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Final Phase I Report and Phase II Work Plan: Expedited Site Characterization, Agenda, Kansas

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Final Phase I Report and Phase II Work Plan: Expedited Site Characterization, Agenda, Kansas

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Contents

Notation vi

1 Introduction 1-1

2 Investigative Methods 2-1

2.1 Drilling Program 2-1
2.2 Electronic Cone Penetrometer Program 2-1
2.3 Water Level Monitoring Program 2-3
2.3.1 Installation of Temporary Wells and Piezometers 2-3
2.3.2 Water Level Measurements 2-4
2.4 Geophysical Logging 2-4
2.4.1 Wireline Induction and Natural Gamma Logging 2-4
2.4.2 Electronic Cone Penetrometer Logging 2-5
2.5 Surveying 2-5
2.6 Collection and Analysis of Vegetation and Surface Soil Samples 2-5
2.7 Collection and Analysis of Groundwater Samples 2-6
2.7.1 Samples from Public Water Supply and Domestic Wells 2-8
2.7.2 Samples from Temporary Well SB01 and the KDHE Monitoring Wells 2-8
2.7.3 Samples Collected with the Electronic Cone Penetrometer 2-9
2.8 Quality Control for Sample Collection, Handling, and Analysis 2-9
2.8.1 Quality Control for Sample Collection and Handling 2-9
2.8.2 Quality Control for Organic Analyses 2-11
2.8.3 Quality Control for Inorganic Analyses 2-13
2.9 Waste Characterization, Handling, and Disposal 2-14
2.9.1 Drilling Wastes 2-14
2.9.2 Purge Water 2-15

3 Geology 3-1

3.1 Lithologic Sequence at SB01 3-1
3.2 Stratigraphic Interpretation 3-4
3.3 Summary 3-11

4 Hydrogeology 4-1

4.1 Hydrostratigraphy 4-1
4.2 Water Level Fluctuations 4-5
4.3 Groundwater Flow 4-8
4.4 Groundwater Geochemistry 4-13
4.4.1 Ionic Compositions 4-13
4.4.2 Isotopic Compositions 4-19
4.5 Summary 4-22

Contents (Cont.)

5 Contaminant Distribution 5-1

5.1 Vegetation and Soils 5-1
5.2 Groundwater Contamination 5-1
5.2.1 Contaminant Distribution 5-1
5.2.2 Potential Migration Pathways 5-3
5.3 Summary 5-4

6 Phase I Conclusions and Phase II Work Plan 6-1

6.1 Phase I Conclusions 6-1
6.2 Technical Work Plan for Phase II 6-4

7 References 7-1

Appendix A: Lithologic, Geophysical, and Electronic Cone Penetrometer Logs A-1

Appendix B: Well Construction Data B-1

Appendix C: Water Level Data C-1

Appendix D: Survey Data D-1

Appendix E: Vegetation and Surface Soil Sample Data E-1

Appendix F: Groundwater Sample Data F-1

Appendix G: Quality Control and Waste Characterization Sample Data G-1

Figures

1.1 Map of Kansas Showing the Location of Republic County and the City of Agenda 1-2

2.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of Domestic, Public Water Supply, and KDHE Monitoring Wells; and the Locations of Phase I Mud Rotary and Electronic Cone Penetrometer Test Holes, Temporary Well SB01, and Piezometer SB02 2-2

2.2 Aerial Photograph of the Former CCC/USDA Site, Illustrating Existing Grain Bins, Existing and Former Locations of Wooden Storage Buildings, and Locations of Vegetation and Soil Samples 2-7

Figures (Cont.)

3.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of Public Water Supply Wells and KDHE Monitoring Wells; and the Locations of Phase I Mud Rotary and Cone Penetrometer Test Holes, Temporary Well SB01, and Piezometer SB02 3-2

3.2 Lithologic, Conductivity, and Natural Gamma Logs of Test Hole SB01..... 3-3

3.3 Map of Agenda, Kansas, Showing the Former CCC/USDA Site, the Locations of Public Water Supply Wells and KDHE Monitoring Wells, the Locations of Phase I Mud Rotary and Cone Penetrometer Test Holes, and the Locations of Geologic Cross Sections A-A′ and B-B′ 3-5

3.4 West-to-East Geologic Cross Section A-A′, Illustrating Local Stratigraphic Relationships in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas 3-6

3.5 South-to-North Geologic Cross Section B-B′, Illustrating Local Stratigraphic Relationships in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas 3-7

4.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site and the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, Piezometer SB02, and Geologic Cross Sections A-A′ and B-B′ 4-2

4.2 West-to-East Geologic Cross Section A-A′, Illustrating Relationships between Local Stratigraphy and the Shallow and Deep Aquifers in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas 4-3

4.3 South-to-North Geologic Cross Section B-B′, Illustrating Relationships between Local Stratigraphy and the Shallow and Deep Aquifers in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas 4-4

4.4 Variations in Groundwater Levels of the Shallow Aquifer from May 19 to May 25, 1996 4-6

4.5 Variations in Groundwater Levels of the Deep Aquifer from May 19 to May 25, 1996 4-7

4.6 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations in the Shallow Aquifer at 3 a.m. on May 20, 1996 4-9

4.7 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations in the Deep Aquifer at 10 p.m. on May 19, 1996 4-10

Figures (Cont.)

4.8 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations in the Deep Aquifer at 3 a.m. on May 20, 1996 4-11

4.9 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations in the Deep Aquifer at 8 a.m. on May 20, 1996 4-12

4.10 Relative Concentrations of Metals and Anions in Groundwater Samples from Shallow-Aquifer Wells..... 4-15

4.11 Relative Concentrations of Metals and Anions in Groundwater Samples from Deep-Aquifer Wells 4-16

4.12 Nitrate Concentrations in Groundwater Samples, Plotted by Elevation..... 4-18

4.13 Oxygen and Hydrogen Stable Isotope Compositions of Groundwater Samples 4-20

4.14 Tritium Compositions of Groundwater Samples, Plotted by Elevation 4-21

5.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site, the Locations and Types of Groundwater Samples, and the Results of Analyses for Carbon Tetrachloride 5-2

6.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of Mud Rotary and Cone Penetrometer Test Holes, the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and the Proposed Locations of Phase II Activities 6-5

Table

4.1 Concentrations of Major Cations and Anions in Well Water Samples from Agenda 4-17

Notation

AMSL	above mean sea level
BGL	below ground level
°C	degree Celsius
CCC	Commodity Credit Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CI	comprehensive investigation
CLP	Contract Laboratory Program
cps	counts per second
DI	deionized
DOE	U.S. Department of Energy
ECPT	electronic cone penetrometer
ESC	Expedited Site Characterization
ft	foot (feet)
gal	gallon(s)
hr	hour
ID	inner diameter
in.	inch(es)
K	hydraulic conductivity
KDHE	Kansas Department of Health and Environment
MCL	maximum contaminant level
meq/L	milliequivalent(s) per liter
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
µS/cm	microsiemen(s) per centimeter
mg/L	milligram(s) per liter
mm	millimeter
mS/m	millisiemens per meter
MS/MSD	matrix spike/matrix spike duplicate
ppb	part(s) per billion
PVC	polyvinyl chloride
PWS	public water supply
QA/QC	quality assurance/quality control
RI	remedial investigation
RPD	relative percent difference

SDG	sample delivery group
TU	tritium unit
USDA	U.S. Department of Agriculture
VOC	volatile organic compound

Final Phase I Report and Phase II Work Plan: Expedited Site Characterization, Agenda, Kansas

1 Introduction

During the 1950s and 1960s, the Commodity Credit Corporation (CCC), a part of the U.S. Department of Agriculture (USDA), operated a grain storage facility in Agenda, Kansas (Figure 1.1). During this time, commercial grain fumigants containing carbon tetrachloride were commonly used by the CCC/USDA and the private grain storage industry to preserve grain in their facilities. In 1987, carbon tetrachloride was detected at a concentration above the maximum contaminant level (MCL) of 5 micrograms per liter (μg/L) promulgated by the U.S. Environmental Protection Agency in one of Agenda's public water supply (PWS) wells during routine screening by the Kansas Department of Health and Environment (KDHE 1992). Subsequent investigations guided by the KDHE detected carbon tetrachloride in both of Agenda's public supply wells and in the groundwater at the site of the CCC/USDA grain storage facility (PRC 1994, 1995). Because this contamination might be linked to historical use of carbon tetrachloride-based grain fumigants at the former CCC/USDA facility, the CCC/USDA is conducting a remedial investigation (RI) to establish the source and extent of the carbon tetrachloride contamination at Agenda and to determine whether the contamination requires remedial action.

The RI 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 an 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 sites. At these sites, Argonne is applying its Expedited Site Characterization (ESC) methodology to satisfy the requirements of a RI under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as specified in Title 40 of the *Code of Federal Regulations* Part 300.

The ESC methodology was developed by Argonne to optimize preremedial site characterization work at hazardous waste sites by obtaining and then exploiting a thorough understanding of a site's geology, hydrogeology, and geochemistry. This approach is essential

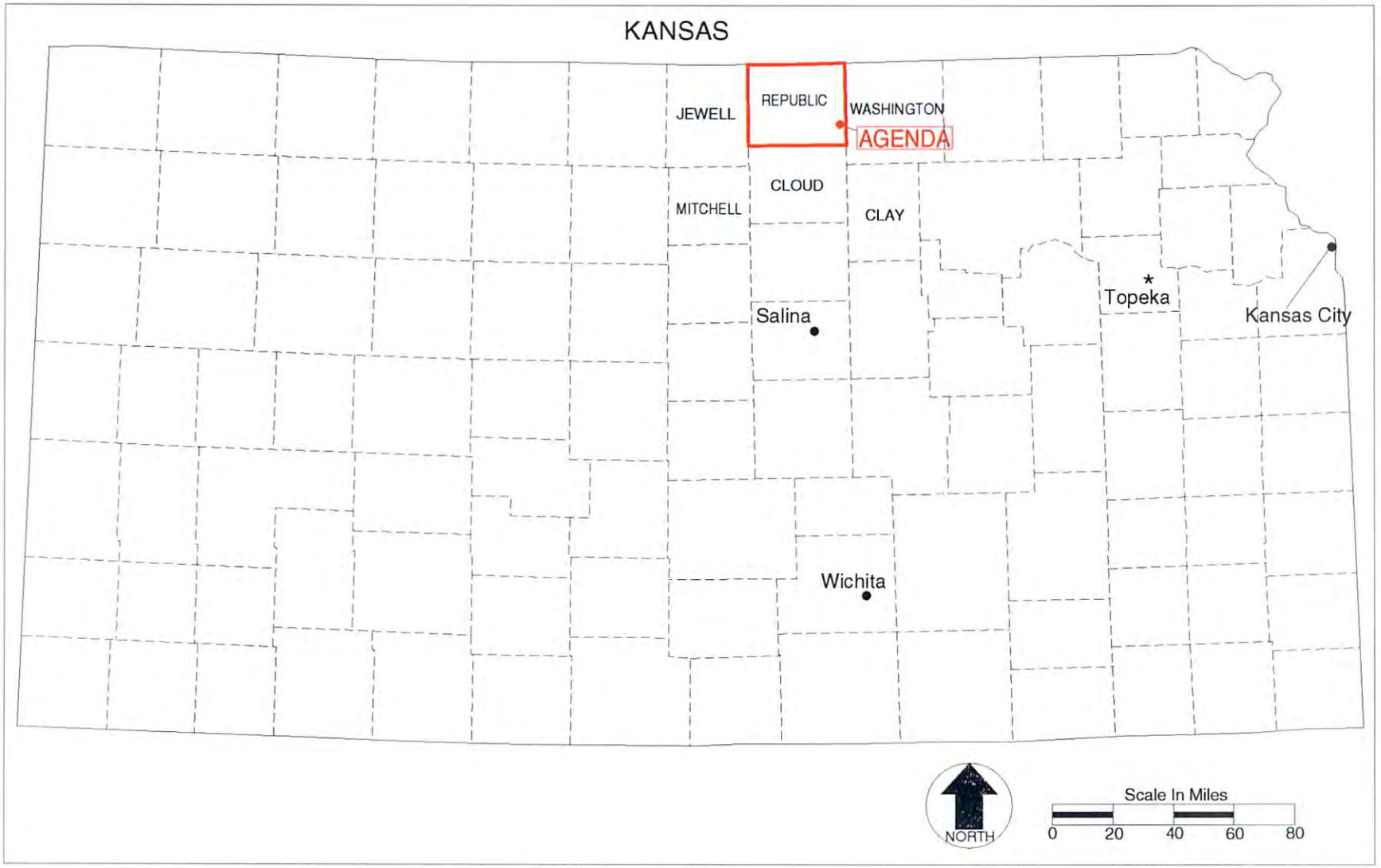


FIGURE 1.1 Map of Kansas Showing the Location of Republic County and the City of Agenda

because the geology, hydrogeology, and geochemistry of a site effectively govern the mobility and fate of the contaminants there. Throughout the ESC program, investigative work is guided by a conceptual geologic, hydrogeologic, and geochemical model of the site. The conceptual model is developed initially by critically reviewing existing data on the site and pertinent regional geologic, hydrogeologic, and geochemical data. This preliminary model is tested and revised during the first phase of the ESC investigation. The revised conceptual model is then used to guide the second phase of investigation, which focuses primarily on delineation of contamination at the site.

This report describes the findings of first phase of the ESC investigation at Agenda. The principal objectives of this phase were (1) to obtain data on the geology, hydrogeology, and groundwater geochemistry in the vicinity of the former CCC/USDA site; (2) to confirm and extend the conceptual geologic and hydrogeologic models of the study area; and (3) to obtain a preliminary understanding of potential sources of and migration pathways for the carbon tetrachloride contamination detected in Agenda's public supply wells. The second phase of this investigation will focus on delineating contamination, as well as refining the conceptual geologic and hydrogeologic model as it relates to understanding and predicting contaminant distribution.

Section 2 of this report describes the investigative methods used during Phase I of the investigation. Sections 3 and 4 present findings of the geologic and hydrogeologic studies, including data on lithology, stratigraphy, hydrostratigraphy, groundwater movement, and groundwater geochemistry at Agenda. Section 5 describes data relevant to the distribution and migration of carbon tetrachloride in soils and groundwater. Section 6 summarizes the information presented in Sections 3, 4, and 5 and presents the work plan that will guide Phase II of the investigation. To streamline the reporting process, materials from the Phase I *Work Plan* (Argonne 1996a) and relevant sections of the *Master Work Plan* (Argonne 1994) are not repeated in detail in this report. Consequently, these two documents must also be consulted to obtain the complete details of the Phase I investigative program.

2 Investigative Methods

This section describes the field and laboratory methods used to investigate the geology and hydrogeology in the study area and the distribution of carbon tetrachloride and chloroform in groundwater, soils, and vegetation there. Detailed descriptions of the field and laboratory procedures associated with these methods are presented in the *Master Work Plan* (Argonne 1994).

2.1 Drilling Program

One conventional soil boring, SB01 (Figure 2.1), was core-drilled by the mud rotary method. This borehole was used to obtain lithologic and stratigraphic data and to install a temporary observation well for groundwater sampling and water level monitoring. Drilling was performed by the Layne-Western Company of Wichita, Kansas. A lithologic log was prepared during drilling by examining drill cuttings and by collecting split-spoon samples and cores over selected intervals. This lithologic log is in Appendix A.

2.2 Electronic Cone Penetrometer Program

Nine locations (SB02-SB10, Figure 2.1) were investigated by using a truck-mounted electronic cone penetrometer (ECPT). The ECPT operations were conducted by Applied Research Associates, Inc., with Argonne's 40-ton ECPT. Activities at the individual ECPT locations varied with location-specific objectives and subsurface conditions. Resistivity and mechanical logs were recorded at all ECPT locations. The initial ECPT test hole, SB02, was located adjacent to SB01 to permit calibration of the ECPT logs to the lithologic sequence at SB01. The additional ECPT logs were used to supplement stratigraphic information obtained at SB01 and SB02, to guide selection of groundwater sampling intervals, and to facilitate the installation of piezometers. The ECPT logging program is discussed further in Section 2.4.2. Geologic sampling at three locations (SB04, SB06, and SB09) with a Mostap® sampler provided lithologic samples for examination and ECPT log calibration and to aid in the selection of groundwater sampling intervals. Groundwater samples were collected at five locations (SB02, SB07-SB10) to obtain information on groundwater geochemistry and contaminant distribution. Details of the ECPT groundwater sampling program are discussed in Section 2.7.3.

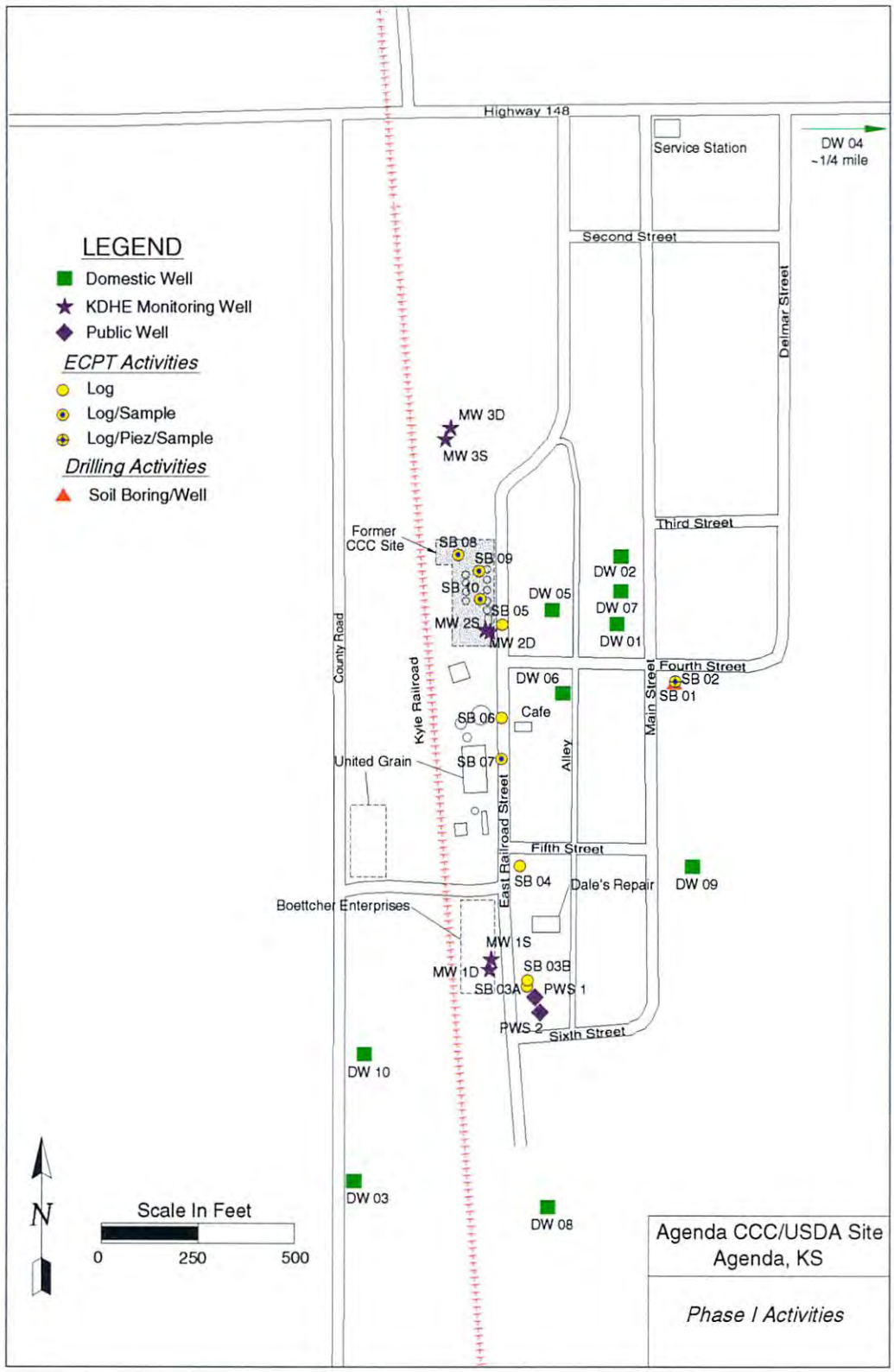


FIGURE 2.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of Domestic, Public Water Supply, and KDHE Monitoring Wells; and the Locations of Phase I Mud Rotary and Electronic Cone Penetrometer Test Holes, Temporary Well SB01, and Piezometer SB02

2.3 Water Level Monitoring Program

The water level monitoring program was designed to determine groundwater potential gradients and directions of groundwater flow. During the comprehensive investigation (CI) conducted by the KDHE, two aquifers were identified: a shallow aquifer consisting of unconsolidated silts and alluvial sands and a deep aquifer hosted by a sandstone (PRC 1994). The KDHE installed three observation wells in each aquifer (MW 1S, MW 1D, MW 2S, MW 2D, MW 3S, and MW 3D, Figure 2.1). However, the linear arrangement of the wells precluded accurate determination of the gradients and directions of flow in the aquifers. This limitation was addressed by Argonne by installing two observation wells (SB01 and SB02, Figure 2.1) and subsequently measuring water levels over the complete observation well network.

2.3.1 Installation of Temporary Wells and Piezometers

A temporary observation well was installed in SB01 to collect groundwater samples and to monitor water levels in the deep aquifer. To protect the deep aquifer from any potential contamination in the shallow aquifer, 8-in.-ID flush-joint, schedule 40 polyvinyl chloride (PVC) casing was installed to a depth below the base of the shallow aquifer, and the annulus was filled with grout to the surface. After an interval to allow the grout to cure, a 7.25-in.-diameter boring was drilled through the 8-in. casing to the final depth. The well was completed by using 4-in.-ID flush-joint, schedule 40 PVC casing with a 0.010-in. slotted screen set from 118.9 to 128.9 ft below ground level (BGL) (1,293 to 1,283 ft above mean sea level [AMSL]). A construction diagram for this well is in Appendix B. After completion, the well was initially developed by surging and bailing. Cycles of surging and bailing continued without pause until the bailing water lacked fines. The well was then purged with a submersible pump until the pH and conductivity of the water stabilized and the water ran clear.

At SB02, a piezometer was installed to monitor water levels in the shallow aquifer. The well point was installed with the ECPT by using a direct-push method, in which casing and screen were attached to a sacrificial cone penetrometer tip and advanced to the desired depth inside the penetrometer rods. The rods were then withdrawn, leaving the sacrificial tip, screen, and casing in place. The annular space was sealed with Benseal® bentonite pellets. The piezometer was completed by using 1-in.-ID PVC casing with a 0.010-in. slotted screen set from 64 to 70 ft BGL (1,348 to 1,342 ft AMSL).

2.3.2 Water Level Measurements

Water levels in the network of observation wells (i.e., in SB01, SB02, MW 1S, MW 1D, MW 2S, MW 2D, MW 3S, and MW 3D) were measured to determine potential gradients and directions of groundwater flow in the aquifers. Initially, several sets of measurements were made by hand to the nearest 0.01 ft by using an electronic water level meter from a surveyed mark at the top of the casing. On May 22 and 23, 1996, pressure transducers and Well Sentinel™ units were installed in SB01, SB02, and the six KDHE monitoring wells to obtain a detailed record of water level fluctuations. All eight devices were configured to record water levels hourly. The water level data are tabulated in Appendix C. Results of the water level monitoring program are discussed in Section 4.

2.4 Geophysical Logging

The geophysical logging program consisted of wireline induction and natural gamma logging in monitoring wells MW 1D, MW 2D, and MW 3D and in temporary well SB01, as well as acquisition of ECPT logs at nine locations. The suite of wireline and ECPT logs was used in conjunction with lithologic data from drill cuttings, drill cores, and split-spoon samples to define lithologic groupings, allowing extension of the stratigraphic interpretation into areas without direct geologic sampling. Results of this program are discussed in Section 3.

2.4.1 Wireline Induction and Natural Gamma Logging

Wireline induction and natural gamma logs were acquired in MW 1D, MW 2D, MW 3D, and SB01 (Figure 2.1) by using Argonne's Mt. Sopris MGX logger and logging tools. The induction probe measures the electrical conductivity of the lithologic units in millisiemens per meter (mS/m) (equivalent to millimhos per meter). The gamma probe was used to measure the amount of natural gamma radiation emitted by the formations in counts per second (cps). The logs were used as an aid in correlating the various stratigraphic units throughout the study area. Copies of the geophysical logs are presented in Appendix A with the corresponding lithologic logs.

2.4.2 Electronic Cone Penetrometer Logging

The ECPT was used to record resistivity, tip stress, sleeve stress, and instantaneous pore pressure logs at nine locations (SB02-SB10, Figure 2.1). Copies of the ECPT logs are in Appendix A. On the logs, resistivity has been converted to conductivity by using the relationship

$$\text{conductivity (mS/m)} = \frac{1}{1{,}000 \times \text{resistivity (ohm} \cdot \text{m)}} ,$$

for consistency with the data obtained with the wireline induction probe. The ECPT logs were compared with the wireline logs of the conventional boreholes to identify stratigraphic horizons between the locations where direct lithologic data were available from drilling.

2.5 Surveying

Surveying services were provided by Schwab-Eaton, Inc., of Manhattan, Kansas. At the conclusion of the field program, the KDHE monitoring wells, ECPT test hole locations, soil boring/temporary well location SB01, and piezometer location SB02 were surveyed to provide horizontal and vertical control for stratigraphic correlation, water level monitoring, and hydrogeologic mapping. In addition, control points were surveyed from which the vegetation sampling and surface soil sampling locations could be hand-measured. The locations of the domestic wells from which water samples were collected were estimated by hand measurement, by aerial photography (USDA 1986), and from the USGS topographic map of the area (USGS 1965). Survey data are in Appendix D.

2.6 Collection and Analysis of Vegetation and Surface Soil Samples

Coordinated vegetation and soil sampling is being investigated as an adjunct tool for determining contaminant distribution and guiding subsurface sampling for carbon tetrachloride, because to date, vadose zone movement appears to be vertical at CCC/USDA sites, with no lateral component. Previous work indicated that low levels of carbon tetrachloride and chloroform can be detected in various plants and grasses growing in contaminated areas (e.g., Argonne 1996b). Vegetation and soil samples collected as part of this research might help to assess shallow subsurface (< 2 ft BGL) contamination at the former CCC/USDA site at Agenda.

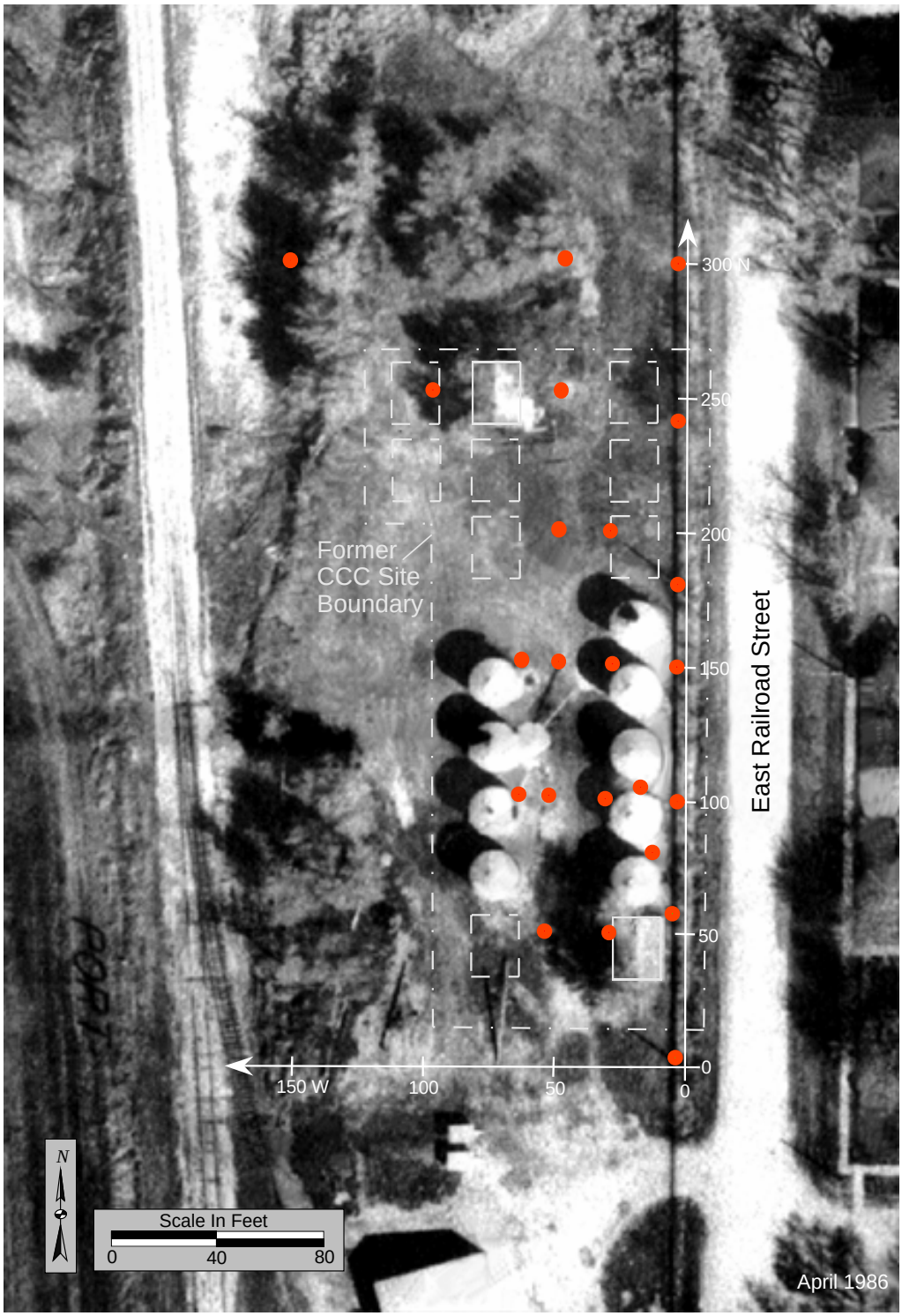
Vegetation and surface soil sampling was performed by using the sample collection and analysis procedures described in the *Master Work Plan* (Argonne 1994). Table E.1 in Appendix E describes each vegetation and surface soil samples collected, including quality assurance/quality control (QA/QC) replicate and standard samples. Figure 2.2 shows the locations of the vegetation and surface soil samples within the former CCC/USDA site. Vegetation and surface soil samples collected during Phase I field activities were shipped immediately to the Hazardous Waste Research and Information Center in Champaign, Illinois, for analysis. All samples were analyzed for carbon tetrachloride and chloroform according to methods described in the *Master Work Plan* (Argonne 1994).

2.7 Collection and Analysis of Groundwater Samples

Groundwater sampling was performed during the Phase I field program at Agenda by using the sample collection and analysis procedures described in the *Master Work Plan* (Argonne 1994). A total of 23 groundwater samples were collected from 23 locations. A detailed listing of the groundwater samples, including location, date sampled, and sample depth, is provided in Table F.1 in Appendix F. Locations where samples were collected are shown in Figure 2.1.

Groundwater samples collected for organic and inorganic analyses were shipped to Inchcape Testing Services, Inc., Colchester, Vermont, for preservation and analysis. All samples were analyzed for carbon tetrachloride and chloroform according to Contract Laboratory Program (CLP) methods described in the *Master Work Plan* (Argonne 1994). The results of these analyses are in Table F.2 in Appendix F. Inorganic analyses were performed on selected Phase I groundwater samples to examine groundwater geochemistry and determine whether the two aquifers at Agenda are distinct chemically. The analytes included dissolved anions (chloride, sulfate, nitrate, and phosphate) and metals (calcium, magnesium, sodium, potassium, aluminum, iron, manganese, phosphorus, zinc, and silicon). All samples were analyzed according to methods described in the *Master Work Plan* (Argonne 1994). The results are given in Table F.3 in Appendix F.

Groundwater samples were also analyzed for tritium (^{3}H) and stable isotopic ratios of hydrogen (D/H) and oxygen ($^{18}O/^{16}O$) by the procedures described in the *Master Work Plan* (Argonne 1994). The hydrogen and oxygen isotope analyses were performed by Krueger



LEGEND

Soil and Vegetation Sampling Locations

Dashed Lines Represent Former Building Locations

FIGURE 2.2 Aerial Photograph of the Former CCC/USDA Site, Illustrating Existing Grain Bins, Existing and Former Locations of Wooden Storage Buildings, and Locations of Vegetation and Soil Samples

Enterprises, Inc., Cambridge, Massachusetts. Tritium analyses were performed at the Tritium Laboratory at the University of Miami, Miami, Florida. Results of the isotope analyses are presented in Table F.4 in Appendix F.

Field parameters (temperature, pH, and conductivity) were measured in the field 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 the alkalinity, dissolved oxygen, and nitrate concentrations. The results of these measurements are given in Appendix F, Table F.5.

2.7.1 Samples from Public Water Supply and Domestic Wells

During Phase I activities at Agenda, water samples were collected from PWS 1 and ten domestic wells (DW01 through DW10, Figure 2.1). The samples were analyzed for carbon tetrachloride, chloroform, major anions (chloride, sulfate, nitrate, and phosphate), metals (calcium, magnesium, sodium, potassium, aluminum, iron, manganese, phosphorus, zinc, and silicon), tritium, and stable isotopic ratios of hydrogen and oxygen. The results of these analyses are in Tables F.2-F.4 in Appendix F.

2.7.2 Samples from Temporary Well SB01 and the KDHE Monitoring Wells

Samples were collected from the six monitoring wells installed by the KDHE in 1994 (Figure 2.1) and the temporary well installed in SB01. Monitoring wells MW 1S, MW 2S, and MW 3S were completed in a shallow water-saturated sand with the tops of the 10-ft screen intervals at depths of 44 ft, 49 ft, and 38 ft, respectively. Monitoring wells MW 1D, MW 2D, and MW 3D were completed in a deeper water-saturated sandstone with the tops of the 10-ft screen intervals at depths of 130 ft, 129 ft, and 104 ft, respectively. Temporary well SB01 was installed in the deeper water-saturated sandstone with the top of its 10-ft screen interval at a depth of 118.9 ft. All samples were analyzed for carbon tetrachloride, chloroform, major anions, major metals, tritium, and stable isotopes of hydrogen and oxygen. Analytical results for these samples are tabulated in Appendix F (Tables F.2-F.4).

2.7.3 Samples Collected with the Electronic Cone Penetrometer

The ECPT was used to collect five groundwater samples from the shallow water-saturated horizon at five locations (SB02, SB07, SB08, SB09, and SB10). The samples were analyzed for carbon tetrachloride, chloroform, anions, metals, tritium, and hydrogen and oxygen isotopes. Results of the analyses for these samples are in Tables F.2-F.4, Appendix F.

2.8 Quality Control for Sample Collection, Handling, and Analysis

2.8.1 Quality Control for Sample Collection and Handling

Quality assurance/quality control of sample collection and handling activities was monitored by the collection of field blanks, equipment rinsates, trip blanks, and field replicate (split) samples. A listing of these QA/QC samples is in Appendix G, Table G.1. The contaminants of concern at the Agenda CCC/USDA site are carbon tetrachloride and chloroform. Analytical results for these compounds in QA/QC samples are in Appendix G, Table G.2.

Water used for equipment decontamination and drilling in conjunction with Phase I field activities was sampled to verify that carbon tetrachloride and chloroform contamination detected in environmental samples did not derive from the water. A sample of water used during the ECPT investigation and a sample of the water used throughout the rotary drilling operation were analyzed. Neither carbon tetrachloride nor chloroform was detected in these blanks at a concentration above the quantitation limit (Table G.2).

One equipment rinsate was collected and analyzed for carbon tetrachloride and chloroform in conjunction with the ECPT groundwater sampling effort (Table G.1). The rinsate did not contain these contaminants of concern at concentrations above the quantitation limit (Table G.2), indicating that proper decontamination procedures were followed for reusable sampling equipment during ECPT groundwater sampling activities. Disposable equipment was used during other groundwater sampling activities, as well as during vegetation and surface soil sampling.

As an indicator of cross-contamination of samples during shipment, a trip blank was prepared and included in each of the eight shipments to the CLP laboratory containing groundwater

samples for carbon tetrachloride and chloroform analysis (Table G.1). Because the container of deionized water brought to the site for preparing trip blanks developed a leak during the field investigation, distilled water was purchased locally to prepare two trip blanks. Chloroform was subsequently detected in these trip blanks (Table G.2). Contamination of the locally purchased distilled water is suspected, because the analytical results for the samples in the associated shipments do not indicate cross-contamination, as evidenced by the following observations:

- Trip blank ANTB05-W-04903 was shipped with six groundwater samples (ANDW10-W-04876, ANMW02S-W-04877, ANMW02D-W-04878, ANSB02-W-04880, ANMW01D-W-04890, and ANMW01S-W-04891) for analysis of volatile organic compounds (VOCs). Two of these samples (ANMW01D-W-04890 and ANMW02D-W-04878) contained carbon tetrachloride; none of the groundwater samples contained chloroform. The chloroform concentration reported for trip blank ANTB05-W-04903 was 6 µg/L.

- Trip blank ANTB06-W-04904 was shipped with five groundwater samples (ANSB01-W-04879, ANSB07-W-04881, ANSB01-W-04900, ANMW03S-W-04901, and ANMW03D-W-04902) for VOC analysis. Neither carbon tetrachloride nor chloroform was detected in any of these groundwater samples. The chloroform concentration reported for trip blank ANTB06-W-04904 was 5 µg/L.

Field replicate (split) samples were collected as an indication of consistent sampling methodology as defined by the sampling protocols in the *Master Work Plan* (Argonne 1994). These samples also provide one measure of the precision of the analytical process. Three vegetation replicate samples and one surface soil replicate sample were collected for organic analysis (Table E.1, Appendix E). Two field replicate (split) groundwater samples were collected for organic and inorganic analyses (Table G.1, Appendix G). Final analytical results for the vegetation and soil samples are not available at this time. Analytical results for groundwater replicate samples were identical for both carbon tetrachloride and chloroform (Table G.2). Quality control for the organic and inorganic analyses is discussed in the following sections.

2.8.2 Quality Control for Organic Analyses

Samples submitted to the CLP laboratory for organic analysis were analyzed in six sample delivery groups (SDGs). Complete CLP data packages were provided by the laboratory. The QA/QC procedures included initial and periodic calibration of instruments, analysis of laboratory blanks, monitoring of surrogate spike recovery, and matrix spike/matrix spike duplicate (MS/MSD) analyses. The results were as follows:

- Analytical instruments were properly tuned; initial and continuing calibration checks remained within the 25% allowable limit.

- Contaminants of concern were not detected in laboratory method blanks for soil or water analyses.

- Surrogate standard determinations were performed on samples and blanks by using the surrogate spike compounds toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4. Table G.3 in Appendix G shows the recovery of the three system-monitoring compounds for each of the organic analyses on water samples. Surrogate compound toluene-d8 exceeded the QC limit by 3% for one sample in SDG 57981, as discussed below.

- The MS/MSD analyses were performed in accordance with CLP protocols by using matrix spike compounds 1,1-dichloroethene, trichloroethene, chlorobenzene, toluene, and benzene in order to evaluate the matrix effect of samples on the analytical methodology. Table G.4 in Appendix G shows the percent recovery of the spike compounds for each of the MS/MSD analyses performed, as well as the calculated relative percent difference (RPD) for each of the MS/MSD analyses. For all analyses, contract-required recovery limits specific to each matrix spike were met. The calculated RPD for MS/MSD analyses also met QC limits.

Deviations from CLP protocol for VOC analyses could affect data quality in two of the SDGs, as noted below.

2.8.2.1 Sample Delivery Group 57981

Sample delivery group 57981 included 17 water samples (12 groundwater samples, 1 field blank, 4 trip blanks). One MS/MSD analysis was performed in conjunction with this group. Samples included in SDG 57981 are identified in Table G.3.

As a result of instrument failure, samples ANDW09-W-04868, ANPW01-W-04869, and ANTB04-W-04875 were analyzed for VOCs after the prescribed holding time, 10 days after receipt of the samples. Samples ANPW01-W-04869 and ANTB04-W-04875 were analyzed within 12 days of sample collection and sample ANDW09-W-04868 within 15 days. The analytical results are considered acceptable, because the samples were shipped on ice overnight to the CLP laboratory and were maintained at 4°C until analysis.

Recoveries of surrogate compounds were within the allowable QC limits for all analyses except one. The percent recovery of surrogate compound toluene-d8 was greater (at 113%) than its upper QC limit of 110% for the matrix spike sample ANDW01-W-04850MS (Table G.3). The QC limits for percent recovery of the other two surrogate compounds were met for this analysis. Recoveries of spike compounds were within QC limits for the MS/MSD analysis, and calculated RPDs ranged from 0% to 4%, indicating good analytical precision (Table G.4).

2.8.2.2 Sample Delivery Group 58574

Sample delivery group 58574 included four wastewater samples (purge water from KDHE monitoring wells MW 1S, MW 1D, MW 2S, and MW 2D) and one trip blank. One MS/MSD analysis was performed in conjunction with this group. Samples included in SDG 58574 are listed in Table G.3. The samples were shipped overnight to the CLP laboratory, but the shipment was delayed in route and did not arrive at the laboratory until two days after the scheduled day of arrival. The temperature of the package was recorded at the laboratory as 25°C. The samples were cooled to 4°C at the laboratory and analyzed within approximately 24 hours. In all four samples, no carbon tetrachloride or chloroform was detected (Table G.2) at the quantitation limit of 5 µg/L for these compounds. Because the temperature of the samples exceeded the maintenance temperature (4°C) for an unknown period of time, these analytical results are considered suspect. These samples were collected for waste characterization, and the suspect results do not affect the investigation of carbon tetrachloride and chloroform contamination in the aquifers at Agenda.

2.8.3 Quality Control for Inorganic Analyses

Inorganic analyses were performed on selected groundwater samples to characterize the geochemistry of the water-saturated horizons. All samples were analyzed for metals (aluminum, calcium, iron, magnesium, manganese, phosphorus, potassium, silicon, sodium, and zinc) and major anions (chloride, sulfate, nitrate, and phosphate). Groundwater samples for metals analysis were preserved by adjusting their pH values to less than 2 upon their arrival at the CLP laboratory.

Samples submitted to the CLP laboratory for inorganic analysis were shipped in two SDGs. Complete CLP data packages were provided by the CLP laboratory. The QA/QC procedures followed included initial and continuing calibration of instruments, duplicate laboratory analyses, and spiked sample analyses. The results were as follows:

- Initial and continuing calibration of analytical equipment was performed according to method protocol, with calibration of instruments verified throughout the analytical process by the analysis of instrument check standards to determine instrument drift. Laboratory QC for accuracy was measured by the percent recovery of known concentrations of the metals and anions of concern added to these laboratory control samples. Percent recovery of the spiked analytes of concern was excellent, well within the acceptable limit of 90-110%. Table G.5 in Appendix G shows the recovery range achieved in laboratory control samples during initial and continuing calibration of analytical instruments.

- Laboratory QC for precision was measured by the calculated RPD between analytical results of duplicate analyses. Two blind replicate samples were submitted to the CLP laboratory for inorganic analysis: (1) sample ANDW04-W-04856, a replicate of sample ANDW04-W-04855, and (2) sample ANSB01-W-04900, a replicate of sample ANSB01-W-04879. Two samples were selected by the CLP laboratory for duplicate analyses: (1) sample ANDW03-W-04852 and (2) sample ANMW01D-W-04890. Table G.6 in Appendix G shows the inorganic analytical results for the four duplicate analyses. The low calculated RPD values indicate a high level of analytical precision.

- Spiked sample analyses provide information about the effect of the sample matrix on the digestion and measurement methodology. Table G.7 in Appendix G shows the inorganic analytical results for the two laboratory duplicate analyses and the recovery of matrix spikes. Spike recovery was within the allowable limit of 75-125%.

Six groundwater samples (samples ANDW05-W-04862, ANDW06-W-04863, and ANDW08-W-04866 in SDG 57981 and samples ANSB08-W-04882, ANSB09-W-04883, and ANSB10-W-04885 in SDG 58098) were analyzed for nitrate and orthophosphate after the standard 48-hour holding time for these analyses. The inorganic data are collected to characterize the geochemistry of the water-bearing zones, not to quantify any potential inorganic contaminants that would be unrelated to the operation of the CCC/USDA facilities. Results for these six samples are consistent with those of other samples analyzed within the prescribed holding time. Therefore, the results are considered acceptable for the intended purpose of aquifer definition.

2.9 Waste Characterization, Handling, and Disposal

Potentially contaminated waste soil derived during drilling of SB01 and water purged from KDHE monitoring wells MW 1S, MW 1D, MW 2S, and MW 2D were drummed and sampled before disposal as described in the following sections.

2.9.1 Drilling Wastes

The drill cuttings, mud slurry, and excess grout accumulated during the drilling and installation of the SB01 temporary well were placed in 44 drums. At the conclusion of the field program, 9 composite samples were collected to represent the waste material. Each composite sample was composed of aliquots from 5 drums, as indicated in Table G.1 in Appendix G. (Sample ANDR09-S-04874 was composed of aliquots from 4 drums.) Neither carbon tetrachloride nor chloroform was detected above the quantitation limit in any of the waste soil samples (Table G.2); therefore, the waste soils and sediments were considered free from carbon tetrachloride and chloroform. These wastes were placed in a fill area owned by the city of Agenda, which was used for drilling wastes generated by the KDHE during the CI (PRC 1994).

2.9.2 Purge Water

Groundwater purged from KDHE monitoring wells MW 1S, MW 1D, MW 2S, and MW 2D was containerized before the wells were sampled. After aeration for approximately three weeks, samples of the containerized purge water from each well were collected (Table G.1, Appendix G) and analyzed for carbon tetrachloride and chloroform contamination. No carbon tetrachloride or chloroform was detected at the quantitation limit of 5 μg/L in any of the four samples analyzed. Because the samples were delayed in shipment, arriving at the CLP laboratory two days late and at a temperature of 25°C, the analytical results are considered suspect. The groundwater samples from MW 1D and MW 2D (Table F.2, Appendix F) contained carbon tetrachloride above the quantitation limit. The purge water was considered potentially contaminated and was disposed of at the Belleville, Kansas, sanitation plant, where the KDHE disposed of purge water during the CI (PRC 1994).

3 Geology

The geologic interpretation presented in the Phase I *Work Plan* (Argonne 1996a) was based on regional stratigraphic data compiled by the Kansas Geological Survey (Wade 1992; Macfarlane et al. 1991) and lithologic data from the logs of the boreholes drilled during the CI of the site (PRC 1994) and the driller's log of Agenda's well PWS 2 (KDHE 1983). The hypothesized stratigraphic sequence consisted of a package of unconsolidated Pleistocene age silts and clays overlying an interbedded sequence of Cretaceous age shales and sandstones. This interpretation differed from the one presented in the CI (PRC 1994).

To resolve this discrepancy, additional lithologic data were obtained by core-drilling a test hole at SB01 (Figure 3.1) and by sampling targeted horizons with the ECPT at SB06 (Figure 3.1). The direct stratigraphic data generated were supplemented by calibrating ECPT resistivity and mechanical logs to the lithologic sequence at SB01 and subsequently acquiring ECPT resistivity and mechanical logs at eight locations (SB03-SB10), as well as through resistivity and natural gamma logging of SB01 and three of the monitoring wells (MW 1D, MW 2D, and MW 3D) installed by the KDHE during the CI. This section describes the findings of and the conclusions drawn from these investigative activities.

3.1 Lithologic Sequence at SB01

The lithologic sequence at SB01 is illustrated in Figure 3.2. A detailed lithologic log for this borehole is presented in Appendix A. The uppermost lithologic unit consists predominantly of unconsolidated, red-brown clayey silt that exhibits some gray mottling and occasionally contains small (< 1 mm in diameter) manganese oxide nodules. Within this unit, a single 2-ft-thick bed of light gray, silty sand occurs at approximately 18 ft BGL. At 58 ft BGL, a transition occurs to a red-brown sandy silt that is interbedded with several thin (< 0.2 ft thick), iron oxide-stained, silty, subangular to subrounded quartz sands.

Underlying the interbedded silt-and-sand sequence is the bedrock (at approximately 66 ft BGL). The bedrock consists of a gray shale, the upper 7 ft of which are mottled light and dark gray, with numerous vertical fractures and a variable amount of iron oxide staining. Below this mottled and fractured zone, the shale has a uniform gray color, is finely laminated, and contains occasional to abundant small (< 3 mm in diameter), disseminated flakes of coal. In addition, a thin

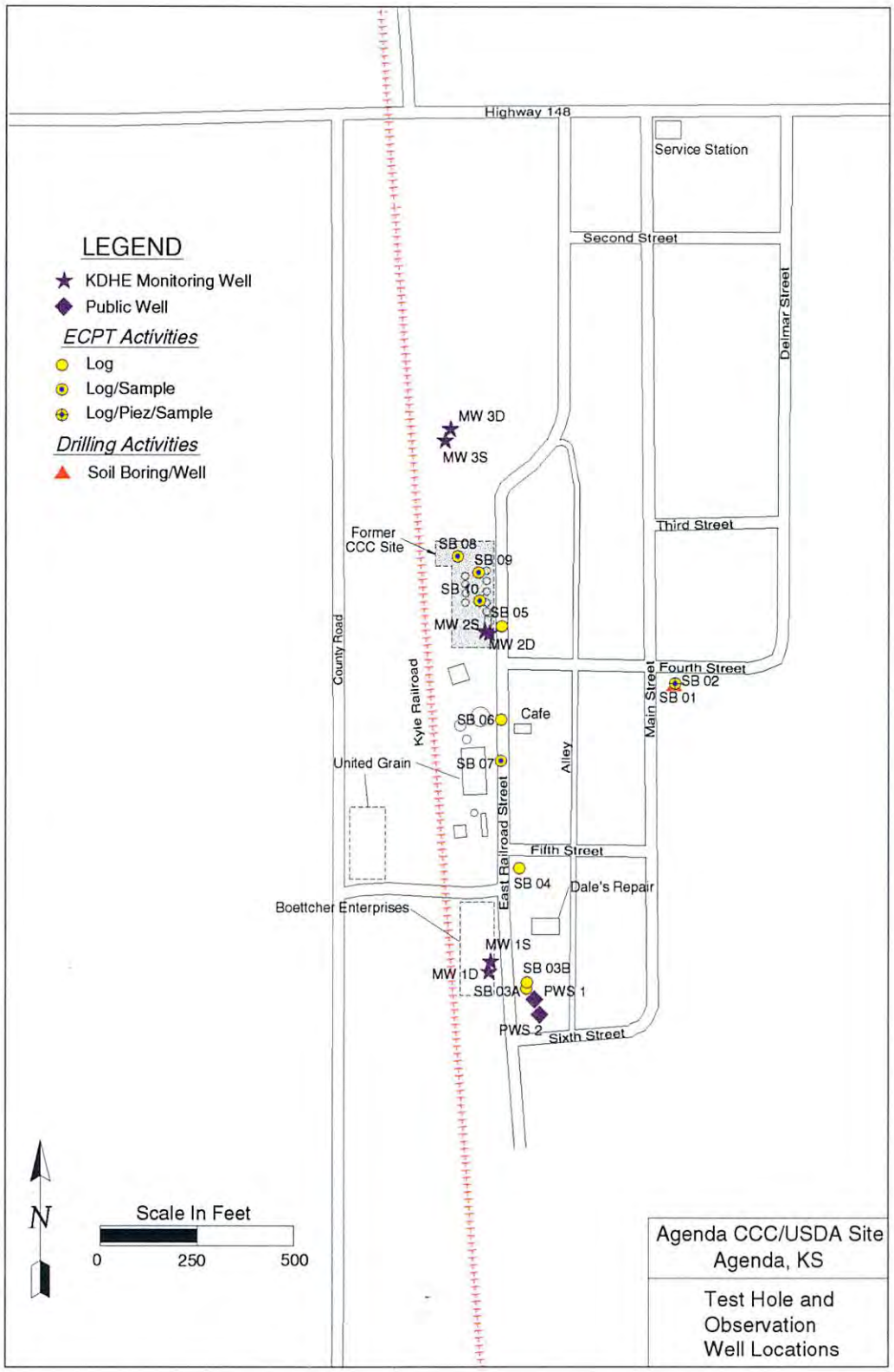


FIGURE 3.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of Public Water Supply Wells and KDHE Monitoring Wells; and the Locations of Phase I Mud Rotary and Cone Penetrometer Test Holes, Temporary Well SB01, and Piezometer SB02

SB01

Agenda CCC/USDA Site Investigation

Sec. 16 ACAB, T4S R1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft.
Lithology by: S. Cook
Company: Argonne National Laboratory

Argonne National Laboratory
Environmental Research Division

Depth: 136.6 ft.
Log Date: April 24,1996
Logged by: W. Saunders
Logging Company: Argonne National Laboratory

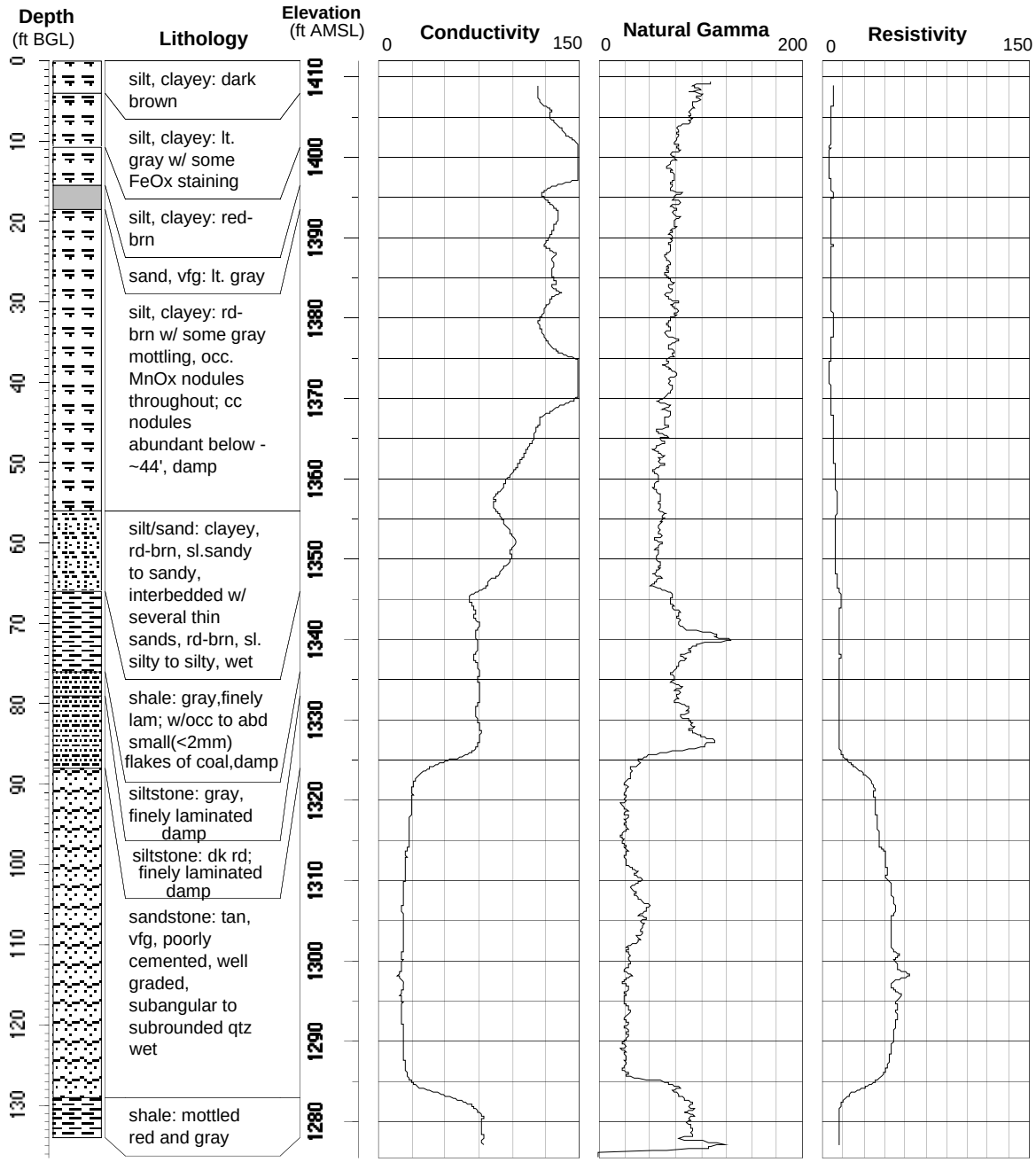


FIGURE 3.2 Lithologic, Conductivity, and Natural Gamma Logs of Test Hole SB01

(approximately 0.2 ft thick) seam of interbedded shale and coal is present at approximately 75 ft BGL. Below the coal, the lithology changes to a light gray siltstone, which retains the fine laminations exhibited by the overlying shale. At 78-79 ft BGL, the color of the siltstone changes gradually from light gray to dark red as it becomes pervasively stained by hematite. At 88 ft, a 0.2-ft section of well-cemented, hematite-stained sandstone was recovered in the core barrel. Below this point, the driller was unable to recover core samples. At 98 ft BGL, a split-spoon sampler was run to obtain a direct sample. This procedure recovered 0.4 ft of tan, poorly consolidated, very fine grained to fine grained quartz sandstone after 52 blows with the rig's hydraulic hammer. Drill cuttings from below this point had characteristics consistent with the sandstone sample recovered with the split spoon. At 129 ft, a second shale was encountered. This shale is light gray with some dark red hematitic mottling.

The geophysical properties of the lithologies at SB01 are also illustrated in Figure 3.2. The logs show that the sandstone within the bedrock portion of the borehole exhibits a significant decrease in both conductivity and natural gamma activity relative to the overlying and underlying shales. This response, typical of a clean quartz sandstone, defines well the occurrence of this lithologic unit. In contrast, the thin sands that immediately overlie the bedrock surface do not display a measurable decrease in conductivity and natural gamma count, probably because of their stratigraphic thickness and their interbedded occurrence. Within the unconsolidated clayey silt sequence, a zone at 36-46 ft BGL exhibits a significant increase in conductivity. A similar zone is present in the corresponding stratigraphic interval on the conductivity log of adjacent ECPT hole SB02 (Appendix A). There were no obvious differences in lithology of this zone relative to the overlying and underlying sediments. The increase in conductivity could be due to a subtle increase in clay content or moisture through this zone.

3.2 Stratigraphic Interpretation

Stratigraphic relationships within the geologic section penetrated by Agenda's public supply wells, the KDHE boreholes, and borehole SB01 are illustrated in two geologic cross sections (Figure 3.3), west-to-east section A-A′ (Figure 3.4) and south-to-north section B-B′ (Figure 3.5). These sections were constructed by correlating the lithologic, conductivity, and natural gamma logs of SB01, the three deep KDHE boreholes (MW 1D, MW 2D, and MW 3D), the ECPT resistivity and mechanical property logs, and the driller's log from PWS 2. Copies of these logs are in Appendix A.

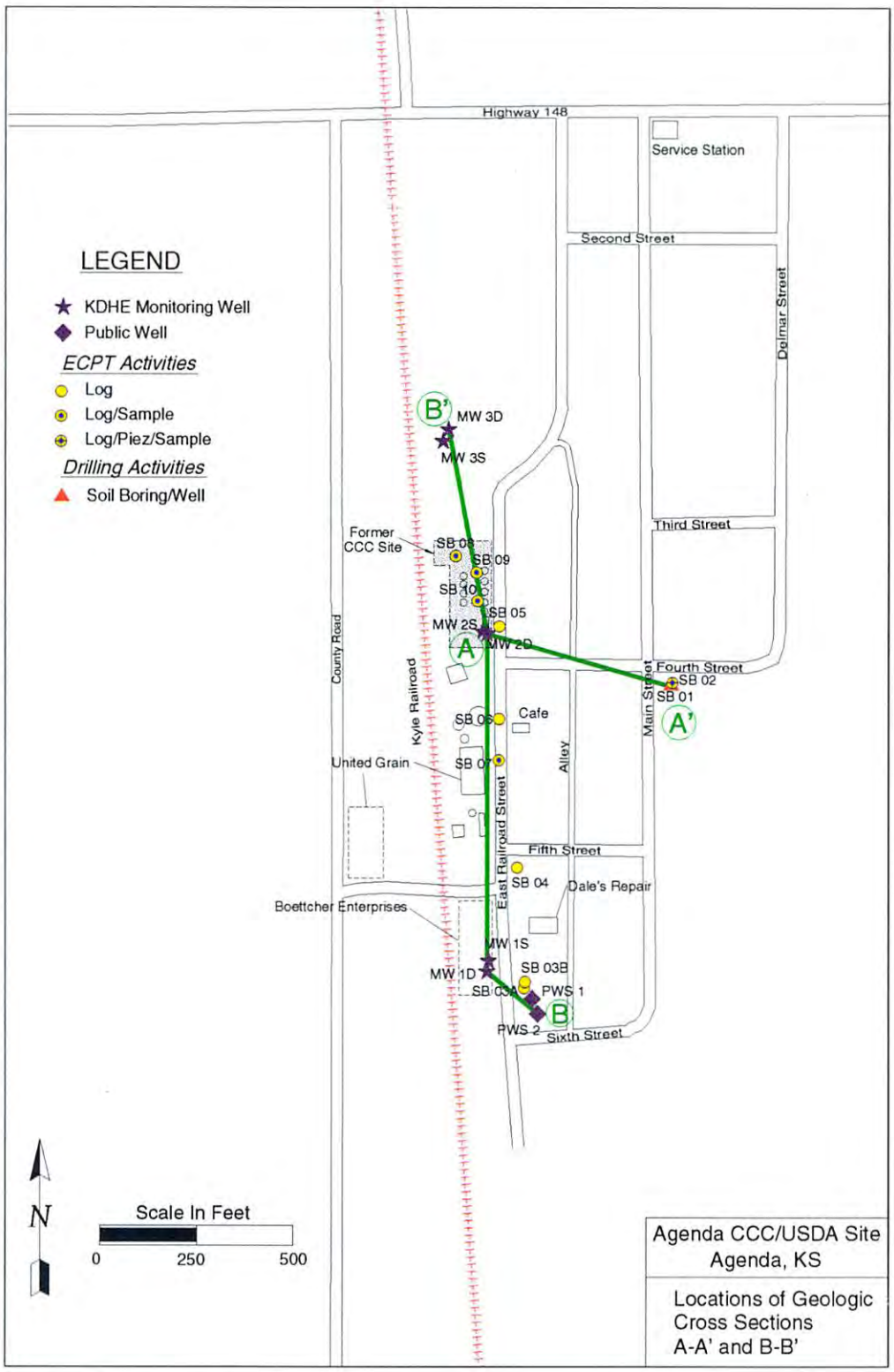


FIGURE 3.3 Map of Agenda, Kansas, Showing the Former CCC/USDA Site, the Locations of Public Water Supply Wells and KDHE Monitoring Wells, the Locations of Phase I Mud Rotary and Cone Penetrometer Test Holes, and the Locations of Geologic Cross Sections A-A′ and B-B′

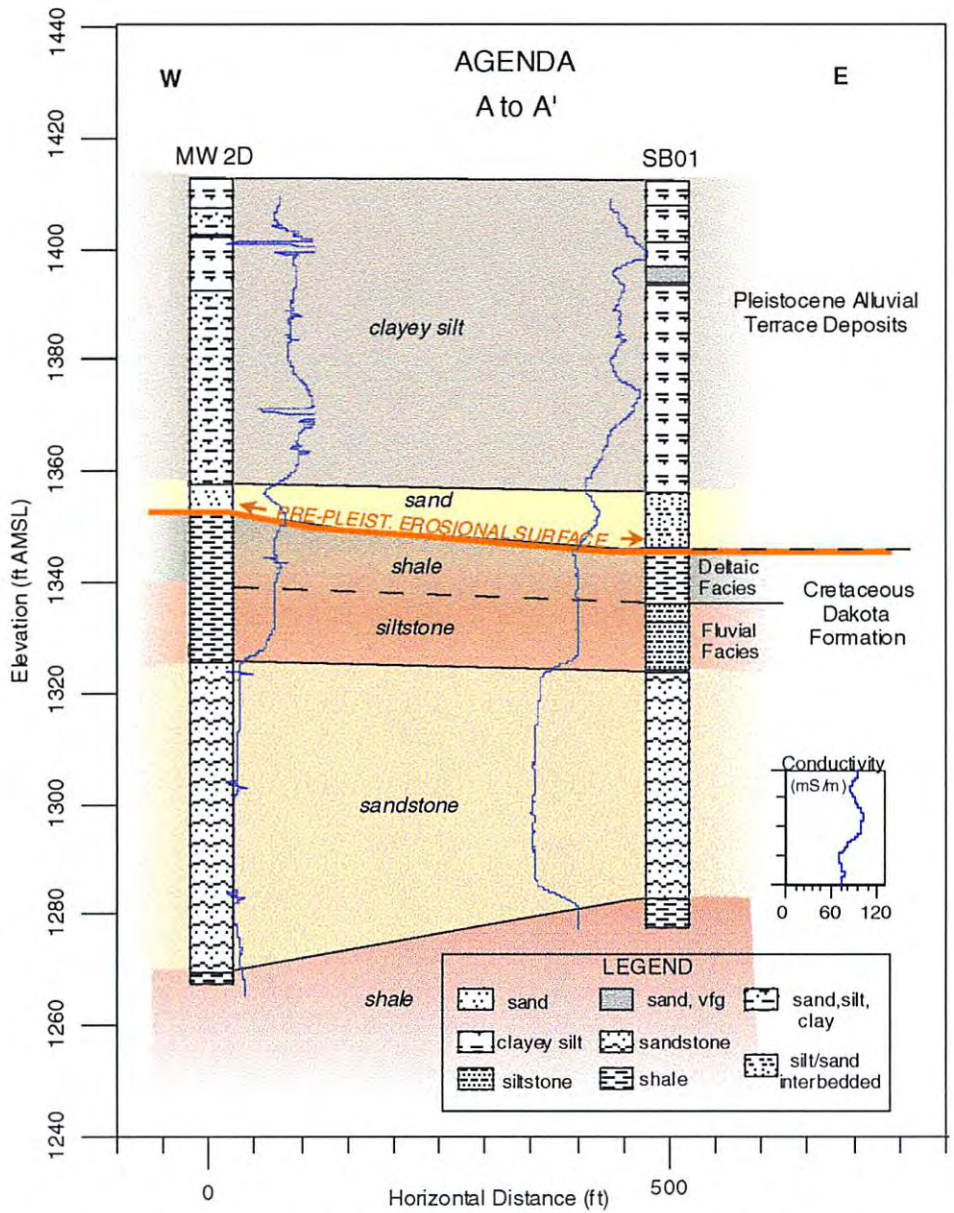


FIGURE 3.4 West-to-East Geologic Cross Section A-A', Illustrating Local Stratigraphic Relationships in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas

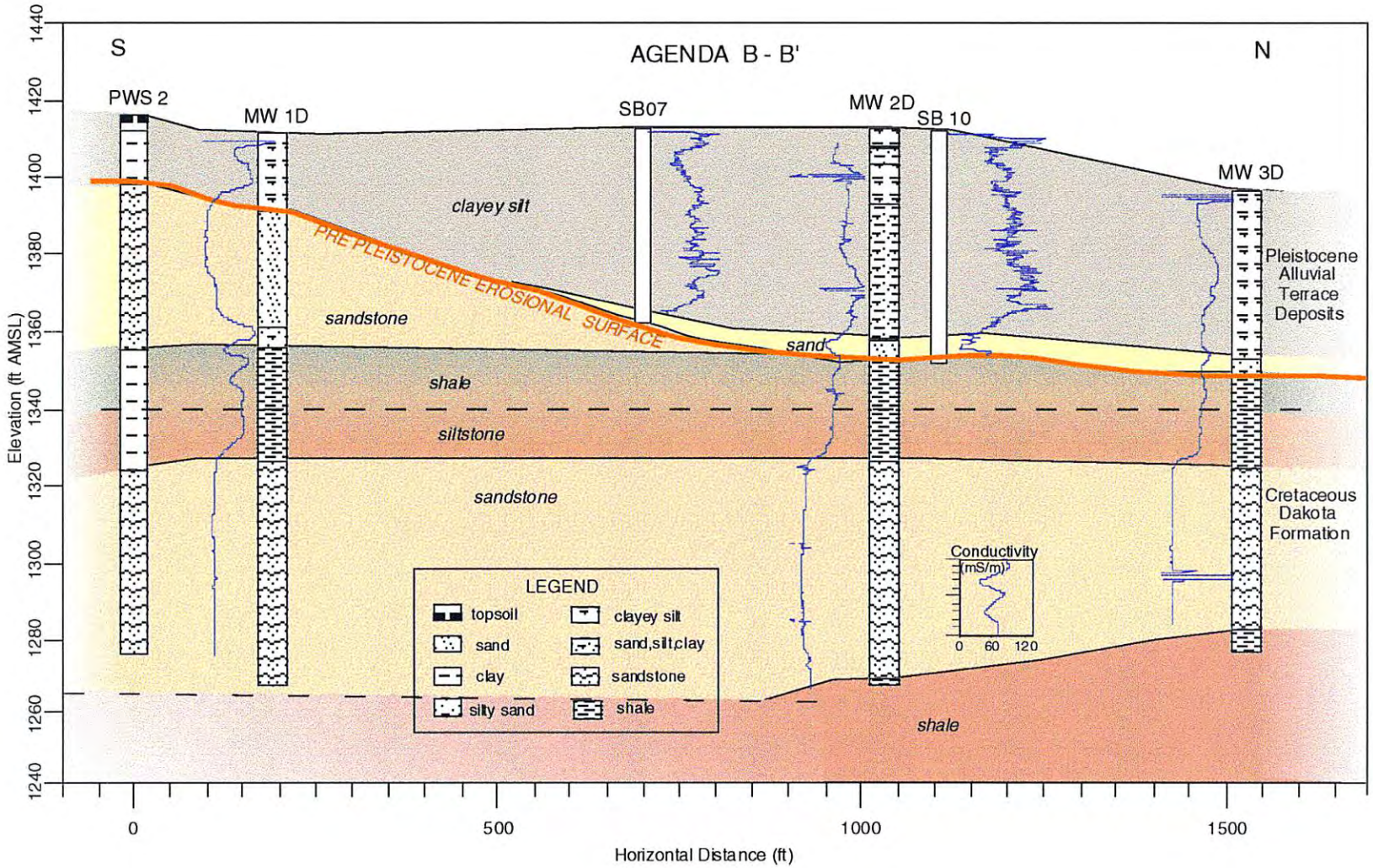


FIGURE 3.5 South-to-North Geologic Cross Section B-B′, Illustrating Local Stratigraphic Relationships in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas

The uppermost stratigraphic unit consists of brown to red-brown unconsolidated silt and silty clay. This unit extends to approximately 55 ft BGL at the north end of the study area (MW 3D, section B-B′), but only to approximately 20 ft BGL at the south end of the area (MW 1D, section B-B′). At SB01 (section A-A′), this unit contains a 2-ft-thick bed of light gray, silty sand at approximately 18 ft BGL; at SB06, a thin (< 0.1 ft) horizon of limestone gravel pebbles occurs at approximately 50 ft BGL.

At MW 2D, MW 3D, and SB01, the silty clay unit is underlain by a tan to orange-brown, very fine to medium grained silty quartz sand, which at SB01 and MW 2D is interbedded with a series of red-brown sandy silts. Along the line of section A-A′ and from approximately SB07 northward along section B-B′, this sand overlies shale bedrock. To the south at MW 1D (section B-B′), the sand appears to be pinched out against a bedrock sandstone.

In the CI report (PRC 1994), this sandstone was interpreted as a fluvial sand. Its lithology was described as a tan to orange-brown, fine to medium grained, well-sorted, subrounded quartz sand containing some “pebbly clasts of Dakota sandstone” (PRC 1994). This description is strikingly similar to the character of the sandstone at SB01. In addition, the driller’s log for PWS 2 (section B-B′) describes the laterally equivalent stratum as a “sandrock” (KDHE 1983), the term used by the local well driller to describe the sandstones in this area (Argonne 1996a). East and somewhat northeast of MW 1D at SB03 and SB04 (Figure 3.3), ECPT test holes achieved refusal at approximately 15 ft BGL, indicating the presence of a well-consolidated horizon. This depth correlates with the top of the shallow sand on the log of MW 1D (Appendix A). The similarity in character, the presence of sandstone clasts, and the material’s mechanical strength are all consistent with interpreting this lithologic unit as a bedrock sandstone.

Beneath the sandstone at MW 1D and beneath the unconsolidated sand elsewhere is a finely laminated gray shale (approximately 10 ft thick at SB01, section A-A′) that contains disseminated flakes and, in two locations (SB01 and MW 1D), thin seams of coal. At SB01, the upper 7 ft of this shale was mottled light and dark gray and contained abundant vertical fractures stained by iron oxide, both characteristics of a weathered zone. This shale grades downward initially into a varicolored gray and red siltstone and finally to a dark red siltstone.

Below the siltstone is tan, fine to medium grained, well-sorted, subrounded quartz sandstone. The sandstone ranged from approximately 42 ft thick at SB01 (section A-A′) to more than 60 ft at MW 1D (south end of section B-B′). At SB01, MW 2D, and MW 3D, this sandstone

is underlain by a gray shale, which at SB01 exhibited some red mottling. The base of the sandstone was not encountered at either MW 1D or PWS 2.

The unconsolidated silty clay and silty sand units that overlie the bedrock together compose a Pleistocene age terrace. Regional mapping of Republic County and the adjacent counties by the Kansas Geological Survey (Bayne and Walters 1959; Walters and Bayne 1959; Fishel and Leonard 1955; Fishel 1948; Wing 1930), and the U.S. Geological Survey (Byrne et al. 1950) indicated that numerous alluvial terraces were formed in the valleys across northeastern Kansas during the repeated cycles of Pleistocene glaciation. The materials in these terraces were derived principally by erosion of local bedrock outcrops (Byrne et al. 1950). In some cases, alluvial materials are mantled by or interbedded with loess. At Agenda, the fine clayey silt that composes the uppermost portion of the unconsolidated section might in part be loess, while the limestone gravel encountered at SB06 and the interbedded silts and sands within the sequence likely represent fluvial deposits. The sands at the base of the sequence were probably derived in part from the sandstone subcrop encountered at MW 1D. In this context, the weathered zone at the top of the shale at SB01 presumably developed prior to the deposition of the terrace.

Regional stratigraphic studies indicate that the bedrock at Agenda is the Cretaceous age Dakota Formation (Wade 1992), which contains two distinct facies assemblages: a *deltaic* assemblage and a *fluvial* assemblage (Wade 1992; Macfarlane et al. 1991). These assamblages are separated by a flooding surface, above which sediments were deposited in the subaqueous portion of a river-dominated delta system and below which sediments were deposited by rivers in a coastal plain setting (Macfarlane et al. 1991).

The deltaic facies assemblage consists of approximately 50% interlaminated shales and mudstones, both of which have a high organic content, along with very fine to fine grained sandstone. The remainder is composed of relatively clean, fine grained sandstone. Wade (1992) interpreted the interlaminated sequence as abandoned distributary channel and delta-front deposits, with the clean sandstones representing active distributary channels and distributary mouth bars. The characteristics of the shales immediately below the bedrock surface at Agenda (finely laminated, with abundant disseminated flakes of coal) indicate that these shales were originally deposited in the deltaic facies of the Dakota. This observation implies that the overlying subcropping sandstone at MW 1D likely was deposited in either an active distributary channel or a distributary mouth bar.

The underlying fluvial facies assemblage of the Dakota Formation consists of approximately 60% varicolored mudstones, with some thin, very fine grained levee and splay sandstones that were deposited on coastal floodplains. The remaining 40% of the Dakota is composed of fine to medium grained sandstones that commonly fine upward and contain large-scale cross beds, characteristics indicating that they were deposited as point bars in river channels (Wade 1992). In this context, the varicolored siltstones that underlie the organic-rich shales in SB01 (section A-A′) document the transition to the alluvial facies of the Dakota, representing sediments deposited on a floodplain, with the underlying sandstone having accumulated in a river channel as a series of point bars.

The assignment of the sandstones to their respective environments of deposition has implications in predicting their areal distribution and continuity. Specifically, regional studies have demonstrated that individual channel sandstones in the alluvial facies are largely discontinuous and ribbon-like (Macfarlane et al. 1991), except for the channel sandstones at the base of the formation, which form a laterally continuous package (Wade 1992). However, the sandstones encountered in the boreholes at Agenda are too high stratigraphically to belong to the basal sandstone package (Argonne 1996a). Measured dips on the cross beds in the channel sandstones indicate that the rivers depositing these sandstones flowed west-southwesterly (Wade 1992; Karl 1976). Thus, the deeper sandstone at Agenda would be expected to trend generally west-southwest.

Predicting the likely orientation of the shallow sandstone is more problematic. This sandstone was originally deposited in the deltaic facies of the Dakota Formation, as either a distributary channel sand or a distributary mouth bar. The orientations of the subaqueous distributary channels in deltas are typically highly variable, while sands deposited in distributary mouth bars tend to form isolated lenses (Blatt et al. 1972). This tendency, together with partial erosion of the shallow sandstone prior to deposition of the alluvial terrace during the Pleistocene, precludes prediction of the depositional trend or the potential lateral extent of the shallow sandstone.

Drillers' logs of nearby irrigation wells (see Appendix A in Argonne 1996a) recorded one to five sandstones interbedded with "red clay" and "blue clay" within the stratigraphic interval of the Dakota equivalent to the section at Agenda. The red coloration is characteristic of the fluvial assemblage of the Dakota (Wade 1992), while "blue clay" probably indicates deltaic facies deposits. Unfortunately, the sinuous, irregular distribution of sandstones deposited in these depositional environments precludes reliable correlation over all but very short distances.

Nevertheless, their frequency of occurrence does suggest a significant potential for cross-cutting between the individual sandstones in the immediate area.

3.3 Summary

The geologic section at Agenda penetrated by the public water supply wells consists of a Pleistocene age terrace overlying Dakota Formation bedrock. The terrace deposit consists largely of clayey silt, with some interbedded, fine grained quartz sands. At Agenda, the Dakota Formation contains two sandstones, separated by an intervening section of shale and siltstone. Both sandstones are poorly consolidated. The shallow sandstone subcrops beneath Pleistocene age terrace deposits and appears to have been partially eroded before the terrace was deposited. The thin sands at the base of the terrace deposits appear to be pinched out against the subcropping sandstone; then probably were derived by erosion of this sandstone. The shallow sandstone appears to have been deposited in the deltaic facies of the formation, in either an active distributary channel or a distributary mouth bar; the deep sandstone was deposited in the fluvial facies of the Dakota as a series of point bars in a meandering river channel. The sinuous and irregular distribution of sands deposited in these depositional environments precludes reliable correlation of the individual sandstones over all but very short distances. Nevertheless, the abundances and stratigraphic positions of the sandstones in nearby irrigation wells suggest a significant potential for cross-cutting between the individual sandstones in the immediate area.

4 Hydrogeology

This section describes the findings of the hydrogeologic portion of the investigation. The hydrogeologic interpretation presented in the Phase I *Work Plan* (Argonne 1996a) was based on the hypothesized stratigraphic sequence, regional hydrogeologic information (Wade 1992; Helgesen et al. 1982; Leonard et al. 1982), and water level measurements made during the CI (PRC 1994). The objectives of Argonne's hydrogeologic investigation were to confirm the hydrostratigraphy and to gather information on directions of groundwater flow, potential gradients, and the geochemistry of the aquifers. The locations where hydrogeologic data were obtained are illustrated in Figure 4.1.

4.1 Hydrostratigraphy

Two aquifers, termed shallow and deep, were identified during the CI within the stratigraphic section penetrated by Agenda's public water supply wells (PRC 1994). In Figures 4.2
and 4.3 the relationships between these aquifers and the previously described stratigraphic units are illustrated by superimposing on geologic cross sections A-A′ and B-B′ the water levels recorded by the Well Sentinel™ units at 10 p.m. on May 19, 1996.

Together with the stratigraphic data, the water levels indicate that the shallow aquifer is a composite of two stratigraphic units: (1) the thin and occasionally interbedded alluvial sands occurring at the base of the Pleistocene age alluvial terrace deposits (MW 2S, MW 2D, and SB01 in section A-A′ and MW 3S and MW 3D in section B-B′) and (2) the subcropping Dakota Formation sandstone (MW 1S, MW 1D, and PSW 2 in section B-B′). The water level in MW 1S is below the top of the sandstone, consistent with the previously reported water levels for this well (PRC 1994, 1995), indicating this aquifer is unconfined at this location. In contrast, water levels in SB01, MW 2S, and MW 3S lie above the basal alluvial sands in the silty clay. During drilling of SB01, split-spoon samples collected above the interbedded silty sands were damp to moist; only the sands appeared to be water saturated. This observation is consistent with the record on the lithologic log for MW 3S (PRC 1994) of a "moist-wet" soil at 44 ft BGL (approximately 1,353 ft AMSL), the elevation that corresponds to the top of the basal alluvial sand at this location. These observations indicate that the shallow aquifer is at least semiconfined at these locations.

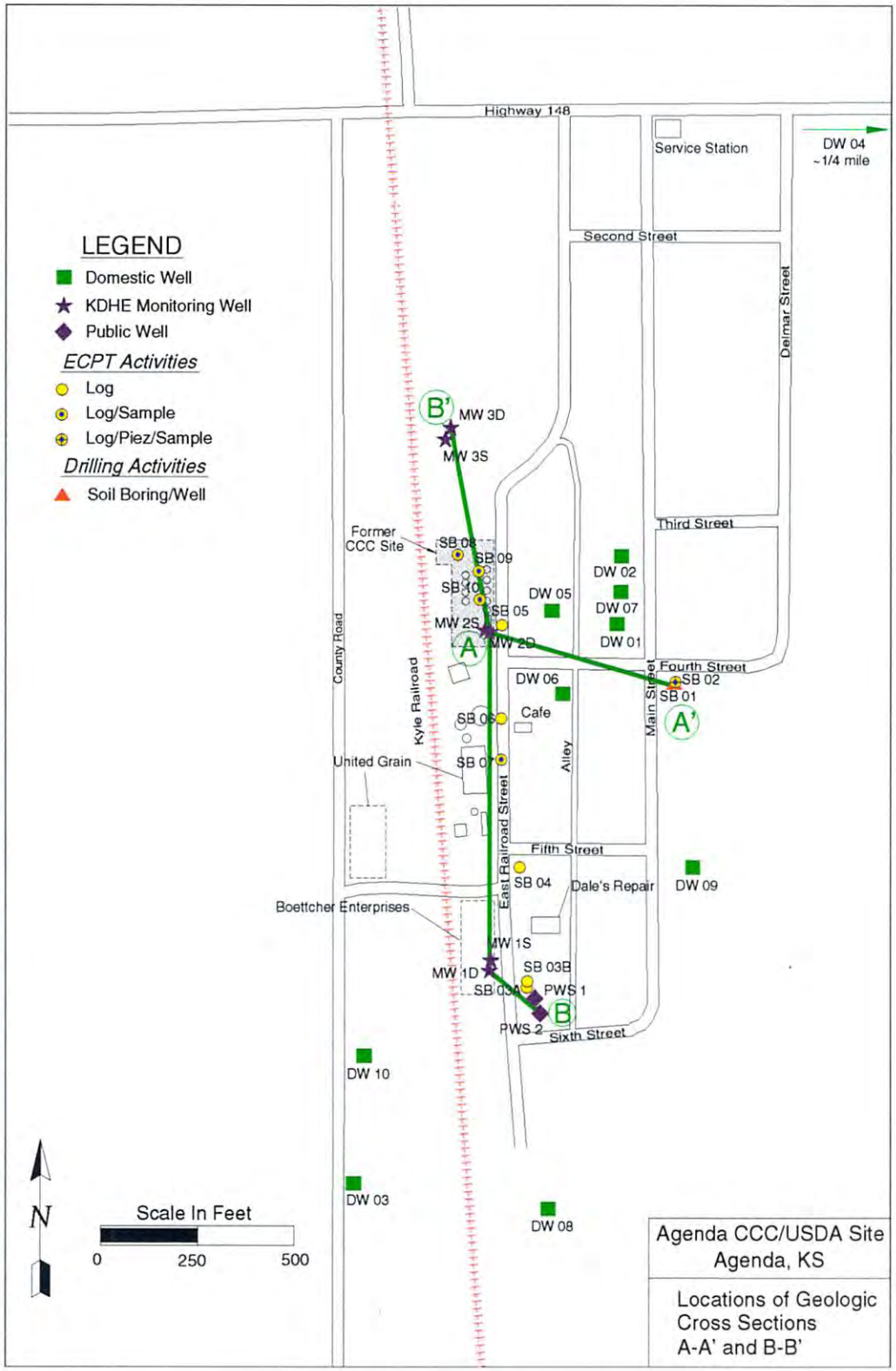


FIGURE 4.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site and the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, Piezometer SB02, and Geologic Cross Sections A-A′ and B-B′

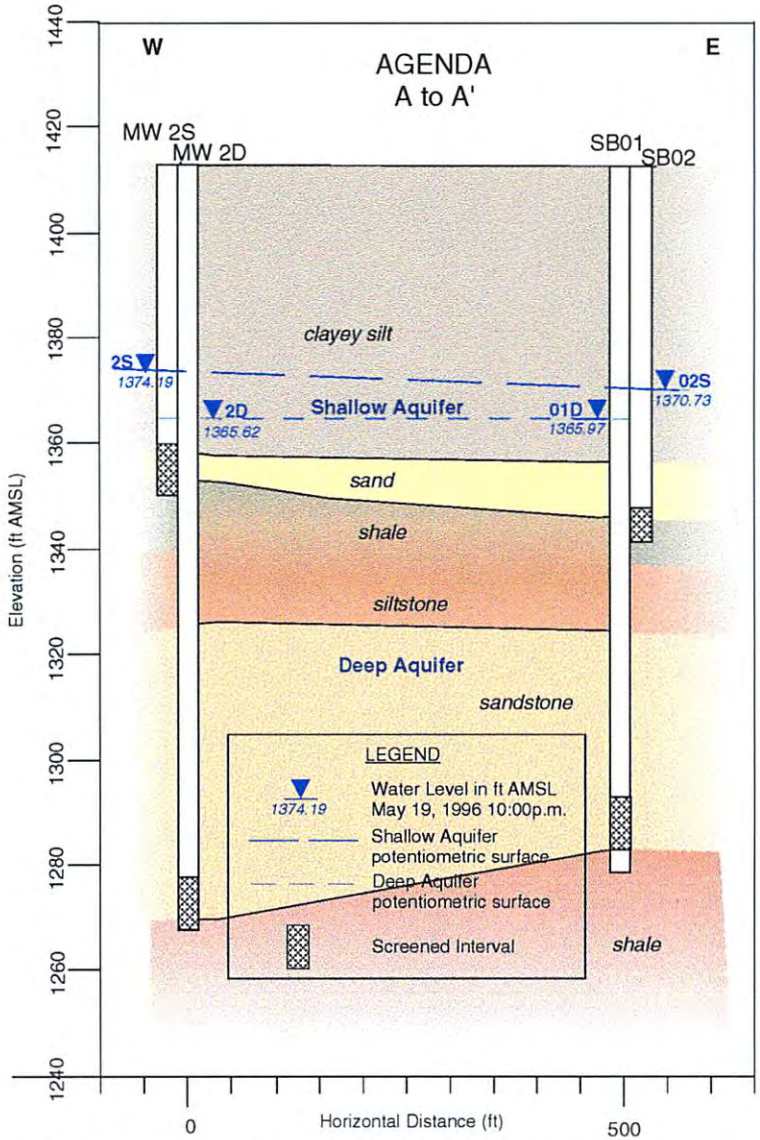


FIGURE 4.2 West-to-East Geologic Cross Section A-A′, Illustrating Relationships between Local Stratigraphy and the Shallow and Deep Aquifers in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas

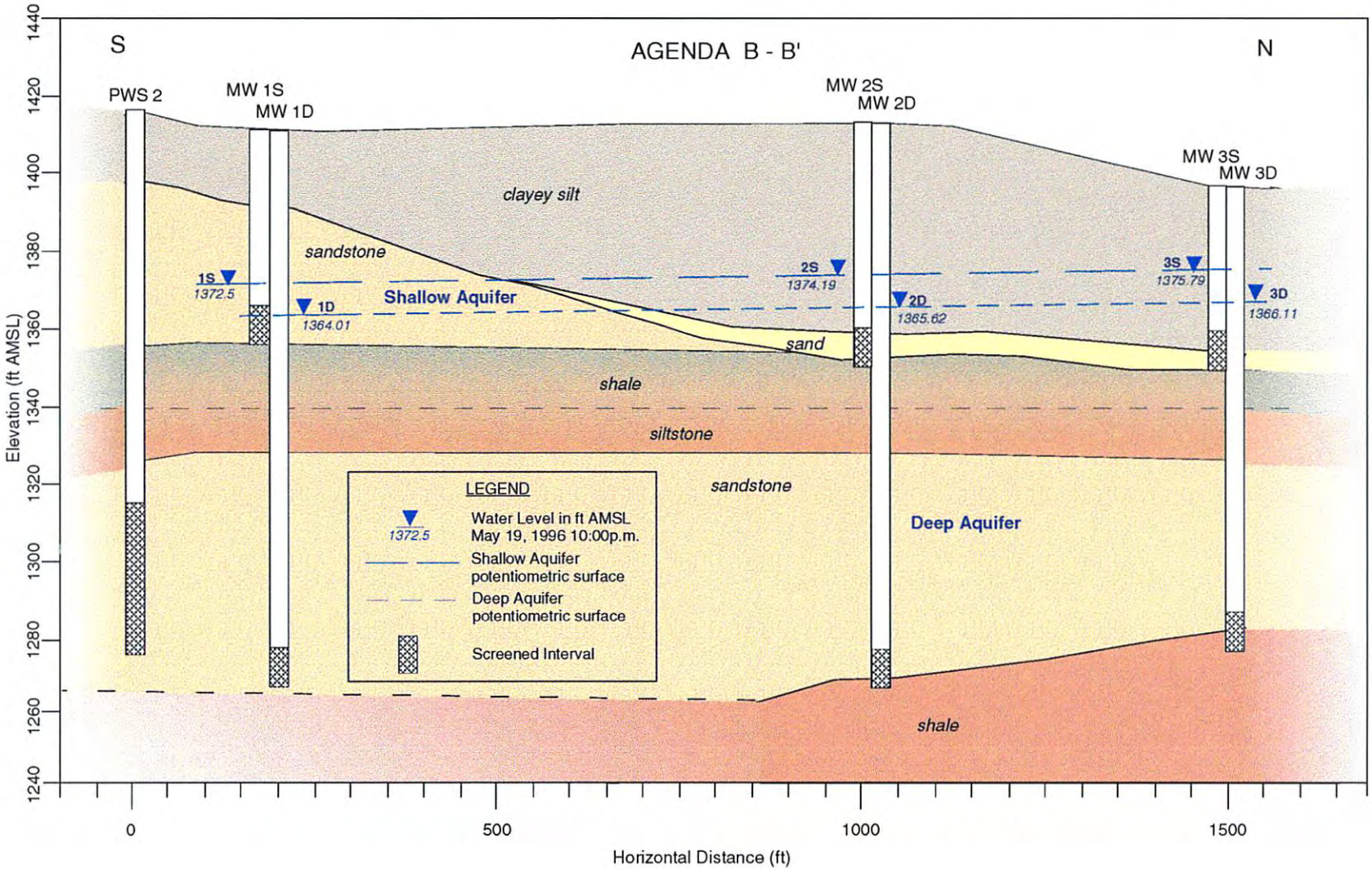


FIGURE 4.3 South-to-North Geologic Cross Section B-B′, Illustrating Relationships between Local Stratigraphy and the Shallow and Deep Aquifers in the Vicinity of the Former CCC/USDA Site at Agenda, Kansas

The deep aquifer is hosted by a channel sandstone package in the fluvial section of the Dakota Formation. The two aquifers are separated by approximately 35 ft of Dakota Formation shales and siltstones. However, the water levels in the deep aquifer are only approximately 5-8 ft lower than the corresponding shallow-aquifer water levels, suggesting that the intervening shales and siltstones function as a confining horizon and that the two aquifers not interconnected hydraulically.

The present data are insufficient to determine whether the intervening shales and siltstones are also water saturated. At SB01, these units were damp, but because the core samples were obtained by the mud rotary method, visual observations of moisture might be misleading. The shales immediately below the shallow sand were fractured vertically and exhibited iron oxide staining, both characteristics that could indicate water-saturated conditions within this zone. Alternatively, the iron oxide staining might have developed while the shale was exposed prior to deposition of the Pleistocene terrace. Below the fractured zone, the siltstones and shales were fresh, implying that they have not been exposed to oxygenated groundwater.

Regionally, the Dakota aquifer is saturated throughout, with siltstones and shales of low hydraulic conductivity contributing significantly to water storage in the aquifer but not to groundwater movement (Wade 1992). The difference in water levels (i.e., the head difference) between the aquifers (approximately 5 ft) indicates that groundwater will flow downward from the shallow aquifer to the deep aquifer, although the magnitude of the downward flux through rocks of low hydraulic conductivity, such as the intervening shales (with K values typically 10^{-1} to 10^{-5} ft^3 ft^{-2} yr^{-1}), would not be significant (< 1 ft^3 ft^{-2}) over short time spans (< 40 years). However, an artificial higher-conductivity conduit, such as a well screened in both aquifers or a well that is gravel packed along its complete length, could produce a locally greater downward flux of shallow-aquifer water into the deep aquifer.

4.2 Water Level Fluctuations

Figures 4.4 and 4.5 illustrate water levels for the shallow and deep aquifers, respectively, as recorded hourly by the Well Sentinel™ units during the week of May 19-25, 1996. The corresponding data are tabulated in Appendix C. During the observation period, water levels in the shallow aquifer were generally stable, with only several small (< 0.2 ft), brief (< 3 hour) events. The magnitude and time scale of these small events are consistent with variations in atmospheric pressure (Kruseman and de Ridder 1991).

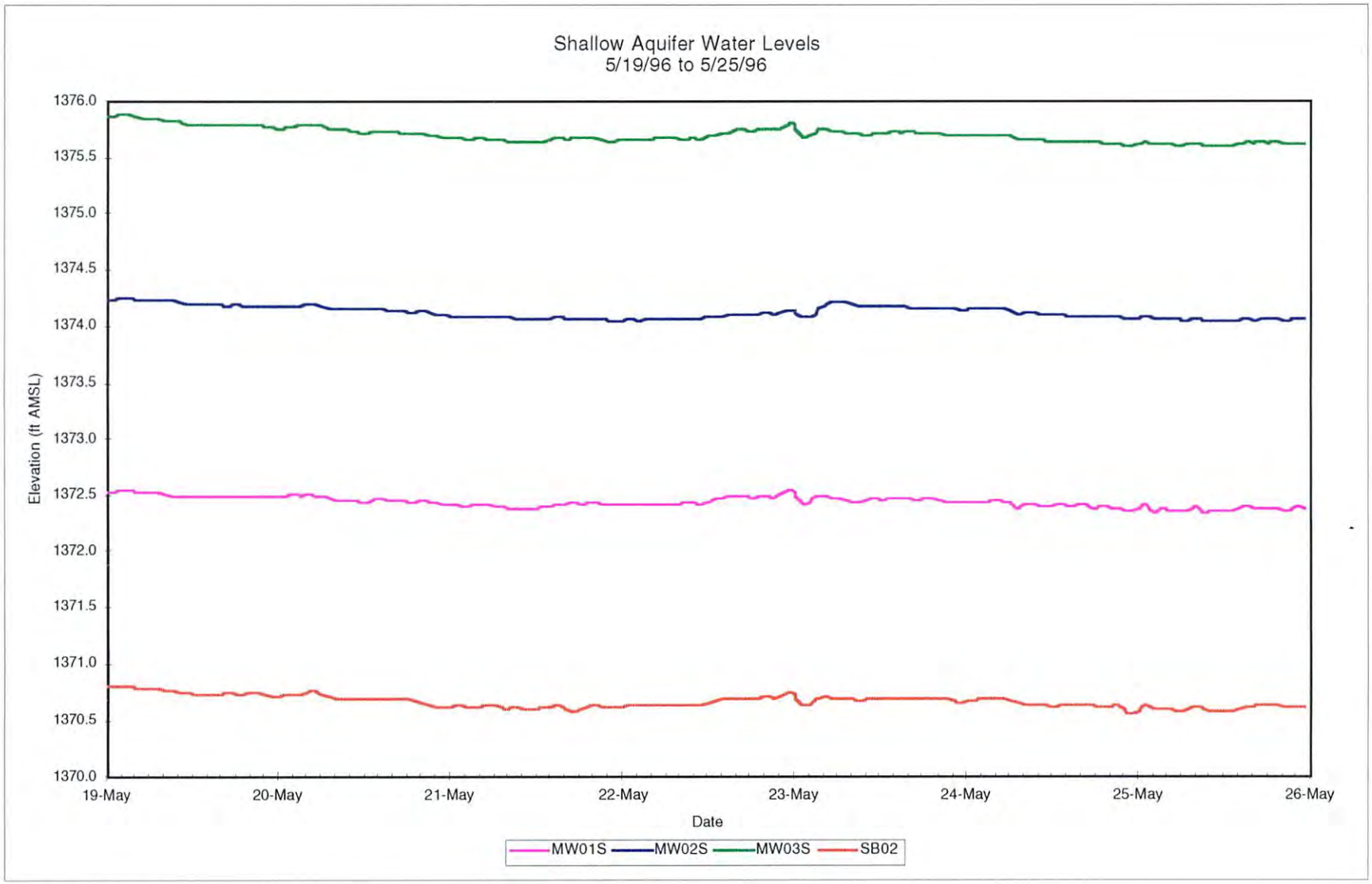


FIGURE 4.4 Variations in Groundwater Levels of the Shallow Aquifer from May 19 to May 25, 1996

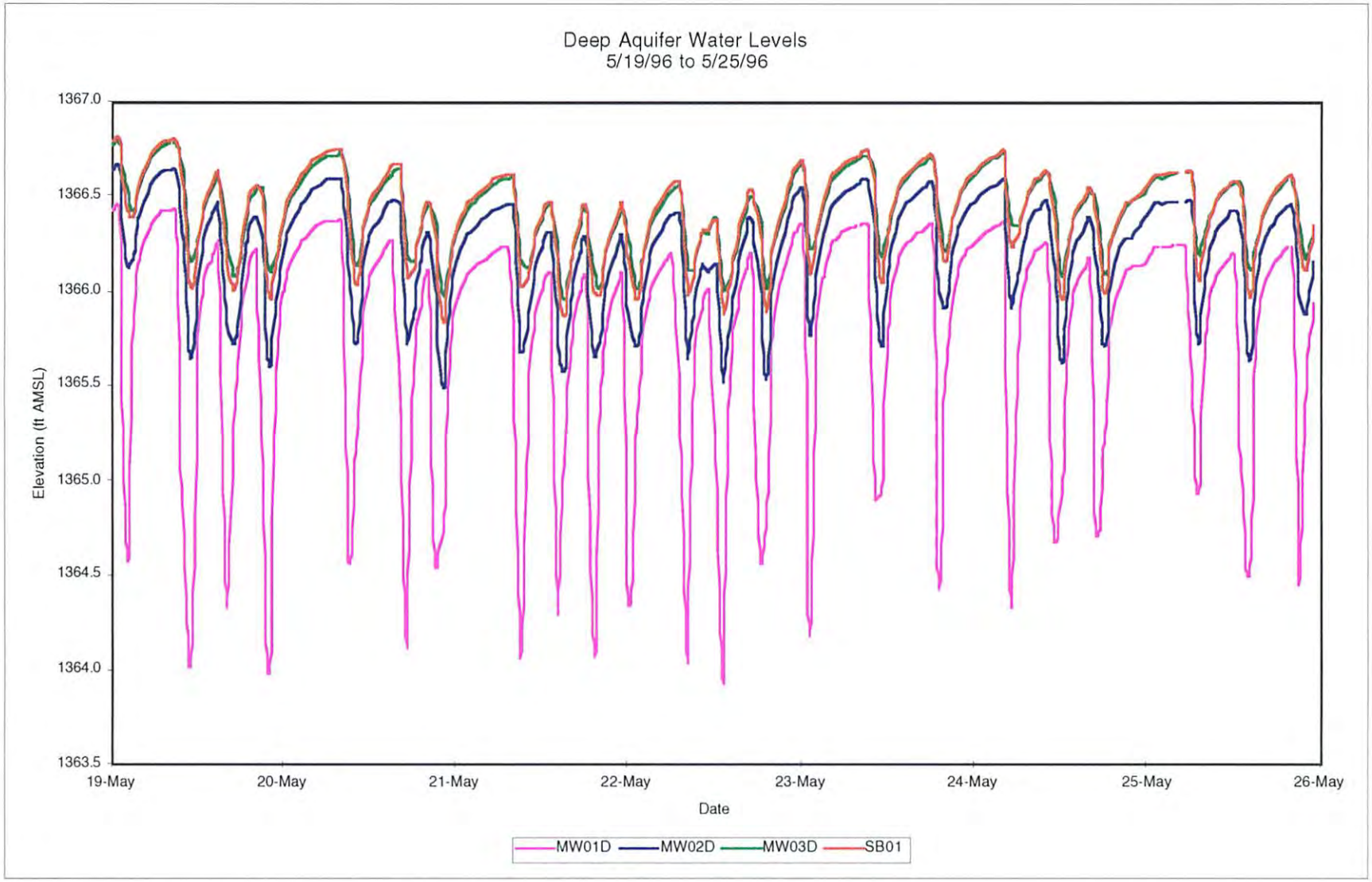


FIGURE 4.5 Variations in Groundwater Levels of the Deep Aquifer from May 19 to May 25, 1996

In sharp contrast with the stable pattern of the shallow aquifer is the pattern of water level fluctuations in the deep aquifer, with water levels in all four observation wells exhibiting synchronized, periodic drawdown. The largest drawdown occurred in MW 1D, the observation well closest to PSW 1 and PSW 2 (Figure 4.1). The magnitude of the drawdown decreased with distance from the public water supply wells. The pattern indicates that the drawdowns resulted from the pumping of the city's wells and that pumping of these wells influences water levels significantly in the deep aquifer throughout the study area. Within each cycle, the aquifer experienced a period of rapid drawdown, followed initially by an equally rapid period of recovery. The recovery rate then declined until the beginning of the next cycle. The small fluctuations in the levels of the shallow aquifer do not correlate with these deep-aquifer cycles.

The absence of a plateau at the recovery end of the cycles indicates that the deep aquifer probably does not achieve complete recovery between pumping cycles. However, the drawdown and recovery levels are nearly constant through time, suggesting that the deep aquifer is in a state of dynamic equilibrium with the pumping wells. To what degree this equilibrium state differs from the undisturbed state of the deep aquifer cannot be determined without prolonged shutdown of the public water supply wells. Such a condition will occur when the city's water system is connected to the rural water supply line in the later half of 1996.

4.3 Groundwater Flow

Potentiometric surfaces in the shallow and deep aquifers are illustrated in Figures 4.6-4.9. The pattern of flow in the shallow aquifer (Figure 4.6) is illustrated by using water levels recorded at 3 a.m. on May 20, 1996. For the deep aquifer, patterns of flow are illustrated by three sets of water levels, at 10 p.m. on May 19, 1996 (Figure 4.7), and at 3 a.m. and 8 a.m. on May 20, 1996 (Figures 4.8 and 4.9). These times correspond to one complete cycle of drawdown and recovery exhibited by the deep aquifer in response to pumping of the public water supply wells (Figure 4.5). During the cycle, water levels in the shallow aquifer were nearly constant (Figure 4.4).

The water levels (Figure 4.6) indicate that within the limits of the observation well network, groundwater in the shallow aquifer was flowing to the southeast under a gradient of approximately 0.0068 ft/ft at this time. However, the overall stability of shallow-aquifer water levels (Figure 4.4) indicates that the pattern of flow in the shallow aquifer is essentially constant through time.

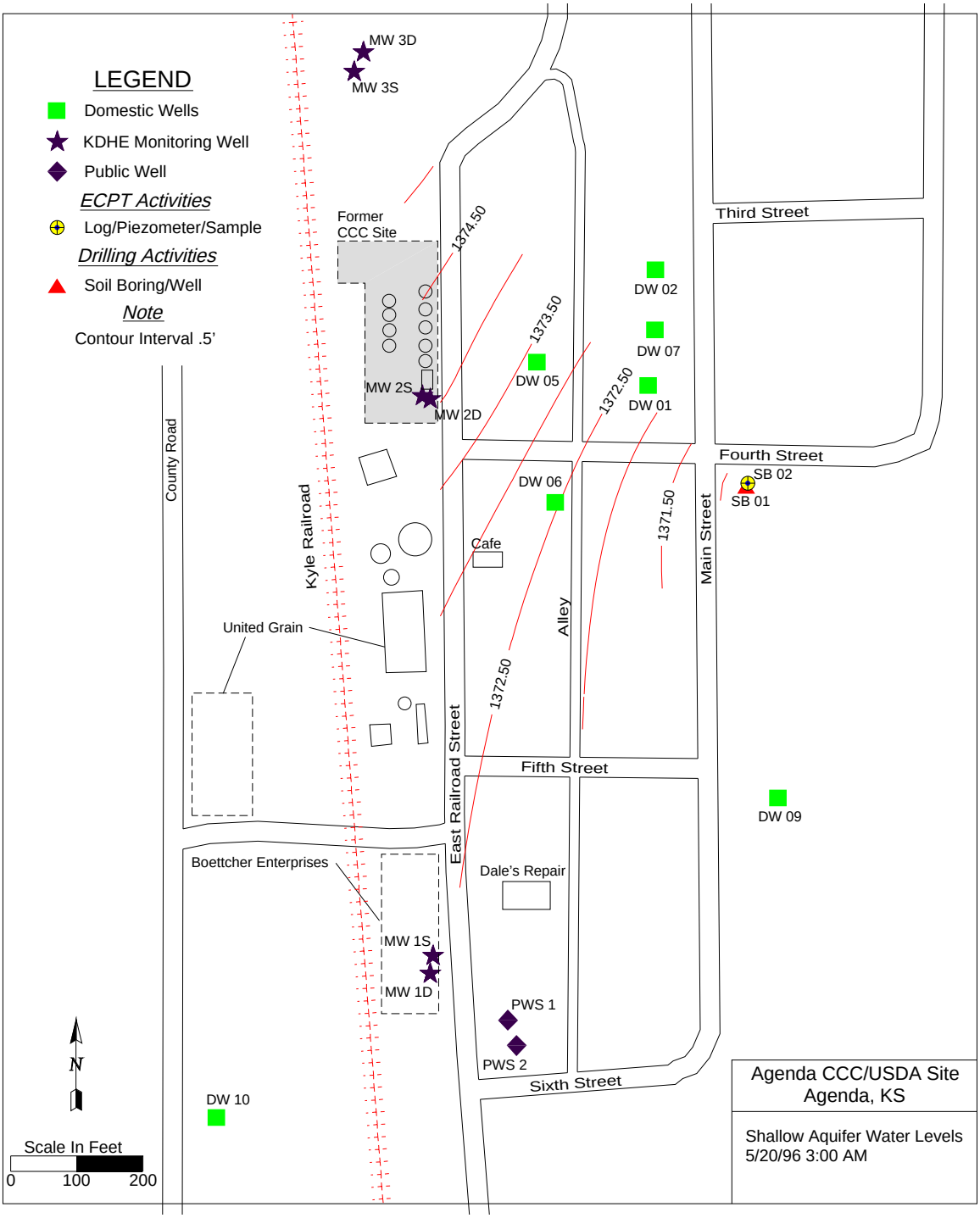


FIGURE 4.6 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations (ft AMSL) in the Shallow Aquifer at 3 a.m. on May 20, 1996

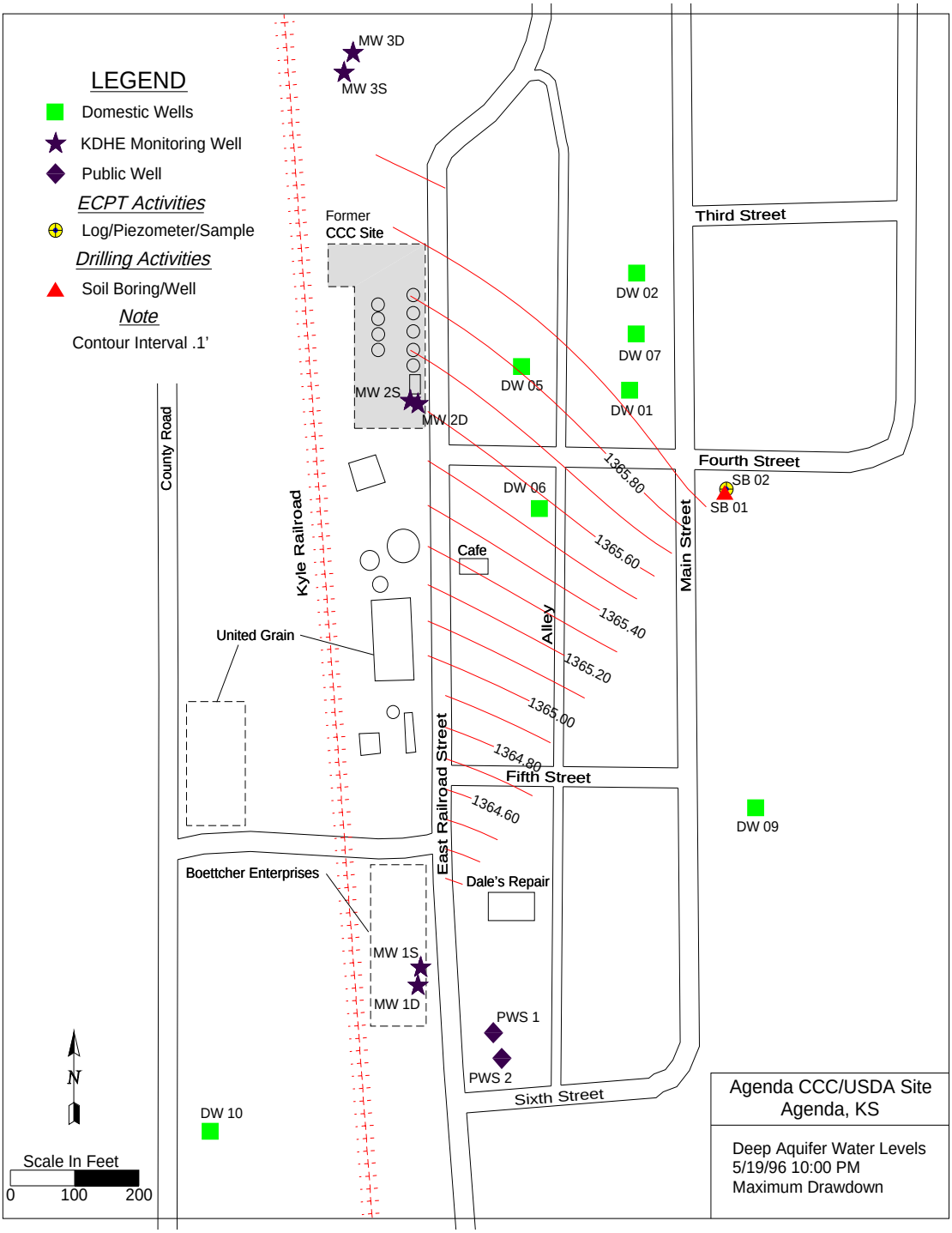


FIGURE 4.7 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations (ft AMSL) in the Deep Aquifer at 10 p.m. on May 19, 1996

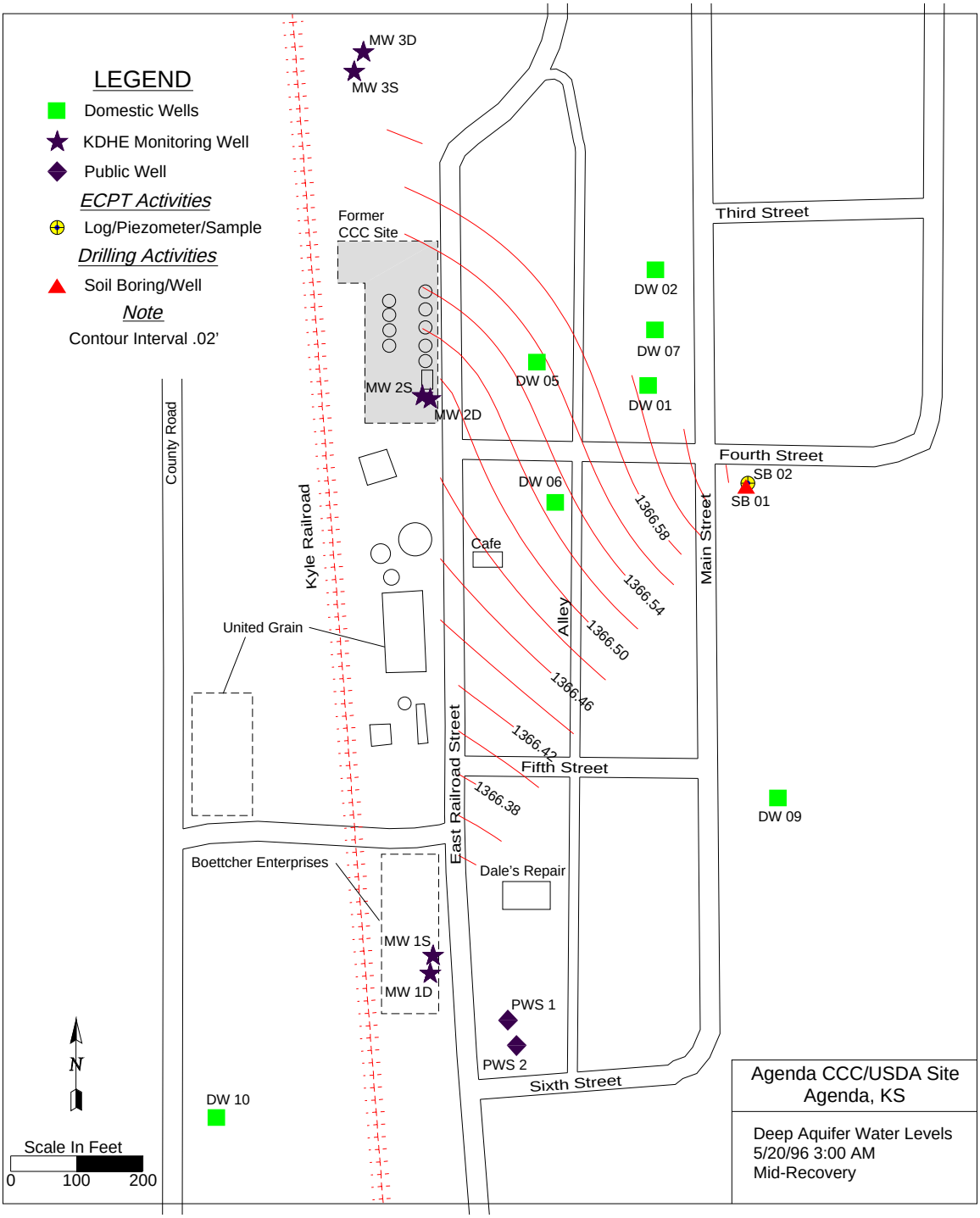


FIGURE 4.8 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations (ft AMSL) in the Deep Aquifer at 3 a.m. on May 20, 1996

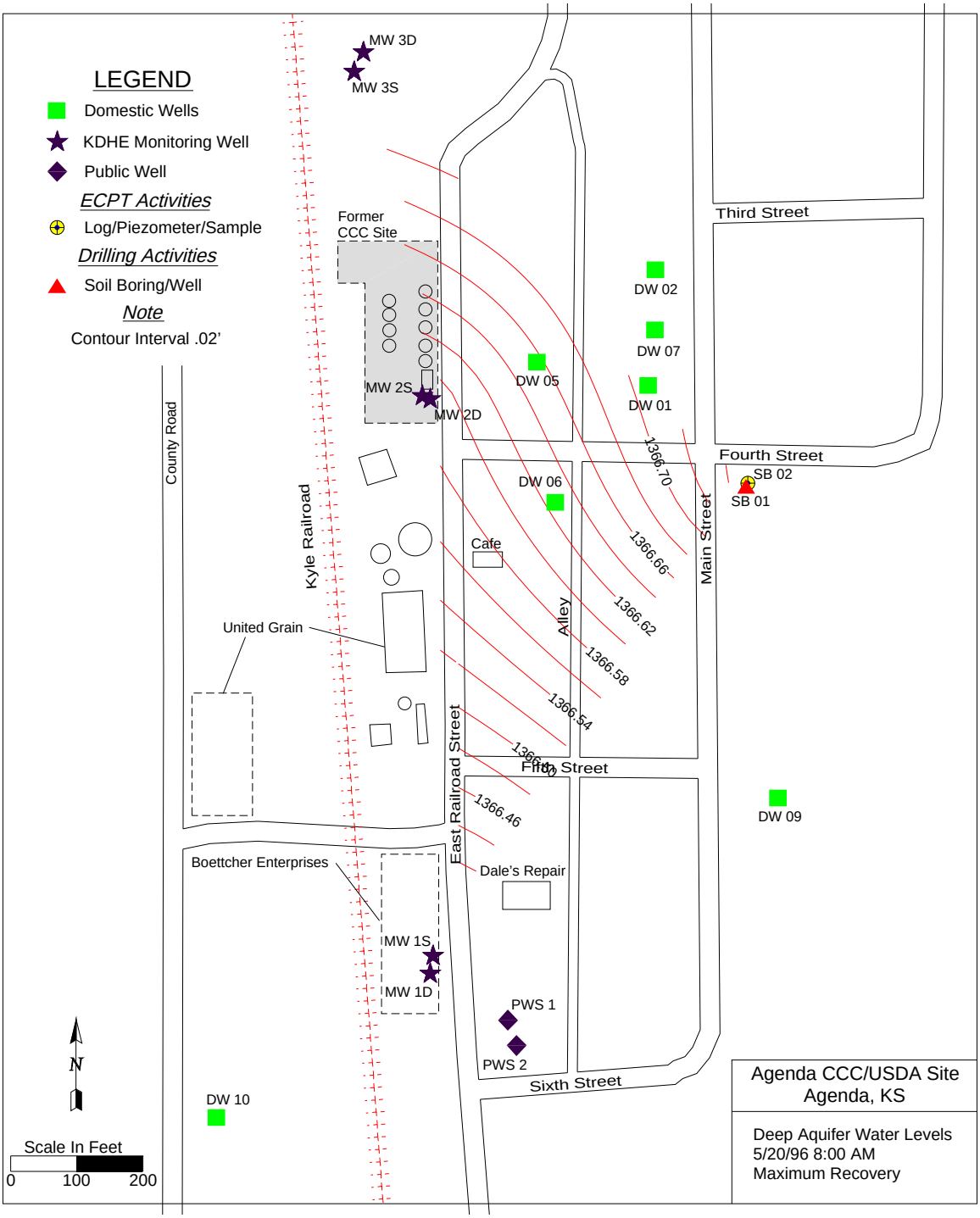


FIGURE 4.9 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and Groundwater Elevations (ft AMSL) in the Deep Aquifer at 8 a.m. on May 20, 1996

The potentiometric surfaces in the deep aquifer (Figures 4.7-4.9) indicate that the groundwater was flowing generally south-southwest within the limits of the observation well network. The direction of flow varied slightly through the pumping cycle in the northern half of the study area, with flow somewhat more southwesterly in the vicinity of the former CCC/USDA site during the later half of the recovery period. The time of the maximum gradient observed during the cycle, 0.0024 ft/ft (Figure 4.7), corresponds to the time of maximum drawdown (Figure 4.5), while the lowest gradient, 0.0004 ft/ft (Figure 4.9), occurred immediately before the next cycle began. The maximum gradient is slightly less than one-half the gradient in the shallow aquifer, while the minimum is more than one order of magnitude less than the upper-aquifer gradient.

The direction of groundwater flow west of the line of section B-B′ (from MW 1D to MW 3D, Figure 4.1) is not known. The systematic variations in water levels demonstrate that the public water supply wells influence water levels throughout study area. This observation suggests that groundwater to the west of section B-B′ might not flow south-southwest; rather, some portion of the flow might be directed south-southeast toward the public water supply wells. The influence of the municipal wells on the water levels of the deep aquifer in the study area precludes determining the natural flow direction in this aquifer at this time. Such a determination will be possible after the public water supply wells are shut down following the city's connection to the rural water supply line.

4.4 Groundwater Geochemistry

The objectives of the groundwater geochemistry program were (1) to characterize the geochemistry of the groundwater in the shallow and deep aquifers and (2) to seek geochemical evidence of hydraulic interconnections between the two aquifers. Groundwater samples were collected from both the shallow and deep aquifers by using the ECPT, the KDHE monitoring wells, temporary well SB01, PSW 1, and ten domestic wells (Figure 4.1). The samples were analyzed for their chemical and isotopic compositions. Detailed descriptions of the samples and the analytical results are in Appendix F.

4.4.1 Ionic Compositions

The relative concentrations of the major cations (calcium, magnesium, and sodium plus potassium) and anions (chloride, sulfate, and bicarbonate or alkalinity) in the groundwater

samples from the observation wells, domestic wells, and PSW 1 are shown in Figures 4.10 and 4.11. Corresponding analytical data are presented in Table 4.1.

Equivalent concentrations vary more widely for the shallow-aquifer samples than for the deep-aquifer samples, although the variations might not be significant for all six constituents. Of the major cations and anions, only the calcium concentrations are largely distinct. The calcium concentrations in the shallow-aquifer samples ranged from 5.1 to 12.5 meq/L (103 to 251 mg/L), while concentrations in the deep aquifer ranged from 4.6 to 6.8 meq/L (92 to 136 mg/L), with the highest concentrations occurring at DW01, DW05, and MW 2D and the lowest at SB01 and MW 3D.

The nitrate analyses showed a distinct difference between the shallow and deep aquifers. In Figure 4.12, the nitrate concentrations are plotted by elevation. Analytical data used to construct this figure are tabulated in Appendix F (Table F.3). Nitrate concentrations were higher in a number of the shallow-aquifer samples than in the deep aquifer, with the highest values occurring at SB07, MW 1S, and MW 2S. The lowest nitrate concentrations in deep aquifer occurred in wells SB01 and MW 3D (0.5 and 2.6 mg/L, respectively). Concentrations in DW01, DW05, and MW 2D were higher than in SB01 and MW 3D, ranging from 9.1 to 13.5 mg/L.

The elevated concentrations of nitrate in the shallow aquifer might be contributing to the elevated nitrate concentrations observed in the deep aquifer. Wells DW01 and DW05 were reportedly completed in the deep aquifer. If these wells are gravel packed along their complete lengths, which is typical of older wells, then shallow-aquifer water with elevated nitrate concentrations could flow downward into the deep aquifer at these locations. Groundwater flow in the deep aquifer would then transport nitrates south-southwest from this area, producing the elevated concentrations observed at MW 1D and PSW 1.

East of the former CCC/USDA site, the deep aquifer flows west-southwest, back toward MW 2D. Additional, unidentified domestic wells existing in the area north of Fourth Street and east of the former CCC/USDA site could also function as conduits for cross-contamination of the deep aquifer by shallow-aquifer water, producing the elevated nitrate concentrations detected at MW 2D. The observed concentrations of calcium in the two aquifers are also consistent with this flow pathway.

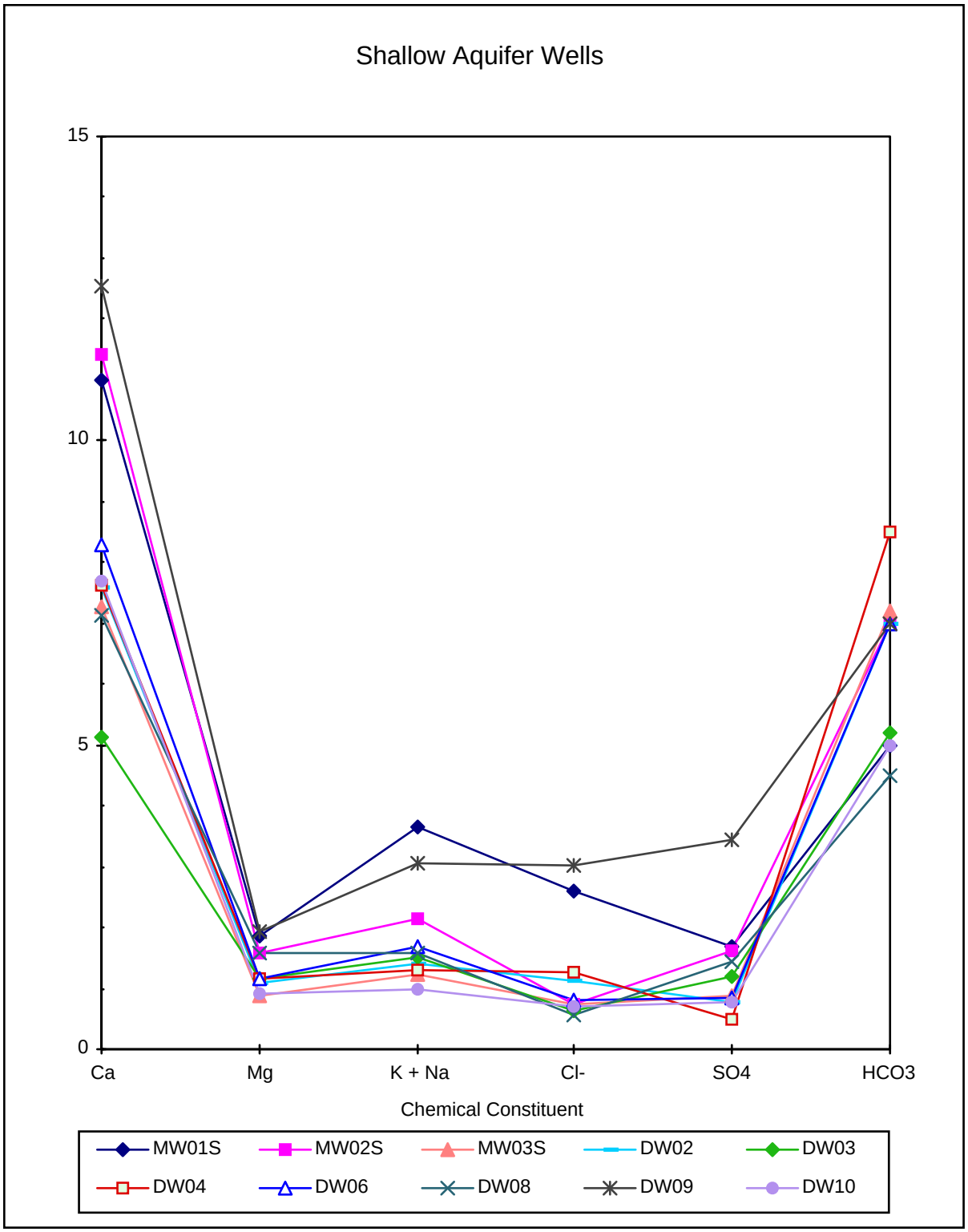


FIGURE 4.10 Relative Concentrations of Metals (calcium, magnesium, and sodium plus potassium) and Anions (chloride, sulfate, and bicarbonate or alkalinity) in Groundwater Samples from Shallow-Aquifer Wells

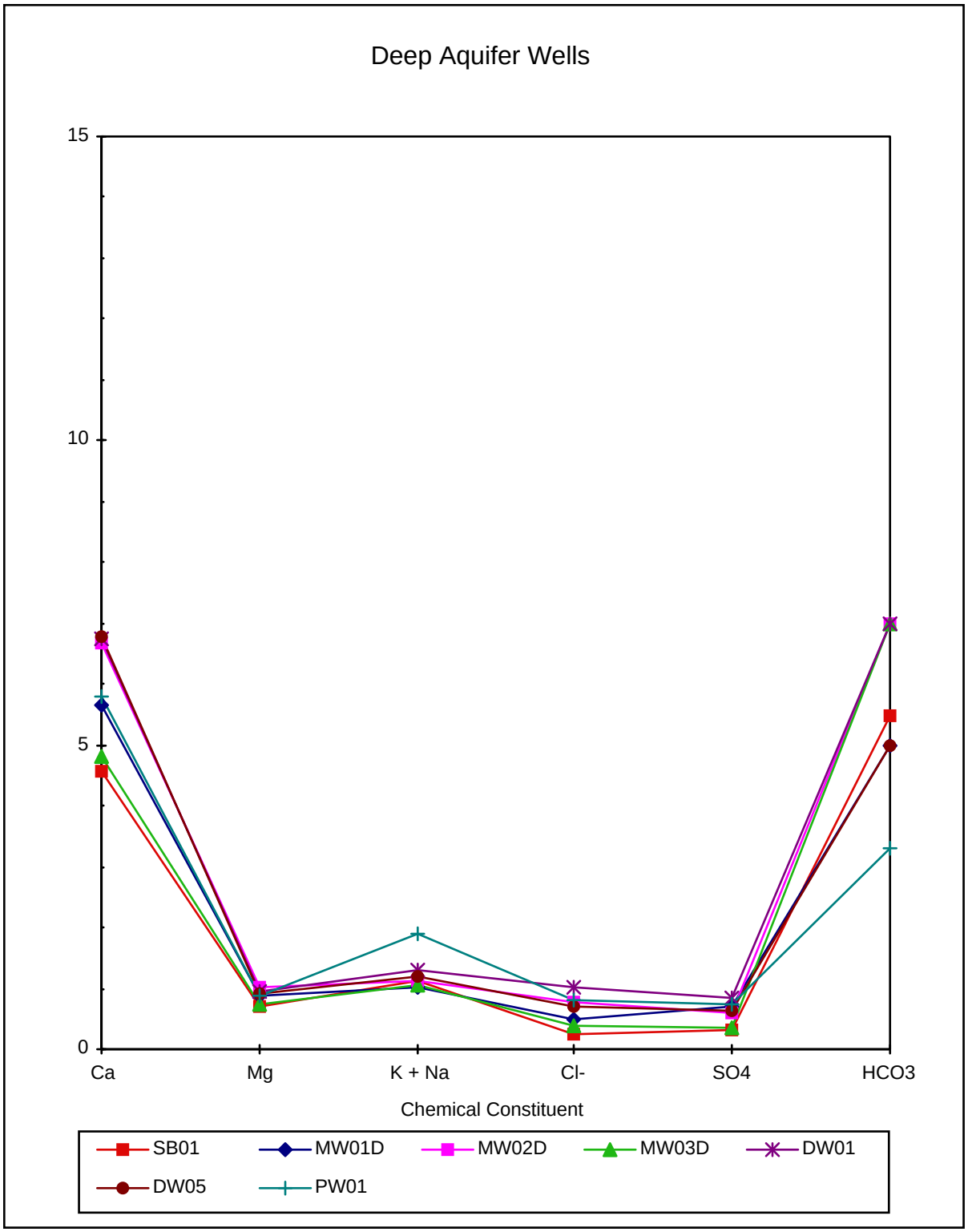


FIGURE 4.11 Relative Concentrations of Metals (calcium, magnesium, and sodium plus potassium) and Anions (chloride, sulfate, and bicarbonate or alkalinity) in Groundwater Samples from Deep-Aquifer Wells

TABLE 4.1 Concentrations of Major Cations and Anions in Well Water Samples from Agenda

	Concentration (meg/L)					
Location	Calcium	Magnesium	Sodium plus Potassium	Chloride	Sulfate	Bicarbonate
Shallow Aquifer						
MW 1S	11.0	1.9	3.7	2.6	1.7	5.0
MW 2S	11.4	1.6	2.1	0.8	1.6	7.0
MW 3S	7.3	0.9	1.2	0.7	0.9	7.2
SB02	6.4	1.0	1.2	1.0	0.7	6.0
SB07	10.9	1.5	2.6	0.7	4.1	3.8
SB08	20.0	2.6	9.3	1.0	2.1	4.5
SB09	22.1	1.3	1.4	1.2	0.8	7.0
SB10	48.0	1.3	1.5	1.0	1.1	6.0
DW02	7.6	1.1	1.4	1.1	0.8	7.0
DW03	5.1	1.2	1.5	0.6	1.2	5.2
DW04	7.6	1.2	1.3	1.3	0.5	8.5
DW06	8.3	1.2	1.7	0.8	0.8	7.0
DW08	7.1	1.6	1.6	0.6	1.5	4.5
DW09	12.5	1.9	3.1	3.0	3.4	7.0
DW10	7.7	0.9	1.0	0.7	0.8	5.0
Deep Aquifer						
SB01	4.6	0.7	1.1	0.3	0.3	5.5
MW 1D	5.6	0.9	1.0	0.5	0.7	5.0
MW 2D	6.7	1.0	1.1	0.8	0.6	7.0
MW 3D	4.8	0.7	1.0	0.4	0.3	7.0
DW01	6.7	1.0	1.3	1.0	0.9	7.0
DW05	6.8	0.9	1.2	0.7	0.6	5.0
PWS 1	5.8	0.9	1.9	0.8	0.7	3.3

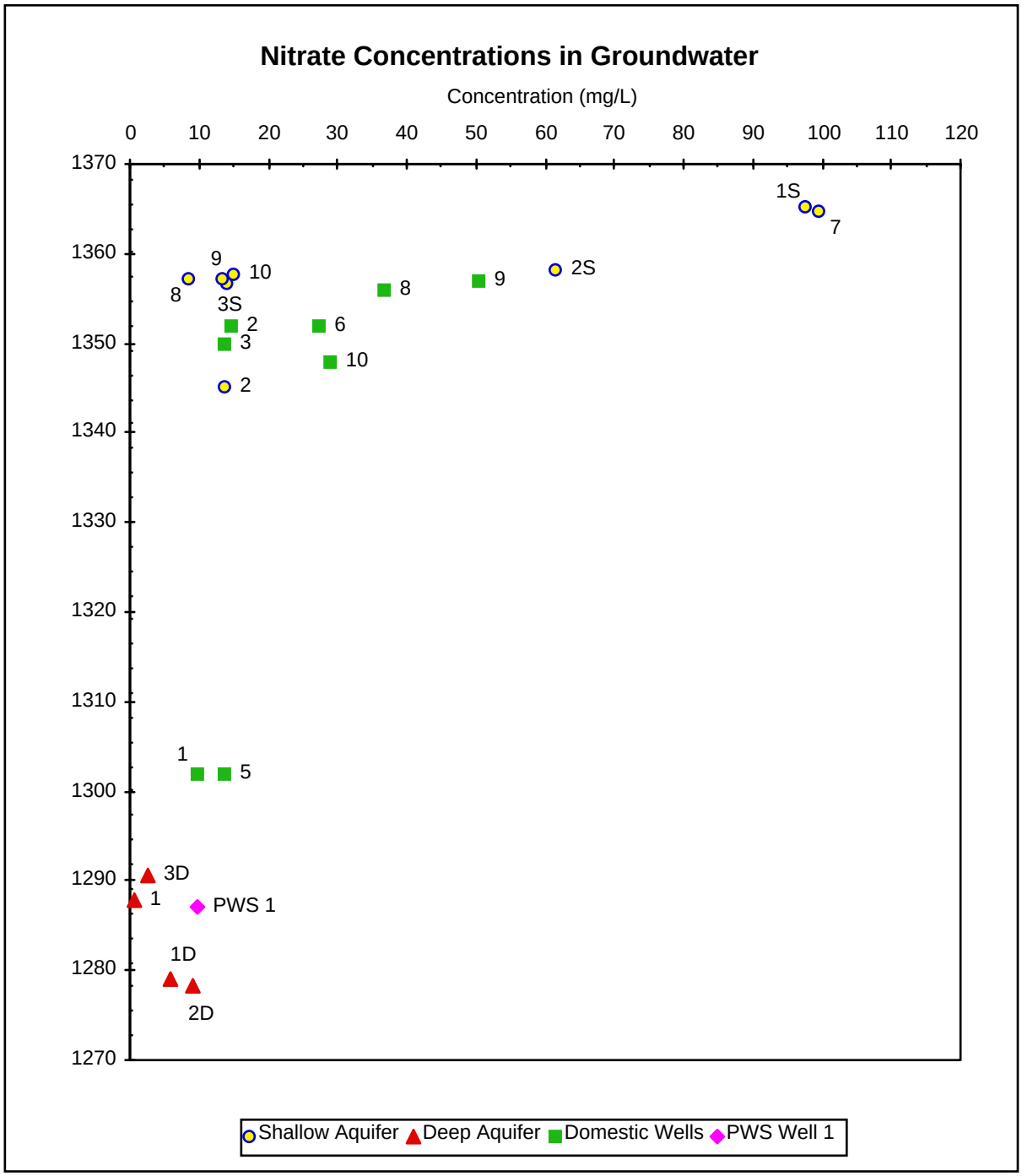


FIGURE 4.12 Nitrate Concentrations in Groundwater Samples, Plotted by Elevation

4.4.2 Isotopic Compositions

The stable oxygen and hydrogen isotope compositions of the groundwater samples are shown in Figure 4.13. The corresponding analytical data are listed in Appendix F, Table F.4. All samples follow the trend for global meteoric water, which represents the oxygen and hydrogen isotopic composition of atmospheric precipitation on a global basis (Craig 1961). The positions of the samples along the meteoric water trend indicate that groundwater in the aquifers originates principally from recharge of precipitation.

The isotopic compositions of the samples from the shallow aquifer are generally more positive for both oxygen and hydrogen than samples from the deep aquifer, but the two groups overlap somewhat. These differences probably reflect different recharge areas for the two aquifers. The elevated nitrate concentrations and the locally unconfined character of the upper aquifer indicate that this aquifer is recharged by downward percolation of local precipitation. In contrast, the deep aquifer probably receives its recharge at some distance upgradient from Agenda, in an area free from significant nitrate contamination.

The tritium concentrations of groundwater samples are shown in Figure 4.14 and listed in Appendix F, Table F.4. Tritium in groundwater is principally a result of atmospheric testing of thermonuclear weapons from 1953 to 1962 (Ferronsky and Polyakov 1982). Thus, water with a tritium concentration of 0 TU[a] indicates groundwater that originated before 1953. The shallow-aquifer compositions ranged from 6 ± 3 TU (SB10) to 26 ± 4 TU (DW10), while compositions in the deep aquifer ranged from 0 ± 3 TU (MW 1D) to 16 ± 3 (MW 2D). These values imply that the water in both aquifer contains at least some younger (i.e., since 1953) water. The compositions of water samples from DW01, DW05, MW 2D, and PSW 1 are similar to compositions of water samples from the shallow aquifer, but the samples from SB01, MW 3D, and MW 1D are less tritiated. This pattern is generally similar to that exhibited by the nitrate data, suggesting mixing of shallow- and deep-aquifer water in proximity to DW01 and DW05. However, the precision of the analyses was insufficient to demonstrate mixing of the shallow- and deep-aquifer waters in this area.

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[a] 1 TU = 1 atom of tritium per 10^{18} atoms of hydrogen (protium).

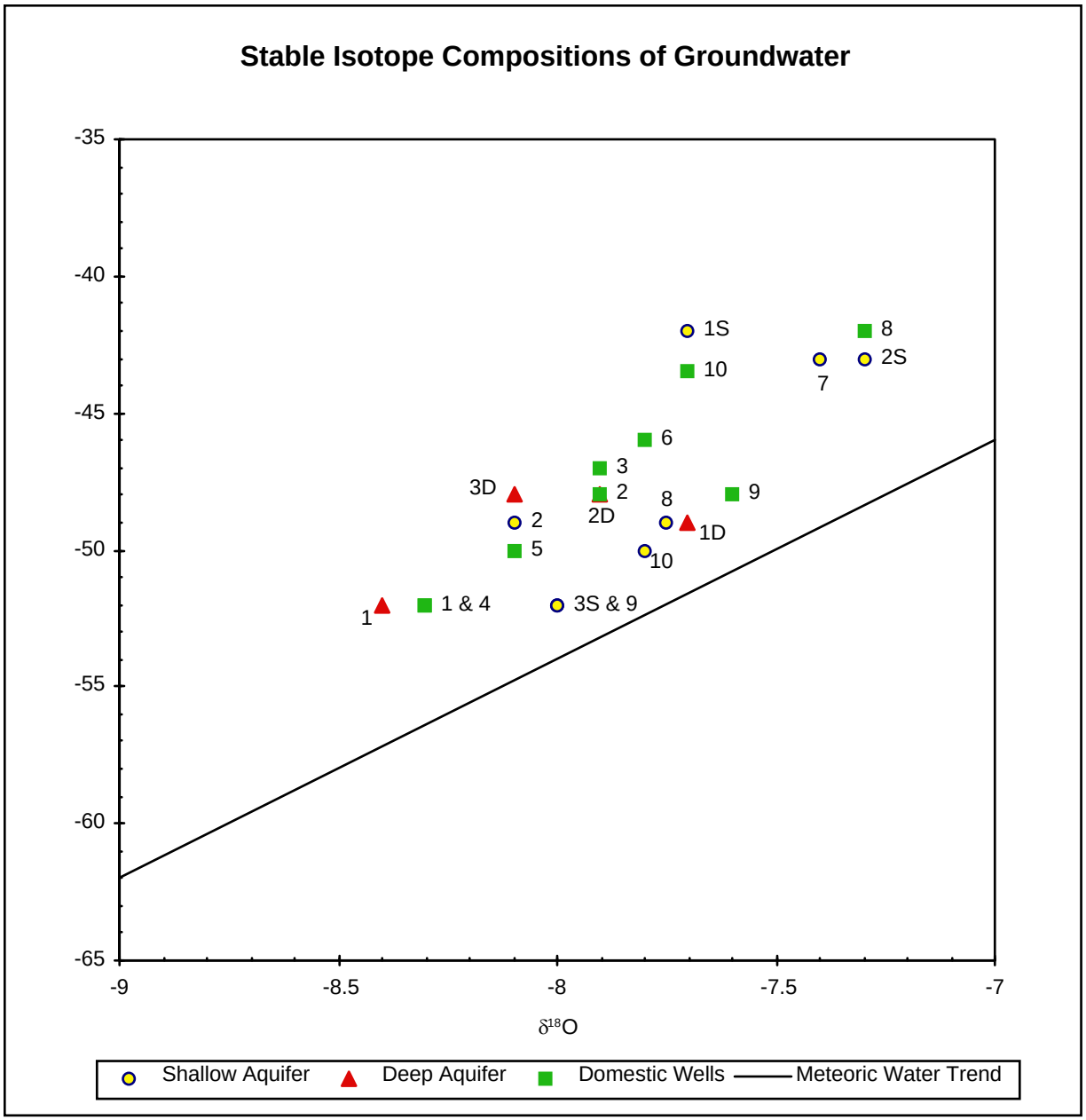

FIGURE 4.13 Oxygen and Hydrogen Stable Isotope Compositions of Groundwater Samples

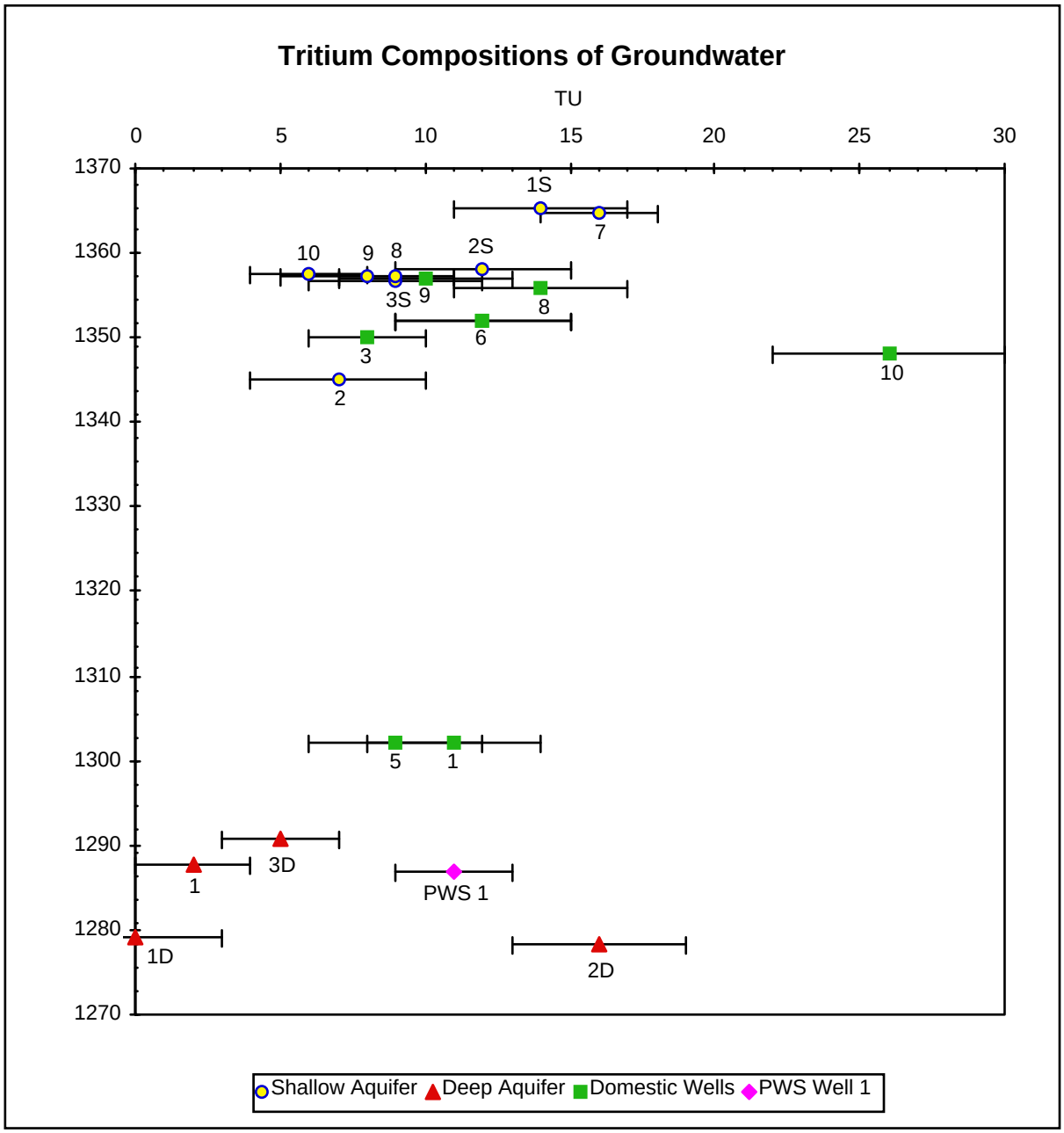

FIGURE 4.14 Tritium Compositions of Groundwater Samples, Plotted by Elevation

4.5 Summary

The two aquifers in the stratigraphic section penetrated by the public water supply and observation wells at Agenda are (1) a shallow, unconfined to partially confined aquifer hosted by a poorly consolidated bedrock sandstone and an adjacent alluvial terrace sand and (2) a deeper, confined aquifer hosted by bedrock sandstone. The two aquifers are separated by approximately 35 ft of generally unweathered bedrock shale and siltstone, which serves as the confining horizon for the deeper aquifer. Within the limits of the observation well network, groundwater flows generally southeast in the shallow aquifer and south-southwest in the deep aquifer. The head differential between the two aquifers indicates that water will flow through the intervening shale from the shallow to the deep aquifer in the presence of a conduit, such as an abandoned well.

Water levels in the shallow aquifer were generally stable, but levels in the deep aquifer exhibited a synchronized periodic drawdown. The largest drawdown occurred in MW 1D, the observation well closest to the municipal wells. The pattern indicates that the drawdowns resulted from pumping of the city's wells and that pumping of these wells significantly influenced water levels, as well as possibly the direction of groundwater flow in the deep aquifer over some portion of the study area.

The shallow-aquifer samples exhibited larger ranges in equivalent concentrations of major cations and anions than the deep-aquifer samples, although these variations might not be significant for all constituents. Of the major cations and anions, only the calcium concentrations are largely distinct. The results of the nitrate analyses show separation between the shallow and deep aquifers. Elevated nitrate concentrations in the shallow aquifer might be contributing to the elevated nitrate concentrations in the deep aquifer via downflow of shallow-aquifer water through gravel packing in domestic wells located east of the former CCC/USDA site. The stable isotopic compositions of the samples from the shallow aquifer are generally more positive, relative to the deep aquifer, for both oxygen and hydrogen, but some overlap occurs between the two groups. The tritium compositions of the water samples are generally consistent with a inflow of shallow-aquifer water to the deep aquifer near DW01 and DW05. However, the precision of the analyses was insufficient to demonstrate mixing of the shallow- and deep-aquifer waters in this area.

5 Contaminant Distribution

This section discusses information gathered on the distribution of carbon tetrachloride and chloroform in vegetation, soils, and groundwater in the context of the geologic and hydrogeologic framework described in Sections 3 and 4 of this report.

5.1 Vegetation and Soils

Experimental vegetation and soil sampling was conducted to test for carbon tetrachloride and chloroform in potential source areas at the former CCC/USDA site. Laboratory work is still in progress, and results cannot yet be interpreted or reported in detail. Preliminary results suggest that any carbon tetrachloride or chloroform concentrations in near-surface (approximately 0.8 ft BGL) soil are extremely low (< 1 ppb [equivalent to µg/kg] in a water-saturated soil sample). The same is true for the vegetation samples. Experience with vegetation sampling at other former CCC/USDA sites (e.g., Argonne 1996b) indicates that results for carbon tetrachloride are a reliable indicator of near-surface soil contamination. The preliminary results for vegetation imply that no significant carbon tetrachloride contamination occurs in the near-surface soils at the former CCC/USDA site in Agenda.

5.2 Groundwater Contamination

5.2.1 Contaminant Distribution

Information on the distribution of carbon tetrachloride and chloroform in the shallow and deep aquifers was obtained by analyzing groundwater samples collected with the ECPT and by sampling the six KDHE monitoring wells, temporary well SB01, PWS 1, and ten domestic wells. Locations of and analytical results for these samples are illustrated in Figure 5.1.

Carbon tetrachloride was detected in only three groundwater samples, while chloroform was detected in only one sample. All three samples containing carbon tetrachloride were from the deep aquifer. Sample ANMW02D-W-04878, at 6 µg/L, was collected from MW 2D in the southeast corner of the former CCC/USDA facility. The remaining two carbon tetrachloride-bearing samples were collected 800 ft south of the former CCC/USDA site, at MW 1D

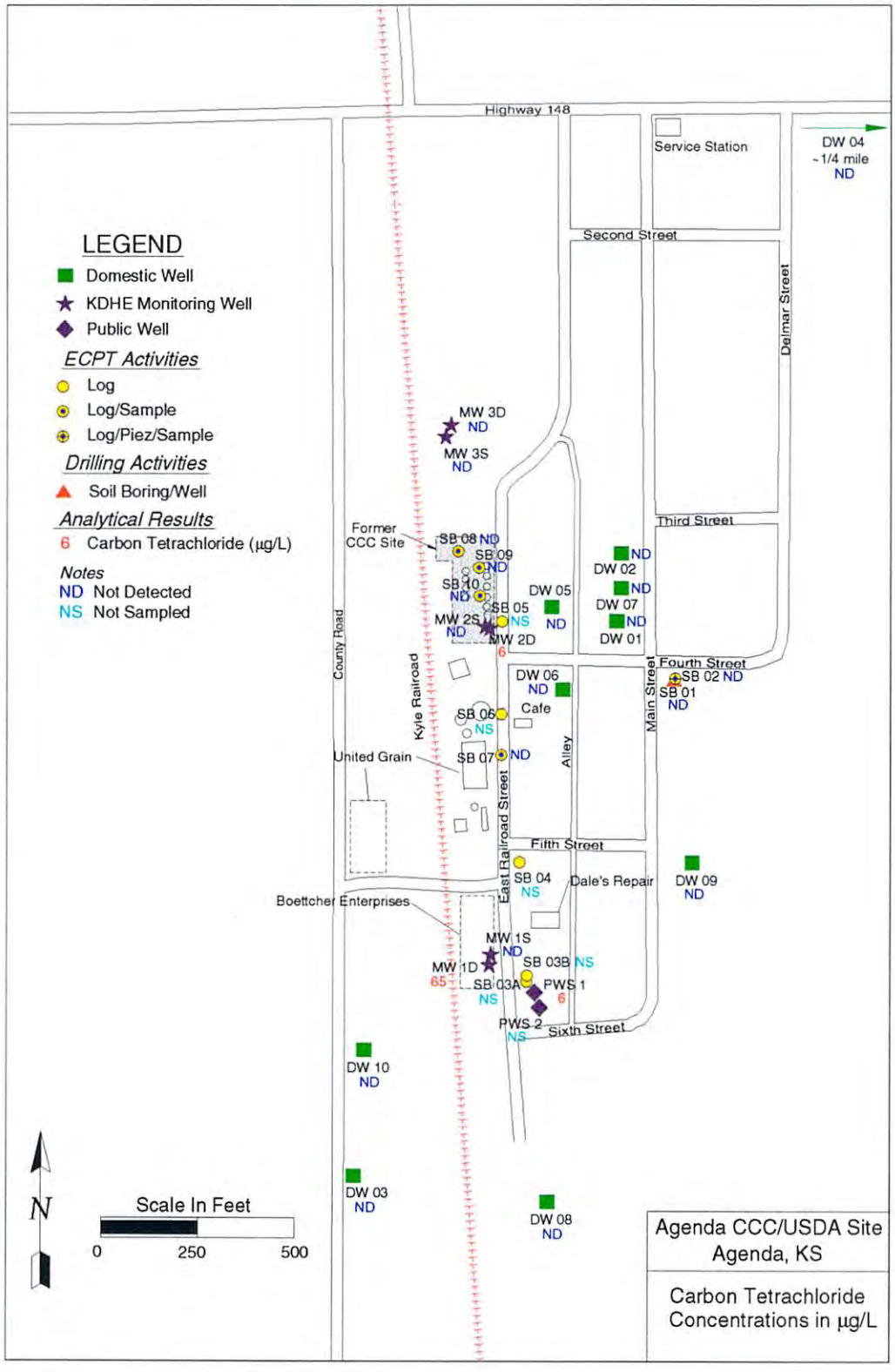

FIGURE 5.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site, the Locations and Types of Groundwater Samples, and the Results of Analyses for Carbon Tetrachloride

(ANMW01D-W-04890, 65 µg/L) and at PWS 1 (ANPW01-W-04869, 6 µg/L). This latter sample also contained chloroform at a concentration of 7 µg/L. Well PWS 2 could not be sampled, because the well was out of service. The observed distribution of carbon tetrachloride matches the findings of the CI (PRC 1994).

5.2.2 Potential Migration Pathways

The occurrence of carbon tetrachloride at MW 2D requires identification of a source area at or upgradient from this location and a migration pathway and mechanism for contamination of the deep aquifer. At least three potential migration pathways could account the contamination at MW 2D. These are (1) direct introduction of the carbon tetrachloride into the lower aquifer through an abandoned deep-aquifer well; (2) direct downward migration of carbon tetrachloride into the deep aquifer through the upper aquifer and the intervening shales; and (3) migration initially in the upper aquifer to a suitable conduit through the intervening shales, such as an active or abandoned well, followed by downward migration to the deep aquifer.

Of these potential pathways, only the third can be reasonably supported by the existing hydrogeologic framework and the known distribution of carbon tetrachloride in the deep aquifer. Although direct introduction cannot be conclusively ruled out, no evidence supports the existence of an abandoned well at or immediately upgradient from the former CCC/USDA site. Direct downward migration would require movement of carbon tetrachloride through 35 ft of highly competent shales and siltstones at the site.

The pattern of groundwater flow within the network of observation wells suggests that the area upgradient from this location in the deep aquifer is generally across East Railroad Street, in the residential section of Agenda. This area is also downgradient from the former CCC/USDA site in the upper aquifer. Thus, one possible migration pathway would involve migration across East Railroad Street in the shallow aquifer to a domestic well (e.g., DW01 and DW05), followed by downflow via the well, with return flow to the CCC/USDA site in the deep aquifer. The pattern of nitrate concentrations in the shallow and deep aquifers might be attributable to a similar migration mechanism.

The present data set is insufficient to define the areal extent of the contamination in the deep aquifer or to establish conclusively the route by which the carbon tetrachloride entered the deep aquifer. These, however, were not the objectives of this phase of the investigation. The objective

of Phase I was to establish the geologic and hydrogeologic framework necessary to investigate contaminant distribution in a systematic way. Defining the areal and vertical extent of the contamination in both aquifers, as well as identifying possible routes for cross-contamination between the aquifers, are the two principal objectives of the second phase of the investigation.

5.3 Summary

Laboratory work on experimental vegetation and soil samples is still in progress, and results cannot yet be interpreted or reported in detail. Carbon tetrachloride was detected in only three groundwater samples, while chloroform was detected in only one sample. All three of these samples were from the deep aquifer. The observed distribution of carbon tetrachloride matches the findings of the CI (PRC 1994).

The present data set is insufficient to define the areal extent of the contamination in the deep aquifer or to conclusively establish the route by which the carbon tetrachloride entered the deep aquifer. These, however, were not the objectives of this phase of the investigation. Defining the extent of the contamination in both aquifers and identifying possible routes for cross-contamination between the aquifers are the principal objectives of the second phase of the investigation.

6 Phase I Conclusions and Phase II Work Plan

This section summarizes the findings of the first phase of the ESC investigation at Agenda, Kansas, and presents the technical plans for the investigations to be conducted during the second phase of the ESC. The objectives of Phase I were (1) to obtain data on the geology, hydrogeology, and groundwater geochemistry in the vicinity of the former CCC/USDA site; (2) to evaluate and revise the conceptual geologic, hydrogeologic, and geochemical model of the study area; and (3) to obtain a preliminary understanding of potential sources of and migration pathways for the carbon tetrachloride contamination detected in Agenda's public water supply wells.

These objectives were achieved through the Phase I investigative program. In achieving these objectives, Phase I work established the geologic, hydrogeologic, and geochemical framework that will guide Phase II of the ESC investigation. This second phase will focus on delineating the contamination and refining, as necessary, the conceptual geologic, hydrogeologic, and geochemical model as it relates to understanding and predicting contaminant distribution.

6.1 Phase I Conclusions

The following are the principal findings of Phase I of the ESC investigation at Agenda:

- The shallow geologic section penetrated by the public water supply wells consists of a Pleistocene age terrace overlying Cretaceous age Dakota Formation bedrock. The terrace deposits consist primarily of clayey silt, with some interbedded fine-grained quartz sands. The bedrock contains two sandstones, separated by an intervening section of shale and siltstone. Both sandstones are poorly consolidated.

- The shallow sandstone subcrops beneath Pleistocene age terrace deposits and appears to have been partially eroded prior to deposition of the terrace. The thin sands at the base of the terrace deposits appear to be pinched out against the subcropping sandstone; the sands likely were derived by erosion of this sandstone.

- The shallow sandstone appears to have been deposited in the deltaic facies of the Dakota Formation, in either an active distributary channel or a distributary mouth bar, while the deep sandstone was deposited in the fluvial facies of the Dakota as a series of point bars in a meandering river channel. The sinuous and irregular distribution of sands deposited in these depositional environments precludes reliable correlation of the individual sandstones over all but very short distances. Nevertheless, the abundances and stratigraphic positions of the sandstones in nearby irrigation wells suggest a significant potential for cross-cutting between the individual sandstones in the immediate area.

- Two aquifers occur in the stratigraphic section penetrated by the public water supply wells, observation wells, and test holes at Agenda: (1) a shallow, unconfined to partially confined aquifer hosted by a poorly consolidated bedrock sandstone and an adjacent alluvial terrace sand and (2) a deeper, confined aquifer hosted by bedrock sandstone. The two aquifers are separated by approximately 35 ft of generally unweathered bedrock shale and siltstone, which serves as the confining horizon for the deeper aquifer.

- Within the limits of the observation well network, groundwater flows generally southeast in the shallow aquifer and south-southwest in the deep aquifer. The head differential between the two aquifers indicates that water will flow from the shallow to the deep aquifer in the presence of a conduit, such as an abandoned well, through the intervening shale.

- Water levels in the shallow aquifer are generally stable, but levels in the deep aquifer exhibit a synchronized periodic drawdown. The largest drawdown occurred in MW 1D, the observation well closest to the public water supply wells. The pattern indicates that the drawdowns resulted from pumping of the city's wells and that pumping of these wells significantly influences water levels and potentially the groundwater flow direction in deep aquifer within the study area.

- The shallow-aquifer samples exhibited greater ranges in equivalent concentrations of major cations and anions than the deep-aquifer samples. Of

these constituents, only the calcium concentrations were generally quantitatively distinct.

- The results of the nitrate analyses showed a separation between the shallow and deep aquifers. Elevated nitrate concentrations in the shallow aquifer might be contributing to the elevated nitrate concentrations in the deep aquifer, via downflow of shallow-aquifer water through gravel packing in domestic wells located east of the former CCC/USDA site.

- The stable isotopic compositions of the samples from the shallow aquifer were generally more positive, relative to the deep aquifer, for both oxygen and hydrogen, with some overlap between the two groups. The general pattern of tritium compositions is similar to that of the nitrate data, suggesting mixing of shallow- and deep-aquifer water near DW01 and DW05. However, the precision of the tritium analyses was insufficient to demonstrate mixing of the shallow- and deep-aquifer waters in this area.

- The consistent spatial patterns in the geochemical data for calcium, nitrate, and tritium imply that upper-aquifer water is flowing downward into the deep aquifer near the deep-aquifer domestic wells located east of the former CCC/USDA site.

- Laboratory work on experimental vegetation and soil samples is still in progress, and results cannot yet be interpreted or reported in detail. The preliminary results for vegetation imply that no significant carbon tetrachloride contamination occurs in the near-surface soils at the former CCC/USDA site.

- Carbon tetrachloride was detected in only three groundwater samples, while chloroform was detected in only one sample. All three of these samples were from the deep aquifer. The observed distribution of carbon tetrachloride matches the findings of the CI (PRC 1994). The present data set is insufficient to define the extent of the groundwater contamination in the aquifers or to establish the routes by which the carbon tetrachloride entered the deep aquifer.

6.2 Technical Work Plan for Phase II

The conceptual geologic and hydrogeologic model of the study area established by the Phase I investigative program will serve as the framework for Phase II of the ESC investigation. The Phase II work will focus on (1) systematic delineation of the distribution of the carbon tetrachloride contamination in the aquifers and (2) refinement of the conceptual geologic and hydrogeologic model as it relates to understanding and predicting contaminant distribution. The locations of the Phase II activities are shown in Figure 6.1. The activities will be the following:

- A piezometer and a temporary observation well will be installed on the west side of Agenda to determine the directions of groundwater flow in the shallow and deep aquifers in this area and to test the area for carbon tetrachloride contamination. A second deep-aquifer temporary well will be installed south-southwest of MW 1D to investigate the areal extent of the carbon tetrachloride plume and to verify the stratigraphy and hydrostratigraphy in this area. Tentative locations for these test holes and observation wells are shown in Figure 6.1. Final locations will be chosen on the basis of site access and the results of the ongoing water level monitoring program.

- Groundwater samples will be collected from the shallow aquifer by using the ECPT at two locations east of the former CCC/USDA site. The shallow-aquifer nitrate data suggest that cross-contamination between the shallow and deep aquifers might be occurring immediately east of the former CCC/USDA site at DW01 and DW05. This contaminant transport pathway is also generally consistent with the observed distribution of carbon tetrachloride downgradient from this area in the deep aquifer. These additional samples will be used to test for carbon tetrachloride and nitrates along this potential contaminant migration pathway.

- The groundwater samples analyzed for tritium in Phase I will be reanalyzed by using a technique with greater precision to reduce the analytical uncertainties and to seek confirming evidence of downward flow of shallow-aquifer water into the deep aquifer in proximity to DW01 and DW05. After evaluation of the analytical data, additional sampling might be performed on selected wells to obtain groundwater ages by using the tritium-helium method.

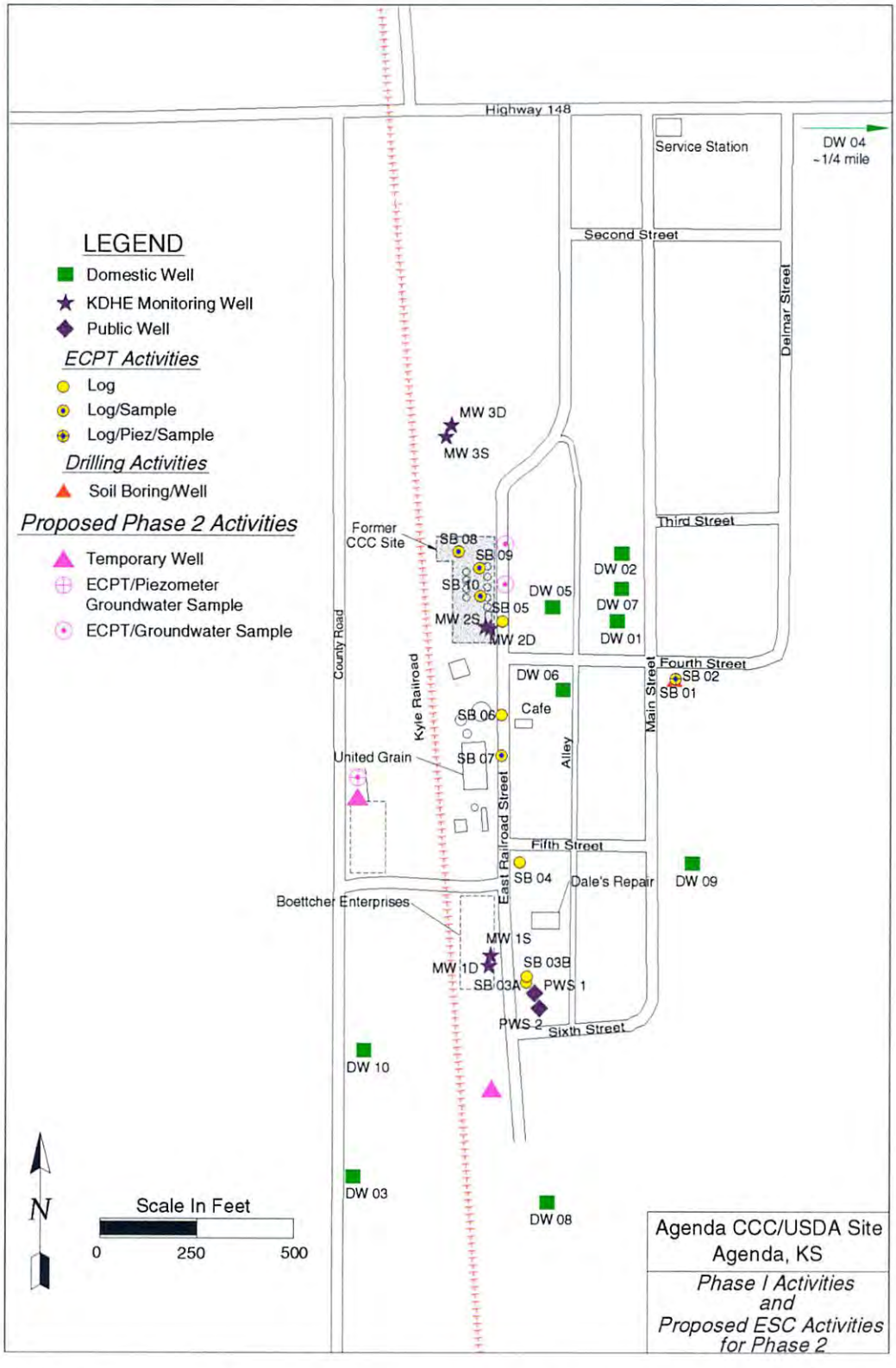

FIGURE 6.1 Map of Agenda, Kansas, Showing the Former CCC/USDA Site; the Locations of Mud Rotary and Cone Penetrometer Test Holes, the Public Water Supply Wells, the KDHE Monitoring Wells, Temporary Well SB01, and Piezometer SB02; and the Proposed Locations of Phase II Activities

7 References

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Appendix A:

Lithologic, Geophysical, and Electronic Cone Penetrometer Logs

SB 01

Agenda CCC/USDA Site

Sec. 16 ACAB T4S R1W, Republic County, Kansas

Ground Surface Elevation: 1411.76 ft

Logged by: S. Cook

Company: Argonne National Lab

Argonne National Laboratory

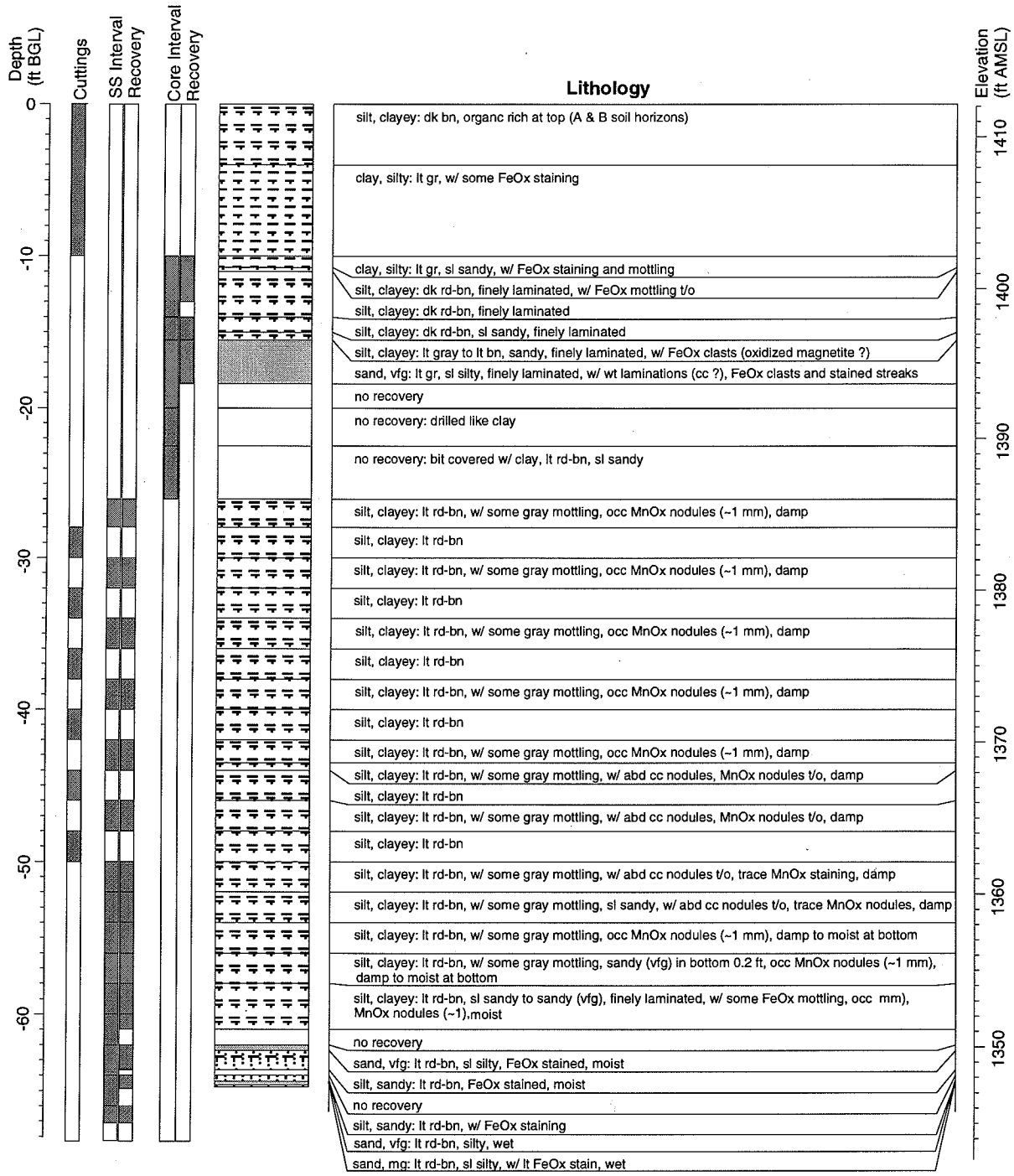
Environmental Research Division

Depth: 134.9 ft

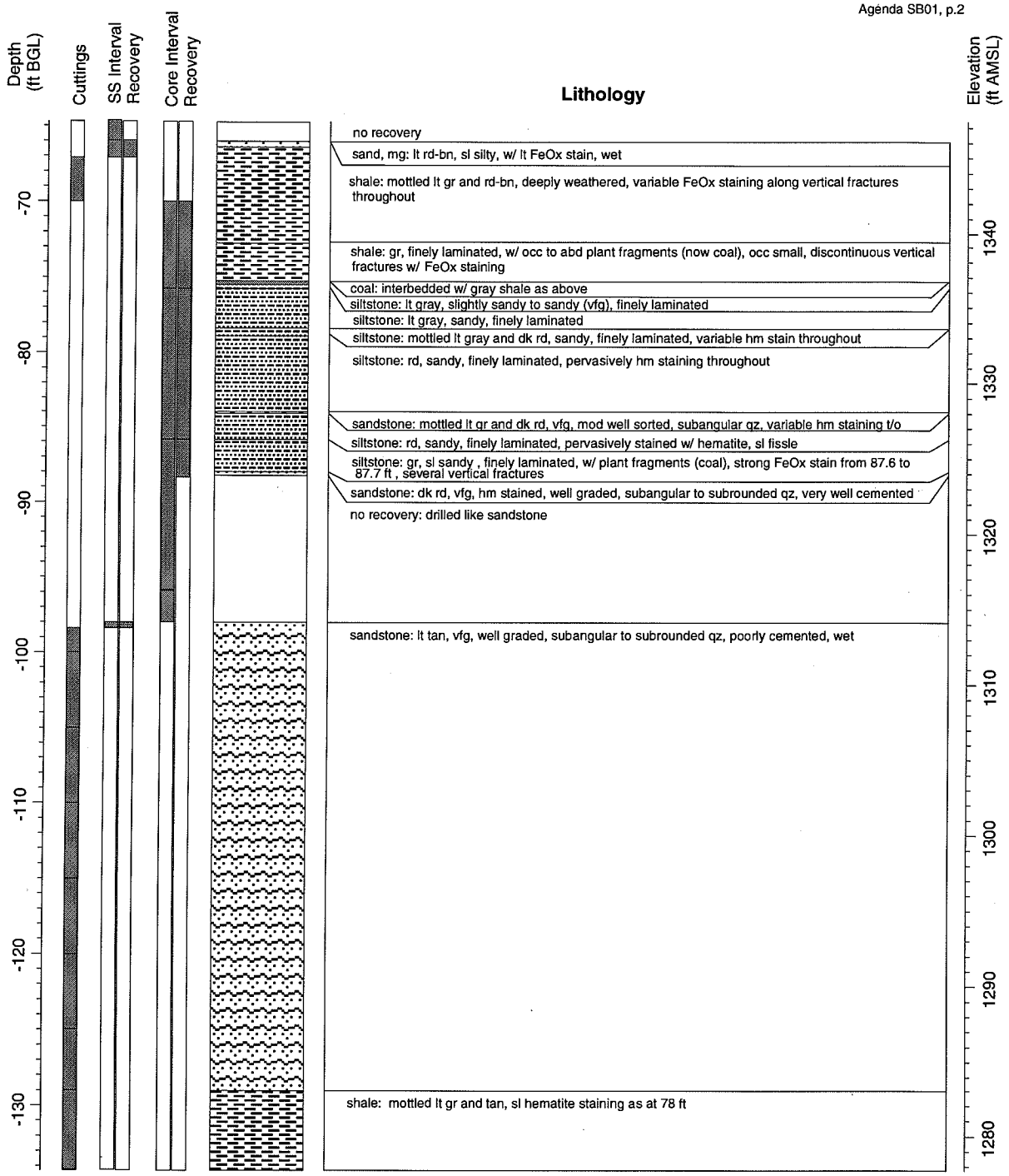
Log Date: April 16 - 18, 1996

Drilled by: M. Stone

Drill Company: Layne-Western



Agenda SB01, p.2



SB01

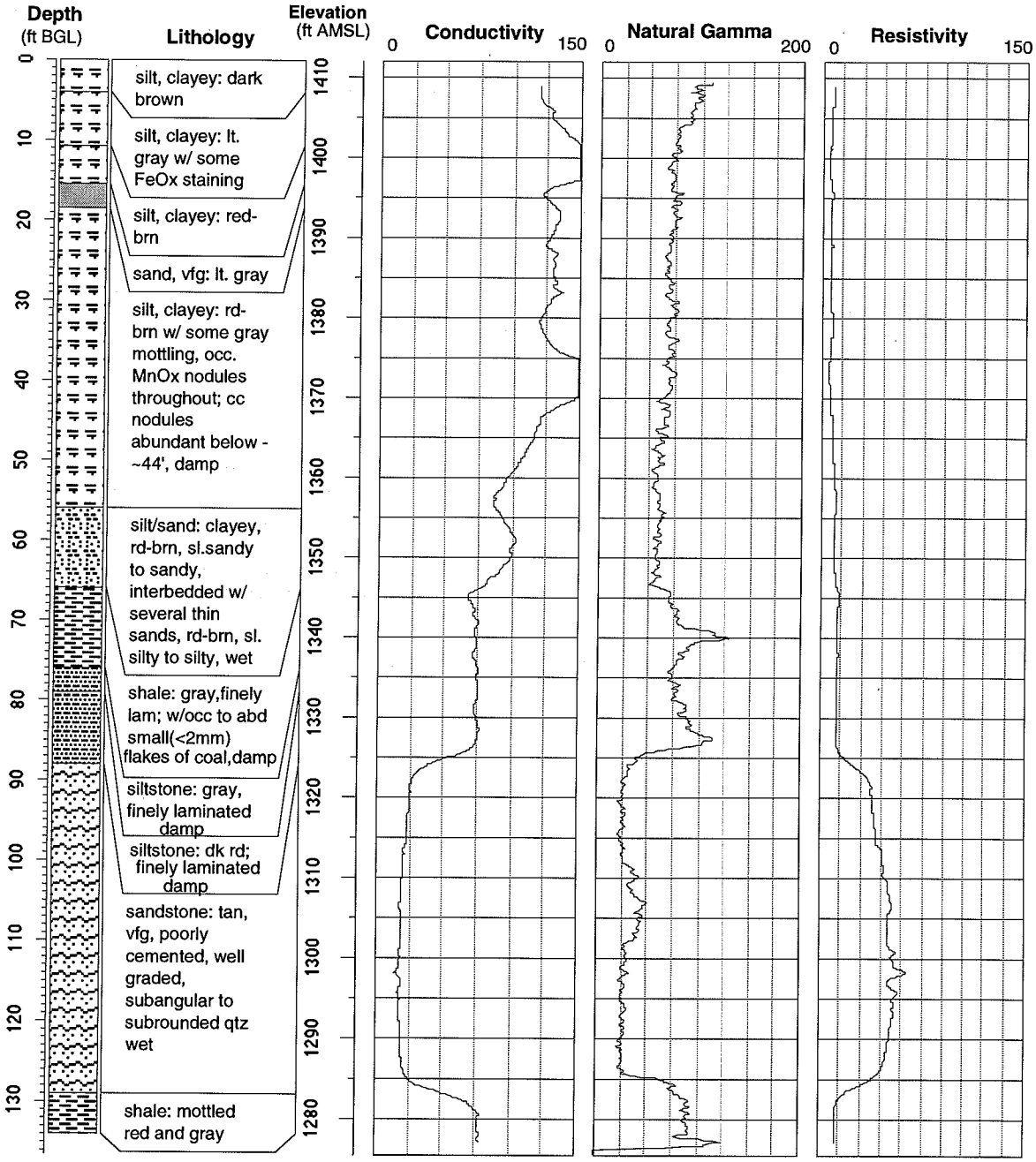
Agenda CCC/USDA Site Investigation

Sec. 16 ACAB, T4S R1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft.
Lithology by: S. Cook
Company: Argonne National Laboratory

Argonne National Laboratory
Environmental Research Division

Depth: 136.6 ft.
Log Date: April 24,1996
Logged by: W. Saunders
Logging Company: Argonne National Laboratory



KDHE MW-1D

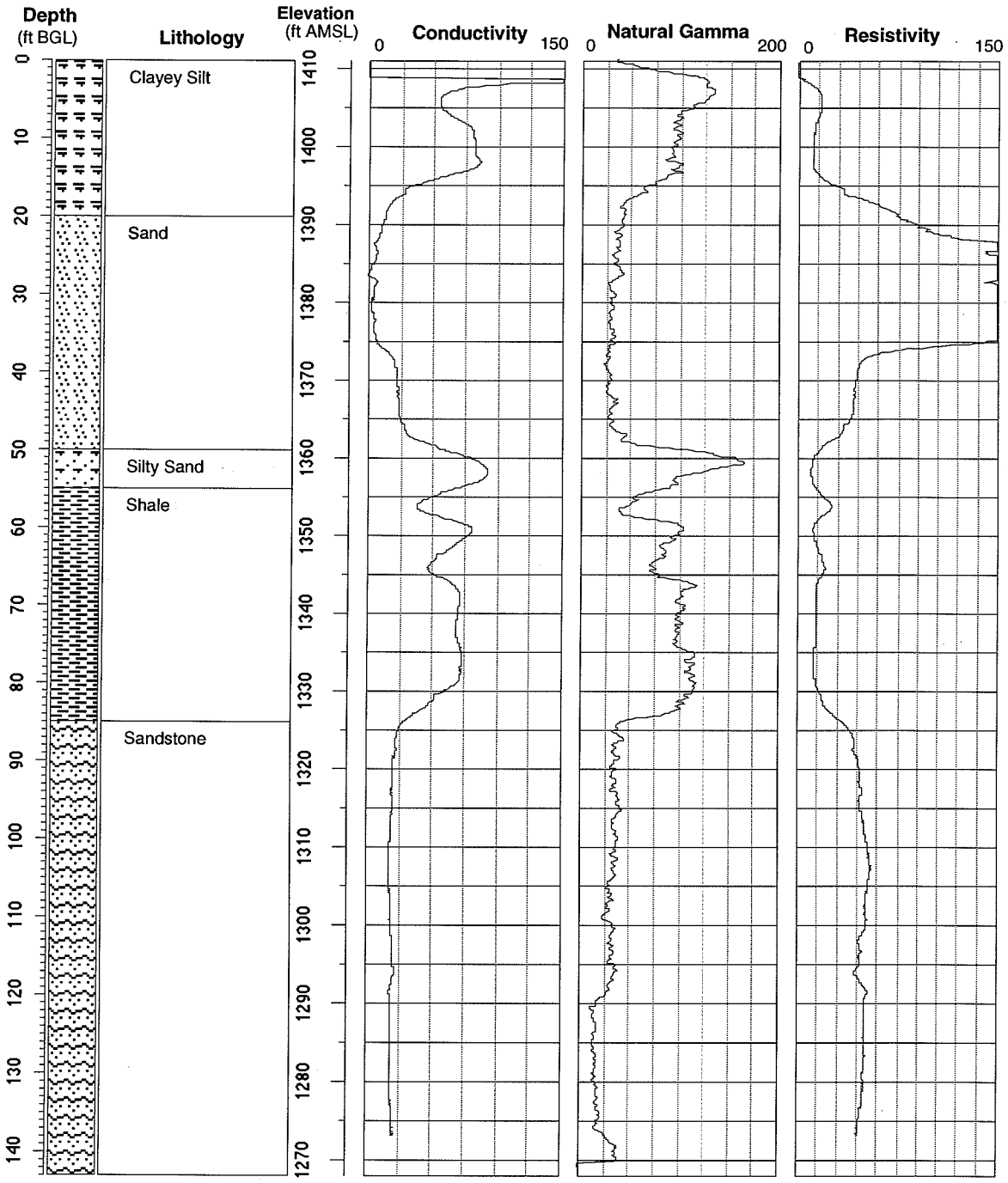
Agenda CCC/USDA Site Investigation

Sec. 16 ACCA, T.4 S., R.1 W, Republic County, Kansas

Ground Surface Elevation: 1411.1 ft
Lithology by: T. Wiberg
Company: PRC Environmental Management, Inc.

Argonne National Laboratory
Environmental Research Division

Depth: 143 ft.
Log Date: April 24, 1996
Logged by: W. Saunders
Logging Company: Argonne National Laboratory



KDHE MW-2D

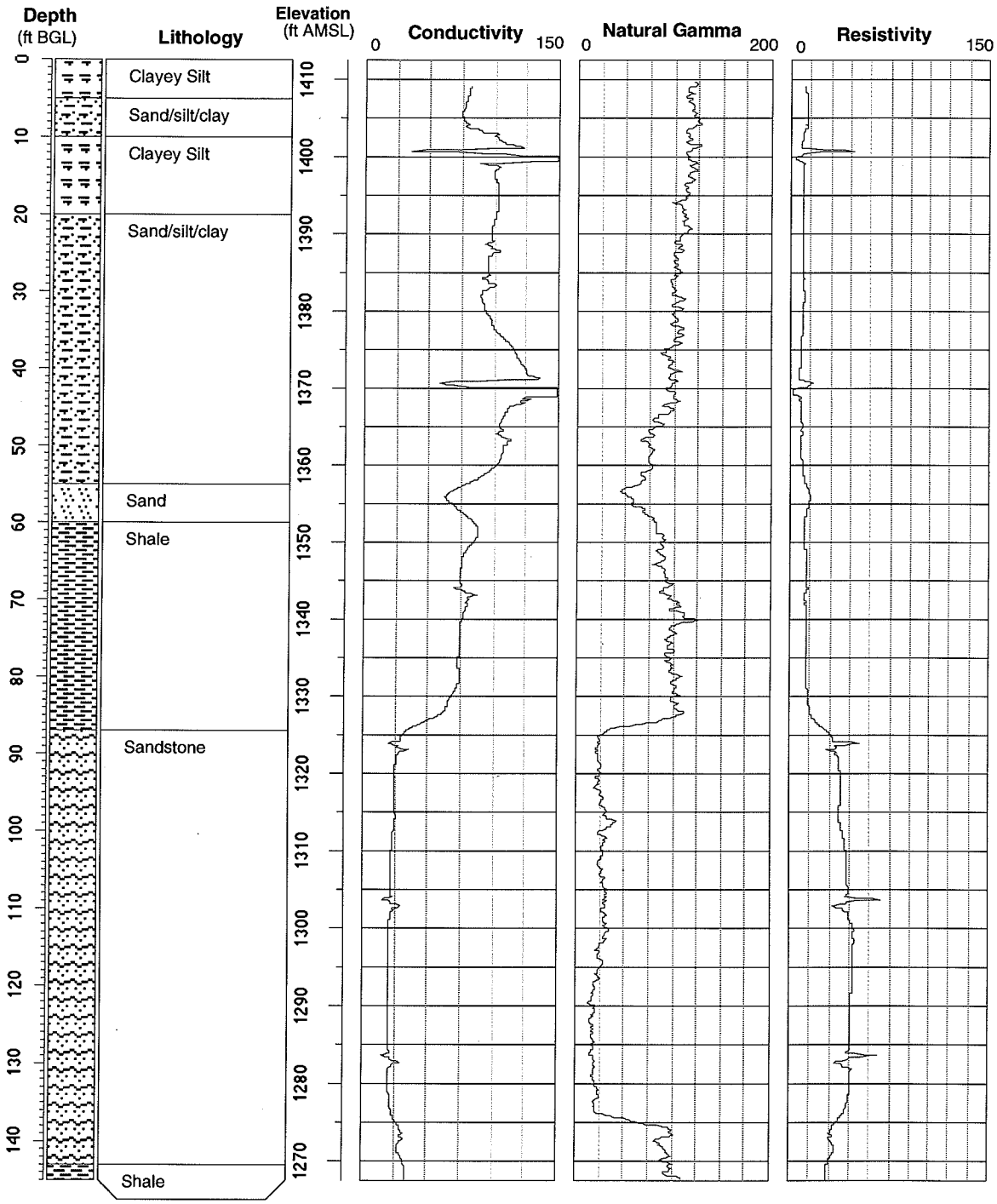
Agenda CCC/USDA Site Investigation

Sec. 16 ACBA, T. 4 S., R. 1 W, Republic County, Kansas

Argonne National Laboratory
Environmental Research Division

Ground Surface Elevation: 1412.53 ft
Lithology by: T. Wiberg
Company: PRC Environmental Management, Inc.

Depth: 145 ft.
Log Date: April 24, 1996
Logged by: W. Saunders
Logging Company: Argonne National Laboratory



KDHE MW-3D

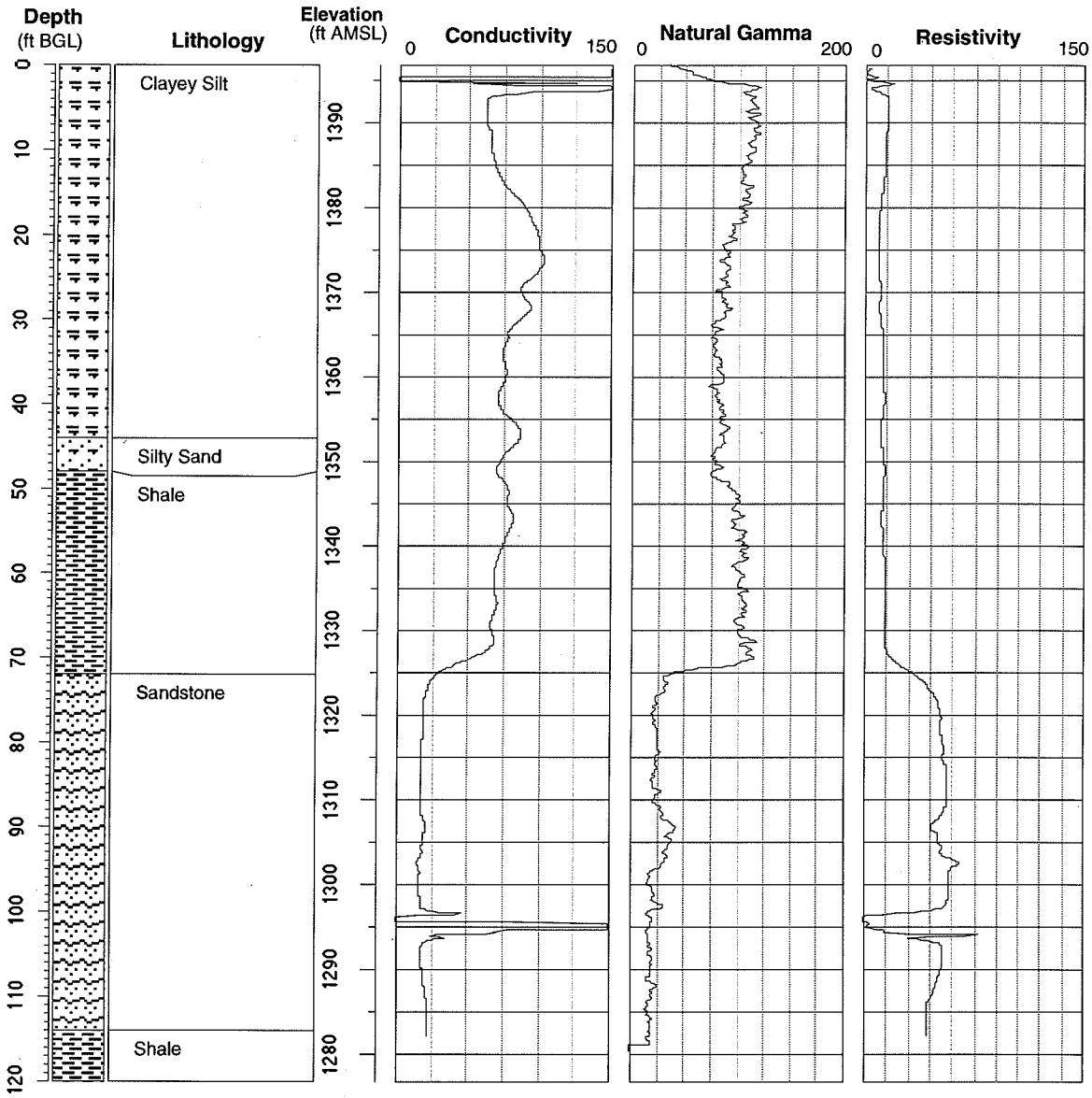
Agenda CCC/USDA Site Investigation

Sec. 16 ABCB, T. 4 S., R. 1 W, Republic County, Kansas

Ground Surface Elevation: 1396.78 ft
Lithology by: T. Wiberg
Company: PRC Environmental Management,Inc.

Argonne National Laboratory
Environmental Research Division

Depth: 120 ft.
Log Date: April 24,1996
Logged by: W. Saunders
Logging Company: Argonne National Laboratory



SB-02

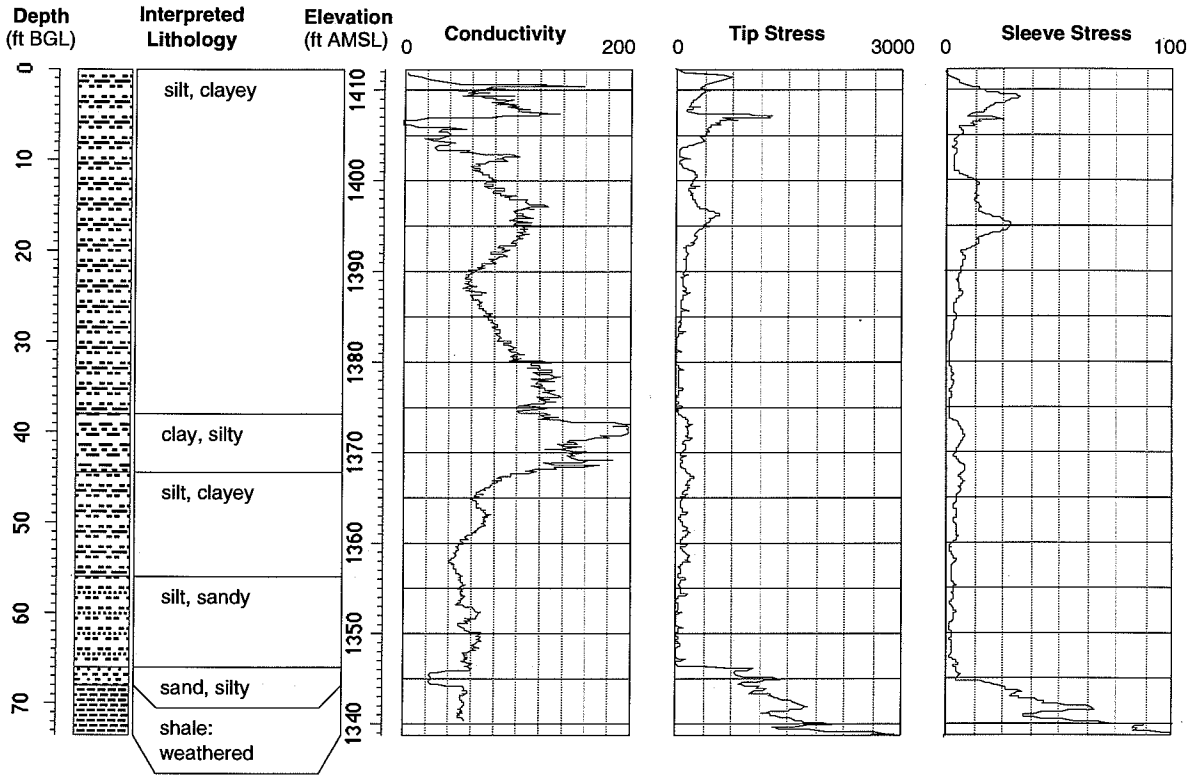
AGENDA CCC/USDA Site Investigation
Sec. 16 ACAB, T.4S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft.
Depth: 73.47 ft.
Interpreted by: S. Cook

Argonne National Laboratory

Environmental Research Division

ECPT Date: 4/22/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C.Rose



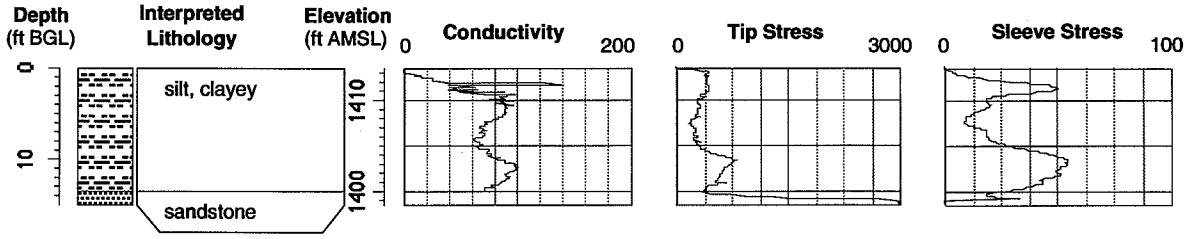
SB-03a

AGENDA CCC/USDA Site Investigation
Sec. 16 ACCA, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft.
Depth: 14.91 ft.
Interpreted by: S. Cook

Argonne National Laboratory
Environmental Research Division

ECPT Date: 4/22/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C.Rose



SB-03b

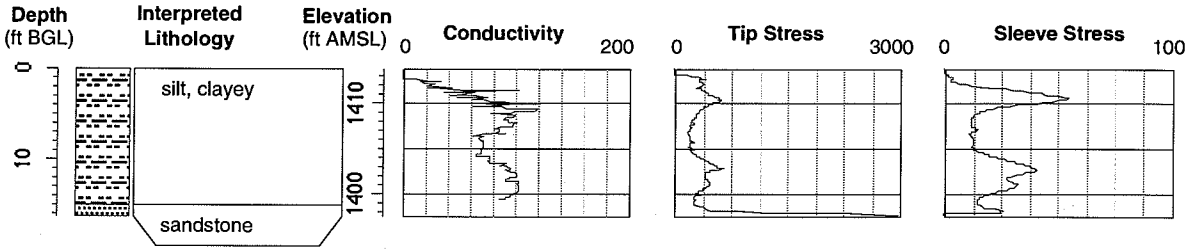
AGENDA CCC/USDA Site Investigation
Sec. 16 ACCA, T.4S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1413.7 ft
Depth: 16.14 ft.
Interpreted by: S. Cook

Argonne National Laboratory

Environmental Research Division

ECPT Date: 4/22/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C. Rose



SB-04

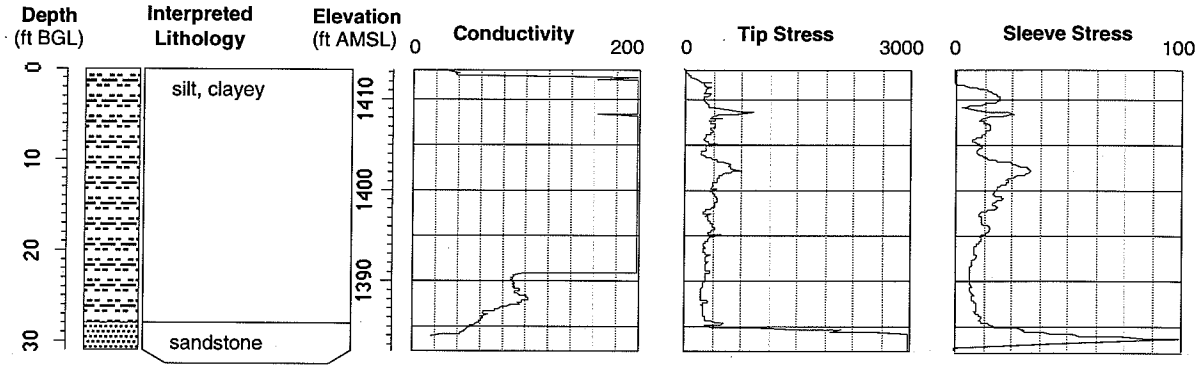
AGENDA CCC/USDA Site Investigation
Sec. 16 ACBD, T.4S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1413.3 ft.
Depth: 30.95 ft.
Interpreted by: S. Cook

Argonne National Laboratory

Environmental Research Division

ECPT Date: 4/22/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C. Rose



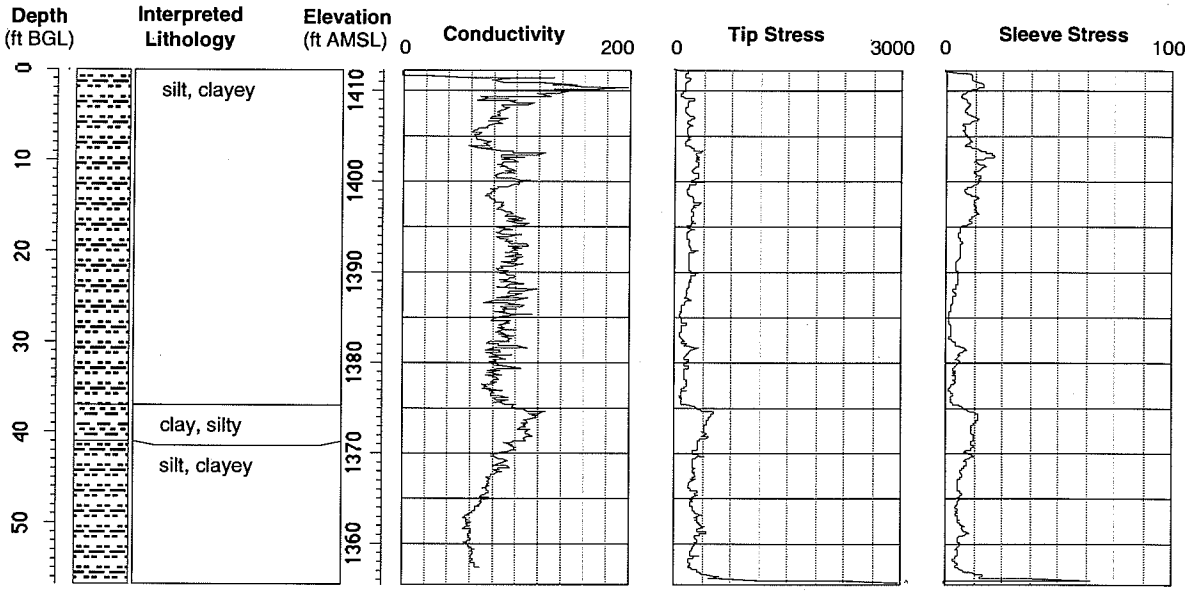
SB-05

AGENDA CCC/USDA Site Investigation
Sec. 16 ACBA, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft.
Depth: 56.69 ft.
Interpreted by: S. Cook

Argonne National Laboratory
Environmental Research Division

ECPT Date: 4/22/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C. Rose



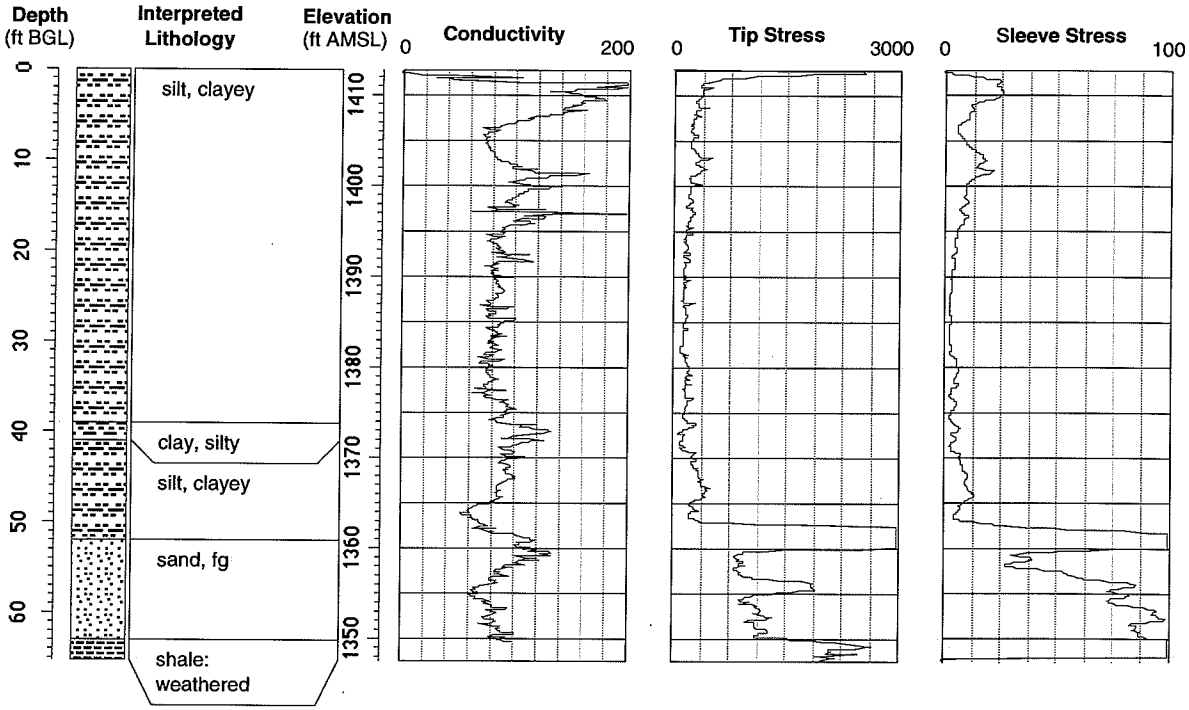
SB-06

AGENDA CCC/USDA Site Investigation
Sec. 16 ACBA, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.7 ft.
Depth: 65.23 ft.
Interpreted by: S. Cook

Argonne National Laboratory
Environmental Research Division

ECPT Date: 4/23/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C. Rose



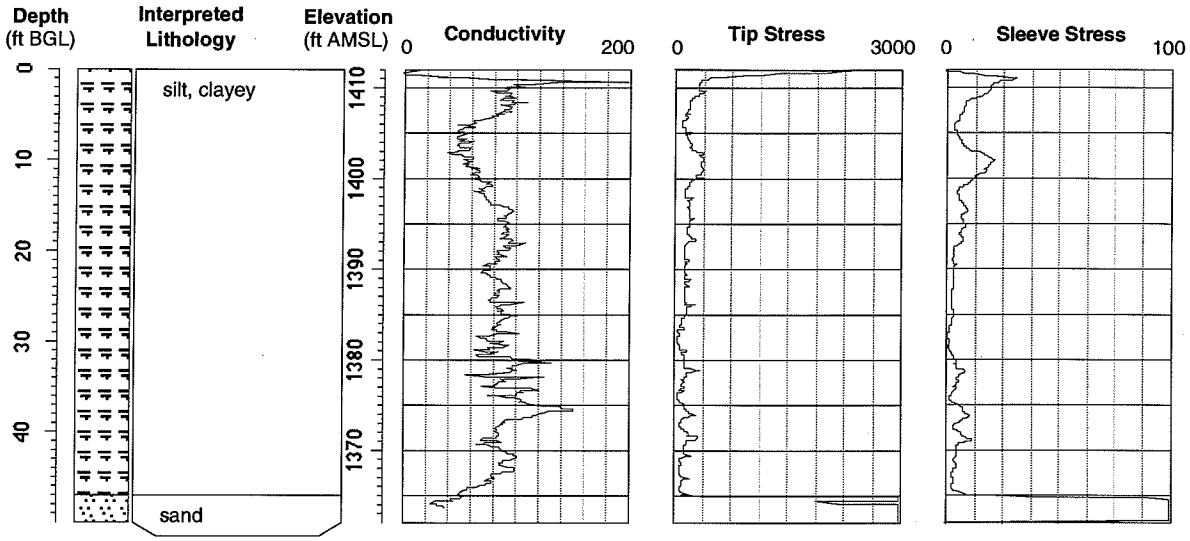
SB07

AGENDA CCC/USDA Site Investigation
Sec. 16 ACBD, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft
Depth: 49.99 ft.
Interpreted by: S. Cook

Argonne National Laboratory
Environmental Research Division

ECPT Date: 4/24/96
ECPT by: ARA, Inc.
ECPT Operator: T. Bauder/C.Rose



SB-08

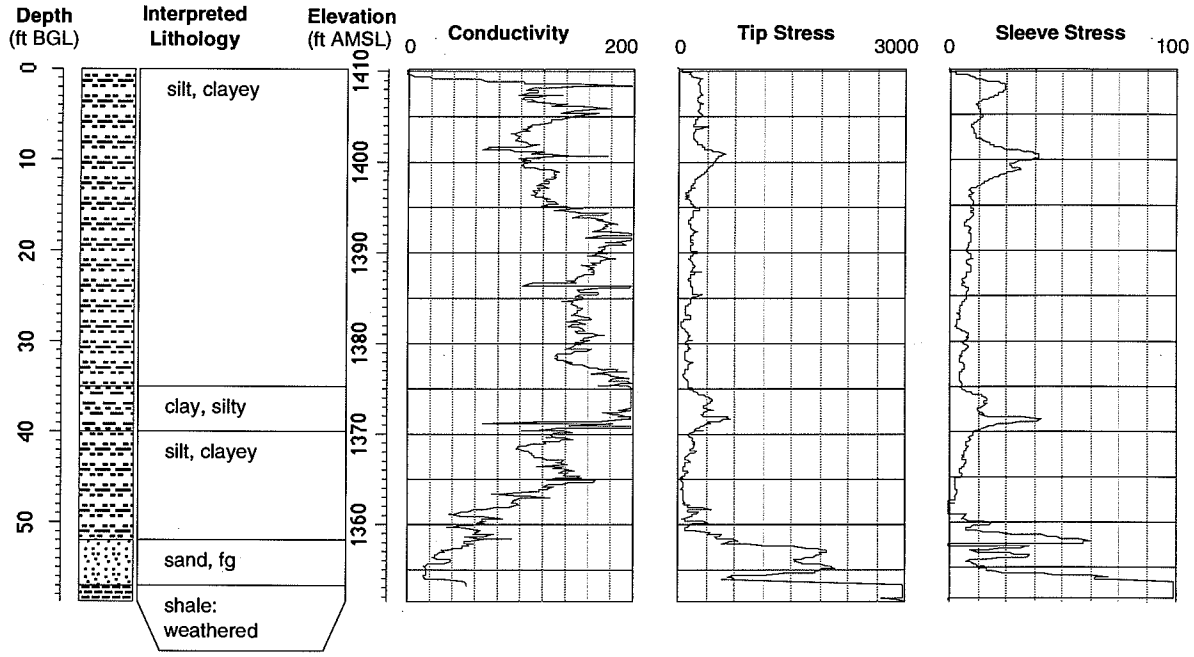
AGENDA CCC/USDA Site Investigation
Sec. 16 ABCD, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1410.3 ft.
Depth: 58.69 ft.
Interpreted by: S. Cook

Argonne National Laboratory

Environmental Research Division

ECPT Date: 4/25/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C. Rose



SB-09

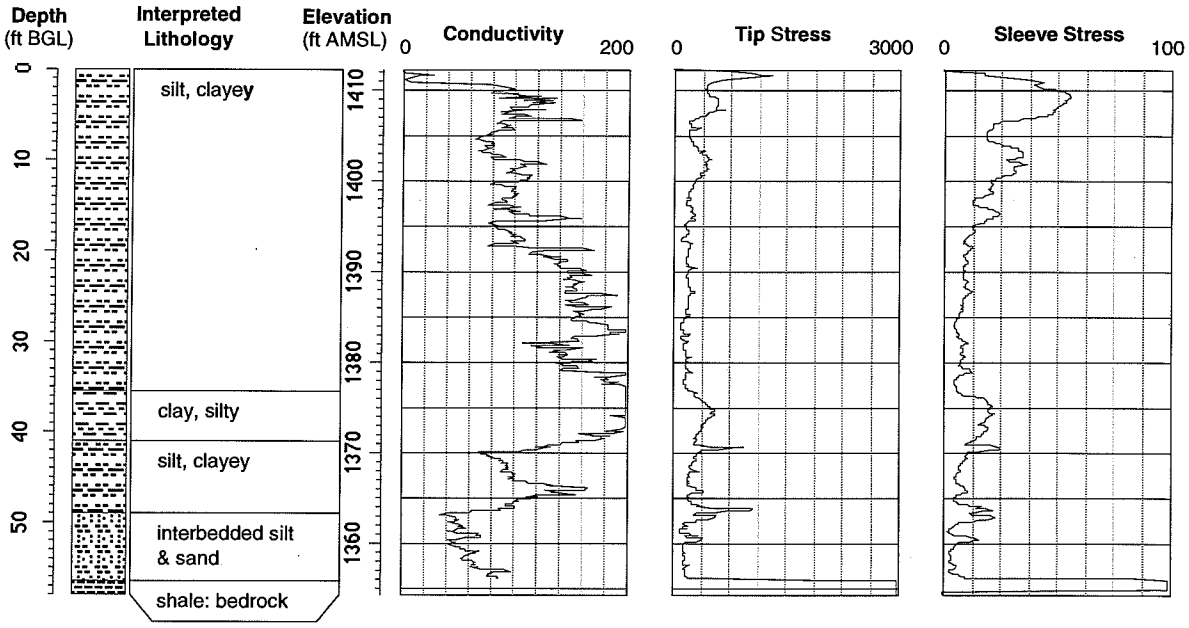
AGENDA CCC/USDA Site Investigation
Sec. 16 ABCD, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.2 ft.
Depth: 58.06 ft.
Interpreted by: S. Cook

Argonne National Laboratory

Environmental Research Division

ECPT Date: 4/25/96
ECPT by: ARA/Argonne
ECPT Operator: T. Bauder/C. Rose



SB10

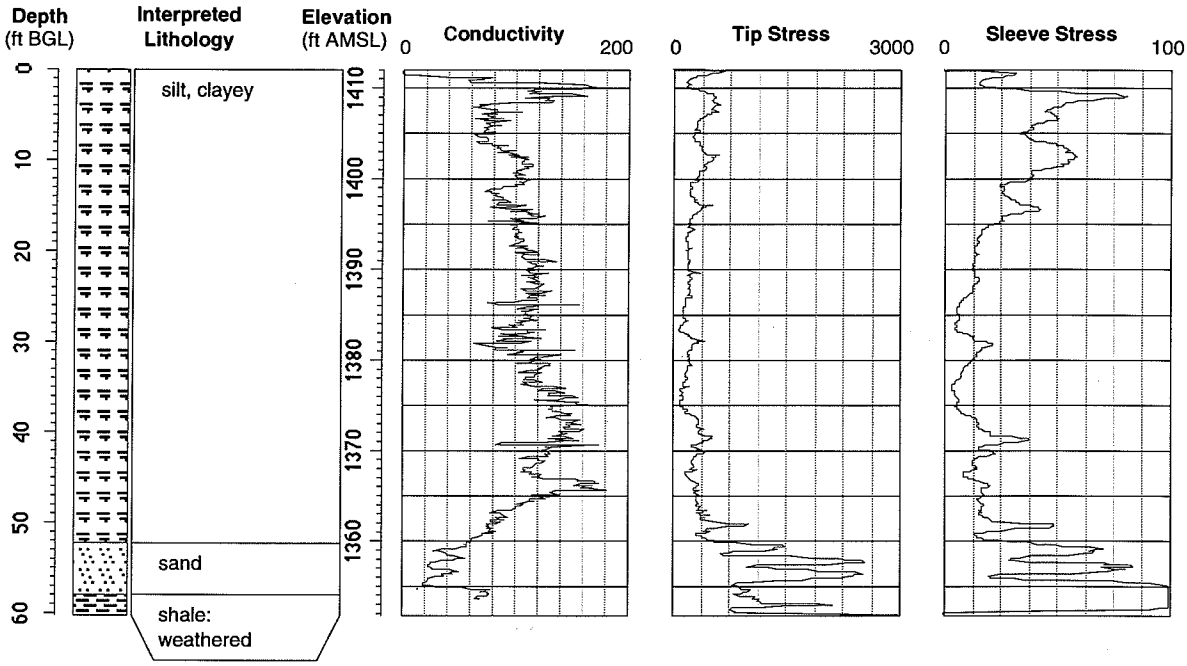
AGENDA CCC/USDA Site Investigation
Sec. 16 ABCD, T.4 S., R.1W, Republic County, Kansas

Ground Surface Elevation: 1412.1 ft
Depth: 60.37 ft.
Interpreted by: S. Cook

Argonne National Laboratory

Environmental Research Division

ECPT Date: 4/25/96
ECPT by: ARA, Inc.
ECPT Operator: T. Bauder/C. Rose



Argonne National Laboratory

AGENDA CCC/USDA Site Investigation

Sec. 16 ACAB T.4 S, R.1 W, Republic County, Kansas

CPT ID: SB-02

Log Type: ECPT Data Only

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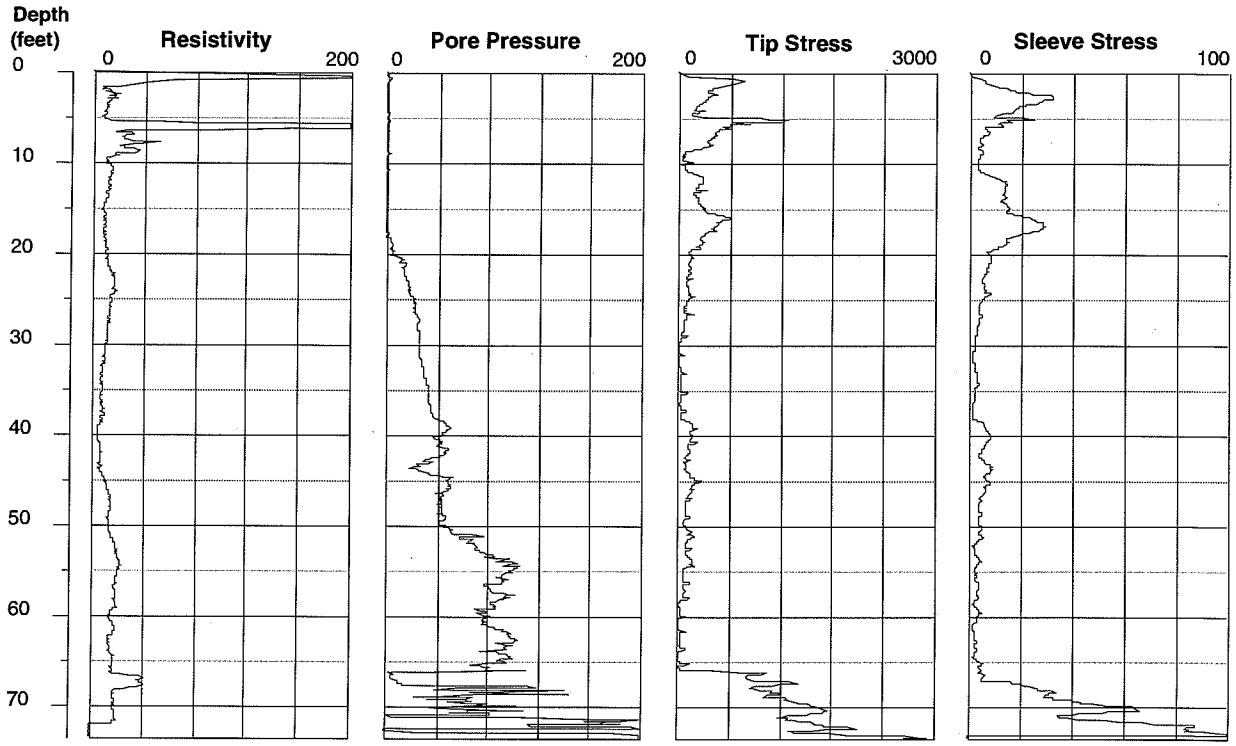

Argonne National Laboratory

AGENDA CCC/USDA Site Investigation

Sec. 16 ACCA, T4S R1W, Republic County, Kansas

CPT ID: SB-03a

Log Type: ECPT Data Only

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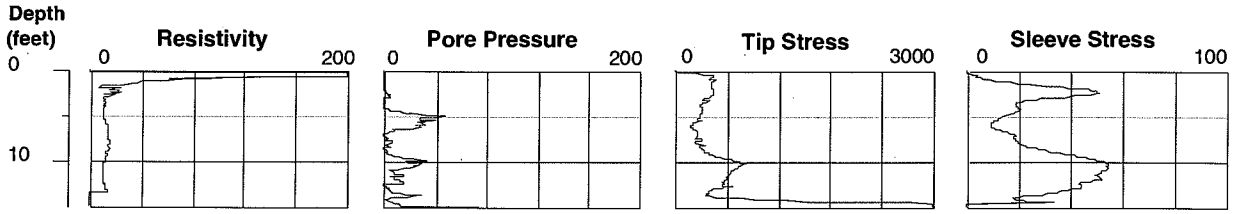

Argonne National Laboratory

AGENDA CCC/USDA Site Investigation

Sec. 16 ACCA, T4S R1W, Republic County, Kansas

CPT ID: SB-03b

Log Type: ECPT Data Only

Date:	4/22/96	**Elevation:**	1413.7	**Depth:**	16.14 ft.	**Operator:**	T. Bauder / C. Rose
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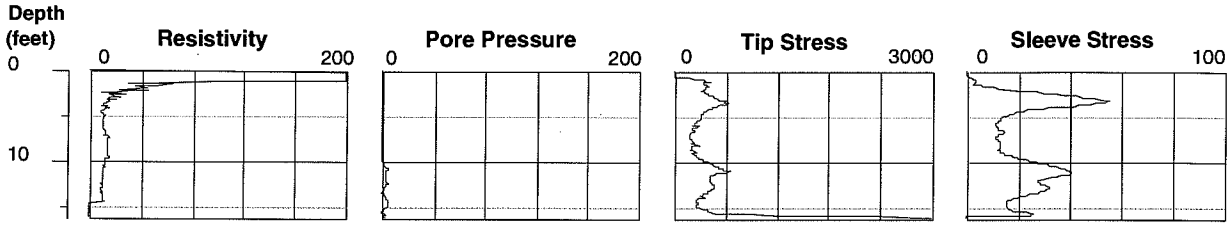

Argonne National Laboratory

AGENDA CCC/USDA Site Investigation

Sec. 16 ACBD, T4S R1W, Republic County, Kansas

CPT ID: SB-04

Log Type: ECPT Data Only

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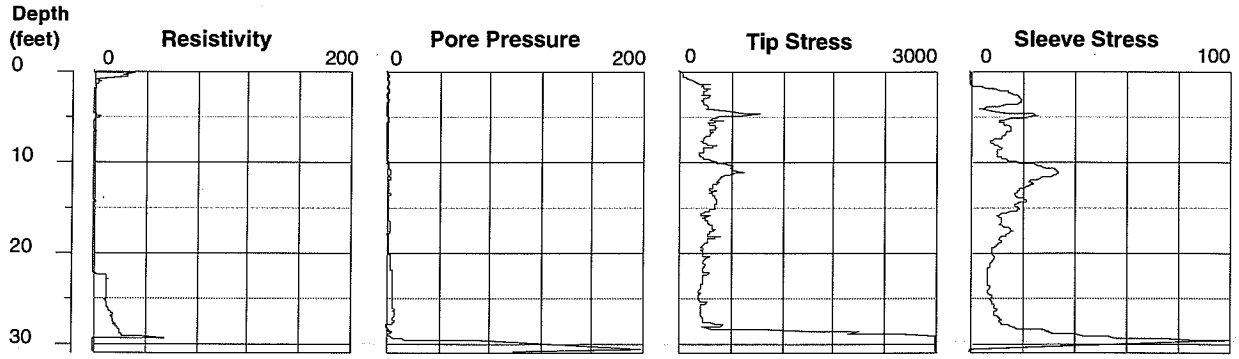
		Plot Date:	5/23/96	**Rig:**	CPT	**Company:**	ARA, Inc.



Argonne National Laboratory

AGENDA CCC/USDA Site Investigation

Sec. 16 ACBA, T4S R1W, Republic County, Kansas

CPT ID: SB-05

Log Type: ECPT Data Only

Date:	4/22/96	**Elevation:**	1412.1	**Depth:**	56.69 ft.	**Operator:**	T. Bauder / C. Rose
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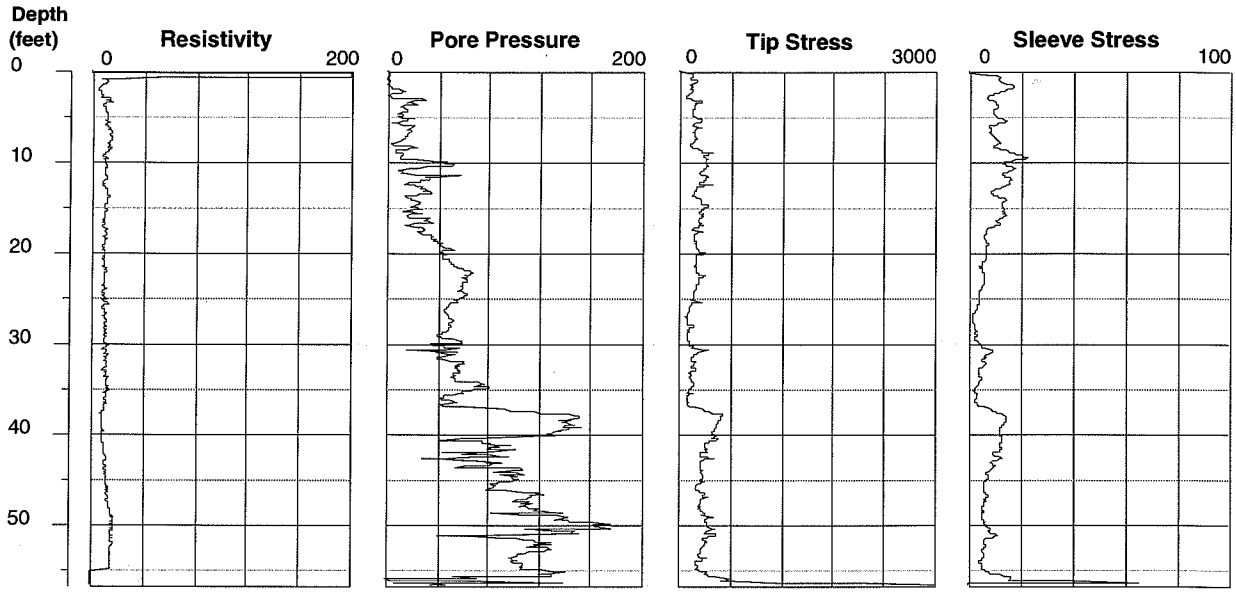

Argonne National Laboratory

AGENDA CCC/USDA Site Investigation

Sec. 16 ACBA, T4S R1W, Republic County, Kansas

CPT ID: SB-06

Log Type: ECPT Data Only

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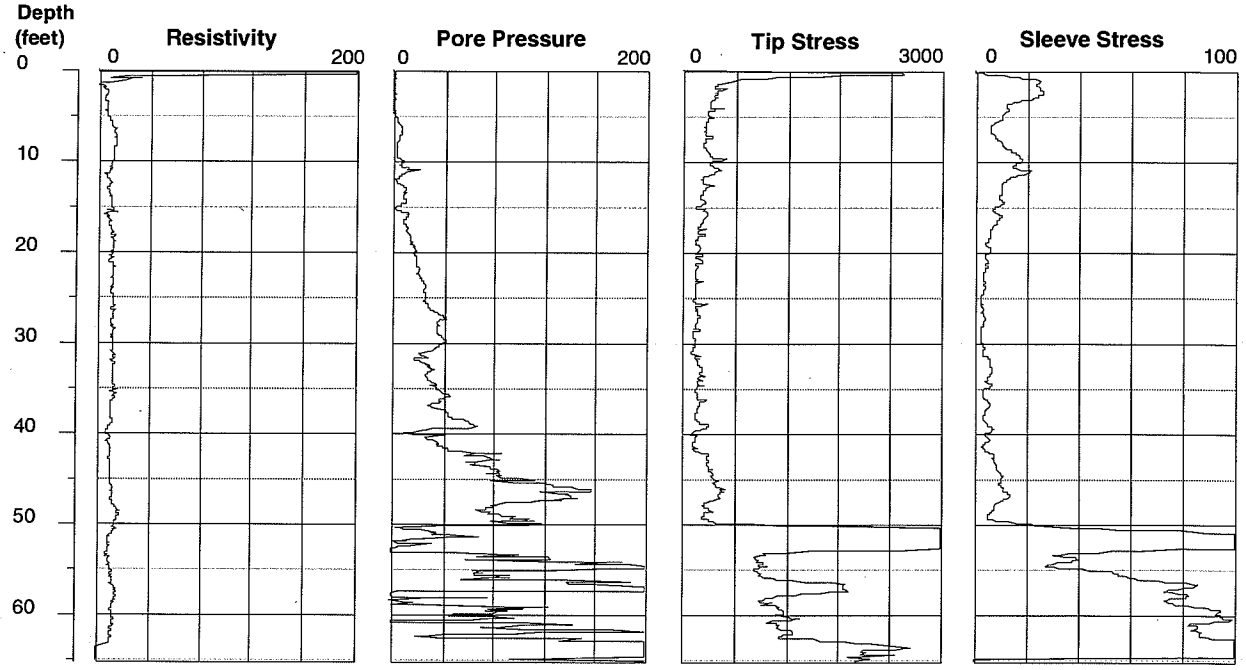


Argonne National Laboratory

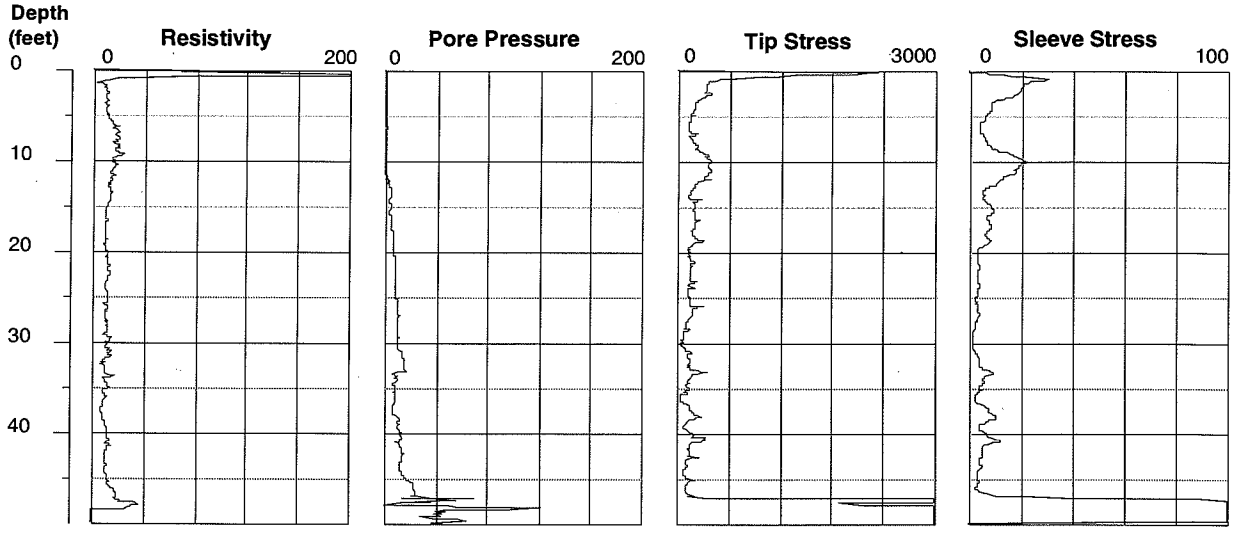
AGENDA CCC/USDA Site Investigation

Sec. 16 ACBD, T4S R1W, Republic County, Kansas

CPT ID: SB-07

Log Type: ECPT Data Only

Date:	4/24/96	**Elevation:**	1412.1	**Depth:**	49.99 ft.	**Operator:**	T. Bauder / C. Rose
		Plot Date:	5/23/96	**Rig:**	CPT	**Company:**	ARA, Inc.



Argonne National Laboratory

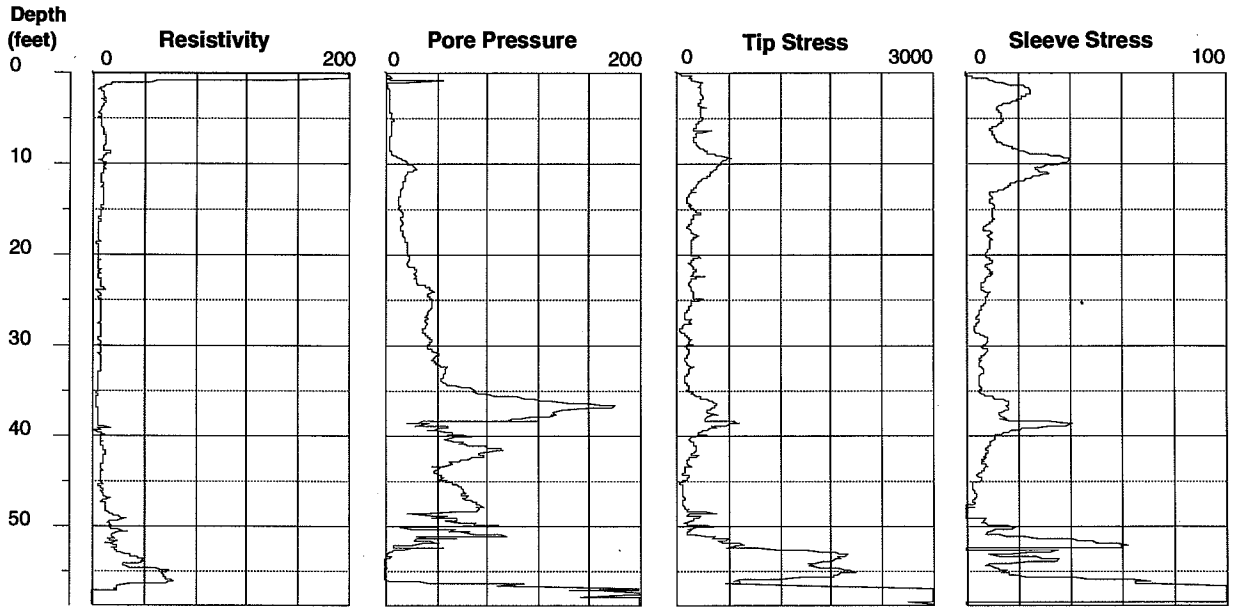
AGENDA CCC/USDA Site Investigation

Sec. 16 ABCD, T4S R1W, Republic County, Kansas

CPT ID: SB-08

Log Type: ECPT Data Only

Date:	4/25/96	**Elevation:**	1410.3	**Depth:**	58.69 ft.	**Operator:**	T. Bauder / C. Rose
		Plot Date:	5/24/96	**Rig:**	CPT	**Company:**	ARA, Inc.



Argonne National Laboratory

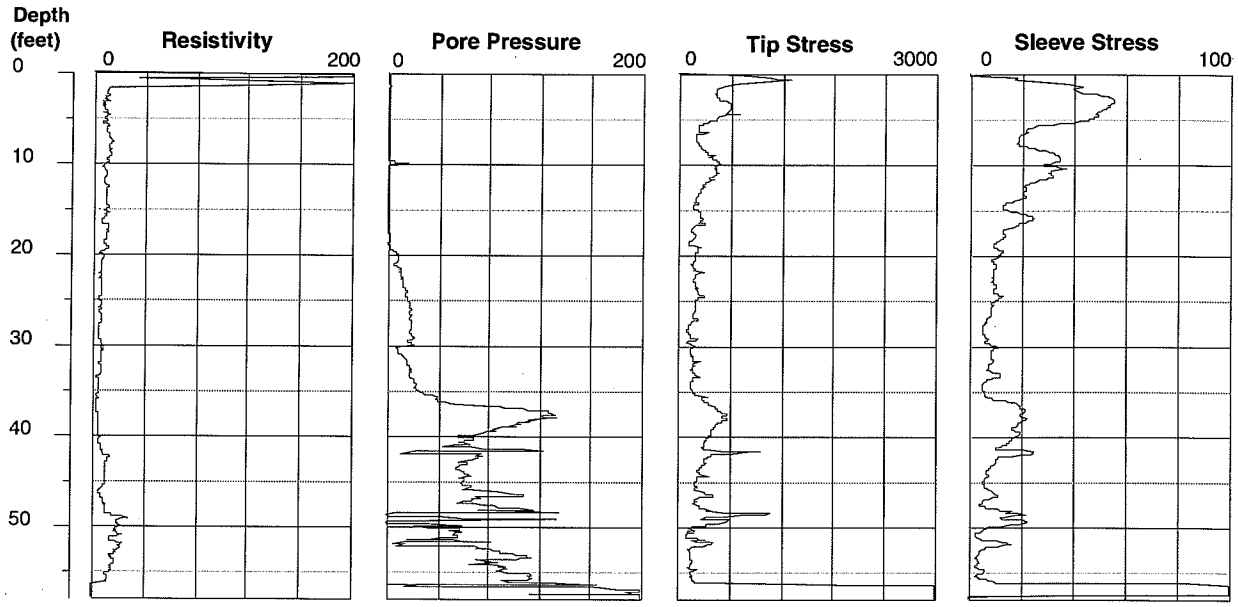
AGENDA CCC/USDA Site Investigation

Sec. 16 ABCD, T4S R1W, Republic County, Kansas

CPT ID: SB-09

Log Type: ECPT Data Only

Date:	4/25/96	**Elevation:**	1412.2	**Depth:**	58.06 ft.	**Operator:**	T. Bauder / C. Rose
		Plot Date:	5/24/96	**Rig:**	CPT	**Company:**	ARA, Inc.



Argonne National Laboratory

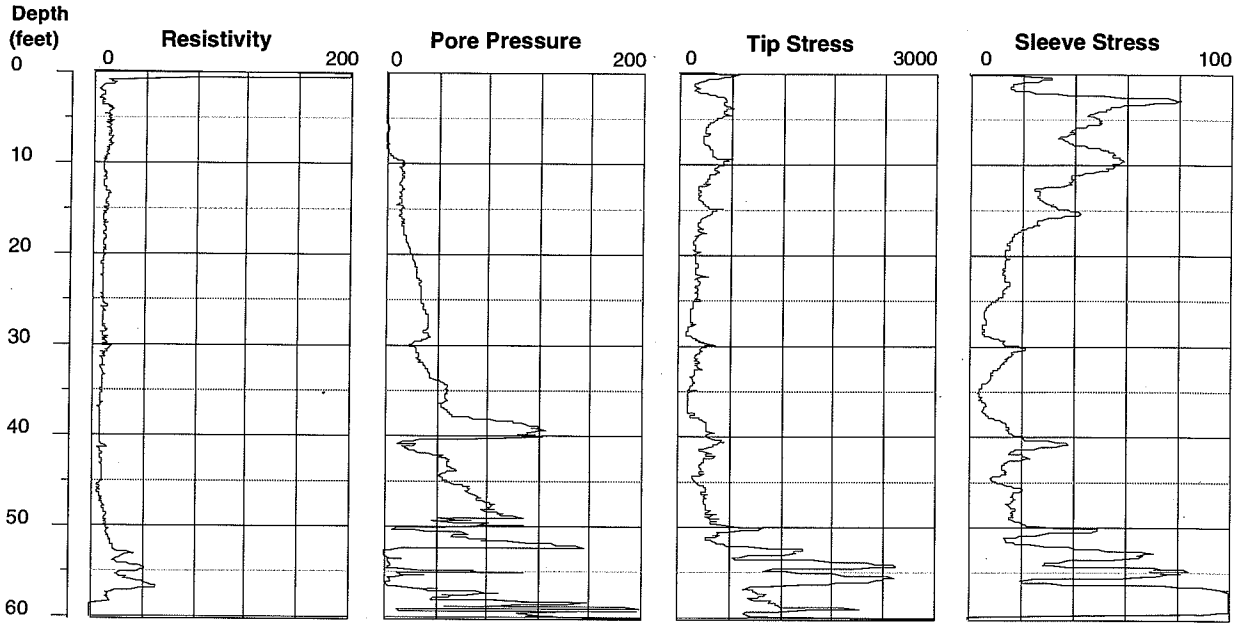
AGENDA CCC/USDA Site Investigation

Sec. 16 ABCD T.4 S, R.1 W, Republic County, Kansas

CPT ID: SB-10

Log Type: ECPT Data Only

Date:	4/25/96	**Elevation:**	1412.1	**Depth:**	60.37 ft.	**Operator:**	T. Bauder / C. Rose
		Plot Date:	5/24/96	**Rig:**	CPT	**Company:**	ARA, Inc.



Appendix B:

Well Construction Data

SB 01

Agenda CCC/USDA Site Investigation

Sec. 16 ACAB , T4S R1W, Republic County, Kansas

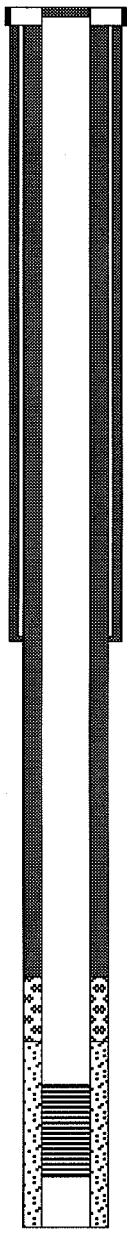
Top of Casing Elevation: 1411.76 ft
Ground Surface Elevation: 1412.1 ft
Supervised by: S. Cook

Argonne National Laboratory

Environmental Research Division

Installed by: **M. Stone** **Date:** April 19, 1996
Company: **Layne-Western**
Developed by: **M. Stone** **Date:** April 20, 1996
Company: **Layne-Western**

Depth ft BGL	Casing Materials	Annular Materials	Elevation ft AMSL
0	steel flush mount set in 3 x 3 ft cement pad	12 in. diameter borehole from 0 to 70 ft BGL	1410
10	8 in. schedule 40 flushjoint PVC conductor casing from 0 to 70 ft BGL	Portland cement with 5% bentonite from 0 to 70 ft BGL	1400
20			1390
30			1380
40			1370
50			1360
60			1350
70	4 in. schedule 40 flushjoint PVC casing from 0 to 118.9 ft BGL	7.5 in. diameter borehole from 70 to 134.3 ft BGL	1340
80		Portland cement with 5% bentonite from 0 to 107 ft BGL	1330
90			1320
100			1310
110		Bentonite chips from 107 to 114 ft BGL	1300
120	4 in. schedule 40 flushjoint PVC 0.010 slotted screen from 118.9 to 128.9 ft BGL	Coarse-graded silica sand filter pack from 114 to 134.9 ft BGL	1290
130	4 in. schedule 40 flushjoint PVC casing sump from 128.9 to 134.9 ft BGL		1280



06-11-00 10:11 FAX 785 864 5317 KS Geol Survey 001

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL: County: REPUBLIC Fraction: NW ¼ SW ¼ NE ¼ Section Number: 16 Township Number: T 4 S Range Number: R 1 E/W

Distance and direction from nearest town or city street address of well if located within city?

2 WATER WELL OWNER: ENV. Research Div. Argonne Nat'l Lab.
RR#, St. Address, Box #: 9700 S. Cass Ave.
City, State, ZIP Code: Argonne, IL 60302 (801)
Board of Agriculture, Division of Water Resources Application Number

3 LOCATION WITH AN "X" IN SECTION BOX: N, NW, NE, X, W, E, SW, SE, S, 1 Mile

4 DEPTH OF COMPLETED WELL: 134 ft. ELEVATION:
Depth(s) Groundwater Encountered 1 ft. 2. ft. 3. ft
WELL'S STATIC WATER LEVEL 46 ft. below land surface measured on mo/day/yr
Pump test data: Well water was ft. after hours pumping gpm
Est. Yield gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 7 7/8 in. to 70-134 ft., and 12 in. to 70 ft.
WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)
Was a chemical/bacteriological sample submitted to Department? Yes No X If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes No X

5 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)
CASING JOINTS: Glued Clamped Welded Threaded X
Blank casing diameter 4 in. to 129-134 ft., Dia 4 in. to 119-129 ft., Dia 8 in. to 0-70 ft.
Casing height above land surface 0 in., weight lbs./ft. Wall thickness or gauge No. Sch. 40
TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)
SCREEN-PERFORATED INTERVALS: From 119 ft. to 129 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 114 ft. to 134 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other
Grout Intervals: From 0 ft. to 110 ft., From 110 ft. to 114 ft., From ft. to ft.
What is the nearest source of possible contamination: 1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)
Direction from well? Unknown How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	10	Dk. brn CLAY			
10	26	Lt brn silty clay			
26	66	Lt brn sandy silty clay			
66	70	Gray wthrd. SHALE			
70	90	RED Shale			
90	98	Wthrd Sandstone			
98	129	Dense SD & Sandstone			
129	134	RED Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 4-19-96 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 581 This Water Well Record was completed on (mo/day/yr) 4-22-96 under the business name of Layne, Inc. by (signature) Steven R. Mitchell

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

Kansas Geological Survey | Hydrology | Water Well Database Query

Specific Water Well Detail

Well T4S, R1W, Sec. 16, NWSWNE, Action: Constructed

Agenda SB01

Location Info

County: Republic	**Location:** T4S, R1W, Sec. 16, NWSWNE
Owner: ENV RESEARCH DI	**Status:** Constructed
Directions:	

General Info

Well Depth: 134 ft.	**Elevation:** 0 ft.
Static Water Level: 46 ft.	**Well Use:** Monitoring Well/Observation/Piezometer
Depths Groundwater Enountered: 0 ft., 0 ft., and 0 ft.	
Pump Test Data: water was 0 ft. after 0 hours pumping 0 gpm	
Est. Yield: 0 ft.	**Chem Analysis Done:** N

Driller Info

Driller: Brian J. Meier, Layne Western	**License #:** 581
Comp. Date: 19-Apr-1996	**DWR Applic. #:**

Casing Info

Casing Type: PVC
Diam: 4 in. to 129 ft.
Diam: 4 in. to 119 ft.
Diam: 8 in. to 70 ft.

Screen and Perforation Info

Screen Type: TORCH CUT	**Screen Openings:** MILL SLOT
From: 119 ft. to 129 ft.	**From:** 0 ft. to 0 ft.
From: 0 ft. to 0 ft.	**From:** 0 ft. to 0 ft.

Grout Info

Grout used: NEAT CEMENT and BENTONITE
From: 0 to 110 ft.
From: 110 to 114 ft.
From: 0 to 0 ft.

Contamination Info

Contamination type: OTHER

Direction:	**Distance: 0**

Lithologic Log

From: 0 ft. to 10 ft.	**Type:** CLAY
From: 10 ft. to 26 ft.	**Type:** SILT
From: 26 ft. to 66 ft.	**Type:** SILTY CLAY
From: 66 ft. to 129 ft.	**Type:** SANDSTONE
From: 129 ft. to 134 ft.	**Type:** SHALE

Kansas Geological Survey
Comments to webadmin@kgs.ukans.edu
URL=http://magellan.kgs.ukans.edu/WaterWell/index.html
Display Programs Updated March 2000
Data added continuously.

Appendix C:

Water Level Data

TABLE C.1 Water Levels (ft AMSL) in Observation Wells at Agenda, Kansas, on May 15, 1996, to June 7, 1996

		Shallow-Aquifer Wells				Deep-Aquifer Wells			
Date	Time	MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/15/96	3:00 p.m.	-[a]	1374.28	-	-	-	1366.28	-	-
	4:00 p.m.	-	1374.28	-	-	-	1365.96	-	-
	5:00 p.m.	-	1374.28	1375.87	-	-	1366.31	1366.49	-
	6:00 p.m.	1372.48	1374.27	1375.87	-	-	1366.46	1366.61	-
	7:00 p.m.	1372.48	1374.27	1375.86	-	1366.27	1366.54	1366.67	-
	8:00 p.m.	1372.48	1374.27	1375.86	-	1366.31	1366.58	1366.71	-
	9:00 p.m.	1372.46	1374.26	1375.85	-	1365.59	1366.59	1366.73	-
	10:00 p.m.	1372.47	1374.26	1375.84	-	1364.16	1365.83	1366.30	-
	11:00 p.m.	1372.47	1374.26	1375.84	-	1365.76	1366.10	1366.33	-
5/16/96	12:00 a.m.	1372.47	1374.26	1375.84	-	1366.05	1366.33	1366.48	-
	1:00 a.m.	1372.46	1374.25	1375.83	-	1366.18	1366.44	1366.58	-
	2:00 a.m.	1372.47	1374.25	1375.84	-	1366.24	1366.50	1366.63	-
	3:00 a.m.	1372.48	1374.26	1375.84	-	1366.29	1366.55	1366.68	-
	4:00 a.m.	1372.44	1374.24	1375.82	-	1366.33	1366.60	1366.73	-
	5:00 a.m.	1372.45	1374.24	1375.82	-	1366.35	1366.60	1366.73	-
	6:00 a.m.	1372.44	1374.23	1375.80	-	1366.38	1366.61	1366.75	-
	7:00 a.m.	1372.47	1374.25	1375.82	-	1366.38	1366.61	1366.75	-
	8:00 a.m.	1372.46	1374.24	1375.82	-	1366.19	1366.64	1366.78	-
	9:00 a.m.	1372.48	1374.25	1375.84	-	1364.27	1365.90	1366.36	-
	10:00 a.m.	1372.48	1374.26	1375.85	-	1365.75	1366.05	1366.30	-
	11:00 a.m.	1372.48	1374.26	1375.85	-	1366.09	1366.31	1366.48	-
	12:00 p.m.	1372.49	1374.26	1375.85	-	1366.23	1366.44	1366.58	-
	1:00 p.m.	1372.50	1374.26	1375.86	-	1366.30	1366.51	1366.65	1366.66
	2:00 p.m.	1372.50	1374.27	1375.86	1370.92	1366.36	1366.55	1366.69	1366.70
	3:00 p.m.	1372.50	1374.27	1375.87	1370.78	1365.06	1366.43	1366.68	1366.64
	4:00 p.m.	1372.50	1374.27	1375.87	1370.78	1365.38	1365.89	1366.29	1366.19
	5:00 p.m.	1372.51	1374.28	1375.87	1370.79	1366.05	1366.28	1366.46	1366.46
	6:00 p.m.	1372.51	1374.28	1375.88	1370.79	1366.24	1366.45	1366.59	1366.61
	7:00 p.m.	1372.51	1374.28	1375.88	1370.79	1366.32	1366.52	1366.66	1366.68
	8:00 p.m.	1372.51	1374.28	1375.88	1370.79	1364.36	1365.93	1366.37	1366.25

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/16/96 (Cont.)	9:00 p.m.	1372.51	1374.28	1375.88	1370.79	1365.79	1366.08	1366.32	1366.30
	10:00 p.m.	1372.52	1374.28	1375.88	1370.80	1366.12	1366.33	1366.49	1366.50
	11:00 p.m.	1372.52	1374.28	1375.89	1370.80	1366.26	1366.45	1366.60	1366.62
5/17/96	12:00 a.m.	1372.52	1374.28	1375.89	1370.81	1366.33	1366.53	1366.66	1366.69
	1:00 a.m.	1372.52	1374.28	1375.89	1370.81	1366.38	1366.58	1366.71	1366.74
	2:00 a.m.	1372.53	1374.29	1375.89	1370.81	1366.42	1366.62	1366.75	1366.78
	3:00 a.m.	1372.53	1374.29	1375.90	1370.81	1366.45	1366.66	1366.79	1366.81
	4:00 a.m.	1372.53	1374.29	1375.90	1370.82	1366.48	1366.69	1366.82	1366.84
	5:00 a.m.	1372.53	1374.30	1375.90	1370.82	1366.50	1366.71	1366.84	1366.87
	6:00 a.m.	1372.52	1374.29	1375.90	1370.82	1366.51	1366.73	1366.86	1366.88
	7:00 a.m.	1372.53	1374.30	1375.90	1370.81	1364.62	1366.19	1366.60	1366.49
	8:00 a.m.	1372.53	1374.29	1375.90	1370.81	1365.48	1365.93	1366.29	1366.21
	9:00 a.m.	1372.53	1374.29	1375.90	1370.81	1366.07	1366.30	1366.49	1366.49
	10:00 a.m.	1372.53	1374.29	1375.89	1370.81	1366.23	1366.41	1366.57	1366.59
	11:00 a.m.	1372.53	1374.28	1375.89	1370.81	1366.32	1366.52	1366.66	1366.69
	12:00 p.m.	1372.52	1374.28	1375.89	1370.80	1365.26	1366.43	1366.68	1366.66
	1:00 p.m.	1372.53	1374.28	1375.89	1370.81	1364.63	1365.71	1366.23	1366.08
	2:00 p.m.	1372.54	1374.28	1375.89	1370.81	1365.90	1366.10	1366.33	1366.33
	3:00 p.m.	1372.53	1374.28	1375.89	1370.81	1366.17	1366.37	1366.52	1366.55
	4:00 p.m.	1372.53	1374.28	1375.89	1370.81	1366.30	1366.49	1366.63	1366.66
	5:00 p.m.	1372.52	1374.27	1375.88	1370.81	1366.36	1366.51	1366.66	1366.69
	6:00 p.m.	1372.49	1374.26	1375.86	1370.78	1364.81	1366.27	1366.60	1366.53
	7:00 p.m.	1372.49	1374.24	1375.84	1370.76	1364.77	1365.55	1366.10	1365.96
	8:00 p.m.	1372.49	1374.24	1375.83	1370.75	1365.84	1366.08	1366.29	1366.29
	9:00 p.m.	1372.48	1374.23	1375.81	1370.74	1366.08	1366.28	1366.44	1366.46
	10:00 p.m.	1372.47	1374.22	1375.80	1370.72	1366.19	1366.40	1366.53	1366.56
	11:00 p.m.	1372.48	1374.22	1375.80	1370.73	1366.24	1366.45	1366.58	1366.61

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/18/96	12:00 a.m.	1372.48	1374.21	1375.80	1370.73	1366.28	1366.49	1366.62	1366.66
	1:00 a.m.	1372.47	1374.21	1375.80	1370.73	1365.61	1366.47	1366.63	1366.66
	2:00 a.m.	1372.48	1374.21	1375.80	1370.73	1364.59	1365.77	1366.24	1366.11
	3:00 a.m.	1372.48	1374.21	1375.80	1370.73	1365.87	1366.13	1366.34	1366.34
	4:00 a.m.	1372.47	1374.21	1375.79	1370.73	1366.12	1366.33	1366.48	1366.50
	5:00 a.m.	1372.47	1374.21	1375.79	1370.73	1366.22	1366.43	1366.57	1366.59
	6:00 a.m.	1372.47	1374.21	1375.79	1370.72	1366.28	1366.49	1366.63	1366.65
	7:00 a.m.	1372.47	1374.21	1375.79	1370.72	1366.31	1366.53	1366.66	1366.69
	8:00 a.m.	1372.47	1374.20	1375.79	1370.72	1366.33	1366.55	1366.69	1366.71
	9:00 a.m.	1372.48	1374.20	1375.79	1370.72	1366.34	1366.56	1366.70	1366.72
	10:00 a.m.	1372.49	1374.21	1375.80	1370.73	1364.85	1366.28	1366.60	1366.54
	11:00 a.m.	1372.50	1374.21	1375.81	1370.74	1364.72	1365.61	1366.12	1365.97
	12:00 p.m.	1372.50	1374.22	1375.82	1370.75	1365.83	1366.06	1366.28	1366.27
	1:00 p.m.	1372.51	1374.22	1375.83	1370.76	1366.08	1366.29	1366.44	1366.46
	2:00 p.m.	1372.50	1374.22	1375.83	1370.77	1366.21	1366.40	1366.55	1366.57
	3:00 p.m.	1372.53	1374.23	1375.84	1370.78	1366.29	1366.48	1366.61	1366.64
	4:00 p.m.	1372.52	1374.24	1375.85	1370.79	1366.34	1366.51	1366.66	1366.68
	5:00 p.m.	1372.54	1374.24	1375.86	1370.79	1364.60	1366.12	1366.50	1366.41
	6:00 p.m.	1372.53	1374.24	1375.86	1370.80	1365.60	1365.95	1366.26	1366.21
	7:00 p.m.	1372.53	1374.24	1375.86	1370.79	1366.07	1366.25	1366.44	1366.45
	8:00 p.m.	1372.53	1374.24	1375.86	1370.79	1366.24	1366.44	1366.58	1366.60
	9:00 p.m.	1372.53	1374.24	1375.86	1370.80	1366.33	1366.52	1366.66	1366.68
	10:00 p.m.	1372.53	1374.25	1375.87	1370.80	1366.38	1366.58	1366.71	1366.73
	11:00 p.m.	1372.54	1374.25	1375.87	1370.80	1366.41	1366.61	1366.75	1366.77
5/19/96	12:00 a.m.	1372.54	1374.25	1375.87	1370.80	1366.44	1366.64	1366.77	1366.80
	1:00 a.m.	1372.55	1374.26	1375.88	1370.81	1366.45	1366.66	1366.79	1366.81
	2:00 a.m.	1372.54	1374.25	1375.88	1370.81	1364.58	1366.14	1366.55	1366.44
	3:00 a.m.	1372.53	1374.25	1375.87	1370.79	1365.87	1366.17	1366.42	1366.39
	4:00 a.m.	1372.53	1374.24	1375.86	1370.79	1366.19	1366.41	1366.57	1366.59
	5:00 a.m.	1372.53	1374.24	1375.86	1370.79	1366.32	1366.52	1366.67	1366.69

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/19/96 (Cont.)	6:00 a.m.	1372.53	1374.24	1375.86	1370.79	1366.38	1366.59	1366.73	1366.75
	7:00 a.m.	1372.51	1374.23	1375.84	1370.78	1366.42	1366.63	1366.77	1366.79
	8:00 a.m.	1372.51	1374.23	1375.83	1370.77	1366.44	1366.65	1366.78	1366.80
	9:00 a.m.	1372.50	1374.22	1375.82	1370.75	1366.43	1366.64	1366.79	1366.80
	10:00 a.m.	1372.49	1374.20	1375.80	1370.74	1364.89	1366.35	1366.67	1366.60
	11:00 a.m.	1372.49	1374.20	1375.80	1370.74	1364.03	1365.66	1366.18	1366.03
	12:00 p.m.	1372.50	1374.20	1375.79	1370.73	1365.74	1366.03	1366.26	1366.24
	1:00 p.m.	1372.50	1374.20	1375.80	1370.74	1366.06	1366.27	1366.43	1366.45
	2:00 p.m.	1372.50	1374.20	1375.80	1370.74	1366.19	1366.40	1366.54	1366.56
	3:00 p.m.	1372.50	1374.20	1375.80	1370.74	1366.27	1366.47	1366.61	1366.64
	4:00 p.m.	1372.50	1374.19	1375.80	1370.74	1364.35	1365.92	1366.35	1366.24
	5:00 p.m.	1372.50	1374.19	1375.80	1370.74	1365.29	1365.72	1366.08	1366.01
	6:00 p.m.	1372.50	1374.19	1375.80	1370.74	1365.83	1365.97	1366.19	1366.22
	7:00 p.m.	1372.50	1374.19	1375.79	1370.74	1366.09	1366.28	1366.42	1366.46
	8:00 p.m.	1372.51	1374.19	1375.80	1370.75	1366.21	1366.40	1366.54	1366.57
	9:00 p.m.	1372.50	1374.19	1375.79	1370.73	1364.94	1366.29	1366.55	1366.51
	10:00 p.m.	1372.48	1374.19	1375.78	1370.72	1364.01	1365.62	1366.11	1365.97
	11:00 p.m.	1372.49	1374.18	1375.77	1370.72	1365.74	1365.99	1366.21	1366.20
5/20/96	12:00 a.m.	1372.50	1374.18	1375.78	1370.73	1366.03	1366.23	1366.38	1366.40
	1:00 a.m.	1372.51	1374.19	1375.79	1370.73	1366.16	1366.36	1366.49	1366.53
	2:00 a.m.	1372.50	1374.19	1375.79	1370.74	1366.24	1366.44	1366.57	1366.59
	3:00 a.m.	1372.51	1374.19	1375.80	1370.75	1366.29	1366.49	1366.62	1366.65
	4:00 a.m.	1372.50	1374.19	1375.80	1370.76	1366.33	1366.54	1366.66	1366.70
	5:00 a.m.	1372.50	1374.19	1375.79	1370.74	1366.36	1366.57	1366.70	1366.72
	6:00 a.m.	1372.47	1374.17	1375.77	1370.72	1366.37	1366.59	1366.72	1366.74
	7:00 a.m.	1372.46	1374.17	1375.76	1370.71	1366.38	1366.59	1366.72	1366.75
	8:00 a.m.	1372.46	1374.17	1375.75	1370.70	1366.37	1366.59	1366.73	1366.75
	9:00 a.m.	1372.46	1374.16	1375.74	1370.69	1364.61	1366.15	1366.53	1366.43
	10:00 a.m.	1372.45	1374.16	1375.74	1370.69	1365.20	1365.73	1366.14	1366.04
	11:00 a.m.	1372.45	1374.15	1375.73	1370.68	1365.88	1366.13	1366.33	1366.33

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/20/96 (Cont.)	12:00 p.m.	1372.46	1374.15	1375.73	1370.68	1366.07	1366.29	1366.45	1366.47
	1:00 p.m.	1372.47	1374.15	1375.74	1370.69	1366.16	1366.36	1366.51	1366.54
	2:00 p.m.	1372.46	1374.15	1375.74	1370.69	1366.22	1366.44	1366.57	1366.60
	3:00 p.m.	1372.46	1374.14	1375.73	1370.68	1366.27	1366.49	1366.62	1366.67
	4:00 p.m.	1372.46	1374.14	1375.72	1370.68	1365.37	1366.46	1366.64	1366.67
	5:00 p.m.	1372.45	1374.13	1375.72	1370.68	1364.12	1365.74	1366.21	1366.08
	6:00 p.m.	1372.45	1374.13	1375.72	1370.67	1365.58	1365.89	1366.16	1366.13
	7:00 p.m.	1372.45	1374.14	1375.72	1370.66	1365.96	1366.17	1366.35	1366.36
	8:00 p.m.	1372.45	1374.13	1375.71	1370.64	1366.11	1366.31	1366.46	1366.48
	9:00 p.m.	1372.42	1374.12	1375.69	1370.62	1364.57	1366.05	1366.39	1366.31
	10:00 p.m.	1372.42	1374.11	1375.68	1370.62	1364.78	1365.50	1365.98	1365.85
	11:00 p.m.	1372.42	1374.10	1375.67	1370.62	1365.70	1365.95	1366.15	1366.15
5/21/96	12:00 a.m.	1372.42	1374.10	1375.68	1370.63	1365.95	1366.15	1366.31	1366.33
	1:00 a.m.	1372.40	1374.09	1375.67	1370.62	1366.06	1366.27	1366.41	1366.43
	2:00 a.m.	1372.41	1374.09	1375.67	1370.62	1366.11	1366.32	1366.46	1366.48
	3:00 a.m.	1372.41	1374.09	1375.67	1370.62	1366.15	1366.36	1366.50	1366.52
	4:00 a.m.	1372.42	1374.09	1375.67	1370.63	1366.18	1366.40	1366.53	1366.56
	5:00 a.m.	1372.41	1374.09	1375.67	1370.62	1366.21	1366.43	1366.57	1366.59
	6:00 a.m.	1372.40	1374.09	1375.66	1370.62	1366.23	1366.45	1366.59	1366.61
	7:00 a.m.	1372.38	1374.08	1375.65	1370.61	1366.23	1366.46	1366.60	1366.62
	8:00 a.m.	1372.39	1374.07	1375.65	1370.61	1365.48	1366.45	1366.60	1366.61
	9:00 a.m.	1372.39	1374.07	1375.65	1370.60	1364.06	1365.69	1366.17	1366.03
	10:00 a.m.	1372.39	1374.07	1375.64	1370.60	1365.56	1365.87	1366.13	1366.10
	11:00 a.m.	1372.39	1374.06	1375.64	1370.60	1365.89	1366.12	1366.29	1366.30
	12:00 p.m.	1372.40	1374.06	1375.65	1370.61	1366.02	1366.24	1366.39	1366.41
	1:00 p.m.	1372.41	1374.07	1375.66	1370.62	1366.09	1366.31	1366.46	1366.47
	2:00 p.m.	1372.42	1374.08	1375.67	1370.63	1364.31	1365.86	1366.26	1366.16
	3:00 p.m.	1372.42	1374.07	1375.67	1370.60	1365.13	1365.58	1365.96	1365.87
	4:00 p.m.	1372.43	1374.07	1375.68	1370.59	1365.76	1365.99	1366.18	1366.19
	5:00 p.m.	1372.42	1374.06	1375.68	1370.60	1365.98	1366.18	1366.33	1366.35

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/21/96 (Cont.)	6:00 p.m.	1372.42	1374.06	1375.67	1370.62	1366.09	1366.29	1366.43	1366.45
	7:00 p.m.	1372.42	1374.06	1375.67	1370.62	1364.08	1365.67	1366.12	1366.00
	8:00 p.m.	1372.42	1374.06	1375.67	1370.62	1365.42	1365.73	1366.02	1365.98
	9:00 p.m.	1372.41	1374.06	1375.65	1370.62	1365.85	1366.06	1366.23	1366.24
	10:00 p.m.	1372.41	1374.06	1375.65	1370.62	1366.01	1366.20	1366.35	1366.37
	11:00 p.m.	1372.41	1374.06	1375.66	1370.62	1366.09	1366.29	1366.43	1366.46
5/22/96	12:00 a.m.	1372.42	1374.06	1375.66	1370.62	1364.36	1365.88	1366.27	1366.17
	1:00 a.m.	1372.41	1374.06	1375.66	1370.62	1365.34	1365.71	1366.02	1365.97
	2:00 a.m.	1372.42	1374.06	1375.66	1370.63	1365.83	1365.99	1366.20	1366.21
	3:00 a.m.	1372.42	1374.06	1375.67	1370.63	1366.01	1366.20	1366.35	1366.38
	4:00 a.m.	1372.42	1374.06	1375.67	1370.64	1366.10	1366.30	1366.43	1366.46
	5:00 a.m.	1372.42	1374.07	1375.67	1370.64	1366.16	1366.36	1366.49	1366.52
	6:00 a.m.	1372.41	1374.06	1375.67	1370.64	1366.20	1366.40	1366.53	1366.57
	7:00 a.m.	1372.42	1374.07	1375.66	1370.63	1365.31	1366.40	1366.56	1366.57
	8:00 a.m.	1372.42	1374.06	1375.67	1370.64	1364.04	1365.66	1366.14	1365.99
	9:00 a.m.	1372.43	1374.07	1375.68	1370.64	1365.57	1365.87	1366.11	1366.10
	10:00 a.m.	1372.41	1374.06	1375.67	1370.64	1365.93	1366.14	1366.31	1366.32
	11:00 a.m.	1372.45	1374.08	1375.69	1370.66	1366.01	1366.10	1366.30	1366.33
	12:00 p.m.	1372.47	1374.09	1375.71	1370.67	1364.96	1366.14	1366.38	1366.37
	1:00 p.m.	1372.48	1374.09	1375.72	1370.68	1363.93	1365.53	1366.02	1365.88
	2:00 p.m.	1372.48	1374.11	1375.73	1370.69	1365.55	1365.81	1366.06	1366.04
	3:00 p.m.	1372.49	1374.12	1375.75	1370.70	1365.94	1366.12	1366.27	1366.30
	4:00 p.m.	1372.50	1374.11	1375.75	1370.69	1366.10	1366.28	1366.41	1366.45
	5:00 p.m.	1372.47	1374.11	1375.74	1370.69	1366.20	1366.38	1366.51	1366.54
	6:00 p.m.	1372.49	1374.12	1375.76	1370.70	1364.59	1366.06	1366.40	1366.33
	7:00 p.m.	1372.50	1374.13	1375.77	1370.72	1364.79	1365.54	1366.02	1365.89
	8:00 p.m.	1372.48	1374.12	1375.75	1370.70	1365.81	1366.03	1366.23	1366.24
	9:00 p.m.	1372.51	1374.13	1375.76	1370.72	1366.07	1366.25	1366.39	1366.42
	10:00 p.m.	1372.55	1374.15	1375.80	1370.75	1366.20	1366.38	1366.51	1366.55
	11:00 p.m.	1372.53	1374.14	1375.79	1370.74	1366.32	1366.50	1366.62	1366.65

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/23/96	12:00 a.m.	1372.42	1374.08	1375.68	1370.63	1366.36	1366.54	1366.66	1366.69
	1:00 a.m.	1372.45	1374.09	1375.69	1370.64	1364.19	1365.78	1366.23	1366.11
	2:00 a.m.	1372.49	1374.12	1375.72	1370.69	1365.83	1366.09	1366.30	1366.29
	3:00 a.m.	1372.49	1374.19	1375.76	1370.72	1366.11	1366.31	1366.47	1366.49
	4:00 a.m.	1372.47	1374.21	1375.74	1370.71	1366.25	1366.45	1366.59	1366.61
	5:00 a.m.	1372.47	1374.22	1375.74	1370.70	1366.29	1366.50	1366.63	1366.66
	6:00 a.m.	1372.45	1374.21	1375.73	1370.70	1366.33	1366.53	1366.66	1366.69
	7:00 a.m.	1372.45	1374.20	1375.72	1370.69	1366.34	1366.55	1366.68	1366.71
	8:00 a.m.	1372.45	1374.19	1375.72	1370.68	1366.35	1366.57	1366.70	1366.72
	9:00 a.m.	1372.46	1374.18	1375.71	1370.68	1366.36	1366.58	1366.72	1366.74
	10:00 a.m.	1372.47	1374.18	1375.72	1370.69	1364.91	1366.34	1366.64	1366.58
	11:00 a.m.	1372.46	1374.18	1375.73	1370.69	1364.93	1365.71	1366.19	1366.05
	12:00 p.m.	1372.47	1374.18	1375.72	1370.70	1365.89	1366.14	1366.35	1366.34
	1:00 p.m.	1372.48	1374.18	1375.73	1370.71	1366.12	1366.32	1366.48	1366.50
	2:00 p.m.	1372.47	1374.18	1375.73	1370.70	1366.22	1366.43	1366.57	1366.59
	3:00 p.m.	1372.47	1374.18	1375.73	1370.70	1366.28	1366.49	1366.62	1366.64
	4:00 p.m.	1372.46	1374.17	1375.72	1370.70	1366.31	1366.52	1366.66	1366.68
	5:00 p.m.	1372.47	1374.17	1375.72	1370.70	1366.33	1366.55	1366.68	1366.70
	6:00 p.m.	1372.47	1374.18	1375.73	1370.71	1366.36	1366.57	1366.71	1366.72
	7:00 p.m.	1372.46	1374.17	1375.72	1370.70	1364.44	1366.01	1366.44	1366.31
	8:00 p.m.	1372.44	1374.17	1375.70	1370.69	1365.55	1365.92	1366.22	1366.17
	9:00 p.m.	1372.44	1374.15	1375.69	1370.68	1366.00	1366.23	1366.41	1366.41
	10:00 p.m.	1372.43	1374.15	1375.69	1370.66	1366.15	1366.37	1366.52	1366.53
	11:00 p.m.	1372.44	1374.15	1375.69	1370.67	1366.22	1366.44	1366.58	1366.59
5/24/96	12:00 a.m.	1372.45	1374.15	1375.70	1370.67	1366.26	1366.47	1366.62	1366.63
	1:00 a.m.	1372.45	1374.15	1375.71	1370.68	1366.30	1366.52	1366.66	1366.68
	2:00 a.m.	1372.45	1374.15	1375.70	1370.69	1366.33	1366.55	1366.69	1366.70
	3:00 a.m.	1372.45	1374.16	1375.71	1370.69	1366.35	1366.57	1366.71	1366.72
	4:00 a.m.	1372.44	1374.15	1375.70	1370.68	1366.36	1366.59	1366.73	1366.74
	5:00 a.m.	1372.43	1374.14	1375.69	1370.67	1364.33	1365.94	1366.39	1366.25

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/24/96 (Cont.)	6:00 a.m.	1372.39	1374.12	1375.66	1370.65	1365.83	1366.12	1366.36	1366.33
	7:00 a.m.	1372.42	1374.13	1375.67	1370.65	1366.07	1366.30	1366.47	1366.48
	8:00 a.m.	1372.42	1374.12	1375.67	1370.64	1366.18	1366.40	1366.55	1366.56
	9:00 a.m.	1372.41	1374.11	1375.66	1370.63	1366.23	1366.45	1366.60	1366.61
	10:00 a.m.	1372.41	1374.11	1375.65	1370.64	1366.25	1366.47	1366.62	1366.64
	11:00 a.m.	1372.40	1374.11	1375.64	1370.62	1364.71	1366.17	1366.51	1366.43
	12:00 p.m.	1372.41	1374.11	1375.65	1370.63	1364.98	1365.63	1366.09	1365.96
	1:00 p.m.	1372.41	1374.10	1375.65	1370.63	1365.81	1366.06	1366.27	1366.26
	2:00 p.m.	1372.40	1374.10	1375.65	1370.62	1366.03	1366.24	1366.41	1366.42
	3:00 p.m.	1372.41	1374.10	1375.65	1370.62	1366.12	1366.32	1366.47	1366.49
	4:00 p.m.	1372.41	1374.10	1375.64	1370.63	1366.17	1366.39	1366.53	1366.55
	5:00 p.m.	1372.39	1374.09	1375.64	1370.62	1364.73	1366.17	1366.47	1366.41
	6:00 p.m.	1372.40	1374.09	1375.64	1370.62	1365.24	1365.71	1366.09	1366.00
	7:00 p.m.	1372.39	1374.08	1375.63	1370.61	1365.84	1366.05	1366.27	1366.26
	8:00 p.m.	1372.39	1374.08	1375.64	1370.62	1366.02	1366.24	1366.39	1366.40
	9:00 p.m.	1372.37	1374.07	1375.61	1370.60	1366.11	1366.28	1366.45	1366.47
	10:00 p.m.	1372.37	1374.07	1375.60	1370.56	1366.14	1366.29	1366.48	1366.49
	11:00 p.m.	1372.39	1374.07	1375.62	1370.59	1366.14	1366.36	1366.50	1366.52
5/25/96	12:00 a.m.	1372.42	1374.09	1375.65	1370.63	1366.18	1366.40	1366.55	1366.57
	1:00 a.m.	1372.34	1374.07	1375.62	1370.61	1366.24	1366.47	1366.61	1366.62
	2:00 a.m.	1372.38	1374.07	1375.62	1370.60	1366.23	1366.46	1366.60	1366.62
	3:00 a.m.	1372.37	1374.07	1375.61	1370.60	1366.24	1366.47	1366.62	1366.63
	4:00 a.m.	1372.36	1374.06	1375.60	1370.59	1366.25	1366.48	1366.63	1366.64
	5:00 a.m.	1372.36	1374.06	1375.60	1370.58	1366.25	1366.48	1366.63	1366.64
	6:00 a.m.	1372.37	1374.06	1375.61	1370.60	1365.48	1366.47	1366.63	1366.63
	7:00 a.m.	1372.40	1374.07	1375.63	1370.61	1364.94	1365.74	1366.21	1366.07
	8:00 a.m.	1372.35	1374.05	1375.61	1370.60	1365.85	1366.12	1366.33	1366.31
	9:00 a.m.	1372.36	1374.05	1375.60	1370.58	1366.04	1366.28	1366.44	1366.44
	10:00 a.m.	1372.37	1374.05	1375.61	1370.59	1366.12	1366.35	1366.51	1366.51
	11:00 a.m.	1372.37	1374.05	1375.60	1370.59	1366.17	1366.40	1366.55	1366.56

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/25/96 (Cont.)	12:00 p.m.	1372.37	1374.05	1375.61	1370.59	1366.20	1366.43	1366.58	1366.58
	1:00 p.m.	1372.39	1374.06	1375.62	1370.60	1365.06	1366.36	1366.58	1366.55
	2:00 p.m.	1372.40	1374.06	1375.64	1370.62	1364.52	1365.64	1366.13	1365.98
	3:00 p.m.	1372.39	1374.06	1375.63	1370.61	1365.77	1366.03	1366.25	1366.23
	4:00 p.m.	1372.39	1374.07	1375.64	1370.63	1366.00	1366.22	1366.39	1366.39
	5:00 p.m.	1372.39	1374.06	1375.64	1370.63	1366.12	1366.33	1366.48	1366.50
	6:00 p.m.	1372.39	1374.07	1375.64	1370.63	1366.18	1366.39	1366.53	1366.55
	7:00 p.m.	1372.38	1374.06	1375.63	1370.62	1366.21	1366.43	1366.57	1366.59
	8:00 p.m.	1372.37	1374.05	1375.62	1370.61	1366.23	1366.45	1366.59	1366.61
	9:00 p.m.	1372.40	1374.06	1375.63	1370.62	1364.46	1366.00	1366.40	1366.29
	10:00 p.m.	1372.39	1374.06	1375.63	1370.62	1365.52	1365.88	1366.17	1366.12
	11:00 p.m.	1372.38	1374.06	1375.63	1370.62	1365.94	1366.16	1366.35	1366.35
5/26/96	12:00 a.m.	1372.39	1374.07	1375.65	1370.63	1366.09	1366.30	1366.45	1366.46
	1:00 a.m.	1372.41	1374.08	1375.67	1370.65	1366.17	1366.39	1366.53	1366.55
	2:00 a.m.	1372.44	1374.10	1375.69	1370.68	1366.24	1366.45	1366.59	1366.61
	3:00 a.m.	1372.38	1374.09	1375.66	1370.65	1366.30	1366.52	1366.65	1366.67
	4:00 a.m.	1372.40	1374.09	1375.67	1370.65	1366.30	1366.51	1366.65	1366.67
	5:00 a.m.	1372.42	1374.10	1375.68	1370.66	1366.32	1366.55	1366.69	1366.70
	6:00 a.m.	1372.45	1374.14	1375.70	1370.69	1366.34	1366.58	1366.72	1366.73
	7:00 a.m.	1372.42	1374.21	1375.70	1370.68	1366.38	1366.61	1366.75	1366.76
	8:00 a.m.	1372.40	1374.24	1375.70	1370.67	1366.38	1366.61	1366.75	1366.75
	9:00 a.m.	1372.42	1374.26	1375.71	1370.70	1364.31	1365.92	1366.38	1366.24
	10:00 a.m.	1372.44	1374.27	1375.72	1370.71	1365.68	1366.01	1366.28	1366.23
	11:00 a.m.	1372.43	1374.26	1375.72	1370.71	1366.06	1366.29	1366.47	1366.46
	12:00 p.m.	1372.45	1374.26	1375.74	1370.72	1366.20	1366.34	1366.55	1366.54
	1:00 p.m.	1372.44	1374.26	1375.73	1370.72	1366.27	1366.46	1366.62	1366.63
	2:00 p.m.	1372.46	1374.26	1375.74	1370.74	1365.29	1366.47	1366.66	1366.64
	3:00 p.m.	1372.44	1374.26	1375.74	1370.75	1364.13	1365.76	1366.25	1366.09
	4:00 p.m.	1372.44	1374.26	1375.75	1370.75	1365.85	1366.11	1366.33	1366.31
	5:00 p.m.	1372.47	1374.28	1375.77	1370.76	1365.20	1366.28	1366.46	1366.46

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/26/96 (Cont.)	6:00 p.m.	1372.47	1374.31	1375.78	1370.77	1365.95	1366.20	1366.41	1366.40
	7:00 p.m.	1372.50	1374.40	1375.81	NR[b]	1366.19	1366.38	1366.54	1366.56
	8:00 p.m.	1372.47	1374.55	1375.80	NR	1366.32	1366.52	1366.65	1366.46
	9:00 p.m.	1372.43	1374.75	1375.82	NR	1366.38	1366.59	1366.73	1366.52
	10:00 p.m.	1372.48	1375.04	1375.90	NR	1366.43	1366.64	1366.78	1366.59
	11:00 p.m.	1372.50	1375.08	1375.99	NR	1366.47	1366.68	1366.82	1366.64
5/27/96	12:00 a.m.	1372.49	1375.10	1376.06	NR	1366.51	1366.72	1366.86	1366.69
	1:00 a.m.	1372.48	1375.10	1376.13	NR	1365.32	1366.63	1366.85	1366.72
	2:00 a.m.	1372.49	1375.09	1376.19	NR	1365.44	1366.00	1366.42	1366.40
	3:00 a.m.	1372.50	1375.07	1376.23	NR	1366.15	1366.39	1366.59	1366.58
	4:00 a.m.	1372.48	1375.04	1376.25	NR	1366.35	1366.57	1366.72	1366.74
	5:00 a.m.	1372.48	1375.00	1376.28	NR	1366.44	1366.65	1366.79	1366.81
	6:00 a.m.	1372.47	1374.97	1376.29	NR	1366.48	1366.69	1366.83	1366.84
	7:00 a.m.	1372.47	1374.95	1376.31	NR	1366.49	1366.71	1366.85	1366.87
	8:00 a.m.	1372.46	1374.92	1376.30	NR	1366.51	1366.73	1366.87	1366.88
	9:00 a.m.	1372.46	1374.89	1376.31	NR	1366.51	1366.74	1366.88	1366.89
	10:00 a.m.	1372.46	1374.88	1376.31	NR	1366.10	1366.73	1366.88	1366.89
	11:00 a.m.	1372.46	1374.87	1376.32	NR	1364.38	1366.00	1366.48	1366.33
	12:00 p.m.	1372.46	1374.85	1376.31	NR	1365.74	1366.08	1366.37	1366.32
	1:00 p.m.	1372.45	1374.83	1376.30	NR	1366.15	1366.38	1366.56	1366.57
	2:00 p.m.	1372.45	1374.82	1376.31	NR	1366.30	1366.52	1366.67	1366.68
	3:00 p.m.	1372.44	1374.80	1376.30	NR	1366.38	1366.59	1366.74	1366.75
	4:00 p.m.	1372.44	1374.79	1376.29	NR	1366.38	1366.64	1366.78	1366.79
	5:00 p.m.	1372.44	1374.78	1376.28	NR	1364.31	1365.93	1366.40	1366.26
	6:00 p.m.	1372.44	1374.77	1376.27	NR	1365.93	1366.21	1366.43	1366.42
	7:00 p.m.	1372.43	1374.76	1376.27	NR	1366.18	1366.41	1366.57	1366.59
	8:00 p.m.	1372.43	1374.74	1376.26	NR	1366.28	1366.47	1366.63	1366.64
	9:00 p.m.	1372.42	1374.73	1376.24	NR	1366.33	1366.54	1366.68	1366.70
	10:00 p.m.	1372.41	1374.72	1376.23	NR	1366.36	1366.56	1366.72	1366.74
	11:00 p.m.	1372.42	1374.71	1376.23	NR	1366.37	1366.59	1366.73	1366.75

TABLE C.1 (Cont.)

		Shallow-Aquifer Wells				Deep-Aquifer Wells			
Date	Time	MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/28/96	12:00 a.m.	1372.42	1374.70	1376.23	NR	1366.40	1366.63	1366.76	1366.79
	1:00 a.m.	1372.40	1374.69	1376.21	NR	1364.92	1366.38	1366.68	1366.62
	2:00 a.m.	1372.39	1374.67	1376.20	NR	1365.55	1365.98	1366.33	1366.25
	3:00 a.m.	1372.39	1374.67	1376.18	NR	1366.05	1366.30	1366.49	1366.49
	4:00 a.m.	1372.38	1374.65	1376.17	NR	1366.21	1366.44	1366.59	1366.60
	5:00 a.m.	1372.38	1374.64	1376.16	NR	1366.27	1366.50	1366.64	1366.66
	6:00 a.m.	1372.37	1374.63	1376.15	NR	1366.29	1366.53	1366.67	1366.69
	7:00 a.m.	1372.37	1374.63	1376.14	NR	1366.30	1366.54	1366.68	1366.70
	8:00 a.m.	1372.37	1374.62	1376.13	NR	1366.32	1366.56	1366.71	1366.72
	9:00 a.m.	1372.37	1374.61	1376.13	NR	1366.33	1366.57	1366.71	1366.72
	10:00 a.m.	1372.37	1374.60	1376.12	NR	1365.58	1366.57	1366.72	1366.73
	11:00 a.m.	1372.37	1374.59	1376.12	NR	1364.16	1365.79	1366.29	1366.14
	12:00 p.m.	1372.37	1374.59	1376.12	NR	1365.72	1366.03	1366.28	1366.25
	1:00 p.m.	1372.38	1374.58	1376.12	NR	1366.04	1366.27	1366.44	1366.45
	2:00 p.m.	1372.39	1374.58	1376.12	NR	1366.17	1366.39	1366.55	1366.56
	3:00 p.m.	1372.37	1374.57	1376.11	NR	1366.25	1366.47	1366.62	1366.63
	4:00 p.m.	1372.37	1374.57	1376.11	NR	1366.28	1366.51	1366.66	1366.67
	5:00 p.m.	1372.38	1374.56	1376.11	NR	1366.31	1366.54	1366.69	1366.70
	6:00 p.m.	1372.37	1374.56	1376.10	NR	1366.33	1366.56	1366.71	1366.72
	7:00 p.m.	1372.37	1374.55	1376.10	NR	1364.31	1365.92	1366.38	1366.24
	8:00 p.m.	1372.38	1374.55	1376.10	NR	1365.57	1365.93	1366.22	1366.17
	9:00 p.m.	1372.36	1374.54	1376.08	NR	1365.99	1366.22	1366.40	1366.41
	10:00 p.m.	1372.36	1374.53	1376.08	NR	1366.12	1366.35	1366.50	1366.51
	11:00 p.m.	1372.37	1374.53	1376.08	NR	1366.19	1366.42	1366.56	1366.58
5/29/96	12:00 a.m.	1372.37	1374.52	1376.08	NR	1366.24	1366.47	1366.61	1366.63
	1:00 a.m.	1372.37	1374.52	1376.08	NR	1366.27	1366.46	1366.63	1366.64
	2:00 a.m.	1372.37	1374.51	1376.07	NR	1366.30	1366.53	1366.67	1366.69
	3:00 a.m.	1372.36	1374.51	1376.07	NR	1366.32	1366.55	1366.69	1366.71
	4:00 a.m.	1372.36	1374.50	1376.06	NR	1366.33	1366.57	1366.71	1366.72
	5:00 a.m.	1372.36	1374.50	1376.06	NR	1366.34	1366.57	1366.72	1366.73

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/29/96 (Cont.)	6:00 a.m.	1372.35	1374.49	1376.05	NR	1366.34	1366.59	1366.73	1366.74
	7:00 a.m.	1372.35	1374.49	1376.05	NR	1364.34	1365.95	1366.40	1366.27
	8:00 a.m.	1372.35	1374.48	1376.03	NR	1365.75	1366.06	1366.32	1366.28
	9:00 a.m.	1372.35	1374.48	1376.03	NR	1366.03	1366.28	1366.45	1366.45
	10:00 a.m.	1372.35	1374.47	1376.03	NR	1366.14	1366.36	1366.51	1366.53
	11:00 a.m.	1372.35	1374.47	1376.03	NR	1366.17	1366.38	1366.54	1366.56
	12:00 p.m.	1372.35	1374.46	1376.03	NR	1366.21	1366.39	1366.57	1366.59
	1:00 p.m.	1372.36	1374.46	1376.03	NR	1366.12	1366.43	1366.60	1366.62
	2:00 p.m.	1372.37	1374.46	1376.03	NR	1364.14	1365.77	1366.24	1366.10
	3:00 p.m.	1372.37	1374.46	1376.03	NR	1365.73	1366.02	1366.27	1366.24
	4:00 p.m.	1372.38	1374.45	1376.04	NR	1366.04	1366.27	1366.43	1366.44
	5:00 p.m.	1372.38	1374.45	1376.04	NR	1366.17	1366.38	1366.54	1366.55
	6:00 p.m.	1372.37	1374.45	1376.04	NR	1366.23	1366.45	1366.60	1366.61
	7:00 p.m.	1372.38	1374.45	1376.03	NR	1366.27	1366.50	1366.64	1366.65
	8:00 p.m.	1372.38	1374.44	1376.03	NR	1365.21	1366.45	1366.65	1366.63
	9:00 p.m.	1372.36	1374.44	1376.02	NR	1364.33	1365.67	1366.20	1366.04
	10:00 p.m.	1372.37	1374.44	1376.01	NR	1365.80	1366.07	1366.29	1366.27
	11:00 p.m.	1372.36	1374.43	1376.01	NR	1366.05	1366.27	1366.43	1366.44
5/30/96	12:00 a.m.	1372.36	1374.43	1376.01	NR	1366.16	1366.37	1366.52	1366.54
	1:00 a.m.	1372.35	1374.42	1376.00	NR	1366.21	1366.43	1366.57	1366.60
	2:00 a.m.	1372.37	1374.42	1376.00	NR	1366.25	1366.47	1366.62	1366.63
	3:00 a.m.	1372.36	1374.42	1376.01	NR	1366.29	1366.51	1366.65	1366.67
	4:00 a.m.	1372.38	1374.42	1376.01	NR	1366.31	1366.54	1366.68	1366.70
	5:00 a.m.	1372.38	1374.42	1376.01	NR	1366.33	1366.56	1366.71	1366.72
	6:00 a.m.	1372.36	1374.41	1376.00	NR	1366.34	1366.57	1366.71	1366.73
	7:00 a.m.	1372.36	1374.41	1376.00	NR	1365.11	1366.45	1366.68	1366.64
	8:00 a.m.	1372.36	1374.41	1375.99	NR	1364.85	1365.73	1366.21	1366.07
	9:00 a.m.	1372.37	1374.40	1375.99	NR	1365.85	1366.12	1366.33	1366.32
	10:00 a.m.	1372.38	1374.40	1376.01	NR	1366.07	1366.30	1366.46	1366.47
	11:00 a.m.	1372.40	1374.41	1376.01	NR	1366.18	1366.40	1366.55	1366.56

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/30/96 (Cont.)	12:00 p.m.	1372.40	1374.41	1376.02	NR	1366.25	1366.47	1366.61	1366.63
	1:00 p.m.	1372.40	1374.41	1376.02	NR	1366.31	1366.52	1366.66	1366.68
	2:00 p.m.	1372.41	1374.41	1376.02	NR	1366.32	1366.55	1366.69	1366.71
	3:00 p.m.	1372.41	1374.41	1376.03	NR	1366.33	1366.56	1366.71	1366.72
	4:00 p.m.	1372.43	1374.42	1376.04	NR	1365.42	1365.87	1366.25	1366.16
	5:00 p.m.	1372.44	1374.43	1376.05	NR	1366.02	1366.26	1366.46	1366.45
	6:00 p.m.	1372.44	1374.43	1376.06	NR	1366.22	1366.43	1366.59	1366.60
	7:00 p.m.	1372.43	1374.43	1376.06	NR	1366.30	1366.47	1366.64	1366.65
	8:00 p.m.	1372.42	1374.42	1376.05	NR	1366.36	1366.57	1366.71	1366.73
	9:00 p.m.	1372.42	1374.41	1376.03	NR	1366.38	1366.59	1366.73	1366.75
	10:00 p.m.	1372.42	1374.41	1376.03	NR	1366.39	1366.61	1366.75	1366.77
	11:00 p.m.	1372.41	1374.40	1376.02	NR	1365.51	1365.93	1366.28	1366.21
5/31/96	12:00 a.m.	1372.44	1374.41	1376.03	NR	1366.03	1366.26	1366.45	1366.45
	1:00 a.m.	1372.43	1374.41	1376.04	NR	1366.22	1366.43	1366.58	1366.60
	2:00 a.m.	1372.43	1374.41	1376.03	NR	1366.31	1366.52	1366.66	1366.68
	3:00 a.m.	1372.43	1374.41	1376.04	NR	1366.37	1366.58	1366.71	1366.73
	4:00 a.m.	1372.42	1374.40	1376.03	NR	1366.40	1366.62	1366.76	1366.77
	5:00 a.m.	1372.45	1374.41	1376.04	NR	1366.43	1366.64	1366.78	1366.79
	6:00 a.m.	1372.41	1374.39	1376.01	NR	1366.45	1366.67	1366.81	1366.83
	7:00 a.m.	1372.43	1374.40	1376.02	NR	1366.44	1366.67	1366.81	1366.82
	8:00 a.m.	1372.45	1374.41	1376.04	NR	1366.45	1366.68	1366.82	1366.83
	9:00 a.m.	1372.43	1374.40	1376.02	NR	1365.19	1366.69	1366.84	1366.84
	10:00 a.m.	1372.44	1374.40	1376.02	NR	1365.62	1366.02	1366.36	1366.28
	11:00 a.m.	1372.43	1374.40	1376.02	NR	1365.60	1366.04	1366.39	1366.32
	12:00 p.m.	1372.45	1374.41	1376.03	NR	1366.12	1366.35	1366.53	1366.53
	1:00 p.m.	1372.44	1374.44	1376.04	NR	1366.28	1366.49	1366.64	1366.66
	2:00 p.m.	1372.45	1374.47	1376.05	NR	1366.36	1366.57	1366.71	1366.73
	3:00 p.m.	1372.48	1374.50	1376.06	NR	1366.42	1366.63	1366.77	1366.79
	4:00 p.m.	1372.45	1374.50	1376.06	NR	1366.46	1366.68	1366.82	1366.83
	5:00 p.m.	1372.44	1374.49	1376.05	NR	1362.93	1366.01	1366.58	1366.37

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
5/31/96 (Cont.)	6:00 p.m.	1372.46	1374.54	1376.06	NR	1365.90	1366.21	1366.46	1366.42
	7:00 p.m.	1372.44	1374.65	1376.06	NR	1366.23	1366.46	1366.63	1366.42
	8:00 p.m.	1372.44	1374.71	1376.09	NR	1366.35	1366.57	1366.72	1366.52
	9:00 p.m.	1372.45	1374.76	1376.14	NR	1366.40	1366.60	1366.76	1366.59
	10:00 p.m.	1372.41	1374.79	1376.15	NR	1366.43	1366.64	1366.78	1366.62
	11:00 p.m.	1372.42	1374.84	1376.19	NR	1366.41	1366.61	1366.77	1366.65
6/1/96	12:00 a.m.	1372.43	1374.96	1376.22	NR	1366.44	1366.64	1366.79	1366.68
	1:00 a.m.	1372.43	1375.13	1376.27	NR	1366.45	1366.67	1366.82	1366.70
	2:00 a.m.	1372.40	1375.24	1376.31	NR	1366.49	1366.71	1366.86	1366.72
	3:00 a.m.	1372.44	1375.40	1376.40	NR	1366.48	1366.70	1366.85	1366.76
	4:00 a.m.	1372.49	1375.47	1376.53	NR	1366.52	1366.76	1366.90	1366.77
	5:00 a.m.	1372.46	1375.50	1376.60	NR	1365.44	1365.99	1366.42	1366.35
	6:00 a.m.	1372.40	1375.48	1376.63	NR	1366.15	1366.41	1366.61	1366.53
	7:00 a.m.	1372.41	1375.47	1376.70	NR	1366.32	1366.54	1366.71	1366.66
	8:00 a.m.	1372.41	1375.45	1376.73	NR	1366.40	1366.62	1366.77	1366.71
	9:00 a.m.	1372.42	1375.43	1376.77	NR	1366.43	1366.66	1366.80	1366.77
	10:00 a.m.	1372.41	1375.41	1376.79	NR	1366.45	1366.62	1366.79	1366.81
	11:00 a.m.	1372.40	1375.38	1376.80	NR	1365.19	1365.76	1366.28	1366.15
	12:00 p.m.	1372.41	1375.36	1376.82	NR	1366.01	1366.27	1366.47	1366.48
	1:00 p.m.	1372.42	1375.34	1376.83	NR	1366.24	1366.43	1366.60	1366.62
	2:00 p.m.	1372.42	1375.32	1376.84	NR	1366.34	1366.55	1366.70	1366.72
	3:00 p.m.	1372.42	1375.31	1376.84	NR	1366.42	1366.63	1366.76	1366.79
	4:00 p.m.	1372.41	1375.29	1376.84	NR	1365.44	1365.92	1366.31	1366.23
	5:00 p.m.	1372.42	1375.28	1376.84	NR	1366.09	1366.33	1366.51	1366.52
	6:00 p.m.	1372.42	1375.26	1376.83	NR	1366.30	1366.49	1366.66	1366.68
	7:00 p.m.	1372.42	1375.25	1376.83	NR	1366.39	1366.60	1366.74	1366.77
	8:00 p.m.	1372.42	1375.23	1376.81	NR	1366.45	1366.66	1366.79	1366.82
	9:00 p.m.	1372.40	1375.22	1376.80	NR	1366.47	1366.69	1366.82	1366.85
	10:00 p.m.	1372.40	1375.20	1376.79	NR	1366.49	1366.71	1366.84	1366.87
	11:00 p.m.	1372.40	1375.19	1376.79	NR	1365.05	1365.80	1366.33	1366.18

TABLE C.1 (Cont.)

		Shallow-Aquifer Wells				Deep-Aquifer Wells			
Date	Time	MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
6/2/96	12:00 a.m.	1372.42	1375.19	1376.79	NR	1366.01	1366.28	1366.48	1366.48
	1:00 a.m.	1372.41	1375.17	1376.78	NR	1366.26	1366.46	1366.62	1366.64
	2:00 a.m.	1372.40	1375.16	1376.77	NR	1366.37	1366.58	1366.71	1366.74
	3:00 a.m.	1372.38	1375.14	1376.74	NR	1366.43	1366.64	1366.77	1366.80
	4:00 a.m.	1372.40	1375.14	1376.75	NR	1366.45	1366.67	1366.79	1366.83
	5:00 a.m.	1372.41	1375.13	1376.75	NR	1366.49	1366.70	1366.84	1366.87
	6:00 a.m.	1372.40	1375.12	1376.74	NR	1366.51	1366.73	1366.87	1366.89
	7:00 a.m.	1372.40	1375.11	1376.73	NR	1366.53	1366.75	1366.88	1366.91
	8:00 a.m.	1372.40	1375.10	1376.72	NR	1366.54	1366.76	1366.90	1366.92
	9:00 a.m.	1372.40	1375.09	1376.71	NR	1366.54	1366.77	1366.90	1366.93
	10:00 a.m.	1372.40	1375.08	1376.70	NR	1365.43	1365.96	1366.38	1366.28
	11:00 a.m.	1372.41	1375.07	1376.70	NR	1366.09	1366.33	1366.54	1366.54
	12:00 p.m.	1372.42	1375.07	1376.69	NR	1366.27	1366.47	1366.64	1366.66
	1:00 p.m.	1372.42	1375.06	1376.70	NR	1366.37	1366.58	1366.72	1366.75
	2:00 p.m.	1372.43	1375.06	1376.70	NR	1366.43	1366.63	1366.77	1366.80
	3:00 p.m.	1372.44	1375.06	1376.70	NR	1363.84	1365.74	1366.41	1366.18
	4:00 p.m.	1372.45	1375.05	1376.70	NR	1365.89	1366.17	1366.41	1366.40
	5:00 p.m.	1372.45	1375.04	1376.70	NR	1366.24	1366.45	1366.61	1366.63
	6:00 p.m.	1372.46	1375.04	1376.70	NR	1366.39	1366.59	1366.73	1366.76
	7:00 p.m.	1372.44	1375.04	1376.69	NR	1366.48	1366.67	1366.80	1366.84
	8:00 p.m.	1372.44	1375.03	1376.67	NR	1366.50	1366.70	1366.83	1366.86
	9:00 p.m.	1372.43	1375.02	1376.65	NR	1366.53	1366.72	1366.86	1366.89
	10:00 p.m.	1372.42	1375.01	1376.64	NR	1366.54	1366.75	1366.88	1366.91
	11:00 p.m.	1372.42	1375.00	1376.63	NR	1365.49	1365.98	1366.36	1366.28
6/3/96	12:00 a.m.	1372.42	1374.99	1376.62	NR	1366.12	1366.36	1366.55	1366.56
	1:00 a.m.	1372.43	1374.99	1376.62	NR	1366.31	1366.52	1366.67	1366.70
	2:00 a.m.	1372.43	1374.98	1376.61	NR	1366.40	1366.61	1366.75	1366.78
	3:00 a.m.	1372.43	1374.98	1376.61	NR	1366.46	1366.67	1366.79	1366.83
	4:00 a.m.	1372.43	1374.97	1376.60	NR	1366.50	1366.71	1366.84	1366.87
	5:00 a.m.	1372.44	1374.96	1376.59	NR	1366.53	1366.74	1366.87	1366.90

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
6/3/96 (Cont.)	6:00 a.m.	1372.43	1374.96	1376.59	NR	1366.55	1366.76	1366.90	1366.92
	7:00 a.m.	1372.44	1374.96	1376.60	NR	1366.56	1366.78	1366.91	1366.94
	8:00 a.m.	1372.45	1374.95	1376.59	NR	1362.90	1366.10	1366.67	1366.47
	9:00 a.m.	1372.46	1374.95	1376.60	NR	1365.76	1366.11	1366.40	1366.35
	10:00 a.m.	1372.47	1374.95	1376.60	NR	1366.19	1366.42	1366.59	1366.61
	11:00 a.m.	1372.47	1374.94	1376.60	NR	1366.36	1366.57	1366.71	1366.74
	12:00 p.m.	1372.48	1374.94	1376.60	NR	1366.45	1366.64	1366.78	1366.81
	1:00 p.m.	1372.48	1374.94	1376.59	NR	1364.41	1365.81	1366.44	1366.23
	2:00 p.m.	1372.48	1374.93	1376.59	NR	1365.98	1366.24	1366.46	1366.46
	3:00 p.m.	1372.48	1374.93	1376.59	NR	1366.27	1366.48	1366.63	1366.66
	4:00 p.m.	1372.49	1374.94	1376.60	NR	1366.42	1366.60	1366.74	1366.77
	5:00 p.m.	1372.49	1374.93	1376.59	NR	1366.50	1366.66	1366.81	1366.84
	6:00 p.m.	1372.50	1374.93	1376.60	NR	1366.55	1366.74	1366.86	1366.90
	7:00 p.m.	1372.49	1374.92	1376.58	NR	1366.59	1366.79	1366.91	1366.95
	8:00 p.m.	1372.48	1374.92	1376.57	NR	1363.86	1366.03	1366.63	1366.42
	9:00 p.m.	1372.48	1374.91	1376.56	NR	1366.04	1366.31	1366.55	1366.54
	10:00 p.m.	1372.47	1374.90	1376.55	NR	1366.32	1366.52	1366.68	1366.71
	11:00 p.m.	1372.48	1374.90	1376.55	NR	1366.44	1366.64	1366.78	1366.82
6/4/96	12:00 a.m.	1372.48	1374.90	1376.55	NR	1366.51	1366.71	1366.84	1366.88
	1:00 a.m.	1372.49	1374.90	1376.55	NR	1366.55	1366.75	1366.88	1366.91
	2:00 a.m.	1372.50	1374.89	1376.55	NR	1366.57	1366.78	1366.91	1366.94
	3:00 a.m.	1372.48	1374.89	1376.54	NR	1366.60	1366.82	1366.94	1366.97
	4:00 a.m.	1372.48	1374.88	1376.53	NR	1366.61	1366.82	1366.95	1366.98
	5:00 a.m.	1372.48	1374.88	1376.52	NR	1366.63	1366.84	1366.97	1366.99
	6:00 a.m.	1372.49	1374.88	1376.53	NR	1366.63	1366.85	1366.98	1367.01
	7:00 a.m.	1372.49	1374.88	1376.53	NR	1366.65	1366.87	1367.01	1367.03
	8:00 a.m.	1372.49	1374.87	1376.51	NR	1364.64	1365.96	1366.61	1366.38
	9:00 a.m.	1372.50	1374.87	1376.52	NR	1366.10	1366.38	1366.62	1366.59
	10:00 a.m.	1372.51	1374.87	1376.53	NR	1366.38	1366.59	1366.76	1366.77
	11:00 a.m.	1372.51	1374.87	1376.53	NR	1366.49	1366.68	1366.83	1366.85

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
6/4/96 (Cont.)	12:00 p.m.	1372.51	1374.86	1376.53	NR	1366.56	1366.75	1366.89	1366.92
	1:00 p.m.	1372.52	1374.87	1376.54	NR	1366.59	1366.79	1366.92	1366.95
	2:00 p.m.	1372.53	1374.87	1376.54	NR	1366.62	1366.83	1366.95	1366.98
	3:00 p.m.	1372.53	1374.87	1376.54	NR	1365.71	1366.13	1366.48	1366.41
	4:00 p.m.	1372.54	1374.87	1376.55	NR	1366.28	1366.50	1366.67	1366.69
	5:00 p.m.	1372.54	1374.87	1376.55	NR	1366.47	1366.66	1366.81	1366.83
	6:00 p.m.	1372.55	1374.87	1376.55	NR	1366.57	1366.76	1366.89	1366.92
	7:00 p.m.	1372.53	1374.86	1376.54	NR	1365.08	1365.90	1366.46	1366.29
	8:00 p.m.	1372.54	1374.86	1376.53	NR	1366.16	1366.40	1366.61	1366.61
	9:00 p.m.	1372.52	1374.85	1376.51	NR	1366.42	1366.61	1366.76	1366.79
	10:00 p.m.	1372.52	1374.85	1376.51	NR	1366.52	1366.71	1366.85	1366.88
	11:00 p.m.	1372.54	1374.85	1376.52	NR	1366.58	1366.77	1366.90	1366.94
6/5/96	12:00 a.m.	1372.55	1374.85	1376.52	NR	1366.63	1366.82	1366.95	1366.98
	1:00 a.m.	1372.55	1374.85	1376.52	NR	1365.39	1365.99	1366.46	1366.35
	2:00 a.m.	1372.55	1374.85	1376.53	NR	1366.22	1366.45	1366.65	1366.66
	3:00 a.m.	1372.55	1374.85	1376.52	NR	1366.45	1366.64	1366.79	1366.82
	4:00 a.m.	1372.55	1374.85	1376.52	NR	1366.55	1366.74	1366.87	1366.91
	5:00 a.m.	1372.55	1374.84	1376.52	NR	1366.61	1366.80	1366.93	1366.97
	6:00 a.m.	1372.55	1374.84	1376.51	NR	1366.65	1366.85	1366.97	1367.01
	7:00 a.m.	1372.56	1374.84	1376.51	NR	1366.68	1366.88	1367.00	1367.04
	8:00 a.m.	1372.55	1374.84	1376.51	NR	1366.71	1366.91	1367.04	1367.06
	9:00 a.m.	1372.56	1374.84	1376.51	NR	1365.03	1366.00	1366.59	1366.40
	10:00 a.m.	1372.59	1374.85	1376.54	NR	1366.20	1366.46	1366.67	1366.67
	11:00 a.m.	1372.57	1374.85	1376.53	NR	1366.48	1366.69	1366.84	1366.87
	12:00 p.m.	1372.59	1374.86	1376.55	NR	1366.60	1366.78	1366.92	1366.95
	1:00 p.m.	1372.56	1374.84	1376.52	NR	1366.65	1366.80	1366.96	1366.99
	2:00 p.m.	1372.59	1374.84	1376.52	NR	1364.11	1366.69	1366.95	1366.91
	3:00 p.m.	1372.59	1374.84	1376.53	NR	1365.90	1366.24	1366.53	1366.49
	4:00 p.m.	1372.59	1374.84	1376.52	NR	1366.36	1366.56	1366.73	1366.75
	5:00 p.m.	1372.60	1374.84	1376.53	NR	1366.54	1366.71	1366.85	1366.88

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
6/5/96 (Cont.)	6:00 p.m.	1372.59	1374.83	1376.52	NR	1366.63	1366.81	1366.93	1366.97
	7:00 p.m.	1372.59	1374.83	1376.51	NR	1364.87	1365.97	1366.57	1366.38
	8:00 p.m.	1372.59	1374.83	1376.51	NR	1366.19	1366.42	1366.64	1366.64
	9:00 p.m.	1372.59	1374.83	1376.51	NR	1366.46	1366.64	1366.79	1366.82
	10:00 p.m.	1372.59	1374.83	1376.51	NR	1366.59	1366.77	1366.91	1366.93
	11:00 p.m.	1372.59	1374.83	1376.51	NR	1366.66	1366.84	1366.97	1367.00
6/6/96	12:00 a.m.	1372.59	1374.82	1376.50	NR	1365.19	1365.97	1366.53	1366.37
	1:00 a.m.	1372.59	1374.82	1376.50	NR	1366.23	1366.46	1366.66	1366.66
	2:00 a.m.	1372.57	1374.81	1376.48	NR	1366.47	1366.66	1366.81	1366.84
	3:00 a.m.	1372.58	1374.81	1376.47	NR	1366.56	1366.75	1366.88	1366.92
	4:00 a.m.	1372.58	1374.80	1376.48	NR	1366.61	1366.80	1366.93	1366.96
	5:00 a.m.	1372.55	1374.79	1376.44	NR	1366.66	1366.85	1366.97	1367.01
	6:00 a.m.	1372.54	1374.78	1376.43	NR	1366.66	1366.85	1366.98	1367.01
	7:00 a.m.	1372.61	1374.81	1376.48	NR	1366.66	1366.86	1366.99	1367.02
	8:00 a.m.	1372.53	1374.78	1376.43	NR	1366.72	1366.92	1367.05	1367.08
	9:00 a.m.	1372.56	1374.78	1376.42	NR	1366.70	1366.91	1367.04	1367.07
	10:00 a.m.	1372.55	1374.77	1376.42	NR	1363.49	1366.48	1366.92	1366.78
	11:00 a.m.	1372.55	1374.77	1376.42	NR	1366.09	1366.40	1366.65	1366.62
	12:00 p.m.	1372.55	1374.76	1376.41	NR	1366.41	1366.63	1366.79	1366.81
	1:00 p.m.	1372.55	1374.76	1376.41	NR	1366.52	1366.73	1366.87	1366.89
	2:00 p.m.	1372.56	1374.76	1376.41	NR	1365.43	1365.92	1366.35	1366.25
	3:00 p.m.	1372.57	1374.76	1376.41	NR	1366.15	1366.38	1366.57	1366.58
	4:00 p.m.	1372.57	1374.75	1376.41	NR	1366.38	1366.57	1366.72	1366.75
	5:00 p.m.	1372.56	1374.75	1376.40	NR	1366.49	1366.68	1366.82	1366.84
	6:00 p.m.	1372.56	1374.74	1376.40	NR	1366.54	1366.71	1366.85	1366.88
	7:00 p.m.	1372.56	1374.74	1376.39	NR	1366.59	1366.78	1366.91	1366.94
	8:00 p.m.	1372.55	1374.73	1376.38	NR	1365.55	1366.03	1366.42	1366.33
	9:00 p.m.	1372.54	1374.73	1376.37	NR	1366.20	1366.42	1366.61	1366.62
	10:00 p.m.	1372.53	1374.72	1376.36	NR	1366.40	1366.60	1366.74	1366.77
	11:00 p.m.	1372.52	1374.71	1376.35	NR	1366.49	1366.68	1366.81	1366.85

TABLE C.1 (Cont.)

Date	Time	Shallow-Aquifer Wells				Deep-Aquifer Wells			
		MW 1S	MW 2S	MW 3S	SB02	MW 1D	MW 2D	MW 3D	SB01
6/7/96	12:00 a.m.	1372.54	1374.71	1376.35	NR	1366.53	1366.72	1366.86	1366.89
	1:00 a.m.	1372.53	1374.71	1376.35	NR	1366.56	1366.77	1366.89	1366.93
	2:00 a.m.	1372.54	1374.71	1376.35	NR	1366.58	1366.79	1366.92	1366.95
	3:00 a.m.	1372.53	1374.70	1376.35	NR	1366.60	1366.81	1366.94	1366.97
	4:00 a.m.	1372.53	1374.70	1376.34	NR	1366.62	1366.82	1366.96	1366.99
	5:00 a.m.	1372.53	1374.69	1376.34	NR	1366.63	1366.84	1366.97	1366.99
	6:00 a.m.	1372.52	1374.69	1376.33	NR	1366.63	1366.84	1366.97	1367.00
	7:00 a.m.	1372.52	1374.69	1376.32	NR	1364.65	1365.92	1366.56	1366.33
	8:00 a.m.	1372.52	1374.68	1376.32	NR	1366.08	1366.36	1366.59	1366.57
	9:00 a.m.	1372.52	1374.68	1376.31	NR	1366.36	1366.58	1366.74	1366.75
	10:00 a.m.	1372.52	1374.68	1376.32	NR	1366.45	1366.62	1366.78	1366.81
	11:00 a.m.	1372.52	1374.67	1376.31	NR	1366.53	1366.73	1366.86	1366.89
	12:00 p.m.	1372.54	1374.67	1376.31	NR	1366.56	1366.76	1366.90	1366.92
	1:00 p.m.	1372.53	1374.67	1376.32	NR	1366.58	1366.79	1366.93	1366.95
	2:00 p.m.	1372.53	1374.66	1376.31	NR	1365.32	1365.89	1366.36	1366.24
	3:00 p.m.	1372.54	1374.67	1376.31	NR	1366.12	1366.36	1366.56	1366.56

[a] No data.

[b] Not recorded; Well Sentinel™ in SB02 went off-line at 7:00 p.m. on 5/26/96.

Appendix D:

Survey Data

TABLE D.1 Sampling Locations at Agenda, Kansas

Location	Horizontal Location[a] Northing	Horizontal Location[a] Easting	Representative Ground Surface Elevation[b] (ft AMSL)	Reference Location (ft AMSL)	Description of Reference Elevation Location
Domestic Wells					
DW01	501229.00	2159952.97	-	-	Estimated coordinates of well at Anderson residence.
DW02	501403.57	2159963.94	-	-	Estimated coordinates of well at Hicks residence.
DW03	499798.93	2159273.04	-	-	Estimated coordinates of well at Bill Pickard, Sr., residence.
DW04	502217.02	2161499.97	-	-	Estimated coordinates of well at Kalivoda residence.
DW05	501264.24	2159784.55	-	-	Estimated coordinates of well at Lowell residence.
DW06	501052.57	2159812.53	-	-	Estimated coordinates of well at Hicks property (old Berrier garage).
DW07	501312.90	2159963.21	-	-	Estimated coordinates of well at Hicks abandoned house.
DW08	499732.68	2159775.21	-	-	Estimated coordinates of old well near Havel residence.
DW09	500606.50	2160149.23	-	-	Estimated coordinates of well at Dana Jones residence.
DW10	500124.25	2159299.89	-	-	Estimated coordinates of abandoned well at Bill Pickard, Sr., residence.
Public Well					
PSW 1	500271.67	2159741.68	-	-	Estimated coordinates of well KS00005265.
KDHE Monitoring Wells					
MW 1S	500391.88	2159657.43	1411.30	1414.16	Top of KDHE MW 1S casing.
MW 1D	500378.83	2159657.13	1411.10	1414.08	Top of KDHE MW 1D casing.
MW 2S	501225.85	2159618.39	1412.40	1412.12	Top of KDHE MW 2S casing.
MW 2D	501220.95	2159626.87	1412.50	1412.37	Top of KDHE MW 2D casing.
MW 3S	501692.94	2159525.21	1396.80	1399.74	Top of KDHE MW 3S casing.
MW 3D	501705.05	2159525.37	1396.80	1399.72	Top of KDHE MW 3D casing.
Temporary Well					
SB01	501073.50	2160101.34	1412.10	1411.76	Top of 4-in. well casing.

TABLE D.1 (Cont.)

Location	Horizontal Location[a] Northing	Horizontal Location[a] Easting	Representative Ground Surface Elevation[b] (ft AMSL)	Reference Location (ft AMSL)	Description of Reference Elevation Location
Cone Penetrometer Locations					
SB02	501081.98	2160103.42	1412.10	1411.81	Top of piezometer casing.
SB03A	500299.66	2159719.32	1413.50	1413.50	Average ground.
SB03B	500315.43	2159721.07	1413.70	1413.70	Average ground.
SB04	500608.11	2159701.14	1413.30	1413.30	Average ground.
SB05	501227.69	2159654.89	1412.10	1412.10	Average ground.
SB06	500989.48	2159653.93	1412.70	1412.70	Average ground.
SB07	500884.14	2159653.35	1412.10	1412.10	Average ground.
SB08	501408.60	2159541.03	1410.30	1409.74	Top of abandoned, plugged piezometer casing.
SB09	501366.47	2159595.25	1412.20	1412.20	Average ground.
SB10	501293.41	2159597.84	1412.10	1412.10	Average ground.

[a] Horizontal coordinates of target location centers are shown, not points selected to represent ground elevations or to provide reference elevations. Northings and Eastings are Kansas State Plane Coordinates shown in feet. Horizontal datum is converted North American Datum (NAD) 27.

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

Appendix E:

Vegetation and Surface Soil Sample Data

TABLE E.1 Vegetation and Surface Soil Samples Collected during the Phase I Field Investigation at Agenda, Kansas

Location	Sample	Sample Depth (ft)	Sample Date	Sample Description
Vegetation Samples				
007N-007W	AN007N-007W-V-04905	NA[a]	5/8/96	Target grass species (downy bromegrass) sampled. Roots rinsed clean with deionized (DI) water and shaken dry.
063N-006W	AN063N-006W-V-04907	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and shaken dry.
100N-005W	AN100N-005W-V-04909	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and shaken dry.
150N-005W	AN150N-005W-V-04911	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and shaken dry.
180N-005W	AN180N-005W-V-04913	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and shaken dry.
242N-005W	AN242N-005W-V-04915	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
300N-005W	AN300N-005W-V-04917	NA	5/8/96	Mixed target and nontarget grass species sampled. Cleaned dry, without use of water.
300N-050W	AN300N-050W-V-04919	NA	5/8/96	Sampled grass species likely foxtail. Cleaned dry, without use of water.
250N-050W	AN250N-050W-V-04921	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
200N-050W	AN200N-050W-V-04923	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
150N-050W	AN150N-050W-V-04925	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
100N-055W	AN100N-055W-V-04927	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
050N-055W	AN050N-055W-V-04929	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
050N-027W	AN050N-027W-V-04931	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and blotted dry.
100N-027W	AN100N-027W-V-04933	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and blotted dry.
150N-027W	AN150N-027W-V-04935	NA	5/8/96	Target grass species sampled. Roots rinsed clean with DI water and blotted dry.
200N-027W	AN200N-027W-V-04937	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
250N-100W	AN250N-100W-V-04939	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
300N-150W	AN300N-150W-V-04941	NA	5/8/96	Nontarget grass species sampled downgradient from landfill. Cleaned dry, without use of water.
081N-015W	AN081N-015W-V-04943	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water. Collected between first and second circular bin (south to north) in east bin row. Possible herbicide use.
100N-021W	AN100N-021W-V-04945	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water. Collected between second and third circular bin (south to north) in east bin row.
100N-067W	AN100N-067W-V-04947	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water. Collected between second and third circular bin (south to north) in west bin row.
150N-070W	AN150N-070W-V-04949	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.
Water tower	ANWATOW-V-04953	NA	5/8/96	Nontarget grass species sampled. Cleaned dry, without use of water. Collected at base of former water tower.
Water tower	ANWATOW-V-04955	NA	5/8/96	Target grass species sampled. Cleaned dry, without use of water.

TABLE E.1 (Cont.)

Location	Sample	Sample Depth (ft)	Sample Date	Sample Description
Surface Soil Samples				
007N-007W	AN007N-007W-S-04906	0.5-1	5/8/96	Disturbed fill or mixed soil.
063N-006W	AN063N-006W-S-04908	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
100N-005W	AN100N-005W-S-04910	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
150N-005W	AN150N-005W-S-04912	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
180N-005W	AN180N-005W-S-04914	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
242N-005W	AN242N-005W-S-04916	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
300N-005W	AN300N-005W-S-04918	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
300N-050W	AN300N-050W-S-04920	0.5-1	5/8/96	Disturbed fill or mixed soil in bulldozer depression.
250N-050W	AN250N-050W-S-04922	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
200N-050W	AN200N-050W-S-04924	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
150N-050W	AN150N-050W-S-04926	0.5-1	5/8/96	Soil-rock mixture collected from limestone driveway.
100N-055W	AN100N-055W-S-04928	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
050N-055W	AN050N-055W-S-04930	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
050N-027W	AN050N-027W-S-04932	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
100N-027W	AN100N-027W-S-04934	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
150N-027W	AN150N-027W-S-04936	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
200N-027W	AN200N-027W-S-04938	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
250N-100W	AN250N-100W-S-04940	0.5-1	5/8/96	Black, clayey loam. Top 2 in. of soil moist, desiccated below. No obvious disturbance of near-surface soil.
300N-150W	AN300N-150W-S-04942	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
081N-015W	AN081N-015W-S-04944	0.5-1	5/8/96	Moist, black, clayey loam. Collected between first and second circular bin (south to north) in east bin row. Possible herbicide use.
100N-021W	AN100N-021W-S-04946	0.5-1	5/8/96	Moist, black, clayey loam. Collected between second and third circular bin (south to north) in east bin row.
100N-067W	AN100N-067W-S-04948	0.5-1	5/8/96	Moist, black, clayey loam. Collected between second and third circular bin (south to north) in west bin row.
150N-070W	AN150N-070W-S-04950	0.5-1	5/8/96	Moist, black, clayey loam. No obvious disturbance of near-surface soil.
Vegetation Duplicate Samples Collected for QA/QC				
150N-070W	AN150N-070W-V-04951	NA	5/8/96	Duplicate of sample AN150N-070W-V-04949.
Water tower	ANWATOW-V-04954	NA	5/8/96	Duplicate of sample ANWATOW-V-04953.
Water tower	ANWATOW-V-04956	NA	5/8/96	Duplicate of sample ANWATOW-V-04955.

TABLE E.1 (Cont.)

Location	Sample	Sample Depth (ft)	Sample Date	Sample Description
Vegetation Standard Samples Used for QA/QC				
QC	YKGCGR-V-04957	NA	5/9/96	Vegetation sample from York Gun Club, York, Nebraska, the site of previously determined vegetation contamination. Sample used as a standard QC sample.
QC	YKGCGR-V-04958	NA	5/9/96	QC standard vegetation sample from York, Nebraska. Duplicate of YKGCGR-V-04957.
Surface Soil Duplicate Sample Collected for QA/QC				
150N-070W	AN150N-070W-S-04952	0.5-1	5/8/96	Duplicate of sample AN150N-070W-S-04950.

[a] NA, depth not applicable.

Appendix F:

Groundwater Sample Data

TABLE F.1 Groundwater Samples Collected during the Phase I Field Investigation at Agenda, Kansas

Location	Sample	Depth (ft)	Date	Sample Description
Domestic Well Samples				
DW01	ANDW01-W-04850	-[a]	4/17/96	Drinking water source at residence. Owner reported well depth as 110 ft with water depth of 75 ft.
DW02	ANDW02-W-04851	-	4/17/96	Owner reported that the 60-ft well was probably drilled when house was built in 1912.
DW03	ANDW03-W-04852	-	4/17/96	Owner reported that well is 40 ft deep.
DW04	ANDW04-W-04855	-	4/18/96	Owner reported that well is 200 ft deep with water at 90 ft. Sampled as a background well, instead of the Hebert well intended for sampling in the *Work Plan*. Resident unavailable at Hebert location.
DW05	ANDW05-W-04862	-	4/19/96	Former owner (George Hicks) reported that well is about 110 ft deep and probably has steel casing.
DW06	ANDW06-W-04863	-	4/19/96	Owner reported that well is about 60 ft deep with 6-in. casing. Water is pumped by a hand pump converted to motor drive. Water is used for drinking and to supply a live-bait tank.
DW07	ANDW07-W-04864	-	4/19/96	Owner reported well depth as 60 ft. Sample collected after purging 15 gal with hand-driven pump. Inadequate purge with significant aeration. Result will not be conclusive.
DW08	ANDW08-W-04866	-	4/20/96	Well depth = 56 ft. Top of water = 37.45 ft. Water purged prior to sampling = 4.4 well volumes.
DW09	ANDW09-W-04868	-	4/22/96	Depth of well = 51.41 ft. Depth to water = 33.6 ft.
DW10	ANDW10-W-04876	-	4/23/96	Depth of well = 42.45 ft. Depth to water = 24.5 ft.
Public Well Sample				
PWS 1	ANPW01-W-04869	-	4/22/96	High-pressure flow was reduced for sampling, resulting in aeration of sample.
Observation Well Samples from KDHE Monitoring Wells				
MW 1S	ANMW01S-W-04891	44.0-54.0	4/23/96	Depth of well = 54.25 ft. Depth to water = 41.72 ft.
MW 1D	ANMW01D-W-04890	130.0-140.0	4/23/96	Depth of well = 141.55 ft. Depth to water = 48.86 ft.
MW 2S	ANMW02S-W-04877	49.0-59.0	4/23/96	Depth of well = 56.9 ft. Depth to water = 38.0 ft.
MW 2D	ANMW02D-W-04878	129.0-139.0	4/23/96	Depth of well = 138.8 ft. Depth to water = 45.85 ft.
MW 3S	ANMW03S-W-04901	38.0-48.0	4/24/96	Depth of well = 48.18 ft. Depth to water = 24.04 ft.
MW 3D	ANMW03D-W-04902	104.0-114.0	4/24/96	Depth of well = 121.6 ft. Depth to water = 33.21 ft.
Observation Well Sample from Temporary Well				
SB01	ANSB01-W-04879	118.9-128.9	4/24/96	Depth of well from top of casing = 133.7 ft. Depth to water from top of casing = 45.05 ft.

TABLE F.1 (Cont.)

Location	Sample	Depth (ft)	Date	Sample Description
Cone Penetrometer Samples				
SB02	ANSB02-W-04880	64.0-70.0	4/23/96	Slow to fill: 3.5 ft of water in rods after 1.5 hr. Vacuum applied to collect sample for metals analysis.
SB07	ANSB07-W-04881	46.0-49.0	4/24/96	Immediate water. Water level = 48.4 ft to top of rod, 38.3 ft to ground surface.
SB08	ANSB08-W-04882	48.5-57.5	4/25/96	Water came in fast.
SB09	ANSB09-W-04883	52.0-58.0	4/26/96	No water available at depth of 55-58 ft. Opened screen at depth of 52-58 ft and got water immediately.
SB10	ABSB10-W-04885	53.0-56.0	4/26/96	Water came in fast. Very silty.

[a] Depth unknown.

TABLE F.2 Organic Analytical Results for Groundwater Samples Collected during the Phase I Field Investigation at Agenda, Kansas

Location	Sample	Depth (ft)	Carbon Tetrachloride (µg/L)	Chloroform (µg/L)
Domestic Wells				
DW01	ANDW01-W-04850	-[a]	< 5	< 5
DW02	ANDW02-W-04851	-	< 5	< 5
DW03	ANDW03-W-04852	-	< 5	< 5
DW04	ANDW04-W-04855	-	< 5	< 5
DW05	ANDW05-W-04862	-	< 5	< 5
DW06	ANDW06-W-04863	-	< 5	< 5
DW07	ANDW07-W-04864	-	< 5	< 5
DW08	ANDW08-W-04866	-	< 5	< 5
DW09	ANDW09-W-04868	-	< 5	< 5
DW10	ANDW10-W-04876	-	< 5	< 5
Public Well				
PWS 1	ANPW01-W-04869	-	6	7
KDHE Monitoring Wells				
MW 1S	ANMW01S-W-04891	44-54	< 5	< 5
MW 1D	ANMW01D-W-04890	130-140	65	< 5
MW 2S	ANMW02S-W-04877	49-59	< 5	< 5
MW 2D	ANMW02D-W-04878	129-139	6	< 5
MW 3S	ANMW03S-W-04901	38-48	< 5	< 5
MW 3D	ANMW03D-W-04902	104-114	< 5	< 5
Temporary Well				
SB01	ANSB01-W-04879	118.9-128.9	< 5	< 5
Cone Penetrometer Locations				
SB02	ANSB02-W-04880	64-70	< 5	< 5
SB07	ANSB07-W-04881	46-49	< 5	< 5
SB08	ANSB08-W-04882	48.5-57.5	< 5	< 5
SB09	ANSB09-W-04883	52-58	< 5	< 5
SB10	ABSB10-W-04885	53-56	< 5	< 5

[a] Depth unknown.

TABLE F.3 Inorganic Analytical Results for Groundwater Samples Collected during the Phase I Field Investigation at Agenda, Kansas

Location	Sample	Depth (ft)	Concentration (µg/L)						
			Aluminum	Calcium	Chloride	Iron	Magnesium	Manganese	Nitrate
Domestic Wells									
DW01	ANDW01-W-04850	-[a]	< 200	135000	36700	139	11700	< 15	9800
DW02	ANDW02-W-04851	-	< 200	152000	40400	109	13100	< 15	14500
DW03	ANDW03-W-04852	-	< 200	103000	22300	< 100	14300	< 15	13700
DW04	ANDW04-W-04855	-	< 200	153000	45300	< 100	14100	< 15	3400
DW05	ANDW05-W-04862	-	< 200	136000	25500	< 100	11100	< 15	13500
DW06	ANDW06-W-04863	-	< 200	166000	28400	< 100	14000	< 15	27400
DW08	ANDW08-W-04866	-	< 200	143000	19800	115	19300	< 15	36900
DW09	ANDW09-W-04868	-	< 200	251000	107000	< 100	23500	22.4	50300
DW10	ANDW10-W-04876	-	< 200	154000	24700	132	10900	< 15	28900
Public Well									
PWS 1	ANPW01-W-04869	-	< 200	116000	28900	< 100	10600	< 15	5000
KDHE Monitoring Wells									
MW 1S	ANMW01S-W-04891	44.0-54.0	< 200	220000	91800	< 100	22800	< 15	97500
MW 1D	ANMW01D-W-04890	130.0-140.0	< 200	113000	17600	< 100	10700	< 15	6000
MW 2S	ANMW02S-W-04877	49.0-59.0	< 200	229000	26700	< 100	19300	< 15	61500
MW 2D	ANMW02D-W-04878	129.0-139.0	< 200	134000	26900	< 100	12300	< 15	9100
MW 3S	ANMW03S-W-04901	38.0-48.0	< 200	146000	26400	< 100	10600	< 15	14000
MW 3D	ANMW03D-W-04902	104.0-114.0	< 200	96100	13300	< 100	8820	< 15	2600
Temporary Well									
SB01	ANSB01-W-04879	118.9-128.9	< 200	91800	9100	< 100	8660	< 15	500
Cone Penetrometer Locations									
SB02	ANSB02-W-04880	64.0-70.0	< 200	128000	35500	< 100	11700	131	13700
SB07	ANSB07-W-04881	46.0-49.0	< 200	218000	25200	< 100	18000	413	99500
SB08	ANSB08-W-04882	48.5-57.5	3020	401000	35600	7560	31000	2190	8300
SB09	ANSB09-W-04883	52.0-58.0	3430	442000	42100	608	15400	458	13300
SB10	ABSB10-W-04885	53.0-56.0	3880	962000	36200	2430	16200	1600	15100

TABLE F.3 (Cont.)

Location	Sample	Depth (ft)	Concentration (µg/L)						
			Phosphate	Phosphorus	Potassium	Silicon	Sodium	Sulfate	Zinc
Domestic Wells									
DW01	ANDW01-W-04850	-	< 100	< 250	< 5000	16200	29500	40900	< 20
DW02	ANDW02-W-04851	-	< 100	< 250	< 5000	15000	32200	36600	1880
DW03	ANDW03-W-04852	-	100	< 250	6030	12100	31300	56700	50.3
DW04	ANDW04-W-04855	-	100	< 250	< 5000	17700	29700	23200	< 20
DW05	ANDW05-W-04862	-	< 100	< 250	< 5000	16200	27800	29800	< 20
DW06	ANDW06-W-04863	-	< 100	< 250	< 5000	16200	38400	40500	673
DW08	ANDW08-W-04866	-	< 100	< 250	< 5000	14300	36500	69900	86.1
DW09	ANDW09-W-04868	-	< 100	< 250	< 5000	16100	70500	165000	1410
DW10	ANDW10-W-04876	-	< 100	< 250	< 5000	15400	22400	37400	526
Public Well									
PWS 1	ANPW01-W-04869	-	< 100	< 250	< 5000	15400	43300	35500	1110
KDHE Monitoring Wells									
MW 1S	ANMW01S-W-04891	44.0-54.0	< 100	< 250	< 5000	18200	84100	81700	< 20
MW 1D	ANMW01D-W-04890	130.0-140.0	< 100	< 250	< 5000	17200	23300	33100	< 20
MW 2S	ANMW02S-W-04877	49.0-59.0	< 100	< 250	< 5000	17000	49000	77200	< 20
MW 2D	ANMW02D-W-04878	129.0-139.0	< 100	< 250	< 5000	16800	25700	28100	< 20
MW 3S	ANMW03S-W-04901	38.0-48.0	< 100	< 250	< 5000	18400	28200	41400	< 20
MW 3D	ANMW03D-W-04902	104.0-114.0	< 100	< 250	< 5000	17200	24000	16600	112
Temporary Well									
SB01	ANSB01-W-04879	118.9-128.9	< 100	< 250	< 5000	16200	26200	15900	< 20
Cone Penetrometer Locations									
SB02	ANSB02-W-04880	64.0-70.0	< 100	< 250	< 5000	15400	28500	32100	36.3
SB07	ANSB07-W-04881	46.0-49.0	< 100	< 250	< 5000	14700	59900	196000	111
SB08	ANSB08-W-04882	48.5-57.5	100	3090	14200	34200	206000	98900	292
SB09	ANSB09-W-04883	52.0-58.0	< 100	1740	< 5000	22300	32200	39500	71.2
SB10	ABSB10-W-04885	53.0-56.0	< 100	3020	< 5000	26300	35200	51600	168

[a] Depth unknown.

TABLE F.4 Analytical Results for Isotopes for Groundwater Samples Collected during the Phase I Field Investigation at Agenda, Kansas

Location	Sample	Depth (ft)	Deuterium δD (per mil)	Oxygen $\delta^{18}O$ (per mil)	Tritium ± Error (TU)
Domestic Wells					
DW01	ANDW01-W-04850	-[a]	-52	-8.3	11 ± 3
DW02	ANDW02-W-04851	-	-48	-7.9	12 ± 3
DW03	ANDW03-W-04852	-	-47	-7.9	8 ± 2
DW04	ANDW04-W-04855	-	-52	-8.3	11 ± 3
DW05	ANDW05-W-04862	-	-50	-8.1	9 ± 3
DW06	ANDW06-W-04863	-	-46	-7.8	12 ± 3
DW08	ANDW08-W-04866	-	-42	-7.3	14 ± 3
DW09	ANDW09-W-04868	-	-48	-7.6	10 ± 3
DW10	ANDW10-W-04876	-	-43.5	-7.7	26 ± 4
Public Well					
PWS 1	ANPW01-W-04869	-	-50	-8.2	2 ± 2
KDHE Monitoring Wells					
MW 1S	ANMW01S-W-04891	44-54	-42	-7.7	14 ± 3
MW 1D	ANMW01D-W-04890	130-140	-49	-7.7	0 ± 3
MW 2S	ANMW02S-W-04877	49-59	-43	-7.3	12 ± 3
MW 2D	ANMW02D-W-04878	129-139	-48	-7.9	16 ± 3
MW 3S	ANMW03S-W-04901	38-48	-52	-8.0	9 ± 3
MW 3D	ANMW03D-W-04902	104-114	-48	-8.1	5 ± 2
Temporary Well					
SB01	ANSB01-W-04879	118.9-128.9	-52	-8.4	2 ± 2
Cone Penetrometer Locations					
SB02	ANSB02-W-04880	64-70	-49	-8.1	7 ± 3
SB07	ANSB07-W-04881	46-49	-43	-7.4	16 ± 3
SB08	ANSB08-W-04882	48.5-57.5	-49	-7.75	9 ± 2
SB09	ANSB09-W-04883	52-58	-52	-8.0	8 ± 3
SB10	ABSB10-W-04885	53-56	-50	-7.8	6 ± 2

[a] Depth unknown.

TABLE F.5 Field Measurements Made during Collection of Groundwater Samples at Agenda, Kansas

Location	Sample	Sample Date	Temperature (°C)	pH	Conductivity (µS/cm)	Alkalinity (mg/L)	Dissolved Oxygen (mg/L)	Nitrates (mg/L)
Domestic Wells								
DW01	ANDW01-W-04850	4/17/96	13.8	6.87	838	350	4	5
DW02	ANDW02-W-04851	4/17/96	NR[a]	7.35	894	350	4	2.5
DW03	ANDW03-W-04852	4/17/96	13.4	7.16[b]	703	260	4	5
DW04	ANDW04-W-04855	4/18/96	13.7	7.41	612	425	4	2.5
DW05	ANDW05-W-04862	4/19/96	13.5	6.93	951	250	6	5
DW06	ANDW06-W-04863	4/19/96	13.2	6.84	983	350	6	7.5
DW07	ANDW07-W-04864	4/19/96	NR	6.40	847	300	7	7.5
DW08	ANDW08-W-04866	4/20/96	14.4	6.81	914	225	7	20
DW09	ANDW09-W-04868	4/22/96	13.9	7.58	1515	350	7	25
DW10	ANDW10-W-04876	4/23/96	13.5	6.89	772	250	4.5	10
KDHE Monitoring Wells								
MW 1D	ANMW01D-W-04890	4/23/96	16.2	6.98	481	250	10	0
MW 1S	ANMW01S-W-04891	4/23/96	14.8	6.85	1080	250	10	25
MW 2D	ANMW02D-W-04878	4/23/96	14.6	6.81	760	350	5	7.5
MW 2S	ANMW02S-W-04877	4/23/96	14.3	6.89	1333	350	1	25
MW 3D	ANMW03D-W-04902	4/24/96	14.1	6.19	561	350	8	2.5
MW 3S	ANMW03S-W-04901	4/24/96	13.9	6.61	771	360	5	10
Public Well								
PWS 1	ANPW01-W-04869	4/22/96	NR	7.8	739	165[c]	10[d]	2.5
Temporary Well								
SB01	ANSB01-W-04879	4/24/96	14.8	7.78	462	275	8	NR

TABLE F.5 (Cont.)

Location	Sample	Sample Date	Temperature (°C)	pH	Conductivity (µS/cm)	Alkalinity (mg/L)	Dissolved Oxygen (mg/L)	Nitrates (mg/L)
Cone Penetrometer Locations								
SB02	ANSB02-W-04880	4/23/96	14.9	7.22	724	300	7	30
SB07	ANSB07-W-04881	4/24/96	17.7	7.00	1297	≅190	4-5	100
SB08	ANSB08-W-04882	4/25/96	16.5	6.88	855	≅225	5-6	NR
SB09	ANSB09-W-04883	4/26/96	14.9	7.09	727	350	3-4	NR
SB10	ABSB10-W-04885	4/26/96	15.2	6.97	902	≅300	4-5	NR

[a] NR, field measurement not recorded.
[b] Instrument malfunction prevented reading of stabilized pH.
[c] Result questionable; standard color not reached in titrimetric test.
[d] Result questionable; high-pressure flow reduced for sampling, causing sample to be aerated.

Appendix G:

Quality Control and Waste Characterization Sample Data

TABLE G.1 Quality Control Samples Collected during the Phase I Field Investigation at Agenda, Kansas

Location	Sample	Depth (ft)	Sample Date	Sample Description
Field Blanks				
QC	ANFB01-W-04884	-[a]	4/26/96	Field blank of water used during ECPT investigation.
QC	ANFB01-W-04853	-	4/17/96	Blank of Agenda city water used throughout rotary drilling operation.
Cone Penetrometer Equipment Rinsate				
QC	ANRI01-W-04886	-	4/26/96	Rinsate of ECPT bailer collected before collection of sample ANSB10-W-04885.
Trip Blanks				
QC	ABTB-42696	-	4/26/96	Trip blank included in shipment of samples to Aquatec Lab on 4/26/96. See COC 375.
QC	ANTB01-W-04854	-	4/17/96	Trip blank included in shipment of samples to Aquatec Lab on 4/18/96. See COC 428.
QC	ANTB02-W-04865	-	4/19/96	Trip blank included in shipment of samples to Aquatec Lab on 4/19/96. See COC 431.
QC	ANTB03-W-04867	-	4/20/96	Trip blank included in shipment of samples to Aquatec Lab on 4/20/96. See COC 432.
QC	ANTB04-W-04875	-	4/22/96	Trip blank included in shipment of samples to Aquatec Lab on 4/22/96. See COC 434 and 434.
QC	ANTB05-W-04903	-	4/24/96	Trip blank included in shipment of samples to Aquatec Lab on 4/24/96. See COC 436.
QC	ANTB06-W-04904	-	4/24/96	Trip blank included in shipment of samples to Aquatec Lab on 4/24/96. See COC 1052.
QC	ANBLANK-W-04897	-	5/17/96	Trip blank included in shipment of samples to Aquatec Lab on 5/17/96. See COC 14142.
Groundwater Field Replicate Samples for Organic and Inorganic Analyses				
DW04	ANDW04-W-04855	-	4/18/96	Well sampled as a background well instead of the Hebert well designated for sampling in the *Work Plan.*
DW04	ANDW04-W-04856	-	4/18/96	Replicate of sample ANDW04-W-04855.
SB01	ANSB01-W-04879	118.9-128.9	4/24/96	Well screen located in deeper water-saturated sandstone.
SB01	ANSB01-W-04900	118.9-128.9	4/24/96	Replicate of sample ANSB01-W-04879.
Groundwater Samples Selected by Contract Laboratory for Duplicate Inorganic Analysis				
DW03	ANDW03-W-04852	-	4/17/96	Sample from domestic well DW03.
DW03	ANDW03-W-04852RE	-	4/17/96	Duplicate laboratory metals and inorganic analysis.
MW 1D	ANMW01D-W-04890	130.0-140.0	4/23/96	Sample from KDHE monitoring well MW 1D.
MW 1D	ANMW01D-W-04890RE	130.0-140.0	4/23/96	Duplicate laboratory metals and inorganic analysis.

TABLE G.1 (Cont.)

Location	Sample	Depth (ft)	Sample Date	Sample Description
Waste Water Samples				
MW 1S	ANMW01S-W-04893	44.0-54.0	5/16/96	Purge water collected for disposal during sampling of KDHE monitoring well MW 1S.
MW 1D	ANMW01D-W-04894	130.0-140.0	5/16/96	Purge water collected for disposal during sampling of KDHE monitoring well MW 1D.
MW 2S	ANMW02S-W-04895	49.0-59.0	5/16/96	Purge water collected for disposal during sampling of KDHE monitoring well MW 2S.
MW 2D	ANMW02D-W-04896	129.0-139.0	5/16/96	Purge water collected for disposal during sampling of KDHE monitoring well MW 2D.
Waste Soil Samples				
QC	ANDR01-S-04858	-	4/18/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 1-5.
QC	ANDR02-S-04859	-	4/18/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 6-10.
QC	ANDR03-S-04860	-	4/18/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 11-15.
QC	ANDR04-S-04861	-	4/18/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 16-20.
QC	ANDR05-S-04870	-	4/22/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 21-25.
QC	ANDR06-S-04871	-	4/22/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 26-30.
QC	ANDR07-S-04872	-	4/22/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 31-35.
QC	ANDR08-S-04873	-	4/22/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 36-40.
QC	ANDR09-S-04874	-	4/22/96	Excess soil, slurry, and grout from SB01. Composite sample from drums 41-44.

[a] Depth unknown or not applicable.

TABLE G.2 Organic Analytical Results for Quality Control Samples Collected during the Phase I Field Program at Agenda, Kansas

			Concentration (µg/L for water, µg/kg for soil)	
Location	Sample	Depth (ft)	Carbon Tetrachloride	Chloroform
Field Blanks				
QC	ANFB01-W-04853	-[a]	< 5	< 5
QC	ANFB01-W-04884	-	< 5	< 5
Equipment Rinsates				
QC	ANRI01-W-04886	-	< 5	< 5
Trip Blanks				
QC	ANTB01-W-04854	-	< 5	< 5
QC	ANBLANK-W-04897	-	< 5	< 5
QC	ANTB02-W-04865	-	< 5	< 5
QC	ANTB03-W-04867	-	< 5	< 5
QC	ANTB04-W-04875	-	< 5	< 5
QC	ANTB05-W-04903	-	< 5	6
QC	ANTB06-W-04904	-	< 5	5
QC	ABTB-42696	-	< 5	< 5
Field Replicate (Split) Samples				
DW04	ANDW04-W-04855	-	< 5	< 5
DW04	ANDW04-W-04856	-	< 5	< 5
SB01	ANSB01-W-04879	118.9-128.9	< 5	< 5
SB01	ANSB01-W-04900	118.9-128.9	< 5	< 5
Waste Water Samples				
MW 1D	ANMW01D-W-04894	130-140	< 5	< 5
MW 1S	ANMW01S-W-04893	44-54	< 5	< 5
MW 2D	ANMW02D-W-04896	129-139	< 5	< 5
MW 2S	ANMW02S-W-04895	49-59	< 5	< 5
Waste Soil Samples				
QC	ANDR01-S-04858	-	< 12	< 12
QC	ANDR02-S-04859	-	< 18	< 18
QC	ANDR03-S-04860	-	< 16	< 16
QC	ANDR04-S-04861	-	< 19	< 19
QC	ANDR05-S-04870	-	< 50	< 50
QC	ANDR06-S-04871	-	< 36	< 36
QC	ANDR07-S-04872	-	< 38	< 38
QC	ANDR08-S-04873	-	< 71	< 71
QC	ANDR09-S-04874	-	< 29	< 29

[a] Depth not applicable or unknown.

TABLE G.3 Recovery of System-Monitoring Compounds in Analyses for Volatile Organic Compounds

Sample	Analysis Date	Sample Delivery Group	Recovery (%) Toluene-d8	Bromofluoro-benzene	1,2-Dichloro-ethane-d4
ANDR01-S-04858	4/25/96	57974	103	103	91
ANDR02-S-04859	4/25/96	57974	105	103	94
ANDR02-S-04859MS	4/25/96	57974	103	101	91
ANDR02-S-04859MSD	4/25/96	57974	103	102	93
ANDR03-S-04860	4/25/96	57974	96	94	87
ANDR04-S-04861	4/25/96	57974	104	103	93
ANDW01-W-04850	4/29/96	57981	99	101	93
ANDW01-W-04850MS	4/29/96	57981	113[a]	114	109
ANDW01-W-04850MSD	4/29/96	57981	107	110	103
ANDW02-W-04851	4/29/96	57981	97	100	93
ANDW03-W-04852	4/29/96	57981	107	107	103
ANDW04-W-04855	4/29/96	57981	107	108	102
ANDW04-W-04856	4/29/96	57981	106	108	103
ANDW05-W-04862	4/29/96	57981	93	93	89
ANDW06-W-04863	4/29/96	57981	108	108	104
ANDW07-W-04864	4/29/96	57981	108	108	105
ANDW08-W-04866	5/1/96	57981	106	109	105
ANDW09-W-04868	5/7/96	57981	107	98	94
ANDW10-W-04876	5/4/96	57981	100	93	84
ANFB01-W-04853	4/29/96	57981	107	107	104
ANPW01-W-04869	5/4/96	57981	101	94	84
ANTB01-W-04854	4/29/96	57981	108	111	105
ANTB02-W-04865	4/29/96	57981	109	110	106
ANTB03-W-04867	5/1/96	57981	102	106	103
ANTB04-W-04875	5/4/96	57981	101	93	85
ANDR05-S-04870	4/25/96	58051	99	101	89
ANDR05-S-04870MS	4/25/96	58051	104	107	95
ANDR05-S-04870MSD	4/25/96	58051	104	104	94
ANDR06-S-04871	4/25/96	58051	101	102	92
ANDR07-S-04872	4/25/96	58051	97	92	86
ANDR08-S-04873	4/26/96	58051	99	100	91
ANDR09-S-04874	4/26/96	58051	101	101	92
ANFB01-W-04884	4/26/96	58098	101	94	88
ANMW03D-W-04902	4/24/96	58098	94	92	78
ANMW03D-W-04902MS	4/24/96	58098	99	100	93
ANMW03D-W-04902MSD	4/24/96	58098	98	100	91
ANMW03S-W-04901	4/24/96	58098	100	96	84
ANRI01-W-04886	4/26/96	58098	96	90	89
ANSB01-W-04900	4/24/96	58098	100	92	82
ANSB07-W-04881	4/24/96	58098	97	97	81
ANSB08-W-04882	4/25/96	58098	94	90	84

TABLE G.3 (Cont.)

Sample	Analysis Date	Sample Delivery Group	Recovery (%) Toluene-d8	Bromofluoro-benzene	1,2-Dichloro-ethane-d4
ANSB09-W-04883	4/26/96	58098	94	87	83
ANSB10-W-04885	4/26/96	58098	92	87	84
ANTB-42696	4/26/96	58098	100	94	90
ANTB05-W-04903	4/24/96	58098	93	91	81
ANTB06-W-04904	4/24/96	58098	98	96	83
ANMW01D-W-04890	5/1/96	58101	104	107	102
ANMW02D-W-04878	5/1/96	58101	108	109	103
ANMW02S-W-04877	5/1/96	58101	107	108	102
ANMW1S-W-04891	5/1/96	58101	104	106	100
ANMW1S-W-04891MS	5/1/96	58101	100	103	98
ANMW1S-W-04891MSD	5/1/96	58101	102	105	99
ANSB01-W-04879	5/1/96	58101	106	108	103
ANSB02-W-04880	5/1/96	58101	107	108	106
ANBLANK-W-04897	5/21/96	58574	91	92	88
ANMW01D-W-04894	5/21/96	58574	95	95	90
ANMW01S-W-04893	5/21/96	58574	96	98	93
ANMW01S-W-04893MS	5/21/96	58574	94	95	90
ANMW01S-W-04893MSD	5/21/96	58574	93	93	89
ANMW02D-W-04896	5/21/96	58574	94	94	90
ANMW02S-W-04895	5/21/96	58574	94	92	89

[a] Value outside contract-required quality control limit. These limits are as follows:

	Recovery (%) in Samples Soil	Water
Toluene-d8	84-138	88-110
Bromofluorobenzene	59-113	86-115
1,2-Dichloroethane-d4	70-121	76-114

TABLE G.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results for Analyses for Volatile Organic Compounds

Compound	Concentration (µg/kg for soil, µg/L for water)				Recovery (%)			Relative Percent Difference	
	Sample	Sample Spike Added	MS Result	MSD Result	MS Result	MSD Result	QC Limit	RPD	QC Limit
MS/MSD Analysis of ANDR02-S-04859 for Soil Sample Delivery Group 57974									
1,1-Dichloroethene	0	180	160	160	89	89	59-172	0	22
Trichloroethene	0	180	160	170	89	94	62-137	5	24
Benzene	0	180	160	170	89	94	66-142	5	21
Toluene	0	180	170	180	94	100	59-139	6	21
Chlorobenzene	0	180	170	180	94	100	60-133	6	21
MS/MSD Analysis of ANDW01-W-04850 for Water Sample Delivery Group 57981									
1,1-Dichloroethene	0	50	46	44	92	88	61-145	4	14
Trichloroethene	0	50	49	49	98	98	71-120	0	14
Benzene	0	50	50	50	100	100	76-127	0	11
Toluene	0	50	49	48	98	96	76-125	2	13
Chlorobenzene	0	50	50	50	100	100	75-130	0	13
MS/MSD Analysis of ANDR05-S-04870 for Soil Sample Delivery Group 58051									
1,1-Dichloroethene	0	500	410	400	82	80	59-172	2	22
Trichloroethene	0	500	450	440	90	88	62-137	2	24
Benzene	0	500	470	450	94	90	66-142	4	21
Toluene	0	500	480	470	96	94	59-139	2	21
Chlorobenzene	0	500	480	460	96	92	60-133	4	21
MS/MSD Analysis of ANMW03D-W-04902 for Water Sample Delivery Group 58098									
1,1-Dichloroethene	0	50	39	45	78	90	61-145	14	14
Trichloroethene	0	50	48	54	96	108	71-120	12	14
Benzene	0	50	45	50	90	100	76-127	10	11
Toluene	0	50	47	52	94	104	76-125	10	13
Chlorobenzene	0	50	49	55	98	110	75-130	12	13

TABLE G.4 (Cont.)

Compound	Concentration (µg/kg for soil, µg/L for water)				Recovery (%)			Relative Percent Difference	
	Sample	Sample Spike Added	MS Result	MSD Result	MS Result	MSD Result	QC Limit	RPD	QC Limit
MS/MSD Analysis of ANMW01S-W-04891 for Water Sample Delivery Group 58101									
1,1-Dichloroethene	0	50	51	50	102	100	61-145	2	14
Trichloroethene	0	50	54	51	108	102	71-120	6	14
Benzene	0	50	56	53	112	106	76-127	6	11
Toluene	0	50	55	53	110	106	76-125	4	13
Chlorobenzene	0	50	55	53	110	106	75-130	4	13
MS/MSD Analysis of ANMW01S-W-04893 for Water Sample Delivery Group 58574									
1,1-Dichloroethene	0	50	46	47	93	95	61-145	2	14
Trichloroethene	0	50	48	48	96	96	71-120	0	14
Benzene	0	50	48	48	96	97	76-127	1	11
Toluene	0	50	49	49	97	98	76-125	1	13
Chlorobenzene	0	50	49	49	97	98	75-130	1	13

TABLE G.5 Recovery of Inorganic Materials during Analysis of Laboratory Control Samples

Analyte	Concentration (µg/L) Laboratory Control Sample	Measured	Recovery (%)
Sample Delivery Group 57981			
Chloride	5000	4880-5120	97.6-102.4
Nitrate	3000	2810-2880	93.7-96.0
Phosphate	2000	1800-1880	90.0-94.0
Sulfate	10000	10010-10250	100.1-102.5
Aluminum	26000	26110	100.4
Calcium	25000	25130	100.5
Iron	25500	25950	101.8
Magnesium	25000	24650	98.6
Manganese	500	505.7	101.1
Potassium	25000	26800	107.2
Sodium	25000	24060	96.2
Zinc	500	518.30	103.7
Silicon	2000	1894	94.7
Phosphorus	500	492.4	98.5
Aluminum	30200	29640-31490	98.1-104.3
Calcium	30200	29170-30910	96.6-102.4
Iron	30200	29690-31530	98.3-104.4
Magnesium	30200	29250-31060	96.9-102.8
Manganese	200	192.6-205.1	96.3-102.6
Potassium	30200	30820-32020	102.1-106.0
Sodium	30200	28440-29790	94.2-98.6
Zinc	200	198.6-212.4	99.3-106.2
Silicon	2500	2379-2466	95.2-98.6
Phosphorus	200	186.4-199.9	93.2-100.0
Sample Delivery Group 58098			
Chloride	5000	4960-5180	99.2-103.6
Nitrate	3000	2870-2890	95.7-96.3
Phosphate	2000	1810-1880	90.5-94.0
Sulfate	10000	10240-10310	102.4-103.1
Aluminum	26000	26110	100.4
Calcium	25000	25120-25250	100.5-101.0
Iron	25500	25990	101.9
Magnesium	25000	24670	98.7
Manganese	500	505.2	101.0

TABLE G.5 (Cont.)

Analyte	Concentration (µg/L) Laboratory Control Sample	Measured	Recovery (%)
Sample Delivery Group 58098 (Cont.)			
Potassium	25000	26700	106.8
Sodium	25000	23970-24080	95.9-96.3
Zinc	500	513.6	102.7
Silicon	2000	1835	91.8
Phosphorus	500	504.70	100.9
Aluminum	30200	30090-31540	99.6-104.4
Calcium	30200	29410-31830	97.4-105.4
Iron	30200	30000-31470	99.3-104.2
Magnesium	30200	29670-31170	98.2-103.2
Manganese	200	195.8-206.5	97.9-103.2
Potassium	30200	31100-32660	103.0-108.1
Sodium	30200	28760-30910	95.2-102.4
Zinc	200	202.3-212.0	101.2-106.0
Silicon	2500	2503-2578	100.1-103.1
Phosphorus	200	192.3-212.5	96.2-106.2

TABLE G.6 Calculated Relative Percent Difference in Duplicate Inorganic Analyses

Analyte	Concentration (µg/L) Sample	Duplicate Analysis	Relative Percent Difference
Duplicate Laboratory Analysis of ANDW03-W-04852 in Sample Delivery Group 57981			
Aluminum	< 45	< 45	NC[a]
Calcium	103000	104000	1
Chloride	22300	21200	5.1
Iron	53.11	50.55	4.9
Magnesium	14300	14460	1
Manganese	< 2	< 2	NC
Nitrate	13700	13800	0.7
Phosphate	100	100	0
Phosphorus	138.1	141.7	2.6
Potassium	6030	6081	0.9
Silicon	12100	11970	1.1
Sodium	31300	31600	0.9
Sulfate	56700	54200	4.5
Zinc	50.3	50.98	1.3
Duplicate Laboratory Analysis of ANMW01D-W-04890 in Sample Delivery Group 58098			
Aluminum	< 45	< 45	NC
Calcium	113000	113400	0.3
Chloride	17600	18900	7.1
Iron	64.13	65.71	2.4
Magnesium	10700	10740	0.4
Manganese	8.47	8.81	3.9
Nitrate	6000	6000	0
Phosphate	< 61	< 61	NC
Phosphorus	49.11	51	3.1
Potassium	2484	2489	0.2
Silicon	17200	17390	1.1
Sodium	23300	23340	0.2
Sulfate	33100	33600	1.5
Zinc	9.97	21.37	72.8

TABLE G.6 (Cont.)

Analyte	Concentration (µg/L) Sample	Duplicate Analysis	Relative Percent Difference
Analysis of ANDW04-W-04855 and Field Replicate ANDW04-W-04856 in Sample Delivery Group 57981			
Aluminum	< 45	< 45	NC
Calcium	153000	154000	0.7
Chloride	45300	44700	1.3
Iron	49	47	4.2
Magnesium	14100	14300	1.4
Manganese	< 2	< 2	NC
Nitrate	3400	3400	0
Phosphate	100	100	0
Phosphorus	96	103	7
Potassium	3022	3088	2.2
Silicon	17700	17700	0
Sodium	29700	30200	1.7
Sulfate	23200	22800	1.7
Zinc	7	9	25
Analysis of ANSB01-W-04879 in Sample Delivery Group 57981 and Analysis of Field Replicate ANSB01-W-04900 in Sample Delivery Group 58098			
Aluminum	< 45	< 45	NC
Calcium	91800	84100	8.8
Chloride	9100	9100	0
Iron	33	40	19
Magnesium	8660	7950	8.5
Manganese	13	12	8
Nitrate	500	500	0
Phosphate	< 61	< 61	NC
Phosphorus	56	56	0
Potassium	3209	3031	5.7
Silicon	16200	18000	10.5
Sodium	26200	24600	6.3
Sulfate	15900	16100	1.3
Zinc	4	8	67

[a] NC, estimated result is less than detection limit, and RPD was not calculated.

TABLE G.7 Recovery Obtained in Inorganic Spike Analyses

Analyte	Concentration (µg/L) Sample	Spike Added	Spiked Sample	Spike Recovery (%)
Sample ANDW03-W-04852 in Sample Delivery Group 57981				
Aluminum	19.5	2000	2092	104.6
Chloride	22300	8300	30200	95.2
Iron	53.11	1000	1063	101.0
Manganese	0.7	500	498.4	99.7
Nitrate	13700	8300	21500	94.0
Phosphate	100	2000	1700	80.0
Silicon	12100	500	12650	110.0
Sulfate	56700	8300	63600	83.0
Zinc	50.3	500	557.5	101.4
Sample ANMW01D-W-04890 in Sample Delivery Group 58098				
Aluminum	19.5	2000	2176	108.8
Chloride	17600	33300	47400	89.5
Iron	64.13	1000	1137	107.3
Manganese	8.47	500	532	104.7
Nitrate	6000	2000	7900	95.0
Phosphate	< 100	2000	1700	85.0
Sulfate	33100	33300	64000	92.8
Zinc	9.97	500	556.3	109.3