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Final Work Plan: Groundwater Monitoring at Morrill, Kansas

prepared by
Environmental Research Division
Argonne National Laboratory

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by
Applied Geosciences and Environmental Management Section
Environmental Research Division, Argonne National Laboratory

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Notation

AGEM	Applied Geosciences and Environmental Management
AMSL	above mean sea level
BGL	below ground level
°C	degree(s) Celsius
CCC	Commodity Credit Corporation
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
h	hour
KDHE	Kansas Department of Health and Environment
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
mi	mile(s)
QA	quality assurance
QC	quality control
USDA	U.S. Department of Agriculture
VOC	volatile organic compound
yr	year(s)

Final Work Plan: Groundwater Monitoring at Morrill, Kansas

1 Introduction

This *Work Plan* outlines the scope of work for a program of twice yearly groundwater monitoring at Morrill, Kansas (Figure 1.1). The purposes of this monitoring program are to follow changes in plume dynamics and to collect data necessary to evaluate the suitability of monitored natural attenuation as a remedial option, under the requirements of Kansas Department of Health and Environment (KDHE) Policy #BER-RS-042. This monitoring program is planned for a minimum of 2 yr.

The planned monitoring activity is part of an investigation at Morrill being performed on behalf of the Commodity Credit Corporation (CCC), an agency of the U.S. Department of Agriculture (USDA), 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 facilities.

Details and background for this *Work Plan* were presented previously (Argonne 2004, 2005). Argonne has also issued a *Master Work Plan* (Argonne 2002) that describes the general scope of and guidance for all investigations at former CCC/USDA facilities in Kansas. The *Master Work Plan* (approved by the KDHE) contains the materials common to investigations at all locations in Kansas. These documents must be consulted for the complete details of plans for this work associated with the former CCC/USDA facility at Morrill.

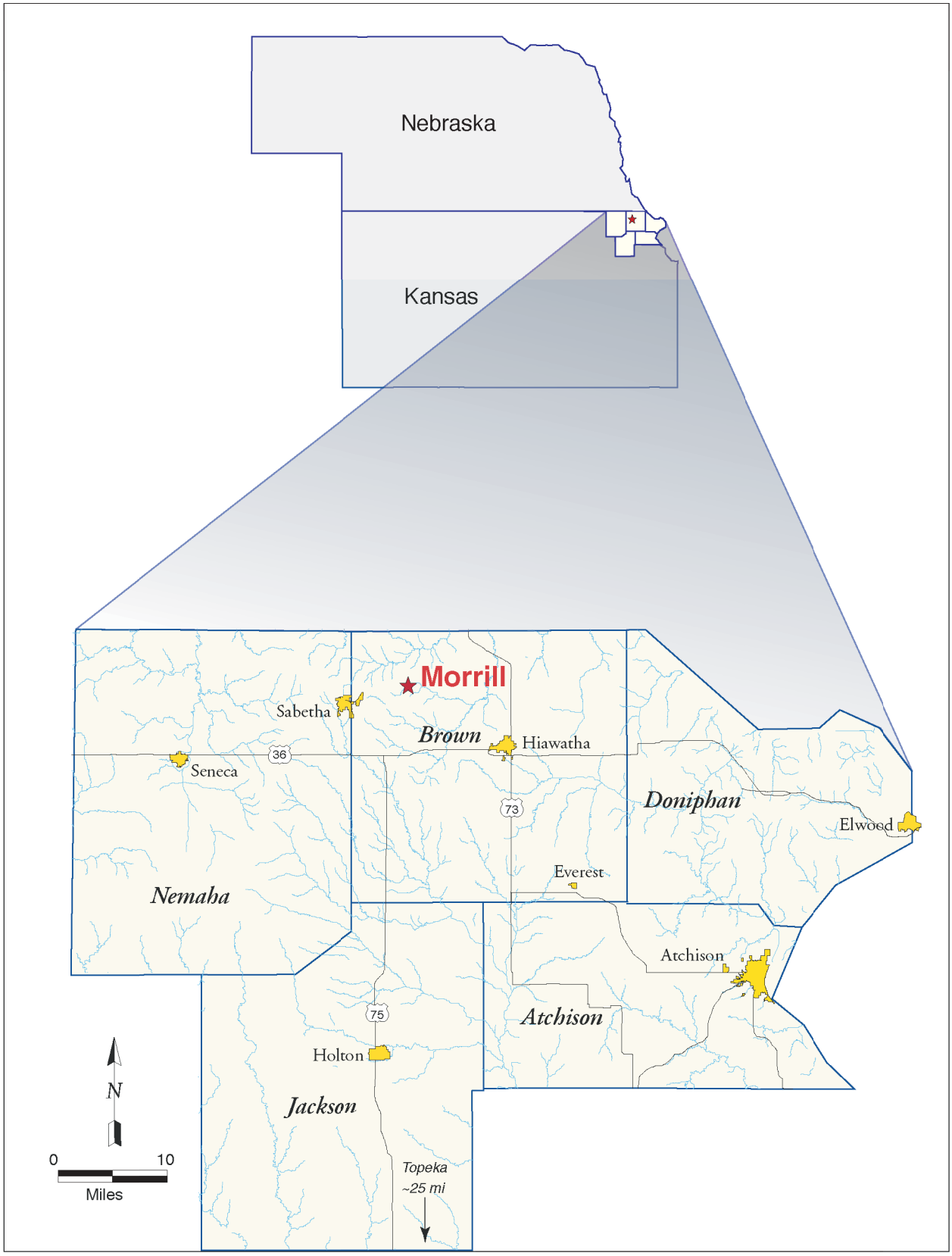

FIGURE 1.1 Location of Morrill, Kansas.

2 Background

Data collected during previous investigations at Morrill indicate that carbon tetrachloride contamination extends in a south-southeasterly direction from the former CCC/USDA facility, toward Terrapin Creek (Figure 2.1). The concentrations of chloroform, a primary degradation product of carbon tetrachloride, detected in the groundwater suggest that reductive dechlorination or natural biodegradation of carbon tetrachloride is taking place *in situ* within the plume. Historic sampling results are summarized in Table 2.1. Complete historical sampling details and well construction details for the permanent monitoring points at Morrill are in Table A.1, Appendix A. Table 2.2 summarizes available information about selected private wells at Morrill.

To evaluate the degree to which the groundwater system is suitable to support natural *in situ* degradation processes such as dechlorination, additional groundwater data such as the groundwater parameters recommended by the U.S. Environmental Protection Agency (EPA 1998) need to be collected and analyzed. The results will be used to evaluate the suitability of monitored natural attenuation as a treatment alternative at the Morrill site.

TABLE 2.1 Analytical results for carbon tetrachloride, chloroform, and methylene chloride in groundwater samples collected from monitoring wells at Morrill in 1995–2004.[a]

Well	Screen Interval (ft BGL)	Concentration (µg/L) in Sampling Event												
		Feb 1995		Aug 1998		Sep 1999		Oct 2000		Oct 2003		Jun 2004		
		CT	CF	CT	CF	CT	CF	CT	CF	CT	CF	CT	CF	MC
MW1S	11–51[b]	6.8	ND	74	NR	92.8	NR	40.8	NR	33	1.6	19	0.9J	ND
MW1D	63–88[b]	ND	ND	ND	NR	ND	NR	ND	NR	ND	ND	ND	ND	ND
MW2S	13–53[b]	ND	1.9	ND	NR	ND	NR	ND	NR	ND	ND	ND	ND	ND
MW3S	18–48[b]	390	9.6	110	NR	80.8	NR	169	NR	89	2.7	110	3.2	ND
MW4S	17–47[b]	ND	1.8	ND	NR	ND	NR	ND	NR	ND	ND	ND	ND	ND
MW5S	15–55[b]	4	ND	1.4	NR	1.0	NR	2.8	NR	5.8	ND	7	ND	ND
MW6S	10–25[c]	—	—	—	—	—	—	—	—	—	—	ND	ND	ND
MW7S	20–45[c]	—	—	—	—	—	—	—	—	—	—	18	ND	ND
MW8S	10–25[c]	—	—	—	—	—	—	—	—	—	—	ND	ND	ND

[a] Abbreviations: CF, chloroform; CT, carbon tetrachloride; MC, methylene chloride; ND, not detected at a method quantitation limit of 1 µg/L; NR, not reported. Qualifier J indicates an estimated concentration below the method quantitation of 1 µg/L.

[b] Well completed on February 28, 1995; owned by the KDHE.

[c] Well completed on May 5, 2004; owned by the CCC/USDA.

TABLE 2.2 Information about selected private wells at Morrill.

Well Name	Well Description	Sample Date	Sampled by	Carbon Tetrachloride (μg/L)
Marie Cain	No description available. Location shown only on large-scale figure. Nitrate level 24.3 mg/L.	1988	KDHE	22.1
Stanley Stover[a]	30-in., hand-dug well.	1994	GeoCore	5.4
Rilinger	5-in., PVC-cased, aboveground well, used for lawn and garden.	1994 2004	GeoCore Argonne	ND[b] ND
Stone	6-in., steel-cased well about 43 ft deep, north of Stover well. Pump removed; well no longer in service. Purged and sampled with Redi-Flo pump.	2004	Argonne	10.0
Isch	Drinking water well south of town. Unregistered. Location established with GPS measurements.	2004	Argonne	ND

[a] Believed by Argonne to be the same as the Marie Cain well sampled by the KDHE in 1988. Conclusion reached on the basis of general location and detection of carbon tetrachloride. This well was not sampled in 2004, because access was denied.

[b] ND, not detected at a method quantitation limit of 1 μg/L.

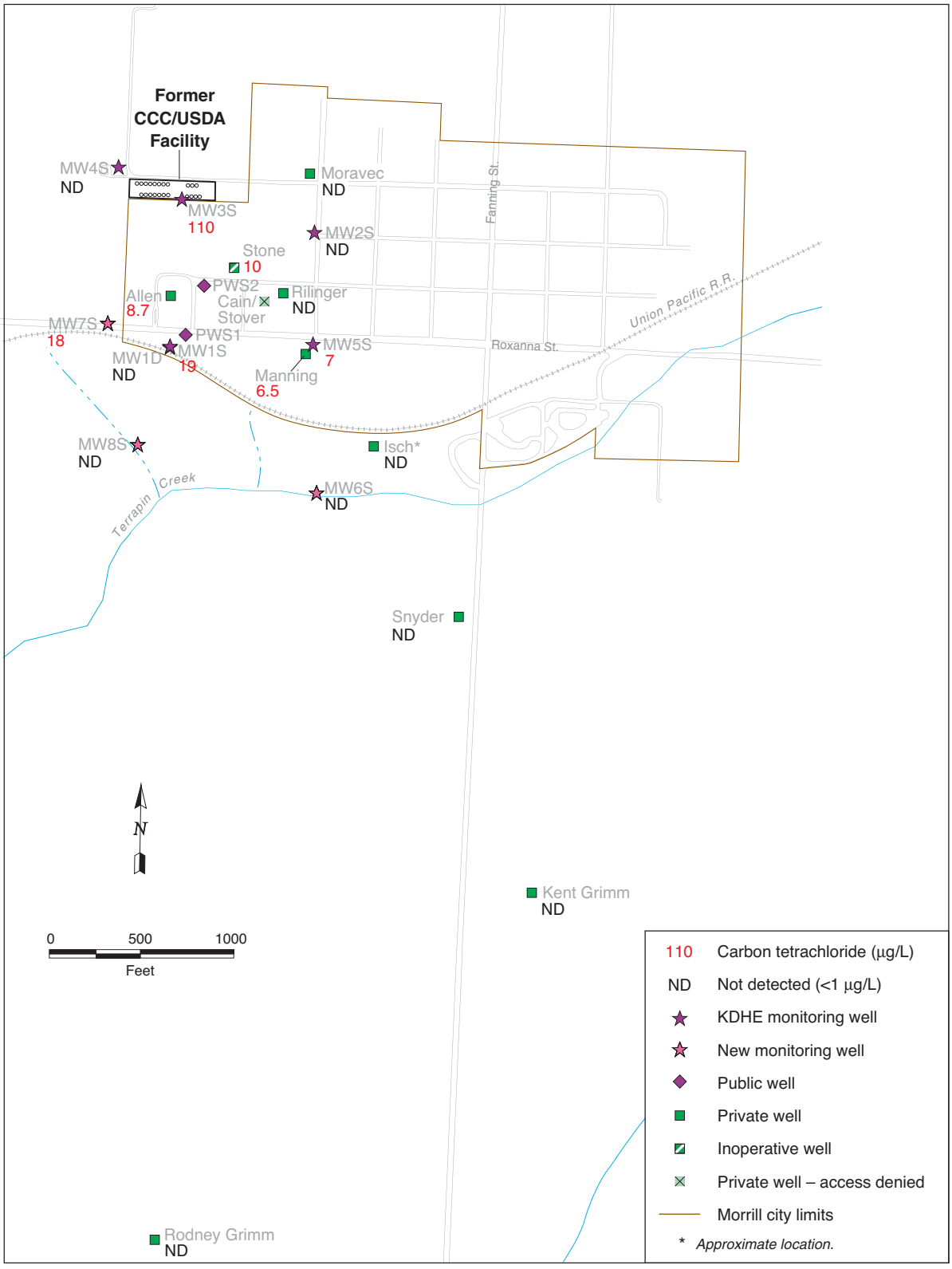

FIGURE 2.1 Carbon tetrachloride concentrations in groundwater at Morrill, June 2004.

3 Monitoring Plan

3.1 Monitoring Objectives

The objective of the monitoring program for Morrill is to collect groundwater samples twice yearly for at least 2 yr. The data to be collected are required to monitor changes in plume dynamics and to evaluate the suitability of monitored natural attenuation as a remedial option.

3.2 Scope of Work

To satisfy the project objective, groundwater samples will be collected from the following nine monitoring wells: MW1S, MW1D, MW2S, MW3S, MW4S, MW5S, MW6S, MW7S, and MW8S (Figure 3.1). Groundwater samples will also be collected from the Isch and Cain/Stover private wells (or from the Stone well if access to the Cain/Stover well is denied). Another recently sampled private well in the area is the Rilinger well (Table 2.2).

The strategy for collecting groundwater samples will include a thorough review of all historical analytical data. After the review, a list will be generated to determine the well sampling order. Wells that have consistently shown no detectable concentrations of volatile organic compounds (VOCs) will be purged and sampled first. Wells that have shown VOCs contamination will be purged and sampled in the order of lowest contamination to highest contamination.

The primary tasks in the proposed sampling event are as follows:

1. Measure static groundwater levels and total depths in each well.

2. Collect a sample from each well for analysis of VOCs, including carbon tetrachloride, chloroform, and dichloromethane (methylene chloride).

3. Collect an additional aliquot from each well/piezometer for analysis of the following groundwater parameters:

   - Dissolved oxygen
   - Nitrate
   - Nitrite
   - Iron II
   - Sulfate
   - Sulfide
   - Methane
   - Oxidation-reduction potential
   - pH
   - Total organic carbon
   - Carbon dioxide
   - Alkalinity
   - Chloride
   - Temperature
   - Conductivity
   - Manganese
   - Phosphate

4. Collect an aliquot for laboratory analysis of dissolved hydrogen from a set of wells/piezometers approved by the KDHE.

3.3 Monitoring and Sampling Procedures

The monitoring and sampling of the wells will be conducted in accordance with procedures described in the *Master Work Plan* (Argonne 2002, Sections 6.1.2 and 6.2), as follows:

- The well number and the condition of the well completion will be documented in the site notebook.

- The depth to groundwater and the total depth will be measured prior to purging.

- Prior to sampling, the wells will be purged of a minimum of three well volumes. Field parameters of pH, temperature, and conductivity will be measured during purging and will be allowed to stabilize before sampling begins.

- The wells will be sampled after adequate recovery has occurred, but no more than 24 h after purging.

- Samples intended for analysis of VOCs (including carbon tetrachloride and chloroform) will be collected in laboratory-approved containers. The containers will be sealed and immediately placed in a cooler at 4°C. The samples will be shipped for overnight delivery to the Applied Geosciences and Environmental Management (AGEM) Laboratory at Argonne for analysis with a modification of EPA Method 524.2. An index to EPA methods is online (http://www.epa.gov/epahome/index/).

- All activities conducted and any deviations from normal procedures will be documented in the site field notebook. Approval for deviations or modifications will be sought from the CCC/USDA and KDHE project managers.

3.4 Sampling and Reporting Schedule

The proposed monitoring events will be conducted approximately every 6 months for a period of 2 yr. The KDHE will be notified 14 days prior to each sampling event. After the groundwater data generated during the sampling event have been analyzed and validated, a report documenting the sampling activities and presenting the sampling results will be prepared and submitted to the KDHE within 90 days of the completion of field work.

The monitoring report will follow the guidelines for site monitoring established by the KDHE (1996). Accordingly, the report will include the following, at a minimum:

- A narrative of the work performed

- Static water level measurements
- Laboratory analytical data reports
- Summary tables presenting current and historical site data
- Results of analyses for natural attenuation parameters
- Maps depicting the sample locations, groundwater gradient, and contaminant levels
- Descriptions of any deviations from the approved sampling procedures
- Field documentation
- Quality assurance and quality control data

3.5 Quality Assurance and Quality Control

Included in this section is a summary of methods that will be followed to meet quality assurance/quality control (QA/QC) standards. Descriptions of all QA/QC methods are in Section 4.2 of the *Master Work Plan* (Argonne 2002). That document should be consulted for more a more detailed narrative of the QA/QC procedures.

The QA/QC requirements during field sampling are as follows:

- Ensure that samples collected are representative of current site conditions.
- Ensure that sample volume is sufficient to meet the monitoring goals.
- Ensure that field instrument calibration procedures are followed and that the appropriate number of field blanks, rinsate samples, trip blanks, and field replicates are collected. For this project, a minimum of one field blank, one

rinsate sample, one trip blank, and one or two field replicates will be collected.

- In a bound notebook with printed page numbers, record all details of the work conducted. Use permanent ink for this documentation.

- To the extent possible, use disposable sampling equipment at each sampling location.

- Between wells, thoroughly rinse RediFlow pumps and hoses. Triple-wash all other nondisposable sampling equipment with a nonionic detergent in water, then rinse with water.

- Collect groundwater samples according to the procedures specified in Section 3.3.

- Label sample containers as instructed in Appendix D, Section D.1.4, of the *Master Work Plan* (Argonne 2002). At a minimum, include the following information: sample identifier, date, time, preservative, and intended analysis. Use preprinted sample labels for this task.

- Complete a preprinted Chain-of-Custody Record as instructed in Appendix D, Section D.1.5, of the *Master Work Plan* (Argonne 2002).

- Appropriately pack and seal shipping containers to ensure that chain of custody is maintained.

- Use preprinted shipping labels for sample containers being sent to laboratories for off-site analyses.

Laboratory QA/QC procedures are designed to ensure that sample integrity is maintained and that sample analysis is reproducible. This will be accomplished, in part, by verifying that laboratory-related field documentation is complete and that procedures have been followed with regard to Chain-of-Custody Records, sample storage, and sample holding times. In addition,

laboratory procedures, equipment calibration, and performance standards (reproducibility, standards, spikes recoveries, etc.) will be reviewed and documented in the monitoring report discussed in Section 3.4.

Groundwater samples received at the AGEM Laboratory will be analyzed for VOCs as indicated in Section 3.3, within the specified holding times. For quality control purposes, selected samples will be analyzed by a second laboratory with the EPA's Contract Laboratory Program methodology.

Quality assurance records completed during the project will be maintained by the QA/QC coordinator and stored with the project files.

3.6 Health and Safety

The general health and safety plan for use during this project, in Section 3 of the *Master Work Plan* (Argonne 2002), addresses all anticipated safety issues for the activities at the Morrill site. Specific emergency information for Morrill is provided below.

Morrill has emergency 911 service. All emergency calls, including police, fire, and ambulance calls, are directed for an appropriate response from this number. No emergency medical facilities exist at Morrill. The nearest hospital with emergency medical facilities is in Sabetha, Kansas, about 7 mi from Morrill. Driving directions to the hospital and a map showing the route are in Figure 3.2. Additional emergency information is in Table 3.1.

TABLE 3.1 Emergency information for field work at Morrill, Kansas.[a]

	Telephone Number	Name/Note
Ambulance	911	Ambulance response is from Hiawatha. Patients may be taken to Hiawatha Community Hospital, 300 Utah Street, (785) 742-3888.
Hospital[b]	(785) 284-2121	Sabetha Community Hospital[b] 14th and Oregon Streets Sabetha, Kansas
Fire	911	Morrill Fire Department (requests relayed by the Brown County Sheriffís Department dispatcher)
Police	911 (785) 742-7125	Brown County Sheriffís Department (nonemergency)
Industrial hygiene	(630) 252-3310	Argonne-Industrial Hygiene
Safety	(630) 252-2885	EVS Division[c] Safety Officer (Monte Brandner)
Environmental concerns	(630) 252-3924 ((630) 252-9553	EVS Division Regulatory Supervisor (Dave Peterson)
Security	(630) 252-5737	Argonne-Operations Security
Poison control	(800) 222-1222 or (913) 588-6633	Mid-America Poison Control Center University of Kansas Medical Center Kansas City, Kansas
Utilities survey	(800) 344-7233 (800) DIG-SAFE	Kansas One Call, Wichita, Kansas

[a] Post this table in the field operations base.

[b] The route from Morrill to the Sabetha Community Hospital is shown in Figure 3.2.

[c] Environmental Science Division at Argonne.

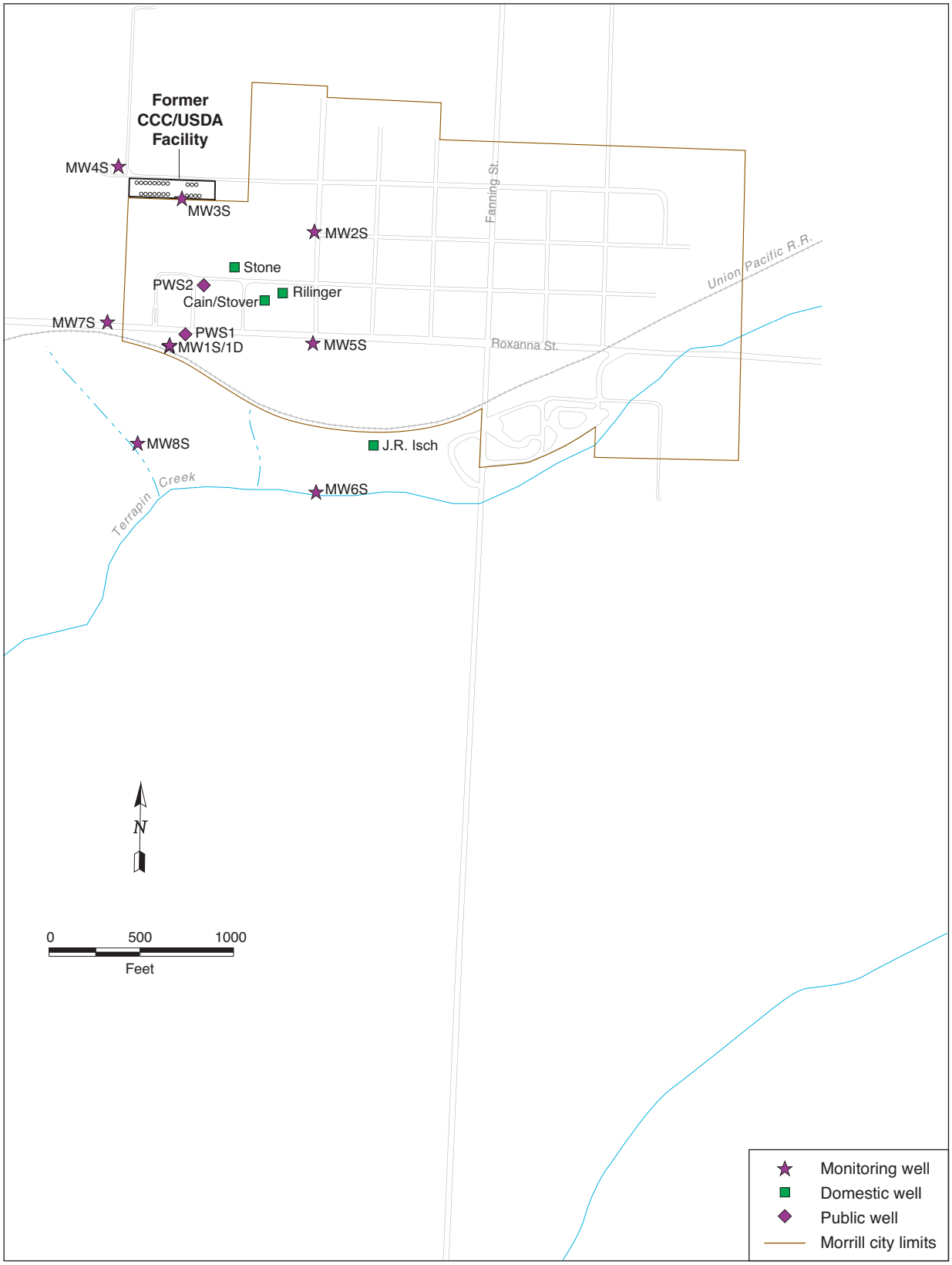

FIGURE 3.1 Locations of proposed monitoring points at Morrill.

Directions from Morrill to Sabetha Community Hospital in Sabetha, Kansas

- From the former CCC/USDA facility, go east on Hanson Street about 2 blocks.
- Turn right onto Walnut Street and proceed south 3 blocks.
- Turn right onto Roxanna Street and follow it west out of town. Roxanna becomes KS-246.
- Continue on KS-246 about 6 miles to Sabetha.
- Turn left onto US-75 and proceed south .3 miles.
- Turn right onto Oregon Street and proceed west 1 mile to 14th Street.
- Turn left on 14th Street. Sabetha Community Hospital is southwest of the intersection of Oregon and 14th Streets.
- Access the emergency entrance from 14th Street.

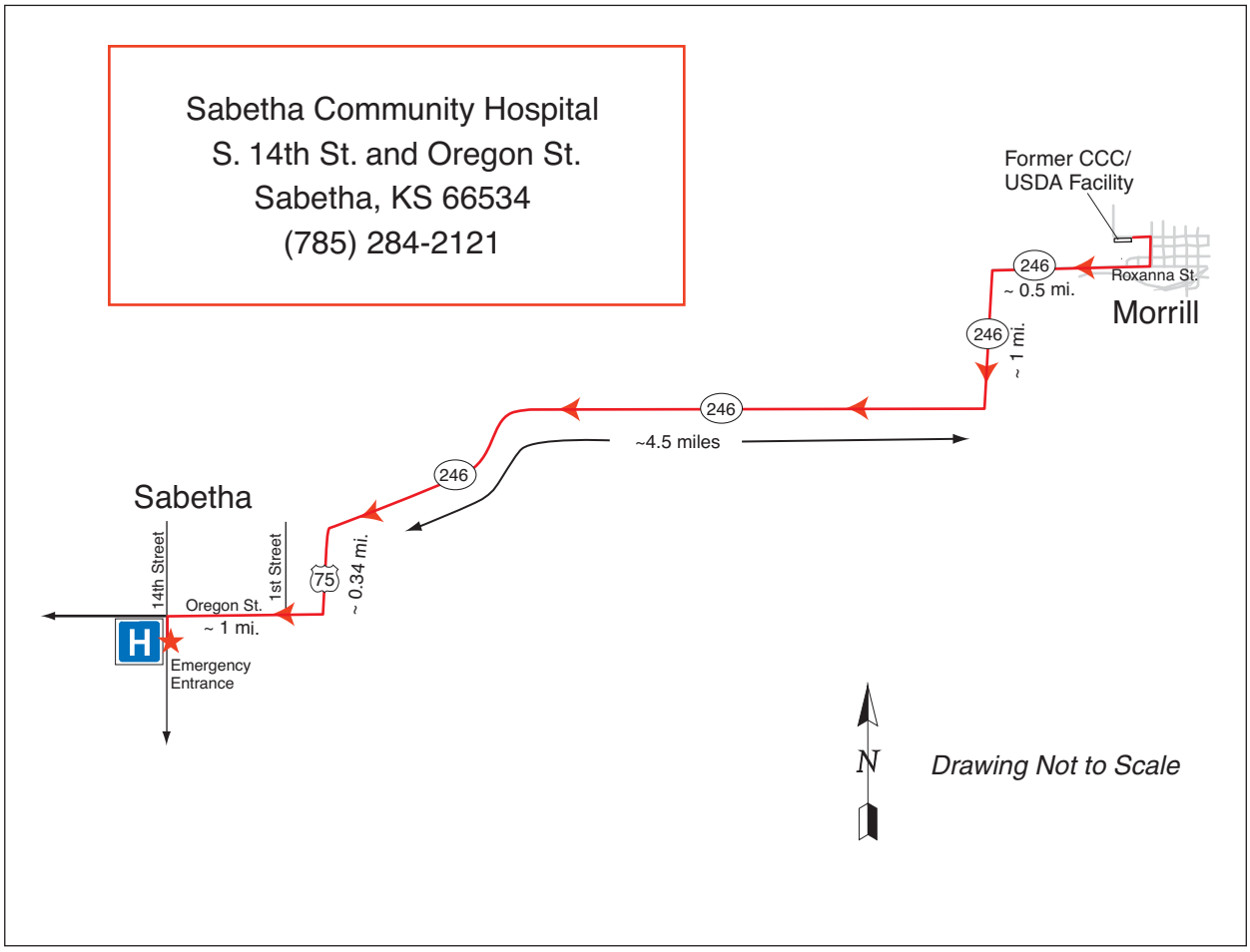

FIGURE 3.2 Emergency route from Morrill to Sabetha Community Hospital.

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Appendix A:

Monitoring Well Construction Details and Historical Sampling Data

TABLE A.1 Sampling and construction details for permanent monitoring locations at Morrill, 1995–2004.[a]

Well[b]	Owner	Horizontal Location[c] (ft)		Completion Date	Surface Elevation (ft AMSl)	Reference Elevation[d] (ft AMSL)	Total Depth (ft BGL)	Screen Interval (ft BGL)			Filter Pack Interval (ft BGL)			Depth to Bedrock (ft BGL)	Depth to Water (ft BGL)	Sample Date	Carbon Tetrachloride (µg/L)	Chloroform (µg/L)	Nitrate as N (mg/L)
		Northing	Easting					Top	Bottom	Total	Top	Bottom	Total						
MW1S	KDHE	589130.2	1957316.76	02/28/95	1122.30	1124.68	56	11	51	40	9	56	47	11	23.50	2/28/95	6.8	ND	0.75
																Aug 1998	74	NR	18.7
																Sep 1999	92.8	NR	17.4
																Oct 2000	40.8	NR	14.6
																10/23/03	33	1.6	14.3
																06/02/04	19	0.9J	11.2
MW1D	KDHE	589129.06	1957314.45	02/28/95	1122.20	1124.63	90	63	88	25	60.5	90	29.5	11	26.30	02/28/95	ND	ND	< 0.05
																Aug 1998	ND	NR	0.08
																Sep 1999	ND	NR	1.6
																Oct 2000	ND	NR	1.8
																10/22/03	ND	ND	< 0.2
																06/02/04	ND	ND	< 0.2
MW2S	KDHE	589789.61	1958063.43	02/28/95	1137.30	1137.07	60	13	53	40	12	60	48	14	40.40	02/28/95	ND	1.9	14.9
																Aug 1998	ND	NR	21.4
																Sep 1999	ND	NR	20.4
																Oct 2000	ND	NR	25.1
																10/22/03	ND	ND	25.1
																06/02/04	ND	ND	16.2
MW3S	KDHE	589929.06	1957333.78	02/28/95	1136.00	1135.76	50	18	48	30	15	50	35	16	34.40	02/28/95	390	9.6	5.5
																Aug 1998	110	NR	13.0
																Sep 1999	80.8	NR	12.9
																Oct 2000	169	NR	13.0
																10/23/03	89	2.7	12.1
																06/02/04	110	3.2	10.1
MW4S	KDHE	590083.24	1956982.15	02/28/95	1143.80	1143.61	51	17	47	30	14.5	51	36.5	10	43.30	02/28/95	ND	1.8	10.2
																Aug 1998	ND	NR	18.9
																Sep 1999	ND	NR	18.9
																Oct 2000	ND	NR	17.9
																10/21/03	ND	ND	19.9
																06/04/04	ND	ND	18.9
MW5S	KDHE	589182.24	1958089.03	02/28/95	1122.40	1122.21	60	15	55	40	12	60	48	16	29.10	02/28/95	4.0	ND	17.3
																Aug 1998	1.4	NR	15.5
																Sep 1999	1.0	NR	15.2
																Oct 2000	2.8	NR	20.3
																10/22/03	5.8	ND	20.4
																06/02/04	7.0	ND	19.5
MW6S	CCC/USDA	588385.33	1958149.44	05/05/04	1091.40	1090.97	27	10	25	15	7	27	20	13	4.45	06/03/04	ND	ND	0.3
MW7S	CCC/USDA	589238.96	1956967.99	05/05/04	1120.40	1119.86	47	20	45	25	18	47	29	7	21.63	06/02/04	18	ND	16.7
MW8S	CCC/USDA	588590.43	1957169.82	05/05/04	1099.00	1098.53	28	10	25	15	7.5	28	20.5	15	4.84	06/02/04	ND	ND	5.9

[a] Abbreviations: AMSL, above mean sea level; BGL, below ground level; ND = not detected at a method quantitation limit of 1 µg/L; NR = not reported. Qualifier J indicates an estimated concentration below the method quantitation limit of µg/L.

[b] All wells are 4-in. monitoring wells. Each has a WWC-5 record on file with the state.

[c] Horizontal coordinates are target location centers. Northings and Eastings are Kansas State Plane Coordinates. Horizontal datum is North American Datum 83.

[d] Vertical datum is National Geodetic Vertical Datum 88.