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DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Steven M. Pirner, Secretary

DIVISION OF FINANCIAL AND TECHNICAL ASSISTANCE
David Templeton, Director

GEOLOGICAL SURVEY
Derric L. Iles, State Geologist

OPEN-FILE REPORT 88-UR

THE WALL LAKE AQUIFER STUDY

by

DRAGAN FILIPOVIC
and
STAN F. PENCE

Science Center
University of South Dakota
Vermillion, South Dakota

2001

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INTRODUCTION

This report was prepared to provide the results of a hydrogeological investigation of the Wall Lake aquifer near Sioux Falls, South Dakota. The area of investigation was predominantly west and southwest of the city of Sioux Falls, encompassing parts of Minnehaha, Lincoln, and Turner Counties (fig. 1).

The city of Sioux Falls currently obtains its water supply from both ground water and surface water. In past years, about 60 percent of the water supply came from ground water and 40 percent from the Big Sioux River (Greg Anderson, Sioux Falls Water Purification Plant, personal communication, 2000). As of June 2000, about 25 percent was coming from ground water and 75 percent from the Big Sioux River. The ground water is obtained from shallow sand and gravel deposits associated with the Big Sioux River and Skunk Creek valleys, and from a buried sand (Split Rock Creek aquifer) located in the southeast portion of Minnehaha County. Increasing demand for water has necessitated that the city find additional sources of water. This investigation of the Wall Lake aquifer was part of the city's effort to secure more water to meet future needs.

The Geological Survey Program, South Dakota Department of Environment and Natural Resources, conducted this study to determine the viability of the Wall Lake aquifer as a supplemental water source for the city of Sioux Falls. Fieldwork for this study began in June 1996 and continued through June 1998. The fieldwork included the drilling of 32 test holes, 10 of which were completed as monitoring wells, and the collection of 9 water samples for laboratory analysis. The locations of the test holes and monitoring wells are shown on figure 2.

METHODOLOGY

The general geology of the investigated area was determined by using data in files at the Geological Survey, by reviewing literature, and by drilling and logging of test holes. Water level data were collected from July 1998 through January 2000. All water level data used in this study were collected regularly from monitoring wells installed for this study. Water samples were collected for analysis of the general inorganic chemistry and trace metals. The Sioux Falls Water Purification Plant laboratory completed the analyses.

Field Methods

Test Hole Drilling

Thirty-two test holes, along with 10 monitoring wells (fig. 2 and app. A) were completed for this study from 1996 through 1998. Drilling was performed using the mud rotary method.

Samples were collected from the drill cuttings at 10-foot intervals. A Century brand geophysical logger was used to log many of the test holes for natural gamma radiation, spontaneous potential, and electrical resistivity. Samples of the cuttings, geophysical logs, the driller's log, and the geologist's log were used jointly to determine the composition of the material encountered while drilling. Additional information was obtained from logs of preexisting test holes and monitoring wells that had been completed for other projects in the area of study.

Monitoring Well Installation

Monitoring wells were completed in 10 of the test holes and were constructed using flush threaded, 2-inch diameter, schedule 80, polyvinyl chloride (PVC) casing and screen. The well screens were 10 feet long and contained 0.018-inch slots. Filter pack was placed through a tremie line to a depth that covered the entire screen and provided for settlement around the screen. Bentonite grout was then placed in the annular space from the top of the filter pack to a depth no less than 4 feet below ground surface. The remaining annular space was filled with cement grout up to the land surface. After placement of the cement grout, a locking steel well protector was installed (fig 3).

Well Development and Water Sampling

The monitoring wells installed for this study were developed with compressed air. Water was removed from all of the wells until water temperature and conductivity had stabilized, and the well water was clear. Nine water samples (five from the Wall Lake aquifer) were collected for this study and analyzed for general inorganic chemistry and trace metals.

At least 10 well volumes of water were pumped from the monitoring wells before a sample was collected. Temperature, pH, and conductivity were all monitored to ensure that these parameters had stabilized before a sample was collected. In all cases, water samples were collected from the screened interval of the monitoring wells using a clean polyethylene bailer.

Water Level Measurement

Water level data were collected beginning in July 1998. Water level data were used to determine the aquifer's response to meteorological events. The depths to water in the monitoring wells were measured to the nearest 0.01 foot using a Solinst electronic water level tape.

GENERAL GEOLOGY

Previous studies have identified three major units of rocks and sediments in the area. Results of test drilling for this study in this area generally agree with previous work. The three general lithologic units found in the study area are the Sioux Quartzite, the various Cretaceous-age sedimentary rocks, and glacial sediments. The oldest and stratigraphically lowest unit is the Precambrian-age Sioux Quartzite that underlies the entire study area. The quartzite is overlain by Cretaceous-age sedimentary rocks including the Dakota Formation, Graneros Shale, Greenhorn Limestone, Carlile Shale, Niobrara Formation, and Split Rock Creek Formation. In many cases, it was not possible to reliably differentiate the Cretaceous-age rocks lying directly on the quartzite surface. In such a case, these rocks are herein referred to as undifferentiated Cretaceous-age rocks. The youngest unit consists of glacial sediments that rest unconformably on the Cretaceous-age sediments. The glacial sediments also directly overlie the Sioux Quartzite in areas where the Cretaceous sediments are absent.

The glacial sediments in the study area consist mainly of clayey till and outwash composed of sand and gravel, with isolated kame and terrace deposits (Pence, 1997). Till is the nonsorted,

nonstratified sediment deposited by a glacier. Till in the study area usually consists of a very compact, silty, clay-rich matrix, reflecting the predominance of shale (clay) in the local Cretaceous bedrock. The till is usually brownish-gray to gray with a yellowish-brown to reddish-brown upper oxidized zone. Outwash is the stratified sediment deposited by water flowing from melting ice. The majority of the outwash deposits encountered in the study area are composed of round to subangular sand grading to a fine to medium gravel. The outwash usually contains a variety of grain types including quartz, limestone, dolomite, shale, quartzite, and granite (Tomhave, 1994).

WALL LAKE AQUIFER

Spatial Distribution and Composition

The areal extent of the Wall Lake aquifer, which formed as an outwash deposit, is shown on figure 4. This outwash is composed of water sorted sands and gravels, with occasional silt and clay lenses (Iles and Frykman, 1991). The sand and gravels of which this aquifer is comprised range in size from fine to medium grained sand to a fine to coarse grained gravel.

This hydrogeological investigation indicated a smaller areal extent of the Wall Lake aquifer than was indicated by previous investigations. The main body of the aquifer occurs west and southwest of the city of Sioux Falls (fig. 4). If the outwash is buried by till, it is identified as the Wall Lake aquifer. If the outwash is essentially at land surface (in the valley of Skunk Creek), it is identified as the Southern Skunk Creek management unit of the Big Sioux aquifer (Iles and Frykman, 1991).

Nine cross sections (figs. 5, 6, 7, 8, 9, 10, 11, 12, and 13) show the relative position of the aquifer. Cross section locations are shown on figure 2. In general, the Wall Lake aquifer is buried under tens of feet of clayey till and overlies till, Cretaceous-age sediments, or the Precambrian-age Sioux Quartzite (Lindgren and Niehus, 1992).

Saturated Thickness

The saturated thickness of the Wall Lake aquifer is also shown on figure 4. The outwash is entirely saturated except for a localized area approximately 1 mile east of Wall Lake (well R2-98-04) and where the outwash adjoins the Skunk Creek valley (Iles and Frykman, 1991). Monitoring well R2-98-04 had 63 feet of saturated sand and gravel and 7 feet of unsaturated sand and gravel on August 28, 1998. The greatest saturated thickness was encountered southwest of the city of Sioux Falls in section 11, T. 100 N., R. 51 W. (82 feet) and in section 34, T. 101 N., R. 50 W. (84 feet).

Hydraulic Conditions

Analysis of lithologic data and water levels indicates that the aquifer is under confined conditions except in two areas where water table conditions are known to exist. One area is approximately 1 mile east of Wall Lake where unsaturated outwash is present near well R2-98-04. The other area is where the aquifer adjoins the Skunk Creek valley (Iles and Frykman, 1991).

The depths to water in the Wall Lake aquifer measured in monitoring wells range from approximately 80 to 100 feet below land surface. Water levels are higher in the northwest part of the aquifer than they are in the southeast part (fig. 14). A recharge source to the Wall Lake aquifer was not identified and recharge quantity was not quantified because insufficient data were available. Similarly, discharge from the aquifer was not quantified. However, some water is discharged from the Wall Lake aquifer to the outwash in the Skunk Creek valley and some water is withdrawn through wells for livestock and domestic purposes (Lindgren and Niehus, 1992).

The maximum fluctuation of ground water levels was observed in monitoring well R2-98-11 (table 1, fig. 15). The water levels varied 1.71 feet in this well. The minimum fluctuation of ground water levels was observed in monitoring well R2-98-03 (table 1, fig. 16). The water levels varied 1.10 feet in this well. Hydrographs of all other measured wells in the Wall Lake aquifer are provided in figures 17-20. The relationship between trends in precipitation (fig. 21) and water level fluctuations in the wells (figs. 15-20) is not clear based on the short time available for observations.

Water Quality

In 1998, nine water samples were collected from monitoring wells for general chemical analysis. Five of them were taken from the Wall Lake aquifer. A summary of analytical results from these five samples is presented in table 2. Individual analyses are provided in appendix B. Figures 22 and 23 show the sample locations and the concentrations of sulfate, total dissolved solids, hardness, iron, and manganese in the Wall Lake aquifer.

Sulfate varied in concentration from 703.5 to 806.9 milligrams per liter (mg/L) with an average of 757.1 mg/L. Total dissolved solids varied in concentration from 1,022 to 1,154 mg/L with an average of 1,086 mg/L. Field measurements of specific conductivity ranged from 1,550 to 1,600 micromhos per centimeter. Data on specific conductivity are not included in table 2. The water from the Wall Lake aquifer can be classified as very hard water having a range in hardness from 920.4 to 1,034.8 mg/L. Iron concentrations ranged from 0.266 to 0.546 mg/L. Manganese concentrations ranged from 2.28 to 3.62 mg/L. No samples exceeded the South Dakota Drinking Water Standards for general inorganic parameters and trace metals.

SUMMARY AND RECOMMENDATION

The purpose of the study was to determine the viability of the Wall Lake aquifer as a supplemental water source for the city of Sioux Falls. Drilling and well installation for this study began in the summer of 1996 and ended in the summer of 1998. The drilling allowed for better delineation of the extent of the aquifer and for the installation of 10 monitoring wells. Results of the study also refined the understanding of the areas of greatest thickness and documented water quality in the aquifer.

The aquifer was found to cover approximately 50 square miles and is found predominantly west and southwest of the city of Sioux Falls in Minnehaha, Lincoln, and Turner Counties (fig. 4). The depths to water in the Wall Lake aquifer measured in monitoring wells ranged from approximately 80 to 100 feet below land surface. The saturated thickness of the Wall Lake aquifer varies widely

throughout the aquifer and was measured to range from 8 feet in the southeast and west portions of the aquifer to 84 feet just west of Sioux Falls (fig. 4).

Water samples collected from monitoring wells completed in the aquifer were analyzed for general inorganic chemistry and trace metals. Predominant chemical constituents in water from the Wall Lake aquifer are calcium and sulfate (table 2 and appendix B). Water quality in the Wall Lake aquifer is fairly uniform, with generally high concentrations of dissolved solids. All samples were in compliance with the South Dakota Drinking Water Standards for general inorganic parameters and trace metals.

There is an area that appears potentially promising in terms of water quantity based on a saturated thickness of aquifer in excess of 80 feet. That area is located approximately 1 to 2 miles west-southwest of Sioux Falls (fig. 4). It is recommended that the following two general areas be considered for the installation of production wells and performance of aquifer tests:

SW¼ section 11, T. 100 N., R. 51 W. and
NW¼ section 34, T. 101 N., R. 50 W.

Performance of aquifer tests will provide information critical to assessing the aquifer's potential as a supplemental source of water for the city of Sioux Falls.

REFERENCES

Iles, D.L., and Frykman, L.J., 1991, *Hydrogeology of the Southern Skunk Creek management unit of the Big Sioux aquifer*: South Dakota Geological Survey Open-File Report 63-UR.

Lindgren, R.J., and Niehus, C.A., 1992, *Water resources of Minnehaha County, South Dakota*: U.S. Geological Survey Water-Resources Investigations Report 91-4101.

Pence, S.F., 1997, *Summary of the Split Rock Creek aquifer study*: South Dakota Geological Survey Open-File Report 87-UR.

Tomhave, D.W., 1994, *Geology of Minnehaha County, South Dakota*: South Dakota Geological Survey Bulletin 37.

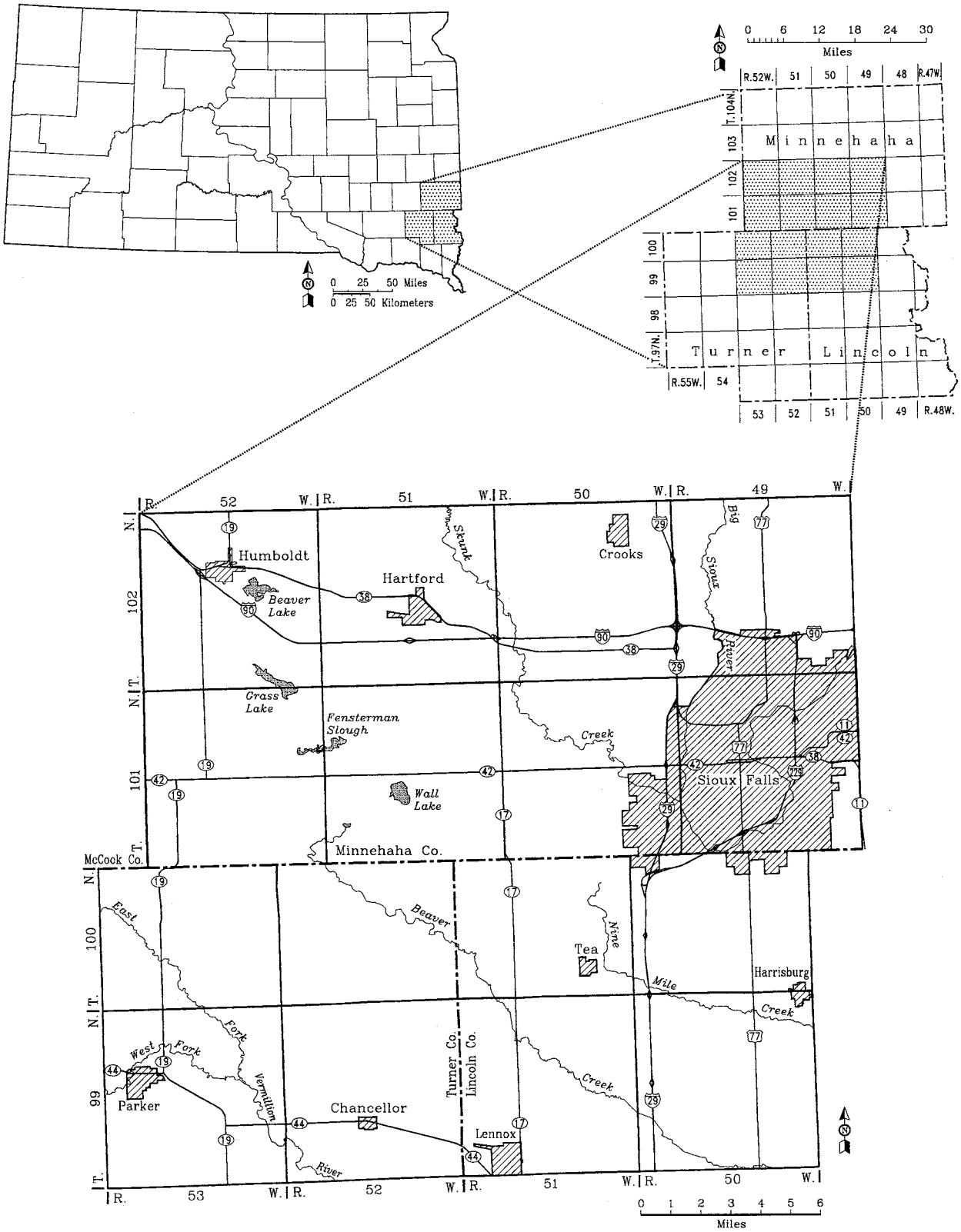
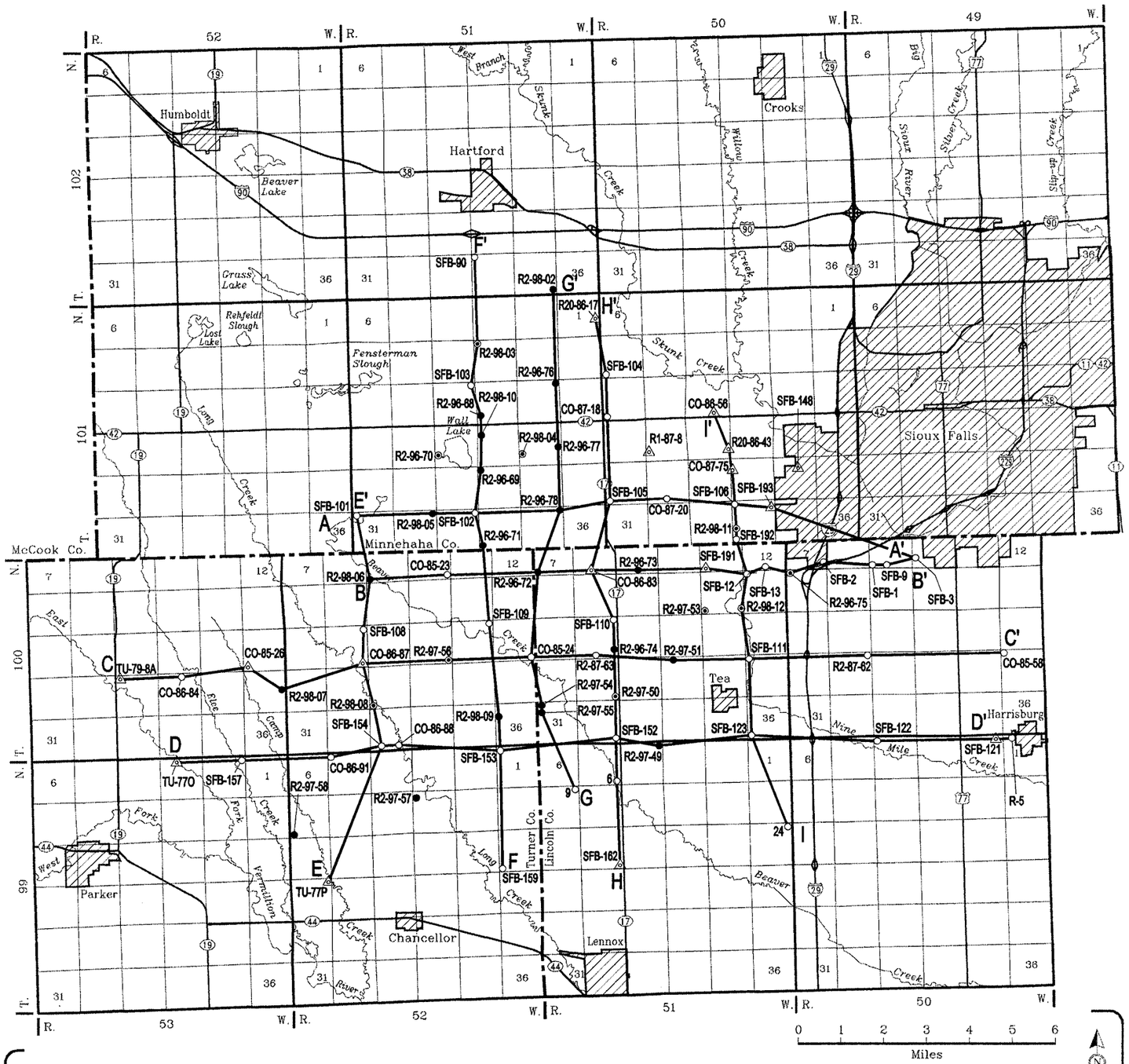


Figure 1. Location of study area.



R2-97-50 — Monitoring well completed for this study. Label denotes well identifcation. Logs are included in appendix A.

R2-96-78 — Test hole drilled for this study. Label denotes test hole identification. Logs are included in appendix A.

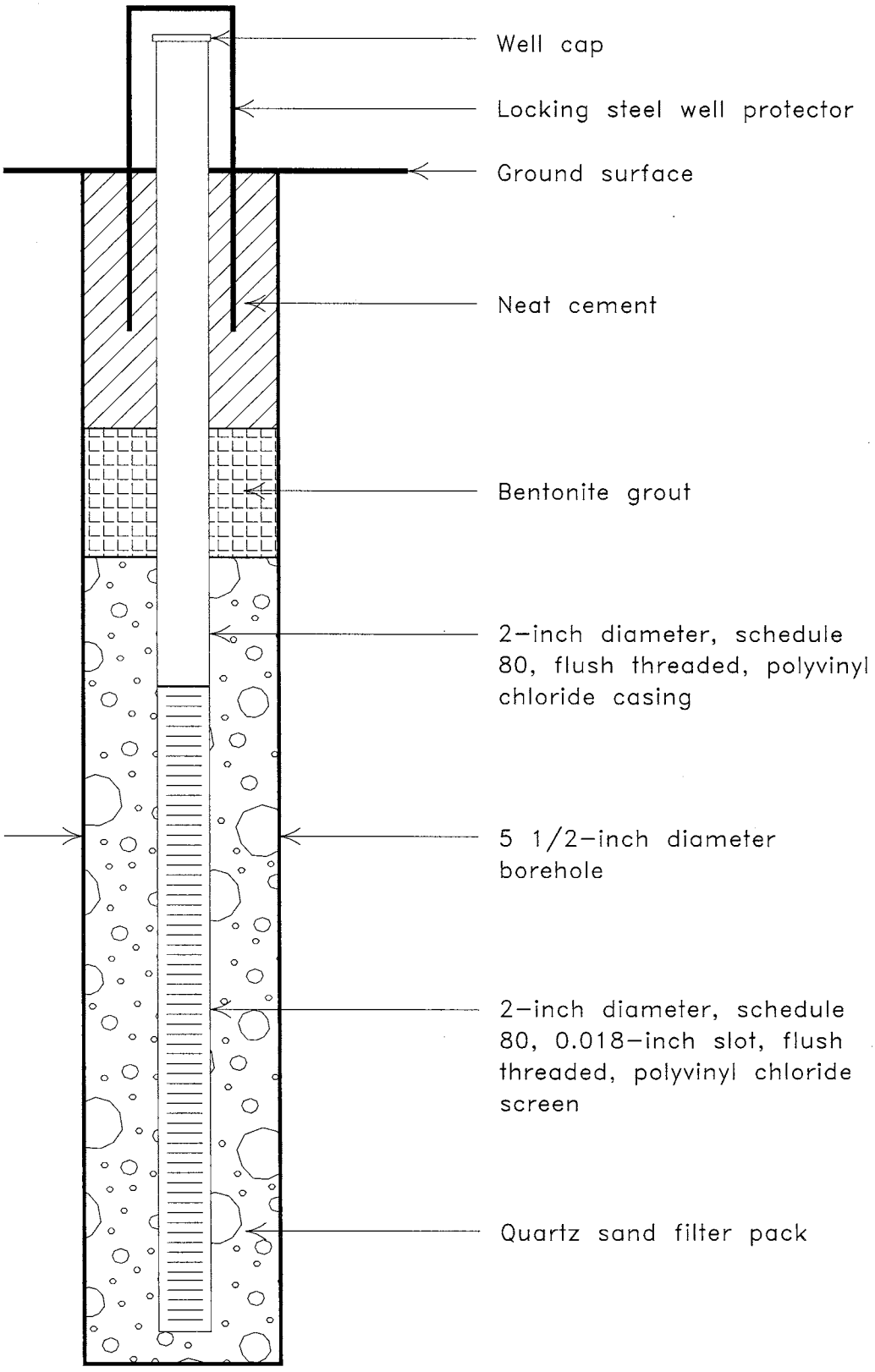
SFB-162 — Well not drilled for this study. Label denotes well identification. Logs are on file at the South Dakota Geological Survey.

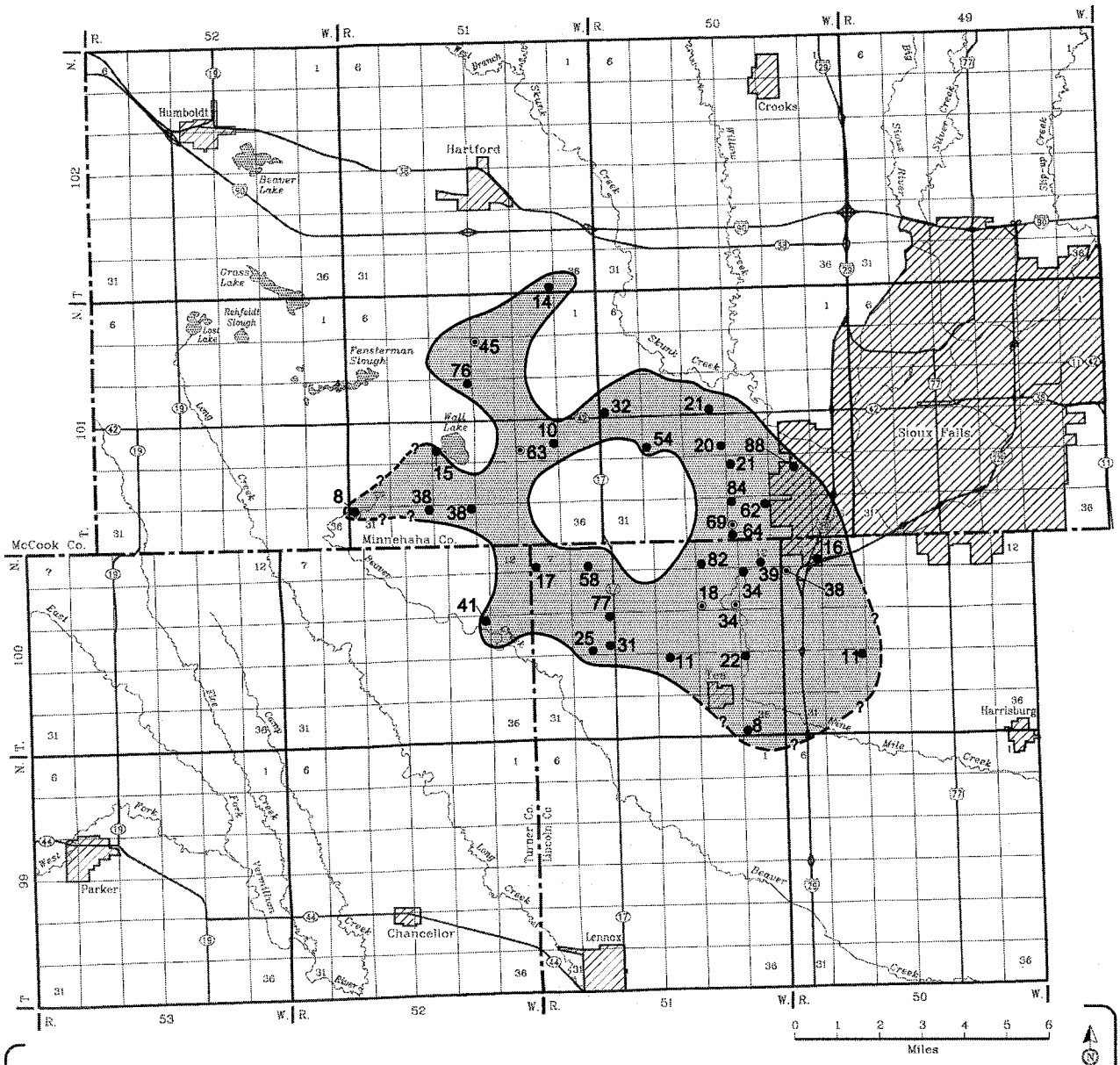
SFB-109 — Test hole not drilled for this study. Label denotes test hole identification. Logs are on file at the South Dakota Geological Survey.

A A' — Cross section location.

Figure 2. Locations of test holes, monitoring wells, and cross sections.

Figure 3. Generalized diagram showing monitoring well construction.





18 Monitoring well. Number is saturated thickness in feet on August 28, 1998.

•25 Test hole. Number is saturated thickness in feet on August 28, 1998. Saturated thicknesses in test holes were inferred from monitoring well water level data.

Boundary of the Wall Lake aquifer. Dashed where approximate.

Figure 4. Areal extent and saturated thickness of the Wall Lake aquifer.

Figure 5. Geologic cross section A-A'.

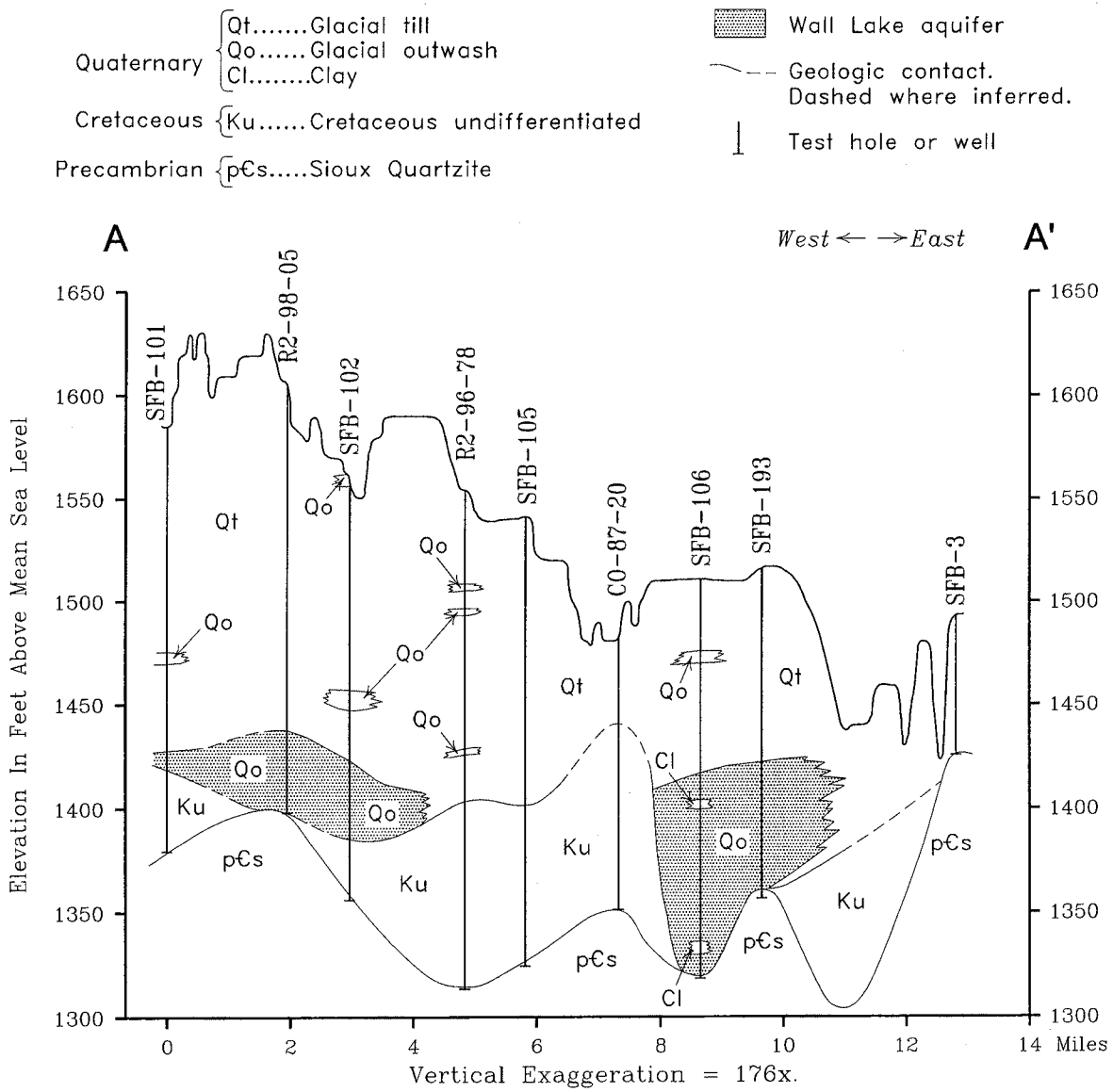


Figure 6. Geologic cross section B-B'.

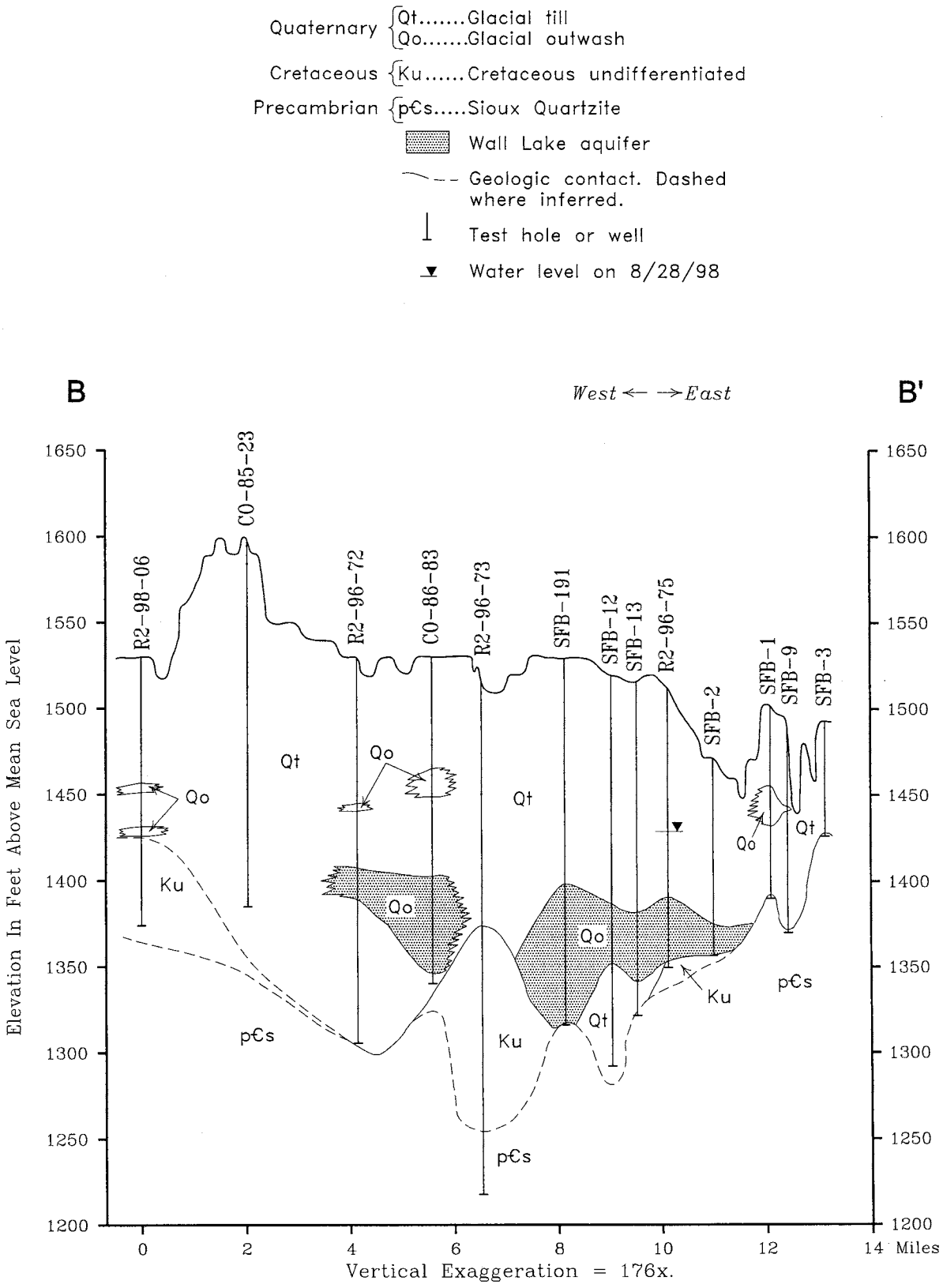


Figure 7. Geologic cross section C-C'.

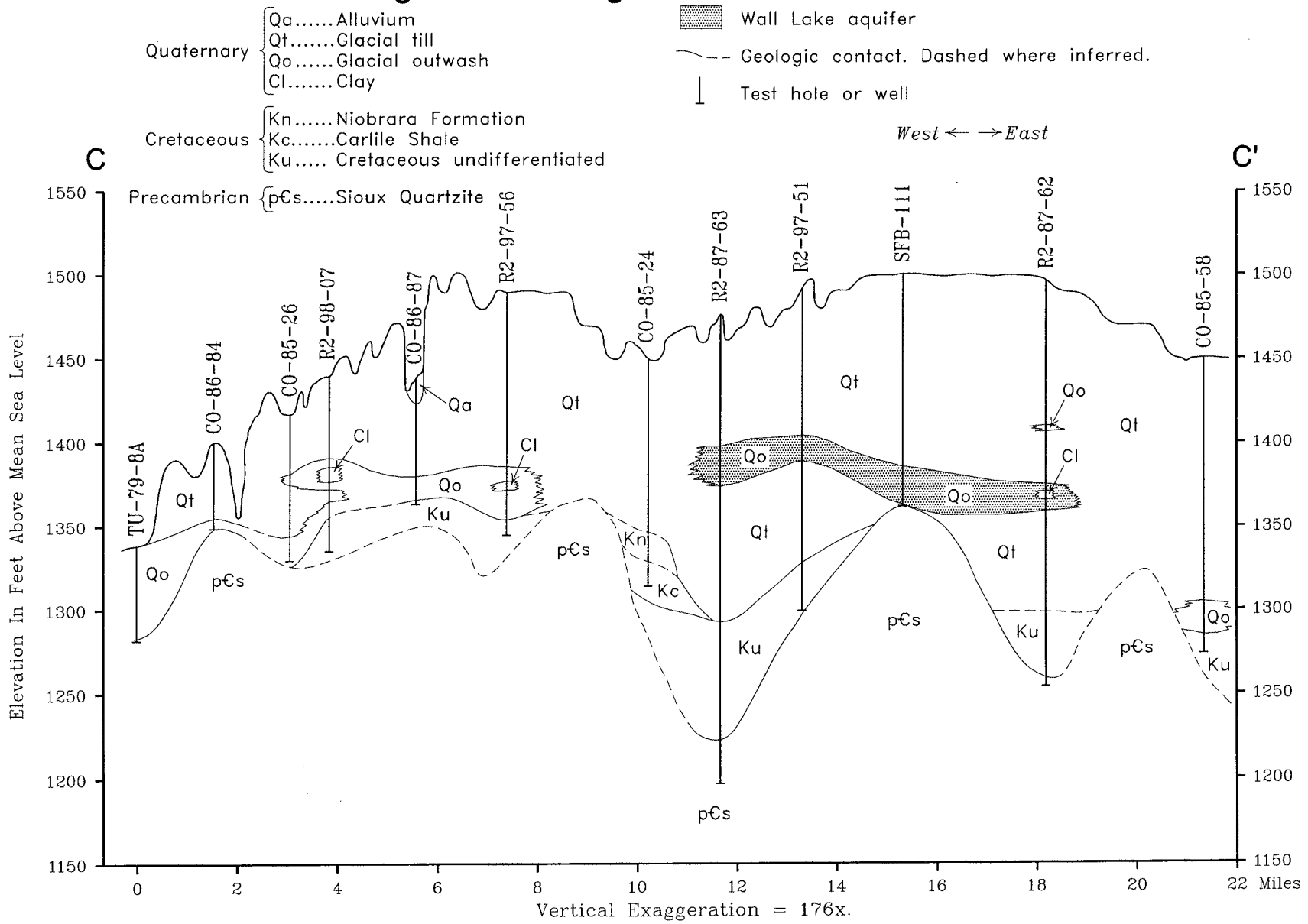


Figure 8. Geologic cross section D-D'.

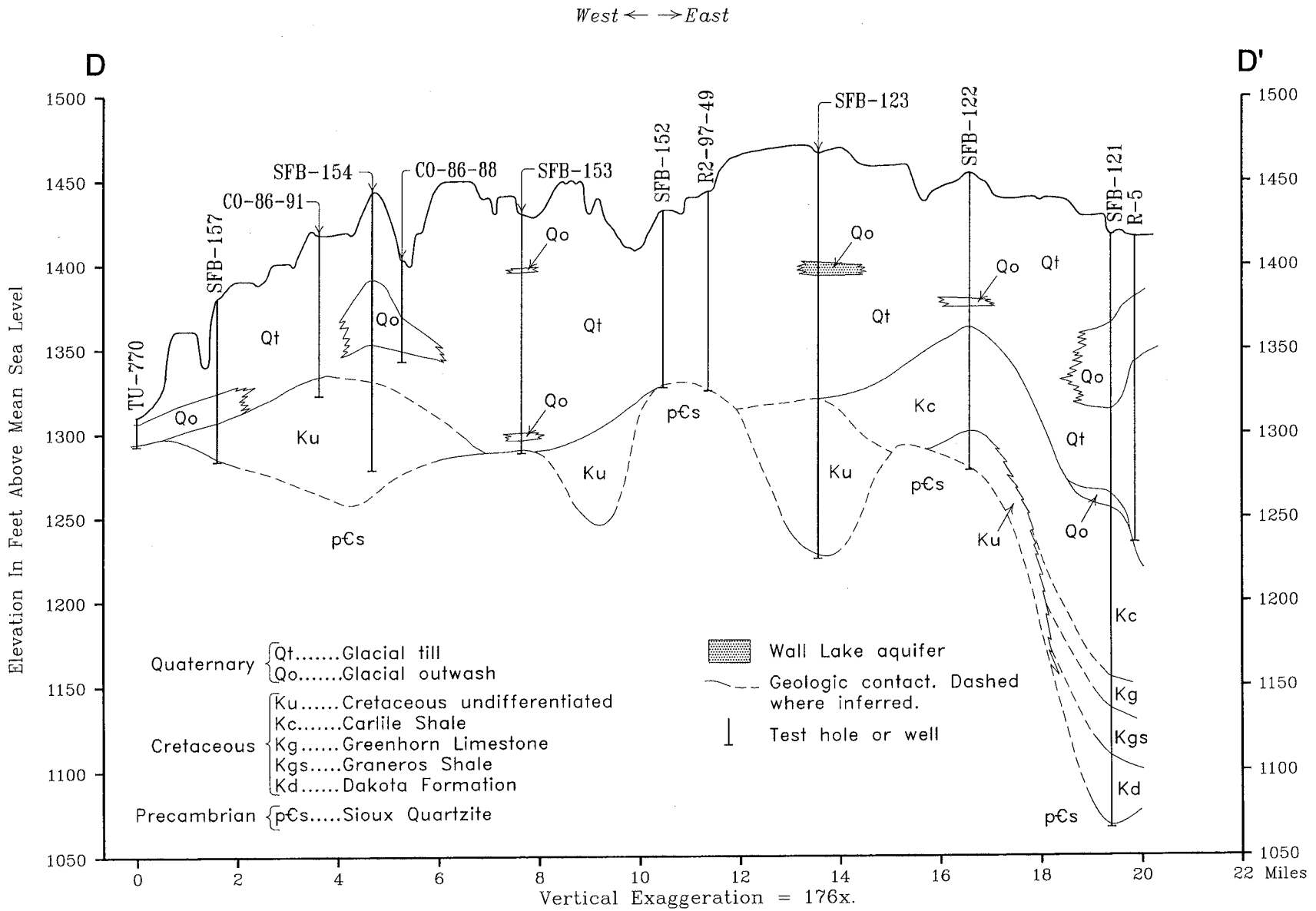


Figure 9. Geologic cross section E-E'.

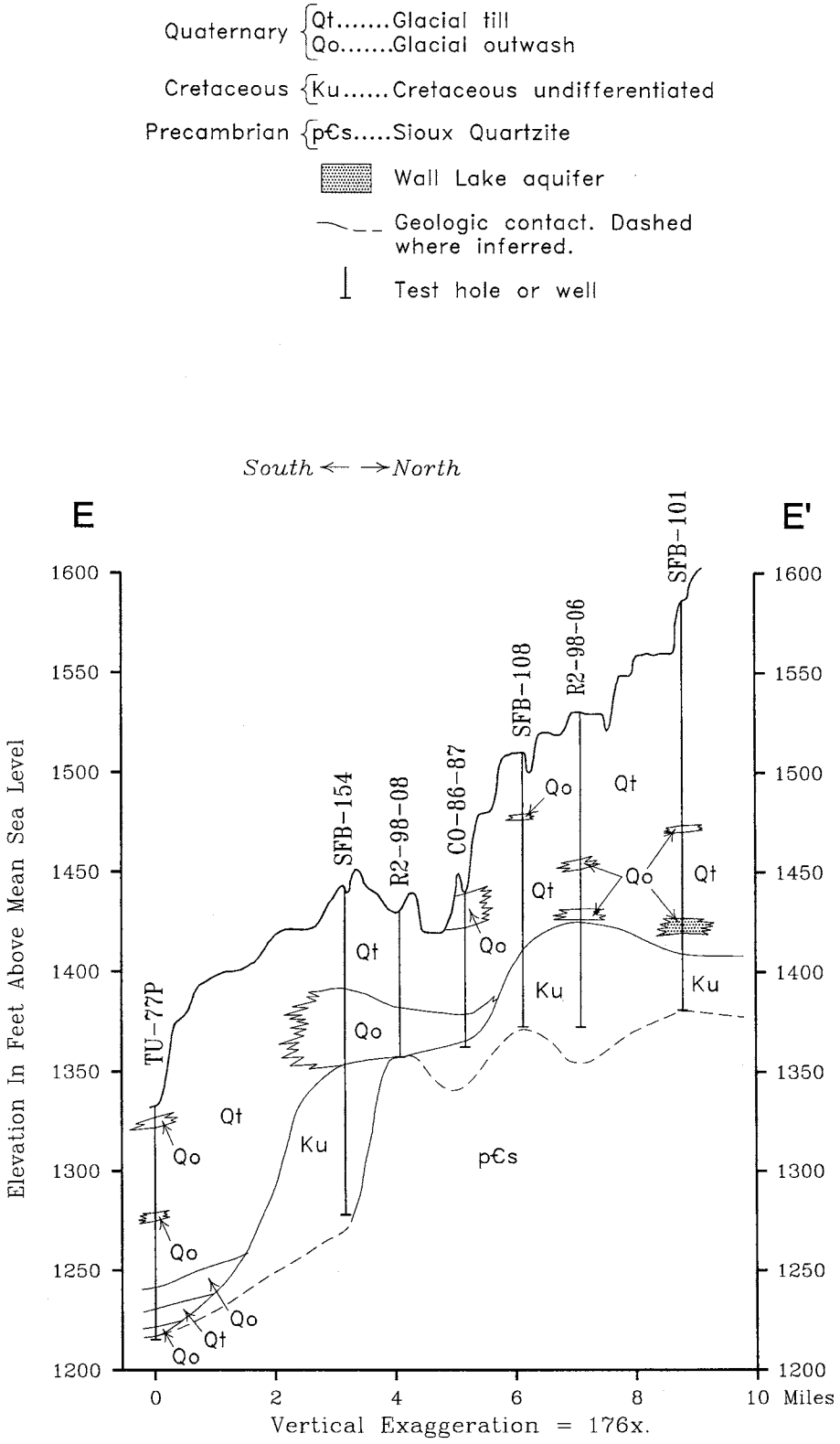


Figure 10. Geologic cross section F-F'.

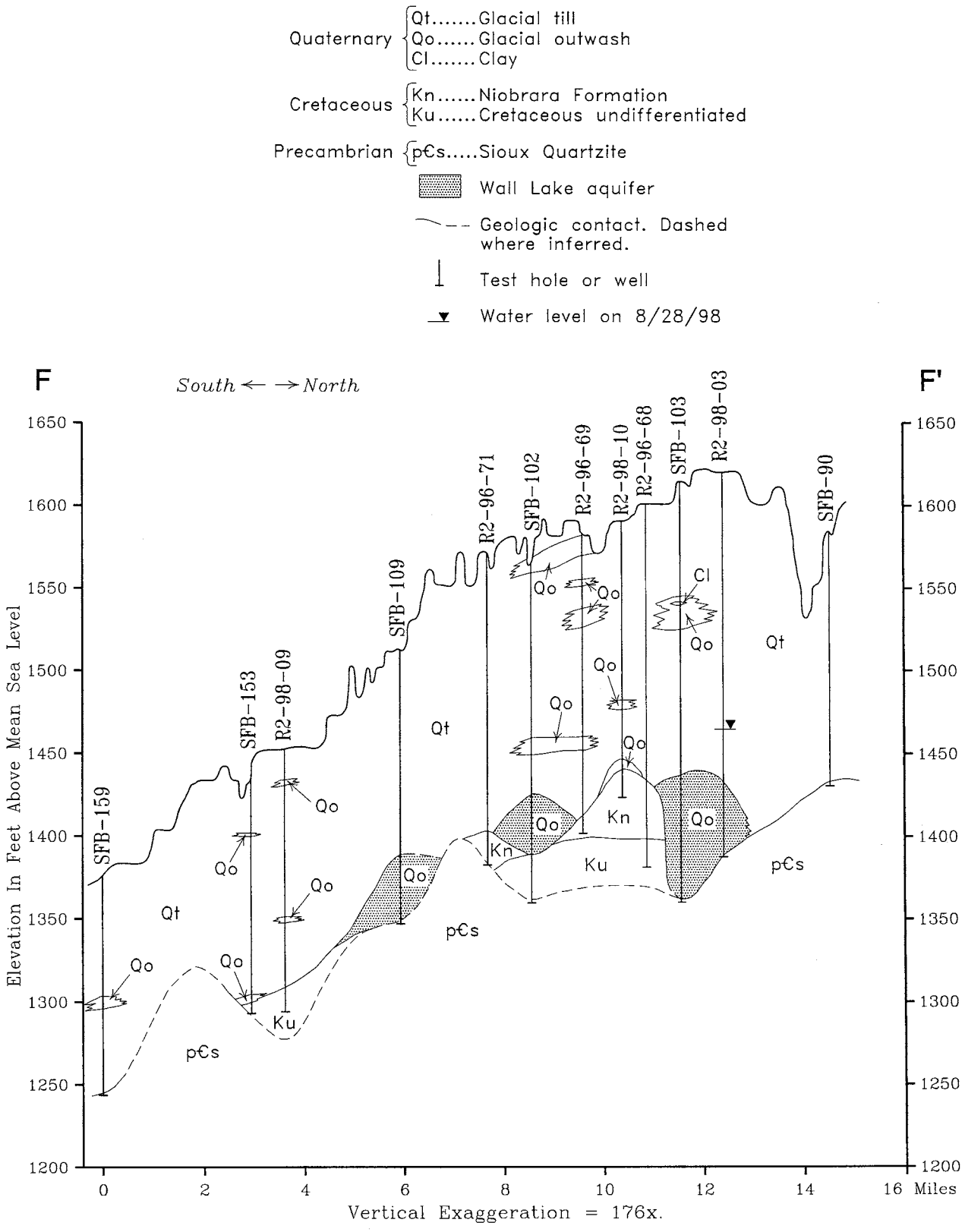


Figure 11. Geologic cross section G-G'.

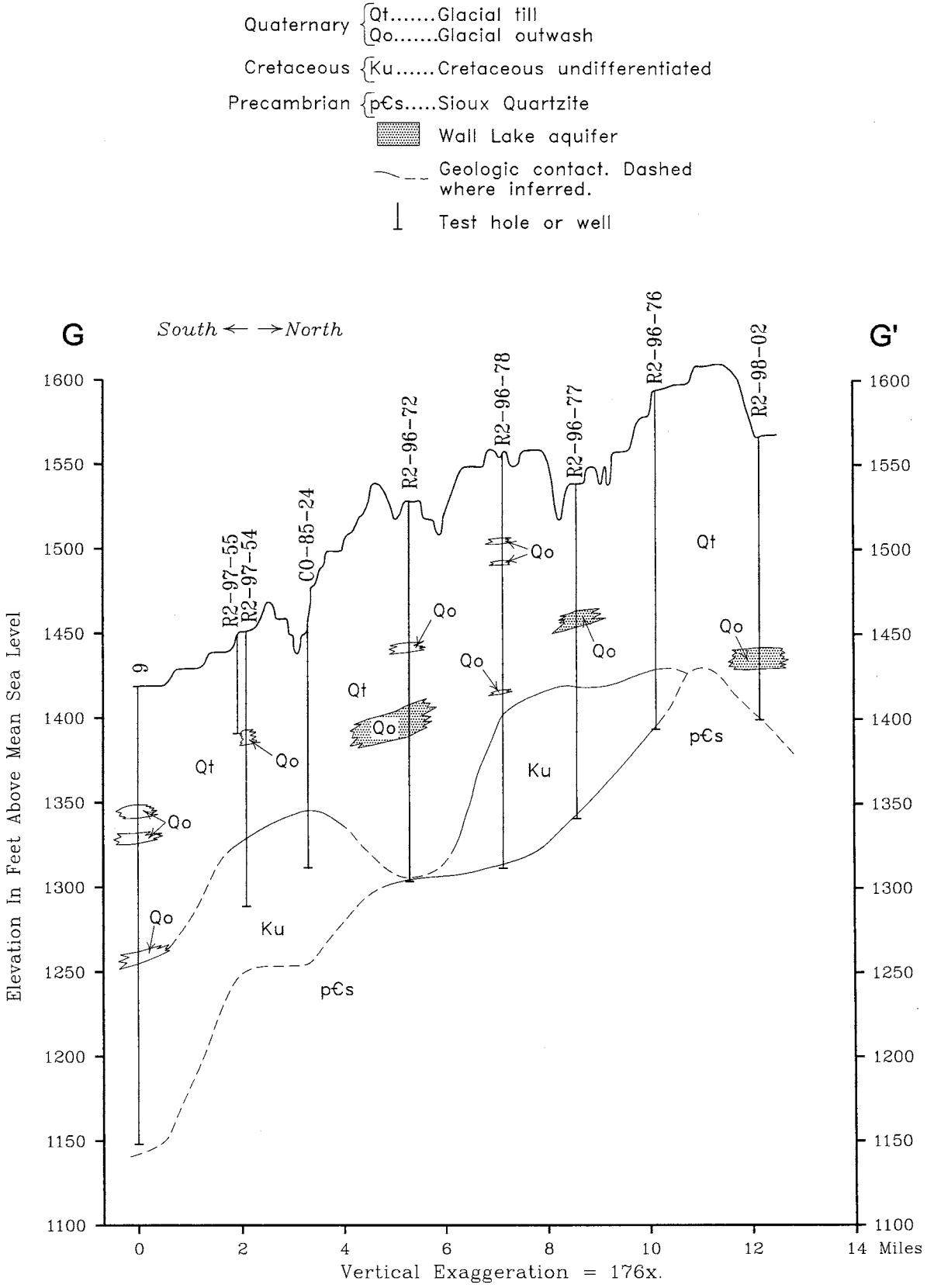


Figure 12. Geologic cross section H-H'.

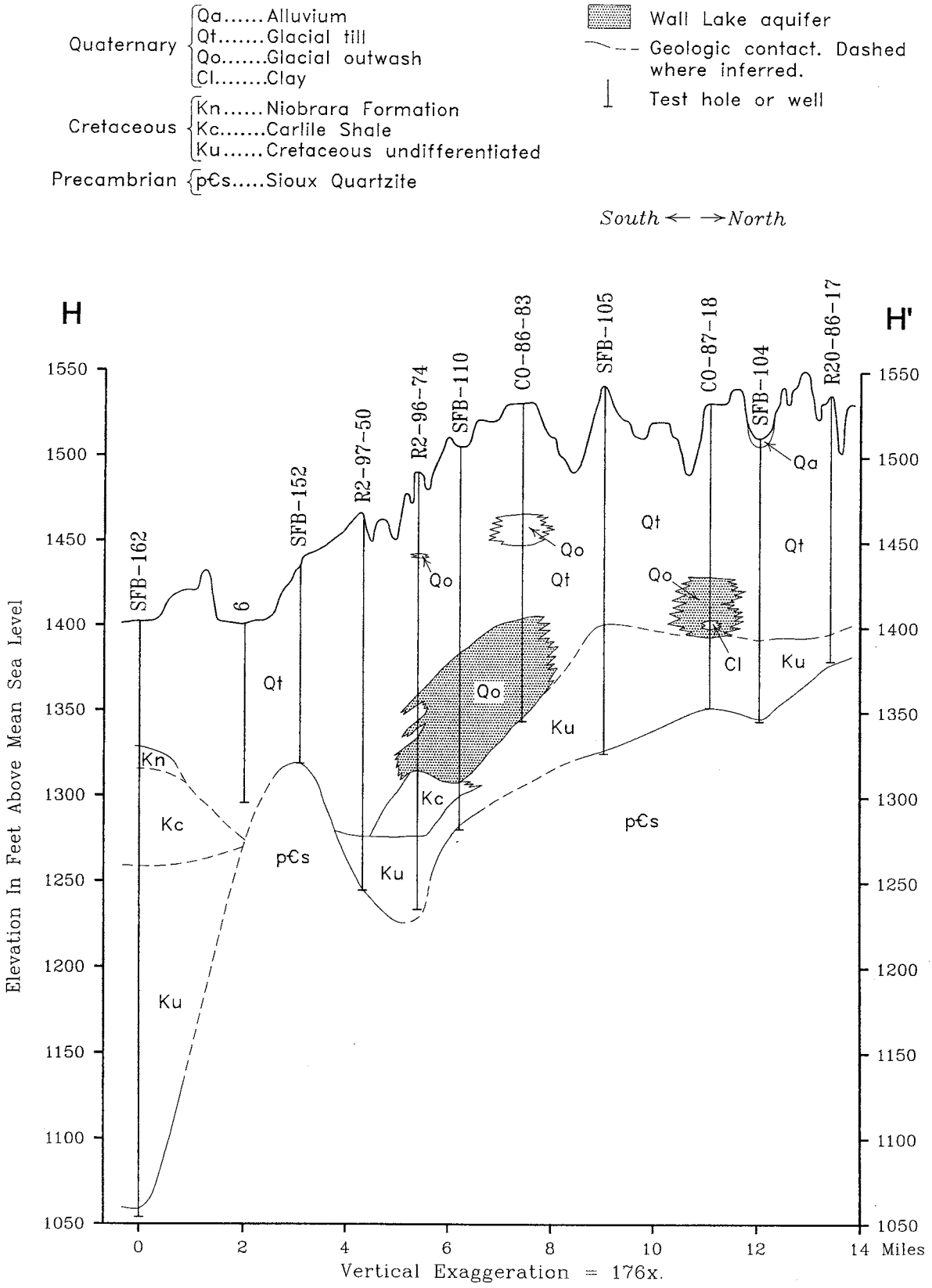


Figure 13. Geologic cross section I-I'.

Quaternary
- Qt.....Glacial till
- Qo.....Glacial outwash
- Cl.....Clay

Cretaceous
- Ku.....Cretaceous undifferentiated

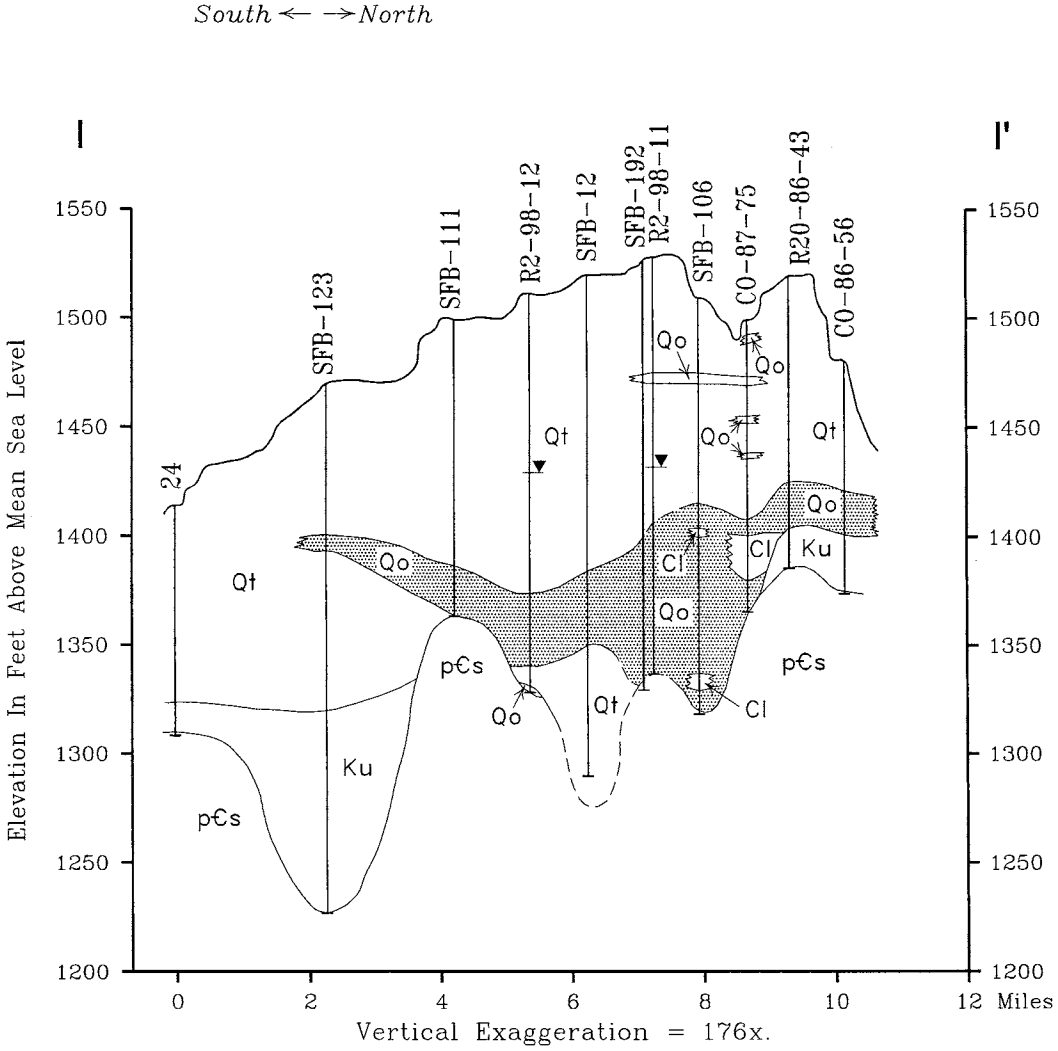
Precambrian
- p€s.....Sioux Quartzite

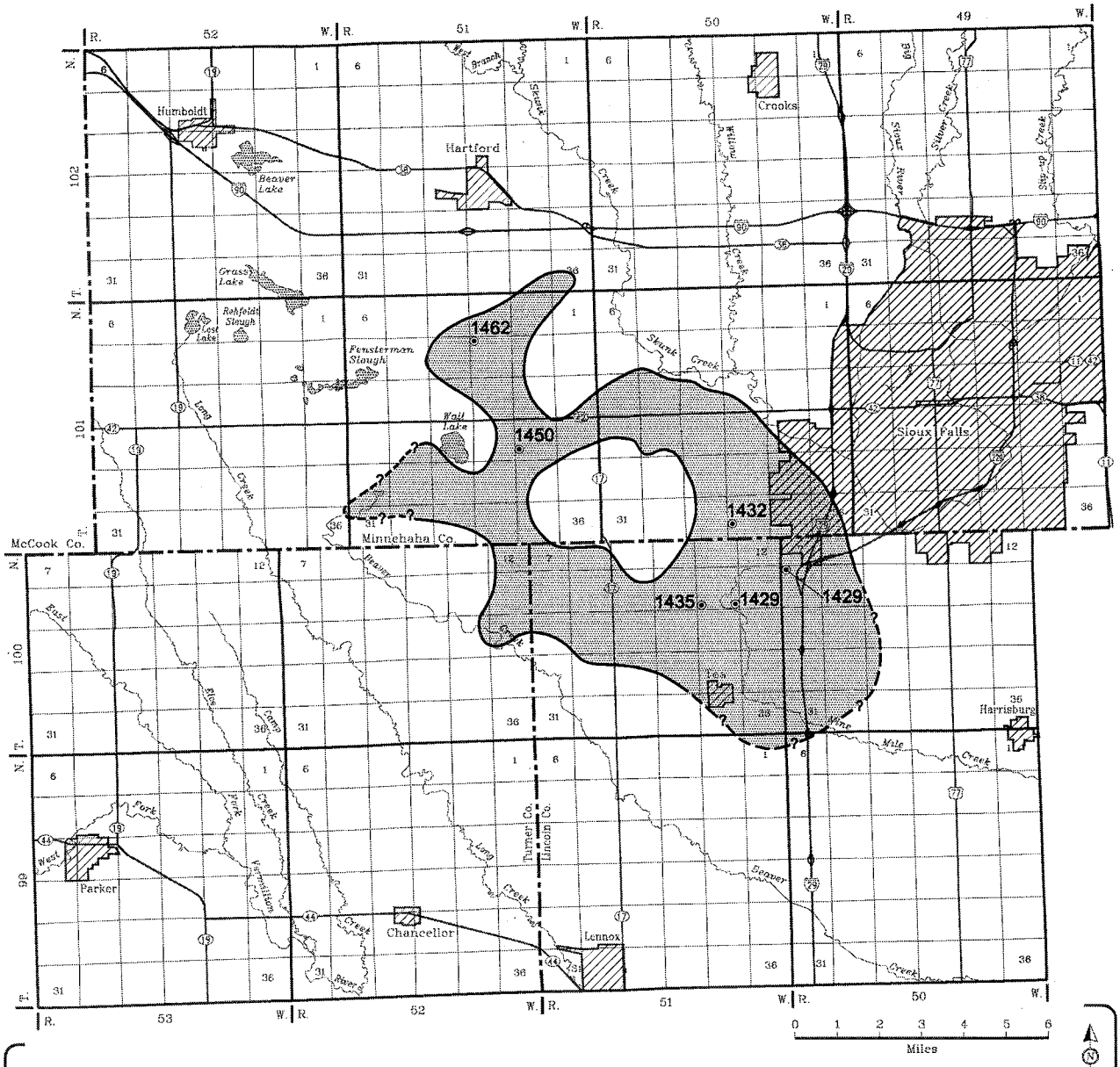
Wall Lake aquifer

Geologic contact. Dashed where inferred.

Test hole or well

Water level on 8/28/98





1435◉ Monitoring well. Number is elevation of the water level in feet above mean sea level.

Boundary of the Wall Lake aquifer. Dashed where approximate.

Figure 14. Water levels in the Wall Lake aquifer on August 28, 1998.

Figure 15. Hydrograph of well R2-98-11

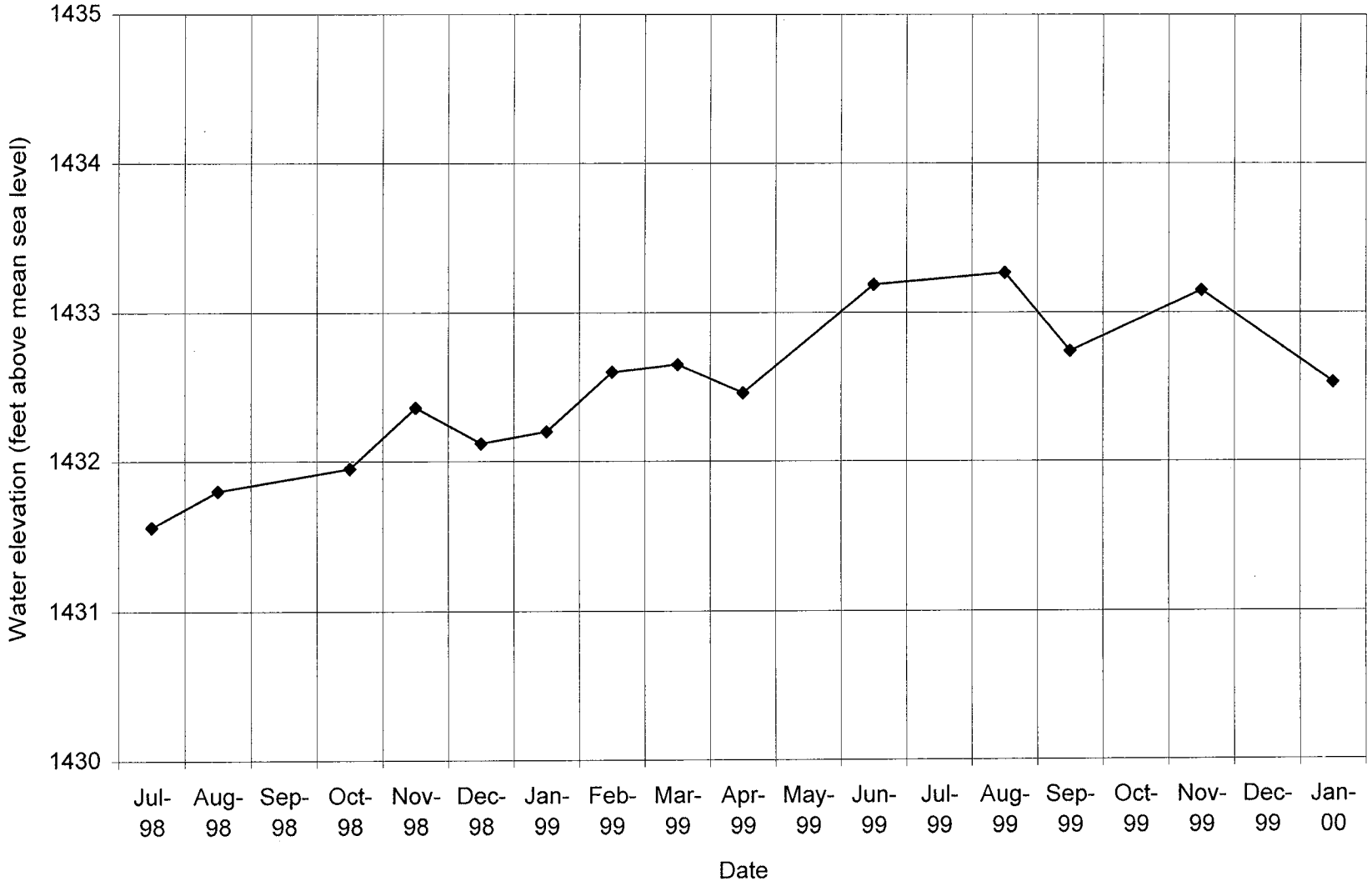


Figure 16. Hydrograph of well R2-98-03

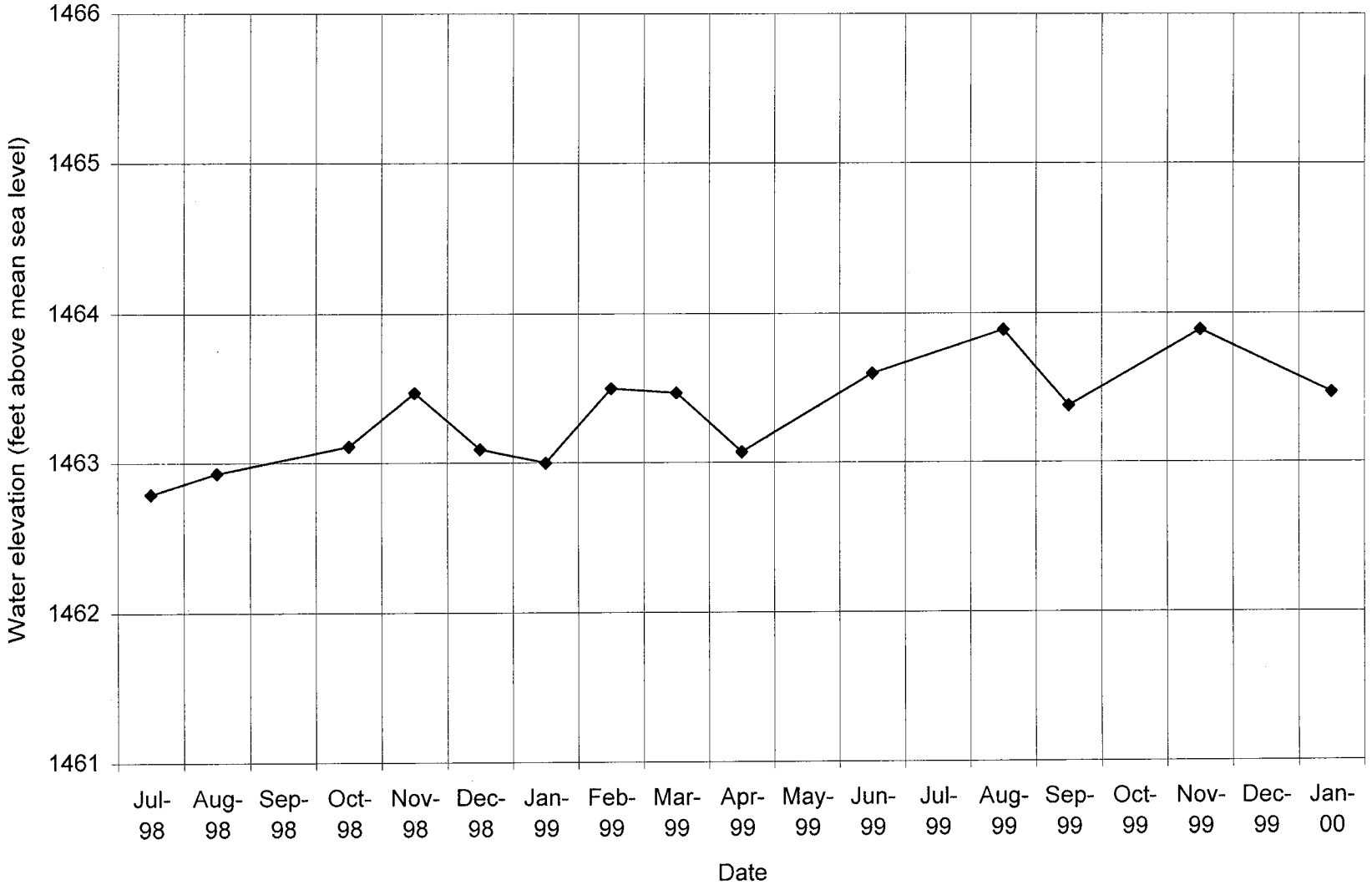


Figure 17. Hydrograph of well R2-96-75

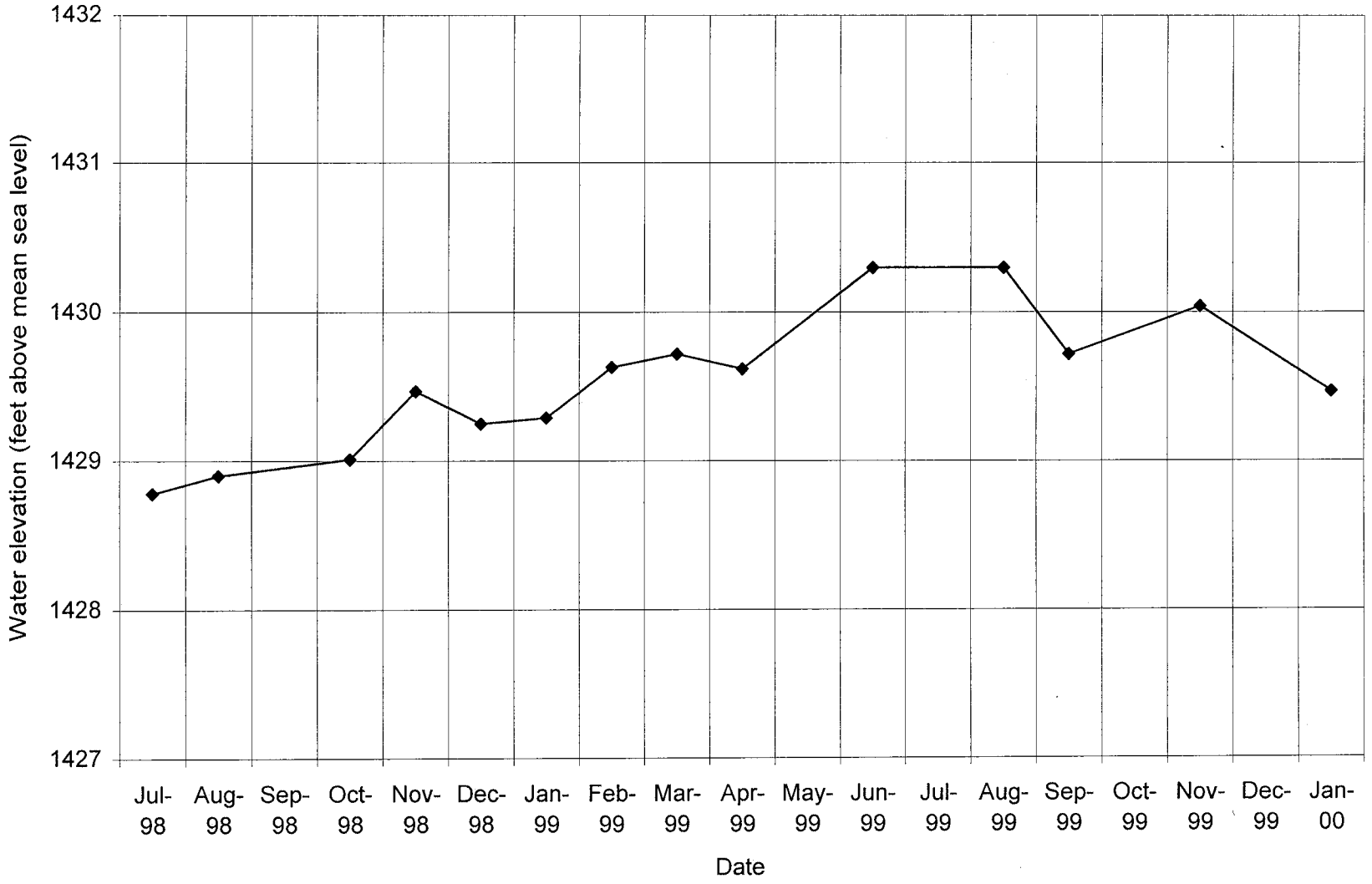


Figure 18. Hydrograph of well R2-97-53

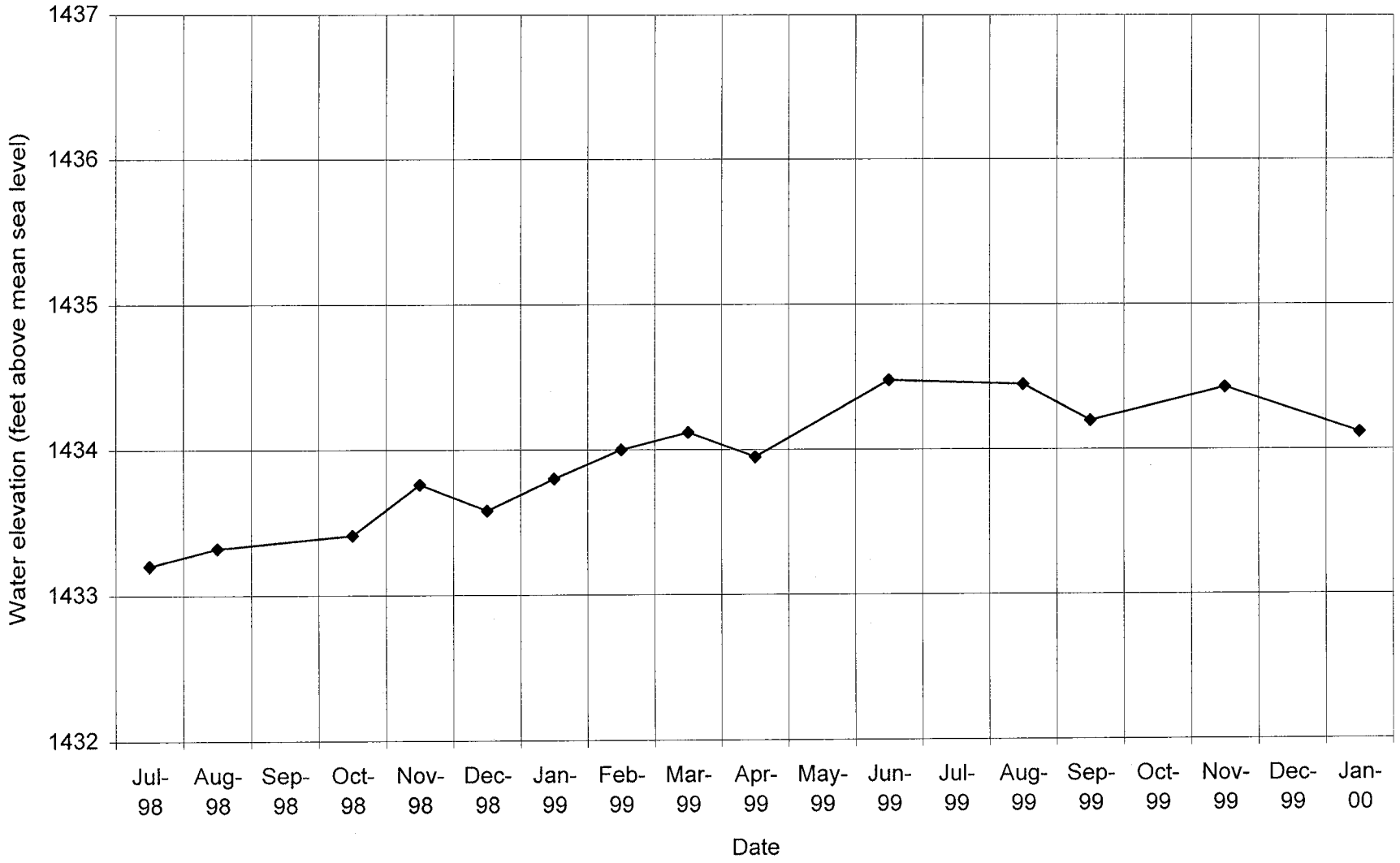


Figure 19. Hydrograph of R2-98-04

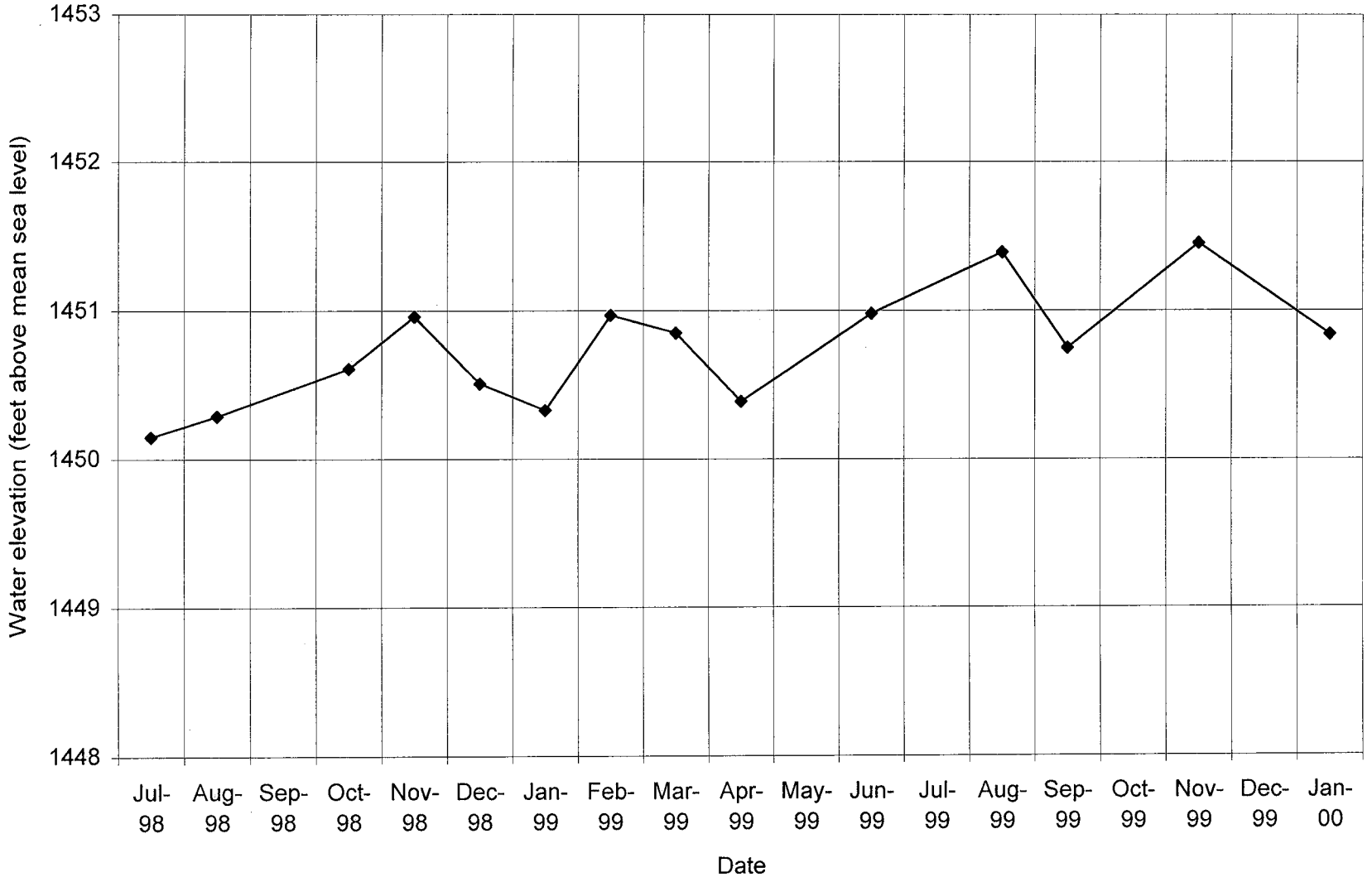


Figure 20. Hydrograph of well R2-98-12

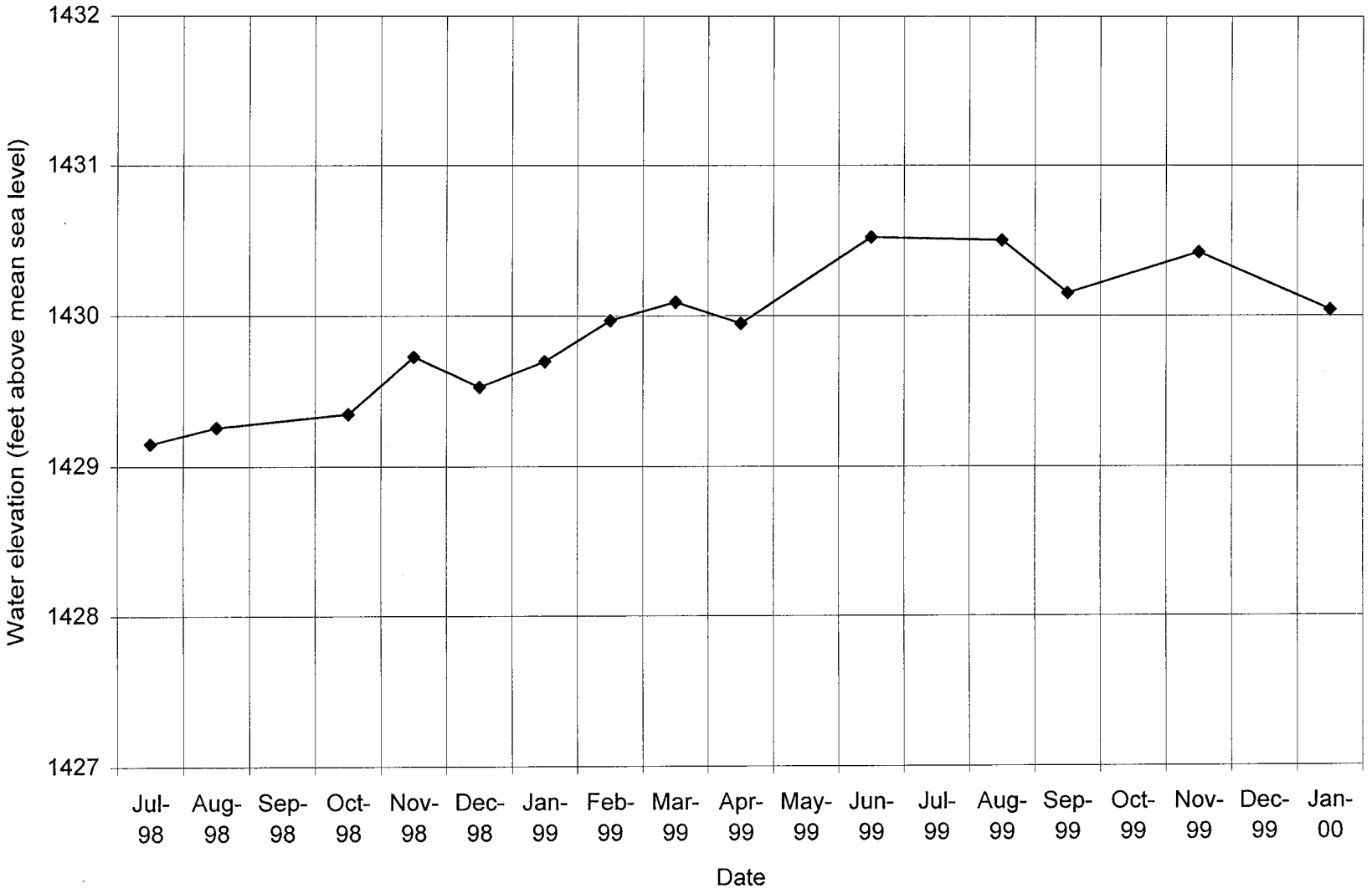
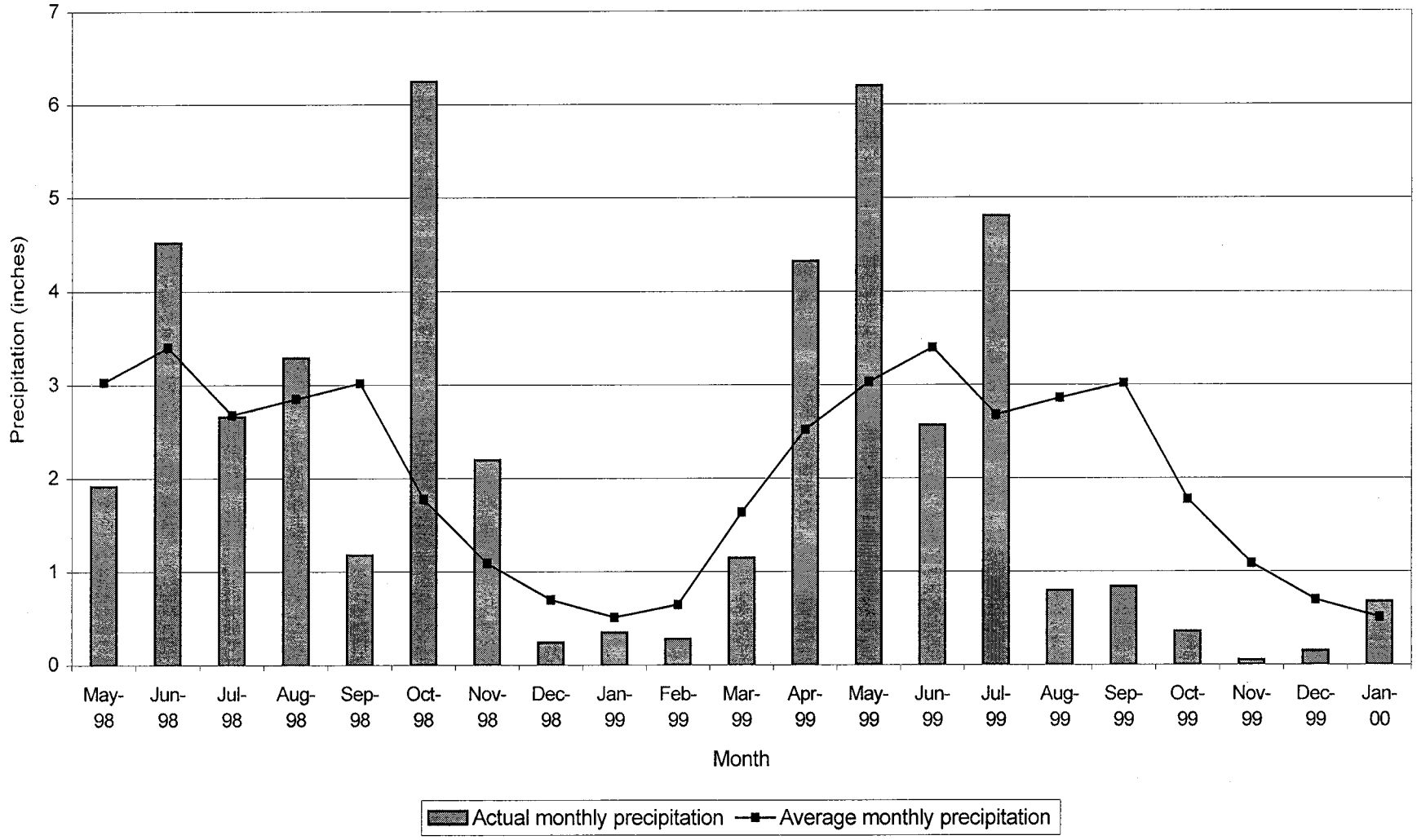
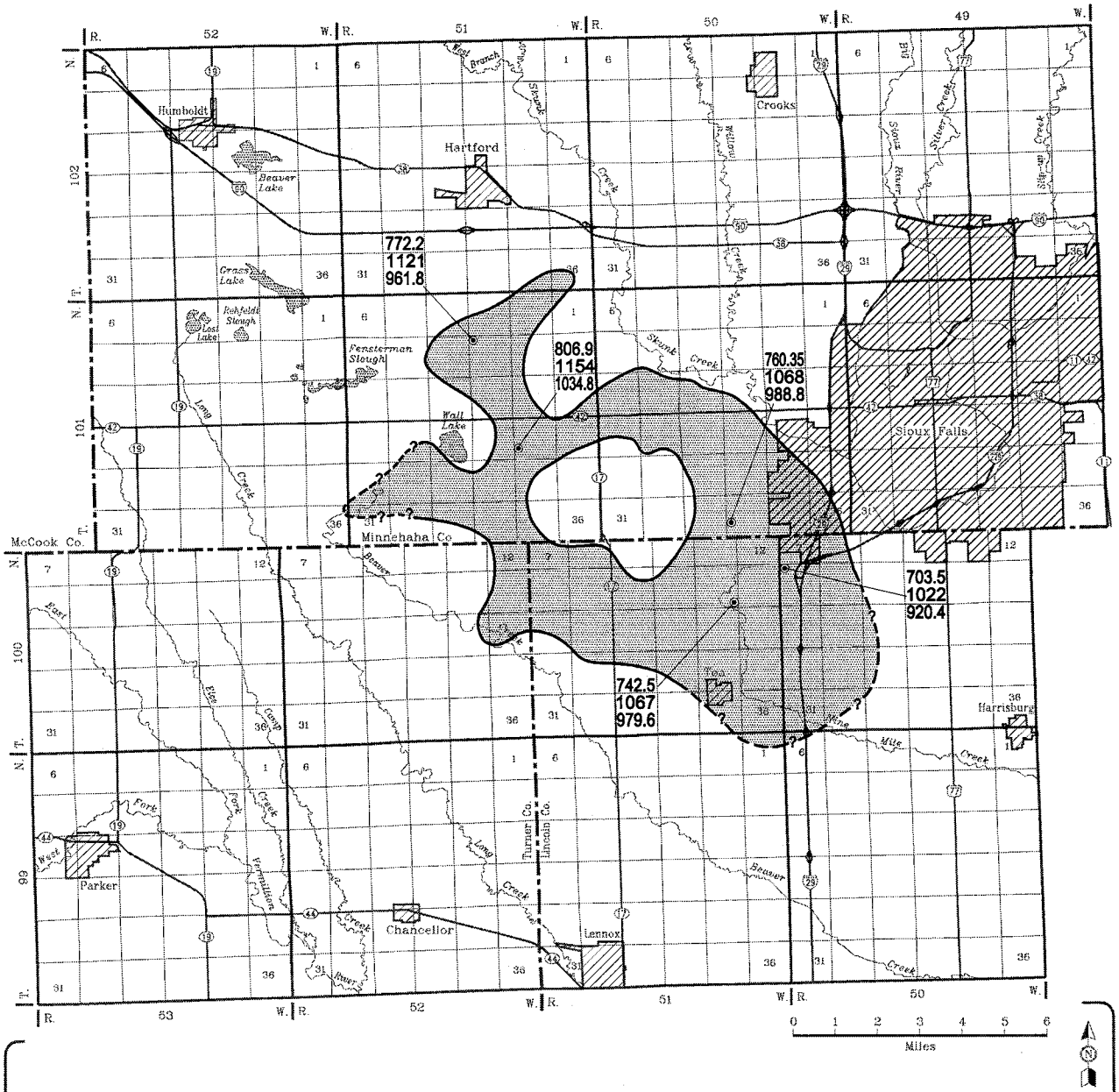


Figure 21. Actual and average monthly precipitation for Sioux Falls



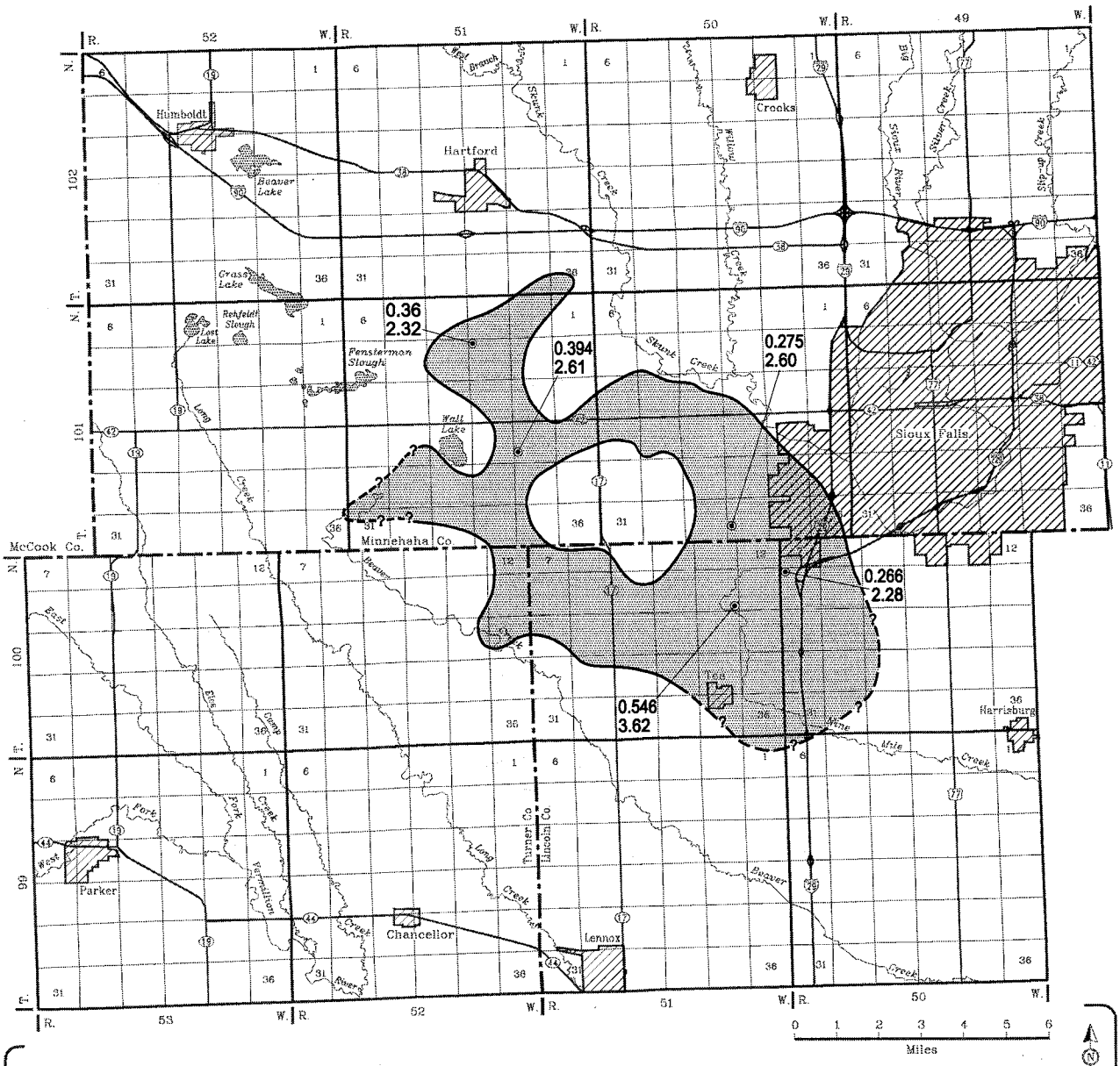
Precipitation data from the Office of Climate and Weather Information, South Dakota State University, Brookings, South Dakota



772.2
1121
961.8 Monitoring well. Upper number is concentration of sulfate, middle number is concentration of total dissolved solids, and the lower number is concentration of hardness. All concentrations are given in milligrams per liter. See appendix B.

Boundary of the Wall Lake aquifer. Dashed where approximate.

Figure 22. Concentrations of sulfate, total dissolved solids, and hardness in the Wall Lake aquifer.



◉ 0.36 / 2.32 — Monitoring well. Upper number is concentration of iron and lower number is concentration of manganese. All concentrations are given in milligrams per liter. See appendix B.

Boundary of the Wall Lake aquifer. Dashed where approximate.

Figure 23. Concentrations of iron and manganese in the Wall Lake aquifer.

Table 1. Water level elevations in the Wall Lake aquifer

	Well identification					
	R2-96-75	R2-97-53	R2-98-03	R2-98-04*	R2-98-11	R2-98-12
Date	Water level elevations in feet above mean sea level					
7/16/98	1428.78	1433.20	1462.79	1450.15	1431.56	1429.15
8/28/98	1428.90	1433.32	1462.93	1450.29	1431.80	1429.26
10/14/98	1429.01	1433.41	1463.11	1450.61	1431.95	1429.35
11/18/98	1429.47	1433.76	1463.47	1450.96	1432.36	1429.73
12/17/98	1429.25	1433.58	1463.09	1450.51	1432.12	1429.53
1/28/99	1429.29	1433.80	1463.00	1450.33	1432.20	1429.70
2/26/99	1429.63	1434.00	1463.50	1450.97	1432.60	1429.97
3/31/99	1429.72	1434.12	1463.47	1450.85	1432.65	1430.09
4/29/99	1429.62	1433.95	1463.07	1450.39	1432.46	1429.95
6/24/99	1430.30	1434.48	1463.60	1450.98	1433.19	1430.52
8/12/99	1430.30	1434.45	1463.89	1451.39	1433.27	1430.50
9/29/99	1429.72	1434.20	1463.38	1450.75	1432.74	1430.15
11/9/99	1430.04	1434.43	1463.89	1451.45	1433.15	1430.42
1/25/00	1429.47	1434.12	1463.47	1450.84	1432.53	1430.04

* This well is present in a localized area of the aquifer which is under water table conditions. All other wells in this table are present in areas of the aquifer which are under confined conditions.

Table 2. Summary of water quality analyses from the Wall Lake aquifer

	Parameter with concentration in milligrams per liter													
	Calcium	Magnesium	Sodium	Chloride	Sulfate	Iron	Manganese	Fluoride	Bromide	Phosphate	Nitrate As nitrogen	Nitrite as nitrogen	Total dissolved solids	Hardness
Average	266	77	85	8.7	757.1	0.37	2.69	0.40	0.51	*	*	*	1086	977.1
Maximum	288	96	102	11.35	806.9	0.546	3.62	0.42	0.60	0.35	0.20	<0.003	1154	1034.8
Minimum	253	68	74	4.30	703.5	0.266	2.28	0.38	0.23	<0.05	<0.004	<0.002	1022	920.4
Standard deviation	14	11	11	2.7	38.1	0.11	0.54	0.02	0.15	*	*	*	52	41.6
SDDWS***								4			10	1		

	Parameter with concentration in milligrams per liter												NTU**
	Antimony	Arsenic	Barium	Beryllium	Cadmium	Copper	Lead	Nickel	Selenium	Thallium	Zinc	Alkalinity-Total	pH	Turbidity
Average	*	0.0018	0.025	*	0.0005	0.007	*	*	*	*	*	380	7.7	6.0
Maximum	0.001	0.0033	0.028	<0.00006	0.0016	0.012	0.0008	<0.05	<0.002	<0.0002	0.066	404	7.85	20.5
Minimum	<0.001	0.0005	0.020	<0.00006	0.0001	0.003	<0.0002	<0.05	<0.002	<0.0002	<0.050	355	7.6	1.1
Standard deviation	*	0.0010	0.003	*	0.0007	0.004	*	*	*	*	*	22	0.1	8.2
SDDWS***	0.006	0.05	2	0.004	0.005	1.3	0.015	0.1	0.05	0.002				

* – Unable to calculate a value because one or more of the concentrations were expressed as "less than" values.

** – Turbidity is expressed in nephelometric turbidity units.

*** – South Dakota Drinking Water Standards; Administrative Rules of South Dakota Chapter 74:04:05

Five samples were used to generate this summary.

All samples were analyzed by the Sioux Falls Water Purification Plant laboratory.

APPENDIX A

Lithologic logs of test holes drilled and monitoring wells installed for this study

Legal Location and Location

The logs are listed by smallest township number, then the smallest range number, the smallest section, and then by quarter section: **NE = A**; **NW = B**, **SW = C**; **SE = D**. A comparison of **Legal Location** and **Location** is as follows. A **Legal Location** of NW SE NE SW sec. 30, T. 99 N., R. 64 W. is the same as a **Location** of 099N-64W-30CADB. A **Location** followed by a "1" or "2" indicates that more than one log may exist for that location.

Hydrologic Unit Code

A number used for watershed identification that indicates the region, sub-region, accounting unit, and cataloging unit.

Ground Surface Elev. and Casing Top Elev.

The elevations are presented in feet above mean sea level. A "T" following the elevation indicates that the elevation was estimated from a 7.5 minute series topographic map.

Company

SDGS is an abbreviation for South Dakota Geological Survey.

Drilling Method

Rotary = direct rotary drilling method

Casing Type and Screen Type

PVC – polyvinyl chloride; **SCH. 80** – schedule 80; **MFG.** – commercially manufactured; **SLOT SIZE 0.010** – width of the screen openings is 0.010 inch

Geophysical Information

An "X" following Spontaneous Potential, Natural Gamma, or Single Point Resistivity indicates that a log of that type exists in the files of the Geological Survey.

Location Information

Legal Location: **NE NE NE NE sec.04, T. 099 N., R. 51 W.**
County: **LINCOLN** Location: **099N-51W-04AAAA**
Basin: **BIG SIOUX** Latitude: **43 deg 25 min 53 sec**
Hydrologic Unit Code: **10170203** Longitude: **96 deg 51 min 58 sec**
Land Owner: Ground Surface Elev. (ft.): **1443 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY** Geologist: **D. FILIPOVIC**
Drill Date: **10/21/1997** Geologist's Log: **X**
Company: **SDGS** Driller: **S. RASMUSSEN**
Drilling Method: **ROTARY** Driller's Log:
Test Hole Number: **R2-97-49** Total Drill Hole Depth (ft.): **117.1**

HOLE PLUGGED WITH CUTTINGS AND BENTONITE GROUT FROM 117.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1443.00 - 1428.00	0.0 - 15.0	CLAY, YELLOW, SILTY; OXIDIZED (TILL)
1428.00 - 1412.00	15.0 - 31.0	CLAY, BROWN, SANDY; OXIDIZED (TILL)
1412.00 - 1384.00	31.0 - 59.0	CLAY, GRAY, SILTY; UNOXIDIZED (TILL)
1384.00 - 1379.00	59.0 - 64.0	CLAY, GRAY; WITH GRAVEL (TILL)
1379.00 - 1326.00	64.0 - 117.0	CLAY, GRAY, SILTY, PEBBLY (TILL)
1326.00 - 1325.90	117.0 - 117.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **SW SW SW SW sec.07, T. 099 N., R. 52 W.**
County: **TURNER** Location: **099N-52W-07CCCC**
Basin: **VERMILLION** Latitude: **43 deg 24 min 09 sec**
Hydrologic Unit Code: **10170102** Longitude: **97 deg 02 min 32 sec**
Land Owner: Ground Surface Elev. (ft.): **1335 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY** Geologist: **D. FILIPOVIC**
Drill Date: **11/17/1997** Geologist's Log: **X**
Company: **SDGS** Driller: **T. MCCUE**
Drilling Method: **ROTARY** Driller's Log:
Test Hole Number: **R2-97-58** Total Drill Hole Depth (ft.): **32.1**

HOLE PLUGGED WITH CUTTINGS FROM 32.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1335.00 - 1333.00	0.0 - 2.0	TOPSOIL
1333.00 - 1318.00	2.0 - 17.0	CLAY, YELLOW, SANDY
1318.00 - 1316.00	17.0 - 19.0	CLAY, BROWN; HARD SURFACE
1316.00 - 1305.00	19.0 - 30.0	CLAY, GRAY, SANDY (TILL)
1305.00 - 1303.00	30.0 - 32.0	CLAY, GRAY, SILTY (TILL)
1303.00 - 1302.90	32.0 - 32.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **SW SW NW NW sec.10, T. 099 N., R. 52 W.**
County: **TURNER** | Location: **099N-52W-10BBCC**
Basin: **VERMILLION** | Latitude: **43 deg 24 min 53 sec**
Hydrologic Unit Code: **10170102** | Longitude: **96 deg 59 min 02 sec**
Land Owner: | Ground Surface Elev. (ft.): **1430 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY** | Geologist: **D. FILIPOVIC**
Drill Date: **11/17/1997** | Geologist's Log: **X**
Company: **SDGS** | Driller: **T. MCCUE**
Drilling Method: **ROTARY** | Driller's Log:
Test Hole Number: **R2-97-57** | Total Drill Hole Depth (ft.): **53.1**

HOLE PLUGGED WITH CUTTINGS FROM 53.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1430.00 - 1429.00	0.0 - 1.0	TOPSOIL
1429.00 - 1408.00	1.0 - 22.0	CLAY, YELLOW-BROWN, SILTY (TILL)
1408.00 - 1406.00	22.0 - 24.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
1406.00 - 1402.00	24.0 - 28.0	CLAY, BROWN, SANDY; HARD
1402.00 - 1377.00	28.0 - 53.0	CLAY, GRAY, PEBBLY
1377.00 - 1376.90	53.0 - 53.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **NW NW NW NW sec.18, T. 100 N., R. 50 W.**
County: **LINCOLN** | Location: **100N-50W-18BBBB 1**
Basin: **BIG SIOUX** | Latitude: **43 deg 29 min 21 sec**
Hydrologic Unit Code: **10170203** | Longitude: **96 deg 48 min 21 sec**
Land Owner: | Ground Surface Elev. (ft.): **1515 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY** | Geologist: **S. PENCE**
Drill Date: **11/06/1996** | Geologist's Log: **X**
Company: **SDGS** | Driller: **G. JENSEN**
Drilling Method: **ROTARY** | Driller's Log:
Test Hole Number: **R2-96-75** | Total Drill Hole Depth (ft.): **167.0**

Well Information

SDGS Well Name: **R2-96-75** | Aquifer: **WALL LAKE**
Other Well Name: | Casing Top Elev. (ft.): **1517.50 T**
Casing Type: **PVC, SCH. 80** | Casing Diameter (in.): **2.0**
Screen Type: **PVC, MFG., SLOT SIZE 0.010** | Screen Length (ft.): **10.0**
Total Casing and Screen (ft.): **163.5** | Casing Stick-up (ft.): **2.50**

SCREEN INTERVAL FROM 161 TO 151 FEET; FILTER PACK (NATURAL) FROM 167 TO 140 FEET; COARSE SAND FILTER PACK FROM 140 TO 130 FEET; BENTONITE GROUT FROM 130 TO 20 FEET; CEMENT GROUT FROM 20 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Test Hole Number: R2-96-75 - continued.

Elevation (ft.)	Depth (ft.)	Description
1515.00 - 1513.00	0.0 - 2.0	TOPSOIL
1513.00 - 1505.00	2.0 - 10.0	CLAY, OLIVE-TAN, SILTY, PEBBLY; OXIDIZED (TILL)
1505.00 - 1494.00	10.0 - 21.0	CLAY, TAN-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1494.00 - 1392.00	21.0 - 123.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1392.00 - 1354.00	123.0 - 161.0	GRAVEL AND SAND, FINE GRAVEL, VERY COARSE SAND
1354.00 - 1348.00	161.0 - 167.0	SHALE, GRAY; GREASY (CARLILE SHALE)

Location Information

Legal Location: **SW SW SW SW sec.07, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-07CCCC**
Latitude: **43 deg 29 min 25 sec**
Longitude: **96 deg 55 min 27 sec**
Ground Surface Elev. (ft.): **1530 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/29/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-72**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **224.0**

HOLE PLUGGED WITH BENTONITE GROUT.

Elevation (ft.)	Depth (ft.)	Description
1530.00 - 1528.00	0.0 - 2.0	TOPSOIL
1528.00 - 1510.00	2.0 - 20.0	CLAY, BROWN, SILTY, PEBBLY; PARTIALLY OXIDIZED (TILL)
1510.00 - 1496.00	20.0 - 34.0	CLAY, OLIVE-GRAY AND BROWN, SILTY, PEBBLY; PARTIALLY OXIDIZED (TILL)
1496.00 - 1445.00	34.0 - 85.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1445.00 - 1442.00	85.0 - 88.0	GRAVEL, FINE TO MEDIUM
1442.00 - 1407.00	88.0 - 123.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1407.00 - 1390.00	123.0 - 140.0	GRAVEL, FINE TO MEDIUM
1390.00 - 1306.00	140.0 - 224.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1306.00 - 1305.90	224.0 - 224.1	QUARTZITE, PINK; VERY HARD; APPROXIMATELY 1 FOOT OF BENTONITE AND BLACK SHALE ON TOP OF QUARTZITE (SIOUX QUARTZITE)

Location Information

Legal Location: **SE SE SE SW sec.09, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-09CDDD**
Latitude: **43 deg 29 min 25 sec**
Longitude: **96 deg 52 min 34 sec**
Ground Surface Elev. (ft.): **1524 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/04/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-73**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **306.0**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE PLUGGED WITH BENTONITE GROUT.

Elevation (ft.)	Depth (ft.)	Description
1524.00 - 1522.00	0.0 - 2.0	TOPSOIL
1522.00 - 1494.00	2.0 - 30.0	CLAY, LIGHT-TAN-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1494.00 - 1374.00	30.0 - 150.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1374.00 - 1363.00	150.0 - 161.0	CHALK, LIGHT-BUFF, CLAYEY; CALCAREOUS (NIOBRARA FORMATION)
1363.00 - 1318.00	161.0 - 206.0	SHALE, GRAY; GREASY (CARLILE SHALE)
1318.00 - 1317.00	206.0 - 207.0	LIMESTONE(?) OR CONCRETION(?); CALCAREOUS, HARD
1317.00 - 1310.00	207.0 - 214.0	SHALE, DARK-GRAY (CARLILE SHALE? OR GRANEROS SHALE?)
1310.00 - 1297.00	214.0 - 227.0	SAND, PINKISH, WELL-ROUNDED AND WELL-SORTED (SPLIT ROCK CREEK FORMATION)
1297.00 - 1274.00	227.0 - 250.0	SHALE, BLACK; GREASY; INTERBEDDED PINK SANDS (SPLIT ROCK CREEK FORMATION)
1274.00 - 1254.00	250.0 - 270.0	CLAY, BUFF-TAN; GREASY (BENTONITE)
1254.00 - 1218.00	270.0 - 306.0	CLAY, BRICK-RED; GREASY; BECOMING HARDER AND SILTIER WITH DEPTH, SOME VERY HARD OLIVE-TAN ZONES PRESENT (PIPESTONE) (SIOUX FORMATION)

Location Information

Legal Location: **SW SW SW SW sec.14, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-14CCCC 1**
Latitude: **43 deg 28 min 34 sec**
Longitude: **96 deg 50 min 45 sec**
Ground Surface Elev. (ft.): **1515 T**

Test Hole Number R2-97-52 - continued.

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/29/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-52**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **T. MCCUE**
Driller's Log:
Total Drill Hole Depth (ft.): **243.1**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE PLUGGED WITH BENTONITE GROUT FROM 243 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1515.00 - 1514.00	0.0 - 1.0	TOPSOIL
1514.00 - 1497.00	1.0 - 18.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED (TILL)
1497.00 - 1494.00	18.0 - 21.0	CLAY, SANDY, PEBBLY (TILL)
1494.00 - 1485.00	21.0 - 30.0	CLAY, DARK-BROWN, PEBBLY (TILL)
1485.00 - 1391.00	30.0 - 124.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
1391.00 - 1387.00	124.0 - 128.0	GRAVEL; WITH CLAY, GRAY (TILL)
1387.00 - 1378.00	128.0 - 137.0	CLAY, GRAY, PEBBLY (TILL)
1378.00 - 1359.00	137.0 - 156.0	GRAVEL, FINE TO MEDIUM
1359.00 - 1353.00	156.0 - 162.0	CLAY, GRAY, SANDY
1353.00 - 1313.00	162.0 - 202.0	SAND, FINE; WITH LAYERS OF CLAY
1313.00 - 1309.00	202.0 - 206.0	CLAY, GRAY, SANDY
1309.00 - 1307.00	206.0 - 208.0	SAND, YELLOW-BROWN, FINE
1307.00 - 1298.00	208.0 - 217.0	CLAY, GRAY, SANDY
1298.00 - 1297.00	217.0 - 218.0	SAND, GRAY, FINE
1297.00 - 1291.00	218.0 - 224.0	CLAY, GRAY, SANDY
1291.00 - 1272.00	224.0 - 243.0	SAND, FINE
1272.00 - 1271.90	243.0 - 243.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **SW SW SW SW sec.14, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-14CCCC 2**
Latitude: **43 deg 28 min 34 sec**
Longitude: **96 deg 50 min 45 sec**
Ground Surface Elev. (ft.): **1515 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/29/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-53**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **T. MCCUE**
Driller's Log:
Total Drill Hole Depth (ft.): **160.0**

Test Hole Number R2-97-53 - continued.

Well Information

SDGS Well Name: **R2-97-53**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.018**
Total Casing and Screen (ft.): **162.0**
Aquifer: **WALL LAKE**
Casing Top Elev. (ft.): **1517.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

SCREEN INTERVAL FROM 160 TO 150 FEET; FILTER PACK: NATIVE MATERIAL FROM 160 TO 140 FEET; BENTONITE GROUT FROM 140 TO 4 FEET; GRANULAR BENTONITE FROM 4 TO 3.5 FEET; CEMENT GROUT FROM 3.5 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1515.00 - 1514.00	0.0 - 1.0	TOPSOIL
1514.00 - 1506.00	1.0 - 9.0	CLAY, YELLOW-GRAY, SANDY (TILL)
1506.00 - 1503.00	9.0 - 12.0	CLAY, GRAY-BROWN, GRAVELLY (TILL)
1503.00 - 1498.00	12.0 - 17.0	CLAY, GRAY, SANDY
1498.00 - 1488.00	17.0 - 27.0	CLAY, DARKER GRAY THAN INTERVAL FROM 12 TO 17 FEET, PEBBLY (TILL)
1488.00 - 1435.00	27.0 - 80.0	CLAY, GRAY
1435.00 - 1376.00	80.0 - 139.0	CLAY, GRAY, SANDY LAYER FROM 108 TO 110 FEET
1376.00 - 1375.00	139.0 - 140.0	CLAY, GRAY; HARD SURFACE
1375.00 - 1357.00	140.0 - 158.0	SAND AND GRAVEL
1357.00 - 1355.00	158.0 - 160.0	CLAY

Location Information

Legal Location: **SE SE SE SE sec.14, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-14DDDD**
Latitude: **43 deg 28 min 33 sec**
Longitude: **96 deg 49 min 34 sec**
Ground Surface Elev. (ft.): **1512 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **06/10/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-12**
Samples:
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **183.1**

Well Information

SDGS Well Name: **R2-98-12**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.018**
Total Casing and Screen (ft.): **172.0**
Aquifer: **WALL LAKE**
Casing Top Elev. (ft.): **1514.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

Test Hole Number R2-98-12 - continued.

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

SCREEN INTERVAL FROM 170 TO 160 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 183.1 TO 155 FEET; BENTONITE GROUT FROM 155 TO 2 FEET; CEMENT GROUT FROM 2 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1512.00 - 1510.00	0.0 - 2.0	TOPSOIL
1510.00 - 1471.00	2.0 - 41.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED (TILL)
1471.00 - 1374.00	41.0 - 138.0	CLAY, GRAY, SANDY, SILTY (TILL)
1374.00 - 1340.00	138.0 - 172.0	SAND AND GRAVEL
1340.00 - 1332.00	172.0 - 180.0	CLAY, GRAY
1332.00 - 1329.00	180.0 - 183.0	GRAVEL
1329.00 - 1328.90	183.0 - 183.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **NE SE NE SE sec.20, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-20DADA**
Latitude: **43 deg 27 min 58 sec**
Longitude: **96 deg 53 min 09 sec**
Ground Surface Elev. (ft.): **1490 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **11/05/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-74**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **256.0**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE PLUGGED WITH BENTONITE GROUT.

Elevation (ft.)	Depth (ft.)	Description
1490.00 - 1488.00	0.0 - 2.0	TOPSOIL
1488.00 - 1467.00	2.0 - 23.0	CLAY, TAN-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1467.00 - 1442.00	23.0 - 48.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1442.00 - 1439.00	48.0 - 51.0	GRAVEL, FINE, CLAYEY

Test Hole Number R2-96-74 - continued.

Elevation (ft.)	Depth (ft.)	Description
1439.00 - 1356.00	51.0 - 134.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, VERY GRAVELLY; UNOXIDIZED (TILL)
1356.00 - 1352.00	134.0 - 138.0	GRAVEL, FINE, CLAYEY
1352.00 - 1342.00	138.0 - 148.0	CLAY, GRAY, GRAVELLY (TILL)
1342.00 - 1338.00	148.0 - 152.0	GRAVEL, FINE, CLAYEY
1338.00 - 1334.00	152.0 - 156.0	CLAY, GRAY, GRAVELLY (TILL)
1334.00 - 1313.00	156.0 - 177.0	GRAVEL AND SAND, BROWN, FINE GRAVEL, COARSE SAND
1313.00 - 1298.00	177.0 - 192.0	SHALE, GRAY; GREASY (CARLILE SHALE)
1298.00 - 1296.00	192.0 - 194.0	ROCK, TAN; HARD (PIPESTONE?)
1296.00 - 1275.00	194.0 - 215.0	SHALE, GRAY; GREASY (CARLILE SHALE)
1275.00 - 1262.00	215.0 - 228.0	SAND, PINKISH, WELL-ROUNDED, WELL-SORTED; MAINLY QUARTZ; INTERBEDDED BLACK SHALES (SPLIT ROCK CREEK FORMATION)
1262.00 - 1237.00	228.0 - 253.0	CLAY, BUFF; GREASY (BENTONITE)
1237.00 - 1234.00	253.0 - 256.0	CLAY, BRICK-RED; GREASY, SLIGHTLY SILTY; (PIPESTONE) (SIOUX FORMATION)

Location Information

Legal Location: **NW NE NW NW sec.27, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-27BBAB 2**
Latitude: **43 deg 27 min 39 sec**
Longitude: **96 deg 51 min 46 sec**
Ground Surface Elev. (ft.): **1497 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/27/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-51**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN/T. MCCUE**
Driller's Log:
Total Drill Hole Depth (ft.): **197.1**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE PLUGGED WITH BENTONITE GROUT FROM 197.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1497.00 - 1464.00	0.0 - 33.0	CLAY, YELLOW, SANDY; OXIDIZED (TILL)
1464.00 - 1457.00	33.0 - 40.0	CLAY, BROWN, SANDY; OXIDIZED (TILL)
1457.00 - 1436.00	40.0 - 61.0	CLAY, GRAY, SANDY; OXIDIZED (TILL)
1436.00 - 1404.00	61.0 - 93.0	CLAY, GRAY, SILTY
1404.00 - 1390.00	93.0 - 107.0	SAND AND GRAVEL, FINE TO MEDIUM; WITH LAYER OF SANDY CLAY FROM 96 TO 99 FEET
1390.00 - 1329.00	107.0 - 168.0	CLAY, GRAY, SILTY, PEBBLY
1329.00 - 1300.00	168.0 - 197.0	SAND AND GRAVEL, WELL-ROUNDED; QUARTZ

Test Hole Number R2-97-51 - continued.

Elevation (ft.)	Depth (ft.)	Description
1300.00 - 1299.90	197.0 - 197.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **SE SE SE SE sec.29, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-29DDDD**
Latitude: **43 deg 26 min 48 sec**
Longitude: **96 deg 53 min 12 sec**
Ground Surface Elev. (ft.): **1465 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/23/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-50**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **220.1**

Well Information

SDGS Well Name: **R2-97-50**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.018**
Total Casing and Screen (ft.): **220.0**
Aquifer: **PLEISTOCENE SERIES**
Casing Top Elev. (ft.): **1467.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

SCREEN INTERVAL FROM 218 TO 208 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 220 TO 160 FEET; BENTONITE GROUT FROM 160 TO 4 FEET; CEMENT GROUT FROM 4 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1465.00 - 1455.00	0.0 - 10.0	CLAY, YELLOW, SILTY; OXIDIZED (TILL)
1455.00 - 1439.00	10.0 - 26.0	CLAY, YELLOW-BROWN; OXIDIZED (TILL)
1439.00 - 1379.00	26.0 - 86.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
1379.00 - 1275.00	86.0 - 190.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1275.00 - 1245.00	190.0 - 220.0	SAND AND GRAVEL, PINK, WELL-ROUNDED; QUARTZ
1245.00 - 1244.90	220.0 - 220.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **NW NW NW NW sec.31, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-31BBBB 1**
Latitude: **43 deg 26 min 47 sec**
Longitude: **96 deg 55 min 27 sec**
Ground Surface Elev. (ft.): **1452 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **11/06/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-54**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **162.0**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE PLUGGED WITH BENTONITE GROUT FROM 162 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1452.00 - 1426.00	0.0 - 26.0	CLAY, YELLOW TO LIGHT-BROWN (TILL)
1426.00 - 1404.00	26.0 - 48.0	CLAY, BROWNISH-GRAY, SANDY, PEBBLY (TILL)
1404.00 - 1394.00	48.0 - 58.0	CLAY, BROWN, SILTY, SANDY (TILL)
1394.00 - 1386.00	58.0 - 66.0	SAND AND GRAVEL, FINE TO MEDIUM
1386.00 - 1330.00	66.0 - 122.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
1330.00 - 1290.00	122.0 - 162.0	CLAY, LIGHT-GRAY (NIOBRARA FORMATION)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **NW NW NW NW sec.31, T. 100 N., R. 51 W.**
County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-51W-31BBBB 2**
Latitude: **43 deg 26 min 47 sec**
Longitude: **96 deg 55 min 27 sec**
Ground Surface Elev. (ft.): **1452 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **11/06/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-55**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **60.0**

HOLE PLUGGED WITH CUTTINGS FROM 60 TO 0 FEET.

Test Hole Number R2-97-55 - continued.

Elevation (ft.)	Depth (ft.)	Description
1452.00 - 1443.00	0.0 - 9.0	CLAY, YELLOW, SILTY, SANDY (TILL)
1443.00 - 1433.00	9.0 - 19.0	CLAY, YELLOW-BROWN, SILTY, SANDY, PEBBLY (TILL)
1433.00 - 1431.00	19.0 - 21.0	CLAY, BROWN-GRAY, SILTY, SANDY (TILL)
1431.00 - 1392.00	21.0 - 60.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)

Location Information

Legal Location: **SW SW SW SW sec.09, T. 100 N., R. 52 W.**
County: **TURNER**
Basin: **VERMILLION**
Hydrologic Unit Code: **10170102**
Land Owner:
Location: **100N-52W-09CCCC**
Latitude: **43 deg 29 min 23 sec**
Longitude: **97 deg 00 min 12 sec**
Ground Surface Elev. (ft.): **1530 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **05/27/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-06**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **157.0**

HOLE PLUGGED WITH BENTONITE GROUT FROM 157 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1530.00 - 1528.00	0.0 - 2.0	TOPSOIL
1528.00 - 1520.00	2.0 - 10.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED
1520.00 - 1457.00	10.0 - 73.0	CLAY, GRAY, SILTY (TILL)
1457.00 - 1452.00	73.0 - 78.0	SAND AND GRAVEL, CLAYEY
1452.00 - 1432.00	78.0 - 98.0	CLAY, GRAY, PEBBLY (TILL)
1432.00 - 1427.00	98.0 - 103.0	SAND AND GRAVEL, CLAYEY
1427.00 - 1390.00	103.0 - 140.0	CLAY, LIGHT-GRAY, SILTY
1390.00 - 1373.00	140.0 - 157.0	CHALK, WHITE AND DARK-GRAY; VERY SOFT, GREASY (NIOBRARA FORMATION)

Location Information

Legal Location: **SE SE SE SE sec.22, T. 100 N., R. 52 W.**
County: **TURNER**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-52W-22DDDD**
Latitude: **43 deg 27 min 39 sec**
Longitude: **96 deg 57 min 52 sec**
Ground Surface Elev. (ft.): **1487 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **11/11/1997**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-97-56**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN/T. MCCUE**
Driller's Log:
Total Drill Hole Depth (ft.): **142.0**

Test Hole Number R2-97-56 - continued.

Well Information

SDGS Well Name: **R2-97-56**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.018**
Total Casing and Screen (ft.): **130.0**
Aquifer: **PLEISTOCENE SERIES**
Casing Top Elev. (ft.): **1489.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

SCREEN INTERVAL FROM 128 TO 118 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 142 TO 80 FEET; BENTONITE GROUT FROM 80 TO 2 FEET; CEMENT GROUT FROM 2 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1487.00 - 1473.00	0.0 - 14.0	CLAY, YELLOW; OXIDIZED (TILL)
1473.00 - 1461.00	14.0 - 26.0	CLAY, DARK-BROWN; OXIDIZED (TILL)
1461.00 - 1387.00	26.0 - 100.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
1387.00 - 1377.00	100.0 - 110.0	GRAVEL, GRAY, FINE, POORLY SORTED
1377.00 - 1371.00	110.0 - 116.0	CLAY, LIGHT-GRAY, VERY SANDY; OXIDIZED
1371.00 - 1355.00	116.0 - 132.0	SAND, WHITE AND YELLOW, COARSE, WELL-ROUNDED, WELL-SORTED; QUARTZ
1355.00 - 1345.00	132.0 - 142.0	SHALE, GRAY AND WHITE

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **SW SW SW SW sec.28, T. 100 N., R. 52 W.**
County: **TURNER**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-52W-28CCCC**
Latitude: **43 deg 26 min 47 sec**
Longitude: **97 deg 00 min 12 sec**
Ground Surface Elev. (ft.): **1429 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **05/28/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-08**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **73.1**

Well Information

SDGS Well Name: **R2-98-08**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.018**
Total Casing and Screen (ft.): **70.0**
Aquifer: **PLEISTOCENE SERIES**
Casing Top Elev. (ft.): **1431.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

Test Hole R2-98-08 - continued.

SCREEN INTERVAL FROM 68 TO 58 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 73 TO 50 FEET; BENTONITE GROUT FROM 50 TO 2 FEET; CEMENT GROUT FROM 2 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1429.00 - 1427.00	0.0 - 2.0	TOPSOIL
1427.00 - 1419.00	2.0 - 10.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED (TILL)
1419.00 - 1382.00	10.0 - 47.0	CLAY, GRAY, SILTY, PEBBLY (TILL)
1382.00 - 1356.00	47.0 - 73.0	SAND AND GRAVEL, YELLOW, PINK, WELL-ROUNDED; QUARTZ
1356.00 - 1355.90	73.0 - 73.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **NW SW NW NW sec.36, T. 100 N., R. 52 W.**
County: **TURNER**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **100N-52W-36BBCB**
Latitude: **43 deg 26 min 37 sec**
Longitude: **96 deg 56 min 38 sec**
Ground Surface Elev. (ft.): **1450 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **06/02/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-09**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **160.0**

HOLE PLUGGED WITH BENTONITE GROUT FROM 160 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1450.00 - 1448.00	0.0 - 2.0	TOPSOIL
1448.00 - 1432.00	2.0 - 18.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED (TILL)
1432.00 - 1428.00	18.0 - 22.0	SAND AND GRAVEL, CLAYEY (TILL)
1428.00 - 1404.00	22.0 - 46.0	CLAY, BROWN, GRAY, SILTY, SANDY, PEBBLY (TILL)
1404.00 - 1348.00	46.0 - 102.0	CLAY, GRAY, SILTY (TILL)
1348.00 - 1344.00	102.0 - 106.0	SAND AND GRAVEL
1344.00 - 1322.00	106.0 - 128.0	CLAY, GRAY, SILTY, SANDY
1322.00 - 1306.00	128.0 - 144.0	CLAY, BLACK (SHALE)
1306.00 - 1290.00	144.0 - 160.0	CHALK, LIGHT-GRAY; SOFT (NIOBRARA FORMATION)

Location Information

Legal Location: **SE SE SE NE sec.25, T. 100 N., R. 53 W.**
County: **TURNER**
Basin: **VERMILLION**
Location: **100N-53W-25ADDD**
Latitude: **43 deg 27 min 13 sec**

Test Hole Number R2-98-07 - continued.

Hydrologic Unit Code: **10170102**
Land Owner:
Longitude: **97 deg 02 min 34 sec**
Ground Surface Elev. (ft.): **1438 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **05/27/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-07**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **103.1**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE PLUGGED WITH BENTONITE GROUT FROM 103.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1438.00 - 1436.00	0.0 - 2.0	TOPSOIL
1436.00 - 1414.00	2.0 - 24.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED (TILL)
1414.00 - 1391.00	24.0 - 47.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
1391.00 - 1385.00	47.0 - 53.0	SAND, GRAY, WELL-SORTED
1385.00 - 1376.00	53.0 - 62.0	CLAY, GRAY, SANDY, PEBBLY
1376.00 - 1372.00	62.0 - 66.0	SAND, GRAY, FINE TO COARSE
1372.00 - 1365.00	66.0 - 73.0	CLAY, GRAY
1365.00 - 1356.00	73.0 - 82.0	SAND, GRAY, FINE TO COARSE
1356.00 - 1352.00	82.0 - 86.0	CHALK, WHITE; SOFT (NIOBRARA FORMATION)
1352.00 - 1341.00	86.0 - 97.0	CHALK, GRAY; SOFT (NIOBRARA FORMATION)
1341.00 - 1335.00	97.0 - 103.0	SHALE, GRAY
1335.00 - 1334.90	103.0 - 103.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **SW SW NW SW sec.34, T. 101 N., R. 50 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-50W-34CBCC**
Latitude: **43 deg 30 min 16 sec**
Longitude: **96 deg 49 min 48 sec**
Ground Surface Elev. (ft.): **1528 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **06/09/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-11**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **191.1**

Test Hole Number R2-98-11 - continued.

Well Information

SDGS Well Name: **R2-98-11**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.018**
Total Casing and Screen (ft.): **167.0**
Aquifer: **WALL LAKE**
Casing Top Elev. (ft.): **1530.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**
Single Point Resistivity: **X**
Extra:

HOLE COLLAPSED FROM 191.1 TO 188 FEET; SCREEN INTERVAL FROM 165 TO 155 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 188 TO 125 FEET; BENTONITE GROUT FROM 125 TO 2 FEET; CEMENT GROUT FROM 2 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1528.00 - 1526.00	0.0 - 2.0	TOPSOIL
1526.00 - 1508.00	2.0 - 20.0	CLAY, YELLOW-BROWN, SILTY; OXIDIZED
1508.00 - 1488.00	20.0 - 40.0	CLAY, YELLOW-BROWN, SANDY; OXIDIZED (TILL)
1488.00 - 1406.00	40.0 - 122.0	CLAY, GRAY, SILTY, SANDY (TILL)
1406.00 - 1384.00	122.0 - 144.0	GRAVEL AND SAND; WITH CLAY
1384.00 - 1337.00	144.0 - 191.0	SAND AND GRAVEL, WELL-ROUNDED; WITH CLAY LAYERS
1337.00 - 1336.90	191.0 - 191.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **NW NW NW NW sec.10, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-10BBBB**
Latitude: **43 deg 34 min 19 sec**
Longitude: **96 deg 56 min 59 sec**
Ground Surface Elev. (ft.): **1620 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **05/20/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-03**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **235.1**

Well Information

SDGS Well Name: **R2-98-03**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Aquifer: **WALL LAKE**
Casing Top Elev. (ft.): **1623.00 T**
Casing Diameter (in.): **2.0**

Test Hole Number R2-98-03 - continued.

Screen Type: **PVC, MFG., SLOT SIZE 0.018** Screen Length (ft.): **10.0**
Total Casing and Screen (ft.): **238.0** Casing Stick-up (ft.): **3.00**

Geophysical Information

Spontaneous Potential: **X** Single Point Resistivity: **X**
Natural Gamma: **X** Extra:

SCREEN INTERVAL FROM 235 TO 225 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 235 TO 210 FEET; BENTONITE GROUT FROM 210 TO 2 FEET; CEMENT GROUT FROM 2 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1620.00 - 1618.00	0.0 - 2.0	TOPSOIL
1618.00 - 1605.00	2.0 - 15.0	CLAY, YELLOW-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1605.00 - 1430.00	15.0 - 190.0	CLAY, GRAY, PEBBLY (TILL)
1430.00 - 1385.00	190.0 - 235.0	SAND AND GRAVEL, PINKISH; MAINLY QUARTZ
1385.00 - 1384.90	235.0 - 235.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

Location Information

Legal Location: **NE NE NE NE sec.14, T. 101 N., R. 51 W.**
County: **MINNEHAHA** Location: **101N-51W-14AAAA**
Basin: **BIG SIOUX** Latitude: **43 deg 33 min 28 sec**
Hydrologic Unit Code: **10170203** Longitude: **96 deg 54 min 38 sec**
Land Owner: Ground Surface Elev. (ft.): **1595 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY** Geologist: **S. PENCE**
Drill Date: **11/06/1996** Geologist's Log: **X**
Company: **SDGS** Driller: **G. JENSEN**
Drilling Method: **ROTARY** Driller's Log:
Test Hole Number: **R2-96-76** Total Drill Hole Depth (ft.): **200.0**

HOLE PLUGGED WITH CUTTINGS AND GRANULAR BENTONITE.

Elevation (ft.)	Depth (ft.)	Description
1595.00 - 1593.00	0.0 - 2.0	TOPSOIL
1593.00 - 1585.00	2.0 - 10.0	CLAY, 0LIVE-TAN, SILTY, SANDY, PEBBLY; OXIDIZED (TILL)
1585.00 - 1556.00	10.0 - 39.0	CLAY, TAN-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1556.00 - 1503.00	39.0 - 92.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDZED (TILL)
1503.00 - 1475.00	92.0 - 120.0	SILT, GRAY, VERY CLAYEY; LACCUSTRINE
1475.00 - 1431.00	120.0 - 164.0	CLAY, YELLOW-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)

Test Hole Number R2-96-76 - continued.

Elevation (ft.)	Depth (ft.)	Description
1431.00 - 1412.00	164.0 - 183.0	CHALK, BUFF, CLAYEY; GREASY (NIOBRARA FORMATION)
1412.00 - 1395.00	183.0 - 200.0	SHALE, GRAY; GREASY (CARLILE SHALE)
1395.00 - 1394.90	200.0 - 200.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **SW NW SW SW sec.15, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-15CCBC**
Latitude: **43 deg 32 min 50 sec**
Longitude: **96 deg 56 min 58 sec**
Ground Surface Elev. (ft.): **1600 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/07/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-68**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **222.0**

HOLE PLUGGED WITH CUTTINGS AND GRANULAR BENTONITE.

Elevation (ft.)	Depth (ft.)	Description
1600.00 - 1598.00	0.0 - 2.0	TOPSOIL
1598.00 - 1570.00	2.0 - 30.0	CLAY, BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1570.00 - 1431.00	30.0 - 169.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1431.00 - 1395.00	169.0 - 205.0	CHALK, LIGHT-BUFF, SOME BROWN MOTTLING, CLAYEY; GREASY, CALCAREOUS (NIOBRARA FORMATION)
1395.00 - 1378.00	205.0 - 222.0	SHALE, VERY LIGHT-GRAY; GREASY (CARLILE SHALE)

Location Information

Legal Location: **SW NW NW SW sec.21, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-21CBBC**
Latitude: **43 deg 32 min 04 sec**
Longitude: **96 deg 58 min 12 sec**
Ground Surface Elev. (ft.): **1575 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/08/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:

Test Hole Number R2-96-70 - continued.

Test Hole Number: **R2-96-70** Total Drill Hole Depth (ft.): **269.1**

Well Information

SDGS Well Name: **R2-96-70**
Other Well Name:
Casing Type: **PVC, SCH. 80**
Screen Type: **PVC, MFG., SLOT SIZE 0.010**
Total Casing and Screen (ft.): **270.0**
Aquifer: **SPLIT ROCK CREEK**
Casing Top Elev. (ft.): **1577.00 T**
Casing Diameter (in.): **2.0**
Screen Length (ft.): **10.0**
Casing Stick-up (ft.): **2.00**

SCREEN INTERVAL FROM 268 TO 258 FEET; FILTER PACK (COARSE QUARTZ SAND) FROM 268 TO 250 FEET; BENTONITE GROUT FROM 250 TO 20 FEET; CEMENT GROUT FROM 20 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1575.00 - 1573.00	0.0 - 2.0	TOPSOIL
1573.00 - 1545.00	2.0 - 30.0	CLAY, BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1545.00 - 1461.00	30.0 - 114.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1461.00 - 1458.00	114.0 - 117.0	GRAVEL, MEDIUM
1458.00 - 1447.00	117.0 - 128.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1447.00 - 1445.00	128.0 - 130.0	GRAVEL, MEDIUM
1445.00 - 1412.00	130.0 - 163.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1412.00 - 1397.00	163.0 - 178.0	GRAVEL, FINE TO MEDIUM (WALL LAKE OUTWASH?)
1397.00 - 1365.00	178.0 - 210.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1365.00 - 1306.00	210.0 - 269.0	SAND, CLEAR COLOR BECOMING PINKISH AT APPROXIMATELY 240 FEET, MEDIUM, VERY WELL-ROUNDED, WELL-SORTED; 90% TO 95% QUARTZ; INTERBEDDED BLACK SHALES STARTING AT APPROXIMATELY 240 FEET (SPLIT ROCK CREEK FORMATION)
1306.00 - 1305.90	269.0 - 269.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **NW SW NW NW sec.22, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-22BBCB**
Latitude: **43 deg 32 min 27 sec**
Longitude: **96 deg 56 min 59 sec**
Ground Surface Elev. (ft.): **1590 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **06/08/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:

Test Hole Number R2-98-10 - continued.

Test Hole Number: **R2-98-10** Total Drill Hole Depth (ft.): **170.0**

HOLE PLUGGED WITH BENTONITE GROUT FROM 170 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1590.00 - 1588.00	0.0 - 2.0	TOPSOIL
1588.00 - 1580.00	2.0 - 10.0	CLAY, YELLOW-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1580.00 - 1480.00	10.0 - 110.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1480.00 - 1474.00	110.0 - 116.0	SAND AND GRAVEL, YELLOW; OXIDIZED
1474.00 - 1444.00	116.0 - 146.0	CLAY, LIGHT-GRAY, YELLOW, SANDY; OXIDIZED
1444.00 - 1438.00	146.0 - 152.0	SAND AND GRAVEL, YELLOW; OXIDIZED
1438.00 - 1420.00	152.0 - 170.0	CHALK, LIGHT-GRAY; GREASY (NIOBRARA FORMATION)

Location Information

Legal Location: **SW SW NW SW sec.23, T. 101 N., R. 51 W.**
County: **MINNEHAHA** Location: **101N-51W-23CBCC**
Basin: **BIG SIOUX** Latitude: **43 deg 30 min 56 sec**
Hydrologic Unit Code: **10170203** Longitude: **96 deg 55 min 46 sec**
Land Owner: Ground Surface Elev. (ft.): **1543 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY** Geologist: **D. FILIPOVIC**
Drill Date: **05/20/1998** Geologist's Log: **X**
Company: **SDGS** Driller: **S. RASMUSSEN**
Drilling Method: **ROTARY** Driller's Log:
Test Hole Number: **R2-98-04** Total Drill Hole Depth (ft.): **162.0**

Well Information

SDGS Well Name: **R2-98-04** Aquifer: **WALL LAKE**
Other Well Name: Casing Top Elev. (ft.): **1545.00 T**
Casing Type: **PVC, SCH. 80** Casing Diameter (in.): **2.0**
Screen Type: **PVC, MFG., SLOT SIZE 0.018** Screen Length (ft.): **20.0**
Total Casing and Screen (ft.): **157.0** Casing Stick-up (ft.): **2.00**

Geophysical Information

Spontaneous Potential: Single Point Resistivity:
Natural Gamma: **X** Extra:

SCREEN INTERVAL FROM 155 TO 135 FEET; FILTER PACK: COARSE QUARTZ SAND FROM 162 TO 126 FEET; BENTONITE GROUT FROM 126 TO 2 FEET; CEMENT GROUT FROM 2 TO 0 FEET; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1543.00 - 1539.00	0.0 - 4.0	SAND AND GRAVEL; OXIDIZED
1539.00 - 1525.00	4.0 - 18.0	CLAY, YELLOW-BROWN, PEBBLY; OXIDIZED
1525.00 - 1501.00	18.0 - 42.0	CLAY, GRAY TO DARK-GRAY, SILTY (TILL)

Test Hole Number R2-98-04 - continued.

Elevation (ft.)	Depth (ft.)	Description
1501.00 - 1470.00	42.0 - 73.0	SAND, GRAY, WELL-SORTED
1470.00 - 1455.00	73.0 - 88.0	CLAY, GRAY, SANDY
1455.00 - 1385.00	88.0 - 158.0	SAND AND GRAVEL, WELL-ROUNDED; WITH SEVERAL TINY LAYERS OF CLAY
1385.00 - 1381.00	158.0 - 162.0	CLAY, DARK-GRAY; VERY HARD

Location Information

Legal Location: **SE NE NE SE sec.23, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-23DAAD**
Latitude: **43 deg 32 min 06 sec**
Longitude: **96 deg 54 min 38 sec**
Ground Surface Elev. (ft.): **1540 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/06/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-77**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **197.0**

HOLE PLUGGED WITH BENTONITE GROUT.

Elevation (ft.)	Depth (ft.)	Description
1540.00 - 1538.00	0.0 - 2.0	TOPSOIL
1538.00 - 1490.00	2.0 - 50.0	CLAY, BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1490.00 - 1465.00	50.0 - 75.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1465.00 - 1455.00	75.0 - 85.0	GRAVEL, BROWN, FINE
1455.00 - 1420.00	85.0 - 120.0	CLAY, YELLOW-BROWN, SILTY, PEBBLY; OXIDIZED, SOME LACCUSTRINE SEDIMENTS AT TOP OF INTERVAL (TILL)
1420.00 - 1379.00	120.0 - 161.0	CHALK, BUFF, BECOMING LIGHT-GRAY AT 145 FEET, CLAYEY (NIOBRARA FORMATION)
1379.00 - 1347.00	161.0 - 193.0	SHALE, VERY DARK-GRAY; GREASY (CARLILE SHALE)
1347.00 - 1343.00	193.0 - 197.0	SAND, PINK, WELL-ROUNDED, WELL-SORTED; QUARTZ (QUARTZITE WASH)
1343.00 - 1342.90	197.0 - 197.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **NW NW NW NW sec.27, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Location: **101N-51W-27BBBB**
Latitude: **43 deg 31 min 43 sec**
Longitude: **96 deg 56 min 56 sec**

Test Hole Number R2-96-69 - continued.

Land Owner: Ground Surface Elev. (ft.): **1580 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/08/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-69**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **182.0**

HOLE PLUGGED WITH BENTONITE GROUT.

Elevation (ft.)	Depth (ft.)	Description
1580.00 - 1578.00	0.0 - 2.0	TOPSOIL
1578.00 - 1568.00	2.0 - 12.0	GRAVEL, BROWN, FINE TO MEDIUM
1568.00 - 1556.00	12.0 - 24.0	CLAY, BROWN, SILTY, SANDY, PEBBLY; OXIDIZED (TILL)
1556.00 - 1553.00	24.0 - 27.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1553.00 - 1550.00	27.0 - 30.0	GRAVEL, GRAY, MEDIUM
1550.00 - 1537.00	30.0 - 43.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1537.00 - 1524.00	43.0 - 56.0	GRAVEL, GRAY, MEDIUM, CLAYEY
1524.00 - 1457.00	56.0 - 123.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED
1457.00 - 1450.00	123.0 - 130.0	GRAVEL, MEDIUM TO COARSE
1450.00 - 1435.00	130.0 - 145.0	CLAY, BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1435.00 - 1410.00	145.0 - 170.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1410.00 - 1398.00	170.0 - 182.0	CHALK, LIGHT-BUFF, CLAYEY; GREASY (NIOBRARA FORMATION)

Location Information

Legal Location: **NE NE NE NE sec.32, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-32AAAA**
Latitude: **43 deg 30 min 52 sec**
Longitude: **96 deg 58 min 12 sec**
Ground Surface Elev. (ft.): **1607 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **05/26/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-05**
Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **209.1**

HOLE PLUGGED WITH BENTONITE GROUT FROM 209.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1607.00 - 1605.00	0.0 - 2.0	TOPSOIL

Test Hole R2-98-05 - continued.

Elevation (ft.)	Depth (ft.)	Description
1605.00 - 1597.00	2.0 - 10.0	CLAY, YELLOW-BROWN; OXIDIZED
1597.00 - 1515.00	10.0 - 92.0	CLAY, GRAY, SILTY, PEBBLY (TILL)
1515.00 - 1472.00	92.0 - 135.0	CLAY, LIGHT-GRAY; VERY PLASTIC
1472.00 - 1437.00	135.0 - 170.0	CLAY, YELLOW, SANDY
1437.00 - 1430.00	170.0 - 177.0	SAND AND GRAVEL, GRAY AND YELLOW
1430.00 - 1399.00	177.0 - 208.0	SAND, YELLOW, CLAYEY
1399.00 - 1398.00	208.0 - 209.0	CHALK, LIGHT-GRAY; SOFT
1398.00 - 1397.90	209.0 - 209.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **SW SW SW SW sec.34, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-34CCCC**
Latitude: **43 deg 30 min 00 sec**
Longitude: **96 deg 57 min 00 sec**
Ground Surface Elev. (ft.): **1570 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **10/09/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-71**
Geologist: **S. PENCE**
Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **190.0**

HOLE PLUGGED WITH CUTTINGS AND GRANULAR BENTONITE.

Elevation (ft.)	Depth (ft.)	Description
1570.00 - 1568.00	0.0 - 2.0	TOPSOIL
1568.00 - 1521.00	2.0 - 49.0	CLAY, BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1521.00 - 1400.00	49.0 - 170.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1400.00 - 1380.00	170.0 - 190.0	CHALK, LIGHT-BUFF TO LIGHT-TAN, CLAYEY; CALCAREOUS (NIOBRARA FORMATION)
1380.00 - 1379.90	190.0 - 190.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **NE NE NE NE sec.35, T. 101 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:
Location: **101N-51W-35AAAA**
Latitude: **43 deg 30 min 52 sec**
Longitude: **96 deg 54 min 39 sec**
Ground Surface Elev. (ft.): **1555 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Geologist: **S. PENCE**

Test Hole Number R2-96-78 - continued.

Drill Date: **11/07/1996**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-96-78**

Geologist's Log: **X**
Driller: **G. JENSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **240.0**

HOLE PLUGGED WITH BENTONITE GROUT.

Elevation (ft.)	Depth (ft.)	Description
1555.00 - 1553.00	0.0 - 2.0	TOPSOIL
1553.00 - 1508.00	2.0 - 47.0	CLAY, BROWN, SILTY, SANDY, PEBBLY; OXIDIZED (TILL)
1508.00 - 1505.00	47.0 - 50.0	SAND, BROWN, COARSE
1505.00 - 1499.00	50.0 - 56.0	CLAY, BROWN, SILTY, SANDY, PEBBLY; OXIDIZED (TILL)
1499.00 - 1495.00	56.0 - 60.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1495.00 - 1493.00	60.0 - 62.0	GRAVEL, BROWN, FINE
1493.00 - 1451.00	62.0 - 104.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED (TILL)
1451.00 - 1428.00	104.0 - 127.0	SILT, GRAY, VERY CLAYEY (LACCUSTRINE)
1428.00 - 1426.00	127.0 - 129.0	GRAVEL, FINE
1426.00 - 1418.00	129.0 - 137.0	SILT, GRAY, VERY CLAYEY (LACCUSTRINE)
1418.00 - 1404.00	137.0 - 151.0	CLAY, LIGHT-BROWN, SILTY, PEBBLY; OXIDIZED (TILL)
1404.00 - 1366.00	151.0 - 189.0	CHALK, BUFF, BECOMING LIGHT-GRAY AT 185 FEET, CLAYEY (NIOBRARA FORMATION)
1366.00 - 1320.00	189.0 - 235.0	SHALE, BLACK; GREASY (CARLILE SHALE)
1320.00 - 1315.00	235.0 - 240.0	SANDSTONE, PINK, WELL-ROUNDED, WELL-SORTED; QUARTZ (SPLIT ROCK CREEK FORMATION)
1315.00 - 1314.90	240.0 - 240.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

Location Information

Legal Location: **SE SE SE SE sec.35, T. 102 N., R. 51 W.**
County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**
Land Owner:

Location: **102N-51W-35DDDD**
Latitude: **43 deg 35 min 14 sec**
Longitude: **96 deg 54 min 39 sec**
Ground Surface Elev. (ft.): **1568 T**

Project Information

Project: **WALL LAKE AQUIFER STUDY**
Drill Date: **05/19/1998**
Company: **SDGS**
Drilling Method: **ROTARY**
Test Hole Number: **R2-98-02**

Geologist: **D. FILIPOVIC**
Geologist's Log: **X**
Driller: **S. RASMUSSEN**
Driller's Log:
Total Drill Hole Depth (ft.): **166.1**

Geophysical Information

Spontaneous Potential: **X**
Natural Gamma: **X**

Single Point Resistivity: **X**
Extra:

Test Hole R2-98-02 - continued.

HOLE PLUGGED WITH BENTONITE GROUT FROM 166.1 TO 0 FEET.

Elevation (ft.)	Depth (ft.)	Description
1568.00 - 1566.00	0.0 - 2.0	TOPSOIL
1566.00 - 1558.00	2.0 - 10.0	CLAY, YELLOW, SILTY; OXIDIZED (TILL)
1558.00 - 1444.00	10.0 - 124.0	CLAY, GRAY, SILTY, PEBBLY; UNOXIDIZED
1444.00 - 1430.00	124.0 - 138.0	GRAVEL, WELL-ROUNDED, WELL-SORTED
1430.00 - 1402.00	138.0 - 166.0	CLAY, GRAY, SILTY, PEBBLY
1402.00 - 1401.90	166.0 - 166.1	QUARTZITE, PINK; VERY HARD (SIOUX QUARTZITE)

GEOLOGY INTERPRETED MAINLY FROM E-LOG.

APPENDIX B

Results of water quality analyses conducted for this study

Legal Location and Location

The logs are listed by smallest township number, then the smallest range number, the smallest section, and then by quarter section: **NE = A**; **NW = B**, **SW = C**; **SE = D**. A comparison of **Legal Location** and **Location** is as follows. A **Legal Location** of NW SE NE SW sec. 30, T. 99 N., R. 64 W. is the same as a **Location** of 099N-64W-30CADB. A **Location** followed by a "1" indicates that information on more than one test hole or well may exist at that location.

Hydrologic Unit Code

A number used for watershed identification that indicates the region, sub-region, accounting unit, and cataloging unit.

Ground Surface Elev. and Casing Top Elev.

The elevations are presented in feet above mean sea level. A "T" following the elevation indicates that the elevation was estimated from a 7.5 minute series topographic map.

Collection Time

The time of sample collection is presented in military time.

Sample Filtered? and Chain of Custody?

An "N" following these means "no," the sample was not filtered in the field and there was no paperwork prepared regarding chain of custody.

Abbreviations

mg/L – milligrams per liter
Ca – calcium
Mg – magnesium
Na – sodium
K – potassium
Fe – iron
Mn – manganese
HCO3 – bicarbonate
CO3 – carbonate
SO4 – sulfate
Cl – chloride
F – fluoride
NO2-N – nitrate as nitrogen
NO3-N – nitrite as nitrogen
CaCO3 – calcium carbonate
Lab Alk-T – alkalinity-total measured in the laboratory
Lab Alk-P – alkalinity-phenolphthalein measured in the laboratory
NH3-N – ammonia as nitrogen
Total P – total phosphorous
Lab TDS – total dissolved solids measured in the laboratory
Field Cond – conductivity measured in the field
Lab pH – pH measured in the laboratory
Field pH – pH measured in the field
Field Temp – water temperature measured in the field
Ag – gold
As – arsenic
B – boron
Ba – barium
Be – beryllium
Cd – cadmium
Cr – chromium
Cu – copper
Hg – mercury
Ni – nickel
Pb – lead
Sb – antimony
Se – selenium
Tl – thallium
Zn – zinc

Location Information

Legal Location: **NW NW NW NW sec. 18, T. 100 N., R. 50 W.**

County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **100N-50W-18BBBB 1**
Latitude: **43 deg 29 min 21 sec**
Longitude: **96 deg 48 min 21 sec**
Ground Surface Elev. (ft): **1515 T**

Sample Information

Sample Number: **WLA-98-006**
Collection Date: **06/08/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-96-75**
Other Well Name:
Water Rights Well Name:
Aquifer: **WALL LAKE**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **163.50**
Casing Top Elev. (ft): **1517.50 T**
Depth to Water (ft from top): **88.36**
Ground Water Elevation(ft): **1429.14**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **12:45**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**253**	HCO3:	
Mg:	**70**	CO3:	
Na:	**74**	SO4:	**703.5**
K:		Cl:	**8.55**
Fe:	**0.266**	F:	**0.38**
Mn:	**2.28**	NO3-N+NO2-N:	
		NO2-N:	**<0.003**
		NO3-N:	**<0.004**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**920.4**	NH3-N:	
Lab Alk-T:	**370.4**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**1022** mg/L @ 180°C
Field Cond:	**1550** unfiltered
Lab pH:	**7.70** compensated to 25°C
Field pH:	**8.0** unfiltered
Field Temp:	**9.0**°C (unfiltered)

Sample Number WLA-98-006 - continued.

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 2.27 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**5** ug/L
As:	**1.4** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**20** ug/L	Pb:	**<0.2** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**<0.1** ug/L	Se:	**<2** ug/L
Cr:	**0.3** ug/L	Tl:	**<0.2** ug/L
		Zn:	**<50** ug/L

Location Information

Legal Location: **SE SE SE SE sec. 14, T. 100 N., R. 51 W.**

County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **100N-51W-14DDDD**
Latitude: **43 deg 28 min 33 sec**
Longitude: **96 deg 49 min 34 sec**
Ground Surface Elev. (ft): **1512 T**

Sample Information

Sample Number: **WLA-98-008**
Collection Date: **06/11/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-98-12**
Other Well Name:
Water Rights Well Name:
Aquifer: **WALL LAKE**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **172.00**
Casing Top Elev. (ft): **1514.00 T**
Depth to Water (ft from top): **66.70**
Ground Water Elevation (ft): **1447.30**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **11:45**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**288**	HCO3:	
Mg:	**68**	CO3:	
Na:	**82.2**	SO4:	**742.5**
K:		Cl:	**9.25**

Sample Number WLA-98-008 Inorganic Information - continued.

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Fe:	**0.546**	F:	**0.42**
Mn:	**3.62**	NO3-N+NO2-N:	
		NO2-N:	**<0.003**
		NO3-N:	**<0.004**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**979.6**	NH3-N:	
Lab Alk-T:	**404**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**1067** mg/L @ 180°C
Field Cond:	**1600** unfiltered
Lab pH:	**7.80** compensated to 25°C
Field pH:	**7.9** unfiltered
Field Temp:	**10.0**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 1.08 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**3** ug/L
As:	**1.7** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**28** ug/L	Pb:	**<0.2** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.2** ug/L	Se:	**<2** ug/L
Cr:	**1.4** ug/L	Tl:	**<0.2** ug/L
		Zn:	**<50** ug/L

Location Information

Legal Location: **SE SE SE SE sec. 29, T. 100 N., R. 51 W.**

County: **LINCOLN**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **100N-51W-29DDDD**
Latitude: **43 deg 26 min 48 sec**
Longitude: **96 deg 53 min 12 sec**
Ground Surface Elev. (ft): **1465 T**

Sample Information

Sample Number: **WLA-98-004**
Collection Date: **06/04/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Sample Number WLA-98-004 - continued.

Well Information

SDGS Well Name: **R2-97-50**
Other Well Name:
Water Rights Well Name:
Aquifer: **PLEISTOCENE SERIES**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **220.00**
Casing Top Elev. (ft): **1467.00 T**
Depth to Water (ft from top): **23.45**
Ground Water Elevation (ft): **1443.55**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **10:00**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**274**	HCO3:	
Mg:	**70**	CO3:	
Na:	**79.5**	SO4:	**766.6**
K:		Cl:	**6.5**
Fe:	**0.072**	F:	**0.39**
Mn:	**3.38**	NO3-N+NO2-N:	
		NO2-N:	**<0.002**
		NO3-N:	**<0.004**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**974.8**	NH3-N:	
Lab Alk-T:	**367.6**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**1115** mg/L @ 180°C
Field Cond:	**1650** unfiltered
Lab pH:	**7.8** compensated to 25°C
Field pH:	**7.8** unfiltered
Field Temp:	**10.0**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 2.44 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**12** ug/L
As:	**0.4** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**16** ug/L	Pb:	**0.2** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.3** ug/L	Se:	**<2** ug/L
Cr:	**3.0** ug/L	Tl:	**<0.2** ug/L
		Zn:	**54** ug/L

Location Information

Legal Location: **SE SE SE SE sec. 22, T. 100 N., R. 52 W.**

County: **TURNER**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **100N-52W-22DDDD**
Latitude: **43 deg 27 min 39 sec**
Longitude: **96 deg 57 min 52 sec**
Ground Surface Elev. (ft): **1487 T**

Sample Information

Sample Number: **WLA-98-005**
Collection Date: **06/04/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-97-56**
Other Well Name:
Water Rights Well Name:
Aquifer: **PLEISTOCENE SERIES**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **130.00**
Casing Top Elev. (ft): **1489.00 T**
Depth to Water (ft from top): **44.75**
Ground Water Elevation (ft): **1444.25**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **11:00**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **Y**
Chain of Custody? **N**

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**283**	HCO3:	
Mg:	**69**	CO3:	
Na:	**84.6**	SO4:	**758.5**
K:		Cl:	**7.1**
Fe:	**0.186**	F:	**0.48**
Mn:	**2.34**	NO3-N+NO2-N:	
		NO2-N:	**0.11**
		NO3-N:	**0.08**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**990.8**	NH3-N:	
Lab Alk-T:	**394.8**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**1117** mg/L @ 180°C
Field Cond:	**1700** unfiltered
Lab pH:	**7.8** compensated to 25°C
Field pH:	**7.8** unfiltered
Field Temp:	**10.0**°C (unfiltered)

Sample Number WLA-98-005 - continued.

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 6.11 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**4** ug/L
As:	**1.5** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**36** ug/L	Pb:	**<0.2** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.2** ug/L	Se:	**<2** ug/L
Cr:	**6.9** ug/L	Tl:	**<0.2** ug/L
		Zn:	**<50** ug/L

Location Information

Legal Location: **SW SW SW SW sec. 28, T. 100 N., R. 52 W.**

County: **TURNER**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **100N-52W-28CCCC**
Latitude: **43 deg 26 min 47 sec**
Longitude: **97 deg 00 min 12 sec**
Ground Surface Elev. (ft): **1429 T**

Sample Information

Sample Number: **WLA-98-003**
Collection Date: **06/03/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-98-08**
Other Well Name:
Water Rights Well Name:
Aquifer: **PLEISTOCENE SERIES**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **70.00**
Casing Top Elev. (ft): **1431.00 T**
Depth to Water (ft from top): **23.05**
Ground Water Elevation (ft): **1407.95**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **15:00**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**309**	HCO3:	
Mg:	**120**	CO3:	
Na:	**64.6**	SO4:	**897.1**
K:		Cl:	**7.15**

Sample Number WLA-98-003 Inorganic Information - continued.

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Fe:	**0.082**	F:	**0.40**
Mn:	**2.33**	NO3-N+NO2-N:	
		NO2-N:	**<0.003**
		NO3-N:	**<0.004**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**1265.2**	NH3-N:	
Lab Alk-T:	**362.0**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**1173** mg/L @ 180°C
Field Cond:	**1600** unfiltered
Lab pH:	**7.6** compensated to 25°C
Field pH:	**7.6** unfiltered
Field Temp:	**9.0**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 4.05 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**2** ug/L
As:	**0.3** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**28** ug/L	Pb:	**<0.2** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.1** ug/L	Se:	**<2** ug/L
Cr:	**5.8** ug/L	Tl:	**<0.2** ug/L
		Zn:	**<50** ug/L

Location Information

Legal Location: **SW SW NW SW sec. 34, T. 101 N., R. 50 W.**

County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **101N-50W-34CBCC**
Latitude: **43 deg 30 min 16 sec**
Longitude: **96 deg 49 min 48 sec**
Ground Surface Elev. (ft): **1528 T**

Sample Information

Sample Number: **WLA-98-007**
Collection Date: **06/11/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Sample Number WLA-98-007 - continued.

Well Information

SDGS Well Name: **R2-98-11**
Other Well Name:
Water Rights Well Name:
Aquifer: **WALL LAKE**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **167.00**
Casing Top Elev. (ft): **1530.00 T**
Depth to Water (ft from top): **97.53**
Ground Water Elevation (ft): **1432.47**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **10:45**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**270**	HCO3:	
Mg:	**76**	CO3:	
Na:	**78.2**	SO4:	**760.35**
K:		Cl:	**11.35**
Fe:	**0.275**	F:	**0.42**
Mn:	**2.60**	NO3-N+NO2-N:	
		NO2-N:	**<0.003**
		NO3-N:	**<0.004**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**988.8**	NH3-N:	
Lab Alk-T:	**403.2**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**1068** mg/L @ 180°C
Field Cond:	**1600** unfiltered
Lab pH:	**7.85** compensated to 25°C
Field pH:	**8.0** unfiltered
Field Temp:	**10.0**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 3.99 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**11** ug/L
As:	**3.3** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**24** ug/L	Pb:	**<0.2** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.3** ug/L	Se:	**<2** ug/L
Cr:	**0.5** ug/L	Tl:	**<0.2** ug/L
		Zn:	**<50** ug/L

Location Information

Legal Location: **NW NW NW NW sec.10, T. 101 N., R. 51 W.**

County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **101N-51W-10BBBB**
Latitude: **43 deg 34 min 19 sec**
Longitude: **96 deg 56 min 59 sec**
Ground Surface Elev. (ft): **1620 T**

Sample Information

Sample Number: **WLA-98-001**
Collection Date: **06/03/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-98-03**
Other Well Name:
Water Rights Well Name:
Aquifer: **WALL LAKE**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **238.00**
Casing Top Elev. (ft): **1623.00 T**
Depth to Water (ft from top): **160.65**
Ground Water Elevation (ft): **1462.35**
Casing Type: **PVC, SCH. 80**

Notes

SCREENED FROM 235.00 TO 225.00 FEET.

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **11:00**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)

Ca:	**264**
Mg:	**73**
Na:	**102**
K:	
Fe:	**0.36**
Mn:	**2.32**

Anion Concentrations (mg/L)

HCO3:	
CO3:	
SO4:	**772.2**
Cl:	**9.8**
F:	**0.38**
NO3-N+NO2-N:	
NO2-N:	**<0.002**
NO3-N:	**0.20**

Parameters in mg/L (as CaCO3)

Hardness:	**961.8**
Lab Alk-T:	**354.6**
Lab Alk-P:	**0**

Parameters in mg/L

NH3-N:	
Total P:	**0.35**

Sample Number WLA-98-001 - continued.

Other Information

Lab TDS:	**1121** mg/L @ 180°C
Field Cond:	**1600** unfiltered
Lab pH:	**7.6** compensated to 25°C
Field pH:	**7.6** unfiltered
Field Temp:	**9.0**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 20.5 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**12** ug/L
As:	**2.2** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**24** ug/L	Pb:	**0.8** ug/L
Be:	**<0.06** ug/L	Sb:	**1** ug/L
Cd:	**1.6** ug/L	Se:	**<2** ug/L
Cr:	**1.3** ug/L	Tl:	**<0.2** ug/L
		Zn:	**66** ug/L

Location Information

Legal Location: **SW NW NW SW sec.21, T. 101 N., R. 51 W.**

County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **101N-51W-21CBBC**
Latitude: **43 deg 32 min 04 sec**
Longitude: **96 deg 58 min 12 sec**
Ground Surface Elev. (ft): **1575 T**

Sample Information

Sample Number: **WLA-98-009**
Collection Date: **06/08/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-96-70**
Other Well Name:
Water Rights Well Name:
Aquifer: **SPLIT ROCK CREEK**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **270**
Casing Top Elev. (ft): **1577.00 T**
Depth to Water (ft from top): **126.80**
Ground Water Elevation(ft): **1450.20**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **11:00**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Sample Number WLA-98-009 Inorganic Information - continued.

Cation Concentrations (mg/L)		Anion Concentrations (mg/L)	
Ca:	**172.8**	HCO3:	
Mg:	**34**	CO3:	
Na:	**30.2**	SO4:	**286.55**
K:		Cl:	**6.75**
Fe:	**0.305**	F:	**0.39**
Mn:	**0.718**	NO3-N+NO2-N:	
		NO2-N:	**<0.003**
		NO3-N:	**<0.004**

Parameters in mg/L (as CaCO3)		Parameters in mg/L	
Hardness:	**572.8**	NH3-N:	
Lab Alk-T:	**367.6**	Total P:	**<0.05**
Lab Alk-P:	**0**		

Other Information

Lab TDS:	**643** mg/L @ 180°C
Field Cond:	**900** unfiltered
Lab pH:	**7.78** compensated to 25°C
Field pH:	**8.0** unfiltered
Field Temp:	**9**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 3.73 NTU.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**12** ug/L
As:	**1.0** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**28** ug/L	Pb:	**0.3** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.2** ug/L	Se:	**<2** ug/L
Cr:	**1.5** ug/L	Tl:	**<0.2** ug/L
		Zn:	**68** ug/L

Location Information

Legal Location: **SW SW NW SW sec.23, T. 101 N., R. 51 W.**

County: **MINNEHAHA**
Basin: **BIG SIOUX**
Hydrologic Unit Code: **10170203**

Location: **101N-51W-23CBCC**
Latitude: **43 deg 30 min 56 sec**
Longitude: **96 deg 55 min 46 sec**
Ground Surface Elev. (ft): **1543 T**

Sample Number WLA-98-002 - continued.

Sample Information

Sample Number: **WLA-98-002**
Collection Date: **06/03/1998**
Collector(s): **D. FILIPOVIC**
D. IVERSON

Project: **WALL LAKE AQUIFER STUDY**
Project Manager: **D. FILIPOVIC**
Sample Type: **GROUND WATER**

Well Information

SDGS Well Name: **R2-98-04**
Other Well Name:
Water Rights Well Name:
Aquifer: **WALL LAKE**
Management Unit:
Owner/Controller: **SDGS**
Usage: **OBSERVATION**

Well Depth (ft from casing top): **157.00**
Casing Top Elev. (ft): **1545.00 T**
Depth to Water (ft from top): **94.68**
Ground Water Elevation (ft): **1450.32**
Casing Type: **PVC, SCH. 80**

Inorganic Information

Sampling Method: **BAILER**
Collection Time: **14:00**
Lab: **SIOUX FALLS WATER PURIFICATION PLANT**

Sample Filtered? **N**
Chain of Custody? **N**

Cation Concentrations (mg/L)

Ca:	**256**
Mg:	**96**
Na:	**86.8**
K:	
Fe:	**0.394**
Mn:	**2.61**

Anion Concentrations (mg/L)

HCO3:	
CO3:	
SO4:	**806.9**
Cl:	**4.30**
F:	**0.39**
NO3-N+NO2-N:	
NO2-N:	**<0.002**
NO3-N:	**0.04**

Parameters in mg/L (as CaCO3)

Hardness:	**1034.8**
Lab Alk-T:	**367.6**
Lab Alk-P:	**0**

Parameters in mg/L

NH3-N:	
Total P:	**<0.05**

Other Information

Lab TDS:	**1154** mg/L @ 180°C
Field Cond:	**1600** unfiltered
Lab pH:	**7.6** compensated to 25°C
Field pH:	**7.6** unfiltered
Field Temp:	**9.0**°C (unfiltered)

Notes

P MEASURED AS ORTHO-PHOSPHATE. LAB TURBIDITY WAS 2.15 NTU.

Sample Number WLA-98-002 - continued.

Trace Element Information

Ag:	**<0.2** ug/L	Cu:	**3** ug/L
As:	**0.5** ug/L	Hg:	**<0.5** ug/L
B:	ug/L	Ni:	**<50** ug/L
Ba:	**28** ug/L	Pb:	**0.3** ug/L
Be:	**<0.06** ug/L	Sb:	**<1** ug/L
Cd:	**0.1** ug/L	Se:	**<2** ug/L
Cr:	**2.6** ug/L	Tl:	**<0.2** ug/L
		Zn:	**<50** ug/L