U.S. Department of the Interior
U.S. Geological Survey

Selected Hydrologic Data through 1996 for the Lake Traverse Reservation/ Roberts County Water-Resources Investigation in South Dakota

By Janet M. Carter and Ryan F. Thompson

Open-File Report 98-647

Prepared in cooperation with the Sisseton-Wahpeton Sioux Tribe,
Roberts County, and the South Dakota Geological Survey

U.S. Department of the Interior
U.S. Geological Survey

Selected Hydrologic Data through 1996 for the Lake Traverse Reservation/ Roberts County Water-Resources Investigation in South Dakota

By Janet M. Carter and Ryan F. Thompson

Open-File Report 98-647

Prepared in cooperation with the Sisseton-Wahpeton Sioux Tribe,
Roberts County, and the South Dakota Geological Survey

U.S. Department of the Interior
Bruce Babbitt, Secretary

U.S. Geological Survey
Charles G. Groat, Director

Rapid City, South Dakota: 1999

For additional information write to:

District Chief
U.S. Geological Survey
1608 Mt. View Road
Rapid City, SD 57702

Copies of this report can be purchased from:

U.S. Geological Survey
Branch of Information Services
Box 25286
Denver, CO 80225-0286

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS—Continued

TABLES

CONTENTS OF SUPPLEMENTAL SECTIONS

C. Hydrographs—Continued

CONTENTS OF SUPPLEMENTAL SECTIONS—Continued

CONTENTS OF SUPPLEMENTAL SECTIONS—Continued

CONTENTS OF SUPPLEMENTAL SECTIONS—Continued

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
Length		
inch	2.54	centimeter
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
Area		
acre	4,047	square meter
acre	0.4047	hectare
square mile	259.0	hectare
square mile	2.590	square kilometer
Flow Rate		
cubic feet per second	0.02832	cubic meter per second

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = (°F - 32) / 1.8$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Water year: In Geological Survey reports dealing with surface-water supply, water year is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends; thus, the water year ending September 30, 1996, is called the "1996 water year."

Selected Hydrologic Data through 1996 for the Lake Traverse Reservation/Roberts County Water-Resources Investigation in South Dakota

By Janet M. Carter *and* Ryan F. Thompson

ABSTRACT

This report presents data on precipitation; geologic logs; water levels for ground water and lakes; stream discharge; and water quality for ground water, streams, and lakes that have been collected or compiled through 1996 for the Lake Traverse/Roberts County Water-Resources Investigation. The investigation was initiated in 1994 as a cooperative effort between the U.S. Geological Survey, the Sisseton-Wahpeton Sioux Tribe, Roberts County, and the South Dakota Geological Survey.

Prior to the water-resources investigation, a reconnaissance drilling program was accomplished from 1988 through 1990 by the U.S. Geological Survey and the Sisseton-Wahpeton Sioux Tribe. During the reconnaissance drilling, 19 test holes were drilled and 9 observation wells were installed. After the water-resources investigation started in 1994, a comprehensive drilling program was initiated in cooperation with the South Dakota Geological Survey. Between 1994 and 1996, 41 test holes were drilled and 19 observation wells were installed. Geologic logs are presented for the test holes and wells completed during both drilling programs.

Fifty-nine observation wells owned by the South Dakota Department of Environment and Natural Resources and eight observation wells owned by the North Dakota State Water Commission were incorporated into the study for purposes of water-level monitoring. Hydrographs are presented for these wells.

Precipitation records through 1996 for eight National Weather Service stations are presented. Peak-flow estimates are computed for 12 streamflow-gaging stations, and summary statistics are computed for eight streamflow-gaging stations. Water-quality samples have been collected by the U.S. Geological Survey from 23 observation wells, 6 streams, and 17 lakes for the water-resources investigation. Data presented for the water-quality samples include field measurements, bacterial concentrations, common and trace elements, nutrients, and radiometrics. Additionally, water-level data collected by the South Dakota Department of Environment and Natural Resources have been compiled for 20 lakes located within the study area. Hydrographs are presented for 18 of these lakes.

INTRODUCTION

A reconnaissance drilling program was accomplished from 1988 through 1990 by the U.S. Geological Survey (USGS) and the Sisseton-Wahpeton Sioux Tribe. During the reconnaissance drilling, 19 test holes were drilled and 9 observation wells were installed. The reconnaissance drilling program identified the need for a more thorough knowledge of the area in order to map the thickness and extent of sand and gravel deposits and delineate aquifers.

The Lake Traverse/Roberts County Water-Resources Investigation was initiated in 1994 as a cooperative effort between the USGS, the Sisseton-Wahpeton Sioux Tribe, Roberts County, and the South Dakota Geological Survey (SDGS). During the water-resources investigation, a comprehensive drilling program was implemented in cooperation with the SDGS. Between 1994 and 1996, 41 test holes were drilled and 19 observation wells were installed for the water-resources investigation. Geologic logs are presented for the test holes and wells that were completed during the reconnaissance and comprehensive drilling programs.

In addition to the observation wells installed during the reconnaissance and comprehensive drilling programs, 59 existing observation wells owned by the South Dakota Department of Environment and Natural Resources (SDDENR) and 8 existing observation wells owned by the North Dakota State Water Commission (NDSWC) were incorporated into the study for purposes of water-level monitoring. Water-level data that have been collected quarterly for most of the SDDENR and NDSWC observation wells by their personnel are included in this report.

Water-quality samples have been collected from selected observation wells, streams, and lakes for the water-resources investigation. These samples were analyzed for field measurements, common and trace elements, and nutrients. The ground-water samples and some lake samples also were analyzed for selected radiometrics. Bacterial concentrations were measured in samples from lakes, streams, and shallow wells. Water-quality data, including quality-assurance data, are included in this report.

Various other hydrologic data have been assembled for this report. Precipitation records have been compiled through calendar year 1996, and streamflow records have been compiled through water year 1996. Water-level data collected by personnel from SDDENR have been compiled for 20 lakes located within the study area.

The purpose of this report is to present hydrologic data that have been collected or compiled for this study through 1996. Specifically, this report contains: (1) precipitation records for 8 sites; (2) geologic logs for 60 test holes and 28 observation wells; (3) hydrographs for 67 observation wells; (4) water-quality data for 23 observation wells; (5) peak-flow frequency estimates for 12 streamflow-gaging stations; (6) summary statistics for 8 streamflow-gaging stations; (7) water-quality data for 6 streams; (7) water-level data for 20 lakes; (8) hydrographs for 18 lakes; and (9) water-quality data for 17 lakes.

Description of Study Area

Most of the Lake Traverse/Roberts County study area is located in northeastern South Dakota, and a small part of the original boundary of the Lake Traverse Reservation is located in southeastern North Dakota (fig. 1). Roberts County has an area of 1,135 square miles, and the original boundaries of the Lake Traverse Reservation included 1,595 square miles in South Dakota and North Dakota.

The study area, which is included in the Central Lowlands physiographic province, occupies the Coteau des Prairies and the Minnesota River-Red River lowland physiographic divisions (Flint, 1955). Present-day topography was formed by the advancement and recession of glaciers during the Wisconsin age of the Pleistocene epoch (Koch, 1975). The Coteau des Prairies, which is drained by the Big Sioux River and the James River, is a massive plateau with rugged morainal topography (Koch, 1975). The Minnesota River-Red River lowland is a broad depression that consists primarily of ground moraine (till) and isolated outwash and lake deposits formed by glacial meltwaters (Koch, 1975). This southern area of the lowland is drained by the Minnesota River to the Mississippi River (Gulf of Mexico), and the northern area is drained by the Bois de Sioux River to the Red River (Hudson Bay).

Glacial deposits (till and outwash) cover the majority of land surface. The glacial deposits are underlain by the Cretaceous-age Pierre Shale, Niobrara Formation, and Carlile Shale and by Precambrian-age granite (Flint, 1955). Isolated surface exposures of the Cretaceous-age formations are present in the study area although they are relatively uncommon. Quaternary-age alluvial deposits also are present in the study area.

Acknowledgments

Many people have assisted with the development and implementation of the water-resources investigation. In particular, Gary Johnson of the Office of Planning and Development for the Sisseton-Wahpeton Dakota Nation Tribe provided valuable assistance. Sheila Crawford and Steve Farmer of the Office of

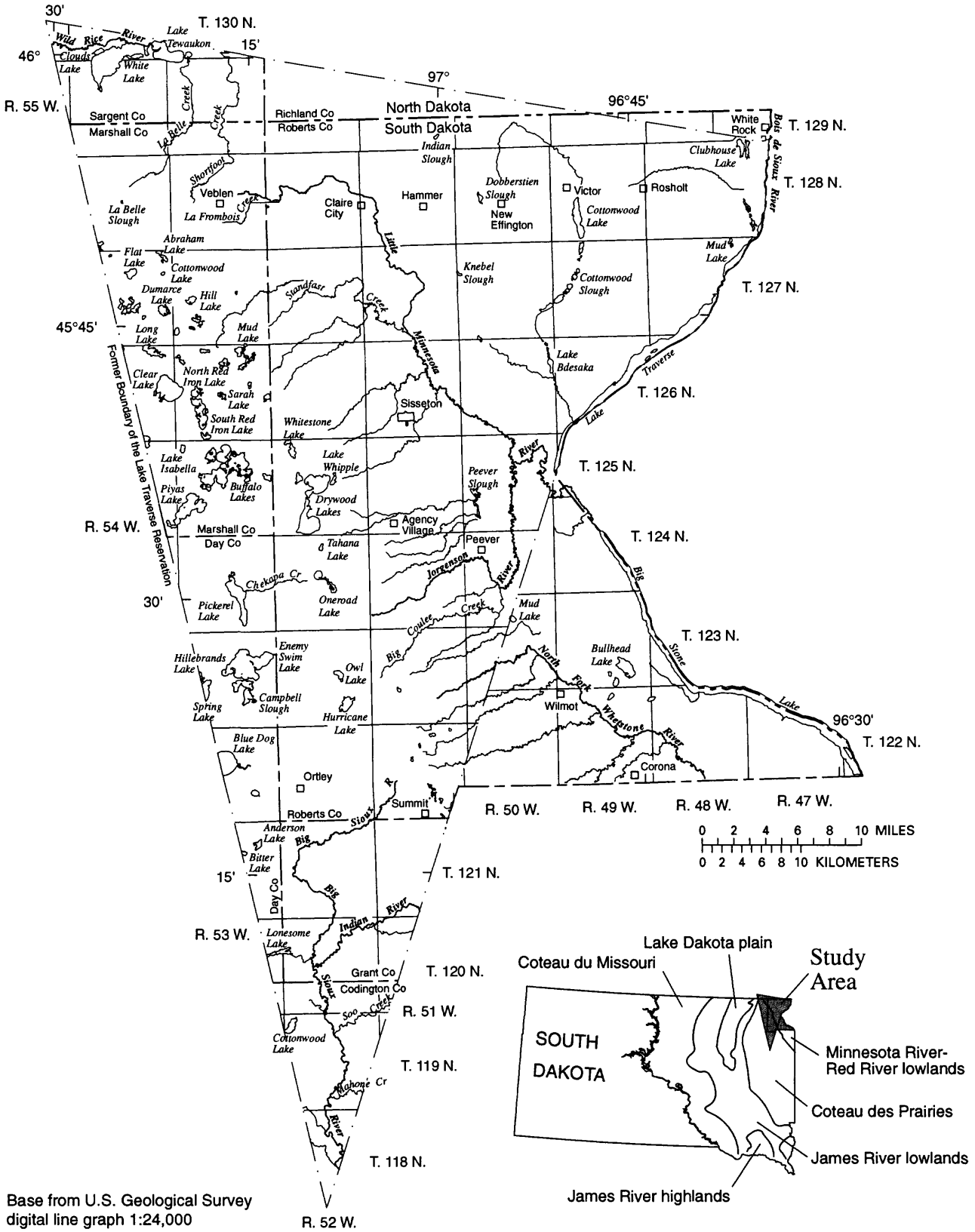


Figure 1. Location of study area.

Environmental Protection for the Sisseton-Wahpeton Dakota Nation Tribe provided assistance during collection of the surface-water samples. The SDGS drilled the test holes and installed the observation wells for the project. Dennis Tomhave (SDGS) greatly assisted in the interpretation of the geologic logs and provided insight and technical guidance. Information on the construction of 59 observation wells in South Dakota and the water levels in those wells was supplied by the SDDENR. Information on the construction of eight observation wells in North Dakota and the water levels in those wells was provided by the NDSWC. The water-level measurements for 20 lakes were provided by SDDENR, Water Rights Program.

PRECIPITATION DATA

Precipitation data are collected by the National Weather Service at eight sites in and near the study area (fig. 2). Monthly precipitation data, compiled from annual summaries (U.S. Department of Commerce, 1931-96a, 1931-96b) through 1996, are presented for Big Stone City, S. Dak. (table A1), Sisseton, S. Dak. (table A2), Summit, S. Dak. (table A3), Victor, S. Dak. (table A4), Watertown, S. Dak. (table A5), Waubay National Wildlife Refuge, S. Dak. (table A6), Wilmot, S. Dak. (table A7), and Forman, N. Dak. (table A8), in Section A of the Supplemental Information section at the end of this report. The period of record presented is from the earliest available record through 1996.

WELL AND TEST-HOLE DATA

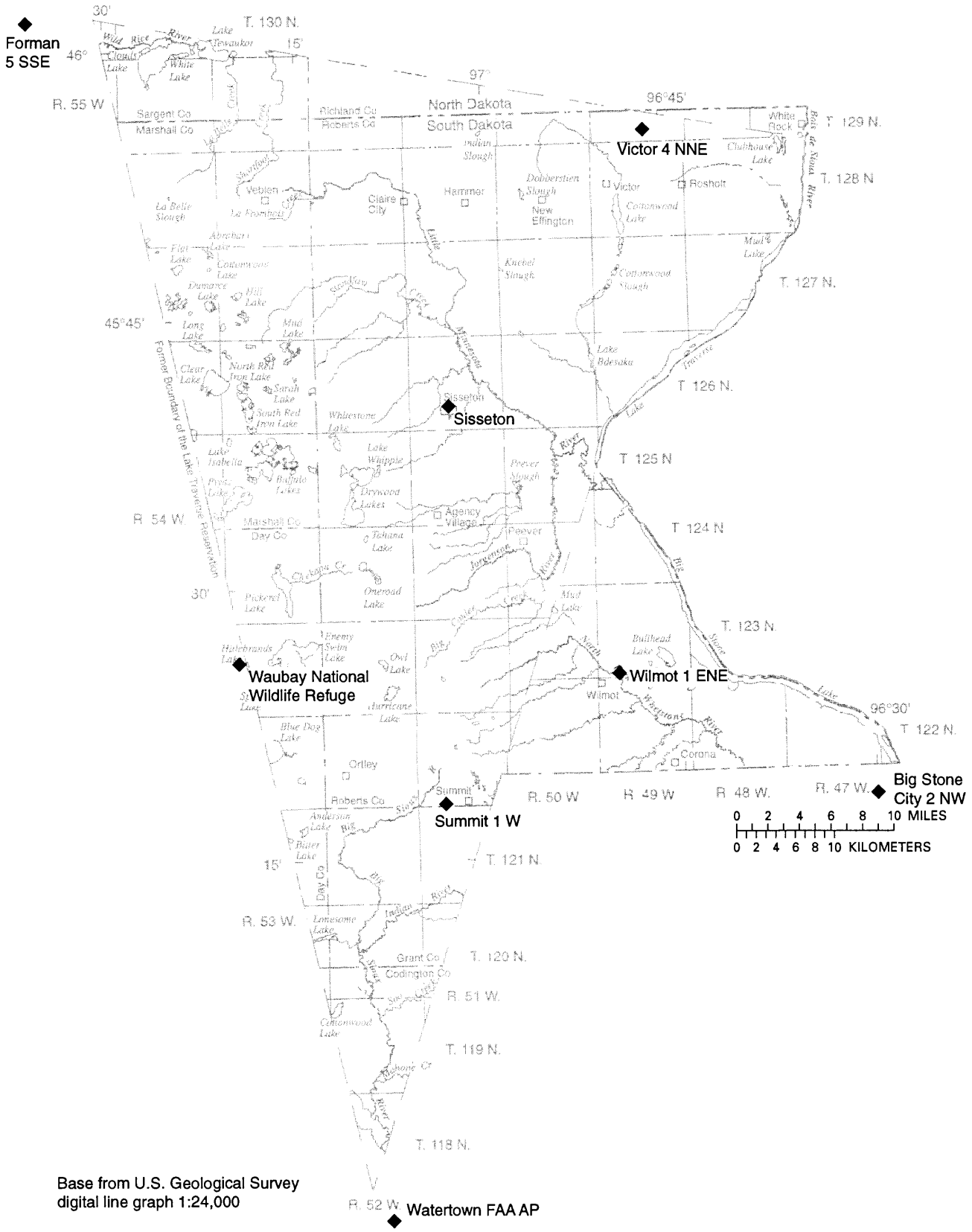
The Lake Traverse/Roberts County Water-Resources Investigation included two drilling programs: a reconnaissance program from 1988 through 1990 and an ongoing comprehensive program that began in 1994. During the reconnaissance drilling program, 19 test holes were drilled and 9 observation wells were installed. During the comprehensive drilling program, 41 test holes were drilled and 19 observation wells were installed between 1994 and 1996. All wells and test holes were drilled in Roberts County during both the reconnaissance and comprehensive drilling programs.

Selected information is presented in table 1 for the test holes and wells installed between 1988 and 1996 for the study. The most recent water level measured in the observation wells is included in the table. The altitudes of all the wells installed for this study were determined using Global Positioning System (GPS) software, which has a vertical accuracy of 0.10 feet (R.F. Thompson, U.S. Geological Survey, written commun., 1997). The location of the observation wells installed for the study are shown in figure 3, and the test holes are shown in figure 4.

Three methods of station identification for the wells and test holes are presented in table 1. The first method is the station identification number, which is based on the international system of latitude and longitude. The number contains 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude north of the equator. The next seven digits denote the degrees, minutes, and seconds of longitude west of the prime (Greenwich) meridian. The last two digits are sequential numbers for sites within the same latitude and longitude.

The second identification method presented in table 1 is the local number, which is based on the Federal land-survey system of eastern South Dakota (shown below). The local number consists of the township number followed by "N," the range number followed by "W," and the section number, followed by a maximum of four uppercase letters that indicate, respectively, the 160-, 40-, 10-, and 2.5-acre tract in which the well or test hole is located. These letters are assigned in a counterclockwise direction beginning with "A" in the northeast quarter. A sequential number following the last letter is used to distinguish between wells in the same 2.5-acre tract. An "R" at the end of the local number distinguishes sites that are located within the former boundary of the Lake Traverse Reservation. Thus, well 128N47W28ABCA R is located within the former boundary of the Lake Traverse Reservation in the NE1/4 of the SW1/4 in the NW1/4 in the NE1/4 of section 28 in township 128 north and range 47 west.

The third identification method is the "other identifier," which was assigned either by the SDGS or the USGS (table 1). Sites that begin with "R2," were designated by the SDGS; this name denotes the year and sequence in which the well or test hole was drilled. Sites that begin with "LTR" were assigned by the USGS; the numbers following the LTR denote the sequence in which the test hole (designated by "NO.") or well (designated with a dash) was drilled.



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 2. Location of precipitation stations within and near study area.

Table 1. Selected site information for observation wells and test holes completed during the reconnaissance and comprehensive drilling programs

[--, no data]

Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measure-ment	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
452337096552401	122N50W 4AADD	R2-94-60	Test hole	322	--	--	--	1,295	--	--
452213096514301	122N50W13DDDD	R2-94-62	Test hole	242	--	--	--	1,222	--	--
452206096552301	122N50W22BBBC	R2-94-61	Test hole	342	--	--	--	1,340	--	--
452725096480401	123N49W16DDDD	R2-94-59	Test hole	162	--	--	--	1,160	--	--
452449096480201	123N49W34CCCC	R2-94-63	Test hole	202	--	--	--	1,155	--	--
452725096584301	123N50W 6CCCC R	R2-94-56	Test hole	402	--	--	--	1,356	--	--
452722096552301	123N50W22BBBB	R2-94-66	Revillo	242	2.1	12-11-96	60.3	1,240.3	202	212
452448096514201	123N50W36DDDD	R2-94-64	Test hole	202	--	--	--	1,195	--	--
452448096584501	123N51W24DDDD R	R2-94-65	Test hole	447	--	--	--	1,425	--	--
452959096480001	124N49W33DDDD	R2-94-57	Test hole	382	--	--	--	1,125	--	--
453238096584201	124N50W 6CCCC R	R2-94-67	Test hole	242	--	--	--	1,233	--	--
453236096550001	124N50W10BBBB R	R2-94-53	Test hole	182	--	--	--	1,172	--	--
452959096545901	124N50W27BBBB R	R2-94-54	Revillo	222	2.2	12-11-96	28.3	1,210.1	176.8	186.8
453000096514201	124N50W36DDDD	R2-94-58	Test hole	162	--	--	--	1,170	--	--
453240097022701	124N51W 4DDDD R	R2-95-01	Revillo	423	2.4	12-11-96	156.7	1,423.4	397.5	407.5
453001096584801	124N51W25AAAB R	R2-94-55	Revillo	282	1.6	12-11-96	14.4	1,274.0	255	265
453749096560401	125N50W 9BBBA R	R2-94-51	Test hole	202	--	--	--	1,160	--	--
453659096560501	125N50W 9CCCD R	R2-94-52	Test hole	222	--	--	--	1,215	--	--
453751097060701	125N51W 7BBBB R	R2-95-04	Test hole	397	--	--	--	1,525	--	--
453751097060702	125N51W 7BBBB2 R	R2-95-05	Revillo[1]	102	1.6	06-22-95	73.9	1,527.3	92	102
453747097022401	125N51W10BBBC R	R2-95-03	Test hole	42	--	--	--	1,252	--	--
453517097022701	125N51W21DDDD R	R2-95-02	Test hole	262	--	--	--	1,325	--	--

Table 1. Selected site information for observation wells and test holes completed during the reconnaissance and comprehensive drilling programs—Continued

[--, no data]

Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measure-ment	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
453331097045301	125N51W32CCCC R	R2-96-01	Revillo	657	1.8	05-22-96	398.5	1,660.2	605	645
454305096475701	126N49W 4DCCD R	R2-96-54	Test hole	537	--	--	--	1,111	--	--
454304096511301	126N49W 7BBBB R	R2-96-55	Test hole	307	--	--	--	1,098.5	--	--
454304096511302	126N49W 7BBBB2 R	R2-96-56	Wilmot[1]	101	1.9	09-26-96	51.1	1,098.5	69.5	79.5
454412096484301	126N49W 9CCCC R	LTR NO.14	Test hole	192	--	--	--	1,110	--	--
454118096511201	126N49W19BBBB R	LTR NO.12	Test hole	41	--	--	--	1,018	--	--
454023096484601	126N49W20DDDD R	LTR NO.13	Test hole	61.5	--	--	--	999	--	--
454216096584101	126N50W 7CCCB R	LTR NO. 1	Test hole	177	--	--	--	1,178	--	--
454304096550001	126N50W 9AAAA R	R2-96-49	Test hole	172	--	--	--	1,135	--	--
454028096582301	126N50W19CCDD R	R2-96-47	Test hole	162	--	--	--	1,138	--	--
454028096550001	126N50W21DDDD R	R2-96-48	Fairmount[1]	202	2.2	12-10-96	68.5	1,165.1	168	178
453939096534401	126N50W27DDDA R	LTR NO.11	Test hole	201	--	--	--	1,170	--	--
454307097095301	126N52W 4DDDD R	R2-95-06	Test hole	42	--	--	--	1,435	--	--
454819096400401	127N48W 4DDDD R	R2-96-59	Test hole	262	--	--	--	1,085	--	--
454726096400301	127N48W 9DDDD R	LTR NO.19	Test hole	240	--	--	--	1,085	--	--
454457096411601	127N48W28CCCB R	LTR NO.18	Test hole	240	--	--	--	1,090	--	--
454818096473001	127N49W10BBBB R	R2-96-52	Test hole	282	--	--	--	1,089.2	--	--
454818096473002	127N49W10BBBB2 R	R2-96-53	Fairmount[1]	62	1.9	12-10-96	19.2	1,089.2	52	62
454718096491601	127N49W17ABCA R	LTR NO.24	Test hole	140	--	--	--	1,033	--	--
454515096434801	127N49W25DAAA R	LTR NO.17	Test hole	260	--	--	--	1,090	--	--
454450096491301	127N49W29DCDC R	LTR NO.15	Test hole	200	--	--	--	1,111.4	--	--
454450096491302	127N49W29DCDC2 R	LTR-16	Veblen[1]	90	4.0	12-10-96	60.2	1,111.4	80	90
454911096534501	127N50W 3AAA R	LTR NO.25	Test hole	180	--	--	--	1,083	--	--

Table 1. Selected site information for observation wells and test holes completed during the reconnaissance and comprehensive drilling programs—Continued

[--, no data]

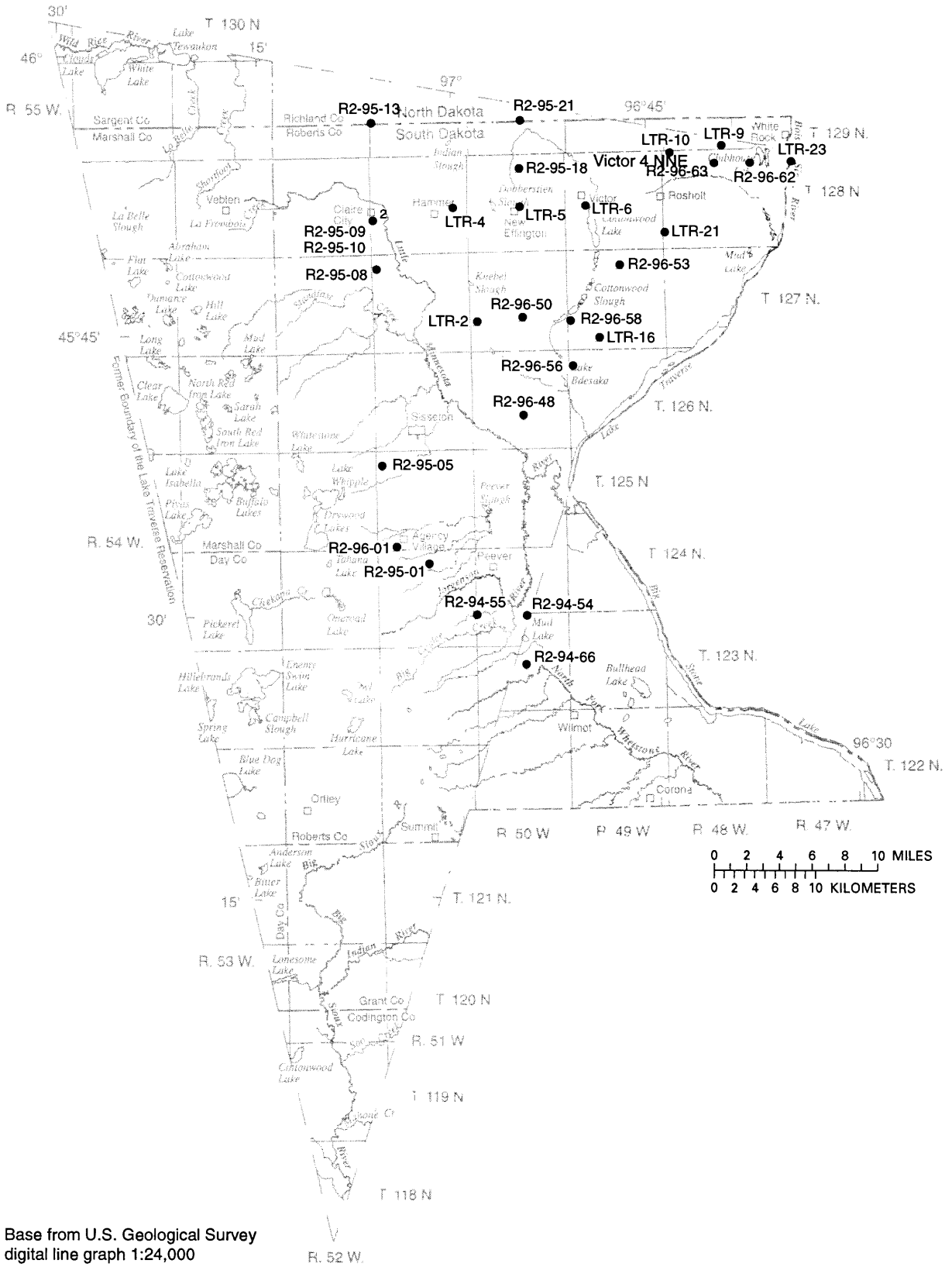
Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measure-ment	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
454910096584901	127N50W 6BBBB R	LTR NO. 3	Test hole	207	--	--	--	1,173	--	--
454817096512301	127N50W12AAAB R	R2-96-51	Test hole	182	--	--	--	1,090	--	--
454547096584301	127N50W19CCCB R	LTR NO. 2	Veblen[1]	203	1.9	10-17-95	43.6	1,175.4	109	119
454541096550001	127N50W21DDDD R	R2-96-50	Fairmount[1]	175	2.0	08-22-96	26.0	1,142.7	138	148
454523096511601	127N50W25ADAD R	R2-96-57	Test hole	182	--	--	--	1,099.5	--	--
454523096511602	127N50W25ADAD2 R	R2-96-58	Veblen[1]	80	1.6	09-26-96	54.2	1,099.5	66	76
454818097060401	127N52W 7CCCD R	R2-95-08	Veblen	147	2.4	12-10-96	30.6	1,194.3	128	138
454543097095301	127N52W21DDDD R	R2-95-07	Test hole	102	--	--	--	1,269	--	--
455558096355301	128N47W 5AAAD R	R2-96-65	Test hole	220	--	--	--	975	--	--
455359096341601	128N47W22BBAA R	LTR-23	--	70	1.7	--	--	975	33.3	43.3
455229096350501	128N47W28ABCA R	LTR NO.23	Test hole	20	--	--	--	974	--	--
455601096393301	128N48W 1BBCB R	R2-96-64	Test hole	204	--	--	--	1,044	--	--
455334096372101	128N48W 1CCDC R	R2-96-61	Test hole	314	--	--	--	1,021.8	--	--
455334096372102	128N48W 1CCDC2 R	R2-96-62	Fairmount[1]	222	1.6	09-26-96	50.4	1,021.8	193	203
455336096400301	128N48W 4DDDD R	R2-96-63	Fairmount[1]	252	0.2	12-10-96	20.6	1,046.6	218	238
455534096432001	128N48W 5DADD R	R2-96-66	Test hole	300	--	--	--	1,071	--	--
455423096434501	128N48W 6BBBB R	LTR NO.10	Fairmount[1]	282	3.1	12-10-96	10.5	1,098.2	249	259
455147096400301	128N48W21AAAA R	LTR-8	Test hole	203	--	--	--	1,057	--	--
455055096374101	128N48W26AAAA R	R2-96-60	Test hole	182	--	--	--	983	--	--
455007096400201	128N48W28DDDD R	LTR NO.20	Test hole	240	--	--	--	1,071	--	--
455321096473201	128N49W10BBCC R	R2-96-67	Test hole	280	--	--	--	1,095	--	--
455146096500001	128N49W20BBBB R	LTR NO. 6	Fairmount[1]	223	4.1	12-10-96	9.6	1,082.6	190	200

Table 1. Selected site information for observation wells and test holes completed during the reconnaissance and comprehensive drilling programs—Continued

[--, no data]

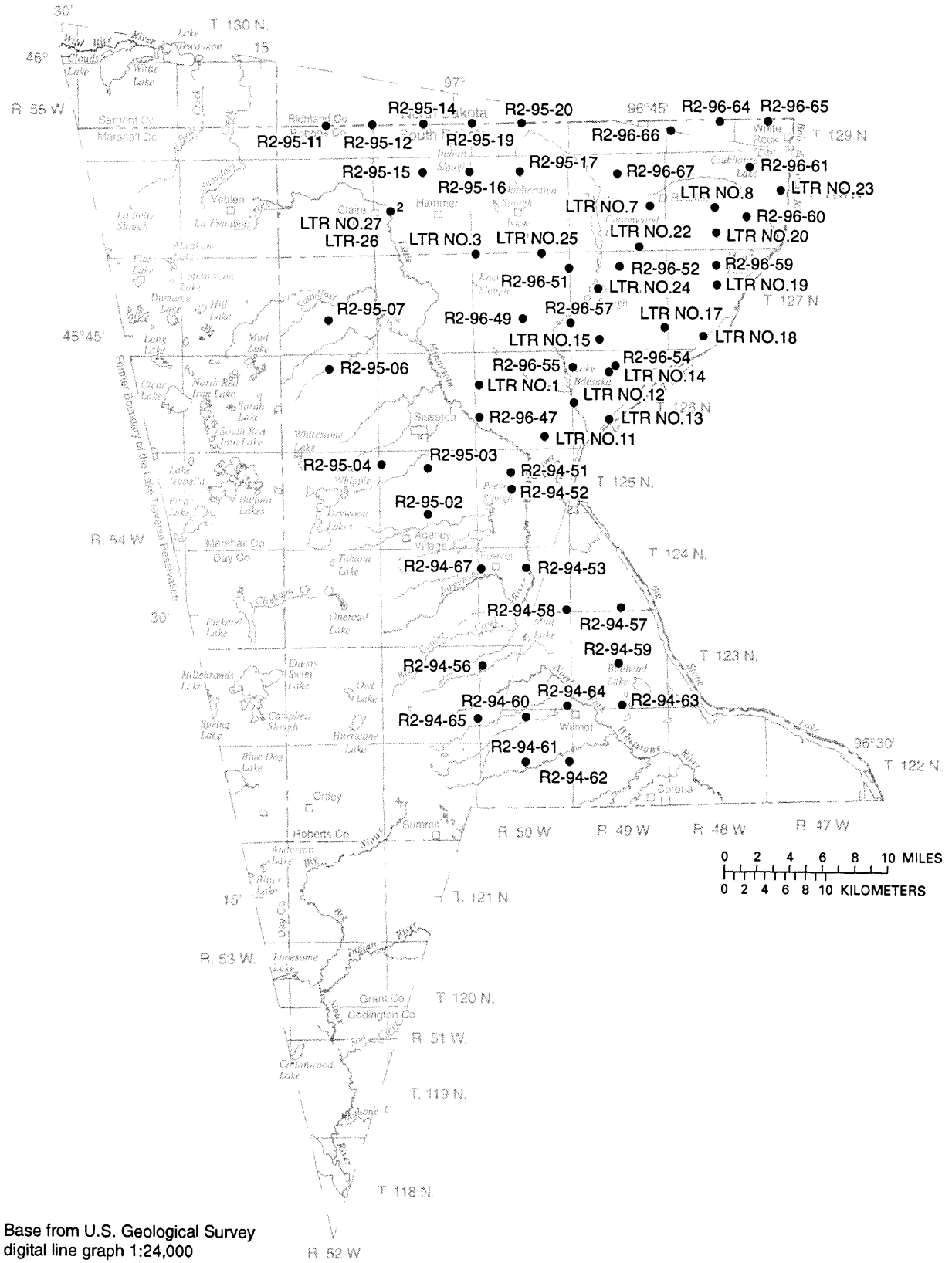
Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measure-ment	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
455156096450301	128N49W23AAAA R	LTR NO. 7	Test hole	223	--	--	--	1,065	--	--
454912096461701	128N49W35CCCC R	LTR NO.22	Test hole	340	--	--	--	1,092	--	--
455003096434701	128N49W36AAAA R	LTR-21	Fairmount[1]	240	4.0	12-10-96	1.5	1,078.9	191	201
455333096550001	128N50W10BBBB R	R2-95-17	Test hole	242	--	--	--	1,092.3	--	--
455333096550002	128N50W10BBBB2 R	R2-95-18	Veblen[1]	57	2.3	12-10-96	16.0	1,092.3	47	57
455148096550001	128N50W21AAAA R	LTR NO. 5	Fairmount[1]	283	2.5	12-10-96	4.8	1,093.7	210	220
455333097022901	128N51W10BBBB R	R2-95-15	Test hole	262	--	--	--	1,190	--	--
455333096585201	128N51W12AAAB R	R2-95-16	Test hole	362	--	--	--	1,160	--	--
455148097050201	128N51W18DDDD R	LTR NO.26	Test hole	60	--	--	--	1,194	--	--
455148097050202	128N51W18DDDD2 R	LTR NO.27	Test hole	230	--	--	--	1,192	--	--
455148097001401	128N51W23AABA R	LTR-4	Veblen[1]	283	2.9	12-10-96	54.2	1,210.0	170	180
455053097061701	128N52W25AAAB R	R2-95-09	Veblen	222	2.4	12-10-96	18.2	1,188.7	191	201
455053097061702	128N52W25AAAB2 R	R2-95-10	Veblen	163	2.3	12-10-96	43.7	1,188.9	153	163
455457096395201	129N48W33ADDA R	LTR NO. 9	Fairmount[1]	253	2.1	12-10-96	-0.5	1,051.7	222	232
455607096545001	129N50W27BBBB R	R2-95-20	Test hole	282	--	--	--	1,106	--	--
455607096545002	129N50W27BBBB2 R	R2-95-21	--	182	2.2	10-18-95	2.5	1,109.0	161	171
455607096583901	129N51W25AAAD R	R2-95-19	Test hole	322	--	--	--	1,165	--	--
455608097022301	129N51W27BBBB R	R2-95-14	Test hole	262	--	--	--	1,207	--	--
455608097061701	129N52W25AAAB R	R2-95-12	Test hole	282	--	--	--	1,194.1	--	--
455608097061702	129N52W25AAAB2 R	R2-95-13	Veblen	178	2.4	12-10-96	23.9	1,194.1	168	178
455606097095301	129N52W28AAAD R	R2-95-11	Test hole	302	--	--	--	1,210	--	--

[1]Preliminary selection of aquifer.



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 3. Location of observation wells installed between 1988 and 1996 for the study.



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 4. Location of test holes drilled between 1988 and 1996 for the study.

All observation wells have 2-inch PVC casing and screen. The wells were gravel packed with washed sand and were sealed with bentonite to approximately 20 feet below land surface and with neat cement from the top of the bentonite to the land surface. The wells were developed using compressed air, after which 5-feet-tall metal protectors were installed over the top of each well.

The geologic logs for the test holes and wells completed during the reconnaissance and comprehensive drilling programs are presented in Section B of the Supplemental Information section. The logs are presented in the order listed in table 1. Information regarding special construction details, site characteristics, and electric-log availability are indicated in the notes following the geologic logs. The electric logs may be obtained from the U.S. Geological Survey in Huron, South Dakota.

In additional to the wells specifically installed for the water-resources investigation, other observation wells have been incorporated into the study. Studies similar to the Lake Traverse/Roberts County Water-Resources Investigation have been completed for Codington and Grant Counties (Hansen, 1990), Marshall County (Koch, 1975), and Day County (Leap, 1988) in South Dakota by the USGS and SDGS, and for Sargent County (Armstrong, 1979, 1982) and Richland County (Baker, 1966; Baker and Paulson, 1967) in North Dakota by the USGS and North Dakota Geological Survey. Comprehensive drilling programs were conducted as part of these investigations. The observation wells that were installed during these other county studies that are within the former boundary of the Lake Traverse Reservation have been incorporated into the study for water-level monitoring; these water-level measurements will be included in the second data report published for this study.

The SDDENR has installed observation wells throughout South Dakota and frequently measures the water levels in these wells. Fifty-nine SDDENR observation wells that are located within or near Roberts County and the former boundary of the Lake Traverse Reservation have been incorporated into the study. Water levels for these wells are presented in the Supplemental Information section of this report, and water levels measured after 1996 will be included in the second data report published for this study. The altitudes of most of these wells that are located in Roberts County have been determined using GPS software. Selected information for the SDDENR observation wells that have been incorporated into this study is presented in table 2, and the locations are shown in figure 5.

The NDSWC has installed observation wells throughout North Dakota, and water levels are available for some wells. Eight NDSWC observation wells that have recent water-level measurements are located within the former boundary of the Lake Traverse Reservation. Water levels for these wells are presented in the Supplemental Information section of this report. Selected site information for the eight NDSWC that have been incorporated into this study is presented in table 2, and the locations are shown in figure 5. Additional NDSWC observation wells may be incorporated into the study for future water-level measurements.

The wells in table 2 are identified by the 15-digit station identification number based on their latitudes and longitudes, the USGS local number based on the Federal land-survey system, and the other identifier, all assigned by the same methods previously described. The other identifier (table 2) for the South Dakota wells was designated by the SDDENR and denotes the county (CD, Codington; GT, Grant; DA, Day; ML, Marshall; RB, Roberts) followed by the year and sequence in which it was drilled. The other identifier (table 2) for the North Dakota wells was designated by the NDSWC. The sequence number in table 2 is a sequential number that is used to identify the wells in figure 5.

GROUND-WATER DATA

The major aquifers in the study area consist of unconsolidated glacial drift and alluvial deposits. The major glacial aquifers that are present in the study area in South Dakota include the Big Sioux, Coteau Lakes, Fairmount, Prairie Coteau, Revillo, Veblen, and Wilmot aquifers. The major glacial aquifer present in the study area in North Dakota is the Brightwood aquifer. Because several different studies have been conducted in the area and the aquifers in these studies were named for a localized area, it is possible that some of these aquifers are interconnected but named differently based on location. This issue will be addressed in the planned Water-Resources Investigation Report for this study.

Table 2. Selected information for South Dakota Department of Environment and Natural Resources observation wells and North Dakota State Water Commission observation wells

[--, no data]

Station identification number	Local number	Other identifier	Sequence number	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
South Dakota State Department of Environment and Natural Resources observation wells									
450205097073302	118N52W18BBBB2	CD-77A	1	Codington	1,775	--	180	--	--
445930097070901	118N52W30CDCD	CD-76B	2	Codington	1,753.2	Big Sioux	50	24.9	29.9
450655097092301	119N52W 4ADDD R	CD-77B	3	Codington	1,770	Big Sioux	20	7.6	12.6
450538097083901	119N52W10DDDD R	CD-77C	4	Codington	1,770	Big Sioux	20	9.2	14.2
450208097101401	119N52W33DCDC R	CD-60A	5	Codington	1,745	Big Sioux	50	25	27
450947097060901	120N51W19BBCC R	GT-77A	6	Grant	1,895.0	Prairie Coteau	190	172.1	177.1
451143097110501	120N52W 9BBBB R	GT-79C	7	Grant	1,834	Prairie Coteau	140	109	124
451141097061701	120N52W12AAAB R	GT-76C	8	Grant	1,873.1	Prairie Coteau	185	159.1	164.1
450956097083401	120N52W23BBBB R	GT-76B	9	Grant	1,820.9	Prairie Coteau	140	117.5	122.5
451047097024401	120N52W26BBBB	GT-77F	10	Grant	1,969	--	230	197	202
450814097091601	120N52W27CDDD R	CD-76D	11	Grant	1,800	Prairie Coteau	129	112.6	128.6
450814097095301	120N52W28DDDD R	CD-56A	12	Grant	1,781.6	Big Sioux	19	--	--
451050097161601	120N54W23DDDC	DA-78H	13	Grant	1,830	Prairie Coteau	200	194	198
451848096363501	121N47W 6CCCC	GT-79E	14	Grant	1,104.0	Veblen	132	123.00	128.00
451418097045501	121N51W29BBBB R	GT-77E	15	Grant	1,955	--	245	221.3	226.3
451606097072501	121N52W 2ADDD R	GT-82A	16	Grant	1,881.3	Big Sioux	35	16.8	21.8
451608097114101	121N52W 8DCCC R	GT-77B	17	Grant	1,831.2	Big Sioux	50	15.7	20.7
451605097071701	121N52W13BBBA R	GT-79A	18	Grant	1,916.9	Prairie Coteau	210	163	198.1
451423097095201	121N52W22CCCC R	GT-77C	19	Grant	1,837	Prairie Coteau	185	97.3	102.3
451328097072301	121N52W25CCCC R	GT-79B	20	Grant	1,880	Prairie Coteau	185	138.4	183.4
451340097121801	121N52W29CCBB R	GT-77D	21	Grant	1,860	Big Sioux	35	18.9	23.9
451506097170401	121N54W34AADA	DA-78E	22	Day	1,803	--	90	77.8	82.8
452352096513901	122N49W 7BBBB	RB-77N	23	Roberts	1,199.9	Veblen	200	179	184

Table 2. Selected information for South Dakota Department of Environment and Natural Resources observation wells and North Dakota State Water Commission observation wells—Continued

[--, no data]

Station identification number	Local number	Other identifier	Sequence number	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
South Dakota State Department of Environment and Natural Resources observation wells—Continued									
452257096491801	122N49W17AAAD	RB-77P	24	Roberts	1,163.9	--	65	38	43
452302096503101	122N49W18AAAA	RB-77O	25	Roberts	1,184.2	--	75	61	66
452117096514201	122N49W30BBBB	RB-77Q	26	Roberts	1,248.3	--	165	146	151
452304097083901	122N52W 2BBBB R	RB-77T	27	Roberts	1,910.9	Coteau Lakes	65	52.4	57.4
452215097121801	122N52W 5CCCC R	RB-77R	28	Roberts	1,871.7	Coteau Lakes	35	24.9	29.9
452122097072301	122N52W12CCCC R	RB-76B	29	Roberts	1,904.9	Coteau Lakes	50	26.5	31.5
452119097083901	122N52W14BBBB R	RB-76A	30	Roberts	1,897.9	Coteau Lakes	50	28.1	33.1
452115097110601	122N52W16BBBC R	RB-82B	31	Roberts	1,855.5	Coteau Lakes	35	16.6	21.6
451936097122301	122N52W30AAAA R	RB-82A	32	Roberts	1,861	Coteau Lakes	50	25	30
451841097110901	122N52W32AAAA R	RB-77S	33	Roberts	1,851.7	Coteau Lakes	110	18.1	23.1
452120097145001	122N53W11DDDD R	DA-78D	34	Day	1,830	Prairie Coteau	40	27.4	32.4
452633096453401	123N49W24CCCC	RB-81B	35	Roberts	1,148.6	Veblen	140	97	107
452721096525701	123N50W23AAAA	RB-77L	36	Roberts	1,175.0	Veblen	170	146	151
452537096525701	123N50W35AAAA	RB-77M	37	Roberts	1,216.1	Veblen	200	178.1	183.1
452540097130901	123N52W19BABA R	RB-81C	38	Roberts	1,918.0	Coteau Lakes	26	8.1	18.1
452357097072401	123N52W25CCCC R	RB-81D	39	Roberts	1,931.9	Coteau Lakes	32	19	29
453819096572501	126N50W32CCCB R	RB-79D	40	Roberts	1,164.4	Veblen	112.1	97.1	112.1
453928096595601	126N51W35AADA R	RB-79C	41	Roberts	1,160.6	Veblen	51	35.2	50.2
454911096384601	127N48W 2BBBB R	RB-77F	42	Roberts	1,069	Veblen	80	38.5	43.5
454818096434501	127N48W 7BBBB R	RB-77G	43	Roberts	1,079.9	Veblen	50	38.4	43.4
454818096434502	127N48W 7BBBB2 R	RB-77H	44	Roberts	1,079.7	Fairmount	245	197.4	202.4
454737096424801	127N48W 7DDBB R	RB-77A	45	Roberts	1,100	Veblen	77	59.4	64.4
454634096434501	127N48W18DDDD R	RB-77B	46	Roberts	1,097.7	Fairmount	240	208.7	213.7

Table 2. Selected information for South Dakota Department of Environment and Natural Resources observation wells and North Dakota State Water Commission observation wells—Continued

[--, no data]

Station identification number	Local number	Other identifier	Sequence number	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
South Dakota State Department of Environment and Natural Resources observation wells—Continued									
454658096450301	127N49W14DAAA R	RB-77I	47	Roberts	1,109.3	Fairmount	170	158	163
454658096450402	127N49W14DAAA2 R	RB-77J	48	Roberts	1,109.9	Veblen	80	75	80
454449096450201	127N49W26DDDD R	RB-77C	49	Roberts	1,124.5	Fairmount	270	265	270
454449096450101	127N49W36BBBB R	RB-77K	50	Roberts	1,129.0	Veblen	125	118.5	123.5
454910097011501	127N51W 3AAAA R	RB-81A	51	Roberts	1,226.3	Veblen	275	185.88	197.88
455148096423101	128N48W20BBBB R	RB-77D	52	Roberts	1,070.7	Veblen	95	38	43
455005096411801	128N48W29DDDD R	RB-77E	53	Roberts	1,081.5	Veblen	110	58.4	63.4
455147096551301	128N50W21AABA R	RB-79A	54	Roberts	1,094.3	--	127	109.7	124.7
455057096561501	128N50W21CCCC R	RB-79B	55	Roberts	1,112.8	Veblen	50	26.7	41.7
455329097172501	128N53W10BBBB R	ML-69A	56	Marshall	1,250	Veblen	215	120	--
455606097322901	128N56W 3BBBB	ML-70C	57	Marshall	1,352	--	230	--	--
455606097172501	129N53W27BBBB R	ML-70A	58	Marshall	1,255	Veblen	260	100	--
455607097211501	129N54W25AAAA R	ML-70B	59	Marshall	1,260	Veblen	230	120	140
North Dakota State Water Commission observation wells									
455611096520101	129N50W24CCD1 R	NDSWC 12186A	60	Richland	1,089.5	--	215	198	203
455611096520102	129N50W24CCD2 R	NDSWC 12186B	61	Richland	1,089.5	--	143	137	142
455611096520103	129N50W24CCD3 R	NDSWC 12186C	62	Richland	1,089.5	--	90	82	87
455755097045501	129N51W 8CCC R	NDSWC 13037	63	Richland	1,196.2	Brightwood	240	148	153
455701097051501	129N51W19ABA R	NDSWC 13422	64	Richland	1,191.2	Brightwood	240	128	133
455608097010801	129N51W26BBB2 R	NDSWC 12276B	65	Roberts	1,198.7	--	80	75	80
455932097092401	129N52W14AAA	NDSWC 13494	66	Richland	1,220	Brightwood	270	78	83
455610097110901	129N52W21CCC R	NDSWC 12277	67	Richland	1,221.2	--	280	128	133

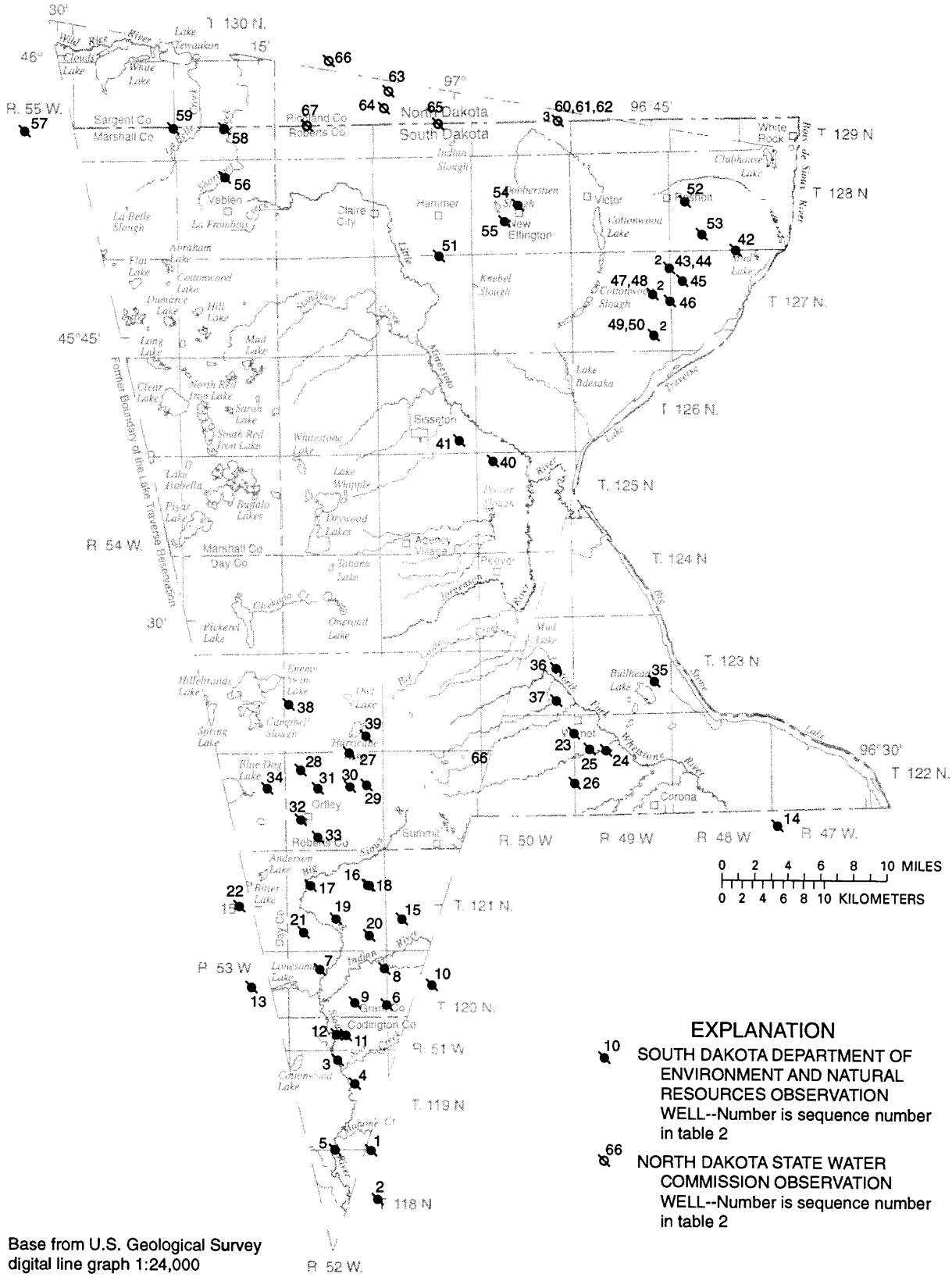


Figure 5. Location of selected South Dakota Department of Environment and Natural Resources and North Dakota State Water Commision observation wells in and near study area.

Hydrographs

Water levels have been compiled for 59 SDDENR observation wells and 8 NDSWC observation wells located within and near the study area. SDDENR and NDSWC personnel have been responsible for the maintenance of the observation wells and for the collection of the water-level data.

Site descriptions and hydrographs for South Dakota observation wells (figs. C1-C58) and North Dakota observation wells (figs. C60-C67) are presented in Section C of the Supplemental Information section. The period of record shown is from the earliest available record through 1996. The water levels are given in feet above (+) or below land surface. A dashed line is shown on the hydrographs when the interval between water-level measurements exceeds one year. The data used to generate the hydrographs are available in the USGS's "Ground Water Site Inventory" (GWSI) data base.

Water-Quality Data

Water-quality samples were collected from 23 of the observation wells that were installed during the reconnaissance and comprehensive drilling programs. The 19 observation wells installed during 1994-96 as part of the comprehensive drilling program have been sampled; however, four wells installed during the reconnaissance drilling program were not sampled because of inaccessibility or because of bent or broken casings. All water-quality samples were collected by USGS field personnel and were analyzed by the USGS National Water Quality Laboratory (NWQL) in Arvada, Colorado. The samples were analyzed for field measurements, common and trace elements, nutrients, and radiometrics. Additionally, bacteria samples (fecal coliform and fecal streptococci) were collected at wells with depths less than 100 feet below land surface. The location of the sampling sites are shown in figure 6 and the analytical results are presented in table 3.

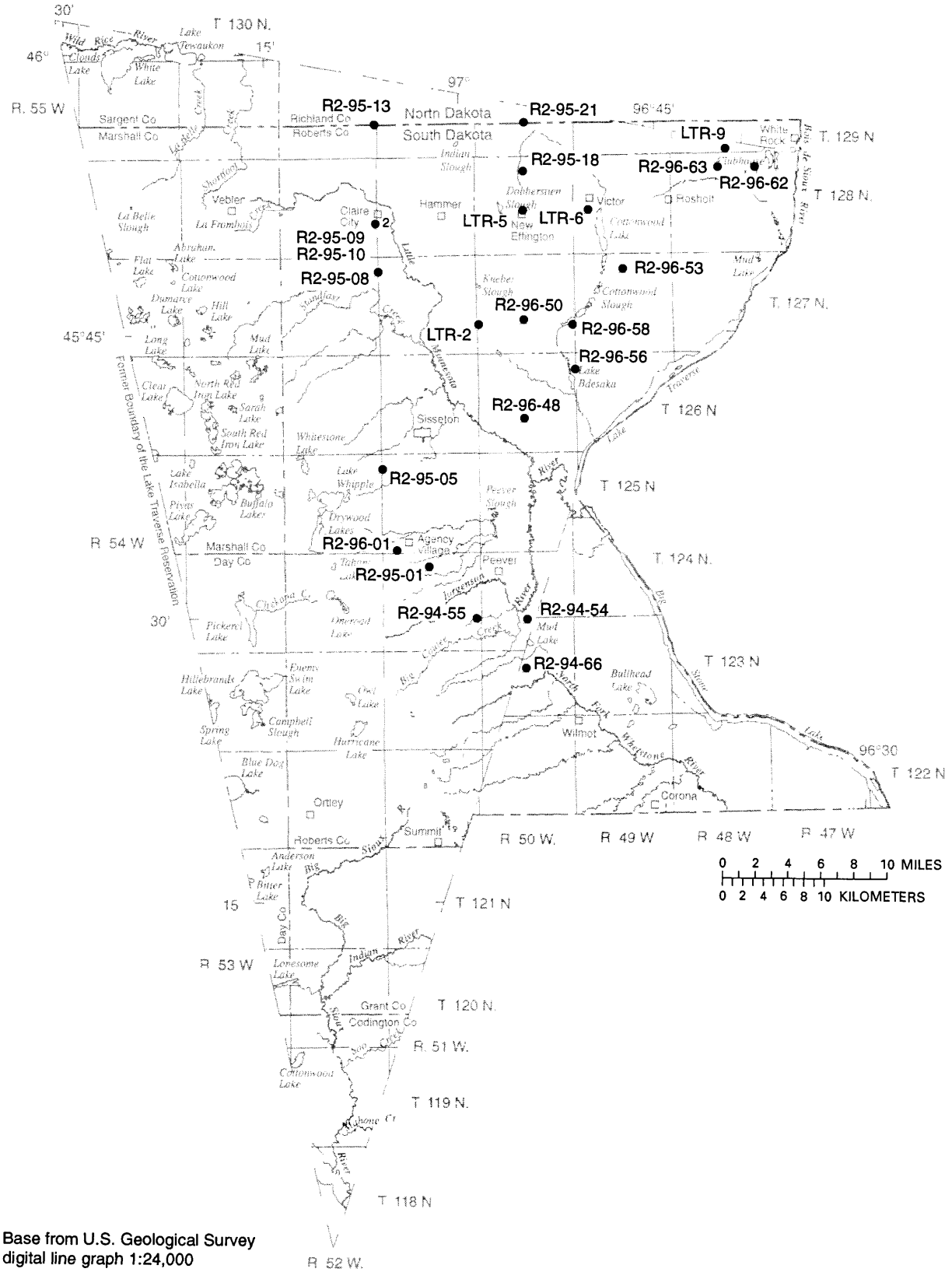
The collection and processing of the ground-water samples followed methods presented in Wood (1976) and Horowitz and others (1994). All ground-water sampling equipment that came in contact with the sample water (submersible pump, tubing, bailer, and churn splitter) was cleaned prior to the sampling trip with a phosphate-free detergent, dilute hydrochloric acid, and deionized water by procedures described by Horowitz and others (1994). After samples were collected from a well, the sampling device (pump or bailer) and tubing were rinsed with deionized water before sampling the next well.

In order to assure that a representative sample from the aquifer at each well was collected, the ground-water samples were collected after purging a minimum of three casing volumes from each well and after field measurements of specific conductance, pH, temperature, and dissolved oxygen had stabilized (Wood, 1976). Stability was reached when specific conductance differed less than 5 percent between readings, pH differed less than 0.1 standard units between readings, and water temperature differed less than 0.2°C between readings. Samples were collected from the observation wells using a stainless-steel submersible pump, with the exception of the sample collected from observation well R2-96-01. Water from the observation wells was passed through a flow-through chamber without coming into contact with the atmosphere so that field measurements were measured in a closed system. The water-quality samples were collected in appropriate bottles directly from a collection tube.

The sample from observation well R2-96-01 was collected using a teflon bailer because the water-level depth exceeded the lift capacity of the submersible pump. After the water had been purged from R2-96-01 with the bailer, the sample water was bailed into a churn splitter. A peristaltic pump was used to collect the samples from the churn splitter. The field measurements were made as quickly as possible, but they were not measured in a closed system.

SURFACE-WATER DATA

Numerous streams and lakes are present within the study area. Four major river systems drain the study area: the Upper Red River, the Minnesota River, the Big Sioux River, and the James River (fig. 7). The portion of the study area that is included in the James River Basin contains many lakes, and much of the area generally is noncontributing. Much of the Big Sioux River Basin also is considered noncontributing. Drainage from the Minnesota, Big Sioux, and James River Basins is to the Gulf of Mexico, and drainage from the Upper Red River Basin is to Hudson Bay.



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 6. Location of ground-water sampling sites.

Table 3. Water-quality data for observation wells

[µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; mV, millivolt; mL, milliliter; µg/L, micrograms per liter; pCi/L, picocuries per liter; deg C, degrees Celsius; cols, colonies; µm-mf; micrometer-membrane filter; IT, incremental titration; FET, fixed end point titration; <, less than; --, no data; K, results based on colony count outside the acceptance range (non-ideal colony count)]

Station identification number	Local number	Other identifier	Date	Specific conductance, field (µS/cm) (00095)	pH, field (standard units) (00400)	Temperature, air (deg C) (00020)	Temperature, water (deg C) (00010)
452722096552301	123N50W22BBBB	R2-94-66	10-16-95	1,540	7.1	14.0	9.5
452959096545901	124N50W27BBBB R	R2-94-54	10-16-95	1,080	7.6	20.0	9.5
453240097022701	124N51W 4DDDD R	R2-95-01	10-09-96	2,970	7.4	4.5	11.5
453001096584801	124N51W25AAAB R	R2-94-55	10-16-95	[1]2,630	7.7	29.0	9.5
453751097060702	125N51W 7BBBB2 R	R2-95-05	10-18-95	[1]3,300	6.8	4.0	8.5
453331097045301	125N51W32CCCC R	R2-96-01	10-09-96	2,380	7.3	11.0	10.0
454304096511302	126N49W 7BBBB2 R	R2-96-56	10-08-96	2,020	6.7	8.0	8.5
454028096550001	126N50W21DDDD R	R2-96-48	10-08-96	1,700	6.9	21.0	11.0
454818096473002	127N49W10BBBB2 R	R2-96-53	10-07-96	1,070	7.3	17.0	9.5
			[2]10-07-96	--	--	--	--
454547096584301	127N50W19CCCB R	LTR-2	10-17-95	1,310	7.1	11.0	9.0
454541096550001	127N50W21DDDD R	R2-96-50	10-08-96	1,220	6.9	22.5	11.5
454523096511602	127N50W25ADAD2 R	R2-96-58	10-08-96	1,630	6.8	9.5	8.5
454818097060401	127N51W 6CCCD R	R2-95-08	10-17-95	1,240	7.2	10.0	9.0
			[2]10-17-95	--	--	--	--
455334096372102	128N48W 1CCDC2 R	R2-96-62	10-08-96	1,520	7.2	18.5	11.0
455336096400301	128N48W 4DDDD R	R2-96-63	10-08-96	1,420	7.2	18.5	11.0
455146096500001	128N49W20BBBB R	LTR-6	10-18-95	2,410	7.3	7.0	9.0
455333096550002	128N50W10BBBB2 R	R2-95-18	10-17-95	1,880	7.1	18.0	9.5
455148096550001	128N50W21AAAA R	LTR-5	10-17-95	1,780	7.5	14.0	9.0
455053097061701	128N52W25AAAB R	R2-95-09	10-17-95	2,830	7.5	18.0	9.5
455053097061702	128N52W25AAAB2 R	R2-95-10	10-17-95	1,570	7.0	18.0	9.0
455457096395201	129N48W33ADDA R	LTR-9	10-18-95	1,750	7.4	7.0	8.5
455607096545002	129N50W27BBBB2 R	R2-95-21	10-18-95	1,830	7.0	9.0	8.5
455608097061702	129N52W25AAAB2 R	R2-95-13	10-17-95	1,310	7.1	19.0	9.0

Table 3. Water-quality data for observation wells—Continued

Other identifier	Date	Oxygen, dissolved (mg/L) (00300)	Oxygen, dissolved (percent saturation) (00301)	Oxidation reduction potential (mV) (00090)	Coliform, fecal, 0.7 µm-mf (cols/ 100 mL) (31625)	Strep-tococci fecal, KF agar (cols per 100 mL) (31673)	Alkalinity, field, dissolved, IT (mg/L as $CaCO_3$) (39086)	Alkalinity, field, dissolved, FET (mg/L as $CaCO_3$) (00418)	Calcium, dissolved (mg/L as Ca) (00915)
R2-94-66	10-16-95	0.1	1	-99	--	--	401	396	180
R2-94-54	10-16-95	0.1	1	-107	--	--	307	303	140
R2-95-01	10-09-96	0.2	2	-150	--	--	405	397	110
R2-94-55	10-16-95	0.1	0	-80	--	--	379	374	58
R2-95-05	10-18-95	0.1	1	-7	--	--	347	347	530
R2-96-01	10-09-96	--	--	--	--	--	352	349	140
R2-96-56	10-08-96	0.9	8	36	K8	29	390	391	250
R2-96-48	10-08-96	0.1	1	-33	--	--	358	350	160
R2-96-53	10-07-96	0.1	1	-34	0	K1	282	283	140
	[2]10-07-96	--	--	--	--	--	--	--	140
LTR-2	10-17-95	0.3	3	-145	--	--	337	331	140
R2-96-50	10-08-96	0.1	1	-61	--	--	432	432	120
R2-96-58	10-08-96	0.1	1	-5	36	K8	387	384	220
R2-95-08	10-17-95	0.1	1	4	--	--	320	313	100
	[2]10-17-95	--	--	--	--	--	--	--	110
R2-96-62	10-08-96	0.1	1	-97	--	--	341	334	110
R2-96-63	10-08-96	0.1	1	-89	--	--	341	336	77
LTR-6	10-18-95	0.0	0	353	--	--	380	373	140
R2-95-18	10-17-95	0.1	1	-21	--	--	425	416	210
LTR-5	10-17-95	0.0	0	-155	--	--	717	705	36
R2-95-09	10-17-95	0.0	0	-95	--	--	572	562	38
R2-95-10	10-17-95	0.0	0	-51	--	--	401	401	160
LTR-9	10-18-95	0.0	0	-97	--	--	407	401	65
R2-95-21	10-18-95	0.1	1	-68	--	--	437	429	240
R2-95-13	10-17-95	0.0	0	-63	--	--	368	362	200

Table 3. Water-quality data for observation wells—Continued

Other identifier	Date	Magnesium, dissolved (mg/L as Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)	Potassium dissolved (mg/L as K) (00935)	Bicarbonate, field, dissolved, IT (mg/L as HCO_3) (00453)	Carbonate, field, dissolved, IT (mg/L as CO_3) (00452)	Sulfate, dissolved (mg/L as SO_4) (00945)	Chloride, dissolved (mg/L as Cl) (00940)
R2-94-66	10-16-95	65	120	11	489	0	570	5.8
R2-94-54	10-16-95	49	51	7.3	375	0	340	3.6
R2-95-01	10-09-96	49	480	11	495	0	1100	78
R2-94-55	10-16-95	21	490	11	463	0	820	97
R2-95-05	10-18-95	260	63	17	423	0	2100	3.5
R2-96-01	10-09-96	52	320	12	430	0	830	53
R2-96-56	10-08-96	72	100	12	476	0	770	16
R2-96-48	10-08-96	42	140	12	437	0	560	15
R2-96-53	10-07-96	53	7.7	4.2	344	0	320	1.3
	[2]10-07-96	53	7.6	4.3	--	--	320	1.3
LTR-2	10-17-95	33	120	11	411	0	400	29
R2-96-50	10-08-96	34	82	10	528	0	220	8.8
R2-96-58	10-08-96	71	31	9.1	472	0	560	1.5
R2-95-08	10-17-95	26	150	9.8	390	0	330	33
	[2]10-17-95	26	150	10	--	--	330	35
R2-96-62	10-08-96	45	150	8.9	416	0	420	32
R2-96-63	10-08-96	29	180	8.0	416	0	320	46
LTR-6	10-18-95	60	310	9.7	464	0	270	500
R2-95-18	10-17-95	99	160	16	519	0	800	35
LTR-5	10-17-95	19	360	5.5	874	0	12	150
R2-95-09	10-17-95	11	610	11	698	0	400	380
R2-95-10	10-17-95	40	170	11	489	0	510	36
LTR-9	10-18-95	28	300	7.8	497	0	360	130
R2-95-21	10-18-95	74	130	13	533	0	750	24
R2-95-13	10-17-95	49	64	11	449	0	460	6.5

Table 3. Water-quality data for observation wells—Continued

Other identifier	Date	Fluoride, dissolved (mg/L as F) (00950)	Silica, dissolved (mg/L as SiO_2) (00955)	Solids, residue at 180 deg. C dissolved (mg/L) (70300)	Nitrogen, ammonia, dissolved (mg/L as N) (00608)	Nitrogen, nitrite, dissolved (mg/L as N) (00613)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N) (00631)	Phosphorus, ortho, dissolved (mg/L as P) (00671)
R2-94-66	10-16-95	0.2	39	1,290	3.60	0.05	0.06	<0.01
R2-94-54	10-16-95	0.2	38	842	2.50	<0.01	<0.05	0.02
R2-95-01	10-09-96	0.2	33	2,060	6.10	<0.01	<0.05	<0.01
R2-94-55	10-16-95	0.4	30	1,810	3.50	<0.01	<0.05	0.17
R2-95-05	10-18-95	0.2	31	3,500	1.60	0.01	0.29	0.01
R2-96-01	10-09-96	0.4	29	1,640	4.50	<0.01	<0.05	<0.01
R2-96-56	10-08-96	0.3	26	1,590	1.00	<0.01	<0.05	0.01
R2-96-48	10-08-96	0.3	29	1,210	1.60	<0.01	<0.05	<0.01
R2-96-53	10-07-96	0.3	29	764	0.04	<0.01	<0.05	0.03
	[2]10-07-96	0.3	29	760	0.03	<0.01	<0.05	0.03
LTR-2	10-17-95	0.2	28	990	1.20	0.01	<0.05	0.02
R2-96-50	10-08-96	0.2	29	788	1.20	<0.01	<0.05	<0.01
R2-96-58	10-08-96	0.2	27	1,240	0.77	<0.01	<0.05	<0.01
R2-95-08	10-17-95	0.2	30	862	1.20	0.01	<0.05	0.01
	[2]10-17-95	0.2	30	870	1.20	<0.01	<0.05	0.02
R2-96-62	10-08-96	0.4	29	1,030	1.90	<0.01	<0.05	<0.01
R2-96-63	10-08-96	0.4	29	914	2.00	<0.01	<0.05	<0.01
LTR-6	10-18-95	0.3	28	1,600	4.60	<0.01	<0.05	0.02
R2-95-18	10-17-95	0.1	29	1,720	0.86	<0.01	<0.05	<0.01
LTR-5	10-17-95	0.6	30	1,110	6.00	0.02	<0.05	0.48
R2-95-09	10-17-95	0.5	29	1,860	2.50	0.02	<0.05	0.09
R2-95-10	10-17-95	0.1	31	1,230	0.99	<0.01	<0.05	<0.01
LTR-9	10-18-95	0.5	29	1,170	2.80	<0.01	0.50	0.02
R2-95-21	10-18-95	0.2	30	1,630	1.80	<0.01	<0.05	<0.01
R2-95-13	10-17-95	0.1	31	1,080	0.72	0.01	<0.05	<0.01

Table 3. Water-quality data for observation wells—Continued

Other identifier	Date	Aluminum, dissolved (µg/L as Al) (01106)	Arsenic, dissolved (µg/L as As) (01000)	Boron, dissolved (µg/L as B) (01020)	Iron, dissolved (µg/L as Fe) (01046)	Manganese, dissolved (µg/L as Mn) (01056)	Selenium, dissolved (µg/L as Se) (01145)	Gross alpha, dissolved (µg/L as natural uranium) (80030)
R2-94-66	10-16-95	10	<1	790	4,400	110	<1	<3.0
R2-94-54	10-16-95	<10	<1	290	2,100	110	<1	<3.0
R2-95-01	10-09-96	<5.0	<1	2,330	2,400	200	<1	--
R2-94-55	10-16-95	<10	2	2,600	890	99	<1	<3.0
R2-95-05	10-18-95	10	<1	480	2,600	830	3	4.3
R2-96-01	10-09-96	9.1	1	2,160	1,300	210	<1	--
R2-96-56	10-08-96	<5.0	10	531	360	1,200	<1	--
R2-96-48	10-08-96	<5.0	52	627	510	1,200	<1	--
R2-96-53	10-07-96	<5.0	4	52	780	800	<1	--
	[2]10-07-96	<5.0	4	49	820	800	<1	--
LTR-2	10-17-95	<10	8	490	260	820	<1	4.5
R2-96-50	10-08-96	7.3	60	326	1,500	490	<1	--
R2-96-58	10-08-96	<5.0	16	226	590	1,000	<1	--
R2-95-08	10-17-95	<10	33	470	300	810	<1	5.7
	[2]10-17-95	<10	34	470	300	820	<1	5.9
R2-96-62	10-08-96	<5.0	3	658	1,700	170	<1	--
R2-96-63	10-08-96	7.5	3	813	670	84	<1	--
LTR-6	10-18-95	<10	<1	900	1,500	120	<1	4.5
R2-95-18	10-17-95	<10	26	500	830	490	<1	10
LTR-5	10-17-95	<10	<1	1,600	890	44	<1	3.7
R2-95-09	10-17-95	<10	24	2,500	240	170	<1	6.2
R2-95-10	10-17-95	<10	46	780	1,500	910	<1	4.3
LTR-9	10-18-95	<10	<1	1,000	1,100	41	<1	<3.0
R2-95-21	10-18-95	<10	11	680	2,900	420	<1	7.0
R2-95-13	10-17-95	<10	67	370	810	970	<1	11

Table 3. Water-quality data for observation wells—Continued

Other identifier	Date	Alpha, count, 2 sigma, dis as natural uranium (µg/L) (75986)	Alpha, radio, dis as Th-230 (pCi/L) (04126)	Alpha, count, 2 sigma, dis as Th-230 (pCi/L) (75987)	Gross beta, dissolved (pCi/L as Cs-137) (03515)	Beta, 2 sigma, dis, as Cs-137 (pCi/L) (75989)	Gross beta, dissolved (pCi/L as Sr/Y-90) (80050)	Beta, 2 sigma, dis, as Sr90/Y90 (pCi/L) (75988)
R2-94-66	10-16-95	1.2	<3.0	0.87	15	3.9	11	2.9
R2-94-54	10-16-95	1.2	<3.0	0.86	8.7	2.5	6.6	1.9
R2-95-01	10-09-96	--	<3.0	0.39	24	13	--	--
R2-94-55	10-16-95	2.0	<3.0	1.4	12	4.3	9.3	3.3
R2-95-05	10-18-95	5.0	3.0	3.6	21	7.2	16	5.5
R2-96-01	10-09-96	--	<3.0	0.41	24	11	--	--
R2-96-56	10-08-96	--	11	1.8	43	14	--	--
R2-96-48	10-08-96	--	4.9	1.0	29	10	--	--
R2-96-53	10-07-96	--	10	1.8	26	8.8	--	--
	[2]10-07-96	--	7.8	1.4	24	8.1	--	--
LTR-2	10-17-95	2.1	3.2	1.5	14	3.3	11	2.5
R2-96-50	10-08-96	--	7.1	1.3	33	10	--	--
R2-96-58	10-08-96	--	9.4	1.7	29	11	--	--
R2-95-08	10-17-95	2.3	4.0	1.6	11	2.8	8.6	2.1
	[2]10-17-95	2.0	4.1	1.4	12	2.9	9.0	2.2
R2-96-62	10-08-96	--	<3.0	0.59	18	7.7	--	--
R2-96-63	10-08-96	--	<3.0	0.68	18	7.3	--	--
LTR-6	10-18-95	2.9	3.1	2.0	13	4.5	9.7	3.3
R2-95-18	10-17-95	4.7	7.4	3.5	26	5.8	19	4.3
LTR-5	10-17-95	2.6	<3.0	1.7	7.4	3.0	5.6	2.3
R2-95-09	10-17-95	3.9	3.9	2.5	11	4.5	8.1	3.4
R2-95-10	10-17-95	2.4	<3.0	1.7	14	3.7	11	2.8
LTR-9	10-18-95	1.5	<3.0	1.0	9.3	3.1	7.0	2.4
R2-95-21	10-18-95	3.7	5.1	2.7	19	4.8	14	3.6
R2-95-13	10-17-95	3.7	7.8	2.6	17	3.8	13	2.9

[1]Laboratory value is presented because field value was determined to be erroneous.
[2]Indicates duplicate sample taken for quality-assurance purposes.

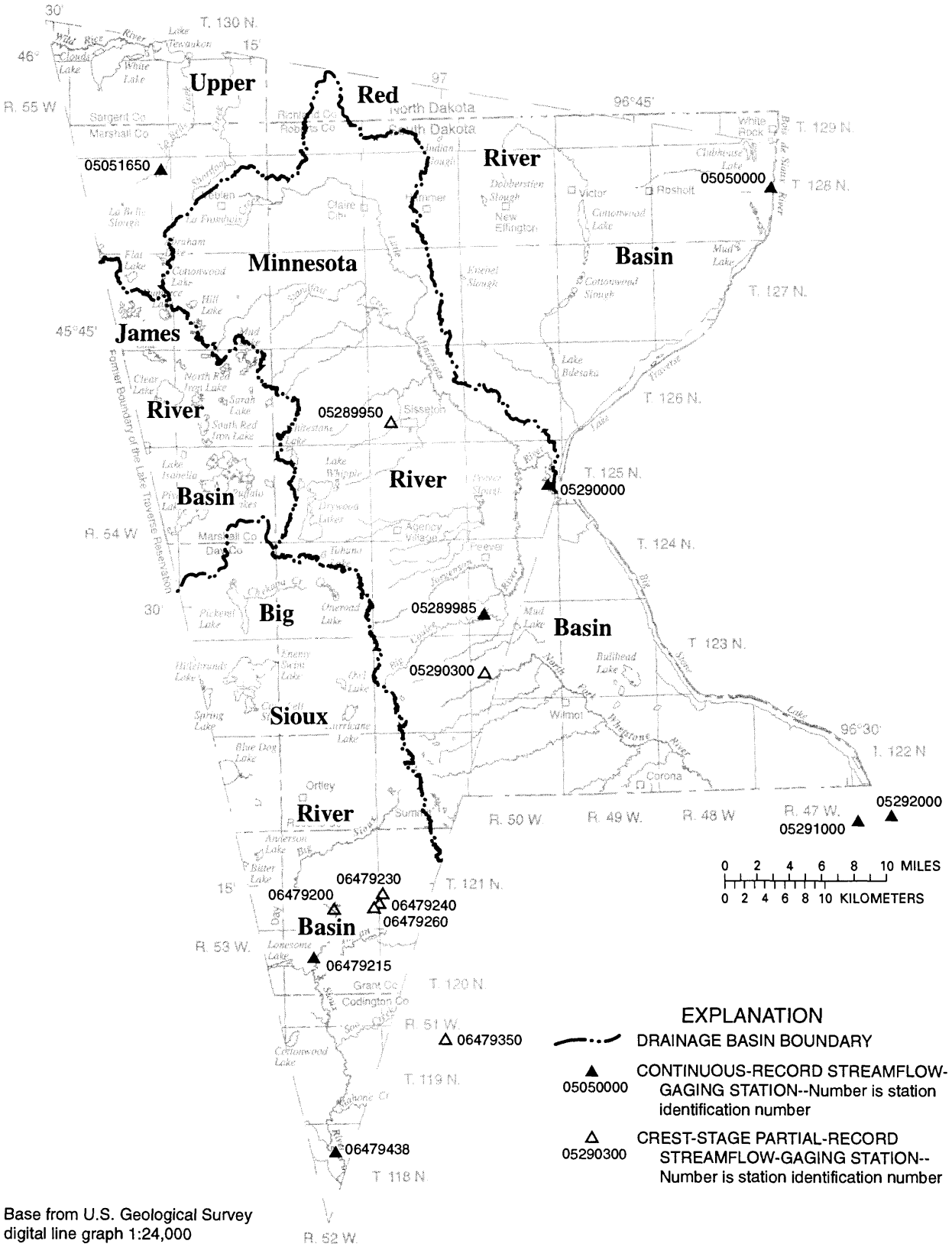


Figure 7. Drainage basins and location of selected streamflow-gaging stations within and near the study area.

Streams

The major streams in the study area include the Big Sioux River, Bois de Sioux River, Little Minnesota River, Whetstone River, LaBelle Creek, and Big Coulee Creek. Locations of 15 streamflow-gaging stations that have been operated by the USGS within or near the study area are presented in figure 7. Selected streamflow information and water-quality data are presented in this section of the report. Water-quality data were collected at six of the streamflow-gaging stations.

Streamflow Data

The streamflow-gaging stations include eight continuous-record gages and seven crest-stage gages. A continuous-record gage allows for the computation of instantaneous or mean daily discharge for any time, or any period of time, during the period of record. A crest-stage gage is a device that will record the peak stage occurring between inspections of the gage. The date of the maximum stage at a crest-stage gage is not always certain, but usually is estimated by comparison with records for nearby continuous-record stations, weather records, or local inquiry. Selected data for the gaging stations are presented in table 4. All continuous-record gaging stations listed in table 4 were in operation during water year 1996; however, all seven of the crest-stage gages had been previously discontinued.

Table 4. Selected data for streamflow-gaging stations in and near the study area

[--, not computed]

Station number	Station name	Drainage area (square miles)	Non-contributing drainage area (square miles)	Period of record used (water year)	Discharge (cubic feet per second)		
					Maximum instant-aneous	Minimum daily	Average
05050000	Bois de Sioux River near White Rock	1,160	0	1942-1996	3,770	0.00	96.0
05051650	LaBelle Creek near Veblen	8.74	0	1988-1996	664	.00	1.91
[1]05289950	Little Minnesota River tributary at Sisseton	4.21	0	1970-1979	393	--	--
05289985	Big Coulee Creek near Peever	12.1	0	1988-1996	456	.00	3.55
05290000	Little Minnesota River near Peever	447	0	1940-1981 1990-1996	8,900	.00	48.0
[1]05290300	North Fork Whetstone River near Wilmot	0.96	0	1970-1979	53	--	--
05291000	Whetstone River near Big Stone City	389	0	1931-1996	6,870	.00	56.4
05292000	Minnesota River at Ortonville, Minn.	1,160	0	1938-1996	3,060	.00	124
[1]06479200	Big Sioux River near Ortley	53.8	0	1956-1968	950	--	--
06479215	Big Sioux River near Florence	638	570	1984-1996	1,810	.00	16.1
[1]06479230	Big Sioux River tributary near Summit	1.27	0	[2]1956-1967	92	--	--
[1]06479240	Big Sioux River tributary no. 2 near Summit	0.26	0	1956-1973	53	--	--
[1]06479260	Big Sioux River tributary no. 3 near Summit	6.61	0	1956-1978	1,050	--	--
[1]06479350	Soo Creek tributary near South Shore	1.56	0	1970-1979	280	--	--
06479438	Big Sioux River near Watertown	1,007	779	1973-1996	4,970	.00	38.8

[1]Indicates a crest-stage gaging station.
[2]Maximum discharge was not determined from 1957-58 and 1964-67.

Peak-Flow Information

Peak-flow frequency estimates were developed for the continuous-record and crest-stage gaging stations that had 10 or more years of record (table 5). Of the 15 gages included in this study, LaBelle Creek near Veblen (station 05051650), Big Coulee Creek near Peever (station 05289985), and Big Sioux River tributary near Summit (06479230) were the only stations that did not meet this criteria. The peak-flow frequency estimates were developed using log-Pearson Type III procedures for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years. The historic peak flows for all stations are presented in Section D of the Supplemental Information section. Peak-flow information through water year 1994 for selected stations with 10 or more years of record were published by Burr and Korkow (1996).

Summary Statistics

Six tables and four graphs are presented for each of the eight continuous-record gaging stations for the period of record listed in table 4. The tables for each station include: (1) monthly and annual mean flows; (2) selected statistics for monthly and annual mean flow; (3) correlation matrix for monthly mean flow; (4) serial correlation for 1-year lag for monthly mean flow; (5) lowest mean flows and ranking for 1, 3, 7, 14, 30, 60, 90, 120, and 183 consecutive-day low flows; and (6) highest mean flows and ranking for 1, 3, 7, 14, 30, 60, 90, 120, and 183 consecutive-day high flows. The graphs for each station include representations of (A) annual mean flow; (B) distribution of monthly mean flow; (C) duration curve of daily mean flow; and (D) duration hydrographs of daily mean flow.

The tables are presented in Section E of the Supplemental Information section. For each station, the first table contains monthly and annual mean flow values for the selected statistics period.

The second table for each station contains selected statistics for monthly and annual mean flow. Each table includes the total number of months used in the analysis, maximum, 75th percentile, 50th percentile, 25th percentile, minimum, mean, standard deviation, skewness, coefficient of variation, and the percent of annual flow.

The third table presents the serial auto correlation matrix for the 1-year lag for monthly mean flow. The correlation coefficient is a measure of the strength of the linear relationship between two variables (Ott, 1993). The correlation coefficient ranges from -1 to +1; a correlation coefficient equal to zero indicates that there is no relationship between the two variables. A positive correlation indicates that both variables vary in the same direction, and a negative correlation indicates that one variable increases as the other variable decreases. The greater the correlation coefficient, the stronger the relationship is between the two variables. For example, in table E2.3, the correlation coefficient for October of each year to October of the following year is 0.985.

The fourth table presents a correlation matrix for monthly mean flow. This matrix contains a correlation coefficient for each month, relative to monthly flow for other months. For example, in table E1.4, the correlation coefficient between October and November is 0.505.

The lowest mean flow and ranking, by year, for 1, 3, 7, 14, 30, 60, 90, 120, and 183 consecutive-day periods is presented in the fifth table. Similarly, the highest mean flow and ranking, by year, for 1, 3, 7, 15, 30, 60, 90, 120, and 183 consecutive-day periods is presented in the sixth table.

Graphical representations of the variations in the annual, monthly, and daily mean flow for each of the eight continuous-record gaging stations are presented in figures 8-15, with four graphs on each figure labeled A, B, C, and D as described previously. Graph A shows the annual mean flow values, and graph B shows a distribution of monthly mean flow. Graph C shows the duration curve for daily mean flows, and Graph D shows the duration hydrographs for selected exceedances.

Water-Quality Data

Water-quality samples were collected from six streams in 1995. The streams were sampled at the most downstream gaging station within or near the study area. All water-quality samples were collected by USGS field personnel and were analyzed by the USGS NWQL. The samples were analyzed for field measurements, common and trace elements, nutrients, and bacteria. The locations of the sampling sites are shown in figure 16, and the analytical results are presented in table 6.

Methods described by Horowitz and others (1994) for the collection and processing of surface-water samples were used. Samples from the Big Sioux River and the Little Minnesota River were collected using the equal-width-increment method described in Edwards and Glysson (1988). A single vertical sample was collected at the other four sites because either the discharge was low or ice conditions did not permit wading.

Table 5. Peak-flow estimates for selected recurrence intervals

[--, not computed]

Station number	Station name	Period of analysis (water year)	Peak flow, in cubic feet per second, for recurrence interval, in years, and annual exceedance probability, in percent						
			Years: 2	5	10	25	50	100	500
			Percent: 20	20	10	4	2	1	0.2
05050000	Bois de Sioux River near White Rock	1942-96	1,260	1,990	2,210	2,320	2,360	2,370	2,380
05051650	LaBelle Creek near Veblen	1988-96	--	--	--	--	--	--	--
05289950	Little Minnesota River tributary at Sisseton	1970-79	80	208	336	552	755	944	1,710
05289985	Big Coulee Creek near Peever	1988-96	--	--	--	--	--	--	--
05290000	Little Minnesota River near Peever	1940-81, 1990-96	841	2,130	3,280	4,980	6,380	7,870	11,600
05290300	North Fork Whetstone River near Wilmot	1970-79	25	42	52	65	75	83	100
05291000	Whetstone River near Big Stone City	1931-96	1,240	3,330	5,300	8,360	11,000	13,900	21,400
05292000	Minnesota River at Ortonville, Minn.	1938-96	834	1,660	2,290	3,120	3,760	4,390	5,860
06479200	Big Sioux River near Ortley	1956-68	141	394	655	1,100	1,530	2,030	3,530
06479215	Big Sioux River near Florence	1984-96	375	1,040	1,580	2,250	2,730	3,160	3,980
06479230	Big Sioux River tributary near Summit	1956-67	--	--	--	--	--	--	--
06476240	Big Sioux River tributary no. 2 near Summit	1956-73	8.9	25	40	68	93	123	214
06479260	Big Sioux River tributary no. 3 near Summit	1956-78	94	331	591	1,040	1,440	1,910	3,180
06479350	Soo Creek tributary near South Shore	1970-79	44	129	222	388	552	754	1,400
06479438	Big Sioux River near Watertown	1973-96	822	2,270	3,600	5,610	7,280	9,050	13,400

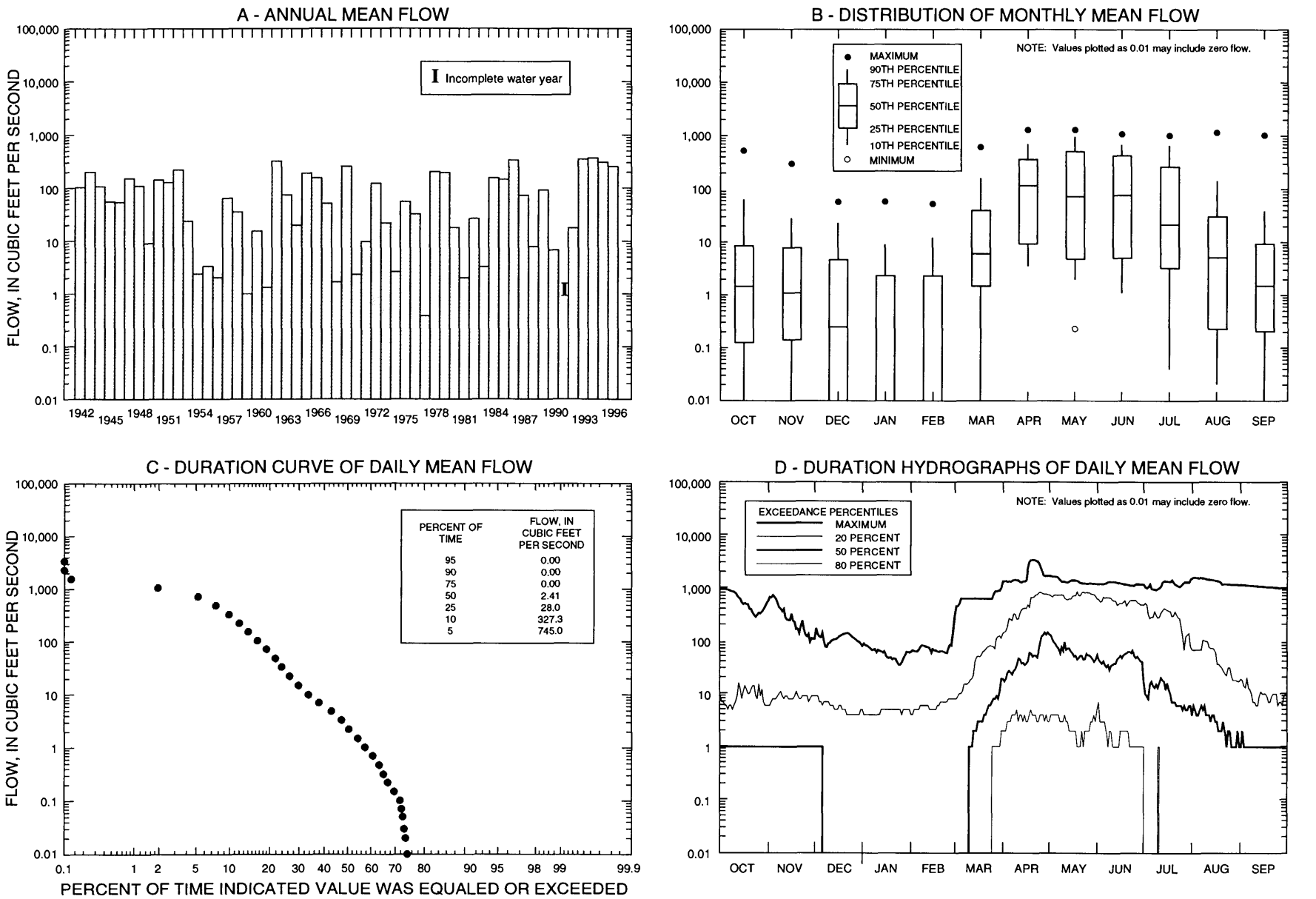


Figure 8. Variations in annual, monthly, and daily mean flow for station 05050000, Bois de Sioux River near White Rock, S. Dak., water years 1942-96

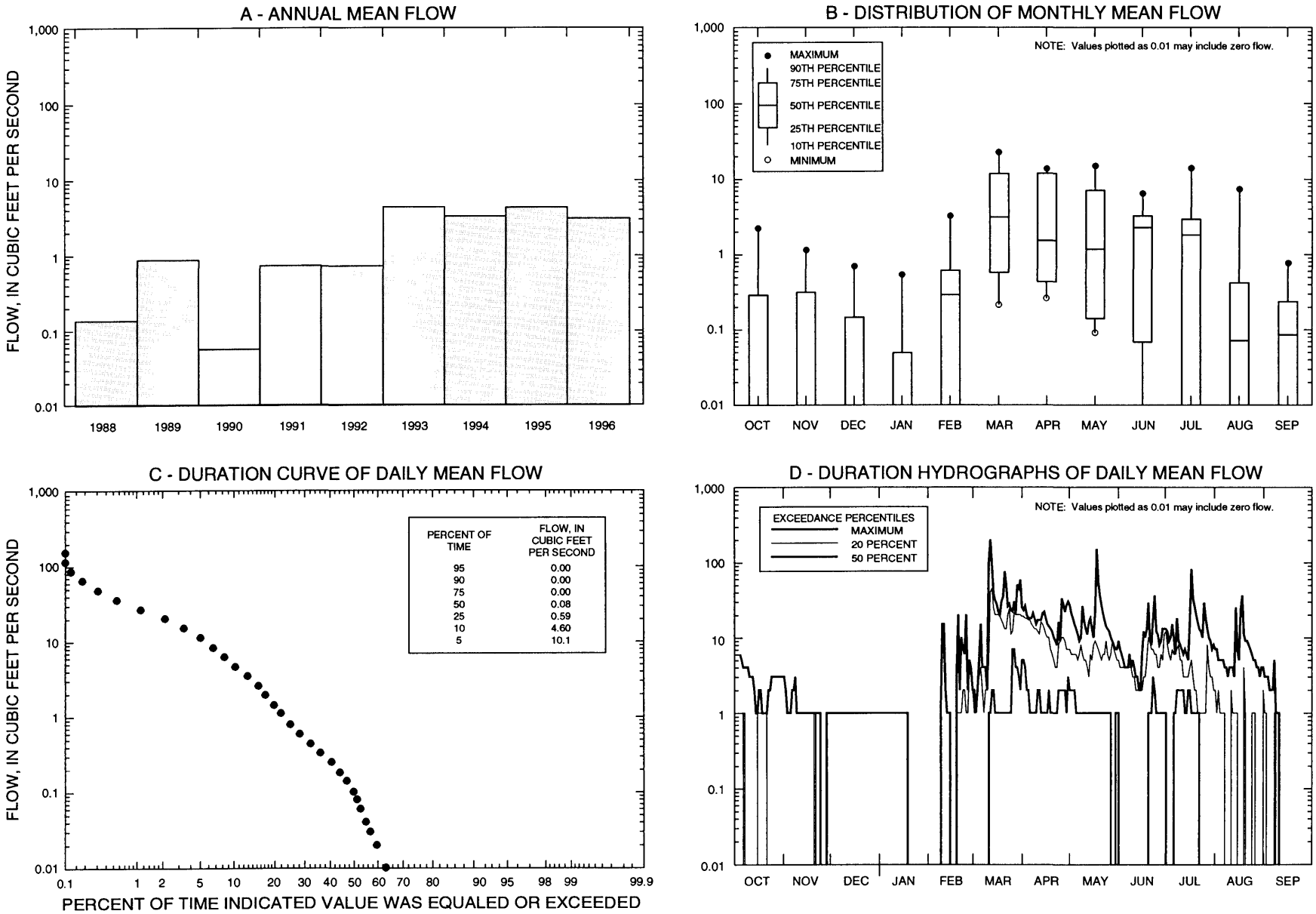


Figure 9. Variations in annual, monthly, and daily mean flow for station 05051650, LaBelle Creek near Veblen, S. Dak., water years 1988-96

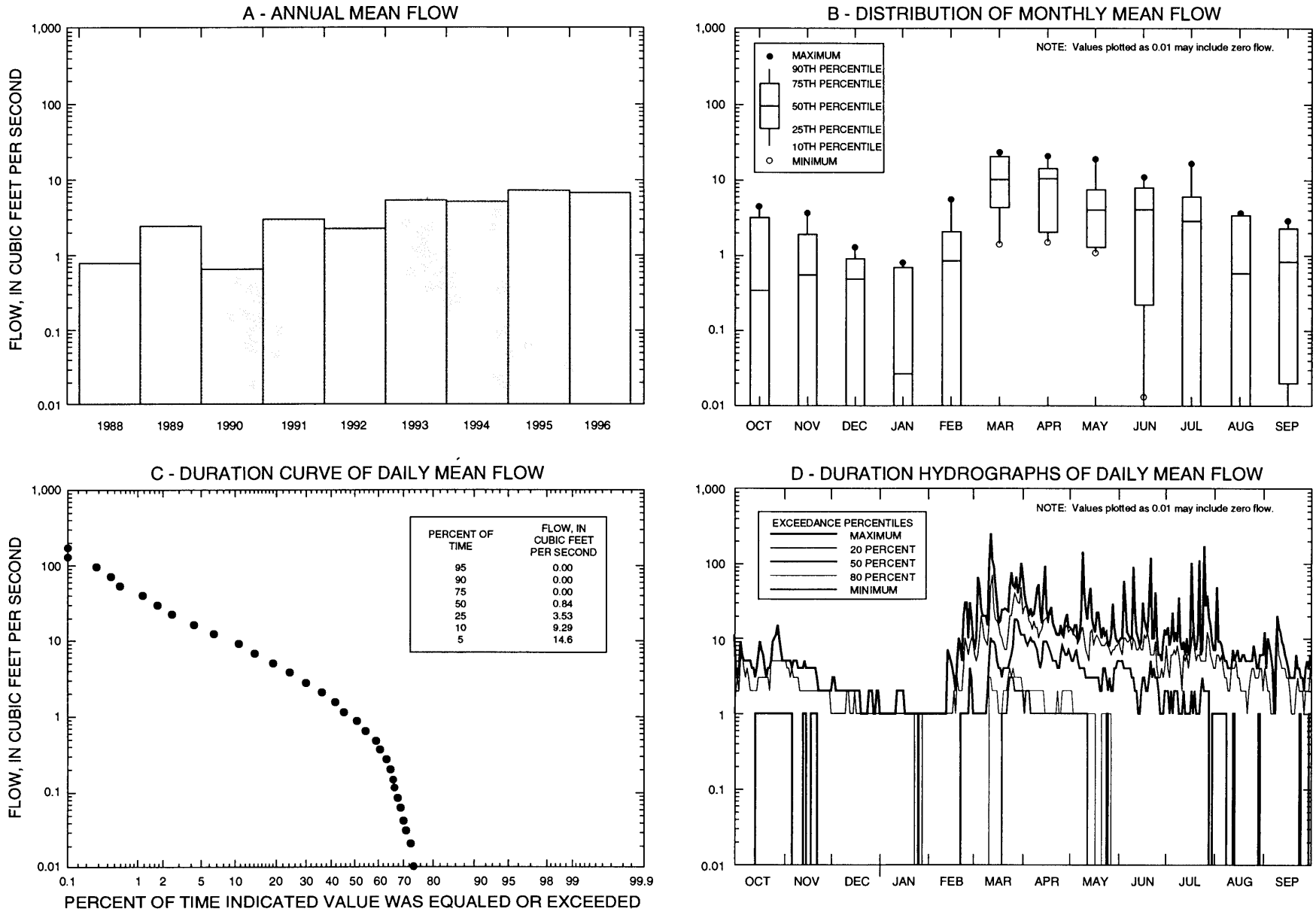


Figure 10. Variations in annual, monthly, and daily mean flow for station 05289985, Big Coulee Creek near Peever, S. Dak., water years 1989-96

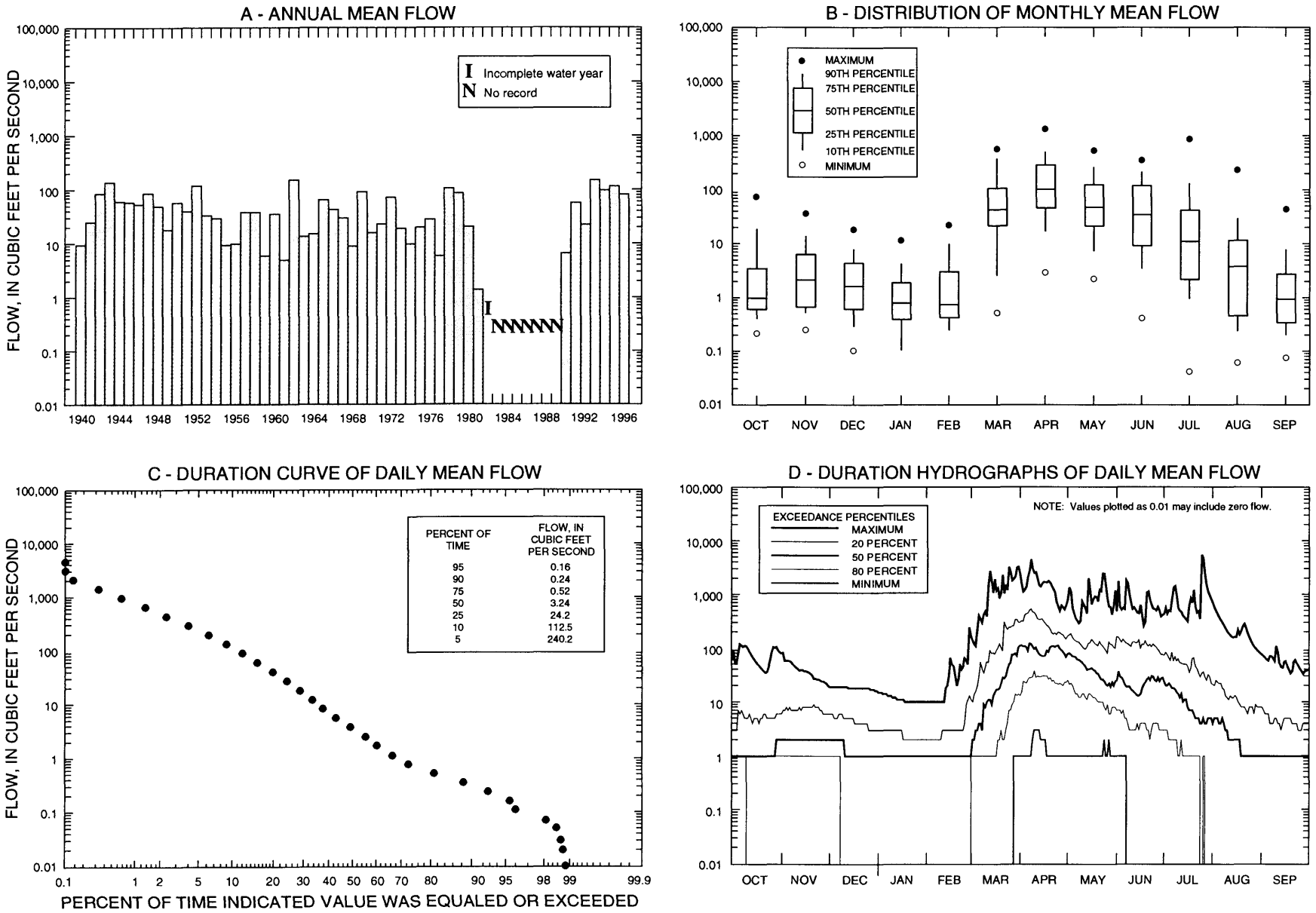


Figure 11. Variations in annual, monthly, and daily mean flow for station 05290000, Little Minnesota River near Peever, S. Dak., water years 1940-96.

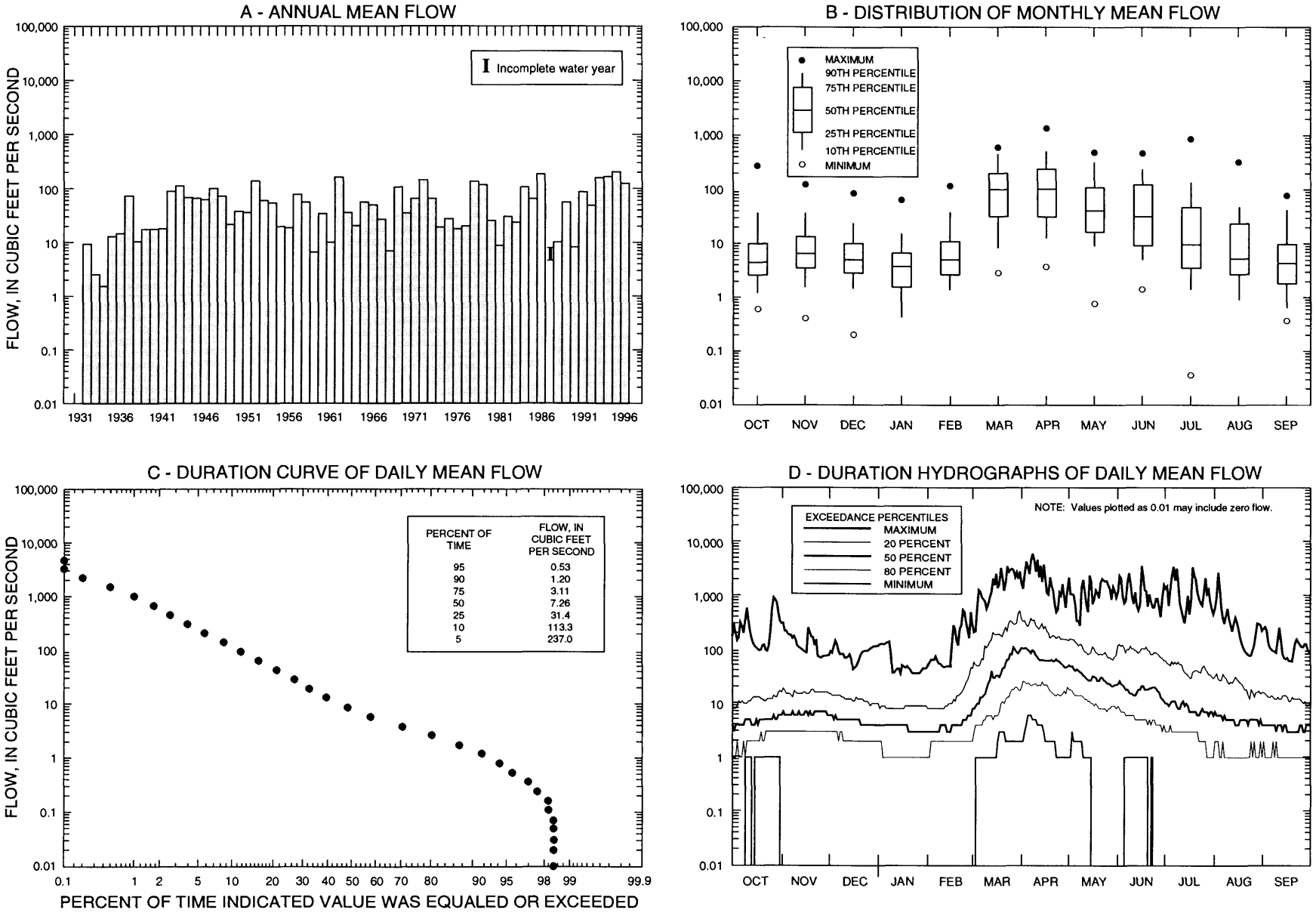


Figure 12. Variations in annual, monthly, and daily mean flow for station 05291000, Whetstone River near Big Stone City, S. Dak., water years 1931-96.

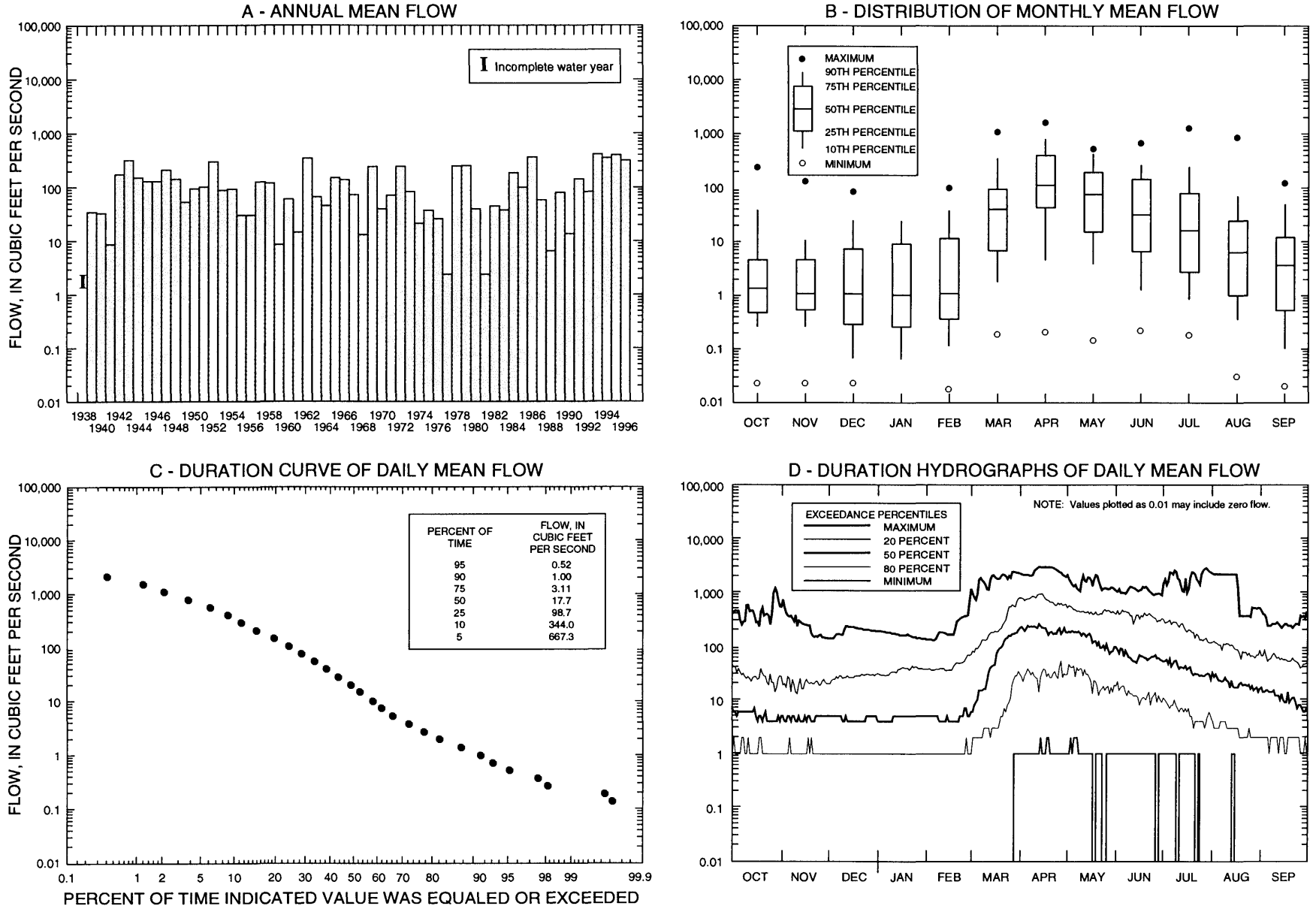


Figure 13. Variations in annual, monthly, and daily mean flow for station 05292000, Minnesota River at Ortonville, Minn., water years 1938-96.

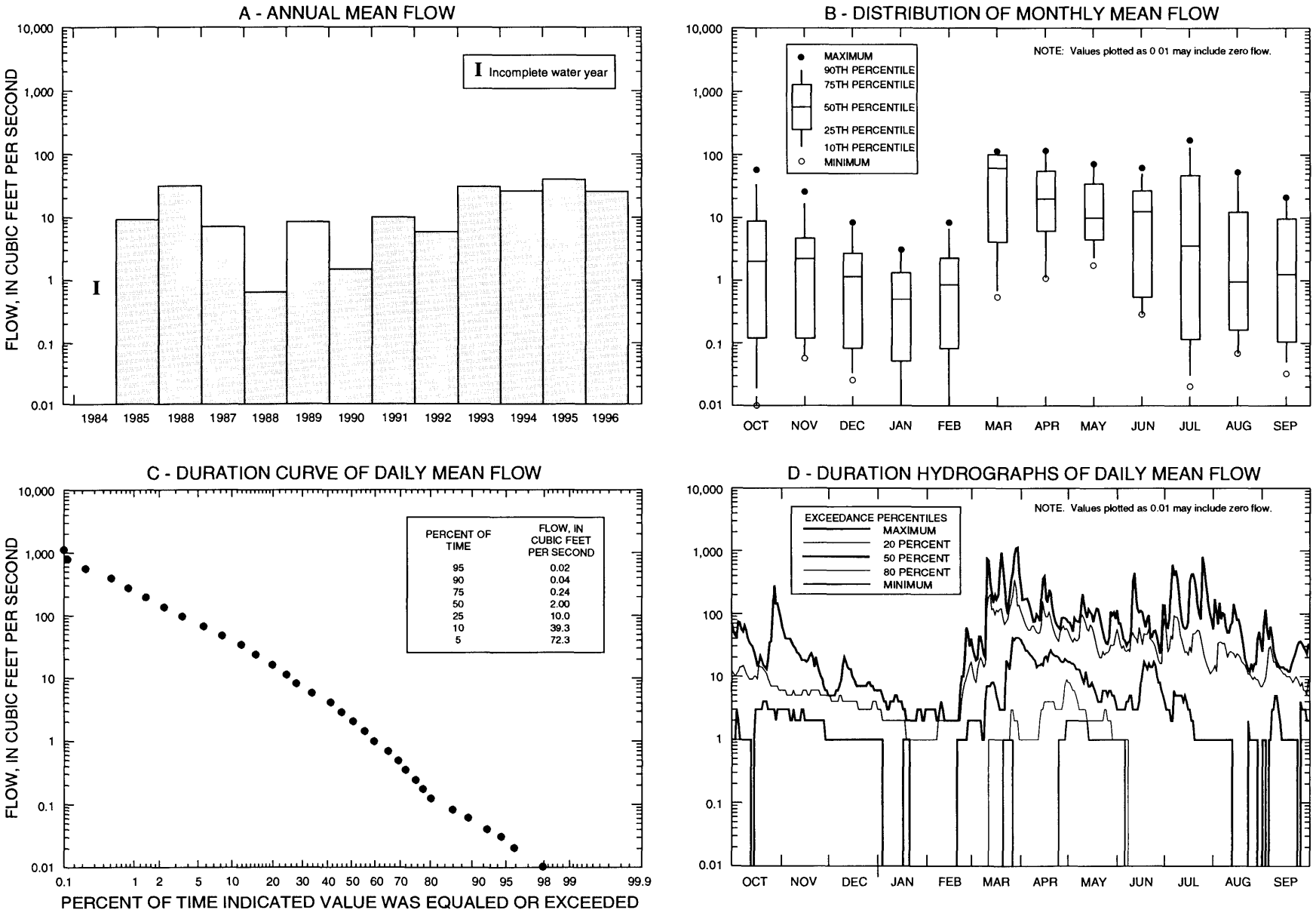


Figure 14. Variations in annual, monthly, and daily mean flow for station 06479215, Big Sioux River near Florence, S. Dak., water years 1984-96.

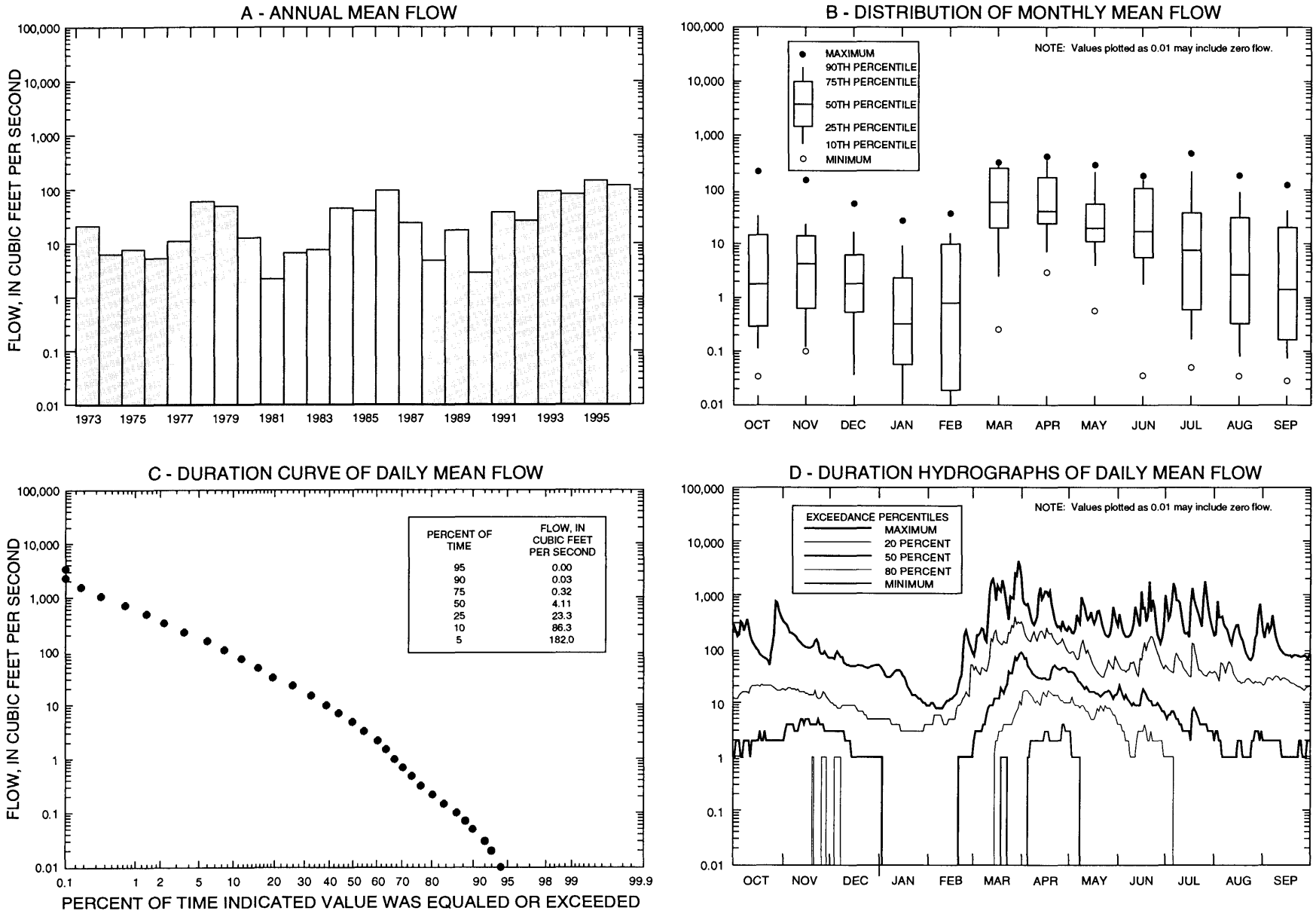
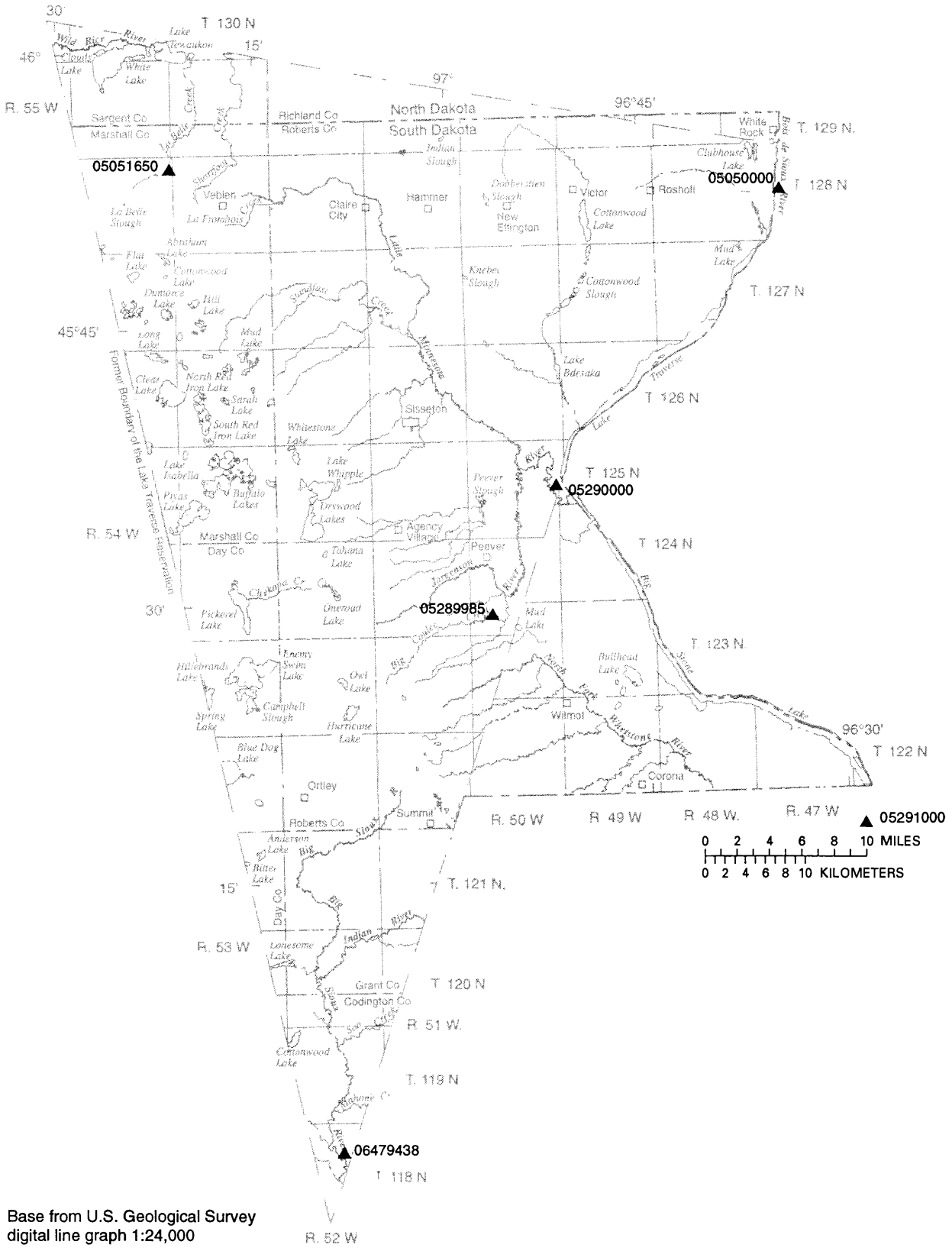


Figure 15. Variations in annual, monthly, and daily mean flow for station 06479438, Big Sioux River near Watertown, S. Dak., water years 1973-96.



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 16. Location of continuous-record streamflow-gaging station sites sampled for water-quality analysis.

Table 6. Water-quality data for selected streams

[E, estimated; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; mm, millimeter; mV, millivolt; mL, milliliter; µg/L, micrograms per liter; deg C, degrees Celsius; inst., instantaneous; IT, incremental titration; FET, fixed end point titration; µm-mf, micrometer-membrane filter; K, non-ideal colony count; cols, colonies; <, less than; -- no data]

Station number	Station name	County	Date	Discharge, inst. (cubic feet per second) (00061)	Specific conductance, field (µS/cm) (00095)	pH, field (standard units) (00400)	Temperature, air (deg C) (00020)	Temperature, water (deg C) (00010)
05289985	Big Coulee Creek near Peever	Roberts	10-31-95	4.8	1,180	7.5	1.0	3.0
06479438	Big Sioux River near Watertown	Codington	10-30-95	506	506	7.2	4.0	3.5
05050000	Bois de Sioux River near White Rock	Roberts	11-02-95	E790	1,130	7.5	-3.0	0.0
			[1]11-02-95	--	--	--	--	--
05051650	LaBelle Creek near Veblen	Marshall	10-31-95	3.0	870	7.5	0.0	2.0
05290000	Little Minnesota River near Peever	Roberts	10-31-95	81	1,330	7.8	2.0	3.0
05291000	Whetstone River near Big Stone City	Grant	12-11-95	34	1,350	7.3	-4.0	0.0

Station name	Date	Oxygen, dissolved (mg/L) (00300)	Coliform, fecal, 0.7 µm-mf (cols per 100 mL) (31625)	Streptococci, fecal, kf agar (cols per 100 mL) (31673)	Alkalinity, field, dissolved, IT (mg/L as $CaCO_3$) (39086)	Alkalinity, field, dissolved, FET (mg/L as $CaCO_3$) (00418)	Calcium, dissolved (mg/L as Ca) (00915)	Magnesium, dissolved (mg/L as Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)
Big Coulee Creek	10-31-95	12.3	K16	140	308	312	160	59	13
Big Sioux River	10-30-95	10.9	440	K2,200	199	199	47	31	13
Bois de Sioux River	11-02-95	13.3	29	120	206	206	100	62	38
	[1]11-02-95	--	--	--	--	--	100	62	38
LaBelle Creek	10-31-95	13.4	K1,100	K1,500	280	281	100	46	12
Little Minnesota R	10-31-95	13.2	97	150	283	285	160	74	51
Whetstone River	12-11-95	6.1	4,200	1,700	412	413	190	82	46

Station name	Date	Sodium, percent (00932)	Sodium, adsorption ratio (00931)	Potassium dissolved (mg/L as K) (00935)	Bicarbonate, field, dissolved IT (mg/L as HCO_3) (00453)	Carbonate, field, dissolved, IT (mg/L as CO_3) (00452)	Sulfate, dissolved (mg/L as SO_4) (00945)	Chloride, dissolved (mg/L as Cl) (00940)	Fluoride, dissolved (mg/L as F) (00950)
Big Coulee Creek	10-31-95	4	0.2	5.2	376	0	380	3.8	0.3
Big Sioux River	10-30-95	10	0.4	6.8	243	0	65	5.8	0.2
Bois de Sioux River	11-02-95	14	0.7	11	251	0	380	17	0.2
	[1]11-02-95	--	--	11	--	--	380	18	0.2
LaBelle Creek	10-31-95	5	0.2	7.7	342	0	230	5.3	0.3
Little Minnesota R	10-31-95	13	0.8	11	345	0	530	16	0.3
Whetstone River	12-11-95	11	0.7	7.0	503	0	470	20	0.3

Table 6. Water-quality data for selected streams—Continued

Station name	Date	Silica, dissolved (mg/L as SiO_2) (00955)	Solids, residue at 180 deg C dissolved (mg/L) (70300)	Nitrogen, ammonia, dissolved (mg/L as N) (00608)	Nitrogen, ammonia+ organic, total (mg/L as N) (00625)	Nitrogen, nitrite, dissolved (mg/L as N) (00613)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N) (00631)	Nitrogen, nitrate, dissolved (mg/L as N) (00618)
Big Coulee Creek	10-31-95	23	910	<0.015	0.3	<0.01	0.15	--
Big Sioux River	10-30-95	17	335	<0.015	1.0	0.01	0.76	0.75
Bois de Sioux River	11-02-95	23	844	0.160	1.6	0.02	0.74	0.72
	[1]11-02-95	22	830	0.160	1.7	0.02	0.73	0.71
LaBelle Creek	10-31-95	20	630	<0.015	0.8	<0.01	0.05	--
Little Minnesota R	10-31-95	21	1,100	<0.015	0.7	<0.01	0.13	--
Whetstone River	12-11-95	25	1,080	0.070	0.5	0.01	1.50	1.49

Station name	Date	Phos-phorus, total (mg/L as P) (00665)	Phos-phorus, ortho, dissolved (mg/L as P) (00671)	Aluminum, dissolved (µg/L as Al) (01106)	Arsenic, dissolved (µg/L as As) (01000)	Boron, dissolved (µg/L as B) (01020)	Iron, dissolved (µg/L as Fe) (01046)	Manga-nese, dissolved (µg/L as Mn) (01056)	Selenium, dissolved (µg/L as Se) (01145)
Big Coulee Creek	10-31-95	0.03	0.01	10	1	100	16	250	<1
Big Sioux River	10-30-95	0.20	0.14	<10	2	40	19	9	<1
Bois de Sioux River	11-02-95	0.32	0.16	<10	6	130	8	22	1
	[1]11-02-95	0.34	0.16	<10	5	130	5	22	<1
LaBelle Creek	10-31-95	0.06	0.04	<10	2	80	11	57	<1
Little Minnesota R	10-31-95	0.10	0.06	<10	2	190	8	85	1
Whetstone River	12-11-95	0.04	0.02	10	<1	180	21	260	3

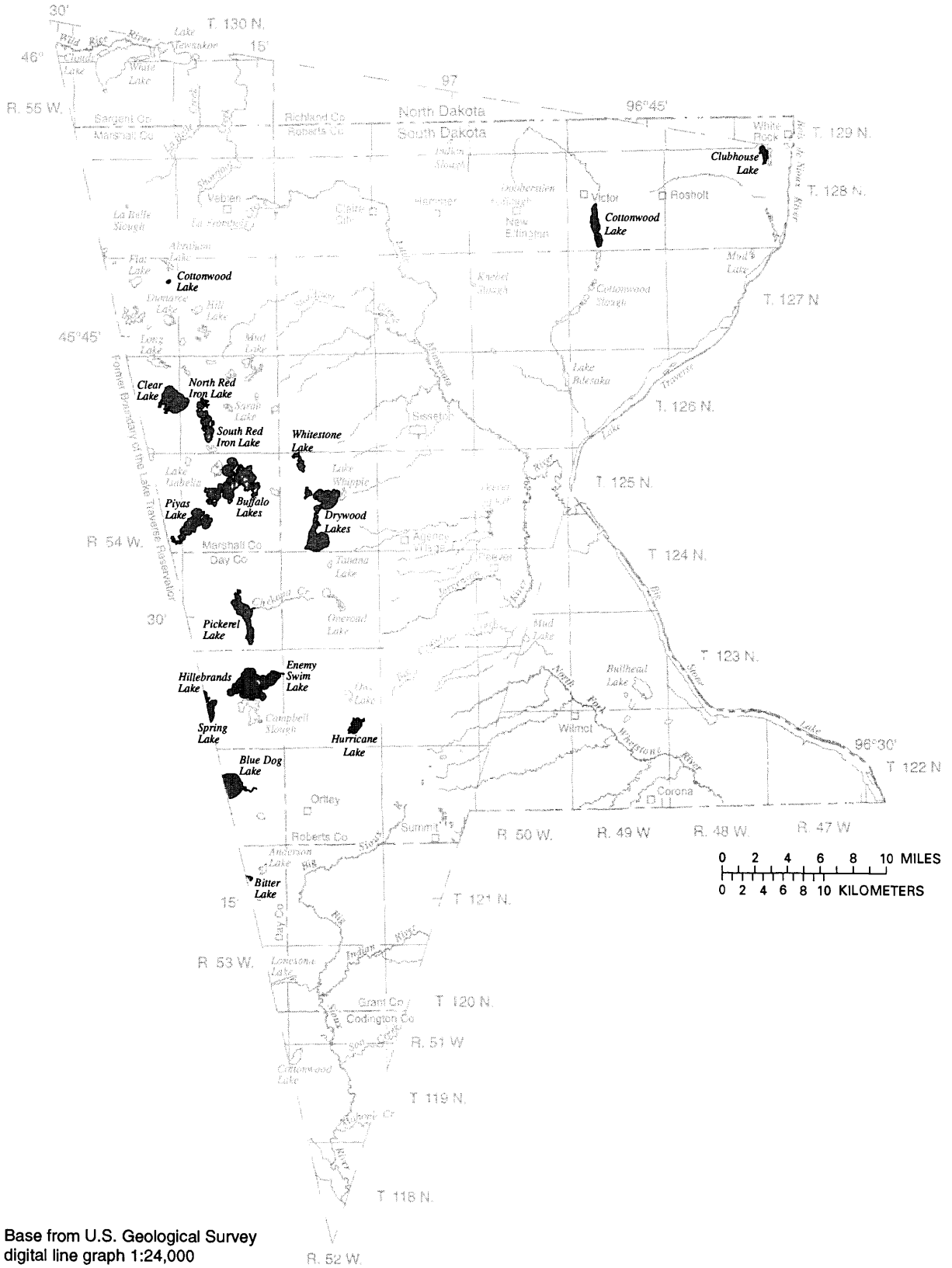
[1] Indicates duplicate sample taken for quality-assurance purposes.

Lakes

Numerous lakes are present in the study area, and the majority of the lakes are located in the James River Basin. Water-quality samples were collected from 17 lakes by the USGS in 1990 and 1995. Additional water-quality data for several lakes located within the study area are presented by South Dakota State Lakes Preservation Committee (1977). Selected lake-level and water-quality data will be presented in this section.

Water Levels

Water levels for 20 lakes within the study area have been recorded since the early 1980's by the SDDENR, Water Rights program (fig. 17). The water levels are recorded twice annually, in the spring and fall, or more often when field conditions dictate. The water levels are taken relative to reference marks of known elevation at points near each lake. Selected information for each of the lakes, including the location of the reference mark and the elevation of the Ordinary High Water Mark, is presented in table 7. For lakes that the South Dakota Water Management Board has formally recognized the Ordinary High Water Mark, a brass disk has been placed to mark its elevation. The Ordinary High Water Mark is the maximum stage reached by a body of water under ordinary variations; it is not the maximum stage reached under extreme conditions (Ron Duvall, South Dakota Department of Environment and Natural Resources, written commun., 1998).



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 17. Location of lakes with recorded water-level elevations.

Table 7. Selected information for lakes with recorded water-level measurements

[--, not determined]

Lake	County	Latitude of reference mark (degrees, minutes, seconds)	Longitude of reference mark (degrees, minutes, seconds)	Local number of reference mark	Elevation of Ordinary High Water Mark (feet)
Bitter Lake	Day	45°17'25"	97°20'20"	121N54W17CABB	--
Blue Dog Lake	Day	45°20'27"	97°18'56"	122N54W28CDDC	1,800.3
Buffalo Lake North	Marshall	45°37'32"	97°17'19"	125N53W10BCCB	1,835.4
Buffalo Lake South	Marshall	45°37'34"	97°17'01"	125N53W10BCAD	1,835.4
Clear Lake	Marshall	45°41'43"	97°20'26"	126N53W18CAAD	1,823.7
Clubhouse Lake	Roberts	45°54'25"	96°35'51"	129N48W36CCBD	--
Cottonwood Lake	Marshall	45°43'32"	97°25'36"	126N55W16ADCB	--
Cottonwood Lake	Roberts	45°50'57"	96°49'01"	128N49W29AABB	--
Drywood Lake North	Roberts	45°36'44"	97°10'06"	125N52W16ADAB	--
Drywood Lake South	Roberts	45°33'30"	97°10'47"	125N52W33CCDD	--
Enemy Swim Lake	Day	45°28'02"	97°17'07"	123N53W15CDAB	1,854.4
Hillebrands Lake	Day	45°26'08"	97°21'07"	123N54W30DBBA	1,787.0
Hurricane Lake	Roberts	45°24'26"	97°07'25"	123N52W26ADDA	--
Pickerel Lake	Day	45°28'55"	97°15'49"	124N53W35BCAA	1,845.6
Piyas Lake	Marshall	45°35'17"	97°18'40"	125N54W20DDCD	--
Red Iron Lake North	Marshall	45°41'11"	97°19'42"	126N53W20BCAB	--
Red Iron Lake South	Marshall	45°41'05"	97°19'26"	126N53W20ACAC	--
Spring Lake	Day	45°24'50"	97°20'24"	123N54W32CCDD	1,787.0
Whitestone Lake North	Roberts	45°38'46"	97°12'11"	126N52W32CCCD	--
Whitestone Lake South	Roberts	45°38'46"	97°12'11"	126N52W32CCCD	--

Water-level measurements for each of the lakes are presented in Section F of the Supplemental Information section. Hydrographs for lakes with more than 10 water-level measurements are presented in figures 18-31. Only two lakes (Cottonwood Lake in Marshall County and Piyas Lake) are excluded. The hydrographs for lakes that have both north and south bodies of water (Buffalo, Drywood, Red Iron, and Whitestone) are presented on the same figure.

Water-Quality Data

Water-quality samples were collected from 17 lakes. Seven of the lakes were sampled in both 1990 and 1995, while the others were sampled only once. All water-quality samples were collected by USGS field personnel and were analyzed by the USGS NWQL. The samples were analyzed for field measurements, common and trace elements, nutrients, and bacteria. The 1990 samples additionally were analyzed for radiometrics. The locations of the sampling sites are shown in figure 32 and the analytical results are presented in table 8.

Methods described by Horowitz and others (1994) for the collection and processing of surface-water samples were used. The lake samples were collected near the approximate center of the lake using a depth-integrated sampling method.

Lake name: Bitter Lake
County: Day
Extremes: June 8, 1984, to October 9, 1996: Highest, 1,785.2 feet, June 5, 1996, July 1, 1996; lowest, 1,770.3 feet, June 8, 1984.

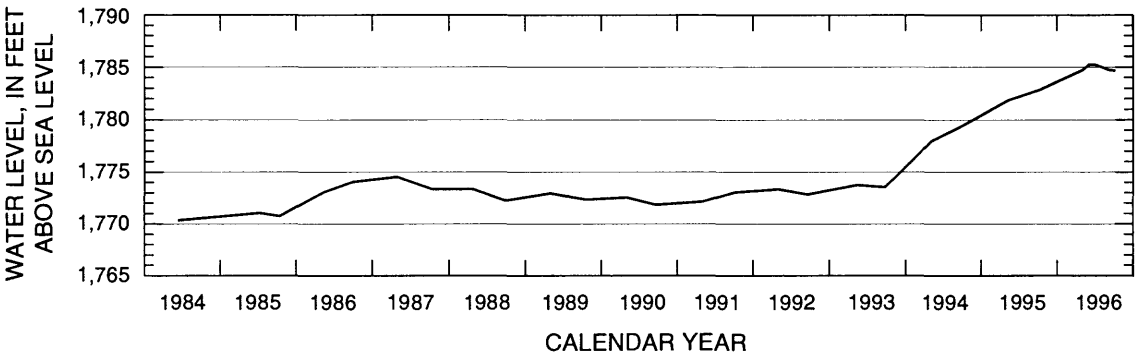


Figure 18. Hydrograph for Bitter Lake in Day County.

Lake name: Blue Dog Lake
County: Day
Extremes: February 21, 1980, to October 9, 1996: Highest, 1,801.1 feet, May 10, 1995; lowest, 1,799.5 feet, November 4, 1980, September 21, 1988.

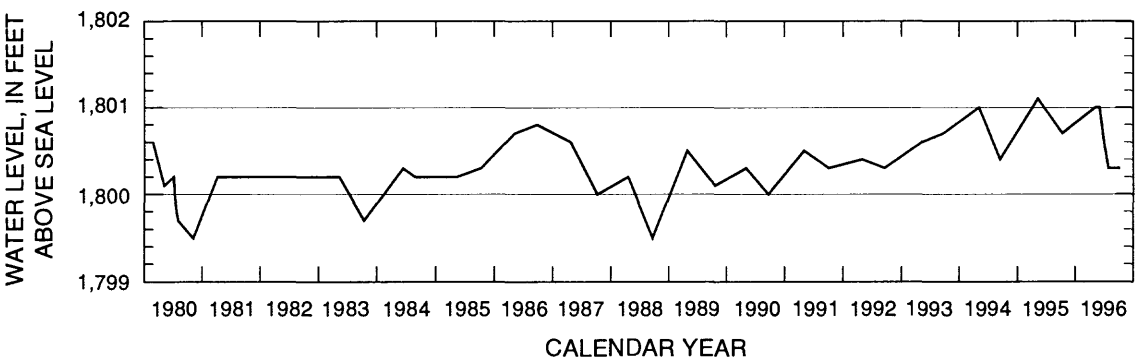


Figure 19. Hydrograph for Blue Dog Lake in Day County.

Lake name: Buffalo Lakes
County: Marshall
Extremes (North Buffalo Lake): June 24, 1982, to October 8, 1996: Highest, 1,836.9 feet, May 5, 1994; lowest, 1,830.3 feet, October 12, 1983.
Extremes (South Buffalo Lake): June 23, 1982, to October 8, 1996: Highest, 1,837.1 feet, May 7, 1996; lowest, 1,830.7 feet, October 12, 1983.

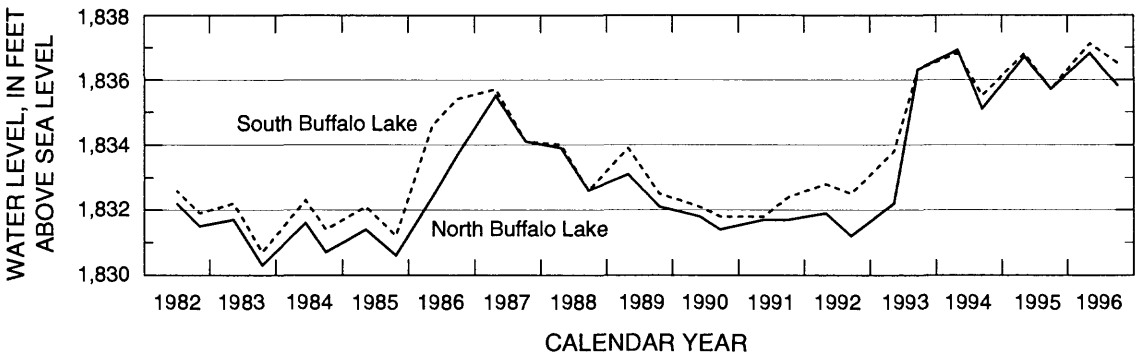


Figure 20. Hydrograph for North and South Buffalo Lakes in Marshalll County.

Lake name: Clear Lake
County: Marshall
Extremes: May 12, 1982, to October 8, 1996: Highest, 1,822.9 feet, May 5, 1994; lowest, 1,816.4 feet, October 9, 1985.

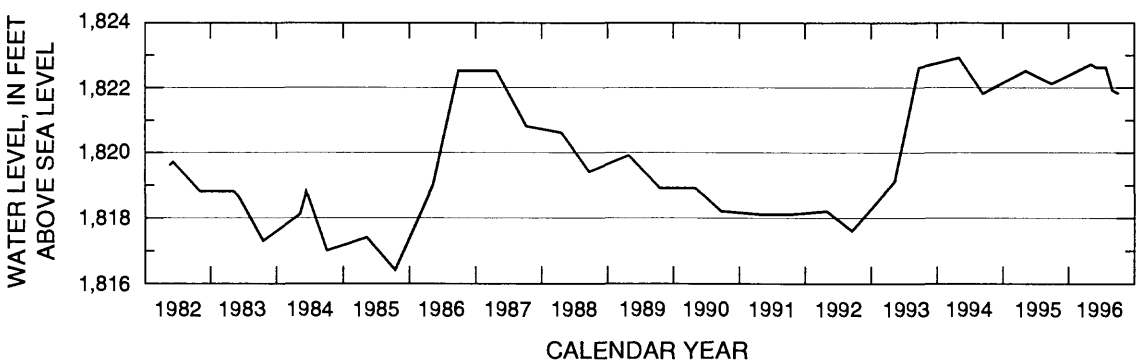


Figure 21. Hydrograph for Clear Lake in Marshall County.

Lake name: Clubhouse Lake
County: Roberts
Extremes: July 10, 1986, to May 7, 1996: Highest, 973.1 feet, May 5, 1994; lowest, 969.5 feet, September 20, 1988.

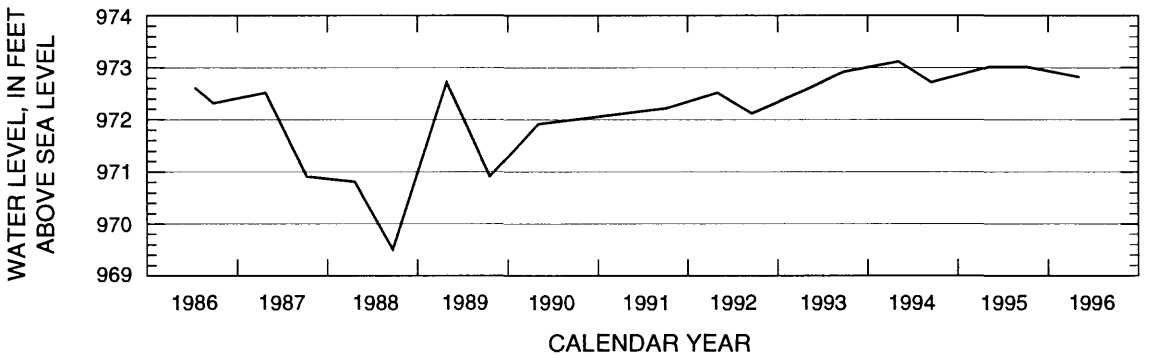


Figure 22. Hydrograph for Clubhouse Lake in Roberts County.

Lake name: Cottonwood Lake
County: Roberts
Extremes: July 10, 1986, to October 2, 1996: Highest, 1,030.4 feet, May 11, 1995; lowest, 1,028.3 feet, September 20, 1988.

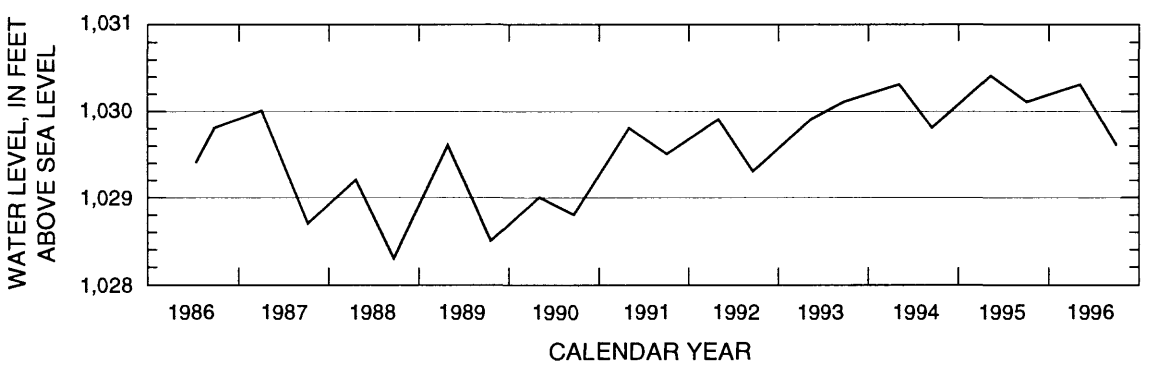


Figure 23. Hydrograph for Cottonwood Lake in Roberts County.

Lake name: Drywood Lakes
County: Roberts
Extremes (Drywood Lake North): November 3, 1983, to October 8, 1996: Highest, 1,948.9 feet, May 7, 1996; lowest, 1,940.9 feet, September 20, 1990.
Extremes (Drywood Lake South): November 3, 1983, to October 8, 1996: Highest, 1,948.9 feet, May 7, 1996; lowest, 1,942.0 feet, May 3, 1990.

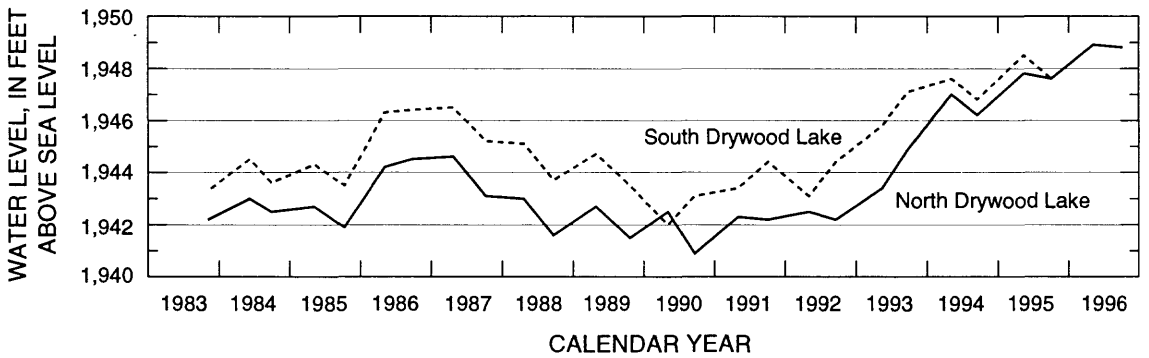


Figure 24. Hydrograph for North and South Drywood Lakes in Roberts County.

Lake name: Enemy Swim Lake
County: Day
Extremes: July 7, 1982, to October 9, 1996: Highest, 1,855.1 feet May 4, 1994; lowest, 1,850.2 feet, October 12, 1983.

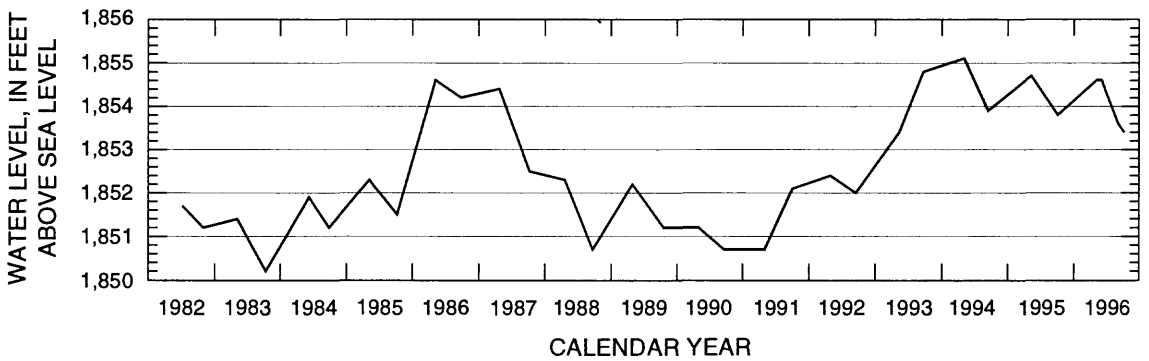


Figure 25. Hydrograph for Enemy Swim Lake in Day County.

Lake name: Hillebrands Lake
County: Day
Extremes: October 11, 1983, to October 9, 1996: Highest, 1,797.2 feet, June 5, 1996; lowest, 1,781.3 feet, October 11, 1983.

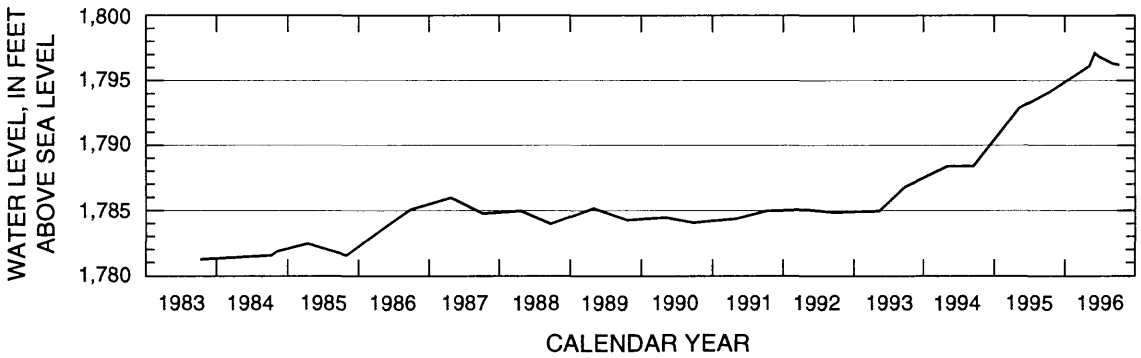


Figure 26. Hydrograph for Hillebrands Lake in Day County.

Lake name: Hurricane Lake
County: Roberts
Extremes: July 10, 1986, to October 8, 1996: Highest, 1,753.7 feet, May 10, 1995; lowest, 1,746.9 feet, May 1, 1991.

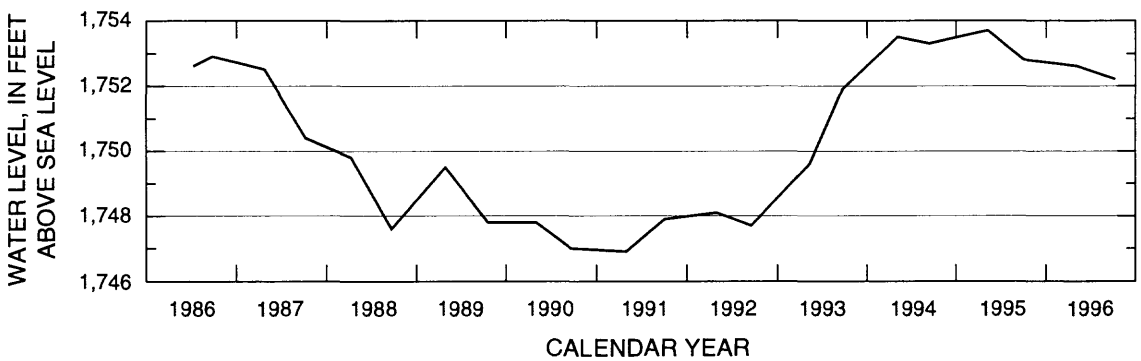


Figure 27. Hydrograph for Hurricane Lake in Roberts County.

Lake name: Pickerel Lake
County: Day
Extremes: June 22, 1982, to October 9, 1996: Highest, 1,845.9 feet, May 7, 1986; lowest, 1,843.5 feet, September 21, 1988.

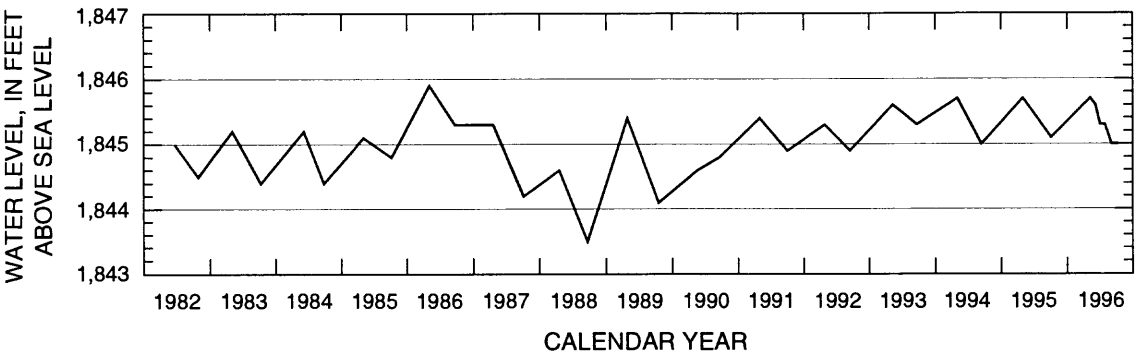


Figure 28. Hydrograph for Pickerel Lake in Day County.

Lake name: Red Iron Lakes
County: Marshall
Extremes (Red Iron Lake North): September 28, 1984, to October 8, 1996: Highest, 1,830.2 feet, May 5, 1994, May 11, 1995; lowest, 1,825.0 feet, September 28, 1984.
Extremes (Red Iron Lake South): September 28, 1994, to October 8, 1996: Highest, 1,832.0 feet, May 5, 1994, May 11, 1995; lowest, 1,826.8 feet, October 9, 1985, September 20, 1988.

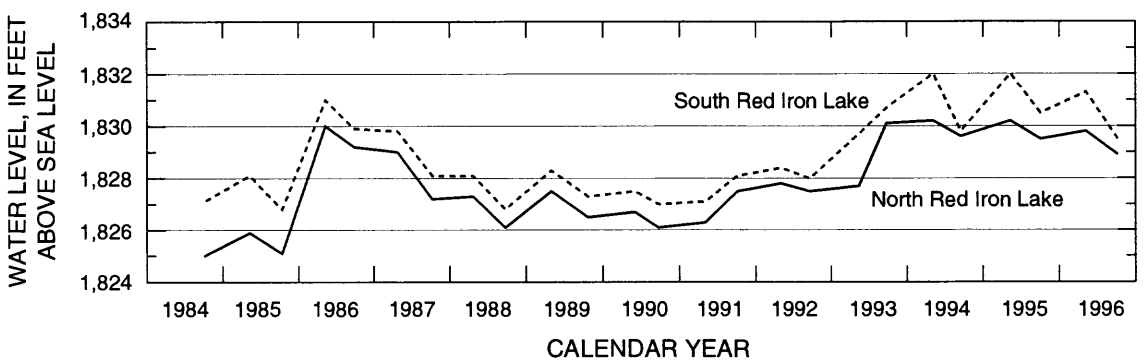


Figure 29. Hydrograph for North and South Red Iron Lakes in Marshall County.

Lake name: Spring Lake
County: Day
Extremes: October 11, 1983, to October 9, 1996: Highest, 1,792.5 feet, June 5, 1996; lowest, 1,785.0 feet, October 11, 1983.

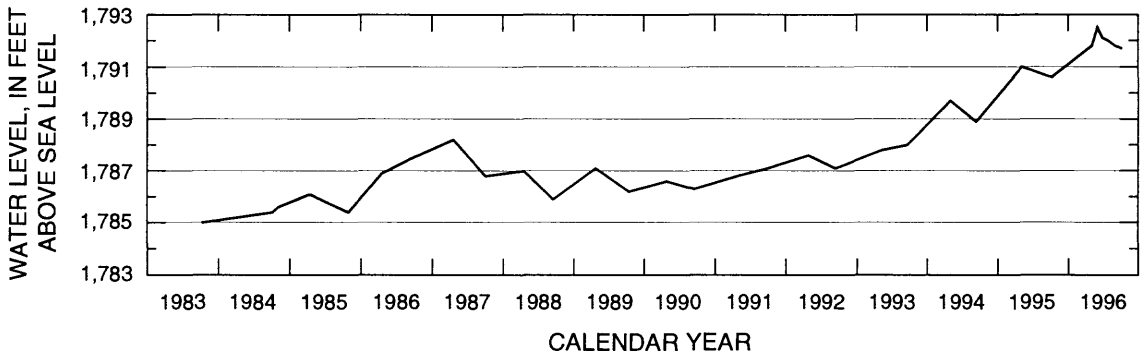


Figure 30. Hydrograph for Spring Lake in Day County.

Lake name: Whitestone Lakes
County: Roberts
Extremes (Whitestone Lake North): June 7, 1984, to October 8, 1996: Highest, 2,015.0 feet, May 7, 1996; lowest, 2,010.4 feet, September 20, 1990.
Extremes (Whitestone Lake South): June 7, 1984, to October 8, 1996: Highest, 2,015.0 feet, May 7, 1996; lowest, 2,009.0 feet, September 17, 1992.

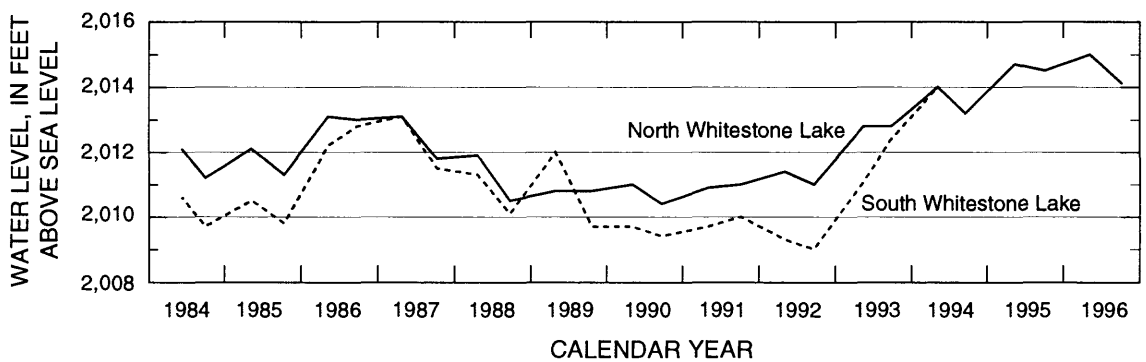
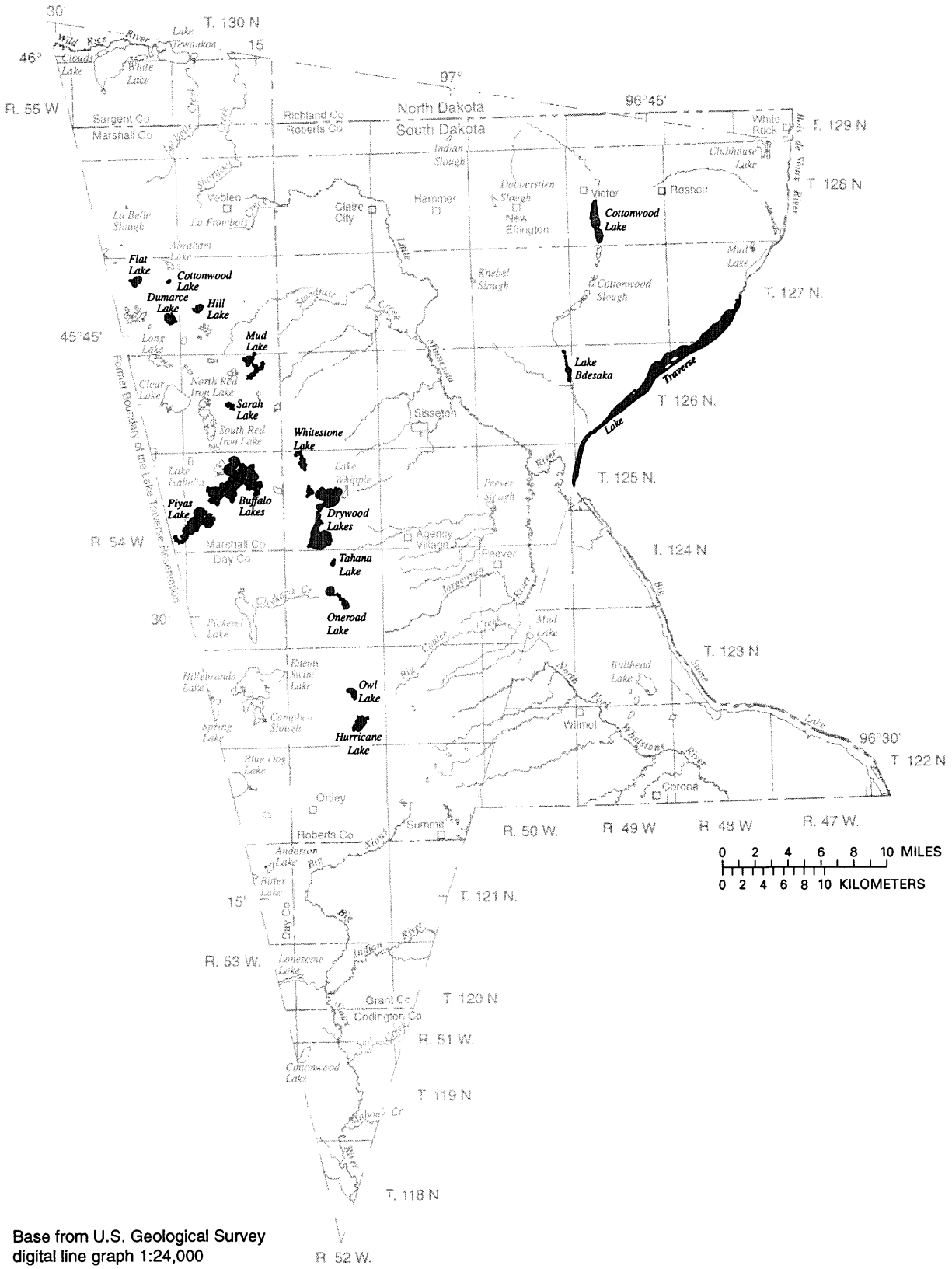


Figure 31. Hydrograph for North and South Whitestone Lakes in Roberts County.



Base from U.S. Geological Survey
digital line graph 1:24,000

Figure 32. Location of lakes sampled for water-quality analyses.

Table 8. Water-quality data for selected lakes

[µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; NTU, nephelometric turbidity units; µm-mf, micrometer-membrane filter; K, non-ideal colony count; cols, colonies; <, less than; -- no data]

Station number	Station name	County	Date	Specific conductance, field (µS/cm) (00095)	pH, field (standard units) (00400)	Temperature, air (deg C) (00020)	Temperature, water (deg C) (00010)
453740097171400	Buffalo Lake North	Marshall	12-12-95	730	8.4	-15.0	4.0
453759097160400	Buffalo Lake South	Marshall	10-26-95	572	7.5	5.5	5.0
455123096492500	Cottonwood Lake	Roberts	09-11-90	2,060	7.9	22.5	20.0
			12-13-95	1,740	8.3	-7.0	2.5
453547097105600	Drywood Lakes	Roberts	09-12-90	1,760	8.7	24.0	21.0
			10-26-95	736	8.0	10.5	3.5
454539097214600	Dumarce Lake	Marshall	09-20-90	1,230	8.7	13.0	15.0
			12-13-95	992	8.6	-6.0	3.0
454757097241900	Flat Lake	Marshall	09-19-90	2,010	8.4	15.0	12.5
454625097195900	Hill Lake	Marshall	09-19-90	1,690	7.5	22.5	15.5
452404097082600	Hurricane Lake	Roberts	12-14-95	453	7.5	-3.0	4.0
454237096512300	Lake Bdeska	Roberts	09-11-90	2,990	8.3	32.0	25.0
			12-13-95	1,930	7.4	-7.0	1.0
453912096495000	Lake Traverse	Roberts	11-01-95	1,110	7.6	3.0	4.5
454335097161700	Mud Lake	Marshall	09-20-90	952	8.0	15.5	15.0
			10-26-95	670	7.6	8.0	4.0
453057097091500	Oneroad Lake	Roberts	09-13-90	451	7.1	22.5	20.0
			10-25-95	340	7.2	5.0	2.5
			[1]10-25-95	--	--	--	--
452542097083700	Owl Lake	Roberts	09-17-90	506	8.9	22.0	16.5
			11-02-95	496	7.9	-6.0	2.0
453525097191400	Piyas Lake	Marshall	12-12-95	2,940	7.9	-20.0	1.5
454107097171500	Sarah Lake	Marshall	12-12-95	662	7.5	-20.0	3.0
453306097124600	Tahana Lake	Roberts	10-25-95	640	7.4	11.0	3.5
453803097120300	Whitestone Lake	Roberts	09-12-90	1,100	8.2	34.0	22.0
			11-01-95	810	8.4	4.5	3.5

Table 8. Water-quality data for selected lakes—Continued

Station name	Date	Turbidity (NTU) (00076)	Oxygen, dissolved (mg/L) (00300)	Coliform, fecal, 0.7 µm-mf (cols per 100 mL) (31625)	Strep-tococci, fecal, kf agar (cols per 100 mL) (31673)	Alkalinity, field, total, FET (mg/L as $CaCO_3$) (00410)	Alkalinity, field, dissolved, IT (mg/L as $CaCO_3$) (39086)	Alkalinity, field, dissolved, FET (mg/L as $CaCO_3$) (00418)
Buffalo Lake North	12-12-95	--	15.8	<1	<1	--	300	299
Buffalo Lake South	10-26-95	--	11.3	21	24	--	204	203
Cottonwood Lake	09-11-90	12	8.7	200	K75	214	--	--
	12-13-95	--	21.1	<1	<1	--	362	355
Drywood Lakes	09-12-90	35	9.7	K42	560	579	--	--
	10-26-95	--	12.5	K8	K14	--	280	278
Dumarce Lake	09-20-90	15	9.7	<5	K150	399	--	--
	12-13-95	--	12.8	<1	<1	--	394	387
Flat Lake	09-19-90	15	10.5	270	670	513	--	--
Hill Lake	09-19-90	6.6	9.4	K1,800	4,500	201	--	--
Hurricane Lake	12-14-95	--	10.9	<1	<1	--	228	227
Lake Bdeska	09-11-90	25	10.8	100	120	253	--	--
	12-13-95	--	10.8	<1	<1	--	424	424
Lake Traverse	11-01-95	--	10.3	K2	K4	--	206	207
Mud Lake	09-20-90	10	10.6	K47	6,300	197	--	--
	10-26-95	--	11.5	K5	37	--	156	158
Oneroad Lake	09-13-90	2.6	8.6	<5	600	214	--	--
	10-25-95	--	13.6	K2	K9	--	164	164
	[1]10-25-95	--	--	--	--	--	--	--
Owl Lake	09-17-90	19	10.5	K11	K31	316	--	--
	11-02-95	--	8.3	K6	K19	--	266	277
Piyas Lake	12-12-95	--	3.0	<1	<1	--	562	561
Sarah Lake	12-12-95	--	10.4	<1	<1	--	294	290
Tahana Lake	10-25-95	--	11.7	K21	K33	--	223	220
Whitestone Lake	09-12-90	3.3	9.4	K15	140	389	--	--
	11-01-95	--	12.2	K2	K4	--	331	329

Table 8. Water-quality data for selected lakes—Continued

Station name	Date	Alkalinity, field, total, IT (mg/L as $CaCO_3$) (00419)	Calcium, dissolved (mg/L as Ca) (00915)	Magnesium, dissolved (mg/L as Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)	Sodium, percent (00932)	Sodium, adsorption ratio (00931)	Potassium, dissolved (mg/L as K) (00935)	Bicarbonate, field, total, FET (mg/L as HCO_3) (00440)
Buffalo Lake North	12-12-95	--	37	68	12	6	0.3	15	--
Buffalo Lake South	10-26-95	--	37	41	7.9	6	0.2	11	--
Cottonwood Lake	09-11-90	211	68	170	140	25	2	27	200
	12-13-95	--	130	130	99	20	1	17	--
Drywood Lakes	09-12-90	583	14	200	69	13	1	92	450
	10-26-95	--	36	54	12	7	0.3	24	--
Dumarce Lake	09-20-90	402	10	150	37	10	0.6	40	320
	12-13-95	--	32	99	23	9	0.5	25	--
Flat Lake	09-19-90	513	13	260	52	9	0.7	53	450
Hill Lake	09-19-90	202	84	150	43	10	0.7	39	250
Hurricane Lake	12-14-95	--	43	26	5.4	5	0.2	4.7	--
Lake Bdeska	09-11-90	253	160	200	260	31	3	38	240
	12-13-95	--	130	140	120	22	2	19	--
Lake Traverse	11-01-95	--	87	61	46	17	0.9	12	--
Mud Lake	09-20-90	195	60	84	17	7	0.3	24	180
	10-26-95	--	42	46	8.5	6	0.2	11	--
Oneroad Lake	09-13-90	215	37	31	5.9	5	0.2	9.6	260
	10-25-95	--	28	24	3.8	5	0.1	5.2	--
	[1]10-25-95	--	29	24	3.8	--	--	5.3	--
Owl Lake	09-17-90	316	8.9	61	11	7	0.3	19	170
	11-02-95	--	25	44	6.5	5	0.2	12	--
Piyas Lake	12-12-95	--	59	330	130	15	1	89	--
Sarah Lake	12-12-95	--	52	47	8.8	5	0.2	8.6	--
Tahana Lake	10-25-95	--	44	50	11	7	0.3	18	--
Whitestone Lake	09-12-90	390	20	120	27	9	0.5	38	390
	11-01-95	--	28	73	16	8	0.4	27	--

Table 8. Water-quality data for selected lakes—Continued

Station name	Date	Bicarbonate, field, dissolved IT (mg/L as HCO_3) (00453)	Carbonate, field, total, FET (mg/L as CO_3) (00445)	Carbonate, field, dissolved, IT (mg/L as CO_3) (00452)	Sulfate, dissolved (mg/L as SO_4) (00945)	Chloride, dissolved (mg/L as Cl) (00940)	Fluoride, dissolved (mg/L as F) (00950)	Silica, dissolved (mg/L as SiO_2) (00955)	Solids, residue at 180 deg C dissolved (mg/L) (70300)
Buffalo Lake North	12-12-95	308	--	29	110	8.0	0.2	34	468
Buffalo Lake South	10-26-95	249	--	0	86	6.4	0.2	29	370
Cottonwood Lake	09-11-90	--	27	--	990	30	0.2	20	1,680
	12-13-95	383	--	29	690	19	0.3	37	1,390
Drywood Lakes	09-12-90	--	127	--	500	49	0.4	5.2	1,410
	10-26-95	342	--	0	99	9.9	0.2	18	462
Dumarce Lake	09-20-90	--	83	--	320	15	<0.1	33	980
	12-13-95	408	--	36	210	8.4	0.3	20	694
Flat Lake	09-19-90	--	85	--	640	28	<0.1	31	1,610
Hill Lake	09-19-90	--	0	--	650	20	<0.1	28	1,310
Hurricane Lake	12-14-95	278	--	0	12	3.0	0.3	20	262
Lake Bdeska	09-11-90	--	32	--	1,500	69	0.4	16	2,480
	12-13-95	517	--	0	730	29	0.4	24	1,510
Lake Traverse	11-01-95	251	--	0	370	16	0.2	19	780
Mud Lake	09-20-90	--	27	--	320	8.5	0.1	36	737
	10-26-95	191	--	0	170	4.0	0.2	16	444
Oneroad Lake	09-13-90	--	0	--	20	8.6	0.3	16	277
	10-25-95	200	--	0	21	2.4	0.2	15	219
	[1]10-25-95	--	--	--	21	2.4	0.2	15	218
Owl Lake	09-17-90	--	108	--	1.4	9.3	0.1	14	369
	11-02-95	311	--	6	1.4	4.2	0.2	15	301
Piyas Lake	12-12-95	686	--	0	1,200	43	0.2	28	2,330
Sarah Lake	12-12-95	359	--	0	69	2.9	0.4	19	393
Tahana Lake	10-25-95	272	--	0	140	7.6	0.2	22	469
Whitestone Lake	09-12-90	--	41	--	230	22	0.2	19	762
	11-01-95	362	--	20	110	12	0.2	23	512

Table 8. Water-quality data for selected lakes—Continued

Station name	Date	Nitrogen, ammonia, dissolved (mg/L as N) (00608)	Nitrogen, ammonia+ organic, total (mg/L as N) (00625)	Nitrogen, nitrite, dissolved (mg/L as N) (00613)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N) (00631)	Nitrogen, nitrate, dissolved (mg/L as N) (00618)	Phosphorus, total (mg/L as P) (00665)	Phosphorus, ortho, dissolved (mg/L as P) (00671)	Aluminum, dissolved (µg/L as Al) (01106)
Buffalo Lake North	12-12-95	<0.015	1.2	<0.010	<0.050	--	<0.01	<0.010	<10
Buffalo Lake South	10-26-95	<0.015	1.1	0.010	0.060	0.050	0.02	<0.010	20
Cottonwood Lake	09-11-90	0.075	--	0.004	0.026	0.022	--	0.002	20
	12-13-95	0.350	2.9	<0.010	<0.050	--	0.06	<0.010	10
Drywood Lakes	09-12-90	0.052	--	0.003	0.016	0.013	--	0.001	<10
	10-26-95	0.020	1.8	0.020	<0.050	--	0.08	<0.010	<10
Dumarce Lake	09-20-90	0.031	--	0.003	<0.010	--	--	0.003	<10
	12-13-95	0.140	2.0	<0.010	<0.050	--	0.03	<0.010	<10
Flat Lake	09-19-90	0.030	--	0.005	<0.010	--	--	0.001	<10
Hill Lake	09-19-90	0.250	--	0.010	0.108	0.098	--	0.002	10
Hurricane Lake	12-14-95	<0.015	0.8	<0.010	<0.050	--	0.03	<0.010	<10
Lake Bdeska	09-11-90	0.062	--	0.007	0.016	0.009	--	0.001	10
	12-13-95	0.320	1.8	<0.010	<0.050	--	0.05	<0.010	10
Lake Traverse	11-01-95	0.190	1.5	0.020	0.240	0.220	0.19	0.140	<10
Mud Lake	09-20-90	0.023	--	0.003	<0.010	--	--	0.001	<10
	10-26-95	0.230	1.4	0.020	0.080	0.060	0.02	<0.010	<10
Oneroad Lake	09-13-90	0.253	--	0.007	0.013	0.006	--	0.002	<10
	10-25-95	<0.015	0.9	<0.010	<0.050	--	0.02	<0.010	<10
	[1]10-25-95	<0.015	1.0	0.020	<0.050	--	0.03	<0.010	<10
Owl Lake	09-17-90	0.032	--	0.007	0.018	0.011	--	0.003	<10
	11-02-95	0.490	3.0	<0.010	<0.050	--	0.09	<0.010	<10
Piyas Lake	12-12-95	3.00	5.8	0.030	0.130	0.100	0.27	0.220	<10
Sarah Lake	12-12-95	<0.015	1.7	<0.010	<0.050	--	0.04	<0.010	<10
Tahana Lake	10-25-95	<0.015	1.8	0.010	<0.050	--	0.05	<0.010	<10
Whitestone Lake	09-12-90	0.050	--	0.008	0.018	0.010	--	0.002	10
	11-01-95	<0.015	2.2	<0.010	<0.050	--	0.05	<0.010	10

Table 8. Water-quality data for selected lakes—Continued

Station name	Date	Arsenic, dissolved (µg/L as As) (01000)	Boron, dissolved (µg/L as B) (01020)	Iron, dissolved (µg/L as Fe) (01046)	Manganese, dissolved (µg/L as Mn) (01056)	Selenium, dissolved (µg/L as Se) (01145)	Gross alpha, dissolved (µg/L as natural uranium) (80030)	Gross beta, dissolved (pCi/L as Cs-137) (03515)	Gross beta, dissolved (pCi/L as Sr/Y-90) (80050)
Buffalo Lake North	12-12-95	5	110	<3	5	<1	--	--	--
Buffalo Lake South	10-26-95	2	50	<3	2	<1	--	--	--
Cottonwood Lake	09-11-90	14	430	10	30	<1	2.9	41	31
	12-13-95	3	190	8	95	<1	--	--	--
Drywood Lakes	09-12-90	15	370	<3	4	<1	4.5	110	85
	10-26-95	4	100	<3	1	<1	--	--	--
Dumarce Lake	09-20-90	2	170	4	3	<1	1.3	43	32
	12-13-95	2	120	6	25	<1	--	--	--
Flat Lake	09-19-90	6	260	<3	4	<1	1.8	63	48
Hill Lake	09-19-90	2	300	20	29	<1	4.5	49	37
Hurricane Lake	12-14-95	1	40	5	2	<1	--	--	--
Lake Bdeska	09-11-90	8	790	20	100	<1	6.8	68	50
	12-13-95	2	320	15	92	<1	--	--	--
Lake Traverse	11-01-95	8	180	<3	16	<1	--	--	--
Mud Lake	09-20-90	4	140	7	2	<1	1.9	25	19
	10-26-95	1	60	<3	1	<1	--	--	--
Oneroad Lake	09-13-90	1	60	4	57	<1	<0.4	13	9.6
	10-25-95	2	20	3	3	<1	--	--	--
	[1]10-25-95	2	20	4	3	<1	--	--	--
Owl Lake	09-17-90	1	60	7	<1	<1	0.9	23	17
	11-02-95	1	50	6	<1	<1	--	--	--
Piyas Lake	12-12-95	8	390	<9	95	<1	--	--	--
Sarah Lake	12-12-95	1	70	<3	2	<1	--	--	--
Tahana Lake	10-25-95	2	60	<3	1	<1	--	--	--
Whitestone Lake	09-12-90	3	150	<3	2	<1	2.2	50	38
	11-01-95	2	90	<3	1	<1	--	--	--

[1]Indicates duplicate sample taken for quality-assurance purposes.

QUALITY-ASSURANCE DATA

Quality-assurance procedures were performed to evaluate the precision and accuracy of the reported analytical results. The procedures were designed to verify that no significant biases were introduced to the data during either field sampling and processing, or during laboratory analysis of the samples. Quality-assurance samples collected during this study included duplicate, laboratory blanks, and field blanks. Duplicate samples are two samples collected as close in time as possible and are considered to be essentially identical in composition. They are collected to evaluate variability in the data that may be attributed to either field collection and processing procedures, or laboratory analytical procedures.

A total of four duplicate sample sets were collected for this study during the period presented in this report. Two duplicate ground-water samples (table 3), one duplicate stream sample (table 6), and one duplicate lake sample (table 8) were collected. The data indicate that the analytical results for the duplicate pairs generally compared very well and were not substantially different.

Blank samples, which included both laboratory and field blanks, were collected and analyzed to identify the presence and magnitude of contamination that potentially could bias analytical results. Laboratory blanks, which are samples of ultrapure deionized water that are processed through the sampling equipment within a laboratory or other controlled environment, are used to identify sample contamination introduced from the sampling equipment. Field blanks, which are samples of ultrapure deionized water that are processed through the sampling equipment at the field collection site, are used to identify sample contamination introduced during collection and processing of samples in the field. Two laboratory blanks and two field blanks were collected for the ground-water portion of this study and one field blank was collected for the surface-water portion of the study. The results of the blank samples (table 9) indicate that external contamination did not substantially contribute to concentrations of constituents presented in this report.

Quality-assurance procedures for the USGS NWQL included analyses of reference and calibration materials and internal analyses of blanks, replicates, and spiked samples. Quality-assurance procedures for the USGS NWQL are presented in Friedman and Erdmann (1982) and Pritt and Raese (1992).

Table 9. Constituent concentrations for quality-assurance laboratory and field blanks

[mg/L, milligrams per liter; mL, milliliter; µg/L, micrograms per liter; pCi/L, picocuries per liter; deg. C, degrees Celsius; dis, dissolved; <, less than; -- no data]

Station number	Sample type	Date	Calcium, dissolved (mg/L as Ca) (00915)	Magnesium, dissolved (mg/L as Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)	Potassium dissolved (mg/L as K) (00935)	Sulfate, dissolved (mg/L as SO_4) (00945)	Chloride, dissolved (mg/L as Cl) (00940)
442142098130700	Laboratory blank[1]	09-15-95	0.06	0.03	0.09	--	--	--
	Laboratory blank[1]	09-20-96	0.033	0.005	0.031	--	--	--
453001096584801	Field blank[1]	10-16-95	0.02	<0.01	<0.20	<0.10	<0.10	<0.10
454818096473002	Field blank[1]	10-07-96	0.04	<0.01	0.20	<0.10	<0.10	0.20
453057097091500	Field blank[2]	10-25-95	<0.02	<0.01	<0.20	<0.10	<0.10	0.10

Table 9. Constituent concentrations for quality-assurance laboratory and field blanks—Continued

Station number	Date	Fluoride, dissolved (mg/L as F) (00950)	Silica, dissolved (mg/L as SiO_2) (00955)	Solids, residue at 180 deg. C dissolved (mg/L) (70300)	Nitrogen, ammonia, dissolved (mg/L as N) (00608)	Nitrogen, ammonia + organic, total (mg/L as N) (00625)	Nitrogen, nitrite, dissolved (mg/L as N) (00613)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N) (00631)	Phosphorus, total (mg/L as P) (00665)
442142098130700	09-15-95	--	0.02	--	<0.002	--	0.001	<0.005	--
	09-20-96	--	<0.02	--	<0.002	--	<0.001	<0.005	--
453001096584801	10-16-95	<0.10	<0.01	<1	<0.015	--	<0.010	<0.050	--
454818096473002	10-07-96	<0.10	0.50	2	<0.015	--	<0.010	<0.050	--
453057097091500	10-25-95	0.20	0.02	4	<0.015	<0.20	<0.010	<0.050	<0.010

Station number	Date	Phosphorus, ortho, dissolved (mg/L as P) (00671)	Aluminum, dissolved (µg/L as Al) (01106)	Arsenic, dissolved (µg/L as As) (01000)	Boron, dissolved (µg/L as B) (01020)	Iron, dissolved (µg/L as Fe) (01046)	Manganese, dissolved (µg/L as Mn) (01056)	Selenium, dissolved (µg/L as Se) (01145)	Gross alpha, dissolved (µg/L as natural uranium) (80030)
442142098130700	09-15-95	<0.001	2	--	3	<3	0	--	--
	09-20-96	<0.001	2.7	--	4.1	<3	2.9	--	--
453001096584801	10-16-95	<0.010	<10	<1	10	<3	<1	<1	<3.0
454818096473002	10-07-96	<0.010	6.2	<1	8.9	<3	3.0	<1	--
453057097091500	10-25-95	<0.010	<10	<1	<10	<3	<1	<1	--

Station number	Date	Alpha, count, 2 sigma, dis as natural uranium (µg/L) (75986)	Alpha radio, dis as Th-230 (pCi/L) (04126)	Alpha, count, 2 sigma, dis as Th-230 (pCi/L) (75987)	Gross beta, dissolved (pCi/L as Cs-137) (03515)	Beta, 2 sigma, dis, as Cs-137 (pCi/L) (75989)	Gross beta, dissolved (pCi/L as Sr/Y-90) (80050)	Beta, 2 sigma, dis, as Sr90/Y90 (pCi/L) (75988)
442142098130700	09-15-95	--	--	--	--	--	--	--
	09-20-96	--	--	--	--	--	--	--
453001096584801	10-16-95	0.31	<3.0	0.21	<4.0	0.36	<4.0	0.36
454818096473002	10-07-96	--	<3.0	0.54	<4.0	1.3	--	--
453057097091500	10-25-95	--	--	--	--	--	--	--

[1]Indicates a ground-water blank.
[2]Indicates a surface-water (lake) blank.

REFERENCES

Armstrong, C.A., 1979, Ground-water basic data for Ransom and Sargent Counties, North Dakota, Part II: North Dakota Geological Survey Bulletin 69 and North Dakota State Water Commission County Ground Water Studies 31, 637 p.

———1982, Ground-water resources of Ransom and Sargent Counties, North Dakota, Part III: North Dakota Geological Survey Bulletin 69 and North Dakota State Water Commission County Ground Water Studies 31, 51 p.

Baker, C.H., Jr., 1966, Geology and ground water resources of Richland County, North Dakota, Part II: North Dakota Geological Survey Bulletin 46 and North Dakota State Water Commission County Ground Water Studies 7, 170 p.

Baker, C.H., Jr., and Paulson, Q.F., 1967, Geology and ground water resources of Richland County, North Dakota, Part III: North Dakota Geological Survey Bulletin 46 and North Dakota State Water Commission County Ground Water Studies 7, 48 p.

Burr, M.J., and Korkow, K.L., 1996, Peak-flow frequency estimates through 1994 for gages streams in South Dakota: U.S. Geological Survey Open-File Report 96-202, 407 p.

Edwards, T.K., and Glysson, G.D., 1988, Field methods for measurement of fluvial sediment: U.S. Geological Survey Open-File Report 86-531, 118 p.

Flint, R. F., 1955, Pleistocene geology of eastern South Dakota: U.S. Geological Survey Professional Paper 262, 173 p.

Friedman, L.C., and Erdmann, D.E., 1982, Quality assurance practices for the chemical and biological analyses of water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A6, 181 p.

Hansen, D.S., 1990, Water resources of Codington and Grant Counties, South Dakota: U.S. Geological Survey Water-Resources Investigations Report 89-4147, 47 p.

Horowitz, A.J., Demas, C.R., Fitzgerald, K.K., Miller, T.L., Rickert, D.A., 1994, U.S. Geological Survey protocol for the collection and processing of surface-water samples for the subsequent determination of inorganic constituents in filtered water: U.S. Geological Survey Open-File Report 94-539, 57 p.

Koch, N.C., 1975, Geology and water resources of Marshall County, South Dakota—Part I—Geology and water resources: South Dakota Geological Survey Bulletin 23, 76 p.

Leap, D.I., 1988, Geology and hydrology of Day County, South Dakota: South Dakota Geological Survey Bulletin 24, 117 p.

Ott, L.O., 1993, An introduction to statistical methods (4th ed.): Belmont, California, Wadsworth, Inc., 1,051 p.

Pritt, J.W., and Raese, J.W., eds., 1992, Quality assurance/ quality control manual - National Water Quality Laboratory: U.S. Geological Survey Open-File Report 92-495, 33 p.

South Dakota State Lakes Preservation Committee, 1977, A plan for the classification, preservation, and restoration of lakes in northeastern South Dakota: Prepared for the Governor and Legislature of South Dakota, 268 p.

U.S. Department of Commerce, 1931-96a, Climatological data annual summary, South Dakota: Asheville, North Carolina, 1931 to 1996 (published annually).

———1931-96b, Climatological data annual summary, North Dakota: Asheville, North Carolina, 1931 to 1996 (published annually).

Wood, W.W., 1976, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, 24 p.

SUPPLEMENTAL INFORMATION

—PAGE 61 FOLLOWS—

Section A - Precipitation Data

—PAGE 63 FOLLOWS—

Table A1. Precipitation, in inches, for the Big Stone City, S. Dak., National Weather Service station, 1983-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1983	---	---	---	---	---	---	---	---	---	---	---	0.32	--
1984	0.21	0.43	1.39	3.41	1.93	7.72	1.40	1.63	1.77	6.77	0.00	.70	27.36
1985	.18	.31	.53	3.23	2.30	2.77	4.29	3.84	4.53	2.22	1.22	.40	25.82
1986	.20	2.30	.88	7.72	3.63	2.14	5.45	3.14	4.69	.12	.64	.00	30.91
1987	.34	.57	1.52	.88	2.32	1.14	3.83	1.94	3.01	.41	1.17	.21	17.34
1988	.32	.15	.93	.89	1.89	1.18	1.68	3.42	1.34	.00	1.32	.40	13.52
1989	.42	.48	1.00	3.59	1.05	1.79	2.68	2.57	1.37	.98	.48	.12	16.53
1990	---	.20	1.64	1.45	1.75	4.83	2.09	5.85	1.21	1.39	. 00	.14	--
1991	.07	.58	1.13	3.88	4.17	8.57	6.35	4.54	1.82	.63	.59	---	--
1992	.84	.42	1.46	1.04	.94	7.60	3.46	1.26	1.25	.04	.68	.15	19.14
1993	---	.21	1.48	2.12	2.89	6.82	8.83	2.27	2.24	.94	1.96	.48	--
1994	.59	.85	.49	4.24	2.84	3.48	7.91	2.11	2.11	2.24	.45	.20	27.51
1995	.81	.33	---	3.37	3.45	1.73	6.65	5.20	2.42	3.72	.29	.53	--
1996	.81	.08	.40	.13	4.32	1.63	3.62	1.93	3.04	3.93	1.82	.39	22.10

Table A2. Precipitation, in inches, for the Sisseton, S. Dak., National Weather Service station, 1931-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1931	---	---	---	---	---	---	---	2.57	---	2.41	0.69	0.75	--
1932	0.72	0.15	0.87	1.86	3.78	3.80	1.57	4.77	0.84	1.15	.60	.60	20.71
1933	.40	.55	1.26	2.00	3.84	3.09	2.28	.77	1.03	.00	.47	.81	16.50
1934	.22	.00	1.19	.58	.36	3.40	.59	2.70	2.70	2.08	1.03	.27	15.12
1935	.65	.81	2.20	3.18	2.09	4.61	5.22	1.93	.30	.40	.23	.92	22.54
1936	.50	.90	.49	1.31	2.01	1.91	1.15	1.95	1.46	.30	1.10	.63	13.71
1937	1.80	.63	1.69	5.54	2.52	4.59	4.33	3.25	.59	.28	.10	.56	25.88
1938	.50	.55	1.13	5.22	3.57	4.99	5.06	.63	3.80	.26	.42	.17	26.30
1939	1.66	.74	.31	1.18	2.14	9.08	2.19	1.22	.75	.94	.07	.14	20.42
1940	.08	.50	2.18	2.54	1.52	1.70	3.27	3.26	.64	3.19	.72	.64	20.24
1941	.75	.14	.07	5.21	1.75	6.53	2.32	6.49	2.81	1.63	.30	.25	28.25
1942	.00	.06	3.19	3.69	5.43	5.23	1.97	4.76	2.25	1.09	.12	.46	28.25
1943	.48	1.28	1.39	.50	3.39	6.52	2.41	2.92	.91	2.29	.68	.00	22.77
1944	.62	.14	.55	2.26	4.14	3.63	4.77	3.98	2.08	.74	1.58	.05	24.54
1945	.02	.86	1.39	1.62	1.92	6.65	3.13	2.28	2.90	.30	.57	.32	21.96
1946	.02	1.05	1.85	.82	1.63	4.58	5.46	.32	3.43	3.78	.67	.56	24.17
1947	.13	.07	.90	4.15	1.85	3.72	1.76	.81	1.31	2.92	2.97	.07	20.66
1948	.07	1.58	.63	2.15	1.26	7.23	4.36	2.69	1.95	1.50	.42	.00	23.84
1949	1.14	.15	.95	.34	2.50	2.45	4.26	.91	1.66	2.29	.53	1.18	18.36
1950	.64	---	---	---	---	---	---	2.07	.81	.68	---	---	--
1951	---	---	---	.39	2.29	5.37	4.32	3.59	.35	2.68	.31	---	--
1952	2.01	1.35	.85	.45	1.27	3.16	.33	.98	.40	.02	1.62	.59	13.03
1953	---	.90	.36	4.87	2.85	6.97	1.50	3.90	.30	.31	1.77	1.09	--
1954	.26	.37	.98	2.94	9.15	2.85	1.16	2.50	3.05	1.18	.31	.00	24.75
1955	.20	1.54	.11	.63	1.82	4.85	2.64	3.61	.74	.13	.38	1.40	18.05
1956	.87	.18	1.21	1.83	3.27	2.16	2.76	4.05	.87	---	---	---	--
1956	---	---	---	---	---	---	---	---	---	---	---	---	--
1957	.24	.41	.91	3.94	5.92	3.68	2.76	5.40	1.88	2.78	.89	.16	28.97
1958	.25	1.39	.48	---	1.42	2.88	2.38	1.13	.73	.29	2.29	.09	--
1959	.11	.59	.03	.64	2.34	5.34	.90	1.68	1.71	1.66	.77	1.24	17.01
1960	.76	.37	.44	4.26	1.74	4.04	2.34	3.24	.79	.87	1.08	.92	20.85
1961	.00	.15	.23	2.04	4.06	2.80	2.48	1.99	3.63	1.90	.05	1.08	20.41
1962	.44	1.63	1.49	2.13	8.95	3.26	8.13	.62	2.39	.97	.82	.00	30.83
1963	.33	.25	.99	1.74	2.44	3.20	4.54	2.47	1.51	.97	.58	.86	19.88
1964	.38	.39	.69	4.07	.59	2.32	2.47	6.91	1.78	.11	.33	.30	20.34
1965	.35	.09	1.71	2.99	9.76	2.41	3.06	2.08	4.59	.20	.55	1.06	28.85
1966	.29	.76	1.58	2.50	.75	2.03	1.60	6.36	.79	1.88	.56	.03	19.13
1967	1.35	.72	.31	3.95	1.00	4.72	2.26	4.07	.83	.75	.11	.61	20.68

Table A2. Precipitation, in inches, for the Sisseton, S. Dak., National Weather Service station, 1931-96—Continued

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1968	0.41	0.11	0.64	5.79	4.16	3.61	1.18	1.65	4.03	2.74	1.07	2.03	27.42
1969	1.60	1.42	.59	1.88	2.40	1.82	3.21	.14	.13	2.43	.47	.90	16.99
1970	.00	.19	.87	2.81	1.85	3.28	2.51	.40	1.78	1.98	2.70	.09	18.46
1971	.79	.85	.54	1.29	3.13	7.10	1.27	2.91	.69	4.17	1.42	.52	24.68
1972	.54	.32	1.21	1.29	7.57	1.27	5.00	1.20	.10	.61	.41	1.90	21.42
1973	.23	.48	1.52	1.22	3.74	1.35	2.96	.98	2.91	1.31	.78	.93	18.41
1974	.00	.96	.46	2.04	4.20	.55	---	2.37	.37	.93	.62	.20	--
1975	1.54	---	2.03	2.78	.99	6.72	.32	4.74	1.48	1.59	.41	.03	--
1976	1.18	---	1.33	.84	.41	1.25	.45	1.09	.85	.50	.04	.26	--
1977	.71	1.15	5.19	2.97	2.52	1.83	2.63	2.46	3.50	2.69	4.77	1.05	31.47
1978	.13	---	.63	2.47	2.39	6.31	3.34	2.73	1.11	.15	1.24	.31	--
1979	1.58	1.17	1.69	3.20	1.33	6.64	4.15	1.45	.11	2.91	.25	.21	24.69
1980	.59	.41	---	.56	.90	3.17	1.71	5.25	.37	.98	.00	.03	--
1981	.40	.90	1.32	1.11	3.31	3.31	3.20	1.47	.53	1.97	.89	.58	18.99
1982	---	.25	2.02	.16	3.69	.67	2.25	1.14	2.51	4.02	.55	.65	--
1983	.10	.15	2.70	.47	.43	2.22	1.62	5.06	1.84	.94	1.74	.57	17.84
1984	.41	1.14	1.99	2.79	1.09	6.61	2.33	3.33	1.21	5.02	.00	.55	26.47
1985	.20	.09	1.08	1.37	3.58	2.44	1.82	2.66	2.17	1.86	2.15	.78	20.20
1986	.28	.52	.74	7.30	3.08	3.53	6.51	2.91	4.96	.44	.92	.00	31.19
1987	.17	.77	1.88	.18	2.89	.64	2.79	1.38	2.31	.58	.62	.27	14.48
1988	.33	.14	.62	.47	3.90	1.57	1.27	4.44	3.88	.26	1.83	.33	19.04
1989	.62	---	1.90	2.49	.75	1.51	3.67	6.03	2.94	.40	.62	.00	--
1990	.10	.47	1.40	2.55	1.33	3.86	2.45	3.19	2.69	1.20	.00	.32	19.56
1991	.01	---	---	4.46	4.60	6.91	4.79	1.86	2.74	.84	---	.14	--
1992	.28	.37	.88	1.27	1.25	5.50	2.66	---	2.13	.48	---	---	--
1993	---	.28	1.20	1.58	4.34	5.50	8.25	1.93	2.11	.57	2.66	---	--
1994	1.84	.75	.48	3.65	2.12	1.26	5.85	1.47	2.29	2.30	.90	.26	23.17
1995	1.26	.68	4.38	2.08	4.08	1.73	4.22	3.61	3.66	2.84	.27	.62	29.43
1996	1.12	.47	.91	.15	4.51	3.55	3.33	.60	3.94	3.93	1.90	1.09	25.50

Table A3. Precipitation, in inches, for the Summit, S. Dak., National Weather Service station, 1956-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1956	---	---	---	---	---	---	---	---	0.76	1.73	---	---	--
1956	---	---	---	---	---	---	---	---	---	---	0.97	0.05	--
1957	---	---	0.24	3.42	7.79	3.30	0.86	6.16	1.82	3.91	---	.14	--
1958	0.09	0.89	.30	2.62	1.26	2.15	2.10	.83	.89	.30	1.43	.07	12.93
1959	.13	.29	.00	.59	3.72	3.29	3.86	3.12	1.18	1.76	.33	1.08	19.35
1960	.29	.43	.86	3.37	2.53	4.07	2.16	2.48	1.57	.59	.59	1.34	20.28
1961	.04	.13	.35	1.70	6.08	.52	2.00	2.85	3.71	2.00	.19	.39	19.96
1962	.54	1.38	.87	1.63	9.34	5.96	6.64	1.18	.97	.50	.56	.02	29.59
1963	.37	.41	1.05	1.21	3.36	3.39	8.15	2.19	2.91	.83	.67	.36	24.90
1964	.11	.22	.84	2.94	.76	1.68	2.25	3.87	1.28	.00	.23	.17	14.35
1965	.19	.18	1.25	3.23	5.94	1.70	3.47	1.17	4.76	.55	.36	.67	23.47
1966	.10	.51	.82	2.00	1.81	2.28	3.58	4.85	.98	1.23	.30	.07	18.53
1967	.58	---	.12	2.15	1.12	5.90	.74	1.15	.90	.59	.09	.55	--
1968	.22	.00	.45	4.41	2.38	3.35	2.04	1.38	2.12	1.89	.51	.60	19.35
1969	1.25	.92	.30	1.33	3.58	1.85	4.20	.88	1.51	3.01	.13	.53	19.49
1970	.19	.05	.96	2.23	1.53	3.55	3.46	1.87	1.83	1.23	2.18	.10	19.18
1971	.26	.48	.01	1.35	3.19	9.44	1.85	3.69	1.65	4.32	1.96	.60	28.80
1972	.40	.43	1.34	1.89	7.18	1.26	6.49	1.84	.12	1.19	---	.77	--
1973	.36	.12	2.11	1.48	5.02	.67	1.42	1.93	1.92	1.05	.67	.22	16.97
1974	.00	.47	.43	1.98	3.30	1.41	2.05	2.67	.32	1.22	.25	.11	14.21
1975	.90	.14	.93	2.12	1.64	4.48	.94	2.43	1.29	.94	.36	.10	16.27
1976	.94	.18	---	1.27	.52	.91	1.24	2.11	1.26	.17	.00	.27	--
1977	.54	.51	6.46	2.79	2.72	2.74	2.81	4.67	3.71	3.66	2.48	.83	33.92
1978	.39	.52	.79	2.52	4.52	4.61	1.93	2.80	1.54	.17	.75	.21	20.75
1979	1.16	.36	1.75	1.98	1.55	5.65	2.44	3.90	.11	2.30	.00	.10	21.30
1980	.67	.77	.63	.43	1.91	5.21	3.90	3.24	.38	.80	.02	.03	17.99
1981	.10	.90	.98	.53	2.05	---	---	---	---	---	---	---	--
1982	---	---	---	---	---	---	6.69	1.52	2.51	3.77	.58	.06	--
1983	.24	.54	2.72	1.20	1.03	3.84	4.12	4.03	2.54	1.46	2.26	.74	24.72
1984	.75	---	2.08	3.56	1.77	7.10	1.51	3.60	1.16	5.14	.02	.57	--
1985	.14	.20	---	1.30	2.03	1.75	3.99	4.72	4.55	1.85	1.75	---	--
1986	---	---	1.55	6.56	3.89	5.54	4.00	3.89	4.69	.75	.63	.00	--
1987	.23	.82	2.14	.58	2.41	.93	3.75	1.81	1.87	---	.91	.18	--
1988	.57	---	---	.62	3.53	1.63	1.21	4.61	3.49	.30	1.29	.41	--
1989	.59	---	---	3.62	1.29	2.09	2.78	4.85	3.76	.37	.59	.09	--
1990	.07	.32	1.51	1.89	2.01	5.14	2.57	3.20	1.28	1.24	.02	.35	19.60
1991	.13	.82	1.33	4.94	---	6.53	3.63	4.61	2.65	.68	---	---	--
1992	.45	.21	---	1.23	.53	6.89	2.57	1.10	3.38	.42	2.27	.46	--
1993	---	---	.96	2.06	3.10	6.89	9.29	1.50	2.49	.75	1.20	---	--
1994	1.23	.92	.36	---	2.03	3.15	9.01	2.79	2.32	2.91	.66	.30	--
1995	.70	.43	2.25	2.90	4.50	3.35	6.96	6.86	2.78	2.97	---	.42	--
1996	1.31	.32	.56	.11	4.85	3.00	3.86	1.69	3.47	3.68	1.48	.43	24.76

Table A4. Precipitation, in inches, for the Victor, S. Dak., National Weather Service station, 1931-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1931	0.20	0.40	1.39	0.72	2.61	6.47	1.36	4.26	0.77	2.32	1.35	0.47	22.32
1932	.32	.09	.60	2.37	3.16	1.96	2.14	2.16	.47	.84	.78	.28	15.17
1933	.34	.24	2.13	1.53	2.86	1.21	2.08	3.75	.61	.02	.43	.95	16.15
1934	.22	.01	.73	.48	.48	4.15	2.73	1.92	2.11	1.23	.82	.34	15.22
1935	.50	.33	1.81	2.65	1.61	5.30	5.28	2.92	.23	.56	.71	.67	22.57
1936	.54	1.03	.85	.91	1.37	1.36	.37	2.17	2.16	.18	1.67	.66	13.27
1937	1.70	.63	1.38	4.85	3.49	2.94	3.41	2.34	.99	.28	.92	.66	23.59
1938	.47	.74	.67	3.35	4.03	4.56	2.58	.98	5.98	.37	.79	.44	24.96
1939	1.70	1.60	.41	.89	2.21	7.52	2.26	1.24	1.10	1.08	.07	.26	20.34
1940	.13	.75	2.26	2.66	2.12	1.30	1.78	3.23	.49	2.86	1.36	.53	19.47
1941	.60	.19	.30	3.02	2.72	12.00	2.62	4.82	2.91	1.60	.22	.20	31.20
1942	.05	.08	3.27	2.07	7.31	5.41	1.33	2.97	4.23	1.69	.16	.52	29.09
1943	.75	1.50	1.92	.70	3.42	6.19	1.89	3.38	1.26	2.55	1.38	.05	24.99
1944	.52	.37	1.10	2.64	3.11	4.03	4.49	3.53	1.30	.42	1.37	.13	23.01
1945	.23	1.19	1.58	1.91	2.54	4.25	1.12	1.06	2.36	.53	.65	.91	18.33
1946	.10	1.97	1.73	1.45	.75	3.99	3.65	.38	2.37	2.97	1.15	.68	21.19
1947	.08	.85	.91	4.15	1.85	3.59	2.08	1.02	1.92	1.39	2.00	.20	20.04
1948	.21	1.89	1.40	1.97	1.21	5.13	5.54	3.17	1.21	1.02	.80	.20	23.75
1949	1.27	.29	.75	.28	2.34	3.77	6.87	.24	.86	2.53	1.01	1.25	21.46
1950	1.46	.07	2.72	1.61	5.57	1.06	6.49	1.05	1.98	1.22	.37	.89	24.49
1951	.74	.82	2.65	1.18	2.17	5.52	1.82	2.42	.92	2.98	.82	1.98	24.02
1952	1.63	1.58	1.19	1.35	1.09	2.61	1.70	3.00	.79	.09	1.71	.67	17.41
1953	.93	.69	.64	3.97	3.88	6.16	1.62	2.59	.25	.47	1.32	1.15	23.67
1954	.49	.36	.83	3.02	3.24	4.20	1.90	2.24	3.70	.81	.21	.13	21.13
1955	.38	.93	.25	.50	2.10	3.01	8.49	3.15	1.27	.22	.47	1.01	21.78
1956	---	---	---	---	---	---	---	---	---	---	1.92	.40	--
1956	.46	.23	1.01	2.24	2.26	2.83	2.76	8.25	.72	1.10	---	---	--
1957	.12	.33	.79	3.38	6.49	4.54	3.42	6.88	2.67	1.67	1.07	.22	31.58
1958	.44	.88	.74	2.57	1.62	2.26	2.82	1.00	1.15	.64	2.54	.25	16.91
1959	.09	.33	.20	.66	2.95	2.60	2.01	2.41	1.60	1.95	.56	1.32	16.68
1960	.55	.38	.36	3.97	1.70	4.71	.87	3.20	.93	.90	.49	.90	18.96
1961	.06	.12	.39	2.28	3.29	1.78	1.53	1.34	3.01	1.34	.08	.83	16.05
1962	.40	1.23	1.39	2.46	10.01	4.89	8.86	1.34	2.63	.64	.65	.12	34.62
1963	.18	.35	1.20	1.11	4.07	3.85	3.77	2.78	2.02	.69	.82	1.00	21.84
1964	.60	.42	.53	3.91	.60	2.83	2.27	2.99	2.24	.09	.27	.25	17.00
1965	.12	.29	.84	3.45	5.74	4.63	3.92	1.72	4.68	.31	.62	1.35	27.67
1966	.19	.63	.93	2.47	.92	3.45	1.25	7.37	.56	1.71	.58	.16	20.22
1967	.62	.45	.19	2.32	1.16	6.41	4.00	.96	.71	.62	.00	.52	17.96

Table A4. Precipitation, in inches, for the Victor, S. Dak., National Weather Service station, 1931-96—Continued

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1968	0.16	0.07	0.57	4.34	3.06	3.22	0.71	1.88	4.24	2.19	0.54	1.08	22.06
1969	1.07	.50	.48	1.85	1.83	1.58	4.37	.00	.18	1.62	.47	.98	14.93
1970	.15	.16	1.41	3.41	3.40	2.11	2.25	.07	1.55	2.23	2.17	.09	19.00
1971	.92	.41	.10	1.14	1.27	6.29	2.00	3.04	.89	3.91	1.60	.26	21.83
1972	.56	.40	1.48	1.02	4.23	.77	4.23	.96	.12	1.23	.18	1.69	16.87
1973	.06	.25	1.54	.81	3.56	.88	2.80	---	3.00	1.52	.89	.83	--
1974	.00	.37	.36	1.79	4.40	.51	2.84	---	.45	.65	.73	.10	--
1975	1.19	.48	1.68	3.30	1.29	8.46	3.90	6.50	1.62	1.31	.55	.06	30.34
1976	.98	.39	.92	1.05	.88	1.39	.35	.58	.65	.23	.03	.21	7.66
1977	.43	.99	3.30	2.38	2.28	4.38	2.77	2.83	3.65	2.90	3.32	1.32	30.55
1978	.36	.34	.21	2.29	2.51	6.65	5.42	1.18	1.16	.06	.93	.43	21.54
1979	1.20	1.54	1.81	3.54	2.19	4.41	3.25	---	.37	2.35	.30	.23	--
1980	1.18	.67	.61	.14	1.13	2.89	.89	2.99	3.95	.92	.02	.02	15.41
1981	.06	1.13	.64	1.46	1.85	5.16	2.87	1.56	.73	2.11	.51	.62	18.70
1982	1.22	.46	1.60	.12	---	1.58	.95	.53	3.17	4.78	.71	.04	--
1983	.10	.00	2.43	.23	.55	2.36	2.26	5.14	1.72	.78	1.10	.68	17.35
1984	.79	1.10	1.60	2.41	1.13	5.34	1.54	1.73	1.23	5.09	.00	.37	22.33
1985	.10	.17	1.33	1.36	5.26	3.12	1.98	3.14	2.05	1.58	1.36	.48	21.93
1986	.18	.72	.81	6.62	3.44	3.91	5.75	3.43	9.68	.16	.49	.00	35.19
1987	.24	.59	1.33	.12	2.13	.91	4.49	1.57	2.59	.32	.61	.44	15.34
1988	.75	.12	.52	.53	2.87	1.61	4.00	5.50	2.56	.43	1.88	.58	21.35
1989	.75	.57	1.36	1.91	1.57	1.42	6.75	2.80	2.61	.30	---	---	--
1990	.30	.36	1.32	2.13	1.60	4.64	1.67	3.38	2.55	1.73	.02	.50	20.20
1991	.10	.86	1.81	3.76	4.40	8.06	3.25	3.01	2.47	.63	.42	.17	28.94
1992	.44	.83	.83	1.61	2.15	5.21	2.31	1.59	2.16	.17	2.47	.50	20.27
1993	---	.38	1.36	2.02	3.96	6.70	6.81	2.13	1.43	.25	3.09	.96	--
1994	1.31	.68	.49	2.99	2.04	1.05	11.07	1.68	1.75	2.59	1.15	.31	27.11
1995	1.49	.55	3.63	1.95	3.52	1.65	4.35	3.85	2.70	4.10	.24	.62	28.65
1996	1.76	.37	1.47	.33	3.87	2.33	2.10	.34	2.40	3.87	1.88	1.17	21.89

Table A5. Precipitation, in inches, for the Watertown, S. Dak., National Weather Service station, 1931-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1931	0.03	0.31	0.58	1.38	8.16	1.91	1.37	1.19	1.16	1.48	0.88	0.82	19.27
1932	.60	.02	.76	4.21	2.37	5.31	1.74	2.47	1.66	1.57	.47	.38	21.56
1933	.11	.00	.70	.70	2.65	1.67	1.33	1.99	2.49	.03	.31	.34	12.32
1934	.19	.04	1.02	.17	.99	3.51	5.65	2.81	4.53	1.43	.39	.20	20.93
1935	.40	.34	1.58	2.91	1.83	4.61	3.26	3.56	.17	.22	.54	.92	20.34
1936	.57	1.21	.53	2.02	1.81	2.29	.88	3.06	.30	.35	1.05	.49	14.56
1937	1.00	.36	1.91	4.62	2.30	4.40	.92	2.54	1.44	.73	.39	.83	21.44
1938	.81	.57	1.20	3.36	4.05	2.72	2.28	2.23	2.63	.12	.38	.29	20.64
1939	1.68	.85	.24	1.17	3.91	6.11	2.46	2.79	.73	.87	.02	.10	20.93
1940	.12	.70	3.16	1.77	.60	3.50	1.84	5.40	1.19	1.62	1.15	.47	21.52
1941	1.45	.09	.40	3.88	3.36	2.66	1.52	1.95	1.54	1.65	.14	.24	18.88
1942	.02	.08	1.56	2.83	6.80	1.91	2.46	3.39	5.20	1.08	.14	.37	25.84
1943	.92	1.35	1.98	.48	3.15	5.65	3.69	3.48	2.51	2.69	1.42	.00	27.32
1944	.58	.32	.52	2.16	2.25	2.57	2.24	3.21	2.28	.11	1.79	.68	18.71
1945	.41	.95	1.12	1.89	5.22	2.86	2.12	2.76	2.41	.32	.50	1.10	21.66
1946	.07	1.67	2.23	.67	2.74	6.00	2.37	.68	3.86	4.53	1.14	.36	26.32
1947	.31	.27	.68	3.50	.99	4.18	1.00	1.65	2.80	1.98	2.64	.03	20.03
1948	.17	1.08	.37	3.60	.51	5.56	2.88	5.63	3.11	1.26	.31	.06	24.54
1949	.54	.01	.41	.36	3.31	2.09	4.55	.79	2.55	1.42	.97	.82	17.82
1950	.41	.03	.65	1.85	3.21	.33	6.14	1.71	1.37	1.83	.42	.26	18.21
1951	.20	.21	1.85	.83	2.55	3.82	4.08	5.00	.40	2.24	.08	.80	22.06
1952	.77	.91	.73	.31	1.15	5.10	2.92	.82	.47	.00	1.10	.27	14.55
1953	.88	1.64	.50	3.86	1.77	8.15	7.77	1.19	.12	.32	1.07	1.85	29.12
1954	.37	.65	2.13	1.74	3.10	3.74	.88	1.67	2.42	1.09	.23	.02	18.04
1955	.26	1.39	.17	1.26	1.23	4.65	4.74	4.35	.94	.16	.46	---	--
1956	---	---	1.04	1.80	2.88	6.56	4.02	6.25	.70	2.44	---	---	--
1956	---	---	---	---	---	---	---	---	---	---	.97	.16	--
1957	.21	.99	.44	3.67	5.68	2.75	.46	3.47	1.98	2.42	.51	.42	23.00
1958	.10	.49	.44	1.46	1.34	1.73	1.35	.77	1.28	.10	2.53	.24	11.83
1959	.39	.74	.06	.64	3.77	.96	1.74	2.20	1.20	1.79	1.14	.56	15.19
1960	.68	.26	.87	2.64	2.49	3.81	1.29	4.40	1.59	.46	1.13	1.08	20.70
1961	.05	.50	.49	1.53	5.58	4.05	.79	2.03	2.31	1.50	.63	.73	20.19
1962	.42	1.67	1.49	2.36	8.75	4.71	4.62	.62	1.84	1.04	.42	.02	27.96
1963	.74	.28	1.65	1.34	4.18	3.48	10.36	1.89	1.39	1.11	.61	.61	27.64
1964	.05	.38	1.22	2.61	1.28	2.57	2.28	5.24	.77	.09	.53	.40	17.42
1965	.29	.29	2.67	3.14	6.41	2.89	2.02	1.39	4.36	.84	.78	.69	25.77
1966	.24	.77	1.33	2.02	1.10	1.63	4.67	5.13	1.37	1.37	.79	.28	20.70
1967	.85	1.75	.25	3.00	.41	6.63	.80	1.26	.95	.50	.07	.56	17.03

Table A5. Precipitation, in inches, for the Watertown, S. Dak., National Weather Service station, 1931-96—Continued

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1968	0.50	0.01	0.64	4.52	2.67	5.06	3.33	2.07	2.71	2.62	0.58	2.40	27.11
1969	1.47	1.53	.23	1.02	4.77	2.47	6.67	1.26	.60	4.59	.25	.70	25.56
1970	.32	.08	1.46	2.69	3.12	3.96	1.37	.75	1.84	2.01	2.88	.32	20.80
1971	.29	.72	.15	2.64	2.12	6.08	.78	5.08	1.63	8.10	2.13	.54	30.26
1972	.38	.31	.95	3.23	8.25	2.26	5.51	1.93	.32	1.66	1.17	.81	26.78
1973	.34	.44	2.29	1.14	2.87	1.00	2.05	1.27	3.81	1.39	.77	.77	18.14
1974	.10	.74	1.43	1.22	3.37	1.45	2.09	3.70	.22	.91	.83	.15	16.21
1975	2.06	.32	2.89	4.15	2.18	4.76	1.25	2.89	2.28	1.64	1.59	.11	26.12
1976	.74	.52	1.69	1.10	1.26	1.49	.51	.79	1.62	.57	.05	.48	10.82
1977	.47	1.86	3.94	3.05	.89	8.30	3.58	4.55	5.66	3.97	2.40	1.37	40.04
1978	.14	.29	.75	3.38	5.15	2.26	2.08	2.43	2.32	.53	.59	.40	20.32
1979	2.11	.46	1.88	3.14	2.17	5.78	3.10	5.21	.53	3.50	.26	.29	28.43
1980	.70	.61	.81	.43	1.56	6.75	1.61	3.47	.50	.86	.14	.13	17.57
1981	.44	.89	1.31	1.02	.87	2.15	4.24	.87	.31	1.68	.52	.52	14.82
1982	---	.22	.65	.83	5.11	2.10	4.08	1.18	2.44	2.93	.70	.26	--
1983	.31	.08	2.60	.76	1.56	2.41	1.64	2.55	2.53	1.51	3.11	.51	19.57
1984	.46	.37	1.34	3.03	2.30	5.28	2.38	3.46	1.29	5.51	.06	.74	26.22
1985	.26	.14	2.22	1.99	1.27	1.57	---	---	5.35	1.68	1.42	.45	--
1986	.33	.70	.54	5.45	4.41	4.87	5.10	3.05	3.35	.03	.35	.00	28.18
1987	.39	.58	2.01	.80	1.28	.69	4.09	4.68	1.82	.38	.70	.18	17.60
1988	.41	.25	.69	.88	2.66	.65	2.75	2.89	2.67	.32	.60	.19	14.96
1989	.23	.47	1.67	1.88	1.27	1.94	2.39	3.40	1.37	.93	---	.04	--
1990	.02	.12	1.05	1.00	2.08	6.74	2.15	2.31	1.03	2.23	.02	.34	19.09
1991	---	.57	---	4.41	5.77	11.37	1.85	3.69	2.09	.74	---	.15	--
1992	.43	---	.93	1.32	.41	7.22	3.21	2.15	2.16	.34	1.28	.58	--
1993	.40	---	---	1.74	2.28	5.59	5.05	2.42	2.99	.15	1.58	.62	--
1994	.64	---	.29	1.79	1.83	7.48	4.96	4.49	1.86	1.83	.49	.21	--
1995	---	---	2.11	2.49	3.55	2.29	3.82	2.21	3.75	2.85	.20	.30	--
1996	.99	.41	.27	.06	---	---	---	---	---	---	1.00	.27	--

Table A6. Precipitation, in inches, for the Waubay National Wildlife Refuge, S. Dak., National Weather Service station, 1952-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1952	---	---	---	---	1.64	4.41	1.90	0.39	0.51	0.00	0.78	0.55	--
1953	1.45	0.70	0.23	3.92	2.67	6.84	2.85	1.83	.15	.45	1.64	.59	23.32
1954	.44	.26	1.05	3.92	2.68	3.94	1.39	1.00	3.13	1.83	.21	.40	20.25
1955	.50	.75	.15	1.20	1.32	5.72	1.60	5.90	.63	.13	.40	1.00	19.30
1956	---	---	---	---	---	---	---	---	---	---	1.14	.20	--
1956	.61	.20	1.14	1.31	3.39	3.48	1.78	4.41	.89	1.30	---	---	--
1957	.13	.45	.63	1.74	5.92	2.78	1.98	5.06	2.09	2.22	.81	.20	24.01
1958	.24	.48	.29	2.48	1.30	2.75	1.03	.38	.43	.29	1.80	.14	11.61
1959	.20	.60	.03	.73	3.80	2.23	3.00	1.50	1.78	1.54	.51	.53	16.45
1960	.67	.46	.43	3.86	2.11	4.16	.64	4.26	1.36	.79	.40	.81	19.95
1961	.11	.30	.20	1.20	4.80	2.32	4.19	2.32	2.93	3.55	.10	.73	22.75
1962	.34	1.02	1.33	2.25	8.31	6.61	8.58	1.17	1.56	.16	.83	.05	32.21
1963	.22	.37	.53	1.48	2.24	4.19	7.95	3.06	1.70	.63	.40	.30	23.07
1964	.12	.28	1.07	2.65	1.02	3.09	3.98	4.92	1.70	.00	.35	.25	19.43
1965	.39	.20	1.18	2.67	7.77	2.34	3.03	1.58	5.62	.30	.34	1.07	26.49
1966	.32	.83	.87	2.18	1.42	3.60	1.98	6.60	1.71	1.66	.58	.16	21.91
1967	1.04	1.10	.24	1.87	.56	6.64	1.27	.48	.79	.72	.18	.54	15.43
1968	.21	.00	.50	3.52	3.12	3.91	2.43	1.17	2.86	1.30	.62	1.41	21.05
1969	1.51	1.55	.30	1.66	3.60	2.13	4.51	.46	.46	2.06	.32	1.05	19.61
1970	.23	.20	1.44	3.26	2.42	2.75	3.38	.49	1.85	1.79	2.39	.13	20.33
1971	.59	.60	.08	1.09	2.51	8.64	1.20	2.95	.66	5.09	1.63	.52	25.56
1972	.27	.45	.71	1.28	6.99	1.09	6.78	1.88	.12	1.03	.50	1.03	22.13
1973	.10	.18	1.03	1.57	3.28	2.14	1.55	1.33	2.97	1.18	.71	.53	16.57
1974	.00	.49	.56	1.38	3.54	.94	2.94	1.43	.31	.42	.30	.02	12.33
1975	1.26	.30	1.16	2.13	1.31	4.35	1.27	1.87	1.85	1.53	.58	---	--
1976	.70	.50	.81	.69	.63	1.10	.45	.64	.86	.28	.00	.34	7.00
1977	.53	.94	3.73	2.16	2.21	3.82	1.99	3.96	3.30	2.40	2.35	.67	28.06
1978	.25	.16	.39	2.13	3.15	5.97	3.45	4.30	.72	.67	.56	.32	22.07
1979	.86	.42	1.53	2.02	1.45	3.87	3.11	3.27	.32	1.95	.06	.14	19.00
1980	.86	.57	.50	.31	1.35	4.40	2.24	4.25	.34	1.47	.00	.04	16.33
1981	.03	1.02	---	.68	1.75	3.39	2.10	2.35	1.05	2.37	.78	.33	--
1982	.63	.23	1.14	.55	2.63	1.04	3.71	1.98	3.55	3.45	.49	.02	19.42
1983	.20	.46	1.82	.55	1.06	2.55	3.59	4.14	1.99	.91	1.39	.35	19.01
1984	.45	.56	1.10	2.76	1.32	6.82	1.45	3.13	1.22	3.76	.06	.54	23.17
1985	.20	.15	.85	.66	---	2.14	2.60	3.89	2.78	1.78	1.66	.39	--
1986	.34	.75	.51	5.54	3.42	4.13	7.32	3.43	4.47	.30	.48	.00	30.69
1987	.15	.98	1.90	.00	1.63	.86	3.63	1.34	1.75	.31	.60	.18	13.33

Table A6. Precipitation, in inches, for the Waubay National Wildlife Refuge, S. Dak., National Weather Service station, 1952-96—Continued

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1988	0.34	0.23	0.28	0.39	4.03	1.04	1.19	5.96	3.19	0.28	0.95	0.48	18.36
1989	.51	.45	1.69	3.19	1.63	1.58	2.15	4.85	2.89	.40	.66	.00	20.00
1990	.00	.28	1.78	1.69	1.74	4.09	3.27	5.81	1.56	.82	.00	.56	21.60
1991	.15	---	.69	4.16	5.40	6.75	3.63	3.08	3.20	.59	.57	.08	--
1992	.35	.40	.87	.89	.60	6.21	2.38	1.15	1.65	.48	1.17	.49	16.64
1993	.54	.30	.81	1.74	2.72	5.83	9.06	1.28	1.17	.49	2.05	.76	26.75
1994	1.43	.85	.30	2.28	2.46	1.11	6.28	2.52	1.16	3.08	.73	.27	22.47
1995	1.18	.60	2.46	2.25	2.90	2.71	5.13	4.25	3.49	2.51	.20	.36	28.04
1996	.83	.36	.66	.19	4.32	2.60	3.14	.94	3.42	3.94	.99	1.12	22.51

Table A7. Precipitation, in inches, for the Wilmot, S. Dak., National Weather Service station, 1943-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	---	---	---	0.45	3.59	6.51	3.71	2.73	1.69	2.69	0.60	---	--
1944	---	---	---	3.36	5.58	9.32	4.36	3.20	2.23	.55	1.53	---	--
1945	0.10	---	1.11	2.43	3.52	4.25	3.47	2.95	2.16	.36	.77	1.12	--
1946	.12	1.11	1.72	1.20	1.68	4.61	4.78	.86	3.11	4.13	1.15	.20	24.67
1947	.30	.38	.25	5.74	.88	2.63	1.43	1.68	2.73	2.51	3.20	.20	21.93
1948	.10	1.55	1.15	2.42	.43	6.13	4.80	3.20	2.13	1.17	.86	.02	23.96
1949	1.23	.19	.98	.33	1.74	1.02	6.92	.80	1.56	2.37	.75	1.22	19.11
1950	.75	.00	2.92	2.34	3.20	.81	2.73	.94	1.08	.87	.13	1.18	16.95
1951	.51	.35	2.86	1.44	1.65	4.64	6.23	---	.51	3.21	.28	2.27	--
1952	2.10	2.04	.90	.24	2.00	4.87	2.34	3.63	.45	.00	1.19	1.29	21.05
1953	.61	2.27	.65	4.01	3.50	6.04	2.51	3.23	.17	.29	1.13	1.60	26.01
1954	.30	.35	1.27	3.90	3.23	3.00	1.82	1.13	3.42	2.40	.05	.30	21.17
1955	.60	1.70	.80	1.12	1.72	3.73	1.99	6.54	1.10	.11	.26	.67	20.34
1956	---	---	---	---	---	---	---	---	---	---	1.03	.00	--
1956	.52	.09	1.07	1.70	3.15	3.00	3.00	3.96	.55	2.07	---	---	--
1957	.05	.49	.50	4.28	8.62	5.88	.74	7.50	3.69	3.92	.85	.19	36.71
1958	.18	1.01	.46	2.37	1.53	2.66	1.90	.91	.88	.36	2.52	.00	14.78
1959	.18	.50	.00	.70	3.03	3.22	1.75	1.81	.83	1.94	.35	1.26	15.57
1960	.47	.26	.58	3.69	2.01	5.41	1.83	2.85	1.50	.69	.96	.69	20.94
1961	.00	.27	.44	1.70	4.56	1.38	1.54	2.15	3.87	1.61	.06	.63	18.21
1962	.20	1.47	1.26	2.15	8.43	7.40	6.81	1.53	1.68	.59	.77	.00	32.29
1963	.26	.36	1.13	1.58	3.24	4.40	7.35	2.08	2.03	1.25	.62	.55	24.85
1964	.10	.25	.96	3.36	1.10	2.48	4.16	4.86	2.37	.00	.30	.29	20.23
1965	.26	.19	1.50	4.15	8.22	1.84	3.74	1.75	5.15	.24	.54	.72	28.30
1966	.34	.82	1.35	2.58	1.01	2.25	2.31	6.88	1.18	1.70	.58	.20	21.20
1967	1.15	.96	.23	2.17	.50	6.08	1.73	.52	.90	.50	.15	.51	15.40
1968	.29	.01	1.22	5.40	2.47	3.09	1.56	1.55	2.40	2.82	.79	1.60	23.20
1969	1.79	1.61	.47	1.94	5.35	1.09	4.21	.44	.49	2.99	.36	.89	21.63
1970	.19	.03	.43	3.02	1.45	3.77	3.12	.72	1.52	1.72	2.77	.09	18.83
1971	.73	1.09	.07	1.04	3.30	8.55	1.04	3.49	.80	4.56	2.74	.30	27.71
1972	.38	.21	1.36	1.96	5.67	1.03	4.72	1.08	.00	3.32	1.24	1.29	22.26
1973	.05	.42	1.09	1.33	5.94	1.10	1.40	1.52	---	1.50	.81	.63	--
1974	.00	.90	.46	1.97	2.97	1.67	1.71	2.83	.35	1.85	.42	.15	15.28
1975	1.44	.30	2.40	2.44	1.15	4.23	.25	1.83	1.26	1.39	1.05	.20	17.94
1976	1.01	.48	1.55	.79	.71	1.09	1.79	.77	1.16	.17	.06	.35	9.93
1977	.54	1.37	5.34	4.13	2.09	3.09	4.76	3.50	---	3.28	2.18	1.29	--
1978	.36	.40	.83	2.29	4.59	4.59	2.51	4.09	1.60	.13	1.58	.31	23.28
1979	1.61	.72	2.50	3.07	1.78	5.75	2.78	1.96	.06	3.55	.11	.11	24.00

Table A7. Precipitation, in inches, for the Wilmot, S. Dak., National Weather Service station, 1943-96—Continued

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1980	0.68	0.75	0.70	0.53	2.66	4.19	2.79	1.79	0.61	0.79	0.00	0.05	15.54
1981	.14	.75	1.19	.87	2.46	4.96	5.87	1.13	.37	1.91	.71	.62	20.98
1982	1.03	.24	1.31	.37	3.27	.85	4.38	1.62	2.36	3.39	.66	.20	19.68
1983	.36	.57	3.32	.53	.64	2.65	2.72	3.85	2.89	1.40	2.65	.50	22.08
1984	.40	.52	2.73	2.99	1.37	9.82	1.39	2.59	1.53	5.27	.00	.75	29.36
1985	.18	.19	1.51	1.81	2.26	1.45	1.86	3.78	3.77	2.02	1.83	.72	21.38
1986	.63	1.01	1.24	6.82	3.35	3.00	6.49	3.56	4.36	.33	.93	.00	31.72
1987	.36	.77	1.88	.50	2.40	.70	4.17	.71	1.58	.52	.74	.21	14.54
1988	---	.25	1.13	.52	2.73	.70	1.50	5.65	4.34	.35	1.96	.60	--
1989	.56	.63	2.13	3.41	1.11	1.87	2.94	4.66	3.57	.68	1.01	.12	22.69
1990	.20	.59	1.27	1.84	1.08	4.05	2.50	3.94	1.04	1.49	.00	.42	18.42
1991	.07	.83	1.21	3.54	4.60	7.10	5.32	4.41	3.25	.65	.70	.13	31.81
1992	.45	.49	.92	1.34	1.25	5.41	2.11	1.08	2.11	.05	2.82	.57	18.60
1993	.81	.39	1.56	2.15	2.54	4.80	5.75	1.34	1.99	.37	2.21	.61	24.52
1994	1.19	.84	.61	3.99	1.89	2.33	5.68	3.37	1.58	2.68	.69	.17	25.02
1995	.73	.47	3.99	3.11	3.31	2.81	4.14	3.99	2.03	3.98	.26	.47	29.29
1996	2.11	.58	.95	.04	4.63	2.99	3.77	.83	2.04	5.31	1.65	.86	25.76

Table A8. Precipitation, in inches, for the Forman, N. Dak., National Weather Service station, 1931-96

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1931	0.13	0.87	1.37	1.65	2.13	6.25	1.49	1.45	0.67	2.18	0.72	0.15	19.06
1932	.18	.00	.35	2.32	4.16	2.54	1.94	4.46	1.02	1.45	.42	.09	18.93
1933	.25	.07	.36	1.64	2.04	2.69	2.49	1.39	.58	.00	.39	1.06	12.96
1934	.05	.00	.31	.64	.40	2.53	1.78	1.35	2.22	1.92	.56	.20	11.96
1935	.25	.35	2.41	3.85	1.49	4.65	2.70	3.95	.17	.06	.34	.87	21.09
1936	.29	.53	.60	1.18	1.14	.93	.51	.45	2.03	.15	.64	.61	9.06
1937	1.18	.66	.92	5.53	2.32	3.59	4.24	3.94	.94	.07	.14	.51	24.04
1938	.40	.73	.73	2.69	2.89	3.55	3.94	.56	1.54	.06	.70	.25	18.04
1939	1.05	.52	.24	1.26	1.29	9.53	2.24	1.14	1.38	1.42	.00	.24	20.31
1940	.08	.45	1.73	1.78	2.06	1.73	5.10	5.74	.63	2.87	.64	1.10	23.91
1941	.61	.20	.41	4.22	1.73	6.78	.89	2.77	5.47	2.39	.43	.10	26.00
1942	.00	.15	2.46	2.14	6.90	4.01	1.52	5.17	2.06	1.08	.00	.99	26.48
1943	.84	1.31	1.02	.80	3.22	7.58	4.11	2.18	.68	1.42	.66	.00	23.82
1944	.21	.42	.53	1.78	3.91	3.84	7.80	3.87	.46	.88	1.78	.03	25.51
1945	.11	1.36	1.21	3.19	1.05	2.64	1.14	.89	2.95	.43	.15	.63	15.75
1946	.07	1.63	2.02	1.23	.78	4.20	5.46	.87	3.33	2.71	1.20	.50	24.00
1947	.20	.54	.27	2.29	1.50	5.11	1.23	.21	.79	1.26	2.52	.30	16.22
1948	.63	.54	.41	1.54	1.05	4.00	4.60	1.62	1.02	.56	---	.08	--
1949	.97	.37	.60	.07	3.76	3.32	9.09	.45	.67	2.89	.57	1.10	23.86
1950	1.59	.05	.99	.73	5.77	.88	2.55	1.06	.96	1.18	.25	.73	16.74
1951	.57	.44	---	.85	2.60	3.96	1.65	3.73	1.24	2.31	.20	1.25	--
1952	---	---	---	---	---	---	---	---	---	---	---	---	--
1952	1.35	1.17	---	---	---	3.54	2.08	1.47	.13	.08	1.77	.31	--
1953	.45	.47	.25	3.05	5.79	4.63	1.07	2.21	.29	.78	.92	.86	20.77
1954	.59	.08	.78	2.17	2.18	2.74	1.59	1.33	3.68	.98	.12	.19	16.43
1955	.29	1.40	.08	.55	2.34	2.88	7.06	2.43	.63	.00	.09	.74	18.49
1956	.89	.18	1.70	1.59	3.12	2.20	3.40	---	---	---	---	---	--
1956	---	---	---	---	---	---	---	2.94	.72	1.02	1.22	.34	--
1957	.27	.26	.11	5.12	5.03	5.58	2.22	4.53	4.63	1.01	.91	.31	29.98
1958	.31	.73	.23	3.36	1.52	3.14	2.55	1.30	1.76	.58	2.22	.00	17.70
1959	.00	---	.01	.74	3.09	3.79	3.38	4.13	1.95	1.90	.42	---	--
1959	---	.44	---	---	---	---	---	---	---	---	---	---	--
1960	.75	.31	.56	2.81	3.41	4.16	1.66	4.21	1.16	1.21	.56	.86	21.66
1961	.03	.11	.20	1.49	2.68	2.43	3.93	.36	3.91	1.94	.00	.36	17.44
1962	.60	1.35	.53	1.98	5.84	4.81	8.78	3.10	2.10	.41	.55	.03	30.08
1963	.09	.44	.54	1.83	4.00	2.53	2.88	3.04	1.34	.86	.24	.22	18.01
1964	.20	.12	.41	3.07	.85	5.62	3.13	5.73	2.18	.11	.20	.65	22.27
1965	.33	.22	.52	2.78	4.06	3.87	3.83	2.80	3.13	.40	.76	.53	23.23

Table A8. Precipitation, in inches, for the Forman, N. Dak., National Weather Service station, 1931-96—Continued

[---, no data; --, not computed]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1966	0.23	0.40	2.21	1.47	0.90	5.00	1.64	6.34	1.59	1.12	0.27	0.18	21.35
1967	.82	.63	.25	5.03	.59	6.07	3.24	1.40	1.33	.94	.01	.71	21.02
1968	.35	.04	1.41	3.55	2.61	4.62	1.18	1.33	3.85	1.32	.58	1.52	22.36
1969	2.00	---	.48	1.62	2.79	2.02	2.58	.13	.79	1.21	.12	1.14	--
1970	.01	.28	1.56	1.57	2.87	3.68	1.49	.09	---	1.28	1.80	.00	--
1971	.81	.33	.07	1.19	1.56	4.85	1.98	3.71	1.25	2.70	1.78	.85	21.08
1972	.67	.39	.52	.67	6.36	.95	5.21	1.08	.72	.83	.10	1.07	18.57
1973	.08	.24	2.40	.91	1.93	1.53	4.35	1.13	4.43	1.94	.99	.55	20.48
1974	.06	.56	.50	1.29	3.99	.55	1.53	2.48	.35	.36	.29	.05	12.01
1975	.88	.28	1.20	3.50	2.38	8.39	1.55	5.18	1.49	1.40	.46	.11	26.82
1976	.79	.60	.60	1.75	.24	2.98	.58	.44	.52	.37	.08	.48	9.43
1977	.64	.93	3.10	1.83	2.88	3.11	2.50	2.91	3.73	1.42	3.69	.55	27.29
1978	.30	.20	.48	1.75	2.43	7.34	1.97	2.30	1.58	.42	1.19	.10	20.06
1979	---	.88	1.60	2.28	1.26	2.30	3.19	2.41	.31	1.82	.64	.16	--
1980	.88	.73	.94	.38	2.22	4.01	.85	3.43	2.10	1.17	.11	.06	16.88
1981	.20	.23	1.07	.89	1.34	4.94	3.05	2.45	.56	2.29	.80	.98	18.80
1982	1.00	.47	2.21	.44	2.44	1.58	1.56	1.44	1.25	4.51	.98	.11	17.99
1983	.39	.10	2.01	.44	1.69	2.71	3.36	2.81	.74	1.81	.72	.53	17.31
1984	.53	1.44	2.06	2.39	.94	5.14	1.64	1.55	.97	4.48	.05	.32	21.51
1985	.34	.05	1.22	.33	4.56	2.29	1.40	2.06	1.99	1.47	1.65	.60	17.96
1986	.22	.46	.63	8.83	2.49	3.51	4.88	3.92	2.67	.40	.80	.00	28.81
1987	.05	.88	1.48	.39	1.77	.79	4.85	1.53	2.43	.19	.69	.36	15.41
1988	.51	.12	.67	.03	2.46	1.62	1.70	2.06	5.68	.33	.99	1.11	17.28
1989	.88	.30	1.65	2.04	2.42	1.97	2.93	2.86	2.02	.29	1.10	.17	18.63
1990	.14	.44	1.68	1.45	.59	3.75	2.32	2.17	2.31	.82	.00	.60	16.27
1991	.13	.80	.41	3.47	4.65	7.21	3.53	1.22	1.23	---	.57	.20	--
1992	.61	.61	.86	.76	2.82	6.86	2.54	2.59	2.60	.10	---	.37	--
1993	1.11	.36	.70	1.64	3.23	5.08	4.91	2.12	.79	.33	2.45	.99	23.71
1994	1.11	.45	.60	2.45	1.37	.89	5.34	1.32	1.56	3.15	.57	.16	18.97
1995	.73	.64	2.62	1.95	2.95	2.38	5.43	1.84	2.17	4.05	---	.55	--
1996	1.24	.48	1.17	.22	4.51	2.14	1.74	.46	2.63	4.27	1.73	.74	21.33

Section B - Geologic logs of wells and test holes completed for the Lake Traverse/Roberts County water-resources study

[The geologic logs that follow describe the lithology of wells and test holes completed during the reconnaissance and comprehensive drilling programs for the Lake Traverse/Roberts County Water Resources Investigation through 1996. The logs are listed in order of their local number. For each site, the other identifier, station identification number, construction date, land surface altitude, and total construction depth are given. Following the log, any pertinent information regarding special construction details or site characteristics are given. For sites at which an observation well was installed, the screened interval, casing diameter, and casing material are provided. Where applicable, electric-log availability also is indicated in the notes following the geologic logs.]

- PAGE 79 FOLLOWS -

Local number: 122N50W4AADD
Other identifier: R2-94-60
Station identification number: 452337096552401
Date of construction: 8-17-94
Land surface altitude: 1,295 feet
Total depth: 322 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,295-1,293	Topsoil
2-43	41	1,293-1,252	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized (till)
43-46	3	1,252-1,249	Sand and gravel, coarse sand to a fine to medium gravel; oxidized
46-71	25	1,249-1,224	Clay, brown and grayish-brown, silty, sandy, pebbly; hard, partially oxidized, differs from above till, cobble and gravel lens from 53 to 55 feet (till)
71-88	17	1,224-1,207	Sand and gravel, medium to coarse sand to fine to medium gravel; oxidized
88-273	185	1,207-1,022	Clay, gray, silty, very sandy, pebbly; hard, sticky, mud collars, unoxidized, electric-log change at 182 feet, cobble at 272 feet (till)
273-280	7	1,022-1,015	Clay, gray, silty; very calcareous (Niobrara Formation)
280-322	42	1,015-973	Clay, dark-gray to black, shaley; hard, greasy, noncalcareous (Carlile Shale)
Electric log available			

Local number: 122N50W13DDDD
Other identifier: R2-94-62
Station identification number: 452213096514301
Date of construction: 8-23-94
Land surface altitude: 1,222 feet
Total depth: 242 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,222-1220	Topsoil
2-12	10	1,220-1210	Clay, yellowish-brown to dark-brown, silty, sandy, pebbly; oxidized, cobbles at 5 and 8 feet (till)
12-18	6	1,210-1,204	Sand and gravel, medium to coarse sand to fine to medium gravel; dry, oxidized
18-42	24	1,204-1,180	Clay, gray, silty, sandy, pebbly; unoxidized (till)
42-85	43	1,180-1,137	Sand and gravel, medium to coarse sand to a fine to medium gravel
85-102	17	1,137-1,120	Clay, gray, silty, sandy, pebbly; cobbly from 89-90 feet, unoxidized (till)
102-123	21	1,120-1,099	Sand and gravel, coarse sand to a medium to coarse gravel; cobbly from 120-122 feet
123-140	17	1,099-1,082	Clay, brown, silty, sandy, pebbly; very hard, oxidized, some unoxidized noticed starting at 136 feet (till)
140-172	32	1,082-1,050	Clay, gray, silty, sandy, pebbly; hard, unoxidized (till)
172-221	49	1,050-1,001	Sand and gravel, coarse sand to a fine to medium gravel grading to a coarse gravel with depth
221-242	21	1,001-980	Clay, dark gray to black, shaley; hard, greasy, some concretions (Carlile Shale)
Electric log available			

Local number: 122N50W22BBBC
Other identifier: R2-94-61
Station identification number: 452206096552301
Date of construction: 8-22-94
Land surface altitude: 1,340 feet
Total depth: 342 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,340-1,338	Topsoil
2-44	42	1,338-1,296	Clay, tan to reddish-brown, silty, sandy, pebbly; contains some very dark-brown inclusions, oxidized (till)
44-72	28	1,296-1,268	Clay, gray, silty, sandy, pebbly; some iron staining still noticed, unoxidized (till)
72-190	118	1,268-1,150	Clay, gray, silty, sandy, pebbly: electric-log change from above till, more shaley, cobbles at 87, 101 to 104 and 138 feet, unoxidized (till)
190-208	18	1,150-1,132	Gravel, fine to medium grading to coarse with depth; cobbly in spots
208-303	95	1,132-1,037	Clay, grayish, brown, silty, sandy, pebbly; changes to a light-green to light-gray color with depth, numerous cobbles and gravel lenses, partially oxidized (till)
303-310	7	1,037-1,030	Gravel, fine to medium; some coarse
310-342	32	1,030-998	Clay, gray; hard, greasy, noncalcareous, contains concretions (Carlile Shale)
Electric-log available			

Local number: 123N49W16DDDD
Other identifier: R2-94-59
Station identification number: 452725096480401
Date of construction: 8-16-94
Land surface altitude: 1,160 feet
Total depth: 162 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,160-1,150	Clay, tan, silty (lake sediments?)
10-12	2	1,150-1,148	Gravel, coarse; oxidized
12-23	11	1,148-1,137	Clay, yellowish-brown to brown, silty, sandy, pebbly; turns grayish-brown at 19 feet, oxidized (till)
23-38	15	1,137-1,122	Clay, light-gray, silty, sandy, pebbly; large cuttings, cobble at 34 feet, unoxidized (till)
38-50	12	1,122-1,110	Clay, dark-gray, silty, very sandy, pebbly; hard, unoxidized (till)
50-54	4	1,110-1,106	Sand and gravel, coarse sand to fine gravel
54-89	35	1,106-1,071	Clay, gray to black, silty, sandy, pebbly; contains shale inclusions form 54 to 61 feet and 73 to 76 feet, lens of cobbles and gravel from 70 to 72 feet, unoxidized (till)
89-98	9	1,071-1,062	Clay, black, silty; oily, greasy, noncalcareous (Sharon Springs Member - Pierre Shale)
98-162	64	1,062-998	Clay, gray to black, shaley; hard, greasy, good cuttings, noncalcareous (Carlile Shale)
No Niobrara Formation encountered. Electric log available			

Local number: 123N49W34CCCC
Other identifier: R2-94-63
Station identification number: 452449096480201
Date of construction: 8-23-94
Land surface altitude: 1,155 feet
Total depth: 202 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,155-1,153	Topsoil
2-13	11	1,153-1,142	Clay, tan to yellowish-brown; silty, sandy, pebbly; oxidized (till)
13-22	9	1,142-1,133	Sand and gravel, coarse sand to a medium to coarse gravel; dry, oxidized
22-58	36	1,133-1,097	Clay, dark-gray to black; silty, sandy, pebbly; very shale-like; sand lens from 37 to 40 feet, unoxidized (till)
58-118	60	1,097-1,037	Clay, dark-gray to black, shaley; hard, greasy, noncalcareous (Pierre Shale)
118-124	6	1,037-1,031	Clay, light-gray, silty; slightly calcareous (Pierre Shale)
124-161	37	1,031-994	Clay, black, silty; greasy, oily noncalcareous (Sharon Springs Member - Pierre Shale)
161-202	41	994-953	Clay, gray, shaley; soft, greasy, noncalcareous (Carlile Shale)
No Niobrara Formation encountered. Electric log available			

Local number: 123N50W6CCCC R
Other identifier: R2-94-56
Station identification number: 452725096584301
Date of construction: 8-10-94
Land surface altitude: 1,356 feet
Total depth: 402 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,356-1,353	Topsoil
3-68	65	1,353-1,288	Clay, tan to brown, silty, sandy, pebbly; becomes darker brown with depth to a grayish-brown at 46 feet, mottled, very shaley in spots, hard, oxidized (till)
68-249	181	1,288-1,107	Clay, gray, silty, sandy, pebbly, shaley; hard, very sticky, mud collars, cobbles at 84 feet and between 200 and 215 feet, electric-log change at 82 feet, unoxidized (till)
249-257	8	1,107-1,099	Gravel, medium to coarse; mostly limestone and shales
257-265	8	1,099-1,091	Clay, gray, silty, sandy, pebbly; unoxidized, sandier than till unit above (till)
265-337	72	1,091-1,019	Gravel, medium to coarse, some fine; various rock types, large cobble at 330 feet
337-402	65	1,019-954	Clay, gray, shaley; greasy, noncalcareous (Carlile Shale)
Electric log available			

Local number: 123N50W22BBBB
Other identifier: R2-94-66
Station identification number: 452722096552301
Date of construction: 8-30-94
Land surface altitude: 1,240.3 feet
Total depth: 242 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,240.3-1,238.3	Topsoil
2-15	13	1,238.3-1,225.3	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized (till)
15-19	4	1,225.3-1,221.3	Gravel, fine to medium; some coarse, highly oxidized
19-30	11	1,221.3-1,210.3	Clay, brown, silty, sandy, pebbly; oxidized (till)
30-86	56	1,210.3-1,154.3	Clay, gray, silty, sandy, pebbly; gravel lenses from 31 to 33 feet, 53 to 37 feet and 47 to 50 feet, unoxidized (till)
86-125	39	1,154.3-1,115.3	Clay, gray, very silty; soft, large cuttings (lake sediments)
125-156	31	1,115.3-1,084.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
156-164	8	1,084.3-1,076.3	Clay, gray, silty; greasy, shale like, unoxidized (lake sediments?)
164-215	51	1,076.3-1,025.3	Sand and gravel, coarse sand to a fine to medium gravel
215-222	7	1,025.3-1,018.3	Clay, grayish-brown, silty; highly calcareous (Niobrara Formation)
222-242	20	1,018.3-998.3	Clay, gray, shaley; greasy, noncalcareous, some concretions (Carlile Shale)
30 feet of blank 2-inch diameter PVC on bottom and open to the screen; screened from 202 to 212 feet. Electric log available			

Local number: 123N50W36DDDD
Other identifier: R2-94-64
Station identification number: 4524480965142001
Date of construction: 8-23-94
Land surface altitude: 1,195 feet
Total depth: 202 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,195-1193	Topsoil
2-25	23	1,193-1,170	Clay, yellowish-brown to brown, silty, sandy, pebbly; some reddish-brown, oxidized (till)
25-28	3	1,170-1,167	Clay, gray, silty, sandy, pebbly; unoxidized (till)
28-45	17	1,167-1,150	Clay, gray, very silty, sandy; unoxidized (lake sediments)
45-62	17	1,150-1,133	Sand, gray, fine to medium; grades to coarse sand then fine gravel with depth, unoxidized
62-74	12	1,133-1,121	Clay, gray, very silty
74-93	19	1,121-1,102	Sand, gray, very silty, clayey from 78 to 84 feet
93-124	31	1,102-1,071	Clay, gray, very silty, sandy, pebbly; unoxidized (till)
124-172	48	1,071-1,023	Sand and gravel, coarse sand to a fine to medium gravel; some coarse gravel
172-202	30	1,023-993	Clay, gray, shaley; greasy, hard, noncalcareous (Carlile Shale)
Electric log available			

Local number: 123N51W24DDDD R
Other identifier: R2-94-65
Station identification number: 452448096584501
Date of construction: 8-24-94
Land surface altitude: 1,425 feet
Total depth: 447 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,425-1,423	Topsoil
2-10	8	1,423-1,415	Clay, brown, silty, sandy, pebbly; oxidized (till)
10-17	7	1,415-1,408	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
17-82	65	1,408-1,343	Clay, gray; silty, sandy, pebbly; large cuttings, hardens with depth, change in resistivity log at 49 feet, unoxidized (till)
82-92	10	1,343-1,333	Sand and gravel, medium to coarse sand to fine to medium gravel, some coarse gravel
92-103	11	1,333-1,322	Clay, gray, silty, sandy, pebbly; unoxidized (till)
103-115	12	1,322-1,310	Clay, brown, silty, sandy, pebbly; cuttings both oxidized and unoxidized, very hard (till)
115-384	269	1,310-1,041	Clay, dark-gray to black, silty, sandy, slightly pebbly, hard, electric-log change at 241 feet, unoxidized (till)
384-391	7	1,041-1,034	Clay, black, silty; noncalcareous (Sharon Springs Member - Pierre Shale)
391-407	16	1,034-1,018	Clay, white, silty; slightly calcareous, grades to a light-gray highly calcareous clay (Niobrara Formation)
407-447	40	1,018-978	Clay, gray, shaley; soft, greasy, some concretions, noncalcareous (Carlile Shale)
Electric log available			

Local number: 124N49W33DDDD
Other identifier: R2-94-57
Station identification number: 452959096480001
Date of construction: 8-16-94
Land surface altitude: 1,125 feet
Total depth: 382 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,125-1,123	Topsoil
2-8	6	1,123-1,117	Clay, tan to yellowish-brown, silty; mottled, cobbles at 8 feet, oxidized (loess?)
8-26	18	1,117-1,099	Clay, yellowish-brown to brown, silty, sandy, pebbly; cobbles at 19 feet, oxidized (till)
26-94	68	1,099-1,031	Clay, gray, very silty, sandy, pebbly; drills easy, large cuttings, gravel lens from 54-58 feet, unoxidized (till)
94-100	6	1,031-1,025	Gravel, fine to medium
100-109	9	1,025-1,016	Clay, gay; greasy, noncalcareous (Carlile Shale)
109-212	103	1,016-913	Clay, dark-gray to black, shaley; hard, greasy, fissile, some concretions, noncalcareous (Carlile Shale)
212-290	78	913-835	Clay, black, silty; not as greasy as above unit, slight brownish tinge, noncalcareous, contains many shaley layers from 238 to 290 feet (Carlile Shale)
290-355	65	835-770	Clay, brownish-black; slightly calcareous white specks (Carlile Shale)
355-382	27	770-743	Siltstone, white and dark-brown; very hard, cemented with some chert from 355 to 364 feet, calcareous (Greenhorn Limestone)
Electric log available			

Local number: 124N50W6CCCC R
Other identifier: R2-94-67
Station identification number: 453238096584201
Date of construction: 8-31-94
Land surface altitude: 1,233 feet
Total depth: 242 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,233-1,231	Topsoil
2-11	9	1,231-1,222	Clay, yellowish-brown to brown, silty, sandy, pebbly; gravel lens from 7 to 9 feet, oxidized (till)
11-54	43	1,222-1,179	Clay, gray, silty, sandy, pebbly; cobbles at 14 and 17 feet, unoxidized (till)
54-81	27	1,179-1,152	Sand, gray, fine to medium; clay layers from 65 to 68 feet and 74 to 77 feet, unoxidized
81-112	31	1,152-1,121	Clay, gray, shaley; hard, greasy, slightly calcareous (Pierre Shale)
112-169	57	1,121-1,064	Clay dark-gray to black, shaley; hard, greasy, noncalcareous (Sharon Springs Member - Pierre Shale)
169-230	61	1,064-1,003	Clay, gray, silty; hard, highly calcareous, noncalcareous shale layer from 205 to 208 feet (Niobrara Formation)
230-242	12	1,003-991	Clay, gray, shaley; soft, greasy, good cuttings, noncalcareous (Carlile Shale)
Electric log available			

Local number: 124N50W10BBBB R
Other identifier: R2-94-53
Station identification number: 453236096550001
Date of construction: 8-2-94
Land surface altitude: 1,172 feet
Total depth: 182 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,175-1,173	Topsoil
2-20	18	1,173-1,155	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
20-67	47	1,155-1,108	Clay, gray, silty, sandy, pebbly; cobble at 60 feet, unoxidized (till)
67-90	23	1,108-1,085	Clay, dark-gray, shaley; hard, greasy (Pierre Shale)
90-158	68	1,085-1,017	Clay, gray, silty; very calcareous, some shaley layers, some thin hard black layers, upper portion may not be Niobrara (Niobrara Formation)
158-182	24	1,017-993	Clay, gray, shaley; greasy, large cuttings noncalcareous, some concretions (Carlile Shale)

Local number: 124N50W27BBBB R
Other identifier: R2-94-54
Station identification number: 452959096545901
Date of construction: 8-3-94
Land surface altitude: 1,210.1 feet
Total depth: 222 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,210.1-1,208.1	Topsoil
2-34	32	1,208.1-1,176.1	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
34-47	13	1,176.1-1,163.1	Clay, gray, silty, sandy, pebbly; becomes very hard at 39 feet, unoxidized (till)
47-58	11	1,163.1-1,152.1	Sand and gravel, medium to coarse sand to fine to medium gravel
58-62	4	1,152.1-1,148.1	Clay, gray, shaley; hard, greasy (lake clay)
62-72	10	1,148.1-1,138.1	Sand and gravel; with a clay layer form 66 to 69 feet
72-78	6	1,138.1-1,132.1	Clay, gray, silty, sandy, pebbly; unoxidized (till)
78-82	4	1,132.1-1,128.1	Gravel and cobbles, very coarse
82-85	3	1,128.1-1,125.1	Clay, gray (till?)
85-91	6	1,125.1-1,119.1	Sand, gray, medium to coarse
91-157	66	1,119.1-1,053.1	Clay, gray, very silty; hard, slightly calcareous, becomes sandy with depth (lake sediments)
157-197	40	1,053.1-1,013.1	Sand and gravel, medium to coarse sand with some fine gravel grading to a coarse gravel with depth; cobbles at 196 feet
197-202	5	1,013.1-1,008.1	Clay, gray, silty
202-210	8	1,008.1-1,000.1	Sand and gravel
210-222	12	1,000.1-998.1	Clay, gray; very greasy (Carlile Shale)

Screened from 176.8 to 186.8 feet; 10 feet of blank 2-inch diameter PVC casing below screen. Electric log available

Local number: 124N50W36DDDD
Other identifier: R2-94-58
Station identification number: 453000096514201
Date of construction: 8-16-94
Land surface altitude: 1,170 feet
Total depth: 162 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,170-1,168	Topsoil
2-14	12	1,168-1,156	Clay, tan to brown, silty, sandy, pebbly; oxidized (till)
14-22	8	1,156-1,148	Clay, gray, silty, sandy, pebbly; unoxidized (till)
22-28	6	1,148-1,142	Sand and gravel
28-65	37	1,142-1,105	Clay, gray, very silty, sandy, pebbly; soft, harder at 58 feet, unoxidized (till)
65-77	12	1,105-1,093	Gravel, medium, some coarse; mostly limestone and shale
77-84	7	1,093-1,086	Clay, gray, silty, sandy, gravelly; unoxidized (till)
84-104	20	1,086-1,066	Clay, gray, shaley; hard, greasy, chunky, some bentonite (Pierre Shale)
104-117	13	1,066-1,053	Clay, black, silty; greasy, some shaley layers (Sharon Springs Member - Pierre Shale)
117-142	25	1,053-1,028	Clay, grayish-white; greasy, noncalcareous, becomes silty, calcareous and uses water with depth, turns to a grayish-brown with depth (Niobrara Formation)
142-162	20	1,028-1,008	Clay, gray, shaley; soft, greasy, noncalcareous, some concretions (Carlile Shale)
Electric log available			

Local number: 124N51W4DDDD R
Other identifier: R2-95-01
Station identification number: 453240097022701
Date of construction: 6-12-95
Land surface altitude: 1,423.4 feet
Total depth: 423 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,423.4-1,421.4	Topsoil, brown to black, silty
2-48	44	1,421.4-1,375.4	Clay, yellowish-brown, silty, sandy, pebbly; reddish-brown sand lens from 35 to 36 feet, oxidized (till)
48-54	6	1,375.4-1,369.4	Clay, grayish-brown, silty, sandy, pebbly; sand lens at 50 feet, rock at 53 feet, partially oxidized (till)
54-56	2	1,369.4-1,367.4	Sand and gravel, coarse sand to medium to coarse gravel
56-88	32	1,367.4-1,335.4	Clay, gray, silty, sandy, pebbly; rocks at 64 and 76 feet, unoxidized (till)
88-240	152	1,335.4-1,183.4	Clay, gray, silty, sandy, pebbly; rock at 124 feet, greasier than interval above, some oxidized clay noticed between 220 and 230 feet (till)
240-256	16	1,183.4-1,167.4	Sand and gravel, coarse sand to very coarse gravel; some cobbles from 250 to 252 feet
256-358	102	1,167.4-1,065.4	Clay, light-gray, silty, sandy, pebbly; rocks at 268 and 288 feet, some oxidized cuttings noticed throughout interval (till)
358-370	12	1,065.4-1,053.4	Sand, fine to medium; with interbedded clay layers
370-410	40	1,053.4-1,013.4	Sand and gravel, medium sand grading to a coarse gravel
410-420	10	1,013.1-1,003.4	Clay, gray; hard, greasy, noncalcareous (Carlile Shale)

Test hole caving. Electric log available to 332 feet. Screened from 397.5 to 407.5 feet with 2-inch diameter PVC.

Local number: 124N51W25AAAB R
Other identifier: R2-94-55
Station identification number: 453001096584801
Date of construction: 8-8-94
Land surface altitude: 1,274.0 feet
Total depth: 282 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,274-1,272	Topsoil
2-7	5	1,272-1,267	Sand and gravel, reddish-0brown, coarse; some cobbles, oxidized
7-14	7	1,267-1,260	Clay, brown, silty, sandy, pebbly; oxidized (till)
14-163	149	1,260-1,111	Clay, gray, silty, sandy, pebbly, very shaley in spots; hard, cobbly, electric-log changes at 40 and 136 feet, large granite boulder from 136 to 138 feet, unoxidized (till)
163-273	110	1,111-1,001	Gravel, fine to medium grading to coarse with depth, cobbly below 252 feet
273-282	9	1,001-992	Clay, gray; greasy, noncalcareous (Carlile Shale)

Screened from 255 to 265 feet; 10 feet of blank 2-inch diameter PVC casing below screen. Electric log available

Local number: 125N50W9BBBA R
Other identifier: R2-94-51
Station identification number: 453749096560401
Date of construction: 8-1-94
Land surface altitude: 1,160 feet
Total depth: 202 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-8	8	1,160-1,152	Clay, black, silty (topsoil and alluvium)
8-10	2	1,152-1,150	Sand, brown, coarse; some gravel
10-19	9	1,150-1,141	Clay, brown, silty, sandy, pebbly; oxidized (till)
19-66	47	1,141-1,094	Clay, gray, silty, sandy, pebbly; unoxidized (till)
66-70	4	1,094-1,090	Sand, grayish-brown, medium to coarse; unoxidized, some fine gravel
70-84	14	1,090-1,076	Clay, gray, very silty, sandy; some light-gray layers, varved unoxidized (lake deposits?)
84-88	4	1,076-1,072	Gravel, coarse; mostly limestone and shale, with some quartz
88-91	3	1,072-1,069	Clay, gray, silty, sandy
91-97	6	1,069-1,063	Gravel, coarse; some coarse sand
97-110	13	1,063-1,050	Clay, gray, shaley; hard, noncalcareous (Pierre Shale)
110-114	4	1,050-1,046	Clay, light-gray, silty; calcareous (Pierre Shale)
114-119	5	1,046-1,041	Clay, black, shaley; noncalcareous, some bentonite (Pierre shale)
119-122	3	1,041-1,038	Clay, light-gray, silty; calcareous (Pierre Shale)
122-128	6	1,038-1,032	Clay, light-gray, silty; calcareous (Pierre Shale)
128-136	8	1,032-1,024	Clay, light-gray, silty; calcareous (Pierre Shale)
136-152	16	1,024-1,008	Clay, black, shaley; hard, greasy, noncalcareous (Sharon Springs Member - Pierre Shale)
152-172	20	1,008-988	Clay, light-brownish-gray, silty; very calcareous (Niobrara Formation)
172-202	30	988-958	Clay, gray to black, shaley; very greasy, large cuttings, noncalcareous (Carlile Shale)

Local number: 125N50W9CCCD R
Other identifier: R2-94-52
Station identification number: 453659096560501
Date of construction: 8-2-94
Land surface altitude: 1,215 feet
Total depth: 222 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,215-1,213	Topsoil
2-11	9	1,213-1,204	Sand and gravel, coarse sand to medium gravel
11-15	4	1,204-1,200	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
15-127	112	1,200-1,088	Clay, gray, silty, sandy, pebbly; several sand and gravel lenses from 25 to 35 feet, cobble at 39 feet, unoxidized (till)
127-133	6	1,088-1,082	Sand and gravel, coarse sand to a medium to coarse gravel; mostly limestones and shales
133-137	4	1,082-1,078	Clay, gray, silty
137-197	60	1,078-1,018	Clay, dark-gray to black, shaley; hard, greasy, noncalcareous, becomes blacker and more silty with depth (Sharon Springs Member - Pierre Shale)
197-204	7	1,018-1,011	Clay, grayish-brown, silty; hard, very calcareous, uses water (Niobrara Formation)
204-222	18	1,011-993	Clay, gray, shaley; greasy, large cuttings, several hard concretions, noncalcareous (Carlile Shale)

Local number: 125N51W7BBBB R
Other identifier: R2-95-04
Station identification number: 453751097060701
Date of construction: 6-13-95
Land surface altitude: 1,525 feet
Total depth: 397 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-53	53	1,525-1,472	Clay, brown to yellowish-brown, silty, sandy, pebbly; rock at 30 feet, highly oxidized (till)
53-59	6	1,472-1,466	Clay, dark-gray, silty, sandy, pebbly; hard, unoxidized (till)
59-62	3	1,466-1,463	Sand and gravel
62-76	14	1,463-1,449	Clay, gray, silty, sandy, pebbly; somewhat larger cuttings than till above, unoxidized
76-104	28	1,449-1,421	Sand and gravel, medium sand grading to a very coarse gravel
104-172	68	1,421-1,353	Clay, gray, silty, sandy, pebbly; rock at 135 feet, shaley, unoxidized (till)
172-184	12	1,353-1,341	Sand and gravel
184-196	12	1,341-1,329	Clay, gray, silty, sandy, pebbly; hit many rocks, unoxidized (till)
196-218	22	1,329-1,307	Clay, gray, very silty; hard (lake clay)
218-297	79	1,307-1,228	Clay, brown, silty, sandy, pebbly; many rocks from 240 to 252 feet, large rock from 296 to 297 feet, oxidized (till)
297-384	87	1,228-1,141	Clay, dark-gray, silty, sandy, pebbly; greasy (till)
384-397	13	1,141-1,128	Clay, dark-gray to black; hard, greasy, shaley (Pierre Shale)

Test hole caving. Electric log available to 313 feet

Local number: 125N51W7BBBB2 R
Other identifier: R2-95-05
Station identification number: 453751097060702
Date of construction: 6-19-95
Land surface altitude: 1,527.3 feet
Total depth: 102 feet

Depth (feet)	Thick-ness	Altitude	Description
0-53	53	1,527.3-1,474.3	Clay, brown, silty, sandy, pebbly; oxidized (till)
53-59	6	1,474.3-1,468.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
59-62	3	1,468.3-1,465.3	Sand and gravel
62-76	14	1,465.3-1,451.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
76-102	26	1,451.3-1,425.3	Sand and gravel, medium sand grading to a very coarse gravel
For electric log, see R2-95-04			

Local number: 125N51W10BBBC R
Other identifier: R2-95-03
Station identification number: 453747097022401
Date of construction: 6-13-95
Land surface altitude: 1,252 feet
Total depth: 42 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,250-1,250	Topsoil, black, silty
2-14	12	1,250-1,238	Clay, brown to yellowish-brown, silty, sandy, pebbly; oxidized (till)
14-22	8	1,238-1,230	Clay, gray to black; hard, brittle, some oxidation (Pierre Shale)
22-32	10	1,230-1,220	Clay, light-gray, silty; calcareous (Pierre Shale)
32-42	10	1,220-1,210	Clay, black; hard, shaley, some bentonite (Pierre Shale)

Local number: 125N51W21DDDD R
Other identifier: R2-95-02
Station identification number: 453517097022701
Date of construction: 6-13-95
Land surface altitude: 1,325 feet
Total depth: 262 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,325-1,323	Topsoil, black, silty
2-14	12	1,323-1,311	Clay, tan to light-brown, silty, sandy, pebbly; oxidized (till)
14-78	64	1,311-1,247	Clay, gray, silty, sandy, pebbly; hard, sand lens from 31 to 33 feet, rock at 40 feet, unoxidized (till)
78-80	2	1,247-1,245	Clay, brown, silty, sandy, pebbly; oxidized (till)
80-175	95	1,245-1,150	Clay, gray, silty, sandy, pebbly; contains shale inclusions in the upper portion, stickier than above interval, unoxidized (till)
175-178	3	1,150-1,147	Clay, gray, silty; hard (lake silt)
178-190	12	1,147-1,135	Sand and gravel, fine to medium sand grading to fine to medium gravel; some thin clay layers
190-235	45	1,135-1,090	Clay, gray; hard, shaley, greasy, noncalcareous (Pierre Shale)
235-262	27	1,090-1,063	Clay, black; hard greasy (Sharon Springs Member - Pierre Shale)
Electric log available			

Local number: 125N51W32CCCC R
Other identifier: R2-96-01
Station identification number: 453331097045301
Date of construction: 5-22-96
Land surface altitude: 1,660.2 feet
Total depth: 657 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,660.2-1,659.2	Topsoil
1-21	20	1,659.2-1,639.2	Clay, tan to yellowish-brown, silty, sandy, pebbly; sand lens at 16 feet, slightly calcareous, oxidized (till)
21-54	33	1,639.2-1,606.2	Clay, gray, silty, sandy, pebbly; harder at 36 feet, becomes darker gray with depth, slightly calcareous, inclusion of reddish-brown till from 40 to 41 feet, rock at 52 feet (till)
54-60	6	1,606.2-1,600.2	Gravel, fine to medium, some coarse
60-67	7	1,600.2-1,593.2	Clay, brown, silty, sandy, pebbly; slightly calcareous, unoxidized, rock from 64 to 67 feet (till)
67-106	39	1,593.2-1,554.2	Clay, brown, silty, sandy, pebbly; slightly calcareous, electric-log signature from 86 to 106 feet may be a fracture zone, oxidized (till)
106-252	146	1,554.2-1,408.2	Clay, gray to dark-gray, silty, sandy, pebbly; hard, many rocks from 203 to 208 feet, slightly calcareous, unoxidized (till)
252-257	5	1,408.2-1,403.2	Clay, light-gray, silty, sandy; cemented, calcareous, unoxidized
257-262	5	1,403.2-1,398.2	Gravel, medium to coarse
262-294	32	1,398.2-1,366.2	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens from 286 to 289 feet (till)
294-322	28	1,366.2-1,338.2	Gravel, fine to medium; rock at 304 feet
322-605	283	1,338.2-1,055.2	Clay, gray, silty, sandy, pebbly; rock at 423 feet, becomes more shale-rick with depth, electric-log signature change at 494 feet may indicate an older till below, unoxidized (till)
605-610	5	1,055.2-1,050.2	Clay, gray; interval from electric-log
610-657	47	1,050.2-1,003.2	Sand and gravel, medium to coarse sand to a fine gravel; some coarse, partially cemented, drill bit wore down, test hole probably did not reach bedrock

Well screened from 605 to 645 feet; 2-inch diameter PVC casing used. Electric log available

Local number: 126N49W4DCCD R
Other identifier: R2-96-54
Station identification number: 454305096475701
Date of construction: 8-20-96
Land surface altitude: 1,111 feet
Total depth: 537 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,111-1,109	Topsoil, black
2-26	24	1,109-1,085	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized (till)
26-28	2	1,085-1,083	Clay, reddish-brown, silty, sandy, pebbly; oxidized (till)
28-58	30	1,083-1,053	Sand and gravel, coarse sand to fine gravel; reddish-brown turning to blackish-brown with many shale pebbles, clay layer from 28 to 42 feet
58-91	33	1,053-1,020	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
91-95	4	1,020-1,016	Sand and gravel, coarse sand to fine gravel; many shale pebbles
95-130	35	1,016-981	Clay, dark-gray, silty, sandy, pebbly; harder and smaller cuttings than above till interval, gravel lenses from 109 to 111, 113 to 117, and 122 to 125 feet, rock at 121 feet (till)
130-137	7	981-974	Gravel, medium to coarse
137-162	25	974-949	Clay, gray, very silty; unoxidized (lake clay)
162-199	37	949-912	Sand, very fine, very silty; slightly cemented
199-206	7	912-905	Clay, gray, very silty (lake clay)
206-281	75	905-830	Sand and gravel, medium sand grading to a fine gravel with depth
281-390	109	830-721	Clay, gray, silty, sandy, pebbly; unoxidized electric-log signature differs between intervals 281 to 304 and 304 to 390 feet (till)
390-509	119	721-602	Clay, gray, silty, sandy, pebbly; unoxidized, electric-log signature differs from above interval (till)
509-537	28	602-574	Shale, black with a purplish tinge; greasy, oily, hard, test-hole depth very near the Dakota Formation surface (Graneros Shale)
Electric log available			

Local number: 126N49W7BBBB R
Other identifier: R2-96-55
Station identification number: 454304096511301
Date of construction: 8-21-96
Land surface altitude: 1,098.5 feet
Total depth: 307 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-8	8	1,098.5-1,090.5	Topsoil, black; valley-fill
8-20	12	1,090.5-1,078.5	Clay, brown, silty, sandy, pebbly; oxidized (till)
20-50	30	1,078.5-1,048.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)
50-81	31	1,048.5-1,017.5	Sand and gravel, medium sand grading to a fine gravel; many shale pebbles, rock at 80 feet
81-88	7	1,017.5-1,010.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)
88-95	7	1,010.5-1,003.5	Sand and gravel, gray, fine to medium sand to fine to coarse gravel; some very coarse to cobbly near bottom
95-165	70	1,003.5-933.5	Clay, dark-gray, silty, sandy, pebbly; hard, unoxidized, gravel lenses from 122 to 125 and 156 to 158 feet (till)
165-242	77	933.5-856.5	Shale, dark-gray to black; greasy, noncalcareous (Blue Hill Shale Member - Carlile Shale)
242-298	56	856.5-800.5	Shale, brownish-black; calcareous, hard (Fairport Chalky Member - Carlile Shale)
298-307	9	800.5-791.5	Clay, brown with some white and tan; hard, some chert, very calcareous (Greenhorn Limestone)

Electric log available

Local number: 126N49W7BBBB2 R
Other identifier: R2-96-56
Station identification number: 454304096511302
Date of construction: 9-17-96
Land surface altitude: 1,098.5 feet
Total depth: 101 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-8	8	1,098.5-1,090.5	Topsoil, black; valley-fill
8-17	9	1,090.5-1,081.5	Clay, brown, silty, sandy, pebbly; oxidized (till)
17-51	34	1,081.5-1,047.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)
51-82	31	1,047.5-1,016.5	Sand and gravel, medium sand grading to fine gravel; many shale pebbles
82-89	7	1,016.5-1,009.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)
89-96	7	1,009.5-1,002.5	Sand, gray, fine
96-101	5	1,002.5-997.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)

Well screened from 69.5 to 79.5 feet, 2-inch diameter PVC casing used

Local number: 126N49W9CCCC R
Other identifier: LTR NO. 14
Station identification number: 454412096484301
Date of construction: 8-21-90
Land surface altitude: 1,110 feet
Total depth: 192 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,110-1,108	Topsoil
2-22	20	1,108-1,088	Clay, light-brown, silty, sandy, pebbly; gravel lens from 13 to 14 feet, oxidized (till)
22-32	10	1,088-1,078	Clay, light-gray, silty, sandy, pebbly; unoxidized (till)
32-44	12	1,078-1,066	Sand and gravel, fine
44-74	30	1,066-1,036	Clay, light-gray, silty, sandy, pebbly; slightly calcareous, some greasy cuttings, unoxidized
74-76	2	1,036-1,034	Gravel, fine
76-96	20	1,034-1,014	Clay, gray, silty, sandy, pebbly; calcareous, unoxidized, rock at 96 feet
96-126	30	1,014-984	Clay, gray, silty, shaley; unoxidized
126-153	27	984-957	Clay, light-gray to gray; very calcareous
153-185	32	957-925	Clay, dark-gray, silty; very calcareous
185-192	7	925-918	Clay, dark-gray, shaley (Carlile Shale)

Local number: 126N49W19BBBB R
Other identifier: LTR NO. 12
Station identification number: 454118096511201
Date of construction: 8-8-90
Land surface altitude: 1,018 feet
Total depth: 41 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,018-1,017	Topsoil, dark-brown to black; fine to very fine sand and silt, clayey, some scattered coarser grains
1-4.5	3.5	1,017-1,013.5	Clay, medium-brown, silty; very fine to fine sand, some coarser grains (probably water-laid and bedded)
4.5-6	1.5	1,013.5-1,012	Sand, mottled light- to dark-brown, medium to coarse; some coarser and finer grains, dry
6-16	10	1,012-1,002	Silt to medium sand, very light-brown to medium-brown, somewhat clayey; bedded, turret0shaped snail shells noticed, rock at 14 feet, some thin beds of clay, all lignite grains are very fine sand to silt size (water-laid and bedded)
16-28	12	1,002-990	Clay, medium- to dark-gray, silty, sandy; some pebbles, rocks at 20 and 25 feet (till)
28-41	13	990-977	Shale, dark-gray to black; noncalcareous (Carlile Shale)

Local number: 126N49W20DDDD R
Other identifier: LTR NO. 13
Station identification number: 454023096484601
Date of construction: 8-9-90
Land surface altitude: 999 feet
Total depth: 61.5 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-0.5	0.5	999-998.5	Topsoil, dark-medium-brown, clayey, silty, sandy; most sand finer than medium
0.5-6.5	6	998.5-992.5	Sand, medium-brown, very fine to medium; somewhat clayey, rock at 6 feet, silty below 6 feet
6.5-59	52.5	992.5-940	Silt and very fine sand, medium-gray; somewhat clayey, highly calcareous clay may be in thin silt and sand free beds, rock at 31 feet, drilling somewhat easier from 28 to 39 feet, pebbles of Pierre Shale, Carlile Shale, greenhorn formation are common
59-61.5	2.5	940-937.5	Shale, dark-gray to black; noncalcareous (Carlile Shale)

Local number: 126N50W7CCCB R
Other identifier: LTR NO. 1
Station identification number: 454216096584101
Date of construction: 7-3-88
Land surface altitude: 1,178 feet
Total depth: 177 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,178-1,176	Topsoil, black to dark-brown, silty, sandy, clayey
2-16.5	14.5	1,176-1,161.5	Clay, light-brown to yellowish-brown, silty, sandy; occasional pebbles (till)
16.5-26	9.5	1,161.5-1,152	Sand, light-brown, very fine to fine; some coarser grains
26-35	9	1,152-1,143	Clay, medium-gray, silty, sandy; occasional pebbles (till)
35-39	4	1,143-1,139	Sand, light-brown to brownish-black, fine to coarse; lignitic, occasional pebbles
39-46	7	1,139-1,132	Clay, dark-gray, silty, sandy; occasional pebbles (till)
46-50	4	1,132-1,128	Sand, light-brown to yellowish-brown, very fine to medium; abundant coarse sand
50-110	60	1,128-1,068	Clay, medium- to light-gray, silty, sandy; occasional pebbles to fine gravel size, very tough drilling, dark-tannish-gray clay noticed by 101 feet, somewhat calcareous (till?)
110-119	9	1,068-1,059	Gravel, very coarse; many rocks, clay from 112.5 to 114 feet
119-165	46	1,059-1,013	Clay, tan to light-brown, silty, sandy; contains primarily medium sand, with some coarser sand and fine gravel, shell fragments
165-177	12	1,013-1,001	Clay, medium- to dark-bluish-gray, slightly silty; noncalcareous (Carlile Shale?)

Local number: 126N50W9AAAA R
Other identifier: R2-96-49
Station identification number: 454304096550001
Date of construction: 8-13-96
Land surface altitude: 1,135 feet
Total depth: 172 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,135-1,132	Topsoil, black
3-6	3	1,132-1,129	Sand, coarse; some gravel, oxidized
6-18	12	1,129-1,117	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
18-51	33	1,117-1,084	Clay, gray, very silty, sandy, pebbly; unoxidized, soft, large cuttings, rock at 50 feet (till)
51-68	17	1,084-1,067	Clay, gray, silty, sandy, pebbly; hard, more sand than above interval, unoxidized (till)
68-84	16	1,067-1,051	Sand, gray, fine, silty
84-86	2	1,051-1,049	Clay, gray, silty
86-125	39	1,049-1,010	Sand, fine to medium; grading to a fine gravel with depth
125-155	30	1,010-980	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens from 145 to 147 feet (till)
155-172	18	980-963	Shale, black; greasy (Carlile Shale)
Electric log available			

Local number: 126N50W19CCDD R
Other identifier: R2-96-47
Station identification number: 454028096582301
Date of construction: 8-12-96
Land surface altitude: 1,138 feet
Total depth: 162 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,138-1,136	Topsoil, black
2-18	16	1,136-1,120	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
18-32	14	1,120-1,106	Clay, brown, very silty
32-42	10	1,106-1,096	Clay, gray, silty, sandy, pebbly; unoxidized (till)
42-54	12	1,096-1,084	Sand and gravel, medium to coarse sand to fine gravel
54-72	18	1,084-1,066	Clay, gray, silty, sandy, pebbly; unoxidized, granite boulder form 70 to 72 feet (till)
72-116	44	1,066-1,022	Shale, dark-gray to black; hard, greasy, noncalcareous (Sharon Springs Member - Pierre Shale)
116-162	46	1,022-976	Shale, gray; soft, large cuttings, noncalcareous, some concretions (Carlile Shale)
Niobrara Formation absent. Electric log available			

Local number: 126N50W21DDDD R
Other identifier: R2-96-48
Station identification number: 454028096550001
Date of construction: 8-13-96
Land surface altitude: 1,165.1 feet
Total depth: 202 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,165.1-1,163.1	Topsoil, black
2-38	36	1,163.1-1,127.1	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized, several sand and gravel lenses from 22 to 30 feet, turns grayish-brown at 35 feet (till)
38-59	21	1,127.1-1,106.1	Clay, gray, silty, sandy, pebbly; unoxidized (till)
59-66	7	1,106.1-1,099.1	Sand and gravel, medium to coarse sand to fine gravel
66-107	41	1,099.1-1,058.1	Clay, gray, silty, sandy, pebbly; unoxidized (till)
107-179	72	1,058.1-986.1	Sand, fine to medium, very silty; with silt and clay layers, some gravel from 170 to 178 feet
179-202	23	986.1-963.1	Shale, black with a brownish tinge; hard, slightly calcareous (Carlile Shale)
Well screened from 168 to 178 feet; 20 feet of 2-inch diameter blank PVC casing below screen. Electric log available			

Local number: 126N50W27DDDA R
Other identifier: LTR NO. 11
Station identification number: 453939096534401
Date of construction: 8-7-90
Land surface altitude: 1,170 feet
Total depth: 201 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,170-1,153	Clay, light-yellowish-brown to light-brown, silty, somewhat sandy; scattered pebbles
17-22	5	1,153-1,148	Clay, yellowish-brown to medium-brown, very silty, sandy; drills easier than above interval
22-25	3	1,148-1,145	Clay, yellowish-brown to medium-brown, silty, sandy; stiffer drilling than above interval, but still fairly easy
25-26.5	1.5	1,145-1,143.5	Silt, yellowish-brown; slightly clayey, abundant very fine sand, easy drilling
26.5-35.5	9	1,143.5-1,134.5	Silt, medium-brown, sandy (very fine sand), somewhat clayey, gravelly; drills slightly stiffer than above interval
35.5-57	21.5	1,134.5-1,113	Clay, light-medium-gray to medium-gray, very silty, sandy; with scattered pebbles, some lignite grains
57-90	33	1,113-1,080	Clay, medium-gray, silty, sandy, gravelly; rocks at 68, 79.5, 82, 87 and 88 feet (till?)
90-105	15	1,080-1,065	Sand, medium-gray, very fine to fine; clay and silt cemented, some coarser sand and gravel, bedded
105-195	90	1,065-975	Silt and very fine sand, medium-brown, clayey; clay is medium- to dark-gray, contains some coarser sand and scattered pebbles, lignite pieces, gravel from 172 to 174 feet, rock at 192 feet (water-laid, bedded)
195-201	6	975-969	Shale, very dark-gray; calcareous, greasy, stiff drilling (Carlile Shale)

Local number: 126N52W4DDDD R
Other identifier: R2-95-06
Station identification number: 454307097095301
Date of construction: 6-19-95
Land surface altitude: 1,435 feet
Total depth: 42 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,435-1,425	Gravel, reddish-brown, fine to coarse; highly oxidized
10-42	32	1,425-1,393	Clay, black; hard, brittle, chunky, greasy, noncalcareous (Pierre Shale)

Local number: 127N48W4DDDD R
Other identifier: R2-96-59
Station identification number: 454819096400401
Date of construction: 9-18-96
Land surface altitude: 1,085 feet
Total depth: 262 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,085-1,083	Topsoil, black
2-19	17	1,083-1,066	Clay, brown, silty, sandy, pebbly; oxidized (till)
19-48	29	1,066-1,037	Sand, brown, fine, silty; becomes more clayey with depth
48-69	21	1,037-1,016	Sand, gray, fine, very silty; with many clay layers
69-112	43	1,016-973	Clay, gray, fine, very silty; unoxidized (lake clay)
112-124	12	973-961	Clay, gray, silty, sandy, pebbly; unoxidized (till)
124-127	3	961-958	Sand and gravel; rock at 124 feet
127-150	23	958-935	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 129 feet, gravel lens from 144 to 147 feet (till)
150-158	8	935-927	Shale, black; greasy (shale inclusion)
158-181	23	927-904	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 175 feet, shale inclusion from 170 to 174 feet (till)
181-193	12	904-892	Sand and gravel; no sample
193-234	41	892-851	Shale, black; greasy (Carlile Shale)
234-262	28	851-823	Clay, brown with much white; hard, cemented layers, some chert, highly calcareous (Greenhorn Limestone)

Electric log available

Local number: 127N48W9DDDD R
Other identifier: LTR NO. 19
Station identification number: 454726096400301
Date of construction: 9-17-90
Land surface altitude: 1,085 feet
Total depth: 240 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-20	20	1,085-1,065	Clay, yellowish-brown to light-brown, silty, sandy; slightly calcareous (till)
20-70	50	1,065-1,015	Sand, light-brown, very fine to medium, silty; some fine gravel near base
70-80	10	1,015-1,005	Clay, gray, silty; greasy, sticky
80-114	34	1,005-971	Clay, gray, silty, sandy; some very fine gravel (till)
114-120	6	971-965	Gravel, grayish-brown, very fine to fine; dolomite and granite
120-160	40	965-925	Clay, gray, silty, sandy, pebbly; slightly calcareous (till)
160-195	35	925-890	Clay, medium-gray, silty, sandy; very fine to fine pebbles, greasy, calcareous to slightly calcareous (till)
195-215	20	890-870	Gravel, grayish-brown, very fine; with coarse to very coarse sand
215-221	6	870-864	Clay, medium-gray, silty; greasy (till?)
221-240	19	864-845	Shale, dark-gray, clayey; greasy, some silt, poor cuttings (Carlile Shale?)

Local number: 127N48W28CCCB R
Other identifier: LTR NO. 18
Station identification number: 454457096411601
Date of construction: 9-13-90
Land surface altitude: 1,090 feet
Total depth: 240 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,090-1,080	Clay, light-brown, silty, sandy, pebbly; calcareous (till)
10-75	65	1,080-1,015	Sand, light-brown, clayey; calcareous, coal from 65 to 66 feet
75-80	5	1,015-1,010	Clay, medium-gray, silty; slightly calcareous
80-122	42	1,010-968	Clay, gray, silty sandy, pebbly; large, 2-foot dolomite boulder at 114 feet (till)
122-130	18	968-960	Gravel, grayish-brown, very fine to fine, sandy
130-156	26	960-934	Clay, gray, silty, sandy; boulder from 154 to 156 feet (till)
156-180	24	934-910	Clay, medium-gray, silty, sandy, gravelly (till)
180-190	10	910-900	Sand and gravel, grayish-brown, very fine gravel to very coarse sand
190-200	10	900-890	Clay, gray silty, sandy; slightly calcareous, some silty, sandy olive-brown clay noticed (till)
200-214	14	890-876	Sand and gravel, grayish-brown, coarse to very coarse sand to very fine gravel
214-220	6	876-870	Clay, gray, silty, sandy; soft, slightly calcareous, some silty, sandy olive-brown clay noticed (till)
220-240	20	870-850	Clay, gray, silty; greasy, calcareous (Carlile Shale?)

Local number: 127N49W10BBBB R
Other identifier: R2-96-52
Station identification number: 454818096473001
Date of construction: 8-19-96
Land surface altitude: 1,089.2 feet
Total depth: 282 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,089.2-1,087.2	Topsoil, black
2-18	16	1,087.2-1,071.2	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
18-68	50	1,071.2-1,021.2	Sand, brown, fine to medium; becomes gray with depth, clayey after 52 feet
68-82	14	1,021.2-1,007.2	Clay, gray, very silty; unoxidized (lake clay)
82-108	26	1,007.2-981.2	Clay, gray, silty, sandy, pebbly; unoxidized (till)
108-116	8	981.2-973.2	Gravel, medium to coarse
116-129	13	973.2-960.2	Clay, gray, silty, sandy, pebbly; unoxidized (till)
129-138	9	960.2-951.2	Gravel and cobbles, coarse gravel
138-180	42	951.2-909.2	Clay, gray, silty, sandy, pebbly; unoxidized (till)
180-194	14	909.2-895.2	Sand; drilled fast, no sample
194-203	9	895.2-886.2	Clay, brown, silty, sandy, pebbly; highly oxidized (till)
203-259	56	886.2-830.2	Sand, fine, very silty; gravel layer from 210 to 214 feet, clay layer from 220 to 224 feet
259-282	23	830.2-807.2	Shale, black; greasy, sticky (Graneros Shale)
Electric log available			

Local number: 127N49W10BBBB2 R
Other identifier: R2-96-53
Station identification number: 454818096473002
Date of construction: 8-19-96
Land surface altitude: 1,089.2 feet
Total depth: 62 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,089.2-1,087.2	Topsoil, black
2-18	16	1,087.2-1,071.2	Clay, brown, silty, sandy, pebbly; oxidized (till)
18-62	44	1,071.2-1,027.2	Sand, brown, fine to medium; becomes gray between 30 and 40 feet
Well screened from 52 to 62 feet, 2-inch diameter PVC casing used			

Local number: 127N49W17ABCA R
Other identifier: LTR NO. 24
Station identification number: 454718096491601
Date of construction: 9-27-90
Land surface altitude: 1,033 feet
Total depth: 140 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,033-1,023	Clay, light-brown and tan, silty, sandy, pebbly; some mottled brown, slightly calcareous (till)
10-24	14	1,023-1,009	Clay, medium-gray, silty
24-39	15	1,009-994	Clay, gray, silty, sandy, pebbly; sand is very fine to medium (till)
39-56	17	994-977	Clay, gray, very sandy; sand is very fine to medium (till)
56-67	11	977-966	Gravel, gray, very fine to fine; some silty, sandy medium-gray clay
67-81	14	966-952	Clay, gray, silty, sandy; sand is very fine to medium, much very fine to medium gravel (till)
81-91	10	952-942	Clay, light-gray, silty, sandy; sand is very fine to medium (till)
91-100	9	942-933	Clay, gray, silty; slightly calcareous
100-110	10	933-923	Clay, gray, silty, sandy; smooth, some chunky, firm layers, sand is very fine to fine, with some medium losing water, dark oily streaks on mud pit
110-120	10	923-913	Clay, gray, silty; greasy, soft, slightly calcareous (Carlile Shale)

Local number: 127N49W25DAAA R
Other identifier: LTR NO. 17
Station identification number: 454515096434801
Date of construction: 9-12-90
Land surface altitude: 1,090 feet
Total depth: 260 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-18	18	1,090-1,072	Clay, light-brown, silty; calcareous
18-35	17	1,072-1,055	Clay, gray, silty, sandy; slightly calcareous (till)
35-56	21	1,055-1,034	Sand, brownish-gray, fine to very fine; some medium, some coal
56-88	32	1,034-1,002	Clay, gray, silty; very slightly calcareous
88-89	1	1,002-1,001	Clay, medium-gray
89-116	27	1,001-974	Clay, gray, silty, sandy, pebbly; very slightly calcareous, 2-inch dolomite boulder at 95 feet, coal at 110 feet (till)
116-124	8	974-966	Sand and gravel, grayish-brown, fine to very coarse sand to very fine gravel
124-152	28	966-938	Clay, gray, silty, sandy, pebbly; some rocks, more sand and gravel than upper till (till)
152-154	2	938-936	Sand and gravel, grayish-brown, very fine to very coarse sand to very fine gravel
154-199	55	936-891	Clay, gray, silty, sandy, pebbly; slightly calcareous (till)
199-210	11	891-880	Clay, medium-gray, silty, sandy; greasy, some very fine gravel, much wood, light-brown
210-230	20	880-860	Clay, gray, silty, sandy, pebbly; calcareous (till)
230-240	10	860-850	Clay, medium-gray, silty; greasy, noncalcareous (Carlile Shale?)
240-260	20	850-830	Clay, medium-gray, silty, sandy; sand is very fine to fine, calcareous, clay from bit is dark-gray with a brownish tint and is calcareous (Carlile Shale)

Local number: 127N49W29DCDC R
Other identifier: LTR NO. 15
Station identification number: 454450096491301
Date of construction: 8-28-90
Land surface altitude: 1,111.4 feet
Total depth: 200 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,111.4-1,109.4	Topsoil, black
2-7	5	1,109.4-1,104.4	Clay, light-brown, silty (till)
7-10	3	1,104.4-1,101.4	Clay, light-brown, silty, sandy, pebbly (till)
10-22	12	1,101.4-1,089.4	Clay, brown, silty; some sand and gravel (till)
22-31	9	1,089.4-1,080.4	Sand and gravel, dark-brown; looking stony
31-36	5	1,080.4-1,075.4	Clay, light-brown to light-gray; slick, smooth, soft
36-53	7	1,075.4-1,058.4	Clay, brown, silty, sandy, pebbly; hard, gravel stringer from 47 to 49 feet (till)
53-68	15	1,058.4-1,043.4	Clay, light-gray, silty, sandy, pebbly (till)
68-76	8	1,043.4-1,035.4	Clay, light-gray, sandy; sand is very fine, passed through sieve
76-83	7	1,035.4-1,028.4	Gravel, fine
83-88	5	1,028.4-1,023.4	Gravel, medium to coarse; with clay stringer
88-117	29	1,023.4-994.4	Clay, light-gray, silty, sandy, pebbly; sand stringer about 96 feet, rock at 102 feet (till)
117-163	46	994.4-948.4	Clay, gray; gravelly
163-165	2	948.4-946.4	Gravel; with clay stringer
165-174	9	946.4-937.4	Clay, gray, silty, sandy, pebbly (till)
174-177	3	937.4-934.4	Gravel; with clay
177-184	7	934.4-927.4	Clay, dark-gray; greasy, slightly calcareous (Carlile Shale?)
184-200	16	927.4-911.4	Clay, dark-gray; slightly to very calcareous (Carlile Shale?)

Local number: 127N49W29DCDC2 R
Other identifier: LTR-16
Station identification number: 454450096491302
Date of construction: 8-30-90
Land surface altitude: 1,111.4 feet
Total depth: 90 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,111.4-1,109.4	Topsoil
2-7	5	1,109.4-1,104.4	Clay, light-brown, silty
7-10	3	1,104.4-1,101.4	Clay, light-brown, silty, sandy, pebbly (till)
10-22	12	1,101.4-1,089.4	Clay, brown, silty, sandy, gravelly (till)
22-31	9	1,089.4-1,080.4	Sand and gravel, dark-brown; shaley, iron stained
31-36	5	1,080.4-1,075.4	Clay, light-brown to light-gray; slick, smooth, soft
36-53	17	1,075.4-1,058.4	Clay, brown, silty, sandy, pebbly; hard, gravel stringer from 47 to 49 feet (till)
53-68	15	1,058.4-1,043.4	Clay, light-gray, silty, sandy, pebbly
68-76	8	1,043.4-1,035.4	Clay, light-gray, very sandy; sand passed through sieve
76-83	7	1,035.4-1,028.4	Gravel, fine
83-90	7	1,028.4-1,021.4	Gravel coarse

Well screened from 80 to 90 feet; 2-inch diameter PVC casing used. Electric log available

Local number: 127N50W3AAA R
Other identifier: LTR NO. 25
Station identification number: 454811096534501
Date of construction: 9-29-90
Land surface altitude: 1,083 feet
Total depth: 180 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-5	5	1,083-1,078	Sand, light-brown, very fine to fine, silty; some medium sand
5-10	5	1,078-1,073	Gravel, light-brown, very fine; some sand
10-30	20	1,073-1,053	Clay, gray, silty, sandy, pebbly; sand is very fine to fine (till)
30-50	20	1,053-1,033	Sand, light-gray, very fine to fine, silty; some medium sand
50-65	15	1,033-1,018	Clay, gray, silty, sandy, pebbly; sand is very fine (till)
65-80	15	1,018-1,003	Clay, gray, silty; some light-gray varves
80-133	53	1,003-950	Clay, gray, silty, sandy; sand is very fine to fine, with some medium (till)
133-180	47	950-903	Clay, dark-gray, silty; micaceous (Carlile Shale)

Log was written from driller's sample piles

Local number: 127N50W6BBBB R
Other identifier: LTR NO. 3
Station identification number: 454910096584901
Date of construction: 8-10-88
Land surface altitude: 1,173 feet
Total depth: 207 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1.5	1.5	1,173-1,171.5	Topsoil, dark-brown, silty, sandy, clayey
1.5-51	49.5	1,171.5-1,122	Clay, yellowish-brown to medium-brown, silty, sandy; occasional pebbles, rocks at 3, 5, 15, 19.5, 21, 35, 40, 45 feet, very sandy and silty 8 to 12 feet, finer with less sand below 15 feet, color turned medium-gray about 26 feet (till)
51-52	1	1,122-1,121	Sand and gravel, coarse sand to fine gravel
52-123.5	71.5	1,121-1,049.5	Clay, medium-gray to medium-bluish-gray, silty, sandy; occasional pebbles, very silty and sandy in spots, rock at 73 feet, occasional 2 to 6-inch thick beds of cleaner material, these beds more common below 85 feet, siltier 105 to 110 feet, less silty 110 to 118.5 feet (till)
123.5-134.5	11	1,049.5-1,038.5	Sand and gravel, coarse sand to fine gravel; somewhat clayey, higher clay content 125 to 127 feet, probably interbeds of sand/gravel and clay/silt, cuttings contain occasional chunks of medium-brown to yellowish-brown clay, rock at 134 feet
134.5-163	28.5	1,038.5-1,010	Clay, medium-gray, silty, sandy; occasional pebbles, rock at 137 feet (till)
163-165	2	1,010-1,008	Sand and gravel, coarse sand to fine gravel
165-198	33	1,008-975	Clay, medium-gray, silty, sandy; occasional pebbles, rocks or gravel lenses 167 to 168 feet, 172 to 180 feet, and 190 to 193 feet, cuttings looked like clay cemented gravel and sand, drilled somewhat easier than upper till zones
198-207	9	975-966	Shale, black; greasy feel, noncalcareous (Carlile Shale)
Electric log available			

Local number: 127N50W12AAAB R
Other identifier: R2-96-51
Station identification number: 454817096512301
Date of construction: 8-14-96
Land surface altitude: 1,090 feet
Total depth: 182 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,090-1,089	Topsoil, black
1-35	34	1,089-1,055	Sand, brown, fine; oxidized, grades to a fine gravel with depth, unoxidized at 20 feet with many black shale pebbles
35-56	21	1,055-1,034	Clay, gray, silty, sandy, pebbly; unoxidized (till)
56-60	4	1,034-1,030	Sand and gravel, coarse sand to fine gravel
60-62	2	1,030-1,028	Clay, brown, silty, sandy, pebbly; oxidized (till)
62-85	23	1,028-1,005	Clay, gray, silty, sandy, pebbly; hard unoxidized (till)
85-92	7	1,005-998	Sand and gravel, coarse sand to fine gravel; many shale pebbles, rock at 92 feet
92-108	16	998-982	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens from 93 to 97 feet (till)
108-116	8	982-974	Gravel, black, fine; many shale pebbles
116-122	6	974-968	Clay, dark-gray, silty, sandy, pebbly; unoxidized, rock at 120 feet (till)
122-152	30	968-938	Clay, gray, silty, sandy, pebbly; unoxidized, rocks at 136 feet (till)
152-156	4	938-934	Gravel, medium to coarse; rock at 156 feet
156-182	26	934-908	Shale, dark-gray to black; hard, greasy, noncalcareous (Carlile Shale)
Electric log available			

Local number: 127N50W19CCCB R
Other identifier: LTR NO. 2
Station identification number: 454547096584301
Date of construction: 8-8-88
Land surface altitude: 1,175.4 feet
Total depth: 203 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,175.4-1,173.4	Topsoil, dark-brown, clayey, silty
2-4	2	1,173.4-1,171.4	Clay, light- to medium-yellowish-brown, silty, sandy
4-85	81	1,171.4-1,090.4	Clay, medium-yellowish-brown, silty, sandy; turning to medium- to dark-blue-gray at about 23 feet, gravelly or rocks at 4, 11 to 11.5, 14, 18.5, and 36 feet, by 36 feet is a silty clay that contains some scattered grains of sand and gravel (till?)
85-98	13	1,090.4-1,077.4	Silt, medium-gray, clayey; somewhat sandy, coarsened to very fine sand by 97 feet, easy drilling from 90 to 97 feet
98-108	10	1,077.4-1,067.4	Clay, medium-gray, silty, sandy; scattered pebbles, rocks at 100, 105, and 107 feet, much stiffer drilling from 98 to 101 feet
108-112	4	1,067.4-1,063.4	Sand and gravel, coarse sand to cobble-sized gravel; shell fragments common, hard drilling because of rocks and gravel
112-114	2	1,063.4-1,061.4	Sand and gravel, medium sand to gravel
114-140	26	1,061.4-1,035.4	Sand and gravel, coarse sand to cobble-sized gravel; minor amount of finer sand, rocks at 114 to 115.5 and 117 to 119 feet, driller thinks entire interval is interbedded sand, gravel and clay
140-183	43	1,035.4-992.4	Sand and gravel, coarse sand to cobble-sized gravel, more clay than above interval, rocks at 160 to 163, 166, 173, 178 to 181, and 182.5 feet, cuttings were clean, shale-free, abundant shell fragments at 157 feet, some medium-brown clay noticed at 178 feet
183-198	15	992.4-977.4	Silt, medium-gray; somewhat clayey, non-calcareous, some bits of medium-brown clay noticed
198-203	5	977.4-972.4	Shale, black; noncalcareous, greasy (Carlile Shale)
Well screened from 109 to 119 feet; blank 2-inch diameter PVC casing below screen to 200 feet. Electric log available			

Local number: 127N50W21DDDD R
Other identifier: R2-96-50
Station identification number: 454541096550001
Date of construction: 8-14-96
Land surface altitude: 1,142.7 feet
Total depth: 175 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,142.7-1,141.7	Roadfill
1-38	37	1,141.7-1,104.7	Clay, yellowish-brown, silty, sandy, pebbly; oxidized, some lake silt inclusions (till)
38-44	4	1,104.7-1,098.7	Clay, gray, silty, sandy, pebbly; unoxidized, large cuttings (till)
44-52	8	1,098.7-1,090.7	Sand and gravel, coarse sand to fine gravel
52-57	5	1,090.7-1,085.7	Clay, gray, silty, sandy, pebbly; hard unoxidized (till)
57-149	92	1,085.7-993.7	Sand, gray, fine to medium; frequent clay layers from 88 to 102 feet, grades to a medium gravel with depth, some coarse gravel near the bottom
149-162	13	993.7-980.7	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 152 feet (till)
162-175	13	980.7-967.7	Shale, dark-gray to black; hard, greasy (Carlile Shale)
Well screened from 138 to 148 feet; 20 feet of blank 2-inch diameter PVC casing below the screen. Electric log available			

Local number: 127N50W25ADAD R
Other identifier: R2-96-57
Station identification number: 454523096511601
Date of construction: 9-17-96
Land surface altitude: 1,099.5 feet
Total depth: 182 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,099.5-1,096.5	Topsoil, black
3-30	27	1,096.5-1,069.5	Clay, brown, silty, sandy, pebbly; oxidized (till)
30-60	30	1,069.5-1,039.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)
60-79	19	1,039.5-1,020.5	Sand and gravel, medium sand to fine to medium gravel; some coal and shale fragments
79-154	75	1,020.5-945.5	Clay, gray, silty, sandy, pebbly; unoxidized, rocks at 98, 105, 1090, and 113 feet, layer of light-gray silty clay at 150 feet, electric-log signature change at 111 feet (till)
154-182	28	945.5-917.5	Shale, black; greasy, some bentonite (Carlile Shale)
Electric log available			

Local number: 127N50W25ADAD2 R
Other identifier: R2-96-58
Station identification number: 454523096511602
Date of construction: 9-18-96
Land surface altitude: 1,099.5 feet
Total depth: 80 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,099.5-1,097.5	Topsoil, black
2-32	30	1,097.5-1,067.5	Clay, brown, silty, sandy, pebbly; oxidized (till)
32-58	26	1,067.5-1,041.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)
58-76	18	1,041.5-1,023.5	Sand and gravel, medium sand to fine to medium gravel; some coal and shale
76-80	4	1,023.5-1,019.5	Clay, gray, silty, sandy, pebbly; unoxidized (till)

Well screened from 66 to 76 feet; 2-inch diameter PVC casing used. Electric log available

Local number: 127N51W6CCCD R
Other identifier: R2-95-08
Station identification number: 454818097060401
Date of construction: 6-20-95
Land surface altitude: 1,194.3 feet
Total depth: 147 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,194.3-1,192.3	Topsoil, black.silty
2-19	17	1,192.3-1,175.3	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized (till)
19-30	11	1,175.3-1,164.3	Clay, brownish-gray, silty, sandy, pebbly; partially oxidized (till)
30-76	46	1,164.3-1,118.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
76-95	19	1,118.3-1,099.3	Clay, gray, very silty (lake deposit)
95-141	46	1,099.3-1,053.3	Sand, medium to coarse grading to fine gravel
141-147	6	1,053.3-1,047.3	Clay, dark-gray to black; hard, greasy, shaley (Pierre Shale)

Well screened from 128 to 138 feet; 2-inch diameter PVC casing used. Electric log available

Local number: 127N52W21DDDD R
Other identifier: R2-95-07
Station identification number: 454543097095301
Date of construction: 6-20-95
Land surface altitude: 1,269 feet
Total depth: 102 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,269-1,268	Topsoil, black, silty
1-25	24	1,268-1,244	Clay, tan to yellowish-brown, silty, sandy, pebbly; rocks at 9, 11, and 18 feet, oxidized (till)
25-30	5	1,244-1,239	Clay, dark-gray, silty, sandy, pebbly; unoxidized (till)
30-42	12	1,239-1,227	Clay, gray, very silty; unoxidized (lake deposit?)
42-46	4	1,227-1,223	Clay, light-gray, silty; calcareous (Pierre Shale)
46-62	16	1,223-1,207	Clay, gray; hard, chunky, shaley, noncalcareous, some bentonite layers (Pierre Shale)
62-92	30	1,207-1,177	Clay, light-gray, silty; calcareous (Pierre Shale)
92-102	10	1,177-1,167	Clay, dark-gray to black; shaley, greasy, noncalcareous (Pierre Shale)

Electric log available

Local number: 128N47W5AAAD R
Other identifier: R2-96-65
Station identification number: 455558096355301
Date of construction: 9-30-96
Land surface altitude: 975 feet
Total depth: 220 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	976-974	Topsoil, black
2-10	8	974-966	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
10-13	3	966-963	Clay, light-brown, silty
13-16	3	963-960	Clay, gray, silty
16-76	60	960-900	Clay, gray, silty, sandy, pebbly; hard, unoxidized, rock at 34 feet, greasy, much shale, gravel lens 34 to 36 feet (till)
76-153	77	900-823	Clay, gray, silty, sandy, pebbly; unoxidized, softer than above interval, rocks at 90, 92, and 96 feet, gravel lenses from 104 to 106, 114 to 117, 127 to 130, and 142 to 145 feet (till)
153-164	11	823-812	Sand and gravel, coarse sand to fine gravel
164-222	58	812-754	Clay, dark-gray; hard, greasy, noncalcareous, poor cuttings, shale contact picked from electric-log (Graneros Shale)

Electric log available

Local number: 128N47W22BBAA R
Other identifier: LTR-23
Station identification number: 455359096341601
Date of construction: 9-26-90
Land surface altitude: 975 feet
Total depth: 70 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	975-973	Clay, black, silty, sandy: sand is fine to very fine, calcareous (topsoil)
2-4	2	973-971	Clay, gray, silty, sandy; sand is very fine to fine
4-6	2	971-969	Clay, tan, silty, sandy; sand is very fine to fine, slightly calcareous
6-15	9	969-960	Sand, light-brown, medium to very coarse: some fine
15-20	5	960-955	Gravel, light-brown, very fine
20-50	30	955-925	Sand and gravel, light-brown, medium to very coarse sand to very fine to fine gravel; some very fine to fine sand, contains dolomite and bluish-gray igneous grains
50-60	10	925-915	Sand, gray, very fine to medium; some coarse, a little light-brown
60-70	10	915-905	Clay, gray, silty, sandy; greasy, sand is very fine to fine
Well was screened from 33.3 to 43.3 feet; 2-inch diameter PVC casing used			

Local number: 128N47W28ABCA R
Other identifier: LTR NO. 23
Station identification number: 455229096350501
Date of construction: 9-25-90
Land surface altitude: 974 feet
Total depth: 20 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	974-964	Clay, light-brown, silty, sandy, very fine to fine sand; some clay has light red streaks; slightly pebbly, slightly calcareous
10-20	10	964-954	Clay, gray, silty, some sand, medium to very coarse; pebbly, calcareous (till)

Local number: 128N48W1BBCB R
Other identifier: R2-96-64
Station identification number: 455601096393301
Date of construction: 9-25-96
Land surface altitude: 1,044 feet
Total depth: 204 feet

Depth (feet)	Thickness	Altitude	Description
0-2	2	1,044-1,042	Topsoil, black
2-10	8	1,042-1,034	Clay, brown, silty, sandy, pebbly; oxidized (till)
10-22	12	1,034-1,022	Clay, gray, silty, sandy, pebbly; unoxidized (till)
22-32	10	1,022-1,012	Sand, gray, medium; unoxidized
32-55	23	1,012-989	Clay, gray, very silty, sandy, pebbly; unoxidized, contains much lake silt (till)
55-82	27	989-962	Clay, gray, silty; soft, greasy, unoxidized (lake clay)
82-161	79	962-883	Sand and gravel, fine sand to medium gravel; grades to coarse gravel with depth
161-178	17	883-866	Clay, gray, silty, sandy, pebbly; unoxidized, rocks at 164 and 168 feet (till)
178-204	26	866-840	Cobbles and gravel, clayey (till)
204-205	1	840-839	Rock, gray; extremely hard, abandoned test hole, chert (?), erratic (?), actually had no penetration

The rock at 204 feet was extremely hard, wore out a rock bit. Electric log available

Local number: 128N48W1CCDC R
Other identifier: R2-96-61
Station identification number: 455334096372101
Date of construction: 9-24-96
Land surface altitude: 1,201.8 feet
Total depth: 314 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,201.8-1,019.8	Topsoil, black
2-19	17	1,019.8-1,002.8	Clay, brown becoming grayish-brown with depth, silty, sandy, pebbly; oxidized to partially oxidized (till)
19-30	11	1,002.8-991.8	Sand, brown, fine; oxidized
30-54	24	991.8-967.8	Clay, gray, silty; some oxidized brown clay noticed near the top of interval (lake clay)
54-62	8	967.8-959.8	Gravel, fine to medium
62-87	25	959.8-934.8	Clay, gray, silty, sandy, pebbly; unoxidized, rocks at 80 and 86 feet, sand and gravel lens from 85 to 87 feet (till)
87-98	11	934.8-923.8	Clay, gray, very silty; hard, unoxidized (lake clay)
98-126	28	923.8-895.8	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 113 feet, gravel lens from 123 to 125 feet (till)
126-142	16	895.8-879.8	Clay, gray, silty; unoxidized (lake clay)
142-222	80	879.8-799.8	Sand and gravel, medium grading to coarse with depth; clay layer from 175 to 177 feet, very coarse near base of interval
222-272	50	799.8-749.8	Clay, gray, silty, sandy, pebbly; very hard unoxidized (till)
272-300	28	749.8-721.8	Clay, white silty, sandy; greasy, noncalcareous (Cretaceous regolith)
300-314	14	721.8-707.8	Siltstone, pink, white and gray; hard, increasing hardness with depth (weathered Precambrian surface?)

Electric log available

Local number: 128N48W1CCDC2 R
Other identifier: R2-96-62
Station identification number: 455334096372102
Date of construction: 9-24-96
Land surface altitude: 1,021.8 feet
Total depth: 222 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,021.8-1,019.8	Topsoil, black
2-30	28	1,019.8-991.8	Clay, brown, becoming grayish-brown with depth, silty, sandy, pebbly; oxidized to partially oxidized, some sand noticed but much less than nearby test hole (till)
30-55	25	991.8-966.8	Clay, gray, silty; unoxidized (lake clay)
55-88	33	966.8-933.8	Clay, gray, silty, sandy, pebbly; unoxidized (till)
88-100	12	933.8-921.8	Clay, gray, silty; unoxidized (lake clay)
100-126	26	921.8-895.8	Clay, gray, silty, sandy, pebbly; unoxidized (till)
126-140	14	895.8-881.8	Clay, gray, silty; unoxidized (lake clay)
140-222	82	881.8-799.8	Sand and gravel, medium to coarse

Well screened from 198 to 203 feet; 2-inch diameter PVC casing used

Local number: 128N48W4DDDD R
Other identifier: R2-96-63
Station identification number: 4553360096400301
Date of construction: 9-25-96
Land surface altitude: 1,046.6 feet
Total depth: 252 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,046.6-1,044.6	Topsoil, black
2-11	9	1,044.6-1,035.6	Clay, brown, silty
11-18	7	1,035.6-1,028.6	Clay, gray, silty, sandy, pebbly; unoxidized (till)
18-58	40	1,028.6-988.6	Sand, gray, fine, very silty, clayey; clay layers from 35 to 47 feet
58-81	23	988.6-956.6	Clay, gray, silty; soft, unoxidized (lake clay)
81-87	6	956.6-959.6	Gravel, fine to medium
87-94	7	959.6-952.6	Clay, gray, silty, sandy, pebbly; unoxidized (till)
94-156	62	952.6-890.6	Sand, gray, fine to medium
156-162	6	890.6-884.6	Clay, gray, very silty, sandy; unoxidized (lake clay)
162-238	76	884.6-808.6	Sand and gravel, fine to medium sand grading to coarse sand and fine to medium gravel with depth, rock from 235 to 237 feet
238-252	14	808.6-794.6	Shale, grayish-black; greasy, noncalcareous

Well screened from 218 to 238 feet; 2-inch diameter PVC casing used. Flush well protector installed. Electric log available

Local number: 128N48W5DADD R
Other identifier: R2-96-66
Station identification number: 455534096432001
Date of construction: 10-1-96
Land surface altitude: 1,071 feet
Total depth: 300 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,071-1,069	Topsoil, black
2-17	15	1,069-1,054	Clay, yellowish-brown, very silty, sandy; some pebbles, oxidized (till)
17-45	28	1,054-1,026	Clay, gray, very silty, sandy, pebbly; unoxidized (till)
45-116	71	1,026-955	Sand and gravel, coarse sand to fine gravel; very coarse gravel from 80 to 110 feet
116-176	60	955-895	Clay, gray, silty, sandy, pebbly; unoxidized (till)
176-179	3	895-892	Granite boulder, pink; very hard
179-223	44	892-848	Clay, gray, silty, sandy, pebbly; unoxidized (till)
223-230	7	848-841	Sand and gravel, coarse; with cobbles
230-264	34	841-807	Clay, gray, silty, sandy, pebbly; unoxidized, much shale, hard, poor cuttings, rock at 264 feet (till)
264-302	28	807-796	Shale, dark-gray to black; hard, greasy, noncalcareous (Graneros Shale)
Electric log available			

Local number: 128N48W6BBBB R
Other identifier: LTR NO. 10
Station identification number: 455423096434501
Date of construction: 8-31-88
Land surface altitude: 1,098.2 feet
Total depth: 282 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-0.5	0.5	1,098.2-1,097.7	Topsoil, light-medium-brown, medium sand to silt; somewhat clayey
0.5-40	39.5	1,097.7-1,058.2	Clay, medium-brown to yellowish-brown, silty, sandy; sand to very coarse, scattered coarser particles (till)
40-58	18	1,058.2-1,040.2	Sand and gravel, yellowish-brown to light-medium-brown, coarse sand to fine gravel; cuttings seemed somewhat clayey, easy drilling
58-90	32	1,040.2-1,008.2	Sand, medium-brown, very fine to fine, very silty; probably interbedded with a few thin beds of medium-gray clay, very clayey below 85 feet
90-141	51	1,008.2-957.2	Sand and gravel, coarse sand to fine gravel; some medium sand, fragments of wood noticed below 100 feet, most gravel to coarse sand particles are frock fragments, quartz, and shale particles, some lignite, medium-brown clay from 129 to 130 feet
141-153	12	957.2-945.2	Clay, light-medium-gray, silty, sandy; contains occasional coarser particles, contains thin sand streaks
153-175	22	945.2-923.2	Sand and gravel, very coarse sand to fine gravel; seems clay-free, coarser from 170 to 173 feet
175-178	3	923.2-920.2	Clay, light-medium-gray, silty, sandy; maybe caving from above
178-217	39	920.2-881.2	Sand and gravel, medium sand to fine gravel; abundant finer sand, clay or clay layer from 195 to 197 feet, coarser from 213 to 217 feet
217-232	15	881.2-866.2	Clay, medium-gray; calcareous, very few cuttings
232-258	26	866.2-840.2	Sand and gravel, coarse sand to fine gravel; some finer sand, seems clay-free
258-282	24	840.2-816.2	Shale, black; highly calcareous (Greenhorn Limestone?)
Well screened form 249 to 259 feet; 2-inch diameter PVC casing used. Electric log available			

Local number: 128N48W21AAAA R
Other identifier: LTR-8
Station identification number: 455147096400301
Date of construction: 8-26-88
Land surface altitude: 1,057 feet
Total depth: 203 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,057-1,055	Topsoil
2-23	21	1,055-1,034	Clay, light-brown, silty, sandy, pebbly (till)
23-70	47	1,034-987	Sand, very fine to fine; salt and pepper appearance, probably clayey
70-104.5	34.5	987-952.5	Clay, gray, silty, pebbly
104.5-109.5	5	952.5-947.5	Sand and gravel; no recognizable cuttings
109.5-143	33.5	947.5-914	Clay, gray, silty, pebbly; less gravelly from 120 to 130 feet (till)
143-147.5	4.5	914-909.5	Gravel
147.5-183	35.5	909.5-874	Clay, gray, silty, pebble; rocks at 170 and 173.5 feet (till)
183-203	20	874-854	Shale, black; calcareous, greasy, contains highly calcareous laminae (Carlile Shale)
Electric log available			

Local number: 128N48W26AAAA R
Other identifier: R2-96-60
Station identification number: 455055096374101
Date of construction: 9-18-96
Land surface altitude: 983 feet
Total depth: 182 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	983-981	Topsoil, black
2-18	16	981-965	Clay, tan, brown, green and black, silty, sandy; layered, oxidized to 10 feet, rock at 18 feet
18-28	10	965-955	Sand, gray, green, and black, fine, very silty
28-32	4	955-951	Clay, gray, silty (lake clay)
32-50	18	951-933	Sand, golden-brown, medium to coarse; well-sorted
50-58	8	933-925	Clay, gray, silty; unoxidized (lake clay)
58-101	43	925-882	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 60 feet, electric-log change from 95 to 101 feet (till)
101-140	39	882-843	Sand, fine, silty; some fine gravel, may be cemented, very little sample, rock at 138 feet
140-150	10	843-833	Clay, gray, silty, sandy, pebbly; very hard, unoxidized, rock at 145 feet (till)
150-182	32	833-801	Shale, black; greasy, noncalcareous (Graneros Shale)
Ground water was flowing from the test hole; plugged with neat cement grout. Electric log available			

Local number: 128N48W28DDDD R
Other identifier: LTR NO. 20
Station identification number: 455007096400201
Date of construction: 9-18-90
Land surface altitude: 1,071 feet
Total depth: 240 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,071-1,061	Clay, light-brown, silty, sandy, pebbly (till)
10-40	30	1,061-1,031	Sand, light-brown, very fine to fine, silty
40-80	40	1,031-991	Sand, gray, very fine to fine, silty; slightly calcareous, some very fine gravel bear base of interval
80-100	20	991-971	Sand, gray, very fine to fine, silty; slightly calcareous
100-105	5	971-966	Clay, gray, silty; greasy in places
105-120	15	966-951	Clay gray, silty, sandy, pebbly; a little very fine to fine gravel, and wood (till)
120-130	10	951-941	Clay, gray, silty, sandy, pebbly (till)
130-140	10	941-931	Sand and gravel, grayish-brown, coarse to very coarse sand to very fine to medium gravel; contains shale, dolomite, and gray granite
140-150	10	931-921	Clay, light-gray, silty, sandy, pebbly; slightly calcareous (till)
150-160	10	921-911	Gravel, light-brown, very fine to fine; some medium
160-190	30	911-881	Clay, gray, silty, sandy pebbly; sand is very fine, greasy, poor cuttings
190-200	10	881-871	Clay, dark-gray, silty; noncalcareous (Carlile Shale)
200-210	10	871-861	Clay, medium-gray, silty; some fine to very fine sand (Carlile Shale)
210-220	10	861-851	Clay, dark-gray, with a brown tint; slightly greasy, noncalcareous (Carlile Shale)
220-240	20	851-831	Clay, gray, silty; greasy, some dark-gray chunks or nodules, some very fine to fine sand, calcareous (Carlile Shale)

Log is from cutting piles

Local number: 128N49W10BBCC R
Other identifier: R2-96-67
Station identification number: 455321096473201
Date of construction: 10-2-96
Land surface altitude: 1,095 feet
Total depth: 280 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,095-1,093	Topsoil, black
2-16	14	1,093-1,079	Clay, tan and yellowish-brown, very silty, sandy, pebbly; oxidized, (till)
16-40	24	1,079-1,055	Sand, yellowish-brown, very fine, silty; oxidized, becomes gray at 38 feet
40-56	16	1,055-1,039	Clay, gray, very silty; greasy, unoxidized (lake clay)
56-66	10	1,039-1,029	Clay, gray, silty, sandy, pebbly; unoxidized (till)
66-108	42	1,029-987	Sand, fine to medium; some fine gravel
108-186	78	987-909	Clay, gray, silty, sandy, pebbly; hard, unoxidized, rocks at 137 and 149 feet, sand lens from 136 to 138 feet (till)
186-234	48	909-861	Sand, medium; some fine gravel, rig chatter, cemented, poor sample
234-262	28	861-833	Clay, brown, silty; some hard white limestone layers, very calcareous (Greenhorn Limestone)
262-282	20	833-813	Shale, dark-gray to black; hard greasy, noncalcareous (Graneros Shale)

Local number: 128N49W20BBBB R
Other identifier: LTR NO. 6
Station identification number: 455146096500001
Date of construction: 8-22-88
Land surface altitude: 1,082.6 feet
Total depth: 223 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,082.6-1,080.6	Topsoil, Black To Light-brown
2-43	41	1,080.6-1,039.6	Clay, light-brown, silty sandy pebbly (till)
43-53	10	1,039.6-1,029.6	Clay, sandy
53-73	20	1,029.6-1,009.6	Sand, very fine to fine
73-123	50	1,009.6-959.6	Clay, gray, gravelly; rock at 95 feet (till)
123-183	60	959.6-899.6	Clay, gray, silty, sandy, pebbly (till)
183-199	16	899.6-883.6	Sand; interbedded with thin clay layers
199-203	4	883.6-879.6	Clay, gray, silty, pebbly (till)
203-223	10	879.6-859.6	Shale, dark-gray (Carlile Shale)
Well screened from 190 to 200 feet; 20 feet of blank 2-inch diameter PVC casing below screen. Electric log available			

Local number: 128N49W23AAAA R
Other identifier: LTR NO. 7
Station identification number: 455156096450301
Date of construction: 8-25-88
Land surface altitude: 1,065 feet
Total depth: 223 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,065-1,063	Topsoil, light-brown, silty, pebbly
2-23	21	1,063-1,042	Sand, light-brown, fine
23-63	40	1,042-1,002	Sand, light-gray, very fine to fine
63-194	131	1,002-871	Clay, light-gray, silty, sandy; pebbly below 90 feet, greenish-light-gray below 160 feet, gravel or rocks from 177 to 180 feet (till)
194-223	29	871-842	Shale, dark-brown; greasy (Carlile Shale)

Local number: 128N49W35CCCC R
Other identifier: LTR NO. 22
Station identification number: 454912096461701
Date of construction: 9-24-90
Land surface altitude: 1,092 feet
Total depth: 340 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-5	5	1,092-1,087	Clay, light-brown, silty, sandy, pebbly; slightly calcareous (till)
5-10	5	1,087-1,082	Sand, light-brown, very fine to fine, silty
10-20	10	1,082-1,072	Clay, light-brown, silty, sandy, pebbly; slightly calcareous (till)
20-50	30	1,072-1,042	Sand, light-brown, very fine to fine silty
50-85	35	1,042-1,007	Sand, light-gray, fine to medium; few coarse and pebbles
85-95	10	1,007-997	Clay, gray, pebbly
95-100	5	997-992	Sand, gray, very fine to fine, pebbly; slightly calcareous
100-150	50	992-942	Clay, gray, silty, sandy, pebbly; sand is very fine to fine, slightly calcareous (till)
150-170	20	942-922	Sand, brownish-gray, very fine to medium, silty; some coarse and very coarse
170-230	60	922-862	Clay, gray, silty, sandy, pebbly; sand is very fine to fine, slightly calcareous (till)
230-250	20	862-842	Gravel, gray, very fine to fine; some very coarse sand and some clay
250-270	20	842-822	Clay, brownish-gray, silty, sandy; sand is very fine to fine, some very fine gravel, calcareous (till)
270-280	10	822-812	Gravel, gray, very fine to fine; some very coarse sand
280-320	40	812-772	Clay, gray with mottled yellowish-brown, silty, sandy; sand is very fine to fine, much gravel, slightly calcareous in places (till)
320-330	10	772-762	Sand, brownish-gray, very fine to medium; some coarse and very coarse, a little very fine to fine gravel
330-340	10	762-752	Clay, gray, silty, sandy; sand is very fine to fine, some yellowish-brown clay, calcareous, much gravel but may be caving from above (till)

Log written from cutting pile

Local number: 128N49W36AAAA R
Other identifier: LTR-21
Station identification number: 45503096434701
Date of construction: 9-9-90
Land surface altitude: 1,078.9 feet
Total depth: 240 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-12	12	1,078.9-1,066.9	Clay, light-brown, silty, sandy; streaked with orange-brown, sand is coarse, some very fine gravel, slightly calcareous (till)
12-17	5	1,066.9-1,061.9	Clay, gray, silty, sandy, shaley
17-20	3	1,061.9-1,058.9	Sand, grayish-brown, fine to medium, silty; slightly calcareous
20-75	55	1,058.9-1,003.9	Sand gray, very fine to fine, silty; some coal
75-115	40	1,003.9-963.9	Clay, gray, silty, pebbly; slightly calcareous (till)
115-119	4	963.9-959.9	Gravel, grayish-brown, fine to very fine; contains dolomite and brown granite
119-131	12	959.9-947.9	Clay, gray, silty, very sandy; slightly calcareous
131-156	25	947.9-922.9	Clay, medium-gray, slightly silty, sandy, pebbly; greasy
156-185	29	922.9-893.9	Clay, medium-gray, silty, sandy; greasy, sand is fine to very fine with some medium to very coarse, some very fine gravel
185-200	15	893.9-878.9	Sand and gravel, brownish-gray, very fine to coarse sand to very fine to fine gravel, silty; some very coarse sand
200-227	27	878.9-851.9	Clay, gray; greasy (Carlile Shale)
227-240	13	851.9-838.9	Clay, dark-gray, silty; greasy, slightly calcareous (Carlile Shale)
Well is screened from 191 to 201 feet; 2-inch diameter PVC casing used			

Local number: 128N50W10BBBB R
Other identifier: R2-95-17
Station identification number: 455333096550001
Date of construction: 6-28-95
Land surface altitude: 1,092.3 feet
Total depth: 242 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,092.3-1,089.3	Topsoil, black, silty
3-15	12	1,089.3-1,077.3	Clay, yellowish-brown to brown, silty, sandy, pebbly; small gravel lens, oxidized (till)
15-20	5	1,077.3-1,072.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
20-26	6	1,072.3-1,066.3	Clay, gray, very silty; soft, drills fast, unoxidized (lake sediment)
26-57	31	1,066.3-1,035.3	Sand, gray, fine to medium grading to coarse; unoxidized
57-102	45	1,035.3-990.3	Clay, gray, very silty; unoxidized (lake deposit)
102-129	27	990.3-963.3	Clay, gray, silty, sandy, pebbly; sand lenses from 104 to 106 feet, and 112 to 116 feet, rock from 128 to 129 feet, unoxidized (till)
129-144	15	963.3-948.3	Sand and gravel
144-157	13	948.3-935.3	Clay, gray, silty, sandy, pebbly; unoxidized, electric-log signature differs from till above (till)
157-195	38	935.3-897.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
195-203	8	897.3-889.3	Sand and gravel, medium sand grading to a fine gravel, rock at 203 feet
203-242	39	889.3-850.3	Clay, gray to black; hard, greasy, calcareous (Carlile Shale)
Electric log available			

Local number: 128N50W10BBBB2 R
Other identifier: R2-95-18
Station identification number: 455333096550002
Date of construction: 7-10-95
Land surface altitude: 1,092.3 feet
Total depth: 57 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,092.3-1,089.3	Topsoil, black, silty
3-15	12	1,089.3-1,077.3	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized (till)
15-20	5	1,077.3-1,072.3	Clay, gray, silty, sandy, pebbly; unoxidized (till)
20-25	5	1,072.3-1,067.3	Clay, gray, very silty; soft, unoxidized (lake deposit)
25-57	32	1,067.3-1,035.3	Sand, gray, fine to medium grading to coarse; unoxidized
For electric log see R2-95-17. Well screened from 47 to 57 feet; 2-inch diameter PVC casing used			

Local number: 128N50W21AAAA R
Other identifier: LTR NO. 5
Station identification number: 455148096550001
Date of construction: 8-22-88
Land surface altitude: 1,093.7 feet
Total depth: 283 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1.5	1.5	1,093.7-1,092.2	Topsoil, dark-brown to brownish-black; fine to medium sand, minor amount of coarser sand, somewhat clayey
1.5-14	12.5	1,092.2-1,079.7	Sand, light-medium-brown, fine to medium; minor amount of coarser sand clean
14-16	2	1,079.7-1,077.7	Sand and gravel, very coarse sand to medium gravel; seems clay-free
16-29	13	1,077.7-1,064.7	Clay, medium-gray to light-medium-gray, silty; somewhat sandy, sand is very fine to medium
29-30	1	1,064.7-1,063.7	Sand, medium-yellowish-brown, fine; abundant medium sand, some silt
30-112	82	1,063.7-981.7	Clay, medium-gray to light-medium-gray; cuttings vary from silt- and sand-free clay to silty clay to silty, sandy clay, possibly bedded, rock or gravel at 54, 74 to 76, 79.5 to 80, 87, 90 to 92, 95 to 96, 97, 98.5 to 99.5, 100.5, 105, and 107 to 108 feet
112-122	10	981.7-971.1	Sand and gravel, very coarse sand to coarse gravel; contains some cobbles and some finer sand, seems clay-free
122-202	80	971.7-891.7	Clay, light- to medium-gray, silty, sandy; sand size to medium, occasional pebbles, rocks at 119 to 124, 125 to 126, 144 to 145, 155, 170, 172, 188, 192, and 194 to 195 feet (till)
202-216	14	891.7-877.7	Sand and gravel, coarse sand to medium gravel; cuttings contain abundant bits of water-sodden, partially decomposed wood, that does not float even in the drilling mud, coarse gravel or rocks at 207 and 210 to 211 feet, fairly rapid drilling
216-273	57	877.7-820.7	Clay, dark-gray to dark-bluish-gray; highly calcareous, rocks from 246 to 253 feet
273-283	10	820.7-810.7	Shale, dark-gray to dark-bluish tray; highly calcareous (Greenhorn Limestone?)
Well screened from 210 to 220 feet; blank 2-inch diameter PVC casing below screen to 280 feet? Electric log available			

Local number: 128N51W10BBBB R
Other identifier: R2-95-15
Station identification number: 455333097022901
Date of construction: 6-27-95
Land surface altitude: 1,190 feet
Total depth: 262 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,190-1,187	Topsoil, black, silty
3-18	15	1,187-1,172	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized (till)
18-54	36	1,172-1,136	Clay, gray, silty, sandy, pebbly; unoxidized (till)
54-124	70	1,136-1,066	Clay, gray, silty; soft, greasy, unoxidized (lake deposit)
124-157	33	1,066-1,033	Sand, gray, fine, silty; unoxidized
157-202	45	1,033-988	Clay, gray, silty; soft, unoxidized (lake deposit)
202-220	18	988-970	Clay, gray, silty, sandy, pebbly; gravel layer from 202 to 207 feet, unoxidized (till)
220-262	42	970-928	Clay, dark-gray; hard, greasy, shaley, noncalcareous (Carlile Shale)
Electric log available			

Local number: 128N51W12AAAB R
Other identifier: R2-95-16
Station identification number: 455333096585201
Date of construction: 6-28-95
Land surface altitude: 1,160 feet
Total depth: 362 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,160-1,158	Topsoil, black, silty
2-18	16	1,158-1,142	Clay, yellowish-brown to brown, silty, sandy, pebbly; oxidized (till)
18-85	67	1,142-1,075	Clay, gray, silty, sandy, pebbly; sand and gravel lenses from 38 to 40 feet, 46 to 49 feet, 63 to 65 feet, and 76 to 78 feet, unoxidized (till)
85-130	45	1,075-1,030	Clay, gray, very silty; soft, unoxidized, sandy from 85 to 94 feet (lake deposit)
130-160	30	1,030-1,000	Sand, gray, very fine to fine, silty; unoxidized
160-169	9	1,000-991	Clay, gray, silty; unoxidized (lake deposit)
169-237	68	991-923	Clay, gray, silty, sandy, pebbly; hard, very sandy in spots, slightly calcareous, unoxidized (till)
237-246	9	923-914	Clay, dark-gray, silty, sandy, pebbly; very hard, many shale inclusions, unoxidized (till)
246-256	10	914-904	Sand, gray, silty; hard, rig chatter
256-271	15	904-889	Clay, brown and light-gray, very silty (lake deposit)
271-319	48	889-841	Clay, dark-gray; hard, greasy, shaley, some silt, calcareous (Carlile Shale)
319-340	21	841-820	Limestone, white and brown; very hard, calcareous (Greenhorn Limestone)
340-362	22	820-798	Clay, dark-gray to black; fairly soft, greasy, some brown specks, slightly calcareous, some concretions (Graneros Shale)
Electric log available			

Local number: 128N51W18DDDD R
Other identifier: LTR NO. 26
Station identification number: 455148097050201
Date of construction: 10-19-90
Land surface altitude: 1,194 feet
Total depth: 60 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,194-1,184	Clay, light-brown and light-gray, silty, sandy, pebbly; sand is very fine to fine, calcareous (till)
10-35	25	1,184-1,159	Clay, light-brown, silty, sandy, pebbly; sand is very fine, with a little medium to very coarse, slightly calcareous (till)
35-55	20	1,159-1,139	Clay, gray, silty, sandy, pebbly; slightly calcareous (till)
55-60	5	1,139-1,134	Clay, gray to light-gray, silty, slightly calcareous

Local number: 128N51W18DDDD2 R
Other identifier: LTR NO. 27
Station identification number: 455148097050202
Date of construction: 10-22-90
Land surface altitude: 1,192 feet
Total depth: 230 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,192-1,182	Clay, light-brown and light-gray, silty, sandy, pebbly; sand is very fine to fine, with a little medium (till)
10-35	25	1,182-1,157	Clay, light-brown, silty, sandy, pebbly; sand is very fine, with a little medium to very coarse, reddish-brown spots (till)
35-40	5	1,157-1,152	Clay, gray, silty, sandy, pebbly; sand is very fine to fine (till)
40-80	40	1,152-1,112	Clay, gray, silty
80-110	30	1,112-1,082	Sand, grayish-brown, very fine to medium, silty; some silty gray clay
110-150	40	1,082-1,082	Clay, gray, silty
150-215	65	1,042-977	Clay, gray, silty, sandy, pebbly; sand is very fine to medium, coal at 165 and 175 feet (till)
215-230	15	977-962	Clay, bluish-gray; smooth, iridescent shell fragments at 215 to 220 feet, harder drilling at 225 feet (Carlile shale)

Local number: 128N51W23AABA R
Other identifier: LTR-4
Station identification number: 455148097001401
Date of construction: 8-19-88
Land surface altitude: 1,210 feet
Total depth: 283 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-29	29	1,210-1,181	Clay, medium-yellowish-brown, silty; abundant pebbles, rocks at 6 and 15 feet (till)
29-31	2	1,181-1,179	Sand and gravel, medium sand to fine gravel; somewhat clayey, abundant finer sand
31-35	4	1,179-1,175	Clay, medium-yellowish-brown, silty, sandy; pebbles common (till)
35-39	4	1,175-1,171	Sand, fine to medium, silty; abundant very fine sand, seem fairly clean
39-92	53	1,171-1,118	Clay, medium-brown, silty, sandy; turned to medium-gray at 45 feet, some fine gravel, seems to be interbedded with beds of fairly clean coarse sand to fine gravel, finer sand, silt and clay, rock at 77 feet
92-181	89	1,118-1,029	Sand and gravel, coarse sand to fine gravel; seems fairly clean, may be clayey or clay bed from 110 to 112 and 131-134 feet, more gravel 135-152 feet, gravel particles coarser 149-171 feet, bit sample from 160 feet yellowish-brown clay with rusty halos
181-227.5	46.5	1,029-982.5	Clay, light- to medium-gray, silty, sandy; some medium brown to medium-yellowish-brown cuttings from 178 to 186 feet, rocks at 190 to 191 and 202 feet, drilling moderately difficult, appears to be some bedding
227.5-230	2.5	982.5-980	Rocks or gravel; no cuttings
230-279	49	980-931	Clay, light- to medium-gray, silty, sandy; occasional pebbles (till)
279-283	4	931-927	Shale, black; noncalcareous, tough drilling (Carlile Shale)
Well screened from 170 to 180 feet; blank 2-inch diameter PVC casing from 180 to 280 feet. Electric log available			

Local number: 128N52W25AAAB R
Other identifier: R2-95-09
Station identification number: 455053097061701
Date of construction: 6-20-95
Land surface altitude: 1,188.7 feet
Total depth: 222 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,188.7-1,186.7	Topsoil, black, silty
2-19	17	1,186.7-1,169.7	Clay, brown, silty, sandy, pebbly; oxidized (till)
19-43	24	1,169.7-1,145.7	Clay, gray, silty, sandy, pebbly; unoxidized (till)
43-54	11	1,145.7-1,134.7	Sand and gravel, medium to coarse sand grading to a fine gravel
54-87	33	1,134.7-1,101.7	Clay, gray, silty, sandy, pebbly; unoxidized (till)
87-120	33	1,101.7-1,068.7	Sand, gray, fine, very silty; very easy drilling, sample lost in mud, coal, unoxidized
120-129	9	1,067.7-1,059.7	Clay, gray, silty; unoxidized (lake deposit)
129-164	35	1,059.7-1,024.7	Sand, gray, fine, very silty; very easy drilling, sample lost in mud, coal, unoxidized
164-192	28	1,024.7-996.7	Clay, gray, very silty; some sand zones, unoxidized (lake deposits)
192-201	9	996.7-987.7	Sand and gravel, medium to coarse sand grading to a medium gravel
201-222	21	987.7-966.7	Clay, black; hard, shaley, greasy (Carlile Shale)

Well is screened from 191 to 201 feet; 2-inch diameter PVC casing used. Electric log available

Local number: 128N52W25AAAB2 R
Other identifier: R2-95-10
Station identification number: 455093097061702
Date of construction: 6-21-95
Land surface altitude: 1,188.9 feet
Total depth: 163 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,188.9-1,186.9	Clay, black, silty (topsoil)
2-14	12	1,186.9-1,174.9	Clay, brown to yellowish-brown, silty, sandy, pebbly; oxidized (till)
14-20	6	1,174.9-1,168.9	Clay, grayish-brown, silty, sandy, pebbly; greasy, large cuttings, partially oxidized (till)
20-41	21	1,168.9-1,147.9	Clay, gray, silty, sandy, pebbly; very soft, large cuttings, unoxidized (till)
41-43	2	1,147.9-1,145.9	Gravel, fine to medium
43-87	44	1,145.9-1,101.9	Clay, gray, silty, sandy pebbly; unoxidized (till)
87-162	75	1,101.9-1,026.9	Sand, gray, fine, very silty; grades to a medium sand with depth

For electric log, see R2-95-09; well is 30 feet west of R2-95-09. Screened from 153 to 163 feet; 2-inch diameter PVC casing used

Local number: 129N48W33ADDA R
Other identifier: LTR NO. 9
Station identification number: 455457096395201
Date of construction: 8-30-88
Land surface altitude: 1,051.7 feet
Total depth: 253 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-1.5	1.5	1,051.7-1,050.2	Topsoil, brownish-black; very sandy, silty clay, sand is coarse with some coarser material
1.5-27	25.5	1,050.2-1,024.7	Clay, medium-brown to yellowish-brown, silty, sandy; sand to medium with minor amount of coarser material, turned medium-gray about 12 feet, sand content coarser below 14 feet, to very coarse (till)
27-37	10	1,024.7-1,014.7	Sand and gravel, medium sand to fine gravel; may be slightly clayey, with some silt and finer sand, may be bedded
37-90	53	1,014.7-961.7	Clay to fine sand; thin interbedded layers ranging from greasy pure clay to silt to fine sand, as well as some coarser material, amount of clay higher below 55 feet and increases with depth, color from medium-dark-brown to grayish brown to dark-medium gray
90-122	32	961.7-929.7	Clay, light-medium-gray to medium-gray; somewhat silty and sandy, occasional coarser particles, rocks from 93-99 feet, sandier and siltier from 93-99 feet, very sandy and silty below 99 feet, rock at 116 and 119 feet, driller says rocks or gravel at 101, 103, 107, and 110 feet
122-128	6	929.7-923.7	Sand and gravel, coarse sand to fine gravel; mostly rock fragments, shale, and quartz with some lignite, rocks at 121 and 124 feet
128-173	45	923.7-878.7	Clay, light-medium-gray, very silty, sandy; occasional coarse particles, a one-foot thick bed of coarse sand to fine gravel from 129 to 130 feet, rocks at 136 and 137 feet
173-177	4	878.7-874.7	Sand and gravel, coarse sand to fine gravel; contains quartz, rock fragments shale pebbles, and minor lignite, clay-free
177-200	23	874.7-851.7	Clay, light-medium-gray, very silty, sandy; sand to medium, occasional coarser particles, rock at 193 feet
200-204	4	851.7-847.7	Sand and gravel, very coarse sand to fine gravel; clay-free, easy drilling, some particles to one-inch diameter
204-214	10	847.7-837.7	Clay, medium-gray, very silty, sandy; cuttings scant, may be bedded, some cuttings were all clay or all silt, tight drilling
214-230	16	837.37-821.7	Sand and gravel, coarse sand to fine gravel; interbedded with clayey beds, rock at 221 feet, most of the interval probably is fairly clean and clay-free
230-253.5	23.5	821.7-798.2	Clay; calcareous, rock or hard layers at 243 and 248 feet, bit sample was black moderately calcareous shale that contained light-gray highly calcareous laminae (Greenhorn Limestone)

Well was screened from 222 to 232 feet; 20 feet of blank 2-inch diameter PVC casing below screen. Electric log available

Local number: 129N50W27BBBB R
Other identifier: R2-95-20
Station identification number: 455607096545001
Date of construction: 7-12-95
Land surface altitude: 1,106 feet
Total depth: 282 feet

Depth (feet)	Thickness (feet)	Aititude (feet)	Description
0-3	3	1,106-1,103	Topsoil, black, silty
3-21	18	1,103-1,085	Clay, yellowish-brown, silty, sandy, pebbly; thin sand and gravel lens, oxidized (till)
21-27	6	1,085-1,079	Clay, yellowish-brown, very silty; oxidized (lake deposit)
27-32	5	1,079-1,074	Clay, gray, very silty; unoxidized (lake deposit)
32-42	10	1,074-1,064	Clay, gray, silty, sandy, pebbly; unoxidized (till)
42-67	25	1,064-1,039	Sand, brown, medium to coarse; oxidized
67-110	43	1,039-996	Clay, gray, very silty; unoxidized (lake deposit)
110-119	9	996-987	Gravel, coarse; many shale pebbles
119-147	28	987-959	Clay, gray, silty, sandy, pebbly; rock at 145 feet, unoxidized (till)
147-210	63	959-896	Gravel, coarse grading to very coarse; rock at 184 feet, caving, clay layer from 184 to 190 feet
210-229	19	896-877	Clay, gray to black; very hard, shaley, greasy, calcareous (Carlile Shale)
229-266	37	877-840	Clay, gray to black; very hard, shaley, greasy, calcareous (Carlile Shale)
266-282	16	840-824	Limestone, white and brown; hard, cherty, calcareous (Greenhorn Limestone)

Test hole caving; electric log available to 161 feet

Local number: 129N50W27BBBB2 R
Other identifier: R2-95-21
Station identification number: 455607096545002
Date of construction: 7-12-95
Land surface altitude: 1,109.0 feet
Total depth: 182 feet

Depth (feet)	Thickness (feet)	Aititude (feet)	Description
0-3	3	1,109-1106	Topsoil, black, silty
3-21	18	1,106-1,088	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized (till)
21-27	6	1,088-1,082	Clay, brown, very silty; layered, oxidized (lake deposit)
27-32	5	1,082-1,077	Clay, gray, very silty; unoxidized (lake deposit)
32-42	10	1,077-1,067	Clay, gray, silty, sandy, pebbly; unoxidized (till)
42-66	24	1,067-1,043	Sand, brown, medium to coarse; some gravel, oxidized
66-110	44	1,043-999	Clay, gray, very silty; unoxidized (lake deposit)
110-119	9	999-990	Gravel, coarse; many shale pebbles
119-147	28	990-962	Clay, gray, silty, sandy, pebbly; unoxidized (till)
147-182	35	962-927	Gravel, coarse grading to very coarse; rig malfunction discontinued drilling

For electric log, see R2-95-20. Well screened from 161 to 171 feet; 2-inch diameter PVC casing used

Local number: 129N51W25AAAD R
Other identifier: R2-95-19
Station identification number: 455607096583901
Date of construction: 7-11-95
Land surface altitude: 1,165 feet
Total depth: 322 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,165-1,163	Topsoil, black
2-10	8	1,163-1,155	Sand and gravel, medium sand to coarse gravel
10-14	4	1,155-1,151	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized (till)
14-41	27	1,151-1,124	Clay, gray, silty, sandy, pebbly; rock from 15 to 17 feet, unoxidized (till)
41-47	6	1,124-1,118	Sand, medium to coarse
47-71	24	1,118-1,094	Clay, gray, silty, sandy, pebbly; unoxidized (till)
71-76	5	1,094-1,089	Sand, medium to coarse
76-101	25	1,089-1,064	Clay, gray, silty, sandy, pebbly; unoxidized
101-142	41	1,064-1,023	Clay, gray, very silty; very soft drills fast, some fine sand layers, unoxidized (lake deposit)
142-180	38	1,023-985	Clay, light-gray; hard, greasy, unoxidized (lake deposit)
180-184	4	985-981	Gravel, medium to very coarse; rock at 180 feet
184-298	114	981-867	Clay, gray, silty, sandy, pebbly, cobbly; hard, unoxidized, rocks at 204, 244, and 288 feet (till)
298-321	23	867-844	Clay, dark-brown to black; very hard, greasy, shaley, calcareous (Carlile Shale)
321-322	1	844-843	Limestone, brown and white; very hard, calcareous (Greenhorn Limestone)

Local number: 129N51W27BBB R
Other identifier: R2-95-14
Station identification number: 455608097022301
Date of construction: 6-27-95
Land surface altitude: 1,207 feet
Total depth: 262 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,207-1,205	Topsoil, black, silty
2-48	46	1,205-1,159	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
48-51	3	1,159-1,156	Sand and gravel; oxidized
51-81	30	1,156-1,126	Clay, gray, silty, sandy, pebbly; sand lenses from 62 to 64 feet and from 67 to 69 feet, unoxidized (till)
81-87	6	1,126-1,120	Sand, fine, silty; unoxidized
87-98	11	1,120-1,109	Clay, gray, very silty; unoxidized (lake deposit)
98-178	80	1,109-1,029	Sand, gray, fine to medium, very silty; clayey from 126 to 152 feet, unoxidized
178-186	8	1,029-1,021	Clay, gray, silty; unoxidized (lake deposit)
186-188	2	1,021-1,019	Gravel, fine; many shale pebbles
188-224	36	1,019-983	Clay, gray, silty, sandy, pebbly; unoxidized (till)
224-237	13	983-970	Sand and gravel, medium sand to fine gravel
237-262	25	970-945	Clay, gray; hard, shaley, greasy, noncalcareous, white specks (Carlile Shale)
Electric log available			

Local number: 129N52W25AAAB R
Other identifier: R2-95-12
Station identification number: 455608097061701
Date of construction: 6-26-95
Land surface altitude: 1,194.1 feet
Total depth: 282 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,194.1-1,192.1	Topsoil, black, silty
2-35	33	1,192.1-1,159.1	Clay, brown to grayish0brown, silty, sandy, pebbly; oxidized grading to partially oxidized (till)
35-38	3	1,159.1-1,156.1	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
38-40	2	1,156.1-1,154.1	Sand and gravel, medium sand to fine gravel
40-85	45	1,154.1-1,109.1	Clay, gray, silty, sandy, pebbly; gray sand lens from 45 to 47 feet, unoxidized (till)
85-178	93	1,109.1-1,016.1	Sand, gray, fine to medium, silty; unoxidized
178-206	28	1,016.1-988.1	Clay, gray, very silty; unoxidized (lake deposit)
206-212	6	988.1-982.1	Sand, gray, fine, very silty; unoxidized
212-230	18	982.1-964.1	Clay, gray, silty, sandy, pebbly; unoxidized (till)
230-282	52	964.1-912.1	Clay, dark-gray to black; hard, noncalcareous (Carlile Shale)
Electric log available			

Local number: 129N52W25AAAB2 R
Other identifier: R2-95-13
Station identification number: 455608097061702
Date of construction: 6-27-95
Land surface altitude: 1,194.1 feet
Total depth: 178 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,194.1-1,192.1	Topsoil, black, silty
2-35	33	1,192.1-1,159.1	Clay, brown to grayish-brown, silty, sandy, pebbly; oxidized grading to partially oxidized (till)
35-85	50	1,159.1-1,109.1	Clay, gray, silty, sandy, pebbly; unoxidized (till)
85-178	93	1,109.1-1,016.1	Sand, gray, fine to medium, silty; unoxidized
For electric-log, see R2-95-12. Well screened from 168 to 178 feet; 2-inch diameter PVC casing used			

Local number: 129N52W28AAAD R
Other identifier: R2-95-11
Station identification number: 455606097095301
Date of construction: 6-21-95
Land surface altitude: 1,210 feet
Total depth: 302 feet

Depth (feet)	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,210-1208	Topsoil, black, silty
2-3	1	1,208-1,207	Gravel, medium to coarse
3-12	9	1,207-1,198	Clay, brown, silty, sandy, pebbly; oxidized (till)
12-23	11	1,198-1,187	Sand and gravel; oxidized
23-36	13	1,187-1,174	Clay, brown, silty, sandy, pebbly; oxidized (till)
36-88	52	1,174-1,122	Clay, gray, very silty; soft, sand lens from 76 to 78 feet (lake deposit)
88-112	24	1,122-1,098	Sand and gravel, fine to medium sand grading to fine to medium gravel
112-132	20	1,098-1,078	Clay, gray, very silty; some sand layers (lake deposit)
132-167	35	1,078-1,043	Sand, gray, fine to medium, silty; clay layer from 139 to 142 feet, unoxidized
167-196	29	1,043-1,014	Clay, gray, silty; unoxidized (lake deposit)
196-203	7	1,014-1,007	Gravel, medium to coarse; mainly shale pebbles
203-253	50	1,007-957	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens from 217 to 219 feet (till)
253-272	19	957-938	Clay, gray, silty, sandy, pebbly; very hard, electric-log signature differs from above interval, unoxidized (till)
272-302	30	938-908	Clay, dark-gray to black; hard, shaley (Carlile Shale)
Electric log available			

- PAGE 135 FOLLOWS -

Section C - Hydrographs

-PAGE 137 FOLLOWS-

Site number from location map: 1
Local well number: 118N52W18BBBB2
Station identification number: 450205097073302
Other identifier: CD-77A
County: Codington, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,775 feet
Measuring point: 0.0 foot
Extremes: April 16, 1981, to November 6, 1996: Highest, -5.6 feet, August 20, 1990; lowest, 12.5 feet, June 19, 1986, July 1, 1986, July 16, 1986.

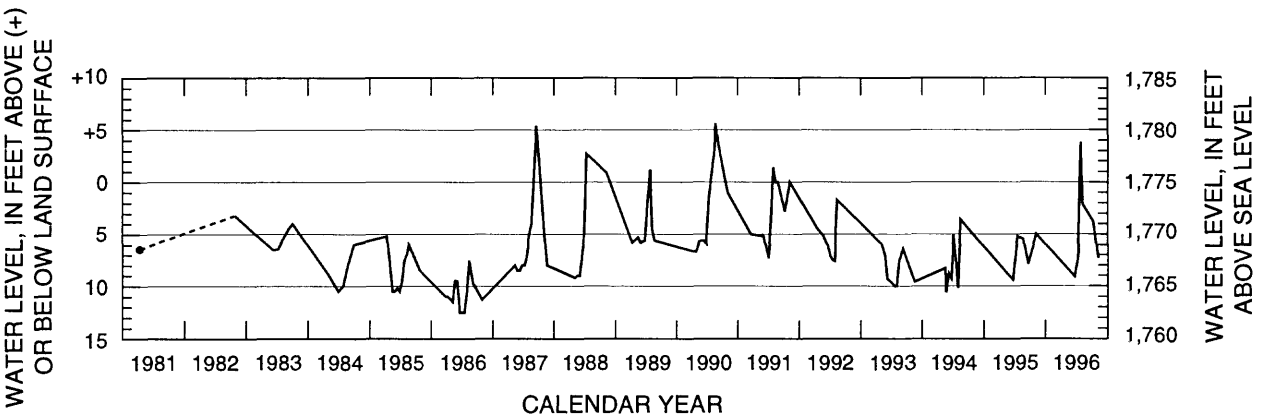


Figure C1. Hydrograph for observation well 118N52W18BBBB2 (site number 1).

Site number from location map: 2
Local well number: 118N52W30CDCD
Station identification number: 445930097070901
Other identifier: CD-76B
County: Codington, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,753.18 feet
Measuring point: 0.0 foot
Extremes: November 30, 1976, to October 9, 1996: Highest, 5.87 feet, March 21, 1985; lowest, 12.2 feet, July 25, 1984.

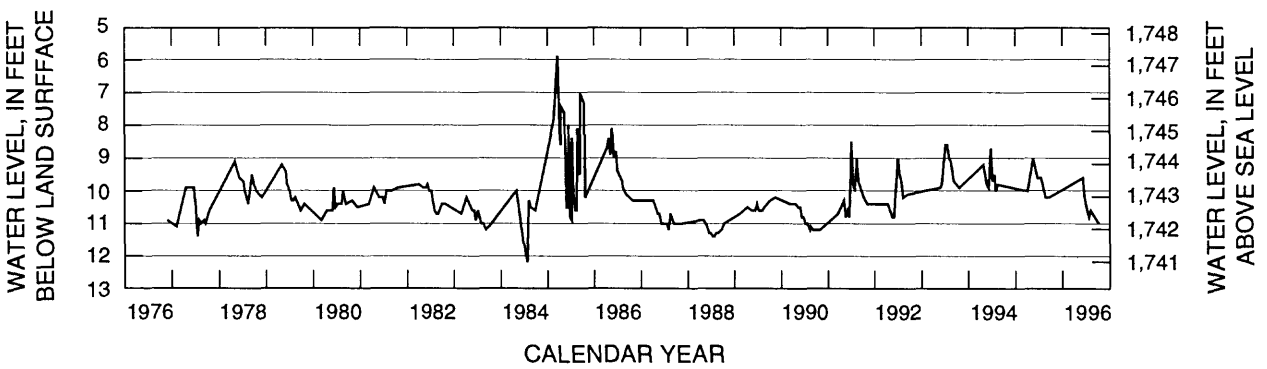


Figure C2. Hydrograph for observation well 118N52W30CDCD (site number 2).

Site number from location map: 3
Local well number: 119N52W4ADDD R
Station identification number: 450655097092301
Other identifier: CD-77B
County: Codington, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,770 feet
Measuring point: 2.4 feet
Extremes: December 1, 1977, to October 9, 1996: Highest, 1.9 feet, July 2, 1991; lowest, 7.67 feet, December 1, 1988.

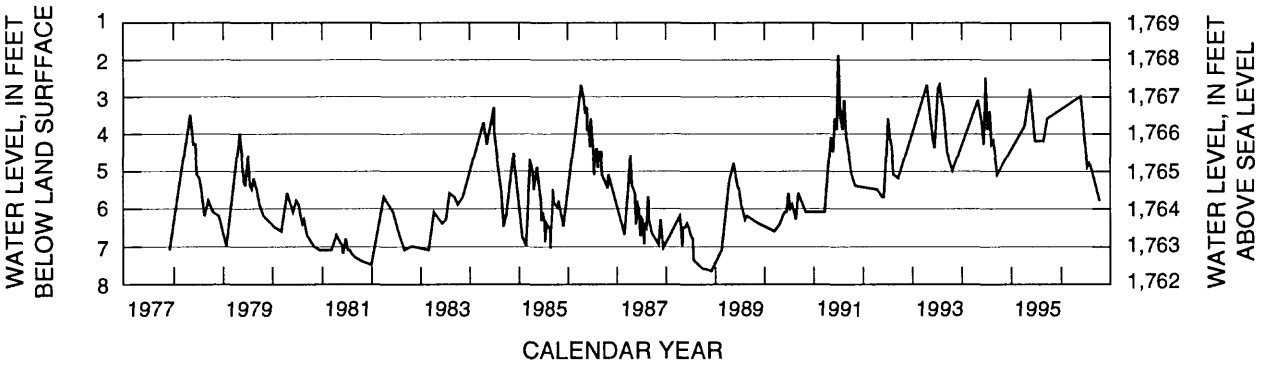


Figure C3. Hydrograph for observation well 119N52W4ADDD R (site number 3).

Site number from location map: 4
Local well number: 119N52W10DDDD R
Station identification number: 450538097083901
Other identifier: CD-77C
County: Codington, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,770 feet
Measuring point: 3.7 feet
Extremes: December 1, 1977, to October 9, 1996: Highest, 1.0 foot, June 23, 1994; lowest, 9.2 feet, December 29, 1981.

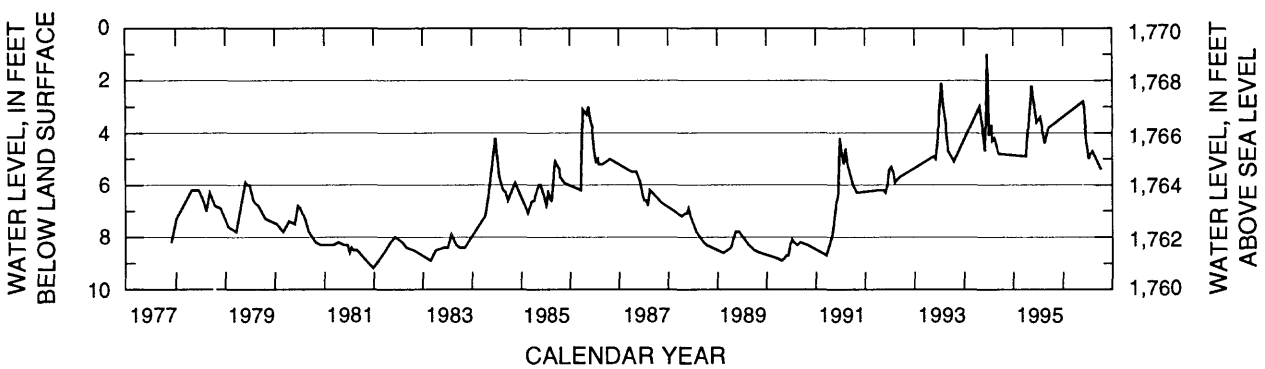


Figure C4. Hydrograph for observation well 119N52W10DDDD R (site number 4).

Site number from location map: 5
Local well number: 119N52W33DCDC R
Station identification number: 450208097101401
Other identifier: CD-60A
County: Codington, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,745 feet
Measuring point: 1.9 feet
Extremes: June 13, 1960, to October 9, 1996: Highest, 3.49 feet, June 11, 1986; lowest, 10.6 feet, November 1, 1990.

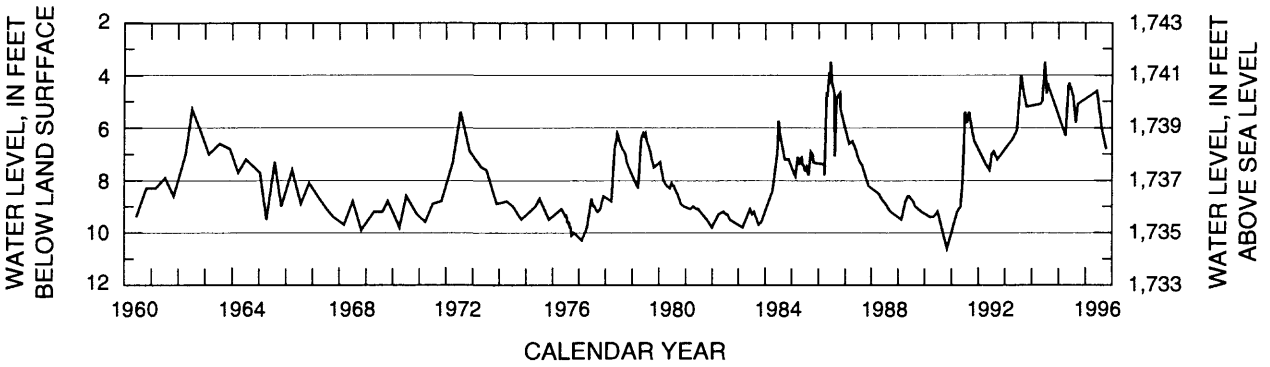


Figure C5. Hydrograph for observation well 119N52W33DCDC R (site number 5).

Site number from location map: 6
Local well number: 120N51W19BBCC R
Station identification number: 450947097060901
Other identifier: GT-77A
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,894.99 feet
Measuring point: 2.0 feet
Extremes: July 20, 1977, to October 9, 1996: Highest, 75.5 feet, November 8, 1995; lowest, 121.5 feet, July 29, 1988.

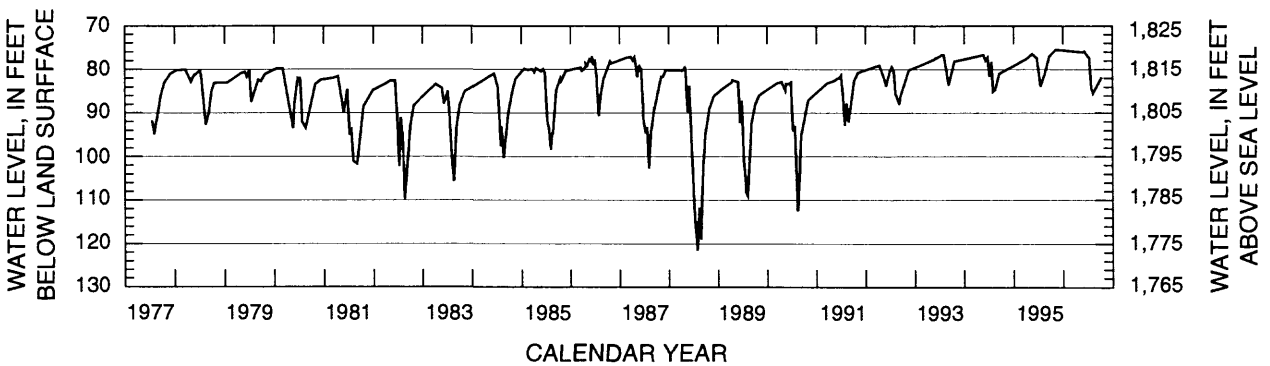


Figure C6. Hydrograph for observation well 120N51W19BBCC R (site number 6).

Site number from location map: 7
Local well number: 120N52W9BBBB R
Station identification number: 451143097110501
Other identifier: GT-79C
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,834 feet
Measuring point: 1.4 feet
Extremes: October 25, 1979, to October 9, 1996: Highest, 14.5 feet, June 6, 1996; lowest, 26.2 feet, September 7, 1988.

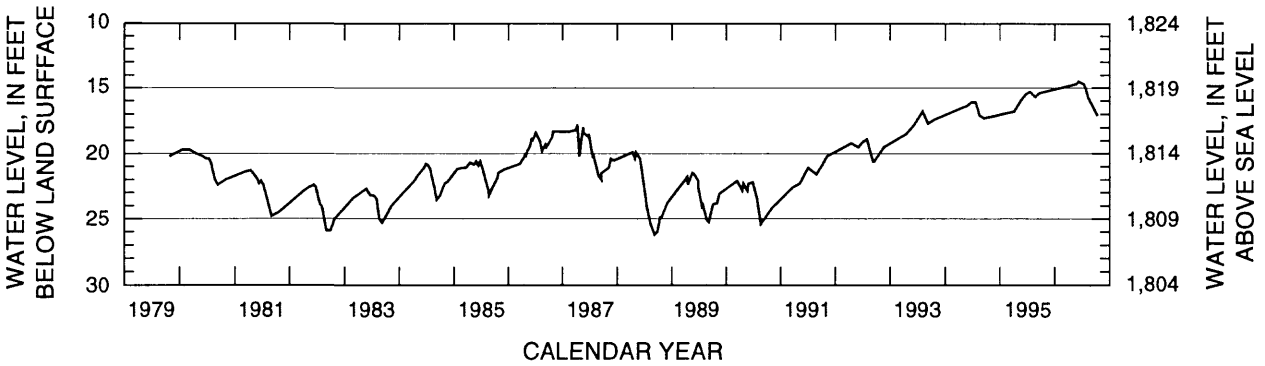


Figure C7. Hydrograph for observation well 120N52W9BBBB R (site number 7).

Site number from location map: 8
Local well number: 120N52W12AAAB R
Station identification number: 451141097061701
Other identifier: GT-76C
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,873.12 feet
Measuring point: 2.1 feet
Extremes: June 17, 1977, to October 9, 1996: Highest, 50.1 feet, June 6, 1996; lowest, 97.1 feet, August 25, 1988.

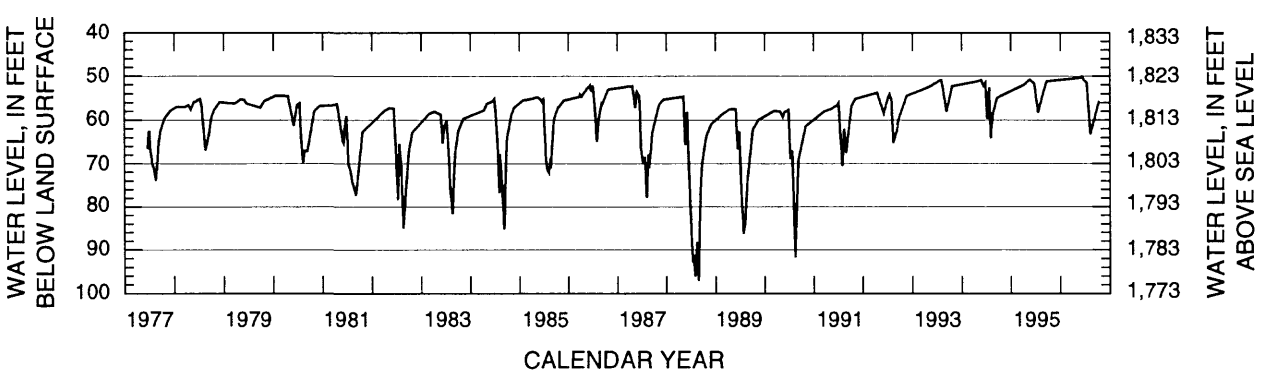


Figure C8. Hydrograph for observation well 120N52W12AAAB R (site number 8).

Site number from location map: 9
Local well number: 120N52W23BBBB R
Station identification number: 450956097083401
Other identifier: GT-76B
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,820.87 feet
Measuring point: 3.0 feet
Extremes: June 16, 1977, to October 9, 1996: Highest, 6.3 feet, June 6, 1996; lowest, 65.0 feet, July 29, 1988.

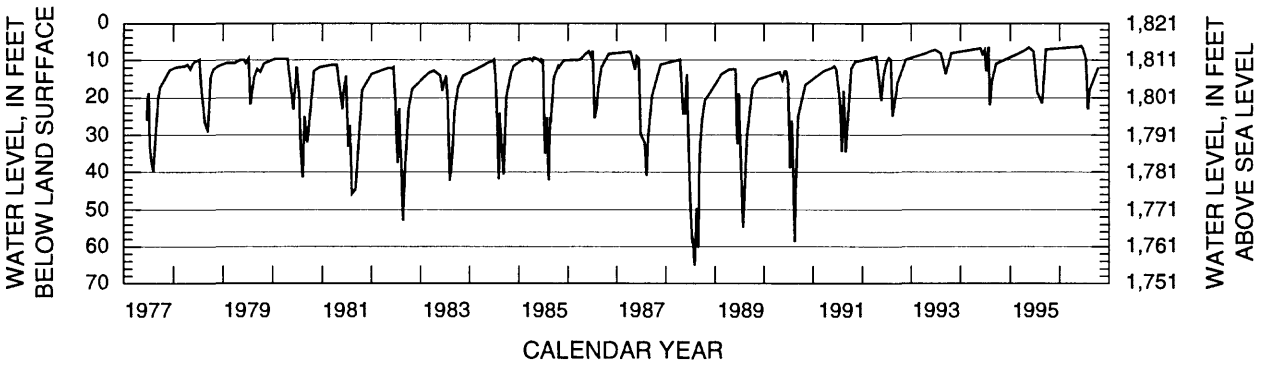


Figure C9. Hydrograph for observation well 120N52W23BBBB R (site number 9).

Site number from location map: 10
Local well number: 120N52W26BBBB
Station identification number: 451047097024401
Other identifier: GT-77F
County: Grant, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,969 feet
Measuring point: 0.0 foot
Extremes: December 1, 1977, to October 9, 1996: Highest, 13.4 feet, May 18, 1995; lowest, 20.8 feet, November 1, 1990.

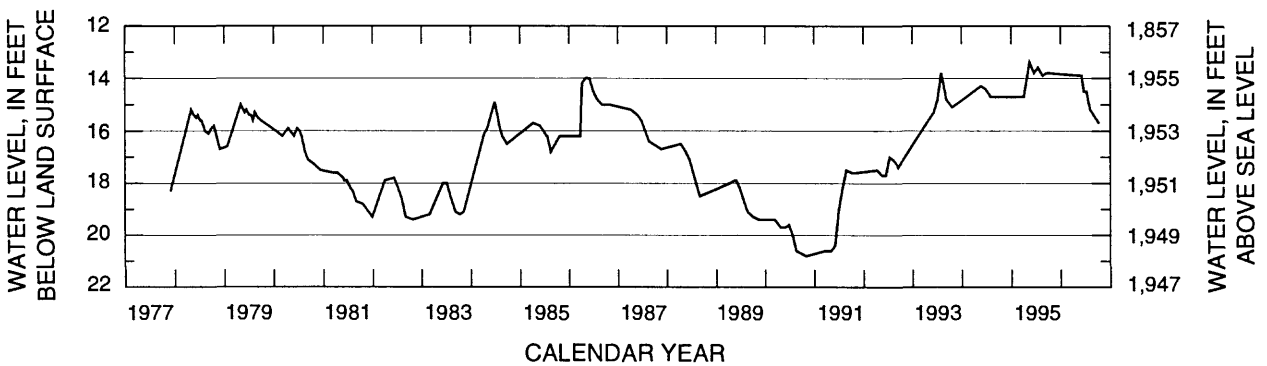


Figure C10. Hydrograph for observation well 120N52W26BBBB (site number 10).

Site number from location map: 11
Local well number: 120N52W27CDDD R
Station identification number: 450814097091601
Other identifier: CD-76D
County: Codington, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,800 feet
Measuring point: 4.2 feet
Extremes: June 16, 1976, to October 9, 1996: Highest, -4.7 feet, November 8, 1995; lowest, 52.1 feet, July 29, 1988.

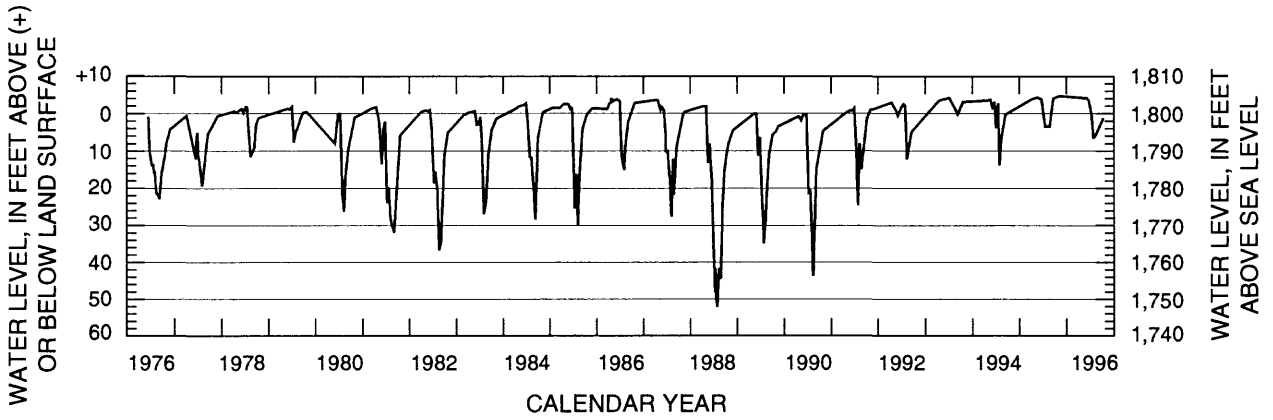


Figure C11. Hydrograph for observation well 120N52W27CDDD R (site number 11).

Site number from location map: 12
Local well number: 120N52W28DDDD R
Station identification number: 450814097095301
Other identifier: CD-56A
County: Codington, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,781.62 feet
Measuring point: 1.5 feet
Extremes: August 29, 1957, to October 9, 1996: Highest, 4.4 feet, July 2, 1991; lowest, 11.6 feet, December 7, 1966.

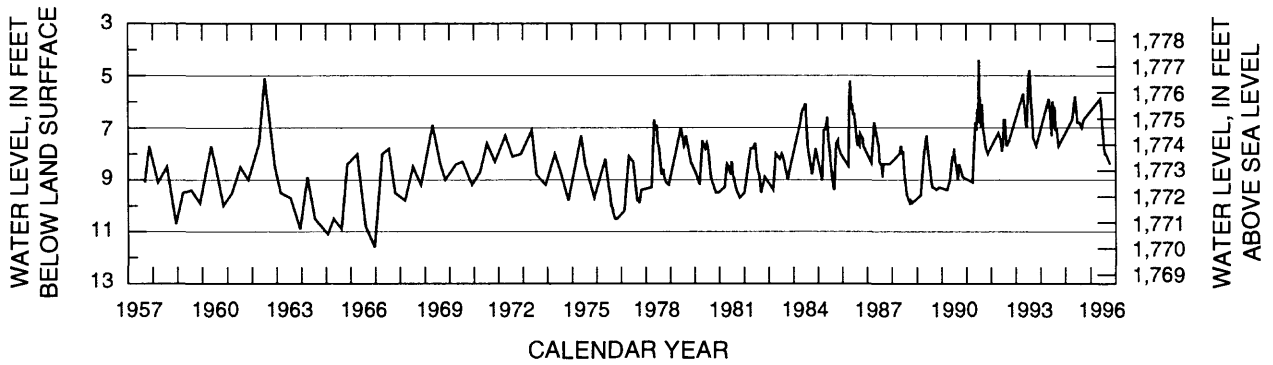


Figure C12. Hydrograph for observation well 120N52W28DDDD R (site number 12).

Site number from location map: 13
Local well number: 120N54W23DDDC
Station identification number: 451050097161601
Other identifier: DA-78H
County: Day, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,830 feet
Measuring point: 0.0 foot
Extremes: October 16, 1978, to October 9, 1996: Highest, 47.4 feet, October 9, 1996; lowest, 56.2 feet, August 4, 1982, October 3, 1983.

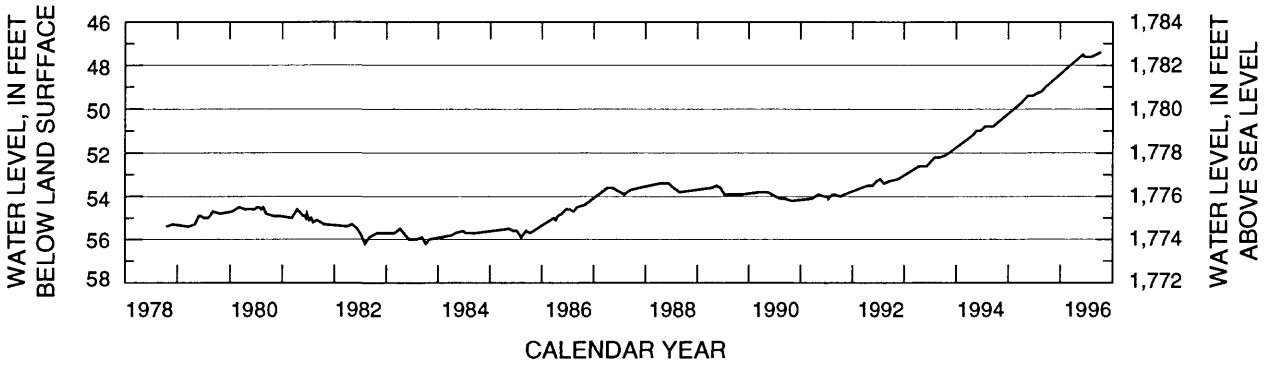


Figure C13. Hydrograph for observation well 120N54W23DDDC (site number 13).

Site number from location map: 14
Local well number: 121N47W6CCCC
Station identification number: 451848096363501
Other identifier: GT-79E
County: Grant, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,104.00 feet
Measuring point: 2.8 feet
Extremes: October 25, 1979, to October 8, 1996: Highest, 21.9 feet, June 18, 1996; lowest, 38.4 feet, October 4, 1983, November 8, 1983.

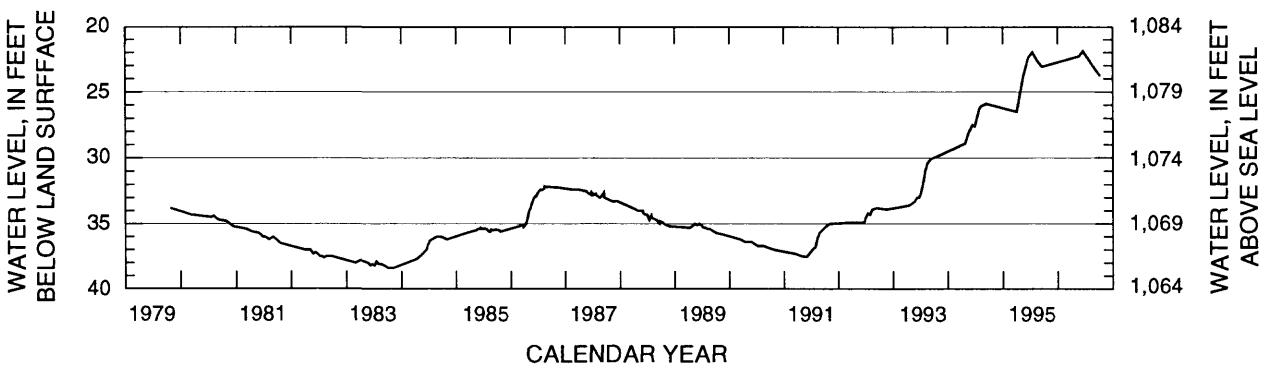


Figure C14. Hydrograph for observation well 121N47W6CCCC (site number 14).

Site number from location map: 15
Local well number: 121N51W29BBBB R
Station identification number: 451418097045501
Other identifier: GT-77E
County: Grant, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,955 feet
Measuring point: 3.6 feet
Extremes: May 2, 1978, to October 9, 1996: Highest, 73.5 feet, June 6, 1996; lowest, 84.72 feet, September 26, 1988.

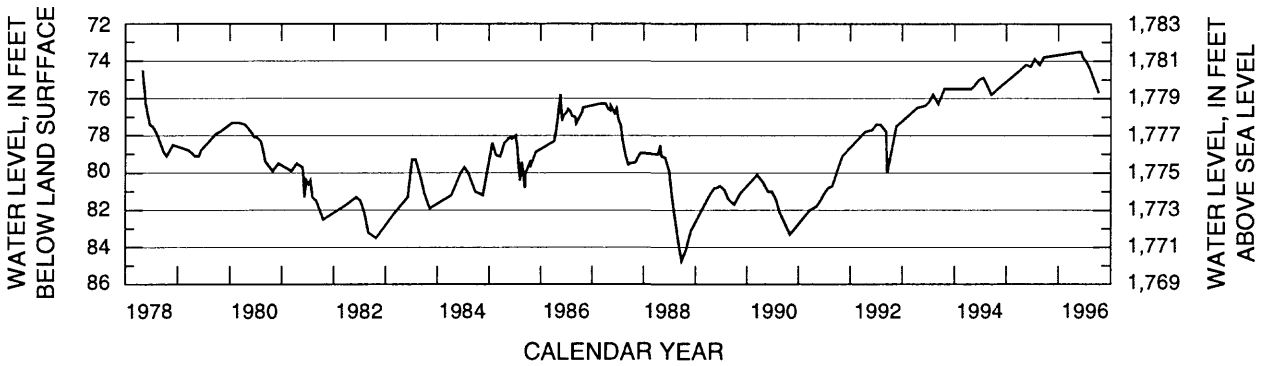


Figure C15. Hydrograph for observation well 121N51W29BBBB R (site number 15).

Site number from location map: 16
Local well number: 121N52W2ADDD R
Station identification number: 451606097072501
Other identifier: GT-82A
County: Grant, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,881.25 feet
Measuring point: 2.7 feet
Extremes: June 29, 1982, to October 9, 1996: Highest, 1.7 feet, April 22, 1986; lowest, 5.8 feet, September 7, 1988.

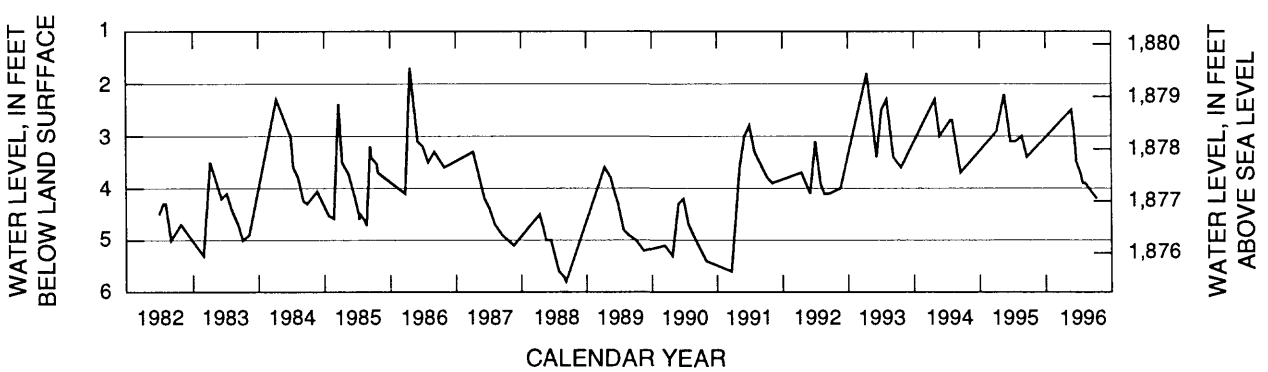


Figure C16. Hydrograph for observation well 121N52W2ADDD R (site number 16).

Site number from location map: 17
Local well number: 121N52W8DCCC R
Station identification number: 451608097114101
Other identifier: GT-77B
County: Grant, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,831.17 feet
Measuring point: 3.5 feet
Extremes: December 1, 1977, to October 9, 1996: Highest, 5.1 feet, August 3, 1993; lowest, 9.8 feet, October 20, 1981.

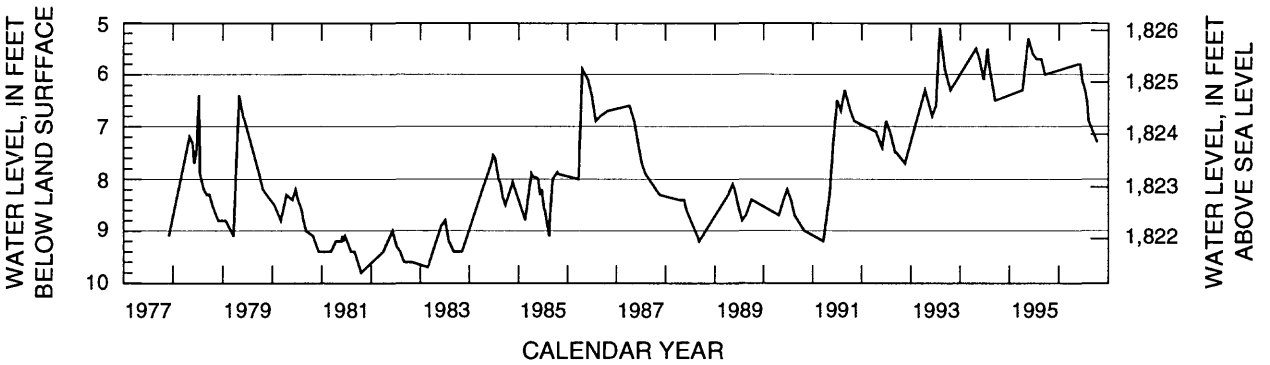


Figure C17. Hydrograph for observation well 121N52W8DCCC R (site number 17).

Site number from location map: 18
Local well number: 121N52W13BBBA R
Station identification number: 451605097071701
Other identifier: GT-79A
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,916.87 feet
Measuring point: 2.2 feet
Extremes: June 9, 1982, to October 9, 1996: Highest, 66.6 feet, September 8, 1992; lowest, 85.4 feet, August 25, 1988.

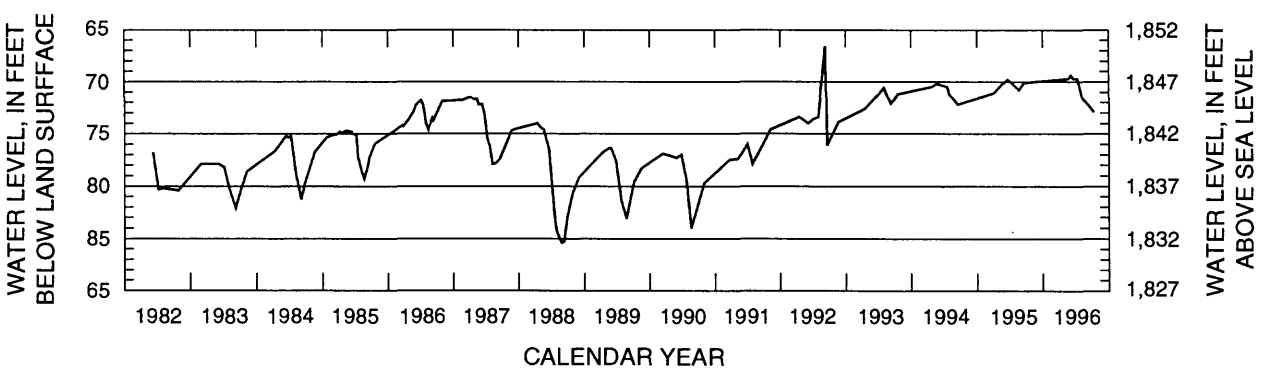


Figure C18. Hydrograph for observation well 121N52W13BBBA R (site number 18).

Site number from location map: 19
Local well number: 121N52W22CCCC R
Station identification number: 451423097095201
Other identifier: GT-77C
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,837 feet
Measuring point: 3.0 feet
Extremes: December 1, 1977, to October 9, 1996: Highest, 4.7 feet, June 6, 1996; lowest, 20.8 feet, August 25, 1988.

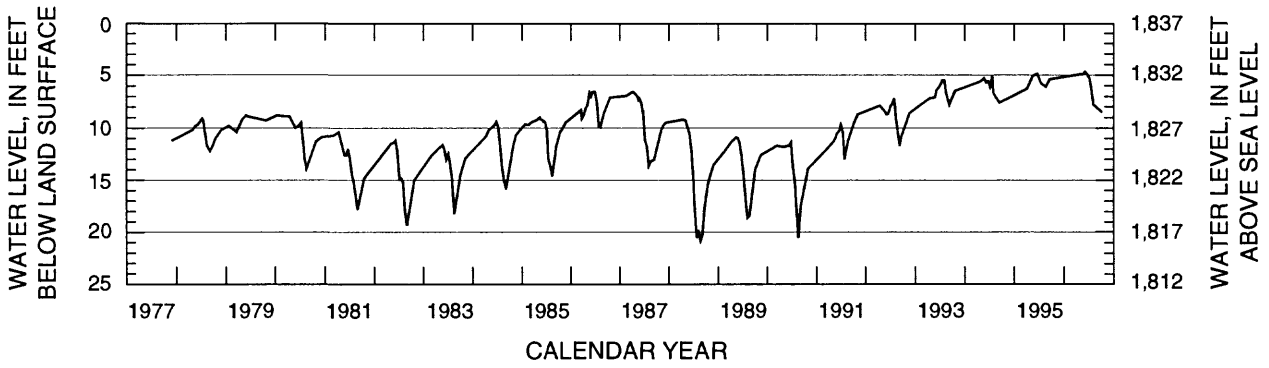


Figure C19. Hydrograph for observation well 121N52W22CCCC R (site number 19).

Site number from location map: 20
Local well number: 121N52W25CCCC R
Station identification number: 451328097072301
Other identifier: GT-79B
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,880 feet
Measuring point: 2.2 feet
Extremes: October 25, 1979, to October 9, 1996: Highest, 51.6 feet, June 6, 1996; lowest, 84.2 feet, July 24, 1988.

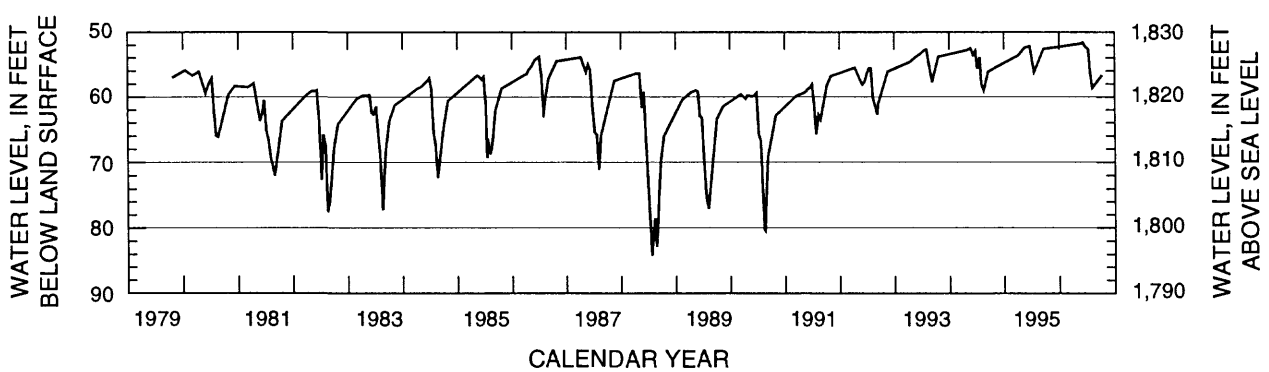


Figure C20. Hydrograph for observation well 121N52W25CCCC R (site number 20).

Site number from location map: 21
Local well number: 121N52W29CCBB R
Station identification number: 451340097121801
Other identifier: GT-77D
County: Grant, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,860 feet
Measuring point: 1.6 feet
Extremes: December 1, 1977, to October 9, 1996: Highest, 1.4 feet, July 20, 1993; lowest, 12.1 feet, October 14, 1988.

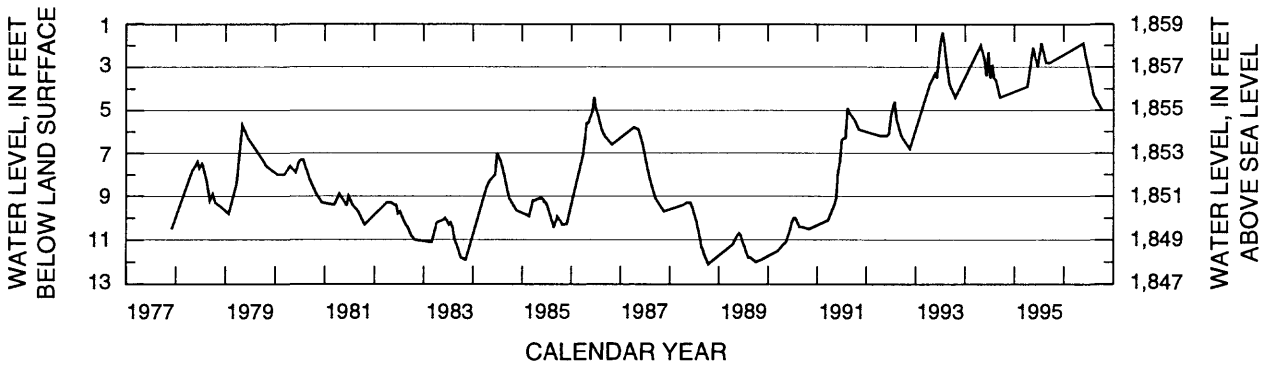


Figure C21. Hydrograph for observation well 121N52W29CCBB R (site number 21).

Site number from location map: 22
Local well number: 121N54W34AADA
Station identification number: 451506097170401
Other identifier: DA-78E
County: Day, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,803 feet
Measuring point: 3.0 feet
Extremes: September 27, 1978, to October 9, 1996: Highest, 7.9 feet, July 24, 1996; lowest, 24.7 feet, August 19, 1982.

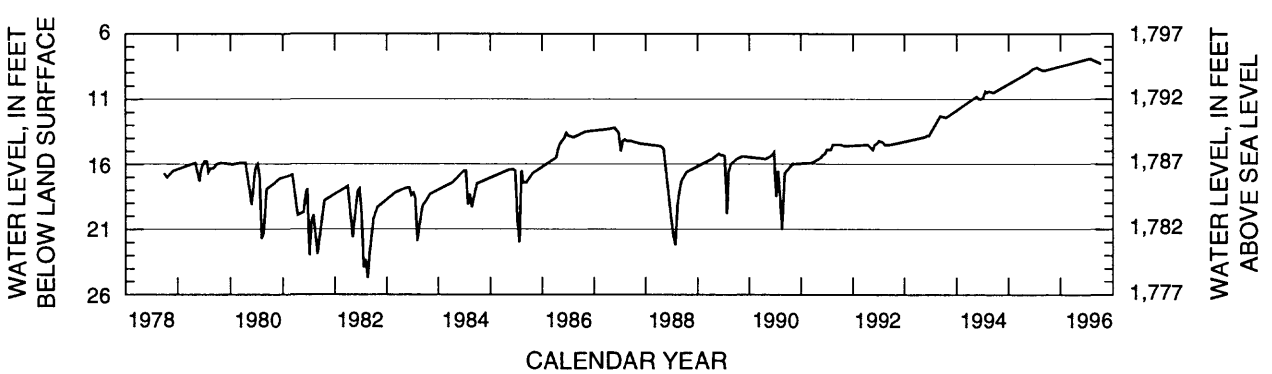


Figure C22. Hydrograph for observation well 121N54W34AADA (site number 22).

Site number from location map: 23
Local well number: 122N49W7BBBB
Station identification number: 452352096513901
Other identifier: RB-77N
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,199.9 feet
Measuring point: 2.0 feet
Extremes: November 30, 1977, to October 8, 1996: Highest, 23.9 feet, May 23, 1996; lowest, 43.2 feet, July 28, 1988.

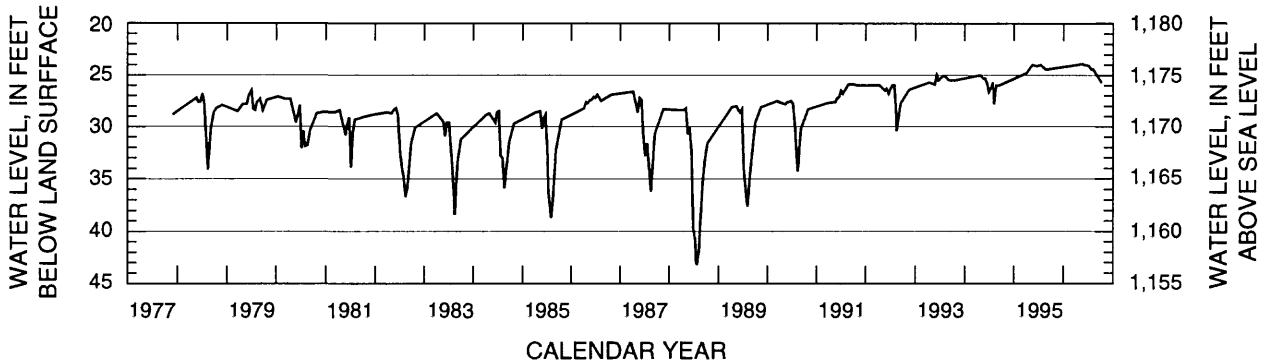


Figure C23. Hydrograph for observation well 122N49W7BBBB (site number 23).

Site number from location map: 24
Local well number: 122N49W17AAAD
Station identification number: 452257096491801
Other identifier: RB-77P
County: Roberts, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,163.9 feet
Measuring point: 2.0 feet
Extremes: November 30, 1977, to October 8, 1996: Highest, 6.7 feet, April 26, 1994; lowest, 12.1 feet, September 8, 1988.

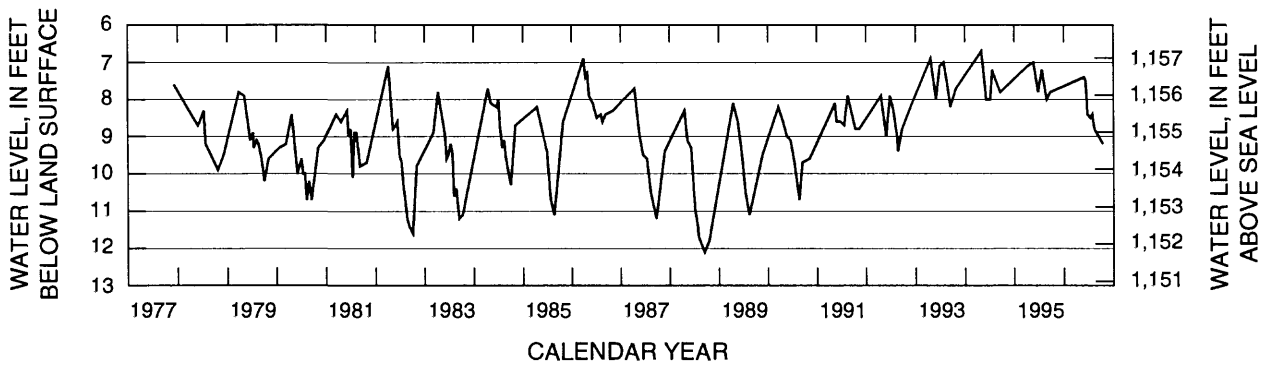


Figure C24. Hydrograph for observation well 122N49W17AAAD (site number 24).

Site number from location map: 25
Local well number: 122N49W18AAAA
Station identification number: 452302096503101
Other identifier: RB-77O
County: Roberts, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,184.2 feet
Measuring point: 0.0 foot
Extremes: November 30, 1977, to October 8, 1996: Highest, 9.8 feet, May 17, 1995; lowest, 25.8 feet, July 28, 1988.

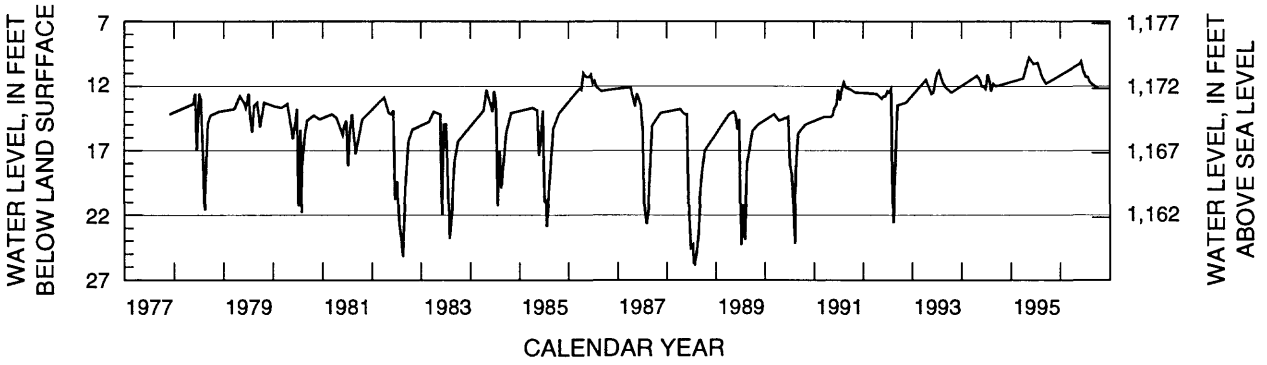


Figure C25. Hydrograph for observation well 122N49W18AAAA (site number 25).

Site number from location map: 26
Local well number: 122N49W30BBBB
Station identification number: 452117096514201
Other identifier: RB-77Q
County: Roberts, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,248.3 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 8, 1996: Highest, 43.1 feet, June 4, 1996; lowest, 49.1 feet, August 18, 1982, September 1, 1982.

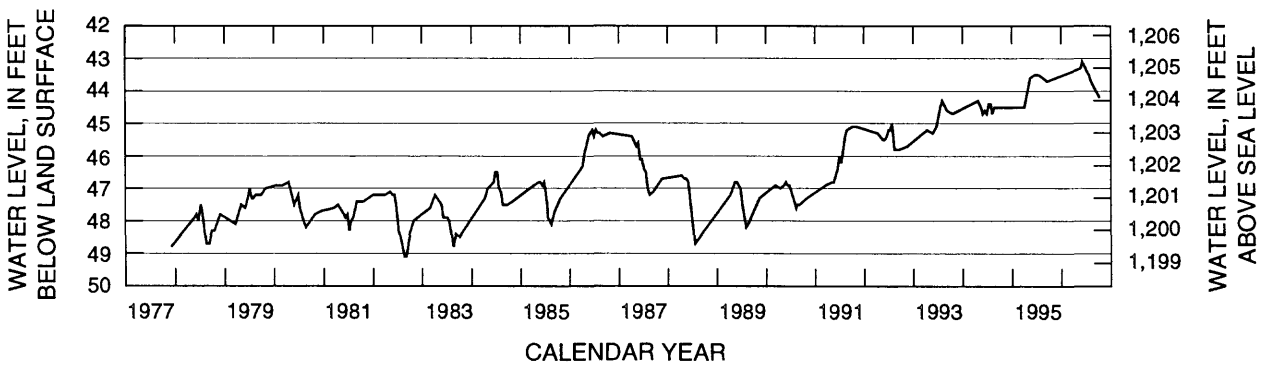


Figure C26. Hydrograph for observation well 122N49W30BBBB (site number 26).

Site number from location map: 27
Local well number: 122N52W2BBBB R
Station identification number: 452304097083901
Other identifier: RB-77T
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,910.9 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 9, 1996: Highest, 11.5 feet, May 18, 1995; lowest, 23.20 feet, November 30, 1977.

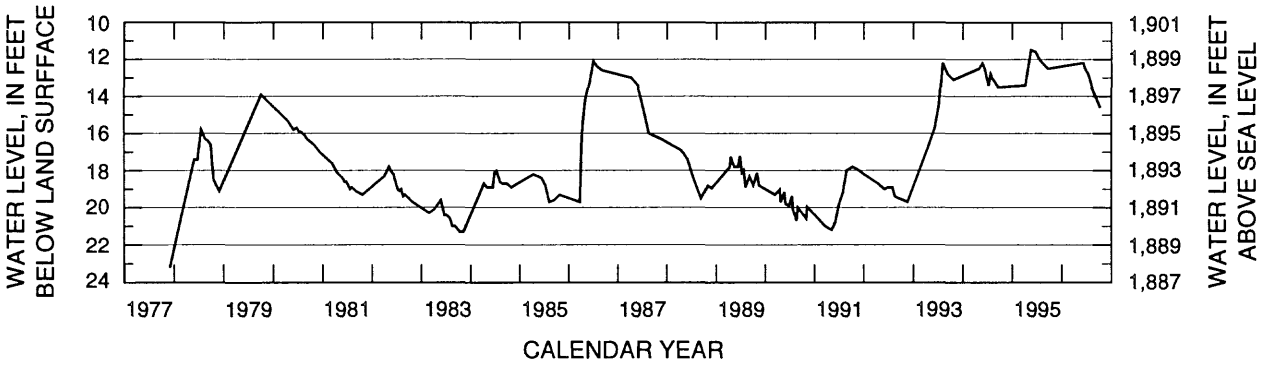


Figure C27. Hydrograph for observation well 122N52W2BBBB R (site number 27).

Site number from location map: 28
Local well number: 122N52W5CCCC R
Station identification number: 452215097121801
Other identifier: RB-77R
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,871.7 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 9, 1996: Highest, 8.8 feet, August 14, 1993; lowest, 16.4 feet, April 1, 1982.

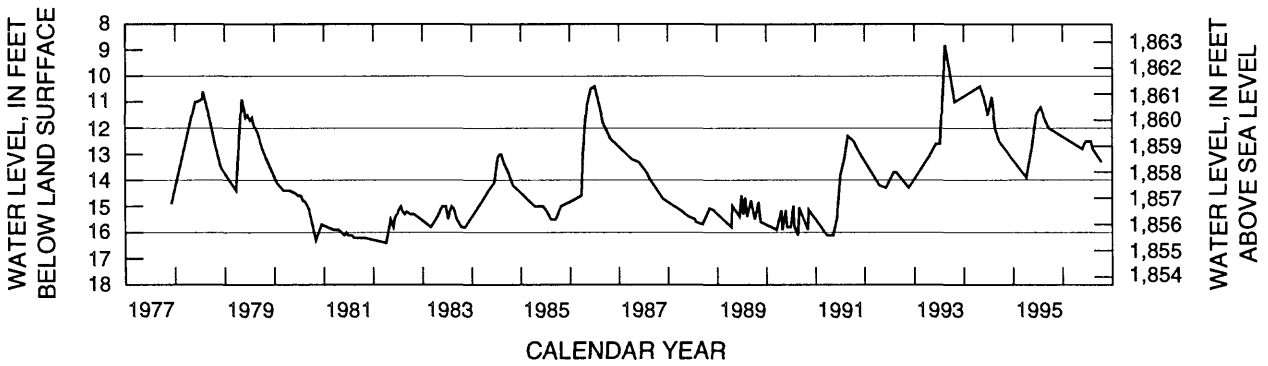


Figure C28. Hydrograph for observation well 122N52W5CCCC R (site number 28).

Site number from location map: 29
Local well number: 122N52W12CCCC R
Station identification number: 452122097072301
Other identifier: RB-76B
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,904.9 feet
Measuring point: 2.0 feet
Extremes: December 1, 1976, to October 9, 1996: Highest, -0.5 feet, August 4, 1993; lowest, 13.0 feet, May 7, 1991.

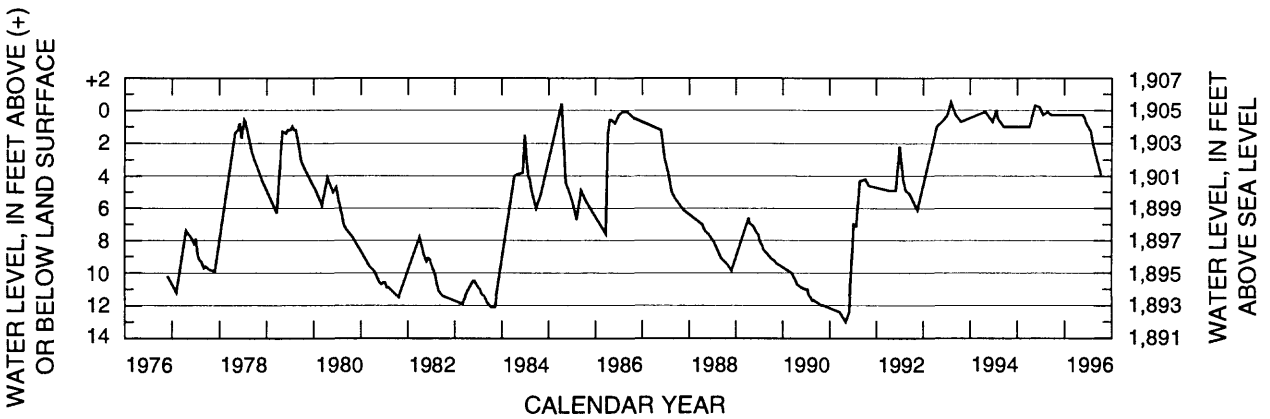


Figure C29. Hydrograph for observation well 122N52W12CCCC R (site number 29).

Site number from location map: 30
Local well number: 122N52W14BBBB R
Station identification number: 452119097083901
Other identifier: RB-76A
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,897.9 feet
Measuring point: 2.0 feet
Extremes: December 1, 1976, to October 9, 1996: Highest, 10.1 feet, October 21, 1993; lowest, 22.8 feet, October 11, 1983, November 9, 1983.

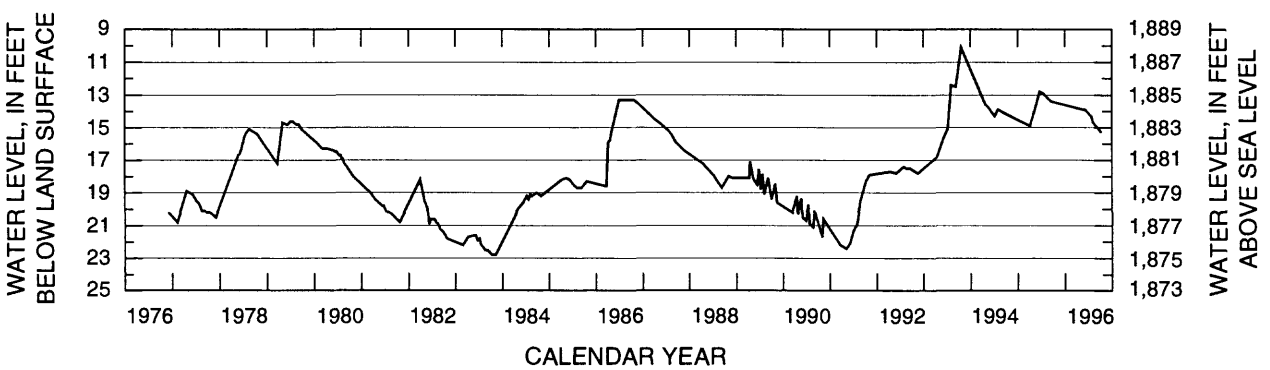


Figure C30. Hydrograph for observation well 122N52W14BBBB R (site number 30).

Site number from location map: 31
Local well number: 122N52W16BBBC R
Station identification number: 452115097110601
Other identifier: RB-82B
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,855.5 feet
Measuring point: 2.7 feet
Extremes: June 29, 1982, to October 9, 1996: Highest, 12.1 feet, August 4, 1993; lowest, 14.8 feet, October 11, 1983.

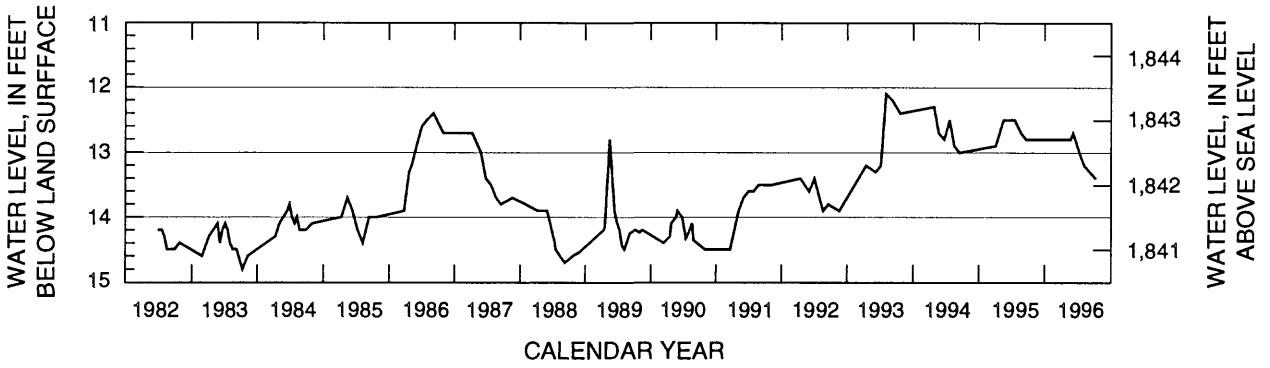


Figure C31. Hydrograph for observation well 122N52W16BBBC R (site number 31).

Site number from location map: 32
Local well number: 122N52W30AAAA R
Station identification number: 451936097122301
Other identifier: RB-82A
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,861 feet
Measuring point: 0.0 foot
Extremes: June 29, 1982, to May 27, 1987: Highest, 24.7 feet, July 2, 1986, July 30, 1986; lowest, 28.7 feet, October 3, 1983.

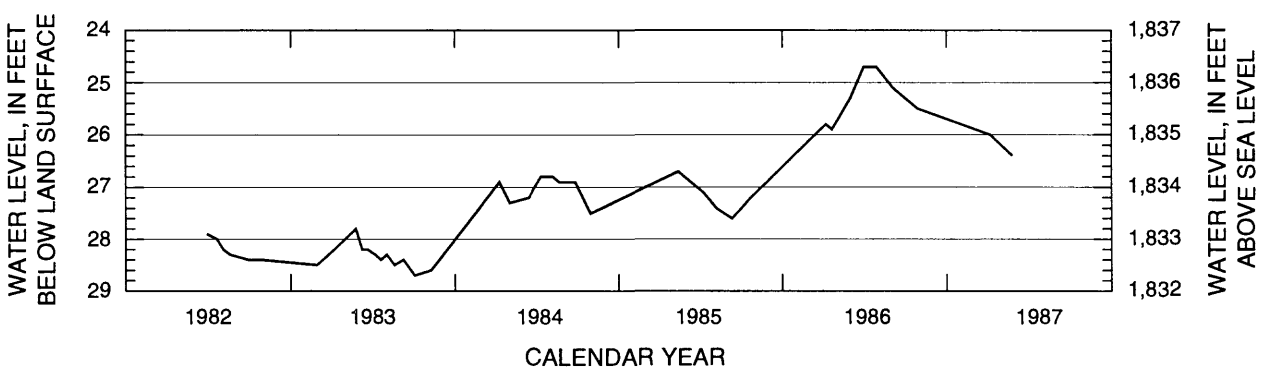


Figure C32. Hydrograph for observation well 122N52W30AAAA R (site number 32).

Site number from location map: 33
Local well number: 122N52W32AAAA R
Station identification number: 451841097110901
Other identifier: RB-77S
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,851.7 feet
Measuring point: 2.2 feet
Extremes: May 23, 1978, to October 9, 1996: Highest, 7.6 feet, August 4, 1993; lowest, 12.0 feet, October 21, 1981.

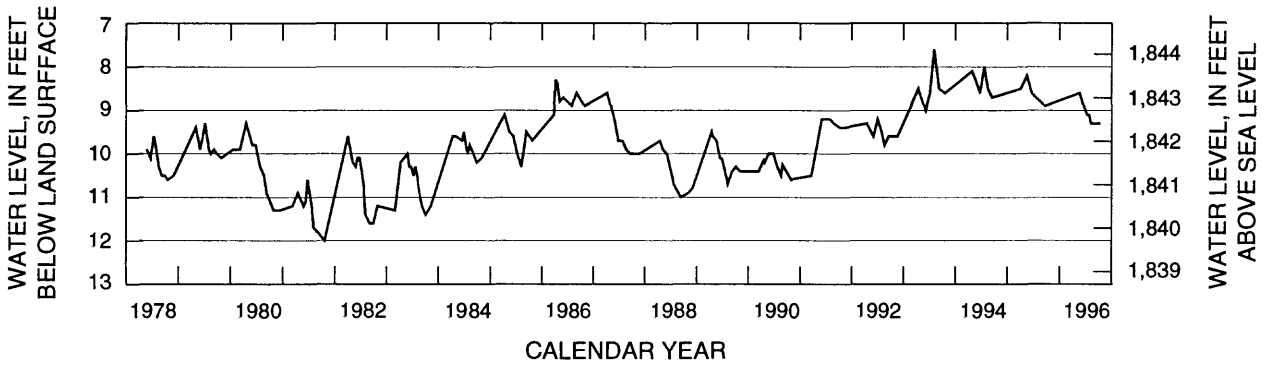


Figure C33. Hydrograph for observation well 122N52W32AAAA R (site number 33).

Site number from location map: 34
Local well number: 122N53W11DDDD R
Station identification number: 452120097145001
Other identifier: DA-78D
County: Day, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,830 feet
Measuring point: 2.8 feet
Extremes: September 27, 1978, to October 9, 1996: Highest, 2.6 feet, April 27, 1994, April 5, 1995, May 18, 1995, May 24, 1996, June 6, 1996; lowest, 10.5 feet, September 1, 1982.

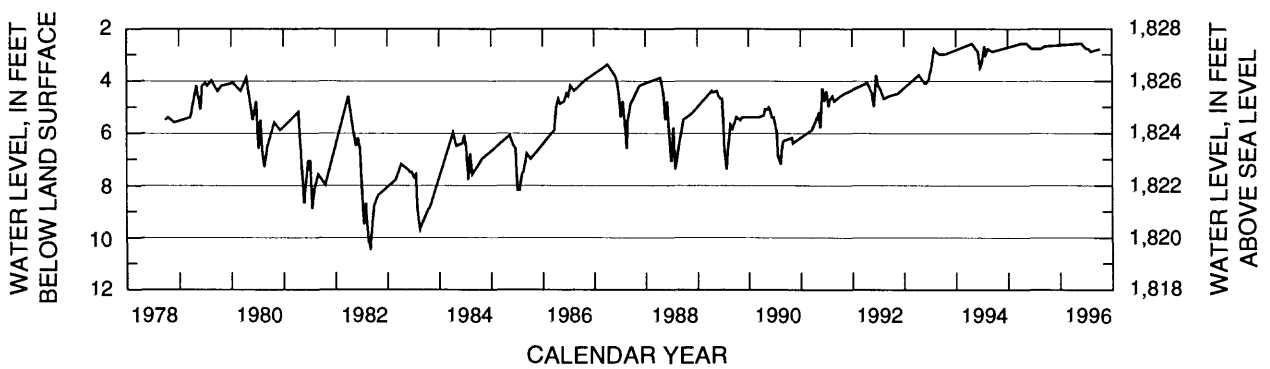


Figure C34. Hydrograph for observation well 122N53W11DDDD R (site number 34).

Site number from location map: 35
Local well number: 123N49W24CCCC
Station identification number: 452633096453401
Other identifier: RB-81B
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,148.6 feet
Measuring point: 0 foot
Extremes: May 29, 1981, to October 8, 1996: Highest, 46.8 feet, July 18, 1995; lowest, 61.0 feet, November 9, 1983.

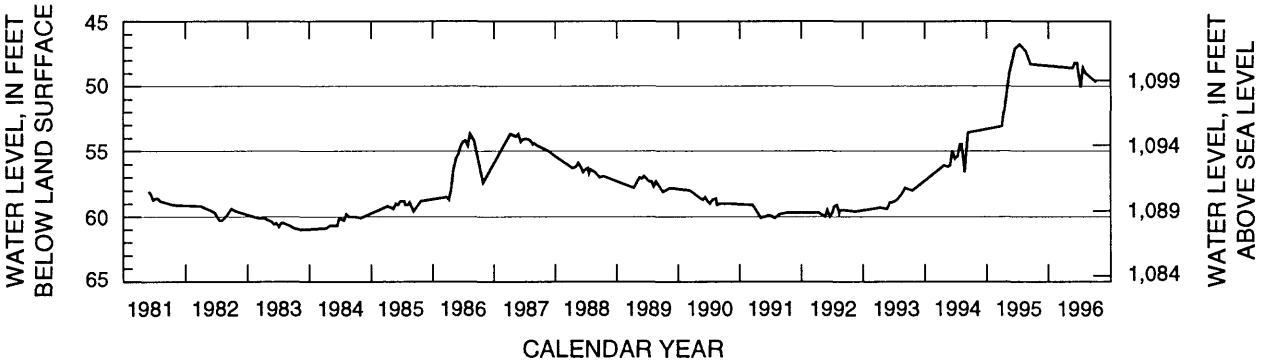


Figure C35. Hydrograph for observation well 123N49W24CCCC (site number 35).

Site number from location map: 36
Local well number: 123N50W23AAAA
Station identification number: 452721096525701
Other identifier: RB-77L
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,175.2 feet
Measuring point: 2.0 feet
Extremes: November 30, 1977, to October 8, 1996: Highest, -1.9 feet, May 17, 1995, June 20, 1995, May 23, 1996, June 4, 1996; lowest, 16.0 feet, July 28, 1988.

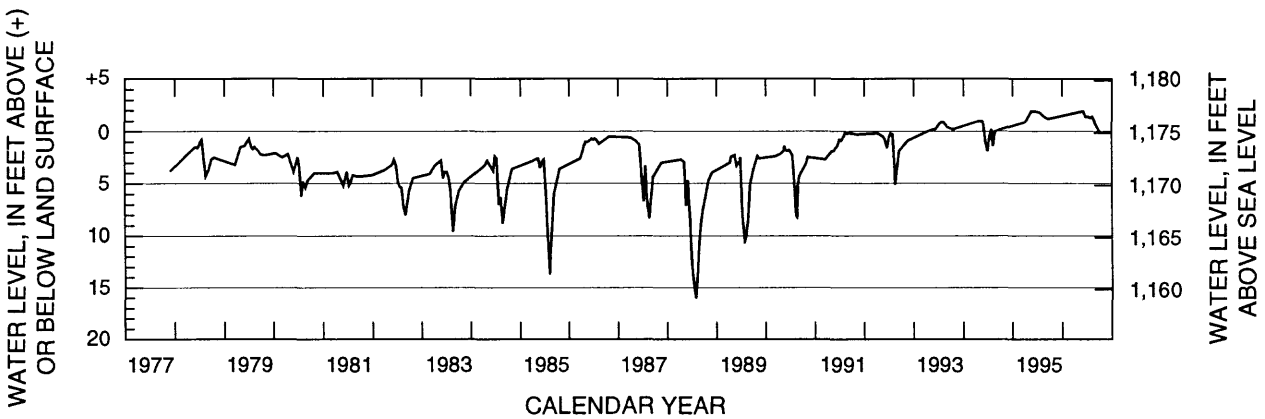


Figure C36. Hydrograph for observation well 123N50W23AAAA (site number 36).

Site number from location map: 37
Local well number: 123N50W35AAAA
Station identification number: 452537096525701
Other identifier: RB-77M
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,216.1 feet
Measuring point: 2.0 feet
Extremes: November 30, 1977, to October 8, 1996: Highest, 40.8 feet, May 23, 1996, June 4, 1996; lowest, 59.1 feet, July 29, 1988.

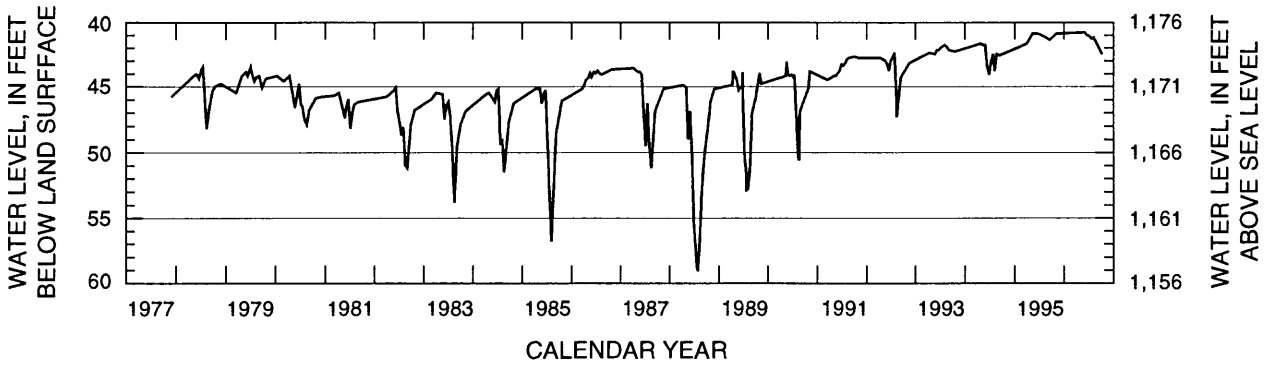


Figure C37. Hydrograph for observation well 123N50W35AAAA (site number 37).

Site number from location map: 38
Local well number: 123N52W19BABA R
Station identification number: 452540097130901
Other identifier: RB-81C
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,918.0 feet
Measuring point: 0.0 foot
Extremes: August 18, 1982, to November 6, 1996: Highest, 3.97 feet, April 20, 1989; lowest, 11.1 feet, September 8, 1988.

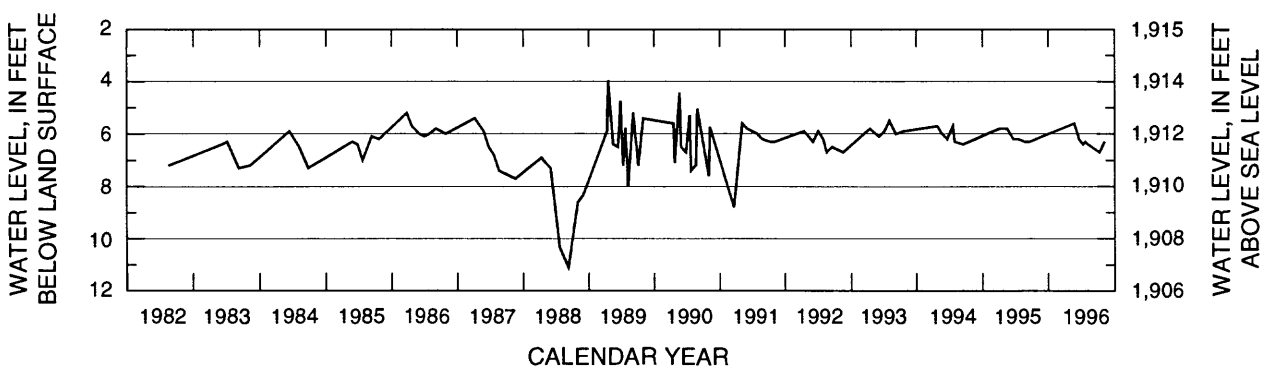


Figure C38. Hydrograph for observation well 123N52W19BABA R (site number 38).

Site number from location map: 39
Local well number: 123N52W25CCCC R
Station identification number: 452357097072401
Other identifier: RB-81D
County: Roberts, South Dakota
Aquifer: Coteau-Lakes
Altitude of land surface: 1,931.9 feet
Measuring point: 0.0 foot
Extremes: July 20, 1982, to October 9, 1996: Highest, 8.8 feet, May 18, 1995, June 21, 1995; lowest, 19.7 feet, March 21, 1991.

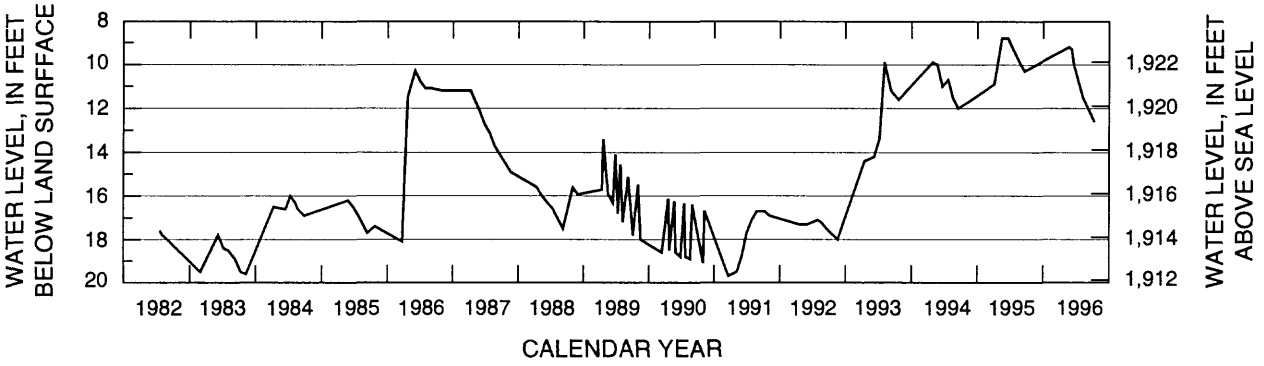


Figure C39. Hydrograph for observation well 123N52W25CCCC R (site number 39).

Site number from location map: 40
Local well number: 126N50W32CCCB R
Station identification number: 453819096572501
Other identifier: RB-79D
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,164.4 feet
Measuring point: 0.0 foot
Extremes: October 26, 1979, to October 8, 1996: Highest, 54.5 feet, July 21, 1993; lowest, 60.4 feet, September 1, 1982.

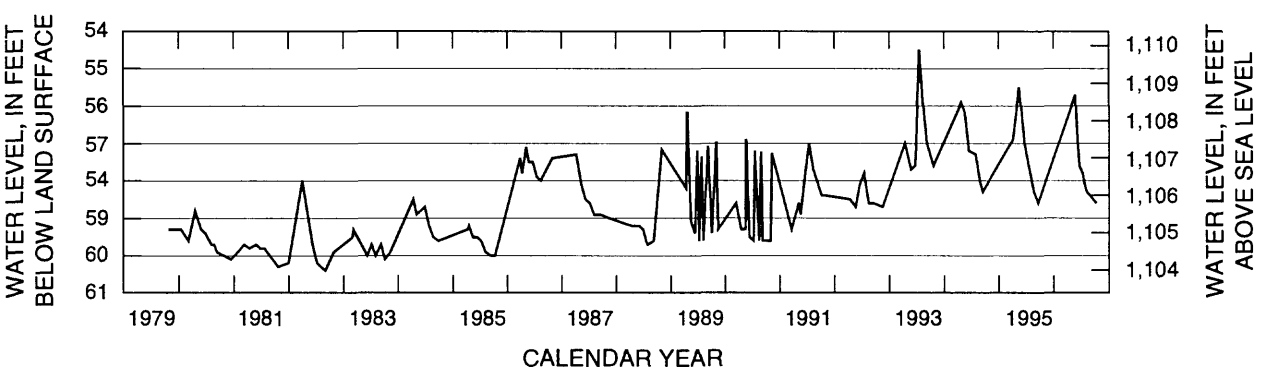


Figure C40. Hydrograph for observation well 126N50W32CCCB R (site number 40).

Site number from location map: 41
Local well number: 126N51W35AADA R
Station identification number: 453928096595601
Other identifier: RB-79C
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,160.6 feet
Measuring point: 2.75 feet
Extremes: October 26, 1979, to October 8, 1996: Highest, 3.1 feet, August 17, 1993; lowest, 14.5 feet, October 21, 1981.

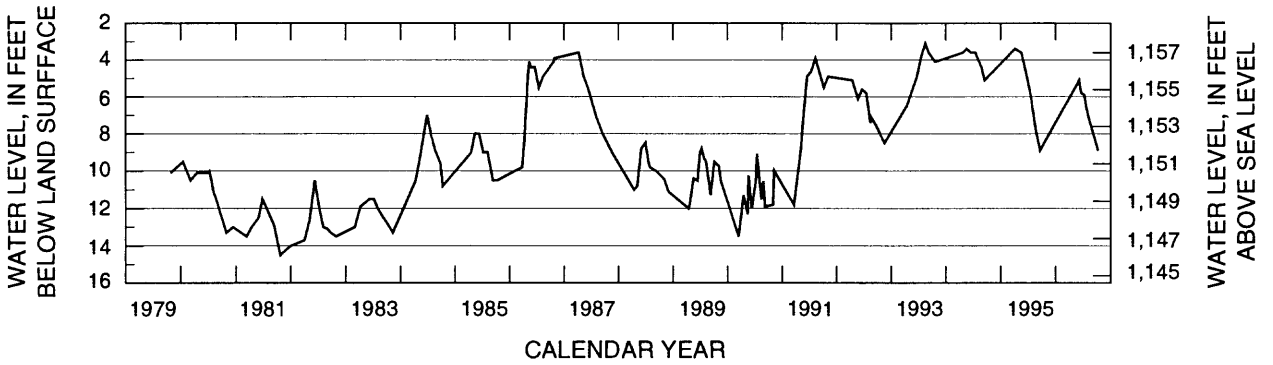


Figure C41. Hydrograph for observation well 126N51W35AADA R (site number 41).

Site number from location map: 42
Local well number: 127N48W2BBBB R
Station identification number: 454911096384601
Other identifier: RB-77F
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,069 feet
Measuring point: 1.0 foot
Extremes: May 28, 1978, to October 8, 1996: Highest, 14.3 feet, June 4, 1996, July 23, 1996; lowest, 28.2 feet, July 20, 1982.

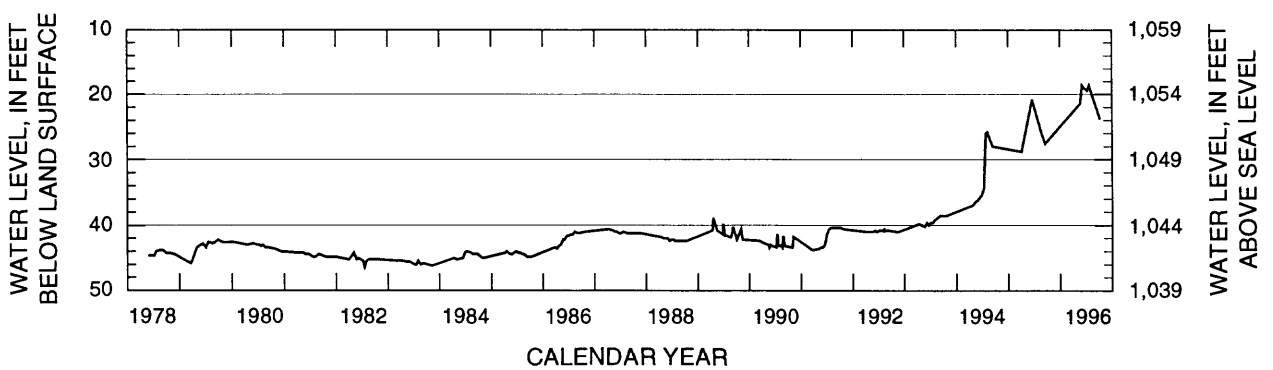


Figure C42. Hydrograph for observation well 127N48W2BBBB R (site number 42).

Site number from location map: 43
Local well number: 127N48W7BBBB R
Station identification number: 454818096434501
Other identifier: RB-77G
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,079.9 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 8, 1996: Highest, 2.2 feet, May 23, 1996; lowest, 13.9 feet, October 4, 1983, November 9, 1983.

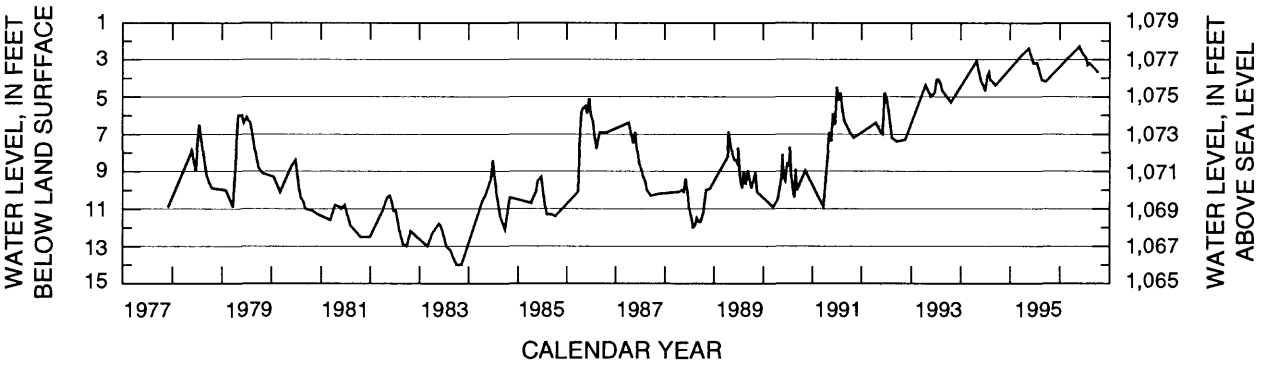


Figure C43. Hydrograph for observation well 127N48W7BBBB R (site number 43).

Site number from location map: 44
Local well number: 127N48W7BBBB2 R
Station identification number: 454818096434502
Other identifier: RB-77H
County: Roberts, South Dakota
Aquifer: Fairmount
Altitude of land surface: 1,079.7 feet
Measuring point: 4.0 feet
Extremes: November 30, 1977, to October 8, 1996: Highest, 9.4 feet, June 4, 1996, June 18, 1996, July 10, 1996; lowest, 20.6 feet, October 4, 1983, November 9, 1983.

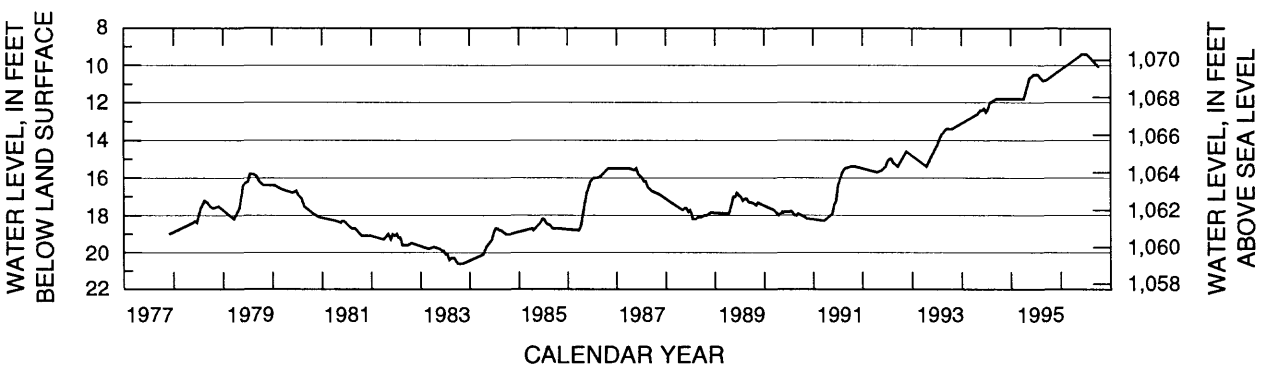


Figure C44. Hydrograph for observation well 127N48W7BBBB2 R (site number 44).

Site number from location map: 45
Local well number: 127N48W7DDBB R
Station identification number: 454737096424801
Other identifier: RB-77A
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,100 feet
Measuring point: 3.0 feet
Extremes: June 6, 1977, to November 6, 1996: Highest, 13.4 feet, July 19, 1988; lowest, 32.6 feet, July 20, 1982.

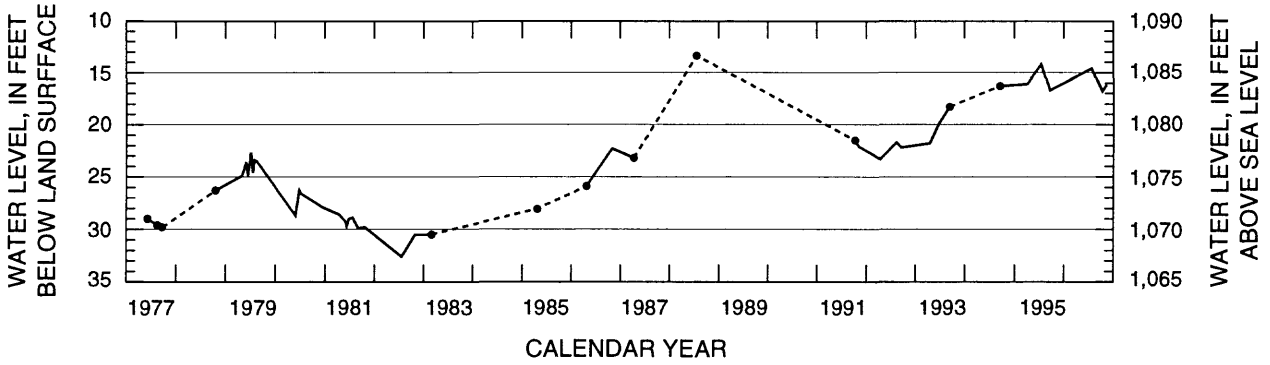


Figure C45. Hydrograph for observation well 127N48W7DDBB R (site number 45).

Site number from location map: 46
Local well number: 127N48W18DDDD R
Station identification number: 454634096434501
Other identifier: RB-77B
County: Roberts, South Dakota
Aquifer: Fairmount
Altitude of land surface: 1,097.7 feet
Measuring point: 1.0 foot
Extremes: June 6, 1977, to October 8, 1996: Highest, 34.1 feet, June 4, 1996, June 18, 1996, July 10, 1996, July 23, 1996, August 6, 1996; lowest, 44.2 feet, September 20, 1977.

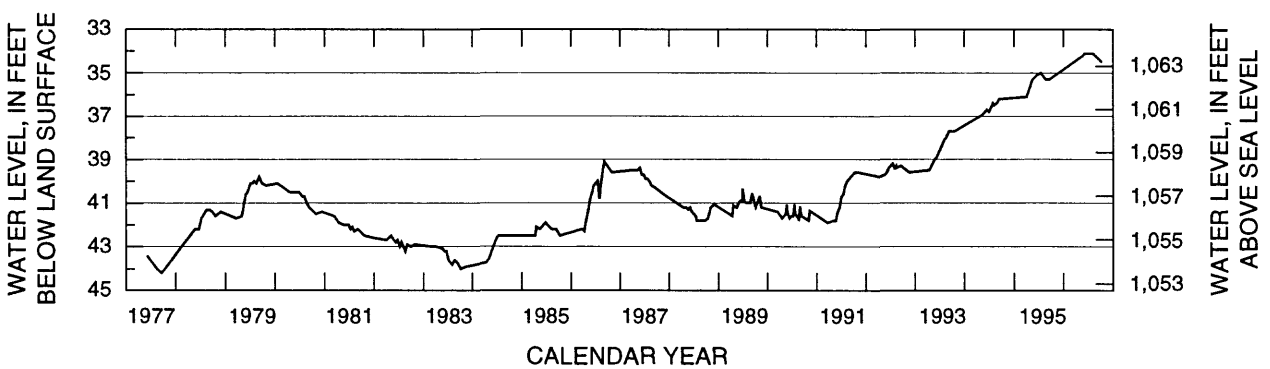


Figure C46. Hydrograph for observation well 127N48W18DDDD R (site number 46).

Site number from location map: 47
Local well number: 127N49W14DAAA R
Station identification number: 454658096450301
Other identifier: RB-77I
County: Roberts, South Dakota
Aquifer: Fairmount
Altitude of land surface: 1,109.3 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 8, 1996: Highest, 40.2 feet, June 4, 1996, June 18, 1996, July 10, 1996, August 6, 1996; lowest, 51.2 feet, October 4, 1983.

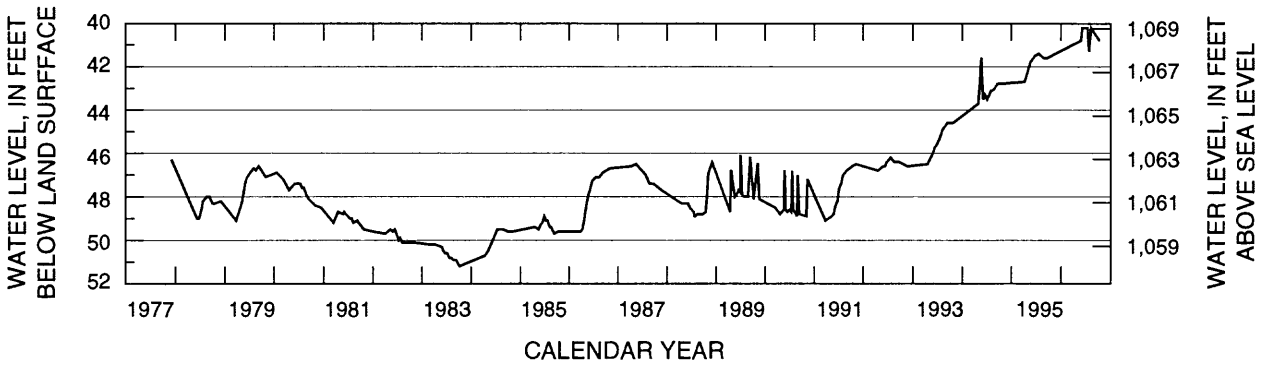


Figure C47. Hydrograph for observation well 127N49W14DAAA R (site number 47).

Site number from location map: 48
Local well number: 127N49W14DAAA2 R
Station identification number: 454658096450402
Other identifier: RB-77J
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,109.9 feet
Measuring point: 2.0 feet
Extremes: November 30, 1977, to October 8, 1996: Highest, 27.0 feet, June 18, 1996; lowest, 42.5 feet, October 4, 1983.

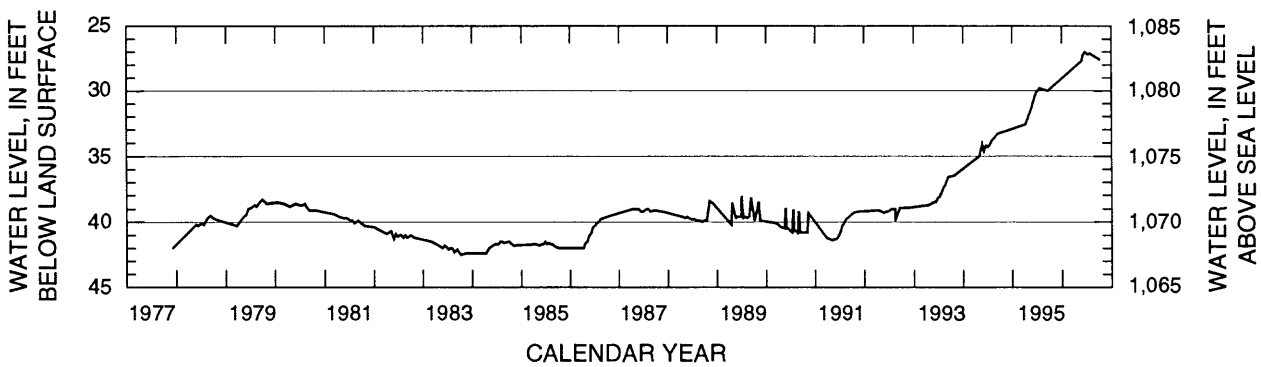


Figure C48. Hydrograph for observation well 127N49W14DAAA2 R (site number 48).

Site number from location map: 49
Local well number: 127N49W26DDDD R
Station identification number: 454449096450201
Other identifier: RB-77C
County: Roberts, South Dakota
Aquifer: Fairmount
Altitude of land surface: 1,124.5 feet
Measuring point: 0.0 foot
Extremes: June 6, 1977, to October 8, 1996: Highest, 57.3 feet, May 23, 1996; lowest, 70.0 feet, September 20, 1977.

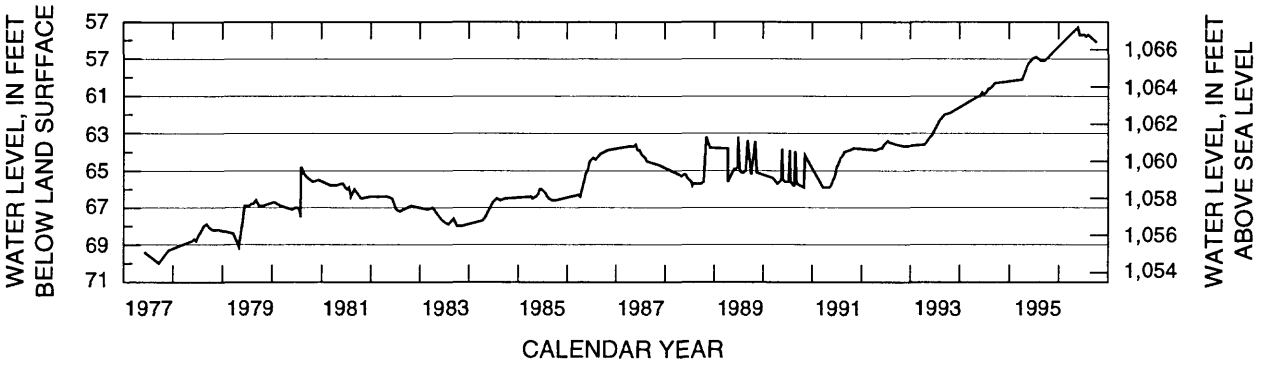


Figure C49. Hydrograph for observation well 127N49W26DDDD R (site number 49).

Site number from location map: 50
Local well number: 127N49W36BBBB R
Station identification number: 454449096450101
Other identifier: RB-77K
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,129.0 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 8, 1996: Highest, 66.6 feet, October 8, 1996; lowest, 77.4 feet, August 1, 1983.

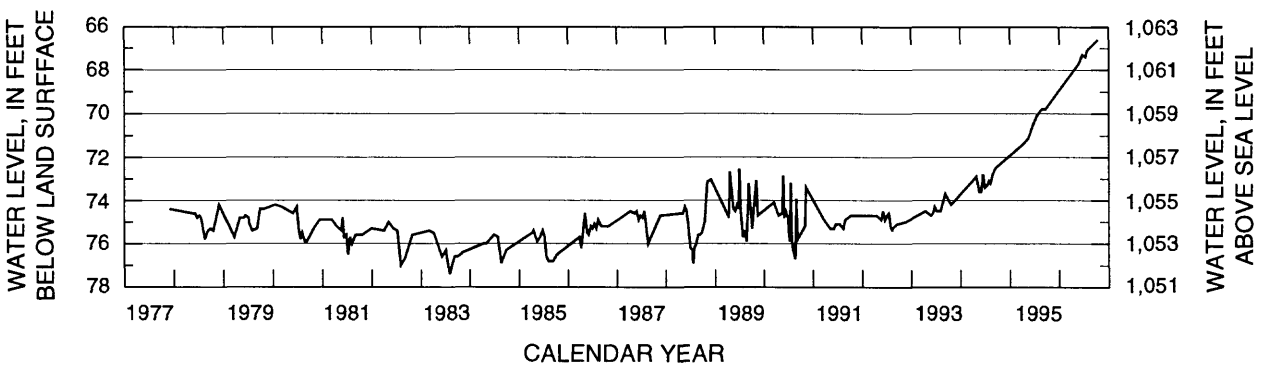


Figure C50. Hydrograph for observation well 127N49W36BBBB R (site number 50).

Site number from location map: 51
Local well number: 127N51W3AAAA R
Station identification number: 454910097011501
Other identifier: RB-81A
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,226.3 feet
Measuring point: 0.0 foot
Extremes: May 29, 1981, to October 8, 1996: Highest, 74.7 feet, July 10, 1996, July 23, 1996, August 6, 1996, October 8, 1996; lowest, 84.8 feet, October 4, 1983.

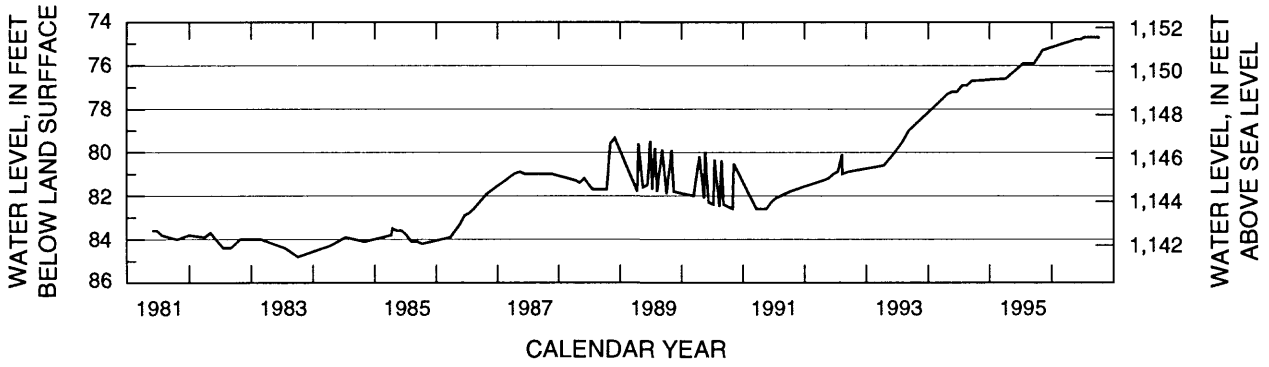


Figure C51. Hydrograph for observation well 127N51W3AAAA R (site number 51).

Site number from location map: 52
Local well number: 128N48W20BBBB R
Station identification number: 455148096423101
Other identifier: RB-77D
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,070.7 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 8, 1996: Highest, 1.5 feet, May 17, 1995; lowest, 18.6 feet, October 4, 1983.

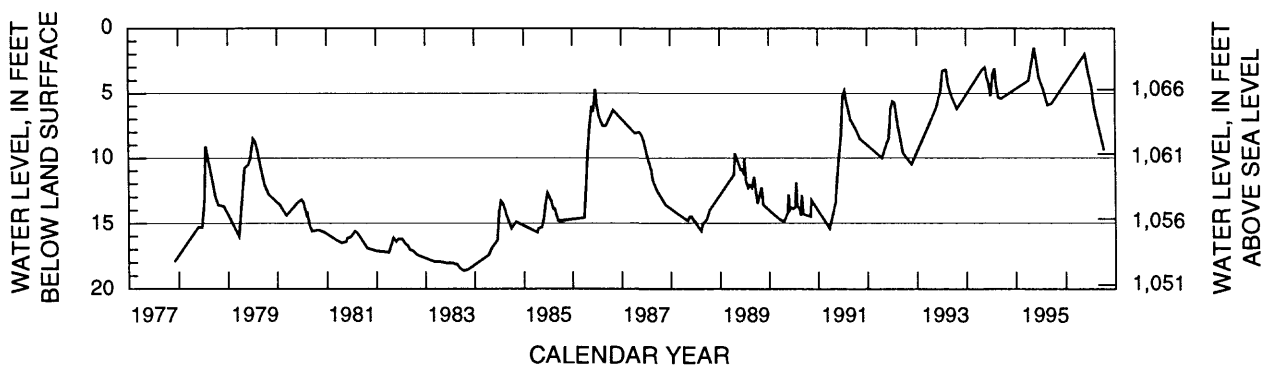


Figure C52. Hydrograph for observation well 128N48W20BBBB R (site number 52).

Site number from location map: 53
Local well number: 128N48W29DDDD R
Station identification number: 455005096411801
Other identifier: RB-77E
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,081.5 feet
Measuring point: 1.0 foot
Extremes: May 23, 1978, to October 8, 1996: Highest, 1.1 feet, May 23, 1996; lowest, 22.6 feet, October 4, 1983.

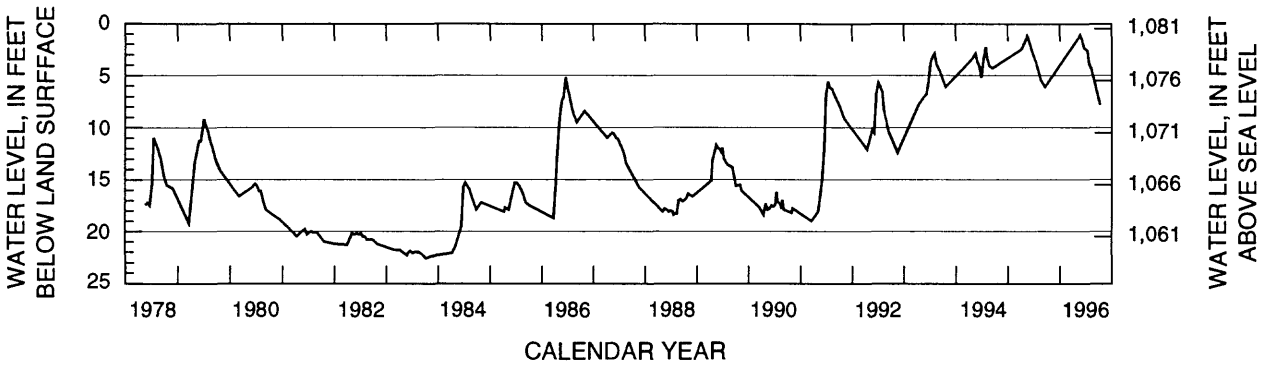


Figure C53. Hydrograph for observation well 128N48W29DDDD R (site number 53).

Site number from location map: 54
Local well number: 128N50W21AABA R
Station identification number: 455147096551301
Other identifier: RB-79A
County: Roberts, South Dakota
Aquifer:
Altitude of land surface: 1,094.3 feet
Measuring point: 3.0 feet
Extremes: October 26, 1979, to October 8, 1996: Highest, 0.3 feet, June 4, 1996; lowest, 6.8 feet, September 8, 1981.

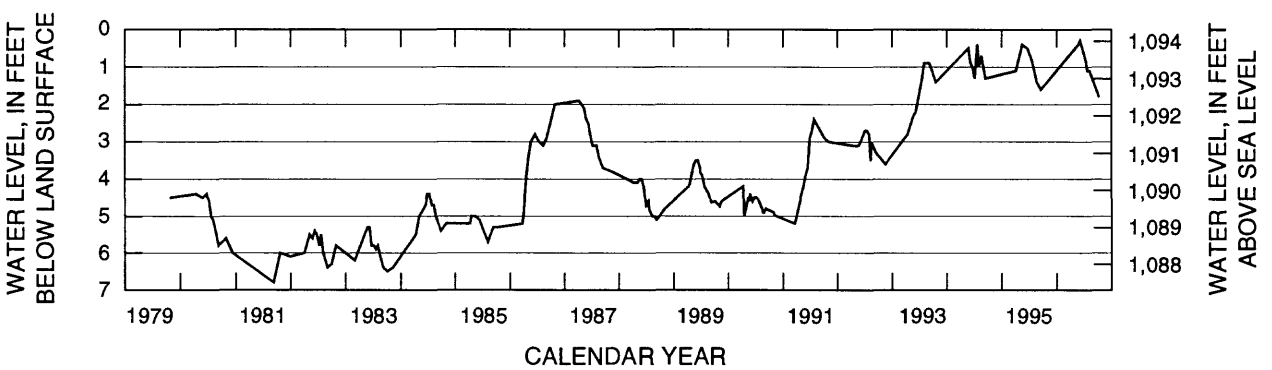


Figure C54. Hydrograph for observation well 128N50W21AABA R (site number 54).

Site number from location map: 55
Local well number: 128N50W21CCCC R
Station identification number: 455057096561501
Other identifier: RB-79B
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,112.8 feet
Measuring point: 2.35 feet
Extremes: October 26, 1979, to November 6, 1996: Highest, -2.8 feet, May 24, 1994, June 8, 1994, June 20, 1994, July 22, 1994, August 2, 1994, May 17, 1995; lowest, 4.5 feet, August 14, 1990.

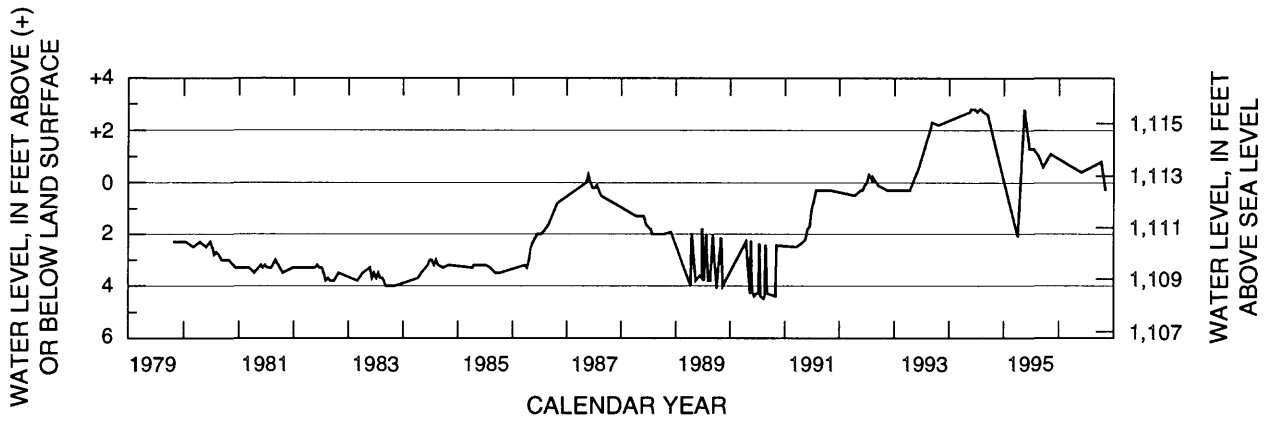


Figure C55. Hydrograph for observation well 128N50W21CCCC R (site number 55).

Site number from location map: 56
Local well number: 128N53W10BBBB R
Station identification number: 455329097172501
Other identifier: ML-69A
County: Marshall, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,250 feet
Measuring point: 2.0 feet
Extremes: December 4, 1969, to October 8, 1996: Highest, 62.3 feet, May 24, 1994; lowest, 75.5 feet, August 2, 1977, September 7, 1977.

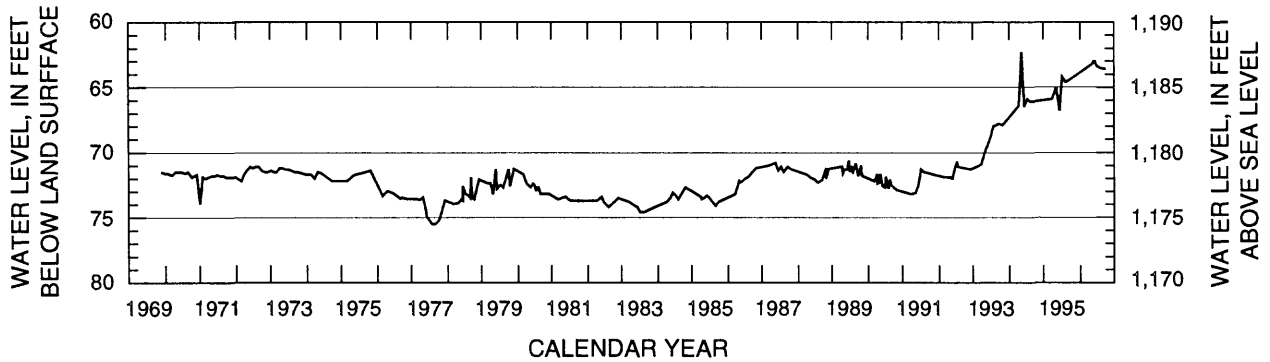


Figure C56. Hydrograph for observation well 128N53W10BBBB R (site number 56).

Site number from location map: 57
Local well number: 128N56W3BBBB
Station identification number: 455606097322901
Other identifier: ML-70C
County: Marshall, South Dakota
Aquifer: Unidentified
Altitude of land surface: 1,352 feet
Measuring point: 0.0 foot
Extremes: June 7, 1977, to October 8, 1996: Highest, 37.0 feet, October 21, 1981; lowest, 42.9 feet, April 2, 1986.

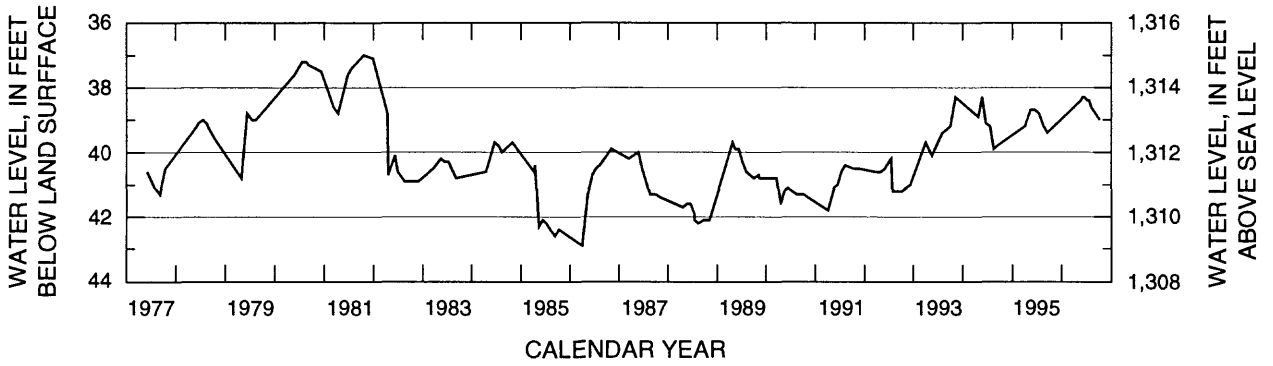


Figure C57. Hydrograph for observation well 128N56W3BBBB (site number 57).

Site number from location map: 58
Local well number: 129N53W27BBBB R
Station identification number: 455606097172501
Other identifier: ML-70A
County: Marshall, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,255 feet
Measuring point: 2.65 feet
Extremes: June 7, 1977, to November 6, 1996: Highest, 67.1 feet, July 23, 1996; lowest, 79.6 feet, August 19, 1983.

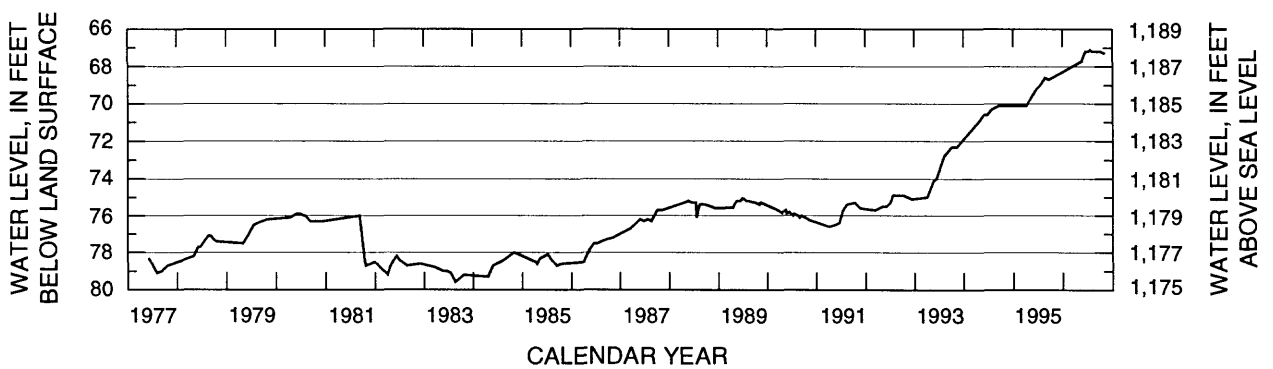


Figure C58. Hydrograph for observation well 129N53W27BBBB R (site number 58).

Site number from location map: 59
Local well number: 129N54W25AAAA R
Station identification number: 455607097211501
Other identifier: ML-70B
County: Marshall, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,260 feet
Measuring point: 3.4 feet
Extremes: June 7, 1977, to August 6, 1996: Highest, 72.4 feet, June 5, 1996, June 19, 1996, July 23, 1996, August 6, 1996; lowest, 88.3 feet, September 7, 1977.

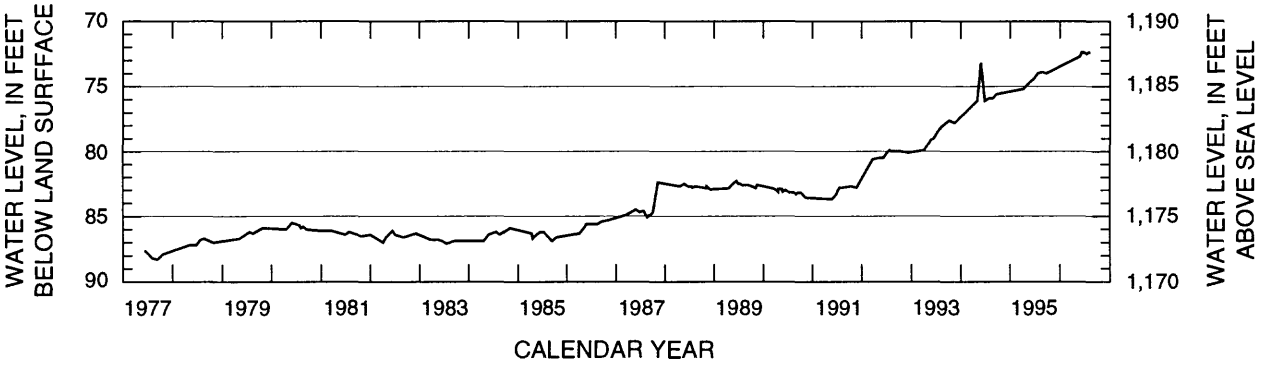


Figure C59. Hydrograph for observation well 129N54W25AAAA R (site number 59).

Site number from location map: 60
Local well number: 129N50W24CCD1 R
Station identification number: 455611096520101
Other identifier: NDSWC 12186A
County: Richland, North Dakota
Aquifer: Unidentified
Altitude of land surface: 1,089.52
Measuring point: 1.45 feet
Extremes: May 7, 1992, to December 10, 1996: Highest, 17.04 feet, June 6, 1996; lowest, 20.11 feet, November 10, 1992.

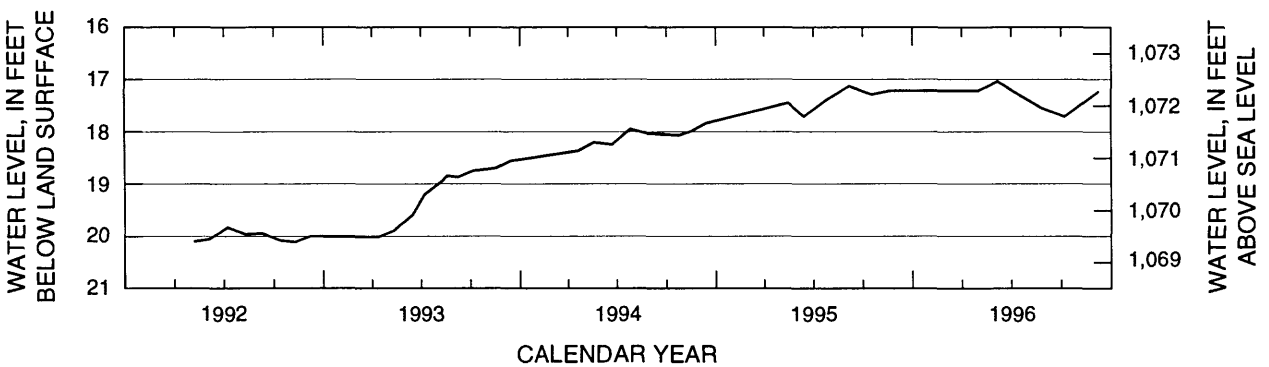


Figure C60. Hydrograph for observation well 129N50W24CCD1 R (site number 60).

Site number from location map: 61
Local well number: 129N50W24CCD2 R
Station identification number: 455611096520102
Other identifier: NDSWC 12186B
County: Richland, North Dakota
Aquifer: Unidentified
Altitude of land surface: 1,089.54
Measuring point: 3.05 feet
Extremes: May 7, 1992, to December 10, 1996: Highest, 16.91 feet, May 16, 1995, lowest; 21.66 feet, October 13, 1992.

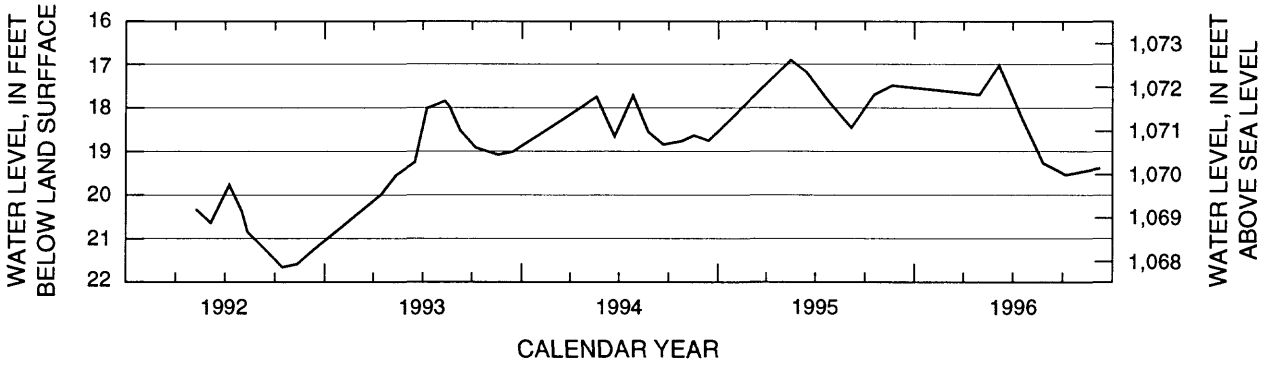


Figure C61. Hydrograph for observation well 129N50W24CCD2 R (site number 61).

Site number from location map: 62
Local well number: 129N50W24CCD3 R
Station identification number: 455611096520103
Other identifier: NDSWC 12186C
County: Richland, North Dakota
Aquifer: Unidentified
Altitude of land surface: 1,089.54
Measuring point: 1.10 feet
Extremes: May 7, 1992, to December 10, 1996: Highest, 15.39 feet, May 16, 1995; lowest, 20.42 feet, October 13, 1992.

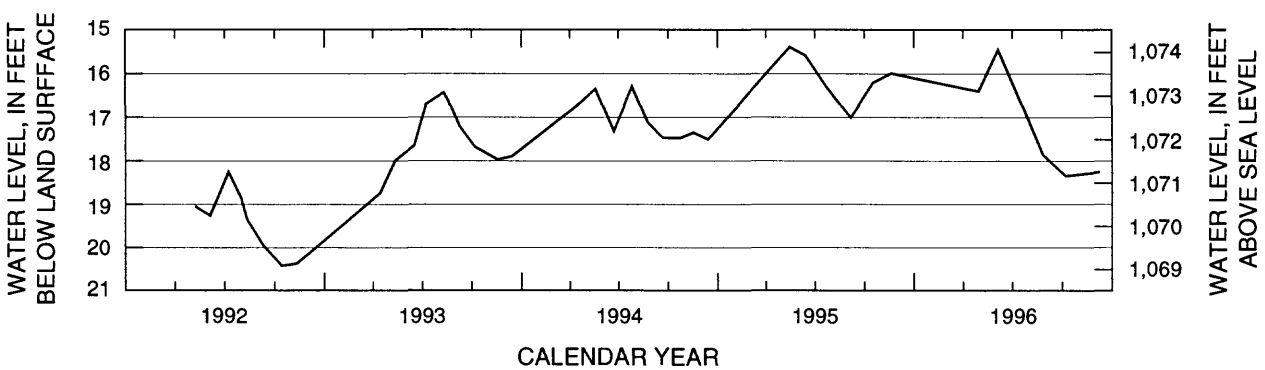


Figure C62. Hydrograph for observation well 129N50W24CCD3 R (site number 62).

Site number from location map: 63
Local well number: 129N51W8CCC R
Station identification number: 455755097045501
Other identifier: NDSWC 13037
County: Richland, North Dakota
Aquifer: Brightwood
Altitude of land surface: 1,196.20
Measuring point: 1.75 feet
Extremes: September 2, 1992, to December 10, 1996: Highest, 36.67 feet, December 10, 1996; lowest, 43.85 feet, November 10, 1992.

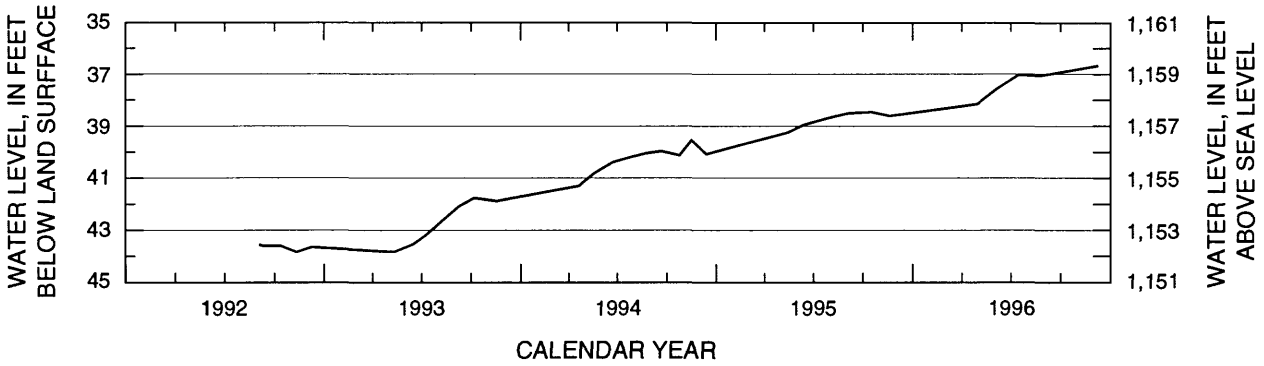


Figure C63. Hydrograph for observation well 129N51W8CCC R (site number 63).

Site number from location map: 64
Local well number: 129N51W19ABA R
Station identification number: 455701097051501
Other identifier: NDSWC 13422
County: Richland, North Dakota
Aquifer: Brightwood
Altitude of land surface: 1,191.23
Measuring point: 1.84 feet
Extremes: October 25, 1994, to December 10, 1996: Highest, 23.92 feet, July 16, 1996; lowest, 27.36 feet, December 14, 1994.

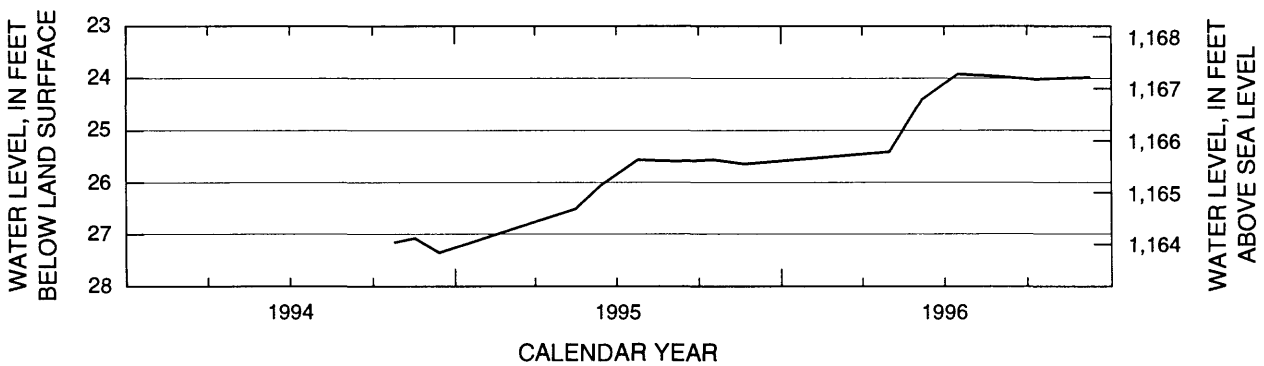


Figure C64. Hydrograph for observation well 129N51W19ABA R (site number 64).

Site number from location map: 65
Local well number: 129N51W26BBB2 R
Station identification number: 455608097010801
Other identifier: NDSWC 12276B
County: Richland, North Dakota
Aquifer: Unidentified
Altitude of land surface: 1,198.72 feet
Measuring point: 2.31 feet
Extremes: July 17, 1991, to July 16, 1996: Highest, 36.51 feet, July 16, 1996; lowest, 46.11 feet, July 17, 1991.

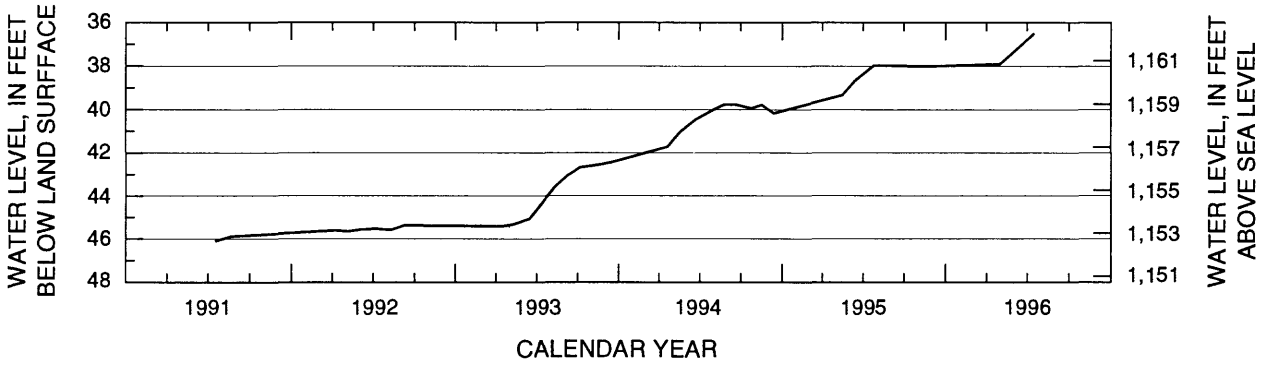


Figure C65. Hydrograph for observation well 128N51W26BBB2 (site number 65).

Site number from location map: 66
Local well number: 129N52W14AAA
Station identification number: 455932097092401
Other identifier: NDSWC 13494
County: Richland, North Dakota
Aquifer: Brightwood
Altitude of land surface: 1,220 feet
Measuring point: 0 foot
Extremes: November 21, 1995, to December 10, 1996: Highest, 37.07 feet, December 10, 1996; lowest 38.70 feet, November 21, 1995.

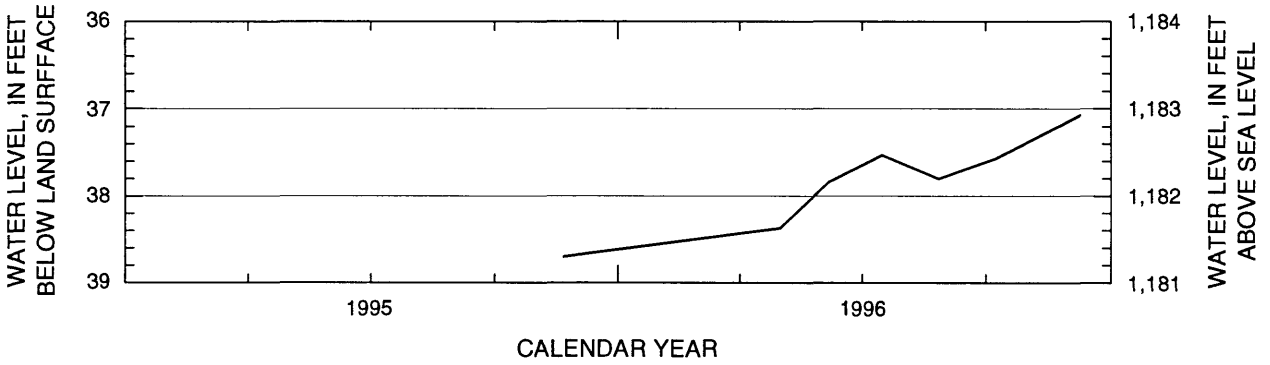


Figure C66. Hydrograph for observation well 129N52W14AAA (site number 66).

Site number from location map: 67
Local well number: 129N52W21CCC R
Station identification number: 455610097110901
Other identifier: NDSWC 12277
County: Richland, North Dakota
Aquifer: Unidentified
Altitude of land surface: 1,221.2 feet
Measuring point: 2.5 feet
Extremes: July 17, 1991, to December 10, 1996: Highest, 38.14 feet, October 8, 1996; lowest. 42.97 feet, April 13, 1993.

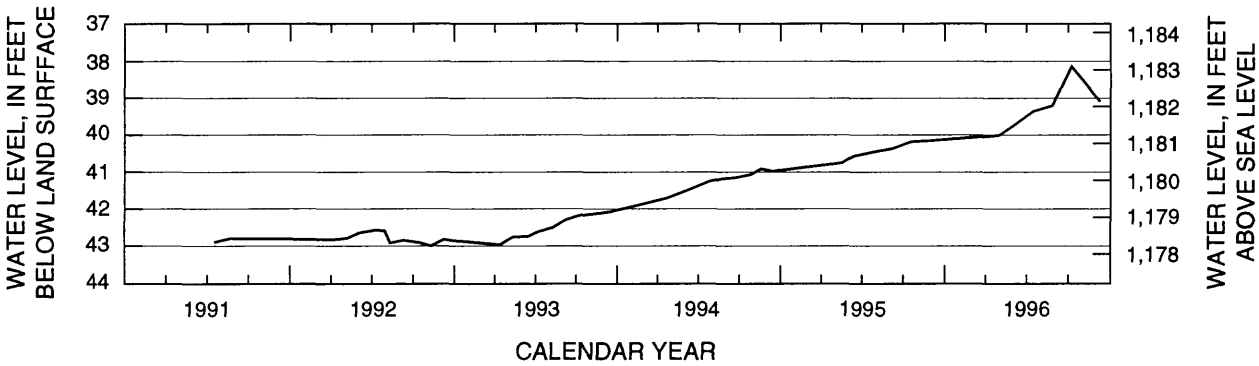


Figure C67. Hydrograph for observation well 129N52W21CCC R (site number 67).

Section D - Annual peak-flow information

-PAGE 173 FOLLOWS-

Table D1. Annual peak-flow information for station 05050000, Bois de Sioux River near White Rock, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; K, known effect of regulation or urbanization; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1942	07-11-42	845	K					
1943	05-24-43	1,120	K	8.95				
1944	06-23-44	1,080	K	9.28	2	9.28	06-23-44	1
1945	04-04-45	900	K	8.10				
1946	04-08-46	850	K	7.89				
1947	05-01-47	975	K	8.67				
1948	04-27-48	1,020	K	8.20				
1949	07-14-49	210	K			8.84	03-29-49	1
1950	07-08-50	1,060	K	9.16				
1951	05-16-51	959	K			9.34	04-07-51	1
1952	06-03-52	1,410	K	10.36				
1953	05-27-53	187	K			6.45	03-18-53	1
1954	09-17-54	124	K	4.67				
1955	07-11-55	152	K	6.01				
1956	08-08-56	303	K	6.94				
1957	06-22-57	610	K	9.09				
1958	04-16-58	418	K	7.05				
1959	07-05-59	43	K			5.82	03-13-59	1
1960	06-11-60	131	K	7.31				
1961	09-14-61	125	K	5.16				
1962	08-06-62	1,620	K	11.52				
1963	06-18-63	945	K	8.65				
1964	04-22-64	209	K	5.44	2	6.34	03-03-64	1
1965	06-09-65	1,320	K	11.05				
1966	04-29-66	921	K	8.77				
1967	04-17-67	530	K	7.33				
1968	04-23-68	58	K	3.94				
1969	04- -69	3,770	K	15.07				
1970	10-14-69	102	K, B	4.68	2	4.87	03-24-69	1
1971	06-26-71	188	K	5.93				
1972	04-10-72	776	K	9.39	2	9.61	03-29-72	1
1973	03-27-73	381	K	7.00				
1974	05-01-74	54	K	4.22	2	5.05	03-07-74	1
1975	07-16-75	552	K	8.95	2	10.41	07-01-75	1
1976	03-21-76	522	K	8.60				
1977	03-13-77	27	K	5.52	1			
1978	04-19-78	929	K	11.59	1			
1979	05-04-79	1,030	K	10.15	1			

Table D1. Annual peak-flow information for station 05050000, Bois de Sioux River near White Rock, S. Dak.—Continued

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; K, known effect of regulation or urbanization; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1980	06-04-80	169	K	6.19				
1981	07-19-81	27	K	4.16	2	4.28	05-09-81	
1982	04-16-82	414	K	8.25				
1983	11-29-82	150	K	6.63	1			
1984	04-14-84	978	K	11.00	2	11.03	06-25-84	
1985	03-31-85	860	K	9.19				
1986	05-07-86	1,820	K	12.12	2			
1987	10-09-86	530	K	7.71		7.80	10-07-86	
1988	04-12-88	180	K	5.84				
1989	04-14-89	693	K	10.72	1			
1990	03-13-90	89	K	4.85				
1991	07-07-91	685	K	11.14				
1992	08-01-92	139		7.17				
1993	08-04-93	1,300		11.52				
1994	04-08-94	1,550		11.88				
1995	04-05-95	1,690		11.85				
1996	05-18-96	1,230				12.98	03-30-96	1

Table D2. Annual peak-flow information for station 05051650, La Belle Creek near Veblen, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 2, discharge is an estimate. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the match for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1988	02-27-88	4	2	5.38	1			
1989	04-03-89	16	2	4.50	1			
1990	04-04-90	1.3		3.22	2	3.58	06-16-90	
1991	06-20-91	77		5.04				
1992	06-18-92	49		4.80				
1993	08-17-93	480	2	7.29				
1994	03-21-94	100		8.42	1			
1995	03-11-95	250		7.49	1			
1996	05-18-96	664		7.34				

Table D3. Annual peak-flow information for station 05289950, Little Minnesota River tributary at Sisseton, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1970	04-27-70	16		4.25				
1971	06-29-71	228		8.54				
1972	03-16-72	175		10.22	1			
1973	05-24-73	83		6.06				
1974	03-03-74	20		8.24	1			
1975	06-21-75	44		5.10				
1976	03-20-76	30		9.85	1			
1977	06-16-77	40		4.99				
1978	07-01-78	315		9.78				
1979	06-20-79	393		10.90				

Table D4. Annual peak-flow information for station 05289985, Big Coulee Creek near Peever, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 2, discharge is an estimate. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the match for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1988	03-12-88	15	2	4.92	1, 2	5.80	03-16-88	1
1989	09-01-89	30	2	4.52	1			
1990	03-12-90	25	2	5.03	1			
1991	06-21-91	456		8.21				
1992	02-27-92	40		5.86	1			
1993	07-25-93	446		8.13				
1994	03-04-94	90		6.73	1			
1995	03-11-95	400		9.08	1			
1996	03-13-96	140		8.26	1			
1997	04-05-97	358		7.73	2	9.43	03-27-97	1

Table D5. Annual peak-flow information for station 052900000, Little Minnesota River near Peever, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 2, discharge is an estimate. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1940	03-30-40	442		5.65	1			
1941	06-23-41	714		5.72				
1942	06-07-42	2,960		9.80				
1943	03-25-43	4,320		13.35	1			
1944	05-04-44	515		4.89	2	6.40	04-06-44	1
1945	06-01-45	1,120		6.60	2	7.49	03-13-45	1
1946	03-21-46	1,040		6.35	2	7.58	03-20-46	1
1947	04-11-47	2,780		9.51				
1948	03-24-48	1,410		8.84	1			
1949	04-02-49	395		4.69	2	5.64	03-05-49	1
1950	04-08-50	1,200	2			13.05	04-01-50	
1951	04-04-51	1,320		6.95	2	7.10	04-04-51	1
1952	04-08-52	4,730		12.16				
1953	06-16-53	818		5.57	2	5.64	03-18-53	1
1954	05-27-54	2,300		8.55				
1955	04-02-55	156		3.95	1, 2	4.56	03-31-55	1
1956	04-15-56	226		3.82	2	4.32	04-06-56	1
1957	05-22-57	697		5.77	2	7.30	03-22-57	1
1958	04-09-58	625		5.55	2	7.63	02-28-58	1
1959	06-27-59	340		4.51				
1960	04-07-60	1,050		6.74				
1961	05-19-61	64		3.10	2	3.39	03-04-61	1
1962	05-23-62	3,140		9.89				
1963	06-10-63	183		3.68				
1964	04-17-64	236		3.89	2	5.39	04-03-64	1
1965	06-02-65	2,920		9.46	2	9.48	05-21-65	1
1966	03-18-66	1,410		7.16	2	11.82	03-13-66	1
1967	03-26-67	472		5.20	1, 2	5.56	03-10-67	
1968	05-09-68	152		3.55				
1969	04-06-69	3,270		11.31				
1970	04-07-70	371		4.49				
1971	06-30-71	595		5.25	2	7.66	03-14-71	1
1972	03-16-72	2,180		9.05				
1973	05-25-73	352		4.41				
1974	03-05-74	368		5.52	1			
1975	06-21-75	352		4.38				
1976	03-21-76	2,960		11.03				

Table D5. Annual peak-flow information for station 052900000, Little Minnesota River near Peever, S. Dak.—Continued

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 2, discharge is an estimate. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1977	03-31-77	161		3.79	2	4.57	03-16-77	1
1978	03-28-78	2,140		8.90	2	10.73	03-23-78	1
1979	04-19-69	1,810		8.23	2	9.62	04-13-79	1
1980	03-31-80	490		5.02	1			
1981	06-15-81	17		3.04				
1990	03-13-90	339		5.12	1			
1991	06-22-91	891		5.77				
1992	07-13-92	271		4.03				
1993	07-25-93	8,900		13.58				
1994	03-21-94	874		5.41	2	9.87	03-06-94	1
1995	03-13-95	2,730		9.04				
1996	04-12-96	816		9.46	1, 2	9.46	03-14-96	1

Table D6. Annual peak-flow information for station 05290300, North Fork Whetstone River near Wilmot, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1970	06-15-70	24		3.66				
1971	06-29-71	36		4.06				
1972	07-26-72	28		3.82				
1973	03-14-73	40		7.71	1			
1974	03-03-74	8		4.92	1			
1975	05-07-75	15		3.56	1			
1976	03-20-76	8		7.09	1			
1977	07-30-77	29		3.86				
1978	06-30-78	37		4.10				
1979	06-20-79	53		4.55				

Table D7. Annual peak-flow information for station 05291000, Whetstone River near Big Stone City, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; H, historic peak; 2, discharge is an estimate; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height is not the maximum for the year; 5, gage height is an estimate. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1910	03-08-10	2,070						
1911	03-19-11	52						
1912	04-15-12	507						
1919	06- -19	29,000	H, B	26.00	5			
1931	05-28-31	1,320		7.10				
1932	03-01-32	244		5.70	1			
1933	06-06-33	45		2.84	2	3.84	03-02-33	1
1934	06-09-34	90		3.32	2	4.60	03-19-34	1
1935	06-18-35	391		4.60	2	7.65	03-05-35	1
1936	03-22-36	422		5.18	2	5.96	03-10-36	1
1937	05-21-37	2,900		10.10				
1938	03-14-38	234		6.00	1			
1939	03-23-39	1,500		8.70	1			
1940	03-31-40	1,040		7.89	2	7.95	03-30-40	1
1941	04-10-41	244		2.42	2	5.05	03-12-41	1
1942	06-07-42	3,740		11.50				
1943	03-25-43	5,140		13.50				
1944	06-02-44	1,010		6.31	2	8.08	03-25-44	1
1945	06-02-45	2,770		9.87				
1946	03-22-46	1,160		7.28	2	7.94	03-15-46	1
1947	04-11-47	5,500		13.95				
1948	03-25-48	3,370		10.87				
1949	07-09-49	344		4.31	2	6.71	03-05-49	1
1950	04-01-50	1,260		7.35	2	9.49	03-27-50	1
1951	04-05-51	1,100	2, B	8.49	2	9.19	04-04-51	1
1952	04-08-52	5,710		13.64				
1953	06-24-53	1,110		6.56	2	6.94	03-19-53	1
1954	06-07-54	3,330		10.46				
1955	03-12-55	570		6.62	1, 2	6.98	03-11-55	1
1956	04-06-56	429		5.22	1, 2	5.33	04-05-56	1
1957	05-21-57	3,680		10.94				

Table D7. Annual peak-flow information for station 05291000, Whetstone River near Big Stone City, S. Dak.—Continued

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; H, historic peak; 2, discharge is an estimate; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height is not the maximum for the year; 5, gage height is an estimate. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1958	04-07-58	998		6.27	2	6.92	02-28-58	1
1959	03-23-59	70		3.69	2	3.84	03-15-59	1
1960	04-06-60	1,560		8.00	2	8.25	03-29-60	1
1961	05-19-61	300		4.26	2	4.68	02-22-61	1
1962	03-29-62	2,900		10.38	1, 2	10.43	03-29-62	1
1963	07-28-63	1,600		7.85				
1964	04-03-64	701		8.61	1			
1965	04-06-65	1,740		8.57	1			
1966	03-14-66	2,600		9.42	2	9.97	03-13-66	1
1967	03-31-67	475		5.18	2	8.30	03-11-67	1
1968	04-24-68	153		3.67	2	4.12	03-11-68	1
1969	04-08-69	6,870		14.32				
1970	03-04-70	1,500	2, B	7.60	5			
1971	06-30-71	2,540		9.94				
1972	03-16-72	2,930	2	10.24	1			
1973	05-25-73	2,470		9.23				
1974	03-05-74	373		5.63	1			
1975	04-19-75	1,000		6.67	1			
1976	03-21-76	675		6.81	1			
1977	03-14-77	717		6.64	1			
1978	03-23-78	3,850		11.50	1			
1979	04-13-79	4,210		12.11	1			
1980	03-20-80	774		6.79	1			
1981	07-25-81	425		5.01				
1982	03-31-82	3,450		10.97	1			
1983	04-01-83	1,400		7.75				
1984	06-16-84	4,850		12.42				
1985	03-19-85	3,900		11.13				
1986	04-15-86	4,730		11.89				
1987	03-26-87	294		4.08	2	4.23	03-06-87	1
1988	03-26-88	249		4.15	1			

Table D7. Annual peak-flow information for station 05291000, Whetstone River near Big Stone City, S. Dak.—Continued

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; H, historic peak; 2, discharge is an estimate; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height is not the maximum for the year; 5, gage height is an estimate. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1989	03-27-89	3,490		10.76	2	10.88	03-26-89	1
1990	03-14-90	286		4.19	1			
1991	08-03-91	3,270		10.40				
1992	06-18-92	1,680		7.97				
1993	07-18-93	3,890		11.25				
1994	07-08-94	3,980		11.14				
1995	07-06-95	4,140		11.55				
1996	05-18-96	1,490		11.50	1, 2	11.50	03-14-97	1

Table D8. Annual peak-flow information for station 05292000, Minnesota River at Ortonville, Minn.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1938	03-31-38	245						
1939	03-30-39	385						
1940	04-11-40	228			2	5.80	03-31-40	1
1941	07-28-41	108		3.27				
1942	06-12-42	1,200		10.45				
1943	04-04-43	1,480		10.52				
1944	05-03-44	1,060		9.37				
1945	06-12-45	664		8.22				
1946	04-01-46	1,210		10.21				
1947	04-16-47	1,660		11.00				
1948	04-08-48	841		9.13				
1949	04-17-49	418		6.14				
1950	05-05-50	930		9.02				
1951	04-09-51	956		9.27				
1952	04-13-52	3,060		12.92				
1953	04-15-53	632		7.65				
1954	06-08-54	905		9.39				
1955	04-20-55	357		6.67				
1956	04-07-56	299		5.32				
1957	05-22-57	939		9.70				
1958	04-28-58	932		9.68				
1959	04-28-59	206		4.50				
1960	03-30-60	618		8.91	1			
1961	04-16-61	230		5.27				
1962	07-10-62	1,400		10.45	2	10.50	03-29-62	1
1963	04-03-63	753		8.81				
1964	04-13-64	956		9.55				
1965	06-07-65	1,160		9.89				
1966	03-18-66	1,250		9.86				
1967	04-17-67	898		10.04				
1968	04-23-68	248		4.91				
1969	04-13-69	2,550		12.09				
1970	05-01-70	394		5.38				
1971	06-30-71	596		6.81				
1972	05-29-72	1,210		9.41				
1973	05-26-73	775		7.70				
1974	04-14-74	388		5.96				

Table D8. Annual peak-flow information for station 05292000, Minnesota River at Ortonville, Minn.—Continued

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1975	04-29-75	715		7.94				
1976	04-03-76	450		6.35				
1977	03-14-77	292		4.53				
1978	04-06-78	1,960		11.32	1			
1979	04-25-79	2,260		11.61				
1980	04-12-80	487		7.19				
1981	06-13-81	57		1.89	2	1.93	09-11-81	1
1982	04-20-82	424		6.87				
1983	04-14-83	927		7.99				
1984	06-16-84	1,570		10.42				
1985	03-21-85	1,490		8.62				
1986	04-19-86	2,570		9.28				
1987	10-03-86	501		6.22				
1988	03-25-88	207		3.64				
1989	03-27-89	2,780		10.76				
1990	08-19-90	257		4.02				
1991	07-02-91	1,880		8.95				
1992	06-18-92	1,760		7.93				
1993	07-28-93	2,950				7.93	06-18-93	
1994	07-08-94	2,740		9.23				
1995	07-06-95	2,530		9.19				
1996	05-19-96	2,230		8.63				

Table D9. Annual peak-flow information for station 06479200, Big Sioux River near Ortley, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1956	05-28-56	56		4.25	1			
1957	03-21-57	110		5.02	1			
1958	04-06-58	126		5.25	1			
1959	05-30-59	30		3.75	1			
1960	03-29-60	495		5.39				
1961	05-17-61	41		3.97	1			
1962	07-01-62	950		5.73				
1963	07-26-63	285		4.92				
1964	04-16-64	66		4.21				
1965	05-24-65	350		5.02				
1966	03-12-66	660		5.52				
1967	03-20-67	150		5.42	1			
1968	05-08-68	15		2.95				

Table D10. Annual peak-flow information for station 06479215, Big Sioux River near Florence, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 2, discharge is an estimate. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage heights not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1984	06-15-84	194		8.05				
1985	03-20-85	268		7.72	2	8.33	03-16-85	1
1986	03-29-86	1,810		9.08				
1987	03-25-87	177		7.51				
1988	02-28-88	14	2	5.62	1			
1989	03-27-89	500	2	8.34	1			
1990	05-23-90	21		4.79	2	5.12	03-10-90	1
1991	08-02-91	287		8.16				
1992	06-30-92	268		7.72				
1993	07-25-93	1,280		9.18				
1994	03-19-94	1,140		8.79				
1995	03-11-95	1,200		9.02	1			
1996	10-28-95	387		7.49	2	8.90	03-12-96	1

Table D11. Annual peak-flow information for station 06479230, Big Sioux River tributary near Summit, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 4, discharge less than indicated value, which is minimum recordable discharge at this station. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data; <, less than]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1956	04-02-56	6		4.99	1			
1957	08-20-57			2.65				
1958	04-06-58			3.10				
1959	03-06-59	4		3.39	1			
1960	04-05-60	45		4.33	1			
1961	- -61	2	4					
1962	07-01-62	92		2.36				
1963	06-09-63	45		2.03				
1964	04-05-64			2.67				
1965	05-24-65			2.76				
1966	04-27-66			3.45				
1967	03-09-67			3.41				

Table D12. Annual peak-flow information for station 06479240, Big Sioux River tributary no. 2 near Summit, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1956	04-02-56	3		2.68	1			
1957	03-20-57	5		3.02	1			
1958	04-06-58	18		2.98				
1959	03-06-59	1		2.02	1			
1960	04- -60	26	B	3.47				
1961	04- -61	3	B	1.76				
1962	07-01-62	53		5.16				
1963	06-09-63	5		1.99				
1964	04-05-64	13		2.70				
1965	05-24-65	38		4.23				
1966	03-13-66	6		2.06				
1967	06-14-67	13		2.62				
1968	- -68	0	B					
1969	04-06-69	40		4.32				
1970	06-16-70	3		1.80				
1971	06-29-71	50		4.97				
1972	07-26-72	9		2.27				
1973	03-14-73	3		2.02	1			

Table D13. Annual peak-flow information for station 06479260, Big Sioux River tributary no. 3 near Summit, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value.; B, month or day of occurrence is unknown or not exact.. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1956	04-02-56	40		4.96	1			
1957	05-21-57	105		4.40				
1958	04-06-58	175		4.82				
1959	05-30-59	2		2.71				
1960	03-30-60	255		5.17				
1961	05-17-61	17		3.33				
1962	07-01-62	1,050		10.68				
1963	06-09-63	170		4.78				
1964	04-05-64	120		4.50				
1965	05-24-65	365		6.15				
1966	03-12-66	75		4.66	1			
1967	06-14-67	250		5.15				
1968	05-08-68	10		3.13				
1969	04-08-69	800		10.18				
1970	06-16-70	52		3.90				
1971	06-29-71	480		7.57				
1972	07-26-72	330		5.72				
1973	05-24-73	90		4.27				
1974	03-03-74	25		4.75	1			
1975	04- -75	3	B	6.14	1			
1976	03-12-76	15		5.53	1			
1977	06-16-77	106		4.40				
1978	05-29-78	112		4.44				

Table D14. Annual peak-flow information for station 06479350, Soo Creek tributary near South Shore, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; B, month or day of occurrence is unknown or not exact. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1970	04-19-70	26		4.28				
1971	06-29-71	38		4.61				
1972	04-12-72	140		6.67				
1973	03-14-73	50		5.85	1			
1974	03-03-74	20		6.65	1			
1975	04- -75	15	B	7.87	1			
1976	03-12-76	5		5.14	1			
1977	06-16-77	279		8.80				
1978	07-06-78	280		8.82				
1979	04- -79	25	B	7.42	1			

Table D15. Annual peak-flow information for station 06479438, Big Sioux River near Watertown, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 2, discharge is an estimate. Gage-height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; gage height affected by backwater; 2, gage height is not the maximum for the year. ft^3/s, cubic feet per second. Blanks indicate no data]

Water year	Date	Peak discharge (ft^3/s)	Discharge codes	Gage height (feet)	Gage-height codes	Maximum gage height (feet)	Date	Gage-height codes
1973	03-15-73	595		8.11				
1974	04-04-74	232		6.75	2	7.88	03-04-74	1
1975	04-17-75	301		7.75				
1976	03-24-76	288		7.07	2	8.40	03-20-76	1
1977	06-16-77	938		8.77	2	9.52	03-13-77	1
1978	03-30-78	3,720		11.07				
1979	04-13-79	1,780		9.82	1			
1980	03-19-80	330		8.04				
1981	06-15-81	88		5.50				
1982	03-30-82	250		8.97				
1983	04-02-83	396		7.52				
1984	06-16-84	1,330		9.25	2	9.52	03-25-84	1
1985	03-17-85	1,700		9.62	1			
1986	03-30-86	4,970		11.08				
1987	03-25-87	601		8.01				
1988	03-25-88	110	2	6.26	1, 2	7.08	03-02-88	1
1989	03-27-89	900	2	8.98	1, 2	9.09	03-24-89	1
1990	06-18-90	28		4.56	2	4.61	02-06-90	1
1991	06-21-91	3,300		11.13	1			
1992	07-02-92	736		8.07				
1993	03-28-93	4,000	2	11.07	1			
1994	03-20-94	2,110		9.86				
1995	03-12-95	2,000		9.81	1			
1996	03-14-96	2,500		10.67	1			

-PAGE 189 FOLLOWS-

Section E - Mean flow and summary statistics

– PAGE 191 FOLLOWS –

Table E1.1. Mean flow, in cubic feet per second, for station 05050000, Bois de Sioux River near White Rock, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1942	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.52	148	623	198	244	102
1943	45.7	.15	.000	.000	.000	5.97	325	935	681	324	35.9	6.85	198
1944	7.56	11.0	1.38	.000	.000	3.66	157	253	598	225	15.8	4.80	106
1945	2.82	1.26	.097	.000	.000	15.9	375	41.4	214	5.87	3.21	1.15	54.5
1946	3.11	1.13	.27	.000	.000	28.1	530	24.7	13.1	38.7	4.17	2.32	53.4
1947	3.12	10.5	4.44	1.70	.81	6.16	271	592	433	453	9.04	5.98	150
1948	6.76	8.36	1.84	.006	.000	36.9	359	750	84.5	15.4	18.2	15.0	108
1949	.62	.70	.22	.000	.000	19.7	826	2.02	2.84	64.9	4.53	1.51	8.91
1950	1.15	1.41	.016	.000	.000	4.60	23.1	17.8	575	713	328	19.4	8.99
1951	4.87	20.5	20	6.38	1.02	3.88	186	820	331	69.6	29.5	4.94	126
1952	4.49	13.0	22.9	20.5	12.7	55.0	260	1,002	944	260	7.52	.36	217
1953	.43	.48	.068	.000	.000	28.2	9.86	74.0	57.9	60.2	33.4	15.6	23.6
1954	1.85	1.19	.000	.000	.000	2.89	5.56	4.66	6.75	2.00	1.33	2.36	2.38
1955	1.31	.85	.084	.000	.000	4.12	5.91	1.66	2.81	18.1	3.69	.72	3.30
1956	.41	.04	.000	.000	.000	.013	13.1	3.29	1.35	.31	5.85	.28	2.05
1957	.16	.7	.13	.000	.000	1.2	24.3	235	324	134	14.8	24.8	63.5
1958	33.8	39.0	4.32	13.6	10.8	41.9	223	41.5	7.74	6.51	.21	.79	35.1
1959	.12	.000	.000	.000	.000	1.50	.60	1.45	4.36	3.75	.087	.003	.99
1960	.016	.000	.000	.000	.000	1.87	19.1	72.8	68.5	19.6	.13	.000	15.2
1961	.042	.000	.000	.000	.000	1.4	5.37	6.38	.84	.000	.045	1.86	1.33
1962	.000	.000	.000	.000	.000	.14	128	413	788	1,035	1,130	260	316
1963	45.7	7.69	5.48	3.52	8.16	17.6	104	42.3	558	75.3	8.38	3.73	72.9
1964	1.46	1.15	.76	.45	.22	.25	108	95.1	20.9	5.73	.4	1.3	19.6
1965	1.17	.98	.47	.000	.000	.000	427	433	1,088	309	9.3	5.26	189
1966	59.8	84.2	28.9	20.1	53.0	58.8	332	729	431	8.30	6.64	1.15	151
1967	23.8	4.02	.000	.000	.000	13.7	224	105	26.2	200	.76	.45	50.0
1968	.34	.030	.000	.000	.000	.016	7.61	7.59	3.55	.69	.058	.043	1.66
1969	.45	.76	.40	.058	.000	.000	1,322	1,310	374	20.6	.23	.000	253
1970	1.82	.31	.000	.000	.000	1.56	14.4	4.3	5.27	.039	.000	.000	2.30
1971	.000	.15	.087	.000	.000	2.40	4.80	4.80	69.3	23.6	4.40	5.42	9.55
1972	.45	2.50	1.74	1.58	.27	100	631	251	304	25.5	105	18.1	119
1973	.064	.60	.68	4.02	8.15	139	77.8	17.7	9.37	.039	.28	.047	21.6
1974	.016	.001	.000	.000	.000	8.86	8.11	9.56	3.77	.12	.35	.15	2.59
1975	.015	.001	.000	.000	.000	.000	26.5	184	87.1	316	12.0	23.4	54.7
1976	1.49	.26	.078	.000	21.5	221	134	4.21	.018	.000	.000	.23	31.9
1977	.000	.000	.000	.000	.000	2.89	1.24	.23	.010	.016	.009	.087	.38
1978	.21	1.02	.011	.000	.000	3.88	623	719	520	416	108	18.4	201
1979	3.34	1.93	1.92	.64	.004	.92	228	938	696	326	103	8.08	193

Table E1.1. Mean flow, in cubic feet per second, for station 05050000, Bois de Sioux River near White Rock, S. Dak.—Continued

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1980	7.20	7.28	9.09	9.35	11.9	40.7	23.3	25.5	62.2	12.8	1.83	1.47	17.7
1981	1.24	.33	.11	.000	.17	.39	1.99	1.46	10.3	8.08	.096	.001	2.01
1982	.000	.000	.000	.000	.000	3.89	200	99.5	3.57	5.43	.19	.024	26.0
1983	.21	5.64	23.2	2.03	.000	2.61	2.54	1.93	.36	.070	.000	.000	3.25
1984	.000	.002	.000	.000	1.94	6.19	717	312	426	281	104	.72	153
1985	101	258	57.5	.20	.20	227	340	205	421	79.7	18.6	19.4	144
1986	8.43	5.17	3.66	4.54	6.84	55.3	7.21	1,092	1,103	723	151	61.9	329
1987	376	120	100	58.2	66.0	39.1	63.9	28.2	2.19	.92	.27	.11	71.6
1988	22.4	8.57	4.57	.31	.009	9.7	41.7	4.82	.45	.000	.005	.000	7.70
1989	.053	.12	.000	.000	.000	1.34	414	491	89.7	5.13	6.69	71.6	90.2
1990	10.1	11.5	6.57	.000	.000	21.9	6.98	11.0	8.24	2.12	.075	1.06	6.68
1991	1.63	--	--	--	--	--	--	--	--	--	--	--	--
1992	58.5	.83	.78	.65	1.38	8.93	10.4	2.93	6.64	22.4	92.4	.24	17.4
1993	.080	3.80	4.68	4.82	4.19	75.5	603	244	240	711	1182	1062	346
1994	253	20.9	6.57	6.61	7.25	199	1,088	1,105	490	689	140	7.22	360
1995	70.0	6.94	5.55	4.62	5.74	209	1,277	1,236	667	101	6.52	7.64	300
1996	272	307	25.3	8.67	16.3	628	842	723	187	5.81	4.17	.47	252

Table E1.2. Statistics on mean flow, in cubic feet per second, for station 05050000, Bois de Sioux River near White Rock, S. Dak. (October 1942 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	55	54	54	54	54	54	54	54	54	54	54	54	54
Maximum	534.6	307.3	57.5	58.2	53.0	628.4	1,322	1,310	1,103	1,035	1,182	1,062	360.2
Percentile													
75th	8.43	7.86	4.60	2.40	2.50	39.5	362.9	516.5	431.6	265.5	30.5	9.81	1.7
50th	1.46	1.08	.246	.000	.000	6.06	117.7	73.4	76.9	21.5	5.19	1.49	.61
25th	.123	.140	.000	.000	.000	1.48	9.46	4.82	5.04	3.34	.255	.208	.07
Minimum	.000	.000	.000	.000	.000	.000	.000	.228	.010	.000	.000	.000	.377
Mean	31.31	17.99	6.38	3.20	4.42	43.77	251.04	291.35	244.49	156.42	72.40	35.78	96.85
Standard deviation	93.91	56.34	16.53	8.90	11.93	99.97	329.43	389.80	306.21	246.87	223.09	150.35	104.66
Skewness	4.22	4.29	4.29	4.92	4.07	4.29	1.73	1.24	1.24	1.84	4.51	6.34	1.07
Coefficient of variation	3.00	3.13	2.59	2.78	2.70	2.28	1.31	1.34	1.25	1.58	3.08	4.20	1.08
Percent of annual flow	2.70	1.55	0.55	0.28	0.38	3.78	21.67	25.15	21.10	13.50	6.25	3.09	100

Table E1.3. Serial correlation for 1-year lag for monthly and annual mean flows for station 05050000, Bois de Sioux River near White Rock, S. Dak. (October 1942 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.065	-0.050	-0.022	-0.002	-0.050	0.479	0.276	0.145	0.120	0.016	0.019	-0.042	0.293

Table E1.4. Correlation matrix for monthly mean flow for station 05050000, Bois de Sioux River near White Rock, S. Dak. (October 1942 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	0.505	0.556	0.554	0.504	0.525	0.362	0.270	0.061	0.125	-0.032	-0.071
Nov.	*	1.000	0.656	0.359	0.397	0.768	0.210	0.127	0.031	-0.123	-0.080	-0.054
Dec.	*	*	1.000	0.833	0.738	0.287	0.023	0.060	0.026	-0.123	-0.077	-0.054
Jan.	*	*	*	1.000	0.888	0.153	0.038	0.111	0.046	-0.066	-0.041	-0.042
Feb.	*	*	*	*	1.000	0.263	0.052	0.091	0.014	-0.115	-0.065	-0.036
Mar.	*	*	*	*	*	1.000	0.450	0.268	0.062	-0.043	-0.017	0.013
Apr.	*	*	*	*	*	*	1.000	0.765	0.465	0.243	0.113	0.126
May.	*	*	*	*	*	*	*	1.000	0.690	0.353	0.065	-0.001
Jun.	*	*	*	*	*	*	*	*	1.000	0.631	0.269	0.074
Jul.	*	*	*	*	*	*	*	*	*	1.000	0.723	0.494
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	0.834
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E1.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05050000, Bois de Sioux River near White Rock, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1942	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
1943	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	6.43	35
1944	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.90	38	3.94	29
1945	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.002	24	.29	32	5.68	34
1946	.0000	5	.0000	5	.0000	5	.0000	5	.0000	5	.0000	5	.001	22	.15	29	5.57	33
1947	.20	48	.20	47	.30	48	.45	49	.61	48	.88	44	1.39	42	2.35	41	4.58	30
1948	.0000	6	.0000	6	.0000	6	.0000	6	.0000	6	.0000	6	.046	32	.83	37	9.08	38
1949	.0000	7	.0000	7	.0000	7	.0000	7	.0000	7	.0000	7	.054	33	.21	30	3.90	28
1950	.0000	8	.0000	8	.0000	8	.0000	8	.0000	8	.0000	8	.001	23	.25	31	1.70	26
1951	.50	50	.50	50	.50	50	.52	50	.80	49	1.18	45	3.82	46	7.86	50	9.60	39
1952	.30	49	.30	49	.30	49	.31	48	.36	46	3.73	49	13.2	54	15.3	51	21.6	47
1953	.0000	9	.0000	9	.0000	9	.0000	9	.0000	9	.0000	9	.020	31	.077	22	5.11	32
1954	.0000	10	.0000	10	.0000	10	.0000	10	.0000	10	.0000	10	.0000	4	.11	26	1.05	20
1955	.0000	11	.0000	11	.0000	11	.0000	11	.0000	11	.0000	11	.00000	5	.14	28	1.13	21
1956	.0000	12	.0000	12	.0000	12	.0000	12	.0000	12	.0000	12	.0000	6	.0000	3	.076	5
1957	.0000	13	.0000	13	.0000	13	.0000	13	.0000	13	.0000	13	.0007	27	.049	18	.38	13
1958	.10	46	.10	46	.10	46	.14	45	.20	43	.42	41	2.47	43	3.75	44	24.2	49
1959	.0000	14	.0000	14	.0000	14	.0000	14	.0000	14	.0000	14	.0000	7	.0000	4	.27	8
1960	.0000	15	.0000	15	.0000	15	.0000	15	.0000	15	.0000	15	.0000	8	.0000	5	.32	10
1961	.0000	16	.0000	16	.0000	16	.0000	16	.0000	16	.0000	16	.0000	9	.0000	6	.27	7
1962	.0000	17	.0000	17	.0000	17	.0000	17	.0000	17	.0000	17	.0000	10	.0000	7	.036	3
1963	1.20	51	1.37	51	2.11	51	2.16	51	3.51	52	4.01	52	5.55	51	6.07	47	13.3	40
1964	.0000	18	.0000	18	.0000	18	.0000	18	.20	44	.23	40	.31	36	.39	33	.69	17
1965	.0000	19	.0000	19	.0000	19	.0000	19	.0000	18	.0000	18	.0000	11	.094	24	.43	14
1966	.0000	20	.013	43	.077	44	.093	44	1.15	50	3.85	50	4.37	47	37.8	53	48.5	50
1967	.0000	21	.0000	20	.0000	20	.0000	20	.0000	19	.0000	19	.0000	12	.036	16	7.12	36
1968	.0000	22	.0000	21	.0000	21	.0000	21	.0000	20	.0000	20	.0000	13	.0000	8	.063	4
1969	.0000	23	.0000	22	.0000	22	.0000	22	.0000	21	.0000	21	.011	28	.087	23	.28	9
1970	.0000	24	.0000	23	.0000	23	.0000	23	.0000	22	.0000	22	.0000	14	.063	20	.63	16
1971	.0000	25	.0000	24	.0000	24	.0000	24	.0000	23	.0000	23	.019	30	.048	17	.49	15
1972	.0000	26	.0000	25	.0000	25	.0000	25	.10	42	.69	42	1.02	41	1.38	40	18.0	46
1973	.0000	27	.0000	26	.001	41	.006	40	.035	37	.15	37	.12	35	1.23	39	17.4	45
1974	.0000	28	.0000	27	.0000	26	.0000	26	.0000	24	.0000	24	.0000	15	.0000	9	1.55	25
1975	.0000	29	.0000	28	.0000	27	.0000	27	.0000	25	.0000	25	.0000	16	.0000	10	.001	2
1976	.0000	30	.0000	29	.0000	28	.0000	28	.0000	26	.0000	26	.003	26	.060	19	22.7	48
1977	.0000	31	.0000	30	.0000	29	.0000	29	.0000	27	.0000	27	.0000	17	.0000	11	.26	6
1978	.0000	32	.0000	31	.0000	30	.0000	30	.0000	28	.0000	28	.0000	18	.031	15	1.14	22
1979	.0000	33	.0000	32	.0000	31	.0000	31	.0000	29	.11	36	.43	37	.82	36	1.50	24

Table E1.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05050000, Bois de Sioux River near White Rock, S. Dak.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1980	0.0000	34	0.0000	33	0.0000	32	0.061	43	0.091	41	1.18	46	4.63	49	7.85	49	14.3	41
1981	.0000	35	.0000	34	.0000	33	.0000	32	.0000	30	.002	35	.071	34	.13	27	.33	11
1982	.0000	36	.0000	35	.0000	34	.0000	33	.0000	31	.0000	29	.0000	19	.0000	12	.96	19
1983	.0000	37	.0000	36	.0000	35	.0000	34	.0000	32	.0000	30	.018	29	.10	25	.81	18
1984	.0000	38	.0000	37	.0000	36	.0000	35	.0000	33	.0000	31	.0000	20	.001	13	1.36	23
1985	.0000	39	.0000	38	.0000	37	.0000	36	.038	38	.16	38	10.1	53	32.8	52	11.2	52
1986	3.3	54	3.3	54	3.3	53	3.35	52	3.48	51	3.87	51	4.41	48	4.92	45	15.1	42
1987	.0000	40	.0000	39	.001	42	.011	41	.067	39	.19	39	.44	38	.74	34	15.8	43
1988	.0000	41	.0000	40	.0000	38	.0000	37	.0000	34	.0000	32	.002	25	.073	21	7.68	37
1989	.0000	42	.0000	41	.0000	39	.0000	38	.0000	35	.0000	33	.0000	21	.019	14	.37	12
1990	.0000	43	.0000	42	.0000	40	.0000	39	.0000	36	.0000	34	.90	40	2.77	42	4.90	31
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1992	.050	45	.087	45	.11	46	.16	46	.24	45	.69	43	.74	39	.76	35	2.99	27
1993	.030	44	.030	44	.030	43	.045	42	.082	40	1.87	47	2.79	44	3.31	43	16.2	44
1994	1.30	52	1.50	52	2.44	52	3.36	53	5.63	54	6.25	54	6.38	52	6.68	48	127	53
1995	1.90	53	3.03	53	3.87	54	4.21	54	4.35	53	4.73	53	5.28	50	5.69	46	58.2	51
1996	.18	47	.22	48	.24	47	.24	47	.47	47	2.27	48	3.41	45	39.3	54	211	54

Table E1.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05050000, Bois de Sioux River near White Rock, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1942	835	23	781	24	763	23	752	22	638	21	454	22	372	20	309	22	204	22
1943	1,080	10	1,080	9	1,063	10	1,018	10	950	9	864	8	716	9	576	10	386	10
1944	1,080	11	1,080	10	1,044	11	939	13	652	20	454	21	368	21	312	20	209	21
1945	875	21	842	22	754	24	500	26	375	27	212	28	210	26	163	27	108	28
1946	825	24	817	23	804	22	788	20	540	24	289	25	196	29	152	29	10	
1947	900	19	875	20	857	20	842	18	697	18	549	17	555	13	446	13	296	14
1948	1,000	13	1,000	13	1,000	13	977	12	802	13	586	16	418	19	316	19	214	20
1949	210	35	183	37	179	36	120	38	67.3	40	36.0	41	24.7	41	21.1	41	17.3	41
1950	945	15	906	18	878	18	855	16	751	16	695	14	550	14	419	15	281	15
1951	945	16	944	15	937	15	920	14	881	11	644	15	466	17	359	17	242	17
1952	1,090	9	1,080	11	1,067	9	1,047	9	1,010	8	997	7	796	7	630	7	423	7
1953	170	38	163	38	144	38	114	39	79.4	39	76.8	36	65.5	36	57.2	36	45.9	34
1954	27.0	50	13.7	53	11.1	52	9.65	51	7.19	51	6.06	51	6.11	50	5.29	49	4.06	48
1955	129	42	98.3	43	57.4	44	32.6	45	19.6	45	11.3	45	8.40	46	7.13	46	6.16	45
1956	70.0	45	56.3	45	33.0	46	22.5	47	13.2	47	8.25	49	5.94	51	4.54	51	4.02	49
1957	583	27	573	27	544	27	476	27	348	28	288	26	241	25	185	25	126	26
1958	410	32	409	31	389	32	329	32	234	32	142	33	103	33	80.2	32	57.3	32
1959	37.0	49	26.6	49	14.0	51	9.15	52	5.88	53	4.54	53	3.35	53	2.81	53	1.96	53
1960	123	43	119	42	117	40	104	40	80.0	38	74.4	37	56.3	37	46.2	37	30.4	37
1961	18.0	54	12.7	54	10.8	54	8.74	53	6.54	52	5.92	52	4.73	52	3.56	52	2.61	52
1962	1,600	2	1,587	2	1,563	2	1,511	2	1,366	2	1,183	3	998	4	853	3	629	3
1963	936	17	923	16	881	17	783	21	581	23	326	24	252	24	197	24	133	24
1964	206	36	205	35	199	35	180	35	153	35	107	35	76.1	35	58.3	35	38.5	36
1965	1,300	6	1,300	6	1,293	6	1,241	5	1,088	7	803	10	711	10	570	11	376	12
1966	895	20	880	19	870	19	826	19	779	15	714	13	506	15	393	16	271	16
1967	480	30	436	30	417	30	400	29	306	30	172	31	152	30	143	30	95.1	30
1968	38.0	47	29.3	47	20.1	49	13.6	50	11.4	50	8.21	50	6.38	49	4.93	50	3.25	51
1969	3,380	1	3,373	1	3,249	1	2,553	1	1,972	1	1,468	1	1,019	3	768	6	504	6
1970	38.0	48	29.3	48	25.0	47	23.9	46	16.7	46	11.0	46	8.08	47	6.44	47	4.23	47
1971	187	37	185	36	169	37	124	37	82.6	37	47.3	39	33.0	40	26.5	40	19.0	40
1972	755	25	738	25	721	25	716	23	679	19	461	20	420	18	324	18	235	18
1973	327	34	311	34	301	34	278	34	208	34	112	34	81.3	34	63.7	34	42.8	35
1974	23.0	52	19.0	51	16.3	50	13.7	49	11.5	49	9.27	48	9.57	45	7.73	45	5.15	46
1975	551	28	526	28	489	29	393	30	336	29	206	29	199	28	158	28	109	27
1976	434	31	404	32	394	31	373	31	275	31	190	30	129	31	96.9	31	63.5	31
1977	19.0	53	15.0	52	10.9	53	5.8	54	3.22	54	2.22	54	1.49	54	1.12	54	.74	54
1978	923	18	918	17	908	16	847	17	790	14	743	12	657	12	579	9	402	9
1979	1,020	12	1,013	12	1,003	12	981	11	941	10	822	9	709	11	566	12	385	11

Table E1.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05050000, Bois de Sioux River near White Rock, S. Dak.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1980	165	39	150	39	111	41	85.7	41	66.4	41	43.9	40	39.2	39	39.5	38	29.7	38
1981	24.0	51	22.3	50	21.0	48	17.2	48	13.1	48	9.42	47	6.74	48	5.53	48	3.73	50
1982	346	33	323	33	307	33	284	33	209	33	151	32	104	32	78.9	33	51.9	33
1983	64.0	46	55.7	46	51.0	45	42.3	43	28.3	43	15.8	44	10.6	44	8.35	44	6.35	44
1984	972	14	963	14	951	14	884	15	728	17	519	18	491	16	440	14	307	13
1985	852	22	850	21	842	21	714	24	504	25	335	23	359	22	311	21	215	19
1986	1,390	4	1,390	4	1,344	4	1,243	4	1,168	6	1,118	6	1,047	2	926	1	642	2
1987	532	29	522	29	500	28	460	28	380	26	253	27	202	27	167	26	127	25
1988	148	40	127	41	103	42	66.1	42	43.2	42	26.9	42	18.9	42	13.4	42	11.6	42
1989	689	26	679	26	673	26	661	25	624	22	478	19	337	23	254	23	180	23
1990	81.0	44	78.7	44	58.6	43	41.5	44	23.1	44	17.2	43	14.1	43	12.6	43	8.78	43
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1992	138	41	134	40	132	39	128	36	114	36	59.7	38	41.8	38	32.4	39	24.3	39
1993	1,290	7	1,277	7	1,256	7	1,209	7	1,188	4	1,126	5	991	5	812	5	675	1
1994	1,420	3	1,403	3	1,349	3	1,235	6	1,181	5	1,133	4	926	6	850	4	620	4
1995	1,340	5	1,333	5	1,316	5	1,293	3	1,277	3	1,257	2	1,101	1	859	2	582	5
1996	1,210	8	1,150	8	1,123	8	1,057	8	856	12	783	11	741	8	607	8	402	8

Table E2.1. Mean flow, in cubic feet per second, for station 05051650, LaBelle Creek near Veblen, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1986													
1987													
1988	--	--	--	--	--	--	--	--	--	--	--	--	--
1989	2.59	--	--	2.51	2.74	--	3.35	2.80	2.79	--	2.79	--	--
1990	3.39	--	5.44	3.02	--	--	--	--	--	--	5.05	5.97	--
1991	--	--	--	--	--	--	--	--	--	--	--	8.98	--
1992	4.45	3.10	3.10	--	--	--	--	--	--	--	--	--	--
1993	--	--	--	--	--	--	--	--	--	--	--	--	--
1994	--	--	--	--	--	--	--	--	--	--	--	--	--
1995													
1996													

Table E2.2. Statistics on mean flow, in cubic feet per second, for station 05051650, LaBelle Creek near Veblen, S. Dak. (October 1988 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	9	9	9	9	9	9	9	9	9	9	9	9	9
Maximum	2.27	1.16	.701	.548	3.26	22.4	13.9	15.1	6.46	14.1	7.42	.771	4.29
Percentile													
75th	.331	.321	.147	.064	.632	12.1	12.0	7.26	3.28	2.92	.422	.238	3.71
50th	.000	.000	.000	.005	.293	3.13	1.53	1.18	2.29	1.83	.072	.086	.854
25th	.000	.000	.000	.000	.003	.646	.475	.141	.078	.010	.002	.000	.421
Minimum	.000	.000	.000	.000	.000	.217	.264	.091	.001	.000	.000	.000	.056
Mean	0.33	0.22	0.11	0.08	0.59	6.67	5.23	3.80	2.01	2.65	0.96	0.16	1.91
Standard deviation	0.75	0.38	0.23	0.18	1.04	7.64	5.83	5.19	2.18	4.47	2.43	0.25	1.75
Skewness	2.75	2.32	2.61	2.82	2.65	1.26	0.67	1.57	1.00	2.57	2.97	2.24	0.38
Coefficient of variation	2.29	1.77	2.00	2.35	1.77	1.15	1.11	1.37	1.09	1.69	2.52	1.52	0.91
Percent of annual flow	1.43	0.95	0.50	0.34	2.57	29.25	22.95	16.65	8.81	11.62	4.22	0.71	100

Table E2.3. Serial correlation for 1-year lag for monthly and annual mean flows for station 05051650, LaBelle Creek near Veblen, S. Dak. (October 1988 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.985	0.922	0.078	-0.119	0.715	0.652	0.401	0.996	0.076	-0.042	-0.184	0.063	0.613

Table E2.4. Correlation matrix for monthly mean flow for station 05051650, LaBelle Creek near Veblen, S. Dak. (October 1988 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	0.981	0.150	0.113	0.987	0.356	-0.111	0.915	0.040	-0.217	-0.177	-0.235
Nov.	*	1.000	0.291	0.238	0.960	0.502	0.077	0.969	0.091	-0.112	-0.090	-0.132
Dec.	*	*	1.000	0.987	0.140	0.577	0.623	0.401	-0.252	-0.057	-0.143	-0.104
Jan.	*	*	*	1.000	0.109	0.442	0.542	0.320	-0.288	-0.087	-0.162	-0.145
Feb.	*	*	*	*	1.000	0.325	-0.168	0.886	0.037	-0.257	-0.228	-0.251
Mar.	*	*	*	*	*	1.000	0.740	0.696	0.087	0.130	0.043	0.179
Apr.	*	*	*	*	*	*	1.000	0.261	0.265	0.560	0.499	0.588
May.	*	*	*	*	*	*	*	1.000	0.072	-0.088	-0.095	-0.096
Jun.	*	*	*	*	*	*	*	*	1.000	0.856	0.785	0.867
Jul.	*	*	*	*	*	*	*	*	*	1.000	0.971	0.970
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	0.935
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E2.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05051650, LaBelle Creek near Veblen, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1986	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1987	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1988	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.062	2
1989	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.58	5
1990	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.040	1
1991	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.076	3
1992	.0000	5	.0000	5	.0000	5	.0000	5	.0000	5	.0000	5	.0000	5	.0000	5	.076	3
1993	.0000	6	.0000	6	.0000	6	.0000	6	.0000	6	.008	7	.013	6	.028	6	1.36	6
1994	.0000	7	.0000	7	.0000	7	.001	8	.024	9	.061	9	.38	9	.43	8	2.86	8
1995	.0000	8	.0007	9	.010	9	.016	9	.018	8	.049	8	.090	8	.16	7	4.14	9
1996	.0000	9	.0000	8	.0000	8	.0000	7	.0000	7	.001	6	.029	7	.47	9	2.68	7

Table E2.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05051650, LaBelle Creek near Veblen, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1986	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1987	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1988	3.50	8	2.83	8	1.96	7	1.58	8	1.17	8	0.76	8	0.53	8	0.41	8	0.27	8
1989	20.0	6	18.3	5	13.7	5	11.9	5	7.79	5	4.69	5	3.34	5	2.51	5	1.70	5
1990	.77	9	.50	9	.47	9	.40	9	.33	9	.227	9	.22	9	.17	9	.11	9
1991	29.0	5	15.1	6	9.59	6	8.43	6	5.45	6	3.37	6	2.35	6	1.96	6	1.41	6
1992	13.0	7	11.6	7	9.40	7	6.75	7	4.71	7	2.53	7	1.83	7	1.56	7	1.37	7
1993	81.0	3	51.0	4	35.9	4	27.0	4	18.9	3	12.3	3	9.54	3	9.99	2	8.51	1
1994	75.0	4	53.3	3	36.7	3	28.3	2	21.0	2	16.3	2	11.5	2	8.78	3	6.11	1
1995	200	1	130	1	72.9	1	41.7	1	26.5	1	18.5	1	14.8	1	11.9	1	8.16	2
1996	150	2	80.3	2	46.9	2	27.2	3	16.0	4	8.92	4	9.53	4	7.94	4	5.39	4

Table E3.1. Mean flow, in cubic feet per second, for station 05289985, Big Coulee Creek near Peever, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1988	0.000	0.000	0.000	0.000	0.85	5.28	1.71	1.09	0.013	0.000	0.000	0.000	0.748
1989	.000	.000	.000	.000	.000	11.8	12.0	2.76	.059	.000	.003	1.19	2.32
1990	.19	.22	.000	.000	.000	3.48	1.52	1.30	.79	.008	.002	.000	.630
1991	.002	.018	.023	.000	.000	1.42	3.61	3.99	11.1	7.85	3.58	2.52	2.85
1992	1.64	.55	.49	.67	2.9	6.59	2.41	1.25	4.09	2.31	.37	2.91	2.17
1993	.34	1.61	.53	.059	.74	10.2	12.6	6.37	7.38	16.6	3.69	.82	5.11
1994	2.70	3.69	1.29	.026	1.36	20.1	10.4	6.55	6.84	2.84	.57	2.10	4.90
1995	3.76	1.18	.68	.75	1.53	23.4	16.2	19.0	8378	2.85	3.24	.37	6.86
1996	4.48	2.24	1.24	.82	5.60	21.3	21.0	8.53	3.62	4.63	2.85	.59	6.41

Table E3.2. Statistics on mean flow, in cubic feet per second, for station 05289985, Big Coulee Creek near Peever, S. Dak. (October 1988 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	9	9	9	9	9	9	9	9	9	9	9	9	9
Maximum	4.48	3.69	1.29	.819	5.60	23.4	21.0	19.0	11.1	16.6	3.69	2.91	6.86
Percentile													
75th	3.23	1.92	.960	.708	2.22	20.7	14.4	7.54	8.08	6.24	3.41	2.31	5.76
50th	.340	.547	.488	.026	.847	10.2	10.4	3.99	4.09	2.84	.573	.825	2.85
25th	.001	.009	.000	.000	.000	4.38	2.06	1.27	.424	.004	.002	.187	1.46
Minimum	.000	.000	.000	.000	.000	1.42	1.52	1.09	.013	.000	.000	.000	0.630
Mean	1.46	1.06	0.47	.26	1.44	11.51	9.05	5.65	4.74	4.12	1.59	1.17	3.56
Standard deviation	1.78	1.27	0.52	0.37	1.82	8.23	7.08	5.68	4.03	5.33	1.69	1.09	2.34
Skewness	0.83	1.25	0.68	0.89	1.74	0.39	0.39	1.85	0.19	1.88	0.29	0.57	0.17
Coefficient of variation	1.22	1.20	1.10	1.43	1.26	0.72	0.78	1.01	0.85	1.29	1.06	0.93	0.66
Percent of annual flow	3.43	2.49	1.11	0.61	3.39	27.07	21.29	13.29	11.15	9.69	3.74	2.75	100.01

Table E3.3. Serial correlation for 1-year lag for monthly mean flow for station 05289985, Big Coulee Creek near Peever, S. Dak. (October 1988 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.775	0.451	0.629	0.279	0.192	0.748	0.421	0.372	0.160	-0.117	-0.224	-0.065	0.720

Table E3.4. Correlation matrix for monthly mean flow for station 05289985, Big Coulee Creek near Peever, S. Dak. (October 1988 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	0.668	0.861	0.821	0.797	0.870	0.725	0.715	0.261	-0.072	0.314	-0.034
Nov.	*	1.000	0.937	0.220	0.456	0.728	0.562	0.403	0.321	0.243	0.199	0.124
Dec.	*	*	1.000	0.534	0.713	0.815	0.675	0.506	0.315	0.177	0.275	0.143
Jan.	*	*	*	1.000	0.821	0.570	0.526	0.569	0.159	-0.066	0.313	0.030
Feb.	*	*	*	*	1.000	0.563	0.551	0.262	-0.020	-0.005	0.198	0.040
Mar.	*	*	*	*	*	1.000	0.865	0.788	0.190	-0.025	0.257	-0.169
Apr.	*	*	*	*	*	*	1.000	0.713	0.211	0.266	0.514	-0.226
May.	*	*	*	*	*	*	*	1.000	0.542	0.176	0.614	-0.226
Jun.	*	*	*	*	*	*	*	*	1.000	0.608	0.797	0.455
Jul.	*	*	*	*	*	*	*	*	*	1.000	0.769	0.143
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	0.037
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E3.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05289985, Big Coulee Creek near Peever, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days															
	1		3		7		14		30		60		90		120		183	
1988	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.47	2
1989	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	.0000	2	2.10	4
1990	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.0000	3	.014	4	.60	3
1991	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.0000	4	.004	7	.010	3	.26	1
1992	.0000	5	.0000	5	.001	8	.014	8	.11	8	.49	7	.54	6	.67	6	2.14	5
1993	.020	9	.027	9	.030	9	.032	9	.044	6	.26	6	.43	5	.64	5	2.38	6
1994	.0000	6	.0000	6	.0000	5	.0000	5	.0000	5	.096	5	.69	8	1.54	8	4.86	7
1995	.0000	7	.0000	7	.0000	6	.0000	6	.25	9	.66	8	.62	7	.83	7	5.33	8
1996	.0000	8	.0000	8	.0000	7	.0000	7	.091	7	.85	9	1.03	9	1.79	9	5.96	9

Table E3.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05289985, Big Coulee Creek near Peever, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1988	10.0	9	8.67	9	7.71	9	7.33	8	5.88	8	3.92	8	2.99	8	2.28	8	1.50	8
1989	75.0	5	58.3	4	43.6	3	31.1	3	19.4	4	12.9	4	9.01	5	6.76	6	4.55	6
1990	20.0	8	15.0	8	9.29	8	6.13	9	4.05	9	2.75	9	2.24	9	1.81	9	1.19	9
1991	118	3	53.3	5	25.9	6	18.2	6	11.5	6	10.2	6	8.05	6	7.14	5	5.56	5
1992	30.0	7	20.7	7	14.0	7	11.1	7	8.41	7	5.45	7	4.21	7	4.11	7	3.27	7
1993	170	2	69.7	3	33.7	4	25.3	4	17.8	5	12.7	5	10.5	4	12.0	3	9.55	3
1994	65.0	6	46.7	6	30.7	5	22.2	5	21.0	3	15.6	3	12.5	3	11.3	4	8.11	4
1995	250	1	140	1	70.9	1	38.3	2	27.4	2	23.7	1	20.5	1	17.5	1	12.3	1
1996	110	4	83.3	2	51.4	2	39.0	1	32.4	1	22.6	2	17.8	2	14.7	2	11.1	2

Table E4.1. Mean flow, in cubic feet per second, for station 05290000, Little Minnesota River near Peever, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1940	.21	.25	.10	.000	.000	26.8	70.4	13.3	1.27	.16	.31	.33	9.38
1941	.61	.65	.21	.36	.43	32.2	87.3	15.6	130	19.2	7.21	5.91	24.8
1942	3.41	3.38	2.11	1.33	.70	16.6	48.3	472	355	40.0	29.7	34.2	84.3
1943	40.7	32.4	5.05	3.36	10.1	573	448	65.5	305	132	16.9	5.09	137
1944	3.75	8.30	9.94	2.80	3.66	57.4	184	165	192	89.1	10.5	5.93	60.9
1945	3.50	5.81	4.30	1.24	.62	276	100	39.5	217	30.4	17.1	2.57	58.4
1946	2.38	3.86	2.74	.84	.57	384	139	28.8	14.4	56.4	3.69	2.55	53.9
1947	20.1	12.5	7.97	4.25	3.33	14.2	729	120	104	16.4	1.90	.66	85.5
1948	.99	5.69	1.96	1.79	1.82	253	216	46.5	24.8	24.7	5.28	1.55	48.7
1949	1.39	3.80	2.72	.78	.30	62.8	111	20.8	4.11	8.22	.36	.34	18.0
1950	.60	.56	.26	.10	.046	108	401	156	14.9	10.1	4.00	.83	58.0
1951	.84	1.00	.90	.85	10.2	16.4	318	45.5	51.4	25.9	4.92	2.03	39.5
1952	4.65	7.75	5.31	2.66	2.7	3.76	1,321	75.5	16.8	9.44	.87	.63	119
1953	.57	.81	.82	.64	.59	30.5	51.8	87.3	163	29.7	29.3	2.3	33.1
1954	.93	2.07	1.42	.18	7.08	25.1	66.1	126	107	10.6	1.73	2.36	29.3
1955	3.23	3.58	2.30	.74	.27	32.4	50.9	6.74	6.69	4.09	.75	.33	9.34
1956	.67	.61	.34	.46	.31	.51	63.7	32.6	12.2	1.67	5.86	.62	9.91
1957	.58	1.26	.78	.27	.83	55.9	74.3	148	109	20.5	13.4	33.7	38.3
1958	24.5	34.7	10.8	2.78	11.9	91.1	221	40.6	10.9	4.62	.33	.32	37.7
1959	.51	1.65	.28	.010	.018	23.5	12.2	3.99	18.7	9.42	.23	.080	5.91
1960	.32	.45	.63	.62	.43	101	259	27.4	19.5	10.9	.69	.67	35.0
1961	.76	.98	.44	.33	.81	19.6	8.78	22.7	2.37	1.54	.22	.29	4.96
1962	.39	.38	.45	.92	1.09	74.9	443	531	277	430	52.1	7.71	153
1963	6.83	7.79	5.16	1.13	.25	32.2	34.0	21.3	45.5	4.33	3.80	.92	13.6
1964	.76	1.71	.87	.58	.68	4.36	134	37.1	3.21	.92	.45	.40	15.3
1965	.40	.56	.43	.34	.24	1.38	283	259	214	17.4	3.95	3.46	65.2
1966	9.73	5.26	3.34	1.94	1.32	297	98	74.8	7.31	1.54	3.54	.98	42.6
1967	1.27	2.11	1.58	1.18	1.03	103	106	63.9	58.0	15.5	3.87	.48	29.9
1968	.78	1.19	.67	.33	.48	2.47	30.2	51.3	16.0	2.15	.45	.67	8.91
1969	2.04	3.10	2.22	1.40	.96	.84	936	132	19.4	8.42	1.25	.41	91.5
1970	.64	.80	.74	.72	.73	23.1	101	37.5	22.7	2.55	.83	.31	15.9
1971	.40	1.58	.37	.071	.39	96.5	39.2	9.74	56.1	66.6	2.17	1.16	23.0
1972	2.78	14.1	7.13	1.32	.99	322	128	284	72.2	17.2	9.91	1.53	72.3
1973	2.19	6.10	4.35	2.36	5.82	104	36.2	47.0	17.0	.98	.14	.57	19.1
1974	.79	1.10	1.64	.56	.40	41.6	41.9	22.6	4.71	.33	.32	.15	9.73
1975	.49	.57	.56	.51	.53	1.13	102	67.6	58.9	8.15	.27	.18	20.0
1976	.87	.65	.63	.53	21.8	250	53.5	5.82	.41	.041	.059	.074	28.1
1977	.31	.27	.23	.052	.061	34.1	23.1	7.06	4.35	.47	.11	.26	5.90

Table E4.1. Mean flow, in cubic feet per second, for station 05290000, Little Minnesota River near Peever, S. Dak.—Continued

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1978	2.27	3.51	3.21	2.35	1.36	410	501	112	45.5	166	12.3	2.86	106
1979	.93	1.45	1.00	.44	.44	26.5	623	98.4	213	58.2	14.3	1.43	86.0
1980	3.30	5.08	2.79	1.31	.76	121	95.0	8.77	6.47	.97	.39	.24	20.5
1981	.29	.51	.48	.12	.38	3.50	2.89	2.20	3.28	2.08	.52	.19	1.37
1990	2.27	2.77	1.02	.41	.51	39.1	9.06	12.3	6.75	1.55	.44	.31	6.44
1991	.45	.60	.67	.63	.70	24.6	16.4	37.5	184	285	89.5	30.3	56.4
1992	9.43	9.94	4.59	4.21	8.23	80.0	38.7	16.0	53.4	62.9	5.55	2.14	22.1
1993	1.03	6.84	3.35	1.02	2.71	69.7	287	107	142	865	235	43.3	148
1994	20.5	17.4	18.2	11.4	9.88	451	262	238	33.5	76.6	9.48	5.19	97.0
1995	11.0	9.44	8.44	5.80	5.65	477	305	327	140	40.8	17.4	7.61	114
1996	73.9	36.6	7.62	4.30	6.52	56.1	382	264	91.1	41.3	13.6	2.37	81.5

Table E4.2. Statistics on mean flow, in cubic feet per second, for station 05290000, Little Minnesota River near Peever, S. Dak. (October 1940 through September 1981, and October 1990 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	50	50	49	49	49	49	49	49	49	49	49	49	49
Maximum	73.9	36.6	18.2	11.4	21.8	572.9	1,321	531.5	354.9	864.8	235.2	43.3	152.6
Percentile													
75th	3.43	6.28	4.32	1.87	3.02	106.3	284.9	123.3	119.3	41.0	11.4	2.71	76.9
50th	.960	2.09	1.58	.777	.727	41.6	100.6	46.5	33.5	10.9	3.69	.920	35.0
25th	.593	.653	.595	.368	.412	21.4	45.1	21.0	9.10	2.12	.444	.330	15.6
Minimum	.210	.250	.100	.000	.000	.510	2.89	2.20	.411	.041	.059	.074	1.37
Mean	5.44	5.48	2.92	1.48	2.67	108.60	205.97	94.60	75.03	55.78	13.00	4.46	48.04
Standard deviation	12.41	8.38	3.54	1.95	4.22	144.81	258.71	116.98	89.56	140.44	35.84	9.61	40.69
Skewness	4.17	2.70	2.25	3.21	2.61	1.75	2.45	2.16	1.46	4.64	5.39	3.06	1.01
Coefficient of variation	2.28	1.53	1.21	1.32	1.58	1.33	1.26	1.24	1.19	2.52	2.76	2.16	0.85
Percent of annual flow	0.94	0.95	0.51	0.26	0.46	18.87	35.79	16.44	13.04	9.69	2.26	0.78	99.99

Table E4.3. Serial correlation for 1-year lag for monthly and annual mean flows for station 05290000, Little Minnesota River near Peever, S. Dak. (October 1940 through September 1981, and October 1990 through September 1996)

Month													Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.099	0.096	0.250	0.325	-0.077	0.047	-0.006	-0.031	0.227	0.028	-0.035	-0.012	0.100

Table E4.4. Correlation matrix fro monthly mean flow for station 05290000, Little Minnesota River near Peever, S Dak. (October 1940 through September 1981, and October 1990 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	0.890	0.541	0.547	0.390	0.282	0.228	0.213	0.162	-0.011	-0.030	-0.054
Nov.	*	1.000	0.710	0.596	0.474	0.396	0.236	0.180	0.155	0.041	0.019	-0.032
Dec.	*	*	1.000	0.895	0.416	0.469	0.246	0.286	0.067	0.034	0.008	-0.011
Jan.	*	*	*	1.000	0.439	0.528	0.285	0.325	0.082	0.041	-0.009	-0.004
Feb.	*	*	*	*	1.000	0.347	0.076	0.016	0.002	0.006	-0.028	-0.057
Mar.	*	*	*	*	*	1.000	0.069	0.168	0.131	0.073	-0.007	-0.037
Apr.	*	*	*	*	*	*	1.000	0.258	0.131	0.122	0.040	-0.065
May.	*	*	*	*	*	*	*	1.000	0.622	0.272	0.195	0.360
Jun.	*	*	*	*	*	*	*	*	1.000	0.381	0.365	0.515
Jul.	*	*	*	*	*	*	*	*	*	1.000	0.945	0.659
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	0.761
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E4.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05290000, Little Minnesota River near Peever, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1940	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.033	1	0.062	1	4.63	12
1941	.10	17	.10	17	.10	16	.11	16	.18	16	.26	13	.32	9	.38	8	6.64	21
1942	.0000	2	.0000	2	.029	8	.00	22	.70	38	1.02	36	1.21	31	1.67	29	4.98	14
1943	1.50	46	1.53	46	1.61	46	1.87	46	2.19	46	3.32	45	4.90	46	7.27	47	125	49
1944	2.00	47	2.00	47	2.00	47	2.11	47	2.40	47	2.79	44	4.53	44	5.97	44	14.5	29
1945	.20	25	.27	30	.30	30	.44	34	.64	36	.94	35	2.03	38	3.01	37	50.0	44
1946	.50	39	.50	39	.50	38	.55	37	.57	34	.72	31	1.38	34	2.01	32	40.7	42
1947	.50	40	.57	42	.59	40	.60	38	.66	37	1.25	40	4.38	43	5.44	42	10.8	27
1948	.10	18	.10	18	.10	17	.12	18	.31	23	1.14	38	1.45	35	2.02	33	44.8	43
1949	.10	19	.10	19	.14	21	.16	19	.21	17	.34	20	1.25	32	1.92	31	13.8	28
1950	.0000	3	.0000	3	.0000	2	.014	5	.040	5	.070	5	.12	5	.23	4	21.9	38
1951	.40	35	.47	38	.56	39	.62	39	.71	39	.80	34	.86	26	.86	21	6.58	20
1952	.40	36	.40	35	.44	36	.51	36	.63	35	.75	32	2.71	42	3.42	39	4.47	9
1953	.40	37	.40	36	.44	37	.49	35	.56	33	.61	30	.68	24	.71	18	6.03	17
1954	.0000	4	.0000	4	.014	7	.079	11	.16	15	.36	22	1.19	30	1.11	24	6.34	18
1955	.20	26	.20	23	.20	22	.24	23	.26	21	.41	25	.91	28	1.52	28	7.77	22
1956	.30	33	.30	32	.30	31	.30	29	.30	22	.32	17	.37	11	.36	6	.48	1
1957	.0000	5	.0000	5	.029	9	.079	12	.15	13	.28	15	.53	19	.69	17	10.4	26
1958	.20	27	.20	24	.24	27	.28	26	.31	25	.32	18	1.73	36	3.90	41	29.9	39
1959	.0000	6	.0000	6	.0000	3	.0000	2	.0000	2	.013	2	.11	3	.49	10	4.54	10
1960	.10	20	.10	20	.10	18	.11	15	.21	18	.33	19	.45	15	.49	9	17.6	34
1961	.10	21	.10	21	.10	19	.10	14	.16	14	325	12	.39	13	.54	14	3.93	8
1962	.20	28	.20	25	.24	28	.28	27	.33	27	.34	21	.40	14	.52	11	16.1	31
1963	.0000	7	.0000	7	.043	11	.071	10	.14	11	.21	9	.90	27	2.45	35	9.36	24
1964	.20	29	.20	26	.20	23	.29	28	.36	28	.41	26	.56	21	.91	22	1.50	6
1965	.20	30	.20	27	.20	24	.20	21	.23	19	.28	14	.32	10	.38	7	.57	2
1966	.50	41	.53	40	.60	41	.66	40	.85	41	1.65	42	2.00	37	2.91	36	31.0	40
1967	.20	31	.30	33	.36	34	.43	33	.48	32	1.11	37	1.27	33	1.48	27	19.7	37
1968	.0000	8	.0000	8	.0000	4	.021	6	.14	12	.39	24	.37	12	.54	13	.99	5
1969	.30	34	.30	34	.30	32	.37	31	.41	29	.79	33	1.06	29	1.34	26	1.76	7
1970	.080	16	.087	16	.13	20	.18	20	.31	26	.55	29	.72	25	.72	20	4.59	11
1971	.050	12	.050	12	.050	12	.050	7	.050	6	.091	6	.26	6	.58	15	17.4	33
1972	.57	43	.59	43	.67	43	.72	41	.77	40	1.16	39	2.55	41	5.48	43	59.0	45
1973	.050	13	.060	14	.063	14	.080	13	.13	9	.22	10	.50	16	3.73	40	17.0	32
1974	.060	15	.063	15	.077	15	.12	17	.14	10	.23	11	.26	7	.93	23	7.86	23
1975	.030	11	.030	11	.041	10	.059	9	.093	8	.21	8	.52	18	.53	12	.63	3
1976	.0000	9	.0000	9	.004	6	.005	4	.025	4	.039	3	.056	2	.13	2	9.85	25
1977	.0000	10	.0000	10	.0000	5	.0000	3	.004	3	.055	4	.12	4	.16	3	5.84	16

Table E4.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05290000, Little Minnesota River near Peever, S. Dak.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1978	0.22	32	0.28	31	0.36	33	1.30	44	1.30	43	1.69	43	2.09	39	2.28	34	80.0	46
1979	.42	38	.42	37	.42	35	.42	32	.42	30	.45	27	.54	20	.72	19	6.40	19
1980	.17	23	.19	22	.22	26	.24	24	.24	20	.32	16	.52	17	1.79	30	18.4	35
1981	.050	14	.050	13	.050	13	.050	8	.051	7	.18	7	.29	8	.33	5	.93	4
1990	.16	22	.20	28	.22	25	.27	25	.31	24	.38	23	.60	23	1.11	25	5.07	15
1991	.19	24	.24	29	.28	29	.32	30	.45	31	.52	28	.58	22	.29	16	4.73	13
1992	.55	42	.56	41	.61	42	.73	42	2.14	45	3.67	46	4.88	45	6.27	45	14.5	30
1993	.66	44	.67	44	.74	44	.84	43	.97	42	1.60	41	2.20	40	3.07	38	18.4	36
1994	3.60	49	3.77	49	4.07	49	4.24	49	5.19	49	7.24	49	13.0	49	14.2	49	90.7	48
1995	3.50	48	3.50	48	3.59	48	3.93	48	4.33	48	5.77	48	6.50	48	7.26	46	89.5	47
1996	1.10	45	1.13	45	1.21	45	1.41	45	1.78	44	4.64	47	5.81	47	9.11	48	31.1	41

Table E4.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05290000, Little Minnesota River near Peever, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1940	320	33	280	35	199	35	144	37	94.6	39	55.4	39	37.6	40	28.3	40	18.6	42
1941	642	25	507	25	318	29	223	31	143	32	76.6	34	77.6	31	69.4	30	48.7	30
1942	1,990	9	1,463	10	950	10	602	15	554	10	419	9	297	11	235	11	165	10
1943	3,210	3	2,900	3	2,499	1	1,749	2	1,007	2	539	3	449	2	382	2	258	3
1944	443	29	411	28	327	28	258	29	219	25	191	22	183	18	164	16	116	15
1945	902	20	797	20	659	20	486	21	309	21	201	20	179	19	163	17	114	17
1946	980	18	927	16	832	16	704	11	478	13	273	15	189	17	149	19	105	19
1947	2,550	6	2,037	6	1,604	5	1,178	5	736	6	426	8	319	9	246	10	163	11
1948	1,200	15	1,083	14	886	12	659	14	433	15	258	16	176	20	140	20	95.4	20
1949	319	35	308	33	285	31	215	32	137	33	88.5	31	65.6	33	50.2	35	34.4	36
1950	950	19	933	15	871	14	712	10	481	12	323	13	226	15	172	15	115	16
1951	1,000	17	917	17	705	19	489	20	322	20	189	23	143	22	114	22	77.5	22
1952	4,400	2	3,253	2	2,389	3	1,931	1	1,323	1	699	1	471	1	357	3	235	4
1953	628	26	422	27	381	26	285	25	171	29	125	27	103	27	88.6	26	65.3	25
1954	1,190	16	639	23	427	25	285	26	177	28	124	28	102	28	82.5	29	57.0	28
1955	145	44	125	45	105	43	78.4	42	60.9	42	43.6	41	31.1	44	25.0	44	16.9	44
1956	203	42	184	39	153	39	103	40	66.5	40	50.3	40	36.5	41	27.8	42	19.4	40
1957	526	28	385	29	328	27	273	28	183	27	134	26	115	25	102	24	73.6	23
1958	531	27	511	24	458	23	331	24	231	24	158	24	122	24	94.3	25	63.3	26
1959	226	38	118	46	68.9	46	41.7	47	28.0	47	18.3	47	14.0	48	15.7	47	11.4	47
1960	774	23	710	22	495	22	460	22	341	18	192	21	134	23	106	23	69.5	24
1961	59.0	48	50.7	48	44.1	48	33.9	48	23.6	48	16.0	48	17.3	47	13.8	48	9.40	48
1962	2,440	7	2,080	5	1,360	7	972	8	690	7	519	5	444	3	440	1	303	1
1963	142	46	132	44	106	42	83.9	41	58.7	43	42.1	44	43.0	39	34.2	39	23.6	39
1964	213	40	202	38	179	38	156	35	136	34	86.8	32	59.2	35	45.1	37	29.8	38
1965	1,740	13	907	18	788	18	664	12	439	14	318	14	225	13	196	14	130	14
1966	1,300	14	1,147	13	866	15	534	17	331	19	213	19	161	21	122	21	81.1	21
1967	350	32	308	32	272	33	196	33	148	31	120	29	92.6	29	84.8	27	58.4	27
1968	145	45	137	42	111	41	75.8	43	66.5	41	43.6	42	33.1	43	25.9	43	17.1	43
1969	2,910	4	2,827	4	2,383	4	1,657	3	947	3	537	4	364	6	275	7	181	7
1970	263	37	225	36	187	36	146	36	114	36	69.6	37	54.4	37	46.5	36	31.1	37
1971	410	31	313	31	213	34	160	34	123	35	71.7	35	56.7	36	63.1	31	45.3	31
1972	1,910	11	1,360	12	920	11	600	16	368	17	250	17	264	12	207	12	140	13
1973	264	36	212	37	183	37	141	38	108	37	71.6	36	63.4	34	52.8	34	35.7	35
1974	220	39	149	41	105	44	71.0	44	45.3	45	42.5	43	36.0	42	28.3	41	18.7	41
1975	320	34	300	34	280	32	233	30	159	30	86.5	33	79.0	30	59.8	32	39.5	32
1976	2,260	8	1,440	11	883	13	507	19	290	23	158	25	112	26	84.8	28	55.8	29
1977	125	47	80.3	47	67.0	47	60.1	46	46.6	44	30.2	45	22.7	45	17.5	45	11.6	45

Table E4.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05290000, Little Minnesota River near Peever, S. Dak.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1978	1,920	10	1,573	8	1,407	6	1,169	6	820	5	504	6	356	7	308	6	209	6
1979	1,760	12	1,560	9	1,250	9	1,009	7	633	8	367	11	311	10	253	8	171	9
1980	420	30	358	30	301	30	282	27	204	26	113	30	77.6	32	58.8	33	38.9	33
1981	13.0	49	8.77	49	7.01	49	5.61	49	4.79	49	3.26	49	2.95	49	2.99	49	2.45	49
1990	173	43	136	43	99.7	45	69.2	45	41.6	46	26.2	46	20.9	46	17.3	46	11.6	46
1991	712	24	481	26	452	24	385	23	292	22	249	18	190	16	152	18	109	18
1992	204	41	179	40	150	40	112	39	99.0	38	60.6	38	43.4	38	43.4	38	38.6	34
1993	5,400	1	4,137	1	2,399	2	1,432	4	924	4	601	2	426	4	355	4	291	2
1994	856	21	839	19	821	17	663	13	498	11	393	10	326	8	252	9	180	8
1995	2,700	5	1,987	7	1,267	8	782	9	580	9	436	7	393	5	322	5	219	5
1996	807	22	761	21	645	21	527	18	383	16	324	12	253	14	203	13	141	12

Table E5.1. Mean flow, in cubic feet per second, for station 05291000, Whetstone River near Big Stone City, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1931	--	--	--	--	--	--	7.27	50.2	20.5	1.62	0.92	0.45	--
1932	0.60	1.40	1.30	1.40	32.0	21.6	30.1	13.3	8.25	1.54	.60	.40	9.24
1933	2.06	1.20	.60	.30	2.60	7.48	4.28	5.25	5.02	.35	.57	.41	2.51
1934	.94	1.04	.60	.000	.000	3.51	3.63	.77	6.62	.035	.000	1.18	1.52
1935	.70	.40	.20	.000	2.10	65.7	13.0	16.2	44.0	5.69	3.79	.36	12.8
1936	.73	1.42	2.00	1.00	.000	122	30.3	12.4	1.42	.087	.29	.36	14.5
1937	.93	.94	.40	.000	.000	86.7	372	301	56.8	5.06	30.9	4.51	71.8
1938	2.59	3.00	3.00	1.50	4.42	60.0	10.8	18.8	9.33	5.18	.88	2.16	10.2
1939	2.16	2.21	1.50	1.50	1.00	152	20.7	5.25	10.6	5.60	1.15	.67	17.2
1940	1.04	1.61	1.64	.31	.40	70.7	116	11.4	2.87	1.03	1.80	1.30	17.4
1941	1.48	2.24	1.80	1.91	2.30	56.2	110	12.3	9.60	5.15	2.12	8.07	17.7
1942	3.92	3.48	3.61	3.01	2.89	17.2	31.5	444	394	37.7	32.6	65.7	86.9
1943	33.2	22.3	8.06	5.18	66.0	494	212	47.7	345	53.5	19.1	9.27	110
1944	10.3	10.6	9.06	12.6	11.0	92.9	212	173	166	72.8	15.6	10.7	66.4
1945	9.26	13.4	10.3	4.57	6.88	206	60.5	45.6	345	44.5	22.8	7.62	64.8
1946	7.09	9.90	5.85	2.98	3.52	394	97.3	40.8	44.9	89.2	11.8	11.3	60.6
1947	50.5	36.5	16.8	11.5	6.38	51.8	788	106	78.1	19.2	5.42	4.71	97.3
1948	8.15	9.88	6.06	5.62	4.84	442	179	51.5	43.0	56.6	19.1	9.38	70.0
1949	8.70	13.1	6.83	3.53	3.43	84.9	65.6	22.9	6.07	32.9	3.14	2.40	21.3
1950	5.55	6.00	4.37	1.60	2.00	125	216	68.0	6.64	3.35	3.72	1.73	37.0
1951	2.96	3.58	2.55	.51	4.06	25.7	286	30.2	36.4	21.0	7.66	6.23	35.3
1952	9.36	14.5	14.0	3.97	5.03	6.68	1,386	83.3	78.0	36.3	6.39	3.10	135
1953	3.26	6.19	3.58	2.37	2.79	117	103	119	204	80.5	48.4	8.88	58.4
1954	6.26	9.57	7.55	3.21	16.3	96.1	116	94.6	241	21.8	10.4	7.64	52.4
1955	11.1	10.4	7.66	5.03	5.15	108	43.8	12.7	9.49	5.92	5.02	3.06	19.1
1956	4.05	3.53	1.74	1.77	2.96	8.89	102	19.6	32.6	12.6	24.7	4.29	18.1
1957	3.57	6.02	3.32	1.13	1.41	73.6	124	412	163	24.3	30.4	57.2	75.5
1958	70.5	77.9	32.4	13.7	29.1	119	224	41.4	21.1	13.4	4.83	3.74	54.2
1959	4.12	7.43	2.38	1.38	1.30	23.7	14.7	9.12	10.1	1.68	.87	.88	6.50
1960	1.91	3.67	6.70	3.92	3.17	88.7	245	17.4	20.0	5.62	4.34	3.18	33.5
1961	3.34	5.97	2.78	2.79	4.29	27.2	14.5	45.1	6.79	3.03	.94	1.09	9.89
1962	1.65	2.66	4.34	3.47	3.21	223	356	388	390	454	46.6	13.9	158
1963	9.89	14.2	10.4	3.98	3.09	37.2	36.0	40.7	72.4	145	32.3	13.2	35.1
1964	8.11	8.48	5.60	4.40	6.53	14.9	150	30.4	5.70	3.35	3.38	2.23	20.1
1965	2.66	4.68	3.78	2.54	1.96	2.92	421	140	53.7	18.4	4.91	5.15	54.8
1966	9.99	6.05	4.86	3.43	12.8	367	66.4	64.5	13.0	4.39	18.3	4.82	48.6
1967	7.41	7.18	6.29	5.28	5.02	117	70.0	33.8	49.5	8.81	3.54	2.00	26.4
1968	3.45	5.06	2.80	.31	2.32	10.8	24.1	16.4	8.71	4.24	2.32	2.74	6.93

Table E5.1. Mean flow, in cubic feet per second, for station 05291000, Whetstone River near Big Stone City, S. Dak.—Continued

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1969	2.42	4.50	4.94	4.26	1.85	2.85	1,001	162	25.9	29.5	7.36	3.73	103
1970	5.77	6.49	5.43	5.04	4.43	143	149	34.1	41.7	5.86	3.45	3.46	34.0
1971	4.42	12.4	5.85	4.02	7.08	175	30.2	17.3	145	137	5.94	5.63	46.1
1972	27.1	78.3	43.3	18.9	11.3	462	238	491	148	113	38.6	10.8	141
1973	14.1	29.7	18.3	13.7	37.6	286	73.0	230	42.7	8.30	5.12	4.59	64.1
1974	6.24	7.81	7.67	8.37	10.1	83.7	60.7	23.4	9.77	2.88	3.09	2.16	18.9
1975	2.49	4.57	4.18	1.85	2.10	17.9	212	56.6	15.5	3.29	1.86	2.09	26.9
1976	3.04	5.88	4.70	9.49	19.8	128	34.2	6.85	2.49	.65	.24	.57	17.7
1977	1.28	1.93	1.14	1.17	2.47	132	64.0	15.8	4.53	2.09	3.70	4.96	19.7
1978	16.0	24.1	19.9	9.15	6.22	612	513	154	64.4	101	38.0	17.3	132
1979	7.13	8.96	8.96	7.99	5.67	236	771	122	123	23.2	51.4	9.86	114
1980	12.6	10.4	10.7	9.47	8.40	129	68.6	7.91	30.4	5.37	3.37	1.81	24.9
1981	2.89	3.52	3.02	3.20	7.23	6.99	9.21	9.58	26.9	23.6	6.08	1.80	8.67
1982	2.42	3.13	3.25	1.21	8.95	150	148	22.3	12.4	3.60	1.70	1.29	29.9
1983	3.58	4.81	3.85	3.76	7.83	101	116	16.4	5.29	10.4	4.14	1.80	23.3
1984	3.41	6.68	4.77	5.33	118	273	259	55.1	478	37.1	10.6	4.93	104
1985	31.1	15.4	9.63	5.59	28.5	488	93.2	42.8	15.6	5.67	5.22	11.8	63.3
1986	9.79	6.92	10.9	9.71	9.34	590	794	370	184	74.5	44.2	65.2	181
1987	53.8	48.9	87.0	64.3	41.6	151	71.7	21.9	8.55	6.41	--	--	--
1988	5.72	9.52	7.25	1.69	11.0	50.9	20.4	8.34	1.78	1.00	1.51	1.16	10.0
1989	1.55	2.99	2.87	2.88	3.36	455	123	44.4	4.72	2.40	3.08	2.58	54.7
1990	3.00	4.10	2.66	1.41	2.70	37.7	9.89	13.9	9.10	3.87	5.98	2.96	8.17
1991	3.13	3.41	4.12	3.80	4.30	19.4	20.7	28.8	251	295	327	53.4	85.2
1992	17.9	21.0	16.9	19.2	57.5	77.9	52.8	23.1	154	108	11.3	9.79	47.3
1993	6.56	15.5	12.7	8.86	9.04	194	356	104	103	885	89.0	49.5	154
1994	39.2	37.5	40.8	36.3	47.6	548	344	224	85.7	443	59.9	38.3	163
1995	51.5	39.6	31.0	24.4	22.6	394	554	426	184	424	170	77.0	201
1996	280	122	31.4	18.3	45.7	107	341	312	130	39.1	24.0	17.9	123

Table E5.2. Statistics on mean flow, in cubic feet per second, for station 05291000, Whetstone River near Big Stone City, S. Dak. (October 1931 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	65	65	65	65	65	65	66	66	66	66	65	65	64
Maximum	279.7	122.4	87.0	64.3	118.4	611.9	1,386	490.7	477.5	885.1	327.5	77.0	201.1
Percentile													
75th	9.94	13.3	9.97	6.80	11.0	200.2	239.8	109.4	125.1	46.8	23.4	9.82	82.8
50th	4.42	6.49	4.94	3.76	5.02	100.7	102.3	40.8	31.5	9.60	5.22	4.29	41.5
25th	2.54	3.50	2.84	1.55	2.65	32.2	31.2	16.4	9.00	3.54	2.70	1.80	17.8
Minimum	.600	.400	.200	.000	.000	2.85	3.63	.774	1.42	.035	.000	.363	1.52
Mean	14.33	13.51	9.44	6.47	12.38	154.94	195.31	92.24	80.72	62.12	20.89	10.65	56.82
Standard deviation	36.39	20.71	13.45	9.71	19.65	163.42	260.09	125.21	110.42	142.37	46.65	17.53	49.70
Skewness	6.35	3.43	3.71	4.02	3.27	1.40	2.52	1.89	1.92	3.99	5.14	2.56	1.12
Coefficient of variation	2.54	1.53	1.42	1.50	1.59	1.05	1.33	1.36	1.37	2.29	2.23	1.65	0.87
Percent of annual flow	2.13	2.01	1.40	0.96	1.84	23.02	29.02	13.71	11.99	9.23	3.10	1.58	0.346[1]

[1]Serial correlation for annual mean flow.

Table E5.3. Serial correlation for 1-year lag for monthly mean flow for station 05291000, Whetstone River near Big Stone City, S. Dak. (October 1931 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0364	0.271	0.185	0.218	0.108	0.210	0.022	0.080	0.173	0.444	0.053	0.249	

Table E5.4. Correlation matrix for monthly mean flow for station 05291000, Whetstone River near Big Stone City, S. Dak. (October 1931 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	0.865	0.487	0.419	0.347	0.110	0.149	0.280	0.079	0.052	0.067	0.140
Nov.	*	1.000	0.727	0.596	0.382	0.254	0.181	0.386	0.096	0.139	0.100	0.158
Dec.	*	*	1.000	0.954	0.379	0.320	0.174	0.287	0.046	0.215	0.224	0.325
Jan.	*	*	*	1.000	0.433	0.314	0.134	0.245	0.062	0.256	0.272	0.402
Feb.	*	*	*	*	1.000	0.319	0.012	0.050	0.488	0.087	0.015	0.060
Mar.	*	*	*	*	*	1.000	0.183	0.341	0.234	0.274	0.146	0.319
Apr.	*	*	*	*	*	*	1.000	0.378	0.151	0.189	0.116	0.227
May.	*	*	*	*	*	*	*	1.000	0.488	0.335	0.294	0.666
Jun.	*	*	*	*	*	*	*	*	1.000	0.334	0.378	0.473
Jul.	*	*	*	*	*	*	*	*	*	1.000	0.569	0.582
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	0.667
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E5.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05291000, Whetstone River near Big Stone City, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1931	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1932	0.20	12	0.20	12	0.21	13	0.35	13	0.37	10	0.50	9	0.84	8	1.17	8	8.97	22
1933	.0000	1	.0000	1	.0000	1	.0000	1	.040	6	.22	5	.44	5	1.05	7	2.40	2
1934	.0000	2	.0000	2	.0000	2	.0000	2	.0000	1	.0000	1	.026	1	.38	3	1.05	1
1935	.0000	3	.0000	3	.0000	3	.0000	3	.0000	2	.097	3	.19	3	.31	1	11.7	23
1936	.0000	4	.0000	4	.0000	4	.0000	4	.0000	3	.15	4	.24	4	.50	4	7.43	15
1937	.0000	5	.0000	5	.0000	5	.0000	5	.0000	4	.007	2	.14	2	.32	2	15.3	28
1938	.30	15	.43	16	.46	17	.50	15	.79	16	1.22	16	1.81	17	2.12	14	7.86	19
1939	.30	16	.30	14	.33	14	.44	14	.67	13	.89	12	1.34	13	1.55	11	7.26	13
1940	.10	9	.10	9	.16	10	.17	9	.20	7	.35	7	.59	7	.91	5	12.8	25
1941	.60	21	.60	21	.80	20	.96	20	1.13	20	1.78	21	1.82	18	1.83	13	12.0	24
1942	2.20	47	2.20	45	2.26	42	2.54	43	2.73	38	2.92	35	3.15	32	3.25	27	6.02	10
1943	3.20	54	3.20	54	3.43	54	3.97	53	4.18	50	5.17	52	6.61	50	11.4	56	112	62
1944	3.80	56	3.90	56	4.36	57	7.99	61	8.63	59	9.18	59	9.98	59	10.4	53	24.6	38
1945	1.50	36	1.53	35	2.67	51	3.61	52	4.46	51	5.47	54	7.22	52	8.64	49	42.5	49
1946	2.60	50	2.60	50	2.60	49	2.60	45	2.66	37	3.12	38	4.17	38	5.58	39	49.2	52
1947	3.60	55	3.73	55	3.87	55	4.03	54	4.58	53	5.04	51	9.17	57	13.6	59	30.1	45
1948	2.40	48	2.40	47	2.46	47	2.80	49	3.51	47	4.73	48	5.15	46	6.42	42	59.4	55
1949	1.60	38	1.67	39	1.71	37	1.88	35	2.31	35	2.73	31	4.48	40	6.68	44	21.6	34
1950	1.00	29	1.00	26	1.11	27	1.34	28	1.54	24	1.78	22	2.52	25	3.43	29	29.8	43
1951	.0000	6	.0000	6	.0000	6	.0000	6	.023	5	.45	8	1.20	11	1.78	12	7.46	16
1952	1.00	30	1.03	28	1.20	30	1.74	32	2.84	40	4.27	47	5.02	45	7.25	47	8.94	21
1953	2.00	43	2.17	44	2.30	44	2.30	39	2.35	36	2.49	28	2.87	29	3.73	32	23.7	36
1954	2.50	49	2.53	49	2.57	48	2.63	46	3.04	43	4.15	44	6.21	49	6.50	43	24.0	37
1955	1.20	32	1.30	32	1.61	35	1.98	37	2.73	39	3.79	42	4.59	42	5.78	40	13.2	26
1956	1.60	39	1.60	38	1.60	33	1.66	31	1.73	26	1.74	20	2.06	19	2.23	15	3.83	5
1957	.80	23	.80	23	.80	21	.84	18	.93	18	1.26	17	1.67	14	2.42	17	15.3	29
1958	3.10	53	3.13	53	3.21	53	3.38	51	3.74	48	4.26	46	7.26	53	10.5	54	50.8	53
1959	.0000	7	.0000	7	.0000	7	.19	10	.69	14	.75	10	1.04	9	2.87	23	6.19	11
1960	.40	18	.50	18	.53	18	1.27	26	1.87	31	2.75	33	3.85	35	4.08	34	18.3	32
1961	.10	10	.10	10	.10	9	.11	8	.53	12	.81	11	1.67	15	2.64	20	7.84	18
1962	.90	27	1.07	29	1.33	31	1.52	29	1.64	25	2.12	24	2.86	28	3.02	24	44.3	50
1963	2.60	51	2.60	51	2.61	50	2.69	47	2.91	42	3.46	41	4.38	39	6.75	46	13.5	27
1964	.30	17	.57	20	.84	22	1.09	22	1.22	21	2.80	34	2.84	27	3.60	30	8.01	20
1965	1.30	33	1.53	36	1.69	36	1.89	36	1.94	32	2.14	25	2.43	23	2.80	22	3.12	3
1966	2.00	44	2.10	43	2.27	43	2.90	50	3.42	46	3.97	43	4.59	43	5.34	38	28.6	40
1967	1.10	31	1.13	31	1.19	29	1.83	33	2.00	33	2.74	32	4.50	41	5.93	41	26.4	39
1968	.20	13	.20	13	.20	12	.20	11	.26	9	.99	13	1.73	16	2.58	19	4.13	6

Table E5.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05291000, Whetstone River near Big Stone City, S. Dak.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																			
	1		3		7		14		30		60		90		120		183			
1969	0.80	24	0.90	24	1.06	25	1.12	23	1.81	29	2.37	27	2.92	30	3.42	28	3.48	4		
1970	1.80	41	1.83	40	2.04	39	2.24	38	3.23	44	3.43	40	4.11	37	5.25	37	28.9	41		
1971	1.70	40	1.97	41	2.19	41	2.53	42	3.89	49	4.23	45	5.60	47	6.68	45	35.5	48		
1972	1.40	35	1.47	34	1.60	34	2.31	40	10.5	61	12.6	61	20.2	61	34.4	62	108	60		
1973	4.10	57	4.10	57	4.31	56	4.39	56	4.56	52	4.84	49	5.86	48	13.1	57	60.9	56		
1974	1.50	37	1.57	37	1.80	38	1.86	34	2.16	34	2.65	30	2.70	26	4.27	35	16.9	31		
1975	.79	22	.79	22	.79	19	.79	17	.79	15	1.89	23	2.31	22	3.08	25	5.63	8		
1976	.0000	8	.0000	8	.0000	8	.086	7	.21	8	.32	6	.46	6	.94	6	7.42	14		
1977	.40	19	.43	17	.45	16	.59	16	1.06	19	1.13	15	1.29	12	1.38	10	15.7	30		
1978	2.00	45	2.20	46	2.34	45	2.78	48	5.72	56	6.66	56	8.45	55	13.1	58	126	63		
1979	4.40	58	5.10	58	5.10	58	5.10	57	5.11	55	6.16	55	6.91	51	7.54	48	54.0	54		
1980	1.30	34	1.33	33	1.41	32	1.52	30	1.81	30	2.61	29	3.48	33	9.26	51	19.4	33		
1981	.82	25	1.10	30	1.17	28	1.30	27	1.80	27	3.11	37	3.14	31	3.16	26	4.51	7		
1982	.83	26	.90	25	.90	23	.90	19	.90	17	1.40	18	2.07	20	2.30	16	31.2	46		
1983	.95	28	1.02	27	1.09	26	1.13	25	1.80	28	2.96	36	3.93	36	4.00	33	22.9	35		
1984	1.80	42	2.00	42	2.14	40	2.48	41	3.41	45	5.00	50	4.96	44	5.03	36	68.4	57		
1985	2.70	52	2.80	52	3.20	52	4.04	55	4.93	54	5.32	53	7.52	54	9.29	52	28.9	42		
1986	4.60	59	5.43	59	6.27	61	6.42	59	6.92	58	8.39	57	9.09	56	9.17	50	112	61		
1987	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1988	.13	11	.14	11	.18	11	.22	12	.44	11	.99	14	1.09	10	1.26	9	5.67	9		
1989	.47	20	.53	19	.92	24	1.12	24	1.50	23	2.25	26	2.46	24	2.55	18	29.9	44		
1990	.29	14	.32	15	.42	15	.97	21	1.40	22	1.73	19	2.19	21	2.71	21	7.63	17		
1991	2.10	46	2.40	48	2.43	46	2.59	44	2.88	41	3.26	39	3.55	34	3.61	31	6.46	12		
1992	5.60	61	5.87	61	6.17	60	7.21	60	9.72	60	10.4	60	18.5	60	18.4	60	34.9	47		
1993	5.30	60	5.50	60	5.63	59	6.04	58	6.50	57	8.89	58	9.83	58	10.9	55	48.4	51		
1994	23.0	64	24.3	64	26.1	64	27.3	64	35.6	64	37.4	64	38.2	64	38.1	63	127	64		
1995	17.0	63	17.7	63	18.1	63	18.4	63	19.6	63	23.4	63	26.1	62	28.7	61	96.6	58		
1996	13.0	62	13.7	62	14.4	62	15.5	62	16.8	62	20.6	62	26.7	63	40.4	64	101	59		

Table E5.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05291000, Whetstone River near Big Stone City, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1931	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1932	219	57	204	55	174	53	94.8	55	49.7	57	37.6	56	31.1	56	25.7	56	17.6	56
1933	43.0	64	26.7	64	16.6	64	9.65	64	7.63	63	5.90	63	5.88	63	5.82	63	4.15	63
1934	63.0	62	49.7	63	25.6	63	12.8	63	6.64	64	3.87	64	4.48	64	3.66	64	2.42	64
1935	360	50	281	50	162	54	109	54	67.6	54	40.3	54	32.5	54	35.2	54	24.9	54
1936	422	47	386	47	292	47	210	46	131	49	80.1	49	56.4	52	42.6	53	28.3	53
1937	2,180	21	1,533	24	1,116	19	602	23	565	14	341	15	258	17	207	17	142	18
1938	234	55	216	54	123	56	80.0	56	63.8	55	36.7	57	31.5	55	26.1	55	18.2	55
1939	1,200	32	977	29	601	33	317	40	170	42	89.7	46	62.5	46	48.9	46	32.9	46
1940	1,000	35	883	35	567	36	325	37	184	38	99.1	44	67.2	44	50.9	44	33.9	46
1941	221	56	180	57	154	55	140	52	128	50	86.8	48	60.5	48	47.9	48	32.5	51
1942	2,620	18	1,786	17	1,094	20	734	19	665	10	424	11	298	14	232	15	168	14
1943	3,190	12	2,723	4	2,076	3	1,228	6	682	9	381	13	358	11	288	11	204	10
1944	830	41	560	41	418	41	323	38	259	31	225	24	207	22	175	20	122	20
1945	2,380	20	1,610	20	918	23	578	24	349	24	202	26	174	26	167	22	121	21
1946	1100	34	967	30	843	24	705	20	444	21	255	23	182	25	151	26	114	23
1947	4,710	3	2,967	3	1,816	5	1,260	5	788	7	457	10	331	12	259	13	174	13
1948	3,070	13	2,683	5	1,635	7	979	9	578	12	335	16	229	19	284	19	133	19
1949	320	52	300	49	253	49	172	50	115	51	77.1	51	58.9	49	45.8	49	36.2	44
1950	1,000	36	867	37	704	28	478	26	317	27	195	27	139	30	105	32	70.4	33
1951	1,000	37	950	32	731	27	452	28	286	29	160	32	119	33	95.5	33	67.6	34
1952	4,860	2	3,720	2	3,444	1	2,299	1	1,388	1	735	2	516	2	397	4	263	6
1953	890	39	792	38	557	37	351	35	224	36	160	33	142	29	145	27	112	25
1954	1,740	25	1,250	26	644	29	435	30	253	33	185	29	165	28	138	28	97.8	28
1955	550	46	500	42	353	44	195	48	133	48	79.2	50	56.6	51	44.5	51	31.1	52
1956	350	51	260	52	210	51	165	51	102	52	61.8	53	51.4	53	43.1	52	33.4	47
1957	2,090	23	1,577	22	1,196	16	782	17	475	19	312	18	241	18	201	18	145	17
1958	854	40	752	39	583	35	357	34	259	30	178	30	135	31	107	31	84.0	31
1959	60.0	63	56.0	62	47.3	62	38.3	62	27.6	62	19.7	62	17.1	62	14.6	62	10.2	62
1960	1,340	28	1,043	28	628	30	518	25	323	26	174	31	123	32	94.5	34	63.3	35
1961	218	58	172	58	109	57	72.3	57	47.7	58	30.7	58	29.1	57	24.4	57	17.1	57
1962	2,750	16	1,803	16	1,131	18	951	10	584	11	522	7	448	5	451	3	312	3
1963	1,290	30	936	33	615	31	331	36	173	40	114	39	90.6	39	76.5	38	61.5	37
1964	379	49	261	51	237	50	195	47	150	45	92.4	45	65.4	45	50.8	45	35.1	45
1965	1,680	26	1,590	21	1,209	15	770	18	423	22	284	22	206	23	159	25	106	26
1966	2,120	22	1,620	19	1,192	17	668	22	381	23	224	25	170	27	133	29	90.0	29
1967	420	48	350	48	326	45	227	44	148	46	104	42	77.5	41	69.1	40	47.5	40
1968	140	61	102	61	66.3	61	40.9	61	31.0	61	21.3	61	18.0	61	15.2	61	11.1	61

Table E5.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05291000, Whetstone River near Big Stone City, S. Dak.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1969	6,090	1	5,117	1	3,280	2	1,879	2	1,027	3	586	5	398	7	306	10	200	36
1970	1,300	29	880	36	513	40	264	41	154	44	150	35	111	34	93.4	35	63.0	36
1971	1,600	27	1,172	27	593	34	367	33	199	37	144	36	102	36	121	30	85.6	30
1972	2,600	19	1,870	15	1,280	14	881	13	507	16	402	12	425	6	344	7	251	7
1973	1,890	24	1,366	25	740	26	426	31	292	28	185	28	199	24	166	23	115	22
1974	320	53	250	53	197	52	138	53	85.7	53	73.2	52	56.7	50	45.7	50	32.9	50
1975	899	38	699	40	529	39	407	32	250	34	138	37	96.9	38	76.2	39	51.0	39
1976	630	43	452	46	360	43	247	43	144	47	87.6	47	62.3	47	48.2	47	33.4	48
1977	610	44	498	43	360	42	214	45	163	43	405	41	72.4	43	55.3	43	37.3	43
1978	3,530	7	2,507	8	2,024	4	1,549	3	986	4	618	3	450	4	365	6	249	8
1979	3,660	5	2,230	12	1,464	12	1,103	8	820	6	551	6	383	8	318	8	221	9
1980	555	45	476	44	314	46	259	42	183	39	101	43	76.5	42	60.0	42	42.7	42
1981	319	54	181	56	89.1	60	47.3	60	31.9	60	26.2	59	21.2	59	17.5	60	14.3	59
1982	2,840	15	1,550	23	835	25	440	29	258	32	151	34	109	35	86.1	36	57.6	38
1983	662	42	463	45	281	48	190	49	173	41	111	40	78.9	40	61.3	41	42.8	41
1984	3,610	6	2,343	10	1,389	13	862	15	494	18	294	21	308	13	270	12	202	12
1985	3,340	10	2,433	9	1,567	8	906	11	500	17	298	20	218	20	169	21	113	24
1986	3,800	4	2,267	11	1,693	6	1,299	4	1,145	2	815	1	618	1	493	1	343	2
1987	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1988	153	60	132	60	96.1	59	65.1	58	51.1	56	39.2	55	28.9	58	23.2	58	16.9	58
1989	2,950	14	2,150	13	1,515	10	870	14	533	15	311	19	213	21	161	24	107	26
1990	217	59	156	59	104	58	63.5	59	38.9	59	25.0	60	20.9	60	18.0	59	13.5	60
1991	2,720	17	1,689	18	972	22	700	21	465	20	364	14	296	15	237	14	164	15
1992	1,280	31	903	34	556	38	318	39	240	35	134	38	100	37	86.1	37	78.7	32
1993	3,440	9	2,643	6	1,567	9	1,142	7	907	5	521	8	376	10	370	5	292	4
1994	3,230	11	2,030	14	1,075	21	822	16	575	13	489	9	379	9	315	9	287	5
1995	3,500	8	2,610	7	1,506	11	886	12	743	8	587	4	485	3	480	2	364	1
1996	1,150	33	953	31	612	32	455	27	346	25	331	17	276	16	226	16	163	16

Table E6.1. Mean flow, in cubic feet per second, for station 05292000, Minnesota River at Ortonville, Minn.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1938	--	--	--	--	--	120.3	55.6	83.5	67.9	24.0	39.6	9.44	--
1939	0.200	0.200	0.200	0.200	0.200	79.6	159.1	90.4	44.6	30.5	9.12	2.00	34.8
1940	1.55	1.52	.477	.168	.159	4.99	148.4	172.3	32.4	23.3	4.67	4.80	32.9
1941	5.08	2.65	.281	11.9	3.86	1.14	1.27	.913	5.85	33.7	22.2	14.7	8.70
1942	8.73	10.9	67.7	48.7	24.9	11.1	5.75	376.2	720.2	363.3	191.6	249.7	173.7
1943	183.4	166.0	193.7	164.3	150.0	208.7	1,008	434.6	654.6	445.5	160.0	82.3	320.6
1944	20.6	9.38	10.0	29.0	103.7	183.3	297.6	462.0	419.5	188.0	68.3	25.3	151.3
1945	9.98	28.9	57.7	58.8	49.5	199.8	229.2	137.6	497.9	203.5	68.0	20.6	130.1
1946	8.24	3.93	.481	.474	.575	384.8	605.3	127.2	88.2	137.8	108.8	81.6	129.3
1947	12.6	7.09	5.87	8.92	13.2	143.5	1,033	736.6	402.3	147.1	15.2	2.66	210.6
1948	2.50	83.9	92.5	72.0	65.0	230.1	689.8	324.0	62.3	46.9	29.5	10.6	142.1
1949	9.24	15.6	28.7	71.2	107.5	153.9	168.0	44.1	22.4	8.86	7.02	5.87	53.1
1950	4.38	2.87	.810	.361	.761	55.7	574.6	386.7	96.7	8.54	8.72	.827	95.0
1951	1.50	9.97	.758	.687	2.80	22.7	652.3	269.3	130.5	82.0	31.4	34.8	102.9
1952	10.4	8.92	29.6	34.6	46.2	148.5	2,195	860.6	212.2	77.3	11.7	5.67	301.5
1953	5.66	2.62	1.66	2.35	2.52	96.6	239.5	257.6	102.4	174.8	142.5	25.4	88.4
1954	3.66	2.82	1.01	.477	29.8	122.5	145.3	183.3	454.2	124.9	31.1	24.5	93.5
1955	23.0	22.1	4.96	4.65	4.19	88.2	151.6	38.6	15.3	5.25	2.79	.930	30.1
1956	2.08	1.56	.435	.465	.448	19.5	98.3	91.1	51.0	33.7	37.5	24.8	30.1
1957	14.2	6.54	5.12	4.50	4.61	20.8	107.6	312.3	549.2	178.4	131.8	178.7	126.2
1958	148.8	159.6	100.5	56.5	35.0	180.4	470.3	207.8	59.0	24.4	6.43	4.01	121.2
1959	5.05	10.6	2.84	1.43	1.51	35.3	22.8	14.0	5.83	2.08	.255	.673	8.57
1960	2.14	3.86	5.17	4.77	3.26	39.5	284.4	173.1	91.4	62.4	26.4	33.2	60.6
1961	9.52	12.1	10.3	10.3	8.79	17.0	37.5	19.6	13.5	14.9	12.0	8.42	14.5
1962	3.75	1.75	1.15	.819	1.69	48.3	874.9	693.3	1,034	915.5	408.9	149.6	345.4
1963	95.8	46.5	29.5	17.1	14.3	75.5	112.6	62.7	69.2	64.2	112.3	91.0	66.2
1964	50.4	32.9	24.1	18.2	19.0	36.5	131.2	124.4	53.2	31.5	10.2	11.1	45.2
1965	1.77	1.16	.829	.700	.814	1.77	490.5	438.3	637.6	160.1	35.7	40.6	150.5
1966	35.3	26.7	30.8	45.4	38.0	613.1	502.6	239.0	41.3	39.6	20.3	16.2	138.1
1967	3.69	1.83	4.90	4.68	4.51	121.4	323.2	178.1	125.1	71.2	22.8	13.7	73.0
1968	8.23	5.11	4.89	3.03	3.03	7.45	18.0	27.7	24.4	25.4	20.9	8.44	13.1
1969	6.21	4.78	8.57	13.7	16.6	115.1	1,559	860.2	212.4	54.2	38.8	23.1	242.3
1970	15.3	9.13	7.23	11.5	12.6	25.9	96.6	141.1	65.1	40.2	31.2	19.5	39.8
1971	11.4	14.8	12.0	11.1	12.3	117.4	148.1	74.1	114.8	234.5	54.1	51.9	71.7
1972	31.7	19.8	56.5	42.8	34.6	533.4	730.6	689.6	502.8	121.3	159.7	7.96	244.6
1973	2.66	2.00	1.65	30.0	70.1	347.0	109.3	237.7	179.9	8.48	3.30	4.78	83.3
1974	3.49	2.80	1.98	1.32	.929	20.5	131.5	59.8	20.6	7.59	3.27	2.48	21.3
1975	2.45	3.18	5.00	4.12	4.13	4.87	113.5	281.9	9.25	11.0	3.51	1.71	37.4
1976	1.00	2.45	2.73	2.59	2.78	97.5	172.7	22.9	4.68	1.40	1.10	.419	25.9

Table E6.1. Mean flow, in cubic feet per second, for station 05292000, Minnesota River at Ortonville, Minn.—Continued

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1977	0.833	0.496	0.446	0.425	0.597	16.8	2.12	2.46	1.30	1.11	1.18	0.537	2.39
1978	1.55	2.99	1.60	1.12	.965	381.2	1,518	382.7	132.3	439.3	62.1	67.5	249.4
1979	29.4	3.08	1.81	1.64	1.50	107.3	1,427	734.7	370.6	289.8	21.9	20.6	250.6
1980	10.9	4.14	1.28	.975	1.10	101.7	297.1	4.37	28.8	12.1	9.05	5.66	39.5
1981	2.92	3.44	2.83	2.07	2.03	1.45	1.92	2.67	3.45	2.64	2.01	1.25	2.39
1982	1.69	1.91	2.75	2.90	2.90	14.7	252.3	192.1	56.2	5.00	3.83	2.64	44.9
1983	3.37	10.1	3.52	4.39	5.31	130.6	262.8	14.8	4.08	4.21	5.18	2.61	37.5
1984	1.90	4.86	2.13	1.54	91.7	320.3	771.4	216.4	488.8	343.3	3.95	.566	186.3
1985	4.75	4.46	1.43	5.96	11.9	632.6	445.9	43.4	32.1	10.6	1.26	.646	100.1
1986	3.31	3.06	4.27	71.4	89.1	730.7	1,960	886.9	265.9	133.3	95.5	121.0	363.5
1987	186.5	24.8	15.0	19.1	46.4	188.3	139.6	49.3	16.2	3.95	1.96	2.75	58.1
1988	1.37	1.47	3.56	2.45	2.19	25.5	25.1	10.9	3.41	1.19	.976	.181	6.54
1989	.833	1.17	1.77	2.18	1.95	416.6	354.8	142.7	5.96	6.64	4.43	13.7	79.9
1990	14.6	6.60	5.86	4.82	4.38	53.9	15.9	15.0	16.8	12.2	6.85	6.50	13.7
1991	4.15	3.14	3.06	2.38	2.10	10.0	12.4	42.3	458.3	618.0	450.9	91.7	142.7
1992	87.4	29.4	25.7	29.1	27.3	90.7	80.3	61.8	219.2	260.7	53.8	36.9	83.7
1993	11.6	13.0	13.2	7.61	7.89	245.5	926.7	278.1	215.3	1,781	1,299	124.9	414.7
1994	72.4	24.0	27.4	26.7	50.7	1,519	676.9	668.3	131.3	769.4	100.1	82.9	349.5
1995	131.0	23.6	69.7	67.0	64.0	1,038	1,191	848.4	332.1	532.4	274.8	155.7	396.3
1996	441	268.6	113.0	110.0	213.0	778.6	712.0	651.7	298.0	100.1	78.3	26.4	316.3

Table E6.2. Statistics on mean flow, in cubic feet per second, for station 05292000, Minnesota River at Ortonville, Minn. (October 1938 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	58	58	58	58	58	59	59	59	59	59	59	59	58
Maximum	441	269	194	164	213	1,519	2,195	887	1,034	1,781	1,299	250	415
Percentile													
75th	16.6	16.6	24.5	29.0	35.8	208.7	676.9	382.7	298.0	178.4	68.3	36.9	176.9
50th	5.93	4.99	4.89	4.72	4.96	101.7	239.5	173.1	88.2	46.9	22.2	13.7	86.1
25th	2.49	2.76	1.64	1.51	2.01	22.7	107.6	44.1	22.4	10.6	4.67	2.66	36.8
Minimum	.20	.20	.20	.17	.16	1.14	1.27	.91	1.30	1.11	.25	.18	2.39
Mean	30.6	20.39	19.19	19.96	26.22	195.54	440.13	257.34	186	161.94	77.45	34.89	124
Standard deviation	69.9	45.55	35.11	31.15	41.28	280.33	504.62	263.54	225.78	289.88	185.11	51.78	113.41
Skewness	4.20	4.07	3.04	2.54	2.52	2.72	1.71	1.14	1.62	3.67	5.38	2.23	1.08
Coefficient of variation	2.28	2.23	1.83	1.56	1.57	1.43	1.15	1.02	1.21	1.79	2.39	1.48	0.91
Percent of annual flow	2.08	1.39	1.31	1.36	1.78	13.31	29.95	17.51	12.66	11.02	5.27	2.37	0.274[1]

[1]Serial correlation for annual mean flows.

Table E6.3. Serial correlation for 1-year lag for monthly mean flow for station 05292000, Minnesota River at Ortonville, Minn. (October 1938 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.259	0.002	0.199	0.284	0.346	0.527	0.074	0.041	-0.001	0.328	0.034	0.136	

Table E6.4. Correlation matrix for monthly mean flow for station 05292000, Minnesota River at Ortonville, Minn. (October 1938 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	.876	.622	.631	.696	.385	.112	.229	.106	.051	.029	.080
Nov.	*	1.000	.827	.748	.715	.265	.122	.180	.119	.018	.015	.020
Dec.	*	*	1.000	.911	.682	.283	.205	.279	.304	.127	.090	.221
Jan.	*	*	*	1.000	.840	.398	.309	.371	.291	.087	.053	.224
Feb.	*	*	*	*	1.000	.469	.289	.376	.285	.069	-.003	.080
Mar.	*	*	*	*	*	1.000	.413	.479	.062	.281	.107	.220
Apr.	*	*	*	*	*	*	1.000	.834	.311	.312	.184	.209
May.	*	*	*	*	*	*	*	1.000	.544	.319	.175	.364
Jun.	*	*	*	*	*	*	*	*	1.000	.478	.336	.602
Jul.	*	*	*	*	*	*	*	*	*	1.000	.906	.596
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	.540
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E6.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05292000, Minnesota River at Ortonville, Minn.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																			
	1		3		7		14		30		60		90		120		183			
1938	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1939	0.20	10	0.20	9	0.20	7	0.20	4	0.20	3	0.20	2	0.20	2	0.20	1	15.2	22		
1940	.10	4	.10	2	.10	2	.14	2	.16	2	.16	1	.18	1	.26	2	1.49	3		
1941	.0000	1	.10	3	.13	.	.19	3	.23	4	.63	9	1.00	12	1.14	7	3.21	5		
1942	1.60	41	1.80	41	2.77	41	3.73	42	5.18	41	8.31	43	13.6	46	22.1	46	28.2	30		
1943	26.0	58	26.0	58	41.6	58	56.4	58	82.3	58	121	58	163	58	167	58	184	55		
1944	8.00	54	8.33	53	8.57	52	8.79	51	9.13	50	9.68	46	9.77	43	15.8	43	59.1	41		
1945	2.10	45	3.60	47	6.93	49	7.07	49	7.81	47	18.9	51	31.6	54	38.4	55	69.9	43		
1946	.10	5	.17	7	.29	12	.39	12	.43	10	.44	6	.48	5	1.18	9	73.1	45		
1947	.10	6	.10	4	.29	13	.81	20	2.60	34	6.43	39	7.26	39	7.90	36	33.5	35		
1948	.20	11	.23	14	.27	10	.70	18	.78	17	19.7	52	29.1	53	36.0	53	91.3	50		
1949	.30	19	.37	17	.46	17	2.06	37	5.87	43	6.44	40	7.15	38	10.8	41	42.3			
1950	.20	12	.20	10	.20	8	.22	6	.31	6	.47	7	.62	6	1.09	6	12.2	18		
1951	.40	21	.40	18	.41	16	.59	14	.69	15	.72	11	.75	7	1.53	15	7.61	14		
1952	2.90	47	3.20	46	3.33	44	3.96	43	5.67	42	8.67	44	16.0	47	20.6	45	46.6	39		
1953	1.30	39	1.30	35	1.30	33	1.31	28	1.57	26	2.00	26	2.04	22	2.23	21	20.2	24		
1954	.20	13	.20	11	.23	9	.30	8	.43	11	.64	10	1.15	16	1.57	16	27.4	28		
1955	.20	14	.43	21	.47	18	.63	16	.93	19	1.78	25	3.00	28	5.65	34	25.5	26		
1956	.20	15	.20	12	.27	11	.35	10	.38	7	.41	4	.43	3	.44	3	4.13	7		
1957	3.80	49	3.90	48	4.10	46	4.16	44	4.39	39	4.43	35	4.53	35	4.80	31	9.59	15		
1958	3.10	48	3.17	45	3.47	45	3.56	41	4.01	37	5.19	37	11.3	44	22.7	49	115	51		
1959	.10	7	.13	5	.17	4	.20	5	.26	5	.33	3	.96	10	1.75	19	7.56	13		
1960	1.20	37	1.33	37	1.54	36	1.81	35	2.13	32	2.97	32	3.50	31	4.01	30	9.89	16		
1961	1.00	34	1.47	40	4.43	47	6.41	48	8.42	49	8.88	45	9.29	41	9.41	38	12.1	17		
1962	.60	23	.60	23	.60	20	.61	15	.68	14	.93	14	1.10	13	1.26	10	12.4	20		
1963	9.90	56	10.3	56	12.7	55	13.2	54	13.8	52	15.4	49	17.2	49	22.6	48	47.8	40		
1964	1.20	38	1.33	38	3.27	43	5.78	47	6.62	45	10.6	47	17.0	48	22.2	47	29.8	33		
1965	.60	24	.60	24	.60	21	.70	19	.70	16	.73	12	.78	9	.85	5	1.21	1		
1966	6.20	51	6.50	50	8.31	51	10.3	53	14.2	53	18.4	50	24.1	50	28.2	52	138	53		
1967	1.00	35	1.00	32	1.07	30	1.09	25	1.56	25	2.73	30	3.46	30	3.77	26	26.4	27		
1968	2.20	46	2.90	44	3.00	42	3.00	39	3.00	36	3.03	33	3.50	32	3.97	27	5.27	9		
1969	.29	18	.34	16	.77	22	1.77	34	4.45	40	5.26	38	6.44	37	8.18	37	28.3	31		
1970	5.00	50	5.27	49	5.41	48	5.48	46	5.94	44	7.91	42	8.96	40	9.72	39	13.7	21		
1971	8.60	55	8.83	55	9.01	53	9.41	52	11.0	51	11.4	48	11.5	45	12.1	42	31.4	34		
1972	1.60	42	2.07	43	2.23	40	5.09	45	7.96	48	25.5	53	35.8	55	37.8	54	121	52		
1973	.90	32	1.07	33	1.47	34	1.54	32	1.62	28	1.74	23	1.95	21	7.75	35	7.77	48		
1974	.82	29	.82	27	.84	26	.91	22	.94	21	1.12	19	1.40	18	1.70	17	5.36	10		
1975	.71	26	.79	26	.84	25	1.21	26	1.71	29	2.58	29	3.52	33	3.68	25	3.97	6		

Table E6.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05292000, Minnesota River at Ortonville, Minn.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																			
	1		3		7		14		30		60		90		120		183			
1976	0.24	16	0.28	15	0.38	15	0.39	11	0.42	9	0.76	13	0.97	11	1.43	13	18.4	23		
1977	.090	3	.15	6	.18	5	.31	9	.41	8	.43	5	.45	4	.48	4	1.45	2		
1978	.67	25	.75	25	.82	24	.90	21	.93	20	1.00	17	1.12	15	1.40	12	75.1	46		
1979	.80	28	1.30	36	1.50	35	1.50	31	1.50	24	1.56	20	1.64	19	1.74	18	28.5	32		
1980	.83	30	.89	29	.92	27	.94	23	.95	22	1.03	18	1.11	14	1.15	8	20.3	25		
1981	.71	27	.85	28	1.00	28	1.08	24	1.25	23	1.58	21	1.72	20	1.84	20	2.10	4		
1982	.83	31	.91	30	1.18	31	1.35	29	1.61	27	1.75	24	2.10	23	2.30	22	5.51	11		
1983	.38	20	.42	20	1.55	37	1.61	33	2.61	35	3.33	34	3.79	34	3.98	28	27.9	29		
1984	.14	8	.18	8	.20	6	.25	7	.49	12	1.68	22	2.76	25	2.60	23	70.5	44		
1985	.18	9	.23	13	.29	14	.46	13	.65	13	.94	15	2.79	26	3.98	29	87.8	49		
1986	.42	22	.47	22	.78	23	2.24	38	2.55	33	2.77	31	3.37	29	17.9	44	164	54		
1987	1.10	36	1.13	34	1.19	32	1.49	30	1.93	30	2.34	28	2.86	27	5.58	33	35.4	36		
1988	.050	2	.070	1	.083	1	.096	1	.14	1	.58	8	.76	8	1.35	11	6.16	12		
1989	.28	17	.41	19	.51	19	.65	17	.83	18	.99	16	1.24	17	1.47	14	75.5	47		
1990	.97	33	.99	31	1.05	29	1.28	27	4.29	38	4.55	36	4.96	36	5.41	32	12.2	19		
1991	1.70	43	1.80	42	1.86	39	2.00	36	2.11	31	2.24	27	2.31	24	2.60	24	4.25	8		
1992	7.00	53	8.60	54	10.1	54	17.5	55	23.9	55	25.9	55	26.8	52	27.4	51	43.8	38		
1993	6.70	52	6.83	51	7.00	50	7.16	50	7.57	46	7.74	41	9.31	42	10.3	40	61.6	42		
1994	1.70	44	6.87	52	15.9	56	21.1	56	23.9	56	25.6	54	26.0	51	25.7	50	296	57		
1995	1.40	40	1.43	39	1.74	38	3.05	40	23.4	54	46.7	56	53.5	56	56.1	56	244	56		
1996	23.0	57	23.0	57	23.3	57	24.1	57	26.4	57	51.5	57	68.8	57	111	57	311	58		

Table E6.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05292000, Minnesota River at Ortonville, Minn.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1938	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1939	379	42	376	39	287	42	218	44	180	44	155	43	120	42	99.7	42	69.1	43
1940	219	49	215	49	204	47	191	47	186	42	165	41	120	43	96.4	43	65.0	46
1941	50.0	57	46.7	57	43.4	56	39.7	55	34.6	55	29.1	54	24.8	55	19.6	55	13.2	55
1942	1,080	19	1,040	20	977	19	855	20	721	19	627	15	496	16	424	16	318	15
1943	1,480	14	1,477	14	1,401	12	1,296	10	1,014	12	729	13	698	13	649	10	486	9
1944	710	29	606	32	533	32	505	30	467	28	451	26	401	20	350	19	276	18
1945	610	34	610	30	603	28	583	26	502	26	352	28	290	28	292	24	222	23
1946	1,080	20	1,067	19	1,051	18	995	16	860	15	520	21	389	21	318	21	247	20
1947	1,600	13	1,563	13	1,514	11	1,399	9	1,159	9	900	10	730	12	597	13	413	13
1948	821	24	815	24	802	23	788	23	705	20	568	19	421	19	336	20	247	21
1949	300	47	225	47	215	46	204	46	181	43	165	42	144	36	126	37	95.4	36
1950	777	26	770	25	723	25	684	24	595	24	484	22	368	23	283	26	188	26
1951	956	23	941	23	908	22	821	22	668	22	466	23	354	25	288	25	201	24
1952	3,050	1	3,023	1	3,017	1	2,911	1	2,378	1	1,544	3	1,108	3	863	5	587	6
1953	433	40	418	37	375	37	339	37	277	37	266	31	210	32	203	31	172	29
1954	787	25	704	26	660	26	581	27	454	29	318	29	274	29	240	27	179	27
1955	255	48	221	48	198	48	191	48	163	46	133	45	96.0	47	74.5	48	50.6	48
1956	184	52	144	51	136	51	124	50	115	50	96.5	49	83.4	49	72.2	49	58.4	47
1957	712	28	670	27	651	27	610	25	586	25	462	24	361	24	303	22	242	22
1958	630	33	607	31	585	30	561	28	487	27	362	27	291	27	234	29	177	28
1959	84.0	56	61.7	55	53.6	55	46.1	54	40.9	54	29.8	53	25.0	54	19.9	54	13.7	54
1960	470	36	404	38	370	38	359	36	323	35	244	34	193	33	163	33	117	35
1961	143	53	124	53	70.3	53	46.5	53	43.7	52	32.4	52	26.2	53	23.0	53	19.1	53
1962	1,290	15	1,263	15	1,207	14	1,182	13	1,142	10	1,020	9	901	6	889	4	685	3
1963	448	39	288	45	234	45	210	45	162	47	111	48	92.9	48	86.5	46	90.7	37
1964	564	35	270	46	191	49	171	49	155	48	130	47	104	45	88.6	44	65.9	45
1965	997	22	980	22	945	21	838	21	722	18	572	18	537	14	437	15	299	16
1966	1,220	17	1,197	16	1,163	16	1,046	14	877	13	602	16	461	18	356	18	249	19
1967	639	32	474	34	440	35	411	35	370	33	294	30	231	31	201	32	141	32
1968	92.0	55	49.0	56	42.3	57	36.6	56	31.7	56	28.1	55	27.0	52	25.5	52	21.3	51
1969	2,540	4	2,507	3	2,386	3	2,157	3	1,794	4	1,247	4	894	7	695	8	472	10
1970	320	46	289	44	250	44	220	43	180	45	131	46	105	44	87.7	45	67.0	44
1971	414	41	336	42	301	41	290	41	248	40	177	39	143	37	146	35	127	34
1972	1,160	18	1,147	17	1,093	17	1,010	15	845	16	736	12	763	11	627	12	458	12
1973	664	30	625	28	587	29	515	29	373	32	245	33	252	30	229	30	163	30
1974	335	45	303	43	257	43	221	42	145	49	96.3	50	72.4	50	58.9	50	40.4	50
1975	649	31	623	29	574	31	501	31	391	30	202	37	140	39	106	40	71.3	41

Table E6.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05292000, Minnesota River at Ortonville, Minn.—Continued

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1976	346	44	338	41	328	40	307	38	250	39	145	44	99.7	46	75.5	47	50.4	49
1977	188	51	141	52	67.5	54	32.6	57	17.6	57	9.83	57	7.37	57	5.83	57	4.21	57
1978	1,910	10	1,853	10	1,784	8	1,732	8	1,562	6	1,107	8	801	9	683	9	491	8
1979	2,220	8	2,163	7	2,140	6	1,959	5	1,579	5	1,112	7	844	8	739	7	492	7
1980	469	37	467	35	459	33	435	33	345	34	202	38	143	38	111	38	75.6	40
1981	23.0	58	11.9	58	7.44	58	5.43	58	4.15	58	3.34	58	3.07	58	2.83	58	2.46	58
1982	372	43	356	40	350	39	306	39	264	38	223	35	173	35	131	36	87.1	38
1983	728	27	548	33	452	34	428	34	306	36	204	36	138	40	105	41	71.1	42
1984	1,060	21	991	21	969	20	956	18	795	17	586	17	486	17	499	14	371	14
1985	1,810	11	1,710	11	1,536	10	1,289	11	865	14	556	20	383	22	294	23	197	25
1986	2,410	7	2,367	5	2,274	4	2,128	4	2,017	3	1,717	1	1,223	1	980	1	678	4
1987	464	38	459	36	397	36	301	4	206	41	166	4	133	41	108	39	81.8	39
1988	126	54	111	54	87.1	52	62.5	52	43.6	53	27.7	56	20.9	56	16.6	56	11.7	56
1989	2,460	5	2,030	8	1,398	13	940	19	638	23	452	25	311	26	235	28	156	31
1990	202	50	196	50	159	50	97.8	51	60.7	51	36.5	51	30.1	51	26.7	51	20.3	52
1991	1,790	12	1,567	12	1,200	15	977	17	689	21	651	14	519	15	412	17	280	17
1992	1,290	16	1,094	18	775	24	450	32	385	31	254	32	186	34	158	34	128	33
1993	2,890	2	2,783	2	2,586	2	2,389	2	2,243	2	1,614	2	1,133	2	934	3	807	1
1994	2,610	3	2,307	6	1,989	7	1,825	6	1,538	7	1,158	6	972	5	772	6	653	5
1995	2,460	6	2,370	4	2,206	5	1,734	7	1,455	8	1,237	5	1,079	4	959	2	714	2
1996	2,150	9	2,003	9	1,646	9	1,258	12	1,033	11	755	11	772	10	646	11	464	11

Table E7.1. Mean flow, in cubic feet per second, for station 06479215, Big Sioux River near Florence, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1984	--	--	--	--	--	--	--	--	--	3.55	1.18	0.088	--
1985	5.02	4.69	1.85	0.11	3.88	61.0	10.8	6.54	0.71	.055	.71	11.2	8.94
1986	6.61	2.35	.63	.40	.27	111	115	36.8	61.1	8.26	6.50	20.6	30.8
1987	10.4	4.15	2.54	1.27	1.49	36.2	21.8	4.00	.49	.22	.068	.099	6.94
1988	.096	.083	.15	.046	.99	2.74	1.24	1.73	.28	.02	.067	.032	.62
1989	.010	.056	.067	.067	.054	72.0	17.2	7.56	.38	.060	.10	1.04	8.32
1990	.23	.22	.025	.000	.000	1.29	1.08	4.74	7.95	1.46	.25	.11	1.45
1991	.079	.096	.061	.020	.019	.54	4.97	12.6	26.1	27.2	37.9	6.66	9.77
1992	.70	1.43	.95	.70	1.93	13.2	11.8	4.36	16.0	16.0	.44	1.23	5.73
1993	.80	2.03	1.36	.60	.72	62.7	54.3	15.5	26.1	169	18.7	7.99	30.3
1994	5.30	4.44	5.47	2.60	2.36	109	43.9	27.3	9.56	81.8	7.88	4.88	25.6
1995	9.52	5.85	2.71	1.32	.73	110	87.9	70.5	31.6	79.7	50.8	20.3	39.6
1996	56.0	25.5	8.19	3.05	8.27	58.8	54.2	60.4	23.2	1.40	.93	.62	25.1

Table E7.2. Statistics on mean flow, in cubic feet per second, for station 06479215, Big Sioux River near Florence, S. Dak. (October 1984 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	12	12	12	12	12	12	12	12	12	13	13	13	12
Maximum	56.0	25.5	8.19	3.05	8.27	111.2	114.6	70.5	61.1	168.8	50.8	20.6	39.6
Percentile													
75th	8.79	4.63	2.67	1.31	2.25	99.4	54.3	34.4	26.1	53.4	13.3	9.59	29.1
50th	2.91	2.19	1.16	.500	.860	59.9	19.5	10.1	12.8	3.55	.934	1.23	9.35
25th	.128	.127	.088	.051	.109	5.36	6.43	4.45	.544	.138	.176	.103	6.03
Minimum	.010	.056	.025	.000	.000	.539	1.08	1.73	.280	.020	.067	.032	0.623
Mean	7.90	4.24	2.00	0.85	1.73	53.22	35.32	21.00	16.96	29.89	9.66	5.76	16.10
Standard deviation	15.62	7.00	2.51	1.04	2.36	42.79	36.63	23.32	18.08	50.83	16.49	7.45	13.28
Skewness	3.11	2.95	1.70	1.33	2.24	0.11	1.14	1.37	1.33	2.07	1.90	1.30	0.50
Coefficient of variation	1.98	1.65	1.26	1.22	1.37	0.80	1.04	1.11	1.07	1.70	1.71	1.29	0.82
Percent of annual flow	4.19	2.25	1.06	0.45	0.92	28.23	18.73	11.14	8.99	15.85	5.12	3.05	0.387[1]

[1]Serial correlation for annual mean flow.

Table E7.3. Serial correlation for 1-year lag for monthly mean flow for station 06479215, Big Sioux River near Florence, S. Dak. (October 1984 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.573	0.644	0.391	0.412	-0.180	0.342	0.115	0.595	-0.268	0.371	-0.206	-0.093	

Table E7.4. Correlation matrix for monthly mean flow for station 6479215, Big Sioux River near Florence, S. Dak. (October 1984 through September 1996

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	.989	.847	.753	.882	.184	.294	.635	.159	-0.174	-0.116	-0.104
Nov.	*	1.000	.889	.787	.919	.233	.295	.656	.133	-0.094	-0.084	-0.070
Dec.	*	*	1.000	.964	.848	.402	.305	.626	.029	.109	-0.056	-0.078
Jan.	*	*	*	1.000	.706	.440	.366	.633	.084	.186	-0.001	-0.076
Feb.	*	*	*	*	1.000	.107	.057	.402	-0.092	-0.181	-0.298	-0.203
Mar.	*	*	*	*	*	1.000	.818	.648	.449	.365	.234	.674
Apr.	*	*	*	*	*	*	1.000	.770	.829	.356	.355	.778
May.	*	*	*	*	*	*	*	1.000	.586	.237	.517	.558
Jun.	*	*	*	*	*	*	*	*	1.000	.258	.437	.734
Jul.	*	*	*	*	*	*	*	*	*	1.000	.517	.331
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	.605
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E7.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 06479215, Big Sioux River near Florence, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1984	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1985	0.0000	1	0.0000	1	0.006	3	0.017	5	0.046	5	0.060	5	0.39	7	1.83	9	4.96	7
1986	.25	9	.25	9	.25	8	.25	8	.26	8	.31	7	.35	6	.48	6	22.1	10
1987	.040	6	.043	6	.049	6	.059	6	.068	6	.079	6	.13	5	.20	5	4.39	6
1988	.010	4	.010	4	.010	4	.011	4	.016	3	.042	4	.039	3	.080	4	.56	3
1989	.010	5	.010	5	.010	5	.010	3	.010	2	.032	3	.044	4	.048	3	4.37	5
1990	.0000	2	.0000	2	.0000	1	.0000	1	.0000	1	.0000	1	.003	1	.042	1	.30	2
1991	.0000	3	.0000	3	.0000	2	.004	2	.016	4	.018	2	.029	2	.046	2	.18	4
1992	.23	8	.24	8	.27	9	.29	9	.41	9	.80	10	.90	9	.93	8	3.18	4
1993	.42	10	.43	10	.49	10	.51	10	.57	10	.65	8	.73	8	.91	7	12.4	8
1994	1.50	12	1.57	12	1.77	12	2.09	12	2.22	12	2.37	12	3.07	12	3.58	11	22.0	9
1995	.50	11	.50	11	.53	11	.55	11	.70	11	.98	11	1.38	11	2.33	10	22.3	11
1996	.18	7	.19	7	.20	7	.21	7	.23	7	.70	9	.93	10	5.02	12	23.4	12

Table E7.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 06479215, Big Sioux River near Florence, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1984	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1985	217	7	186	7	170	6	109	6	62.8	7	37.0	7	27.8	8	21.2	8	14.3	8
1986	1,140	1	917	1	549	1	325	1	216	1	131	1	108	1	83.9	2	58.8	3
1987	137	9	130	8	96.7	8	67.1	8	44.5	9	29.7	9	21.0	9	16.2	9	11.4	9
1988	13.0	12	12.0	12	8.29	12	4.70	12	3.41	12	2.39	12	2.17	12	1.76	12	1.17	12
1989	460	5	337	5	213	5	123	5	84.4	5	48.1	6	33.2	6	25.0	7	16.4	7
1990	22.0	11	19.3	11	16.1	11	12.3	11	8.32	11	6.32	11	5.00	11	4.05	11	2.80	11
1991	173	8	119	9	93.7	9	64.2	9	45.6	8	36.8	8	31.8	7	26.5	6	19.4	6
1992	137	10	82.0	10	46.0	10	42.0	10	30.6	10	16.3	10	14.8	10	12.3	10	10.6	10
1993	884	3	575	4	329	3	290	2	173	2	105	3	73.5	3	70.1	3	59.2	2
1994	944	2	657	2	390	2	218	3	128	3	85.9	4	61.5	5	60.7	4	47.2	4
1995	750	4	583	3	314	4	164	4	122	4	108	2	94.4	2	90.4	1	74.7	1
1996	300	6	233	6	233	6	164	7	100	7	82.0	6	64.6	5	63.3	4	50.6	5

Table E8.1. Mean flow, in cubic feet per second, for station 06479438, Big Sioux River near Watertown, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1973	6.73	14.9	2.47	1.32	11.1	120	36.9	45.1	11.8	1.13	0.48	0.44	21.2
1974	.78	1.84	.94	.16	.22	31.2	22.4	13.2	4.24	.34	.35	.12	6.35
1975	.13	.20	.30	.055	.017	.26	68.3	16.9	5.84	.98	.32	.11	7.73
1976	.10	.13	.020	.002	.008	50.1	11.1	1.87	.035	.051	.035	.092	5.36
1977	.26	.11	.005	.000	.000	60.0	27.6	8.26	32.9	2.21	.48	.65	11.1
1978	1.55	6.44	3.61	.33	.025	292	297	58.2	23.8	22.7	16.1	6.98	61.0
1979	2.64	2.11	.98	.000	.000	35.6	399	44.7	53.1	11.9	40.5	7.64	49.5
1980	3.68	11.5	3.11	1.11	.000	56.0	28.6	10.5	34.0	4.76	1.32	.44	12.9
1981	.15	.55	.57	.14	6.22	5.09	4.66	.57	8.82	.28	.044	.12	2.22
1982	.12	.26	.065	.000	.86	17.1	36.5	13.5	11.9	.45	.15	.028	6.74
1983	1.16	1.13	.54	.071	.26	3.03	50.3	12.9	2.35	18.2	1.15	.78	7.64
1984	1.46	6.16	1.33	.69	36.7	157	123	41.1	155	14.5	5.83	1.49	45.1
1985	18.9	15.8	6.34	2.17	10.3	278	42.1	32.5	5.58	27.2	4.57	34.3	40.2
1986	18.1	8.03	3.09	2.21	.72	321	403	170	121	27.4	32.1	49.6	96.6
1987	33.0	19.0	10.6	6.81	8.45	111	66.0	17.4	7.56	3.75	3.81	2.88	24.3
1988	2.06	2.81	2.74	.20	.97	28.8	10.3	8.56	1.32	.099	.18	.056	4.88
1989	.034	.10	.33	.32	.30	145	37.7	21.7	2.81	.50	.22	.59	17.7
1990	.41	1.05	.54	.004	.000	2.67	2.95	9.52	11.2	3.08	1.85	1.35	2.89
1991	.93	.89	.89	.059	.031	2.22	11.5	29.1	157	111	120	21.2	38.1
1992	7.61	9.45	5.52	3.53	10.6	46.6	35.8	16.6	63.3	91.9	8.67	16.8	26.4
1993	4.18	11.3	7.45	2.34	3.48	187	183	60.7	93.5	467	67.5	30.2	94.0
1994	20.5	17.3	18.4	10.2	10.4	310	131	94.1	139	167	39.2	27.5	82.7
1995	32.0	28.2	15.0	8.24	7.20	283	306	290	184	290	190	125	147
1996	221	155	55.7	26.5	22.9	281	215	265	111	41.3	26.2	12.2	177

Table E8.2. Statistics on mean flow, in cubic feet per second, for station 06479438, Big Sioux River near Watertown, S. Dak. (October 1973 through September 1996)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	24	24	24	24	24	24	24	24	24	24	24	24	24
Maximum	221.3	155.4	55.7	26.5	36.7	320.9	403.0	290.0	183.7	467.3	190.4	124.8	147.5
Percentile													
75th	15.5	14.0	6.14	2.31	9.84	255.0	169.8	54.9	107.0	37.8	30.6	20.1	58.1
50th	1.80	4.48	1.90	.323	.793	58.0	39.9	19.5	17.8	8.33	2.83	1.42	22.8
25th	.299	.638	.563	.056	.019	20.0	23.7	11.1	5.64	.619	.329	.199	6.96
Minimum	.034	.100	.005	.000	.000	.257	2.95	.575	.035	.051	.035	.028	2.22
Mean	15.74	13.11	5.86	2.77	5.45	117.59	106.20	53.42	51.69	54.48	23.40	14.18	38.84
Standard deviation	44.91	31.25	11.67	5.78	8.81	116.22	126.07	78.14	60.26	111.13	45.40	27.23	41.10
Skewness	4.53	4.45	3.72	3.38	2.39	0.69	1.41	2.32	1.01	2.87	2.78	3.24	1.31
Coefficient of variation	2.85	2.38	1.99	2.09	1.62	0.99	1.19	1.46	1.17	2.04	1.94	1.92	1.06
Percent of annual flow	3.39	2.83	1.26	0.60	1.17	25.35	22.89	11.51	11.14	11.74	5.04	3.06	0.640[1]

[1]Serial correlation for annual mean flow

Table E8.3. Serial correlation for 1-year lag for monthly mean flow for station 06479438, Big Sioux River near Watertown, S. Dak. (October 1973 through September 1996)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.619	0.660	0.684	0.659	0.106	0.502	0.228	0.630	0.291	0.430	0.104	0.223	

Table E8.4. Correlation matrix for monthly mean flow for station 06479438, Big Sioux River near Watertown, S. Dak. (October 1973 through September 1996)

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1.000	0.993	0.963	0.946	0.458	0.424	0.256	0.681	0.290	0.046	0.112	0.137
Nov.	*	1.000	0.970	0.948	0.498	0.445	0.254	0.691	0.311	0.096	0.134	0.155
Dec.	*	*	1.000	0.991	0.479	0.532	0.288	0.830	0.398	0.221	0.221	0.252
Jan.	*	*	*	1.000	0.494	0.536	0.285	0.743	0.425	0.214	0.236	0.284
Feb.	*	*	*	*	1.000	0.370	0.075	0.327	0.436	0.050	-0.003	0.067
Mar.	*	*	*	*	*	1.000	0.616	0.710	0.507	0.371	0.328	0.580
Apr.	*	*	*	*	*	*	1.000	0.666	0.503	0.302	0.445	0.528
May.	*	*	*	*	*	*	*	1.000	0.679	0.412	0.641	0.757
Jun.	*	*	*	*	*	*	*	*	1.000	0.569	0.754	0.657
Jul.	*	*	*	*	*	*	*	*	*	1.000	0.688	0.622
Aug.	*	*	*	*	*	*	*	*	*	*	1.000	0.848
Sep.	*	*	*	*	*	*	*	*	*	*	*	1.000

Table E8.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 06479438, Big Sioux River near Watertown, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1973	0.060	16	0.15	17	0.21	17	0.25	17	0.36	16	0.44	15	0.62	14	2.81	17	16.0	15
1974	.0000	1	.0000	1	.0000	1	.001	1	.025	12	.18	13	.26	12	.79	12	5.99	9
1975	.0000	2	.0000	2	.0000	2	.0000	2	.001	7	.015	6	.063	3	.13	4	.16	1
1976	.0000	3	.0000	3	.0000	3	.0000	3	.0000	1	.004	5	.007	2	.020	2	2.18	6
1977	.0000	4	.0000	4	.0000	4	.0000	3	.0000	2	.0000	1	.0000	1	.018	1	10.6	12
1978	.0000	5	.0000	5	.0000	5	.009	11	.022	9	.057	8	.41	13	1.56	13	63.2	20
1979	.0000	6	.0000	6	.0000	6	.0000	4	.0000	3	.0000	2	.11	7	.49	11	7.46	10
1980	.0000	7	.0000	7	.0000	7	.0000	5	.0000	4	.24	14	.81	15	2.19	14	12.7	13
1981	.0000	8	.0000	8	.0000	8	.001	9	.022	10	.067	10	.11	6	.35	8	2.09	5
1982	.0000	9	.0000	9	.0000	9	.0000	6	.0000	5	.003	4	.078	5	.098	3	4.08	8
1983	.020	15	.027	15	.031	15	.033	15	.054	14	.098	11	.23	11	.48	10	1.69	4
1984	.0000	10	.0000	10	.0000	10	.019	14	.18	15	.87	16	1.66	16	2.35	15	34.0	18
1985	.10	17	.10	16	.10	16	.14	16	.59	17	1.70	17	3.77	20	7.16	21	24.3	17
1986	.50	18	.50	18	.54	18	.59	18	.71	18	1.31	17	1.88	17	2.46	16	66.5	23
1987	.71	19	.76	19	.78	19	1.18	19	2.57	20	3.09	20	3.48	19	4.05	18	16.8	16
1988	.0000	11	.0000	11	.003	13	.009	12	.020	8	.12	12	.11	8	.32	7	3.41	7
1989	.0000	12	.0000	12	.013	14	.018	13	.031	13	.065	9	.16	10	.19	5	10.5	11
1990	.0000	13	.0000	13	.0000	11	.0000	7	.0000	6	.0000	3	.065	4	.29	6	.81	2
1991	.0000	14	.0000	14	.0000	12	.004	10	.022	11	.039	7	.15	9	.37	9	.87	3
1992	2.5	21	2.5	21	2.64	21	2.68	21	3.30	21	4.22	21	5.13	21	6.01	20	13.9	14
1993	2.00	20	2.00	20	2.00	20	2.07	20	2.32	19	2.88	19	3.38	18	4.78	19	39.4	19
1994	6.00	23	6.33	24	7.07	24	8.36	24	8.85	23	9.84	23	11.8	23	13.4	23	66.0	22
1995	4.00	22	4.17	22	4.64	22	5.93	22	6.48	22	7.17	22	8.64	22	12.7	22	63.9	21
1996	6.00	24	6.00	23	6.57	23	7.71	23	9.63	24	19.0	24	26.6	24	42.9	24	11.2	24

Table E8.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 06479438, Big Sioux River near Watertown, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1973	306	15	226	17	185	15	178	13	124	14	81.3	13	68.7	12	56.6	11	38.0	12
1974	180	21	140	21	86.6	21	53.7	21	32.7	21	27.5	21	22.7	19	18.1	20	12.0	20
1975	250	18	233	16	168	17	121	15	79.5	15	43.2	17	30.7	17	23.2	17	15.3	17
1976	229	20	202	19	167	18	106	18	59.5	18	32.3	18	21.6	21	16.2	21	10.7	21
1977	400	14	315	14	203	14	110	17	72.7	17	45.6	16	32.9	16	33.1	16	22.0	16
1978	3,450	2	2,897	2	1,754	1	978	2	579	2	323	3	227	4	176	6	119	6
1979	1,390	9	1,086	8	984	4	666	4	399	5	235	7	166	7	136	7	97.5	7
1980	300	16	267	15	181	16	118	16	78.3	16	46.3	15	41.2	15	33.5	15	22.6	15
1981	78.0	23	49.3	23	28.3	23	17.0	23	10.1	24	7.01	24	5.40	24	5.49	24	4.17	24
1982	230	19	203	18	142	19	83.7	19	50.2	20	31.4	20	25.7	18	20.0	19	13.4	19
1983	278	17	181	20	122	20	78.7	20	50.3	19	31.9	19	22.4	20	21.1	18	14.6	18
1984	1,180	10	893	10	543	9	365	10	246	9	151	10	144	8	123	8	87.9	8
1985	1,500	8	1,327	6	910	8	516	6	286	8	165	9	123	10	92.4	10	66.9	10
1986	4,300	1	2,920	1	1,728	2	1,019	1	698	1	444	1	339	1	262	2	184	2
1987	532	13	471	12	312	12	212	12	138	13	91.0	12	66.2	13	52.1	14	37.3	13
1988	90.0	22	66.7	22	44.9	22	31.3	22	29.2	22	20.2	22	16.3	22	12.8	22	8.71	22
1989	800	11	670	11	441	11	249	11	167	11	99.5	11	70.2	11	53.1	12	35.0	14
1990	27.0	24	25.0	24	23.1	24	16.4	24	12.0	23	10.4	23	8.19	23	6.94	23	5.38	23
1991	1,800	6	853	9	442	10	387	9	221	10	175	8	132	9	106	9	75.2	9
1992	637	12	400	13	233	13	177	14	140	12	81.3	14	61.1	14	52.5	13	44.9	11
1993	2,500	3	1,649	3	970	5	689	3	475	3	303	4	216	5	216	4	181	3
1994	1,890	5	1,440	5	991	3	606	5	361	7	250	6	185	6	194	5	149	5
1995	1,790	7	1,297	7	913	7	503	7	403	4	341	2	236	2	317	1	271	1
1996	2,000	4	1,500	4	932	6	500	8	375	6	291	5	278	3	222	3	159	4

– PAGE 233 FOLLOWS –

Section F - Water-level measurements for lakes

- PAGE 235 FOLLOWS -

Table F1. Water-level measurements for Bitter Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
06-08-1984	1,770.3	10-18-1989	1,772.3	09-14-1994	1,779.2
07-07-1985	1,771.0	05-02-1990	1,772.5	05-10-1995	1,781.8
10-09-1985	1,770.7	09-19-1990	1,771.8	10-10-1995	1,782.8
05-06-1986	1,773.0	05-02-1991	1,772.1	05-08-1996	1,784.7
09-24-1986	1,774.0	10-03-1991	1,773.0	06-05-1996	1,785.2
04-23-1987	1,774.5	04-29-1992	1,773.3	07-01-1996	1,785.2
10-06-1987	1,773.3	09-16-1992	1,772.8	07-29-1996	1,785.0
04-19-1988	1,773.3	05-12-1993	1,773.7	09-04-1996	1,784.7
09-21-1988	1,772.2	09-22-1993	1,773.5	10-09-1996	1,784.6
04-26-1989	1,772.9	05-05-1994	1,777.9		

Table F2. Water-level measurements for Blue Dog Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
02-21-1980	1,800.6	10-09-1985	1,800.3	09-16-1992	1,800.3
05-01-1980	1,800.1	05-06-1986	1,800.7	05-12-1993	1,800.6
07-02-1980	1,800.2	09-24-1986	1,800.8	09-23-1993	1,800.7
07-07-1980	1,800.0	04-22-1987	1,800.6	05-05-1994	1,801.0
07-22-1980	1,799.8	10-06-1987	1,800.0	09-14-1994	1,800.4
07-31-1980	1,799.7	04-19-1988	1,800.2	05-10-1995	1,801.1
11-04-1980	1,799.5	09-21-1988	1,799.5	10-10-1995	1,800.7
04-02-1981	1,800.2	04-26-1989	1,800.5	05-08-1996	1,801.0
05-01-1981	1,800.2	10-18-1989	1,800.1	06-04-1996	1,801.0
05-08-1983	1,800.2	05-02-1990	1,800.3	07-01-1996	1,800.6
10-11-1983	1,799.7	09-19-1990	1,800.0	07-29-1996	1,800.3
06-08-1984	1,800.3	05-01-1991	1,800.5	09-04-1996	1,800.3
08-22-1984	1,800.2	10-03-1991	1,800.3	10-09-1996	1,800.3
05-07-1985	1,800.3	04-29-1992	1,800.4		

Table F3. Water-level measurements for Buffalo Lake North in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
06-24-1982	1,832.2	04-22-1987	1,835.5	04-30-1992	1,831.9
10-29-1982	1,831.5	10-06-1987	1,834.1	09-17-1992	1,831.2
05-07-1983	1,831.7	04-19-1988	1,833.9	05-13-1993	1,832.2
10-12-1983	1,830.3	09-20-1988	1,832.6	09-23-1993	1,836.3
06-07-1984	1,831.6	04-27-1989	1,833.1	05-05-1994	1,836.9
09-27-1984	1,830.7	10-19-1989	1,832.1	09-15-1994	1,835.1
05-07-1985	1,831.4	05-30-1990	1,831.8	05-11-1995	1,836.7
10-19-1985	1,830.6	09-20-1990	1,831.4	10-02-1995	1,835.7
05-07-1986	1,832.4	05-02-1991	1,831.7	05-07-1996	1,836.8
09-23-1986	1,833.7	10-03-1991	1,831.7	10-08-1996	1,035.8

Table F4. Water-level measurements for Buffalo Lake South in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
06-23-1982	1,832.6	04-22-1987	1,835.7	04-30-1992	1,832.8
10-29-1982	1,831.9	10-06-1987	1,834.1	09-17-1992	1,832.5
05-07-1983	1,832.2	04-19-1988	1,834.0	05-13-1993	1,833.8
10-12-1983	1,830.7	09-20-1988	1,832.6	09-23-1993	1,836.3
06-07-1984	1,832.3	04-27-1989	1,833.9	05-05-1994	1,836.8
09-27-1984	1,831.4	10-19-1989	1,832.5	09-15-1994	1,835.5
05-07-1985	1,832.1	05-30-1990	1,832.1	05-11-1995	1,836.8
10-09-1985	1,831.2	09-20-1990	1,831.8	10-02-1995	1,835.7
05-07-1986	1,834.6	05-02-1991	1,831.8	05-07-1996	1,837.1
09-23-1986	1,835.4	10-03-1991	1,832.4	10-08-1996	1,836.5

Table F5. Water-level measurements for Clear Lake in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-12-1982	1,819.6	04-22-1987	1,822.5	09-23-1993	1,822.6
06-01-1982	1,819.7	10-06-1987	1,820.8	05-05-1994	1,822.9
10-29-1982	1,818.8	04-19-1988	1,820.6	09-15-1994	1,821.8
05-06-1983	1,818.8	09-20-1988	1,819.4	05-11-1995	1,822.5
06-03-1983	1,818.6	04-27-1989	1,819.9	10-02-1995	1,822.1
10-12-1983	1,817.3	10-19-1989	1,818.9	05-07-1996	1,822.7
05-02-1984	1,818.1	05-03-1990	1,818.9	06-06-1996	1,822.6
06-07-1984	1,818.8	09-20-1990	1,818.2	07-02-1996	1,822.6
09-28-1984	1,817.0	05-02-1991	1,818.1	07-30-1996	1,822.6
05-07-1985	1,817.4	10-03-1991	1,818.1	09-04-1996	1,821.9
10-09-1985	1,816.4	04-30-1992	1,818.2	10-08-1996	1,821.8
05-07-1986	1,819.0	09-17-1992	1,817.6		
09-23-1986	1,822.5	05-13-1993	1,819.1		

Table F6. Water-level measurements for Clubhouse Lake in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
07-10-1986	972.6	10-19-1989	970.9	05-05-1994	973.1
09-23-1986	972.3	05-03-1990	971.9	09-15-1994	972.7
04-22-1987	972.5	10-03-1991	972.2	05-11-1995	973.0
10-06-1987	970.9	04-30-1992	972.5	10-03-1995	973.0
04-19-1988	970.8	09-17-1992	972.1	05-07-1996	972.8
09-20-1988	969.5	05-13-1993	972.6		
04-27-1989	972.7	09-23-1993	972.9		

Table F7. Water-level measurements for Cottonwood Lake in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
10-03-1995	1,826.9	07-02-1996	1,827.2	10-08-1996	1,826.8
05-07-1996	1,827.5	07-30-1996	1,827.2		
06-06-1996	1,827.5	09-04-1996	1,826.8		

Table F8. Water-level measurements for Cottonwood Lake in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
07-10-1986	1,029.4	05-03-1990	1,029.0	05-05-1994	1,030.3
09-23-1986	1,029.8	09-20-1990	1,028.8	09-15-1994	1,029.8
04-22-1987	1,030.0	05-02-1991	1,029.8	05-11-1995	1,030.4
10-06-1987	1,028.7	10-03-1991	1,029.5	10-03-1995	1,030.1
04-19-1988	1,029.2	04-30-1992	1,029.9	05-07-1996	1,030.3
09-20-1988	1,028.3	09-17-1992	1,029.3	10-02-1996	1,029.6
04-27-1989	1,029.6	05-13-1993	1,029.9		
10-19-1989	1,028.5	09-23-1993	1,030.1		

Table F9. Water-level measurements for Drywood Lake North in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
11-03-1983	1,942.2	04-19-1988	1,943.0	09-17-1992	1,942.2
06-07-1984	1,943.0	09-20-1988	1,941.6	05-13-1993	1,943.4
09-27-1984	1,942.5	04-27-1989	1,942.7	09-23-1993	1,944.9
05-07-1985	1,942.7	10-19-1989	1,941.5	05-05-1994	1,947.0
10-09-1985	1,941.9	05-03-1990	1,942.5	09-15-1994	1,946.2
05-07-1986	1,944.2	09-20-1990	1,940.9	05-11-1995	1,947.8
09-24-1986	1,944.5	05-02-1991	1,942.3	10-02-1995	1,947.6
04-22-1987	1,944.6	10-03-1991	1,942.2	05-07-1996	1,948.9
10-06-1987	1,943.1	04-30-1992	1,942.5	10-08-1996	1,948.8

Table F10. Water-level measurements for Drywood Lake South in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
11-03-1983	1,943.3	04-19-1988	1,945.1	09-17-1992	1,944.4
06-07-1984	1,944.5	09-20-1988	1,943.7	05-13-1993	1,945.8
09-27-1984	1,943.6	04-27-1989	1,944.7	09-23-1993	1,947.1
05-07-1985	1,944.3	10-19-1989	1,943.5	05-05-1994	1,947.6
11-13-1985	1,943.5	05-03-1990	1,942.0	09-15-1994	1,946.8
05-07-1986	1,946.3	09-20-1990	1,943.1	05-11-1995	1,948.5
09-24-1986	1,946.4	05-02-1991	1,943.4	10-02-1995	1,947.6
04-22-1987	1,946.5	10-03-1991	1,944.4	05-07-1996	1,948.9
10-06-1987	1,945.2	04-30-1992	1,943.1	10-08-1996	1,948.8

Table F11. Water-level measurements for Enemy Swim Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
07-07-1982	1,851.7	04-19-1988	1,852.3	05-04-1994	1,855.1
10-29-1982	1,851.2	09-21-1988	1,850.7	09-14-1994	1,853.9
05-07-1983	1,851.4	04-28-1989	1,852.2	05-10-1995	1,854.7
10-12-1983	1,850.2	10-18-1989	1,851.2	10-04-1995	1,853.8
06-08-1984	1,851.9	05-02-1990	1,851.2	05-08-1996	1,854.6
09-27-1984	1,851.2	09-19-1990	1,850.7	06-04-1996	1,854.6
05-07-1985	1,852.3	05-01-1991	1,850.7	07-10-1996	1,854.3
10-09-1985	1,851.5	10-02-1991	1,852.1	07-29-1996	1,854.0
05-07-1986	1,854.6	04-29-1992	1,852.4	09-04-1996	1,853.6
09-24-1986	1,854.2	09-16-1992	1,852.0	10-09-1996	1,853.4
04-23-1987	1,854.4	05-12-1993	1,853.4		
10-07-1987	1,852.2	09-22-1993	1,854.8		

Table F12. Water-level measurements for Hillebrands Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
10-11-1983	1,781.3	04-28-1989	1,785.2	09-14-1994	1,788.4
10-09-1984	1,781.6	10-18-1989	1,784.3	05-11-1995	1,792.9
11-07-1984	1,781.9	05-02-1990	1,784.5	10-11-1995	1,794.1
04-14-1985	1,782.5	09-21-1990	1,784.1	05-08-1996	1,796.1
11-01-1985	1,781.6	05-01-1991	1,784.4	06-05-1996	1,797.2
04-21-1986	1,783.5	10-02-1991	1,785.0	07-01-1996	1,796.8
09-24-1986	1,785.1	04-29-1992	1,785.1	07-29-1996	1,796.6
04-23-1987	1,786.0	09-16-1992	1,784.9	09-04-1996	1,796.3
10-07-1987	1,784.8	05-12-1993	1,785.0	10-09-1996	1,796.2
04-20-1988	1,785.0	09-22-1993	1,786.8		
09-21-1988	1,784.0	05-04-1994	1,788.4		

Table F13. Water-level measurements for Hurricane Lake in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
07-10-1986	1,752.6	05-02-1990	1,747.8	05-05-1994	1,753.5
09-24-1986	1,752.9	09-19-1990	1,747.0	09-14-1994	1,753.3
04-22-1987	1,752.5	05-01-1991	1,746.9	05-10-1995	1,753.7
10-06-1987	1,750.4	10-02-1991	1,747.9	10-02-1995	1,752.8
04-19-1988	1,749.8	04-29-1992	1,748.1	05-07-1996	1,752.6
09-20-1988	1,747.6	09-16-1992	1,747.7	10-08-1996	1,752.2
04-27-1989	1,749.5	05-12-1993	1,749.6		
10-18-1989	1,747.8	09-23-1993	1,751.9		

Table F14. Water-level measurements for Pickerel Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
06-22-1982	1,845.0	04-19-1988	1,844.6	05-04-1994	1,845.7
10-29-1982	1,844.5	09-21-1988	1,843.5	09-14-1994	1,845.0
05-08-1983	1,845.2	04-28-1989	1,845.4	05-10-1995	1,845.7
10-12-1983	1,844.4	10-18-1989	1,844.1	10-04-1995	1,845.1
06-08-1984	1,845.2	05-02-1990	1,844.6	05-08-1996	1,845.7
09-27-1984	1,844.4	09-19-1990	1,844.8	06-05-1996	1,845.6
05-07-1985	1,845.1	05-01-1991	1,845.4	07-01-1996	1,845.3
10-09-1985	1,844.8	10-02-1991	1,844.9	07-29-1996	1,845.3
05-07-1986	1,845.9	04-29-1992	1,845.3	09-04-1996	1,845.0
09-24-1986	1,845.3	09-16-1992	1,844.9	10-09-1996	1,845.0
04-23-1987	1,845.3	05-12-1993	1,845.6		
10-07-1987	1,844.2	09-22-1993	1,845.3		

Table F15. Water-level measurements for Piyas Lake in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
10-04-1995	1,828.0	05-07-1996	1,829.2	10-08-1996	1,829.1

Table F16. Water-level measurements for Red Iron Lake North in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
09-28-1984	1,825.0	04-27-1989	1,827.5	09-23-1993	1,830.1
05-07-1985	1,825.9	10-19-1989	1,826.5	05-05-1994	1,830.2
10-09-1985	1,825.1	05-30-1990	1,826.7	09-15-1994	1,829.6
05-07-1986	1,830.0	09-20-1990	1,826.1	05-11-1995	1,830.2
09-23-1986	1,829.2	05-02-1991	1,826.3	10-02-1995	1,829.5
04-22-1987	1,829.0	10-03-1991	1,827.5	05-07-1996	1,829.8
10-06-1987	1,827.2	04-30-1992	1,827.8	10-08-1996	1,828.9
04-19-1989	1,827.3	09-17-1992	1,827.5		
09-20-1988	1,826.1	05-13-1993	1,828.7		

Table F17. Water-level measurements for Red Iron Lake South in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
09-28-1984	1,827.1	04-27-1989	1,828.3	09-23-1993	1,830.7
05-07-1985	1,828.1	10-19-1989	1,827.3	05-05-1994	1,832.0
10-09-1985	1,826.8	05-03-1990	1,827.5	09-15-1994	1,829.8
05-07-1986	1,831.0	09-20-1990	1,827.0	05-11-1995	1,832.0
09-23-1986	1,829.9	05-02-1991	1,827.1	10-02-1995	1,830.5
04-22-1987	1,829.8	10-03-1991	1,828.1	05-07-1996	1,831.3
10-06-1987	1,828.1	04-30-1992	1,828.4	10-08-1996	1,829.5
04-19-1988	1,828.1	09-17-1992	1,828.0		
09-20-1988	1,826.8	05-13-1993	1,829.7		

Table F18. Water-level measurements for Spring Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
10-11-1983	1,785.0	04-28-1989	1,787.1	09-14-1994	1,788.9
10-09-1984	1,785.4	10-18-1989	1,786.2	05-11-1995	1,791.0
11-07-1984	1,785.6	05-02-1990	1,786.6	10-11-1995	1,790.6
04-17-1985	1,786.1	09-20-1990	1,786.3	05-08-1996	1,791.8
11-01-1985	1,785.4	05-01-1991	1,786.8	06-05-1996	1,792.5
04-21-1986	1,786.9	10-02-1991	1,787.1	07-01-1996	1,792.1
09-24-1986	1,787.5	04-29-1992	1,787.6	07-29-1996	1,792.0
04-23-1987	1,788.2	09-16-1992	1,787.1	09-04-1996	1,791.8
10-07-1987	1,786.8	05-12-1993	1,787.8	10-09-1996	1,791.7
04-20-1988	1,787.0	09-22-1993	1,788.0		
09-21-1988	1,785.9	05-04-1994	1,789.7		

Table F19. Water-level measurements for Whitestone Lake North in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
06-07-1984	2,012.1	09-20-1988	2,010.5	05-13-1993	2,012.8
09-27-1984	2,011.2	04-27-1989	2,010.8	09-23-1993	2,012.8
05-07-1985	2,012.1	10-19-1989	2,010.8	05-05-1994	2,014.0
10-09-1985	2,011.3	05-03-1990	2,011.0	09-15-1994	2,013.2
05-07-1986	2,013.1	09-20-1990	2,010.4	05-11-1995	2,014.7
09-24-1986	2,013.0	05-02-1991	2,010.9	10-02-1995	2,014.5
04-22-1987	2,013.1	10-03-1991	2,011.0	05-07-1996	2,015.0
10-06-1987	2,011.8	04-30-1992	2,011.4	10-08-1996	2,014.1
04-19-1988	2,011.9	09-17-1992	2,011.0		

Table F20. Water-level measurements for Whitestone Lake South in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
06-07-1984	2,010.6	09-20-1988	2,010.1	05-13-1993	2,011.1
09-27-1984	2,009.7	04-27-1989	2,012.0	09-23-1993	2,012.4
05-07-1996	2,010.5	10-19-1989	2,009.7	05-05-1994	2,014.0
10-09-1985	2,009.8	05-03-1990	2,009.7	09-15-1994	2,013.2
05-07-1986	2,012.2	09-20-1990	2,009.4	05-11-1995	2,014.7
09-24-1986	2,012.8	05-02-1991	2,009.7	10-02-1995	2,014.5
04-22-1987	2,013.1	10-03-1991	2,010.0	05-07-1996	2,015.0
10-06-1987	2,011.5	04-30-1992	2,009.3	10-08-1996	2,014.1
04-19-1988	2,011.3	09-17-1992	2,009.0		

☆ U.S. GOVERNMENT PRINTING OFFICE: 1999—773-090 / 24511 Region No. 8