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Final Phase II Report: QuickSite® Investigation, Adams, Nebraska

Environmental Research Division

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Final Phase II Report: QuickSite® Investigation, Adams, Nebraska

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Contents

Notation viii

1 Introduction 1-1

2 Investigation Methods 2-1

2.1 Electronic Cone Penetrometer Program 2-1
2.2 Geoprobe Program 2-2
2.3 Survey Coordinates 2-2
2.4 Collection and Analysis of Subsurface Soil Samples 2-2
2.5 Collection and Analysis of Groundwater Samples 2-4
2.5.1 Water Samples Collected with the Cone Penetrometer 2-4
2.5.2 Field Measurements 2-4
2.5.3 Analysis of Groundwater Samples 2-4
2.6 Quality Control for Sample Collection, Handling, and Analysis 2-5
2.7 Waste Characterization, Handling, and Disposal 2-6

3 Field and Laboratory Data 3-1

3.1 Geologic Data 3-1
3.1.1 Electronic Cone Penetrometer Data 3-1
3.1.2 Geoprobe Soil Boring Cores 3-2
3.2 Survey Coordinates 3-2
3.3 Soil Sample Data 3-2
3.4 Analytical Data for Groundwater Samples 3-3
3.4.1 Field Measurements 3-3
3.4.2 Contaminants 3-3
3.4.3 Nitrate (as Nitrogen) 3-4
3.5 Results of Quality Control Activities 3-4
3.6 Results of Waste Characterization, Handling, and Disposal 3-7

4 Interpretation of Field and Laboratory Data 4-1

4.1 Introduction 4-1
4.2 Geologic Framework for the Western Part of Adams 4-1
4.2.1 Stratigraphic Interpretation for the Western Part of Adams 4-2
4.2.2 Summary of Geology of the Western Part of Adams 4-5
4.3 Hydrogeology of the Western Part of Adams 4-5
4.3.1 Hydrostratigraphic Interpretation 4-6
4.3.2 Pleistocene Fluvial Aquifer 4-6
4.3.3 Summary of Hydrogeology of the Western Part of Adams 4-7
4.4 Nitrate (as Nitrogen) in Groundwater 4-8
4.5 Overall Summary of Data Interpretation 4-8

5 Contaminant Distribution and Migration Pathways 5-1

5.1 Introduction 5-1
5.2 Contaminant Distribution in Subsurface Soils and Attendant Health Risks 5-1
5.3 Contaminant Distribution in Groundwater 5-2
5.4 Migration Pathway 5-4
5.5 Summary of Contaminant Distribution in Western Adams 5-6

Contents (Cont.)

6 Predicted Groundwater Flow and Contaminant Transport 6-1

6.1 Introduction 6-1
6.2 Groundwater Flow Model 6-1
6.3 Contaminant Transport Model 6-5
6.3.1 Contaminant Transport in the Vadose Zone 6-5
6.3.2 Contaminant Transport in the Pleistocene Aquifer 6-9
6.4 Model Calibration and Testing 6-10
6.4.1 Flow Model Calibration 6-10
6.4.2 Simulation of the Existing Contaminant Plume 6-13
6.4.3 Sensitivity Analyses 6-14
6.5 Results 6-15
6.5.1 Predicted Effect of Continued Pumping of PWS 70-1 6-15
6.5.2 Predicted Effect of Shutdown of PWS 70-1 6-16
6.6 Summary 6-17

7 Conclusions and Recommendations 7-1

8 References 8-1

Appendix A: Electronic Cone Penetrometer Logs A-1

Appendix B: Geoprobe Logs B-1

Appendix C: Survey Coordinates C-1

Appendix D: Soil Sample Data D-1

Appendix E: Groundwater Sample Data E-1

Appendix F: Quality Control for Sample Collection, Handling, and Analysis F-1

Figures

1.1 Locations of Gage County and Adams, Nebraska 1-7

1.2 Locations of the former CCC/USDA grain storage facility, public wells, the nitrate treatment plant, and former and existing grain storage facilities in eastern Adams 1-8

1.3 Locations of the former CCC/USDA grain storage facility; public, domestic, and monitoring wells; the nitrate treatment plant; and former and existing grain storage facilities in eastern Adams, with the results of groundwater sampling conducted for the expanded site investigation 1-9

1.4 Locations of the former CCC/USDA facility and Phase I groundwater samples, with results of analyses of these samples for carbon tetrachloride 1-10

1.5 Locations of the former CCC/USDA facility and other potential source areas, with results of Phase I particle tracking simulation for 1981-1991 1-11

Figures (Cont.)

2.1 Locations of the former CCC/USDA facility and Phase II investigative activities with the electronic cone penetrometer in the western part of Adams..... 2-7

2.2 Locations of grain bins at the former Adams CCC/USDA facility in 1965, with Phase II Geoprobe subsurface soil sampling locations 2-8

3.1 Locations of the former CCC/USDA facility, public and domestic wells, and Phase II investigative activities at Adams. 3-8

3.2 Approximate locations of grain bins at the former Adams CCC/USDA facility in 1965, locations of Phase II Geoprobe subsurface soil sampling, and the range of carbon tetrachloride and chloroform concentrations at each location..... 3-9

3.3 Locations of the former CCC/USDA facility and Phase II water samples in the western part of Adams. 3-10

3.4 Location of the former CCC/USDA facility, locations of Phase II groundwater samples in the western part of Adams, and the range of carbon tetrachloride values in these samples. 3-11

3.5 Location of the former CCC/USDA facility, locations of Phase II groundwater samples in the western part of Adams, and the range of chloroform values in these samples. 3-12

3.6 Location of the former CCC/USDA facility, locations of Phase II groundwater samples in the western part of Adams, and the range of nitrate-nitrogen values in these samples. 3-13

4.1 Locations of the former CCC/USDA facility; public wells; Phase I and Phase II investigative activities; and Phase II vertical geologic and hydrogeologic cross sections A-A´, B-B´, and C-C´ in the western part of Adams..... 4-11

4.2 Interpretive west-to-east geologic cross section A-A´, showing stratigraphic relationships between the former Adams CCC/USDA facility and well PWS 70-1..... 4-12

4.3 Interpretive south-to-north geologic cross section B-B´, showing stratigraphic relationships across the axis of section A-A´, along the eastern boundary of the former CCC/USDA facility at Adams..... 4-13

4.4 Interpretive south-to-north geologic cross section C-C´, showing stratigraphic relationships across the axis of section A-A´, through the central part of the former CCC/USDA facility at Adams. 4-14

4.5 Interpretive west-to-east geologic cross section A-A´, showing the Pleistocene aquifer between the former CCC/USDA facility and well PWS 70-1 at Adams. 4-15

4.6 Interpretive south-to-north geologic cross section B-B´, showing the Pleistocene aquifer across the axis of section A-A´, along the eastern boundary of the former CCC/USDA facility at Adams. 4-16

Figures (Cont.)

4.7 Interpretive south-to-north geologic cross section C-C´, showing the Pleistocene aquifer across the axis of section A-A´, through the central part of the former CCC/USDA facility at Adams. 4-17

4.8 Location of the former Adams CCC/USDA facility and the potentiometric surface for the Pleistocene fluvial aquifer, as measured on May 11, 2000. 4-18

4.9 Locations of the former Adams CCC/USDA facility and the groundwater samples analyzed for nitrate-nitrogen, with the range of results for each sample..... 4-19

5.1 Locations of grain bins at the former Adams CCC/USDA facility in 1965, Geoprobe subsurface soil sampling locations in Phase II, and the range of results of GC-MS purge-and-trap analyses for carbon tetrachloride and chloroform at each location. 5-10

5.2 Lithologic logs for SB50 and SB31 at the former CCC/USDA facility, showing soil sample locations and the results of purge-and-trap GC-MS analyses of these samples for carbon tetrachloride and chloroform. 5-11

5.3 Locations of the former Adams CCC/USDA facility and Phase I and Phase II groundwater samples in the western part of Adams, with the maximum carbon tetrachloride concentration at each location. 5-12

5.4 Locations of the former CCC/USDA facility and Phase I and Phase II groundwater samples in the western part of Adams, with the maximum chloroform concentration at each location..... 5-13

5.5 West-to-east cross section A-A´, showing the Pleistocene aquifer in the western part of Adams and the distribution of carbon tetrachloride in groundwater..... 5-14

5.6 South-to-north cross section B-B´, showing the Pleistocene aquifer in the western part of Adams and the distribution of carbon tetrachloride in groundwater. 5-15

5.7 South-to-north cross section C-C´, showing the Pleistocene aquifer in the western part of Adams and the distribution of carbon tetrachloride in groundwater. 5-16

6.1 Topography of Adams groundwater flow model domain, in which flow model boundaries coincide with boundaries of the natural watershed. 6-19

6.2 West-east cross section across the Adams groundwater flow model, partially equivalent to geologic cross section A-A´ 6-20

6.3 South-north cross section across the Adams groundwater flow model, equivalent to geologic cross section B-B´ 6-21

6.4 Hydraulic conductivity distribution for Adams groundwater flow model layers 2 and 3. 6-22

6.5 Hydraulic conductivity distribution for Adams groundwater flow model layer 4. 6-23

6.6 Hydraulic conductivity distribution for Adams groundwater flow model layer 5. 6-24

Figures (Cont.)

6.7 Drain configuration for Adams groundwater flow model layer 2. 6-25

6.8 Initial carbon tetrachloride concentrations for source areas A and B in the one-dimensional flow and transport model for prediction of carbon tetrachloride release from the vadose zone to groundwater..... 6-26

6.9 Initial carbon tetrachloride distribution and locations of time-varying MT3D constant-concentration cells, representing areas of continued carbon tetrachloride release from the vadose zone, in the Adams contaminant transport model, layer 2..... 6-27

6.10 Initial carbon tetrachloride distribution in the Adams contaminant transport model, layer 3..... 6-28

6.11 Locations of the May 11, 2000, water level measurements used for calibration of the Adams groundwater flow model. 6-29

6.12 Measured water levels and simulated hydraulic heads for final calibration of the Adams groundwater flow model. 6-30

6.13 Simulated potentiometric surface for the fluvial aquifer at Adams..... 6-31

6.14 Measured and simulated water level fluctuations at wells SB13, SB14, and SB19 under intermittent pumping of PWS 70-1 and 79-1 from 12:00 hr on July 6 to 18:00 hr on July 7, 2000..... 6-32

6.15 Summary of parameter sensitivity analyses for the Adams steady-state groundwater flow model..... 6-33

6.16 Simulated 5-yr carbon tetrachloride distribution in model layer 2 under continued pumping of PWS 70-1 and 79-1..... 6-34

6.17 Simulated 10-yr carbon tetrachloride distribution in model layer 2 under continued pumping of PWS 70-1 and 79-1..... 6-35

6.18 Simulated 20-yr carbon tetrachloride distribution in model layer 2 under continued pumping of PWS 70-1 and 79-1..... 6-36

6.19 Plot of simulated carbon tetrachloride concentration versus time at PWS 70-1 in Adams..... 6-37

6.20 Simulated 5-yr carbon tetrachloride distribution in model layer 2 under continued pumping of only PWS 79-1..... 6-38

6.21 Simulated 10-yr carbon tetrachloride distribution in model layer 2 under continued pumping of only PWS 79-1..... 6-39

6.22 Simulated 20-yr carbon tetrachloride distribution in model layer 2 under continued pumping of only PWS 79-1..... 6-40

Figures (Cont.)

6.23 Simulated 10-yr vertical carbon tetrachloride distribution along the center of the groundwater plume in the west-east direction under continued pumping of only PWS 79-1 6-41

Tables

4.1 Stratigraphy of the area of investigation at Adams..... 4-2

6.1 Hydraulic conductivity values for the Adams groundwater flow model..... 6-4

6.2 Soil and chemical parameters for the vadose zone transport model..... 6-7

6.3 Results of simulation for leaching of carbon tetrachloride to groundwater through the vadose zone. 6-8

6.4 Values of parameters for Adams solute transport model..... 6-14

Notation

AGEM	Applied Geosciences and Environmental Management
AMSL	above mean sea level
ASTM	American Society for Testing and Materials
BGL	below ground level
CCC	Commodity Credit Corporation
CLP	Contract Laboratory Program
cm	centimeter(s)
COC	chain-of-custody
1,2-DCA	1,2-dichloroethane
d	day(s)
DGPS	differential global positioning system
DOE	U.S. Department of Energy
ECPT	electronic cone penetrometer
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
g	gram(s)
gal	gallon(s)
GC-MS	gas chromatograph-mass spectrometer
gpd	gallon(s) per day
gpm	gallon(s) per minute
GPS	global positioning system
hr	hour(s)
ID	inner diameter
in.	inch(es)
MCL	maximum contaminant level
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
mi	mile(s)
min	minute(s)
mL	milliliter(s)
MS/MSD	matrix spike/matrix spike duplicate
NAD	North American Datum
NGVD	National Geodetic Vertical Datum

NDEQ	Nebraska Department of Environmental Quality
NHHS	Nebraska Health and Human Services
PWS	public water supply
QA	quality assurance
QC	quality control
RMS	root mean squared
RPD	relative percent difference
SDG	sample delivery group
STL	Severn-Trent Laboratory
USDA	U.S. Department of Agriculture
VOC	volatile organic compound
yr	year(s)

Final Phase II Report: QuickSite® Investigation, Adams, Nebraska

1 Introduction

The village of Adams, Nebraska, is a small rural community located in the southeastern part of the state (Figure 1.1). The Commodity Credit Corporation (CCC), an agency of the U.S. Department of Agriculture (USDA), operated a grain storage facility in the western part of Adams from 1950 to 1975, as documented in the Phase I *Work Plan* (Argonne 2000). During this period, commercial grain fumigants containing carbon tetrachloride were in use by the CCC/USDA and the private grain storage industry to preserve grain in their facilities.

Carbon tetrachloride was detected at 12.9 μg/L in a sample from one of the three Adams public water supply (PWS) wells during routine screening by Nebraska Health and Human Services (NHHS) in February 1990. This level exceeds the maximum contaminant level (MCL) of 5 μg/L promulgated by the U.S. Environmental Protection Agency (EPA) for drinking water. The well (PWS 64-1) was disconnected from the municipal water system in May 1991 because of the carbon tetrachloride contamination. Two public supply wells, PWS 79-1 and PWS 70-1, currently serve the municipal system. Figure 1.2 is a map of the village showing the locations of the public wells, the nitrate treatment plant, the former CCC/USDA facility, and former and existing grain storage facilities in the eastern part of Adams.

In October 1990, sampling of well PWS 70-1 (Figure 1.2), which lies immediately east of the former CCC/USDA facility, found carbon tetrachloride at 0.4 μg/L. Samples collected from PWS 70-1 and the nitrate treatment plant since 1990 have resulted in the occasional detection of carbon tetrachloride, at levels well below the MCL. Well PWS 70-1 continues to serve as an active producing well for the village. Carbon tetrachloride has never been detected in the village's third well (PWS 79-1), which is located just north of the village limits (Figure 1.2).

Previous investigations of the carbon tetrachloride contamination in the groundwater at Adams for EPA Region VII are a preliminary assessment conducted by Jacobs Engineering Group, Inc. (Jacobs 1992); a focused site investigation by the Nebraska Department of Environmental Quality (NDEQ 1997); and an expanded site investigation conducted by Ecology and Environment, Inc., in 1999. The report for the last of these had not been released at the time of writing, but preliminary data from the investigation were supplied to Argonne by the EPA (Curry 2000) and

were reported in the Phase I *Work Plan* (Argonne 2000). Soil and groundwater samples were collected for the EPA at numerous locations, including the former CCC/USDA facility and the Farmers Elevator Company. The preliminary results from the expanded site investigation indicate the presence of carbon tetrachloride in groundwater and soils at the former CCC/USDA facility and in groundwater at the Farmers Elevator Company site (Figure 1.3). Other commercial grain storage facilities and sites formerly used for commercial grain storage are also located in eastern Adams near PWS 64-1, where groundwater exceeds the MCL for carbon tetrachloride. According to the preliminary assessment, the Farmers Elevator Company formerly used fumigants containing carbon tetrachloride (Jacobs 1992). Thus, preexisting data suggest that at least two separate source areas exist for the carbon tetrachloride contamination in public water supply wells at Adams.

The CCC/USDA investigation at Adams is being performed by the Environmental Research Division of Argonne National Laboratory. Argonne is a nonprofit, multidisciplinary research center operated by the University of Chicago for the U.S. Department of Energy (DOE). The CCC/USDA has entered into interagency agreement with DOE, under which Argonne provides technical assistance to the CCC/USDA with environmental site characterization and remediation at its former grain storage facilities. At these facilities, Argonne is applying its QuickSite® environmental site characterization methodology. This methodology has been applied successfully at a number of former CCC/USDA facilities in Nebraska and Kansas and has been adopted by the American Society for Testing and Materials (ASTM 1998) as standard practice for environmental site characterization.

In the Phase I QuickSite® investigation (Argonne 2001), the goals were (1) to test and refine the preliminary hydrogeologic model of the site presented in the Phase I *Work Plan* (Argonne 2000) and (2) to develop a preliminary understanding of the occurrence and migration of carbon tetrachloride. The Phase I studies were targeted to examine the key lithologic, stratigraphic, hydrostratigraphic, and hydrogeochemical relationships within the subsurface, which together define the groundwater flow system in this area. The following summarize the principal technical findings of the Phase I investigation:

- The Recent and Pleistocene sediments in the area of investigation were deposited on the southern edge of a major paleovalley that was cut into the Permian bedrock during the Pleistocene. Consequently, the former CCC/USDA facility lies within a transitional zone between fluvial sediments to the north and glacial sediments to the south. The thickness of the Recent and Pleistocene units varies between 70 and 150+ ft, becoming thicker to the north.

- The Pleistocene aquifer, consisting of fluvial sand and gravel, is semiconfined by overlying loess and sandy silt and confined by the underlying older Pleistocene gray silt and Permian limestone. Normally, the aquifer is under a leaky-confined condition. Groundwater flows to the east. The hydraulic conductivity of the fluvial aquifer varies from a few to 100 ft/day. Saturated gray silt that lies in direct contact with the southern edge of the aquifer acts as an aquitard or poor aquifer, providing a slow discharge of groundwater to the fluvial aquifer from the south.

- Tritium analyses show that groundwater from the Pleistocene aquifer at Adams is the result of modern (post-1951) recharge. Most of the samples represent recharge within the past 20 yr. However, groundwater at the southern edge of the fluvial sand and gravel aquifer may contain an older groundwater component that originated as precipitation in the drift hills south of Adams before 1980.

- Groundwater samples from the sand and gravel aquifer at Adams are largely of the calcium bicarbonate type characteristic of the Pleistocene shallow and paleovalley alluvial aquifers of the region. This geochemically distinct aquifer is the only groundwater system affected by carbon tetrachloride contamination at Adams.

- Samples from the sand and gravel aquifer are nearly all contaminated with nitrate-nitrogen in excess of the MCL of 10 mg/L.

- Analyses of vegetation identified grass contaminated with carbon tetrachloride in several subareas of the former CCC/USDA grain storage facility where Quonsets huts or bins once stood.

- Contamination was detected at the top of the Pleistocene fluvial aquifer in the northeast part of the former facility. Maximum carbon tetrachloride and chloroform values were 59 μg/L and 20 μg/L, respectively. The contamination occurs in an area previously occupied by Quonset grain storage buildings. Groundwater contamination extends due east from the northern part of the former CCC/USDA facility (e.g., carbon tetrachloride values in Figure 1.4).

- Groundwater level fluctuations at Adams indicate that the local groundwater flow system is significantly affected by pumping of the public water supply and irrigation wells.

- Groundwater flow beneath the former CCC/USDA grain storage facility is eastward toward PWS 70-1, and any contamination in groundwater originating from the property is currently captured by this well. Carbon tetrachloride concentrations detected at PWS 70-1 have never exceeded the MCL in the monitoring events from 1990 to the present. The low values of carbon tetrachloride found in samples from PWS 70-1 probably result from the dilution of a small volume of contaminated groundwater originating at the former facility with a large volume of uncontaminated water drawn from the area of influence of the well.

- Particle tracking simulations in Phase I demonstrated that no contamination originating at the former CCC/USDA facility could have bypassed PWS 70-1 and migrated farther east toward PWS 64-1. For example, Figure 1.5 shows the particle tracking simulation for the period 1981-1991, when both PWS 64-1 and 70-1 were pumping. Consequently, it is unlikely that the former CCC/USDA facility caused the contamination found at well PWS 64-1. It is more likely that groundwater at PWS 64-1 was contaminated by carbon tetrachloride from source areas in eastern Adams.

The Phase I results indicate that the former CCC/USDA grain storage facility in the western part of Adams is not the source of the carbon tetrachloride levels exceeding the MCL in water from PWS 64-1 in eastern Adams. However, the former CCC/USDA facility is clearly the source of carbon tetrachloride occasionally detected at levels below the MCL in PWS 70-1 in western Adams.

An additional finding of the Phase I investigation was that regular pumping of well PWS 70-1 serves to contain and extract diluted groundwater contamination originating at the former CCC/USDA facility. Without the continued pumping of PWS 70-1, the contaminant plume would be free to migrate to the east, and it could affect future development of the downgradient portion of the aquifer. Because the well provides a containment and remediation function for the carbon tetrachloride contamination, the Phase I investigation concluded that it would be prudent for the village to continue pumping PWS 70-1 until an alternative plan for remediation of the plume

was in effect or remediation of the former grain storage facility had been accomplished, even if the well was disconnected from the distribution system.

The continued operation of PWS 70-1 as a source of drinking water for the Adams municipal system is currently in doubt. In a letter to the village board chairperson dated October 12, 2000, the NHHS indicated that extensive root invasion through the well screen provided a conduit for contaminants to enter the well, and the NHHS determined that the well is under the direct influence of surface water (Daniel 2000a,b). The NHHS provided five options for addressing the problem: (1) treat the water, (2) abandon the well, (3) consider using PWS 64-1, (4) construct a new well, or (5) connect to the Lancaster Rural Water District. A subsequent test of PWS 64-1 showed that pumping of that well for two weeks induced a rise in the carbon tetrachloride values (Buss 2001), eliminating this option from the list. Construction of a new well at a location other than PWS 70-1 is effectively barred by the high nitrate content of the aquifer. Well PWS 70-1 is at the only location within the village known to yield water below the MCL for nitrate-nitrogen. Water treatment is a costly alternative, as is connection to the rural water district. Consequently, replacement or reconditioning of PWS 70-1 may be a viable solution. However, in a letter to the CCC/USDA commenting on the Phase I results, NHHS expressed concern over the future concentration of carbon tetrachloride in PWS 70-1 if the well is reconditioned and used both as a supply and remediation well (Daniel 2001). To address this concern, numerical modeling to predict future contaminant concentrations at PWS 70-1 was added to the original list of objectives for Argonne's Phase II investigation, presented at the end of Phase I activities (Argonne 2001).

Phase II work to investigate the groundwater contamination at Adams further was restricted to the area of the former CCC/USDA grain storage facility and the contaminated groundwater between the former facility and PWS 70-1 in the western part of Adams. The field investigation started on August 20, 2001, and continued through September 7, 2001. The Phase II objectives were to (1) map the groundwater plume from the former CCC/USDA facility to PWS 70-1; (2) assess whether a continuing soil source exists; (3) if a soil source was confirmed, quantify that source; and (4) model the future impact of carbon tetrachloride on PWS 70-1.

This report documents the findings of the Phase II activities at Adams. Section 1 provides a brief history of the area and the QuickSite® process, a summary of the Phase I results, objectives of the Phase II investigation, and a brief description of the sections contained in this report. Section 2 describes the investigative methods used during the Phase II investigation. Section 3 presents all of the data obtained during the Phase II investigation. Section 4 interprets the data in the context of the geology, hydrogeology, and hydrogeochemistry of the area.

Contaminant migration pathways in soil and groundwater are discussed in Section 5. Section 6 evaluates groundwater flow and contaminant transport to predict the future impact of carbon tetrachloride on PWS 70-1. Section 7 summarizes the findings and conclusions and outlines recommendations for future activities. To streamline the reporting process, material from the Phase I *Work Plan* (Argonne 2000), the Phase I report (Argonne 2001), and relevant sections of the *Master Work Plan* (Argonne 1994) are not repeated in detail in this report. Consequently, these documents must also be consulted to obtain the complete details of the Phase II investigative program.

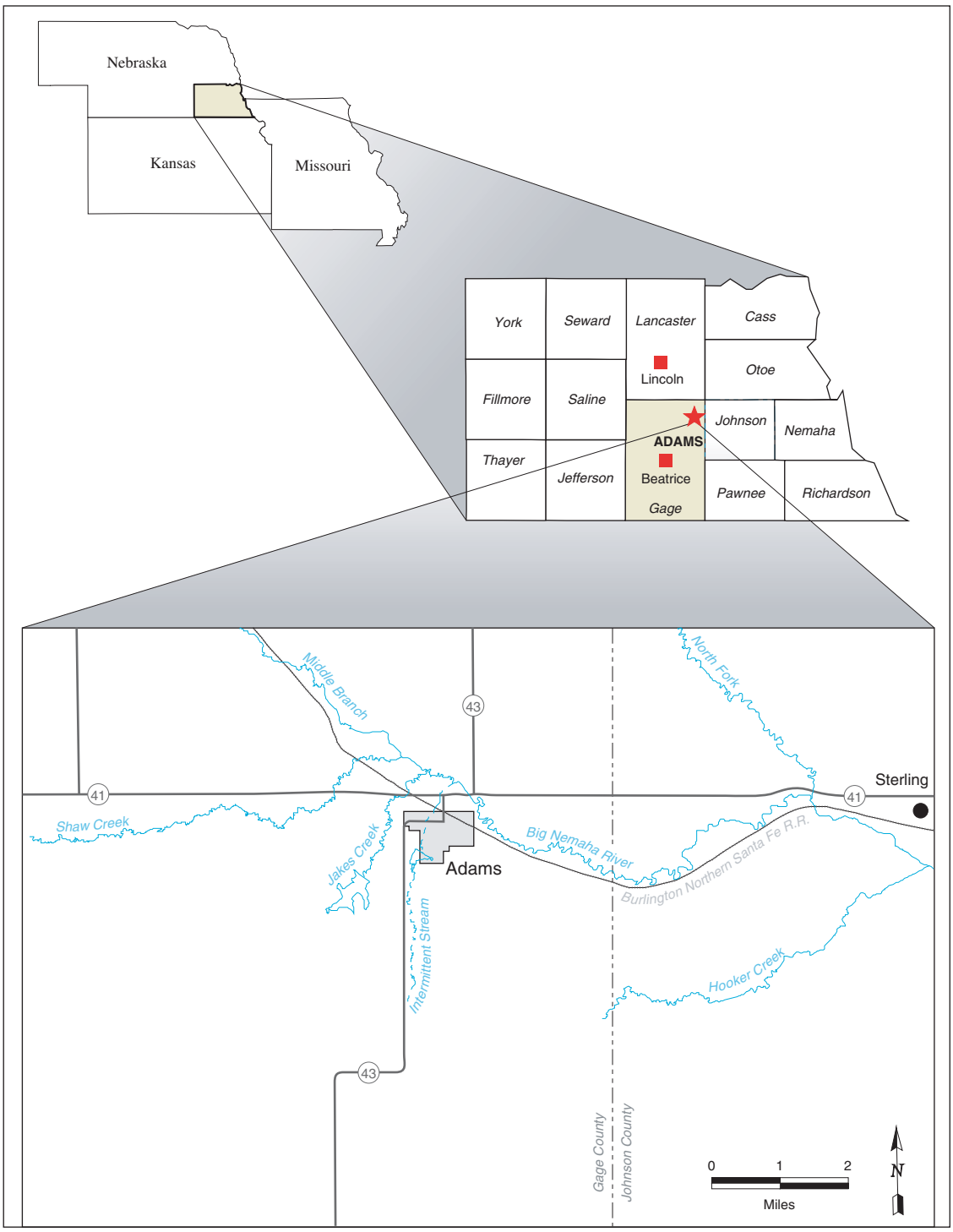


FIGURE 1.1 Locations of Gage County and Adams, Nebraska.

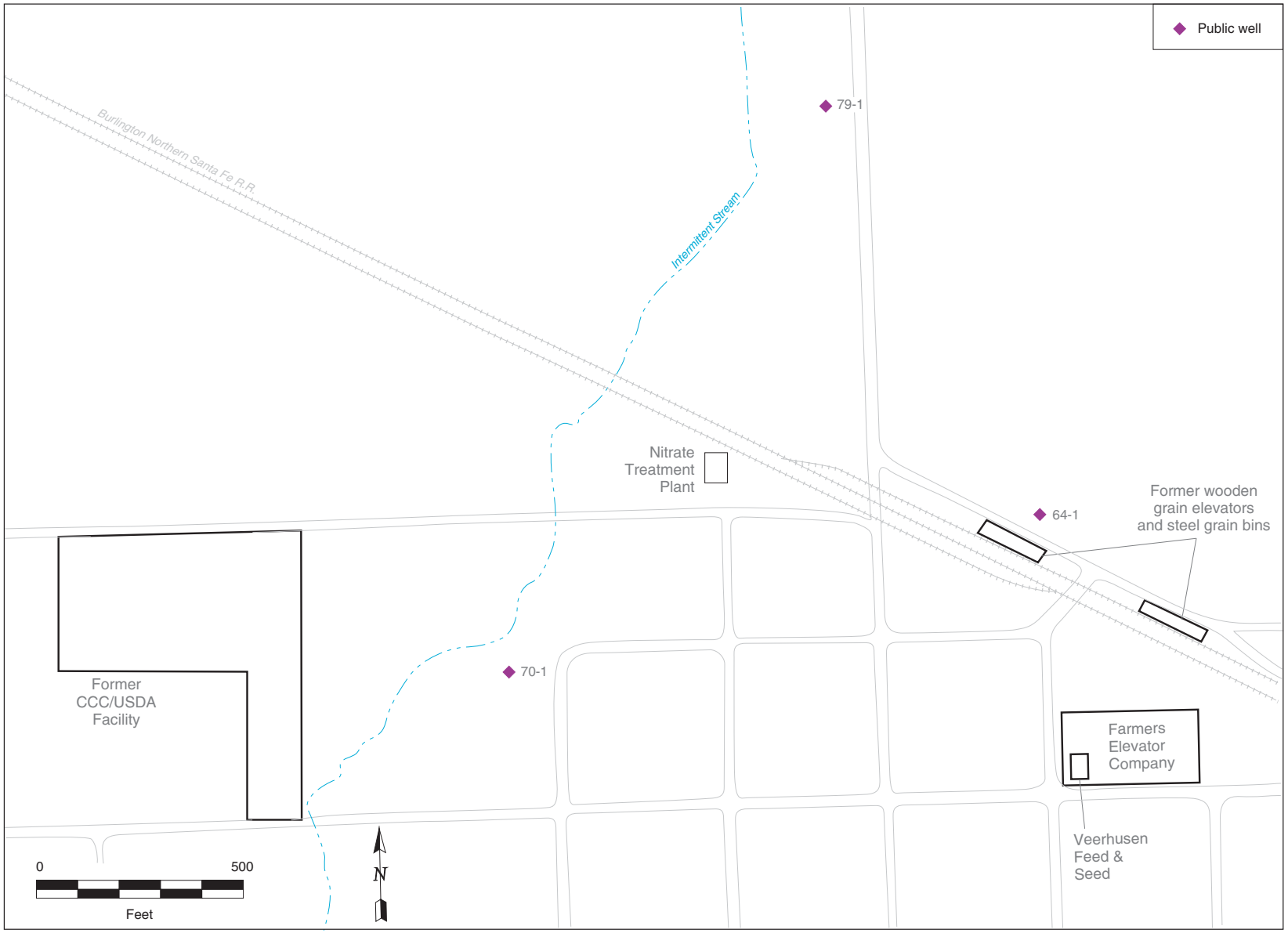


FIGURE 1.2 Locations of the former CCC/USDA grain storage facility, public wells, the nitrate treatment plant, and former and existing grain storage facilities in eastern Adams.

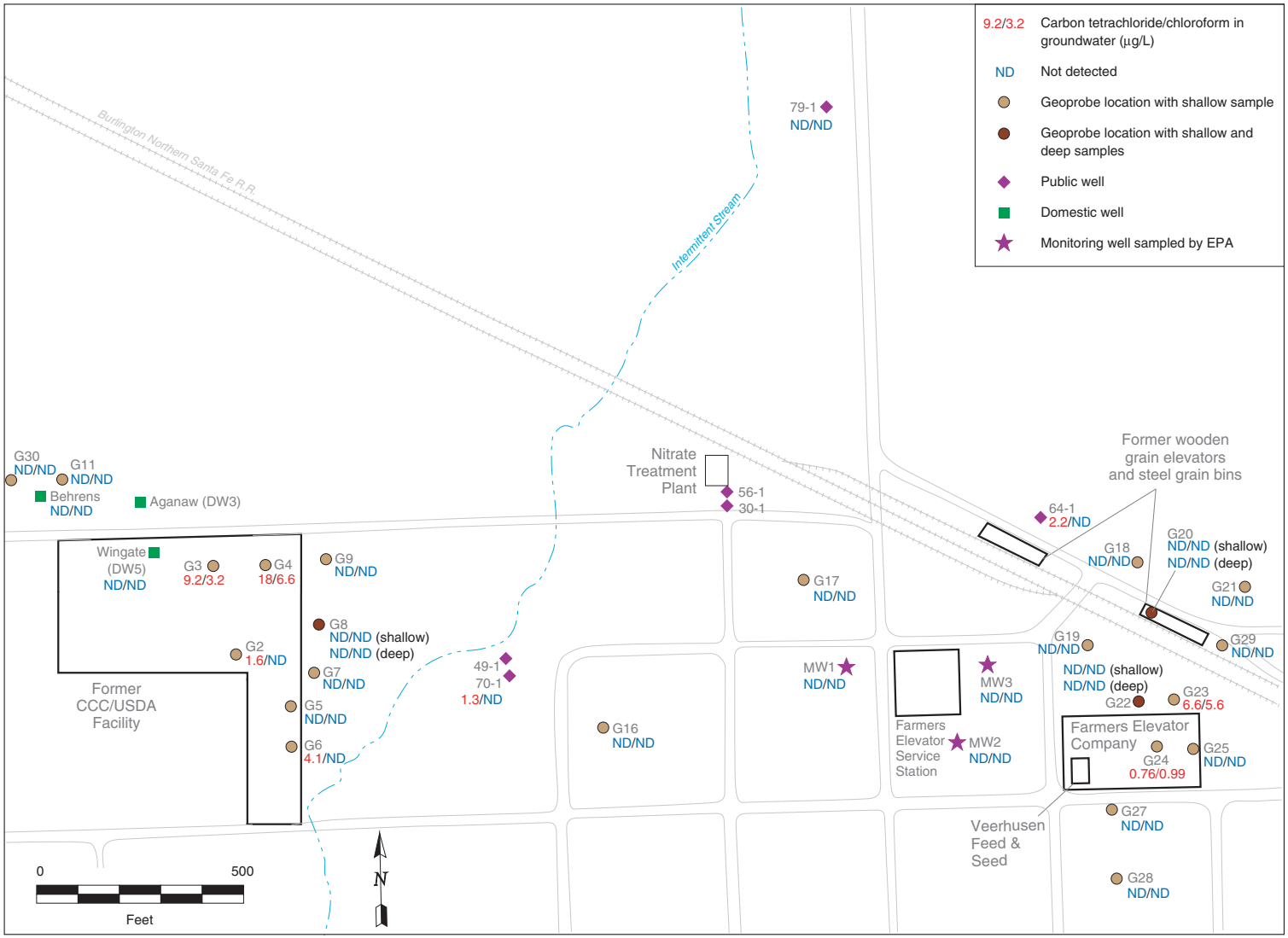


FIGURE 1.3 Locations of the former CCC/USDA grain storage facility; public, domestic, and monitoring wells (associated with leaking underground storage tanks at a service station); the nitrate treatment plant; and former and existing grain storage facilities in eastern Adams, with the results of groundwater sampling conducted for the expanded site investigation. (Source of data: Curry 2000.)

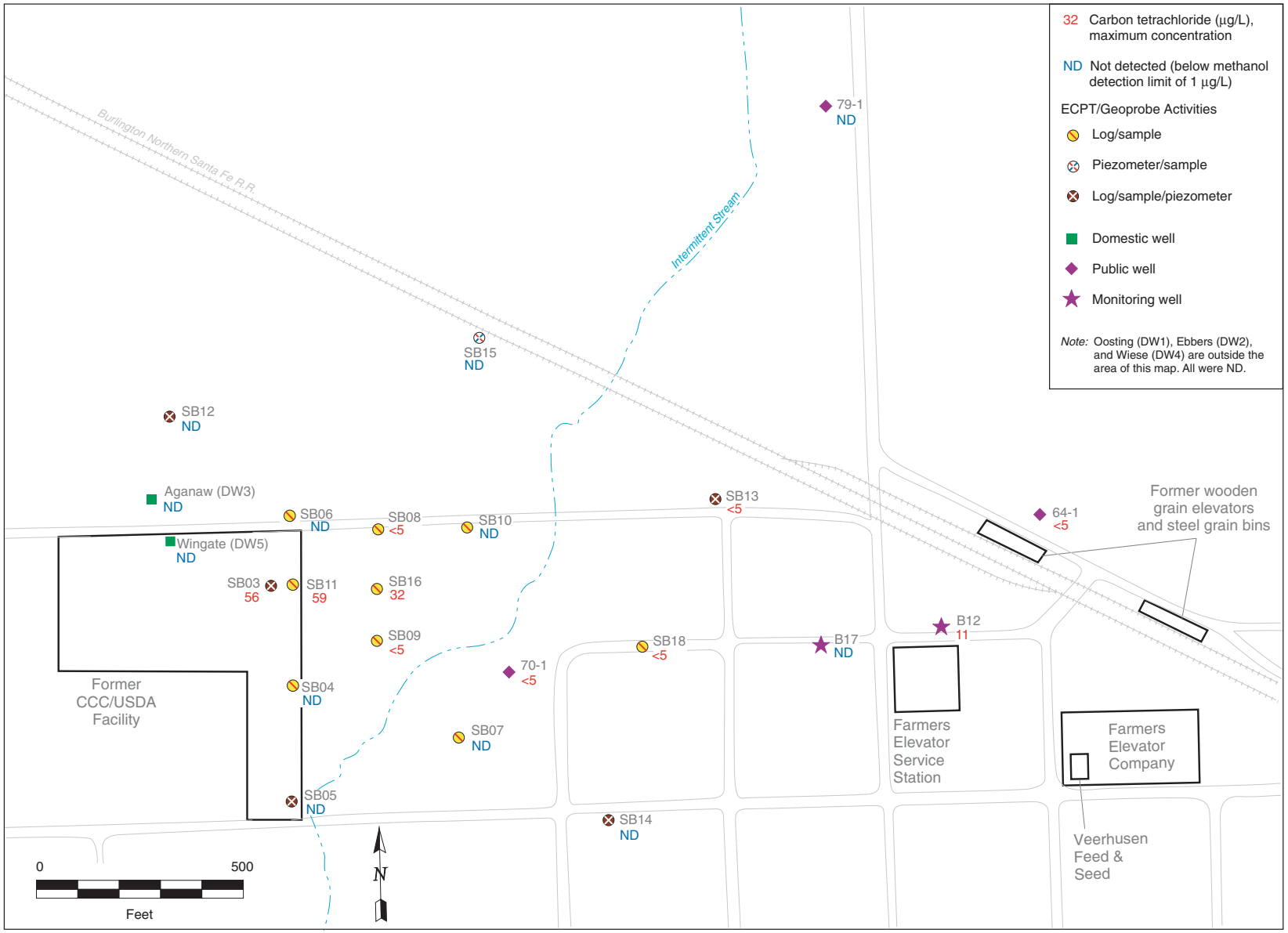


FIGURE 1.4 Locations of the former CCC/USDA facility and Phase I groundwater samples, with results of analyses of these samples for carbon tetrachloride.

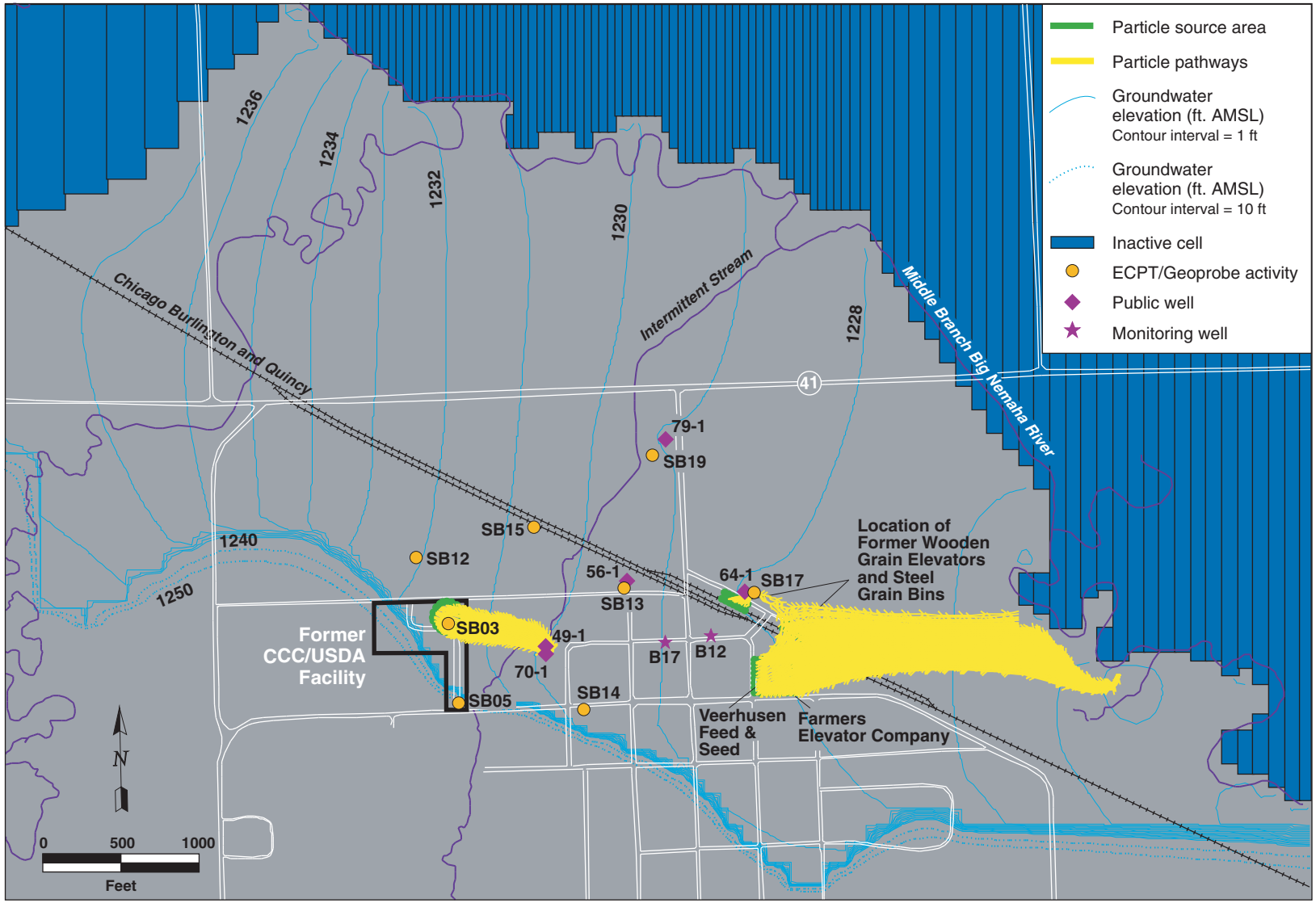


FIGURE 1.5 Locations of the former CCC/USDA facility and other potential source areas, with results of Phase I particle tracking simulation for 1981-1991.

2 Investigation Methods

This section describes the objectives of the investigative program and the field and laboratory methods used during Phase II work to investigate the geology, hydrogeology, and hydrogeochemistry at the Adams site and the distribution of carbon tetrachloride and chloroform in groundwater and soils there. Detailed descriptions of the field and laboratory procedures associated with these methods are in the *Master Work Plan* (Argonne 1994).

2.1 Electronic Cone Penetrometer Program

The Phase II electronic cone penetrometer (ECPT) program was designed (1) to collect groundwater samples to the east of the former CCC/USDA facility, in the area between the facility and PWS 70-1 and immediately to the northeast of PWS 70-1, to determine whether any contaminants are currently bypassing the PWS 70-1 capture zone as postulated in Phase I; (2) to collect groundwater samples from the upper 15 ft of the Pleistocene fluvial aquifer at the former CCC/USDA facility to further characterize the distribution of carbon tetrachloride and chloroform in groundwater there; and (3) to collect ECPT sensor data to provide additional data on the depth and thickness of the fluvial aquifer at these locations.

Seven locations (SB21-23, SB25, SB27, SB44, and SB52) were investigated by using the Argonne tracked ECPT vehicle (Figure 2.1). The ECPT operations were performed in accordance with procedures described in the *Master Work Plan* (Argonne 1994). Activities at the individual ECPT locations varied with location-specific objectives and subsurface conditions. Logs of tip and sleeve stress measurements were obtained at all seven locations. The ECPT logs were interpreted through comparison with the geology in continuously cored soil borings sampled in Phase I (Argonne 2001). The ECPT sensor logs are in Appendix A.

Groundwater samples were collected at all seven ECPT locations to obtain information on contaminant distribution (Figure 2.1). The groundwater sampling program is discussed further in Section 2.5.

2.2 Geoprobe Program

The objectives of the Geoprobe program were (1) to collect soil cores from the vadose zone in the area of grain storage bins and Quonset huts at the former CCC/USDA facility in order to map the geology of the vadose zone; (2) to systematically sample the vadose zone soil cores in order to map contaminant distribution; and (3) to generate data for quantifying contaminant mass as input for numerical modeling. Geoprobe cores were collected at 27 locations (SB24-43 and SB45-51; Figure 2.2). Cores 4 ft long were recovered in transparent plastic sleeves by using the hydraulically driven Geoprobe coring device, and representative samples of the core were labeled and placed in core boxes stored in Argonne's Lincoln warehouse. Geologic logs of the cores are in Appendix B. The subsurface soil sampling program is discussed further in Section 2.4.

2.3 Survey Coordinates

At the conclusion of field operations, the ECPT and Geoprobe test hole locations were surveyed to provide horizontal and vertical control. Elevations were determined by use of a surveyor's level referenced to piezometer elevations surveyed in Phase I. Locations were recorded by using a global positioning system (GPS) unit (Garmin GPS III Plus) adjusted for bias errors. Real-time differential corrections were provided by a Communications Systems International, Inc., MBX-3 beacon receiver that acquired differential GPS (DGPS) corrections broadcast from the nearest U.S. Coast Guard DGPS transmitter at Omaha, Nebraska. Survey coordinates are in Table C.1, Appendix C.

2.4 Collection and Analysis of Subsurface Soil Samples

To systematically map contamination by volatile organic compounds (VOCs) as a basis for contaminant transport modeling, a total of 424 soil samples were collected with the Geoprobe, representing 27 locations (Figure 2.2). Samples were collected at 2-ft intervals to the top of the fluvial aquifer, starting at 1 ft below ground level (BGL). The vertical sampling locations for each soil boring are shown on the geologic logs in Appendix B. Soil sample descriptions are in Table D.1, Appendix D.

Two soil samples were recovered from each 4-ft Geoprobe sleeved core. The samples (approximately 200 g) were put into 125-mL jars and placed immediately on dry ice for shipment to the Applied Geosciences and Environmental Management (AGEM) Laboratory in the Environmental Research Division at Argonne for carbon tetrachloride and chloroform analyses.

Although VOCs are volatile at room temperature, decreasing the sample temperature decreases the volatility. For example, the vapor pressure of carbon tetrachloride decreases by four orders of magnitude (10,000-fold) when the temperature falls from 15.8°C to -79.4°C (Lide 2000). The sublimation point of dry ice (-78.5°C) therefore makes it an appropriate preservative for samples to be analyzed for VOCs. Samples were placed in a subzero refrigeration system immediately upon arrival at the laboratory. Experiments in the AGEM Laboratory have demonstrated that sample concentrations do not change significantly when samples are stored in a subzero-temperature refrigeration system for up to 60 days.

At the time of analysis, a 10- to 15-g portion of each sample was placed in a 20-mL VOC analysis vial. A known amount of methanol was added, and the vial was sealed and shaken. After the sample was allowed to equilibrate at room temperature, purge-and-trap analysis for VOCs was conducted with a gas chromatograph-mass spectrometer (GC-MS), according to EPA Method 8260B.

Analytical results are described in Section 3.3. Quality assurance/quality control (QA/QC) soil samples collected, including replicate/split samples shipped to Severn-Trent Laboratory (STL) in Colchester, Vermont, for verification VOC analysis with EPA Contract Laboratory Program (CLP) methodology, are discussed in Section 2.6.

To quantify numerical modeling parameters, nine soil samples were analyzed for total organic carbon and bulk density. Total organic carbon was analyzed at STL with the Lloyd Kahn method of analysis, which employs high-temperature combustion and an infrared detector to measure carbon dioxide, after acidification to remove inorganic carbon. Bulk dry density was determined by HWS Consulting Group, Lincoln, Nebraska, along with percent moisture content, specific gravity, and calculated percent porosity. Bulk dry density was calculated from the sample weight, volume, and water content. The specific gravity test was performed in accordance with ASTM D854. Results are presented in Section 3.3.

2.5 Collection and Analysis of Groundwater Samples

Groundwater sampling was performed during the Phase II field program at Adams to map the contaminant distribution in groundwater at and to the east of the former CCC/USDA facility. Groundwater samples were collected at seven ECPT locations (Figure 2.1). Sampling and analytical methods are described below.

2.5.1 Water Samples Collected with the Cone Penetrometer

The ECPT vehicle was used to collect 45 groundwater samples from multiple depths at seven ECPT boring locations (SB21-23, SB25, SB27, SB44, and SB52). Samples were collected by using the procedure described in the *Master Work Plan* (Argonne 1994), in which groundwater passes through a disposable tip-and-filter system attached directly to the cone penetrometer push rods. A Teflon bailer inserted through the rod was used to retrieve each groundwater sample.

2.5.2 Field Measurements

Field parameters (temperature, pH, and conductivity) were measured in the field during groundwater sampling by using a Checkmate field meter system after calibration with the appropriate standard solutions. Titrimetric techniques using commercial kits manufactured by CHEMetric, Inc., were used to determine alkalinity and nitrate-nitrogen concentrations. Results are presented in Section 3.4.1.

2.5.3 Analysis of Groundwater Samples

Groundwater samples collected during Phase II field activities were analyzed for VOCs including carbon tetrachloride and chloroform and for nitrate-nitrogen according to procedures described in the *Master Work Plan* (Argonne 1994).

Groundwater samples collected for VOC analysis, including carbon tetrachloride and chloroform, were shipped immediately to the AGEM Laboratory for analysis by EPA Method 524.2. Analytical results for carbon tetrachloride and chloroform in groundwater samples are presented in Section 3.4.2. The QA/QC groundwater samples collected, including

replicate/split groundwater samples shipped to Clayton Laboratory in Novi, Michigan, for verification VOC analysis with CLP methodology, are discussed in Section 2.6.

Groundwater was further characterized by nitrate-nitrogen analysis. After collection, the samples were shipped immediately to STL for filtration, preservation, and analysis. The analyses were made with EPA Method 200. Results are presented in Section 3.4.3.

2.6 Quality Control for Sample Collection, Handling, and Analysis

The QA/QC procedures for sample collection, handling, and analysis followed during Adams Phase II activities are described in detail in the *Master Work Plan* (Argonne 1994) and the Phase I *Work Plan* (Argonne 2000). Significant points include the following:

- Sample integrity throughout the collection, shipping, and analysis activities was tracked by the documentation of samples as they were collected and the use of custody seals and chain-of-custody records.

- Rinsates of decontaminated ECPT sampling bailers and rods were collected periodically according to decontamination procedures defined in the *Master Work Plan* (Argonne 1994). Disposable equipment was used during collection of other sample types.

- Field blanks and trip blanks were collected to verify that samples collected for organic analysis were not contaminated during collection, handling, and shipment. Laboratory method blanks were analyzed to verify that contamination was not introduced within the laboratory.

- Soil samples were analyzed at the AGEM Laboratory for VOCs by using a modification of EPA Method 8260B (purge-and-trap method using GC-MS). Blind replicate samples were collected, and other samples were selected by the laboratory for duplicate analyses as one measure of analytical precision. On the basis of the results obtained, replicate samples were sent to STL for verification analysis with EPA Method 8260B.

- Groundwater samples were analyzed at the AGEM Laboratory for VOCs by using EPA Method 524.2 (purge-and-trap method). Blind replicate samples were collected, and other samples were selected by the laboratory for duplicate analyses as one measure of analytical precision. On the basis of the results obtained, replicate samples were sent to Clayton Laboratory for verification analysis with EPA CLP methodology.

- Groundwater samples for nitrate-nitrogen analysis by EPA Method 300 were collected and shipped immediately to STL for preservation, filtration, and analysis.

Results of QA/QC analyses are reported in Section 3.5.

2.7 Waste Characterization, Handling, and Disposal

Potentially contaminated waste soil cores collected at Adams during the sampling of Geoprobe borings for VOC analysis were accumulated in sealed drums to await the results of investigational analyses prior to disposal. Results are presented in Section 3.6.

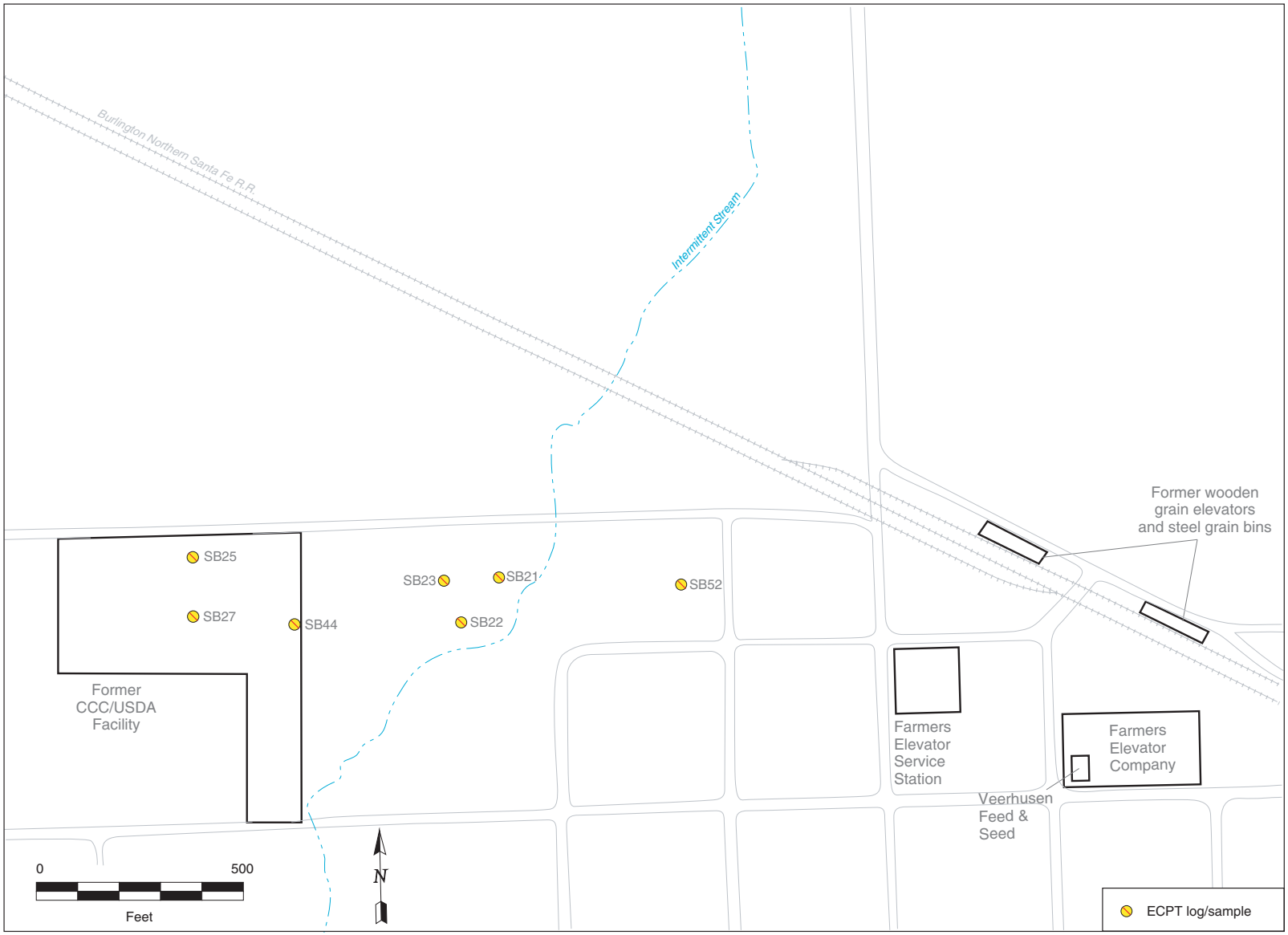


FIGURE 2.1 Locations of the former CCC/USDA facility and Phase II investigative activities with the electronic cone penetrometer in the western part of Adams.

FIGURE 2.2 Locations of grain bins at the former Adams CCC/USDA facility in 1965, with Phase II Geoprobe subsurface soil sampling locations. (Source of photograph: USDA 1965.)

3 Field and Laboratory Data

This section presents the field and laboratory data generated during the Phase II work at Adams. The methods used to acquire these data are described in Section 2, and field and laboratory procedures followed during the investigation are described in the *Master Work Plan* (Argonne 1994). Figure 3.1 shows the locations of Phase II field activities at Adams.

3.1 Geologic Data

The geologic data obtained during the Phase II investigation include ECPT sensor logs and Geoprobe soil boring logs. The following sections present these data in detail.

3.1.1 Electronic Cone Penetrometer Data

The ECPT was used at Adams in Phase II to (1) obtain sensor (tip and sleeve stress) data and (2) retrieve a vertical profile of water samples. Sensor data were obtained with the ECPT from SB21-23, SB25, SB27, SB44, and SB52 (Figure 3.1 and Appendix A). Groundwater samples (discussed in Section 3.4) were collected at the same ECPT locations (Figure 3.1 and Appendix E).

The ECPT sensor data obtained from SB03 and SB13, collected adjacent to cored soil borings SB01 and SB02, respectively, were used in Phase I to determine the general sensor response to lithologic changes (Argonne 2001). In general, the topsoil and clayey silt (loess) is characterized by relatively low tip stress and low but variable sleeve stress. The underlying sandy silt and clay unit also shows low tip and sleeve stress, but the ratio of sleeve to tip stress is highly variable and spiky. Relatively high tip and sleeve stresses and low sleeve/tip ratios are characteristic of the fluvial sand and gravel unit. The blue-gray clayey silt unit that underlies the sand and gravel is distinguished by a relatively flat, intermediate tip stress, a relatively high sleeve stress, and a high sleeve/tip ratio. The off-scale tip and sleeve stress records associated with push refusal at the bottom of the hole are interpreted as the top of bedrock. Interpretations of the sensor logs for the ECPT made with these criteria are in Appendix A.

3.1.2 Geoprobe Soil Boring Cores

To accomplish the objectives of the Geoprobe program described in Section 2.2, 27 soil borings at the former CCC/USDA facility were continuously cored to the top of the fluvial aquifer at about 32 ft BGL (Figure 3.1). Cores were logged geologically according to the classification established in Phase I (Argonne 2001) to differentiate the principal lithologic units in the vadose zone and at the top of the aquifer. Starting from the surface, the typical sequence encountered consisted of dark brown-black loamy clay with patches of iron oxide staining at 0-2 ft BGL (topsoil); brown clay to silty clay with occasional layers of dark brown organic-stained clay at 2-20 ft BGL (unit 1); gray-brown clayey silt with a few sand stringers, plus iron oxide and manganese oxide staining, at about 20-31 ft BGL (unit 2); and gray medium-grained wet sand at about 31-32 ft BGL (unit 3). Where the fluvial sand (unit 3) was absent, coring found gray-brown wet sandy silt to sandy clay with some fine sand (unit 4). The geologic logs for SB24-43 and SB45-51 are in Appendix B.

3.2 Survey Coordinates

Survey coordinates are discussed in Section 2.3. Results are in Table C.1, Appendix C.

3.3 Soil Sample Data

Figure 3.2 shows the Geoprobe locations and the range of purge-and-trap GC-MS results for carbon tetrachloride and chloroform in vadose zone samples (above the saturated zone) on a map of the former CCC/USDA facility (with estimated locations of former storage bins and Quonsets). In all, 424 soil samples were collected, representing 27 locations. Samples were collected at 2-ft intervals to the top of the fluvial aquifer, starting at 1 ft BGL. The vertical distributions of carbon tetrachloride and chloroform are shown on the geologic logs in Appendix B. Results of VOC analyses for soil samples are in Table D.2, Appendix D.

Values of 0-527 μg/kg for carbon tetrachloride and 0 to < 10 μg/kg for chloroform were found in vadose zone soils at SB50. Also at SB50, 1,2-dichloroethane (1,2-DCA) was detected in two samples from clay at the base of the vadose zone and within the fluvial aquifer (611 and 495 μg/kg at 33 ft and 35 ft BGL, respectively). In addition, 1,2-DCA was detected at 358 μg/kg

in one vadose zone sample from a depth of 1 ft BGL at SB46. Significant results of QA/QC activities related to the 1,2-DCA analyses are discussed in Section 3.5.

Results of analyses for total organic carbon and bulk density are in Appendix D, Table D.3. These values were used in the modeling discussed in Section 6.

3.4 Analytical Data for Groundwater Samples

Groundwater samples collected during the Phase II field activities (Figure 3.3) were analyzed for carbon tetrachloride, chloroform, and nitrate-nitrogen. All samples were analyzed by following analytical procedures described in the *Master Work Plan* (Argonne 1994). Details about groundwater samples collected, including locations, date sampled, and sample depths, are in Table E.1 in Appendix E.

3.4.1 Field Measurements

Field measurements provide immediate results and sometimes give indications of groundwater chemistry that can aid in evaluating groundwater zones and patterns and can assist in site evaluation and decision making in the field. For example, nitrate-nitrogen concentrations determined in the field are often useful as indicators of surface recharge to shallow groundwater aquifers. The results of the field measurements are in Table E.2 in Appendix E.

3.4.2 Contaminants

Figure 3.4 shows the Phase II ECPT investigation locations and the range of carbon tetrachloride in groundwater at each location. Carbon tetrachloride and chloroform were the only organic contaminants found in groundwater. Carbon tetrachloride was found in groundwater at all seven locations, at concentrations ranging from < 5 to 26 μg/L (Appendix E, Table E.3). (Values reported as < 5 μg/L indicate that the compound was present but could not be quantified.) The highest concentration was found at a depth of 32-37 ft in SB27, at the center of the former CCC/USDA facility. Chloroform contamination was found in groundwater at five locations (Figure 3.5), at concentrations of < 5 to 8 μg/L (Appendix E, Table E.3). The highest chloroform concentration was found in SB27, at the same depth as the highest carbon tetrachloride value.

All organic analytical results for groundwater samples are shown in Table E.3 in Appendix E. These results are discussed in Section 5. The QA/QC results, including results for samples analyzed with EPA CLP methodology, are discussed in Appendix F.

3.4.3 Nitrate (as Nitrogen)

Nitrate-nitrogen concentrations in groundwater samples ranged from 0.53 to 31.5 mg/L. The samples analyzed were collected from ECPT locations SB21, SB23, SB27, SB44, and SB52. The highest value was found at SB52, south of the nitrate treatment plant. The distribution of nitrate-nitrogen at all Phase II locations sampled for this analysis is shown in Figure 3.6. Nitrate-nitrogen results are shown in detail in Table E.4 in Appendix E and are discussed in Section 4.4.

3.5 Results of Quality Control Activities

The QA/QC report for sample collection, handling, and analysis activities, including an evaluation of the analytical data generated, is in Appendix F. Significant results include the following:

- Sample integrity throughout the collection, shipping, and analysis activities was tracked by the documentation of samples as they were collected and the use of custody seals and chain-of-custody (COC) records. For some samples, minor discrepancies in sample identifications listed on COC records and on the sample containers were resolved by comparison of the various documentation records. Samples were received at appropriate temperature. Samples for organic analysis were analyzed within required holding times. Because of a shipping delay, four samples for nitrate-nitrogen analysis were not filtered/preserved within the required 48-hr limit.

- Rinsates of decontaminated ECPT sampling bailers and rods contained no carbon tetrachloride and chloroform, indicating that decontamination procedures for that reusable sampling equipment were followed properly. Disposable equipment was used during collection of other sample types.

- Contaminants of concern were not detected in trip blanks, indicating that the environmental samples were not contaminated during collection, handling, and shipment. Chloroform was present at a low concentration in the methanol used for extraction of VOCs from soils. The lack of contamination in laboratory method blanks verified that contamination was not introduced within the laboratory.

- Soil samples were analyzed at the AGEM Laboratory for 23 VOCs, including carbon tetrachloride, chloroform, and 1,2-DCA, by using a modification of EPA Method 8260B. The quantitation limit achieved for this purge-and-trap GC-MS method was 10 μg/kg. As one measure of the analytical precision, blind replicate samples were submitted for analysis, and other samples were selected by the laboratory for duplicate analyses. Except for two samples qualified because of low surrogate recovery (Table D.2, Appendix D), accuracy and precision limits (described in detail in Appendix F) were met for the analyses.

  On the basis of the results obtained, selected replicate samples were sent to STL for verification analysis with EPA Method 8260B. For the soil samples collected during the Phase II investigation, the carbon tetrachloride and chloroform data and (to a somewhat lesser degree) the 1,2-DCA data from AGEM Laboratory were supported by verification analyses at STL, and the data from the AGEM Laboratory are accepted.

- 1,2-Dichloroethane was detected at high concentrations in soil near the surface in SB46. A concentration of 358 μg/kg was found by the AGEM Laboratory in the initial sample taken at 1 ft BGL (described as medium organic loam), but the compound was not detected either in a field replicate sample at that depth (analyzed by AGEM) or in the split of the initial sample analyzed by STL (Table F.7, Appendix F). Therefore, the near-surface detection in SB46 must be regarded as unverified.

- 1,2-Dichloroethane was also detected by the AGEM Laboratory in two samples from SB50. The concentrations were 611 μg/kg at 33 ft BGL and 495 μg/kg at 35 ft BGL (Table D.2, Appendix D). The soil at these depths was described as clayey silt transitioning to silty clay. Because of the high

concentration of 1,2-DCA and to confirm the presence of the contaminant, the methanol extract in the same two sample vials was reanalyzed by the AGEM Laboratory and by STL. Concentrations found by both laboratories in the confirmation analyses (Table F.7, Appendix F) were of the same order of magnitude as (but somewhat lower than) the concentrations in the initial analyses. The lower values most likely are due to the degradation of the contaminants in the soil-methanol matrix in the sample vials during the time elapsed between analyses. Nevertheless, both laboratories confirmed the presence of 1,2-DCA in the samples from 33 and 35 ft BGL. No 1,2-DCA was detected in the adjacent soil sample at 31 ft BGL (Table D.2, Appendix D), and no sample was collected in SB50 below the clay sample at 35 ft BGL. The reanalyses confirmed that 1,2-DCA was present in the two clay samples from SB50, though some uncertainty exists about the exact concentrations.

- Groundwater samples were analyzed for VOCs at the AGEM Laboratory with EPA Method 524.2 (purge-and-trap method). The concentration of each component was calculated by comparison of the mass spectrometer response for the quantitation ion to the response on corresponding calibration curves, for internal standards, or both. Calibration checks with each sample delivery group were required to be within ±20%. The internal standard recovery limits were 80-120%. If the internal standard was outside these limits, reanalysis was conducted (if sample volume permitted), or the data were flagged accordingly (Appendix E, Table E.3). As one measure of the analytical precision achieved by the laboratory, blind replicate samples were submitted for analysis, and other samples were selected by the laboratory for duplicate analyses. Accuracy and precision limits were met for these analyses (described in detail in Appendix F). On the basis of the results obtained, selected replicate samples were sent to Clayton Laboratory for verification analysis with EPA CLP methodology. For the water samples collected during the Phase II investigation, the organic analytical data from AGEM Laboratory were supported by verification analysis at Clayton Laboratory, and the data from AGEM Laboratory are accepted.

- Groundwater samples collected for nitrate-nitrogen analysis by EPA Method 300 were shipped immediately to STL for preservation, filtration, and analysis. Because of a shipping delay, four samples were not prepared for

analysis within the 48-hr limit, and the results are qualified (Appendix E, Table E.4). Accuracy in the analytical methodology followed was measured by the analysis of laboratory QC samples with each sample delivery group. The nitrate-nitrogen data from STL are accepted.

3.6 Results of Waste Characterization, Handling, and Disposal

Potentially contaminated waste soil cores collected during the sampling of Geoprobe borings for VOC analysis at Adams were accumulated in sealed drums to await the results of analyses prior to disposal. The composite averages of all carbon tetrachloride and chloroform analyses of investigative samples from these cores (Table D.2, Appendix D) were below the quantitation limit (10 μg/kg). The waste soil was placed in the Industrial Services, Inc., landfill in Lincoln, Nebraska.

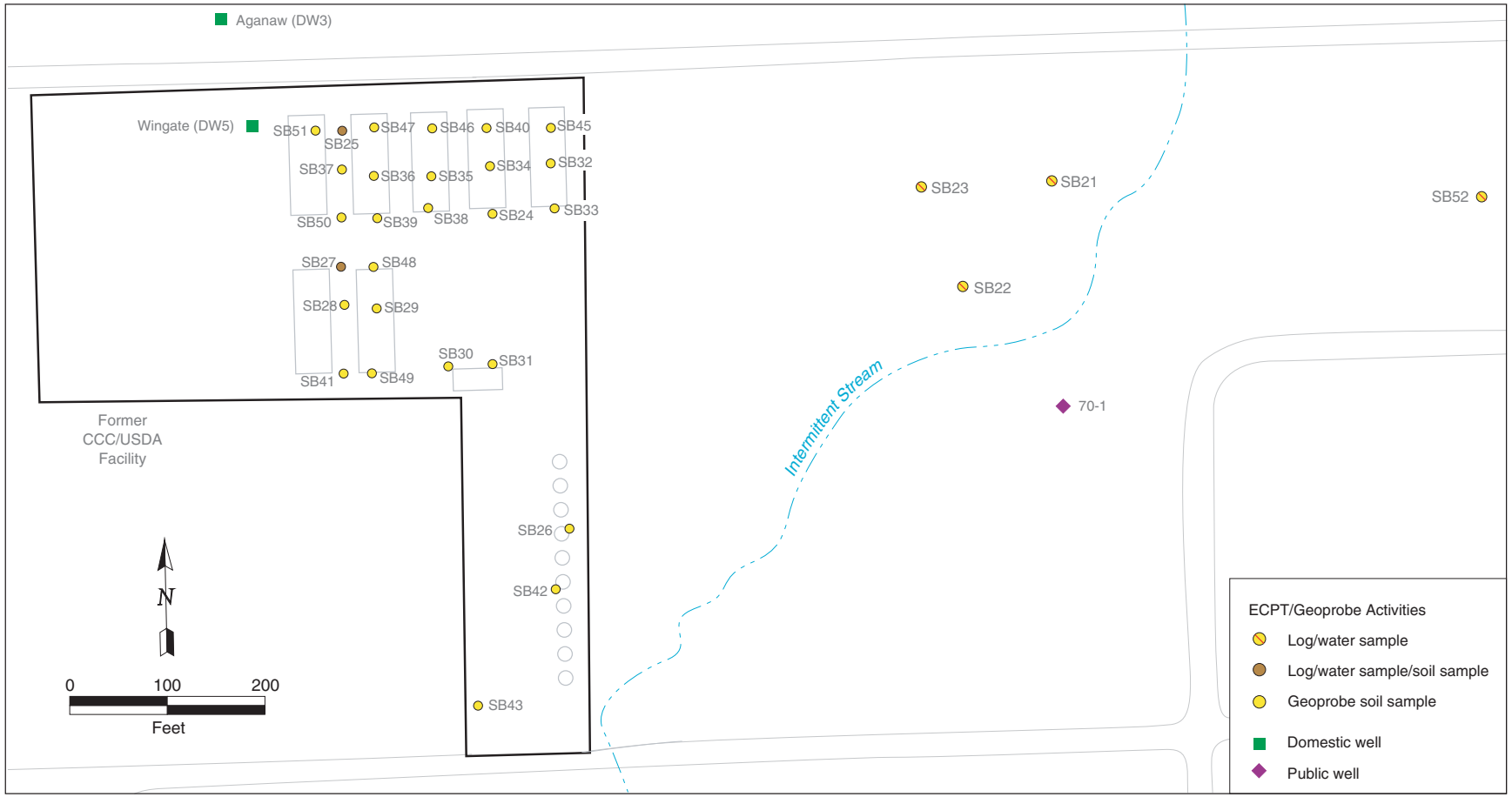


FIGURE 3.1 Locations of the former CCC/USDA facility, public and domestic wells, and Phase II investigative activities at Adams.

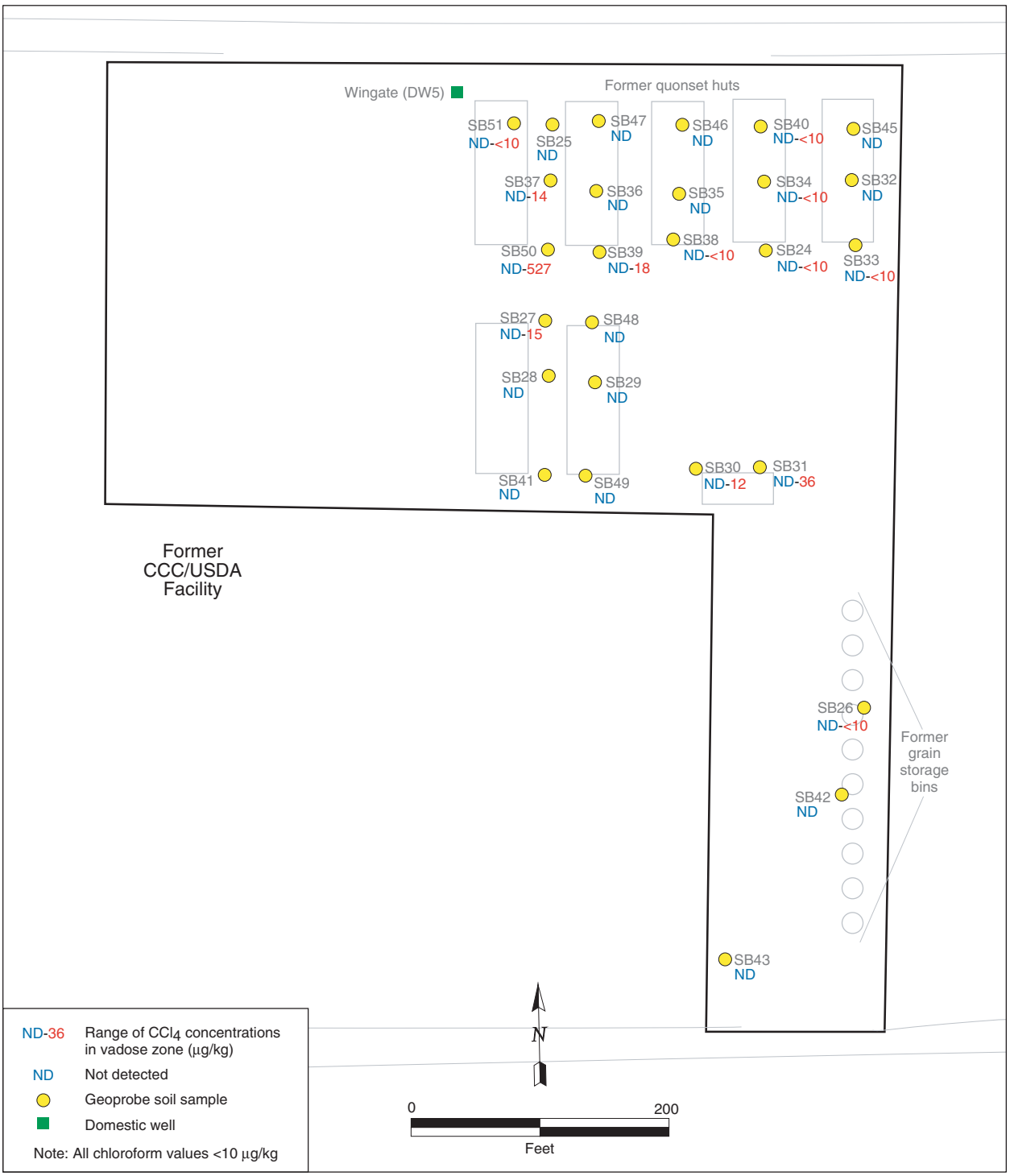


FIGURE 3.2 Approximate locations of grain bins at the former Adams CCC/USDA facility in 1965, locations of Phase II Geoprobe subsurface soil sampling, and the range of carbon tetrachloride and chloroform concentrations (from purge-and-trap GC-MS analyses) at each location.

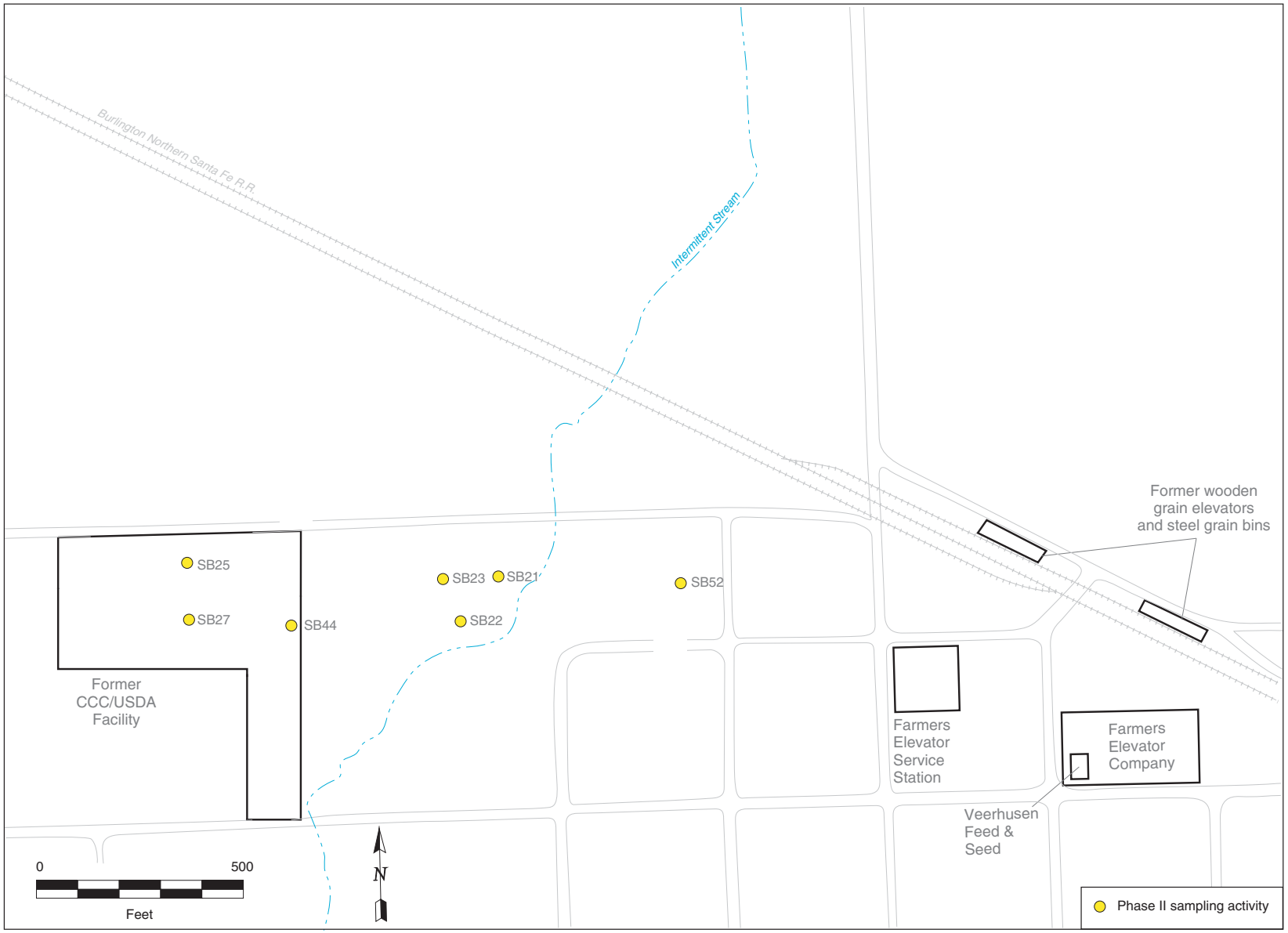


FIGURE 3.3 Locations of the former CCC/USDA facility and Phase II water samples in the western part of Adams.

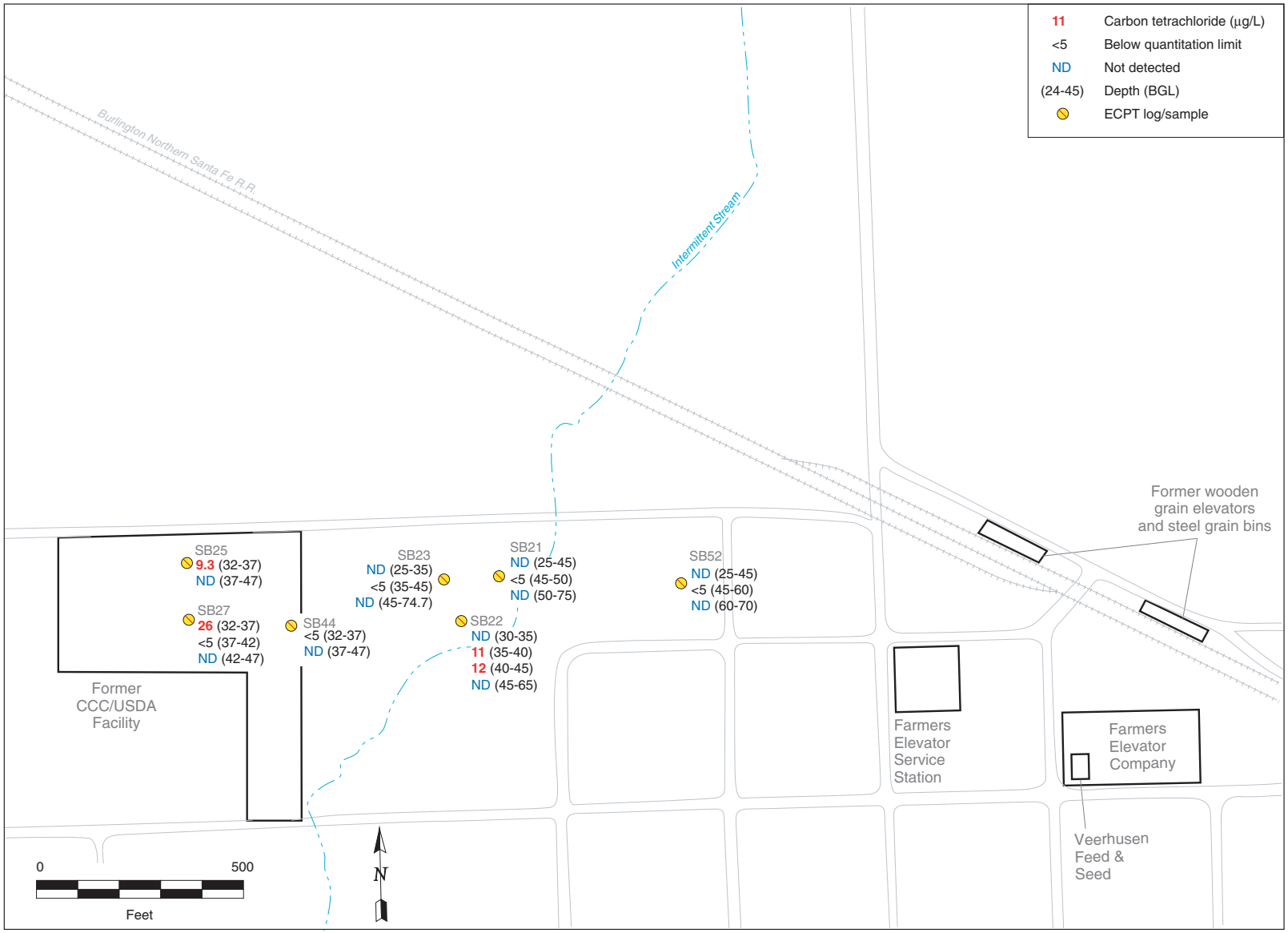


FIGURE 3.4 Location of the former CCC/USDA facility, locations of Phase II groundwater samples in the western part of Adams, and the range of carbon tetrachloride values in these samples.

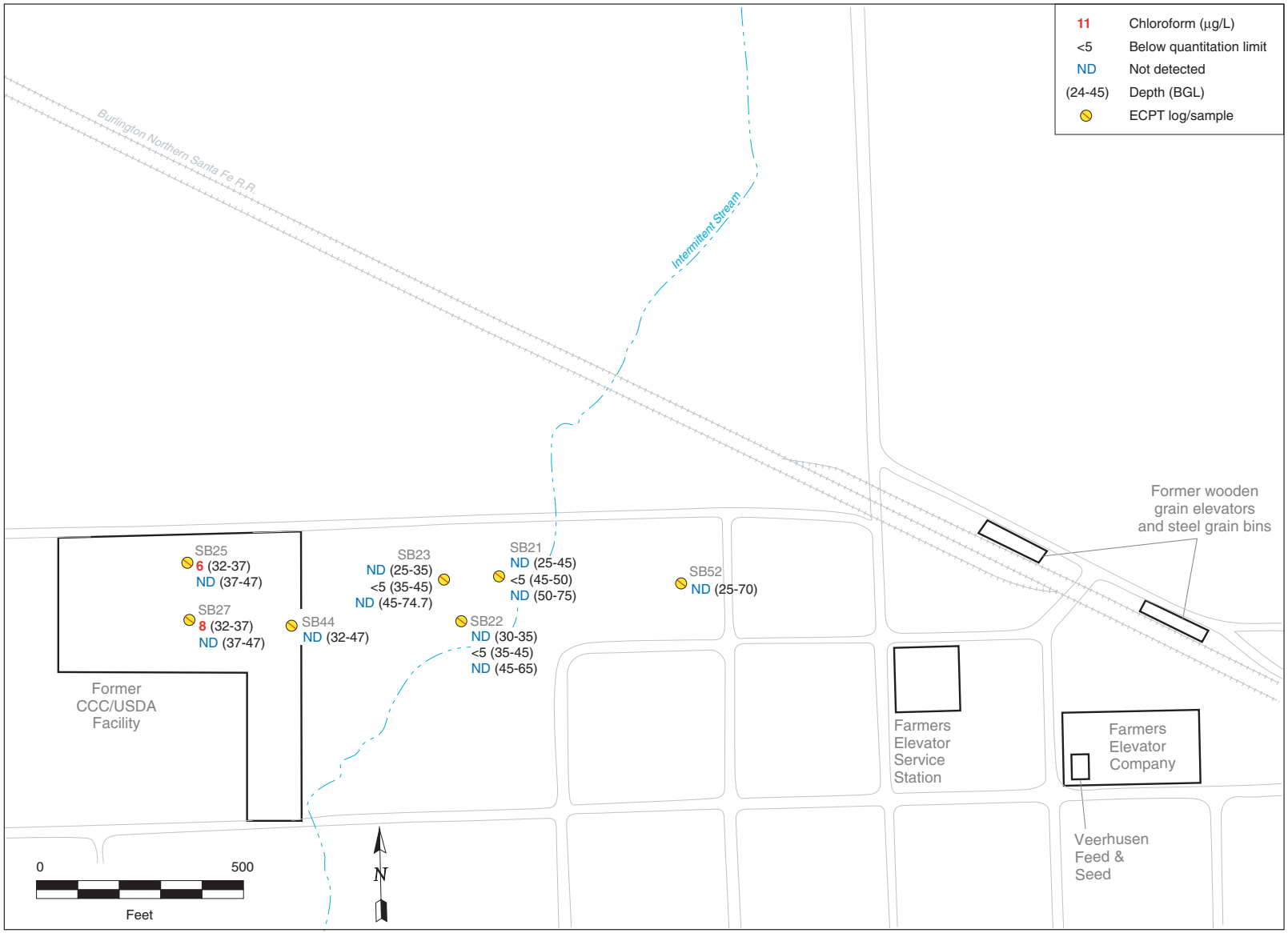


FIGURE 3.5 Location of the former CCC/USDA facility, locations of Phase II groundwater samples in the western part of Adams, and the range of chloroform values in these samples.

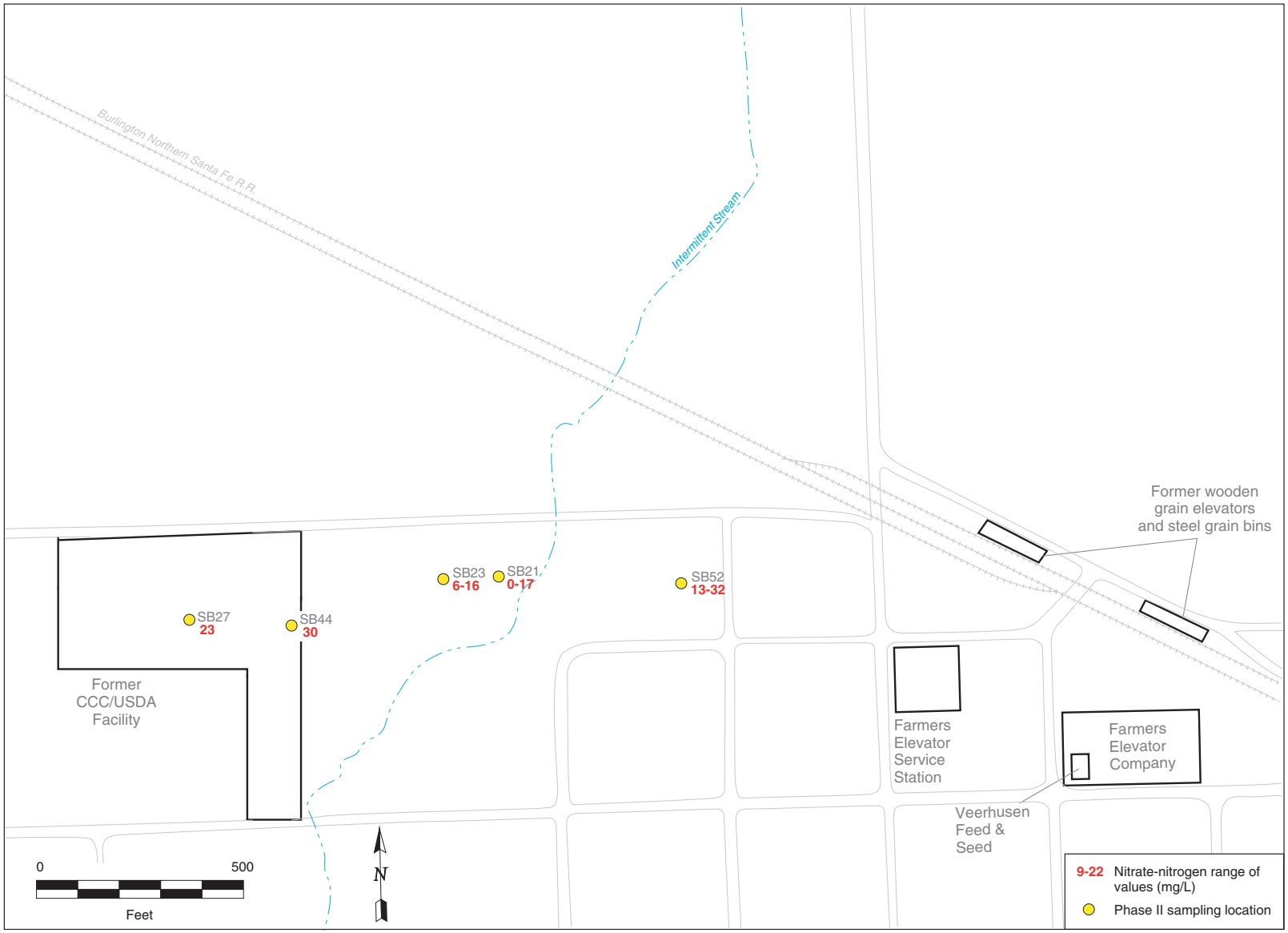


FIGURE 3.6 Location of the former CCC/USDA facility, locations of Phase II groundwater samples in the western part of Adams, and the range of nitrate-nitrogen values in these samples.

4 Interpretation of Field and Laboratory Data

4.1 Introduction

A conceptual model of the geology, hydrogeology, and hydrogeochemistry of the Adams area was developed in the *Work Plan* (Argonne 2000) and revised during the Phase I investigation (Argonne 2001). Work in Phase II was restricted to the western part of Adams, in the vicinity of the former CCC/USDA facility, and was directed toward (1) confirming postulated capture of the groundwater contaminant plume by PWS 70-1 and (2) defining the distribution of contaminants in vadose zone soils at the former facility. Additional geologic data acquired during soil and water sampling in Phase II provided a more detailed understanding of the distribution of the significant lithologic units. No hydrogeologic data were collected in Phase II.

4.2 Geologic Framework for the Western Part of Adams

The Holocene and Pleistocene sediments in the area of investigation were deposited on the southern edge of a major paleovalley that was cut into the Permian bedrock during the Pleistocene. Work in Phase I (Argonne 2001) established that the former CCC/USDA facility lies within a transitional zone between fluvial sediments to the north and glacial sediments to the south. The thickness of the Holocene and Pleistocene units varies between 70 and 150+ ft, becoming thicker to the north. The primary stratigraphic units of interest at Adams include the overlying loess mantle of Holocene and Pleistocene age (unit 1); the Pleistocene sandy silt and clay unit (unit 2); the Pleistocene fluvial sand and gravel (unit 3); the Pleistocene gray silt (unit 4); the older Pleistocene blue-gray silt (unit 5); and the Permian bedrock (unit 6), consisting of limestone and shale of the Council Grove Group.

The stratigraphy for the area of investigation is summarized in Table 4.1. Throughout this section, references to wells or soil boring locations with identification numbers SB01-SB20 pertain to the Phase I investigation. The geologic and sensor logs for these locations were reported previously (Argonne 2001). Phase II ECPT sensor and Geoprobe geologic logs are in Appendixes A and B of this report, respectively.

TABLE 4.1 Stratigraphy of the area of investigation at Adams.

Age	Rock Unit	Thickness (ft)	Physical Characteristics
Holocene	Topsoil	0-4.5	Dark brown-black silty loam to black loamy clay; abundant roots, high organic content, noncalcareous.
Holocene/ Pleistocene (Illinoian-Wisconsin Stage)	Loess (1)	15-24	Brown to dark brown clayey silt; minor iron oxide staining and manganese concretions, many root and worm holes, noncalcareous.
Pleistocene	Sandy silt with silty clay and sand stringers (2)	0-30	Gray and brown sandy silt and silty clay; sand stringers, some root tubules, iron oxide staining, dry.
	Sand and gravel (3)	0-45	Multiple upward-fining sequences of fluvial gravel, coarse sand, medium-grained and fine sand; gray-brown to red-brown, wet.
	Gray silt with trace of sand (4)	0-40	Gray calcareous clayey silt with a trace of sand; damp to wet, with fine sand in thin stringers.
	Blue-gray to olive silty clay (5)	0-55	Blue-gray to olive silty clay to clayey silt; massive, calcareous, dense, brittle fracture, dry.
Permian Council Grove Group	Shale and limestone (6)	Unknown	Gray limestone and calcareous shale.

4.2.1 Stratigraphic Interpretation for the Western Part of Adams

Three geologic cross sections were interpreted and constructed for western Adams by using a combination of data. The locations of the vertical sections are shown in Figure 4.1. Geologic cross section A-A´ runs from west to east, from SB50 in the central part of the former CCC/USDA facility, through SB39, SB38, SB01/03, SB33, SB11, SB16, SB22, and PWS 70-1, ending at SB18 (Figure 4.2). The location of cross section A-A´ was selected to illustrate the distribution of the stratigraphic units along the direct contaminant migration pathway from the former CCC/USDA facility to well PWS 70-1. Geologic cross section B-B´ (Figure 4.3) runs south to north along the eastern boundary of the former CCC/USDA facility. The section starts at the location of ECPT test hole SB05 in the southernmost part of the former CCC/USDA leaseholding and continues north through SB42, SB26, SB04, SB44, SB11, SB32, and SB45,

ending north of the facility at SB06. Cross section B-B´ was oriented to show the pinchout of the sand and gravel body (unit 3) in the southern part of the former CCC/USDA facility. Geologic cross section C-C´ (Figure 4.4) runs south to north from the location of ECPT test hole SB20 at the southern boundary of the main part of the former CCC/USDA facility through SB28, SB27, SB50, SB37, and SB25 to SB12, 250 ft north of the former facility boundary. The location of cross section C-C´ was selected to show the stratigraphic relationships perpendicular to the long axis of the sand and gravel body and to illustrate the pinchout of the sand unit in the south central part of the former facility.

Cross section A-A´ (Figure 4.2) integrates data from the geologic log for continuously cored mud rotary hole SB01; the ECPT sensor logs and core samples from SB11, SB16, SB22, and SB18; and the geologic logs for Geoprobe cores from SB50, SB39, SB38, and SB33. Although the section passes through well PWS 70-1, only the well depth is shown because no record of the driller's log can be found. The cross section shows that the unconsolidated sequence of silt, sand, gravel, and clay is 63-107 ft thick in this area. The uppermost silt unit is a 20-ft-thick layer of loess of Holocene and Pleistocene age that is primarily wind blown in origin, forming a mantle over the older sediments (unit 1). The loess is described in the logs as dry, brown to dark brown clayey silt. Underlying the loess is a gray to light brown sandy silt with silty clay and sand stringers (unit 2). This moist-dry unit is 16 ft thick (18-34 ft BGL) at SB50, and it becomes thinner to the east.

A saturated sand and gravel deposit (unit 3) is found beneath the loess and sandy silt along the entire length of section A-A´ (Figure 4.2). The fluvial sand and gravel was deposited by a Pleistocene river that occupied a paleovalley centered north of the present-day Middle Branch Nemaha River. The sand unit is 30-45 ft thick along this section, thinning to the west and over the bedrock high at SB16 and thickening to 45 ft at SB18, east of the public well. The sand body is made up of a series of upward-fining depositional sequences ranging from gravel and coarse sand at the base of each cycle, through medium sand, to fine-grained sand (occasionally clayey) at the top. Except where it overlies unit 4 silt at the western end of the section, the fluvial sand body overlies a dry, dense, blue-gray Pleistocene silt (unit 5) that ranges from 0 to 20 ft in thickness along the line of the section. The glacial silt was deposited on the eroded surface of the Permian bedrock. The bedrock surface occurs at 63 ft BGL at SB16, where it forms a local bedrock high between the former CCC/USDA facility and PWS 70-1, and it deepens to 107 ft BGL at the western end of section A-A´ (interpolated from section C-C´).

Cross section B-B´ (Figure 4.3) was constructed from south to north by using control from the ECPT sensor logs and core samples from SB05, SB04, SB44, SB11, and SB06 and the geologic logs of Geoprobe cores from SB42, SB26, SB32, and SB45. The cross section shows the upper 75-85 ft of the geologic section to be composed of Pleistocene and Holocene silt, sand and gravel, and clay. The uppermost silt unit is a 16- to 24-ft-thick layer of loess (unit 1) overlying a sandy silt and clay (unit 2). The sandy silt and clay unit is 7-13 ft thick. The sand and gravel (unit 3) is found beneath the loess and sandy silt at and to the north of SB04 at the former CCC/USDA facility. The saturated sand and gravel is about 14 ft thick at SB04 and pinches out to the south before reaching SB05. To the north, the sand body thickens to 38 ft at SB44, where it forms a subtle channel-like feature in cross section. South of the unit 3 pinchout, a sample collected from SB05 in Phase I showed a change in lithology to gray clayey silt with a trace of sand (unit 4). The underlying dry, blue-gray silt (unit 5) ranges from 15 to 30 ft in thickness along section B-B´. The bedrock surface occurs at 76 ft BGL at SB05 (refusal), at the southern end of the former CCC/USDA facility, and it deepens to 85 ft BGL at SB04.

Cross section C-C´ (Figure 4.4) combines the data from ECPT sensor logs and core samples from SB20, SB27, SB25, and SB12 with geologic logs for Geoprobe cores from SB28, SB27, SB50, SB37, and SB25. The cross section shows the upper 111-123 ft of the geologic section to be composed of Pleistocene and Holocene silt, sand and gravel, and clay. The uppermost silt unit is a 15- to 24-ft-thick layer of loess (unit 1) overlying a sandy silt and clay (unit 2). The sandy silt and clay unit is 20 ft thick at the southern boundary of the former facility and thins progressively to the north, where it is 4 ft thick at SB12. The fluvial sand and gravel (unit 3) is found beneath the loess and sandy silt at and to the north of SB27, but it pinches out to the south before reaching SB20. North of the pinchout, the sand and gravel unit thickens rapidly to 41 ft at SB25. The fluvial system is cut into wet gray clayey silt with a trace of sand (unit 4). The underlying dry, blue-gray silt (unit 5) ranges from 15 to 53 ft in thickness along the line of section C-C´. The bedrock surface occurs at 111 ft BGL at SB20 (refusal), at the southern end of the main part of the former CCC/USDA facility, and it deepens to 123 ft BGL at SB12, 250 ft north of the facility boundary.

4.2.2 Summary of Geology of the Western Part of Adams

The Holocene and Pleistocene sediments in the area of investigation were deposited on the southern edge of a major paleovalley cut into the Permian bedrock. Therefore, the former CCC/USDA facility lies within a transitional zone between fluvial deposition to the north and glacial deposition to the south. In the western part of Adams, the thickness of the unconsolidated Holocene and Pleistocene units varies between 63 and 123 ft, becoming thicker toward the center of the paleovalley. A wind-blown loess mantle (unit 1) covers the underlying Pleistocene glacial and fluvial units. The uppermost unit immediately underlying the loess is sandy silt with clay (unit 2) that thins from south to north and overlaps the southern edge of the fluvial valley fill.

The sand and gravel (unit 3) at Adams represents the southern edge of the extensive fluvial sands and gravels that fill the paleovalley. The sand and gravel unit in the area of investigation is 0-45 ft thick and is made up of a series of upward-fining depositional sequences ranging from gravel and coarse sand at the base of each cycle, through medium sand, to fine-grained sand (occasionally clayey) at the top. Pleistocene glacial silts are found to the south of the fluvial deposits, at the northern boundary of the drift hills. The sand and gravel body pinches out to the south and is replaced in the sequence by gray clayey silt with a trace of sand (unit 4). This unit is wet and may slowly contribute groundwater to the fluvial sand and gravel aquifer from the glacial sediments that form the drift hills. The older Pleistocene blue-gray silt (unit 5) was deposited directly on the bedrock surface prior to deposition of the fluvial sand and gravel.

Two stratigraphic units with potential hydrostratigraphic significance in the study area are the Pleistocene sand and gravel (unit 3) and, to a lesser extent, the Pleistocene glacial gray silt (unit 4).

4.3 Hydrogeology of the Western Part of Adams

No new hydrogeologic data were acquired in Phase II. The following discussion is focused on interpretation of the hydrogeologic database from Phase I as it relates to the area of the Phase II investigation in the western part of Adams.

4.3.1 Hydrostratigraphic Interpretation

Five primary stratigraphic units overlying Permian bedrock were identified at Adams in Phase I. The top two units are loess (unit 1) and sandy silt and clay (unit 2). Both units are unsaturated. The major water movement in these units is vertical infiltration of surface water. Carbon tetrachloride released from grain storage facilities will likewise move vertically downward through these units to reach the underlying saturated zone.

The Pleistocene aquifer in the western part of Adams is shown on geologic cross sections A-A´, B-B´, and C-C´ in Figures 4.5-4.7, respectively. The fluvial aquifer pinches out to the south where it is in contact with glacial silts at the northern boundary of the drift hills (Figures 4.6 and 4.7). The glacial silt (unit 4) consists of gray silt and a trace of sand with a relatively low overall permeability. The water level measured at SB05 (in the silt unit) in Phase I is more than 15 ft above the water level in the adjacent fluvial aquifer (Figure 4.6). The large hydraulic gradient between the glacial silt (unit 4) and the fluvial sand and gravel (unit 3) aquifer provides the driving force for groundwater discharge from the glacial drift deposits into the fluvial aquifer, even though the glacial silt has a low hydraulic conductivity. The glacial silt (unit 4) acts as a very poor aquifer, and its ability to transmit groundwater lies somewhere between that of a typical aquitard and an aquifer.

The underlying blue-gray Pleistocene silt (unit 5) is dry and dense with very low permeability, forming an aquiclude that confines the overlying fluvial aquifer (unit 3) and the saturated glacial silt (unit 4). This confining layer is laterally continuous at the former CCC/USDA facility (Figures 4.5, 4.6, and 4.7), but it thins over the bedrock high near SB16 (Figure 4.5).

4.3.2 Pleistocene Fluvial Aquifer

The Pleistocene fluvial aquifer was developed in a paleovalley that lies beneath the valley of the present-day Middle Branch Big Nemaha River. The aquifer is more than 100 ft thick near the river, north and northeast of Adams. At the former CCC/USDA facility in the western part of Adams, the aquifer is 0-45 ft thick. In this area, the aquifer thins and pinches out to the south, at the northern edge of the glacial drift hills (Figures 4.6 and 4.7). The pinchout cuts across the former facility from southeast to northwest, and no groundwater is produced from wells to the south of this boundary (see Figure 4.8). The upper part of aquifer, to the north of the

pinchout, provides a path for preferential migration for contaminants carried downward by vertical infiltration of surface water.

The fluvial aquifer is completely saturated in the western part of Adams and is generally under a leaky-confined condition. In Phase I, the hydraulic conductivity of the aquifer was estimated from grain size analyses to range from a few to 100 ft/day. Hydraulic conductivity is generally higher at the top and bottom of the aquifer and lower in the middle. The potentiometric surface of the Pleistocene fluvial aquifer, constructed with hand-measured water levels taken on May 11, 2000, during the Phase I investigation, is illustrated in Figure 4.8. Groundwater in the aquifer flows eastward with a gentle hydraulic gradient of 0.0016.

Groundwater flow into the aquifer from the drift hills through the low-permeability unit (gray silt) appears to be slow and limited. Because this slow influx plus recharge by surface infiltration cannot immediately compensate for discharge from the fluvial aquifer due to usage, relatively large groundwater declines were observed in Phase I in response to pumping at Adams. This general decrease of water level indicated that the groundwater system at Adams was under stress, with inadequate recharge to compensate for routine pumping.

4.3.3 Summary of Hydrogeology of the Western Part of Adams

In Phase I (Argonne 2001), the investigation focused on the Pleistocene fluvial aquifer that produces most of the water for public supply, domestic, and irrigation uses at Adams. The study showed that the aquifer is semiconfined by the overlying loess (unit 1) and sandy silt unit (unit 2) and confined by the underlying older Pleistocene blue-gray silt (unit 5) and Permian limestone (unit 6). Normally, the aquifer is under a leaky-confined condition. The aquifer thickens toward the center of the paleovalley and pinches out at the southern edge of the paleovalley where the sand and gravel unit is in contact with unit 4, a gray silt aquitard (or poor aquifer) at the northern boundary of the drift hills. This contact cuts across the former CCC/USDA facility from southeast to northwest, and no groundwater is produced from wells to the south of this boundary.

The potentiometric surface measured in Phase I indicates groundwater flow to the east with a gentle hydraulic gradient of 0.0016. Primary recharge is from precipitation falling over the broad upgradient region, supplemented by influx from the drift hills through the saturated gray silt aquitard. Minor local recharge occurs through infiltration of surface water. Pumping of

the public water supply wells has a significant effect on the groundwater flow system and, potentially, the contaminant migration pathways.

4.4 Nitrate (as Nitrogen) in Groundwater

In Phase I sampling, water from two of the public water supply wells (PWS 64-1 and PWS 79-1) exceeded the MCL of 10 mg/L for nitrate-nitrogen in drinking water at 15 and 16.3 mg/L, respectively. Groundwater from active wells PWS 79-1 and PWS 70-1 (8.5 mg/L nitrate-nitrogen) is mixed and treated to remove nitrate before it enters the town's water supply. Any attempt to replace PWS 70-1 will have to take into consideration the high levels of nitrate prevalent in the Pleistocene fluvial aquifer. Previous groundwater sampling in the region has shown that the paleovalley fluvial aquifers are enriched in nitrate relative to both the shallow aquifers of the drift hills and bedrock aquifers (Tanner and Steele 1989).

Additional nitrate-nitrogen samples were collected in Phase II. The analytical results are shown in detail in Table E.4 in Appendix E. These data were combined with the Phase I results to produce a map showing the range of nitrate-nitrogen values recorded at each sampling location (Figure 4.9). This map shows that groundwater with nitrate-nitrogen levels below the MCL (10 mg/L) is found only to the south of a line extending west-east along Elm Street. Well PWS 70-1 lies immediately to the south of this line. The samples low in nitrate-nitrogen occurred either along the thin southern edge of the fluvial aquifer or in groundwater recovered from the saturated glacial silt (unit 4). Phase I results suggested that high-nitrate water in the paleovalley fluvial aquifer is diluted by low-nitrate groundwater from the glacial sediments of the drift hills near the southern edge of the paleovalley.

4.5 Overall Summary of Data Interpretation

The primary stratigraphic units at Adams include the overlying loess mantle of Holocene and Pleistocene age (unit 1); the Pleistocene sandy silt and clay (unit 2); the Pleistocene fluvial sand and gravel (unit 3); the Pleistocene gray silt (unit 4); the older Pleistocene blue-gray silt (unit 5); and the Permian bedrock, consisting of limestone and shale of the Council Grove Group (unit 6).

The Holocene and Pleistocene sediments in the area of investigation were deposited on the southern edge of a major paleovalley that was cut into the Permian bedrock. Therefore, the

former CCC/USDA facility lies within a transitional zone between fluvial deposition to the north and glacial deposition to the south. In the western part of Adams, the thickness of the Holocene and Pleistocene units varies between 63 and 123 ft, becoming thicker toward the center of the paleovalley. A wind-blown loess mantle (unit 1) covers the underlying Pleistocene glacial and fluvial units. In the glacial zone, the uppermost unit immediately underlying the loess is sandy silt with clay (unit 2) that thins from south to north and partly overlaps the southern edge of the fluvial valley fill.

In the fluvial zone at Adams, the sand and gravel (unit 3) represents the southern edge of the extensive fluvial sands and gravels that fill the paleovalley. The sand and gravel unit is 0-45 ft thick in the area of investigation, made up of a series of upward-fining depositional sequences ranging from gravel and coarse sand at the base of each cycle, through medium sand, to fine-grained sand (occasionally clayey) at the top. Pleistocene glacial silts are found along the southern edge of the fluvial deposits, at the northern boundary of the drift hills that lie to the south. The sand and gravel body pinches out to the south and is replaced in the sequence by gray clayey silt with a trace of sand (unit 4). This unit is wet and may slowly contribute groundwater to the fluvial sand and gravel aquifer from the glacial sediments that form the drift hills. The older Pleistocene blue-gray silt (unit 5) was deposited directly on the bedrock surface prior to deposition of the fluvial sand and gravel.

Two stratigraphic units with potential hydrostratigraphic significance in the study area are the Pleistocene sand and gravel (unit 3) and, to a lesser extent, the Pleistocene glacial gray silt (unit 4).

In Phase I (Argonne 2001), the hydrogeologic investigation focused on the Pleistocene fluvial aquifer that produces most of the water for public supply, domestic, and irrigation uses at Adams. The study showed that the aquifer is semiconfined by the overlying loess (unit 1) and sandy silt unit (unit 2) and confined by the underlying older Pleistocene blue-gray silt (unit 5) and Permian limestone (unit 6). Normally, the aquifer is under a leaky-confined condition. The hydraulic conductivity of the aquifer is generally higher at the top and bottom and lower in the middle. The aquifer thickens to the north, toward the center of the paleovalley, and it pinches out at the southern edge of the paleovalley. The pinchout occurs where the sand and gravel unit is in contact with unit 4, a gray silt aquitard (or poor aquifer) at the northern boundary of the drift hills. This contact cuts across the former CCC/USDA facility from southeast to northwest, and no groundwater is produced from wells to the south of this boundary.

The potentiometric surface measured in Phase I indicates groundwater flow to the east with a gentle hydraulic gradient of 0.0016. The fluvial aquifer at Adams is recharged primarily from precipitation falling over the broad upgradient region and recharged partially from glacial drift through the saturated gray silt aquitard. Minor local recharge occurs through infiltration of surface water. Pumping of the public water supply wells has a significant effect on the groundwater flow system and, potentially, the contaminant migration pathways.

Groundwater with nitrate-nitrogen levels below the MCL of 10 mg/L is found only to the south of a line extending west-east along Elm Street. Well PWS 70-1 lies immediately south of this line. The low-nitrate samples are found either along the thin southern edge of the fluvial aquifer or in groundwater recovered from the saturated glacial silt (unit 4). Phase I results suggested that high-nitrate water in the paleovalley fluvial aquifer is diluted by low-nitrate groundwater from the glacial sediments of the drift hills near the southern edge of the paleovalley.

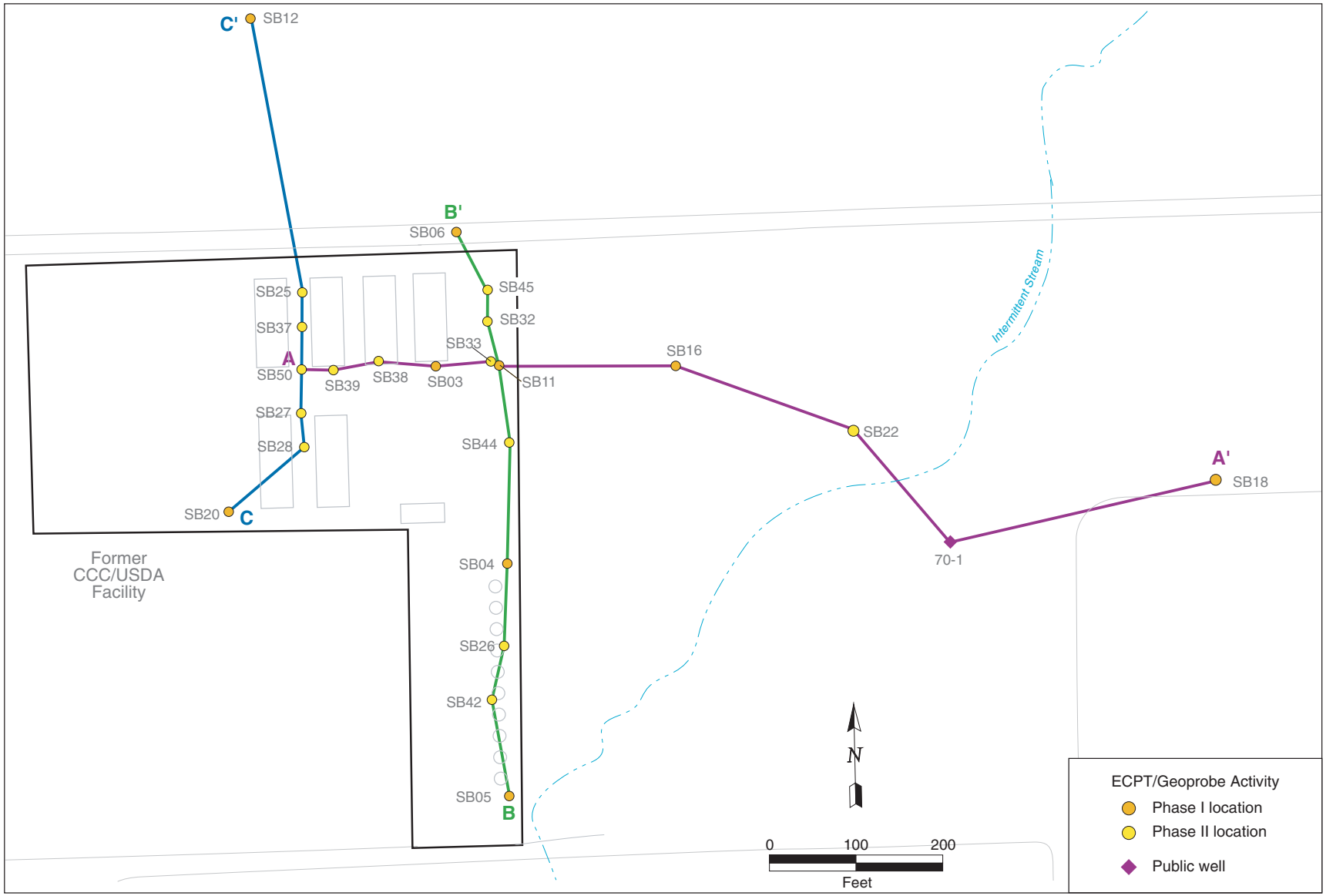


FIGURE 4.1 Locations of the former CCC/USDA facility; public wells; Phase I and Phase II investigative activities; and Phase II vertical geologic and hydrogeologic cross sections A-A´, B-B´, and C-C´ in the western part of Adams.

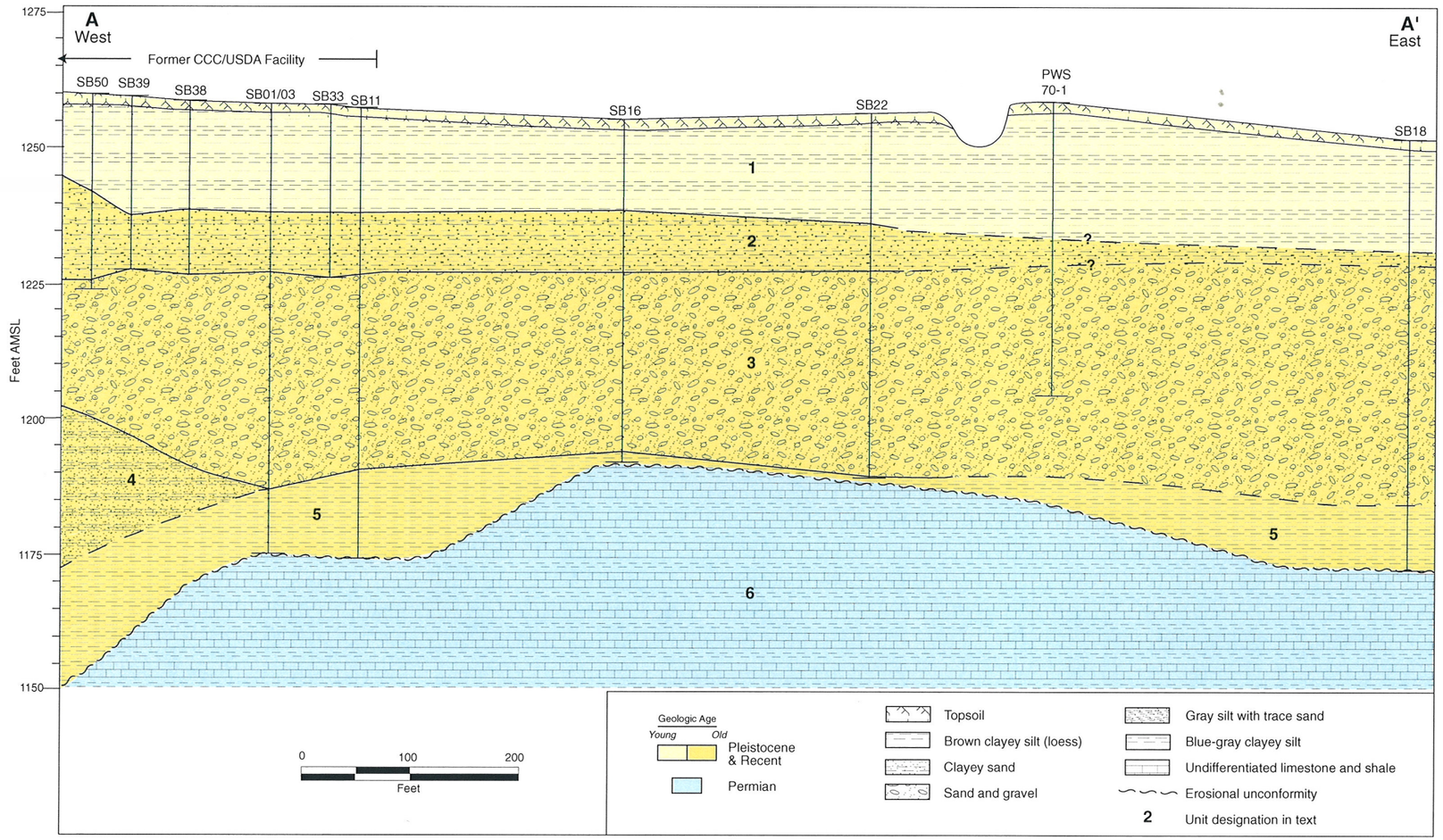


FIGURE 4.2 Interpretive west-to-east geologic cross section A-A´, showing stratigraphic relationships between the former Adams CCC/USDA facility and well PWS 70-1.

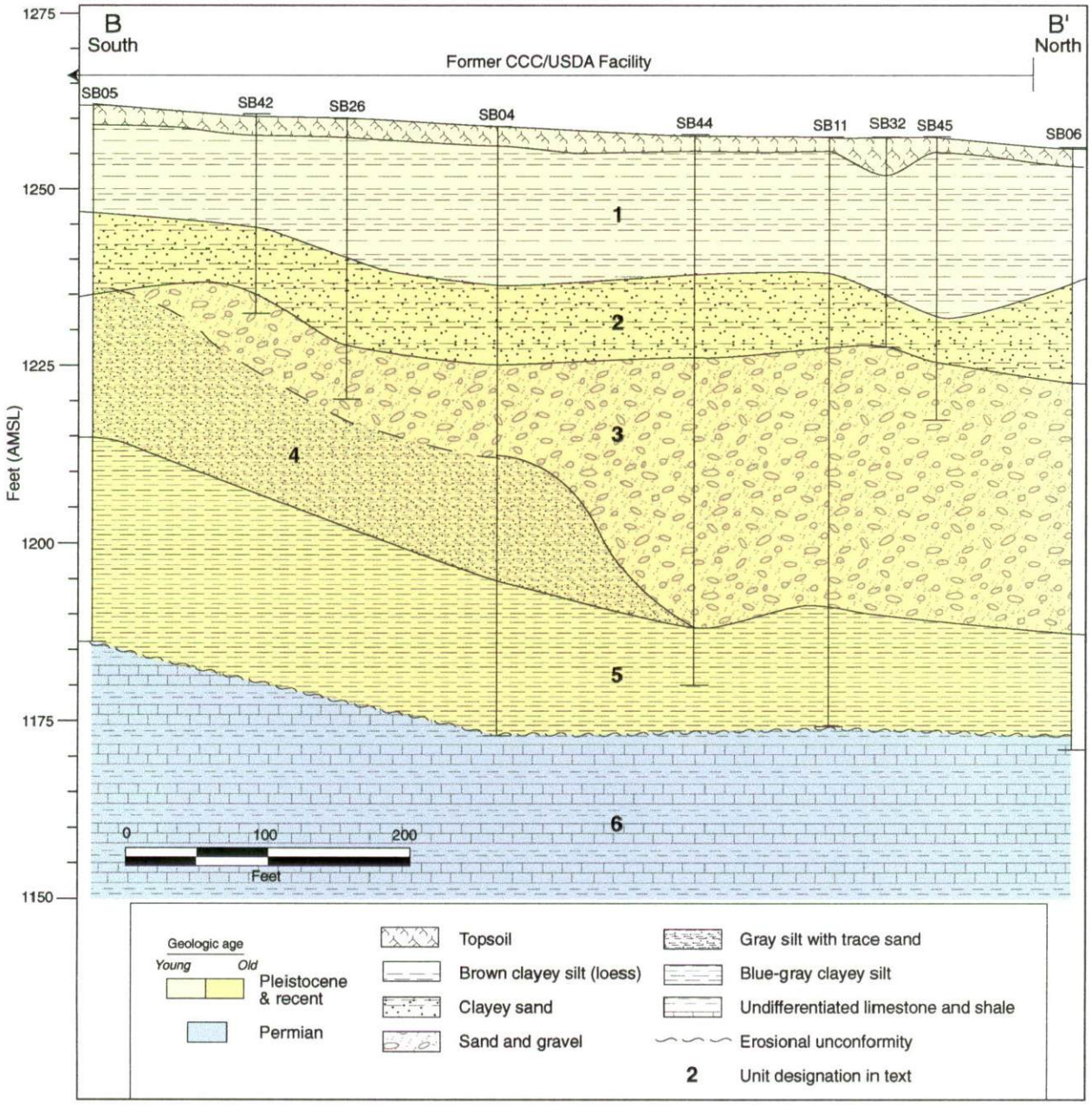


FIGURE 4.3 Interpretive south-to-north geologic cross section B-B´, showing stratigraphic relationships across the axis of section A-A´, along the eastern boundary of the former CCC/USDA facility at Adams.

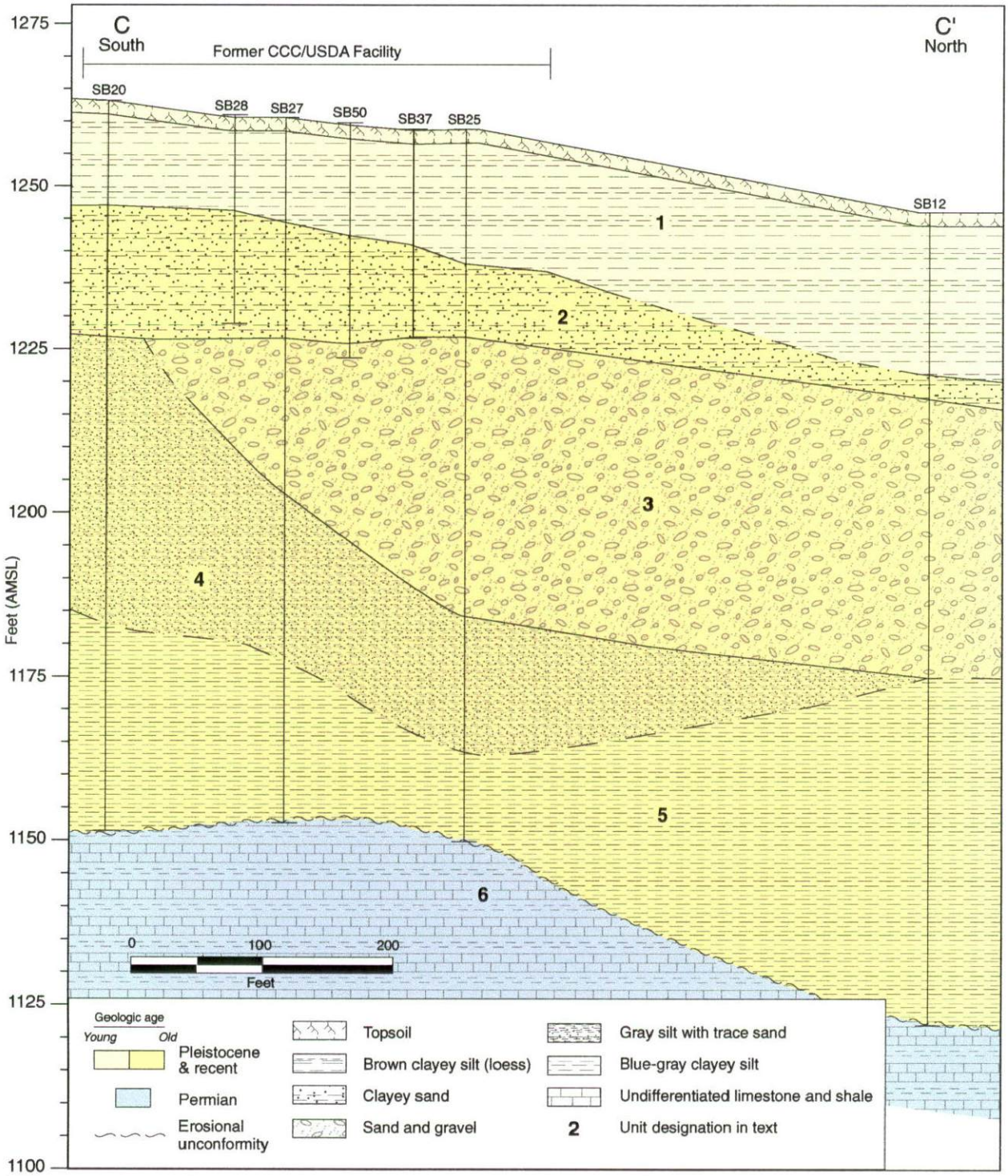


FIGURE 4.4 Interpretive south-to-north geologic cross section C-C′, showing stratigraphic relationships across the axis of section A-A′, through the central part of the former CCC/USDA facility at Adams.

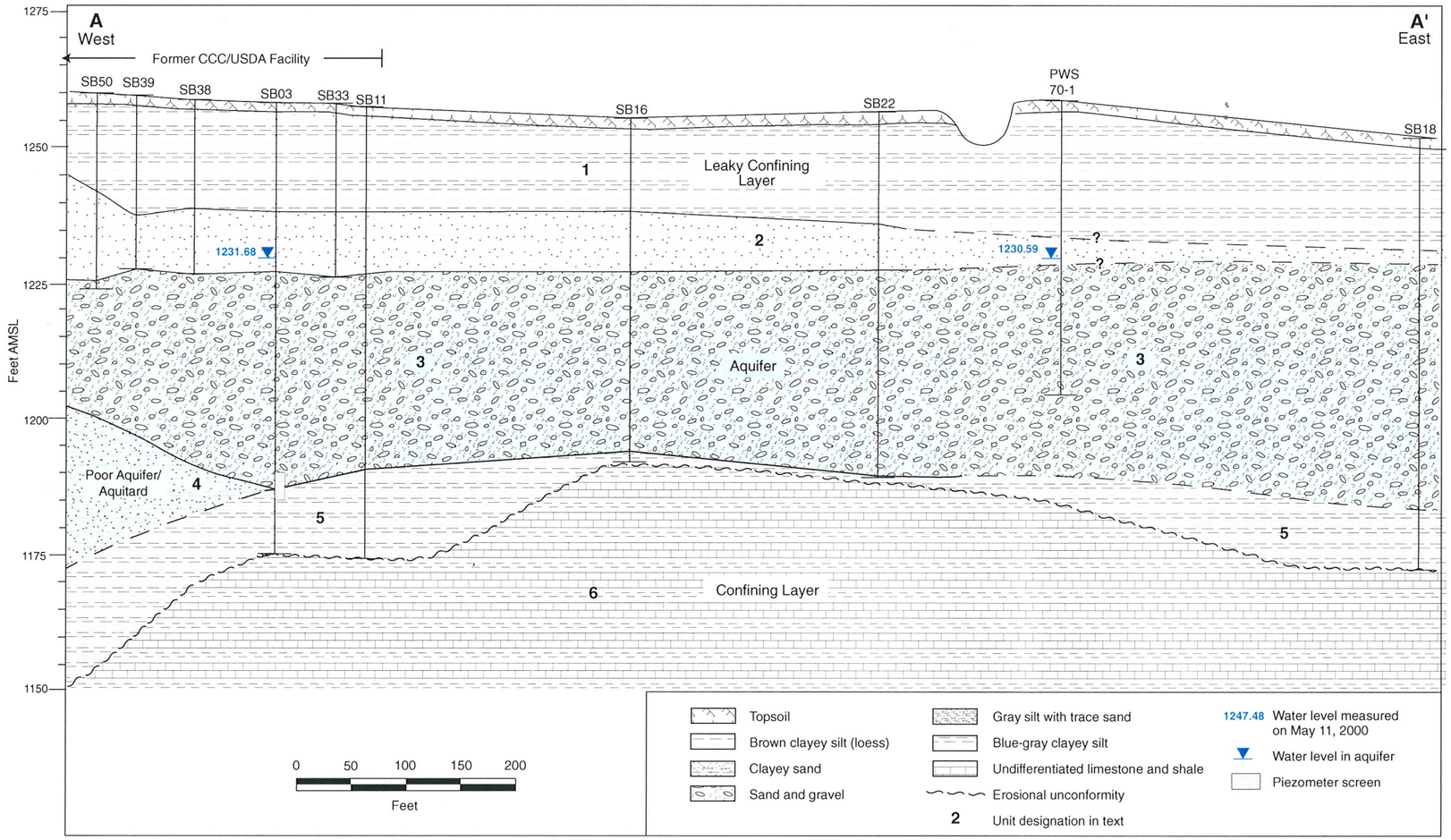


FIGURE 4.5 Interpretive west-to-east geologic cross section A-A´, showing the Pleistocene aquifer between the former CCC/USDA facility and well PWS 70-1 at Adams.

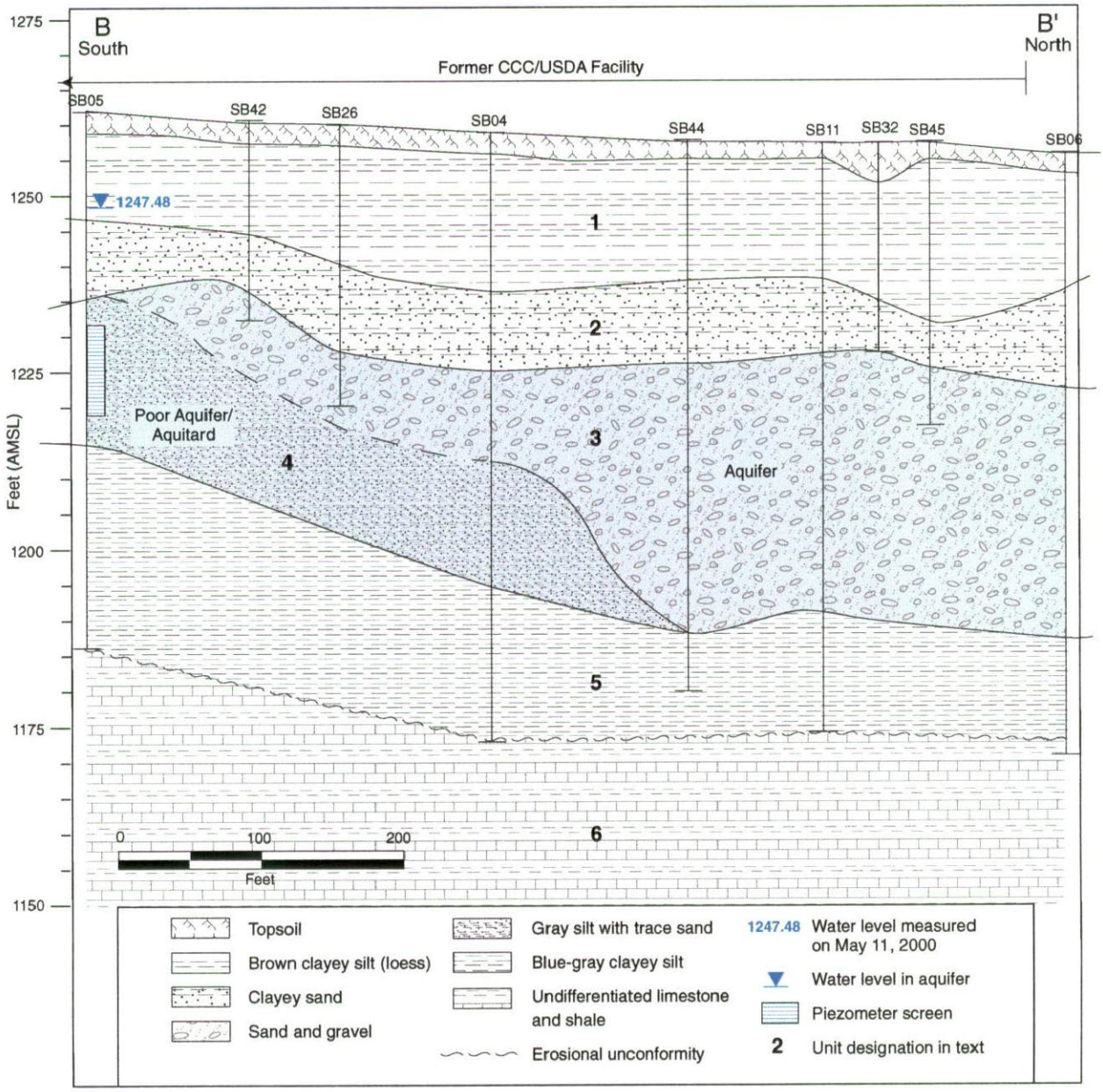


FIGURE 4.6 Interpretive south-to-north geologic cross section B-B′, showing the Pleistocene aquifer across the axis of section A-A′, along the eastern boundary of the former CCC/USDA facility at Adams.

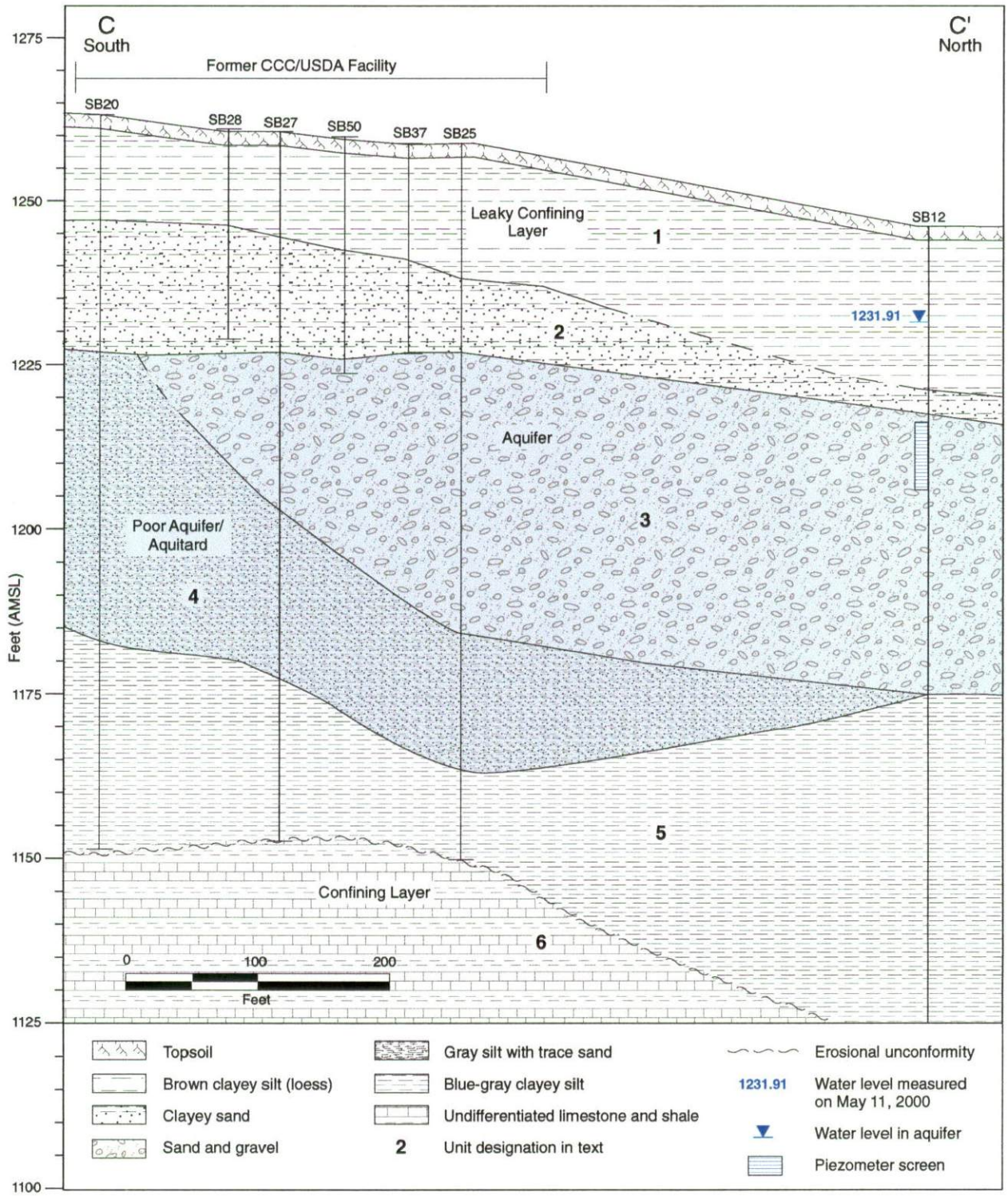


FIGURE 4.7 Interpretive south-to-north geologic cross section C-C′, showing the Pleistocene aquifer across the axis of section A-A′, through the central part of the former CCC/USDA facility at Adams.

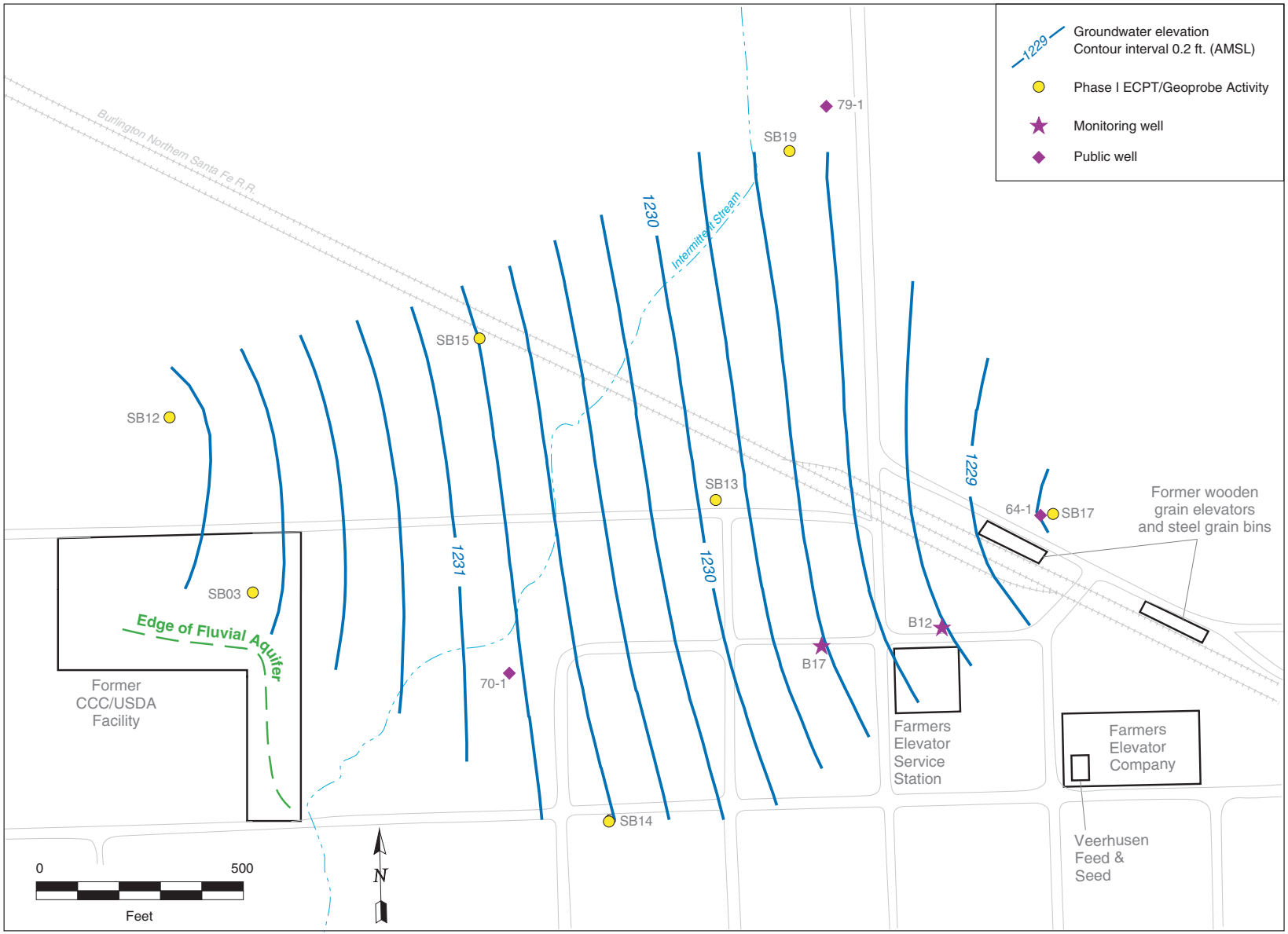


FIGURE 4.8 Location of the former Adams CCC/USDA facility and the potentiometric surface for the Pleistocene fluvial aquifer, as measured on May 11, 2000.

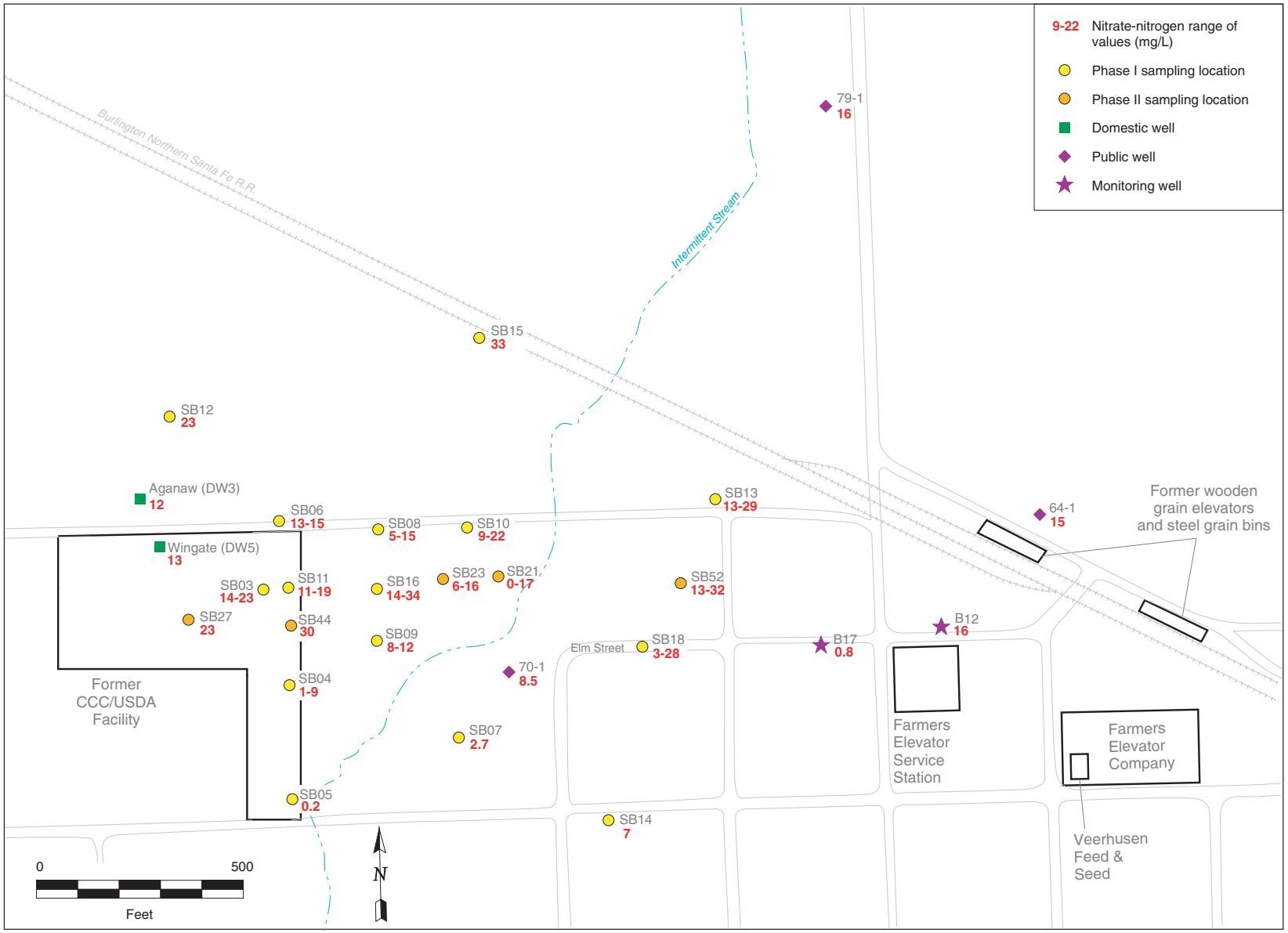


FIGURE 4.9 Locations of the former Adams CCC/USDA facility and the groundwater samples analyzed for nitrate-nitrogen, with the range of results for each sample.

5 Contaminant Distribution and Migration Pathways

5.1 Introduction

This section uses the integrated model of geology, hydrogeology, and hydrogeochemistry of western Adams presented in Section 4 as a framework for analyzing the data obtained in the Phase I and II investigations on carbon tetrachloride and chloroform levels in soils and groundwater. Phase I work established that contaminants have migrated from the surface of the former CCC/USDA grain storage facility through vadose zone infiltration into the groundwater system, resulting in contamination of PWS 70-1 at levels below the MCL. To characterize the contaminant migration pathway further, the analysis in this section includes (1) a determination of the contaminant distribution in subsurface soils at the former CCC/USDA grain storage facility, with an evaluation of the risk to human health due to the soil contamination, and (2) a refinement of the contaminant migration pathway in groundwater to evaluate the effect of capture of the contaminant plume by PWS 70-1.

5.2 Contaminant Distribution in Subsurface Soils and Attendant Health Risks

Soil sampling from the surface to the top of the Pleistocene aquifer at the former Adams CCC/USDA facility located two areas with carbon tetrachloride concentrations that exceeded the quantitation limit of 10 μg/kg for the purge-and-trap analytical method. Figure 5.1 shows the 27 Geoprobe locations and the range of carbon tetrachloride values for vadose zone samples (above the saturated zone) on a map of the former CCC/USDA facility. Results of all chloroform analyses were below the quantitation limit of 10 μg/kg. Estimated locations of former bins, Quonsets, and a storage building are also shown. The two contaminated areas are defined by (A) the grouping of SB50, SB39, SB37, and SB27, along the former access road between the Quonsets in the center of the former facility, and (B) the pair of Geoprobe locations (SB30 and SB31) at either end of a former storage building. In contaminated soil area A, the maximum carbon tetrachloride values occur below 12 ft BGL (12-527 μg/kg), largely in geologic unit 2, which makes up the lower part of the vadose zone. In contaminated soil area B, the carbon tetrachloride occurs throughout the vadose zone, with values above the quantitation limit both near surface (36 μg/kg) and in geologic unit 2 (18-24 μg/kg). The difference in the vertical

distribution patterns can be seen in Figure 5.2, a comparison of logs for SB50 (area A) and SB31 (area B). All geologic logs, with carbon tetrachloride and chloroform results, are in Appendix B.

A sample of saturated silty clay, interbedded within the upper part of the fluvial aquifer (unit 3) at 35 ft BGL in SB50, contains carbon tetrachloride at 402 μg/kg (Figure 5.2). Samples of clay in the lower part of the vadose zone and within the fluvial aquifer at SB50 were also contaminated with 1,2-DCA at 611 and 495 μg/kg, at 33 and 35 ft BGL, respectively. However, 1,2-DCA was not found in groundwater samples at the former CCC/USDA grain storage facility. Because the CCC/USDA never used fumigants containing 1,2-DCA at any of its grain storage facilities (Agricultural Research Service 1971), the discovery of 1,2-DCA suggests that another party might have contributed to the contamination found beneath the former CCC/USDA facility.

Levels of soil contamination required to exceed EPA limits for risks due to ingestion and inhalation of carbon tetrachloride in soils have been calculated by using parameters defined as reasonable maximum exposures for average Americans (EPA 1989a, 1991). The pathways considered were direct ingestion of contaminated soil, inhalation of contaminated dust (indoors and outdoors), and ingestion of vegetables and fruits grown in contaminated soil. Pathways requiring transfer of contaminants from soil to groundwater were not included.

The results show that a concentration of 5,800 μg/kg would be required to yield a carcinogenic risk of 1E-4, the maximum risk within the acceptable (1E-4 to 1E-6) range (EPA 1990). The concentration of carbon tetrachloride in soil required to yield the maximum allowable hazard index is 2,333 μg/kg. Because none of the near-surface samples (from approximately the surface to the frost line) exceeded the carbon tetrachloride quantitation limit of 10 μg/kg for the purge-and-trap GC-MS method, there is no health risk due to contaminated soil at the former Adams CCC/USDA facility.

5.3 Contaminant Distribution in Groundwater

The distribution of carbon tetrachloride in groundwater in western Adams, based on Phase I and Phase II water sampling, is mapped in Figure 5.3. The chloroform distribution is shown in Figure 5.4. (More detailed distributions of carbon tetrachloride and chloroform are shown in Figures E.1 and E.2, respectively, in Appendix E.) Contamination was detected at the top of the Pleistocene fluvial aquifer in the northern part of the former facility. Two soil

contamination areas were identified in Phase II (described in Section 5.2). Area A is at the upgradient edge of the groundwater plume, at a location previously occupied by Quonset grain storage buildings adjacent to the access road. Downward movement of dissolved carbon tetrachloride likely penetrated through the loess and sandy silt units to reach the underlying Pleistocene fluvial aquifer near this area. Maximum carbon tetrachloride and chloroform values at the top of the fluvial aquifer (31-42 ft BGL) in the northern part of the former facility were 59 and 20 μg/L, respectively (measured at SB11 in Phase I). The lower part of the aquifer (42-72 ft BGL) is not contaminated at the location of the former CCC/USDA grain storage facility.

Soil contamination area B lies to the south of the pinchout of the fluvial aquifer (see Figure 4.8) and is underlain by glacial silt (unit 4) consisting of gray silt and a trace of sand with a relatively low overall permeability. There is no evidence of contaminated groundwater downgradient of this location. All groundwater and soil samples from the southern limb of the former CCC/USDA facility were free of contamination.

The groundwater contamination extends due east from the northern part of the former CCC/USDA facility. Particle tracking simulations conducted in Phase I (Argonne 2001) showed that the eastward flow lines leaving this location curve toward PWS 70-1. This result suggested that contamination migrating in groundwater from the former facility is largely captured by PWS 70-1. Groundwater sampling was conducted at SB21, SB22, and SB23 in Phase II to investigate the contaminant distribution to the north of PWS 70-1, where the flow lines were predicted to curve toward the well, and SB52 was sampled to determine the extent of any contamination bypassing the well to the north. As Figure 5.3 shows, the axis of the carbon tetrachloride plume can be followed due east from the former facility at SB11 (59 μg/L) to SB16 (32 μg/L), then southeast through SB22 (12 μg/L) to PWS 70-1. Therefore, the axis of the contaminant plume follows the predicted particle tracking flow lines in this area.

Thin zones of low contaminant values (carbon tetrachloride < 5 μg/L) were found at SB23, SB21, and SB52, due east of SB16. Here the aquifer is more than 50 ft thick (53, 55, and 56 ft thick at SB23, SB21, and SB52, respectively). These low-contaminant zones probably represent remnants of the low-grade northern edge of the plume that were not diverted by PWS 70-1. The northernmost edge of the plume at the former facility contains carbon tetrachloride at 9.3 μg/L at SB25, less than 20% of the values found on the axis of the plume at SB03 and SB11 (56-59 μg/L). Low concentrations (< 5 μg/L) attributed to the northern edge of the plume were also found at SB08 and SB13 in Phase I.

The vertical distribution of carbon tetrachloride in the fluvial aquifer is demonstrated on geologic cross sections along (A-A´) and across (B-B´ and C-C´) the migration pathway (locations shown in Figure 4.1). Cross section A-A´ (Figure 5.5) follows the axis of the plume from the former CCC/USDA facility to PWS 70-1, ending at SB18 (due east of the well). This view shows that the contaminant plume is restricted to the upper part of the aquifer beneath the former CCC/USDA facility, then drifts downward as it migrates toward PWS 70-1. At PWS 70-1 the sub-MCL carbon tetrachloride concentration probably results from dilution of the narrow plume of contaminated groundwater originating at the former facility with a large volume of uncontaminated water drawn from the area of influence of the well and the thick, uncontaminated part of the aquifer. Plume thickness does not exceed 10 ft to the west of PWS 70-1. East of the well, the remnants of the plume that escape extraction by PWS 70-1 drift even lower in the aquifer (43-68 ft BGL), and the concentration of carbon tetrachloride in the plume remains below the MCL. Thickening of the plume to the east of PWS 70-1 is probably the result of the mixing effect of the well.

Cross section B-B´ (Figure 5.6) is oriented across the axis of the plume and parallels the eastern boundary of the former CCC/USDA facility. This figure shows that the carbon tetrachloride contamination in groundwater is restricted to a narrow zone under the northern part of the former facility, between SB44 (< 5 μg/L) and SB11 (59 μg/L), and remains at the top of the aquifer. No groundwater contamination is found to the south of SB44.

Cross section C-C´ (Figure 5.7) is oriented south-north across the axis of the plume where it crosses the center of the former CCC/USDA facility. The line of the section passes through contaminated soil area A between SB27 and SB50. Carbon tetrachloride contamination of the groundwater is restricted to the top of the aquifer at SB27 (26 μg/L), where groundwater is in contact with contaminated soil, and at the northern edge of the former Quonset grain storage buildings at SB25 (9.3 μg/L).

5.4 Migration Pathway

Only one migration pathway exists for contaminated groundwater originating at the former Adams CCC/USDA facility, but the natural pathway has been modified by the historical pumping of public wells, as demonstrated in Phase I (Argonne 2001). Groundwater contamination is detected only beneath the northern part of the former facility and is restricted to the top of the Pleistocene fluvial aquifer at and downgradient from an area of subsurface soil

contamination. The lower part of the aquifer is not contaminated at the location of the former facility. The most likely source of the groundwater contamination is associated with an area of soil contamination (area A) at the upgradient edge of the plume where Quonset grain storage buildings once stood, adjacent to the access road. (The area farther upgradient, to the west of contaminated soil area A within the former grain storage facility, was never occupied by Quonsets or bins and was shown to be free of carbon tetrachloride by vegetation sampling in Phase I.) Dissolved carbon tetrachloride likely penetrated downward through the loess and sandy silt units near area A to reach the top of the underlying Pleistocene fluvial aquifer. The second area of soil contamination (area B), coinciding with a former storage building, does not contribute to the groundwater plume because it lies south of the pinchout of the fluvial aquifer. There is no evidence of contaminated groundwater downgradient from this location. All groundwater and soil samples from the southern limb of the former CCC/USDA facility were free of contamination.

The contaminant plume extends due east for about 500 ft from the northern part of the former CCC/USDA facility, following the direction of groundwater flow. Then the central part of the plume is diverted to the south under the influence of PWS 70-1. The plume is restricted to the upper part of the aquifer beneath the former facility, and it drifts downward as it migrates toward PWS 70-1. At PWS 70-1 the narrow plume of contaminated groundwater originating at the former facility is diluted with a large volume of uncontaminated water pumped from the remaining thickness and surrounding area of the aquifer. East of the well, the remnants of the plume that were not fully extracted by PWS 70-1 drift lower in the aquifer and are mixed and diluted.

Traces of the plume can also be found along the direction of groundwater flow due east of the northern part of the former CCC/USDA facility, to the north of PWS 70-1. The carbon tetrachloride values are all below the MCL in these thin plume remnants (< 10 ft thick in an aquifer > 50 ft thick) and probably represent the northernmost edge of the plume, which is not fully captured by PWS 70-1. (The > 50-ft-thick aquifer lies to the north of section A-A´.)

Contamination of PWS 64-1 in the eastern part of Adams cannot be explained by the low levels of contamination originating at the former CCC/USDA facility that avoid direct extraction by PWS 70-1 (as at SB18) or bypass capture of the main part of the plume (as at SB23, SB21, SB08, SB52, and SB13). Any well in the area of low carbon tetrachloride values to the east of PWS 70-1 would produce water at concentrations well below the MCL, particularly if it was screened across the entire aquifer (as a public supply well would be). For example, due east of

the former CCC/USDA facility and 1,000 ft upgradient of PWS 64-1, SB52 contains carbon tetrachloride at < 5 μg/L over an interval of 15 ft in an aquifer that is 56 ft thick. Carbon tetrachloride in water produced from a public supply well at this location would be at or below the detection limit. However, at downgradient well PWS 64-1, in the eastern part of Adams, a carbon tetrachloride concentration of 12.9 μg/L was found in 1990, and recent tests have confirmed that the well is still contaminated (Buss 2001). The downgradient increase in carbon tetrachloride concentration implies a second source of contamination in the eastern part of Adams.

These results are consistent with the conclusions from particle tracking simulations in Phase I (Argonne 2001). Results of the preliminary evaluation of the effects of historical pumping on past groundwater flow and contaminant transport at Adams indicated that the former CCC/USDA facility was unlikely to be responsible for the carbon tetrachloride contamination of PWS 64-1. The evaluation also showed that similar hydraulic conditions leading to the present capture of the contaminant plume from the former CCC/USDA facility (by PWS 70-1) would have existed since operation of an earlier well (PWS 49-1) began at this location in 1949. The analysis also demonstrated that PWS 64-1 could have captured contaminated groundwater emanating from a number of other potential sources in eastern Adams.

The dilute nature of the contamination downgradient from the former CCC/USDA facility and the small volume of contaminated groundwater that would be produced compared to the total volume of the water within the capture zone of a public well both tend to minimize the carbon tetrachloride threat to public drinking water. The low values of carbon tetrachloride found in samples from PWS 70-1 are an example of this circumstance. Consequently, a public drinking water well placed anywhere downgradient from PWS 70-1 should produce water suitable for human consumption, subject to acceptable analysis for nitrates and contamination from other potential sources.

The future course of contaminant migration and its effect on concentrations of carbon tetrachloride at the location of PWS 70-1 are examined in Section 6.

5.5 Summary of Contaminant Distribution in Western Adams

The following points summarize the Phase II findings related to contaminant distribution in the western part of Adams:

- Soil sampling from surface to the top of the Pleistocene aquifer (vadose zone) at the former Adams CCC/USDA facility located two areas with carbon

tetrachloride concentrations that exceeded the quantitation limit of 10 μg/kg for the purge-and-trap analytical method. All chloroform analyses were below the quantitation limit. In contaminated soil area A, the carbon tetrachloride occurs below 12 ft BGL (12-527 μg/kg). In contaminated soil area B, the carbon tetrachloride occurs throughout the vadose zone, with values above the quantitation limit of 10 μg/kg both near the surface (36 μg/kg) and immediately above the aquifer (18-24 μg/kg).

- A sample of saturated silty clay, interbedded within the upper part of the fluvial aquifer (unit 3) at 35 ft BGL in SB50, contains carbon tetrachloride at 402 μg/kg (Figure 5.2). Samples of clay in the lower part of the vadose zone and within the fluvial aquifer at SB50 were also contaminated with 1,2-DCA at 611 and 495 μg/kg, at 33 and 35 ft BGL, respectively. However, 1,2-DCA was not found in groundwater samples at the former CCC/USDA grain storage facility. Because the CCC/USDA never used fumigants containing 1,2-DCA at any of its grain storage facilities, the discovery of 1,2-DCA suggests that another party might have contributed to the contamination found beneath the former CCC/USDA facility.

- There is no health risk due to contaminated near-surface soil at the former Adams CCC/USDA facility.

- Contamination was detected in groundwater at the top of the Pleistocene fluvial aquifer in the northern part of the former facility. Soil contamination area A is at the upgradient edge of the plume, in an area previously occupied by Quonset grain storage buildings adjacent to the access road. Downward movement of dissolved carbon tetrachloride likely penetrated through the loess and sandy silt units to reach the underlying Pleistocene fluvial aquifer. Maximum carbon tetrachloride and chloroform values at the top of the fluvial aquifer (31-42 ft BGL) in the northern part of the former facility were 59 and 20 μg/L, respectively. The lower part of the aquifer (42-72 ft BGL) is not contaminated at the location of the former CCC/USDA grain storage facility.

- Soil contamination area B lies to the south of the pinchout of the fluvial aquifer, and there is no evidence of contaminated groundwater downgradient

of this location. All groundwater and soil samples from the southern limb of the former grain storage area were free of contamination.

- The axis of the carbon tetrachloride plume can be followed due east from the northern part of the former CCC/USDA facility at SB11 (59 μg/L) to SB16 (32 μg/L), then southeast through SB22 (12 μg/L) to PWS 70-1 (< 5 μg/L). Thus, the plume follows the predicted particle tracking flow lines in this area.

- Thin zones of low contaminant values (carbon tetrachloride < 5 μg/L) north of PWS 70-1 probably represent remnants of the low-grade northern edge of the plume that were not diverted by the public well.

- The carbon tetrachloride plume is restricted to the upper part of the aquifer beneath the former CCC/USDA facility, then drifts downward as it migrates toward PWS 70-1. At PWS 70-1 the sub-MCL carbon tetrachloride concentration probably results from dilution of the narrow plume of contaminated groundwater originating at the former facility with a large volume of uncontaminated water drawn from the area of influence of the well and the thick, uncontaminated part of the aquifer. East of the well, the remnants of the plume that escape extraction by PWS 70-1 drift even lower in the aquifer (43-68 ft BGL), and the concentration of carbon tetrachloride in the plume remains below the MCL. Thickening of the plume to the east of PWS 70-1 is probably the result of the mixing effect of the public well.

- Only one migration pathway exists for contaminated groundwater originating at the former Adams CCC/USDA facility, but the natural pathway has been modified by the historical pumping of public wells.

- Contamination of PWS 64-1 in the eastern part of Adams cannot be explained by the low levels of contamination from the former CCC/USDA facility that avoid direct extraction by PWS 70-1 or bypass capture of the main part of the plume. Any well located within the area of low carbon tetrachloride values to the east of PWS 70-1 would produce water with contaminant concentrations well below the MCL, particularly if screened across the entire aquifer (as a public supply well would be). The downgradient increase in carbon

tetrachloride concentration at PWS 64-1 implies a second source of contamination in the eastern part of Adams.

- The Phase II results are consistent with the conclusions from particle tracking simulations in Phase I (Argonne 2001). Results of the preliminary evaluation of the effects of historical pumping on past groundwater flow and contaminant transport at Adams indicated that the former CCC/USDA facility was unlikely to be responsible for the carbon tetrachloride contamination of PWS 64-1. The evaluation also showed that similar hydraulic conditions leading to the present capture of the contaminant plume from the former CCC/USDA facility (by PWS 70-1) would have existed since operation of an earlier well (PWS 49-1) began at this location in 1949. The analysis also demonstrated that PWS 64-1 could have captured contaminated groundwater emanating from a number of other potential sources in eastern Adams.

- The dilute nature of the contamination downgradient from the former CCC/USDA facility and the small volume of contaminated groundwater that would be produced compared to the total volume of the water within the capture zone of a public well both tend to minimize the carbon tetrachloride threat to public drinking water. The low values of carbon tetrachloride found in samples from PWS 70-1 are an example of this circumstance. Consequently, a public drinking water well placed anywhere downgradient from PWS 70-1 should produce water suitable for human consumption, subject to acceptable analysis for nitrates and contamination from other potential sources.

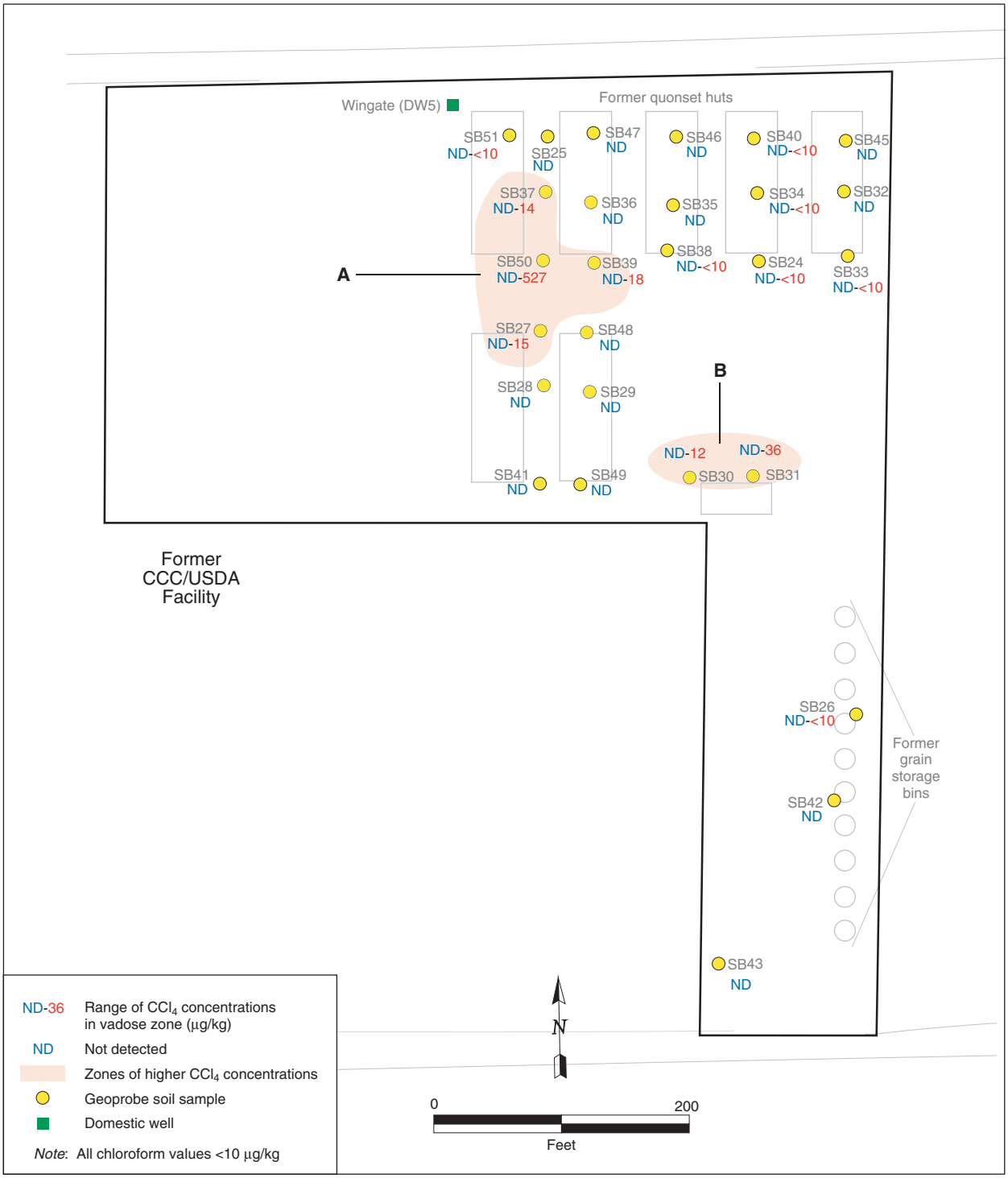


FIGURE 5.1 Locations of grain bins at the former Adams CCC/USDA facility in 1965, Geoprobe subsurface soil sampling locations in Phase II, and the range of results of GC-MS purge-and-trap analyses for carbon tetrachloride and chloroform at each location.

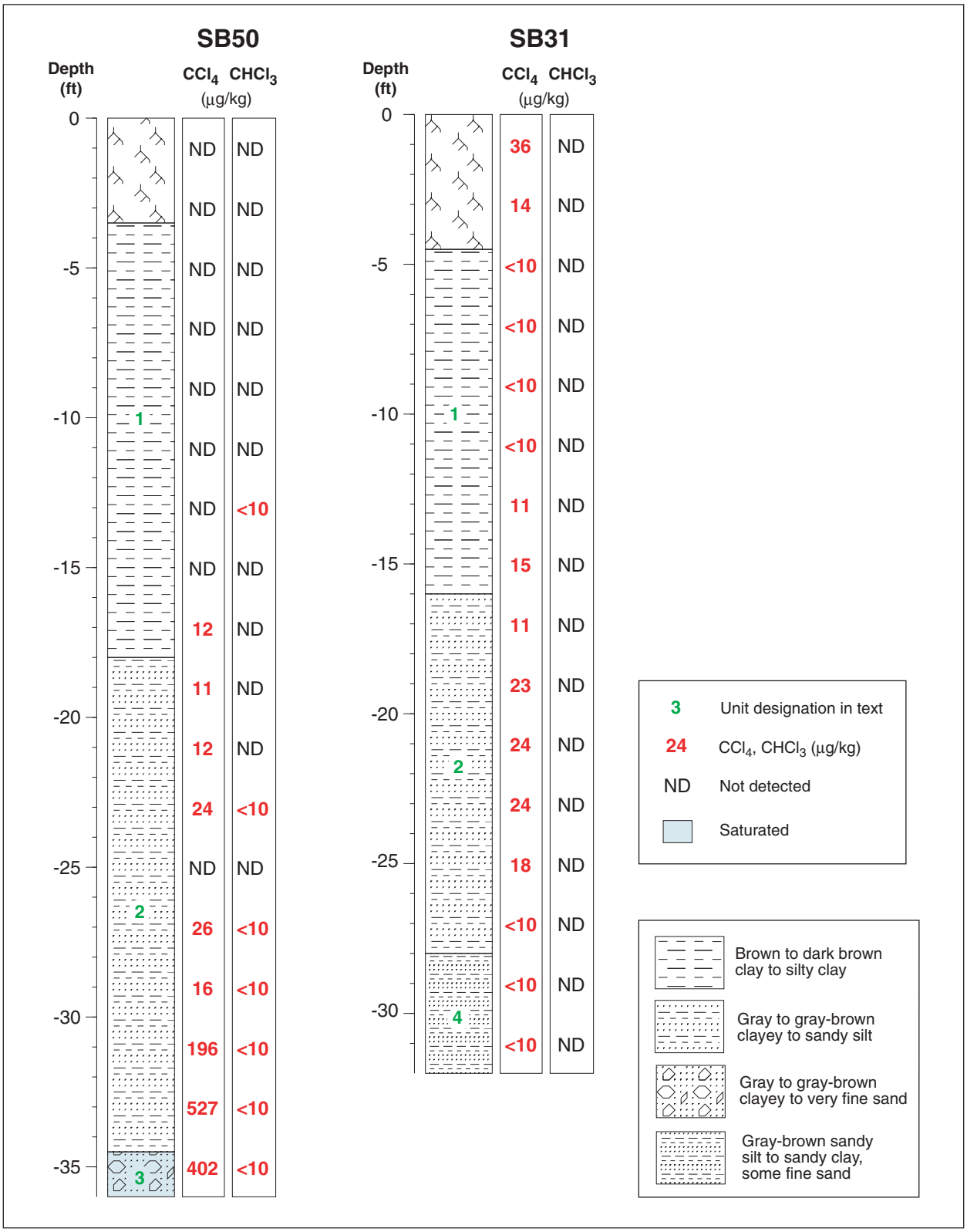


FIGURE 5.2 Lithologic logs for SB50 (Area A) and SB31 (Area B) at the former CCC/USDA facility, showing soil sample locations and the results of purge-and-trap GC-MS analyses of these samples for carbon tetrachloride and chloroform.

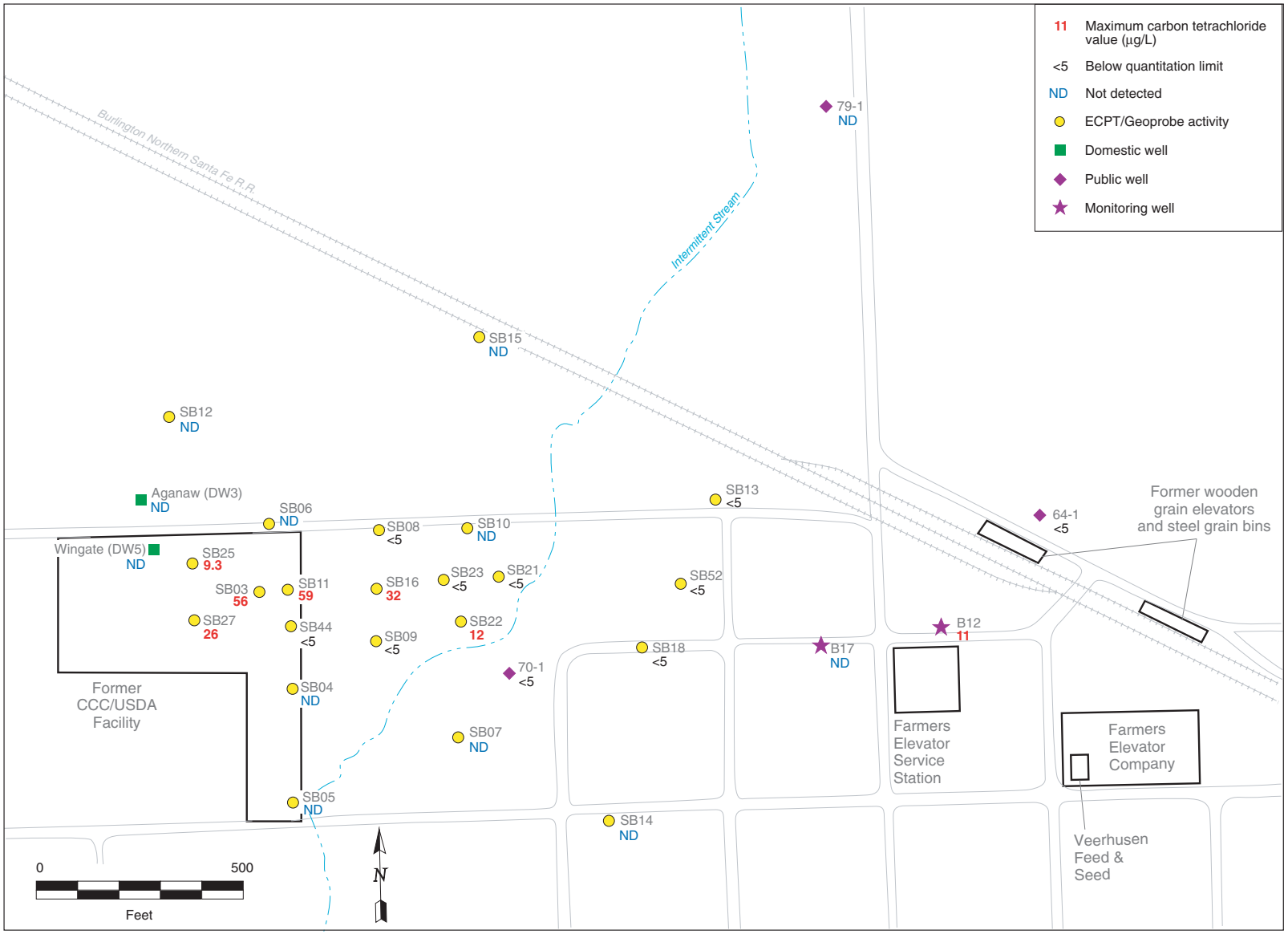


FIGURE 5.3 Locations of the former Adams CCC/USDA facility and Phase I and Phase II groundwater samples in the western part of Adams, with the maximum carbon tetrachloride concentration at each location.

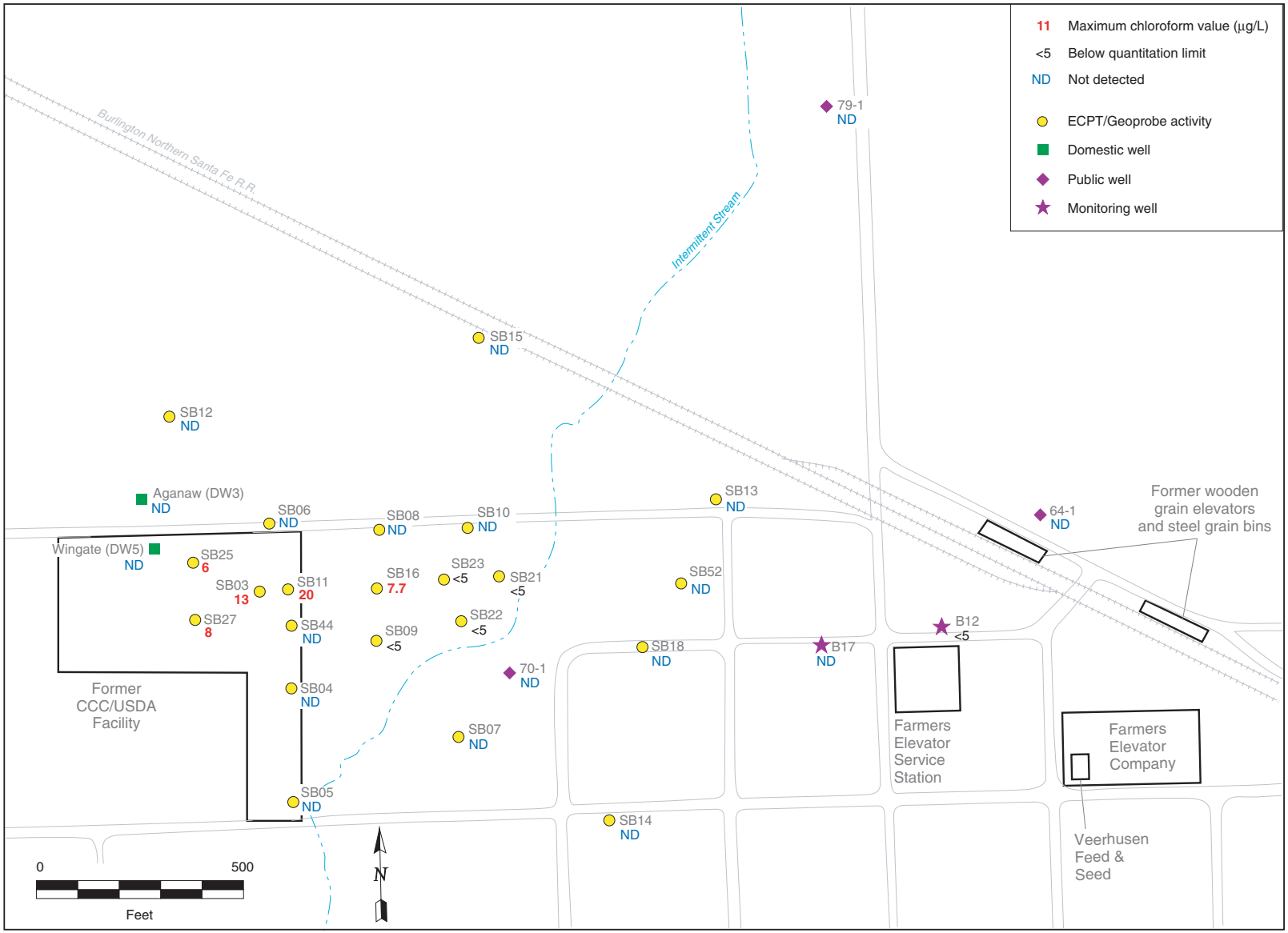


FIGURE 5.4 Locations of the former CCC/USDA facility and Phase I and Phase II groundwater samples in the western part of Adams, with the maximum chloroform concentration at each location.

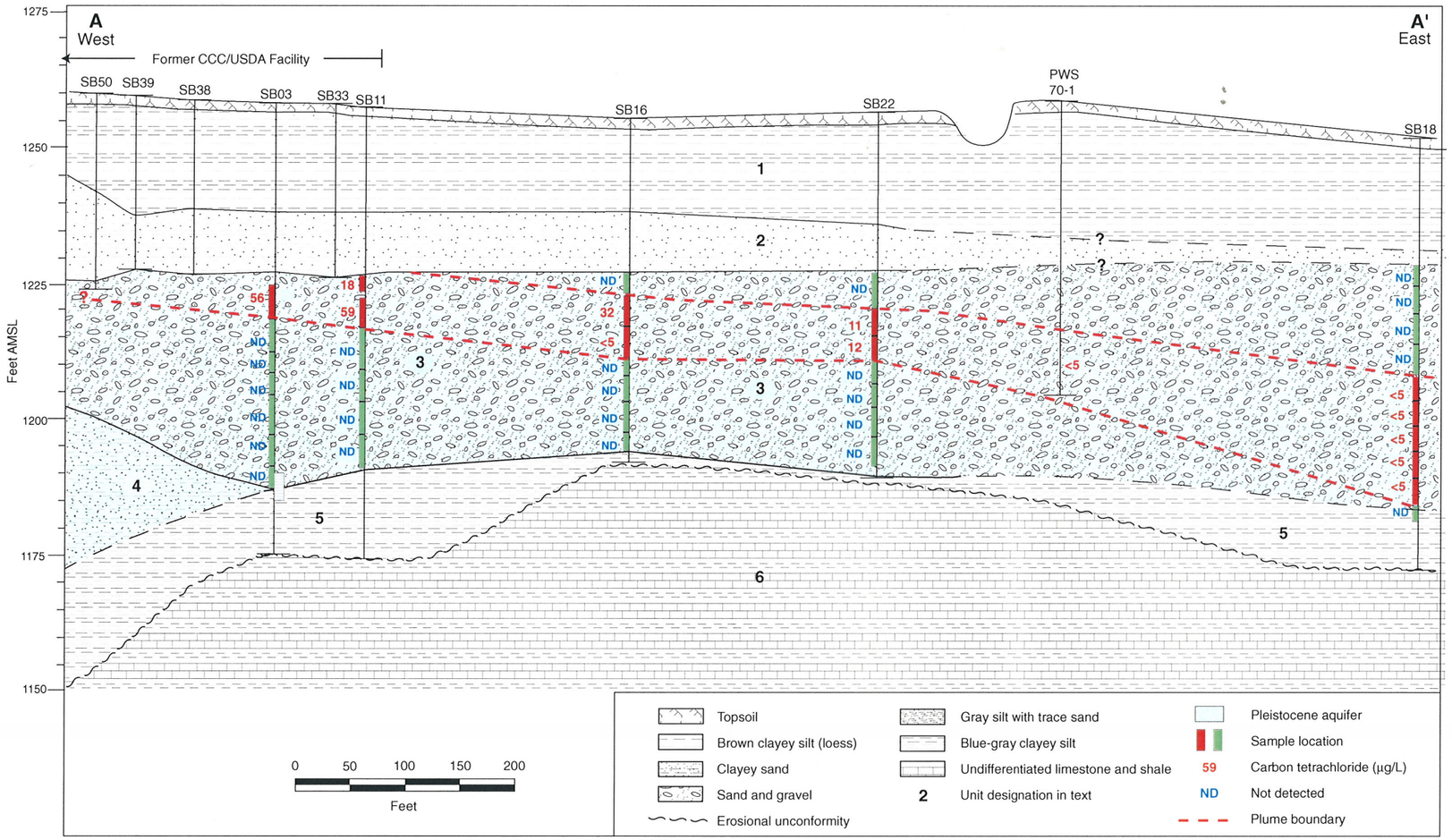


FIGURE 5.5 West-to-east cross section A-A´, showing the Pleistocene aquifer in the western part of Adams and the distribution of carbon tetrachloride in groundwater.

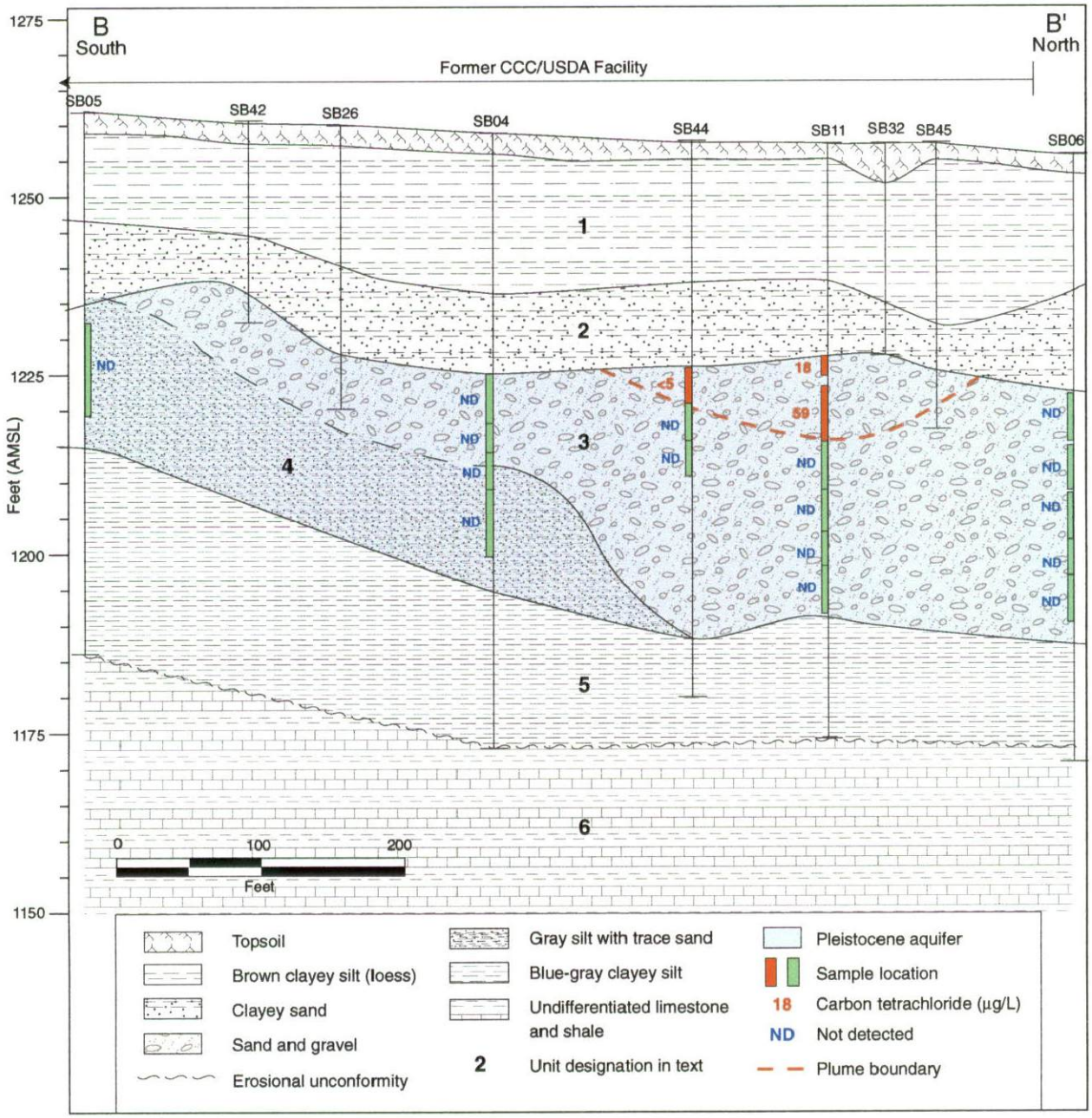


FIGURE 5.6 South-to-north cross section B-B′, showing the Pleistocene aquifer in the western part of Adams and the distribution of carbon tetrachloride in groundwater.

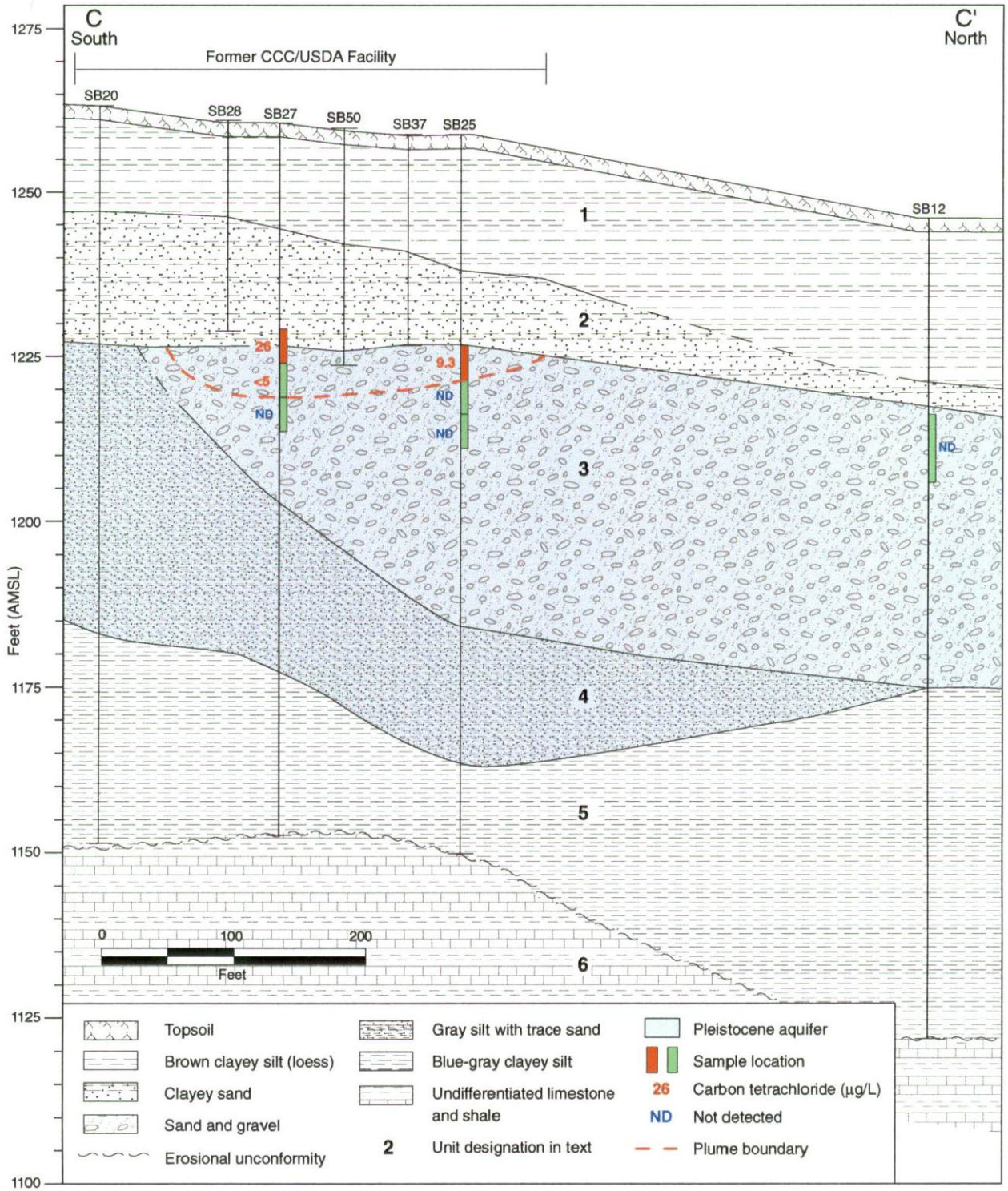


FIGURE 5.7 South-to-north cross section C-C´, showing the Pleistocene aquifer in the western part of Adams and the distribution of carbon tetrachloride in groundwater.

6 Predicted Groundwater Flow and Contaminant Transport

6.1 Introduction

This section evaluates the future migration of the carbon tetrachloride found in soil and groundwater at Adams in the Phase I and Phase II investigations. The evaluation was undertaken to determine the future effect of contaminated groundwater on the public water supply and the aquifer downgradient from the former CCC/USDA facility under two scenarios: (1) continued pumping of PWS 70-1 and (2) shutdown of PWS 70-1.

The carbon tetrachloride contamination at Adams is presently distributed in contaminated soils in two former surface release areas (A and B) within the former CCC/USDA facility and in a groundwater plume emanating from the facility that can be traced eastward through SB11 and SB16, then southeast through SB22 to PWS 70-1 (Section 5). The analyses in this section include (1) an evaluation over time of future contaminant release to groundwater from soil in the vadose zone beneath the former CCC/USDA facility and (2) a characterization of future migration of the groundwater plume with either continued pumping of PWS 70-1 or shutdown of this well.

To estimate future release of contaminants to groundwater in the source area, the vertical migration of carbon tetrachloride in the vadose zone was modeled by using a one-dimensional model of unsaturated flow and transport. Investigation of probable carbon tetrachloride migration in groundwater at Adams was facilitated by using the three-dimensional numerical model of groundwater flow developed in Phase I (Argonne 2001). That model was refined in Phase II to fit the integrated site model of geology, hydrogeology, and hydrogeochemistry of western Adams presented in Section 4 and was enhanced by calibration with observed hydraulic heads under both steady-state and transient conditions. Carbon tetrachloride migration was simulated by using a three-dimensional numerical solute transport model, coupled with the results from flow field simulations.

6.2 Groundwater Flow Model

A preliminary groundwater flow model based on the site conceptual model of geology and hydrogeology was developed in Phase I. This model predicted capture of water particles

originating at the former CCC/USDA facility by PWS 70-1, a prediction confirmed by the results of the Phase II investigation. The principal features of the Phase I numerical model are as follows:

- A rectangular model domain measuring 26,000 ft west-east by 24,000 ft south-north was constructed with 152 columns (west-east) and 137 rows (south-north). Variable grid spacing was used to provide the highest model resolution ($\Delta x_{min} = \Delta y_{min} = 50$ ft) within the area of greatest concern.

- The geographic limits of the flow model were chosen to coincide with the boundaries of a natural watershed to eliminate the effect of artificially imposed boundaries on the model results. The Middle Branch Big Nemaha River forms the northeastern boundary of the model, and watershed divides form the eastern, southern, western, and northwestern boundaries (Figure 6.1).

- The model was divided vertically into three layers incorporating all stratigraphic units. The first (uppermost) layer includes the top two lithologic units, loess and sandy silt and clay (units 1 and 2 in Section 4.2 of this report). The second and third layers represent the upper and lower parts of the fluvial aquifer and the gray silt unit (units 3 and 4 in Section 4.2). A dry, dense, blue-gray Pleistocene silt unit and bedrock (units 5 and 6 in Section 4.2) define the lower no-flow boundary of the model.

- The model boundaries were specifically designed to capture all influences on local groundwater flow at Adams. Constant-head boundaries were set along the Middle Branch Big Nemaha River and the northwest fluvial aquifer boundary for model layers 2 and 3. All of the other external boundaries of the flow domain are no-flow boundaries along the watershed divides.

- Recharge was assumed to occur over the flat areas in the uplands and lowlands at Adams. The final, calibrated, locally uniform recharge rate is 6.5 in./yr.

- Hydraulic conductivities and storativities for the flow model were estimated on the basis of the results of grain size analyses and representative values from the literature.

To predict future migration of the groundwater plume emanating from the former CCC/USDA facility, the Phase I flow model was further refined and improved to provide more detailed, accurate flow fields for the solute transport model. The refinements for the flow model were as follows:

- The Phase I flow model was adjusted from three to five layers. The upper part of the fluvial aquifer (originally model layer 2) was divided into two layers (layers 2 and 3). The revised layer 2 currently contains dissolved carbon tetrachloride in groundwater at the CCC/USDA facility, and the new layer 3 carries dissolved carbon tetrachloride near PWS 70-1. The third layer of the Phase I flow model was further split, forming revised layers 4 and 5, which emulate the middle and lower parts of the aquifer, respectively.

- The boundary between the fluvial aquifer and the glacial silt unit was refined in the area of the former CCC/USDA facility to fit the final model of geology and hydrogeology for western Adams described in Section 4. West-east and south-north cross sections for the refined model at and near the former CCC/USDA facility (Figures 6.2 and 6.3) are comparable to geologic cross sections A-A´ and B-B´ in Figures 4.2 and 4.3.

- Hydraulic conductivities were adjusted for model layers 2-5 to reflect heterogeneity within the fluvial aquifer. The results of grain size analyses indicate that the hydraulic conductivity is higher in the upper (model layers 2-3) and lower (model layer 5) parts of the fluvial aquifer and lower in the middle part (model layer 4). Figures 6.4, 6.5, and 6.6 show the hydraulic conductivity distributions for model layers 2 and 3, 4, and 5, respectively. Initial hydraulic conductivities for the fluvial aquifer in layers 2-5 (k_{2b}, k_{2c}, k_{3b}, k_{3c}, k_{4b}, and k_{5b}) were initially based on results of grain size analyses and subsequently adjusted through the calibration process. Hydraulic conductivities for the loess unit (k_1) overlying the aquifer and for the glacial silt unit (k_{2a}, k_{3a}, k_{4a}, and k_{5a}) were initially derived from the calibrated results for the Phase I flow model. These values were refined during calibration. Table 6.1 lists the final calibrated hydraulic conductivities for each model layer.

TABLE 6.1 Hydraulic conductivity values for the Adams groundwater flow model.

Model Layer	Stratigraphic Unit	Hydraulic Conductivity (ft/d)	
		Horizontal, K_h	Vertical, K_v
1	Loess and sandy silt	0.02	0.02
2	Glacial silt (2a) Upper aquifer (2b and 2c)	Figure 6.4	K_h (2a) 0.1 K_h (2b and 2c)
3	Glacial silt (3a) Upper aquifer (3b and 3c)	Figure 6.4	K_h (3a) 0.1 K_h (3b and 3c)
4	Glacial silt (4a) Middle aquifer (4b)	Figure 6.5	K_h (4a) 0.1 K_h (4b)
5	Glacial silt (5a) Lower aquifer (5b)	Figure 6.6	K_h (5a) 0.1 K_h (5b)

- Storativities for the revised flow model were initially based on the Phase I model and refined through an additional calibration process. The calibration under steady-state conditions is insensitive to storativity. An additional calibration for fitting hydrographs measured in the piezometers under intermittent pumping conditions was conducted to refine flow model storativities. The final calibrated storativity for layers 2-5 is 8×10^{-5} ft^{-1}; the value is unchanged for layer 1 (0.02 ft^{-1}).

- MODFLOW drain cells were added to represent the surface seeps and creeks within the watershed by specifying the locations and elevations of the drains and the hydraulic conductance (ft^2/d) of the interface between the drains and the glacial till units. Figure 6.7 shows the drain configuration for model layer 2. During model calibration, changes in drain conductance were found to have little influence on the simulated flow field in the fluvial aquifer; however, a significant change of water level was induced in the glacial till unit, for example at SB05. The final calibrated drain conductance for the creek was uniformly set to 250 ft^2/d.

- The basic flow model assumed long-term continuous pumping at PWS 70-1 and PWS 79-1. The pumping rate was estimated from the recent average daily water consumption recorded by the village of Adams (Argonne 2001), equivalent to an average pumping rate of 18 gpm at PWS 70-1 and 45 gpm at PWS 79-1. Flow fields were simulated under two scenarios: (1) pumping at both PWS 70-1 and PWS 79-1, as defined in the basic flow model, and (2) pumping only at PWS 79-1, with PWS 70-1 shut down.

6.3 Contaminant Transport Model

Contaminant migration in the western part of Adams is expected to occur vertically in the vadose zone in the source area at the former CCC/USDA facility and horizontally in groundwater. Carbon tetrachloride in the vadose zone exists in multiple phases: vapor, aqueous solution (dissolved in water), and solid (adsorbed to solid surface). Dissolved contaminants in the liquid (aqueous) phase in the vadose zone migrate vertically and provide a source for the groundwater plume. Thus, prediction of groundwater plume migration in western Adams requires the simulation of contaminant transport in both the vadose zone and the fluvial aquifer.

6.3.1 Contaminant Transport in the Vadose Zone

The vertical mobilization and migration of organic contaminants in the vadose zone involves complex processes such as sorption, degradation, hydrolysis, volatilization, and air diffusion. Accurate simulation of all these processes would be difficult because of the many uncertainties associated with the physical, chemical, and biological characteristics of the vadose zone and a limited ability to calibrate the model. A simplified approach was therefore adopted in developing the vadose zone transport model. This approach accounts for the key processes by which contaminants are continuously partitioned among the vapor, dissolved, and adsorbed phases. The leaching of contaminants through the vadose zone simulated by this approach represents the worst-case scenario for contaminant release to groundwater and ignores the potential loss of contaminants from the system due to biodegradation, hydrolysis, and air diffusion.

The transport modeling was carried out by using the EPA’s the one-dimensional finite-difference vadose zone leaching model VLEACH, as implemented in the WHI UnSat Suite (Waterloo Hydrogeologic 2000). Simulation of carbon tetrachloride leaching through the vadose

zone was conducted for the source areas (A and B) identified in Section 5. The purposes of the simulation were to evaluate the potential effect of the existing carbon tetrachloride in soil on groundwater and to generate quantitative data on the release of carbon tetrachloride to groundwater for transport modeling in the aquifer.

The vadose zone was divided vertically into multiple cells to emulate the detailed contaminant distribution along the soil profile, as measured in the Phase II investigation. As discussed in Section 5, soil borings SB50, SB39, SB37, and SB27 define source area A, and borings SB31 and SB30 define source area B. The highest soil contamination levels were found at SB50 in area A and at SB31 in area B (Figure 5.1). Thus, the transport model assumed that the contaminant distributions at SB50 and SB31 represent the soil contamination patterns and levels in the central parts of source areas A and B, respectively. On the basis of the soil contaminant distributions at SB50 and SB31, the vertical profile of the model was constructed with 12 cells for source area A and 10 cells for source area B. Figure 6.8 shows the initial carbon tetrachloride configurations for the transport simulations in areas A and B.

The soil parameters for transport modeling were based on measurements for soil samples collected at SB50 and SB31 (Appendix D, Table D.3). Averaged values for bulk density, effective porosity, water content, and organic content in contaminated soil samples were assigned uniformly to the soil profiles. Chemical parameters for carbon tetrachloride migration, including water solubility, partition coefficient, and Henry's law constant, were derived from the literature (Schwille 1988). Simulation of free-air diffusion was not attempted; an air diffusion coefficient of zero was assigned to the model to generate conservative estimates for contaminant leaching. All soil and chemical parameters used for areas A and B are listed in Table 6.2. A recharge rate through the vadose zone of 6.5 in./yr was used as the final calibrated value in the flow model described in Section 6.2.

The transport and fate of carbon tetrachloride in the vapor, dissolved, and adsorbed phases were simulated for 80 yr with a 1-yr time step. Table 6.3 summarizes the results of simulation of the concentration of carbon tetrachloride in pore water (aqueous phase) at the base of the vadose zone before leaching to groundwater occurs. In source area A, the simulated present-day pore water concentration before leaching is 691 μg/L. The model predicts that at least 60 yr will elapse before contaminants leach completely out of the vadose zone. In source area B, however, the simulated pore water concentration before leaching to groundwater is very low, never exceeding 10 μg/L.

TABLE 6.2 Soil and chemical parameters for the vadose zone transport model.

Parameter	Source Area		
	A (measured value)	B (measured value)	A and B[a]
Bulk density (g/cm^3)	1.65	1.6	
Water content (%)	21	11	
Effective porosity	0.38	0.39	
Organic content (%)	0.08	0.2	
Water solubility (mg/L)			785
Partition coefficient (mL/g)			439
Henry's law constant (atm-m^3/mol)			0.023

[a] Schwille (1988).

Mixing is expected in the top layer of the aquifer when contaminated pore water from the vadose zone leaches to groundwater. Results from the Phase I and Phase II investigations indicate that approximately the top 6 ft of the aquifer is contaminated in or near the source areas at the former CCC/USDA facility. Mixing appears to occur between the vertical flow of contaminated leach water from the overlying vadose zone and the uncontaminated groundwater flow from the upgradient area. The leach water flow (Q_L) can be approximated by the recharge rate (6.5 in./yr) as an upper limit and applied to the source areas (50 ft by 50 ft). The groundwater flow (Q_G) below the source areas can be estimated from Darcy's law as

$$Q_G = A\ K\ dh/dl\ , \tag{6.1}$$

where

Q_G = groundwater flow = L^3/T (volume/time in ft^3/d);

A = cross sectional area of flow = L^2 (area) = 300 ft^2 (width of the source area × thickness of top layer of the aquifer);

TABLE 6.3 Results of simulation for leaching of carbon tetrachloride to groundwater through the vadose zone.

Time (yr)	Concentration in Pore Water at the Base of the Vadose Zone before Leaching to Groundwater (C_L) (μg/L)		Concentration in Groundwater after Mixing (C_{mix}) (μg/L)	
	Source Area A	Source Area B	Source Area A	Source Area B
0	691	< 1	49	< 1
5	492	2	35	< 1
10	335	4	24	< 1
15	222	6	16	< 1
20	146	8	10	< 1
25	95	9	7	< 1
30	62	9	4	< 1
35	41	10	3	< 1
40	27	10	2	< 1
45	18	10	1	< 1
50	12	10	< 1	< 1
55	8	9	< 1	< 1
60	6	9	< 1	< 1
65	4	9	< 1	< 1
70	3	8	< 1	< 1
75	2	8	< 1	< 1
80	1	7	< 1	< 1

K = hydraulic conductivity = L/T (length/time) = 100 ft/d; and

dh/dl = hydraulic gradient = 0.00162.

The concentration of carbon tetrachloride in groundwater after mixing can be estimated as

$$C_{mix} = \frac{C_G Q_G + C_L Q_L}{Q_G + Q_L} , \qquad (6.2)$$

where

C_{mix} = contaminant concentration after mixing = M/L^3 (mass/volume in μg/L);

C_G = contaminant concentration in the upgradient groundwater before mixing = M/L^3 (mass/volume in μg/L) = 0 μg/L; and

C_L = contaminant concentration in leach water before mixing = M/L^3 (mass/volume in μg/L).

Table 6.3 lists the results for carbon tetrachloride concentration in groundwater after mixing, as calculated by Equations 6.1 and 6.2. The results suggest the following:

- The simulated concentrations of carbon tetrachloride in groundwater after mixing at time = 0 yr are consistent with the existing concentrations in groundwater in both source areas A and B.

- Existing carbon tetrachloride in the vadose zone in source area A will contribute contamination to the groundwater for the next 30 yr. The quantitative estimate of the contribution provides input for contaminant source loads in the transport modeling of the aquifer system.

- No contaminant contribution to groundwater is predicted from the existing vadose zone source in source area B.

6.3.2 Contaminant Transport in the Pleistocene Aquifer

The expected migration of dissolved carbon tetrachloride in the Pleistocene aquifer in the western part of Adams was simulated for the two selected groundwater flow and contaminant transport scenarios by coupling the steady-state results from the calibrated groundwater flow model described above to the numerical solute transport code MT3D96 (S.S. Papadopulos and Associates 1996).

Data on specific transport characteristics of the aquifer materials (e.g., dispersivity and adsorption properties) and the contaminated groundwater (e.g., natural decay and adsorption properties) at Adams were unavailable for use in construction of the transport model. Therefore, conservative literature estimates of these parameters were used. Longitudinal dispersivities of 10 ft and 20 ft were tested for the aquifer materials. A ratio of 10:1 for longitudinal to horizontal transverse dispersivity was used for all model layers. The vertical transverse dispersivity was tested at a very low value and at zero. A retardation factor estimated from the partition coefficient, organic content, and bulk density was tested through calibration. As a conservative measure, no natural decay was applied to the model.

Concentration data for carbon tetrachloride in groundwater (Section 5) were used as initial concentrations in the transport model. Figures 6.9 and 6.10, respectively, show the initial plume configurations in model layers 2 and 3 (the upper part of the fluvial aquifer). To account for the potential effect on groundwater of existing contaminants in the vadose zone in source area A, a time-varying MT3D constant-concentration condition was imposed to the top of the aquifer (model layer 2) beneath source area A (Figure 6.9). The constant-concentration condition was defined by assigning a different carbon tetrachloride concentration in groundwater for each 5-yr period from 0 to 30 yr. Values assigned to each 5-yr period were based on the maximum concentration for that time interval as computed by the vadose zone transport model (Table 6.3).

6.4 Model Calibration and Testing

The numerical flow model was calibrated by attempting to match simulated hydraulic heads with measured head data from monitoring wells and piezometers for both steady-state and transient conditions. The flow model was initially developed for steady-state simulation of the three-dimensional hydraulic head regime under representative flow conditions. The model was initially calibrated against a set of ten water level measurements taken on May 11, 2000. The subsequent calibration was carried out by optimizing agreement between simulated and measured well hydrographs recorded during July 2000.

Further testing was conducted by using the results from the calibrated flow model, coupled to both particle tracking and advective-dispersive contaminant transport simulations, to assess the ability of the models to reproduce the existing contaminant distribution in groundwater.

Finally, a sensitivity analysis was performed to address the uncertainty in the calibrated model due to uncertainty in the estimates of parameters (Anderson and Woessner 1992). Sensitivity testing of the Adams flow model consisted of systematic perturbation of the most significant model parameters.

6.4.1 Flow Model Calibration

The refined flow model was calibrated via a trial-and-error, iterative process of adjusting specific model parameters to achieve the best possible match to measured water levels. This process was repeated until no significant improvement in model results could be achieved.

Parameters that had been reassigned because of refinement of the Phase I flow model were selected and adjusted heuristically. For steady-state matching, the following selected parameters were adjusted:

- K_h for glacial silt (layers 2a, 3a, 4a, 5a)
- Stream conductance
- K_h for the upper fluvial aquifer (layers 2b, 2c, 3b, 3c)
- K_h for the middle fluvial aquifer (layer 4b)
- K_h for the lower fluvial aquifer (layer 5b)

The major focus of the calibration was matching simulated hydraulic heads to measured water levels in the fluvial aquifer, where contaminant migration occurs. The best match was identified from minimized averaged root mean squared (RMS) errors, calculated as follows:

$$RMS = \frac{1}{\mathrm{n}}\sqrt{\sum_{i=1}^{n}(h_s - h_o)_i^2} \tag{6.3}$$

Here h_o represents a measured water level, h_s equals the corresponding simulated water level from the flow model, and n equals the number of observation wells. Locations of observation wells in the fluvial aquifer are shown in Figure 6.11. Because the water level is at least 15 ft higher in the glacial sandy silt than in the fluvial aquifer, matching with a measurement made in the glacial till at an additional monitoring point was done separately to maintain the integrity of the matching process for the flow model in the fluvial aquifer. Sensitivity analyses (discussed in Section 6.4.3) indicate that the model results in the fluvial aquifer are insensitive to the hydraulic conductivity for the glacial silt, as well as to stream conductance. However, changes in these two parameters significantly alter the model results in the glacial silt. Therefore, calibration proceeded (1) to match one water level measurement in the glacial silt (at SB05) by adjusting the hydraulic conductivity in the glacial silt unit and the drain conductance and (2) to match water level measurements in the fluvial aquifer by adjusting hydraulic conductivities in the upper, middle, and lower layers of the fluvial aquifer.

Figure 6.12 compares measured water levels in the fluvial aquifer with simulated hydraulic heads from the calibrated Adams groundwater flow model. Agreement is excellent, with all deviations between measured and simulated heads less than 0.65 ft. The simulated steady-state potentiometric surface for the fluvial aquifer at Adams is shown in Figure 6.13.

The minimum RMS error for model results for the fluvial aquifer was 0.27 ft, and the minimum deviation between simulated and measured water levels in the glacial silt unit at SB05 was 0.39 ft. The resultant hydraulic conductivities for the fluvial aquifer in model layers 2-5 are within the range suggested by grain size analyses.

The simulation results generated by the steady-state flow model are insensitive to the hydraulic parameter storativity. However, storativity is one of the significant aquifer parameters that control the response of the aquifer to changes in external stresses, such as pumping under transient conditions. Because measured storativity data are unavailable at this time and literature values vary widely, uncertainties remain in the flow model. To reduce this uncertainty, the flow model was calibrated further under transient conditions against well hydrographs observed in July 2000.

Well hydrographs recorded at 2-min intervals in July 2000 indicate that the water level at locations SB13, SB14, and SB19 fluctuated in response to intermittent pumping at PWS 70-1 and 79-1 (Argonne 2001). Fluctuations in the water levels on July 6 and July 7, which were least affected by irrigation pumping, were selected as the observed database for calibration matching. The intermittent pumping schedule for synchronized pumping at PWS 70-1 and 79-1 was recorded by a transducer installed at PWS 70-1 (Appendix D in Argonne 2001). Pumping rates calculated from this pumping schedule and recorded daily water pumpage (87,100 gpd) on July 6-7, 2000 (Village of Adams Water Department 2000), are consistent with the pumping rates of 90 gpm for PWS 70-1 and 230 gpm for 79-1 reported by the Adams Water Department (Argonne 2001). Well hydrographs were simulated on the basis of the recorded pumping schedule and calculated pumping rates for the 30-hr period from 12:00 hr on July 6 to 18:00 hr on July 7, 2000. Parameters, mainly storativity and hydraulic conductivity in the fluvial aquifer, were adjusted until agreement between simulated and measured well hydrographs was good. Figure 6.14 shows that simulated well hydrographs from the final calibrated flow model compare favorably with measured well hydrographs. Deviations between measured and simulated water level fluctuations are less than 0.2 ft for SB14 and 0.1 ft for SB13. The larger deviation for SB19 appears to be caused by the coarse grid spacing (50 ft) in the flow model compared to the

relatively short distance (145 ft) between SB19 and pumping well PWS 79-1. Therefore, no attempt was made to adjust the parameters further to reduce the deviation at SB19.

6.4.2 Simulation of the Existing Contaminant Plume

No detailed historical records are available to document the specific location(s), timing, mechanism(s), and amounts of entry of carbon tetrachloride into the Adams groundwater flow system, assumed to have occurred during operation of the former CCC/USDA grain storage facility (1950-1975). Lack of this information prevents any rigorous determination of the detailed initial distribution or migration history of the carbon tetrachloride found in the fluvial aquifer at Adams. A simplified approach, therefore, was used to qualitatively simulate the general form of the existing migration pathway of carbon tetrachloride identified in the Phase II investigation.

The advective transport (particle tracking) code MODPATH was used to perform forward particle tracking and test whether the flow path lines are consistent with the existing migration pathway of carbon tetrachloride. A circle of 40 particles was defined in the upper aquifer (model layer 2) around the area of contamination identified at the former CCC/USDA facility, to serve as starting points for tracking migration pathways leading from this source area. The pumping scenario was selected to emulate current conditions. The resulting simulated path lines were similar to the results of particle tracking analyses in the Phase I study and were in good qualitative agreement with both the extent and orientation of the carbon tetrachloride plume in groundwater presented in Section 5.

An additional test using the mass transport code MT3D96 was conducted to examine whether the transport model developed in this study can reproduce the existing plume. The test was implemented by assigning a constant concentration of carbon tetrachloride to model layer 2 in the source area at the former CCC/USDA facility under the current pumping scenario. The constant-concentration condition is an assumption that the existing plume was fed by a constant source from the first carbon tetrachloride release until the present. The parameters for the transport model were adjusted until agreement was good. The final calibrated transport parameters were used to predict future carbon tetrachloride migration in the fluvial aquifer. Table 6.4 lists the values of these parameters.

6.4.3 Sensitivity Analyses

Sensitivity analyses for the Phase I flow model (Argonne 2001) indicated that the simulated water levels are highly sensitive to recharge rate, the hydraulic conductivity of model layer 1, and the constant-head boundary. In Phase I, these parameters were selected through a systematic calibration process to provide the best fit of the flow model to the measured data. Sensitivity analyses for the refined flow model in this study mainly focus on (1) the hydraulic conductivities in the fluvial aquifer and the glacial silt and (2) drain conductance.

Sensitivity testing of the refined steady-state flow model consisted of systematic perturbation of the selected model parameters. A simulation was computed for each perturbation, and the deviation from the measured water levels in the fluvial aquifer on May 11, 2000, was calculated. To provide an unbiased, quantitative, comparative measure of the model sensitivity for each sensitivity analysis simulation, the RMS errors were calculated with Equation 6.3 for each parameter perturbation. Results of sensitivity analyses are in Figure 6.15. Findings are as follows:

- The model results for water levels in the fluvial aquifer are insensitive to hydraulic conductivity in the glacial silt and to drain conductance. This observation indicates that uncertainties in the estimates of these two parameters have no significant effect on simulation of the flow field in the fluvial aquifer where contaminants migrate, although no measurements for these two parameters are available.

TABLE 6.4 Values of parameters for Adams solute transport model.

Parameter	Model Layer 1	Model Layers 2-5
Longitudinal dispersivity (ft)	20	20
Horizontal dispersivity (ft)	2	2
Vertical transverse dispersivity (ft)	0.2	0.2
Bulk density (kg/ft^3)	45	60
Total porosity	0.40	0.20
Effective porosity	0.36	0.15
K_d (L/μg)	4.741E-11	4.39E-10

- Within the variation range of hydraulic conductivity values in the fluvial aquifer indicated by grain size analyses, changes in simulated water levels are insignificant compared to measured water levels (with increased RMS errors of less than 0.1 ft).

- The calibrated flow model has the least RMS error. The final parameters selected through the systematic calibration process provide the best fit of the flow model to the measured data.

6.5 Results

Results and discussions presented in Sections 6.2-6.4 demonstrate that the conceptual and numerical models developed for the vadose zone and the aquifer in the Adams flow and transport system yield an acceptable simulation of existing groundwater flow and contaminant transport. The simulations are in general quantitative agreement with the observed characteristics of the actual vadose zone and aquifer systems at the site. On this basis, the calibrated numerical models are believed to be suitable for simulation of possible long-term contaminant migration for the two municipal well pumping scenarios: (1) continued pumping of both PWS 70-1 and 79-1 and (2) shutdown of PWS 70-1 with continued pumping of PWS 79-1.

6.5.1 Predicted Effect of Continued Pumping of PWS 70-1

Simulation of 60 yr of groundwater flow and contaminant transport under the current pumping scenario predicts that carbon tetrachloride migration in the fluvial aquifer will occur within model layers 2 and 3 (top 12-15 ft of the aquifer) as depicted in Figures 6.16-6.18. Carbon tetrachloride concentrations in model layers 4 and 5 will remain below 5 μg/L. As a conservative measure, the long-term simulations were performed under the assumption of no natural decay of carbon tetrachloride.

The contaminant migration pattern generated under this scenario suggests that dissolved carbon tetrachloride released from the vadose zone will move eastward from the former CCC/USDA facility in the upper part of the aquifer and that the plume will veer to the southeast under the influence of pumping at PWS 70-1. This predicted migration pathway is consistent with the historic development of the plume emanating from the former CCC/USDA facility.

The 5-, 10-, and 20-yr simulations in model layer 2, shown in Figures 6.16-6.18, indicate that the plume will gradually decrease in both size and concentration, even though no natural decay is imposed on the model. The amount of contaminant released from the vadose zone was simulated for a worst-case scenario on the basis of results of the detailed Phase II soil investigation. However, the existing carbon tetrachloride in the vadose zone and aquifer systems is insufficient to support development of a large plume. The predicted time-versus-concentration profile (Figure 6.19) for PWS 70-1 indicates that the carbon tetrachloride concentration will remain below the MCL (5 μg/L), never exceeding 2 μg/L. This model result is consistent with measured concentrations for PWS 70-1 over the last 10 yr, which vary from below the quantitation limit to less than 2 μg/L.

The predicted contaminant distribution under this scenario indicates that carbon tetrachloride will be captured and diluted by continued pumping of PWS 70-1. The contaminant level at PWS 70-1 is extremely low and will decrease with time. Low-level contamination (< 2 μg/L) in the plume at PWS 70-1 poses no risk to the health of residents using water from the well.

6.5.2 Predicted Effect of Shutdown of PWS 70-1

A simulation under the second scenario was performed to assess the impact of the potential shutdown of PWS 70-1. As before, the simulation assumed no natural decay of carbon tetrachloride. The predicted contaminant migration resulting from this scenario is shown in Figures 6.20-6.23.

Without pumping of PWS 70-1, the contaminant plume in the fluvial aquifer will migrate due east to the central part of Adams. Figure 6.20 indicates that the plume will be diluted rapidly as it migrates downgradient. Concentrations above 5 μg/L will be restricted to western Adams and are not predicted to extend to central Adams. Five-, 10-, and 20-yr simulations in model layer 2, shown in Figures 6.20-6.22, indicate that the plume will gradually decrease in both size and concentration. In 20 yr, carbon tetrachloride concentrations above 5 μg/L will be contained entirely within the boundary of the former CCC/USDA facility (Figure 6.22).

The vertical distribution of carbon tetrachloride shown in Figure 6.23 demonstrates that concentrations above 5 μg/L will be confined to the upper part of the aquifer at and near the former CCC/USDA facility. The diluted plume (with concentrations below 5 μg/L) will move

downward, spreading to model layers 3-5 (the middle and lower parts of the aquifer) with the eastward migration. This pattern is consistent with the existing low-level plume to the east of PWS 70-1 that escaped extraction by the well, as shown in Section 5. These results indicate that the contamination found at PWS 64-1 implies the existence of carbon tetrachloride source area(s) in the eastern part of Adams.

6.6 Summary

The numerical models for the Adams groundwater flow and transport systems were refined, developed, and calibrated by using data from the actual systems, as indicated in this section. The calibrated models were used to simulate the future migration of carbon tetrachloride under two scenarios: (1) continued pumping of both PWS 70-1 and 79-1 and (2) shutdown of PWS 70-1 with continued pumping of PWS 79-1. Impacts of existing carbon tetrachloride in the vadose zone and aquifer systems on PWS 70-1 and the aquifer in the central and eastern parts of Adams were evaluated. The major findings are as follows:

- The results and discussion presented here demonstrate that the Adams numerical models are consistent with site-specific geologic and hydrogeologic data, as well as with data from similar groundwater and transport systems. These models yield simulated patterns of groundwater flow and contaminant transport that are in general quantitative agreement with the observed characteristics of the actual groundwater system at Adams. Therefore, the calibrated groundwater flow and transport models are believed to be suitable for use in the investigation of possible long-term contaminant migration under the two selected scenarios.

- Carbon tetrachloride remaining in the vadose zone in source area A will contribute contaminant to the groundwater for the next 30 yr. Quantitative estimates of the actual contribution provide meaningful input for contaminant source loads in transport modeling of the aquifer system.

- No contribution to groundwater is expected from the existing contamination in the vadose zone in source area B.

- Under the scenario of continued pumping at both PWS 70-1 and 79-1, the models predict that carbon tetrachloride will be diluted quickly and captured

entirely by continued pumping of PWS 70-1. In 20 yr, the plume will be reduced in size and confined within the boundary of the former CCC/USDA facility.

- The level of carbon tetrachloride extracted by pumping of PWS 70-1 is extremely low (< 2 μg/L) over the simulation time of 60 yr and will decrease continuously with time. Results of the simulation suggest that continued pumping at PWS 70-1 will pose no health risk to the public.

- Under the scenario of shutdown of PWS 70-1 with continued pumping of PWS 79-1, migration of carbon tetrachloride is predicted to be due eastward. However, concentrations above 5 μg/L will remain in the upper part of the aquifer in western Adams. The plume that will potentially reach central Adams will have a carbon tetrachloride concentration of < 5 μg/L. The impact of contamination from the former CCC/USDA facility on the aquifer in eastern Adams will be minimal.

- The amounts of carbon tetrachloride currently existing in the vadose zone and the aquifer systems are limited and have no potential to support a large plume with a concentration above the MCL (5 μg/L). Predicted contaminant distributions under both pumping scenarios indicate that the plume will decrease in both size and concentration with time and will eventually dissipate because of dilution after 20 yr.

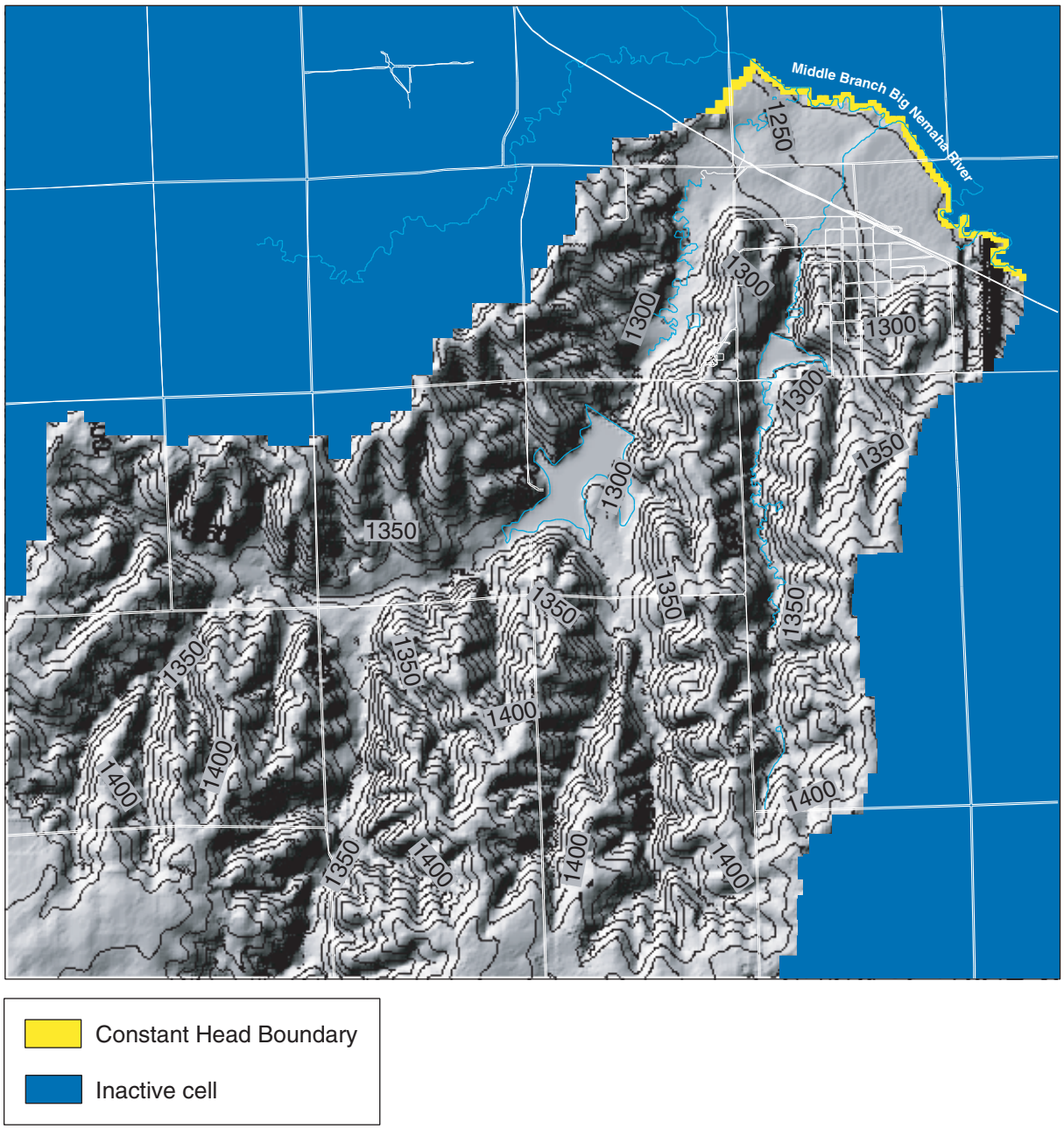


FIGURE 6.1 Topography of Adams groundwater flow model domain, in which flow model boundaries coincide with boundaries of the natural watershed.

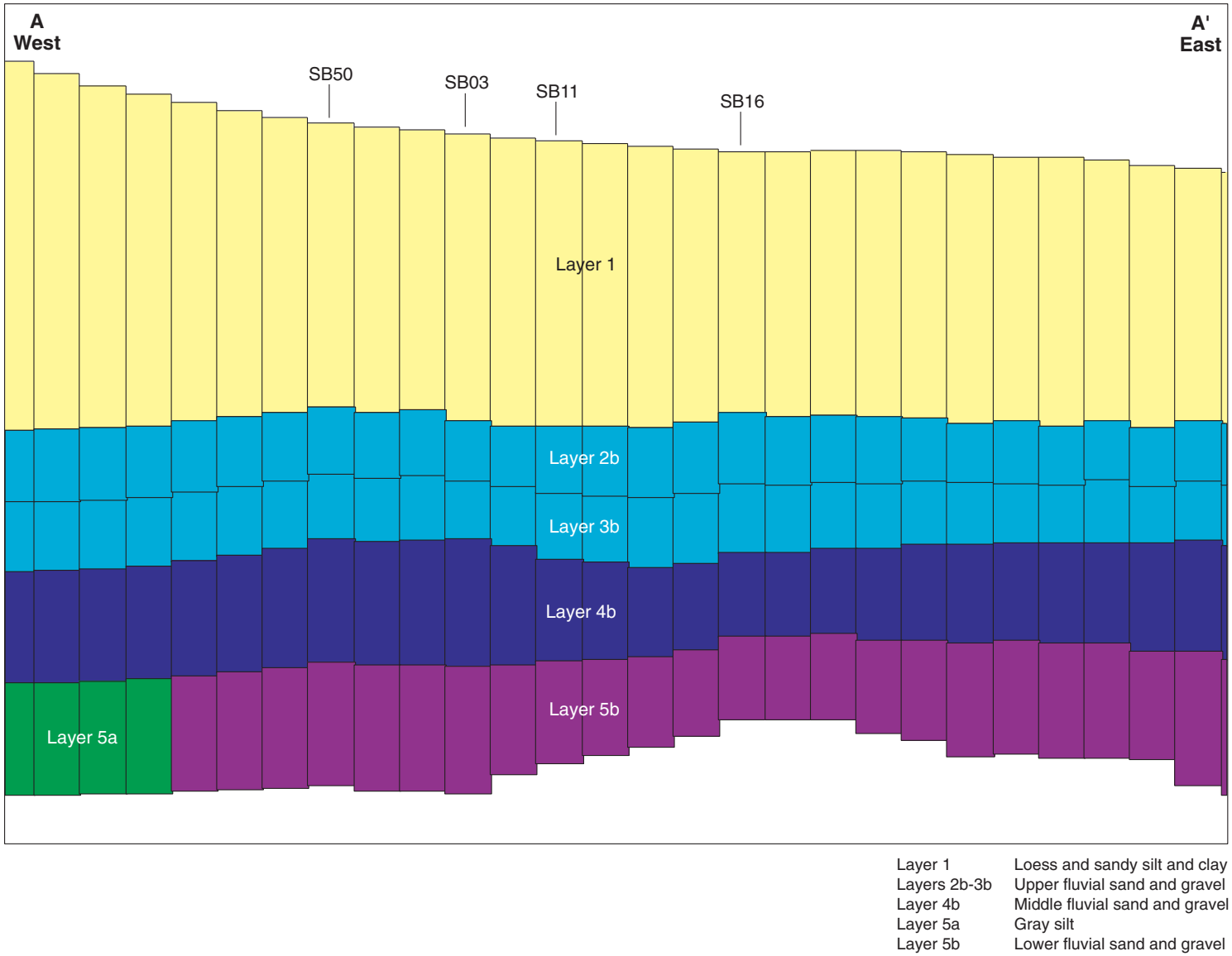
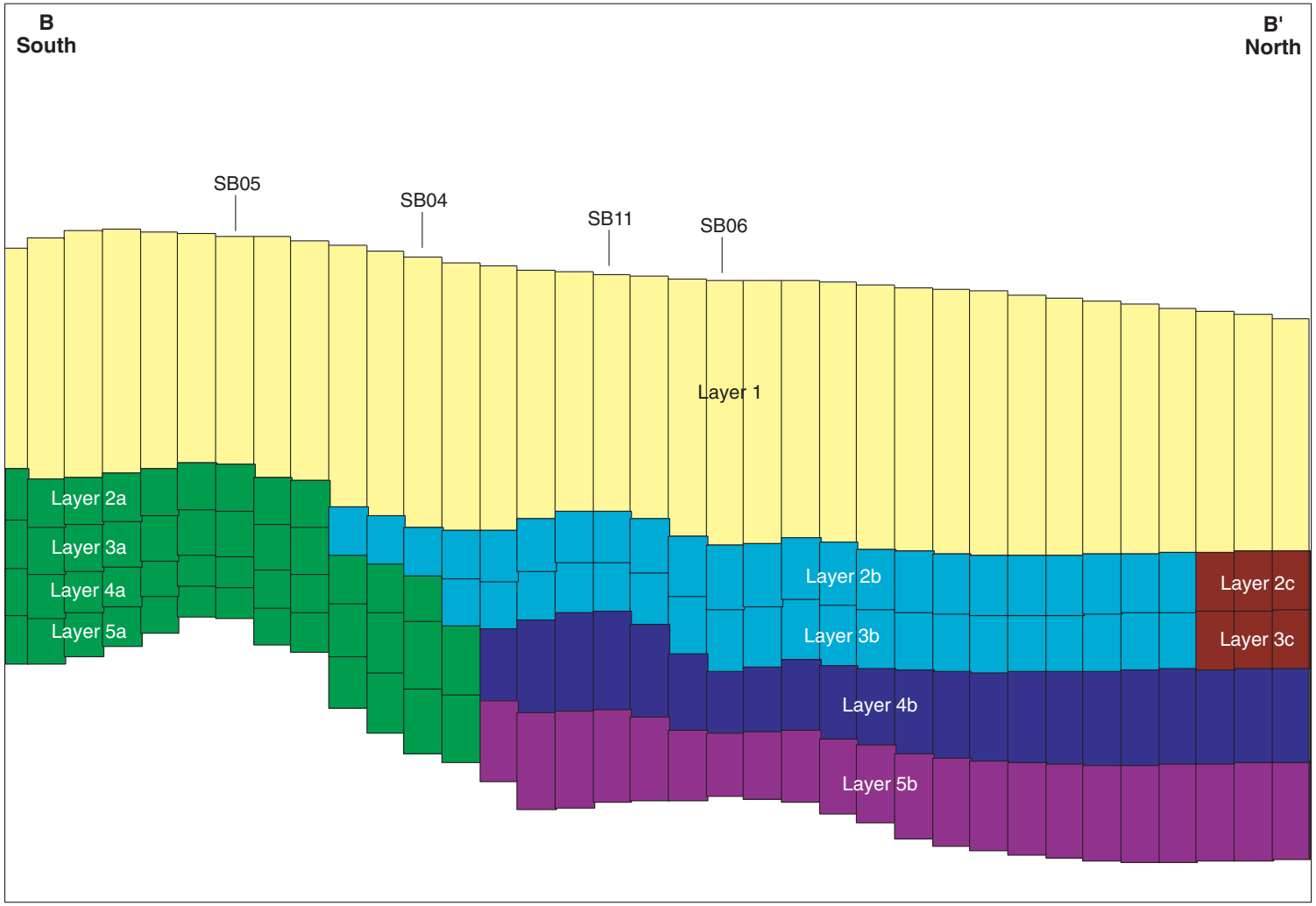


FIGURE 6.2 West-east cross section across the Adams groundwater flow model, partially equivalent to geologic cross section A-A´ (Figure 4.2).



Layer 1	Loess and sandy silt and clay
Layers 2b-2c 3b-3c	Upper fluvial sand and gravel
Layer 2a-5a	Gray silt
Layer 4b	Middle fluvial sand and gravel
Layer 5b	Lower fluvial sand and gravel

FIGURE 6.3 South-north cross section across the Adams groundwater flow model, equivalent to geologic cross section B-B´ (Figure 4.3).

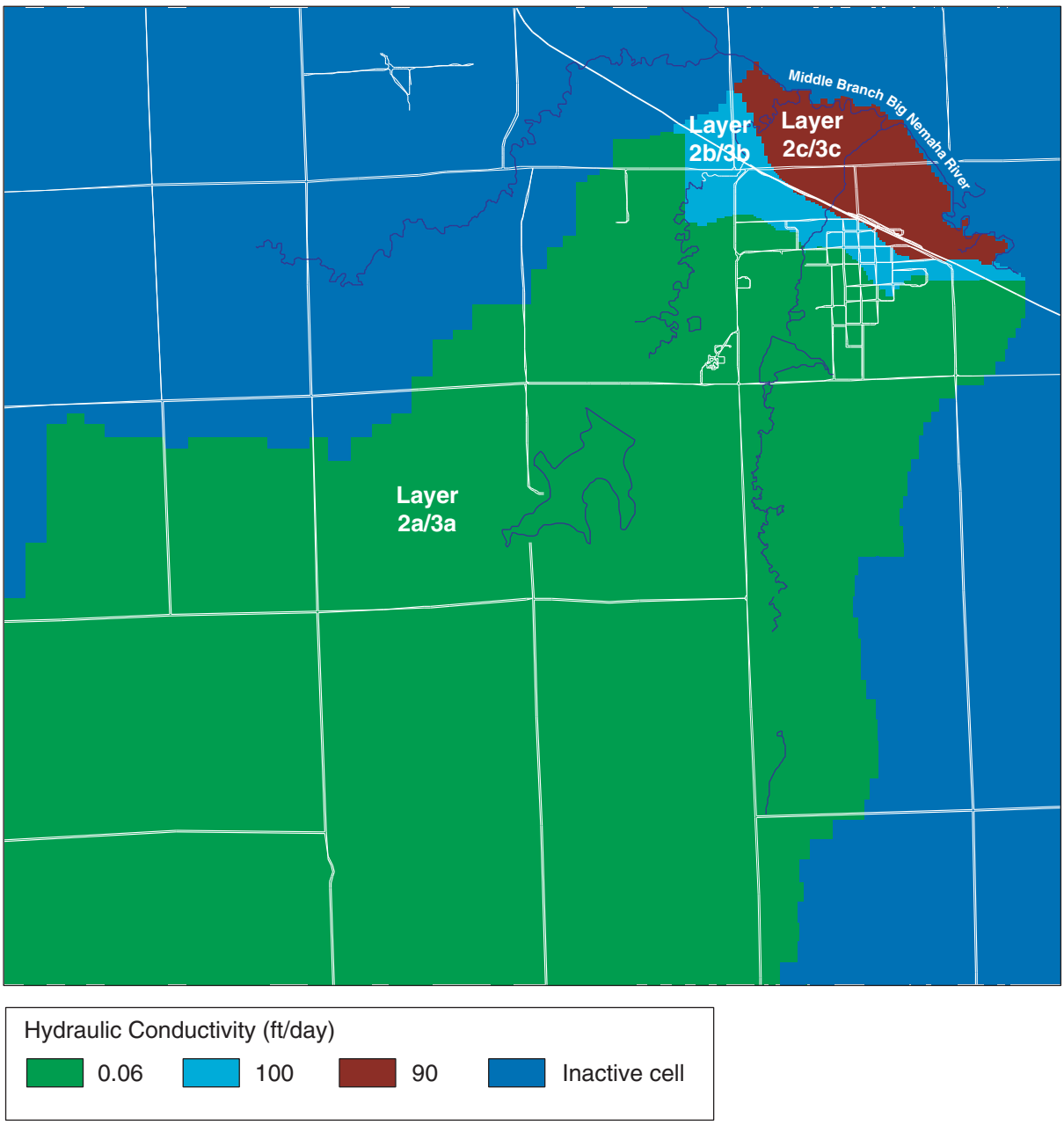


FIGURE 6.4 Hydraulic conductivity distribution for Adams groundwater flow model layers 2 and 3.

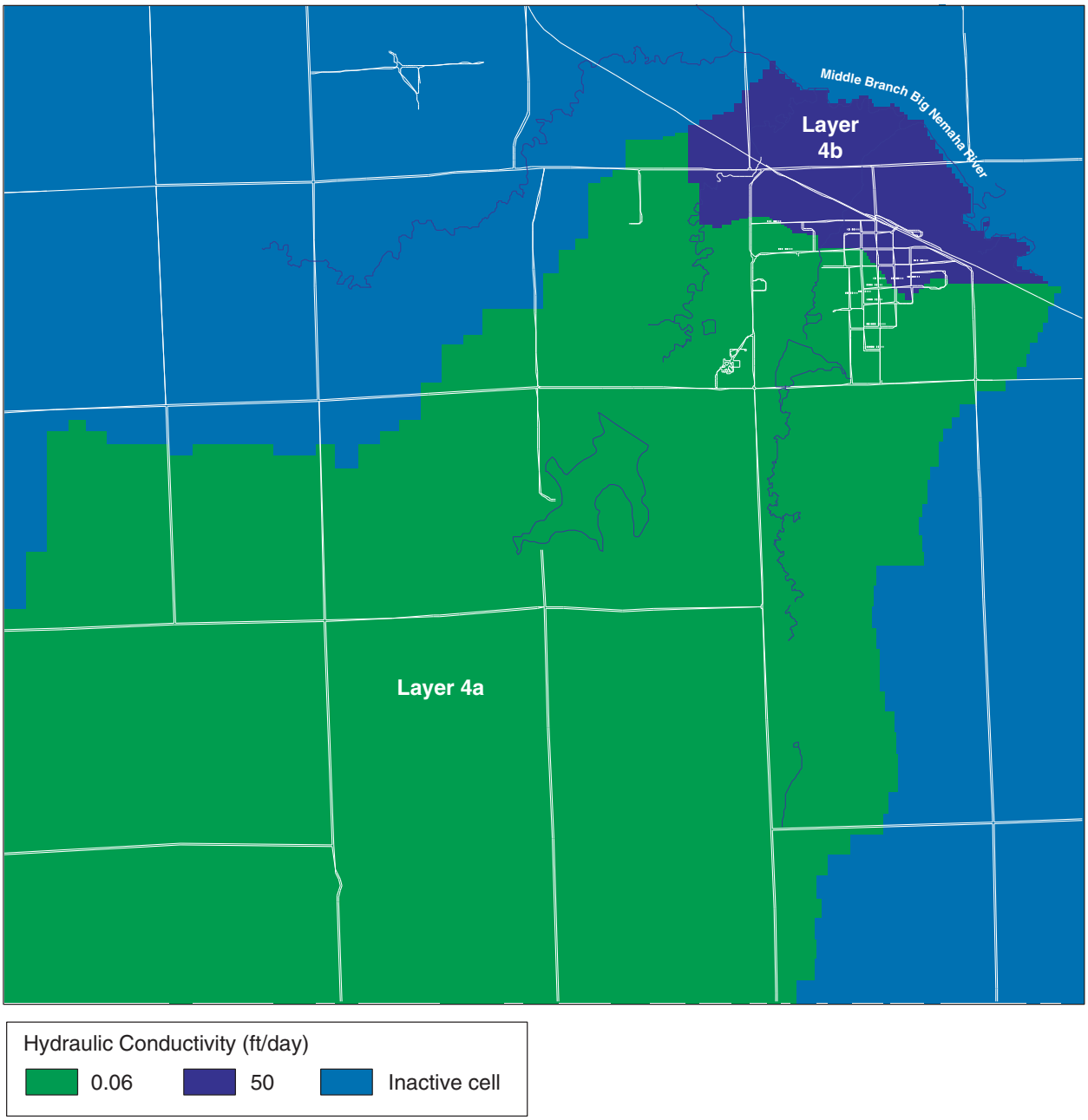


FIGURE 6.5 Hydraulic conductivity distribution for Adams groundwater flow model layer 4.

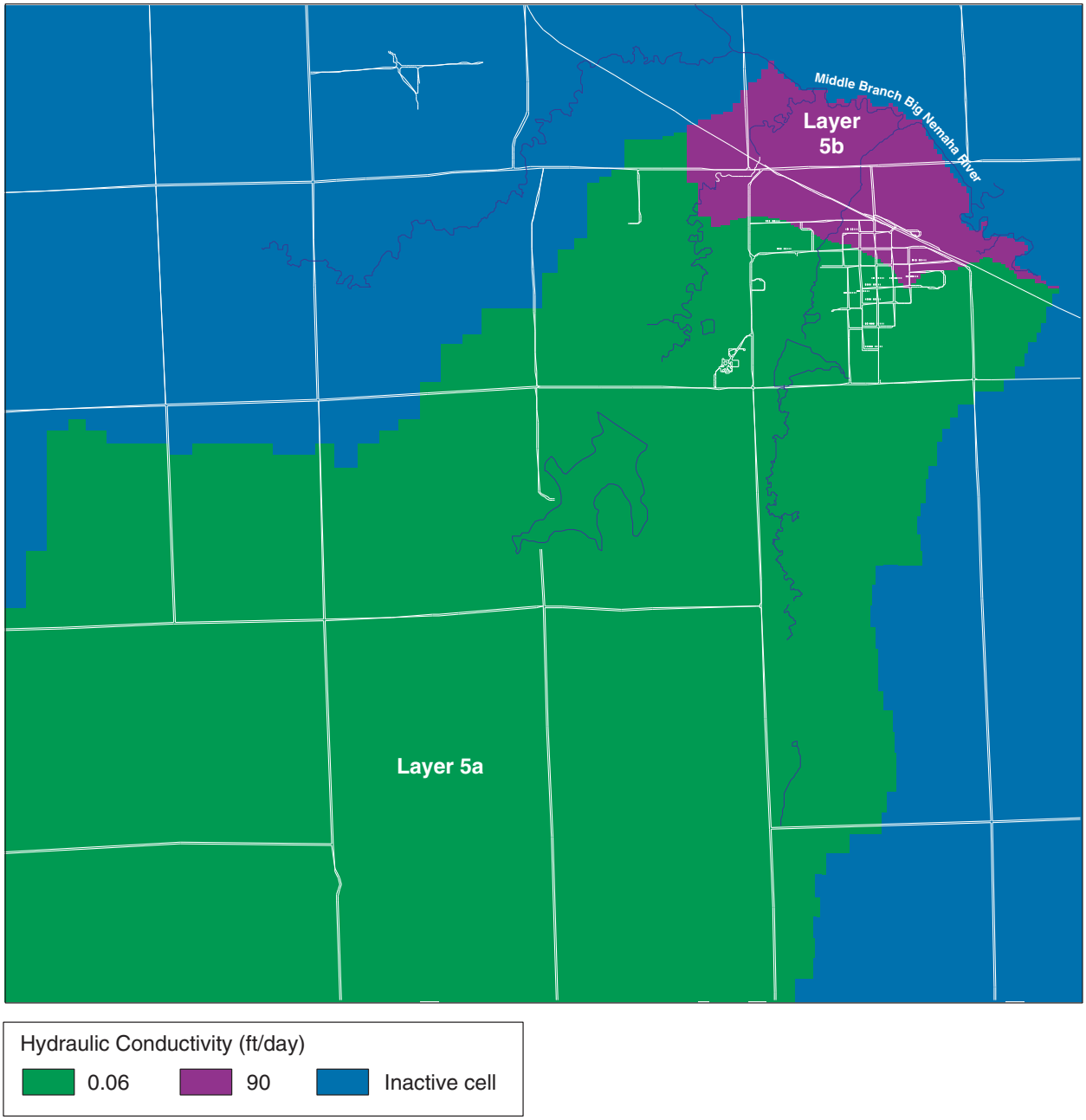


FIGURE 6.6 Hydraulic conductivity distribution for Adams groundwater flow model layer 5.

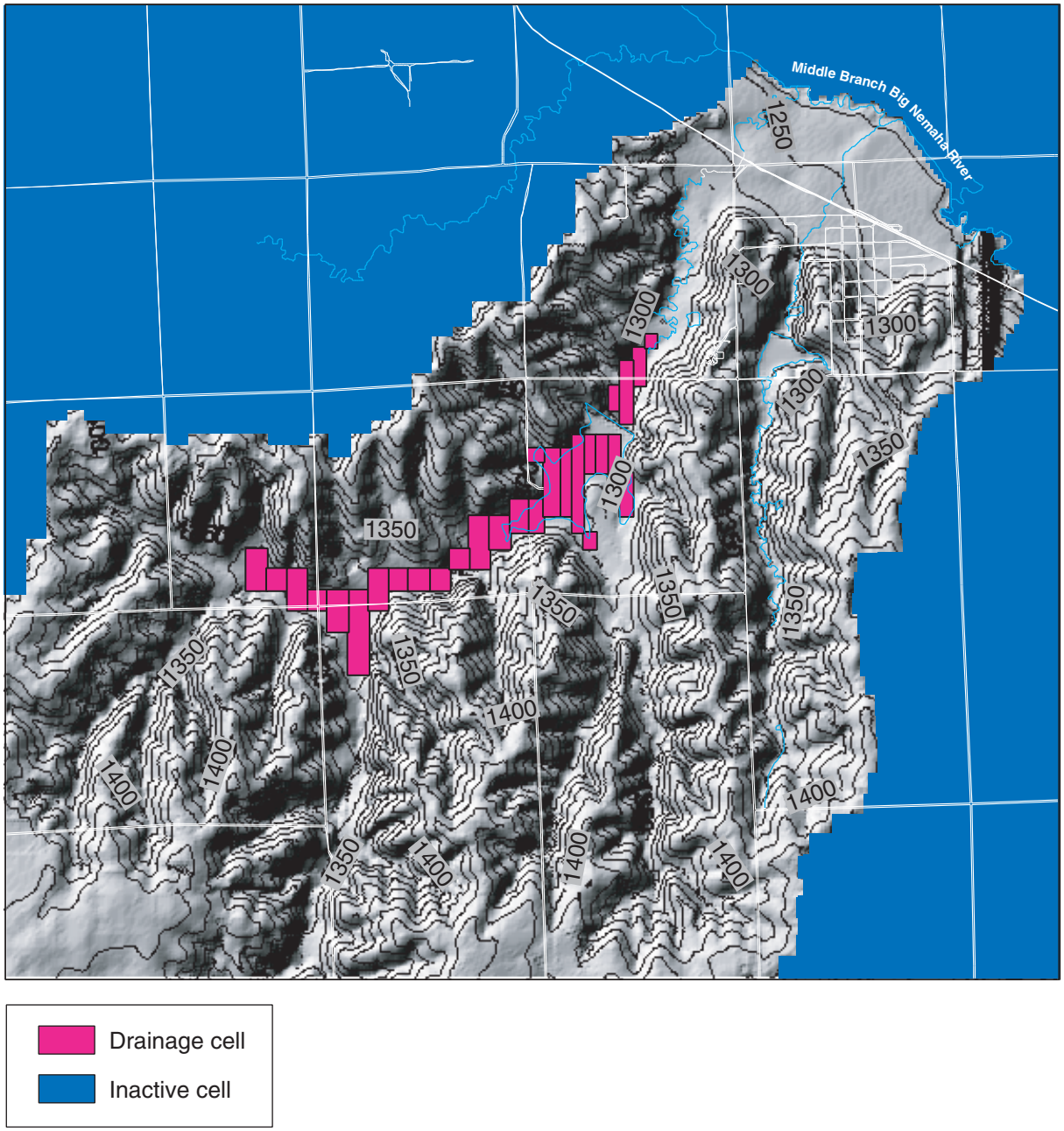


FIGURE 6.7 Drain configuration for Adams groundwater flow model layer 2.

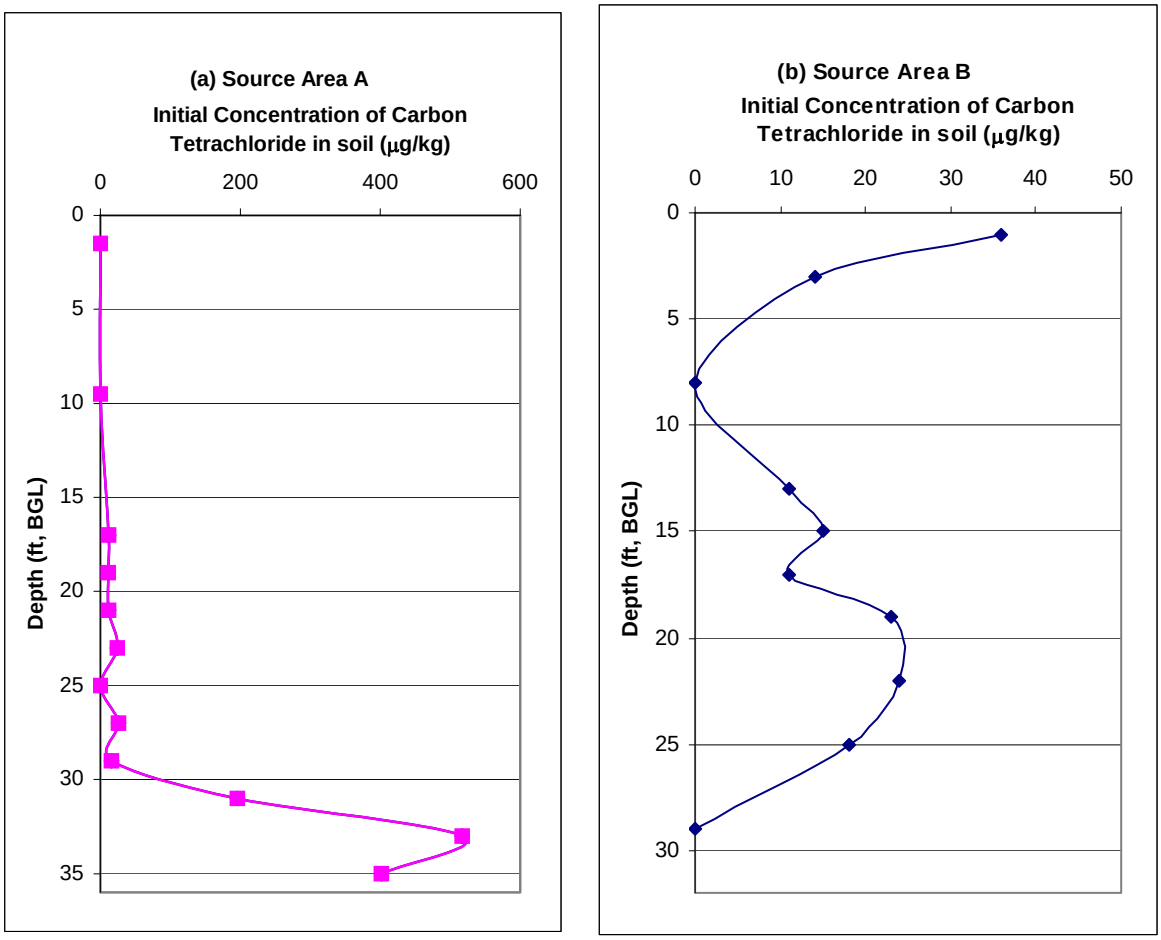


FIGURE 6.8 Initial carbon tetrachloride concentrations for source areas A (left) and B (right) in the one-dimensional flow and transport model for prediction of carbon tetrachloride release from the vadose zone to groundwater.

FIGURE 6.9 Initial carbon tetrachloride distribution and locations of time-varying MT3D constant-concentration cells, representing areas of continued carbon tetrachloride release from the vadose zone, in the Adams contaminant transport model, layer 2.

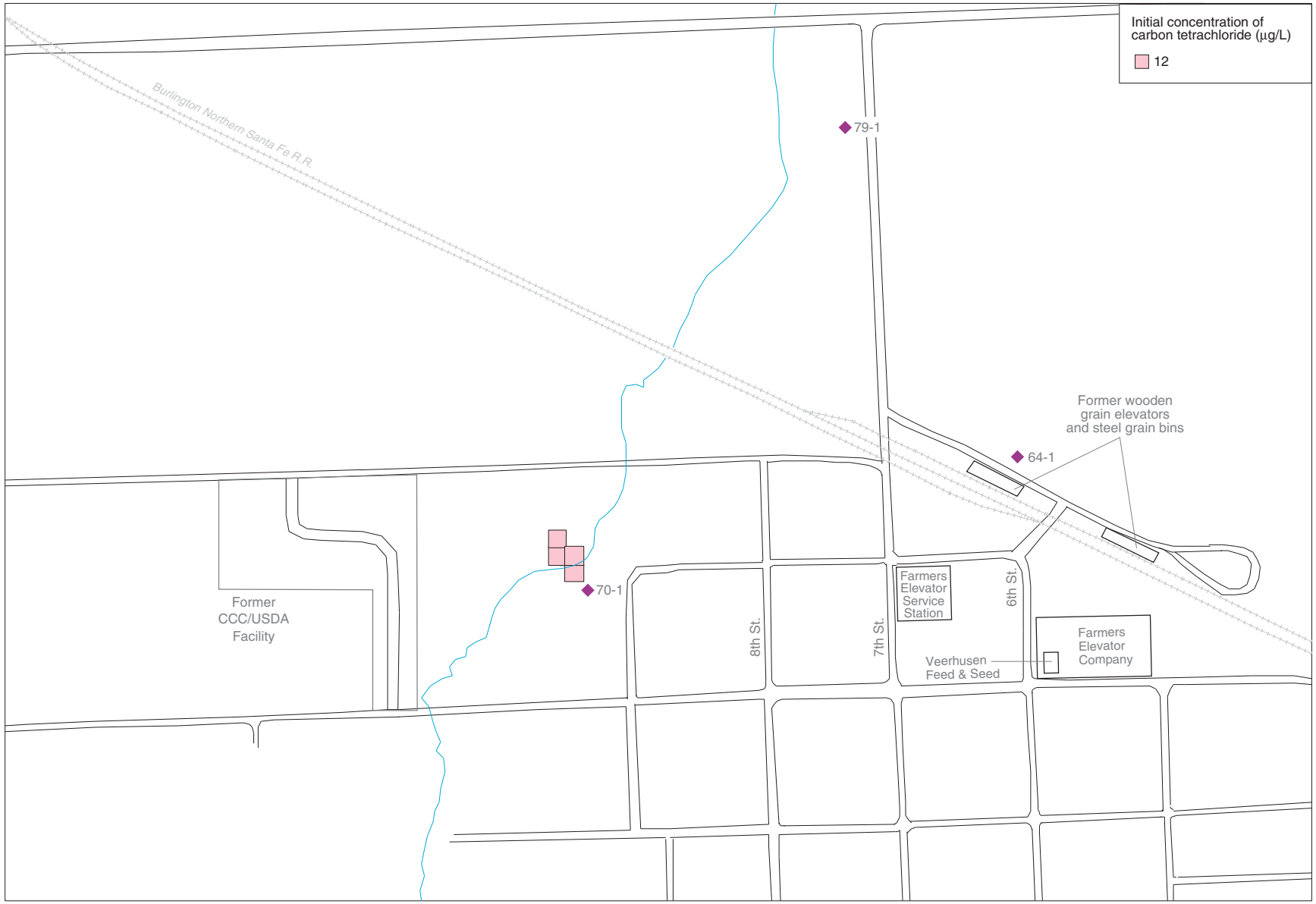


FIGURE 6.10 Initial carbon tetrachloride distribution in the Adams contaminant transport model, layer 3.

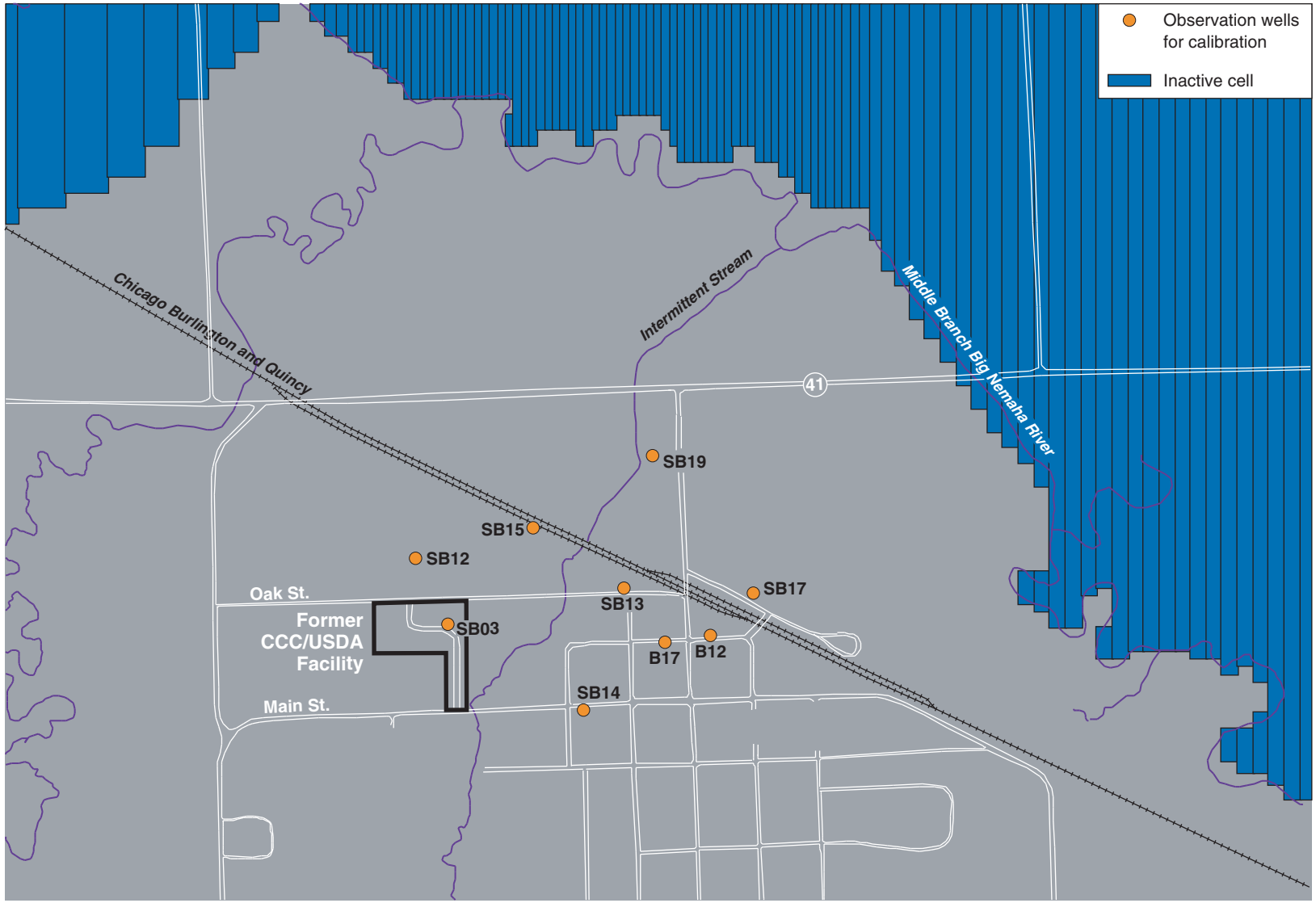


FIGURE 6.11 Locations of the May 11, 2000, water level measurements used for calibration of the Adams groundwater flow model.

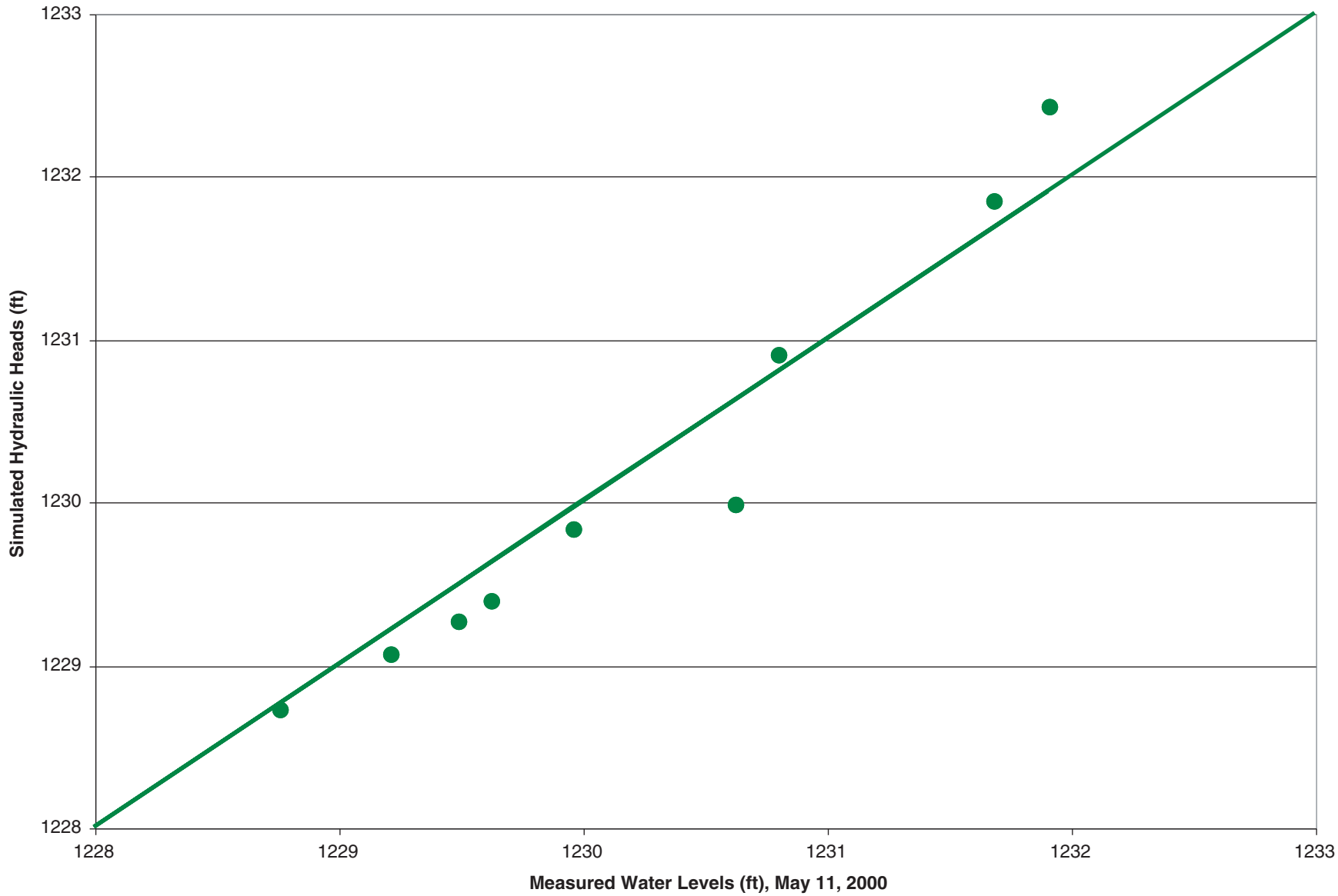


FIGURE 6.12 Measured water levels and simulated hydraulic heads for final calibration of the Adams groundwater flow model.

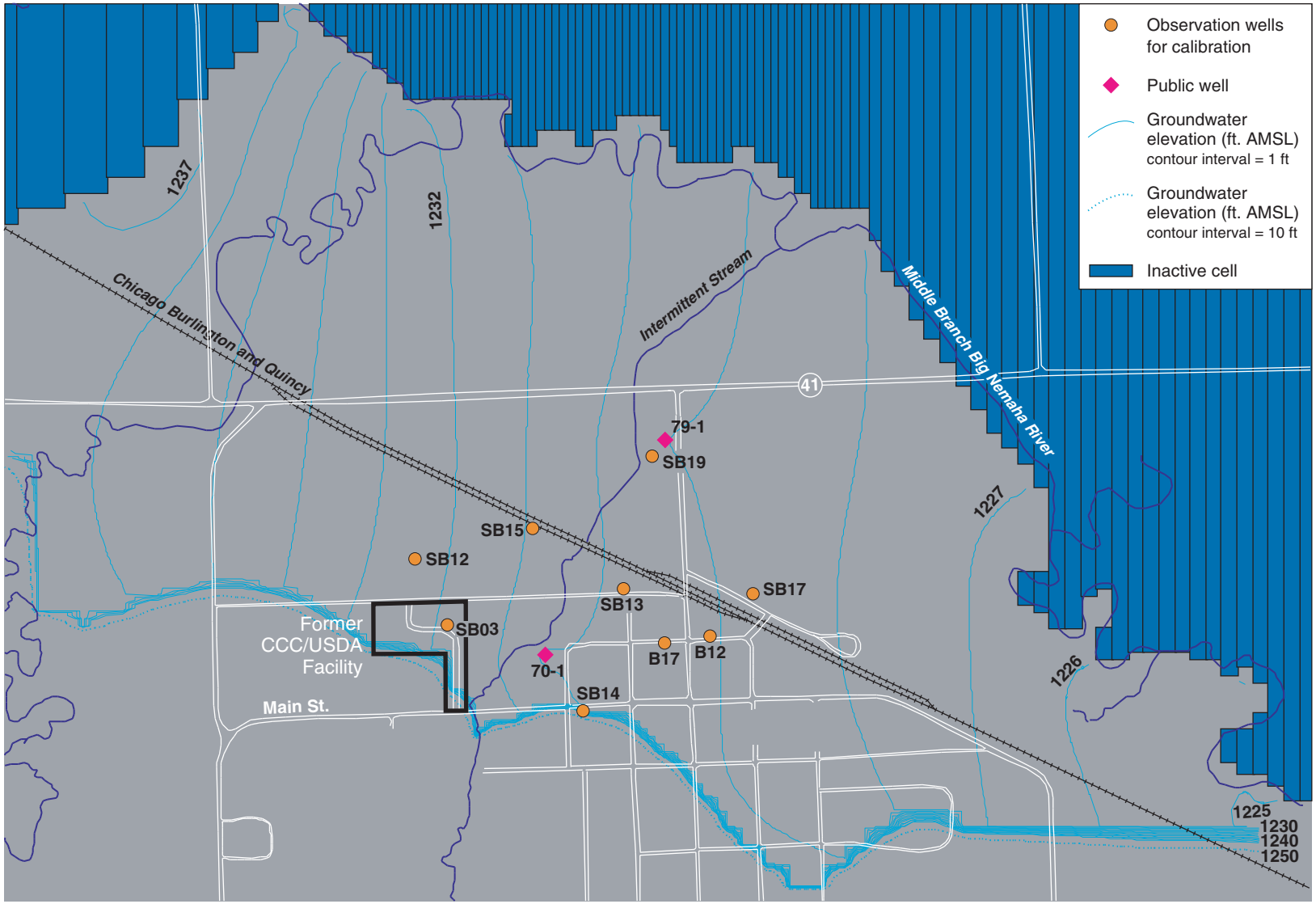


FIGURE 6.13 Simulated potentiometric surface for the fluvial aquifer at Adams.

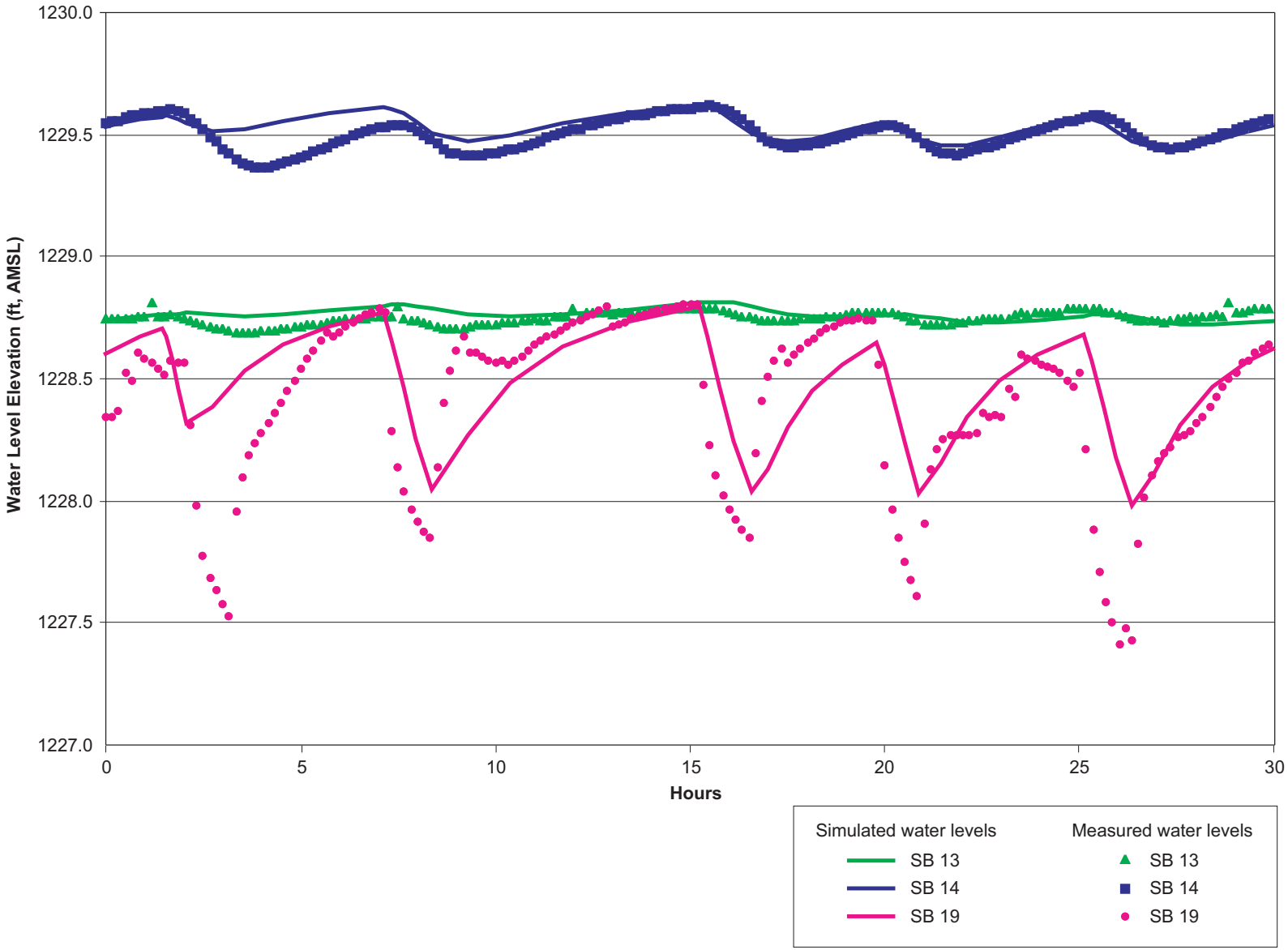


FIGURE 6.14 Measured and simulated water level fluctuations at wells SB13, SB14, and SB19 under intermittent pumping of PWS 70-1 and 79-1 from 12:00 hr on July 6 to 18:00 hr on July 7, 2000.

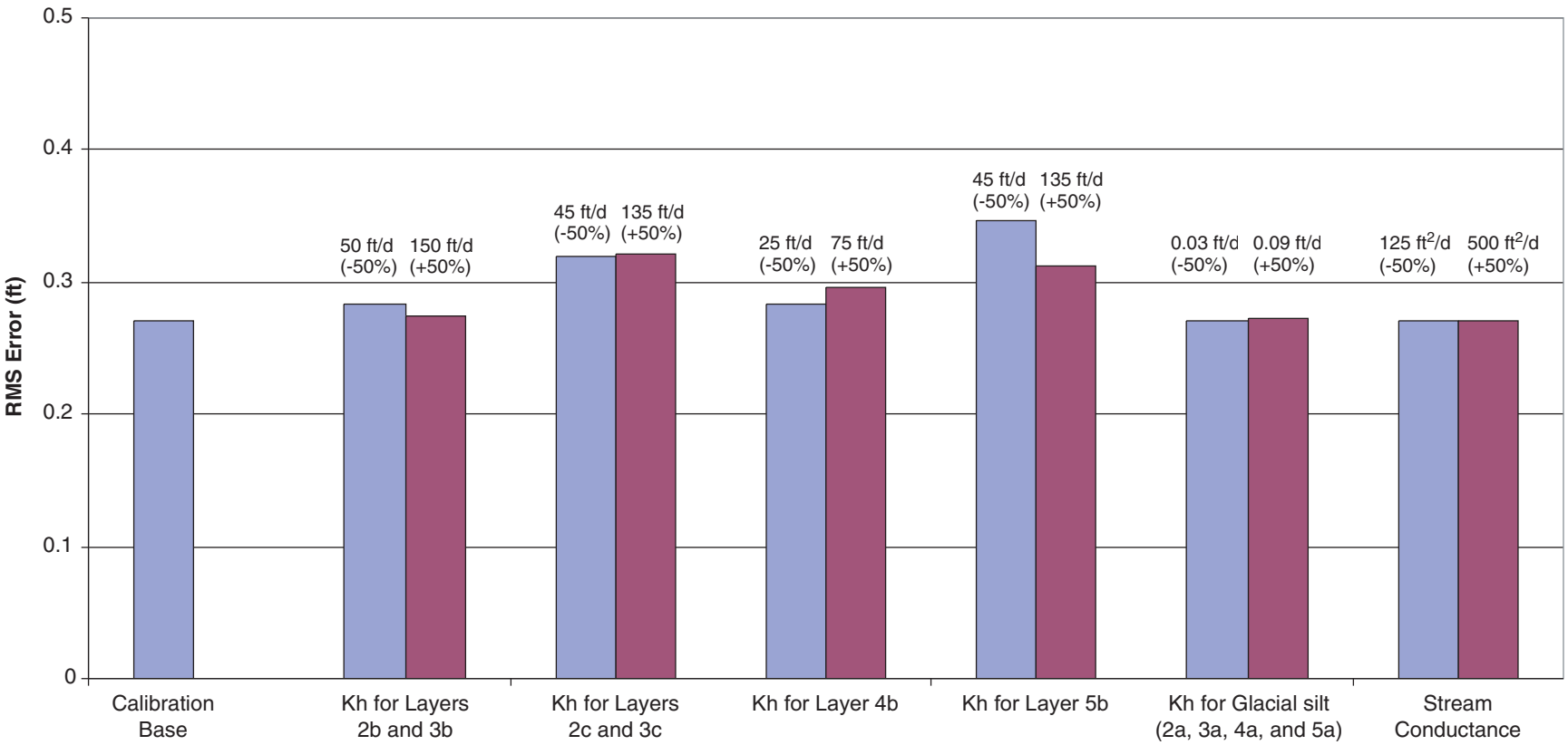


FIGURE 6.15 Summary of parameter sensitivity analyses for the Adams steady-state groundwater flow model.

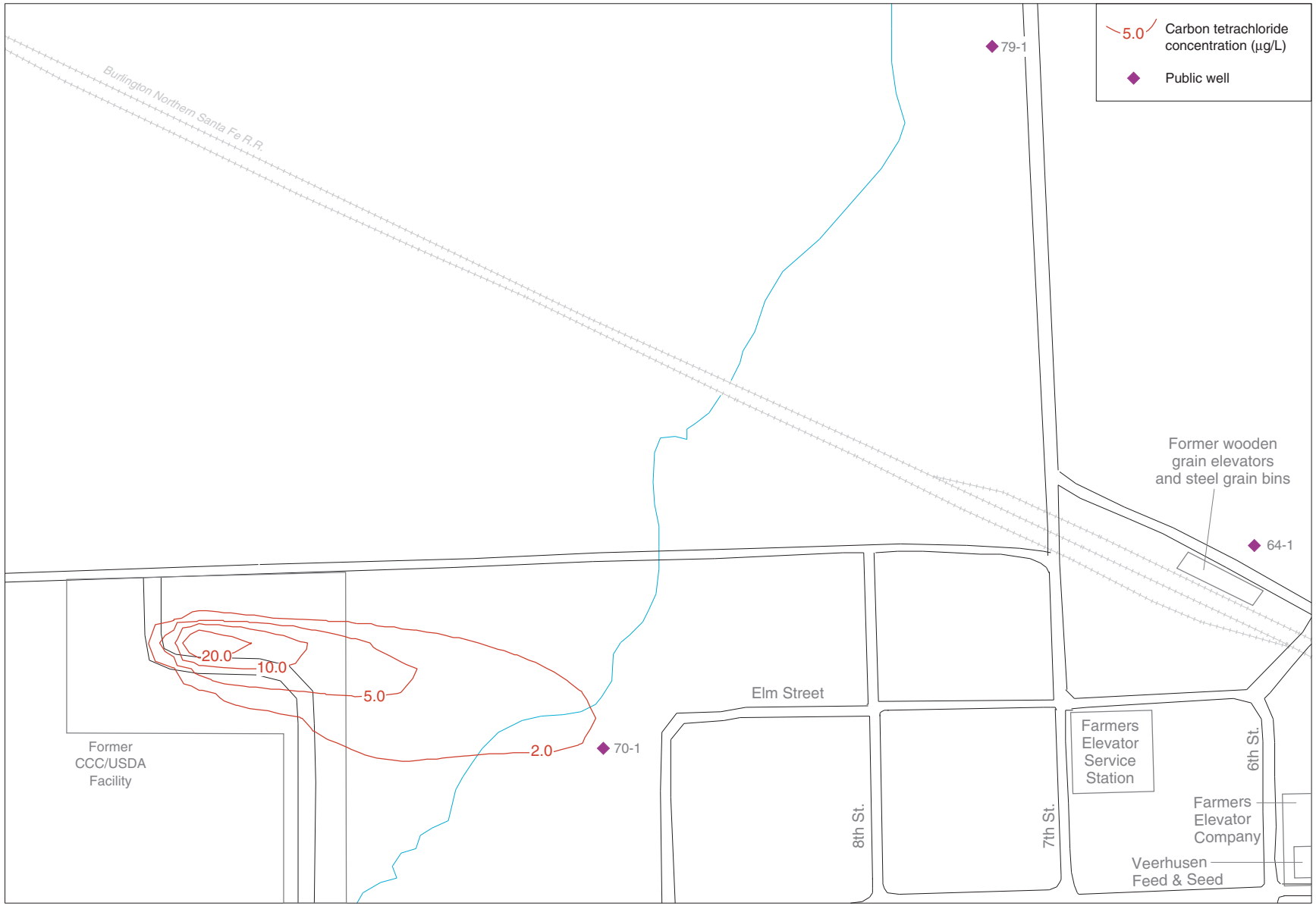


FIGURE 6.16 Simulated 5-yr carbon tetrachloride distribution in model layer 2 under continued pumping of PWS 70-1 and 79-1.

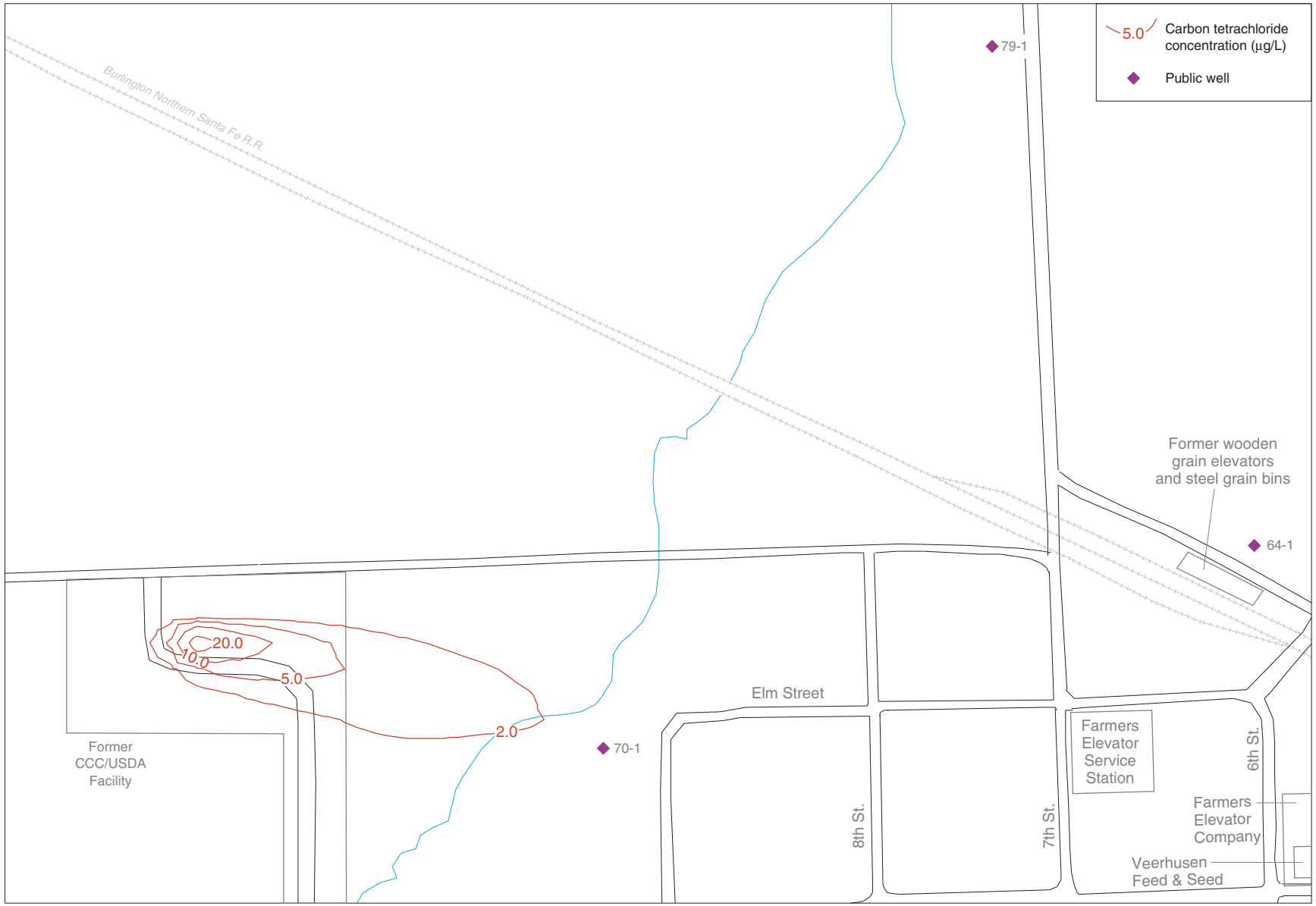


FIGURE 6.17 Simulated 10-yr carbon tetrachloride distribution in model layer 2 under continued pumping of PWS 70-1 and 79-1.

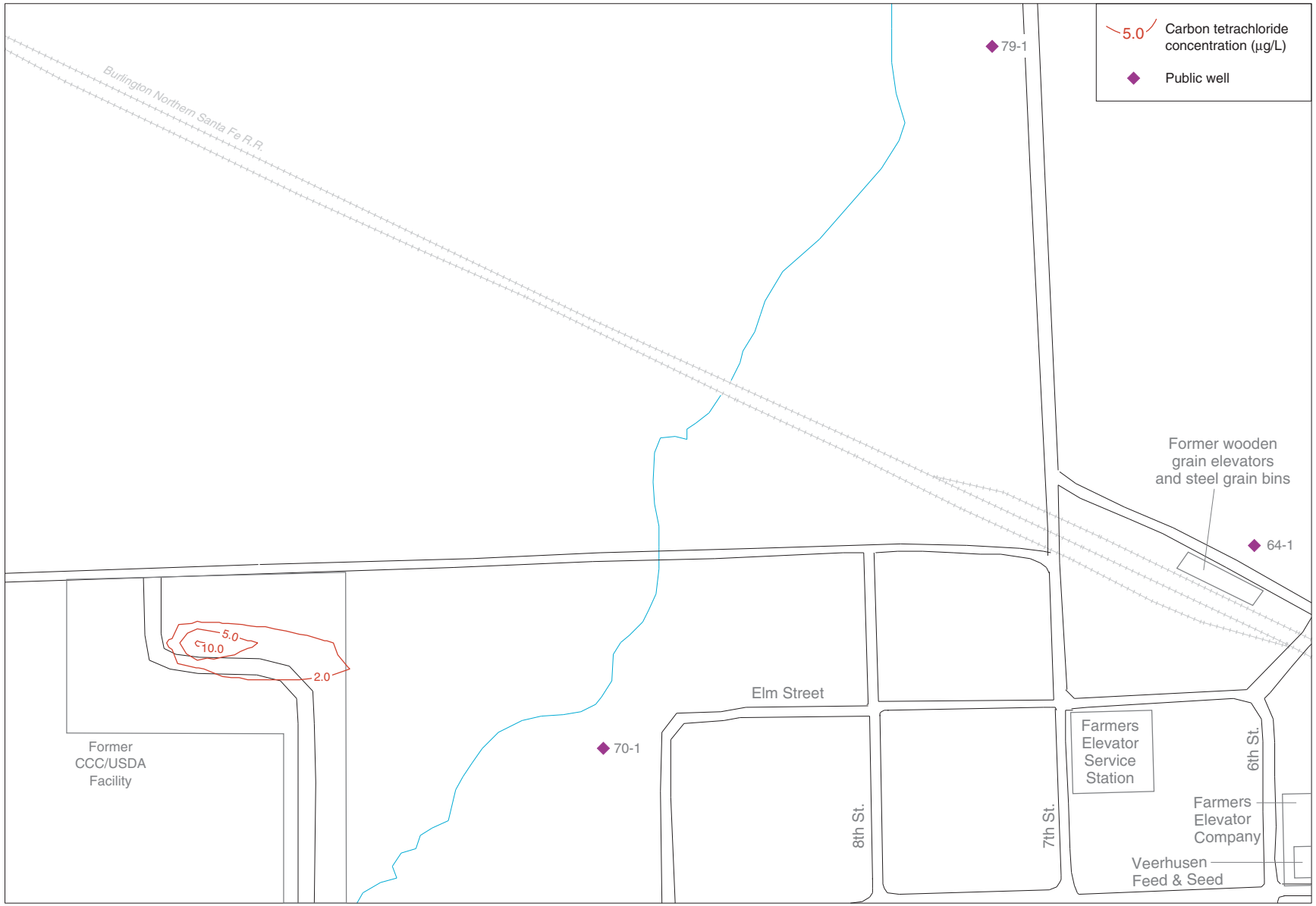


FIGURE 6.18 Simulated 20-yr carbon tetrachloride distribution in model layer 2 under continued pumping of PWS 70-1 and 79-1.

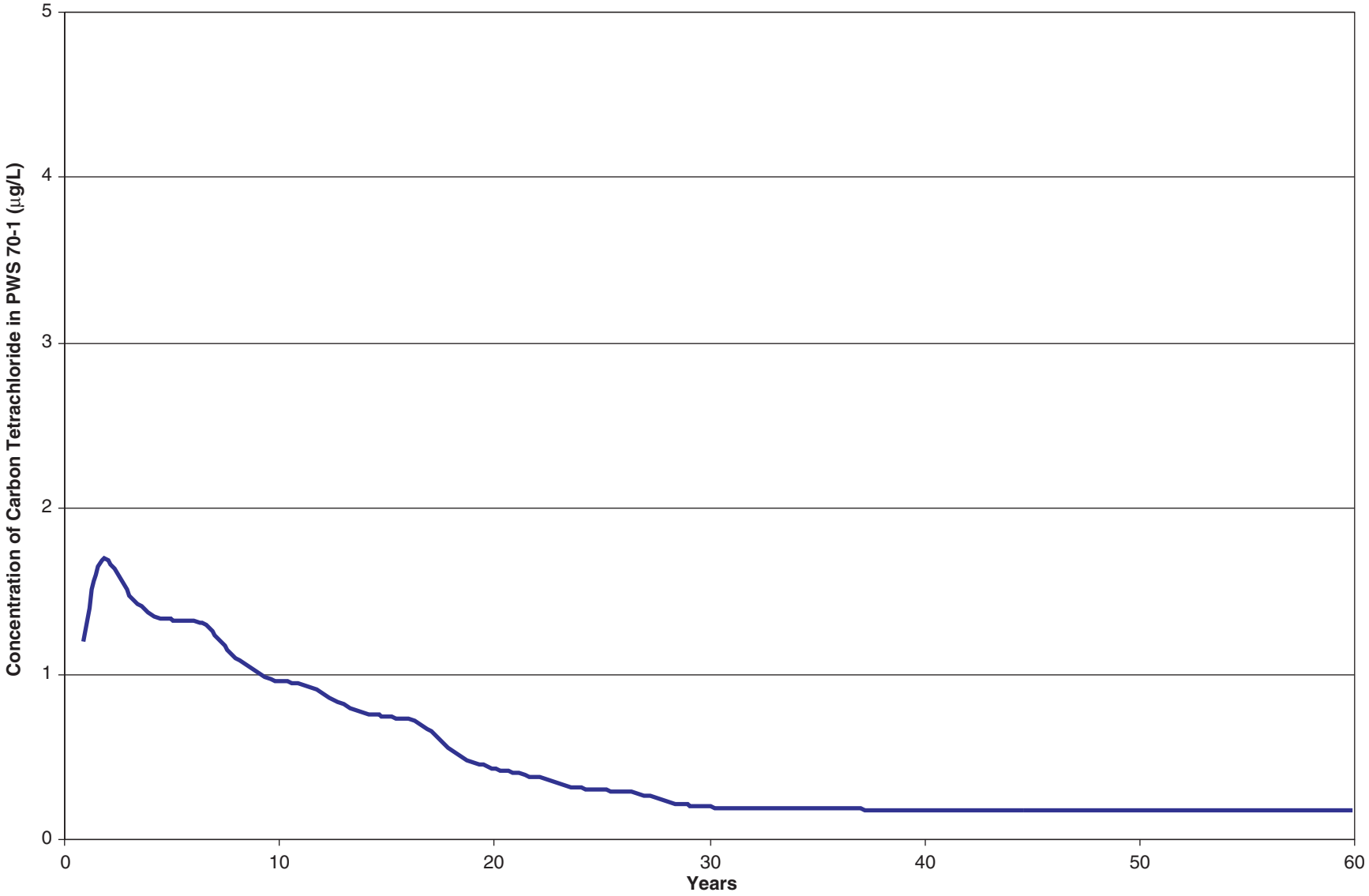


FIGURE 6.19 Plot of simulated carbon tetrachloride concentration versus time at PWS 70-1 in Adams.

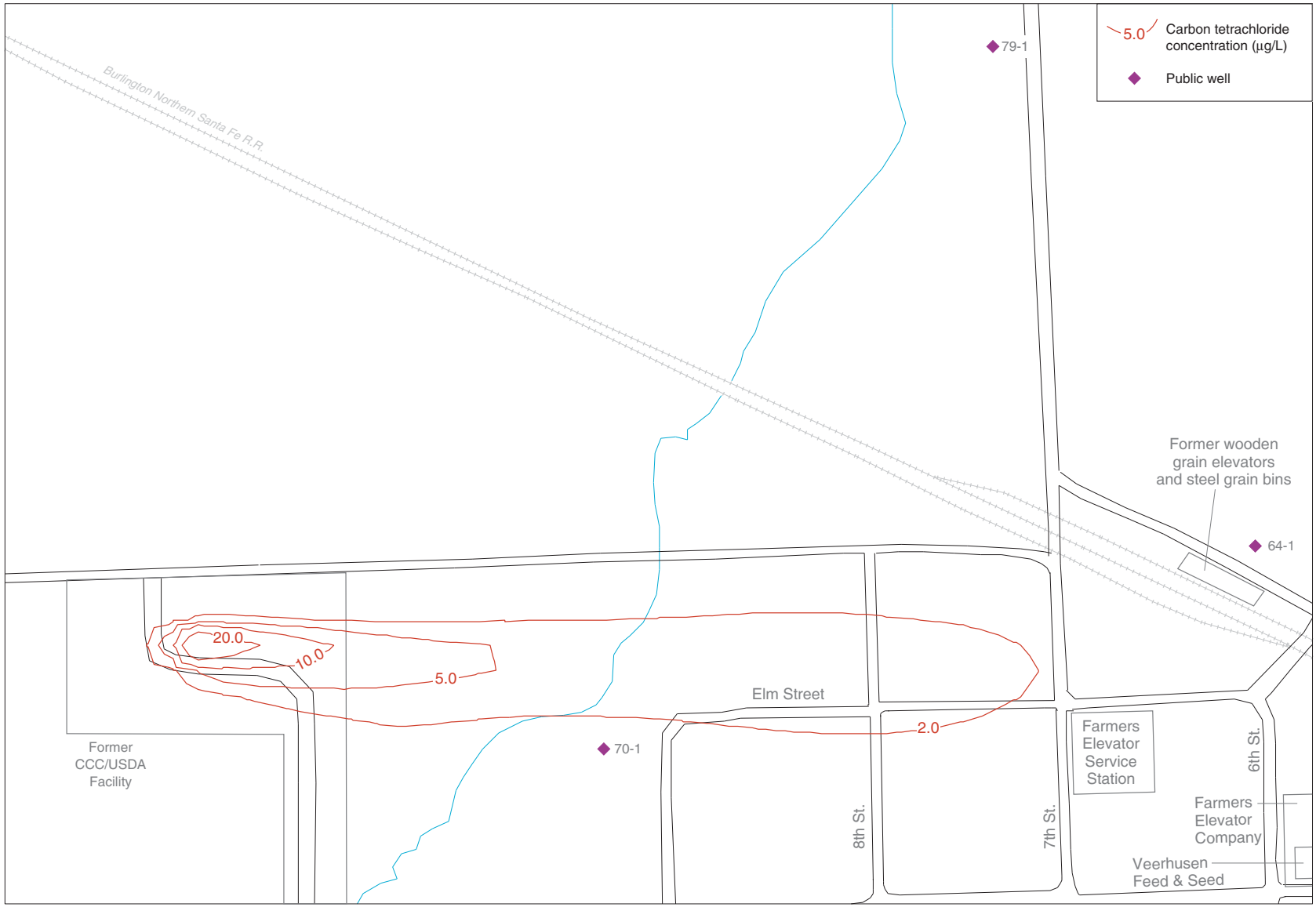


FIGURE 6.20 Simulated 5-yr carbon tetrachloride distribution in model layer 2 under continued pumping of only PWS 79-1 (with no pumping of PWS 70-1).

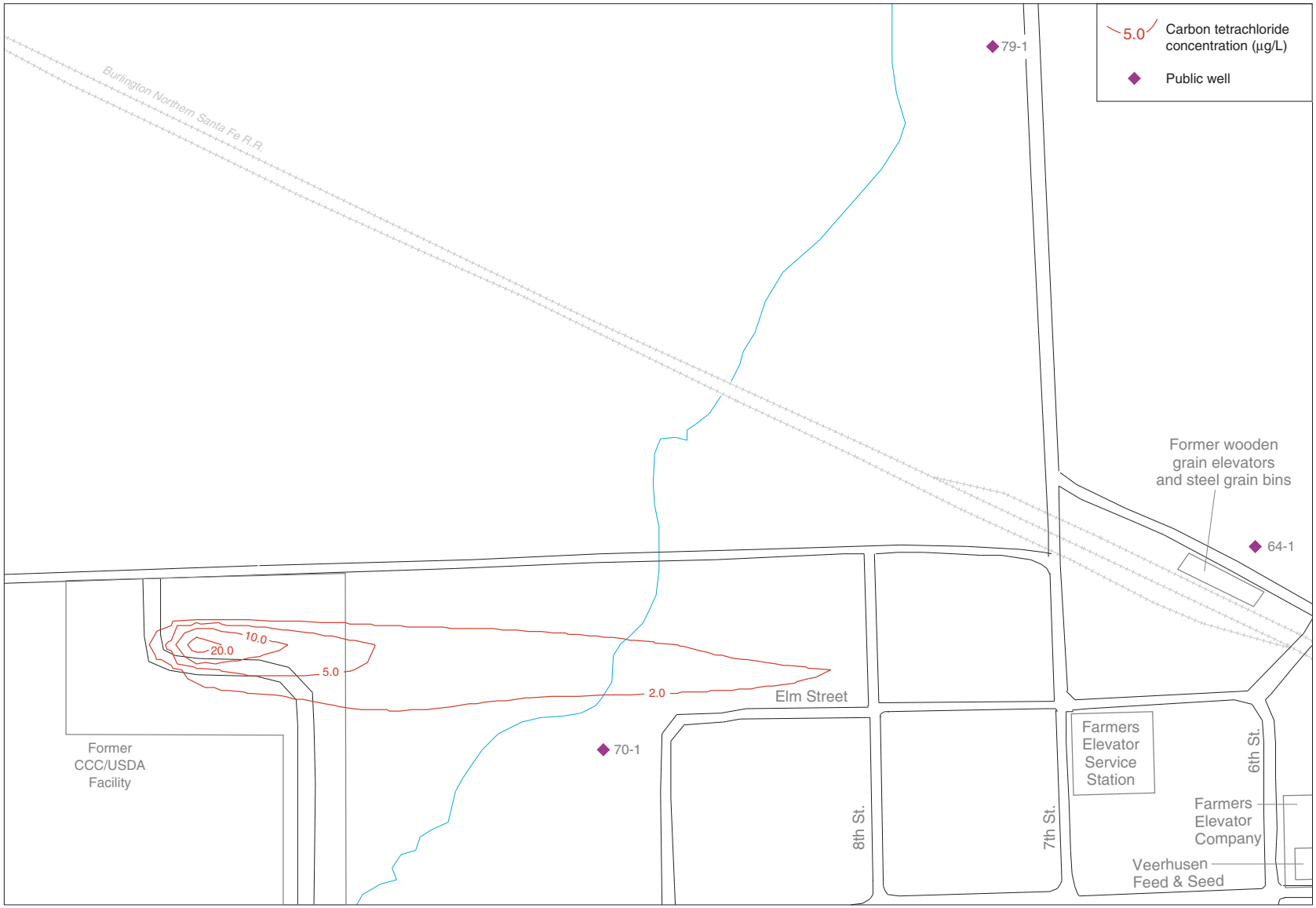


FIGURE 6.21 Simulated 10-yr carbon tetrachloride distribution in model layer 2 under continued pumping of only PWS 79-1 (with no pumping of PWS 70-1).

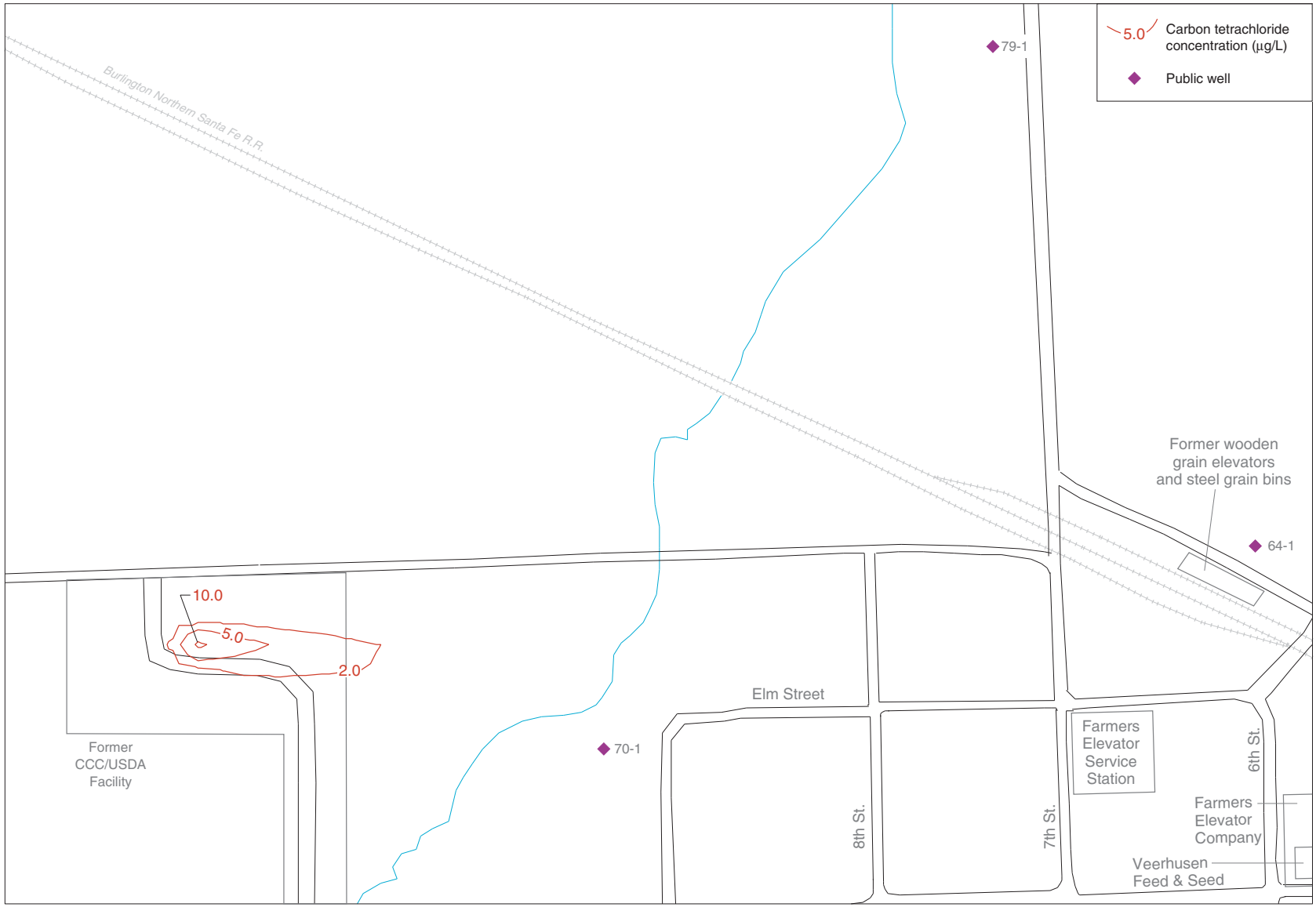


FIGURE 6.22 Simulated 20-yr carbon tetrachloride distribution in model layer 2 under continued pumping of only PWS 79-1 (with no pumping of PWS 70-1).

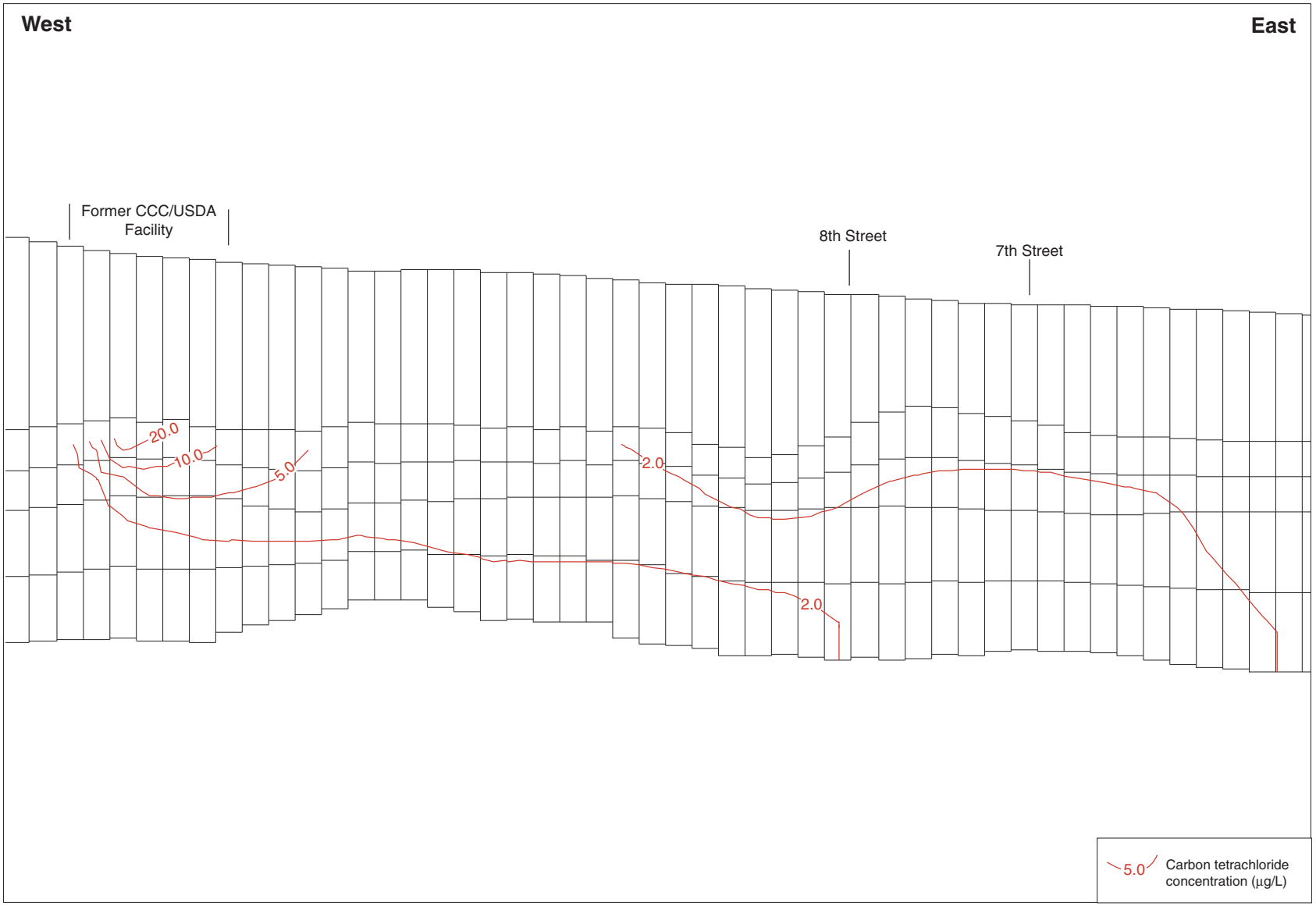


FIGURE 6.23 Simulated 10-yr vertical carbon tetrachloride distribution along the center of the groundwater plume in the west-east direction under continued pumping of only PWS 79-1 (with no pumping of PWS 70-1).

7 Conclusions and Recommendations

The Phase II QuickSite® investigation at Adams, Nebraska, confirmed the Phase I (Argonne 2001) conclusion that the former CCC/USDA facility in the western part of Adams is not the source of the carbon tetrachloride contamination found in groundwater samples from PWS 64-1 in eastern Adams. Nevertheless, the discovery of carbon tetrachloride in PWS 64-1 was the reason for the environmental investigations initiated by the EPA and extended by the CCC/USDA.

The Phase I conclusion that the former CCC/USDA facility location is a source of carbon tetrachloride occasionally detected at levels below the MCL in PWS 70-1 in western Adams was confirmed by tracing the migration pathway from an area of contaminated subsurface soil at the former grain storage area to the public well. However, the discovery of 1,2-dichloroethane in vadose zone soils beneath the former CCC/USDA facility points to the presence of another party that might have contributed to the carbon tetrachloride contamination. Phase II investigations also confirmed that well PWS 70-1 serves to contain and extract dilute groundwater contamination originating at the former CCC/USDA facility.

No threat to human health was identified from contaminated near-surface soils or from PWS 70-1, either at the present time or in the future, if the well continues to be used as a source of drinking water for Adams residents. Similarly, if pumping of PWS 70-1 is discontinued, there will be minimal effect on the aquifer downgradient from the well in central and eastern Adams. Any future well constructed for public supply purposes in central or eastern Adams, downgradient from the former CCC/USDA facility, will produce water with carbon tetrachloride levels below the MCL, subject to the possible effect of contamination of groundwater from one or more of the potentially responsible parties identified by the EPA in eastern Adams (Curry 2000).

Because the results of numerical modeling show that there will be minimal impact on the aquifer downgradient from PWS 70-1 if pumping is discontinued, continued operation of the well is not needed for containment and extraction of the dilute carbon tetrachloride plume. The amount of carbon tetrachloride currently in the vadose zone and the aquifer systems is limited and is not a threat to future production of public drinking water. Predicted contaminant distributions under both scenarios indicate that the plume will decrease with time in both size and concentration and will eventually dissipate by dilution after 20 yr.

On the basis of the findings outlined above, Argonne suggests that the town could relocate PWS 70-1 in the vicinity of the existing well if required by the NHHS determination that the well is under the direct influence of surface water. The results of nitrate sampling during the QuickSite® investigation at Adams indicate that a suitable location meeting the requirements of adequate aquifer thickness and acceptable nitrate content could probably be found southeast of PWS 70-1 and south of Elm Street. As is the case for PWS 70-1, there will be no impact on human health due to carbon tetrachloride in drinking water extracted from this area.

Because of the results of the Phase II investigation and the existing uncertainty over the continued operation, relocation, or abandonment of PWS 70-1, no further investigations are recommended until the situation with PWS 70-1 is resolved. After resolution of the issue regarding PWS 70-1, consideration should be given to modeling the impact of a new well, if one is installed, and implementing a groundwater monitoring scheme to confirm the prediction of eventual dissipation of the plume.

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Appendix A:

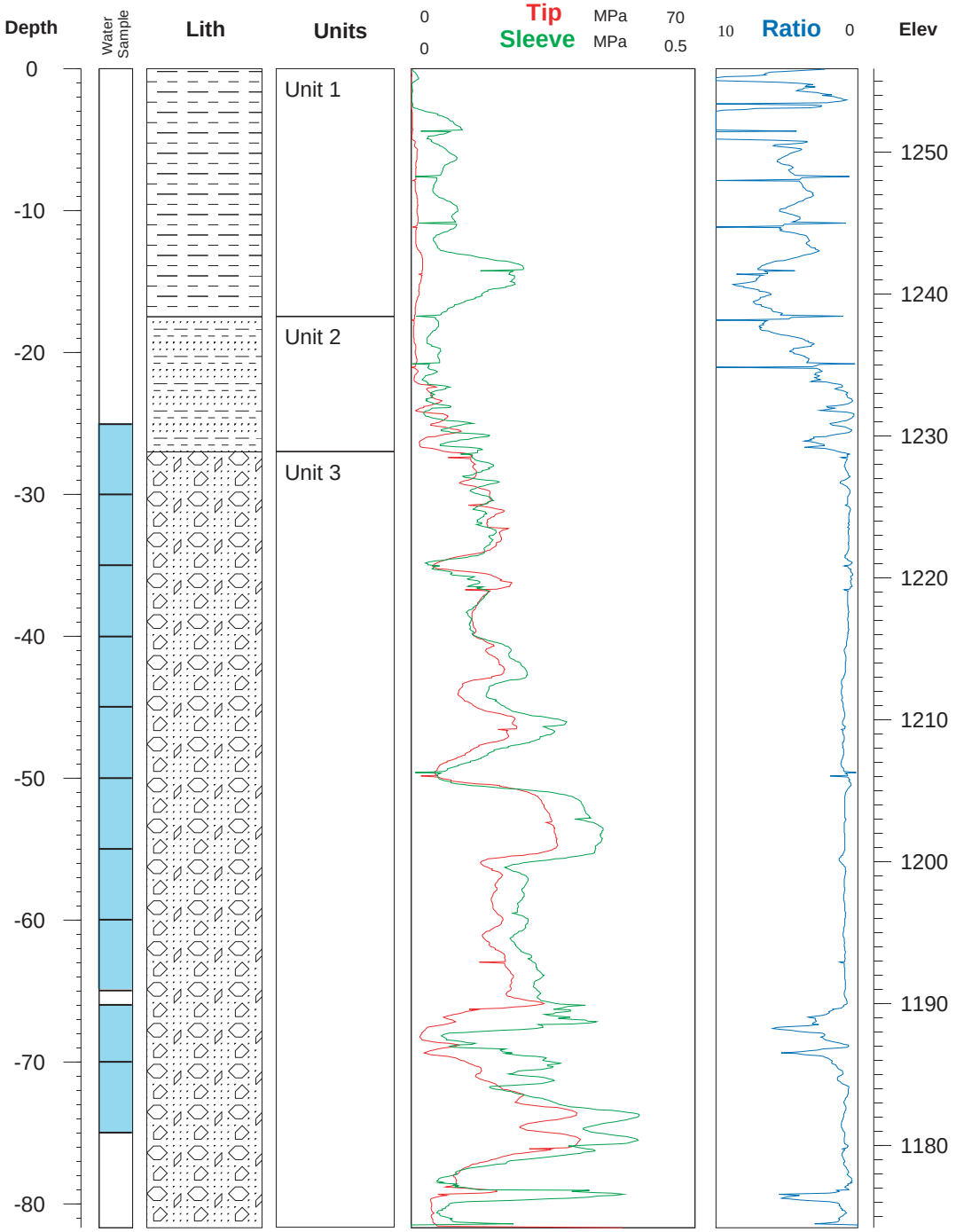
Electronic Cone Penetrometer Logs

Argonne National Laboratory

Project: Adams
Elevation: 1255.9 ft
Depth: 81.7 ft
Geologist: LaFreniere/Meyer

Boring ID: SB21
Log Date: 8/22/01
Plot Date: 12/7/01

Rig: CPT
Driller: Toby
Company: Argonne

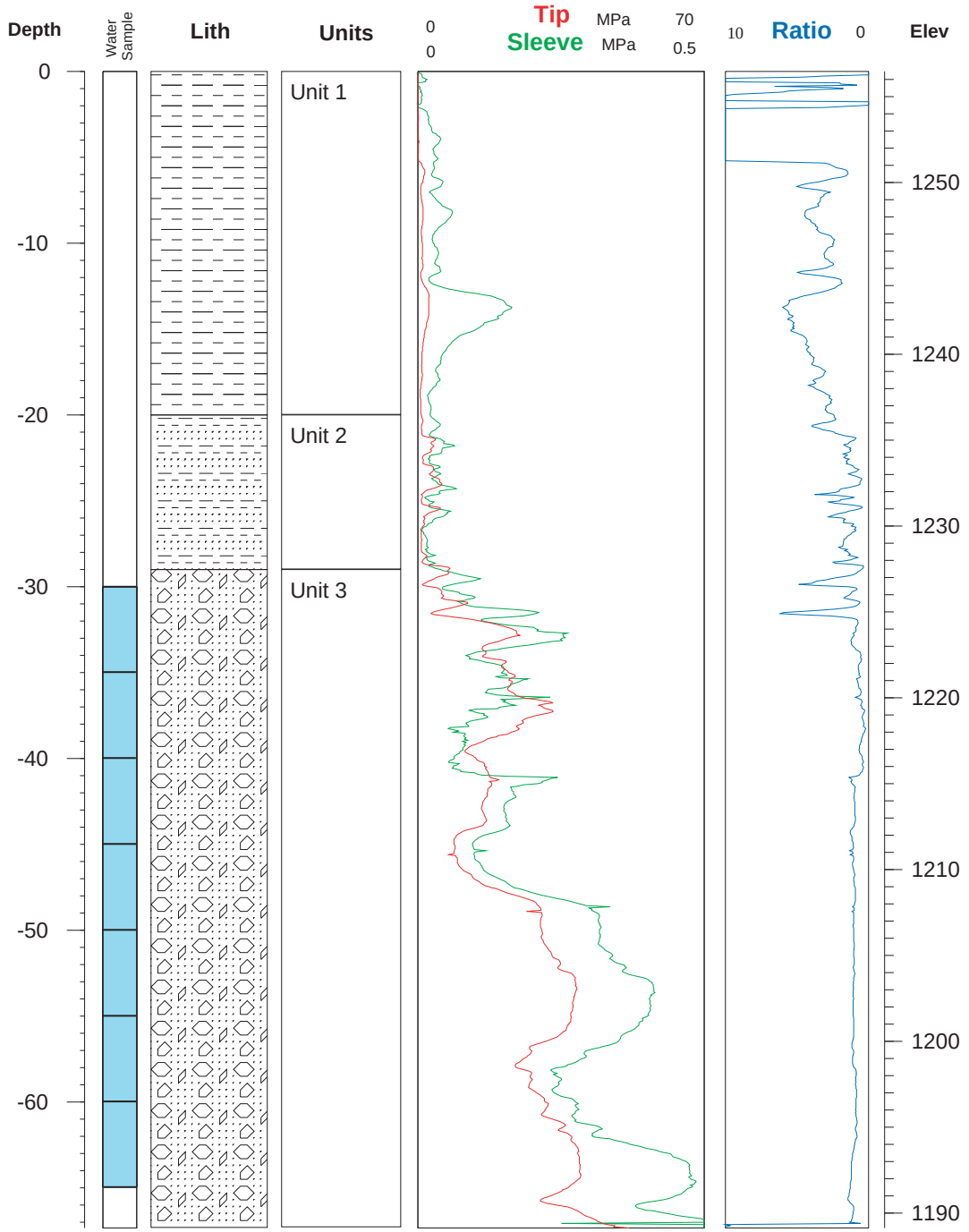


Argonne National Laboratory

Project: Adams
Elevation: 1256.45 ft
Depth: 67.32 ft
Geologist: LaFreniere/Meyer

Boring ID: SB22
Log Date: 8/25/01
Plot Date: 12/7/01

Rig: CPT
Driller: Toby
Company: Argonne

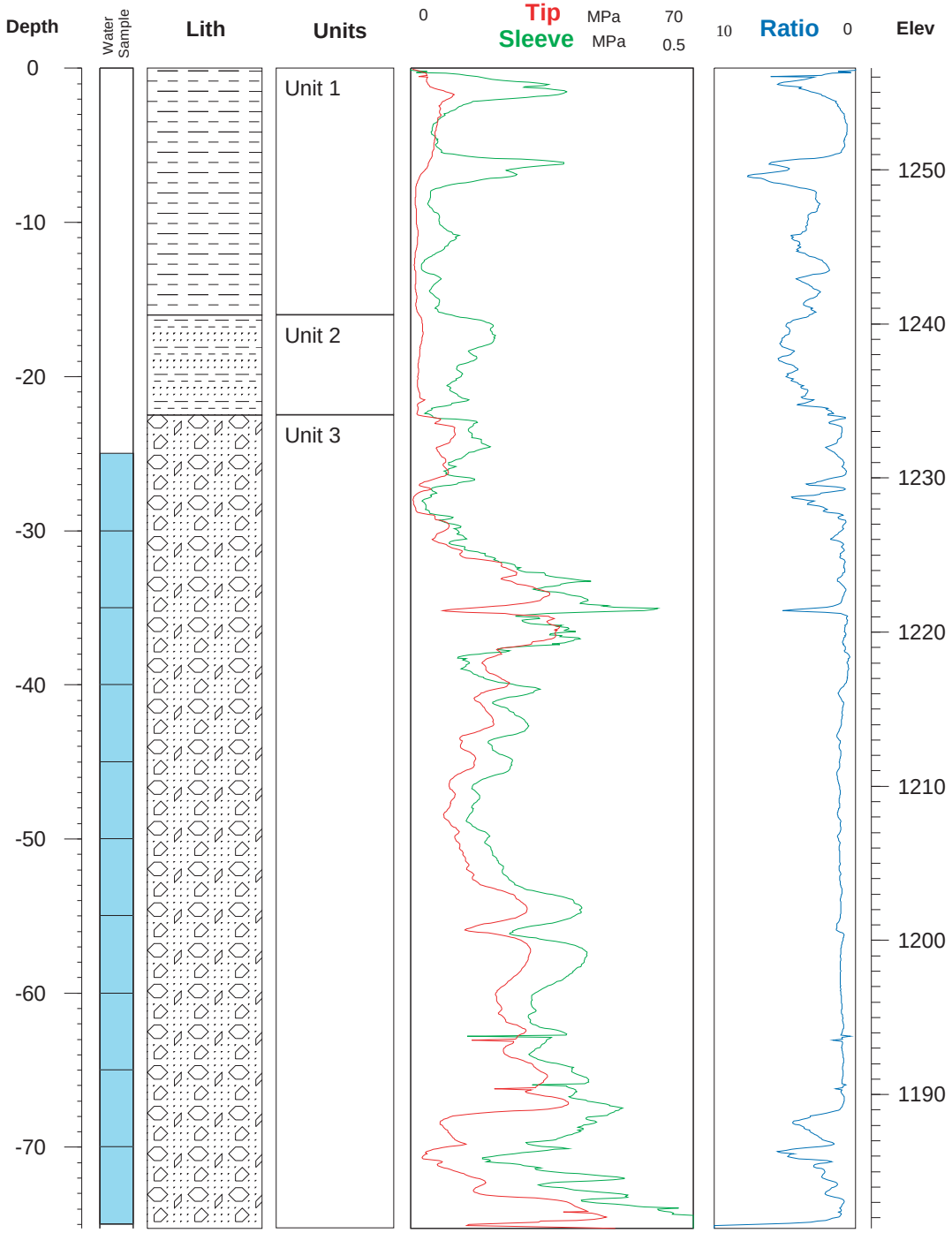


Argonne National Laboratory

Project: Adams
Elevation: 1256.58 ft
Depth: 75.26 ft
Geologist: LaFreniere/Meyer

Boring ID: SB23
Log Date: 8/24/01
Plot Date: 12/7/01

Rig: CPT
Driller: Toby
Company: Argonne

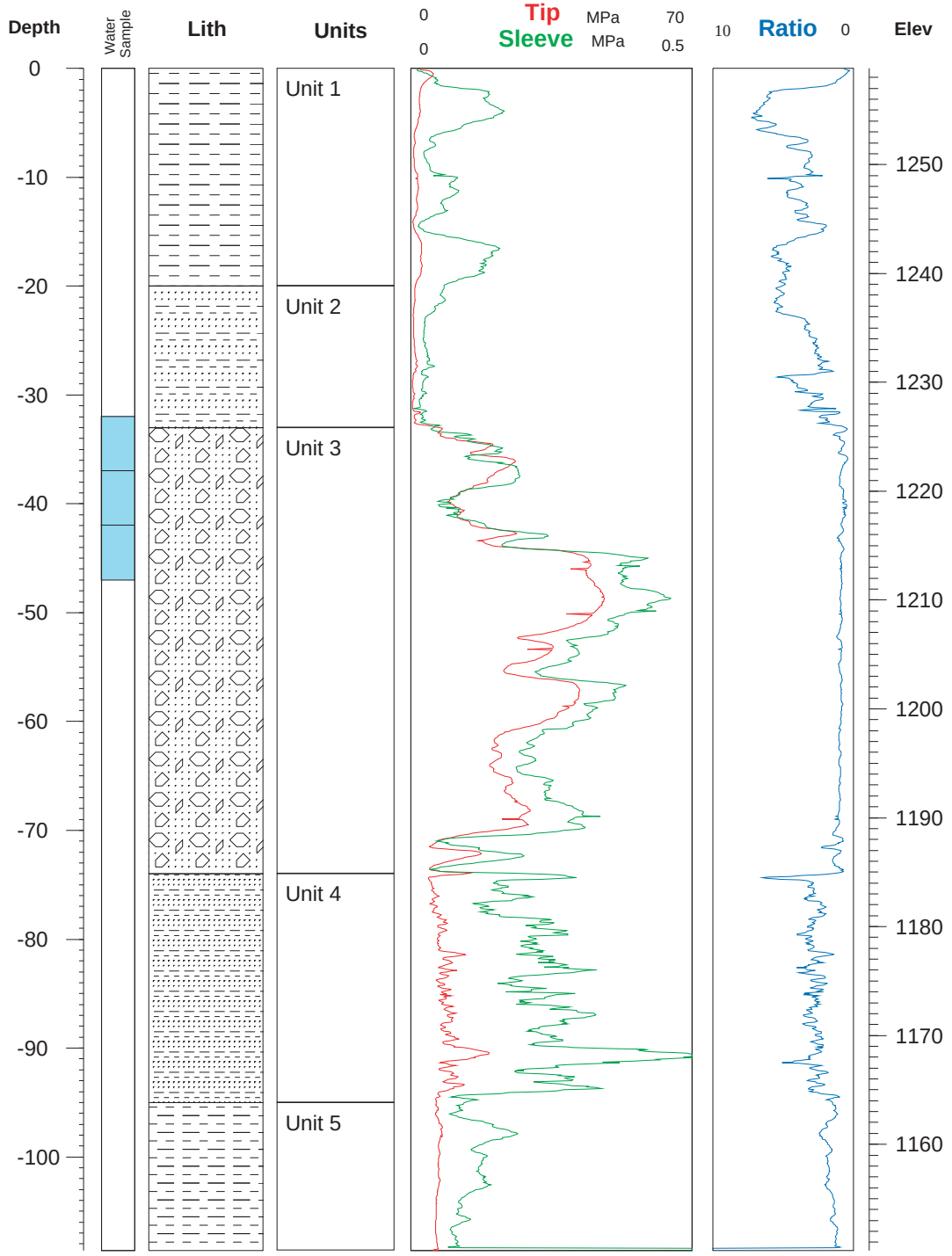


Argonne National Laboratory

Project: Adams
Elevation: 1258.84 ft
Depth: 108.60 ft
Geologist: L. LaFreniere

Boring ID: SB25
Log Date: 9/6/01
Plot Date: 9/10/01

Rig: CPT
Driller: Toby
Company: Argonne

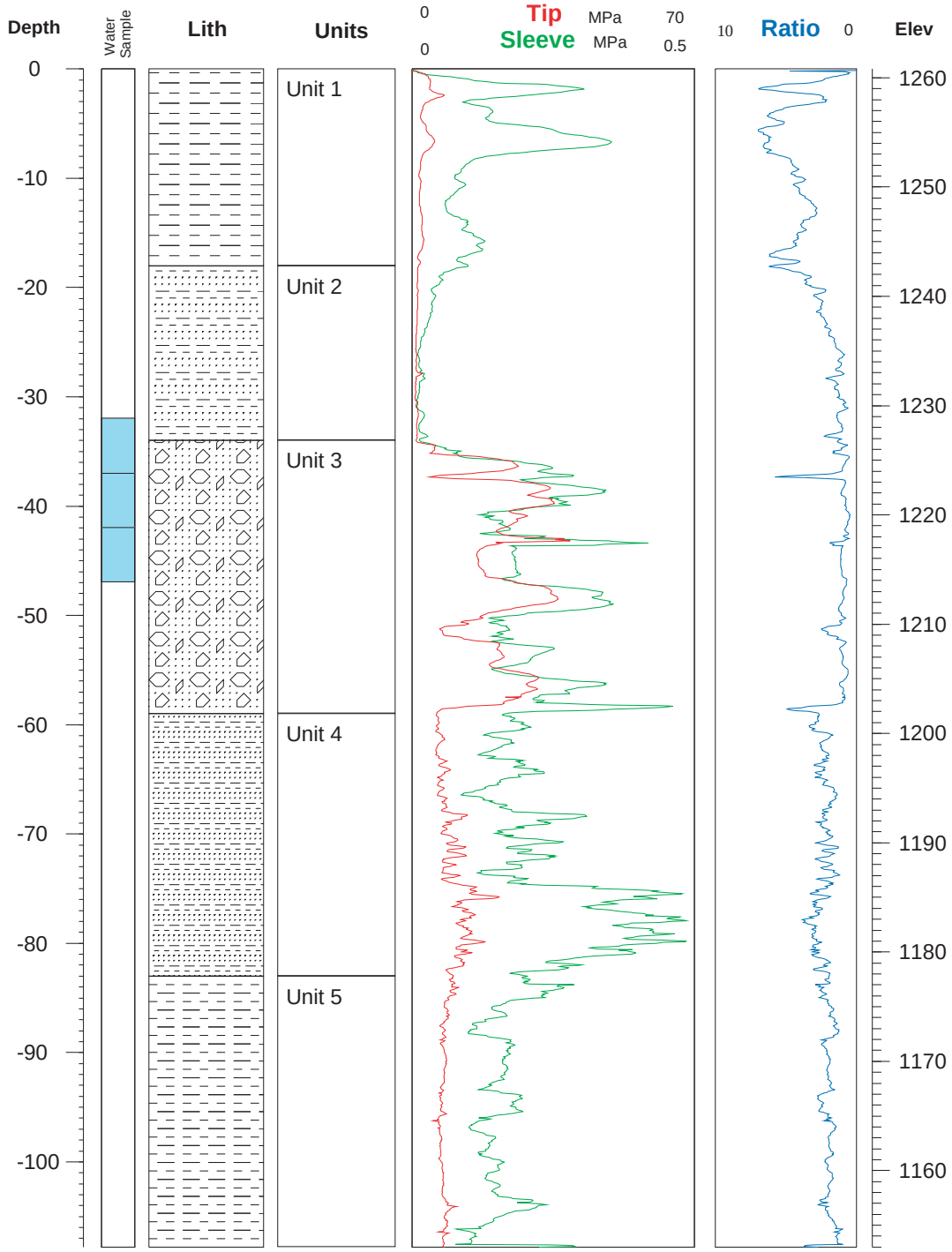


Argonne National Laboratory

Project: Adams
Elevation: 1260.8 ft
Depth: 107.8 ft
Geologist: LaFreniere/Meyer

Boring ID: SB27
Log Date: 8/28/01
Plot Date: 12/7/01

Rig: CPT
Driller: B. Olson
Company: Argonne

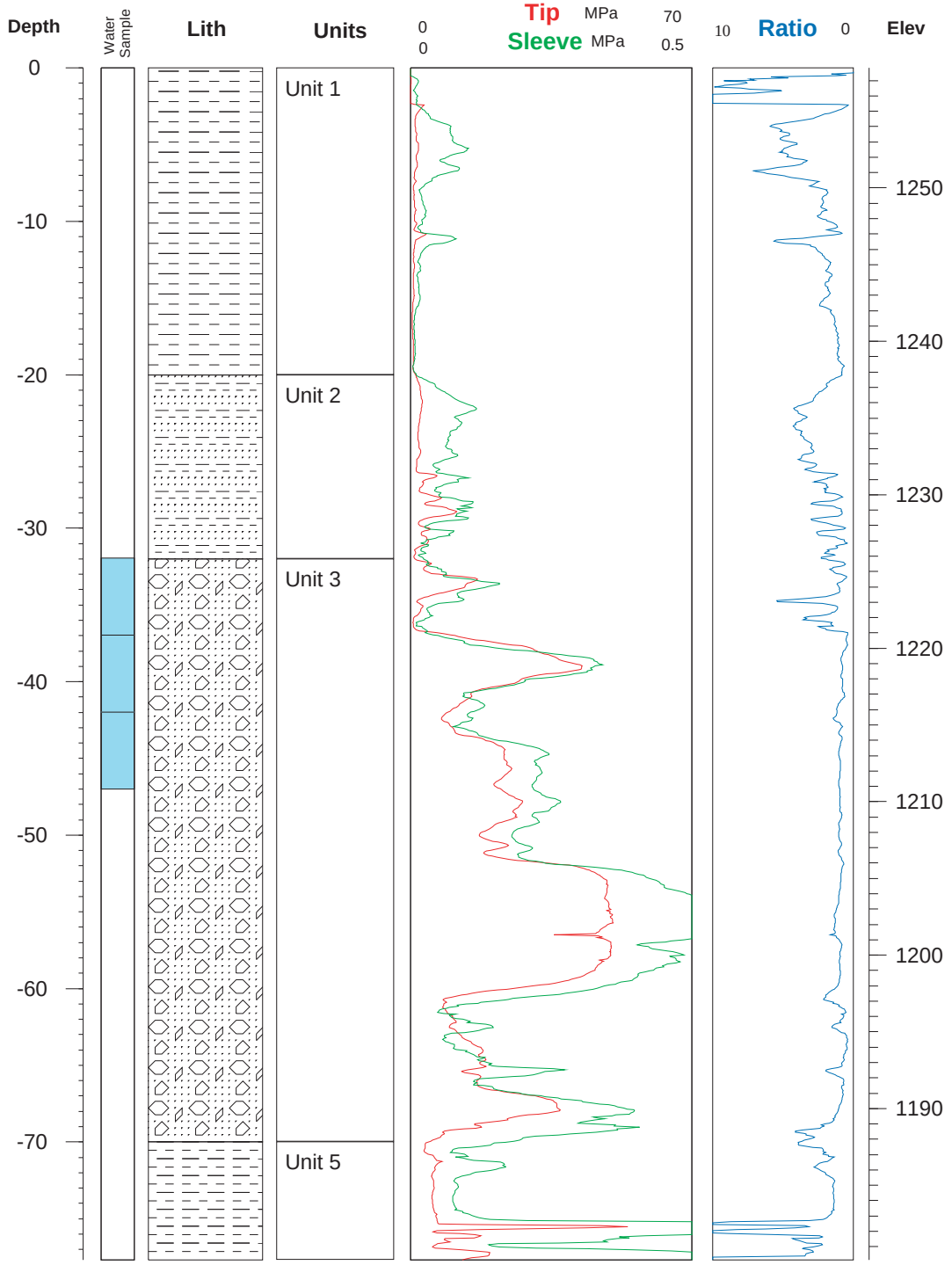


Argonne National Laboratory

Project: Adams
Elevation: 1257.82 ft
Depth: 77.7 ft
Geologist: LaFreniere/Meyer

Boring ID: SB44
Log Date: 8/27/01
Plot Date: 12/7/01

Rig: CPT
Driller: Toby
Company: Argonne

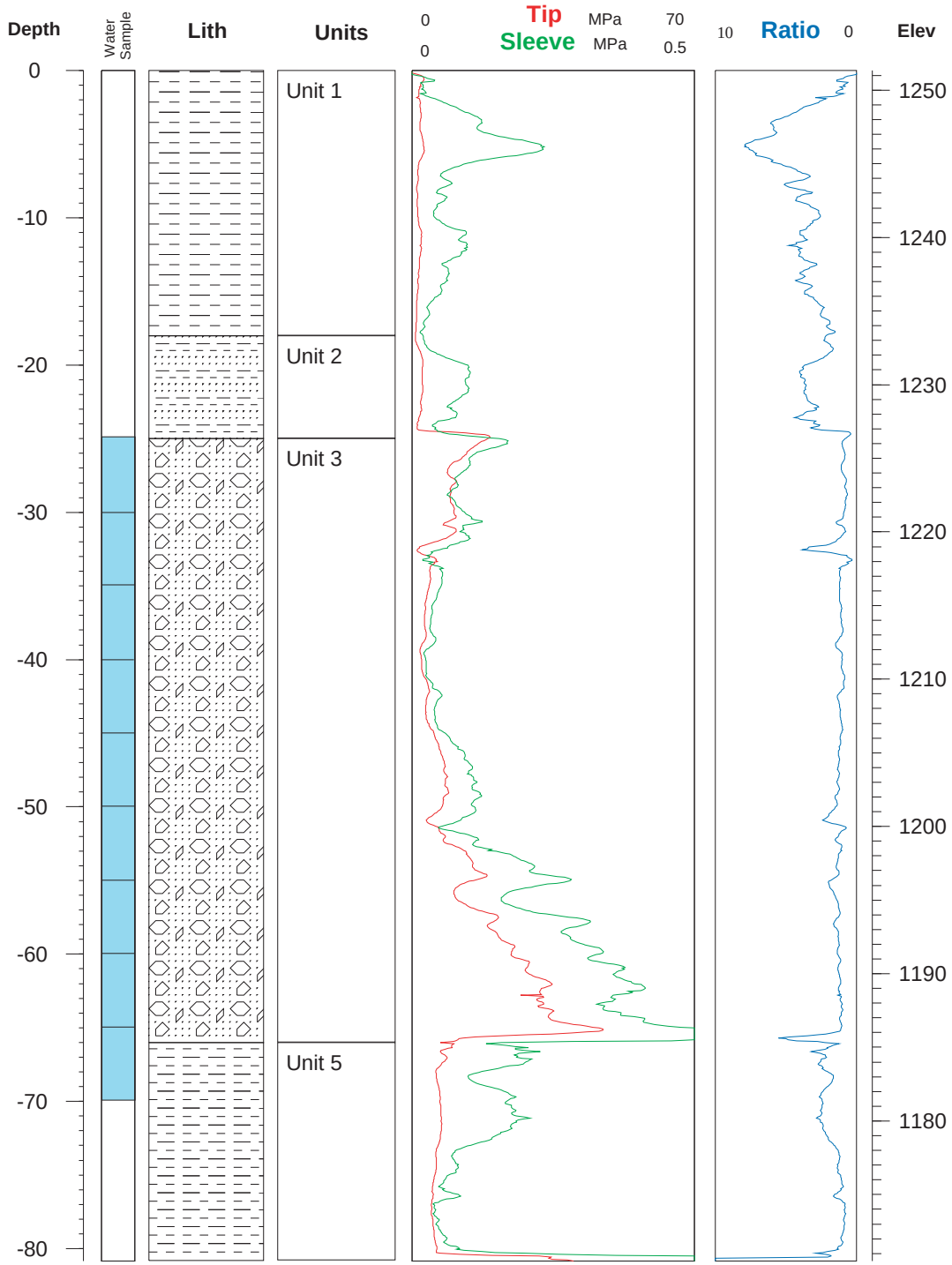


Argonne National Laboratory

Project: Adams
Elevation: 1251.33 ft
Depth: 80.8 ft
Geologist: LaFreniere/Meyer

Boring ID: SB52
Log Date: 9/6/01
Plot Date: 12/7/01

Rig: CPT
Driller: Toby
Company: Argonne



Appendix B:

Geoprobe Logs

Argonne National Laboratory

Well ID: **SB24**

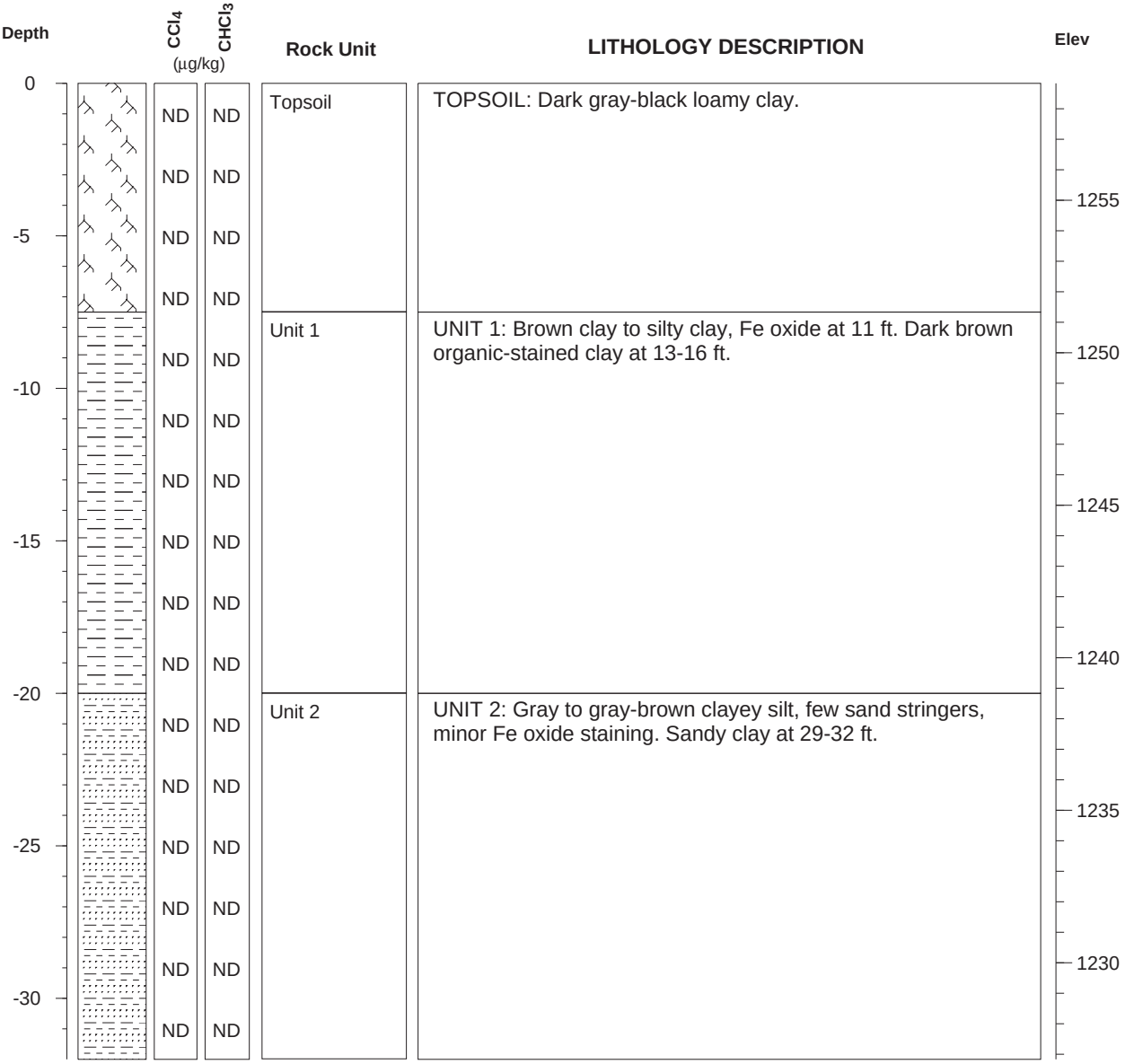
Project: **Adams, NE** **Elevation:** 1258.40 **Log Date:** 8/22/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 36 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark brown-black loamy clay, patches of iron oxide staining.	
	ND	ND			1255
-5	ND	ND	Unit 1	UNIT 1: Brown clay to silty clay. Dark brown organic-stained clay at 17-20 ft.	
	ND	ND			
	ND	ND			1250
-10	ND	ND			
	ND	ND			1245
-15	ND	ND			
	<10	ND			1240
-20	<10	ND	Unit 2	UNIT 2: Gray-brown clayey silt, few sand stringers, Fe and Mn oxide staining	
	<10	ND			1235
-25	<10	ND			
	<10	ND			1230
	ND	ND			
-30	<10	ND			
	<10	ND			1225
-35	23	ND	Unit 3	UNIT 3: Gray medium-grained sand.	

Argonne National Laboratory

Well ID: **SB25**

Project: **Adams, NE** **Elevation:** 1258.84 **Log Date:** 8/23/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW



Argonne National Laboratory

Well ID: **SB26**

Project: **Adams, NE** **Elevation:** 1260.12 **Log Date:** 8/23/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 40 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	<10	ND	Topsoil	TOPSOIL: Dark gray-black loamy clay. Some sand fill from 0-1 ft.	1260
	<10	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, yellow brown at 13-15 ft.	
-5	ND	ND			1255
	ND	ND			
	ND	ND			
-10	ND	ND			1250
	ND	ND			
	ND	ND			
-15	ND	ND			1245
	ND	ND			
	ND	ND			
-20	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, sand stringers at 21-23 ft.	1240
	ND	ND			
-25	ND	ND			1235
	ND	ND			
	ND	ND			
-30	ND	ND			1230
	ND	ND	Unit 3	UNIT 3: Gray clayey sand. Wet.	
-35	ND	ND			1225
	ND	ND			
-40	ND	ND			

Argonne National Laboratory

Well ID: **SB27**

Project: **Adams, NE** **Elevation:** 1260.8 ft **Log Date:** 8/23/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 28 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark brown-black silty loam.	1260
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, yellow brown at 9-11 ft.	1255
	ND	ND			
-10	ND	ND			
	<10	ND			1250
	<10	ND			
-15	10	ND			1245
	11	ND			
-20	10	ND	Unit 2	UNIT 2: Olive-brown to gray-brown clayey to sandy silt, minor Fe oxide staining.	1240
	11	ND			
	<10	ND			
-25	12	ND			1235
	15	ND			

Argonne National Laboratory

Well ID: **SB28**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1261.1 ft
Depth: 32 ft

Log Date: 8/23/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray-brown clay loam.	1260
	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, yellow brown at 9-11 ft.	
-5	ND	ND			1255
	ND	ND			
	ND	ND			
-10	ND	ND			1250
	ND	ND			
-15	ND	ND			1245
	ND	ND	Unit 2	UNIT 2: Gray-brown clayey to sandy silt, minor Fe oxide staining. Wet below 26 ft BGL.	
-20	ND	ND			1240
	ND	ND			
-25	ND	ND			1235
	ND	ND			
-30	ND	ND			1230

Argonne National Laboratory

Well ID: **SB29**

Project: **Adams, NE** **Elevation:** 1260.46 ft **Log Date:** 8/24/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray organic loam.	1260
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark gray organic clay from 13-16 ft.	1255
	ND	ND			
	ND	ND			
-10	ND	ND			1250
	ND	ND			
-15	ND	ND			1245
	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining at 17-27 ft.	
	ND	ND			
-20	ND	ND			1240
	ND	ND			
-25	ND	ND			1235
	ND	ND			
	ND	ND			
-30	ND	ND	Unit 4	UNIT 4: Gray-brown sandy silt to sandy clay. Much Fe-Mn oxide staining.	1230

Argonne National Laboratory

Well ID: **SB30**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1259.64 ft
Depth: 28 ft

Log Date: 8/24/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	12	ND	Topsoil	TOPSOIL: Dark gray to black organic loam.	
	<10	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark gray organic clay from 13-16 ft.	1255
	ND	ND			
	ND	ND			
-10	ND	ND			1250
	ND	ND			
-15	<10	ND			1245
	<10	ND			
	ND	ND			1240
-20	ND	ND	Unit 2	UNIT 2: Olive-brown to gray-brown clayey to sandy silt, Fe-Mn oxide staining.	
	ND	ND			
-25	ND	ND			1235
	ND	ND			

Argonne National Laboratory

Well ID: **SB31**

Project: **Adams, NE** **Elevation:** 1259.44 ft **Log Date:** 8/24/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	36	ND	Topsoil	TOPSOIL: Dark gray to black organic loam.	
	14	ND			
-5	<10	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark gray organic clay from 12-14 ft. Fe oxide staining at 14-16 ft.	1255
	<10	ND			
	<10	ND			1250
-10	<10	ND			
	11	ND			
-15	15	ND			1245
	11	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining at 17-27 ft.	
	23	ND			1240
-20	24	ND			
	24	ND			
-25	18	ND			1235
	<10	ND			
	<10	ND	Unit 4	UNIT 4: Gray-brown sandy silt to sandy clay, some fine sand. Wet.	1230
-30	<10	ND			

Argonne National Laboratory

Well ID: **SB32**

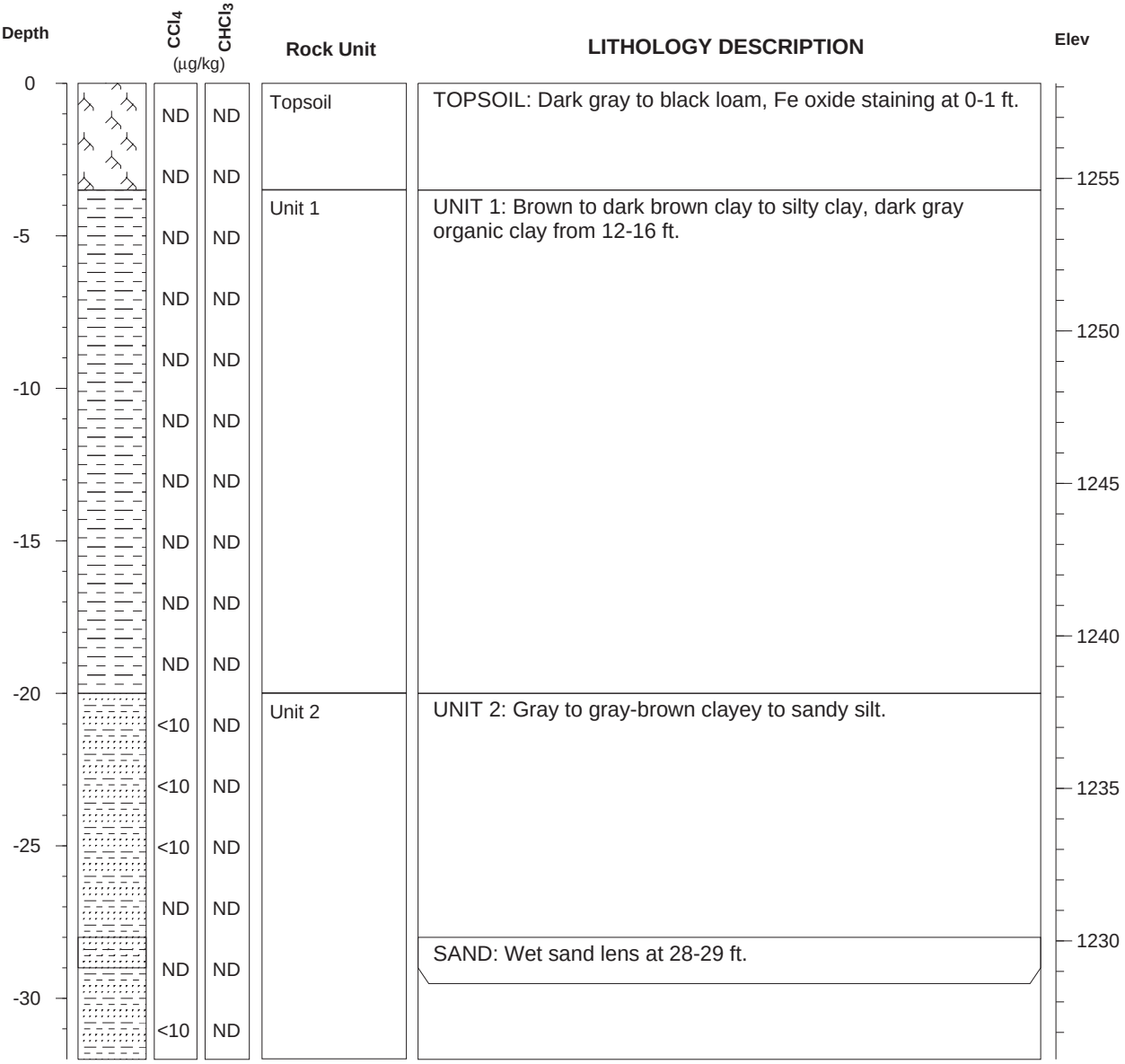
Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold
Elevation: 1257.60 ft
Depth: 30 ft
Log Date: 8/24/01
Plot Date: 10/16/01
Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic loam.	
	ND	ND			1255
-5	ND	ND			
	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark gray organic-rich clay at 9-10 ft and organic-rich silty clay at 15-22 ft.	1250
	ND	ND			
-10	ND	ND			
	ND	ND			1245
	ND	ND			
-15	ND	ND			
	ND	ND			1240
	ND	ND			
-20	ND	ND			
	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining in clayey zone at 23-27 ft.	1235
-25	ND	ND			
	ND	ND		SAND: Wet sand lens at 27 -27.5 ft.	1230
	ND	ND			
-30					

Argonne National Laboratory

Well ID: **SB33**

Project: **Adams, NE** **Elevation:** 1258.11 ft **Log Date:** 8/25/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW



Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)
0	ND	ND
	ND	ND
-5	ND	ND
	ND	ND
	ND	ND
-10	ND	ND
	ND	ND
-15	ND	ND
	ND	ND
	ND	ND
-20	<10	ND
	<10	ND
-25	<10	ND
	ND	ND
	ND	ND
-30	<10	ND

Rock Unit	LITHOLOGY DESCRIPTION
Topsoil	TOPSOIL: Dark gray to black loam, Fe oxide staining at 0-1 ft.
Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark gray organic clay from 12-16 ft.
Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt.
	SAND: Wet sand lens at 28-29 ft.

Elev: 1255, 1250, 1245, 1240, 1235, 1230

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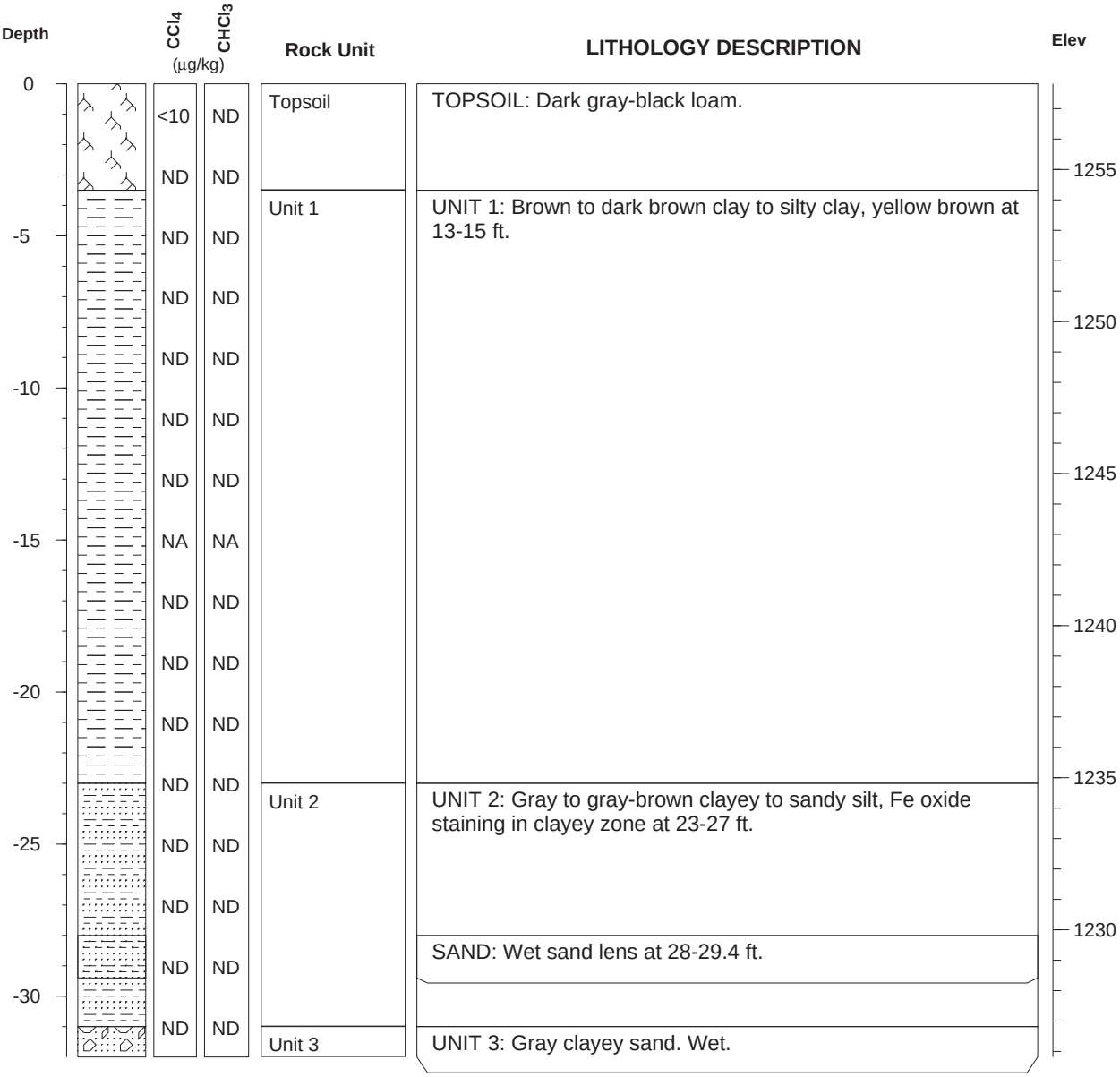
Well ID: **SB34**

Project: **Adams, NE** **Elevation:** 1257.82 ft **Log Date:** 8/25/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW



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Well ID: **SB35**

Project: **Adams, NE** **Elevation:** 1258.30 ft **Log Date:** 8/25/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black loam, Fe oxide staining.	
	ND	ND			1255
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark brown organic clay from 17-20 ft.	
	ND	ND			1250
-10	ND	ND			
	ND	ND			1245
-15	ND	ND			
	ND	ND			1240
-20	ND	ND			
	NA	NA	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt. Black (Mn) staining at 27 ft.	
	ND	ND			1235
-25	ND	ND			
	ND	ND			1230
	ND	ND		SAND: Thin (0.1-0.2 ft), wet sand lens at 29 ft.	
-30	ND	ND			

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Well ID: **SB36**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1258.95 ft
Depth: 32 ft

Log Date: 8/25/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic loam.	
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay, dark brown organic clay from 17-20 ft.	1255
	ND	ND			
-10	ND	ND			1250
	ND	ND			
	ND	ND			
-15	ND	ND			1245
	ND	ND			
-20	ND	ND			1240
	ND	ND			
	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining at 23-26 ft. Wet from 25-32 ft.	
-25	ND	ND			1235
	ND	ND			
-30	ND	ND			1230
	ND	ND			

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Well ID: **SB37**

Project: **Adams, NE** **Elevation:** 1258.97 ft **Log Date:** 8/26/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	14	ND	Topsoil	TOPSOIL: Dark gray to black organic loam.	
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay.	1255
	ND	ND			
-10	ND	ND			1250
	ND	ND			
	ND	ND			1245
-15	ND	ND			
	ND	ND			
-20	<10	ND			1240
	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining at 20-24 ft and 31-32 ft. Some gravel mixed with sandy clay at 32 ft.	
	ND	ND			1235
-25	ND	ND			
	<10	ND			
-30	<10	ND			1230
	<10	ND			

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Well ID: **SB38**

Project: **Adams, NE** **Elevation:** 1258.72 ft **Log Date:** 8/26/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black loam, Fe oxide staining at 0-1 ft.	
	ND	ND			
			Unit 1	UNIT 1: Brown to dark brown clay to silty clay.	1255
-5	ND	ND			
	ND	ND			
	ND	ND			1250
-10	ND	ND			
	ND	ND			
					1245
-15	ND	ND			
	<10	ND			
	ND	ND			1240
-20			Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe-Mn oxide staining at 20-26 ft. Sand stringers at 27-27.5 ft and at 29-31 ft (wet).	
	<10	ND			
	<10	ND			1235
-25	ND	ND			
	<10	ND			
	ND	ND			1230
-30	ND	ND			

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Well ID: **SB39**

Project: **Adams, NE** **Elevation:** 1259.53 ft **Log Date:** 8/26/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic loam, Fe oxide staining at 0-1 ft.
	<10	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay.
-5	ND	ND		
	ND	ND		
	ND	ND		
-10	ND	ND		
	<10	ND		
-15	<10	ND		
	10	ND		
	16	ND		
-20	18	ND		
	12	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe-Mn oxide staining at 22-28 ft.
-25	13	ND		
	15	ND		
	12	ND		
-30	12	ND	Unit 3	UNIT 3: Gray-brown fine silty sand.

Elev: 1255, 1250, 1245, 1240, 1235, 1230

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Well ID: **SB40**

Project: **Adams, NE** **Elevation:** 1257.63 ft **Log Date:** 8/27/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 31.5 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic loam.	
	ND	ND			1255
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Organic-rich clay at 15-18 ft.	
	ND	ND			1250
-10	ND	ND			
	ND	ND			1245
	ND	ND			
-15	ND	ND			
	ND	ND			1240
-20	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe-Mn oxide staining at 25 and 29 ft. Wet at 29 ft (capillary zone).	
	ND	ND			1235
-25	ND	ND			
	<10	ND			1230
-30	ND	ND			
	<10	ND			

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Well ID: **SB41**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold
Elevation: 1261.15 ft
Depth: 28 ft
Log Date: 8/27/01
Plot Date: 10/16/01
Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic-rich clay.	1260
	ND	ND			
-5	ND	ND			
	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Extensive Fe-Mn oxide staining at 12-16 ft.	1255
	ND	ND			
-10	ND	ND			1250
	ND	ND			
-15	ND	ND			1245
	ND	ND			
-20	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe-Mn oxide staining at 19 ft.	1240
	ND	ND			
	ND	ND		SAND: Sand stringer at 22.5-23 ft	
-25	ND	ND			1235
	ND	ND			

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Well ID: **SB42**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1260.58 ft
Depth: 28 ft

Log Date: 8/27/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic-rich clay.	1260
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Fe-Mn oxide staining at 13-16 ft.	1255
	ND	ND			
-10	ND	ND			1250
	ND	ND			
-15	ND	ND			1245
	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Mn oxide staining at 21 ft.	
-20	ND	ND			1240
	ND	ND			
-25	ND	ND	UNIT 3	UNIT 3: Gray to gray-brown medium to fine sand. Wet.	1235

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Well ID: **SB43**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1264.00 ft
Depth: 24 ft

Log Date: 8/27/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black loam to sandy loam.	
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay.	1260
	ND	ND			
-10	ND	ND			1255
	ND	ND			
-15	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining at 21-24 ft. Wet from 12-24 ft.	1250
	ND	ND			
	NA	NA			
-20	NA	NA			1245
	ND	ND			
	ND	ND			1240

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Well ID: **SB45**

Project: **Adams, NE** **Elevation:** 1257.52 ft **Log Date:** 8/28/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 40 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black loam to sandy loam.	
	ND	ND			1255
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Organic-rich clay at 20-24 ft.	
	ND	ND			1250
-10	ND	ND			
	ND	ND			1245
-15	ND	ND			
	ND	ND			1240
-20	ND	ND			
	ND	ND			1235
-25	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt, Fe oxide staining at 26-30 ft. Wet at 31 ft.	
	ND	ND			1230
-30	NA	NA			
	ND	ND			
-35	12	ND	UNIT 3	UNIT 3: Gray to gray-brown fine sand and silt, changing to coarse sand at 38 ft. Wet.	1225
	22	<10			1220
-40					

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Well ID: **SB46**

Project: **Adams, NE** **Elevation:** 1258.50 ft **Log Date:** 8/28/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	<10	Topsoil	TOPSOIL: Dark gray to black sandy loam.	
	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Organic-rich silty clay at 20-24 ft.	1255
-5	ND	ND			
	ND	ND			
	ND	ND			1250
-10	ND	ND			
	ND	ND			1245
-15	ND	ND			
	ND	ND			1240
-20	ND	ND			
	ND	ND			1235
-25	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey silt.	
	ND	ND			1230
-30	ND	ND	UNIT 3	UNIT 3: Gray to gray-brown clayey sand. Wet.	

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Well ID: **SB47**

Project: **Adams, NE** **Elevation:** 1258.94 ft **Log Date:** 8/28/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 32 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black sandy loam.	
	ND	ND			
			Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Organic-rich silty clay at 16-20 ft.	1255
-5	ND	ND			
	ND	ND			
	ND	ND			1250
-10	ND	ND			
	ND	ND			
					1245
-15	ND	ND			
	ND	ND			
	ND	ND			1240
-20			Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt.	
	ND	ND			
	ND	ND			1235
-25	ND	ND			
	ND	ND			
	ND	ND			1230
-30					
	ND	ND	Unit 3	UNIT 3: Gray-brown silty sand. Wet.	

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Well ID: **SB48**

Project: **Adams, NE** **Elevation:** 1260.35 ft **Log Date:** 8/28/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 36 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black organic-rich loam.	1260
	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Organic-rich clay loam at 3.5-9 ft and highly organic clay at 24-25.5 ft. Fe-Mn oxides at 20-24.5 ft.	
-5	ND	ND			1255
	ND	ND			
	ND	ND			
-10	ND	ND			1250
	ND	ND			
-15	ND	ND			1245
	ND	<10			
	ND	<10			
-20	ND	<10			1240
	ND	ND			
-25	ND	ND			1235
	ND	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt. Fe oxide staining at 31 ft.	
	ND	ND			
-30	ND	ND			1230
	ND	ND	Unit 3	UNIT 3: Gray to gray-brown clayey to very fine sand, coarse sand at 34.5-35 ft, Fe oxide staining. Wet.	
-35	ND	ND			1225

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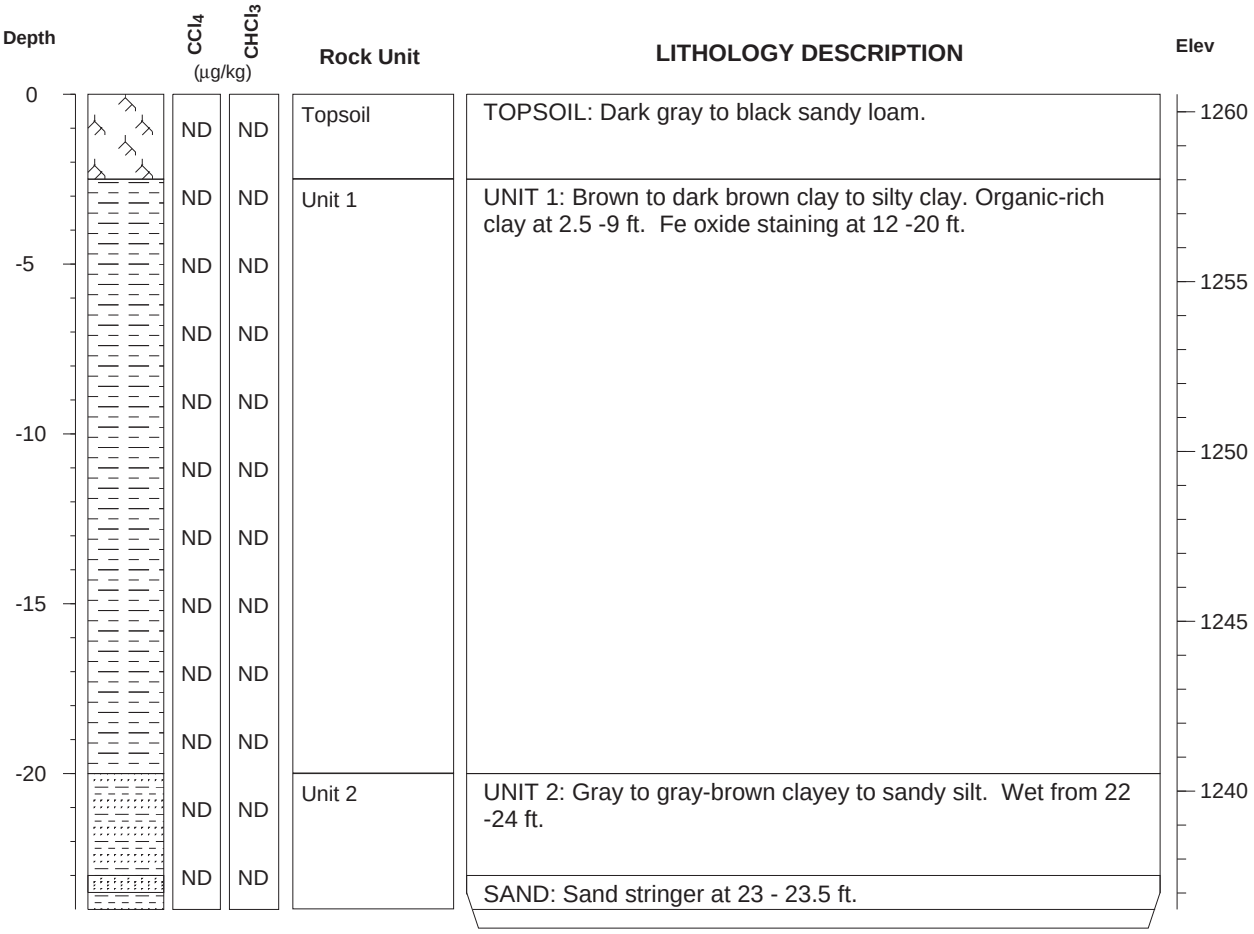
Well ID: **SB49**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1260.51 ft
Depth: 24 ft

Log Date: 8/27/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW



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Well ID: **SB50**

Project: **Adams, NE** **Elevation:** 1259.88 ft **Log Date:** 8/28/01 **Rig:** Geoprobe Model 6600 DT
Geologist: T. Meyer, B. Nashold **Depth:** 36 ft **Plot Date:** 10/16/01 **Drilling Company:** ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	ND	ND	Topsoil	TOPSOIL: Dark gray to black loam.	
	ND	ND			
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Organic stained clay from 3.5-16 ft and highly organic clay at 16-18 ft.	1255
	ND	ND			
	ND	ND			
-10	ND	ND			1250
	ND	<10			
-15	ND	ND			1245
	12	ND			
-20	11	ND	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt. Fe-Mn oxide staining at 18-23 ft and some Fe oxide staining at 31 ft. Wet from 29-34.5 ft.	1240
	12	ND			
	24	<10			
-25	ND	ND			1235
	26	<10			
	16	<10			
-30	196	<10			1230
	527	<10			
-35	402	<10	Unit 3	UNIT 3: Gray to gray-brown clayey to very fine sand, medium grained sand at 35-36 ft, Fe oxide staining. Wet.	1225

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Well ID: **SB51**

Project: **Adams, NE**
Geologist: T. Meyer, B. Nashold

Elevation: 1259.00 ft
Depth: 28 ft

Log Date: 8/29/01
Plot Date: 10/16/01

Rig: Geoprobe Model 6600 DT
Drilling Company: ASW

Depth	CCl_4 (µg/kg)	$CHCl_3$ (µg/kg)	Rock Unit	LITHOLOGY DESCRIPTION	Elev
0	<10	ND	Topsoil	TOPSOIL: Dark gray to black loam to loamy sand.	
	ND	ND			1255
-5	ND	ND	Unit 1	UNIT 1: Brown to dark brown clay to silty clay. Minor organic staining from 11-20 ft. Mn oxide staining at 20 ft.	
	ND	ND			
	ND	ND			1250
-10	ND	ND			
	ND	ND			
					1245
-15	ND	ND			
	<10	ND			
	<10	ND			1240
-20	<10	<10	Unit 2	UNIT 2: Gray to gray-brown clayey to sandy silt. Fe-Mn oxide staining throughout.	
	<10	<10			
					1235
-25	<10	ND			
	<10	ND	Unit 3	UNIT 3: Gray to gray-brown silty sand. Wet.	

Appendix C:

Survey Coordinates

TABLE C.1 Survey coordinates for Phase II sampling locations at Adams, Nebraska.

Location	Horizontal Location[a] (ft)		Representative Ground Surface Elevation[b] (ft AMSL)
	Northing	Easting	
SB21	303634	2831068	1255.90
SB22	303535	2831009	1256.45
SB23	303637	2830940	1256.58
SB24	303591	2830471	1258.40
SB25	303676	2830316	1258.84
SB26	303273	2830552	1260.12
SB27	303538	2830317	1260.80
SB28	303499	2830320	1261.10
SB29	303495	2830353	1260.46
SB30	303437	2830426	1259.64
SB31	303440	2830472	1259.44
SB32	303644	2830530	1257.60
SB33	303598	2830533	1258.11
SB34	303641	2830467	1257.82
SB35	303630	2830408	1258.30
SB36	303630	2830349	1258.95
SB37	303636	2830316	1258.97
SB38	303597	2830405	1258.72
SB39	303587	2830353	1259.53
SB40	303680	2830464	1257.63
SB41	303430	2830321	1261.15
SB42	303211	2830539	1260.58
SB43	303093	2830461	1264.00
SB44	303521	2830563	1257.82
SB45	303680	2830529	1257.52
SB46	303680	2830408	1258.50
SB47	303679	2830349	1258.94
SB48	303538	2830350	1260.35
SB49	303430	2830350	1260.51
SB50	303587	2830317	1259.88
SB51	303676	2830289	1259.00
SB52	303611	2831527	1251.33

[a] Northings and Eastings are Nebraska State Plane Coordinates. Horizontal datum is North America Datum (NAD) 27.

[b] Vertical datum is National Geodetic Vertical Datum (NGVD) 29.

Appendix D:

Soil Sample Data

TABLE D.1 Soil samples collected during the Phase II field investigation at Adams, Nebraska.

Location	Sample	Sample Depth (ft BGL)	Sample Date	Sample Description
SB24	ADNGP91-S-11458	1	8/22/01	Clay loam, black.
SB24	ADNGP93-S-11459	3	8/22/01	Very dark brown clay loam with iron oxides.
SB24	ADNGP95-S-11460	5	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP97-S-11461	7	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP99-S-11462	9	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP911-S-11463	11	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP913-S-11464	13	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP915-S-11465	15	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP917-S-11466	17	8/22/01	Dark brown clay.
SB24	ADNGP919-S-11467	19	8/22/01	Medium dark brown clay.
SB24	ADNGP921-S-11468	21	8/22/01	Brown clayey silt.
SB24	ADNGP923-S-11469	23	8/22/01	Brown clayey silt. Sand at bottom of core.
SB24	ADNGP925-S-11470	25	8/22/01	Brown-gray, slightly silty clay.
SB24	ADNGP927-S-11471	27	8/22/01	Brown-gray, slightly silty clay.
SB24	ADNGP929-S-11472	29	8/22/01	Brown-gray clay with manganese streak and iron oxide.
SB24	ADNGP931-S-11473	31	8/22/01	Brown-gray clay with much iron oxide stain.
SB24	ADNGP933-S-11474	33	8/22/01	Brown clay.
SB24	ADNGP935-S-11475	35	8/22/01	Gray sandy clay.
SB25	ADSB25-S-11483	1	8/23/01	Clay loam, very dark gray.
SB25	ADSB25-S-11484	3	8/23/01	Clay loam, very dark gray.
SB25	ADSB25-S-11485	5	8/23/01	Clay loam, very dark gray.
SB25	ADSB25-S-11486	7	8/23/01	Clay loam, very dark gray.
SB25	ADSB25-S-11487	9	8/23/01	Brown clay.
SB25	ADSB25-S-11488	11	8/23/01	Brown clay with iron oxide.
SB25	ADSB25-S-11489	13	8/23/01	Dark brown clay.
SB25	ADSB25-S-11490	15	8/23/01	Dark brown clay.
SB25	ADSB25-S-11491	17	8/23/01	Brown clay.
SB25	ADSB25-S-11492	19	8/23/01	Brown clay.
SB25	ADSB25-S-11493	21	8/23/01	Pinkish gray clay with iron oxide.
SB25	ADSB25-S-11494	23	8/23/01	Pinkish gray clay with less iron oxide.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB25	ADSB25-S-11495	25	8/23/01	Gray-brown clay.
SB25	ADSB25-S-11496	27	8/23/01	Gray-brown clay.
SB25	ADSB25-S-11497	29	8/23/01	Gray-brown sandy clay.
SB25	ADSB25-S-11498	31	8/23/01	Gray-brown sandy clay.
SB26	ADSB26-S-11682	1	8/23/01	Black loam with sand and small gravel.
SB26	ADSB26-S-11683	3	8/23/01	Black clay loam.
SB26	ADSB26-S-11684	5	8/23/01	Dark brown clay.
SB26	ADSB26-S-11685	7	8/23/01	Dark brown clay.
SB26	ADSB26-S-11686	9	8/23/01	Brown clay, some organics.
SB26	ADSB26-S-11687	11	8/23/01	Brown clay.
SB26	ADSB26-S-11688	13	8/23/01	Dark yellow-brown silty clay.
SB26	ADSB26-S-11689	15	8/23/01	Dark yellow-brown silty clay.
SB26	ADSB26-S-11690	17	8/23/01	Brown silty clay.
SB26	ADSB26-S-11691	19	8/23/01	Dark gray-brown silty clay.
SB26	ADSB26-S-11692	21	8/23/01	Brown very fine sand.
SB26	ADSB26-S-11693	23	8/23/01	Brown clayey very fine sand.
SB26	ADSB26-S-11694	25	8/23/01	Gray-brown clayey silt.
SB26	ADSB26-S-11695	27	8/23/01	Light brownish gray silt
SB26	ADSB26-S-11696	29	8/23/01	Gray-brown extra fine sandy silt (loess like).
SB26	ADSB26-S-11697	31	8/23/01	Gray-brown extra fine sandy silt.
SB26	ADSB26-S-11698	33	8/23/01	Gray clayey sand.
SB26	ADSB26-S-11699	35	8/23/01	Gray clayey sand.
SB26	ADSB26-S-11700	37	8/23/01	Gray clayey sand.
SB26	ADSB26-S-11701	39	8/23/01	Gray clayey sand.
SB27	ADSB27-S-13728	1	8/23/01	Very dark brown silty loam.
SB27	ADSB27-S-13729	3	8/23/01	Black loam.
SB27	ADSB27-S-13730	5	8/23/01	Very dark gray clay, organics.
SB27	ADSB27-S-13731	7	8/23/01	Brown clay with black organic stains.
SB27	ADSB27-S-13732	9	8/23/01	Yellow-brown clay.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB27	ADSB27-S-13733	11	8/23/01	Yellow-brown clay.
SB27	ADSB27-S-13734	13	8/23/01	Very dark gray-brown clay.
SB27	ADSB27-S-13735	15	8/23/01	Very dark gray-brown clay.
SB27	ADSB27-S-13736	17	8/23/01	Brown clay.
SB27	ADSB27-S-13737	19	8/23/01	Light olive-brown silty clay with iron oxide.
SB27	ADSB27-S-13738	21	8/23/01	Light olive-brown silty clay with iron oxide.
SB27	ADSB27-S-13739	23	8/23/01	Light olive-brown silty clay with iron oxide.
SB27	ADSB27-S-13740	25	8/23/01	Brown clayey silt.
SB27	ADSB27-S-13741	27	8/23/01	Grayish brown clayey silt.
SB27	ADSB27-S-13742	29	8/23/01	No description noted.
SB27	ADSB27-S-13743	31	8/23/01	No description noted.
SB28	ADSB28-S-13478	1	8/23/01	Dark grayish brown clay loam.
SB28	ADSB28-S-13479	3	8/23/01	Dark grayish brown clay.
SB28	ADSB28-S-13480	5	8/23/01	Grayish brown clay.
SB28	ADSB28-S-13481	7	8/23/01	Brown clay.
SB28	ADSB28-S-13482	9	8/23/01	Brown clay.
SB28	ADSB28-S-13483	11	8/23/01	Brown clay.
SB28	ADSB28-S-13484	13	8/23/01	Brown clay.
SB28	ADSB28-S-13485	15	8/23/01	Brown clay.
SB28	ADSB28-S-13486	17	8/23/01	Grayish brown clay with iron oxide.
SB28	ADSB28-S-13487	19	8/23/01	Grayish brown clay with iron oxide.
SB28	ADSB28-S-13518	21	8/23/01	Grayish brown clay with iron oxide.
SB28	ADSB28-S-13519	23	8/23/01	Grayish brown clay with iron oxide.
SB28	ADSB28-S-13520	25	8/23/01	Grayish brown clay with iron oxide and manganese.
SB28	ADSB28-S-13521	27	8/23/01	Grayish brown clayey sand/sandy clay.
SB28	ADSB28-S-13522	29	8/23/01	Grayish brown fine sandy silty clay.
SB28	ADSB28-S-13523	31	8/23/01	Grayish brown clayey silt.
SB29	ADSB29-S-13530	1	8/24/01	Very dark gray loam; high in organics.
SB29	ADSB29-S-13531	3	8/24/01	Black loam; high in organics.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB29	ADSB29-S-13532	5	8/24/01	Dark brown clay; organics.
SB29	ADSB29-S-13533	7	8/24/01	Brown clay; medium organics.
SB29	ADSB29-S-13534	9	8/24/01	Dark brown clay; organics.
SB29	ADSB29-S-13535	11	8/24/01	Dark brown clay; organics.
SB29	ADSB29-S-13536	13	8/24/01	Very dark gray clay; organics.
SB29	ADSB29-S-13537	15	8/24/01	Very dark gray clay; organics.
SB29	ADSB29-S-13538	17	8/24/01	Gray-brown sandy clay with a little iron oxide and manganese oxide.
SB29	ADSB29-S-13539	19	8/24/01	Gray-brown silty clay.
SB29	ADSB29-S-13540	21	8/24/01	Gray-brown silty clay with much iron oxide.
SB29	ADSB29-S-13541	23	8/24/01	Gray-brown silty clay with much iron oxide.
SB29	ADSB29-S-13542	25	8/24/01	Gray-brown silty clay with little iron oxide.
SB29	ADSB29-S-13543	27	8/24/01	Gray-brown silty clay.
SB29	ADSB29-S-13544	29	8/24/01	Gray-brown, very fine, sandy clayey silt
SB29	ADSB29-S-13545	31	8/24/01	Gray-brown, very fine, sandy clayey silt. Transitions to clay and sand with much iron oxide and manganese below sampling point.
SB30	ADSB30-S-13548	1	8/24/01	Very dark gray loam; high in organics.
SB30	ADSB30-S-13549	3	8/24/01	Black loam; high in organics.
SB30	ADSB30-S-13550	5	8/24/01	Dark brown clay; organics.
SB30	ADSB30-S-13551	7	8/24/01	Brown clay; organics.
SB30	ADSB30-S-13552	9	8/24/01	Dark brown clay; medium organics.
SB30	ADSB30-S-13553	11	8/24/01	Dark brown clay; organics.
SB30	ADSB30-S-13554	13	8/24/01	Dark brown clay with some iron oxide; organic streaks.
SB30	ADSB30-S-13555	15	8/24/01	Dark brown clay.
SB30	ADSB30-S-13556	17	8/24/01	Dark brown clay.
SB30	ADSB30-S-13557	19	8/24/01	Dark brown clay with manganese oxide.
SB30	ADSB30-S-13558	21	8/24/01	Light olive-brown silty clay with iron oxide.
SB30	ADSB30-S-13559	23	8/24/01	Light olive-brown silty clay with iron oxide.
SB30	ADSB30-S-13560	25	8/24/01	Light olive-brown silty clay with iron oxide and manganese oxide.
SB30	ADSB30-S-13561	27	8/24/01	Light olive-brown silty clay with iron oxide and manganese oxide.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB31	ADSB31-S-13568	1	8/24/01	Very dark gray clay loam; high in organics.
SB31	ADSB31-S-13569	3	8/24/01	Brown clay loam; high in organics.
SB31	ADSB31-S-13570	5	8/24/01	Clay; high in organics.
SB31	ADSB31-S-13571	7	8/24/01	Clay; some organics.
SB31	ADSB31-S-13572	9	8/24/01	Clay.
SB31	ADSB31-S-13573	11	8/24/01	Clay.
SB31	ADSB31-S-13574	13	8/24/01	Clay loam; high in organics.
SB31	ADSB31-S-13575	15	8/24/01	Clay with some iron oxide staining; some organics.
SB31	ADSB31-S-13576	17	8/24/01	Silty clay.
SB31	ADSB31-S-13577	19	8/24/01	Silty clay.
SB31	ADSB31-S-13758	21	8/24/01	Silty clay.
SB31	ADSB31-S-13759	23	8/24/01	Clayey silt.
SB31	ADSB31-S-13760	25	8/24/01	Silt.
SB31	ADSB31-S-13761	27	8/24/01	Silt, saturated below sampling point.
SB31	ADSB31-S-13762	29	8/24/01	Very fine sandy clayey silt.
SB31	ADSB31-S-13763	31	8/24/01	Clayey silt.
SB32	ADSB32-S-13768	1	8/24/01	Loam; organic rich.
SB32	ADSB32-S-13769	3	8/24/01	Loam; organic rich.
SB32	ADSB32-S-13770	5	8/24/01	Loam; some organics.
SB32	ADSB32-S-13771	7	8/24/01	Clay loam; some organics.
SB32	ADSB32-S-13772	9	8/24/01	Clay; organic rich.
SB32	ADSB32-S-13773	11	8/24/01	Clay; organic rich.
SB32	ADSB32-S-13774	13	8/24/01	Silty loamy clay; organics.
SB32	ADSB32-S-13775	15	8/24/01	Silty clay; organics.
SB32	ADSB32-S-13776	17	8/24/01	Silty clay; organic rich.
SB32	ADSB32-S-13777	19	8/24/01	Silty clay; organic rich.
SB32	ADSB32-S-13778	21	8/24/01	3/1 Clayey silt; organic rich.
SB32	ADSB32-S-13779	23	8/24/01	Silty clay; organic rich.
SB32	ADSB32-S-13780	25	8/24/01	Clay with iron oxide.
SB32	ADSB32-S-13781	27	8/24/01	Clay with iron oxide.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB32	ADSB32-S-13782	29	8/24/01	Clayey sand with iron oxide, saturated.
SB32	ADSB32-S-13783	31	8/24/01	Clayey silt.
SB33	ADSB33-S-13788	1	8/25/01	Loam with iron oxide and a little iron-manganese oxide; medium organics.
SB33	ADSB33-S-13789	3	8/25/01	Loam; medium organics.
SB33	ADSB33-S-13790	5	8/25/01	Sandy clay; medium organics.
SB33	ADSB33-S-13791	7	8/25/01	Silty clay; medium organics.
SB33	ADSB33-S-13792	9	8/25/01	Clay; medium organics.
SB33	ADSB33-S-13793	11	8/25/01	Clay; medium organics.
SB33	ADSB33-S-13794	13	8/25/01	Clay; organics.
SB33	ADSB33-S-13795	15	8/25/01	Clay; organics.
SB33	ADSB33-S-13796	17	8/25/01	Silty clay; medium organics.
SB33	ADSB33-S-13797	19	8/25/01	Clay; medium organics.
SB33	ADSB33-S-13798	21	8/25/01	Clay.
SB33	ADSB33-S-13799	23	8/25/01	Silty clay.
SB33	ADSB33-S-13800	25	8/25/01	Silty clay.
SB33	ADSB33-S-13801	27	8/25/01	Clayey silt.
SB33	ADSB33-S-13802	29	8/25/01	Clay with fine to medium sand, saturated.
SB33	ADSB33-S-13803	31	8/25/01	Clay, tight.
SB34	ADSB34-S-13806	1	8/25/01	Loam; high in organics.
SB34	ADSB34-S-13807	3	8/25/01	Loam; high in organics.
SB34	ADSB34-S-13808	5	8/25/01	Clay; some organics.
SB34	ADSB34-S-13809	7	8/25/01	Clay; some organics.
SB34	ADSB34-S-13810	9	8/25/01	Clay; medium organics.
SB34	ADSB34-S-13811	11	8/25/01	Silty clay; medium organics.
SB34	ADSB34-S-13812	13	8/25/01	Silty clay.
SB34	ADSB34-S-13813	15	8/25/01	Clayey silt.
SB34	ADSB34-S-13814	17	8/25/01	Clayey silt; medium organics.
SB34	ADSB34-S-13815	19	8/25/01	Clayey silt; medium organics.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB34	ADSB34-S-13816	21	8/25/01	Stiff clay; medium organics.
SB34	ADSB34-S-13817	23	8/25/01	Stiff clay with iron oxide stain; little organic stain.
SB34	ADSB34-S-13818	25	8/25/01	Silty clay with iron oxide stain.
SB34	ADSB34-S-13819	27	8/25/01	Silty clay with iron oxide nodules.
SB34	ADSB34-S-13820	29	8/25/01	Medium sand, saturated.
SB34	ADSB34-S-13821	31	8/25/01	Clay.
SB35	ADSB35-S-13830	1	8/25/01	Loam with iron oxide and little iron oxide; much organic material.
SB35	ADSB35-S-13831	3	8/25/01	Loam; much organic material.
SB35	ADSB35-S-13832	5	8/25/01	Loamy clay; some organics.
SB35	ADSB35-S-13833	7	8/25/01	Loamy clay; some organics.
SB35	ADSB35-S-13834	9	8/25/01	Clay; medium organics.
SB35	ADSB35-S-13835	11	8/25/01	Clay; medium organics.
SB35	ADSB35-S-13836	13	8/25/01	Clay; some organics.
SB35	ADSB35-S-13837	15	8/25/01	Silty clay; little organic material.
SB35	ADSB35-S-13838	17	8/25/01	3/1 Silty clay; organics.
SB35	ADSB35-S-13839	19	8/25/01	Silt; organics.
SB35	ADSB35-S-13840	21	8/25/01	Clay; little organic material.
SB35	ADSB35-S-13841	23	8/25/01	Stiff clay.
SB35	ADSB35-S-13842	25	8/25/01	Silty clay.
SB35	ADSB35-S-13843	27	8/25/01	Clayey silt with black stains.
SB35	ADSB35-S-13844	29	8/25/01	Sand with iron nodules and stains, saturated.
SB35	ADSB35-S-13845	31	8/25/01	5/1 Clay.
SB36	ADSB36-S-13848	1	8/25/01	Loam; much organic material.
SB36	ADSB36-S-13849	3	8/25/01	Loam; much organic material.
SB36	ADSB36-S-13850	5	8/25/01	Clay; some organics.
SB36	ADSB36-S-13851	7	8/25/01	Clay; some organics.
SB36	ADSB36-S-13852	9	8/25/01	Clay; medium organics.
SB36	ADSB36-S-13853	11	8/25/01	Clay; medium organics.
SB36	ADSB36-S-13854	13	8/25/01	Clay; some organics.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB36	ADSB36-S-13855	15	8/25/01	Clay; little organic material.
SB36	ADSB36-S-13856	17	8/25/01	Silty clay; organics.
SB36	ADSB36-S-13857	19	8/25/01	Clay; organics.
SB36	ADSB36-S-13858	21	8/25/01	Clay with iron oxide; little organic material.
SB36	ADSB36-S-13859	23	8/25/01	Silty clay with iron oxide.
SB36	ADSB36-S-13860	25	8/25/01	Silty clay with iron oxide, saturated.
SB36	ADSB36-S-13861	27	8/25/01	Silty clay with iron oxide, saturated.
SB36	ADSB36-S-13862	29	8/25/01	Silty clay with iron oxide, wet.
SB36	ADSB36-S-13863	31	8/25/01	Silty fine sandy clay with iron oxide.
SB37	ADSB37-S-13886	1	8/26/01	Loam; high in organics.
SB37	ADSB37-S-13887	3	8/26/01	Loam; high in organics.
SB37	ADSB37-S-13888	5	8/26/01	Silty clay; some organics.
SB37	ADSB37-S-13889	7	8/26/01	Clay; some organics.
SB37	ADSB37-S-13890	9	8/26/01	Clay; some organics.
SB37	ADSB37-S-13891	11	8/26/01	No description noted.
SB37	ADSB37-S-13892	13	8/26/01	Clay; some organics.
SB37	ADSB37-S-13893	15	8/26/01	Clay; some organics.
SB37	ADSB37-S-13894	17	8/26/01	Clay.
SB37	ADSB37-S-13895	19	8/26/01	Clay with a little iron oxide and manganese oxide.
SB37	ADSB37-S-13896	21	8/26/01	Silty clay with much iron oxide and manganese oxide.
SB37	ADSB37-S-13897	23	8/26/01	Clayey silt with very much iron oxide and a little manganese oxide.
SB37	ADSB37-S-13898	25	8/26/01	No description noted.
SB37	ADSB37-S-13899	27	8/26/01	Clayey silt.
SB37	ADSB37-S-13900	29	8/26/01	Silty clay.
SB37	ADSB37-S-13901	31	8/26/01	Silty sandy clay with iron oxide nodules. Coarse sandy clay with manganese and iron oxides and specks of reduced iron at bottom of hole below sampling location, with some gravel up to 1 cm.
SB38	ADSB38-S-13904	1	8/26/01	Loam with iron oxide stain.
SB38	ADSB38-S-13905	3	8/26/01	Loam.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB38	ADSB38-S-13906	5	8/26/01	Loamy clay.
SB38	ADSB38-S-13907	7	8/26/01	Clay with light yellow mottles.
SB38	ADSB38-S-13918	9	8/26/01	Clay.
SB38	ADSB38-S-13919	11	8/26/01	Clay.
SB38	ADSB38-S-13920	13	8/26/01	Silty clay.
SB38	ADSB38-S-13921	15	8/26/01	Clay.
SB38	ADSB38-S-13922	17	8/26/01	Silty clay.
SB38	ADSB38-S-13923	19	8/26/01	Clay.
SB38	ADSB38-S-13924	21	8/26/01	Clay with some manganese oxide.
SB38	ADSB38-S-13925	23	8/26/01	Clay with some iron oxide and manganese oxide.
SB38	ADSB38-S-13926	25	8/26/01	Clayey silt with some iron oxide and manganese oxide.
SB38	ADSB38-S-13927	27	8/26/01	Medium sand.
SB38	ADSB38-S-13928	29	8/26/01	Clayey silt.
SB38	ADSB38-S-13929	31	8/26/01	Silty clay.
SB39	ADSB39-S-13932	1	8/26/01	Loam with iron stains.
SB39	ADSB39-S-13933	3	8/26/01	Loam.
SB39	ADSB39-S-13934	5	8/26/01	Clay.
SB39	ADSB39-S-13935	7	8/26/01	Clay.
SB39	ADSB39-S-13936	9	8/26/01	Clay.
SB39	ADSB39-S-13937	11	8/26/01	Clay.
SB39	ADSB39-S-13938	13	8/26/01	Clay.
SB39	ADSB39-S-13939	15	8/26/01	Clay.
SB39	ADSB39-S-13940	17	8/26/01	Clay.
SB39	ADSB39-S-13941	19	8/26/01	Clay.
SB39	ADSB39-S-13942	21	8/26/01	Clay.
SB39	ADSB39-S-13943	23	8/26/01	Clay with manganese oxide and iron oxide.
SB39	ADSB39-S-13944	25	8/26/01	Clayey silt with iron oxide.
SB39	ADSB39-S-13945	27	8/26/01	Silty clay with iron oxide and manganese oxide.
SB39	ADSB39-S-13946	29	8/26/01	Fine sandy silt.
SB39	ADSB39-S-13947	31	8/26/01	Silty fine sand.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB40	ADSB40-S-13648	1	8/27/01	Organic-rich loam.
SB40	ADSB40-S-13649	3	8/27/01	Organic-rich loam.
SB40	ADSB40-S-13650	5	8/27/01	Organic clay.
SB40	ADSB40-S-13651	7	8/27/01	Organic clay.
SB40	ADSB40-S-13652	9	8/27/01	Organic clay.
SB40	ADSB40-S-13653	11	8/27/01	Organic silty clay.
SB40	ADSB40-S-13654	13	8/27/01	Organic silty clay.
SB40	ADSB40-S-13655	15	8/27/01	Organic silty clay.
SB40	ADSB40-S-13656	17	8/27/01	Organic-rich clay.
SB40	ADSB40-S-13657	19	8/27/01	Organic-rich silty clay.
SB40	ADSB40-S-13658	21	8/27/01	Silty clay; nonorganic.
SB40	ADSB40-S-13659	23	8/27/01	Clay.
SB40	ADSB40-S-13660	25	8/27/01	Clay.
SB40	ADSB40-S-13661	27	8/27/01	Clay with iron oxide and manganese oxide stains.
SB40	ADSB40-S-13662	29	8/27/01	Silty clay.
SB40	ADSB40-S-13663	31	8/27/01	Silty clay with iron oxide and manganese oxide stains, wet but not in saturated sand.
SB41	ADSB41-S-13666	1	8/27/01	Organic clay.
SB41	ADSB41-S-13667	3	8/27/01	Organic clay.
SB41	ADSB41-S-13668	5	8/27/01	Very organic clay.
SB41	ADSB41-S-13669	7	8/27/01	Clay with a little organic material.
SB41	ADSB41-S-13670	9	8/27/01	Clay with a little organic material.
SB41	ADSB41-S-13671	11	8/27/01	Clay with a little organic material.
SB41	ADSB41-S-13672	13	8/27/01	Clay with much iron oxide and manganese oxide.
SB41	ADSB41-S-13673	15	8/27/01	Clay with iron oxide.
SB41	ADSB41-S-13674	17	8/27/01	Clayey silt.
SB41	ADSB41-S-13675	19	8/27/01	Sandy silty clay with iron oxide and manganese oxide.
SB41	ADSB41-S-13676	21	8/27/01	Water-saturated clay.
SB41	ADSB41-S-13677	23	8/27/01	Sand with organic content.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB41	ADSB41-S-13678	25	8/27/01	Saturated sandy silt.
SB41	ADSB41-S-13679	27	8/27/01	Saturated sandy silt.
SB42	ADSB42-S-13682	1	8/27/01	Sandy loam; organics.
SB42	ADSB42-S-13683	3	8/27/01	Loam; organics.
SB42	ADSB42-S-13684	5	8/27/01	Clay; organics.
SB42	ADSB42-S-13685	7	8/27/01	Clay; organics.
SB42	ADSB42-S-13686	9	8/27/01	Silty clay; organics.
SB42	ADSB42-S-13687	11	8/27/01	Silty clay; organics.
SB42	ADSB42-S-13688	13	8/27/01	Silty clay with iron oxide stains; low in organics.
SB42	ADSB42-S-13689	15	8/27/01	Silty clay with manganese oxide stains; medium organics.
SB42	ADSB42-S-13690	17	8/27/01	Fine sandy silty clay; medium organics.
SB42	ADSB42-S-13691	19	8/27/01	Fine sandy clay; medium organics.
SB42	ADSB42-S-13692	21	8/27/01	Sandy clay with manganese oxide; no organics.
SB42	ADSB42-S-13693	23	8/27/01	Clayey sand; no organics.
SB43	ADSB43-S-13698	1	8/27/01	Sandy loam; high in organics.
SB43	ADSB43-S-13699	3	8/27/01	Clay loam; high in organics.
SB43	ADSB43-S-13700	5	8/27/01	Clay; high in organics.
SB43	ADSB43-S-13701	7	8/27/01	Clay; high in organics.
SB43	ADSB43-S-13702	9	8/27/01	Clay; high in organics.
SB43	ADSB43-S-13703	11	8/27/01	Silty clay; no organics.
SB43	ADSB43-S-13704	13	8/27/01	Saturated (loess-like) slightly clayey silt; no organics.
SB43	ADSB43-S-13705	15	8/27/01	Saturated (loess-like) very slightly clayey silt; no organics.
SB43	ADSB43-S-13706	17	8/27/01	Saturated (loess-like) very slightly clayey silt with occasional large stains; no organics.
SB43	ADSB43-S-13707	19	8/27/01	Saturated (loess-like) very fine sandy silt.
SB43	ADSB43-S-13948	21	8/27/01	Saturated very fine sandy silt with discrete iron oxide; no organics.
SB43	ADSB43-S-13949	23	8/27/01	Saturated very fine sandy silt with discrete iron oxide; no organics.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB45	ADSB45-S-13513	1	8/28/01	Loam; high in organics.
SB45	ADSB45-S-13514	3	8/28/01	Loam; medium organics.
SB45	ADSB45-S-13515	5	8/28/01	Clayey sandy; no organics.
SB45	ADSB45-S-13516	7	8/28/01	Loam; low in organics.
SB45	ADSB45-S-13517	9	8/28/01	Loamy clay; low in organics.
SB45	ADSB45-S-13525	11	8/28/01	Loamy clay; low in organics.
SB45	ADSB45-S-13767	13	8/28/01	Clayey silt; very low in organics.
SB45	ADSB45-S-13747	15	8/28/01	Clayey silt; very low in organics.
SB45	ADSB45-S-11480	17	8/28/01	Clay; organics.
SB45	ADSB45-S-11481	19	8/28/01	Clay; organics.
SB45	ADSB45-S-11482	21	8/28/01	Clay; high in organics.
SB45	ADSB45-S-13694	23	8/28/01	Clay; high in organics.
SB45	ADSB45-S-13695	25	8/28/01	Clay; no organics.
SB45	ADSB45-S-13696	27	8/28/01	Clay with iron stains; no organics.
SB45	ADSB45-S-13697	29	8/28/01	Clay with iron stains; no organics.
SB45	ADSB45-S-13510	31	8/28/01	Saturated, very fine sandy clay; no organics.
SB45	ADSB45-S-13958	33	8/28/01	Saturated silt; no organics.
SB45	ADSB45-S-13959	35	8/28/01	Saturated silt; no organics.
SB46	ADSB46-S-13962	1	8/28/01	Loam; medium organics.
SB46	ADSB46-S-13963	3	8/28/01	Loam with inclusions; medium organics.
SB46	ADSB46-S-13964	5	8/28/01	Clay; medium organics.
SB46	ADSB46-S-13965	7	8/28/01	Sandy clay; low to no organics.
SB46	ADSB46-S-13966	9	8/28/01	Clay; medium organics.
SB46	ADSB46-S-13967	11	8/28/01	Clay; medium organics.
SB46	ADSB46-S-13968	13	8/28/01	Clay; medium organics.
SB46	ADSB46-S-13969	15	8/28/01	Clay; low in organics.
SB46	ADSB46-S-13970	17	8/28/01	Silty clay; medium organics.
SB46	ADSB46-S-13971	19	8/28/01	Silty clay; medium organics.
SB46	ADSB46-S-13972	21	8/28/01	Clay; high in organics.
SB46	ADSB46-S-13973	23	8/28/01	Black silty clay; very high in organics. Continues to bottom of core at 24 ft.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB46	ADSB46-S-13974	25	8/28/01	Clay with some iron oxide and manganese oxide; no organics.
SB46	ADSB46-S-13975	27	8/28/01	Clay with some iron oxide and manganese oxide; no organics.
SB46	ADSB46-S-13976	29	8/28/01	Clay with some iron oxide and manganese oxide.
SB46	ADSB46-S-13977	31	8/28/01	Clay with iron staining. Collected immediately below saturated sand pocket with heavy iron staining; partly reduced and partly oxidized.
SB47	ADSB47-S-13982	1	8/28/01	Sandy loam; organics.
SB47	ADSB47-S-13983	3	8/28/01	Sandy loam; organic stain.
SB47	ADSB47-S-13984	5	8/28/01	Clay; organic stain.
SB47	ADSB47-S-13985	7	8/28/01	Clay; organic stain.
SB47	ADSB47-S-13986	9	8/28/01	Clay; organic stain.
SB47	ADSB47-S-13987	11	8/28/01	Clay; organic stain.
SB47	ADSB47-S-13988	13	8/28/01	Clay; organic stain.
SB47	ADSB47-S-13989	15	8/28/01	Clay; organic stain.
SB47	ADSB47-S-13990	17	8/28/01	Silty clay; organics.
SB47	ADSB47-S-13991	19	8/28/01	Clayey silt; organics.
SB47	ADSB47-S-13992	21	8/28/01	Clay; no organics.
SB47	ADSB47-S-13993	23	8/28/01	Clay; no organics.
SB47	ADSB47-S-13994	25	8/28/01	Clayey silt; no organics.
SB47	ADSB47-S-13995	27	8/28/01	Clayey silt; no organics.
SB47	ADSB47-S-13996	29	8/28/01	Silty clay; no organics.
SB47	ADSB47-S-13997	31	8/28/01	Clayey silt; no organics. Grades to clayey sand and water-saturated sand at bottom of core at 32 ft.
SB48	ADSB48-S-14022	1	8/28/01	Base of fill or disturbed loam; organics.
SB48	ADSB48-S-14023	3	8/28/01	Loam; high in organics.
SB48	ADSB48-S-14024	5	8/28/01	Clay loam; heavy organic stain.
SB48	ADSB48-S-14025	7	8/28/01	Clay loam; high in organics.
SB48	ADSB48-S-14026	9	8/28/01	Clay loam; heavy organic stain.
SB48	ADSB48-S-14027	11	8/28/01	Clay.
SB48	ADSB48-S-14028	13	8/28/01	Clay.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB48	ADSB48-S-14029	15	8/28/01	Clay.
SB48	ADSB48-S-14030	17	8/28/01	Clay.
SB48	ADSB48-S-14031	19	8/28/01	Clay.
SB48	ADSB48-S-14032	21	8/28/01	Clay with iron and manganese oxides.
SB48	ADSB48-S-14033	23	8/28/01	Clay with iron and manganese oxides.
SB48	ADSB48-S-14034	25	8/28/01	Clay; high in organics.
SB48	ADSB48-S-14035	27	8/28/01	Silty clay.
SB48	ADSB48-S-14036	29	8/28/01	Clay; high in organics.
SB48	ADSB48-S-14037	31	8/28/01	Silty clay with iron oxide.
SB48	ADSB48-S-14038	33	8/28/01	Silty clayey very fine sand with iron oxide.
SB48	ADSB48-S-14039	35	8/28/01	Sandy clayey silt with iron oxide at transition to coarse sand.
SB49	ADSB49-S-13956	1	8/27/01	Sandy loam; medium organics.
SB49	ADSB49-S-13957	3	8/27/01	Clay; medium organics.
SB49	ADSB49-S-13638	5	8/27/01	Clay; high in organics.
SB49	ADSB49-S-13639	7	8/27/01	Clay; high in organics.
SB49	ADSB49-S-13640	9	8/27/01	Clay; low in organics.
SB49	ADSB49-S-13641	11	8/27/01	Clay; no organics.
SB49	ADSB49-S-13642	13	8/27/01	Clay with some iron oxide; no organics.
SB49	ADSB49-S-13643	15	8/27/01	Silty clay with much iron oxide; no organics.
SB49	ADSB49-S-13644	17	8/27/01	Silty clay with iron oxide; no organics.
SB49	ADSB49-S-13645	19	8/27/01	Silty clay with iron oxide; no organics.
SB49	ADSB49-S-13646	21	8/27/01	Very fine sandy silt; no organics.
SB49	ADSB49-S-13647	23	8/27/01	Saturated (loess-like) sandy silt; no organics. Grades to sand, then back to silty sand below sampling point; single 2-cm piece of gravel at bottom of core.
SB50	ADSB50-S-14000	1	8/28/01	Loam; organics.
SB50	ADSB50-S-14001	3	8/28/01	Loam; organics.
SB50	ADSB50-S-14002	5	8/28/01	Clay; organic stain.
SB50	ADSB50-S-14003	7	8/28/01	Clay; organic stain.

TABLE D.1 (Cont.)

Location	Sample ID	Sample Depth (ft BGL)	Sample Date	Sample Description
SB50	ADSB50-S-14004	9	8/28/01	Clay; organic stain.
SB50	ADSB50-S-14005	11	8/28/01	Clay; organic stain.
SB50	ADSB50-S-14006	13	8/28/01	Clay; organic stain.
SB50	ADSB50-S-14007	15	8/28/01	Clay; organic stain.
SB50	ADSB50-S-14008	17	8/28/01	Clay; no organics.
SB50	ADSB50-S-14009	19	8/28/01	Silty clay with manganese oxide; no organics.
SB50	ADSB50-S-14010	21	8/28/01	Silty clay with iron and manganese oxides; no organics.
SB50	ADSB50-S-14011	23	8/28/01	Silty clay with iron and manganese oxides; no organics.
SB50	ADSB50-S-14012	25	8/28/01	Silty clay; no organics.
SB50	ADSB50-S-14013	27	8/28/01	Silty clay; no organics.
SB50	ADSB50-S-14014	29	8/28/01	Saturated clayey silt; no organics.
SB50	ADSB50-S-14015	31	8/28/01	Clayey silt with some iron oxide; no organics.
SB50	ADSB50-S-14016	33	8/28/01	Clayey silt; no organics.
SB50	ADSB50-S-14017	35	8/28/01	Fine sand silty clay; no organics. At 34.5 ft, coarse sand transitions to sandy silty clay at sampling point, with medium-grained sand below at 35-36 ft.
SB51	ADSB51-S-14042	1	8/29/01	Loam; low in organics.
SB51	ADSB51-S-14043	3	8/29/01	Loamy sand; low in organics.
SB51	ADSB51-S-14044	5	8/29/01	Loam; low in organics.
SB51	ADSB51-S-14045	7	8/29/01	Clay; low in organics.
SB51	ADSB51-S-14046	9	8/29/01	Clayey sand; low in organics.
SB51	ADSB51-S-14047	11	8/29/01	Clay; medium organic stain.
SB51	ADSB51-S-14048	13	8/29/01	Clay; medium organic stain.
SB51	ADSB51-S-14049	15	8/29/01	Clay; medium organic stain.
SB51	ADSB51-S-14050	17	8/29/01	Clay; medium organic stain.
SB51	ADSB51-S-14051	19	8/29/01	Clay, manganese present; medium organic stain.
SB51	ADSB51-S-14052	21	8/29/01	Slightly silty clay, with iron and manganese oxides; no organics.
SB51	ADSB51-S-14053	23	8/29/01	Slightly silty clay, manganese and much iron oxides; no organics.
SB51	ADSB51-S-14054	25	8/29/01	Silty clay, with iron oxide; no organics.
SB51	ADSB51-S-14055	27	8/29/01	Silty clay, less iron oxide than above; no organics.

TABLE D.2 Results of organic analyses by purge-and-trap method on soil samples collected during the Phase II investigation at Adams, Nebraska.

				Concentration (μg/kg)		
Location	Sample	Depth (ft BGL)	Sample Date	Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB24	ADNGP91-S-11458	1	8/22/01	ND[a]	ND	ND
SB24	ADNGP93-S-11459	3	8/22/01	ND	ND	ND
SB24	ADNGP95-S-11460	5	8/22/01	ND	ND	ND
SB24	ADNGP97-S-11461	7	8/22/01	ND	ND	ND
SB24	ADNGP99-S-11462	9	8/22/01	ND	ND	ND
SB24	ADNGP911-S-11463	11	8/22/01	ND	ND	ND
SB24	ADNGP913-S-11464	13	8/22/01	ND	ND	ND
SB24	ADNGP915-S-11465	15	8/22/01	ND	ND	ND
SB24	ADNGP917-S-11466	17	8/22/01	< 10[b]	ND	ND
SB24	ADNGP919-S-11467	19	8/22/01	< 10	ND	ND
SB24	ADNGP921-S-11468	21	8/22/01	< 10	ND	ND
SB24	ADNGP923-S-11469	23	8/22/01	< 10	ND	ND
SB24	ADNGP925-S-11470	25	8/22/01	< 10	ND	ND
SB24	ADNGP927-S-11471	27	8/22/01	< 10	ND	ND
SB24	ADNGP929-S-11472	29	8/22/01	ND	ND	ND
SB24	ADNGP931-S-11473	31	8/22/01	< 10	ND	ND
SB24	ADNGP933-S-11474	33	8/22/01	< 10	ND	ND
SB24	ADNGP935-S-11475	35	8/22/01	23	ND	ND
SB25	ADSB25-S-11483	1	8/23/01	ND	ND	ND
SB25	ADSB25-S-11484	3	8/23/01	ND	ND	ND
SB25	ADSB25-S-11485	5	8/23/01	ND	ND	ND
SB25	ADSB25-S-11486	7	8/23/01	ND	ND	ND
SB25	ADSB25-S-11487	9	8/23/01	ND	ND	ND
SB25	ADSB25-S-11488	11	8/23/01	ND	ND	ND
SB25	ADSB25-S-11489	13	8/23/01	ND	ND	ND
SB25	ADSB25-S-11490	15	8/23/01	ND	ND	ND
SB25	ADSB25-S-11491	17	8/23/01	ND	ND	ND
SB25	ADSB25-S-11492	19	8/23/01	ND	ND	ND
SB25	ADSB25-S-11493	21	8/23/01	ND	ND	ND
SB25	ADSB25-S-11494	23	8/23/01	ND	ND	ND
SB25	ADSB25-S-11495	25	8/23/01	ND	ND	ND
SB25	ADSB25-S-11496	27	8/23/01	ND	ND	ND
SB25	ADSB25-S-11497	29	8/23/01	ND	ND	ND
SB25	ADSB25-S-11498	31	8/23/01	ND	ND	ND
SB26	ADSB26-S-11682	1	8/23/01	< 10	ND	ND
SB26	ADSB26-S-11683	3	8/23/01	ND	ND	ND
SB26	ADSB26-S-11684	5	8/23/01	ND	ND	ND
SB26	ADSB26-S-11685	7	8/23/01	ND	ND	ND
SB26	ADSB26-S-11686	9	8/23/01	ND	ND	ND
SB26	ADSB26-S-11687	11	8/23/01	ND	ND	ND
SB26	ADSB26-S-11688	13	8/23/01	ND	ND	ND
SB26	ADSB26-S-11689	15	8/23/01	ND	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB26	ADSB26-S-11690	17	8/23/01	ND	ND	ND
SB26	ADSB26-S-11691	19	8/23/01	ND	ND	ND
SB26	ADSB26-S-11692	21	8/23/01	ND	ND	ND
SB26	ADSB26-S-11693	23	8/23/01	ND	ND	ND
SB26	ADSB26-S-11694	25	8/23/01	ND	ND	ND
SB26	ADSB26-S-11695	27	8/23/01	ND	ND	ND
SB26	ADSB26-S-11696	29	8/23/01	ND	ND	ND
SB26	ADSB26-S-11697	31	8/23/01	ND	ND	ND
SB26	ADSB26-S-11698	33	8/23/01	ND	ND	ND
SB26	ADSB26-S-11699	35	8/23/01	ND	ND	ND
SB26	ADSB26-S-11700	37	8/23/01	ND	ND	ND
SB26	ADSB26-S-11701	39	8/23/01	ND	ND	ND
SB27	ADSB27-S-13728	1	8/23/01	ND	ND	ND
SB27	ADSB27-S-13729	3	8/23/01	ND	ND	ND
SB27	ADSB27-S-13730	5	8/23/01	ND	ND	ND
SB27	ADSB27-S-13731	7	8/23/01	ND	ND	ND
SB27	ADSB27-S-13732	9	8/23/01	ND	ND	ND
SB27	ADSB27-S-13733	11	8/23/01	ND	ND	ND
SB27	ADSB27-S-13734	13	8/23/01	< 10	ND	ND
SB27	ADSB27-S-13735	15	8/23/01	< 10	ND	ND
SB27	ADSB27-S-13736	17	8/23/01	10	ND	ND
SB27	ADSB27-S-13737	19	8/23/01	11	ND	ND
SB27	ADSB27-S-13738	21	8/23/01	10	ND	ND
SB27	ADSB27-S-13739	23	8/23/01	11	ND	ND
SB27	ADSB27-S-13740	25	8/23/01	12	ND	ND
SB27	ADSB27-S-13741	27	8/23/01	15	ND	ND
SB27	ADSB27-S-13742	29	8/23/01	< 10	ND	ND
SB27	ADSB27-S-13743	31	8/23/01	< 10	ND	ND
SB28	ADSB28-S-13478	1	8/23/01	ND	ND	ND
SB28	ADSB28-S-13479	3	8/23/01	ND	ND	ND
SB28	ADSB28-S-13480	5	8/23/01	ND	ND	ND
SB28	ADSB28-S-13481	7	8/23/01	ND	ND	ND
SB28	ADSB28-S-13482	9	8/23/01	ND	ND	ND
SB28	ADSB28-S-13483	11	8/23/01	ND	ND	ND
SB28	ADSB28-S-13484	13	8/23/01	ND	ND	ND
SB28	ADSB28-S-13485	15	8/23/01	ND	ND	ND
SB28	ADSB28-S-13486	17	8/23/01	ND	ND	ND
SB28	ADSB28-S-13487	19	8/23/01	ND	ND	ND
SB28	ADSB28-S-13518	21	8/23/01	ND	ND	ND
SB28	ADSB28-S-13519	23	8/23/01	ND	ND	ND
SB28	ADSB28-S-13520	25	8/23/01	ND	ND	ND
SB28	ADSB28-S-13521	27	8/23/01	ND	ND	ND
SB28	ADSB28-S-13522	29	8/23/01	ND	ND	ND
SB28	ADSB28-S-13523	31	8/23/01	ND	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB29	ADSB29-S-13530	1	8/24/01	ND	ND	ND
SB29	ADSB29-S-13531	3	8/24/01	ND	ND	ND
SB29	ADSB29-S-13532	5	8/24/01	ND	ND	ND
SB29	ADSB29-S-13533	7	8/24/01	ND	ND	ND
SB29	ADSB29-S-13534	9	8/24/01	ND	ND	ND
SB29	ADSB29-S-13535	11	8/24/01	ND	ND	ND
SB29	ADSB29-S-13536	13	8/24/01	ND	ND	ND
SB29	ADSB29-S-13537	15	8/24/01	ND	ND	ND
SB29	ADSB29-S-13538	17	8/24/01	ND	ND	ND
SB29	ADSB29-S-13539	19	8/24/01	ND	ND	ND
SB29	ADSB29-S-13540	21	8/24/01	ND	ND	ND
SB29	ADSB29-S-13541	23	8/24/01	ND	ND	ND
SB29	ADSB29-S-13542	25	8/24/01	ND	ND	ND
SB29	ADSB29-S-13543	27	8/24/01	ND	ND	ND
SB29	ADSB29-S-13544	29	8/24/01	ND	ND	ND
SB29	ADSB29-S-13545	31	8/24/01	ND	ND	ND
SB30	ADSB30-S-13548	1	8/24/01	12	ND	ND
SB30	ADSB30-S-13549	3	8/24/01	< 10	ND	ND
SB30	ADSB30-S-13550	5	8/24/01	ND	ND	ND
SB30	ADSB30-S-13551	7	8/24/01	ND	ND	ND
SB30	ADSB30-S-13552	9	8/24/01	ND	ND	ND
SB30	ADSB30-S-13553	11	8/24/01	ND	ND	ND
SB30	ADSB30-S-13554	13	8/24/01	ND	ND	ND
SB30	ADSB30-S-13555	15	8/24/01	< 10	ND	ND
SB30	ADSB30-S-13556	17	8/24/01	< 10	ND	ND
SB30	ADSB30-S-13557	19	8/24/01	ND	ND	ND
SB30	ADSB30-S-13558	21	8/24/01	ND	ND	ND
SB30	ADSB30-S-13559	23	8/24/01	ND	ND	ND
SB30	ADSB30-S-13560	25	8/24/01	ND	ND	ND
SB30	ADSB30-S-13561	27	8/24/01	ND	ND	ND
SB31	ADSB31-S-13568	1	8/24/01	36	ND	ND
SB31	ADSB31-S-13569	3	8/24/01	14	ND	ND
SB31	ADSB31-S-13570	5	8/24/01	< 10	ND	ND
SB31	ADSB31-S-13571	7	8/24/01	< 10	ND	ND
SB31	ADSB31-S-13572	9	8/24/01	< 10	ND	ND
SB31	ADSB31-S-13573	11	8/24/01	< 10	ND	ND
SB31	ADSB31-S-13574	13	8/24/01	11	ND	ND
SB31	ADSB31-S-13575	15	8/24/01	15	ND	ND
SB31	ADSB31-S-13576	17	8/24/01	11	ND	ND
SB31	ADSB31-S-13577	19	8/24/01	23	ND	ND
SB31	ADSB31-S-13758	21	8/24/01	24	ND	ND
SB31	ADSB31-S-13759	23	8/24/01	24	ND	ND
SB31	ADSB31-S-13760	25	8/24/01	18	ND	ND
SB31	ADSB31-S-13761	27	8/24/01	< 10	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB31	ADSB31-S-13762	29	8/24/01	< 10	ND	ND
SB31	ADSB31-S-13763	31	8/24/01	< 10	ND	ND
SB32	ADSB32-S-13768	1	8/24/01	ND	ND	ND
SB32	ADSB32-S-13769	3	8/24/01	ND	ND	ND
SB32	ADSB32-S-13770	5	8/24/01	ND	ND	ND
SB32	ADSB32-S-13771	7	8/24/01	ND	ND	ND
SB32	ADSB32-S-13772	9	8/24/01	ND	ND	ND
SB32	ADSB32-S-13773	11	8/24/01	ND	ND	ND
SB32	ADSB32-S-13774	13	8/24/01	ND	ND	ND
SB32	ADSB32-S-13775	15	8/24/01	ND	ND	ND
SB32	ADSB32-S-13776	17	8/24/01	ND	ND	ND
SB32	ADSB32-S-13777	19	8/24/01	ND	ND	ND
SB32	ADSB32-S-13778	21	8/24/01	ND	ND	ND
SB32	ADSB32-S-13779	23	8/24/01	ND	ND	ND
SB32	ADSB32-S-13780	25	8/24/01	ND	ND	ND
SB32	ADSB32-S-13781	27	8/24/01	ND	ND	ND
SB32	ADSB32-S-13782	29	8/24/01	ND	ND	ND
SB32	ADSB32-S-13783	31	8/24/01	ND	ND	ND
SB33	ADSB33-S-13788	1	8/25/01	ND	ND	ND
SB33	ADSB33-S-13789	3	8/25/01	ND	ND	ND
SB33	ADSB33-S-13790	5	8/25/01	ND	ND	ND
SB33	ADSB33-S-13791	7	8/25/01	ND	ND	ND
SB33	ADSB33-S-13792	9	8/25/01	ND	ND	ND
SB33	ADSB33-S-13793	11	8/25/01	ND	ND	ND
SB33	ADSB33-S-13794	13	8/25/01	ND	ND	ND
SB33	ADSB33-S-13795	15	8/25/01	ND	ND	ND
SB33	ADSB33-S-13796	17	8/25/01	ND	ND	ND
SB33	ADSB33-S-13797	19	8/25/01	ND	ND	ND
SB33	ADSB33-S-13798	21	8/25/01	< 10	ND	ND
SB33	ADSB33-S-13799	23	8/25/01	< 10	ND	ND
SB33	ADSB33-S-13800	25	8/25/01	< 10	ND	ND
SB33	ADSB33-S-13801	27	8/25/01	ND	ND	ND
SB33	ADSB33-S-13802	29	8/25/01	ND	ND	ND
SB33	ADSB33-S-13803	31	8/25/01	< 10	ND	ND
SB34	ADSB34-S-13806	1	8/25/01	< 10	ND	ND
SB34	ADSB34-S-13807	3	8/25/01	ND	ND	ND
SB34	ADSB34-S-13808	5	8/25/01	ND	ND	ND
SB34	ADSB34-S-13809	7	8/25/01	ND	ND	ND
SB34	ADSB34-S-13810	9	8/25/01	ND	ND	ND
SB34	ADSB34-S-13811	11	8/25/01	ND	ND	ND
SB34	ADSB34-S-13812	13	8/25/01	ND	ND	ND
SB34	ADSB34-S-13813	15	8/25/01	NA[c]	NA	NA

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB34	ADSB34-S-13814	17	8/25/01	ND	ND	ND
SB34	ADSB34-S-13815	19	8/25/01	ND	ND	ND
SB34	ADSB34-S-13816	21	8/25/01	ND	ND	ND
SB34	ADSB34-S-13817	23	8/25/01	ND	ND	ND
SB34	ADSB34-S-13818	25	8/25/01	ND	ND	ND
SB34	ADSB34-S-13819	27	8/25/01	ND	ND	ND
SB34	ADSB34-S-13820	29	8/25/01	ND	ND	ND
SB34	ADSB34-S-13821	31	8/25/01	ND	ND	ND
SB35	ADSB35-S-13830	1	8/25/01	ND	ND	ND
SB35	ADSB35-S-13831	3	8/25/01	ND	ND	ND
SB35	ADSB35-S-13832	5	8/25/01	ND	ND	ND
SB35	ADSB35-S-13833	7	8/25/01	ND	ND	ND
SB35	ADSB35-S-13834	9	8/25/01	ND	ND	ND
SB35	ADSB35-S-13835	11	8/25/01	ND	ND	ND
SB35	ADSB35-S-13836	13	8/25/01	ND	ND	ND
SB35	ADSB35-S-13837	15	8/25/01	ND	ND	ND
SB35	ADSB35-S-13838	17	8/25/01	ND	ND	ND
SB35	ADSB35-S-13839	19	8/25/01	ND	ND	ND
SB35	ADSB35-S-13840	21	8/25/01	NA	NA	NA
SB35	ADSB35-S-13841	23	8/25/01	ND	ND	ND
SB35	ADSB35-S-13842	25	8/25/01	ND	ND	ND
SB35	ADSB35-S-13843	27	8/25/01	ND	ND	ND
SB35	ADSB35-S-13844	29	8/25/01	ND	ND	ND
SB35	ADSB35-S-13845	31	8/25/01	ND	ND	ND
SB36	ADSB36-S-13848	1	8/25/01	ND	ND	ND
SB36	ADSB36-S-13849	3	8/25/01	ND	ND	ND
SB36	ADSB36-S-13850	5	8/25/01	ND	ND	ND
SB36	ADSB36-S-13851	7	8/25/01	ND	ND	ND
SB36	ADSB36-S-13852	9	8/25/01	ND	ND	ND
SB36	ADSB36-S-13853	11	8/25/01	ND	ND	ND
SB36	ADSB36-S-13854	13	8/25/01	ND	ND	ND
SB36	ADSB36-S-13855	15	8/25/01	ND	ND	ND
SB36	ADSB36-S-13856	17	8/25/01	ND	ND	ND
SB36	ADSB36-S-13857	19	8/25/01	ND	ND	ND
SB36	ADSB36-S-13858	21	8/25/01	ND	ND	ND
SB36	ADSB36-S-13859	23	8/25/01	ND	ND	ND
SB36	ADSB36-S-13860	25	8/25/01	ND	ND	ND
SB36	ADSB36-S-13861	27	8/25/01	ND	ND	ND
SB36	ADSB36-S-13862	29	8/25/01	ND	ND	ND
SB36	ADSB36-S-13863	31	8/25/01	ND	ND	ND
SB37	ADSB37-S-13886	1	8/26/01	14	ND	ND
SB37	ADSB37-S-13887	3	8/26/01	ND	ND	ND
SB37	ADSB37-S-13888	5	8/26/01	ND	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB37	ADSB37-S-13889	7	8/26/01	ND	ND	ND
SB37	ADSB37-S-13890	9	8/26/01	ND	ND	ND
SB37	ADSB37-S-13891	11	8/26/01	ND	ND	ND
SB37	ADSB37-S-13892	13	8/26/01	ND	ND	ND
SB37	ADSB37-S-13893	15	8/26/01	ND	ND	ND
SB37	ADSB37-S-13894	17	8/26/01	ND	ND	ND
SB37	ADSB37-S-13895	19	8/26/01	< 10	ND	ND
SB37	ADSB37-S-13896	21	8/26/01	ND	ND	ND
SB37	ADSB37-S-13897	23	8/26/01	ND	ND	ND
SB37	ADSB37-S-13898	25	8/26/01	ND	ND	ND
SB37	ADSB37-S-13899	27	8/26/01	< 10	ND	ND
SB37	ADSB37-S-13900	29	8/26/01	< 10	ND	ND
SB37	ADSB37-S-13901	31	8/26/01	< 10	ND	ND
SB38	ADSB38-S-13904	1	8/26/01	ND	ND	ND
SB38	ADSB38-S-13905	3	8/26/01	ND	ND	ND
SB38	ADSB38-S-13906	5	8/26/01	ND	ND	ND
SB38	ADSB38-S-13907	7	8/26/01	ND	ND	ND
SB38	ADSB38-S-13918	9	8/26/01	ND	ND	ND
SB38	ADSB38-S-13919	11	8/26/01	ND	ND	ND
SB38	ADSB38-S-13920	13	8/26/01	ND	ND	ND
SB38	ADSB38-S-13921	15	8/26/01	ND	ND	ND
SB38	ADSB38-S-13922	17	8/26/01	< 10	ND	ND
SB38	ADSB38-S-13923	19	8/26/01	ND	ND	ND
SB38	ADSB38-S-13924	21	8/26/01	< 10	ND	ND
SB38	ADSB38-S-13925	23	8/26/01	< 10	ND	ND
SB38	ADSB38-S-13926	25	8/26/01	ND	ND	ND
SB38	ADSB38-S-13927	27	8/26/01	< 10	ND	ND
SB38	ADSB38-S-13928	29	8/26/01	ND	ND	ND
SB38	ADSB38-S-13929	31	8/26/01	ND	ND	ND
SB39	ADSB39-S-13932	1	8/26/01	ND	ND	ND
SB39	ADSB39-S-13933	3	8/26/01	< 10	ND	ND
SB39	ADSB39-S-13934	5	8/26/01	ND	ND	ND
SB39	ADSB39-S-13935	7	8/26/01	ND	ND	ND
SB39	ADSB39-S-13936	9	8/26/01	ND	ND	ND
SB39	ADSB39-S-13937	11	8/26/01	ND	ND	ND
SB39	ADSB39-S-13938	13	8/26/01	< 10	ND	ND
SB39	ADSB39-S-13939	15	8/26/01	< 10	ND	ND
SB39	ADSB39-S-13940	17	8/26/01	10	ND	ND
SB39	ADSB39-S-13941	19	8/26/01	16	ND	ND
SB39	ADSB39-S-13942	21	8/26/01	18	ND	ND
SB39	ADSB39-S-13943	23	8/26/01	12	ND	ND
SB39	ADSB39-S-13944	25	8/26/01	13	ND	ND
SB39	ADSB39-S-13945	27	8/26/01	15	ND	ND
SB39	ADSB39-S-13946	29	8/26/01	12	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB39	ADSB39-S-13947	31	8/26/01	12	ND	ND
SB40	ADSB40-S-13648	1	8/27/01	ND	ND	ND
SB40	ADSB40-S-13649	3	8/27/01	ND	ND	ND
SB40	ADSB40-S-13650	5	8/27/01	ND	ND	ND
SB40	ADSB40-S-13651	7	8/27/01	ND	ND	ND
SB40	ADSB40-S-13652	9	8/27/01	ND	ND	ND
SB40	ADSB40-S-13653	11	8/27/01	ND	ND	ND
SB40	ADSB40-S-13654	13	8/27/01	ND	ND	ND
SB40	ADSB40-S-13655	15	8/27/01	ND	ND	ND
SB40	ADSB40-S-13656	17	8/27/01	ND	ND	ND
SB40	ADSB40-S-13657	19	8/27/01	ND	ND	ND
SB40	ADSB40-S-13658	21	8/27/01	ND	ND	ND
SB40	ADSB40-S-13659	23	8/27/01	ND	ND	ND
SB40	ADSB40-S-13660	25	8/27/01	ND	ND	ND
SB40	ADSB40-S-13661	27	8/27/01	< 10	ND	ND
SB40[d]	ADSB40-S-13662	29	8/27/01	ND	ND	ND
SB40	ADSB40-S-13663	31	8/27/01	< 10	ND	ND
SB41	ADSB41-S-13666	1	8/27/01	ND	ND	ND
SB41	ADSB41-S-13667	3	8/27/01	ND	ND	ND
SB41	ADSB41-S-13668	5	8/27/01	ND	ND	ND
SB41	ADSB41-S-13669	7	8/27/01	ND	ND	ND
SB41	ADSB41-S-13670	9	8/27/01	ND	ND	ND
SB41	ADSB41-S-13671	11	8/27/01	ND	ND	ND
SB41	ADSB41-S-13672	13	8/27/01	ND	ND	ND
SB41	ADSB41-S-13673	15	8/27/01	ND	ND	ND
SB41	ADSB41-S-13674	17	8/27/01	ND	ND	ND
SB41	ADSB41-S-13675	19	8/27/01	ND	ND	ND
SB41	ADSB41-S-13676	21	8/27/01	ND	ND	ND
SB41	ADSB41-S-13677	23	8/27/01	ND	ND	ND
SB41	ADSB41-S-13678	25	8/27/01	ND	ND	ND
SB41	ADSB41-S-13679	27	8/27/01	ND	ND	ND
SB42	ADSB42-S-13682	1	8/27/01	ND	ND	ND
SB42	ADSB42-S-13683	3	8/27/01	ND	ND	ND
SB42	ADSB42-S-13684	5	8/27/01	ND	ND	ND
SB42	ADSB42-S-13685	7	8/27/01	ND	ND	ND
SB42	ADSB42-S-13686	9	8/27/01	ND	ND	ND
SB42	ADSB42-S-13687	11	8/27/01	ND	ND	ND
SB42	ADSB42-S-13688	13	8/27/01	ND	ND	ND
SB42	ADSB42-S-13689	15	8/27/01	ND	ND	ND
SB42	ADSB42-S-13690	17	8/27/01	ND	ND	ND
SB42	ADSB42-S-13691	19	8/27/01	ND	ND	ND
SB42	ADSB42-S-13692	21	8/27/01	ND	ND	ND
SB42	ADSB42-S-13693	23	8/27/01	ND	ND	ND
SB43	ADSB43-S-13698	1	8/27/01	ND	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB43	ADSB43-S-13699	3	8/27/01	ND	ND	ND
SB43	ADSB43-S-13700	5	8/27/01	ND	ND	ND
SB43	ADSB43-S-13701	7	8/27/01	ND	ND	ND
SB43	ADSB43-S-13702	9	8/27/01	ND	ND	ND
SB43	ADSB43-S-13703	11	8/27/01	ND	ND	ND
SB43	ADSB43-S-13704	13	8/27/01	ND	ND	ND
SB43	ADSB43-S-13705	15	8/27/01	ND	ND	ND
SB43	ADSB43-S-13706	17	8/27/01	NA	NA	NA
SB43	ADSB43-S-13707	19	8/27/01	NA	NA	NA
SB43	ADSB43-S-13948	21	8/27/01	ND	ND	ND
SB43	ADSB43-S-13949	23	8/27/01	ND	ND	ND
SB45	ADSB45-S-13513	1	8/28/01	ND	ND	ND
SB45	ADSB45-S-13514	3	8/28/01	ND	ND	ND
SB45	ADSB45-S-13515	5	8/28/01	ND	ND	ND
SB45	ADSB45-S-13516	7	8/28/01	ND	ND	ND
SB45	ADSB45-S-13517	9	8/28/01	ND	ND	ND
SB45	ADSB45-S-13525	11	8/28/01	ND	ND	ND
SB45	ADSB45-S-13767	13	8/28/01	ND	ND	ND
SB45[d]	ADSB45-S-13747	15	8/28/01	ND	ND	ND
SB45	ADSB45-S-11480	17	8/28/01	ND	ND	ND
SB45	ADSB45-S-11481	19	8/28/01	ND	ND	ND
SB45	ADSB45-S-11482	21	8/28/01	ND	ND	ND
SB45	ADSB45-S-13694	23	8/28/01	ND	ND	ND
SB45	ADSB45-S-13695	25	8/28/01	ND	ND	ND
SB45	ADSB45-S-13696	27	8/28/01	ND	ND	ND
SB45	ADSB45-S-13697	29	8/28/01	NA	NA	NA
SB45	ADSB45-S-13510	31	8/28/01	ND	ND	ND
SB45	ADSB45-S-13958	33	8/28/01	12	ND	ND
SB45	ADSB45-S-13959	35	8/28/01	22	< 10	ND
SB46	ADSB46-S-13962	1	8/28/01	ND	< 10	358
SB46	ADQCDU-S-13960	1	8/28/01	ND	ND	ND
SB46	ADSB46-S-13963	3	8/28/01	ND	ND	ND
SB46	ADSB46-S-13964	5	8/28/01	ND	ND	ND
SB46	ADSB46-S-13965	7	8/28/01	ND	ND	ND
SB46	ADSB46-S-13966	9	8/28/01	ND	ND	ND
SB46	ADSB46-S-13967	11	8/28/01	ND	ND	ND
SB46	ADSB46-S-13968	13	8/28/01	ND	ND	ND
SB46	ADSB46-S-13969	15	8/28/01	ND	ND	ND
SB46	ADSB46-S-13970	17	8/28/01	ND	ND	ND
SB46	ADSB46-S-13971	19	8/28/01	ND	ND	ND
SB46	ADSB46-S-13972	21	8/28/01	ND	ND	ND
SB46	ADSB46-S-13973	23	8/28/01	ND	ND	ND
SB46	ADSB46-S-13974	25	8/28/01	ND	ND	ND
SB46	ADSB46-S-13975	27	8/28/01	ND	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB46	ADSB46-S-13976	29	8/28/01	ND	ND	ND
SB46	ADSB46-S-13977	31	8/28/01	ND	ND	ND
SB47	ADSB47-S-13982	1	8/28/01	ND	ND	ND
SB47	ADSB47-S-13983	3	8/28/01	ND	ND	ND
SB47	ADSB47-S-13984	5	8/28/01	ND	ND	ND
SB47	ADSB47-S-13985	7	8/28/01	ND	ND	ND
SB47	ADSB47-S-13986	9	8/28/01	ND	ND	ND
SB47	ADSB47-S-13987	11	8/28/01	ND	ND	ND
SB47	ADSB47-S-13988	13	8/28/01	ND	ND	ND
SB47	ADSB47-S-13989	15	8/28/01	ND	ND	ND
SB47	ADSB47-S-13990	17	8/28/01	ND	ND	ND
SB47	ADSB47-S-13991	19	8/28/01	ND	ND	ND
SB47	ADSB47-S-13992	21	8/28/01	ND	ND	ND
SB47	ADSB47-S-13993	23	8/28/01	ND	ND	ND
SB47	ADSB47-S-13994	25	8/28/01	ND	ND	ND
SB47	ADSB47-S-13995	27	8/28/01	ND	ND	ND
SB47	ADSB47-S-13996	29	8/28/01	ND	ND	ND
SB47	ADSB47-S-13997	31	8/28/01	ND	ND	ND
SB48	ADSB48-S-14022	1	8/28/01	ND	ND	ND
SB48	ADSB48-S-14023	3	8/28/01	ND	ND	ND
SB48	ADSB48-S-14024	5	8/28/01	ND	ND	ND
SB48	ADSB48-S-14025	7	8/28/01	ND	ND	ND
SB48	ADSB48-S-14026	9	8/28/01	ND	ND	ND
SB48	ADSB48-S-14027	11	8/28/01	ND	ND	ND
SB48	ADSB48-S-14028	13	8/28/01	ND	ND	ND
SB48	ADSB48-S-14029	15	8/28/01	ND	ND	ND
SB48	ADSB48-S-14030	17	8/28/01	ND	< 10	ND
SB48	ADSB48-S-14031	19	8/28/01	ND	< 10	ND
SB48	ADSB48-S-14032	21	8/28/01	ND	< 10	ND
SB48	ADSB48-S-14033	23	8/28/01	ND	ND	ND
SB48	ADSB48-S-14034	25	8/28/01	ND	ND	ND
SB48	ADSB48-S-14035	27	8/28/01	ND	ND	ND
SB48	ADSB48-S-14036	29	8/28/01	ND	ND	ND
SB48	ADSB48-S-14037	31	8/28/01	ND	ND	ND
SB48	ADSB48-S-14038	33	8/28/01	ND	ND	ND
SB48	ADSB48-S-14039	35	8/28/01	ND	ND	ND
SB49	ADSB49-S-13956	1	8/27/01	ND	ND	ND
SB49	ADSB49-S-13957	3	8/27/01	ND	ND	ND
SB49	ADSB49-S-13638	5	8/27/01	ND	ND	ND
SB49	ADSB49-S-13639	7	8/27/01	ND	ND	ND
SB49	ADSB49-S-13640	9	8/27/01	ND	ND	ND
SB49	ADSB49-S-13641	11	8/27/01	ND	ND	ND
SB49	ADSB49-S-13642	13	8/27/01	ND	ND	ND

TABLE D.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB49	ADSB49-S-13643	15	8/27/01	ND	ND	ND
SB49	ADSB49-S-13644	17	8/27/01	ND	ND	ND
SB49	ADSB49-S-13645	19	8/27/01	ND	ND	ND
SB49	ADSB49-S-13646	21	8/27/01	ND	ND	ND
SB49	ADSB49-S-13647	23	8/27/01	ND	ND	ND
SB50	ADSB50-S-14000	1	8/28/01	ND	ND	ND
SB50	ADSB50-S-14001	3	8/28/01	ND	ND	ND
SB50	ADSB50-S-14002	5	8/28/01	ND	ND	ND
SB50	ADSB50-S-14003	7	8/28/01	ND	ND	ND
SB50	ADSB50-S-14004	9	8/28/01	ND	ND	ND
SB50	ADSB50-S-14005	11	8/28/01	ND	ND	ND
SB50	ADSB50-S-14006	13	8/28/01	ND	< 10	ND
SB50	ADSB50-S-14007	15	8/28/01	< 10	ND	ND
SB50	ADSB50-S-14008	17	8/28/01	12	ND	ND
SB50	ADSB50-S-14009	19	8/28/01	11	ND	ND
SB50	ADSB50-S-14010	21	8/28/01	12	ND	ND
SB50	ADSB50-S-14011	23	8/28/01	24	< 10	ND
SB50	ADSB50-S-14012	25	8/28/01	21	< 10	ND
SB50	ADSB50-S-14013	27	8/28/01	26	< 10	ND
SB50	ADSB50-S-14014	29	8/28/01	16	< 10	ND
SB50	ADSB50-S-14015	31	8/28/01	196	< 10	ND
SB50	ADSB50-S-14016	33	8/28/01	527	< 10	611
SB50	ADSB50-S-14017	35	8/28/01	402	< 10	495
SB51	ADSB51-S-14042	1	8/29/01	< 10	ND	ND
SB51	ADSB51-S-14043	3	8/29/01	ND	ND	ND
SB51	ADSB51-S-14044	5	8/29/01	ND	ND	ND
SB51	ADSB51-S-14045	7	8/29/01	ND	ND	ND
SB51	ADSB51-S-14046	9	8/29/01	ND	ND	ND
SB51	ADSB51-S-14047	11	8/29/01	ND	ND	ND
SB51	ADSB51-S-14048	13	8/29/01	ND	ND	ND
SB51	ADSB51-S-14049	15	8/29/01	ND	ND	ND
SB51	ADSB51-S-14050	17	8/29/01	< 10	ND	ND
SB51	ADSB51-S-14051	19	8/29/01	< 10	ND	ND
SB51	ADSB51-S-14052	21	8/29/01	< 10	< 10	ND
SB51	ADSB51-S-14053	23	8/29/01	< 10	< 10	ND
SB51	ADSB51-S-14054	25	8/29/01	< 10	ND	ND
SB51	ADSB51-S-14055	27	8/29/01	< 10	ND	ND

[a] ND, contaminant not detected.

[b] < 10, contaminant detected at a concentration below the quantitation limit of 10 μg/kg.

[c] NA, sample not analyzed by purge-and-trap method.

[d] Surrogate recovery outside quality control limit of 80-120%.

TABLE D.3 Results of physical parameter and total organic carbon analyses on soil samples collected during the Phase II field investigation at Adams, Nebraska.

Location	Sample	Sample Depth (ft BGL)	Sample Date	Total Organic Carbon (mg/kg dry weight)	Solids[a] (%)	Bulk Dry Density (lb/ft^3)	Moisture (%)	Specific Gravity	Porosity (%)
SB31	ADSB31-S-13569	3	8/24/01	18,900	83.4	77.1	22.6	2.758	55.2
SB31	ADSB31-S-13574	13	8/24/01	4,090	89.7	101.0	11.8	2.651	38.9
SB31	ADSB31-S-13758	21	8/24/01	487	92.7	100.3	10.8	2.636	39.0
SB31	ADSB31-S-13763	31	8/24/01	< 108	92.6	97.8	9.7	2.608	39.9
SB33	ADSB33-S-13799	23	8/25/01	1,330	93.1	111.3	7.6	2.630	32.2
SB33	ADSB33-S-13803	31	8/25/01	906	82.9	105.7	21.1	2.643	35.9
SB50	ADSB50-S-14011	23	8/28/01	560	83.5	102.5	20.1	2.628	37.5
SB50	ADSB50-S-14016	33	8/28/01	612	83.7	99.4	24.2	2.616	39.1
SB50	ADSB50-S-14017	35	8/28/01	946	83.4	105.6	20.2	2.625	35.5

[a] Solids (%) = [(wt of dry sample - wt of dish) ÷ (wt of wet sample - wt of dish)] x 100.

Appendix E:

Groundwater Sample Data

TABLE E.1 Groundwater samples collected during the Phase II investigation at Adams, Nebraska.

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
SB21	ADSB21-W-13578	25-30	8/22/01	Dark gray with heavy sediment load. Good water recovery immediately.
SB21	ADSB21-W-13588	30-35	8/23/01	Slow water recovery; dark brown.
SB21	ADSB21-W-13579	35-40	8/22/01	No description noted.
SB21	ADSB21-W-13589	40-45	8/23/01	Ample water recovery; pale brown.
SB21	ADSB21-W-13581	45-50	8/22/01	Very limited water recovery despite indication of good sand (high tip and sleeve on ECPT sensor log). Composite of two bailers.
SB21	ADSB21-W-13590	50-55	8/23/01	Abundant water; less sediment load.
SB21	ADSB21-W-13584	55-60	8/22/01	Very limited water recovery. Water reddish in color, oxidized. Heavy sediment load. Problem with screen being forced off the sacrificial tip.
SB21	ADSB21-W-13593	60-65	8/23/01	Abundant, fairly clear water; sediment settled out quickly.
SB21	ADSB21-W-13585	66-70	8/23/01	Water abundant and very clear.
SB21	ADSB21-W-13594	70-75	8/23/01	No description noted.
SB22	ADSB22-W-13613	30-35	8/25/01	No description noted.
SB22	ADSB22-W-13618	35-40	8/26/01	Abundant water recovery; heavy sediment load; dark brown color.
SB22	ADSB22-W-13614	40-45	8/25/01	Abundant water available; heavy sediment load.
SB22	ADSB22-W-13620	45-50	8/26/01	Good water recovery; slightly oxidized; substantial sediment load.
SB22	ADSB22-W-13615	50-55	8/25/01	No description noted.
SB22	ADSB22-W-13621	55-60	8/26/01	No description noted.
SB22	ADSB22-W-13617	60-65	8/25/01	Abundant water recovery.
SB23	ADSB23-W-13595	25-30	8/24/01	Very slow water recovery and limited production.
SB23	ADSB23-W-13604	30-35	8/24/01	Good water recovery; oxidized; sediment in suspension.
SB23	ADSB23-W-13596	35-40	8/24/01	No description noted.
SB23	ADSB23-W-13607	40-45	8/25/01	Abundant water recovery; clear; little sediment.
SB23	ADSB23-W-13599	45-50	8/24/01	Very poor water recovery, slow. Very fine sand to silt clogging bailer. Bailed dry during sampling. Slow recovery may be due to incorrect installation of sacrificial tip and downhole pressure.
SB23	ADSB23-W-13606	50-55	8/25/01	Very low water recovery.
SB23	ADSB23-W-13609	50-55	8/25/01	Abundant water; clear; little sediment.
SB23	ADSB23-W-13600	55-60	8/24/01	Moderate water recovery.
SB23	ADSB23-W-13611	60-65	8/25/01	Clear water with some sediment; oxidized.

TABLE E.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
SB23	ADSB23-W-13601	65-70	8/24/01	Abundant, very clear water.
SB23	ADSB23-W-13610	70-74.7	8/25/01	Abundant water; clear; rapidly settling fine silt to very fine sand.
SB25	ADSB25-W-13623	32-37	8/26/01	Sampling opposite SB25 core hole. Abundant water recovery; heavy sediment load; dark brown in color.
SB25	ADSB25-W-13626	37-42	8/26/01	No description noted.
SB25	ADSB25-W-13624	42-47	8/26/01	No description noted.
SB27	ADSB27-W-13628	32-37	8/27/01	Abundant water; heavy sediment load; medium brown in color.
SB27	ADSB27-W-13631	37-42	8/27/01	Abundant water.
SB27	ADSB27-W-13629	42-47	8/27/01	Abundant water.
SB44	ADSB44-W-13633	32-37	8/27/01	Limited water recovery, slow recovery.
SB44	ADSB44-W-13635	37-42	8/27/01	Abundant water recovery.
SB44	ADSB44-W-13634	42-47	8/27/01	No description noted.
SB52	ADSB52-W-14088	25-30	8/30/01	Abundant water; gray in color; heavy sediment.
SB52	ADSB52-W-14095	30-35	8/30/01	Poor, limited water recovery.
SB52	ADSB52-W-14089	35-40	8/30/01	No description noted.
SB52	ADSB52-W-14097	40-45	8/30/01	No description noted.
SB52	ADSB52-W-14092	45-50	8/30/01	Abundant water recovery; very slightly oxidized.
SB52	ADSB52-W-14098	50-55	8/30/01	Good water recovery; light brownish gray in color with fine suspended silt sediment.
SB52	ADSB52-W-14093	55-60	8/30/01	Abundant clear water.
SB52	ADSB52-W-14100	60-65	8/30/01	No description noted.
SB52	ADSB52-W-14101	65-70	8/30/01	No description noted.

TABLE E.2 Field measurements made during collection of groundwater samples at Adams, Nebraska.

Location	Sample	Depth (ft BGL)	Sample Date	Temper-ature (°C)	pH	Conductivity (μS/cm)	Alkalinity (mg/L)	Nitrate (mg/L)
SB21	ADSB21-W-13578	25-30	8/22/01	18.5	6.68	557	200	0.5
SB21	ADSB21-W-13588	30-35	8/23/01	17.1	6.7	639	175	0.5
SB21	ADSB21-W-13579	35-40	8/22/01	18.4	6.68	676	200	5
SB21	ADSB21-W-13589	40-45	8/23/01	16.5	6.92	745	190	10
SB21	ADSB21-W-13581	45-50	8/22/01	NA[a]	NA	NA	NA	NA
SB21	ADSB21-W-13590	50-55	8/23/01	16.1	7.19	891	230	10
SB21	ADSB21-W-13584	55-60	8/22/01	NA	NA	NA	NA	NA
SB21	ADSB21-W-13593	60-65	8/23/01	17.1	7	837	240	10
SB21	ADSB21-W-13585	66-70	8/23/01	16.3	6.93	975	230	10
SB21	ADSB21-W-13594	70-75	8/23/01	18.6	7.23	896	250	20
SB22	ADSB22-W-13613	30-35	8/25/01	16.6	7.04	638	210	0.5
SB22	ADSB22-W-13618	35-40	8/26/01	15.9	6.74	636	175	10
SB22	ADSB22-W-13614	40-45	8/25/01	17.2	6.9	808	210	20
SB22	ADSB22-W-13620	45-50	8/26/01	16.7	7.04	1,026	245	20
SB22	ADSB22-W-13615	50-55	8/25/01	19	7.23	1,153	220	20
SB22	ADSB22-W-13621	55-60	8/26/01	17.8	7.16	1,202	200	20
SB22	ADSB22-W-13617	60-65	8/25/01	19.9	7.27	1,064	200	20
SB23	ADSB23-W-13595	25-30	8/24/01	18.8	6.56	750	250	5
SB23	ADSB23-W-13604	30-35	8/24/01	19.6	6.61	616	175	10
SB23	ADSB23-W-13596	35-40	8/24/01	19.9	6.98	567	160	10
SB23	ADSB23-W-13597	35-40	8/24/01	19.4	7.04	574	135	10
SB23	ADSB23-W-13607	40-45	8/25/01	16.8	7.01	760	210	10
SB23	ADSB23-W-13599	45-50	8/24/01	19.9	7.18	929	240	10
SB23	ADSB23-W-13606	50-55	8/25/01	NA	NA	NA	NA	NA
SB23	ADSB23-W-13609	50-55	8/25/01	16.9	7.11	919	230	10
SB23	ADSB23-W-13600	55-60	8/24/01	18.1	7.31	923	210	10
SB23	ADSB23-W-13611	60-65	8/25/01	17.4	7.44	827	235	10
SB23	ADSB23-W-13601	65-70	8/24/01	17.5	7.29	861	235	10
SB23	ADSB23-W-13610	70-74.7	8/25/01	17.8	7.35	930	250	5
SB25	ADSB25-W-13623	32-37	8/26/01	17.9	6.56	376	100	5
SB25	ADSB25-W-13626	37-42	8/26/01	18.2	7.09	868	245	10
SB25	ADSB25-W-13624	42-47	8/26/01	17.1	7.06	926	200	10
SB27	ADSB27-W-13628	32-37	8/27/01	16.9	6.75	553	135	0.5
SB27	ADSB27-W-13631	37-42	8/27/01	17.2	6.87	980	200	20
SB27	ADSB27-W-13629	42-47	8/27/01	18.6	7.04	700	200	10
SB44	ADSB44-W-13633	32-37	8/27/01	21.2	7.11	791	175	20
SB44	ADSB44-W-13635	37-42	8/27/01	16.8	6.97	1,069	200	20
SB44	ADSB44-W-13634	42-47	8/27/01	19	7.06	1,151	185	20

TABLE E.2 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Temper-ature (°C)	pH	Conductivity (μS/cm)	Alkalinity (mg/L)	Nitrate (mg/L)
SB52	ADSB52-W-14088	25-30	8/30/01	18	6.73	835	155	20
SB52	ADSB52-W-14095	30-35	8/30/01	20.2	7.26	698	180	10
SB52	ADSB52-W-14089	35-40	8/30/01	18.3	6.98	617	150	10
SB52	ADSB52-W-14097	40-45	8/30/01	17.1	7.07	679	185	0.5
SB52	ADSB52-W-14092	45-50	8/30/01	17.6	7	695	175	10
SB52	ADSB52-W-14098	50-55	8/30/01	16.5	7.15	789	225	10
SB52	ADSB52-W-14093	55-60	8/30/01	17.2	7.32	1,052	200	20
SB52	ADSB52-W-14100	60-65	8/30/01	16.7	7.21	1,018	200	20
SB52	ADSB52-W-14101	65-70	8/30/01	17.3	7.29	961	200	10

[a] NA, field measurement not taken.

TABLE E.3 Results of organic analyses by the purge-and-trap method on groundwater samples collected during the Phase II investigation at Adams, Nebraska.

				Concentration (μg/L)	
Location	Sample	Depth (ft BGL)	Sample Date	Carbon Tetrachloride	Chloroform
SB21	ADSB21-W-13578	25-30	8/22/01	ND[a]	ND
SB21	ADSB21-W-13588	30-35	8/23/01	ND	ND
SB21	ADSB21-W-13579	35-40	8/22/01	ND	ND
SB21	ADSB21-W-13589	40-45	8/23/01	ND	ND
SB21	ADSB21-W-13581	45-50	8/22/01	< 5[b]	< 5
SB21	ADSB21-W-13590	50-55	8/23/01	ND	ND
SB21	ADSB21-W-13584	55-60	8/22/01	ND	ND
SB21	ADSB21-W-13593	60-65	8/23/01	ND	ND
SB21	ADSB21-W-13585	66-70	8/23/01	ND	ND
SB21	ADSB21-W-13594	70-75	8/23/01	ND	ND
SB22	ADSB22-W-13613	30-35	8/25/01	ND	ND
SB22	ADSB22-W-13618	35-40	8/26/01	11	< 5
SB22	ADSB22-W-13614	40-45	8/25/01	12	< 5
SB22	ADSB22-W-13620	45-50	8/26/01	ND	ND
SB22	ADSB22-W-13615	50-55	8/25/01	ND	ND
SB22	ADSB22-W-13621	55-60	8/26/01	ND	ND
SB22	ADSB22-W-13617	60-65	8/25/01	ND	ND
SB23	ADSB23-W-13595	25-30	8/24/01	ND	ND
SB23	ADSB23-W-13604	30-35	8/24/01	ND	ND
SB23	ADSB23-W-13596	35-40	8/24/01	< 5	< 5
SB23	ADSB23-W-13597	35-40	8/24/01	< 5	< 5
SB23	ADSB23-W-13607	40-45	8/25/01	< 5	< 5
SB23	ADSB23-W-13608	40-45	8/25/01	< 5	< 5
SB23	ADSB23-W-13599	45-50	8/24/01	ND	ND
SB23	ADSB23-W-13606	50-55	8/25/01	ND	ND
SB23	ADSB23-W-13609	50-55	8/25/01	ND	ND
SB23	ADSB23-W-13600	55-60	8/24/01	ND	ND
SB23	ADSB23-W-13611	60-65	8/25/01	ND	ND
SB23	ADSB23-W-13601	65-70	8/24/01	ND	ND
SB23	ADSB23-W-13610	70-74.7	8/25/01	ND	ND
SB25	ADSB25-W-13623	32-37	8/26/01	9.3	6
SB25	ADSB25-W-13626	37-42	8/26/01	ND	ND
SB25	ADSB25-W-13624	42-47	8/26/01	ND	ND
SB27	ADSB27-W-13628	32-37	8/27/01	26	8[c]
SB27	ADSB27-W-13631	37-42	8/27/01	< 5	< 5[c]
SB27	ADSB27-W-13629	42-47	8/27/01	ND	ND

TABLE E.3 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/L) Carbon Tetrachloride	Chloroform
SB44	ADSB44-W-13633	32-37	8/27/01	< 5	ND
SB44	ADSB44-W-13635	37-42	8/27/01	ND	ND
SB44	ADSB44-W-13634	42-47	8/27/01	ND	ND
SB52	ADSB52-W-14088	25-30	8/30/01	ND	ND
SB52	ADSB52-W-14095	30-35	8/30/01	ND	ND
SB52	ADSB52-W-14089	35-40	8/30/01	ND	ND
SB52	ADSB52-W-14097	40-45	8/30/01	ND	ND
SB52	ADSB52-W-14092	45-50	8/30/01	< 5	ND
SB52	ADSB52-W-14098	50-55	8/30/01	< 5	ND
SB52	ADSB52-W-14099	50-55	8/30/01	< 5	ND
SB52	ADSB52-W-14093	55-60	8/30/01	< 5	ND
SB52	ADSB52-W-14100	60-65	8/30/01	ND	ND
SB52	ADSB52-W-14101	65-70	8/30/01	ND	ND

[a] ND, not detected above the EPA Method 524.2 (purge-and-trap method) quantitation limit of 1 μg/L.

[b] < 5, not detected above the EPA CLP quantitation limit of 5 μg/L.

[c] Low surrogate recovery during analysis of this sample.

TABLE E.4 Results of nitrate-nitrogen analyses on groundwater samples collected during the Phase II investigation at Adams, Nebraska.

Location	Sample	Depth (ft BGL)	Sample Date	Nitrate-Nitrogen (mg/L)
SB21	ADSB21-W-13578	25-30	8/22/01	0.53
SB21	ADSB21-W-13588	30-35	8/23/01	0.82
SB21	ADSB21-W-13579	35-40	8/22/01	9.23
SB21	ADSB21-W-13589	40-45	8/23/01	13
SB21	ADSB21-W-13590	50-55	8/23/01	14.3
SB21	ADSB21-W-13593	60-65	8/23/01	10.6
SB21	ADSB21-W-13585	66-70	8/23/01	16.3
SB21	ADSB21-W-13594	70-75	8/23/01	16.4
SB23	ADSB23-W-13595	25-30	8/24/01	5.87
SB23	ADSB23-W-13604	30-35	8/24/01	10.9
SB23	ADSB23-W-13596	35-40	8/24/01	12
SB23	ADSB23-W-13599	45-50	8/24/01	12.1
SB23	ADSB23-W-13600	55-60	8/24/01	16
SB23	ADSB23-W-13601	65-70	8/24/01	12.4
SB27	ADSB27-W-13631	37-42	8/27/01	22.6
SB44	ADSB44-W-13635	37-42	8/27/01	29.9
SB52	ADSB52-W-14088	25-30	8/30/01	25.1[a]
SB52	ADSB52-W-14089	35-40	8/30/01	12.9[a]
SB52	ADSB52-W-14092	45-50	8/30/01	16.7[a]
SB52	ADSB52-W-14093	55-60	8/30/01	31.5[a]

[a] The sample was preserved and filtered after the 48-hr holding time limit.

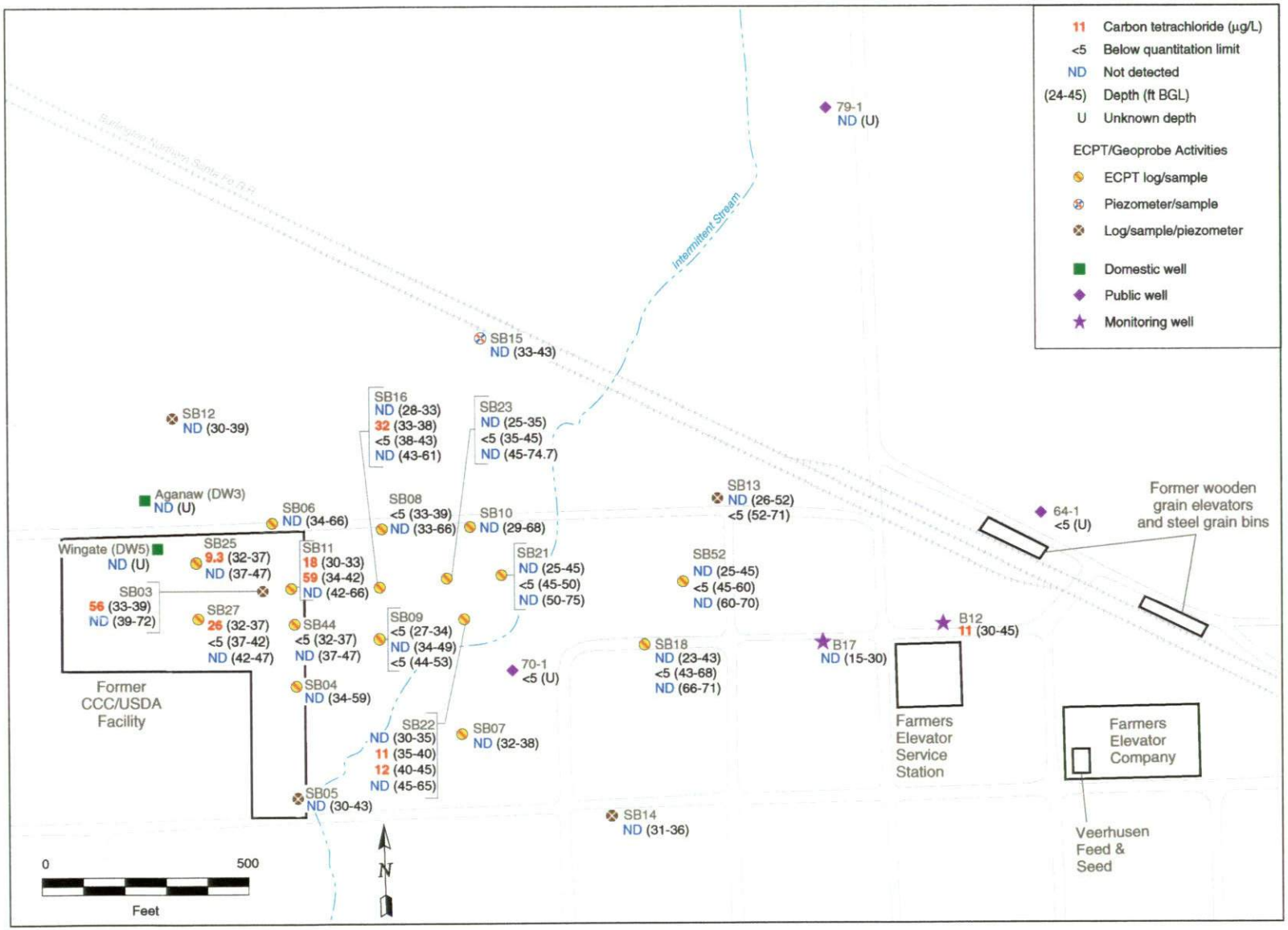

FIGURE E.1 Locations of the former Adams CCC/USDA facility and Phase I and Phase II groundwater samples in the western part of Adams, with the range of results of analyses for carbon tetrachloride at each location.

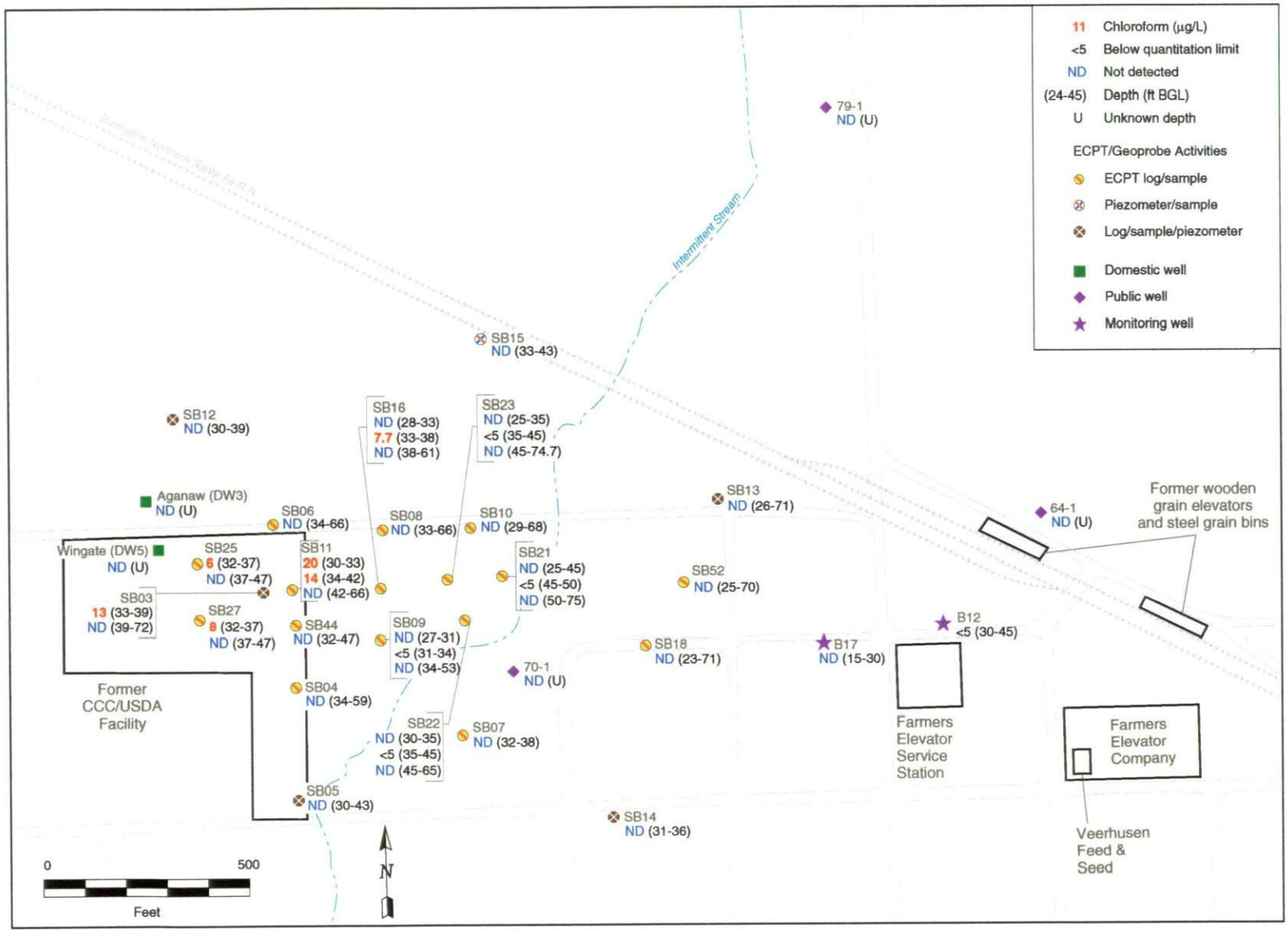

FIGURE E.2 Locations of the former CCC/USDA facility and Phase I and Phase II groundwater samples in the western part of Adams, with the range of results of analyses for chloroform at each location.

Appendix F:

Quality Control for Sample Collection, Handling, and Analysis

Appendix F:

Quality Control for Sample Collection, Handling, and Analysis

Soil and groundwater sampling was conducted during the Phase II investigation at Adams to determine whether a continuing soil source for groundwater contamination exists at the site, to delineate the extent of soil contamination (if present), and to further delineate the lateral extent of the groundwater plume. Throughout the investigation, QA/QC samples were collected to monitor sample collection, handling, and analysis activities. The QA/QC procedures for sample collection, handling, and analysis followed during the Phase II effort are described in detail in the *Master Work Plan* (Argonne 1994) and the Adams Phase I *Work Plan* (Argonne 2000).

F.1 Monitoring of Sample Collection, Handling, and Analysis Procedures

Sample collection and handling activities were monitored by the documentation of samples as they were collected and the use of chain-of-custody (COC) forms and custody seals to ensure sample integrity during the handling and shipment of samples for analysis. For some samples, minor discrepancies in sample identification numbers as listed on the COC records and sample containers were resolved by comparison of the various documentation records. The COC records and complete QA/QC documentation are on file at Argonne.

The QA/QC samples collected included equipment rinsates and field/trip blanks. Replicate samples were collected, and other samples were selected for duplicate analyses as a measure of analytical precision. The QA/QC samples are listed in Table F.1. Analytical results for carbon tetrachloride, chloroform, and 1,2-dichloroethane (1,2-DCA; contaminants of concern detected during the investigation) in the QA/QC samples collected to monitor sample collection and handling activities are in Table F.2.

F.1.1 Equipment Rinsates

Reusable sampling bailers were used during collection of groundwater samples with the ECPT vehicle. Rinsates from the decontaminated bailers and ECPT rods were collected periodically to ensure that cross-contamination of samples did not occur during sample collection. Disposable sampling equipment was used during collection of other samples.

F.1.2 Trip/Field Blanks

Trip blanks were prepared and included in shipments of soil or water samples for organic analysis as an indicator of cross-contamination of samples during shipment. No trip blank was included in the shipment of water samples to AGEM Laboratory on August 27, 2001, as listed on COCs 1068, 1019, and 1017. The shipment included 6 equipment rinsates and 17 groundwater samples or replicates in which no contamination was detected. Cross-contamination of the samples during shipment is not indicated.

Blanks of the methanol used for soil extraction were collected to verify that contamination was not introduced during preparation of the soil samples for organic analysis. Chloroform was present at low concentration (Table F.2) in one of these blanks.

F.1.3 Replicate Samples and Duplicate Analyses

As an indicator of the consistency of the sampling methodology followed and to provide a measure of analytical precision, blind replicate soil and groundwater samples were collected. In addition, samples were selected by AGEM Laboratory for duplicate organic analyses. On the basis of the organic results obtained by AGEM Laboratory, selected samples were shipped to another laboratory for verification analysis. Blind replicate samples, samples selected for duplicate organic or nitrate-nitrogen analyses, and samples selected for verification organic analysis are listed in Table F.1.

F.2 Quality Control for Organic Analysis of Soil Samples

In all, 476 soil samples (including 50 blind field replicate samples) were collected for organic analysis. Under the EPA's CLP analytical method for soils collected without extractant, SOW 2/88 (EPA 1989b), which uses a capillary column GC-MS, detection limits are as high as 60 μg/kg for medium-level soils. Accordingly, the Adams soil samples were analyzed at the AGEM Laboratory by using a modification of EPA Method 8260B (purge-and-trap method), as referenced in the EPA's SW-846 (EPA 1986), to achieve the lower detection limit of 10 μg/kg. To verify the accuracy of the analytical results, duplicate samples were prepared for verification analysis at STL with the same analytical method. On the basis of the results obtained by AGEM Laboratory, selected duplicate samples were subjected to the verification analysis.

The following sections describe QC measures during analysis of the soil samples with EPA Method 8260B and discuss the quality of the organic analytical data from each laboratory. Analytical data from AGEM Laboratory are discussed in Section F.2.1, and data from STL are discussed in Section F.2.2. The analytical results from AGEM Laboratory and STL are compared in Section F.2.3.

F.2.1 Analysis of Soil Samples at AGEM Laboratory

Soil samples were quick-frozen on dry ice as they were collected. The VOCs present in each soil sample were extracted with methanol from the sample matrix in the laboratory. An aliquot of the extract was purged, and the volatile species were transferred to a sorbent tube. After purging, the sorbent tube was heated and back-flushed with an inert gas to desorb the components into the GC-MS system. The compounds eluting from the GC column were identified by retention time and by comparison with reference library spectra. The concentration of each component was calculated by comparison of the MS response for the quantitation ion to the response for internal standards.

Soil samples were analyzed by the AGEM Laboratory in 29 sample delivery groups (SDGs), as shown in Table F.3. The QA/QC procedures followed included initial and continuing calibration of instruments, analysis of laboratory blanks, monitoring of surrogate spike recovery, analysis of replicate samples, and duplicate analyses of selected samples. Significant results include the following:

- Soil samples were received with custody seals intact and at appropriate temperature. All samples were analyzed within required holding times. (Five soil samples were not analyzed at AGEM Laboratory with the purge-and-trap method: ADSB34-S-13813, ADSB35-S-13840, ADSB43-S-13706, ADSB43-S-13707, and ADSB45-S-13697. Sample ADSB43-S-13707 was analyzed at STL.)

- Contaminants of concern were not detected in the laboratory method blanks.

- For each SDG, analytical instrument calibration was monitored by the analysis of calibration check standards. Table F.3 shows the relative percent difference (RPD) values between the known and calculated concentrations of

the standards. The concentrations of calibration check standards measured in all SDGs were within the acceptable range of ±20% for carbon tetrachloride. In SDG 01-8-30 the RPD for chloroform was 21.2%, and in SDG 01-9-7 the RPD for chloroform was 22.2%. Chloroform results for the affected samples were adjusted to reflect the difference in calibration.

- Surrogate standard determinations were performed on the samples and blanks by using the surrogate spike compounds fluorobenzene, 4-bromofluorobenzene, and 1,2-dichlorobenzene-d_4. Table F.3 shows the percent recovery values for these system-monitoring compounds for each of the analyses. Except for six soil samples (described below), reanalysis was conducted if the surrogate recovery limit of 80% was not met in the initial analysis.

  - Subsurface soil sample ADSB25-S-11497, collected from SB25 at a depth of 29 ft BGL, was analyzed in SDG 01-8-29, with recovery of all three surrogate compounds below 80%. No contamination was detected in any other sample collected at 1-31 ft BGL in SB25 (Table D.2), and the result for sample ADSB25-S-11497 (contaminant not detected) is accepted without qualification.

  - Subsurface soil sample ADSB32-S-13777, collected from SB32 at a depth of 19 ft BGL, was analyzed in SDG 01-8-30, with recovery of two of the three surrogate compounds below 80%. No contamination was detected in any other sample collected at 1-31 ft BGL in SB32, and the result for sample ADSB32-S-13777 (contaminant not detected) is accepted without qualification.

  - Subsurface soil sample ADSB34-S-13819, collected from SB34 at a depth of 27 ft BGL, was analyzed in SDG 01-9-3, with recovery of two of the three surrogate compounds below 80%. Carbon tetrachloride was detected at < 10 µg/kg in the sample from 1 ft BGL at this location. No contamination was detected in any other sample collected at 3-31 ft BGL in SB34, and the result for sample ADSB34-S-13819 (contaminant not detected) is accepted without qualification.

- Replicate subsurface soil sample ADQCDU-S-13511, collected from SB45 at a depth of 1 ft BGL as a replicate for sample ADSB45-S-13513, was analyzed in SDG 01-9-12, with recovery of all three surrogate compounds below 80%. No contamination was detected in sample ADSB45-S-13513, analyzed in SDG 01-9-22 without surrogate recovery error, and the result for replicate ADQCDU-S-13511 (contaminant not detected), is accepted without qualification.

- Subsurface soil sample ADSB40-S-13662, collected from SB40 at a depth of 29 ft BGL, was analyzed in SDG 01-9-14, with recovery of all three surrogate compounds below 80%. Although no contamination was detected in samples collected at 1-25 ft BGL in SB40, carbon tetrachloride was detected (at < 10 µg/kg) in samples from depths of 27 ft and 31 ft BGL. The result for sample ADSB40-S-13662, collected at 29 ft BGL (contaminant not detected), is qualified.

- Subsurface soil sample ADSB45-S-13747, collected from SB45 at a depth of 15 ft BGL, was analyzed in SDG 01-9-21, with recovery of all three surrogate compounds below 80%. Although no contamination was detected in other samples collected at 1-31 ft BGL in SB45, carbon tetrachloride was detected at 12 µg/kg in the sample from 33 ft BGL and at 22 µg/kg in the sample from 35 ft BGL. The result for sample ADSB45-S-13747, collected at 15 ft BGL (contaminant not detected), is qualified.

• Replicates of 50 soil samples were collected in the field for organic analysis by the purge-and-trap method. (Two of the replicates, ADQCDU-S-13784 and ADQCDU-S-14021, were not analyzed.) In addition, 35 soil samples were selected by AGEM Laboratory for duplicate analyses. Two samples with high contaminant levels (ADSB50-S-14016RE and ADSB50-S-14017RE) were also reanalyzed to confirm the detections in earlier analyses. Table F.4 compares the sample and replicate/duplicate results at AGEM Laboratory. Significant results include the following:

- At most of the sample locations, the initial analysis and the duplicate analysis or replicate sample analysis gave equivalent results, with no detection of

contamination in all analyses or detection of contaminants at similar concentrations in all analyses.

- For six sample locations, no carbon tetrachloride was detected in one analysis, and concentrations *below* the quantitation limit of 10 µg/kg were found in the associated replicate sample analysis or duplicate analysis.

- For three sample locations, no carbon tetrachloride was detected in one analysis, and concentrations *above* the quantitation limit of 10 µg/kg were found in the associated replicate sample analysis or duplicate analysis. Among these cases, the maximum difference in reported results was for sample ADSB50-S-14012, with reported carbon tetrachloride concentrations of "not detected" and 21 µg/kg.

- The 1,2-DCA concentrations measured in sample ADSB46-S-13962 and its replicate ADQCDU-S-13960 (collected at the SB46 location at a depth of 1 ft BGL) do not agree, with a detection in the sample of 358 µg/kg and no detection in the replicate. Analytical error was not evident.

- At the SB50 location, in clayey silt transitioning to sandy silty clay, high concentrations of carbon tetrachloride and 1,2-DCA were detected in sample ADSB50-S-14016, collected at a depth of 33 ft BGL, and in sample ADSB50-S-14017, collected at a depth of 35 ft. Duplicate analyses of the samples showed good agreement (Table F.4), with a maximum RPD value between the initial and duplicate analyses of 1.9% for carbon tetrachloride and 5.3% for 1,2-DCA. The contaminant detections were confirmed upon reanalysis of the samples, but the concentrations were significantly lower.

The analytical data from AGEM Laboratory are acceptable quantitatively (except for sample ADSB40-S-13662 and sample ADSB45-S-13747, qualified because of low surrogate recovery) for determination of contaminant distribution in the near-surface and subsurface soils at Adams.

F.2.2 Analysis of Soil Samples at Severn-Trent Laboratory

In accordance with the QA/QC procedures defined in the *Master Work Plan* (Argonne 1994), selected soil samples analyzed at the AGEM Laboratory for carbon tetrachloride and chloroform with EPA Method 8260B were subjected to verification analysis at STL. A comparison of the analytical results from the two laboratories is in Section F.2.3. Below is a discussion of the quality of the organic analytical data from STL.

In all, 35 soil samples were shipped to STL in three shipments, with a trip/field blank of the methanol used for sample extraction in each. Complete data packages were provided. The QA/QC procedures followed included initial and continuing calibration of instruments, analysis of laboratory blanks, monitoring of surrogate spike recovery, and matrix spike/matrix spike duplicate (MS/MSD) analyses. Significant results include the following:

- Soil samples shipped to STL were received with custody seals intact and at appropriate temperature. All samples were analyzed within required holding times.

- Analytical instruments were properly tuned; initial and continuing calibration checks remained within the allowable limit.

- Carbon tetrachloride and 1,2-DCA were not detected in the field/trip blanks of methanol used in VOC extraction. Chloroform was detected at low concentration. Contaminants of concern were not detected in the laboratory method blanks.

- Surrogate standard determinations were performed on samples and blanks by using the surrogate spike compounds toluene-d_8, 1,2-dichloroethane-d_4, 4-bromofluorobenzene, and 1,2-dichlorobenzene-d_4. Table F.5 shows the percent recovery of the system-monitoring compounds for each of the analyses. For 12 of the 35 soil samples, the recovery of 1 or more of the 4 surrogate compounds was outside the QC limits identified in Table F.5.

- Matrix spike/matrix spike duplicate analyses were performed by using a suite of matrix spike compounds that included carbon tetrachloride, chloroform,

and 1,2-DCA (the contaminants of concern detected during the investigation) to evaluate the matrix effect of samples on the analytical methodology. Table F.6 shows the percent recovery of carbon tetrachloride and chloroform in the three MS/MSD analyses, as well as the calculated RPD values in the MS/MSD analytical results. Significant results are as follows:

- The QC limits (identified in Table F.6) were met for carbon tetrachloride in each of the MS/MSD analyses.

- The recoveries of chloroform and 1,2-DCA in the spike/spike duplicate analysis of sample ADSB31-S-13568 (associated with samples in SDG 84515) were outside the respective control limits. As a result, the detection of 1,2-DCA in sample ADSB31-S-13568 is qualified, as are the chloroform results for all samples in the SDG (identified in Table F.5).

The organic analytical data for the soil samples analyzed at STL are acceptable for comparison with AGEM Laboratory data.

F.2.3 Verification Organic Analysis of Soil Samples

In accordance with the QA/QC procedures defined in the *Master Work Plan* (Argonne 1994), selected replicates of the soil samples analyzed at AGEM Laboratory for carbon tetrachloride and chloroform with EPA Method 8260B were subjected to verification analysis at a second laboratory (STL). In all, 35 samples from the 426 soil sample locations (8% of the soil samples) were subjected to verification analysis. Table F.7 compares the analytical results for the soil samples from the two laboratories. Significant results include the following:

- For most of the sample locations, verification analyses gave equivalent results, with no detection of contamination or detection of contaminants at similar concentrations.

- For four sample locations, no carbon tetrachloride was detected by AGEM Laboratory, and concentrations *below* the quantitation limit of 10 µg/kg were found by STL.

- Carbon tetrachloride results compare favorably for six sample locations with concentrations *above* the quantitation limit of 10 µg/kg, with calculated RPD values of 0-51%.

- Chloroform results from the two laboratories are acceptable. Most of the chloroform results from STL are qualified because of high surrogate recovery.

- The 1,2-DCA results from the two laboratories for samples ADSB50-S-14016RE and ADSB50-S-14017RE (collected at 33 ft BGL and 35 ft BGL, respectively) are acceptable, with calculated RPD values of 61% and 0.2%, respectively. However, for samples ADSB31-S-13568 and ADSB46-S-13962 (both collected at 1 ft BGL), 1,2-DCA was detected by one laboratory but not by the other, as follows:

  - For sample ADSB31-S-13568, STL reported a 1,2-DCA concentration of 19 µg/kg, a value qualified because of high surrogate recovery. No 1,2-DCA was detected by AGEM Laboratory in the sample and its replicate (ADQCDU-S-13565).

  - For sample ADSB46-S-13962, the AGEM Laboratory reported a 1,2-DCA concentration of 358 µg/kg, while STL reported no 1,2-DCA in its analysis. The AGEM Laboratory found no 1,2-DCA in the replicate of the sample (ADQCDU-S-13960).

Analytical data from AGEM Laboratory, obtained with EPA Method 8260B, are supported by the data from STL, but to a lesser degree for 1,2-DCA than for carbon tetrachloride and chloroform.

F.3 Quality Control for Total Organic Carbon Analysis of Soil Samples

Selected soil samples were analyzed at STL for total organic carbon content by using the Lloyd Kahn method of analysis, with high-temperature combustion and an infrared detector to measure carbon dioxide. The samples were acidified prior to analysis to remove inorganic carbon. Matrix spike and replicate analyses were performed on sample ADSB31-S-13569, with recovery approximating 100% in the matrix spike and good correlation in the replicate analysis.

Recovery in laboratory QC samples was 94.3-101.1%. Method blanks associated with the analyses were free of contamination. Results are in Table D.3, Appendix D.

F.4 Quality Control for Bulk Density Analysis of Soil Samples

Selected soil samples were sent to HWS Consulting Group for determination of bulk dry density, percent moisture content, specific gravity, and calculated percent porosity. Bulk dry density was calculated from the sample weight, volume, and water content. The specific gravity test was performed in accordance with ASTM D854. Results are in Table D.3, Appendix D.

F.5 Quality Control for Organic Analysis of Water Samples

In all, 58 groundwater samples (including 12 blind field replicate samples) were collected for organic analysis. Groundwater samples (and associated QC samples) collected for carbon tetrachloride and chloroform analyses were shipped immediately to AGEM Laboratory for analysis with EPA Method 524.2. As one measure of the precision of the analytical process, samples were selected by the laboratory for duplicate analyses. To verify the accuracy of the analytical results obtained with EPA Method 524.2, replicate (split) samples were collected for verification analysis at Clayton Laboratory with CLP methodology. On the basis of the results obtained by AGEM Laboratory, selected replicate samples were subjected to the verification analysis.

The following sections describe the QC procedures followed during analysis of groundwater samples and replicates and discuss the quality of the organic analytical data from each laboratory. Analytical data from AGEM Laboratory are discussed in Section F.5.1, and analytical data from Clayton Laboratory are discussed in Section F.5.2. A comparison of the analytical results from AGEM Laboratory and Clayton Laboratory is in Section F.5.3.

F.5.1 Analysis of Water Samples at AGEM Laboratory

Water samples shipped to the AGEM Laboratory were analyzed by the purge-and-trap method with a GC-MS system. For the purge-and-trap analyses, VOCs present in the groundwater sample were extracted (purged) from the sample matrix by bubbling an inert gas through the sample. The purged components were trapped in a specified sorbent tube. After the

purging, the sorbent tube was heated and back-flushed with an inert gas to desorb the components into the GC-MS system. The compounds eluting from the GC column were identified by retention time and by comparison with reference library spectra. The concentration of each component was calculated by comparison of the MS response for the quantitation ion to the response for corresponding calibration curves and/or internal standards. The internal standard recovery limits were 80-120%. If the internal standard was outside these limits, the data were flagged accordingly. Calibration checks with each SDG were required to be within ±20% of the standard.

Water samples submitted to the AGEM Laboratory for organic analysis were analyzed in seven SDGs. Table F.8 identifies the groundwater samples and associated QA/QC samples analyzed in each of the SDGs. The QA/QC procedures followed included analysis of instrument calibration check standards, analysis of laboratory blanks, monitoring of surrogate spike recovery, and duplicate laboratory analyses. Significant results include the following:

- Samples shipped to AGEM Laboratory were received with custody seals intact and at appropriate temperature. All samples were analyzed within required holding times.

- Contaminants of concern were not detected in field blanks, equipment rinsates, trip blanks shipped with the samples, or laboratory method blanks analyzed with the samples.

- For each SDG, analytical instrument calibration was monitored by the analysis of calibration check standards. Table F.8 shows the RPD values between the known and calculated concentrations of the standards. The concentrations of calibration check standards measured in all SDGs were within the acceptable range of ±20%.

- Surrogate standard determinations were performed on samples and blanks by using surrogate spike compounds fluorobenzene, 1,2-dichlorobenzene-d_4, and 4-bromofluorobenzene. Table F.8 shows the percent recovery of these

system-monitoring compounds for each of the analyses. Significant results are as follows:

- SDG 01-8-23: In the analysis of groundwater sample ADSB21-W-13580 (replicate of groundwater sample ADSB21-W-13579), the recovery of surrogate compound 1,2-dichlorobenzene-d_4 at 120.8% was at the QC limit of 120%. The data for this sample are accepted without qualification.

- SDG 01-8-28: In the analysis of groundwater sample ADSB27-W-13628, the recovery of all three surrogate compounds was below the QC limit of 80%. The sample, described in the field logbook as having a heavy sediment load, was not reanalyzed. The data for this sample are accepted with qualification.

- SDG 01-8-29: In the analysis of groundwater sample ADSB27-W-13631, the recovery of fluorobenzene was below the QC limit of 80%. The sample was reanalyzed (in SDG 01-9-4), with low recovery of fluorobenzene and 4-bromofluorobenzene. However, the results for replicate sample ADSB27-W-13632, analyzed in SDG 01-8-29 without a surrogate recovery error, support the results for sample ADSB27-W-13631, and the results for sample ADSB27-W-13631 are accepted without qualification.

- SDG 01-9-1: In the analysis of the rinsate ADSB52-W-14096, the recovery of all three surrogate compounds was below the QC limit of 80%. The rinsate (in which no contamination was detected) was collected after collection of groundwater sample ADSB52-W-14101 (also with no contamination detected), and the results for rinsate ADSB52-W-14096 are accepted without qualification.

• To provide a measure of the analytical precision, 12 blind replicate groundwater samples were collected for organic analysis at AGEM Laboratory, and an additional 5 groundwater samples were selected by the laboratory for duplicate organic analyses. The analytical results for the multiple analyses of samples from the 17 locations/depths are shown in Table F.9. Agreement is excellent.

The analytical data for groundwater from AGEM Laboratory are acceptable quantitatively (except for sample ADSB27-W-13628, results for which are because of low surrogate recovery) for determination of contaminant distribution.

F.5.2 Analysis of Water Samples at Clayton Laboratory

In accordance with the QA/QC procedures defined in the *Master Work Plan* (Argonne 1994), some replicates of groundwater samples analyzed at the AGEM Laboratory for carbon tetrachloride and chloroform with EPA Method 524.2 (identified in Table F.1) were selected for verification analysis with EPA-defined CLP methodology. The selection was based on the results determined by AGEM Laboratory. A comparison of the AGEM Laboratory and CLP analytical results for the replicate samples is in Section F.5.3. Below is a discussion of the quality of the organic analytical data obtained with CLP methodology.

Sixteen replicate groundwater samples were shipped to Clayton Laboratory for organic analysis with CLP methodology. The samples were sent in two shipments with a trip blank in each. Complete CLP data packages were provided. The QA/QC procedures followed in the CLP analysis of the samples included initial and continuing calibration of instruments, analysis of laboratory blanks, monitoring of surrogate spike recovery, and MS/MSD analyses. Significant results include the following:

- Samples shipped to the CLP laboratory were received with custody seals intact and at appropriate temperature. All samples were analyzed within required holding times. (Sample ADSB44-W-13633 was broken during shipment and was not analyzed.)

- Analytical instruments were properly tuned; initial and continuing calibration checks remained within the allowable limit.

- Contaminants of concern were not detected in trip blanks or laboratory method blanks.

- Surrogate standard determinations were performed on samples and blanks by using the surrogate spike compounds toluene-d_8, 4-bromofluorobenzene, and 1,2-dichloroethane-d_4. Table F.10 shows the percent recovery of the

system-monitoring compounds for each of the CLP analyses. Recovery of the surrogate spikes was within the acceptable range (identified in Table F.10) specific to each surrogate for all analyses.

- Matrix spike/matrix spike duplicate analyses were performed in accordance with CLP protocol by using matrix spike compounds 1,1-dichloroethene, trichloroethene, chlorobenzene, toluene, and benzene to evaluate the matrix effect of samples on the analytical methodology. Table F.11 shows the percent recovery of each spike compound in the two MS/MSD analyses, as well as the calculated RPD values for the MS/MSD analytical results. The recovery of spike compounds was within control limits for both MS/MSD analyses. The RPD value for one of the five spike compounds was slightly outside the QC limit for the MS/MSD analysis conducted with SDG 1081000-ARG112.

Organic analytical data from Clayton Laboratory for the replicate groundwater samples are acceptable for comparison to AGEM Laboratory data.

F.5.3 Verification Organic Analysis of Water Samples

In accordance with the QA/QC procedures defined in the *Master Work Plan* (Argonne 1994), selected replicates of the groundwater samples analyzed at AGEM Laboratory for carbon tetrachloride and chloroform with EPA Method 524.2 were subjected to verification analysis with EPA-defined CLP methodology. Of the 46 groundwater samples analyzed at AGEM Laboratory for carbon tetrachloride and chloroform, 15 (33% of the groundwater samples) were also analyzed with CLP methodology. Table F.12 compares the analytical results for groundwater samples obtained with EPA Method 524.2 and CLP methodology. Comparable results were obtained by the two laboratories over the range of contaminant concentrations detected during the Phase II investigation.

Analytical results for samples analyzed at AGEM Laboratory with EPA Method 524.2 are supported by the analytical results for replicate samples analyzed at Clayton Laboratory with EPA CLP methodology.

F.6 Quality Control for Nitrate-Nitrogen Analyses of Groundwater Samples

Selected groundwater samples were collected during the Phase II investigation for nitrate-nitrogen analysis to aid in geochemical characterization of the water-bearing zone. These samples were shipped immediately to STL for preservation, filtration, and analysis by ion chromatography with EPA Method 300.

Nitrate-nitrogen analysis of the groundwater samples was conducted in five SDGs. The QA/QC procedures followed included instrument calibration through analysis of spiked calibration check standards, verification of interelement and background correction factors through the analysis of ion chromatography interference check samples, and duplicate analyses of selected samples. Significant points are the following:

- As a result of instrument failure, the analysis of four samples (ADSB52-W-14088; ADSB52-W-14089; ADSB52-W-14092; and ADSB52-W-14093) was delayed five days from the date of collection. The holding time for this method of analysis, for samples that have not been preserved, is 48 hr. The analytical results for these samples are reported with qualification.

- Initial and continuing calibration of analytical equipment was verified according to method protocol by the analysis of instrument check standards to determine instrument drift. Percent recovery of the spiked analytes of concern in the calibration check standards was within the acceptable range of 90-110% for each SDG.

- Accuracy in the analytical methodology followed was measured by the analysis of laboratory QC samples with each SDG. Recovery of known concentrations of nitrate-nitrogen in spiked laboratory QC samples, in the range of 86-94%, was within the allowable range of 80-120%.

- Precision was measured by duplicate analyses of two samples (Table F.1). Good precision in the nitrate-nitrogen analyses is indicated by the low RPDs of 1.5% and 5.5% achieved between the initial and duplicate analyses.

The nitrate-nitrogen results from STL for groundwater samples are acceptable (with the aforementioned holding time qualifications) on the basis of the recovery of known concentrations of nitrate-nitrogen in laboratory QC samples analyzed with each SDG and the RPD achieved in duplicate analyses.

TABLE F.1 Quality control samples collected during the Phase II investigation at Adams, Nebraska.

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Equipment rinsates				
QC	ADSB21-W-13587	NA	8/23/01	Rinsate of ECPT sampling rod after collection of sample ADSB21-W-13585 and replicate ADSB21-W-13586.
QC	ADSB21-W-13592	NA	8/23/01	Rinsate of ECPT sampling bailer after collection of sample ADSB21-W-13590 and replicate ADSB21-W-13591.
QC	ADSB23-W-13598	NA	8/24/01	Rinsate of ECPT bailer after collection of sample ADSB23-W-13596 and replicate ADSB23-W-13597.
QC	ADSB23-W-13605	NA	8/24/01	Rinsate of ECPT rod after collection of sample ADSB23-W-13604.
QC	ADSB22-W-13616	NA	8/25/01	Rinsate of ECPT rod after collection of sample ADSB22-W-13615.
QC	ADSB23-W-13612	NA	8/25/01	Rinsate of ECPT bailer after collection of sample ADSB23-W-13610.
QC	ADSB22-W-13622	NA	8/26/01	Rinsate of ECPT bailer after collection of sample ADSB22-W-13621.
QC	ADSB25-W-13627	NA	8/26/01	Rinsate of ECPT bailer after collection of sample ADSB25-W-13626.
QC	ADSB27-W-13630	NA	8/27/01	Rinsate of ECPT bailer after collection of sample ADSB27-W-13629.
QC	ADSB44-W-13636	NA	8/27/01	Rinsate of ECPT bailer after collection of sample ADSB44-W-13634.
QC	ADSB52-W-14091	NA	8/30/01	Rinsate of ECPT bailer after collection of sample ADSB52-W-14089 and replicate ADSB52-W-14090.
QC	ADSB52-W-14096	NA	8/30/01	Rinsate of ECPT rod after collection of sample ADSB52-W-14101.
Soil trip blanks sent to AGEM Laboratory				
QC	AD-TB-Vial #13	NA	8/22/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3501 and 3502.
QC	AD-TB-Vial #31	NA	8/23/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 461, 2061, 2062, 2063, and 2065.
QC	AD-TB-Vial #22	NA	8/26/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3601, 3605, 3602, 3603, 3503, and 3506.
QC	AD-TB-Vial #36	NA	8/26/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3504, 3505, 2049, 2050, 2051, 2052, and 2053.
QC	AD-TB-Vial #23	NA	8/29/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3507, 3508, 3509, and 3510.
QC	AD-TB-Vial #35	NA	8/30/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3626, 3627, 3628, 3629, 3630, 3631, and 3632.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Soil trip blanks sent to AGEM Laboratory (Cont.)				
QC	AD-TB-Vial #34	NA	8/30/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3633, 3634, 3635, 3636, 3637, and 3638.
QC	AD-TB-Vial #27	NA	8/30/01	Trip blank sent to AGEM Laboratory with soil samples listed on COCs 3639, 3640, and 3641. Samples listed on COC 3641 and some of the samples listed on COC 3640 were collected for experimental purposes unrelated to the Adams Phase II investigation.
Soil trip blanks sent to Severn-Trent Laboratory				
QC	MeOH Blank-082901	NA	8/29/01	Field blank of methanol used for extraction of soil samples, also serving as trip blank for soil samples sent to STL and listed on COCs 2460 and 2461.
QC	MeOH Blank-091001	NA	9/10/01	Field blank of methanol used for extraction of soil samples, also serving as trip blank for soil samples sent to STL and listed on COCs 216 and 217.
QC	MeOH Blank-102601	NA	10/26/01	Field blank of methanol used for extraction of soil samples, also serving as trip blank for soil samples sent to STL and listed on COC 108.
Water trip blanks sent to AGEM Laboratory				
QC	ADSB21-W-13582	NA	8/22/01	Trip blank sent to AGEM Laboratory with water samples listed on COCs 1062 and 1063.
QC	ADSB23-W-13603	NA	8/24/01	Trip blank sent to AGEM Laboratory with water samples listed on COC 1066.
QC	ADSB52-W-14094	NA	8/30/01	Trip blank sent to AGEM Laboratory with water samples listed on COCs 1070 and 1071.
Water trip blanks sent to Clayton Laboratory				
QC	AD-TB-082801	NA	8/28/01	Trip blank sent to Clayton Laboratory with groundwater samples listed on COC 2459.
QC	AD-TB-090401	NA	9/4/01	Trip blank sent to Clayton Laboratory with groundwater samples listed on COC 2462.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Replicate soil samples				
SB24	ADQCDU-S-13508	25	8/22/01	Replicate of sample ADNGP925-S-11470.
SB24	ADQCDU-S-13509	27	8/22/01	Replicate of sample ADNGP927-S-11471.
SB26	ADQCDU-S-11500	1	8/23/01	Replicate of sample ADSB26-S-11682.
SB26	ADQCDU-S-11501	3	8/23/01	Replicate of sample ADSB26-S-11683.
SB26	ADQCDU-S-11502	5	8/23/01	Replicate of sample ADSB26-S-11684.
SB27	ADQCDU-S-11702	25	8/23/01	Replicate of sample ADSB27-S-13740.
SB28	ADQCDU-S-13526	17	8/23/01	Replicate of sample ADSB28-S-13486.
SB28	ADQCDU-S-13527	19	8/23/01	Replicate of sample ADSB28-S-13487.
SB29	ADQCDU-S-13528	1	8/24/01	Replicate of sample ADSB29-S-13530.
SB29	ADQCDU-S-13529	3	8/24/01	Replicate of sample ADSB29-S-13531.
SB31	ADQCDU-S-13565	1	8/24/01	Replicate of sample ADSB31-S-13568.
SB31	ADQCDU-S-13566	3	8/24/01	Replicate of sample ADSB31-S-13569.
SB31	ADQCDU-S-13567	5	8/24/01	Replicate of sample ADSB31-S-13570.
SB31	ADQCDU-S-13547	7	8/24/01	Replicate of sample ADSB31-S-13571.
SB32	ADQCDU-S-13784	25	8/24/01	Replicate of sample ADSB32-S-13780.
SB32	ADQCDU-S-13785	27	8/24/01	Replicate of sample ADSB32-S-13781.
SB34	ADQCDU-S-13804	1	8/25/01	Replicate of sample ADSB34-S-13806.
SB34	ADQCDU-S-13805	3	8/25/01	Replicate of sample ADSB34-S-13807.
SB35	ADQCDU-S-13828	1	8/25/01	Replicate of sample ADSB35-S-13830.
SB35	ADQCDU-S-13829	3	8/25/01	Replicate of sample ADSB35-S-13831.
SB36	ADQCDU-S-13846	1	8/25/01	Replicate of sample ADSB36-S-13848.
SB36	ADQCDU-S-13847	3	8/25/01	Replicate of sample ADSB36-S-13849.
SB37	ADQCDU-S-13902	1	8/26/01	Replicate of sample ADSB37-S-13886.
SB37	ADQCDU-S-13903	3	8/26/01	Replicate of sample ADSB37-S-13887.
SB38	ADQCDU-S-13916	1	8/26/01	Replicate of sample ADSB38-S-13904.
SB38	ADQCDU-S-13917	3	8/26/01	Replicate of sample ADSB38-S-13905.
SB39	ADQCDU-S-13930	1	8/26/01	Replicate of sample ADSB39-S-13932.
SB39	ADQCDU-S-13931	3	8/26/01	Replicate of sample ADSB39-S-13933.
SB40	ADQCDU-S-13664	1	8/27/01	Replicate of sample ADSB40-S-13648.
SB40	ADQCDU-S-13665	3	8/27/01	Replicate of sample ADSB40-S-13649.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Replicate soil samples (Cont.)				
SB41	ADQCDU-S-13786	1	8/27/01	Replicate of sample ADSB41-S-13666.
SB41	ADQCDU-S-13787	3	8/27/01	Replicate of sample ADSB41-S-13667.
SB42	ADQCDU-S-13745	1	8/27/01	Replicate of sample ADSB42-S-13682.
SB42	ADQCDU-S-13746	3	8/27/01	Replicate of sample ADSB42-S-13683.
SB43	ADQCDU-S-13765	1	8/27/01	Replicate of sample ADSB43-S-13698.
SB43	ADQCDU-S-13766	3	8/27/01	Replicate of sample ADSB43-S-13699.
SB45	ADQCDU-S-13511	1	8/28/01	Replicate of sample ADSB45-S-13513.
SB45	ADQCDU-S-13512	3	8/28/01	Replicate of sample ADSB45-S-13514.
SB46	ADQCDU-S-13960	1	8/28/01	Replicate of sample ADSB46-S-13962.
SB46	ADQCDU-S-13961	3	8/28/01	Replicate of sample ADSB46-S-13963.
SB47	ADQCDU-S-13980	1	8/28/01	Replicate of sample ADSB47-S-13982.
SB47	ADQCDU-S-13981	3	8/28/01	Replicate of sample ADSB47-S-13983.
SB48	ADQCDU-S-14020	1	8/28/01	Replicate of sample ADSB48-S-14022.
SB48	ADQCDU-S-14021	3	8/28/01	Replicate of sample ADSB48-S-14023.
SB49	ADQCDU-S-13954	1	8/27/01	Replicate of sample ADSB49-S-13956.
SB49	ADQCDU-S-13955	3	8/27/01	Replicate of sample ADSB49-S-13957.
SB50	ADQCDU-S-14018	1	8/28/01	Replicate of sample ADSB50-S-14000.
SB50	ADQCDU-S-14019	3	8/28/01	Replicate of sample ADSB50-S-14001.
SB51	ADQCDU-S-14040	1	8/29/01	Replicate of sample ADSB51-S-14042.
SB51	ADQCDU-S-14041	3	8/29/01	Replicate of sample ADSB51-S-14043.
Soil samples selected by AGEM Laboratory for duplicate organic analysis by the purge-and-trap method				
SB24	ADNGP917-S-11466	17	8/22/01	Dark brown clay.
SB25	ADSB25-S-11490	15	8/23/01	Dark brown clay.
SB25	ADSB25-S-11494	23	8/23/01	Pinkish gray clay with less iron oxide than sample at 21 ft BGL.
SB27	ADSB27-S-13742	29	8/23/01	No description noted.
SB30	ADSB30-S-13561	27	8/24/01	Light olive-brown silty clay with iron oxide and manganese oxide.
SB31	ADSB31-S-13571	7	8/24/01	Clay; some organics.
SB31	ADSB31-S-13761	27	8/24/01	Silt, saturated below sampling point.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Soil samples selected by AGEM Laboratory for duplicate organic analysis by the purge-and-trap method (Cont.)				
SB32	ADSB32-S-13770	5	8/24/01	Loam; some organics.
SB32	ADSB32-S-13773	11	8/24/01	Clay; organic rich.
SB32	ADSB32-S-13776	17	8/24/01	Silty clay; organic rich.
SB33	ADSB33-S-13797	19	8/25/01	Clay; medium organics.
SB34	ADSB34-S-13812	13	8/25/01	Silty clay.
SB35	ADSB35-S-13843	27	8/25/01	Clayey silt with black stains.
SB35	ADSB35-S-13845	31	8/25/01	Clay.
SB36	ADSB36-S-13861	27	8/25/01	Silty clay with iron oxide, saturated.
SB38	ADQCDU-S-13916	1	8/26/01	Replicate of sample ADSB38-S-13904.
SB38	ADQCDU-S-13917	3	8/26/01	Replicate of sample ADSB38-S-13905.
SB38	ADSB38-S-13906	5	8/26/01	Loamy clay.
SB38	ADSB38-S-13907	7	8/26/01	Clay with light yellow mottles.
SB38	ADSB38-S-13922	17	8/26/01	Silty clay.
SB40	ADSB40-S-13657	19	8/27/01	Organic-rich silty clay.
SB41	ADSB41-S-13668	5	8/27/01	Very organic clay.
SB42	ADSB42-S-13687	11	8/27/01	Silty clay; organics.
SB42	ADSB42-S-13689	15	8/27/01	Silty clay with manganese oxide stains; medium organics.
SB42	ADSB42-S-13693	23	8/27/01	Clayey sand; no organics.
SB46	ADSB46-S-13974	25	8/28/01	Clay with some iron oxide and manganese oxide; no organics.
SB48	ADSB48-S-14038	33	8/28/01	Silty clayey very fine sand with iron oxide.
SB49	ADSB49-S-13647	23	8/27/01	Saturated (loess-like) sandy silt; no organics.
SB50	ADSB50-S-14001	3	8/28/01	Loam; organics.
SB50	ADSB50-S-14008	17	8/28/01	Clay; no organics.
SB50	ADSB50-S-14010	21	8/28/01	Silty clay with iron and manganese oxides; no organics.
SB50	ADSB50-S-14012	25	8/28/01	Silty clay; no organics.
SB50	ADSB50-S-14016	33	8/28/01	Clayey silt; no organics. The sample was also reanalyzed as ADSB50-S-14016RE.
SB50	ADSB50-S-14017	35	8/28/01	Fine sand silty clay; no organics. The sample was also reanalyzed as ADSB50-S-14017RE.
SB51	ADSB51-S-14042	1	8/29/01	Loam; low in organics.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Soil samples selected for verification organic analysis at Severn-Trent Laboratory by EPA Method 8260B				
SB24	ADNGP97-S-11461	7	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP99-S-11462	9	8/22/01	Dark brown clay loam, no iron oxides.
SB24	ADNGP929-S-11472	29	8/22/01	Brown-gray clay with manganese oxide streaks and iron oxide.
SB27	ADSB27-S-13729	3	8/23/01	Black loam.
SB28	ADQCDU-S-13527	19	8/23/01	Replicate of sample ADSB28-S-13487.
SB30	ADSB30-S-13558	21	8/24/01	Light olive-brown silty clay with iron oxide.
SB31	ADSB31-S-13568	1	8/24/01	Very dark gray clay loam; high in organics.
SB31	ADSB31-S-13759	23	8/24/01	Clayey silt.
SB32	ADSB32-S-13771	7	8/24/01	Clay loam; some organics.
SB32	ADSB32-S-13775	15	8/24/01	Silty clay; organics.
SB32	ADSB32-S-13779	23	8/24/01	Silty clay; organic rich.
SB32	ADQCDU-S-13784	25	8/24/01	Replicate of sample ADSB32-S-13780.
SB32	ADSB32-S-13783	31	8/24/01	Clayey silt.
SB34	ADSB34-S-13817	23	8/25/01	Stiff clay with iron oxide stain; little organic stain.
SB35	ADSB35-S-13831	3	8/25/01	Loam; much organic material.
SB35	ADSB35-S-13835	11	8/25/01	Clay; medium organics.
SB35	ADSB35-S-13844	29	8/25/01	Sand with iron nodules and stains, saturated.
SB35	ADSB35-S-13845	31	8/25/01	Clay.
SB38	ADSB38-S-13922	17	8/26/01	Silty clay.
SB39	ADSB39-S-13933	3	8/26/01	Loam.
SB40	ADSB40-S-13652	9	8/27/01	Organic clay.
SB40	ADSB40-S-13655	15	8/27/01	Organic silty clay.
SB40	ADSB40-S-13663	31	8/27/01	Silty clay with iron oxide and manganese oxide stains; wet, but not in saturated sand.
SB42	ADSB42-S-13689	15	8/27/01	Silty clay with manganese oxide stains; medium organics.
SB43	ADSB43-S-13707	19	8/27/01	Saturated (loess-like), very fine sandy silt.
SB45	ADSB45-S-13958	33	8/28/01	Saturated silt; no organics.
SB45	ADSB45-S-13959	35	8/28/01	Saturated silt; no organics.
SB46	ADSB46-S-13962	1	8/28/01	Loam; medium organics.
SB46	ADSB46-S-13963	3	8/28/01	Loam; medium organics.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Soil samples selected for verification organic analysis at Severn-Trent Laboratory by EPA Method 8260B (Cont.)				
SB46	ADSB46-S-13964	5	8/28/01	Clay; medium organics.
SB46	ADSB46-S-13965	7	8/28/01	Sandy clay; low to no organics.
SB50	ADSB50-S-14016RE	33	8/28/01	Clayey silt; no organics.
SB50	ADSB50-S-14017RE	35	8/28/01	Fine sand-silty clay; no organics.
SB51	ADSB51-S-14054	25	8/29/01	Silty clay, with iron oxide; no organics.
SB51	ADSB51-S-14055	27	8/29/01	Silty clay, less iron oxide than above; no organics.
Replicate groundwater samples				
SB21	ADSB21-W-13580	35-40	8/22/01	Replicate of sample ADSB21-W-13579.
SB21	ADSB21-W-13591	50-55	8/23/01	Replicate of sample ADSB21-W-13590.
SB21	ADSB21-W-13586	66-70	8/23/01	Replicate of sample ADSB21-W-13585.
SB22	ADSB22-W-13619	35-40	8/26/01	Replicate of sample ADSB21-W-13618.
SB23	ADSB23-W-13597	35-40	8/24/01	Replicate of sample ADSB23-W-13596.
SB23	ADSB23-W-13608	40-45	8/25/01	Replicate of sample ADSB23-W-13607.
SB23	ADSB23-W-13602	65-70	8/24/01	Replicate of sample ADSB23-W-13601.
SB25	ADSB25-W-13625	42-47	8/26/01	Replicate of sample ADSB25-W-13624.
SB27	ADSB27-W-13632	37-42	8/27/01	Replicate of sample ADSB27-W-13631.
SB44	ADSB44-W-13637	37-42	8/27/01	Replicate of sample ADSB44-W-13635.
SB52	ADSB52-W-14090	35-40	8/30/01	Replicate of sample SDSB52-W-14089.
SB52	ADSB52-W-14099	50-55	8/30/01	Replicate of sample ADSB52-W-14098.
Groundwater samples selected by AGEM Laboratory for duplicate organic analysis by the purge-and-trap method				
SB21	ADSB21-W-13578	25-30	8/22/01	Dark gray with heavy sediment load. Good water recovery immediately.
SB21	ADSB21-W-13579	35-40	8/22/01	No description noted.
SB21	ADSB21-W-13591	50-55	8/23/01	Replicate of sample ADSB21-W-13590.
SB22	ADSB22-W-13617	60-65	8/25/01	Abundant water recovery.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Sample Description
Groundwater samples selected by AGEM Laboratory for duplicate organic analysis by the purge-and-trap method (Cont.)				
SB25	ADSB25-W-13623	32-37	8/26/01	Sampling opposite SB25 core hole. Abundant water recovery; heavy sediment load; dark brown in color.
SB52	ADSB52-W-14101	65-70	8/30/01	No description noted.
Groundwater samples selected for verification organic analysis at Clayton Laboratory with CLP methodology				
SB21	ADSB21-W-13578	25-30	8/22/01	Dark gray with heavy sediment load. Good water recovery immediately.
SB21	ADSB21-W-13591	50-55	8/23/01	Replicate of sample ADSB21-W-13590.
SB21	ADSB21-W-13590	50-55	8/23/01	Abundant water; less sediment load.
SB21	ADSB21-W-13594	70-75	8/23/01	No description noted.
SB22	ADSB22-W-13621	55-60	8/26/01	No description noted.
SB23	ADSB23-W-13595	25-30	8/24/01	Very slow water recovery and limited production.
SB23	ADSB23-W-13609	50-55	8/25/01	Abundant water; clear; little sediment.
SB23	ADSB23-W-13601	65-70	8/24/01	Abundant, very clear water.
SB25	ADSB25-W-13623	32-37	8/26/01	Abundant water recovery; heavy sediment load; dark brown in color.
SB25	ADSB25-W-13624	42-47	8/26/01	No description noted.
SB27	ADSB27-W-13628	32-37	8/27/01	Abundant water; heavy sediment load; medium brown in color.
SB44	ADSB44-W-13633	32-37	8/27/01	Limited water recovery, slow recovery.
SB44	ADSB44-W-13637	37-42	8/27/01	Replicate of sample ADSB44-W-13635.
SB52	ADSB52-W-14092	45-50	8/30/01	Abundant water recovery; very slightly oxidized.
SB52	ADSB52-W-14100	60-65	8/30/01	No description noted.
SB52	ADSB52-W-14101	65-70	8/30/01	No description noted.
Groundwater samples selected by Severn-Trent Laboratory for duplicate nitrate-nitrogen analysis with EPA Method 300				
SB21	ADSB21-W-13578	25-30	8/22/01	Dark gray with heavy sediment load. Good water recovery immediately.
SB21	ADSB21-W-13589	40-45	8/23/01	Ample water recovery; pale brown.

TABLE F.2 Results of organic analyses on quality control samples collected to monitor sample collection and handling activities during the Phase II investigation at Adams, Nebraska.

		Concentration (μg/kg in soil; μg/L in water)		
Sample	Sample Date	Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
Soil trip blanks sent to AGEM Laboratory				
AD-TB-Vial #13	8/22/01	ND[a]	ND	ND
AD-TB-Vial #31	8/23/01	ND	ND	ND
AD-TB-Vial #22	8/26/01	ND	ND	ND
AD-TB-Vial #36	8/26/01	ND	ND	ND
AD-TB-Vial #23	8/29/01	ND	ND	ND
AD-TB-Vial #27	8/30/01	ND	ND	ND
AD-TB-Vial #34	8/30/01	ND	ND	ND
AD-TB-Vial #35	8/30/01	ND	ND	ND
Soil trip blanks sent to Severn-Trent Laboratory				
MeOH blank-082901	8/29/01	ND	< 10[b]	ND
MeOH blank-091001	9/10/01	ND	ND	ND
Water trip blanks sent to AGEM Laboratory				
ADSB21-W-13582	8/22/01	ND	ND	ND
ADSB23-W-13603	8/24/01	ND	ND	ND
ADSB52-W-14094	8/30/01	ND	ND	ND
Water trip blanks sent to Clayton Laboratory				
AD-TB-082801	8/28/01	ND	ND	ND
AD-TB-090401	9/4/01	ND	ND	ND
Equipment rinsates				
ADSB21-W-13587	8/23/01	ND	ND	ND
ADSB21-W-13592	8/23/01	ND	ND	ND
ADSB23-W-13598	8/24/01	ND	ND	ND
ADSB23-W-13605	8/24/01	ND	ND	ND
ADSB22-W-13616	8/25/01	ND	ND	ND
ADSB23-W-13612	8/25/01	ND	ND	ND
ADSB22-W-13622	8/26/01	ND	ND	ND
ADSB25-W-13627	8/26/01	ND	ND	ND
ADSB27-W-13630	8/27/01	ND	ND	ND
ADSB44-W-13636	8/27/01	ND	ND	ND
ADSB52-W-14091	8/30/01	ND	ND	ND
ADSB52-W-14096	8/30/01	ND	ND	ND

[a] ND, contaminant not detected.

[b] < 10, contaminant detected at a concentration below the soil quantitation limit of 10 μg/kg.

TABLE F.3 Results of organic analyses on quality control samples collected to monitor soil analyses at AGEM Laboratory by the purge-and-trap method.

				Measured Values for Calibration Check Standards			
	Recovery of Surrogate Compounds[a] (%)			Carbon Tetrachloride		Chloroform	
Sample	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-8-24, analysis date August 24, 2001							
20-μg/kg standard	91	85	93	18.7	6.7	18.86	5.9
Laboratory blank	97	82	89				
ADNGP917-S-11466	104	106	105				
ADNGP91-S-11458	97	98	98				
ADNGP93-S-11459	101	101	101				
ADQCDU-S-13508	88	93	92				
ADQCDU-S-13509	94	97	96				
ADNGP913-S-11464	96	93	96				
ADNGP915-S-11465	96	96	97				
ADNGP95-S-11460	98	98	99				
ADNGP97-S-11461	89	92	91				
ADNGP927-S-11471	79[c]	78[c]	78[c]	Reanalysis on 9/24 without error.			
ADNGP931-S-11473	89	87	89				
ADNGP929-S-11472	99	94	99				
ADNGP921-S-11468	101	99	102				
ADNGP923-S-11469	95	95	98				
ADNGP99-S-11462	97	95	101				
ADNGP911-S-11463	93	92	95				
ADNGP933-S-11474	94	95	96				
ADNGP925-S-11470	89	90	93				
ADNGP935-S-11475	94	95	98				
AD-TB-Vial #13	30[c]	39[c]	38[c]	Reanalysis on 9/24 without error.			

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-8-25, analysis date August 25, 2001							
20-µg/kg standard	89	98	94	19.34	3.3	19	5.1
Laboratory blank	100	100	100				
ADNGP919-S-11467	110	99	103				
ADSB25-S-11495	98	96	98				
ADSB25-S-11496	102	99	101				
ADSB25-S-11485	97	93	94				
ADSB25-S-11486	99	97	98				
ADSB25-S-11487	38[c]	46[c]	41[c]	Reanalysis on 9/24 without error.			
ADSB25-S-11488	92	87	91				
ADSB25-S-11493	88	69[c]	75[c]	Reanalysis on 9/24 without error.			
ADSB25-S-11494	91	94	93				
ADSB25-S-11494DUP	97	94	96				
ADSB26-S-11698	96	95	95				
ADSB26-S-11699	96	95	96				
ADSB25-S-11491	92	92	94				
ADSB25-S-11492	97	95	98				
ADSB26-S-11690	86	86	89				
ADSB26-S-11691	99	99	101				
ADSB26-S-11696	100	98	99				
ADSB26-S-11697	96	97	97				
ADSB26-S-11686	95	99	100				
ADSB26-S-11687	104	96	98				
ADSB27-S-13732	95	98	99				
ADSB27-S-13733	102	94	94				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-8-26, analysis date August 26, 2001							
20-µg/kg standard	100	100	100	17.02	16.1	16.9	16.8
Laboratory blank	100	100	100				
ADSB26-S-11682	117	118	119				
ADSB26-S-11683	116	118	120				
ADSB26-S-11693	113	120	119				
ADNGP917-S-11466DUP	105	113	112				
ADSB26-S-11692	99	107	104				
ADSB26-S-11688	108	111	110				
ADSB26-S-11689	104	111	111				
ADSB25-S-11489	106	110	109				
ADSB25-S-11490	93	84	86				
ADSB25-S-11490DUP	104	111	109				
ADSB26-S-11684	100	108	107				
ADSB26-S-11685	106	111	109				
ADQCDU-S-11500	100	106	105				
ADQCDU-S-11501	100	107	104				
ADQCDU-S-11502	99	105	102				
SDG 01-8-27, analysis date August 27, 2001							
20-µg/kg standard	110	108	110	17.69	12.2	17.02	16.1
Laboratory blank	100	100	100				
ADSB27-S-13734	108	110	110				
ADSB27-S-13735	113	115	113				
ADSB25-S-11483	102	101	102				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-8-27, analysis date August 27, 2001 (Cont.)							
ADSB28-S-13478	103	103	102				
ADSB28-S-13479	107	108	107				
ADSB28-S-13518	89	96	92				
ADSB25-S-11484	103	104	103				
SDG 01-8-29, analysis date August 29, 2001							
20-µg/kg standard	103	93	102	20.04	0.2	18.96	5.3
Laboratory blank	100	100	100				
ADSB28-S-13519	104	111	109				
ADSB27-S-13738	94	106	102				
ADSB27-S-13739	95	107	104				
ADSB26-S-11694	89	102	97				
ADSB26-S-11695	87	97	95				
ADSB26-S-11700	87	97	94				
ADSB26-S-11701	87	97	94				
ADSB27-S-13730	83	95	90				
ADSB27-S-13731	86	98	95				
ADSB25-S-11497	77[c]	74[c]	77[c]	Not reanalyzed.			
ADSB25-S-11498	88	97	96				
ADSB27-S-13740	90	101	99				
ADSB27-S-13741	88	100	97				
ADSB27-S-13742	90	100	98				
ADSB28-S-13522	63[c]	78[c]	73[c]	Reanalysis on 9/24 without error.			
ADSB28-S-13523	82	90	87				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-8-29, analysis date August 29, 2001 (Cont.)							
ADSB28-S-13482	82	99	93				
ADSB28-S-13483	82	94	92				
SDG 01-8-30, analysis date August 30, 2001							
20-µg/kg standard	92	92	89	17	16.2	16.16	21.2[c]
Laboratory blank	100	100	100				
ADSB28-S-13520	91	98	98				
ADSB28-S-13521	108	110	109				
ADQCDU-S-13526	98	100	100				
ADQCDU-S-11702	101	111	110				
ADSB28-S-13486	99	106	104				
ADSB28-S-13487	100	105	106				
ADQCDU-S-13785	94	101	98				
ADSB32-S-13780	96	103	101				
ADSB32-S-13781	88	79[c]	78[c]	Reanalysis on 9/24 without error.			
ADSB32-S-13782	94	100	96				
ADSB32-S-13783	99	106	104				
ADSB32-S-13774	94	105	101				
ADSB32-S-13775	95	104	100				
ADSB32-S-13773	93	106	102				
ADSB32-S-13773DUP	94	102	99				
ADSB32-S-13772	96	101	101				
ADSB32-S-13770	101	103	101				
ADSB32-S-13770DUP	101	105	105				
ADSB32-S-13771	99	107	104				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-8-30, analysis date August 30, 2001 (Cont.)							
ADSB32-S-13768	101	105	106				
ADSB32-S-13769	99	104	102				
ADSB32-S-13778	98	105	104				
ADSB32-S-13779	93	101	100				
ADSB32-S-13776	93	100	97				
ADSB32-S-13777	88	76[c]	77[c]	Not reanalyzed.			
ADSB27-S-13743	98	105	103				
ADSB28-S-13480	85	90	90				
ADSB28-S-13481	96	102	100				
ADSB27-S-13736	95	105	103				
ADSB27-S-13737	93	103	101				
ADSB28-S-13484	94	103	101				
ADSB28-S-13485	91	101	100				
ADSB27-S-13728	89	100	100				
ADSB27-S-13729	93	100	99				
SDG 01-8-31, analysis date August 31, 2001							
20-µg/kg standard	84	96	90	18.73	6.6	16.67	18.2
Laboratory blank	90	85	87				
ADQCDU-S-13527	103	108	111				
ADSB33-S-13802	110	115	113				
AD-TB-Vial #31	103	104	109				
ADSB33-S-13803	106	112	112				
ADSB33-S-13794	103	111	109				
ADSB33-S-13795	102	107	109				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-8-31, analysis date August 31, 2001 (Cont.)							
ADSB33-S-13798	99	107	107				
ADSB33-S-13799	98	103	100				
ADSB33-S-13790	88	82	83				
ADSB33-S-13791	99	106	106				
ADSB33-S-13788	99	106	106				
ADSB33-S-13789	98	110	110				
ADSB33-S-13796	89	102	99				
ADSB33-S-13797	97	106	107				
ADSB33-S-13797DUP	91	101	98				
ADSB33-S-13800	109	98	99				
ADSB33-S-13801	103	94	96				
ADSB33-S-13792	107	94	97				
ADSB33-S-13793	108	95	97				
ADSB29-S-13538	108	98	99				
ADSB29-S-13539	105	96	95				
ADQCDU-S-13528	99	87	88				
ADQCDU-S-13529	98	88	89				
ADSB29-S-13534	92	81	80				
ADSB29-S-13535	95	85	84				
ADSB30-S-13550	98	90	90				
ADSB30-S-13551	100	94	89				
ADSB30-S-13554	98	92	90				
ADSB30-S-13555	42[c]	46[c]	43[c]	Reanalysis on 10/1 without error.			
ADSB29-S-13532	93	85	86				
ADSB29-S-13533	94	85	87				
ADSB31-S-13576	74[c]	75[c]	73[c]	Reanalysis on 9/24 without error.			
ADSB31-S-13577	98	90	93				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-9-1, analysis date September 1, 2001							
20-μg/kg standard	107	96	102	20.21	1	17.28	14.6
Laboratory blank	100	100	100				
ADSB31-S-13572	102	82	86				
ADSB31-S-13573	111	89	96				
ADSB31-S-13570	115	95	105				
ADSB31-S-13571	113	94	105				
ADSB29-S-13543	100	89	97				
ADSB29-S-13542	103	90	101				
ADSB30-S-13552	116	95	107				
ADSB30-S-13553	103	91	101				
ADSB31-S-13763	110	90	101				
ADSB31-S-13762	99	80	81				
ADSB31-S-13574	98	89	97				
ADSB31-S-13575	108	95	106				
ADSB30-S-13560	103	90	98				
ADSB30-S-13561	106	98	108				
ADSB30-S-13561DUP	112	102	112				
ADQCDU-S-13565	109	99	110				
ADSB29-S-13540	106	102	110				
ADSB29-S-13541	107	102	115				
ADSB29-S-13536	105	101	110				
ADSB29-S-13537	97	95	104				
ADSB29-S-13530	93	91	104				
ADSB29-S-13531	97	97	107				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-9-2, analysis date September 2, 2001							
20-μg/kg standard	100	100	100	19.72	1.4	16.93	16.6
Laboratory blank	100	100	100				
ADSB31-S-13760	102	102	105				
ADSB31-S-13761	85	103	98				
ADSB31-S-13761DUP	93	96	94				
ADSB31-S-13568	95	96	96				
ADSB31-S-13569	94	99	99				
ADQCDU-S-13547	94	99	97				
ADQCDU-S-13567	97	101	101				
ADSB30-S-13558	94	99	97				
ADSB30-S-13559	84	78[c]	77[c]	Reanalysis on 9/24 without error.			
ADSB30-S-13556	92	102	100				
ADSB30-S-13557	93	101	98				
ADSB31-S-13758	96	99	99				
ADSB31-S-13759	89	99	96				
ADSB30-S-13548	91	94	96				
ADSB30-S-13549	87	96	92				
ADSB29-S-13544	95	102	99				
ADSB29-S-13545	97	103	100				
ADQCDU-S-13566	100	104	103				
ADSB36-S-13850	98	102	100				
ADSB36-S-13851	88	98	93				
ADSB36-S-13858	101	106	107				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-3, analysis date September 3, 2001							
20-µg/kg standard	97	107	106	18.53	7.6	16.63	18.4
Laboratory blank	91	88	87				
ADSB36-S-13859	109	112	113				
ADSB36-S-13862	101	106	105				
ADSB36-S-13863	102	105	105				
ADSB36-S-13856	92	98	98				
ADSB36-S-13857	91	100	97				
ADQCDU-S-13846	94	100	98				
ADSB34-S-13814	92	96	95				
ADSB34-S-13815	92	97	96				
ADSB34-S-13819	85	75[c]	79[c]	Not reanalyzed.			
ADSB35-S-13830	83	90	87				
ADSB35-S-13831	95	104	103				
ADSB34-S-13818	91	94	95				
ADSB35-S-13842	82	87	84				
ADSB35-S-13843	87	90	91				
ADSB35-S-13843DUP	90	95	94				
ADSB35-S-13844	89	93	92				
ADSB35-S-13845	88	95	92				
ADSB35-S-13832	90	97	94				
ADSB35-S-13833	94	97	96				
ADSB35-S-13834	94	99	98				
ADSB35-S-13835	83	90	88				
ADSB34-S-13816	87	93	91				
ADSB34-S-13817	54[c]	64[c]	60[c]	Reanalysis on 9/24 without error.			

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-3, analysis date September 3, 2001 (Cont.)							
ADSB35-S-13841	87	90	88				
ADSB35-S-13836	79[c]	68[c]	68[c]	Reanalysis on 9/24 without error.			
SDG 01-9-4, analysis date September 4, 2001							
20-µg/kg standard	100	100	100	18.36	8.6	18.64	7
Laboratory blank	114	104	113				
ADSB35-S-13837	94	98	95				
ADSB34-S-13820	92	86	85				
ADSB34-S-13821	94	80	81				
ADSB35-S-13839	100	100	100				
ADSB35-S-13838	85	82	79.4[c]	Accepted.			
ADSB34-S-13806	113	104	108				
ADSB34-S-13807	102	103	110				
ADSB34-S-13812	115	109	108				
ADSB34-S-13812DUP	93	94	97				
SDG 01-9-5, analysis date September 5, 2001							
20-µg/kg standard	100	100	100	23.26	15.1	22.84	13.3
Laboratory blank	100	100	100				
ADSB36-S-13848	117	112	112				
ADSB36-S-13849	105	103	103				
ADSB34-S-13810	109	103	101				
ADSB34-S-13811	112	106	105				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-5, analysis date September 5, 2001 (Cont.)							
ADSB34-S-13808	105	99	97				
ADSB34-S-13809	101	96	94				
ADSB36-S-13852	97	95	93				
ADSB36-S-13853		Lost due to computer error.		Reanalysis on 9/24 without error.			
ADSB35-S-13845DUP		Lost due to computer error.		Reanalysis on 9/24 without error.			
ADSB36-S-13854		Lost due to computer error.		Reanalysis on 9/24 without error.			
ADSB36-S-13855	109	106	103				
ADSB36-S-13860	99	98	95				
ADSB36-S-13861	106	103	102				
ADSB36-S-13861DUP	95	97	93				
SDG 01-9-6, analysis date September 6, 2001							
20-µg/kg standard	95	97	94	20.42	2.1	17.4	13.9
Laboratory blank	105	103	106				
ADSB38-S-13907	100	94	100				
ADQCDU-S-13805	108	103	107				
ADQCDU-S-13847	94	91	95				
ADQCDU-S-13804	100	98	102				
ADQCDU-S-13828	97	96	100				
ADSB43-S-13948	91	87	92				
ADQCDU-S-13829	87	70[c]	75[c]	Reanalysis on 9/24 without error.			
ADSB37-S-13900	85	88	89				
ADSB37-S-13901	92	92	95				
ADSB38-S-13920	96	97	100				
ADSB38-S-13921	94	97	97				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-6, analysis date September 6, 2001 (Cont.)							
ADQCDU-S-13916	89	88	91				
ADQCDU-S-13916DUP	93	95	98				
ADSB38-S-13926	87	95	96				
ADSB38-S-13927	99	101	105				
ADSB39-S-13946	95	95	95				
ADSB39-S-13947	90	95	98				
ADSB39-S-13932	81	83	84				
ADSB39-S-13933	91	94	98				
ADQCDU-S-13903	84	84	86				
ADSB37-S-13888	84	83	84				
ADSB37-S-13889	100	101	101				
SDG 01-9-7, analysis date September 7, 2001							
20-µg/kg standard	94	97	100	18.98	5.2	16	22.2[c]
Laboratory blank	105	103	106				
ADSB39-S-13934	102	90	99				
ADSB39-S-13935	102	98	101				
ADSB37-S-13896	103	99	104				
ADSB37-S-13897	91	87	92				
ADSB37-S-13898	125[c]	123[c]	130[c]	Reanalysis on 10/1 without error.			
ADSB37-S-13899	112	106	112				
ADSB38-S-13928	105	99	104				
ADSB38-S-13929	100	94	98				
ADSB38-S-13904	89	73[c]	81	Reanalysis on 9/25 without error.			
ADSB38-S-13905	83	85	88				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-9-7, analysis date September 7, 2001 (Cont.)							
ADSB39-S-13936	125[c]	127[c]	132[c]	Reanalysis on 9/24 without error.			
ADSB39-S-13937	128[c]	111	119	Reanalysis on 9/25 without error.			
ADQCDU-S-13902	90	99	101				
ADQCDU-S-13917	87	83	87				
ADQCDU-S-13917DUP	85	81	84				
ADSB39-S-13940	103	97	105				
ADSB39-S-13941	110	106	115				
ADSB39-S-13942	108	103	109				
ADSB39-S-13943	105	106	108				
ADSB37-S-13894	69[c]	75[c]	74[c]	Reanalysis on 9/24 without error.			
ADSB37-S-13895	97	83	90				
ADSB37-S-13892	84	83	85				
ADSB37-S-13893	110	99	108				
ADSB38-S-13918	98	71[c]	82	Reanalysis on 9/25 without error.			
ADSB38-S-13919	104	102	105				
ADSB39-S-13938	101	94	100				
SDG 01-9-10, analysis date September 10, 2001							
20-μg/kg standard	100	110	102	20.42	2.1	16.55	18.9
Laboratory blank	96	89	92				
ADSB39-S-13939	90	108	99				
ADSB38-S-13925	98	104	99				
ADQCDU-S-13930	90	92	87				
ADSB39-S-13944	104	111	108				
ADSB37-S-13886	98	102	95				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-10, analysis date September 10, 2001 (Cont.)							
ADSB37-S-13887	100	97	94				
ADSB37-S-13890	94	82	83				
ADSB37-S-13891	97	101	97				
ADQCDU-S-13931	93	95	90				
ADSB38-S-13906	99	100	93				
ADSB39-S-13945	101	103	100				
ADSB38-S-13922	93	88	85				
ADSB38-S-13922DUP	104	108	103				
AD-TB-Vial #36	101	94	98				
ADSB38-S-13924	103	104	102				
ADSB38-S-13923	69[c]	77[c]	72[c]	Reanalysis on 9/25 without error.			
ADSB38-S-13907DUP	110	109	107				
ADSB38-S-13906DUP	112	109	108				
ADSB50-S-14005	101	101	97				
SDG 01-9-11, analysis date September 11, 2001							
20-µg/kg standard	100	100	100	23.23	14.9	22.06	9.8
Laboratory blank	115	94	104				
ADSB43-S-13949	97	106	104				
ADSB43-S-13702	108	96	101				
ADSB43-S-13703	108	95	101				
ADSB43-S-13704	101	92	97				
ADSB43-S-13705	97	92	93				
ADSB49-S-13645	119	106	113				
ADSB49-S-13644	93	90	92				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-9-11, analysis date September 11, 2001 (Cont.)							
ADSB49-S-13638	103	93	98				
ADSB49-S-13956	96	73[c]	81	Reanalysis on 9/24 without error.			
ADSB49-S-13957	103	95	96				
ADSB42-S-13686	103	95	101				
ADSB42-S-13687	103	97	102				
ADSB42-S-13692	107	99	104				
ADSB42-S-13693	102	96	96				
ADSB42-S-13693DUP	106	96	101				
SDG 01-9-12, analysis date September 12, 2001							
20-μg/kg standard	97	97	96	23.65	16.7	20.83	4.1
Laboratory blank	92	88	89				
ADSB49-S-13639	102	101	102				
ADSB49-S-13647	102	101	106				
ADSB49-S-13647DUP	97	96	98				
ADSB49-S-13640	102	101	102				
ADSB49-S-13641	97	95	98				
ADSB42-S-13690	98	96	97				
ADSB42-S-13691	98	98	99				
ADSB49-S-13646	100	97	101				
ADSB43-S-13699	92	87	81				
ADSB42-S-13682	97	94	98				
ADSB42-S-13683	96	98	100				
ADQCDU-S-13955	94	96	96				
ADQCDU-S-13766	108	112	111				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-12, analysis date September 12, 2001 (Cont.)							
ADSB43-S-13698	111	110	115				
ADQCDU-S-13746	107	106	112				
ADSB49-S-13642	96	98	97				
ADSB49-S-13643	103	107	109				
ADQCDU-S-13954	96	100	101				
ADQCDU-S-13765	73[c]	75[c]	71[c]	Reanalysis on 9/24 without error.			
ADSB47-S-13990	82	81	81				
ADSB47-S-13991	81	85	83				
ADQCDU-S-14019	116	106	108				
ADQCDU-S-13511	66[c]	70[c]	67[c]	Not reanalyzed.			
ADSB40-S-13648	112	102	106				
ADSB40-S-13649	104	80	87				
ADSB41-S-13674	84	92	92				
ADSB41-S-13675	104	101	103				
SDG 01-9-13, analysis date September 13, 2001							
20-µg/kg standard	92	113	103	22.74	12.8	19.85	0.8
Laboratory blank	110	119	118				
ADSB40-S-13650	94	108	107				
ADSB40-S-13651	103	116	114				
ADSB43-S-13700	86	100	95				
ADSB43-S-13701	90	103	99				
ADSB41-S-13672	92	106	103				
ADSB41-S-13673	96	109	103				
ADSB41-S-13668	99	112	111				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-13, analysis date September 13, 2001 (Cont.)							
ADSB41-S-13668DUP	90	102	99				
ADSB41-S-13669	85	84	85				
ADSB40-S-13658	92	111	104				
ADSB51-S-14044	92	108	107				
ADSB51-S-14045	95	112	109				
ADSB51-S-14046	109	100	99				
ADSB51-S-14047	14[c]	22[c]	14[c]	Reanalysis on 9/25 without error.			
ADQCDU-S-14040	104	99	93				
ADSB50-S-14002	112	103	102				
ADSB51-S-14050	107	97	97				
ADSB51-S-14055	112	106	103				
SDG 01-9-14, analysis date September 14, 2001							
20-µg/kg standard	106	117	111	20.42	2.1	17.6	12.8
Laboratory blank	100	100	100				
ADSB51-S-14051	101	101	97				
ADSB51-S-14054	103	105	100				
ADSB40-S-13659	103	110	104				
ADSB41-S-13678	105	107	103				
ADSB41-S-13679	99	104	99				
ADSB42-S-13688	94	97	92				
ADSB42-S-13689	98	102	98				
ADSB42-S-13689DUP	94	101	95				
ADSB40-S-13652	106	113	109				
ADSB40-S-13653	104	106	103				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-14, analysis date September 14, 2001 (Cont.)							
ADSB41-S-13670	96	101	96				
ADSB41-S-13671	94	101	94				
ADSB40-S-13662	56[c]	71[c]	62[c]	Not reanalyzed.			
ADSB40-S-13663	90	95	89				
ADSB40-S-13656	107	106	103				
ADSB40-S-13657	99	101	96				
ADSB40-S-13657DUP	89	91	87				
SDG 01-9-17, analysis date September 17, 2001							
20-µg/kg standard	82	85	82	21.19	5.8	17.91	11
Laboratory blank	100	100	100				
AD-TB-Vial #35	114	115	119				
ADSB40-S-13660	105	108	107				
ADSB40-S-13661	99	102	99				
ADSB41-S-13666	98	101	99				
ADSB41-S-13667	100	105	100				
ADSB41-S-13676	102	105	102				
ADSB40-S-13654	88	92	90				
ADSB40-S-13655	96	103	96				
ADSB41-S-13677	90	77[c]	78[c]	Reanalysis on 9/24 without error.			
ADSB42-S-13684	111	116	114				
ADSB42-S-13685	98	101	97				
ADSB50-S-14000	68[c]	73[c]	68[c]	Reanalysis on 10/1 without error.			
ADSB50-S-14001	95	100	97				
ADSB50-S-14001DUP	85	95	88				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-17, analysis date September 17, 2001 (Cont.)							
ADSB48-S-14036	100	112	106				
ADSB48-S-14037	104	117	109				
ADSB47-S-13986	92	103	97				
ADSB47-S-13987	101	102	101				
ADSB48-S-14026	21[c]	34[c]	26[c]	Reanalysis on 9/25 without error.			
ADSB50-S-14010	99	98	100				
ADSB50-S-14010DUP	95	99	95				
ADSB48-S-14027	83	88	80				
SDG 01-9-18, analysis date September 18, 2001							
20-µg/kg standard	103	113	105	20.28	1.4	17.75	11.9
Laboratory blank	100	100	100				
ADSB50-S-14016	107	106	101				
ADSB50-S-14017	109	111	106				
ADSB50-S-14016DUP	108	111	109				
ADSB50-S-14017DUP	101	104	101				
ADSB50-S-14011	96	99	97				
ADSB45-S-11480	101	103	101				
ADSB48-S-14031	99	103	99				
ADSB45-S-11481	102	110	99				
ADSB45-S-13695	95	83	85				
ADSB45-S-13696	96	101	95				
ADSB48-S-14024	97	100	93				
ADSB48-S-14025	97	102	96				
AD-TB-Vial #34	95	105	101				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-18, analysis date September 18, 2001 (Cont.)							
ADSB50-S-14006	103	109	105				
ADSB50-S-14007	104	106	102				
ADSB50-S-14008	94	105	100				
ADSB48-S-14030	108	117	111				
ADSB50-S-14009	42[c]	52[c]	44[c]	Reanalysis on 9/25 without error.			
ADQCDU-S-13960	91	94	91				
ADQCDU-S-13981	100	104	101				
ADSB46-S-13968	101	105	103				
ADSB46-S-13969	110	117	112				
ADSB46-S-13962	105	110	106				
ADSB46-S-13963	93	93	90				
SDG 01-9-19, analysis date September 19, 2001							
20-µg/kg standard	120	105	98	18.42	8.2	16.65	18.3
Laboratory blank	100	100	100				
ADSB46-S-13964	85	76[c]	74[c]	Reanalysis on 9/25 without error.			
ADSB46-S-13965	98	100	96				
ADSB45-S-13958	87	94	90				
ADSB45-S-13959	102	97	94				
ADSB48-S-14032	91	93	86				
ADSB48-S-14033	95	94	93				
ADSB50-S-14012	100	100	100				
ADQCDU-S-14018	80	82	79[c]	Accepted.			
ADQCDU-S-13745	91	89	89				
ADQCDU-S-13786	94	95	96				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-19, analysis date September 19, 2001 (Cont.)							
ADQCDU-S-13665	94	92	92				
ADQCDU-S-13787	108	104	106				
ADQCDU-S-13664	96	97	97				
ADSB51-S-14048	103	102	99				
ADSB51-S-14049	120	87	85				
SDG 01-9-20, analysis date September 20, 2001							
20-µg/kg standard	108	108	113	18.69	6.8	16.97	16.4
Laboratory blank	110	108	107				
ADSB51-S-14052	97	95	95				
ADSB51-S-14053	110	106	108				
ADSB48-S-14034	103	100	102				
ADSB48-S-14035	105	100	106				
ADSB50-S-14014	118	113	117				
ADSB50-S-14015	100	100	106				
ADSB47-S-13988	93	94	98				
ADSB45-S-11482	89	69[c]	77[c]	Reanalysis on 9/27 without error.			
ADSB45-S-13694	91	89	90				
ADSB48-S-14022	96	93	92				
ADSB48-S-14023	82	80	82				
ADSB47-S-13984	90	92	93				
ADSB48-S-14038	98	95	94				
ADSB48-S-14038DUP	85	87	90				
ADSB47-S-13989	93	91	93				
ADSB48-S-14039	111	106	109				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-20, analysis date September 20, 2001 (Cont.)							
ADSB46-S-13974	16[c]	23[c]	19[c]	Reanalysis on 9/27 without error.			
ADSB46-S-13975	104	98	102				
ADQCDU-S-13980	106	101	103				
ADQCDU-S-14020	113	104	110				
ADSB47-S-13985	104	100	102				
ADSB47-S-13996	102	98	100				
ADSB47-S-13997	94	89	91				
SDG 01-9-21, analysis date September 21, 2001							
20-µg/kg standard	100	100	100	20.76	3.7	17.54	13.1
Laboratory blank	108	102	104				
ADSB50-S-14003	99	102	103				
ADSB45-S-13517	94	95	96				
ADSB45-S-13525	84	93	91				
ADSB47-S-13994	85	94	89				
ADSB47-S-13995	92	98	96				
ADSB46-S-13972	84	74[c]	77[c]	Reanalysis on 10/1 without error.			
ADSB46-S-13973	90	97	95				
ADSB46-S-13970	89	94	95				
ADSB46-S-13971	93	93	94				
ADSB46-S-13966	91	96	95				
ADSB46-S-13967	94	99	98				
ADSB48-S-14028	93	99	99				
ADSB48-S-14029	84	92	90				
ADSB46-S-13976	87	90	89				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-21, analysis date September 21, 2001 (Cont.)							
ADSB46-S-13977	91	94	96				
ADSB45-S-13515	79[c]	82	81	Reanalysis on 9/27 without error.			
ADSB45-S-13516	92	95	93				
ADSB45-S-13747	79[c]	71[c]	75[c]	Not reanalyzed.			
SDG 01-9-22, analysis date September 22, 2001							
20-µg/kg standard	96	111	100	22.07	9.8	20.52	2.6
Laboratory blank	108	96	99				
ADSB45-S-13767	109	112	110				
ADSB47-S-13982	109	109	106				
ADSB47-S-13983	107	108	104				
ADSB47-S-13992	103	102	102				
ADSB47-S-13993	101	105	102				
ADSB50-S-14012DUP	98	100	97				
ADQCDU-S-13961	88	93	89				
ADQCDU-S-13512	103	100	100				
ADSB45-S-13514	86	72[c]	72[c]	Reanalysis on 9/27 without error.			
ADSB50-S-14013	100	104	102				
ADSB42-S-13687DUP	98	100	98				
ADSB45-S-13513	95	98	94				
ADSB45-S-13510	91	97	93				
ADSB51-S-14042	40[c]	48[c]	43[c]	Reanalysis on 10/1 without error.			
ADSB50-S-14004	93	94	93				
ADQCDU-S-14041	96	95	95				
ADSB51-S-14043	98	101	100				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-22, analysis date September 22, 2001 (Cont.)							
AD-TB-Vial #22	79[c]	84	83	Reanalysis on 9/27 without error.			
AD-TB-Vial #27	95	100	102				
AD-TB-Vial #23	12[c]	21[c]	16[c]	Reanalysis on 9/27 without error.			
SDG 01-9-24, analysis date September 24, 2001							
20-µg/kg standard	100	114	108	23.82	17.4	21.16	5.6
Laboratory blank	100	100	100				
ADNGP927-S-11471	105	119	116				
AD-TB-Vial #13	109	104	113				
ADSB25-S-11487	107	112	111				
ADSB25-S-11493	100	101	101				
ADSB31-S-13571DUP	99	100	104				
ADSB28-S-13522	95	97	98				
ADSB30-S-13559	101	99	101				
ADSB30-S-13555	85	72[c]	76[c]	Reanalysis on 10/1 without error.			
ADSB31-S-13576	97	99	100				
ADSB41-S-13677	98	96	97				
ADSB32-S-13781	100	103	101				
ADQCDU-S-13765	98	105	101				
ADSB32-S-13776DUP	96	100	98				
ADSB35-S-13845DUP	109	114	117				
ADSB36-S-13854	96	98	100				
ADSB37-S-13898	c	c	c	Reanalysis on 10/1 without error.			
ADQCDU-S-13829	80	84	84				
ADSB34-S-13817	100	100	102				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/kg)	RPD[b]	Concentration (μg/kg)	RPD[b]
SDG 01-9-24, analysis date September 24, 2001 (Cont.)							
ADSB37-S-13894	89	94	94				
ADSB36-S-13853	99	97	103				
ADSB35-S-13836	87	91	90				
ADSB49-S-13956	88	90	92				
ADSB39-S-13936	88	82	81				
SDG 01-9-25, analysis date September 25, 2001							
20-μg/kg standard	100	100	100	19.15	4.3	18.13	9.8
Laboratory blank	100	100	100				
ADSB38-S-13918	95	108	103				
ADSB38-S-13923	109	113	110				
ADSB39-S-13937	80	97	92				
ADSB38-S-13904	85	97	92				
ADSB51-S-14047	94	95	95				
ADSB50-S-14000	69[c]	83	77[c]	Reanalysis on 10/1 without error.			
ADSB48-S-14026	88	91	87				
ADSB46-S-13972	75[c]	64[c]	67[c]	Reanalysis on 10/1 without error.			
ADSB50-S-14009	90	91	90				
ADSB50-S-14008DUP	88	90	88				
ADSB46-S-13964	87	94	89				
ADSB51-S-14042	65[c]	73[c]	69[c]	Reanalysis on 10/1 without error.			
ADSB27-S-13742DUP	81	84	83				

TABLE F.3 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/kg)	RPD[b]	Concentration (µg/kg)	RPD[b]
SDG 01-9-27, analysis date September 27, 2001							
20-µg/kg standard	105	92	99	23.74	17.1	22.67	12.52
Laboratory blank	100	100	100				
ADSB45-S-13515	112	110	109				
ADSB45-S-11482	105	109	105				
ADSB46-S-13974	102	104	102				
ADSB46-S-13974DUP	92	95	100				
AD-TB-Vial #23	90	99	102				
AD-TB-Vial #22	92	104	110				
ADSB45-S-13514	85	102	109				
SDG 01-10-1, analysis date October 1, 2001							
20-µg/kg standard	112	109	107	23.22	14.9	19.82	0.9
Laboratory blank	100	100	100				
ADSB37-S-13898	96	101	108				
ADSB30-S-13555	113	107	117				
ADSB50-S-14000	112	105	115				
ADSB46-S-13972	98	98	104				
ADSB51-S-14042	103	96	109				
ADSB51-S-14042DUP	99	94	104				

[a] Quality control limit = 80-120%.

[b] Quality control limit = ±20%.

[c] Surrogate recovery outside QC limit.

TABLE F.4 Results for organic analyses of replicate subsurface soil samples and duplicate organic analyses of subsurface soil samples at AGEM Laboratory by the purge-and-trap method.

			Concentration (μg/kg)		
Location	Depth (ft BGL)	Sample	Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB24	17	ADNGP917-S-11466	< 10[a]	ND[b]	ND
SB24	17	ADNGP917-S-11466DUP	< 10	ND	ND
SB24	25	ADNGP925-S-11470	< 10	ND	ND
SB24	25	ADQCDU-S-13508	< 10	ND	ND
SB24	27	ADNGP927-S-11471	ND	ND	ND
SB24	27	ADQCDU-S-13509	< 10	ND	ND
SB25	15	ADSB25-S-11490	ND	ND	ND
SB25	15	ADSB25-S-11490DUP	ND	ND	ND
SB25	23	ADSB25-S-11494	ND	ND	ND
SB25	23	ADSB25-S-11494DUP	ND	ND	ND
SB26	1	ADSB26-S-11682	< 10	ND	ND
SB26	1	ADQCDU-S-11500	< 10	ND	ND
SB26	3	ADSB26-S-11683	ND	ND	ND
SB26	3	ADQCDU-S-11501	ND	ND	ND
SB26	5	ADSB26-S-11684	ND	ND	ND
SB26	5	ADQCDU-S-11502	ND	ND	ND
SB27	25	ADSB27-S-13740	12	ND	ND
SB27	25	ADQCDU-S-11702	< 10	ND	ND
SB27	29	ADSB27-S-13742	< 10	ND	ND
SB27	29	ADSB27-S-13742DUP	ND	ND	ND
SB28	17	ADSB28-S-13486	ND	ND	ND
SB28	17	ADQCDU-S-13526	ND	ND	ND
SB28	19	ADSB28-S-13487	ND	ND	ND
SB28	19	ADQCDU-S-13527	ND	ND	ND
SB29	1	ADSB29-S-13530	ND	ND	ND
SB29	1	ADQCDU-S-13528	ND	ND	ND
SB29	3	ADSB29-S-13531	ND	ND	ND
SB29	3	ADQCDU-S-13529	ND	ND	ND

TABLE F.4 (Cont.)

Location	Depth (ft BGL)	Sample	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB30	27	ADSB30-S-13561	ND	ND	ND
SB30	27	ADSB30-S-13561DUP	ND	ND	ND
SB31	1	ADSB31-S-13568	10	ND	ND
SB31	1	ADQCDU-S-13565	36	ND	ND
SB31	3	ADSB31-S-13569	< 10	ND	ND
SB31	3	ADQCDU-S-13566	14	ND	ND
SB31	5	ADSB31-S-13570	< 10	ND	ND
SB31	5	ADQCDU-S-13567	ND	ND	ND
SB31	7	ADSB31-S-13571	< 10	ND	ND
SB31	7	ADSB31-S-13571DUP	< 10	ND	ND
SB31	7	ADQCDU-S-13547	< 10	ND	ND
SB31	27	ADSB31-S-13761	< 10	ND	ND
SB31	27	ADSB31-S-13761DUP	< 10	ND	ND
SB32	5	ADSB32-S-13770	ND	ND	ND
SB32	5	ADSB32-S-13770DUP	ND	ND	ND
SB32	11	ADSB32-S-13773	ND	ND	ND
SB32	11	ADSB32-S-13773DUP	ND	ND	ND
SB32	17	ADSB32-S-13776	ND	ND	ND
SB32	17	ADSB32-S-13776DUP	ND	ND	ND
SB32	25	ADSB32-S-13780	ND	ND	ND
SB32	25	ADQCDU-S-13784	NA[c]	NA	NA
SB32	27	ADSB32-S-13781	ND	ND	ND
SB32	27	ADQCDU-S-13785	ND	ND	ND
SB33	19	ADSB33-S-13797	ND	ND	ND
SB33	19	ADSB33-S-13797DUP	ND	ND	ND
SB34	1	ADSB34-S-13806	ND	ND	ND
SB34	1	ADQCDU-S-13804	< 10	ND	ND
SB34	3	ADSB34-S-13807	ND	ND	ND
SB34	3	ADQCDU-S-13805	ND	ND	ND
SB34	13	ADSB34-S-13812	ND	ND	ND
SB34	13	ADSB34-S-13812DUP	ND	ND	ND

TABLE F.4 (Cont.)

Location	Depth (ft BGL)	Sample	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB35	1	ADSB35-S-13830	ND	ND	ND
SB35	1	ADQCDU-S-13828	ND	ND	ND
SB35	3	ADSB35-S-13831	ND	ND	ND
SB35	3	ADQCDU-S-13829	ND	ND	ND
SB35	27	ADSB35-S-13843	ND	ND	ND
SB35	27	ADSB35-S-13843DUP	ND	ND	ND
SB35	31	ADSB35-S-13845	ND	ND	ND
SB35	31	ADSB35-S-13845DUP	ND	ND	ND
SB36	1	ADSB36-S-13848	ND	ND	ND
SB36	1	ADQCDU-S-13846	ND	ND	ND
SB36	3	ADSB36-S-13849	ND	ND	ND
SB36	3	ADQCDU-S-13847	ND	ND	ND
SB36	27	ADSB36-S-13861	ND	ND	ND
SB36	27	ADSB36-S-13861DUP	ND	ND	ND
SB37	1	ADSB37-S-13886	ND	ND	ND
SB37	1	ADQCDU-S-13902	14	ND	ND
SB37	3	ADSB37-S-13887	ND	ND	ND
SB37	3	ADQCDU-S-13903	ND	ND	ND
SB38	1	ADSB38-S-13904	ND	ND	ND
SB38	1	ADQCDU-S-13916	ND	ND	ND
SB38	1	ADQCDU-S-13916DUP	ND	ND	ND
SB38	3	ADSB38-S-13905	ND	ND	ND
SB38	3	ADQCDU-S-13917	ND	ND	ND
SB38	3	ADQCDU-S-13917DUP	ND	ND	ND
SB38	5	ADSB38-S-13906	ND	ND	ND
SB38	5	ADSB38-S-13906DUP	ND	ND	ND
SB38	7	ADSB38-S-13907	ND	ND	ND
SB38	7	ADSB38-S-13907DUP	ND	ND	ND
SB38	17	ADSB38-S-13922	< 10	ND	ND
SB38	17	ADSB38-S-13922DUP	< 10	ND	ND
SB39	1	ADSB39-S-13932	ND	ND	ND
SB39	1	ADQCDU-S-13930	ND	ND	ND

TABLE F.4 (Cont.)

Location	Depth (ft BGL)	Sample	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB39	3	ADSB39-S-13933	ND	ND	ND
SB39	3	ADQCDU-S-13931	< 10	ND	ND
SB40	1	ADSB40-S-13648	ND	ND	ND
SB40	1	ADQCDU-S-13664	ND	ND	ND
SB40	3	ADSB40-S-13649	ND	ND	ND
SB40	3	ADQCDU-S-13665	ND	ND	ND
SB40	19	ADSB40-S-13657	ND	ND	ND
SB40	19	ADSB40-S-13657DUP	ND	ND	ND
SB41	1	ADSB41-S-13666	ND	ND	ND
SB41	1	ADQCDU-S-13786	ND	ND	ND
SB41	3	ADSB41-S-13667	ND	ND	ND
SB41	3	ADQCDU-S-13787	ND	ND	ND
SB41	5	ADSB41-S-13668	ND	ND	ND
SB41	5	ADSB41-S-13668DUP	ND	ND	ND
SB42	1	ADSB42-S-13682	ND	ND	ND
SB42	1	ADQCDU-S-13745	ND	ND	ND
SB42	3	ADSB42-S-13683	ND	ND	ND
SB42	3	ADQCDU-S-13746	ND	ND	ND
SB42	11	ADSB42-S-13687	ND	ND	ND
SB42	11	ADSB42-S-13687DUP	ND	ND	ND
SB42	15	ADSB42-S-13689	ND	ND	ND
SB42	15	ADSB42-S-13689DUP	ND	ND	ND
SB42	23	ADSB42-S-13693	ND	ND	ND
SB42	23	ADSB42-S-13693DUP	ND	ND	ND
SB43	1	ADSB43-S-13698	ND	ND	ND
SB43	1	ADQCDU-S-13765	ND	ND	ND
SB43	3	ADSB43-S-13699	ND	ND	ND
SB43	3	ADQCDU-S-13766	ND	ND	ND
SB45	1	ADSB45-S-13513	ND	ND	ND
SB45	1	ADQCDU-S-13511	ND	ND	ND

TABLE F.4 (Cont.)

Location	Depth (ft BGL)	Sample	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB45	3	ADSB45-S-13514	ND	ND	ND
SB45	3	ADQCDU-S-13512	ND	ND	ND
SB46	1	ADSB46-S-13962	ND	< 10	358
SB46	1	ADQCDU-S-13960	ND	ND	ND
SB46	3	ADSB46-S-13963	ND	ND	ND
SB46	3	ADQCDU-S-13961	ND	ND	ND
SB46	25	ADSB46-S-13974	ND	ND	ND
SB46	25	ADSB46-S-13974DUP	ND	ND	ND
SB47	1	ADSB47-S-13982	ND	ND	ND
SB47	1	ADQCDU-S-13980	ND	ND	ND
SB47	3	ADSB47-S-13983	ND	ND	ND
SB47	3	ADQCDU-S-13981	ND	ND	ND
SB48	1	ADSB48-S-14022	ND	ND	ND
SB48	1	ADQCDU-S-14020	ND	ND	ND
SB48	3	ADSB48-S-14023	ND	ND	ND
SB48	3	ADQCDU-S-14021	NA	NA	NA
SB48	33	ADSB48-S-14038	ND	ND	ND
SB48	33	ADSB48-S-14038DUP	ND	ND	ND
SB49	1	ADSB49-S-13956	ND	ND	ND
SB49	1	ADQCDU-S-13954	ND	ND	ND
SB49	3	ADSB49-S-13957	ND	ND	ND
SB49	3	ADQCDU-S-13955	ND	ND	ND
SB49	23	ADSB49-S-13647	ND	ND	ND
SB49	23	ADSB49-S-13647DUP	ND	ND	ND
SB50	1	ADSB50-S-14000	ND	ND	ND
SB50	1	ADQCDU-S-14018	ND	ND	ND
SB50	3	ADSB50-S-14001	ND	ND	ND
SB50	3	ADSB50-S-14001DUP	ND	ND	ND
SB50	3	ADQCDU-S-14019	ND	ND	ND
SB50	17	ADSB50-S-14008	12	ND	ND
SB50	17	ADSB50-S-14008DUP	ND	ND	ND

TABLE F.4 (Cont.)

Location	Depth (ft BGL)	Sample	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB50	21	ADSB50-S-14010	12	ND	ND
SB50	21	ADSB50-S-14010DUP	12	ND	ND
SB50	25	ADSB50-S-14012	ND	ND	ND
SB50	25	ADSB50-S-14012DUP	21	< 10	ND
SB50	33	ADSB50-S-14016	517	< 10	579
SB50	33	ADSB50-S-14016DUP	527	< 10	611
SB50	35	ADSB50-S-14017	402	< 10	495
SB50	35	ADSB50-S-14017DUP	402	< 10	480
SB51	1	ADSB51-S-14042	ND	ND	ND
SB51	1	ADSB51-S-14042DUP	ND	ND	ND
SB51	1	ADQCDU-S-14040	< 10	ND	ND
SB51	3	ADSB51-S-14043	ND	ND	ND
SB51	3	ADQCDU-S-14041	ND	ND	ND

[a] < 10, contaminant detected at a concentration below the quantitation limit of 10 μg/kg.

[b] ND, contaminant not detected.

[c] NA, sample not analyzed by purge-and-trap method.

TABLE F.5 Recovery of system-monitoring compounds in verification organic analyses of soil samples at Severn-Trent Laboratory with EPA Method 8260B.

Sample	Analysis Date	Sample Delivery Group	Recovery[a] (%)			
			Toluene-d_8	1,2-Dichloro-ethane-d_4	Bromofluoro-benzene	1,2-Dichloro-benzene-d_4
MeOHK8 LCS	9/5/01	84515	94	97	105	102
ADSB31-S-13568	9/5/01	84515	80[b]	128[b]	98	96
ADSB31-S-13568MS	9/5/01	84515	70[b]	141[b]	100	100
ADSB31-S-13568MSD	9/5/01	84515	80[b]	97	101	99
ADSB32-S-13779	9/5/01	84515	86	115	104	103
ADNGP97-S-11461	9/5/01	84515	85	118	100	100
ADQCDU-S-13784	9/5/01	84515	85	119	106	101
ADNGP99-S-11462	9/5/01	84515	85	114	101	101
ADNGP929-S-11472	9/5/01	84515	85	124[b]	101	99
ADSB27-S-13729	9/5/01	84515	76[b]	118	99	99
ADQCDU-S-13527	9/5/01	84515	76[b]	159[b]	99	99
ADSB32-S-13783	9/5/01	84515	84	124[b]	102	101
ADSB32-S-13771	9/5/01	84515	82	117	99	99
ADSB30-S-13558	9/5/01	84515	63[b]	106	77	77[b]
ADSB31-S-13759	9/5/01	84515	69[b]	166[b]	101	101
ADSB35-S-13831	9/5/01	84515	90	123[b]	109	109
ADSB35-S-13844	9/5/01	84515	87	111	96	95
ADSB35-S-13845	9/5/01	84515	92	112	101	101
MeOHL2 LCS	9/5/01	84515	88	152[b]	100	100
MeOH blank-082901	9/5/01	84515	89	104	96	95
ADSB35-S-13835	9/5/01	84515	75[b]	156[b]	100	99
ADSB34-S-13817	9/5/01	84515	78[b]	114	99	97
MeOH LCS	9/13/01	84673	96	132[b]	101	98
ADSB51-S-14055	9/13/01	84673	71[b]	133[b]	105	103
ADSB32-S-13775	9/13/01	84673	85	130[b]	100	99
ADSB42-S-13689	9/13/01	84673	93	119	98	95
ADSB38-S-13922	9/13/01	84673	82	98	89	87
MVNG MeOH LCS	9/14/01	84673	102	106	101	95
ADSB39-S-13933	9/14/01	84673	97	89	102	100
ADSB51-S-14054	9/14/01	84673	97	87	99	99
ADSB40-S-13655	9/14/01	84673	96	88	103	98
ADSB46-S-13962	9/14/01	84673	96	91	101	99
ADSB46-S-13963	9/14/01	84673	97	87	102	96
ADSB46-S-13964	9/14/01	84673	98	88	100	97
ADSB46-S-13965	9/14/01	84673	96	92	93	93
ADSB45-S-13958	9/14/01	84673	93	92	92	95
ADSB45-S-13959	9/14/01	84673	97	88	95	93
ADSB40-S-13652	9/14/01	84673	92	88	93	92
MeOH blank-091001	9/14/01	84673	90	85	90	89
ADSB40-S-13663	9/14/01	84673	96	96	102	100
ADSB43-S-13707	9/14/01	84673	96	92	96	95

TABLE F.5 (Cont.)

Sample	Analysis Date	Sample Delivery Group	Recovery[a] (%)			
			Toluene-d_8	1,2-Dichloro-ethane-d_4	Bromofluoro-benzene	1,2-Dichloro-benzene-d_4
MeOH LCS	11/2/01	85332	106	99	99	96
ADSB50-S-14016RE	11/2/01	85332	104	91	100	102
ADSB50-S-14017RE	11/2/01	85332	103	89	102	102
MeOH Blank-102601	11/2/01	85332	102	86	100	102

[a] Quality control limits are as follows:

Analyte	QC Limit (%)
Toluene-d_8	81-117
1,2-Dichloroethane-d_4	80-120
Bromofluorobenzene	74-121
1,2-Dichlorobenzene-d_4	80-120

[b] Recovery was outside the quality control limit for this analyte.

TABLE F.6 Recovery and relative percent difference values for spike/spike duplicate organic analyses of soil samples at Severn-Trent Laboratory.

Compound	Concentration (µg/kg)				Recovery (%)			Relative Difference (%)	
	Sample	Spike Added	Spike Analysis	Duplicate Analysis	Spike Analysis	Duplicate Analysis	QC Limit	RPD	QC Limit
MS/MSD analysis of ADSB31-S-13568 for SDG 84515									
Chloroform	36	65	140	150	139[a]	149[a]	74-106	7	40
Carbon tetrachloride	21	65	67	62	78	72	62-106	8	40
1,2-Dichloroethane	19	65	99	120	118[a]	143[a]	80-110	19	40
MS/MSD analysis of MeOH LCS in SDG 84673									
Chloroform	0	10	9.8	9.4	98	94	74-106	4	40
Carbon tetrachloride	0	10	9.9	9.5	99	95	62-106	4	40
1,2-Dichloroethane	0	10	9.5	9.4	95	94	80-110	1	40
MS/MSD analysis of LWBB LCS in SDG 85332									
Chloroform	0	10	9.6	9.6	96	96	74-106	0	40
Carbon tetrachloride	0	10	9.5	9.6	95	96	62-106	1	40
1,2-Dichloroethane	19	65	9.6	9.7	96	97	80-110	1	40

[a] Recovery of spike compound outside the specified QC limit.

TABLE F.7 Results for verification organic analysis of soil samples at Severn-Trent Laboratory.

				Concentration (μg/kg)		
Location	Depth (ft BGL)	Sample	Analytical Laboratory	Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB24	7	ADNGP97-S-11461	AGEM	ND[a]	ND	ND
SB24	7	ADNGP97-S-11461	STL	ND	< 10[b,c]	ND
SB24	9	ADNGP99-S-11462	AGEM	ND	ND	ND
SB24	9	ADNGP99-S-11462	STL	ND	< 10[c]	ND
SB24	29	ADNGP929-S-11472	AGEM	ND	ND	ND
SB24	29	ADNGP929-S-11472	STL	ND	< 10[c]	ND
SB27	3	ADSB27-S-13729	AGEM	ND	ND	ND
SB27	3	ADSB27-S-13729	STL	< 10	31[c]	ND
SB28	19	ADQCDU-S-13527	AGEM	ND	ND	ND
SB28	19	ADQCDU-S-13527	STL	ND	ND	ND
SB30	21	ADSB30-S-13558	AGEM	ND	ND	ND
SB30	21	ADSB30-S-13558	STL	ND	31[c]	ND
SB31	1	ADQCDU-S-13565	AGEM	36	ND	ND
SB31	1	ADSB31-S-13568	AGEM	10	ND	ND
SB31	1	ADSB31-S-13568	STL	21	36[c]	19[c]
SB31	23	ADSB31-S-13759	AGEM	24	ND	ND
SB31	23	ADSB31-S-13759	STL	18	66[c]	ND
SB32	7	ADSB32-S-13771	AGEM	ND	ND	ND
SB32	7	ADSB32-S-13771	STL	ND	< 10[c]	ND
SB32	15	ADSB32-S-13775	AGEM	ND	ND	ND
SB32	15	ADSB32-S-13775	STL	ND	< 10	ND
SB32	23	ADSB32-S-13779	AGEM	ND	ND	ND
SB32	23	ADSB32-S-13779	STL	ND	< 10[c]	ND
SB32	25	ADSB32-S-13780	AGEM	ND	ND	ND
SB32	25	ADQCDU-S-13784	STL	ND	< 10[c]	ND
SB32	31	ADSB32-S-13783	AGEM	ND	ND	ND
SB32	31	ADSB32-S-13783	STL	ND	< 10[c]	ND
SB34	23	ADSB34-S-13817	AGEM	ND	ND	ND
SB34	23	ADSB34-S-13817	STL	ND	48[c]	ND

TABLE F.7 (Cont.)

Location	Depth (ft BGL)	Sample	Analytical Laboratory	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB35	3	ADSB35-S-13831	AGEM	ND	ND	ND
SB35	3	ADSB35-S-13831	STL	ND	62[c]	ND
SB35	11	ADSB35-S-13835	AGEM	ND	ND	ND
SB35	11	ADSB35-S-13835	STL	ND	60[c]	ND
SB35	29	ADSB35-S-13844	AGEM	ND	ND	ND
SB35	29	ADSB35-S-13844	STL	ND	52[c]	ND
SB35	31	ADSB35-S-13845	AGEM	ND	ND	ND
SB35	31	ADSB35-S-13845	STL	< 10	35[c]	ND
SB38	17	ADSB38-S-13922	AGEM	< 10	ND	ND
SB38	17	ADSB38-S-13922	STL	< 10	17	ND
SB39	3	ADQCDU-S-13931	AGEM	< 10	ND	ND
SB39	3	ADSB39-S-13933	AGEM	ND	ND	ND
SB39	3	ADSB39-S-13933	STL	< 10	12	ND
SB40	9	ADSB40-S-13652	AGEM	ND	ND	ND
SB40	9	ADSB40-S-13652	STL	< 10	< 10	ND
SB40	15	ADSB40-S-13655	AGEM	ND	ND	ND
SB40	15	ADSB40-S-13655	STL	< 10	< 10	ND
SB40	31	ADSB40-S-13663	AGEM	< 10	ND	ND
SB40	31	ADSB40-S-13663	STL	< 10	< 10	ND
SB42	15	ADSB42-S-13689	AGEM	ND	ND	ND
SB42	15	ADSB42-S-13689	STL	ND	< 10	ND
SB43	19	ADSB43-S-13707	AGEM	NA[d]	NA	NA
SB43	19	ADSB43-S-13707	STL	ND	14	ND
SB45	33	ADSB45-S-13958	AGEM	12	ND	ND
SB45	33	ADSB45-S-13958	STL	12	< 10	ND
SB45	35	ADSB45-S-13959	AGEM	22	< 10	ND
SB45	35	ADSB45-S-13959	STL	24	< 10	ND
SB46	1	ADQCDU-S-13960	AGEM	ND	ND	ND
SB46	1	ADSB46-S-13962	AGEM	ND	< 10	358
SB46	1	ADSB46-S-13962	STL	ND	ND	ND

TABLE F.7 (Cont.)

Location	Depth (ft BGL)	Sample	Analytical Laboratory	Concentration (μg/kg) Carbon Tetrachloride	Chloroform	1,2-Dichloro-ethane
SB46	3	ADSB46-S-13963	AGEM	ND	ND	ND
SB46	3	ADSB46-S-13963	STL	ND	ND	ND
SB46	5	ADSB46-S-13964	AGEM	ND	ND	ND
SB46	5	ADSB46-S-13964	STL	ND	ND	ND
SB46	7	ADSB46-S-13965	AGEM	ND	ND	ND
SB46	7	ADSB46-S-13965	STL	ND	ND	ND
SB50	33	ADSB50-S-14016RE[e]	AGEM	61	ND	300
SB50	33	ADSB50-S-14016RE[e]	STL	36	< 10	160
SB50	35	ADSB50-S-14017RE[e]	AGEM	354	< 10	389
SB50	35	ADSB50-S-14017RE[e]	STL	330	< 10	390
SB51	25	ADSB51-S-14054	AGEM	4.8	ND	ND
SB51	25	ADSB51-S-14054	STL	< 10	< 10	ND
SB51	27	ADSB51-S-14055	AGEM	< 10	ND	ND
SB51	27	ADSB51-S-14055	STL	< 10	13	ND

[a] ND, contaminant not detected.

[b] < 10, contaminant detected at a concentration below the quantitation limit of 10 μg/kg.

[c] Surrogate recovery outside quality control limit for analysis at STL.

[d] NA, sample not analyzed by purge-and-trap method.

[e] RE indicated reanalysis of the sample. Initial results are reported in Table D.2, Appendix D.

TABLE F.8 Results of organic analyses on quality control samples collected to monitor water analyses at AGEM Laboratory by the purge-and-trap method.

	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
Sample	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (μg/L)	RPD[b]	Concentration (μg/L)	RPD[b]
SDG 01-8-23, analysis date August 23, 2001							
20-μg/L standard	85	80	86	20.73	3.6	20.38	1.9
Laboratory blank	100	100	100				
ADSB21-W-13578	96	98	102				
ADSB21-W-13578DUP	99	105	106				
ADSB21-W-13579	102	109	108				
ADSB21-W-13579DUP	94	100	102				
ADSB21-W-13580	118	120.8[c]	120	Accepted.			
ADSB21-W-13581	108	117	115				
ADSB21-W-13582	103	107	110				
SDG 01-8-24, analysis date August 24, 2001							
20-μg/L standard	91	85	93	18.7	6.7	18.86	5.9
Laboratory blank	97	82	89				
ADSB21-W-13584	101	104	107				
ADSB21-W-13585	102	108	108				
ADSB21-W-13586	83	89	88				
ADSB21-W-13588	105	105	108				
ADSB21-W-13589	97	100	101				
ADSB21-W-13590	103	104	106				
ADSB21-W-13591	103	109	109				
ADSB21-W-13591DUP	87	89	88				
ADSB21-W-13593	99	101	101				
ADSB21-W-13594	90	95	95				

TABLE F.8 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/L)	RPD[b]	Concentration (µg/L)	RPD[b]
SDG 01-8-24, analysis date August 24, 2001 (Cont.)							
ADSB21-W-13587	100	100	100				
ADSB21-W-13592	93	95	94				
SDG 01-8-27, analysis date August 27, 2001							
20-µg/L standard	110	108	110	17.69	12.2	17.02	16.1
Laboratory blank	100	100	100				
ADSB23-W-13595	85	93	92				
ADSB23-W-13596	105	103	106				
ADSB23-W-13597	98	97	96				
ADSB23-W-13599	95	95	93				
ADSB23-W-13600	94	98	97				
ADSB23-W-13601	101	100	97				
ADSB23-W-13602	98	98	97				
ADSB23-W-13604	93	93	92				
ADSB23-W-13603	97	91	90				
ADSB23-W-13598	86	86	86				
ADSB23-W-13605	90	89	87				
SDG 01-8-28, analysis date August 28, 2001							
20-µg/L standard	98	97	97	19.32	3.5	19.11	4.6
Laboratory blank	94	123[c]	112				
ADSB23-W-13606	102	111	114				
ADSB23-W-13607	104	110	110				

TABLE F.8 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/L)	RPD[b]	Concentration (µg/L)	RPD[b]
SDG 01-8-28, analysis date August 28, 2001 (Cont.)							
ADSB23-W-13608	99	103	101				
ADSB23-W-13609	56[c]	63[c]	60[c]	Reanalysis on 9/4 without error.			
ADSB23-W-13610	98	99	98				
ADSB23-W-13611	99	105	101				
ADSB22-W-13613	100	100	100				
ADSB22-W-13614	100	97	96				
ADSB22-W-13615	94	85	83				
ADSB22-W-13617	97	101	97				
ADSB22-W-13617DUP	86	89	85				
ADSB22-W-13618	97	94	94				
ADSB22-W-13619	99	95	92				
ADSB22-W-13620	93	86	82				
ADSB22-W-13621	95	93	91				
ADSB25-W-13623	4[c]	9[c]	0[c]	Reanalysis on 8/29 without error.			
ADSB25-W-13624	95	93	93				
ADSB25-W-13625	99	102	99				
ADSB25-W-13626	88	89	87				
ADSB27-W-13628	68[c]	74[c]	69[c]	Not reanalyzed.			
ADSB27-W-13629	90	95	91				
SDG 01-8-29, analysis date August 29, 2001							
20-µg/L standard	103	93	102	20.04	0.2	18.96	5.3
Laboratory blank	100	100	100				
ADSB27-W-13631	77[c]	85	84	Reanalyzed on 9/4 also with surrogate recovery error. Higher value on 9/4 reported.			

TABLE F.8 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/L)	RPD[b]	Concentration (µg/L)	RPD[b]
SDG 01-8-29, analysis date August 29, 2001 (Cont.)							
ADSB27-W-13632	113	111	115				
ADSB44-W-13633	108	109	112				
ADSB44-W-13634	10[c]	15[c]	9[c]	Reanalysis on 9/4 without error.			
ADSB44-W-13635	95	91	94				
ADSB44-W-13637	85	86	86				
ADSB22-W-13616	94	91	90				
ADSB22-W-13622	100	100	100				
ADSB25-W-13627	99	88	95				
ADSB27-W-13630	98	95	96				
ADSB44-W-13636	101	99	101				
ADSB23-W-13612	95	100	97				
ADSB25-W-13623	97	105	102				
ADSB25-W-13623DUP	102	107	108				
SDG 01-9-1, analysis date September 1, 2001							
20-µg/L standard	107	96	102	20.21	1	17.28	14.6
Laboratory blank	100	100	100				
ADSB52-W-14088	101	100	104				
ADSB52-W-14089	112	114	115				
ADSB52-W-14090	102	104	105				
ADSB52-W-14092	87	82	83				
ADSB52-W-14095	103	99	100				
ADSB52-W-14093	107	104	106				
ADSB52-W-14097	109	101	104				
ADSB52-W-14098	106	104	105				

TABLE F.8 (Cont.)

Sample	Recovery of Surrogate Compounds[a] (%)			Measured Values for Calibration Check Standards			
				Carbon Tetrachloride		Chloroform	
	Fluorobenzene	1,2-Dichloro-benzene-d_4	4-Bromo-fluorobenzene	Concentration (µg/L)	RPD[b]	Concentration (µg/L)	RPD[b]
SDG 01-9-1, analysis date September 1, 2001 (Cont.)							
ADSB52-W-14099	102	81	86				
ADSB52-W-14100	97	93	93				
ADSB52-W-14101	106	97	98				
ADSB52-W-14101DUP	103	97	98				
ADSB52-W-14094	85	82	80				
ADSB52-W-14096	79[c]	75[c]	72[c]	Not reanalyzed.			
ADSB52-W-14091	94	90	91				
SDG 01-9-4, analysis date September 4, 2001							
20-µg/L standard	100	100	100	18.36	8.6	18.64	7
Laboratory blank	114	104	113				
ADSB23-W-13609	95	108	100				
ADSB27-W-13631	76[c]	82	77[c]	Second analysis with surrogate recovery error.			
ADSB44-W-13634	92	93	92				

[a] Quality control limit = 80-120%.

[b] Quality control limit = ±20%.

[c] Surrogate recovery outside QC limit.

TABLE F.9 Results of duplicate organic analyses of groundwater samples at AGEM Laboratory by the purge-and-trap method.

				Concentration (μg/L)	
Location	Sample	Depth (ft BGL)	Sample Date	Carbon Tetrachloride	Chloroform
SB21	ADSB21-W-13578	25-30	8/22/01	ND	ND
SB21	ADSB21-W-13578DUP	25-30	8/22/01	ND	ND
SB21	ADSB21-W-13579	35-40	8/22/01	ND	ND
SB21	ADSB21-W-13579DUP	35-40	8/22/01	ND	ND
SB21	ADSB21-W-13580	35-40	8/22/01	ND	ND
SB21	ADSB21-W-13590	50-55	8/23/01	ND	ND
SB21	ADSB21-W-13591	50-55	8/23/01	ND	ND
SB21	ADSB21-W-13591DUP	50-55	8/23/01	ND	ND
SB21	ADSB21-W-13585	66-70	8/23/01	ND	ND
SB21	ADSB21-W-13586	66-70	8/23/01	ND	ND
SB22	ADSB22-W-13618	35-40	8/26/01	11	< 5
SB22	ADSB22-W-13619	35-40	8/26/01	11	< 5
SB22	ADSB22-W-13617	60-65	8/25/01	ND	ND
SB22	ADSB22-W-13617DUP	60-65	8/25/01	ND	ND
SB23	ADSB23-W-13596	35-40	8/24/01	< 5	< 5
SB23	ADSB23-W-13597	35-40	8/24/01	< 5	< 5
SB23	ADSB23-W-13607	40-45	8/25/01	< 5	< 5
SB23	ADSB23-W-13608	40-45	8/25/01	< 5	< 5
SB23	ADSB23-W-13606	50-55	8/25/01	ND	ND
SB23	ADSB23-W-13609	50-55	8/25/01	ND	ND
SB23	ADSB23-W-13601	65-70	8/24/01	ND	ND
SB23	ADSB23-W-13602	65-70	8/24/01	ND	ND
SB25	ADSB25-W-13623	32-37	8/26/01	9.3	6
SB25	ADSB25-W-13623DUP	32-37	8/26/01	8.8	5.8
SB25	ADSB25-W-13624	42-47	8/26/01	ND	ND
SB25	ADSB25-W-13625	42-47	8/26/01	ND	ND
SB27	ADSB27-W-13631	37-42	8/27/01	< 5	< 5
SB27	ADSB27-W-13632	37-42	8/27/01	< 5	< 5
SB44	ADSB44-W-13635	37-42	8/27/01	ND	ND
SB44	ADSB44-W-13637	37-42	8/27/01	ND	ND

TABLE F.9 (Cont.)

Location	Sample	Depth (ft BGL)	Sample Date	Concentration (μg/L) Carbon Tetrachloride	Chloroform
SB52	ADSB52-W-14089	35-40	8/30/01	ND	ND
SB52	ADSB52-W-14090	35-40	8/30/01	ND	ND
SB52	ADSB52-W-14098	50-55	8/30/01	< 5	ND
SB52	ADSB52-W-14099	50-55	8/30/01	< 5	ND
SB52	ADSB52-W-14101	65-70	8/30/01	ND	ND
SB52	ADSB52-W-14101DUP	65-70	8/30/01	ND	ND

[a] ND, not detected above the quantitation limit of 1 μg/L for EPA Method 524.2 (purge-and-trap method).

[b] < 5, not detected above the EPA CLP quantitation limit of 5 μg/L.

TABLE F.10 Recovery of system-monitoring compounds in organic analyses of water samples at Clayton Laboratory with CLP methodology.

Sample	Analysis Date	Sample Delivery Group	Recovery[a] (%)		
			Toluene-d_8	Bromofluoro-benzene	1,2-Dichloro-ethane-d_4
VBLKBP	9/3/01	1081000-ARG112	102	98	100
ADSB21-W-13590	9/3/01	1081000-ARG112	102	100	100
ADSB21-W-13594	9/3/01	1081000-ARG112	102	100	104
ADSB21-W-13591	9/3/01	1081000-ARG112	102	100	102
ADSB23-W-13595	9/3/01	1081000-ARG112	102	102	102
ADSB23-W-13601	9/3/01	1081000-ARG112	102	100	102
ADSB21-W-13578	9/3/01	1081000-ARG112	102	100	100
ADSB44-W-13637	9/3/01	1081000-ARG112	102	100	100
ADSB25-W-13624	9/3/01	1081000-ARG112	104	102	102
ADSB25-W-13609	9/3/01	1081000-ARG112	102	98	102
ADSB22-W-13621	9/3/01	1081000-ARG112	102	100	102
AD-TB-082801	9/3/01	1081000-ARG112	102	102	102
VBLKBQ	9/3/01	1081000-ARG112	98	100	100
ADSB25-W-13609MS	9/3/01	1081000-ARG112	100	102	98
ADSB25-W-13609MSD	9/3/01	1081000-ARG112	100	100	100
ADSB44-W-13633	9/3/01	1081000-ARG112	b	b	b
VHBLKBA	9/3/01	1081000-ARG112	100	102	102
VBLKBW	9/10/01	1090052-ARG113	100	94	98
ADSB25-W-13623	9/10/01	1090052-ARG113	100	98	100
ADSB25-W-13623MS	9/10/01	1090052-ARG113	98	98	100
ADSB25-W-13623MSD	9/10/01	1090052-ARG113	106	102	102
ADSB52-W-14101	9/10/01	1090052-ARG113	102	98	100
ADSB27-W-13628	9/10/01	1090052-ARG113	100	98	104
ADSB52-W-14092	9/10/01	1090052-ARG113	100	96	102
ADSB52-W-14100	9/10/01	1090052-ARG113	100	98	102
AD-TB-090401	9/10/01	1090052-ARG113	100	96	100
VHBLKBA	9/10/01	1090052-ARG113	102	96	108

[a] Quality control limits are as follows:

Analyte	QC Limit (%)
Toluene-d_8	88-110
Bromofluorobenzene	86-115
1,2-Dichloroethane-d_4	76-114

[b] Sample broken during shipment.

TABLE F.11 Recovery and relative percent difference values for spike/spike duplicate organic analyses of water samples at Clayton Laboratory with CLP methodology.

Compound	Concentration (μg/L)				Recovery (%)			Relative Difference (%)	
	Sample	Spike Added	Spike Analysis	Duplicate Analysis	Spike Analysis	Duplicate Analysis	QC Limit	RPD	QC Limit
MS/MSD analysis of ADSB25-W-13609 with SDG 1081000-ARG112									
1,1-Dichloroethene	0	50	52	58	104	116	61-145	11	14
Trichloroethene	0	50	50	55	100	110	71-120	10	14
Benzene	0	50	51	58	102	116	76-127	13[a]	11
Toluene	10	50	61	67	102	114	76-125	11	13
Chlorobenzene	0	50	51	55	102	110	75-130	8	13
MS/MSD analysis of ADSB25-W-13623 with SDG 1090052-ARG113									
1,1-Dichloroethene	0	50	41	41	82	82	61-145	0	14
Trichloroethene	0	50	39	40	78	80	71-120	3	14
Benzene	0	50	41	41	82	82	76-127	0	11
Toluene	28	50	64	71	82	91	76-125	10	13
Chlorobenzene	0	50	41	41	82	82	75-130	0	13

[a] Value outside QC limit.

TABLE F.12 Results for Verification Organic Analysis of Groundwater Samples at Clayton Laboratory

			Concentration (μg/L)			
			Carbon Tetrachloride		Chloroform	
Location	Sample	Depth (ft BGL)	AGEM	Clayton	AGEM	Clayton
SB21	ADSB21-W-13578	25-30	ND[a]	ND	ND	ND
SB21	ADSB21-W-13590	50-55	ND	ND	ND	ND
SB21	ADSB21-W-13591	50-55	ND	ND	ND	ND
SB21	ADSB21-W-13594	70-75	ND	ND	ND	ND
SB22	ADSB22-W-13621	55-60	ND	ND	ND	ND
SB23	ADSB23-W-13595	25-30	ND	ND	ND	ND
SB23	ADSB23-W-13609	50-55	ND	ND	ND	ND
SB23	ADSB23-W-13601	65-70	ND	ND	ND	ND
SB25	ADSB25-W-13623	32-37	9.3	< 5[b]	6	< 5
SB25	ADSB25-W-13624	42-47	ND	ND	ND	ND
SB27	ADSB27-W-13628	32-37	26[c]	11	8[c]	5
SB44	ADSB44-W-13633	32-37	< 5	Broken	ND	Broken
SB44	ADSB44-W-13637	37-42	ND	ND	ND	ND
SB52	ADSB52-W-14092	45-50	< 5	ND	ND	ND
SB52	ADSB52-W-14100	60-65	ND	ND	ND	ND
SB52	ADSB52-W-14101	65-70	ND	ND	ND	ND

[a] ND, not detected above the EPA Method 524.2 (purge-and-trap method) quantitation limit of 1 μg/L.

[b] < 5, not detected above the EPA CLP quantitation limit of 5 μg/L.

[c] Surrogate recovery outside quality control limit for analysis at AGEM Laboratory.