Prepared in cooperation with the Bureau of Reclamation, U.S. Department of the Interior

Summary and Trend Analysis of Water-Quality Data for the Oakes Test Area, Southeastern North Dakota, 1984–2004

Scientific Investigations Report 2007–5056

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

This page intentionally left blank.

Summary and Trend Analysis of Water-Quality Data for the Oakes Test Area, Southeastern North Dakota, 1984–2004

By Karen R. Ryberg

Prepared in cooperation with the Bureau of Reclamation,
U.S. Department of the Interior

Scientific Investigations Report 2007–5056

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

U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia: 2007

For product and ordering information:
World Wide Web: http://www.usgs.gov/pubprod
Telephone: 1-888-ASK-USGS

For more information on the USGS--the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment:
World Wide Web: http://www.usgs.gov
Telephone: 1-888-ASK-USGS

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted materials contained within this report.

Suggested citation:
Ryberg, K.R., 2007, Summary and trend analysis of water-quality data for the Oakes Test Area, southeastern North Dakota, 1984–2004: U.S. Geological Survey Scientific Investigations Report 2007–5056, 118 p.

Contents

Abstract 1
Introduction 1
Purpose and Scope 1
Description of Oakes Test Area 1
Methods 5
Summary Statistics 7
Results of Trend Analysis 7
Summary 26
References Cited 27
Supplements 29

Figures

1. Map showing the Garrison Diversion Conservancy District and Oakes Test Area in North Dakota 2
2. Oakes Test Area drain system and water-quality sampling sites, southeastern North Dakota 3

3–5. Graph showing:
3. Sources and amounts of irrigation water used in the Oakes Test Area, southeastern North Dakota, 1988–2004 4
4. Drainflow for sites in the Oakes Test Area, southeastern North Dakota 5
5. Base-10 logarithm of constituent concentrations at site 3 in the Oakes Test Area, southeastern North Dakota, and associated trend lines 24

Tables

1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004 8
2. Trends by site for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004 16
3. Trends by constituent for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004 20

Supplements 1-4:

1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004 30
2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004. 46
3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004. 71
4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004. 95

Conversion Factors

Multiply	By	To obtain
	Length	
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.4047	square hectometer (hm^2)
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

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

°F=(1.8×°C)+32

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

°C=(°F-32)/1.8

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Summary and Trend Analysis of Water-Quality Data for the Oakes Test Area, Southeastern North Dakota, 1984–2004

By Karen R. Ryberg

Abstract

The Oakes Test Area is operated and maintained by the Garrison Diversion Conservancy District, under a cooperative agreement with the Bureau of Reclamation, to evaluate the effectiveness and environmental consequences of irrigation. As part of the evaluation, the Bureau of Reclamation collected water-quality samples from seven sites on the James River and the Oakes Test Area. The data were summarized and examined for trends in concentration.

A nonparametric statistical test was used to test whether each concentration was increasing or decreasing with time for selected physical properties and constituents, and a trend slope was estimated for each constituent at each site. Trends were examined for two time periods, 1988–2004 and 1994–2004.

Results varied by site and by constituent. All sites and all constituents tested had at least one statistically significant trend in the period 1988–2004. Sulfate, total dissolved solids, nitrate, and orthophosphate have significant positive trends at multiple sites with no significant negative trend at any site. Alkalinity and arsenic have single significant positive trends. Hardness, calcium, magnesium, sodium, sodium-adsorption ratio, potassium, and chloride have both significant positive and negative trends. Ammonia has a single significant negative trend. Fewer significant trends were identified in 1994–2004, and all but one were positive. The contribution to the James River from Oakes Test Area drainage appears to have little effect on water quality in the James River.

Introduction

The Oakes Test Area is a Federal project in southeastern North Dakota developed as part of the Garrison Diversion Unit (GDU) to evaluate the effectiveness and environmental consequences of irrigation in North Dakota. The GDU was created by the U.S. Congress in 1965 with the intent of providing water for agricultural irrigation in North Dakota. Subsequent acts of Congress (the Garrison Diversion Unit Reformulation Act of 1986 and the Dakota Water Resources Act of 2000) have changed the focus of the GDU; however, the Oakes Test Area has continued to operate. The Oakes Test Area is operated and maintained by the Garrison Diversion Conservancy District (GDCD; fig. 1) under a cooperative agreement with the U.S. Department of the Interior, Bureau of Reclamation (Garrison Diversion Conservancy District, 2004a).

To evaluate the environmental consequences of irrigation, the Bureau of Reclamation collected water-quality samples from seven sites on the James River and the Oakes Test Area drain system (fig. 2). The James River is one of the sources of Oakes Test Area irrigation water and receives return flow from the drain system. A cooperative project with the U.S. Geological Survey (USGS) and the Bureau of Reclamation was conducted to evaluate the data for possible trends in constituent concentrations and to provide information to support decisions regarding the necessity and frequency of continued water-quality sampling.

Purpose and Scope

Presented in the report are summary statistics for 31 water-quality physical properties and constituents from samples collected by the Bureau of Reclamation at 7 sites on the James River and the Oakes Test Area from January 1984 through November 2004. This report also presents the results of a trend analysis performed on selected physical properties, dissolved solids, major ions, nutrients, and trace elements at the 7 sites. The data used for the statistical summaries and trend analysis are provided in supplements at the end of the report.

Description of Oakes Test Area

The Oakes Test Area is a 5,000-acre area east of the James River between Oakes and Ludden, North Dakota (fig. 2). The area was established as part of the Garrison Diversion Unit (created by the U.S. Congress on August 5, 1965). The Oakes Test Area was “designed to demonstrate that a well-managed irrigation system could produce high-value, irrigated crops without the potential for damage to nearby water supplies” (Garrison Diversion Conservancy District, 2004b). Irrigation water has been a combination of ground water, surface water from the James

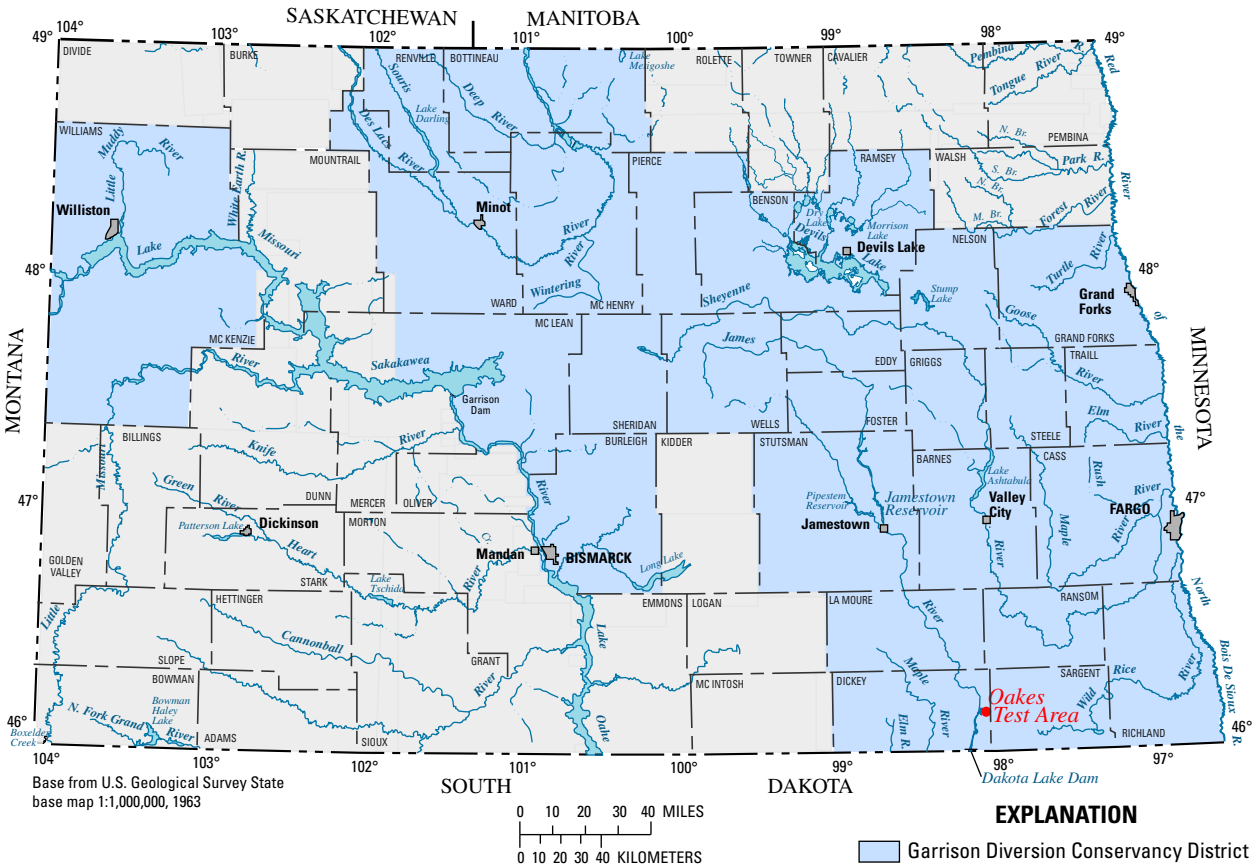


Figure 1. The Garrison Diversion Conservancy District and Oakes Test Area in North Dakota.

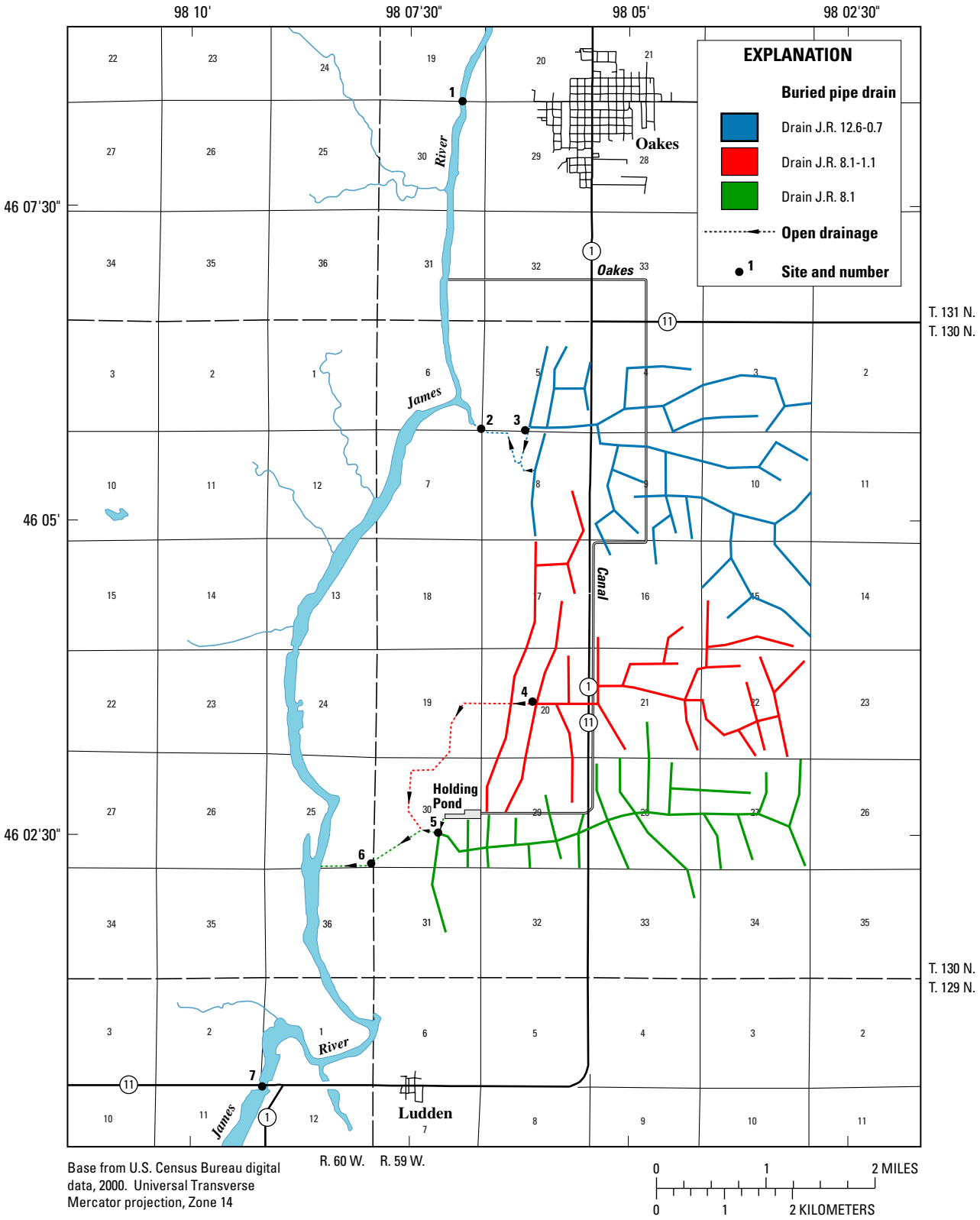


Figure 2. Oakes Test Area drain system and water-quality sampling sites, southeastern North Dakota.

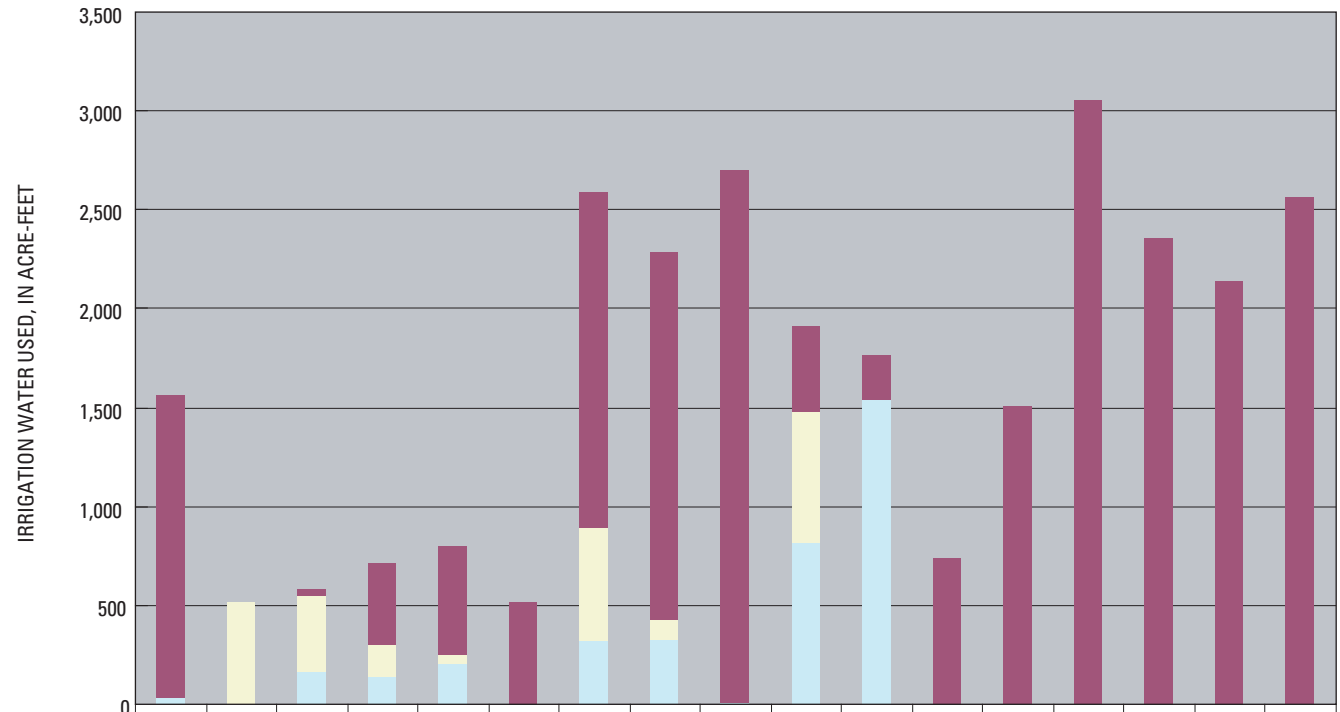
River, and water recaptured from the drain system by drain pumps (fig. 3).

The James River originates in central North Dakota and flows southeast into South Dakota. At the North Dakota-South Dakota State line, the drainage area of the James River Basin is 5,480 mi^2 (Brigham and Payne, 1999). Natural lakes, low-head dams, and regulated reservoirs are located along the James River. Upstream from the Oakes Test Area is the Jamestown Reservoir (fig. 1), constructed primarily for flood control (Simonds, 1996). The Dakota Lake Dam, 4.5 mi southwest of Ludden, North Dakota, and 0.8 mi upstream from the North Dakota-South Dakota State line, directly affects the James River in the study area (fig. 1). The water-quality sampling sites on the James River (sites 1 and 7, fig. 2) are lake-affected and wind-affected (B.R. Hanson, U.S. Geological Survey, oral commun., 2006).

Approximately 40 miles of subsurface pipe drains were installed in the Oakes Test Area during 1983–85 as a means to control the water table (Goolsby and others, 1989; fig. 2). Irrigation delivery began in 1988, and the number of acres receiving water has varied from 500 to 3,500 acres (Weckerly, 2006). The drains discharge into three open collector drains that discharge water to the James River (Goolsby and others, 1989). The north drain (J.R. 12.6-0.7) discharges to the James River about 3 mi south of Oakes, North Dakota. The middle drain (J.R. 8.1-1.1) and the south drain (J.R. 8.1) join together and discharge to the James River at the southern end of the Oakes Test Area.

The hydrologic and climatic conditions at the Oakes Test Area were variable over the sampling period of record. From 1986 to the delivery of irrigation water in 1988, water flowed in the drains and water-quality samples were collected and analyzed. Most of the drainflow was due to ground-water infiltration (D. Esser, Garrison Diversion Conservancy District, oral commun., 2007). Under irrigation conditions, the source of water in the drains has varied (fig. 3). Warm, dry conditions during 1988–92 resulted in low runoff and decreased ground-water recharge (Williams-Sether, 1999). A cool, wet period resulting in high runoff began in 1993 (Williams-Sether, 1999). The high runoff resulted in higher drainflow as shown in figure 4. The drainflow data shown in figure 4 are presented in Supplement 1 at the end of the report.

The Oakes Test Area has many other sources of variability, including the types of crops grown and methods used to clean the drain pipes. “North Dakota State University, operating with Garrison Diversion funding, studies test plots of cabbages, peppers, tomatoes, Chinese vegetables and more” (Garrison Diversion Conservancy District, 2004b). Different



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
James River	1,526.9	0	29.2	415.0	555.4	512.1	1,694.7	1,861.1	2,692.3	437.3	219.8	737.6	1,507.7	3,056.8	2,354.9	2,143.1	2,561.2
Drain pumps	0	512.1	391.9	162.4	38.3	0	572.9	101.9	0	658.7	0	0	0	0	0	0	0
Ground water	34.8	0	159.7	136.3	207.5	0	320.2	325.0	11.2	816.8	1,543.6	0	0	0	0	0	0

Figure 3. Sources and amounts of irrigation water used in the Oakes Test Area, southeastern North Dakota, 1988–2004.

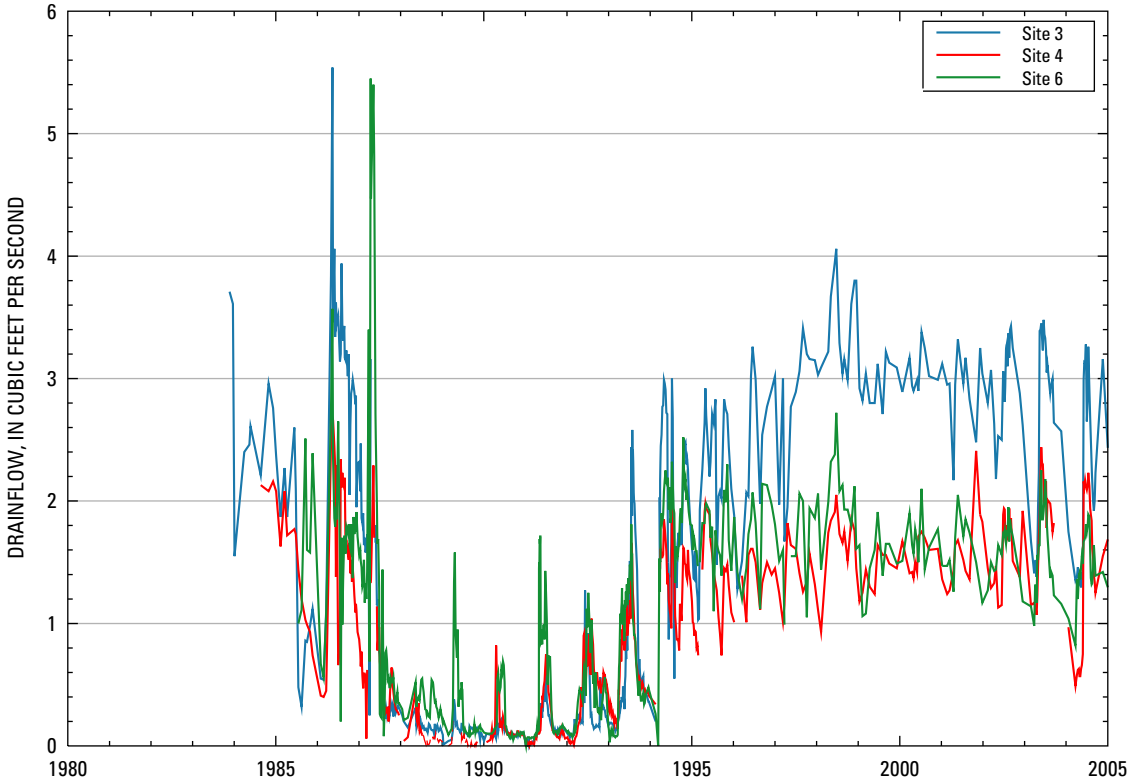


Figure 4. Drainflow for sites in the Oakes Test Area, southeastern North Dakota.

crops have different irrigation requirements and contribute to the variability in irrigation and drainage. The drain pipes need to be cleaned periodically. Depending on location and use, some pipes are cleaned more often than others and the method used may be high pressure water or a brush system (D. Esser, Garrison Diversion Conservancy District, oral commun., 2007).

Methods

Water-quality data were collected by the Bureau of Reclamation using collection methods that varied with the type of site. Sites on the James River were depth integrated (D. Hartman, Bureau of Reclamation, written commun., 2007). Some sites in the drainage system involved removing a manhole cover to access the buried drain and lowering a weighted bottle to collect a dip sample. Site 2, where the drain flows into the James River, was dip sampled (L.L. Rutschke, U.S. Geological Survey, oral commun., 2007). For quality assurance, periodic duplicate samples were collected from the same location, and periodic split samples were collected and filtered into one bottle and then split into two different bottles prior to preservation and analysis (D. Hartman, Bureau of Reclamation, written commun., 2007).

All water-quality samples were analyzed by the Bureau of Reclamation Dakotas Area Office Water and Soil Laboratory in Bismarck, North Dakota. Laboratory methods used were those of the manufacturer of the analyzing equipment and were based on U.S. Environmental Protection Agency approved methods (D. Hartman, Bureau of Reclamation, written commun., 2007). Quality-control measures included the calibration of equipment and analysis of blank, duplicate, and split samples. The results of these quality-control measures were verified manually and data were accepted according to criteria in an internal quality-control manual (D. Hartman, Bureau of Reclamation, oral commun., 2007). Other quality control measures included the use of check standards, control samples, analytical spikes and duplicates, and cation/anion balance comparison (D. Hartman, Bureau of Reclamation, written commun., 2007). The water-quality concentration data are on file at the Bureau of Reclamation Dakotas Area Office, Bismarck, North Dakota.

Drainflow data were collected by GDCD personnel at Oakes, North Dakota, and are on file in the Oakes office. Drainflow was measured using a portable ultrasonic meter (D. Esser, Garrison Diversion Conservancy District, oral commun., 2007). The amount and source of irrigation water (fig. 3) also were monitored by GDCD personnel at Oakes, and data are on file in that office.

Summary statistics were calculated for 31 physical properties, dissolved and suspended solids, major ions, nutrients, and trace elements. Some suspended solids, nutrient, and trace element values were censored. Censored values represent concentrations that are known to be less than a certain laboratory reporting level (LRL), but for which the exact value is not known. Summary statistics were estimated for constituents with censored values if less than 80 percent of the values were censored. For constituents with less than 50-percent censoring, the maximum concentration was reported, the minimum concentration was reported as less than the lowest LRL, and the percentiles were estimated by the nonparametric Kaplan-Meier method (Helsel, 2005). For constituents with 50–80 percent of values censored, the maximum concentration was reported, the minimum concentration was reported as less than the lowest LRL for each particular site, and the percentiles were estimated by using regression on order statistics (ROS), a method that calculates summary statistics with a regression equation on a probability plot (Helsel, 2005). ROS estimation requires at least three uncensored observations; therefore, small samples that had less than 80-percent censoring were treated as those with more than 80-percent censoring if there were not three or more uncensored observations. For constituents with more than 80-percent censoring, the maximum concentration was reported, the minimum concentration was reported as less than the lowest LRL, and the 95th percentile was reported if the data had 95-percent censoring or less. Means also were estimated by using the Kaplan-Meier and ROS methods. If a particular site had no censored concentrations for a constituent, the summary statistics reported are actual concentrations, not estimated values.

The trend analysis method used was the nonparametric Mann-Kendall test, which tests whether values tend to increase or decrease with time (monotonic change; Helsel and Hirsch, 1992). In hypothesis terms, the test can be expressed as

$$\begin{aligned} H_0 &: \mathrm{Prob}\left[Y\left(t_j\right) > Y\left(t_i\right)\right] = 0.5 \\ H_1 &: \mathrm{Prob}\left[Y\left(t_j\right) > Y\left(t_i\right)\right] \neq 0.5, \end{aligned} \tag{1}$$

where

Prob denotes probability,

$Y(t)$ is constituent concentration for time t,

and

$t_j > t_i$.

The test statistic is Kendall's S According to Helsel and Hirsch (1992), "Kendall's S is calculated by subtracting the number of 'discordant pairs' M, the number of (x,y) pairs where y decreases as x increases, from the number of 'concordant pairs' P, the number of (x,y) pairs where y increases with increasing x." As used in this study, y is constituent concentration and x is time.

Because Mann-Kendall is a nonparametric test, the assumption of normality is not required and a small percentage of outliers does not substantially affect the results (Helsel and Hirsch, 1992). The Mann-Kendall test was used for both uncensored and censored constituents. The test makes comparisons between all possible pairs of observations. The censored, or "less than," values are considered to be tied with each other when compared. Comparisons are difficult to make when data have multiple LRLs; for example, ammonia at site 2 was censored at 0.02, 0.05, and 0.10 milligrams per liter. In order to perform the Mann-Kendall test, the data were further censored by using the highest LRL, 0.10, to represent all "less than" values. Not every physical property or constituent was tested at each site, because at some sites sample size was too small or no samples were collected.

The slope of the trend is a Sen slope estimate (also called Theil slope estimate) and is the median of all possible pairwise slopes (U.S. Geological Survey, variously dated). The sign of the Sen slope estimate is accurate for highly censored data; however, the magnitude of the slope may not be accurate (Helsel and Hirsch, 1992). The percentage change from the beginning of any year to the end of that year calculated for statistically significant trends is $\left(10^{b_1} - 1\right)\mathrm{x}100$, where b_1 is the estimated Sen slope as the base-10 logarithm of milligrams per liter or micrograms per liter (Helsel and Hirsch, 1992).

Because of the climatic variability during the sampling period of record and the ground-water drainage prior to irrigation, there are three separate populations of water-quality data, pre-1988 for some sites/constituents, 1988–1993, and post-1993. The number of samples collected before 1988 is small and samples were not collected at all sites; therefore, trends were not calculated for the pre-1988 period. Two trends were calculated for each site/constituent combination: one trend for the sampling period of record under irrigation conditions, 1988–2004, and one for the period 1994–2004.

Other methods of trend analysis were considered for this study. Understanding why these other methods were not used contributes to the understanding of the availability and variability of data related to the Oakes Test Area. Methods considered included regression or LOWESS (Locally Weighted Scatterplot Smoothing; Helsel and Hirsch, 1992) of constituent concentration on time and streamflow or drainflow, and regression or LOWESS of constituent concentration on time and other exogenous variables.

Regression on streamflow, drainflow, or another variable would remove variation in concentration caused by these variables, increasing the ability of a trend test to discern changes in concentration over time. Adjustment for streamflow was an option only for sites 1 and 7 because they are on the James River (fig. 2). The James River sites (sites 1 and 7, fig. 2) are lake-affected because of Dakota Lake Dam (fig. 1) downstream, and are affected by releases from the Jamestown Reservoir (fig. 1) upstream. The lake conditions vary seasonally and with releases from the Jamestown Reservoir (R.J. Renner, U.S. Geological Survey, oral commun., 2007). Because of the lake conditions and the need to have a consistent manner in which to present trends, streamflow was not an appropriate variable for regression.

Drainflow adjustment was an option for sites 2–6 (fig. 3). For regression analysis, the probability distribution of the exogenous variable is assumed to be unchanged over the period of record (Helsel and Hirsch, 1992). Figure 4 shows that the probability distribution of drainflow has changed over the period of record with low flows in the late 1980s through early 1990s and higher flows in succeeding years. Drainflow is highly variable, being affected by weather conditions and nonrandom conditions including the types of crops grown in the Oakes Test Area and the conditions of the drains, which need to be cleaned periodically.

Other exogenous variables representing natural, random processes that might affect all sites were considered. The North Dakota Agricultural Weather Network (NDAWN, *http://ndawn.ndsu.nodak.edu/*) collects weather data at Oakes. Variables that might affect irrigation, air temperature and solar radiation, were considered for regression analysis. These variables did not explain a significant amount of the variation in concentration (R^2 of approximately 0.10 for some sites), and the period of record for weather data at Oakes did not begin until 1990. Use of the weather data would result in an omission of data early in the period of record, and in many cases this would result in a different trend slope than the slope of a trend identified over the entire period of record.

LOWESS is a robust nonparametric technique that requires the verification of fewer assumptions than does regression. However, LOWESS had the same shortcomings as regression in that possible exogenous variables for LOWESS of concentration were not effective in adjusting concentration. Also, LOWESS is not appropriate for highly censored data.

The data set used to calculate the summary statistics and for trend analysis is presented in Supplements 2–4 at the end of the report.

Summary Statistics

Summary statistics of the physical properties and constituents are listed in table 1, including summary statistics for censored concentrations. Censored values are indicated by the number of censored values for each site/constituent combination and the LRLs. An LRL of 0.10 indicates that one or more values were censored at 0.10 and recorded as <0.10. Multiple LRLs occur for some constituents, such as ammonia at site 1 (table 1), which has LRLs of 0.01, 0.02, 0.05, and 0.10. Multiple LRLs may occur because of changes in laboratory methods or equipment. The summary statistics are for the entire period of record for each constituent at each site.

Results of Trend Analysis

The procedure to test for trends in water quality resulted in a p-value for the Mann-Kendall test and a Sen slope estimate. A p-value less than 0.01 was considered statistically significant, indicating it was likely that the slope of the observations with time was significantly different from 0. A negative slope indicates a downward trend, decreasing concentration with time, and a positive slope indicates an upward trend, increasing concentration with time. The slopes and p-values for each site/constituent concentration combination are listed in tables 2 and 3. The leftmost Sen slope and p-value are calculated for the period 1988–2004. The rightmost Sen slope and p-value are calculated for the period 1994–2004. Tables 2 and 3 contain the same data; however, table 2 is grouped by site and table 3 is grouped by constituent to allow for examination of trends by site or by constituent. Significant trends have a + or – following the p-value to indicate significant upward or downward trends. Also listed for significant trends is the percentage change from beginning of any year to the end of that year, based on the Sen slope estimate.

As a visual example of the trends, the base-10 logarithm of constituents tested for site 3 and the associated trend lines are shown in figure 5. The blue trend line represents the trend calculated by using concentrations for 1988–2004. The green trend line represents the trend calculated by using concentrations for 1994–2004. For some constituents, the two trend lines are very similar. Potassium, for example, has a Sen slope of 0.005 for both trend periods. Other constituents appear to have been affected by the change in climatic conditions that began in 1993.

Chloride had relatively low measured concentrations prior to irrigation in 1988. Concentrations were relatively high in 1988, decreased until 1994, and increased afterward. Because of the high concentrations in the beginning of the irrigation period, the long term, 1988–2004, slope is downward, despite the upward trend from 1994 through 2004. Both the overall downward trend and the upward trend for 1994 through 2004 are statistically significant at the 0.01 significance level. Nitrate trends also appear to have been affected by the change in conditions that began in 1993; however, in a manner opposite to that of chloride. Nitrate concentrations were relatively low in 1988, increased until about 1995, and decreased afterward. Because of the low concentrations in the beginning of the irrigation period, the long-term, 1988–2004, slope is upward, despite the downward trend for 1994–2004. Only the overall upward trend for 1988–2004 is statistically significant at the 0.01 significance level.

Alkalinity has statistically significant upward trends for both periods; the slope is steepest for 1994–2004. Sodium and sodium-adsorption ratio have significant upward trends in both periods, with the slopes being less steep for 1994–2004. Ammonia has a downward trend for both periods; however, the trend for 1994–2004 is not statistically significant.

The total dissolved solids graph (fig. 5) and trend test results at site 3 (tables 2 and 3) are examples of the Mann-Kendall test and Sen slope resistance to potential outliers. There was one total dissolved solids concentration that was low in relation to the other observations, but the slope estimates were not unduly affected by the single observation.

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
1	Specific conductance	87	0	--	1,690	540	966	1,360	1,130	950	755	589	04/20/1989	11/17/2004
1	pH	79	0	--	8.8	7.4	8.2	8.7	8.5	8.2	8.1	7.5	04/18/1990	11/17/2004
1	Temperature, water	76	0	--	29.3	0	13.0	25.8	18.8	13.9	5.0	.5	04/20/1989	11/17/2004
1	Hardness	51	0	--	580	200	350	510	400	330	290	250	04/18/1990	11/17/2004
1	Calcium	61	0	--	150	40	72	110	77	67	58	52	04/20/1989	11/17/2004
1	Magnesium	61	0	--	62	20	39	56	48	36	32	26	04/20/1989	11/17/2004
1	Sodium	61	0	--	220	37	88	140	100	89	61	44	04/20/1989	11/17/2004
1	Sodium-adsorption ratio	61	0	--	4.1	1.1	2	3.1	2.3	2.0	1.5	1.2	04/20/1989	11/17/2004
1	Potassium	61	0	--	33	4.7	14	20	16	14	12	9.5	04/20/1989	11/17/2004
1	Bicarbonate	9	0	--	361	204	280	348	299	270	266	216	04/20/1989	05/16/1990
1	Carbonate	4	0	--	0	0	0	0	0	0	0	0	04/20/1989	05/16/1989
1	Alkalinity	55	0	--	470	160	280	380	320	270	230	200	04/18/1990	11/17/2004
1	Sulfate	59	0	--	390	86	200	310	240	180	150	120	04/20/1989	11/17/2004
1	Chloride	59	0	--	120	14	43	93	55	40	22	15	04/20/1989	11/17/2004
1	Total dissolved solids, calculated	59	0	--	1,210	332	611	848	725	589	476	398	04/20/1989	08/24/2004
1	Dissolved solids, residue at 105°C	28	1	0.5	255	<0.5	106	243	144	84	47	7	04/20/1989	08/23/1995
1	Dissolved solids, residue at 180°C	9	0	--	251	67	174	240	219	207	116	71	04/20/1989	05/16/1990
1	Dissolved solids, residue at 550°C	28	1	0.5	219	<0.5	80	192	99	89	32	4	04/20/1989	08/23/1995
1	Nitrate	84	51	0.10	3.7	<0.10	.29	2.0	.22	.06	.01	<0.01	04/20/1989	11/17/2004
1	Nitrite	63	54	0.02	<0.02	<0.02	--	.05	--	--	--	--	04/20/1989	11/17/2004
1	Ammonia	70	15	0.01, 0.02, 0.05, 0.10	.67	<0.01	.13	.28	.16	.13	.07	<0.01	04/20/1989	11/17/2004
1	Phosphorus, total	0	--	--	--	--	--	--	--	--	--	--	--	--
1	Orthophosphate	63	3	0.01	.64	<0.01	.16	.47	.20	.09	.04	.01	04/20/1989	11/17/2004
1	Arsenic	10	0	--	10	2	5	9	8	4	3	2	03/14/1991	11/17/2004
1	Boron	0	--	--	--	--	--	--	--	--	--	--	--	--
1	Cadmium	0	--	--	--	--	--	--	--	--	--	--	--	--
1	Iron	0	--	--	--	--	--	--	--	--	--	--	--	--
1	Manganese	0	--	--	--	--	--	--	--	--	--	--	--	--

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
1	Mercury	16	16	0.2	<0.2	<0.2	--	--	--	--	--	--	03/14/1991	11/17/2004
1	Molybdenum	0	--	--	--	--	--	--	--	--	--	--	--	--
1	Selenium	20	19	1, 2, 2.6	3.6	<1	--	--	--	--	--	--	03/14/1991	11/17/2004
2	Specific conductance	41	0	--	1,760	790	1,010	1,340	1,040	950	900	840	03/14/1991	11/17/2004
2	pH	38	0	--	8.7	7.0	7.9	8.5	8.1	7.9	7.6	7.4	03/14/1991	11/17/2004
2	Temperature, water	38	0	--	31.6	0	10.6	27.2	19.9	7.0	2.6	0.7	03/14/1991	11/17/2004
2	Hardness	24	0	--	570	330	430	520	440	420	400	370	03/14/1991	11/17/2004
2	Calcium	24	0	--	140	52	98	120	100	98	94	76	03/14/1991	11/17/2004
2	Magnesium	24	0	--	67	33	45	53	48	43	41	38	03/14/1991	11/17/2004
2	Sodium	24	0	--	190	30	63	170	60	48	43	33	03/14/1991	11/17/2004
2	Sodium-adsorption ratio	24	0	--	3.8	.6	1.3	3.4	1.2	1.0	.9	.7	03/14/1991	11/17/2004
2	Potassium	24	0	--	16	4.5	7.6	13	7.4	6.8	5.8	5	03/14/1991	11/17/2004
2	Bicarbonate	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Carbonate	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Alkalinity	22	0	--	400	250	320	380	330	320	290	260	03/14/1991	11/17/2004
2	Sulfate	22	0	--	320	150	190	310	210	180	170	150	03/14/1991	11/17/2004
2	Chloride	22	0	--	180	19	48	100	46	36	26	22	03/14/1991	11/17/2004
2	Total dissolved solids, calculated	23	0	--	1,100	547	651	979	690	589	566	552	03/14/1991	11/17/2004
2	Dissolved solids, residue at 105°C	2	0	--	59	26	--	--	--	--	--	--	08/18/1992	08/03/1994
2	Dissolved solids, residue at 180°C	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Dissolved solids, residue at 550°C	2	0	--	37	15	--	--	--	--	--	--	08/18/1992	08/03/1994
2	Nitrate	41	10	0.10	2.8	<0.10	1.1	2.6	1.7	1.1	.13	.02	03/14/1991	11/17/2004
2	Nitrite	27	9	0.02	.26	<0.02	.05	.22	.06	.03	.02	<0.01	03/14/1991	11/17/2004
2	Ammonia	32	5	0.02, 0.05, 0.10	.42	<0.02	.19	.37	.27	.20	.11	.01	03/14/1991	11/17/2004
2	Phosphorus, total	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Orthophosphate	25	7	0.01	.06	<0.01	.02	.05	.02	.01	.01	<0.01	03/14/1991	11/17/2004
2	Arsenic	26	8	1, 2	10	<1	2	4	3	2	1	1	03/14/1991	11/17/2004
2	Boron	0	--	--	--	--	--	--	--	--	--	--	--	--

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
2	Cadmium	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Iron	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Manganese	0	--	--	--	--	--	--	--	--	--	--	--	--
2	Mercury	32	31	0.1, 0.2	<0.2	<0.1	--	--	--	--	--	--	03/14/1991	11/17/2004
2	Molybdenum	0	0	--	--	--	--	--	--	--	--	--	--	--
2	Selenium	38	28	1, 2, 2.6, 4	<4	<1	1	2	1	1	<1	<1	03/14/1991	11/17/2004
3	Specific conductance	122	0	--	1,060	620	900	1,030	960	900	850	770	01/01/1984	11/17/2004
3	pH	111	0	--	7.8	6.7	7.3	7.7	7.5	7.3	7.2	7	12/10/1986	11/17/2004
3	Temperature, water	98	0	--	18.7	3.4	9.2	14.0	10.4	8.8	7.4	6.1	05/28/1986	11/17/2004
3	Hardness	57	0	--	600	330	450	540	470	440	420	380	05/24/1990	11/17/2004
3	Calcium	77	0	--	160	70	110	140	120	110	100	93	05/28/1986	11/17/2004
3	Magnesium	77	0	--	52	32	40	48	44	40	38	34	05/28/1986	11/17/2004
3	Sodium	77	0	--	55	20	34	50	42	32	26	23	05/28/1986	11/17/2004
3	Sodium-adsorption ratio	76	0	--	1.2	.4	.7	1.1	.9	.7	.5	.5	05/28/1986	11/17/2004
3	Potassium	77	0	--	9.5	4.3	5.4	6.6	5.5	5.2	4.9	4.6	05/28/1986	11/17/2004
3	Bicarbonate	20	0	--	409	356	378	405	383	378	371	356	09/24/1986	11/13/1990
3	Carbonate	16	0	--	0	0	0	0	0	0	0	0	09/24/1986	03/01/1990
3	Alkalinity	58	0	--	360	280	320	350	330	310	300	290	05/24/1990	11/17/2004
3	Sulfate	74	0	--	22	98	160	200	170	160	140	110	05/28/1986	11/17/2004
3	Chloride	75	0	--	36	11	25	36	31	23	2	14	05/28/1986	11/17/2004
3	Total dissolved solids, calculated	83	0	--	705	217	552	644	600	553	522	452	01/01/1984	11/17/2004
3	Dissolved solids, residue at 105°C	16	2	0.5	41	<0.5	5.0	14	4.0	2.0	1.2	.2	08/18/1992	10/05/1995
3	Dissolved solids, residue at 180°C	0	--	--	--	--	--	--	--	--	--	--	--	--
3	Dissolved solids, residue at 550°C	16	11	0.5	20	<0.5	1.8	17	1.1	.1	<.1	<.1	08/18/1992	10/05/1995
3	Nitrate	124	0	--	5	.59	2.5	4.1	3.1	2.5	1.8	1.3	01/01/1984	11/17/2004
3	Nitrite	91	85	0.02	.03	<0.02	--	.02	--	--	--	--	05/28/1986	11/17/2004
3	Ammonia	100	14	0.05, 0.1	.59	<0.05	.18	.33	.24	.18	.09	.02	05/28/1986	11/17/2004
3	Phosphorus, total	2	0	--	.07	.02	--	--	--	--	--	--	06/19/1990	06/30/1994

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
3	Orthophosphate	90	16	0.01	.22	<0.01	.03	.06	.03	.02	.01	<.01	05/28/1986	11/17/2004
3	Arsenic	66	15	1, 2	3	<1	2	3	2	2	1	< 1	12/10/1986	11/17/2004
3	Boron	4	0	--	100	50	80	--	--	--	--	--	12/10/1986	09/15/1987
3	Cadmium	4	3	0.2	.3	<0.2	--	--	--	--	--	--	12/10/1986	09/15/1987
3	Iron	4	0	--	500	180	310	--	--	--	--	--	12/10/1986	09/15/1987
3	Manganese	4	0	--	490	400	460	--	--	--	--	--	12/10/1986	09/15/1987
3	Mercury	76	68	0.1, 0.2	.2	<0.1	--	.2	--	--	--	--	12/10/1986	11/17/2004
3	Molybdenum	4	0	--	3	2	3	--	--	--	--	--	12/10/1986	09/15/1987
3	Selenium	83	41	0.5, 1, 2, 2.6, 4	4	<0.5	1.5	3.1	1.7	1.1	.3	.1	12/10/1986	11/17/2004
4	Specific conductance	116	0	--	1,560	680	819	890	850	820	780	725	10/29/1984	11/17/2004
4	pH	108	0	--	7.8	6.7	7.3	7.7	7.4	7.3	7.2	7.0	12/10/1986	11/17/2004
4	Temperature, water	98	0	--	15.9	0	9.5	14.4	11.5	9.5	7.3	5.9	05/28/1986	11/17/2004
4	Hardness	47	0	--	490	360	420	460	440	420	410	380	05/24/1990	11/17/2004
4	Calcium	64	0	--	120	87	100	120	110	100	100	93	05/28/1986	11/17/2004
4	Magnesium	64	0	--	44	31	38	43	40	38	36	33	05/28/1986	11/17/2004
4	Sodium	64	0	--	47	9.8	23	28	25	23	21	18	05/28/1986	11/17/2004
4	Sodium-adsorption ratio	64	0	--	.9	.3	.5	.6	.5	.5	.5	.4	05/28/1986	11/17/2004
4	Potassium	64	0	--	8.5	1.9	5.0	6.6	5.4	5.1	4.5	3.5	05/28/1986	11/17/2004
4	Bicarbonate	19	0	--	403	342	373	399	386	376	355	346	05/28/1986	11/13/1990
4	Carbonate	16	0	--	0	0	0	0	0	0	0	0	05/28/1986	03/01/1990
4	Alkalinity	46	0	--	330	280	300	320	320	300	300	280	05/24/1990	11/17/2004
4	Sulfate	62	0	--	200	85	120	160	140	120	110	98	05/28/1986	11/17/2004
4	Chloride	63	0	--	42	12	17	24	19	17	13	12	05/28/1986	11/17/2004
4	Total dissolved solids, calculated	68	0	--	659	193	490	544	521	486	466	438	10/29/1984	11/17/2004
4	Dissolved solids, residue at 105°C	2	0	--	2	2	2	--	--	--	--	--	06/03/1994	08/23/1995
4	Dissolved solids, residue at 180°C	0	--	--	--	--	--	--	--	--	--	--	--	--
4	Dissolved solids, residue at 550°C	2	1	<0.5	1	<0.5	--	--	--	--	--	--	06/03/1994	08/23/1995
4	Nitrate	118	0	--	6.0	.33	2.0	3.9	2.8	1.8	1.1	.6	10/29/1984	11/17/2004

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
4	Nitrite	79	77	0.02	.06	<0.02	--	--	--	--	--	--	05/28/1986	11/17/2004
4	Ammonia	95	17	0.05, 0.10	.26	<0.05	.13	.22	.17	.13	.07	.03	05/28/1986	11/17/2004
4	Phosphorus, total	0	--	--	--	--	--	--	--	--	--	--	--	--
4	Orthophosphate	78	12	0.01	.14	<0.01	.02	.06	.02	.02	.01	<0.01	05/28/1986	11/17/2004
4	Arsenic	34	5	1, 2	9	<1	3	6	3.	2	2	1	12/10/1986	11/17/2004
4	Boron	4	0	--	80	70	73.8	--	--	--	--	--	12/10/1986	09/15/1987
4	Cadmium	4	3	<.2	.3	<.2	--	--	--	--	--	--	12/10/1986	09/15/1987
4	Iron	4	0	--	240	60	140	--	--	--	--	--	12/10/1986	09/15/1987
4	Manganese	4	0	--	660	460	550	--	--	--	--	--	12/10/1986	09/15/1987
4	Mercury	45	41	0.1, 0.2	.2	<0.1	--	.2	--	--	--	--	12/10/1986	11/17/2004
4	Molybdenum	4	0	--	4.6	2.3	3.6	--	--	--	--	--	12/10/1986	09/15/1987
4	Selenium	51	32	0.5, 1, 2, 2.6	2.7	<0.5	1.0	2.5	1.3	.9	.6	.3	12/10/1986	11/17/2004
5	Specific conductance	98	0	--	1,550	510	882	1,080	928	880	840	600	09/24/1986	11/17/2004
5	pH	92	0	--	9.2	7.0	7.7	8.4	8.0	7.7	7.4	7.2	02/25/1988	11/17/2004
5	Temperature, water	86	0	--	28.1	0	12.4	25.7	18.9	13.0	4.2	.4	02/25/1988	11/17/2004
5	Hardness	53	0	--	500	180	390	470	430	400	370	270	05/24/1990	11/17/2004
5	Calcium	62	0	--	120	31	86	110	99	89	80	57	02/25/1988	11/17/2004
5	Magnesium	62	0	--	60	23	42	49	45	43	40	30	02/25/1988	11/17/2004
5	Sodium	62	0	--	91	32	47	71	50	44	39	33	02/25/1988	11/17/2004
5	Sodium-adsorption ratio	62	0	--	2.6	.7	1.0	1.5	1.1	1.0	.8	.7	02/25/1988	11/17/2004
5	Potassium	62	0	--	15	2.2	7.4	11	8.4	7.1	6.0	4.4	02/25/1988	11/17/2004
5	Bicarbonate	11	0	--	521	298	428	502	471	420	401	345	02/25/1988	11/13/1990
5	Carbonate	9	0	--	306	0	34	184	0	0	0	0	02/25/1988	08/09/1990
5	Alkalinity	51	0	--	430	160	310	370	340	320	290	230	05/24/1990	11/17/2004
5	Sulfate	60	0	--	210	76	140	170	150	140	130	95	02/25/1988	11/17/2004
5	Chloride	60	0	--	39	12	24	36	27	24	21	15	02/25/1988	11/17/2004
5	Total dissolved solids, calculated	64	0	--	709	324	535	628	569	542	504	392	09/24/1986	11/17/2004
5	Dissolved solids, residue at 105C	13	0	--	13	1	6	12	9	5	3	1	08/20/1992	10/05/1995

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
5	Dissolved solids, residue at 180C	0	--	--	--	--	--	--	--	--	--	--	--	--
5	Dissolved solids, residue at 550C	13	4	0.5	6.8	<0.5	2.1	6.6	3.6	.8	.4	.1	08/20/1992	10/05/1995
5	Nitrate	99	38	0.10	2.9	<0.10	.63	1.8	1.2	.25	.07	.01	09/24/1986	11/17/2004
5	Nitrite	71	43	0.02	.17	<0.02	.03	.08	.04	.02	.01	<0.01	02/25/1988	11/17/2004
5	Ammonia	80	8	0.05, 0.10	1.1	<0.05	.24	.56	.31	.18	.13	.04	02/25/1988	11/17/2004
5	Phosphorus, total	1	0	--	.16	.16	--	--	--	--	--	--	06/19/1990	06/19/1990
5	Orthophosphate	70	6	0.01	.29	<0.01	.05	.12	.07	.03	.02	.01	02/25/1988	11/17/2004
5	Arsenic	59	2	1	8	<1	3	5	4	3	2	1	06/19/1990	11/17/2004
5	Boron	0	--	--	--	--	--	--	--	--	--	--	--	--
5	Cadmium	0	--	--	--	--	--	--	--	--	--	--	--	--
5	Iron	0	--	--	--	--	--	--	--	--	--	--	--	--
5	Manganese	0	--	--	--	--	--	--	--	--	--	--	--	--
5	Mercury	66	61	0.1, 0.2	.3	<0.1	--	.2	--	--	--	--	03/14/1991	11/17/2004
5	Molybdenum	0	--	--	--	--	--	--	--	--	--	--	--	--
5	Selenium	73	65	1, 2, 2.6, 4	<4	<1	--	2	--	--	--	--	06/19/1990	11/17/2004
6	Specific conductance	114	0	--	1,100	720	919	1,020	950	920	880	827	10/02/1985	11/17/2004
6	pH	107	0	--	8.2	6.6	7.4	7.9	7.5	7.3	7.2	7.0	03/10/1987	11/17/2004
6	Temperature, water	96	0	--	21.1	0	9.4	15.7	11.5	9.2	6.6	5.2	05/28/1986	11/17/2004
6	Hardness	58	0	--	480	380	440	470	460	440	430	400	05/24/1990	11/17/2004
6	Calcium	72	0	--	120	83	100	120	110	100	100	93	05/28/1986	11/17/2004
6	Magnesium	72	0	--	48	35	43	47	44	43	42	39	05/28/1986	11/17/2004
6	Sodium	72	0	--	77	30	45	67	46	43	40	35	05/28/1986	11/17/2004
6	Sodium-adsorption ratio	72	0	--	1.6	.6	.9	1.4	1.0	.9	.8	.7	05/28/1986	11/17/2004
6	Potassium	72	0	--	9.9	4.7	6.5	8.4	7.1	6.3	5.9	5.2	05/28/1986	11/17/2004
6	Bicarbonate	17	0	--	510	385	432	503	456	418	403	392	05/28/1986	11/13/1990
6	Carbonate	13	0	--	0	0	0	0	0	0	0	0	05/28/1986	03/01/1990
6	Alkalinity	57	0	--	390	28	350	380	360	350	330	320	05/24/1990	11/17/2004
6	Sulfate	69	0	--	180	82	150	180	160	150	140	110	05/28/1986	11/17/2004
6	Chloride	70	0	--	30	9.1	19	26	20	18	17	14	05/28/1986	11/17/2004

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
6	Total dissolved solids, calculated	78	0	--	663	487	576	648	596	572	551	527	10/02/1985	11/17/2004
6	Dissolved solids, residue at 105°C	15	1	0.5	32	<0.5	5	16	5	2	1	.4	08/18/1992	10/05/1995
6	Dissolved solids, residue at 180°C	0	--	--	--	--	--	--	--	--	--	--	--	--
6	Dissolved solids, residue at 550°C	15	11	0.5	19	<0.5	2	15	1	.1	< .1	< .1	08/18/1992	10/05/1995
6	Nitrate	116	0	--	7.6	.20	3.5	6.1	4.5	3.4	2.5	1.6	10/02/1985	11/17/2004
6	Nitrite	86	84	0.02	.06	<0.02	--	--	--	--	--	--	05/28/1986	11/17/2004
6	Ammonia	95	20	0.02, 0.05, 0.10	.39	<0.02	.12	.27	.17	.12	.07	.01	05/28/1986	11/17/2004
6	Phosphorus, total	1	0	--	.1	.1	--	--	--	--	--	--	06/19/1990	06/19/1990
6	Orthophosphate	85	8	0.01	.15	<0.01	.03	.06	.04	.03	.02	.01	05/28/1986	11/17/2004
6	Arsenic	65	1	1	5	<1	3	5	4	3	3	2	12/10/1986	11/17/2004
6	Boron	3	0	--	100	80	90	--	--	--	--	--	03/10/1987	09/15/1987
6	Cadmium	3	2	0.2	.4	<0.2	--	--	--	--	--	--	03/10/1987	09/15/1987
6	Iron	3	0	--	100	50	70	--	--	--	--	--	03/10/1987	09/15/1987
6	Manganese	3	0	--	410	160	280	--	--	--	--	--	03/10/1987	09/15/1987
6	Mercury	75	65	0.1, 0.2	.2	<0.1	--	.2	--	--	--	--	12/10/1986	11/17/2004
6	Molybdenum	3	0	--	4.7	3.5	4.3	--	--	--	--	--	03/10/1987	09/15/1987
6	Selenium	82	47	0.5, 1, 2, 2.6, 4	<4	<0.5	1.2	2.9	1.6	1.0	.8	.5	12/10/1986	11/17/2004
7	Specific conductance	85	0	--	3,420	520	1,050	1,750	1,200	990	780	584	06/19/1990	11/17/2004
7	pH	84	0	--	9.4	7.5	8.4	9.0	8.6	8.4	8.3	7.6	06/19/1990	11/17/2004
7	Temperature, water	74	0	--	29.0	0	12.2	24.5	20.0	13.4	3.6	.17	06/19/1990	11/17/2004
7	Hardness	57	0	--	880	150	360	520	420	340	290	240	06/19/1990	11/17/2004
7	Calcium	57	0	--	170	31	72	110	77	66	56	40	06/19/1990	11/17/2004
7	Magnesium	57	0	--	110	19	44	65	53	43	34	27	06/19/1990	11/17/2004
7	Sodium	57	0	--	350	35	100	200	120	90	63	46	06/19/1990	11/17/2004
7	Sodium-adsorption ratio	57	0	--	5.2	1.1	2.3	4.3	2.7	2.0	1.5	1.2	06/19/1990	11/17/2004
7	Potassium	57	0	--	36	6.9	16	22	18	15	13	11	06/19/1990	11/17/2004
7	Bicarbonate	4	0	--	542	338	434	529	477	428	385	347	06/19/1990	12/11/1990

Table 1. Summary of statistics for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; <, less than]

Site	Water-quality physical property or constituent	Descriptive statistics						Percent of samples in which values were less than or equal to those shown					Period of Record	
		Sample size	Number of censored values	Laboratory reporting levels	Maximum	Minimum	Mean	0.95	0.75	(Median) 0.50	0.25	0.05	Begin date	End date
7	Carbonate	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Alkalinity	55	0	--	740	150	290	440	320	280	240	190	06/19/1990	11/17/2004
7	Sulfate	54	0	--	640	82	220	340	270	210	160	110	06/19/1990	11/17/2004
7	Chloride	54	0	--	230	13	51	120	61	40	20	16	06/19/1990	11/17/2004
7	Total dissolved solids, calculated	53	0	--	1,970	315	678	1,060	784	635	480	394	06/19/1990	08/24/2004
7	Dissolved solids, residue at 105°C	16	0	--	103	24	59	101	87	58	32	25	06/17/1992	08/23/1995
7	Dissolved solids, residue at 180°C	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Dissolved solids, residue at 550°C	16	0	--	73	12	41	69	59	45	23	17	06/17/1992	08/23/1995
7	Nitrate	81	56	0.10	3.4	<0.1	.22	1.3	.14	.03	.01	<0.01	06/19/1990	11/17/2004
7	Nitrite	61	55	0.02	.06	<0.02	--	.02	--	--	--	--	06/19/1990	11/17/2004
7	Ammonia	71	16	0.02, 0.05, 0.10	2.6	<0.02	.17	.36	.17	.12	.06	<0.01	06/19/1990	11/17/2004
7	Phosphorus, total	1	0	--	.09	.09	--	--	--	--	--	--	06/19/1990	06/19/1990
7	Orthophosphate	61	4	0.01	.89	<0.01	.17	.58	.22	.09	.03	.01	06/19/1990	11/17/2004
7	Arsenic	9	0	--	10	3	6	9	9	6	5	3	08/24/2000	11/17/2004
7	Boron	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Cadmium	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Iron	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Manganese	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Mercury	16	16	0.2	<0.2	<0.2	--	--	--	--	--	--	02/08/2000	11/17/2004
7	Molybdenum	0	--	--	--	--	--	--	--	--	--	--	--	--
7	Selenium	20	20	1, 2, 2.6	<2.6	<1	--	--	--	--	--	--	02/08/2000	11/17/2004

Table 2. Trends by site for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Site	Constituent	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
1	Hardness	0.009	0.011			0.018	0.005	+	1.85
	Alkalinity	0.003	0.442			0.013	0.057		
	Calcium	0.006	0.022			0.011	0.017		
	Magnesium	0.014	0	+	1.37	0.022	0.001	+	2.17
	Sodium	0	0.995			0.031	0	+	3.18
	Sodium-adsorption ratio	-0.005	0.108			0.023	0	+	2.30
	Potassium	0.012	0	+	1.16	0.015	0.001	+	1.52
	Sulfate	0.012	0.019			0.026	0.002	+	2.61
	Chloride	-0.022	0.005	-	-2.14	0.030	0.007	+	3.06
	Total dissolved solids, calculated	0.004	0.195			0.021	0.016		
	Orthophosphate	0.085	0	+	8.88	0.096	0	+	10.08
2	Hardness	-0.002	0.413			0.007	0.228		
	Alkalinity	0.001	0.735			0.004	0.193		
	Calcium	0.003	0.321			0.006	0.584		
	Magnesium	-0.007	0.004	-	-0.65	-0.002	0.661		
	Sodium	-0.002	0.728			-0.001	0.869		
	Sodium-adsorption ratio	-0.001	0.862			0	1.000		
	Potassium	-0.014	0.015			-0.005	0.511		
	Sulfate	-0.004	0.215			0.012	0.034		
	Chloride	-0.022	0.011			0.021	0.115		
	Total dissolved solids, calculated	-0.002	0.398			0.004	0.200		
	Ammonia	-0.021	0.012			-0.011	0.490		
3	Hardness	-0.005	0.005	-	-0.46	0.003	0.083		
	Alkalinity	0.003	0	+	0.33	0.005	0.001	+	0.47
	Calcium	-0.006	0	-	-0.56	0.002	0.177		
	Magnesium	-0.002	0.119			0.003	0.067		
	Sodium	0.024	0	+	2.40	0.013	0.002	+	1.29

Table 2. Trends by site for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Site	Constituent	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
	Sodium-adsorption ratio	0.026	0	+	2.66	0.011	0.004	+	1.13
	Potassium	0.005	0	+	0.46	0.005	0.034		
	Sulfate	-0.003	0.121			0.005	0.075		
	Chloride	-0.008	0.002	-	-0.84	0.009	0	+	0.91
	Total dissolved solids, calculated	0.001	0.630			0.005	0	+	0.53
	Nitrate	0.018	0	+	1.78	-0.009	0.047		
	Ammonia	-0.024	0	-	-2.41	-0.015	0.055		
	Orthophosphate	0.021	0	+	2.11	-0.005	0.634		
4	Hardness	0.003	0.003	+	0.26	-0.001	0.767		
	Alkalinity	0.002	0.026			0.003	0.017		
	Calcium	0.002	0.006	+	0.22	0.001	0.607		
	Magnesium	0.005	0	+	0.46	-0.001	0.384		
	Sodium	0.003	0.040			0.001	0.551		
	Sodium-adsorption ratio	0.002	0.128			0.001	0.449		
	Potassium	-0.004	0.058			-0.005	0.418		
	Sulfate	0.008	0	+	0.77	-0.002	0.692		
	Chloride	0.013	0	+	1.35	0.008	0.014		
	Total dissolved solids, calculated	0.004	0	+	0.40	0.001	0.378		
	Nitrate	0.032	0	+	3.22	-0.026	0	-	-2.58
	Ammonia	-0.006	0.061			-0.015	0.036		
	Orthophosphate	0	0.080			-0.007	0.317		
5	Hardness	0.001	0.485			0.004	0.239		
	Alkalinity	-0.002	0.276		-0.18	0.002	0.374		
	Calcium	0.003	0.215			0.007	0.116		
	Magnesium	0	0.458			0.001	0.532		
	Sodium	-0.012	0	-	-1.16	-0.001	0.830		
	Sodium-adsorption ratio	-0.012	0	-	-1.20	-0.004	0.391		

Table 2. Trends by site for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Site	Constituent	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
	Potassium	-0.010	0.007	-	-0.99	-0.003	0.643		
	Sulfate	0.006	0.003	+	0.57	0.005	0.228		
	Chloride	0.004	0.287			0.008	0.110		
	Total dissolved solids, calculated	-0	0.843			0.003	0.228		
	Ammonia	0.003	0.627			0	0.978		
	Orthophosphate	-0.027	0.024			-0.042	0.044		
	Arsenic	0.011	0.100			0.028	0.007	+	2.85
6	Hardness	-0	0.957			0.001	0.211		
	Alkalinity	0.001	0.302			0.001	0.546		
	Calcium	0.001	0.147			0.002	0.114		
	Magnesium	0.001	0.114			0.001	0.451		
	Sodium	0.003	0.059			-0.001	0.787		
	Sodium-adsorption ratio	0.003	0.075			-0.002	0.589		
	Potassium	-0	0.779			-0.003	0.378		
	Sulfate	0.007	0	+	0.72	0.004	0.141		
	Chloride	0.008	0.001	+	0.75	0.014	0.014		
	Total dissolved solids, calculated	0.002	0.001	+	0.23	0.002	0.133		
	Nitrate	-0.010	0.022			-0.022	0.020		
	Orthophosphate	0	0.898			-0.012	0.396		
	Arsenic	0.013	0.001	+	1.28	0.010	0.029		
7	Hardness	0.005	0.305			0.013	0.018		
	Alkalinity	-0.003	0.416			0.009	0.077		
	Calcium	0.006	0.125			0.009	0.154		
	Magnesium	0.003	0.401			0.021	0.001	+	2.13
	Sodium	-0.016	0.024			0.031	0	+	3.19
	Sodium-adsorption ratio	-0.020	0.001	-	-1.94	0.024	0	+	2.41
	Potassium	0.002	0.675			0.015	0.002	+	1.48

Table 2. Trends by site for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Site	Constituent	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
	Sulfate	0.003	0.737			0.026	0.001	+	2.60
	Chloride	-0.042	0	-	-4.07	0.032	0.005	+	3.26
	Total dissolved solids, calculated	-0.007	0.273			0.019	0.015		
	Orthophosphate	0.079	0	+	8.21	0.090	0	+	9.45

Table 3. Trends by constituent for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Constituent	Site	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
Hardness	1	0.009	0.011			0.018	0.005	+	1.85
	2	-0.002	0.413			0.007	0.228		
	3	-0.005	0.005	-	-0.46	0.003	0.083		
	4	0.003	0.003	+	0.26	-0.001	0.767		
	5	0.001	0.485			0.004	0.239		
	6	-0	0.957			0.001	0.211		
	7	0.005	0.305			0.013	0.018		
Alkalinity	1	0.003	0.442			0.013	0.057		
	2	0.001	0.735			0.004	0.193		
	3	0.003	0	+	0.33	0.005	0.001	+	0.47
	4	0.002	0.026			0.003	0.017		
	5	-0.002	0.276			0.002	0.374		
	6	0.001	0.302			0.001	0.546		
	7	-0.003	0.416			0.009	0.077		
Calcium	1	0.006	0.022			0.011	0.017		
	2	0.003	0.321			0.006	0.584		
	3	-0.006	0	-	-0.56	0.002	0.177		
	4	0.002	0.006	+	0.22	0.001	0.607		
	5	0.003	0.215			0.007	0.116		
	6	0.001	0.147			0.002	0.114		
	7	0.006	0.125			0.009	0.154		
Magnesium	1	0.014	0	+	1.37	0.022	0.001	+	2.17
	2	-0.007	0.004	-	-0.65	-0.002	0.661		
	3	-0.002	0.119			0.003	0.067		
	4	0.005	0	+	0.46	-0.001	0.384		

Table 3. Trends by constituent for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Constituent	Site	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
	5	0	0.458			0.001	0.532		
	6	0.001	0.114			0.001	0.451		
	7	0.003	0.401			0.021	0.001	+	2.13
Sodium	1	0	0.995			0.031	0	+	3.18
	2	-0.002	0.728			-0.001	0.869		
	3	0.024	0	+	2.40	0.013	0.002	+	1.29
	4	0.003	0.040			0.001	0.551		
	5	-0.012	0	-	-1.16	-0.001	0.830		
	6	0.003	0.059			-0.001	0.787		
	7	-0.016	0.024			0.031	0	+	3.19
Sodium-adsorption ratio	1	-0.005	0.108			0.023	0	+	2.30
	2	-0.001	0.862			0	1.000		
	3	0.026	0	+	2.66	0.011	0.004	+	1.13
	4	0.002	0.128			0.001	0.449		
	5	-0.012	0	-	-1.20	-0.004	0.391		
	6	0.003	0.075			-0.002	0.589		
	7	-0.020	0.001	-	-1.94	0.024	0	+	2.41
Potassium	1	0.012	0	+	1.16	0.015	0.001	+	1.52
	2	-0.014	0.015			-0.005	0.511		
	3	0.005	0	+	0.46	0.005	0.034		
	4	-0.004	0.058			-0.005	0.418		
	5	-0.010	0.007	-	-0.99	-0.003	0.643		
	6	-0	0.779			-0.003	0.378		
	7	0.002	0.675			0.015	0.002	+	1.48

Table 3. Trends by constituent for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Constituent	Site	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
Sulfate	1	0.012	0.019			0.026	0.002	+	2.61
	2	-0.004	0.215			0.012	0.034		
	3	-0.003	0.121			0.005	0.075		
	4	0.008	0	+	0.77	-0.002	0.692		
	5	0.006	0.003	+	0.57	0.005	0.228		
	6	0.007	0	+	0.72	0.004	0.141		
	7	0.003	0.737			0.026	0.001	+	2.60
Chloride	1	-0.022	0.005	-	-2.14	0.030	0.007	+	3.06
	2	-0.022	0.011			0.021	0.115		
	3	-0.008	0.002	-	-0.84	0.009	0	+	0.91
	4	0.013	0	+	1.35	0.008	0.014		
	5	0.004	0.287			0.008	0.110		
	6	0.008	0.001	+	0.75	0.014	0.014		
	7	-0.042	0	-	-4.07	0.032	0.005	+	3.26
Total dissolved solids, calculated	1	0.004	0.195		0.35	0.021	0.016		
	2	-0.002	0.398		-0.18	0.004	0.200		
	3	0.001	0.630		0.06	0.005	0	+	0.53
	4	0.004	0	+	0.40	0.001	0.378		
	5	-0	0.843		-0.03	0.003	0.228		
	6	0.002	0.001	+	0.23	0.002	0.133		
	7	-0.007	0.273		-0.72	0.019	0.015		
Nitrate	3	0.018	0	+	1.78	-0.009	0.047		
	4	0.032	0	+	3.22	-0.026	0	-	-2.58
	6	-0.010	0.022			-0.022	0.020		

Table 3. Trends by constituent for water-quality physical properties and constituents at sampling sites in the Oakes Test Area, southeastern North Dakota, 1988 through 2004, and 1994 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; arsenic in micrograms per liter; other constituents in milligrams per liter; + indicates a statistically significant (p-value <0.01) positive, upward, trend in concentration; – indicates a statistically significant negative, downward, trend in concentration]

Constituent	Site	1988–2004				1994–2004			
		Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year	Sen slope	p-value for Mann-Kendall test	Significant trends	Percent change from beginning of any year to the end of that year
Ammonia	2	-0.021	0.012			-0.023	0.471		
	3	-0.024	0	-	-2.41	-0.015	0.088		
	4	-0.006	0.061			-0.010	0.170		
	5	0.003	0.627			-0.001	0.774		
Orthophosphate	1	0.085	0	+	8.88	0.096	0	+	10.08
	3	0.021	0	+	2.11	-0.005	0.634		
	4	0	0.080			-0.007	0.317		
	5	-0.027	0.024			-0.042	0.044		
	6	0	0.898			-0.012	0.396		
	7	0.079	0	+	8.21	0.090	0	+	9.45
Arsenic	5	0.011	0.100			0.028	0.007	+	2.85
	6	0.013	0.001	+	1.28	0.010	0.029		

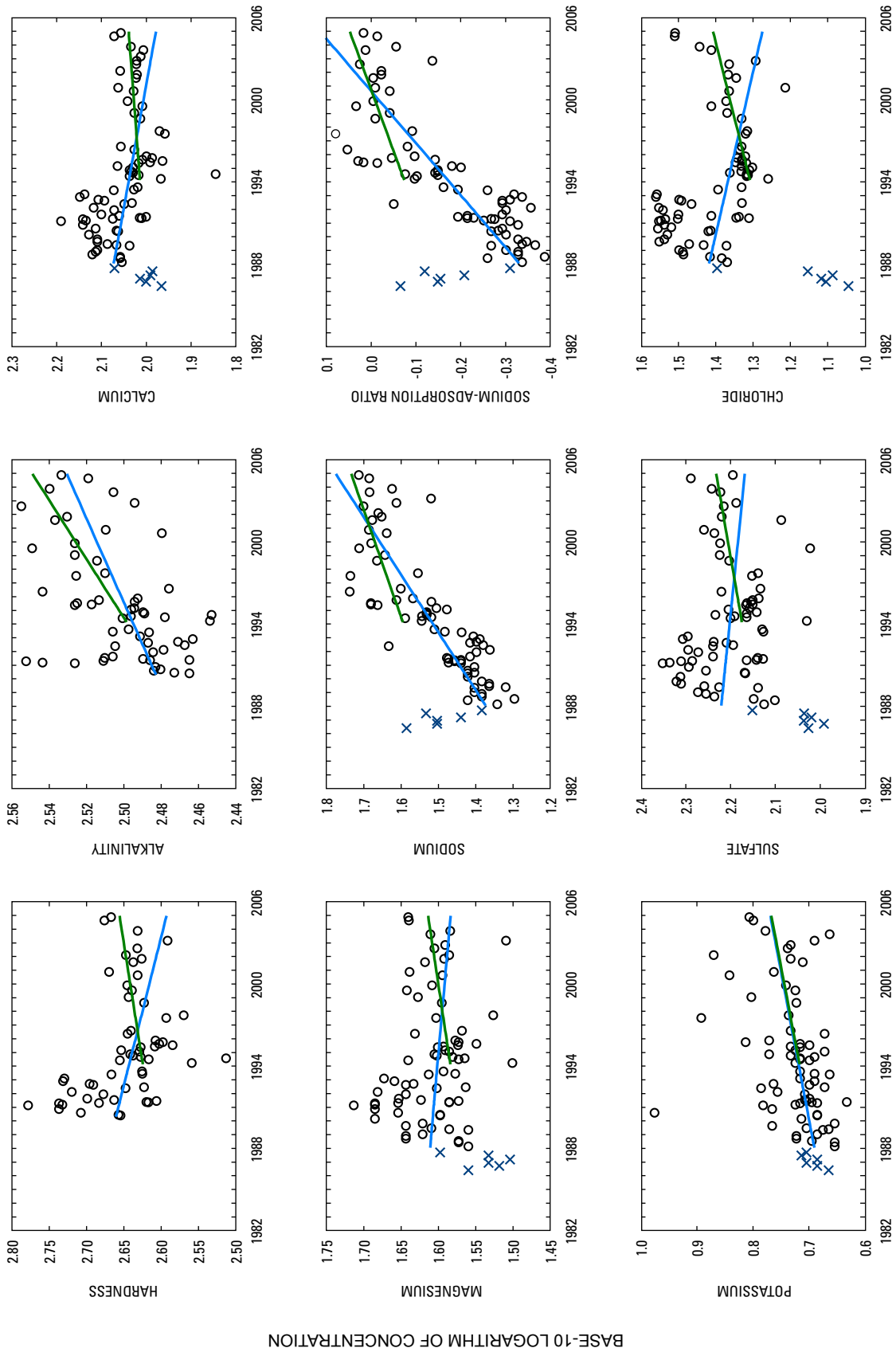


Figure 5. Base-10 logarithm of constituent concentrations at site 3 in the Oakes Test Area, southeastern North Dakota, and associated trend lines.

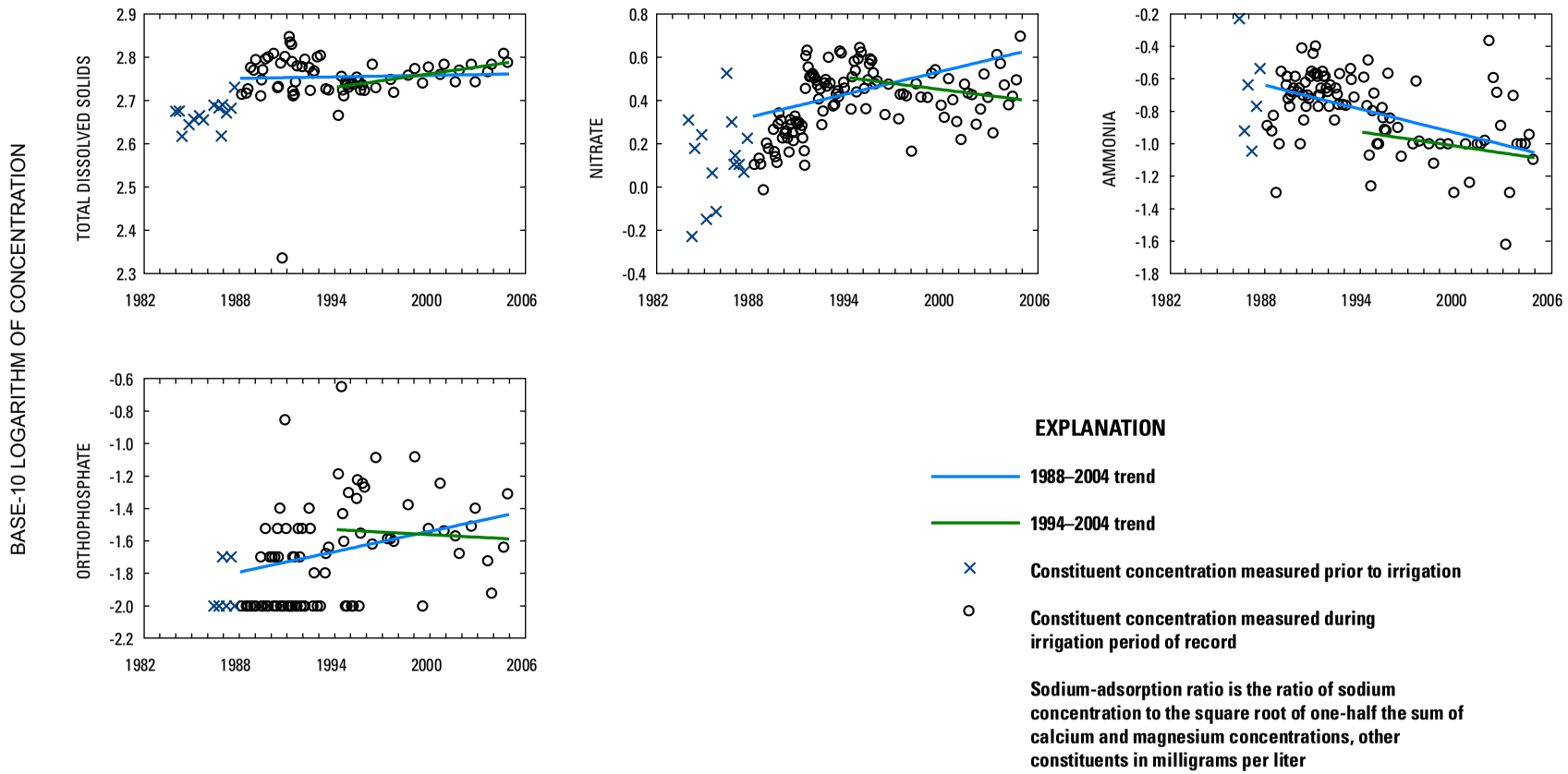


Figure 5. Base-10 logarithm of constituent concentrations at site 3 in the Oakes Test Area, southeastern North Dakota, and associated trend lines.—Continued

The orthophosphate graph (fig. 5) and trend test results (table 2 and 3) are examples of the Mann-Kendall test and Sen slope calculated for highly censored data. At site 3, orthophosphate was censored at 0.01 (base-10 logarithm -2.0). The positive sign of the slope for 1988–2004 appears to be correct because of the low, highly censored, concentrations early in the period of record. However, the magnitude of the slope is most likely not correct because the censored concentrations were actually lower than the LRL used to calculate the slope. Therefore, the actual slope may be steeper because of the low concentrations early in the period of record.

For 1988–2004, site 2 (fig. 2) has the fewest statistically significant trends (table 2) with 1 negative trend for magnesium, and site 3 has the most trends with 4 negative trends (hardness, calcium, chloride, and ammonia) and 6 positive trends (alkalinity, sodium, sodium-adsorption ratio, potassium, nitrate, and orthophosphate). Sites 4 and 6 have only positive trends, and sites 1 and 5 have both positive and negative trends. Both sites on the James River, sites 1 and 7, have negative trends in chloride and positive trends in orthophosphate. All constituents have at least 1 significant trend, and no constituent has significant trends at all sampling sites (table 3).

For 1994–2004, more statistically significant trends were identified on the James River sites (sites 1 and 7) than for the entire irrigation period (1988–2004). All of the trends are positive, and with the exception of hardness, which is significant only at site 1, the constituents with statistically significant upward trends are the same for both sites (magnesium, sodium, sodium-adsorption ratio, potassium, sulfate, chloride, and orthophosphate). For 1994–2004, sites 2 and 6 have no significant trends, site 3 has fewer significant trends than for 1988–2004 and all significant trends were positive, site 4 has 1 significant trend (downward for nitrate), and site 5 has 1 significant trend (upward for arsenic). Calcium and ammonia have no significant trends for 1994–2004 (table 3).

Comparison of sites 1 and 7 indicates that the contribution to the James River from Oakes Test Area drainage has little effect on water quality in the James River. For example, sites 4, 5, and 6 had statistically significant upward trends for sulfate for 1988–2004. Upstream from the Oakes Test Area, the James River at site 1 did not have a significant trend in sulfate. Downstream from the Oakes Test Area, the James River at site 7 did not have a significant trend in sulfate despite contribution from Oakes Test Area drainage. For 1994–2004, the Sen slope and p-values for sites 1 and 7 are almost identical in magnitude and all match in sign.

Because of their location (fig. 2), sites 2 and 3 would be expected to have similar trends. However, for 1988–2004 site 2 had only 1 significant trend (table 2) and site 3 had 10 significant trends (table 2). This may occur because of the difference in sampling period of record between the two sites (table 1). Site 3 has a longer sampling period of record and low concentrations early in the period that contribute to a positive slope for many of the constituents. Another difference between the two sites is that nitrate and orthophosphate were highly censored (>20 percent) at site 2 and were not tested for trends.

Sites 4, 5, and 6 might be expected to have similar trends because of their locations. All three sites have a positive trend in sulfate for 1988–2004. Sodium and sodium-adsorption ratio have significant downward trends at site 5 for 1988–2004; the corresponding trends are positive at sites 4 and 6 but are not significant at either site. Sites 4 and 6 have significant positive trends in chloride and total dissolved solids for 1988–2004.

Summary

The Oakes Test Area is operated and maintained by the Garrison Diversion Conservancy District, under a cooperative agreement with the Bureau of Reclamation, to evaluate the effectiveness and environmental consequences of irrigation. As part of the evaluation, the Bureau of Reclamation collected water-quality samples from seven sites on the James River and the Oakes Test Area. The data were summarized and examined for trends in concentration during two periods, 1988–2004 and 1994–2004, by the U.S. Geological Survey in cooperation with the Bureau of Reclamation.

The nonparametric Mann-Kendall test was used to indicate whether concentration was increasing or decreasing with time for the water-quality physical properties and constituents hardness, alkalinity, calcium, magnesium, sodium, sodium-adsorption ratio, potassium, sulfate, chloride, total dissolved solids, nitrate, ammonia, orthophosphate, and arsenic. Not every physical property or constituent was tested at each site because at some sites sample size was too small or no samples were collected. A Sen slope was estimated for each trend. Trend results with a p-value less than 0.01 are considered statistically significant.

Significant trends varied by site, constituent, and time period. For the period 1988–2004 all sites and all constituents tested have at least 1 significant trend. Site 2 (fig. 2) has the fewest trends (table 3) with 1 negative trend (magnesium), and site 3 has the most trends, 4 negative trends (hardness, calcium, chloride, and ammonia) and 6 positive trends (alkalinity, sodium, sodium-adsorption ratio, potassium, nitrate, and orthophosphate). Sulfate, total dissolved solids, nitrate, orthophosphate have significant positive trends at multiple sites with no significant negative trend at any site. Ammonia has a single significant trend, downward at site 3. Alkalinity and arsenic have single significant positive trends at sites 3 and 6, respectively. The remaining constituents have both upward and downward trends at multiple sites.

Fewer trends were identified for 1994–2004 than for 1988–2004. All statistically significant trends are positive, except for a negative trend in nitrate at site 4. For chloride, the

positive trend at sites 1, 3, and 7 is in contrast to an overall (1988–2004) negative trend at the same sites. The sign of a nitrate trend (site 4) also changed. The trend is negative for 1994–2004 and positive for 1988–2004.

The contribution to the James River from Oakes Test Area drainage appears to have little effect on water quality in the James River. Sites 4, 5, and 6 have statistically significant upward trends for sulfate for 1988–2004. Upstream from the Oakes Test Area, the James River at site 1 does not have a significant trend in sulfate. Downstream from the Oakes Test Area, the James River at site 7 does not have a significant trend in sulfate despite contribution from Oakes Test Area drainage. For 1994–2004, the Sen slope and p-values for sites 1 and 7 are almost identical in magnitude and all match in sign.

References Cited

Brigham, M.E., and Payne, G.A., 1999, Stream water-quality characteristics and trends, James River Basin, North Dakota, 1949–95: U.S. Geological Survey Water-Resources Investigations Report 99–4187, 129 p.

Garrison Diversion Conservancy District, 2004a, Operations and maintenance, Garrison Diversion Conservancy District, accessed December 19, 2006, at *http://www.garrisondiv.org/pages/programs/om/index.epl*

Garrison Diversion Conservancy District, 2004b, The Oakes Irrigation Test Area and agri-processing: Carrington, North Dakota, Garrison Diversion Conservancy District, accessed December 19, 2006, at *http://www.garrisondiv.org/pages/programs/agriculture/index.epl*

Goolsby, D.A., Severson, R.C., Wilson, S.A., and Webber, Kurt, 1989, Geochemistry of soils and shallow ground water, with emphasis on arsenic and selenium, in part of the Garrison Diversion Unit, North Dakota, 1985–87: U.S. Geological Survey Water-Resources Investigations Report 89–4104, 132 p., accessed August 3, 2006, at *http://pubs.er.usgs.gov/pubs/wri/wri894104*

Helsel, D.R., 2005, Nondetects and data analysis—Statistics for censored environmental data: Hoboken, New Jersey, John Wiley & Sons, Inc., 250 p.

Helsel, D.R., and Hirsch, R.M., 1992, Statistical methods in water resources: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. A3, 510 p., accessed September 12, 2006, at *http://pubs.usgs.gov/twri/twri4a3/*

Simonds, W.J., 1996, Jamestown Dam and Reservoir—A feature of the Garrison Diversion Unit Pick-Sloan Missouri Basin Program: U.S. Department of the Interior, Bureau of Reclamation Research on Historic Reclamation Projects, accessed August 3, 2006, at *http://www.usbr.gov/dataweb/html/jamestownh.html*

U.S. Geological Survey [variously dated], USGS Library Reference for Release 3.1 of the U.S. Geological Survey S-PLUS library [variously paged].

Weckerly, Tessa, 2006, Garrison Diversion continues to support Oakes Test Area: North Dakota Water, v. 14, no. 6, p. 25–27.

Williams-Sether, Tara, 1999, From dry to wet, 1988–97, North Dakota: U.S. Geological Survey Fact Sheet FS–075–99, 4 p., accessed February 26, 2007, at *http://pubs.er.usgs.gov/pubs/fs/fs07599*

This page intentionally left blank.

Supplements

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
01/04/1984	1.55	--	--
03/29/1984	2.40	--	--
05/14/1984	2.46	--	--
05/23/1984	2.61	--	--
08/22/1984	2.21	2.13	--
10/29/1984	2.96	2.08	--
12/07/1984	2.76	2.16	--
01/03/1985	2.37	2.08	--
02/12/1985	1.87	1.63	--
03/18/1985	2.27	2.08	--
04/10/1985	1.87	1.72	--
06/13/1985	2.60	1.77	--
06/25/1985	2.10	1.73	--
07/18/1985	0.48	1.44	1.00
08/14/1985	0.32	1.20	1.11
09/18/1985	0.86	1.03	2.51
10/02/1985	0.85	0.99	1.60
10/28/1985	0.98	0.93	1.58
11/20/1985	1.12	0.74	2.39
01/30/1986	0.55	0.41	0.67
02/24/1986	0.54	0.40	0.56
03/19/1986	1.11	0.45	1.08
04/30/1986	3.84	2.46	2.74
05/13/1986	5.54	2.68	3.57
05/19/1986	3.46	2.66	2.35
05/30/1986	4.06	2.45	1.86
06/06/1986	3.34	2.28	1.79
06/13/1986	3.62	1.38	1.89
06/20/1986	3.45	2.29	1.85
07/03/1986	3.51	0.66	2.65
07/18/1986	3.14	0.85	1.50
07/25/1986	3.20	2.34	0.20
08/01/1986	3.94	2.11	1.70
08/08/1986	3.43	2.23	0.99
08/15/1986	3.31	2.15	1.36
08/25/1986	3.43	2.11	1.71
08/29/1986	3.17	2.19	1.71
09/05/1986	3.15	1.63	1.57
09/12/1986	3.23	1.68	1.79

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
09/24/1986	3.02	1.57	1.74
10/03/1986	3.20	1.52	1.81
10/10/1986	2.05	1.66	1.64
10/17/1986	2.62	1.41	1.61
10/24/1986	2.88	1.52	1.81
10/31/1986	2.92	1.34	1.67
11/07/1986	2.99	1.45	1.37
11/14/1986	2.94	1.36	1.87
11/21/1986	2.89	1.23	1.73
12/01/1986	2.79	1.09	1.82
12/05/1986	2.86	1.16	1.75
12/10/1986	1.95	1.11	1.91
12/19/1986	2.31	0.93	1.71
01/02/1987	2.32	0.87	1.56
01/12/1987	2.08	0.76	1.60
01/16/1987	2.47	0.65	1.51
01/23/1987	1.86	0.77	1.46
01/30/1987	1.82	0.58	1.30
02/06/1987	1.90	0.47	1.33
02/13/1987	1.64	0.59	1.52
02/20/1987	1.70	0.59	1.17
02/27/1987	1.58	0.56	1.33
03/06/1987	1.64	0.06	1.20
03/13/1987	1.73	0.62	1.42
03/27/1987	--	1.35	--
04/03/1987	0.25	--	0.69
04/13/1987	--	3.16	1.33
04/17/1987	--	--	1.36
05/01/1987	--	--	1.96
05/08/1987	--	--	2.29
05/15/1987	--	--	1.70
05/26/1987	1.66	--	2.71
05/29/1987	1.80	--	2.51
06/08/1987	1.15	1.14	1.96
06/12/1987	1.20	0.78	1.65
06/19/1987	0.89	0.88	1.69
06/27/1987	0.77	0.97	1.29
07/02/1987	0.75	0.69	0.26
07/10/1987	0.67	0.62	0.24

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
07/17/1987	0.49	0.57	0.23
07/27/1987	0.46	0.41	1.44
08/07/1987	0.38	0.34	0.08
08/14/1987	0.31	0.25	0.31
08/21/1987	0.22	0.30	0.76
08/28/1987	0.30	0.28	0.78
09/04/1987	0.25	0.27	0.70
09/10/1987	0.29	0.32	0.54
09/18/1987	0.28	0.20	0.56
09/25/1987	0.24	0.31	0.48
10/02/1987	0.30	0.46	0.48
10/07/1987	0.35	0.50	0.55
10/15/1987	0.31	0.64	0.52
10/23/1987	0.34	0.51	0.52
10/30/1987	0.24	0.44	0.56
11/06/1987	0.31	0.38	0.46
11/13/1987	0.35	0.34	0.37
11/20/1987	0.27	0.30	0.35
12/04/1987	0.31	0.28	0.44
12/11/1987	0.33	0.27	0.35
12/18/1987	0.31	0.25	0.35
01/15/1988	0.25	--	0.30
01/29/1988	0.20	0.04	0.21
03/04/1988	0.15	0.07	0.23
05/12/1988	0.31	0.45	0.52
05/20/1988	0.16	0.24	0.32
05/27/1988	0.20	0.20	0.38
06/06/1988	0.22	0.35	0.40
06/10/1988	0.18	0.20	0.38
06/17/1988	0.24	0.12	0.37
06/24/1988	0.22	0.14	0.46
07/01/1988	0.15	0.11	0.54
07/09/1988	0.17	0.09	0.55
07/13/1988	0.15	0.09	0.50
07/22/1988	0.16	0.08	0.44
07/29/1988	0.13	0.05	0.36
08/05/1988	0.13	0.03	0.30
08/12/1988	0.14	0.01	0.30
08/19/1988	0.13	0.05	0.25

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
08/26/1988	0.11	0.01	0.27
09/06/1988	0.18	0.01	0.24
09/14/1988	0.17	0.03	0.23
09/23/1988	0.14	0.08	0.42
09/30/1988	0.13	0.07	0.54
10/11/1988	0.13	0.07	0.52
10/14/1988	0.13	0.06	0.50
10/21/1988	0.10	0.07	0.42
10/28/1988	0.18	0.06	0.36
11/04/1988	0.12	0.10	0.37
11/09/1988	0.15	0.06	0.32
11/18/1988	0.17	0.06	0.30
11/30/1988	0.12	0.03	0.23
12/09/1988	0.13	0.05	0.26
12/16/1988	0.15	0.05	0.30
01/06/1989	0.09	0.03	0.19
01/11/1989	0.01	--	0.21
02/24/1989	0.04	0.00	0.09
03/24/1989	0.05	0.02	0.14
04/05/1989	0.13	0.24	0.31
04/14/1989	0.38	--	1.34
04/21/1989	0.33	--	1.58
04/28/1989	0.17	--	0.91
05/10/1989	0.19	--	0.72
05/17/1989	0.14	--	0.95
05/24/1989	0.14	--	0.32
05/31/1989	0.13	--	0.44
06/07/1989	0.11	--	0.45
06/14/1989	0.10	--	0.38
06/19/1989	0.18	0.11	0.48
06/20/1989	0.18	0.05	0.52
06/22/1989	0.18	0.06	0.47
06/27/1989	0.18	0.03	0.46
07/05/1989	0.13	0.08	0.16
07/12/1989	0.12	0.10	0.12
07/19/1989	0.11	0.02	0.14
07/25/1989	0.12	0.03	0.12
08/02/1989	0.10	0.05	0.11
08/09/1989	0.10	0.03	0.10

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
08/15/1989	0.08	0.00	0.09
08/23/1989	0.08	0.02	0.08
08/29/1989	0.16	0.03	0.13
09/08/1989	0.14	0.00	0.09
09/13/1989	0.15	0.03	0.10
09/19/1989	0.15	0.00	0.10
09/26/1989	0.14	0.00	0.10
10/03/1989	0.13	0.03	0.12
10/10/1989	0.14	0.00	0.18
10/18/1989	0.15	0.02	0.11
10/24/1989	0.15	0.00	0.14
11/01/1989	0.12	0.03	0.12
11/08/1989	0.14	0.02	0.12
11/15/1989	0.12	0.04	0.14
11/21/1989	0.10	--	0.16
11/29/1989	0.05	0.12	0.17
12/05/1989	0.11	0.12	0.14
12/12/1989	0.10	0.12	0.14
01/02/1990	0.04	--	0.11
01/24/1990	0.10	0.03	0.10
03/01/1990	0.09	0.05	0.10
03/13/1990	0.10	0.14	0.10
03/21/1990	0.10	0.07	0.11
03/29/1990	0.08	0.11	0.12
04/03/1990	0.09	0.10	0.14
04/09/1990	0.09	0.10	0.14
04/19/1990	0.06	0.82	0.16
04/24/1990	0.12	0.62	0.18
04/30/1990	0.17	0.58	0.55
05/07/1990	0.12	0.53	0.59
05/14/1990	0.18	0.49	0.47
05/21/1990	0.18	0.15	0.45
05/29/1990	0.21	0.20	0.48
06/05/1990	0.22	0.19	0.63
06/11/1990	0.18	0.15	0.60
06/18/1990	0.16	0.24	0.69
06/25/1990	0.18	0.21	0.66
07/02/1990	0.12	0.20	0.52
07/09/1990	0.14	0.13	0.17

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
07/16/1990	0.14	0.12	0.16
07/23/1990	0.13	0.10	0.11
07/30/1990	0.11	0.11	0.09
08/06/1990	0.10	0.10	0.09
08/13/1990	0.10	0.10	0.07
08/20/1990	0.08	0.09	0.06
08/27/1990	0.07	0.11	0.07
09/05/1990	0.11	0.09	0.10
09/11/1990	0.10	0.09	0.08
09/17/1990	0.08	0.07	0.05
09/24/1990	0.09	0.09	0.07
10/01/1990	0.08	0.08	0.08
10/09/1990	0.09	0.08	0.08
10/15/1990	0.08	0.09	0.08
10/23/1990	0.10	0.12	0.11
10/29/1990	0.08	0.12	0.10
11/05/1990	0.10	0.10	0.09
11/14/1990	0.11	0.10	0.08
11/19/1990	0.11	0.10	0.11
11/26/1990	0.11	0.10	0.10
12/03/1990	0.10	0.09	0.11
12/10/1990	0.11	0.10	0.10
12/17/1990	0.11	0.10	0.11
01/07/1991	0.00	0.02	0.00
01/14/1991	0.00	0.01	0.07
01/22/1991	0.00	0.03	0.07
01/28/1991	0.06	0.02	0.07
02/04/1991	0.00	0.00	0.07
02/11/1991	0.02	0.03	0.06
02/19/1991	0.02	0.02	0.06
02/25/1991	0.02	0.03	0.07
03/04/1991	0.02	0.02	0.07
03/11/1991	0.04	0.02	0.07
03/18/1991	0.05	0.01	0.06
03/25/1991	0.07	0.06	0.09
04/01/1991	0.07	0.07	0.10
04/08/1991	0.08	0.06	0.09
04/15/1991	0.10	0.13	0.17
04/22/1991	0.10	0.10	0.12

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
04/29/1991	0.11	0.10	0.13
05/01/1991	0.15	0.10	1.45
05/02/1991	0.19	0.11	1.50
05/03/1991	0.19	0.11	1.41
05/06/1991	0.26	0.11	1.69
05/08/1991	0.27	0.12	1.68
05/09/1991	0.27	0.13	1.65
05/10/1991	0.27	0.13	1.71
05/13/1991	0.26	0.13	1.71
05/16/1991	0.35	0.18	0.84
05/20/1991	0.32	0.31	0.85
05/23/1991	0.31	0.32	0.95
05/28/1991	0.23	0.32	0.83
05/30/1991	0.29	0.41	0.89
06/03/1991	0.29	0.38	0.90
06/10/1991	0.43	0.48	0.99
06/18/1991	0.36	0.53	0.87
06/24/1991	0.48	0.64	1.43
07/01/1991	0.59	0.75	1.25
07/08/1991	0.36	0.60	1.02
07/15/1991	0.33	0.61	0.50
07/22/1991	0.25	0.44	0.74
07/29/1991	0.25	0.41	0.66
08/05/1991	0.21	0.36	0.73
08/12/1991	0.18	0.30	0.49
08/19/1991	0.16	0.26	0.26
08/26/1991	0.17	0.13	0.19
09/03/1991	0.13	0.13	0.11
09/09/1991	0.12	0.12	0.10
09/16/1991	0.14	0.12	0.12
09/23/1991	0.11	0.11	0.12
09/30/1991	0.12	0.08	0.12
10/07/1991	0.10	0.07	0.10
10/15/1991	0.14	0.07	0.12
10/21/1991	0.13	0.07	0.11
10/28/1991	0.09	0.06	0.14
11/04/1991	0.14	0.10	0.15
11/12/1991	0.12	0.11	0.16
11/18/1991	0.10	0.14	0.15

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
11/25/1991	0.14	0.10	0.17
12/02/1991	0.13	0.11	0.15
12/09/1991	0.13	0.08	0.15
12/16/1991	0.13	0.06	0.14
01/06/1992	0.10	0.07	0.11
01/13/1992	0.09	0.05	0.12
01/21/1992	0.10	0.03	0.10
01/27/1992	0.07	0.04	0.09
02/03/1992	0.09	0.02	0.10
02/10/1992	0.08	0.03	0.10
02/18/1992	0.08	0.04	0.07
02/24/1992	0.08	0.03	0.09
03/02/1992	0.13	0.01	0.09
03/09/1992	0.22	0.05	0.15
03/16/1992	0.15	0.07	0.13
03/23/1992	0.18	0.08	0.17
03/30/1992	0.22	0.11	0.28
04/06/1992	0.22	0.16	0.36
04/13/1992	0.25	0.18	0.41
04/20/1992	0.26	0.20	0.46
04/27/1992	0.23	0.23	0.44
05/04/1992	0.19	0.48	0.44
05/11/1992	0.20	0.32	0.42
05/18/1992	0.19	0.46	0.38
05/26/1992	0.63	0.90	0.59
06/01/1992	0.35	0.92	0.65
06/08/1992	1.27	0.63	0.61
06/15/1992	0.71	0.53	0.41
06/22/1992	0.91	0.72	1.12
06/29/1992	0.70	0.65	0.97
07/06/1992	0.92	0.80	1.25
07/13/1992	0.71	0.91	1.09
07/20/1992	0.50	0.70	0.95
07/27/1992	0.25	0.58	0.76
08/03/1992	0.26	1.04	1.03
08/10/1992	0.18	0.91	0.77
08/17/1992	0.17	0.83	0.51
08/24/1992	0.14	0.63	0.57
08/31/1992	0.15	0.56	0.31

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
09/08/1992	0.15	0.57	0.60
09/14/1992	0.17	0.54	0.47
09/21/1992	0.16	0.60	0.34
09/28/1992	0.16	0.52	0.28
10/06/1992	0.17	0.49	0.27
10/13/1992	0.15	0.52	0.31
10/19/1992	0.56	0.53	0.31
10/26/1992	0.35	0.43	0.21
11/02/1992	0.30	0.49	0.33
11/09/1992	0.30	0.49	0.38
11/16/1992	0.32	0.60	0.48
11/23/1992	0.30	0.58	0.51
11/30/1992	0.29	0.58	0.56
12/07/1992	0.24	0.48	0.44
12/14/1992	0.24	0.51	0.43
12/21/1992	0.20	0.47	0.30
12/29/1992	0.17	0.41	0.17
01/04/1993	0.19	0.29	0.13
01/11/1993	0.18	0.27	0.03
01/18/1993	0.19	0.35	0.09
01/25/1993	0.19	0.32	0.13
02/01/1993	0.18	0.25	0.10
02/08/1993	0.18	0.27	0.13
02/16/1993	0.15	0.21	0.08
02/22/1993	0.15	0.18	0.08
03/01/1993	0.12	0.23	0.07
03/08/1993	0.14	0.21	0.08
03/16/1993	0.14	0.18	0.08
03/22/1993	0.16	0.14	0.09
03/29/1993	0.31	0.32	0.47
03/31/1993	0.25	0.46	0.56
04/02/1993	0.27	0.42	0.64
04/05/1993	0.29	0.51	0.68
04/08/1993	0.27	0.57	0.81
04/12/1993	0.31	0.76	1.02
04/14/1993	0.35	0.79	1.07
04/16/1993	0.37	0.85	1.08
04/19/1993	0.34	0.87	1.00
04/21/1993	0.36	0.69	1.10

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
04/23/1993	0.36	0.76	1.13
04/26/1993	0.40	0.85	1.17
04/28/1993	0.38	0.86	1.29
04/30/1993	0.38	0.95	1.09
05/03/1993	0.37	0.89	1.06
05/05/1993	0.37	0.93	0.99
05/07/1993	0.48	1.04	1.13
05/10/1993	0.48	0.95	1.12
05/14/1993	0.40	0.83	1.07
05/17/1993	0.38	0.83	1.12
05/19/1993	0.33	0.80	0.86
05/21/1993	0.30	0.78	1.00
05/24/1993	0.51	0.88	1.19
05/28/1993	0.57	0.86	1.13
06/01/1993	0.78	0.93	1.26
06/04/1993	0.71	0.90	1.17
06/07/1993	0.83	0.95	1.20
06/10/1993	0.89	1.20	1.32
06/14/1993	0.78	0.90	1.15
06/17/1993	0.97	0.94	1.19
06/21/1993	1.24	0.98	1.37
06/24/1993	1.19	1.06	1.24
06/29/1993	1.07	1.00	1.29
07/06/1993	1.51	1.19	1.48
07/12/1993	1.28	1.04	1.39
07/15/1993	1.32	1.08	1.38
07/19/1993	2.44	1.66	1.81
07/22/1993	2.04	1.64	1.55
07/26/1993	1.88	1.56	1.57
07/28/1993	2.58	1.50	1.23
07/30/1993	2.26	1.34	1.13
08/02/1993	2.42	1.25	1.04
08/05/1993	2.32	1.20	1.01
08/09/1993	2.07	1.11	0.97
08/12/1993	2.01	1.04	0.91
08/16/1993	1.98	0.88	0.91
08/23/1993	1.76	0.85	0.88
08/30/1993	1.62	0.68	0.69
09/08/1993	1.44	0.63	0.57

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
09/14/1993	1.13	0.58	0.50
09/20/1993	0.57	0.53	0.41
09/27/1993	0.71	0.55	0.53
10/04/1993	0.58	0.48	0.44
10/12/1993	0.53	0.51	0.37
10/18/1993	0.52	0.48	0.37
10/25/1993	0.55	0.51	0.40
11/01/1993	0.57	0.48	0.43
11/08/1993	0.34	0.45	0.34
11/15/1993	0.45	0.46	0.36
11/23/1993	0.45	0.43	0.42
12/16/1993	0.36	0.44	0.48
12/20/1993	0.36	0.41	0.46
02/17/1994	0.20	0.34	0.26
03/22/1994	2.03	1.29	1.53
03/28/1994	1.45	1.45	1.26
03/29/1994	2.17	1.45	1.51
04/01/1994	2.32	1.59	1.51
04/04/1994	2.45	1.61	1.79
04/11/1994	2.54	1.54	1.90
04/18/1994	2.77	1.54	1.84
04/25/1994	2.78	1.56	1.89
05/02/1994	2.99	1.85	2.08
05/09/1994	2.96	1.78	2.17
05/16/1994	2.91	1.69	2.25
05/23/1994	2.72	1.59	2.15
05/31/1994	2.71	1.32	2.13
06/06/1994	1.50	1.41	2.19
06/13/1994	0.87	1.19	1.93
06/20/1994	1.37	1.12	2.11
06/27/1994	1.40	1.07	1.82
07/05/1994	1.66	0.96	1.88
07/11/1994	3.00	2.00	2.32
07/18/1994	2.68	1.69	2.15
07/25/1994	1.17	1.67	1.94
08/01/1994	0.55	1.36	1.90
08/08/1994	1.35	1.06	1.33
08/15/1994	1.49	0.97	1.63
08/22/1994	1.29	0.87	1.56

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
08/29/1994	1.65	0.87	1.54
09/06/1994	1.74	0.85	1.62
09/12/1994	1.63	0.78	1.67
09/19/1994	1.75	1.16	1.87
09/26/1994	1.90	1.10	1.94
10/03/1994	1.64	1.02	1.82
10/11/1994	1.90	1.27	1.97
10/19/1994	2.38	1.62	2.52
10/24/1994	2.51	1.61	2.26
10/31/1994	2.45	1.49	2.14
11/07/1994	2.47	1.48	2.18
11/14/1994	2.30	1.39	2.01
11/21/1994	2.34	1.36	2.06
11/28/1994	2.26	1.60	2.00
12/05/1994	2.05	1.44	1.91
12/19/1994	1.81	1.35	1.81
01/03/1995	1.62	1.18	1.80
01/09/1995	1.55	1.01	1.60
01/17/1995	1.37	1.00	1.72
01/23/1995	1.36	0.90	1.69
01/30/1995	1.59	0.94	1.64
02/06/1995	1.49	0.93	1.59
02/13/1995	1.30	0.80	1.59
02/21/1995	1.21	0.82	1.48
02/27/1995	1.03	0.74	1.47
03/06/1995	1.04	--	--
03/13/1995	1.93	--	1.50
04/04/1995	2.26	1.44	1.82
04/24/1995	2.64	1.91	1.82
05/01/1995	2.92	1.98	1.95
05/08/1995	2.70	1.94	1.98
06/06/1995	2.20	1.89	1.92
06/15/1995	2.32	1.68	1.70
06/28/1995	2.71	1.57	1.79
07/12/1995	2.64	1.41	1.10
07/28/1995	2.83	1.33	1.76
08/09/1995	1.48	1.27	1.65
08/24/1995	2.04	1.05	1.59
09/06/1995	2.08	0.92	1.56

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
09/20/1995	2.02	0.74	1.39
10/12/1995	2.83	1.45	2.09
10/26/1995	2.75	1.43	1.99
11/09/1995	2.71	1.48	2.30
11/22/1995	2.45	1.31	1.68
12/14/1995	2.10	1.09	1.43
01/08/1996	1.88	1.01	1.87
02/06/1996	1.28	--	1.42
03/18/1996	1.51	1.39	1.20
04/24/1996	2.07	1.01	1.45
05/13/1996	2.04	1.56	1.73
06/04/1996	3.02	1.61	1.85
06/18/1996	3.26	1.61	2.07
07/15/1996	2.99	1.50	1.82
08/23/1996	1.98	1.11	1.12
09/10/1996	2.54	1.33	2.14
10/23/1996	2.77	1.50	2.13
12/02/1996	2.91	1.40	1.97
01/01/1997	3.02	1.45	1.81
02/06/1997	1.97	1.25	1.51
03/12/1997	3.00	1.01	1.60
03/25/1997	1.67	1.15	0.99
04/21/1997	1.95	1.82	--
05/20/1997	2.77	1.64	1.55
07/02/1997	2.89	1.61	1.55
08/04/1997	3.06	1.41	2.06
09/04/1997	3.41	1.26	2.00
10/07/1997	3.20	1.34	1.05
10/31/1997	3.16	1.57	1.94
12/16/1997	3.15	1.32	1.86
01/14/1998	3.03	1.11	2.06
02/09/1998	3.09	0.93	1.44
04/14/1998	3.22	1.74	1.99
05/06/1998	3.67	1.84	2.32
06/10/1998	3.95	1.91	2.38
06/23/1998	4.06	2.05	2.72
07/21/1998	3.29	1.73	2.08
08/17/1998	3.04	1.66	2.13
09/01/1998	3.16	1.75	1.93

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
09/30/1998	2.99	1.51	1.93
11/02/1998	3.61	1.85	1.80
11/30/1998	3.80	1.76	2.12
12/15/1998	3.80	1.45	1.61
01/13/1999	2.92	1.18	1.64
02/08/1999	2.82	1.25	1.06
03/10/1999	3.04	1.44	1.08
04/12/1999	2.80	1.30	1.45
05/26/1999	2.80	1.24	1.60
06/22/1999	3.12	1.64	1.91
08/04/1999	2.71	1.56	1.39
09/02/1999	3.22	1.56	1.65
10/01/1999	3.13	1.49	1.65
12/06/1999	3.09	1.45	1.49
01/24/2000	2.89	1.67	1.51
03/27/2000	3.17	1.41	1.90
04/19/2000	2.94	1.42	1.64
05/02/2000	2.90	1.37	1.57
05/15/2000	2.94	1.50	1.77
06/01/2000	2.99	1.42	1.67
06/13/2000	2.90	1.71	1.50
07/10/2000	3.38	1.75	2.10
08/08/2000	3.25	1.70	1.44
09/14/2000	3.02	1.60	1.62
12/01/2000	2.99	1.61	1.77
01/08/2001	3.12	1.36	1.47
02/20/2001	2.95	1.24	1.47
03/14/2001	2.96	1.27	1.52
04/18/2001	2.17	1.43	1.26
05/02/2001	2.95	1.64	1.70
05/25/2001	3.32	1.68	2.05
07/12/2001	2.96	1.52	1.71
08/01/2001	3.17	1.43	1.85
09/05/2001	2.83	1.36	1.74
11/02/2001	2.48	2.41	1.50
12/07/2001	3.25	1.89	1.29
12/27/2001	3.04	1.83	1.17
02/13/2002	2.80	1.45	1.27
03/13/2002	3.07	1.29	1.50

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
04/09/2002	2.63	1.33	1.43
04/25/2002	2.18	1.47	1.44
05/15/2002	2.53	1.13	1.64
06/14/2002	2.50	1.15	1.56
06/27/2002	3.06	1.89	1.73
07/04/2002	2.87	1.94	1.72
07/11/2002	2.81	1.93	1.76
07/16/2002	2.93	1.73	1.70
07/23/2002	3.24	1.66	1.65
07/30/2002	3.28	1.80	1.74
08/06/2002	3.10	1.71	1.73
08/13/2002	3.37	1.73	1.95
08/20/2002	3.17	1.94	1.67
08/27/2002	3.40	1.77	1.85
09/04/2002	3.43	1.86	1.78
09/20/2002	3.25	1.51	1.71
11/20/2002	2.88	1.38	1.37
12/16/2002	2.62	1.92	1.18
02/26/2003	1.67	1.15	1.14
03/27/2003	1.41	1.17	0.98
04/04/2003	1.51	1.14	1.31
04/11/2003	1.51	1.11	1.31
04/17/2003	1.38	1.07	1.17
04/24/2003	1.57	1.23	1.56
04/30/2003	1.95	1.46	1.52
05/06/2003	2.23	1.69	1.64
05/13/2003	3.39	1.88	1.64
05/20/2003	3.40	2.19	2.17
05/28/2003	3.45	2.44	2.25
06/03/2003	3.33	2.31	1.85
06/10/2003	3.23	2.30	1.85
06/17/2003	3.48	2.12	1.92
06/24/2003	3.36	1.98	2.02
07/01/2003	3.33	2.10	2.18
07/08/2003	3.23	2.16	2.03

Supplement 1. Drainflow at sampling sites 3, 4, and 6 in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Drainflow in cubic feet per second; --, no data]

Date	Site 3	Site 4	Site 6
07/15/2003	3.05	1.78	1.84
07/22/2003	3.11	2.01	1.72
08/14/2003	2.88	1.98	1.37
08/20/2003	2.93	1.93	1.43
09/04/2003	3.00	1.75	1.39
09/15/2003	2.64	1.82	1.23
11/19/2003	2.57	--	1.16
01/22/2004	1.75	0.97	1.04
03/23/2004	1.35	0.49	0.82
04/05/2004	1.38	0.58	1.36
04/13/2004	1.46	0.62	1.20
04/22/2004	1.37	0.63	1.39
04/27/2004	1.34	0.57	1.41
05/04/2004	1.37	0.57	1.36
05/12/2004	1.30	0.63	1.47
05/18/2004	1.42	0.66	1.55
05/27/2004	1.36	0.75	1.49
06/03/2004	2.99	2.16	1.67
06/09/2004	3.13	2.12	1.68
06/16/2004	3.12	2.17	1.70
06/23/2004	3.28	2.12	1.81
07/01/2004	2.65	2.09	1.75
07/09/2004	2.86	2.14	1.81
07/13/2004	3.26	2.23	1.89
07/23/2004	2.91	2.12	1.87
07/30/2004	2.69	1.94	1.58
08/05/2004	2.48	1.89	1.37
08/12/2004	2.30	1.84	1.32
08/18/2004	2.16	1.61	1.33
08/25/2004	2.00	1.54	1.45
09/01/2004	1.92	1.39	1.64
09/08/2004	2.00	1.34	1.53
09/15/2004	2.23	1.25	1.39
11/18/2004	3.16	1.55	1.42

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
1	04/20/1989	580	--	15.1	--	--	368.72	213.00	208.00	172.00
1	05/02/1989	770	--	13.5	--	--	466.80	69.00	67.00	50.00
1	05/08/1989	840	--	13.0	--	--	512.43	221.00	219.00	182.00
1	05/16/1989	950	--	21.0	--	--	622.19	77.00	76.00	58.00
1	04/18/1990	810	8.10	7.8	240.56	220.10	468.42	199.00	197.00	170.00
1	04/24/1990	860	8.30	20.0	267.88	236.00	523.54	207.00	207.00	168.00
1	05/02/1990	860	8.55	12.0	290.67	245.01	567.06	118.00	116.00	97.00
1	05/07/1990	1,000	8.25	16.0	286.96	220.89	574.45	255.00	251.00	219.00
1	05/16/1990	1,040	8.11	12.2	359.87	269.29	691.67	255.00	223.00	192.00
1	03/14/1991	1,340	7.87	0.7	453.65	395.00	1,005.40	--	--	--
1	04/11/1991	730	8.50	7.2	--	212.48	473.01	--	--	--
1	04/24/1991	840	8.46	8.5	254.15	234.91	554.08	--	--	--
1	05/08/1991	1,090	8.40	12.5	330.62	257.94	707.57	--	--	--
1	05/21/1991	1,140	8.13	18.6	303.30	254.96	706.30	--	--	--
1	06/13/1991	1,080	8.14	24.5	334.33	290.47	646.50	--	--	--
1	07/17/1991	870	8.16	29.3	293.95	293.31	526.41	--	--	--
1	08/20/1991	940	8.25	25.6	297.32	261.58	544.30	--	--	--
1	09/18/1991	1,360	8.71	7.8	--	--	--	--	--	--
1	10/24/1991	1,210	8.79	1.3	--	--	--	--	--	--
1	11/14/1991	1,410	8.22	3.1	--	--	--	--	--	--
1	12/12/1991	1,690	8.09	0.7	543.35	469.85	1,211.74	--	--	--
1	01/15/1992	1,420	7.68	0.5	--	--	--	--	--	--
1	02/12/1992	1,020	8.38	1.6	397.69	334.43	731.67	--	--	--
1	03/12/1992	--	--	--	--	--	--	--	--	--
1	04/14/1992	940	8.53	5.3	--	--	--	--	--	--
1	05/20/1992	1,180	8.19	20.9	--	329.40	728.69	104.00	--	72.75
1	05/26/1992	980	8.27	16.1	365.23	328.50	663.37	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
1	06/17/1992	950	7.89	18.5	302.51	265.42	593.37	129.00	--	99.00
1	07/23/1992	1,090	8.18	19.2	--	--	--	71.00	--	50.00
1	08/18/1992	1,200	8.05	19.3	388.01	366.68	844.00	106.00	--	82.00
1	09/15/1992	1,140	--	--	327.03	318.43	715.90	144.00	--	118.50
1	10/22/1992	1,250	8.34	10.5	--	--	--	--	--	--
1	12/01/1992	1,070	8.40	3.6	409.16	344.26	721.19	--	--	--
1	03/17/1993	630	7.46	1.2	--	--	--	--	--	--
1	04/22/1993	610	8.24	12.0	--	--	--	--	--	--
1	05/21/1993	850	8.21	16.3	302.62	294.36	531.75	46.80	--	32.00
1	06/10/1993	880	7.76	17.4	--	246.43	531.58	<0.50	--	<0.50
1	07/07/1993	650	7.72	18.4	--	--	--	75.20	--	68.00
1	08/11/1993	690	7.55	23.9	249.73	255.53	399.46	7.20	--	3.60
1	10/04/1993	570	8.08	12.8	--	--	--	10.80	--	6.80
1	10/28/1993	560	8.24	4.9	--	--	--	--	--	--
1	04/20/1994	730	8.80	--	--	--	--	--	--	--
1	06/03/1994	680	8.08	18.6	259.61	212.90	401.79	57.00	--	48.33
1	06/29/1994	730	--	21.4	--	216.47	450.36	94.40	--	71.20
1	08/03/1994	800	8.39	25.5	288.62	239.66	493.32	84.00	--	59.20
1	08/30/1994	840	8.40	18.3	309.81	252.41	529.70	166.00	--	37.00
1	10/06/1994	720	8.44	16.5	280.33	219.16	442.56	54.80	--	42.00
1	11/15/1994	810	8.32	--	320.87	249.01	528.89	--	--	--
1	01/26/1995	1,060	7.47	--	--	372.15	769.26	--	--	--
1	03/02/1995	1,090	7.54	2.4	448.14	373.35	764.15	--	--	--
1	04/20/1995	670	8.48	--	--	--	--	--	--	--
1	05/17/1995	710	8.66	--	--	187.85	444.75	36.80	--	27.20
1	06/07/1995	--	8.24	--	250.06	199.38	423.06	40.40	--	31.60
1	07/12/1995	780	8.28	27.4	271.94	228.39	479.85	37.20	--	28.40

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
1	08/23/1995	970	--	--	--	--	622.95	84.40	--	59.20
1	10/05/1995	1,060	8.55	13.8	379.23	321.76	709.41	--	--	--
1	11/17/1995	920	8.14	--	439.72	346.48	754.06	--	--	--
1	05/15/1996	540	8.82	16.0	197.06	165.26	332.15	--	--	--
1	08/07/1996	650	8.25	--	245.51	186.04	389.84	--	--	--
1	03/26/1997	670	7.64	5.0	--	--	--	--	--	--
1	04/30/1997	550	8.41	--	--	--	--	--	--	--
1	07/10/1997	670	8.08	24.2	256.64	200.38	411.23	--	--	--
1	09/23/1997	690	8.12	18.1	298.43	226.37	459.70	--	--	--
1	01/15/1998	1,130	7.49	2.9	--	--	--	--	--	--
1	04/30/1998	830	8.72	16.2	--	--	--	--	--	--
1	08/18/1998	900	8.46	23.4	298.89	265.77	551.84	--	--	--
1	01/13/1999	1,340	7.67	0.0	570.88	420.78	879.55	--	--	--
1	04/21/1999	740	8.55	10.1	--	--	--	--	--	--
1	07/16/1999	770	8.41	23.8	277.91	224.38	415.36	--	--	--
1	11/30/1999	1,040	8.40	2.8	435.32	346.08	749.45	--	--	--
1	02/08/2000	1,260	8.06	0.6	--	--	--	--	--	--
1	05/17/2000	1,350	8.50	13.9	--	--	--	--	--	--
1	08/24/2000	960	8.38	21.4	318.70	256.71	589.34	--	--	--
1	11/16/2000	870	8.42	0.5	434.80	297.55	711.23	--	--	--
1	02/21/2001	1,320	7.56	0.2	--	--	--	--	--	--
1	05/15/2001	720	8.70	21.0	--	--	--	--	--	--
1	08/08/2001	1,220	--	29.0	416.29	312.24	750.17	--	--	--
1	11/06/2001	1,130	8.73	7.9	387.78	304.92	755.38	--	--	--
1	02/11/2002	1,150	8.14	0.6	477.50	--	--	--	--	--
1	05/15/2002	1,270	8.60	17.6	--	--	--	--	--	--
1	08/12/2002	1,050	--	--	359.54	302.17	679.16	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
1	11/21/2002	1,120	8.20	5.3	393.96	303.14	736.80	--	--	--
1	02/26/2003	1,690	7.42	0.5	584.55	--	--	--	--	--
1	05/28/2003	1,290	8.28	18.5	--	--	--	--	--	--
1	08/16/2003	1,260	8.22	26.2	400.68	299.48	770.22	--	--	--
1	11/19/2003	1,100	8.72	3.6	383.18	335.94	657.09	--	--	--
1	05/20/2004	910	8.37	16.2	--	--	--	--	--	--
1	08/24/2004	1,100	8.52	17.6	423.82	292.00	749.27	--	--	--
1	11/17/2004	1,100	8.84	8.8	430.14	270.44	--	--	--	--
2	03/14/1991	1,340	7.87	0.7	453.65	395.05	1,005.40	--	--	--
2	04/11/1991	1,100	8.58	6.9	420.01	264.37	731.95	--	--	--
2	04/24/1991	1,760	8.36	9.5	520.77	383.24	1,099.48	--	--	--
2	07/17/1991	1,040	7.97	31.6	439.00	333.54	585.52	--	--	--
2	08/20/1991	910	8.11	26.0	410.79	272.88	560.00	--	--	--
2	09/18/1991	1,030	8.70	8.1	--	--	--	--	--	--
2	10/24/1991	910	8.53	2.6	--	--	--	--	--	--
2	12/12/1991	950	7.79	1.1	515.53	335.74	670.99	--	--	--
2	01/15/1992	1,020	7.70	0.8	--	--	--	--	--	--
2	02/12/1992	860	8.11	1.4	406.93	247.17	546.96	--	--	--
2	03/12/1992	920	7.85	1.0	--	--	--	--	--	--
2	04/14/1992	1,170	8.13	5.8	--	--	--	--	--	--
2	07/23/1992	810	7.19	18.8	--	--	--	--	--	--
2	08/18/1992	840	8.07	27.1	430.18	271.98	565.55	58.67	--	37.33
2	09/15/1992	1,120	--	--	361.85	331.76	724.51	--	--	--
2	10/21/1992	1,210	7.94	7.6	--	--	--	--	--	--
2	11/30/1992	1,080	7.44	3.7	570.33	314.23	708.08	--	--	--
2	06/30/1994	900	7.83	20.3	--	--	--	--	--	--
2	08/03/1994	940	7.81	28.0	329.16	288.74	562.40	26.00	--	14.67

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
2	11/15/1994	1,040	--	--	--	--	630.26	--	--	--
2	01/15/1998	790	7.56	3.2	--	--	--	--	--	--
2	08/18/1998	970	7.91	21.2	405.22	324.75	570.03	--	--	--
2	01/13/1999	950	7.71	0.0	442.44	325.38	570.74	--	--	--
2	11/30/1999	910	8.13	5.8	439.06	337.86	602.50	--	--	--
2	02/08/2000	870	7.98	4.4	--	--	--	--	--	--
2	05/17/2000	1,130	8.10	11.1	--	--	--	--	--	--
2	08/24/2000	930	7.79	22.8	402.00	284.76	550.76	--	--	--
2	11/16/2000	--	--	--	--	--	--	--	--	--
2	02/21/2001	840	7.44	0.7	--	--	--	--	--	--
2	11/06/2001	880	7.91	8.6	413.33	326.77	588.50	--	--	--
2	02/11/2002	850	7.51	0.9	426.17	--	--	--	--	--
2	05/15/2002	1,520	8.14	20.3	--	--	--	--	--	--
2	08/12/2002	910	--	--	392.05	320.37	558.65	--	--	--
2	11/02/2002	900	7.46	6.1	424.37	316.07	569.08	--	--	--
2	02/26/2003	860	7.02	2.3	393.85	--	--	--	--	--
2	05/28/2003	1,220	7.64	20.5	--	--	--	--	--	--
2	08/16/2003	1,010	7.79	27.0	392.46	308.36	567.00	--	--	--
2	11/19/2003	1,040	8.12	7.0	426.27	329.15	607.48	--	--	--
2	02/25/2004	860	8.04	2.6	--	--	--	--	--	--
2	05/20/2004	960	8.09	15.6	--	--	--	--	--	--
2	08/24/2004	1,010	7.48	17.6	448.65	328.97	646.65	--	--	--
2	11/17/2004	990	7.43	4.0	473.03	382.96	743.60	--	--	--
3	01/01/1984	810	--	--	--	--	473.00	--	--	--
3	03/22/1984	770	--	--	--	--	474.00	--	--	--
3	05/23/1984	720	--	--	--	--	414.00	--	--	--
3	10/29/1984	750	--	--	--	--	441.00	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
3	02/12/1985	740	--	--	--	--	454.00	--	--	--
3	06/26/1985	760	--	--	--	--	462.00	--	--	--
3	10/02/1985	770	--	--	--	--	452.00	--	--	--
3	05/28/1986	840	--	10.0	--	--	489.29	--	--	--
3	09/24/1986	810	--	12.2	--	--	482.22	--	--	--
3	11/18/1986	720	--	--	--	--	415.00	--	--	--
3	12/10/1986	800	7.40	9.0	--	--	490.30	--	--	--
3	03/10/1987	790	7.40	6.9	--	--	468.65	--	--	--
3	06/23/1987	820	7.40	8.6	--	--	480.68	--	--	--
3	09/15/1987	890	7.50	10.1	--	--	537.68	--	--	--
3	02/24/1988	850	7.40	6.7	--	--	517.91	--	--	--
3	06/08/1988	850	7.40	8.2	--	--	521.03	--	--	--
3	07/13/1988	890	7.50	10.5	--	--	533.63	--	--	--
3	09/14/1988	940	7.50	10.4	--	--	597.78	--	--	--
3	11/30/1988	960	--	8.9	--	--	588.80	--	--	--
3	01/11/1989	950	7.60	--	--	--	622.79	--	--	--
3	05/04/1989	860	7.30	7.0	--	--	513.74	--	--	--
3	05/24/1989	910	7.40	7.7	--	--	559.66	--	--	--
3	06/23/1989	920	7.40	10.3	--	--	589.95	--	--	--
3	07/27/1989	1,000	7.60	9.6	--	--	--	--	--	--
3	08/23/1989	1,020	7.30	10.3	--	--	626.04	--	--	--
3	09/13/1989	1,000	7.70	10.5	--	--	--	--	--	--
3	10/25/1989	890	7.50	10.3	--	--	632.33	--	--	--
3	11/30/1989	1,000	7.70	8.8	--	--	--	--	--	--
3	01/24/1990	930	7.40	7.0	--	--	--	--	--	--
3	03/01/1990	1,020	7.50	7.4	--	--	644.63	--	--	--
3	03/29/1990	1,060	7.20	6.8	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
3	05/02/1990	820	7.36	6.7	--	--	--	--	--	--
3	05/24/1990	--	7.43	8.3	451.48	291.72	536.83	--	--	--
3	06/19/1990	850	6.91	11.5	454.22	297.18	539.95	--	--	--
3	07/17/1990	930	7.57	8.5	--	--	--	--	--	--
3	08/09/1990	840	7.36	--	509.83	304.82	611.06	--	--	--
3	09/11/1990	880	7.75	11.2	--	302.30	216.75	--	--	--
3	10/11/1990	850	7.56	9.7	--	--	--	--	--	--
3	11/13/1990	1,000	7.54	9.2	545.40	304.17	633.89	--	--	--
3	12/11/1990	980	7.55	8.3	--	--	--	--	--	--
3	01/16/1991	910	7.47	8.0	--	--	--	--	--	--
3	02/20/1991	920	7.26	6.8	600.19	336.03	704.65	--	--	--
3	03/14/1991	1,020	7.68	6.8	539.90	349.65	683.45	--	--	--
3	04/11/1991	960	7.71	6.8	545.40	356.76	675.20	--	--	--
3	04/23/1991	950	7.47	6.8	482.37	324.30	616.97	--	--	--
3	05/08/1991	810	7.53	7.6	413.99	306.22	527.49	--	--	--
3	05/21/1991	830	7.52	7.6	416.73	291.70	513.81	--	--	--
3	06/13/1991	800	7.54	8.6	403.96	308.86	517.94	--	--	--
3	07/17/1991	870	7.21	9.8	460.11	323.73	553.72	--	--	--
3	08/20/1991	970	7.37	10.7	499.93	320.58	602.87	--	--	--
3	09/18/1991	1,040	7.55	10.6	--	--	--	--	--	--
3	10/24/1991	1,050	7.60	9.6	--	--	--	--	--	--
3	11/14/1991	1,000	7.40	9.5	--	--	--	--	--	--
3	12/11/1991	780	7.86	8.7	475.84	305.00	600.27	--	--	--
3	01/15/1992	1,040	7.47	7.8	--	--	--	--	--	--
3	02/12/1992	960	7.79	6.6	524.77	301.13	624.13	--	--	--
3	03/12/1992	850	7.33	5.6	--	--	--	--	--	--
3	04/14/1992	910	7.34	5.8	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
3	05/26/1992	970	7.53	7.9	444.38	319.70	597.57	--	--	--
3	06/16/1992	860	7.28	8.6	419.65	293.38	529.10	--	--	--
3	07/22/1992	880	7.36	10.4	--	--	--	--	--	--
3	08/18/1992	850	7.13	10.1	490.82	306.88	579.35	4.00	--	<0.50
3	09/15/1992	930	--	--	496.69	295.75	586.70	--	--	--
3	10/22/1992	1,020	7.73	10.2	--	--	--	--	--	--
3	12/01/1992	1,030	7.33	9.0	538.86	290.51	631.93	--	--	--
3	02/11/1993	1,040	7.50	6.7	536.80	309.96	636.99	--	--	--
3	03/16/1993	990	7.42	--	--	--	--	--	--	--
3	04/22/1993	910	7.37	6.8	--	--	--	--	--	--
3	05/21/1993	860	7.41	7.8	463.98	306.48	--	4.80	--	<0.50
3	06/08/1993	820	7.17	8.4	421.84	320.58	533.50	1.60	--	1.20
3	07/08/1993	860	7.25	9.8	--	--	--	1.20	--	<0.50
3	08/10/1993	920	7.12	12.4	422.36	314.44	530.45	4.40	--	3.20
3	10/05/1993	880	7.50	--	--	--	--	2.40	--	0.80
3	10/28/1993	890	7.44	10.2	--	--	--	--	--	--
3	03/24/1994	620	7.35	--	362.26	284.43	463.35	--	--	--
3	04/20/1994	840	7.31	--	--	--	--	--	--	--
3	06/03/1994	930	7.33	--	452.13	316.79	569.91	0.67	--	<0.50
3	06/30/1994	880	7.26	10.2	413.70	300.67	530.29	<0.50	--	<0.50
3	08/03/1994	850	7.14	18.7	325.92	313.51	513.91	2.80	--	<0.50
3	08/30/1994	900	7.29	13.0	424.07	283.76	552.56	<0.50	--	<0.50
3	10/06/1994	920	7.31	14.3	434.40	308.32	544.44	2.00	--	<0.50
3	11/15/1994	890	7.18	--	438.13	308.80	537.95	--	--	--
3	01/26/1995	850	7.23	--	425.72	313.39	551.26	--	--	--
3	03/02/1995	860	7.24	6.1	450.25	312.15	547.11	--	--	--
3	04/20/1995	800	7.02	6.3	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
3	05/17/1995	900	7.24	--	424.00	336.03	567.81	5.00	--	2.50
3	06/07/1995	--	7.30	--	406.13	329.09	555.77	2.00	--	<0.50
3	07/12/1995	920	7.29	12.5	384.15	334.97	554.42	40.80	--	20.00
3	08/23/1995	840	7.24	--	400.47	312.08	530.43	2.00	--	<0.50
3	10/05/1995	900	7.32	11.3	396.22	326.07	544.16	2.40	--	<0.50
3	11/17/1995	860	7.30	--	405.36	310.88	528.63	--	--	--
3	05/15/1996	920	7.08	13.0	441.68	349.62	608.26	--	--	--
3	08/07/1996	880	7.21	--	437.02	299.12	536.14	--	--	--
3	03/26/1997	840	7.05	6.0	--	--	--	--	--	--
3	04/30/1997	910	7.22	--	--	--	--	--	--	--
3	07/10/1997	890	7.21	15.2	391.86	335.39	560.20	--	--	--
3	09/23/1997	860	7.13	14.0	371.58	323.60	523.45	--	--	--
3	01/15/1998	800	6.97	3.4	--	--	--	--	--	--
3	04/30/1998	880	7.17	7.5	--	--	--	--	--	--
3	08/18/1998	970	6.96	10.9	419.69	326.84	573.71	--	--	--
3	01/13/1999	940	7.29	--	440.03	336.03	594.35	--	--	--
3	04/21/1999	900	7.20	8.2	--	--	--	--	--	--
3	07/16/1999	1,050	7.27	14.0	435.72	354.17	549.92	--	--	--
3	11/30/1999	920	7.10	9.5	442.11	336.01	598.95	--	--	--
3	02/08/2000	920	7.36	7.2	--	--	--	--	--	--
3	05/17/2000	980	7.30	7.7	--	--	--	--	--	--
3	08/24/2000	960	7.23	15.8	428.27	301.81	575.43	--	--	--
3	11/16/2000	900	7.32	10.5	467.54	323.37	607.68	--	--	--
3	02/21/2001	890	7.10	6.0	--	--	--	--	--	--
3	05/15/2001	900	7.20	8.0	--	--	--	--	--	--
3	08/08/2001	950	7.29	11.7	434.08	344.24	553.07	--	--	--
3	11/06/2001	780	7.35	10.4	422.95	339.15	589.68	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
3	02/11/2002	910	7.01	7.0	443.95	--	--	--	--	--
3	05/15/2002	980	7.10	6.7	--	--	--	--	--	--
3	08/12/2002	1,000	--	--	428.64	358.89	607.29	--	--	--
3	11/02/2002	960	6.76	8.6	--	312.00	554.00	--	--	--
3	02/26/2003	880	6.77	8.7	390.20	--	--	--	--	--
3	05/28/2003	950	6.83	10.0	--	--	--	--	--	--
3	08/16/2003	1,000	6.74	13.6	--	320.26	584.17	--	--	--
3	11/19/2003	940	7.33	8.9	428.27	346.60	607.86	--	--	--
3	02/25/2004	910	7.51	6.6	--	--	--	--	--	--
3	05/20/2004	940	7.43	8.6	--	--	--	--	--	--
3	08/24/2004	990	7.16	12.6	474.19	330.47	644.56	--	--	--
3	11/17/2004	990	7.23	10.6	464.61	341.62	614.73	--	--	--
4	10/29/1984	750	--	--	--	--	438.00	--	--	--
4	02/12/1985	740	--	--	--	--	435.00	--	--	--
4	06/26/1985	800	--	--	--	--	447.00	--	--	--
4	10/02/1985	770	--	--	--	--	433.00	--	--	--
4	05/28/1986	820	--	8.9	--	--	448.47	--	--	--
4	09/24/1986	790	--	12.2	--	--	469.65	--	--	--
4	11/18/1986	800	--	--	--	--	475.00	--	--	--
4	12/10/1986	800	7.30	9.0	--	--	478.62	--	--	--
4	03/10/1987	790	7.30	6.4	--	--	468.21	--	--	--
4	06/23/1987	790	7.30	9.5	--	--	448.52	--	--	--
4	09/15/1987	790	7.40	11.5	--	--	474.39	--	--	--
4	02/25/1988	800	7.50	6.0	--	--	485.72	--	--	--
4	06/08/1988	800	7.50	8.9	--	--	479.18	--	--	--
4	07/13/1988	790	7.50	10.6	--	--	469.73	--	--	--
4	09/14/1988	740	7.70	12.6	--	--	459.17	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
4	11/30/1988	820	--	9.2	--	--	503.08	--	--	--
4	05/04/1989	780	7.30	8.0	--	--	452.02	--	--	--
4	05/24/1989	820	7.40	6.9	--	--	515.04	--	--	--
4	06/23/1989	800	7.30	11.5	--	--	457.26	--	--	--
4	07/27/1989	810	7.10	10.3	--	--	--	--	--	--
4	08/23/1989	800	7.00	11.8	--	--	464.54	--	--	--
4	09/13/1989	890	7.40	13.0	--	--	--	--	--	--
4	10/25/1989	750	7.20	13.4	--	--	466.60	--	--	--
4	11/30/1989	770	7.50	9.5	--	--	--	--	--	--
4	01/24/1990	700	7.10	7.3	--	--	--	--	--	--
4	03/01/1990	770	7.50	6.6	--	--	462.35	--	--	--
4	03/29/1990	800	7.20	6.7	--	--	--	--	--	--
4	05/02/1990	710	6.96	6.5	--	--	--	--	--	--
4	05/24/1990	--	7.26	6.8	406.71	290.31	470.29	--	--	--
4	06/19/1990	820	--	8.7	--	--	--	--	--	--
4	07/17/1990	750	7.62	9.5	--	--	--	--	--	--
4	08/09/1990	770	7.39	10.0	396.69	291.04	459.28	--	--	--
4	09/11/1990	700	7.77	11.6	--	297.11	192.57	--	--	--
4	10/11/1990	680	7.77	11.5	--	--	--	--	--	--
4	11/13/1990	730	7.45	10.3	399.43	290.91	455.91	--	--	--
4	12/11/1990	760	7.65	8.8	--	--	--	--	--	--
4	01/16/1991	810	7.68	8.2	--	--	--	--	--	--
4	02/20/1991	700	6.94	7.2	404.93	315.72	475.91	--	--	--
4	03/13/1991	680	7.64	6.3	393.94	305.26	461.51	--	--	--
4	04/10/1991	730	7.39	5.1	409.46	302.09	487.16	--	--	--
4	05/08/1991	730	7.47	6.3	380.21	313.25	474.54	--	--	--
4	06/13/1991	740	7.29	8.6	380.21	292.56	469.21	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
4	07/17/1991	750	7.15	10.7	425.15	311.28	478.05	--	--	--
4	08/20/1991	820	7.53	12.3	413.68	319.99	497.85	--	--	--
4	09/18/1991	780	7.73	12.2	--	--	--	--	--	--
4	10/24/1991	840	7.72	11.3	--	--	--	--	--	--
4	11/14/1991	750	7.66	10.5	--	--	--	--	--	--
4	12/11/1991	790	7.78	9.3	361.37	299.81	437.46	--	--	--
4	01/15/1992	780	7.37	7.3	--	--	--	--	--	--
4	02/12/1992	770	7.81	6.0	384.59	291.15	443.65	--	--	--
4	03/12/1992	740	7.53	5.8	--	--	--	--	--	--
4	04/14/1992	810	7.29	5.9	--	--	--	--	--	--
4	05/26/1992	1,040	7.22	11.4	490.82	328.80	659.36	--	--	--
4	06/16/1992	940	7.24	10.5	--	--	--	--	--	--
4	07/22/1992	850	7.14	11.6	--	--	--	--	--	--
4	08/18/1992	830	7.14	11.4	420.29	303.56	520.52	--	--	--
4	09/15/1992	850	7.20	8.4	--	--	--	--	--	--
4	10/22/1992	820	7.62	11.8	--	--	--	--	--	--
4	12/01/1992	860	7.40	9.8	434.46	294.27	508.59	--	--	--
4	02/11/1993	1,560	7.38	7.6	425.39	302.19	524.16	--	--	--
4	03/16/1993	790	7.33	--	--	--	--	--	--	--
4	04/22/1993	780	7.27	5.9	--	--	--	--	--	--
4	05/21/1993	880	7.18	8.1	413.41	308.57	533.09	--	--	--
4	06/08/1993	850	7.14	10.2	409.65	320.77	531.37	--	--	--
4	07/08/1993	790	7.27	8.9	--	--	--	--	--	--
4	08/10/1993	820	7.18	--	416.72	302.89	500.84	--	--	--
4	10/05/1993	840	7.50	11.5	--	--	--	--	--	--
4	10/28/1993	840	7.40	11.1	--	--	--	--	--	--
4	03/24/1994	850	6.94	--	447.75	292.35	535.58	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
4	04/20/1994	830	7.38	--	--	--	--	--	--	--
4	06/03/1994	840	7.29	--	440.52	299.98	488.29	1.67	--	0.67
4	06/30/1994	810	7.24	11.1	--	--	--	--	--	--
4	08/03/1994	850	7.09	15.9	--	--	--	--	--	--
4	08/30/1994	850	7.25	12.2	419.49	278.06	518.93	--	--	--
4	10/06/1994	810	7.26	15.2	--	--	--	--	--	--
4	11/15/1994	860	7.22	--	436.87	308.23	512.12	--	--	--
4	01/26/1995	830	7.37	--	--	--	--	--	--	--
4	03/02/1995	840	7.25	5.9	446.91	311.69	522.90	--	--	--
4	04/20/1995	780	7.40	--	--	--	--	--	--	--
4	05/17/1995	840	7.14	--	437.72	317.51	520.36	--	--	--
4	06/07/1995	--	7.16	--	--	--	--	--	--	--
4	07/12/1995	860	7.21	11.6	--	--	--	--	--	--
4	08/23/1995	850	7.14	--	430.33	304.25	528.70	2.00	--	<0.50
4	10/05/1995	900	7.25	11.5	--	--	--	--	--	--
4	11/17/1995	870	7.19	--	422.73	315.27	528.77	--	--	--
4	05/15/1996	840	7.12	12.1	443.10	278.28	515.72	--	--	--
4	08/07/1996	890	7.23	--	430.49	275.10	513.60	--	--	--
4	03/26/1997	850	7.13	8.0	--	--	--	--	--	--
4	04/30/1997	860	7.13	--	--	--	--	--	--	--
4	07/10/1997	850	7.20	15.6	395.53	303.74	502.58	--	--	--
4	09/23/1997	890	7.26	15.7	417.83	301.04	534.68	--	--	--
4	01/15/1998	840	7.55	6.8	--	--	--	--	--	--
4	04/30/1998	820	7.12	6.6	--	--	--	--	--	--
4	08/18/1998	850	6.94	12.1	405.27	302.01	477.14	--	--	--
4	01/13/1999	820	7.37	0.0	406.51	317.56	487.56	--	--	--
4	04/21/1999	810	7.31	8.2	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
4	07/16/1999	870	7.23	12.3	408.80	309.02	482.98	--	--	--
4	11/30/1999	870	7.17	9.8	459.13	313.83	553.79	--	--	--
4	02/08/2000	840	7.34	6.8	--	--	--	--	--	--
4	05/17/2000	870	7.20	7.7	--	--	--	--	--	--
4	08/24/2000	890	7.24	14.3	443.12	299.97	532.26	--	--	--
4	11/16/2000	820	7.24	10.0	468.32	302.67	549.50	--	--	--
4	02/21/2001	780	7.15	6.0	--	--	--	--	--	--
4	05/15/2001	790	7.20	8.4	--	--	--	--	--	--
4	08/08/2001	880	7.26	11.8	442.00	319.43	516.49	--	--	--
4	11/06/2001	830	7.22	10.9	424.49	315.60	526.33	--	--	--
4	02/11/2002	790	7.19	7.3	426.34	--	--	--	--	--
4	05/15/2002	830	7.06	6.9	--	--	--	--	--	--
4	08/12/2002	880	--	--	439.38	323.62	542.24	--	--	--
4	11/21/2002	790	6.73	8.4	417.89	275.97	478.70	--	--	--
4	02/26/2003	820	6.71	7.3	376.86	--	--	--	--	--
4	05/28/2003	850	7.00	10.0	--	--	--	--	--	--
4	08/19/2003	840	7.23	15.8	408.92	301.03	507.33	--	--	--
4	11/19/2003	860	7.51	9.8	452.32	326.32	544.41	--	--	--
4	02/25/2004	830	7.48	6.5	--	--	--	--	--	--
4	05/20/2004	820	7.60	8.5	--	--	--	--	--	--
4	08/24/2004	810	7.33	12.5	437.36	323.30	539.34	--	--	--
4	11/17/2004	840	7.14	10.1	448.09	325.72	529.48	--	--	--
5	09/24/1986	860	--	--	--	--	507.00	--	--	--
5	12/18/1986	850	--	--	--	--	504.00	--	--	--
5	06/23/1987	850	--	--	--	--	482.00	--	--	--
5	09/15/1987	890	--	--	--	--	523.00	--	--	--
5	02/25/1988	900	7.70	0.0	--	--	558.54	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
5	06/08/1988	900	8.20	27.7	--	--	543.35	--	--	--
5	07/13/1988	900	8.10	24.4	--	--	539.84	--	--	--
5	11/30/1988	1,070	--	0.7	--	--	660.42	--	--	--
5	05/04/1989	860	7.90	14.9	--	--	549.83	--	--	--
5	05/24/1989	880	8.00	18.4	--	--	543.27	--	--	--
5	06/23/1989	890	7.60	19.4	--	--	535.84	--	--	--
5	07/27/1989	850	8.30	23.9	--	--	--	--	--	--
5	08/23/1989	800	9.00	25.9	--	--	502.68	--	--	--
5	09/13/1989	800	8.60	12.0	--	--	--	--	--	--
5	10/25/1989	930	8.10	14.0	--	--	596.71	--	--	--
5	12/01/1989	1,110	7.30	9.7	--	--	--	--	--	--
5	03/29/1990	510	8.20	1.5	--	--	--	--	--	--
5	05/02/1990	840	7.74	11.0	--	--	--	--	--	--
5	05/24/1990	--	7.52	16.8	399.14	331.30	540.04	--	--	--
5	06/19/1990	830	--	23.7	381.85	325.70	512.68	--	--	--
5	07/17/1990	870	8.21	25.6	--	--	--	--	--	--
5	08/09/1990	780	8.69	20.3	272.65	250.69	494.55	--	--	--
5	11/13/1990	1,010	7.69	5.4	499.09	426.80	708.84	--	--	--
5	12/11/1990	1,160	7.72	1.6	--	--	--	--	--	--
5	03/14/1991	560	7.71	0.1	283.86	233.47	388.58	--	--	--
5	04/10/1991	600	8.07	10.7	275.16	234.44	380.66	--	--	--
5	04/23/1991	840	8.14	10.7	314.29	288.46	477.36	--	--	--
5	05/07/1991	930	7.73	11.3	388.16	332.87	594.62	--	--	--
5	05/20/1991	940	7.88	19.1	385.41	342.16	577.24	--	--	--
5	06/13/1991	910	7.43	22.0	389.12	332.18	526.67	--	--	--
5	07/17/1991	880	7.28	26.3	415.03	349.92	523.09	--	--	--
5	08/20/1991	970	7.25	24.0	424.89	374.96	567.77	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
5	09/18/1991	1,140	8.28	9.8	--	--	--	--	--	--
5	10/24/1991	1,020	8.46	2.3	--	--	--	--	--	--
5	11/14/1991	930	7.38	1.5	--	--	--	--	--	--
5	12/11/1991	860	7.43	0.7	461.47	412.18	628.30	--	--	--
5	01/15/1992	870	7.29	0.0	--	--	--	--	--	--
5	02/12/1992	920	7.75	0.4	457.35	368.35	611.84	--	--	--
5	03/12/1992	600	7.55	1.3	--	--	--	--	--	--
5	04/13/1992	780	7.91	5.6	--	--	--	--	--	--
5	05/26/1992	900	7.56	13.7	404.30	319.00	549.88	--	--	--
5	06/17/1992	830	7.45	17.7	371.58	284.44	504.54	--	--	--
5	07/22/1992	880	7.27	16.4	--	--	--	--	--	--
5	08/20/1992	840	7.34	16.9	447.50	347.46	569.54	5.33	--	2.00
5	09/16/1992	880	7.34	15.8	426.77	335.06	553.17	--	--	--
5	10/22/1992	870	7.78	7.0	--	--	--	--	--	--
5	12/02/1992	930	7.16	2.8	446.75	332.09	561.09	--	--	--
5	02/11/1993	980	7.44	1.0	455.10	353.95	589.70	--	--	--
5	03/16/1993	1,110	7.08	--	--	--	--	--	--	--
5	04/22/1993	830	7.65	6.8	--	--	--	--	--	--
5	05/21/1993	860	7.48	11.8	413.14	322.68	551.00	4.80	--	<0.50
5	06/10/1993	890	7.37	16.8	385.47	311.51	518.56	3.20	--	1.20
5	07/08/1993	910	7.36	16.5	--	--	--	1.20	--	0.80
5	08/12/1993	700	7.25	--	265.10	255.44	410.12	1.20	--	0.80
5	10/05/1993	840	8.35	10.1	--	--	--	11.60	--	3.60
5	10/28/1993	870	7.85	4.3	--	--	--	--	--	--
5	03/24/1994	540	7.37	--	248.40	186.57	367.49	--	--	--
5	04/20/1994	900	8.10	--	--	--	--	--	--	--
5	06/03/1994	930	7.70	16.2	440.23	342.51	580.86	9.00	--	3.67

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
5	06/29/1994	920	7.63	22.3	398.84	335.54	554.84	3.60	--	<0.50
5	08/03/1994	940	7.31	21.2	392.12	316.37	558.18	5.20	--	0.80
5	08/30/1994	840	7.50	17.4	352.82	277.60	502.79	2.40	--	<0.50
5	10/06/1994	880	7.66	14.8	407.70	315.64	518.79	10.40	--	6.80
5	11/15/1994	920	7.68	--	440.83	323.26	557.53	--	--	--
5	08/23/1995	930	7.16	--	388.18	313.67	640.34	6.50	--	<0.50
5	10/05/1995	830	7.66	12.3	356.19	294.31	499.43	12.80	--	6.40
5	11/17/1995	770	7.57	--	427.60	322.83	547.27	--	--	--
5	05/15/1996	540	9.22	14.5	177.96	163.06	323.81	--	--	--
5	08/07/1996	830	7.47	--	381.83	295.00	508.12	--	--	--
5	03/26/1997	830	7.23	8.0	--	--	--	--	--	--
5	07/10/1997	850	7.77	19.6	348.67	275.53	485.21	--	--	--
5	09/23/1997	850	7.65	15.9	376.74	291.16	519.99	--	--	--
5	01/15/1998	830	7.28	4.0	--	--	--	--	--	--
5	04/30/1998	1,040	8.06	18.2	--	--	--	--	--	--
5	08/18/1998	880	7.80	21.5	385.03	314.43	503.42	--	--	--
5	01/13/1999	860	7.71	0.0	427.20	316.03	528.67	--	--	--
5	04/21/1999	920	8.20	9.7	--	--	--	--	--	--
5	07/16/1999	930	7.64	22.3	343.95	286.04	482.00	--	--	--
5	11/30/1999	910	7.78	3.1	471.56	345.21	625.57	--	--	--
5	02/08/2000	860	8.03	1.5	--	--	--	--	--	--
5	05/17/2000	1,000	8.10	13.7	--	--	--	--	--	--
5	08/24/2000	870	7.78	23.4	383.12	275.20	521.97	--	--	--
5	11/16/2000	870	7.73	3.7	486.07	330.60	604.96	--	--	--
5	02/21/2001	880	7.14	1.0	--	--	--	--	--	--
5	05/15/2001	830	8.00	22.7	--	--	--	--	--	--
5	08/08/2001	950	7.55	28.1	351.16	269.88	469.10	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
5	11/06/2001	1,550	7.88	9.6	419.55	339.78	568.27	--	--	--
5	02/11/2002	750	7.74	0.6	425.16	--	--	--	--	--
5	05/15/2002	960	7.79	17.1	--	--	--	--	--	--
5	08/12/2002	910	--	--	386.84	318.34	567.33	--	--	--
5	11/21/2002	850	7.64	4.1	417.00	331.09	557.29	--	--	--
5	02/26/2003	870	6.95	1.4	411.80	--	--	--	--	--
5	05/28/2003	1,060	7.86	20.5	--	--	--	--	--	--
5	08/16/2003	910	7.92	25.7	358.95	268.84	500.39	--	--	--
5	11/19/2003	840	8.08	4.7	399.89	338.32	588.50	--	--	--
5	02/25/2004	830	7.45	5.0	--	--	--	--	--	--
5	05/20/2004	910	7.84	15.2	--	--	--	--	--	--
5	08/24/2004	940	7.67	18.0	426.99	323.99	586.59	--	--	--
5	11/17/2004	870	8.00	5.6	460.34	352.40	598.20	--	--	--
6	10/02/1985	860	--	--	--	--	499.00	--	--	--
6	05/28/1986	910	--	7.8	--	--	522.43	--	--	--
6	09/24/1986	860	--	--	--	--	545.00	--	--	--
6	11/18/1986	900	--	--	--	--	549.00	--	--	--
6	12/10/1986	910	--	--	--	--	562.00	--	--	--
6	03/10/1987	900	7.30	6.1	--	--	553.77	--	--	--
6	06/23/1987	880	7.50	9.6	--	--	486.77	--	--	--
6	09/15/1987	1,020	7.50	11.8	--	--	618.96	--	--	--
6	02/25/1988	900	7.70	0.0	--	--	558.54	--	--	--
6	06/08/1988	1,000	--	--	--	--	597.00	--	--	--
6	07/13/1988	970	7.50	10.2	--	--	582.08	--	--	--
6	09/14/1988	1,020	7.50	12.3	--	--	638.55	--	--	--
6	11/30/1988	1,000	--	9.8	--	--	599.70	--	--	--
6	05/04/1989	950	7.40	8.0	--	--	552.19	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
6	05/24/1989	850	7.50	7.6	--	--	532.85	--	--	--
6	06/23/1989	910	7.40	10.2	--	--	547.62	--	--	--
6	07/27/1989	950	7.50	11.4	--	--	--	--	--	--
6	08/23/1989	900	7.40	12.6	--	--	533.32	--	--	--
6	09/13/1989	830	7.90	12.6	--	--	--	--	--	--
6	10/25/1989	820	7.30	11.9	--	--	505.76	--	--	--
6	11/30/1989	850	7.70	8.9	--	--	--	--	--	--
6	01/24/1990	830	7.70	6.3	--	--	--	--	--	--
6	03/01/1990	900	7.60	6.1	--	--	541.03	--	--	--
6	03/29/1990	870	7.20	5.4	--	--	--	--	--	--
6	05/02/1990	820	7.10	5.8	--	--	--	--	--	--
6	05/24/1990	--	7.19	6.9	455.86	341.25	570.91	--	--	--
6	06/19/1990	900	--	8.0	445.84	349.15	571.70	--	--	--
6	07/17/1990	900	7.43	9.7	--	--	571.70	--	--	--
6	08/09/1990	930	7.48	10.3	452.15	332.69	550.04	--	--	--
6	09/11/1990	800	7.71	11.5	--	330.74	550.04	--	--	--
6	10/11/1990	830	7.99	11.1	--	--	--	--	--	--
6	11/13/1990	880	7.67	9.9	444.06	331.23	559.40	--	--	--
6	12/11/1990	970	7.85	8.3	--	--	559.43	--	--	--
6	01/16/1991	1,050	7.42	7.5	--	--	--	--	--	--
6	02/20/1991	870	7.37	5.5	457.79	367.62	588.83	--	--	--
6	03/14/1991	830	7.92	4.8	472.34	347.37	587.40	--	--	--
6	04/10/1991	890	7.58	5.6	433.07	339.72	540.42	--	--	--
6	04/23/1991	880	7.58	5.6	393.80	350.01	589.00	--	--	--
6	05/08/1991	930	7.34	6.1	449.41	362.81	530.00	--	--	--
6	05/21/1991	850	7.29	7.7	439.38	349.67	604.00	--	--	--
6	06/13/1991	890	7.28	9.2	423.87	327.93	574.00	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
6	07/17/1991	930	7.20	11.0	453.23	357.48	551.00	--	--	--
6	08/20/1991	970	7.46	12.5	469.84	367.33	556.00	--	--	--
6	09/18/1991	970	8.15	12.1	--	--	606.00	--	--	--
6	10/24/1991	990	7.96	11.0	--	--	--	--	--	--
6	11/14/1991	940	7.73	9.7	--	--	--	--	--	--
6	12/11/1991	720	7.98	8.2	404.43	345.14	548.09	--	--	--
6	01/15/1992	940	7.58	6.2	--	--	--	--	--	--
6	02/12/1992	940	7.65	6.4	443.38	341.44	570.95	--	--	--
6	03/12/1992	860	7.61	5.2	--	--	--	--	--	--
6	04/14/1992	930	7.14	6.1	--	--	--	--	--	--
6	05/26/1992	970	7.46	8.1	440.88	352.40	599.49	--	--	--
6	06/16/1992	870	7.15	9.1	438.31	333.80	567.19	--	--	--
6	07/22/1992	940	7.19	11.0	--	--	--	--	--	--
6	08/18/1992	930	7.31	8.7	449.12	320.37	570.17	9.33	--	4.00
6	09/15/1992	930	7.24	12.1	473.21	346.06	602.16	--	--	--
6	10/22/1992	950	7.78	11.7	--	--	--	--	--	--
6	12/01/1992	920	7.50	8.7	461.37	330.74	575.06	--	--	--
6	03/16/1993	870	7.87	--	--	--	--	--	--	--
6	04/22/1993	870	7.31	5.2	--	--	--	--	--	--
6	05/21/1993	920	7.30	8.3	439.66	337.32	--	5.20	--	<0.50
6	06/08/1993	920	7.20	8.6	429.38	347.76	574.62	<0.50	--	<0.50
6	07/08/1993	900	7.24	10.3	--	--	--	1.20	--	<0.50
6	08/10/1993	900	7.19	--	424.61	324.31	549.49	4.80	--	0.80
6	10/05/1993	930	7.61	11.9	--	--	--	4.80	--	<0.50
6	10/28/1993	910	7.33	10.7	--	--	--	--	--	--
6	03/24/1994	960	7.14	--	465.76	381.57	643.12	--	--	--
6	04/20/1994	910	7.27	--	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
6	06/03/1994	940	7.32	9.0	456.14	336.33	596.36	0.67	--	<0.50
6	06/30/1994	1,020	7.22	10.2	430.17	382.01	638.09	--	--	--
6	08/03/1994	1,030	7.02	16.4	435.11	377.47	649.12	2.00	--	<0.50
6	08/30/1994	920	7.27	15.0	430.61	307.89	571.38	0.80	--	<0.50
6	10/06/1994	930	7.28	14.0	448.40	319.83	554.76	1.60	--	<0.50
6	11/15/1994	950	7.16	--	448.34	336.17	571.72	--	--	--
6	01/26/1995	920	7.35	--	437.25	366.67	593.31	--	--	--
6	03/02/1995	930	7.25	--	463.02	368.29	594.96	--	--	--
6	04/20/1995	820	7.41	--	--	--	--	--	--	--
6	05/17/1995	920	7.21	--	436.35	356.10	566.91	5.00	--	1.00
6	06/07/1995	--	7.23	--	409.30	354.83	562.31	1.60	--	<0.50
6	07/12/1995	920	7.41	19.1	381.44	318.25	535.13	32.40	--	19.20
6	08/23/1995	920	7.14	--	428.53	343.08	576.63	4.00	--	<0.50
6	10/05/1995	930	6.85	11.7	427.24	350.69	574.41	2.40	--	<0.50
6	11/17/1995	920	7.17	--	413.08	324.32	539.85	--	--	--
6	05/15/1996	940	7.12	10.7	447.08	324.70	568.30	--	--	--
6	08/07/1996	960	7.21	--	466.78	317.46	572.87	--	--	--
6	03/26/1997	910	7.15	5.0	--	--	--	--	--	--
6	04/30/1997	720	8.01	--	--	--	--	--	--	--
6	07/10/1997	910	7.19	14.8	401.51	344.64	561.34	--	--	--
6	09/23/1997	870	7.27	15.7	417.18	284.12	571.04	--	--	--
6	01/15/1998	870	7.04	6.0	--	--	--	--	--	--
6	04/30/1998	850	7.14	6.7	--	--	--	--	--	--
6	08/18/1998	1,070	7.23	12.5	416.93	387.96	647.56	--	--	--
6	01/13/1999	920	7.36	0.0	442.94	343.75	527.97	--	--	--
6	04/21/1999	1,000	7.27	7.7	--	--	--	--	--	--
6	07/16/1999	1,100	7.18	13.0	430.18	391.55	595.38	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
6	11/30/1999	990	7.21	9.5	453.92	379.01	650.02	--	--	--
6	02/08/2000	910	7.35	6.7	--	--	--	--	--	--
6	05/17/2000	940	7.30	7.8	--	--	--	--	--	--
6	08/24/2000	960	7.26	15.7	450.58	328.79	582.91	--	--	--
6	11/16/2000	900	7.30	10.0	482.64	335.03	599.96	--	--	--
6	02/21/2001	870	7.28	6.5	--	--	--	--	--	--
6	05/15/2001	860	7.90	21.1	--	--	--	--	--	--
6	08/08/2001	1,000	7.24	11.6	470.63	348.25	621.86	--	--	--
6	11/06/2001	910	7.34	10.5	438.79	359.95	593.74	--	--	--
6	02/11/2002	900	7.50	6.3	456.83	--	--	--	--	--
6	05/15/2002	920	7.02	6.1	--	--	--	--	--	--
6	08/12/2002	940	--	--	455.66	363.95	619.58	--	--	--
6	11/02/2002	1,020	6.80	9.1	441.77	358.12	587.81	--	--	--
6	02/26/2003	940	6.69	6.4	411.47	--	--	--	--	--
6	05/28/2003	990	6.61	11.0	--	--	--	--	--	--
6	08/16/2003	930	7.29	16.8	432.78	329.39	580.18	--	--	--
6	11/19/2003	980	7.31	9.2	449.80	373.35	621.49	--	--	--
6	02/25/2004	880	7.90	2.3	--	--	--	--	--	--
6	05/20/2004	960	7.39	8.1	--	--	--	--	--	--
6	08/24/2004	1,000	7.26	11.6	483.64	366.74	655.09	--	--	--
6	11/17/2004	960	7.30	9.7	479.44	372.58	663.35	--	--	--
7	06/19/1990	1,120	8.06	24.8	341.46	276.90	685.09	--	--	--
7	09/10/1990	1,270	8.79	21.3	354.91	300.60	854.61	--	--	--
7	10/10/1990	1,230	9.24	4.4	376.74	328.21	891.73	--	--	--
7	11/08/1990	1,630	9.00	3.1	417.65	372.80	1,031.40	--	--	--
7	12/11/1990	1,800	8.57	3.1	504.68	443.85	1,259.28	--	--	--
7	01/16/1991	3,420	7.76	1.3	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
7	02/20/1991	2,470	7.62	1.1	879.54	743.77	1,966.36	--	--	--
7	03/13/1991	1,440	8.20	1.5	468.20	464.57	1,045.49	--	--	--
7	04/10/1991	580	8.59	10.5	153.91	154.36	339.24	--	--	--
7	04/23/1991	760	8.54	9.4	207.60	203.48	449.20	--	--	--
7	05/07/1991	860	8.39	10.5	265.95	236.72	570.98	--	--	--
7	05/20/1991	1,080	8.47	18.9	303.30	245.31	672.58	--	--	--
7	06/13/1991	1,020	8.26	23.9	275.98	239.05	599.13	--	--	--
7	07/17/1991	960	8.37	26.7	317.91	287.18	563.65	--	--	--
7	08/20/1991	990	8.53	24.4	260.48	238.45	587.99	--	--	--
7	09/18/1991	1,070	8.71	8.2	--	--	--	--	--	--
7	10/24/1991	1,110	9.08	3.0	--	--	--	--	--	--
7	11/14/1991	1,360	8.63	3.6	--	--	--	--	--	--
7	12/12/1991	1,450	8.10	1.4	504.01	426.49	1,091.60	--	--	--
7	01/15/1992	1,780	7.80	0.0	--	--	--	--	--	--
7	02/12/1992	1,330	8.34	0.0	457.97	386.00	903.36	--	--	--
7	03/12/1992	540	8.51	0.7	--	--	--	--	--	--
7	04/13/1992	730	8.32	6.0	--	--	--	--	--	--
7	05/26/1992	1,140	8.67	15.1	361.72	302.30	740.41	--	--	--
7	06/17/1992	990	8.42	18.0	335.06	272.35	634.69	84.67	--	60.67
7	07/23/1992	920	8.61	20.3	--	--	--	--	--	--
7	08/19/1992	1,020	8.92	23.7	303.68	276.40	653.22	103.33	--	54.00
7	09/15/1992	1,060	8.31	19.0	304.42	269.80	680.18	--	--	--
7	10/22/1992	1,270	8.33	8.1	--	--	--	--	--	--
7	12/02/1992	1,390	8.18	3.8	416.54	357.60	834.00	--	--	--
7	04/22/1993	630	8.70	13.5	--	--	--	--	--	--
7	05/21/1993	860	8.30	13.4	307.41	284.77	--	42.00	--	26.80
7	06/10/1993	960	8.27	20.1	311.99	293.21	576.48	59.60	--	46.40

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
7	07/07/1993	810	8.09	18.4	--	--	--	60.00	--	48.00
7	08/12/1993	680	7.61	22.7	248.99	255.80	393.06	25.60	--	19.20
7	10/04/1993	600	--	--	--	--	--	23.60	--	12.40
7	10/28/1993	560	8.25	--	--	--	--	--	--	--
7	04/20/1994	740	8.80	--	--	--	--	--	--	--
7	06/03/1994	700	8.04	18.5	271.61	221.91	423.29	56.67	--	44.33
7	06/29/1994	760	8.33	21.0	289.09	234.04	480.09	92.80	--	72.80
7	08/03/1994	780	8.52	23.6	287.39	236.04	485.27	83.60	--	58.40
7	08/30/1994	860	8.47	18.2	318.48	254.81	534.90	92.00	--	62.00
7	10/06/1994	770	8.49	14.5	298.17	252.56	473.68	32.80	--	23.60
7	11/15/1994	820	8.67	--	326.28	251.80	536.32	--	--	--
7	01/26/1995	1,170	7.51	--	488.65	402.51	833.17	--	--	--
7	03/02/1995	1,080	7.76	3.6	462.65	374.83	777.59	--	--	--
7	04/20/1995	720	8.33	7.5	--	--	--	--	--	--
7	05/17/1995	700	8.67	--	279.48	190.93	452.55	36.50	--	25.00
7	06/07/1995	--	8.19	--	260.82	208.46	431.69	26.40	--	18.80
7	07/12/1995	790	8.29	23.3	271.53	229.69	474.77	30.80	--	21.20
7	08/23/1995	950	8.44	--	354.33	291.00	619.35	100.00	--	67.00
7	10/05/1995	1,000	8.48	15.5	--	--	--	--	--	--
7	11/17/1995	1,020	8.46	--	446.66	340.59	806.63	--	--	--
7	05/15/1996	520	9.13	15.3	186.72	155.03	314.60	--	--	--
7	08/07/1996	690	8.26	--	249.41	188.60	394.60	--	--	--
7	03/26/1997	850	7.64	5.0	--	--	--	--	--	--
7	04/30/1997	540	8.51	--	--	--	--	--	--	--
7	07/10/1997	670	8.27	23.6	252.50	199.59	402.10	--	--	--
7	09/23/1997	700	8.35	16.5	289.21	238.07	462.90	--	--	--
7	01/15/1998	1,250	7.64	5.6	--	--	--	--	--	--

Supplement 2. Physical properties and dissolved solids for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Specific conductance in microsiemens per centimeter at 25°C, degrees Celsius; pH in standard units; temperature in degrees Celsius; other properties and dissolved solids in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Specific conductance	pH	Temperature, water	Hardness	Alkalinity	Total dissolved solids, calculated	Dissolved solids, residue at 105°C	Dissolved solids, residue at 180°C	Dissolved solids, residue at 550°C
7	04/30/1998	840	8.72	16.6	--	--	--	--	--	--
7	08/18/1998	960	8.52	23.4	334.75	280.84	590.00	--	--	--
7	01/13/1999	1,370	7.72	0.0	605.22	442.49	895.60	--	--	--
7	04/21/1999	750	8.75	10.2	--	--	--	--	--	--
7	07/16/1999	790	8.34	23.3	292.16	226.42	425.10	--	--	--
7	11/30/1999	1,010	8.64	3.4	448.75	339.79	720.70	--	--	--
7	02/08/2000	1,140	8.17	0.7	--	--	--	--	--	--
7	05/17/2000	1,310	8.80	14.2	--	--	--	--	--	--
7	08/24/2000	900	8.49	23.4	324.68	258.56	596.50	--	--	--
7	11/16/2000	950	8.52	0.6	423.14	282.39	691.20	--	--	--
7	02/21/2001	1,370	7.47	0.1	--	--	--	--	--	--
7	05/15/2001	710	8.50	21.1	--	--	--	--	--	--
7	08/08/2001	1,160	8.28	29.0	406.20	303.76	719.60	--	--	--
7	11/06/2001	1,070	8.73	8.6	400.04	316.24	737.20	--	--	--
7	02/11/2002	1,050	8.19	0.4	461.22	--	--	--	--	--
7	05/15/2002	1,260	8.50	17.2	--	--	--	--	--	--
7	08/12/2002	950	--	--	344.70	283.22	629.00	--	--	--
7	11/21/2002	1,010	8.60	5.2	320.11	265.99	677.00	--	--	--
7	02/26/2003	1,900	7.50	0.2	684.74	--	--	--	--	--
7	05/28/2003	1,200	8.52	19.6	--	--	--	--	--	--
7	08/16/2003	1,330	8.52	25.1	417.52	298.62	788.40	--	--	--
7	11/19/2003	1,140	8.90	5.6	391.68	314.30	784.00	--	--	--
7	02/25/2004	1,340	8.26	1.8	--	--	--	--	--	--
7	05/20/2004	880	8.30	16.4	--	--	--	--	--	--
7	08/24/2004	1,080	8.71	19.3	423.03	292.28	749.00	--	--	--
7	11/17/2004	960	9.39	4.2	359.22	240.66	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
1	04/20/1989	49.5	19.8	44	1.34	11.4	204.38	0	116.6	26.6
1	05/02/1989	57.2	26.4	63.8	1.75	11.99	233.99	0	156.1	36.03
1	05/08/1989	66	29.7	64.9	1.67	10.89	266.39	0	172.4	37.23
1	05/16/1989	78.9	35.2	86.9	2.07	14.3	361.18	0	190.6	41.2
1	04/18/1990	52.8	26.4	79.2	2.22	9.5	268.7	--	126.6	41.98
1	04/24/1990	58.3	29.7	88	2.34	11.9	288.1	--	148.9	45.17
1	05/02/1990	63.8	31.9	89.1	2.27	11.33	299.1	--	170.3	53.41
1	05/07/1990	60.5	33	95.7	2.46	12.3	269.6	--	179.1	61.15
1	05/16/1990	77	40.7	116.6	2.68	14.74	328.7	--	214.1	66.82
1	03/14/1991	94.6	52.8	185.9	2.8	16.39	--	--	316.3	102.05
1	04/11/1991	51.7	26.4	83.6	2.36	8.7	--	--	126.2	48.56
1	04/24/1991	52.8	29.7	99	2.7	9.13	--	--	165.8	56.54
1	05/08/1991	67.1	39.6	119.9	2.87	9.57	--	--	232.9	83.37
1	05/21/1991	61.6	36.3	136.4	3.41	4.73	--	--	222.5	91.54
1	06/13/1991	70.4	38.5	105.6	2.51	13.2	--	--	184.4	59.78
1	07/17/1991	60	35	76	1.93	13	--	--	124.1	41.98
1	08/20/1991	63	34	77	1.94	14	--	--	146.8	52.23
1	09/18/1991	--	--	--	--	--	--	--	--	--
1	10/24/1991	--	--	--	--	--	--	--	--	--
1	11/14/1991	--	--	--	--	--	--	--	--	--
1	12/12/1991	117	61	221	4.13	18.4	--	--	389.8	122.36
1	01/15/1992	--	--	--	--	--	--	--	--	--
1	02/12/1992	90	42	113	2.27	14.3	--	--	203.1	68.32
1	03/12/1992	--	--	--	--	--	--	--	--	--
1	04/14/1992	--	--	--	--	--	--	--	--	--
1	05/20/1992	74	45	111	2.51	15.5	--	--	228.3	57.07
1	05/26/1992	77	42	97	2.21	13.7	--	--	193.4	42.99
1	06/17/1992	65.9	33.5	91	2.28	13.7	--	--	180.2	49.55
1	07/23/1992	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
1	08/18/1992	79.2	46.2	161.7	3.57	17.38	--	--	199.6	119.78
1	09/15/1992	65	40	130	3.13	15.2	--	--	194.6	79.69
1	10/22/1992	--	--	--	--	--	--	--	--	--
1	12/01/1992	94.1	42.3	112	2.41	13.2	--	--	194.8	57.98
1	03/17/1993	--	--	--	--	--	--	--	--	--
1	04/22/1993	--	--	--	--	--	--	--	--	--
1	05/21/1993	67.1	32.8	67.9	1.7	14.4	--	--	140.4	32.34
1	06/10/1993	54.3	28.4	88.1	2.41	13.9	--	--	149.4	49.4
1	07/07/1993	--	--	--	--	--	--	--	--	--
1	08/11/1993	54	27.9	44.3	1.22	13.7	--	--	86.1	19.55
1	10/04/1993	--	--	--	--	--	--	--	--	--
1	10/28/1993	--	--	--	--	--	--	--	--	--
1	04/20/1994	--	--	--	--	--	--	--	--	--
1	06/03/1994	54	30.3	43.7	1.18	13	--	--	116.1	16.19
1	06/29/1994	62	31.5	50	1.29	14.4	--	--	146.8	15.52
1	08/03/1994	61	33.1	52	1.33	14.1	--	--	170.3	18.77
1	08/30/1994	68	34	59	1.46	13.2	--	--	179.5	24.48
1	10/06/1994	59	32.3	54	1.4	12.8	--	--	137.3	15.48
1	11/15/1994	66	37.9	61	1.48	15	--	--	177.7	21.54
1	01/26/1995	98	51	91	1.86	12	--	--	258.9	33.97
1	03/02/1995	98	49.4	94	1.93	13.2	--	--	249.6	35.02
1	04/20/1995	--	--	--	--	--	--	--	--	--
1	05/17/1995	58	32.1	45	1.18	12.8	--	--	164.5	19.44
1	06/07/1995	51	29.8	51	1.4	11.7	--	--	145.2	14.27
1	07/12/1995	53	33.9	55	1.45	13.1	--	--	172.5	14.76
1	08/23/1995	--	--	--	2.03	--	--	--	--	--
1	10/05/1995	77	45.4	91	--	16.28	--	--	245.5	40.99
1	11/17/1995	91	51.6	96	1.99	13.8	--	--	253.5	39.5
1	05/15/1996	40	23.6	37	1.15	10.9	--	--	106.8	14.52

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
1	08/07/1996	53.3	27.3	44.6	1.24	13.1	--	--	122.1	17.58
1	03/26/1997	--	--	--	--	--	--	--	--	--
1	04/30/1997	--	--	--	--	--	--	--	--	--
1	07/10/1997	53.8	29.7	47.2	1.28	12.3	--	--	132.1	15.14
1	09/23/1997	67.4	31.6	51.8	1.31	12.97	--	--	140	19.08
1	01/15/1998	--	--	--	--	--	--	--	--	--
1	04/30/1998	--	--	--	--	--	--	--	--	--
1	08/18/1998	66.1	32.5	68.8	1.73	19.56	--	--	173.2	31.5
1	01/13/1999	127.2	61.5	96.8	1.76	16.75	--	--	273.8	49.32
1	04/21/1999	--	--	--	--	--	--	--	--	--
1	07/16/1999	54.4	34.5	51.4	1.34	11.5	--	--	109.7	18.81
1	11/30/1999	96	47.5	90.2	1.88	16.36	--	--	244.7	45.8
1	02/08/2000	--	--	--	--	--	--	--	--	--
1	05/17/2000	--	--	--	--	--	--	--	--	--
1	08/24/2000	61.5	40.1	80	1.95	16.28	--	--	213	23.79
1	11/16/2000	82.6	55.5	92.3	1.93	13.55	--	--	272.1	16.08
1	02/21/2001	--	--	--	--	--	--	--	--	--
1	05/15/2001	--	--	--	--	--	--	--	--	--
1	08/08/2001	77	54.4	89.7	1.91	15.68	--	--	303.3	21.8
1	11/06/2001	70.2	51.6	110.9	2.45	19.03	--	--	263.1	57.46
1	02/11/2002	112.4	47.8	104.6	2.08	21.13	--	--	--	--
1	05/15/2002	--	--	--	--	--	--	--	--	--
1	08/12/2002	70.6	44.5	83.3	1.91	18.83	--	--	241.1	38.29
1	11/21/2002	70.2	53.1	100.9	2.21	16.6	--	--	278.8	34.41
1	02/26/2003	152.3	49.6	127.5	2.3	32.6	--	--	--	--
1	05/28/2003	--	--	--	--	--	--	--	--	--
1	08/16/2003	72.4	53.4	104.6	2.27	15.8	--	--	310	33.66
1	11/19/2003	75.3	47.4	101.5	2.26	18.16	--	--	168.2	44.64
1	05/20/2004	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
1	08/24/2004	85	52	87.8	1.86	16.9	--	--	304	28.6
1	11/17/2004	74.3	59.4	108	2.27	21.1	--	--	317.36	67.81
2	03/14/1991	94.6	52.8	185.9	3.8	16.4	--	--	316.3	102.05
2	04/11/1991	90.2	47.3	102.3	2.17	11.77	--	--	224.5	96.94
2	04/24/1991	97.9	67.1	188.1	3.59	12.54	--	--	322.6	181.09
2	07/17/1991	95	49	47	0.98	6.3	--	--	146.3	40.86
2	08/20/1991	87	47	39	0.84	6.8	--	--	179.6	36.52
2	09/18/1991	--	--	--	--	--	--	--	--	--
2	10/24/1991	--	--	--	--	--	--	--	--	--
2	12/12/1991	124	50	34	0.65	6.2	--	--	210.7	41.58
2	01/15/1992	--	--	--	--	--	--	--	--	--
2	02/12/1992	97	40	29	0.63	10.9	--	--	182.5	37.9
2	03/12/1992	--	--	--	--	--	--	--	--	--
2	04/14/1992	--	--	--	--	--	--	--	--	--
2	07/23/1992	--	--	--	--	--	--	--	--	--
2	08/18/1992	97.9	45.1	33	0.69	5.83	--	--	185.5	34.75
2	09/15/1992	74	43	108	2.47	13.3	--	--	210.9	76.06
2	10/21/1992	--	--	--	--	--	--	--	--	--
2	11/30/1992	141	53	42.9	0.78	6.8	--	--	225.4	47.71
2	06/30/1994	--	--	--	--	--	--	--	--	--
2	08/03/1994	52	48.4	73	1.75	7.6	--	--	169.5	38.38
2	11/15/1994	--	--	--	--	--	--	--	--	--
2	01/15/1998	--	--	--	--	--	--	--	--	--
2	08/18/1998	94.5	41.1	50.5	1.09	6.05	--	--	158.3	23.19
2	01/13/1999	107.1	42.5	44.1	0.91	7.1	--	--	152.9	19.24
2	11/30/1999	106.9	41.8	50.5	1.05	5.63	--	--	165.4	27.22
2	02/08/2000	--	--	--	--	--	--	--	--	--
2	05/17/2000	--	--	--	--	--	--	--	--	--
2	08/24/2000	94.2	40.5	45.1	0.98	6.85	--	--	168.2	24.14

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
2	11/16/2000	--	--	--	--	--	--	--	--	--
2	02/21/2001	--	--	--	--	--	--	--	--	--
2	11/06/2001	96.1	42.1	50.5	1.08	5.73	--	--	170.7	25.44
2	02/11/2002	108.5	37.7	45.5	0.96	7.26	--	--	--	--
2	05/15/2002	--	--	--	--	--	--	--	--	--
2	08/12/2002	91.7	39.6	49.2	1.08	4.95	--	--	154.5	23.8
2	11/02/2002	102.5	40.9	42.5	0.9	4.5	--	--	164	22.34
2	02/26/2003	103.8	32.7	33.1	0.73	5.2	--	--	--	--
2	05/28/2003	--	--	--	--	--	--	--	--	--
2	08/16/2003	88.4	41.7	50	1.1	5	--	--	168	27.42
2	11/19/2003	105.8	39.36	44.15	0.93	6.74	--	--	182.76	28.82
2	02/25/2004	--	--	--	--	--	--	--	--	--
2	05/20/2004	--	--	--	--	--	--	--	--	--
2	08/24/2004	102	47.1	55.4	1.14	7.2	--	--	201.07	36.18
2	11/17/2004	105	51.2	76.8	1.54	6.9	--	--	216.13	55.11
3	01/01/1984	--	--	--	--	--	--	--	--	--
3	03/22/1984	--	--	--	--	--	--	--	--	--
3	05/23/1984	--	--	--	--	--	--	--	--	--
3	10/29/1984	--	--	--	--	--	--	--	--	--
3	02/12/1985	--	--	--	--	--	--	--	--	--
3	06/26/1985	--	--	--	--	--	--	--	--	--
3	10/02/1985	--	--	--	--	--	--	--	--	--
3	05/28/1986	92.4	36.3	38.5	0.86	4.62	--	--	106.2	11.06
3	09/24/1986	100.1	33	31.9	0.71	4.84	404.9	0	98.08	12.72
3	11/18/1986	--	--	--	--	--	--	--	--	--
3	12/10/1986	103.2	34.1	31.9	0.7	5.06	392.5	0	108.84	13.1
3	03/10/1987	97.9	31.9	27.5	0.62	4.84	382.53	0	104.51	12.2
3	06/23/1987	96.8	34.1	34.1	0.76	5.17	378.47	0	108.48	14.23
3	09/15/1987	117.7	39.6	24.2	0.49	5.06	370.74	0	141.65	24.87

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
3	02/24/1988	113.3	36.3	22	0.46	4.51	372.77	0	133.36	23.4
3	06/08/1988	114.4	37.4	26.4	0.55	4.51	378.67	0	126.12	24.16
3	07/13/1988	114.4	37.4	19.8	0.41	4.95	383.75	0	140.6	26
3	09/14/1988	132	44	24.2	0.47	5.28	382.53	0	172.2	30.64
3	11/30/1988	129.8	44	24.2	0.47	5.28	--	--	179.7	30.78
3	01/11/1989	128.7	41.8	25.3	0.5	4.84	408.77	0	187.5	31.49
3	05/04/1989	108.9	36.3	25.3	0.54	4.73	356.14	0	137.5	23.47
3	05/24/1989	116.6	38.5	20.9	0.43	4.62	370.03	0	168	27.02
3	06/23/1989	122.1	40.7	23.1	0.46	5.06	378.26	0	181.5	29.57
3	07/27/1989	--	--	--	--	--	--	--	--	--
3	08/23/1989	128.7	44	23.1	0.45	5.83	370.03	0	204.4	35.53
3	09/13/1989	--	--	--	--	--	--	--	--	--
3	10/25/1989	128.7	41.8	24.2	0.47	4.51	379.79	0	209.3	34.47
3	11/30/1989	--	--	--	--	--	--	--	--	--
3	01/24/1990	--	--	--	--	--	--	--	--	--
3	03/01/1990	134.2	48.4	26.4	0.5	5.17	384.97	0	204.9	33.83
3	03/29/1990	--	--	--	--	--	--	--	--	--
3	05/02/1990	--	--	--	--	--	--	--	--	--
3	05/24/1990	115.5	39.6	26.4	0.54	4.84	356.1	--	146.9	26.27
3	06/19/1990	116.6	39.6	25.3	0.52	4.84	362.7	--	147.3	25.89
3	07/17/1990	--	--	--	--	--	--	--	--	--
3	08/09/1990	129.8	45.1	26.4	0.51	9.46	372.1	--	179.7	35.89
3	09/11/1990	--	--	--	--	--	--	--	--	33.03
3	10/11/1990	--	--	--	--	--	--	--	--	--
3	11/13/1990	138.6	48.4	25.3	0.47	5.83	371.3	--	196.4	34.49
3	12/11/1990	--	--	--	--	--	--	--	--	--
3	01/16/1991	--	--	--	--	--	--	--	--	--
3	02/20/1991	155.1	51.7	27.5	0.49	6.05	--	--	224.8	35.67
3	03/14/1991	136.4	48.4	29.7	0.56	5.3	--	--	216.6	35.18

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
3	04/11/1991	138.6	48.4	28.6	0.53	5.2	--	--	204.4	34.23
3	04/23/1991	118.8	45.1	27.5	0.54	4.84	--	--	192.9	31.73
3	05/08/1991	102.3	38.5	28.6	0.61	4.95	--	--	145.9	20.46
3	05/21/1991	103.4	38.5	27.5	0.59	4.29	--	--	138.7	22.13
3	06/13/1991	100.1	37.4	29.7	0.64	5.06	--	--	134.1	21.76
3	07/17/1991	115	42	30	0.61	5.1	--	--	137.8	25.76
3	08/20/1991	126	45	26	0.51	5	--	--	173.4	31.58
3	09/18/1991	--	--	--	--	--	--	--	--	--
3	10/24/1991	--	--	--	--	--	--	--	--	--
3	11/14/1991	--	--	--	--	--	--	--	--	--
3	12/11/1991	118	44	25	0.5	5.1	--	--	187	34.73
3	01/15/1992	--	--	--	--	--	--	--	--	--
3	02/12/1992	131	48	23	0.44	5.7	--	--	196.9	35.64
3	03/12/1992	--	--	--	--	--	--	--	--	--
3	04/14/1992	--	--	--	--	--	--	--	--	--
3	05/26/1992	112	40	43	0.89	6.1	--	--	173.4	29.12
3	06/16/1992	107.7	36.6	24	0.51	4.7	--	--	156.2	21.37
3	07/22/1992	--	--	--	--	--	--	--	--	--
3	08/18/1992	124	44	26	0.51	5	--	--	161.9	30.99
3	09/15/1992	128	43	25	0.49	5.8	--	--	172.8	31.44
3	10/22/1992	--	--	--	--	--	--	--	--	--
3	12/01/1992	140.6	45.6	24.5	0.46	4.9	--	--	202.5	36.29
3	02/11/1993	137.3	47.1	25.5	0.48	5.2	--	--	197.3	36.06
3	03/16/1993	--	--	--	--	--	--	--	--	--
3	04/22/1993	--	--	--	--	--	--	--	--	--
3	05/21/1993	118.2	41	27.4	0.55	4.6	--	--	--	--
3	06/08/1993	106.6	37.8	30.4	0.64	4.9	--	--	133.8	24.76
3	07/08/1993	--	--	--	--	--	--	--	--	--
3	08/10/1993	104.5	39.2	32.4	0.69	5.2	--	--	134.7	21.39

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
3	10/05/1993	--	--	--	--	--	--	--	--	--
3	10/28/1993	--	--	--	--	--	--	--	--	--
3	03/24/1994	92.8	31.7	35.1	0.8	5.3	--	--	107	18.16
3	04/20/1994	--	--	--	--	--	--	--	--	--
3	06/03/1994	109	43.7	38.8	0.79	5	--	--	158.4	20.72
3	06/30/1994	104	37.4	33	0.71	5.2	--	--	145.9	20.56
3	08/03/1994	70	36.7	35	0.84	5.2	--	--	155.3	20.74
3	08/30/1994	107	38.1	34	0.72	4.9	--	--	171.3	23.02
3	10/06/1994	108	40	34	0.71	5.4	--	--	146	21.46
3	11/15/1994	109	40.3	34	0.71	5.9	--	--	138.6	20.41
3	01/26/1995	107	38.5	30	0.63	4.7	--	--	160.1	20.03
3	03/02/1995	116	39	32	0.66	5.3	--	--	143.8	21.4
3	04/20/1995	--	--	--	--	--	--	--	--	--
3	05/17/1995	104	39.9	46	0.97	5.2	--	--	146.4	20.77
3	06/07/1995	98	39.2	48	1.04	5.4	--	--	141.4	22.19
3	07/12/1995	92	37.5	48	1.07	5	--	--	145.6	21.35
3	08/23/1995	102	35.4	33	0.72	5.2	--	--	142.7	21.34
3	10/05/1995	97	37.4	41	0.9	6.5	--	--	141.3	21.98
3	11/17/1995	100	37.8	37	0.8	5.9	--	--	137.2	20.91
3	05/15/1996	106.3	42.8	54.6	1.13	4.7	--	--	166.1	21.65
3	08/07/1996	114	37	39.9	0.83	5.4	--	--	135.8	21.39
3	03/26/1997	--	--	--	--	--	--	--	--	--
3	04/30/1997	--	--	--	--	--	--	--	--	--
3	07/10/1997	90.8	40.1	54.4	1.2	7.8	--	--	142	20.89
3	09/23/1997	93.4	33.6	35.9	0.81	5.45	--	--	137.5	20.67
3	01/15/1998	--	--	--	--	--	--	--	--	--
3	04/30/1998	--	--	--	--	--	--	--	--	--
3	08/18/1998	103.1	39.4	46.2	0.98	5.28	--	--	159.5	21.38
3	01/13/1999	106.3	42.4	44	0.91	6.35	--	--	167.6	23.39

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
3	04/21/1999	--	--	--	--	--	--	--	--	--
3	07/16/1999	102.1	43.9	51.6	1.08	5.3	--	--	105.2	25.79
3	11/30/1999	110.1	40.6	47.9	0.99	5.51	--	--	167.2	23.55
3	02/08/2000	--	--	--	--	--	--	--	--	--
3	05/17/2000	--	--	--	--	--	--	--	--	--
3	08/24/2000	106.7	39.3	43.5	0.91	6.95	--	--	172.2	23.11
3	11/16/2000	115.5	43.5	48.6	0.98	5.79	--	--	181.8	16.35
3	02/21/2001	--	--	--	--	--	--	--	--	--
3	05/15/2001	--	--	--	--	--	--	--	--	--
3	08/08/2001	105.4	41.5	47.6	0.99	5.14	--	--	122	22.1
3	11/06/2001	104.9	39.1	44.9	0.95	5.4	--	--	165.8	23.27
3	02/11/2002	114.3	38.5	45.8	0.95	7.41	--	--	--	--
3	05/15/2002	--	--	--	--	--	--	--	--	--
3	08/12/2002	105.2	40.3	50.2	1.06	5.47	--	--	164.1	23.09
3	11/02/2002	105	39	41	0.73	5.4	--	--	154	19.6
3	02/26/2003	103	32.3	33.1	--	4.9	--	--	--	--
3	05/28/2003	--	--	--	--	--	--	--	--	--
3	08/16/2003	101.5	40.8	48.4	1.03	4.6	--	--	167	25.77
3	11/19/2003	108.2	38.39	42.06	0.88	5.99	--	--	174.58	27.73
3	02/25/2004	--	--	--	--	--	--	--	--	--
3	05/20/2004	--	--	--	--	--	--	--	--	--
3	08/24/2004	118	43.6	48.5	0.97	6.3	--	--	194.27	32.34
3	11/17/2004	114	43.7	51.7	1.04	6.4	--	--	156.64	32.23
4	10/29/1984	--	--	--	--	--	--	--	--	--
4	02/12/1985	--	--	--	--	--	--	--	--	--
4	06/26/1985	--	--	--	--	--	--	--	--	--
4	10/02/1985	--	--	--	--	--	--	--	--	--
4	05/28/1986	95.7	37.4	18.7	0.41	4.29	376.64	0	88.98	13.29
4	09/24/1986	101.2	35.2	22	0.48	4.84	403.28	0	92.66	13.14

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
4	11/18/1986	--	--	--	--	--	--	--	--	--
4	12/10/1986	106.7	35.2	23.1	0.5	5.5	398.4	0	97.5	12.95
4	03/10/1987	101.2	34.1	18.7	0.41	4.18	385.38	0	106.92	12.53
4	06/23/1987	99	34.1	22	0.49	5.39	383.96	0	85.31	12.2
4	09/15/1987	105.6	34.1	23.1	0.5	5.72	391.68	0	99.5	12.43
4	02/25/1988	106.7	33	22	0.48	5.28	385.79	0	115.44	12.77
4	06/08/1988	103.4	33	24.2	0.53	4.95	376.02	0	115.64	12.25
4	07/13/1988	101.2	31.9	22	0.49	5.72	386.8	0	105.45	12.29
4	09/14/1988	105.6	33	22	0.48	5.28	366.67	0	99.48	12.69
4	11/30/1988	117.7	35.2	24.2	0.5	6.05	--	--	131.9	11.99
4	05/04/1989	101.2	33	25.3	0.56	4.84	348.4	0	98.1	16.81
4	05/24/1989	105.6	37.4	20.9	0.44	5.06	346.23	0	160.7	13.83
4	06/23/1989	100.1	34.1	25.3	0.56	5.06	342.27	0	107.7	15.32
4	07/27/1989	--	--	--	--	--	--	--	--	--
4	08/23/1989	96.8	31.9	20.9	0.47	6.49	364.84	0	112.5	15.11
4	09/13/1989	--	--	--	--	--	--	--	--	--
4	10/25/1989	97.9	33	9.8	0.44	4.51	376.43	0	110.5	14.25
4	11/30/1989	--	--	--	--	--	--	--	--	--
4	01/24/1990	--	--	--	--	--	--	--	--	--
4	03/01/1990	99	36.3	19.8	0.43	4.4	380.7	0	101.6	12.77
4	03/29/1990	--	--	--	--	--	--	--	--	--
4	05/02/1990	--	--	--	--	--	--	--	--	--
4	05/24/1990	101.2	37.4	22	0.47	4.84	354.4	--	114.8	14.05
4	06/19/1990	--	--	--	--	--	--	--	--	--
4	07/17/1990	--	--	--	--	--	--	--	--	--
4	08/09/1990	99	36.3	19.8	0.43	8.47	355.2	--	102.3	17.17
4	09/11/1990	--	--	--	--	--	--	--	--	13
4	10/11/1990	--	--	--	--	--	--	--	--	--
4	11/13/1990	100.1	36.3	17.6	0.38	5.39	355.1	--	108.8	11.85

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
4	12/11/1990	--	--	--	--	--	--	--	--	--
4	01/16/1991	--	--	--	--	--	--	--	--	--
4	02/20/1991	102.3	36.3	18.7	0.4	4.73	--	--	110.3	13.02
4	03/13/1991	97.9	36.3	18.7	0.41	3.4	--	--	109.2	11.67
4	04/10/1991	102.3	37.4	20.9	0.45	4.3	--	--	102.8	37.13
4	05/08/1991	92.4	36.3	26.4	0.59	5.7	--	--	107.2	15.87
4	06/13/1991	92.4	36.3	24.2	0.54	4.73	--	--	116	14.7
4	07/17/1991	101	42	20	0.42	5.2	--	--	104.2	13.63
4	08/20/1991	103	38	23	0.49	5.3	--	--	120.3	12.53
4	09/18/1991	--	--	--	--	--	--	--	--	--
4	10/24/1991	--	--	--	--	--	--	--	--	--
4	11/14/1991	--	--	--	--	--	--	--	--	--
4	12/11/1991	87	35	18	0.41	5	--	--	97.7	12.97
4	01/15/1992	--	--	--	--	--	--	--	--	--
4	02/12/1992	93	37	16	0.36	5.1	--	--	102.8	13.23
4	03/12/1992	--	--	--	--	--	--	--	--	--
4	04/14/1992	--	--	--	--	--	--	--	--	--
4	05/26/1992	124	44	47	0.92	7.4	--	--	196.8	42.24
4	06/16/1992	--	--	--	--	--	--	--	--	--
4	07/22/1992	--	--	--	--	--	--	--	--	--
4	08/18/1992	104	39	27	0.57	5.4	--	--	138.3	21.83
4	09/15/1992	--	--	--	--	--	--	--	--	--
4	10/22/1992	--	--	--	--	--	--	--	--	--
4	12/01/1992	110.5	38.5	23.6	0.49	5.1	--	--	135.1	17.37
4	02/11/1993	103.9	40.3	23.9	0.5	5.2	--	--	150.9	17.04
4	03/16/1993	--	--	--	--	--	--	--	--	--
4	04/22/1993	--	--	--	--	--	--	--	--	--
4	05/21/1993	102.4	38.3	31	0.66	5.2	--	--	145.6	23.91
4	06/08/1993	100.4	38.6	30.5	0.66	5.6	--	--	140.5	21.06

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
4	07/08/1993	--	--	--	--	--	--	--	--	--
4	08/10/1993	102.9	38.8	24.5	0.52	4.8	--	--	126.8	17.45
4	10/05/1993	--	--	--	--	--	--	--	--	--
4	10/28/1993	--	--	--	--	--	--	--	--	--
4	03/24/1994	108.4	43	25.3	0.52	4.6	--	--	153.4	19.21
4	04/20/1994	--	--	--	--	--	--	--	--	--
4	06/03/1994	106	42.7	22.7	0.47	5	--	--	111.4	16.84
4	06/30/1994	--	--	--	--	--	--	--	--	--
4	08/03/1994	--	--	--	--	--	--	--	--	--
4	08/30/1994	105	38.2	22	0.47	4.8	--	--	160.8	17.29
4	10/06/1994	--	--	--	--	--	--	--	--	--
4	11/15/1994	108	40.6	25	0.52	5.8	--	--	127.1	17.25
4	01/26/1995	--	--	--	--	--	--	--	--	--
4	03/02/1995	114	39.4	21	0.43	5.2	--	--	136.4	17.94
4	04/20/1995	--	--	--	--	--	--	--	--	--
4	05/17/1995	109	40.2	26	0.54	4.5	--	--	127.7	18.36
4	06/07/1995	--	--	--	--	--	--	--	--	--
4	07/12/1995	--	--	--	--	--	--	--	--	--
4	08/23/1995	110	37.8	21	0.44	4.4	--	--	151.6	17.38
4	10/05/1995	--	--	--	--	--	--	--	--	--
4	11/17/1995	103	40.2	24	0.51	5.4	--	--	145.3	19.2
4	05/15/1996	110	40.9	24	0.5	4.7	--	--	148.2	18.74
4	08/07/1996	106.6	39.9	23.8	0.5	4.9	--	--	151.2	19.14
4	03/26/1997	--	--	--	--	--	--	--	--	--
4	04/30/1997	--	--	--	--	--	--	--	--	--
4	07/10/1997	92.6	39.9	27.3	0.6	5.6	--	--	134.2	17.4
4	09/23/1997	101.2	40.1	23.6	0.5	5.33	--	--	162.9	18.73
4	01/15/1998	--	--	--	--	--	--	--	--	--
4	04/30/1998	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
4	08/18/1998	99.8	37.9	24	0.52	4.5	--	--	107.1	19.12
4	01/13/1999	99.8	38.2	22.7	0.49	5.13	--	--	111.7	16.54
4	04/21/1999	--	--	--	--	--	--	--	--	--
4	07/16/1999	99.4	39	25.1	0.54	2.9	--	--	107.7	20.54
4	11/30/1999	118.4	39.7	24	0.49	3.88	--	--	156.8	20.97
4	02/08/2000	--	--	--	--	--	--	--	--	--
4	05/17/2000	--	--	--	--	--	--	--	--	--
4	08/24/2000	111	40.3	23	0.48	6.7	--	--	153	16.53
4	11/16/2000	117.3	42.6	24.7	0.5	3.96	--	--	166.4	11.53
4	02/21/2001	--	--	--	--	--	--	--	--	--
4	05/15/2001	--	--	--	--	--	--	--	--	--
4	08/08/2001	108.9	41.3	24	0.5	4.39	--	--	123.5	19.69
4	11/06/2001	107	38.2	24	0.51	3.8	--	--	143	18.94
4	02/11/2002	111.7	35.8	24.9	0.52	6.62	--	--	--	--
4	05/15/2002	--	--	--	--	--	--	--	--	--
4	08/12/2002	109.5	40.3	23.4	0.49	5.1	--	--	145.4	20.83
4	11/21/2002	103.7	38.6	14.2	0.3	1.9	--	--	135.4	16.6
4	02/26/2003	99.8	31	21.9	0.49	4	--	--	--	--
4	05/28/2003	--	--	--	--	--	--	--	--	--
4	08/19/2003	100.6	38.3	22.7	0.49	3.5	--	--	137.2	20.92
4	11/19/2003	109.9	43.2	28.36	0.58	4.75	--	--	139.44	20.33
4	02/25/2004	--	--	--	--	--	--	--	--	--
4	05/20/2004	--	--	--	--	--	--	--	--	--
4	08/24/2004	111	38.9	25.7	0.53	5.6	--	--	139.04	22.82
4	11/17/2004	112	40.9	26.6	0.55	5.5	--	--	119.08	26.79
5	09/24/1986	--	--	--	--	--	--	--	--	--
5	12/18/1986	--	--	--	--	--	--	--	--	--
5	06/23/1987	--	--	--	--	--	--	--	--	--
5	09/15/1987	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
5	02/25/1988	95.7	37.4	53.9	1.18	9.9	447	0	121.44	19.29
5	06/08/1988	89.1	42.9	59.4	1.29	5.72	478.32	0	97.59	12.72
5	07/13/1988	80.3	42.9	57.2	1.28	8.14	483.81	0	95.43	17.26
5	11/30/1988	121	49.5	67.1	1.3	10.56	--	--	153	20.57
5	05/04/1989	84.7	40.7	55	1.23	10.23	391.41	0	138.5	26.95
5	05/24/1989	82.5	40.7	50.6	1.14	7.81	420.36	0	133.1	21.21
5	06/23/1989	88	42.9	55	1.2	2.2	403.58	0	136.3	12.34
5	07/27/1989	--	--	--	--	--	--	--	--	--
5	08/23/1989	30.8	39.6	91.3	2.56	9.9	297.73	0	144.6	39.43
5	09/13/1989	--	--	--	--	--	--	--	--	--
5	10/25/1989	90.2	45.1	57.2	1.23	9.35	463.07	0	140.1	26.45
5	12/01/1989	--	--	--	--	--	--	--	--	--
5	03/29/1990	--	--	--	--	--	--	--	--	--
5	05/02/1990	--	--	--	--	--	--	--	--	--
5	05/24/1990	89.1	42.9	50.6	1.1	7.7	404.4	--	127.2	23.59
5	06/19/1990	85.8	40.7	46.2	1.03	4.18	397.5	--	125	15.15
5	07/17/1990	--	--	--	--	--	--	--	--	--
5	08/09/1990	33	46.2	81.4	2.15	8.14	--	306	147.4	27.66
5	11/13/1990	100.1	60.5	72.6	1.41	14.96	521	--	165.6	38.33
5	12/11/1990	--	--	--	--	--	--	--	--	--
5	03/14/1991	64.7	29.7	33	0.85	8.69	--	--	93.7	17.56
5	04/10/1991	59.4	30.8	37.4	0.98	11.22	--	--	76.2	24.67
5	04/23/1991	66	36.3	48.4	1.19	9.13	--	--	115.1	29.08
5	05/07/1991	84.7	42.9	66	1.46	10.56	--	--	152.7	36.54
5	05/20/1991	83.6	42.9	63.8	1.41	9.79	--	--	135.7	35.62
5	06/13/1991	86.9	41.8	45.1	1	3.85	--	--	130.4	18.21
5	07/17/1991	92	45	40	0.85	5.1	--	--	112.1	16.99
5	08/20/1991	91	48	49	1.03	8	--	--	121.8	24.49
5	09/18/1991	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
5	10/24/1991	--	--	--	--	--	--	--	--	--
5	11/14/1991	--	--	--	--	--	--	--	--	--
5	12/11/1991	104	49	50	1.01	8.2	--	--	141.7	26.23
5	01/15/1992	--	--	--	--	--	--	--	--	--
5	02/12/1992	104	48	49	1	8.2	--	--	156.1	24.09
5	03/12/1992	--	--	--	--	--	--	--	--	--
5	04/13/1992	--	--	--	--	--	--	--	--	--
5	05/26/1992	91	43	44	0.95	7.6	--	--	146.6	25.81
5	06/17/1992	86.8	37.6	38.7	0.87	5.75	--	--	136.7	27.8
5	07/22/1992	--	--	--	--	--	--	--	--	--
5	08/20/1992	105	45	44	0.91	4.8	--	--	140.8	21.23
5	09/16/1992	100	43	40	0.84	7.6	--	--	136.4	24.74
5	10/22/1992	--	--	--	--	--	--	--	--	--
5	12/02/1992	108	43	36.9	0.76	7.3	--	--	142.2	22.57
5	02/11/1993	109.2	44.3	48.5	0.99	6.6	--	--	146.6	19.74
5	03/16/1993	--	--	--	--	--	--	--	--	--
5	04/22/1993	--	--	--	--	--	--	--	--	--
5	05/21/1993	95.2	42.6	41.8	0.9	6	--	--	148.1	23.31
5	06/10/1993	88.9	39.7	40.1	0.89	6.2	--	--	134.1	22.32
5	07/08/1993	--	--	--	--	--	--	--	--	--
5	08/12/1993	59	28.6	39.9	1.07	11.7	--	--	91.1	26.31
5	10/05/1993	--	--	--	--	--	--	--	--	--
5	10/28/1993	--	--	--	--	--	--	--	--	--
5	03/24/1994	56.6	26	35.4	0.98	5.9	--	--	110.5	19.32
5	04/20/1994	--	--	--	--	--	--	--	--	--
5	06/03/1994	95	49.3	45.8	0.95	7	--	--	153	24.19
5	06/29/1994	87	44.1	50	1.09	6.5	--	--	143.5	22.13
5	08/03/1994	82	45.5	45	0.99	6.6	--	--	163.6	25.21
5	08/30/1994	75	40.2	43	1	6.5	--	--	147.9	23.53

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
5	10/06/1994	95	41.4	33	0.71	6	--	--	132.2	20.08
5	11/15/1994	102	45.2	40	0.83	7.3	--	--	142.9	23.84
5	08/23/1995	73	50	71	1.57	11.1	--	--	211.2	35.57
5	10/05/1995	78	39.2	39	0.9	7.6	--	--	132.8	24.21
5	11/17/1995	100	43.2	33	0.69	6.5	--	--	146.3	21.35
5	05/15/1996	34	22.6	35	1.14	10.5	--	--	110.2	13.47
5	08/07/1996	82	43	37	0.82	6.3	--	--	141.7	20.84
5	03/26/1997	--	--	--	--	--	--	--	--	--
5	07/10/1997	70.7	41.8	47.3	1.1	6.7	--	--	130.3	22.88
5	09/23/1997	85.9	39.4	34.7	0.78	6.03	--	--	156	22.96
5	01/15/1998	--	--	--	--	--	--	--	--	--
5	04/30/1998	--	--	--	--	--	--	--	--	--
5	08/18/1998	94	36.5	36.9	0.82	5.21	--	--	121.5	19.9
5	01/13/1999	103.8	40.8	32.1	0.68	5.92	--	--	132.4	21.55
5	04/21/1999	--	--	--	--	--	--	--	--	--
5	07/16/1999	66.5	43.2	51.7	1.21	4.4	--	--	109.5	35.1
5	11/30/1999	112	46.6	42.4	0.85	8.45	--	--	175	32.15
5	02/08/2000	--	--	--	--	--	--	--	--	--
5	05/17/2000	--	--	--	--	--	--	--	--	--
5	08/24/2000	81.2	43.8	40.4	0.9	8.03	--	--	161.9	21.36
5	11/16/2000	115.5	48	39.8	0.79	6.29	--	--	180.1	15.74
5	02/21/2001	--	--	--	--	--	--	--	--	--
5	05/15/2001	--	--	--	--	--	--	--	--	--
5	08/08/2001	65.1	45.8	43.3	1.01	4.88	--	--	124.7	23.37
5	11/06/2001	97.6	42.7	38.5	0.82	5.75	--	--	155.2	23.06
5	02/11/2002	107.6	38	34.4	0.73	7.81	--	--	--	--
5	05/15/2002	--	--	--	--	--	--	--	--	--
5	08/12/2002	81.7	44.4	45.2	1	7.02	--	--	166.5	29.42
5	11/21/2002	94.6	43.9	39.9	0.85	5.09	--	--	150	23.24

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
5	02/26/2003	106.7	35.3	32.9	0.71	5.4	--	--	--	--
5	05/28/2003	--	--	--	--	--	--	--	--	--
5	08/16/2003	70.2	44.6	38.5	0.88	6.1	--	--	152	26.82
5	11/19/2003	92.3	41.1	45.9	1	8.92	--	--	165.4	29.41
5	02/25/2004	--	--	--	--	--	--	--	--	--
5	05/20/2004	--	--	--	--	--	--	--	--	--
5	08/24/2004	95.8	45.6	42.1	0.89	6.6	--	--	173.09	27.86
5	11/17/2004	108	46.3	43.9	0.89	7.2	--	--	146.27	32.05
6	10/02/1985	--	--	--	--	--	--	--	--	--
6	05/28/1986	96.8	44	37.4	0.79	5.61	455.54	0	96	13.29
6	09/24/1986	--	--	--	--	--	--	--	--	--
6	11/18/1986	--	--	--	--	--	--	--	--	--
6	12/10/1986	--	--	--	--	--	--	--	--	--
6	03/10/1987	106.7	39.6	41.8	0.88	6.05	476.69	0	107.7	15.32
6	06/23/1987	92.4	38.5	46.2	1.02	5.72	425.65	0	81.94	9.08
6	09/15/1987	115.5	41.8	60.5	1.23	8.36	501.91	0	126.02	17.12
6	02/25/1988	95.7	37.4	53.9	1.18	9.9	447	0	121.44	19.29
6	06/08/1988	--	--	--	--	--	--	--	--	--
6	07/13/1988	104.5	39.6	51.7	1.09	8.14	468.15	0	125.8	18.77
6	09/14/1988	113.3	41.8	70.4	1.44	8.8	509.74	0	132.64	17.94
6	11/30/1988	110	40.7	62.7	1.3	8.36	--	--	135.2	16.03
6	05/04/1989	99	46.2	41.8	0.87	5.39	401.16	0	137.1	18.44
6	05/24/1989	100.1	40.7	31.9	0.68	5.39	385.28	0	144.8	16.67
6	06/23/1989	100.1	41.8	40.7	0.86	6.16	393.21	0	143.1	19.01
6	07/27/1989	--	--	--	--	--	--	--	--	--
6	08/23/1989	97.9	41.8	39.6	0.84	5.5	403.28	0	125.2	16.95
6	09/13/1989	--	--	--	--	--	--	--	--	--
6	10/25/1989	100.1	37.4	29.7	0.64	5.83	403.28	0	116.3	13.9
6	11/30/1989	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
6	01/24/1990	--	--	--	--	--	--	--	--	--
6	03/01/1990	108.9	40.7	34.1	0.71	6.16	417.92	0	125.3	17.45
6	03/29/1990	--	--	--	--	--	--	--	--	--
6	05/02/1990	--	--	--	--	--	--	--	--	--
6	05/24/1990	110	44	41.8	0.85	6.49	416.5	--	142.4	18.6
6	06/19/1990	107.8	42.9	41.8	0.86	6.82	426.2	--	142.4	17.08
6	07/17/1990	--	--	--	--	--	--	--	--	--
6	08/09/1990	106.7	45.1	37.4	0.77	8.47	406.1	--	125.4	20.44
6	09/11/1990	--	--	--	--	--	--	--	--	18.47
6	10/11/1990	--	--	--	--	--	--	--	--	--
6	11/13/1990	108.9	41.8	40.7	0.84	6.6	404.3	--	140.5	17.91
6	12/11/1990	--	--	--	--	--	--	--	--	--
6	01/16/1991	--	--	--	--	--	--	--	--	--
6	02/20/1991	114.4	41.8	39.6	0.81	6.16	--	--	144.7	18.47
6	03/14/1991	116.6	44	45.1	0.9	6.27	--	--	145.3	18.64
6	04/10/1991	104.5	41.8	44	0.92	5.17	--	--	121.8	16.03
6	04/23/1991	92.4	39.6	44	0.96	4.73	--	--	120	16.06
6	05/08/1991	105.6	45.1	45.1	0.93	7.59	--	--	160.2	19.24
6	05/21/1991	103.4	44	38.5	0.8	5.94	--	--	149.5	17.45
6	06/13/1991	99	42.9	37.4	0.79	6.05	--	--	145.4	18.51
6	07/17/1991	104	47	38	0.78	6.3	--	--	124	17.13
6	08/20/1991	109	48	44	0.88	6.5	--	--	150.3	21.66
6	09/18/1991	--	--	--	--	--	--	--	--	--
6	10/24/1991	--	--	--	--	--	--	--	--	--
6	11/14/1991	--	--	--	--	--	--	--	--	--
6	12/11/1991	96	40	40	0.87	6.1	--	--	135.9	19.02
6	01/15/1992	--	--	--	--	--	--	--	--	--
6	02/12/1992	105	44	41	0.85	6.9	--	--	145.5	20.02
6	03/12/1992	--	--	--	--	--	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
6	04/14/1992	--	--	--	--	--	--	--	--	--
6	05/26/1992	104	44	43	0.89	6.4	--	--	168.9	18.3
6	06/16/1992	106.6	41.8	42.9	0.89	5.96	--	--	147.3	17.9
6	07/22/1992	--	--	--	--	--	--	--	--	--
6	08/18/1992	104	46	46	0.94	6.2	--	--	148.8	20.39
6	09/15/1992	112	47	39	0.78	7.1	--	--	164.1	19.66
6	10/22/1992	--	--	--	--	--	--	--	--	--
6	12/01/1992	112.7	43.7	39.3	0.8	6.4	--	--	153.3	17.49
6	03/16/1993	--	--	--	--	--	--	--	--	--
6	04/22/1993	--	--	--	--	--	--	--	--	--
6	05/21/1993	104.5	43.4	38.6	0.8	5.9	--	--	--	--
6	06/08/1993	102.2	42.3	41.9	0.88	6.4	--	--	151.8	17.31
6	07/08/1993	--	--	--	--	--	--	--	--	--
6	08/10/1993	99.3	42.9	34.8	0.73	6.3	--	--	150.5	16.07
6	10/05/1993	--	--	--	--	--	--	--	--	--
6	10/28/1993	--	--	--	--	--	--	--	--	--
6	03/24/1994	113.8	44.1	61.8	1.25	7.8	--	--	167	16.98
6	04/20/1994	--	--	--	--	--	--	--	--	--
6	06/03/1994	105	47.1	46.6	0.95	6	--	--	164.7	20.37
6	06/30/1994	104	41.4	69	1.45	7.9	--	--	159.7	22.37
6	08/03/1994	104	42.6	65	1.36	7.5	--	--	175.6	23.63
6	08/30/1994	105	40.9	39	0.82	6	--	--	172.5	18.89
6	10/06/1994	108	43.4	39	0.8	6.3	--	--	143.5	17.7
6	11/15/1994	106	44.6	42	0.86	6.8	--	--	148.6	17.23
6	01/26/1995	107	41.3	43	0.89	6.1	--	--	154.2	18.77
6	03/02/1995	116	42.1	46	0.93	7	--	--	140.5	19.89
6	04/20/1995	--	--	--	--	--	--	--	--	--
6	05/17/1995	104	42.9	45	0.94	6.1	--	--	134.7	15.94
6	06/07/1995	93	43	54	1.16	6.3	--	--	131.6	15.55

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
6	07/12/1995	83	42.3	43	0.96	6.4	--	--	148.4	18.62
6	08/23/1995	104	41	41	0.86	6.4	--	--	156.8	16.8
6	10/05/1995	102	41.9	44	0.93	7.2	--	--	147.8	16.95
6	11/17/1995	96	42.1	35	0.75	6.1	--	--	145.3	16.88
6	05/15/1996	105	44.9	48	0.99	6.4	--	--	148.1	18.43
6	08/07/1996	118	41.8	42.2	0.85	6.8	--	--	150.4	19.37
6	03/26/1997	--	--	--	--	--	--	--	--	--
6	04/30/1997	--	--	--	--	--	--	--	--	--
6	07/10/1997	91.2	42.2	50.2	1.09	7.7	--	--	140.7	18.86
6	09/23/1997	98.3	41.7	44.8	0.95	5.56	--	--	179.4	25.94
6	01/15/1998	--	--	--	--	--	--	--	--	--
6	04/30/1998	--	--	--	--	--	--	--	--	--
6	08/18/1998	101.5	39.7	77.2	1.65	8.43	--	--	159.4	25.59
6	01/13/1999	104	44.5	36.9	0.76	5.9	--	--	117	11.94
6	04/21/1999	--	--	--	--	--	--	--	--	--
6	07/16/1999	101.2	43.1	68.3	1.43	5.94	--	--	109.9	28.47
6	11/30/1999	111.2	42.8	63.1	1.29	7.38	--	--	171	25.14
6	02/08/2000	--	--	--	--	--	--	--	--	--
6	05/17/2000	--	--	--	--	--	--	--	--	--
6	08/24/2000	109.7	42.9	39.6	0.81	7.58	--	--	163	20.21
6	11/16/2000	116.6	46.5	40.3	0.8	4.92	--	--	175.9	12.86
6	02/21/2001	--	--	--	--	--	--	--	--	--
6	05/15/2001	--	--	--	--	--	--	--	--	--
6	08/08/2001	110.8	47.1	45.5	0.91	5.14	--	--	177	23.67
6	11/06/2001	105.8	42.4	41.3	0.86	5.49	--	--	158.3	21.74
6	02/11/2002	115.5	40.9	45	0.92	8.05	--	--	--	--
6	05/15/2002	--	--	--	--	--	--	--	--	--
6	08/12/2002	108.6	44.8	46.7	0.95	6.46	--	--	165.7	24.24
6	11/02/2002	106.5	42.7	45.3	0.94	5.09	--	--	150.8	19.47

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
6	02/26/2003	106.9	35.1	37.2	0.8	5.7	--	--	--	--
6	05/28/2003	--	--	--	--	--	--	--	--	--
6	08/16/2003	101.9	43.3	42.5	0.89	5.2	--	--	159.3	25.32
6	11/19/2003	111.1	41.86	42.87	0.88	6.83	--	--	168.4	23.61
6	02/25/2004	--	--	--	--	--	--	--	--	--
6	05/20/2004	--	--	--	--	--	--	--	--	--
6	08/24/2004	117	46.5	49.7	0.98	7.3	--	--	184.84	28.51
6	11/17/2004	114	47.3	50.8	1.01	7.3	--	--	185.26	29.84
7	06/19/1990	66	42.9	119.9	2.82	14.96	337.9	--	205.3	69.82
7	09/10/1990	60.5	49.5	180.4	4.17	19.91	--	--	268.1	95.56
7	10/10/1990	63.8	52.8	187	4.19	19.14	400.6	--	275.5	95.87
7	11/08/1990	69.3	59.4	216.7	4.62	17.6	455.1	--	328.8	115.3
7	12/11/1990	71.5	79.2	268.4	5.2	21.45	541.8	--	392.8	158.84
7	01/16/1991	--	--	--	--	--	--	--	--	--
7	02/20/1991	167.2	112.2	354.2	5.2	23.1	--	--	636.6	226.48
7	03/13/1991	96.8	55	190.3	3.83	15.4	--	--	306.2	102.78
7	04/10/1991	30.8	18.7	62.7	2.2	6.93	--	--	91.6	35.39
7	04/23/1991	39.6	26.4	79.2	2.39	9.35	--	--	127.7	44.7
7	05/07/1991	53.9	31.9	99	2.64	11.55	--	--	174.1	58.25
7	05/20/1991	61.6	36.3	130.9	3.27	15.73	--	--	204.8	75.89
7	06/13/1991	56.1	33	104.5	2.74	13.86	--	--	188.3	59.71
7	07/17/1991	63	39	82	2	13	--	--	146.9	47.16
7	08/20/1991	40	39	109	2.94	14.2	--	--	188.4	54.1
7	09/18/1991	--	--	--	--	--	--	--	--	--
7	10/24/1991	--	--	--	--	--	--	--	--	--
7	11/14/1991	--	--	--	--	--	--	--	--	--
7	12/12/1991	93	66	188	3.64	17.3	--	--	347.6	123.64
7	01/15/1992	--	--	--	--	--	--	--	--	--
7	02/12/1992	96	53	141	2.83	18.4	--	--	273.4	86.76

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
7	03/12/1992	--	--	--	--	--	--	--	--	--
7	04/13/1992	--	--	--	--	--	--	--	--	--
7	05/26/1992	69	46	119	2.72	17.6	--	--	246.2	61.09
7	06/17/1992	66.9	40.8	92	2.19	14.22	--	--	207.6	49.56
7	07/23/1992	--	--	--	--	--	--	--	--	--
7	08/19/1992	54	41	122	3.05	15.5	--	--	193.3	61.35
7	09/15/1992	51	43	124	3.09	16	--	--	218.1	65.99
7	10/22/1992	--	--	--	--	--	--	--	--	--
7	12/02/1992	80.4	52.4	143.2	3.05	15	--	--	233.1	95.16
7	04/22/1993	--	--	--	--	--	--	--	--	--
7	05/21/1993	67.7	33.6	73.6	1.83	15.4	--	--	--	--
7	06/10/1993	66.4	35.5	80.8	1.99	14.4	--	--	158.7	44.57
7	07/07/1993	--	--	--	--	--	--	--	--	--
7	08/12/1993	54.2	27.6	41.7	1.15	13.6	--	--	81.5	20.34
7	10/04/1993	--	--	--	--	--	--	--	--	--
7	10/28/1993	--	--	--	--	--	--	--	--	--
7	04/20/1994	--	--	--	--	--	--	--	--	--
7	06/03/1994	56	32	46	1.21	13	--	--	125.3	17.36
7	06/29/1994	63	32	52	1.33	14.5	--	--	160.2	17.7
7	08/03/1994	61	32.8	51	1.31	14	--	--	165.3	19.23
7	08/30/1994	69	35.5	57	1.39	13.1	--	--	184.3	22.95
7	10/06/1994	64	33.6	49	1.23	13.2	--	--	145.8	16.42
7	11/15/1994	68	38	64	1.54	15.8	--	--	176.6	22.5
7	01/26/1995	104	55.6	97	1.91	12.9	--	--	284.6	36.65
7	03/02/1995	102	50.5	96	1.94	12.9	--	--	252.7	37.68
7	04/20/1995	--	--	--	--	--	--	--	--	--
7	05/17/1995	58	32.7	46	1.2	12.7	--	--	167.9	20.51
7	06/07/1995	53	31.2	52	1.4	12.3	--	--	142.7	15.07
7	07/12/1995	53	33.8	54	1.43	12.5	--	--	169.5	13.78

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
7	08/23/1995	70	43.6	74	1.71	14.1	--	--	225.7	17.02
7	10/05/1995	--	--	--	--	--	--	--	--	--
7	11/17/1995	89	54.5	114	2.35	18.7	--	--	265.4	60.49
7	05/15/1996	38	22.3	35	1.11	10.5	--	--	102.7	12.92
7	08/07/1996	54.2	27.7	45.1	1.24	12.4	--	--	124.1	17.81
7	03/26/1997	--	--	--	--	--	--	--	--	--
7	04/30/1997	--	--	--	--	--	--	--	--	--
7	07/10/1997	52.8	29.3	46.9	1.28	12.1	--	--	124.2	16.41
7	09/23/1997	64.7	31	51.4	1.32	13.33	--	--	140.6	18.36
7	01/15/1998	--	--	--	--	--	--	--	--	--
7	04/30/1998	--	--	--	--	--	--	--	--	--
7	08/18/1998	73.7	36.6	73.6	1.75	17.83	--	--	183.5	35.98
7	01/13/1999	136.5	64.2	94.2	1.67	17.63	--	--	272.1	43.03
7	04/21/1999	--	--	--	--	--	--	--	--	--
7	07/16/1999	57.8	35.9	53.7	1.37	11.7	--	--	109.5	20.57
7	11/30/1999	99.4	48.7	83.7	1.72	13.66	--	--	231.5	39.8
7	02/08/2000	--	--	--	--	--	--	--	--	--
7	05/17/2000	--	--	--	--	--	--	--	--	--
7	08/24/2000	63.4	40.4	76.8	1.86	15.83	--	--	220.4	24.19
7	11/16/2000	80.9	53.7	89.2	1.89	13.45	--	--	268	15.97
7	02/21/2001	--	--	--	--	--	--	--	--	--
7	05/15/2001	--	--	--	--	--	--	--	--	--
7	08/08/2001	75.6	52.8	87.1	1.88	15.34	--	--	282.3	23.44
7	11/06/2001	76.1	51	99.9	2.17	16.24	--	--	255.3	48.76
7	02/11/2002	107.2	47	96	1.95	19.31	--	--	--	--
7	05/15/2002	--	--	--	--	--	--	--	--	--
7	08/12/2002	66.8	43.2	73.1	1.71	17.1	--	--	220.4	37.87
7	11/21/2002	46.4	49.6	99.8	2.43	21	--	--	259.7	39.57
7	02/26/2003	172.8	61.5	146.5	2.44	36.5	--	--	--	--

Supplement 3. Major ions for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Sodium-adsorption ratio is the ratio of sodium concentration to the square root of one-half the sum of calcium and magnesium concentrations; other constituents in milligrams per liter; --, no data; data not rounded]

Site	Date	Calcium	Magnesium	Sodium	Sodium-adsorption ratio	Potassium	Bicarbonate	Carbonate	Sulfate	Chloride
7	05/28/2003	--	--	--	--	--	--	--	--	--
7	08/16/2003	77	54.7	107.2	2.28	16.7	--	--	318	34.75
7	11/19/2003	70.41	52.4	110.7	2.43	18.65	--	--	294.13	48.9
7	02/25/2004	--	--	--	--	--	--	--	--	--
7	05/20/2004	--	--	--	--	--	--	--	--	--
7	08/24/2004	83	52.4	89.2	1.89	17.1	--	--	301.23	30.74
7	11/17/2004	55.3	53.7	106	2.43	23.1	--	--	292.39	67.42

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
1	04/20/1989	<0.020	<0.100	0.070	--	0.020	--	--	--	--	--	--	--	--
1	05/02/1989	<0.020	<0.100	--	--	0.010	--	--	--	--	--	--	--	--
1	05/08/1989	<0.020	<0.100	0.080	--	<0.010	--	--	--	--	--	--	--	--
1	05/16/1989	--	--	0.160	--	--	--	--	--	--	--	--	--	--
1	04/18/1990	<0.020	<0.100	0.140	--	0.060	--	--	--	--	--	--	--	--
1	04/24/1990	<0.020	<0.100	0.070	--	0.022	--	--	--	--	--	--	--	--
1	05/02/1990	<0.020	0.100	0.080	--	0.030	--	--	--	--	--	--	--	--
1	05/07/1990	<0.020	--	0.090	--	0.060	--	--	--	--	--	--	--	--
1	05/16/1990	<0.020	<0.100	0.110	--	0.030	--	--	--	--	--	--	--	--
1	03/14/1991	<0.020	--	0.250	--	0.040	2.1	--	--	--	--	<0.10	--	<1.0
1	04/11/1991	<0.020	--	0.280	--	0.030	--	--	--	--	--	--	--	--
1	04/24/1991	<0.020	<0.100	0.140	--	0.010	--	--	--	--	--	--	--	--
1	05/08/1991	<0.020	<0.100	0.270	--	0.040	--	--	--	--	--	--	--	--
1	05/21/1991	<0.020	<0.100	0.150	--	0.070	--	--	--	--	--	--	--	--
1	06/13/1991	<0.020	<0.100	0.200	--	0.120	--	--	--	--	--	--	--	--
1	07/17/1991	<0.020	<0.100	0.160	--	0.120	--	--	--	--	--	--	--	--
1	08/20/1991	<0.020	<0.100	0.190	--	0.100	--	--	--	--	--	--	--	--
1	09/18/1991	<0.020	<0.100	0.160	--	0.140	--	--	--	--	--	--	--	--
1	10/24/1991	<0.020	<0.100	0.120	--	0.110	--	--	--	--	--	--	--	--
1	11/14/1991	<0.020	<0.100	0.160	--	0.090	--	--	--	--	--	--	--	--
1	12/12/1991	<0.020	<0.100	0.170	--	0.100	--	--	--	--	--	--	--	--
1	01/15/1992	<0.020	<0.100	0.140	--	0.080	--	--	--	--	--	--	--	--
1	02/12/1992	<0.020	<0.100	0.130	--	0.060	--	--	--	--	--	--	--	--
1	03/12/1992	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	04/14/1992	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	05/20/1992	<0.020	<0.100	0.130	--	0.040	--	--	--	--	--	--	--	--
1	05/26/1992	<0.020	<0.100	0.110	--	0.060	--	--	--	--	--	--	--	--
1	06/17/1992	<0.020	<0.100	0.170	--	0.070	--	--	--	--	--	--	--	--
1	07/23/1992	--	<0.100	0.185	--	--	--	--	--	--	--	--	--	--
1	08/18/1992	0.174	<0.100	0.124	--	<0.010	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
1	09/15/1992	<0.020	<0.100	0.277	--	0.068	--	--	--	--	--	--	--	--
1	10/22/1992	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	12/01/1992	<0.020	<0.100	0.070	--	0.183	--	--	--	--	--	--	--	--
1	03/17/1993	--	0.600	--	--	--	--	--	--	--	--	--	--	--
1	04/22/1993	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	05/21/1993	<0.020	<0.100	0.154	--	0.037	--	--	--	--	--	--	--	--
1	06/10/1993	<0.020	--	0.143	--	0.081	--	--	--	--	--	--	--	--
1	07/07/1993	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	08/11/1993	<0.020	<0.100	0.197	--	0.337	--	--	--	--	--	--	--	--
1	10/04/1993	--	0.140	--	--	--	--	--	--	--	--	--	--	--
1	10/28/1993	--	0.180	--	--	--	--	--	--	--	--	--	--	--
1	04/20/1994	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	06/03/1994	0.083	0.300	0.290	--	0.093	--	--	--	--	--	--	--	--
1	06/29/1994	<0.020	<0.100	0.188	--	0.050	--	--	--	--	--	--	--	--
1	08/03/1994	<0.020	<0.100	0.142	--	0.083	--	--	--	--	--	--	--	--
1	08/30/1994	<0.020	<0.100	<0.050	--	0.054	--	--	--	--	--	--	--	--
1	10/06/1994	<0.020	<0.100	0.107	--	<0.010	--	--	--	--	--	--	--	--
1	11/15/1994	<0.020	<0.100	0.175	--	0.090	--	--	--	--	--	--	--	--
1	01/26/1995	<0.020	0.770	--	--	0.045	--	--	--	--	--	--	--	--
1	03/02/1995	<0.020	0.825	<0.050	--	0.090	--	--	--	--	--	--	--	--
1	04/20/1995	--	0.501	--	--	--	--	--	--	--	--	--	--	--
1	05/17/1995	<0.020	<0.100	0.123	--	0.053	--	--	--	--	--	--	--	--
1	06/07/1995	0.020	0.110	0.161	--	0.170	--	--	--	--	--	--	--	--
1	07/12/1995	0.031	0.270	0.075	--	0.179	--	--	--	--	--	--	--	--
1	08/23/1995	--	0.300	--	--	--	--	--	--	--	--	--	--	--
1	10/05/1995	<0.020	<0.100	0.155	--	0.013	--	--	--	--	--	--	--	--
1	11/17/1995	0.020	0.440	0.148	--	0.164	--	--	--	--	--	--	--	--
1	05/15/1996	<0.020	<0.100	0.065	--	0.117	--	--	--	--	--	--	--	--
1	08/07/1996	<0.020	<0.100	0.103	--	0.117	--	--	--	--	--	--	--	--
1	03/26/1997	--	0.850	--	--	--	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
1	04/30/1997	<0.020	0.180	<0.050	--	0.117	--	--	--	--	--	--	--	--
1	07/10/1997	0.053	0.390	0.128	--	0.199	--	--	--	--	--	--	--	--
1	09/23/1997	0.052	0.460	0.148	--	0.361	--	--	--	--	--	--	--	--
1	01/15/1998	--	1.090	--	--	--	--	--	--	--	--	--	--	--
1	04/30/1998	--	<0.100	<0.050	--	--	--	--	--	--	--	--	--	--
1	08/18/1998	<0.020	0.170	0.132	--	0.401	--	--	--	--	--	--	--	--
1	01/13/1999	<0.020	1.280	0.110	--	0.320	--	--	--	--	--	--	--	--
1	04/21/1999	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
1	07/16/1999	<0.020	0.190	<0.050	--	0.204	--	--	--	--	--	--	--	--
1	11/30/1999	0.020	0.870	<0.050	--	0.350	--	--	--	--	--	--	--	--
1	02/08/2000	--	2.260	--	--	--	--	--	--	--	--	<0.20	--	<1.0
1	05/17/2000	--	<0.100	--	--	--	--	--	--	--	--	<0.20	--	<1.0
1	08/24/2000	<0.020	0.180	<0.050	--	0.450	6.4	--	--	--	--	<0.20	--	<1.0
1	11/16/2000	<0.020	0.227	<0.050	--	0.340	--	--	--	--	--	<0.20	--	<1.0
1	02/21/2001	--	3.670	--	--	--	--	--	--	--	--	<0.20	--	<1.0
1	05/15/2001	--	<0.100	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
1	08/08/2001	<0.020	0.350	<0.050	--	0.584	9.7	--	--	--	--	<0.20	--	<1.0
1	11/06/2001	<0.020	<0.100	<0.050	--	0.117	--	--	--	--	--	<0.20	--	<1.0
1	02/11/2002	--	2.340	0.040	--	--	2.0	--	--	--	--	<0.20	--	<1.0
1	05/15/2002	--	0.107	0.194	--	--	--	--	--	--	--	<0.20	--	<1.0
1	08/12/2002	0.042	<0.100	0.669	--	0.455	8.5	--	--	--	--	--	--	<1.0
1	11/21/2002	<0.020	0.184	0.084	--	0.603	4.3	--	--	--	--	<0.20	--	<2.6
1	02/26/2003	--	3.080	0.201	--	--	--	--	--	--	--	--	--	3.6
1	05/28/2003	--	0.100	<0.020	--	--	--	--	--	--	--	--	--	<2.0
1	08/16/2003	<0.020	0.100	0.185	--	0.458	9.1	--	--	--	--	--	--	<2.0
1	11/19/2003	<0.020	<0.100	<0.100	--	0.473	3.7	--	--	--	--	<0.20	--	<1.0
1	05/20/2004	--	0.340	0.130	--	--	--	--	--	--	--	<0.20	--	<2.0
1	08/24/2004	<0.020	<0.100	<0.100	--	0.200	4.6	--	--	--	--	<0.20	--	<2.0
1	11/17/2004	<0.020	<0.100	<0.010	--	0.641	2.4	--	--	--	--	<0.20	--	<2.0
2	03/14/1991	<0.020	<0.100	0.250	--	0.040	2.1	--	--	--	--	<0.10	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
2	04/11/1991	<0.020	<0.100	0.300	--	0.010	2.4	--	--	--	--	--	--	<1.0
2	04/24/1991	<0.020	<0.100	0.200	--	<0.010	3.5	--	--	--	--	--	--	1.0
2	07/17/1991	0.060	0.540	0.330	--	0.010	3.0	--	--	--	--	0.10	--	3.0
2	08/20/1991	0.020	0.130	0.220	--	<0.010	--	--	--	--	--	--	--	--
2	09/18/1991	<0.020	<0.100	0.220	--	0.020	4.0	--	--	--	--	<0.10	--	1.0
2	10/24/1991	<0.020	0.180	0.180	--	0.010	2.1	--	--	--	--	<0.10	--	1.0
2	12/12/1991	0.040	2.790	0.270	--	0.010	--	--	--	--	--	--	--	--
2	01/15/1992	0.040	1.880	0.370	--	0.010	1.1	--	--	--	--	<0.10	--	1.4
2	02/12/1992	0.030	1.140	0.170	--	0.020	1.5	--	--	--	--	<0.10	--	<1.0
2	03/12/1992	--	0.930	--	--	--	2.1	--	--	--	--	<0.10	--	<1.0
2	04/14/1992	--	0.140	--	--	--	<1.0	--	--	--	--	<0.10	--	1.1
2	07/23/1992	--	1.190	0.278	--	--	2.1	--	--	--	--	<0.10	--	<1.0
2	08/18/1992	0.022	<0.100	0.173	--	<0.010	1.6	--	--	--	--	<0.10	--	<1.0
2	09/15/1992	<0.020	<0.100	0.182	--	<0.010	2.5	--	--	--	--	<0.10	--	<1.0
2	10/21/1992	--	<0.100	--	--	--	3.3	--	--	--	--	<0.10	--	<1.0
2	11/30/1992	0.030	2.570	0.120	--	<0.010	1.3	--	--	--	--	<0.10	--	1.8
2	06/30/1994	--	0.228	0.277	--	--	--	--	--	--	--	<0.20	--	--
2	08/03/1994	<0.020	<0.100	0.238	--	0.031	2.8	--	--	--	--	<0.20	--	<4.0
2	11/15/1994	--	<0.100	--	--	--	10.3	--	--	--	--	--	--	<1.0
2	01/15/1998	--	1.590	--	--	--	--	--	--	--	--	--	--	--
2	08/18/1998	0.127	0.970	0.424	--	0.019	1.5	--	--	--	--	<0.20	--	1.5
2	01/13/1999	<0.020	2.550	<0.050	--	0.023	--	--	--	--	--	<0.20	--	<1.0
2	11/30/1999	0.040	2.210	0.090	--	0.010	--	--	--	--	--	<0.20	--	<1.0
2	02/08/2000	--	1.697	--	--	--	--	--	--	--	--	<0.20	--	<1.0
2	05/17/2000	--	1.560	--	--	--	--	--	--	--	--	<0.20	--	<1.0
2	08/24/2000	0.065	0.830	0.050	--	0.022	<2.0	--	--	--	--	<0.20	--	<1.0
2	11/16/2000	--	--	--	--	--	--	--	--	--	--	<0.20	--	<1.0
2	02/21/2001	--	1.310	--	--	--	--	--	--	--	--	<0.20	--	<1.0
2	11/06/2001	0.039	1.490	0.290	--	0.045	--	--	--	--	--	<0.20	--	1.4
2	02/11/2002	--	1.688	0.138	--	--	<2.0	--	--	--	--	<0.20	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
2	05/15/2002	0.260	<0.100	--	--	--	--	--	--	--	--	<0.20	--	1.0
2	08/12/2002	0.084	2.400	0.196	--	<0.010	<2.0	--	--	--	--	--	--	<1.0
2	11/02/2002	0.034	2.470	0.207	--	0.022	<2.0	--	--	--	--	<0.20	--	<2.6
2	02/26/2003	--	1.552	<0.020	--	--	--	--	--	--	--	--	--	<2.0
2	05/28/2003	0.260	1.126	<0.020	--	--	--	--	--	--	--	--	--	<2.0
2	08/16/2003	0.070	1.080	0.280	--	<0.010	<2.0	--	--	--	--	--	--	<2.0
2	11/19/2003	0.028	2.233	0.106	--	0.018	<2.0	--	--	--	--	<0.20	--	<1.0
2	02/25/2004	--	1.729	<0.100	--	--	--	--	--	--	--	<0.20	--	<1.0
2	05/20/2004	--	0.184	<0.100	--	--	--	--	--	--	--	<0.20	--	<2.0
2	08/24/2004	0.026	0.132	0.141	--	0.045	3.0	--	--	--	--	<0.20	--	<2.0
2	11/17/2004	<0.020	2.420	0.200	--	0.061	<2.0	--	--	--	--	<0.20	--	<2.0
3	01/01/1984	--	2.040	--	--	--	--	--	--	--	--	--	--	--
3	03/22/1984	--	0.590	--	--	--	--	--	--	--	--	--	--	--
3	05/23/1984	--	1.510	--	--	--	--	--	--	--	--	--	--	--
3	10/29/1984	--	1.740	--	--	--	--	--	--	--	--	--	--	--
3	02/12/1985	--	0.710	--	--	--	--	--	--	--	--	--	--	--
3	06/26/1985	--	1.160	--	--	--	--	--	--	--	--	--	--	--
3	10/02/1985	--	0.770	--	--	--	--	--	--	--	--	--	--	--
3	05/28/1986	<0.020	3.360	0.590	--	<0.010	--	--	--	--	--	--	--	--
3	09/24/1986	<0.020	2.000	0.120	--	<0.010	--	--	--	--	--	--	--	--
3	11/18/1986	--	1.270	--	--	--	--	--	--	--	--	--	--	--
3	12/10/1986	<0.020	1.400	0.230	--	0.020	1.0	88	<0.20	240	490	<0.10	3.30	<0.5
3	03/10/1987	<0.020	1.270	0.090	--	<0.010	2.0	50	0.27	180	470	<0.10	3.40	3.0
3	06/23/1987	<0.020	1.170	0.170	--	0.020	2.0	100	<0.20	310	403	0.19	2.60	1.5
3	09/15/1987	<0.020	1.680	0.290	--	<0.010	2.2	90	<0.20	500	474	<0.10	1.80	2.5
3	02/24/1988	<0.020	1.270	0.130	--	0.010	--	--	--	--	--	--	--	--
3	06/08/1988	<0.020	1.360	0.120	--	0.010	--	--	--	--	--	--	--	--
3	07/13/1988	<0.020	1.280	0.150	--	0.010	--	--	--	--	--	--	--	--
3	09/14/1988	<0.020	0.970	0.050	--	<0.010	--	--	--	--	--	--	--	--
3	11/30/1988	<0.020	1.600	<0.050	--	<0.010	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
3	01/11/1989	<0.020	1.510	0.280	--	0.010	--	--	--	--	--	--	--	--
3	05/04/1989	<0.020	1.850	0.230	--	0.020	--	--	--	--	--	--	--	--
3	05/24/1989	<0.020	1.460	0.260	--	0.010	--	--	--	--	--	--	--	--
3	06/23/1989	<0.020	1.380	0.190	--	0.010	--	--	--	--	--	--	--	--
3	07/27/1989	<0.020	1.300	0.170	--	--	--	--	--	--	--	--	--	--
3	08/23/1989	<0.020	1.960	0.200	--	0.030	--	--	--	--	--	--	--	--
3	09/13/1989	<0.020	2.200	0.210	--	0.010	--	--	--	--	--	--	--	--
3	10/25/1989	<0.020	2.040	0.220	--	0.010	--	--	--	--	--	--	--	--
3	11/30/1989	<0.020	1.690	0.260	--	0.020	--	--	--	--	--	--	--	--
3	01/24/1990	<0.020	1.770	0.210	--	0.020	--	--	--	--	--	--	--	--
3	03/01/1990	0.020	1.820	0.220	--	0.010	--	--	--	--	--	--	--	--
3	03/29/1990	<0.020	1.690	<0.050	--	0.020	--	--	--	--	--	--	--	--
3	05/02/1990	<0.020	1.450	0.390	--	0.010	--	--	--	--	--	--	--	--
3	05/24/1990	<0.020	2.050	0.200	--	0.030	--	--	--	--	--	--	--	--
3	06/19/1990	<0.020	1.950	0.140	0.070	0.020	2.2	--	--	--	--	--	--	1.3
3	07/17/1990	<0.020	1.790	0.240	--	0.040	--	--	--	--	--	--	--	--
3	08/09/1990	<0.020	1.640	0.170	--	0.010	--	--	--	--	--	--	--	--
3	09/11/1990	<0.020	2.130	0.200	--	0.010	--	--	--	--	--	--	--	--
3	10/11/1990	<0.020	2.010	0.190	--	0.010	--	--	--	--	--	--	--	--
3	11/13/1990	<0.020	1.960	0.260	--	0.140	--	--	--	--	--	--	--	--
3	12/11/1990	<0.020	1.990	0.280	--	0.030	--	--	--	--	--	--	--	--
3	01/16/1991	<0.020	1.850	0.360	--	0.010	--	--	--	--	--	--	--	--
3	02/20/1991	<0.020	1.930	0.270	--	<0.010	--	--	--	--	--	--	--	--
3	03/14/1991	<0.020	1.690	0.400	--	0.010	--	--	--	--	--	--	--	--
3	04/11/1991	<0.020	1.470	0.270	--	<0.010	--	--	--	--	--	--	--	--
3	04/23/1991	<0.020	1.260	0.260	--	<0.010	2.1	--	--	--	--	--	--	3.0
3	05/08/1991	<0.020	2.860	0.170	--	0.020	3.0	--	--	--	--	<0.10	--	3.7
3	05/21/1991	<0.020	4.050	0.200	--	0.020	1.0	--	--	--	--	<0.10	--	3.2
3	06/13/1991	<0.020	4.280	0.200	--	0.020	1.0	--	--	--	--	<0.10	--	4.0
3	07/17/1991	<0.020	3.590	0.220	--	0.010	2.0	--	--	--	--	0.10	--	4.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
3	08/20/1991	<0.020	3.240	0.280	--	0.010	<1.0	--	--	--	--	<0.10	--	2.0
3	09/18/1991	<0.020	3.250	0.260	--	0.030	2.0	--	--	--	--	<0.10	--	3.0
3	10/24/1991	0.020	3.350	0.260	--	0.020	1.3	--	--	--	--	<0.10	--	3.0
3	11/14/1991	<0.020	3.270	0.220	--	0.010	2.9	--	--	--	--	<0.10	--	2.0
3	12/11/1991	<0.020	3.200	0.210	--	0.030	1.9	--	--	--	--	<0.10	--	1.4
3	01/15/1992	<0.020	3.110	0.170	--	0.010	2.3	--	--	--	--	<0.10	--	1.9
3	02/12/1992	<0.020	2.960	0.230	--	0.010	1.5	--	--	--	--	<0.10	--	2.0
3	03/12/1992	--	2.550	--	--	--	1.5	--	--	--	--	<0.10	--	1.8
3	04/14/1992	--	2.850	--	--	--	<1.0	--	--	--	--	<0.10	--	3.1
3	05/26/1992	<0.020	1.940	0.140	--	0.040	<1.0	--	--	--	--	<0.10	--	1.9
3	06/16/1992	<0.020	2.250	0.220	--	0.030	2.4	--	--	--	--	<0.10	--	<1.0
3	07/22/1992	--	3.023	0.202	--	--	<1.0	--	--	--	--	<0.10	--	<1.0
3	08/18/1992	<0.020	3.147	0.175	--	0.010	1.7	--	--	--	--	<0.10	--	1.0
3	09/15/1992	<0.020	2.923	0.271	--	0.016	2.2	--	--	--	--	<0.10	--	1.5
3	10/22/1992	--	3.987	--	--	--	2.2	--	--	--	--	<0.10	--	1.5
3	12/01/1992	<0.020	3.031	0.175	--	0.010	2.1	--	--	--	--	<0.10	--	1.7
3	02/11/1993	<0.020	2.370	0.173	--	<0.010	3.0	--	--	--	--	<0.10	--	1.7
3	03/16/1993	--	2.410	--	--	--	<1.0	--	--	--	--	<0.10	--	1.8
3	04/22/1993	--	2.690	--	--	--	1.4	--	--	--	--	<0.10	--	2.7
3	05/21/1993	<0.020	2.790	0.290	--	0.016	1.6	--	--	--	--	<0.10	--	1.2
3	06/08/1993	<0.020	2.620	0.249	--	0.021	1.4	--	--	--	--	<0.10	--	<1.0
3	07/08/1993	--	4.260	--	--	--	1.6	--	--	--	--	<0.10	--	1.4
3	08/10/1993	<0.020	4.174	0.194	--	0.023	1.1	--	--	--	--	<0.10	--	<1.0
3	10/05/1993	--	3.050	--	--	--	1.0	--	--	--	--	<0.10	--	1.0
3	10/28/1993	--	2.870	--	--	--	1.2	--	--	--	--	0.10	--	1.1
3	03/24/1994	<0.020	2.297	0.258	--	0.065	<1.0	--	--	--	--	<0.20	--	1.4
3	04/20/1994	--	3.235	--	--	--	1.1	--	--	--	--	<0.20	--	1.6
3	06/03/1994	<0.020	3.814	0.172	--	0.224	<2.0	--	--	--	--	<0.20	--	3.0
3	06/30/1994	<0.020	3.453	0.329	0.021	0.037	1.0	--	--	--	--	<0.20	--	1.2
3	08/03/1994	<0.020	2.751	0.085	--	0.025	1.1	--	--	--	--	<0.20	--	<4

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
3	08/30/1994	<0.020	3.919	0.055	--	<0.010	1.1	--	--	--	--	<0.20	--	<2.0
3	10/06/1994	<0.020	4.415	0.160	--	<0.010	1.6	--	--	--	--	<0.20	--	1.2
3	11/15/1994	<0.020	4.208	0.205	--	0.050	1.5	--	--	--	--	--	--	<1.0
3	01/26/1995	<0.020	2.859	<0.050	--	<0.010	1.0	--	--	--	--	0.18	--	<1.0
3	03/02/1995	<0.020	2.298	<0.050	--	<0.010	1.3	--	--	--	--	<0.10	--	<1.0
3	04/20/1995	--	3.127	--	--	--	1.8	--	--	--	--	0.11	--	<1.0
3	05/17/1995	<0.020	3.706	0.167	--	0.046	1.2	--	--	--	--	<0.10	--	<1.0
3	06/07/1995	<0.020	3.915	0.145	--	0.060	2.3	--	--	--	--	0.14	--	<1.0
3	07/12/1995	<0.020	3.854	0.123	--	<0.010	2.5	--	--	--	--	<0.10	--	1.0
3	08/23/1995	<0.020	3.378	0.121	--	0.028	1.1	--	--	--	--	<0.10	--	<1.0
3	10/05/1995	<0.020	3.002	0.272	--	0.057	1.2	--	--	--	--	<0.10	--	<1.0
3	11/17/1995	<0.020	3.087	0.144	--	0.054	2.1	--	--	--	--	<0.10	--	<1.0
3	05/15/1996	0.025	2.164	0.126	--	0.024	--	--	--	--	--	0.10	--	1.0
3	08/07/1996	<0.020	2.991	0.084	--	0.082	1.6	--	--	--	--	0.10	--	<1.0
3	03/26/1997	--	2.070	--	--	--	--	--	--	--	--	--	--	--
3	04/30/1997	<0.020	2.684	<0.050	--	0.026	--	--	--	--	--	<0.20	--	1.5
3	07/10/1997	<0.020	2.690	0.243	--	0.026	2.5	--	--	--	--	<0.20	--	<1.0
3	09/23/1997	<0.020	2.638	0.104	--	0.025	1.9	--	--	--	--	<0.20	--	<1.0
3	01/15/1998	--	1.467	--	--	--	--	--	--	--	--	--	--	--
3	04/30/1998	--	3.004	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
3	08/18/1998	<0.020	2.610	0.076	--	0.042	1.0	--	--	--	--	<0.20	--	1.3
3	01/13/1999	<0.020	2.598	<0.050	--	0.083	--	--	--	--	--	<0.20	--	<1.0
3	04/21/1999	--	3.363	--	--	--	--	--	--	--	--	<0.20	--	<1.0
3	07/16/1999	<0.020	3.491	<0.050	--	<0.010	1.0	--	--	--	--	<0.20	--	1.1
3	11/30/1999	<0.020	2.390	0.050	--	0.030	--	--	--	--	--	<0.20	--	<1.0
3	02/08/2000	--	2.103	--	--	--	--	--	--	--	--	<0.20	--	<1.0
3	05/17/2000	--	3.170	--	--	--	--	--	--	--	--	<0.20	--	<1.0
3	08/24/2000	<0.020	2.528	<0.050	--	0.057	<2.0	--	--	--	--	<0.20	--	<1.0
3	11/16/2000	<0.020	2.010	0.058	--	0.029	--	--	--	--	--	<0.20	--	<1.0
3	02/21/2001	--	1.660	--	--	--	--	--	--	--	--	<0.20	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
3	05/15/2001	--	2.990	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
3	08/08/2001	<0.020	2.712	<0.050	--	0.027	3.3	--	--	--	--	<0.20	--	<1.0
3	11/06/2001	<0.020	2.670	0.105	--	0.021	--	--	--	--	--	<0.20	--	1.1
3	02/11/2002	--	1.954	0.434	--	--	<2.0	--	--	--	--	<0.20	--	<1.0
3	05/15/2002	--	2.292	0.256	--	--	--	--	--	--	--	<0.20	--	1.5
3	08/12/2002	0.032	3.330	0.207	--	0.031	<2.0	--	--	--	--	--	--	<1.0
3	11/02/2002	<0.020	2.600	0.130	--	0.040	<2.0	--	--	--	--	<0.20	--	<2.6
3	02/26/2003	--	1.780	0.024	--	--	--	--	--	--	--	--	--	<2.0
3	05/28/2003	--	4.090	0.050	--	--	--	--	--	--	--	--	--	<2.0
3	08/16/2003	0.024	3.724	0.199	--	0.019	<2.0	--	--	--	--	--	--	<2.0
3	11/19/2003	<0.020	2.962	<0.100	--	0.012	<2.0	--	--	--	--	<0.20	--	<1.0
3	02/25/2004	--	2.400	<0.100	--	--	--	--	--	--	--	<0.20	--	<1.0
3	05/20/2004	--	2.630	<0.100	--	--	--	--	--	--	--	<0.20	--	<2.0
3	08/24/2004	0.024	3.130	0.114	--	0.023	<2.0	--	--	--	--	<0.20	--	<2.0
3	11/17/2004	<0.020	4.980	0.080	--	0.049	<2.0	--	--	--	--	<0.20	--	<2.0
4	10/29/1984	--	2.480	--	--	--	--	--	--	--	--	--	--	--
4	02/12/1985	--	0.900	--	--	--	--	--	--	--	--	--	--	--
4	06/26/1985	--	1.220	--	--	--	--	--	--	--	--	--	--	--
4	10/02/1985	--	0.620	--	--	--	--	--	--	--	--	--	--	--
4	05/28/1986	<0.020	4.550	0.030	--	<0.010	--	--	--	--	--	--	--	--
4	09/24/1986	<0.020	1.850	0.100	--	<0.010	--	--	--	--	--	--	--	--
4	11/18/1986	--	0.860	--	--	--	--	--	--	--	--	--	--	--
4	12/10/1986	--	1.150	--	--	--	3.1	75	<0.20	180	658	0.15	4.00	<0.5
4	03/10/1987	<0.020	0.670	0.070	--	<0.010	2.9	70	0.28	240	625	<0.10	3.50	2.4
4	06/23/1987	<0.020	1.260	0.110	--	0.010	3.0	70	<0.20	60	468	<0.10	4.60	2.3
4	09/15/1987	<0.020	0.720	0.260	--	0.010	2.8	80	<0.20	90	455	<0.10	2.30	2.7
4	02/25/1988	<0.020	0.380	0.100	--	0.010	--	--	--	--	--	--	--	--
4	06/08/1988	<0.020	0.430	0.070	--	0.010	--	--	--	--	--	--	--	--
4	07/13/1988	<0.020	0.490	0.120	--	0.010	--	--	--	--	--	--	--	--
4	09/14/1988	<0.020	0.460	<0.050	--	0.020	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
4	11/30/1988	<0.020	0.330	0.040	--	0.010	--	--	--	--	--	--	--	--
4	05/04/1989	<0.020	1.000	0.140	--	0.010	--	--	--	--	--	--	--	--
4	05/24/1989	<0.020	0.790	0.170	--	0.020	--	--	--	--	--	--	--	--
4	06/23/1989	<0.020	0.950	0.110	--	0.020	--	--	--	--	--	--	--	--
4	07/27/1989	<0.020	0.880	0.120	--	--	--	--	--	--	--	--	--	--
4	08/23/1989	<0.020	0.970	0.120	--	0.030	--	--	--	--	--	--	--	--
4	09/13/1989	<0.020	0.810	0.150	--	0.020	--	--	--	--	--	--	--	--
4	10/25/1989	<0.020	1.050	0.120	--	0.030	--	--	--	--	--	--	--	--
4	11/30/1989	<0.020	0.800	0.130	--	0.030	--	--	--	--	--	--	--	--
4	01/24/1990	<0.020	1.060	0.100	--	0.030	--	--	--	--	--	--	--	--
4	03/01/1990	<0.020	0.730	0.170	--	0.030	--	--	--	--	--	--	--	--
4	03/29/1990	<0.020	0.840	0.130	--	0.060	--	--	--	--	--	--	--	--
4	05/02/1990	<0.020	1.170	0.210	--	0.020	--	--	--	--	--	--	--	--
4	05/24/1990	<0.020	1.580	0.200	--	0.030	--	--	--	--	--	--	--	--
4	06/19/1990	<0.020	2.020	0.160	--	0.020	--	--	--	--	--	--	--	--
4	07/17/1990	<0.020	1.940	0.180	--	0.020	--	--	--	--	--	--	--	--
4	08/09/1990	<0.020	1.510	0.090	--	0.020	--	--	--	--	--	--	--	--
4	09/11/1990	<0.020	1.180	0.110	--	0.010	--	--	--	--	--	--	--	--
4	10/11/1990	<0.020	1.030	0.140	--	0.020	--	--	--	--	--	--	--	--
4	11/13/1990	<0.020	1.020	0.170	--	0.130	--	--	--	--	--	--	--	--
4	12/11/1990	<0.020	1.090	0.170	--	0.040	--	--	--	--	--	--	--	--
4	01/16/1991	<0.020	0.860	0.220	--	0.040	--	--	--	--	--	--	--	--
4	02/20/1991	<0.020	0.970	0.140	--	0.020	--	--	--	--	--	--	--	--
4	03/13/1991	<0.020	0.960	0.190	--	0.020	--	--	--	--	--	--	--	--
4	04/10/1991	<0.020	0.950	0.130	--	0.010	--	--	--	--	--	--	--	--
4	05/08/1991	<0.020	2.500	0.180	--	0.020	3.0	--	--	--	--	<0.10	--	2.7
4	06/13/1991	<0.020	5.120	0.200	--	0.020	--	--	--	--	--	--	--	--
4	07/17/1991	<0.020	5.100	0.130	--	0.020	--	--	--	--	--	--	--	--
4	08/20/1991	<0.020	3.480	0.230	--	0.020	4.0	--	--	--	--	<0.10	--	2.0
4	09/18/1991	<0.020	3.130	0.150	--	0.030	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
4	10/24/1991	<0.020	2.090	0.140	--	0.030	--	--	--	--	--	--	--	--
4	11/14/1991	<0.020	1.970	0.160	--	0.020	--	--	--	--	--	--	--	--
4	12/11/1991	<0.020	1.770	0.110	--	0.020	2.9	--	--	--	--	<0.10	--	2.0
4	01/15/1992	<0.020	1.570	0.130	--	0.010	--	--	--	--	--	--	--	--
4	02/12/1992	<0.020	1.690	0.110	--	0.020	2.2	--	--	--	--	<0.10	--	1.7
4	03/12/1992	--	1.750	--	--	--	--	--	--	--	--	--	--	--
4	04/14/1992	--	2.030	--	--	--	--	--	--	--	--	--	--	--
4	05/26/1992	<0.020	0.390	0.240	--	0.010	<1.0	--	--	--	--	<0.10	--	<1.0
4	06/16/1992	--	1.120	--	--	--	--	--	--	--	--	--	--	--
4	07/22/1992	--	2.494	0.190	--	--	--	--	--	--	--	--	--	--
4	08/18/1992	<0.020	2.647	0.185	--	0.019	--	--	--	--	--	--	--	--
4	09/15/1992	<0.020	2.383	0.189	--	0.022	--	--	--	--	--	--	--	--
4	10/22/1992	--	2.039	--	--	--	--	--	--	--	--	--	--	--
4	12/01/1992	<0.020	1.778	0.060	--	0.022	4.5	--	--	--	--	<0.10	--	1.1
4	02/11/1993	<0.020	1.430	0.140	--	0.030	4.4	--	--	--	--	<0.10	--	1.3
4	03/16/1993	--	1.360	--	--	--	--	--	--	--	--	--	--	--
4	04/22/1993	--	2.265	--	--	--	--	--	--	--	--	--	--	--
4	05/21/1993	<0.020	1.334	0.189	--	0.014	1.2	--	--	--	--	--	--	<1.0
4	06/08/1993	<0.020	2.078	0.152	--	0.017	--	--	--	--	--	--	--	--
4	07/08/1993	--	3.460	--	--	--	--	--	--	--	--	--	--	--
4	08/10/1993	<0.020	3.676	0.155	--	0.024	2.8	--	--	--	--	<0.10	--	1.1
4	10/05/1993	--	3.050	--	--	--	--	--	--	--	--	--	--	--
4	10/28/1993	--	2.550	--	--	--	--	--	--	--	--	--	--	--
4	03/24/1994	0.032	6.020	0.181	--	0.028	2.8	--	--	--	--	<0.20	--	1.5
4	04/20/1994	--	2.819	--	--	--	--	--	--	--	--	--	--	--
4	06/03/1994	<0.020	3.555	0.145	--	0.017	2.0	--	--	--	--	<0.20	--	<2.0
4	06/30/1994	--	3.000	<0.050	--	--	--	--	--	--	--	--	--	--
4	08/03/1994	--	3.716	0.141	--	--	--	--	--	--	--	--	--	--
4	08/30/1994	<0.020	3.854	0.136	--	0.014	--	--	--	--	--	--	--	--
4	10/06/1994	--	3.466	0.142	--	--	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
4	11/15/1994	<0.020	3.154	0.256	--	0.020	2.3	--	--	--	--	--	--	<1.0
4	01/26/1995	--	2.337	<0.050	--	--	--	--	--	--	--	--	--	--
4	03/02/1995	<0.020	1.923	<0.050	--	<0.010	2.0	--	--	--	--	<0.10	--	<1.0
4	04/20/1995	--	3.230	--	--	--	--	--	--	--	--	--	--	--
4	05/17/1995	<0.020	3.884	0.177	--	0.033	1.8	--	--	--	--	<0.10	--	<1.0
4	06/07/1995	--	3.680	0.154	--	--	--	--	--	--	--	--	--	--
4	07/12/1995	--	4.414	0.104	--	--	--	--	--	--	--	--	--	--
4	08/23/1995	<0.020	3.798	0.153	--	0.020	3.3	--	--	--	--	0.24	--	<1.0
4	10/05/1995	--	2.949	0.221	--	--	--	--	--	--	--	--	--	--
4	11/17/1995	<0.020	2.331	0.164	--	0.014	1.6	--	--	--	--	<0.10	--	<1.0
4	05/15/1996	<0.020	2.036	0.164	--	<0.010	--	--	--	--	--	0.10	--	1.0
4	08/07/1996	<0.020	2.853	0.081	--	0.058	2.4	--	--	--	--	0.10	--	<1.0
4	03/26/1997	--	1.589	--	--	--	--	--	--	--	--	--	--	--
4	04/30/1997	0.061	2.930	<0.050	--	<0.010	--	--	--	--	--	<0.20	--	<1.0
4	07/10/1997	<0.020	3.237	0.097	--	<0.010	2.0	--	--	--	--	<0.20	--	<1.0
4	09/23/1997	<0.020	2.095	0.089	--	0.011	3.3	--	--	--	--	<0.20	--	<1.0
4	01/15/1998	--	1.568	--	--	--	--	--	--	--	--	--	--	--
4	04/30/1998	--	2.198	<0.050	--	--	--	--	--	--	--	<0.20	--	1.1
4	08/18/1998	<0.020	3.414	0.075	--	0.023	2.2	--	--	--	--	<0.20	--	1.8
4	01/13/1999	<0.020	2.802	<0.050	--	0.142	--	--	--	--	--	<0.20	--	<1.0
4	04/21/1999	--	1.819	--	--	--	--	--	--	--	--	<0.20	--	<1.0
4	07/16/1999	<0.020	2.918	<0.050	--	<0.010	1.7	--	--	--	--	<0.20	--	1.0
4	11/30/1999	<0.020	1.720	<0.050	--	<0.010	--	--	--	--	--	<0.20	--	<1.0
4	02/08/2000	--	1.486	--	--	--	--	--	--	--	--	<0.20	--	<1.0
4	05/17/2000	--	1.840	--	--	--	--	--	--	--	--	<0.20	--	<1.0
4	08/24/2000	<0.020	1.735	<0.050	--	0.012	2.3	--	--	--	--	<0.20	--	<1.0
4	11/16/2000	<0.020	1.366	<0.050	--	0.017	--	--	--	--	--	<0.20	--	<1.0
4	02/21/2001	--	1.170	--	--	--	--	--	--	--	--	<0.20	--	<1.0
4	05/15/2001	--	2.310	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
4	08/08/2001	<0.020	3.033	<0.050	--	0.012	2.6	--	--	--	--	<0.20	--	1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
4	11/06/2001	<0.020	2.018	<0.050	--	0.011	--	--	--	--	--	<0.20	--	1.4
4	02/11/2002	--	1.072	0.163	--	--	<2.0	--	--	--	--	<0.20	--	<1.0
4	05/15/2002	--	1.589	0.215	--	--	--	--	--	--	--	<0.20	--	1.3
4	08/12/2002	<0.020	3.354	0.171	--	<0.010	3.0	--	--	--	--	--	--	<1.0
4	11/21/2002	<0.020	2.585	0.055	--	0.044	9.3	--	--	--	--	<0.20	--	<2.6
4	02/26/2003	--	0.700	0.058	--	--	--	--	--	--	--	--	--	<2.0
4	05/28/2003	--	2.730	0.050	--	--	--	--	--	--	--	--	--	<2.0
4	08/19/2003	<0.020	3.305	0.182	--	<0.010	<2.0	--	--	--	--	--	--	<2.0
4	11/19/2003	<0.020	2.700	<0.100	--	0.022	5.5	--	--	--	--	<0.20	--	<1.0
4	02/25/2004	--	1.215	0.182	--	--	--	--	--	--	--	<0.20	--	<1.0
4	05/20/2004	--	1.579	<0.100	--	--	--	--	--	--	--	<0.20	--	<2.0
4	08/24/2004	<0.020	2.300	<0.100	--	<0.010	<2.0	--	--	--	--	<0.20	--	<2.0
4	11/17/2004	<0.020	3.120	0.040	--	0.015	<2.0	--	--	--	--	<0.20	--	2.1
5	09/24/1986	--	1.680	--	--	--	--	--	--	--	--	--	--	--
5	12/18/1986	--	1.780	--	--	--	--	--	--	--	--	--	--	--
5	06/23/1987	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
5	09/15/1987	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
5	02/25/1988	<0.020	0.470	0.200	--	0.030	--	--	--	--	--	--	--	--
5	06/08/1988	<0.020	0.250	0.050	--	<0.010	--	--	--	--	--	--	--	--
5	07/13/1988	<0.020	<0.100	0.180	--	0.040	--	--	--	--	--	--	--	--
5	11/30/1988	<0.020	0.890	0.160	--	0.050	--	--	--	--	--	--	--	--
5	05/04/1989	<0.020	0.760	0.160	--	0.010	--	--	--	--	--	--	--	--
5	05/24/1989	<0.020	<0.100	0.160	--	0.060	--	--	--	--	--	--	--	--
5	06/23/1989	<0.020	<0.100	0.230	--	0.030	--	--	--	--	--	--	--	--
5	07/27/1989	<0.020	<0.100	0.130	--	--	--	--	--	--	--	--	--	--
5	08/23/1989	<0.020	0.210	0.140	--	0.030	--	--	--	--	--	--	--	--
5	09/13/1989	<0.020	<0.100	0.110	--	0.010	--	--	--	--	--	--	--	--
5	10/25/1989	<0.020	<0.100	0.120	--	0.020	--	--	--	--	--	--	--	--
5	12/01/1989	0.020	0.390	0.320	--	0.060	--	--	--	--	--	--	--	--
5	03/29/1990	<0.020	<0.100	0.060	--	0.040	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
5	05/02/1990	<0.020	0.290	0.130	--	0.070	--	--	--	--	--	--	--	--
5	05/24/1990	<0.020	<0.100	0.140	--	0.040	--	--	--	--	--	--	--	--
5	06/19/1990	<0.020	<0.100	0.140	0.160	0.100	3.0	--	--	--	--	--	--	<1.0
5	07/17/1990	<0.020	<0.100	0.170	--	0.030	--	--	--	--	--	--	--	--
5	08/09/1990	<0.020	<0.100	0.290	--	0.040	--	--	--	--	--	--	--	--
5	11/13/1990	<0.020	<0.100	0.370	--	0.290	--	--	--	--	--	--	--	--
5	12/11/1990	<0.020	0.160	0.210	--	0.090	--	--	--	--	--	--	--	--
5	03/14/1991	<0.020	0.420	0.610	--	0.120	1.5	--	--	--	--	<0.10	--	<1.0
5	04/10/1991	<0.020	<0.100	0.150	--	0.130	2.1	--	--	--	--	--	--	<1.0
5	04/23/1991	<0.020	<0.100	0.180	--	0.070	3.0	--	--	--	--	--	--	<1.0
5	05/07/1991	<0.020	1.170	0.270	--	0.050	3.0	--	--	--	--	<0.10	--	1.7
5	05/20/1991	0.020	0.150	0.290	--	0.070	2.0	--	--	--	--	<0.10	--	1.1
5	06/13/1991	0.020	0.800	0.250	--	0.030	3.0	--	--	--	--	<0.10	--	<1.0
5	07/17/1991	0.170	1.480	0.280	--	0.020	4.0	--	--	--	--	<0.10	--	2.0
5	08/20/1991	<0.020	<0.100	0.460	--	0.040	3.0	--	--	--	--	<0.10	--	<1.0
5	09/18/1991	<0.020	<0.100	0.230	--	0.060	3.0	--	--	--	--	<0.10	--	<1.0
5	10/24/1991	<0.020	<0.100	0.140	--	0.010	3.2	--	--	--	--	<0.10	--	<1.0
5	11/14/1991	0.060	1.220	0.380	--	0.080	4.1	--	--	--	--	<0.10	--	<1.0
5	12/11/1991	0.050	1.430	0.320	--	0.060	3.3	--	--	--	--	<0.10	--	<1.0
5	01/15/1992	0.050	1.610	0.490	--	0.040	2.6	--	--	--	--	<0.10	--	1.0
5	02/12/1992	0.020	1.200	0.200	--	0.020	2.5	--	--	--	--	<0.10	--	<1.0
5	03/12/1992	--	1.030	--	--	--	3.2	--	--	--	--	<0.10	--	<1.0
5	04/13/1992	--	0.330	--	--	--	1.4	--	--	--	--	<0.10	--	1.7
5	05/26/1992	<0.020	0.280	0.120	--	0.060	2.4	--	--	--	--	<0.10	--	<1.0
5	06/17/1992	0.020	0.100	0.360	--	0.070	1.7	--	--	--	--	<0.10	--	<1.0
5	07/22/1992	--	<0.100	0.161	--	--	1.4	--	--	--	--	<0.10	--	<1.0
5	08/20/1992	<0.020	<0.100	0.183	--	0.030	<1.0	--	--	--	--	0.11	--	<1.0
5	09/16/1992	<0.020	<0.100	0.277	--	0.067	<1.0	--	--	--	--	<0.10	--	<1.0
5	10/22/1992	--	0.553	--	--	--	5.9	--	--	--	--	<0.10	--	<1.0
5	12/02/1992	<0.020	1.690	0.068	--	0.097	3.6	--	--	--	--	<0.10	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
5	02/11/1993	0.050	1.740	0.529	--	0.070	3.4	--	--	--	--	<0.10	--	1.1
5	03/16/1993	--	0.160	--	--	--	5.0	--	--	--	--	<0.10	--	1.5
5	04/22/1993	--	0.776	--	--	--	2.5	--	--	--	--	<0.10	--	<1.0
5	05/21/1993	<0.020	0.180	0.176	--	0.018	2.2	--	--	--	--	<0.10	--	<1.0
5	06/10/1993	0.024	0.100	0.179	--	0.032	2.3	--	--	--	--	<0.10	--	<1.0
5	07/08/1993	--	<0.100	--	--	--	3.9	--	--	--	--	<0.10	--	<1.0
5	08/12/1993	<0.020	<0.100	0.155	--	0.073	2.6	--	--	--	--	<0.10	--	<1.0
5	10/05/1993	--	<0.100	--	--	--	2.4	--	--	--	--	<0.10	--	<1.0
5	10/28/1993	--	<0.100	--	--	--	2.1	--	--	--	--	<0.10	--	<1.0
5	03/24/1994	0.050	1.120	0.536	--	0.119	2.1	--	--	--	--	<0.20	--	<1.0
5	04/20/1994	--	<0.100	--	--	--	2.4	--	--	--	--	<0.20	--	<1.0
5	06/03/1994	0.067	0.630	0.345	--	0.022	3.0	--	--	--	--	<0.20	--	<2.0
5	06/29/1994	<0.020	<0.100	0.243	--	0.031	2.1	--	--	--	--	<0.20	--	<1.0
5	08/03/1994	<0.020	<0.100	0.369	--	0.062	3.3	--	--	--	--	<0.20	--	<4
5	08/30/1994	<0.020	<0.100	0.094	--	<0.010	2.1	--	--	--	--	<0.20	--	<2.0
5	10/06/1994	<0.020	1.150	0.555	--	<0.010	2.0	--	--	--	--	<0.20	--	<1.0
5	11/15/1994	0.040	2.290	<0.050	--	0.010	2.6	--	--	--	--	--	--	<1.0
5	08/23/1995	<0.020	<0.100	0.173	--	0.095	4.0	--	--	--	--	0.29	--	<1.0
5	10/05/1995	0.061	0.800	1.105	--	0.069	2.4	--	--	--	--	<0.10	--	<1.0
5	11/17/1995	0.063	2.760	0.314	--	0.086	3.1	--	--	--	--	0.18	--	<1.0
5	05/15/1996	<0.020	<0.100	0.094	--	0.092	--	--	--	--	--	0.10	--	<1.0
5	08/07/1996	0.061	<0.100	0.147	--	0.085	3.6	--	--	--	--	0.10	--	<1.0
5	03/26/1997	--	1.420	--	--	--	--	--	--	--	--	--	--	--
5	07/10/1997	<0.020	<0.100	0.098	--	0.026	2.9	--	--	--	--	<0.20	--	<1.0
5	09/23/1997	0.030	<0.100	0.234	--	0.013	1.6	--	--	--	--	<0.20	--	<1.0
5	01/15/1998	--	1.710	--	--	--	--	--	--	--	--	--	--	--
5	04/30/1998	--	0.289	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
5	08/18/1998	0.067	0.420	0.246	--	0.020	2.6	--	--	--	--	<0.20	--	<1.0
5	01/13/1999	<0.020	2.479	<0.050	--	<0.010	2.0	--	--	--	--	<0.20	--	<1.0
5	04/21/1999	--	0.185	--	--	--	--	--	--	--	--	<0.20	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
5	07/16/1999	<0.020	<0.100	<0.050	--	<0.010	3.0	--	--	--	--	<0.20	--	<1.0
5	11/30/1999	0.040	1.700	0.080	--	0.020	--	--	--	--	--	<0.20	--	<1.0
5	02/08/2000	--	1.541	--	--	--	--	--	--	--	--	<0.20	--	<1.0
5	05/17/2000	--	0.470	--	--	--	--	--	--	--	--	<0.20	--	<1.0
5	08/24/2000	<0.020	0.120	<0.050	--	0.020	3.7	--	--	--	--	<0.20	--	<1.0
5	11/16/2000	0.035	0.950	0.171	--	0.011	--	--	--	--	--	<0.20	--	--
5	02/21/2001	--	1.380	--	--	--	--	--	--	--	--	<0.20	--	<1.0
5	05/15/2001	--	<0.100	0.130	--	--	--	--	--	--	--	<0.20	--	<1.0
5	08/08/2001	<0.020	<0.100	<0.050	--	0.017	3.5	--	--	--	--	<0.20	--	<1.0
5	11/06/2001	0.055	1.070	0.456	--	0.014	--	--	--	--	--	<0.20	--	<1.0
5	02/11/2002	--	1.190	0.151	--	--	2.8	--	--	--	--	<0.20	--	<1.0
5	05/15/2002	--	0.129	0.435	--	--	--	--	--	--	--	<0.20	--	1.1
5	08/12/2002	0.107	1.450	0.518	--	0.010	5.1	--	--	--	--	--	--	<1.0
5	11/21/2002	0.035	1.630	0.226	--	0.011	4.4	--	--	--	--	<0.20	--	<2.6
5	02/26/2003	--	1.251	0.045	--	--	--	--	--	--	--	--	--	<2.0
5	05/28/2003	--	0.459	<0.050	--	--	--	--	--	--	--	--	--	<2.0
5	08/16/2003	0.075	0.250	0.542	--	<0.010	7.6	--	--	--	--	--	--	<2.0
5	11/19/2003	0.100	1.700	0.656	--	0.019	5.4	--	--	--	--	<0.20	--	<1.0
5	02/25/2004	--	1.665	0.200	--	--	--	--	--	--	--	<0.20	--	<1.0
5	05/20/2004	--	0.100	<0.100	--	--	--	--	--	--	--	<0.20	--	<2.0
5	08/24/2004	0.052	0.252	0.877	--	0.013	5.0	--	--	--	--	<0.20	--	<2.0
5	11/17/2004	0.047	2.860	0.150	--	0.030	2.4	--	--	--	--	<0.20	--	<2.0
6	10/02/1985	--	2.980	--	--	--	--	--	--	--	--	--	--	--
6	05/28/1986	<0.020	4.930	<0.050	--	<0.010	--	--	--	--	--	--	--	--
6	09/24/1986	--	4.440	--	--	--	--	--	--	--	--	--	--	--
6	11/18/1986	--	2.150	--	--	--	--	--	--	--	--	--	--	--
6	12/10/1986	--	2.680	--	--	--	2.5	--	--	--	--	0.10	--	<0.5
6	03/10/1987	<0.020	1.720	0.050	--	0.010	2.3	90	0.37	100	411	<0.10	4.70	1.3
6	06/23/1987	<0.020	3.130	0.100	--	0.020	2.3	80	<0.20	60	160	<0.10	4.60	2.3
6	09/15/1987	<0.020	2.130	0.270	--	0.020	3.5	100	<0.20	50	280	<0.10	3.50	1.3

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
6	02/25/1988	<0.020	0.470	0.200	--	0.030	--	--	--	--	--	--	--	--
6	06/08/1988	--	1.690	--	--	--	--	--	--	--	--	--	--	--
6	07/13/1988	<0.020	2.770	0.150	--	0.030	--	--	--	--	--	--	--	--
6	09/14/1988	<0.020	2.500	<0.050	--	0.030	--	--	--	--	--	--	--	--
6	11/30/1988	<0.020	1.970	0.070	--	0.020	--	--	--	--	--	--	--	--
6	05/04/1989	<0.020	6.500	0.130	--	0.020	--	--	--	--	--	--	--	--
6	05/24/1989	<0.020	3.300	0.170	--	0.020	--	--	--	--	--	--	--	--
6	06/23/1989	<0.020	2.930	0.110	--	0.010	--	--	--	--	--	--	--	--
6	07/27/1989	<0.020	6.000	0.090	--	--	--	--	--	--	--	--	--	--
6	08/23/1989	<0.020	7.570	0.090	--	0.050	--	--	--	--	--	--	--	--
6	09/13/1989	<0.020	6.180	0.100	--	0.040	--	--	--	--	--	--	--	--
6	10/25/1989	<0.020	3.740	0.100	--	0.030	--	--	--	--	--	--	--	--
6	11/30/1989	<0.020	3.070	0.260	--	0.030	--	--	--	--	--	--	--	--
6	01/24/1990	<0.020	2.710	0.110	--	0.040	--	--	--	--	--	--	--	--
6	03/01/1990	<0.020	2.400	0.110	--	0.030	--	--	--	--	--	--	--	--
6	03/29/1990	<0.020	2.530	0.080	--	0.060	--	--	--	--	--	--	--	--
6	05/02/1990	<0.020	2.390	0.170	--	0.030	--	--	--	--	--	--	--	--
6	05/24/1990	<0.020	2.390	0.210	--	0.030	--	--	--	--	--	--	--	--
6	06/19/1990	<0.020	2.630	0.090	0.100	0.030	2.0	--	--	--	--	--	--	1.4
6	07/17/1990	<0.020	3.290	0.150	--	0.030	--	--	--	--	--	--	--	--
6	08/09/1990	<0.020	6.780	0.100	--	0.030	--	--	--	--	--	--	--	--
6	09/11/1990	<0.020	6.790	0.140	--	0.030	--	--	--	--	--	--	--	--
6	10/11/1990	<0.020	4.270	0.120	--	0.070	--	--	--	--	--	--	--	--
6	11/13/1990	<0.020	4.210	0.280	--	0.150	--	--	--	--	--	--	--	--
6	12/11/1990	<0.020	3.850	0.140	--	0.030	--	--	--	--	--	--	--	--
6	01/16/1991	<0.020	3.470	0.390	--	0.040	--	--	--	--	--	--	--	--
6	02/20/1991	<0.020	2.970	0.140	--	0.020	--	--	--	--	--	--	--	--
6	03/14/1991	<0.020	2.880	0.170	--	0.020	--	--	--	--	--	--	--	--
6	04/10/1991	<0.020	3.100	0.170	--	0.020	--	--	--	--	--	--	--	--
6	04/23/1991	<0.020	2.970	0.170	--	0.020	2.9	--	--	--	--	--	--	2.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
6	05/08/1991	<0.020	3.270	0.270	--	0.020	3.0	--	--	--	--	<0.10	--	3.1
6	05/21/1991	<0.020	2.880	0.150	--	0.020	3.0	--	--	--	--	<0.10	--	3.0
6	06/13/1991	<0.020	5.000	0.220	--	0.020	3.0	--	--	--	--	0.10	--	3.0
6	07/17/1991	<0.020	5.170	0.140	--	0.020	3.0	--	--	--	--	0.10	--	2.0
6	08/20/1991	<0.020	4.990	0.280	--	0.010	2.0	--	--	--	--	<0.10	--	3.0
6	09/18/1991	<0.020	6.060	0.220	--	0.030	3.0	--	--	--	--	<0.10	--	2.0
6	10/24/1991	<0.020	4.730	0.140	--	0.030	4.3	--	--	--	--	<0.10	--	2.0
6	11/14/1991	<0.020	4.690	0.140	--	0.030	4.0	--	--	--	--	<0.10	--	2.0
6	12/11/1991	<0.020	4.130	0.110	--	0.030	4.3	--	--	--	--	<0.10	--	1.5
6	01/15/1992	<0.020	3.700	0.120	--	0.020	2.8	--	--	--	--	<0.10	--	1.5
6	02/12/1992	<0.020	3.520	0.110	--	0.030	2.0	--	--	--	--	<0.10	--	1.3
6	03/12/1992	--	3.560	--	--	--	2.8	--	--	--	--	<0.10	--	2.0
6	04/14/1992	--	2.830	--	--	--	<1.0	--	--	--	--	<0.10	--	1.9
6	05/26/1992	<0.020	3.320	0.090	--	0.030	2.2	--	--	--	--	0.18	--	2.5
6	06/16/1992	<0.020	4.240	0.170	--	0.040	2.8	--	--	--	--	<0.10	--	1.0
6	07/22/1992	--	5.819	0.159	--	--	3.9	--	--	--	--	<0.10	--	1.3
6	08/18/1992	<0.020	6.397	0.120	--	0.034	2.5	--	--	--	--	<0.10	--	1.7
6	09/15/1992	<0.020	5.437	0.202	--	0.023	4.2	--	--	--	--	<0.10	--	2.4
6	10/22/1992	--	4.869	--	--	--	3.7	--	--	--	--	<0.10	--	1.2
6	12/01/1992	<0.020	3.680	<0.050	--	0.023	4.2	--	--	--	--	<0.10	--	1.6
6	03/16/1993	--	4.300	--	--	--	1.4	--	--	--	--	<0.10	--	1.6
6	04/22/1993	--	2.973	--	--	--	3.0	--	--	--	--	<0.10	--	<1.0
6	05/21/1993	<0.020	3.608	0.150	--	0.028	3.0	--	--	--	--	<0.10	--	1.9
6	06/08/1993	<0.020	3.863	0.164	--	0.030	3.2	--	--	--	--	<0.10	--	<1.0
6	07/08/1993	--	4.890	--	--	--	5.1	--	--	--	--	<0.10	--	1.7
6	08/10/1993	<0.020	4.824	0.177	--	0.035	5.0	--	--	--	--	<0.10	--	<1.0
6	10/05/1993	--	4.570	--	--	--	3.7	--	--	--	--	<0.10	--	<1.0
6	10/28/1993	--	3.780	--	--	--	3.3	--	--	--	--	<0.10	--	<1.0
6	03/24/1994	<0.020	2.416	0.219	--	0.067	4.2	--	--	--	--	<0.20	--	<1.0
6	04/20/1994	--	3.642	--	--	--	3.7	--	--	--	--	<0.20	--	1.3

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
6	06/03/1994	<0.020	4.585	0.170	--	0.030	3.0	--	--	--	--	<0.20	--	2.0
6	06/30/1994	<0.020	4.281	0.177	--	0.057	1.9	--	--	--	--	<0.20	--	<1.0
6	08/03/1994	<0.020	4.059	0.199	--	0.054	2.9	--	--	--	--	<0.20	--	<4
6	08/30/1994	<0.020	4.210	0.099	--	0.051	2.2	--	--	--	--	<0.20	--	<2.0
6	10/06/1994	<0.020	4.812	0.151	--	<0.010	3.3	--	--	--	--	<0.20	--	<1.0
6	11/15/1994	<0.020	4.560	0.191	--	0.040	3.0	--	--	--	--	--	--	<1.0
6	01/26/1995	<0.020	2.942	<0.050	--	<0.010	2.4	--	--	--	--	0.14	--	<1.0
6	03/02/1995	<0.020	2.473	<0.050	--	<0.010	2.1	--	--	--	--	<0.10	--	<1.0
6	04/20/1995	--	3.945	--	--	--	4.3	--	--	--	--	0.14	--	<1.0
6	05/17/1995	<0.020	4.398	0.155	--	0.059	3.3	--	--	--	--	<0.10	--	<1.0
6	06/07/1995	<0.020	5.807	0.092	--	0.060	4.0	--	--	--	--	<0.10	--	<1.0
6	07/12/1995	0.060	2.170	0.233	--	<0.010	4.6	--	--	--	--	<0.10	--	<1.0
6	08/23/1995	<0.020	4.657	0.097	--	0.030	4.1	--	--	--	--	0.11	--	<1.0
6	10/05/1995	<0.020	3.949	0.171	--	0.022	3.8	--	--	--	--	0.13	--	<1.0
6	11/17/1995	<0.020	3.687	0.120	--	0.051	4.6	--	--	--	--	<0.10	--	<1.0
6	05/15/1996	<0.020	2.497	0.115	--	0.021	--	--	--	--	--	0.10	--	1.0
6	08/07/1996	<0.020	3.685	0.053	--	0.079	4.6	--	--	--	--	0.10	--	<1.0
6	03/26/1997	--	2.450	--	--	--	--	--	--	--	--	--	--	--
6	04/30/1997	<0.020	0.204	<0.050	--	<0.010	--	--	--	--	--	<0.20	--	<1.0
6	07/10/1997	<0.020	3.570	0.082	--	0.025	4.1	--	--	--	--	<0.20	--	<1.0
6	09/23/1997	<0.020	4.800	0.055	--	0.012	3.2	--	--	--	--	<0.20	--	1.3
6	01/15/1998	--	1.680	--	--	--	--	--	--	--	--	--	--	--
6	04/30/1998	--	2.630	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
6	08/18/1998	<0.020	2.780	0.103	--	0.064	3.6	--	--	--	--	<0.20	--	1.6
6	01/13/1999	<0.020	1.470	<0.050	--	<0.010	--	--	--	--	--	<0.20	--	<1.0
6	04/21/1999	--	2.890	--	--	--	--	--	--	--	--	<0.20	--	<1.0
6	07/16/1999	<0.020	3.520	<0.050	--	0.013	3.2	--	--	--	--	<0.20	--	1.5
6	11/30/1999	<0.020	1.940	<0.050	--	0.030	--	--	--	--	--	<0.20	--	<1.0
6	02/08/2000	--	1.770	--	--	--	--	--	--	--	--	<0.20	--	<1.0
6	05/17/2000	--	2.380	--	--	--	--	--	--	--	--	<0.20	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
6	08/24/2000	<0.020	2.610	<0.050	--	0.032	4.8	--	--	--	--	<0.20	--	<1.0
6	11/16/2000	<0.020	1.800	<0.050	--	0.043	--	--	--	--	--	<0.20	--	<1.0
6	02/21/2001	--	0.940	--	--	--	--	--	--	--	--	<0.20	--	<1.0
6	05/15/2001	--	0.400	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0
6	08/08/2001	<0.020	3.670	<0.050	--	0.020	4.4	--	--	--	--	<0.20	--	<1.0
6	11/06/2001	<0.020	2.670	<0.050	--	0.036	--	--	--	--	--	<0.20	--	1.0
6	02/11/2002	--	1.800	0.083	--	--	2.8	--	--	--	--	<0.20	--	<1.0
6	05/15/2002	--	2.150	0.188	--	--	--	--	--	--	--	<0.20	--	<1.0
6	08/12/2002	<0.020	4.520	0.146	--	0.033	4.4	--	--	--	--	--	--	<1.0
6	11/02/2002	<0.020	2.950	0.073	--	0.044	4.3	--	--	--	--	<0.20	--	<2.6
6	02/26/2003	--	1.820	0.023	--	--	--	--	--	--	--	--	--	<2.0
6	05/28/2003	--	3.940	<0.020	--	--	--	--	--	--	--	--	--	<2.0
6	08/16/2003	<0.020	4.820	0.191	--	<0.010	4.2	--	--	--	--	--	--	<2.0
6	11/19/2003	<0.020	2.800	<0.100	--	0.017	3.6	--	--	--	--	<0.20	--	<1.0
6	02/25/2004	--	2.200	<0.100	--	--	--	--	--	--	--	<0.20	--	<1.0
6	05/20/2004	--	2.790	<0.100	--	--	--	--	--	--	--	<0.20	--	<2.0
6	08/24/2004	0.021	1.040	0.131	--	0.019	4.4	--	--	--	--	<0.20	--	<2.0
6	11/17/2004	<0.020	5.240	<0.050	--	0.045	3.7	--	--	--	--	<0.20	--	<2.0
7	06/19/1990	<0.020	<0.100	0.060	0.090	0.020	--	--	--	--	--	--	--	--
7	09/10/1990	<0.020	<0.100	0.140	--	0.090	--	--	--	--	--	--	--	--
7	10/10/1990	<0.020	<0.100	0.090	--	0.580	--	--	--	--	--	--	--	--
7	11/08/1990	<0.020	<0.100	0.360	--	0.270	--	--	--	--	--	--	--	--
7	12/11/1990	<0.020	<0.100	0.400	--	0.350	--	--	--	--	--	--	--	--
7	01/16/1991	<0.020	<0.100	2.580	--	0.890	--	--	--	--	--	--	--	--
7	02/20/1991	<0.020	<0.100	0.280	--	0.040	--	--	--	--	--	--	--	--
7	03/13/1991	<0.020	--	0.210	--	0.060	--	--	--	--	--	--	--	--
7	04/10/1991	<0.020	--	0.220	--	0.030	--	--	--	--	--	--	--	--
7	04/23/1991	<0.020	<0.100	0.140	--	<0.010	--	--	--	--	--	--	--	--
7	05/07/1991	<0.020	<0.100	0.210	--	0.010	--	--	--	--	--	--	--	--
7	05/20/1991	<0.020	<0.100	0.150	--	0.010	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
7	06/13/1991	<0.020	<0.100	0.200	--	0.020	--	--	--	--	--	--	--	--
7	07/17/1991	<0.020	<0.100	0.150	--	0.040	--	--	--	--	--	--	--	--
7	08/20/1991	<0.020	<0.100	0.170	--	0.030	--	--	--	--	--	--	--	--
7	09/18/1991	<0.020	<0.100	0.150	--	0.020	--	--	--	--	--	--	--	--
7	10/24/1991	<0.020	<0.100	0.110	--	0.010	--	--	--	--	--	--	--	--
7	11/14/1991	<0.020	<0.100	0.140	--	<0.010	--	--	--	--	--	--	--	--
7	12/12/1991	<0.020	<0.100	0.120	--	0.050	--	--	--	--	--	--	--	--
7	01/15/1992	<0.020	<0.100	0.240	--	0.090	--	--	--	--	--	--	--	--
7	02/12/1992	<0.020	0.160	0.140	--	0.170	--	--	--	--	--	--	--	--
7	03/12/1992	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	04/13/1992	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	05/26/1992	<0.020	<0.100	0.120	--	0.010	--	--	--	--	--	--	--	--
7	06/17/1992	<0.020	<0.100	0.160	--	0.030	--	--	--	--	--	--	--	--
7	07/23/1992	--	<0.100	0.203	--	--	--	--	--	--	--	--	--	--
7	08/19/1992	<0.020	<0.100	0.110	--	0.122	--	--	--	--	--	--	--	--
7	09/15/1992	<0.020	<0.100	0.162	--	0.040	--	--	--	--	--	--	--	--
7	10/22/1992	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	12/02/1992	<0.020	<0.100	0.055	--	0.119	--	--	--	--	--	--	--	--
7	04/22/1993	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	05/21/1993	<0.020	<0.100	0.245	--	0.033	--	--	--	--	--	--	--	--
7	06/10/1993	<0.020	--	0.159	--	0.025	--	--	--	--	--	--	--	--
7	07/07/1993	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	08/12/1993	<0.020	--	0.234	--	0.380	--	--	--	--	--	--	--	--
7	10/04/1993	--	0.130	--	--	--	--	--	--	--	--	--	--	--
7	10/28/1993	--	--	--	--	--	--	--	--	--	--	--	--	--
7	04/20/1994	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	06/03/1994	0.050	0.130	0.258	--	0.043	--	--	--	--	--	--	--	--
7	06/29/1994	<0.020	<0.100	0.173	--	0.073	--	--	--	--	--	--	--	--
7	08/03/1994	<0.020	<0.100	0.173	--	0.081	--	--	--	--	--	--	--	--
7	08/30/1994	<0.020	<0.100	<0.050	--	0.067	--	--	--	--	--	--	--	--

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
7	10/06/1994	<0.020	<0.100	0.121	--	<0.010	--	--	--	--	--	--	--	--
7	11/15/1994	<0.020	<0.100	0.159	--	0.140	--	--	--	--	--	--	--	--
7	01/26/1995	<0.020	0.661	0.201	--	0.040	--	--	--	--	--	--	--	--
7	03/02/1995	<0.020	0.807	<0.050	--	0.090	--	--	--	--	--	--	--	--
7	04/20/1995	--	0.364	--	--	--	--	--	--	--	--	--	--	--
7	05/17/1995	<0.020	<0.100	0.114	--	0.044	--	--	--	--	--	--	--	--
7	06/07/1995	<0.020	<0.100	0.104	--	0.190	--	--	--	--	--	--	--	--
7	07/12/1995	0.022	0.170	0.068	--	0.117	--	--	--	--	--	--	--	--
7	08/23/1995	0.027	<0.100	0.103	--	0.145	--	--	--	--	--	--	--	--
7	10/05/1995	--	<0.100	0.155	--	--	--	--	--	--	--	--	--	--
7	11/17/1995	<0.020	<0.100	0.102	--	0.088	--	--	--	--	--	--	--	--
7	05/15/1996	<0.020	<0.100	0.064	--	0.112	--	--	--	--	--	--	--	--
7	08/07/1996	<0.020	<0.100	0.079	--	0.056	--	--	--	--	--	--	--	--
7	03/26/1997	--	0.650	--	--	--	--	--	--	--	--	--	--	--
7	04/30/1997	<0.020	<0.100	<0.050	--	0.082	--	--	--	--	--	--	--	--
7	07/10/1997	0.058	0.280	0.080	--	0.215	--	--	--	--	--	--	--	--
7	09/23/1997	<0.020	0.311	0.057	--	0.338	--	--	--	--	--	--	--	--
7	01/15/1998	--	1.180	--	--	--	--	--	--	--	--	--	--	--
7	04/30/1998	--	<0.100	<0.050	--	--	--	--	--	--	--	--	--	--
7	08/18/1998	<0.020	<0.100	0.050	--	0.260	--	--	--	--	--	--	--	--
7	01/13/1999	0.025	0.780	0.310	--	0.446	--	--	--	--	--	--	--	--
7	04/21/1999	--	<0.100	--	--	--	--	--	--	--	--	--	--	--
7	07/16/1999	<0.020	<0.100	<0.050	--	<0.010	--	--	--	--	--	--	--	--
7	11/30/1999	<0.020	<0.100	<0.050	--	0.060	--	--	--	--	--	--	--	--
7	02/08/2000	--	0.980	--	--	--	--	--	--	--	--	<0.20	--	<1.0
7	05/17/2000	--	<0.100	--	--	--	--	--	--	--	--	<0.20	--	<1.0
7	08/24/2000	<0.020	<0.100	<0.050	--	0.335	6.3	--	--	--	--	<0.20	--	<1.0
7	11/16/2000	<0.020	0.223	<0.050	--	0.328	--	--	--	--	--	<0.20	--	<1.0
7	02/21/2001	--	3.410	--	--	--	--	--	--	--	--	<0.20	--	<1.0
7	05/15/2001	--	<0.100	<0.050	--	--	--	--	--	--	--	<0.20	--	<1.0

Supplement 4. Nutrients and trace elements for sampling sites in the Oakes Test Area, southeastern North Dakota, 1984 through 2004.—Continued

[Arsenic, boron, cadmium, iron, manganese, mercury, molybdenum, and selenium in micrograms per liter; other constituents in milligrams per liter; --, no data; <, less than; data not rounded]

Site	Date	Nitrite	Nitrate	Ammonia	Phosphorus, total	Orthophosphate	Arsenic	Boron	Cadmium	Iron	Manganese	Mercury	Molybdenum	Selenium
7	08/08/2001	<0.020	0.285	<0.050	--	0.502	9.1	--	--	--	--	<0.20	--	<1.0
7	11/06/2001	<0.020	<0.100	<0.050	--	0.155	--	--	--	--	--	<0.20	--	<1.0
7	02/11/2002	--	1.300	0.070	--	--	3.6	--	--	--	--	<0.20	--	<1.0
7	05/15/2002	--	<0.100	0.154	--	--	--	--	--	--	--	<0.20	--	<1.0
7	08/12/2002	<0.020	0.264	0.126	--	0.197	9.7	--	--	--	--	--	--	<1.0
7	11/21/2002	<0.020	0.205	0.080	--	0.823	4.9	--	--	--	--	<0.20	--	<2.6
7	02/26/2003	--	2.020	<0.020	--	--	--	--	--	--	--	--	--	<2.0
7	05/28/2003	--	0.100	<0.020	--	--	--	--	--	--	--	--	--	<2.0
7	08/16/2003	0.024	0.102	0.397	--	0.457	9.0	--	--	--	--	--	--	<2.0
7	11/19/2003	<0.020	<0.100	<0.100	--	0.342	6.4	--	--	--	--	<0.20	--	<1.0
7	02/25/2004	--	1.718	0.110	--	--	--	--	--	--	--	<0.20	--	<1.0
7	05/20/2004	--	0.328	0.262	--	--	--	--	--	--	--	<0.20	--	<2.0
7	08/24/2004	<0.020	<0.100	<0.100	--	0.121	4.6	--	--	--	--	<0.20	--	<2.0
7	11/17/2004	<0.020	0.100	<0.100	--	0.656	3.2	--	--	--	--	<0.20	--	<2.0

Manuscript approved for publication, April 3, 2007.

Prepared by the Helena Publishing Service Center.

For more information concerning the research in this report, contact:

U.S. Geological Survey
Director, North Dakota Water Science Center
821 E. Intersate Avenue
Bismarck, ND 58503–1199
http://nd.water.usgs.gov/

Ryberg—**Summary and Trend Analysis of Water-Quality Data for the Oakes Test Area, Southeastern North Dakota, 1984–2004**—SIR 2007–5056

Printed on recycled paper