DOE–LM/1493–2007

Pinellas Environmental Restoration Project

Semiannual Progress Report for the Young - Rainey STAR Center's 4.5 Acre Site December 2006 through May 2007

June 2007

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.

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Acronyms and Abbreviations

cDCE	cis-1,2-DCE
COPC	contaminants of potential concern
CTL	cleanup target level
DCE	dichloroethene
DHC	*Dehalococcoides ethenogenes*
DOE	U.S. Department of Energy
DPE	dual-phase extraction
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
ft	feet
ft bls	feet below land surface
IRA	Interim Remedial Action
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MCL	maximum contaminant level
mg/L	milligrams per liter
mV	millivolts
NGVD	national geodetic vertical datum
NTU	Nephelometric Turbidity Units
QA/QC	quality assurance/quality control
RBCA	Risk-Based Corrective Action
RPD	relative percent difference
STAR Center	Young - Rainey Science, Technology, and Research Center
TCE	trichloroethene
TCOPC	total contaminants of potential concern
VC	vinyl chloride
VOCs	volatile organic compounds

1.0 Introduction

The *Pinellas Environmental Restoration Project Semiannual Progress Report 4.5 Acre Site* describes environmental restoration activities for the Pinellas 4.5 Acre Site located in Pinellas County, Largo, Florida (Figure 1). The former U.S. Department of Energy (DOE) Pinellas Plant facility consisted of the 4.5 Acre Site and the Young - Rainey Science, Technology, and Research Center (STAR Center) (Figure 2). The facility was constructed in the mid-1950s as part of a nationwide nuclear weapons research, development, and production complex. Production of weapons-related components ceased in September 1994. However, as a result of these operations, contamination exists in the surficial ground water beneath the Site.

Administration of DOE activities at the 4.5 Acre Site is the responsibility of the DOE Office of Legacy Management in Grand Junction, Colorado. S.M. Stoller Corporation (Stoller), a prime contractor to DOE's Office of Legacy Management, provides technical support to DOE for remediation and closure of all active solid-waste management units on site and for the 4.5 Acre Site.

The 4.5 Acre Site is located to the northwest of the STAR Center, in the northeast quarter of Section 13, Township 30 South, Range 15 East (Figure 1). This parcel was owned by DOE from 1957 to 1972, at which time it was sold to a private landowner. During the period of DOE ownership, the property was used for disposal of drums of waste resins and solvents. As a result of this practice, the surficial aquifer was impacted by volatile organic compounds (VOCs), primarily vinyl chloride (VC), toluene, trichloroethene (TCE), and 1,2-dichloroethene (DCE). DOE completed a source removal in 1985.

An Interim Remedial Action (IRA) consisting of ground water extraction and treatment via air stripping, and a routine ground water monitoring program were initiated in May 1990. In July 1997, a modification of the IRA involving installation of dual-phase extraction (DPE) wells provided a more aggressive system to remove ground water contamination. In November 1999, the DPE/air-stripping system was replaced with an in-situ biosparge treatment system.

The *4.5 Acre Site Biosparge System Integration Plan* (DOE 2000) was approved by the Florida Department of Environmental Protection (FDEP) on January 17, 2001. This plan states that performance monitoring would be undertaken on a quarterly basis. Therefore, in April 2001, performance monitoring of the remedial system through the use of direct push technology was undertaken. However, the biosparge systems were shut off in May 2003 with no plans to restart them and no performance monitoring data have been collected since April 2003. Subsequent monitoring was then adapted to fit the new remediation scenario and performance monitoring as defined in the *Interim Remedial Action Plan for Ground Water Recovery at the 4.5 Acre Site* (DOE 2003b).

The IRA Plan for Ground Water Recovery at the 4.5 Acre Site was submitted to FDEP on August 29, 2003, and approved by FDEP on September 19, 2003. Implementation of the IRA Plan commenced on March 8, 2004, when construction activities began on the IRA treatment system. The treatment system consisted of an extraction well field (three recovery wells), pumps and associated piping, transmission water pipeline, utility connection, a low profile tray air stripper unit, and effluent piping. The new IRA system began operations on April 26, 2004.

The IRA system was a temporary measure that was outlined in the *Remedial Action Plan for the Pinellas 4.5 Acre Site* (DOE 2001) as a contingency option in the event that biosparging resulted in extending the contaminant plume. In April 2005, the *Pinellas Environmental Restoration Project 4.5 Acre Site Remedial Action Plan Addendum* (DOE 2005) was submitted to FDEP. This document presented a proposed final action for the 4.5 Acre Site that involves closure of the site using the provisions of the recently adopted State of Florida Global Risk-Based Corrective Action (RBCA) regulations.

Technical discussions between FDEP and DOE regarding the proposed final action continue. Part of DOE's proposed final action for the 4.5 Acre Site was to shut down the IRA system and begin a 2-year monitoring period. Approval from FDEP to shut down the IRA system was received on December 20, 2005, thus commencing the DOE's 2-year monitoring period.

Although DOE has conducted numerous remediation activities at the 4.5 Acre Site since 1985, FDEP has recently suggested that, based on elevated levels of VOCs in ground water, a source of VOCs may remain in the subsurface, and that removal of contaminated soil may be necessary (FDEP 2005). Therefore, in late June 2007 DOE will perform additional characterization activities that will better define the areas that contain contaminant source at the 4.5 Acre Site.

This document is the semiannual progress report for the 4.5 Acre Site for December 2006 through May 2007, as requested by FDEP. The results of monitoring activities and a summary of ongoing and projected work are provided in this report.

1.1 Site Activities

- Obtained water-level measurements from all monitoring wells on February 28, 2007.
- Conducted the semiannual sampling event (i.e., collected ground water samples from 41 monitoring wells in March 2007.) Forty-one wells were sampled for VOCs and analyzed using U.S. Environmental Protection Agency (EPA) SW-846 Method 8260. Two wells were sampled for arsenic and analyzed using EPA SW-846 Method 6010. Six wells were sampled for biological remediation parameters.
- Reported the results of this semiannual sampling event (this document).

2.0 Monitoring Data

2.1 Ground Water Elevations and Flow

Within a 4-hour period on February 28, 2007, depth-to-water measurements were taken in all monitoring wells and former recovery wells at the 4.5 Acre Site as part of the sitewide semiannual sampling event. The depth to water in each well was measured with an electronic water-level indicator. The February ground water elevation data for the 4.5 Acre Site are listed in Table 1. The data and information from deep wells were used to construct contours of water levels in the deep surficial aquifer in Figure 3.

The interpretative contours on Figure 3 show that there is a slight ground water mound in the southern half of the 4.5 Acre Site. From this mound, ground water in most of the site flows to the northwest. In the southern part of the site there is a component of flow toward the southeast.

These flow patterns are consistent with those observed at the site in September and December 2006.

The water table ranged from about 1.7 to 4.5 feet below land surface (ft bls), with ground water elevations that ranged from a high of 15.63 ft at PIN20–M064 to a low of 13.93 ft at PIN20−M38D. The average hydraulic gradient across the northern part of site was approximately 0.002 feet per foot. This gradient is the same as that observed in September 2006. Calculations using Darcy's Law along with approximations of 1 ft/day for hydraulic conductivity and 0.3 for effective porosity indicate that ground water at the site is estimated to move about 2 to 3 ft/year. This velocity is on the low end of the previously observed velocity range of 3 to 10 ft/year.

2.2 Ground Water Sampling

Ground water samples were collected from 41 monitoring wells in March 2007. Samples from all 41 wells were analyzed for VOCs, samples from 2 wells were analyzed for arsenic, and samples from 6 wells were analyzed for biodegradation parameters.

All samples were collected in accordance with the *Pinellas Environmental Restoration Project Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site* (DOE 2006) using FDEP procedures. All samples collected were submitted to Severn-Trent Laboratories for analysis. Severn-Trent is accredited by the Florida Department of Health in accordance with the National Environmental Laboratory Accreditation Conference, certification number E84282. VOCs were analyzed using EPA SW-846 Method 8260 and arsenic was analyzed using EPA Method 6010.

All of the monitoring wells were micropurged with dedicated bladder pumps and samples were collected when the field measurements stabilized. Table 2 lists measurements of pH, specific conductance, dissolved oxygen, oxidation/reduction potential, turbidity, and temperature recorded at the time each sample was collected. These measurements were collected using a flow cell and multiparameter meter.

2.3 Ground Water Analytical Results

Individual contaminants of potential concern (COPC) and total COPCs (TCOPCs) concentrations in samples collected from wells at the 4.5 Acre Site are presented in Table 3. The previous two semiannual results are included in Table 3 for comparison. Arsenic data are shown in Table 4. Figure 4 shows the TCOPCs concentrations for March 2007.

The maximum TCOPCs value detected in March was 9,420 micrograms per liter (µg/L) at PIN20−M063. The compound detected at the highest concentration in PIN20−M063 was cis-1,2-DCE (cDCE) at a concentration of 5,400 µg/L.

Samples were also collected for dissolved gases and microbial activity analyses. The dissolved gases are ethene, ethane, and methane. The microbiological analysis is for *Dehalococcoides ethenogenes* (DHC). Analytical results for these gases and this microorganism are summarized in Table 5.

Laboratory reports for semiannual samples collected in March 2007 are provided in Appendix A.

2.4 Quality Assurance/Quality Control

The results from the analytical laboratory, Severn-Trent Laboratories, were checked for quality assurance/quality control (QA/QC) through duplicate samples and trip blanks. Detected analytes for each duplicate sample collected from the 4.5 Acre Site are listed in Table 6. The duplicate sample results were compared and the relative percent differences (RPDs) between the results were calculated. All data passed QA/QC criteria at a Class A level, indicating that the data may be used for quantitative and qualitative purposes.

As specified in *Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site* (DOE 2006), duplicate samples should be collected at a frequency of one duplicate for every 20 or fewer samples. For the STAR Center and the 4.5 Acre Site, there were 174 ground water samples collected, with 8 duplicate samples collected. The duplicate requirements for this sampling event were nearly met. There were 20 trip blanks collected during this event. Bromoform and dibromochloromethane were detected in seven of the 20 trip blanks analyzed, but these compounds were not detected in any of the associated samples.

A data validation software module for identifying and tracking anomalous ground water data points within the SeePRO database was used to generate a report of analytical results that fall outside of historical minimum or maximum values. No anomalous data were identified for this sampling event.

3.0 Data Interpretation

This data interpretation section is included to aid in evaluating plume stability. This section consists of plots showing contaminant concentration trends (Section 3.1), plume maps (Section 3.2), and a discussion of site geochemistry (Section 3.3).

While most of the previous documents for the 4.5 Acre Site have compared ground water contaminant concentrations to drinking water standards (i.e., maximum contaminant levels [MCLs]), those standards are not the applicable default Cleanup Target Levels (CTLs) for the purposes of evaluating site remediation under RBCA. Based on a comprehensive review of background data for the site (DOE 2003a), it was determined that the shallow ground water in the site vicinity is naturally elevated in aluminum and iron at levels far exceeding State of Florida Secondary Drinking Water Standards (Chapter 62-550, Florida Administrative Code [F.A.C.]). Specifically, the average background concentration of 1.1 milligrams/liter (mg/L) for aluminum exceeds the 0.2 mg/L secondary standard, and the average background concentration for iron of 9.3 mg/L exceeds the 0.3 mg/L secondary standard. The ambient shallow ground water in the area is, therefore, designated as “poor quality” as defined in 62-780.200 (35), F.A.C. Thus, the applicable ground water CTLs are those for ground water of “low yield/poor quality” provided in Table 1 of Chapter 62-777, F.A.C. In essence, these CTL values are a factor of 10 higher than the MCL values. On the plume maps in Section 3.2, the current plumes are based on the CTL, and the previous year’s plumes were revised from being based on the MCL to being based on the CTL.

3.1 Contaminant Concentration Trends

Figures 5 and 6 show the cDCE and VC concentration trends in wells PIN20−0502 and −M001, respectively. These two wells, located hydraulically downgradient from the area of highest contaminant concentrations, have shown increasing concentration trends over the last few years. This appears to be a result of past operation of the biosparging system. This system injected air into the subsurface with the goal of converting aquifer conditions from anaerobic to aerobic to facilitate contaminant degradation. While this conversion to aerobic conditions was not achieved, the disturbance of the subsurface by the air injection apparently caused contaminants to desorb from the soil into the ground water, as evidenced by increasing contaminant concentrations at some biosparge monitoring locations. Additionally, subsurface pressurization surges that occurred during stopping and starting of the biosparging system may have facilitated contaminant transport by intermittently increasing the hydraulic gradient. The biosparging system operated from fall 1999 until it was permanently shut down in May 2003, but ground water containing elevated contaminant concentrations continues to move downgradient, producing the concentration trends observed in these wells.

Natural attenuation processes, particularly biodegradation, likely are occurring in the area of wells 0502 and M001. Evidence for biodegradation in the area of these wells is the presence of the dechlorinating microorganism *Dehalococcoides ethenogenes* and daughter products ethane and ethene (Table 5).

Figures 7 and 8 show TCE, cDCE, and VC concentration trends in wells PIN20−MWL4 and −M063. These two wells are in the area of highest contaminant concentrations on the eastern side of the site. Concentrations in these wells have shown an overall decreasing trend, although some increases have been observed in recent sampling events. Biodegradation, as evidenced by the presence of significant numbers of DHC along with the daughter products ethane and ethene, could be the cause of the cDCE and VC concentration increases (Table 5).

Figures 9 and 10 show TCE, cDCE, and VC concentration trends in wells PIN20−M060 and −M061. These wells are in the area of elevated contaminant concentrations near the southwest property boundary. A significant increase in TCE and cDCE concentrations was observed in well M061 in September 2006, but these concentrations decreased back to previous levels in March 2007.

3.2 Plume Maps

Plume maps were generated for TCOPCs (Figure 4) and the individual site COPCs: TCE (Figure 11), cis-1,2-DCE (Figure 12), VC (Figure 13), and benzene (Figure 14). The inferred plume boundaries for the individual compounds are based on the respective CTLs of the compounds. Concentrations that are below the CTL are not included in the individual compound plumes. The TCOPCs map is a summary of the individual compound maps. The plume maps also show the plume boundary from the previous year to show any changes over the last year.

The TCE plume for 2007 (Figure 11) is similar in size to the 2006 plume. TCE above the 30 µg/L CTL is located in two small areas, one near the southwest property boundary and one in the east central part of the site. The cDCE plume is located in the same areas as the TCE plume, and also extends downgradient to well M001. The 2007 cDCE plume is identical in size to the

2006 plume. The 2007 VC plume is slightly smaller than the 2006 plume. Benzene was not detected above the 10 µg/L CTL.

In summary, the 2007 contaminant plume at the 4.5 Acre Site is similar in size to the 2006 plume. No COPCs were detected above the CTL in off-site wells. The plume appears stable in terms of area.

3.3 Geochemical Parameters

Geochemical parameters measured in the field in all wells at the 4.5 Acre Site during March 2007 are summarized in Table 2. Conditions across the site generally are reducing as evidenced by the low values of dissolved oxygen and oxygen reduction potential.

4.0 Tasks to be Performed Semiannually

The following tasks are scheduled during the next semiannual period (June through November 2007).

- Semiannual sampling and analysis of ground water in September 2007.
- Collect water-level measurements in September 2007.

5.0 References

DOE (U.S. Department of Energy), 2000. *4.5 Acre Site Biosparge System Integration Plan*, GJO–2000–182–TAR, MAC–PIN 25.5.1.1, prepared by U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, December.

DOE (U.S. Department of Energy), 2001. *Remedial Action Plan for the Pinellas 4.5 Acre Site*, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, July.

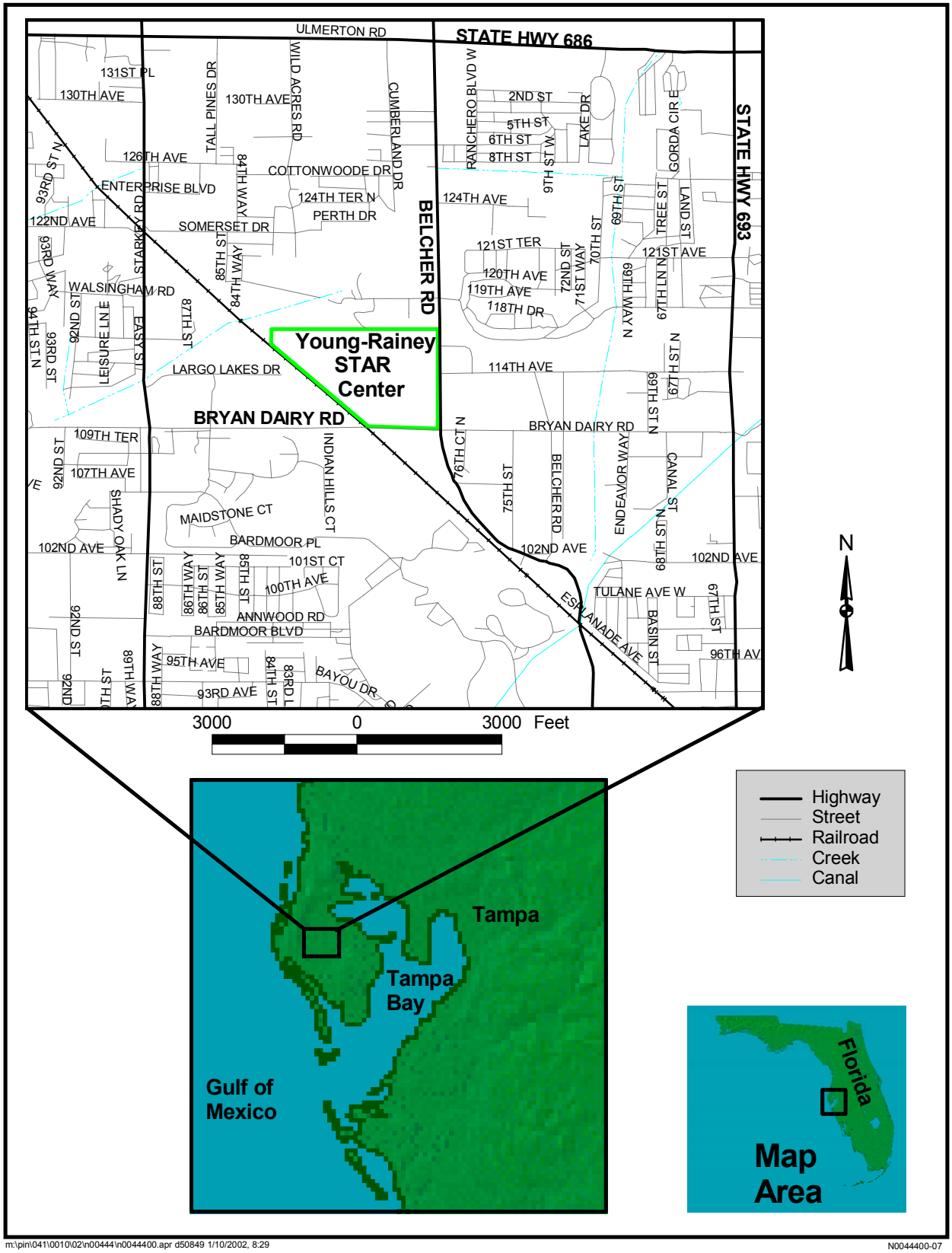
DOE (U.S. Department of Energy), 2003a. *Historical Review and Evaluation of Contaminants of Potential Concern*, GJO-2002-359-TAC, February.

DOE (U.S. Department of Energy), 2003b. *Pinellas Environmental Restoration Project Interim Remedial Action Plan for Ground Water Recovery at the 4.5 Acre Site*, GJO-2003-480-TAC, prepared by U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, August.

DOE (U.S. Department of Energy), 2005. *Pinellas Environmental Restoration Project 4.5 Acre Site Remedial Action Plan Addendum*, DOE-LM/GJ858-2005, prepared by the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2006. *Pinellas Environmental Restoration Project Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site,* DOE-LM/GJ1159-2006, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

FDEP (Florida Department of Environmental Protection), 2005. Letter from John Armstrong (FDEP) to David Ingle, dated July 7, 2005.



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N0044400-07

Figure 1. Young - Rainey STAR Center Location

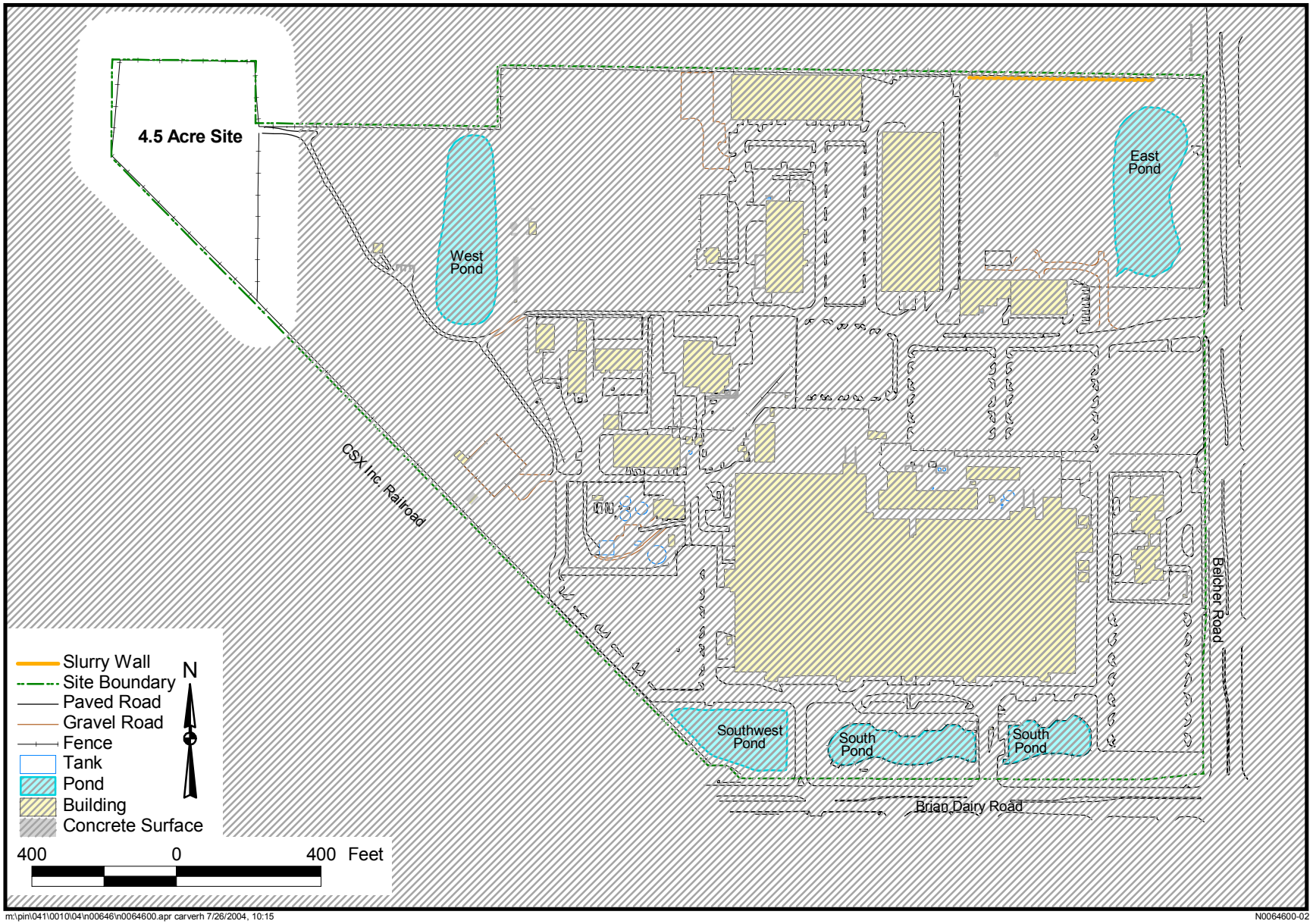

Figure 2. 4.5 Acre Site Location

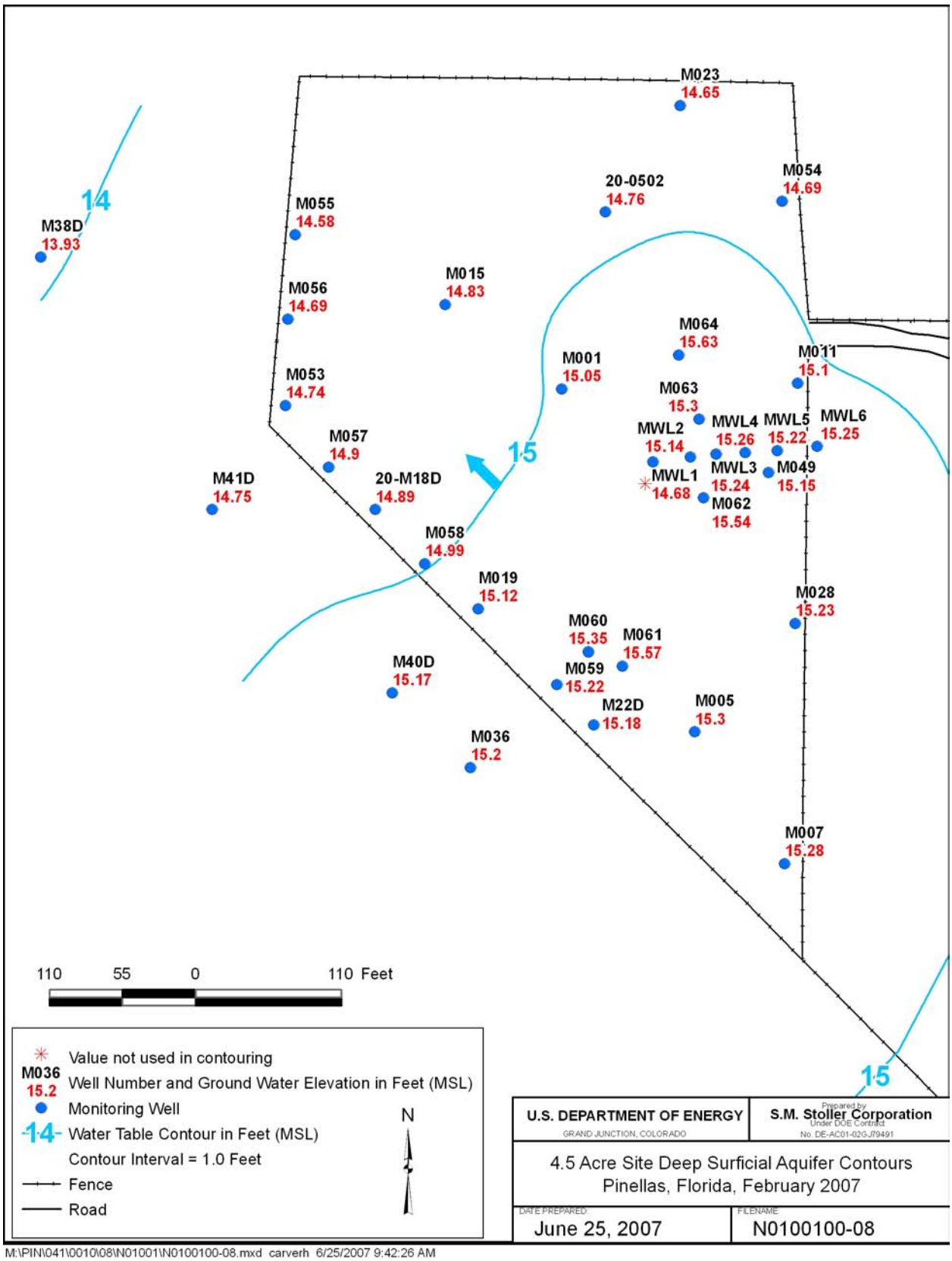

Figure 3. Ground Water Elevations and Deep Surficial Aquifer Flow, 4.5 Acre Site, February 2007

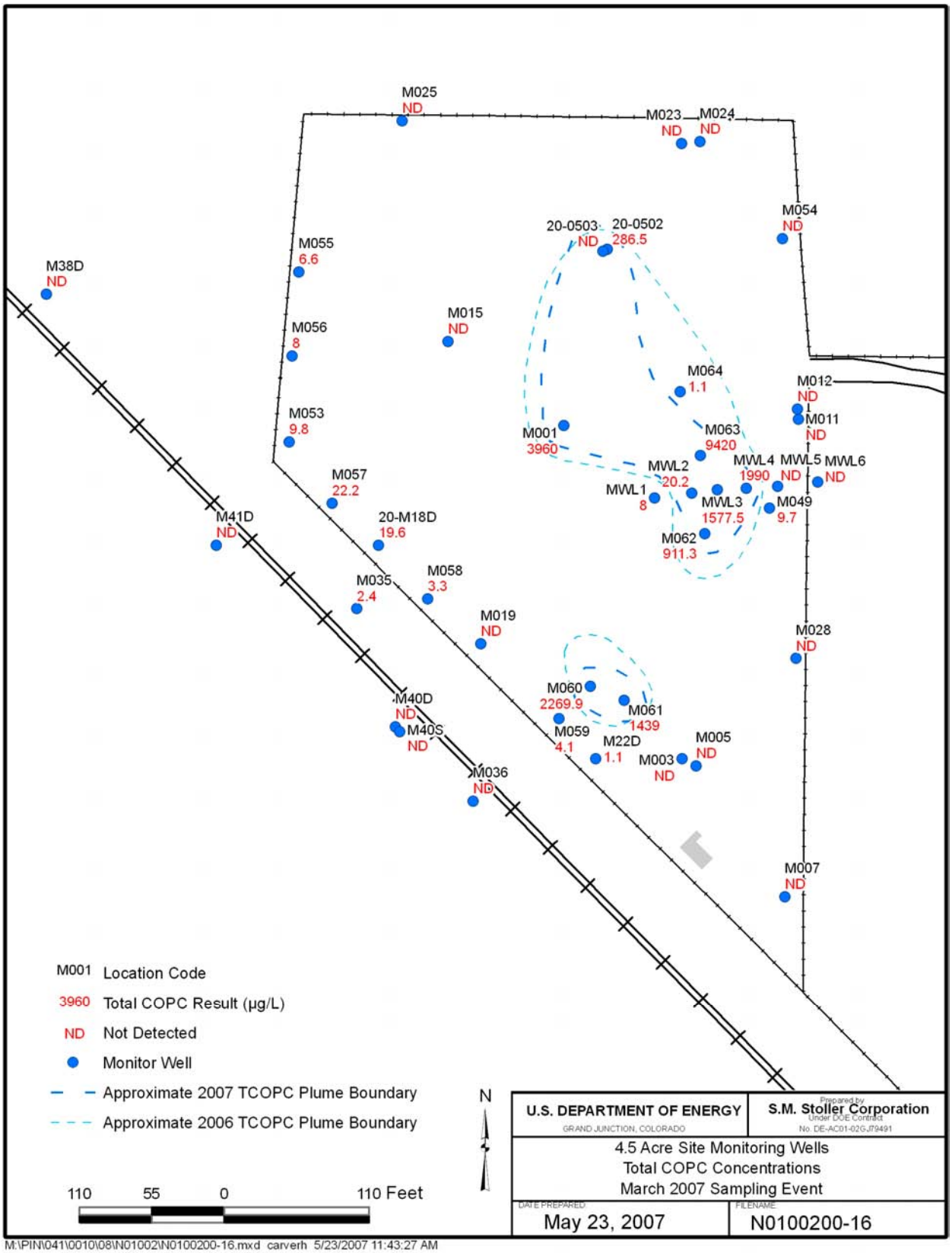

Figure 4. 4.5 Acre Site TCOPC Concentrations March 2007 Sampling Event

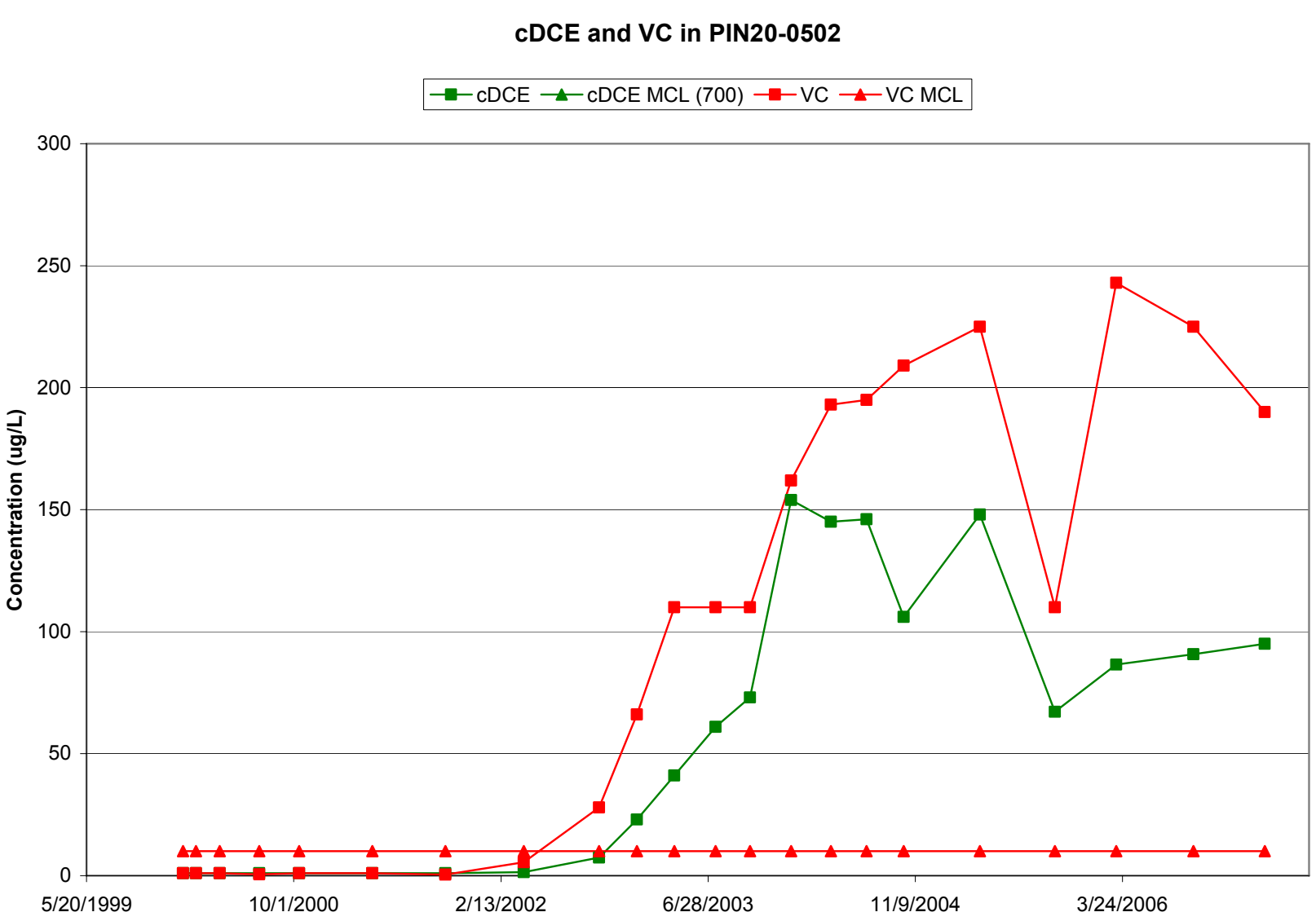

Figure 5. cDCE and VC in PIN20−0502

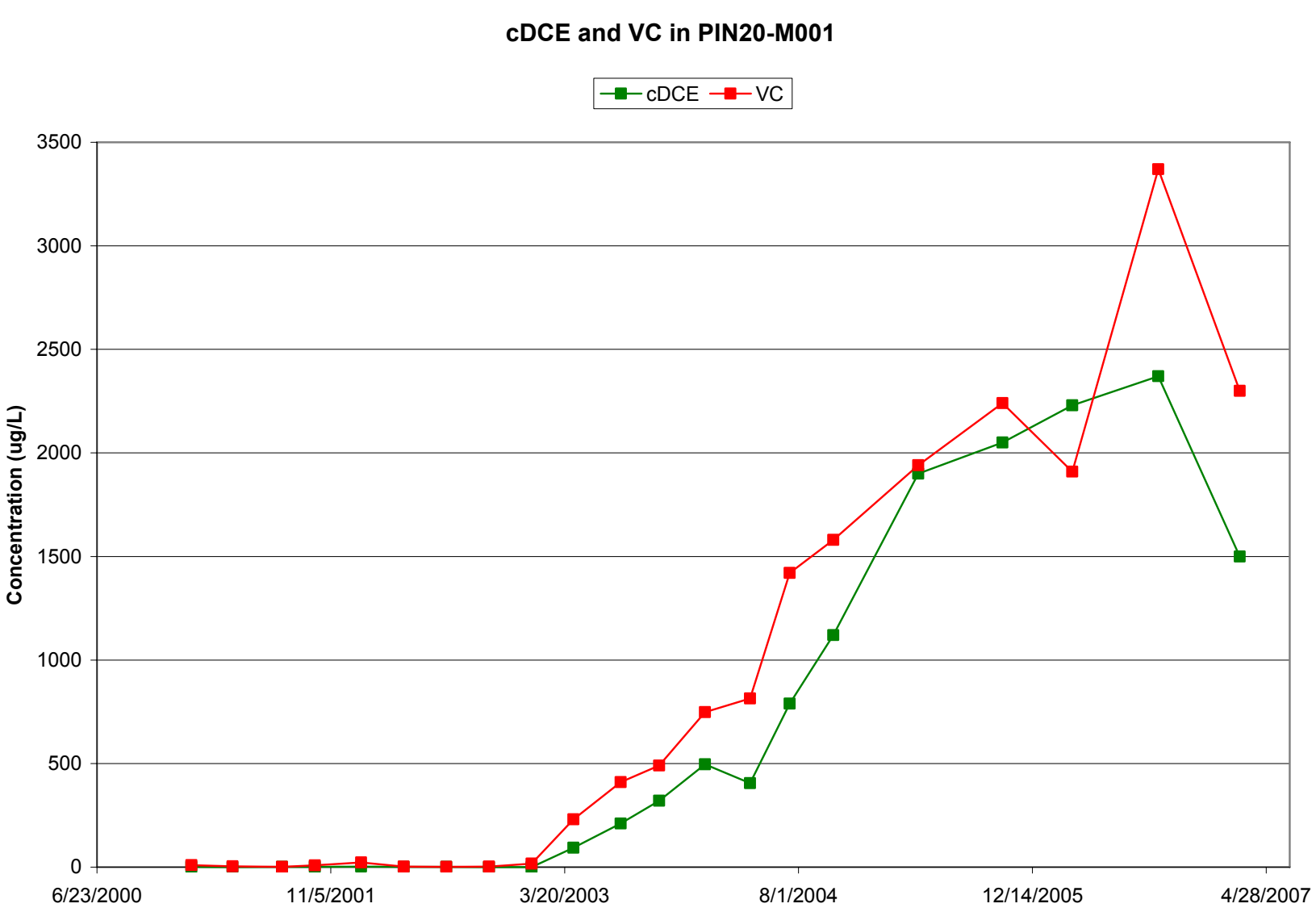

Figure 6. cDCE and VC in PIN20−M001

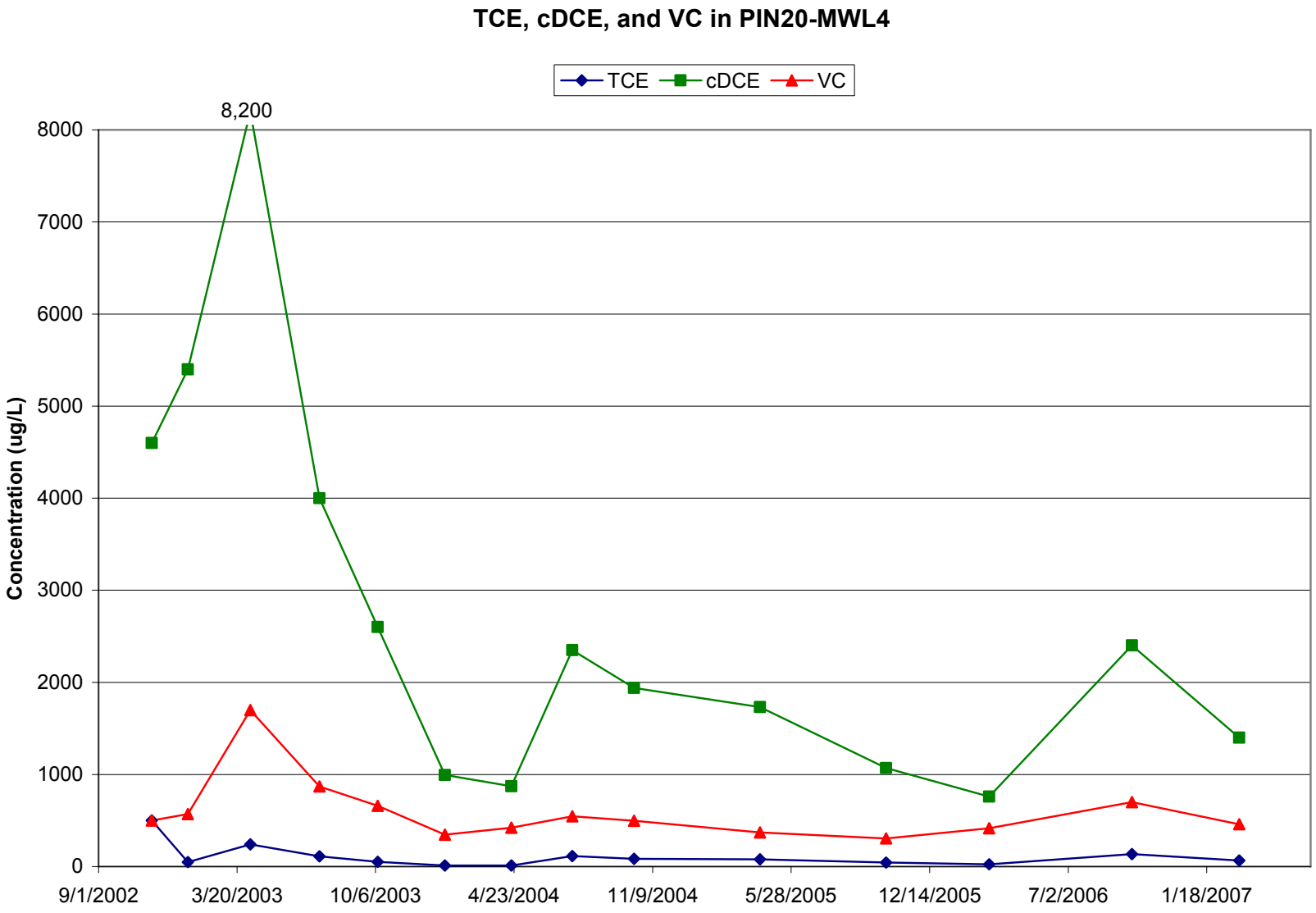

Figure 7. TCE, cDCE, and VC in PIN20−MWL4

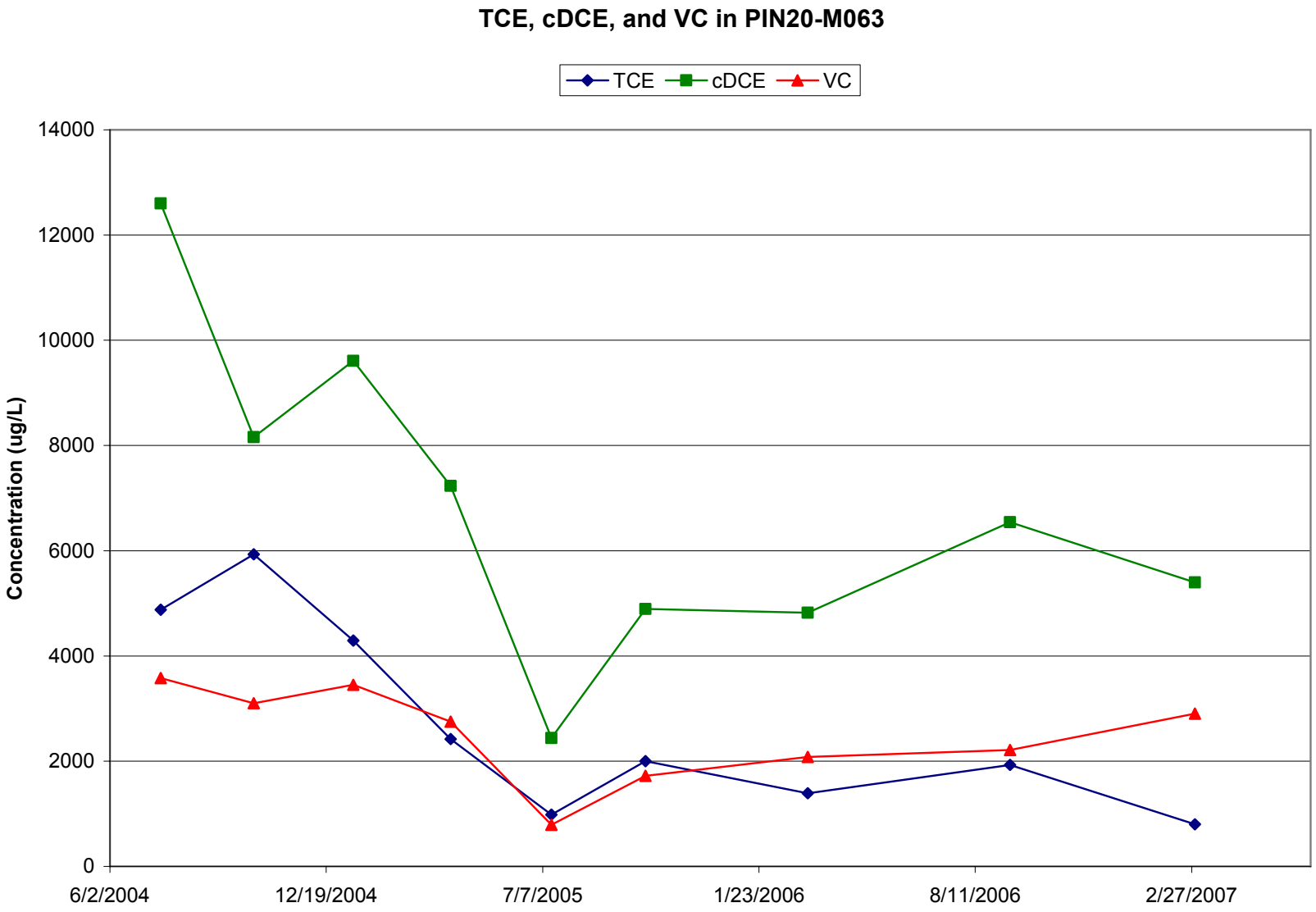

Figure 8. TCE, cDCE, and VC in PIN20−M063

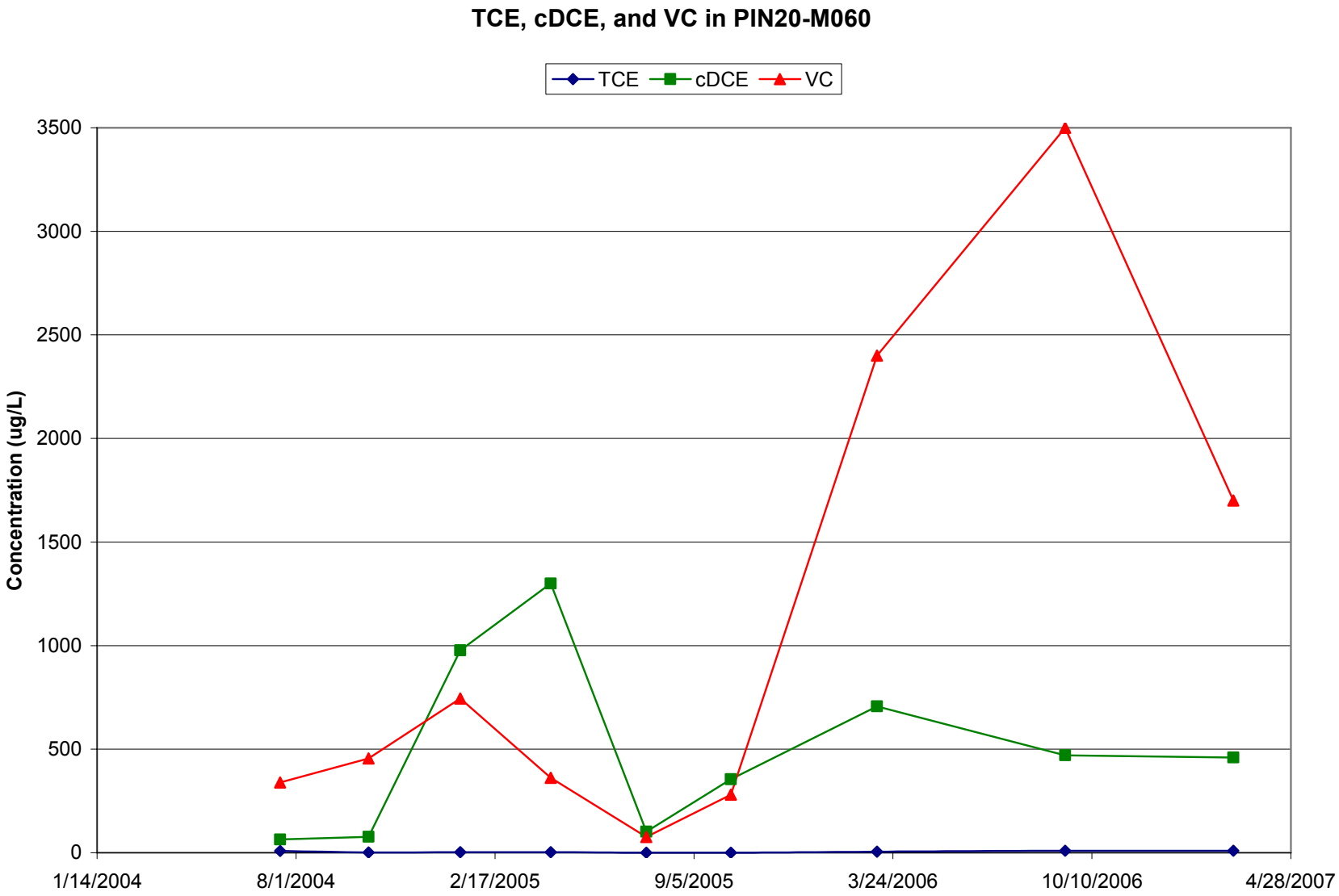

Figure 9. TCE, cDCE, and VC in PIN20−M060

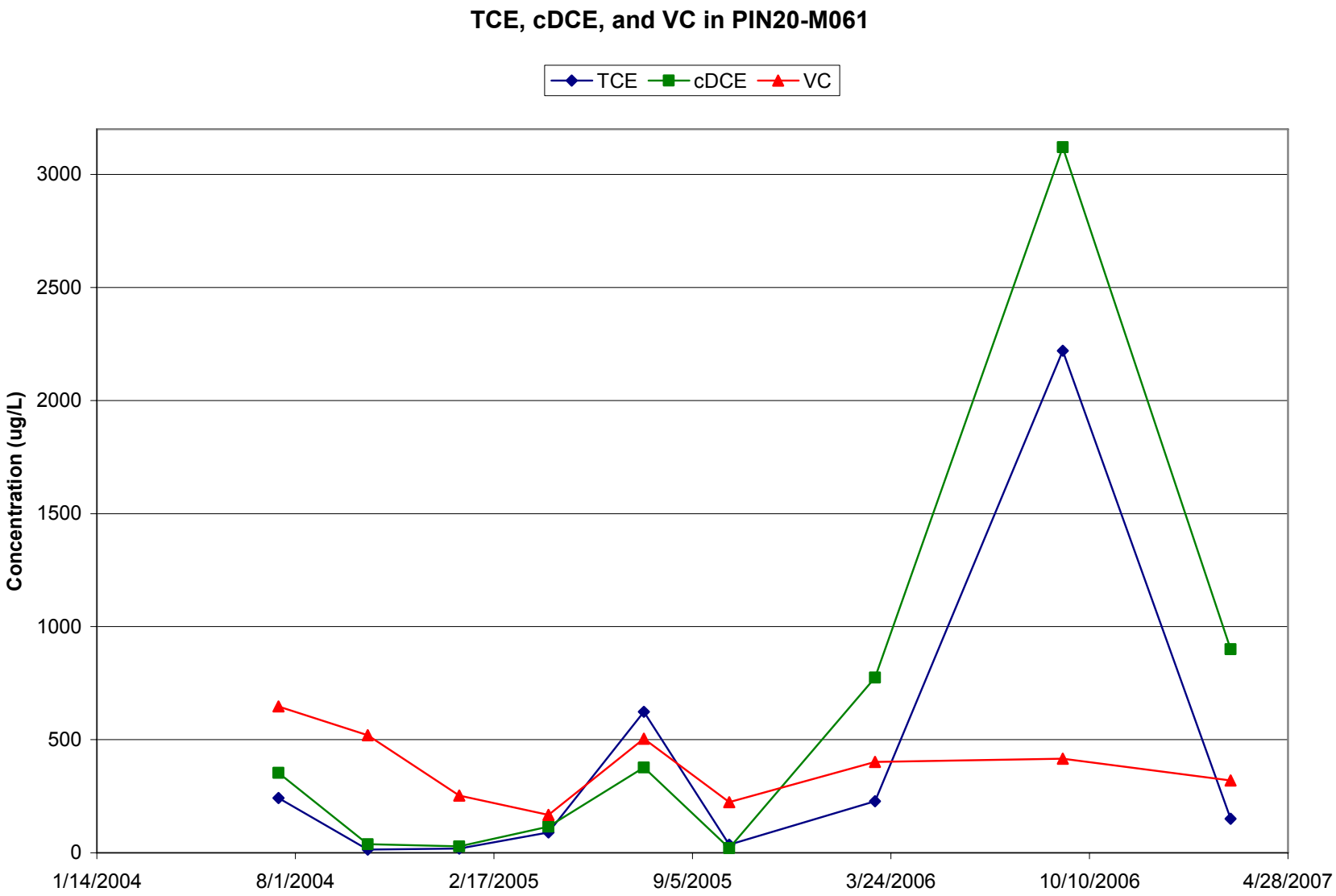

Figure 10. TCE, cDCE, and VC in PIN20−M061

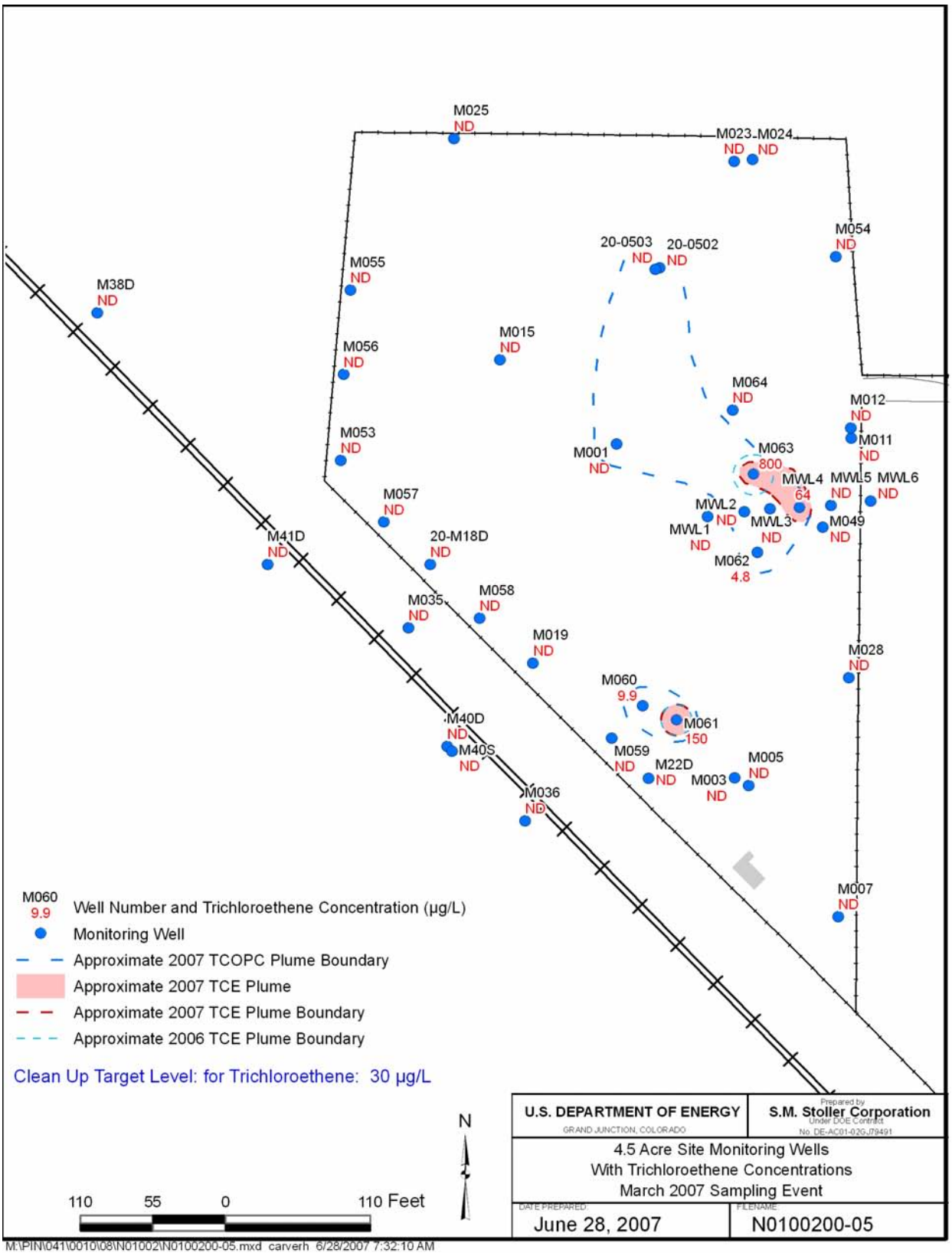

Figure 11. 4.5 Acre Site TCE Concentrations—March 2007 Sampling Event

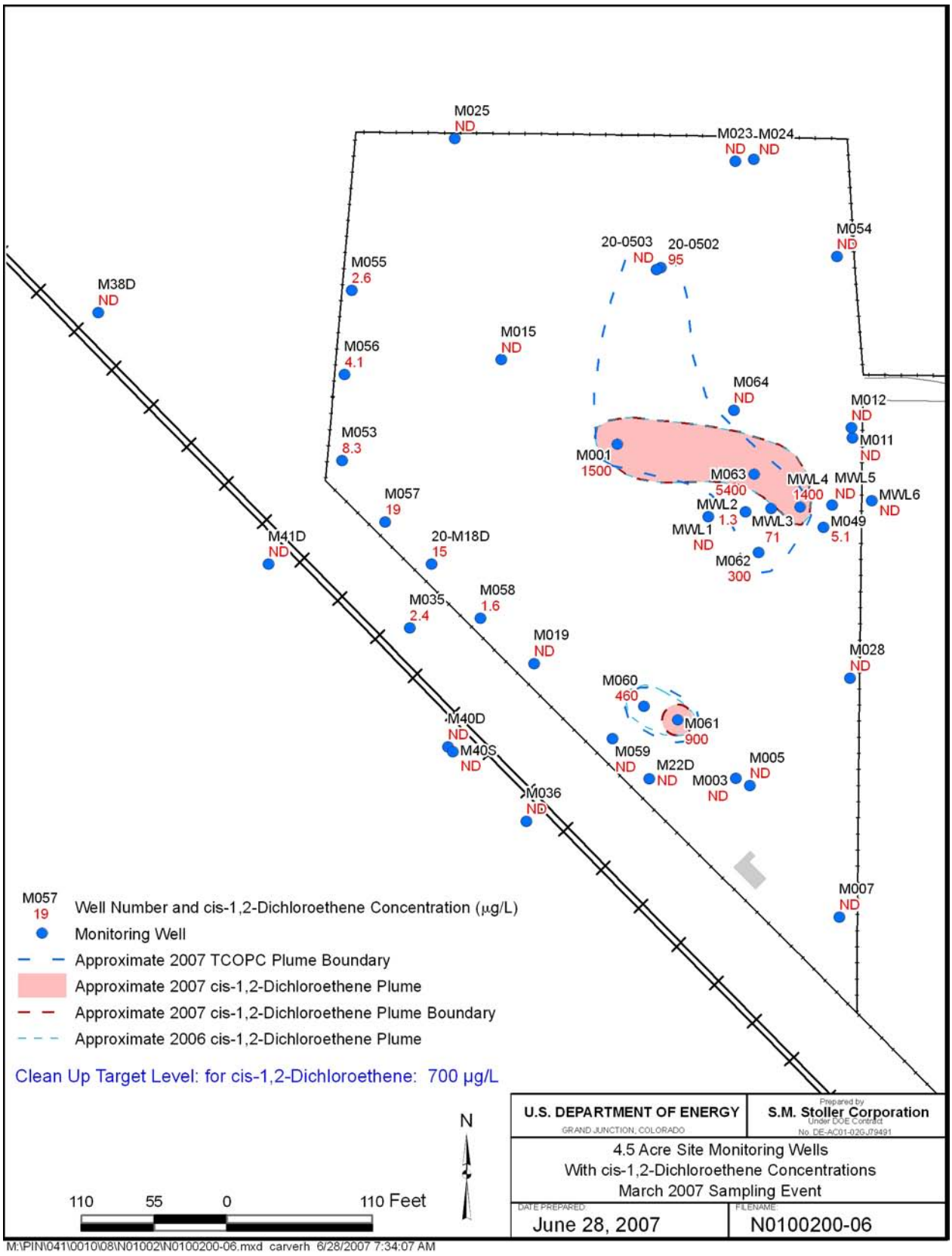

Figure 12. 4.5 Acre Site cis-1,2-DCE Concentrations—March 2007 Sampling Event

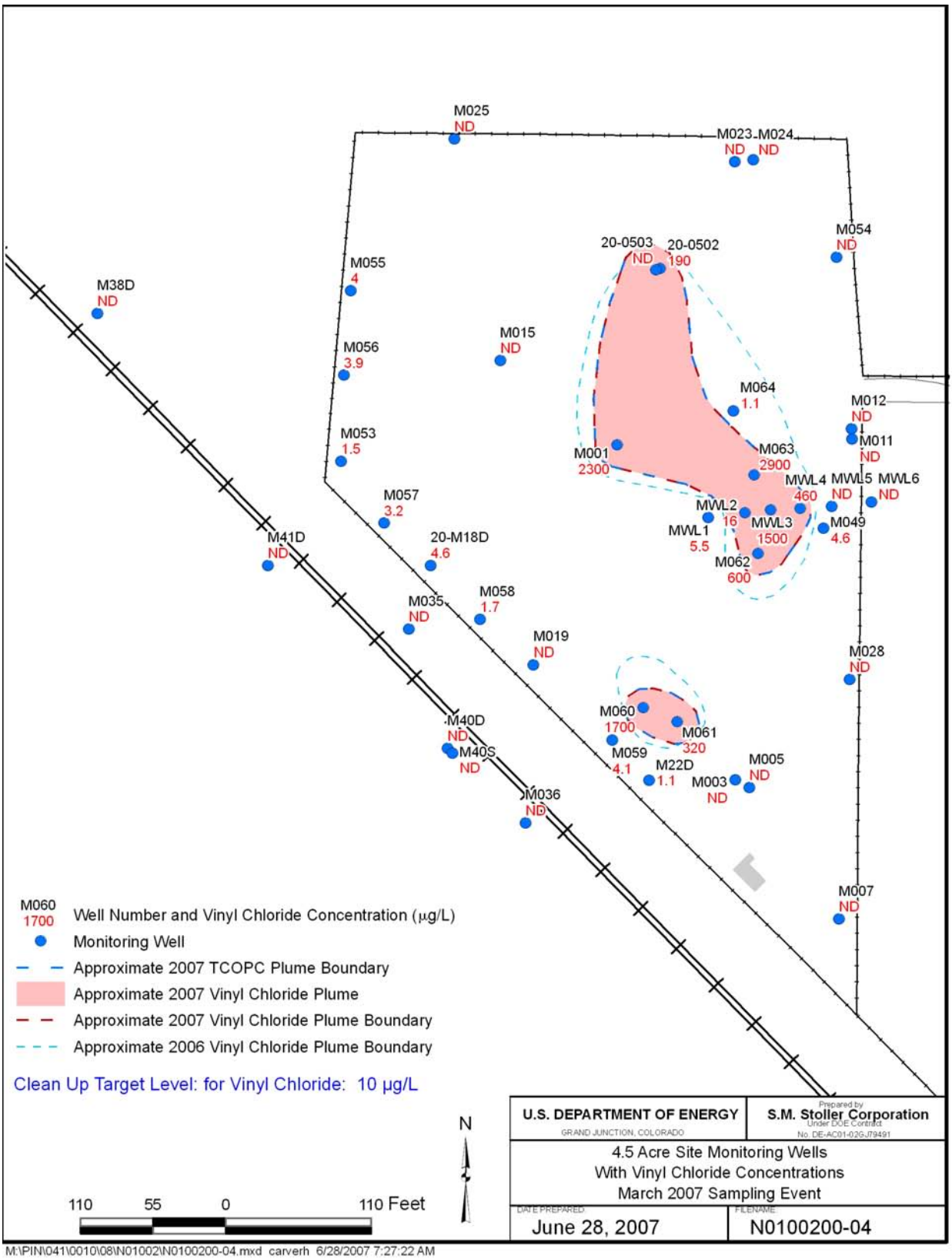

Figure 13. 4.5 Acre Site Vinyl Chloride Concentrations—March 2007 Sampling Event

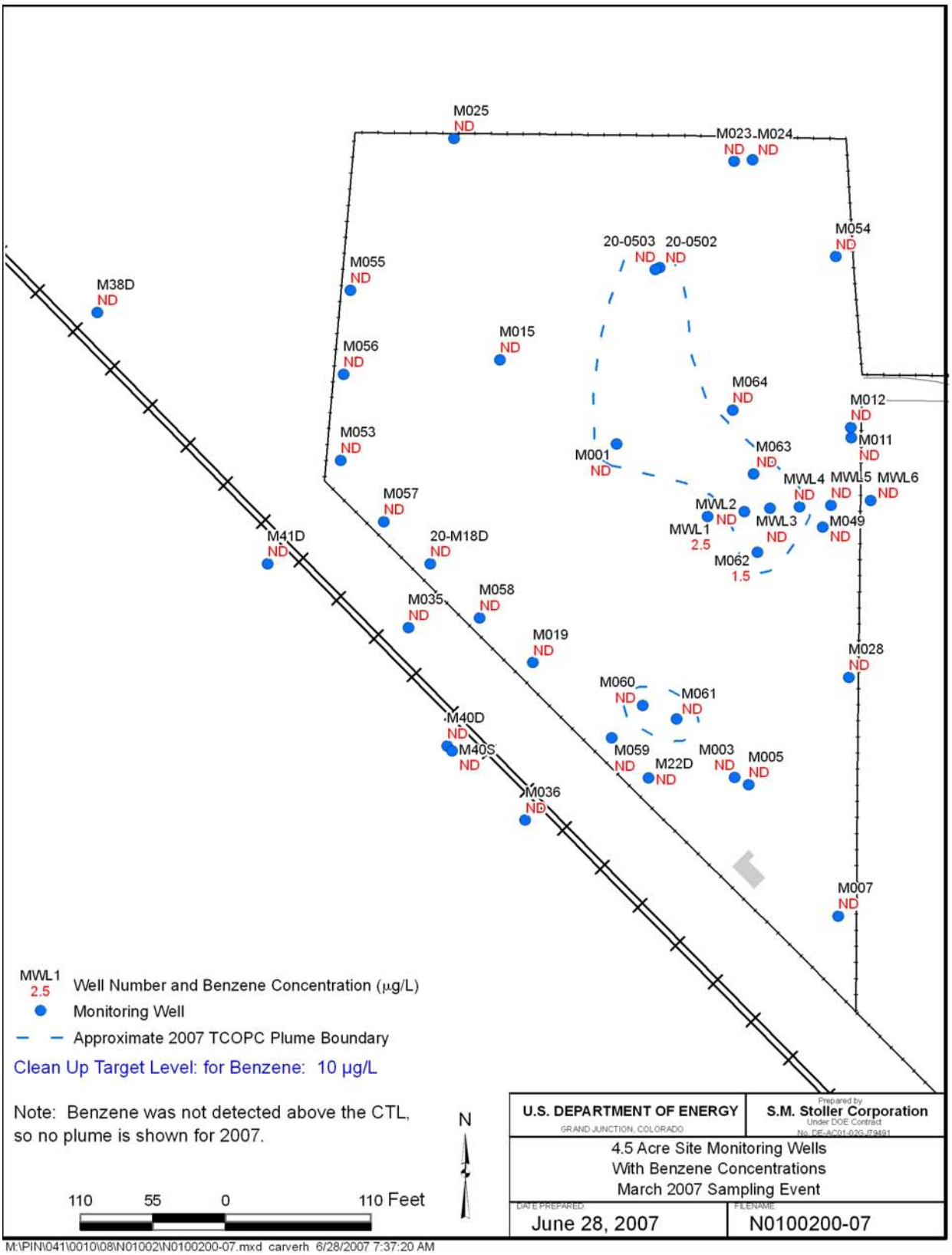

Figure 14. 4.5 Acre Site Benzene Concentrations—March 2007 Sampling Event

Table 1. Water-Level Data at the 4.5 Acre Site

Location	Measurement		Water Depth From Land Surface (ft)	Ground Water Elevation (ft NGVD)
	Date	Time		
PIN20	**4.5 Acre Site**			
0502	2/28/07	10:38	2.64	14.76
0503	2/28/07	10:39	2.65	14.75
M001	2/28/07	10:49	2.55	15.05
M003	2/28/07	10:21	2.92	15.28
M005	2/28/07	10:22	3.00	15.30
M007	2/28/07	10:24	4.17	15.28
M011	2/28/07	10:31	3.00	15.10
M012	2/28/07	10:32	2.84	15.16
M015	2/28/07	10:48	2.67	14.83
M019	2/28/07	10:15	2.88	15.12
M023	2/28/07	10:36	4.82	14.65
M024	2/28/07	10:35	3.01	14.79
M025	2/28/07	10:40	1.75	14.55
M028	2/28/07	10:26	2.97	15.23
M035	2/28/07	10:03	3.78	15.02
M036	2/28/07	10:01	4.10	15.20
M049	2/28/07	10:29	2.65	15.15
M053	2/28/07	10:07	2.46	14.74
M054	2/28/07	10:33	3.01	14.69
M055	2/28/07	10:44	2.82	14.58
M056	2/28/07	10:06	2.41	14.69
M057	2/28/07	10:11	3.00	14.90
M058	2/28/07	10:14	2.71	14.99
M059	2/28/07	10:18	2.58	15.22
M060	2/28/07	13:42	1.98	15.35
M061	2/28/07	13:40	1.71	15.57
M062	2/28/07	13:24	2.29	15.54
M063	2/28/07	13:30	2.80	15.30
M064	2/28/07	13:34	2.08	15.63
M18D	2/28/07	10:12	2.81	14.89
M22D	2/28/07	10:19	2.62	15.18
M38D	2/28/07	09:51	4.57	13.93
M40D	2/28/07	09:58	4.23	15.17
M40S	2/28/07	09:57	3.98	15.22
M41D	2/28/07	09:53	4.35	14.75
MWL1	2/28/07	10:55	4.23	14.01
MWL2	2/28/07	13:29	2.63	15.14
MWL3	2/28/07	13:32	2.46	15.24
MWL4	2/28/07	13:33	2.48	15.26
MWL5	2/28/07	13:37	3.35	15.22
MWL6	2/28/07	13:47	3.20	15.25
RW01	2/28/07	10:43	2.96	14.64
RW02	2/28/07	10:09	2.29	14.81
RW03	2/28/07	10:17	2.40	15.20

Table 2. Field Measurements of Samples Collected at the 4.5 Acre Site

Location	Screen Depth (ft bls)	Temperature (°C)	Specific Conductance (µmhos/cm)[a]	Turbidity (NTU)	pH	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)
PIN20	**4.5 Acre Site**						
0502	21.2–31.2	23.63	1,480	18.3	6.6	-164.3	2.54
0503	13.2–23.2	23.84	1,579	47.8	6.66	-59.8	0.23
M001	20–25	23.4	1,416	30.2	6.61	-196.1	3.3
M003	9–14	22.24	1,020	8.29	6.75	1	0.81
M005	25.8–30.7	23.81	1,112	1.58	6.83	-23.1	0.19
M007	25.3–30.3	22.97	1,014	6.02	6.95	-53.3	0.29
M011	23.7–28.7	23.6	895	5.87	6.69	-74.5	0.41
M012	8.6–13.6	21.37	759	27.8	6.69	-25	0.44
M015	20.8–25.8	22.66	1,079	2.95	6.82	-78.3	0.22
M019	22–27	24.06	1,999	12.3	6.63	-43	1.1
M023	19.8–24.8	23.89	1,000	10.6	6.8	-99.8	0.13
M024	8.7–13.7	22.28	824	16.3	6.88	-35.6	0.45
M025	8.6–13.6	21.63	2,329	14.5	6.6	-75.2	0.44
M028	22–27	23.61	872	10.6	6.7	-75.4	0.12
M035	9–14	22.55	2,479	12.5	6.7	-75.8	0.33
M036	25–30	24.58	8.31	2.66	6.79	-64.8	0.15
M049	20–30	23.17	1,092	19.6	6.66	-67.7	0.25
M053	20–30	24.04	1,232	38.9	6.77	-80.4	0.25
M054	20–30	23.61	1,194	66.3	6.68	-88	0.38
M055	21–31	24.17	1,546	44.3	6.71	-49.3	0.17
M056	19–29	23.98	1,490	35.9	6.69	-93.5	0.19
M057	20–30	23.96	1,651	16.8	6.76	-101.9	0.13
M058	18–28	23.99	1,734	70.8	6.76	-105.1	0.21
M059	19–29	23.36	1,281	29.7	6.81	-85.4	0.2
M060	18–28	24.69	909	21.2	6.79	-260	2.88
M061	20–30	24.14	1,038	17.1	6.78	-203.9	3.39
M062	20–30	23.94	2,129	402	6.38	-142.6	3.44
M063	19.5–29.5	23.8	2,351	293	6.23	-193.3	3.56
M064	15–25	20.76	3,087	296	6.35	-96	0.02
M18D	20–30	23.79	1,785	10.1	6.77	-93.7	0.38
M22D	20–30	23.48	1,223	9.42	6.76	-97.8	0.31
M38D	20–30	22.89	827	4.82	6.88	-85.3	0.32
M40D	18–28	24.5	1,064	25.3	6.83	-79.3	0.23
M40S	4–14	21.84	225	9.23	6.43	13.5	0.84
M41D	16–26	23.56	2,143	18.6	6.71	-96.4	0.06
MWL1	21–26	22.45	2,634	6.07	5.86	-52.1	0.18
MWL2	21–26	21.59	2,681	5.4	6.42	-64.4	0.19
MWL3	21–26	22.21	1,671	2.78	6.38	-88.9	0.08
MWL4	20.8–25.8	22.79	889	1.22	6.67	-75.8	0.37
MWL5	20.8–25.8	23.68	858	3.41	6.71	-84.6	0.18
MWL6	21.5–26.5	23.82	953	5.21	6.69	-75.3	0.59

Table 3. COPC Concentrations from Wells at the 4.5 Acre Site[a]
(reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[b]	Vinyl chloride	Benzene	Total COPC[c]
FDEP MCL			**3**	**70**	**100**	**63**	**1**	**1**	
PIN20	**4.5 Acre Site**								
0502	21.2–31.2	3/9/06	0.69J	86.5	2	88.5	243	<0.5	331.5
		9/11/06	<0.5	90.8	1.3	92.1	225	<0.5	317.1
		3/2/07	<0.5	95	1.5	96.5	190	<0.5	286.5
0503	13.2–23.2	3/9/06	<0.5	<0.5	<0.5	ND	1	<0.5	1
		9/19/06	<0.5	<0.5	<0.5	ND	0.77J	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M001	20–25	3/9/06	<25	2,230	208	2,438	1,910	<25	4,348
		9/9/06	<0.5	2,370	229	2,599	3,370	3.5	5,972.5
		3/2/07	<2.5	1,500	160	1,660	2,300	<2.5	3,960
M003	9–14	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/1/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M005	25.8–30.7	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/1/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M007	25.3–30.3	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/1/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M011	23.7–28.7	3/13/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/20/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M012	8.6–13.6	3/13/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/20/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M015	20.8–25.8	3/13/06	<0.5	<0.5	<0.5	ND	0.91J	<0.5	ND
		10/2/06	<0.5	<0.5	<0.5	ND	0.69J	<0.5	ND
		3/6/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M019	22–27	3/13/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/19/06	<0.5	0.84J	<0.5	0.84J	0.6J	<0.5	ND
		3/1/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M023	19.8–24.8	3/9/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/12/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M024	8.7–13.7	3/9/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/12/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M025	8.6–13.6	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/12/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M028	22–27	3/13/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/20/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND

Table 3 (continued). COPC Concentrations from Wells at the 4.5 Acre Site (reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[b]	Vinyl chloride	Benzene	Total COPC[c]
FDEP MCL			**3**	**70**	**100**	**63**	**1**	**1**	
M035	9–14	3/9/06	0.53J	1.8	<0.5	1.8	<0.5	<0.5	1.8
		9/14/06	<0.5	3.9	<0.5	3.9	<0.5	<0.5	3.9
		3/7/07	<0.5	2.4	0.45J	2.4	<0.5	<0.5	2.4
M036	25–30	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/14/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/7/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M049	20–30	3/10/06	<0.5	5.6	0.54J	5.6	4.8	<0.5	10.4
		9/20/06	<0.5	6.2	0.57J	6.2	4	<0.5	10.2
		3/2/07	<0.5	5.1	<0.44	5.1	4.6	<0.5	9.7
M053	20–30	3/10/06	<0.5	<0.5	<0.5	ND	1.6	<0.5	1.6
		9/19/06	<0.5	2.4	<0.5	2.4	1.4	<0.5	3.8
		3/1/07	<0.5	8.3	<0.44	8.3	1.5	<0.5	9.8
M054	20–30	3/9/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/2/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M055	21–31	3/10/06	<0.5	<0.5	<0.5	ND	1.7	<0.5	1.7
		9/12/06	<0.5	2.3	<0.5	2.3	2.7	<0.5	5
		3/2/07	<0.5	2.6	<0.44	2.6	4	<0.5	6.6
M056	19–29	3/10/06	<0.5	1.1	<0.5	1.1	2.2	<0.5	3.3
		9/19/06	<0.5	4.2	<0.5	4.2	2.8	<0.5	7
		3/2/07	<0.5	4.1	<0.44	4.1	3.9	<0.5	8
M057	20–30	3/8/06	0.71J	17	0.52J	17	3.2	<0.5	20.2
		9/13/06	<0.5	14.8	<0.5	14.8	1.9	<0.5	16.7
		3/1/07	<0.5	19	<0.44	19	3.2	<0.5	22.2
M058	18–28	3/13/06	<0.5	1.3	<0.5	1.3	2.2	<0.5	3.5
		9/19/06	<0.5	2.2	<0.5	2.2	1.6	<0.5	3.8
		3/1/07	<0.5	1.6	<0.44	1.6	1.7	<0.5	3.3
M059	19–29	3/8/06	<0.5	0.69J	<0.5	0.69J	6.7	<0.5	6.7
		9/11/06	<0.5	3.7	1	4.7	12	<0.5	16.7
		3/1/07	<0.5	<0.65	<0.44	ND	4.1	<0.5	4.1
M060	18–28	3/8/06	5.1J	707	119	826	2,400	<5	3,226
		9/13/06	<10	470	142	612	3,500	<10	4,112
		3/1/07	9.9	460	100	560	1,700	<2.5	2,269.9
M061	20–30	3/8/06	228	775	49.2	824.2	402	<0.5	1,454.2
		9/13/06	2,220	3,120	153	3,273	416	<2.5	5,909
		3/1/07	150	900	69	969	320	<1	1,439
M062	20–30	3/9/06	<10	180	<10	180	949	<10	1,129
		9/12/06	<10	648	<10	648	1,930	<10	2,578
		3/1/07	4.8	300	5	305	600	1.5	911.3
M063	19.5–29.5	3/9/06	1,390	4,820	274	5,094	2,080	<100	8,564
		9/12/06	1,930	6,540	486	7,026	2,210	<50	11,166
		3/2/07	800	5,400	320	5,720	2,900	<5	9,420
M064	15–25	3/9/06	<0.5	5.4	0.78J	5.4	10	<0.5	15.4
		9/11/06	<0.5	1.2	<0.5	1.2	5.8	<0.5	7
		3/6/07	<0.5	<0.65	<0.44	ND	1.1	<0.5	1.1

Table 3 (continued). COPC Concentrations from Wells at the 4.5 Acre Site (reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[b]	Vinyl chloride	Benzene	Total COPC[c]
FDEP MCL			**3**	**70**	**100**	**63**	**1**	**1**	
M18D	20–30	3/10/06	<0.5	13.1	0.64J	13.1	6.8	<0.5	19.9
		9/19/06	<0.5	14.5	0.65J	14.5	5.8	<0.5	20.3
		3/1/07	<0.5	15	<0.44	15	4.6	<0.5	19.6
M22D	20–30	3/10/06	<0.5	<0.5	<0.5	ND	0.85J	<0.5	ND
		9/19/06	<0.5	<0.5	<0.5	ND	0.72J	<0.5	ND
		3/1/07	<0.5	<0.65	<0.44	ND	1.1	<0.5	1.1
M38D	20–30	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/14/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/7/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M40D	18–28	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/14/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/7/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M40S	4–14	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/14/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/7/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M41D	16–26	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		9/14/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/7/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
MWL1	21–26	3/10/06	<0.5	<0.5	<0.5	ND	7	2.8	9.8
		9/20/06	<0.5	<0.5	<0.5	ND	5.4	3.1	8.5
		3/6/07	<0.5	<0.65	<0.44	ND	5.5	2.5	8
MWL2	21–26	3/10/06	<0.5	2.9	5.1	8	25.8	<0.5	33.8
		10/2/06	<0.5	1.7	5.7	7.4	19.6	<0.5	27
		3/6/07	<0.5	1.3	2.9	4.2	16	<0.5	20.2
MWL3	21–26	3/10/06	<25	286	<25	286	1,790	<25	2,076
		10/2/06	<25	305	<25	305	2,760	<25	3,065
		3/6/07	<0.5	71	6.5	77.5	1,500	<0.5	1,577.5
MWL4	20.8–25.8	3/10/06	23.3	759	28.4	787.4	417	<10	1,227.7
		10/2/06	135	2,400	105	2,505	700	<10	3,340
		3/6/07	64	1,400	66	1,466	460	<0.5	1,990
MWL5	20.8–25.8	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/6/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
MWL6	21.5–26.5	3/10/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/2/06	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		3/6/07	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND

[a]"<" values are reporting limits.
[b]Total 1,2–DCE is the sum of cis–1,2–DCE and trans–1,2–DCE.
[c]Total COPC is the sum of the individual COPC concentrations. The cis–1,2–DCE and trans–1,2–DCE values are not part of the total COPC value because these values are included in the total 1,2–DCE value. "J" values are not included in the total COPC value.
ND = Not detected.
J = Estimated value, result is between the reporting limit and the method detection limit.
Arsenic, while a COPC, is not included in this table, nor in the Total COPC value.

Table 4. Arsenic Concentrations from Wells at the 4.5 Acre Site

Location	Sample Date	Concentration (mg/L)
0502	3/2/07	<0.0048
0503	3/2/07	0.046

"<" values are method detection limits.

Table 5. Dissolved Gas and Dehalococcoides ethenogenes

Location		Date Sampled	Ethane (µg/L)	Ethene (µg/L)	Methane (µg/L)	Dehalococcoides ethenogenes (copy numbers/L)
4.5 Acre Site						
PIN20	0502	3/2/07	23	2.8	1300	800J
	M001	3/2/07	150	47	3000	9,000,000
	M060	3/1/07	23	120	3400	50,000,000
	M061	3/1/07	0.21	15	2000	400,000
	M062	3/1/07	1.4	21	580	30,000,000
	M063	3/2/07	88	74	820	1,000,000

J = Estimated value, result is between the reporting limit and the method detection limit.

Table 6. RPD for Duplicate Samples, 4.5 Acre Site

Sample ID	Duplicate ID	Job Number	Analyte	S	D	RPD	RL	5xRL	Fail
PIN20-0503	PIN24-0500	660-14283	Arsenic	0.046	0.041	11.5	0.01	0.05	
PIN20-M024	PIN24-0501	660-14283	Non-detect for VOCs						
PIN20-M055	PIN24-0502	660-14283	cis-1,2-Dichloroethylene	2.6	2.5	3.9	0.65	3.3	
			Vinyl chloride	4.0	3.9	2.5	0.5	2.5	

S = Original sample (N001), VOC concentrations in µg/L and metals in mg/L.
D = Duplicate sample (N002), VOC concentrations in µg/L and metals in mg/L.
RL = Reporting limit.
Fail = Volatiles "Fail" when the RPD is greater than ± 30% and the concentration is more than 5 times the reporting limit. Metals "Fail" when the samples are more than 5 times the reporting limit and the RPD is greater than 20%. For metals samples that are less than 5 times the reporting limit the difference must be less than ± the reporting limit (this includes the case when only one of the duplicate/sample values is less than 5 times the reporting limit).