S. S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

S. S. PAPADOPULOS
S. P. LARSON
C. B. ANDREWS

2002

May 7, 2002

United States Environmental Protection Agency (3 copies)
Region VI - Technical Section (6EN-HX)
Compliance Assurance & Enforcement Division
1445 Ross Avenue
Dallas, TX 75202
Attn: Sparton Technology, Inc. Project Coordinator Michael Hebert

Director, Water & Waste Management Division (1 copy)
New Mexico Environment Department
1190 St. Francis Drive, 4th Floor
Santa Fe, NM 87505

Chief, Hazardous & Radioactive Materials Bureau (1 copy)
New Mexico Environment Department
1190 St. Francis Drive, 4th Floor
Santa Fe, NM 87505

Chief, Groundwater Bureau (1 copy)
New Mexico Environment Department
1190 St. Francis Drive, 4th Floor
Santa Fe, NM 87505

Mr. Baird Swanson (1 copy)
New Mexico Environment Department – District 1
4131 Montgomery Boulevard, NE
Albuquerque, NM 87109

Subject: Sparton Technology, Inc. Former Coors Road Plant Remedial Program
2001 Annual Report

Gentlemen:

On behalf of Sparton Technology, Inc. (Sparton), S. S. Papadopulos & Associates, Inc. (SSP&A) is pleased to submit the subject report. The report presents data collected at Sparton's former Coors Road Plant during the operation of the remedial systems in 2001, and evaluations of these data to assess the performance of the systems. This document was prepared by SSP&A in cooperation with Metric Corporation, Inc.

I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of either the person or persons who manage the system and/or the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify, to the best of my knowledge and belief, that this document is consistent with the applicable requirements of the Consent Decree entered among the New Mexico Environment Department, the U.S. Environmental Protection Agency, Sparton Technology, Inc., and others in connection with Civil Action No. CIV 97 0206 LH/JHG, United States District Court for the District of New Mexico. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions concerning the report, please contact me.

Sincerely,

S. S. PAPADOPULOS & ASSOCIATES, INC.

Stavros S. Papadopulos, PhD, PE
Founder & Senior Principal

cc: Secretary, Sparton Technology, Inc., w/ 1 copy
Mr. R. Jan Appel, w/1 copy
Mr. James B. Harris, w/1 copy
Mr. Tony Hurst, w/2 copies
Mr. Gary L. Richardson, w/1 copy

Sparton Technology, Inc.
Former Coors Road Plant
Remedial Program

2001 Annual Report

Prepared For:

Sparton Technology, Inc.
Rio Rancho, New Mexico

Prepared By:

S.S. PAPADOPULOS & ASSOCIATES, INC.
Bethesda, Maryland

In Association with:

Metric Corporation, Albuquerque, New Mexico

May 7, 2002

Executive Summary

Sparton Technology, Inc. agreed to implement remedial measures at its former Coors Road Plant in Albuquerque, New Mexico under the terms of a Consent Decree entered on March 3, 2000. These remedial measures consist of: (a) the installation and operation of an off-site containment system; (b) the installation and operation of a source containment system; and (c) the operation of an on-site, 400 cubic feet per minute soil vapor extraction system, for an aggregate period of one year. The goals of these remedial measures are: (a) to control hydraulically the migration of the off-site plume; (b) to control hydraulically any potential source areas that may be continuing to contribute to groundwater contamination at the on-site area; (c) to reduce contaminant concentrations in vadose-zone soils in the on-site area and thereby reduce the likelihood that these soils remain a source of groundwater contamination; and (d) in the long-term, restore the groundwater to beneficial use.

The installation of the off-site containment system, consisting of a containment well near the leading edge of the plume, an off-site treatment system, an infiltration gallery in the Arroyo de las Calabacillas, and associated conveyance and monitoring components, began in late 1998 and was completed in early May 1999. The off-site containment well began operating on December 31, 1998; except for brief interruptions for maintenance activities or due to power outages, the well has operated continuously since that date. The source containment system, consisting of a containment well immediately downgradient from the site, an on-site treatment system, six on-site infiltration ponds, and associated conveyance and monitoring components, was installed during 2001 and began operating on January 3, 2002. The 400 cubic feet per minute soil vapor extraction system operated for a total of about 372 days between April 10, 2000 and June 15, 2001.

During 2001, considerable progress was made towards achieving the goals of the remedial measures:

- The off-site containment well was operated at a rate sufficient to contain the plume;
- The pumped water was treated and returned to the aquifer through the infiltration gallery. The concentrations of constituents of concern in the treated water met all the requirements of the Groundwater Discharge Permit for the infiltration gallery. Chromium concentrations in the influent to the treatment system decreased to levels that no longer required treatment for chromium; the chromium reduction process was, therefore, discontinued on November 1, 2001;
- All components of the source containment system were installed in 2001 and the system was tested in December 2001;
- The 400 cubic feet per minute soil vapor extraction system operated for 165 days and 11 hours between the beginning of the year and June 15, 2001;

- Groundwater monitoring was conducted as specified in Attachment A to the Consent Decree. Water levels in all accessible wells and/or piezometers, and the Corrales Main Canal were measured quarterly. Samples were collected for water-quality analyses from monitoring wells at the frequency specified in the Consent Order and analyzed for volatile organic compounds and total chromium;

- Samples were obtained from the influent and effluent of the off-site treatment system and the infiltration gallery monitoring wells at the frequency specified in the Groundwater Discharge Permit. All samples were analyzed for volatile organic compounds, total chromium, iron, and manganese;

- Samples were also obtained from the newly installed source containment well and from the infiltration pond monitoring wells to establish conditions prior to the operation of the source containment system. The sample from the containment well was analyzed for volatile organic compounds and total chromium; the samples from the monitoring wells were analyzed for volatile organic compounds, total chromium, iron, and manganese;

- The influent to the 400 cubic feet per minute soil vapor extraction system was sampled several times during the operation of the system and analyzed for volatile organic compounds;

- Two rounds of sampling of the soil gas were conducted in September and October 2001, three months after the shutdown of the soil vapor extraction system, to evaluate the performance of the system as required by the Consent Order;

- The groundwater flow and transport model that was developed in 1999 to simulate the hydrogeologic system underlying the site was recalibrated and used to simulate trichloroethylene concentrations in the aquifer from start-up of the off-site containment well in December 1998 through November 2001 and to predict concentrations in November 2002. Calibration and improvement of the model will continue next year.

The off-site containment well operated at an average rate of about 216 gallons per minute during 2001, and maintained hydraulic control of the contaminant plume throughout the year. A total of about 114 million gallons were pumped from the well. This pumped water represented about 10 percent of the initial volume of contaminated groundwater (pore volume). The total volume of water pumped since the start of the well operation on December 1998 is 344 million gallons and represents 31 percent of the initial pore volume.

Approximately 550 kilograms (1,200 pounds) of contaminants consisting of 520 kilograms (1,140 pounds) of trichloroethylene and 27 kilograms (60 pounds) of 1,1-dichloroethylene were removed from the aquifer during 2001. The total mass that was removed since the beginning of the off-site containment well is 1,410 kilograms (3,100 pounds) consisting of 1,340 kilograms (2,950 pounds) of trichloroethylene and 70 kilograms (150 pounds) of 1,1-dichloroethylene. This represents about 39 percent of the total dissolved contaminant mass (41 percent of the trichloroethylene and 35 percent of the 1,1-dichloroethylene mass) currently estimated to have been present in the aquifer prior to operation of the containment well.

The extent of the trichloroethylene plume, and hence the volume of contaminated groundwater, did not change significantly during 2001. The extent of the 1,1,1-trichloroethane plume, however, was much smaller; the plume was confined to the on-site area, with only two wells, MW-26 and MW-72, at concentrations that exceeded the maximum allowable concentration in groundwater set by the New Mexico Water Quality Control Commission.

Changes in concentrations since the implementation of the current remedial measures indicate that significant decreases in the concentration of trichloroethylene, 1,1-dichloroethylene, and 1,1,1-trichloroethane occurred in the on-site area. There were no discernible patterns in the changes that occurred in off-site wells, concentrations increased in some wells, decreased at others, or remained unchanged (mostly non-detect wells). The increase in the trichloroethylene and 1,1-dichloroethylene concentrations that occurred at the containment well CW-1 soon after the beginning of its operation, the persistence of these concentrations at the levels that have been observed during the last several years, and the past concentrations at well MW-60, however, indicate the presence of a high concentration area upgradient from the containment well. This conclusion was confirmed by the model calibration results.

The duration of the soil vapor extraction system operation and the results of the two rounds of soil gas monitoring that was conducted to evaluate the performance of the system indicated that the system had met the requirements of the Consent Order for termination of the system. The operation of the soil vapor extraction system is, therefore, no longer required.

The remedial systems were operated with only minor difficulties during 2001. The off-site containment system was out of service for a total of 8.6 days during September and October 2001 due to an intermittent problem with the discharge pump motor starter. The starter was replaced in October 2001 to remedy the problem. To address the continuing presence of contaminants in the deep-flow-zone monitoring well MW-71, an investigation was conducted on the well, and the well was plugged during 2001. Based on the results of the investigation a replacement well was proposed about 30 feet south of the original well location. The well location was approved, and installation of the replacement well was scheduled for early 2002.

Table of Contents

Table of Contents

(continued)

Table of Contents

(continued)

List of Figures

List of Figures
(Continued)

List of Figures
(Continued)

List of Tables

List of Appendices

List of Acronyms

3rdFZ	Third depth interval of the Lower Flow Zone
cfm	cubic feet per minute
cm^2/s	centimeter square per second
CMS	Corrective Measure Study
DCE	1,1-Dichloroethylene
DFZ	Deep Flow Zone below 4800 – foot clay
ft	foot or feet
ft^3	cubic feet
ft/d	feet per day
ft MSL	feet above Mean Sea Level
ft/yr	feet per year
ft^2/d	feet squared per day
g/cm^3	grams per cubic centimeter
gpd	gallons per day
gpm	gallons per minute
IM	Interim Measure
kg	Kilogram
lbs	Pounds
LLFZ	Lower Lower Flow Zone
MCL	Maximum Contaminant Level
Metric	Metric Corporation
mg/m^3	milligrams per cubic meter
µg/L	micrograms per liter
MSL	Mean Sea Level
NMED	New Mexico Environmental Department
NMEID	New Mexico Environmental Improvement Division
NMWQCC	New Mexico Water Quality Control Commission
Ppmv	parts per million by volume
RFI	RCRA Facility Investigation
rpm	revolutions per minute
Sparton	Sparton Technology, Inc.
SSP&A	S.S. Papadopulos & Associates, Inc.
SVE	Soil Vapor Extraction
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
UFZ	Upper Flow Zone
ULFZ	Upper Lower Flow Zone
USEPA	United States Environmental Protection Agency
USF	Upper Santa Fe Group
USGS	United States Geological Survey
VOC	Volatile Organic Compound

REPORT

Section 1
Introduction

The former Coors Road Plant of Sparton Technology, Inc. (*Sparton*) is located at 9621 Coors Boulevard NW (the west side of the boulevard), Albuquerque, New Mexico, north of Paseo del Norte and south of the Arroyo de las Calabacillas (see Figure 1.1). Investigations conducted between 1983 and 1987 at and around the plant revealed that past waste management activities had resulted in the contamination of on-site soils and groundwater and that contaminated groundwater had migrated beyond the boundaries of the facility to downgradient, off-site areas.

In 1988, the United States Environmental Protection Agency (*USEPA*) and Sparton negotiated an Administrative Order on Consent, which became effective on October 1, 1988. Under the provisions of this Order, Sparton implemented in December 1988 an Interim Measure (*IM*) that consisted of an on-site, eight-well groundwater recovery and treatment system. The initial average recovery rate of the system was about 1.5 gallons per minute (*gpm*); however, the recovery rate began declining within a few years due to a regional decline in water levels. As a result, the system was shut-down and permanently taken out of service on November 16, 1999.

In 1998 and 1999, during settlement negotiations associated with lawsuits brought by the USEPA, the State of New Mexico, the County of Bernalillo, and the City of Albuquerque, Sparton agreed to implement a number of remedial measures and take certain actions, including: (a) the installation, testing, and continuous operation of an off-site extraction well designed to contain the contaminant plume; (b) the replacement of the on-site groundwater recovery system by a source containment well designed to address the release of contaminants from potential on-site source areas; (c) the operation of a 400 cubic feet per minute (*cfm*) capacity on-site soil vapor extraction (*SVE*) system for a total operating time of one year over a period of eighteen months; (d) the implementation of a groundwater monitoring plan; (e) the assessment of aquifer restoration; and (f) the implementation of a public involvement plan. Work Plans for the implementation of the measures and actions agreed upon by the parties were developed and included in a Consent Decree entered by the parties on March 3, 2000 [Consent Order, 2000; S. S. Papadopulos & Associates, Inc. (*SSP&A*), 2000a, 2000b, 2000c; and P. Chandler, 2000].

The off-site containment well was installed and tested in late 1998. Based on the test results, a pumping rate of about 225 gpm was determined to be adequate for containing the off-site plume (SSP&A, 1998), and the well began operating at approximately this rate on December 31, 1998. An air stripper for treating the pumped water and an infiltration gallery for returning the treated water to the aquifer were constructed in the spring of 1999, and the well was connected to these facilities in late April 1999. In 2000, due to chromium concentrations that exceeded the permit requirements for the discharge of the treated water, a chromium reduction process was added to the treatment system and began operating on December 15, 2000; however, chromium concentrations were lower in 2001 and the process was discontinued on October 31,

2001. The year 2001 constitutes the third full year of operation of the off-site containment system.

Throughout 1999 and 2000, Sparton applied for and obtained approvals for the different permits and work plans required for the installation of the source-containment system. The Construction Work Plan for the system was approved on February 20, 2001, and construction began soon after that date. The installation of the system was completed by the end of 2001, and the system began operating on January 3, 2002.

SVE systems of different capacities were operated at the Sparton facility between April and October 1998, and between May and August 1999. The 400 cfm SVE system was installed in the spring of 2000 and operated for an aggregate of about 372 days between April 10, 2000 and June 15, 2001, meeting the one-year operation requirement of the Consent Decree.

The purpose of this 2001 Annual Report is to:

- provide a brief history of the Sparton plant and affected areas downgradient from the plant,
- summarize remedial and other actions taken by the end of 2001,
- present the data collected during 2001 from operating and monitoring systems, and
- provide the interpretations of these data with respect to meeting remedial objectives.

This report was prepared on behalf of Sparton by SSP&A in cooperation with Metric Corporation (*Metric*). Background information on the site, the implementation of remedial actions, and initial site conditions, as they existed prior to the implementation of the remedial actions agreed upon in the Consent Decree, are discussed in Section 2; a brief summary of operations during 1999 and 2000 is included in this section. Issues related to the year-2001 operation of the off-site containment and the SVE systems, and to the installation of the source containment system are discussed in Section 3. Data collected to evaluate system performance and to satisfy permit or other requirements are presented in Section 4. Section 5 presents the interpretations of the data and discusses the results with respect to the performance and the goals of the remedial systems. A description of the site's groundwater flow and transport model that was developed in 1999 (see 1999 Annual Report, SSP&A, 2001), modifications to the model based on data collected during 2001, and predictions made using this model are presented in Section 6. Section 7 summarizes the report and discusses future plans. References cited in the report are listed in Section 8.

Section 2 Background

2.1 Description of Facility

The site of Sparton's former Coors Road plant is an approximately 12-acre property located in northwest Albuquerque, on Coors Boulevard NW. The property is about one-quarter mile south of the Arroyo de las Calabacillas, about three-quarters of mile north of the intersection of Coors Boulevard and Paseo del Norte, and about one-half mile west of the Rio Grande (see Figure 1.1). The property sits on a terrace about 60 feet (*ft*) above the Rio Grande floodplain. An irrigation canal, the Corrales Main Canal, is within a few hundred feet from the southeast corner of the property. About one-quarter mile west of the property, the land rises approximately 150 ft forming a hilly area with residential properties.

The plant consisted of a 64,000-square-foot manufacturing and office building and of several other small structures that were used for storage or as workshops (see Figure 2.1). Manufacturing of electronic components, including printed-circuit boards, at the plant began in 1961 and continued until 1994. Between 1994 and the end of 1999, Sparton operated a machine shop at the plant in support of manufacturing at the company's Rio Rancho plant and other locations. The property was leased to Melloy Dodge in October 1999. During 2000 and early 2001, the tenant made modifications and renovations to the property to convert it to an automobile dealership and began operating it as a dealership on April 23, 2001.

2.2 Waste Management History

The manufacturing processes at the plant generated two waste streams that were managed as hazardous wastes: a solvent waste stream and an aqueous metal-plating waste stream. Waste solvents were accumulated in an on-site concrete sump (see Figure 2.1) and allowed to evaporate. In October 1980, Sparton discontinued using the sump and closed it by removing remaining wastes and filling it with sand. After that date, Sparton began to accumulate the waste solvents in drums and disposed of them off-site at a permitted facility.

The plating wastes were stored in a surface impoundment (see Figure 2.1), and wastewater that accumulated in the impoundment was periodically removed by a vacuum truck for off-site disposal at a permitted facility. Closure of the former impoundment and sump area occurred in December 1986 under a New Mexico State-approved closure plan. The impoundment was backfilled, and an asphaltic concrete cap was placed over the entire area to divert rainfall and surface-water run on, and thus to minimize infiltration of water into the subsurface through this area.

2.3 Hydrogeologic Setting

The Sparton site lies in the northern part of the Albuquerque Basin. The Albuquerque Basin is one of the largest sedimentary basins of the Rio Grande rift, a chain of linked basins that extend south from central Colorado into northern Mexico. Fill deposits in the basin are as much as 15,000 ft thick. The deposits at the site have been characterized by borings advanced for 82 monitoring and production wells, and by a 1,505-foot-deep boring (the Hunter Park I Boring) advanced by the United States Geological Survey (USGS) about 0.5 mile north of the facility on the north side of the Arroyo de las Calabacillas (Johnson and others, 1996).

The fill deposits in the upper 1,500 ft of the subsurface consist primarily of sand and gravel with minor amounts of silt and clay. The near-surface deposits consist of less than 200 ft of Quaternary alluvium associated with terrace, arroyo fan, and channel and floodplain deposits. These deposits are saturated beneath the facility and to the east of the facility toward the Rio Grande, but are generally unsaturated to the west of the site. Two distinct geologic units have been mapped in the saturated portion of these deposits: Recent Rio Grande deposits, and a silt/clay unit (see Figure 2.2). The Recent Rio Grande deposits occur to the east of the facility adjacent to the Rio Grande. These deposits consist primarily of pebble to cobble gravel and sand, and sand and pebbly sand. These deposits are Holocene-age and are up to 70-feet thick. Beneath the facility, and in an approximately 1,500-foot-wide band trending north from the facility, a silty/clay unit has been mapped between an elevation of about 4,965 ft above mean sea level (*ft MSL*) and 4,975 ft MSL. This unit, which is referred to as the 4970-foot silt/clay unit, represents Late-Pleistocene-age overbank deposits. The areal extent of the unit at and in the vicinity of the Sparton site is shown in Figure 2.3. [Additional information on this unit is presented in Appendix A to both the 1999 and 2000 Annual Reports (SSP&A, 2001a; 2001b).] Holocene-age arroyo fan and terrace deposits, which are primarily sand and gravel, overlie this unit.

The water table over much of the site occurs within the deposits of the Pliocene-age Upper Santa Fe Group (USF). These deposits, to an elevation of 4,800 ft MSL, consist primarily of sand with lenses of sand and gravel and silt and clay. The lithologic descriptions of these deposits are variable, ranging from "sandy clay," to "very fine to medium sand," to "very coarse sand, to small pebble gravel." Most of the borings into this unit were advanced using the mud-rotary drilling technique, and as a result, it has not been possible to map the details of the geologic structure. The sand and gravel unit is primarily classified as USF2 lithofacies assemblages 2 and 3 (Hawley, 1996). Locally, near the water table, in some areas, the sands and gravels are classified as USF4 lithofacies assemblages 1 and 2. Lithofacies 2 represents basin-floor alluvial deposits that are primarily sand with lenses of pebble sand and silty clay. Lithofacies 3 represents basin-floor, overbank, and playa and lake deposits that are primarily interbedded sand and silty clay with lenses of pebbly sand.

At an elevation of approximately 4,800 ft MSL, a 2- to 3-foot thick clay layer is encountered. This clay, which is referred to as the 4800-foot clay unit (see Figure 2.2), likely represents lake deposits. This clay unit was encountered in borings for five wells (MW-67, MW-71, CW-1, OB-1, and OB-2) installed during site investigations and remedial actions. The unit was also encountered in the USGS Hunter Park I Boring which is located about 0.5 mile north of the Sparton Site on the north side of the Arroyo de las Calabacillas. The nature of the depositional environment (i.e. lake deposits), and the fact that that the unit has been encountered in every deep well drilled in the vicinity of the site, as well as at the more distant USGS boring, indicate that the unit is areally extensive. The deposits of the Santa Fe Group immediately below the 4800-foot clay are similar to those above the clay.

A total of 87 wells and were installed at the site to define hydrogeologic conditions and the extent and nature of groundwater contamination and to implement and monitor remedial actions; of these wells, 10 have been plugged and abandoned. The locations of the remaining wells are shown in Figure 2.3.

The off-site containment well, CW-1, and two associated observation wells, OB-1 and OB2, were drilled to the top of the 4800-foot clay unit and were screened across the entire saturated thickness of the aquifer above the clay unit. The monitoring wells have short screened intervals (5 to 30 ft) and, during past investigations, were classified according to their depth and screened interval. Wells screened across, or within 15 ft of, the water table were referred to as Upper Flow Zone (*UFZ*) wells; wells screened 15 to 45 and 45 to 75 ft below the water table were referred to as Upper Lower Flow Zone (*ULFZ*) and Lower Lower Flow Zone (*LLFZ*) wells, respectively. At cluster well locations where an LLFZ well already existed, wells screened at a somewhat deeper interval were referred to as Third Flow Zone (*3rdFZ*) wells. Wells completed below the 4800-foot clay unit were referred to as Deep Flow Zone (*DFZ*) wells.

The completion flow zone, location coordinates, and measuring point elevation of all existing wells are presented on Table 2.1; their screened intervals are summarized in Table 2.2. In Figure 2.4, the screened interval of each monitoring well is projected onto a schematic cross-section through the site to show its position relative to the flow zones defined above. (Monitoring wells screened in the DFZ or across multiple flow zones are not included in this figure.) The screened intervals in three of the monitoring wells shown on Figure 2.4 are inconsistent with the completion flow zones listed on Table 2.1 and which were defined at the time of well construction. These monitoring wells are: MW-32, which is listed in Table 2.1 as a LLFZ well but is shown on Figure 2.4 as a ULFZ well; and MW-49 and MW-70 which are listed on Table 2.1 as 3rdFZ wells but are shown on Figure 2.4 as LLFZ wells. In the evaluations of water-level and water-quality data for the flow zones, MW-32 was treated as a ULFZ well, and MW-49 and MW-70 were treated as LLFZ wells.

Data collected from these wells indicate that the saturated thickness of the aquifer above the 4800-foot clay ranges from about 180 ft at the Site to about 160 ft west of the Site and averages about 170 ft. Groundwater in the aquifer occurs under unconfined conditions; however, in the areas where the 4970-foot silt/clay unit is present, the unit provides confinement to the underlying saturated deposits, and the water table in these areas is considerably higher than the potentiometric surface of the underlying confined portion of the aquifer.

Analyses of data from aquifer tests conducted at the Site (Harding Lawson Associates, 1992; SSP&A, 1998, 1999) indicate that the hydraulic conductivity of the aquifer is in the range of 25 to 30 feet per day (*ft/d*), corresponding to a transmissivity of about 4,000 to 5,000 feet squared per day (*ft^2/d*). A transmissivity of about 4,000 ft^2/d, corresponding to a hydraulic conductivity of about 25 ft/d, is also indicated by the response of water levels to long-term pumping from the containment well CW-1. Analyses of the water levels measured quarterly in observation wells OB-1 and OB-2, and in monitoring wells within 1,000 ft of the off-site containment well, indicate that the response of these wells to the long-term pumping from CW-1 is best explained with a transmissivity of 4,000 ft^2/d; that is, a transmissivity of 4,000 ft^2/d produces the smallest residual between calculated and measured water levels in these wells.

Water-level data indicate that the general direction of groundwater flow is to the northwest with gradients that generally range from 0.0025 to 0.006. The water table in the area underlain by the 4970-foot silt/clay unit, however, has a steeper gradient ranging from 0.010 to 0.016. Vertical flow is downward with a gradient of about 0.002. Groundwater production from the deeper aquifers and a reduction in the extent of irrigated lands in the vicinity of the Site have resulted in a regional decline of water levels. Until a few years ago, this regional decline averaged about 0.65 foot per year (*ft/yr*); however, the rate of decline has slowed down and averaged about 0.3 ft/yr during the last two years (see well hydrographs presented in Figure 2.5).

2.4 Site Investigations and Past Remedial Actions

In 1983, several groundwater monitoring wells were installed around the impoundment and sump area to determine whether there had been a release of constituents of concern from the impoundment or the sump. Analytical results from groundwater samples taken from these wells indicated concentrations of several constituents above New Mexico State standards.

Since this initial finding in 1983, several investigations were conducted to define the nature and extent of the contamination, and to implement remedial measures; these investigations continued through 1999. The results of the investigations indicate that the primary constituents of concern found in on-site soils and in both on-site and off-site groundwater are volatile organic compounds (VOCs), primarily trichloroethene (*TCE*), 1,1,1-trichloroethane (*TCA*) and its abiotic transformation product 1,1-dichloroethene (*DCE*). Of these constituents, TCE has the highest concentrations and is the constituent that has been used to define the extent of groundwater contamination. DCE has been detected at low concentrations relative to TCE in groundwater, but it has the second largest plume extent. Groundwater contamination by TCA is primarily limited to the facility and its immediate vicinity. Various metals have also been detected in both soil and groundwater samples. Historically, chromium has the highest frequency of occurrence at elevated concentrations.

During the period 1983 to 1987, Sparton worked closely with the New Mexico Environmental Improvement Division (*NMEID*), the predecessor to the New Mexico Environment Department (*NMED*). Several investigations were conducted during this period (Harding and Lawson Associates, 1983; 1984; 1985). In 1987, when it became apparent that contaminants had migrated beyond plant boundaries, the USEPA commenced negotiations with Sparton to develop an Administrative Order on Consent. This Order was signed and became effective on October 1, 1988. Under the provisions of this Order, Sparton implemented an IM in December 1988. The IM consisted of groundwater recovery through eight on-site wells (PW-1, MW-18, and MW-23 through MW-28), and treatment of the recovered water in an on-site air stripper (see Figure 2.1). The purpose of this IM was to remove contaminants from areas of high concentration in the UFZ. Due to the regional decline of water levels, the total discharge rate from the IM system dropped to less than 0.25 gpm by November 1999. As a result, the system was shut-down and taken permanently out of service on November 16, 1999. Groundwater production from this system, during its 11-year operation, is summarized on Table 2.3. A total of 4.4 million gallons of water were recovered during the 11-year operation period, as shown on this table.

From 1988 through 1990, horizontal and vertical delineation of the groundwater plume continued under the October 1, 1988 Order on Consent. On July 6, 1990, the first draft of the RCRA Facility Investigation (*RFI*) report was submitted to USEPA; the final RFI was issued on May 20, 1992 (Harding Lawson Associates, 1992) and approved by USEPA on July 1, 1992. A draft Corrective Measures Study (*CMS*) report was submitted to USEPA on November 6, 1992. The report was revised in response to USEPA comments, and a draft Final CMS was issued on May 13, 1996; the draft was approved, subject to some additional revisions, by USEPA on June 24, 1996. The Revised Final CMS was issued on March 14, 1997 (HDR Engineering, Inc., 1997). Nine additional monitoring wells (MW-65 through MW-73) were installed between 1996 and 1999 to delineate further the groundwater plume.

The investigations conducted at the site included several soil-gas surveys to determine the extent of groundwater contamination and to characterize vadose zone soil contamination and its potential impacts on groundwater quality. The results of soil-gas surveys conducted in 1984, 1985, 1987, and 1991 were reported in the RFI and the CMS. Additional soil-gas investigations to characterize vadose zone contamination were conducted between April 1996 and February 1997 (Black & Veatch, 1997). This work included the installation and sampling of a six-probe vertical vapor probe cluster in the source area, five vapor sampling probes at various radial distances from the former sump area, and vapor sampling of nine on-site and four off-site UFZ monitoring wells that are screened across the water table. The locations of the vapor probes (VP-1-6 and VR-1 through VR-5) and of the sampled on-site monitoring wells are shown in Figure 2.6; the locations of the sampled off-site monitoring wells (MW-37, MW-48, MW-57, and MW-61) are shown on Figure 2.3. The area where TCE concentrations in soil-gas exceeded 10 parts per million by volume (*ppmv*) was determined from the results of this investigation (see Figure 2.7).

Following this investigation, a SVE pilot test was conducted on February 27 and 28, 1997 (Black & Veatch, 1997). The test was conducted on vapor recovery well VR-1 using an AcuVac System operating at a flow of 65 cfm at a vacuum of 5 inches of water.

Based on the results of this pilot test, an AcuVac System was installed at the site in the spring of 1998 and operated at a flow rate of 50 cfm on vapor recovery well VR-1 from April 8, 1998 to October 20, 1998 (195 days). Influent and effluent concentrations measured during the operation of the system are shown in Figure 2.8. As shown in this figure, influent TCE concentrations dropped from about 18,000 milligrams per cubic meter (mg/m^3), or about 4,000 ppmv, during the first day of operation, to about 150 mg/m^3 (34 ppmv) in about 120 days. Trend lines determined by analysis of the data (see Figure 2.8) indicate that influent TCE concentration was probably as low as 75 mg/m^3 (17 ppmv) prior to the shut-down of the system after 195 days of operation. The mass of TCE removed during this operation of the SVE system was calculated to be about 145 kilograms (kg) or 320 pounds (lbs).

2.5 Implementation of Current Remedial Actions

Based on settlement negotiations that led to the March 3, 2000 Consent Decree, Sparton agreed to implement the following remedial measures: (a) installation and operation of an off-site containment system designed to contain the contaminant plume; (b) replacement of the on-site groundwater recovery system by a source containment system designed to address the release of contaminants from potential on-site source areas; and (c) operation of a robust SVE system for a total operating time of one year over a period of eighteen months.

Implementation of the off-site containment system, as originally planned, was completed in 1999. A chromium reduction process was added to the treatment component of the system in 2000. Chromium treatment ceased in 2001 because the chromium concentration in the influent dropped below the New Mexico groundwater standard. The system currently consists of:

- A containment well (CW-1) installed near the leading edge of the TCE plume;
- An off-site treatment system for the water pumped by CW-1, consisting of an air stripper housed in a building;
- An infiltration gallery installed in the Arroyo de las Calabacillas for returning treated water to the aquifer;
- A pipeline for transporting the treated water from the treatment building to the gallery;
- A piezometer, with an horizontal screen placed near the bottom of the gallery, for monitoring the water level in the gallery; and
- Three monitoring wells (MW-74, MW-75, and MW-76) for monitoring potential water-quality impacts of the gallery.

The location of these components of the off-site containment system are shown in Figure 2.9.

The containment well was installed in August 1998, and aquifer tests were conducted on the well and evaluated in December (SSP&A, 1998). The well began operating at a design rate of 225 gpm on December 31, 1998. During the testing of the well and during its continuous operation between December 31, 1998 and April 14, 1999, the groundwater pumped from the well was discharged into a sanitary sewer without treatment. Installation of the air stripper, the infiltration gallery, and other components of the system (except the chromium reduction process) was completed in early April, 1999. The containment well was shut-down on April 14, 1999 to install a permanent pump and to connect the well to the air stripper. Between April 14 and May 6, 1999, the well operated intermittently to test the air stripper and other system components. The tests were completed on May 6, 1999, and the well was placed into continuous operation. Due to increases in chromium concentrations in the influent to, and hence in the effluent from, the air stripper, a chromium reduction process was added to the treatment system on December 15, 2000. Chromium concentrations, however, declined during 2001 and the chromium reduction process was removed on November 1, 2001. The off-site containment system is now operating with all other system components functioning.

All permits and approvals required for the implementation of the source containment system were obtained between May 1999 and February 2001. The installation of the system began soon after the approval of the Construction Work Plan for the system in February 2001, and completed in December 2001. The system was tested in December 2001 and placed into operation on January 3, 2002. The system consists of:

- A source containment well (CW-2) installed immediately downgradient of the Site;
- An on-site treatment system for the water pumped by CW-2, consisting of an air stripper housed in a building;
- Six on-site infiltration ponds for returning the treated water to the aquifer;
- Pipelines for transporting the pumped water to the air stripper and the treated water to the ponds; and
- Three monitoring wells (MW-17, MW-77, and MW-78) for monitoring the potential water-quality impacts of the ponds.

The layout of the system is shown in Figure 2.10. Early data from this system indicate that chromium concentrations in the influent to, and hence in the effluent from, the air stripper meets the New Mexico water-quality standard for groundwater. Provisions have been made, however, to add a chromium reduction process to the system if it becomes necessary.

An AcuVac SVE system was installed on vapor recovery well VR-1 (see Figure 2.6) in the spring of 1998 and operated between April 8 and October 20, 1998. Additional SVE operations at this location with the AcuVac system at 50 cfm and with a 200-cfm Roots blower occurred in 1999 between May 12 and June 23 and between June 28 and August 25, respectively. An additional 200-cfm Roots blower was installed in 2000, and the SVE system was operated at 400 cfm between April 10, 2000 and June 15, 2001. The total operating time during this period, 371 days and 13 hours, met the requirements of the Consent Decree on the operation of the 400-cfm SVE system.

2.6 Initial Site Conditions

Initial site conditions as referred to in this report represent hydrogeologic and soil-gas conditions as they existed prior to the implementation of the current remedial measures (the installation and operation of the off-site containment well, the 1999-2001 operation of SVE systems, and the installation of the source containment system).

2.6.1 Hydrogeologic Conditions

2.6.1.1 Groundwater Levels

The elevation of water levels in monitoring wells, based on measurements made in November 1998, is presented on Table 2.4. These data were used to prepare maps showing the configuration of the water levels at the site prior to the implementation of the current remedial measures.

Water-level data from well pairs screened in the UFZ and the ULFZ indicate that UFZ wells screened above or within the 4970-foot silt/clay unit (most of the UFZ wells on the Sparton site) have a water level that is considerably higher than that in the adjacent ULFZ wells that are screened below this unit. These water-level differences range from less than one foot near the western and southwestern limit of the unit to more than 10 feet north and northeast of the Sparton site. Outside the area underlain by the 4970-foot silt/clay unit, however, the water-level difference between UFZ and ULFZ well pairs is 0.2 foot or less. A schematic cross-section illustrating this relationship between UFZ and ULFZ water levels is shown in Figure 2.11.

In past interpretations of water-level data, including those presented in the 1999 and 2000 Annual Reports (SSP&A, 2001a; 2001b), separate water-level maps for the UFZ, ULFZ and the LLFZ were developed using data from wells screened within these flow zones. Based on the above observations, however, in this and in future Annual Reports, water level conditions at the site and its vicinity will be depicted by presenting the following three maps: (1) a map of the water table at the Sparton site and at the area north of the site based on data from UFZ wells screened above or within the 4970-foot silt/clay unit, hereafter referred to as the "on-site water table"; (2) a map of the combined UFZ/ULFZ water levels based on data from UFZ and ULFZ wells outside the area underlain by the 4970-foot silt/clay unit (using the average water level at UFZ/ULFZ well pair locations) and ULFZ wells screened below this unit; and (3) a map of the LLFZ water levels based on wells screened within this flow zone.

The elevation of the on-site water table in November 1998 is shown in Figure 2.12. The corresponding water-level elevations in the UFZ/ULFZ and LLFZ are shown in Figures 2.13 and 2.14, respectively. These water-level maps indicate that in the off-site areas downgradient from the site, the direction of groundwater flow is generally to the northwest with a gradient of approximately 0.0025. On-site, the direction of flow is also northwesterly in the UFZ/ULFZ and the LLFZ; however, the gradients are steeper, approximately 0.005 in the UFZ/ULFZ and 0.006 in the LLFZ. The on-site water table is affected by the on-site groundwater recovery system, which was operating during the November 1998 water-level measurements, and the presence of the 4970-foot silt/clay unit; the direction of flow changes from westerly north of the site to southwesterly on the site, with gradients that range from 0.01 to 0.016.

2.6.1.2 Groundwater Quality

The concentrations of TCE, DCE, and TCA in groundwater samples obtained from monitoring wells during the Fourth Quarter 1998 sampling event are summarized on Table 2.5. Also included on this table are data obtained on September 1, 1998 from the off-site containment well, CW-1, and the nearby observation wells, OB-1 and OB-2, and from temporary wells, TW-1 and TW-2, drilled in early 1998 at the current location of MW-73 and sampled on February 18 and 19, 1998, respectively. For each of the compounds reported on Table 2.5, concentrations that exceed the more stringent of its Maximum Contaminant Level (*MCL)* for drinking water or its maximum allowable concentration in groundwater set by the New Mexico Water Quality Control Commission (*NMWQCC*) are highlighted.

These concentration data were used to prepare maps showing the horizontal extent of the TCE, DCE and TCA plumes as they existed in November 1998, prior to the beginning of pumping from the off-site containment well. The procedures presented in the Work Plan for the Off-Site Containment System were used in preparing these maps (SSP&A, 2000a). The horizontal extent of the TCE plume (in November 1998) is shown in Figure 2.15 and the extent of the DCE and TCA plumes is shown in Figures 2.16 and 2.17, respectively. The extent of these plumes forms a basis for evaluating the effectiveness of the remedial actions that have been implemented at the site.

2.6.1.3 Pore Volume of Plume

TCE is the predominant contaminant at the Sparton site and has the largest plume. Calculation of the initial volume of water contaminated above MCLs, referred to as the pore volume of the plume, was therefore based on the horizontal and vertical extent of the TCE plume.

In preparing the plume maps presented in the previous section (Figures 2.15 through 2.17), the completion zone of monitoring wells was not considered; that is, data from an UFZ well at one location was combined with data from an ULFZ or LLFZ well at another location. At well cluster locations, the well with the highest concentration was used, regardless of its completion zone. As such, the horizontal extent of the TCE plume shown in Figure 2.15 represents the envelop of the extent of contamination at different depths, rather than the extent of the plume at a specific depth within the aquifer.

To estimate the initial pore volume of the plume, the horizontal extent of the TCE plume was separately determined for the UFZ, the ULFZ and LLFZ by preparing plume maps based on data from monitoring wells completed within each of these zones. The concentrations measured in the fully penetrating containment well CW-1 and observation wells OB-1 and OB2 were assumed to represent average concentrations present in the entire aquifer above the 4800-foot clay, and these data were used in preparing all three maps. An estimate of the horizontal extent of TCE contamination at the top of the 4800-foot clay was also made using the data from the containment well and the two observation wells, and data from two temporary wells that obtained samples from about 30-35 feet above the top of the clay during the construction of DFZ wells MW-67 (July 1996) and MW-71 (June 1998). [The estimated TCE plume maps for each of these four zones were presented in Appendix B to both the 1999 and the 2000 Annual Reports (SSP&A, 2001a; 2001b).]

The extent of the plume in the UFZ was assumed to represent conditions at the water table; based on the elevation of the screened intervals in ULFZ and LLFZ wells (see Figure 2.4), the extent of the plume in the ULFZ was assumed to represent conditions at an elevation of 4,940 ft MSL, and that of the LLFZ conditions at an elevation of 4,900 ft MSL. The extent of the plume at the top of the clay was assumed to represent conditions at an elevation of 4,800 ft MSL. The area of the TCE plumes at each of these four horizons was calculated. Using these areas, the thickness of the interval between horizons, and a porosity of 0.3, the pore volume was estimated to be approximately 150 million cubic feet (ft^3), or 1.13 billion gallons, or 3,450 acre-ft.[1]

2.6.1.4 Dissolved Contaminant Mass

The calibration of the numerical transport model that was developed for the site and its vicinity (see Section 6.2.3) was used to provide an estimate of the initial contaminant mass. During the calibration process of this model, the initial TCE concentration distribution within each model layer is adjusted, in a manner consistent with the initial concentrations observed in monitoring wells, until computed concentrations of TCE in the pumped water closely match the observed concentrations. Based on the calibration of the model against 1999 through 2001 water-quality data, the initial dissolved TCE mass is currently estimated to be (see Table 6.2) about 3,300 kg (7,280 lbs). Using this estimate, and the ratios of TCE mass to DCE and TCA mass in plume-map based estimates that were discussed in both the 1999 and 2000 Annual Reports (SSP&A, 2001a; 2001b), the initial masses of dissolved DCE and TCA are estimated to be approximately 200 kg (440 lbs) and 100 kg (220 lbs), respectively. Thus, the total mass of dissolved contaminants is estimated to be about 3,600 kg (7,940 lbs).

2.6.2 Soil Gas Conditions

A supplemental vadose zone characterization was conducted between March 15 and May 5, 1999, which included installation and sampling of eight additional vapor probes, VP-7 through VP-14 (see Figure 2.6) and resampling of 15 vapor monitoring points that had exhibited soil-gas concentrations greater than 10 ppmv during the initial characterization. The results of the supplemental investigation are presented in Figure 2.18, with the approximate 10 ppmv TCE plume limit delineated. The extent of the TCE plume presented in this figure represents the initial conditions prior to the resumption of soil vapor extraction remedial actions in 1999.

---

[1] The features of the commercially available mapping program Surfer 7.0 (copyright © 1999, Golden Software, Inc.) were used in generating the plume maps and in calculating plume areas and pore volumes.

2.7 Summary of the 1999 and 2000 Operations

During 1999 and 2000, significant progress was made in implementing and operating the remedial measures Sparton agreed to implement under the terms of the Consent Decree entered on March 3, 2000. These remedial measures resulted in the containment of the plume at the site, the removal of a significant amount of mass from the plume of groundwater contamination, and a significant reduction in soil-gas concentrations in the on-site source areas.

The remedial measures undertaken in 1999 and 2000 included the following:

- Between December 31, 1998 and April 14, 1999, and from May 6, 1999 through December 31, 2000, the off-site containment well was operated at a rate sufficient to contain the plume. An air stripper for treating the pumped water and an infiltration gallery for returning the treated water to the aquifer were constructed in the spring of 1999. These systems were connected to the containment well and tested between April 14 and May 6, 1999. A chromium reduction process was added to the off-site treatment system on December 15, 2000 to control chromium concentrations in the air stripper effluent and thus meet discharge permit requirements for the infiltration gallery.

- A 50-cfm AcuVac SVE system was operated at vapor recovery well VR-1 from May 12 through June 23, 1999, and a 200-cfm Root blower system was operated at this well from June 28 to August 25, 1999. A second 200-cfm Root blower was added to the system in the Spring of 2000, and the 400-cfm SVE system operated for 206 days between April 10, 2000 and the end of the year.

- By the end of 2000, all permits and licenses required for the implementation of the source containment system had been obtained and preparation of the Construction Work Plan for the system had began; the system was expected to be in operation in early 2002.

- Groundwater monitoring was conducted as specified in Attachment A to the Consent Decree. Water levels in accessible monitoring wells, the containment well, observation wells, piezometers, and the Corrales Main Canal were measured quarterly. Samples were collected for water-quality analyses from monitoring wells and from the influent and effluent of the air stripper at the frequency specified in the Consent Order. Water samples were analyzed for TCE, DCE, TCA and total chromium (during 1999 samples were occasionally also analyzed for hexavalent chromium).

- A groundwater flow and transport model of the hydrogeologic system underlying the site was developed. The model was calibrated against available data and used to simulate TCE concentrations in the aquifer from the start-up of the containment well in December 1998 through November 2000 and to predict TCE concentrations in November 2001. Plans were made to continue the calibration and improvement of the model during 2001.

A total of 229 million gallons of water, corresponding to an average rate of 218 gpm, were pumped from the off-site containment well during 1999 and 2000. The pumped water represented 20 percent of the initial volume of contaminated groundwater (pore volume) estimated to be present in the aquifer prior to the operation of the well. Evaluation of quarterly water-level data indicated that containment of the contaminant plume was maintained throughout both years.

Approximately 860 kg (1,900 lbs) of contaminants consisting of 820 kg (1,810 lbs) of TCE and 40 kg (90 lbs) of DCE were removed from the aquifer during these two years. This represents about 24 percent of the dissolved contaminant mass (25 percent of the TCE and 20 percent of the DCE mass) currently estimated to have been present in the aquifer prior to operation of the containment well.

The operation of the soil vapor extraction systems at vapor recovery well VR-1 in 1999 and 2000 had a measurable impact on soil-gas concentrations at the site. The 1999 SVE operations had reduced TCE concentrations in soil gas below 10 ppmv at all but one (MW-18) of the monitored locations; however, the soil-gas TCE at this location was attributed to volatilization from the shallow groundwater which had a TCE concentration of 980 µg/L in November 1999. Soil-gas was not monitored during the 2000 operation of the 400-cfm system, but influent concentrations to the system decreased from about 20 mg/m^3 (4.5 ppmv) at the beginning of the operation in April 2000 to less than 1 mg/m^3 (0.22 ppmv) near the end of the year.

The remedial systems were operated with only minor difficulties during 1999 and 2000. In 1999, the metering pump adding anti-scaling chemicals to the influent to the off-site air-stripper was not operating correctly. This problem was solved in December 1999 by replacing the pump. Also, chromium concentrations in the influent to, and hence in the effluent from, the air stripper increased from 20 µg/L at system start-up to 50 µg/L by May 1999, and fluctuated near this level, which is the discharge permit limit for the infiltration gallery, throughout the remainder of 1999 and during 2000. To solve this problem, a chromium reduction process was added to the treatment system on December 15, 2000. Another problem was the continuing presence of contaminants in the DFZ monitoring well MW-71. Sparton agreed to test, plug, and replace this well. Other minor problems included the shutdown of the off-site system due to failures of the monitoring or paging systems. Appropriate measures were taken to address these problems.

Section 3
System Operations - 2001

3.1 Off-Site Containment System

Except for some minor interruptions, the off-site containment well CW-1 operated continuously during 2001. Several power outages and maintenance activities caused short-duration shutdowns of the system. These shutdown periods are discussed in Section 3.5. The net operating period for the system during 2001 constituted 97.3 percent of the available time.

To remedy the increased chromium concentrations that were observed in the pumped water during 1999 and 2000, a chromium reduction process was added to the treatment system on December 15, 2000. This process diverted part of the influent for chromium treatment, and then returned the chromium-treated water to the remaining influent prior to air stripping. During 2001, the chromium concentrations in the pumped water decreased well below the New Mexico groundwater standard. As a result, chromium treatment was discontinued on November 1, 2001.

3.2 Source Containment System

A Construction Work Plan for the installation of the source containment system was completed in January 2001 and submitted to the USEPA and NMED on January 31, 2001. Approval of this Work Plan was obtained on February 20, 2001. Installation of the system began soon after approval and completed in December 2001. The system was operated intermittently during December 2001, to test the equipment and the infiltration ponds, and placed into continuous operation at 13:37 on January 3, 2002. A month-by-month summary of activities related to the installation of the system is presented below:

January 2001	Discussions were held with the contractor regarding the submittal of a proposal for the earthwork on the ponds/ramps. The Source Containment Work Plan was submitted to USEPA/NMED on the 31st for review and approval.
February 2001	The Construction Work Plan approval was received on the 20th. Contracts were issued for pond construction earthwork and the air stripper building. The contractor applied for a building permit on the 22nd, and work started on earthmoving.
March 2001	The ponds were 90% completed. The earth pad for the building and the ramp to the well site were complete.
April 2001	Received Building Permit and started work on air stripper building on the 23rd. Pond piping and the ponds were completed except for final grading and reseeding. Finalized the Public Service of New Mexico power line extension agreement. Ran the power conduit half way to the building.

May 2001	Ordered air stripper on the 14th. Completed power conduit to the pump house building and walls for pump house building. The earthwork for ponds, pump house, and ramp, and the pipeline from the containment well site to the stripper building were completed. Ponds were reseeded and pond monitoring wells MW-77 and MW-78 were 90% completed.
June 2001	Pond monitoring wells MW-77 and MW-78 were fully completed and pre-sampled. Pump house building roof was completed. The control system logic was sent to Sparton-Albuquerque for design.
July 2001	Installation of containment well CW-2 was completed between the 19th and the 27th. The air stripper and chemical feed pump were received. Prepared a punch list with the contractor for the pump house building.
August 2001	Fifty percent of the pump house interior wiring was completed. The interior plumbing started on the 7th.
September 2001	Punch list items were completed for the pump house building. Ninety percent of the pump house interior wiring was completed. The interior plumbing was substantially (90%) completed. The CW-2 wellhead and installation of the air stripper was completed. The monitoring control system design was completed by Sparton-Albuquerque.
October 2001	Ninety eight percent of interior plumbing was completed. The installation of the chemical feed pump was nearly complete. The permanent pump was set in CW-2 and the well was purged (8,000 gallons) and sampled to analyze for VOCs and chromium.
November 2001	Interior wiring for the pump house was 99% complete. The flow switch awaits completion. Interior plumbing 99% complete. Installation of the chemical feed pump was completed.
December 2001	The flow switch was installed in the inlet pipeline to the stripper. Initial system and individual pond testing was performed, but not to the extent of confirming infiltration rates. The pump house interior wiring was completed. The interior plumbing was completed. The system was operated intermittently to test the equipment and the ponds.
January 2002	The system was placed into operation on the 3rd, at 1:37 pm. Installation of the monitoring control system was completed on the 4th.

3.3 Soil Vapor Extraction System

The 400-cfm SVE system at vapor recovery well VR-1, consisting of two 200-cfm Roots blowers, operated continuously between the beginning of the year and the shut down of the system on June 15, 2001. Thus, the total operating time of the system during 2001 was 165 days and 11 hours. Monitoring of the blower influent on February 14, April 16, and before shut down on June 15 indicated that, throughout the period of operation in 2001, constituent concentrations in the blower influent, and hence in the effluent, remained within city/county emission requirements for direct discharge to the atmosphere.

3.4 Monitoring Well System

The wellhead of a number of monitoring wells had to be modified during 2001 to accommodate the use of the Sparton property as an automobile dealership, or due to the regrading of the land in the off-site area for the development of a residential subdivision, or to repair damage to the well.

Two UFZ monitoring wells, MW-14 and MW-37, which were dry during the last several years due to declining water levels, were replaced in November 2001 with wells MW-14R and MW-37R. These replacement wells have 30-foot screens that extend 20 feet below the current water table and thus they are open both to the UFZ and the ULFZ.

Vapor probes VR-3, VP-7, VP-12, and VP-13 were plugged in February 2001 to allow for the construction of the infiltration ponds for the source containment system.

In July 2001, a purge test was conducted on DFZ monitoring well MW-71 to assess the source of contaminants that have been detected in this well since its installation in July 1998 and its subsequent recompletion in October 1998. A deviation survey was also conducted on this well on September 13, 2001 to determine the feasibility of installing a replacement well at the same location by overdrilling it after plugging. The well was plugged on September 17, 2001. Based on the results of the deviation survey, Sparton obtained approval from USEPA and NMED to replace this well at a location about 30 feet south of the original well. The results of the purge test and of the deviation survey, and details on the plugging of the well were presented in a report entitled "Results of Investigation Conducted in Monitoring Well MW-71" (SSP&A and Metric, 2002).

These modifications to the monitoring well system are summarized on Table 3.1.

3.5 Problems and Responses

The off-site containment system was out of service for a total of 8.6 days during September and October 2001 due to an intermittent problem with the discharge pump motor starter. The starter was replaced in October 2001 to remedy the problem.

The remaining shut downs of the off-site containment system were for periods of less than 24 hours due to routine maintenance or power failures.

Section 4
Monitoring Results - 2001

Data collected in 2001 to evaluate the performance of the operating remedial systems and to meet the requirements of the Consent Decree and of the permits for the site are presented in this section.

4.1 Off-Site Containment System

The following data were collected to evaluate the performance of the off-site containment system:

- Water levels;
- Containment well flow rate; and
- Water quality.

4.1.1 Water Levels

The depth to water was measured quarterly during 2001 in all accessible monitoring wells, the off-site containment well, the two observation wells, the piezometer installed in the infiltration gallery, and the Corrales Main Canal near the southeast corner of the Sparton property. The quarterly elevations of the water levels, calculated from these data, are summarized on Table 4.1.

4.1.2 Containment Well Flow Rate

The flow rate of the off-site containment well during 2001 was monitored with a totalizer meter that also measured the instantaneous flow rate of the well. The meter was read at irregular frequencies. The intervals between meter readings ranged from one day to seven days, and averaged about 2.5 days. The totalizer and instantaneous discharge rate data collected from these flow meter readings are presented in Appendix A. Also included in this appendix are the average discharge rate between readings and the total volume pumped between the start of continuous pumping on December 31, 1998 and the time of the measurement, calculated from the totalizer meter readings.

The average monthly discharge rate and the total volume of water pumped during each month of 2001, as calculated from the totalizer data, are summarized on Table 4.2. As indicated on this table, approximately 114 million gallons of water, corresponding to an average rate of 216 gpm, were pumped in 2001.

4.1.3 Water Quality

During 2001, samples were collected for water-quality analyses from monitoring wells, from the discharge of the off-site containment well (influent[2]), and from the effluent from the air stripper.

4.1.3.1 Monitoring Wells

Monitoring wells within and in the vicinity of the plume were sampled at the frequency specified in the Groundwater Monitoring Program Plan (Attachment A to Consent Order). The samples were analyzed for VOCs (primarily for determination of TCE, DCE, and TCA concentrations), and for total chromium (unfiltered, and occasionally filtered, samples). The results of the analysis of the samples collected from these monitoring wells during all sampling events conducted in 2001, and for all of the analyzed constituents, are presented in Appendix B-1. Data on TCE, DCE and TCA concentrations, in samples collected during the Fourth Quarter of 2001 (November 2001), are summarized on Table 4.3. Samples were also obtained quarterly from the infiltration gallery monitoring wells (MW-74, MW-75, and MW-76) and analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese, as specified in the Groundwater Discharge Permit for the infiltration gallery. The results of the analysis of these samples are presented in Appendix B-2. For each of the compounds reported on Table 4.3 and in Appendix B, concentrations that exceed the more stringent of its MCL for drinking water or its maximum allowable concentration in groundwater set by NMWQCC are highlighted.

4.1.3.2 Influent and Effluent

During 2001, the influent to and effluent from the treatment plant was sampled monthly. These monthly samples were analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese. The results of these influent and effluent sample analyses are presented in Appendix C. Concentrations of TCE, DCE, TCA, and total chromium in samples collected during 2001 are summarized on Table 4.4. For each of the compounds shown on Table 4.4, concentrations that exceed the more stringent of its MCL for drinking water or its maximum allowable concentrations in groundwater set by NMWQCC are highlighted. Data on TCE, DCE, and TCA concentrations for the November sample of influent are also included in Table 4.3, as the Fourth Quarter concentrations in CW-1, and were used in the preparation of the plume maps discussed in the next section.

In addition to the monthly effluent samples reported above, the weekly sampling of the effluent, which was initiated in December 1999 to monitor chromium concentrations, continued through the end of November 2001. The total chromium concentrations in these weekly effluent samples are presented on Table 4.5. Chromium treatment of the effluent ceased on November 1, 2001 and weekly sampling of the effluent was discontinued after November 27, 2001.

---

[2] The "discharge from the containment well" is the "influent" to the treatment system; therefore, the two terms are used interchangeably in this report.

4.2 Source Containment System

Except for intermittent operations in December 2001 to test the equipment and the infiltration ponds, the source containment system was not operated during 2001. Samples were obtained, however, from the infiltration pond monitoring wells (MW-17, MW-77, and MW-78) and from the source containment well (CW-2) to establish conditions prior to the operation of the system. The infiltration pond wells were sampled on July 31, August 15, and November 19, 2001, and the samples were analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese. The results of the analysis of these samples are included in Appendix B-2. A sample was obtained from the source containment well on October 25, 2001, after purging 8,000 gallons of water. The sample was analyzed for VOCs (primarily TCE, DCE, and TCA), and total chromium. The results of the analysis of this sample are included in Appendix B-3.

4.3 Soil Vapor Extraction System

Data collected during 2001 from the operation of the 400-cfm SVE system, and the results of the performance monitoring conducted after the termination of the system on June 15, 2001 are presented in the following sections.

4.3.1 System Operation

Flow rate, operating pressure, and influent concentration data collected during the 2001 operation of the 400-cfm SVE system are presented below.

4.3.1.1 Flow Rates

During 2001, the SVE system consisting of two 200-cfm Roots blowers was operated at vapor recovery well VR-1 at a total flow rate of 400 cfm for 165 days and 11 hoursbetween the beginning of the year and the termination of the system on June 15, 2001. The operating logs for the two blowers of the system are presented in Appendix D. The 200-cfm blowers are positive displacement blowers for a given size. The flow rate is proportional to the blower speed (rate of rotation). To maintain a flow rate of 200 cfm each, a blower speed of 2274 revolutions per minute (rpm) is required. The motor supplied with the blower turns at 1750 rpm; a belt drive between the motor and the blower increases the blower speed to 2274 rpm, and thus maintains a flow rate of 200 cfm.

4.3.1.2 Operating Pressures

The vacuum during the operation of the Roots Blower Number 1 ranged from 4.0 to 5.5 inches of mercury (see Appendix D), corresponding to 54.4 to 74.8 inches of water, and averaged 4.7 inches of mercury, or 64.3 inches of water. The vacuum for Roots Blower Number 2 ranged from 2.0 to 4.0 inches of mercury (27.2 to 54.4 inches of water) and averaged 2.6 inches of mercury (35.8 inches of water).

4.3.1.3 Influent Concentration

During the 2001 operation of the 400-cfm SVE system the influent to the blowers was sampled 3 times, on February 14, 2001, on April 16, 2001, and prior to shutting down the system on June 15, 2001. The results of the analysis of all the influent samples collected between the April 10, 2000 start up of the system and its June 15, 2001 shut down are presented on Table 4.6.

4.3.2 Performance Monitoring

As required under the terms of the Consent Decree (Attachment E, Vadose Zone Investigation and Implementation Workplan), two consecutive monthly sampling events of soil gas were conducted in September and October 2001 (three months after the termination of the SVE system) to evaluate the performance of the system. Samples were obtained from soil gas probes and a number of on-site, shallow monitoring wells. The results of these sampling events were presented in the Final Report on the On-Site Soil Vapor Extraction System (Chandler, Metric, and SSP&A, 2001), and are duplicated on Table 4.7.

Section 5
Evaluation of Operations - 2001

The goal of the off-site containment system is to control hydraulically the migration of the plume in the off-site area and, in the long-term, restore the groundwater to beneficial use. The goal of the source containment system is to control hydraulically, within a short distance from the site, any potential source areas that may be continuing to contribute to groundwater contamination at the on-site area. The goal of the SVE system was to reduce contaminant concentrations in vadose-zone soils in the on-site area and thereby reduce the likelihood that these soils remain a source of groundwater contamination. The source containment system was installed during 2001 and began to operate on January 3, 2002; evaluation of its performance will be presented in next year's Annual Report. This section presents the results of evaluations based on data collected during 2001 of the performance of the off-site containment and of the SVE systems with respect to their above stated goals.

5.1 Off-Site Containment System

5.1.1 Hydraulic Containment

The quarterly water-level elevation data presented in Table 4.1 were used to evaluate the performance of the off-site containment well with respect to providing hydraulic containment for the plume. Maps of the elevation of the on-site water table and of the water levels in the UFZ/ULFZ and the LLFZ during each of the four rounds of water-level measurements during 2001 are shown in Figures 5.1 through 5.12. Also shown in these figures are: (1) the limit of the capture zone of the off-site containment well in the UFZ/ULFZ or the LLFZ, as determined from the configuration of the water levels; and (2) the extent of the TCE plume based on previous year's (November 2000) water-quality data from monitoring wells. (The November 2000 extent of the plume is used as representative of the area that must be contained during 2001.) In all these figures, the limits of the capture zone during 2001 were beyond the extent of the plume. Hydraulic containment of the plume was, therefore, maintained throughout the year.

5.1.2 Flow Rates

The volume of water pumped from the off-site containment well during each month of 2001 is shown on Table 4.2; a plot of the monthly production is presented in Figure 5.13. Based on the total volume of water pumped during the year (approximately 114 million gallons), the average discharge rate for the year was 216 gpm. The well operated 97.3 percent of the time available during the year, thus the average operating discharge rate was 222 gpm. These data indicate that the 2001 operation of the system was essentially identical to that during 2000. Although the average discharge rates are slightly lower than the design rate of 225 gpm, the evaluations of water-level data during both years indicate that they are sufficient for maintaining hydraulic control of the plume.

Since the beginning of pumping from the off-site containment well in December 1998, a total of about 344 million gallons of water was pumped from the aquifer. (This total includes 1.7 million gallons pumped during the testing and the first day of operation of the well in December 1998.) This represents approximately 31 percent of the initial plume pore volume reported in Subsection 2.6.1.3 of this report. A cumulative plot of the volume of water pumped from the off-site containment well is presented in Figure 5.14.

Essentially all the water pumped from the containment well since the beginning of operations came from within the contaminated groundwater plume. (See Figure 5.17 for the approximate area of origin of the water pumped during the last three years.) The approximately 344 million gallons of groundwater that have been removed from the aquifer represent water that was in storage around the well within an approximately cylindrical volume with an average radius of about 540 feet and a height equal to the saturated thickness of the aquifer above the 4800-foot clay[3]. Because of the regional gradient, the well is not at the center of the cylinder, but it is off-centered toward the downgradient side of the cylinder. Also, because the water table is declining, the source of some of the pumped water is vertical drainage from the water table rather than purely horizontal flow. Therefore, the storage volume from which the pumped water is derived is not totally cylindrical; it has a smaller radius near the water table than in the deeper horizons of the aquifer.

5.1.3 Water Quality

5.1.3.1 Groundwater Quality

Plots of TCE, DCE, and TCA concentrations were prepared for a number of on-site and off-site wells to evaluate long-term water-quality changes at the Sparton site. Plots for on-site wells are shown in Figure 5.15 and plots for off-site wells in Figure 5.16. The concentrations in the on-site wells (Figure 5.15) indicate a general decreasing trend; in fact, the data from wells MW-9 and MW-16, which have the longest record, suggest that this decreasing trend may have started before 1983. A significant decrease in concentrations occurred in well MW-16 during the last several years. This well is located near the area of the SVE system operations and it is apparent that it has been influenced by these operations that started in 1998. A similar trend also occurred in MW-21 during 1998 and 1999, but this well has been dry during the last two years and could not be sampled.

A plot for well MW-72 is also included in Figure 5.15. Well MW-72 (see Figure 2.3 for well location) was installed in late February 1999 to provide a means for assessing whether source areas exist outside the capture zone of the source containment well. The first two samples from this well, in March and May 1999, had TCE concentrations of 1,800 μg/L; in November 1999, the TCE concentration had declined to 1,200 μg/L. During 2000 and early 2001, the TCE concentration in this well increased reaching 4,100 and 4,200 μg/L in duplicate samples collected in May 2001. The November 2001 sample, however, had 2,900 μg/L of TCE. Semi-

[3] A porosity of 0.3 and an average saturated thickness of 165 ft were used in estimating the radius of the cylinder.

annual sampling of this well will continue for another two years before an evaluation is made of these data, and of other data that would be available from the operation of the source containment well, to determine whether they indicate the presence of a source area outside the capture zone of the source containment well.

The concentrations in most off-site wells also had a decreasing trend during the last four to six years. Of the six wells shown in Figure 5.16, concentrations in wells MW-55, MW-56, MW-58 and MW-61 appear to have peaked between 1995 and 1997, and then began to decline; however, some leveling, and even some trend reversal, has been occurring during the last two years. In well MW-48, this trend reversal occurred in late 1998; TCE concentration in this well increased from 28 µg/L in November 1998 to 90 µg/L in November 2000, and remained at about the same level in November 2001 (85 µg/L). Concentrations of TCE in well MW-60 had increased from low µg/L levels in 1993 to a high of 11,000 µg/L in November 1999; however, during the last two years (November 2000 and 2001) TCE concentrations were 2,900 and 3,700 µg/L, respectively.

One of the two DFZ wells, MW-67 of the MW-48/55/56/67 cluster, continued to be free of any contaminants in 2001 as it has been since its installation in July 1996. The other DFZ well, MW-71 of the MW-60/61/71 cluster, had been problematic since its installation in June 1998, and its recompletion in October 1998. The problems encountered with the well are discussed in detail in the 1999 Annual Report (SSP&A, 2001a). In response to concerns expressed by USEPA and NMED, Sparton had proposed to conduct a purging test for evaluating the nature of the leakage through this well and replace the well at the same or a nearby location, based on the results of a proposed deviation survey. A Work Plan for these activities (SSP&A and Metric, 2001) was finalized and submitted to USEPA and NMED on May 24, 2001, and approval for the work was received on June 12, 2001.

The purge test and the deviation survey were conducted in July and September 2001, respectively, and the well was plugged in October 2001. The results of the purge test and of the deviation survey were discussed in a report prepared by SSP&A and Metric (2002). Briefly, the results of the purge test indicated that the source of the contaminants detected in samples from this well was contaminated groundwater from shallower zones leaking into the DFZ through the wellbore; the results of the deviation survey indicated that it would be difficult to overdrill the well. A replacement well, located about 30 feet south of MW-71 was proposed, verbal approval for its installation was obtained on November 26, 2001 (see SSP&A and Metric, 2002), and its installation was scheduled for early 2002.

The Fourth Quarter (November) 2001 water-quality data presented in Table 4.3 were used to prepare concentration distribution maps showing conditions near the end of 2001. The horizontal extent of the TCE plume and the concentration distribution within the plume in November 2001, as determined from the monitoring well data, is shown on Figure 5.17. Also shown on this figure are the approximate areas of origin of the water pumped by the off-site containment well during the last three years. [Particle tracking analysis (see Section 6.1.4) on the ULFZ water surface computed with the calibrated model of the site was used to determine these areas of origin.] The horizontal extent of the DCE and TCA plumes, and the concentration distribution within these plumes in November 2001 are shown in Figures 5.18 and 5.19, respectively. The extent of the TCE and DCE plumes (Figures 5.17 and 5.18) is similar to that in November 2000. The extent of the TCA plume (Figure 5.19), however, is much smaller; the plume is confined to the on-site area, with only two wells, MW-26 and MW-72, at concentrations that exceed the 60 μg/L maximum allowable concentration in groundwater set by the NMWQCC.

Changes that occurred between November 1998 (prior to the implementation of the current remedial activities) and November 2001 in the TCE, DCE, and TCA concentrations at monitoring wells that were used for plume definition and sampled during both sampling events are shown in Figures 5.20, 5.21, and 5.22. Also shown on these figures is the extent of the plumes in November 1998 and November 2001. Note that significant decreases in the concentration of all three constituents occurred in the on-site area. The only on-site wells where an increase in the TCE concentration (Figure 5.20) occurred are MW-72 and MW-7 (the change in MW-72 is from 1999 to 2001). On-site increases in DCE concentrations also occurred in these two wells and in well MW-73 (Figure 5.21). TCA concentrations decreased in all on-site wells (Figure 5.22). There are no discernible patterns in the changes that occurred in off-site wells, concentrations increased in some wells, decreased at others, or remained unchanged (mostly non-detect wells). The increase in the TCE and DCE concentrations that occurred at the containment well CW-1, the persistence of these concentrations at the levels that have been observed in this well during the last several years, and the past concentrations at well MW-60, however, indicate the presence of a high concentration area upgradient from the containment well. This conclusion is confirmed by the model calibration results discussed in Section 6.

5.1.3.2 Influent and Effluent Quality

The concentrations of TCE, DCE, TCA, total chromium, iron, and manganese in the influent to and effluent from the air stripper during 2001, as determined at the beginning of each month, are presented on Table 4.4. (The accuracy of the chromium analyses is ±13 percent; this occasionally results in reported effluent concentrations that are equal or greater that the reported influent concentrations. See for example, the February and October 2001 and the January 2002 results on Table 4.4.) A plot of the TCE, DCE, and total chromium concentrations in the influent is presented in Figure 5.23. Weekly total chromium concentrations in the effluent are presented on Table 4.5.

Except for a concentration of 770 μg/L measured in October 2001, the concentrations of TCE in the influent during 2001 fluctuated between 1,100 and 1,400 μg/L. The average TCE concentration for the year was about 1,200 μg/L. The concentrations of DCE fluctuated within a relatively narrow range and averaged about 60 μg/L. At the beginning of the year, the concentrations of TCA were reported to be below detection limits, at detection limits of 10 or 20 μg/L; however, TCA concentrations were at the 5 μg/L level when analyzed at lower detection limit during the last half of the year. Throughout the year, total chromium concentrations in the influent were below the 50 μg/L maximum allowable concentration in groundwater set by

NMWQCC and averaged about 40 μg/L. Based on these lower chromium concentrations, the chromium reduction process was removed on November 1, 2001, and weekly sampling for chromium was discontinued after November 27, 2001.

The concentrations of TCE, DCE, and TCA in the air stripper effluent (see Table 4.4) were below detection limits throughout the year (note, however, that TCE was detected at a concentration of 0.8 μg/L on January 3, 2002). Total chromium concentrations in the effluent were below 50 μg/L, and remained below 50 μg/L after the removal of the chromium reduction process.

5.1.3.3 Contaminant Mass Removal

The monthly mass removal rates of TCE and DCE by the off-site containment system during the 2001 operating year were estimated using the concentration of these compounds shown on Table 4.4 and the monthly discharge volumes presented on Table 4.1. These monthly removal rates are summarized on Table 5.1 and plotted in Figure 5.24. As shown on Table 5.1, 546 kg (1,200 lbs) of contaminants, consisting of 519 kg (1,140 lbs) of TCE and 27 kg (60 lbs) of DCE, were removed by the off-site containment system during 2001.

A plot showing the cumulative mass removal by the off-site containment system, including 1.3 kg (3 lbs) removed during the December 1998 testing and operation of the containment well, is presented in Figure 5.25. As shown in this figure, by the end of 2001 the off-site containment system had removed a total of approximately 1,410 kg (3,100 lbs) of contaminants, consisting of approximately 1,340 kg (2,950 lbs) of TCE and 70 kg (150 lbs) of DCE. This represents about 39 percent of the total dissolved contaminant mass, or about 41 percent of the TCE and about 35 percent of the DCE mass, currently estimated to have been present in the aquifer prior to the testing and operation of the off-site containment system (see Section 2.6.1.4).

5.2 Evaluation of SVE Operation

The 400-cfm SVE system at vapor recovery well VR-1, consisting of two 200-cfm Roots blowers, was operated for approximately 165 days between the beginning of the year and the termination of the system on June 15, 2001. During 2000, the system had operated for about 206 days between its start up on April 10, 2000 and the end of the year. Influent samples collected at the beginning, during and prior to the end of the operating period of the system indicate that throughout the period of operation of the system, constituent concentrations in the blower influent, and hence in the effluent, remained within city/county emission requirements for direct discharge to the atmosphere (see Table 4.6). The most prevalent constituent was TCE, with concentrations of 15 to 24 mg/m^3 (3.3 to 5.4 ppmv) at the beginning of the operation that declined below 1.0 mg/m^3 (0.22 ppmv) by the end of 2000 and remained below that concentration until the shut down of the system.

The total operating time of the system over the 14-month plus period between the April 10, 2000 start up and the June 15, 2001 shut down of the system was about 371.5 days (1 year, 6 days and 13 hours). This operating time met the requirement of the Consent Decree (a total operating time of one year over a period of 18 months or less) concerning the duration of the system operation.

As also required by the Consent Decree, two rounds of performance monitoring sampling of soil gas were conducted in September and October 2001, after a 3-month shut-off period. The results of these two sampling events, presented on Table 4.7, indicate that TCE concentrations at all monitoring locations were considerably below the 10 ppmv remediation goal of the Consent Decree. In fact, the highest concentration detected during these sampling events was 1.5 ppmv, detected in the September sample from MW-15.

A discussion of the SVE operations at the Sparton site and the results of the performance monitoring sampling were presented in a report entitled " Final Report on the On-Site Soil Vapor Extraction System" (Chandler and Metric, 2001). The duration of the operation of the system and the results of the performance monitoring sampling satisfy the requirements of the Consent Decree for the termination of the system.

5.3 Site Permits - Off-Site Containment System

The infiltration gallery associated with the off-site containment system is operated under State of New Mexico Groundwater Discharge Permit DP-1184. This permit requires the monthly sampling of the treatment system effluent, and the quarterly sampling of the infiltration gallery monitoring wells MW-74, MW-75 and MW-76. The samples are analyzed for TCE, 1,1-DCE, 1,1,1-TCA, chromium, iron and manganese. The concentrations of these constituents must not exceed the maximum allowable concentrations for groundwater set by NMWQCC, and the results of the analyses must be reported quarterly.

These requirements of the Groundwater Discharge Permit were met throughout 2001. The chromium concentrations in the treatment system influent, which had occasionally exceeded the NMWQCC standard of 50 µg/L during 2000 and required the installation of a chromium reduction process on December 15, 2000, were below 50 µg/L throughout 2001. The chromium reduction process was, therefore discontinued on November 1, 2001.

No violation notices were received during 2001 for activities associated with the operation of the off-site containment system.

5.4 Contacts

During 2001 Baird Swanson (NMED Groundwater Bureau) made several routine visits to the site to obtain split samples during the soil gas performance monitoring sampling, from monitoring well MW-71, and from the source containment well CW-2. Tami Engle and John

Fellinger (USEPA contractors) were also on site to obtain split samples from the soil gas performance monitoring sampling.

A notification for a public meeting to be held on June 15, 2001 was mailed to property owners located above the plume and adjacent to the treated water discharge pipeline on June 4, 2001. A copy of the notification and the list of the property owners to which it was mailed are presented in Appendix E. Representatives of the city, state, and federal governments, and of Sparton, and a few members of the public attended the meeting.

Section 6
Groundwater Flow and Transport Model

This section describes a numerical groundwater and contaminant transport model of the aquifer system underlying the Sparton site and its vicinity. This model was developed following the general outline described in Task 3 of the "Work Plan for the Assessment of Aquifer Restoration" (SSP&A, 1999), which is incorporated as Appendix D in the Consent Order. The development of the model is described in the 1999 Annual Report (SSP&A, 2001a). The groundwater flow component of the model is based on the MODFLOW96 simulation code developed by the U.S. Geological Survey (Harbaugh and McDonald, 1996). This flow model has been calibrated to water-level data obtained from a period prior to the operation of the off-site containment well and to water-level data collected during operation of the off-site containment well. The flow model is coupled with the solute transport simulation code $MT3D^{99}$ for the simulation of constituents of concern underlying the site (Zheng and SSP&A, 1999). The model has been used to simulate TCE concentrations in the aquifer from start-up of the containment well in December 1998 through November 2002.

6.1 Groundwater Flow Model

6.1.1. Structure of Model

The model area and model grid are presented in Figure 6.1. The overall model dimensions are 8,050 ft by 7,300 ft. The model consists of 88 rows and 114 columns. The fine model area consists of uniform discretization of 50 ft, covering an area of 4,100 ft by 2,600 ft. The grid spacing is gradually increased to 200 ft towards the limits of model domain. The model grid is aligned with principal axes corresponding to the approximate groundwater flow direction and plume orientation (45° clockwise rotation).

The model consists of 13 layers. The vertical discretization used in the model is shown in Figure 6.2. Layers 1 through 11 correspond to the unconfined surficial aquifer. Layers 1 and 2 are 5 ft thick, layers 3 through 7 are 10 ft thick, layers 8 and 9 are 20 ft thick, and layers 10 and 11 are 40 ft thick. Layer 12 is a 4-foot-thick unit that represents the 4800-foot clay unit. Layer 13 represents the upper 100 ft of the aquifer underlying the 4800-foot clay unit. The vertical discretization was selected to minimize vertical numerical dispersion.

6.1.1.1 Boundary Conditions

The northeast and southwest model boundaries are specified as no-flow boundaries. The northwest and southeast model domain boundaries are constant head boundaries (Figure 6.1). As part of this year's modeling analysis, a procedure was developed for setting the boundary heads for the transient flow model. The method captures the regional water decline that has been observed at the Site over the past decade. The method incorporates the following assumptions:

- the water levels from the ULFZ and LLFZ wells are best represented by a planar surface;
- the water levels vary linearly with depth;
- the coefficients of the plane of best-fit vary linearly over time; and
- the seasonal variation of the water levels is best represented by a sinusoidal function.

The resulting equation for the water level at any well, incorporating the above assumptions, is:

$$h = (at + b)x + (ct + d)y + (et + f)z + (gt + p) + q\sin(2\pi t - r) \qquad (1)$$

where: h is the computed head, in ft MSL;
t is the time in years, relative to January 1, 1992;
x and y are the Easting and Northing of the well in New Mexico "Modified State Plane" coordinates;
z is the elevation of the midpoint of the well screen, in ft MSL; and
a, b, c, d, e, f, g, p, q, and r are coefficients determined by a best-fit procedure.

The coefficients were determined using a model-independent parameter estimation code, PEST (Doherty, 2000).

The declining trend of water levels is different over two time periods: 1992 to 1998 and 1999 to present; therefore, coefficients were determined for these two periods. The regional trend observed in water levels in three representative wells in the ULFZ and the LLFZ are shown in Figure 6.3. Also shown in Figure 6.3 are the water levels at these three wells computed using the equation (1). The following table summarizes the coefficients determined by the parameter estimation process:

Coefficient	1992-1998	1999+
a	3.3775295E-05	2.8453422E-06
b	1.7919271E-03	2.3089653E-03
c	-6.7286972E-05	-6.0460096E-05
d	-1.9638627E-03	-2.0976455E-03
e	-2.4882833E-05	2.8974258E-04
f	1.1732360E-03	2.4788732E-03
g	8.9372990E+01	8.9372960E+01
p	7.2876060E+03	7.2876060E+03
q	3.2817740E-01	2.7573582E-02
r	2.6258680E+00	2.7696575E-03

The boundary heads for the flow model along the northwest and southeast model boundaries were set using the determined coefficients, the coordinates of the centroid of the model cell containing a constant head cell, and the time of the stress period. The seasonal variation was not included in the setting the boundary heads for the flow model because there is insufficient temporal discretization to capture the effects of the variation. The coefficient p was decreased by 3.3 ft and 5.6 ft in calculating the boundary heads in the simulation of 1992-1998 and 1999-2001 conditions, respectively (the coefficient p can be thought of as the intercept of the fitted surface). This adjustment was necessary to obtain a good match between observed and computed water levels. The adjustment is required because the model incorporates recharge along the Arroyo de las Calabacillas, the Corrales Main Canal, and irrigated fields. Constant head elevations for cells within layers 12 and 13 were adjusted to account for the observed head drop of about 6 ft across the 4800-foot silt/clay unit.

6.1.1.2 Hydraulic Properties

Four different zones of hydraulic conductivity are specified within the model domain:

- Holocene channel and flood plain deposits, also referred to as Recent Rio Grande deposits;
- The 4970-foot silt/clay unit;
- Sands of the Upper Santa Fe Group, Late-Pleistocene channel and flood plain deposits, and Late-Pleistocene and Holocene arroyo fan and terrace deposits, collectively referred to as the sand unit; and
- The 4800-foot clay unit.

The sand unit is primarily classified as USF2 facies assemblages 2 and 3 (Hawley, 1996). Locally, near the water table, in some areas, the sands and gravels are classified as USF4 facies assemblages 1 and 2. In areas where the 4970-foot silt/clay unit is present, the sands and gravels overlying this unit are Late-Pleistocene arroyo fan and terrace deposits. The 4970-foot silt/clay unit represents Late-Pleistocene overbank deposits. The 4800-foot clay unit is included in the USF2.

The specific storage of all model units was specified at 2×10^{-6} ft^{-1} consistent with the value specified in the USGS model of the Albuquerque Basin (Kernodle, 1998). The specific yield of the sand unit and the Recent Rio Grande deposits was specified as 0.20.

The spatial extent of the recent Rio Grande deposits and the 4970-foot silt/clay unit are shown in Figure 6.1. The following table summarizes the estimates of hydraulic properties:

Hydrogeologic Zone	Hydraulic Conductivity, ft/d		Specific Yield	Specific Storage, ft^{-1}	Model Layers in which zone is present
	Horizontal	Vertical			
Sand unit	25	0.133	0.2	2×10^{-6}	1-11,13
Recent Rio Grande deposits	25	0.133	0.2	2×10^{-6}	1-6
4970-foot silt/clay unit	0.1	0.001		2×10^{-6}	2.3
4800-foot clay unit	0.017	0.000017		2×10^{-6}	12

6.1.1.3 Sources and Sinks

The groundwater sinks in the model domain are the off-site containment well CW-1, the source containment well CW-2, and eight on-site shallow wells (PW-1, MW-18, and MW-23 through MW-28) that are used for remedial extraction. The off-site containment well has been in operation since December 31, 1998 with a brief shut down in April 1999. The average pumping rate between January and November 1999 was about 219 gpm, the average pump rate in 2000 was 216 gpm, and the average pump rate in 2001 was 216 gpm. The pumping at CW-1 is distributed across model layers 5 through 11 and is apportioned based on layer transmissivities. The discharge from well CW-1 to the infiltration galleries is simulated using wells injecting into layer 2. The discharge flow is distributed across the area of the galleries. The source containment well, CW-2, began operation in January 2002. The well is operated at a nominal rate of 50 gpm. Ninety-five percent of the treated water from this well is assumed to infiltrate back to the aquifer from the on-site infiltration ponds.

The shallow extraction wells were operated from December 1988 to November 1999. Total extraction rates from the wells declined with time. The average pump rate was 0.26 gpm in 1999. Since discharge from the shallow extraction wells was to the city sewer, infiltration of this water was not simulated in the model. Infiltration of precipitation is considered to be negligible due to high evapotranspiration and low precipitation.

Recharge within the modeled area was assumed to occur from the Arroyo de las Calabacillas, the Corrales Main Canal, and irrigated fields. The recharge rate for the arroyo and the canal was estimated in the model calibration process described below. The calibrated recharge rate from the arroyo and the canal was 10 ft/yr. Recharge from the irrigated fields east of the Corrales Main Canal was simulated at a rate of 1 ft/yr. Recharge was applied to the highest layer active within the model. The resulting total recharge rates within the modeled area were 141 gpm from the arroyo, 8 gpm from the canal, and 24 gpm from irrigated fields.

6.1.2 Model Calibration

The groundwater flow model was calibrated to three sets of groundwater levels. The model was calibrated to water levels prior to the start of pumping at well CW-1 (November 1998, see Table 2.4), to water levels in October 1999 (refer to Table 4.1 of 1999 Annual Report), and to water levels in November 2000 (refer to Table 4.1). An initial calibration of the groundwater model, based on the first two sets of water-level data listed above, is described in the 1999 Annual Report (SSP&A, 2001a). The model was recalibrated for the 2000 Annual Report (SSP&A, 2001b) to incorporate the new information in the additional year of water-level data, and to fix an error made in the assignment of the vertical hydraulic conductivity of the sand unit and the Recent Rio Grande deposits in the groundwater model described in the 1999 Annual Report (2000 Annual Report; SSP&A, 2001b).

The minor changes that were made to model parameters and boundary conditions as the result of the recalibration conducted are the following:

- The vertical hydraulic conductivity of the sand unit and the recent Rio Grande deposits was increased from 0.114 to 0.133 ft/d. This change was made to fix an incorrect specification of this parameter in the initial model.
- The northwest boundary heads were increased by one foot for the simulations with pumping at CW-1. This change was made to reduce the bias in residuals in the vicinity of CW-1.
- The horizontal hydraulic conductivity of the 4970-foot silt/clay unit was increased slightly, from 0.085 ft/d to 0.1 ft/d, and the vertical hydraulic conductivity was increased from 0.00085 ft/d to 0.001 ft/d.
- The thickness of model layer 13 was increased from 10 ft to 100 ft. This change was made because a model layer thickness of 10 feet introduced artificial boundary effects.

6.1.3 Transient Simulation – January 1998 to December 2001

The previously calibrated groundwater model was used to simulate groundwater levels in the aquifer system underlying the former Sparton site and its vicinity from January 1998 prior to the startup of containment well CW-1 until December 2001. Monthly stress periods were used in the transient simulation, and the pumping rates specified for well CW-1 were those specified on Table 4.2. The calculated water levels at the end of this simulation, representing December 2001, for the UFZ, ULFZ, and LLFZ are shown in Figures 6.4 to 6.6.

The groundwater levels measured between November 1998 and November 2001 at each of the monitoring wells at the former Sparton site and its vicinity were compared to model simulated water levels. Measured water levels were compared to calculated water levels in the model layer corresponding to the location of the screened interval of the monitoring well. When the screened interval of a monitoring well spanned more than one model layer, the measured water levels were compared to the average of the calculated water levels in the layers penetrated by the well.

The correspondence between measured and model-calculated water levels was evaluated using both qualitative and quantitative measures. Scatter plots of observed versus calculated water levels were used to provide a visual comparison of the fit of model to the measured water level data. For a calibrated model, the points on the scatter plot should be randomly and closely distributed about the straight line that represents an exact match between the calculated and observed groundwater levels. The scatter plot shown in Figure 6.7 is a plot of measured versus calculated water levels for all of the water level data collected between January 1998 and November 2001. This scatter plot visually illustrates the excellent comparison between model calculated water levels and observed water levels.

The quantitative evaluation of the model simulation consisted of examining the residuals between the 980 measured and calculated water levels from the monitoring wells at the former Sparton site and its vicinity. The residual is defined as the observed water level minus the calculated water level. To quantify model error, three statistics were calculated for the residuals: the mean of the residuals, the mean of the absolute value of the residuals, and the sum of squared residuals. The mean of the residuals is –0.10 ft, the mean of the absolute value of the residuals is 1.18 feet, and the sum of squared residuals is 3,356 ft^2. The near-zero value of the mean residuals demonstrates that there is no systematic bias in the calibration. The absolute mean residual of 1.18 feet is considered acceptable since the observed water-level measurements applied as calibration targets have a total range of 23 feet, and seasonal fluctuations of water levels are on the order of several feet. The residuals at each monitoring well for each monitoring period and the calibration statistics are presented in Appendix F.

6.1.4 Capture Zone Analysis

The capture zone of containment well CW-1 in November 2001 was calculated using particle tracking. The particle tracking was applied to the calculated November 2001 water levels, assuming that these water levels represented a steady-state condition. The particle tracking was carried out using the PATH3D computer code (Zheng, 1991).

The calculated capture zones of well CW-1 in the UFZ, the ULFZ, and the LLFZ are presented in Figures 6.3, 6.4, and 6.5, respectively. Also shown in these figures are the extents of the TCE plume in November 2001. These model results confirm the water-level-data based evaluation of the capture zone of the containment well shown in Figures 5.10 through 5.12.

Particle tracking analysis was also used to determine the aquifer area from which the water pumped during 1999, 2000 and 2001 originated. The area of origin of the water pumped from the aquifer in 1999, 2000, and 2001 is shown in Figure 5.17. In the 1999 Annual Report, the use of particle tracking to estimate the travel time between the former Sparton facility and the containment well is described. The travel time between the former Sparton facility and the containment well was calculated as 20 years. Note that this calculation assumes that the containment well is operating continuously, and that water levels remain at their 1999 conditions throughout the 20-year travel period.

6.2 Solute Transport Model

A solute transport model is linked to the groundwater flow model to simulate the concentration of constituents of concern at the site. The three-dimensional contaminant transport simulation code MT3D^{99} (Zheng and SSP&A, 1999) was applied for this study. The model was used to simulate TCE concentrations in the aquifer from December 1998 through December 2002.

Model input parameters were specified based on available data, and the TCE concentrations in the model domain at the start of the simulation period were estimated from November 1998 measured concentration data. The model was calibrated by adjusting the initial TCE concentration distribution until a reasonable match was obtained between the calculated and measured TCE concentrations and TCE mass removal at the containment well, CW-1, between December 1998 and December 2001. Once the model was calibrated, the model was used to predict TCE concentrations in the aquifer between January 2002 and December 2002. No attempt was made to simulate DCE and TCA. DCE is generally detected at monitoring wells where TCE is detected, but DCE concentrations are much lower than TCE concentrations. Downgradient of the facility, between the facility and the containment well, DCE concentrations are typically only 3 to 6 percent of the TCE concentrations; DCE represents about 5 percent of the total mass of chlorinated volatile organic compounds extracted at CW-1. In monitoring wells at the facility, the ratio of DCE to TCE concentrations is higher, but is typically less than 20 percent.

The other constituent of concern, TCA, has been detected at concentrations greater than the 60 µg/L maximum allowable concentration in groundwater set by the NMWQCC, only in monitoring wells at the facility. In the latest sampling round conducted in November 2001, TCA concentrations exceeded 60 µg/L in only two well wells at the facility, and the maximum concentration was only 92 µg/L at MW-92. The limited distribution of TCA is the result of the abiotic transformation of TCA to acetic acid and DCE; a transformation that occurs relatively rapidly when TCA is dissolved in water. Only about 20 percent of TCA degrades to DCE, the rest degrades to acetic acid (Vogel and McCarty, 1987). The current concentrations of TCA and DCE in monitoring wells at the facility indicate that it is not likely that DCE concentrations will increase significantly in the future as the result of TCA degradation.

6.2.1 Transport Parameters

A number of aquifer and chemical properties are required as input parameters for the contaminant transport simulation. The required aquifer properties are porosity, bulk density, and dispersivity. The required chemical properties are: (1) the fraction organic carbon, (2) the organic-carbon partition coefficient for the organic compound being simulated, and (3) the effective diffusion coefficient. The following table summarizes the transport parameters:

Transport Parameters	Value Specified in All Units
Porosity	0.3
Longitudinal dispersivity	25 ft
Transverse horizontal dispersivity	0.25 ft
Transverse vertical dispersitvity	0.025 ft
Bulk density	1.56 g/cm^3
Fraction organic carbon content	< 0.0001
Organic-carbon partition coefficient for TCE	97 L/kg
Effective diffusion coefficient	2.3 x 10^{-4} ft^2/day

The rationale for choosing these transport parameters is described in the 2000 Annual Report (SSP&A, 2001b).

The retardation coefficient for TCE can be estimated using data on the organic-carbon content, effective porosity, and bulk density of the aquifer materials, and the organic-carbon partition coefficient for TCE. Because the value of the fraction organic-carbon content is very small and the calculated retardation coefficient is small, a retardation coefficient of unity was used in the transport simulations presented in this report.

6.2.2 Initial Concentration Distribution

The initial TCE distribution was generated based on the November 1998 measured concentration data. An interpolated concentration distribution was created for each flow zone and the base of the contaminated zone using linear kriging of the log values of concentration. The zones for which concentration distributions were generated are the following:

- the upper flow zone (UFZ), corresponding to concentrations at the water table;
- the upper lower flow zone (ULFZ), corresponding to concentrations at an elevation of 4,940 ft MSL;
- the lower-lower flow zone (LLFZ), corresponding to an elevation of 4920 ft MSL at the facility and an elevation of 4,900 ft MSL west of the facility; and
- the base of the contaminated zone, corresponding to top of 4800-foot clay west of facility and an elevation of 4,910 ft MSL at the facility.

The concentration distributions generated for these four zones were used as the basis for specifying initial concentrations at each node in the model domain. The concentrations generated for a given flow zone were assumed to represent concentrations on an approximately horizontal surface. These surfaces generally did not coincide with the node centers of the model grid and, therefore, the initial concentration at a given node was calculated by vertical linear interpolation of the log values of concentration corresponding to the overlying and underlying surfaces.

The concentration distribution for the UFZ was assumed to represent concentration at the water table as estimated based on November 1998 water levels at wells screened within the UFZ. The concentration distribution for the ULFZ was assumed to represent concentrations on a horizontal surface at an elevation of 4,940 ft MSL. The concentration distribution for the LLFZ was assumed to represent concentrations on a horizontal surface at an elevation of 4,920 ft MSL at the facility and at an elevation of 4,900 ft MSL west of the facility. The concentration distribution for the bottom zone was assumed to represent concentrations on a horizontal surface at an elevation of 4,910 ft MSL at the facility and at an elevation of 4,800 ft MSL west of the facility. The 4,910 ft MSL elevation at the facility is based on no detections of TCE in monitoring wells MW-38, MW-39, MW-40, and MW-70. A processor was developed to generate one horizontal concentration distribution for each model layer, representing the initial contaminant distribution for the transport model.

6.2.3 Model Calibration

Calibration of the transport model has consisted of adjustment of the initial contaminant concentration distribution, TCE concentrations prior to startup of containment well CW-1, to achieve a reasonable match between calculated and observed TCE concentrations and mass removal at the containment well CW-1. The model was initially calibrated in 2000 when the model was developed (1999 Annual Report), the model was recalibrated in 2001 (2000 Annual Report), and the model was again recalibrated this year. A better representation of the TCE distribution prior to startup of the containment system has been obtained with each model calibration effort.

The concentration distributions calculated with the procedures described in the previous section resulted in an underestimation of the total TCE mass extracted at well CW-1 in the initial model calibration effort in 2000. The likely reason for the underestimation of the TCE mass is that the kriging procedure leads to an underestimation of TCE concentrations along the center line of the plume. The procedure for estimating the initial TCE distribution was modified by adding a number of control points along the center line of the plume to the monitoring well data for use in estimating the concentration distributions in each flow zone. The concentrations specified at the control points were the parameters varied during the model calibration process. A trial and error calibration procedure was used to estimate the concentrations at the control points in the initial calibration and in the recalibration in 2000. This year, the control point concentrations were estimated using the parameter estimation code PEST (Doherty, 2000).

The calibration process has resulted in an excellent agreement between observed and calculated TCE mass removal from containment well CW-1, and excellent agreement between observed and calculated concentrations at CW-1 (Figure 6.8). The observed and calculated TCE mass removal and TCE concentrations at CW-1 are tabulated below:

	Cumulative TCE mass removed, kg		Concentration at CW-1, µg/L	
	Measured	Calculated	Measured	Calculated
December 31, 1998	1.3	1.4	190	218
January 3, 2000	359	378	860	1056
January 2, 2001	822	870	1200	1176
January 3, 2002	1340	1367	1100	1119

The estimate of the mass of TCE in the aquifer prior to startup of the containment wells has changed from 2,180 kg in the initial model calibration (1999 Annual Report), to 3,100 kg after the first recalibration (2000 Annual Report), to the current estimate of 3,295 kg. The initial mass and the maximum TCE concentrations within each model layer, under the recalibrated initial concentration distribution specified in the model, are summarized on Table 6.1.

A comparison of calculated to observed concentrations of TCE at all monitoring wells for all samples analyzed between for November 1998 and November 2001 is presented in Figure 6.9. Also presented in Figure 6.9 is a comparison of calculated to observed concentrations of TCE for all samples analyzed in November 2001. The general agreement between observed and computed concentrations is reasonable given the uncertainty of the initial contaminant distribution.

6.2.4 Predictions of TCE Concentrations in 2002

The groundwater transport model was applied to predict TCE concentrations through December 2002 after 48 months of pumping at well CW-1, and after 12 months of pumping at CW-2. The containment well CW-1 was assumed to pump at an average rate of 216 gpm, and the containment well CW-2 was assumed to pump at an average rate of 50 gpm in 2002. In addition, it was assumed that 47.5 gpm is discharged to the on-site infiltration ponds. The TCE concentrations calculated for December 2001 are specified as the initial conditions for the predictive groundwater transport model.

The predicted TCE concentrations in November 2002 are presented in Figure 6.10. The concentration distribution is based on the maximum TCE concentration simulated within any given layer. A mass removal of 467 kg of TCE by containment well CW-1 and 13 kg from containment well CW-2 is predicted for the period of January 2002 to December 2002. The calculated TCE concentration at well CW-1 in December 2002 is 961 µg/L, a decrease of 13% for the concentration measured at the end of 2001. The initial TCE concentration used in the transport model, and the calculated TCE concentrations in November 1999, November 2000, November 2001, and November 2002 are compared in Figure 6.11.

6.3 Future Simulations

The accuracy of this modeling effort will be evaluated during the next 12 months based on the concentrations measured at the containment well and the monitoring wells. As new data are collected, the initial conditions and parameters in the model will be adjusted to improve the model. It is anticipated that as improvements are made to the flow and transport model, the model will become a reliable tool for predicting future water-quality conditions and assessing aquifer restoration.

Section 7
Conclusions and Future Plans

7.1 Summary and Conclusions

Sparton Technology, Inc. agreed to implement remedial measures at its former Coors Road Plant in Albuquerque, New Mexico under the terms of a Consent Decree entered on March 3, 2000. These remedial measures consist of: (a) the installation and operation of an off-site containment system; (b) the installation and operation of a source containment system; and (c) the operation of an on-site, 400-cfm SVE system for an aggregate period of one year. The goals of these remedial measures are: (a) to control hydraulically the migration of the off-site plume; (b) to control hydraulically any potential source areas that may be continuing to contribute to groundwater contamination at the on-site area; (c) to reduce contaminant concentrations in vadose-zone soils in the on-site area and thereby reduce the likelihood that these soils remain a source of groundwater contamination; and (d) in the long-term, restore the groundwater to beneficial use.

The installation of the off-site containment system, consisting of a containment well near the leading edge of the plume, an off-site treatment system, an infiltration gallery in the Arroyo de las Calabacillas, and associated conveyance and monitoring components, began in late 1998 and was completed in early May 1999. The off-site containment well began operating on December 31, 1998; except for brief interruptions for maintenance activities or due to power outages, the well has operated continuously since that date. The source containment system, consisting of a containment well immediately downgradient from the site, an on-site treatment system, six on-site infiltration ponds, and associated conveyance and monitoring components, was installed during 2001 and began operating on January 3, 2002. The 400-cfm SVE system operated for a total of about 372 days between April 10, 2000 and June 15, 2001.

During 2001, considerable progress was made towards achieving the goals of the remedial measures:

- The off-site containment well was operated at a rate sufficient to contain the plume;
- The pumped water was treated and returned to the aquifer through the infiltration gallery. The concentrations of constituents of concern in the treated water met all the requirements of the Groundwater Discharge Permit for the infiltration gallery. Chromium concentrations in the influent to the treatment system decreased to levels that no longer required treatment for chromium; the chromium reduction process was, therefore, discontinued on November 1, 2001;
- All components of the source containment system were installed in 2001 and the system was tested in December 2001;

- The 400-cfm SVE system operated for 165 days and 11 hours between the beginning of the year and June 15, 2001;

- Groundwater monitoring was conducted as specified in Attachment A to the Consent Decree. Water levels in all accessible wells and/or piezometers, and the Corrales Main Canal were measured quarterly. Samples were collected for water-quality analyses from monitoring wells at the frequency specified in the Consent Order and analyzed for VOCs and total chromium;

- Samples were obtained from the influent and effluent of the off-site treatment system and the infiltration gallery monitoring wells at the frequency specified in the Groundwater Discharge Permit. All samples were analyzed for VOCs, total chromium, iron, and manganese;

- Samples were also obtained from the newly installed source containment well and from the infiltration pond monitoring wells to establish conditions prior to the operation of the source containment system. The sample from the containment well was analyzed for VOCs and total chromium; the samples from the monitoring wells were analyzed for VOCs, total chromium, iron, and manganese;

- The influent to the 400-cfm SVE system was sampled several times during the operation of the system and analyzed for VOCs;

- Two rounds of sampling of the soil gas were conducted in September and October 2001, three months after the shutdown of the SVE system, to evaluate the performance of the system as required by the Consent Order;

- The groundwater flow and transport model that was developed in 1999 to simulate the hydrogeologic system underlying the site was recalibrated and used to simulate TCE concentrations in the aquifer from start-up of the off-site containment well in December 1998 through November 2001 and to predict concentrations in November 2002. Calibration and improvement of the model will continue next year.

The off-site containment well operated at an average rate of about 216 gpm during 2001, and maintained hydraulic control of the contaminant plume throughout the year. A total of about 114 million gallons were pumped from the well. This pumped water represented about 10 percent of the initial volume of contaminated groundwater (pore volume). The total volume of water pumped since the start of the well operation on December 1998 is 344 million gallons and represents 31 percent of the initial pore volume.

Approximately 550 kg (1,200 lbs) of contaminants consisting of 520 kg (1,140 lbs) of TCE and 27 kg (60 lbs) of DCE were removed from the aquifer during 2001. The total mass that was removed since the beginning of the off-site containment well is 1,410 kg (3,100 lbs) consisting of 1,340 kg (2,950 lbs) of TCE and 70 kg (150 lbs) of DCE. This represents about 39 percent of the total dissolved contaminant mass (41 percent of the TCE and 35 percent of the DCE mass) currently estimated to have been present in the aquifer prior to operation of the containment well.

The extent of the TCE plume, and hence the volume of contaminated groundwater, did not change significantly during 2001. The extent of the TCA plume, however, was much smaller; the plume was confined to the on-site area, with only two wells, MW-26 and MW-72, at concentrations that exceeded the maximum allowable concentration in groundwater set by the NMWQCC.

Changes in concentrations since the implementation of the current remedial measures indicate that significant decreases in the concentration of TCE, DCE, and TCA occurred in the on-site area. There were no discernible patterns in the changes that occurred in off-site wells, concentrations increased in some wells, decreased at others, or remained unchanged (mostly non-detect wells). The increase in the TCE and DCE concentrations that occurred at the containment well CW-1 soon after the beginning of its operation, the persistence of these concentrations at the levels that have been observed during the last several years, and the past concentrations at well MW-60, however, indicate the presence of a high concentration area upgradient from the containment well. This conclusion was confirmed by the model calibration results.

The duration of the SVE system operation and the results of the two rounds of soil gas monitoring that was conducted to evaluate the performance of the system indicated that the system had met the requirements of the Consent Order for termination of the system. The operation of the SVE system is, therefore, no longer required.

The remedial systems were operated with only minor difficulties during 2001. The off-site containment system was out of service for a total of 8.6 days during September and October 2001 due to an intermittent problem with the discharge pump motor starter. The starter was replaced in October 2001 to remedy the problem. To address the continuing presence of contaminants in the DFZ monitoring well MW-71, an investigation was conducted on the well, and the well was plugged during 2001. Based on the results of the investigation a replacement well was proposed about 30 feet south of the original well location. The well location was approved, and installation of the replacement well was scheduled for early 2002.

7.2 Future Plans

The off-site containment system will continue to operate at the average discharge rates that have been maintained during the last several years.

Evaluations will be conducted of the source containment system that began operating on January 3, 2002.

The replacement well for MW-71 (MW-71R) will be installed at the approved location. (The well was already installed at the date of this report.)

Data collection will continue in accordance with the Groundwater Monitoring Program Plan and site permits, and as necessary for the evaluation of the performance of the remedial systems. As additional data are being collected, calibration and improvement of the flow and transport model developed to assess aquifer restoration will continue.

Upon approval of the final SVE report (Chandler and Metric, 2001), the 400-cfm SVE system will be dismantled, and the vapor recovery well and the remaining vapor probes will be plugged and abandoned. (Approval of the final SVE report was received on March 12, 2002.)

Dry UFZ monitoring wells MW-14 and MW-37, which have been replaced by MW-14R and MW-37R, will be plugged and abandoned. Wells MW-15, MW-28, and MW-50, which also have been dry and had been planned for plugging and abandonment, will be plugged and abandoned during 2002. Replacement of well MW-21, which had been dry for the last several years, may no longer be necessary; the well has been reported to contain water since the beginning of the operation of the on-site infiltration ponds.

Regulatory agencies will continue to be kept informed of any significant milestones or changes in remedial system operations. The goal of the systems will continue to be the return of the contaminated groundwater to beneficial use.

Section 8
References

Black & Veatch, 1997: Report on Soil Gas Characterization and Vapor Extraction System Pilot Testing. Report prepared for Sparton Technology, Inc., June 3, 1997.

Chandler, Pierce, L., Jr., 1999a: Vadose Zone Investigation Workplan (Additional Soil Gas Characterization). Report prepared for Sparton Technology, Inc., February 19, 1997.

Chandler, Pierce, L., Jr., 1999b: Vadose Zone Investigation Report (Additional Soil Gas Characterization). Report prepared for Sparton Technology, Inc., June 17, 1999.

Chandler, Pierce, L., Jr., 2000: Vadose Zone Investigation and Implementation Workplan. Attachment E to the Consent Decree. City of Albuquerque and The Board of County Commissioners of the County of Bernalillo, plaintiffs, v. Sparton Technology, Inc., defendant. Civil Action No. CIV 97 0206, U.S. District Court for the District of New Mexico, filed March 3, 2000.

Chandler, Pierce, L., Jr. and Metric Corporation, 2001: Sparton Technology, Inc., Coors Road Plant Remedial Program, Final Report on the On-Site Soil Vapor Extraction System. Report prepared for Sparton Technology, Inc. in association with S. S. Papadopulos & Associates, Inc., November 29, 2001.

Consent Decree, 2000: City of Albuquerque and The Board of County Commissioners of the County of Bernalillo, plaintiffs, v. Sparton Technology, Inc., defendant. Civil Action No. CIV 97 0206, U.S. District Court for the District of New Mexico, filed March 3, 2000.

Detmer, D.M., 1995: Permeability, Porosity, and Grain-Size Distribution of Selected Pliocene and Quaternary Sediments in the Albuquerque Basin; New Mexico Geology, Vol. 17, No. 4, November 1995, pp. 79 – 87.

Doherty, John, 2002: PEST - Model Independent Parameter Estimation, Version 5.5, Watermark Numerical Computing, Queensland, Australia, February 2002.

Gelhar, L.W., C. Welty, and K.W. Rehfeldt, 1992: A Critical Review of Data on Field-Scale Dispersion in Aquifers, Water Resources Research, Vol. 28, No. 7, pp. 1955-1974.

Harbaugh, A.W. and M.G. McDonald, 1996: User's Documentation for MODFLOW-96, An Update to the U.S. Geological Survey Modular Finite-Difference Ground-Water Flow Model, U.S. Geological Survey Open-File Report 96-485, Reston, Virginia.

Harding Lawson Associates, 1983: Groundwater Monitoring Program, Sparton Southwest, Inc. Report prepared for Sparton Corporation, June 29, 1983.

Harding Lawson Associates, 1984: Investigation of Soil and Groundwater Contamination, Sparton Technology, Coors Road Facility. Report prepared for Sparton Corporation, March 19, 1984.

Harding Lawson Associates, 1985: Hydrogeologic Characterization and Remedial Investigation, Sparton Technology, Inc.. Report prepared for Sparton Corporation, March 15, 1985.

Harding Lawson Associates, 1992: RCRA Facility Investigation. Report revised by HDR Engineering, Inc. in conjunction with Metric Corporation. Report prepared for Sparton Technology, Inc., May 1, 1992.

Hawley, J.W., 1996: Hydrogeologic Framework of Potential Recharge Areas in the Albuquerque Basin, Central New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Report 402-D, Chapter 1.

HDR Engineers, Inc., 1997: Revised Final Corrective Measure Study. Report revised by Black & Veatch. Report prepared for Sparton Technology, Inc., March 14, 1997.

Johnson, P., B. Allred, and S. Connell, 1996: Field Log and Hydrogeologic Interpretation of the Hunter Park I Boring. New Mexico Bureau of Mines and Mineral Resources, Open-File Report 426c, 25 p.

Johnson, R.L., J.A. Cherry, and J.F. Pankow, 1989: Diffusive Contaminant Transport in Natural Clay: A Field Example and Implications for Clay-Lined Waste Disposal Sites, Environmental Science & Technology, Vol. 23, pp. 340-349.

Kernodle, J.M., D.P. McAda, and C. R. Thorn, 1995, Simulation of Ground-Water Flow in the Albuquerque Basin, Central New Mexico, 1901-1994, with Projections to 2020. U.S. Geological Survey, Water-Resources Investigations Report 94-4251.

Kernodle, J.M., 1998, Simulation of Ground-Water Flow in the Albuquerque Basin, Central New Mexico, 1901-1995, with Projections to 2020. U.S. Geological Survey, Open-File Report 96-209.

Mercer, J. W., D. C. Skipp, and Daniel Giffin, 1990, Basics of Pump-and-Treat – Ground-Water Remediation Technology, EPA/600/8-90/003, USEPA, Robert S. Kerr Environmental Research Laboratory, Ada, OK 74820.

Myrand, D., R.W. Gillham, E.A. Sudicky, S.F. O'Hannesin, and R.L. Johnson, 1992: Diffusion of Volatile Organic Compounds in Natural Clay Deposits: Laboratory Tests, Journal of Contaminant Hydrology, Vol. 10, pp. 159-177.

Rose, John, 2000: Coors Road Facilities Groundwater Monitoring Program, Semi-Annual Progress Report. Vadose Zone Investigation Workplan (Additional Soil Gas Characterization). Report prepared for Sparton Technology, Inc.

Rubenstein, H. Mitchell, 1999: Analytical Reports 908091, 908100, Sparton Technology, Inc.

S. S. Papadopulos & Associates, Inc., 1998: Interim Report on Off-Site Containment Well Pumping Rate. Report prepared for Sparton Technology, Inc., December 28, 1998.

S. S. Papadopulos & Associates, Inc., 1999: Report on the Installation of On-Site Monitoring Wells MW-72 and MW-73. Report prepared for Sparton Technology, Inc., April 2, 1999.

S. S. Papadopulos & Associates, Inc., 1999: Groundwater Investigation Report –Performance Assessment of the Off-Site Containment Well, Sparton Technology, Inc. Report prepared for Sparton Technology, Inc., August 6, 1999.

S. S. Papadopulos & Associates, Inc., 2000a: Work Plan for the Off-Site Containment System. Attachment C to the Consent Decree. City of Albuquerque and The Board of County Commissioners of the County of Bernalillo, plaintiffs, v. Sparton Technology, Inc., defendant. Civil Action No. CIV 97 0206, U.S. District Court for the District of New Mexico, filed March 3, 2000.

S. S. Papadopulos & Associates, Inc., 2000b: Work Plan for the Assessment of Aquifer Restoration. Attachment D to the Consent Decree. City of Albuquerque and The Board of County Commissioners of the County of Bernalillo, plaintiffs, v. Sparton Technology, Inc., defendant. Civil Action No. CIV 97 0206, U.S. District Court for the District of New Mexico, filed March 3, 2000.

S. S. Papadopulos & Associates, Inc., 2000c: Work Plan for the Installation of a Source Containment System. Attachment F to the Consent Decree. City of Albuquerque and The Board of County Commissioners of the County of Bernalillo, plaintiffs, v. Sparton Technology, Inc., defendant. Civil Action No. CIV 97 0206, U.S. District Court for the District of New Mexico, filed March 3, 2000.

S. S. Papadopulos & Associates, Inc., 2001a: Sparton Technology, Inc., Coors Road Plant Remedial Program, 1999 Annual Report. Report prepared for Sparton Technology, Inc. in association with Metric Corporation and Pierce L. Chandler, Jr., Original issue: June 1, 2000; Modified issue: February 9, 2001.

S. S. Papadopulos & Associates, Inc., 2001b: Sparton Technology, Inc., Former Coors Road Plant Remedial Program, 2000 Annual Report. Report prepared for Sparton Technology, Inc. in association with Metric Corporation: May 17, 2001.

S. S. Papadopulos & Associates, Inc. and Metric Corporation, 2001: Sparton Technology, Inc., Former Coors Road Plant Remedial Program, Work Plan for Testing and Replacing Monitoring Well MW-71. Prepared for Sparton Technology, Inc., May 24, 2001.

S. S. Papadopulos & Associates, Inc. and Metric Corporation, 2002: Sparton Technology, Inc., Former Coors Road Plant Remedial Program, Results of Investigation Conducted in

Monitoring Well MW-71. Report prepared for Sparton Technology, Inc., January 9, 2002.

U.S. Environmental Protection Agency, 1996: Soil Screening Guidance: Technical Background Document, Office of Solid Waste and Emergency Response, EPA/540/R-95/128.

Vogel, T.M., and P.L. McCarty, 1987: Abiotic and Biotic Transformations of 1,1,1-Trichloroethane under Methanogenic Conditions, Environmental Science and Technology, Vol. 21, pp. 1208-1213.

Zheng, C. and S.S. Papadopulos & Associates, Inc., 1999: MT3D99, A Modular, Three-Dimensional Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems, S.S. Papadopulos & Associates, Inc., Bethesda, Maryland.

Zheng, C., 1991: PATH3D, A Groundwater and Travel-Time Simulator, Version 3.2, S.S. Papadopulos & Associates, Inc., Bethesda, Maryland.

FIGURES

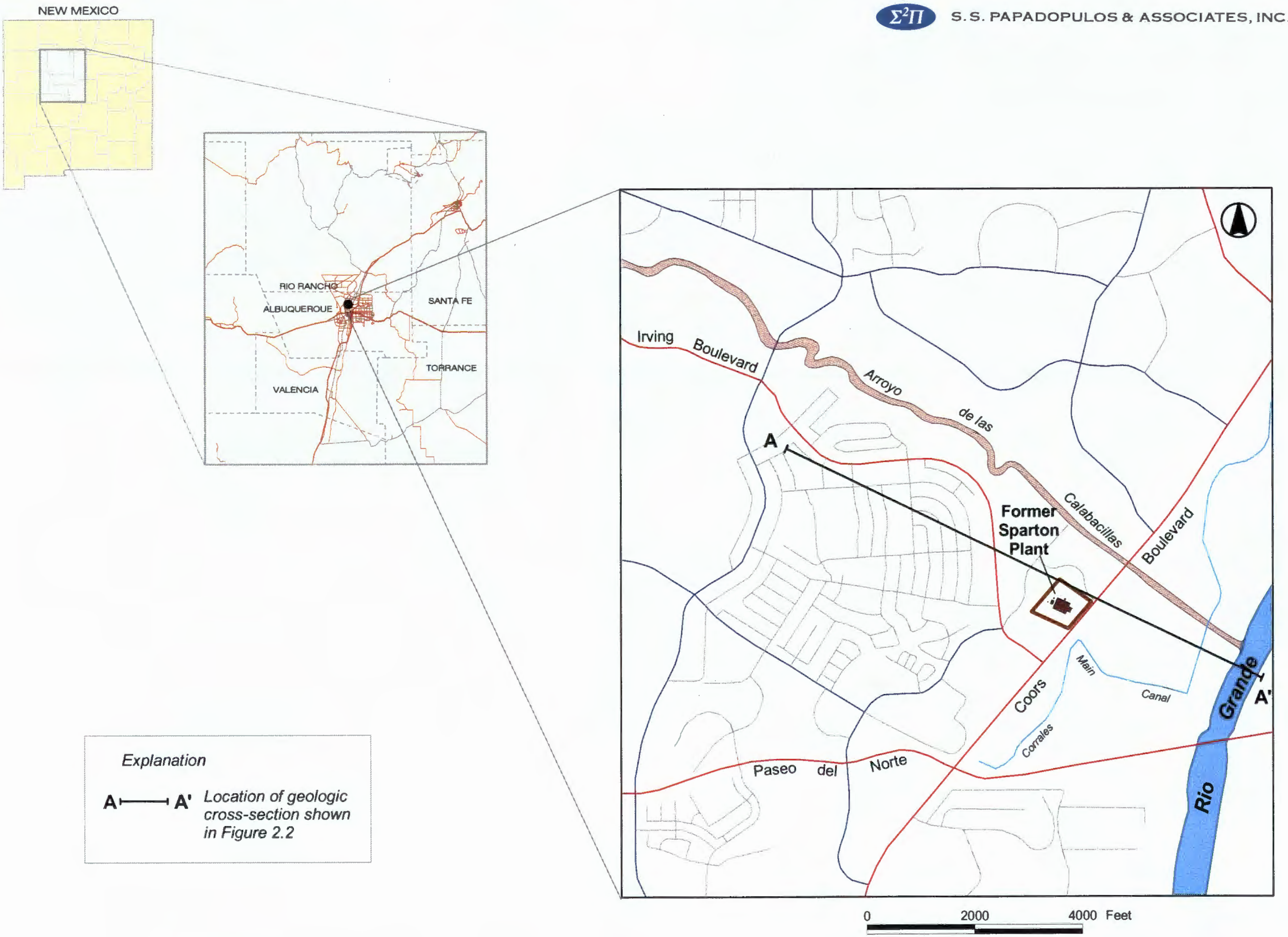


Figure 1.1 Location of the Former Sparton Coors Road Plant

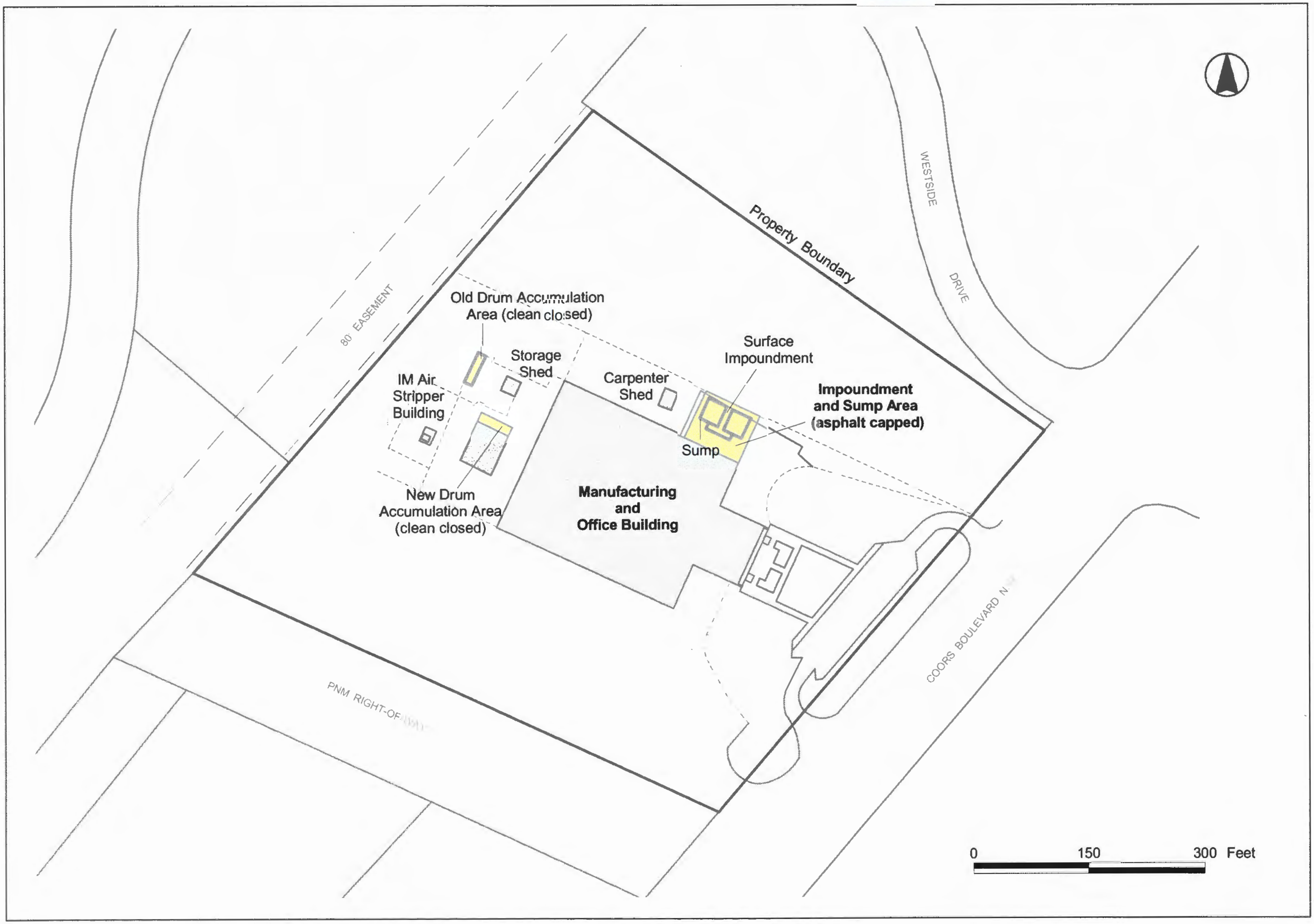
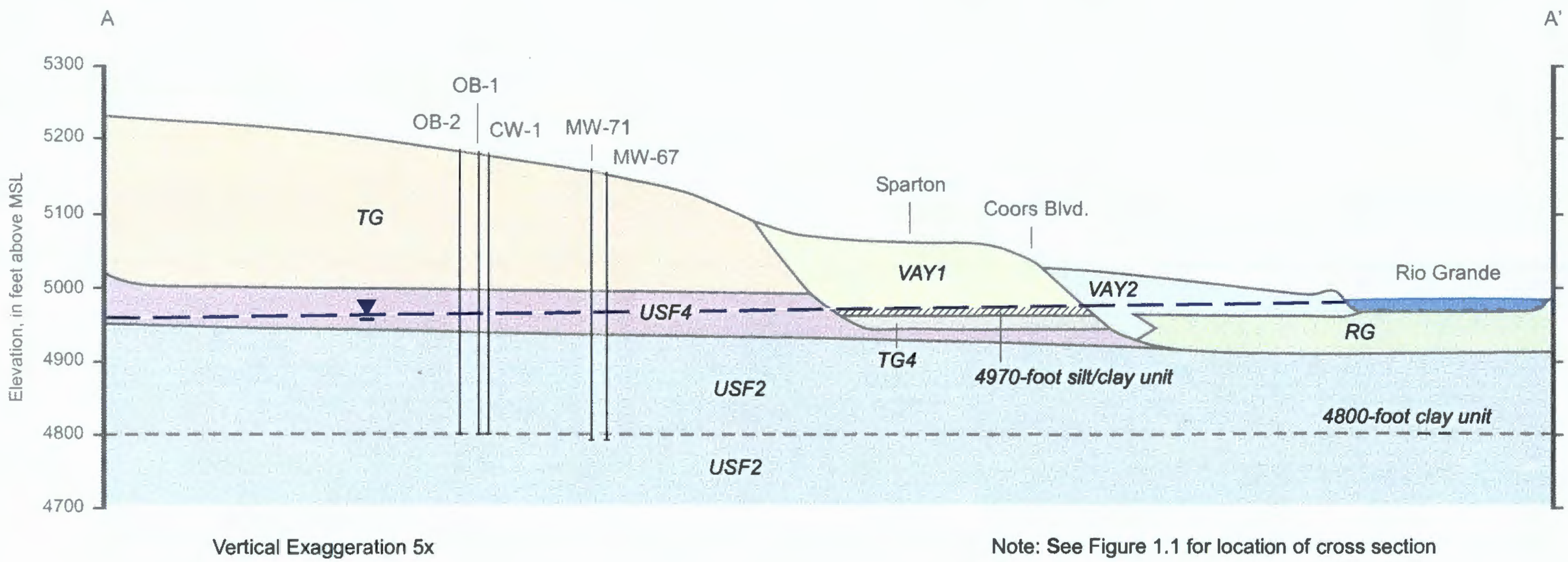


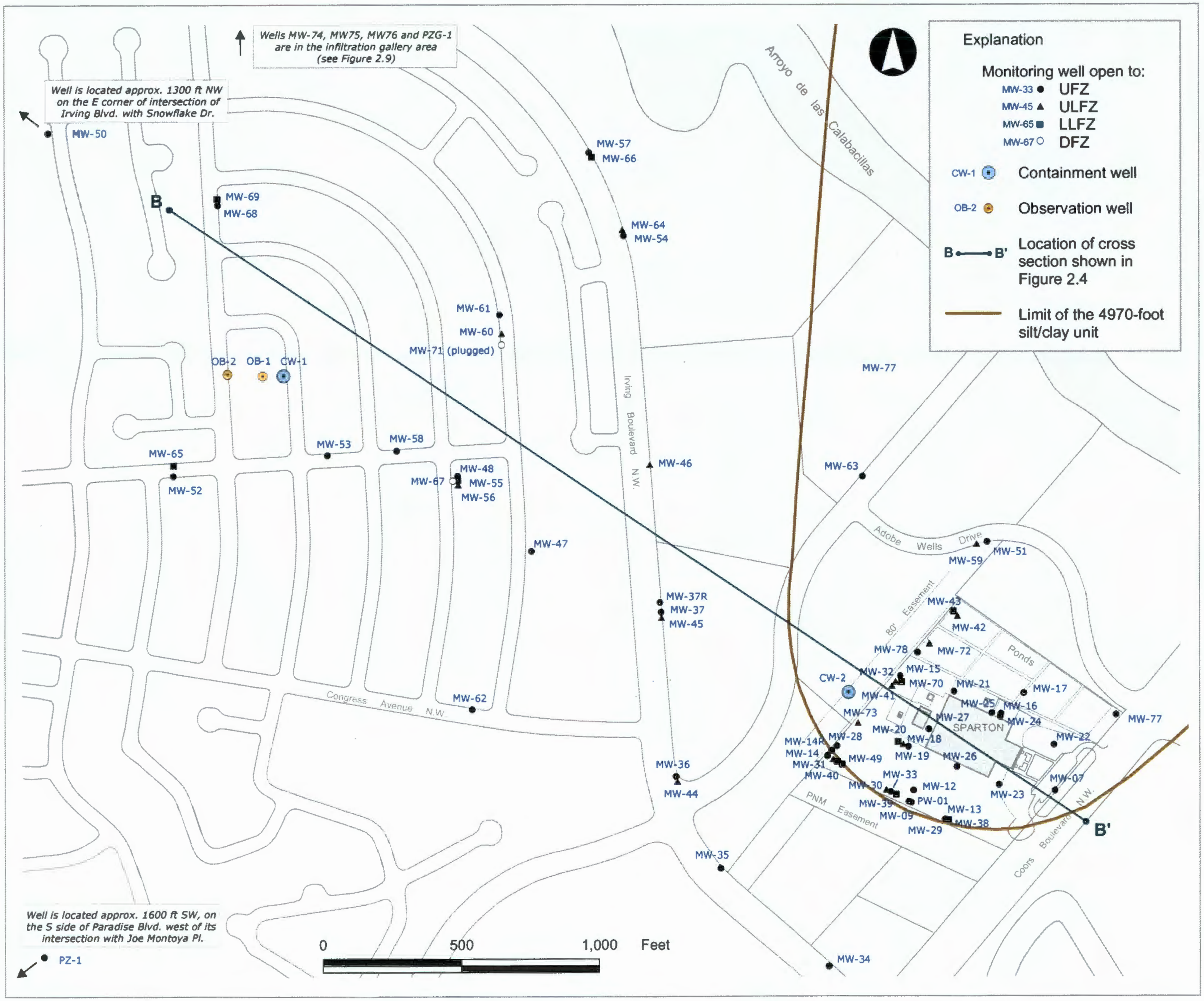
Figure 2.1 The Former Sparton Coors Road Plant



Explanation

RG	Holocene channel and flood plain deposits	*TG*	Middle Pleistocene undifferentiated deposits
VAY2	Holocene arroyo fan and terrace deposits	*USF4*	Pliocene Upper Santa Fe Group Western Basin fluvial facies
VAY1	Late Pleistocene arroyo fan and terrace deposits	*USF2*	Pliocene Upper Santa Fe Group Rio Grande facies
TG4	Late Pleistocene channel and flood plain deposits, upper portion is the 4970-foot silt/clay unit		

Figure 2.2 Geologic Cross Section Showing Shallow Deposits


Wells MW-74, MW75, MW76 and PZG-1 are in the infiltration gallery area (see Figure 2.9)
Well is located approx. 1300 ft NW on the E corner of intersection of Irving Blvd. with Snowflake Dr.
Well is located approx. 1600 ft SW, on the S side of Paradise Blvd. west of its intersection with Joe Montoya Pl.
Explanation
Monitoring well open to:
MW-33 UFZ
MW-45 ULFZ
MW-65 LLFZ
MW-67 DFZ
CW-1 Containment well
OB-2 Observation well
B B' Location of cross section shown in Figure 2.4
Limit of the 4970-foot silt/clay unit
Arroyo de las Calabacillas
Irving Boulevard N.W.
Congress Avenue N.W.
Adobe Wells Drive
80' Easement
Ponds
PNM Easement
Coors Boulevard N.W.
SPARTON
MW-50
MW-69
MW-68
MW-57
MW-66
MW-64
MW-54
MW-61
MW-60
MW-71 (plugged)
OB-2
OB-1
CW-1
MW-77
MW-65
MW-52
MW-53
MW-58
MW-48
MW-67
MW-55
MW-56
MW-46
MW-63
MW-47
MW-51
MW-59
MW-37R
MW-37
MW-45
MW-43
MW-42
MW-78
MW-72
MW-15
MW-32
MW-70
MW-21
MW-17
CW-2
MW-41
MW-25
MW-16
MW-73
MW-27
MW-24
MW-62
MW-20
MW-14R
MW-28
MW-18
MW-22
MW-14
MW-49
MW-19
MW-26
MW-31
MW-40
MW-33
MW-07
MW-36
MW-30
MW-12
MW-23
MW-44
MW-39
PW-01
MW-09
MW-13
MW-38
MW-29
MW-35
MW-34
PZ-1
B
B'
0
500
1,000
Feet

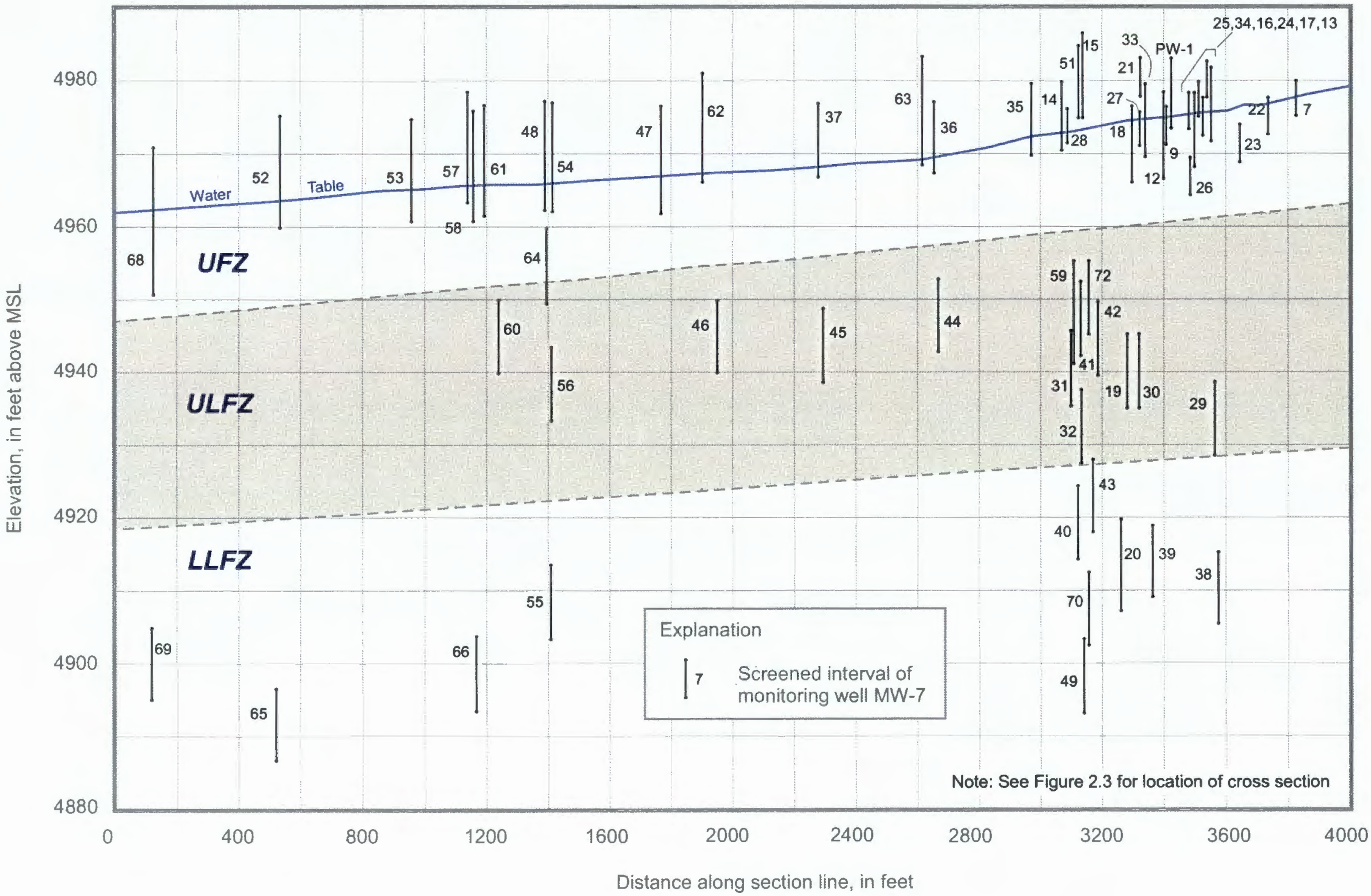


Figure 2.4 Screened Interval of Monitoring Wells and Relation to Flow Zones

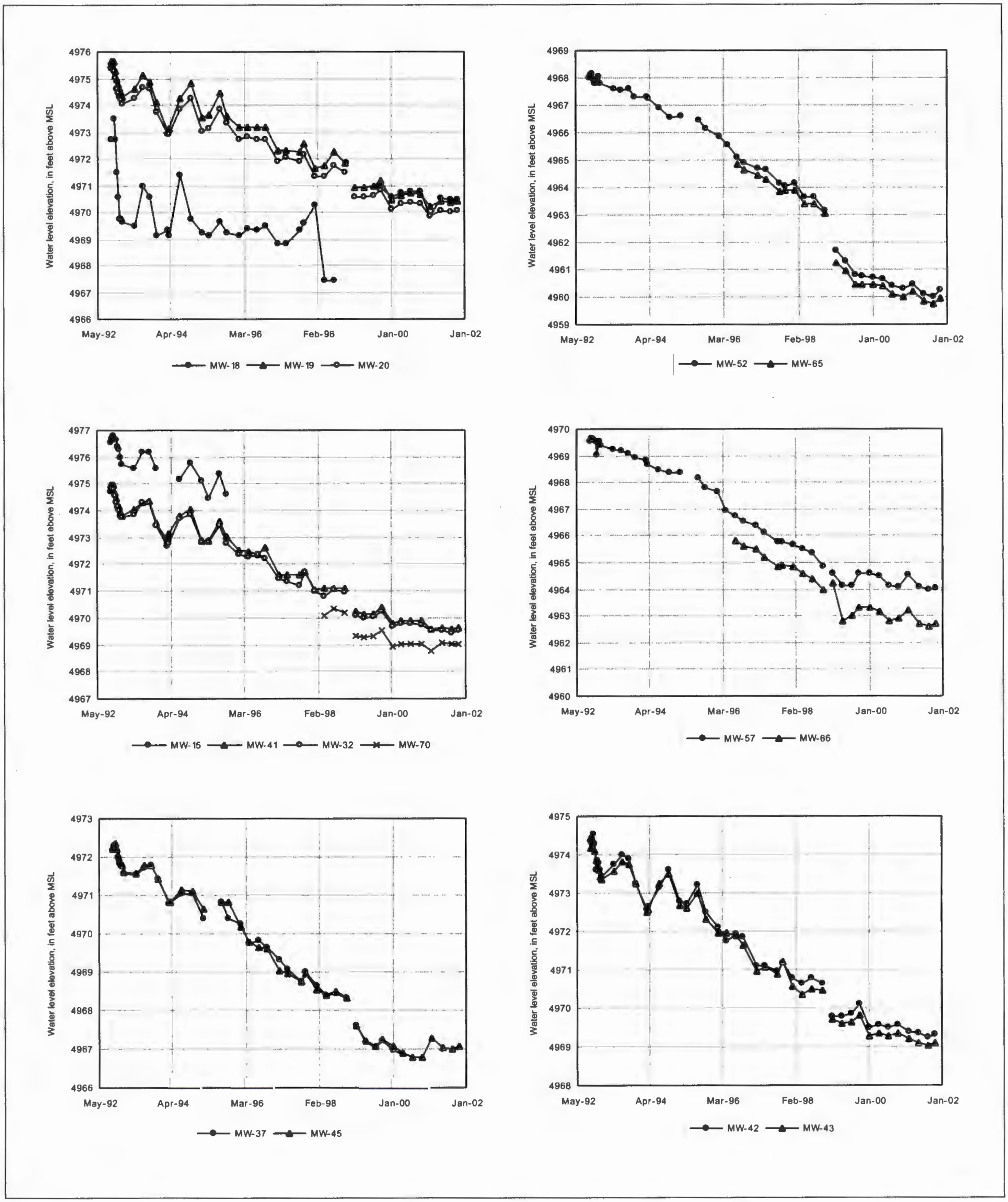
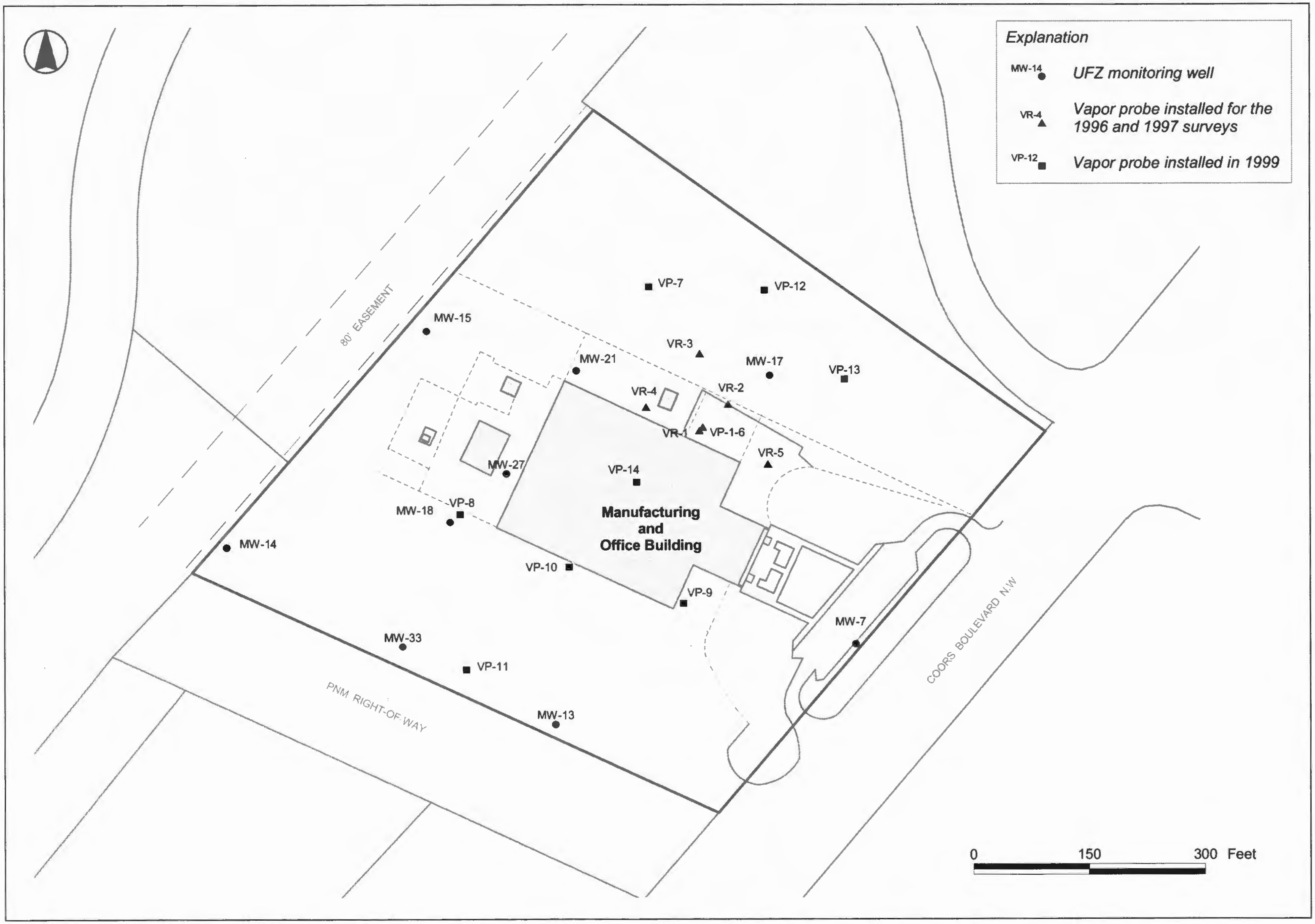
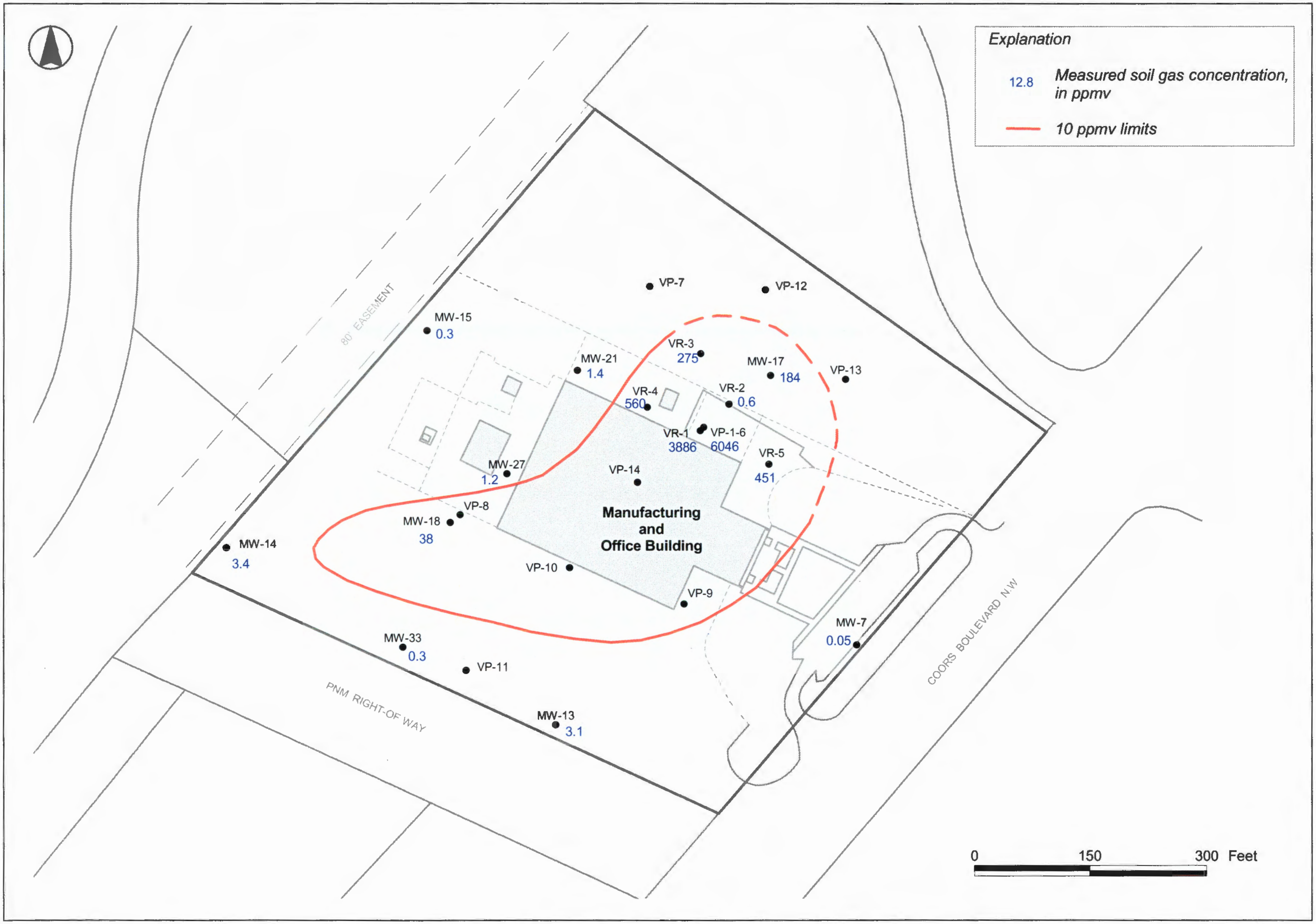


Figure 2.5 Monitoring Well Hydrographs



Explanation
MW-14
UFZ monitoring well
VR-4
Vapor probe installed for the 1996 and 1997 surveys
VP-12
Vapor probe installed in 1999
80' EASEMENT
MW-15
VP-7
VP-12
VR-3
MW-21
MW-17
VP-13
VR-4
VR-2
VR-1
VP-1-6
VR-5
MW-27
VP-14
Manufacturing and Office Building
MW-18
VP-8
MW-14
VP-10
VP-9
MW-7
COORS BOULEVARD N.W
MW-33
VP-11
PNM RIGHT-OF-WAY
MW-13
0
150
300 Feet

Σ²Π S. S. PAPADOPULOS & ASSOCIATES, INC.



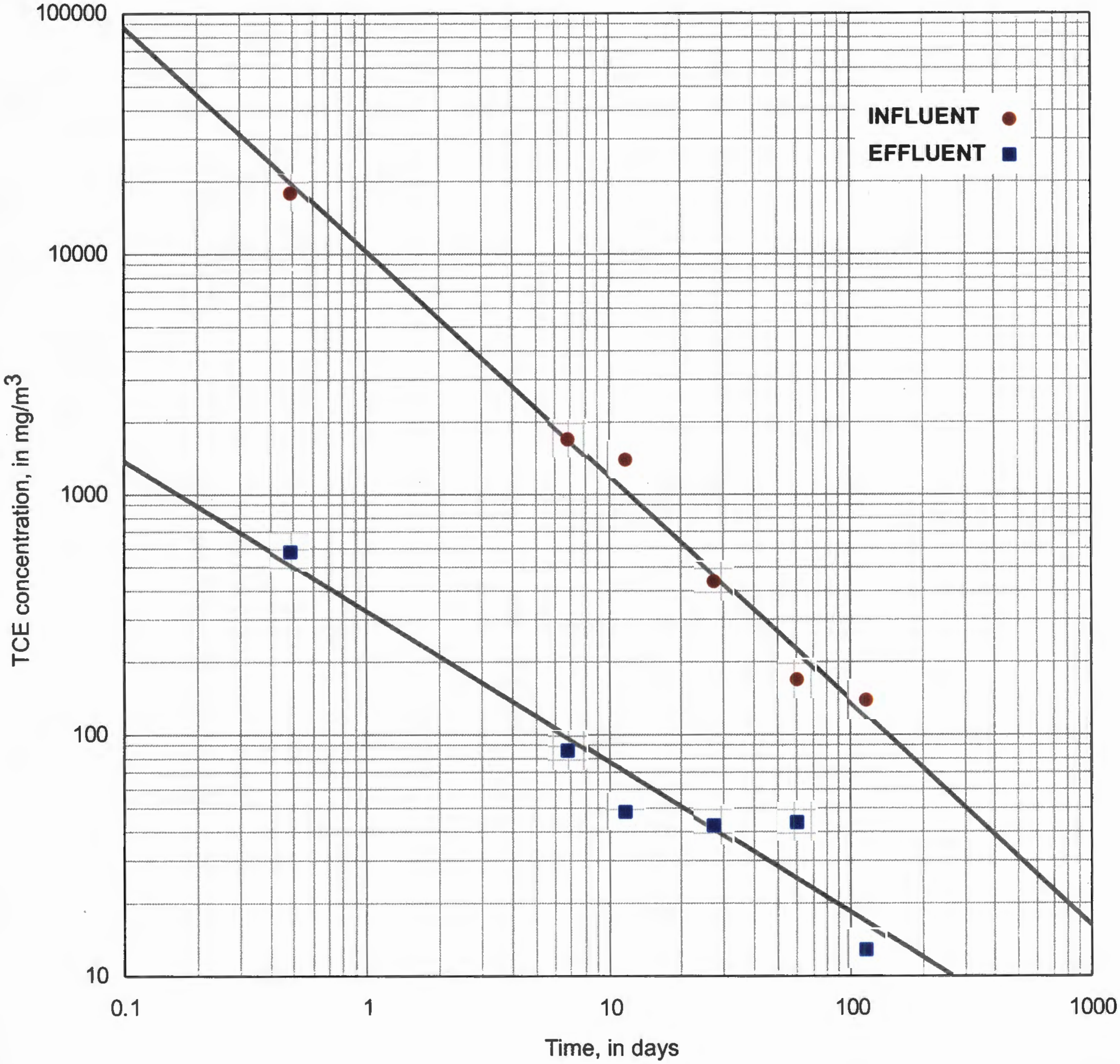


Figure 2.8 Influent and Effluent Concentrations - SVE Operation
April 8 - October 20, 1998

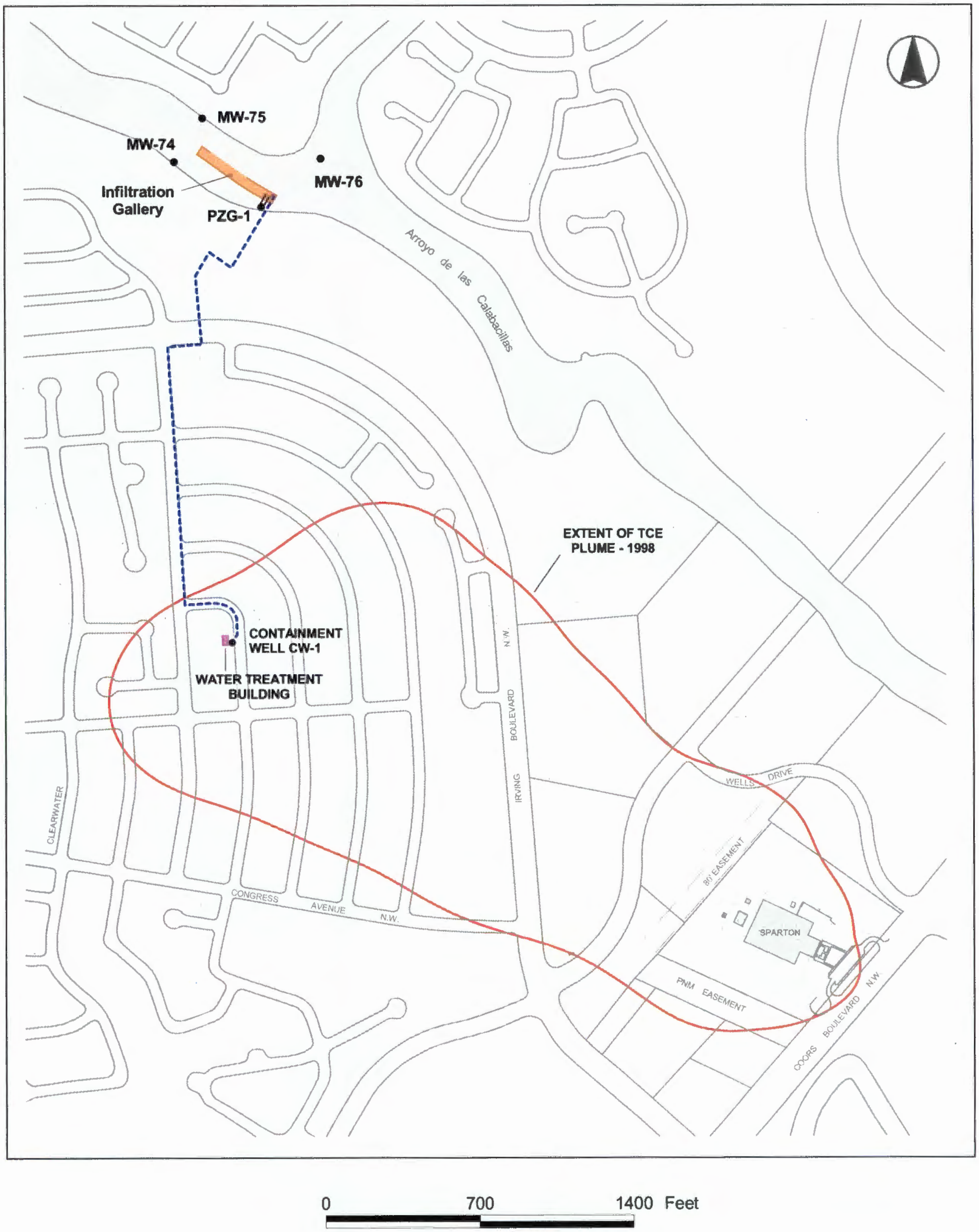


Figure 2.9 Layuout of the Off-Site Containment System Components

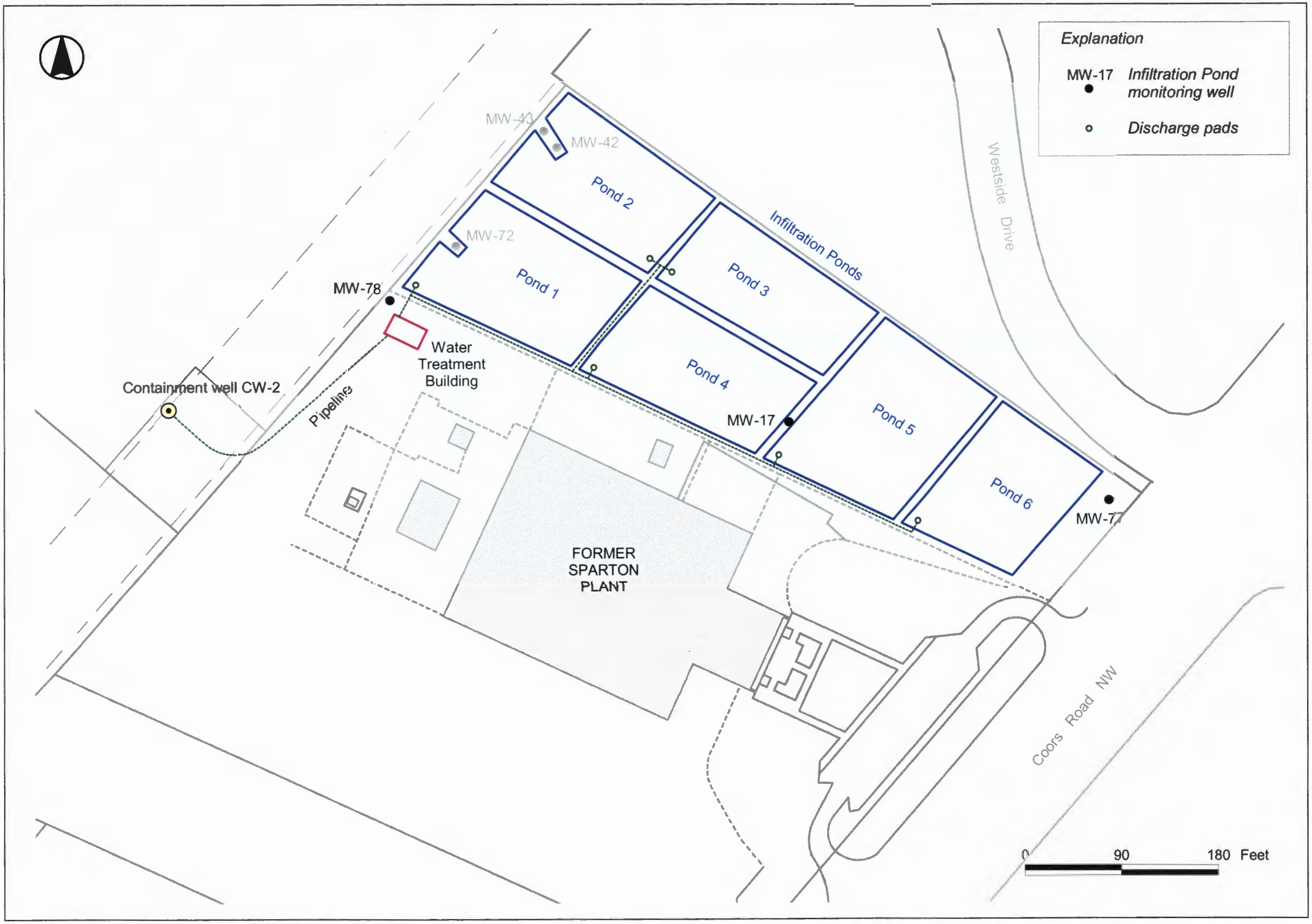


Figure 2.10 Layout of the Source Containment System Components

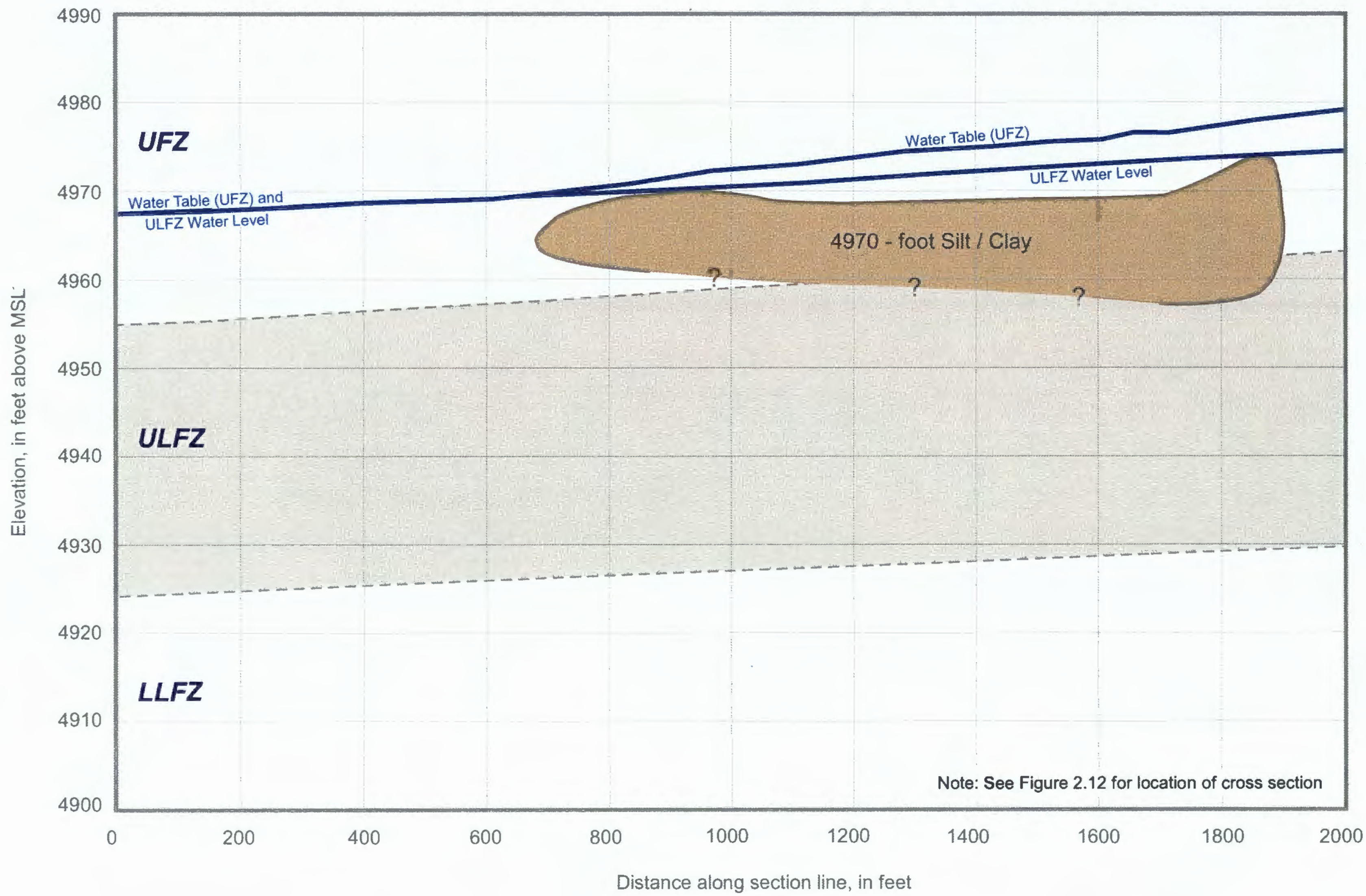


Figure 2.11 Schematic Cross-Section of the UFZ and ULFZ Water Levels

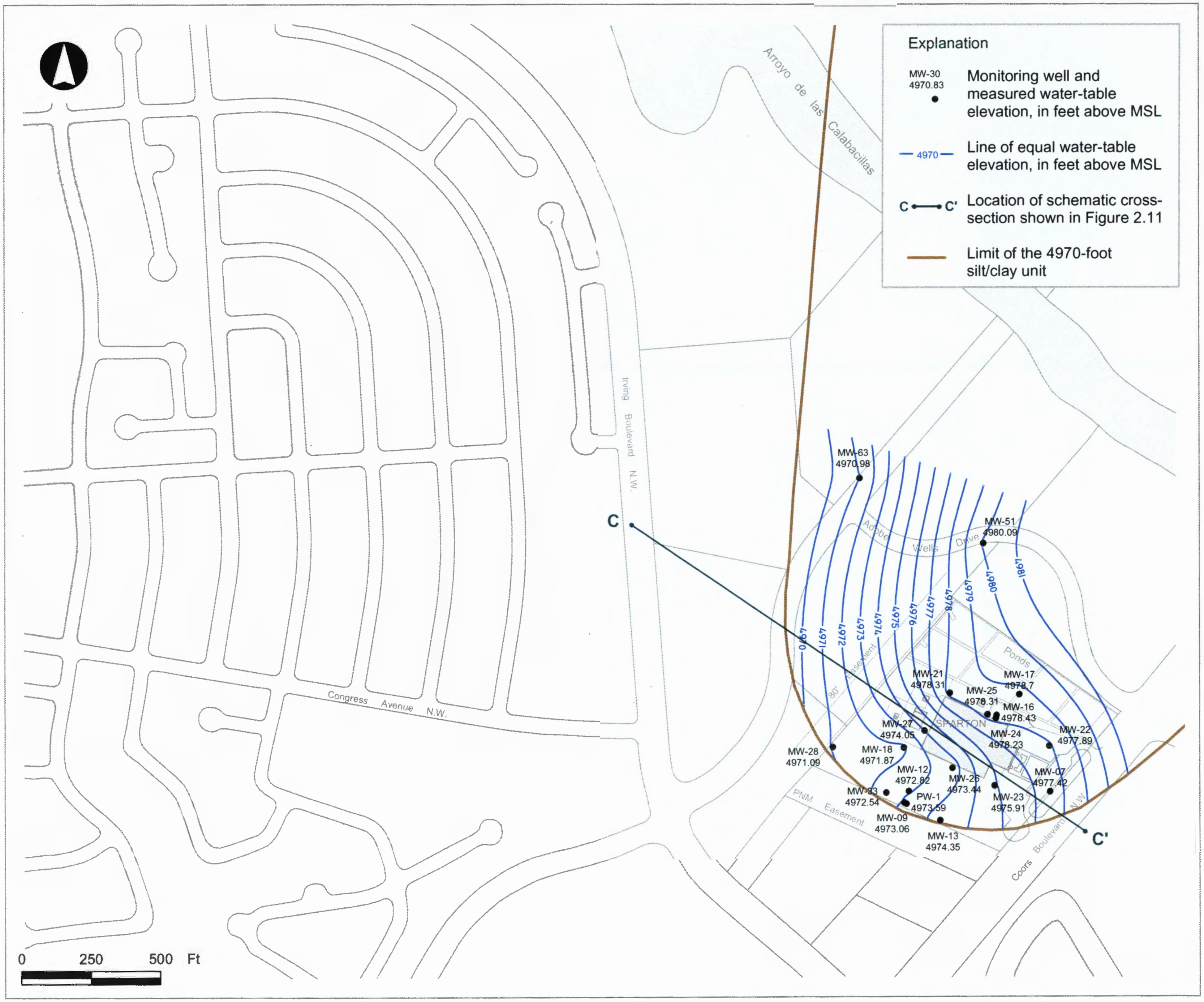


Figure 2.12 Elevation of the On-Site Water Table - November 1998

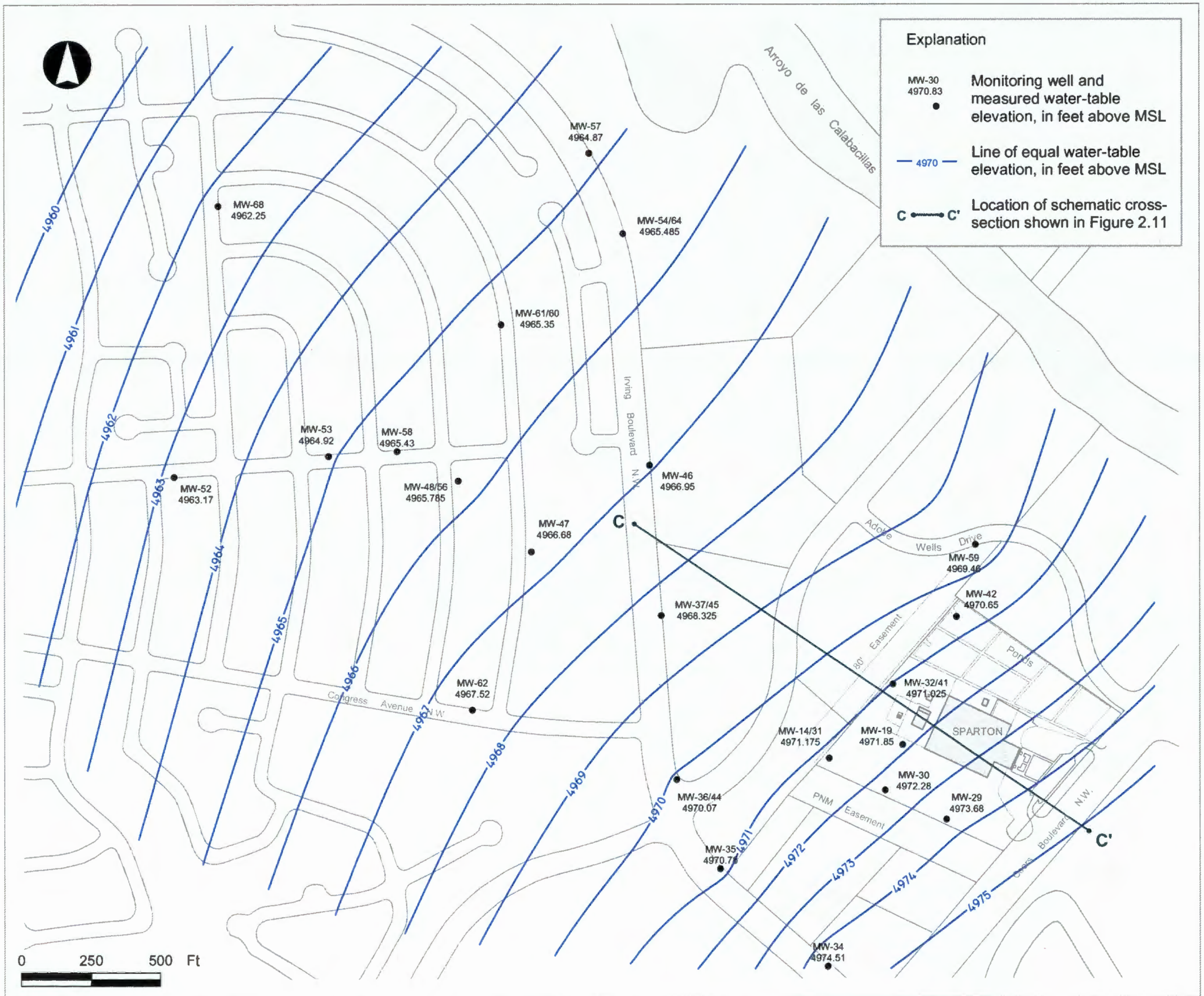
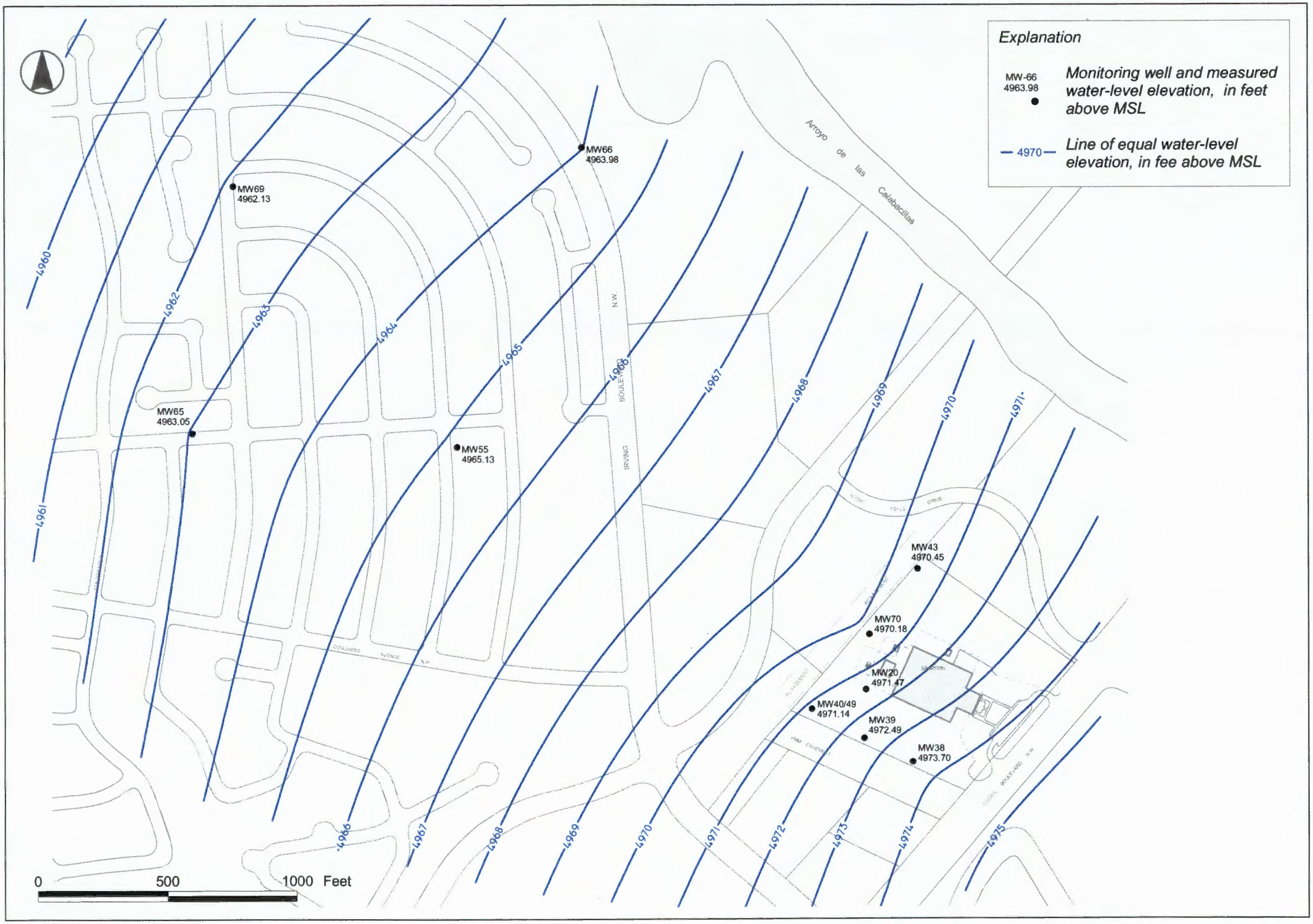


Figure 2.12 Elevation of the Water Levels in the UFZ/ULFZ, November, 1998


Explanation
MW-66
4963.98
Monitoring well and measured water-level elevation, in feet above MSL
4970
Line of equal water-level elevation, in fee above MSL
Arroyo de las Calabacillas
MW66
4963.98
MW69
4962.13
MW65
4963.05
MW55
4965.13
MW43
4970.45
MW70
4970.18
MW20
4971.47
MW40/49
4971.14
MW39
4972.49
MW38
4973.70
IRVING BOULEVARD N.W.
4960
4961
4962
4963
4964
4965
4966
4967
4968
4969
4970
4971
4972
4973
4974
4975
0
500
1000 Feet

S. S. PAPADOPULOS & ASSOCIATES, INC.

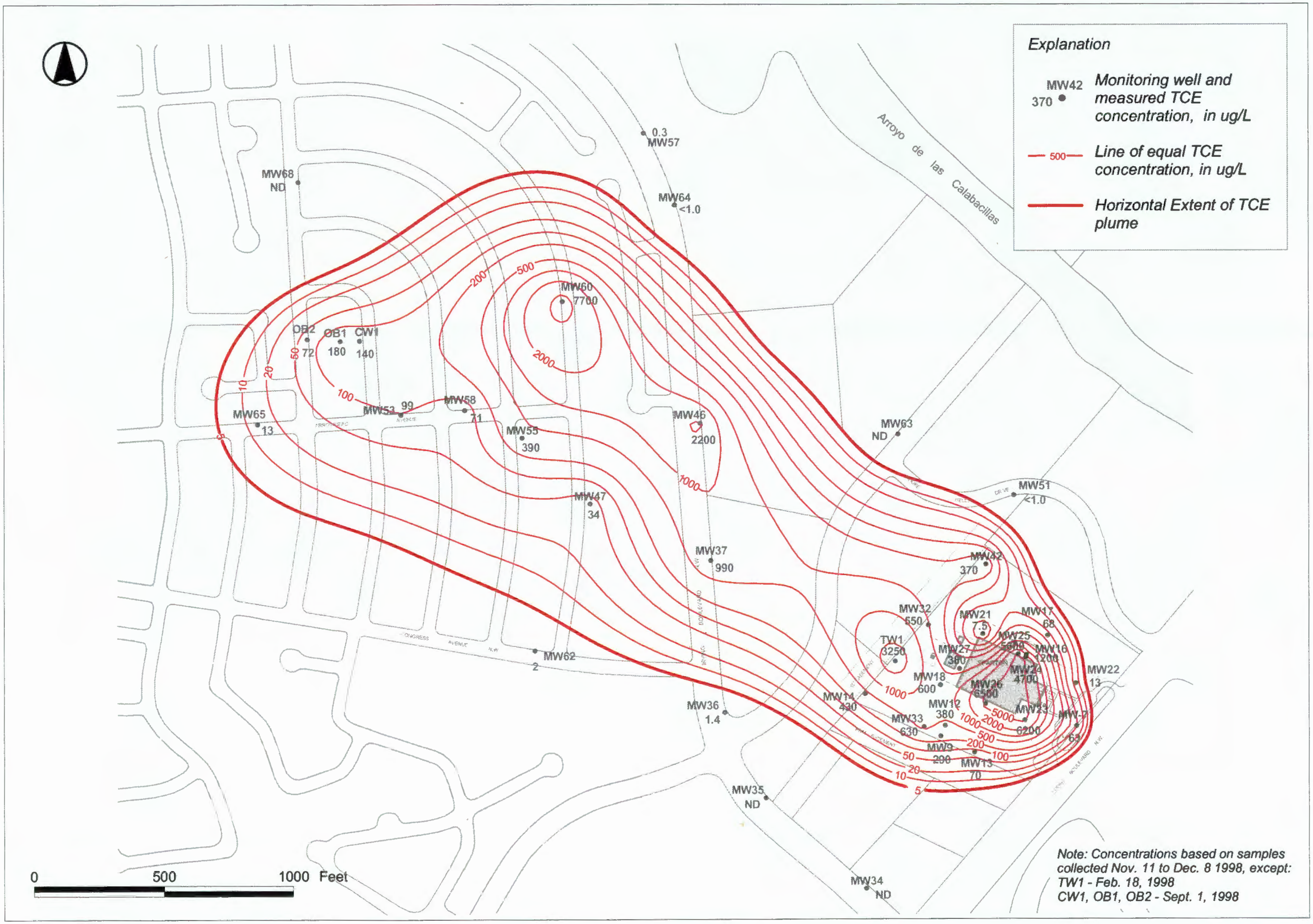


Figure 2.15 Horizontal Extent of TCE Plume - November 1998

S.S. PAPADOPULOS & ASSOCIATES, INC.

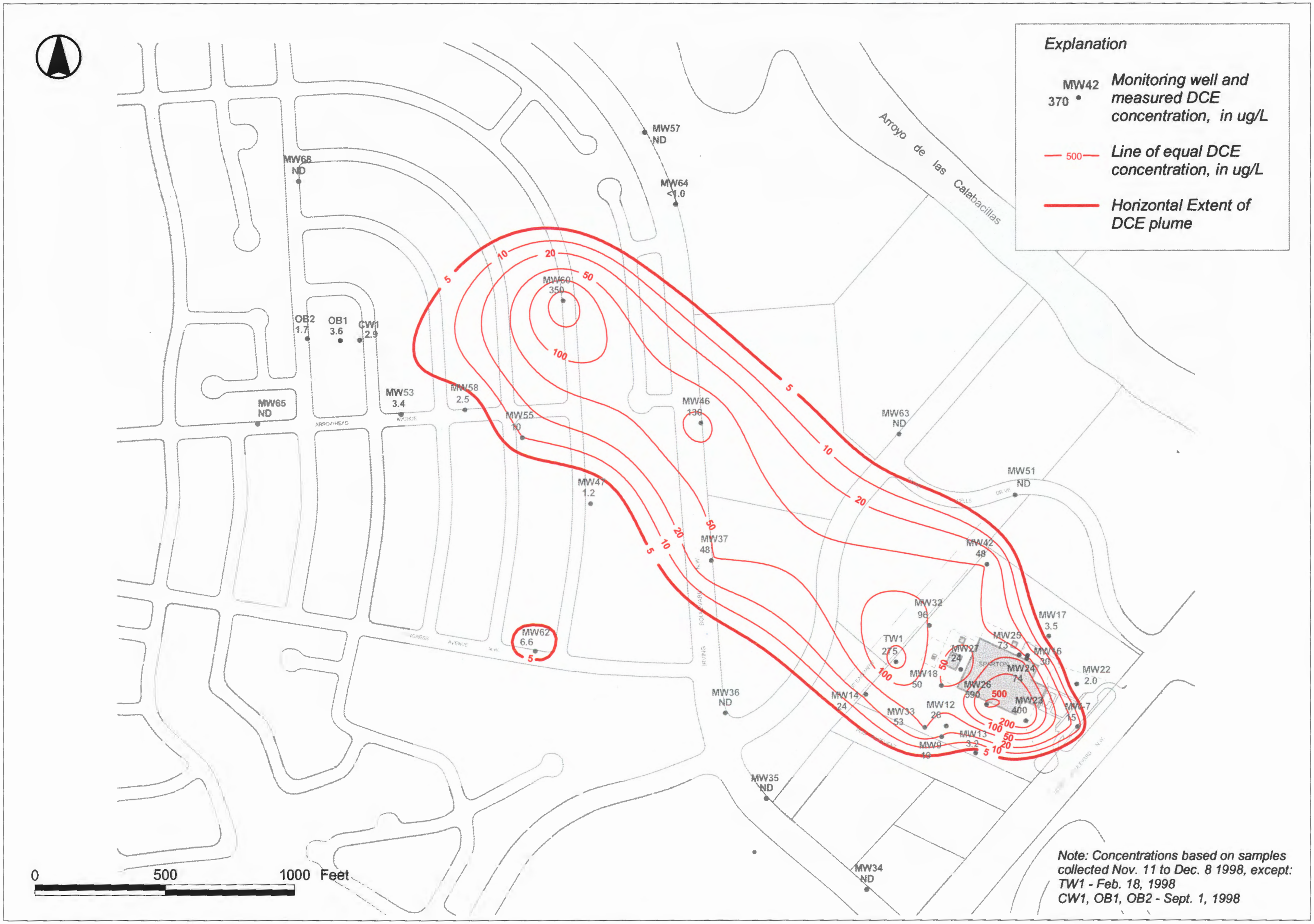


Figure 2.16 Horizontal Extent of DCE Plume - November 1998

Figure 2.17 Horizontal Extent of TCA Plume - November 1998

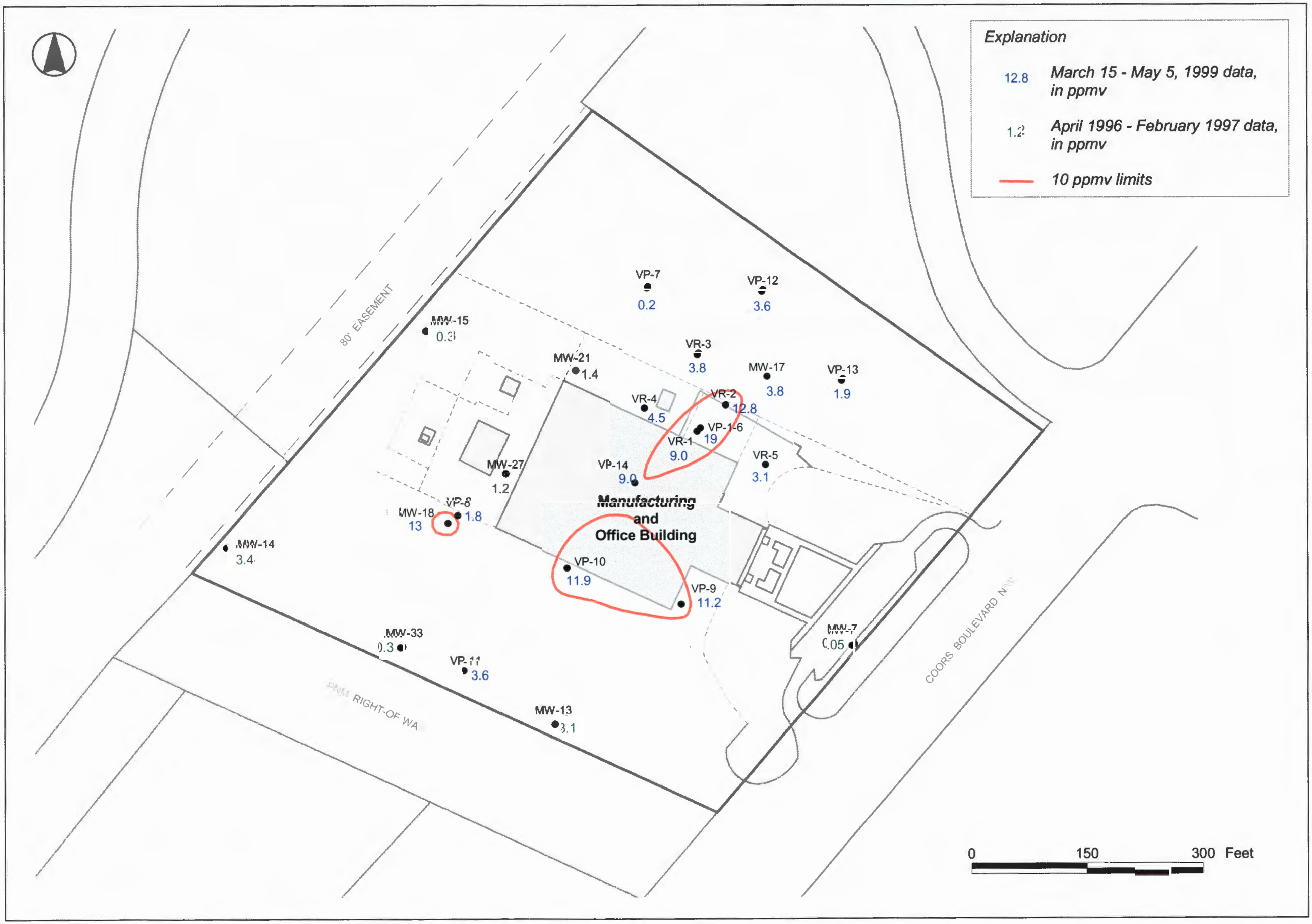


Figure 2.18 TCE Soil Gas Concentrations Prior to the 1999 Resumption of SVE System Operations

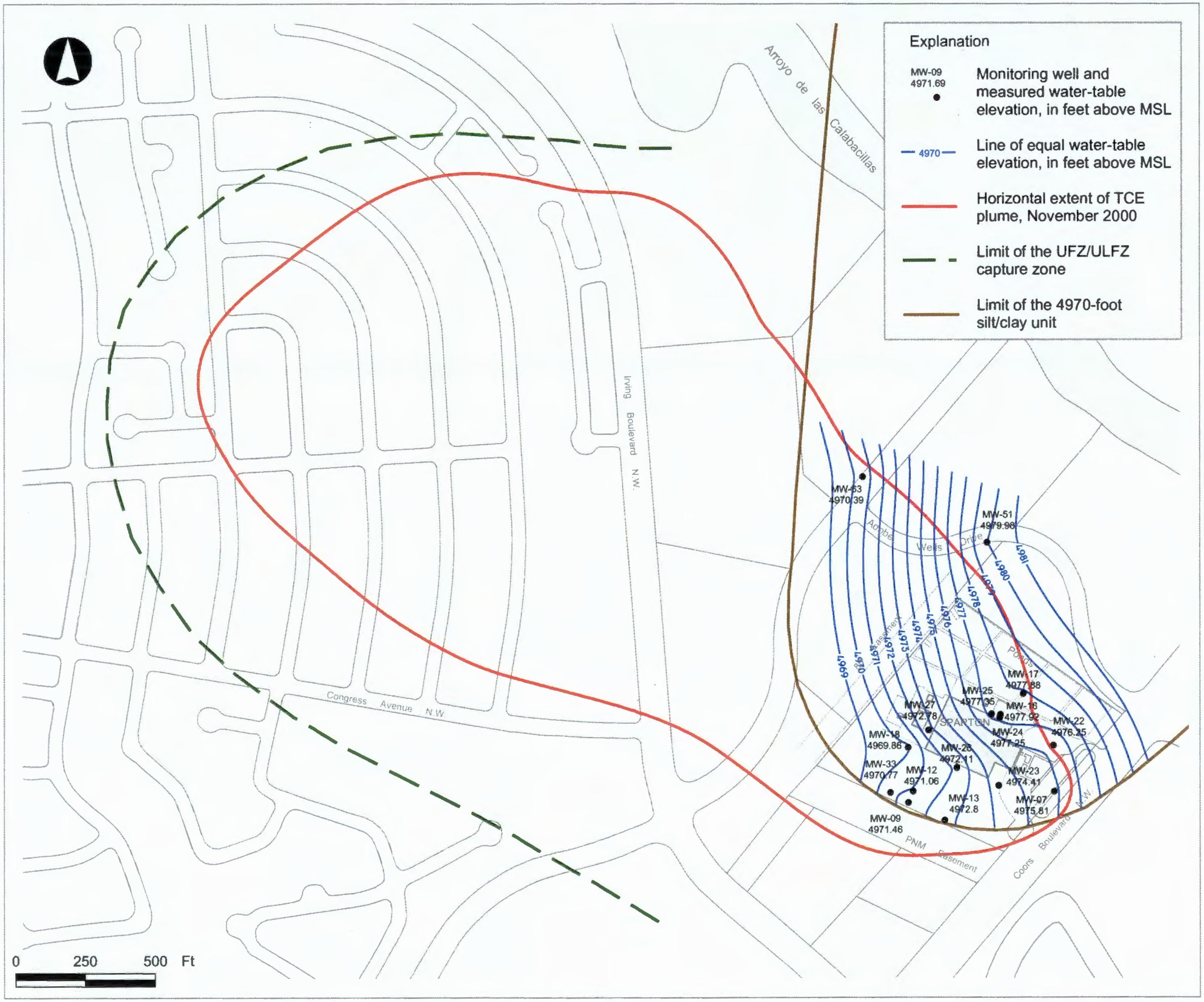


Figure 5.1 Elevation of the On-Site Water Table - February 13, 2001

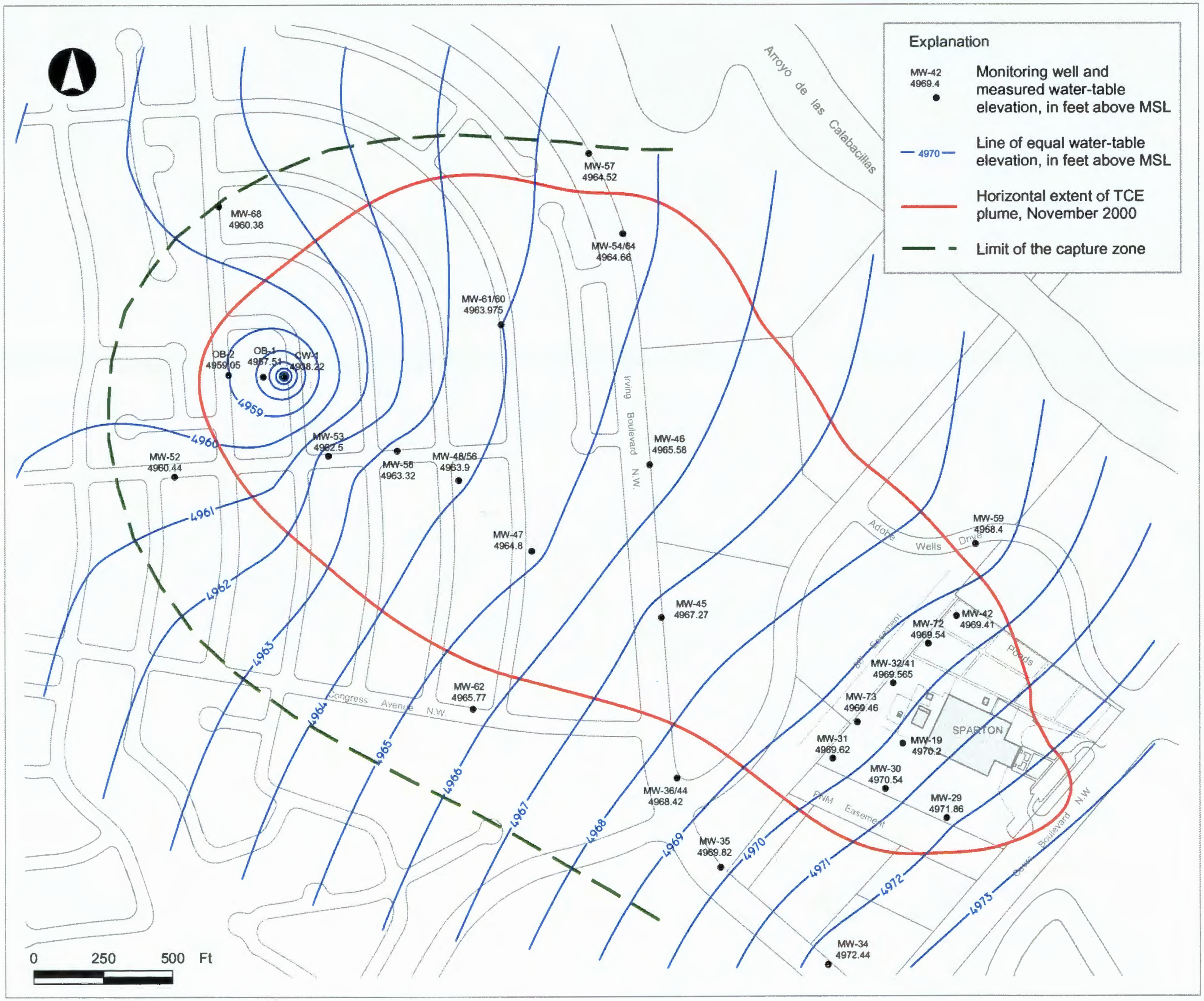
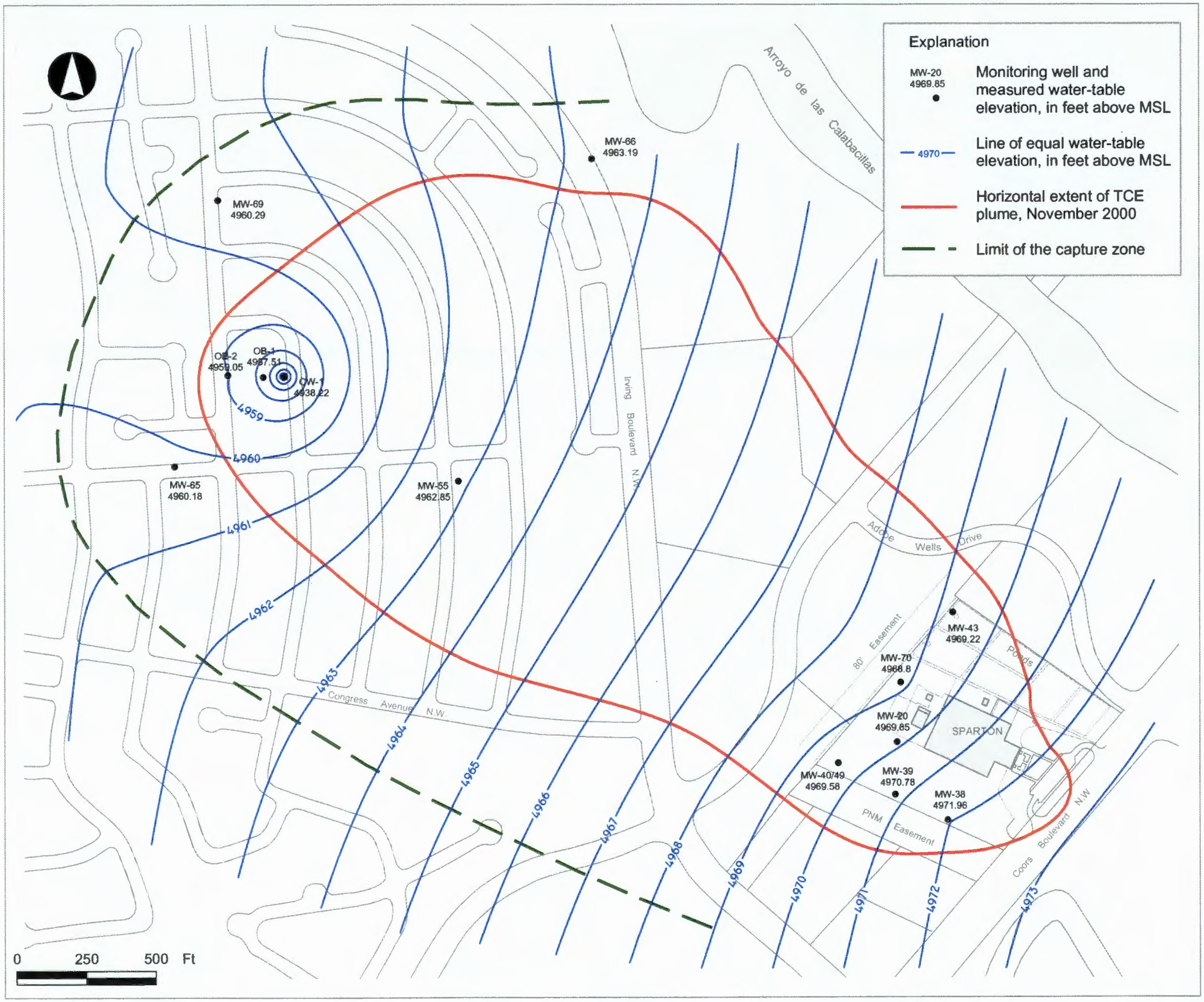
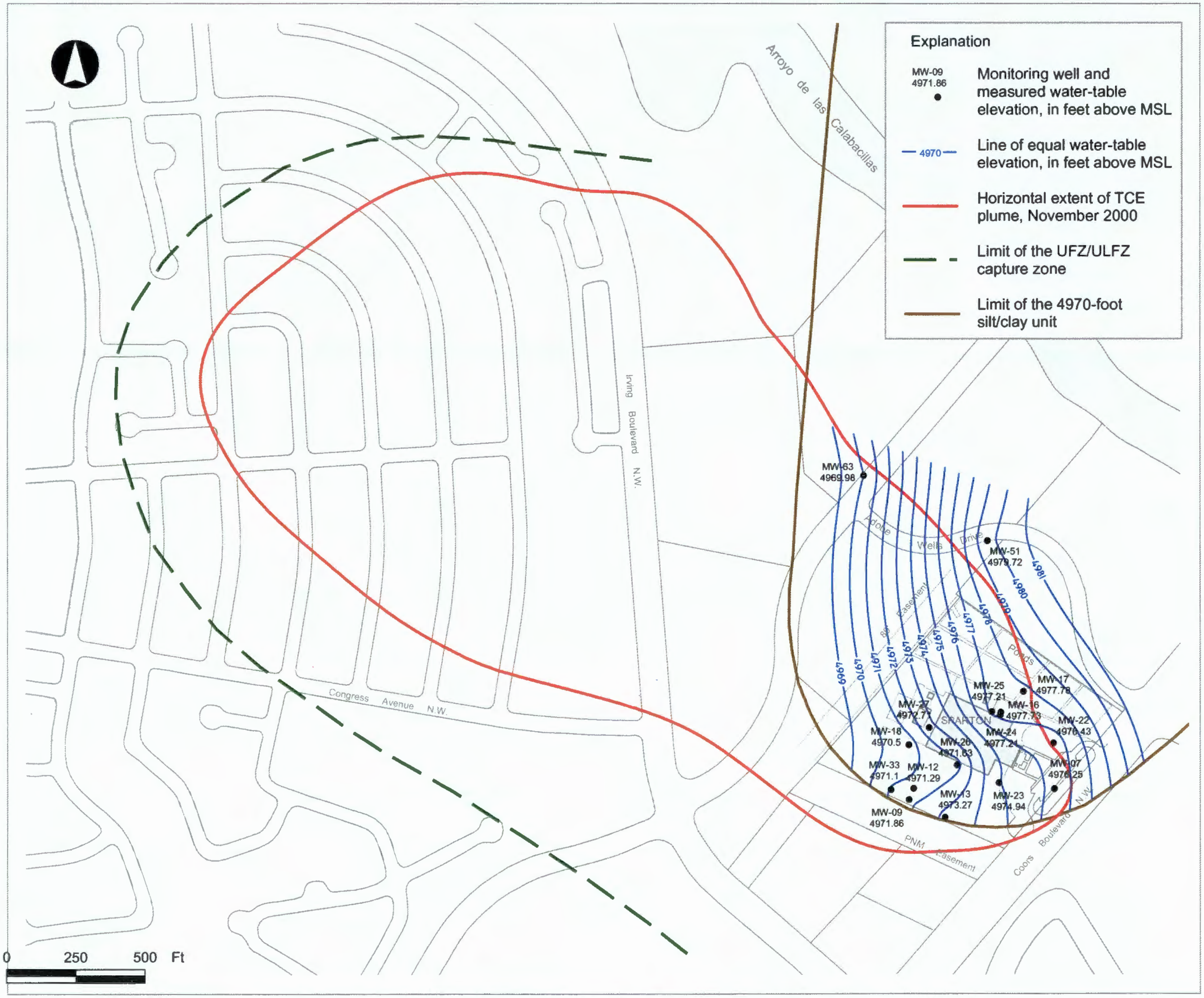
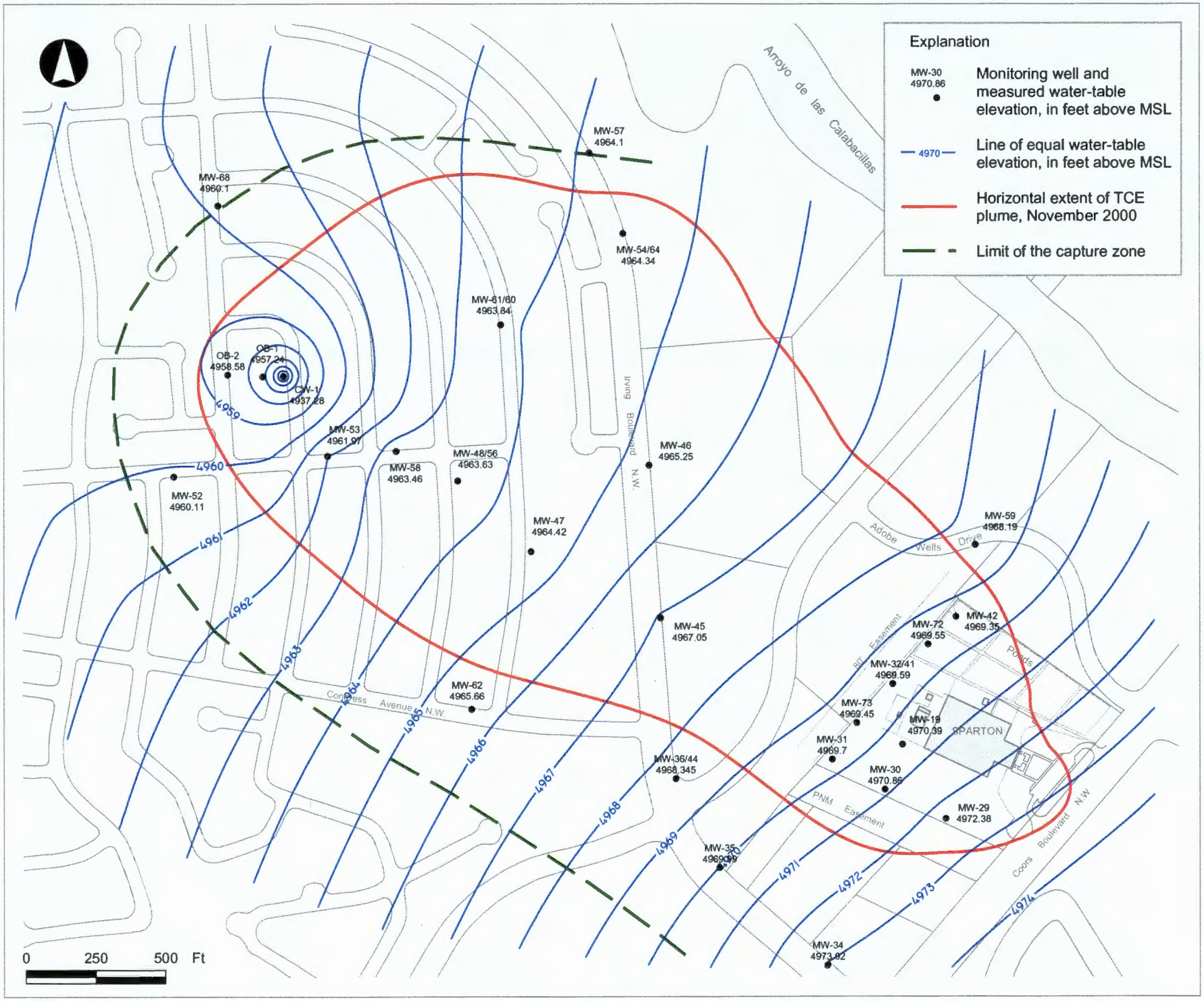


Figure 5.2 Elevation of the Water Levels in the UFZ/ULFZ and the Capture Zone of the Off-Site Containment Well, February 13, 2001


Explanation
MW-20
4969.85
Monitoring well and measured water-table elevation, in feet above MSL
4970
Line of equal water-table elevation, in feet above MSL
Horizontal extent of TCE plume, November 2000
Limit of the capture zone
MW-66
4963.19
MW-69
4960.29
OB-2
4959.05
OB-1
4957.51
CW-1
4938.22
MW-65
4960.18
MW-55
4962.85
MW-43
4969.22
MW-70
4968.8
MW-20
4969.85
MW-40/49
4969.58
MW-39
4970.78
MW-38
4971.96
4959
4960
4961
4962
4963
4964
4965
4966
4967
4968
4969
4970
4971
4972
4973
Arroyo de las Calabacillas
Irving Boulevard N.W.
Congress Avenue N.W.
Adobe Wells Drive
80' Easement
Ponds
SPARTON
PNM Easement
Coors Boulevard N.W.
0
250
500
Ft


Explanation
MW-09
4971.86
Monitoring well and measured water-table elevation, in feet above MSL
4970
Line of equal water-table elevation, in feet above MSL
Horizontal extent of TCE plume, November 2000
Limit of the UFZ/ULFZ capture zone
Limit of the 4970-foot silt/clay unit
Arroyo de las Calabacillas
Irving Boulevard N.W.
Congress Avenue N.W.
Adobe Wells Drive
85 Easement
Ponds
SPARTON
PNM Easement
Coors Boulevard N.W.
MW-63
4969.98
MW-51
4979.72
MW-25
4977.21
MW-17
4977.78
MW-16
4977.73
MW-27
4972.77
MW-24
4977.24
MW-22
4976.43
MW-18
4970.5
MW-26
4971.63
MW-07
4976.25
MW-33
4971.1
MW-12
4971.29
MW-13
4973.27
MW-23
4974.94
MW-09
4971.86
4969
4970
4971
4972
4973
4974
4975
4976
4977
4978
4979
4980
4981
0
250
500
Ft

S. S. PAPADOPULOS & ASSOCIATES, INC.



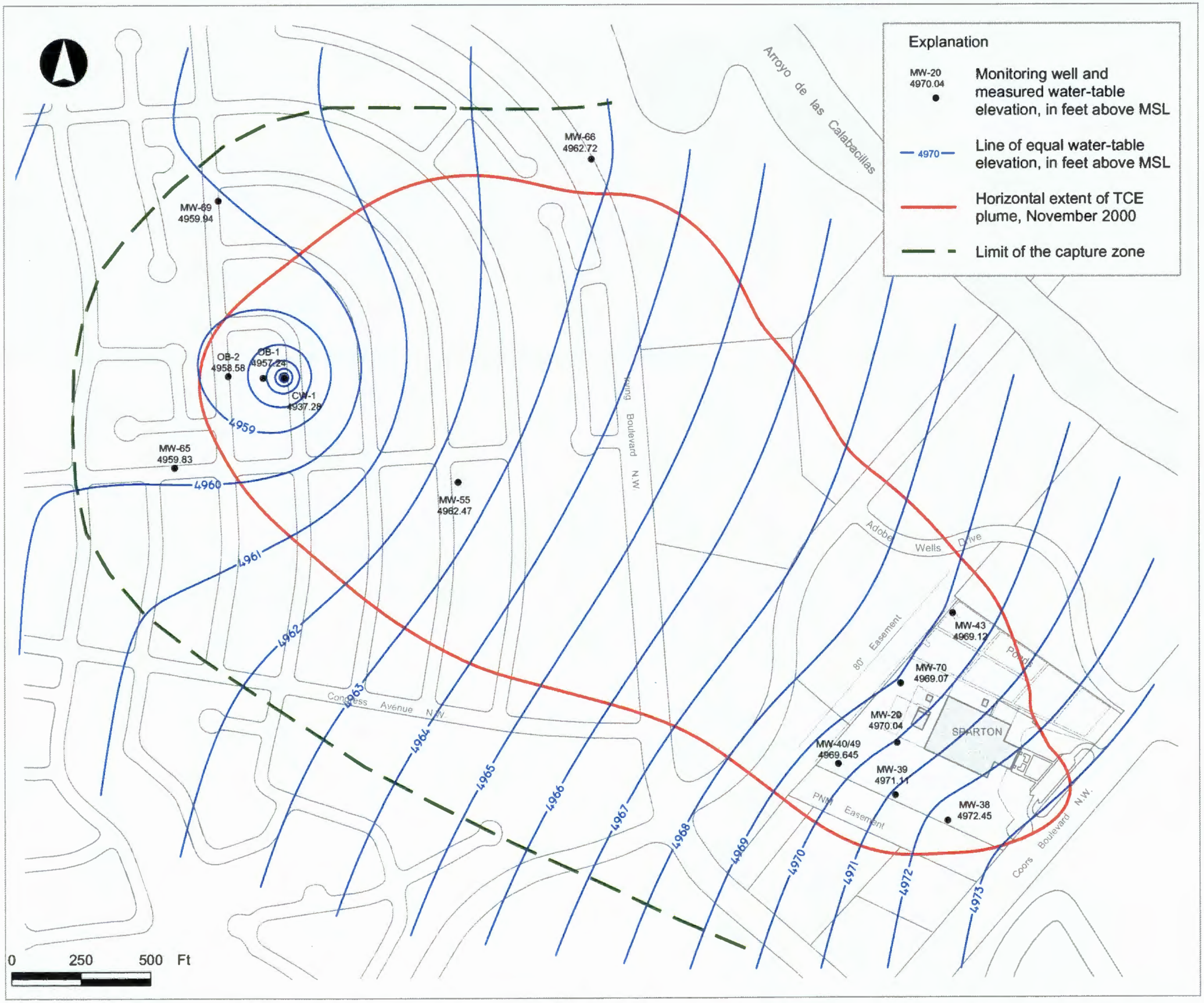


Figure 5.8. Elevation of the Water Levels in the ULFZ and the Capture Zone of the Off-Site Containment Wall, May 22, 2001

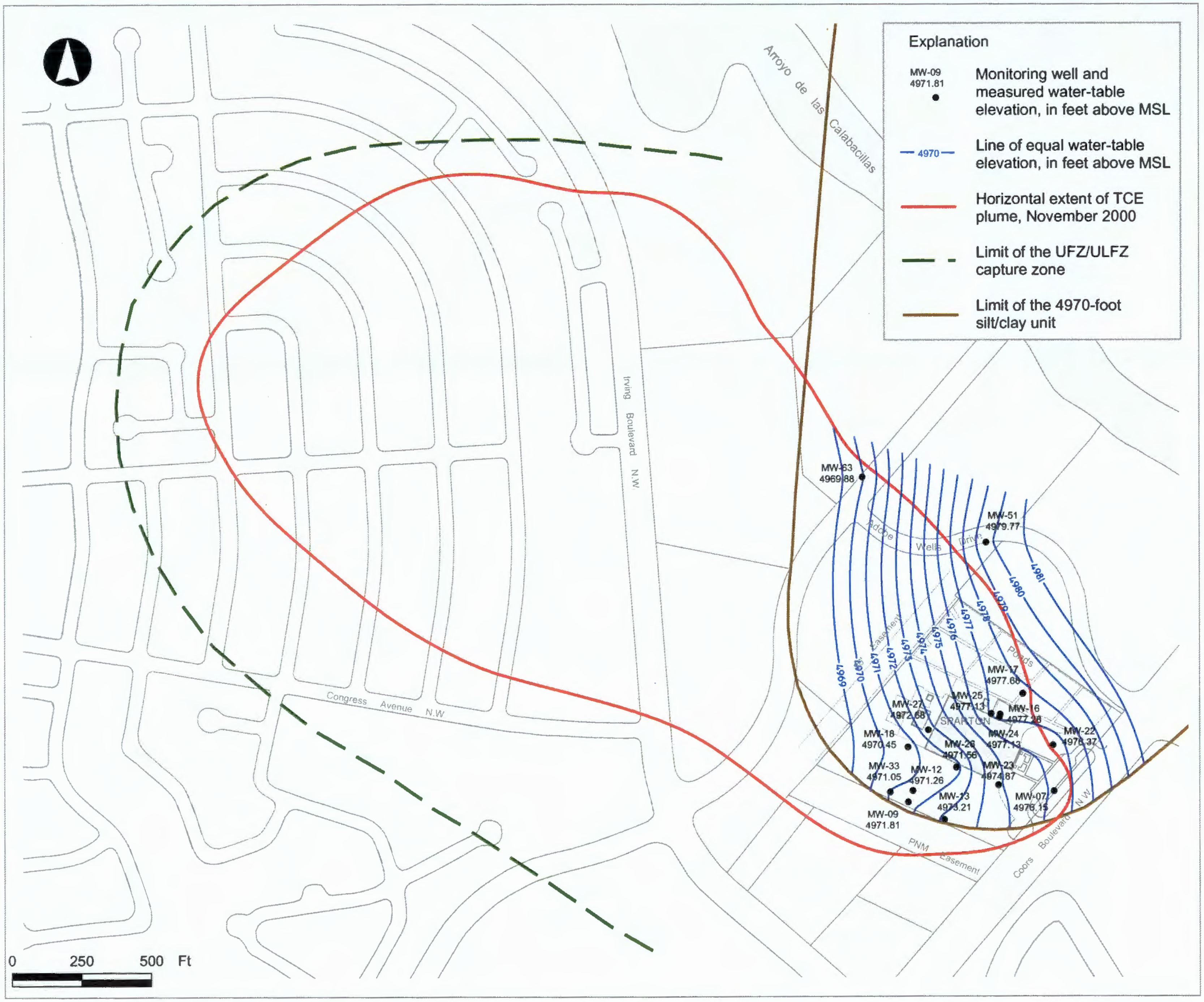


Figure 5.7 Elevation of the On-Site Water Table - August 27, 2001

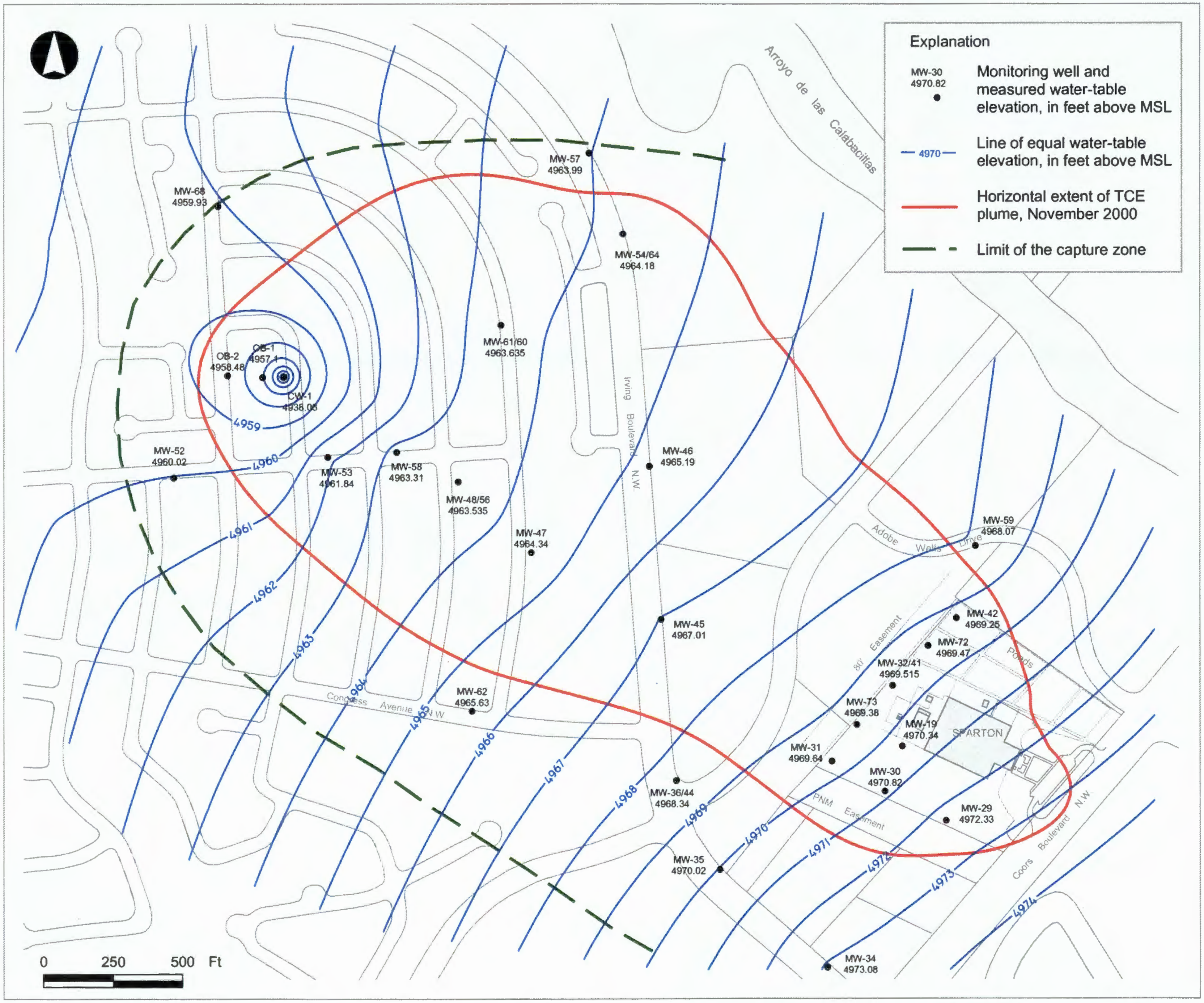
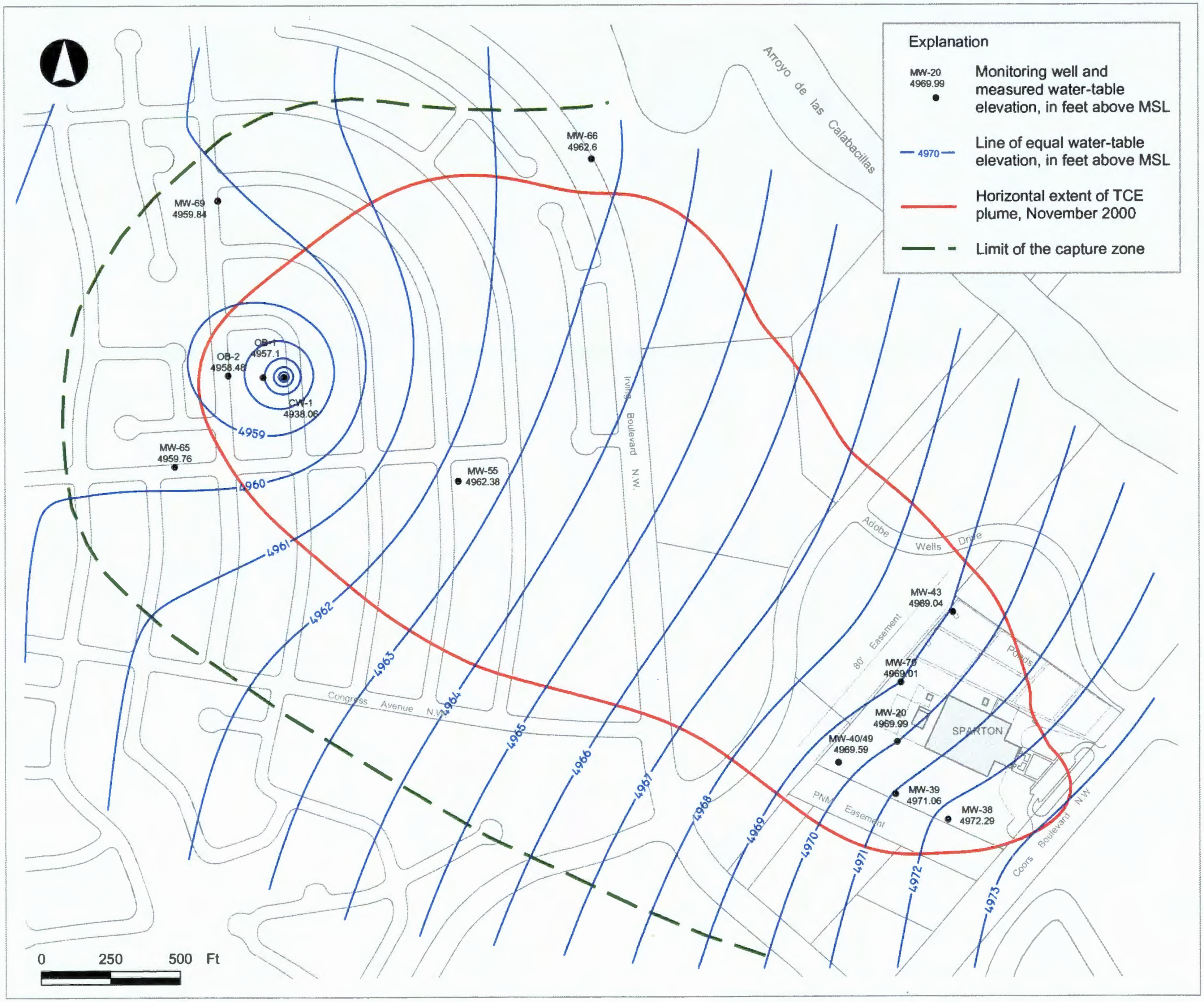
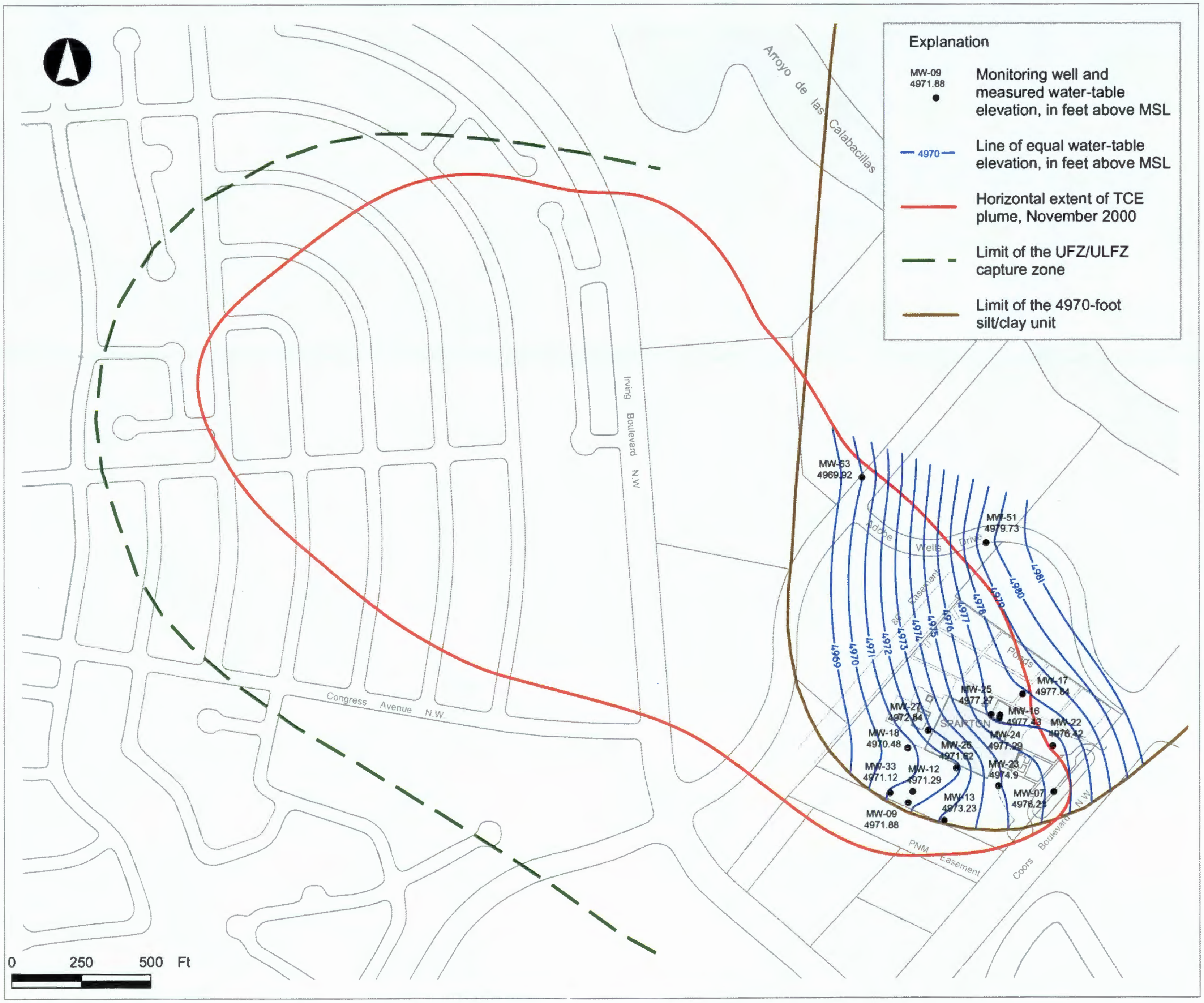


Figure 5.8. Elevation of the Water Levels in the UFZ/ULFZ and the Capture Zone of the Off-Site Containment Wall, August 27, 2001


Explanation
MW-20
4969.99
Monitoring well and measured water-table elevation, in feet above MSL
4970
Line of equal water-table elevation, in feet above MSL
Horizontal extent of TCE plume, November 2000
Limit of the capture zone
Arroyo de las Calabacillas
MW-66
4962.6
MW-69
4959.84
OB-1
4957.1
OB-2
4958.48
CW-1
4938.06
MW-65
4959.76
MW-55
4962.38
Irving Boulevard N.W.
Congress Avenue N.W.
Adobe Wells Drive
80' Easement
PNM Easement
Coors Boulevard N.W.
SPARTON
MW-43
4969.04
MW-70
4969.01
MW-20
4969.99
MW-40/49
4969.59
MW-39
4971.06
MW-38
4972.29
4959
4960
4961
4962
4963
4964
4965
4966
4967
4968
4969
4970
4971
4972
4973
0
250
500
Ft


Explanation
MW-09
4971.88
Monitoring well and measured water-table elevation, in feet above MSL
4970
Line of equal water-table elevation, in feet above MSL
Horizontal extent of TCE plume, November 2000
Limit of the UFZ/ULFZ capture zone
Limit of the 4970-foot silt/clay unit
Arroyo de las Calabacillas
Irving Boulevard N.W.
Congress Avenue N.W.
Coors Boulevard N.W.
PNM Easement
Wells Drive
Ponds
SPARTON
MW-63
4969.92
MW-51
4979.73
MW-17
4977.84
MW-25
4977.27
MW-27
4972.84
MW-16
4977.43
MW-22
4976.42
MW-18
4970.48
MW-24
4977.29
MW-26
4971.52
MW-33
4971.12
MW-12
4971.29
MW-23
4974.9
MW-13
4973.23
MW-07
4976.21
MW-09
4971.88
4969
4970
4971
4972
4973
4974
4975
4976
4977
4978
4979
4980
4981
0
250
500
Ft

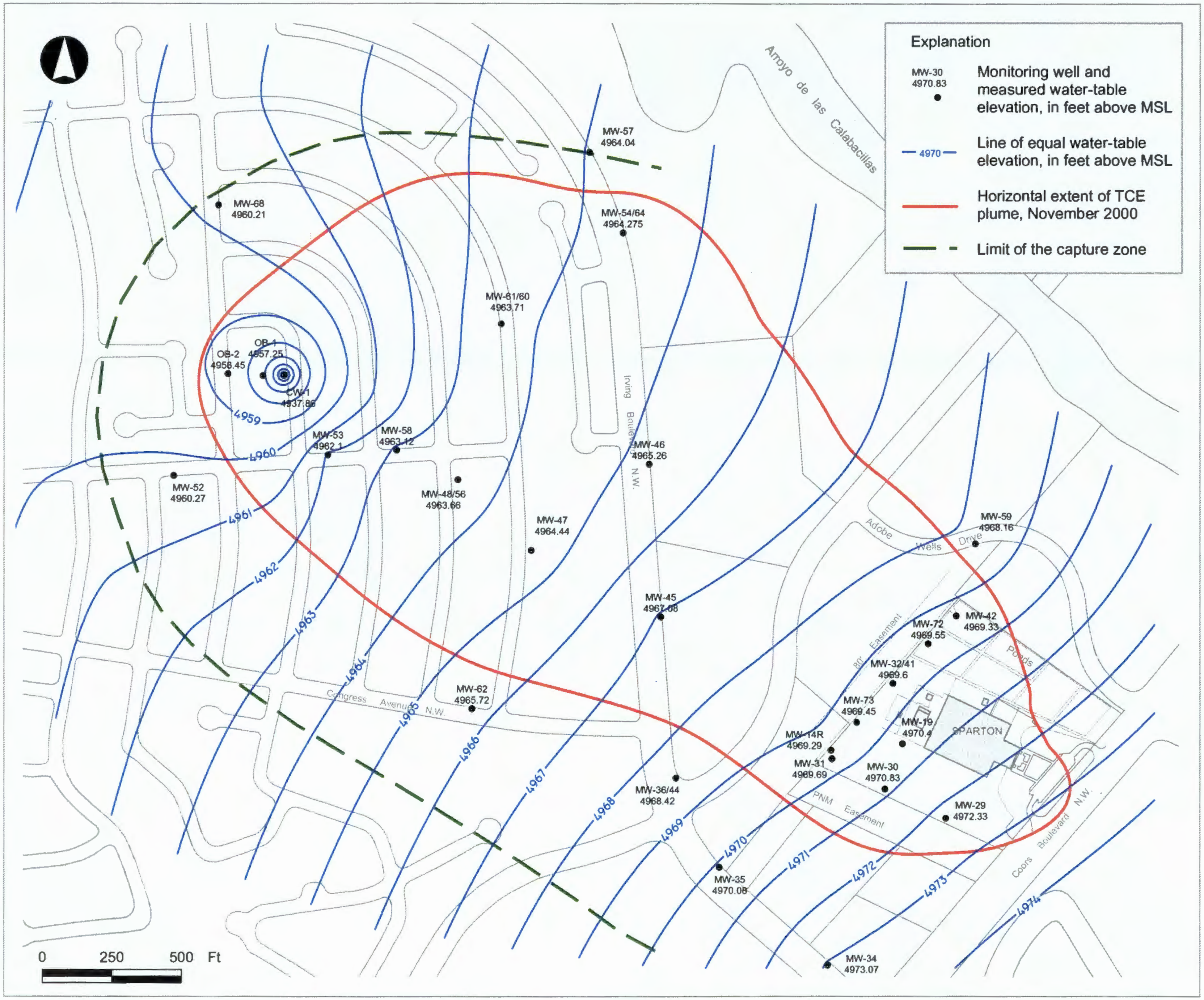


Figure 5.11 Elevation of the Water Levels in the UFZ/ULFZ and the Capture Zone of the Off-Site Containment Well - November 1, 2001

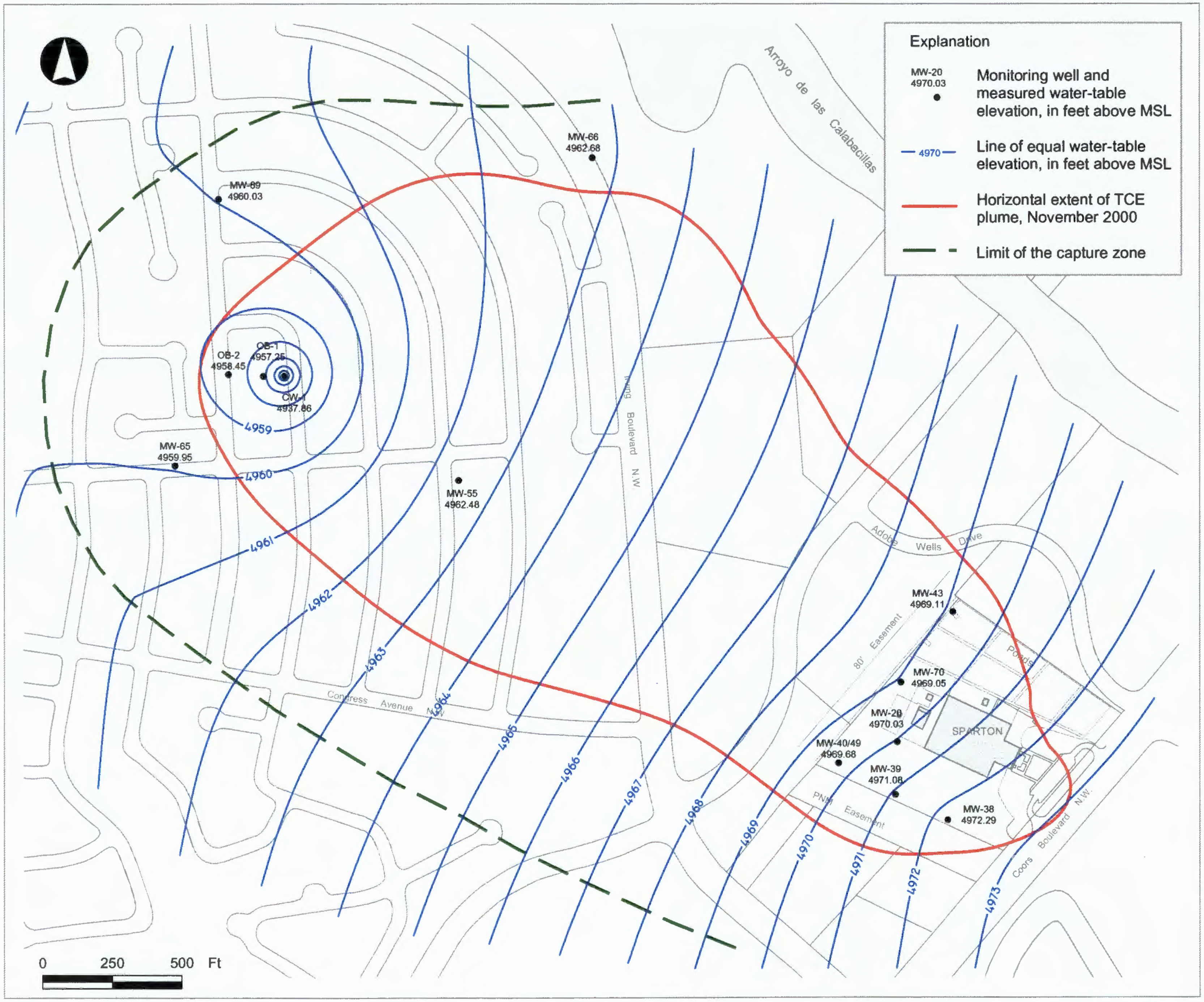


Figure 5.12 Elevation of the Water Levels in the ULEZ and the Capture Zone of the Off-Site Containment Well - November 1, 2001

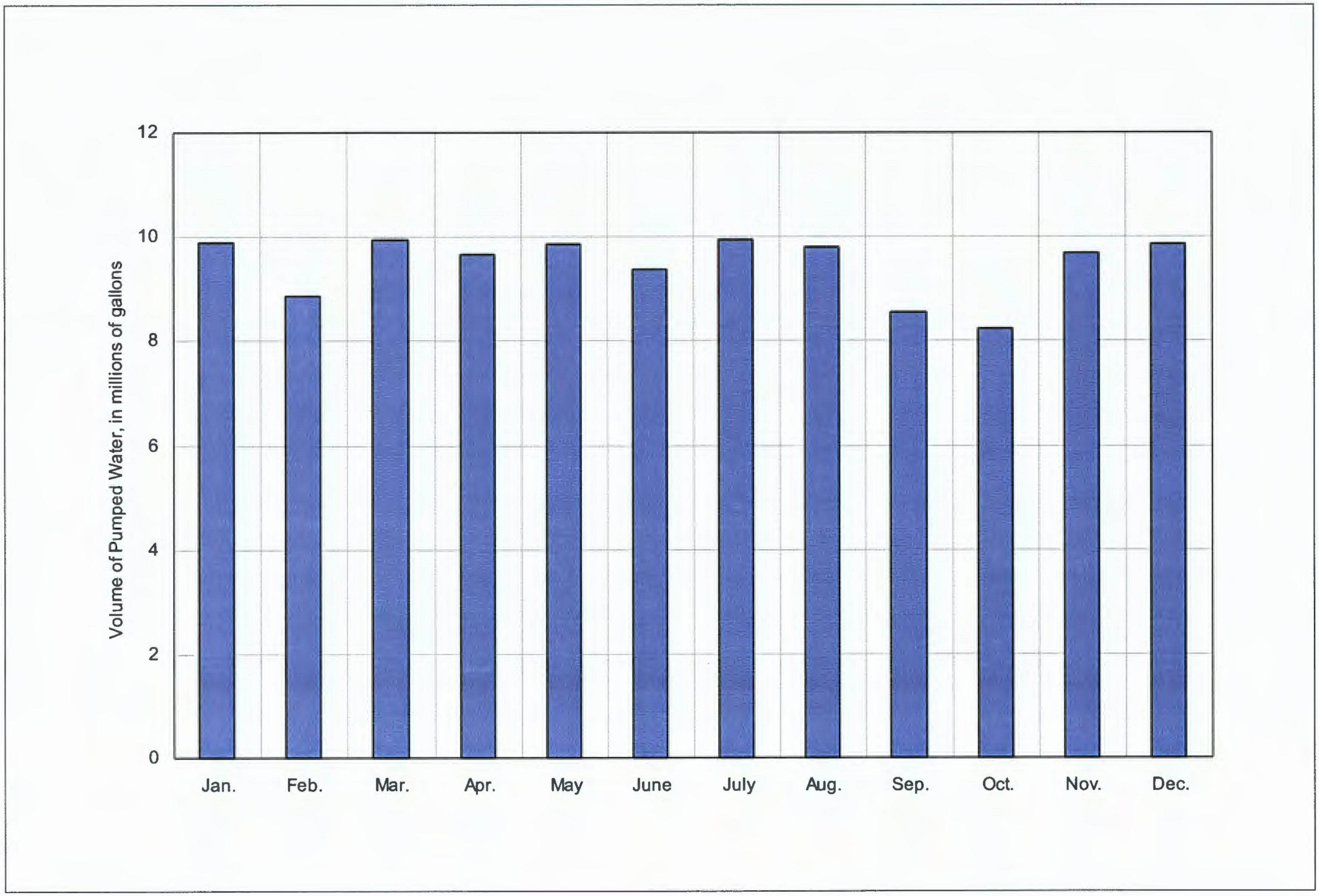


Figure 5.13 Monthly Volume of Water Pumped by the Off-Site Containment Well - 2001

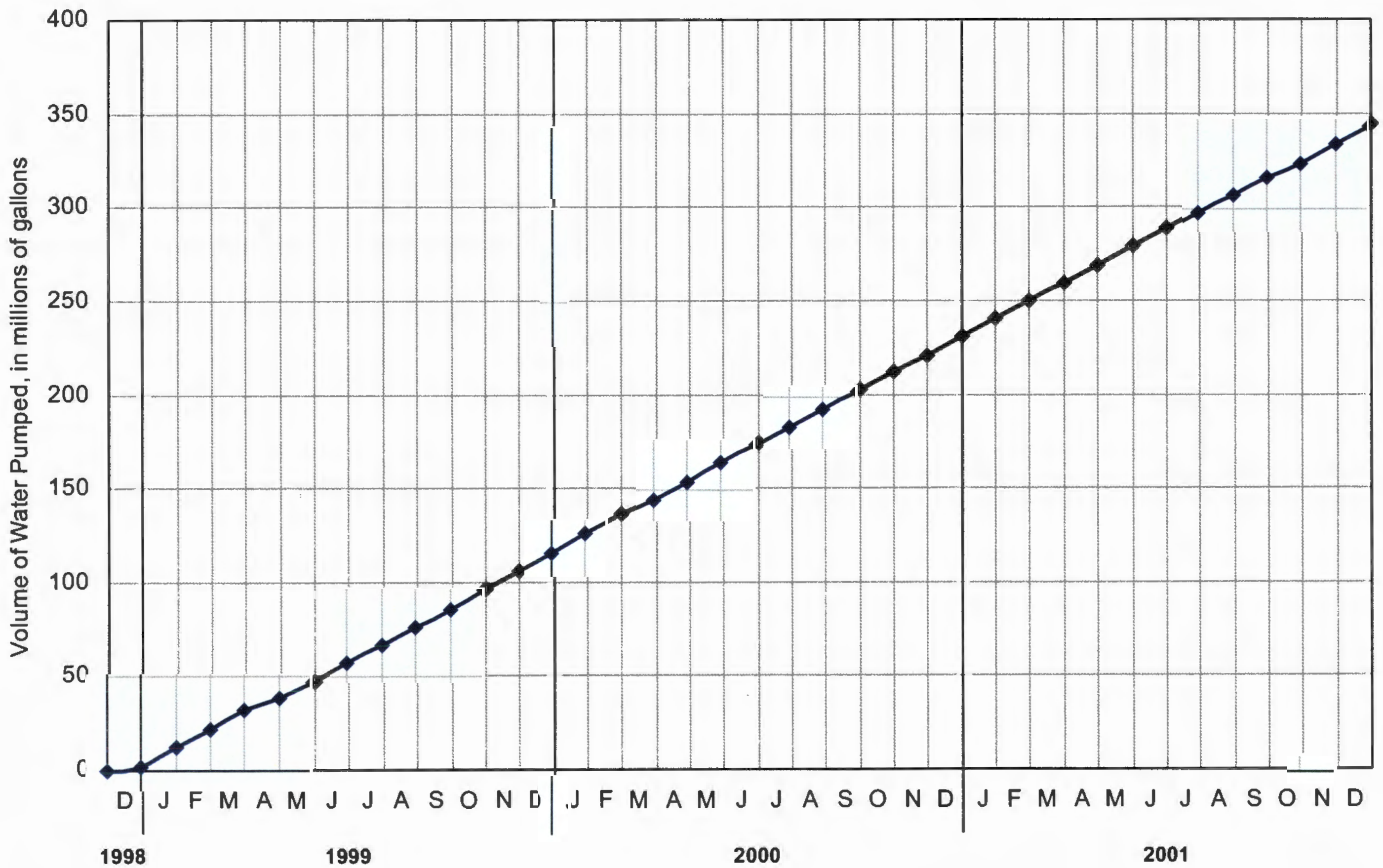


Figure 5.14 Cumulative Volume of Water Pumped by the Off-Site Containment Well

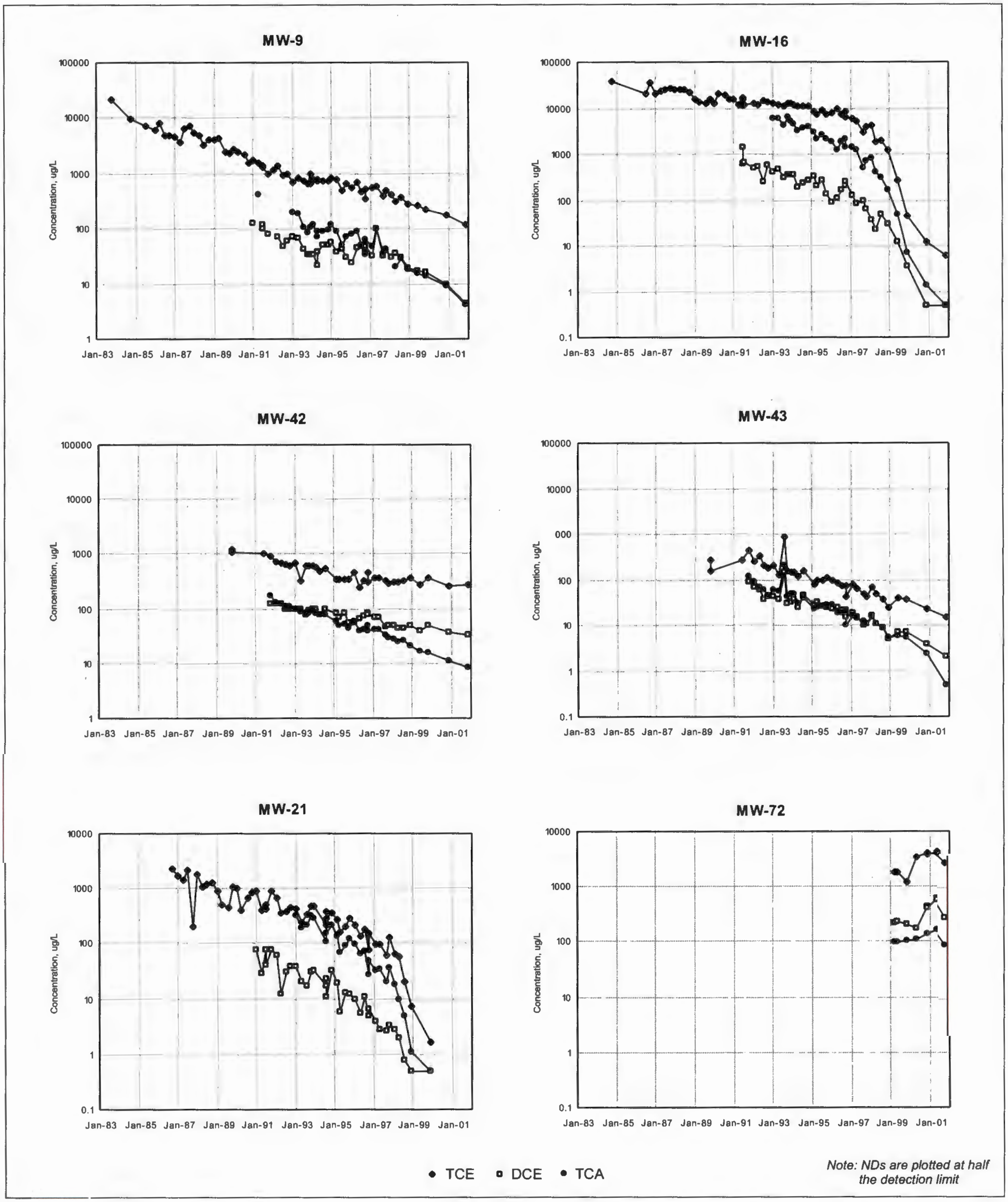


Figure 5.15 Contaminant Concentration Trends in On-Site Monitoring Wells

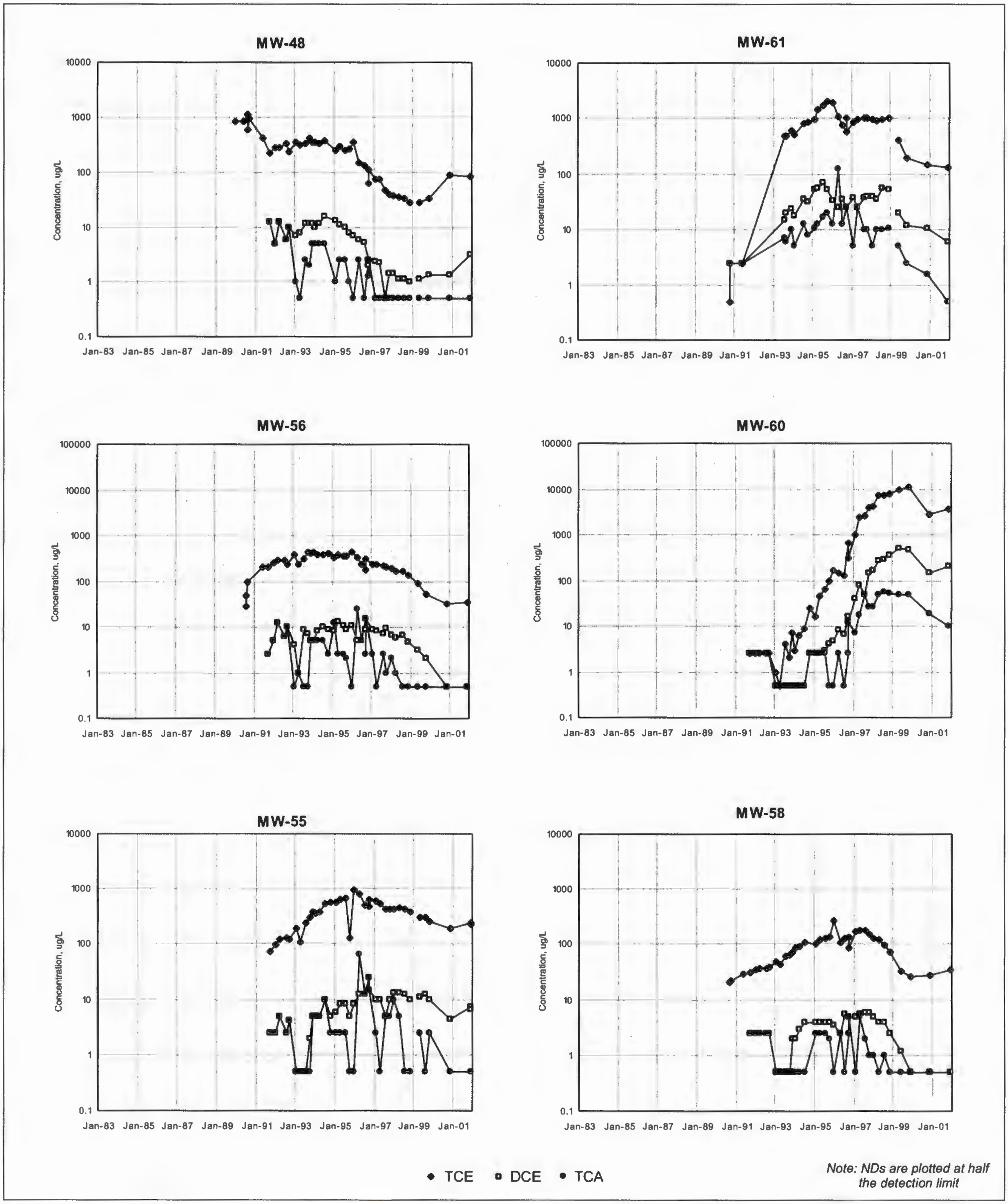


Figure 5.16 Contaminant Concentration Trends in Off-Site Monitoring Wells

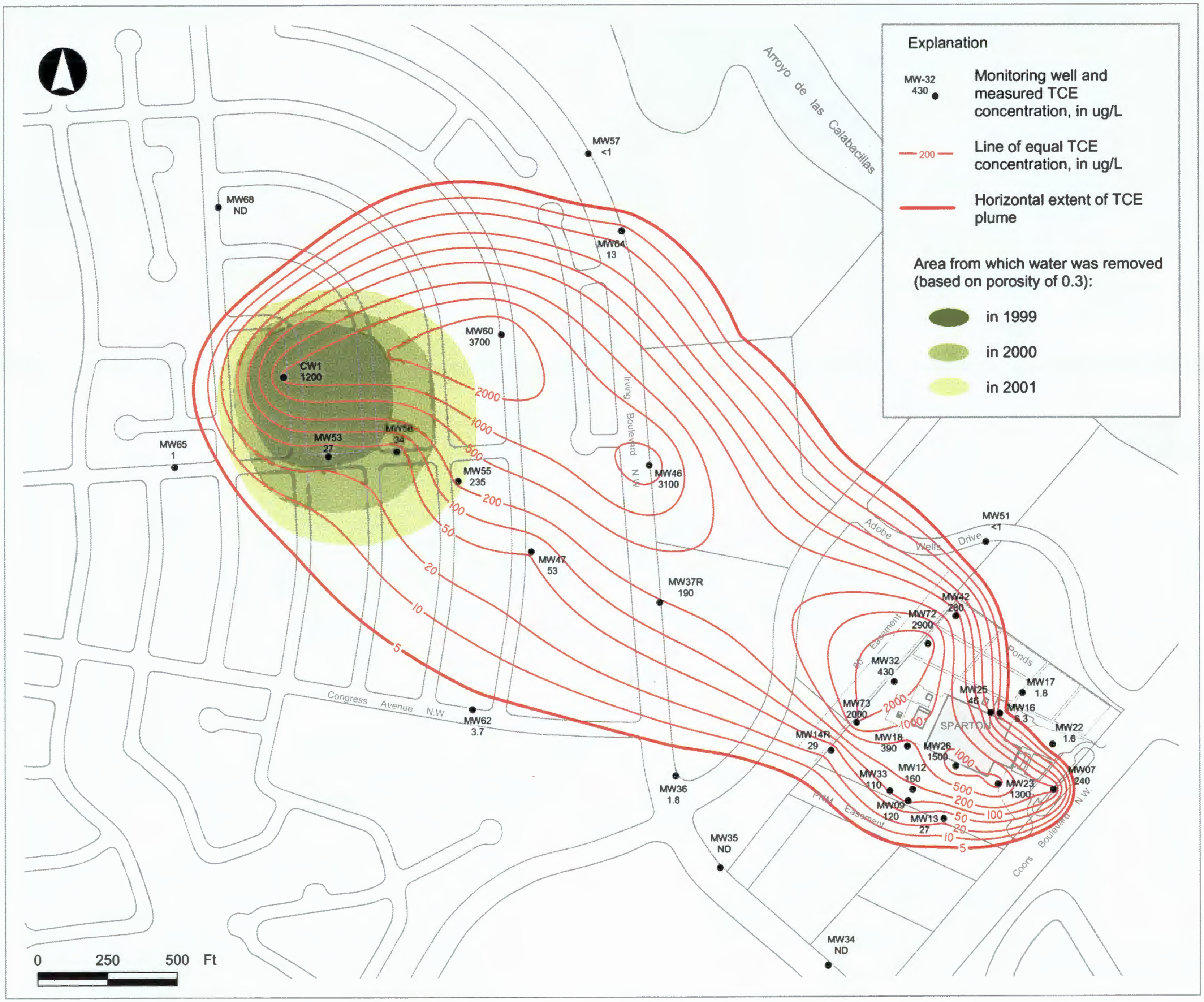


Figure 5.17 Horizontal Extent of TCE Plume - November, 2001

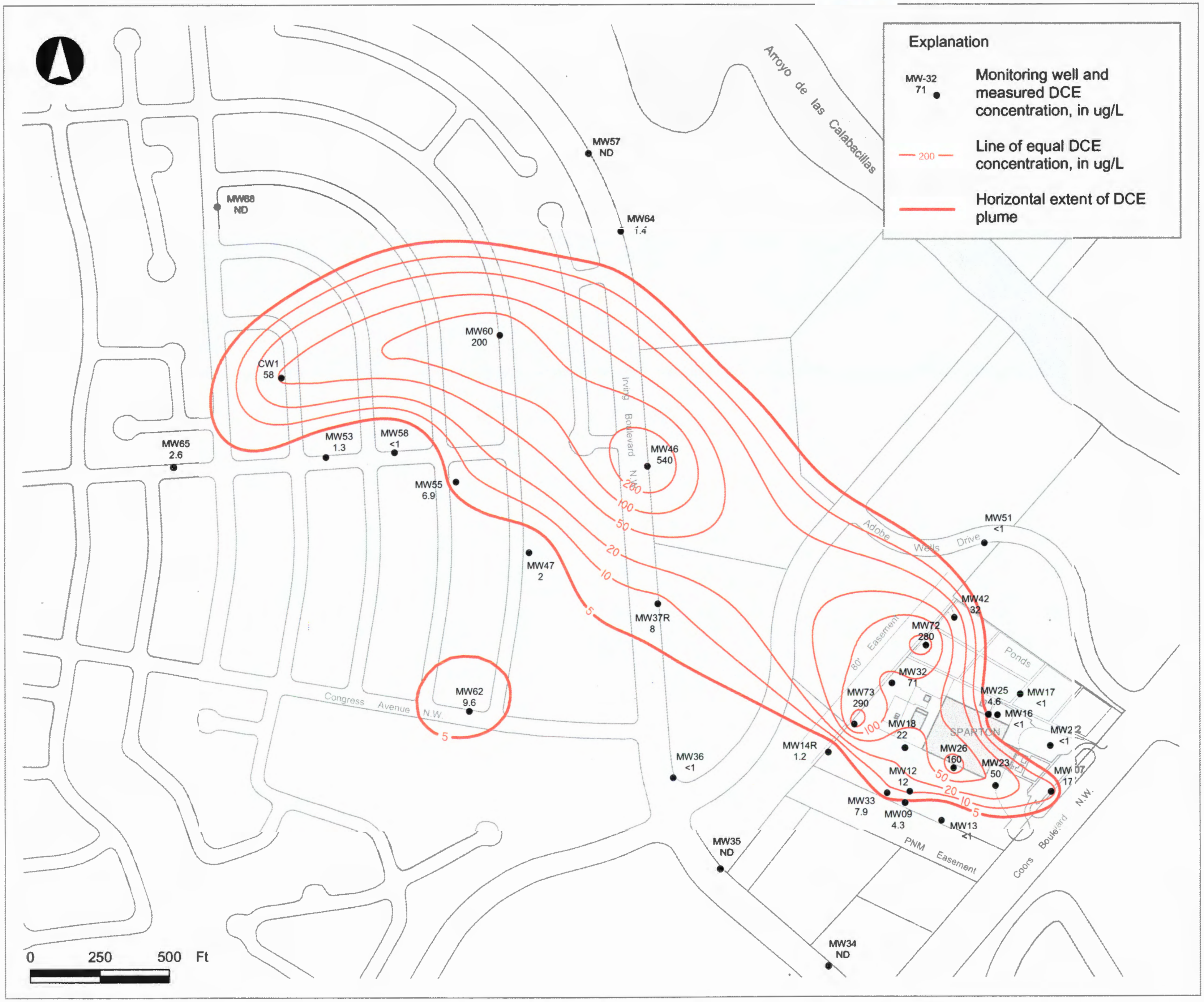


Figure 5.18 Horizontal Extent of DCE Plume - November, 2001

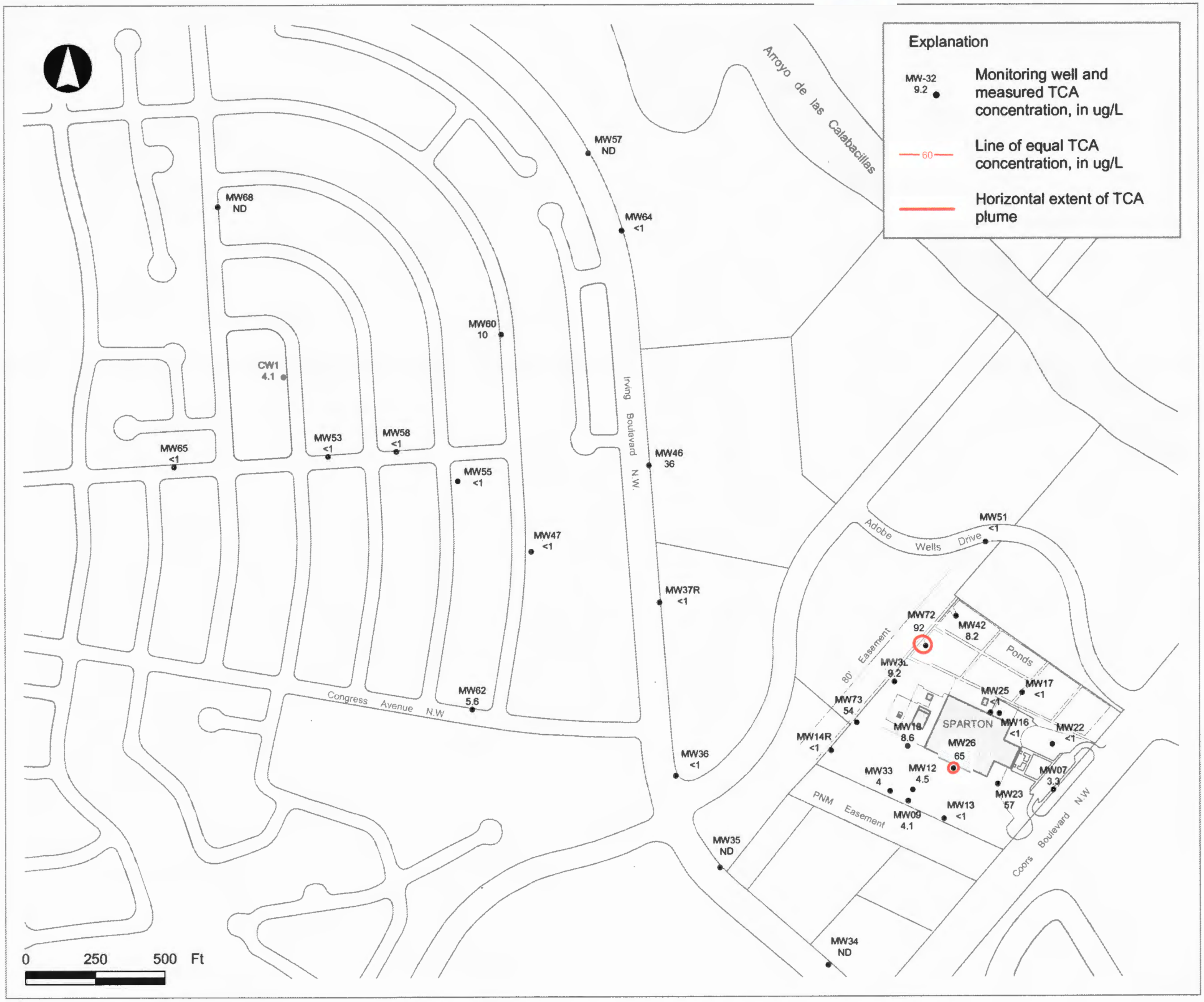


Figure 5.19 Horizontal Extent of TCA Plume - November, 2001

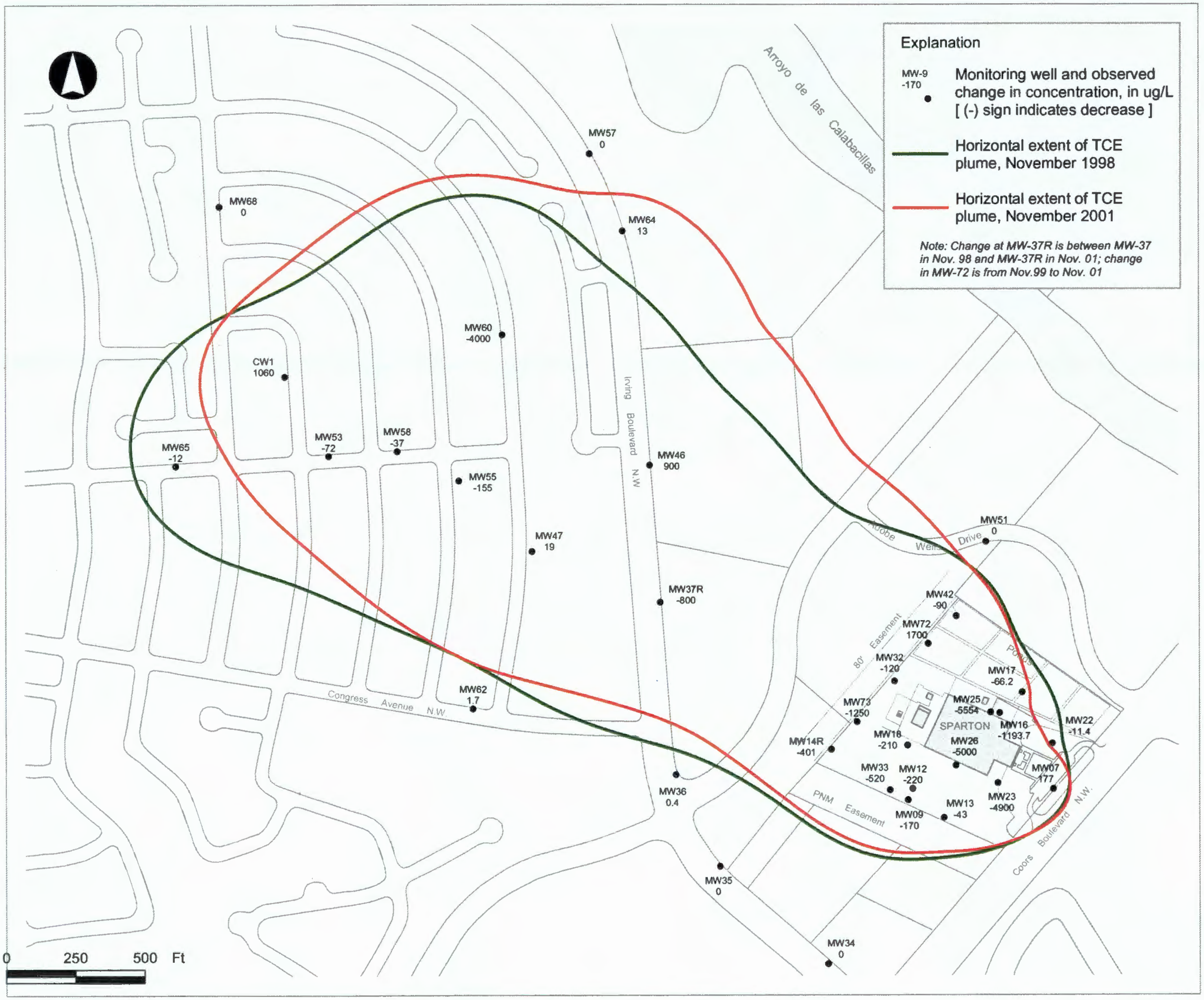


Figure 5.20 Changes in TCE Concentrations at Wells used for Plume Definition - November 1998 to November 2001

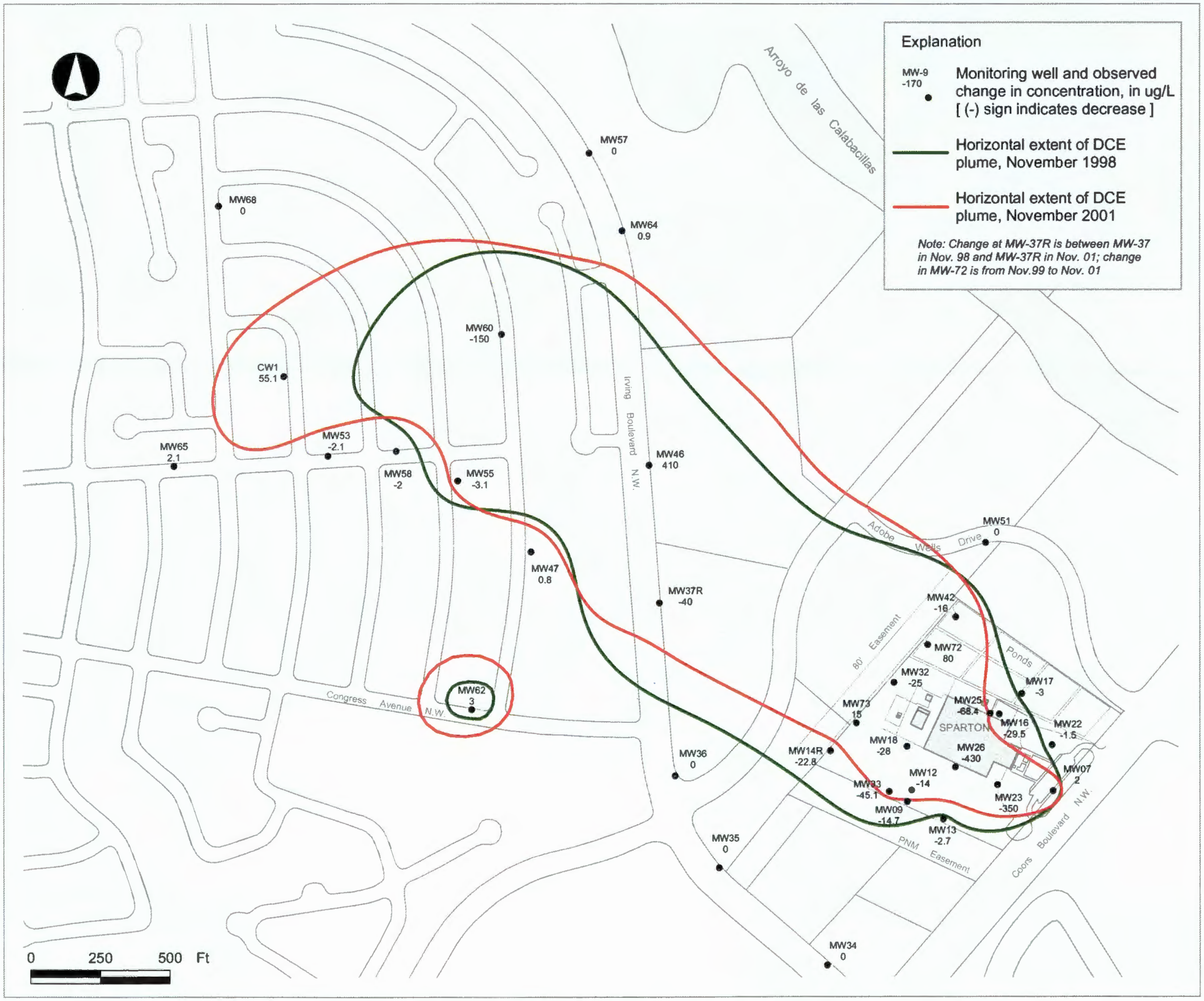


Figure 5.21 Changes in DCE Concentrations at Wells used for Plume Definition - November 1998 to November 2001

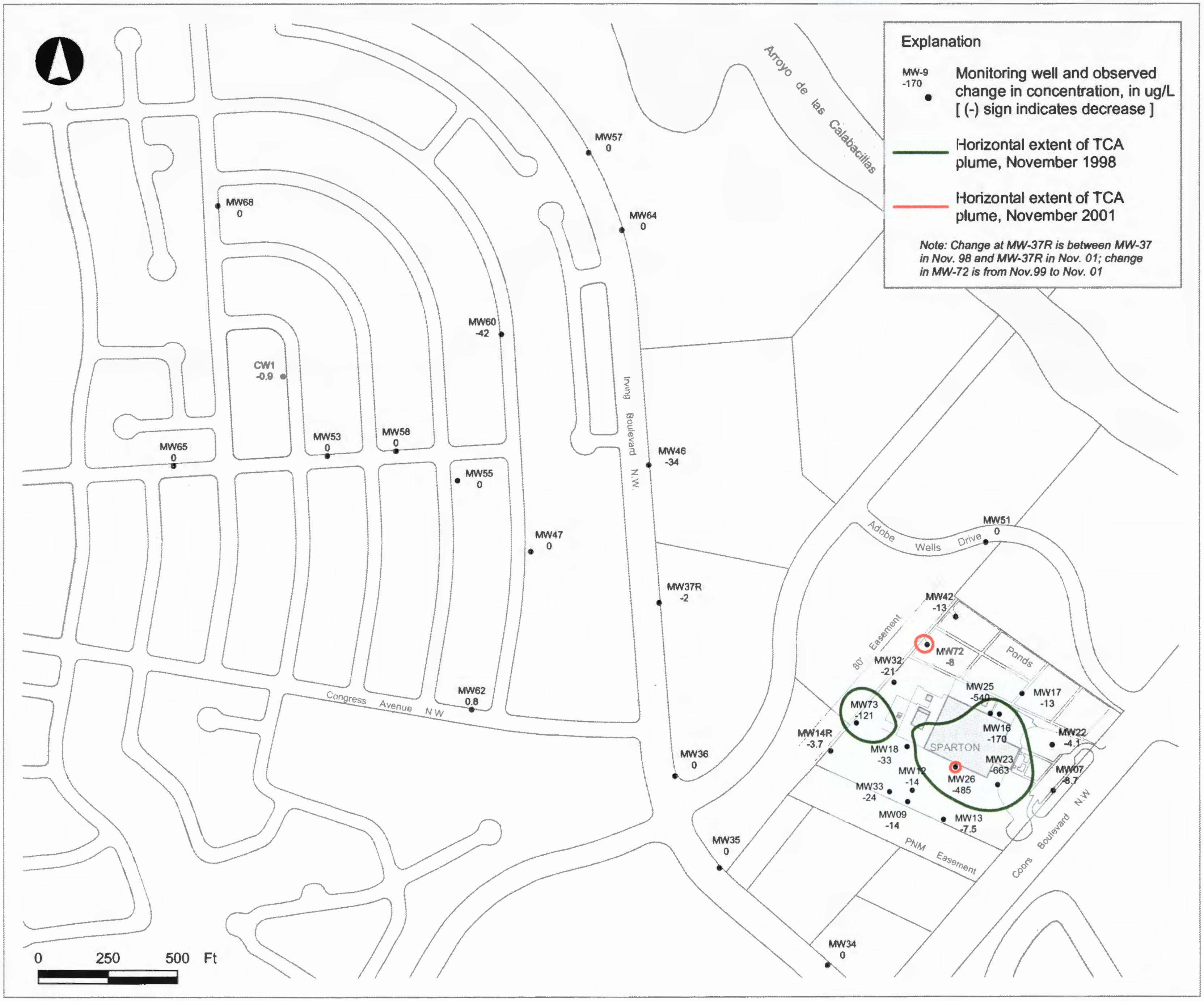


Figure 5.22 Changes in TCA Concentrations at Wells used for Plume Definition - November 1998 to November 2001

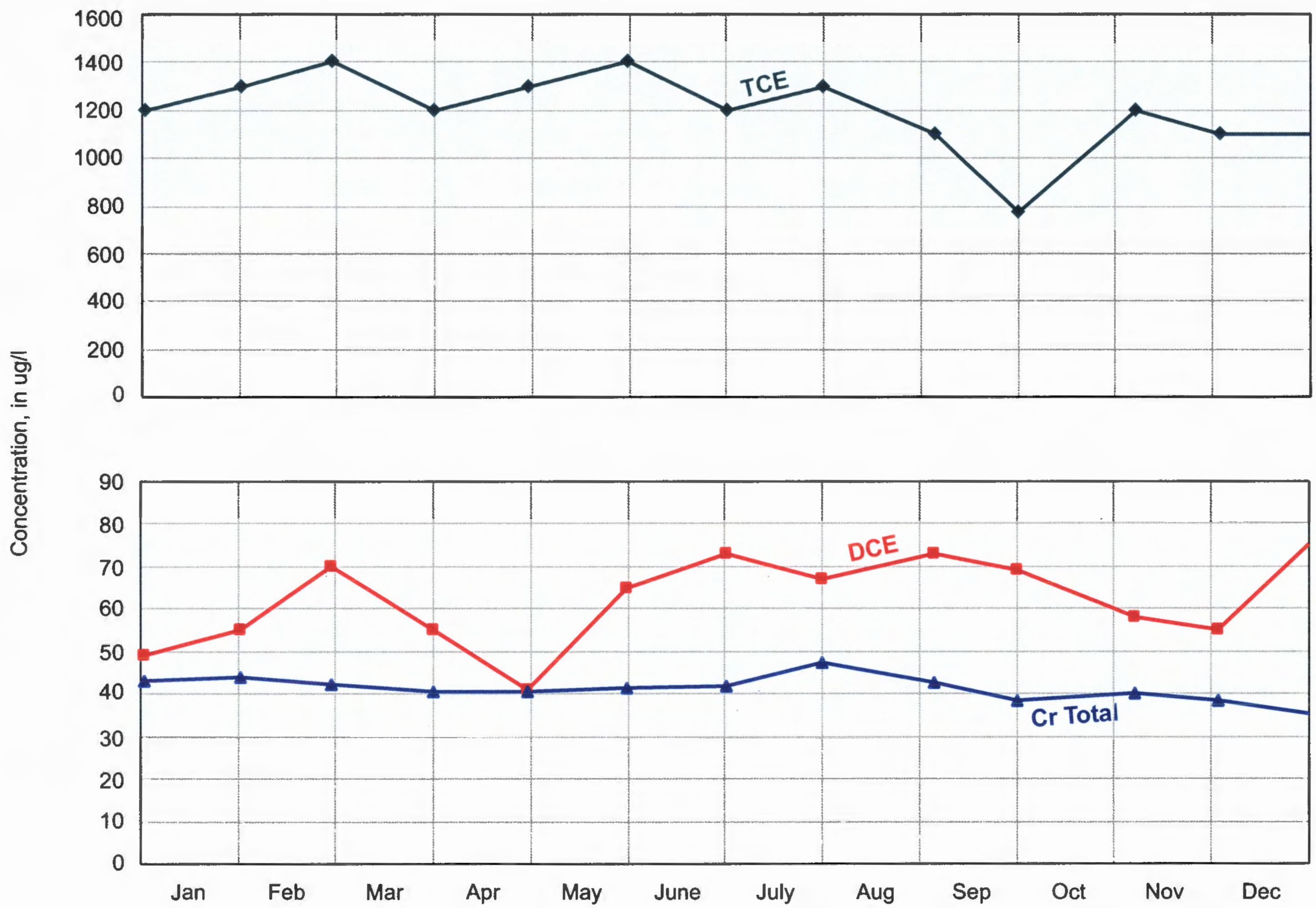


Figure 5.23 Off-Site Containment System - TCE, DCE and Total Chromium Concentrations in the Influent - 2001

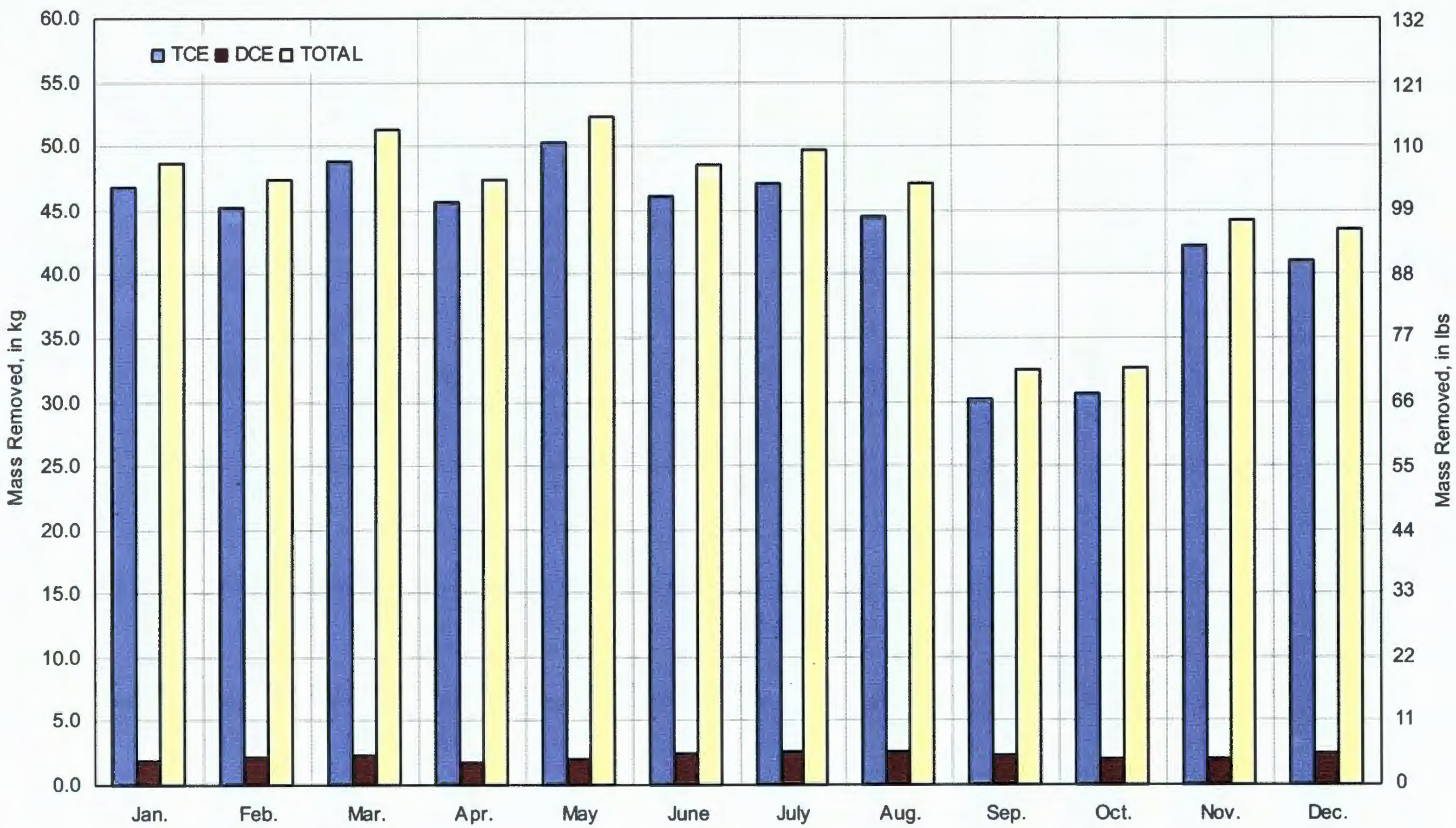


Figure 5.24 Monthly Contaminant Mass Removal by the Off-Site Containment Well - 2001

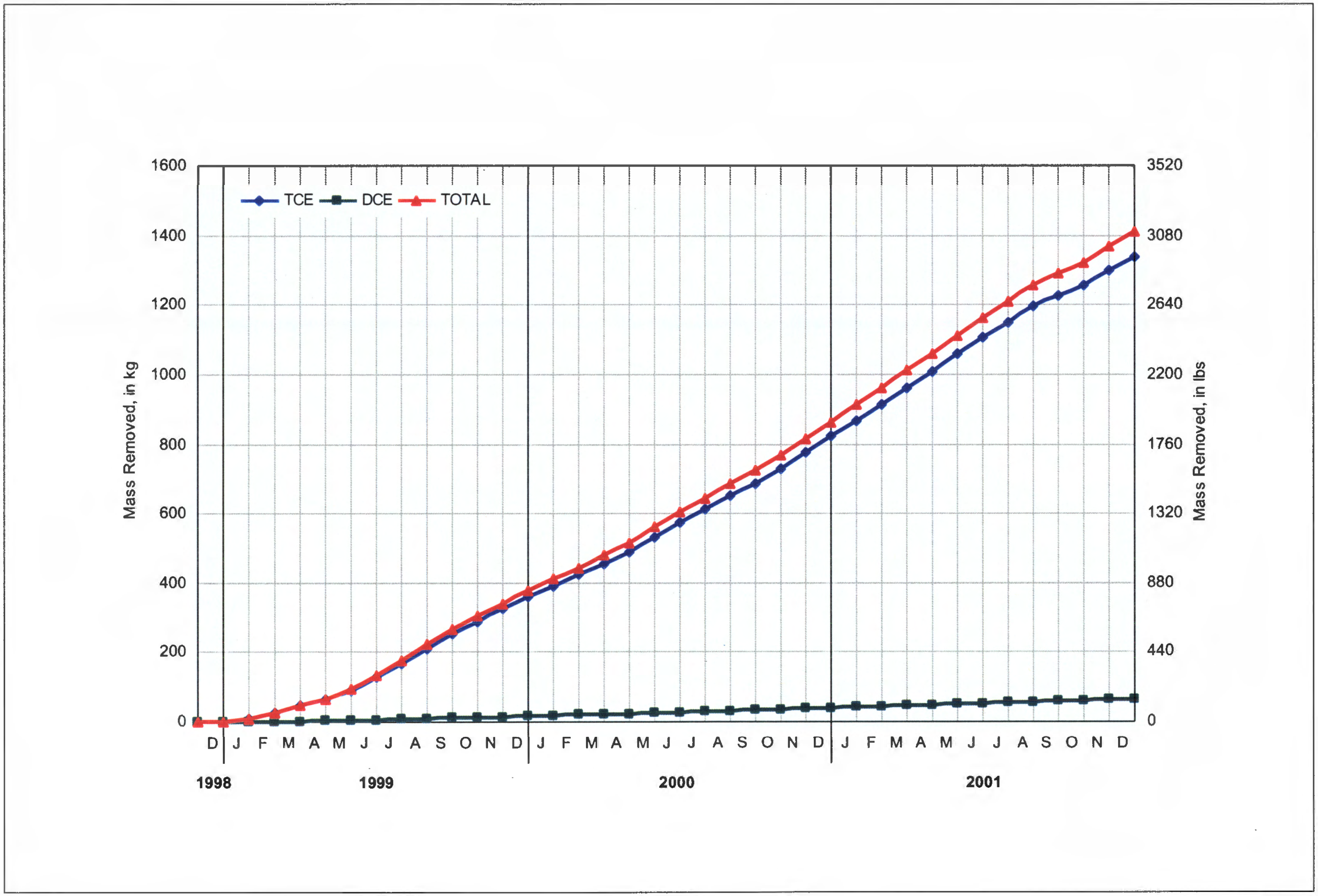


Figure 5.25 Cumulative Contaminant Mass Removal by the Off-Site Containment Well

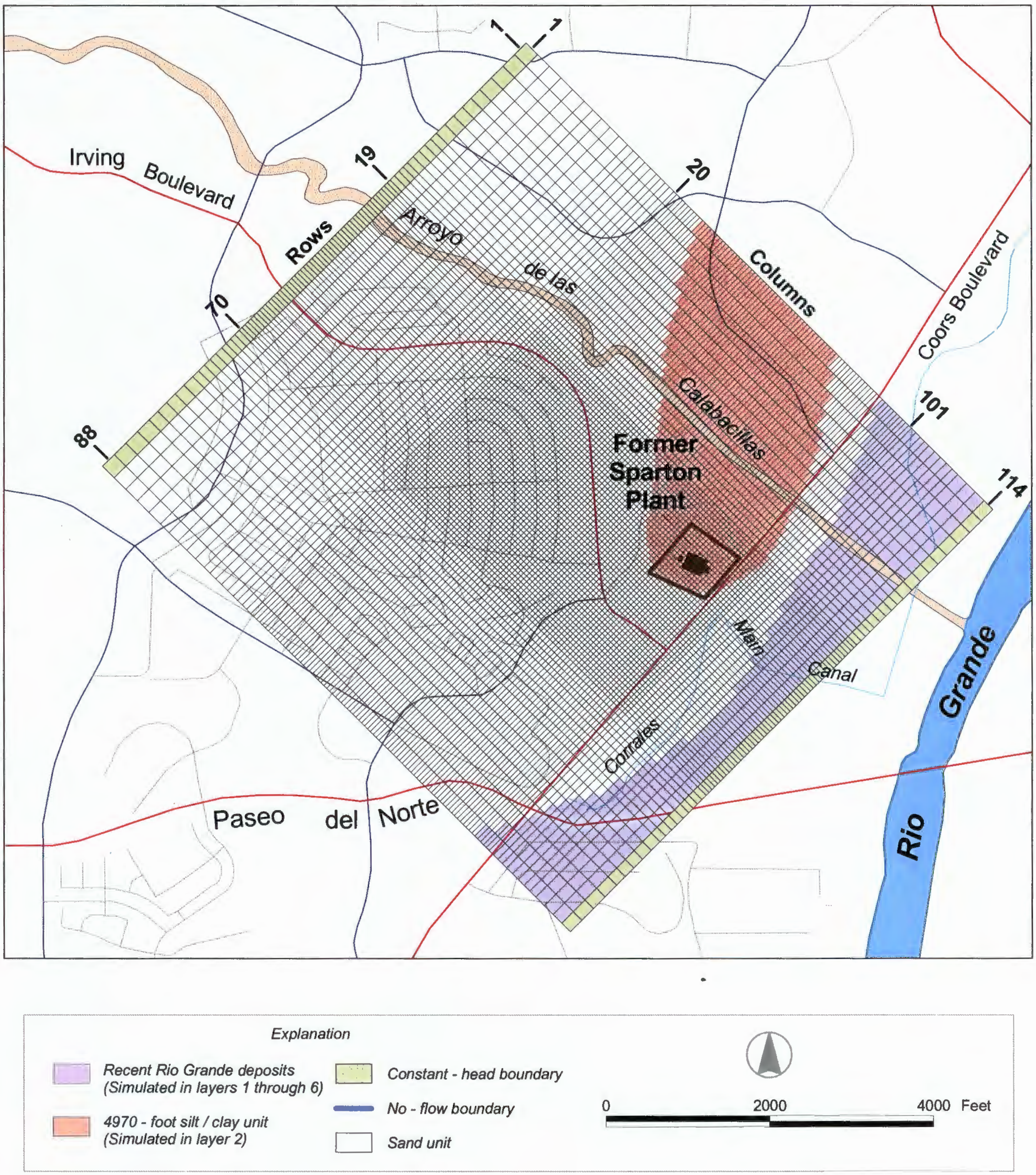


Figure 6.1 Model Grid, Hydraulic Property Zones and Boundary Conditions

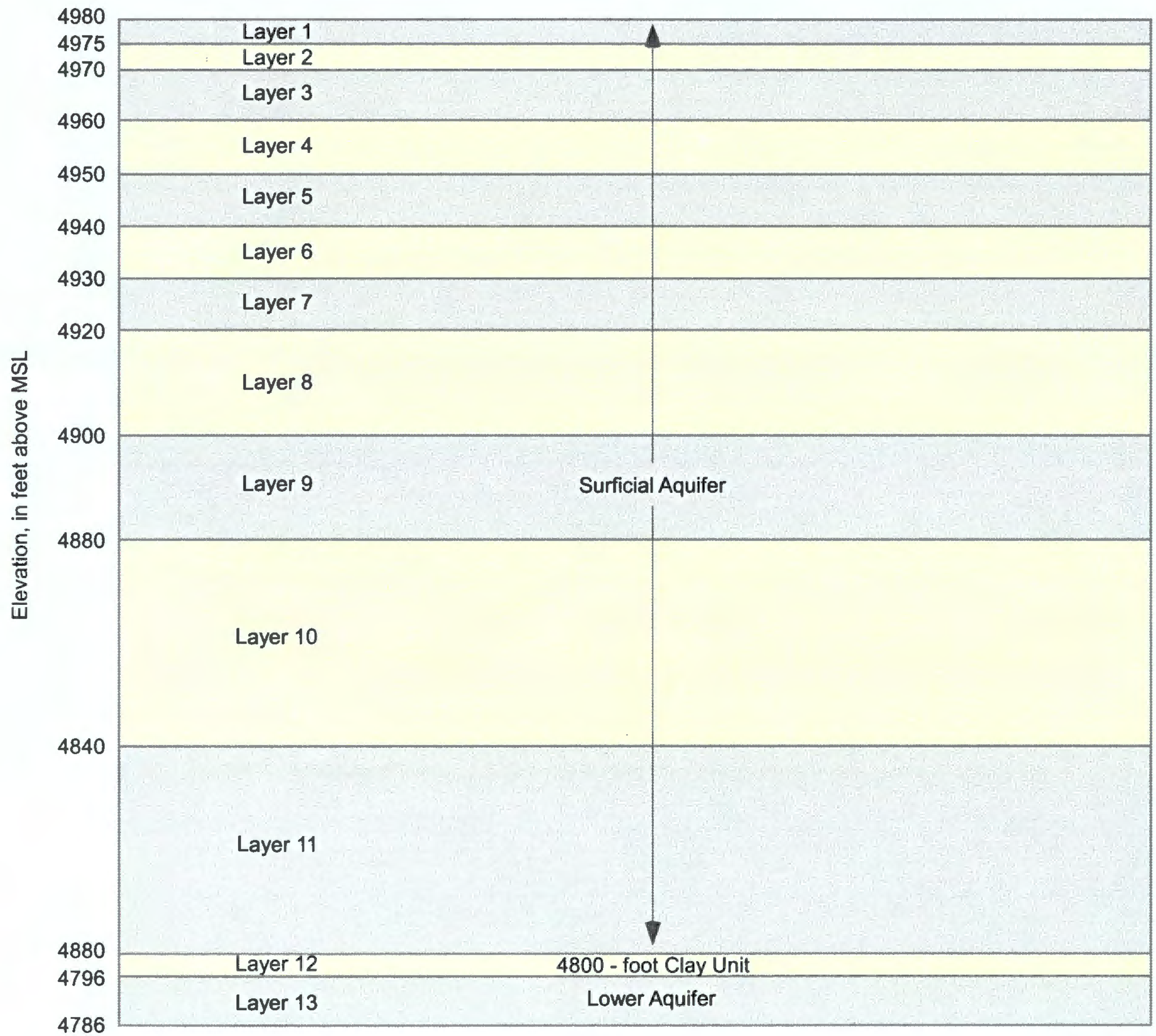


Figure 6.2 Model Layers

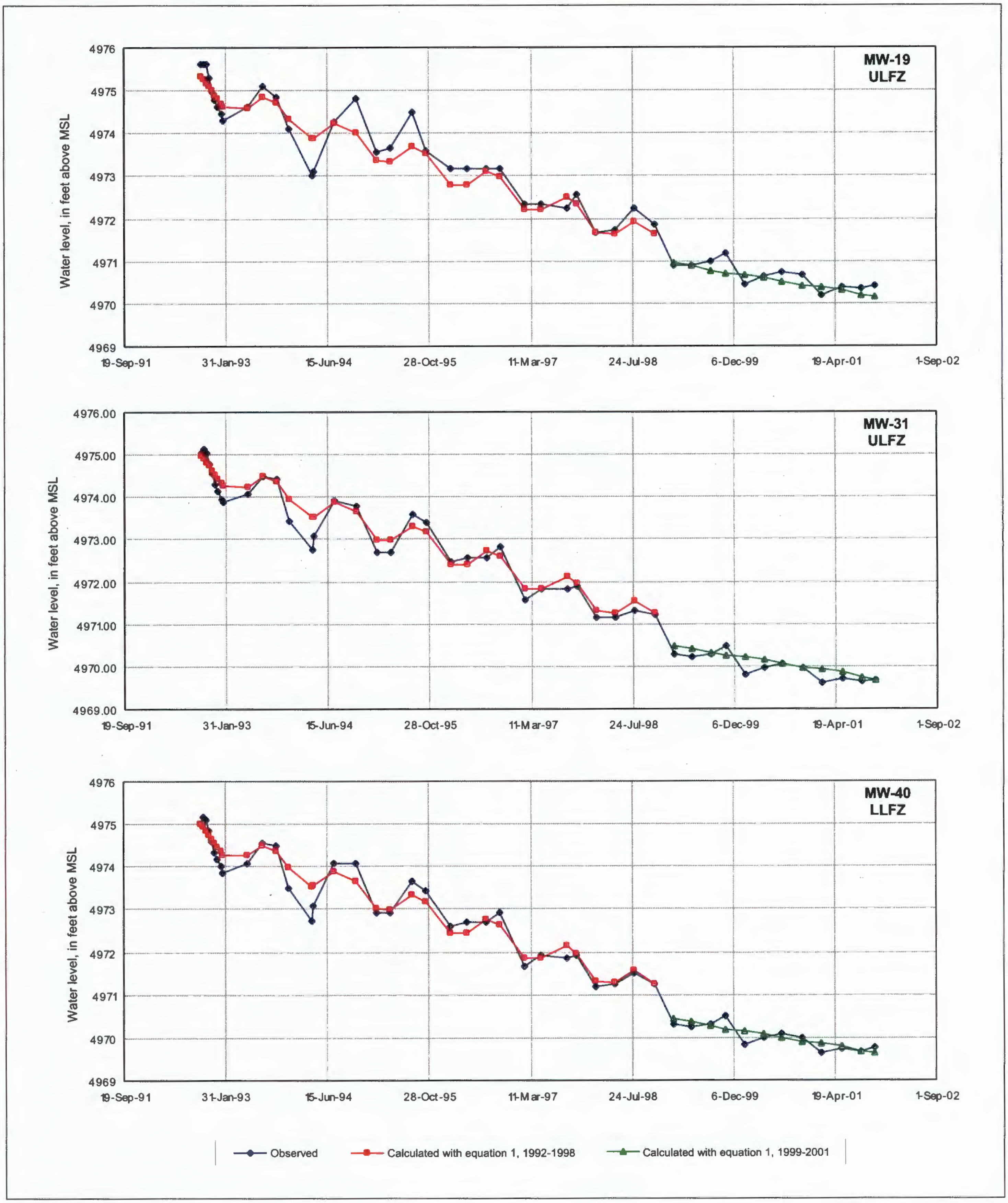


Figure 6.3 Regional Water Level Trends

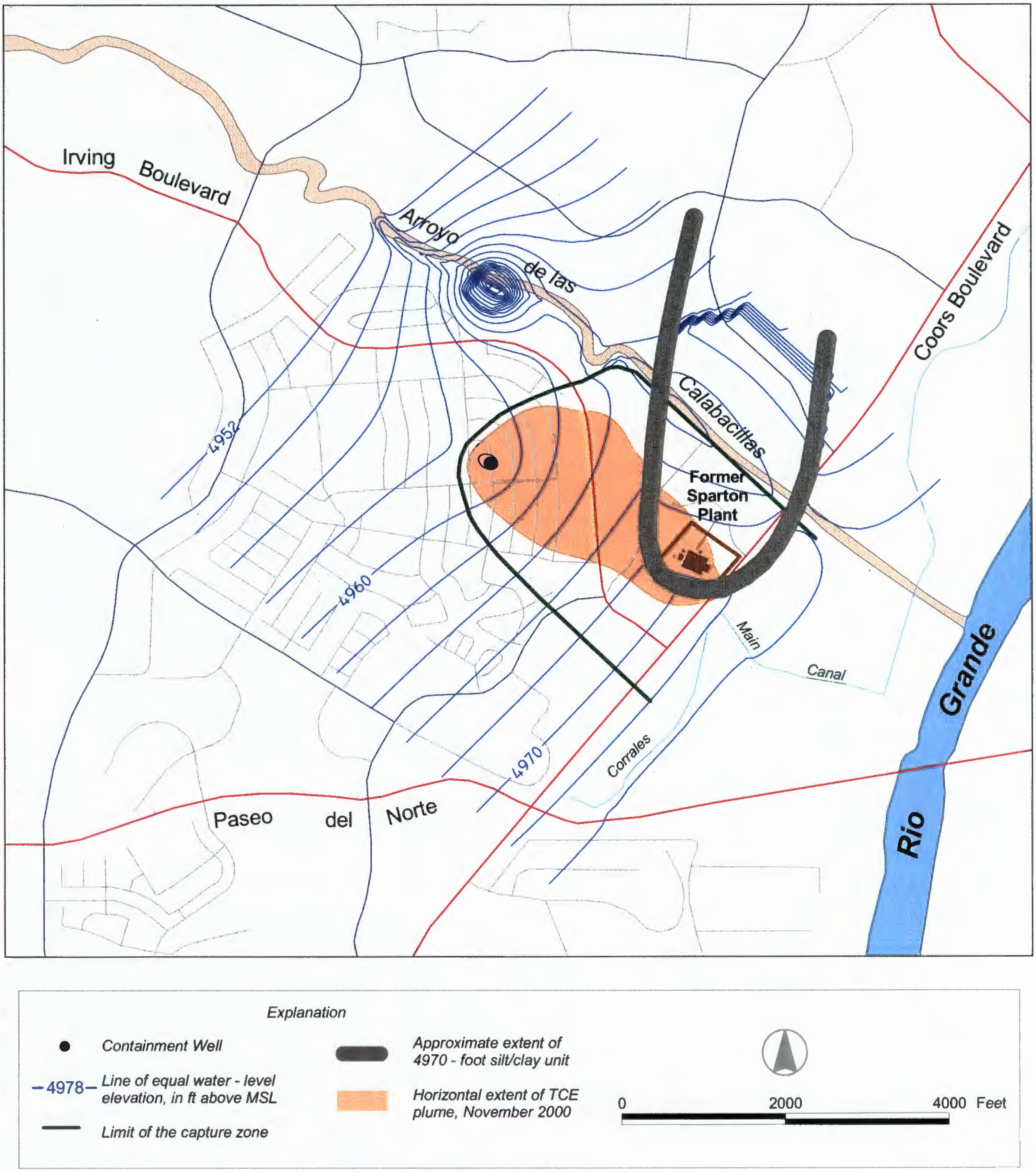


Figure 6.4 Calculated Water Levels in the UFZ and Comparison of the Calculated Capture Zone to the TCE Plume Extent

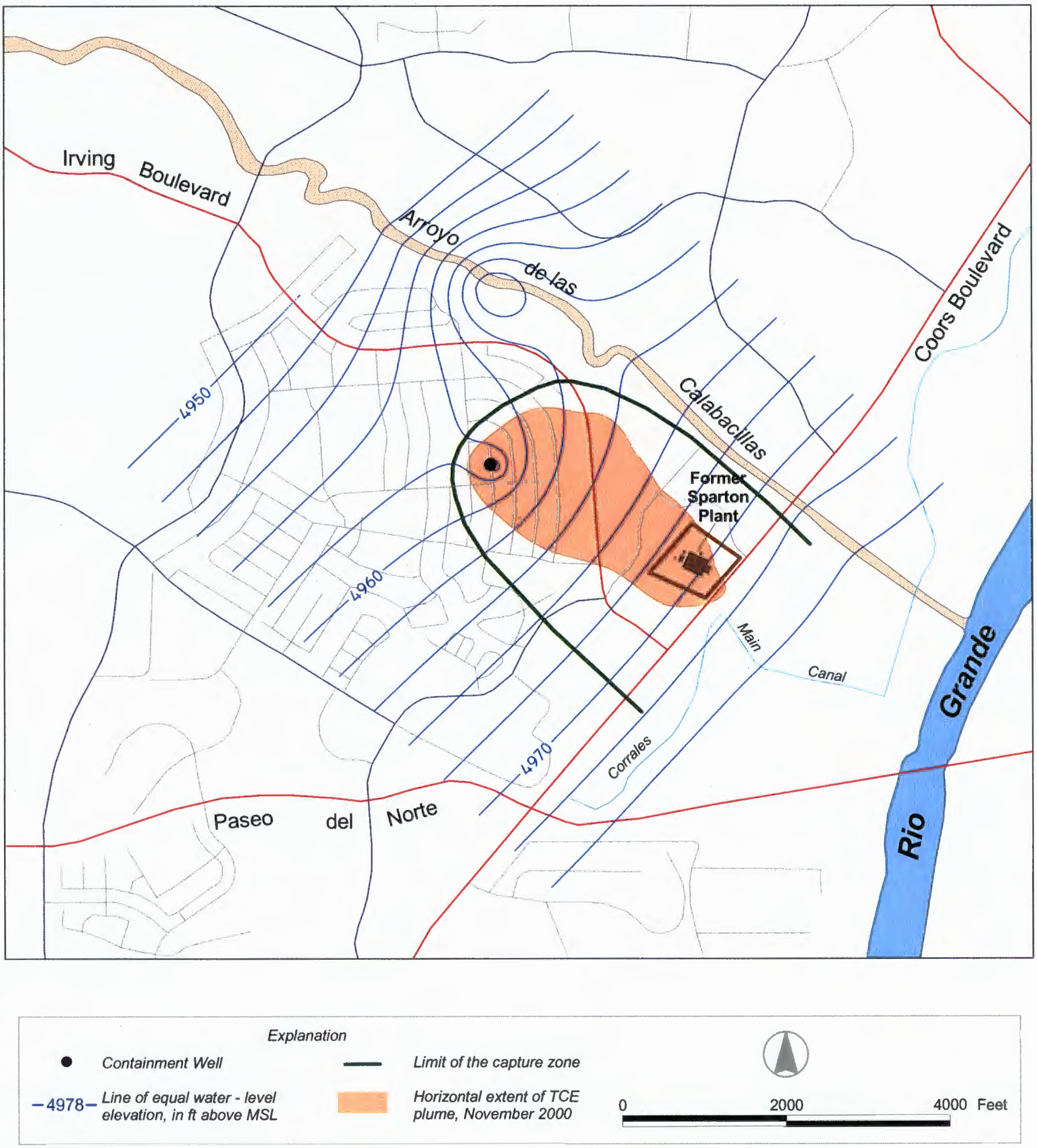
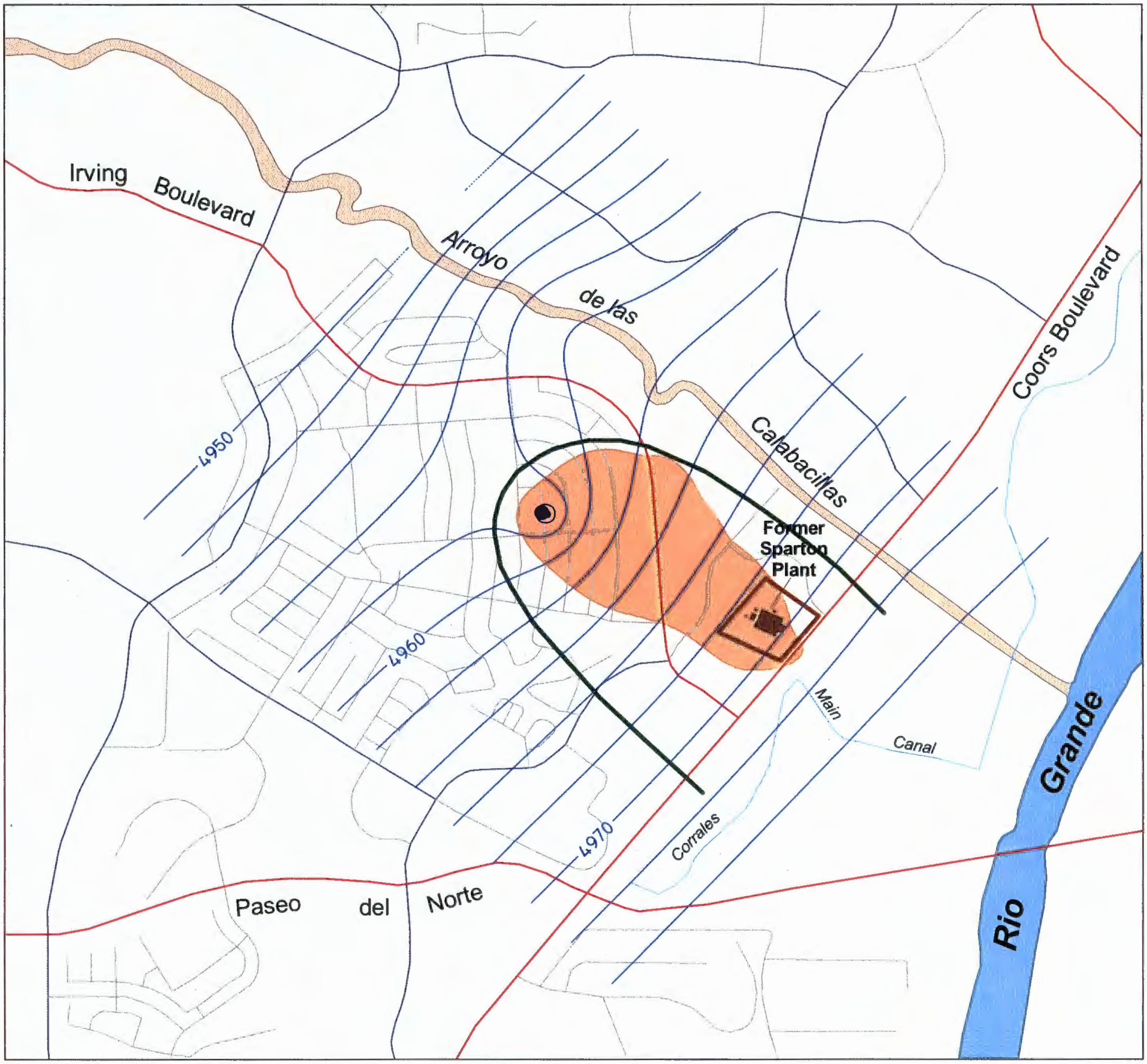


Figure 6.5 Calculated Water Levels in the ULFZ and Comparison of the Calculated Capture Zone to the TCE Plume Extent



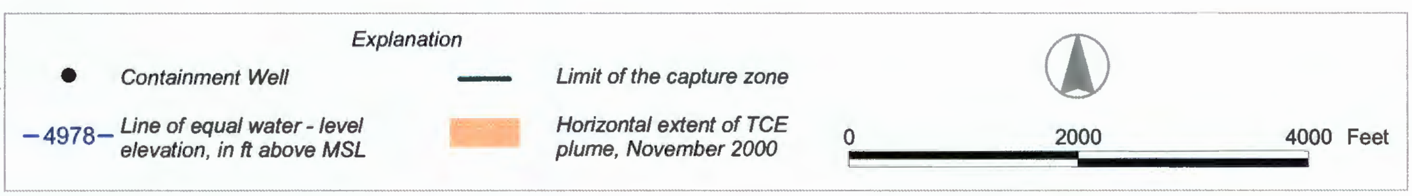


Figure 6.6 Calculated Water Levels in the LLFZ and Comparison of the Calculated Capture Zone to the TCE Plume Extent

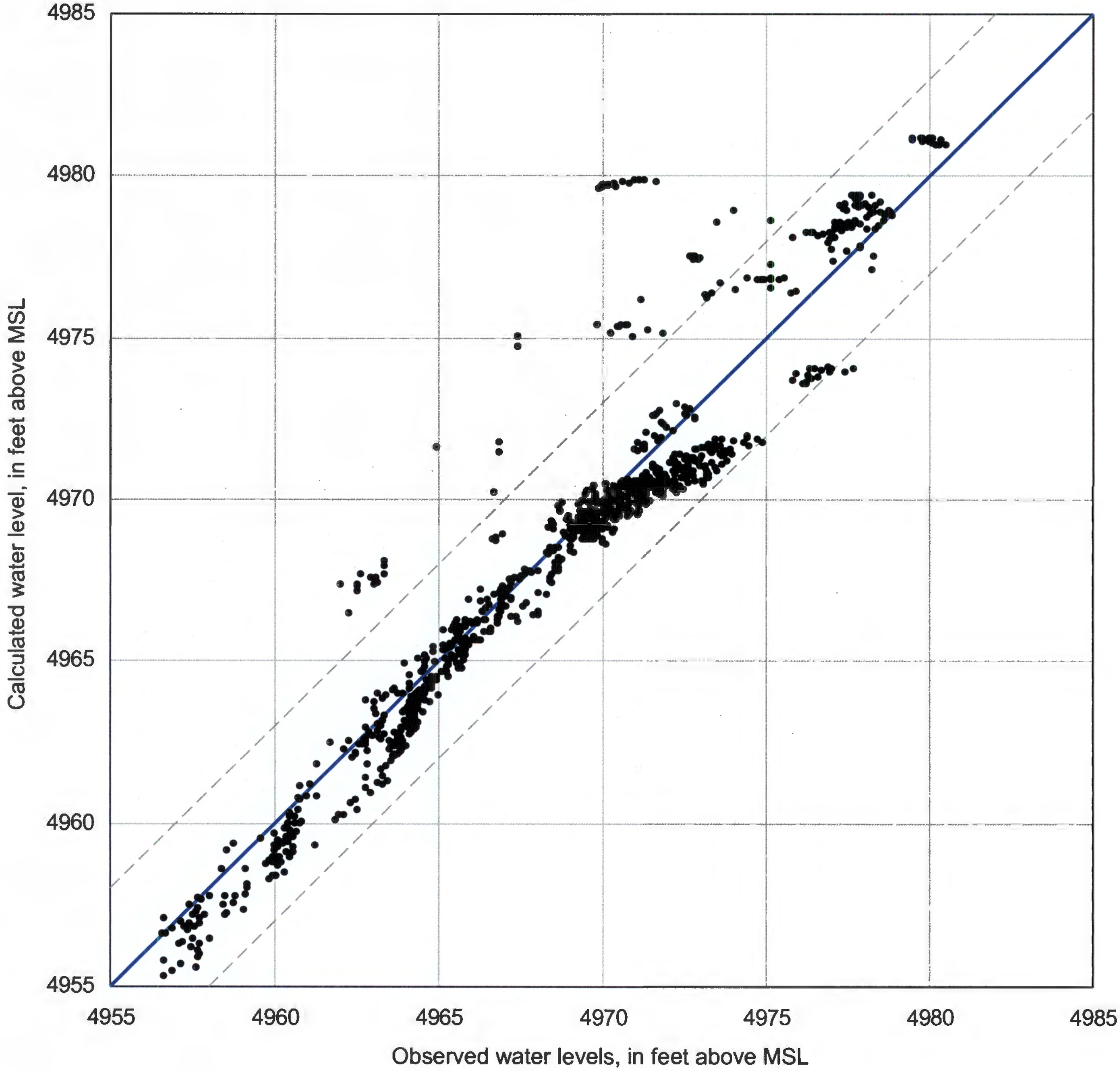


Figure 6.7 Comparison of Calculated to Observed Water Levels - November 1998 to November 2001

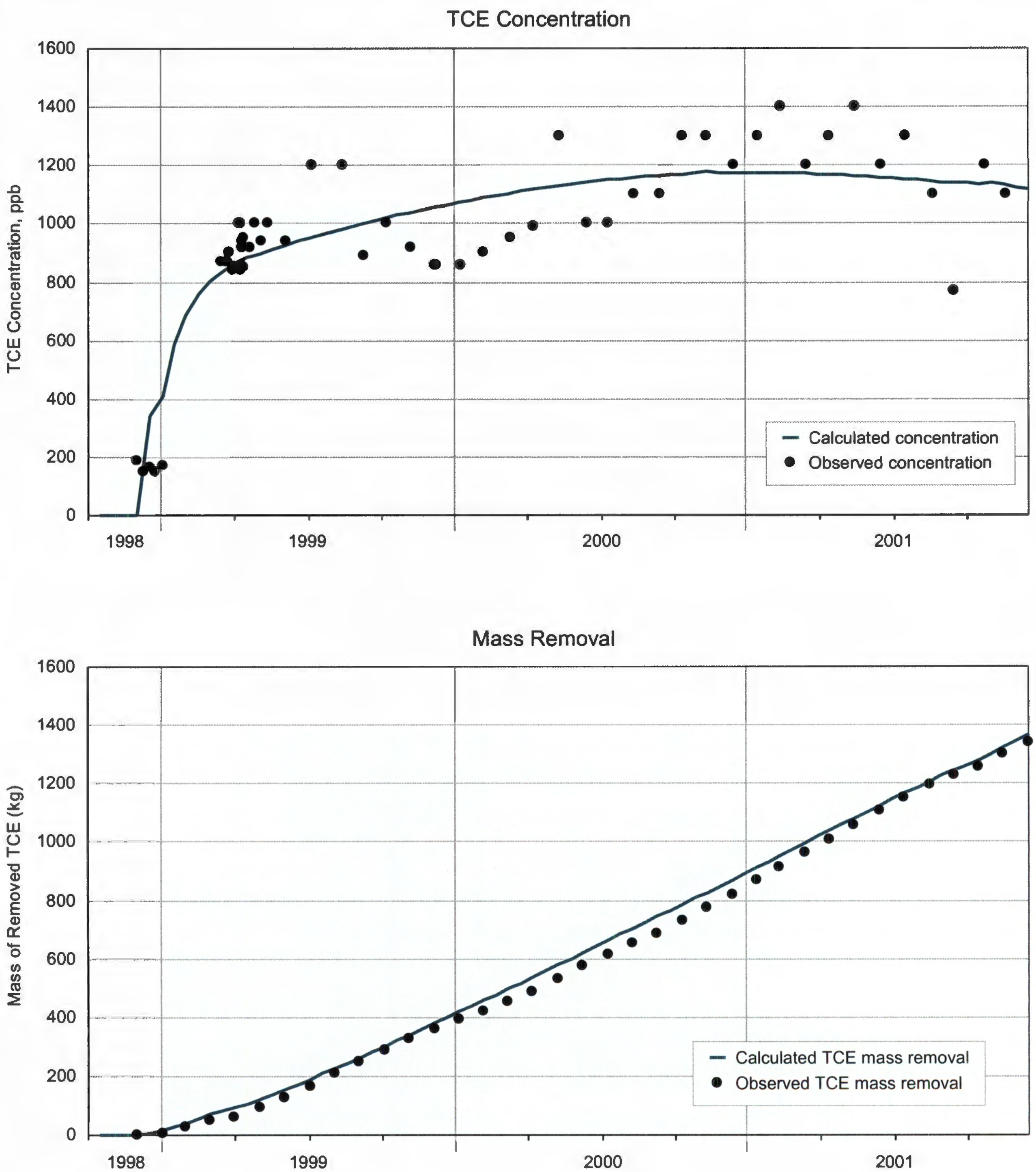
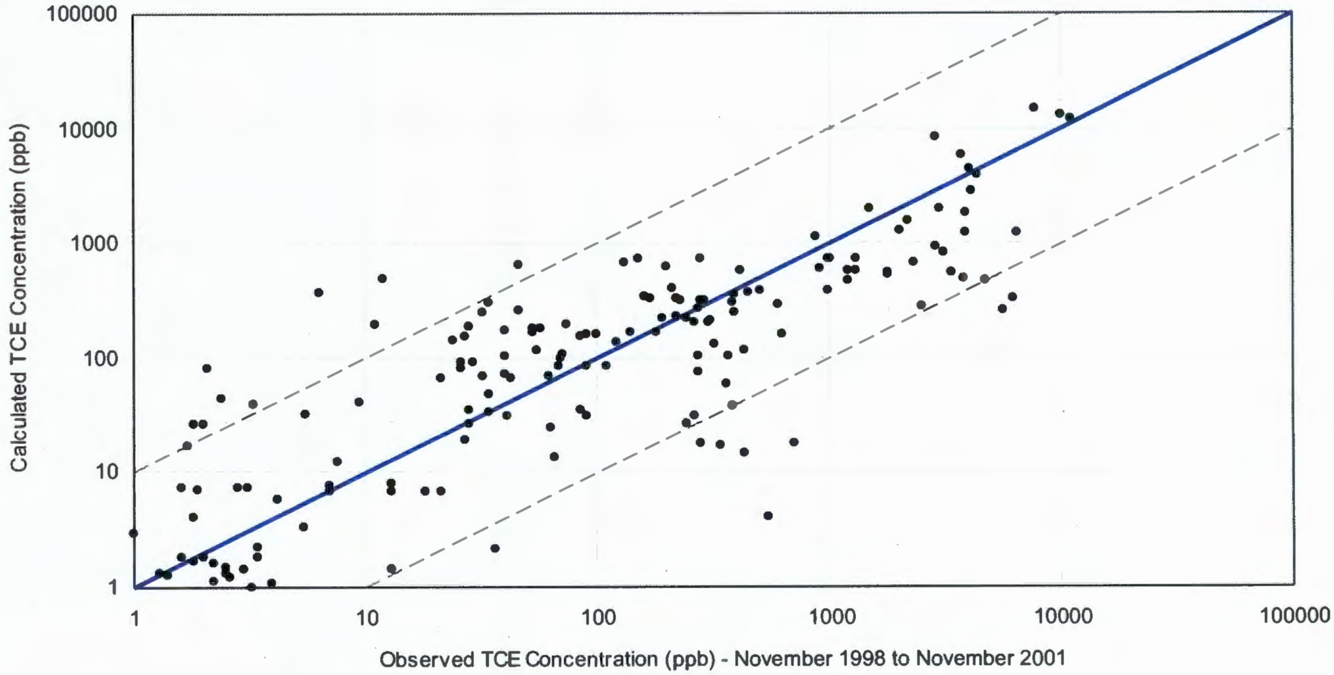


Figure 6.8 Comparisons of Calculated and Observed TCE Concentrations and Mass Removal at CW-1



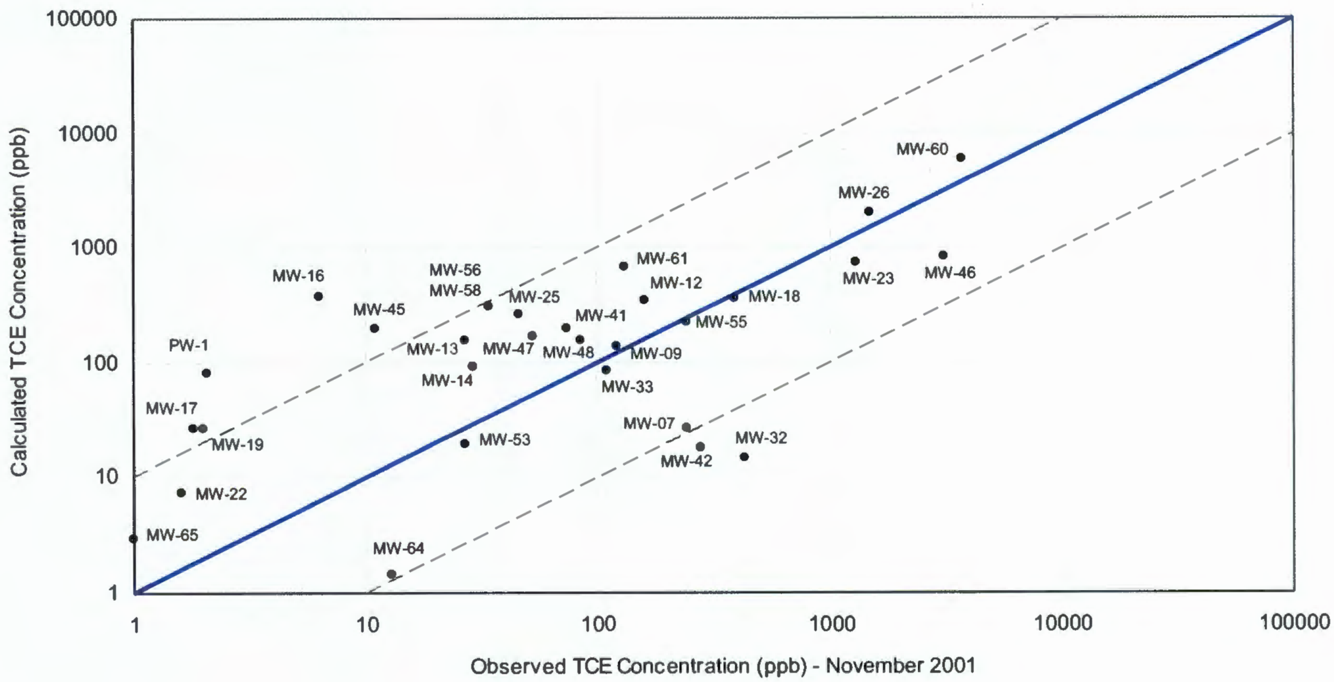


Figure 6.9 Comparisons of Calculated to Observed Concentrations of TCE

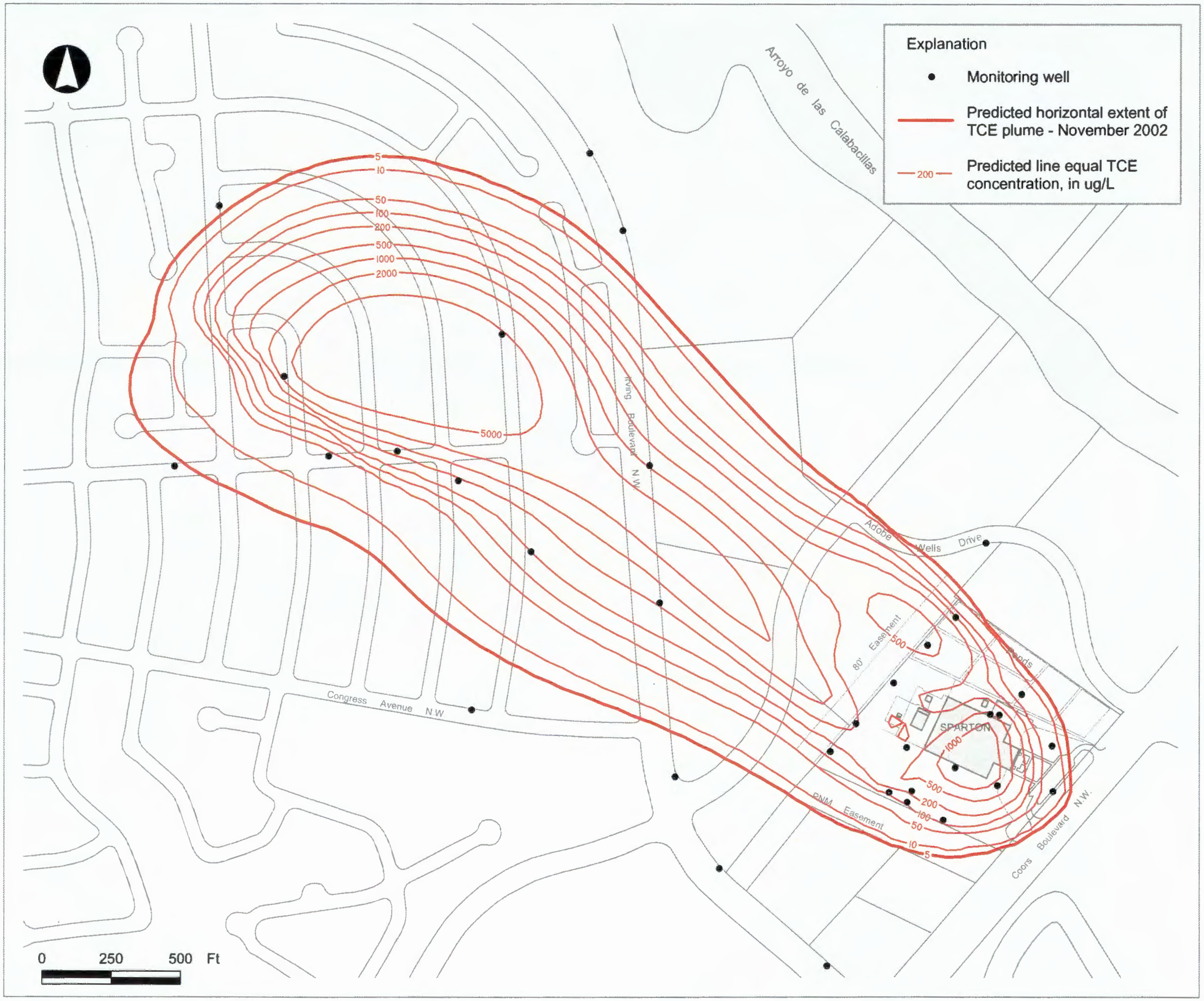


Figure 6.10 Predicted Extent of TCE Plume - November, 2002

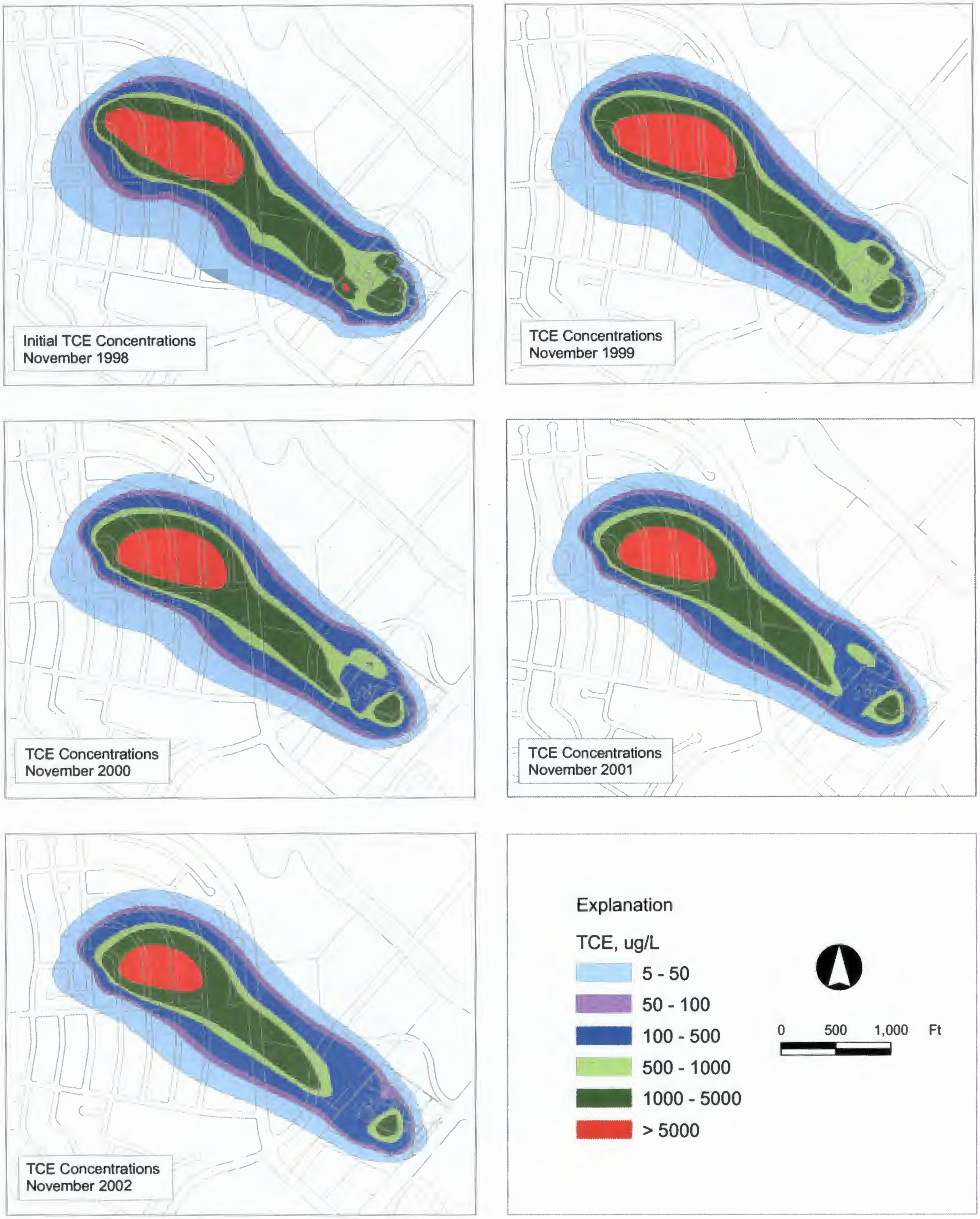


Figure 6.11 TCE Concentrations Calculated with the Recalibrated Model

TABLES

Table 2.1

Completion Flow Zone, Location Coordinates, and Measuring Point Elevation of Wells

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
CW-1	UFZ&LFZ	374740.43	1525601.48	5168.02
CW-2	UFZ - LLFZ	376788.70	1524459.40	5045.61
OB-1	UFZ&LFZ	374665.16	1525599.52	5169.10
OB-2	UFZ&LFZ	374537.98	1525606.65	5165.26
				5165.22 [e]
PW-1	UFZ	377014.89	1524058.48	5042.30 [d]
PZ-1	UFZ	372283.60	1523143.31	5141.79 [d]
MW-7	UFZ	377535.41	1524101.14	5044.80
				5043.48 [e]
MW-9	UFZ	377005.75	1524062.25	5042.37 [d]
				5042.46 [e]
MW-12	UFZ	377023.27	1524102.56	5042.45 [d]
				5042.41 [e]
MW-13	UFZ	377137.23	1523998.34	5041.98 [d]
MW-14R	UFZ	376727.10	1524246.40	5040.92
MW-15	UFZ	376976.13	1524514.13	5047.49
				5047.63 [e]
MW-16	UFZ	377340.57	1524378.38	5047.50
MW-17	UFZ	377423.18	1524452.68	5049.28
MW-18	UFZ	377005.22	1524260.58	5043.35 [d]
				5043.38 [e]
MW-19	ULFZ	376986.52	1524269.27	5043.28 [d]
				5043.30 [e]
MW-20	LLFZ	376967.98	1524277.98	5043.16 [d]
				5043.20 [e]
MW-21	UFZ	377171.22	1524458.71	5048.36
MW-22	UFZ	377531.77	1524267.24	5044.80 [d]
				5044.73 [e]
MW-23	UFZ	377333.63	1524123.03	5045.71 [d]
				5045.74 [e]
MW-24	UFZ	377338.05	1524367.39	5048.70

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
MW-25	UFZ	377307.91	1524380.40	5049.00
				5046.17 [e]
MW-26	UFZ	377180.89	1524187.40	5045.71
				5045.37 [e]
MW-27	UFZ	377078.91	1524323.46	5045.50
				5046.04 [e]
MW-28	UFZ	376745.76	1524262.70	5042.69
				5041.31 [e]
MW-29	ULFZ	377144.48	1523998.74	5041.84 [d]
				5041.88 [e]
MW-30	ULFZ	376924.12	1524105.15	5042.07 [d]
				5042.12 [e]
MW-31	ULFZ	376731.49	1524215.04	5043.53
				5041.38 [e]
MW-32	LLFZ	376958.37	1524494.18	5048.05
				5045.29 [e]
MW-33	UFZ	376940.80	1524097.74	5042.12 [d]
				5042.20 [e]
MW-34	UFZ	376715.25	1523469.17	5034.49
MW-35	UFZ	376322.45	1523822.39	5042.50
MW-36	UFZ	376161.85	1524154.66	5059.46
MW-37R	UFZ	376104.50	1524782.90	NA
MW-38	LLFZ	377150.52	1523995.17	5041.75 [d]
				5041.7 [e]
MW-39	LLFZ	376961.13	1524088.17	5042.23 [d]
				5042.3 [e]
MW-40	LLFZ	376745.33	1524207.40	5043.35
				5041.44 [e]
MW-41	ULFZ	376945.67	1524479.28	5046.77
				5044.56 [e]

[a] UFZ denotes the Upper Flow Zone; ULFZ, LLFZ and 3rdFZ denote the upper, lower, and deeper intervals of the Lower Flow Zone (LFZ); DFZ denotes a deeper flow zone separated from the Lower Flow Zone by a continuous clay layer that causes significant head differences between LFZ and DFZ.

[b] New Mexico "Modified State Plane" coordinates, in feet

[c] In feet above mean sea level (MSL)

[d] Elevation effective February 13, 2001

[e] Elevation effective May 22, 2001

[f] Elevation effective August 27, 2001

[g] Elevation effective November 11, 2001

Table 2.1
(Continued)

Completion Flow Zone, Location Coordinates, and Measuring Point Elevation of Wells

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
MW-42	ULFZ	377183.28	1524730.69	5057.33
MW-43	LLFZ	377169.66	1524747.27	5057.74
MW-44	ULFZ	376166.14	1524136.09	5058.71 [d]
				5058.74 [g]
MW-45	ULFZ	376108.80	1524726.75	5090.11 [d]
MW-46	ULFZ	376067.09	1525279.84	5118.98
MW-47	UFZ	375638.14	1524967.74	5132.03 [d]
				5132.50 [e]
				5122.11 [f]
MW-48	UFZ	375369.75	1525239.86	5159.03 [d]
				5151.8 [e]
				5145.6 [f]
MW-49	3rdFZ	376763.40	1524197.32	5043.67
				5041.44 [e]
MW-50	UFZ	372810.17	1527180.09	5211.51 [d]
MW-51	UFZ	377291.45	1525000.02	5060.31
MW-52	UFZ	374343.43	1525239.45	5156.79
MW-53	UFZ	374899.50	1525314.41	5163.57 [d]
				5154.36 [e]
				5148.62 [g]
MW-54	UFZ	375974.55	1526106.27	5097.64
MW-55	LLFZ	375370.70	1525224.15	5157.83 [d]
				5151.64 [e]
				5145.02 [f]
MW-56	ULFZ	375371.31	1525207.68	5158.77 [d]
				5152.23 [e]
				5144.12 [f]
MW-57	UFZ	375849.02	1526406.98	5103.54
MW-58	UFZ	375148.43	1525330.73	5168.34 [d]
				5151.31 [e]
				5146.4 [g]

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
MW-59	ULFZ	377253.38	1524991.51	5060.61
MW-60	ULFZ	375530.19	1525753.61	5134.87
MW-61	UFZ	375523.16	1525821.65	5135.23
MW-62	UFZ	375421.24	1524395.94	5075.00
				5075.06 [e]
MW-63	UFZ	376840.50	1525236.52	5063.10
MW-64	ULFZ	375968.81	1526127.81	5097.84
MW-65	LLFZ	374343.87	1525277.92	5156.45
MW-66	LLFZ	375859.24	1526389.09	5103.03
MW-67	DFZ	375352.47	1525220.38	5159.16 [d]
				5151.63 e
				5143.78 [f]
				5143.81 [g]
MW-68	UFZ	374503.81	1526216.71	5165.53
				5168.54 [g]
MW-69	LLFZ	374502.80	1526239.55	5165.46
				5167.79 [g]
MW-70	3rdFZ	376981.33	1524492.75	5046.65
				5046.75 [e]
MW-71	DFZ	375530.63	1525711.81	5134.59
MW-72	ULFZ	377079.68	1524630.73	5056.25
MW-73	ULFZ	376821.45	1524346.08	5045.07
				5051.08 [e]
MW-74	UFZ/ULFZ	374484.30	1527810.76	5094.80
MW-75	UFZ/ULFZ	374613.33	1528009.97	5113.74
MW-76	UFZ/ULFZ	375150.41	1527826.10	5108.32
MW-77	UFZ/ULFZ	377754.90	1524374.20	5045.64
MW-78	UFZ/ULFZ	377038.50	1524599.30	5052.91
PZG-1	Infilt. Gall.	374871.44	1527608.15	5090.90
Canal				4996.07

[a] UFZ denotes the Upper Flow Zone; ULFZ, LLFZ and 3rdFZ denote the upper, lower, and deeper intervals of the Lower Flow Zone (LFZ); DFZ denotes a deeper flow zone separated from the Lower Flow Zone by a continuous clay layer that causes significant head differences between LFZ and DFZ.

[b] New Mexico "Modified State Plane" coordinates, in feet

[c] In feet above mean sea level (MSL)

[d] Elevation effective February 13, 2001

[e] Elevation effective May 22, 2001

[f] Elevation effective August 27, 2001

[g] Elevation effective November 11, 2001

Table 2.2

Well Screen Data

Well ID	Flow Zone	Elevation, in ft above MSL			Depth below Ground, in ft		Screen Length in ft
		Ground Surface	Top of Screen	Bottom of Screen	Top of Screen	Bottom of Screen	
CW-1	UFZ&LFZ	5166.4	4957.5	4797.5	208.9	368.9	160.0
CW-2	UFZ - LLFZ	5048.5	4968.5	4918.5	80.0	130.0	50.0
OB-1	UFZ&LFZ	5166.2	4960.3	4789.8	205.9	376.4	170.5
OB-2	UFZ&LFZ	5164.8	4960.3	4789.7	204.5	375.1	170.6
PW-1	UFZ	5040.7	4982.9	4972.9	57.7	67.7	10.0
PZ-1	UFZ	5146.7	4961.5	4951.3	185.2	195.4	10.2
MW-7	UFZ	5041.8	4979.7	4974.7	62.1	67.1	5.0
MW-9	UFZ	5040.5	4975.8	4970.8	64.7	69.7	5.0
MW-12	UFZ	5042.2	4978.2	4966.2	64.0	76.0	12.0
MW-13	UFZ	5041.5	4981.5	4971.6	60.0	69.9	9.9
MW-14	UFZ	5038.7	4979.4	4970.0	59.3	68.7	9.4
MW-14R	UFZ/ULFZ	5040.8	4980.5	4950.5	60.3	90.3	30.0
MW-15	UFZ	5045.8	4986.1	4974.4	59.7	71.4	11.7
MW-16	UFZ	5046.2	4979.7	4974.7	66.5	71.5	5.0
MW-17	UFZ	5047.5	4982.3	4977.3	65.2	70.3	5.0
MW-18	UFZ	5041.6	4976.0	4966.0	65.6	75.6	10.0
MW-19	ULFZ	5040.4	4944.8	4934.8	95.6	105.6	10.0
MW-20	LLFZ	5040.7	4919.2	4906.8	121.5	133.9	12.4
MW-21	UFZ	5042.3	4982.8	4977.7	59.5	64.6	5.1
MW-22	UFZ	5041.9	4977.2	4972.2	64.7	69.7	5.0
MW-23	UFZ	5042.7	4973.8	4968.8	68.9	73.9	5.0
MW-24	UFZ	5046.2	4977.5	4972.5	68.8	73.8	5.0
MW-25	UFZ	5043.1	4977.9	4972.9	65.2	70.2	5.0
MW-26	UFZ	5043.4	4969.1	4964.1	74.3	79.3	5.0
MW-27	UFZ	5044.3	4975.4	4970.4	68.9	73.9	5.0
MW-28	UFZ	5039.6	4975.8	4970.8	63.7	68.7	5.0
MW-29	ULFZ	5039.2	4938.3	4928.3	100.8	110.8	10.0
MW-30	ULFZ	5039.3	4944.8	4934.8	94.5	104.5	10.0
MW-31	ULFZ	5038.7	4945.2	4935.2	93.5	103.5	10.0
MW-32	LLFZ	5042.3	4937.3	4927.3	105.1	115.1	10.0
MW-33	UFZ	5039.9	4979.1	4969.1	60.8	70.8	10.0
MW-34	UFZ	5034.5	4978.0	4968.0	56.5	66.5	10.0
MW-35	UFZ	5042.5	4979.3	4969.3	63.2	73.2	10.0
MW-36	UFZ	5059.5	4976.9	4966.9	82.5	92.5	10.0
MW-37	UFZ	5090.9	4976.6	4966.6	114.3	124.3	10.0
MW-37R	UFZ/ULFZ	5093.0	4976.6	4946.6	116.4	146.4	30.0
MW-38	LLFZ	5039.1	4915.0	4905.0	124.2	134.2	10.0
MW-39	LLFZ	5040.3	4918.7	4908.7	121.6	131.6	10.0
MW-40	LLFZ	5039.1	4923.9	4913.9	115.2	125.2	10.0

Table 2.2
(Continued)

Well Screen Data

Well ID	Flow Zone	Elevation, in ft above MSL			Depth below Ground, in ft		Screen Length in ft
		Ground Surface	Top of Screen	Bottom of Screen	Top of of Screen	Bottom of Screen	
MW-41	ULFZ	5042.1	4952.1	4942.1	90.1	100.1	10.0
MW-42	ULFZ	5054.8	4949.3	4939.3	105.5	115.5	10.0
MW-43	LLFZ	5055.2	4927.7	4917.7	127.5	137.5	10.0
MW-44	ULFZ	5058.8	4952.4	4942.4	106.3	116.3	10.0
MW-45	ULFZ	5089.7	4948.5	4938.5	141.2	151.2	10.0
MW-46	ULFZ	5118.5	4949.6	4939.6	168.9	178.9	10.0
MW-47	UFZ	5120.7	4976.4	4961.4	144.3	159.3	15.0
MW-48	UFZ	5143.0	4976.9	4961.9	166.1	181.1	15.0
MW-49	3rd FZ	5039.0	4903.2	4893.2	135.8	145.8	10.0
MW-50	UFZ	5210.8	4976.5	4961.5	234.3	249.3	15.0
MW-51	UFZ	5058.5	4984.5	4974.5	74.0	84.0	10.0
MW-52	UFZ	5155.9	4974.8	4959.6	181.1	196.3	15.2
MW-53	UFZ	5148.2	4974.4	4960.4	173.8	187.8	14.0
MW-54	UFZ	5097.2	4976.8	4961.8	120.4	135.4	15.0
MW-55	LLFZ	5143.0	4913.1	4903.1	230.0	240.0	10.0
MW-56	ULFZ	5141.0	4942.9	4932.9	198.1	208.1	10.0
MW-57	UFZ	5103.1	4978.0	4963.0	125.1	140.1	15.0
MW-58	UFZ	5146.0	4975.4	4960.4	170.5	185.5	15.0
MW-59	ULFZ	5058.7	4954.9	4944.4	103.9	114.4	10.5
MW-60	ULFZ	5134.4	4949.5	4939.5	185.0	195.0	10.0
MW-61	UFZ	5134.8	4976.2	4961.2	158.6	173.6	15.0
MW-62	UFZ	5073.2	4980.8	4965.8	92.4	107.4	15.0
MW-63	UFZ	5062.7	4983.1	4968.1	79.5	94.5	15.0
MW-64	ULFZ	5097.4	4959.3	4949.1	138.1	148.3	10.2
MW-65	LLFZ	5156.0	4896.4	4886.4	259.6	269.6	10.0
MW-66	LLFZ	5102.6	4903.3	4893.3	199.2	209.2	10.0
MW-67	DFZ	5141.8	4798.1	4788.1	343.7	353.7	10.0
MW-68	UFZ	5168.1	4970.5	4950.5	197.6	217.6	20.0
MW-69	LLFZ	5167.3	4904.7	4894.7	262.7	272.7	10.0
MW-70	3rd FZ	5044.4	4912.1	4902.1	132.3	142.3	10.0
MW-71	DFZ	5134.1	4786.0	4781.0	348.1	353.1	5.0
MW-72	ULFZ	5053.7	4955.0	4945.0	98.7	108.7	10.0
MW-73	ULFZ	5048.2	4945.6	4940.6	102.7	107.7	5.0
MW-74	UFZ/ULFZ	5092.4	4969.2	4939.2	123.2	153.2	30.0
MW-75	UFZ/ULFZ	5111.6	4971.2	4941.2	140.5	170.5	30.0
MW-76	UFZ/ULFZ	5105.5	4972.4	4942.4	133.0	163.0	30.0
MW-77	UFZ/ULFZ	5045.5	4985.9	4955.9	59.6	89.6	30.0
MW-78	UFZ/ULFZ	5050.5	4988.1	4958.1	62.4	92.4	30.0

Table 2.3

Production History of the Former On-Site Groundwater Recovery System

Year	Volume of Recovered Water, in gal	Average Discharge Rate, in gpm
1988[a]	25,689	1.05
1989	737,142	1.40
1990	659,469	1.25
1991	556,300	1.06
1992	440,424	0.84
1993	379,519	0.72
1994	370,954	0.71
1995	399,716	0.76
1996	306,688	0.58
1997	170,900	0.33
1998	232,347	0.44
1999[b]	137,403	0.26
Total Recovered Volume, in gal	**4,416,550**	
Average Discharge Rate, in gpm		**0.77**

[a] System began operating on December 15, 1988.

[b] System was terminated on November 16, 1999.

Table 2.4

Water-Level Elevations - Fourth Quarter 1998[a]

Well ID	Flow Zone	Elevation, in ft above MSL
PW-1	UFZ	4973.59
PZ-1	UFZ	4956.59
MW-7	UFZ O/S *	4977.42
MW-9	UFZ O/S	4973.06
MW-12	UFZ O/S	4972.82
MW-13	UFZ O/S	4974.35
MW-14	UFZ	4971.12
MW-15	UFZ	Dry
MW-16	UFZ O/S	4978.43
MW-17	UFZ O/S	4978.7
MW-18	UFZ O/S	4971.87
MW-19	ULFZ	4971.85
MW-20	LLFZ	4971.47
MW-21	UFZ O/S	4978.31
MW-22	UFZ O/S	4977.89
MW-23	UFZ O/S	4975.91
MW-24	UFZ O/S	4978.23
MW-25	UFZ O/S	4978.31
MW-26	UFZ O/S	4973.44
MW-27	UFZ O/S	4974.05
MW-28	UFZ O/S	4971.09
MW-29	ULFZ	4973.68
MW-30	ULFZ	4972.28
MW-31	ULFZ	4971.23
MW-32	ULFZ **	4970.96
MW-33	UFZ O/S	4972.54
MW-34	UFZ	4974.51
MW-35	UFZ	4970.78
MW-36	UFZ	4970.03
MW-37	UFZ	4968.32
MW-38	LLFZ	4973.7
MW-39	LLFZ	4972.49

Well	Flow Zone	Elevation, in ft above MSL
MW-40	LLFZ	4971.25
MW-41	ULFZ	4971.09
MW-42	ULFZ	4970.65
MW-43	LLFZ	4970.45
MW-44	ULFZ	4970.11
MW-45	ULFZ	4968.33
MW-46	ULFZ	4966.95
MW-47	UFZ	4966.68
MW-48	UFZ	4965.81
MW-49	LLFZ **	4971.03
MW-50	UFZ	Dry
MW-51	UFZ O/S	4980.09
MW-52	UFZ	4963.17
MW-53	UFZ	4964.92
MW-54	UFZ	4965.56
MW-55	LLFZ	4965.13
MW-56	ULFZ	4965.76
MW-57	UFZ	4964.87
MW-58	UFZ	4965.43
MW-59	ULFZ	4969.46
MW-60	ULFZ	4965.33
MW-61	UFZ	4965.37
MW-62	UFZ	4967.52
MW-63	UFZ O/S	4970.98
MW-64	ULFZ	4965.41
MW-65	LLFZ	4963.05
MW-66	LLFZ	4963.98
MW-67	DFZ	4958.56
MW-68	UFZ	4962.25
MW-69	LLFZ	4962.13
MW-70	LLFZ ***	4970.18
MW-71	DFZ	4958.51

[a] Water levels were measured on November 10, 1998, except for wells PW-1, MW-18, and MW-23 through MW-28 which were measured on November 25, 1998.

* UFZ O/S denotes UFZ wells, mostly on-site, which are screened above or within the 4970-foot silt/clay.

** Previously classified as LLFZ

*** Previously classified as 3rdFZ

Table 2.5

Water-Quality Data - Fourth Quarter 1998[a]

Well ID	Sampling Date	Concentration, in µg/L		
		TCE	DCE	TCA
CW1	09/01/98	140	2.9	<20
OB1	09/01/98	180	3.6	<20
OB2	09/01/98	72	1.7	<20
PW1	12/04/98	48	1	2.2
MW7	12/01/98	63	15	12
MW9	12/03/98	290	19	18
MW12	12/07/98	380	26	18
MW13	12/01/98	70	3.2	8
MW14	12/01/98	430	24	4.2
MW16	12/08/98	1200	30	170
MW17	12/01/98	68	3.5	13
MW18	12/02/98	600	50	42
MW19	11/23/98	4.2	<1.0	<1.0
MW20	11/23/98	<1.0	<1.0	<1.0
MW21	12/02/98	7.5	<1.0	1.1
MW22	11/19/98	13	2	4.6
MW23	12/03/98	6200	400	720
MW24	12/08/98	4700	74	480
MW25	12/08/98	5600	73	540
MW26	12/03/98	6500	590	550
MW27	12/02/98	380	24	90
MW29	11/19/98	<1.0	<1.0	<1.0
MW30	11/23/98	5.4	<1.0	<1.0
MW31	11/23/98	<1.0	<1.0	<1.0
MW32	11/30/98	550	96	30
MW33	12/02/98	630	53	28
MW34	11/18/98	<1.0	<1.0	<1.0
MW35	12/08/98	<1.0	<1.0	<1.0
MW36	12/07/98	1.4	<1.0	<1.0
MW37	12/03/98	990	48	<5
MW38	11/19/98	<1.0	<1.0	<1.0
MW39	11/23/98	<1.0	<1.0	<1.0
MW40	11/30/98	<1.0	<1.0	<1.0
MW41	11/19/98	170	26	<15
MW42	11/19/98	370	48	21
MW43	11/19/98	25	5.1	5.4
MW44	11/18/98	1.3	<1.0	<1.0
MW45	11/18/98	40	1.7	<1.0
MW46	11/19/98	2200	130	2.3
MW47	11/17/98	34	1.2	<1.0
MW48	11/17/98	28	1	<1.0
MW49	11/23/98	<1.0	<1.0	<1.0
MW51	11/18/98	<1.0	<1.0	<1.0
MW52	11/30/98	<1.0	<1.0	<1.0
MW53	11/16/98	99	3.4	<1.0
MW55	11/16/98	390	10	<1.0
MW56	11/16/98	140	4.7	<1.0
MW57	12/08/98	<1.0	<1.0	<1.0
MW58	11/16/98	71	2.5	<1.0
MW59	11/18/98	<1.0	<1.0	<1.0
MW60	11/17/98	7700	350	52
MW61	12/07/98	1000	54	11
MW62	12/07/98	2	6.6	4.8
MW63	12/02/98	<1.0	<1.0	<1.0
MW64	11/17/98	<1.0	<1.0	<1.0
MW65	11/16/98	13	<1.0	<1.0
MW66	11/17/98	<1.0	<1.0	<1.0
MW67	11/17/98	<1.0	<1.0	<1.0
MW68	11/12/98	<1.0	<1.0	<1.0
MW69	11/12/98	<1.0	<1.0	<1.0
MW70	11/23/98	<1.0	<1.0	<1.0
MW71	11/17/98	56	1.6	<1.0
TW1	02/18/98	3100	280	180
TW1 Dup.		3400	270	170
TW2	02/19/98	18	<1.0	<1.0
TW2 Dup.		16	<1.0	<1.0

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 µg/L for TCE and DCE, and 60 µg/L for TCA).

[a] Includes 2/18/98 data from temporary well TW1/2 which was drilled at the current location of well MW73, and 9/1/98 data from the containment well CW.

Table 3.1

Modifications to Monitoring Wells and Vapor Probes - 2001

Well	Date	Work Done
MW-7	April	Lowered wellhead.
MW-13	February	Lowered wellhead.
MW-14	March	Lowered wellhead.
MW-14R	November	Completed as a replacement for MW-14
MW-15	April	Lowered wellhead.
MW-18	February	Lowered wellhead.
MW-19	February	Lowered wellhead.
	March	Slab damaged and repaired.
MW-20	February	Lowered wellhead.
MW-21	March	Lowered wellhead.
MW-22	January	Wellhead and PVC damaged.
	February	Wellhead and PVC repaired.
	March	Slab damaged and repair.
MW-23	February	Lowered wellhead.
MW-26	February	Wellhead damaged.
	March	Lowered wellhead. Wellhead damaged and repaired.
MW-27	February	Wellhead damaged.
	March	Lowered wellhead and repaired.
MW-28	February	Wellhead damaged.
	March	Lowered wellhead and repaired.
MW-29	February	Lowered wellhead.
	March	Slab damaged and repaired.
MW-31	March	Lowered wellhead.
MW-32	April	Lowered wellhead.
MW-37R	November	Completed as a replacement for MW-37 with temporary
MW-38	February	Lowered wellhead.
MW-39	March	Slab damaged and repaired. Slab damaged and repaired.
MW-40	March	Lowered wellhead.
MW-41	April	Lowered wellhead.
MW-47	February	Lowered wellhead.
	May	Repaired damaged wellhead.
	July	Lowered wellhead.
MW-48	February	Lowered wellhead.
	May	Lowered wellhead.
	July	Lowered wellhead.
MW-49	March	Lowered wellhead.
MW-52	December	Lowered wellhead.
MW-53	May	Lowered wellhead.
	August	Lowered wellhead.

Well	Date	Work Done
MW-55	February	Lowered wellhead.
	May	Lowered wellhead.
	July	Lowered wellhead.
MW-56	February	Lowered wellhead.
	May	Lowered wellhead.
	July	Lowered wellhead.
MW-58	May	Lowered wellhead.
	August	Lowered wellhead.
MW-62	December	Lowered wellhead.
MW-66	June	Installed new packer. Sampled.
MW-67	February	Lowered wellhead.
	May	Lowered wellhead.
	July	Lowered wellhead.
	August	Lowered wellhead.
	September	Wellhead damaged and repaired.
MW-68	August	Raised wellhead.
MW-69	June	Installed new packer. Sampled.
	August	Raised wellhead.
MW-70	March	Wellhead and PVC damaged and repaired.
	April	Lowered wellhead.
MW-71	July	Conducted Purge Test.
	September	Conducted alignment survey and perforated.
	October	Plugged.
MW-73	February	Wellhead damaged and repaired. Raised wellhead.
	April	Lowered wellhead.
MW-77	June	Completed.
MW-78	June	Completed.
PW-1	March	Wellhead damaged and repaired. Slab damaged and repaired.
OB-2	August	Raised wellhead.
VR-3	February	Plugged.
VP-4	March	Lowered wellhead.
VP-5	February	Lowered wellhead.
	March	Slab damaged and repaired.
VP-7	February	Plugged.
VP-8	February	Lowered wellhead.
VP-10	March	Lowered wellhead.
VP-12	February	Plugged.
VP-13	February	Plugged.

Table 4.1

Quarterly Water-Level Elevations - 2001

Well ID	Flow Zone	Elevation, in feet above MSL			
		Feb. 13	May 22	Aug. 27	Nov. 1
CW-1	UFZ&LFZ	4938.22	4937.28	4938.06	4937.86
OB-1	UFZ&LFZ	4957.51	4957.24	4957.10	4957.25
OB-2	UFZ&LFZ	4959.05	4958.58	4958.48	4958.45
PW-1	UFZ	DRY	DRY	DRY	DRY
PZ-1	UFZ	4955.61	4955.04	4954.71	4954.82
MW-7	UFZ O/S	4975.81	4976.25	4976.15	4976.23
MW-9	UFZ O/S	4971.46	4971.86	4971.81	4971.88
MW-12	UFZ O/S	4971.06	4971.29	4971.26	4971.29
MW-13	UFZ O/S	4972.80	4973.27	4973.21	4973.23
MW-14R	UFZ/ULFZ				4969.29
MW-16	UFZ O/S	4977.92	4977.73	4977.28	4977.43
MW-17	UFZ O/S	4977.88	4977.78	4977.68	4977.84
MW-18	UFZ O/S	4969.86	4970.50	4970.45	4970.48
MW-19	ULFZ	4970.20	4970.39	4970.34	4970.40
MW-20	LLFZ	4969.85	4970.04	4969.99	4970.03
MW-22	UFZ O/S	4976.25	4976.43	4976.37	4976.42
MW-23	UFZ O/S	4974.41	4974.94	4974.87	4974.90
MW-24	UFZ O/S	4977.25	4977.21	4977.13	4977.29
MW-25	UFZ O/S	4977.35	4977.21	4977.13	4977.27
MW-26	UFZ O/S	4972.11	4971.63	4971.56	4971.62
MW-27	UFZ O/S	4972.78	4972.71	4972.68	4972.84
MW-29	ULFZ	4971.86	4972.38	4972.33	4972.33
MW-30	ULFZ	4970.54	4970.86	4970.82	4970.83
MW-31	ULFZ	4969.62	4969.70	4969.64	4969.69
MW-32	ULFZ	4969.52	4969.53	4969.46	4969.54
MW-33	UFZ O/S	4970.77	4971.10	4971.05	4971.12
MW-34	UFZ	4972.44	4973.02	4973.08	4973.07
MW-35	UFZ	4969.82	4969.99	4970.02	4970.08
MW-36	UFZ	4968.41	4968.31	4968.30	4968.38
MW-37R	UFZ/ULFZ				MP NA
MW-38	LLFZ	4971.96	4972.45	4972.29	4972.29
MW-39	LLFZ	4970.78	4971.11	4971.06	4971.08
MW-40	LLFZ	4969.65	4969.75	4969.69	4969.76
MW-41	ULFZ	4969.61	4969.65	4969.57	4969.66
MW-42	ULFZ	4969.41	4969.35	4969.25	4969.33
MW-43	LLFZ	4969.22	4969.12	4969.04	4969.11
MW-44	ULFZ	4968.43	4968.38	4968.38	4968.46
MW-45	ULFZ	4967.27	4967.05	4967.01	4967.08
MW-46	ULFZ	4965.58	4965.25	4965.19	4965.26
MW-47	UFZ	4964.80	4964.42	4964.34	4964.44
MW-48	UFZ	4963.89	4963.60	4963.55	4963.67
MW-49	LLFZ	4969.51	4969.54	4969.49	4969.60
MW-51	UFZ O/S	4979.98	4979.72	4979.77	4979.73
MW-52	UFZ	4960.44	4960.11	4960.02	4960.27
MW-53	UFZ	4962.50	4961.97	4961.84	4962.10
MW-54	UFZ	4964.57	4964.38	4964.16	4964.27
MW-55	LLFZ	4962.85	4962.47	4962.38	4962.48
MW-56	ULFZ	4963.91	4963.66	4963.52	4963.65
MW-57	UFZ	4964.52	4964.10	4963.99	4964.04
MW-58	UFZ	4963.32	4963.46	4963.31	4963.12
MW-59	ULFZ	4968.40	4968.19	4968.07	4968.16
MW-60	ULFZ	4963.94	4963.80	4963.62	4963.68
MW-61	UFZ	4964.01	4963.88	4963.65	4963.74
MW-62	UFZ	4965.77	4965.66	4965.63	4965.72
MW-63	UFZ O/S	4970.39	4969.98	4969.88	4969.92
MW-64	ULFZ	4964.75	4964.30	4964.20	4964.28
MW-65	LLFZ	4960.18	4959.83	4959.76	4959.95
MW-66	LLFZ	4963.19	4962.72	4962.60	4962.68
MW-67	DFZ	4957.59	4956.91	4956.58	4956.70
MW-68	UFZ	4960.38	4960.10	4959.93	4960.21
MW-69	LLFZ	4960.29	4959.94	4959.84	4960.03
MW-70	LLFZ	4968.80	4969.07	4969.01	4969.05
MW-71	DFZ	4957.61	4956.89	4956.66	DRY
MW-72	ULFZ	4969.54	4969.55	4969.47	4969.55
MW-73	ULFZ	4969.46	4969.45	4969.38	4969.45
MW-74	UFZ/ULFZ	4963.14	4962.02	4962.53	4962.25
MW-75	UFZ/ULFZ	4966.95	4965.93	4966.56	4965.67
MW-76	UFZ/ULFZ	4968.03	4966.87	4967.41	4966.27
MW-77	UFZ/ULFZ	NI	NI	4977.23	4977.23
MW-78	UFZ/ULFZ	NI	NI	4971.21	4971.74
PZG-1	Infilt. Gall.	DRY	DRY	DRY	DRY
Canal[a]		DRY	4992.94	4992.04	DRY

Notes: Wells MW-74, 75, 76, 77, and 78 were measured on 2/14/01, 5/14/01, 8/15/01, and 11/19/01
Wells MW-14, 15, 21, 28, 37, and 50 were dry all year

[a] Measured near the SE corner of Sparton property.
MP NA: Measuring point elevation not available
NI: Well not yet installed

Table 4.2

Production from the Off-Site Containment Well - 2001

Month	Volume of Pumped Water, in gal.		Average Discharge Rate, in gpm	
	Monthly	Annual	Monthly	Annual
Jan.	9,885,166		221	
Feb.	8,861,386		220	
Mar.	9,937,653		223	
Apr.	9,653,081		223	
May	9,850,919		221	
June	9,374,931		217	
July	9,960,636		223	
Aug.	9,807,584		220	
Sep.	8,541,400		198	
Oct.	8,230,366		184	
Nov.	9,692,860		224	
Dec.	9,858,202	**113,654,183**	221	**216**

Table 4.3

Water-Quality Data - Fourth Quarter 2001

Well ID	Sampling Date	Concentration, in µg/L		
		TCE	DCE	TCA
MW-7	11/16/01	240	17	3.3
MW-9	11/16/01	120	4.3	4.1
MW-12	11/20/01	160	12	4.5
MW-13	11/16/01	27	<1.0	1.9
MW-14R	12/07/01	29	1.2	<1.0
MW-16	11/16/01	6.3	<1.0	<1.0
MW-17	11/19/01	1.8	<1.0	<1.0
MW-18	11/20/01	390	22	8.6
MW-19	11/13/01	2.0	<1.0	<1.0
MW-20	11/12/01	<1.0	<1.0	<1.0
MW-22	11/13/01	1.6	<1.0	<1.0
MW-23	11/16/01	1300	50	57
MW-25	11/20/01	46	4.6	<1.0
MW-26	11/21/01	1500	160	65
MW-29*	11/07/01	<1.0	<1.0	<1.0
MW-30	11/09/01	2.0	<1.0	<1.0
MW-31	11/09/01	<1.0	<1.0	<1.0
MW-32	11/13/01	430	71	9.2
MW-33	11/16/01	110	7.9	4
MW-34	11/20/01	<1.0	<1.0	<1.0
MW-35	11/22/01	<1.0	<1.0	<1.0
MW-36	11/26/01	1.8	<1.0	<1.0
MW-37R	12/07/01	190	8	<1.0
MW-38	11/07/01	<1.0	<1.0	<1.0
MW-39	11/09/01	<1.0	<1.0	<1.0
MW-40	11/12/01	<1.0	<1.0	<1.0
MW-41	11/12/01	74	10	2.8
MW-42	11/13/01	280	32	8.2
MW-43	11/13/01	15	2	<1.0
MW-44	11/07/01	<1.0	<1.0	<1.0
MW-45	11/07/01	11	<1.0	<1.0
MW-46	11/07/01	3100	540	36
MW-47	11/29/01	53	2	<1.0
MW-48	11/30/01	85	3.1	<1.0
MW-49	11/09/01	<1.0	<1.0	<1.0
MW-51	11/07/01	<1.0	<1.0	<1.0
MW-52	11/26/01	<1.0	<1.0	<1.0
MW-53	11/26/01	27	1.3	<1.0
MW-55*	11/28/01	235	6.9	<1.0
MW-56	11/30/01	34	<1.0	<1.0
MW-57	11/26/01	<1.0	<1.0	<1.0
MW-58	11/27/01	34	<1.0	<1.0
MW-59	11/07/01	<1.0	<1.0	<1.0
MW-60	11/06/01	3700	200	10
MW-61	11/30/01	130	6.1	<1.0
MW-62	11/27/01	3.7	9.6	5.6
MW-64	11/06/01	13	1.4	<1.0
MW-65	11/30/01	1.0	2.6	<1.0
MW-66*	11/06/01	<1.0	<1.0	<1.0
MW-67	11/28/01	<1.0	<1.0	<1.0
MW-68	11/06/01	<1.0	<1.0	<1.0
MW-69	11/06/01	<1.0	<1.0	<1.0
MW-70	11/12/01	<1.0	<1.0	<1.0
MW-72	11/13/01	2900	280	92
MW-73	11/12/01	2000	290	54
PW-1	11/21/01	2.1	<1.0	<1.0
CW-1	11/07/01	1200	58	4.1

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 µg/L for TCE and DCE, and 60 µg/L for TCA).

* Results for well are the average of duplicate samples

Table 4.4

Off-Site Treatment System Influent and Effluent Quality - 2001[a]

Sampling Date	Concentration, in μg/L							
	Influent				Effluent			
	TCE	DCE	TCA	Cr Total	TCE	DCE	TCA	Cr Total
1/2/01	1200	49	<20	43.2	<0.3	<1.0	<0.2	41.9
2/1/01	1300	55	<10	44.1	<0.3	<0.2	<1.0	44.1
3/1/01	1400	70	<10	42.1	<0.3	<0.2	<1.0	32.6
4/2/01	1200	55	<10	40.7	<0.3	<0.2	<1.0	39.9
5/1/01	1300	41	<10	40.5	<0.3	<0.2	<1.0	33.7
6/1/01	1400	65	5.1	41.5	<0.3	<0.2	<1.0	35.9
7/2/01	1200	73	<20	41.9	<0.3	<0.2	<1.0	35.2
8/1/01	1300	67	5.6	47.5	<0.35	<0.38	<0.38	35.1
9/5/01	1100	73	5.7	42.8	<0.35	<0.38	<0.38	38.6
10/1/01	770	69	4.5	38.4	<0.3	<0.2	<1.0	41.4
11/7/01	1200	58	4.1	40	<0.3	<0.2	<1.0	39.4
12/3/01	1100	55	4.6	38.3	<0.3	<0.2	<1.0	37.3
1/3/02	1100	77	4.3	35	0.8	<0.2	<1.0	39

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).

[a] Data from 1/3/02 has been included to show conditions at the end of the year.

Table 4.5

Weekly Total Chromium Concentrations in the Air Stripper Effluent

Date	Concentration (µg/l)	Date	Concentration (µg/l)
01/01/01	41.9	06/11/01	31.5
01/11/01	35.3	06/20/01	34.8
01/19/01	34.8	06/27/01	36.3
01/24/01	41.6	07/02/01	35.2
02/01/01	44.1	07/09/01	31
02/07/01	36.7	07/16/01	34.7
02/14/01	42.2	07/23/01	39.1
02/23/01	32.8	08/06/01	33.8
03/08/01	34.0	08/13/01	35.6
03/15/01	39.0	08/21/01	39.8
03/22/01	42.7	08/28/01	32.5
03/29/01	38.0	09/05/01	38.6
04/02/01	39.9	09/11/01	34.2
04/09/01	39.8	09/18/01	34
04/16/01	39.7	09/25/01	32.7
04/23/01	34.6	10/10/01	36.4
05/01/01	33.7	10/17/01	38.9
05/07/01	54.9	10/24/01	45.6
05/14/01	34.3	11/01/01	39.4
05/21/01	12.9	11/07/01*	41.9
05/29/01	40.5	11/14/01	41.4
06/01/01	35.9	11/21/01	40.2
06/06/01	9.1	11/27/01**	41.1

Notes: Shaded cell indicates concentration exceeds the 50 ug/L maximum allowable concentrations in groundwater set for total chromium by the NMWQCC.

* Chromium treatment ceased Nov. 1, 2001.
** Weekly chromium sampling discontinued at this date.

Table 4.7

SVE System
Results of Performance Monitoring of Soil Gas

Sampling Location	September, 2001		October, 2001	
	TCE mg/m^3	TCE ppmv	TCE mg/m^3	TCE ppmv
MW-7	1.9	0.43	1.9	0.43
MW-13	0.55	0.12	0.48	0.11
MW-15	6.6	1.5	1.8	0.4
MW-17	0.24	0.05	0.14	0.03
MW-18	5.8	1.3	5.4	1.21
MW-21	2.4	0.54	1.1	0.25
VR-1	4.2	0.94	4.9	1.1
VR-2	1.2	0.27	2.2	0.49
VR-4	0.97	0.22	1.1	0.25
VR-5	0.17	0.04	<0.10	<0.02
VP-1	5.6	1.3	<0.10	<0.02
VP-2	4.5	1	4.5	1
VP-4	1.7	0.38	2.1	0.47
VP-5	<0.10	<0.02	1.8	0.4
VP-6	3.9	0.87	1.6	0.36
VP-8	<0.10	<0.02	<0.10	<0.02
VP-9	0.79	0.18	1.1	0.25
VP-10	0.18	0.04	0.22	0.05
VP-11	0.12	0.03	<0.10	<0.02
VP-14	0.16	0.04	0.12	0.03

Table 5.1

Contaminant Mass Removal by the Off-Site Containment Well - 2001

Month	Mass of Removed TCE		Mass of Removed 1,1-DCE		Total Removed Mass	
	in kg	in lbs	in kg	in lbs	in kg	in lbs
Jan.	46.8	103.1	1.9	4.3	48.7	107.4
Feb.	45.3	99.8	2.1	4.6	47.4	104.5
Mar.	48.9	107.8	2.4	5.2	51.3	113.0
Apr.	45.7	100.7	1.8	3.9	47.4	104.6
May	50.3	111.0	2.0	4.4	52.3	115.3
June	46.1	101.7	2.4	5.4	48.6	107.1
July	47.1	103.9	2.6	5.8	49.8	109.7
Aug.	44.6	98.2	2.6	5.7	47.1	103.9
Sep.	30.2	66.6	2.3	5.1	32.5	71.7
Oct.	30.7	67.7	2.0	4.4	32.7	72.0
Nov.	42.2	93.0	2.1	4.6	44.3	97.6
Dec.	41.0	90.5	2.5	5.4	43.5	95.9
Total	**519.0**	**1144.1**	**26.6**	**58.7**	**545.6**	**1202.8**

Table 6.1

Initial Mass and Maximum Concentration of TCE in Model Layers

Model Layer	Approximate Mass		Maximum Concentration in µg/L
	in kg	in lbs	
1	0.0	0.0	6,540
2	8.8	19.5	5,298
3	11.8	26.0	1,361
4	453.4	999.6	12,000
5	770.7	1,699.0	34,035
6	769.5	1,696.4	34,035
7	555.2	1,224.0	15,000
8	364.1	802.7	4,033
9	178.7	394.1	1,987
10	137.8	303.7	1,005
11	45.3	100.0	411
Total	**3,295.4**	**7,265.0**	-

APPENDIX A

Appendix A

Off-Site Containment Well 2001 Flow Rate Data

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
12/28/00	15:17	221	192406000		228088500
				222	
01/02/01	12:30	222	193963900		229646400
				222	
01/04/01	15:20	---	194639800		230322300
				222	
01/06/01	16:53	---	195299300		230981800
				222	
01/08/01	12:48	---	195883600		231566100
				222	
01/10/01	10:40	---	196494000		232176500
				222	
01/11/01	12:48	221	196841700		232524200
				222	
01/15/01	14:20	---	198139500		233822000
				222	
01/18/01	14:00	---	199094800		234777300
				146	
01/19/01	19:12	222	199350200		235032700
				260	
01/22/01	6:38	---	200276300		235958800
				222	
01/24/01	7:45	---	200931400		236613900
				221	
01/26/01	6:37	221	201552400		237234900
				220	
01/29/01	7:14	---	202511800		238194300
				219	
01/31/01	16:53	---	203270500		238953000
				219	
02/01/01	9:14	220	203485200		239167700
				218	
02/02/01	6:30	---	203762900		239445400
				216	
02/05/01	6:30	---	204697400		240379900
				216	
02/07/01	12:38	---	205398500		241081000
				215	
02/09/01	6:40	223	205941100		241623600
				227	
02/12/01	6:18	---	206918400		242600900
				220	
02/13/01	8:55	---	207270000		242952500
				231	

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
02/14/01	8:10	---	207592000		243274500
				231	
02/15/01	8:17	221	207925900		243608400
				0	
02/16/01	11:30	---	207925900		243608400
				248	
02/17/01	6:37	222	208210300		243892800
				288	
02/20/01	12:16	---	209551300		245233800
				220	
02/23/01	6:52	221	210429400		246111900
				218	
03/01/01	9:38	218	212351500		248034000
				233	
03/08/01	6:30	---	214653700		250336200
				208	
03/14/01	6:10	---	216446900		252129400
				224	
03/15/01	12:00	---	216847500		252530000
				223	
03/16/01	8:24	222	217120500		252803000
				223	
03/19/01	6:32	222	218059600		253742100
				220	
03/22/01	11:35	224	219077200		254759700
				226	
03/26/01	6:17	226	220308500		255991000
				226	
03/29/01	12:38	223	221370300		257052800
				223	
04/02/01	6:37	226	222571800		258254300
				225	
04/05/01	7:08	225	223549400		259231900
				223	
04/09/01	6:42	222	224828400		260510900
				223	
04/12/01	12:48	223	225874300		261556800
				224	
04/16/01	7:50	222	227100000		262782500
				224	
04/19/01	6:38	222	228052200		263734700
				224	
04/23/01	6:50	223	229342900		265025400
				223	

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
04/26/01	6:50	223	230307500		265990000
				223	
04/28/01	18:17	221	231102600		266785100
				221	
04/30/01	6:36	221	231585200		267267700
				221	
05/01/01	7:07	---	231910500		267593000
				222	
05/02/01	6:34	222	232222200		267904700
				221	
05/05/01	15:07	---	233289600		268972100
				221	
05/07/01	7:04	222	233819500		269502000
				221	
05/09/01	6:27	221	234447700		270130200
				221	
05/12/01	13:21	---	235492800		271175300
				221	
05/14/01	9:26	221	236077000		271759500
				221	
05/16/01	17:37	222	236821700		272504200
				220	
05/18/01	8:02	222	237329800		273012300
				221	
05/23/01	6:03	---	238892200		274574700
				221	
05/25/01	9:50	222	239578400		275260900
				220	
05/29/01	6:39	---	240804900		276487400
				220	
06/01/01	6:18	222	241750100		277432600
				219	
06/04/01	6:20	221	242698600		278381100
				219	
06/06/01	8:17	---	243354400		279036900
				218	
06/08/01	6:35	222	243960300		279642800
				218	
06/11/01	6:37	221	244901900		280584400
				220	
06/13/01	6:58	---	245539100		281221600
				220	
06/15/01	12:15	---	246242400		281924900
				221	

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
06/18/01	6:39	220	247121500		282804000
				124	
06/19/01	16:25	---	247372500		283055000
				224	
06/20/01	6:39	223	247563500		283246000
				224	
06/22/01	6:28	222	248205200		283887700
				225	
06/25/01	7:10	222	249187500		284870000
				226	
06/27/01	7:02	224	249836100		285518600
				226	
06/29/01	7:49	---	250497300		286179800
				226	
06/30/01	7:03	---	250812300		286494800
				226	
07/02/01	6:53	224	251460300		287142800
				226	
07/03/01	6:30	---	251780300		287462800
				226	
07/05/01	8:15	224	252453700		288136200
				224	
07/09/01	12:32	223	253802900		289485400
				225	
07/10/01	7:50	---	254063000		289745500
				224	
07/13/01	6:45	224	255014800		290697300
				224	
07/16/01	13:45	---	256074300		291756800
				214	
07/19/01	17:10	---	257044000		292726500
				148	
07/20/01	6:30	---	257162400		292844900
				227	
07/23/01	7:32	227	258158600		293841100
				227	
07/27/01	8:30	224	259482000		295164500
				227	
07/30/01	8:10	---	260459100		296141600
				227	
07/31/01	13:27	224	260858700		296541200
				227	
08/01/01	7:29	224	261104600		296787100
				227	

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
08/06/01	6:29	225	262725500		298408000
				222	
08/08/01	6:35	---	263366000		299048500
				221	
08/10/01	6:36	---	264003900		299686400
				221	
08/13/01	14:37	222	265063900		300746400
				220	
08/15/01	13:00	---	265676400		301358900
				220	
08/17/01	6:37	---	266226000		301908500
				219	
08/21/01	11:00	220	267546800		303229300
				222	
08/24/01	6:30	222	268447400		304129900
				220	
08/31/01	7:00	220	270672700		306355200
				135	
09/04/01	6:30	223	271444800		307127300
				216	
09/05/01	6:40	---	271757800		307440300
				222	
09/06/01	6:32	---	272076100		307758600
				225	
09/07/01	15:45	---	272524400		308206900
				224	
09/10/01	8:00	222	273387000		309069500
				219	
09/11/01	15:47	---	273804900		309487400
				223	
09/12/01	7:20	---	274013400		309695900
				222	
09/13/01	7:03	---	274330000		310012500
				223	
09/14/01	15:40	---	274766300		310448800
				70	
09/17/01	6:00	---	275028500		310711000
				218	
09/18/01	6:40	224	275351500		311034000
				181	
09/19/01	16:58	---	275723800		311406300
				223	
09/21/01	6:30	---	276227100		311909600
				222	

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
09/24/01	8:00	---	277208200		312890700
				122	
09/26/01	12:45	---	277594000		313276500
				351	
09/28/01	6:44	223	278477700		314160200
				223	
10/01/01	6:40	223	279440800		315123300
				223	
10/03/01	10:53	---	280140200		315822700
				224	
10/05/01	6:47	---	280729100		316411600
				223	
10/10/01	12:10	---	282409100		318091600
				205	
10/12/01	14:25	224	283026500		318709000
				224	
10/15/01	7:10	---	283898600		319581100
				224	
10/17/01	12:40	---	284618500		320301000
				225	
10/19/01	6:45	224	285185600		320868100
				96	
10/22/01	12:33	---	285632200		321314700
				0	
10/23/01	9:10	---	285632200		321314700
				41	
10/25/01	11:00	---	285754700		321437200
				30	
10/26/01	6:45	---	285789900		321472400
				212	
10/29/01	6:38	222	286704200		322386700
				224	
11/01/01	7:00	---	287675900		323358400
				224	
11/02/01	6:30	223	287992400		323674900
				224	
11/05/01	7:00	223	288964900		324647400
				224	
11/07/01	8:00	---	289624400		325306900
				224	
11/09/01	11:53	---	290321100		326003600
				224	
11/12/01	7:18	---	291228100		326910600
				224	

Appendix A

Off-Site Containment Well
Flow Rate Data - 2001

Date	Time	Instantaneous Discharge	Totalizer	Average Discharge	Total Gallons*
11/14/01	6:40	222	291866000		327548500
				224	
11/21/01	7:50	225	294142500		329825000
				225	
11/27/01	8:00	225	296086600		331769100
				225	
11/30/01	15:10	---	297155300		332837800
				225	
12/03/01	8:06	226	298033500		333716000
				225	
12/07/01	6:50	---	299314900		334997400
				225	
12/11/01	8:55	---	300637000		336319500
				210	
12/14/01	6:30	---	301512400		337194900
				199	
12/15/01	18:07	---	301937300		337619800
				225	
12/17/01	7:07	225	302436700		338119200
				222	
12/18/01	6:36	---	302749000		338431500
				222	
12/20/01	11:16	---	303449700		339132200
				222	
12/21/01	12:12	---	303781300		339463800
				222	
01/02/02	8:45		307568900		343251400

* Total Pumpage since 12/31/98

APPENDIX B

Appendix B

2001 Groundwater Quality Data

B-1: Groundwater Monitoring Program Wells

B-2: Infiltration Gallery and Pond Monitoring Wells

B-3: Source Containment Well CW-2

B-1: Groundwater Monitoring Program Wells

Appendix B-1

Groundwater Monitoring Program
2001 Analytical Results*

Well ID	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total, mg/L		Other
					Unfiltered	Filtered	
PW-1	11/21/01	2.1	<1.0	<1.0	0.331	0.0717	MethChl:3.4
MW-7	11/16/01	240	17	3.3	0.0145	0.00860	
MW-9	11/16/01	120	4.3	4.1	<0.005	<0.005	MeCl:5.5
MW-12	11/20/01	160	12	4.5	0.0314	0.0262	MeCl:2.8; 1,1,2-TCTFA5.9
MW-13	11/16/01	27	<1.0	1.9	0.00530	<0.00500	
MW-14R	12/07/01	29	1.2	<1.0	0.213	0.209	1,1,2-TCTFA:6.4
MW-16	11/16/01	6.3	<1.0	<1.0	0.306	0.216	
MW-17	11/19/01	1.8	<1.0	<1.0	<0.0050	<0.0050	
MW-18	11/20/01	390	22	8.6	<0.00500	<0.00500	1,1,2-TCTFA:5.5; 1,1,2-TCA:1.4; PCE:2.4
MW-19	11/13/01	2.0	<1.0	<1.0	<0.005	NA	1,1,2-TCTFA:6.2; CarTet:1.0
MW-20	11/12/01	<1.0	<1.0	<1.0	<0.005	NA	
MW-22	03/16/01	2.8	<1.0	1.1	0.01	<0.0050	
MW-22	11/13/01	1.6	<1.0	<1.0	0.0194	NA	
MW-23	11/16/01	1300	50	57	4.08	0.194	Chloro:1.8; 1,1,2-TCA:5.1; PCE:7.6; 1,1,1,2-PCA:2.1
MW-25	11/20/01	46	4.6	<1.0	0.462	0.00550	MeCl:1.1
MW-26	11/21/01	1500	160	65	0.371	0.186	1,1,2-TCTFA:6.0; 1,1-DCA:3.1; Chlor:3.6; Benz:1.0; 1,1,2-TCA:2.3; PCE:11
MW-29	11/07/01	<1.0	<1.0	<1.0	<0.005	NA	
		<1.0	<1.0	<1.0	<0.005	NA	Duplicate
MW-30	11/09/01	2	<1.0	<1.0	0.0322	NA	
MW-31	11/09/01	<1.0	<1.0	<1.0	0.0266	NA	
MW-32	11/13/01	430	71	9.2	<0.005	NA	1,1,2-TCTFA:10; 1,1-DCA:3.5; PCE:3.9
MW-33	11/16/01	110	7.9	4	0.0705	0.0111	1,1,2-TCA:1.2
MW-34	11/20/01	<1.0	<1.0	<1.0	0.247	0.0128	
MW-35	11/22/01	<1.0	<1.0	<1.0	NA	NA	1,1,2-TCTFA:15
MW-36	11/26/01	1.8	<1.0	<1.0	0.0512	0.0293	
MW-37R	12/07/01	190	8	<1.0	0.0088	0.0079	Bromomethane:3.1; 1,1,2-TCTFA:8.2

Appendix B-1

Groundwater Monitoring Program
2001 Analytical Results*

Well ID	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total, mg/L		Other
					Unfiltered	Filtered	
MW-38	11/07/01	<1.0	<1.0	<1.0	0.00640	NA	
MW-39	11/09/01	<1.0	<1.0	<1.0	0.0592	NA	
MW-40	11/12/01	<1.0	<1.0	<1.0	<0.005	NA	1,1,2-TCTFA:7.6
MW-41	11/12/01	74	10	2.8	<0.005	NA	1,1,2-TCTFA:7.5;
MW-42	11/13/01	280	32	8.2	<0.005	NA	PCE:2.1
MW-43	11/13/01	15	2	<1.0	<0.005	NA	
MW-44	11/07/01	<1.0	<1.0	<1.0	<0.005	NA	
MW-45	02/27/01	NA	NA	NA	0.0959	0.0946	
	11/07/01	11	<1.0	<1.0	0.102	NA	
MW-46	11/07/01	3100	540	36	0.0101	NA	VinChl:2.1; 1,1,2-TCTFA:21; 1,1-DCA:13; Benz:2.5; 1,1,2-TCA:4.3; PCE:30; ChlorBenz:2.3; Chlor:3.7
MW-47	11/29/01	53	2	<1.0	0.216	NA	
MW-48	11/30/01	85	3.1	<1.0	5.58	0.247	
MW-49	11/09/01	<1.0	<1.0	<1.0	<0.005	NA	
MW-51	11/07/01	<1.0	<1.0	<1.0	<0.0050	NA	
MW-52	02/27/01	<1.0	<1.0	<1.0	0.0133	0.0122	
		<1.0	<1.0	<1.0	0.0138	0.0121	Duplicate
	05/23/01	<1.0	<1.0	<1.0	0.0147	0.0129	
	08/28/01	<1.0	<1.0	<1.0	0.0196	0.0148	
	11/26/01	<1.0	<1.0	<1.0	0.0132	0.0128	
MW-53	11/26/01	27	1.3	<1.0	0.0528	0.0393	
MW-55	11/28/01	240	7.2	<1.0	0.122	NA	
		230	6.6	<1.0	0.119	NA	Duplicate
MW-56	11/30/01	34	<1.0	<1.0	0.0642	NA	

Appendix B-1

Groundwater Monitoring Program
2001 Analytical Results*

Well ID	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total, mg/L Unfiltered	Cr Total, mg/L Filtered	Other
MW-57	02/27/01	3.9	<1.0	7.5	0.0143	<0.005	
	05/23/01	<1.0	<1.0	<1.0	0.0093	<0.005	
	08/29/01	<1.0	<1.0	<1.0	0.0174	<0.005	
	11/26/01	<1.0	<1.0	<1.0	0.0069	<0.005	
MW-58	11/27/01	34	<1.0	<1.0	0.125	0.0567	
MW-59	11/07/01	<1.0	<1.0	<1.0	<0.0050	NA	
MW-60	11/06/01	3700	200	10	0.099	NA	cis-1,2-dce:1.6; 1,1,2-TCTFA:27; Chlor:4.1;
MW-61	11/30/01	130	6.1	<1.0	0.0095	NA	1,1,2-TCA:1.6; PCE:24; PCE:1.2
MW-62	02/27/01	3.9	8.2	7.5	0.0237	0.0092	
	05/23/01	3.2	12	6.5	0.0117	0.0083	
	08/29/01	7	14	9	0.0154	0.0076	
		7	14	9	0.0219	0.0081	Duplicate
	11/27/01	3.7	9.6	5.6	0.0434	0.0093	Naph:3.6; 1,2,3-TCBenz:1.5
MW-64	11/06/01	13	1.4	<1.0	<0.005	NA	
MW-65	02/14/01	<1.0	<1.0	<1.0	<0.005	NA	
	05/24/01	<1.0	1.4	<1.0	<0.005	NA	Chlor:1.1
	08/28/01	<1.0	<1.0	<1.0	<0.005	NA	
	11/30/01	1	2.6	<1.0	<0.005	NA	
MW-66	02/14/01	<1.0	<1.0	<1.0	0.015	NA	
	06/06/01	<1.0	<1.0	<1.0	<0.005	NA	
	08/28/01	<1.0	<1.0	<1.0	<0.005	NA	
	11/06/01	<1.0	<1.0	<1.0	<0.005	NA	
		<1.0	<1.0	<1.0	<0.005	NA	Duplicate
MW-67	05/24/01	<1.0	<1.0	<1.0	<0.005	NA	
	11/28/01	<1.0	<1.0	<1.0	<0.00500	NA	

Appendix B-1

Groundwater Monitoring Program
2001 Analytical Results*

Well ID	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total, mg/L		Other
					Unfiltered	Filtered	
MW-68	02/14/01	<1.0	<1.0	<1.0	<0.005	NA	
	05/23/01	<1.0	<1.0	<1.0	<0.005	NA	
	08/28/01	<1.0	<1.0	<1.0	<0.005	NA	
	11/06/01	<1.0	<1.0	<1.0	<0.005	NA	
MW-69	02/14/01	<1.0	<1.0	<1.0	<0.005	NA	
	06/06/01	<1.0	<1.0	<1.0	<0.005	NA	
	08/28/01	<1.0	<1.0	<1.0	<0.005	NA	
	11/06/01	<1.0	<1.0	<1.0	<0.005	NA	
MW-70	11/12/01	<1.0	<1.0	<1.0	<0.005	NA	
MW-71	02/14/01	140	4.5	<1.0	<0.005	NA	
	05/24/01	340	12	<5.0	0.0321	NA	
	08/28/01	200	10	<1.0	0.0332	NA	
MW-72	05/24/01	4100	600	160	0.197	NA	PCE:30; ChlBenz:1.8; 1,1,1,2-PCA:2.2
		4200	570	160	0.207	NA	Duplicate
	11/13/01	2900	280	92	0.293	NA	1,1,2-TCTFA:19; 1,1-DCA:2.4; Chlor:12; Benz:1.9; 1,1,2-TCA:2.2; PCE:25; ChlBenz:1.4; 1,1,1,2-PCA:1.7
MW-73	11/12/01	2000	290	54	0.0486	NA	1,1,2-TCTFA:14; 1,1-DCA:7.3; Chlor:4.5; Benz:1.5; 1,1,2-TCA:3.2; PCE:7.9;

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).
*VOCs by EPA Method 8260
NA = Not analyzed

B-2: Infiltration Gallery and Pond Monitoring Wells

Appendix B-2

Inflitration Gallery and Pond Monitoring Wells
2001 Analytical Results*

Well ID	Sample Date	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr(total) (mg/l)	Fe(total) (mg/l)	Mn(total) (mg/l)	Cr(diss) (mg/l)	Fe(diss) (mg/l)	Mn(diss) (mg/l)
MW-17	07/31/01	2.8	<0.38	0.51	0.0165	4.7500	0.1760	<0.00500	0.0222	<0.00500
	08/15/01	2.3	<0.38	0.48	0.00960	1.6100	0.0575	<0.00500	0.1070	0.0107
	11/19/01	2.4	<0.2	<1.0	<0.0050	0.4320	0.0153	<0.00500	0.0300	0.00510
MW-74	01/15/01				0.0432					
	02/14/01	<0.3	<0.2	<1.0	0.0409	0.0411	<0.0050			
	03/16/01				0.042					
	04/16/01				0.0391					
	05/14/01	<0.3	<0.2	<1.0	0.0380	0.0286	<0.005			
	06/15/01				0.0370					
	07/16/01				0.0351					
	08/15/01	<0.35	<0.38	<0.38	0.0345	0.0247	<0.005			
	11/19/01	<0.3	<0.2	<1.0	0.0332	0.0218	<0.005			
MW-75	01/15/01				0.0425					
	02/14/01	<0.3	<0.2	<1.0	0.0411	0.0292	<0.0050			
	03/16/01				0.041					
	04/16/01				0.0394					
	05/14/01	<0.3	<0.2	<1.0	0.0356	0.0172	<0.0050			
	06/15/01				0.0350					
	07/16/01				0.0329					
	08/15/01	<0.35	<0.38	<0.38	0.0337	<0.0100	<0.0050			
	11/19/01	<0.3	<0.2	<1.0	0.0338	<0.0100	<0.0050			
MW-76	01/15/01				0.0417					
	02/14/01	<0.3	<0.2	<1.0	0.0377	0.0147	<0.005			
	03/16/01				0.043					
	04/16/01				0.0369					
	05/14/01	<0.3	<0.2	<1.0	0.0373	0.0195	<0.005			

Appendix B-2

Inflitration Gallery and Pond Monitoring Wells
2001 Analytical Results*

Well ID	Sample Date	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr(total) (mg/l)	Fe(total) (mg/l)	Mn(total) (mg/l)	Cr(diss) (mg/l)	Fe(diss) (mg/l)	Mn(diss) (mg/l)
MW-76	06/15/01				0.0437					
	07/16/01				0.0333					
	08/15/01	<0.35	<0.38	<0.38	0.0356	<0.0100	<0.0050			
	11/19/01	0.3	<0.2	<1.0	0.0361	0.0145	<0.0050			
MW-77	07/31/01	16	1.2	<0.21	<0.0050	0.1890	0.796	<0.00500	<0.0100	0.779
	08/15/01	16	1.3	<0.38	<0.0050	0.3340	0.791			
	11/19/01	12	<0.2	<1.0	<0.0050	0.2210	0.807	<0.0050	<0.0100	0.628
MW-78	07/31/01	6	<0.38	<0.38	0.0069	5.1400	0.357	<0.00500	0.0348	<0.00500
	08/15/01	5.1	<0.38	<0.38	<0.0050	1.3500	0.0863	<0.00500	0.0222	0.0198
	11/19/01	8.8	<0.2	<1.0	<0.0050	0.0690	0.0538	<0.00500	0.0310	0.00520

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for
*VOCs by EPA Method 8021

B-3: Source Containment Well CW-2

Appendix B-3

Source Containment Well CW-2
2001 Analytical Results*

Sample Date	TCE (ug/l)	1,1-DCE (ug/l)	1,1,1-TCA (ug/l)	Cr(total) (mg/l)	Other
10/25/01	1000	190	35	0.00520	(Filtered) 1,1-DCA:1.9; Chlor:2.8; PCE:6.0;
				0.00570	(Unfiltered)

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).
*VOCs by EPA Method 8260

APPENDIX C

Appendix C

Off-Site Treatment System Influent and Effluent 2001 Analytical Results

Appendix C

Off-Site Treatment System Influent and Effluent
2001 Analytical Results*

Sample Date	Influent						Effluent					
	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr(total) (mg/l)	Fe(total) (mg/l)	Mn(total) (mg/l)	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr(total) (mg/l)	Fe(total) (mg/l)	Mn(total) (mg/l)
01/02/01	1200	49	<20	0.0432	0.0145	<0.005	<0.3	<0.2	<1.0	0.0419	0.0116	<0.005
02/01/01	1300	55	<10	0.0441	0.0117	<0.005	<0.3	<0.2	<1.0	0.0441	0.0184	<0.005
03/01/01	1400	70	<10	0.0421	0.0561	<0.005	<0.3	<0.2	<1.0	0.0326	<0.005	<0.005
04/02/01	1200	55	<10	0.0407	0.0225	<0.005	<0.3	<0.2	<1.0	0.0399	0.0140	<0.005
05/01/01	1300	41	<10	0.0405	0.0205	<0.005	<0.3	<0.2	<1.0	0.0337	0.1280	<0.005
06/01/01	1400	65	5.1	0.0415	0.0163	<0.005	<0.3	<0.2	<1.0	0.0359	<0.0100	<0.005
07/02/01	1200	73	<20	0.0419	0.0615	<0.005	<0.3	<0.2	<1.0	0.0352	0.0201	<0.005
08/01/01	1300	67	5.6	0.0475	0.4460	<0.005	<0.35	<0.38	<0.38	0.0351	<0.0100	<0.005
09/05/01	1100	73	5.7	0.0428	0.103	<0.005	<0.35	<0.38	<0.38	0.0386	0.0862	<0.005
10/01/01	770	69	4.5	0.0384	0.1600	<0.005	<0.3	<0.2	<1.0	0.0414	0.461	<0.005
11/07/01	1200	58	4.1	0.0400	<0.0100	<0.0100	<0.3	<0.2	<1.0	0.0394	<0.0100	<0.0100
12/03/01	1100	55	4.6	0.0383	<0.0100	<0.005	<0.3	<0.2	<1.0	0.0373	<0.0100	0.00970
01/03/02	1100	77	4.3	0.0350	0.19	0.0007	0.8	<0.2	<1.0	0.039	0.21	0.0015

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).

*VOCs by EPA Method 8021

APPENDIX D

Appendix D

Monthly Operating Logs for the 400-cfm SVE System January Through June 2001

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

200 SCFM Roots Blower Log
Number 1 (West)
Number 2 (East)

JANUARY 2001 Well ID VR-1

Date	Time	Status On/Off		Samples Yes/No		Oil Yes/No		Greased Yes/No		VAC (in-Hg)		H_20 Gallons*	Weather	Initials
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2			
01	---													
02	--													
03	---													
04	---													
05	---													
06	1630	Y	Y	N	N	Ok	Ok	Y	Y	4.0	2.0	50/04	Overcast	DG
07	---													
08	---													
09	---													
10	---													
11	1400	Y	Y	N	N	Ok	Ok	Y	Y	4.0	2.0	25/00	Sunny	DG
12	---													
13	---													
14	---													
15	---													
16	---												Snow	DG
17	---													
18	---													
19	1015	Y	Y	N	N	*	*	Y	Y	4.0	2.0	50/04	Sunny	DG
20	---													
21	---													
22	---													
23	---													
24	---													
25	---													
26	---													
27	---												Snow	DG
28	---													
29	0630	Y	Y	N	N	Ok	Ok	Y	Y	4.0	2.0	55/05	Cloudy	DG
30	---													
31	---													

* Volume of condensate accumulated in collection barrel; if followed by a "/" and a second number, the second number is the volume remaining in barrel after pumping for transfer to offsite treatment system.

SPARTON TECHNOLOGY, INC.
subsidiary of **SPARTON CORPORATION**
An ISO 9001 registered company

Date	Time	Maintenance Activities Performed	Ini.

01-06	1630	Pumped 46 gals. of H2O from sump to CW-1 / Greased Motors	DG

01-11	1400	Pumped 25 gals. of H2O from sump to CW-1 / Greased Motors	DG

01-19	1015	Pumped 46 gals of H2O from sump to CW-1 / Changed Oil & Greased Motors	DG

01-29	0630	Pumped 50 gals. of H2O from sump to CW-1 / Greased Motors	DG
		NOTE: No sampling of VR-1 This Month	DG

SPARTON TECHNOLOGY, INC.
subsidiary of **SPARTON CORPORATION**
An ISO 9001 registered company

200 SCFM Roots Blower Log
Number 1 (West)
Number 2 (East)

FEBRUARY 2001 Well ID VR-1

Date	Time	Status On/Off		Samples Yes/No		Oil Yes/No		Greased Yes/No		VAC (in-Hg)		H_20 Gallons *	Weather	Initials
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2			
01	---													
02	---													
03	---													
04	---													
05	---													
06	---													
07	1200	Y	Y	N	N	Ok	Ok	Y	Y	4.5	2.5	50 / 0	P.Cloudy	DG
08	---													
09	---													
10	---													
11	---													
12	---													
13	---													
14	1730	Y	Y	Y	Y	Ok	Ok	Y	Y	4.5	2.5	25	P.Cloudy	DG/DB
15	---													
16	---													
17	---													
18	---													
19	---													
20	1100	Y	Y	N	N	*	*	Y	Y	4.5	2.5	50 / 0	P.Cloudy	DG
21	---													
22	---													
23	---													
24	---													
25	---													
26	---													
27	---													
28	---													
29														
30														
31														

* Volume of condensate accumulated in collection barrel; if followed by a "/" and a second number, the second number is the volume remaining in barrel after pumping for transfer to offsite treatment system.

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

Date	Time	Maintenance Activities Performed	Ini.

02-07	1200	Greased Motors & Pumped 50 gals. of H2O to CW1	DG

02-14	1730	Greased Motors & Sampled VR1 with Metric DB	DG

02-20	1100	Greased Motors / Changed Oil & Pumped 50 gals.of H2O to CW1	DG

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

200 SCFM Roots Blower Log
Number 1 (West)
Number 2 (East)

MARCH 2001

Well ID VR-1

Date	Time	Status On/Off		Samples Yes/No		Oil Yes/No		Greased Yes/No		VAC (in-Hg)		H_20 Gallons *	Weather	Initials
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2			
01	1015	On	On	N	N	Ok	Ok	Y	Y	5.0	2.0	31	Sunny	DG
02	---													
03	---													
04	---													
05	---													
06	---													
07	---													
08	1550	On	On	N	N	Ok	Ok	Y	Y	5.0	2.0	50/00	P.Cloudy	DG
09	---													
10	---													
11	---													
12	---													
13	---													
14	---													
15	---													
16	1400	On	On	N	N	Ok	Ok	Y	Y	5.0	2.0	25/00	Sunny	DG
17	---													
18	---													
19	---													
20	---													
21	---													
22	1300	On	On	N	N	*	*	Y	Y	5.0	2.0	25	Sunny	DG
23	---													
24	---													
25	---													
26	---													
27	---													
28	---													
29	1200	On	On	N	N	Ok	Ok	Y	Y	5.0	2.5	40/00	Cloudy	DG
30	---													
31	---													

* Volume of condensate accumulated in collection barrel; if followed by a "/" and a second number, the second number is the volume remaining in barrel after pumping for transfer to offsite treatment system.

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

Date	Time	Maintenance Activities Performed	Ini.

03-08	1550	Greased & Pumped 50 gals of H2O to CW1	DG

03-16	1400	Greased & Pumped 25 gals of H2O to CW1	DG

03-22	1300	Greased & Changed Oil	DG

03-29	1200	Greased & Pumped 40 gals of H2O to CW1	DG

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

200 SCFM Roots Blower Log
Number 1 (West)
Number 2 (East)

APRIL 2001

Well ID VR-1

Date	Time	Status On/Off		Samples Yes/No		Oil Yes/No		Greased Yes/No		VAC (in-Hg)		H_2O Gallons *	Weather	Initials
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2			
01	---													
02	---													
03	---													
04	---													
05	0715	Y	Y	N	N	Ok	Ok	Y	Y	5.0	2.5	12	Cloudy	DG
06	---													
07	---													
08	---													
09	---													
10	---													
11	---													
12	1310	Y	Y	N	N	Ok	Ok	Y	Y	Na	Na	NA	Sunny	DG
13	---													
14	---													
15	---													
16	1656	Y	Y	Y	Y	Ok	Ok	N	N	5.0	4.0	30	SUNNY	DG/DB
17	---													
18	---													
19	---													
20	0730	Y	Y	N	N	Ok	Ok	Y	Y	5.0	4.0	38/0 *	Cloudy	DG
21	---													
22	---													
23	---													
24	---													
25	---													
26	0700	Y	Y	N	N	Ok	Ok	Y	Y	5.0	4.0	10	Sunny	DG
27	---													
28	---													
29	---													
30	---													
31	---													

* Volume of condensate accumulated in collection barrel; if followed by a "/" and a second number, the second number is the volume remaining in barrel after pumping for transfer to offsite treatment system.

SPARTON TECHNOLOGY, INC.

subsidiary of SPARTON CORPORATION

An ISO 9001 registered company

Date	Time	Maintenance Activities Performed	Ini.

04-16	1656	Sampled VR-1 M8260	DG

04-20	0730	Greased & Changed oil & pumped 38 gals to CW-1	DG

04-26	0700	Greased Motors	DG

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

200 SCFM Roots Blower Log
Number 1 (West)
Number 2 (East)

MAY 2001 Well ID VR-1

Date	Time	Status On/Off		Samples Yes/No		Oil Yes/No		Greased Yes/No		VAC (in-Hg)		H_20 Gallons *	Weather	Initials
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2			
01	---													
02	---													
03	1130	Y	Y	N	N	Ok	Ok	Y	Y	5.5	2.5	15	Sunny	DG
04	---													
05	---													
06	---													
07	---													
08	---													
09	---													
10	1200	Y	Y	N	N	Ok	Ok	Y	Y	5.0	2.5	18	Sunny	DG
11	---													
12	---													
13	---													
14	---													
15	---													
16	1700	Y	Y	N	N	Ok	Ok	Y	Y	5.0	2.5	20	Sunny	DG
17	---													
18	---													
19	---													
20	---													
21	---													
22	---													
23	---													
24	---													
25	1000	Y	Y	N	N	Ok	Ok	Y	Y	4.8	2.5	20	Sunny	DG
26	---													
27	---													
28	---													
29	---													
30	---													
31	---													

* Volume of condensate accumulated in collection barrel; if followed by a "/" and a second number, the second number is the volume remaining in barrel after pumping for transfer to offsite treatment system.

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

Date	Time	Maintenance Activities Performed	Ini.

05-03	1140	Greased Motors	DG

05-10	1200	Greased Motors	DG

05-16	1700	Greased Motors	DG

05-25	1000	Greased Motors	DG

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

200 SCFM Roots Blower Log
Number 1 (West)
Number 2 (East)

JUNE 2001 | Well ID VR-1

Date	Time	Status On		Samples Yes/No		Oil Yes/No		Greased Yes/No		VAC (in-Hg)		H_20 Gallons *	Weather	Initials
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2			
01														
02														
03														
04														
05														
06														
07	1000	Y	Y	N	N	Ok	Ok	Y	Y	--	3.0	15	Sunny	DG
08														
09														
10														
11														
12														
13														
14														
15	1000	Y	Y	Y	Y	Ok	Ok	N	N	--	3.0	25	Sunny	DG
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														

* Volume of condensate accumulated in collection barrel; if followed by a "/" and a second number, the second number is the volume remaining in barrel after pumping for transfer to offsite treatment system.

SPARTON TECHNOLOGY, INC.
subsidiary of SPARTON CORPORATION
An ISO 9001 registered company

Date	Time	Maintenance Activities Performed	Ini.
JUNE			
2001			

15th	1050	Began Purge 2 SCFH	
	1052	Stop Purge	
	1053	Sample Bag #1	
	1054	Stop Sampling	
	1055	Sample Bag #2	
	1056	Stop Sampling	
	1057	Sample Bag #3	

	1100	**SHUT DOWN SVE ROOTS BLOWER SYSTEM**	**DG**

APPENDIX E

Appendix E

Copy of Notification
for Public Meeting and Mailing List

NOTIFICATION

Sparton Technology, Inc., wishes to notify you of the opportunity to participate in a public information meeting concerning the progress of the current and planned environmental remediation activities at their former plant at 9621 Coors Road. Sparton Technology operated a defense electronics component manufacturing plant at this location from 1961 through 1994. In 1983, it was determined that several industrial solvents used in the manufacturing processes had impacted soil and groundwater under the plant. A series of investigations detailed the nature and extent of the solvent contamination. Trichloroethylene (TCE), 1,1,1-trichloroethane (TCA) and lesser amounts of methylene chloride (MeCL), acetone, and 1,1-dichlorethylene (DCE) were the primary constituents impacting soil, soil gas, and groundwater. Groundwater sampling further indicated that these constituents had migrated off site up to one-half mile to the northwest of the plant. However, the various studies have indicated that no existing water supply wells have been impacted.

Sparton Technology began environmental restoration activities at the plant in late 1988 by installing a groundwater recovery and treatment system on site. In 1998, additional restoration activities were implemented. A groundwater recovery and treatment system was installed off site near the intersection of Chantilly and Benton approximately one-half mile northwest of the plant. This system intercepts and prevents further migration of the solvent constituents in groundwater. Treated water is recharged to the aquifer using an infiltration gallery installed in the Arroyo Calabacillas near its confluence with Black Arroyo. This containment system has halted further migration of the solvent constituents since December 31st, 1998. On site, a robust soil vapor extraction (SVE) system was installed to remove solvent constituents from the soil and soil gas above the water table. The SVE system will have been operational for one year in June 2001. Subsequent testing will be performed to determine if cleanup objectives have been met.

Sparton Technology is currently in the process of implementing additional on-site groundwater recovery and treatment to prevent further off-site migration of solvent constituents. This system will replace the existing on-site system installed in 1988. Treated water from the on-site system will be recharged to the aquifer through rapid infiltration ponds constructed on site. The water being returned to the aquifer from both the off-site and on-site systems is required to meet the federal Drinking Water Standards (Maximum Contaminant Levels, or MCL's, established under the Safe Drinking Water Act) and/or the maximum allowable concentrations in groundwater set by the New Mexico Water Quality Control Commission.

All cleanup activities are now being implemented pursuant to the requirements reached between Sparton Technology, Inc., EPA, the City of Albuquerque, the Bernalillo County Commissioners, the New Mexico Environment Department, the New Mexico Attorney General's Office, and the New Mexico Office of the Natural Resources Trustee, as documented in a Consent Decree [CIV 97 0206 LH/JHG (D.N.M.)] dated March 3, 2000, which is filed with the U.S. District Court for the District of New Mexico.

Copies of the Consent Decree and its associated remediation work plans as well as historical investigation/remedial work plans and reports submitted to the City, County, NMED, and EPA are available for review at the:

Taylor Ranch Public Library, (Telephone # 505 897-8816) located at:
5700 Bogart NW, Albuquerque, NM 87120.

City of Albuquerque Department of Public Works, (Telephone # 505 768-2561)
located at:
One Civic Plaza NW, Albuquerque, NM 87103

New Mexico Environment Department/HWB District 1,
(Telephone # 505 841-9033) located at:
4131 Montgomery Boulevard NE, Albuquerque, NM 87109

Alternatively, you may contact Mr. Tony Hurst, Sparton Technology's local representative, at (505) 861-0987

The 1999 Annual Report (available for review at the Taylor Ranch Library) provides a summary of remedial action taken through the end of 1999, data collected, and interpretations of the data. The remedial measures have resulted in containment of the plume at the site, removal of a significant amount of mass from the plume, and a significant reduction in soil-gas concentrations in the on-site source areas.

On June 15, 2001, Sparton Technology will conduct a public information meeting at Cibola High School, 1510 Ellison Drive NW at 7:00 p.m. The meeting will cover the progress and schedule of environmental restoration activities being conducted by Sparton Technology. Representatives of the City of Albuquerque, Bernalillo County, State of New Mexico, New Mexico Environment Department, and U.S. EPA will also be present to answer questions.

Mailing List

ADAMS, NORMAN C & SONJA
5721 AVENIDA LA MIRADA NW
ALBUQUERQUE NM 87114

ADOBE WELLS LTD LIABILITY CO
C/O DUNN-EDWARDS CORP
4885 E 52ND PL
LOS ANGELES CA 90040

ADOBE WELLS LTD LIABILITY CO
500 COPPER SQUARE NW
ALBUQUERQUE NM 87102

ALBUQUERQUE US EMPLOYEES
FEDERAL CREDIT UNION
PO BOX 129
ALBUQUERQUE NM 87103

APODACA, ROBERT P & ARCADIA
9916 WILD TURKEY RD NW
ALBUQUERQUE NM 87120

ARCHULETA, FAUSTIN E & RAMONA M
4112 BRYAN AVE NW
ALBUQUERQUE NM 87114

ARELLANO, CRAIG E
4009 CRESTA PARK AVE NW
ALBUQUERQUE NM 87114

ARELLANO, EDWARD L JR & MARIE L
SPRINGER NM 87747

ARIAS, CHARLES & BARBARA
1819 PROPPS NE
ALBUQUERQUE NM 87112

ARMIJO, UVALDO L & THERESA C
3609 OAKMOUNT DR SE
RIO RANCHO NM 87124

ARMIJO, F TED & ANGIE A
8719 TIERRA ALEGRE NE
ALBUQUERQUE NM 87122

ASSENT, ANTONIO
28 WINDSOR ISLE
LONGWOOD FL 32779

ASSOCIATED PROPERTY INVESTOR
7913 CHARGER TRAIL NE
ALBUQUERQUE NM 87109

BACA,BEVERLY A
81 LIVING WATERS RD
EDGEWOOD NM 87015

BACA, DAVID W & CHRISTY
4227 NEW VISTOS CT NW
ALBUQUERQUE NM 87114

BEASLEY, KEITH R & JOY
TRSTEES OF KEITH R & JOY BEASLEY RVT
10000 CHANTILLY NW
ALBUQUERQUE NM 87114

BECKER, MARVIN A & LISA
4116 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

BENTLEY, ROB M & DENISE M
4200 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

BLAZEK, JOHN J ETUX
5713 ALLYN RD
MANTUA OH 44255

BOKOR, SYLVIA
TRUSTEE BOKOR LIVING TRUST
4105 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

BURTON, ELLEN E
23203 ROYALE ST
MORENO VALLEY CA 92557

BUTTS, HAROLD D & MARY VERA RENDON
BUTTS TR OF RVLT
4207 BRYAN AVE NW
ALBUQUERQUE NM 87114

CASAUS RANDY & PAULETTE BACA
CASAUS
4517 PALMYRA NW
ALBUQUERQUE NM 87114

CASTILLO, MICHAEL A ETAL &
IRIS S WEINSTEIN
2800 SAN MATEO NE
ALBUQUERQUE NM 87110

CERNO, JANICE I & MATTHEW J
4308 PRAIRIE HILL PL NW
ALBUQUERQUE NM 87114

CHAVEZ, LORENZO & CECILIA
10104 SIERRA HILL DR NW
ALBUQUERQUE NM 87114

CHAVEZ, LEO R & ISABELL M
4316 BRYAN AVE NW
ALBUQUERQUE NM 87114

CITY OF ALBUQUERQUE
ATTN: REAL ESTATE DEPT
ALBUQUERQUE NM 87103

COFMAN, DEANE
10012 CHANTILLY RD NW
ALBUQUERQUE NM 87114

COLE, LEON M & JEANNIE C
TRUSTEES OF THE COLE LIVING TRUST
4231 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

COMAN, RODGER E & E HOPE
9904 WILD TURKEY DR NW
ALBUQUERQUE NM 87114

CORLEY, WAYNE D ETUX
9801 RIVERSIDE NW
ALBUQUERQUE NM 87114

CURIEL, RAUL R
3230 170TH PL
HAMMOND IN 46323

DAVALA, ANDREW M & JOANNE
1725 E DRY CREEK PL
LITTLETON CO 80122

DAVIDSON, HECTOR M & ESTHER M
4215 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

DEAL, CRAIG & STONEKING, JENNIFER M
4204 NEW VISTAS CT NW
ALBUQUERQUE NM 87120

DI GANGI, PETER JR & ELISA M
1209 GEORGIA NE
ALBUQUERQUE NM 87110

DOMBRAUSKY, ALAN & LINDA
15 DOXDAM CT
GERMANTOWN MD 20876

DOTSON, TIMOTHY L & MAE C
18975 PINION PARK
PEYTON CO 80831

DRY, EDDIE & BARBARA
4224 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

DUDLEY, TREVA L
9908 WILD TURKEY DR NW
ALBUQUERQUE NM 87114

DUDLEY, FRANCIS B & MARY ELIZABETH
10016 CHANTILLY NW
ALBUQUERQUE NM 87114

EUL, GARRY D & CHRISTINE A
4223 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

FALLS, D W INVESTMENTS
9124 FLUSHING MEADOWS DR NE
ALBUQUERQUE NM 87111

FISHER, JACKIE
801 E SANTA FE AVE
GRANTS NM 87020

FLORES, CARLOS
3027 TRUMAN NE
ALBUQUERQUE NM 87110

FOLTZ, LEROY J & LOIS L
TRUSTEES RVT
532 EAST 7TH ST
WINNER SD 57580

GALLEGOS, MICHAEL J &
MARTINEZ, KIMBERLY K
4216 NEW VISTAS NW
ALBUQUERQUE NM 87114

GALLEGOS, MICHAEL LEE
4236 NEW VISTA CT NW
ALBUQUERQUE NM 87114

GALLEGOS, BARBARA
4236 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

GARCIA, DENISE J
12351 CLAREMONT NE
ALBUQUERQUE NM 87112

GARCIA, TOBY H & ANNA M
4319 BRYAN AVE NW
ALBUQUERQUE NM 87114

GARCIA, RAMON I & RACHEL
401 W VISTA PARKWAY
ROSWELL NM 88201

GARCIA, CHARLES P
1316 INDIANA ST NE
ALBUQUERQUE NM 87110

GARCIA,TONY A & MARGARET J
4304 BRYAN AVE NW
ALBUQUERQUE NM 87114

GARZA, ISRAEL JR & SUE C
4219 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

GHERARDI, ROBERT J TRUSTEE &
MOORE, DAVID T TRUSTEE GHERARDI &
3900 EUBANK NE
ALBUQUERQUE NM 87111

GHERARDI, ROBERT J
DMD PA PROFIT SHARING & TRUST
3900 EUBANK BLVD NE
ALBUQUERQUE NM 87111

GHERARDI, ROBERT J & NANCY
TRUSTEES GHERARDI LVT
11304 SANTA MONICA AVE NE
ALBUQUERQUE NM 87122

GHERARDI & MOORE PA
MONEY PURCHASE PLAN & TRUST
3900 EUBANK NE
ALBUQUERQUE NM 87111

GNEKOW, RICHARD & LUELLA
4404 BRYAN AVE NW
ALBUQUERQUE NM 87114

GUNDERSON, DONALD O & BARBARA J
1716 WELLS DR NE
ALBUQUERQUE NM 87112

GUTIERREZ, RLANDO A & DEBORAH L
4300 BRYAN AVE NW
ALBUQUERQUE NM 87114

GUTIERREZ, ANSELMO
724 MARK LN NE
ALBUQUERQUE NM 87123

HAINEY, IRENE
4205 BRYAN NW
ALBUQUERQUE NM 87114

HALFORD, RODNEY P & CAROLE
PO BOX 35758
ALBUQUERQUE NM 87176-5758

HARLESS, CHARLES L IV &
CHAMBO, JENNIFER
4209 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

HARRISON, MEL & DIANE
PO BOX 6277
SANTA FE NM 87502

HAY, ROBERT G
4110 W. 222ND ST
FAIRVIEW PK OH 44126

HENRY, DONALD & CYNTHIA
731 WEST CHERRYWOOD DR
CHANDLER AZ 85248

HERMAN, ROBERT
751 TWELFTH AVE
SAN FRANCISCO CA 94118

HIGGINS, RONNIE L & SONJA A
10008 CHANTILLY RD NW
ALBUQUERQUE NM 87114

HIGH KNOLL DEV INC
PO BOX 3532
ALBUQUERQUE NM 87125

HIMEL, PAUL & NAGATHA & JAMES L
4205 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

HOFHEINS, MARK & GARCIA, VANESSA
5609 KACHINA RD NW
ALBUQUERQUE NM 87120

HOUSE, ROBERT A & HAZEL ADALINE
TRUST OF R A & H A HOUSE RVT
10400 ACADEMY RD NE
ALBUQUERQUE NM 87111

HUNING LIMITED PARTNERSHIP
PO BOX 178
LOS LUNAS NM 87031

HUNT,CHARLOTTE
2113 BRENTWOOD PARK NE
ALBUQUERQUE NM 87112

IRVING LAND PARTNERS,
% IRIS S WEINSTEIN
2800 SAN MATEO NE
ALBUQUERQUE NM 87110

JACKSON, LUCY W
202 GREEN MEADOW BLV
SAN ANTONIO TX 78213

JAHNKE, TERRANCE L & ANNE B
4109 NEW VISTA CT NW
ALBUQUERQUE NM 87114

JALILI, JAVID
PO BOX 4703
ALBUQUERQUE NM 87196-4703

JONES, ROBERT LEE & EDITH IRENE
170 MORRISON DR
BOSQUE FARMS NM 87068

JUZANG, WILLIAM J
4215 BRYAN AVE NW
ALBUQUERQUE NM 87114

KAUSHAL, ASHOK K & INDU
9721 REGAL RIDGE NE
ALBUQUERQUE NM 87111

KELLNER, ANNE DIANA
1829 LAFAYETTE NE
ALBUQUERQUE NM 87106

KENNAMAN, JOHN & ANITA L
4107 NEW VISTA CT NW
ALBUQUERQUE NM 87114

KENNEN, KRISTI LYNN
7 CERRADO DR
SANTA FE NM 87505

KHALIL,NAZIR S & MEHNOOR M
4309 BRYAN AVE NW
ALBUQUERQUE NM 87114

KINZER, JOHN D & MARCELLA Y
11413 NASSAU DR NE
ALBUQUERQUE NM 87111

KINZER, DAVID & PRISCILLA
216 HERMOSA DR SE
ALBUQUERQUE NM 87108

KNOLLS LIMTED (THE)
PO BOX 1417
LOS LUNAS NM 87031

KNOTT, GALE
2117 N AZURITE CIR
MESA AZ 85207

LAPOINTE, WILLIAM J ETUX
14650 NW HIGHWAY 326
MORRISTON FL 32668

LOPEZ, BRYAN I
PO 14835
ALBUQUERQUE NM 87191

LOPEZ, EDWARD G & FRANCES K
4000 CONSTITUTION NE
ALBUQUERQUE NM 87110

LOPEZ-BENNINGTON, TESS
3051 IDAHO AVE NW
WASHINGTON DC 20016

LOPEZ, DAVID
1309 57TH ST NW
ALBUQUERQUE NM 87105

LOUIE LI LEE ETUX
2212 RAVENWOOD LN NW
ALBUQUERQUE NM 87107

LOWRY, KINZER G
2737 RHODE ISLAND NE
ALBUQUERQUE NM 87110

LUJAN, ANDY L & AMY R
4320 BRYAN AVE NW
ALBUQUERQUE NM 87120

MACCORNACK, JAMES A & JOAN G
CO-TRUSTEES MACCORNAC
4143 DIETZ FARM CIR NW
ALBUQUERQUE NM 87107

MACHUT, EMILY S
23150 CROOKED ARROW DR
WILDOMAR CA 92595

MACKENZIE, JOHN M & REGINA
416 MISSION NE
ALBUQUERQUE NM 87107

MADER, EDWARD J & JEANEAN P
6232 WHITEMAN DR NW
ALBUQUERQUE NM 87120

MALDONADO, CARLOS R
7313 ACADEMY R RT 27
SANTA FE NM 87505

MANN, DEWEY S & JEANNETTE
4437 RIO TRUMPEROS CT NW
ALBUQUERQUE NM 87102

MARCHUK,DONNA JEAN & ABRAHAM
GABRE-AB
819 TENTH AVE
REDWOOD CITY CA 94063

MARTINEZ, BERNARD E & DANA L
6220 BRIDLE ST NW
ALBUQUERQUE NM 87120

MCCAUSLAND, MARK R & SHARON H
10 FORSYTH AVE
FORT RILEY KS 66442

MCLAUGHLIN,JAMES PEPPER
13432 PINNACLE VIEW PL NE
ALBUQUERQUE NM 87112

MILKS, DENNIS C & LINDA B
10112 SIERRA HILL DR NW
ALBUQUERQUE NM 87114

MILLION, JIM
PO BOX 67920
ALBUQUERQUE NM 87193

MIRANDA, FEDERICO & AMALIA
10400 VISTA DEL SOL NW
ALBUQUERQUE NM 87114

MISTRETTA, CHARLES J
8205 COUNTRYWOOD RD NE
ALBUQUERQUE NM 87109

MONTY, KAREN ANN
9912 WILD TURKEY NW
ALBUQUERQUE NM 87114

MUENZE, CHARLES R
1208 SAN PEDRO NE
ALBUQUERQUE NM 87110

MULLANEY, DIANE M
4324 BRYAN AVE NW
ALBUQUERQUE NM 87114

NEW VISTAS INVESTMENTS CORPRII LTD
5528 EUBANK NE
ALBUQUERQUE NM 87111

NEW VISTAS II LTD
C/O JEFFREY R HARRIS
5528 EUBANK NE
ALBUQUERQUE NM 87111

NEW VISTAS II LTD
C/O CHARLES MOLLO
5528 EUBANK NE
ALBUQUERQUE NM 87111

NVIBBR LTD CO
5528 EUBANK NE
ALBUQUERQUE NM 87111

ORTIZ, MELVIN & CATALINA L
518 EL DORADO DR NW
ALBUQUERQUE NM 87114

O'NEILL, JOHN J & ANNE M
136 MONEE RD
PARK FOREST IL 60466

PARKES, MARY L
4301 BRYAN AVE NW
ALBUQUERQUE NM 87120

PODNAR, KRISTOPHER A & RILEY AMY L
4360 BRYAN AVE NW
ALBUQUERQUE NM 87114

POLMAN, LOIS B
14489 JANICE DR
MAPLE HEIGHTS OH 44137

POWELL, BOBBY L & LAUREL WETAL
PO BOX 1467
CORRALES NM 87048

PUBLIC SERVICE COMPANY OF NEW MEXICO
ALVARADO SQUARE
ALBUQUERQUE NM 87158

REED, DENNIS N & LYDIA R
4305 BRYAN AVE NW
ALBUQUERQUE NM 87114

RICH, CORY & POLLY F FITTER
4119 NEW VISTAS CT NW
ALBUQUERQUE NM 87120

RICH, RALPH L & DIONNE P
4235 NEW VISTAS CT NW
ALBUQUERQUE NM 87120

RIDENOUR, ROB K & TAMI L
4304 PRAIRIE HILL PL NW
ALBUQUERQUE NM 87114

RIVERA, JOSE & MARGARITA
2400 STEVENS DR NE
ALBUQUERQUE NM 87112

ROHRSCHEIB, LUKE C ETUX
3411 11TH AVE W
SEATTLE WA 98119

ROMERO, RANDY M
13220 MARQUETTE NE
ALBUQUERQUE NM 87123

ROWLAND, MICHAEL PATRICK
5500 KIM RD
RIO RANCHO NM 87124

ROYBAL, TOBY LOUIS
1872 ALEXANDER NW
ALBUQUERQUE NM 87107

RUIZ, BEN & MARGARET
6625 COORS RD NW
ALBUQUERQUE NM 87120

RUIZ, BEN J & MARGARET J
TRUSTEES RUIZ REV TRUST
6625 COORS BLVD NW
ALBUQUERQUE NM 87120

SANCHEZ, PHILIP A & KASSANDRA C
7509 STARWOOD NW
ALBUQUERQUE NM 87120

SANCHEZ, MICHAEL A & KATHLEEN E
3016 DONA TERESA SW
ALBUQUERQUE NM 87121

SCHLUETER, GLEN A & JOAN E
4211 BRYAN AVE NW
ALBUQUERQUE NM 87114

SCOTT, ROBERT A
4106 NEW VISTAS CT NW
ALBUQUERQUE NM 87114

SHAVER, ALDYNE & KOCH CARL
4201 BRYAN AVE NW
ALBUQUERQUE NM 87114

SILVER SUN INC
4216 BRYAN AVE NW
ALBUQUERQUE NM 87114

SINGER, JO ANNE H TRUSTEE
PO BOX 1621
SANTA FE NM 87504

SINGLETON, CAROL J & JOSEPH W
SAWYER
TRUSTEES SINGLETON/SAWYE
4209 BRYAN AVE NW
ALBUQUERQUE NM 87114

SKY CREST INC
1208 SAN PEDRO NE
ALBUQUERQUE NM 87110

SOMMERS, MARVIN F & SUSAN M GASS
348 ENCHANTED VALLEY RD NW
RIO RANCHO NM 87107

SORIANO, ABEL A & SANDRA S & ANNETTE
10005 CACTUS POINTE DR NW
ALBUQUERQUE NM 87114

SOTELO, ENRIQUE & MARTHA
549 58TH ST NW
ALBUQUERQUE NM 87105

SOULE, PAT L & MARGARET L
PO BOX 92602
ALBUQUERQUE NM 87199-2602

SPARTON TECHNOLOGY INC
ATTN ACCOUNTS PAYABLE
5612 JOHNSON LAKE RD
DE LEON SPRINGS FL 32130

SPARTON SOUTHWEST INC
4901 ROCKAWAY BLVD
RIO RANCHO NM 87124

SPENCE. DOUGLAS H & MAVIS JEAN
TRUSTEE SPENCE REVOCABLE TRUST
10809 CORONADO NE
ALBUQUERQUE NM 87122

STAEDEN, CARY C & LOU E
1679 PACE RD NW
ALBUQUERQUE NM 87114

STANLEY, HERBERT & LEVATER B
1517 ALAMO AVE SE
ALBUQUERQUE NM 87106

STONE, PHILIP B
11410 NW PERMIAN DR
PORTLAND OR 97229

SUAREZ, MARSHALL & KATHY Q
6916 TESUQUE DR NW
ALBUQUERQUE NM 87120

TAYLOR, GANARLD
615 LA VETA NE
ALBUQUERQUE NM 87108

TAYLOR, DEREK A
615 LA VETA NE
ALBUQUERQUE NM 87108

TAYLOR, SCOTT M
7440 TANGLE RIDGE DR
MECHANICSVILLE VA 23111

TAYLOR, PAUL
3201 PITT ST NE
ALBUQUERQUE NM 87111

THE CITY OF ALBUQUERQUE
ATTN: REAL ESTATE DEPT
ALBUQUERQUE NM 87103

THOMSON, CHRISTOPHER K &
STEPHANIE D
4219 BRYAN AVE NW
ALBUQUERQUE NM 87114

TORRES, VALENTINO OR DEEDEE
1611 TORRIBIO NE
ALBUQUERQUE NM 87112

TORRES, LUCILLE D
2134 COAL PL SE
ALBUQUERQUE NM 87106

TRUJILLO, JOHN P & CATHERINE L
10100 SIERRA HILL DR NW
ALBUQUERQUE NM 87114

TUCKER, MARK D
9375 SAN DIEGO AVE NE
ALBUQUERQUE NM 87122

UNITED PROPERTIES LTD CO
7201 LOMAS BLV NE
ALBUQUERQUE NM 87110

VAROZ, EDWARD & MARGARET
1900 11TH AVE SE
RIO RANCHO NM 87124

VAU, GARY N & MARYANN K VAU
9733 ACADEMY RD NW
ALBUQUERQUE NM 87114

WARREN, MARK A & DAWNE D
3600 32ND CIR SE
RIO RANCHO NM 87124

WEISENBURGER, VIRTUE V S
6048 GOLDEN VALLEY RD
MINNEAPOLIS MN 55422

WEITHMAN, JOHN A
1243 NORTH GENOA CLAY CTR RD
GENOA OH 43430

WILLCOCKSON, LARRY
10108 SIERRA HILL DR NW
ALBUQUERQUE NM 87114

WINE, MARIE
15222 N CAVE CREEK RD
PHOENIX AZ 85032

WOJCICKI, RAYMOND J WOJCICKI
RAYMOND J DECLARATION OF TRUST
7701 CATALPA AVE
CHICAGO IL 60656

YOVANOVICH, MILAN ETUX
5212 D ROYAL AVE
PORTAGE IN 46368

ZABALZA, DAVID R & KATHLEEN
1487 BERONA WAY
SAN JOSE CA 95122

ZAMORA, PAUL & PADILLA, PATRICIA
4212 BRYAN AVE NW
ALBUQUERQUE NM 87114

ZEIGLER, YAEKO
9717 CAMINO DEL SOL NE
ALBUQUERQUE NM 87111

APPENDIX F

Appendix F

Water Level Residuals
January 1998 to November 2001
Simulation

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-07	01/28/98	4,976.89	4,974.10	-2.79
MW-09	01/28/98	4,972.91	4,971.57	-1.34
MW-12	01/28/98	4,972.50	4,972.63	0.13
MW-13	01/28/98	4,974.42	4,971.97	-2.45
MW-14	01/28/98	4,971.22	4,970.54	-0.68
MW-16	01/28/98	4,978.36	4,978.37	0.01
MW-17	01/28/98	4,978.86	4,978.79	-0.07
MW-18	01/28/98	4,970.24	4,975.14	4.90
MW-19	01/28/98	4,971.66	4,970.98	-0.68
MW-20	01/28/98	4,971.32	4,970.83	-0.49
MW-21	01/28/98	4,978.59	4,978.84	0.25
MW-22	01/28/98	4,977.47	4,977.66	0.19
MW-23	01/28/98	4,975.75	4,976.41	0.66
MW-24	01/28/98	4,975.56	4,976.87	1.31
MW-25	01/28/98	4,977.06	4,977.38	0.32
MW-26	01/28/98	4,966.88	4,971.76	4.88
MW-27	01/28/98	4,973.15	4,976.35	3.20
MW-28	01/28/98	4,971.70	4,970.51	-1.19
MW-29	01/28/98	4,973.24	4,971.71	-1.53
MW-30	01/28/98	4,972.06	4,971.13	-0.93
MW-31	01/28/98	4,971.14	4,970.57	-0.57
MW-32	01/28/98	4,971.02	4,970.54	-0.48
MW-33	01/28/98	4,972.24	4,971.42	-0.82
MW-34	01/28/98	4,973.68	4,971.85	-1.83
MW-35	01/28/98	4,971.24	4,970.49	-0.75
MW-36	01/28/98	4,970.02	4,969.61	-0.41
MW-37	01/28/98	4,968.65	4,968.50	-0.15
MW-38	01/28/98	4,973.14	4,971.62	-1.52
MW-39	01/28/98	4,972.22	4,971.13	-1.09
MW-40	01/28/98	4,971.18	4,970.55	-0.63
MW-41	01/28/98	4,971.04	4,970.58	-0.46
MW-42	01/28/98	4,970.79	4,970.65	-0.14
MW-43	01/28/98	4,970.58	4,970.50	-0.08
MW-44	01/28/98	4,970.07	4,969.62	-0.45
MW-45	01/28/98	4,968.54	4,968.51	-0.03
MW-46	01/28/98	4,967.46	4,967.54	0.08
MW-47	01/28/98	4,967.15	4,967.22	0.07
MW-48	01/28/98	4,966.41	4,966.24	-0.17
MW-49	01/28/98	4,970.99	4,970.55	-0.44
MW-51	01/28/98	4,980.52	4,980.93	0.41
MW-52	01/28/98	4,964.13	4,964.16	0.03

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-53	01/28/98	4,965.70	4,965.16	-0.54
MW-54	01/28/98	4,966.16	4,966.24	0.08
MW-55	01/28/98	4,965.83	4,966.19	0.36
MW-56	01/28/98	4,966.43	4,966.26	-0.17
MW-57	01/28/98	4,965.68	4,965.72	0.04
MW-58	01/28/98	4,966.26	4,965.64	-0.62
MW-59	01/28/98	4,969.74	4,970.40	0.66
MW-60	01/28/98	4,966.09	4,965.72	-0.37
MW-61	01/28/98	4,966.03	4,965.63	-0.40
MW-62	01/28/98	4,968.02	4,967.78	-0.24
MW-63	01/28/98	4,971.67	4,979.80	8.13
MW-64	01/28/98	4,966.14	4,966.20	0.06
MW-65	01/28/98	4,963.91	4,963.99	0.08
MW-66	01/28/98	4,964.83	4,965.25	0.42
MW-67	01/28/98	4,960.00	4,959.66	-0.34
MW-68	01/28/98	4,963.33	4,962.75	-0.58
MW-69	01/28/98	4,963.24	4,962.58	-0.66
PW-1	01/28/98	4,964.96	4,971.60	6.64
MW-07	04/28/98	4,977.03	4,974.07	-2.96
MW-09	04/28/98	4,972.83	4,971.54	-1.29
MW-12	04/28/98	4,972.59	4,972.59	0.00
MW-13	04/28/98	4,974.42	4,971.93	-2.49
MW-14	04/28/98	4,971.22	4,970.51	-0.71
MW-16	04/28/98	4,978.11	4,978.36	0.25
MW-17	04/28/98	4,978.64	4,978.82	0.18
MW-18	04/28/98	4,967.44	4,975.06	7.62
MW-19	04/28/98	4,971.74	4,970.92	-0.82
MW-20	04/28/98	4,971.32	4,970.77	-0.55
MW-21	04/28/98	4,978.18	4,978.84	0.66
MW-22	04/28/98	4,977.47	4,977.70	0.23
MW-23	04/28/98	4,973.37	4,976.36	2.99
MW-24	04/28/98	4,973.62	4,976.70	3.08
MW-25	04/28/98	4,975.13	4,977.27	2.14
MW-26	04/28/98	4,966.88	4,971.48	4.60
MW-27	04/28/98	4,971.16	4,976.19	5.03
MW-28	04/28/98	4,971.62	4,970.47	-1.15
MW-29	04/28/98	4,973.49	4,971.65	-1.84
MW-30	04/28/98	4,972.22	4,971.08	-1.14
MW-31	04/28/98	4,971.14	4,970.52	-0.62
MW-32	04/28/98	4,970.79	4,970.47	-0.32
MW-33	04/28/98	4,972.35	4,971.39	-0.96

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-34	04/28/98	4,974.01	4,971.82	-2.19
MW-35	04/28/98	4,971.24	4,970.46	-0.78
MW-36	04/28/98	4,969.86	4,969.58	-0.28
MW-37	04/28/98	4,968.40	4,968.47	0.07
MW-38	04/28/98	4,973.47	4,971.56	-1.91
MW-39	04/28/98	4,972.30	4,971.07	-1.23
MW-40	04/28/98	4,971.26	4,970.49	-0.77
MW-41	04/28/98	4,971.13	4,970.51	-0.62
MW-42	04/28/98	4,970.63	4,970.58	-0.05
MW-43	04/28/98	4,970.37	4,970.43	0.06
MW-44	04/28/98	4,969.95	4,969.59	-0.36
MW-45	04/28/98	4,968.38	4,968.47	0.09
MW-46	04/28/98	4,967.22	4,967.49	0.27
MW-47	04/28/98	4,966.91	4,967.20	0.29
MW-48	04/28/98	4,966.18	4,966.22	0.04
MW-49	04/28/98	4,971.08	4,970.49	-0.59
MW-51	04/28/98	4,980.29	4,980.94	0.65
MW-52	04/28/98	4,963.66	4,964.13	0.47
MW-53	04/28/98	4,965.41	4,965.14	-0.27
MW-54	04/28/98	4,965.99	4,966.21	0.22
MW-55	04/28/98	4,965.54	4,966.14	0.60
MW-56	04/28/98	4,966.16	4,966.23	0.07
MW-57	04/28/98	4,965.51	4,965.65	0.14
MW-58	04/28/98	4,965.84	4,965.62	-0.22
MW-59	04/28/98	4,969.71	4,970.33	0.62
MW-60	04/28/98	4,965.83	4,965.68	-0.15
MW-61	04/28/98	4,965.89	4,965.61	-0.28
MW-62	04/28/98	4,967.77	4,967.75	-0.02
MW-63	04/28/98	4,971.30	4,979.84	8.54
MW-64	04/28/98	4,966.03	4,966.14	0.11
MW-65	04/28/98	4,963.41	4,963.93	0.52
MW-66	04/28/98	4,964.61	4,965.17	0.56
MW-67	04/28/98	4,959.60	4,959.50	-0.10
MW-68	04/28/98	4,962.87	4,962.72	-0.15
MW-69	04/28/98	4,962.78	4,962.51	-0.27
MW-70	04/28/98	4,970.09	4,970.44	0.35
PW-1	04/28/98	4,971.00	4,971.56	0.56
MW-07	07/30/98	4,977.70	4,974.03	-3.67
MW-09	07/30/98	4,973.33	4,971.46	-1.87
MW-12	07/30/98	4,972.84	4,972.53	-0.31
MW-13	07/30/98	4,974.76	4,971.86	-2.90

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-14	07/30/98	4,971.64	4,970.44	-1.20
MW-16	07/30/98	4,978.59	4,978.60	0.01
MW-17	07/30/98	4,978.81	4,978.87	0.06
MW-18	07/30/98	4,967.44	4,974.70	7.26
MW-19	07/30/98	4,972.24	4,970.84	-1.40
MW-20	07/30/98	4,971.74	4,970.69	-1.05
MW-21	07/30/98	4,978.51	4,978.86	0.35
MW-22	07/30/98	4,977.89	4,977.78	-0.11
MW-23	07/30/98	4,973.20	4,976.21	3.00
MW-24	07/30/98	4,973.53	4,978.58	5.05
MW-25	07/30/98	4,975.13	4,978.61	3.48
MW-26	07/30/98	4,966.71	4,970.21	3.50
MW-27	07/30/98	4,971.41	4,975.22	3.81
MW-28	07/30/98	4,971.62	4,970.35	-1.27
MW-29	07/30/98	4,973.91	4,971.56	-2.35
MW-30	07/30/98	4,972.47	4,971.00	-1.47
MW-31	07/30/98	4,971.31	4,970.44	-0.87
MW-32	07/30/98	4,971.04	4,970.39	-0.65
MW-33	07/30/98	4,972.73	4,971.32	-1.41
MW-34	07/30/98	4,974.88	4,971.76	-3.12
MW-35	07/30/98	4,971.83	4,970.41	-1.42
MW-36	07/30/98	4,970.27	4,969.52	-0.75
MW-37	07/30/98	4,968.44	4,968.41	-0.03
MW-38	07/30/98	4,973.81	4,971.47	-2.34
MW-39	07/30/98	4,972.64	4,970.98	-1.66
MW-40	07/30/98	4,971.51	4,970.41	-1.10
MW-41	07/30/98	4,971.13	4,970.44	-0.69
MW-42	07/30/98	4,970.77	4,970.49	-0.28
MW-43	07/30/98	4,970.51	4,970.35	-0.16
MW-44	07/30/98	4,970.27	4,969.52	-0.75
MW-45	07/30/98	4,968.50	4,968.40	-0.10
MW-46	07/30/98	4,967.23	4,967.42	0.19
MW-47	07/30/98	4,966.98	4,967.15	0.17
MW-48	07/30/98	4,966.20	4,966.16	-0.04
MW-49	07/30/98	4,971.16	4,970.41	-0.75
MW-51	07/30/98	4,980.19	4,980.97	0.78
MW-52	07/30/98	4,963.63	4,964.08	0.45
MW-53	07/30/98	4,965.22	4,965.08	-0.14
MW-54	07/30/98	4,965.80	4,966.13	0.33
MW-55	07/30/98	4,965.48	4,966.06	0.58
MW-56	07/30/98	4,966.14	4,966.16	0.02

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-57	07/30/98	4,965.36	4,965.56	0.20
MW-58	07/30/98	4,965.78	4,965.56	-0.22
MW-59	07/30/98	4,969.54	4,970.25	0.71
MW-60	07/30/98	4,965.76	4,965.61	-0.15
MW-61	07/30/98	4,965.71	4,965.54	-0.17
MW-62	07/30/98	4,967.86	4,967.71	-0.15
MW-63	07/30/98	4,971.11	4,979.85	8.74
MW-64	07/30/98	4,965.80	4,966.06	0.26
MW-66	07/30/98	4,964.39	4,965.07	0.68
MW-67	07/30/98	4,958.75	4,959.33	0.58
MW-68	07/30/98	4,962.80	4,962.64	-0.16
MW-69	07/30/98	4,962.67	4,962.41	-0.26
MW-70	07/30/98	4,970.34	4,970.36	0.02
PW-1	07/30/98	4,971.08	4,971.49	0.41
MW-07	11/10/98	4,977.42	4,973.97	-3.45
MW-09	11/10/98	4,973.06	4,971.37	-1.69
MW-12	11/10/98	4,972.82	4,972.47	-0.35
MW-13	11/10/98	4,974.35	4,971.76	-2.59
MW-14	11/10/98	4,971.12	4,970.34	-0.78
MW-16	11/10/98	4,978.43	4,978.45	0.02
MW-17	11/10/98	4,978.75	4,978.92	0.17
MW-19	11/10/98	4,971.85	4,970.74	-1.11
MW-20	11/10/98	4,971.47	4,970.58	-0.89
MW-21	11/10/98	4,978.31	4,978.86	0.55
MW-22	11/10/98	4,977.89	4,977.84	-0.05
MW-29	11/10/98	4,973.68	4,971.46	-2.22
MW-30	11/10/98	4,972.28	4,970.90	-1.38
MW-31	11/10/98	4,971.23	4,970.35	-0.88
MW-32	11/10/98	4,970.96	4,970.29	-0.67
MW-33	11/10/98	4,972.54	4,971.22	-1.32
MW-34	11/10/98	4,974.51	4,971.66	-2.85
MW-35	11/10/98	4,970.78	4,970.32	-0.46
MW-36	11/10/98	4,969.43	4,969.44	0.00
MW-37	11/10/98	4,968.32	4,968.32	0.00
MW-38	11/10/98	4,973.70	4,971.37	-2.33
MW-39	11/10/98	4,972.49	4,970.88	-1.61
MW-40	11/10/98	4,971.25	4,970.31	-0.94
MW-41	11/10/98	4,971.09	4,970.33	-0.76
MW-42	11/10/98	4,970.65	4,970.39	-0.26
MW-43	11/10/98	4,970.45	4,970.24	-0.21
MW-44	11/10/98	4,970.11	4,969.43	-0.68

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-45	11/10/98	4,968.33	4,968.31	-0.02
MW-46	11/10/98	4,966.95	4,967.32	0.37
MW-47	11/10/98	4,966.68	4,967.06	0.38
MW-48	11/10/98	4,965.81	4,966.07	0.26
MW-49	11/10/98	4,971.03	4,970.30	-0.73
MW-51	11/10/98	4,980.09	4,981.01	0.92
MW-52	11/10/98	4,963.17	4,963.98	0.81
MW-53	11/10/98	4,964.92	4,964.99	0.07
MW-54	11/10/98	4,965.56	4,966.02	0.46
MW-55	11/10/98	4,965.13	4,965.95	0.82
MW-56	11/10/98	4,965.76	4,966.06	0.30
MW-57	11/10/98	4,964.87	4,965.44	0.57
MW-58	11/10/98	4,965.43	4,965.47	0.04
MW-59	11/10/98	4,969.46	4,970.14	0.68
MW-60	11/10/98	4,965.18	4,965.50	0.32
MW-61	11/10/98	4,965.37	4,965.44	0.07
MW-62	11/10/98	4,967.52	4,967.62	0.10
MW-63	11/10/98	4,970.98	4,979.86	8.88
MW-64	11/10/98	4,965.41	4,965.95	0.54
MW-65	11/10/98	4,963.05	4,963.72	0.67
MW-66	11/10/98	4,963.98	4,964.94	0.96
MW-67	11/10/98	4,958.56	4,959.15	0.59
MW-68	11/10/98	4,962.25	4,962.53	0.28
MW-69	11/10/98	4,962.13	4,962.27	0.14
MW-70	11/10/98	4,970.18	4,970.25	0.07
MW-71	11/10/98	4,958.51	4,957.74	-0.77
MW-18	11/25/98	4,971.87	4,975.12	3.25
MW-23	11/25/98	4,975.91	4,976.42	0.51
MW-24	11/25/98	4,978.23	4,977.12	-1.11
MW-25	11/25/98	4,978.31	4,977.55	-0.76
MW-26	11/25/98	4,973.44	4,971.86	-1.58
MW-27	11/25/98	4,974.05	4,976.47	2.42
MW-28	11/25/98	4,971.09	4,970.29	-0.80
PW-1	11/25/98	4,973.59	4,971.38	-2.21
MW-07	02/16/99	4,976.36	4,974.04	-2.32
MW-09	02/16/99	4,972.14	4,971.28	-0.86
MW-12	02/16/99	4,971.80	4,972.40	0.60
MW-13	02/16/99	4,973.39	4,971.71	-1.68
MW-14	02/16/99	4,970.20	4,970.15	-0.05
MW-16	02/16/99	4,977.89	4,978.51	0.62
MW-17	02/16/99	4,978.16	4,979.03	0.87

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-19	02/16/99	4,970.91	4,970.54	-0.37
MW-20	02/16/99	4,970.54	4,970.32	-0.22
MW-21	02/16/99	4,974.02	4,978.94	4.92
MW-22	02/16/99	4,976.91	4,977.95	1.04
MW-29	02/16/99	4,972.59	4,971.37	-1.22
MW-30	02/16/99	4,971.26	4,970.71	-0.55
MW-31	02/16/99	4,970.29	4,970.06	-0.23
MW-33	02/16/99	4,971.53	4,971.11	-0.42
MW-34	02/16/99	4,973.03	4,971.59	-1.44
MW-35	02/16/99	4,970.63	4,970.10	-0.53
MW-36	02/16/99	4,969.20	4,969.09	-0.11
MW-37	02/16/99	4,967.62	4,967.81	0.19
MW-38	02/16/99	4,972.61	4,971.26	-1.35
MW-39	02/16/99	4,971.46	4,970.67	-0.79
MW-40	02/16/99	4,970.32	4,969.98	-0.34
MW-41	02/16/99	4,970.24	4,970.07	-0.17
MW-42	02/16/99	4,969.79	4,970.15	0.36
MW-43	02/16/99	4,969.72	4,969.97	0.25
MW-44	02/16/99	4,969.27	4,969.01	-0.26
MW-45	02/16/99	4,967.62	4,967.66	0.04
MW-46	02/16/99	4,966.35	4,966.51	0.16
MW-47	02/16/99	4,965.58	4,966.25	0.67
MW-48	02/16/99	4,965.31	4,964.90	-0.41
MW-49	02/16/99	4,970.07	4,969.95	-0.12
MW-51	02/16/99	4,979.99	4,981.04	1.05
MW-52	02/16/99	4,961.69	4,962.46	0.77
MW-53	02/16/99	4,964.40	4,963.12	-1.28
MW-54	02/16/99	4,965.18	4,965.35	0.17
MW-55	02/16/99	4,963.74	4,963.95	0.21
MW-56	02/16/99	4,965.29	4,964.48	-0.81
MW-57	02/16/99	4,964.61	4,964.82	0.21
MW-58	02/16/99	4,965.00	4,963.94	-1.06
MW-59	02/16/99	4,968.76	4,969.88	1.12
MW-60	02/16/99	4,964.78	4,964.14	-0.64
MW-61	02/16/99	4,964.93	4,964.37	-0.56
MW-62	02/16/99	4,967.04	4,966.99	-0.05
MW-63	02/16/99	4,970.62	4,979.81	9.19
MW-64	02/16/99	4,965.72	4,965.21	-0.51
MW-65	02/16/99	4,961.27	4,960.83	-0.44
MW-66	02/16/99	4,964.21	4,963.81	-0.40
MW-67	02/16/99	4,958.05	4,957.74	-0.31

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-68	02/16/99	4,961.08	4,961.17	0.09
MW-69	02/16/99	4,960.80	4,960.03	-0.77
MW-70	02/16/99	4,969.36	4,969.95	0.59
MW-71	02/16/99	4,958.02	4,956.43	-1.59
MW-07	05/13/99	4,976.51	4,974.05	-2.46
MW-09	05/13/99	4,972.22	4,971.17	-1.05
MW-12	05/13/99	4,971.87	4,972.33	0.46
MW-13	05/13/99	4,973.61	4,971.64	-1.97
MW-16	05/13/99	4,977.52	4,978.58	1.06
MW-17	05/13/99	4,977.92	4,979.10	1.18
MW-19	05/13/99	4,970.90	4,970.43	-0.47
MW-20	05/13/99	4,970.54	4,970.23	-0.31
MW-22	05/13/99	4,976.98	4,978.02	1.04
MW-29	05/13/99	4,972.80	4,971.30	-1.50
MW-30	05/13/99	4,971.31	4,970.61	-0.70
MW-31	05/13/99	4,970.21	4,969.93	-0.28
MW-32	05/13/99	4,970.02	4,969.90	-0.12
MW-33	05/13/99	4,971.53	4,971.00	-0.53
MW-34	05/13/99	4,973.32	4,971.49	-1.83
MW-35	05/13/99	4,970.44	4,969.89	-0.55
MW-36	05/13/99	4,968.86	4,968.86	0.00
MW-37	05/13/99	4,967.18	4,967.51	0.33
MW-38	05/13/99	4,972.82	4,971.19	-1.63
MW-39	05/13/99	4,971.53	4,970.58	-0.95
MW-40	05/13/99	4,970.25	4,969.87	-0.38
MW-41	05/13/99	4,970.13	4,969.95	-0.18
MW-42	05/13/99	4,969.80	4,970.06	0.26
MW-43	05/13/99	4,969.59	4,969.88	0.29
MW-44	05/13/99	4,968.97	4,968.81	-0.16
MW-45	05/13/99	4,967.20	4,967.42	0.22
MW-46	05/13/99	4,965.85	4,966.25	0.40
MW-47	05/13/99	4,965.58	4,965.84	0.26
MW-48	05/13/99	4,964.63	4,964.40	-0.23
MW-49	05/13/99	4,970.05	4,969.85	-0.20
MW-51	05/13/99	4,979.77	4,981.07	1.30
MW-52	05/13/99	4,961.31	4,961.82	0.51
MW-53	05/13/99	4,963.49	4,962.52	-0.97
MW-54	05/13/99	4,964.65	4,965.05	0.40
MW-55	05/13/99	4,963.28	4,963.85	0.57
MW-56	05/13/99	4,964.59	4,964.19	-0.40
MW-57	05/13/99	4,964.12	4,964.57	0.45

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-58	05/13/99	4,964.18	4,963.38	-0.80
MW-59	05/13/99	4,968.65	4,969.80	1.15
MW-60	05/13/99	4,964.22	4,963.84	-0.38
MW-61	05/13/99	4,964.30	4,963.93	-0.37
MW-62	05/13/99	4,966.44	4,966.61	0.17
MW-64	05/13/99	4,964.57	4,964.95	0.38
MW-65	05/13/99	4,960.96	4,960.81	-0.15
MW-66	05/13/99	4,962.80	4,963.76	0.96
MW-67	05/13/99	4,957.78	4,957.64	-0.14
MW-68	05/13/99	4,960.71	4,960.74	0.03
MW-69	05/13/99	4,960.77	4,960.01	-0.76
MW-70	05/13/99	4,969.27	4,969.85	0.58
MW-71	05/13/99	4,957.72	4,956.30	-1.42
MW-73	05/13/99	4,970.03	4,969.91	-0.12
OB-1	05/13/99	4,958.42	4,958.61	0.19
OB-2	05/13/99	4,961.24	4,959.30	-1.94
MW-07	08/12/99	4,976.70	4,974.01	-2.69
MW-09	08/12/99	4,972.33	4,971.02	-1.31
MW-12	08/12/99	4,971.96	4,972.21	0.25
MW-13	08/12/99	4,973.77	4,971.51	-2.26
MW-16	08/12/99	4,977.72	4,978.62	0.90
MW-17	08/12/99	4,978.03	4,979.16	1.13
MW-19	08/12/99	4,970.98	4,970.25	-0.73
MW-20	08/12/99	4,970.61	4,970.04	-0.57
MW-22	08/12/99	4,977.12	4,978.08	0.96
MW-29	08/12/99	4,972.94	4,971.14	-1.80
MW-30	08/12/99	4,971.41	4,970.43	-0.98
MW-31	08/12/99	4,970.28	4,969.72	-0.56
MW-32	08/12/99	4,970.07	4,969.70	-0.37
MW-33	08/12/99	4,971.66	4,970.84	-0.82
MW-34	08/12/99	4,973.67	4,971.34	-2.33
MW-37	08/12/99	4,967.04	4,967.17	0.13
MW-38	08/12/99	4,972.97	4,971.03	-1.94
MW-39	08/12/99	4,971.66	4,970.40	-1.26
MW-40	08/12/99	4,970.33	4,969.66	-0.67
MW-41	08/12/99	4,970.17	4,969.75	-0.42
MW-42	08/12/99	4,969.84	4,969.88	0.04
MW-43	08/12/99	4,969.63	4,969.70	0.07
MW-44	08/12/99	4,969.04	4,968.53	-0.51
MW-45	08/12/99	4,967.07	4,967.09	0.02
MW-46	08/12/99	4,965.68	4,965.89	0.21

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-47	08/12/99	4,965.28	4,965.40	0.12
MW-48	08/12/99	4,964.17	4,963.87	-0.30
MW-49	08/12/99	4,970.12	4,969.64	-0.48
MW-51	08/12/99	4,979.81	4,981.09	1.28
MW-52	08/12/99	4,960.78	4,961.15	0.37
MW-53	08/12/99	4,962.83	4,961.82	-1.01
MW-54	08/12/99	4,964.56	4,964.73	0.17
MW-55	08/12/99	4,963.08	4,963.34	0.26
MW-56	08/12/99	4,964.18	4,963.68	-0.50
MW-57	08/12/99	4,964.14	4,964.31	0.17
MW-58	08/12/99	4,963.66	4,962.77	-0.89
MW-59	08/12/99	4,968.70	4,969.61	0.91
MW-60	08/12/99	4,963.91	4,963.39	-0.52
MW-61	08/12/99	4,963.98	4,963.48	-0.50
MW-62	08/12/99	4,966.15	4,966.20	0.05
MW-64	08/12/99	4,964.47	4,964.64	0.17
MW-65	08/12/99	4,960.46	4,960.19	-0.27
MW-66	08/12/99	4,963.03	4,963.49	0.46
MW-67	08/12/99	4,957.44	4,957.50	0.06
MW-68	08/12/99	4,960.47	4,960.27	-0.20
MW-69	08/12/99	4,960.35	4,959.56	-0.79
MW-70	08/12/99	4,969.32	4,969.65	0.33
MW-71	08/12/99	4,957.46	4,956.20	-1.26
MW-72	08/12/99	4,970.02	4,969.83	-0.19
MW-73	08/12/99	4,970.07	4,969.70	-0.37
MW-74	08/12/99	4,962.63	4,967.67	5.04
MW-75	08/12/99	4,966.30	4,967.19	0.89
MW-76	08/12/99	4,966.89	4,966.75	-0.14
OB-1	08/12/99	4,957.70	4,957.72	0.02
OB-2	08/12/99	4,959.10	4,958.57	-0.53
MW-07	10/28/99	4,976.94	4,973.96	-2.98
MW-09	10/28/99	4,972.56	4,970.90	-1.66
MW-12	10/28/99	4,972.19	4,972.13	-0.06
MW-13	10/28/99	4,973.98	4,971.40	-2.58
MW-14	10/28/99	4,970.37	DRY	DRY
MW-16	10/28/99	4,978.07	4,978.73	0.66
MW-17	10/28/99	4,978.53	4,979.21	0.68
MW-18	10/28/99	4,970.93	4,975.01	4.08
MW-19	10/28/99	4,971.17	4,970.11	-1.06
MW-20	10/28/99	4,970.80	4,969.90	-0.90
MW-21	10/28/99	4,978.34	4,979.08	0.74

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-22	10/28/99	4,975.84	4,978.12	2.28
MW-23	10/28/99	4,975.14	4,976.56	1.42
MW-25	10/28/99	4,977.01	4,977.72	0.71
MW-26	10/28/99	4,971.28	4,971.53	0.25
MW-29	10/28/99	4,973.16	4,971.02	-2.14
MW-30	10/28/99	4,971.63	4,970.29	-1.34
MW-31	10/28/99	4,970.49	4,969.57	-0.92
MW-32	10/28/99	4,970.27	4,969.55	-0.72
MW-33	10/28/99	4,971.86	4,970.71	-1.15
MW-34	10/28/99	4,973.81	4,971.22	-2.59
MW-35	10/28/99	4,970.79	4,969.50	-1.29
MW-36	10/28/99	4,969.04	4,968.38	-0.66
MW-37	10/28/99	4,967.23	4,966.94	-0.29
MW-38	10/28/99	4,973.18	4,970.90	-2.28
MW-39	10/28/99	4,971.88	4,970.26	-1.62
MW-40	10/28/99	4,970.51	4,969.51	-1.00
MW-41	10/28/99	4,970.39	4,969.60	-0.79
MW-42	10/28/99	4,970.11	4,969.74	-0.37
MW-43	10/28/99	4,969.82	4,969.56	-0.26
MW-44	10/28/99	4,969.13	4,968.34	-0.79
MW-45	10/28/99	4,967.24	4,966.86	-0.38
MW-46	10/28/99	4,965.84	4,965.65	-0.19
MW-47	10/28/99	4,965.50	4,965.10	-0.40
MW-48	10/28/99	4,964.39	4,963.53	-0.86
MW-49	10/28/99	4,970.37	4,969.48	-0.89
MW-51	10/28/99	4,980.36	4,981.11	0.75
MW-52	10/28/99	4,960.75	4,960.72	-0.03
MW-53	10/28/99	4,962.79	4,961.38	-1.41
MW-54	10/28/99	4,964.81	4,964.52	-0.29
MW-55	10/28/99	4,963.27	4,963.01	-0.26
MW-56	10/28/99	4,964.30	4,963.35	-0.95
MW-57	10/28/99	4,964.57	4,964.14	-0.43
MW-58	10/28/99	4,963.75	4,962.38	-1.37
MW-59	10/28/99	4,968.95	4,969.48	0.53
MW-60	10/28/99	4,964.17	4,963.10	-1.07
MW-61	10/28/99	4,964.20	4,963.19	-1.01
MW-62	10/28/99	4,966.40	4,965.92	-0.48
MW-63	10/28/99	4,970.85	4,979.75	8.90
MW-64	10/28/99	4,964.83	4,964.44	-0.39
MW-65	10/28/99	4,960.47	4,959.79	-0.68
MW-66	10/28/99	4,963.33	4,963.30	-0.03

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-67	10/28/99	4,957.68	4,957.39	-0.29
MW-68	10/28/99	4,960.64	4,959.97	-0.67
MW-69	10/28/99	4,960.55	4,959.27	-1.28
MW-70	10/28/99	4,969.52	4,969.51	-0.01
MW-71	10/28/99	4,957.70	4,956.10	-1.60
MW-72	10/28/99	4,970.22	4,969.69	-0.53
MW-73	10/28/99	4,970.27	4,969.55	-0.72
MW-74	10/28/99	4,963.34	4,968.07	4.73
MW-75	10/28/99	4,967.32	4,967.58	0.26
MW-76	10/28/99	4,968.02	4,967.10	-0.92
OB-1	10/28/99	4,957.89	4,957.17	-0.72
OB-2	10/28/99	4,959.19	4,958.11	-1.08
MW-07	02/03/00	4,975.95	4,973.90	-2.05
MW-09	02/03/00	4,971.69	4,970.77	-0.92
MW-12	02/03/00	4,971.34	4,972.05	0.71
MW-13	02/03/00	4,972.98	4,971.27	-1.71
MW-16	02/03/00	4,977.48	4,978.94	1.46
MW-17	02/03/00	4,977.85	4,979.27	1.42
MW-18	02/03/00	4,970.57	4,975.41	4.84
MW-19	02/03/00	4,970.46	4,969.97	-0.49
MW-20	02/03/00	4,970.11	4,969.76	-0.35
MW-22	02/03/00	4,976.59	4,978.17	1.58
MW-23	02/03/00	4,974.73	4,976.78	2.05
MW-24	02/03/00	4,977.34	4,978.29	0.95
MW-25	02/03/00	4,977.45	4,978.42	0.97
MW-26	02/03/00	4,972.27	4,972.93	0.66
MW-27	02/03/00	4,972.95	4,977.42	4.47
MW-29	02/03/00	4,972.18	4,970.90	-1.28
MW-30	02/03/00	4,970.82	4,970.15	-0.67
MW-31	02/03/00	4,969.81	4,969.41	-0.40
MW-32	02/03/00	4,969.68	4,969.41	-0.27
MW-33	02/03/00	4,971.07	4,970.58	-0.49
MW-34	02/03/00	4,972.61	4,971.07	-1.54
MW-35	02/03/00	4,970.07	4,969.32	-0.75
MW-36	02/03/00	4,968.66	4,968.17	-0.49
MW-37	02/03/00	4,966.98	4,966.72	-0.26
MW-38	02/03/00	4,972.20	4,970.78	-1.42
MW-39	02/03/00	4,971.03	4,970.12	-0.91
MW-40	02/03/00	4,969.85	4,969.36	-0.49
MW-41	02/03/00	4,969.79	4,969.46	-0.33
MW-42	02/03/00	4,969.49	4,969.61	0.12

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-43	02/03/00	4,969.30	4,969.43	0.13
MW-44	02/03/00	4,968.75	4,968.14	-0.61
MW-45	02/03/00	4,967.08	4,966.66	-0.42
MW-46	02/03/00	4,965.84	4,965.45	-0.39
MW-47	02/03/00	4,965.31	4,964.84	-0.47
MW-48	02/03/00	4,964.28	4,963.25	-1.03
MW-49	02/03/00	4,969.66	4,969.34	-0.32
MW-51	02/03/00	4,979.80	4,981.12	1.32
MW-52	02/03/00	4,960.72	4,960.38	-0.34
MW-53	02/03/00	4,962.80	4,961.07	-1.73
MW-54	02/03/00	4,964.81	4,964.33	-0.48
MW-55	02/03/00	4,963.16	4,962.83	-0.33
MW-56	02/03/00	4,964.33	4,963.12	-1.21
MW-57	02/03/00	4,964.60	4,963.97	-0.63
MW-58	02/03/00	4,963.75	4,962.09	-1.66
MW-59	02/03/00	4,968.46	4,969.35	0.89
MW-60	02/03/00	4,964.29	4,962.90	-1.40
MW-61	02/03/00	4,964.35	4,962.95	-1.40
MW-62	02/03/00	4,966.15	4,965.64	-0.51
MW-63	02/03/00	4,970.37	4,979.73	9.36
MW-64	02/03/00	4,964.81	4,964.26	-0.55
MW-65	02/03/00	4,960.47	4,959.61	-0.86
MW-66	02/03/00	4,963.30	4,963.17	-0.13
MW-67	02/03/00	4,957.65	4,957.29	-0.36
MW-68	02/03/00	4,960.68	4,959.74	-0.94
MW-69	02/03/00	4,960.57	4,959.12	-1.45
MW-70	02/03/00	4,968.94	4,969.37	0.43
MW-71	02/03/00	4,957.72	4,956.01	-1.71
MW-72	02/03/00	4,969.65	4,969.55	-0.10
MW-73	02/03/00	4,969.67	4,969.40	-0.27
MW-74	02/03/00	4,963.33	4,967.93	4.60
MW-75	02/03/00	4,967.48	4,967.51	0.03
MW-76	02/03/00	4,968.32	4,967.04	-1.28
OB-1	02/03/00	4,957.73	4,957.10	-0.63
OB-2	02/03/00	4,959.18	4,957.99	-1.19
PW-1	02/03/00	4,971.89	4,970.80	-1.09
MW-07	05/02/00	4,976.27	4,973.85	-2.42
MW-09	05/02/00	4,971.98	4,970.66	-1.32
MW-12	05/02/00	4,971.62	4,971.99	0.37
MW-13	05/02/00	4,973.37	4,971.17	-2.20
MW-16	05/02/00	4,977.39	4,978.99	1.60

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-17	05/02/00	4,977.72	4,979.31	1.59
MW-18	05/02/00	4,970.70	4,975.40	4.70
MW-19	05/02/00	4,970.64	4,969.87	-0.77
MW-20	05/02/00	4,970.29	4,969.65	-0.64
MW-22	05/02/00	4,976.76	4,978.20	1.44
MW-23	05/02/00	4,975.13	4,976.80	1.67
MW-24	05/02/00	4,977.12	4,978.33	1.21
MW-25	05/02/00	4,977.16	4,978.46	1.29
MW-26	05/02/00	4,972.52	4,972.88	0.36
MW-27	05/02/00	4,972.79	4,977.45	4.66
MW-29	05/02/00	4,972.59	4,970.80	-1.79
MW-30	05/02/00	4,971.06	4,970.04	-1.02
MW-31	05/02/00	4,969.95	4,969.30	-0.65
MW-32	05/02/00	4,969.78	4,969.30	-0.48
MW-33	05/02/00	4,971.28	4,970.47	-0.81
MW-34	05/02/00	4,973.12	4,970.96	-2.16
MW-35	05/02/00	4,970.15	4,969.19	-0.96
MW-36	05/02/00	4,968.54	4,968.03	-0.51
MW-37	05/02/00	4,966.86	4,966.57	-0.29
MW-38	05/02/00	4,972.60	4,970.68	-1.92
MW-39	05/02/00	4,971.30	4,970.02	-1.28
MW-40	05/02/00	4,969.98	4,969.25	-0.73
MW-41	05/02/00	4,969.89	4,969.35	-0.54
MW-42	05/02/00	4,969.58	4,969.50	-0.08
MW-43	05/02/00	4,969.37	4,969.32	-0.05
MW-44	05/02/00	4,968.65	4,968.01	-0.64
MW-45	05/02/00	4,966.89	4,966.52	-0.37
MW-46	05/02/00	4,965.61	4,965.31	-0.30
MW-47	05/02/00	4,965.10	4,964.67	-0.43
MW-48	05/02/00	4,964.09	4,963.08	-1.01
MW-49	05/02/00	4,969.82	4,969.23	-0.59
MW-51	05/02/00	4,979.51	4,981.13	1.62
MW-52	05/02/00	4,960.63	4,960.18	-0.45
MW-53	05/02/00	4,962.94	4,960.90	-2.04
MW-54	05/02/00	4,964.68	4,964.20	-0.48
MW-55	05/02/00	4,962.99	4,962.67	-0.32
MW-56	05/02/00	4,964.07	4,962.96	-1.11
MW-57	05/02/00	4,964.47	4,963.84	-0.63
MW-58	05/02/00	4,963.54	4,961.92	-1.62
MW-59	05/02/00	4,968.48	4,969.24	0.76
MW-60	05/02/00	4,964.12	4,962.75	-1.38

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-61	05/02/00	4,964.18	4,962.80	-1.38
MW-62	05/02/00	4,965.92	4,965.47	-0.45
MW-63	05/02/00	4,970.20	4,979.72	9.52
MW-64	05/02/00	4,964.69	4,964.12	-0.57
MW-65	05/02/00	4,960.39	4,959.43	-0.96
MW-66	05/02/00	4,963.16	4,963.03	-0.13
MW-67	05/02/00	4,957.55	4,957.19	-0.36
MW-68	05/02/00	4,960.58	4,959.58	-1.00
MW-69	05/02/00	4,960.48	4,958.95	-1.53
MW-70	05/02/00	4,969.05	4,969.26	0.21
MW-71	05/02/00	4,957.66	4,955.90	-1.76
MW-72	05/02/00	4,969.75	4,969.44	-0.31
MW-73	05/02/00	4,969.79	4,969.28	-0.51
MW-74	05/02/00	4,963.33	4,967.68	4.35
MW-75	05/02/00	4,967.11	4,967.22	0.11
MW-76	05/02/00	4,967.67	4,966.77	-0.90
OB-1	05/02/00	4,957.71	4,956.93	-0.78
OB-2	05/02/00	4,959.11	4,957.81	-1.30
PW-1	05/02/00	4,971.96	4,970.69	-1.27
MW-07	08/02/00	4,976.60	4,973.80	-2.80
MW-09	08/02/00	4,972.18	4,970.55	-1.63
MW-12	08/02/00	4,971.80	4,971.91	0.11
MW-13	08/02/00	4,973.67	4,971.07	-2.60
MW-16	08/02/00	4,977.84	4,979.03	1.19
MW-17	08/02/00	4,977.90	4,979.35	1.45
MW-18	08/02/00	4,970.78	4,975.40	4.62
MW-19	08/02/00	4,970.72	4,969.77	-0.96
MW-20	08/02/00	4,970.35	4,969.56	-0.79
MW-22	08/02/00	4,977.02	4,978.23	1.21
MW-23	08/02/00	4,975.41	4,976.82	1.41
MW-24	08/02/00	4,977.30	4,978.36	1.06
MW-25	08/02/00	4,977.32	4,978.49	1.17
MW-26	08/02/00	4,972.67	4,972.82	0.15
MW-27	08/02/00	4,972.85	4,977.47	4.62
MW-29	08/02/00	4,972.79	4,970.70	-2.09
MW-30	08/02/00	4,971.20	4,969.94	-1.26
MW-31	08/02/00	4,970.05	4,969.19	-0.86
MW-32	08/02/00	4,969.80	4,969.20	-0.60
MW-33	08/02/00	4,971.44	4,970.36	-1.08
MW-34	08/02/00	4,973.53	4,970.86	-2.67
MW-35	08/02/00	4,970.35	4,969.06	-1.29

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-36	08/02/00	4,968.57	4,967.90	-0.67
MW-38	08/02/00	4,972.82	4,970.59	-2.23
MW-39	08/02/00	4,971.45	4,969.92	-1.53
MW-40	08/02/00	4,970.09	4,969.14	-0.95
MW-41	08/02/00	4,969.90	4,969.25	-0.65
MW-42	08/02/00	4,969.51	4,969.41	-0.10
MW-43	08/02/00	4,969.29	4,969.22	-0.07
MW-44	08/02/00	4,968.68	4,967.88	-0.80
MW-45	08/02/00	4,966.79	4,966.39	-0.40
MW-46	08/02/00	4,965.42	4,965.18	-0.24
MW-47	08/02/00	4,964.93	4,964.52	-0.41
MW-48	08/02/00	4,963.89	4,962.92	-0.97
MW-49	08/02/00	4,970.17	4,969.13	-1.04
MW-51	08/02/00	4,979.48	4,981.14	1.66
MW-52	08/02/00	4,960.39	4,959.96	-0.43
MW-53	08/02/00	4,962.47	4,960.72	-1.75
MW-54	08/02/00	4,964.39	4,964.06	-0.33
MW-55	08/02/00	4,962.74	4,962.56	-0.18
MW-56	08/02/00	4,963.88	4,962.82	-1.06
MW-57	08/02/00	4,964.12	4,963.70	-0.42
MW-58	08/02/00	4,963.38	4,961.75	-1.63
MW-59	08/02/00	4,968.33	4,969.14	0.81
MW-60	08/02/00	4,963.77	4,962.61	-1.16
MW-61	08/02/00	4,963.87	4,962.65	-1.22
MW-62	08/02/00	4,965.82	4,965.31	-0.51
MW-63	08/02/00	4,970.02	4,979.70	9.68
MW-64	08/02/00	4,964.37	4,963.99	-0.38
MW-65	08/02/00	4,960.11	4,959.33	-0.78
MW-66	08/02/00	4,962.80	4,962.92	0.12
MW-67	08/02/00	4,956.63	4,957.09	0.46
MW-68	08/02/00	4,960.28	4,959.42	-0.86
MW-69	08/02/00	4,960.13	4,958.84	-1.29
MW-70	08/02/00	4,969.03	4,969.16	0.13
MW-71	08/02/00	4,956.64	4,955.80	-0.84
MW-72	08/02/00	4,969.75	4,969.34	-0.41
MW-73	08/02/00	4,969.83	4,969.18	-0.65
MW-74	08/02/00	4,962.92	4,967.54	4.62
MW-75	08/02/00	4,966.88	4,967.09	0.21
MW-76	08/02/00	4,967.60	4,966.66	-0.94
OB-1	08/02/00	4,957.41	4,956.91	-0.50
OB-2	08/02/00	4,958.83	4,957.75	-1.08

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
PW-1	08/02/00	4,972.22	4,970.59	-1.63
MW-07	11/07/00	4,976.39	4,973.75	-2.64
MW-09	11/07/00	4,972.03	4,970.46	-1.57
MW-12	11/07/00	4,971.68	4,971.84	0.16
MW-13	11/07/00	4,973.44	4,970.98	-2.46
MW-16	11/07/00	4,977.80	4,979.06	1.26
MW-17	11/07/00	4,978.25	4,979.38	1.13
MW-18	11/07/00	4,970.77	4,975.39	4.62
MW-19	11/07/00	4,970.66	4,969.67	-0.99
MW-20	11/07/00	4,970.29	4,969.46	-0.83
MW-22	11/07/00	4,976.97	4,978.25	1.28
MW-23	11/07/00	4,975.16	4,976.83	1.67
MW-24	11/07/00	4,977.62	4,978.39	0.77
MW-25	11/07/00	4,977.66	4,978.51	0.85
MW-26	11/07/00	4,972.58	4,972.78	0.20
MW-27	11/07/00	4,972.98	4,977.49	4.51
MW-29	11/07/00	4,972.58	4,970.61	-1.97
MW-30	11/07/00	4,971.07	4,969.84	-1.23
MW-31	11/07/00	4,969.95	4,969.09	-0.86
MW-32	11/07/00	4,969.76	4,969.10	-0.66
MW-33	11/07/00	4,971.33	4,970.17	-1.16
MW-34	11/07/00	4,973.22	4,970.77	-2.46
MW-35	11/07/00	4,970.30	4,968.96	-1.34
MW-36	11/07/00	4,968.56	4,967.78	-0.78
MW-38	11/07/00	4,972.61	4,970.50	-2.11
MW-39	11/07/00	4,971.34	4,969.83	-1.51
MW-40	11/07/00	4,970.00	4,969.04	-0.96
MW-41	11/07/00	4,969.87	4,969.15	-0.72
MW-42	11/07/00	4,969.56	4,969.31	-0.25
MW-43	11/07/00	4,969.35	4,969.12	-0.23
MW-44	11/07/00	4,968.68	4,967.77	-0.92
MW-45	11/07/00	4,966.80	4,966.27	-0.53
MW-46	11/07/00	4,965.41	4,965.05	-0.36
MW-47	11/07/00	4,964.88	4,964.39	-0.49
MW-48	11/07/00	4,963.81	4,962.79	-1.02
MW-49	11/07/00	4,969.87	4,969.03	-0.84
MW-51	11/07/00	4,980.08	4,981.14	1.06
MW-52	11/07/00	4,960.29	4,959.81	-0.48
MW-53	11/07/00	4,962.32	4,960.59	-1.73
MW-54	11/07/00	4,964.43	4,963.93	-0.50
MW-55	11/07/00	4,962.76	4,962.41	-0.35

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-56	11/07/00	4,963.82	4,962.68	-1.14
MW-57	11/07/00	4,964.09	4,963.57	-0.52
MW-58	11/07/00	4,963.24	4,961.62	-1.62
MW-59	11/07/00	4,968.48	4,969.04	0.56
MW-60	11/07/00	4,963.65	4,962.47	-1.18
MW-61	11/07/00	4,963.75	4,962.52	-1.23
MW-62	11/07/00	4,965.82	4,965.17	-0.65
MW-63	11/07/00	4,970.16	4,979.69	9.53
MW-64	11/07/00	4,964.35	4,963.86	-0.49
MW-65	11/07/00	4,960.01	4,959.15	-0.86
MW-66	11/07/00	4,962.89	4,962.77	-0.12
MW-67	11/07/00	4,957.15	4,956.96	-0.19
MW-68	11/07/00	4,960.11	4,959.26	-0.85
MW-69	11/07/00	4,960.08	4,958.67	-1.41
MW-70	11/07/00	4,969.01	4,969.06	0.05
MW-71	11/07/00	4,957.14	4,955.67	-1.47
MW-72	11/07/00	4,969.75	4,969.24	-0.51
MW-73	11/07/00	4,969.77	4,969.07	-0.70
MW-74	11/07/00	4,962.55	4,967.29	4.74
MW-75	11/07/00	4,966.27	4,966.84	0.57
MW-76	11/07/00	4,967.22	4,966.38	-0.84
OB-1	11/07/00	4,957.35	4,956.70	-0.65
OB-2	11/07/00	4,958.74	4,957.56	-1.18
PW-1	11/07/00	4,972.21	4,970.50	-1.71
MW-74	01/15/01	4,963.03	4,967.35	4.32
MW-75	01/15/01	4,966.90	4,966.89	-0.01
MW-76	01/15/01	4,967.89	4,966.42	-1.47
MW-07	02/13/01	4,975.81	4,973.70	-2.11
MW-09	02/13/01	4,971.46	4,970.36	-1.10
MW-12	02/13/01	4,971.06	4,971.78	0.72
MW-13	02/13/01	4,972.80	4,970.88	-1.92
MW-16	02/13/01	4,977.92	4,979.08	1.17
MW-17	02/13/01	4,977.88	4,979.40	1.52
MW-18	02/13/01	4,969.86	4,975.38	5.52
MW-19	02/13/01	4,970.20	4,969.56	-0.64
MW-20	02/13/01	4,969.85	4,969.35	-0.50
MW-22	02/13/01	4,976.25	4,978.26	2.01
MW-23	02/13/01	4,974.41	4,976.83	2.42
MW-24	02/13/01	4,977.25	4,978.41	1.16
MW-25	02/13/01	4,977.35	4,978.54	1.19
MW-26	02/13/01	4,971.77	4,972.73	0.96

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-27	02/13/01	4,972.78	4,977.51	4.73
MW-29	02/13/01	4,971.86	4,970.52	-1.34
MW-30	02/13/01	4,970.54	4,969.74	-0.80
MW-31	02/13/01	4,969.62	4,968.98	-0.64
MW-32	02/13/01	4,969.52	4,968.99	-0.53
MW-33	02/13/01	4,970.77	4,970.07	-0.70
MW-34	02/13/01	4,972.44	4,970.67	-1.77
MW-35	02/13/01	4,969.82	4,968.85	-0.97
MW-38	02/13/01	4,971.96	4,970.40	-1.56
MW-39	02/13/01	4,970.78	4,969.73	-1.05
MW-40	02/13/01	4,969.65	4,968.93	-0.72
MW-41	02/13/01	4,969.61	4,969.04	-0.57
MW-42	02/13/01	4,969.41	4,969.20	-0.21
MW-43	02/13/01	4,969.22	4,969.01	-0.21
MW-44	02/13/01	4,968.47	4,967.64	-0.83
MW-45	02/13/01	4,966.81	4,966.13	-0.68
MW-46	02/13/01	4,965.58	4,964.91	-0.67
MW-47	02/13/01	4,964.80	4,964.24	-0.56
MW-48	02/13/01	4,963.89	4,962.61	-1.28
MW-49	02/13/01	4,969.51	4,968.92	-0.59
MW-51	02/13/01	4,979.98	4,981.15	1.17
MW-52	02/13/01	4,960.44	4,959.61	-0.83
MW-53	02/13/01	4,962.50	4,960.38	-2.12
MW-54	02/13/01	4,964.57	4,963.78	-0.79
MW-55	02/13/01	4,962.85	4,962.24	-0.61
MW-56	02/13/01	4,963.91	4,962.51	-1.40
MW-57	02/13/01	4,964.52	4,963.42	-1.10
MW-58	02/13/01	4,963.32	4,961.43	-1.89
MW-59	02/13/01	4,966.97	4,968.93	1.96
MW-60	02/13/01	4,963.94	4,962.30	-1.64
MW-61	02/13/01	4,964.01	4,962.35	-1.66
MW-62	02/13/01	4,965.77	4,965.03	-0.74
MW-63	02/13/01	4,970.39	4,979.67	9.28
MW-64	02/13/01	4,964.75	4,963.71	-1.04
MW-65	02/13/01	4,960.18	4,958.95	-1.23
MW-66	02/13/01	4,963.19	4,962.62	-0.57
MW-67	02/13/01	4,957.59	4,956.84	-0.75
MW-68	02/13/01	4,960.38	4,959.08	-1.30
MW-69	02/13/01	4,960.29	4,958.48	-1.81
MW-70	02/13/01	4,968.80	4,968.95	0.15
MW-71	02/13/01	4,957.61	4,955.55	-2.06

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-72	02/13/01	4,969.54	4,969.14	-0.40
MW-73	02/13/01	4,969.46	4,968.97	-0.49
MW-74	02/13/01	4,963.14	4,967.39	4.25
MW-75	02/13/01	4,966.95	4,966.92	-0.03
MW-76	02/13/01	4,968.03	4,966.42	-1.61
OB-1	02/13/01	4,957.51	4,956.46	-1.05
OB-2	02/13/01	4,959.05	4,957.35	-1.70
PW-1	02/13/01	4,971.57	4,970.40	-1.17
MW-74	03/16/01	4,963.10	4,967.54	4.44
MW-75	03/16/01	4,966.92	4,967.06	0.14
MW-76	03/16/01	4,968.05	4,966.51	-1.54
MW-74	04/16/01	4,963.10	4,967.43	4.33
MW-75	04/16/01	4,967.01	4,966.97	-0.04
MW-76	04/16/01	4,968.04	4,966.46	-1.58
MW-07	05/22/01	4,976.25	4,973.65	-2.60
MW-09	05/22/01	4,971.86	4,970.27	-1.59
MW-12	05/22/01	4,971.29	4,971.72	0.43
MW-13	05/22/01	4,973.27	4,970.79	-2.48
MW-16	05/22/01	4,977.73	4,979.10	1.37
MW-17	05/22/01	4,977.78	4,979.41	1.63
MW-18	05/22/01	4,970.50	4,975.36	4.86
MW-19	05/22/01	4,970.39	4,969.47	-0.92
MW-20	05/22/01	4,970.04	4,969.26	-0.78
MW-22	05/22/01	4,976.43	4,978.26	1.83
MW-23	05/22/01	4,974.94	4,976.82	1.88
MW-24	05/22/01	4,977.21	4,978.41	1.20
MW-25	05/22/01	4,977.21	4,978.54	1.33
MW-26	05/22/01	4,971.63	4,972.66	1.03
MW-27	05/22/01	4,972.71	4,977.50	4.79
MW-29	05/22/01	4,972.38	4,970.43	-1.95
MW-30	05/22/01	4,970.86	4,969.65	-1.21
MW-31	05/22/01	4,969.70	4,968.88	-0.82
MW-32	05/22/01	4,969.53	4,968.89	-0.64
MW-33	05/22/01	4,971.10	4,969.97	-1.13
MW-34	05/22/01	4,973.02	4,970.58	-2.44
MW-35	05/22/01	4,969.99	4,968.74	-1.25
MW-38	05/22/01	4,972.45	4,970.31	-2.14
MW-39	05/22/01	4,971.11	4,969.63	-1.48
MW-40	05/22/01	4,969.75	4,968.84	-0.91
MW-41	05/22/01	4,969.65	4,968.94	-0.71
MW-42	05/22/01	4,969.35	4,969.10	-0.25

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-43	05/22/01	4,969.12	4,968.91	-0.21
MW-44	05/22/01	4,968.42	4,967.54	-0.88
MW-45	05/22/01	4,966.59	4,966.02	-0.57
MW-46	05/22/01	4,965.25	4,964.78	-0.47
MW-47	05/22/01	4,964.42	4,964.10	-0.32
MW-48	05/22/01	4,963.60	4,962.47	-1.13
MW-49	05/22/01	4,969.54	4,968.83	-0.71
MW-51	05/22/01	4,979.72	4,981.14	1.42
MW-52	05/22/01	4,960.11	4,959.45	-0.66
MW-53	05/22/01	4,961.97	DRY	DRY
MW-54	05/22/01	4,964.38	4,963.64	-0.74
MW-55	05/22/01	4,962.47	4,962.11	-0.36
MW-56	05/22/01	4,963.66	4,962.38	-1.28
MW-57	05/22/01	4,964.10	4,963.28	-0.82
MW-58	05/22/01	4,963.46	4,961.28	-2.18
MW-59	05/22/01	4,966.76	4,968.83	2.07
MW-60	05/22/01	4,963.80	4,962.16	-1.64
MW-61	05/22/01	4,963.88	4,962.20	-1.68
MW-62	05/22/01	4,965.66	4,964.90	-0.76
MW-63	05/22/01	4,969.98	4,979.65	9.67
MW-64	05/22/01	4,964.30	4,963.58	-0.72
MW-65	05/22/01	4,959.83	4,958.83	-1.00
MW-66	05/22/01	4,962.72	4,962.50	-0.22
MW-67	05/22/01	4,956.91	4,956.74	-0.17
MW-68	05/22/01	4,960.10	4,958.92	-1.18
MW-69	05/22/01	4,959.94	4,958.36	-1.58
MW-70	05/22/01	4,969.07	4,968.85	-0.22
MW-71	05/22/01	4,956.89	4,955.45	-1.44
MW-72	05/22/01	4,969.55	4,969.04	-0.51
MW-73	05/22/01	4,969.45	4,968.87	-0.58
MW-74	05/22/01	4,962.02	4,967.34	5.32
MW-75	05/22/01	4,965.93	4,966.88	0.95
MW-76	05/22/01	4,966.87	4,966.38	-0.49
OB-1	05/22/01	4,957.24	4,956.34	-0.90
OB-2	05/22/01	4,958.58	4,957.22	-1.36
PW-1	05/22/01	4,972.14	4,970.30	-1.84
MW-74	07/16/01	4,962.53	4,967.33	4.80
MW-75	07/16/01	4,966.50	4,966.87	0.37
MW-76	07/16/01	4,967.39	4,966.37	-1.02
MW-17	07/31/01	4,977.63	4,979.42	1.79
MW-07	08/27/01	4,976.15	4,973.59	-2.56

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-09	08/27/01	4,971.81	4,970.18	-1.63
MW-12	08/27/01	4,971.26	4,971.66	0.40
MW-13	08/27/01	4,973.21	4,970.70	-2.51
MW-16	08/27/01	4,977.28	4,979.11	1.83
MW-17	08/27/01	4,977.68	4,979.42	1.73
MW-18	08/27/01	4,970.45	4,975.34	4.89
MW-19	08/27/01	4,970.34	4,969.38	-0.96
MW-20	08/27/01	4,969.99	4,969.17	-0.82
MW-22	08/27/01	4,976.37	4,978.27	1.90
MW-23	08/27/01	4,974.87	4,976.81	1.94
MW-24	08/27/01	4,977.13	4,978.42	1.29
MW-25	08/27/01	4,977.13	4,978.54	1.41
MW-26	08/27/01	4,971.56	4,972.61	1.05
MW-27	08/27/01	4,972.68	4,977.51	4.83
MW-29	08/27/01	4,972.33	4,970.35	-1.98
MW-30	08/27/01	4,970.82	4,969.56	-1.26
MW-31	08/27/01	4,969.64	4,968.79	-0.85
MW-32	08/27/01	4,969.46	4,968.80	-0.66
MW-33	08/27/01	4,971.05	4,969.89	-1.16
MW-34	08/27/01	4,973.08	4,970.50	-2.58
MW-35	08/27/01	4,970.02	4,968.65	-1.37
MW-38	08/27/01	4,972.29	4,970.23	-2.06
MW-39	08/27/01	4,971.06	4,969.55	-1.51
MW-40	08/27/01	4,969.69	4,968.75	-0.94
MW-41	08/27/01	4,969.57	4,968.85	-0.72
MW-42	08/27/01	4,969.25	4,969.01	-0.24
MW-43	08/27/01	4,969.04	4,968.82	-0.22
MW-44	08/27/01	4,968.42	4,967.44	-0.98
MW-45	08/27/01	4,966.55	4,965.92	-0.63
MW-46	08/27/01	4,965.19	4,964.68	-0.51
MW-47	08/27/01	4,964.34	4,963.98	-0.35
MW-48	08/27/01	4,963.55	4,962.35	-1.20
MW-49	08/27/01	4,969.49	4,968.74	-0.75
MW-51	08/27/01	4,979.77	4,981.14	1.37
MW-52	08/27/01	4,960.02	4,959.32	-0.70
MW-53	08/27/01	4,961.84	DRY	DRY
MW-54	08/27/01	4,964.16	4,963.52	-0.64
MW-55	08/27/01	4,962.38	4,962.02	-0.36
MW-56	08/27/01	4,963.52	4,962.27	-1.25
MW-57	08/27/01	4,963.99	4,963.16	-0.83
MW-58	08/27/01	4,963.31	4,961.15	-2.16

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-59	08/27/01	4,966.64	4,968.74	2.10
MW-60	08/27/01	4,963.62	4,962.05	-1.57
MW-61	08/27/01	4,963.65	4,962.08	-1.57
MW-62	08/27/01	4,965.63	4,964.78	-0.85
MW-63	08/27/01	4,969.88	4,979.63	9.75
MW-64	08/27/01	4,964.20	4,963.46	-0.74
MW-65	08/27/01	4,959.76	4,958.74	-1.02
MW-66	08/27/01	4,962.60	4,962.40	-0.20
MW-67	08/27/01	4,956.58	4,956.63	0.05
MW-68	08/27/01	4,959.93	4,958.80	-1.13
MW-69	08/27/01	4,959.84	4,958.26	-1.58
MW-70	08/27/01	4,969.01	4,968.77	-0.24
MW-71	08/27/01	4,956.66	4,955.33	-1.33
MW-72	08/27/01	4,969.47	4,968.95	-0.52
MW-73	08/27/01	4,969.38	4,968.78	-0.60
MW-74	08/27/01	4,962.53	4,967.17	4.64
MW-75	08/27/01	4,966.56	4,966.71	0.15
MW-76	08/27/01	4,967.41	4,966.22	-1.19
OB-1	08/27/01	4,957.10	4,956.31	-0.79
OB-2	08/27/01	4,958.48	4,957.16	-1.32
PW-1	08/27/01	4,971.67	4,970.21	-1.46
MW-07	11/01/01	4,976.23	4,973.57	-2.66
MW-09	11/01/01	4,971.88	DRY	DRY
MW-12	11/01/01	4,971.29	4,971.63	0.34
MW-13	11/01/01	4,973.23	4,970.66	-2.57
MW-16	11/01/01	4,977.43	4,979.11	1.68
MW-17	11/01/01	4,977.84	4,979.42	1.58
MW-18	11/01/01	4,970.48	4,975.34	4.86
MW-19	11/01/01	4,970.40	4,969.36	-1.04
MW-20	11/01/01	4,970.03	4,969.16	-0.87
MW-22	11/01/01	4,976.42	4,978.27	1.85
MW-23	11/01/01	4,974.90	4,976.81	1.91
MW-24	11/01/01	4,977.29	4,978.43	1.14
MW-25	11/01/01	4,977.27	4,978.55	1.28
MW-26	11/01/01	4,971.62	4,972.60	0.98
MW-27	11/01/01	4,972.84	4,977.51	4.67
MW-29	11/01/01	4,972.33	4,970.32	-2.01
MW-30	11/01/01	4,970.83	4,969.54	-1.29
MW-31	11/01/01	4,969.69	4,968.77	-0.92
MW-32	11/01/01	4,969.54	4,968.78	-0.76
MW-33	11/01/01	4,971.12	4,969.85	-1.27

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-34	11/01/01	4,973.07	4,970.46	-2.61
MW-35	11/01/01	4,970.08	4,968.61	-1.47
MW-38	11/01/01	4,972.29	4,970.21	-2.08
MW-39	11/01/01	4,971.08	4,969.53	-1.55
MW-40	11/01/01	4,969.76	4,968.74	-1.02
MW-41	11/01/01	4,969.66	4,968.83	-0.83
MW-42	11/01/01	4,969.33	4,968.99	-0.34
MW-43	11/01/01	4,969.11	4,968.81	-0.30
MW-44	11/01/01	4,968.47	4,967.42	-1.05
MW-45	11/01/01	4,966.62	4,965.91	-0.71
MW-46	11/01/01	4,965.26	4,964.68	-0.58
MW-47	11/01/01	4,964.44	4,963.98	-0.46
MW-48	11/01/01	4,963.67	4,962.37	-1.30
MW-49	11/01/01	4,969.60	4,968.74	-0.86
MW-51	11/01/01	4,979.73	4,981.14	1.41
MW-52	11/01/01	4,960.27	4,959.38	-0.89
MW-53	11/01/01	4,962.10	DRY	DRY
MW-54	11/01/01	4,964.27	4,963.49	-0.78
MW-55	11/01/01	4,962.48	4,962.16	-0.32
MW-56	11/01/01	4,963.65	4,962.35	-1.30
MW-57	11/01/01	4,964.04	4,963.12	-0.92
MW-58	11/01/01	4,963.12	4,961.21	-1.91
MW-59	11/01/01	4,966.73	4,968.72	1.99
MW-60	11/01/01	4,963.68	4,962.10	-1.58
MW-61	11/01/01	4,963.74	4,962.09	-1.65
MW-62	11/01/01	4,965.72	4,964.76	-0.96
MW-63	11/01/01	4,969.92	4,979.62	9.70
MW-64	11/01/01	4,964.28	4,963.44	-0.84
MW-65	11/01/01	4,959.95	4,958.95	-1.00
MW-66	11/01/01	4,962.68	4,962.41	-0.27
MW-67	11/01/01	4,956.70	4,956.58	-0.12
MW-68	11/01/01	4,960.21	4,958.81	-1.40
MW-69	11/01/01	4,960.03	4,958.36	-1.67
MW-70	11/01/01	4,969.05	4,968.75	-0.29
MW-72	11/01/01	4,969.55	4,968.93	-0.62
MW-73	11/01/01	4,969.45	4,968.76	-0.69
MW-74	11/01/01	4,962.25	4,966.48	4.23
MW-75	11/01/01	4,965.67	4,966.06	0.39
MW-76	11/01/01	4,966.27	4,965.63	-0.64
OB-1	11/01/01	4,957.25	4,956.82	-0.43
OB-2	11/01/01	4,958.45	4,957.51	-0.94

Appendix F

Water Level Residuals
January 1998 to November 2001 Simulation

Monitoring Well	Date	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
PW-1	11/01/01	4,971.74	4,970.13	-1.61

Number of active observation points =	980.00	
Number of inactive observation points =	5.00	
Mean of residuals =	-0.10	ft
Standard Deviation of residuals =	1.85	ft
Sum of squared residuals =	3,356.19	ft^2
Mean of absolute residuals =	1.18	ft
Minimum residual =	-3.67	ft
Maximum residual =	9.75	ft
Range in observed heads =	23.94	ft
Standard Deviation/Range in observed heads =	0.08	ft/ft