

March-April 2007 Monitoring Results for Morrill, Kansas

Environmental Science Division



United States Department of Agriculture

Work sponsored by Commodity Credit Corporation,
United States Department of Agriculture

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

May 2007



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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
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
gal	gallon(s)
gpm	gallon(s) per minute
hr	hour
KDHE	Kansas Department of Health and Environment
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
µS/cm	microsiemen(s) per centimeter
mg/L	milligram(s) per liter
min	minute
mV	millivolt(s)
nM	nanomolar
ORP	oxidation-reduction potential
USDA	U.S. Department of Agriculture
VOC	volatile organic compound

March-April 2007 Monitoring Results for Morrill, Kansas

1 Introduction and Background

In September 2005, the Commodity Credit Corporation of the U.S. Department of Agriculture (CCC/USDA) initiated periodic sampling of groundwater in the vicinity of a grain storage facility formerly operated by the CCC/USDA at Morrill, Kansas. The sampling at Morrill is being performed on behalf of the CCC/USDA by Argonne National Laboratory, in accord with a monitoring program approved by the Kansas Department of Health and Environment (KDHE), to monitor levels of carbon tetrachloride contamination identified in the groundwater at this site (Argonne 2004, 2005a). Under the KDHE-approved *Monitoring Plan* (Argonne 2005b), the groundwater is being sampled twice yearly for a recommended period of two years. The samples are analyzed for volatile organic compounds (VOCs), as well as for selected geochemical parameters to aid in the evaluation of possible natural contaminant degradation (reductive dechlorination) processes in the subsurface environment. The sampling is presently conducted in a network of 12 monitoring wells and 3 private wells (Argonne 2006a; Figure 1.1), at locations approved by the KDHE.

The analytical results for groundwater sampling events at Morrill in September 2005, March 2006, and September 2006 were previously documented (Argonne 2006a,b). The results have demonstrated the presence of carbon tetrachloride contamination, at levels exceeding the KDHE Tier 2 Risk-Based Screening Level (5 $\mu\text{g/L}$) for this compound, in a groundwater plume extending generally south-southeastward from the former CCC/USDA facility, toward Terrapin Creek at the south edge of the town. Little clear pattern of change in the concentrations observed at the individual monitoring points or plume migration was observed in the previous monitoring events. Low levels ($\leq 1.3 \mu\text{g/L}$) of carbon tetrachloride have persistently been detected at monitoring well MW8S, however, along an intermittent tributary to Terrapin Creek. This observation suggests a possible risk of contamination of the surface waters of the creek. In light of these findings, the CCC/USDA recommended expansion of the approved monitoring program to include the collection and analysis of surface water samples along Terrapin Creek (Argonne 2006a). At the request of the KDHE (KDHE 2007a), locations for both surface water and shallow sediment sampling were discussed with the KDHE in January 2007. An *Addendum* to the existing *Monitoring Plan* and a standard operating procedure (SOP AGEM-15) for sediment sampling were submitted to the KDHE on the basis of these discussions (Argonne 2007a,b).

This report presents the results of groundwater, surface water, and sediment sampling performed at Morrill in March 2007, in accord with the *Monitoring Plan* (Argonne 2005b) and the *Addendum* to that plan (Argonne 2007a). To supplement these studies, Argonne also sampled natural vegetation along Terrapin Creek in April 2007 for analyses for VOCs. The results of the plant tissue analyses are included in this report.

The March 2007 sampling at Morrill represents the fourth monitoring event performed under the recommended two-year monitoring program approved by the KDHE. The final sampling event under this program is presently scheduled to take place in September 2007.

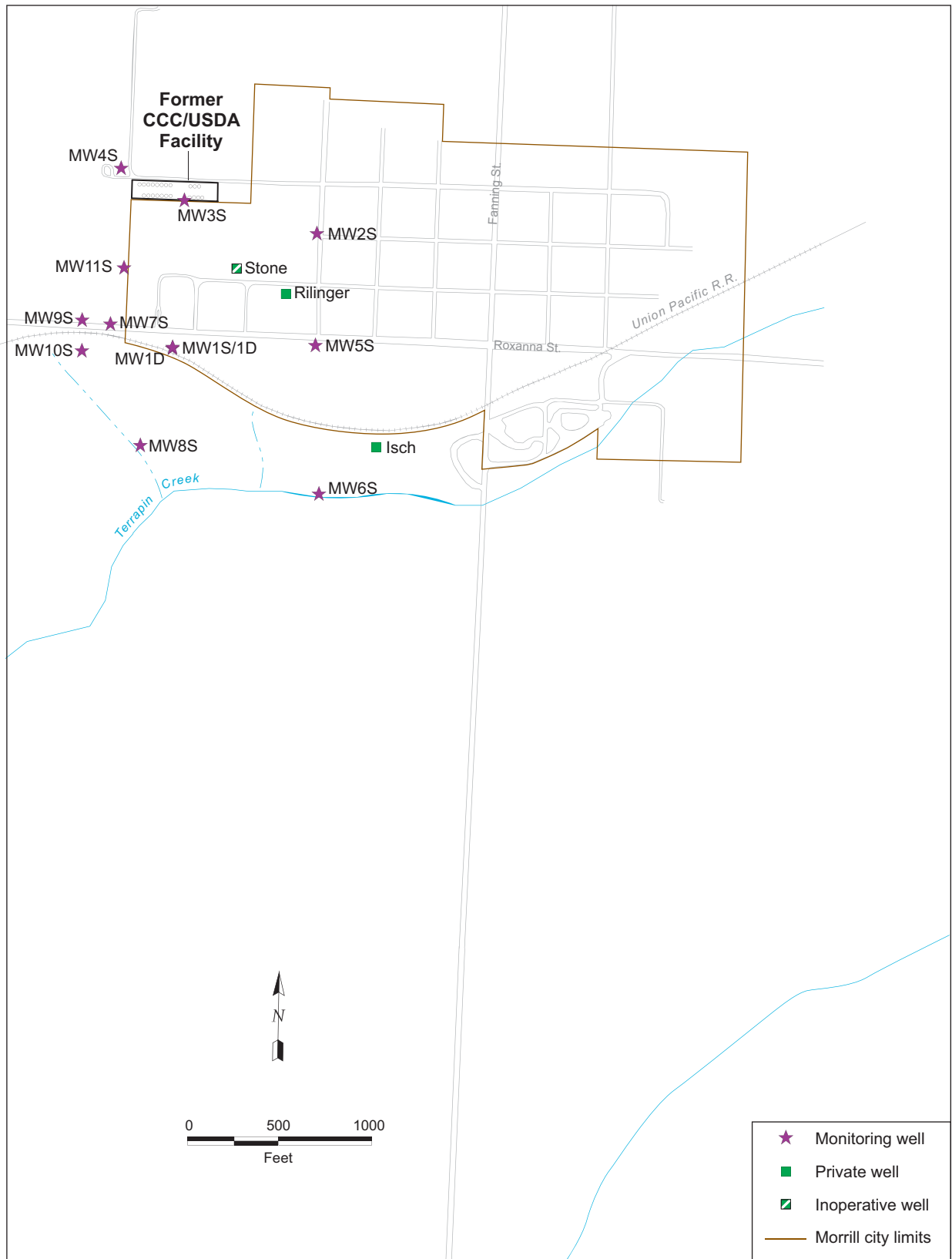


FIGURE 1.1 Monitoring network at Morrill, as of March 2007.

2 Sample Collection and Analysis Activities

2.1 Measurement of Groundwater Levels

Monitoring wells MW1D and MW1S-MW11S and the Stone and Isch private wells (Figure 1.1) were sampled on March 20-22, 2007. The Rilinger well was sampled on March 29, 2007, after approval for the sampling was received from the owner. Before each well was purged, a water level indicator was used (where possible) to measure the depth to groundwater and the total depth from the top of the well casing, with an accuracy of ± 0.01 ft.

Data recorders currently installed in wells MW1S-MW4S and MW6S-MW8S are gathering long-term data on the groundwater elevation and gradient at Morrill. The data recorders in these wells were downloaded on January 8, 2007, and water levels were measured manually in all monitoring wells.

The groundwater level data are discussed in Section 3.1.

2.2 Monitoring and Private Well Sampling and Analyses

After measurement of water levels and dissolved oxygen (DO), the wells were purged of a minimum of three well volumes. Field measurements of temperature, pH, and conductivity were taken, while purging continued until the measurements stabilized. Field measurements of carbon dioxide, iron(II), and oxidation-reduction potential (ORP) were made for the evaluation of possible biodegradation processes, as outlined in the *Monitoring Plan* (Argonne 2005b). All sampling and field analyses were performed in accord with procedures in the *Master Work Plan* (Argonne 2002). The sequence of activities during the March well sampling event and the April vegetation sampling is summarized in Appendix A.

Groundwater samples for VOCs and selected geochemical analyses identified in the *Monitoring Plan* (Argonne 2005b) were collected in appropriate laboratory containers, labeled, packaged, and chilled to 4°C by placement in ice-filled coolers. The samples were shipped by an overnight delivery service to the Applied Geosciences and Environmental Management (AGEM) Laboratory at Argonne for VOCs analyses with U.S. Environmental Protection Agency (EPA)

Method 524.2 (EPA 1995). Separate aliquots of selected samples (chosen in the field) were shipped to EnviroSystems, Inc., Columbia, Maryland, for verification VOCs analyses.

Samples for laboratory analyses of degradation parameters were collected and shipped to Severn-Trent Laboratories, South Burlington, Vermont. The analyses included dissolved chloride, sulfate, nitrate, and phosphate concentrations by EPA Method 300; total alkalinity by EPA Method 310.1; nitrate/nitrite nitrogen by EPA Method 353.2; sulfide by EPA Method 376.2; total organic carbon by EPA Method 415.1; and dissolved metals (aluminum, calcium, iron, magnesium, manganese, phosphorus, potassium, silicon, sodium, and zinc) by EPA Method 6010 (EPA 1998a). Analyses for the natural attenuation indicators methane, ethane, and ethene were conducted with Method RSK-175 (Kampbell and Vandegrift 1998). Prior sampling events included analyses for the attenuation parameters nitrate nitrogen (by EPA Method 354.1 at Severn-Trent Laboratories) and dissolved hydrogen (by Method AM20GAX at Microseeps Laboratory, Pittsburgh, Pennsylvania).

The analytical results are presented and discussed in Section 3.2.

2.3 Surface Water and Sediment Sampling and Analyses

At the request of the KDHE (2007a), surface water samples and corresponding samples of the underlying shallow sediments in the creek bed were collected for VOCs analyses on March 22, 2007, at five locations along Terrapin Creek (Figure 2.1), as outlined in the *Addendum* (Argonne 2007a) and in accord with procedures in the *Master Work Plan* (Argonne 2002) and SOP AGEM-15 (Argonne 2007b). Surface water flow in Terrapin Creek south of Morrill originates at the outfall from an earthen dam and retention pond located approximately 1,900 ft southwest of the former CCC/USDA facility (Figure 2.1). Surface water and sediment sampling location SMB, which is directly downstream of this outfall, is believed to lie upgradient, or cross-gradient, to groundwater flow (and hence possible contaminant migration) from the vicinity of the former CCC/USDA facility. (See Section 3.1.) Sampling locations SM1-SM4 were selected to lie downgradient and downstream from the carbon tetrachloride detections previously identified at MW8S and elsewhere in the monitoring well network.

Samples of surface water were collected in appropriate containers, labeled, preserved at 4°C, and shipped by an overnight delivery service to the AGEM Laboratory for VOCs analyses

with EPA Method 524.2 (EPA 1995). Samples of the shallow creek bed sediments were collected by directly scooping the materials into appropriate laboratory containers (Argonne 2006b, 2007b). The samples were labeled, preserved on dry ice, and shipped to the AGEM Laboratory for sample preparation and VOCs analyses with EPA Methods 5030B and 8260B

The analytical results for these analyses are presented and discussed in Section 3.3.

2.4 Vegetation Sampling and Analyses

Samples of natural vegetation, consisting of branch tissue material recovered from mature trees, were collected on April 2, 2007, at 18 locations along Terrapin Creek and its intermittent tributaries south and southeast of the former CCC/USDA facility (Figure 2.2). The sampling locations were selected to lie in the apparent direction of groundwater flow from the former facility. The tissue samples were collected in appropriate laboratory containers, labeled, preserved on dry ice, and shipped to the AGEM Laboratory for VOCs analyses by a headspace technique based on a modification of EPA Method 5021 (<http://www.epa.gov/epahome/index/>).

The analytical results for the vegetation samples are presented and discussed in Section 3.4.

2.5 Handling and Disposal of Investigation-Derived Waste

Purge water generated as potentially contaminated investigation-derived waste was containerized on-site in 55-gal drums. The accumulated wastewater was sampled and analyzed for VOCs and found to contain no unacceptable levels of these contaminants. With the approval of the KDHE (2007b), the water was discharged to the ground surface on May 9, 2007, away from sensitive receptors.

2.6 Quality Control for Sample Collection, Handling, and Analysis

The quality control/quality assurance procedures followed during the March 2007 monitoring event are described in detail in the *Master Work Plan* (Argonne 2002) and SOP AGEM-15 (Argonne 2007b). These procedures are summarized as follows:

- Sample collection and handling activities were monitored by the documentation of samples as they were collected and the use of chain-of-custody forms and custody seals to ensure sample integrity during the handling and shipment of samples for analysis.
- Samples for VOCs analyses were received with custody seals intact and at the appropriate preservation temperature. All samples were analyzed within required holding times.
- Quality control samples collected to monitor sample collection and handling activities included a field blank, equipment rinsates, trip blanks, and method blanks. The quality control samples were analyzed with the investigative samples to monitor analytical methodologies. The quality control samples were free of carbon tetrachloride contamination.
- Groundwater, surface water, and sediment samples were analyzed for VOCs at the AGEM Laboratory by using the purge-and-trap method with a gas chromatograph-mass spectrometer system. Calibration checks with each sample delivery group were required to be within $\pm 20\%$ of the standard. With the exception of one trip blank, surrogate standard determinations performed on samples and blanks were within the specified range of 80-120% for all samples, in either the initial analysis or a successful reanalysis of the sample. Cross-contamination of the samples during shipment is not indicated, and the result for the trip blank in question is accepted without qualification.
- Vegetation samples were analyzed for carbon tetrachloride and chloroform at the AGEM Laboratory by using a gas chromatograph with electron capture detection to achieve the low detection limits required. An 11-point calibration of the gas chromatograph system was established on the basis of the mass of known quantities of carbon tetrachloride and chloroform. Consistency in the results for secondary quality control analyses provides support for the sampling and analytical methodologies.
- In accordance with the quality assurance/quality control procedures defined in the *Master Work Plan* (Argonne 2002), the analyses of water samples at the

- AGEM Laboratory were verified by a second laboratory. Two groundwater samples were analyzed according to the EPA's Contract Laboratory Program methodology by EnviroSystems, Inc. The sample from monitoring well MW1D that was analyzed at the AGEM Laboratory with no carbon tetrachloride detected was analyzed by EnviroSystems, Inc., with similar result. The sample from MW7S analyzed at the AGEM Laboratory with carbon tetrachloride detected at 16 µg/L was analyzed by EnviroSystems, Inc., with a concentration of 20 µg/L reported, for a relative percent difference of 22.2%. High surrogate recovery was noted by EnviroSystems, Inc., in the analyses of both groundwater samples and the associated trip blank. Summary pages for the verification organic analyses are included in Appendix B.
- Samples shipped to Severn-Trent Laboratories for attenuation parameter analysis were received with custody seals intact and at the appropriate preservation conditions. All samples were analyzed within the required holding times. (Although the analyses of some samples for nitrate by EPA Method 300 did occur beyond the 48-hr holding time limit, the primary analyses of preserved sample volumes for total nitrogen with EPA Method 353.2 were within the holding time limit.) Laboratory quality control samples, prepared and analyzed with the samples to evaluate accuracy and precision, were within quality control limits.

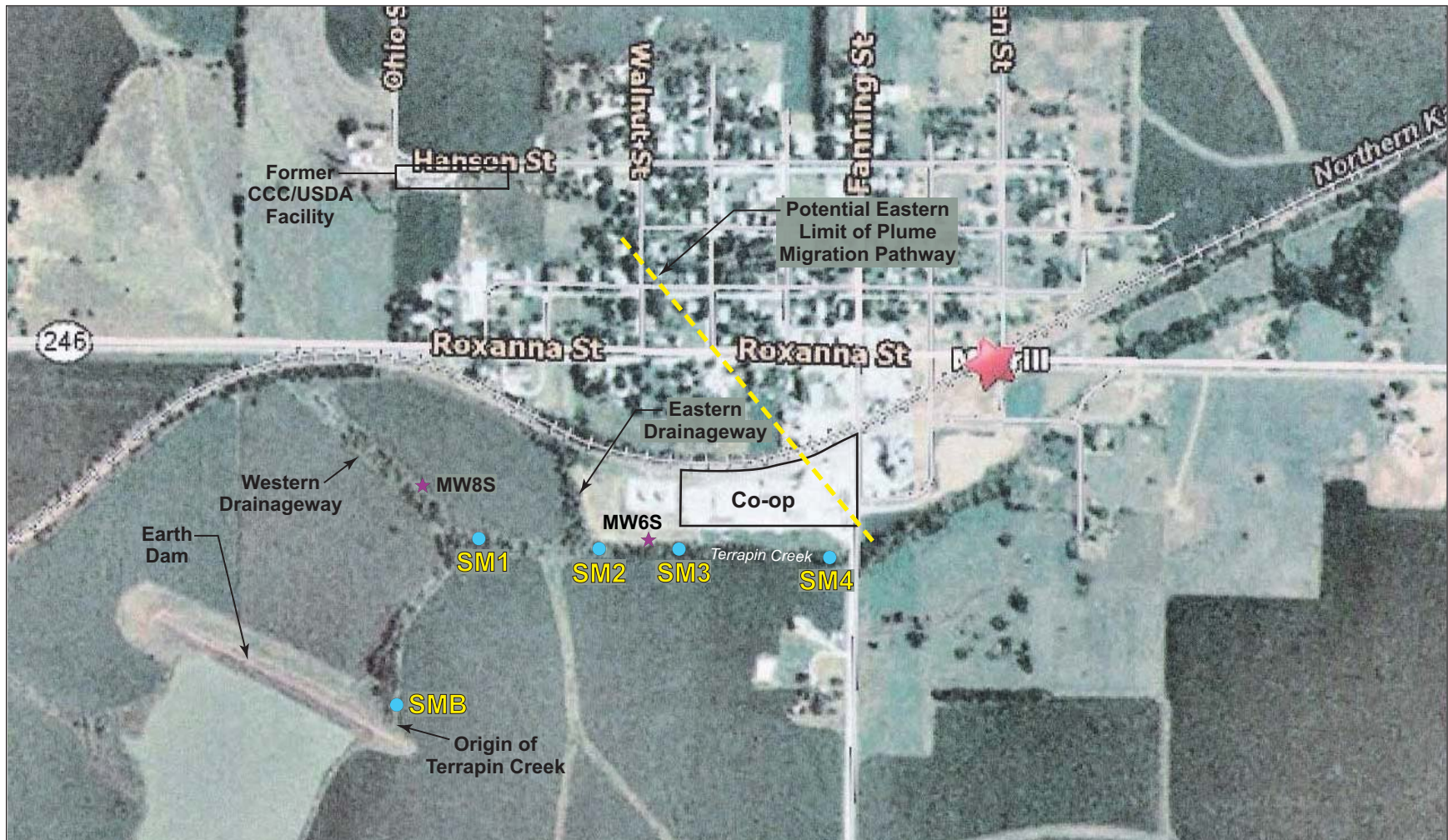


FIGURE 2.1 Locations of surface water and creek bed sediment sampling (SM1-SM4, SMB) along Terrapin Creek at Morrill in March 2007.



FIGURE 2.2 Locations of native vegetation (tree branch tissue) sampling along Terrapin Creek at Morrill in April 2007. Source of photograph: NAIP (2005).

3 Results and Discussion

3.1 Groundwater Level Data

Depths to groundwater were measured manually in all available monitoring wells on January 8, 2007, and March 20-22, 2007 (during sampling). The hand-measured water level data are in Table 3.1. The tables are grouped at the end of the Section 3 text, before the figures.

The potentiometric surface at Morrill, based on manual measurements on January 8, 2007, is depicted in Figure 3.1. The recent results are consistent with previous measurements (Figures 4.1-4.3 in Argonne 2006a), indicating a groundwater flow direction toward the south-southeast from the former CCC/USDA facility. Persistently low water levels observed at MW11S (Figure 3.1 of this report and Figure 4.3 in Argonne 2006a) empirically suggest the apparent presence of a groundwater “sink” southwest of the former facility in the vicinity of this monitoring well. This feature will require investigation during the planned September 2007 monitoring event.

Data for the long-term recording transducers installed in monitoring wells MW1S-MW4S and MW6S-MW8S for the period June 16, 2006, through January 8, 2007, are summarized in Figure 3.2. Groundwater levels at the site were relatively stable, showing a maximum net decline of approximately 2 ft during this monitoring period. Responses to individual recharge events are most prominent in wells MW1S-MW3S. The traces for wells MW6S and MW8S show the least variation over time, in keeping with the shallow groundwater at these locations near Terrapin Creek.

The cause for the drawdown spikes apparent in the hydrograph for monitoring well MW8S in late July and August 2006 is presently unknown. This feature will be investigated during the planned September 2007 monitoring event.

3.2 Groundwater Analysis Results

3.2.1 Results of the Groundwater Analyses for VOCs

The analytical data for VOCs in the groundwater samples collected in March 2007 are in Table 3.2, together with data for the previous sampling events conducted under the KDHE-approved *Monitoring Plan* (Argonne 2005b). The March 2007 data for carbon tetrachloride are illustrated in Figure 3.3.

Carbon tetrachloride was detected at 8 of the 15 monitoring locations, at concentrations ranging from $< 1 \mu\text{g/L}$ (at MW8S) to a maximum of $84 \mu\text{g/L}$ at MW3S. Low levels of chloroform ($< 1 \mu\text{g/L}$ to a maximum of $2.3 \mu\text{g/L}$ at MW3S) were detected in association with the carbon tetrachloride at each of the 8 locations, except for MW8S.

In comparison to the September 2006 sampling event, the present results indicate that carbon tetrachloride concentrations have declined slightly at three locations (MW7S, MW8S, MW11S). The levels were unchanged or rose slightly at the remaining sampling locations. Figure 3.4 indicates that the contaminant plume appears to be migrating toward Terrapin Creek; however, Table 3.2 demonstrates no consistent patterns of changing contaminant levels or migration since the CCC/USDA began its investigations at Morrill in 2003.

3.2.2 Results of Groundwater Analyses for Indicators of Possible Contaminant Degradation

The results of field measurements and selected laboratory geochemical analyses of the groundwater samples are summarized in Tables 3.3 and 3.4. The reported parameters can be used to estimate whether the *in situ* conditions at Morrill are suitable for possible degradation of carbon tetrachloride by natural anaerobic (reductive dechlorination) processes, as outlined in KDHE (2001) and EPA (1998b) guidance for the evaluation of these conditions.

In monitoring to date, no substantial evidence has been found for anaerobic biodegradation of carbon tetrachloride at Morrill. Though the data density and distribution of sampling points could affect this interpretation to an extent, the available results do not suggest that better sampling coverage would reveal a significant potential for anaerobic biodegradation of carbon tetrachloride at this site.

3.3 Surface Water and Sediment Analysis Results

The results of VOCs analyses of the surface water and shallow sediment samples collected (at the request of the KDHE) along Terrapin Creek are in Table 3.5.

No carbon tetrachloride was detected in the surface water samples at an analytical method detection limit of 0.1 µg/L. Similarly, no carbon tetrachloride was identified in the associated sediment samples at an analytical method detection limit of 1.0 µg/kg. The March 2007 results therefore indicate that the surface waters and underlying sediments of Terrapin Creek have not been impacted by carbon tetrachloride contamination.

3.4 Vegetation Analysis Results

Experience gained by the CCC/USDA and Argonne in monitoring of the phytoremediation treatment programs in operation at the Murdock, Nebraska, former CCC/USDA grain storage facility and at the Argonne National Laboratory facility near Chicago, Illinois (Argonne 2005c, 2006c; LaFreniere et al., 2006) has demonstrated that the detection of VOCs in native vegetation, and particularly in the branch tissues of trees, can provide a sensitive indicator of the presence of VOCs in the surface water or shallow groundwater to which these plants are exposed. This experience has also demonstrated, however, that the occurrence of VOCs contamination in branch tissues is associated with seasonal uptake of water by the trees during the active growing season; VOC levels in the plant tissues appear to fall rapidly as the trees enter their dormancy period during the fall and winter months.

At the request of the CCC/USDA, branch tissue samples from mature native trees were collected for VOCs analyses at 18 locations along Terrapin Creek and along several intermittent tributary drainages that feed into Terrapin Creek, in the area south and downgradient of the former CCC/USDA facility. The tissue samples were collected on April 2, 2007, very early in the present growing season.

The analytical data for VOCs in the branch tissue samples are in Table 3.6. No carbon tetrachloride was identified at any of the vegetation sampling locations, at an analytical method detection limit of 0.1 µg/kg. The observed results are qualitatively consistent with the absence of carbon tetrachloride in surface waters and shallow sediments discussed in Section 3.3, as well as

with the absence of carbon tetrachloride to trace levels identified in the shallow groundwater at monitoring well locations MW6S and MW8S (Section 3.2.1) along Terrapin Creek.

Further branch tissue sampling of the trees along Terrapin Creek and its tributaries is recommended in conjunction with the planned September 2007 sampling event at Morrill, to investigate for possible contaminant uptake by these plants at or near the anticipated peak of the summer 2007 growing season.

TABLE 3.1 Groundwater levels at Morrill, measured by hand on January 8 and March 20-22, 2007.

Well	Horizontal Location ^a (ft)		Top of Casing Elevation ^b (ft AMSL)	January 8, 2007		March 20-22, 2007	
	Northing	Easting		Depth to Water (ft BGL)	Groundwater Elevation (ft AMSL)	Depth to Water (ft BGL)	Groundwater Elevation (ft AMSL)
MW1s	589130.20	1957316.76	1124.68	26.79	1097.89	25.80	1098.88
MW2s	589789.61	1958063.43	1137.07	37.83	1099.24	35.77	1101.30
MW3s	589929.06	1957333.78	1135.76	31.73	1104.03	26.19	1109.57
MW4s	590083.24	1956982.15	1143.61	42.72	1100.89	38.74	1104.87
MW5s	589182.24	1958089.03	1122.21	26.50	1095.71	25.14	1097.07
MW6s	588385.33	1958149.44	1090.97	4.93	1086.04	5.42	1085.55
MW7s	589238.96	1956967.99	1119.86	20.40	1099.46	18.01	1101.85
MW8s	588590.43	1957169.82	1098.53	3.31	1095.22	2.63	1095.90
MW9s	589243.57	1956819.91	1118.31	19.29	1099.02	16.69	1101.62
MW10s	589081.48	1956829.05	1110.78	11.62	1099.16	10.77	1100.01
MW11s	589542.25	1957031.81	1133.08	36.45	1096.63	34.65	1098.43

^a Horizontal coordinates are target location centers. Northings and eastings are Kansas State Plane Coordinates. Horizontal datum is North American Datum (NAD) 83.

^b Vertical datum is National Geodetic Vertical Datum (NGVD) 88.

Source: Schwab-Eaton, Manhattan, Kansas.

TABLE 3.2 Results of analyses at the AGEM Laboratory for volatile organic compounds in groundwater samples collected at Morrill, October 2003 through March 2007.

Well	Screen Interval (ft BGL)	Sample Date	Concentration (µg/L)		
			Carbon Tetrachloride	Chloroform	Methylene Chloride
MW1S	11-51	10/23/03	33	1.6	ND ^a
		6/2/04	19	0.9 J ^b	ND
		9/13/05	35	1.7	ND
		3/22/06	40	1.8	ND
		9/20/06	23	0.9 J	ND
		3/21/07	23	1.1	ND
MW1D	63-88	10/22/03	ND	ND	ND
		6/2/04	ND	ND	ND
		9/13/05	ND	ND	ND
		3/19/06	ND	ND	0.4 J B ^c
		9/20/06	ND	ND	ND
		3/21/07	ND	ND	ND
MW2S	13-53	10/22/03	ND	ND	ND
		6/2/04	ND	ND	ND
		9/14/05	ND	ND	ND
		3/21/06	ND	ND	ND
		9/18/06	ND	ND	ND
		3/22/07	ND	ND	ND
MW3S	18-48	10/23/03	89	2.7	ND
		6/2/04	110	3.2	ND
		9/13/05	101	3.2	ND
		3/23/06	91	2.6	ND
		9/20/06	49	1.5	ND
		3/22/07	84	2.3	ND
MW4S	17-47	10/21/03	ND	ND	ND
		6/4/04	ND	ND	ND
		9/14/05	ND	ND	ND
		3/21/06	ND	ND	ND
		9/18/06	ND	ND	ND
		3/22/07	ND	ND	ND
MW5S	15-55	10/22/03	5.8	ND	ND
		6/2/04	7.0	ND	ND
		9/13/05	6.3	0.2 J	ND
		3/22/06	7.3	0.2 J	ND

TABLE 3.2 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (µg/L)		
			Carbon Tetrachloride	Chloroform	Methylene Chloride
		9/20/06	6.4	0.3 J	ND
		3/22/07	6.5	0.4 J	ND
MW6S	10–25	6/3/04	ND	ND	ND
		9/14/05	ND	ND	ND
		3/20/06	ND	ND	ND
		9/18/06	ND	ND	ND
		3/21/07	ND	ND	ND
MW7S	20–45	6/3/04	18	ND	ND
		9/12/05	43	1.1	ND
		3/22/06	21	0.4 J	ND
		9/19/06	38	0.7 J	ND
		3/20/07	16	0.4 J	ND
MW8S	10–25	6/3/04	ND	ND	ND
		9/14/05	0.9 J	ND	ND
		3/20/06	0.6 J	ND	0.4 J B
		9/19/06	1.3	ND	ND
		3/20/07	0.6 J	ND	ND
MW9S	38.8–53.8	3/22/06	ND	ND	ND
		9/19/06	ND	ND	ND
		3/20/07	ND	ND	ND
MW10S	30–45	3/21/06	ND	ND	ND
		9/18/06	ND	ND	ND
		3/21/07	ND	ND	ND
MW11S	53–68	3/22/06	39	0.9 J	ND
		9/19/06	53	1.0	ND
		3/20/07	37	0.8 J	ND
Isch	Unknown	2/19/04	ND	ND	ND
		9/14/05	ND	ND	ND
		3/23/06	ND	ND	ND
		9/19/06	ND	ND	ND
		3/22/07	ND	ND	ND
Rilinger	Unknown	6/4/04	ND	ND	ND
		9/14/05	2.6	0.1 J	ND
		3/19/06	ND	ND	0.4 J B

TABLE 3.2 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration ($\mu\text{g/L}$)		
			Carbon Tetrachloride	Chloroform	Methylene Chloride
		9/19/06	ND	ND	ND
		3/29/07	1.3	1.1	ND
Stone	40 ^d (TD)	6/4/04	10	ND	ND
		9/14/05	2.6	0.3 J	ND
		3/19/06	14	0.8 J	0.4 J B
		9/19/06	2.1	ND	ND
		3/22/07	5.4	0.3 J	ND

^a ND, not detected at instrument detection limit of 0.1 $\mu\text{g/L}$.

^b Qualifier J indicates an estimated concentration below the method quantitation limit of 1.0 $\mu\text{g/L}$.

^c Qualifier B indicates that the contaminant was present in the associated method blank.

^d Total depth.

TABLE 3.3 Field measurements on groundwater samples collected at Morrill, October 2003 through March 2007.

Well	Screen Interval (ft BGL)	Sample Date	Temperature (°C)	pH	Conductivity (µS/cm)	Concentration (mg/L)			ORP (mV)
						Dissolved Oxygen	Carbon Dioxide	Iron(II)	
MW1S	11–51	10/23/03	14.6	7.14	933	– ^a	–	–	13
		6/2/04	14.4	7.16	970	–	–	–	–
		9/13/05	15.3	6.95	1174	7.17	55	0.00	200
		3/22/06	15.5	7.23	927	9.94	40	0.01	220
		9/20/06	15.7	7.12	973	7.52	40	0.03	–
		3/21/07	16.6	6.48	960	5.45	40	0.00	88
MW1D	63–88	10/22/03	14.9	6.87	2620	–	–	–	25
		6/2/04	13.9	6.87	2460	–	–	–	–
		9/13/05	15.5	6.56	2470	–	–	–	–
		3/19/06	12.9	6.95	2460	5.11	–	0.00	230
		9/20/06	12.5	6.93	2690	–	–	–	–
		3/21/07	15.3	6.39	2540	0.08	40	0.39	12
MW2S	13–53	10/22/03	16.2	6.86	875	–	–	–	20
		6/2/04	16.9	7.07	861	–	–	–	–
		9/14/05	15.2	6.94	801	7.85	65	–	142
		3/21/06	13.0	7.07	863	9.40	25	0.14	262
		9/18/06	13.6	6.99	844	6.81	80	0.00	69
		3/22/07	15.2	6.40	790	5.82	30	0.00	69
MW3S	18–48	10/23/03	16.8	7.23	655	–	–	–	6
		6/2/04	14.2	7.23	664	–	–	–	–
		9/13/05	14.6	7.13	663	8.82	100	0.00	223
		3/23/06	8.9	7.16	662	6.74	25	0.08	269
		9/20/06	12.9	7.15	669	7.64	–	0.00	105
		3/22/07	15.0	6.44	578	5.90	30	0.17	261
MW4S	17–47	10/21/03	–	7.17	758	–	–	–	–
		6/4/04	15.4	6.93	769	–	–	–	–
		9/14/05	15.4	7.3	751	8.00	50	0.00	174
		3/21/06	6.7	7.25	729	10.9	25	0.00	154
		9/18/06	13.1	7.25	728	8.05	50	0.00	41
		3/22/07	14.2	6.53	765	5.91	25	0.10	78
MW5S	15–55	10/22/03	15.3	7.1	816	–	–	–	6
		6/2/04	14.3	7.21	817	–	–	–	–
		9/13/05	16.0	7.04	763	13.9	60	0.00	228
		3/22/06	13.9	7.25	781	4.52	35	0.06	234
		9/20/06	13.9	7.19	787	5.82	35	0.00	73
		3/22/07	15.5	6.5	436	3.98	30	0.08	159

TABLE 3.3 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Temperature (°C)	pH	Conductivity (µS/cm)	Concentration (mg/L)			ORP (mV)
						Dissolved Oxygen	Carbon Dioxide	Iron(II)	
MW6S	10–25	6/3/04	15.1	6.89	2410	–	–	–	–
		9/14/05	14.1	7.06	2350	0.01	60	0.00	54
		3/20/06	9.8	6.91	2360	1.37	60	0.38	89
		9/18/06	12.5	6.96	2410	0.08	85	0.35	- 29
		3/21/07	18.0	6.34	2450	0.12	40	0.78	75
MW7S	20–45	6/3/04	13.8	7.19	763	–	–	–	–
		9/12/05	15.0	7.26	760	8.35	50	0.00	240
		3/22/06	15.2	7.32	740	5.52	25	0.03	268
		9/19/06	13.2	7.15	764	7.37	25	0.00	114
		3/20/07	14.6	6.43	750	5.31	30	0.00	95
MW8S	10–25	6/3/04	12.8	7.12	941	–	–	–	–
		9/14/05	14.1	7.3	853	0.02	40	0.00	65
		3/20/06	12.5	7.04	954	0.90	30	0.05	153
		9/19/06	11.8	7.09	903	0.58	50	0.13	284
		3/20/07	11.0	6.52	1026	0.77	30	0.00	76
MW9S	38.8–53.8	3/22/06	14.6	7.17	715	0.41	35	0.00	25
		9/19/06	13.0	7.08	707	0.10	55	0.00	113
		3/20/07	14.2	6.39	714	0.21	20	0.00	40
MW10S	30–45	3/21/06	6.3	7.11	701	2.10	40	0.01	88
		9/18/06	14.3	7.17	701	0.04	60	0.08	24
		3/21/07	14.5	6.51	720	0.88	30	0.00	11
MW11S	53–68	3/22/06	14.8	7.33	762	9.40	30	0.06	237
		9/19/06	13.0	7.24	764	1.42	30	0.02	158
		3/20/07	14.6	6.33	782	3.90	30	0.00	76
Isch	Unknown	2/19/04	–	–	–	–	–	–	–
		9/14/05	20.4	6.73	2300	–	–	–	–
		3/23/06	13.0	7.23	9400	–	–	–	–
		9/19/06	–	–	–	–	–	–	–
		3/22/07	–	–	–	–	–	–	–
Rilinger	Unknown	6/4/04	15.9	6.99	2450	–	–	–	–
		9/14/05	–	–	–	–	–	–	–
		3/19/06	11.9	7.05	2550	–	–	–	–
		9/19/06	–	–	–	–	–	–	–
		3/29/07	–	–	–	–	–	–	–

TABLE 3.3 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Temperature (°C)	pH	Conductivity (µS/cm)	Concentration (mg/L)			ORP (mV)
						Dissolved Oxygen	Carbon Dioxide	Iron(II)	
Stone	40 ^b	6/4/04	17.1	7.35	682	–	–	–	–
		9/14/05	17.3	6.81	638	–	–	–	–
		3/19/06	12.9	6.42	650	–	–	0.00	213
		9/19/06	16.7	7.12	639	–	–	–	–
		3/22/07	16.7	6.58	679	4.71	35	0.28	19

^a Not measured.

^b Total depth.

TABLE 3.4 Results of attenuation parameters analyses on groundwater samples collected at Morrill, October 2003 through March 2007.

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)											
			Total Alkalinity	Chloride	Sulfate	Sulfide	Nitrate	Nitrite	Nitrate-Nitrite Nitrogen	Phosphate	Aluminum	Calcium	Iron	Magnesium
MW1S	11-51	10/23/03	323	67.8	32.5	-	14.3	-	13.5	U < 0.2 ^a	U < 0.2	123	U < 0.1	31.4
		6/2/04	-	84.6	35.1	-	11.2	U < 0.005	11.8	U < 0.2	U < 0.2	118	U < 0.1	27.5
		9/13/05	304	85.4	31.1	U < 0.02	14.2	0.0212	14.5	U < 0.2	U < 0.2	126	U < 0.1	28.2
		3/22/06	311	87.0	39.3	U < 0.02	15.2	U < 0.005	14.2	U < 0.2	U < 0.2	120	U < 0.1	27.8
		9/20/06	306	95.8	36.4	U < 0.02	9.67	-	8.78	U < 0.2	U < 0.2	123	U < 0.1	23.3
		3/21/07	300	79.0	32	U < 0.02	11 H ^b	-	12.0	U < 0.2	U < 0.2	114	U < 0.1	23.8
MW1D	63-88	10/22/03	278	19.0	1430	-	U < 0.2	-	U < 0.01	U < 0.2	U < 0.2	572	0.102	49.5
		6/2/04	-	18.5	1340	-	U < 0.2	U < 0.005	U < 0.01	U < 0.2	U < 0.2	582	U < 0.1	52.0
		9/13/05	-	-	-	-	-	-	-	-	-	-	-	-
		3/19/06	-	-	-	-	-	-	-	-	-	-	-	-
		9/20/06	-	-	-	-	-	-	-	-	-	-	-	-
		3/21/07	270	23.0	1500	U < 0.02	U < 0.1	-	U < 0.1	U < 0.2	U < 0.2	567	0.18	47.6
MW2S	13-53	10/22/03	295	23.2	44	-	25.1	-	24.2	U < 0.2	U < 0.2	129	U < 0.1	31.0
		6/2/04	-	17.1	61.8	-	16.2	U < 0.005	17.2	U < 0.2	U < 0.2	124	U < 0.1	25.8
		9/14/05	289	11.0	56.6	U < 0.02	18.2	U < 0.005	20.4	0.307	U < 0.2	130	U < 0.1	21.4
		3/21/06	301	23.3	51	U < 0.02	25.4	U < 0.005	25.2	U < 0.2	U < 0.2	125	U < 0.1	31.4
		9/18/06	306	15.1	71.3	U < 0.02	12.4	-	14.5	U < 0.2	U < 0.2	124	U < 0.1	24.3
		3/22/07	280	13.0	40	U < 0.02	19 H	-	20.0	U < 0.2	U < 0.2	102	U < 0.1	23.8
MW3S	18-48	10/23/03	298	3.38	19.7	-	12.1	-	11.5	U < 0.2	U < 0.2	93.4	U < 0.1	17.5
		6/2/04	-	3.12	20.6	-	10.1	U < 0.005	10.9	U < 0.2	U < 0.2	92.6	U < 0.1	15.8
		9/13/05	280	3.28	28	U < 0.02	13.5	U < 0.005	14.6	0.374	U < 0.2	106	U < 0.1	15.6
		3/23/06	287	3.85	22.8	U < 0.02	15.2	U < 0.005	13.4	U < 0.2	U < 0.2	90.5	U < 0.1	15.5
		9/20/06	294	4.18	23.8	U < 0.02	12.3	-	11.5	U < 0.2	U < 0.2	94.7	U < 0.1	14.3
		3/22/07	290	4.40	23	U < 0.02	11 H	-	12	U < 0.2	U < 0.2	93.4	U < 0.1	14.4
MW4S	17-47	10/21/03	327	11.1	21.3	-	19.9	-	18.3	U < 0.2	U < 0.2	89.5	U < 0.1	36.0
		6/4/04	-	10.2	23.5	-	18.9	U < 0.005	19.3	U < 0.2	U < 0.2	86.2	U < 0.1	36.6
		9/14/05	292	10.3	24.6	U < 0.02	20.8	U < 0.005	22.9	0.271	U < 0.2	92.5	U < 0.1	34.1

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)											
			Total Alkalinity	Chloride	Sulfate	Sulfide	Nitrate	Nitrite	Nitrate-Nitrite Nitrogen	Phosphate	Aluminum	Calcium	Iron	Magnesium
		3/21/06	222	9.11	18.2	U < 0.02	16.2	U < 0.005	15.2	U < 0.2	U < 0.2	55	U < 0.1	23.4
		9/18/06	298	11.0	22.2	U < 0.02	19.6	-	18.9	U < 0.2	-	-	-	-
		3/22/07	300	11.0	22	U < 0.02	18 H	-	19	U < 0.2	U < 0.2	83.2	U < 0.1	34.0
MW5S	15-55	10/22/03	308	12.2	53.3	-	20.4	-	19.1	U < 0.2	U < 0.2	117	U < 0.1	31.6
		6/2/04	-	11.7	48.7	-	19.5	U < 0.005	21	U < 0.2	U < 0.2	106	U < 0.1	30.5
		9/13/05	292	11.4	41.4	U < 0.02	18.3	0.0148	20.9	U < 0.2	U < 0.2	102	U < 0.1	29.3
		3/22/06	297	13.1	48.5	U < 0.02	22	U < 0.005	20.1	U < 0.2	U < 0.2	99.1	U < 0.1	28.4
		9/20/06	295	11.1	37	U < 0.02	19.8	-	19.2	U < 0.2	U < 0.2	98	U < 0.1	28.5
		3/22/07	310	12.0	38	U < 0.02	20 H	-	21	U < 0.2	U < 0.2	95.6	U < 0.1	27.7
MW6S	10-25	6/3/04	-	25.8	1280	-	0.339	U < 0.005	0.0694	U < 0.2	U < 0.2	470	U < 0.1	111
		9/14/05	261	27.2	1330	0.0443	U < 0.4	U < 0.005	U < 0.01	0.272	U < 0.2	481	U < 0.1	104
		3/20/06	263	31.4	1560	U < 0.02	0.321	0.0061	U < 0.01	U < 0.2	U < 0.2	413	U < 0.1	86.2
		9/18/06	264	26.0	1330	U < 0.02	0.353	-	0.0142	U < 0.2	U < 0.2	461	0.13 B ^c	98.5
		3/21/07	270	28.0	1400	U < 0.02	U < 0.1	-	U < 0.1	U < 0.2	U < 0.2	452	U < 0.1	93.8
MW7S	20-45	6/3/04	-	12.8	19.3	-	16.7	0.0089	17.6	U < 0.2	U < 0.2	100	U < 0.1	21.9
		9/12/05	303	12.0	23.3	U < 0.02	18	U < 0.005	19.8	U < 0.2	U < 0.2	105	U < 0.1	22.4
		3/22/06	304	9.76	25.8	U < 0.02	19.8	U < 0.005	18.4	U < 0.2	U < 0.2	96.9	U < 0.1	20.4
		9/19/06	333	9.73	21.9	U < 0.02	18.3	-	18.3	U < 0.2	U < 0.2	101	U < 0.1	21.6
		3/20/07	290	11.0	20	U < 0.02	17 H	-	17	U < 0.2	U < 0.2	96.3	U < 0.1	20.5
MW8S	10-25	6/3/04	-	14.3	163	-	5.85	U < 0.005	6.52	U < 0.2	U < 0.2	130	U < 0.1	35.2
		9/14/05	285	41.6	139	U < 0.02	10.4	U < 0.005	11.7	0.328	-	-	-	-
		3/20/06	302	26.8	159	U < 0.02	8.97	0.0109	8.39	U < 0.2	U < 0.2	110	U < 0.1	28.5
		9/19/06	295	37.9	108	U < 0.02	13.8	-	12.9	U < 0.2	U < 0.2	115	U < 0.1	29.0
		3/20/07	300	35.0	130	U < 0.02	10 H	-	8.1	U < 0.2	U < 0.2	120	U < 0.1	34.0
MW9S	38.8-53.8	3/22/06	350	5.97	57.1	U < 0.02	0.349	0.0066	0.0427	U < 0.2	U < 0.2	76.9	U < 0.1	33.7
		9/19/06	-	5.86	40.9	U < 0.02	1.04	-	0.916	U < 0.2	U < 0.2	79	U < 0.1	34.8
		3/20/07	290	5.90	21.0	U < 0.02	3.9 H	-	8.4	U < 0.2	U < 0.2	75.5	U < 0.1	31.2

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)												
			Total Alkalinity	Chloride	Sulfate	Sulfide	Nitrate	Nitrite	Nitrate-Nitrite		Phosphate	Aluminum	Calcium	Iron	Magnesium
									Nitrogen						
MW10S	30-45	3/21/06	351	6.07	42	U < 0.02	0.357	U < 0.005	0.162	U < 0.2	U < 0.2	86.3	U < 0.1	32.6	
		9/18/06	322	5.95	39.2	U < 0.02	0.411	-	U < 0.01	U < 0.2	U < 0.2	82.9	U < 0.1	31.3	
		3/21/07	360	5.80	30	U < 0.02	1.6 H	-	1.5	U < 0.2	U < 0.2	79.4	U < 0.1	30.3	
MW11S	53-68	3/22/06	316	8.22	25.2	U < 0.02	21.8	0.0052	20.3	U < 0.2	U < 0.2	90.5	U < 0.1	30.5	
		9/19/06	311	7.33	21.3	U < 0.02	19.6	-	18.6	U < 0.2	U < 0.2	91.5	U < 0.1	30.4	
		3/20/07	310	7.20	20	U < 0.02	18 H	-	15.0	U < 0.2	U < 0.2	87.3	U < 0.1	28.7	
Isch	Unknown	2/19/04	-	-	-	-	-	-	-	-	-	-	-	-	
		9/14/05	-	-	-	-	-	-	-	-	-	-	-	-	
		3/23/06	-	-	-	-	-	-	-	-	-	-	-	-	
		9/19/06	-	-	-	-	-	-	-	-	-	-	-	-	
		3/22/07	-	-	-	-	-	-	-	-	-	-	-	-	
Rilinger	Unknown	6/4/04	-	19.6	1320	-	0.348	U < 0.005	0.179	U < 0.2	U < 0.2	542	U < 0.1	48.6	
		9/14/05	-	-	-	-	-	-	-	-	-	-	-	-	
		3/19/06	-	-	-	-	-	-	-	-	-	-	-	-	
		9/19/06	-	-	-	-	-	-	-	-	-	-	-	-	
		3/29/07	-	-	-	-	-	-	-	-	-	-	-	-	
Stone	40 ^d	6/4/04	-	10.9	42.2	-	10.6	U < 0.005	11.2	U < 0.2	U < 0.2	98.2	U < 0.1	17.6	
		9/14/05	-	-	-	-	-	-	-	-	-	-	-	-	
		3/19/06	-	-	-	-	-	-	-	-	-	-	-	-	
		9/19/06	-	-	-	-	-	-	-	-	-	-	-	-	
		3/22/07	250	18.0	45	U < 0.02	9.5 H	-	9.3	U < 0.2	U < 0.2	96.3	U < 0.1	15.6	

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)					Concentration (µg/L)			Total Organic Carbon (mg/L)	Dissolved Hydrogen (nM)
			Phosphorus	Potassium	Silicon	Sodium	Zinc	Ethane	Ethene	Methane		
MW1S	11-51	10/23/03	U < 0.25	U < 5.00	7.69	35.0	U < 0.02	-	-	-	-	-
		6/2/04	U < 0.25	U < 5.00	7.86	36.4	U < 0.02	-	-	-	-	-
		9/13/05	U < 0.25	U < 5.00	7.52	41.1	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	2.7
		3/22/06	U < 0.25	U < 5.00	7.45	37.3	U < 0.02	< 4.00	< 3.00	< 2.00	1.68	-
		9/20/06	U < 0.25	U < 5.00	7.69	40.7	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/21/07	U < 0.25	U < 5.00	7.74	36.4	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW1D	63-88	10/22/03	U < 0.25	U < 5.00	7.79	26.4	U < 0.02	-	-	-	-	-
		6/2/04	U < 0.25	U < 5.00	8.43	27.0	U < 0.02	-	-	-	-	-
		9/13/05	-	-	-	-	-	-	-	-	-	-
		3/19/06	-	-	-	-	-	-	-	-	-	-
		9/20/06	-	-	-	-	-	-	-	-	-	-
		3/21/07	U < 0.25	U < 5.00	7.96	23.7	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW2S	13-53	10/22/03	U < 0.25	U < 5.00	8.62	18.7	U < 0.02	-	-	-	-	-
		6/2/04	U < 0.25	U < 5.00	9.26	20.3	U < 0.02	-	-	-	-	-
		9/14/05	U < 0.25	U < 5.00	8.72	19.2	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	2.4
		3/21/06	U < 0.25	U < 5.00	8.29	18.8	U < 0.02	< 4.00	< 3.00	< 2.00	7.63	-
		9/18/06	U < 0.25	U < 5.00	8.73	18.5	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/22/07	U < 0.25	U < 5.00	8.44	15.9	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW3S	18-48	10/23/03	U < 0.25	U < 5.00	7.34	20.2	U < 0.02	-	-	-	-	-
		6/2/04	U < 0.25	U < 5.00	7.70	23.5	U < 0.02	-	-	-	-	-
		9/13/05	U < 0.25	U < 5.00	7.04	25.9	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	2.8
		3/23/06	U < 0.25	U < 5.00	7.27	20.1	U < 0.02	< 4.00	< 3.00	< 2.00	1.95	-
		9/20/06	U < 0.25	U < 5.00	7.32	20.0	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/22/07	U < 0.25	U < 5.00	7.46	20.9	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW4S	17-47	10/21/03	U < 0.25	U < 5.00	7.90	19.8	U < 0.02	-	-	-	-	-
		6/4/04	U < 0.25	U < 5.00	8.26	18.9	U < 0.02	-	-	-	-	-
		9/14/05	U < 0.25	U < 5.00	8.01	18.0	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	8.5
		3/21/06	U < 0.25	U < 5.00	5.85	12.9	U < 0.02	< 4.00	< 3.00	< 2.00	9.28	-

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)					Concentration (µg/L)			Total Organic Carbon (mg/L)	Dissolved Hydrogen (nM)
			Phosphorus	Potassium	Silicon	Sodium	Zinc	Ethane	Ethene	Methane		
MW5S	15-55	9/18/06	-	-	-	-	-	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/22/07	U < 0.25	U < 5.00	7.88	17.5	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		10/22/03	U < 0.25	U < 5.00	8.32	19.0	U < 0.02	-	-	-	-	-
		6/2/04	U < 0.25	U < 5.00	8.32	19.0	U < 0.02	-	-	-	-	-
		9/13/05	U < 0.25	U < 5.00	8.55	17.7	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	31
		3/22/06	U < 0.25	U < 5.00	7.91	16.3	U < 0.02	< 4.00	< 3.00	< 2.00	2.38	-
		9/20/06	U < 0.25	U < 5.00	7.79	16.3	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
3/22/07	U < 0.25	U < 5.00	7.91	16.1	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-		
MW6S	10-25	6/3/04	U < 0.25	U < 5.00	10.4	36.5	U < 0.02	-	-	-	-	-
		9/14/05	U < 0.25	U < 5.00	10.0	34.2	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/20/06	U < 0.25	U < 5.00	9.71	29.0	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		9/18/06	U < 0.25	U < 5.00	9.75	31.9	0.0212	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/21/07	U < 0.25	U < 5.00	9.74	31.0	0.0247	< 4.00	< 3.00	< 2.00	< 1.00	-
MW7S	20-45	6/3/04	U < 0.25	U < 5.00	7.76	23.9	U < 0.02	-	-	-	-	-
		9/12/05	U < 0.25	U < 5.00	7.53	26.7	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	7.2
		3/22/06	U < 0.25	U < 5.00	7.26	20.6	U < 0.02	< 4.00	< 3.00	< 2.00	2.00	-
		9/19/06	U < 0.25	U < 5.00	7.27	22.0	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/20/07	U < 0.25	U < 5.00	7.37	21.3	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW8S	10-25	6/3/04	U < 0.25	U < 5.00	8.50	30.6	U < 0.02	-	-	-	-	-
		9/14/05	-	-	-	-	-	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/20/06	U < 0.25	U < 5.00	8.22	24.3	U < 0.02	< 4.00	< 3.00	< 2.00	1.12	-
		9/19/06	U < 0.25	U < 5.00	8.74	24.0	U < 0.02	< 4.00	< 3.00	< 2.00	1.44	-
		3/20/07	U < 0.25	U < 5.00	8.06	27.0	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW9S	38.8-53.8	3/22/06	U < 0.25	U < 5.00	8.71	23.6	U < 0.02	< 4.00	< 3.00	< 2.00	1.60	-
		9/19/06	U < 0.25	U < 5.00	8.14	23.8	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/20/07	U < 0.25	U < 5.00	7.33	20.8	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)					Concentration (µg/L)			Total Organic Carbon (mg/L)	Dissolved Hydrogen (nM)
			Phosphorus	Potassium	Silicon	Sodium	Zinc	Ethane	Ethene	Methane		
MW10S	30-45	3/21/06	U < 0.25	U < 5.00	8.90	28.2	U < 0.02	< 4.00	< 3.00	< 2.00	4.26	-
		9/18/06	U < 0.25	U < 5.00	8.82	25.8	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/21/07	U < 0.25	U < 5.00	7.81	23.2	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
MW11S	53-68	3/22/06	U < 0.25	U < 5.00	7.48	22.6	U < 0.02	< 4.00	< 3.00	< 2.00	2.19	-
		9/19/06	U < 0.25	U < 5.00	7.28	24.3	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
		3/20/07	U < 0.25	U < 5.00	7.38	23.4	U < 0.02	< 4.00	< 3.00	< 2.00	< 1.00	-
Isch	Unknown	2/19/04	-	-	-	-	-	-	-	-	-	-
		9/14/05	-	-	-	-	-	-	-	-	-	-
		3/23/06	-	-	-	-	-	-	-	-	-	-
		9/19/06	-	-	-	-	-	-	-	-	-	-
		3/22/07	-	-	-	-	-	-	-	-	-	-
Rilinger	Unknown	6/4/04	U < 0.25	U < 5.00	8.36	26.6	U < 0.02	-	-	-	-	-
		9/14/05	-	-	-	-	-	-	-	-	-	-
		3/19/06	-	-	-	-	-	-	-	-	-	-
		9/19/06	-	-	-	-	-	-	-	-	-	-
		3/29/07	-	-	-	-	-	-	-	-	-	-
Stone	40 ^d	6/4/04	U < 0.25	U < 5.00	7.87	15.6	0.0296	-	-	-	-	-
		9/14/05	-	-	-	-	-	-	-	-	-	-
		3/19/06	-	-	-	-	-	-	-	-	-	-
		9/19/06	-	-	-	-	-	-	-	-	-	-
		3/22/07	U < 0.25	U < 5.00	7.44	15.6	0.0322	< 4.00	< 3.00	< 2.00	< 1.00	-

^a Not detected at the indicated limit.

^b Qualifier H indicates that the holding time before the analysis was exceeded.

^c Qualifier B indicates that the constituent was present in the blank.

^d Total depth.

TABLE 3.5 Results of analyses at the AGEM Laboratory for volatile organic compounds in surface water and sediment samples collected at Morrill in March 2007.^a

Location	Sample	Sample Date	Medium	Concentration ($\mu\text{g/L}$ in water; $\mu\text{g/kg}$ in sediment)			Quantitation Limit
				Carbon Tetrachloride	Chloroform	Methylene Chloride	
SM1	MRSM1-W-16572	3/22/07	Water	ND ^b	ND	ND	1.0
SM1	MRSM1-S-16573	3/22/07	Sediment	ND	ND	ND	10.0
SM2	MRSM2-W-16574	3/22/07	Water	ND	ND	ND	1.0
SM2	MRSM2-S-16575	3/22/07	Sediment	ND	ND	ND	10.0
SM3	MRSM3-W-16576	3/22/07	Water	ND	ND	ND	1.0
SM3	MRSM3-S-16577	3/22/07	Sediment	ND	ND	ND	10.0
SM4	MRSM4-W-16578	3/22/07	Water	ND	ND	ND	1.0
SM4	MRSM4-S-16579	3/22/07	Sediment	ND	ND	ND	10.0
SMB	MRSMB-W-16570	3/22/07	Water	ND	ND	ND	1.0
SMB	MRSMB-S-16571	3/22/07	Sediment	ND	ND	ND	10.0

^a Analyses conducted at the AGEM Laboratory, Argonne, Illinois, with EPA Method 524.2 for surface water samples and modified EPA Method 5030B/8260B for sediment samples.

^b ND, not detected at the instrument detection limits of 0.1 $\mu\text{g/L}$ for surface water samples and 1.0 $\mu\text{g/kg}$ for sediment samples.

TABLE 3.6 Results of analyses at the AGEM Laboratory for volatile organic compounds in tree branch tissue samples collected at Morrill in April 2007.^a

Location	Sample	Sample Date	Concentration ($\mu\text{g}/\text{kg}$)	
			Carbon Tetrachloride	Chloroform
MR001	MR001-B-23173	4/2/07	ND ^b	ND
MR002	MR002-B-23174	4/2/07	ND	1.5
MR003	MR003-B-23175	4/2/07	ND	ND
MR004	MR004-B-23176	4/2/07	ND	ND
MR005	MR005-B-23177	4/2/07	ND	ND
MR006	MR006-B-23161	4/2/07	ND	ND
MR007	MR007-B-23162	4/2/07	ND	ND
MR008	MR008-B-23163	4/2/07	ND	0.8
MR009	MR009-B-23165	4/2/07	ND	ND
MR010	MR010-B-23167	4/2/07	ND	ND
MR011	MR011-B-23168	4/2/07	ND	ND
MR012	MR012-B-23169	4/2/07	ND	ND
MR013	MR013-B-23160	4/2/07	ND	ND
MR014	MR014-B-23164	4/2/07	ND	ND
MR015	MR015-B-23166	4/2/07	ND	0.8
MR016	MR016-B-23170	4/2/07	ND	1.1
MR017	MR017-B-23171	4/2/07	ND	ND
MR018	MR018-B-23172	4/2/07	ND	ND

^a Analyses conducted at the AGEM Laboratory, Argonne, Illinois, by using modified EPA Method 5021 (headspace analysis on a gas chromatograph with electron capture detection).

^b ND, not detected at the instrument detection limits of 0.1 $\mu\text{g}/\text{kg}$ for carbon tetrachloride and 0.75 $\mu\text{g}/\text{kg}$ for chloroform.

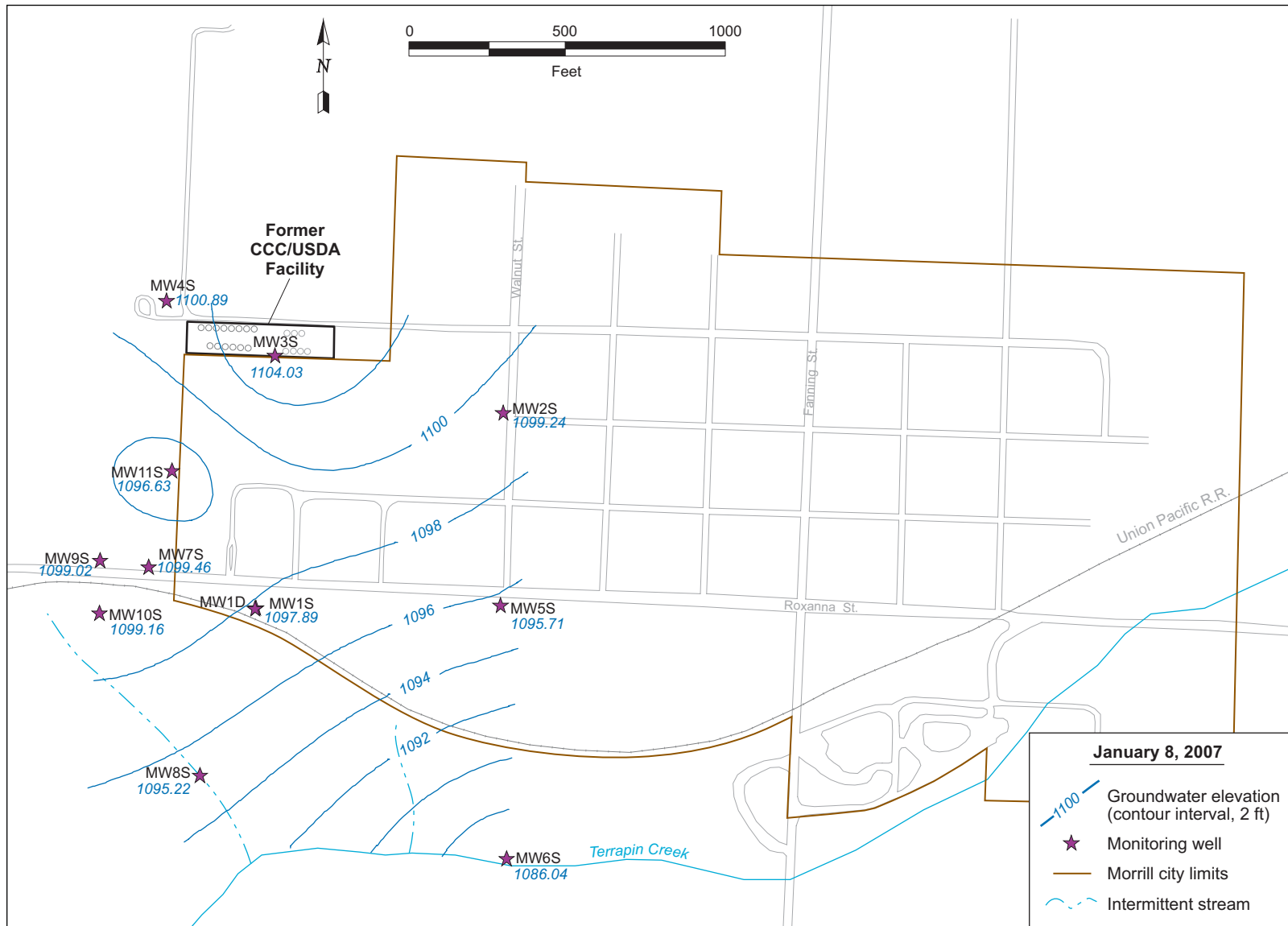


FIGURE 3.1 Potentiometric surface at Morrill, based on water levels measured manually on January 8, 2007.

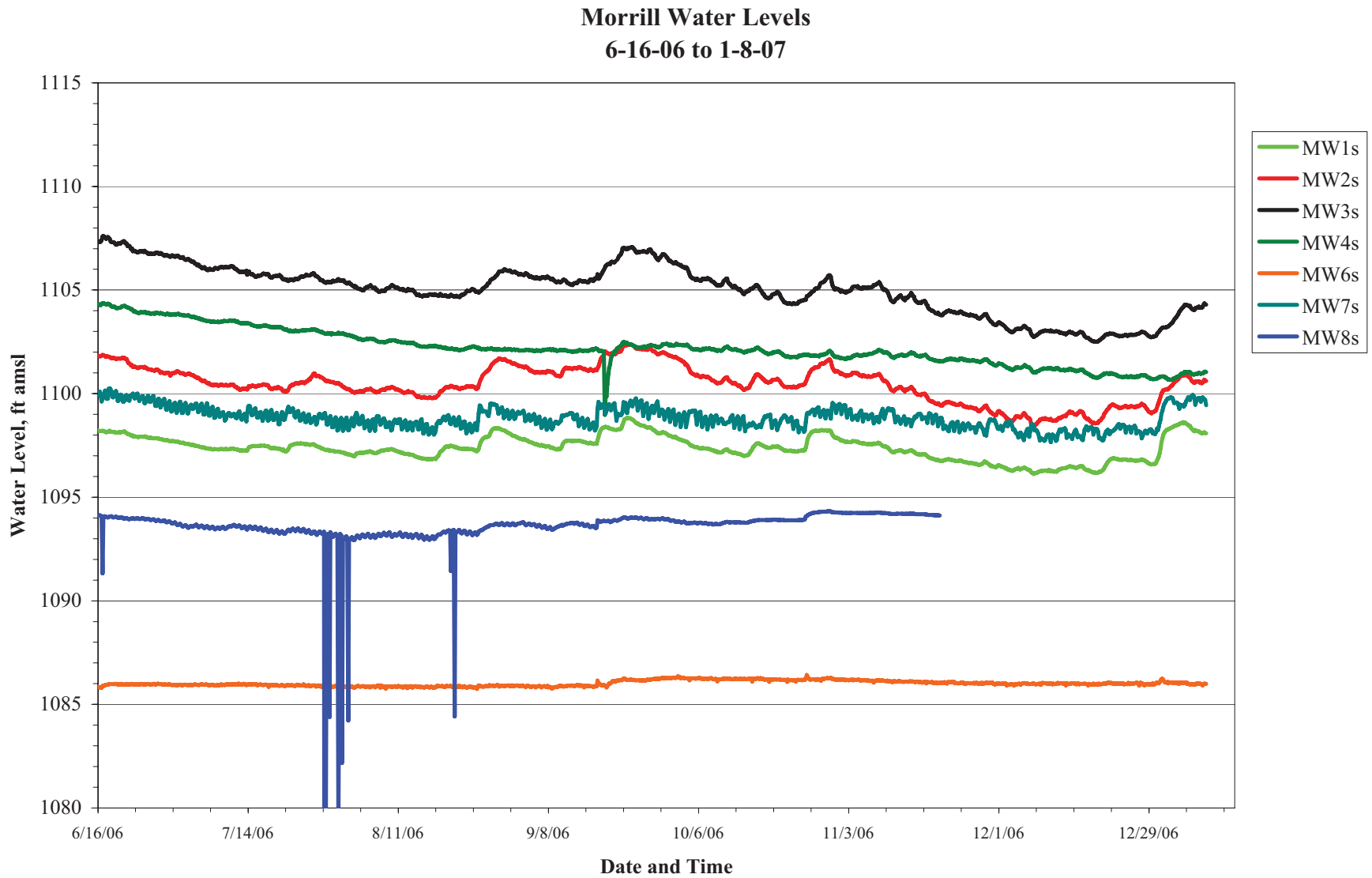


FIGURE 3.2 Hydrographs summarizing results of long-term water level monitoring in wells MW1S-MW4S and MW6S-MW8S at Morrill, from June 16, 2006 to January 8, 2007.

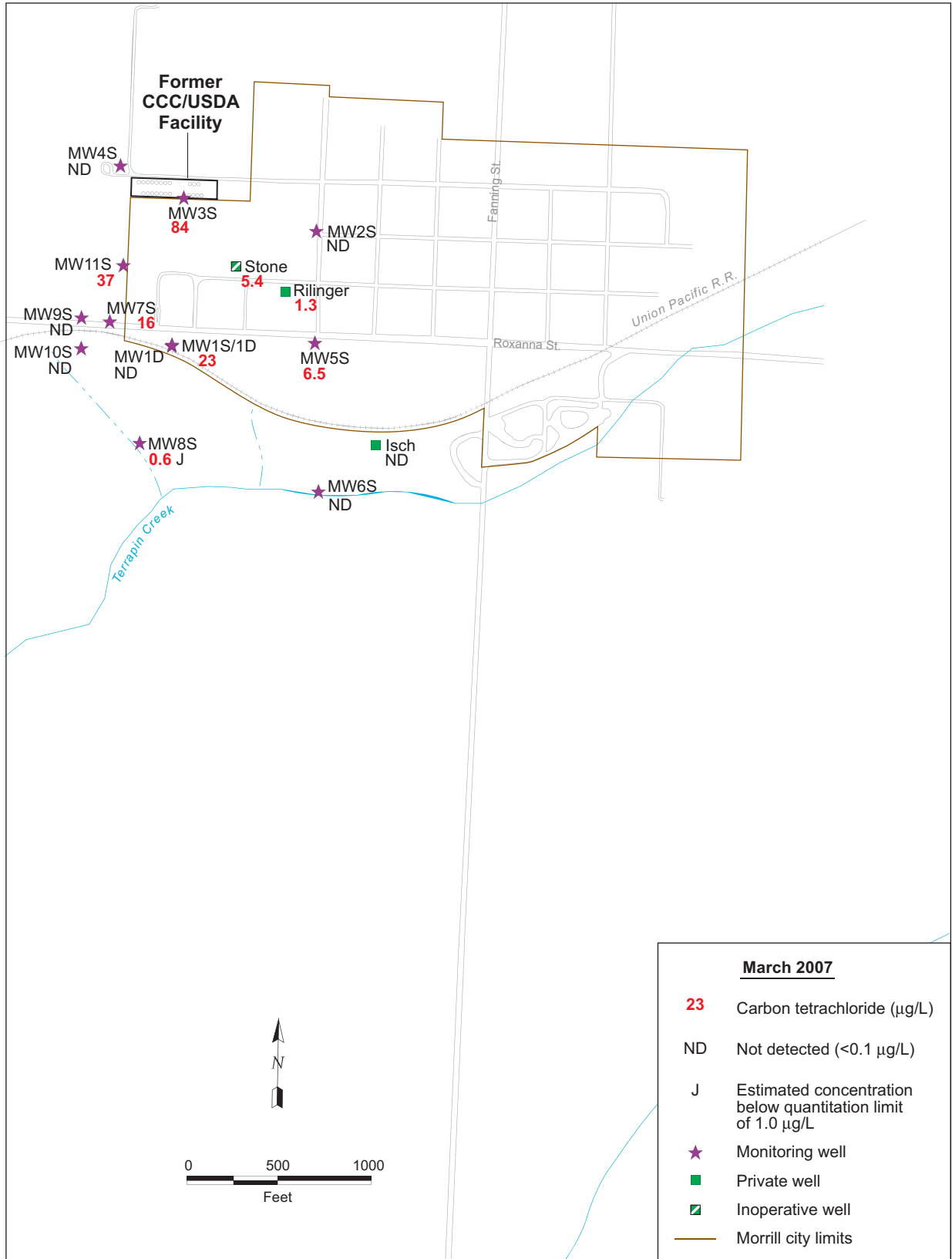


FIGURE 3.3 Carbon tetrachloride levels in groundwater at Morrill, March 2007.

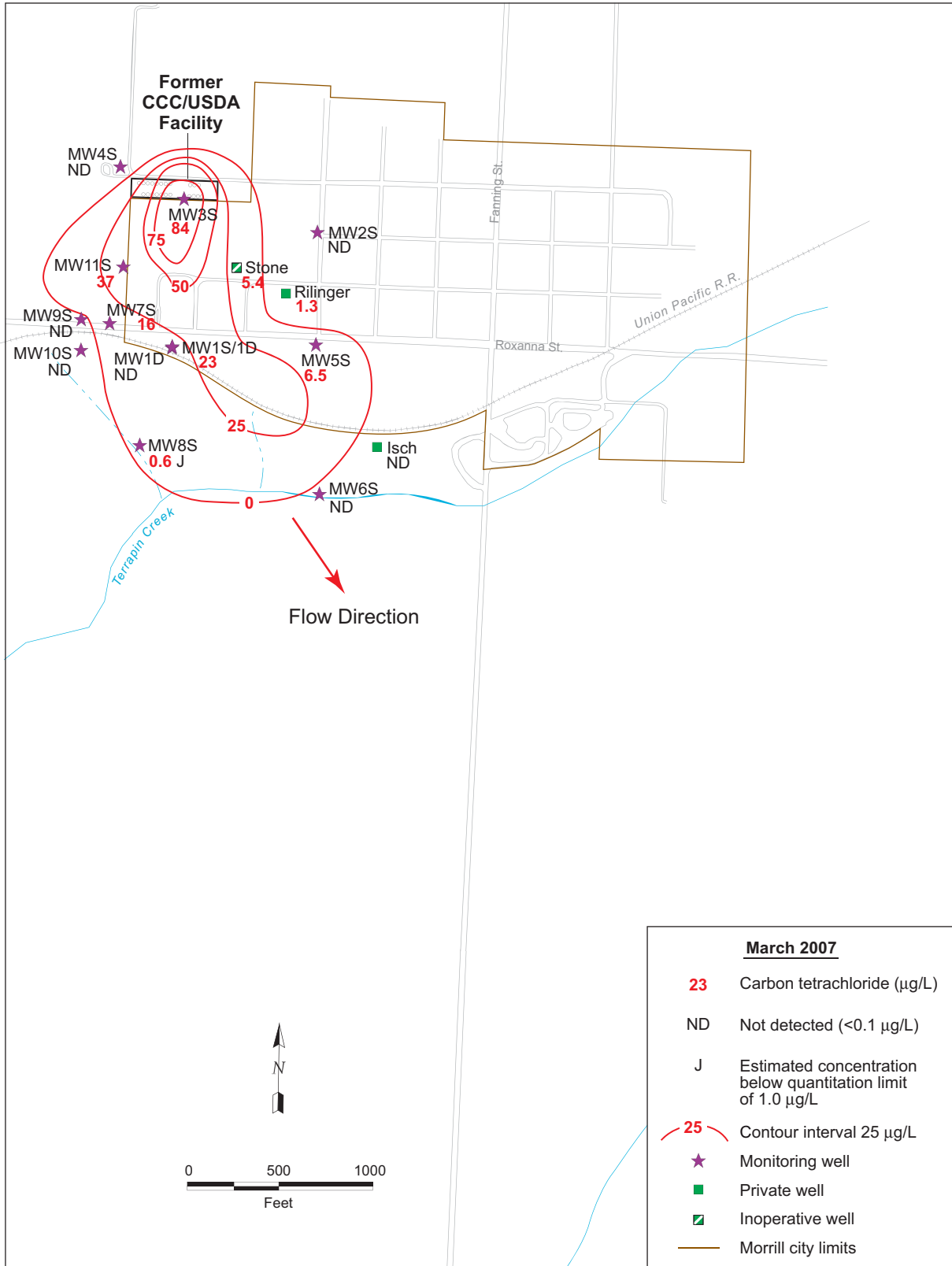


FIGURE 3.4 Lateral extent of the carbon tetrachloride contamination in groundwater at Morrill, as interpreted on the basis of sampling and analysis in March 2007 and the flow direction determined on January 8, 2007.

4 Conclusions and Recommendations

4.1 Conclusions

The findings of the March-April 2007 monitoring event at Morrill support the following conclusions:

- Measurements of groundwater levels made both manually and through the use of automatic recorders have consistently indicated an apparent direction of groundwater flow to the south-southeast from the former CCC/USDA facility. Requiring further investigation are the possible causes of an apparent, localized groundwater low near MW11S, southwest of the former facility, plus sporadic apparent drawdown events at MW8S.
- The March 2007 well sampling data are generally consistent with previous results and show minor increases or decreases in contaminant levels at various locations relative to the September 2006 sampling event. The changes do not define a clear pattern. Little net change in the levels or distribution of carbon tetrachloride identified in the groundwater at Morrill has occurred since the CCC/USDA began its investigations at this site in 2003. Contaminant levels have declined considerably, however, from the maximum level of 390 µg/L detected in 1995, when KDHE monitoring began (GeoCore 1996).
- Trace levels of carbon tetrachloride have consistently been detected in the shallow groundwater at MW8S, suggesting that the downgradient edge of the plume may lie near this location.
- Sampling to date has shown no substantial evidence for the presence of subsurface conditions at Morrill conducive to anaerobic degradation of the observed carbon tetrachloride contamination in groundwater.
- No carbon tetrachloride contamination was detected in surface waters or shallow stream bed sediments sampled (at the request of the KDHE) at five

locations along Terrapin Creek, downgradient of the former CCC/USDA facility.

- No carbon tetrachloride was detected in samples of branch tissues collected from mature trees at 18 locations along Terrapin Creek and its tributaries, south and downgradient of the former CCC/USDA facility.

4.2 Recommendations

The final event of the twice yearly sampling events approved by the KDHE under the existing *Monitoring Plan* (Argonne 2005b) is presently scheduled for September 2007. The following recommendations for this event are based on the results reported here and on previous work at Morrill:

- Surface water and shallow sediment sampling, as requested by the KDHE and outlined in the *Addendum* (Argonne 2007a) to the approved *Monitoring Plan* (Argonne 2005b), should be performed as part of the September 2007 monitoring event to substantiate the results of the March 2007 sampling.
- Sampling of branch tissues from the trees along Terrapin Creek and its tributaries is recommended in conjunction with the planned September 2007 sampling event, to investigate possible contaminant uptake by these plants at or near the anticipated peak of the summer 2007 growth season.
- Possible causes for the apparent groundwater level anomalies noted at MW8S and MW11S should be investigated during the September 2007 monitoring event.

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Appendix A:

Sequence of Sampling Activities at Morrill, Kansas, in March 2007

TABLE A.1 Sequence of sampling activities at Morrill in March–April 2007.

Sample Date	Time	Location	Sample	Sample Medium	Type	Depth (ft BGL)	Chain of Custody No.	Sample Description
3/20/07	11:00	MW11S	MRMW11S-W-16479	Water	MW	53–68	3132	Depth to water from top of casing (TOC) = 34.65 ft BGL. Depth of well = 73.14 ft BGL. Sample collected at low flow after purging of 20 gal with Redi-Flo pump at 1 gpm. Purged to container.
3/20/07	13:40	MW9S	MRMW9S-W-16480	Water	MW	38.8–53.8	3132	Depth to water from TOC = 16.69 ft BGL. Depth of well = 59.00 ft BGL. Sample collected at low flow after purging of 22 gal with Redi-Flo pump at 1 gpm. Purged to ground.
3/20/07	15:40	MW7S	MRMW7S-W-16481	Water	MW	20–45	3132	Depth to water from TOC = 18.01 ft BGL. Depth of well = 47.02 ft BGL. Sample collected at low flow after purging of 50 gal with Redi-Flo pump at 1 gpm. Purged to container.
3/20/07	15:41	MW7S	MRQCDU-W-16482	Water	MW	20–45	3132	Replicate of sample MRMW7S-W-16481.
3/20/07	17:35	MW8S	MRMW8S-W-16483	Water	MW	10–25	3132	Depth to water from TOC = 2.63 ft BGL. Depth of well = 26.82 ft BGL. Sample collected with bailer after purging of 49 gal with bailer. Purged to ground.
3/21/07	7:30	QC	MRQCRI-W-16484	Water	RI	–	3132	Rinsate of decontaminated Redi-Flo pump after sampling of monitoring well MW7S and prior to sampling of MW10S.
3/21/07	8:30	MW10S	MRMW10S-W-16485	Water	MW	30–45	3132	Depth to water from TOC = 10.77 ft BGL. Depth of well = 49.61 ft BGL. Sample collected at low flow after purging of 20 gal with Redi-Flo pump at 1 gpm. Purged to ground.
3/21/07	12:00	MW6S	MRMW6S-W-16486	Water	MW	10–25	3132	Depth to water from TOC = 5.42 ft BGL. Depth of well = 26.92 ft BGL. Sample collected after 15-min recharge after well was purged dry with Redi-Flo at 30 gal. Purged to ground.
3/21/07	14:25	MW1D	MRMW1D-W-16487	Water	MW	63–88	3132	Depth to water from TOC = 25.79 ft BGL. Depth of well = 88.80 ft BGL. Sample collected at low flow after purging of 125 gal with Redi-Flo pump at 2 gpm. Purged to ground.
3/21/07	16:08	MW1S	MRMW1S-W-16488	Water	MW	11–51	3132	Depth to water from TOC = 25.80 ft BGL. Depth of well = 53.98 ft BGL. Sample collected at low flow after purging of 55 gal with Redi-Flo pump at 1 gpm. Purged to container.
3/21/07	16:09	MW1S	MRQCDU-W-16489	Water	MW	11–51	3132	Replicate of sample MRMW1S-W-16488.
3/21/07	16:15	QC	MRQCRI-W-16490	Water	RI	–	3132	Rinsate of decontaminated Redi-Flo pump after sampling of monitoring well MW1S and prior to sampling of MW10S.
3/21/07	17:45	QC	MRQCTB-W-16491	Water	TB	–	3128	Trip blank shipped to Severn-Trent Laboratories for methane analysis with water samples listed on chain of custody (COC) 3128.
3/21/07	17:50	QC	MRQCTB-W-16492	Water	TB	–	3129	Trip blank shipped to Severn-Trent Laboratories for methane analysis with water samples listed on COC 3129.

TABLE A.1 (Cont.)

Sample Date	Time	Location	Sample	Sample Medium	Type	Depth (ft BGL)	Chain of Custody No.	Sample Description
3/21/07	17:55	QC	MRQCTB-W-16493	Water	TB	–	3132	Trip blank shipped to the AGEM Laboratory for organic analyses with water samples listed on COC 3132.
3/21/07	18:00	QC	MRQCTB-W-16494	Water	TB	–	3125	Trip blank shipped to EnviroSystems, Inc., for verification organic analyses with water samples listed on COC 3125.
3/22/07	9:15	MW2S	MRMW2S-W-16559	Water	MW	13–53	3137	Depth to water from TOC = 35.77 ft BGL. Depth of well = 53.30 ft BGL. Sample collected at low flow rate after purging of 35 gal with Redi-Flo pump at 1 gpm. Purged to ground.
3/22/07	12:05	Stone	MRSTONE-W-16560	Water	DW	43	3137	Depth to water from TOC = 20.62 ft BGL. Depth of well = 38.80 ft BGL. Sample collected at low flow rate after purging of 56 gal with Redi-Flo pump at 1.2 gpm. Purged to ground.
3/22/07	13:26	QC	MRQCTB-S-16580	Soil	TB	–	3296	Trip blank shipped to AGEM Laboratory for organic analyses with soil samples listed on COC 3296.
3/22/07	14:10	MW5S	MRMW5S-W-16569	Water	MW	15–55	3137	Depth to water from TOC = 25.14 ft BGL. Depth of well = 54.56 ft BGL. Sample collected at low flow after purging of 58 gal with Redi-Flo pump at 1 gpm. Purged to container.
3/22/07	14:36	Isch	MRISCH-W-16564	Water	DW	–	3137	Sample collected after running dedicated pump for 5 min.
3/22/07	15:05	SM3	MRSM3-W-16576	Water	SW	–	3137	Water sample from Terrapin Creek.
3/22/07	15:06	SM3	MRSM3-S-16577	Soil	Sed	–	3296	Sediment sample from Terrapin Creek.
3/22/07	16:00	MW3S	MRMW3S-W-16563	Water	MW	18–48	3137	Depth to water from TOC = 26.19 ft BGL. Depth of well = 47.75 ft BGL. Sample collected at low flow rate after purging of 45 gal with Redi-Flo pump at 1 gpm. Purged to container.
3/22/07	16:10	QC	MRQCFB-W-16566	Water	FB	–	3137	Field blank of water used during March 2007 monitoring event for equipment decontamination.
3/22/07	16:20	QC	MRQCRI-W-16567	Water	RI	–	3137	Rinsate of decontaminated Redi-Flo pump after sampling of monitoring well MW3S.
3/22/07	16:25	MW4S	MRMW4S-W-16562	Water	MW	17–47	3137	Depth to water from TOC = 38.74 ft BGL. Depth of well = 47.75 ft BGL. Sample collected at low flow rate after purging of 6 gal with Redi-Flo pump at <1 gpm. Purged to ground.
3/22/07	16:39	SMB	MRSMB-W-16570	Water	SW	–	3137	Water sample from Terrapin Creek.
3/22/07	16:40	SMB	MRSMB-S-16571	Soil	Sed	–	3296	Sediment sample from Terrapin Creek.
3/22/07	16:51	SM1	MRSM1-W-16572	Water	SW	–	3137	Water sample from Terrapin Creek.
3/22/07	16:52	SM1	MRSM1-S-16573	Soil	Sed	–	3296	Sediment sample from Terrapin Creek.
3/22/07	17:00	SM2	MRSM2-W-16574	Water	SW	–	3137	Water sample from Terrapin Creek.

TABLE A.1 (Cont.)

Sample Date	Time	Location	Sample	Sample Medium	Type	Depth (ft BGL)	Chain of Custody No.	Sample Description
3/22/07	17:01	SM2	MRS2-S-16575	Soil	Sed	–	3296	Sediment sample from Terrapin Creek.
3/22/07	17:17	SM4	MRS4-W-16578	Water	SW	–	3137	Water sample from Terrapin Creek.
3/22/07	17:18	SM4	MRS4-S-16579	Soil	Sed	–	3296	Sediment sample from Terrapin Creek.
3/22/07	18:20	QC	MRQCTB-W-16568	Water	TB	–	3133	Trip blank shipped to Severn-Trent Laboratories for methane analysis with water samples listed on COC 3133.
3/22/07	18:30	QC	MRQCTB-W-16565	Water	TB	–	3137	Trip blank shipped to the AGEM Laboratory for organic analyses with water samples listed on COC 3137.
3/27/07	15:18	QC	MRPURGEWATER-W-16570	Water	BT	–	4581	Composite sample of waste purge water during March 2007 sampling event (shipped with samples from Centralia site).
3/29/07	14:48	Rilinger	MRRILINGER-W-16561	Water	DW	–	4593	Sample collected after minimal purge.
3/29/07	15:00	QC	CNQCTB-W-16186	Water	TB	–	4594	Trip blank shipped to the AGEM Laboratory for organic analyses with water samples listed on COC 4594 (Centralia site) and COC 4593 (Morrill site).
4/2/07	16:20	MR013	MR013-B-23160	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Standing water at base of tree just beginning to bud. Sample collected 7 ft above ground.
4/2/07	16:45	MR006	MR006-B-23161	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Large cottonwood beginning to bud. Sample collected 6.5 ft above ground.
4/2/07	16:50	MR007	MR007-B-23162	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Large tree just beginning to leaf out. Water at base of tree. Prior records identify tree as a willow, but no leaves for confirmation. Sample collected 7 ft above ground.
4/2/07	17:00	MR008	MR008-B-23163	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Near standing water. Sample collected 6 ft above ground.
4/2/07	17:05	MR014	MR014-B-23164	Veg	Branch	–	3142	Willow starting to bud at beginning of creek. New location marked with stake. Sample collected 6 ft above ground.
4/2/07	17:15	MR009	MR009-B-23165	Veg	Branch	–	3142	Large willow with three trunks at base. East of creek. Standing water 6 ft to the west. Sample collected 5 ft above ground. Tree may be dead.
4/2/07	17:20	MR015	MR015-B-23166	Veg	Branch	–	3142	Small tree (mulberry?) at edge of water near willow. Sample collected 2.5 ft above ground.

TABLE A.1 (Cont.)

Sample Date	Time	Location	Sample	Sample Medium	Type	Depth (ft BGL)	Chain of Custody No.	Sample Description
4/2/07	17:35	MR010	MR010-B-23167	Veg	Branch	–	3142	Prior sampling location, but stake not found. Elm (?) tree growing 3 ft up the bank. Sample collected 6 in. above ground. Marked with new stake.
4/2/07	17:40	MR011	MR011-B-23168	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Thorny, large tree with reddish roots. Sample collected 3 ft above ground.
4/2/07	17:45	MR012	MR012-B-23169	Veg	Branch	–	3142	Willow on south side of creek with several large trunks. Sample collected 6 ft above ground. Prior location confirmed by stake.
4/2/07	17:55	MR016	MR016-B-23170	Veg	Branch	–	3145	Willow on south side of creek not yet leafed out. Sample collected 6 ft above ground on north side, toward the creek. New location staked.
4/2/07	18:00	MR017	MR017-B-23171	Veg	Branch	–	3142	Willow on north side of creek not yet leafed out. Small diameter: 3-4 cm. Sample collected 2 ft above ground on north side, toward the creek. New location marked with pink ribbon.
4/2/07	18:10	MR018	MR018-B-23172	Veg	Branch	–	3145	Unknown tree at bend of creek about 20 ft from water. Sample collected 1 ft above ground. Marked with pink ribbon.
4/2/07	18:15	MR001	MR001-B-23173	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Willow shows burn/fire mark on north side. Sample collected 1 ft above ground.
4/2/07	18:25	MR002	MR002-B-23174	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Willow sampled 3 ft above ground.
4/2/07	18:30	MR003	MR003-B-23175	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Willow on south side of creek sampled 2.5 ft above ground.
4/2/07	18:40	MR004	MR004-B-23176	Veg	Branch	–	3145	Prior sampling location confirmed by stake. Willow east of MW6S on north side of creek. Sample collected 3 ft above ground.
4/2/07	18:45	MR005	MR005-B-23177	Veg	Branch	–	3142	Prior sampling location confirmed by stake. Tree (maple?) on south side of creek. Sample collected 5 ft above ground.

^a Sample types: DW, domestic well; FB, field blank; MW, monitoring well; RI, rinsate; Sed, sediment; SW, surface water; TB, trip blank.

Appendix B:

Data Summary for Verification VOCs Analyses by EnviroSystems, Inc.

ENVIROSYSTEMS, INC.

9200 Rumsey Road • Suite B102 • Columbia, Maryland 21045-1934
Phone (410) 964-0330 • Fax (410) 740-9306
Email: info@envsystems.com • Webpage: www.envsystems.com/envsys

April 10, 2007

Jorge S. Alvarado, Ph.D
Argonne National Laboratory
Environmental Sciences Division
Applied Geoscience and Environmental
Management Section
9700 South Cass Avenue, EV-203-A137
Argonne, Illinois 60439

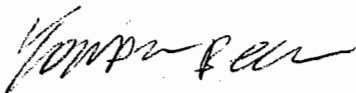
RE: ENVSYS Report 070212

Dear Jorge:

Enclosed is the Analytical Data Package for the samples received on March 22, 2007 for volatile organics analysis by US EPA CLP SOW OLM04.3

Please do not hesitate to call me if you have any questions, comments, or require additional information.

Sincerely,



for → Mohan Khare, Ph.D
President/CEO

MK/pl

**SDG NARRATIVE
VOLATILE ORGANICS (VOC)**

EnviroSystems, Inc.

Contract: N/A
Client: Argonne National Laboratory
Case: N/A
SDG: N/A

1. SAMPLE RECEIPT

Date received: 22-07-2007
Cooler Temperature: 3

Sample Summary

Client ID	Laboratory ID	Matrix	pH
MRMW 7S-W-16481	0070305-01	WATER	7
MRMW ID-W-16487	0070305-02	WATER	7
MRQC TB-W 16494	0070305-03	WATER	7

2. HOLDING TIMES

- A. **Sample Preparation:** All holding times were met.
- B. **Sample Analysis:** All holding times were met

3. METHODS

The samples were analyzed and reported by using method SW-846 8260B and USEPA CLP SOW OLM04.3 for target compound list.

4. INSTRUMENT AND CHROMATOGRAPHIC CONDITIONS

A Hewlett Packard 6890 gas chromatograph equipped with a Hewlett Packard 5973 MSD was used for sample analysis. The capillary column used was a Restek 20m by 0.18 mm ID by 1.0 µm film thickness (Restek Cat. # RTX-624). The trap used with the sample concentrator is an OI Analytical Trap #10, 30cm packed with Tenax/silica gel/cms (PN#228122).

5. PREPARATION

The submitted samples were analyzed as received.

6. ANALYSIS

A. Calibration:

I. Initial calibration

All acceptance criteria as stipulated by SW-846 8260b were met for all SPCC's and CCC's.

**SDG NARRATIVE
VOLATILE ORGANICS (VOC)**

B. Blanks:

All acceptance criteria were met.

C. Spikes:

i. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

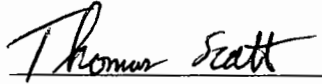
A MS/MSD was not required for this case.

b. Internal Standards/Surrogates

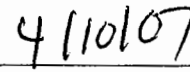
All acceptance criteria were met.

c. Samples

Sample analysis proceeded normally.



Laboratory Manager



Date

2A
WATER VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

	EPA SAMPLE NO.	SMC1 (TOL) #	SMC2 (BFB) #	SMC3 (DCE) #	OTHER	TOT OUT
	=====	=====	=====	=====	=====	=====
01	VBLK1	104	98	96		0
02	MRQCTB-W-164	114*	102	104		1
03	MRMW7S-W-164	114*	104	106		1
04	MRMWID-W-164	112*	104	102		1
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QC LIMITS

SMC1 (TOL) = Toluene-d8 (88-110)
 SMC2 (BFB) = Bromofluorobenzene (86-115)
 SMC3 (DCE) = 1,2-Dichloroethane-d4 (76-114)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D System Monitoring Compound diluted out

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MRMW7S-W-16481

Lab Name: ENVIROSYSTEMS, INC. Contract: ARGONNE

Lab Code: ENVSYS Case No.: ARGONNE SAS No.: N/A SDG No.: NA

Matrix: (soil/water) WATER Lab Sample ID: 0070305-01

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: AG75HE857

Level: (low/med) LOW Date Received: 03/22/07

% Moisture: not dec. _____ Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	5.0	U
74-87-3	Chloromethane	5.0	U
75-01-4	Vinyl Chloride	5.0	U
74-83-9	Bromomethane	5.0	U
75-00-3	Chloroethane	5.0	U
75-69-4	Trichlorofluoromethane	5.0	U
75-35-4	1,1-Dichloroethene	5.0	U
76-13-1	1,1,2-Trichloro-1,2,2-triflu	5.0	U
67-64-1	Acetone	5.0	U
75-15-0	Carbon Disulfide	5.0	U
79-20-9	Methyl Acetate	5.0	U
75-09-2	Methylene Chloride	5.0	U
156-60-5	trans-1,2-Dichloroethene	5.0	U
1634-04-4	Methyl tert-Butyl Ether	5.0	U
75-34-3	1,1-Dichloroethane	5.0	U
156-59-2	cis-1,2-Dichloroethene	5.0	U
78-93-3	2-Butanone	5.0	U
67-66-3	Chloroform	5.0	U
71-55-6	1,1,1-Trichloroethane	5.0	U
110-82-7	Cyclohexane	5.0	U
56-23-5	Carbon Tetrachloride	20	
71-43-2	Benzene	5.0	U
107-06-2	1,2-Dichloroethane	5.0	U
79-01-6	Trichloroethene	5.0	U
108-87-2	Methylcyclohexane	5.0	U
78-87-5	1,2-Dichloropropane	5.0	U
75-27-4	Bromodichloromethane	5.0	U
10061-01-5	cis-1,3-Dichloropropene	5.0	U
108-10-1	4-Methyl-2-Pentanone	5.0	U
108-88-3	Toluene	5.0	U
10061-02-6	trans-1,3-Dichloropropene	5.0	U
79-00-5	1,1,2-Trichloroethane	5.0	U
127-18-4	Tetrachloroethene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MRMW7S-W-16481

Lab Name: ENVIROSYSTEMS, INC. Contract: ARGONNE
 Lab Code: ENVSYS Case No.: ARGONNE SAS No.: N/A SDG No.: NA
 Matrix: (soil/water) WATER Lab Sample ID: 0070305-01
 Sample wt/vol: 5.000 (g/mL) ML Lab File ID: AG75HE857
 Level: (low/med) LOW Date Received: 03/22/07
 % Moisture: not dec. _____ Date Analyzed: 03/29/07
 GC Column: RTX-624 ID: 0.18 (mm) Dilution Factor: 1.0
 Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
591-78-6	2-Hexanone	5.0	U
124-48-1	Dibromochloromethane	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
108-90-7	Chlorobenzene	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylene (Total)	5.0	U
100-42-5	Styrene	5.0	U
75-25-2	Bromoform	5.0	U
98-82-8	Isopropylbenzene	5.0	U
79-34-5	1,1,2,2-Tetrachloroethane	5.0	U
541-73-1	1,3-Dichlorobenzene	5.0	U
106-46-7	1,4-Dichlorobenzene	5.0	U
95-50-1	1,2-Dichlorobenzene	5.0	U
96-12-8	1,2-Dibromo-3-chloropropane	5.0	U
120-82-1	1,2,4-Trichlorobenzene	5.0	U
91-20-3	Naphthalene	10	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MRMWID-W-16487

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070305-02

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE858

Level: (low/med) LOW

Date Received: 03/22/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	5.0	U
74-87-3	Chloromethane	5.0	U
75-01-4	Vinyl Chloride	5.0	U
74-83-9	Bromomethane	5.0	U
75-00-3	Chloroethane	5.0	U
75-69-4	Trichlorofluoromethane	5.0	U
75-35-4	1,1-Dichloroethene	5.0	U
76-13-1	1,1,2-Trichloro-1,2,2-triflu	5.0	U
67-64-1	Acetone	5.0	U
75-15-0	Carbon Disulfide	5.0	U
79-20-9	Methyl Acetate	5.0	U
75-09-2	Methylene Chloride	5.0	U
156-60-5	trans-1,2-Dichloroethene	5.0	U
1634-04-4	Methyl tert-Butyl Ether	5.0	U
75-34-3	1,1-Dichloroethane	5.0	U
156-59-2	cis-1,2-Dichloroethene	5.0	U
78-93-3	2-Butanone	5.0	U
67-66-3	Chloroform	5.0	U
71-55-6	1,1,1-Trichloroethane	5.0	U
110-82-7	Cyclohexane	5.0	U
56-23-5	Carbon Tetrachloride	5.0	U
71-43-2	Benzene	5.0	U
107-06-2	1,2-Dichloroethane	5.0	U
79-01-6	Trichloroethene	5.0	U
108-87-2	Methylcyclohexane	5.0	U
78-87-5	1,2-Dichloropropane	5.0	U
75-27-4	Bromodichloromethane	5.0	U
10061-01-5	cis-1,3-Dichloropropene	5.0	U
108-10-1	4-Methyl-2-Pentanone	5.0	U
108-88-3	Toluene	5.0	U
10061-02-6	trans-1,3-Dichloropropene	5.0	U
79-00-5	1,1,2-Trichloroethane	5.0	U
127-18-4	Tetrachloroethene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MRMWID-W-16487

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070305-02

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE858

Level: (low/med) LOW

Date Received: 03/22/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

591-78-6-----	2-Hexanone	5.0	U
124-48-1-----	Dibromochloromethane	5.0	U
106-93-4-----	1,2-Dibromoethane	5.0	U
108-90-7-----	Chlorobenzene	5.0	U
100-41-4-----	Ethylbenzene	5.0	U
1330-20-7-----	Xylene (Total)	5.0	U
100-42-5-----	Styrene	5.0	U
75-25-2-----	Bromoform	5.0	U
98-82-8-----	Isopropylbenzene	5.0	U
79-34-5-----	1,1,2,2-Tetrachloroethane	5.0	U
541-73-1-----	1,3-Dichlorobenzene	5.0	U
106-46-7-----	1,4-Dichlorobenzene	5.0	U
95-50-1-----	1,2-Dichlorobenzene	5.0	U
96-12-8-----	1,2-Dibromo-3-chloropropane	5.0	U
120-82-1-----	1,2,4-Trichlorobenzene	5.0	U
91-20-3-----	Naphthalene	10	U



Environmental Science Division

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Argonne_{LLC}

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