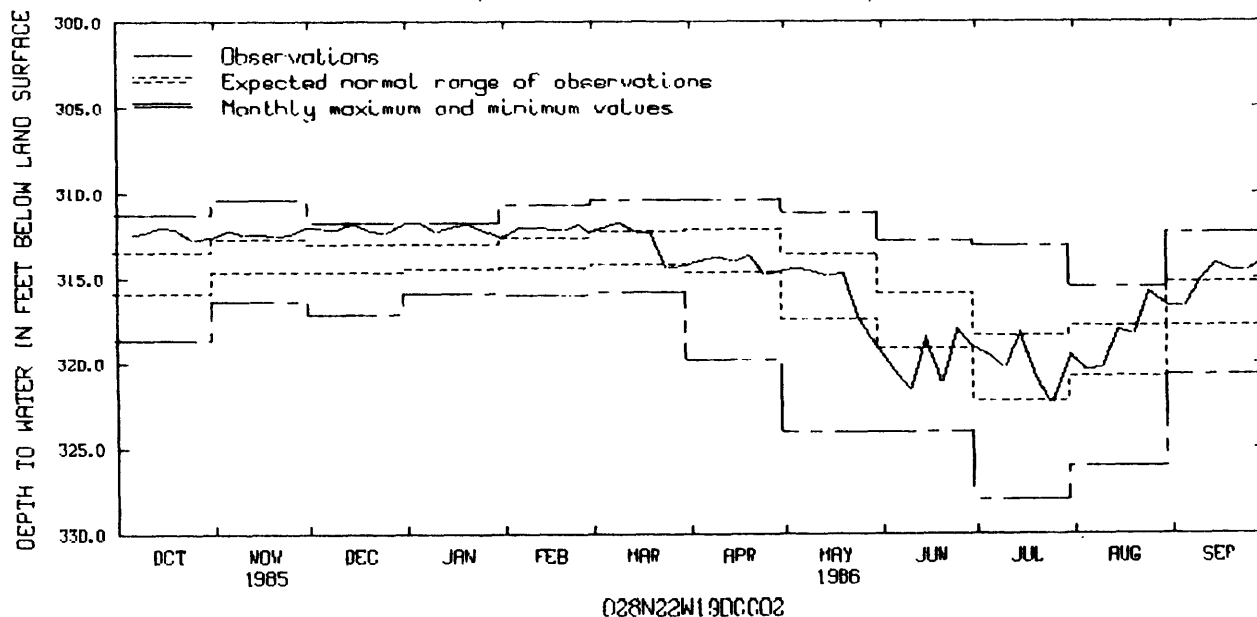
PERIOD OF RECORD.--January 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 309.8 ft (94.43 m) below land-surface datum, Mar. 7, 1983; lowest, 328.0 ft (99.97 m) below land-surface datum, July 31, 1975.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	312.51	312.25	312.12	311.74	312.15	312.01	313.93	314.41	320.52	319.53	320.48	316.70
10	312.35	312.51	312.13	312.31	312.06	311.72	313.72	314.60	321.58	320.33	320.32	315.09
15	312.00	312.45	311.88	311.99	312.15	312.27	314.07	314.95	318.46	318.18	318.11	314.14
20	312.25	312.56	312.24	311.79	312.22	312.33	313.67	314.75	321.20	320.76	318.40	314.49
25	312.84	312.40	312.41	312.19	311.88	314.47	314.83	317.46	318.00	322.44	315.80	314.64
EOC	312.62	312.06	311.87	312.56	312.31	314.24	314.67	319.23	319.01	319.49	316.69	314.06

WTR YEAR 1986      HIGHEST 311.00 DEC 23, 1985      LOWEST 323.15 JUL 26, 1986



443146093002201. Local number, 112N18W08ABA01.

LOCATION.--Lat 44°31'46", long 93°00'22", in NE¼NW¼NE¼ sec.8, T.112 N., R.18 W., Hydrologic Unit 07040002, northeast of Randolph.

Owner: U.S. Geological Survey

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 44 ft (13.4 m), screened 42 to 44 ft (12.8 to 13.4 m).

DATUM.--Altitude of land-surface datum is 880 ft (268 m). Measuring point: Top of casing, 3.40 ft (1.04 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to current year.

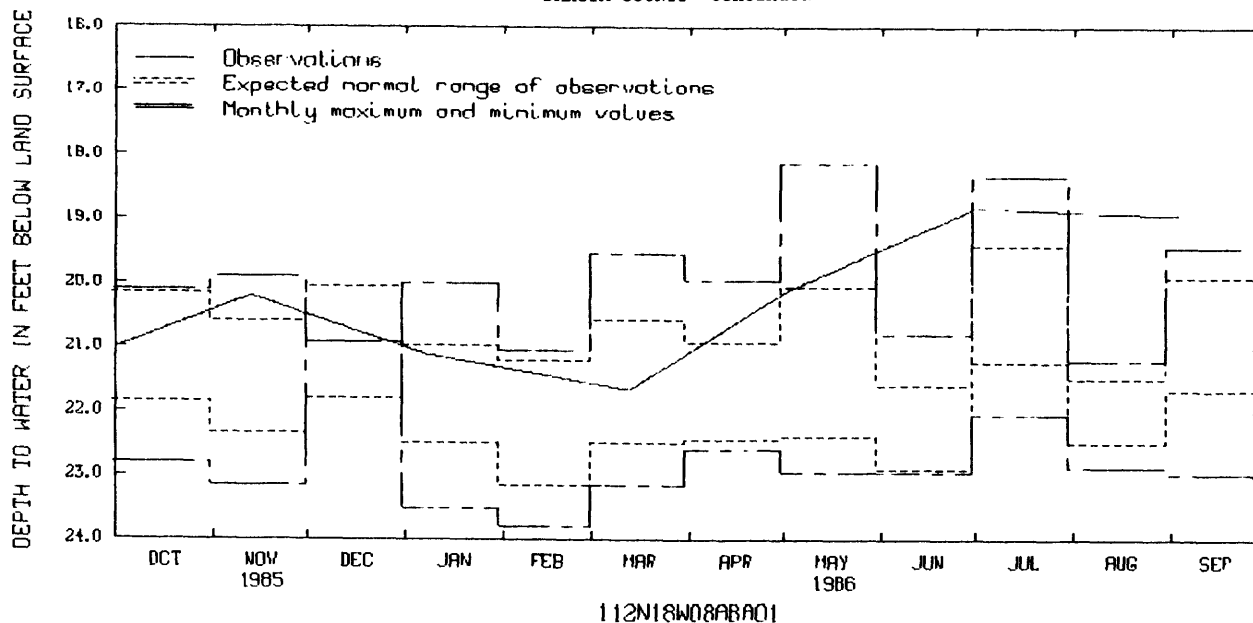
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.13 ft (5.53 m) below land-surface datum, May 3, 1983; lowest, 23.80 ft (7.25 m) below land-surface datum, Feb. 21, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	20.20	JAN 8	21.13	MAR 13	21.68	MAY 2	20.10	JUL 1	18.82	SEP 4	18.95

## GROUND-WATER LEVELS

DAKOTA COUNTY--Continued



443134093010601. Local number, 112N18W08BAC01.

LOCATION.--Lat 44°31'34", long 93°01'06", in SW1/4NW1/4 sec.8, T.112 N., R.18 W., Hydrologic Unit 07040002, at Randolph Fire Station.

Owner: City of Randolph.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled fire protection artesian well, diameter 10 in (0.25 m), depth 150 ft (45.7 m), cased to 64 ft (19.5 m).

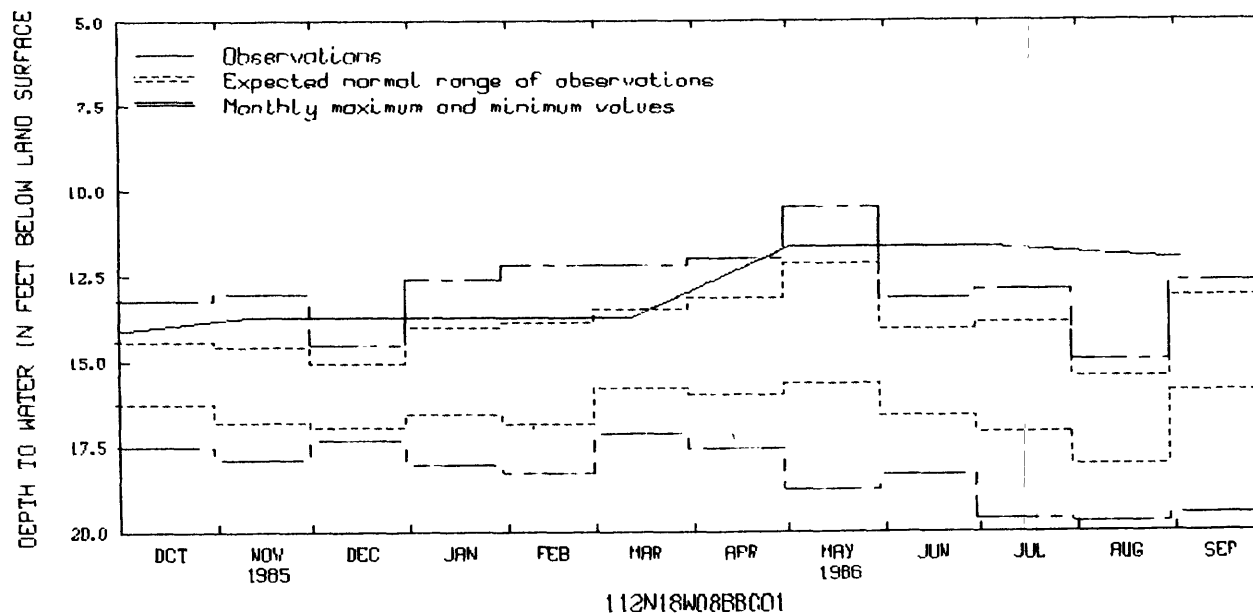
DATUM.--Altitude of land-surface datum is 883 ft (269 m). Measuring point: Top of 3/4-inch (0.02 m) breather pipe, 2.20 ft (0.67 m) above land-surface datum.

PERIOD OF RECORD.--July 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.47 ft (3.19 m) below land-surface datum, May 3, 1983; lowest, 19.70 ft (6.00 m) below land-surface datum, Aug. 11, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	13.70	JAN 8	13.77	MAR 13	13.72	MAY 2	11.63	JUL 1	11.64	SEP 4	12.03



## GROUND-WATER LEVELS

## DAKOTA COUNTY--Continued

442830093085201. Local number, 112N19W30DBD01.

LOCATION.--Lat 44°28'30", long 93°08'52", in SE¼NW¼SE¼ sec.30, T.112 N., R.19 W., Hydrologic Unit 07040002, at Northfield waste treatment plant.

Owner: City of Northfield.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 6 in (0.15 m), depth 275 ft (83.8 m), cased to 212 ft (64.6 m).

DATUM.--Altitude of land-surface datum is 890 ft (271 m). Measuring point: Center of pressure guage, 2.05 ft (0.62 m) above land-surface datum.

PERIOD OF RECORD.--May 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.54 ft (5.65 m) above land-surface datum, July 12, 1983; lowest, 9.19 ft (2.80 m) above land-surface datum, July 10, 1985.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	11.26	JAN 8	11.03	MAR 13	10.57	MAY 2	13.33	JUL 1	14.25	SEP 4	14.13

443645093014701. Local number, 113N18W07BAC01.

LOCATION.--Lat 44°36'45", long 93°01'47", in SW¼NE¼NW¼ sec.7, T.113 N., R.18 W., Hydrologic Unit 07040001, west of Hampton.

Owner: Eugene Dohmen.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in (0.41 m), depth 325 ft (99.1 m), cased to 65 ft (19.8 m).

DATUM.--Altitude of land-surface datum is 915 ft (217 m). Measuring point: Hole in pump base, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to August 1977, January 1978, June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.17 ft (7.36 m) below land-surface datum, Sept. 4, 1986; lowest, 33.19 ft (10.12 m) below land-surface datum, Aug. 12, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	27.62	JAN 8	27.81	MAR 13	28.16	MAY 2	26.60	JUL 1	24.93	SEP 4	24.17

444205092500001. Local number, 114N17W10AAA01.

LOCATION.--Lat 44°42'05", long 92°50'00", in NE¼NE¼NE¼ sec.10, T.114 N., R.17 W., Hydrologic Unit 07040001, southeast of Hastings.

Owner: John Conzemius.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in (0.10 m), depth 151 ft (46.0 m), depth of casing unknown.

DATUM.--Altitude of land-surface datum is 827 ft (252 m). Measuring point: Top of platform, 2.50 ft (0.76 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 95.91 ft (29.23 m) below land-surface datum, Sept. 25, 1986; lowest, 107.4 ft (32.74 m) below land-surface datum, Mar. 12, 1978.

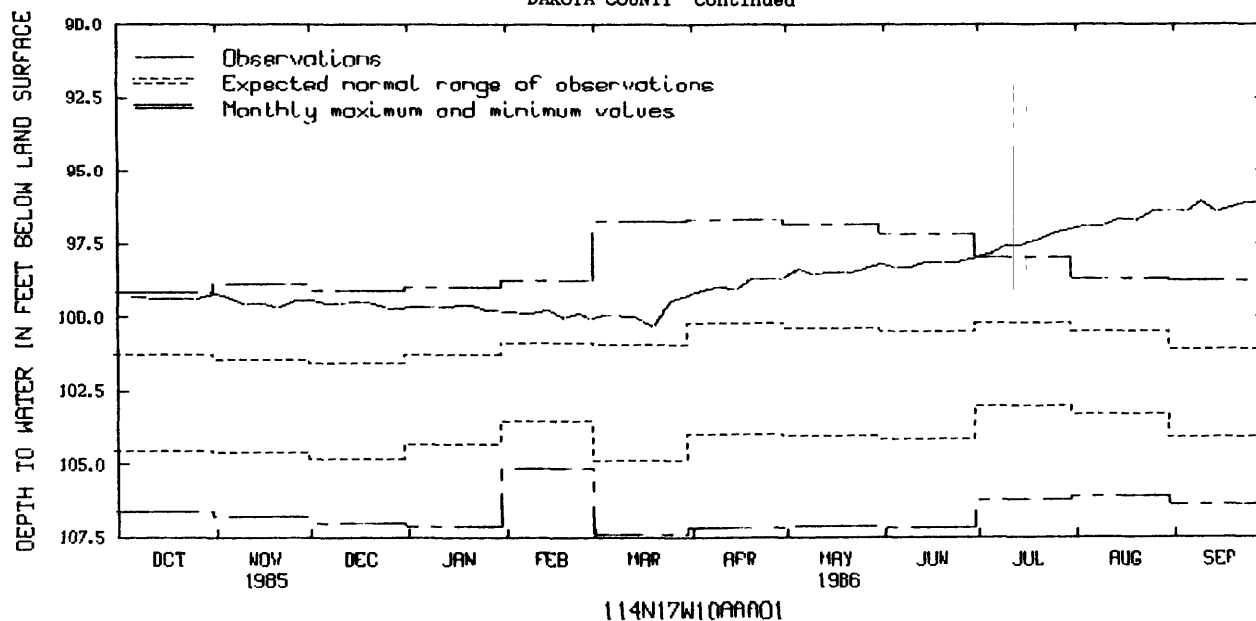
WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	99.31	99.35	99.52	99.68	99.87	99.91	99.07	98.34	98.38	97.88	96.91	96.46
10	99.38	99.61	99.60	99.69	99.87	99.97	99.00	98.59	98.30	97.58	96.88	96.06
15	99.39	99.53	99.49	99.68	99.77	100.06	99.10	98.45	98.15	97.55	96.68	96.48
20	99.38	99.69	99.54	99.61	100.07	100.32	98.72	98.53	98.22	97.40	96.76	96.31
25	99.43	99.50	99.69	99.74	99.89	99.46	98.70	98.43	98.14	97.16	96.45	96.13
ECM	99.23	99.44	99.70	99.82	100.09	99.27	98.70	98.20	98.02	97.03	96.40	96.16

WTR YEAR 1986      HIGHEST 95.91 SEP 25, 1986      LOWEST 100.32 MAR 20, 1986

## GROUND-WATER LEVELS

DAKOTA COUNTY--Continued



444047092521901. Local number, 114N17W16CBB01.

LOCATION.--Lat 44°40'47", long 92°52'19", in NW1/4SW1/4 sec.16, T.114 N., R.17 W., Hydrologic Unit 07040001, Kirby Avenue, 0.5 mi (0.8 km) north of 190th Street.

Owner: Jim Huneke Construction Company.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic water-table well, diameter 4 in (0.10 m), depth 170 ft (51.8 m), screened 164 to 170 ft (50.0 to 51.8 m).

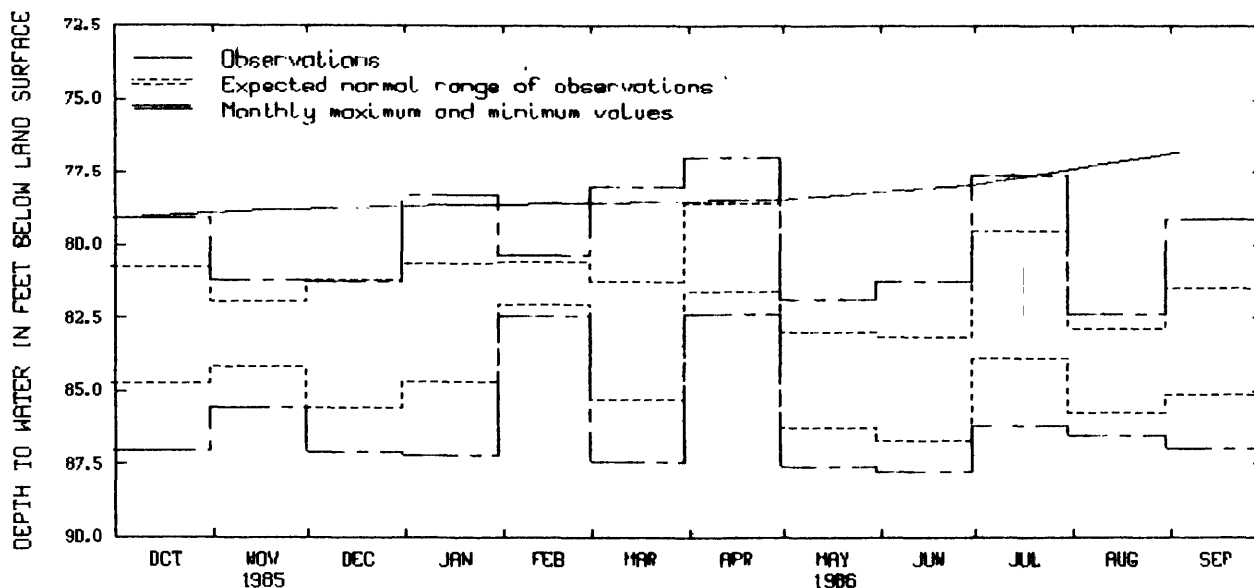
DATUM.--Altitude of land-surface datum is 823 ft (251 m). Measuring point: Top of casing, 1.10 ft (0.34 m) above land-surface datum.

PERIOD OF RECORD.--March 1976, March 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 76.84 ft (23.42 m) below land-surface datum, Sept. 4, 1986; lowest, 87.75 ft (26.75 m) below land-surface datum, June 27, 1978.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	78.86	JAN 8	78.69	MAR 13	78.56	MAY 2	78.43	JUL 1	77.97	SEP 4	76.84



## GROUND-WATER LEVELS

## DAKOTA COUNTY--Continued

443827092521801. Local number, 114N17W33BBC01.

LOCATION.--Lat 44°38'27", long 92°52'18", in SW¼NW¼ sec.33, T.114 N., R.17 W., Hydrologic Unit 07040001, 39 ft (11.9 m) south of irrigation well.

Owner: Rainer Kimmes.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

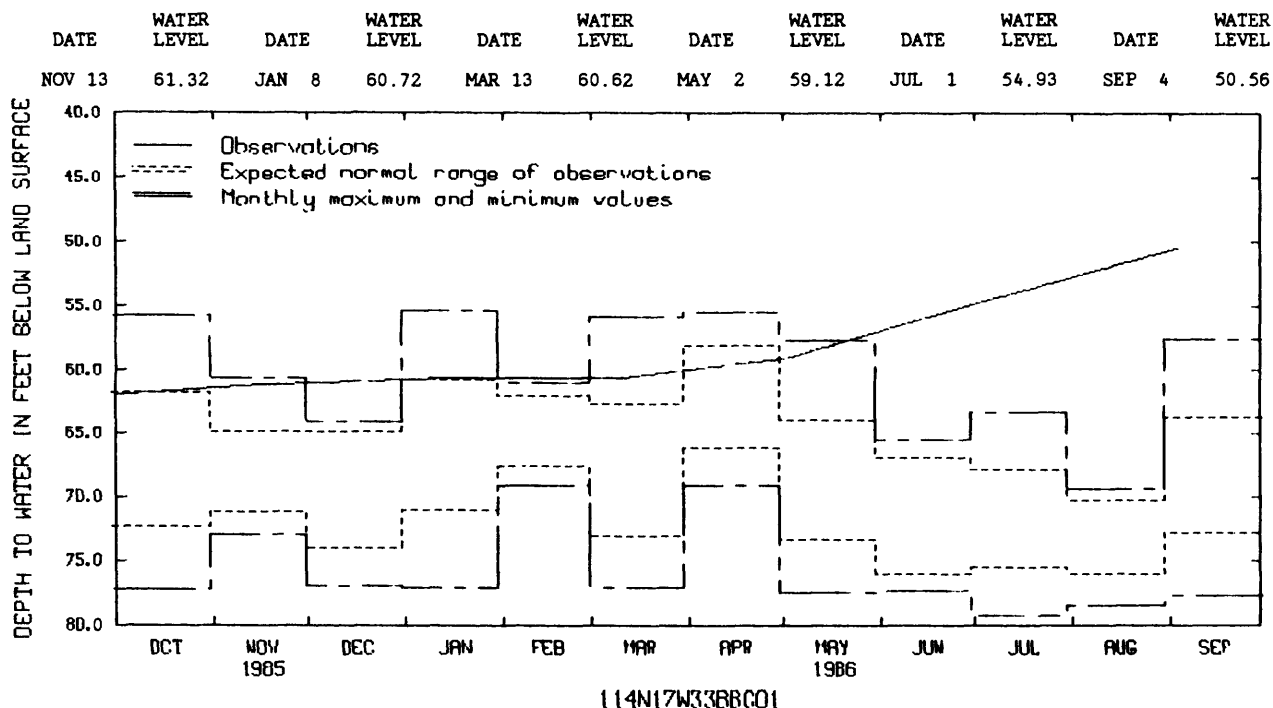
WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 16 in (0.41 m), depth 290 ft (88.4 m), cased to 25 ft (7.6 m).

DATUM.--Altitude of land-surface datum is 862 ft (263 m). Measuring point: Hole in plate over well, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--August 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 50.56 ft (15.41 m) below land-surface datum, Sept. 4, 1986; lowest, 79.20 ft (24.14 m) below land-surface datum, July 11, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



444117092595701. Local number, 114N18W17AAB01.

LOCATION.--Lat 44°41'17", long 92°59'57", in NW¼NE¼ sec.17, T.114 N., R.18 W., Hydrologic Unit 07040001, 180th Street, 0.25 mi (0.40 km) west of Emery Avenue.

Owner: Joe Ries.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in (0.41 m), depth 280 ft (85.3 m), cased to 39 ft (11.9 m).

DATUM.--Altitude of land-surface datum is 905 ft (276 m). Measuring point: Edge of vent pipe, 1.40 ft (0.43 m) above land-surface datum.

PERIOD OF RECORD.--June 1979 to current year.

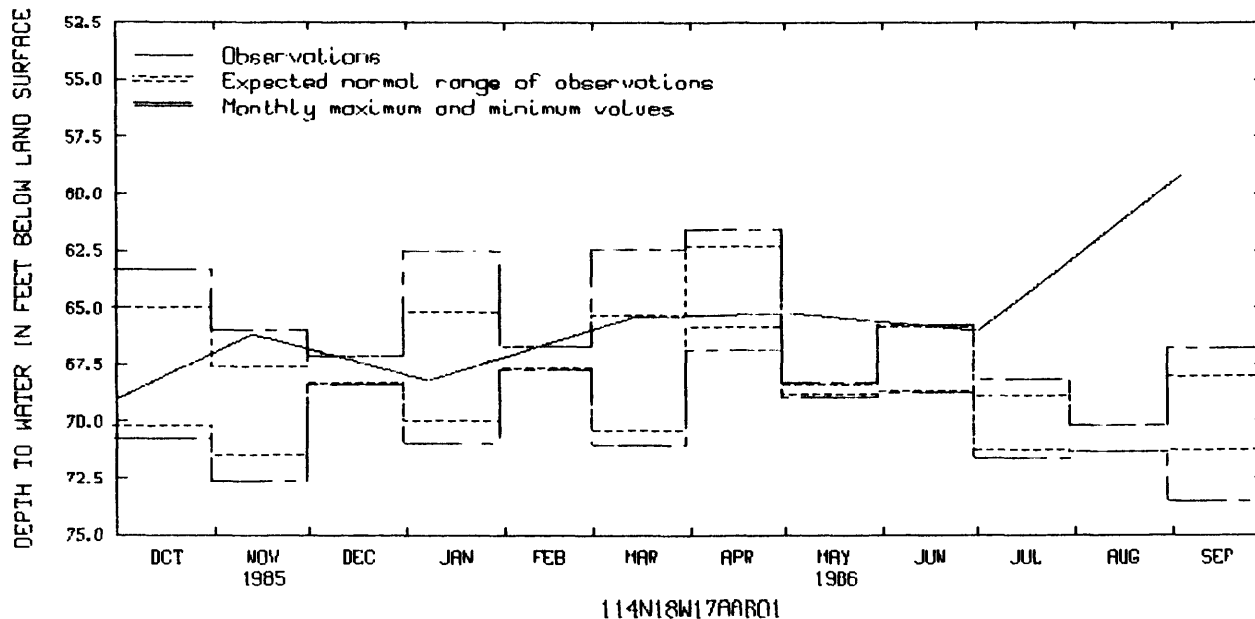
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 59.24 ft (18.05 m) below land-surface datum, Sept. 4, 1986; lowest, 73.52 ft (22.41 m) below land-surface datum, Sept. 13, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	66.19	JAN 8	68.22	MAR 13	65.48	MAY 2	65.26	JUL 1	66.05	SEP 4	59.24

## GROUND-WATER LEVELS

DAKOTA COUNTY--Continued



443801092571301. Local number, 114N18W3SCCB01.

LOCATION.--Lat 44°38'01", long 92°57'13", in NW¼SW¼SW¼ sec.35, T.114 N., R.18 W., Hydrologic Unit 07040001, Goodwin Avenue, 1.1 mi (1.8 km) south of Northfield Boulevard.

Owner: Al Wagner, Jr.

AQUIFER.--Buried gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 203 ft (61.9 m), screened 173 to 203 ft (52.7 to 61.9 m).

DATUM.--Altitude of land-surface datum is 898 ft (274 m). Measuring point: Hole in pump base, 1.25 ft (0.38 m) above land-surface datum.

PERIOD OF RECORD.--June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.85 ft (5.74 m) below land-surface datum, Sept. 4, 1986; lowest, 38.28 ft (11.67 m) below land-surface datum, Sept. 13, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	26.98	JAN 8	26.57	MAR 13	26.89	MAY 2	23.64	JUL 1	19.85	SEP 4	18.85

444220093055001. Local number, 114N19W04DAC01.

LOCATION.--Lat 44°42'20", long 93°05'50", in SW¼NE¼SE¼ sec.4, T.114 N., R.19 W., Hydrologic Unit 07040001, 2.1 mi (3.4 km) southeast of Rosemount.

Owner: University of Minnesota Agricultural Experiment Station (Plant Pathology).

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 6 in (0.15 m), depth 415 ft (126 m), cased to 355 ft (108 m).

DATUM.--Altitude of land-surface datum is 947 ft (289 m). Measuring point: Top of 1-inch breather pipe, 2.10 ft (0.64 m) above land-surface datum.

PERIOD OF RECORD.--August 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 56.20 ft (17.12 m) below land-surface datum, Sept. 12, 1986; lowest, 65.23 ft (19.88 m) below land-surface datum, Nov. 27, 1970.

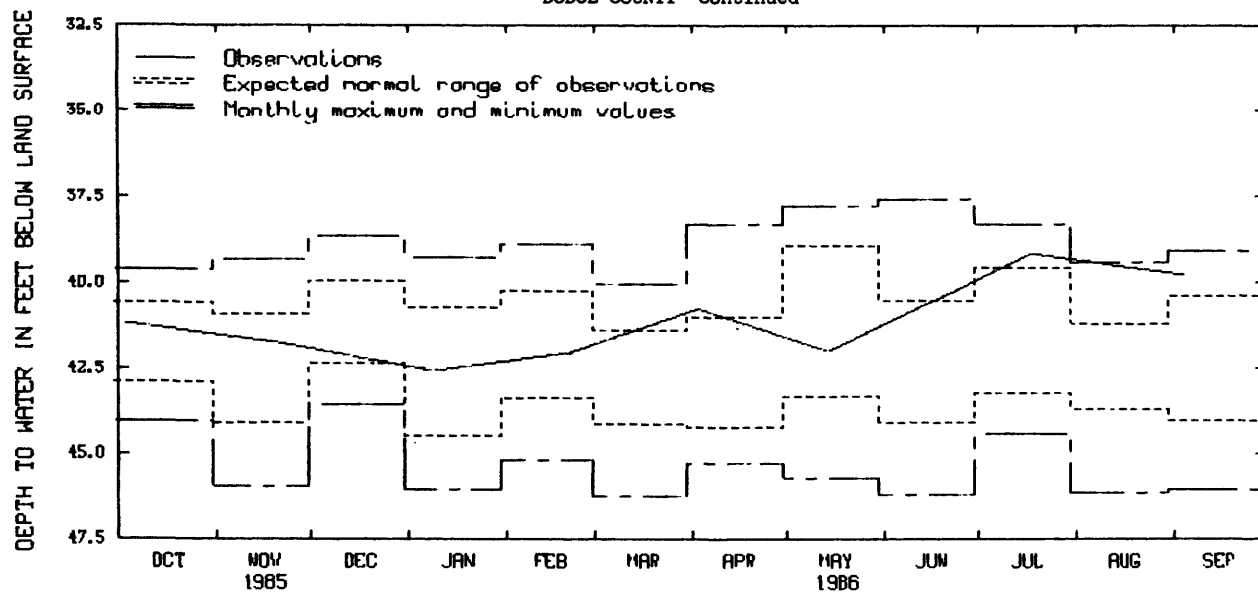
WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 8	58.14	JAN 14	58.33	MAR 21	58.54	MAY 7	57.50	JUL 7	56.83	SEP 12	56.20



## GROUND-WATER LEVELS

DODGE COUNTY--Continued



105N18W1300D01

440448092485501. Local number, 107N17W13BBA01.

LOCATION.--Lat 44°04'48", long 92°48'55", in NE1/4NW1/4 sec.13, T.107 N., R.17 W., Hydrologic Unit 07040004, in city of Wasioja.

Owner: Wasioja Township Garage.

AQUIFER.--Galena Formation of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled maintenance artesian well, diameter 6 in (0.15 m), depth 100 ft (30.5 m), cased to 52 ft (15.8 m).

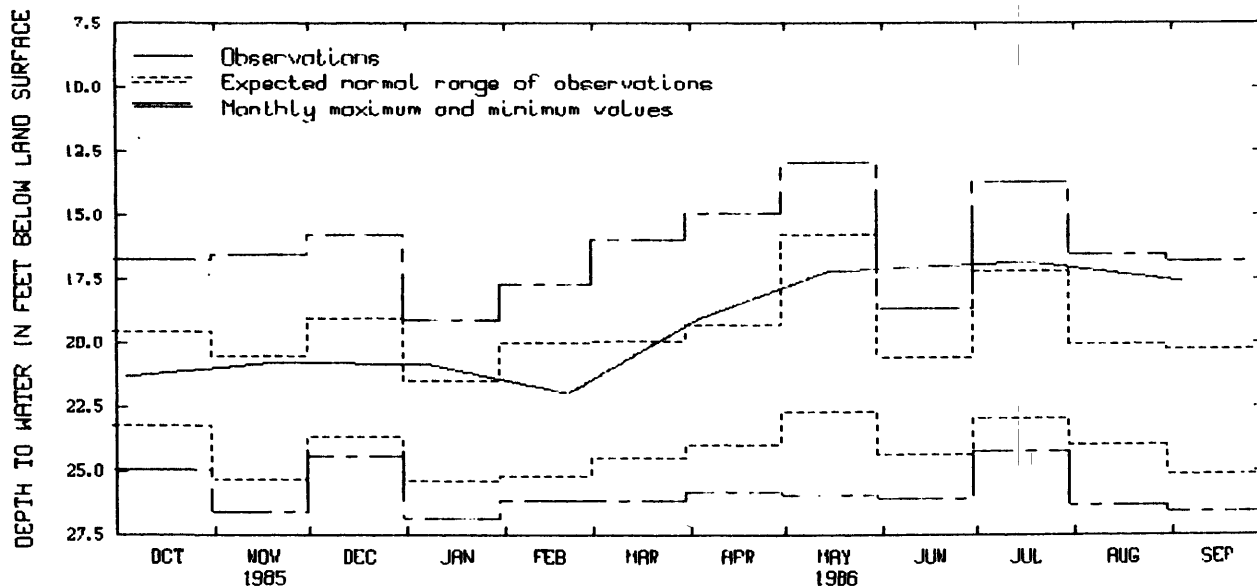
DATUM.--Altitude of land-surface datum is 1,185 ft (361 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 12.94 ft (3.94 m) below land-surface datum, May 23, 1983; lowest, 26.88 ft (8.19 m) below land-surface datum, Jan. 5, 1978.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	21.34	JAN 9	20.90	APR 3	19.11	MAY 14	17.24	JUL 18	16.84	SEP 5	17.63
NOV 21	20.80	FEB 21	21.98								



107N17W13BBA01

## GROUND-WATER LEVELS

## FARIBAULT COUNTY

434237094082901. Local number, 103N28W24BDC01.

LOCATION.--Lat 43°42'37", long 94°08'29", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.24, T.103 N., R.28 W., Hydrologic Unit 07020009, 4.5 mi (7.2 km) south of Winnebago.

Owner: Riverside Town and Country Club.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 8 in (0.20 m), depth 352 ft (107 m), cased to 291 ft (88.7 m).

DATUM.--Altitude of land-surface datum is 1,085 ft (331 m). Measuring point: Top of coupling, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--July 1979, April 1980, May 1981 to current year.

EXTREMES FOR PERIODS OF RECORD.--Highest water level, 34.82 ft (10.61 m) below land-surface datum, May 10, 1983; lowest, 39.30 ft (11.98 m) below land-surface datum, July 31, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
MAR 28	36.63	MAY 14	36.29	SEP 17	37.90

434558093540001. Local number, 104N26W36CAC01.

LOCATION.--Lat 43°45'58", long 93°54'00", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.36, T.104 N., R.26 W., Hydrologic Unit 07020011, at Easton Creamery.

Owner: City of Easton.

AQUIFER.--Platteville Formation of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 6 in (0.15 m), depth 145 ft (44.2 m), cased to 120 ft (36.6 m).

DATUM.--Altitude of land-surface datum is 1,060 ft (323 m). Measuring point: Top of well cap, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--August 1979, April 1980, May 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.97 ft (9.13 m) below land-surface datum, May 10, 1983; lowest, 35.25 ft (10.74 m) below land-surface datum, Aug. 1, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 22	32.60	JAN 23	31.82	MAR 28	32.54	MAY 14	31.10	JUL 16	31.70	SEP 17	31.54

434902094042901. Local number, 104N27W16ABA01.

LOCATION.--Lat 43°49'02", long 94°04'29", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$  sec.16, T.104 N., R.27 W., Hydrologic Unit 07020011, at Bass Lake Baptist Camp.

Owner: Baptist Church.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 240 ft (73.2 m), cased to 190 ft (57.9 m).

DATUM.--Altitude of land-surface datum is 1,050 ft (320 m). Measuring point: Hole in well cap, 0.90 ft (0.27 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 27.48 ft (8.38 m) below land-surface datum, May 10, 1983; lowest, 29.92 ft (9.11 m) below land-surface datum, Sept. 11, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 22	28.82	JAN 23	28.76	MAR 28	28.67	MAY 14	28.29	SEP 17	29.22

## GROUND-WATER LEVELS

## FREEBORN COUNTY

433434093331201. Local number, 101N23W02DAC01.

LOCATION.--Lat 43°34'34", long 93°33'12", in SW¼NE¼SE¼ sec.2, T.101 N., R.23 W., Hydrologic Unit 07080203, 3 mi (4.8 km) southwest of Conger.

Owner: Richard Steele.

AQUIFER.--Upper Carbonates of Devonian and Ordovician Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in (0.41 m), depth 373 ft (114 m), cased to 156 ft (47.6 m).

DATUM.--Altitude of land-surface datum is 1,280 ft (390 m). Measuring point: Vent pipe, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--July 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 65.58 ft (19.99 m) below land-surface datum, Mar. 8, 1983; lowest, 69.83 ft (21.28 m) below land-surface datum, Sept. 11, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 22	69.39	MAR 28	68.50	MAY 14	67.70	JUL 16	67.94	SEP 17	68.44
JAN 23	69.06								

433846093220601. Local number, 102N21W09CCB01.

LOCATION.--Lat 43°38'46", long 93°22'06", in NW¼SW¼SW¼ sec.9, T.102 N., R.21 W., Hydrologic Unit 07080202, at Freeborn County Courthouse.

Owner: Freeborn County.

AQUIFER.--Cedar Valley Formation of Middle Devonian Age.

WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 5 in (0.13 m), depth 150 ft (45.7 m), cased to 138 ft (42.1 m).

DATUM.--Altitude of land-surface datum is 1,240 ft (378 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--November 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 40.50 ft (12.34 m) below land-surface datum, Mar. 8, 1983; lowest, 48.82 ft (14.88 m) below land-surface datum, July 10, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 22	43.50	JAN 23	42.96	MAR 28	43.38	MAY 14	42.68	JUL 16	45.02	SEP 17	47.77

434032093111801. Local number, 103N20W36CCB01.

LOCATION.--Lat 43°40'32", long 93°11'18", in NE¼SW¼SW¼ sec.36, T.103 N., R.20 W., Hydrologic Unit 07080201, at Pillsbury Grain Station.

Owner: Pillsbury Co.

AQUIFER.--Cedar Valley Formation of Middle Devonian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 5 in (0.13 m), depth 231 ft (70.4 m), cased to 136 ft (41.4 m).

DATUM.--Altitude of land-surface datum is 1,255 ft (383 m). Measuring point: Top of casing, 1.80 ft (0.55 m) above land-surface datum.

PERIOD OF RECORD.--July 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 48.40 ft (14.75 m) below land-surface datum, May 10, 1984; lowest, 52.82 ft (12.09 m) below land-surface datum, July 10, 1985.

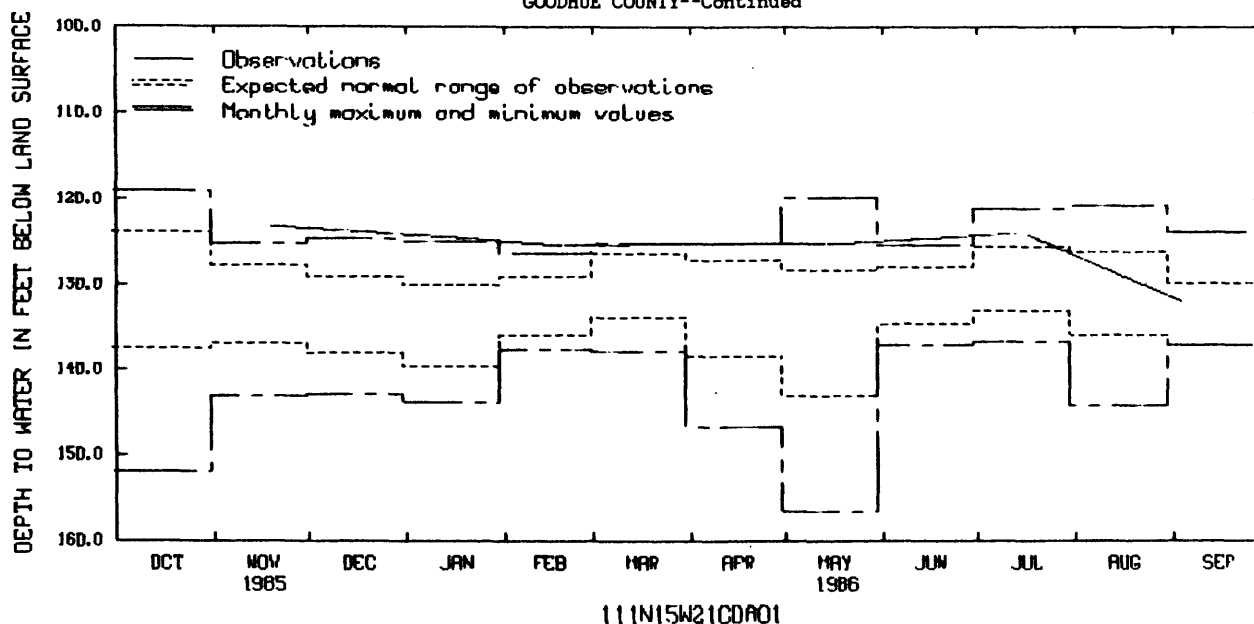
## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 22	51.37	JAN 23	51.32	MAR 28	50.62	MAY 14	50.40	JUL 16	50.22	SEP 17	50.97



## GROUND-WATER LEVELS

GOODHUE COUNTY--Continued



443012092362201. Local number, 113N15W27BAB01.

LOCATION.--Lat 44°30'12", long 92°26'22", in NW¼NE¼NW¼ sec.27, T.113 N., R.15 W., Hydrologic Unit 07040002, at Red Wing.

Owner: City of Red Wing, Anderson Park.

AQUIFER.--Eau Claire-Mount Simon Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 560 ft (171 m), cased to 243 ft (74.1 m).

DATUM.--Altitude of land-surface datum is 800 ft (244 m). Measuring point: Edge of casing, 2.70 ft (0.82 m) above land-surface datum.

PERIOD OF RECORD.--April 1976, June 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 100.5 ft (30.63 m) below land-surface datum, Apr. 20, 1983; lowest, 108.2 ft (32.98 m) below land-surface datum, Sept. 14, 1978.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 18	102.53	FEB 18	102.15	MAY 12	101.38	JUL 8	102.32	AUG 2	103.38	AUG 16	102.76
JAN 6	102.35	MAR 31	101.07	JUN 24	103.37						

## GROUND-WATER LEVELS

## HENNEPIN COUNTY

444815093194901. Local number, 027N24W30AAA01.

LOCATION.--Lat 44°48'15", long 93°19'49", in NE¼NE¼NE¼ sec.30, T.27 N., R.24 W., Hydrologic Unit 07020012, at 4001 West 110th Street, Bloomington.

Owner: Transfiguration Church.

AQUIFER.--Buried Sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 139 ft (42.4 m), screened 135 to 139 ft (41.2 to 42.4 m).

DATUM.--Altitude of land-surface datum is 832 ft (254 m). Measuring point: Top of casing, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--March 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 63.97 ft (19.50 m) below land-surface datum, Mar. 2, 1979; lowest, 69.86 ft (21.29 m) below land-surface datum, Sept. 9, 1985.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 1	68.37	MAR 7	68.40	MAY 7	68.87	JUL 16	69.64	SEP 9	69.86
JAN 9	68.30								

444801093202801. Local number, 027N24W30BDA01.

LOCATION.--Lat 44°48'01", long 93°20'28", in NE¼SE¼NW¼ sec.30, T.27 N., R.24 W., Hydrologic Unit 07020012, in Bloomington.

Owner: City of Bloomington, at Southwood Terrace.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 330 ft (101 m), cased to 269 ft (82.0 m).

DATUM.--Altitude of land-surface datum is 815 ft (248 m). Measuring point: Top of recorder platform, 2.20 ft (0.67 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--March 1969 to current year.

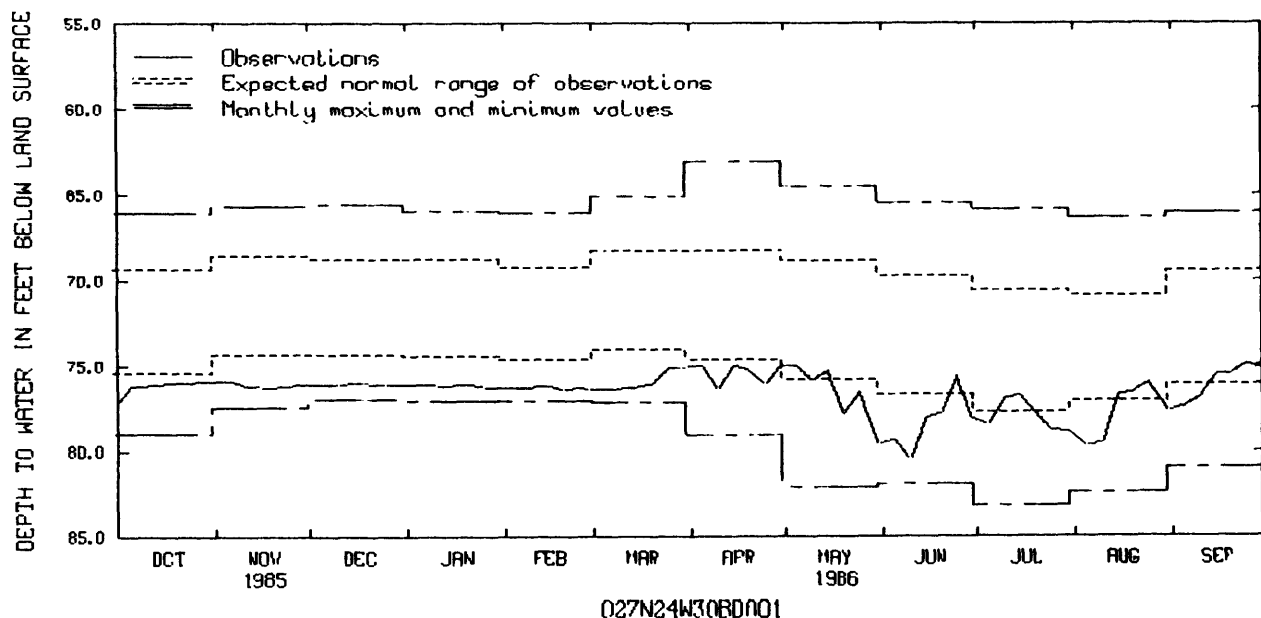
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 63.05 ft (19.22 m) below land-surface datum, Apr. 15, 1969; lowest, 83.24 ft (25.37 m) below land-surface datum, July 5-6, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	76.83	75.09	75.03	75.32	75.56	75.83	74.90	76.79	78.17	80.40	80.52	76.56
10	77.13	75.16	75.38	75.42	75.58	75.52	74.93	76.01	79.69	81.86	79.77	78.43
15	75.82	74.94	75.41	75.44	75.60	75.48	75.01	76.16	76.72	81.58	78.32	79.16
20	75.22	75.10	75.23	75.58	75.56	75.00	75.18	78.29	78.47	81.28	79.41	78.95
25	74.83	74.91	75.31	75.76	75.62	74.79	74.57	77.09	77.76	78.75	77.08	76.50
EQM	75.07	75.13	75.40	75.66	75.61	74.92	75.46	76.96	78.71	78.33	77.36	77.16

WTR YEAR 1985 HIGHEST 74.36 APR 29, 1985

LOWEST 82.58 JUL 13, 1985



## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

445356093145301. Local number, 028N24W23ADD01.

LOCATION.--Lat 44°53'56", long 93°14'53", in SE¼SE¼NE¼ sec.23, T.28 N., R.24 W., Hydrologic Unit 07010206, at 5728 Cedar Avenue, Minneapolis.

Owner: Hope Lutheran Church.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 6 in (0.15 m), depth 245 ft (74.7 m), cased to 172 ft (52.4 m).

DATUM.--Altitude of land-surface datum is 835 ft (254 m). Measuring point: Top of casing, 0.30 ft (0.09 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 36.89 ft (11.24 m) below land-surface datum, Mar. 8, 1984; lowest, 52.90 ft (16.12 m) below land-surface datum, July 15, 1983.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	38.08	MAR 18	38.58	MAY 3	41.47	JUL 16	52.08	SEP 17	42.93
JAN 9	38.52								

450116093205301. Local number, 029N24W06CCC01.

LOCATION.--Lat 45°61'16", long 93°20'53", in SW¼SW¼SW¼ sec.6, T.29 N., R.24 W., Hydrologic Unit 07010206, at 3610 Unity Avenue North, Robbinsdale.

Owner: Minnesota Department of Transportation.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in (0.13 m), depth 200 ft (61.0 m), cased to 152 ft (46.3 m).

DATUM.--Altitude of land-surface datum is 870 ft (265 m). Measuring point: Top of casing, 3.50 ft (1.07 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--March 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.54 ft (7.48 m) below land-surface datum, Dec. 28-29, 1975; lowest, 50.11 ft (15.27 m) below land-surface datum, July 14, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	32.25	28.62	29.29	.....	29.81	30.17	28.02	34.33	35.94	41.34	39.96	35.71
10	31.62	29.04	.....	29.93	30.22	29.60	28.05	36.56	38.69	47.54	37.47	34.80
15	31.45	29.15	.....	29.54	31.00	30.38	29.07	33.60	36.08	45.78	37.25	33.23
20	30.10	28.27	.....	29.62	30.85	30.16	33.56	34.98	37.07	39.41	35.82	36.31
25	29.69	27.55	.....	30.06	29.64	29.06	31.85	36.84	38.87	41.37	34.66	32.11
ECM	29.23	29.18	.....	30.71	30.17	28.90	33.03	34.47	38.41	38.40	35.00	30.03

WTR YEAR 1985 HIGHEST 26.47 NOV 26, 1984 LOWEST 47.63 JUL 12, 1985

445849093155802. Local number, 029N24W23CCB02.

LOCATION.--Lat 44°58'49", long 93°15'58", in NW¼SW¼SW¼ sec.23, T.29 N., R.24 W., Hydrologic Unit 07010206, at 245 Marquette Avenue, Minneapolis.

Owner: IBM Corporation.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 10 in (0.25 m), depth 430 ft (131 m), cased to 250 ft (76.2 m).

DATUM.--Altitude of land-surface datum is 840 ft (256 m). Measuring point: Edge of 2 in (0.05 m) vent pipe, 9.60 ft (2.93 m) below land-surface datum.

REMARKS.--Water level affected by pumping of nearby wells.

PERIOD OF RECORD.--July 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 74.40 ft (22.67 m) below land-surface datum, Dec. 27, 1984; lowest, 179.6 ft (54.74 m) below land-surface datum, Aug. 16, 1972.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 29	75.50	DEC 27	74.40	FEB 27	77.20	APR 26	80.90	JUN 24	124.05	AUG 28	121.10
NOV 29	75.55	JAN 29	77.14	MAR 27	79.70	MAY 28	97.85	JUL 29	124.50	SEP 26	85.05

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

445833093154301. Local number, 029N24W26BAB01.

LOCATION.--Lat 44°58'33", long 93°15'43", in NW¼NE¼NW¼ sec.26, T.29 N., R.24 W., Hydrologic Unit 07010206, at 425 Portland Avenue.

Owner: Minneapolis Star and Tribune.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in (0.41 m), depth 445 ft (136 m), cased to 252 ft (76.8 m).

DATUM.--Altitude of land-surface datum is 835 ft (254 m). Measuring point: Top of steel cover, 7.60 ft (7.90 m) below land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--June 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 56.45 ft (17.21 m) below land-surface datum, Jan. 10, 1983; lowest, 145.2 ft (44.26 m) below land-surface datum, July 22, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	96.83	.....	69.96	.....	70.89	.....	69.83	77.35	101.82	117.91	122.95	124.89
10	103.87	66.63	68.24	68.93	65.58	.....	78.26	122.62	110.01	125.86	103.82	111.28
15	.....	71.61	.....	70.43	70.68	.....	87.93	97.58	91.61	121.91	118.06	87.90
20	.....	69.29	.....	64.85	.....	75.25	93.30	96.09	115.66	110.32	104.53	110.86
25	.....	65.52	.....	70.57	.....	71.25	84.86	93.49	124.40	125.59	93.19	79.87
EQM	.....	69.09	.....	70.61	.....	66.30	108.08	103.73	80.82	120.80	100.60	72.13

WTR YEAR 1985      HIGHEST 61.70 NOV 23, 1984      LOWEST 132.13 JUL 18, 1985

445829093162901. Local number, 029N24W27ABD01.

LOCATION.--Lat 44°58'29", long 93°16'29", in SE¼NW¼NE¼ sec.27, T.29 N., R.24 W., Hydrologic Unit 07010206, at 911 LaSalle Avenue, Minneapolis.

Owner: American Linen Supply Co.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age and Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in (0.41 m), depth 1,094 ft (333 m), cased to 812 ft (248 m).

DATUM.--Altitude of land-surface datum is 850 ft (259 m). Measuring point: Hole in pump base, 22.00 ft (6.71 m) below land-surface datum.

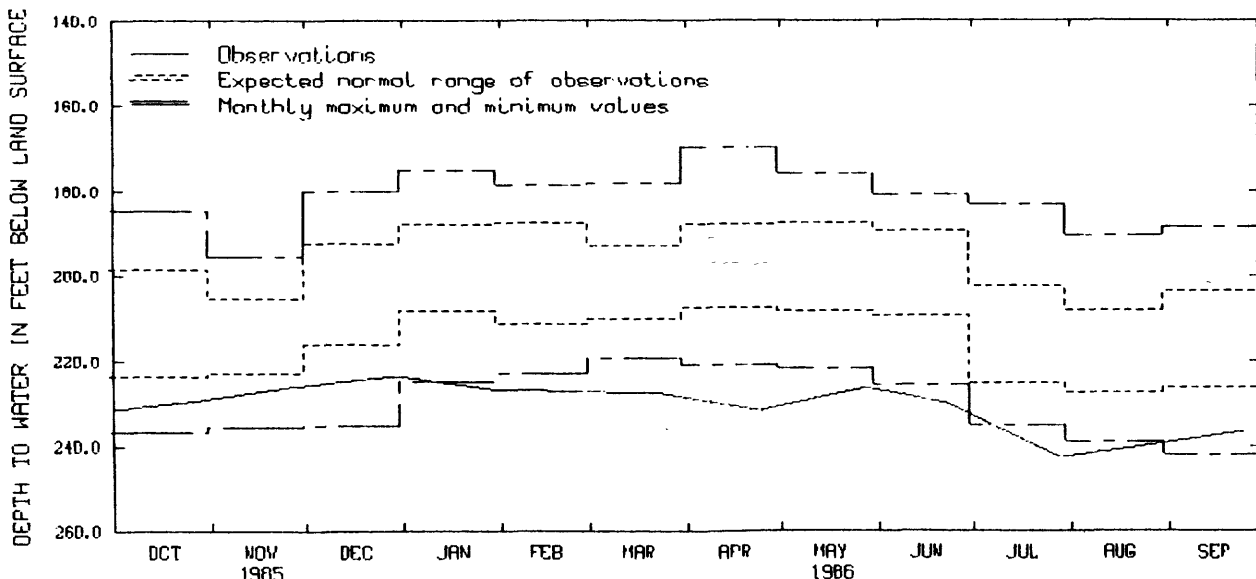
REMARKS.--Water level affected by regional pumping.

PERIOD OF RECORD.--July 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 169.8 ft (51.76 m) below land-surface datum, Apr. 15, 1980; lowest, 242.0 ft (73.76 m) below land-surface datum, Sept. 27, 1984.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 29	236.56	DEC 27	235.05	FEB 27	218.82	APR 26	213.17	JUN 24	213.96	AUG 28	231.54
NOV 29	235.34	JAN 29	223.26	MAR 27	213.38	MAY 28	212.92	JUL 29	227.75	SEP 26	231.69



029N24W27ABD01

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

445158093225101. Local number, 116N21W07DAD01.

LOCATION.--Lat 44°51'58", long 93°22'51", in SE¼NE¼SE¼ sec.7, T.116 N., R.21 W., Hydrologic Unit 07020012, at Braemer Golf Course.

Owner: City of Edina, well 14.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 16 in (0.41 m), depth 420 ft (128 m), cased to 325 ft (99.1 m).

DATUM.--Altitude of land-surface datum is 848 ft (258 m). Measuring point: Vent pipe at land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.26 ft (9.53 m) below land-surface datum, Apr. 4, 1966; lowest, 63.20 ft (19.26 m) below land-surface datum, July 21, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	47.45	JAN 9	49.02	MAR 7	49.12	MAY 3	54.82	SEP 9	50.46

445615093212301. Local number, 117N21W16CCA01.

LOCATION.--Lat 44°56'15", long 93°21'23", in NE¼SW¼SW¼ sec.16, T.117 N., R.21 W., Hydrologic Unit 07010206, at 6021 36th Street West by water tower.

Owner: City of St. Louis Park, old well 1.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in (0.41 m), depth 421 ft (128 m), cased to 280 ft (85.3 m).

DATUM.--Land-surface datum is 917.4 ft (279.6 m), revised, National Geodetic Vertical Datum of 1929. Measuring point: Top of well cover, 0.70 ft (0.21 m) above land-surface datum.

REMARKS.--Water level affected by pumping of nearby wells.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 66.0 ft (20.11 m) below land-surface datum, Mar. 23, 1953; lowest, 110.5 ft (33.68 m) below land-surface datum, July 31, 1959.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	86.89	80.15	81.82	81.21	82.94	81.92	83.12	89.12	87.94	96.98	93.92	.....
10	86.97	80.72	81.05	82.17	81.76	81.77	82.86	92.51	94.75	103.40	95.24	.....
15	86.06	82.80	81.67	81.50	83.61	83.26	84.31	89.12	89.52	100.81	90.01	.....
20	82.71	81.12	82.11	81.34	83.53	83.07	88.58	87.27	89.11	97.98	.....	.....
25	82.23	78.23	79.25	82.62	82.41	82.49	86.84	89.38	91.88	98.38	.....	.....
EQM	81.95	81.58	79.39	82.51	83.42	81.81	87.50	89.62	90.89	91.75	WELL DESTROYED	

WTR YEAR 1985 HIGHEST 77.46 NOV 25, 1984 LOWEST 103.54 JUL 11, 1985

445618093211801. Local number, 117N21W16CDB01.

LOCATION.--Lat 44°56'18", long 93°21'18", in NW¼SE¼SW¼ sec.16, T.117 N., R.21 W., Hydrologic Unit 07010206, at 2565 Wooddale Avenue South, St. Louis Park.

Owner: D-A Lubricant Co.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 691 ft (211 m), screened 651 to 661 ft (198 to 202 m).

DATUM.--Altitude of land-surface datum is 917.2 ft (279.6 m), National Geodetic Vertical Datum of 1929. Measuring point: Hole in well seal, 3.60 ft (1.10 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--April 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 131.8 ft (40.17 m) below land-surface datum, Apr. 16, 1982; lowest, 146.7 ft (44.71 m) below land-surface datum, Aug. 31, 1982.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	140.35	JAN 9	135.27	MAR 7	133.20	MAY 3	133.24	JUL 16	139.02	SEP 9	142.17

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

445347093213901. Local number, 117N21W32DAD01.

LOCATION.--Lat 44°53'47", long 93°21'39", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.32, T.117 N., R.21 W., Hydrologic Unit 07010206, at Hanson Road and Benton Avenue.

Owner: City of Edina, well 9.

AQUIFER.--Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 16 in (0.41 m), depth 1,130 ft (344 m), cased to 1,010 ft (308 m).

DATUM.--Land-surface datum is 933.3 ft (284.5 m) National Geodetic Vertical Datum of 1929. Measuring point: Hole in east side of pump base, 2.00 ft (0.61 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--August 1961 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 230.8 ft (70.35 m) below land-surface datum, Apr. 20, 1962; lowest, 379.0 ft (115.5 m) below land-surface datum, Sept. 25, 1985.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	341.84	MAR 7	314.57	MAY 3	310.35	SEP 25	379.00
JAN 9	335.92						

445740093333001. Local number, 117N23W11BBD01.

LOCATION.--Lat 44°57'40", long 93°33'30", in SE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$  sec.11, T.117 N., R.23 W., Hydrologic Unit 07010206, 2 mi (3.2 km) southwest of Wayzata, at Lake Minnetonka.

Owner: Minnetonka Boat Works, Inc., Orono.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in (0.15 m), depth 437 ft (133 m), cased to 270 ft (82.3 m).

DATUM.--Altitude of land-surface datum is 930.8 ft (283.7 m) National Geodetic Vertical Datum of 1929. Measuring point: Wood floor of instrument shelter, 3.30 ft (1.01 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

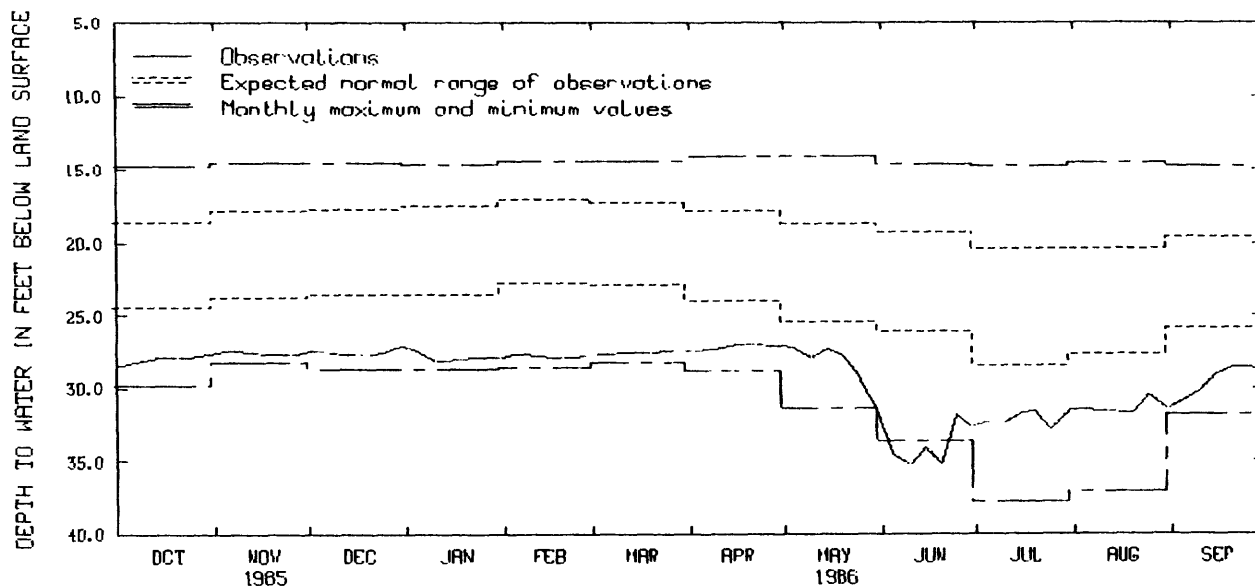
PERIOD OF RECORD.--August 1942 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 14.05 ft (4.33 m) below land-surface datum, Apr. 30, 1954; lowest, 37.82 ft (11.52 m) below land-surface datum, July 16, 1985.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	29.76	28.18	28.22	28.47	.....	.....	27.17	29.36	30.41	33.62	33.70	29.13
10	28.90	28.09	28.40	28.48	.....	27.76	27.62	29.94	31.75	36.54	33.46	29.20
15	28.46	27.87	28.66	28.37	.....	27.61	27.92	29.08	30.12	37.75	31.34	28.91
20	28.44	28.12	28.50	28.51	.....	27.75	28.36	29.09	29.63	37.13	31.63	29.57
25	.....	27.80	28.50	28.67	.....	26.67	28.26	29.65	30.94	35.98	30.53	28.91
EOM	.....	27.82	28.39	.....	.....	27.40	27.84	29.15	31.00	32.15	29.86	28.62

WTR YEAR 1985      HIGHEST    27.01 APR 12, 1985      LOWEST    37.82 JUL 16, 1985



117N23W11BBD01



## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

450854093212801. Local number, 119N21W04BBA01.

LOCATION.--Lat 45°08'54", long 93°21'28", in NE¼NW¼NW¼ sec.4, T.119 N., R.21 W., Hydrologic Unit 07010206, 109th Avenue North, 0.15 mi (0.24 km) east of Zane Avenue North, Brooklyn Park.

Owner: Walter Tessman.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation water-table well, diameter 12 in (0.30 m), depth 80 ft (24.4 m), screened 62 to 80 ft (18.9 to 24.4 m).

DATUM.--Altitude of land-surface datum is 876 ft (267 m). Measuring point: Hole in pump base, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--September 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 15.66 ft (4.77 m) below land-surface datum, July 26, 1978; lowest, 21.18 ft (6.45 m) below land-surface datum, Mar. 8, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	19.85	JAN 10	20.65	MAR 8	21.18	MAY 7	19.89	SEP 17	17.62

450519093281401. Local number, 119N22W28ACC01.

LOCATION.--Lat 45°05'19", long 93°28'14", in SW¼SW¼NE¼ sec.28, T.119 N., R.22 W., Hydrologic Unit 07010206, at 7349 Mariner Drive, Maple Grove.

Owner: Cliff Lake.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in (0.10 m), depth 192 ft (58.5 m), cased to 187 ft (57.0 m).

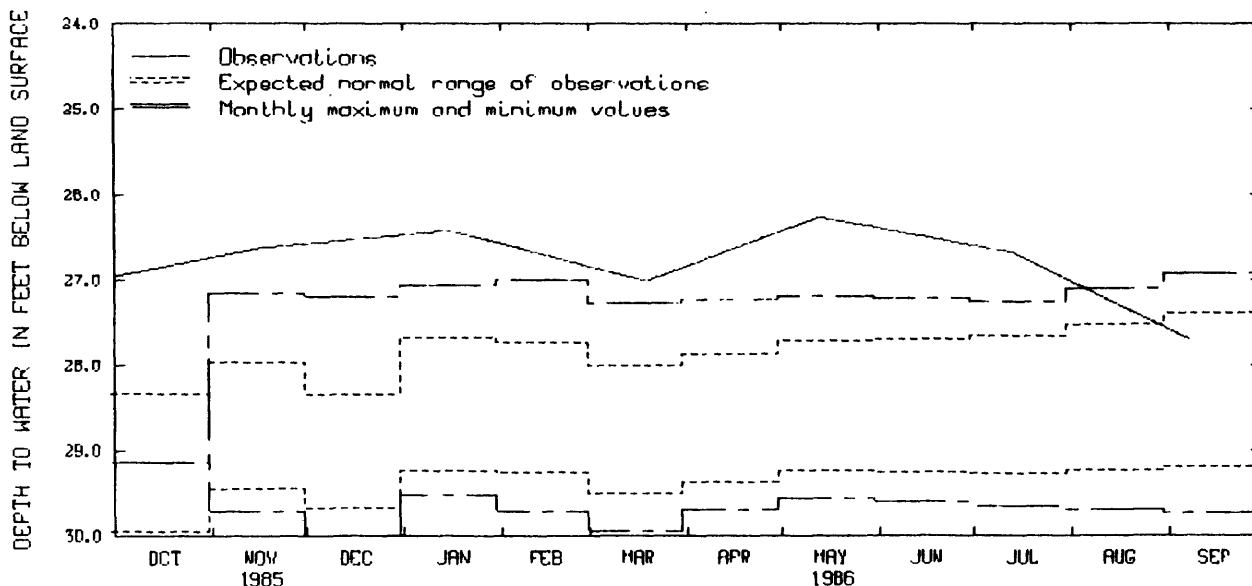
DATUM.--Altitude of land-surface datum is 925 ft (288 m). Measuring point: Top of well cap, 1.80 ft (0.55 m) above land-surface datum.

PERIOD OF RECORD.--October 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 26.92 ft (8.21 m) below land-surface datum, Sept. 12, 1984; lowest, 29.94 ft (9.13 m) below land-surface datum, Mar. 11, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	27.16	JAN 10	27.06	MAR 8	27.27	MAY 7	27.20	SEP 17	26.97



119N22W28ACC01

## GROUND-WATER LEVELS

## HOUSTON COUNTY

433935091251801. Local number, 102N05W03DCC01.

LOCATION.--Lat 43°39'53", long 91°25'18", in SW¼SW¼SE¼ sec.3, T.102 N., R.5 W., Hydrologic Unit 07060001, 3 mi (4.8 km) east of Caledonia.

Owner: U.S Geological Survey.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 4 in (0.10 m), depth 360 ft (110 m), cased to 309 ft (94.2 m).

DATUM.--Altitude of land-surface datum is 1,210 ft (369 m). Measuring point: Top of casing, 2.50 ft (0.76 m) above land-surface datum.

PERIOD OF RECORD.--June 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 213.76 ft (65.15 m) below land-surface datum, July 17, 1985; lowest, 245.50 ft (74.82 m) below land-surface datum, June 4, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	216.14	MAY 6	220.56	JUNE 24	221.56	SEP 16	222.92

433935091252001. Local number, 102N05W03DCC02.

LOCATION.--Lat 43°39'35", long 91°25'20", in SW¼SW¼SE¼ sec.3, T.102 N., R.5 W., Hydrologic Unit 07060001, 3 mi (4.8 km) east of Caledonia.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 650 ft (198 m), cased to 614 ft (187 m).

DATUM.--Altitude of land-surface datum is 1,210 ft (369 m). Measuring point: Top of casing, 2.50 ft (0.76 m) above land-surface datum.

PERIOD OF RECORD.--November 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 441.50 ft (134.56 m) below land-surface datum, June 4, 1981; lowest, 448.50 ft (136.70 m) below land-surface datum, Nov. 25, 1980.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	443.78	MAY 6	444.86	JUN 24	445.70	SEP 16	446.18

443935091252901. Local number, 102N05W03DCC03.

LOCATION.--Lat 44°39'35", long 91°25'19", in SW¼SW¼SE¼ sec.3, T.102 N., R.5 W., Hydrologic Unit 07060001, 3 mi (4.8 km) east of Caledonia.

Owner: U.S. Geological Survey

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 888 ft (271 m), cased to 858 ft (262 m).

DATUM.--Altitude of land-surface datum is 1,210 ft (369 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--July 1982 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 522.00 ft (159.10 m) below land-surface datum, Nov. 10, 1983; lowest, 524.59 ft (159.89 m) below land-surface datum, Sept. 20, 1983.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	523.76	MAY 6	523.63	JUN 24	524.16	SEP 16	524.68

## GROUND-WATER LEVELS

## HUBBARD COUNTY

465142094433201. Local number, 139N32W16AAA01.

LOCATION.--Lat 46°51'42", long 94°43'32", in NE¼NE¼NE¼ sec.16, T.139 N., R.32 W., Hydrologic Unit 07010106, at Badoura Nursery.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 21 ft (6.4 m), screened 19 to 21 ft (5.8 to 6.4 m).

DATUM.--Altitude of land-surface datum is 1,419 ft (433 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

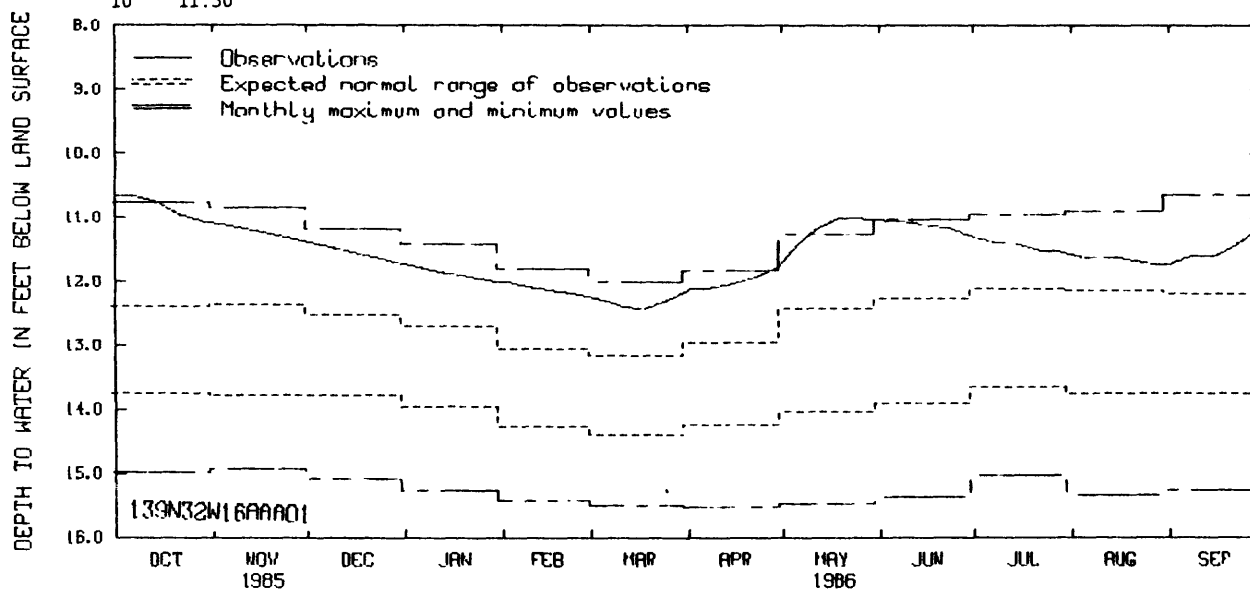
REMARKS.--Measured weekly by Archie Hakala.

PERIOD OF RECORD.--September 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.63 ft (3.24 m) below land-surface datum, Sept. 24, 1985; lowest, 15.51 ft (4.73 m) below land-surface datum, Apr. 12, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 1	10.68	DEC 17	11.57	FEB 25	12.22	APR 22	11.96	JUN 17	11.14	AUG 12	11.61
8	10.70	JAN 7	11.81	MAR 4	12.29	29	11.79	24	11.19	18	11.65
15	10.80	14	11.87	11	12.38	MAY 6	11.40	JUL 1	11.30	26	11.71
22	10.97	21	11.93	18	12.43	13	11.15	8	11.39	SEP 2	11.73
29	11.08	29	12.00	25	12.30	20	11.01	15	11.41	9	11.60
NOV 5	11.13	FEB 4	12.04	APR 1	12.14	27	11.04	22	11.51	16	11.58
26	11.33	11	12.11	8	12.10	JUN 3	11.05	29	11.53	23	11.41
DEC 3	11.41	18	12.15	14	12.05	10	11.09	AUG 5	11.61	29	11.22
10	11.50										



## ISANTI COUNTY

453125093181101. Local number, 035N24W14BCD01.

LOCATION.--Lat 45°31'25", long 93°18'11", in SE¼SW¼NW¼ sec.14, T.35 N., R.24 W., Hydrologic Unit 07010207, northwest of Isanti.

Owner: Allen Kluck.

AQUIFER.--Eau Claire - Mount Simon Formations of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 300 ft (91.4 m), cased to 105 ft (32.0 m).

DATUM.--Altitude of land-surface datum is 940 ft (287 m). Measuring point: Hole in pump base, 0.10 ft (0.03 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 11.18 ft (3.40 m) below land-surface datum, June 24, 1986; lowest, 15.72 ft (4.79 m) below land-surface datum, Apr. 4, 1968.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 1	11.50	JUN 24	11.18	AUG 19	11.57

## GROUND-WATER LEVELS

## ISANTI COUNTY--Continued

453058093175901. Local number, 035N24W14CDC01.

LOCATION.--Lat 45°30'58", long 93°17'59", in SW¼SE¼SW¼ sec.14, T.35 N., R.24 W., Hydrologic Unit 07010207, northwest of Isanti.

Owner: Ernest Kluck.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Driven unused water-table well, diameter 1½ in (0.03 m), depth 17 ft (5.18 m), screen information not available.

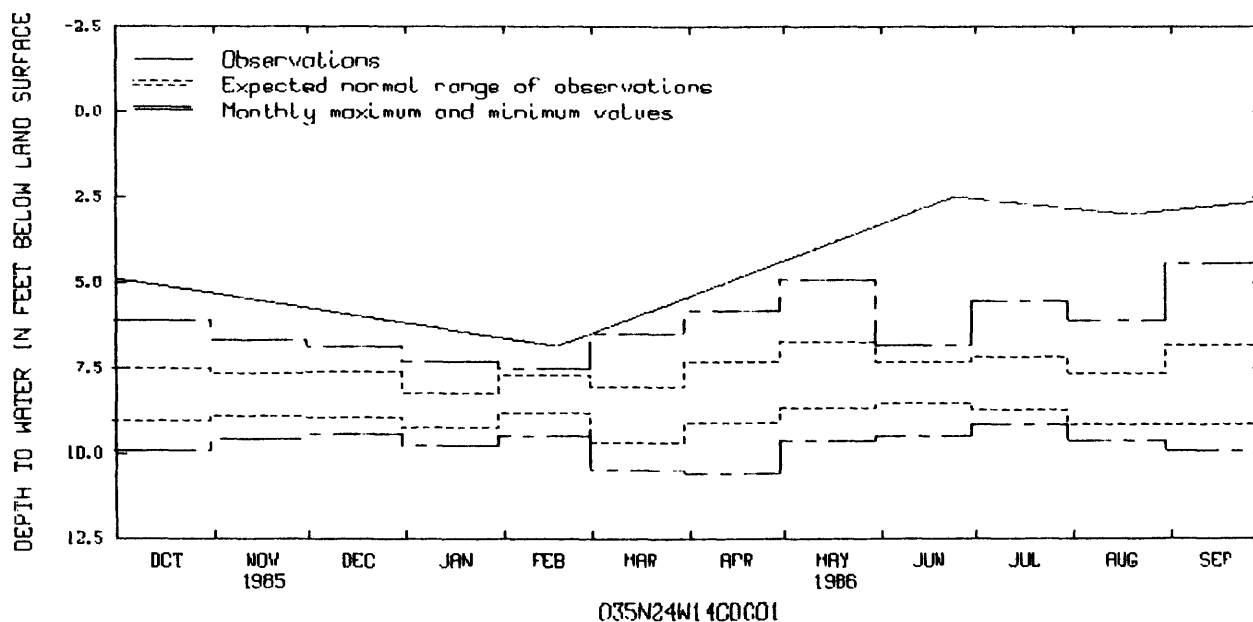
DATUM.--Altitude of land-surface datum is 930 ft (283 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.50 ft (0.76 m) below land-surface datum, June 24, 1986; lowest, 10.60 ft (3.23 m) below land-surface datum, Apr. 4, 1968.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 1	4.89	FEB 18	6.89	JUN 24	2.50	AUG 19	3.03



453410093140001. Local number, 036N23W32ACB01.

LOCATION.--Lat 45°34'10", long 93°14'00", in NW¼SW¼NE¼ sec.32, T.36 N., R.23 W., Hydrologic Unit 07010207, in Cambridge.

Owner: City of Cambridge, well 4.

AQUIFER.--Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 20 in (0.51 m), depth 630 ft (192 m), cased to 352 ft (107 m).

DATUM.--Altitude of land-surface datum is 960 ft (293 m). Measuring point: Edge of vent pipe, 3.00 ft (0.91 m) above land-surface datum.

REMARKS.--Measured weekly by Thomas Minar. Water level affected by pumping.

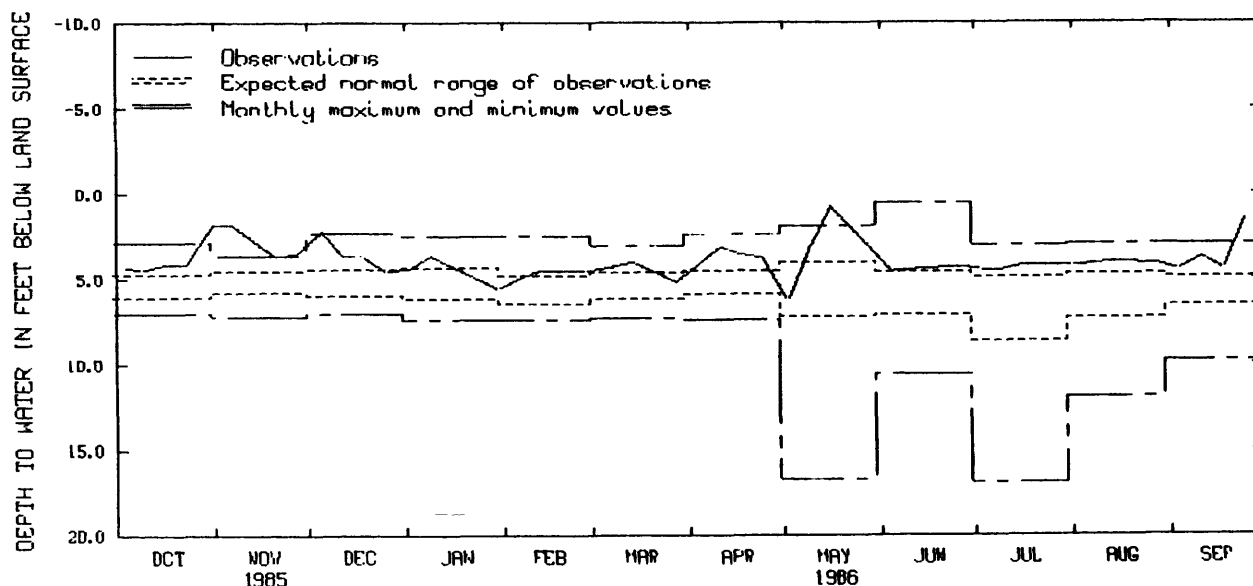
PERIOD OF RECORD.--July 1972 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 0.60 ft (0.18 m) below land-surface datum, June 21, 1984; lowest, 16.95 ft (5.17 m) below land-surface datum, July 11, 1974.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	4.30	NOV 27	3.58	JAN 30	5.60	APR 11	3.15	JUN 19	4.48	AUG 15	4.08
9	4.54	DEC 5	2.26	FEB 6	4.99	17	3.55	26	4.38	29	4.28
17	4.15	12	3.69	13	4.55	25	3.85	JUL 3	4.50	SEP 4	4.54
23	4.17	19	3.79	27	4.60	MAY 2	6.25	10	4.49	11	3.80
31	1.80	26	4.58	MAR 7	4.36	9	3.25	17	4.22	18	4.45
NOV 7	1.90	JAN 2	4.40	14	4.09	16	0.75	24	4.25	25	1.50
21	3.75	9	3.66	28	5.24	JUN 5	4.65	AUG 1	4.31		

## ISANTI COUNTY--Continued



036N23W32ACB01

## ITASCA COUNTY

471450093322001. Local number, 055N25W17ACD01.

LOCATION.--Lat 47°14'50", long 93°32'20", in SE¼SW¼NE¼ sec.17, T.55 N., R.25 W., Hydrologic Unit 07010103, at west end of 13th Street NW, Grand Rapids.

Owner: U.S. Geological Survey.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 4 in (0.10 m), depth 147 ft (44.8 m), screened 143 to 147 ft (43.6 to 44.8 m).

DATUM.--Altitude of land-surface datum is 1,318 ft (402 m). Measuring point: Top of platform, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--April 1962 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.04 ft (8.85 m) below land-surface datum, June 1, 1966; lowest, 33.92 ft (10.34 m) below land-surface datum, May 17, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 18	31.44	DEC 8	31.58	FEB 25	31.90	JUN 13	31.06	SEP 19	31.00
NOV 19	31.43	JAN 8	31.68	APR 21	31.80	JUL 30	31.08		

## JACKSON COUNTY

434742095191501. Local number, 104N37W19DBD01.

LOCATION.--Lat 43°47'42", long 95°19'15", in SE¼NW¼SE¼ sec.19, T.104 N., R.37 W., Hydrologic Unit 07100001, at Heron Lake.

Owner: City of Heron Lake, old railroad well.

AQUIFER.--Sioux Quartzite of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 16 in (0.41 m), depth 323 ft (98.4 m), screened 205 to 225 ft (62.5 to 68.6 m).

DATUM.--Altitude of land-surface datum is 1,420 ft (433 m). Measuring point: Edge of breather pipe, 2.60 ft (0.79 m) above land-surface datum.

PERIOD OF RECORD.--August 1972, July 1973, September 1976, July 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 59.16 ft (18.03 m) below land-surface datum, Aug. 11, 1972; lowest, 66.10 ft (20.15 m) below land-surface datum, July 14, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	61.82	JAN 17	61.24	MAY 21	61.52	JUL 16	61.67	SEP 11	62.20

## GROUND-WATER LEVELS

## KANABEC COUNTY

455236093172301. Local number, 039N24W11DDC01.

LOCATION.--Lat 45°52'36", long 93°17'23", in SW¼SE¼ sec.11, T.39 N., R.24 W., Hydrologic Unit 07030004, intersection of Forest Avenue and U.S. Highway 65.

Owner: City of Mora, well 3.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 12 in (0.30 m), depth 170 ft (51.8 m), screened 150 to 170 ft (45.7 to 51.8 m).

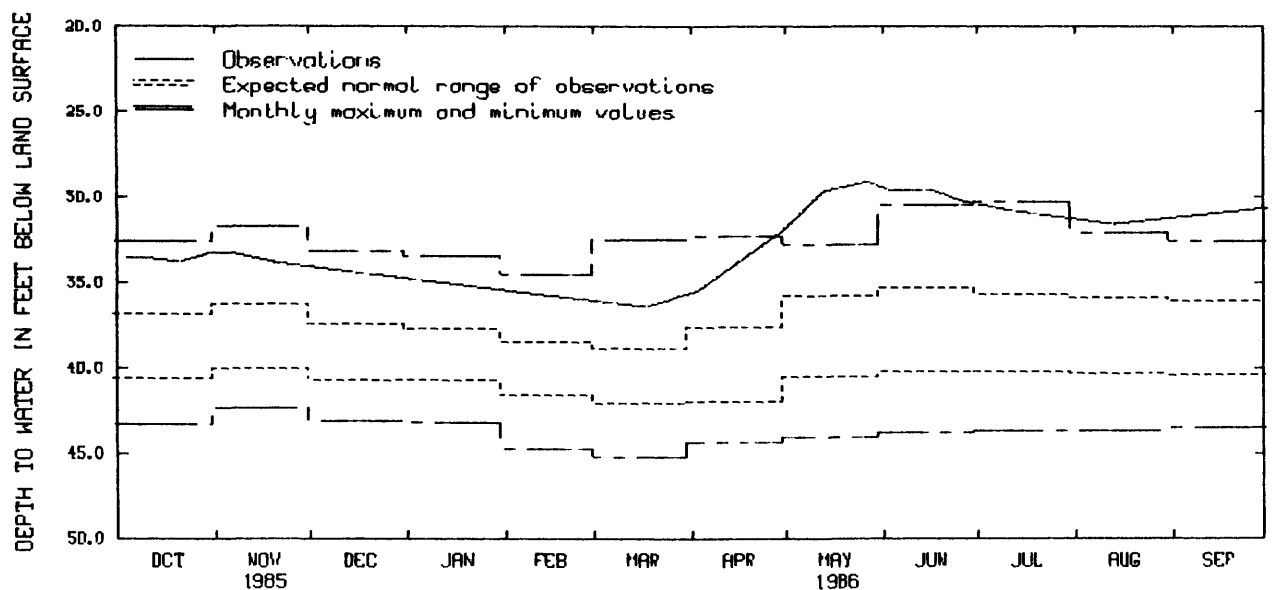
DATUM.--Altitude of land-surface datum is 1,011 ft (308 m). Measuring point: Edge of vent pipe, 2.40 ft (0.73 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 30.26 ft (9.22 m) below land-surface datum, July 5, 1984; lowest, 45.18 ft (13.77 m) below land-surface datum, Mar. 15, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	33.64	OCT 29	33.38	FEB 5	35.56	APR 29	32.11	JUN 3	29.60	JUL 10	30.74
8	33.60	NOV 6	33.30	MAR 18	36.46	MAY 13	29.75	18	29.70	AUG 13	31.60
21	33.84	20	33.85	APR 3	35.51	27	29.10	27	30.30	SEP 30	30.67



039N24W11DDC01

## KANDIYOHI COUNTY

450730095014801. Local number, 119N35W14ABB01.

LOCATION.--Lat 45°07'30", long 95°01'48", in NW¼NW¼ sec.14, T.119 N., R.35 W., Hydrologic Unit 07020004, at Willmar.

Owner: Burlington Northern, Inc.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 10 in (0.25 m), depth 320 ft (97.5 m), screened 297 to 320 ft (89.9 to 97.5 m).

DATUM.--Altitude of land-surface datum is 1,140 ft (347 m). Measuring point: Wood floor of recorder shelter, 1.00 ft (0.30 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

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

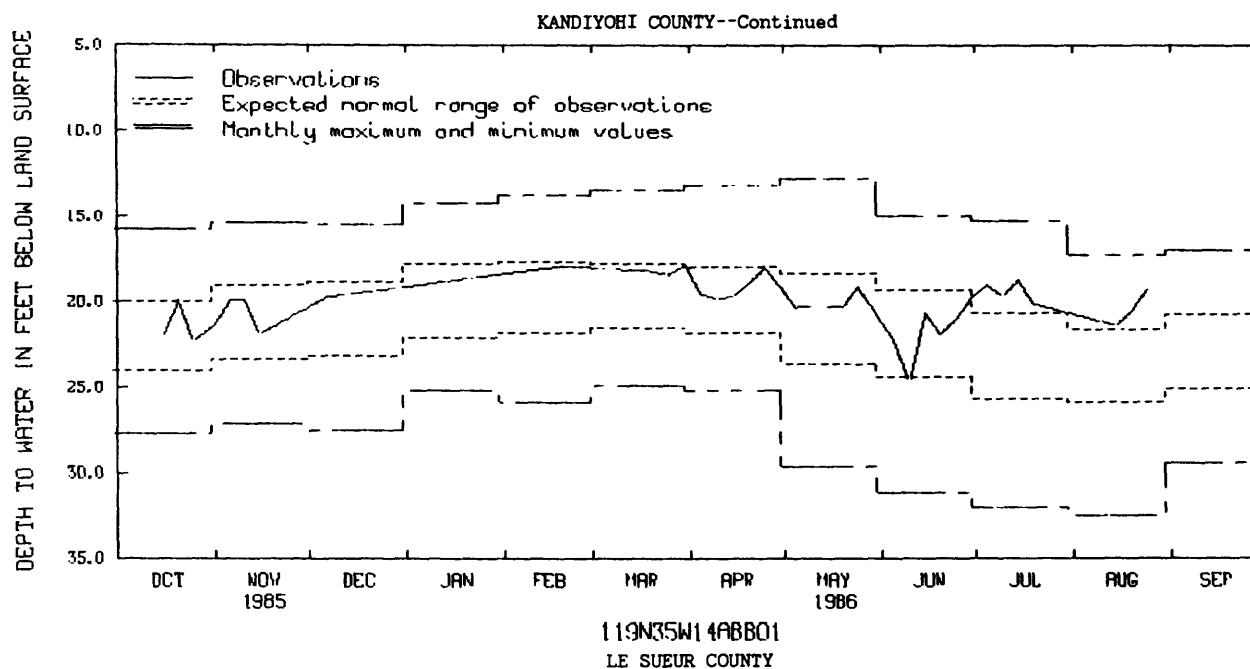
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 12.78 ft (3.90 m) below land-surface datum, May 12, 1969; lowest, 32.50 ft (9.91 m) below land-surface datum, Aug. 27, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	.....	20.04	19.78	.....	.....	.....	19.61	20.42	22.20	19.00	.....	.....
10	23.03	19.90	.....	.....	.....	.....	19.96	.....	24.65	19.75	.....	.....
15	22.06	21.90	.....	.....	.....	.....	19.69	.....	20.71	18.80	21.45	.....
20	19.96	.....	.....	.....	17.98	18.24	18.95	20.33	21.95	20.25	20.58	.....
25	22.34	.....	.....	.....	.....	18.51	18.10	19.14	21.05	.....	19.37	.....
EOM	21.46	.....	.....	.....	.....	17.89	19.15	20.90	19.78	.....	.....	.....

WTR YEAR 1986      HIGHEST    17.05 APR 28, 1986      LOWEST    24.97 JUN 11, 1986

## GROUND-WATER LEVELS



442522093543901. Local number, 111N26W14ADA01.

LOCATION.--Lat 44°25'22", long 93°54'39", in NE&SE&NE& sec.14, T.111 N., R.26 W., Hydrologic Unit 07020012, 0.85 mi (1.37 km) south of Le Sueur.

Owner: Merle Moser.

AQUIFER.--Buried gravel of Pleistocene Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in (0.41 m), depth 242 ft (73.8 m), screened 212 to 242 ft (64.6 to 73.8 m).

DATUM.--Altitude of land-surface datum is 855 ft (261 m). Measuring point: Edge of vent pipe, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--January 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 73.06 ft (22.26 m) below land-surface datum, Sept. 18, 1986; lowest, 84.55 ft (25.77 m) below land-surface datum, Mar. 9, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	74.59	MAR 27	74.90	MAY 15	73.92	SEP 18	73.06

443234093333501 Local number, 112N23W02BAB01.

LOCATION.--Lat 44°32'34", long 93°33'35", in NW&NE&NW& sec.2, T.112 N., R.23 W., Hydrologic Unit 07020012, just east of New Prague.

Owner: Holy Trinity Lutheran Church.

AQUIFER.--St. Lawrence Formation of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 180 ft (54.9 m), cased to 155 ft (47.2 m).

DATUM.--Altitude of land-surface datum is 1,005 ft (306 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 94.30 ft (28.74 m) below land-surface datum, Mar. 12, 1985; lowest, 99.42 ft (30.30 m) below land-surface datum, July 26, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	95.18	MAR 21	94.62	JUL 17	94.63	SEP 4	94.45
JAN 8	94.92						

## GROUND-WATER LEVELS

## LE SUEUR COUNTY--Continued

443147093374501. Local number, 112N23W06DDD01.

LOCATION.--Lat 44°31'47", long 93°37'45", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.6, T.112 N., R.23 W., Hydrologic Unit 07020012, 3 mi (4.8 km) southwest of New Prague.

Owner: Friedens Lutheran Church.

AQUIFER.--St. Lawrence Formation of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 5 in (0.13 m), depth 265 ft (80.8 m), cased to 209 ft (63.7 m).

DATUM.--Altitude of land-surface datum is 1,019 ft (311 m). Measuring point: Top of casing, 1.70 ft (0.52 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 150.8 ft (45.96 m) below land-surface datum, Mar. 18, 1981; lowest, 152.0 ft (46.33 m) below land-surface datum, Sept. 13, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	151.35	JAN 14	151.20	MAR 21	151.17	MAY 2	151.23	JUL 17	151.40	SEP 5	151.48

## LINCOLN COUNTY

441705096084501. Local number, 110N44W33DCD01.

LOCATION.--Lat 44°17'05", long 96°08'45", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec.33, T.110 N., R.44 W., Hydrologic Unit 07020006, at Tyler.

Owner: U.S. Geological Survey.

AQUIFER.--Dakota Sandstone of Early Cretaceous Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 8 in (0.20 m), depth 967 ft (295 m), screened 890 to 900 ft (271 to 274 m).

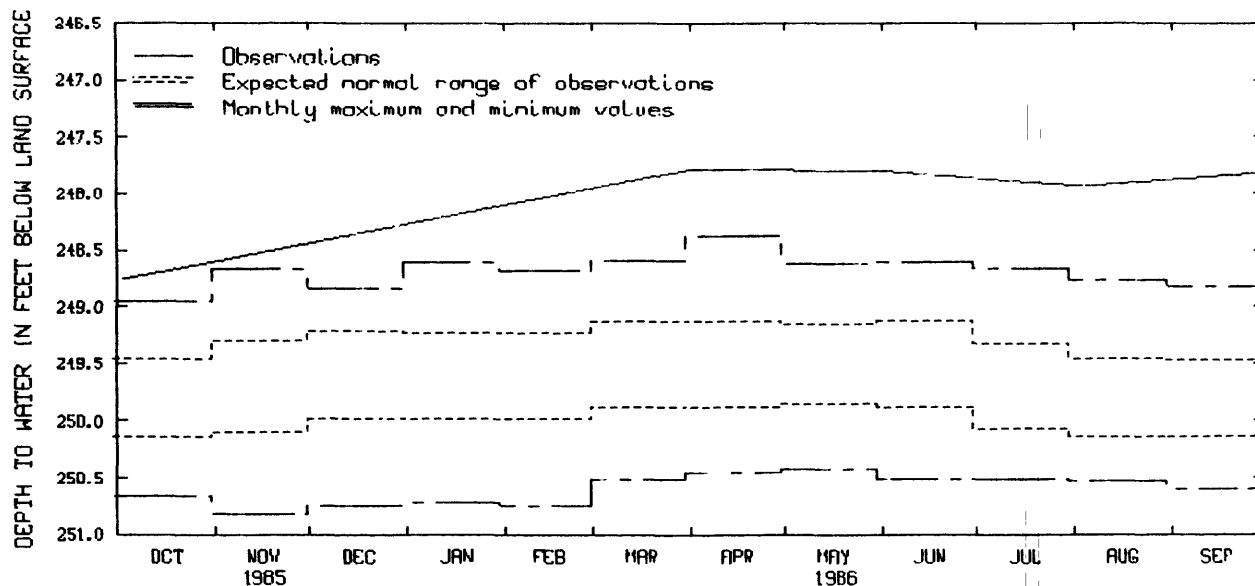
DATUM.--Altitude of land-surface datum is 1,738 ft (530 m). Measuring point: Top of recorder platform, 3.50 ft (1.07 m) above land-surface datum.

PERIOD OF RECORD.--November 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 247.8 ft (75.52 m) below land-surface datum, Apr. 2, 1986; lowest, 250.8 ft (76.44 m) below land-surface datum, Nov. 12, 1976.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
APR 2	247.79	JUN 5	247.82	AUG 4	247.95



## GROUND-WATER LEVELS

## MARTIN COUNTY

434359094422201. Local number, 103N32W08CCD01.

LOCATION.--Lat 43°43'59", long 94°42'22", in SE¼SW¼SW¼ sec.8, T.103 N., R.32 W., Hydrologic Unit 07020009, 1.5 mi (2.4 km) south of Trimont.

Owner: Robert Olson.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in (0.41 m), depth 412 ft (126 m), screened 372 to 412 ft (113 to 126 m).

DATUM.--Altitude of land-surface datum is 1,242 ft (379 m). Measuring point: Vent pipe, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--July 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 90.72 ft (27.65 m) below land-surface datum, May 9, 1984; lowest, 95.17 ft (29.01 m) below land-surface datum, Nov. 15, 1984.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	91.68	JAN 23	91.25	MAR 27	91.10	MAY 14	90.89	JUL 16	90.92	SEP 17	91.06

434725094483001. Local number, 104N33W28BAB01.

LOCATION.--Lat 43°47'25", long 94°48'30", in NW¼NE¼NW¼ sec.28, T.104 N., R.33 W., Hydrologic Unit 07020009, 6.6 mi (10.6 km) northwest of Trimont.

Owner: Kenneth Schafer.

AQUIFER.--Sioux Quartzite of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in (0.13 m), depth 178 ft (54.2 m), cased to 121 ft (36.9 m).

DATUM.--Altitude of land-surface datum is 1,290 ft (393 m). Measuring point: Top of casing, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 83.15 ft (25.35 m) below land-surface datum, Nov. 7, 1984; lowest, 85.17 ft (25.96m) below land-surface datum, Nov. 9, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	83.94	JAN 23	83.74	MAR 27	83.82	MAY 14	83.58	JUL 16	83.46	SEP 17	83.57

## MC LEOD COUNTY

444758094132101. Local number, 115N28W05ACC01.

LOCATION.--Lat 44°47'58", long 94°13'21", in SW¼SW¼NE¼ sec.5, T.115 N., R.28 W., Hydrologic Unit 07010205, northwest of Glencoe.

Owner: Graupmann Farms, Inc.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 472 ft (144 m), screened 432 to 472 ft (132 to 144 m).

DATUM.--Altitude of land-surface datum is 1,036 ft (316 m). Measuring point: Edge of vent pipe, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--September 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 80.50 ft (24.54 m) below land-surface datum, Aug. 20, 1979; lowest, 109.6 ft (33.41 m) below land-surface datum, Oct. 1, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	92.07	MAR 24	82.89	JUN 19	82.43	JUL 28	93.39
JAN 23	90.74						

## GROUND-WATER LEVELS

## MC LEOD COUNTY--Continued

444704094090801. Local number, 115N28W11ADD01.

LOCATION.--Lat 44°47'04", long 94°09'08", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.11, T.115 N., R.28 W., Hydrologic Unit 07010205, 0.4 mi (0.6 km) north of Glencoe.

Owner: McLeod County Highway Department.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

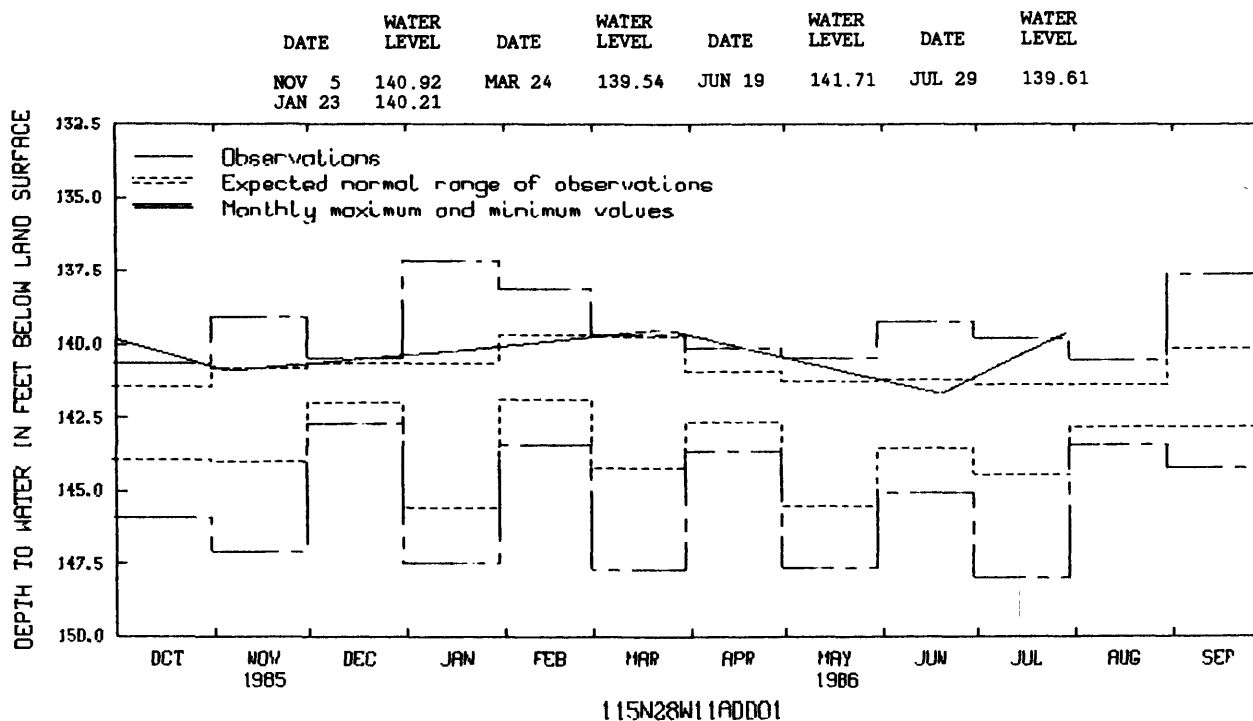
WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 5 in (0.13 m), depth 500 ft (152 m), cased to 446 ft (136 m).

DATUM.--Altitude of land-surface datum is 1,020 ft (311 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--November 1972 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 137.2 ft (41.82 m) below land-surface datum, Jan. 7, 1982; lowest, 148.0 ft (45.10 m) below land-surface datum, July 18, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



444819094164701. Local number, 116N29W35DDC01.

LOCATION.--Lat 44°48'19", long 94°16'47", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.35, T.116 N., R.29 W., Hydrologic Unit 07010205, 1.3 mi (2.1 km) south of Biscay.

Owner: Charles Johnson.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 269 ft (82.0 m), screened 229 to 269 ft (69.8 to 82.0 m).

DATUM.--Altitude of land-surface datum is 1,050 ft (320 m). Measuring point: Edge of vent pipe, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--September 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.21 ft (7.37 m) below land-surface datum, Jan. 23, 1986; lowest, 29.93 ft (9.12 m) below land-surface datum, Sept. 9, 1980.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	25.54	JAN 23	24.21	MAR 24	24.83	JUN 19	24.28	JUL 28	24.81

## GROUND-WATER LEVELS

## MC LEOD COUNTY--Continued

445721094031201. Local number 117N27W10DAA01.

LOCATION.--Lat 44°57'21", long 94°03'12", in NE¼NE¼SE¼ sec.10, T.117 N., R.27 W., Hydrologic Unit 07010205, 0.1 mi (0.2 km) south of Winsted.

Owner: Winsted Farmers Coop.

AQUIFER.--Buried sand of Pleistocene Age.

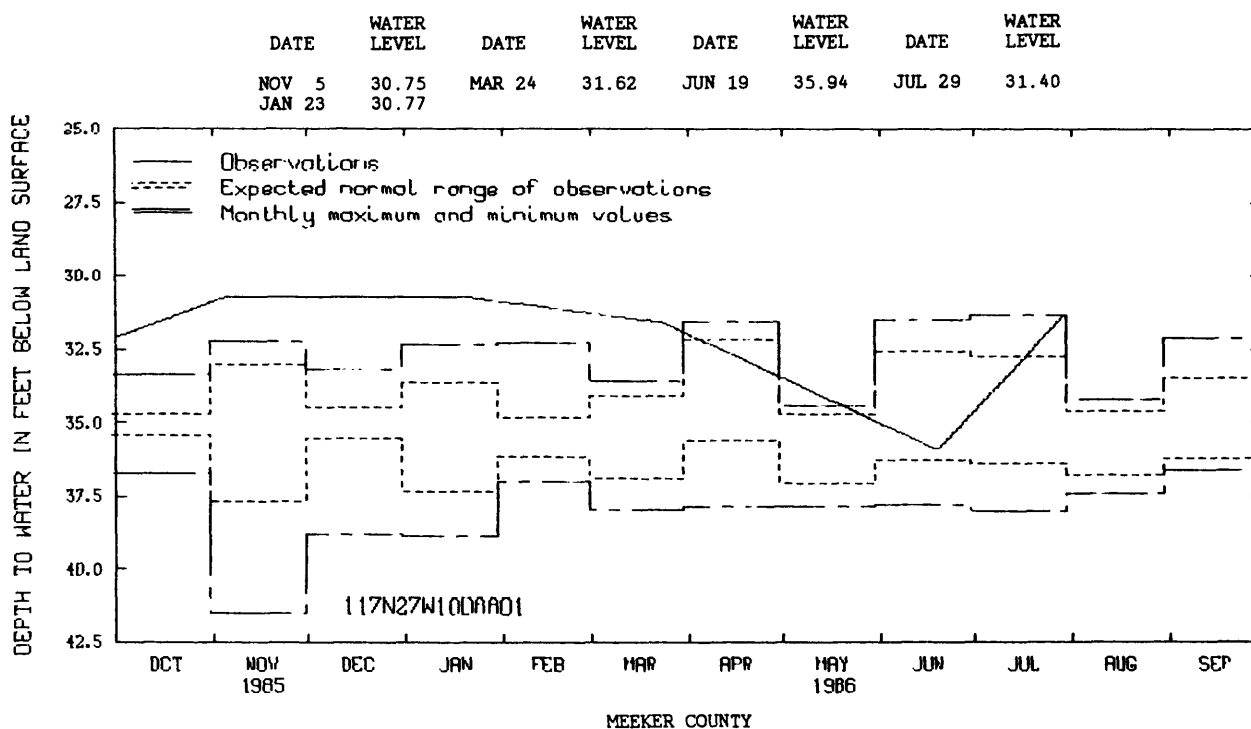
WELL CHARACTERISTICS.--Drilled industrial artesian well, diameter 4 in (0.10 m), depth 129 ft (39.3 m), screened 125 to 129 ft (38.1 to 39.3 m).

DATUM.--Altitude of land-surface datum is 1,015 ft (309 m). Measuring point: Top of casing, 1.40 ft (0.43 m) above land-surface datum.

PERIOD OF RECORD.--November 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 30.75 ft (9.37 m) below land-surface datum, Nov. 5, 1985; lowest, 41.52 ft (12.66 m) below land-surface datum, Nov. 3, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



450632094290801. Local number, 119N30W19AAB01.

LOCATION.--Lat 45°06'32", long 94°29'08", in NW¼NE¼NE¼ sec.19, T.119 N., R.30 W., Hydrologic Unit 07010204, on Ted Carlson farm.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.04 m), depth 26 ft (7.9 m), screened 24 to 26 ft (7.3 to 7.9 m).

DATUM.--Altitude of land-surface datum is 1,130 ft (344 m). Measuring point: Top of casing, 3.30 ft (1.01 m) above land-surface datum.

PERIOD OF RECORD.--November 1977 to current year.

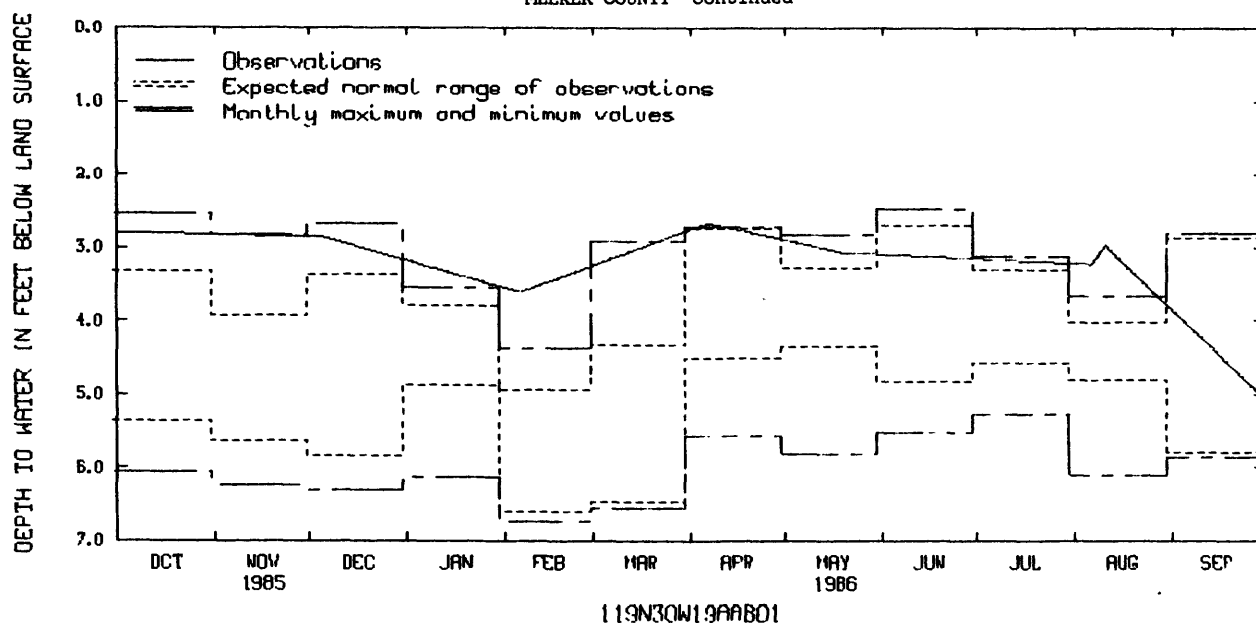
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.47 ft (1.75 m) below land-surface datum, June 14, 1983; lowest 6.74 ft (2.05 m) below land-surface datum, Feb. 3, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 6	2.87	FEB 6	3.61	APR 7	2.67	MAY 19	3.08	AUG 6	3.23	AUG 11	2.97

## GROUND-WATER LEVELS

MEEKER COUNTY--Continued



451542094322301. Local number, 121N31W26BDC01.

LOCATION.--Lat 45°15'42", long 94°32'23", in SW¼SE¼NW¼ sec.26, T.121 N., R.31 W., Hydrologic Unit 07010204, on Keith Langmo farm.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1F in (0.04 m), depth 16 ft (4.9 m), screened 14 to 16 ft (4.3 to 4.9 m).

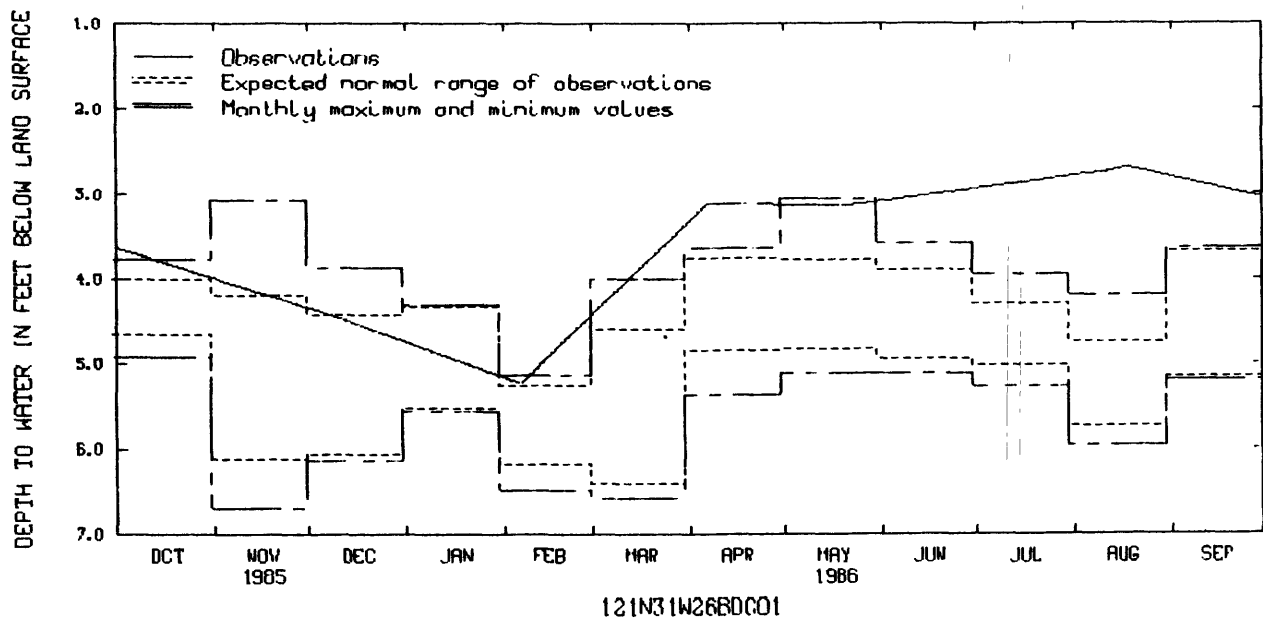
DATUM.--Altitude of land-surface datum is 1,112 ft (339 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--November 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.70 ft (0.82 m) below land-surface datum, Aug. 18, 1986; lowest, 6.59 ft (2.01 m) below land-surface datum, Mar. 12, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 6	4.40	FEB 6	5.24	APR 7	3.12	MAY 19	3.15	AUG 11	2.75	AUG 18	2.70



## GROUND-WATER LEVELS

## MILLE LACS COUNTY

454450093395701. Local number, 038N27W35ABC01.

LOCATION.--Lat 45°44'50", long 93°39'57", in SW 1/4 NE 1/4 sec.35, T.38 N., R.27 W., Hydrologic Unit 07010207, in Milaca.

Owner: City of Milaca, creamery well.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 82 ft (25.0 m), screened 67 to 82 ft (20.4 to 25.0 m).

DATUM.--Land-surface datum is 1,082.2 ft (329.8 m) National Geodetic Vertical Datum of 1929. Measuring point:  
Top of platform, 3.00 ft (0.91 m) above land-surface datum.

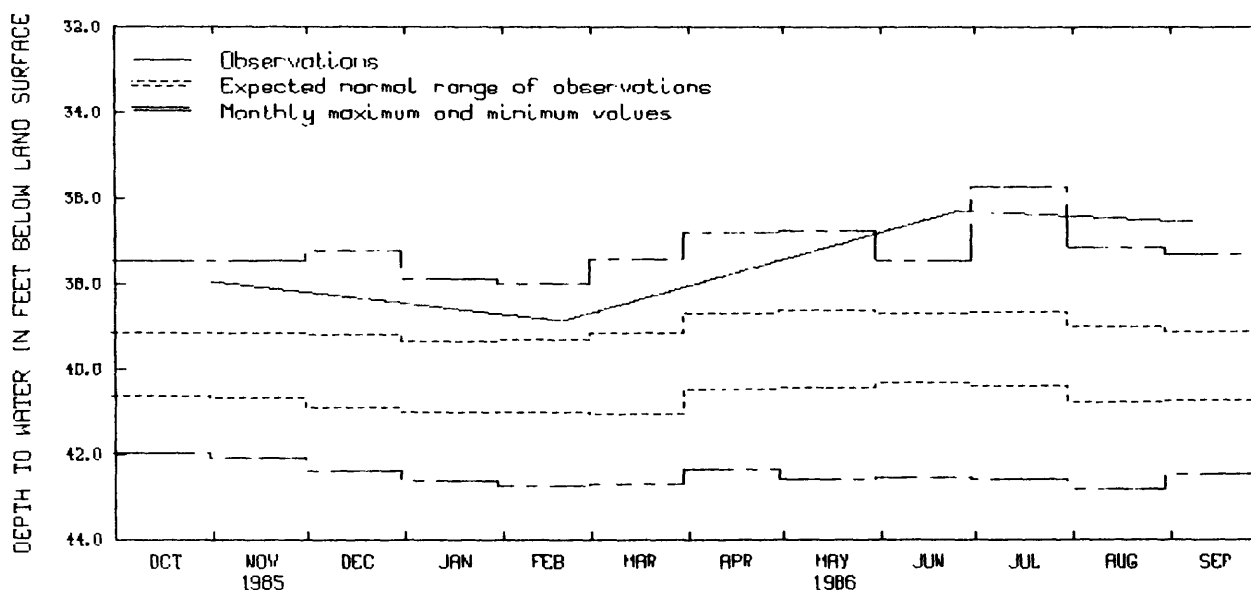
REMARKS.--Water level affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 35.72 ft (10.89 m) below land-surface datum, July 20, 1984;  
lowest, 42.81 ft (13.05 m) below land-surface datum, Aug. 27, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 31	37.97	FEB 20	38.87	JUN 26	36.31	SEP 9	36.59



038N27W35ABC01

## MORRISON COUNTY

460444094212501. Local number, 130N29W08DCC01.

LOCATION.--Lat 46°04'44", long 94°21'25", in SW<sup>1</sup>/<sub>4</sub>SW<sup>1</sup>/<sub>4</sub>SE<sup>1</sup>/<sub>4</sub> sec.8, T.130 N., R.29 W., Hydrologic Unit 07010104, at Camp Ripley.

Owner: U.S. Geological Survey.

**AQUIFER.**--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 2 in (0.05 m), depth 59 ft (18.0 m), screened 56 to 59 ft (17.1 to 18.0 m).

DATUM--Land-surface datum is 1,149.0 ft (350.2 m) National Geodetic Vertical Datum of 1929. Measuring point:  
Top of casing, 2.10 ft (0.64 m) above land-surface datum.

REMARKS.--Water levels used in monthly Water Resources Review.

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

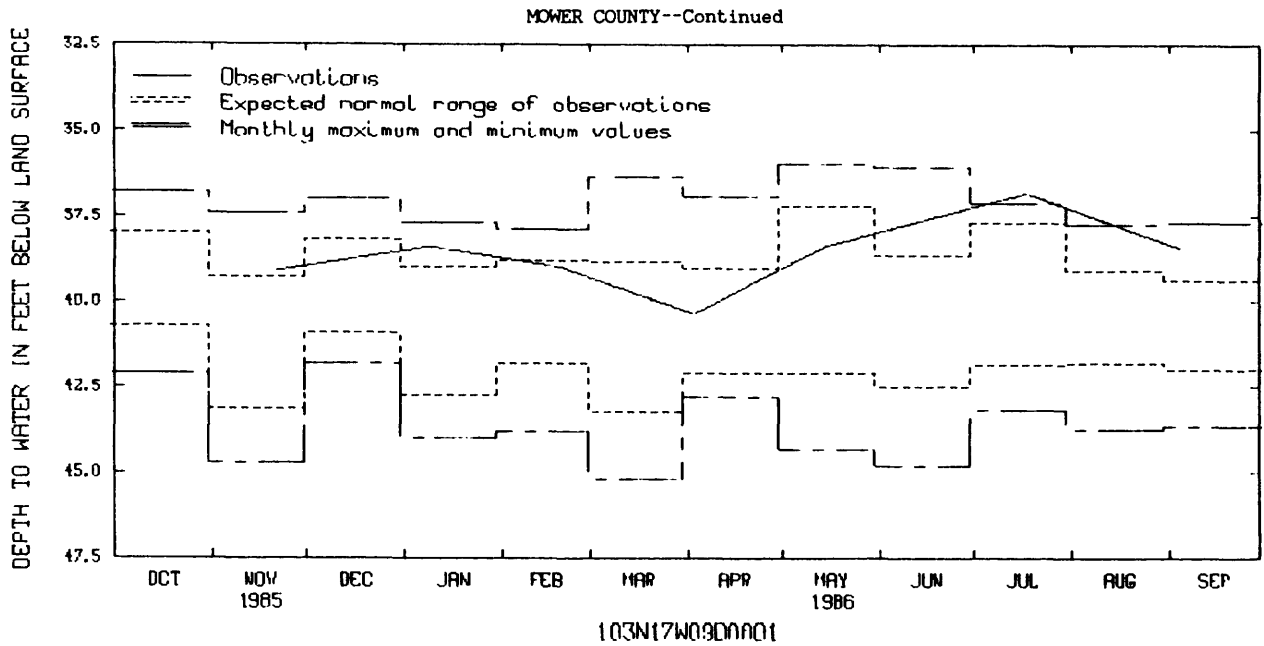
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 7.35 ft (2.24 m) below land-surface datum, July 28, 1972;  
lowest, 19.75 ft (6.02 m) below land-surface datum, Aug. 4, 1961.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

[illegible]



## GROUND-WATER LEVELS



## OLMSTED COUNTY

435920092273801. Local number, 106N14W14ADB01.

LOCATION.--Lat 43°59'20", long 92°27'38", in NW¼SE¼NE¼ sec.14, T.106 N., R.14 W., Hydrologic Unit 07040004, in Rochester.

Owner: Golden Hill School Dist. #1371.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in (0.15 m), depth 478 ft (146 m), cased to 397 ft (121 m).

DATUM.--Altitude of land-surface datum is 1,065 ft (325 m). Measuring point: Edge of well cap, 1.80 ft (0.55 m) above land-surface datum.

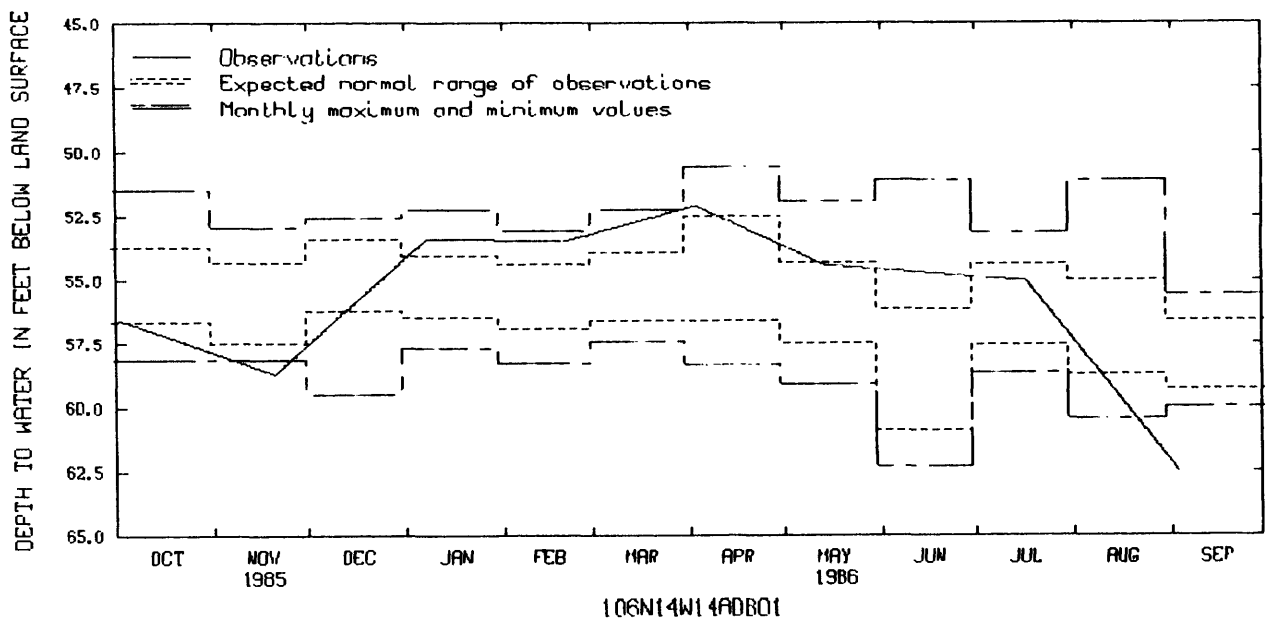
REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--August 1974 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 50.58 ft (15.42 m) below land-surface datum, Apr. 12, 1983; lowest, 62.30 ft (18.99 m) below land-surface datum, June 8, 1976.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 2	56.63	JAN 8	53.39	APR 3	52.13	MAY 14	54.41	JUN 17	55.07	SEP 4	62.59
NOV 20	58.70	FEB 20	53.52								



## GROUND-WATER LEVELS

## PINE COUNTY

462112092495801. Local number, 045N20W26DBB01.

LOCATION.--Lat 46°21'12", long 92°49'58", in NW¼NW¼SE¼ sec.26, T.45 N., R.20 W., Hydrologic Unit 07030003, at General Andrews Nursery.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Driven observation water-table well, diameter 1½ in (0.03 m), depth 28 ft (8.5 m), screened 26 to 28 ft (7.9 to 8.5 m).

DATUM.--Altitude of land-surface datum is 1,060 ft (323 m). Measuring point: Top of casing, 0.50 ft (0.15 m) above land-surface datum.

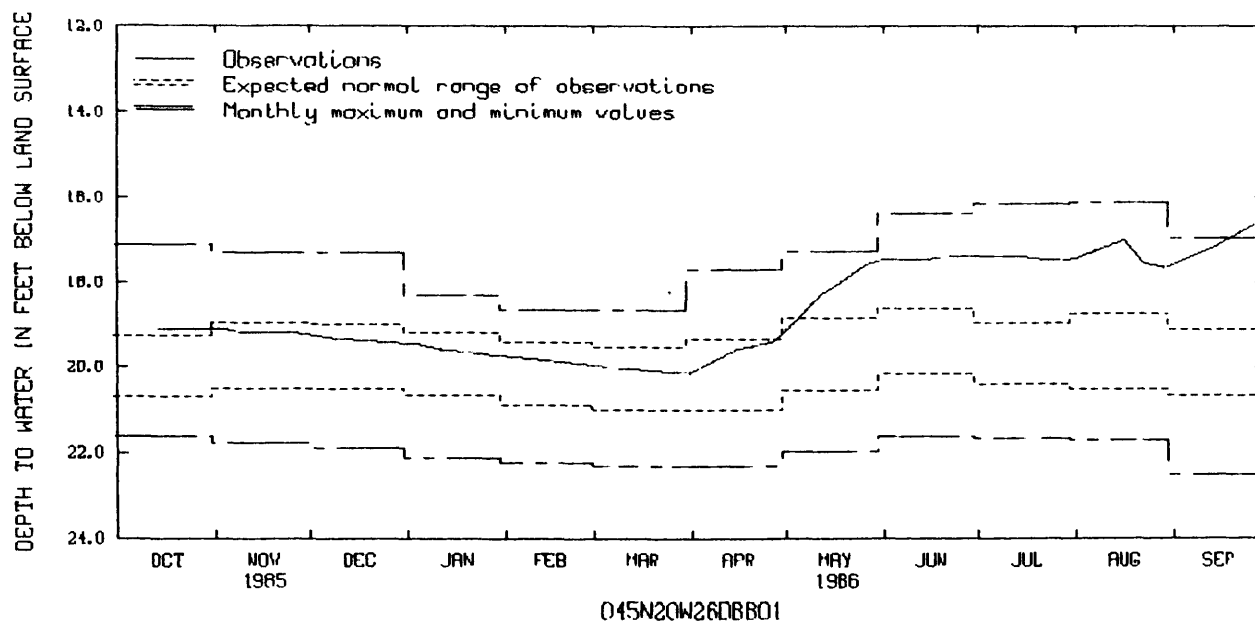
REMARKS.--Measured weekly by Ralph Nelson.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 16.10 ft (4.91 m) below land-surface datum, Aug. 12, 1974; lowest, 22.49 ft (6.85 m) below land-surface datum, Sept. 26, 1980.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 13	19.15	JAN 12	19.61	APR 20	19.55	MAY 26	17.62	JUL 9	17.39	AUG 17	17.02
22	19.11	MAR 9	20.04	27	19.43	31	17.52	17	17.41	23	17.54
NOV 2	19.13	16	20.08	MAY 4	18.93	JUN 16	17.47	21	17.45	30	17.66
8	19.18	23	20.12	12	18.28	22	17.42	28	17.49	SEP 15	17.16
24	19.20	31	20.15	16	18.11	29	17.37	AUG 2	17.43	27	16.66
DEC 8	19.36	APR 15	19.64								
JAN 5	19.50										



## GROUND-WATER LEVELS

## RAMSEY COUNTY

445955093011001. Local number, 029N22W14CAB01.

LOCATION.--Lat 44°59'55", long 93°01'10", in NW¼NE¼SW¼ sec.14, T.29 N., R.22 W., Hydrologic Unit 07010206, at Goodrich Golf Course.

Owner: Ramsey County.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 523 ft (159 m), cased to 303 ft (92.4 m).

33DATUM.--Altitude of land-surface datum is 969 ft (295 m). Measuring point: Edge of vent pipe, 2.50 ft (0.76 m) above land-surface datum.

PERIOD OF RECORD.--May 1965, April 1966 to August 1966, August 1971, May 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 125.5 ft (38.25 m) below land-surface datum, May 1, 1986; lowest, 140.6 ft (42.85 m) below land-surface datum, Apr. 6, 1966.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 18	126.00	MAR 26	126.05	MAY 1	125.50	JUL 11	129.20	SEP 11	125.30

445955093011002. Local number, 029N22W14CAB02.

LOCATION.--Lat 44°59'55", long 93°01'10", in NW¼NE¼SW¼ sec.14, T.29 N., R.22 W., Hydrologic Unit 07010206, at Goodrich Golf Course.

Owner: U.S. Geological Survey.

AQUIFER.--Buried gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation artesian well, diameter 2 in (0.05 m), depth 81 ft (24.7 m), screened 78 to 81 ft (23.8 to 24.7 m).

DATUM.--Altitude of land-surface datum is 970 ft (296 m). Measuring point: Top of casing, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--October 1966 to August 1971, August 1977, June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.80 ft ( 9.69 m) below land-surface datum, Sept. 11, 1986; lowest, 45.36 ft (13.83 m) below land-surface datum, June 3, 1968.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 18	32.58	MAR 26	35.15	MAY 1	33.86	JUN 30	31.85	SEP 11	31.80

445955093011003. Local number, 029N22W14CAB03.

LOCATION.--Lat 44°59'55", long 93°01'10", in NW¼NE¼SW¼ sec.14, T.29 N., R.22 W., Hydrologic Unit 07010206, at Goodrich Golf Course.

Owner: U.S. Geological Survey.

AQUIFER.--Buried gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in (0.05 m), depth 52 ft (15.8 m), screened 49 to 52 ft (14.9 to 15.8 m).

DATUM.--Altitude of land-surface datum is 970 ft (296 m). Measuring point: Top of casing, 1.80 ft (0.55 m) above land-surface datum.

PERIOD OF RECORD.--October 1966 to August 1971, June 1980 to current year.

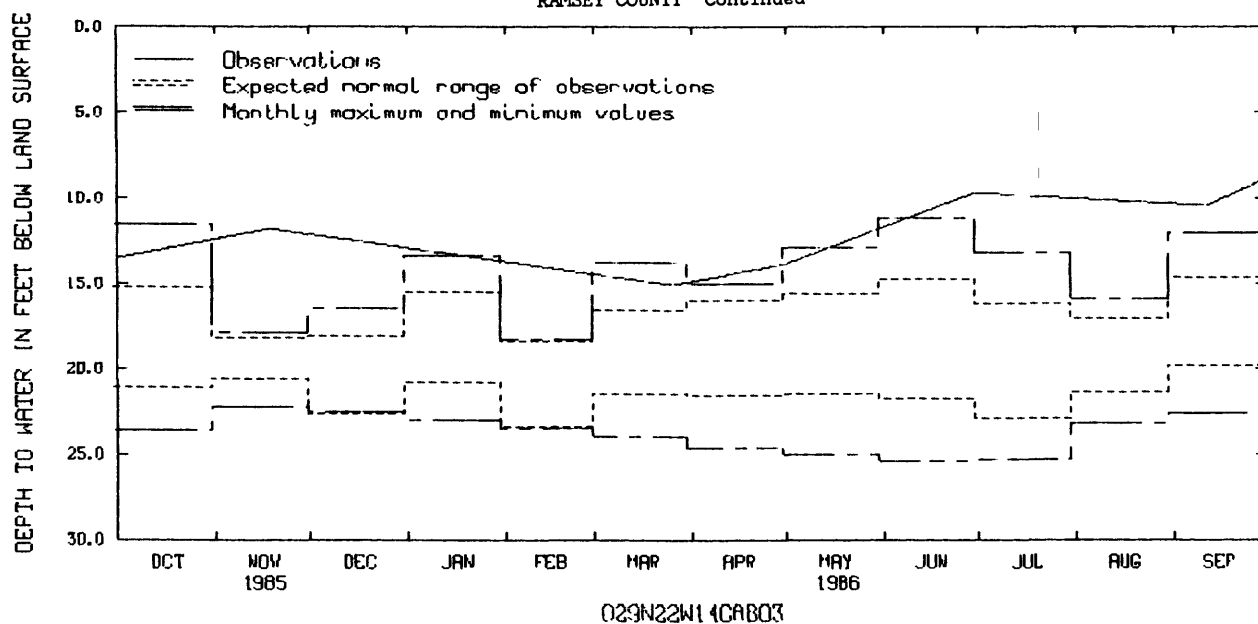
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 9.75 ft (2.97 m) below land-surface datum, June 30, 1986; lowest, 25.43 ft (7.75 m) below land-surface datum, June 3, 1968.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 18	11.86	MAR 26	15.14	MAY 1	13.87	JUN 30	9.75	SEP 11	10.53

## GROUND-WATER LEVELS

## RAMSEY COUNTY--Continued



450001093024701. Local number, 029N22W16ADD01.

LOCATION.--Lat 45°00'01", long 93°02'47", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.16, T.29 N., R.22 W., Hydrologic Unit 07010206, at 1955 English St.

Owner: Maplewood Bowl.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in (0.10 m), depth 163 ft (49.7 m), screened 156 to 163 ft (48.2 to 49.7 m).

DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Top of well cap, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--January 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 67.03 ft (20.43 m) below land-surface datum, Sept. 3, 1986; lowest, 73.18 ft (22.31 m) below land-surface datum, Jan. 14, 1983.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	68.65	JAN 13	68.05	MAR 14	67.86	MAY 1	67.80	JUN 30	67.33	SEP 3	67.03

445918092590901. Local number, 029N22W24ADA01.

LOCATION.--Lat 44°59'18", long 92°59'09", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.24, T.29 N., R.22 W., Hydrologic Unit 07010206, at 1555 Century Avenue.

Owner: Northern States Power Co., Maplewood Gas Plant.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled fire protection artesian well, diameter 12 in (0.30 m), depth 523 ft (159 m), cased to 420 ft (128 m).

DATUM.--Land-surface datum is 996.5 ft (303.7 m) National Geodetic Vertical Datum of 1929. Measuring point: Edge of 2 in (0.05 m) breather pipe, 2.40 ft (0.73 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--August 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 133.3 ft (40.63 m) below land-surface datum, Apr. 30, 1984; lowest, 151.0 ft (46.02 m) below land-surface datum, May 14, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JAN 22	134.20	MAR 20	136.15	MAY 20	133.83	JUL 22	136.89

## GROUND-WATER LEVELS

## RAMSEY COUNTY--Continued

445700093051001. Local number, 029N22W31DDD01.

LOCATION.--Lat 44°57'00", long 93°05'10", in SE¼SE¼SE¼ sec.31, T.29 N., R.22 W., Hydrologic Unit 07010206, at 261 East 5th Street, St. Paul.

Owner: Control Data Corp.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 298 ft (91 m), cased to 151 ft (46.0 m).

DATUM.--Altitude of land-surface datum is 750 ft (229 m). Measuring point: Top of recorder platform, 9.00 ft (2.74 m) below land-surface datum.

REMARKS.--Water level affected by pumping of nearby wells.

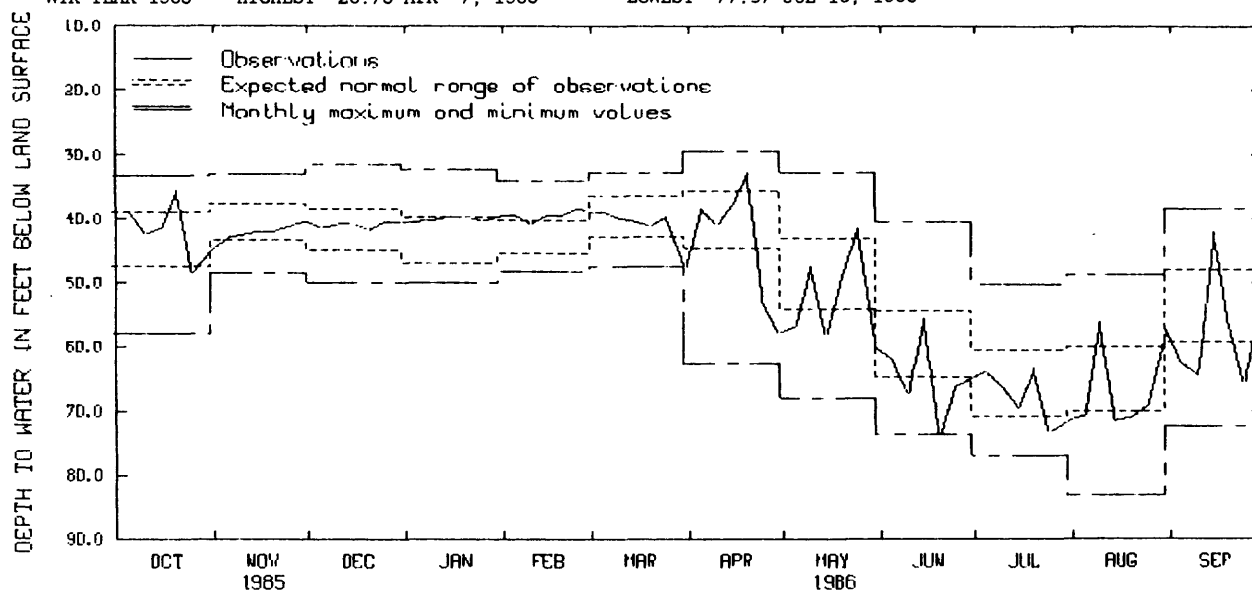
PERIOD OF RECORD.--December 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 28.76 ft (8.76 m) below land-surface datum, Apr. 7, 1986; lowest, 83.06 ft (25.32 m) below land-surface datum, Aug. 16, 1972.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	39.02	43.03	41.54	40.58	39.38	38.95	38.38	56.96	62.10	63.79	70.81	62.60
10	42.69	42.67	40.98	40.26	40.90	39.89	40.95	47.41	67.21	66.07	56.20	64.33
15	41.68	41.98	40.71	39.72	39.45	40.59	37.98	58.19	55.68	69.63	71.56	41.97
20	35.67	42.11	41.91	39.74	39.45	41.33	32.75	48.63	73.69	63.42	71.02	56.37
25	48.58	41.37	40.48	40.54	38.54	39.82	53.26	41.64	66.32	73.46	69.26	65.71
EOM	44.96	40.56	40.67	39.67	38.91	47.80	57.92	60.21	.....	71.66	57.50	53.40

WTR YEAR 1986 HIGHEST 28.76 APR 7, 1986 LOWEST 77.57 JUL 18, 1986



029N22W31DDD01

450026093084201. Local number, 029N23W11CCC01.

LOCATION.--Lat 45°00'26", long 93°08'42", in SW¼SW¼SW¼ sec.11, T.29 N., R.23 W., Hydrologic Unit 07010206, at 2204 North Lexington Avenue, Roseville.

Owner: Lexington Court Apartments.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in (0.15 m), depth 325 ft (99.1 m), cased to 192 ft (58.5 m).

DATUM.--Altitude of land-surface datum is 945 ft (288 m). Measuring point: Top of well cap, 1.40 ft (0.43 m) above land-surface datum.

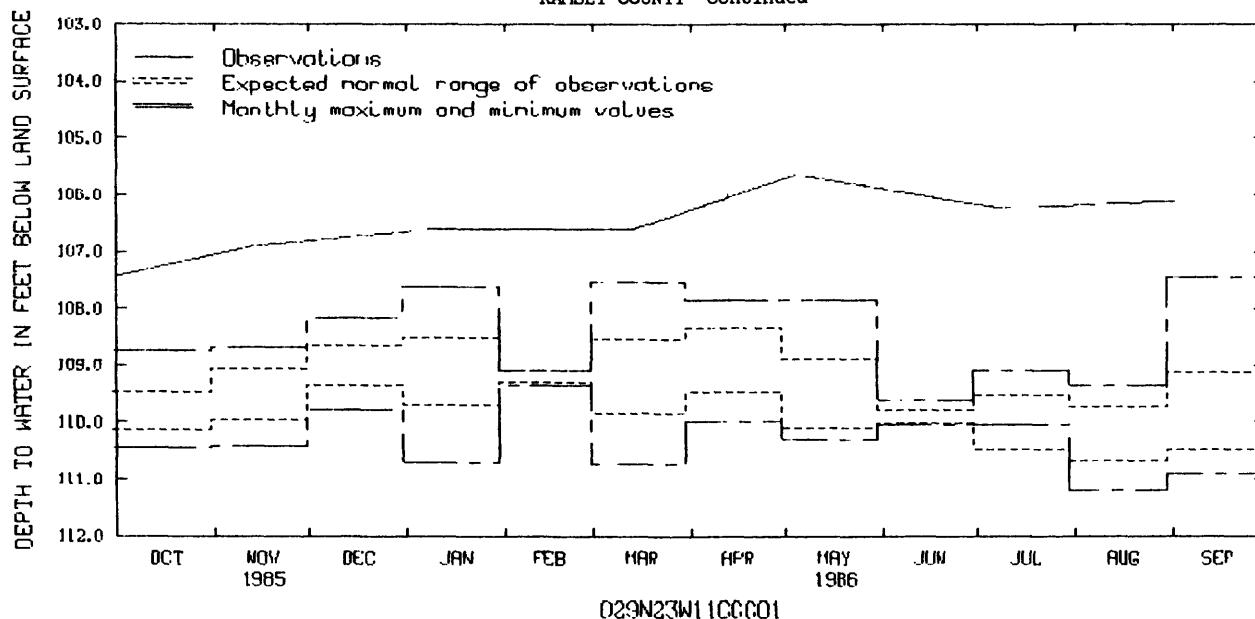
PERIOD OF RECORD.--January 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 105.6 ft (32.18 m) below land-surface datum, May 5, 1986; lowest, 111.2 ft (33.89 m) below land-surface datum, Aug. 18, 1975.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 12	106.94	JAN 13	106.62	MAR 14	106.60	MAY 5	105.65	JUL 10	106.26	SEP 2	106.13

## RAMSEY COUNTY--Continued



445751093072301. Local number, 029N23W25CCD01.

LOCATION.--Lat 44°57'51", long 93°07'23", SE&SW&SW& sec.25, T.29 N., R.23 W., Hydrologic Unit 07010206, at 760 North Dale Street, St. Paul.

Owner: Burlington Northern, Inc., Dale Street Shops.

AQUIFER.--Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 8 in (0.20 m), depth 999 ft (304 m), cased to 955 ft (291 m).

DATUM.--Land-surface datum is 859.5 ft (262.0 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder floor, 4.60 ft (1.40 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--December 1970, November 1976 to current year.

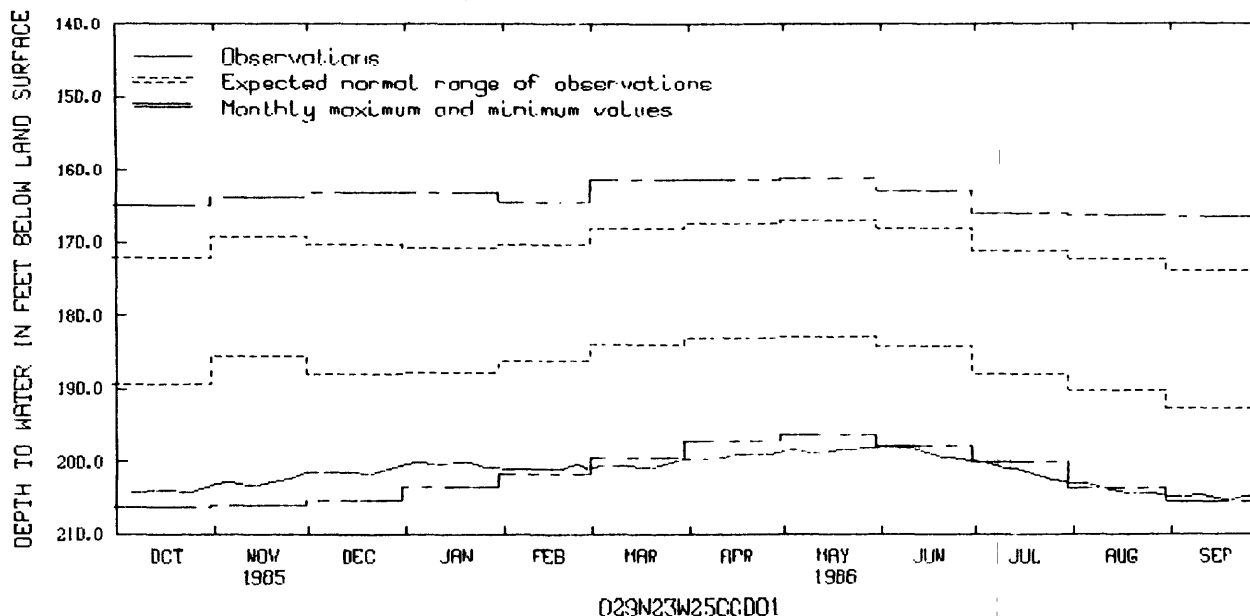
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 161.0 ft (49.07 m) below land-surface datum, May 10, 1980; lowest, 206.4 ft (62.91 m) below land-surface datum, Nov. 2, 1984.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	204.19	202.96	201.66	200.12	200.97	200.69	199.85	198.28	198.15	200.48	203.16	205.08
10	204.32	203.36	201.59	200.58	201.01	200.61	199.63	199.14	198.06	200.99	203.69	204.69
15	203.99	203.32	201.53	200.35	201.08	200.88	199.22	198.73	198.73	201.25	204.23	205.08
20	204.27	202.79	201.97	200.27	201.00	201.02	199.10	198.48	199.47	202.03	204.62	205.47
25	204.19	202.40	201.40	200.93	200.45	200.45	199.17	198.46	199.70	202.65	204.35	204.81
ECM	203.31	201.58	200.71	201.11	200.99	199.66	198.87	198.06	200.48	203.09	204.89	204.89

WTR YEAR 1986 HIGHEST 197.37 MAY 27, 1986

LOWEST 205.47 SEP 20, 1986



## GROUND-WATER LEVELS

## RAMSEY COUNTY--Continued

445739093081201. Local number, 029N23W35BAD01.

LOCATION.--Lat 44°57'39", long 93°08'12", in SE~~NE~~NW~~SE~~ sec.35, T.29 N., R.23 W., Hydrologic Unit 07010206, Victoria Street, 0.35 mi (0.56 km) north of University Avenue.

Owner: City of St. Paul.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 16 in (0.41 m), depth 234 ft (71.3 m), screened 174 to 234 ft (53.0 to 71.3 m).

DATUM.--Altitude of land-surface datum is 888 ft (261 m). Measuring point: Top of coupling, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--May 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 120.3 ft (36.66 m) below land-surface datum, June 30, 1986; lowest, 133.0 ft (40.54 m) below land-surface datum, May 5, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 28	121.22	MAR 11	120.12	MAY 5	119.23	JUN 30	120.29	JUL 31	120.58	SEP 2	120.55
JAN 7	121.10										

450414093012701. Local number, 030N22W23CBB01.

LOCATION.--Lat 45°04'14", long 93°01'27", in NW~~NE~~NW~~SE~~ sec.23, T.30 N., R.22 W., Hydrologic Unit 07010206, Hoffman Road, 0.85 mi (1.4 km) southwest of Highway 61.

Owner: White Bear Town Hall.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 96 ft (29.3 m), screened 91 to 96 ft (27.7 to 29.3 m).

DATUM.--Altitude of land-surface datum is 928 ft (283 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--April 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.18 ft (5.54 m) below land-surface datum, July 10, 1986; lowest, 22.80 ft (6.95 m) below land-surface datum, Sept. 8, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	18.68	JAN 15	19.27	MAR 20	19.50	MAY 1	18.54	JUL 10	18.18	SEP 3	18.44

450723093071801. Local number, 030N23W01BAB01.

LOCATION.--Lat 45°07'23", long 93°07'18", in NW~~NE~~NW~~SE~~ sec.1, T.30 N., R.23 W., Hydrologic Unit 07010206, at Bucher Playground.

Owner: City of Shoreview.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled recreation artesian well, diameter 8 in (0.20 m), depth 155 ft (47.2 m), cased to 101 ft (30.8 m).

DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Top of breather pipe, 2.40 ft (0.73 m) above land-surface datum.

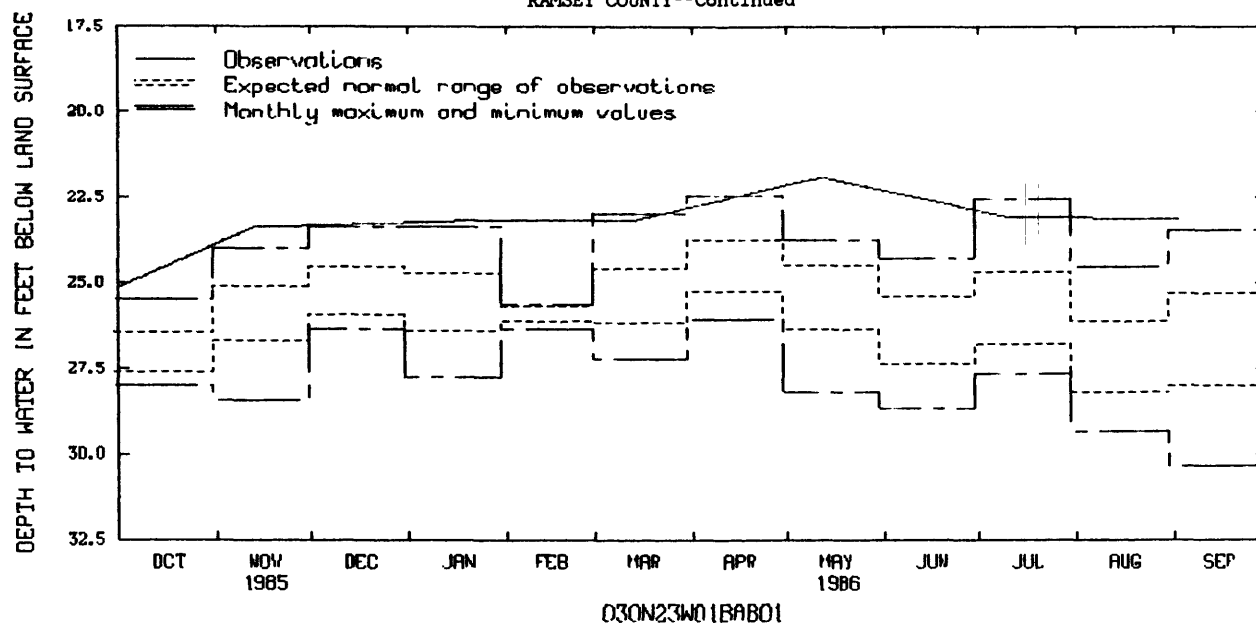
PERIOD OF RECORD.--August 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 21.93 ft (6.68 m) below land-surface datum, May 12, 1986; lowest, 30.35 ft (9.25 m) below land-surface datum, Sept. 8, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 12	23.44	JAN 15	23.23	MAR 14	23.20	MAY 12	21.93	JUL 10	23.07	SEP 3	23.18

## RAMSEY COUNTY--Continued



450238093082501. Local number, 030N23W35BDC01.

LOCATION.--Lat 45°02'38", long 93°08'25", in SW¼SE¼NW¼ sec.35, T.30 N., R.23 W., Hydrologic Unit 07010206, southeast corner of Arbogast Street and Richmond Avenue.

Owner: City of Shoreview.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 510 ft (155 m), cased to 465 ft (142 m).

DATUM.--Altitude of land-surface datum is 960 ft (293 m). Measuring point: Hole in shelter floor, 1.50 ft (0.46 m) above land-surface datum.

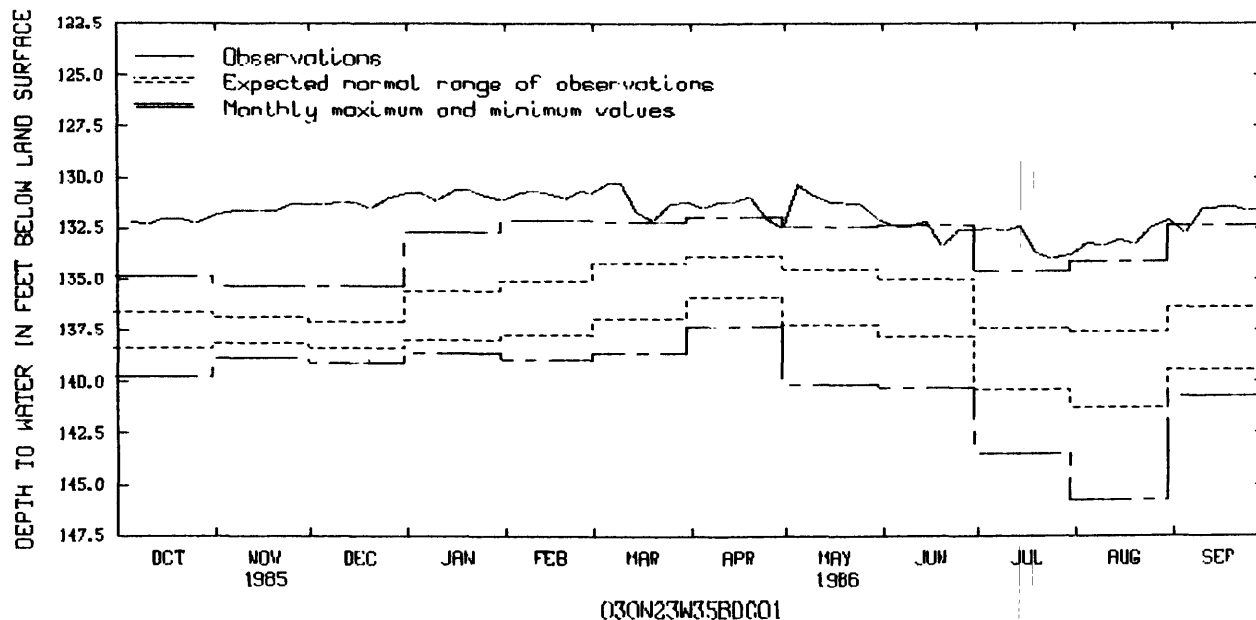
PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 131.3 ft (40.02 m) below land-surface datum, Mar. 4, 1985; lowest, 145.9 ft (44.47 m) below land-surface datum, Aug. 21, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	132.22	131.69	131.37	130.73	130.84	130.38	131.53	130.39	132.48	132.51	133.21	132.75
10	132.37	131.64	131.25	131.17	130.66	130.25	131.21	130.95	132.46	132.72	133.37	131.64
15	132.06	131.63	131.27	130.70	130.87	131.73	131.21	131.24	132.18	132.41	133.06	131.57
20	132.05	131.65	131.54	130.60	131.11	132.10	130.98	131.30	133.44	133.76	133.34	131.45
25	132.27	131.31	131.09	130.89	130.67	131.43	132.05	131.31	132.57	134.01	132.49	131.74
ECM	131.91	131.29	130.81	131.17	130.81	131.20	132.51	132.16	132.67	133.78	132.13	131.65

WTR YEAR 1986 HIGHEST 129.93 MAR 5, 1986 LOWEST 134.02 JUL 26, 1986



## GROUND-WATER LEVELS

## REDWOOD COUNTY

441323095280701. Local number, 109N38W30BBD01.

LOCATION.--Lat 44°13'23", long 95°28'07", in SE¼NW¼ sec.30, T.109 N., R.38 W., Hydrologic Unit 07020008, at city of Walnut Grove.

Owner: Plum Creek Cheese Co.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in (0.13 m), depth 240 ft (73.2 m), casing depth not available.

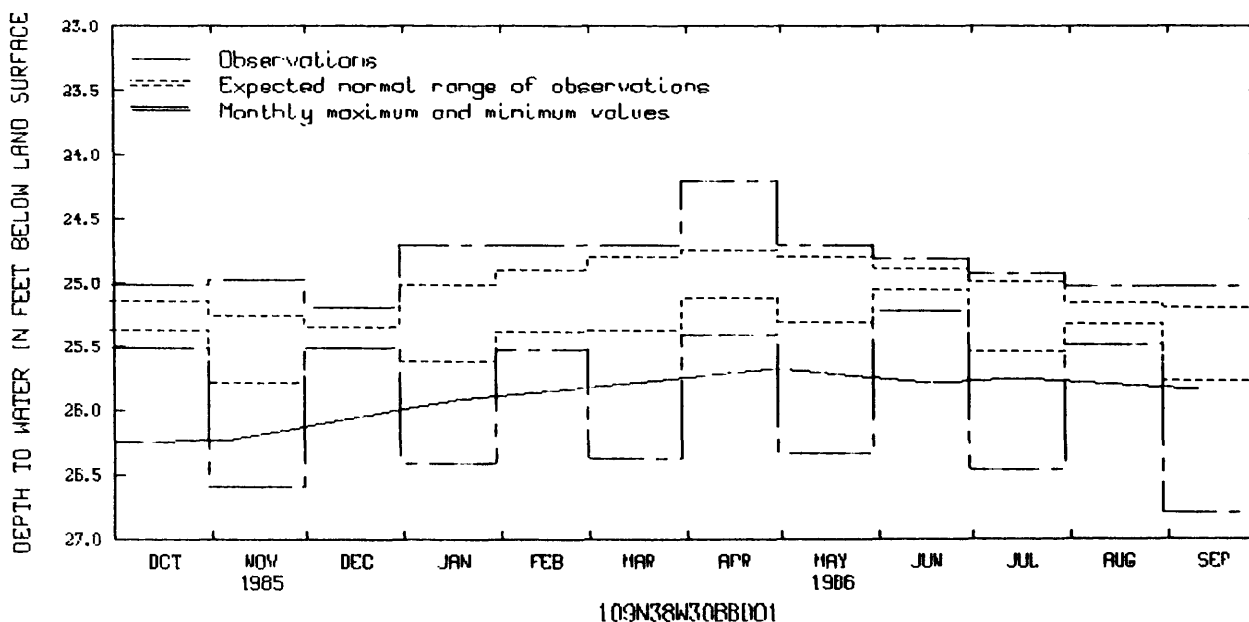
DATUM.--Altitude of land-surface datum is 1,218 ft (371 m). Measuring point: Top of well seal, 0.55ft (0.17 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.20 ft (7.37 m) below land-surface datum, April 3, 1984; lowest, 26.80 ft (8.16 m) below land-surface datum, Sept. 26, 1984.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	26.23	MAR 19	25.79	APR 29	25.68	JUN 18	25.80	JUL 16	25.76	SEP 11	25.85
JAN 17	25.92										



443051095074201. Local number, 112N36W14AAA01.

LOCATION.--Lat 44°30'51", long 95°07'42", in NE¼NE¼ sec.14, T.112 N., R.36 W., Hydrologic Unit 07020007, 2 mi (3.2 km) south of Redwood Falls.

Owner: Frank Boots.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in (0.10 m), measured depth 214 ft (65.2 m), reported screened 213 to 218 ft (64.9 to 66.4 m).

DATUM.--Land-surface datum is 1,038.9 ft (316.7 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

REMARKS.--Measured weekly by Michael Goebel. Water level affected by regional pumping.

PERIOD OF RECORD.--July 1952 to current year.

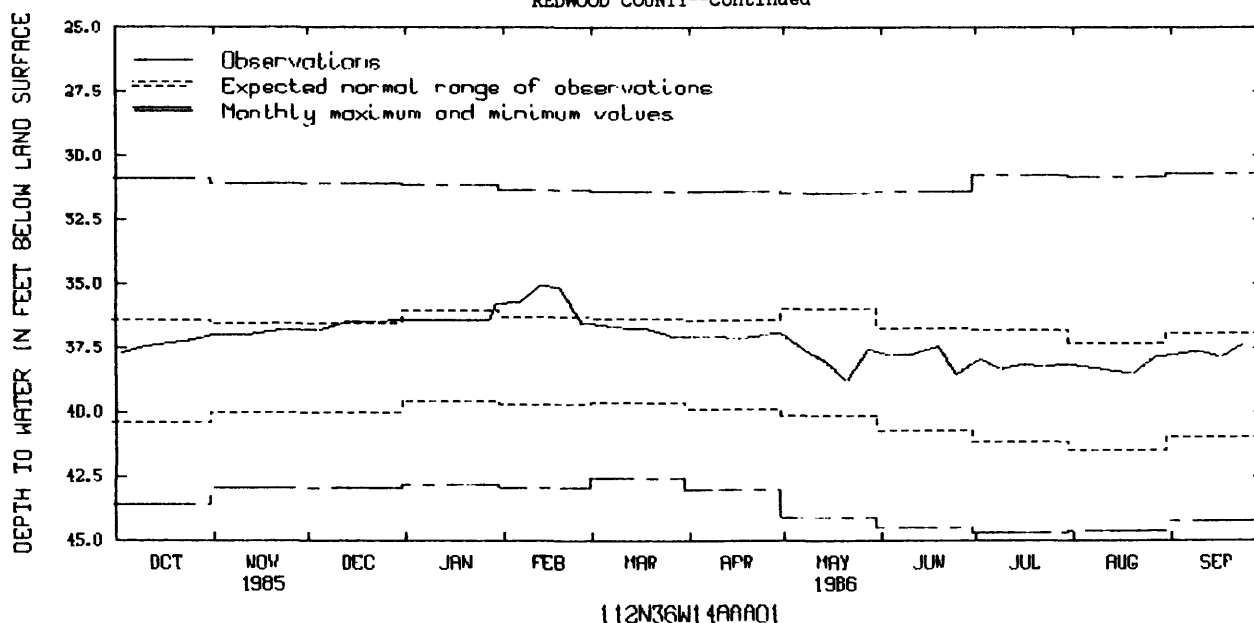
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 30.72 ft (9.36 m) below land-surface datum, Sept. 10, 1953; lowest, 44.68 ft (13.62 m) below land-surface datum, July 16, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 2	37.77	DEC 4	36.84	FEB 6	35.74	APR 9	37.09	JUN 11	37.78	AUG 6	38.30
9	37.48	12	36.53	12	35.10	16	37.21	19	37.47	13	38.39
16	37.38	18	36.50	19	35.18	23	37.03	25	38.53	20	38.51
23	37.25	26	36.49	26	36.56	30	36.92	JUL 2	37.94	27	37.87
30	37.07	JAN 2	36.42	MAR 6	36.70	MAY 7	37.59	9	38.36	SEP 3	37.76
NOV 5	36.98	8	36.40	11	36.76	14	38.05	16	38.17	10	37.63
13	37.02	15	36.44	19	36.80	21	38.79	23	38.30	17	37.87
20	36.87	27	36.41	26	37.05	28	37.57	30	38.18	24	37.38
27	36.83	29	35.87	APR 2	37.11	JUN 4	37.86				

## GROUND-WATER LEVELS

## REDWOOD COUNTY--Continued



442906095064101. Local number, 112N36W24DDC01.

LOCATION.--Lat 44°29'06", long 95°06'41", in SW¼SE¼SE¼ sec.24, T.112 N., R.36 W., Hydrologic Unit 07020007, 3.6 mi 3.6 mi (5.8 km) south of Redwood Falls.

Owner: City of Redwood Falls.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in (0.05 m), depth 144 ft (43.9 m), screened 141 to 144 ft (43.0 to 43.9 m).

DATUM.--Altitude of land-surface datum is 1,041 ft (317 m). Measuring point: Top of casing, 2.50 ft (0.76 m) above land-surface datum.

REMARKS.--Water level affected by pumping from nearby well field.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 39.52 ft (12.05 m) below land-surface datum, Mar. 13, 1971; lowest, 51.21 ft (15.61 m) below land-surface datum, July 16, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 2	42.94	DEC 4	41.75	FEB 6	41.50	APR 9	43.20	JUN 11	42.12	AUG 6	41.95
9	42.73	12	41.85	12	41.70	16	42.21	19	40.30	13	41.88
16	42.50	18	41.87	19	40.86	23	42.10	25	40.30	20	41.99
23	42.54	26	41.47	26	41.73	30	41.89	JUL 2	42.57	27	42.30
30	42.38	JAN 2	41.51	MAR 6	41.81	MAY 7	41.75	9	42.34	SEP 3	42.11
NOV 5	42.24	8	41.65	11	41.76	14	41.16	16	42.47	10	42.20
13	42.24	15	41.59	19	41.73	21	41.79	23	42.32	17	42.17
20	42.07	27	41.62	26	42.12	28	41.62	30	42.40	24	42.14
27	41.89	29	41.50	APR 2	42.27	JUN 4	41.96				

## RENNVILLE COUNTY

444437094425001. Local number, 115N32W29AAC01.

LOCATION.--Lat 44°44'37", long 94°42'50", in SW¼NE¼NE¼ sec.29, T.115 N., R.32 W., Hydrologic Unit 07010205, in Hector.

Owner: Hector Creamery.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 8 in (0.20 m), depth 370 ft (109 m), screened 360 to 370 ft (110 to 113 m).

DATUM.--Altitude of land-surface datum is 1,080 ft (329 m). Measuring point: Top of casing, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--March 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 30.75 ft (9.37 m) below land-surface datum, June 16, 1986; lowest, 38.48 ft (11.73 m) below land-surface datum, Oct. 24, 1978.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
FEB 7	31.52	JUN 4	30.79	JUN 16	30.75	AUG 20	30.79
APR 8	31.02						

## GROUND-WATER LEVELS

## RICE COUNTY

441912093162901. Local number, 110N20W19BDC01.

LOCATION.--Lat 44°19'12", long 93°16'29", in SW¼SE¼NW¼ sec.19, T.110 N., R.20 W., Hydrologic Unit 07040002, just north of Faribault.

Owner: St. Lawrence Cemetery Assn.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

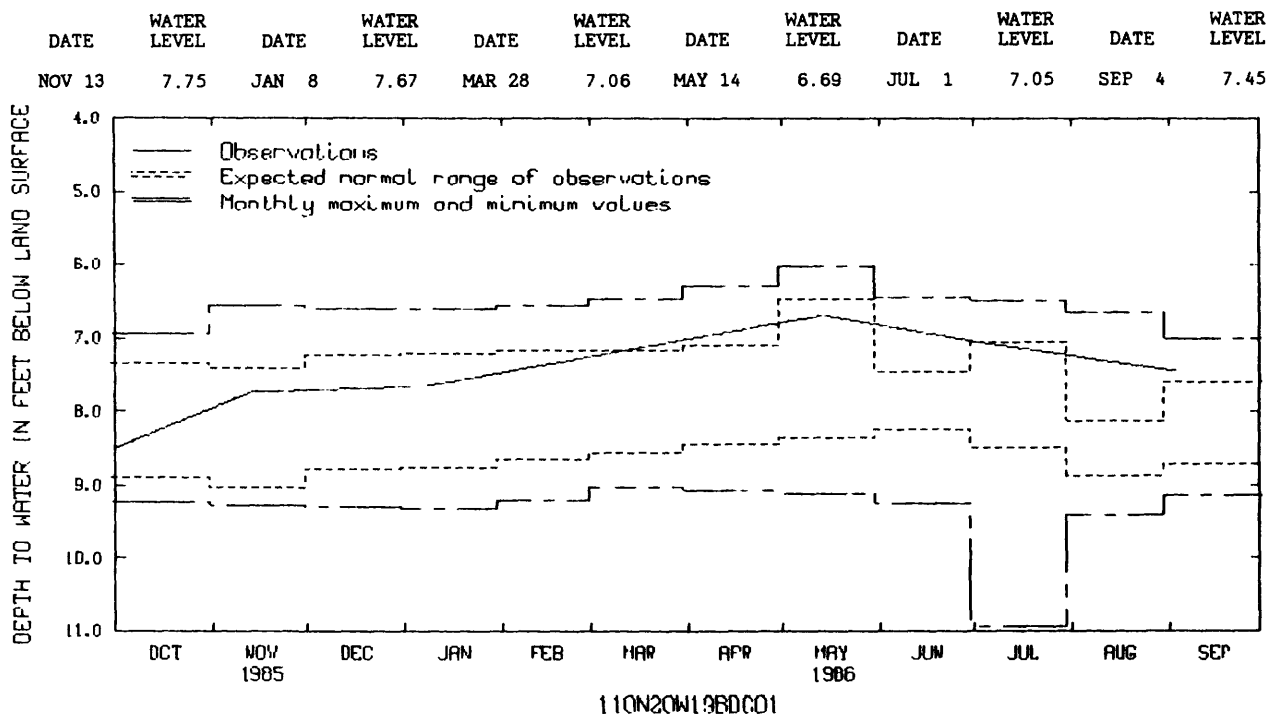
WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 400 ft (122 m), cased to 357 ft (110 m).

DATUM.--Altitude of land-surface datum is 985 ft (300 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 6.02 ft (1.83 m) below land-surface datum, May 2, 1984; lowest, 10.94 ft (3.33 m) below land-surface datum, July 10, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



442543093113701. Local number, 111N20W11CDC01.

LOCATION.--Lat 44°25'43", long 93°11'37", in SW¼SE¼SW¼ sec.11, T.111 N., R.20 W., Hydrologic Unit 07040002, Highway 218 at Dundas.

Owner: Rollie Green.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled commercial artesian well, diameter 4 in (0.10 m), depth 158 ft (48.2 m), cased to 101 ft (30.8 m).

DATUM.--Altitude of land-surface datum is 950 ft (290 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--October 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 21.72 ft (6.62 m) below land-surface datum, May 14, 1986; lowest, 27.24 ft (8.30 m) below land-surface datum, Jan. 12, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	23.50	JAN 8	23.88	MAR 28	22.03	MAY 14	21.72	JUL 1	22.00	SEP 4	22.69

## GROUND-WATER LEVELS

## RICE COUNTY--Continued

442751093240701. Local number, 112N21W31CBB01.

LOCATION.--Lat 44°27'51", long 93°24'07", in NW¼NW¼SW¼ sec.31, T.112 N., R.21 W., Hydrologic Unit 07040002, 1.0 mi (1.6 km) south of Highway 19.

Owner: Trondhjem Church.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 276 ft (84.1 m), cased to 232 ft (70.7 m).

DATUM.--Altitude of land-surface datum is 1,130 ft (344 m). Measuring point: Top of casing, 1.10 ft (0.34 m) above land-surface datum.

PERIOD OF RECORD.--June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 137.7 ft (41.97 m) below land-surface datum, Sept. 4, 1986; lowest, 141.8 ft (43.22 m) below land-surface datum, Oct. 30, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	138.58	MAY 2	138.54	JUL 1	137.90	SEP 4	137.74

## SCOTT COUNTY

443732093460301. Local number, 113N24W06BCB01.

LOCATION.--Lat 44°37'32", long 93°46'03", in NW¼SW¼NW¼ sec.6, T.113 N., R.24 W., Hydrologic Unit 07020012, in Belle Plaine.

Owner: Creative Tool and Engineering. Formerly Belle Plaine Coop Creamery.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

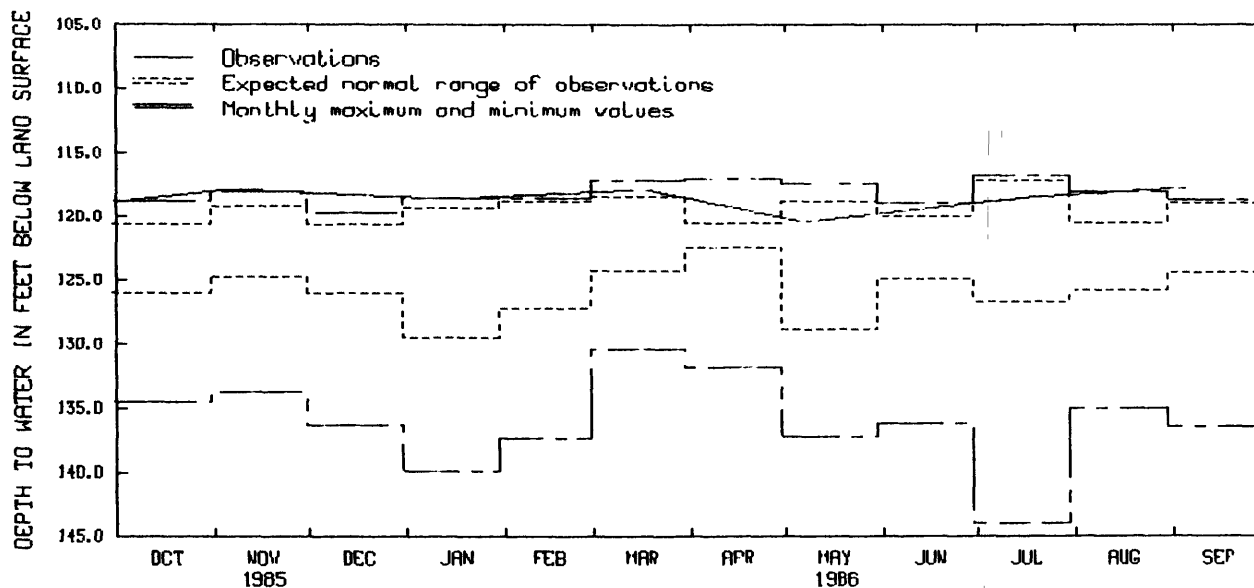
WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 12 in (0.30 m), depth 272 ft (82.9 m), screen information not available.

DATUM.--Altitude of land-surface datum is 840 ft (256 m). Measuring point: Top of well cap, 2.30 ft (0.70 m) above land-surface datum.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 116.8 ft (35.60 m) below land-surface datum, July 11, 1983; lowest, 144.0 ft (43.89 m) below land-surface datum, July 9, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	LEVEL	DATE	LEVEL
NOV 5	117.95	MAR 18	117.93	MAY 7	120.58	JUL 17	118.58	SEP 5	117.82
JAN 14	118.75								



113N24W06BCB01

## GROUND-WATER LEVELS

## SCOTT COUNTY--Continued

443352093423001. Local number, 113N24W28DAA01.

LOCATION.--Lat 44°33'52", long 93°42'30", in NE¼NE¼SE¼ sec.28, T.113 N., R.24 W., Hydrologic Unit 07020012, at Michelle Wildlife Area.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in (0.15 m), depth 450 ft (137 m), cased to 219 ft (66.8 m).

DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Top of well seal, 2.30 ft (0.70 m) above land-surface datum.

PERIOD OF RECORD.--August 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 131.7 ft (40.14 m) below land-surface datum, May 2, 1984; lowest, 136.5 ft (41.60 m) below land-surface datum, July 11, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	133.30	MAR 21	132.63	MAY 2	132.57	JUL 17	132.21	SEP 5	132.45
JAN 14	132.70								

443352093423002. Local number, 113N24W28DAA02.

LOCATION.--Lat 44°33'52", long 93°42'30", in NE¼NE¼SE¼ sec.28, T.113 N., R.24 W., Hydrologic Unit 07020012, at Michelle Wildlife Area.

Owner: U.S. Geological Survey.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in (0.05 m), depth 655 ft (200 m), screened 650 to 655 ft (198 to 200 m).

DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--August 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 221.1 ft (67.39 m) below land-surface datum, May 3, 1983; lowest, 222.8 ft (67.90 m) below land-surface datum, Sept. 4, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	222.98	MAR 21	222.54	MAY 2	222.54	JUL 17	222.34	SEP 5	222.67
JAN 14	222.53								

443715093480801. Local number, 113N25W02CAC01.

LOCATION.--Lat 44°37'15", long 93°48'08", in SW¼NE¼SW¼ sec.2, T.113 N., R.25 W., Hydrologic Unit 07020012, 0.75 mi (1.21 km) west of Belle Plaine at Shep's Gravel Pit.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.04 m), depth 323 ft (98.4 m), cased to 193 ft (58.8 m).

DATUM.--Altitude of land-surface datum is 750 ft (229 m). Measuring point: Top of casing, 0.25 ft (0.08 m) above land-surface datum.

PERIOD OF RECORD.--October 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.59 ft (1.70 m) below land-surface datum, May 7, 1986; lowest, 10.35 ft (3.15 m) below land-surface datum, Jan. 8, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	7.89	MAR 27	6.55	MAY 7	5.59	JUL 17	6.66	SEP 5	7.53

## GROUND-WATER LEVELS

## SCOTT COUNTY--Continued

444025093220801. Local number, 114N21W20BAA01.

LOCATION.--Lat 44°40'25", long 93°22'08", in NE¼NE¼NW¼ sec.20, T.114 N., R.21 W., Hydrologic Unit 07020012, 0.5 mi (0.8 km) east of Credit River.

Owner: Credit River Town Hall.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 98 ft (29.9 m), screened 93 to 98 ft (28.4 to 29.9 m).

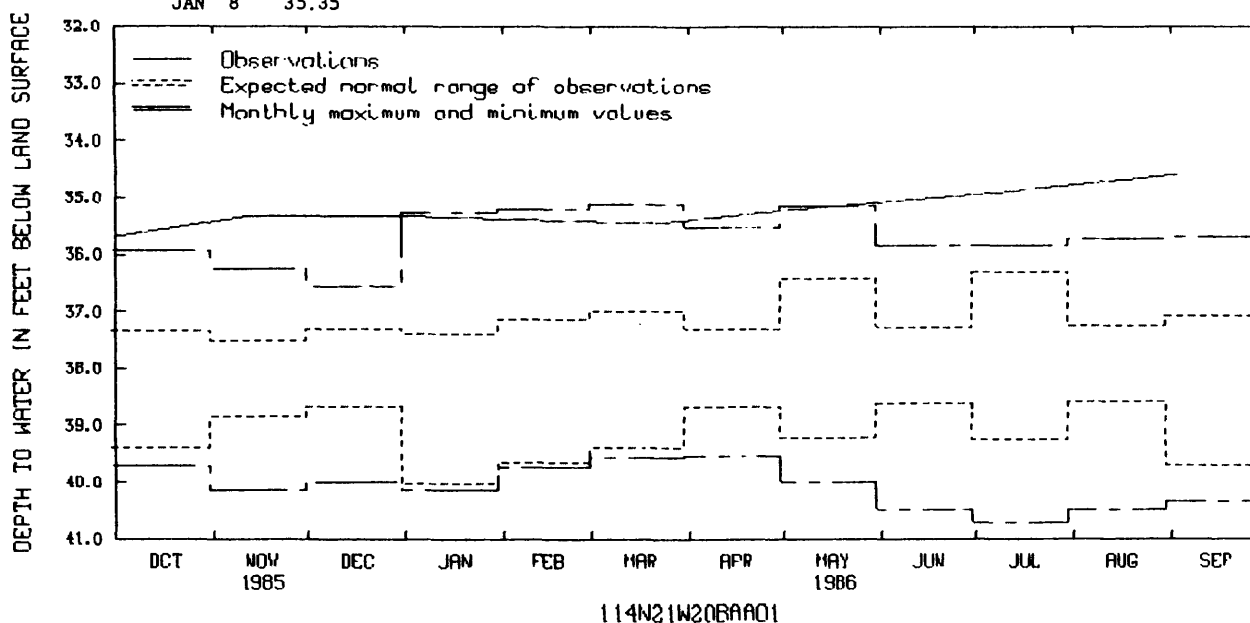
DATUM.--Altitude of land-surface datum is 946 ft (288 m). Measuring point: Top of casing, 1.10 ft (0.34 m) above land-surface datum.

PERIOD OF RECORD.--September 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 34.59 ft (10.54 m) below land-surface datum, Sept. 4, 1986; lowest, 40.72 ft (12.41 m) below land-surface datum, July 16, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	35.33	MAR 21	35.45	MAY 2	35.22	JUL 10	34.92	SEP 4	34.59
JAN 8	35.35								



443752093254401. Local number, 114N22W35DCC01.

LOCATION.--Lat 44°37'52", long 93°25'44", in SW¼SW¼SE¼ sec.35, T.114 N., R.22 W., Hydrologic Unit 07020012, southwest of Credit River.

Owner: St. Catherine's Church.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 235 ft (71.6 m), cased to 194 ft (59.1 m).

DATUM.--Altitude of land-surface datum is 1,015 ft (309 m). Measuring point: Top of casing, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--September 1979 to current year.

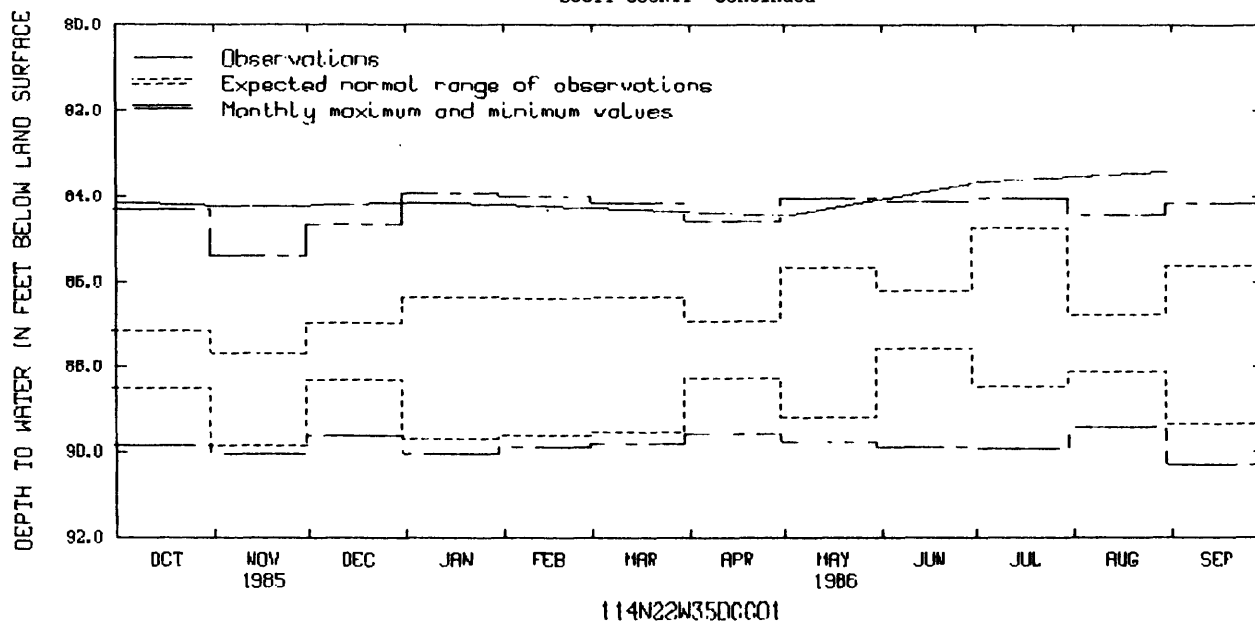
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 83.42 ft (25.42 m) below land-surface datum, Sept. 4, 1986; lowest, 90.30 ft (27.52 m) below land-surface datum, Sept. 6, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 13	84.28	JAN 8	84.16	MAR 21	84.36	MAY 2	84.46	JUL 1	83.68	SEP 4	83.42

## GROUND-WATER LEVELS

SCOTT COUNTY--Continued



444633093212901. Local number, 115N21W09CCC01.

LOCATION.--Lat 44°46'33", long 93°21'29", in SW¼SW¼SW¼ sec.9, T.115 N., R.21 W., Hydrologic Unit 07020012, at Savage waste treatment plant.

Owner: City of Savage, well 2.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age and Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, depth 846 ft (258 m), 16 in (0.41 m) casing 0 ft to 280 ft (85.3 m), 10 in (0.25 m) casing 250 ft to 660 ft (85.3 m to 201 m).

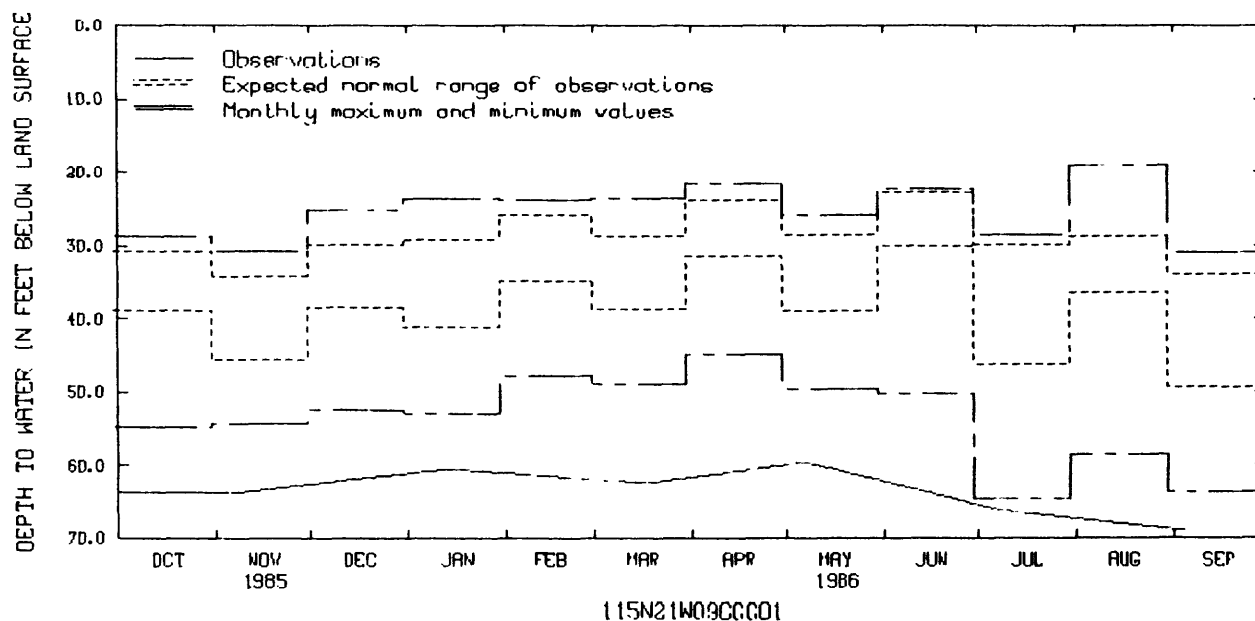
DATUM.--Land-surface datum is 730 ft (222.5 m). Measuring point: Edge of vent pipe 0.75 ft (0.23 m) above land-surface datum.

PERIOD OF RECORD.--February 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.98 ft (5.79 m) below land-surface datum, Aug. 9, 1979; lowest, 69.24 ft (21.10 m) below land-surface datum, Sept. 5, 1986.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	63.89	JAN 14	60.60	MAR 18	62.64	MAY 7	59.68	JUL 7	66.31	SEP 5	69.24



## GROUND-WATER LEVELS

## SCOTT COUNTY--Continued

444427093353901. Local number, 115N23W28BDD01.

LOCATION.--Lat 44°44'27", long 93°43'53", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.28, T.115N., R.23 W., Hydrologic Unit 07020012, Merriam Junction.

Owner: Chicago and Northwestern Transportation Company.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 16 in (0.40 m), depth 140ft (42.7m), cased to 75 ft (22.9m).

DATUM.--Altitude of land-surface datum is 758 ft (231m). Measuring point: Top of casing, 0.90 ft (0.27 m) above land-surface datum.

PERIOD OF RECORD.--November 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 25.75ft (7.84 m) below land-surface datum, Mar. 8, 1985; lowest, 38.86 ft (11.84m) below land-surface datum, Mar. 21, 1986.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	37.13	JAN 14	38.34	MAR 21	38.86	MAY 7	37.73	JUL 15	36.56	SEP 5	37.03

444427093353902. Local number, 115N23W28BDD02.

LOCATION.--Lat 44°44'27", long 93°35'39", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.28, T.115N., R.23 W., Hydrologic Unit 07020012, Merriam Junction.

Owner: Chicago and Northwestern Transportation Company.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 355 ft (108 m), screened 350 to 355 ft (107 to 108 m).

DATUM.--Altitude of land-surface datum is 758 ft (231 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--November 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 21.44ft (6.53 m) below land-surface datum, Mar. 21, 1986; lowest, 38.80 ft (9.99 m) below land-surface datum, July 9, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	27.56	MAR 21	21.44	MAY 7	25.23	JUL 15	27.06	SEP 5	28.77
JAN 14	21.69								

444427093353903. Local number, 115N23W28BDD03.

LOCATION.--Lat 44°44'27", long 93°35'39", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.28, T.115N., R.23 W., Hydrologic Unit 07020012, Merriam Junction.

Owner: Chicago and Northwestern Transportation Company.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 525 ft (160 m), screened 520 to 525ft (158 to 160 m).

DATUM.--Altitude of land-surface datum is 758 ft (231 m). Measuring point: Top of casing, 1.00 ft (0.30m) above land-surface datum.

PERIOD OF RECORD.--November 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 33.85 ft (10.31m)below land-surface datum, Mar. 8, 1985; lowest, 47.73 ft (14.54m) below land-surface datum, Oct. 2, 1985.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	45.34	38.94	37.05	37.17	38.23	37.78	37.87	35.61	45.90	44.98	43.52	41.74
10	45.96	39.01	38.41	37.19	37.82	37.73	37.66	37.70	45.46	45.94	43.26	41.29
15	43.74	38.26	37.30	37.00	37.57	38.19	37.21	39.09	44.36	45.80	42.84	41.08
20	43.02	37.79	37.13	36.90	37.87	38.54	37.04	39.57	47.16	44.88	42.68	40.41
25	40.46	38.21	37.16	37.02	37.69	37.72	36.95	38.74	45.76	47.20	42.09	39.59
EOM	39.91	37.47	36.99	37.13	37.76	38.32	36.26	43.76	44.78	44.53	41.77	39.75

WTR YEAR 1986 HIGHEST 35.49 MAY 5, 1986

LOWEST 47.73 OCT 2, 1985

## GROUND-WATER LEVELS

## SHERBURNE COUNTY

452938093432701. Local number, 035N27W29DBB02.

LOCATION.--Lat 45°29'38", long 93°43'27", in NW¼NW¼SE¼ sec.29, T.35 N., R.27 W., Hydrologic Unit 07010203, 3.2 mi (5.2 km) north of Orrock in Sherburne National Wildlife Refuge.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2½ in (0.05 m), depth 15 ft (4.6 m), screened 13 to 15 ft (4.0 to 4.6 m).

DATUM.--Altitude of land-surface datum is 987 ft (301 m). Measuring point: Top of casing, 1.70 ft (0.52 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 3.63 ft (1.11 m) below land-surface datum, Nov. 21, 1984; lowest, 8.48 ft (2.58 m) below land-surface datum, Nov. 30, 1976.

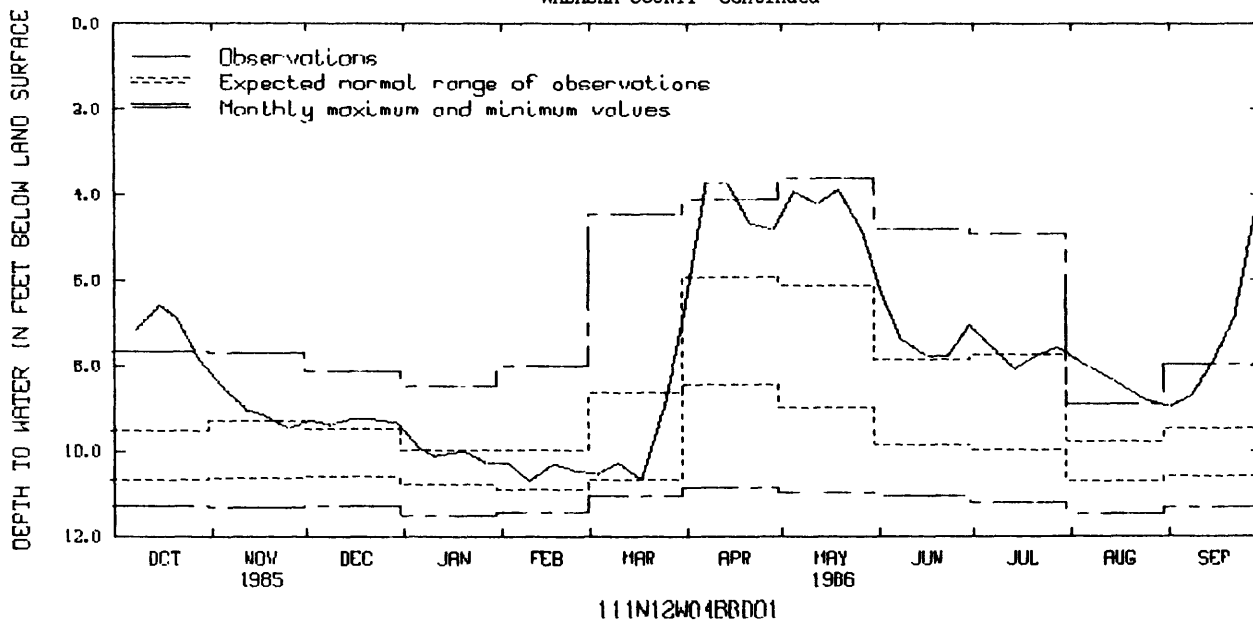
## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 2	3.93	NOV 29	5.39	FEB 19	6.42	MAY 28	3.98	JUN 26	4.04
20	4.14	JAN 14	6.24	MAR 26	4.31				

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	7.20	DEC 9	9.38	FEB 10	10.69	APR 7	3.74	JUN 2	6.28	AUG 4	7.93
15	6.60	16	9.25	17	10.32	14	3.76	8	7.39	11	8.18
21	6.90	23	9.26	24	10.48	21	4.69	16	7.76	25	8.82
28	7.89	30	9.36	MAR 3	10.54	28	4.85	23	7.77	SEP 1	8.95
NOV 4	8.47	JAN 6	9.92	10	10.29	MAY 5	3.91	30	7.04	8	8.70
12	9.04	11	10.11	17	10.66	12	4.22	JUL 14	8.07	15	7.93
18	9.16	20	9.99	24	9.04	19	3.87	21	7.76	22	6.88
25	9.46	27	10.28	31	6.69	27	4.94	28	7.60	29	4.32
DEC 2	9.27	FEB 3	10.28								

## GROUND-WATER LEVELS

## WABASHA COUNTY--Continued



## WADENA COUNTY

462415095003001. Local number, 134N34W19ADD01.

LOCATION.--Lat 46°24'21", long 95°00'36", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.19, T.134 N., R.34 W., Hydrologic Unit 07010107, 0.05 mi (0.08 km) north of Verndale.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in (0.05 m), depth 37 ft (11.3 m), screened 34 to 37 ft (10.4 to 11.3 m).

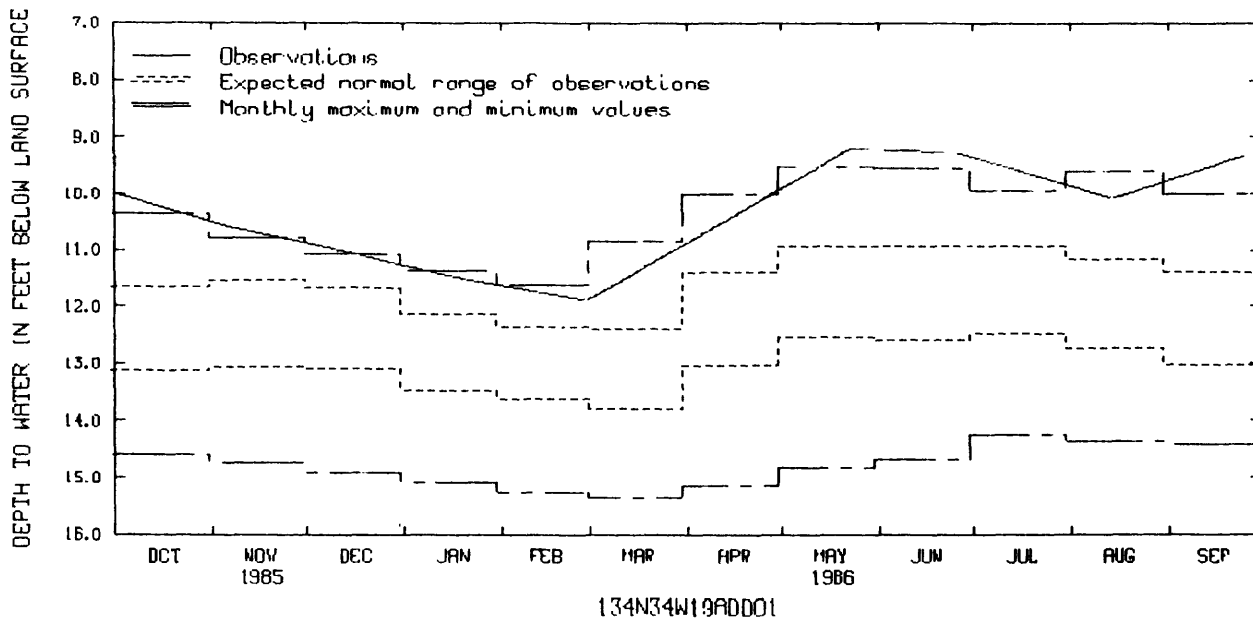
DATUM.--Altitude of land-surface datum is 1,342 ft (409 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 9.18 ft (2.79 m) below land-surface datum, May 23, 1986; lowest, 15.33 ft (4.41 m) below land-surface datum, Mar. 10-11, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL
NOV 7	10.60	JAN 21	11.52	MAY 23	9.18	JUN 26	9.28	AUG 14	10.09	SEP 25	9.35
DEC 9	10.99	FEB 28	11.91								



## GROUND-WATER LEVELS

## WASHINGTON COUNTY

445125092464001. Local number, 027N20W02BCC01.

LOCATION.--Lat 44°51'25", long 92°46'40", in SW<sup>1</sup>/<sub>4</sub>SW<sup>1</sup>/<sub>4</sub> sec.2, T.27 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park by Afton Alps.

Owner: U.S. Geological Survey.

AQUIFER.--St. Lawrence Formation and Franconian Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in (0.15 m), depth 285 ft (86.9 m), cased to 105 ft (32.0 m).

DATUM.--Altitude of land-surface datum is 695 ft (212 m). Measuring point: Center of pressure guage, 3.80 ft (1.16 m) above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 33.94 ft (10.38 m) above land-surface datum, May 2, 1980; lowest, 19.67 ft (5.991 m) above land-surface datum, Jan. 8, 1985.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	26.22	MAR 26	27.03	MAY 1	29.79	JUL 2	29.33	SEP 5	28.64

445125092464002. Local number, 027N20W02BCC02.

LOCATION.--Lat 44°51'25", long 92°46'40", in SW<sup>1</sup>/<sub>4</sub>SW<sup>1</sup>/<sub>4</sub> sec.2, T.27 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park by Afton Alps.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in (0.10 m), depth 385 ft (117 m), cased to 365 ft (111 m).

DATUM.--Altitude of land-surface datum is 695 ft (212 m). Measuring point: Center of pressure guage, 3.80 ft (1.16 m) above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 42.35 ft (12.91 m) above land-surface datum, May 2, 1980; lowest, 23.81 ft (7.25 m) above land-surface datum, Jan. 8, 1985.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	31.98	MAR 26	32.55	MAY 1	35.31	JUL 2	35.08	SEP 5	35.08

445125092464003. Local number, 027N20W02BCC03.

LOCATION.--Lat 44°51'25", long 92°46'40", in SW<sup>1</sup>/<sub>4</sub>SW<sup>1</sup>/<sub>4</sub> sec.2, T.27 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park by Afton Alps.

Owner: U.S. Geological Survey.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 1F in (0.04 m), depth 535 ft (163 m), screened 530 to 535 ft (162 to 163 m).

DATUM.--Altitude of land-surface datum is 695 ft (212 m). Measuring point: Center of pressure guage, 3.40 ft (1.04 m) above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 22.05 ft (6.72 m) above land-surface datum, May 2, 1980; lowest, 6.62 ft (2.01 m) above land-surface datum, Aug. 16, 1985.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	8.92	MAR 26	9.84	MAY 1	11.68	JUL 2	10.30	SEP 5	10.30

## GROUND WATER LEVELS

## WASHINGTON COUNTY--Continued

444751092563101. Local number, 027N21W28BCC01.

LOCATION.--Lat 44°47'51", 92°56'31", in SW¼SW¼NW¼ sec.28, T.27 N., R.21 W., Hydrologic Unit 07010206, 0.1 mi (0.2 km) east of Ideal Avenue South.

Owner: Eugene Smallidge.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation water-table well, diameter 16 in (0.41 m), depth 345 ft (105 m), cased to 60 ft (18.3 m).

DATUM.--Altitude of land-surface datum is 807 ft (246 m). Measuring point: Hole in pump base, 2.10 ft (0.64 m) above land-surface datum.

PERIOD OF RECORD.--August 1977, January 1978, December 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 62.34 ft (19.00 m) below land-surface datum, Dec. 10, 1979; lowest, 81.87 ft (24.95 m) below land-surface datum, Aug. 3, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 6	69.08	JAN 8	68.50	MAR 21	68.62	MAY 1	66.82	JUL 1	64.66	SEP 4	62.56

445536092462401. Local number, 028N20W11CAA01.

LOCATION.--Lat 44°55'36", long 92°46'24", in NE¼NE¼SW¼ sec.11, T.28 N., R.20 W., Hydrologic Unit 07030005, at Lake St. Croix Beach.

Owner: Lower St. Croix Valley Fire Department.

AQUIFER.--Franconian Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic water-table well, diameter 4 in (0.10 m), depth 94 ft (28.6 m), cased to 78 ft (23.8 m).

DATUM.--Altitude of land-surface datum is 720 ft (220 m). Measuring point: Top of electrical housing, 1.70 ft (0.52 m) above land-surface datum.

PERIOD OF RECORD.--June 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.27 ft (9.53 m) below land-surface datum, May 1, 1986; lowest, 38.65 ft (11.78 m) below land-surface datum, Mar. 3, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	34.98	JAN 15	37.03	MAR 20	37.86	MAY 1	31.27	JUL 2	32.28	SEP 2	34.76

445220092465901. Local number, 028N20W34ADA01.

LOCATION.--Lat 44°52'20", long 92°46'59", in NE¼SE¼NE¼ sec.34, T.28 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park.

Owner: State of Minnesota.

AQUIFER.--Franconia Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in (0.10 m), depth 306 ft (93.2 m), cased to 276 ft (84.1 m).

DATUM.--Altitude of land-surface datum is 970 ft (296 m). Measuring point: Top of casing, 0.90 ft (0.27 m) above land-surface datum.

PERIOD OF RECORD.--August 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 240.4 ft (73.27 m) below land-surface datum, June 27, 1984; lowest, 245.2 ft (74.74 m) below land-surface datum, Jan. 6, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	241.47	MAY 1	240.70	JUL 2	241.12	SEP 19	241.49

## GROUND-WATER LEVELS

## WASHINGTON COUNTY--Continued

450134092583101. Local number, 029N21W06CAD01.

LOCATION.--Lat 45°01'34", long 92°58'31", in SE¼NE¼SW¼ sec.6, T.29 N., R.21 W., Hydrologic Unit 07010206, at 6488 North Highway 36 Boulevard.

Owner: Twenty Nine Pines Trailer Park.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

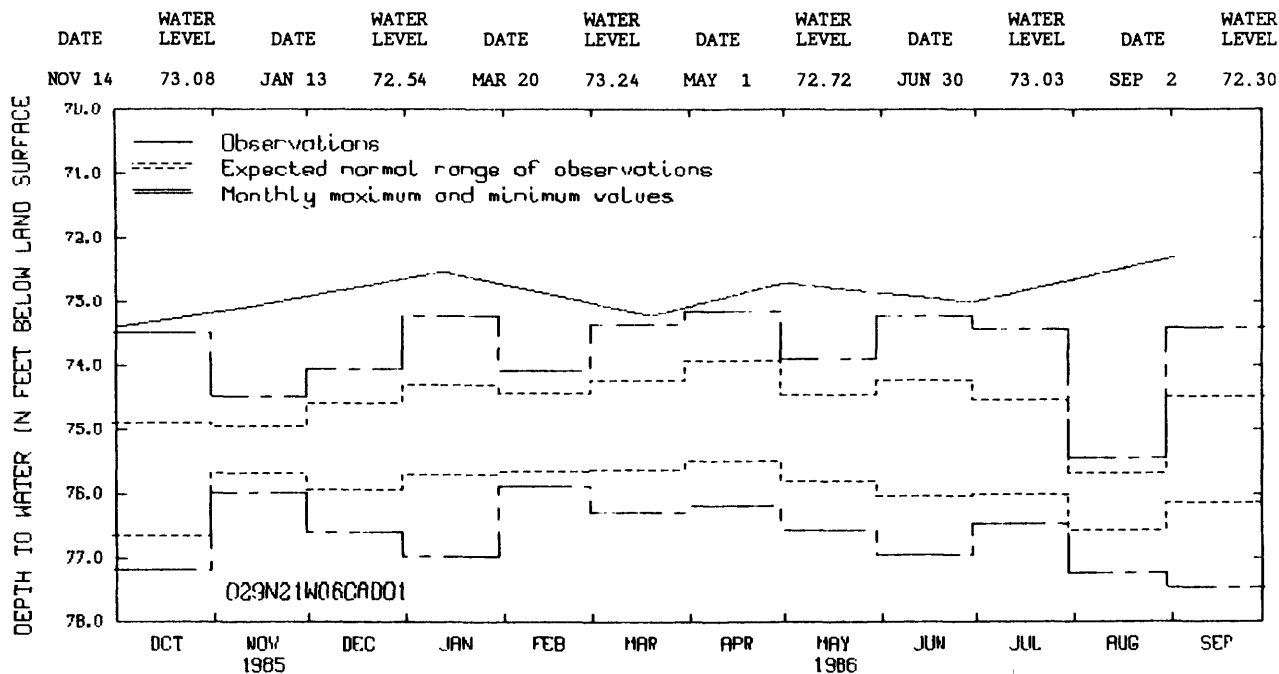
WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in (0.15 m), depth 210 ft (64.0 m), cased to 141 ft (43.0 m).

DATUM.--Altitude of land-surface datum is 980 ft (299 m). Measuring point: Hole in pump base, 2.20 ft (0.67 m) above land-surface datum.

PERIOD OF RECORD.--April 1974 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 72.30 ft (22.03 m) below land-surface datum, Sept. 2, 1986; lowest, 77.47 ft (23.61 m) below land-surface datum, Sept. 13, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



450027092552101. Local number, 029N21W10CCC01.

LOCATION.--Lat 45°00'27", long 95°55'21", in SW¼SW¼SW¼ sec.10, T.29 N., R.21 W., Hydrologic Unit 07010206, Lake Jane Road, 0.7 mi (1.1 km) north of Highway 212.

Owner: City of Lake Elmo.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in (0.15 m), depth 348 ft (106 m), cased to 280 ft (85.3 m).

DATUM.--Altitude of land-surface datum is 935 ft (285 m). Measuring point: Top of well cap, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--September 1977, February 1978, February 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 32.90 ft (10.02 m) below land-surface datum, Sept. 2, 1986; lowest, 45.65 ft (13.91 m) below land-surface datum, Sept. 28, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	34.77	JAN 13	34.78	MAR 20	35.65	MAY 1	34.53	JUN 30	33.26	SEP 2	32.90

## GROUND-WATER LEVELS

## WASHINGTON COUNTY--Continued

445958092523901. Local number, 029N21W13CAB01.

LOCATION.--Lat 44°59'58", long 92°52'39", in NW¼NE¼SW¼ sec.13, T.29 N., R.21 W., Hydrologic Unit 07010206, in City of Lake Elmo.

Owner: Elmo Lumber and Plywood. Formerly Lake Elmo Creamery.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

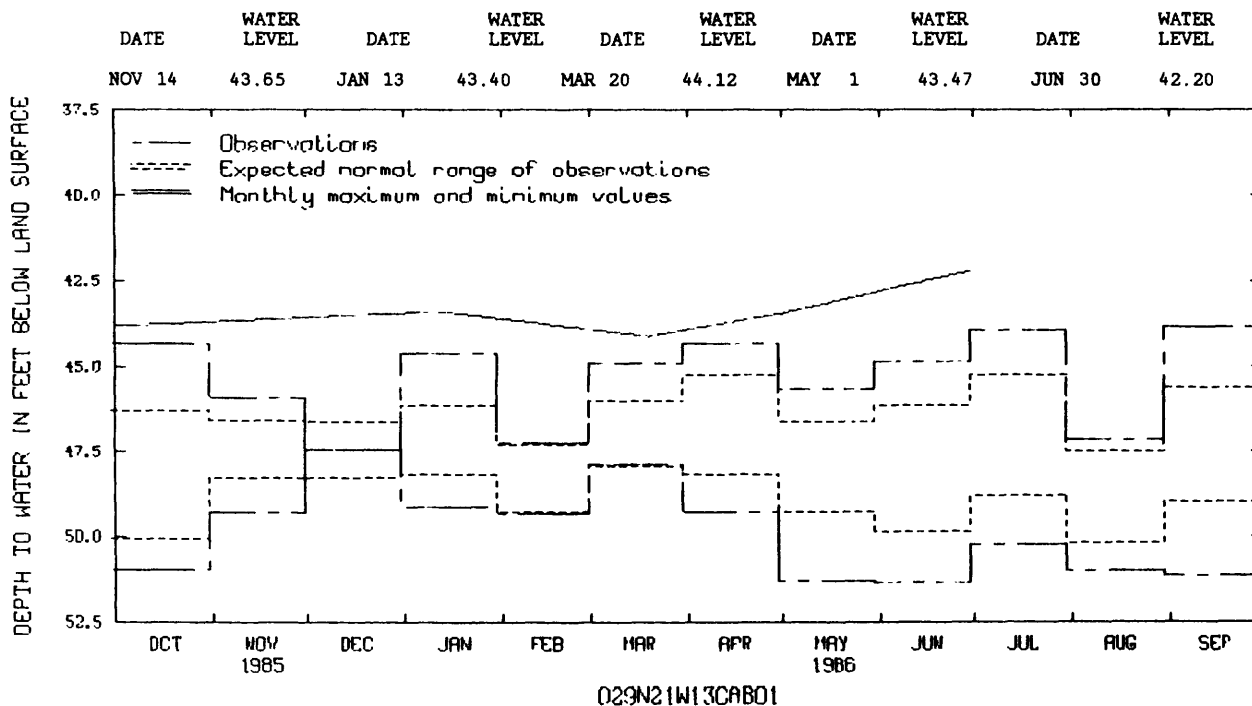
WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 122 ft (37.2 m), screened 106 to 122 ft (32.3 to 37.2 m).

DATUM.--Altitude of land-surface datum is 938 ft (286 m). Measuring point: Hole in pump base, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--August 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 42.20 ft (12.37 m) below land-surface datum, June 30, 1986; lowest, 51.37 ft (15.66 m) below land-surface datum, June 12, 1978.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



450858092575001. Local number, 031N21W28ABD01.

LOCATION.--Lat 45°08'58", long 92°57'50", in SE¼NW¼NE¼ sec.28, T.31 N., R.21 W., Hydrologic Unit 07010206, County Road 8A, 1.65 mi (2.6 km) east of Highway 61.

Owner: White Bear Gun Club.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in (0.10 m), depth 142 ft (43.3 m), cased to 94 ft (28.6 m).

DATUM.--Altitude of land-surface datum is 939 ft (28.6 m). Measuring point: Top of well cap, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--September 1977, February 1978, February 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 7.88 ft (2.40 m) below land-surface datum, May 1, 1986; lowest, 13.17 ft (4.01 m) below land-surface datum, Sept. 30, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	8.72	MAR 20	9.29	MAY 1	7.88	JUL 10	8.05	SEP 3	8.29
JAN 15	9.02								

## GROUND-WATER LEVELS

## WASHINGTON COUNTY--Continued

451355092532601. Local number, 032N20W30BCD01.

LOCATION.--Lat 45°13'55", long 92°53'26", in SE¼SW¼NW¼ sec.30, T.32 N., R.20 W., Hydrologic Unit 07030005, 0.25 mi (0.4 km) north of 192nd Street.

Owner: Arno Birr.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 260 ft (79.2 m), cased to 141 ft (43.0 m).

DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Vent pipe, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--March 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 51.67 ft (15.74 m) below land-surface datum, Sept. 3, 1986; lowest, 53.97 ft (16.43 m) below land-surface datum, Mar. 9, 1983.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 14	52.90	MAR 20	53.60	MAY 1	53.80	JUL 10	51.98	SEP 3	51.67

## WATONWAN COUNTY

440037094372601. Local number, 106N32W01DDB01.

LOCATION.--Lat 44°00'37", long 94°37'26", in NW¼SE¼SE¼ sec.1, T.106 N., R.32 W., Hydrologic Unit 07020010, north of St. James.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in (0.05 m), depth 22 ft (6.7 m), screened 19 to 22 ft (5.8 to 6.7 m).

DATUM.--Altitude of land-surface datum is 1,056.2 ft (321.9 m) National Geodetic Vertical Datum of 1929.

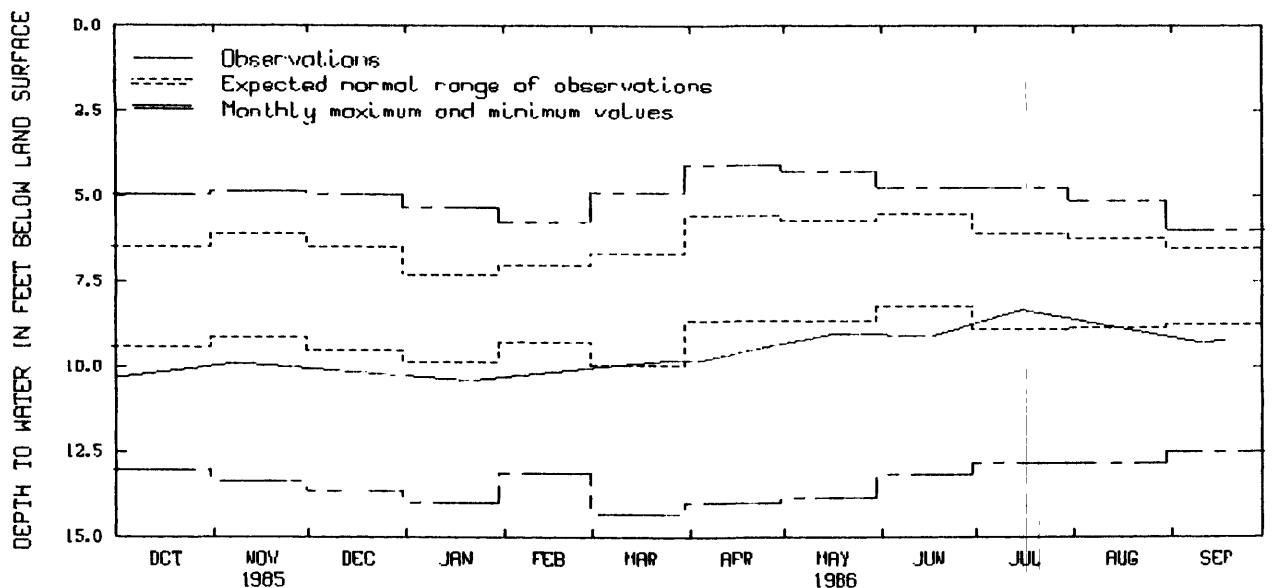
Measuring point: Top of wood platform, 0.80 ft (0.24 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 4.11 ft (1.25 m) below land-surface datum, Apr. 27, 1969; lowest, 14.34 ft (4.37 m) below land-surface datum, Mar. 1, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 8	9.93	JAN 24	10.38	APR 3	9.87	MAY 20	9.06	JUL 16	8.31	SEP 11	9.35
JAN 17	10.39	MAR 27	9.80	MAY 15	9.07	JUN 17	9.13	JUL 17	8.36	SEP 18	9.23



106N32W01DDB01

## GROUND-WATER LEVELS

## WATONWAN COUNTY--Continued

440409094304901. Local number, 107N31W14DAC01.

LOCATION.--Lat 44°04'09", long 94°30'49", in SW¼NE¼SE¼ sec.14, T.107 N., R.31 W., Hydrologic Unit 07020010, 2.75 mi (4.4 km) east of LaSalle.

Owner: William Lassas.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in (0.30 m), depth 150 ft (45.7 m), screened 100 to 135 ft (30.5 to 41.2 m).

DATUM.--Altitude of land-surface datum is 1,008 ft (307 m). Measuring point: Vent pipe, 1.80 ft (0.55 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.44 ft (3.18 m) below land-surface datum, May 9, 1983; lowest, 14.65 ft (4.36 m) below land-surface datum, July 9, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	12.48	MAR 27	10.99	MAY 15	11.07	JUL 17	11.26	SEP 18	11.94

440133094312501. Local number, 107N31W35CAC01.

LOCATION.--Lat 44°01'33", long 94°31'25", in SW¼NE¼SW¼ sec.35, T.107 N., R.31 W., Hydrologic Unit 07020010, northeast of St. James.

Owner: Al Guyer.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 10 in (0.25 m), depth 350 ft (107 m), screened 310 to 350 ft (94.5 to 107 m).

DATUM.--Altitude of land-surface datum is 1,055 ft (322 m). Measuring point: Vent pipe, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.83 ft (9.09 m) below land-surface datum, May 9, 1983; lowest, 33.70 ft (10.27 m) below land-surface datum, Sept. 15, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 21	31.93	MAR 27	31.33	MAY 15	30.55	JUL 17	30.72	SEP 18	31.26

## WINONA COUNTY

435746092034202. Local number, 106N10W19DDA02.

LOCATION.--Lat 43°57'46", long 92°03'42", in NE¼SE¼SE¼ sec. 19, T.106N., R.10W., Hydrologic Unit 07040003, at St. Charles.

Owner: City of St. Charles, Well 5.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 12 in (0.30 m), depth 702 ft (214 m), cased to 645 ft (197 m).

DATUM.--Altitude of land-surface datum is 1,160 ft (354 m); Measuring point: Edge of vent pipe, 1.00 ft (0.30 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--May 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 223.6 ft (68.15 m) below land-surface datum, May 18, 1984; lowest, 266.8 ft (81.32m) below land-surface datum, July 20, 1985.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	263.70	DEC 16	254.00	FEB 18	230.00	APR 15	231.00	JUN 17	225.60	AUG 12	227.39
14	246.30	23	255.40	25	231.20	22	233.40	24	223.60	19	229.20
21	249.10	30	261.50	MAR 4	246.20	29	232.50	JUL 1	222.70	26	228.56
28	256.90	JAN 6	252.80	11	242.00	MAY 6	225.80	8	224.00	SEP 2	226.60
NOV 4	257.20	13	260.90	18	233.50	13	225.40	16	223.80	9	227.30
12	256.10	21	259.40	31	225.40	20	226.10	22	224.42	23	228.30
DEC 1	263.33	28	249.00	APR 1	228.80	27	225.30	29	254.42	30	223.00
9	260.50	FEB 10	250.20	8	227.30	JUN 3	224.40	AUG 5	233.20		

## GROUND-WATER LEVELS

## WRIGHT COUNTY

450318094040603. Local number, 118N27W03CAC03.

LOCATION.--Lat 45°03'18", long 94°04'06", in SW¼NE¼SW¼ sec.3, T.118 N., R.27 W., Hydrologic Unit 07010204, at Howard Lake water tower.

Owner: City of Howard Lake, well 3.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 12 in (0.30 m), depth 148 ft (45.1 m), screened 138 to 148 ft (42.1 to 45.1 m).

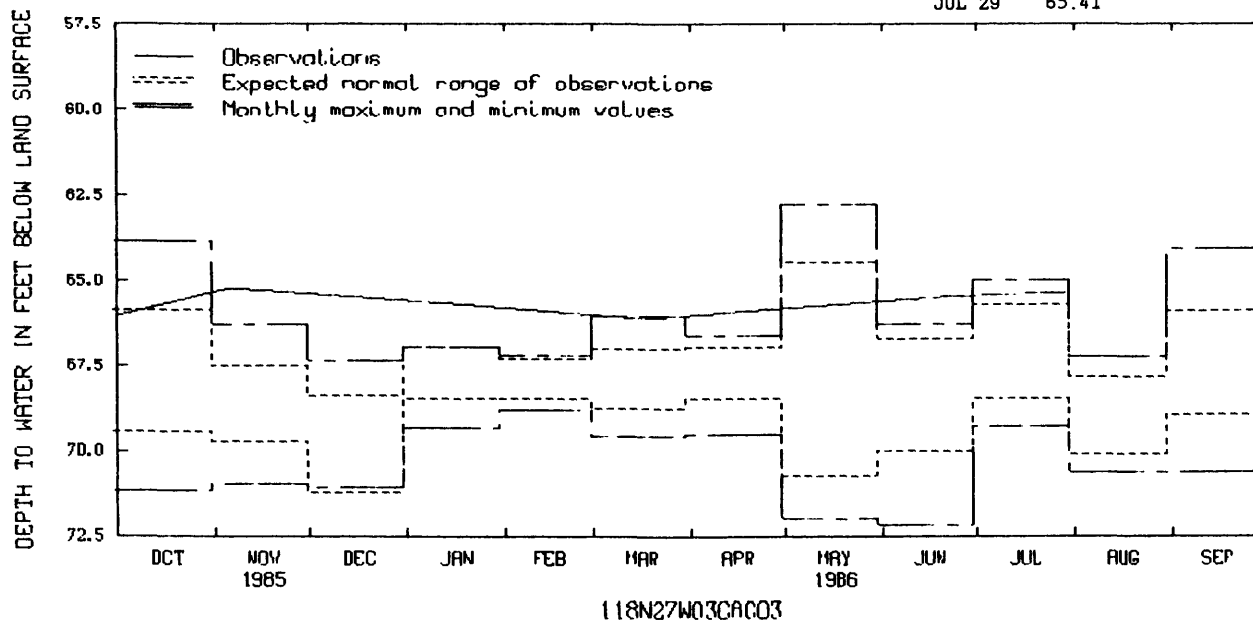
DATUM.--Altitude of land-surface datum is 1,045 ft (319 m). Measuring point: Top of breather pipe, 1.80 ft (0.55 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 62.78 ft (19.14 m) below land-surface datum, May 29, 1979; lowest, 72.19 ft (22.00 m) below land-surface datum, June 24, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	65.26	JAN 23	65.76	MAR 17	66.15	JUN 19	65.54
						JUL 29	65.41



118N27W03CAC03

450403093544501. Local number, 119N26W35DDA01.

LOCATION.--Lat 45°04'03", long 93°54'45", in NE¼SE¼SE¼ sec.35, T.119 N., R.26 W., Hydrologic Unit 07010204, at Montrose.

Owner: City of Montrose, well 1.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age and Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 10 in (0.25 m), depth 693 ft (211 m), cased to 526 ft (160 m).

DATUM.--Altitude of land-surface datum is 1,000 ft (305 m). Measuring point: Edge of breather pipe, 1.50 ft (0.46 m) above land-surface datum.

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

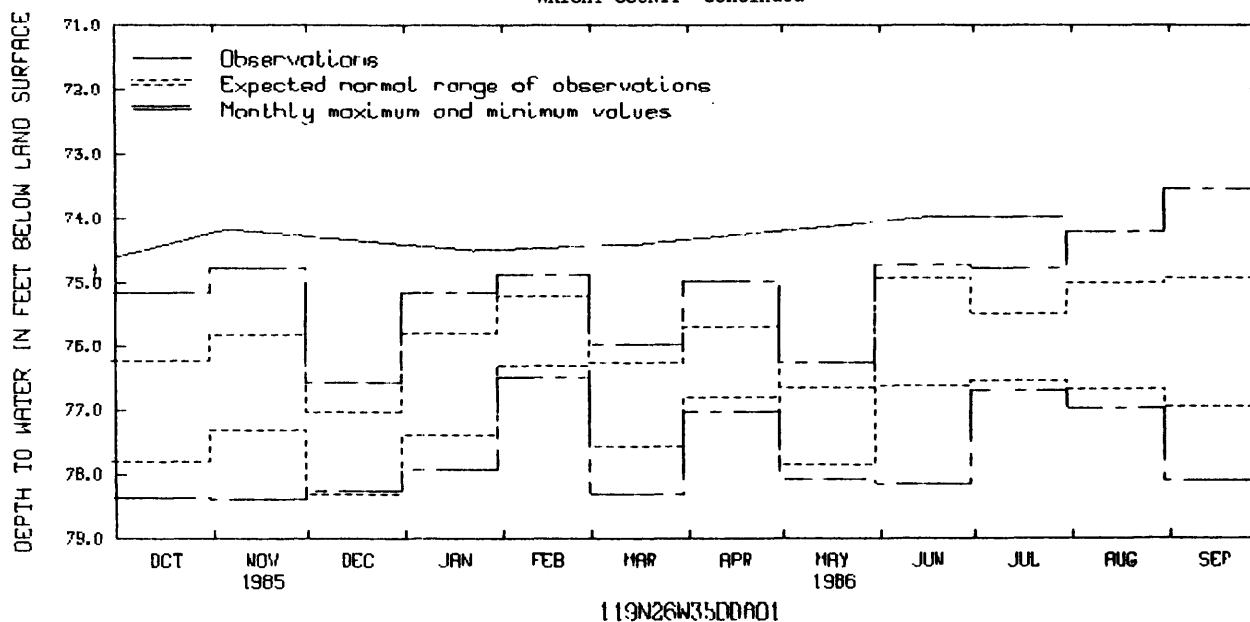
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 73.54 ft (22.41 m) below land-surface datum, Sept. 28, 1981; lowest, 78.38 ft (23.89 m) below land-surface datum, Nov. 3, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 5	74.18	JAN 23	74.52	MAR 17	74.40	JUN 19	73.97	JUL 29	73.97

## GROUND-WATER LEVELS

## WRIGHT COUNTY--Continued



## YELLOW MEDICINE COUNTY

444219096165501. Local number, 114N45W04DCD01.

LOCATION.--Lat 44°42'19", long 96°16'55", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec.4, T.114 N., R.45 W., Hydrologic Unit 07020003, at Canby City Park.

Owner: City of Canby, well 6.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 12 in (0.30 m), depth 62 ft (18.9 m), screened 44 to 68 ft (13.4 to 20.7 m).

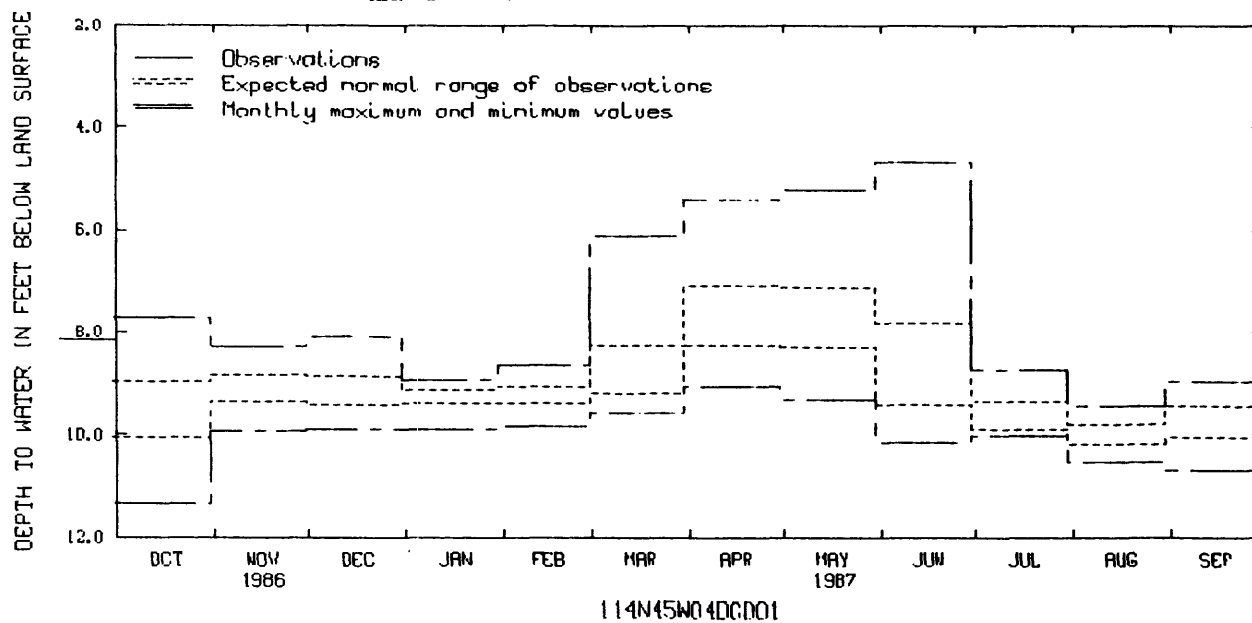
DATUM.--Altitude of land-surface datum is 1,255 ft (382 m). Measuring point: Top of casing, 2.90 ft (0.88 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 4.67 ft (1.42 m) below land-surface datum, June 5, 1965; lowest, 11.32 ft (3.45 m) below land-surface datum, Oct. 7, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
APR 2	6.39	JUN 5	8.25	JUL 31	8.27



QUALITY OF GROUND WATER  
WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

ANOKA COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPECIFIC CONDUCTANCE (US/CM) (00095)
451441093271701	032N25W21DAC01	112OTSH	06-18-86	0900	-0.33	7.0	370
		112OTSH	08-19-86	0830	0.18	7.0	150
451441093271702	032N25W21DAC02 PETERSON D(A2	112OTSH	06-18-86	1200	-0.22	22	360
451442093193201	032N24W22CBC01SLYZUK_S(A1)	112OTSH	06-06-86	1330	11.57	20	390
		112OTSH	07-09-86	0800	12.28	20	370
		112OTSH	08-22-86	1430	13.11	20	430
451442093271604	032N25W21DAC04 PETERSON SIT	112OTSH	08-19-86	0930	2.64	6.0	1700
451534093263401	032N25W15CAC01	112OTSH	06-18-86	1600	8.39	14	230
451534093263402	032N25W15CAC02	112OTSH	06-18-86	1700	8.47	29	700
451535093263406	032N25W15CAC06-FOSSEN, ED DR	112OTSH	08-19-86	1300	9.46	12	195
451637093034601	032N22W10ADC01 THURNBECK, DA	112OTSH	08-20-86	1200	2.24	7.0	465
451651093035001	032N22W10AAC01 THURNBECK, DA	112OTSH	08-20-86	1400	8.00	10	345
452132093045301	033N22W10CCB01BROADBENT_FLD	112OTSH	07-10-86	0800	7.07	13	235
452132093045302	033N22W10CCB02BROADBENT_FLD	112OTSH	07-10-86	1000	7.09	28	370
452153093050201	033N22W09ADB01BROADBENT_S(A	112OTSH	07-09-86	1500	9.45	15	115
452155093050503	033N22W09ADB03 BROADBENT-SI	112OTSH	07-02-86	0800	4.55	--	585
		112OTSH	08-22-86	1100	5.02	--	655
452155093050504	033N22W09ADB04 BROADBENT-SI	112OTSH	07-02-86	0900	4.58	--	650
		112OTSH	08-22-86	1200	5.04	--	805
452156093050405	033N22W09ADB05 BROADBENT-SH	112OTSH	07-02-86	1200	5.51	--	3600
		112OTSH	08-22-86	0900	5.92	--	4200
452156093050406	033N22W09ADB06 BROADBENT SH	112OTSH	07-02-86	1400	5.51	--	1030
		112OTSH	07-09-86	1400	5.58	--	1160
		112OTSH	07-10-86	1300	5.58	--	1140
		112OTSH	08-22-86	1000	5.92	--	1150

STATION NUMBER	SPECIFIC CONDUCTANCE (US/CM) (90095)	PH (STANDARD UNITS) (00400)	PH LAB (STANDARD UNITS) (00403)	TEMPERATURE, AIR (DEG C) (00020)	TEMPERATURE (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	CALCIUM DIS-SOLVED (MG/L) (00915)	MAGNESIUM, DIS-SOLVED (MG/L) (00925)	SODIUM, DIS-SOLVED (MG/L) (00930)
451441093271701	206	8.3	8.5	22.5	11.0	6.3	--	--	--
	--	7.8	--	22.0	16.5	--	--	--	--
451441093271702	381	8.0	7.9	23.0	9.0	9.1	--	--	--
451442093193201	381	8.0	8.1	25.0	11.0	--	--	--	--
	--	7.9	--	20.5	9.0	6.2	--	--	--
	--	8.0	--	20.0	9.0	5.5	--	--	--
451442093271604	1740	6.7	6.8	22.0	19.5	0.3	30	13	290
451534093263401	239	7.7	8.0	29.5	10.0	8.3	--	--	--
451534093263402	662	7.7	7.7	29.5	10.0	1.9	--	--	--
451535093263406	205	6.5	6.7	29.5	14.0	1.3	14	3.9	21
451637093034601	371	6.3	5.9	21.0	14.5	--	30	10	19
451651093035001	333	7.9	7.6	21.0	11.5	--	36	13	12
452132093045301	280	6.5	6.3	22.5	9.0	2.2	--	--	--
452132093045302	393	8.1	8.0	25.0	7.5	2.5	--	--	--
452153093050201	130	6.2	6.3	25.0	9.0	3.3	--	--	--
452155093050503	648	6.2	6.3	18.0	11.0	1.2	--	--	--
	726	6.5	6.4	20.0	12.5	3.6	93	23	8.4
452155093050504	646	7.1	7.2	22.0	10.0	0.8	--	--	--
	782	7.4	7.3	20.0	10.5	3.6	140	15	12
452156093050405	3350	6.9	6.9	29.5	11.0	1.1	--	--	--
	4110	7.2	7.0	20.0	14.0	0.7	110	80	80
452156093050406	1020	6.8	7.0	32.0	9.0	0.8	--	--	--
	--	7.0	--	29.0	9.0	0.7	--	--	--
	--	7.0	--	30.0	9.0	0.7	--	--	--
	1190	7.2	7.0	20.0	10.5	0.6	160	35	16

## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## ANOKA COUNTY--Continued

STATION NUMBER	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LITY, IT-FLD (MG/L AS CACO3) (99430)	ALKA- LITY LAB (MG/L AS CACO3) (90410)	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)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
451441093271701	--	50	--	27	1.6	--	--	--	5.5
	--	58	--	--	--	--	--	--	--
451441093271702	--	150	--	17	9.2	--	--	--	4.5
451442093193201	--	130	--	11	20	--	--	--	5.6
	--	140	--	--	--	--	--	--	--
	--	130	--	--	--	--	--	--	7.6
451442093271604	19	300	243	13	340	0.2	16	<0.01	<0.10
451534093263401	--	110	--	6.4	8.6	--	--	--	1.2
451534093263402	--	250	--	26	40	--	--	--	7.1
451535093263406	0.9	76	78	17	4.4	<0.1	20	<0.01	0.68
451637093034601	3.2	56	--	81	43	0.2	34	<0.01	<0.10
451651093035001	3.3	160	142	18	1.7	<0.1	22	0.02	4.1
452132093045301	--	44	--	27	13	--	--	--	14
452132093045302	--	160	--	16	19	--	--	--	2.0
452153093050201	--	26	--	7.5	17	--	--	--	1.5
452155093050503	--	280	--	20	43	--	--	--	0.14
	23	310	307	21	45	<0.1	14	<0.01	<0.10
452155093050504	--	290	--	24	33	--	--	--	<0.10
	2.3	360	342	22	46	0.1	16	<0.01	<0.10
452156093050405	--	1790	--	33	150	--	--	--	1.4
	770	1890	1850	38	180	0.4	9.0	0.01	0.32
452156093050406	--	480	--	55	51	--	--	--	7.6
	--	570	--	--	--	--	--	--	--
	--	500	--	--	--	--	--	--	--
	60	560	547	28	56	<0.1	15	0.12	8.2

STATION NUMBER	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L) (38260)	N-15/ N-14 STABLE ISOTOPE RATIO PER MIL (82084)
451441093271701	0.07	--	--	--	--	--	--	3.9
	--	--	--	--	--	--	--	7.2
451441093271702	<0.01	--	--	--	--	--	--	4.8
451442093193201	<0.01	--	--	--	--	--	--	2.0
	--	--	--	--	--	--	--	2.1
	0.01	--	--	--	--	--	--	--
451442093271604	10	14	0.13	410	1100	730	--	--
451534093263401	<0.01	--	--	--	--	--	--	3.2
451534093263402	0.04	--	--	--	--	--	--	11.7
451535093263406	0.07	0.2	0.02	20	53	41	--	--
451637093034601	0.51	0.7	3.00	<10	37000	550	--	--
451651093035001	0.04	0.5	0.03	40	81	32	--	--
452132093045301	0.21	--	--	--	--	--	--	0.9
452132093045302	0.02	--	--	--	--	--	--	-2.2
452153093050201	0.03	--	--	--	--	--	--	3.2
452155093050503	3.0	3.8	--	--	--	--	--	--
	3.0	3.0	0.01	50	2000	12000	--	--
452155093050504	0.06	0.5	--	--	--	--	--	--
	0.05	0.3	<0.01	20	670	720	--	--
452156093050405	120	150	--	--	--	--	0.31	11.5
	0.09	6.4	0.02	50	12000	12000	--	--
452156093050406	0.08	0.9	--	--	--	--	0.11	30.9
	--	--	--	--	--	--	--	32.5
	--	--	--	--	--	--	--	33.2
	0.09	0.9	<0.01	50	130	1500	--	--

## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## CHISAGO COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)
452837092525901	035N20W31DAB01WHEELER S(C1)	112OTSH	07-26-86	0900	6.30	13	185	172
453302092493401	035N20W03BDD01BOUDREAU S(C4)	112OTSH	07-26-86	1400	8.70	15	65	72
453302092493402	035N20W03BDD02BOUDREAU D(C5)	112OTSH	07-26-86	1500	8.80	29	165	155

STATION NUMBER	PH (STANDARD UNITS) (00400)	PH LAB (STANDARD UNITS) (00403)	TEMPER-ATURE, AIR (DEG C) (00020)	TEMPER-ATURE (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	ALKA-LINITY, IT-FLD (MG/L AS CACO3) (99430)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)
452837092525901	6.1	7.0	24.0	11.5	2.7	28	9.5	5.1	8.50	<0.01
453302092493401	6.0	6.3	26.0	11.0	8.5	14	9.0	1.3	2.90	<0.01
453302092493402	8.3	7.7	26.0	8.5	10.1	50	5.5	10	2.70	<0.01

## ISANTI COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STANDARD UNITS) (00400)
452545093211901	034N24W17DCC01JENSEN S(I1)	112OTSH	07-01-86	0830	6.11	12	430	418	6.9
		112OTSH	08-21-86	1100	7.14	12	370	--	6.5
452545093211902	034N24W17DCC02JENSEN D(I2)	112OTSH	07-01-86	1130	6.19	18	820	805	8.5
453242093143501	035N23W05CCC01GOLDENWOOD S(I)	112OTSH	08-21-86	1600	13.40	17	935	908	7.6
453242093143502	035N23W05CCC02GOLDENWOOD D(I)	112OTSH	08-21-86	1700	13.40	22	960	970	7.7
453626093270101	036N25W15CBB01HAUBENSCHILD S(I4)	112OTSH	08-21-86	1300	--	42	65	707	7.9
453631093263701	036N25W15CAB01MORAN S(I4)	112OTSH	08-21-86	1400	14.07	21	230	234	7.2
453631093263702	036N25W15CAB02MORAN D(I5)	112OTSH	08-21-86	1422	14.22	36	435	418	7.7

STATION NUMBER	PH LAB (STANDARD UNITS) (00403)	TEMPER-ATURE, AIR (DEG C) (00020)	TEMPER-ATURE (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	ALKA-LINITY, IT-FLD (MG/L AS CACO3) (99430)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	N-15/ N-14 STABLE ISOTOPE RATIO PER MIL (82084)
452545093211901	6.5	20.0	11.0	6.4	24	18	7.6	43.0	0.07	3.2
	--	25.0	14.0	5.0	48	--	--	--	--	3.0
452545093211902	7.5	25.0	9.0	5.6	150	28	70	45.0	0.12	5.4
453242093143501	7.5	24.0	10.0	5.5	250	17	110	12.0	0.03	7.8
453242093143502	7.5	24.0	9.0	5.6	240	18	140	12.0	0.03	7.9
453626093270101	7.7	27.0	15.5	--	210	5.8	26	35.0	0.03	--
453631093263701	7.2	27.0	9.0	8.7	62	10	9.5	9.00	0.02	--
453631093263702	7.5	27.0	8.0	1.2	220	10	2.1	0.55	0.20	--

QUALITY OF GROUND WATER  
WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

KANDIYOHI COUNTY

STATION NUMBER	LOCAL IDENT- I- FIER	GEO- LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)
452104094591902	122N34W29BCB2OLETJBRUENS(I)	112OTSH	07-30-86	1700	1.80	9.0	545	524

STATION NUMBER	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	ALKA- LITY, IT-FLD (MG/L AS CACO3) (99430)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)
452104094591902	7.6	7.6	27.0	15.0	300	3.1	1.2	0.48	<0.01

POPE COUNTY

STATION NUMBER	LOCAL IDENT- I- FIER	GEO- LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)
452742095144801	123N36W18CDBA ROBERT LALOR	112BRDO	05-30-86	1300	--	--	670
452938095081502	123N36W01ACA02 CLINT WELTE	112OTSH	07-30-86	1400	4.20	16	840
453147095080301	124N36W24DDB ERLING BAALSON	112BRDO	05-29-86	1515	--	--	548
453332095180101	124N37W10DDBC HAROLD STROMM	112BRDO	05-30-86	1200	--	--	580
453333095122701	124N36W16BABA LOREN BUCHHOL	112BRDO	05-29-86	1630	--	--	560
453458095213001	124N37W06AADD JAMES OLSON C	112BRDO	05-30-86	1100	--	--	640
453603095181801	125N37W27DDDD CHARLES LARSO	112BRDO	05-30-86	1015	--	--	480
454036095143001	126N36W32CBC HARLAN RAJ	112BRDO	05-29-86	1730	--	--	660
454254095160501	126N37W24ABAA VILLARD AG. S	112BRDO	05-30-86	0920	--	--	790
454319095183501	126N37W15DBAD WAYNE GANSKE	112BRDO	05-30-86	0830	--	--	740

STATION NUMBER	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	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)
452742095144801	656	7.4	7.4	--	9.5	--	80	34	5.6
452938095081502	807	7.5	7.7	26.5	10.0	5.3	--	--	--
453147095080301	551	7.5	7.7	--	9.5	--	62	22	21
453332095180101	578	7.6	7.7	--	9.5	--	68	22	20
453333095122701	559	7.5	7.6	--	8.5	--	56	24	26
453458095213001	638	7.4	7.5	--	8.5	--	58	28	35
453603095181801	493	7.6	7.7	--	8.5	--	61	18	13
454036095143001	642	7.4	7.5	--	9.0	--	83	29	8.8
454254095160501	781	7.4	7.5	--	9.0	--	88	35	22
454319095183501	738	7.3	7.3	--	9.0	--	98	32	7.4

## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## POPE COUNTY--Continued

STATION	NUMBER	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINEITY, IT-FLD (MG/L AS CACO3) (99430)	ALKA- LINEITY LAB (MG/L AS CACO3) (90410)	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)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)
452742095144801		3.8	364	367	1.7	1.8	0.2	32	374
452938095081502		--	180	--	49	43	--	--	--
453147095080301		2.2	296	306	1.9	0.8	0.4	23	310
453332095180101		3.6	316	314	2.6	1.3	0.3	25	330
453333095122701		2.3	300	309	1.7	1.1	0.3	26	331
453458095213001		1.8	348	345	3.5	1.1	0.4	24	353
453603095181801		3.7	254	253	15	0.7	0.2	28	289
454036095143001		2.2	360	352	2.3	0.7	0.3	24	366
454254095160501		2.5	432	431	5.7	0.9	0.3	24	442
454319095183501		2.6	420	406	1.5	0.9	0.2	25	408

STATION	NUMBER	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- SOLVED (MG/L AS N) (00623)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	CARBON, ORGANIC TOTAL (MG/L AS C) (00680)
452742095144801		<0.10	1.2	1.4	0.13	40	3800	100	3.7
452938095081502		44	<0.01	--	--	--	--	--	--
453147095080301		<0.10	0.79	0.8	0.01	110	1800	100	2.6
453332095180101		<0.10	0.76	0.9	0.12	130	1200	88	2.1
453333095122701		<0.10	1.2	1.2	0.11	170	820	42	2.6
453458095213001		0.31	1.9	1.9	0.10	160	680	75	4.0
453603095181801		<0.10	<0.20	<0.2	0.02	110	300	480	0.7
454036095143001		<0.10	0.50	0.5	0.08	60	1600	200	--
454254095160501		<0.10	2.00	2.0	0.02	130	5000	80	2.5
454319095183501		<0.10	0.80	0.8	0.01	50	7700	180	8.7

## RAMSEY COUNTY

STATION	NUMBER	LOCAL IDENT- I- FIER	GEO- LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	PUMP OR FLOW PERIOD PRIOR TO SAM- PLING (MIN) (72004)	FLOW RATE, INSTAN- TANEOUS (GPM) (00059)
450401093114601	30N23W20DCBD-1	409548	367PRDC	08-13-86	1515	36.00	275	42	13
450417093125801	30N23W19DBBA	409549	367PRDC	08-13-86	1722	89.00	307	42	11
450426093113502	30N23W20ADBC-1	NW1U3	112SPRO	08-12-86	1030	39.00	113	33	10
450444093105102	30N23W21BABA-2	PD3L3	112SPRO	08-14-86	0905	50.00	143	27	10
450447093104101	30N23W16CDD-1	T2U4	367PRDC	08-14-86	1100	--	181	31	13
450503093105003	30N23W16CAAC-3	3LS002	112SPRO	08-13-86	1210	66.00	236	47	12
450505093110302	30N23W16CBAD-2	T6U3	112SPRO	08-14-86	1710	60.00	124	25	12
450505093110304	30N23W16CBAD-4	T6L3	112SPRO	08-14-86	1545	60.00	242	38	12
450505093110401	30N23W16CBAD-1	T6U4	367PRDC	08-14-86	1400	--	286	54	12
450508093094601	30N23W15CBAA	3LS081	112SPRO	08-12-86	1715	87.00	403	64	12
450526093095101	30N23W15BBDC-1	3US113	112SPRO	08-13-86	0930	114.00	159	25	11
450629093092002	30N23W10ABBA-2	3MS010	112SPRO	08-12-86	1435	22.00	94	28	15

## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## RAMSEY COUNTY--Continued

STATION NUMBER	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 (DEG C) (00010)	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)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)
450401093114601	508	505	7.2	7.9	10.5	67	26	6.0	2.4	320
450417093125801	448	457	6.9	7.8	10.5	61	23	6.6	2.1	290
450426093113502	492	484	7.7	7.8	10.5	60	23	11	2.4	300
450444093105102	686	691	7.1	7.8	10.5	92	38	6.7	2.1	420
450447093104101	435	435	7.3	7.9	10.5	57	22	7.1	2.1	290
450503093105003	593	583	7.2	7.8	10.5	81	26	6.5	2.3	340
450505093110302	612	615	7.5	7.8	11.0	87	31	5.1	1.8	390
450505093110304	642	633	7.4	7.8	11.0	84	32	5.8	3.0	370
450505093110401	528	408	7.3	8.1	11.0	70	25	6.8	2.5	330
450508093094601	462	462	7.5	7.8	10.5	60	24	6.6	2.2	320
450526093095101	447	461	7.1	7.7	10.0	66	21	4.4	2.0	290
450629093092002	378	346	8.6	8.3	9.5	44	22	8.8	3.0	290

STATION NUMBER	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)	ALKA- LINEITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA- LINEITY LAB (MG/L AS CAC03) (90410)	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)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)
450401093114601	0	260	264	19	5.5	0.2	24	<0.01	<0.10	0.07
450417093125801	0	240	243	11	3.4	0.2	20	<0.01	0.12	0.03
450426093113502	0	240	244	17	8.0	0.5	17	0.01	0.42	0.01
450444093105102	0	340	330	22	22	0.2	24	<0.01	<0.10	0.01
450447093104101	0	240	237	3.9	1.4	0.2	20	<0.01	<0.10	0.02
450503093105003	0	280	283	8.1	27	0.2	23	<0.01	<0.10	0.14
450505093110302	0	320	311	21	10	0.2	23	<0.01	<0.10	0.02
450505093110304	0	300	250	17	27	0.2	24	<0.01	<0.10	0.02
450505093110401	0	270	251	6.9	13	0.2	23	<0.01	<0.10	0.02
450508093094601	0	270	259	1.6	1.6	0.2	19	<0.01	<0.10	0.04
450526093095101	0	240	232	16	2.3	0.2	24	<0.01	1.6	0.01
450629093092002	12	250	187	7.4	1.0	0.2	21	<0.01	<0.10	0.02

STATION NUMBER	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	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)	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)
450401093114601	10	5	130	<0.5	40	<1	<3	<10	220	<10
450417093125801	10	<1	27	<0.5	40	<1	<3	<10	69	<10
450426093113502	--	<1	52	<0.5	100	1	<3	<10	650	<10
450444093105102	10	2	93	<0.5	390	<1	<3	<10	430	<10
450447093104101	10	<1	92	<0.5	30	<1	<3	<10	200	<10
450503093105003	10	<1	130	<0.5	30	<1	<3	<10	36	<10
450505093110302	30	1	51	<0.5	30	<1	<3	<10	530	<10
450505093110304	30	<1	98	<0.5	120	<1	<3	<10	620	<10
450505093110401	<10	<1	150	<0.5	70	<1	<3	<10	160	<10
450508093094601	20	1	84	<0.5	30	<1	<3	<10	10	<10
450526093095101	<10	<1	38	<0.5	30	<1	<3	<10	5	<10
450629093092002	10	<1	93	<0.5	50	<1	<3	<10	4	<10



## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## SHERBURNE COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEOLOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPECIFIC CONDUCTANCE (US/CM) (00095)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)	PH (STANDARD) (00400)
451825093422101	033N27W33ACC01ZIMMERMAN S(S	1120TSH	06-19-86	1600	5.61	11	450	485	6.9
451957093412701	033N27W22CBD01HUDSON S(SH1)	1120TSH	07-16-86	1000	11.62	20	580	615	7.3
451957093412702	033N27W22CBD02HUDSON D(SH2)	1120TSH	07-16-86	1100	--	35	905	--	8.0
452030093511401	033N28W20BAC01NSP S(SH5)	1120TSH	07-16-86	1400	16.57	23	565	561	7.6
		1120TSH	07-29-86	1200	16.80	23	570	--	7.8
452030093511402	033N28W20BAC02NSP D(SH6)	1120TSH	07-16-86	1600	16.58	35	645	628	7.5
452302093573603	033N29W04BBD03GOENNERED HT(	1120TSH	07-17-86	1800	--	35	660	665	7.3
452309093573701	033N29W04BBA01GOENNERE S(SH	1120TSH	07-17-86	1600	13.45	20	550	564	7.3
452309093573702	033N29W04BBA02GOENNERE D(SH	1120TSH	07-17-86	1700	13.49	35	630	606	7.7
452545093571004	034N29W21ABB04GOENNERM S(SH	1120TSH	07-17-86	1200	17.43	23	560	575	7.4
452720093552201	034N29W10AAD01BERGER S(SH10	1120TSH	07-17-86	0800	10.40	14	710	710	7.4
452720093552202	034N29W10AAD02BERGER D(SH11	1120TSH	07-17-86	0900	10.45	25	660	665	7.6

STATION NUMBER	PH LAB (STANDARD) (00403)	TEMPERATURE, AIR (DEG C) (00020)	TEMPERATURE (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	ALKALINITY, IT-FLD (MG/L AS CACO3) (99430)	SULFATE, DIS-SOLVED (MG/L AS SO4) (00945)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	N-15/N-14 STABLE ISOTOPE RATIO PER MIL (82084)
451825093422101	7.0	34.0	9.5	1.5	110	25	23	20	0.08	2.5
451957093412701	7.7	28.0	9.0	7.4	240	17	30	12	0.04	4.3
451957093412702	--	--	9.0	--	180	--	--	--	--	--
452030093511401	7.7	32.0	9.5	5.6	170	42	24	15	0.06	4.3
	--	30.5	9.5	1.9	170	--	--	--	--	4.4
452030093511402	7.8	34.0	9.5	8.4	160	53	37	19	0.18	5.0
452302093573603	7.7	31.0	9.0	--	240	25	17	22	0.06	6.6
452309093573701	7.6	34.0	9.5	0.8	170	66	22	10	0.04	8.4
452309093573702	7.6	34.0	8.0	0.7	160	98	21	0.50	0.06	9.7
452545093571004	7.5	32.0	8.0	4.0	300	15	10	0.99	0.05	4.4
452720093552201	7.6	30.0	9.0	6.5	230	34	30	24	0.07	3.9
452720093552202	7.7	30.0	8.0	1.1	230	55	26	14	0.07	8.8

## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## STEARNS COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	SPECIFIC CONDUCTANCE (US/CM) (00095)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)
452610095042601	123N35W28ADB HENRY QUISBERG	112BRDO	05-29-86	1345	--	--	840	770
452709095001101	123N34W19BBD BELGRADE NO.	112BRDO	05-14-86	1145	--	200	540	542
452751094300103	123N30W18BCD03 DRONTILE-CORN		07-31-86	1400	3.14	--	675	655
452751094300104	123N30W18BCD04 DRONTILE-CORN		07-31-86	1500	3.16	--	1000	962
452751094301803	123N30W18BCC03 DRONTILE-OBS		07-31-86	1800	5.52	--	650	613
452751094301804	123N30W18BCC04 DRONTILE-OBS		07-31-86	1900	5.56	--	820	769
452752094300401	123N30W18BCD01 DRONTILE-OAK		07-31-86	1100	5.87	--	1420	1380
452752094300402	123N30W18BCD02 DRONTILE-OAK		07-31-86	1200	7.74	--	1200	1120
452843094230502	123N30W12ADD02 LEANDER HANS	112OTSH	08-01-86	1430	5.88	15	565	503
452939094580601	123N34W05ADAC VERN BRAEGEL	112BRDO	05-14-86	1040	--	142	840	812
453146094091101	124N28W25BBA01TEIGEN S(S35)	112OTSH	08-01-86	1100	10.74	17	890	824
453146094091102	124N28W25BBA02TEIGEN D(S36)	112OTSH	08-01-86	1200	10.71	22	870	824
453333095330201	124N35W12DCBC01 RUSSELL ELL	112BRDO	05-14-86	1445	--	146	740	749
453333095330202	124N35W12DCBC02 RUSSELL EL	112BRDO	05-14-86	1500	--	40	985	941
453410094192401	WELL 5A NEAR WWTP AT ST. JO		04-17-86	1145	--	--	--	--
			06-13-86	1019	--	--	--	--
			08-21-86	1240	--	--	--	--
453410094192402	WELL 5B NEAR WWTP AT ST. JO		04-17-86	1020	--	--	--	--
			06-13-86	1019	--	--	--	--
			08-21-86	1245	--	--	--	--
453410094192403	WELL 5C NEAR WWTP AT ST. JO		04-17-86	1015	--	--	--	--
			06-13-86	1010	--	--	--	--
			08-21-86	1250	--	--	--	--
453418094193601	WELL 14A NEAR WWTP AT ST. J		04-17-86	1033	--	--	--	--
			06-13-86	1045	--	--	--	--
			08-21-86	1300	--	--	--	--
453440094135801	124N28W05CAC01STMICHAELS S(	112OTSH	07-29-86	1500	15.95	22	505	458
453440094135802	124N28W05CAC02STMICHAELS D(	112OTSH	07-29-86	1600	15.96	37	785	744
454320094131401	126N28W16CBC01STEARNSCOPK D	112OTSH	08-01-86	1730	4.65	42	380	405
454320094131402	126N28W16CBC02STEARNSCOPK S	112OTSH	08-01-86	1630	4.74	8.0	290	257
454428095051701	126N35W09BAD01 GERALD BEUNI	112OTSH	07-30-86	1000	4.95	26	640	542
454428095051702	126N35W09BAD02 GERALD BEUNI	112OTSH	07-30-86	0900	5.00	10	770	706

QUALITY OF GROUND WATER  
WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

STEARNS COUNTY--Continued

STATION	NUMBER	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	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- LITY, IT-FLD (MG/L AS CAO3) (99430)
452610095042601		6.9	7.0	--	9.0	--	100	35	5.9	3.1	428
452709095001101		7.4	7.6	--	9.5	--	69	20	17	2.1	299
452751094300103		6.9	7.5	22.5	19.0	0.5	70	17	9.5	46	240
452751094300104		7.1	7.7	22.5	14.0	0.4	130	40	13	4.1	360
452751094301803		7.2	7.6	22.0	11.5	1.6	90	21	4.2	1.1	250
452751094301804		7.2	7.6	22.0	8.5	0.6	100	34	7.7	2.6	340
452752094300401		6.8	7.2	25.0	13.5	0.5	120	35	18	150	600
452752094300402		6.9	7.5	25.0	11.0	0.6	150	47	16	14	430
452843094230502		8.2	7.7	28.0	11.0	0.6	--	--	--	--	240
452939094580601		7.2	7.4	--	9.0	--	100	36	20	2.9	437
453146094091101		8.0	7.6	20.5	9.0	2.7	--	--	--	--	280
453146094091102		8.1	7.6	20.5	9.0	2.4	--	--	--	--	300
453333095330201		7.3	7.5	--	8.5	--	99	34	13	2.9	421
453333095330202		7.1	7.2	--	7.0	--	130	41	16	2.6	393
453410094192401		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
453410094192402		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
453410094192403		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
453418094193601		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
		--	--	--	--	--	--	--	--	--	--
453440094135801		7.6	7.8	30.0	10.5	9.3	--	--	--	--	140
453440094135802		7.5	7.6	30.0	9.5	7.2	--	--	--	--	280
454320094131401		7.6	7.9	22.0	9.0	4.2	--	--	--	--	110
454320094131402		7.5	7.6	22.0	12.0	0.7	--	--	--	--	140
454428095051701		7.5	8.0	25.0	8.0	0.7	--	--	--	--	300
454428095051702		7.6	7.7	24.0	12.5	5.2	--	--	--	--	210

QUALITY OF GROUND WATER  
WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

STEARNS COUNTY--Continued

STATION NUMBER	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	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)	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 DIS- SOLVED (MG/L AS N) (00608)
452610095042601	428	9.1	1.9	0.1	32	469	--	<0.10	1.10
452709095001101	296	0.8	1.1	0.3	27	309	--	<0.10	0.47
452751094300103	234	35	25	0.1	27	--	<0.01	9.2	<0.01
452751094300104	342	48	36	0.2	20	--	0.37	30	0.08
452751094301803	245	12	9.0	0.1	20	--	0.01	17	0.03
452751094301804	330	32	12	0.2	18	--	0.07	15	0.03
452752094300401	582	38	55	0.1	26	--	0.03	8.0	2.90
452752094300402	433	47	43	0.1	20	--	0.05	29	1.20
452843094230502	--	13	10	--	--	--	--	7.5	0.03
452939094580601	432	22	2.1	0.2	26	473	--	<0.10	1.40
453146094091101	--	44	85	--	--	--	--	4.8	<0.01
453146094091102	--	49	83	--	--	--	--	3.5	<0.01
453333095330201	324	6.2	0.9	0.2	24	425	--	<0.10	1.00
453333095330202	402	65	21	0.2	26	590	--	11	0.03
453410094192401	--	--	--	--	--	--	--	--	--
453410094192402	--	--	--	--	--	--	--	--	--
453410094192403	--	--	--	--	--	--	--	--	--
453418094193601	--	--	--	--	--	--	--	--	--
453440094135801	--	--	--	--	--	--	--	--	--
453440094135802	--	8.1	2.5	--	--	--	--	1.6	<0.01
454320094131401	--	24	53	--	--	--	--	8.4	<0.01
454320094131402	--	14	4.8	--	--	--	--	1.4	<0.01
454320094131402	--	3.6	0.7	--	--	--	--	0.14	<0.01
454428095051701	--	53	10	--	--	--	--	<0.10	<0.01
454428095051702	--	42	32	--	--	--	--	33	<0.01

[illegible]

## CHEMICAL QUALITY OF PRECIPITATION

461458094295000 PRECIPITATION STATION AT CAMP RIPLEY, MN

## WATER-QUALITY RECORDS

LOCATION.--Lat 46°14'58", long 94°29'50", in NE¼ sec.18, T.132 N., R.30 W., Morrison County, Hydrologic Unit 07010104, approximately 500 ft southwest of the abandoned Gilgal Church and approximately 5 miles south of the town of Pillager.

PERIOD OF RECORD.--October 1983 to September 1986 (weekly composite).

INSTRUMENTATION.--Samples are collected in a polyethylene bucket by an electrically operated wet/dry collector. A recording rain gage and a standard U.S. Weather Service bulk rain gage measure rainfall quantity.

REMARKS.--An observer collects only the wetfall bucket and services the rain gages every Tuesday around 0900 hours. The observer weighs the bucket and if there is enough wetfall, determines specific conductance and pH. The bucket with its remaining contents is then sent to the Illinois State Water Survey Laboratory for analysis. Asterisk indicates a bulk sample.

## CHEMICAL ANALYSIS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## WEEKLY COMPOSITE

DATE	TIME	PRECIP- ITATION (INCHES) (46529)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	CIF- CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
OCT								
01-08	0900	0.7	21	16	4.5	4.8	0.39	0.05
08-15	0900	0.4	12	8	4.8	5.1	0.06	0.03
15-22	0900	0.08	57	55	4.0	4.0	0.15	0.04
NOV								
05-12	0800	0.14	7	6	5.3	6.2	0.23	0.05
12-19	0800	1.1	23	19	4.5	4.5	0.06	0.02
NOV 26-								
*DEC 03	1000	0.77	8	6	5.0	5.0	0.09	0.02
DEC								
* 03-10	0830	0.05	39	39	4.1	4.2	--	--
* 10-17	0830	0.03	--	17	--	4.8	0.53	0.11
* 17-24	0830	0.04	--	19	--	5.1	0.34	0.1
* 24-31	0930	0.06	--	25	--	6.7	1.6	0.34
JAN								
14-21	0900	0.21	6	6	5.1	5.2	0.05	0.01
21-28	0900	0.27	13	11	5.4	6.1	0.33	0.03
JAN 28-								
FEB 04	0900	0.24	12	10	4.7	4.8	0.18	0.02
FEB								
11-18	1100	0.04	9	8	--	6.1	0.54	0.04
18-25	0800	0.5	4	4	5.0	5.3	0.04	0.01
FEB 25-								
MAR 04	0900	0.12	14	10	4.7	5.4	0.09	0.04
MAR								
04-11	1100	0.4	8	7	5.0	5.3	0.2	0.03
11-18	0830	0.64	14	12	4.6	4.7	0.1	0.02
18-25	0700	0.17	17	14	4.7	4.9	0.05	0.02
APR								
01-08	0900	0.84	--	14	4.2	4.7	0.12	0.02
08-15	0900	0.8	18	15	4.6	4.7	0.16	0.03
15-22	0830	0.9	17	15	4.5	4.8	0.22	0.03
22-29	0900	2.2	9	10	5.5	6.6	0.41	0.06
APR 29-								
MAY 06	0830	0.15	9	10	5.2	5.9	0.27	0.04
MAY								
06-13	0830	2.4	10	10	4.6	5.1	0.22	0.03
13-20	0830	0.15	17	18	5.4	6.7	0.51	0.12
20-27	1000	0.27	18	16	4.6	4.8	0.29	0.08
JUN								
03-10	0930	2.3	10	10	4.9	5.0	0.13	0.05
10-17	1300	0.67	8	8	4.7	5.0	0.08	0.02
17-24	0900	1.3	9	10	5.3	5.7	0.27	0.04
JUN 24-								
JUL 01	1030	0.09	10	4	4.6	5.8	0.08	0.03
JUL								
01-08	0900	1.6	5	6	6.1	6.1	0.2	0.04
08-15	1000	1.8	5	5	5.1	5.3	0.05	0.01
15-22	1130	0.98	4	5	5.6	6.3	0.18	0.05
22-29	0830	2.0	4	4	5.3	5.6	0.08	0.02
JUL 29-								
AUG 05	0915	0.3	11	11	5.7	6.7	0.71	0.2
AUG								
05-12	0900	2.5	4	5	5.6	6.2	0.11	0.03
12-19	0700	0.53	7	7	5.0	5.0	0.03	0.01
19-26	0800	1.7	6	6	4.9	5.0	0.05	0.01
AUG 26-								
SEP 02	0900	0.85	9	8	5.3	6.1	0.26	0.06
SEP								
02-09	0900	0.88	27	27	4.4	4.4	0.29	0.05
09-16	0900	1.6	12	11	4.9	4.8	0.1	0.02
16-23	0830	3.1	8	8	5.0	5.0	0.05	0.01
23-30	0800	0.35	8	8	5.4	5.2	0.21	0.03

## CHEMICAL QUALITY OF PRECIPITATION

461458094295000 PRECIPITATION STATION AT CAMP RIPLEY, MN--Continued

## CHEMICAL ANALYSIS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

## WEEKLY COMPOSITE

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)
OCT							
01-08	0.02	0.05	1.9	0.07	0.44	0.27	<0.001
08-15	0.02	0.01	0.9	<0.03	0.20	0.12	<0.001
15-22	0.1	0.07	<0.1	0.15	0.02	0.09	<0.001
NOV							
05-12	0.03	0.03	0.5	0.07	0.17	0.16	<0.001
12-19	0.03	0.01	1.6	0.09	0.40	0.42	0.004
NOV 26- *DEC 03	0.04	0.04	0.3	0.09	0.16	<0.02	0.003
DEC							
* 03-10	--	--	--	--	--	--	--
* 10-17	0.21	0.04	1.2	0.3	0.67	<0.02	<0.001
* 17-24	0.28	0.15	2.2	0.4	0.86	0.87	<0.001
* 24-31	0.33	0.21	3.3	0.61	0.97	0.81	0.003
JAN							
14-21	0.02	0.01	0.6	0.05	0.09	0.07	<0.003
21-28	0.03	0.02	1.1	0.08	0.53	0.76	<0.003
JAN 28- FEB 04	0.02	0.01	0.6	0.07	0.32	0.10	<0.003
FEB							
11-18	0.1	0.05	0.3	0.18	0.29	0.12	<0.003
18-25	0.01	0.0	0.3	<0.03	0.04	0.02	<0.003
FEB 25- MAR 04	0.08	0.05	1.7	0.13	0.25	0.47	<0.003
MAR							
04-11	0.03	0.01	0.6	0.06	0.28	0.19	<0.003
11-18	0.02	0.01	1.2	0.04	0.22	0.21	<0.003
18-25	0.03	0.02	2.1	0.06	0.22	0.36	<0.003
APR							
01-08	0.03	0.01	1.5	0.06	0.30	0.32	<0.003
08-15	0.02	0.03	2.0	0.07	0.30	0.36	<0.003
15-22	0.03	0.03	2.1	0.06	0.33	0.50	<0.003
22-29	0.04	0.03	1.2	0.06	0.26	0.71	<0.003
APR 29- MAY 06	0.05	0.02	1.3	0.08	0.41	0.61	<0.003
MAY							
06-13	0.09	0.04	1.3	0.14	0.28	0.08	<0.003
13-20	0.06	0.06	1.7	0.12	0.61	0.66	0.003
20-27	0.02	0.04	2.0	0.05	0.40	0.44	<0.003
JUN							
03-10	0.07	0.01	1.1	0.07	0.20	<0.02	<0.003
10-17	0.01	0.01	1	<0.03	0.13	0.19	<0.003
17-24	0.06	0.04	1.0	0.12	0.40	0.59	<0.003
JUN 24- JUL 01	0.09	0.05	0.4	0.15	0.11	0.14	<0.003
JUL							
01-08	0.04	0.04	0.6	0.09	0.18	0.10	<0.003
08-15	0.02	0.01	0.5	<0.03	<0.01	<0.02	<0.003
15-22	0.01	0.02	0.4	<0.03	0.16	0.07	<0.003
22-29	0.02	0.01	0.5	<0.03	0.14	<0.02	<0.003
JUL 29- AUG 05	0.04	0.06	1.1	0.11	0.26	0.22	<0.003
AUG							
05-12	0.02	0.01	0.5	<0.03	0.12	0.14	<0.003
12-19	0.01	0.01	0.5	<0.03	0.15	<0.02	<0.003
19-26	0.03	0.01	0.8	<0.03	0.08	0.11	<0.003
AUG 26- SEP 02	0.05	0.05	1.2	0.04	0.22	0.46	<0.003
SEP							
02-09	0.02	0.02	3.7	0.05	0.30	0.42	<0.003
09-16	0.04	0.01	1.2	0.05	0.21	0.22	<0.003
16-23	0.02	0.01	0.9	<0.03	0.15	0.12	<0.003
23-30	0.1	0.02	1	0.09	0.21	0.17	<0.003



GORGE AND FALLS OF PIGEON RIVER.

Engraving from original field sketch by W. Roberts  
on wood by C.E. Dupler  
From *Report of a Geological Survey of  
Wisconsin, Iowa, and Minnesota*  
published October, 1851.

# INDEX

Page	Page
Access to WATSTORE data.....	19-20
Accuracy of the records.....	15-16
Acre-foot, definition of.....	20
Adenosine triphosphate, definition of.....	20
Aitkin, Mississippi River at.....	51,196
Akeley, Williams Lake near.....	38-42
Aldrich, Leaf River near.....	173
Algae, definition of.....	20
Algal growth potential, definition of.....	20
Altura, South Fork Whitewater River near.....	179
Analyses of samples collected at water-quality partial-record stations.....	191-195
Anoka, Mississippi River near.....	67-70,197
Appleton, Pomme de Terre River at.....	88,198
Aquifer, definition of.....	20
Arrangement of records.....	16
Artesian, definition of.....	20
Artificial substrate, definition of.....	24
Ashley Creek near Sauk Centre.....	173
Ash mass, definition of.....	20
Austin, Cedar River near.....	166,203
Bacteria, definition of.....	20
Bancroft, Bancroft Creek at.....	168,180
Bancroft Creek at Bancroft.....	168,180
Beaver Creek at Beaver Falls.....	176
at Valley Springs, S.D.....	180
Beaver Falls, Beaver Creek at.....	176
Becida, Hennepin Creek near.....	172
Bed load, definition of.....	24
discharge, definition of.....	24
Bed material, definition of.....	20
Bemidji, Mississippi River at.....	172
Big Lake, Elk River near.....	61,197
Big Sioux River basin, high-flow partial- record stations in.....	180-181
Big Stone City, SD, Whetstone River near.....	78-81,198
Big Stone Lake at Ortonville.....	82
Biochemical oxygen demand, definition of.....	20
Biomass, definition of.....	20
Blue Earth River, East Branch, near Bricelyn..	176
East Branch, near Walters.....	176
near Rapidan.....	100,200
Blue-green algae, definition of.....	23
Bottom material, definition of.....	20
Boy River near Remer.....	172
Brainerd, Gull Lake near.....	55
Gull River at Gull Lake Dam near.....	56
Bricelyn, East branch Blue Earth River near...	176
Brownton, Buffalo Creek tributary near.....	175
Buffalo Creek tributary near Brownton.....	175
Calumet, Swan River near.....	47,196
Canby, Lazarus Creek tributary near.....	175
Cannon River at Northfield.....	178
at Welch.....	178
Cannon River basin, gaging-station records in...	155,202
high-flow partial-record stations in.....	178
Cannon River below Sabre Lake near Kilkenny...	178
Cat River near Nimrod.....	173
Cedar River near Austin.....	166,203
Cells/volume, definition of.....	21
Ceylon, East Fork Des Moines River at.....	180
Cfs/day, definition of.....	21
Champlin, Elm Creek near.....	66,197
Chanarambie Creek near Edgerton.....	180
Chemical oxygen demand, definition of.....	21
Chemical quality of precipitation.....	288-289
Chippewa and Crow River basins, low-flow investigations in.....	183-190
Chippewa River below diversion near Watson....	182
diversion near Watson.....	182
Chippewa River near Milan.....	91,199
Chlorophyll, definition of.....	21
Classification of records.....	16
Clearwater, Mississippi River at.....	174
Clearwater River near South Haven.....	174
Collection and computation of ground-water levels.....	18
ground-water quality.....	19
stage and water discharge.....	13
Color unit, definition of.....	21
Concord, Milliken Creek near.....	178
Contents, definition of.....	21
Control, definition of.....	21
Cooperation.....	1
Cottage Grove, Mississippi River at Grey Cloud Island near.....	127-133
Cottonwood River near New Ulm.....	97,200
near Springfield.....	176
tributary No. 2 near Sanborn.....	176
Courtland, Little Cottonwood River near.....	98,200
Crooked Creek at Freeburg.....	180
Crooked Creek basin, high-flow partial-record stations in.....	18
Crooked Creek near Hinckley.....	177
Cross Lake, Pine River at Cross Lake Dam, at..	53
Pine River Reservoir at.....	52
Crow River at Rockford.....	63,197
Middle Fork near Spicer.....	62,197
North Fork, at Paynesville.....	174
North Fork, near Kingston.....	175
South Fork, near Mayer.....	175
Crow River basin, gaging-station records in...	62-63,197
high-flow partial-record stations in.....	174-175
Crow Wing River at Nimrod.....	173
near Pillager.....	57,196
Crow Wing River basin, gaging-station records in.....	54-57,196
high-flow partial-record stations in.....	173
Cubic foot per second, definition of.....	21
Cubic feet per second per square mile, definition of.....	21
Data collection and computation, ground-water levels.....	18
ground-water quality.....	19
stage and water discharge.....	14
Data presentation, ground-water levels.....	18-19
ground-water quality.....	19
stage and water discharge.....	14-15
surface-water quality.....	17-18
Deer River, Mississippi River at Winnibigoshish Dam near.....	37
Winnibigoshish Lake near.....	36
Definition of terms.....	20-25
Delft, Watonwan River near.....	177
Des Moines River at Jackson.....	167,203
Des Moines River basin, gaging-station records in.....	167,203
high-flow partial-record stations in.....	180
Diatoms, definition of.....	23
Discharge at partial-record stations and miscellaneous sites.....	168-182
high-flow partial-record stations.....	169-181
low-flow partial-record stations.....	168
miscellaneous sites.....	182
Discharge, definition of.....	21
Discontinued gaging stations.....	28-31
Dissolved, definition of.....	21
Dissolved solids concentration.....	21
Diversity index, definition of.....	21
Downstream order system and station number, definition of.....	12
Drainage area, definition of.....	21
Drainage basin, definition of.....	21
Dry mass, definition of.....	20
Dunnel, Fourmile Creek near.....	180

## INDEX

	Page		Page
East Branch Blue Earth River near Bricelyn....	176	Identifying estimated daily discharge.....	15
near Walters.....	176	Introduction.....	1
East Fork Des Moines River near Celyon.....	180	Instantaneous discharge, definition of.....	21
Edgerton, Chanarambie Creek near.....	180	Iowa River basin, gaging-station records in... 166,203	
Elba, North Fork Whitewater River near.....	158-160,202	high-flow partial-record stations in.....	180
Elbow Lake, Pomme de Terre River near.....	175		
Elk River basin, gaging-station records in....	61-197	Jackson, Des Moines River at.....	167,203
high-flow partial-record stations in.....	174	Johnsburg, Little Cedar River near.....	180
Elk River near Big Lake.....	61,197	Johnson Creek basin, high-flow partial-record	
Elm Creek basin, gaging-station records in....	66,197	stations in.....	174
miscellaneous measurement in.....	182	Johnson Creek near St. Augusta.....	174
Elm Creek near Champlin.....	66,197	tributary at Luxemburg.....	174
Empire, Vermillion River near.....	147-154,202	Jordan, Minnesota River near.....	107-116,201
Explanation of the records.....	12		
Factors for converting Inch-Pound Units		Kanaranzi Creek tributary No. 2 near Wilmont..	181
to International System (SI)		Kellogg, Zumbro River at.....	157,202
Units.....	Inside back cover	Kenyon, Little Cannon River tributary near...	178
Faribault, Straight River near.....	155,202	Kettle River, Glaisby Brook near.....	177
Fecal coliform bacteria, definition of.....	20	Kettle River below Sandstone.....	141,201
Fecal streptococcal bacteria, definition of...	20	Kilkenny, Cannon River below Sabre Lake near..	178
Federal Dam, Leech Lake at.....	43	Kingston, North Fork Crow River near.....	175
Leech Lake River at.....	44	Knife River near Mora.....	142,201
Foley, Stony Brook tributary near.....	174		
Fort Ripley, Mississippi River near.....	173	Laboratory measurements, surface-water quality	17
Nokasippi River near.....	173	Lac qui Parle, Lac qui Parle River near.....	89,198
Fourmile Creek near Dunnell.....	180	Minnesota River near.....	90,199
Freeburg, Crooked Creek at.....	180	Lac qui Parle River near Lac qui Parle.....	89,198
Fridley, Mississippi River at.....	71-77	Lakes and Reservoirs:	
		Big Stone Lake at Ortonville.....	82
Gage height, definition of.....	21	Gull Lake near Brainerd.....	55
Gaging station, definition of.....	21	Leech Lake at Federal Dam.....	44
Gaging stations, discontinued.....	28-31	Mille Lacs Lake at Garrison.....	64
records.....	36-167	Pokegama Lake near Grand Rapids.....	45
Garden City, Watonwan River near.....	99,200	Pine River Reservoir at Cross Lake.....	52
Garrison, Mille Lacs Lake at.....	64	Sandy Lake at Libby.....	48
Garvin Brook near Minnesota City.....	161,203	Williams Lake near Akeley.....	38-42
Garvin Brook basin, gaging-station		Winnibigoshish Lake near Deer River.....	36
records in.....	161,203	Lamberts Creek above Vadnais Lake at	
Gaylord, Middle Branch Rush River near.....	177	Vadnais Heights.....	182
Glaisby Brook near Kettle River.....	177	Lanesboro, Root River near.....	179
Goodhue, Trout Brook tributary near.....	178	South Branch Root River at.....	179
Goose Creek near Harris.....	178	Latitude-longitude system for wells and	
Grand Rapids, Mississippi River at.....	46,196	miscellaneous sites.....	12
Pokegama Lake near.....	45	Lazarus Creek tributary near Canby.....	175
Granite Falls, Yellow Medicine River near....	94,199	Leaf River near Aldrich.....	173
Graph showing comparison of dissolved solids		Leech Lake at Federal Dam.....	43
concentrations.....	8	Leech Lake River at Federal Dam.....	44
discharge at three long-term gaging		Leech Lake River Basin, gaging-station	
stations.....	6-7	records in.....	38-44
nitrate concentrations.....	9	Le Sueur River near Rapidan.....	101,200
Green algae, definition of.....	23	Lester Prairie, Otter Creek near.....	175
Ground water, water quality data.....	276-287	Otter Creek tributary near.....	175
Ground-water-level records, by county.....	206-275	Libby, Mississippi River below Sandy	
Ground-water levels, records of.....	18	River near.....	50
in summary of hydrologic conditions.....	5	Sandy Lake at.....	48
Ground-water records, by county, quality.....	276-287	Sandy River at Sandy Lake Dam at.....	49
Gull Lake near Brainerd.....	55	List of counties for which ground-water-	
Gull River at Gull Lake Dam, near Brainerd....	56	level records are publish.....	viii-x
		for which ground-water-quality records	
		published.....	x
Hardness of water, definition of.....	21	List of gaging stations, in downstream order,	
Harris, Goose Creek near.....	178	for which records are published.....	vi-vii
Hastings, Mississippi River at.....	182	Little Cannon River tributary near Kenyon....	178
Mississippi River at Lock and Dam 2 at....	136-140	Little Cedar River near Johnsburg.....	180
Hawk Creek near Maynard.....	176	Little Chippewa River near Starbuck.....	175
Henderson, High Island Creek near.....	106,201	Little Cottonwood River near Courtland.....	98,200
Hennepin Creek near Becida.....	172	Little Sioux River basin, high-flow	
High-flow partial-record stations.....	172-181	partial-record stations in.....	181
High Island Creek near Henderson.....	106,201	Little Sioux River near Spafford.....	181
Hill City, Smith Creek near.....	172	Long Creek near Potsdam.....	179
Hillman Creek near Pierz.....	173	Long Prairie, Long Prairie River at.....	54-196
Hinckley, Crooked Creek near.....	177	Long Prairie River at Long Prairie.....	54,196
Houston, Root River near.....	179	Low-flow investigations in the Crow and	
South Fork Root River near.....	179	Chippewa River basins.....	183-190
Hydrologic bench-mark network, definition of..	12	Low-flow partial-record stations.....	168
Hydrologic conditions, graphs or maps of.....	3,6-11	Luverne, Rock River at.....	181
Hydrologic unit, definition of.....	21	Luxemburg, Johnson Creek tributary at.....	174

## INDEX

Page	Page
Mankato, Minnesota River at.....102-105,201	Newport, Mississippi River at Fifth Street at.....120-126
Map of Minnesota, ground-water observation wells.....204-205	New Prague, Sand Creek near.....177
seasonal water levels in confined aquifers.....11	New Ulm, Cottonwood River near.....97,200
seasonal water-table levels.....10	Nimrod, Cat River near.....173
annual precipitation.....3	Crow Wing River at.....173
high-flow partial record stations.....170-171	Nininger, Mississippi River at.....134-135
lake and stream-gaging stations.....32-33	Nokasippi River near Fort Ripley.....173
surface water-quality stations.....34-35	North Fork Crow River at Paynesville.....174
Maple River near Rapidan.....177	near Kingston.....175
Marshall, Redwood River near.....95,199	North Fork Whitewater River near Elba.....158-160,202
Mayer, South Fork Crow River near.....175	Northfield, Cannon River at.....178
Maynard, Hawk Creek near.....176	Numbering system for wells and miscellaneous sites.....12-13
Mean concentration, definition of.....24	Odessa, Yellow Bank River near.....84-87,198
Mean discharge, definition of.....21	On-site measurement and collection.....16-17
Methylene blue active substance, definition of.....22	Organic mass, definition of.....20
Metamorphic stage, definition of.....22	Organism, definition of.....22
Micrograms per gram, definition of.....22	count/area, definition of.....22
Micrograms per kilogram, definition of.....22	count/volume, definition of.....22
Micrograms per liter, definition of.....22	Ormsby, South Fork Watonwan River near.....177
Middle Branch Rush River near Gaylord.....177	Ortonville, Big Stone Lake at.....82
Middle Fork Crow River near Spicer.....62,197	Minnesota River at.....83,198
Milan, Chippewa River near.....91,199	Other records available.....16
Mille Lacs Lake at Garrison.....64	Otsego Creek basin, high-flow partial-record stations in.....174
Milligrams per liter, definition of.....22	Otsego Creek near Otsego.....174
Milligrams of carbon per area or volume per unit time for periphyton, macrophytes, and phytoplankton.....23	Otsego, Otsego Creek near.....174
Milligrams of oxygen per area or volume per unit time for periphyton, macrophytes, and phytoplankton.....23	Otter Creek near Lester Prairie.....175
Milliken Creek near Concord.....178	tributary near Lester Prairie.....175
Minneapolis, Mississippi River at lower St. Anthony Falls lock and dam at.....182	Palisade, Willow River below.....172
Minnesota, South Branch Yellow Medicine River at.....93	Parameter code numbers.....22
Minnesota City, Garvin Brook near.....161,203	Partial-record station, definition of.....22
Minnesota River at Mankato.....102-105,201	discharge at.....168-182
at Montevideo.....92,199	Particle size, definition of.....22
at Ortonville.....83,198	Particle-size classification, definition of.....22
near Jordan.....107-116,201	Paynesville, North Fork Crow River at.....174
near Lac qui Parle.....90,199	Percent composition, definition of.....22
Minnesota River basin, gaging-station records in.....78-116,198-201	Periphyton, definition of.....23
high-flow partial-record stations in.....175-177	Pesticides, definition of.....23
low-flow investigations in.....189-190	Phytoplankton, definition of.....23
measurements at miscellaneous sites in.....182	Piccocurie, definition of.....23
Miscellaneous sites, discharge measurements at.....182	Pierz, Hillman Creek near.....173
Miscellaneous water-quality data collected at continuous-record stations.....196-203	Pillager, Crow Wing River near.....57,196
Mississippi River at Aitkin.....51,196	Sevenmile Creek near.....173
at Bemidji.....172	Pine City, Snake River near.....177
at Clearwater.....174	Pine River at Cross Lake Dam, at Cross Lake.....53
at Fifth Street at Newport.....120-126	at Pine River.....172
at Fridley.....71-77	Pine River basin, gaging-station records in.....52-53
at Grand Rapids.....46,196	Pine River, Pine River at.....172
at Grey Cloud Island near Cottage Grove.....127-133	Pine River Reservoir at Cross Lake.....52
at lock and dam 2, at Hastings.....136-140	Plankton, definition of.....23
at lower St. Anthony Falls lock and dam, at Minneapolis.....182	Platte River above Royalton.....173
at Nininger.....134-135	Platte River basin, high-flow partial-record stations in.....173
at Prescott, WI.....146,202	Pokegama Lake near Grand Rapids.....45
at St. Paul.....117-119,201	Polychlorinated biphenyls, definition of.....23
at Winnibigoshish Dam, near Deer River.....37	Pomme de Terre River at Appleton.....88,198
at Winona.....162-165,203	near Elbow Lake.....175
below Sandy River near Libby.....50	Potsdam, Long Creek near.....179
near Anoka.....67-70,197	Precipitation, chemical quality of.....288-289
near Fort Ripley.....173	in summary of hydrologic conditions.....2
near Royalton.....58-60,197	Prescott, WI, Mississippi River at.....146,202
Montevideo, Minnesota River at.....92,199	Primary productivity, definition of.....23
Spring Creek near.....176	Publication on techniques of water-resources investigations.....26-27
Mora, Knife River near.....142,201	Quality of ground-water, by county.....276-287
National Geodetic Vertical Datum of 1929 (NGVD), definition of.....22	Radiochemical program, definition of.....12,23
National stream-quality accounting network (NASQAN), definition of.....12,22	Rapidan, Blue Earth River near.....100,200
National trends network (NTN), definition of.....12,22	Le Sueur River near.....101,200
Natural substrate, definition of.....24	Maple River near.....177
	Records, accuracy of.....15-16
	other available.....16
	Records of ground-water levels.....18
	ground-water quality.....19
	stage and water discharge.....13
	surface-water quality.....16

## INDEX

	Page		Page
Recoverable from bottom material, definition of.....	23	Spring Creek near Montevideo.....	176
Redwood Falls, Redwood River near.....	96,200	near Sleepy Eye.....	176
Redwood River near Marshall.....	95,199	tributary near Sleepy Eye.....	176
near Redwood Falls.....	96,200	near Wanamingo.....	178
Remark codes, surface-water quality.....	18	Springfield, Cottonwood River near.....	176
Remer, Boy River near.....	172	Spring Hill, Sauk River tributary at.....	174
Reservoirs (see lakes and reservoirs)		Stage-discharge relation, definition of.....	24
Return period, definition of.....	23	Starbuck, Little Chippewa River near.....	175
Rochester, South Fork Zumbro River at.....	156,202	Station identification numbers.....	12
Rock River at Luverne.....	181	Stony Brook tributary near Foley.....	174
Rockford, Crow River at.....	63,197	Straight River near Faribault.....	155,202
Root River at Rushford.....	179	Streamflow, definition of.....	24
near Houston.....	179	in summary of hydrologic conditions.....	2
near Lanesboro.....	179	Substrate, definition of.....	24
South Branch, at Lanesboro.....	179	Summary of hydrologic conditions.....	2
South Fork, near Houston.....	179	ground-water levels.....	5
Root River basin, high-flow partial-record stations in.....	179	precipitation.....	2
Royalton, Mississippi River near.....	58-60,197	streamflow.....	2
Platte River above.....	173	water quality.....	2
Rum River near St. Francis.....	65,197	Surface area, definition of.....	24
Rum River basin, gaging-station records in.....	64-65,197	Surficial bed material, definition of.....	24
Runoff at streamflow stations (table 1).....	4-5	Suspended, definition of.....	24
Runoff in inches, definition of.....	23	Suspended recoverable, definition of.....	24-25
Rush Creek near Rushford.....	179	Suspended sediment, definition of.....	24
Rushford, Root River at.....	179	Suspended-sediment concentration, definition of.....	24
Rush Creek near.....	179	Suspended-sediment discharge, definition of.....	24
Rush River, Middle Branch near Gaylord.....	177	Suspended-sediment load, definition of.....	24
		Suspended total, definition of.....	25
St. Augusta, Johnson Creek near.....	174	Swan River basin, gaging-station records in... 47,196	
St. Croix Falls, WI, St. Croix River at.....	143-145	Swan River near Calumet.....	47,196
St. Croix River at Prescott, WI.....	182		
at St. Croix Falls, WI.....	143-145	Table of runoff at streamflow stations.....	4-5
St. Croix River basin, gaging-station records in.....	141-145,201	Taxonomy, definition of.....	25
high-flow partial-record stations in.....	177-178	Thermograph, definition of.....	25
miscellaneous measurement in.....	182	Time-weighted average, definition of.....	25
St. Francis, Rum River near.....	65,197	Tons per acre-foot, definition of.....	25
St. Michael, School Lake Creek tributary near.....	175	Tons per day, definition of.....	25
St. Paul, Mississippi River at.....	117-119,201	Total, definition of.....	25
Sanborn, Cottonwood tributary No. 2 near.....	176	bottom material, definition of.....	25
Sand Creek near New Prague.....	177	coliform bacteria, definition of.....	20
Sandstone, Kettle River below.....	141,201	load, definition of.....	25
Wolf Creek tributary near.....	177	organism count, definition of.....	22
Sandy Lake at Libby.....	48	recoverable, definition of.....	25
Sandy River at Sandy Lake Dam, at Libby.....	49	sediment discharge, definition of.....	24
Sandy River basin, gaging-station records in... 48-49		sediment load, definition of.....	24
Sauk Centre, Ashley Creek near.....	173	Tritium network, definition of.....	12,25
Sauk River tributary at Spring Hill.....	174	Trout Brook tributary near Goodhue.....	178
Sauk River basin, high-flow partial-record stations in.....	173-174		
School Lake Creek tributary near St. Michael.. 175		Vadnais Heights, Lamberts Creek above	
Sediment, definition of.....	23	Vadnais Lake at.....	182
collection of.....	17	Vadnais Lake basin, miscellaneous sites in... 182	
Seven-day 10-year low dlog, definition of.....	24	Valley Springs, S.D., Beaver Creek near.....	180
Severnile Creek near Pillager.....	173	Vermillion River near Empire.....	147-154,202
Sleepy Eye, Spring Creek near.....	176	Vermillion River basin, gaging-station records in.....	147-154,202
Spring Creek tributary near.....	176		
Smith Creek basin, high-flow partial-record stations in.....	172	Walters, Blue Earth River East Branch near... 176	
Smith Creek near Hill City.....	172	Wanamingo, Spring Creek near.....	178
Snake River near Pine City.....	177	Warren Lake tributary near Windom.....	180
Sodium-adsorption ratio, definition of.....	24	Water quality, in summary of hydrologic conditions.....	2
Solute, definition of.....	24	Water-quality records, analyses of samples collected at ground-water wells.....	276-287
South Branch Root River at Lanesboro.....	179	analyses of samples collected at partial-record stations.....	191-196
Yellow Medicine River at Minneota.....	93	miscellaneous analyses at streamflow stations.....	196-203
South Fork Crow River near Mayer.....	175	Water temperature, surface-water quality.....	17
Root River near Houston.....	179	Water year, definition of.....	25
Watsonwan River near Ormsby.....	177	Watsonwan River, near Delft.....	177
Whitewater River near Altura.....	179	near Garden City.....	99,200
Zumbro River at Rochester.....	156,202	South Fork near Ormsby.....	177
South Haven, Clearwater River near.....	174	Watson, Chippewa River below diversion near... 182	
Spafford, Little Sioux River near.....	181	Chippewa River diversion near.....	182
Special networks and programs.....	12	Weighted average, definition of.....	25
Specific conductance, definition of.....	24	Welch, Cannon River at.....	178
Specific conductance and temperature at streamflow stations.....	196-203	Wet mass.....	20
Spicer, Middle Fork Crow River near.....	62,197	Whetstone River near Big Stone City, SD.....	78-81,198

## INDEX

	Page		Page
Whitewater River, North Fork, near Elba.....	158-160,202	WRD, definition of.....	25
South Fork, near Altura.....	179	WSP, definition of.....	25
Whitewater River basin, gaging-station		Yellow Bank River near Odessa.....	84-87,198
records in.....	158-160,202	Yellow Medicine River near Granite Falls.....	94,199
high-flow partial-record stations in.....	179	South Branch, at Minneota.....	93
Williams Lake near Akeley.....	38-42	Zooplankton, definition of.....	23
Willow River basin, high-flow partial-record		Zumbro Falls, Zumbro River at.....	178
stations in.....	172	Zumbro River at Kellogg.....	157,202
Willow River below Palisade.....	172	at Zumbro Falls.....	178
Wilmont, Kanaranzi Creek tributary No. 2 near.	181	South Fork, at Rochester.....	156,202
Windom, Warren Lake tributary near.....	180	Zumbro River basin, gaging-station records	
Winnibigoshish Lake near Deer River.....	36	in.....	156-157,202
Winona, Mississippi River at.....	162-165,203	high-flow partial-record stations in.....	178-179
Wolf Creek tributary near Sandstone.....	177		
WDR, definition of.....	25		

## 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). This report contains both the inch-pound and SI unit equivalents in the station manuscript descriptions.

Multiply inch-pound units	By	To obtain SI units
<i>Length</i>		
inches (in)	$2.54 \times 10^1$	millimeters (mm)
	$2.54 \times 10^{-2}$	meters (m)
feet (ft)	$3.048 \times 10^{-1}$	meters (m)
miles (mi)	$1.609 \times 10^0$	kilometers (km)
<i>Area</i>		
acres	$4.047 \times 10^3$	square meters (m <sup>2</sup> )
	$4.047 \times 10^{-1}$	square hectometers (hm <sup>2</sup> )
	$4.047 \times 10^{-3}$	square kilometers (km <sup>2</sup> )
square miles (mi <sup>2</sup> )	$2.590 \times 10^0$	square kilometers (km <sup>2</sup> )
<i>Volume</i>		
gallons (gal)	$3.785 \times 10^0$	liters (L)
	$3.785 \times 10^0$	cubic decimeters (dm <sup>3</sup> )
	$3.785 \times 10^{-3}$	cubic meters (m <sup>3</sup> )
million gallons	$3.785 \times 10^3$	cubic meters (m <sup>3</sup> )
	$3.785 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
cubic feet (ft <sup>3</sup> )	$2.832 \times 10^1$	cubic decimeters (dm <sup>3</sup> )
	$2.832 \times 10^{-2}$	cubic meters (m <sup>3</sup> )
cfs-days	$2.447 \times 10^3$	cubic meters (m <sup>3</sup> )
	$2.447 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
acre-feet (acre-ft)	$1.233 \times 10^3$	cubic meters (m <sup>3</sup> )
	$1.233 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
	$1.233 \times 10^{-6}$	cubic kilometers (km <sup>3</sup> )
<i>Flow</i>		
cubic feet per second (ft <sup>3</sup> /s)	$2.832 \times 10^1$	liters per second (L/s)
	$2.832 \times 10^1$	cubic decimeters per second (dm <sup>3</sup> /s)
	$2.832 \times 10^{-2}$	cubic meters per second (m <sup>3</sup> /s)
gallons per minute (gal/min)	$6.309 \times 10^{-2}$	liters per second (L/s)
	$6.309 \times 10^{-2}$	cubic decimeters per second (dm <sup>3</sup> /s)
	$6.309 \times 10^{-5}$	cubic meters per second (m <sup>3</sup> /s)
million gallons per day	$4.381 \times 10^1$	cubic decimeters per second (dm <sup>3</sup> /s)
	$4.381 \times 10^{-2}$	cubic meters per second (m <sup>3</sup> /s)
<i>Mass</i>		
tons (short)	$9.072 \times 10^{-1}$	megagrams (Mg) or metric tons

POSTAGE AND FEES PAID  
U.S. DEPARTMENT OF THE INTERIOR  
INT 413



U.S. DEPARTMENT OF THE INTERIOR  
Geological Survey  
702 Post Office Building  
St. Paul, MN 55101

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300  
SPECIAL 4TH CLASS BOOK RATE