DOE–LM/GJ750–2004

Pinellas Environmental Restoration Project

Quarterly Progress Report
4.5 Acre Site
July Through September 2004

October 2004

U.S. Department of Energy

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

bls	below land surface
COPC	contaminants of potential concern
DCE	dichloroethene
DOE	U.S. Department of Energy
DPE	dual-phase extraction
FDEP	Florida Department of Environmental Protection
ft	feet
IRA	Interim Remedial Action
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
mg/L	milligrams per liter
mV	millivolts
NGVD	national geodetic vertical datum
NTU	Nephelometric Turbidity Units
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 Quarterly Progress Report for the 4.5 Acre Site* describes environmental restoration activities for the Pinellas 4.5 Acre Site located in Pinellas County, Largo, Florida. 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 1). 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 in Grand Junction, 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, northeast quarter of Section 13, Township 30 South, Range 15 East (Figure 2). 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.

Currently, ground water cleanup is proceeding according to provisions in the document *Remediation Agreement for the Four and One-Half Acre Site in Largo, Pinellas County, Florida* (Remediation Agreement) (FDEP 2001), an agreement between DOE and the Florida Department of Environmental Protection (FDEP); and in accordance with applicable portions of "Corrective Actions for Contamination Site Cases," an appendix to FDEP's *Enforcement Manual* (FDEP 1999).

The *4.5 Acre Site Biosparge System Integration Plan* (DOE 2000) was approved by 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 will be 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 2003).

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 consists 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 new IRA system is 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. The final, long-term remedy selection and conceptual design is planned for submittal to FDEP by December 1, 2004, and when approved, will become an addendum to the Remedial Action Plan.

This document is the quarterly progress report for the 4.5 Acre Site for July through September 2004, 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 Update

In addition to routine quarterly sampling for VOCs, ground water samples were collected from 10 wells at the 4.5 Acre Site in April 2004, representing the dry season, and in July 2004, representing the wet season. Both sets of ground water samples were analyzed for a broad suite of geochemical and microbiological parameters. The purpose of these sampling events were to begin a baseline evaluation of whether or not subsurface conditions are currently suitable for enhanced bioremediation, and, if not, to provide recommendations to develop a remedial strategy for the site. As part of the enhanced bioremediation evaluation, microcosm testing commenced in August and will be completed in November 2004. A report summarizing these two sampling events and the microcosm test, along with recommendations for the Remedial Action Plan addendum due in December 2004, will be prepared in November 2004.

1.2 Quarterly Site Activities

- Obtained water-level measurements from all monitoring wells on July 12, 2004.
- Conducted the quarterly sampling event (i.e., collected ground water samples from 39 monitoring wells and three recovery wells) in July 2004. The wells were sampled for VOCs and analyzed using U.S. Environmental Protection Agency (EPA) SW-846 Method 8260.
- Conducted the second round of Bioremediation Baseline sampling under Ad Hoc Plan PIN-AT. Three additional wells, selected from the newly installed wells, were included in this sampling.
- Reported the results of quarterly sampling events (this document).

2.0 Monitoring Data

2.1 Ground Water Elevations and Flow

Within a 3-hour period on July 12, 2004, depth-to-water measurements were taken in all monitoring wells at the 4.5 Acre Site as part of the sitewide annual sampling event. The depth to water in each well was measured with an electronic water-level indicator. The July 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 ground water flow generally to the west-northwest. These flow patterns are consistent with those observed at the site during the previous six quarters following shutdown of the biosparging system in May 2003.

The water table ranged from about 3.5 to 7 feet below land surface (ft bls), with ground water elevations that ranged from a high of 15.04 ft at PIN20–TE01 to a low of 11.65 ft at PIN20−M025. The hydraulic gradient across the site was approximately 0.007 feet per foot. This gradient is very similar to that observed the previous five quarters. Using Darcy's Law, along with approximations of 1 ft/day for hydraulic conductivity and 0.3 for effective porosity, ground water at the site is estimated to move about 8 ft/year. This velocity is consistent with previously observed velocities of 3 to 10 ft/year.

2.2 Ground Water Sampling

Forty-two monitoring and recovery wells were sampled by Stoller personnel in July 2004 for VOCs.

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 2004) using FDEP procedures. All samples collected were submitted to Accutest Laboratory for analysis. Accutest is accredited by the Florida Department of Health in accordance with the National Environmental Laboratory Accreditation Conference, certification number E83510. VOCs were analyzed using EPA SW-846 Method 8260.

All but four of the monitoring wells were micropurged with dedicated bladder pumps and samples were collected when the field measurements stabilized. The wells, PIN20−M007, −M061, −M062, and −M063, used standard peristaltic pump purging (three casing volumes). The monitoring wells were sampled using Teflon tubing. Extraction wells were sampled using their associated flowlines with dedicated sampling ports. 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 included in Table 3. The previous four quarters of results are included in Table 3 for comparison. Figure 4 shows the TCOPCs concentrations for April 2004.

No COPCs were detected in samples from the 16 sample locations listed below (results listed in Table 3).

PIN20–0503	PIN20–M023	PIN20–M036	PIN20–M40S
PIN20–M007	PIN20–M024	PIN20–M054	PIN20–M41D
PIN20–M011	PIN20–M025	PIN20–M38D	PIN20–MWL5
PIN20–M012	PIN20–M028	PIN20–M40D	PIN20–MWL6

Samples from 26 sample locations listed below contained COPCs at detectable levels (results listed in Table 3).

PIN20–0502	PIN20–M053	PIN20–M060	PIN20–M22D	PIN20–RW02
PIN20–M001	PIN20–M055	PIN20–M061	PIN20–MWL1	PIN20–RW03
PIN20–M015	PIN20–M056	PIN20–M062	PIN20–MWL2	
PIN20–M019	PIN20–M057	PIN20–M063	PIN20–MWL3	
PIN20–M035	PIN20–M058	PIN20–M064	PIN20–MWL4	
PIN20–M049	PIN20–M059	PIN20–M18D	PIN20–RW01	

The maximum TCOPCs value detected was 21,672 micrograms per liter (µg/L) at PIN20−M063. The compound detected at the highest concentration in PIN20−M063 was cis-1,2-DCE at a concentration of 12,600 µg/L. Reported "J" values are not considered in the TCOPC analyte concentrations.

Laboratory reports for quarterly samples collected in July 2004 are provided in Appendix A. IRA treatment system influent, effluent, and recovery well analytical results are provided in Appendix B.

2.4 Quality Assurance/Quality Control

Two duplicate samples were compared to their paired sample and the relative percent differences (RPDs) between the results were calculated. Results of analyses for each duplicate sample are listed in Table 4. From the two duplicate samples, 72 individual compounds were analyzed. All analytes met the RPD guideline. All data are considered Class A level, indicating that the data may be appropriately used for quantitative and qualitative purposes.

According to the Stoller Sampling Procedures, duplicate samples should be collected at a frequency of one duplicate for every 20 or less samples. There were 42 regular samples and two duplicate samples. The duplicate criteria were met because 39 of the samples were scheduled quarterly samples. Three VOC samples were associated with Ad Hoc Plan PIN-AT which did not require that duplicates be collected.

Six trip blanks and one equipment blank were submitted for analysis. All blanks were non-detect except one blank had an estimated concentration for toluene of 0.68 J, which is above the instrument detection limit but below the reporting limit.

No significant deficiencies were found in this quarter's validation of the field data collected during the quarterly sampling event. A software module for identifying and tracking anomalous ground water data points within the SEEPro database was implemented during January 2004. The program reports which of the COPC values lie outside of historical minimum and maximums for that location. Anomalous concentrations of methylene chloride (61.2 µg/L) were

seen in the treatment system influent. Previous results for methylene chloride have been below detection limits. This location will continue to be monitored during routine monthly sampling to ascertain if the methylene chloride exists in the ground water or if it is due to laboratory or sampling contamination.

3.0 Treatment System and Recovery Well Operations

The 4.5 Acre Site IRA ground water treatment system and recovery wells began operation the week of April 20. The treatment system is a small skid-mounted assembly that contains a low-profile air stripper, a blower, and two transfer pumps. The air stripper contains four shallow trays to strip the VOCs from the ground water. The treatment system and a surge tank reside on a concrete containment pad. The following picture shows the new treatment system. The recovery wellfield consists of three recovery wells with electric submersible pumps in each well. The recovery wells are installed along the western boundary of the 4.5 Acre Site (Figure 4).

From July 1 through September 30, 2004, the treatment system processed 745,109 gallons of ground water. Figures 5, 6, and 7 present the monthly volume of ground water recovered during July through September 2004 from the 4.5 Acre Site recovery wells.

A summary of analytical results for samples collected at the 4.5 Acre Site treatment system during this quarter is provided in Table 5. Treatment system influent and effluent samples were analyzed for VOCs and the effluent discharge volume was recorded to comply with the Pinellas County wastewater permit. In the effluent samples, all volatile organic aromatic concentrations were under the Pinellas County regulatory limit of 50 µg/L.

Table 6 presents the average monthly concentration and the calculated mass of selected analytes processed by the 4.5 Acre Site treatment system for each month of this quarter. These monthly results are based on the measured system influent concentration and ground water flow.

FeRemede® is being utilized at the new 4.5 Acre Site treatment system to control the deposition of iron and hardness salts in the air stripper. Additionally, sodium hypochlorite is also being utilized as a microbiocide to control biological growth in the air stripper.

4.0 Tasks to be Performed Next Quarter

The following tasks are scheduled during the next quarter (October through December 2004).

- Quarterly sampling and analysis of ground water and water level measurements in early October.
- Continue monitoring of the new IRA treatment system for short-term ground water recovery action.
- Collect ground water samples from PIN20−0502, −M001, −M007, −M028, −M053, −M060, −M061, −M063, −M064, −M18D, −MWL3, and −MWL4 and analyze them for a suite of natural attenuation analytes. The analytes to be measured are total organic carbon, biochemical oxygen demand, chemical oxygen demand, total Kjeldahl nitrogen, ammonia, total phosphate, orthophosphate, chloride, sulfate, sulfide, nitrate, and nitrite. Additionally, the field analytes alkalinity, total iron, and ferrous iron will also be analyzed for in the field.
- Begin preparation of an addendum to the Remedial Action Plan (DOE 2001b).
- Assess TCE detection in PIN20−M035. Concentration in PIN20−M035 is less than the maximum contaminant level and may possibly be laboratory artifact.

5.0 References

Florida Department of Environmental Protection (FDEP), 1999. "Corrective Actions for Contamination Site Cases," Appendix to FDEP *Enforcement Manual*, May.

———, 2001. *Remediation Agreement for the Four and One-Half Acre Site in Largo, Pinellas County, Florida*, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, January.

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.

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

———, 2003. *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.

———, 2004. *Pinellas Environmental Restoration Project Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site,* DOE-LM/GJ718-2004, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, September.

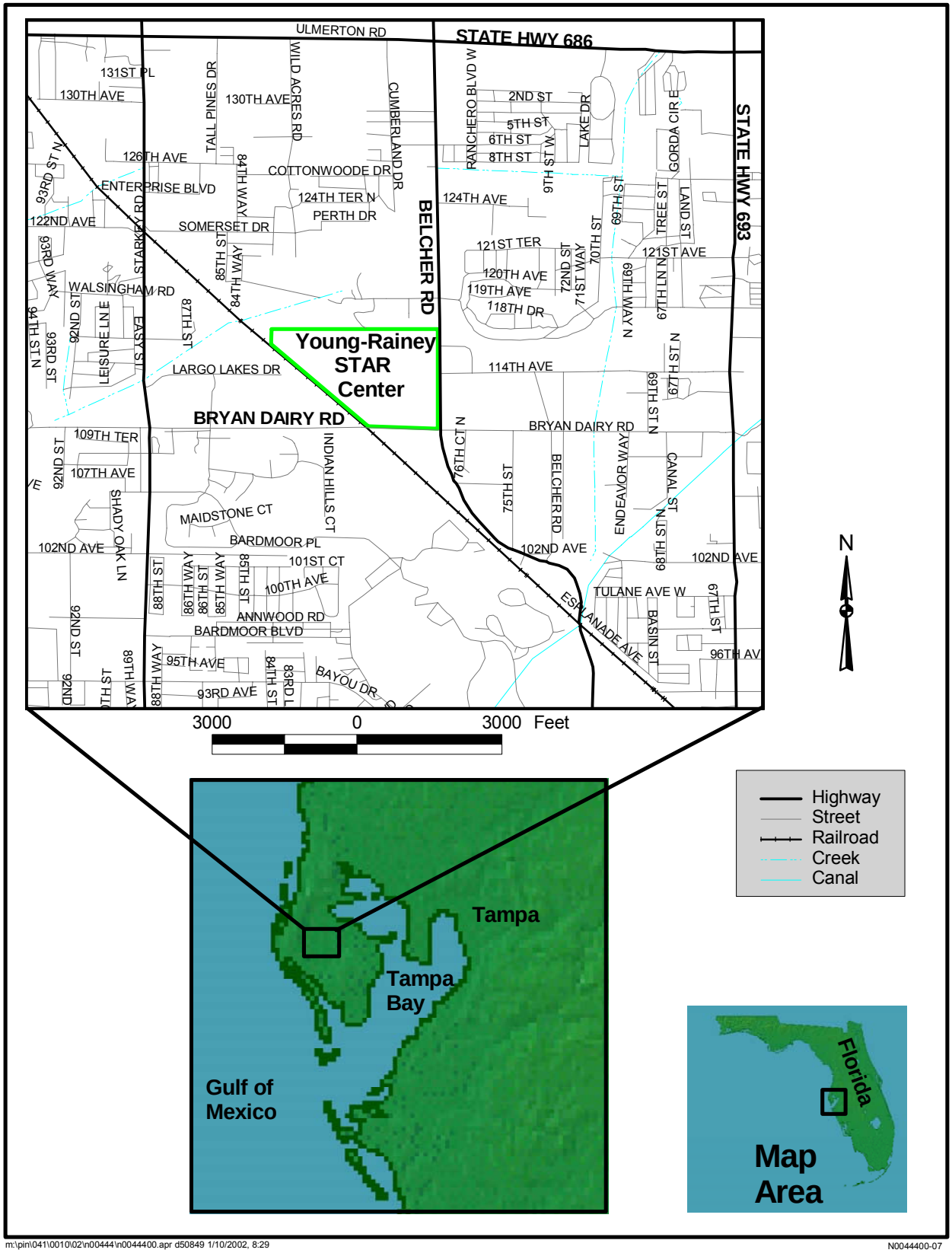

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Figure 1. Young - Rainey STAR Center Location

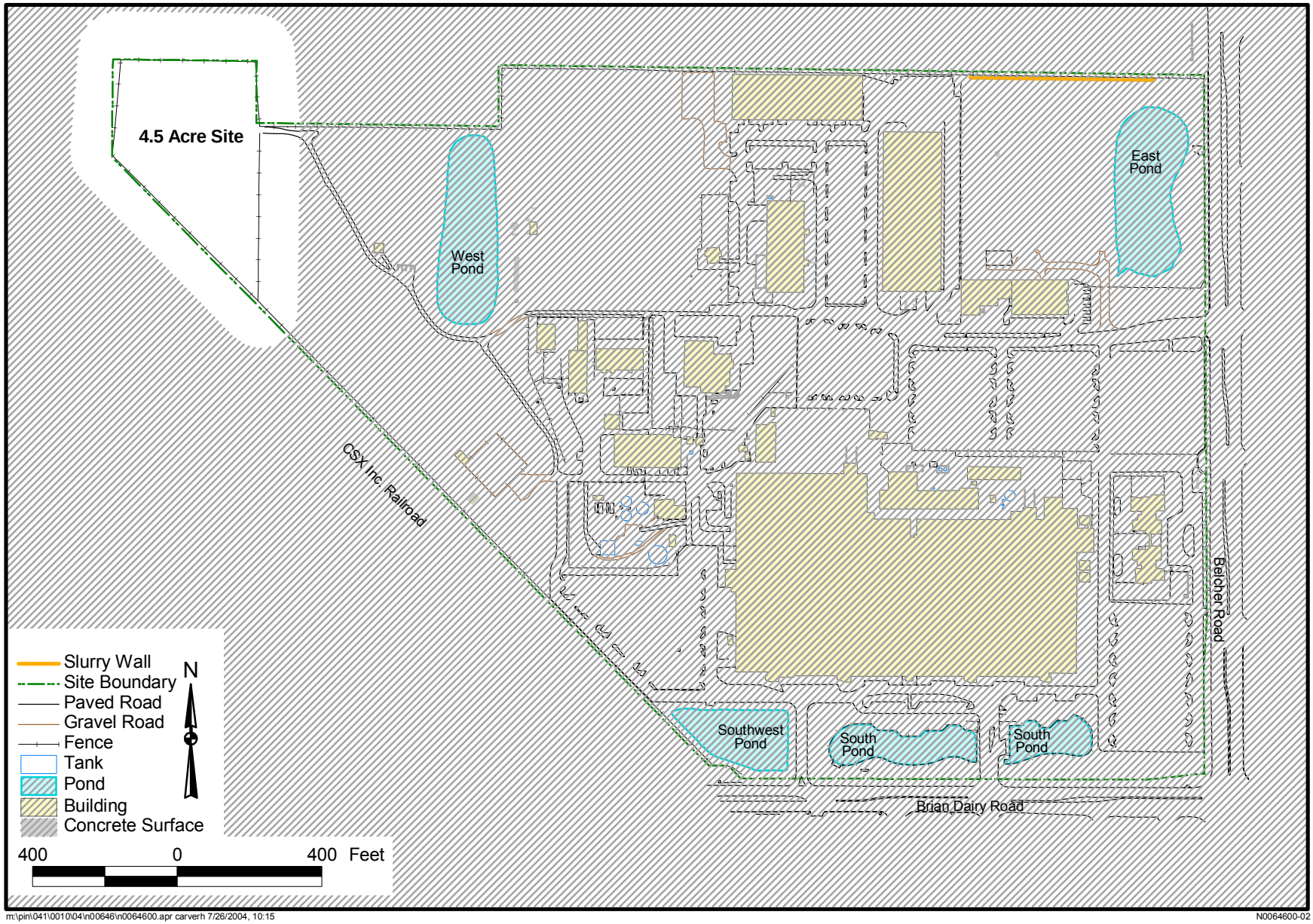

Figure 2. 4.5 Acre Site Location

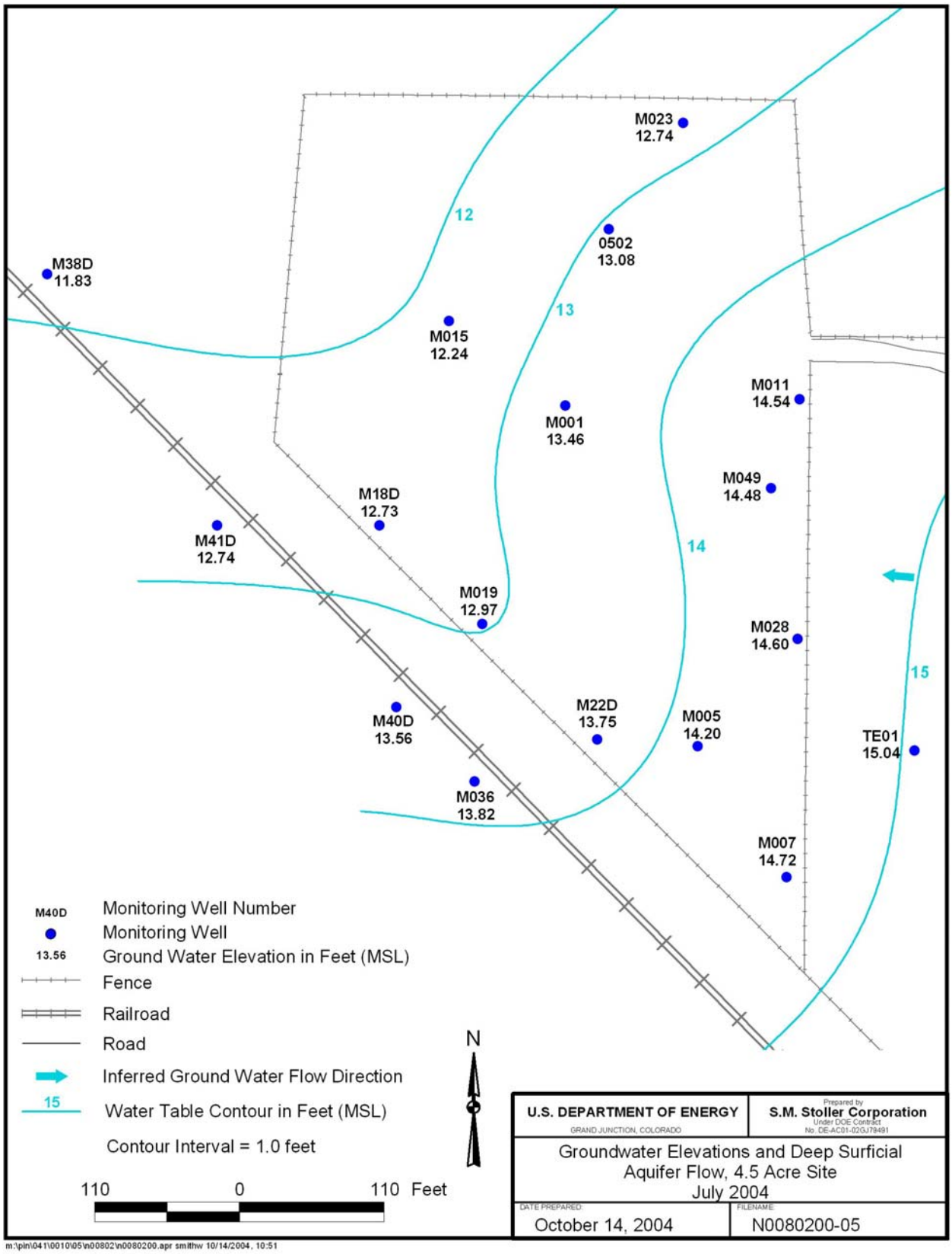

Figure 3. Ground Water Elevations and Deep Surficial Aquifer Flow, 4.5 Acre Site, July 2004

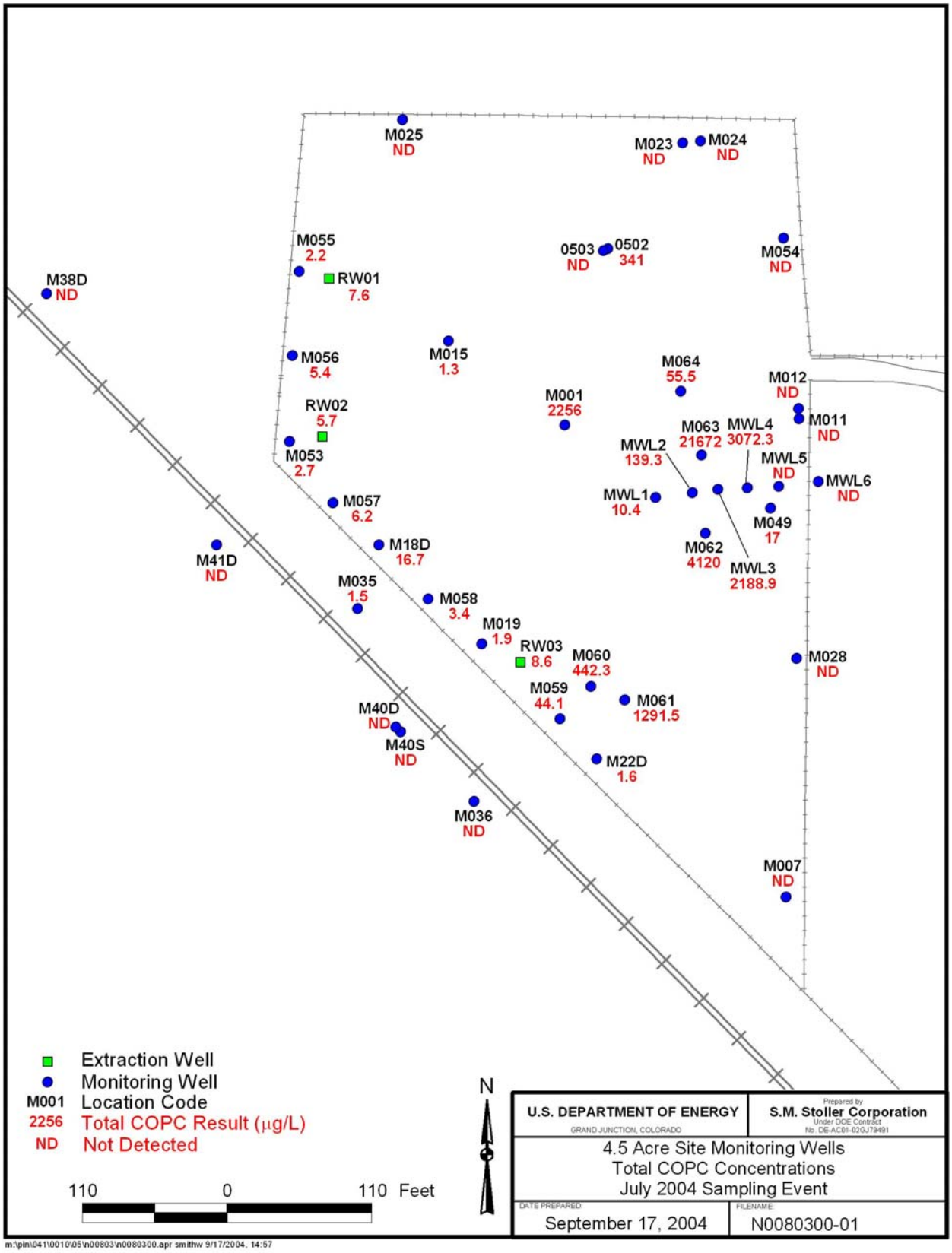

Figure 4. TCOPC Plume Map

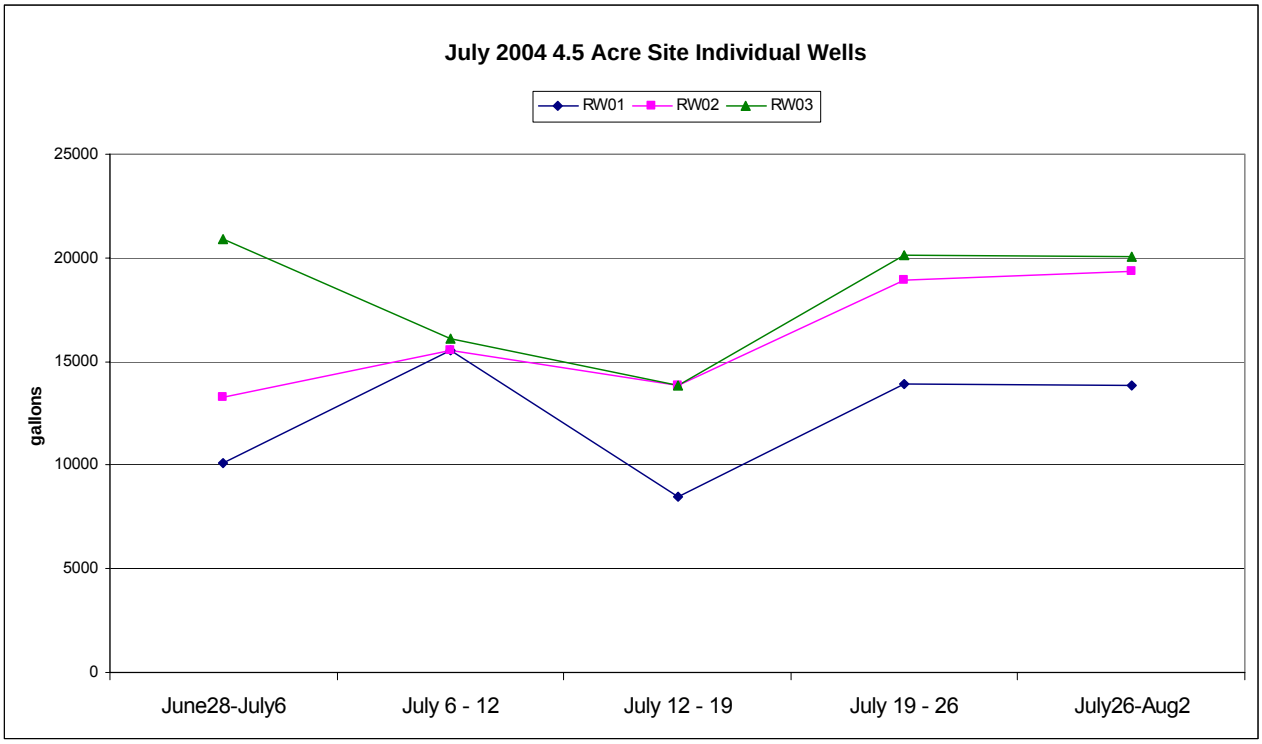

Figure 5. July 2004 4.5 Acre Site Ground Water Recovery

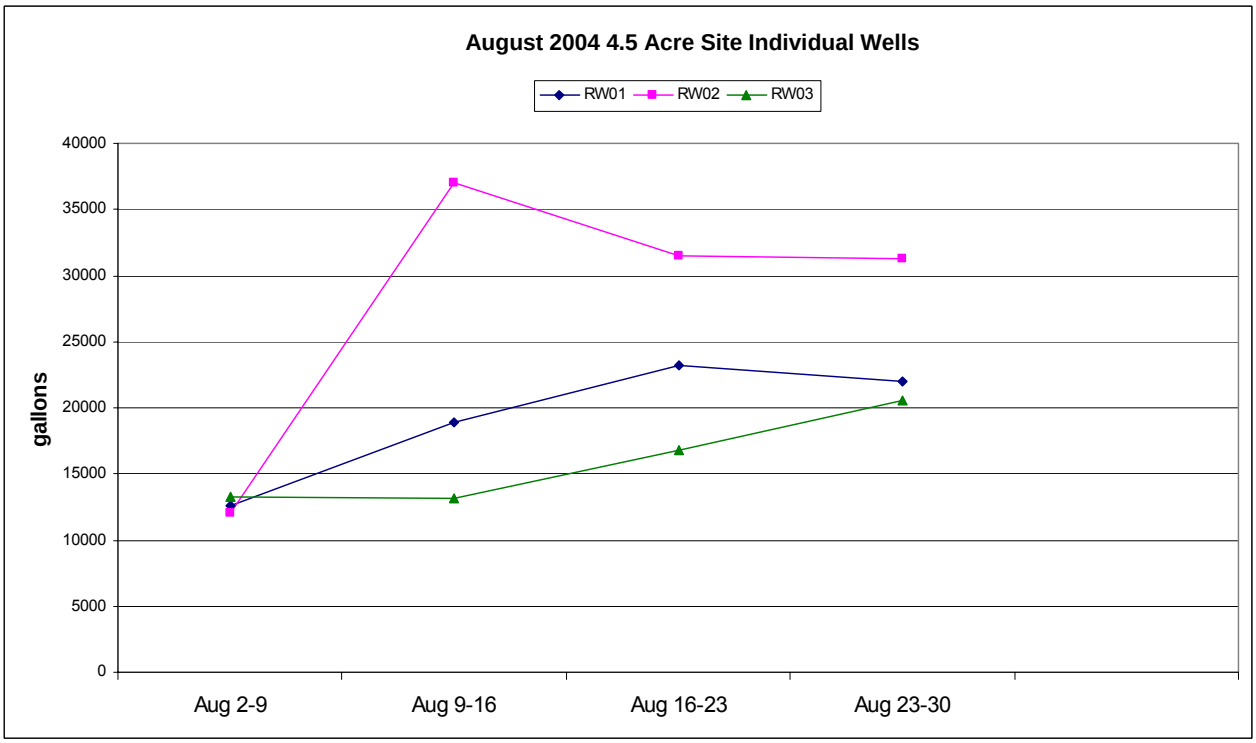

Figure 6. August 2004 4.5 Acre Site Ground Water Recovery

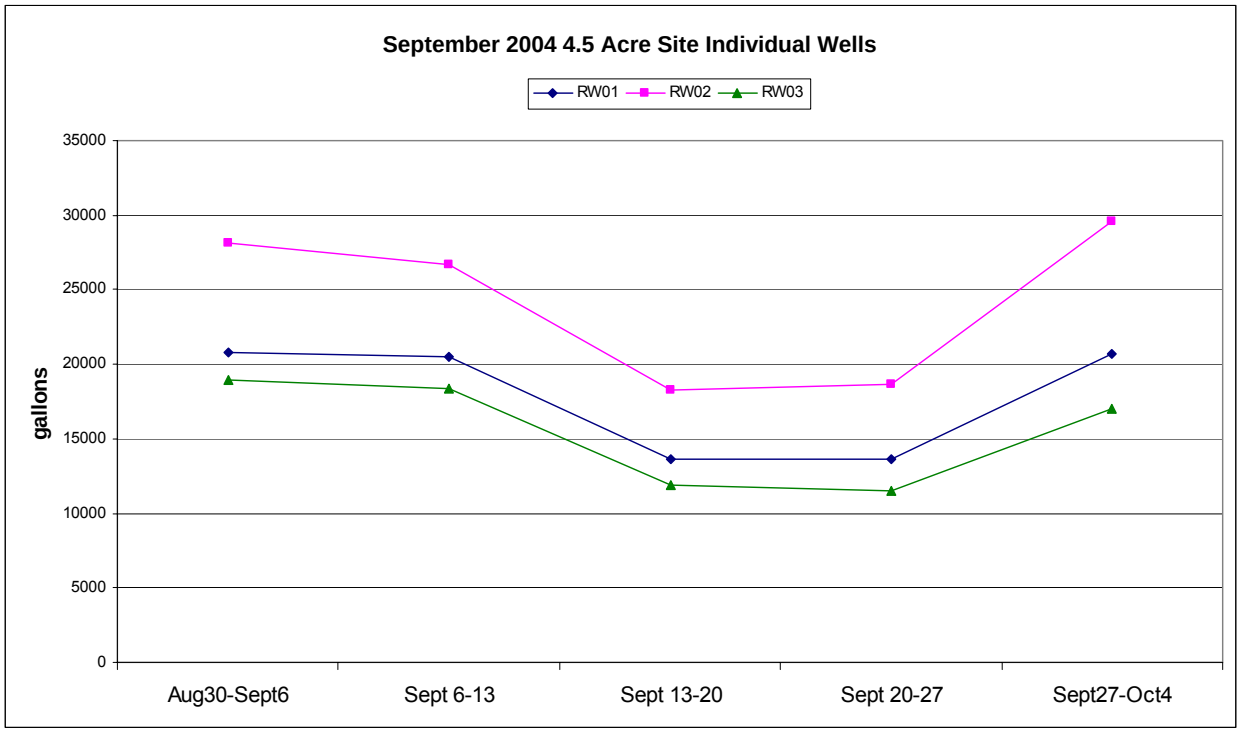

Figure 7. September 2004 4.5 Acre Site Ground Water Recovery

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		
PIN02			**West Pond**	
502D	7/12/2004	13:32	3.31	15.19
W004	7/12/2004	13:41		15.32
PIN05			**Trench Site**	
0500	7/12/2004	13:34	3.16	15.34
PIN20			**4.5 Acre Site**	
0502	7/12/2004	13:12	4.32	13.08
0503	7/12/2004	13:13	4.39	13.01
M001	7/12/2004	11:34	4.14	13.46
M003	7/12/2004	12:57	3.81	14.39
M005	7/12/2004	12:58	4.10	14.20
M007	7/12/2004	13:00	4.73	14.72
M011	7/12/2004	13:04	3.56	14.54
M012	7/12/2004	13:06	3.34	14.66
M015	7/12/2004	11:33	5.26	12.24
M019	7/12/2004	12:55	5.03	12.97
M023	7/12/2004	13:10	6.73	12.74
M024	7/12/2004	13:09	4.72	13.08
M025	7/12/2004	11:31	4.65	11.65
M028	7/12/2004	13:02	3.60	14.60
M035	7/12/2004	11:26	5.69	13.11
M036	7/12/2004	11:24	5.48	13.82
M049	7/12/2004	13:03	3.32	14.48
M053	7/12/2004	13:16	6.17	11.03
M054	7/12/2004	13:08	3.84	13.86
M055	7/12/2004	11:30	7.13	10.27
M056	7/12/2004	11:29	6.05	11.05
M057	7/12/2004	11:36	5.73	12.17
M058	7/12/2004	11:38	4.60	13.10
M059	7/12/2004	12:56	4.31	13.49
M060	7/12/2004	10:55	3.57	13.76
M061	7/12/2004	10:58	3.36	13.92
M062	7/12/2004	13:23	3.35	14.48
M063	7/12/2004	13:24	3.87	14.23
M064	7/12/2004	13:26	3.37	14.34
M18D	7/12/2004	11:37	4.97	12.73
M22D	7/12/2004	12:57	4.05	13.75
M38D	7/12/2004	11:18	6.67	11.83
M40D	7/12/2004	11:22	5.84	13.56
M40S	7/12/2004	11:23	5.31	13.89
M41D	7/12/2004	11:20	6.36	12.74
MWL1	7/12/2004	11:00	4.54	13.70
MWL2	7/12/2004	11:02	3.83	13.94
MWL3	7/12/2004	11:03	3.57	14.13

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

Location	Measurement		Water Depth From Land Surface (ft)	Ground Water Elevation (ft NGVD)
	Date	Time		
MWL4	7/12/2004	11:06	3.27	14.47
MWL5	7/12/2004	11:07	4.06	14.51
MWL6	7/12/2004	11:10	3.83	14.62
RW01	7/12/2004	10:51	8.88	8.72
RW02	7/12/2004	10:49	7.69	9.41
RW03	7/12/2004	10:48	9.38	8.22
TE01	7/12/2004	13:36	3.06	15.04

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)	Field Ferrous Iron (mg/L)	Field Total Iron (mg/L)	Oxidized Iron as Percent of Total Iron
PIN20		**4.5 Acre Site**								
0502	21.2–31.2	25.39	1,332	17.5	6.64	-64.1	0.87	1.96	4.12	52
0503	13.2–23.2	25.14	1,562	14.6	6.58	-92.9	0.56	--	--	--
M001	20–25	25.86	1,139	2.4	6.69	-109.4	0.18	3.3	8.48	61
M007	25.3–30.3	25.68	821	3.83	6.72	-92	0.46	2.4	3.05	21
M011	23.7–28.7	24.78	879	1.41	6.64	-96	0.11	--	--	--
M012	8.6–13.6	26.81	828	5.45	6.53	-11.5	0.33	--	--	--
M015	20.8–25.8	26.37	739	1.06	6.86	-110.9	--	--	--	--
M019	22–27	26.24	999	1.84	6.56	-58.4	0.5	--	--	--
M023	19.8–24.8	26.02	710	4.9	6.86	-105	0.13	--	--	--
M024	8.7–13.7	26.63	811	5.41	6.71	-47	0.25	--	--	--
M025	8.6–13.6	24.5	2,417	2.4	6.53	-72.7	1.3	--	--	--
M028	22–27	24.96	896	2.28	6.53	-154	0.34	5	3.56	0[b]
M035	9–14	25.4	2,412	1.6	6.61	-125.8	1.47	--	--	--
M036	25–30	24.4	911	0.8	6.59	-134.8	0.88	--	--	--
M049	20–30	25.13	1,118	8.81	6.66	-67.2	0.22	--	--	--
M053	20–30	25.22	1,224	8.83	6.67	-137	0.23	5.45	6.75	19
M054	20–30	24.65	1,142	31.2	6.66	-100	0.21	--	--	--
M055	21–31	24.8	913	17.9	6.71	-214.1	0.68	--	--	--
M056	19–29	25.41	1,326	18.7	6.7	-126.2	0.83	--	--	--
M057	20–30	24.83	1,085	2.05	6.69	-93.1	0.91	--	--	--
M058	18–28	25.33	1,305	19.4	6.7	-115.3	0.45	--	--	--
M059	19–29	25.08	934	35	6.82	-110	0.15	--	--	--
M060	18–28	26.44	1,005	8.85	6.74	-92	0.28	5.7	8.1	30
M061	20–30	25.69	811	4.49	6.88	-116	0.31	4.4	6.7	34
M062	20–30	23.7	2,417	13.1	6.64	-106.1	0.2	--	--	--
M063	19.5–29.5	24.1	2,517	13.7	6.39	-72.5	4.78	39.4	39.4	0
M064	15–25	25.06	2,615	14.5	6.48	-86	0.21	26.7	30.9	14
M18D	20–30	24.5	1,317	5.58	6.71	-139.3	0.37	4.32	4.72	8
M22D	20–30	24.86	1,385	2.09	6.69	-116	0.15	--	--	--
M38D	20–30	24.68	7.8	1.9	6.82	-98.2	0.98	--	--	--
M40D	18–28	24.5	446	15.2	6.62	-113.3	0.84	--	--	--
M40S	4–14	27.74	263	4.16	6.12	158.5	3	--	--	--
M41D	16–26	24.84	919	2.71	6.59	-86.3	0.93	--	--	--
MWL1	21–26	24.59	2,999	17.3	6.47	-110.7	0.18	--	--	--
MWL2	21–26	24.63	1,774	5.11	6.69	-108.9	0.18	--	--	--
MWL3	21–26	25.1	2,168	1.1	6.46	-155.7	0.99	19	20.6	8
MWL4	20.8–25.8	25.2	992	0.8	6.59	-145.5	0.7	2.6	5.2	50
MWL5	20.8–25.8	25.28	902	1.26	6.68	-90.9	0.31	--	--	--
MWL6	21.5–26.5	25.07	1,007	5.61	6.6	-67.4	0.63	--	--	--

[a]Temperature corrected to 25°C
[b]Ferrous Iron > Total Iron
-- Not measured

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	7/16/2003	<2.5	61	<2.5	61	110	<2.5	171
		10/7/2003	<2.5	73	<2.5	73	110	<2.5	183
		1/14/2004	<0.5	154	1.3	155.3	162	<0.5	317.3
		4/19/2004	<2.5	145	<2.5	145	193	<2.5	338
		7/14/2004	<2.5	146	<2.5	146	195	<2.5	341
0503	13.2–23.2	7/16/2003	<1	<1	<1	ND	<1	<1	ND
		10/7/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<5	<5	<5	ND	<5	<5	ND
		4/20/2004	<0.5	<0.5	<0.5	ND	0.55J	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	0.95J	<0.5	ND
M001	20–25	7/18/2003	<5	210	6.8	216.8	410	1.7J	626.8
		10/8/2003	<5	320	6.6	326.6	490	<5	816.6
		1/14/2004	<25	496	<25	496	748	<25	1,244
		4/19/2004	<5	405	17.4	422.4	814	<5	1,236.4
		7/13/2004	8J	789	47	836	1,420	<5	2,256
M003	9–14	4/21/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M005	25.8–30.7	4/21/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M007	25.3–30.3	4/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M011	23.7–28.7	7/18/2003	<1	<1	<1	ND	<1	<1	ND
		10/9/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/21/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M012	8.6–13.6	7/18/2003	<1	<1	<1	ND	<1	<1	ND
		10/9/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/21/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M015	20.8–25.8	7/18/2003	<1	<1	<1	ND	0.61J	<1	ND
		10/9/2003	<1	<1	<1	ND	0.47J	<1	ND
		1/14/2004	<5	<5	<5	ND	<5	<5	ND
		4/21/2004	<0.5	<0.5	<0.5	ND	2.2	<0.5	2.2
		7/13/2004	<0.5	<0.5	<0.5	ND	1.3	<0.5	1.3
M019	22–27	7/16/2003	<1	<1	<1	ND	1.2	<1	1.2
		10/8/2003	<1	<1	<1	ND	1.6	<1	1.6
		1/14/2004	<0.5	<0.5	<0.5	ND	3.4	<0.5	3.4
		4/21/2004	<0.5	<0.5	<0.5	ND	2.3	<0.5	2.3
		7/15/2004	<0.5	0.74J	<0.5	0.74J	1.9	<0.5	1.9
M023	19.8–24.8	7/16/2003	<1	<1	<1	ND	<1	<1	ND
		10/7/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/15/2004	<0.5	<0.5	<0.5	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**	
M024	8.7–13.7	7/16/2003	<1	<1	<1	ND	<1	<1	ND
		10/7/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M025	8.6–13.6	7/18/2003	<1	<1	<1	ND	<1	<1	ND
		10/7/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M028	22–27	4/19/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M035	9–14	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/10/2003	<1	<1	<1	ND	<1	<1	ND
		1/15/2004	<5	<5	<5	ND	<5	<5	ND
		4/16/2004	<0.5	0.61J	<0.5	0.61J	<0.5	<0.5	ND
		7/20/2004	1.5	<0.5	<0.5	ND	<0.5	<0.5	1.5
M036	25–30	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/10/2003	<1	<1	<1	ND	<1	<1	ND
		1/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M049	20–30	7/17/2003	<1	28	1.4	29.4	3.5	<1	32.9
		10/8/2003	<1	24	<1	24	7.9	<1	31.9
		1/14/2004	<0.5	17.2	1.1	18.3	5.9	<0.5	24.2
		4/21/2004	<0.5	17.5	1.7	19.2	9.1	<0.5	28.3
		7/21/2004	<0.5	9.6	1.1	10.7	6.3	<0.5	17
M053	20–30	7/16/2003	<1	<1	<1	ND	2.6	<1	2.6
		10/8/2003	<1	<1	<1	ND	2.7	<1	2.7
		1/14/2004	<5	<5	<5	ND	<5	<5	ND
		4/20/2004	<0.5	<0.5	<0.5	ND	1.8	<0.5	1.8
		7/14/2004	<0.5	<0.5	<0.5	ND	2.7	<0.5	2.7
M054	20–30	7/16/2003	<1	<1	<1	ND	<1	<1	ND
		10/8/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<2.5	<2.5	<2.5	ND	<2.5	<2.5	ND
		4/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M055	21–31	4/21/2004	<0.5	1.5	<0.5	1.5	9.9	<0.5	11.4
		7/16/2004	<0.5	<0.5	<0.5	ND	2.2	<0.5	2.2
M056	19–29	4/21/2004	<0.5	<0.5	<0.5	ND	9.6	<0.5	9.6
		7/15/2004	<0.5	<0.5	<0.5	ND	5.4	<0.5	5.4
M057	20–30	4/21/2004	<0.5	3.8	<0.5	3.8	3.8	<0.5	7.6
		7/20/2004	<0.5	1.7	<0.5	1.7	4.5	<0.5	6.2
M058	18–28	4/21/2004	<0.5	5.6	0.69J	5.6	3.7	<0.5	9.3
		7/15/2004	<0.5	2	<0.5	2	1.4	<0.5	3.4
M059	19–29	4/21/2004	<0.5	<0.5	<0.5	ND	8.3	<0.5	8.3
		7/14/2004	<0.5	<0.5	<0.5	ND	44.1	<0.5	44.1

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**	
M060	18–28	7/16/2004	7.9	63.5	31.9	95.4	339	<0.5	442.3
M061	20–30	7/15/2004	242	353	49.5	402.5	647	<5	1,291.5
M062	20–30	7/21/2004	<25	1,810	<25	1,810	2,310	<25	4,120
M063	19.5–29.5	7/19/2004	4,880	12,600	612	13,212	3,580	<100	21,672
M064	15–25	7/16/2004	<0.5	10.3	<0.5	10.3	45.2	<0.5	55.5
M18D	20–30	7/16/2003	<1	3.2	<1	3.2	2.7	<1	5.9
		10/8/2003	<1	5.2	<1	5.2	3.8	<1	9
		1/14/2004	<0.5	10.2	<0.5	10.2	4.6	<0.5	14.8
		4/20/2004	<0.5	10.2	<0.5	10.2	5.7	<0.5	15.9
		7/14/2004	<0.5	11.1	<0.5	11.1	5.6	<0.5	16.7
M22D	20–30	7/18/2003	<1	<1	<1	ND	24	<1	24
		10/8/2003	<1	<1	<1	ND	7.3	<1	7.3
		1/14/2004	<0.5	<0.5	<0.5	ND	2.3	<0.5	2.3
		4/20/2004	<0.5	<0.5	<0.5	ND	1.9	<0.5	1.9
		7/14/2004	<0.5	<0.5	<0.5	ND	1.6	<0.5	1.6
M38D	20–30	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/9/2003	<1	<1	<1	ND	<1	<1	ND
		1/15/2004	<5	<5	<5	ND	<5	<5	ND
		4/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M40D	18–28	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/9/2003	<1	<1	<1	ND	<1	<1	ND
		1/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M40S	4–14	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/10/2003	<1	<1	<1	ND	<1	<1	ND
		1/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M41D	16–26	7/18/2003	<1	<1	<1	ND	<1	<1	ND
		10/9/2003	<1	<1	<1	ND	<1	<1	ND
		1/15/2004	<5	<5	<5	ND	<5	<5	ND
		4/16/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
MWL1	21–26	7/17/2003	<1	<1	<1	ND	3.6	6.7	10.3
		10/9/2003	<1	<1	<1	ND	4.1	6.8	10.9
		1/14/2004	<25	<25	<25	ND	<25	<25	ND
		4/21/2004	<0.5	<0.5	<0.5	ND	4	9.2	13.2
		7/21/2004	<0.5	<0.5	<0.5	ND	6.8	3.6	10.4
MWL2	21–26	7/17/2003	<1	2	0.8J	2	41	1.4	44.4
		10/9/2003	<1	9.5	4.2	13.7	82	2.9	98.6
		1/14/2004	<10	14J	<10	14J	120	<10	120
		4/19/2004	0.91J	16.1	14.7	30.8	99.3	1.6	131.7
		7/21/2004	<1	11.8	17.5	29.3	110	<1	139.3

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**	
MWL3	21–26	7/17/2003	<10	<10	<10	ND	640	<10	640
		10/9/2003	<10	<10	<10	ND	680	<10	680
		1/14/2004	<5	<5	<5	ND	<5	<5	ND
		4/19/2004	<0.5	0.54J	<0.5	0.54J	735	<0.5	735
		7/16/2004	<0.5	8.9	<0.5	8.9	2,180	<0.5	2,188.9
MWL4	20.8–25.8	7/17/2003	110	4,000	43J	4,000	870	<50	4,980
		10/9/2003	<50	2,600	13J	2,600	660	<50	3,260
		1/14/2004	<10	993	17.9J	993	347	<10	1,340
		4/19/2004	<10	873	19.8J	873	422	<10	1,295
		7/16/2004	113	2,350	63.3	2,413.3	546	<0.5	3,072.3
MWL5	20.8–25.8	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/8/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<5	<5	<5	ND	<5	<5	ND
		4/21/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/21/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
MWL6	21.5–26.5	7/17/2003	<1	<1	<1	ND	<1	<1	ND
		10/10/2003	<1	<1	<1	ND	<1	<1	ND
		1/14/2004	<5	<5	<5	ND	<5	<5	ND
		4/22/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/20/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
RW01	10–30	4/20/2004	<0.5	1.2	<0.5	1.2	7.4	<0.5	8.6
		7/6/2004	<0.5	2.9	<0.5	2.9	4.7	<0.5	7.6
RW02	8–28	4/20/2004	<0.5	<0.5	<0.5	ND	1.2	<0.5	1.2
		7/6/2004	<0.5	1.1	<0.5	1.1	4.6	<0.5	5.7
RW03	8–28	4/20/2004	<0.5	<0.5	<0.5	ND	4.9	<0.5	4.9
		7/6/2004	<0.5	0.57J	1.3	1.3	7.3	<0.5	8.6

[a]Before December 18, 2003, "<" values are reporting limits. On or after December 18, 2003, "<" values are method detection 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.

Table 4. RPD for Duplicate Samples, 4.5 Acre Site

Sample ID	Duplicate ID	Case Number	Constituent	S[a]	D[b]	RPD Value	5 times DL[c]	Fail[d]
PIN20–M061	PIN20–0550	F25473	cis-1,2-dichloroethene	353	365	3.3	25	
			trans-1,2-dichloroethene	49.5	48.7	1.6	25	
			Trichloroethene	242	244	0.8	25	
			Vinyl chloride	647	614	5.2	25	
PIN20–MWL2	PIN20–0551	F25486	cis-1,2-dichloroethene	11.8	12.6	1.6	2.5	
			trans-1,2-dichloroethene	17.5	16.6	1.3	2.5	
			Vinyl chloride	110	97.1	3.1	2.5	

[a]S = Original sample (N001), VOC concentration in μg/L.
[b]D = Duplicate sample (N002), VOC concentration in μg/L.
[c]DL = Detection limit.
[d]Fail is an RPD greater than "30% and an original or duplicate sample more than 5 times the detection limit.

Table 5. Summary of Analytical Results for the 4.5 Acre Site Treatment System (reported in micrograms per liter unless otherwise noted)[a]

Location[b]	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[c]	Vinyl chloride	Benzene	Total COPC[d]	$CaCO_3$ mg/L	Fe mg/L
PIN20					**4.5 Acre Site**					
TRTI	7/6/2004	<25	<25	<25	ND	<25	<25	ND	849	5.52
TRTI	8/10/2004	<10	<10	<10	ND	<10	<10	ND	874	5.37
TRTI	9/9/2004	<0.5	1.9	<0.5	1.9	2.5	<0.5	4.4	983	6.41
TRTE	7/6/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND	840	5.58
TRTE	8/10/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND	842	5.01
TRTE	9/9/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND	960	8.21

[a]"<" values are method detection limits.
[b]TRTI is the system influent and TRTE is the system effluent.
[c]Total 1,2-DCE is the sum of cis-1,2-DCE and trans-1,2-DCE
[d]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 this value is included in the total 1,2-DCE value. "J" values are not included in the total COPC value.
J = Estimated value, result is between the reporting limit and the method detection limit.
ND = Not detected.

Table 6. Estimated Mass of VOCs Recovered from the 4.5 Acre Site Recovery Wells During July, August, and September 2004

Month	Volume Treated (gallons)	Concentration[a]						
		cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Toluene (µg/L)	TCE (µg/L)	Methylene Chloride (µg/L)	Vinyl Chloride (µg/L)	Total VOCs (µg/L)
July 2004	217,093	12.5	12.5	12.5	12.5	25.0	12.5	87.5
August 2004	308,387	5.0	5.0	5.0	5.0	61.2	5.0	86.2
September 2004	219,629	1.9	0.3	0.3	0.3	0.5	2.5	5.7

Month	Volume Treated (gallons)	Recovery[b]						
		cis-1,2-DCE (lbs)	trans-1,2-DCE (lbs)	Toluene (lbs)	TCE (lbs)	Methylene Chloride (lbs)	Vinyl Chloride (lbs)	Total VOCs (lbs)
July 2004	217,093	0.02	0.02	0.02	0.02	0.05	0.02	0.16
August 2004	308,387	0.01	0.01	0.01	0.01	0.16	0.01	0.22
September 2004	219,629	0.00	0.00	0.00	0.00	0.00	0.00	0.01

[a]These concentrations represent the average of weekly sampling results.
[b]Includes "J" (estimated) values. For any detection of "<", which indicates the laboratory could not detect that analyte, 50 percent of the "<" value was used for the calculation of recovery.