SFUND RECORDS CTR
2109385

SECOND FIVE YEAR REVIEW

OPERABLE UNIT 2

MOTOROLA 52ND STREET SUPERFUND SITE PHOENIX, ARIZONA

SEPTEMBER 25, 2006

LFR

ADEQ
Arizona Department of Environmental Quality

REPORT PREPARATION, CERTIFICATIONS, AND APPROVALS

Report Title: Second Five-Year Review Report for Operable Unit 2, Motorola 52nd Street Superfund Site, Phoenix, Arizona

Report Date: September 25, 2006

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADWR	Arizona Department of Water Resources
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
A R.S.	Arizona Revised Statutes
AS	Air Sparging
ASRAC	Arizona Superfund Response Action Contract
AST	aboveground storage tank
ATSDR	Agency for Toxic Substance and Disease Registry
AWQS	Aquifer Water Quality Standard
bgs	below ground surface
BSVE	Bioenhanced Soil Vapor Extraction
CAG	Community Advisory Group
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIP	Community Involvement Plan
cis-1,2-DCE	cis-1,2-dichloroethylene or cis-1,2-dichloroethene
CO	Consent Order
COC	Contaminant of Concern
COP	City of Phoenix
CRA	Conestoga-Rovers & Associates
1,2-DCB	1,2-dichlorobenzene
1,1-DCA	1,1-dichloroethane
1,1-DCE	1-dichloroethene
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
ERA	Early Response Action
Freescale	Freescale Semiconductor, Inc.
FS	Feasibility Study
FSP	Field Sampling Plan
ft/day	feet per day
ft/ft	foot per foot
GAC	granular activated carbon
GES	groundwater extraction system
gpd/ft^2	gallons per day per square foot
GPL	Groundwater Protection Limit
gpm	gallons per minute
GWTP	Groundwater Treatment Plant
HASP	Health and Safety Plan

HBGL	Health Based Guidance Level
IGWTP	Integrated Groundwater Treatment Plant
K_{oc}	organic carbon partition coefficient
lbs/day	pounds per day
LFR	LFR Inc.
LOD	Letter of Determination
MCL	maximum contaminant level
MDL	method detection limit
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
ml	milliliters
Motorola	Motorola Inc.
MRL	method reporting limit
msl	mean sea level
MTBE	methyl tertiary-butyl ether
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NIOSH	National Institute of Occupational Health and Safety
NPL	National Priority List
ORD	EPA's Office of Research and Development
OSWER	Office of Solid Waste and Emergency Response
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
PA	Preliminary Assessment
PCE	tetrachloroethylene or tetrachloroethene
ppm	parts per million
ppmv	parts per million by volume
PRG	Preliminary Remediation Goals
PSC	Preliminary Site Characterization
psi	pounds per square inch
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
redox	oxidation-reduction
RI	Remedial Investigation
ROD	Record of Decision
RSRL	Residential Soil Remediation Level
SARA	Superfund Amendments and Reauthorization Act of 1986
scfm	standard cubic feet per minute
SI	Site Inspection
SRL	Soil Remediation Level

SRP	Salt River Project
SVE	Soil Vapor Extraction
SVETS	Soil Vapor Extraction and Treatment System
SVM	Soil Vapor Monitoring
TAG	Technical Assistance Grant
TBC	To Be Considered
TCA	1,1,1-trichloroethane
TCE	Trichloroethylene or Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TCZ	Target Capture Zone
TOC	Total Organic Carbon
trans-1,2-DCE	trans-1,2-dichloroethylene or trans-1,2-dichloroethene
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WQARF	Water Quality Assurance Revolving Fund

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EXECUTIVE SUMMARY

The second Five-Year Review for the Motorola 52nd Street Superfund site, Operable Unit 2 (OU2), located in Phoenix, Arizona was conducted by LFR Inc. (LFR) on behalf of Arizona Department of Environmental Quality (ADEQ). The third Five-Year Review for Operable Unit 1 (OU1) is being conducted concurrently by the ADEQ and LFR. The review period was from September 30, 2001 through July 2006.

The U. S. Environmental Protection Agency (EPA) is the lead agency for OU2; however, ADEQ is conducting this OU2 Five-Year Review on behalf of EPA. EPA and ADEQ are required to conduct this Five-Year Review pursuant to Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). Together, these regulations require that the remedial actions resulting in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every five years to assure protection of human health and the environment. Since hazardous substances, pollutants, or contaminants are left on site above levels that allow for unlimited use and unrestricted exposure, this review is required for OU2 site. The purpose of the five-year review is to determine whether OU2 continues to meet remedial objectives and is protective of human health and the environment.

The five-year review consisted of the following activities: (1) review of relevant documents (Appendix A); (2) interviews with appropriate operations staff, state and federal agencies, local government officials, and concerned community members; and (3) a site inspection.

The assessment identified several issues in the review of the existing OU2 system capture analyses. These problems include non-conservative interpretation of groundwater data, failure to use all available data, and failing to effectively evaluate the results of specific analyses in conjunction with the conceptual site model. Several data gaps have been identified that need to be filled in order to fully evaluate the OU2 capture effectiveness. A review of applicable or relevant and appropriate requirements (ARARs) determined that there are no newly promulgated standards that affect OU2; however, new ARARs and To Be Considereds (TBCs) are likely to be determined for the final remedy.

A protectiveness determination of the OU2 interim remedy cannot be made at this time due to the zone of capture issues identified in this review. The follow-up actions and recommendations identified under Section 9 are needed to determine protectiveness. The actions will require the efforts of the Companies and agency oversight to be completed. An iterative approach with effective communication among the stakeholders throughout the recommended actions is needed to address these issues quickly and effectively.

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FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION

Site Name: Motorola 52nd Street

EPA ID: AZD009004177

Region: 9 | **State:** Arizona | **City/County:** Phoenix/Maricopa

SITE STATUS

NPL Status: ■ Final ☐ Deleted ☐ Other (specify)_____

Remediation Status: (choose all that apply). ■ Under Construction ■ Operating ☐ Complete

Multiple OUs? ■ Yes ☐ No | **Construction Completion Date:** Interim Remedy

Has site been put into reuse? ■ Yes ☐ No The site was never out of use.

REVIEW STATUS

Reviewing Agency: ☐ EPA ■ State ☐ Tribe ☐ Other_____

Author Name: Robert Forsberg c/o LFR Inc

Author Title: Senior Hydrogeologist | **Author Affiliation:** ADEQ Consultant

Review Period: September 2001 to July 2006

Date(s) of Site Inspection: June 6 and 7, 2006

Type of Review: ■ Statutory
☐ Policy ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal Only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-Lead
☐ Regional Discretion

Review Number: ☐ First ■ Second ☐ Third ☐ Other_____

Triggering Action:

☐ Actual RA Onsite Construction at OU ☐ Actual RA Start at OU

☐ Construction Completion ■ Previous Five-Year Review Report

☐ Other (Specify)_____

Triggering Action Date: September 28, 2001

Due Date (*five years after triggering action date*) September 28, 2006

FIVE-YEAR REVIEW SUMMARY FORM

DEFICIENCIES/ISSUES AND NOTED CONCERNS

Groundwater Capture Issues

1) Little to no groundwater elevation and quality data are available in any of the subunits along the north side of the OU2 plume As a result, the impact of the OU2 treatment system can not be adequately evaluated in that area

2) Groundwater elevation and quality data are lacking in all three subunits along the south side of the OU2 plume As a result, the impact of the OU2 treatment system is difficult to assess in this area

3) Additional groundwater elevation and quality data are needed downgradient of the OU2 treatment system to evaluate capture in the D

4) Based on a conservative interpretation of the data, using converging lines of evidence, it appears the TCZ along the south side of the plume is not fully captured

Groundwater Future Issues

5) EW-S groundwater extraction rates have declined If the rate declines further in the future, capture to the south may also be reduced

6) Future containment of the D subunit is problematic because the D subunit is primarily contaminated in the south portion of OU2, EW-S does not penetrate the D subunit and therefore does not directly extract from the D subunit, and capture is currently questionable and may decrease if EW-S extraction rates continue to decline

7) The Agencies are concerned that the stagnation zone on the upgradient and downgradient side of the Honeywell bedrock ridge is not being addressed by the OU2 Treatment System

8) Long-term multi-well aquifer tests in subunits B and D are needed to gain a better understanding of the OU2 conceptual site model and to facilitate future OU2 analyses

9) The OU2 system is an interim remedy and therefore a final remedy for OU2 must be developed The final remedy will necessarily address the issues identified in this five-year review and must consider and integrate the Honeywell light nonaqueous phase liquid (LNAPL) remedy

Health Assessment Issues

10) Changes to the toxicity levels for certain contaminants have occurred since the last five-year review

11) New methodology is being developed for indoor air risk evaluation Once the methodology is finalized or EPA and ADEQ can agree to the process to evaluate the pathway, an indoor air risk evaluation should be performed for the OU2 area

12) Boron has been detected in influent and effluent samples from the treatment plant

General Issues

13) Consistent interpretation of the hydrostratigraphic subunits and available data is needed for OU2 analyses

FIVE-YEAR REVIEW SUMMARY FORM

CORRECTIVE ACTIONS AND RECOMMENDATIONS

Groundwater Capture Issues Corrective Actions

1) A work plan should be prepared and submitted to ADEQ to address the data gaps along the north side of the OU2 plume The work plan should include the installation of monitor wells in each of the three alluvial subunits

2) A work plan should be prepared and submitted to ADEQ to address the data gaps along the south side of the OU2 plume The work plan should include the installation of monitor wells in each of the three alluvial subunits

3) A work plan should be prepared and submitted to ADEQ to address the data gaps downgradient of the OU2 treatment system The work plan should include the installation of monitor wells in the D subunit

4) Future capture evaluations shall include a conservative interpretation of groundwater elevation data, an analysis of water level pairs for appropriately configured monitor wells, capture zone calculations that are conceptually consistent with site data and interpretation, and concentration trend analysis that includes historic data

Groundwater Future Issues Corrective Actions

5) The Companies should continue to monitor the extraction rates for EW-S

6) The Companies should develop a plan to monitor groundwater capture along the southern boundary, particularly in subunit D

7) The Companies should prepare a plan to evaluate the effectiveness of the OU2 treatment system on the stagnation zones upgradient and downgradient of the Honeywell bedrock ridge

8) The Companies should develop a plan to conduct long-term multi-well aquifer tests in subunits B and D The data obtained from these tests will be useful for designing a final remedy for OU2

9) The final OU2 remedy will need to incorporate the Honeywell LNAPL remedy

Health Assessment Issues Corrective Actions

10) A review of the toxicity values for COCs at the Site should be conducted before the final remedy is selected

11) An indoor air risk evaluation should be conducted at the Site once the guidance for evaluating the vapor intrusion to indoor air pathway is finalized or EPA and ADEQ can agree to a process for evaluating the pathway

12) Effluent samples should be collected and analyzed for boron If the results are above the surface water limit for agricultural irrigation, SRP should be notified

General Issues Corrective Actions

13) The Agencies recommend a technical work group meeting to discuss and address groundwater elevation and quality data, capture issues, and hydrostratigraphic issues

PROTECTIVENESS STATEMENT

A protectiveness determination of the OU2 interim remedy cannot be made at this time until further information is obtained The necessary follow-up actions and recommendations identified in this report are needed to evaluate protectiveness The actions will require the efforts of the Companies and the Agencies to be completed It is expected that these actions will take approximately 1 year to complete at which time a protectiveness determination will be made

OTHER COMMENTS

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1.0 INTRODUCTION

The Arizona Department of Environmental Quality (ADEQ) and LFR Inc. (LFR) have prepared this Second Five-Year Review Report for Operable Unit 2 (OU2) at the Motorola 52nd Street Superfund Site, Phoenix, Arizona. LFR conducted the work under Arizona Superfund Response Action Contract (ASRAC) EV03-0073 and Task Assignment 06-0165 dated May 26, 2006. The review period was from September 30, 2001 through July 2006.

The purpose of the five-year review is to determine whether OU2 continues to meet remedial objectives and is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in this Report.

OU2 is part of the Motorola 52nd Street Superfund Site that consists of three operable units: OU1, OU2, and OU3, as shown on Figure 1. The OU1 area is bounded by Palm Lane to the north, Roosevelt Street to the south, 52nd Street to the east, and by the zone of hydraulic capture to the west (approximately 46th Street). The OU2 area is bounded approximately by Roosevelt Street to the north, the northern runway of Phoenix Sky Harbor International Airport to the south, the OU1 groundwater capture zone to the east (approximately 46th Street), and by the zone of hydraulic capture to the west (approximately 17th Street). The OU2 treatment system is located on the northwest corner of the intersection of 20th Street and Washington Street (Figure 2). The OU3 study area is bounded by approximately McDowell Road to the north, Buckeye Road to the south, 20th Street to the east and 7th Avenue to the west. A small cut-out is located in the southwest corner of the OU3 Study Area approximately defined by Buchanan Street and 3rd Avenue.

EPA is the lead agency for OU2; however, ADEQ is conducting the OU2 five-year review on behalf of EPA. EPA and ADEQ are required to conduct this five-year review pursuant to Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). Together, these regulations require that the remedial actions resulting in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every five years to assure protection of human health and the environment. Since hazardous substances, pollutants, or contaminants are left on site above levels that allow for unlimited use and unrestricted exposure, this review is required for OU2. This review was prepared according to Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P, Comprehensive Five-Year Review Guidance, June 2001.

This is the second five-year review for OU2, EPA completed the first Five-Year Review Report in September 2001. At the time of the review, the treatment system was under construction. The first and second five-year reviews for OU2 were triggered by the five-year review cycle for OU1. The third five-year review for OU1 is being conducted concurrently by ADEQ and LFR.

In 2000, AlliedSignal purchased Honeywell International and assumed the Honeywell name. For the purpose of continuity, Honeywell will be used to refer to both Honeywell International and AlliedSignal throughout the Five-Year Review Report.

In December 2004, Motorola spun off its semiconductor sector to form a new independent company (Freescale Semiconductor). For the purpose of continuity, Freescale will be used to refer to both Motorola and Freescale Semiconductor throughout the Five-Year Review Report.

2.0 SITE CHRONOLOGY

A chronology of OU2 events is included in Table 1.

3.0 BACKGROUND INFORMATION

3.1 Site Location Information

OU2 is part of the Motorola 52nd Street Superfund Site that consists of three operable units: OU1, OU2, and OU3, as shown on Figure 1. OU2 is bounded approximately by Roosevelt Street on the north, the northern runway of Phoenix Sky Harbor International Airport on the south, the OU1 area groundwater capture zone on the east (approximately 46th Street), and by the zone of hydraulic capture to the west (approximately 17th Street). The OU2 treatment system is located on the northwest corner of the intersection of 20th Street and Washington Street (Figure 2). The system consists of three groundwater extraction wells (EWN, EWM, and EWS) and a groundwater treatment system (Figure 3). The OU2 Treatment System is operated by Freescale and Honeywell (jointly referred to as the Companies).

3.2 Land and Resource Use

The surrounding area is comprised of a mixture of residential, commercial, and industrial uses. Groundwater within the OU2 area is a potential source of drinking water. Currently, the City of Phoenix (COP) is not using this groundwater as a source for drinking water. However, Salt River Project (SRP) is currently using the groundwater for irrigation purposes.

3.3 Site History and Operable Unit 2 (OU2) Information

The contamination in groundwater in the OU2 area is the result of cleaning solvent released into the environment during the late 1950's to early 1980's at nearby facilities including the former Motorola 52nd Street Facility (currently the location of ON Semiconductor) and the Honeywell 34th Street Facility. The Site was listed on the National Priorities List (NPL) in 1989. Motorola was identified as a responsible party (RP) at that time. Honeywell was identified as a RP in 1992. Several additional potentially responsible parties (PRPs) have been identified in the OU2 area. Currently, these PRPs include: D-Velco, Honeywell Area 13, Honeywell Area 21, ITT Cannon, Joray/Kachina, Laundry Cleaners & Supply, and Papago Plating. The PRP search is still ongoing and additional PRPs may be named by the agencies.

The following sections provide a summary of the main site activities associated with OU2. The majority of the site information was obtained from the review of key documents associated with OU2. The list of key documents is included in Appendix A. Table 1 provides a brief summary of the chronological history of OU2.

3.3.1 Site Discovery

In 1982, groundwater contamination was discovered in wells in the OU2 area. Trichloroethene (TCE) was detected in the Desert Hills well (Monroe and 27th Street) at 640 parts per billion (ppb) and in the Eastlake Park well (Jefferson and 16th Street) at 44 ppb. The groundwater contamination was initially thought to be a separate plume from the Motorola 52nd Street Site. ADEQ designated the area as the East Washington Area.

3.3.2 Preliminary Investigation

From 1985 to 1989, ADEQ conducted a remedial investigation and initiated an investigation of potentially responsible parties. In 1987, ADEQ designated the area as the East Washington Water Quality Assurance Revolving Fund (WQARF) Area.

3.3.3 Groundwater Investigation

Between 1990 and 1992, ADEQ and Freescale conducted an area-wide groundwater investigation to define the extent of groundwater contamination in the OU2 area. Approximately 48 monitor wells (with a total of 120 sampling ports) were installed and over 300 aquifer tests were conducted. The area-wide sampling effort confirmed that contamination from the Motorola 52nd Street Facility had migrated west into the East Washington area. As a result, ADEQ and EPA developed a second operable unit (OU2) to address the groundwater contamination before the final remedy was selected.

3.3.4 Health Assessments

ADHS completed a Baseline Risk Assessment in November 1992. The assessment included both OU1 and OU2, however, for the purposes of this five year review, only the OU2 issues will be discussed The Baseline Risk Assessment concluded that *the risk of public exposure to groundwater is limited, and therefore causes no imminent health hazard.*

In April 2002, ADHS conducted a health assessment of the Motorola 52nd Street Superfund Site area to identify any current groundwater use that might result in human exposure to site contaminants. The Report updated the 1992 well use inventory for OU1 and OU2 and provided an evaluation of potential groundwater exposure pathways in OU3. The Report concluded that *for those wells whose status was verified, no exposure to contaminated groundwater was found; therefore, those wells pose no public health hazard. However, unregistered private wells might exist within the Motorola 52nd Street Superfund Site.*

3.3.5 Interim Remedy

In 1993, Freescale submitted a series of reports for developing an interim remedy for OU2 including a flow and transport model, a draft Detailed Analysis of Alternatives

Report, a draft Interim Remedy Feasibility Study (FS) Report, and an Updated Interim Remedy FS Report.

3.3.6 Decision Documents

In July 1994, ADEQ and EPA issued a Record of Decision (ROD) selecting the interim groundwater remedy. The purpose of the OU2 interim remedy is to provide additional containment of contaminated portions of the groundwater. The interim remedy includes groundwater extraction near 20th Street and Washington Street, treatment of water by granular activated carbon (GAC) and discharge of the treated water to the Grand Canal for irrigation use. The specified remedial objectives of the ROD are to establish a capture zone across the entire width and depth of the contaminant plume, and to reduce concentrations of contaminated groundwater within the alluvial aquifer upgradient of the extraction wells. The ROD specified that groundwater will be extracted and treated to a level at or below Maximum Contaminant Levels (MCLs).

In September 1999, EPA issued an *Explanation of Significant Differences to July 1994 Record of Decision, Operable Unit Two, East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona* (ESD). The ESD modified the interim remedial action selected by EPA and ADEQ in the July 1994 OU2 ROD because of changes to the design EPA and ADEQ determined that the use of carbon adsorption and ultraviolet oxidation for treatment of groundwater and the discharge of the treated water to the Grand Canal for end-use were efficient and cost effective modifications to the selected remedy.

3.3.7 ADEQ Consent Decree for OU2 Treatment System Design

In November 1996, a Consent Decree was entered into by ADEQ, Freescale, and the City of Phoenix for the design of the OU2 Treatment System. The Consent Decree required the following design performance standards:

1) establishing and maintaining a zone of capture that will prevent groundwater in alluvium and bedrock contaminated with TCE in excess of 5 micrograms per liter (μg/L) from migrating beyond the OU2 Area provided that it does not adversely impact on other groundwater remediation programs as determined by the State; and
2) treating the groundwater from the extraction system so that effluent water quality meets the applicable standards at point(s) of compliance.

In addition, the treatment system was to be designed to provide beneficial end use of the treated water.

In July 1999, Freescale submitted the OU2 Final (100%) Design Report. The final design included the following components:

- three groundwater extraction wells (EWN, EWM, and EWS);
- treatment facility with GAC adsorption (and ultraviolet oxidation if required); and
- discharge of treated groundwater to the SRP Grand Canal.

3.3.8 EPA Unilateral Administrative Order and Treatment System Construction, Operation and Maintenance

On November 30, 1998, EPA issued a Unilateral Administrative Order (UAO) to the Companies for construction, start up, and two years of operation and maintenance (O&M) of the groundwater treatment system. Construction of the treatment system began in March 2000 and was completed in September 2001. The treatment system became fully operational on December 31, 2001. A Second Amended UAO was issued on December 11, 2003 that required continued O&M of the interim remedy. The UAO also requires the Companies to prepare monthly progress reports of O&M activities, quarterly groundwater monitoring reports, and annual Effectiveness Reports. Conestoga-Rovers & Associates (CRA) was selected by the Companies as the supervising contractor for the O&M.

The monthly progress reports discuss the O&M activities during the reporting period, activities scheduled for the next 45 days, and analytical results of influent, GAC effluent, and facility discharge Table 2 provides a summary of the monthly progress reports. Few significant issues other than annual SRP Grand Canal shutdowns have been reported during this five-year review timeframe. However, in December 2005, the treatment system was shutdown because TCE was detected in the November 2005 facility discharge sample at concentrations of 4.1 μg/L and 4.2 μg/L. The system was restarted following change outs of the four primary GAC carbon vessels.

CRA also conducts the quarterly groundwater monitoring as part of the O&M activities. The locations of the OU2 Treatment System wells are shown in Figure 3. The monitoring plan is outlined in the revised O&M Manual; groundwater quality monitoring is performed semiannually (March and September). However, a subset of monitor wells are monitored on a quarterly basis as described in the 2004 Effectiveness Report. The objectives of the groundwater monitoring program are (1) to provide groundwater quality and hydraulic data to monitor trends in the groundwater levels and contaminants of concern (COCs) and (2) provide data to determine when the groundwater extraction system should be modified or discontinued.

The annual Effectiveness Reports provide an assessment of the overall effectiveness of the OU2 Treatment System with respect to the treatment system and hydraulic containment of contaminated groundwater. The Companies concluded in each of their yearly evaluations that the OU2 Treatment System has maintained a capture zone adequate to contain the entire width and depth of the groundwater contaminant plume (Appendix B). The total gallons pumped from OU2, from 2001 through May 2006, were estimated to be 5.23 billion gallons. The total VOCs removed from the

groundwater in OU2, from 2001 through May 2006, was estimated to be 7,926 pounds. The reports further concluded that the overall trend of VOC concentrations in the groundwater showed an overall decrease since start up.

3.3.9 First Five Year Review

In September 2001, EPA completed the first five-year review report for OU2. At the time of the review, the treatment system was under construction. The first five-year review found that the remedy was being constructed in accordance with the requirements of the ROD, ESD, and design documents. A protectiveness statement was not issued at the time since no assessment of the treatment system could be made.

3.3.10 Staged Restart of Extraction Wells

In March 2004, the Companies completed an evaluation of hydraulic capture following the staged restart of the OU2 Area extraction wells after the SRP Grand Canal shutdown in February 2004. The evaluation was requested by EPA in a February 2, 2004 letter. The staged start-up consisted of re-starting only the middle (EW-M) and southern (EW-S) extraction wells. The initial flow rate at the start-up for the middle extraction well was approximately 1,650 gallons per minute (gpm) and for the southern extraction well was 200 gpm. Groundwater elevations were monitored in the OU2 treatment system monitoring network. Water levels declined almost immediately after starting the two extraction wells.

The Companies concluded that there was sufficient capture to the north using only the middle and southern extraction wells. Additionally, capture to the south occurred potentially south of monitor well EW-06. The Companies requested EPA approval to leave the northern extraction well off and just use the middle and southern extraction wells to achieve plume capture. EPA granted the Companies' request to leave EW-N off in a letter dated April 8, 2004. However, EW-N was subsequently turned on again to compensate for the reduction of flow at EW-M on September 23, 2004 (CRA, 2005b).

3.3.11 Capture Zone Calculations

In May 2004, the Companies submitted a letter report presenting an analysis of the extent of the combined capture zone provided by extraction wells EW-M and EW-S to confirm containment between the two extraction wells and to show the extent of capture to the south. The Companies used three lines of evidence for this evaluation:

- a flow net was manually drawn based on observed groundwater elevation contours to illustrate the extent of capture provided by EW-M and EW-S in the Salt River Gravels and in Basin Fill;
- a simple capture zone analysis using the computer code RESSQ was done for each hydrostratigraphic unit;

- groundwater chemistry concentration trends at specific monitoring wells were evaluated to determine the effect of the extraction system on water quality conditions n the area.

In addition, the Companies provided an updated capture zone analysis in Appendix A of the 2005 Effectiveness Report based on data from additional groundwater monitor wells and piezometers that were installed subsequent to the 2004 analysis. The 2005 analysis followed the same procedure noted above using converging lines of evidence to determine whether capture was being achieved. The Report concluded that *the OU2 groundwater extraction system (GES) capture zone in the Subunits "A and B" extends from south of EW06 and north of NW09 to the north of CRA01. In Subunit "D", the OU2 GES capture zone extends from south of EW06 to at least NW12-D to the north.*

Copies of these reports are provided in Appendix C. A detailed review of this assessment is provided in Section 7.

3.3.12 Additional Monitor Well Installations

The Companies installed additional monitor wells near the OU2 Treatment System as requested by ADEQ and EPA to provide further information on site lithology and groundwater conditions. Four rounds of drilling have occurred since 2003. Monitor wells NW04-S, NW04-D, NW05-S, NW06-S, NW06-D, NW07-S, NW07-D, NW08-S, NW08-M, and NW08-D were installed between June and July 2003. NW09-D was installed in January 2004. Monitor wells NW09-D2, NW10-D, NW11-D, and NW12-D were installed between January and February 2005. Monitor wells NW07-M, NW09-M, NW13-M, NW13-D, NW14-M, and NW14-D were installed between November and December 2005.

3.3.13 Honeywell Remedial Investigation and Action

An investigation of the Honeywell 34th Street Facility began in 1988 upon notice by ADEQ. In 1992, EPA issued a general notice letter to Honeywell stating that the 34th Street Facility may have contributed to the regional groundwater contamination, known as the Motorola 52nd Street Superfund Site. In 1999, ADEQ and Honeywell entered into an Administrative Order on Consent (AOC) to complete a focused remedial investigation of the 34th Street Facility. The objective of the AOC was to identify and characterize potential source areas and to determine the nature and extent of contamination emanating from the Facility. In December 2005, Honeywell submitted the Final Focused Remedial Investigation Report and is currently under review by ADEQ.

During remedial investigations at the Honeywell Facility, petroleum hydrocarbons were detected in soil and groundwater. An investigation was initiated under the ADEQ Underground Storage Tank (UST) Corrective Action Section. Honeywell installed several monitor wells on and off their Facility to characterize the extent of the petroleum hydrocarbons. Honeywell has determined that a floating free product plume

exist under the Facility and the Sky Harbor International Airport. The free product plume measures approximately 1500 feet by 2500 feet. Honeywell also determined that the free-product plume is composed primarily of Jet-A fuel and is contaminated with chlorinated VOCs. Honeywell developed a corrective action plan (CAP) under UST to address the free product. The CAP recommends the following remedial actions:

- remediate soil contamination in the vadose zone, the free-phase hydrocarbon smear zone, and the free-phase hydrocarbon pool with bioenhanced soil vapor extraction (BSVE);
- supplement BSVE remediation by selectively removing free product from existing groundwater monitoring wells.

This remedial action is not part of the ROD, UAO, or ESD for the OU2 area and therefore has not been reviewed as part of this five-year review process; however, a discussion of the remedial action is presented below since it will be incorporated into the final remedy for OU2

4.0 REMEDIAL ACTIONS

4.1 Remedy Selection

The OU2 ROD selected an interim groundwater containment remedy for the OU2 Area between the Old Crosscut Canal and Interstate 10. The remedy was classified as an interim action in order to reflect the possibility that additional remedial actions may be needed. An ESD was issued in September 1999 to modify the requirements of the ROD.

The specified remedial action objectives of the ROD are to establish a capture zone across the entire width and depth of the contaminant plume and to reduce concentrations of contaminated groundwater within the alluvial aquifer upgradient of the extraction wells. The ROD specified that groundwater will be extracted and treated to a level at or below MCLs.

The basic components of the selected interim remedy include the following:

- groundwater extraction near 20th Street and Washington Street;
- treatment of water by ultraviolet oxidation and GAC; and
- discharge of the treated water to the Grand Canal for irrigation use.

The OU2 interim remedy evaluated during this five-year review consists of three extraction wells which are all piped to the OU2 Treatment System. The locations of the key components of the interim treatment system are shown in Figure 2.

4.1.1 Groundwater Remedy

The groundwater extraction system consists of 3 extraction wells located along 20th Street. The extraction wells provide hydraulic containment west of Interstate 10. There are also a total of 54 monitoring wells within OU2 and OU3 that constitute the OU2 Treatment System monitoring network (See Figure 3).

The OU2 Treatment System consists of 18 GAC vessels and one ultraviolet oxidation system with hydrogen peroxide pre-treatment. Figure 4 through 8 provide a process flow diagram of the system and schematics of the system parts. Groundwater from the extraction wells is pumped at a current average rate of 2,150 gpm (600 gpm from EW-N; 1,350 from EW-M, and 200 from EW-S) to the treatment plant and through four pairs of GAC vessels connected in series. Currently, the ultraviolet oxidation system is not in operation because vinyl chloride has not been detected in groundwater. The treated water is routed through underground piping to a discharge point on the Grand Canal (Figure 2). Occasional slow flow backflushing of the GAC units is required to flush out the entrained air from the carbon. The backflushed water is collected in a backwash wastewater tank and subsequently discharged to the City of Phoenix sanitary

sewer system. Spent GAC is returned to the supplier for regeneration and then returned to the treatment plant.

4.2 Remedy Implementation

The OU2 Treatment System has been in operation since December 31, 2001. The groundwater extraction system is designed to treat approximately 5,300 gpm and receives groundwater from 3 extraction wells. Currently, due to dewatering of the alluvium, the treatment system is operated at approximately 2,150 gpm. As of May 31, 2006, the treatment system processed approximately 5.23 billion gallons of groundwater, from which approximately 7,926 pounds of VOCs have been removed. A monthly update of the remedy progress is included in Table 2.

4.3 System Operations

For the operation of the treatment system, the Companies retained the services of CRA to conduct all O&M and monitoring activities. Daily maintenance activities are performed by CRA in accordance with the updated July 2004 *Revised Final Operation and Maintenance Manual, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona.*

In 2001, O&M costs for the treatment system was approximately $415,702. These costs reflected the timing of start-up and commissioning of the OU2 system. O&M costs increased to $1,027,508 in 2002. The costs for 2003, 2004, and 2005 were $776,431, $1,009,540, and $828,500, respectively. From 2002 to 2005, the O&M costs were generally consistent. Table 3 provides the annual O&M costs from 2001 to 2005. These costs do not include other response costs that were incurred for OU2 (e.g., agency oversight costs).

5.0 PROGRESS SINCE THE LAST FIVE YEAR REVIEW

5.1 Protectiveness Statement from First Five-Year Review

The First Five-Year Review for OU2 was completed by EPA on September 28, 2001. At the time of the Report, a protectiveness determination of the OU2 remedy could not be made until further information was obtained. EPA provided a list of actions that needed to be completed before a protectiveness statement could be issued. EPA issued the following statement with regard to the OU2 remedy:

> *A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained on the issues that affect protectiveness. Further information will be obtained by the following actions: 1) ADHS will complete the public health assessment on groundwater use in the area; and 2) the previous risk calculations will be reviewed in light of changes to both inhalation toxicity values and the model used to project indoor air risks from subsurface. Also, more evaluation needs to be conducted by EPA to ensure the remedy will achieve the hydraulic containment standards. An addendum will be prepared by EPA within 6 months to reassess the protectiveness of the remedy. In the meantime, the groundwater treatment system is meeting the required treatment standards, and the exposures at the site have been restricted through institutional controls to address immediate health threats: drinking water is being supplied to the public by the City of Phoenix, and ADWR permitting requirements on new groundwater wells provide a mechanism for which groundwater use may be identified and monitored. The site Health and Safety Plan is current and on-site, is sufficient to control health risks, and is being properly implemented.*

5.2 Status of Recommendations and Follow-up Actions from Last Review

Table 4 presents a summary of the status of the recommendations and follow-up actions from the First Five-Year Review. Most of the recommendations and follow-up actions were addressed by the Companies; however, several of the issues raised continue to be problematic. Monitor well coverage to the north, south, and downgradient of the treatment system remains sparse. Since a final remedy for OU2 has not yet been developed, issues regarding final ARARs and institutional controls have yet to be addressed.

5.3 Results of Implemented Actions

The following paragraphs discuss some of the results of the implemented actions from the First Five-Year Review. Table 4 summarizes the actions taken and outcomes for each issue raised during the First Five-Year Review.

The Companies have evaluated the lower than expected extraction rates from EW-S. While the extraction rate for EW-S has been steady at approximately 200 gpm since late 2003, the lower than expected rate remains a concern for the future effectiveness of the remedy. Further discussion is provided in Section 7.1.

The Companies finalized the O&M Manual in January 2002 and updated it in July 2004. However, there is still some question as to whether the monitor well network is sufficient to adequately evaluate capture. Further discussion is provided in Section 7.1.

Institutional controls have been implemented by ADEQ regarding access to contaminated groundwater. Since WQARF was revised in 1997, ADEQ and ADWR have developed a procedure whereby ADWR notifies ADEQ when a Notice of Intent (NOI) to Drill a Monitor Well within the Motorola 52nd Street Superfund Site has been filed. ADEQ can then notify the property owner of the risk involved with using the groundwater.

Additionally, in April 2002 ADHS conducted a health assessment of the Motorola 52nd Street Superfund Site area to identify any current groundwater use that might result in human exposure to site contaminants. The Report updated the 1992 well use inventory for OU1 and OU2 and provided an evaluation of potential groundwater exposure pathways in OU3. No additional wells were found.

Since the last five-year review, EPA and ADEQ have not evaluated any additional ARARs since a final remedy for the OU2 Area has not been selected.

Groundwater sampling was conducted in 2001 and 2002 to evaluate additional constituents in groundwater. Groundwater samples were collected and tested for VOCs, metals, inorganics, and cyanide. In addition to the known VOC COCs, boron was detected slightly above the surface water limit for agricultural irrigation.

The evaluation of indoor vapor intrusion within the OU2 Area is pending the completion of the OU1 Area assessment. The OU1 Area may represent a worst case scenario for the vapor intrusion since concentrations are higher and the groundwater table is shallower than any other area of the Motorola 52nd Street Site. This has not yet been conducted since the guidance for conducting indoor air pathway evaluations is still draft. Once the guidance is finalized, or EPA and ADEQ can agree to the process for evaluating the pathway, the indoor air pathway evaluation should be conducted.

5.4 Other Progress Made During the Review Period

The following progress was made in the operation of OU2 since the last review:

- start-up and operation of the OU2 Treatment System. As of May 31, 2006, approximately 7,926 pounds of VOCs have been removed and approximately 5.23 billion gallons of groundwater have been remediated and returned to beneficial use;

- additional monitor wells were installed to provide additional data for evaluating the effectiveness of the system.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components

The 52nd Street OU2 Five-Year Review was lead by Kris Paschall, Project Manager of ADEQ, who provided oversight of the review process that was conducted by LFR (ADEQ's consultant). The following team members took part in the review:

- Kris Paschall, ADEQ Project Manager;
- David Haag, ADEQ Project Hydrologist;
- Robert Forsberg, LFR Project Manager;
- Bradley Cross, LFR Principal Hydrogeologist;
- Ned Overs, LFR Professional Engineer;
- Michael Nesky, LFR Senior Engineer;
- John Kivett, LFR Senior Hydrologist;
- Laura Malone, LFR Senior Project Scientist;
- Nadia Hollan, EPA Project Manager.

The five year review consisted of the following activities: (1) review of relevant documents (Appendix A); (2) interviews with appropriate operations staff, state and federal agencies, local government officials, and concerned community members; and (3) a site inspection.

6.2 Community Involvement

A public notice regarding the initiation of the forthcoming review was mailed to the Motorola 52nd Street mailing list in April 2006 (Appendix D). The final report is available at ADEQ and the local site repositories which are located at the Central Branch and the Saguaro Branch of the City of Phoenix public libraries. ADEQ will provide a brief summary of this Report to community members by holding a public meeting and/or distributing a fact sheet.

Additional community involvement activities during this five-year review period included periodic community advisory group (CAG) meetings, update of the community involvement plan (CIP), and involvement with the Technical Advisory Grant (TAG) Lindon Park Neighborhood Association.

The CIP was updated in March 2002 and again in July 2004. ADEQ conducted several interviews with the OU2 community to gather information for both of these updates. The primary concerns of the community in OU2 related to having access to enough

information about the project, health impacts, the current status of contamination, and understanding the proposed cleanup.

Both EPA and ADEQ worked with the TAG recipient, Lindon Park Neighborhood Association, during this review period. In addition, EPA and ADEQ have held periodic CAG meetings to discuss activities and the status of OU2. Minutes from these CAG meetings are available for review in the repositories and on ADEQ's website.

6.3 Document Review

The following primary site documents have been reviewed:

- Baseline Health Risk Assessment, Motorola 52nd Street Facility, Phoenix, Arizona, prepared by ADHS, November 1992
- Record of Decision, Operable Unit Two East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona, July 1994
- Amended Unilateral Administrative Order, #98-15, Motorola 52nd Street Superfund Site, November 1998
- Final (100%) Remedial Design Report, Operable Unit 2 Area, Motorola 52nd Street Superfund Site, Phoenix, Arizona, July 1999
- Explanation of Significant Differences (ESD#1) to July 1994 Record of Decision, Operable Unit Two East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona, September 1999
- Technical Memorandums and supporting information prepared by CRA on behalf of Freescale and Honeywell
- Final Remedial Action Report for Motorola 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona, September 2003
- Revised Final Operation and Maintenance Manual, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Area, July 2004
- The following routine documentation: Monthly OU2 Progress Reports, Quarterly Groundwater Monitoring Reports, Annual OU2 Effectiveness Reports (December 2001 - present)

6.4 Data Review

The following sections briefly discuss the main data sources reviewed for the five-year review evaluation. A review of ARARs is discussed in Tables 4, 5, and 6.

6.4.1 Groundwater Data Review

Since the interim remedy was primarily implemented to reduce the concentration of contamination and to capture the migrating plume, the groundwater data review evaluated trends in groundwater concentrations in key areas around the treatment system. Data from monitor wells downgradient of the extraction wells were used to evaluate the effectiveness of capture and to determine whether the plume was being contained vertically and horizontally.

The groundwater monitoring network that is monitored in the OU2 Area consists of wells located in the vicinity of the OU2 Treatment System. The network consists of monitor wells in OU2 and OU3, and some of the wells monitored include wells in the Honeywell 34th St Facility network. These monitor wells are used to collect groundwater elevation and water quality data from the alluvium and bedrock upgradient, downgradient, and cross-gradient from the treatment system. The locations of the wells are shown on Figure 3. Groundwater samples collected from these wells are analyzed for VOCs and selected inorganic compounds. Hydrographs of groundwater elevations and concentrations for selected wells are provided in Appendix E.

Groundwater quality monitoring is performed semiannually in March and September. As agreed upon, following the submittal of the 2004 Effectiveness Report, a subset of the monitor wells south of the southern extraction well was monitored quarterly for one year. This recommendation was extended through 2006.

The main analytes that are detected most frequently exceeding their respective MCLs are TCE, tetrachloroethene (PCE), 1,1-dichloroethene (1,1-DCE), and cis-1,2-dichloroethene (cis-1,2-DCE). Boron has been detected in groundwater samples slightly above the surface water limit for agricultural irrigation. In addition, sampling for metals in soils at the Papago Plating facility, an identified PRP in OU2, indicated elevated levels of metals above Arizona Non-residential Soil Remediation Levels (SRLs) including chromium and nickel. Cadmium, chromium, lead, and nickel concentrations exceeded their Groundwater Protection Limits (GPLs) indicating the potential for continued threat to the groundwater.

A groundwater sample collected in 1996 from the Alamo well MW-1 indicated concentrations of chromium above the MCL of 0.1 ppm. Groundwater samples collected in 2001 prior to start-up of the treatment system did not indicate concentrations of chromium above the MCL (IT Group, 2003).

6.4.2 Treatment Plant Data Review

Another primary requirement of the ROD is to treat the extracted groundwater to meet MCLs. Treatment plant influent and effluent data are collected on a monthly basis. The effluent results were compared to the established MCLs. Based on the data provided by

the Companies in monthly Progress Reports, none of the constituents exceeded the MCLs.

Available copies of historical design and engineering documents, record drawings, treated effluent monitoring plan, the City of Phoenix Polluted Groundwater Discharge Permit, the groundwater treatment plant (GWTP) effluent monitoring records/data, liquid-phase carbon change out records, waste profiling data, and manifests of the spent carbon sent off-site for regeneration and recycling were reviewed. During the inspection, ADEQ and LFR reviewed the GWTP records, including: daily/bi-weekly/monthly operating logs, equipment calibration logs, maintenance logs, and other documents to assess operation and maintenance compliance.

6.4.3 Additional Well Installation Data Review

ADEQ and LFR reviewed additional well construction completion reports prepared by CRA on behalf of the Companies. The data was used to evaluate the lithology of the OU2 Area. In addition, groundwater samples and elevations from the new wells were used in conjunction with the quarterly groundwater sampling data to evaluate the vertical and horizontal extent of the plume within each subunit.

6.4.4 Capture Zone Analysis and Hydraulic Testing

ADEQ and LFR reviewed data obtained following the staged restart of the extraction wells following the annual winter shutdown and the *Capture Zone Calculations – Operable Unit 2* Letter Report dated May 28, 2004. ADEQ and LFR also reviewed the updated capture zone analysis provided in Appendix A of the *Effectiveness Report – 2005, 52nd Street Superfund Site, Operable Unit 2 Area* Report. The data was used to evaluate the vertical and horizontal extent of capture and the effectiveness in plume containment of the OU2 extraction wells.

6.5 Interviews

The following individuals were interviewed for OU2 during this five-year review process by personal contact or by telephone:

- Tom Suriano, Remediation Project Manager, Freescale Semiconductor – Interviewed on May 10, 2006 at the ADEQ office.
- Nadia Hollan, Project Manager, EPA – Interviewed on May 10, 2006 at the ADEQ office.
- Martha Breitenbach, CAB Member – Telephone interview on May 23, 2006.
- Karen O'Regan, Environmental Programs Director for the City of Phoenix – Interviewed May 25, 2006 at the ADEQ office.
- Dave Gordon of Malcolm Pirnie and Chris Mattison representing Joray – Telephone interview on May 25, 2006.

- Steve Whillier, Manfred Plaschke and Dave Hilliard of Conestoga Rovers & Associates provided a written response to the interview questions on June 1, 2006.
- George Ring of CH2M Hill (representing Troy Meyer of Honeywell) - Interviewed on June 9, 2006 at the ADEQ office.
- Donn Stoltzfus, Environmental Program Specialist, City of Phoenix - Telephone interview on July 21, 2006.

The following individuals were invited to interview and ADEQ either received a decline to interview or did not receive a response:

- Steve Brittle - Don't Waste Arizona
- Daniel Casiraro - Salt River Project
- Mario Castenada - Gateway TAG technical consultant
- Jeff Conover - Walker Power
- Janet Corrigan - Paul McCoy's Laundry
- Gine Flury - AdobeAir
- Andrew Frisbie - Wabash National
- Linda Furlough - Arvin Meritor
- Richard Guimond - Motorola
- John Held - Phoenix Newspapers
- Mark Hess - Cooper Industries
- Judith Heywood - APS
- Kenneth Hodson - BDR Liquidating
- Ed Honig - Union Pacific Railroad
- Michael Johnson -City of Phoenix Councilman
- John Maris - D-Velco
- Scott Miller - AZ. Department of Water Resources
- Teresa Olmstead - ITT Industries
- Tommy Padgett - Citizen - Requested interview, but was not available
- Cynthia Parker - City of Phoenix Aviation Department
- Stephen Smith - BDR Liquidating
- Greg Stanton -City of Phoenix Councilman
- Douglas Watson - Joray

The detailed accounts of the interviews are presented in Appendix F, which are briefly summarized in the following paragraphs. Concerns or questions raised during the interviews will be addressed in a responsiveness summary prepared following the 30 day public comment period.

Mr. Tom Suriano, Remediation Project Manager, Freescale Semiconductor. Mr. Suriano of Freescale Semiconductor, in conjunction with Honeywell, is responsible for the O&M of the OU2 interim remedy. Mr. Suriano is familiar with all aspects of the project and was familiar with all O&M and monitoring activities. Excerpts of his responses are as follows. OU2 is a containment remedy that captures contaminants in the vicinity of I-10 and includes all the PRPs that have contributed. OU2 is effective at achieving the objectives. Freescale and Honeywell have contracted with Conestoga Rovers & Associates for O&M, and reporting issues. Mr. Suriano stated that there haven't been any O&M problems or activities that would have affected the protectiveness or effectiveness of OU2. Regional drought has decreased water levels and studies have been performed to show that the remedy is still capturing. Due to the declining water levels, adjustments have been made in flow rates and optimization of the system has occurred to achieve capture. Mr. Suriano provided several recommendations including: (1) completing the O&M Consent Decree with ADEQ, (2) completing the PRP evaluation, and (3) oversight is fairly high at OU2 and the agencies should consider a reduction in oversight.

Nadia Hollan, Project Manager, EPA Region 9. Ms. Hollan oversees the Companies in regards to the implementation and operations at OU2 Excerpts of her responses to the interview are as follows. There is a Unilateral Administrative Order with Honeywell and Freescale. The OU2 remedy is an interim groundwater containment remedy. OU2 has been doing what it was intended to do. There are questions on capture due to the declining water levels and the unknown areas of contamination on the south side of the system, which need to be addressed. EPA has published fact sheets, conducted public meetings, and continues to work with ADEQ. Periodically, there have been inquiries made to EPA on OU2. Specific details could not be remembered, however, the majority of the inquiries were minor issues. Ms. Hollan is aware that there are community concerns on whether the water discharged to the Grand Canal has been treated to safe levels. Ms. Hollan was unaware of any new regulations or guidance that would affect the operation of OU2. She stated that the public record reflects all the communications and/or EPA's thoughts on the overall system. In regards to recommendations, Ms. Hollan stated that new COCs may be an issue and that there needs to be follow up on the evaluation of the vapor intrusion issue.

Martha Breitenbach, CAB Member. Ms. Breitenbach has been a member of the Motorola 52nd Street Superfund Site CAG for approximately 5 years and participates in CAG meetings. Excerpts of her responses to the interview are as follows. OU2 is a pump and treat system similar to OU1, with the only difference being the jet fuel contamination. Ms. Breitenbach expressed disappointment that the resolution is slow and that more aggressive action should be taken. Ms. Breitenbach is very concerned that the plume is growing. She stated that Honeywell is not amenable to anyone describing where to put their wells and that Honeywell installed wells without ADEQ

approval. She sees this as skewing the results. Ms. Breitenbach stated that she has been kept well informed on the monitoring well issues and that the written materials provided are helpful. However, she would appreciate seeing raw data rather than averaged data. Ms. Breitenbach would also like to see points on a graph that show concentrations and what contamination is left. She would also like to see more information on how much was released.

Karen O'Regan, Director of the Environmental Programs Department, City of Phoenix. Ms. O'Regan is a representative of the City of Phoenix and is involved in issues regarding the redevelopment of the Site. Excerpts of her responses to the interview are as follows. OU2 is a groundwater containment system and is working fairly well. There are boundary issues associated with OU2 as they relate to containment. There is a concern that OU2 is dewatering the aquifer. The City of Phoenix is copied on associated OU2 reports. The City hasn't really received any citizen complaints regarding OU2, other than general questions on what the treatment system is. Ms. O'Regan stated that she was unaware of any new regulations/guidance that would affect OU2. Development in the area includes the new light rail system and associated redevelopment of certain areas. Ms. O'Regan stated that vapor intrusion is a top issue for the City, along with OU3, and the declining water levels. In regards to vapor intrusion, there aren't any standards and the guidance is controversial and she would appreciate some appropriate guidance on how to handle this issue. Ms. O'Regan stated a concern regarding the Honeywell's plume and how Honeywell has determined the extent. She also expressed concern regarding Honeywell's pilot test for air emissions and what impacts it will have on the residents. Ms. O'Regan recommended that Councilman Mattox, Cynthia Parker, and Donn Stoltzfus be interviewed.

David Gordon, Malcolm Pirnie and Chris Mattison representing Joray. Mr. Gordon is the consultant representing Joray and Chris Mattison is an attorney also representing Joray. Excerpts of their responses to the interview are as follows. OU2 is an interim remedy for the groundwater contamination. The system seems fairly sufficient, but is aware that there is the AFFC fuel issue and was not sure this was accounted for. Mr. Gordon stated that he feels he has been kept informed about all phases of the project and that he is not aware of any events or incidents affecting OU2. Mr. Gordon stated that he, as well as others, (as expressed in open house meetings) would like to see more rapid progress.

Steve Whillier, Manfred Plaschke and Dave Hilliard with Conestoga Rovers & Associates (CRA). CRA has been retained as the supervising consultant by Freescale and Honeywell to conduct all O&M and monitoring activities. Mssrs. Whillier, Plaschke, and Hilliard provided a written response to the interview questions. Excerpts from their written responses are as follows. OU2 is an interim remedy and was implemented on September 26, 2001. OU2 is a groundwater extraction and treatment system. OU2 objectives are to fully contain the entire north-south width and depth of the VOC contamination plume in the vicinity of 20th Street. OU2 includes 3 extraction wells and the treated water meets discharge standards. Since system startup, OU2 has been effective in capturing and containing the groundwater plume at approximately 20th

Street and has treated approximately 4.8 billion gallons of groundwater and removed over 7,300 pounds of VOCs. OU2 is working as designed.

Changes to the OU2 groundwater monitoring network and extraction wells have been documented in reports submitted to EPA. Other O&M optimization activities have included reducing flow rate set points due to the regional drought, the number of GAC vessels has decreased, and the UV oxidation is not being used since vinyl chloride has not been detected. CRA states that there have been no issues that have adversely impacted the effectiveness of the remedy.

Changes in monitoring activities include the removal and addition of monitoring wells to the overall monitoring network. Monitoring has increased in both location and frequency from the original plan. Annual O&M costs are consistent with original costs.

The Companies make recommendations in each annual effectiveness report for the next year of O&M. These recommendations are included in their written response.

George Ring, Hydrogeologist with CH2M Hill. Mr. Ring has been retained by and represented Troy Meyer of Honeywell. Excerpts of his responses to the interview are as follows. OU2 is an interim remedy and a feasibility study is currently being conducted to develop the final remedy. OU2 consists of 3 extraction wells and the groundwater treatment system. Mr. Ring stated that the remedy is functioning and is capturing the plume and treating the water to applicable standards. He indicated that there are no issues or problems with OU2 or any significant changes to the system, other than the monitoring well network has been expanded in order to answer some questions regarding capture. Difficulties with O&M are of a routine nature and have not impacted the effectiveness. Mr. Ring stated that the declining water levels are a big issue and that flow rates have been adjusted accordingly. Ms. Paschall asked questions regarding capture and whether there was a point at which declining water levels would impact the extent of capture. Mr. Ring stated that they have not gotten to that point.

Mr. Ring stated that the annual O&M costs are consistent within an order of magnitude and that costs may even be a little bit lower due to smooth system operations.

Mr. Ring stated that overall things are going well; the parties have a good relationship and are fairly responsive to getting issues resolved.

Donn Stoltzfus, Environmental Program Specialist, City of Phoenix. Mr. Stoltzfus is a representative of the City of Phoenix. Excerpts from his interview are as follows. OU2 is a groundwater treatment system and is relatively successful at what it was designed to do. The City of Phoenix is involved due to redevelopment issues and the potential for the fuel plume at the Sky Harbor Airport to co-mingle with the Superfund Site. The City is also concerned about groundwater resources in the area. Mr. Stoltzfus stated that vapor intrusion is also a concern with the Site. He stated that his office has provided briefings to city council members and department heads regarding OU2. He is not aware of any complaints received by his office or any community concerns regarding OU2. He is also not aware of any planned changes to regulations/ordinances

that would impact the Site. He stated that he thought the O&M and monitoring activities have been implemented in accordance with approved plans and stated that he has been kept informed of OU2 activities. He would like to see more coordination between ADEQ's Superfund and UST programs. These programs seem to have different approaches, philosophies and objectives and coordination between the programs would be very helpful.

6.6 Site Inspection

Representatives of ADEQ, LFR, CRA, CH2M Hill, Hargis & Associates, and Freescale conducted a site inspection of the OU2 Treatment System on June 6 and 7, 2006. The inspection was lead by Kris Paschall, Project Manager for ADEQ, and Robert Forsberg, Project Manager for LFR. Other inspection participants included Michael Nesky and Ned Overs with LFR, David Haag with ADEQ, George Ring with CH2M Hill (representing Honeywell), Mike Long with Hargis & Associates (representing Honeywell), and Tom Suriano with Freescale. The inspection was supported by Manfred Plaschke, Project Manager for CRA, Steve Whillier and David Hilliard with CRA, Operations Supervisor of CRA, who guided the inspection team around the OU2 Treatment System and answered questions from the inspection team. The treatment system inspection was performed using a checklist prepared by LFR. The completed checklist is included in Appendix G.

The site inspection involved the following activities:

- conducting interviews with onsite operators;
- reviewing documents that are maintained off site and on site;
- visual inspection of the OU2 Treatment System.

Weather conditions during the inspection were favorable, sunny with high temperatures. No problems were encountered with access to relevant site features inspected. The treatment system inspection was conducted to provide information regarding the O&M status and document the conditions of the treatment plant.

Prior to performing the site inspection, ADEQ and LFR reviewed available copies of design and engineering documents, record drawings, treated effluent monitoring plan, the City of Phoenix Polluted Groundwater Discharge Permit, the GWTP effluent monitoring records/data, liquid-phase carbon change out records, waste profiling data, and manifests of the spent carbon sent off-site for regeneration and recycling. During the inspection, LFR reviewed the GWTP records, including: daily/bi-weekly/monthly operating logs, equipment calibration logs, maintenance logs, and other documents to assess operation and maintenance compliance. No significant issues with record keeping were discovered, and all operation and maintenance activities were being performed in compliance with original and/or modified design specifications.

A discussion of the annual O&M costs is included in Section 4.3. The costs for 2001 reflect the start-up and commissioning of the OU2 system, 2002 costs reflect the first full year of operation, and from 2002 to 2005 the costs were generally consistent.

In general, the OU2 GWTP remediation system was in excellent condition and operating within specified ranges. No other significant or minor issues were noted during the inspection.

7.0 TECHNICAL ASSESSMENT

In accordance with the *Comprehensive Five Year Review Guidance* (Guidance), dated June 2001, the five year review should determine if the remedy is protective of human health and the environment and that it satisfies the performance criteria set forth in the decision documents. In order to assess the protectiveness of the remedy, the technical assessment should address three questions:

Question A: Is the remedy functioning as intended by the decision documents?

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Pursuant to the Guidance, these questions were developed as the framework for organizing and evaluating data and information, and to ensure that all relevant issues are considered when determining the protectiveness of the remedy.

The following subsections will examine each of these questions in detail.

7.1 Question A: Is the remedy functioning as intended by the decision documents?

The following sections discuss the performance of the OU2 remedy. The technical assessment included reviewing the following:

- remedial action performance and monitoring results;
- system operations/O&M;
- costs of the system operations/O&M;
- monitoring activities;
- opportunities for optimization;
- early indicators of potential remedy problems; and
- implementation of institutional controls and other measures.

The relevant decision documents are summarized in Section 3.3.6. The OU2 ROD presents the selected remedial action and identifies the performance standards. According to the OU2 ROD, *the selected remedial action is an interim remedy designed to address groundwater that is contaminated with VOCs in the OU2 area. The major components of the remedy are:*

- *extraction of groundwater in the vicinity of Interstate 10 and Van Buren Street;*
- *treatment of extracted water near extraction locations by either air stripping with off-gas treatment by synthetic resin adsorption, or advanced oxidation based on final design considerations;*
- *injection of treated water back into the aquifer in a location allowing additional control of the contaminant plume.*

The OU2 ROD also identifies the performance standards for the remedy and establishes that the remedy will comply with the respective ARARs. The OU2 ROD notes that *cleanup of the aquifer to drinking water standards is not an ARAR because it is beyond the scope of this interim action for OU2: no ARARs waiver are expected to be needed.*

The UAO and superseding Amended UAO direct the Respondents to implement the remedial action and perform operation and maintenance for the interim remedy described in the OU2 ROD. The Amended UAO includes a detailed Statement of Work which sets forth the framework and requirements for implementing the OU2 interim remedial action. The Amended UAO (Section VI, ¶ j.) requires the Respondents to meet the Performance Standards identified in the ROD and the Statement of Work attached to the UAO.

The ESD modifies the interim remedial action selected in the OU2 ROD *due to developments during the design of the groundwater treatment system for OU2. The OU2 ROD specified either air stripping or ultraviolet oxidation as a treatment technology and reinjection as a beneficial end-use of treated groundwater. EPA and ADEQ have determined that the use of carbon adsorption and ultraviolet oxidation for groundwater treatment and the discharge of the treated groundwater to the Grand Canal for end-use are efficient and cost effective modifications to the selected remedy* (ESD, page 1). The ESD also establishes that the *revised remedy remains protective of human health and the environment.*

In summary, the above described decision documents establish the primary performance standards for the OU2 interim remedy as:

- establish and maintain a capture zone across the entire width and depth of the contaminant plume near Interstate 10 and Van Buren Street;
- remove and permanently destroy groundwater contamination above drinking water standards; and
- discharge treated water to the SRP Grand Canal to be used for agricultural irrigation and agricultural livestock.

Technical assessment of the later two performance standards were evaluated by confirming effective operation of the treatment system. Technical assessment of the capture zone is complex and requires converging lines of evidence as discussed in the section below.

7.1.1 Remedial Action Performance and Monitoring Results

In order to effectively assess groundwater contaminant capture, an evaluation of the OU2 interim remedy based on the systematic approach developed by EPA using six basic steps for capture zone analysis was performed. These steps use "converging lines of evidence" and an iterative approach to assess capture (Capture Zone Analyses for Pump-and-Treat System, EPA Training Course hand-outs presented to the State of Arizona, May 25, 2005). The following guidance documents were also used to perform the analysis:

- *Methods for Monitoring Pump-and-Treat Performance, U.S. EPA, Office of Research and Development, 1994 (EPA 600-R-94-123)*
- *Elements for Effective Management of Operating Pump and Treat Systems, U.S EPA, Office of Solid Waste and Emergency Response, 2002 (EPA 542-R-02-009)*

7.1.1.1 Step 1: Review site data, site conceptual model, and remedy objective.

The review of site data was summarized in Section 6.4.

Conceptual Site Model

The Site is located in the eastern part of the City of Phoenix. There is a mixture of residential, commercial, and industrial land use in the area overlying the Site. According to the 1992 RI Report, completed by Freescale, and the 2005 Honeywell Focused RI Report, releases of hazardous substances from the former Motorola 52nd Street Facility and the Honeywell International, Inc. 34th Street Facility impacted soil and groundwater and the combined releases from their source areas have created an extensive groundwater contaminant plume (Figure 1). Additional potentially responsible parties may have also contributed to the groundwater plume. The contaminants of concern are primarily TCE, TCA, and their reductive daughter products. These contaminants seeped into the subsurface, though the vadose zone, and have mixed into and spread with the groundwater.

The Site is situated in the western Salt River Valley of the Basin and Range Physiographic Province characterized by alluvial-filled basins bounded by fault-block mountain ranges (Reynolds and Bartlett, 2002). The 1992 RI Report identifies three hydrogeologic units: an upper coarse sandy gravel, and underlying clayey sandy gravel, and bedrock. Recent investigations by Honeywell (2005 Focused RI Report) generally confirm these findings. Reynolds and Bartlett identified the upper coarse-grained alluvial unit as the Salt River Gravel and the lower finer-grained unit as "Basin Fill". Basin Fill was also identified as having interbedded fine and coarse deposits.

Investigations conducted by the Companies and, farther to the west in the OU3 Study Area by EPA, have identified a slightly more complex alluvial stratigraphy. A consistently identified fine-grained subunit has been observed in drilling samples in the

majority of deeper borings advanced in western OU2 and within OU3. This subunit has been identified as the "D" subunit. It is characterized as finer-grained interbeds of sandy silt with clay and coarser-grained interbeds of sand with gravel and lesser amounts of silt and clay. The overlying "B" subunit is characterized by finer-grained interbeds of sandy silt with clay and coarser-grained interbeds of gravely sand with cobbles and lesser amounts of silt and clay. These two subunits have also been collectively referred to as the "Basin Fill" unit. The overlying "A" subunit is characterized by gravely sand with cobbles and lesser amount of silt and clay. The A subunit is generally identified as Salt River Gravels (Reynolds and Bartlett, 2002). Correlation of boring logs also indicates that, in general, cobbles are encountered more frequently in the A subunit and are generally larger than the cobbles encountered in the B subunit. Review of boring logs in the OU2 area also indicates that the fine-grained interbeds of the B subunit are not present in all boreholes, notably in borings located in the southwest portion of OU2. The boring logs also indicate that if adequate depth was attained and bedrock was not encountered first, the uppermost fine-grained interbed of the D subunit generally is encountered at a consistent depth. Boring logs to the east of the OU2 system (e.g., east of BC-11A) indicate that the D subunit is pinched-out at the Honeywell bedrock ridge.

It should be noted that interpretation of the three subunits is also supported by the fundamental concept that groundwater movement in the alluvial aquifer is generally horizontal necessitating correlation of data from similarly screened monitor wells. Groundwater chemistry data also indicates that concentrations of contaminants vary with depth. Correlation of concentration data from similarly screened wells also supports this hydrostratigraphic interpretation.

Data collected from hundreds of groundwater monitor wells installed during investigations of the Site starting in 1983 indicates that the groundwater table is encountered at depths ranging from approximately 60 ft bgs in the eastern portion of the Site to 100 ft bgs near the west boundary of OU2. Potentiometric maps of these data indicate groundwater flow under the Site is generally west although locally may be observed as southwest and northwest. Two subsurface bedrock "ridges" locally impede and alter groundwater flow. As the predominantly horizontal flowing groundwater encounters these ridges, groundwater flow divides and moves around the ridges, converging downgradient. Areas of low hydraulic gradient on the upgradient and downgradient sides of the ridges correspond to the areas of flow divide and convergence and are also identified as stagnation zones. Both ridge features trend northwest-southeast. The eastern of the two ridges is located under the Honeywell Facility and has a significant impact on flow in both the A and B subunits. The western ridge, which is located under the OU2 Treatment System and Sky Harbor International Airport, primarily impacts flow in the B and D subunits.

Groundwater contaminant plumes have been identified in each of the subunits. TCE concentrations range from approximately 1,000 μg/L near the Honeywell bedrock ridge to 5 μg/L along the north and south Site boundaries of OU2.

Hydraulic conductivity values have not been established for each of the three subunits. Several multi-well, long-term aquifer tests have been conducted in OU2, but the tests were generally performed in wells constructed across the entire alluvial aquifer (i.e., across the subunits). Results of these combined subunit tests are variable, but generally indicate hydraulic conductivity values from approximately 130 feet per day (ft/day) to 340 ft/day in ASE-37A and EW-S, respectively (CH2M Hill, 2005).

The multi-well aquifer test was conducted in TEW-1, which is screened exclusively in the A subunit, indicated a hydraulic conductivity value of 450 ft/day (CRA, 1999).

In 2005, two short-term single-well aquifer tests were performed in OU2 in an attempt to test the B and D subunits exclusively. The results of these tests are presented in the *Addendum to the Construction Completion Report, Results of Additional Groundwater Monitor Well and Piezometer (NW07-M, NW09-M, NW13-M/D, and NW14-M/D) Installations, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*, dated March 27, 2006 and prepared by CRA (Addendum Report). Appendix E of the Addendum Report concluded that *based on the aquifer testing results, Unit B has a lower permeability than Unit D by approximately an order of magnitude. The average hydraulic conductivity for Unit D is estimated at 16.9 ft/day. For Unit B, the average hydraulic conductivity is 2.40 ft/day.*

Although it is not discussed in the conclusions, the well yield observed during the initial step test in NW11-M was lower than expected. Upon inspection, abundant scaling was noted in the well. The well was redeveloped in an attempt to improve the well efficiency, but as noted in the Companies response to EPA's May 17, 2006 comments (see item #6), *the short-term single well response aquifer test specific capacity values for NW-11M were lower than expected due to a number of factors including: scale build-up within the well, well screen and sand pack, and well construction (well screen is 0.020" vertical slots).* As such, ADEQ believes there were technical issues with the test and that the hydraulic conductivity values derived from the tests are inconclusive. Long-term multi-well aquifer tests in subunits B and D are needed to gain a better understanding of the OU2 conceptual site model and to facilitate future OU2 analyses.

Remedial Objectives

The remedial objectives are to establish and maintain a capture zone across the entire width and depth of the contaminant plume near Interstate 10 and Van Buren Street.

7.1.1.2 Step 2: Define the site-specific Target Capture Zone

The site-specific Target Capture Zone (TCZ) is defined as the entire width and depth of the OU2 contaminant plume to the COC specific MCL, primarily TCE, in the vicinity of Interstate 10 and Van Buren Street. This means that the width of the contaminant plume in each of the subunits (A, B, and D) constitute the TCZ.

The OU2 interim remedy includes three groundwater extraction wells, EW-N, EW-M, and EW-S. As required under the Amended UAO, these wells were constructed in 2001 in accordance with the 100% Remedial Design Report. The wells are 20 inch diameter with louvered screen intervals constructed from 100–220 feet bgs, 86–206 feet bgs, and 94-194 feet bgs in EW-N, EW-M, and EW-S, respectively. The north, middle, and south extractions wells were designed to operate at flow rates of 1,400 gpm, 2,200 gpm, and 1,700 gpm, respectively. The total volume of groundwater extracted was shown via groundwater modeling in the Remedial Design Report (CRA, 1999) to produce a TCZ in excess of the width of the 1997 OU2 contaminant plume (approximately 6,000 ft)

7.1.1.3 Step 3: Interpret water levels using potentiometric surface maps and water level pairs

Potentiometric Surface Maps

Groundwater levels have been interpreted for the OU2 remedy in the OU2 Groundwater Monitoring Reports and Annual Effectiveness Reports. Appendix B includes copies of the annual groundwater elevation maps from the 2002, 2003, 2004, and 2005 Effectiveness Reports. These figures depict the groundwater elevation contours and zones of capture as interpreted by the Companies. ADEQ and LFR reviewed the groundwater elevation data and contours depicted on each of these figures. ADEQ and LFR also evaluated the corresponding interpretation of capture depicted on the figures and evaluated the adequacy of capture with respect to the TCZ. Review of these figures indicates the following:

2001

2001 Effectiveness Report Figure 2.1 depicts baseline OU2 remedy conditions. The September 2001 groundwater elevation contours interpreted by the Companies depict southwest changing to westerly groundwater flow in pre-pumping conditions. No capture zone is depicted since the data predates OU2 system operations. No comment regarding capture or the TCZ is applicable to this Figure.

2002

2002 Effectiveness Report Figure 2.3 depicts the September 2002 groundwater elevation contours following one year of groundwater extraction at the OU2 system. Because the current level of understanding of the conceptual site model and the hydrostratigraphic subunits A, B, and D was not incorporated into the annual effectiveness reports until 2005, the alluvial groundwater elevations and groundwater contours are depicted on a single figure. Northwest deflection of the south side of the 1,010 ft contour is interpreted in the Figure; however, groundwater elevation data was not available for the southern-most well in the area, AS-02. Groundwater elevation data supporting the 1,015 and 1,005 contours from wells ASE-36A and AA-MW-2 indicate that flow is generally west, and not northwest. It is reasonable to assume that the 1,010

contour should be drawn similar to the 1,015 and 1,005 ft contours. Changing the 1,010 contour would result in generally western flow along the south side of the OU2 plume. This interpretation indicates that the TCZ may not have been fully achieved by the OU2 system in September 2002.

2003

2003 Effectiveness Report Figure 3.7 depicts the September 2003 groundwater elevation contours. Like the September 2002 data, the lack of groundwater elevation data south of EW-06 inhibits interpretation of the contours. As a result, interpretation of the south zone of capture is questionable. Conservative interpretation of these contours indicates that the TCZ may not have been fully achieved by the OU2 system in September 2003.

2004

2004 Effectiveness Report Figures 3.10 and 3.11 depict the September 2004 groundwater elevation contours as interpreted for the Salt River Gravel and Basin Fill, respectively. The Salt River Gravel contours again suffer from a lack of groundwater elevation data south of EW-06 compromising interpretation of both the contours and the zone of capture. The Basin Fill contours indicate that the TCZ was not achieved along the south side of the plume.

2005

2005 Effectiveness Report Figures 3.8 and 3.9 depict the September 2005 groundwater elevation contours as interpreted for the A+B and D subunits, respectively. The lack of A or B subunit groundwater elevation data south of the plume boundary in the vicinity of Interstate 10 inhibits effective interpretation of the groundwater elevation contours. Conservative interpretation of these contours indicates that the TCZ may not have been fully achieved by the OU2 system in September 2005. The D subunit groundwater elevation contours on 2005 Effectiveness Report Figure 3.9 indicate that the TCZ was not fully achieved along the south side of the plume.

It is noted that Honeywell data located to the east of the system indicates rotation of groundwater gradient to the northwest along the south side of the plume. Review of these data indicate that the 2005 Salt River flow event impacted the area with local recharge from the river causing a temporary shift from west to northwest groundwater flow. The flow event appears to have facilitated improved capture along the south side of the OU2 plume in 2005. As the impact of the flow events subside, groundwater gradients are expected to return to conditions similar to the first three years of operation.

Flow Net Analysis

2004

In addition to the groundwater elevation maps in the Effectiveness Reports, the Companies completed capture zone calculations for the OU2 system. The results are reported in *Capture Zone Calculations - Operable Unit 2, 52nd Street Superfund Site - Phoenix, Arizona* (Capture Letter) dated May 28, 2004 and prepared by CRA (see Appendix C). Three evaluations were performed for the Capture Letter: a flow net analysis, a theoretical capture zone analysis, and chemical concentration trends were analyzed. The flow net analysis is discussed below; the other analyses are discussed under Steps 4 and 5 below.

The flow net analysis was performed by manually producing groundwater elevation contours and streamlines for the Salt River Gravels and Basin Fill (A and B subunits). The resulting flow nets are depicted on Figures 3a and 3b of the Capture Letter. The Letter concludes that *the southern capture boundary extends beyond EW-06 to the south* and that the capture zones *are similar for the Salt River Gravels and Basin Fill.*

As discussed under Potentiometric Surface Maps, above, limited subunit A and B groundwater elevation data south of EW-06 makes interpretation of the groundwater elevation contours difficult. Conservative interpretation of the available elevation data indicates that the TCZ may not be fully achieved along the south boundary. Figure 3b indicates that the TCZ was not achieved along the southern boundary, as the extent of contamination in subunit B is farther south, between NW11-M and NW09-M (see Appendix C).

2005

A flow net analysis was also included in Appendix A of the 2005 Effectiveness Report (see Appendix C). Figures A.1 and A.2 depict the hand-drawn flow paths and groundwater contours based on groundwater elevation data collected in January 2006. These data include water elevations from new groundwater monitor wells NW09-M, NW13-M, and NW14-M.

Review of Figure A.1 indicates that the groundwater elevation reported for wells NW05-S and NW06-S (1,006.10 ft and 1,006.45 ft, respectively) do not appear to have been incorporated into the groundwater contours. As depicted in the Figure, the 1,006 ft contour along the south side of the plume has a southwest-northeast orientation. As drawn, this contour seems to support capture of the plume in the A and B subunit to the south; however, incorporating the data discussed above would change the 1,006 ft contour and the flow paths. Employing a conservative interpretation using the data, the 1,006 ft contour would likely have a more north-south orientation from the area of NW06-S to the area of NW13-M. Corresponding flow paths along the south side of the plume in both the A and B subunits would be oriented generally east to west, indicating inadequate capture. Conservative interpretation of recent groundwater elevation data indicates that the TCZ was not achieved along the southern boundary.

Water Level Pairs

Analysis of water level pairs is also recommended in EPA's 2002 *Elements for Effective Management of Operating Pump and Treat Systems*. Comparison of groundwater elevations at two or more monitor well locations oriented perpendicular to the TCZ may provide an additional line of evidence to evaluate capture.

Analysis of water level pairs was not included in the Effectiveness Reports. In an effort to evaluate this potential line of evidence, a review was performed of water level pairs for the five year review based on the September 2005 Effectiveness Report data. The water level pair analysis is summarized below:

Subunits A and B

Review of the most recent groundwater elevation map in the 2005 Effectiveness Report for the A and B subunits (Figure 3.8 of the 2005 Effectiveness Report) indicates that few well pairs exist which are perpendicular to the zone of capture; however, several well pairs are sufficiently oriented to analyze water level pairs. These wells are highlighted on the Figure 3.8 (see Appendix B) and include:

- CRA-01 and EW-07
- NW-04S and NW-02
- NW-04S and NW-05S
- NW-05S and NW-02
- NW-05S and NW-03
- NW-06S and NW-03
- NW-07S and NW-06S
- NW-07S and EW-06
- EW-06 and EWSPZ1

Review of the groundwater elevations for the north water level pairs generally indicates inward flow. These data provide supporting evidence that the TCZ is being achieved along the north side of the OU2 plume in the A and B subunits.

Analysis of water level pairs on the south side of the TCZ is problematic due to limited groundwater elevation data. Inward flow is indicated by well pairs EW-06 and EWSPZ1, indicating that the zone of capture may exist as far south as EW-06; however, no additional A or B well data is reported to the south or southwest of EW-06. It should also be noted that EWSPZ1 is screened across all three subunits and limits the applicability of this water level pair for capture zone analysis of the A and B subunits. Based on the available data, water level pair analysis along the south side of the TCZ does not provide supporting evidence for adequate capture.

Subunit D

Review of the most recent groundwater elevation map in the 2005 Effectiveness Report for the D subunit (Figure 3.9) indicates that very few well pairs exist to perform water level pair analysis. Potential well pairs for subunit D include:

- NW-12D and OU3-14D
- NW-07D and NW-11D
- NW-11D and NW-09D
- NW-09D and NW-10D

Comparison of NW-12D and OU3-14D, which are located near the north side of the TCZ, is problematic because the wells are not located perpendicular to the zone of capture. Evidence to support capture can not be determined from this water level pair.

Comparison of the water levels between NW-09D and NW-10D indicates that some degree of inward flow occurs as far south as NW-10D; however, outward flow is indicated by water levels collected from NW-07D and NW-11D. These data show that while some inward flow is occurring along the south side of the OU2 plume in the D subunit, capture of the southern boundary of the plume is not confirmed. Analysis of these water level pairs in the D subunit provides little evidence to evaluate capture of the south side of the D subunit plume.

7.1.1.4 Step 4: Perform calculations (if appropriate based on site complexity)

Theoretical Capture Zone Analysis

2004

The theoretical capture zone analysis was performed by simulating the OU2 system using a RESSQ computer simulation, a semi-analytical solution developed by Javandel, et al. (1984). Two simulations were performed: one for the Salt River Gravel and one for the Basin Fill. Input parameters were provided for each simulation; however, little information was provided regarding the selected extraction rates within each of the subunits and no discussion was provided regarding sensitivity analysis.

Figures 4 and 5 of the Capture Letter depict the results of these simulations. The figures depict a wide zone of capture in both subunits. The simulated zone of capture appears to realistically represent conditions to the north, but capture to the south appears to be significantly greater than observed (compare with Figures 3a and 3b). The difference in simulated and observed capture indicates that the theoretical capture zone is flawed. Initial orientation of the RESSQ grid or aquifer heterogeneities and/or anisotropy may be the cause of the difference in capture. As provided in the Capture Letter, the theoretical capture zone analysis does not provide evidence to support adequate capture.

2006

Another capture zone evaluation was also performed as part of the 2005 Effectiveness Report (CRA, 2006b). The evaluation is included in Appendix A of the Effectiveness Report (see Appendix C). A theoretical capture zone analysis was performed in a manner similar to the analysis performed in the Capture Letter discussed above; however, three scenarios instead of two were run for the Effectiveness Report. Again, input parameters were provided for each of the simulations; however, little information was provided regarding the selected extraction rates within each subunit and no discussion was provided regarding sensitivity analysis.

It should be noted that an extraction rate of 10.5 gpm was selected for EW-S yet the D subunit was not observed in soil core from this location. The model may have been more realistically run with no extraction in subunit D at EW-S.

Figures A.3, A.4, and A.5 of Appendix A depict the results of the three simulations superimposed over the subunit plume boundaries. Like the 2004 Capture Letter, the figures depict a wide zone of capture in each of the three subunits. Comparison with the hand-contoured flow paths depicted on Figures A.1 and A.2 indicate some similarities along the north side of the plume but simulated capture to the south appears to be significantly greater than observed. The difference in simulated and observed capture indicates that the theoretical capture zone is flawed. Contrary to the conclusions set forth in Appendix A of the 2005 Effectiveness Report, the theoretical capture zone analysis does not calibrate with actual site data and therefore can not be used as evidence to support adequate capture.

7.1.1.5 Step 5: Evaluate concentration trends

Groundwater Chemistry Changes

The Annual Effectiveness reports and the 2004 and 2006 capture zone analyses included an evaluation of concentration trends in groundwater chemistry by plotting and reviewing concentrations trends for selected wells in the OU2 system network. The concentrations versus time graphs included in Appendix E depict concentrations collected from 2001 to 2004. Selected wells included 16 A subunit wells and 9 B/D subunit wells. Because the trends do not include data prior to the baseline sampling event, it is difficult to determine if the decline observed in the wells is due to the operation of the OU2 system or an existing trend in the OU2 plume.

Concentration trends were plotted for two wells: EW-06 located near the southern side of the OU2 plume at 20th Street and EW-07 located near the northern side of the OU2 plume at 20th Street. These data are shown on graphs included at the end of Appendix E of this five year review.

EW-07 rapidly decreased from 14 μg/L in the baseline sample to below detection limits after one year of operation in the September 2002 sample and has remained below

detection limits since. Concentration trends in wells located along the southern boundary of the TCZ are less clear. EW-06 indicates a declining trend since 2001; however, concentrations increased from 6.8 µg/L in September 2004 to 22 µg/L in September 2005. It should be noted that both of the graphs show that a declining trend was observed in the wells prior to system start-up. The TCE trend for EW-07 is more consistent and provides some supporting evidence for capture to the north. The trend in EW-06 is not conclusive and does not provide supporting evidence for capture along the south side of the TCZ.

7.1.1.6 Step 6: Interpret actual capture based on Steps 1-5, compare to target capture zone, and assess uncertainties and data gaps

The 2002, 2003, 2004, and 2005 Annual Effectiveness Reports and supplemental capture zone analyses performed in 2004 and 2006 all generally conclude that the OU2 groundwater extraction system is containing the full width and depth of the groundwater plume.

Based on a review of the data conducted in Steps 1 though 5, it appears that the OU2 system is meeting the remedial objectives with respect to plume capture on the north side of OU2; however, based on a conservative interpretation of the data, it appears that the south side of the plume is not fully captured. More specifically, capture in subunit A is questionable, capture in subunit B is likely inadequate, and capture in subunit D is inadequate.

Because data are lacking in all three subunits along the south side of the TCZ, some uncertainty exists in the interpretation. Less uncertainty exists to the north. Alternative interpretations of capture are possible; they are related to alternative interpretation of groundwater elevation contours along the south side of the TCZ. Conclusions derived from capture calculations and concentration trends provide little support for the alternative interpretations. Additional data are needed to address the northern, southern, and the downgradient TCZ in each of the three subunits.

7.1.2 System Operations/O&M

In general, the OU2 groundwater treatment system was in excellent condition and operating within specified ranges. No other significant or minor issues were noted during the inspection.

Extracted groundwater is treated at the treatment plant and transferred to SRP's Grand Canal for irrigation use providing a beneficial end use for the water. Treatment plant influent and effluent data are collected on a monthly basis. The effluent results were compared to the requirements of the ROD and ESD. Based on the data reviewed, the treated effluent met the requirements of the ROD and ESD.

7.1.3 Costs of System Operations/O&M

A discussion of the annual O&M costs was included in Section 4.3. The costs for 2001 reflect the start-up and commissioning of the OU2 system, 2002 costs reflect the first full year of operation of the treatment system, and from 2002 to 2005 costs were generally consistent, but below the anticipated annual costs of $1,640,000. This suggests that the treatment system is operating below expectations, which is likely due to the decreased extraction rate from EW-S.

7.1.4 Monitoring Activities

Capture and containment can only be confirmed with an adequate monitor well network that provides both groundwater level data to demonstrate hydraulic capture and groundwater quality data to demonstrate overall reduction of mass within and outside the capture zone(s). A review of the existing monitor well network indicated several areas where lack of data hinders the evaluation of the effectiveness of the remedy. Additional alluvial monitor wells are needed in all three subunits to the north, south, and downgradient of the treatment system to evaluate capture of the TCZ.

7.1.5 Opportunities for Optimization

No opportunities for treatment system optimization were identified during this review.

7.1.6 Early Indicators or Potential Remedy Problems

EW-S groundwater extraction rates have declined. The well was designed to operate at 1,700 gpm. The initial extraction rate for the well was approximately 800 gpm and has declined to the current extraction rate of approximately 200 gpm. It is not believed that construction is an issue for this well; rather, EW-S is located near the airport bedrock ridge and is screened in finer grained materials than the other extraction wells. Nonetheless, if the rate declines further in the future, capture to the south may also be reduced, further aggravating effectiveness of the remedy.

The groundwater elevation maps from the first four years of operation of the OU2 system indicate that the majority of the groundwater entering the system originates from the northeast portion of OU2. This may lead to a lower than expected impact on the south side of OU2, especially in the stagnation zone on the downgradient side of the Honeywell bedrock ridge.

Reduced effectiveness of cleanup on the upgradient Honeywell bedrock ridge stagnation zone is also expected, as concentrations in those wells have shown minimal change.

7.1.7 Implementation of Institutional Controls and Other Measures

Institutional controls have been implemented by ADEQ regarding access to contaminated groundwater. Since WQARF was revised in 1997, ADEQ and ADWR have developed a procedure whereby ADWR notifies ADEQ when a NOI to Drill a Monitor Well within the Motorola 52nd Street Superfund Site has been filed. ADEQ can then notify the property owner of the risk involved with using the groundwater.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

7.2.1 Changes in Standards and To Be Considered

OU2 is currently in compliance with the ARARs established in the ROD and ESD (Tables 5 and 6). No chemical-specific soil or groundwater clean-up levels were established in the ROD and ESD. However, the remedy does require that treated groundwater effluent meet drinking water standards with no exceedances of the MCLs.

There are no newly promulgated standards or revisions to the ARARs that would call into question the protectiveness of the remedy. However, new ARARs and TBCs are likely to be determined for the final remedy for OU2.

7.2.2 Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

Land use at the site has remained relatively the same and no new human health or ecological routes of exposure have been identified.

Since the 1992 health evaluation, there have been a number of changes to the toxicity values for certain COCs at the Site (Table 7). Revisions to the toxicity values for 1,1-DCE and vinyl chloride indicate a lower risk from exposure to these chemicals that were previously considered. On the other hand, evaluation of the toxicity values for PCE and TCE is ongoing and may indicate higher risks from exposure than previously considered.

The greatest uncertainty with toxicological changes for the Site is associated with TCE. In August 2001, U.S. EPA's Office of Research and Development (ORD) released the draft *Trichloroethylene Health Risk Assessment: Synthesis and Characterization* (TCE Health Risk Assessment) for external peer review. The draft TCE Health Risk Assessment takes into account recent scientific studies of the health risks posed by TCE. According to the draft TCE Health Risk Assessment, for those who have increased susceptibility and/or higher background exposures, TCE could pose a higher risk through inhalation than previously considered. The draft TCE Health Risk Assessment is available on-line at: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249.

The Science Advisory Board, a team of outside experts convened by EPA, reviewed the draft TCE Health Risk Assessment in 2002. The Science Advisory Board's review of the draft TCE Health Risk Assessment is available at: http://www.epa.gov/sab/pdf/ehc03002.pdf.

In July 2006, the National Academy of Sciences completed additional peer review of scientific issues that were the basis for the draft TCE Health Risk Assessment. In response to this review, EPA will revise the draft TCE Health Risk Assessment. Consequently, review of the toxicity value for TCE may continue for a number of years. This issue will need to be updated in subsequent five-year reviews.

In addition, a Health Based Guidance Level (HBGL) and Preliminary Remediation Goal (PRG) have been established for 1,4-dioxane. This contaminant has been detected at the Site at elevated concentrations and should be addressed in the final remedy.

As discussed in Section 6.4.1, elevated levels of metals above SRLs and GPLs have been detected at the Papago Plating Facility (located upgradient from the OU2 GWTP) and above MCLs in groundwater downgradient of the Facility indicating the potential for a continued threat to the groundwater and to the OU2 GWTP. It is recommended that groundwater samples be evaluated periodically for the presence of metals.

7.2.3 Changes in Risk Assessment Methods

The1992 risk assessment methodology used was based on *EPA Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual: Part A* (EPA, 1989). Current methodology for risk assessment has not changed, however, the air model used to estimate indoor risks has changed and it would be prudent to model current risks based on this newer model (EPA *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils, November 2002*) and updated toxicity values. ADEQ is currently evaluating the methodology for evaluating the indoor air risks and will implement the methodology once the guidance is finalized or EPA and ADEQ agree to the process for evaluating the pathway.

7.2.4 Progress Towards Meeting RAOs

The RAOs provided in the ROD and ESD were selected to set goals for an interim groundwater remedy designed to contain and reduce groundwater contamination. No chemical-specific groundwater clean-up levels were established in the ROD and ESD. The interim groundwater remedy is generally meeting these goals; however, issues regarding the containment of groundwater contamination have been raised (see Section 7.1.1).

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would call into question the protectiveness of the remedy.

7.4 Summary of Technical Assessment

According to the data reviewed, the site inspection, and the interviews, ADEQ has identified several concerns that call into question the effectiveness of the remedy. Because data are lacking in all three subunits along the north and south side of the TCZ, some uncertainty exists in the interpretation. It appears that the OU2 system is meeting the remedial action objectives with respect to plume capture on the north side of OU2; however, based on a conservative interpretation of the data, it appears that the south side of the plume is not fully captured. More specifically, capture in subunit A is questionable, capture in subunit B is likely inadequate, and capture in subunit D is inadequate. Additional data are needed to address the northern, southern, and the downgradient TCZ in each of the three subunits.

The OU2 groundwater treatment system was in excellent condition and operating within specified ranges. No significant issues were noted during the inspection. The extracted groundwater is treated and then transferred to SRP's Grand Canal for irrigation use providing a beneficial end use for the water. Treatment plant influent and effluent data are collected on a monthly basis. Based on the data reviewed, the treated effluent met the requirements of the ROD and ESD.

Changes to toxicity factors of certain COCs have occurred and should be evaluated. In addition, new methodology to evaluate indoor air risks is being developed. While no chemical-specific groundwater clean-up levels were established in the ROD and ESD, new chemical-specific ARARs and TBCs are likely to be determined for the final remedy for OU2.

8.0 ISSUES

The following issues discovered during the five-year review are discussed below and are included in Table 8.

8.1 Groundwater Issues

Several issues were identified during the technical assessment of the OU2 interim remedy. These issues are primarily associated with groundwater capture. The following is a list of the issues.

8.1.1 Capture Issues

1) Little to no groundwater elevation and quality data are available in any of the subunits along the north side of the OU2 plume. As a result, the impact of the OU2 treatment system can not be adequately evaluated in that area. Additional monitor wells are needed along the north side of the OU2 plume in each of the subunits to evaluate the OU2 capture effectiveness.

2) Groundwater elevation and quality data are lacking in all three subunits along the south side of the OU2 plume. As a result, the impact of the OU2 treatment system is difficult to assess in this area. Additional monitor wells are needed along the south side of the OU2 plume in each of the subunits to evaluate the OU2 capture effectiveness.

3) Additional groundwater elevation and quality data are needed downgradient of the OU2 treatment system to evaluate capture in the D subunit. Additional monitor wells are needed in the D subunit downgradient of the OU2 treatment system to evaluate capture in subunit D.

4) Although capture appeared more effective in 2005, it appears to be related to a northwest rotation of groundwater gradients due to recharge from the Salt River flow event. However, based on a conservative interpretation of the data, using converging lines of evidence, it appears the TCZ along the south side of the plume is not fully captured.

8.1.2 Future Issues

5) EW-S groundwater extraction rates have declined. The well was designed to operate at 1,700 gpm. The initial extraction rate for the well was approximately 800 gpm and has declined to the current extraction rate of approximately 200 gpm. If the rate declines further in the future, capture to the south may also be reduced.

6) Future containment of the D subunit is problematic because: (1) the D subunit is primarily contaminated in the south portion of OU2, (2) EW-S does not penetrate

the D subunit and therefore does not directly extract from the D subunit, and (3) capture is currently questionable and may decrease if EW-S extraction rates continue to decline.

7) The Agencies are concerned that the stagnation zone on the upgradient and downgradient side of the Honeywell bedrock ridge is not being addressed by the OU2 system.

8) Long-term multi-well aquifer tests in subunits B and D are needed to gain a better understanding of the OU2 conceptual site model and to facilitate future OU2 analyses.

9) The OU2 system is an interim remedy and therefore a final remedy for OU2 must be developed. The final remedy will address the issues identified in this five-year review and must consider and integrate the Honeywell light nonaqueous phase liquid (LNAPL) remedy.

8.2 Health Assessment Issues

The following issues were discovered during the five-year review.

10) Changes to the toxicity levels for certain contaminants have occurred since the last five-year review.

11) New methodology is being developed for indoor air risk evaluation. Once the methodology is finalized or EPA and ADEQ can agree to the process for evaluating the pathway, an indoor air risk evaluation should be performed for the OU2 Area.

12) Boron has been detected in influent and effluent samples from the treatment plant.

8.3 General Issues

The following general issues are noted:

13) The 2005 Effectiveness Report is not consistent with respect to the lithologic and hydrogeologic representation and interpretation of the D subunit. Cross section Figure 2.6 does not include the interpretation of bedrock or the D subunit on the east portion of the cross-section. Figure 3.9 does not depict the area where the D subunit is pinched-out by the OU2 bedrock ridge. Consistent interpretation of the hydrostratigraphic subunits and available data is needed for OU2 analyses (e.g., interpretation of subunit D as both unconfined and semiconfined). Additionally, consistent use of available data is needed for OU2 analyses (e.g., D subunit groundwater elevations along the north side of OU2).

9.0 FOLLOW-UP ACTIONS AND RECOMMENDATIONS

Based on the issues identified during the five-year review process, the following corrective actions should be taken. Table 9 provides a summary of the follow-up actions and recommendations listed below along with the responsible party, oversight agency, and schedule for completion.

9.1 Follow-up Actions

The following actions regarding the groundwater issues at the OU2 Area should be addressed.

9.1.1 Groundwater Follow-up Actions

9.1.1.1 Groundwater Capture Follow-up Actions

1) A work plan should be prepared and submitted to ADEQ to address the data gaps along the north side of the OU2 plume. The work plan should include the installation of monitor wells in each of the three alluvial subunits.

2) A work plan should be prepared and submitted to ADEQ to address the data gaps along the south side of the OU2 plume. The work plan should include the installation of monitor wells in each of the three alluvial subunits.

3) A work plan should be prepared and submitted to ADEQ to address the data gaps downgradient of the OU2 treatment system. The work plan should include the installation of monitor wells in the D subunit.

4) Future capture evaluations shall consider the following when examining multiple lines of evidence:

   - conservative interpretation of groundwater elevation data when producing groundwater elevation contours, especially in areas where data are lacking;
   - analysis of water level pairs for appropriately configured monitor wells;
   - capture zone calculations that are conceptually consistent with site data and interpretation. The method(s) used to calculate the capture zone should be discussed by the appropriate representatives from the Companies and the Agencies; the final methodology will be approved by the Agencies Capture zone calculations must consider site lithology and hydrogeology and address the potential impact of simplifying site data in interpretation. Capture zone calculation should also incorporate sensitivity analyses; and
   - concentration trend analysis shall include all historic data. Analysis of trends shall consider the impact of fluctuations in groundwater levels, changes in groundwater gradient, and the conceptual site model.

9.1.1.2 Future Groundwater Issues Follow-up Actions

5) The Companies should continue to monitor the extraction rates for EW-S.

6) The Companies should develop a plan to monitor groundwater capture along the southern boundary, particularly in subunit D.

7) The Companies should prepare a plan to evaluate the effectiveness of the OU2 treatment system on the stagnation zones upgradient and downgradient of the Honeywell bedrock ridge.

8) The Companies should develop a plan to conduct long-term multi-well aquifer tests in subunits B and D. The data obtained from these tests will be useful for designing a final remedy for OU2.

9) A final remedy will need to be developed for OU2 that incorporates the Honeywell LNAPL remedy.

9.1.2 Health Assessment Follow-up Actions

The following actions regarding health assessment issues at the OU2 Area should addressed.

10) A review of the toxicity values for COCs at the Site should be conducted before the final remedy is selected.

11) New methodology is being developed for indoor air risk evaluation. Once the methodology is finalized or EPA and ADEQ can agree to the process for evaluating the pathway, an indoor air risk evaluation should be performed for the OU2 Area.

12) Effluent samples should be collected and analyzed for boron. If the results are above the surface water limit for agricultural irrigation, SRP should be notified.

9.1.3 General Follow-up Actions

The following actions regarding general issues at the OU2 Area should be addressed.

13) The Agencies recommend a technical work group meeting to discuss and address groundwater elevation and quality data, capture issues, and hydrostratigraphic issues.

9.2 Parties Responsible for Implementation

The Companies, as identified in the Amended UAO and supporting decision documents, are responsible for the recommended actions.

9.3 Agencies with Oversight Authority

The EPA is the current agency with oversight authority. ADEQ and the Companies are currently negotiating an agreement whereby ADEQ will assume oversight authority.

9.4 Schedule for Completion

Because the OU2 interim remedy issues identified above are current and ongoing, the recommended actions under Section 9.1 should be conducted as soon as practical. Table 9 outlines the expected completion date.

10.0 PROTECTIVENESS STATEMENT

A protectiveness determination of the OU2 interim remedy cannot be made at this time until further information is obtained. The necessary follow-up actions and recommendations identified in this Report are needed to evaluate protectiveness. The actions will require the efforts of the Companies and the Agencies to be completed. It is expected that these actions will take approximately 1 year to complete at which time a protectiveness determination will be made.

11.0 NEXT REVIEW

The next review for the Site is required within five years of EPA's signature of this review. It is anticipated that the next review will be completed by the end of September 2011.

Table 1 - Chronology of Events at the OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Date	Event
1985-1989	ADEQ conducted an Remedial Investigation and initiated and investigation of potentially responsible parties (PRP's)
1987	The East Washington area was listed on ADEQ's Water Quality Assurance Revolving Fund (WQARF) Priority List
July 1988	Questionnaires mailed to 995 facilities located in the East Washington area requesting information regarding their hazardous substance use, storage, and disposal practices
August 1989	ADEQ completed the Phase I Report for the East Washington area, which was made available for public review
1990-1992	ADEQ and Freescale continued an area-wide groundwater investigation to define the extent of groundwater contamination in the OU2 area Approximately 48 monitor wells with 120 sampling ports were installed and over 300 aquifer tests were conducted
1992	ADEQ and EPA developed a second operable unit (OU2) study area to address groundwater contamination and a final remedy
1992	Freescale submitted the Remedial Investigation Report to ADEQ confirming that contamination was migrating from the Motorola facility and into the East Washington area
1992	ADHS completed a Baseline Risk Assessment concluding *no imminent health hazard*
1992	EPA named additional potentially responsible parties Honeywell, ITT Cannon, and Tiernay Turbines (now Walker Power Systems)
February 1992	Freescale submitted the Final Remedy Remedial Investigation Report to ADEQ.
June 8, 1992	Freescale submitted the Response to Comments on Final Remedy Remedial Investigation Report to the EPA
July 15, 1992	Freescale submitted a Pre-Design Remedial Investigation Work Plan
August 3, 1992	Freescale submitted the Addendum to the Pre-Design Remedial Investigation Work Plan
November 1992	ADHS submitted the Baseline Risk Assessment to ADEQ
November 1992	Center for Environmental Health Studies submitted the Critique of the Baseline Risk Assessment to ADHS
1993	ADEQ discovered groundwater contamination (TCE) in the area of beyond the Old Cross Cut Canal thought to be a part of the East Washington Area, a separate contaminant plume
1993	EPA named the City of Phoenix a potentially responsible party
1993	Freescale issued a series of reports documenting the development and calibration of a flow and transport model that was used for the evaluation of remedial alternatives in the are from 46th Street to approximately 24th Street between McDowell and Buckeye Roads
1993	ATSDR completed an update to the 1988 Health Assessment
March-August 1993	ADEQ and EPA determined that this would be a second interim remedy (OU2)
March 1993	Freescale submitted a Draft Detailed Analysis of Alternatives for the final remedy
August 1993	Freescale submitted a Draft Interim Remedy Feasibility Study Report to ADEQ
October 1, 1993	Freescale submitted an updated Interim Remedy Feasibility Study Report to ADEQ.
October 1993	Freescale submitted an updated Interim Remedy Feasibility Study Report to ADEQ
November 9, 1993	Freescale submitted the Interim Remedy Feasibility Study Report to ADEQ
December 1993	Freescale submitted the Supplement to Interim Remedy Feasibility Study Report to ADEQ

Table 1 - Chronology of Events at the OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Date	Event
December 1993	ADEQ and EPA issued a proposed groundwater remedy for public review and comment
1994	ADEQ requested Honeywell, ITT Cannon, the City of Phoenix, and Freescale to implement the groundwater remedy
January 1994	ADEQ approved the updated Interim Remedy Feasibility Study Report submitted by Freescale
February 1994	Freescale submitted a Hydrogeologic Investigation of Subsurface Bedrock Conditions Report of the East Washington area WQARF Site
February 9, 1994	Public meeting held to take oral comment from the public regarding the OU2 Feasibility Study
July 21, 1994	The EPA submitted the Record of Decision Operable Unit 2 East Phoenix Groundwater Containment
November 1994	Freescale submitted a letter with results of additional drilling conducted to confirm the depth to bedrock
1995	ADEQ issued a No Further Action letter to ITT Cannon.
1996	ATSDR completed an update to the 1988 Health Assessment and the 1993 update to the Health Assessment
February 1996	Freescale submitted M152 Model documentation Report to ADEQ
February 1996	Freescale submitted the MI52 Model Documentation Report presenting models of predicted groundwater flow and contaminant transport of VOCs from Freescale and other sources
October 1, 1996	Freescale and the City of Phoenix signed a Consent Decree with ADEQ to implement the design of a groundwater containment and treatment system for OU2 Honeywell withdrew from the agreement and did not participate in the design
1997	ADEQ and EPA determined that the investigation of groundwater contamination from 52nd Street would continue to 7th Avenue under the federal Superfund program
January 1997	Honeywell submitted the Honeywell Preliminary Analysis of Freescale Model to ADEQ
March 1997	The Companies submitted the Remedial Design Work Plan Operable Unit 2 to ADEQ
October 1997	The Companies submitted the Preliminary (30%) Design Report Operable Unit 2 Area to ADEQ
September 18, 1998	The Companies submitted the Pre-Final (90%) Design Report Operable Unit 2 Area to ADEQ
November 1998	Environmental Simulations Inc submitted the Groundwater Modeling of the OU2 Recovery System to Honeywell
November 10, 1998	EPA issued a Unilateral Administrative Order (UAO) to The Companies for construction, star up, and two years of operation and maintenance of the groundwater treatment system
July 1999	The Final 100% Design Report Operable Unit 2, Motorola 52nd Street Superfund Site
September 30, 1999	EPA issued the Explanation of Significant Differences to Operable Unit 2 Record of Decision
November 1999	The Companies submitted the Remedial Action Work Plan Operable Unit 2 Area
March 2000	Construction of the treatment system began
May 2000	EPA submitted Comments to Draft and Final Remedial Action Work Plans to Freescale, Honeywell
March 2001	IT Corporation submitted the Summary of Preliminary Groundwater Flow and Contaminant Transport Simulations to EPA

Table 1 - Chronology of Events at the OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Date	Event
July 11, 2001	The Arbitrators Final Decision and Findings of Fact and Conclusions of Law was submitted to the Companies.
September 24, 2001	Construction Completion Notification was provided to the EPA
September 26, 2001	Pre-final construction inspection was conducted by ADEQ and EPA
September 28, 2001	EPA issued the Five Year Review Report First Five Year Review Report
October 23, 2001	Final construction inspection was conducted by ADEQ and EPA
December 6, 2001	The Companies submitted the Construction Completion Report
December 13, 2001	The OU2 groundwater treatment system became fully operational, designed to pump at a rate of approximately 5,000 gallons per minute
January 2002	The Companies submitted the Start Up Report 20th Street Groundwater Treatment Facility to EPA
January 24, 2002	The Companies submitted the Operation and Maintenance Manual.
February 6, 2002	Updates and revisions to the Operation and Maintenance Manual were submitted
May 2002	Freescale conducted an additional investigation of the bedrock ridge area and submitted a report of the results
May 11, 2002	Updates and revisions to the Operation and Maintenance Manual was submitted
June 7, 2002	The Companies submitted the Revised Tables and Figures July thru November 2001 Baseline Monitoring Report OU2 to EPA
July 13, 2002	Updates and revisions to the Operation and Maintenance Manual was submitted
August 29, 2002	The Companies submitted the Results of Hydrogeological and Construction Services for Installation of Extraction and Monitor Wells to Honeywell, Freescale.
October 18, 2002	The Companies submitted the Groundwater Extraction System Adjustments OU2 to EPA
November 2002	The OU2 groundwater treatment system's pumping rate was reduced to 2,650 gpm
November 5, 2002	Freescale submitted the Evaluation of Groundwater Extraction Rates OU2 Remedy to EPA
December 24, 2002	The Companies submitted the Proposal/Concurrence to Install Additional Groundwater Monitoring Wells OU2 to EPA.
February 28, 2003	The Companies submitted a Revised Proposal to Install Additional groundwater Monitoring Wells and Responses to February 7th EPA Comment on the December 24, 2002 Proposal to Install Additional Monitoring Wells
March 27, 2003	The Companies submitted an Addendum to Revised Proposal to Install Additional Monitor Wells dated February 28, 2003
April 2003	The Companies submitted the Effectiveness Report 2002, 20th Street Groundwater Treatment Facility
April 4, 2003	EPA approved the revised proposal to install 11 groundwater monitoring wells
April 10, 2003	The Companies submitted the Draft Remedial Action Report for Motorola 52nd Street Superfund Site Operable Unit 2
April 10, 2003	The Companies submitted the Remedial Action Report
April 11, 2003	The Companies submitted the Revised 2002 OU2 Annual Effectiveness Report.
May 15, 2003	The Companies submitted a clarification letter to the revised proposal dated February 28, 2003 to install eight additional groundwater monitoring wells at four locations
June -July 2003	The Companies installed 11 additional monitoring wells to provide more data to assess groundwater capture of the treatment system.
September 12, 2003	The Companies submitted Results of Additional Monitoring Well Installations.

Table 1 - Chronology of Events at the OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Date	Event
November 2003	The combined extraction well flow rate was maintained at 2,350 gpm (300 gpm lower than the previous year) with the southern extraction well operating in a cyclic pumping mode
December 2003	EPA issued the Second Amended UAO.
January 26, 2004	The Companies submitted a proposal Staged Restart of Extraction Wells EW-M and EW-S in February 2004 After SRP Grand Canal Shutdown
February 6, 2004	The Companies submitted Responses to February 2nd EPA comments on the Staged Restart of Extraction Wells EW-M and EW-S Proposal Dated January 26, 2004
March 1, 2004	The Companies submitted a Proposal to Install One Additional Groundwater Monitor Well Screened in the Basin Fill Deposits South of EW-06 in response to EPA's letter dated February 19, 2004.
March 2004	A new monitor well (NW09-D) was added to better define the lateral and vertical extent of contamination to the south around 20th Street
March 23, 2004	The Companies submitted an Evaluation of Hydraulic Capture After Staged Restart of Extraction Wells EW-M and EW-S on February 11, 2004 after SRP Grand Canal Shutdown
April 15, 2004	The Companies submitted the 2003 Effectiveness Report
May 18, 2004	The Companies submitted a Notification Letter of a Newly Installed Groundwater Monitor Well NW09-D Preliminary Analytical Results. TCE was found at a concentration of 10 ppb. This well location is slightly outside of the southern extent of capture
May 28, 2004	The Companies submitted Capture Zone Calculations for OU2 The following analyses were conducted (1) a flow net was manually drawn, (2) a simple capture zone analysis, (3) an evaluation of groundwater chemistry concentration trends
July 1, 2004	The Companies submitted a revised Operation and Maintenance Manual
July 14, 2004	The Quarterly Groundwater Monitoring Report for the period March through May 3004 was submitted
July 19, 2004	The Companies submitted a report documenting the abandonment of ADEQ monitor well EW-12 and the modification of ADEQ monitor well EW-7
October 14, 2004	The Companies submitted a Work Plan to Install Four Additional Groundwater Monitor Wells The Work Plan describes the rationale, procedures, and schedule for the groundwater monitor well installations planned to further characterize the extent of chlorinated solvents at the boundaries of the groundwater plume around 20th Street
October 15, 2004	The Quarterly Groundwater Monitoring Report for the period June through August 2004 was submitted
November 10, 2004	The Companies submitted the revised Work Plan to Install Four Additional Groundwater Monitor Wells, Operable Unit 2 Area
January 15, 2005	The Quarterly Monitoring Report for the period September through November 2004 was submitted
April 14, 2005	The Companies submitted the December 2004 through February 2005 Groundwater Monitoring Report, and the Effectiveness Report - 2004 20th Street Groundwater Treatment Facility 52nd Street Superfund Site
June 14, 2005	The Companies submitted the Addendum the Construction Completion Report, Results of Additional Groundwater Monitor Well (NW09-D2, NW10-D, NW11-D, and NW-12D) Installations
July 11, 2005	The Companies submitted the March - May 2005 Groundwater Monitoring Report

Table 1 - Chronology of Events at the OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Date	Event
July 27, 2005	Freescale letter submitted requesting EPA concurrence on the sale of portion of the land at 12 N 20th for the City of Phoenix Light Rail Project
August 29, 2005	EPA concurrence on sale of 255 square feet of land
September 22, 2005	The Companies submitted the Technical Memorandum including Work Plan to Install Additional Groundwater Monitor Wells/Piezometers at Four Locations
October 7, 2005	The Companies submitted Responses to EPA September 6, 2005 Comments.
October 14, 2005	The Companies submitted the June through August 2005 Groundwater Monitoring Report
April 14, 2006	The Companies submitted the 2005 Effectiveness for OU2

Notes:
On the 15th of each month Conestoga-Rovers submitted Monthly Progress Reports.
ADEQ - Arizona Department of Environmental Quality
ADHS - Arizona Department of Health and Safety
ATSDR - Agency for Toxic Substances and Disease Registry
Companies - Refers to Freescale and Honeywell
CRA - Conestoga-Rovers
EPA - U S Environmental Protection Agency
GMR - Groundwater Monitoring Report
OU2 - Operable Unit 2
PRP - Potentially Responsible Party
TCE - Trichloroethene
WQARF - Water Quality Assurance Revolving Fund

Freescale was used to refer to both Motorola and Freescale
Honeywell was used to refer to both Allied-Signal and Honeywell

Table 2 - Summary of Monthly Progress Reports for the OU2 Treatment System
Motorola 52nd Street Superfund Site
Phoenix, Arizona

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	**Summary of Monthly Progress Reports- Motorola OU2 (From January 2002)**																				
2																					
3	**Report Period**	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03
4																					
5	**System Operations**								EW-N and EW-S				EW-N and EW-S								
6	Significant Issues	None	SRP Down	None	None	None	None	None	Flow reduced	None	EW-S reduced	None	Flow Reduced	None	SRP Down	SRP Maint	SRP Flooded	None	EW-S low levels	EW-S Reduced	None
7	Percent Operational	97	100	87	99 3	99 3	99 8	100	94	99 9	96 4	99 5	99 6	99 6	100*	100*	87 3*	98 2	99 9	99 9	99 4
8	Carbon Changeout	None	None	None	None	None	Yes	Yes	None	None	Yes	Yes	None	None	None	None	None	None	None	None	None
9	**Average Well Extraction Rate, gpm**																				
10	EW-N																				
11	EW-M																				
12	EW-S, Cyclic Operation (10/03 to 2/04)																				
13	**Total System Extraction Rate, gpm**	NR	NR	NR	NR	NR	NR	3,400	3,250	3,250	3,200	3,200	2,650	2,650	2,650	2,650	2,650	2,650	2,650	2,600	2,600
14	**Volume Water Extracted (MG)**																				
15	Total Volume Extracted	156 8	13 9	126 9	159 8	147 7	150 7	144 5	132 8	134 5	132 8	133 6	114 9	116 4	28 3	50 9	102 3	111 4	117 1	110 8	114 7
16	Cumulative (from 12/01)	156 8	170 7	297 6	457 4	605 1	755 8	900 3	1,033 1	1,167 6	1,300 4	1,434 0	1,548 9	1,665 3	1,693 6	1,744 5	1,846 8	1,958 2	2,075 3	2,186 1	2,300 8
17	**Volume Water Discharged (MG)**																				
18	Report Period	153 8	13 6	124 5	157 3	144 2	148	141 7	131 6	133 2	130 4	131 1	113 3	114 5	27 9	50 5	101 7	109 9	115 8	109 8	113 3
19	Cumulative (from 12/01)	153 8	167 4	291 9	449 2	593 4	741 4	883 1	1,014 7	1,147 9	1,278 3	1,409 4	1,522 7	1,637 2	1,665 1	1,715 6	1,817 3	1,927 2	2,043 0	2,152 8	2,266 1
20																					
21	**VOCs Influent, ug/L**																				
22	**(based quarterly sample event)** EW-N	85 8		78 3			57 1				41 3			33 7			30 3			21 4	
23	EW-M	457 9		471 8			346 7				281 7			253			276 6			238 1	
24	EW-S	298 8		231 8			186 2				148 3			133 9			140 5			97 1	
25																					
26	**VOCs Combined Influent, ug/L**	293 8	NR	292 8	261 2	215	205 7	180 7	215 6	217	183 2	205 3	176	181 6	180 1	201 7	194 9	180	180 5	151 9	167 3
27	**VOCs Discharged, ug/L**	0	NR	0	15 3	32 2	31 8	4 2	23 8	33 6	53 4	24 8	10 4	15 3	31 9	23 4	22 1	0	0	3 2	13 4
28	**Estimated Percent VOC Removal**	100	NC	100	94	85	85	82	89	85	71	88	94	92	82	88	89	100	100	98	92
29	**Reported Total VOCs Removed, lbs.**	384	NR	344	328	225	219	213	213	206	144	201	159	162	35	76	147	167	176	138	147
30	Cumulative (from 12/01)	384	384	728	1056	1281	1500	1713	1926	2132	2276	2477	2636	2798	2833	2909	3056	3223	3399	3537	3684
31																					
32	**Facility Discharge Criteria Exceedances**	None	NS	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
33	**SRP Discharge Criteria Exceedances**	None		None			None				None			None			None			None	
34																					
35																					
36	**Legend**																				
37	NC= not calculated																				
38	NS= not sampled																				
39	NR= not reported																				
40	* = When operational																				
41	(1) = Breakthrough on 3 of 4 primary GAC units																				
42	(2) = Reached 82% of TCE discharge standard																				
43	(3) = No carbon changeout, but spent carbon was removed																				
44	(4) = Estimated, inadequate surrogate compound recovery																				

Table 2 - Summary of Monthly Progress Reports for the OU2 Treatment System
Motorola 52nd Street Superfund Site
Phoenix, Arizona

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
1	**Summary of Monthly Progress Reports- Motoro**																				
2																					
3	**Report Period**	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05
4																					
5	**System Operations**		EW-N					SRP partially down	Continuing	EW-M		EW-M	EW-M		EW-M	EW-S Pump	EW-M FCV & EW-S Motor		SRP Flooded &	EW-M Repair &	
6	Significant Issues	None	Reduced	EW-S Cyclical	None	None	SRP Down	and Staged Startup	Staged Startup	Reduced	None	Rehab	Reduced	None	Reduced	Motor Replaced	Repaired, SRP Flooded	SRP Flooded	Annual Shutdown	SRP Shutdown	None
7	Percent Operational	98 9	99 9	99 9	97 8	99 9	100	99 5	99 9	97 9	99 9	95 3	98 8	100	99 4	94 6	95	86*	0	100*	99 9
8	Carbon Changeout	None	Yes	Yes	None	None	None	Yes	Yes	Yes	Yes	Yes	None	None	Yes	Yes	None	None	None	None	None
9	**Average Well Extraction Rate, gpm**																				
10	EW-N				650	650	650	0	0	0	0	850	0	0	600*	600	600	600*	0	800/600	600
11	EW-M				1,450	1,450	1,450	1,650	1,650	1,600	1,600	0	1,400	1,400	1,300	1,300	1300*	1300*	0	1350*	1350
12	EW-S, Cyclic Operation (10/03 to 2/04)				209	209	209	200	200	200	200	200	200	200	200	200*	200*	200*	0	200	200
13	**Total System Extraction Rate, gpm**	2,600	2,400	2,350	2,309	2,309	2309	1,850	1,850	1,800	1,800	1050	1600	1600	2100*	2100*	2100*	2100*	0	2150*	2150
14	**Volume Water Extracted (MG)**																				
15	*Total Volume Extracted*	*112*	*107*	*98 9*	*94 5*	*97*	*26 4*	*44 3*	*73 3*	*69 7*	*74 9*	*49 3*	*70*	*68 7*	*71 8*	*82 3*	*75 3*	*80 2*	*0*	*39 0*	*95 9*
16	Cumulative (from 12/01)	2,412 8	2,519 8	2,618 7	2,713 2	2,810 2	2,836 6	2,880 9	2,954 2	3,023 9	3,098 8	3,148 1	3,218 1	3,286 8	3,358 6	3,440 9	3,516 2	3,596 4	3,596 4	3,635 4	3,731 3
17	**Volume Water Discharged (MG)**						-759 8														
18	Report Period	110 9	105	96 9	93 3	93 3	25 8	43 3	71 8	66 1	73 4	47 7	68 2	67 1	70 3	80 7	74 6	78 9	0	38 8	95 3
19	Cumulative (from 12/01)	2,377 0	2,482 0	2,578 9	2,672 2	2,765 5	2,791 3	2,834 6	2,906 4	2,972 5	3,045 9	3,093 6	3,161 8	3,228 9	3,299 2	3,379 9	3,454 5	3,533 4	3,533 4	3,572 2	3,667 5
20							-742 1														
21	**VOCs Influent, ug/L**																				
22	**(based quarterly sample event)** EW-N		21 5			17						10 7			15			18 7			11 2
23	EW-M		195 4			192 4									186 2			213 8			220 4
24	EW-S		104 6			99 4						99 3			120 7			117 4			140 2
25																					
26	**VOCs Combined Influent, ug/L**	154 2	142	151	150 2	161 5	137 3	244 4	218	207 1	182 5	29 2	197 1	190 1	174 4	123	151 5	136 5	NS	141 1	148 2
27	**VOCs Discharged, ug/L**	36 7	41 5	21 7	12 6	39 3	61 4	27 7	5 2	0	5 2	0	0	2 9	5 6	0	0	1 0	NS	7 8	10 7
28	**Estimated Percent VOC Removal**	76	71	86	92	76	55	89	98	100	97	100	100	98	97	100	100	99	0	94	93
29	**Reported Total VOCs Removed, lbs**	110	90	107	108	100	17	80	116	120	111	12	115	107	101	84	95	91	NC	43	110
30	Cumulative (from 12/01)	3794	3884	3991	4099	4199	4216	4296	4412	4532	4643	4655	4770	4877	4978	5062	5157	5248	5248	5291	5401
31							-1032														
32	**Facility Discharge Criteria Exceedances**	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
33	**SRP Discharge Criteria Exceedances**		None			None			None			None			None			None			None
34																					
35																					
36	**Legend**																				
37	NC= not calculated																				
38	NS= not sampled																				
39	NR= not reported																				
40	* = When operational																				
41	(1) = Breakthrough on 3 of 4 primary GAC units																				
42	(2) = Reached 82% of TCE discharge standard																				
43	(3) = No carbon changeout, but spent carbon was re																				
44	(4) = Estimated, inadequate surrogate compound re																				

Table 2 - Summary of Monthly Progress Reports for the OU2 Treatment System
Motorola 52nd Street Superfund Site
Phoenix, Arizona

	A	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD
1	**Summary of Monthly Progress Reports- Motoro**															
2																
3	**Report Period**	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06
4										Shutdown -						
5	**System Operations**									elevated TCE	SRP Annual					
6	Significant Issues	None	None	None	None	None	None	None	None	discharge	Shutdown	None	None	None	None	None
7	Percent Operational	99 9	99 9	99 8	99 9	94 0	100 0	99 6	98 2	76 5	13 9	80 9	98 8	99 7	99 8	99 4
8	Carbon Changeout	None	None	None	None	Yes	Yes	None	None(1)	Yes	Yes	None(3)	None(3)	Yes	None	None
9	**Average Well Extraction Rate, gpm**															
10	EW-N	600	600	600	600	600	600	600	600	600*	600*	600*	600	600	600	600
11	EW-M	1350	1350	1350	1350	1350	1350	1350	1350	1350*	1350*	1350*	1350	1350	1350	1350
12	EW-S, Cyclic Operation (10/03 to 2/04)	200	200	200	200	200	200	200	200	200*	200*	200*	200	200	200	200
13	**Total System Extraction Rate, gpm**	2150	2150	2150	2150	2150	2150	2150	2150	2150*	2150*	2150*	2150	2150	2150	2150
14	**Volume Water Extracted (MG)**															
15	Total Volume Extracted	92 4	95 2	90 6	94 3	88 6	92 0	95 0	90 2	69 9	16 1	68 8	93 5	90 9	92 9	89 5
16	Cumulative (from 12/01)	3,823 7	3,918 9	4,009 5	4,103 8	4,192 4	4,284 4	4,379 4	4,469 6	4,539 5	4,555 6	4,624 4	4,717 9	4,808 8	4,901 7	4,991 2
17	**Volume Water Discharged (MG)**															
18	Report Period	91 7	93 7	89 1	93 3	87 4	90 2	93 1	89 0	68 5	15 7	67 9	93 0	90 1	92 9	89 6
19	Cumulative (from 12/01)	3,759 2	3,852 9	3,942 0	4,035 3	4,122 7	4,212 9	4,306 0	4,395 0	4,463 5	4,479 2	4,547 1	4,640 1	4,730 2	4,823 1	4,912 7
20																
21	**VOCs Influent, ug/L**															
22	**(based quarterly sample event)** EW-N			13 2			16 7						21 2			15 8(4)
23	EW-M			251 8			234 3						269 4			269 2(4)
24	EW-S			100 2			94 9						87			84 7(4)
25																
26	**VOCs Combined Influent, ug/L**	161 5	188 1	172 5	224	105 2	161 4	184 3	177 1	189 1	177 6	185 6	177 2	217 1	169 7(4)	188 8(4)
27	**VOCs Discharged, ug/L**	23 3	17 7	0	3	15	0	3	12 6	0	0	0	1 4	7 8	0(4)	0(4)
28	**Estimated Percent VOC Removal**	86	91	100	99	86	100	98	93	100	100	100	99	96	100	100
29	**Reported Total VOCs Removed, lbs**	107	135	130	174	67	124	144	124	110	24	106	137	157	132	141
30	Cumulative (from 12/01)	5508	5643	5773	5947	6014	6138	6282	6406	6516	6540	6646	6783	6940	7072	7213
31																
32	**Facility Discharge Criteria Exceedances**	None	None	None	None	None	None	None	None(2)	None	None	None	None	None	None	None
33	**SRP Discharge Criteria Exceedances**			None			None			None			None			None
34																
35																
36	**Legend**															
37	NC= not calculated															
38	NS= not sampled															
39	NR= not reported															
40	* = When operational															
41	(1) = Breakthrough on 3 of 4 primary GAC units															
42	(2) = Reached 82% of TCE discharge standard															
43	(3) = No carbon changeout, but spent carbon was re															
44	(4) = Estimated, inadequate surrogate compound re															

Table 3 - Annual O&M Costs for the OU2 Treatment System
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Year	Total O&M Costs
2001	$415,702[1]
2002	$1,027,508
2003	$776,431
2004	$1,009,540
2005	$828,500

Notes

1 The total for 2001 reflects the timing of the start-up and commissioning of the OU2 system.

Table 4 - Actions Taken Since the Last Five-Year Review for OU2
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Issues from Previous Review	Recommendations/Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Evaluation of lower flow rates in extraction wells particularly EW-S not completed and revised model inputs have not been provided	PRPs will submit remaining information and EW-S analysis and model inputs EPA and ADEQ will need to conduct a thorough review of data	Honeywell & Motorola	10/15/2001	The Companies have evaluated EW-S on a number of occasions including in *Results of Hydrogeologic and Construction Services for Installation of Extraction and Monitor Wells, 52nd Street Superfund Site, Operable Unit 2, Phoenix, Arizona* report dated August 29, 2002 , the *2002 Effectiveness Report*, the *Capture Zone Calculations - Operable Unit 2* letter report (2004), and the *2005 Effectiveness Report*	8/29/2002
Hydraulic monitoring well network possibly not adequate	PRPs will update the Draft O&M Manual EPA and ADEQ will need to conduct a thorough review of modified monitoring plans	Honeywell & Motorola	10/24/2001	A Final O&M Manual was submitted to EPA and ADEQ on January 25, 2002 The Final O&M Manual was revised on July 14, 2004	1/25/2002 and 7/14/2004
Institutional controls regarding access to groundwater are not identified in the ROD as part of the remedy	EPA and ADEQ will evaluate institutional controls regarding access to contaminated groundwater for the final remedy	EPA/ADEQ	NA	A final remedy for OU2 has not been selected yet	3/31/2008
Well inventory information is outdated	ADHS will complete a Draft Public Health Assessment on groundwater well use and make recommendations for further assessment	ADHS/ATSDR	10/26/2001	ADHS prepared a *Status Verification of Private Drinking Water Wells, Motorola 52nd Street Superfund Site* report	4/17/2002
ARARs are not very specific	EPA and ADEQ will evaluate more specific ARARs and also consider AZ Surface Water Limits during final remedy evaluation	EPA/ADEQ	NA	A final remedy for OU2 has not been selected yet	3/31/2008
Boron is detected at the Arizona Surface Water Limit for agricultural irrigation, and is not in the Companies monitoring program	PRPs will add boron to the treatment plant monitoring program and the data will be reviewed to confirm protectiveness is not impacted	Honeywell & Motorola	10/15/2001	Groundwater samples were collected and analyzed for boron in 2001 and 2002 Boron was detected at levels slightly above the surface water limit for agricultural irrigation	2001/2002
New chemicals of potential concern have been detected in the aquifer, as well as some chemicals may not longer be of concern	The list of COPC should be modified to reflect current groundwater conditions prior to next risk assessment Monitoring program should be revised accordingly (mercury should be evaluated)	Honeywell & Motorola	10/15/2001	Groundwater samples were collected and analyzed for metals, inorganics, VOCs, and cyanide in 2001 and 2002 Boron was the only compound other than the known COCs to be detected above a standard	2001/2002
Model used for indoor air risk evaluation is outdated and there are new inhalation toxicity values	Previous risk calculations for "current risk scenario in the baseline risk assessment (1992)" should be updated and air risk modeled using new model	EPA or ADHS/ATSDR	4/1/2002	EPA is currently developing guidance for evaluating indoor air risk Once the guidance is finalized it should be used to evaluate risks	on going

Table 5 - Summary of Current Chemical-Specific Standards
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Authority	Medium	Requirements	Requirement Synopsis	Remedy Compliance with Current Standards
Federal Regulatory Requirements	Groundwater	Federal safe Drinking Water Maximum Contaminant Levels (MCLs) for organic and inorganic chemicals (40 CFR 141 Subparts B and G)	MCLs have been promulgated for a number of common organic and inorganic contaminants These levels regulate the concentrations of contaminants in public drinking water supplies, and are considered relevant and appropriate for groundwater aquifers potentially used for drinking water	Current groundwater conditions within the Site have shown that many of the contaminants of concern are above their specific MCLs in OU2 wells This may be an ARAR for the final remedy
		EPA Region IX Preliminary Remediation goals (PRGs)	EPA Region IX guidelines establishing concentrations of compounds in tap water considered to be protective of human health	VOCs such as 1,4-Dioxane have been detected in groundwater This may be an ARAR for the final remedy
	Wastewater	Federal safe Drinking Water Maximum Contaminant Levels (MCLs) for organic and inorganic chemicals (40 CFR 141 Subparts B and G)	ARARs established in the ROD and ESD requires that treated groundwater effluent meet drinking water standards with exceedances of MCLs	Yes
	Air	EPA Region IX Preliminary Remediation goals (PRGs)	EPA Region IX guidelines establishing concentrations of compounds in air considered to be protective of human health	This may be an ARAR for the final remedy
State and Local Regulatory Requirements	Groundwater	Arizona Aquifer Water Quality Standards (AWQS), (AAC R18-11-109, AAC R18-11-406)	Statewide aquifer protection standards for organic and inorganic compounds, established for drinking water protective usage Many of the compound concentrations are comparable to the Federal MCLs If the AWQSs are more stringent than the MCLs, than the AWQSs should be used	Current groundwater conditions within the Site have shown that many of the contaminants of concern are above their specific AWQSs in OU2 wells This ARAR may be applicable to the final remedy
		ADEQ's (Office of Environmental Health) Human Health-Based Guidance Levels (HBGLs) for the Ingestion of Contaminants in Drinking Water, December 1997	This guidance document lists a variety of compounds that provides different concentration/limits based upon calculated risk-based ingestion concentrations, MCLs, proposed MCLs, and state laboratory levels of quantitation values	Current groundwater conditions within the Site have shown that many of the contaminants of concern are above their specific HBGLs in OU2 wells This may be an ARAR for the final remedy
	Air	Arizona Ambient Air Quality Guidelines	ADEQ issues permits to industries and facilities that emit regulated pollutants to ensure that these emissions do not harm public health or cause significant detenoration in areas that presently have clean air	This may be an ARAR for the final remedy
		Maricopa County VOC Limitation	This standard limits VOC emissions from any source within Maricopa County to less than 3 pounds per day	This may be an ARAR for the final remedy

Table 6 - Summary of Location and Action-Specific Standards
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Authority	Requirements	Requirement Synopsis	Remedy Compliance with ARARs
Location-Specific ARARs			
Federal Regulatory Requirements	Endangered Species 16 U S C §1531 et seq	If endangered species are found within or adjacent to the site, remedial actions shall comply with the substantive portions of the requirements for endangered species in accordance with the Endangered Species Act	Yes
	Fish and Wildlife 16 U S C §661 et seq , 40 CFR §6 302	Remedial actions shall protect the fish and wildlife of the area in accordance with 16 U S C §661 et seq	Yes
	National Archeological and Historical Preservation Act, 16 U S C §469, 36 CFR Part 65, A R S §41-841-847 and A R S §41-865	The substantive portions of the laws governing archeological discovery and preservation shall be followed if artifacts or human remains are discovered	Yes
Action-Specific ARARs			
Federal Regulatory Requirements	Federal Hazardous Materials Transportation Law, 49 U S C §§ 5401, et seq and associated rules, 40 CFR Parts 107, 171 1 - 172 558	This law regulates the transportation of hazardous substances	Yes
	Section 402 of the Clean Water Act, 33 U S C §1342	Requires a National Pollution Discharge Elimination System (NPDES) permit for discharge of pollutants to waters of the United States Discharge to the Grand Canal is within the Site boundary, therefore, the substantive requirements of §402 of the Clean Water Act is an ARAR	Yes
State and Local Regulatory Requirements	New Well Construction & Groundwater Use Requirements A R S , Title 45, 45 A R S §454 01, and A R S §45-594, -595, and -596	For activities conducted onsite, the substantive portions of the Arizona Groundwater Management Act Section 45-454 01 (GMA) are applicable Remedial actions undertaken pursuant to CERCLA must meet the following requirements a new well is subject to sections 45-594 (Well construction standards), 45-595 (Well construction requirements, licensing of well drillers and pump installation contractors), withdrawn groundwater must be reinjected into the aquifer of be put to reasonable and beneficial use, and a person who uses groundwater withdrawn in an active management area may be subject to the withdrawal fee and shall use the groundwater only pursuant to Articles 5-12 of Title 45 , Chapter 2, and 3	Yes

Table 6 - Summary of Location and Action-Specific Standards
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Authority	Requirements	Requirement Synopsis	Remedy Compliance with ARARs
State and Local Regulatory Requirements	Arizona Air Pollution Control Regulations A R S 49-401 et seq , Maricopa County Air Pollution Control Regulations Rules 200, 210, 220, and 320	As a part of the delegated program, the Maricopa County Air Pollution Control Regulations adopted by the Board of Supervisors, October 1, 1990, Maricopa County Air Quality Standards (Rules 200, 210, 220, and 320) are part of the State Implementation Plan as dictated by the Clean Air Act and/or 40 CFR 264, Subparts AA and BB The substantive portions of the regulations are applicable for remediation of groundwater at the site	Yes
	"Contained in" principle Arizona Hazardous Waste Management Act (AAC R18-8-261)	The "contained in" principle provides that any non-waste material (e g , groundwater) that contains a listed hazardous waste must be managed as if it were a hazardous waste Groundwater extracted as part of this interim remedy will contain a listed hazardous waste, therefore these regulations are applicable to the management of that groundwater	Yes
	Arizona Hazardous Waste Management Act, AAC R18-8-262	The regeneration or disposal of spent carbon or other media after use to control emissions of VOCs must be managed in conformance with the generator requirements of the state Hazardous Waste Management Act, including disposal at a permitted hazardous waste facility	Yes
	Arizona Hazardous Waste Management Act Land Disposal Restrictions, AAC R18-8-268	Groundwater treatment residuals or other media contaminated with volatile organic compounds are banned from land disposal Treatment standards must be met before wastes can be land disposed	Yes
	ROD ESD	Requires that the treated groundwater treated groundwater effluent meet drinking water standards with no exceedances of MCLs	Yes

Table 7 - Confirmation of Chemical-Specific Toxicity Values for OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Chemical of Concern	Toxicity Value Name	Toxicity Value		Source (oral/inhal)	Impact on Risk Assessment
COCs with Carcinogenic Endpoint					
Vinyl Chloride	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	1 9 / 0 3	EPA, 1997	Impact on the risk assessment needs to be evaluated
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	1 5 / 0 031	EPA, 2004	
1,1-Dichloroethene	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	0 6 / 0 18	EPA, 1999	Impact on the risk assessment de minimis
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	0 6 / 0 18	EPA, 1999	
Chloroform	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	0 0061 / 0 081	EPA, 1999	Impact on the risk assessment de minimis
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	0 031 / 0 019	EPA, 2004	
Trichloroethene	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	0 011 / 0 006	EPA, 1999	Impact on the risk assessment needs to be evaluated
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	0 013 / 0 007	EPA, 2004	
Benzene	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	0 029 / 0 027	EPA, 1999	Impact on the risk assessment de minimis
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	0 055 / 0 027	EPA, 2004	
Tetrachlorethene	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	0 052 / 0 002	EPA, 1999	Impact on the risk assessment needs to be evaluated
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	0 54 / 0 021	EPA, 2004	
1,4-Dioxane	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	Not Evaluated Previously		Impact on the risk assessment needs to be evaluated
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	0 011 / 0 011	EPA, 2004	
Total Chromium	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Previous (oral/inhalation)	Not Evaluated Previously		Impact on the risk assessment needs to be evaluated.
	Cancer Slope Factor [SF] $(mg/kg\text{-}day)^{-1}$	Current (oral/inhalation)	NL / 420	EPA, 2004	

Table 7 - Confirmation of Chemical-Specific Toxicity Values for OU2 Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Chemical of Concern	Toxicity Value Name	Toxicity Value		Source (oral/inhal)	Impact on Risk Assessment
COCs with Noncarcinogenic Effects					
1,1-Dichloroethane	Reference Doses (mg/kg-day)	Previous (oral/inhalation)	0 1 / 0 14	EPA, 1997	Impact on the risk assessment de minimis
	Reference Doses (mg/kg-day)	Current (oral/inhalation)	0 0057 / 0 0057	EPA, 2004	
1,1,1-Trichlorethane	Reference Doses (mg/kg-day)	Previous (oral/inhalation)	0 09 / 0.3	EPA, 1991	Impact on the risk assessment de minimis
	Reference Doses (mg/kg-day)	Current (oral/inhalation)	0 035 / 0 29	EPA, 1999	
trans-1,2-Dichloroethene	Reference Doses (mg/kg-day)	Previous (oral/inhalation)	0 02 / NL	EPA, 1991	Impact on the risk assessment de minimis
	Reference Doses (mg/kg-day)	Current (oral/inhalation)	0 02 / 0 02	EPA, 1999	
Chlorobenzene	Reference Doses (mg/kg-day)	Previous (oral/inhalation)	0 02 / 0 005	EPA, 1991	Impact on the risk assessment de minimis
	Reference Doses (mg/kg-day)	Current (oral/inhalation)	0 02 / 0 017	EPA, 1999	

Notes:
NL - Not Listed

Table 8 - Identified Issues and Noted Concerns for OU2
Motorola 52nd Street Superfund Site
Phoenix, Arizona

#	Issue Type	Issues	Protectiveness Affected?	
			Current	Future
1	Groundwater Capture Issues	Little to no groundwater elevation and quality data are available in any of the subunits along the north side of the OU2 plume As a result, the impact of the OU2 treatment system can not be adequately evaluated in that area Additional monitoring wells are needed along the north side of the OU2 plume in each of the subunits to evaluate the OU2 capture effectiveness	Yes	Unknown
2		Groundwater elevation and quality data are lacking in all three subunits along the south side of the OU2 plume As a result, the impact of the OU2 treatment system is difficult to assess in this area Additional monitoring wells are needed along the south side of the OU2 plume in each of the subunits to evaluate the OU2 capture effectiveness	Yes	Unknown
3		Additional groundwater elevation and quality data are needed downgradient of the OU2 treatment system to evaluate capture in the D subunit Additional monitoring wells are needed in the D subunit downgradient of the OU2 treatment system to evaluate capture in subunit D	Yes	Unknown
4		Although capture appeared more effective in 2005, it appears to be related to a northwest rotation of groundwater gradients due to recharge from the Salt River flow event However, based on a conservative interpretation of the data, using converging lines of evidence, it appears the TCZ along the south side of the plume is not fully captured	Yes	Unknown
5	Groundwater Future Issues	EW-S groundwater extraction rates have declined The well was designed to operate at 1,700 gpm The initial extraction rate for the well was approximately 800 gpm and has declined to the current extraction rate of approximately 200 gpm If the rate declines further in the future, capture to the south may also be reduced	Unknown	Unknown
6		Future containment of the D subunit is problematic because the D subunit is primarily contaminated in the south portion of OU2, EW-S does not penetrate the D subunit and therefore does not directly extract from the D subunit, and capture is currently questionable and may decrease if EW-S extraction rates continue to decline	Unknown	Unknown
7		The Agencies are concerned that the stagnation zone on the upgradient and downgradient side of the Honeywell bedrock ridge is not being addressed by the OU2 system	Unknown	Unknown
8		Long-term multi-well aquifer tests in subunits B and D are needed to gain a better understanding of the OU2 conceptual site model and to facilitate future OU2 analyses	Unknown	Unknown
9		The OU2 system is an interim remedy and therefore a final remedy for OU2 must be developed The final remedy will necessarily address the issues identified in this five-year review and must consider and integrate the Honeywell light nonaqueous phase liquid (LNAPL) remedy	Unknown	Unknown
10	Health Assessment Issues	Changes to the toxicity levels for certain contaminants have occurred since the last five-year review	Unknown	Unknown
11		New methodology is being developed for indoor air risk evaluation Once the methodology is finalized or EPA and ADEQ can agree to the process for evaluating the pathway, an indoor air risk evaluation should be performed for the OU2 area	Unknown	Unknown
12		Boron has been detected in influent and effluent samples from the treatment plant	Unknown	Unknown
13	General Issues	The 2005 Effectiveness Report is not consistent with respect to the lithologic and hydrogeologic representation and interpretation of the D subunit Cross section Figure 2 6 does not include the interpretation of bedrock or the D subunit on the east portion of the cross-section Figure 3 9 does not depict the area where the D subunit is pinched-out by the OU2 bedrock ridge Consistent interpretation of the hydrostratigraphic subunits and available data is needed for OU2 analyses (e g , interpretation of subunit D as both unconfined and semiconfined) Additionally, consistent use of available data is needed for OU2 analyses (e g , D subunit groundwater elevations along the north side of OU2)	Unknown	Unknown

Notes

ADEQ - Arizona Department of Environmental Quality
OU2 - Operable Unit 2
EPA - Environmental Protection Agency
MCL - Maximum Contaminant Level
TCE - Trichloroethene
PCE - Tetrachloroethene
VOC - Volatile Organic Compounds

Table 9 - Follow-up Actions and Recommendations
Motorola 52nd Street Superfund Site
Phoenix, Arizona

Reference Number*	Recommendation	Follow-up Actions/Recommendations	Responsible Party	Oversight Agency	Completion Date
		Follow-up Actions			
1	Groundwater Capture Issues	A work plan should be prepared and submitted to ADEQ to address the data gaps along the north side of the OU2 plume The work plan should include the installation of monitor wells in each of the three alluvial subunits	The Companies	EPA, ADEQ	9/28/2007
2		A work plan should be prepared and submitted to ADEQ to address the data gaps along the south side of the OU2 plume The work plan should include the installation of monitor wells in each of the three alluvial subunits	The Companies	EPA, ADEQ	9/28/2007
3		A work plan should be prepared and submitted to ADEQ to address the data gaps downgradient of the OU2 treatment system The work plan should include the installation of monitor wells in the D subunit	The Companies	EPA, ADEQ	9/28/2007
4		Future capture evaluations shall include a conservative interpretation of groundwater elevation data, an analysis of water level pairs for appropriately configured monitor wells, capture zone calculations that are conceptually consistent with site data and interpretation, and concentration trend analysis that includes historic data	The Companies	EPA, ADEQ	3/30/2007
5	Groundwater Future Issues	The Companies should continue to monitor the extraction rates for EW-S	The Companies	EPA, ADEQ	9/28/2007
6		The Companies should develop a plan to monitor groundwater capture along the southern boundary, particularly in subunit D	The Companies	EPA, ADEQ	9/28/2007
7		The Companies should prepare a plan to evaluate the effectiveness of the OU2 treatment system on the stagnation zones upgradient and downgradient of the Honeywell bedrock ridge	The Companies	EPA, ADEQ	9/28/2007
8		The Companies should develop a plan to conduct long-term multi-well aquifer tests in subunits B and D The data obtained from these tests will be useful for designing a final remedy for OU2	The Companies	EPA, ADEQ	9/28/2007
9		The final OU2 remedy will need to incorporate the Honeywell LNAPL remedy	EPA, ADEQ	EPA, ADEQ	September 2008
10	Health Assessment Issues	A review of the toxicity values for COCs at the Site should be conducted before the final remedy is selected	EPA, ADEQ	EPA, ADEQ	On going
11		New methodology is being developed for indoor air risk evaluation Once the methodology is finalized or EPA and ADEQ can agree to the process for evaluating the pathway, an indoor air risk evaluation should be performed for the OU2 Area	The Companies	EPA, ADEQ	1 year following ADEQ and EPA agreement on process
12		Effluent samples should be collected and analyzed for boron If the results are above the surface water limit for agricultural irrigation, SRP should be notified	The Companies	EPA, ADEQ	3/30/2007
13	General Issues	The Agencies recommend a technical work group meeting to discuss and address groundwater elevation and quality data, capture issues, and hydrostratigraphic issues	The Companies, ADEQ	EPA, ADEQ	12/1/2006

Notes

* Refer to Table 8 for reference number

ADEQ - Arizona Department of Environmental Quality

COC - Contaminant of Concern

COP - City of Phoenix

EPA - Environmental Protection Agency

MCL - Maximum Contaminant Level

O&M - Operation and Maintenance

OU2 - Operable Unit 2

The Companies - Refers to Freescale and Honeywell

TCE - Trichloroethene

VOC - Volatile Organic Compounds

FIGURES

7th Ave.
7th St.
16th St.
20th St.
24th St.
32nd St.
40th St.
44th St.
52nd St.

McDowell Rd.
Roosevelt St.
Van Buren St.
Washington St.
Buckeye Rd.

OU1
OU2
OU3

Integrated Groundwater Treatment Plant
Former Motorola 52nd St. Facility
Milum Textiles
Phoenix Newspapers
Paul McCoy's Laundry and Dry Cleaners
Baker Metal/ WAMCO/BDR
Walker Power
Capitol Engineering
Union Pacific Phoenix Railyard
Arizona Public Service (APS)
Fruehauf/Wabash
Arvin Meritor/ AdobeAir/Cooper
Salt River Project (SRP) 16th St.
OU2 Groundwater Treatment Facility
Westinghouse
Papago Plating
Honeywell Area 13
Honeywell Area 21
Fleetwood Machine Products
Aerotec International/Fleetwood
Joray/Kachina
Aviall, Inc.
Honeywell 34th St. Facility
ITT Cannon
D-Velco
Laundry Cleaners
Nelson Engineering Company

N

0 2,500 5,000 feet

1" = 2,500'

LEGEND

- Responsible Parties
- Potentially Responsible Parties
- OU3 Study Area
- M52 Site Boundary
- Treatment Systems
- OU Boundaries
- Streets

NOTES

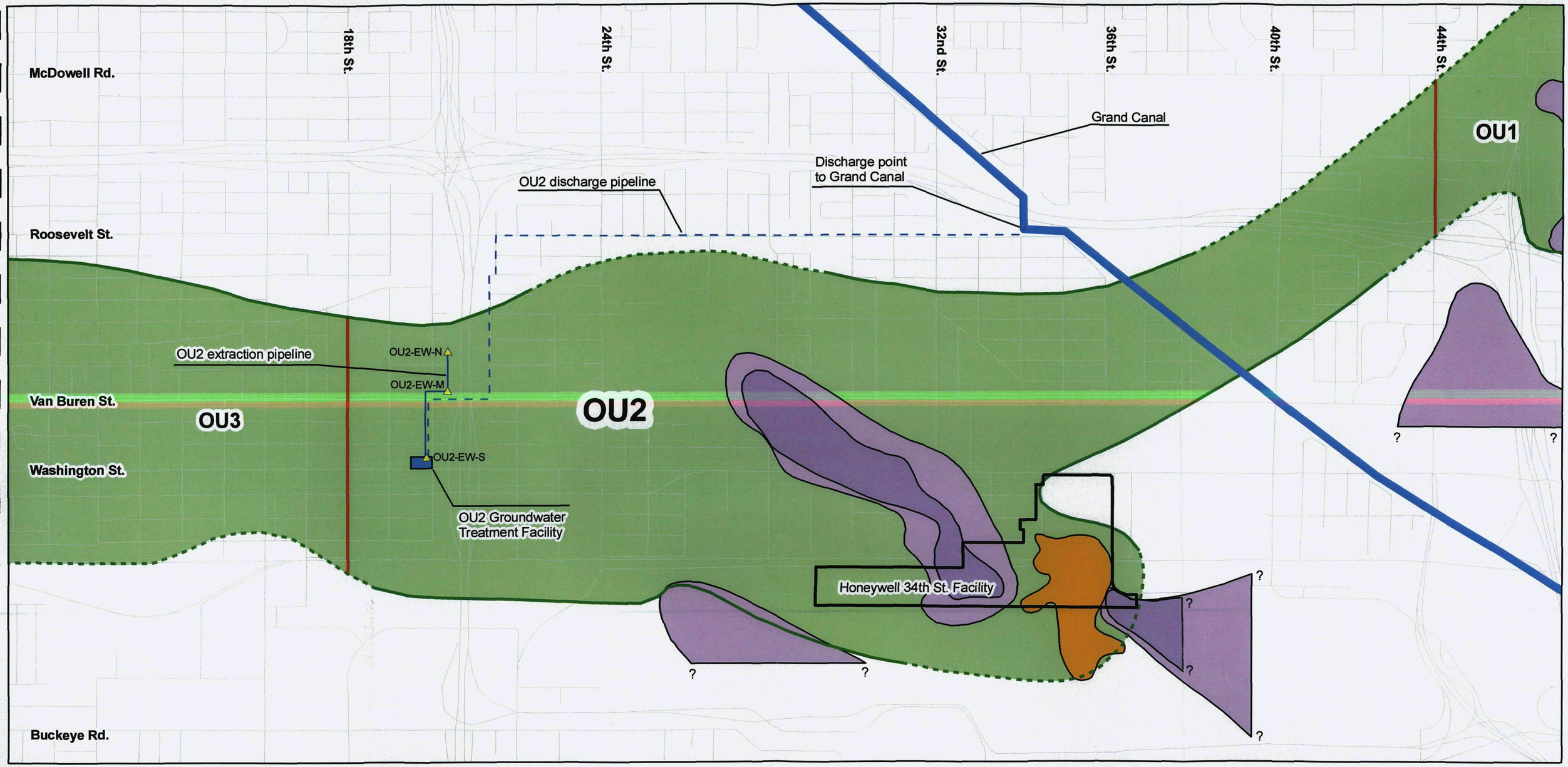
- M52 Site Boundary represents the estimated area of volatile organic compounds in alluvial and bedrock groundwater that exceed the Arizona Aquifer Water Quality Standards (AWQS) based on samples taken in September 2005. (dashed line = inferred)

MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 1

Site Vicinity Map

LFR



N

0 1,500 3,000 feet

1" = 1,500'

LEGEND

- M52 Site Boundary
- Maximum LNAPL Extent
- Unsaturated Alluvium
- Unsaturated Basin Fill
- OU Boundaries
- Streets
- Extraction Wells

NOTES

- M52 Site Boundary represents the estimated area of volatile organic compounds in alluvial and bedrock groundwater that exceed the Arizona Aquifer Water Quality Standards (AWQS) based on samples taken in September 2005 (dashed line = inferred).
- Unsaturated Alluvium represents the area of intersection of the water table and bedrock.
- Unsaturated Basin Fill represents the area of intersection of the "B" HSU and bedrock.
- Maximum LNAPL extent taken from Honeywell Focused Remedial Investigation Report (2005).

MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 2

Site Plan

LFR

12th St.
16th St.
24th St.
32nd St.
Roosevelt St.
Van Buren St.
Washington St.
EW-23
CRA1
OU2-NW-1
OU3-14D
OU3-14M
EW-7
EW-21
OU2-EW-N
OU2-PZ-2D
OU2-PZ-2S
OU3-13D
OU3-13M
EW-22D
EW-22S
OU2-NW-4D
OU2-NW-4S
OU2-NW-2
TEW-01
OU2-PZ-1D
OU2-PZ-1S
OU2-NW-5S
OU2-EW-M
EW-19D
EW-19S
OU2-NW-8D
OU2-NW-8M
OU2-NW-8S
OU2-NW-3
DM-515-210
DM-515-115
OU2-EW-S
ASE-86A
OU2-NW-6D
OU2-NW-6S
OU3-12D
OU3-12M
EWS-PZ1
ASE-77A
ASE-77B
OU2-NW-7D
OU2-NW-7S
OU2-NW-11D
OU2-NW-11M
EW-6
PHXA-06
BC-11A
BC-11B
OU2-NW-14D
OU2-NW-14M
ASE-78B
ASE-76A
ASE-76B
OU2-NW-13D
OU2-NW-13M
OU2-NW-9D
OU2-NW-9D2
OU2-NW-9M
Honeywell 34th St. Facility
ASE-88B
OU2-NW-10D

N

0 1,000 2,000 feet

1" = 1000'

LEGEND

- M52 Site Boundary
- OU2 Groundwater Treatment Facility
- Unsaturated Alluvium
- Unsaturated Basin Fill
- Streets
- Groundwater Monitor Network Wells
- Non-network Wells
- Extraction Wells

NOTES

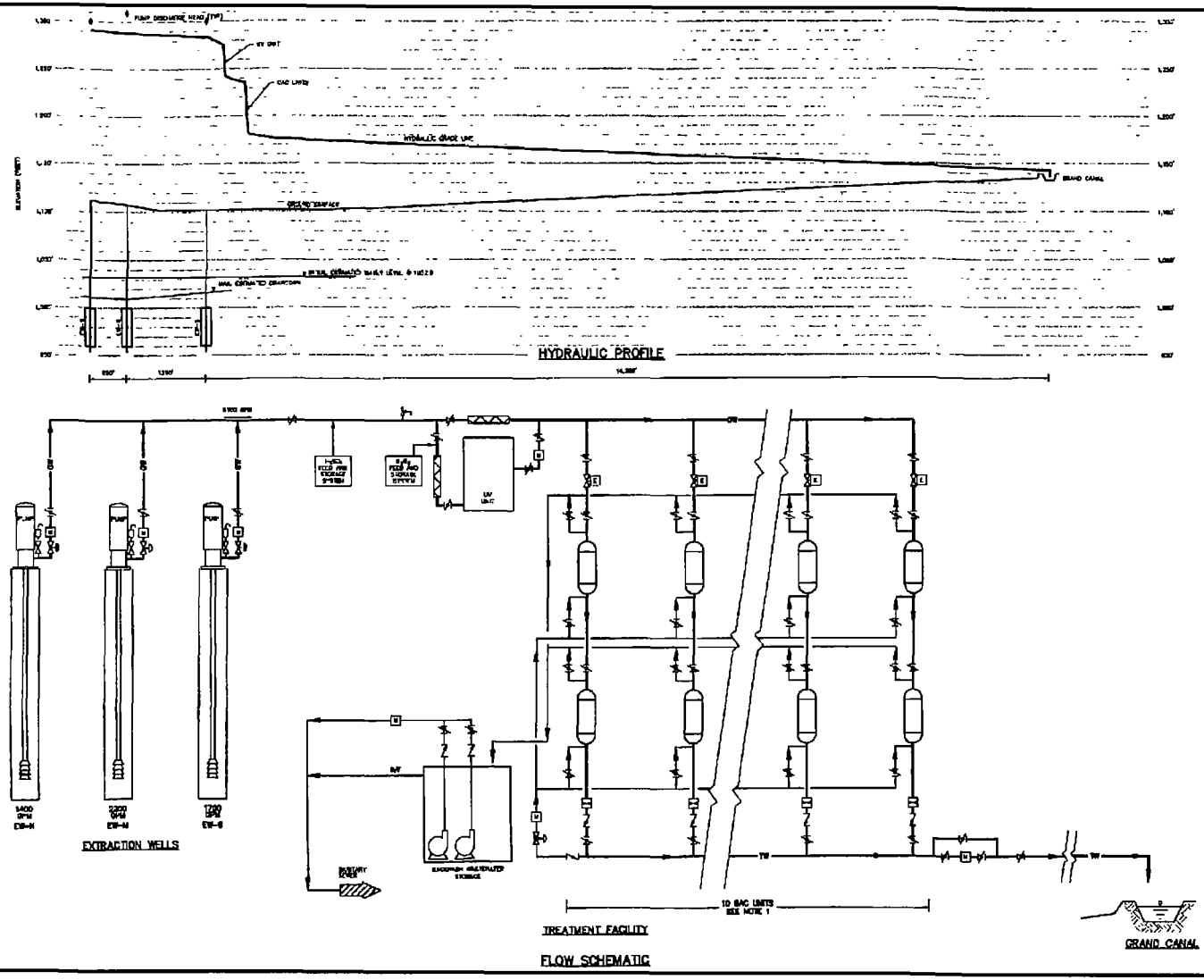
- M52 Site Boundary represents the estimated area of volatile organic compounds in alluvial and bedrock groundwater that exceed the Arizona Aquifer Water Quality Standards (AWQS) based on samples taken in September 2005 (dashed line = inferred).
- Unsaturated Alluvium represents the area of intersection of the water table and bedrock.
- Unsaturated Basin Fill represents the area of intersection of the "B" HSU and bedrock.

MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 3

Site Location Map

LFR

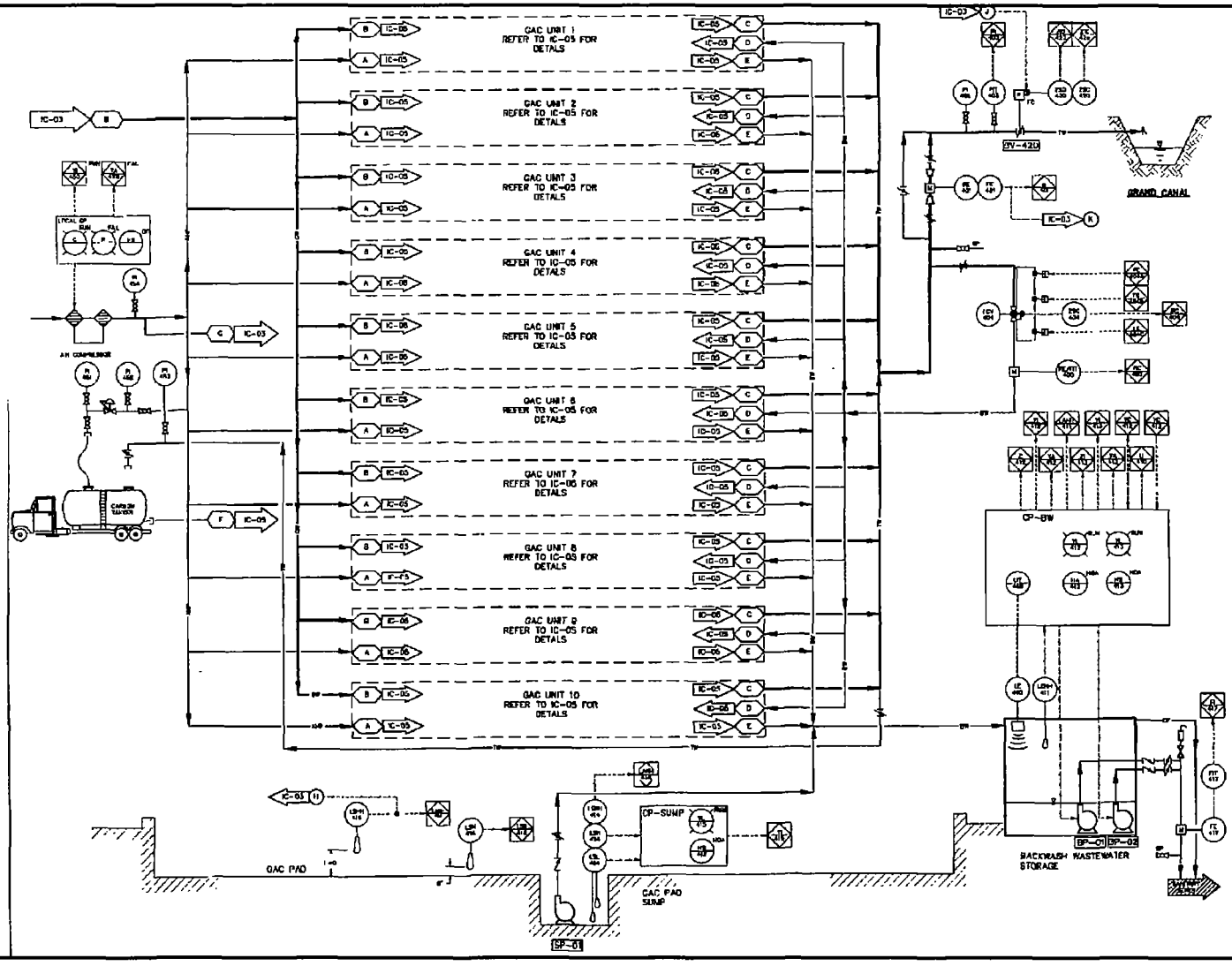


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 4

OU2 Flow Schematic
and Hydraulic Profile

LFR

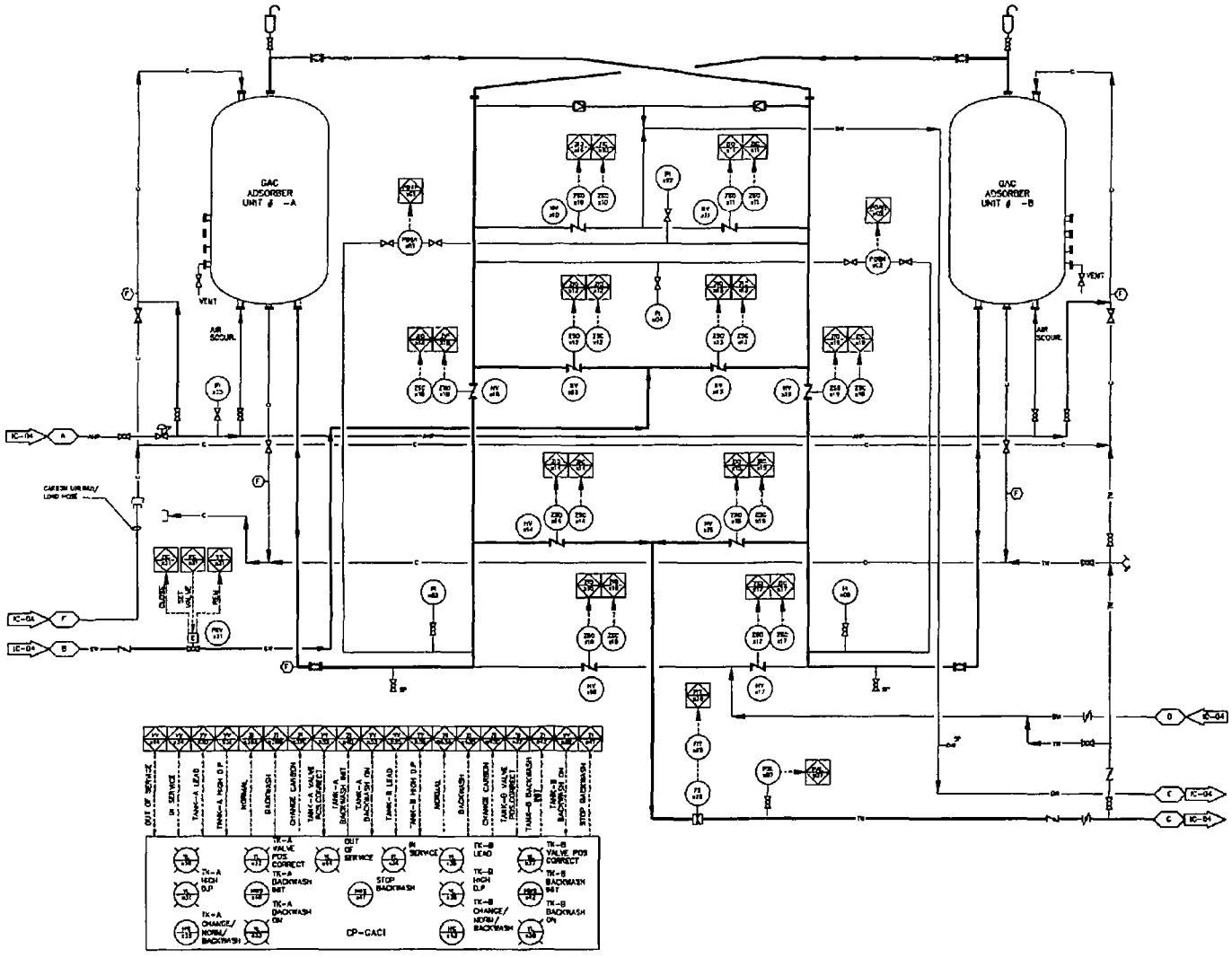


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 5

OU2 GAC System

LFR

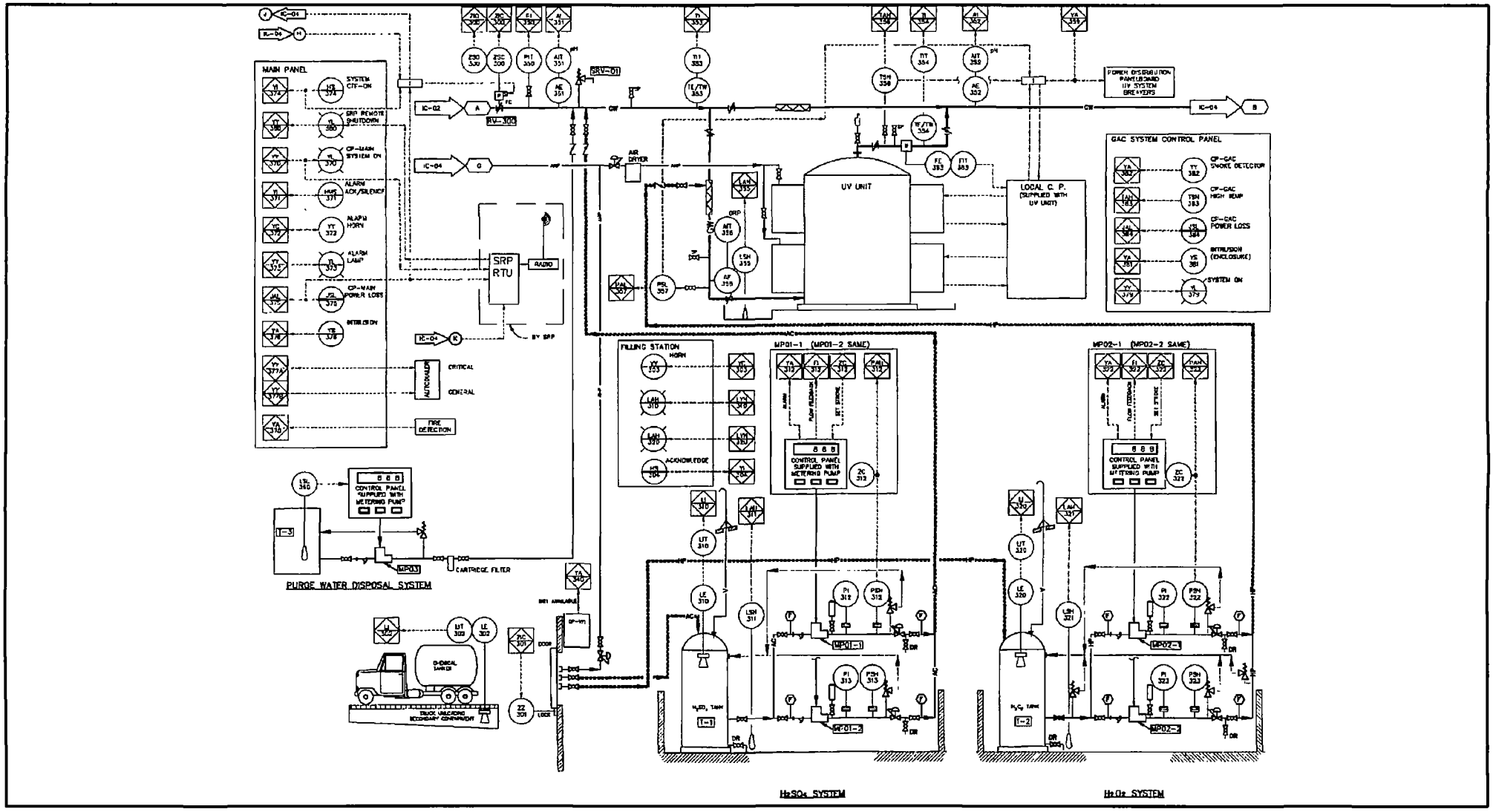


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 6

OU2 Typical GAC Unit

LFR

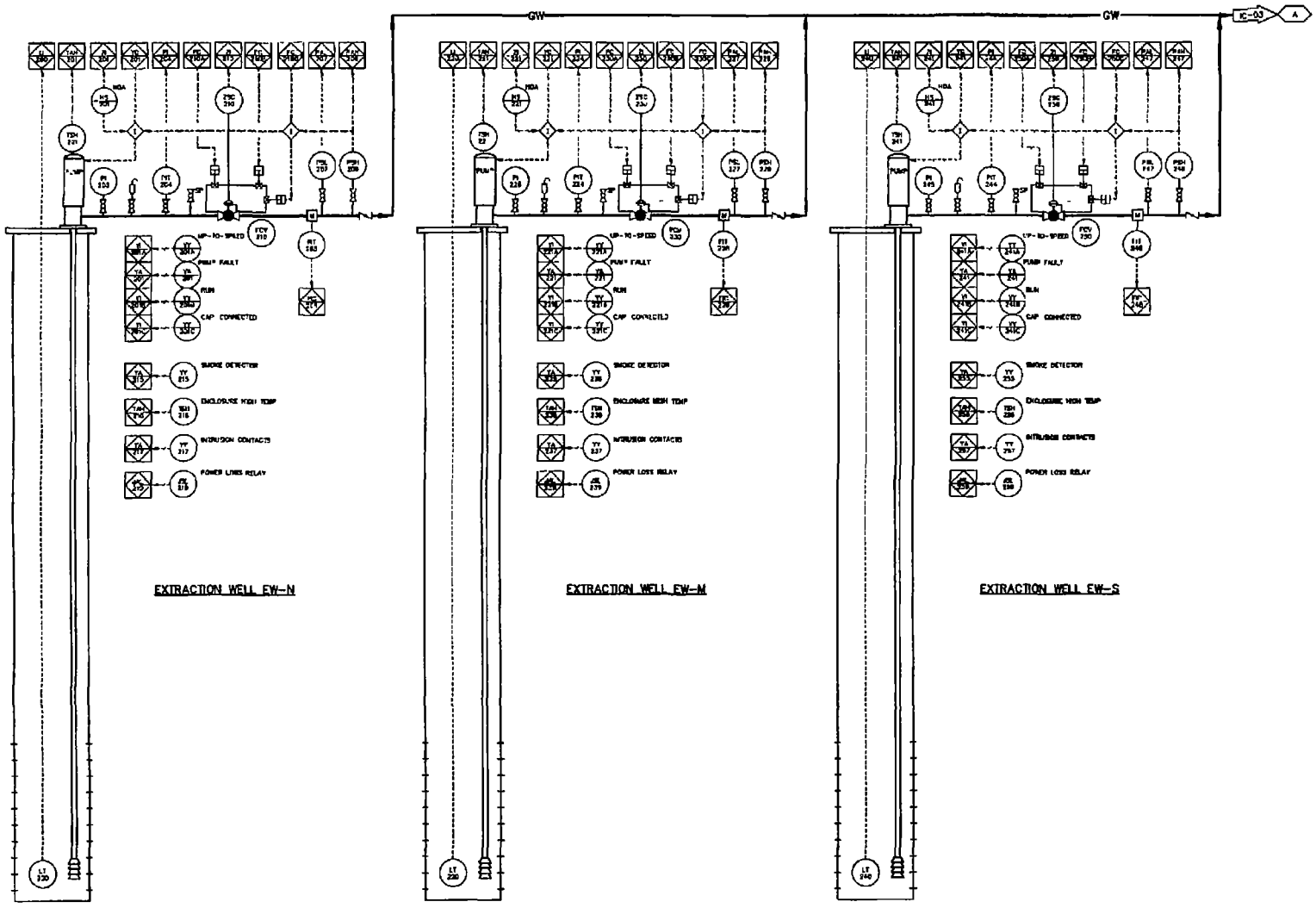


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 7

OU2 UV Unit - Chemical Storage

LFR



MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 8

OU2 Extraction Well Diagram

LFR

APPENDIX A

LIST OF DOCUMENTS REVIEWED

Amended Unilateral Administrative Order, Motorola 52nd Street Superfund Site, Operable Unit 2, U.S. EPA Operable Docket No. 98-15, dated November 30, 1998.

Black and Veach. 2003. Final Remedial Action Report, Operable Unit 2, Motorola 52nd Street Superfund Site. Report dated September 12, 2003.

Clear Creek Associates. 2003. Operable Unit 2 Groundwater Modeling 52nd Street Superfund Site. Letter dated October 2003.

CH2M Hill. 2004. Revised Corrective Action Plan, Honeywell 34th Street Facility, Phoenix, Arizona. ADEQ Facility No 0-002227, LUST File Nos. 0393.02 through 0393.10. July.

CH2M Hill. 2005. Final Focused Remedial Investigation Report, Honeywell 34th Street Facility, Phoenix, Arizona. December.

CRA. 1999. Final (100%) Design Report, Operable Unit 2 Area, Motorola 52nd Street Superfund Site, Phoenix, Arizona. Report dated July 1, 1999. Four Volumes.

CRA. 2000. Technical Memorandum Number 3, Operable Unit 2 Area, 52nd Street Superfund Site, Phoenix, Arizona. Memo dated September 7, 2000.

CRA. 2002a. Start-Up Report, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. Report dated January 11, 2002.

CRA. 2002b. Final Operation and Maintenance Manual, 20th Street groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. Report dated January 25, 2002. Thirteen volumes.

CRA. 2002c. Baseline Groundwater Monitoring Report, July through November 2001, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona. Letter report dated April 12, 2002.

CRA. 2003a. Effectiveness Report - 2002, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. April 15, 2003.

CRA. 2003b. Revised Effectiveness Report - 2002, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. August 8, 2003.

CRA. 2003c. Results of Additional Groundwater Monitor Well Installations (Addendum to the Construction Completion Report), 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. September 12, 2003.

CRA. 2004a. Staged Restart of Extraction Wells EW-M and EW-S in February 2004 after SRP Shutdown, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona. Letter report dated January 26, 2004.

CRA. 2004b. Evaluation of Hydraulic Capture After Staged Restart of Extraction Wells EW-M and EW-S on February 11, 2004 after SRP Shutdown, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona. Letter dated March 23, 2004.

CRA. 2004c. December 2003 to February 2004 Groundwater Monitoring Report, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona. Letter report dated April 15, 2004.

CRA. 2004d. Effectiveness Report - 2003, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. April 15, 2004.

CRA. 2004e. Capture Zone Calculations - Operable Unit 2 52nd Street Superfund Site - Phoenix, Arizona. Letter dated May 28, 2004.

CRA. 2004f. Addendum to Construction Completion Report, Results of Additional Groundwater Monitor Well Installation, 52nd Street Superfund Site, Operable Unit 2 Area Phoenix, Arizona. Letter report dated June 24, 2004

CRA. 2004g. March to May 2004 Groundwater Monitoring Report, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona. Letter report dated July 14, 2004.

CRA. 2004h. Revised Final Operation and Maintenance Manual, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. Report dated July 14, 2004.

CRA. 2004i. June to August 2004 Groundwater Monitoring Report, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona Letter report dated October 15, 2004.

CRA. 2005a. September to November 2004 Groundwater Monitoring Report, Operable Unit 2 Area - 52nd Street Superfund Site, Phoenix, Arizona. Letter report dated January 14, 2005.

CRA. 2005b. Effectiveness Report - 2004, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. April 14, 2005.

CRA. 2005c. Addendum to the Construction Completion Report, Results of Additional Groundwater Monitor Well (NW09-D2, NW10-D, NW11-D, and NW12-D) Installations, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. June 14, 2005.

CRA. 2005d. Revised Technical Memorandum including a Work Plan to Install Additional Groundwater Monitor Wells/Piezometers at Four Locations, 52nd Street Superfund Site - Operable Unit 2 Area, Phoenix, Arizona. October 17, 2005.

CRA. 2006a. Addendum to the Construction Completion Report, Results of Additional Groundwater Monitor Well and Piezometer (NW07-M, NW09-M, NW13-M/D, and NW14-M/D) Installations, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. March 27, 2006.

CRA. 2006b. Effectiveness Report - 2005, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. April 14, 2006.

Dames & Moore. 1993. Draft Aquifer Test Report, Well DM 518, Motorola 52nd St., dated October 20, 1993.

EPA. 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual: Part A. 1989.

EPA. 1994. Methods for Monitoring Pump-and-Teat Performance, U.S. EPA, Office of Research and Development, 1994 (EPA 600-R-94-123).

EPA. 2001. Five-Year Review Report, First Five-Year Review report for Motorola 52nd Street Superfund Site, Operable Unit Two (OU2), Phoenix, Maricopa County, Arizona. September 28, 2001.

EPA. 2002a. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, November 2002

EPA. 2002b. Elements for Effectiveness Management of Operating Pump and Treat Systems. OSWER 93555.4-27FS-A. 542-R-02-009.

EPA. 2002c. Results of Hydrogeologic and Construction Services for Installation of Extraction and Monitor Wells, 52nd Street Superfund Site, Operable Unit 2, Phoenix, Arizona. Two Volumes. Report dated August 29, 2002.

EPA. 2002d. Elements for Effective Management of Operating Pump and Treat Systems, U.S. EPA, Office of Solid Waste and Emergency Response, 2002 (EPA 542-R-02-009).

EPA. 2003a. February 28, 2003 Revised Proposal/Concurrence to Install Additional Groundwater Monitoring Wells and March 27, 2003 Addendum to Revised Proposal/Concurrence to Install Additional Groundwater Monitoring Wells, Motorola 52nd Street Superfund Site, Phoenix, Arizona, Operable Unit 2 Area. Letter dated April 4, 2003.

EPA. 2003b. Second Amended Unilateral Administrative Order. Dated December 11, 2003.

EPA. 2005. Capture Zone Analyses for Pump-and-Treat System, EPA Training Course hand-outs, presented to the State of Arizona, May 25, 2005

Explanation of Significant Difference (ESD #1) to July 1994 Record of Decision, Operable Unit Two, East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona, dated September 1999.

IT Group. 2003. Technical Memorandum, Comparison of Split Sample Results Against Surface Water Discharge Criteria, Sacramento TERC II - Contract No. DACW05-96-D-0011, CTO #12, WAD #01, Motorola, Phoenix, Arizona, dated March 31, 2003.

Reynolds, S.J. and R.D. Bartlett. 2002. Subsurface Geology of the Easternmost Phoenix Basin, Arizona: Implications for Groundwater Flow. Arizona Geological Survey Contributed Report CR-02A. Report dated August 2002.

Record of Decision, Operable Unit Two, East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona, dated July 21, 1994.

Shaw Environmental and Infrastructure. 2004. Final Split Sample Report (September 2003), Motorola 52nd Street Superfund Site, Operable Unit 2, Phoenix, Arizona. May 4, 2004.

Unilateral Administrative Order for Remedial Action, Motorola 52nd Street Superfund Site, Operable Unit 2, U.S. EPA Docket No. 98-15, dated September 11, 1998.

APPENDIX B

TCE Concentrations of Alluvial and Bedrock Aquifer and Groundwater Elevations Presented in Effectiveness Reports for 2001 (Baseline), 2002, 2003, 2004, and 2005 Operations

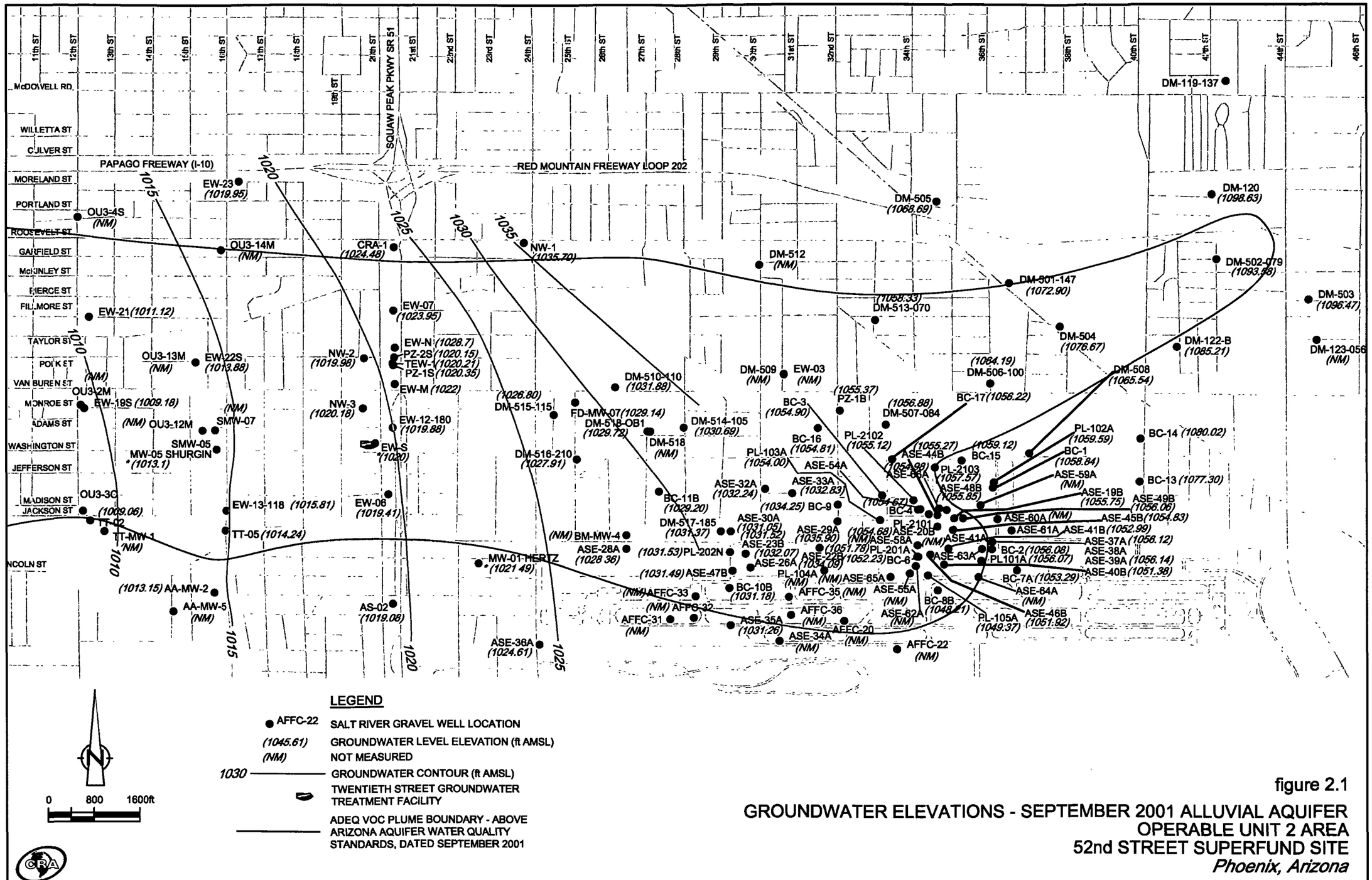


figure 2.1

GROUNDWATER ELEVATIONS - SEPTEMBER 2001 ALLUVIAL AQUIFER
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-134(008)GN-WA014 AUG 08/2003

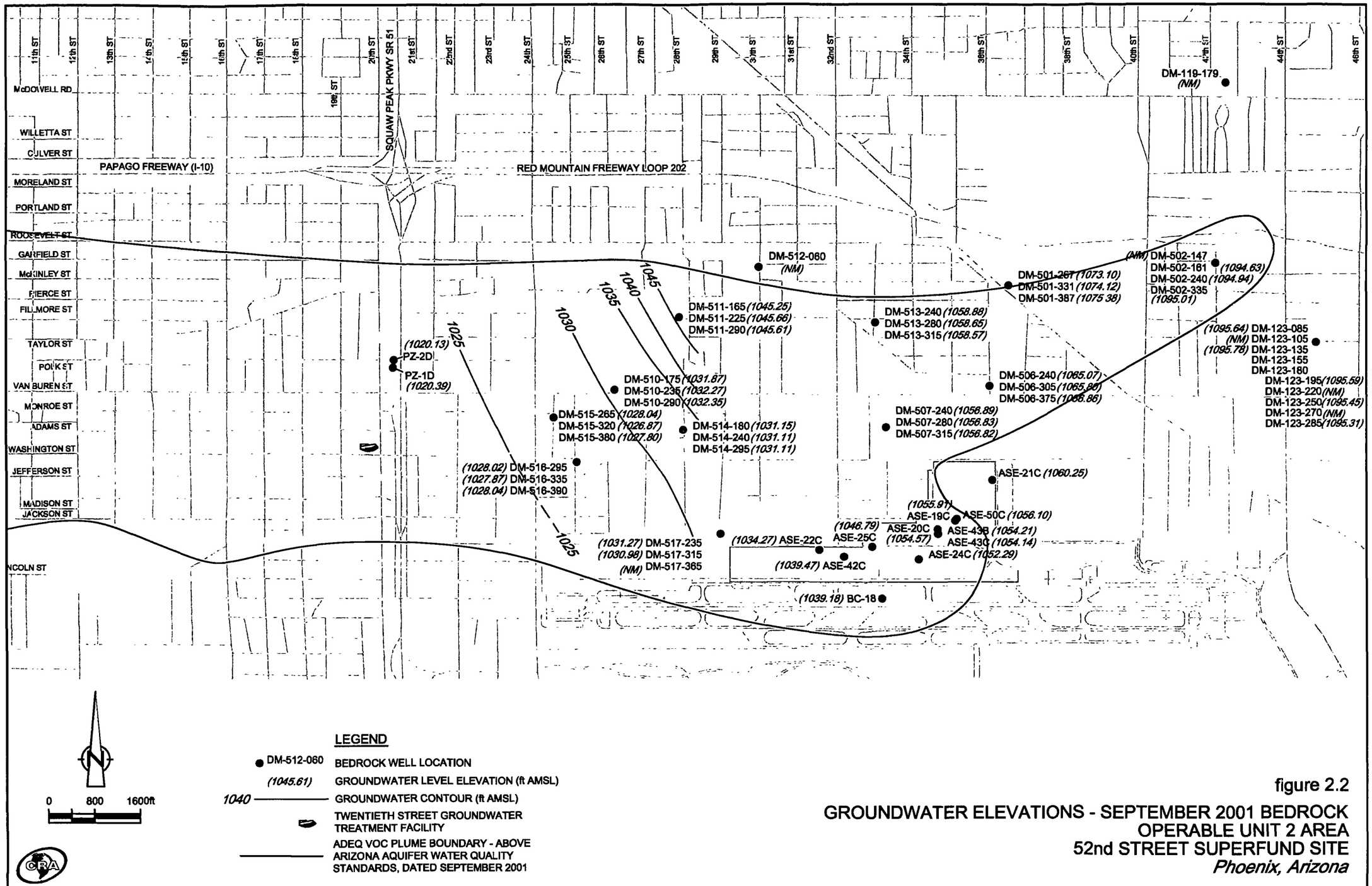


figure 2.2

GROUNDWATER ELEVATIONS - SEPTEMBER 2001 BEDROCK
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-134(008)GN-WA012 AUG 08/2003

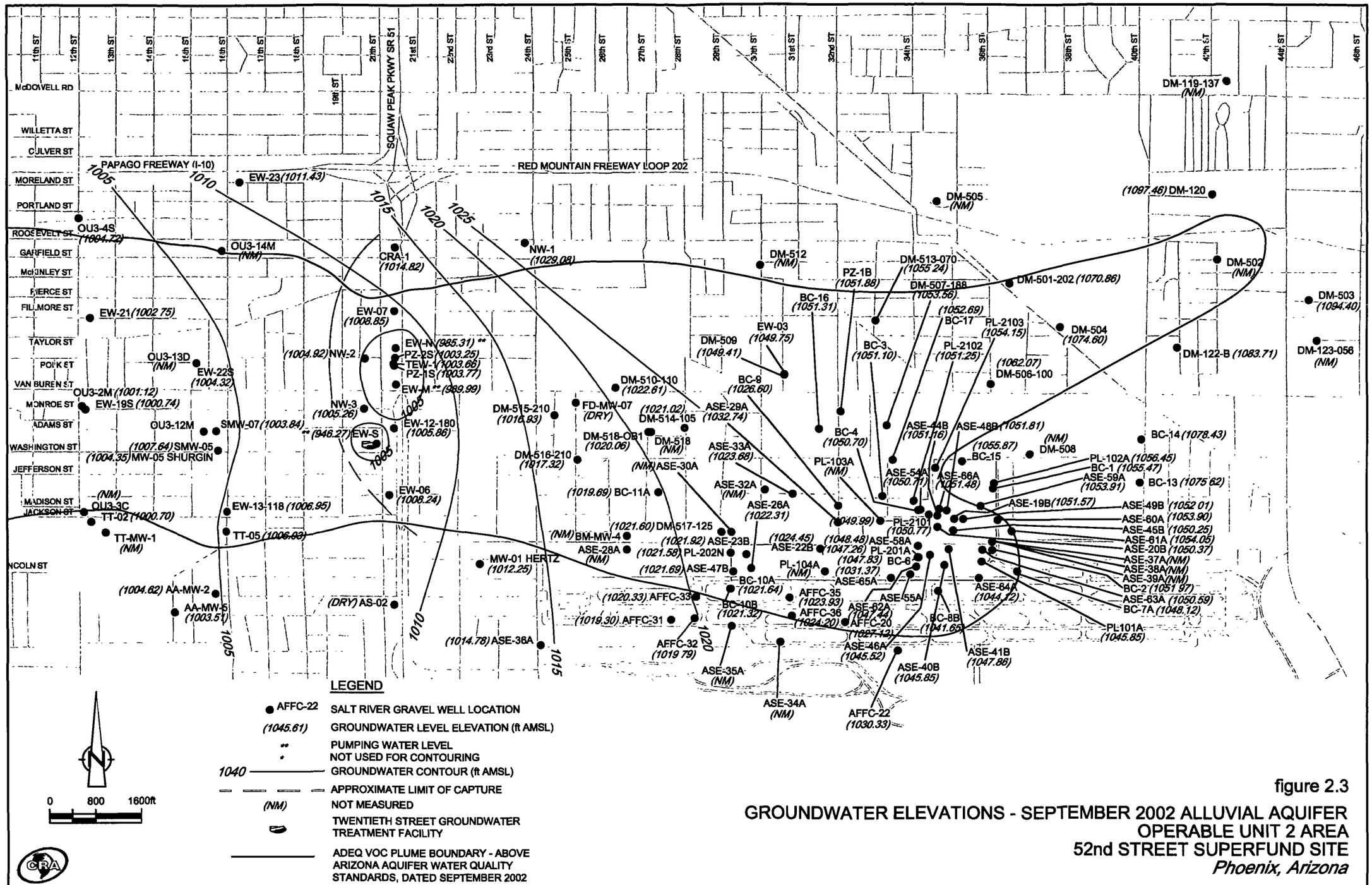


figure 2.3

GROUNDWATER ELEVATIONS - SEPTEMBER 2002 ALLUVIAL AQUIFER
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-134(008)GN-WA017 AUG 08/2003

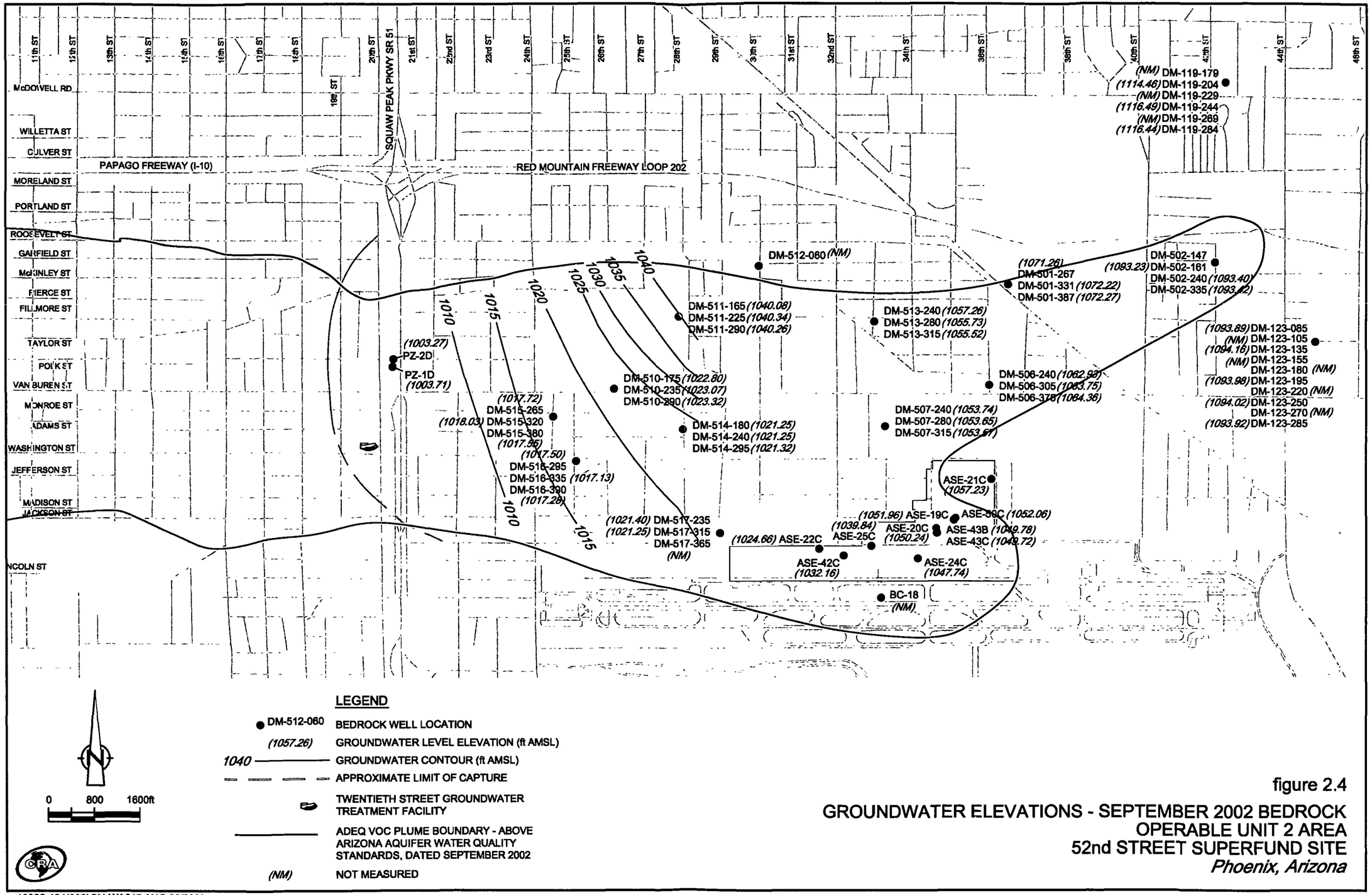
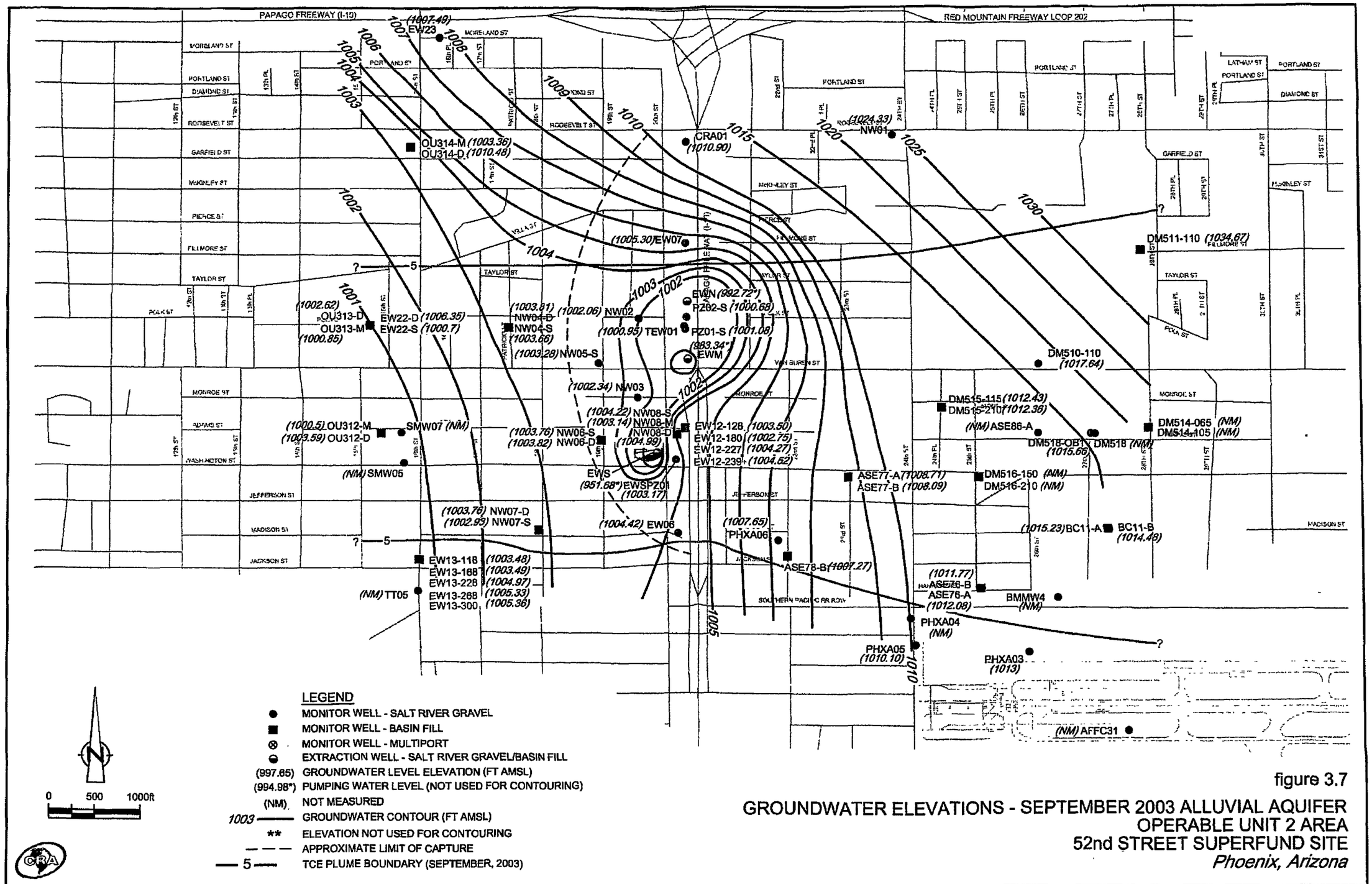


figure 2.4

GROUNDWATER ELEVATIONS - SEPTEMBER 2002 BEDROCK
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-134(008)GN-WA015 AUG 08/2003



LEGEND

- ● MONITOR WELL - SALT RIVER GRAVEL
- ■ MONITOR WELL - BASIN FILL
- ⊗ MONITOR WELL - MULTIPORT
- ◒ EXTRACTION WELL - SALT RIVER GRAVEL/BASIN FILL
- (997.65) GROUNDWATER LEVEL ELEVATION (FT AMSL)
- (994.98*) PUMPING WATER LEVEL (NOT USED FOR CONTOURING)
- (NM) NOT MEASURED
- 1003 —— GROUNDWATER CONTOUR (FT AMSL)
- ** ELEVATION NOT USED FOR CONTOURING
- — — — APPROXIMATE LIMIT OF CAPTURE
- —— 5 —— TCE PLUME BOUNDARY (SEPTEMBER, 2003)

figure 3.7

GROUNDWATER ELEVATIONS - SEPTEMBER 2003 ALLUVIAL AQUIFER
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(009)GN-PX006_fig3-7 JUN 24/2004

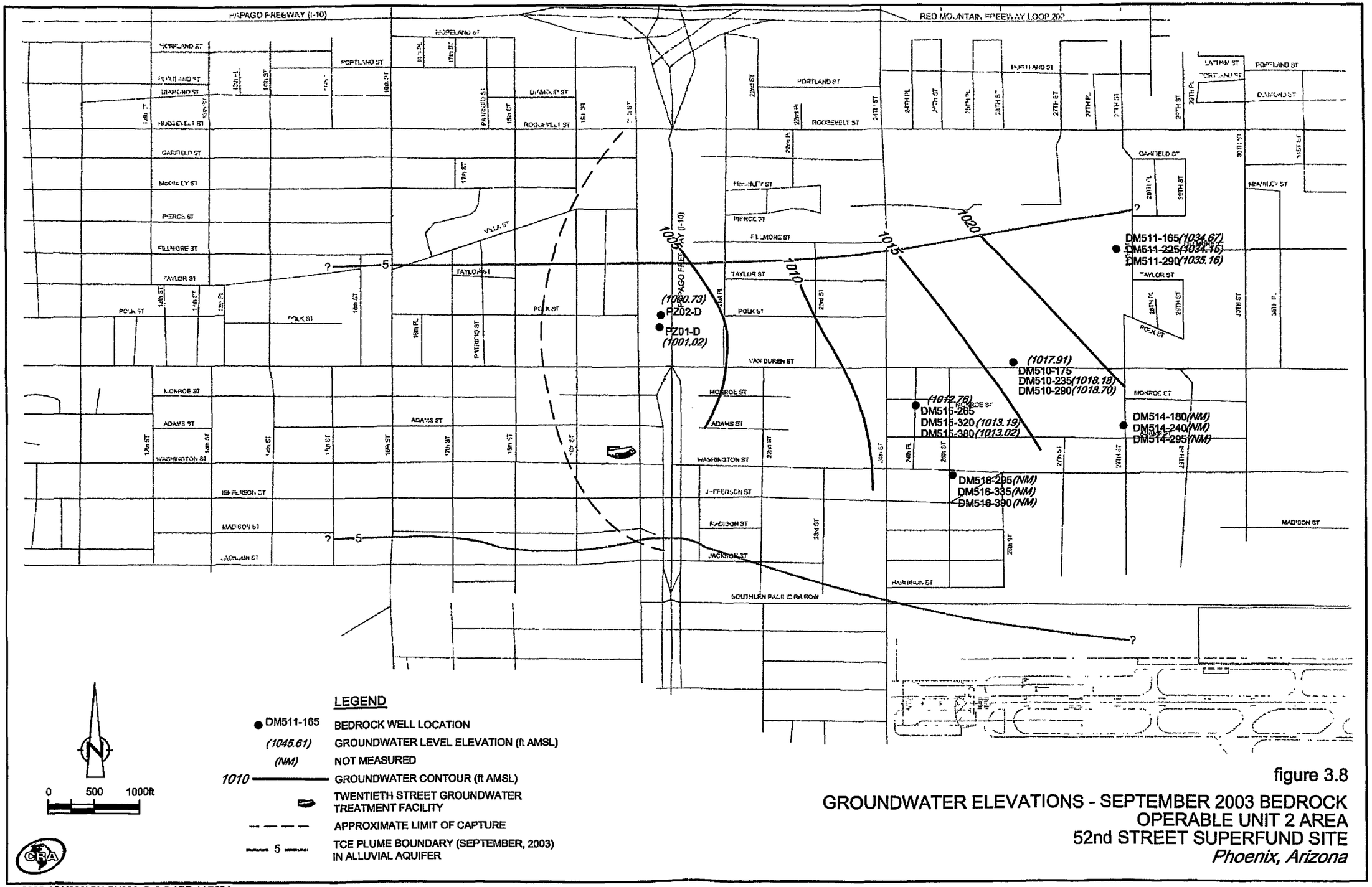
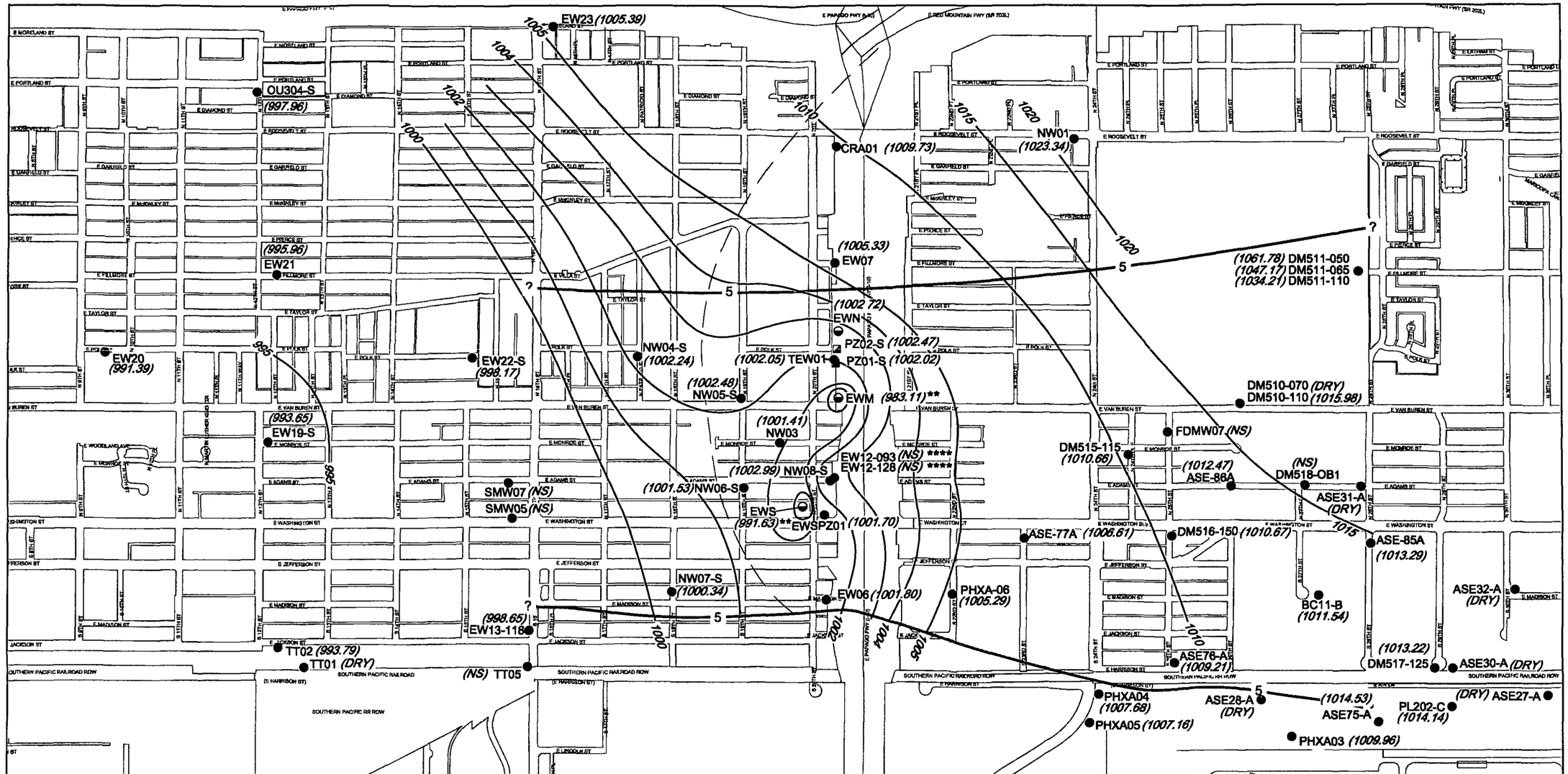


figure 3.8

GROUNDWATER ELEVATIONS - SEPTEMBER 2003 BEDROCK
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(009)GN-PX008_fig3-8 APR 14/2004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PZ01-S (1002.02)
(1002.48) NW05-S
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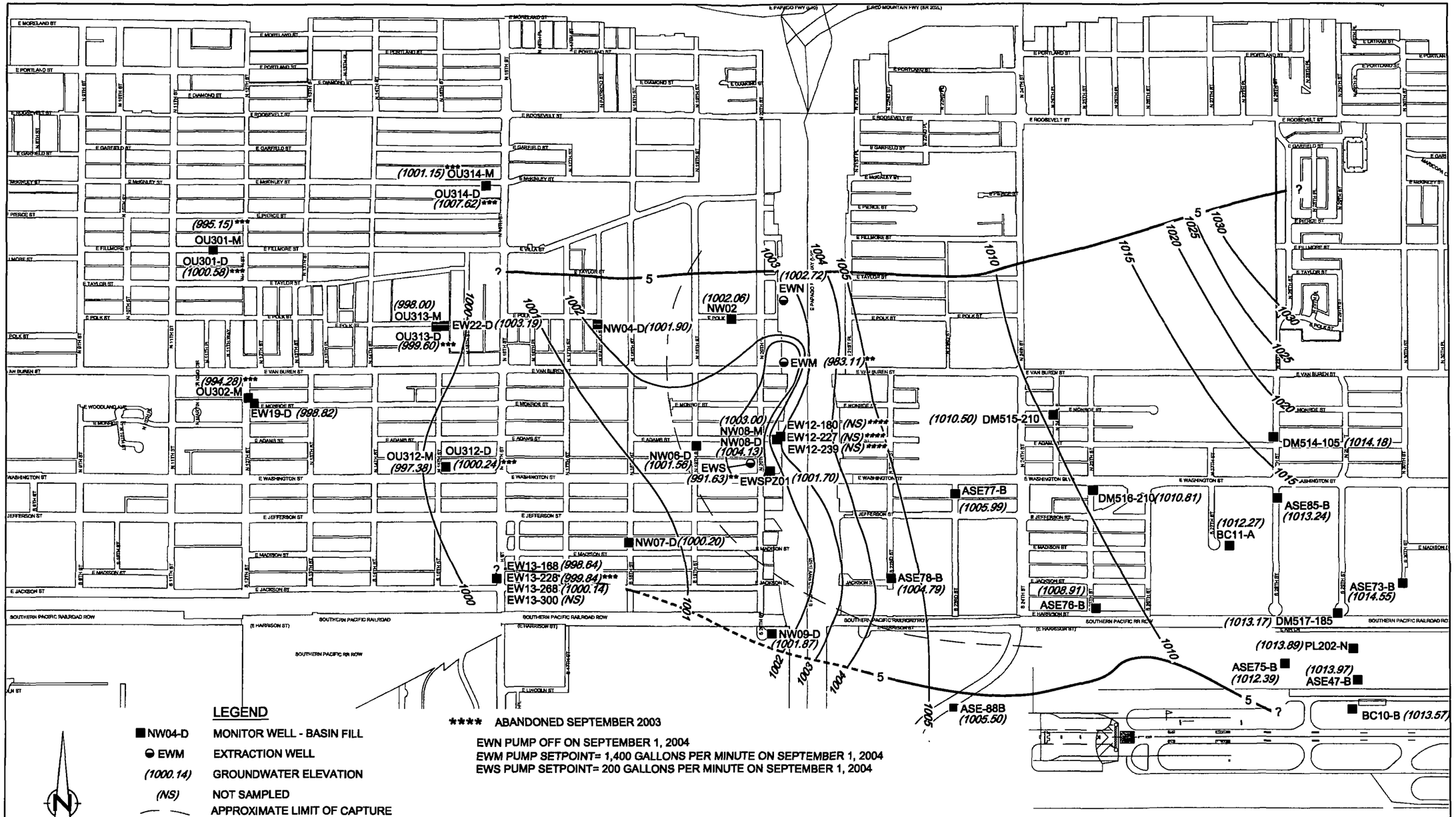
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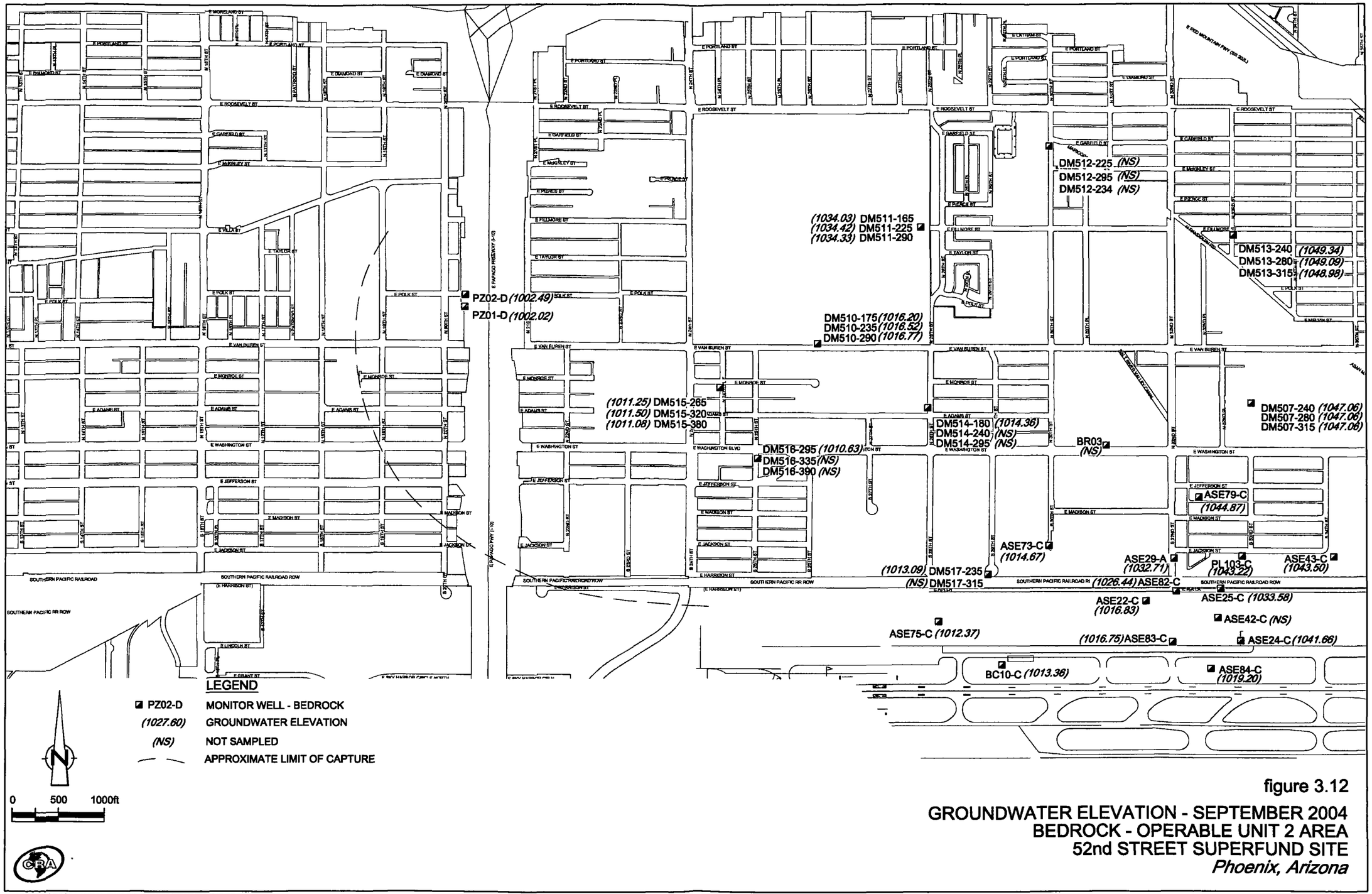


figure 3.12

GROUNDWATER ELEVATION - SEPTEMBER 2004
BEDROCK - OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(011)GN-PX056_fig3-12 APR 12/2005

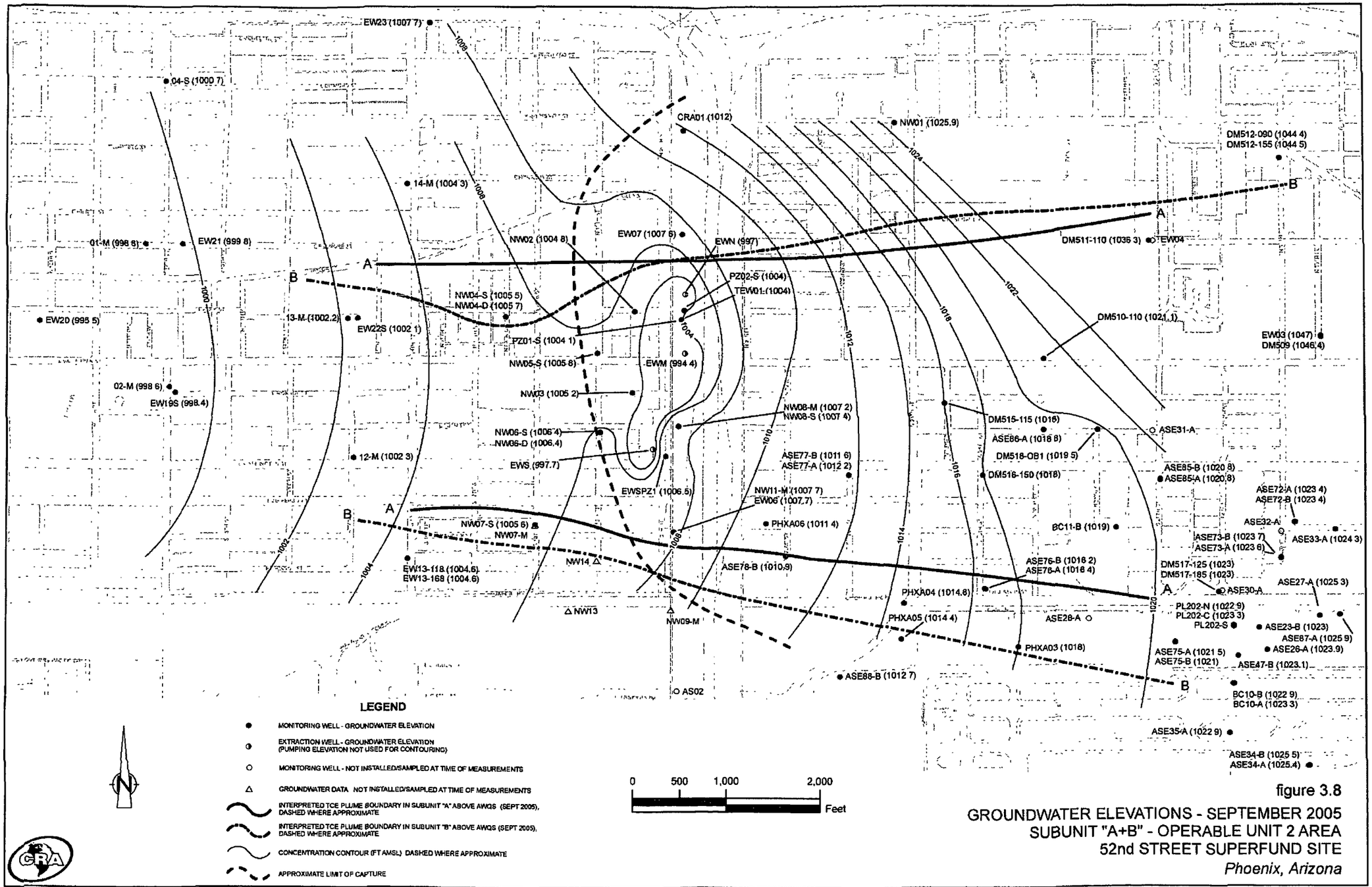
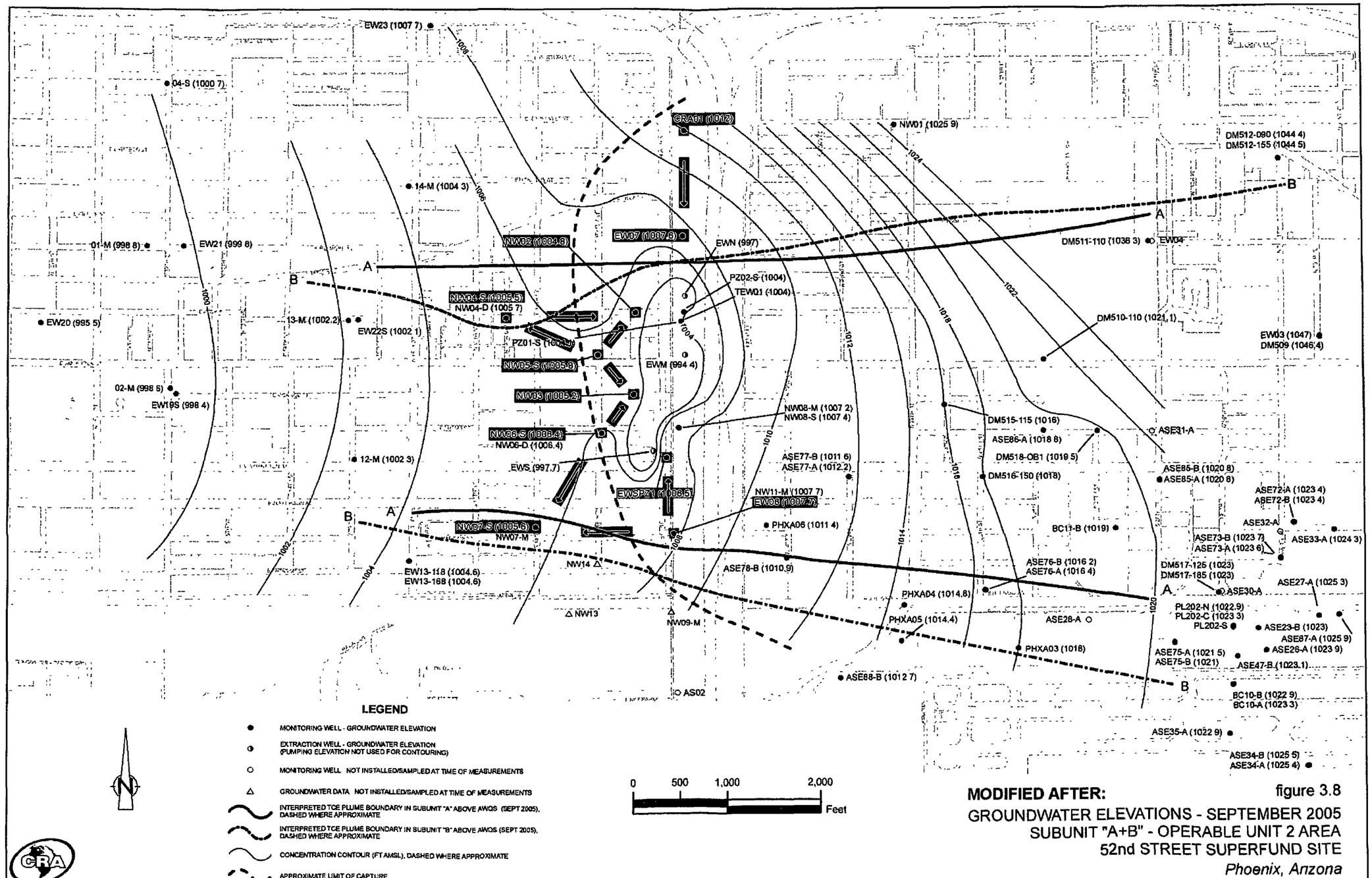


figure 3.8

GROUNDWATER ELEVATIONS - SEPTEMBER 2005
SUBUNIT "A+B" - OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GIS(WA083)_fig3_8



MODIFIED AFTER:

figure 3.8

GROUNDWATER ELEVATIONS - SEPTEMBER 2005
SUBUNIT "A+B" - OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GIS(WA063)_fig3_8

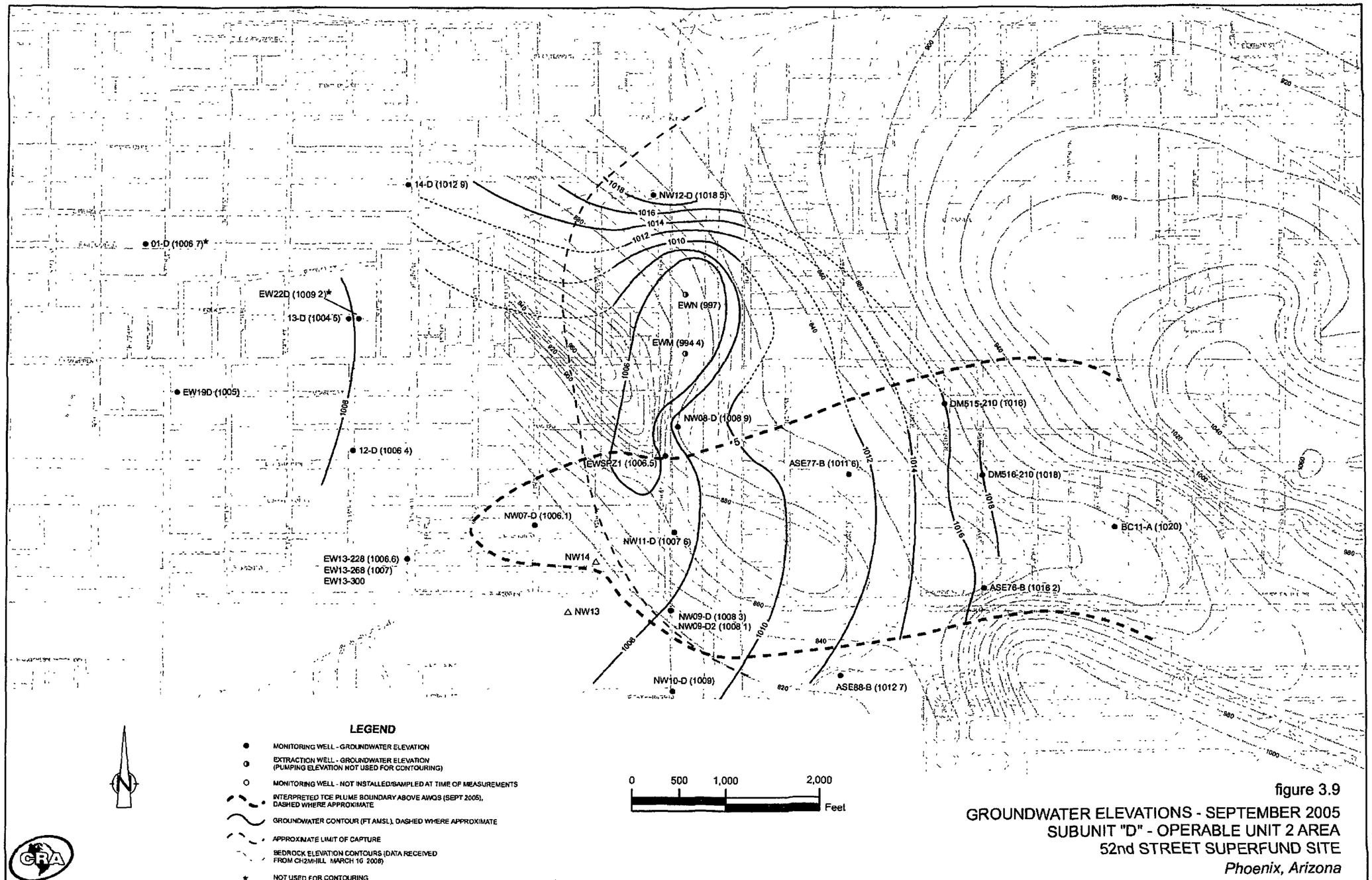


figure 3.9

GROUNDWATER ELEVATIONS - SEPTEMBER 2005
SUBUNIT "D" - OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GIS(WA064)_fig3_9

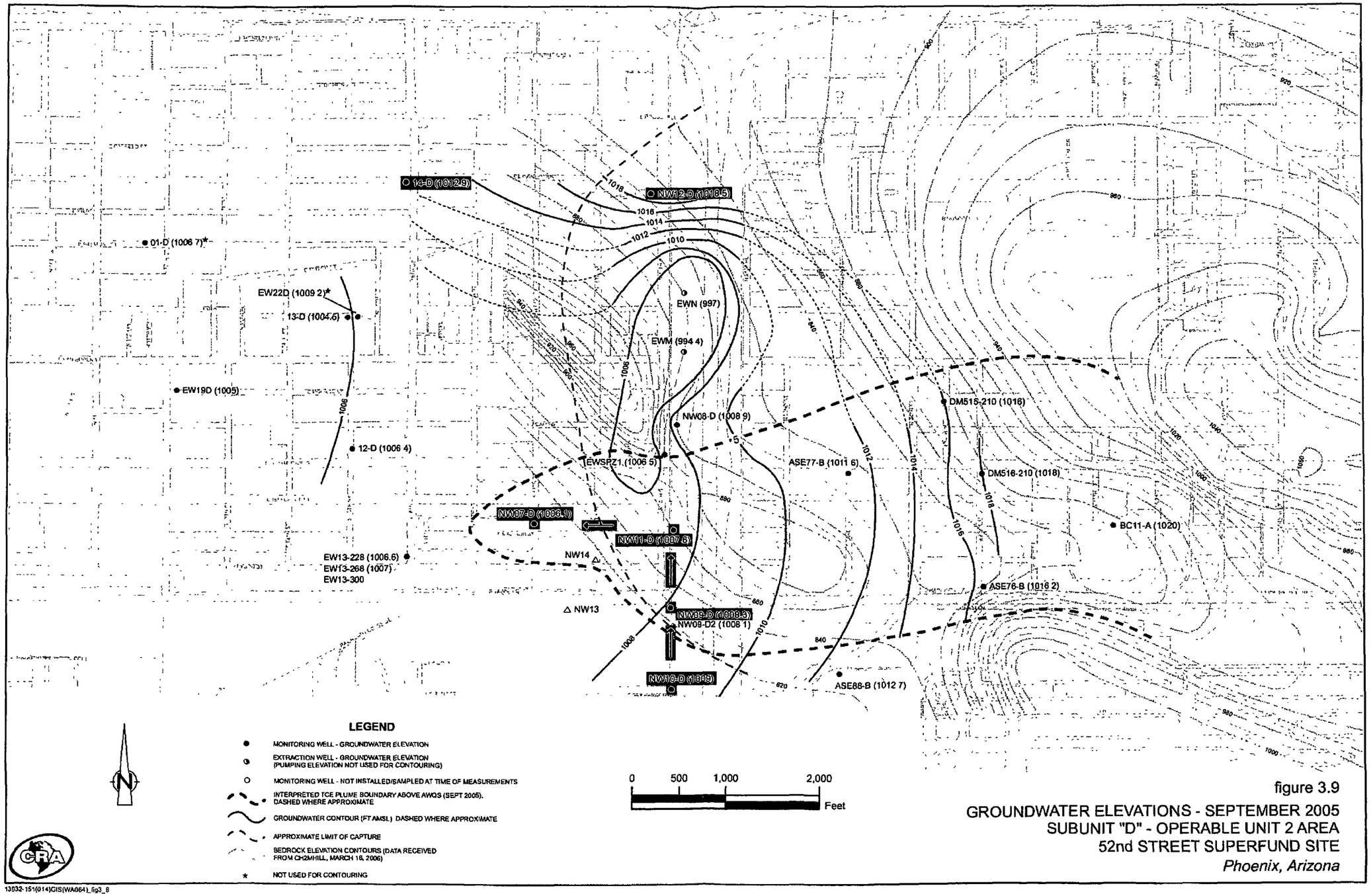


figure 3.9

GROUNDWATER ELEVATIONS - SEPTEMBER 2005
SUBUNIT "D" - OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13832-151(014)GIS(WA064)_fig3_8

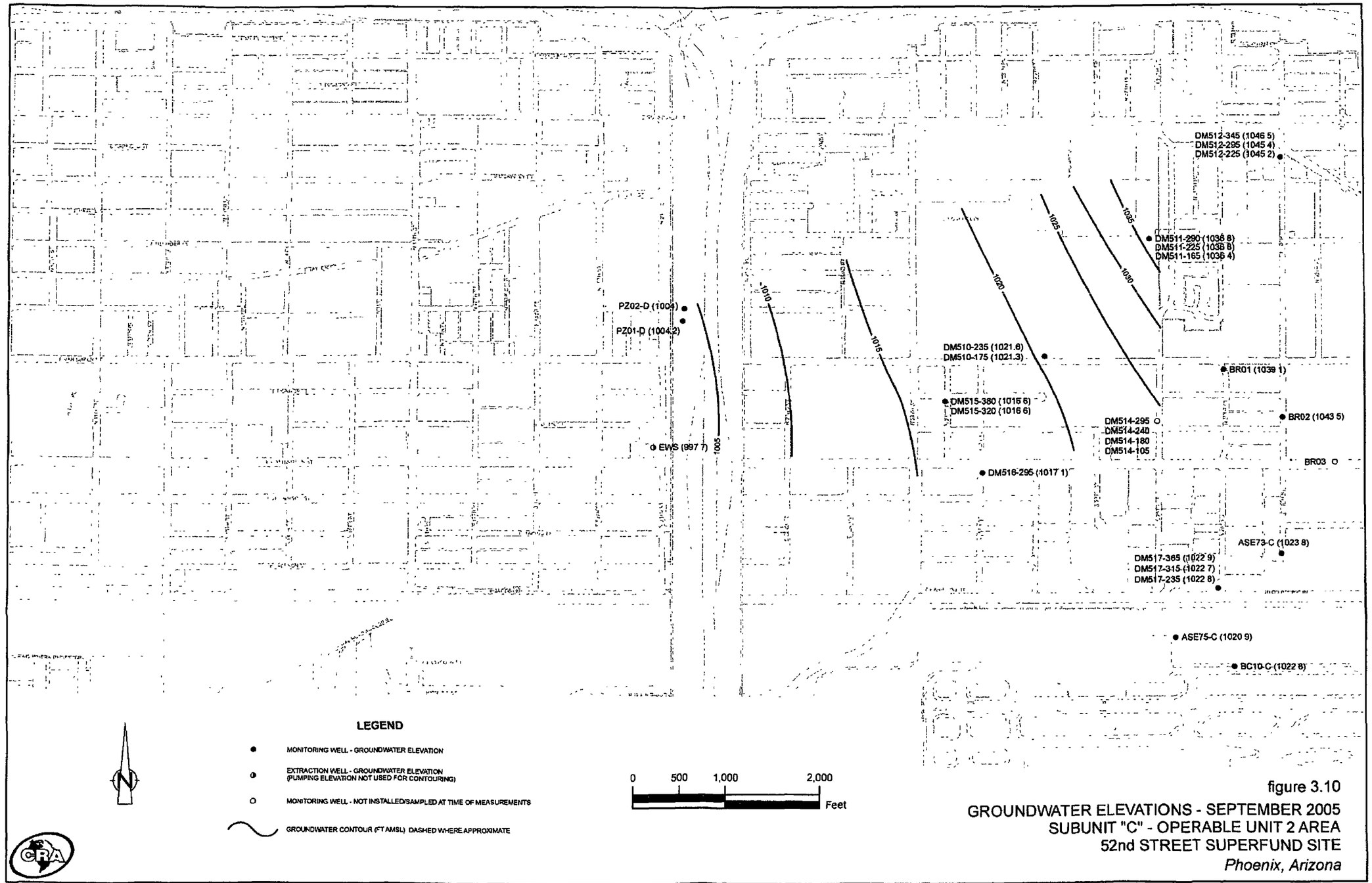


figure 3.10

GROUNDWATER ELEVATIONS - SEPTEMBER 2005
SUBUNIT "C" - OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932 151(014)GIS(WR065)_fg3_10

APPENDIX C

CAPTURE ZONE ANALYSES

CONESTOGA-ROVERS
& ASSOCIATES

4050 E. Cotton Center Blvd., Suite 49, Phoenix, AZ 85040
Telephone: 602.749.9400 Facsimile: 602.749.9500
www.CRAworld.com

May 28, 2004

Reference No. 13932-130

Ms. Nadia Hollan
Remedial Project Manager (SFD-7-1)
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region IX
75 Hawthorne Street
San Francisco, California 94105-3901

Dear Ms. Hollan:

Re: Capture Zone Calculations - Operable Unit 2
52nd Street Superfund Site - Phoenix, Arizona

As discussed in our meeting of April 28,2004 and in response to the United States Environmental Protection Agency's (USEPA) letter of May 14, 2004, Conestoga-Rovers & Associates (CRA) herewith submits the following capture zone evaluation on behalf of Honeywell International, Inc. and Freescale Semiconductor, Inc. (the Companies) for the area of the groundwater extraction wells located along 20th Street in Operable Unit (OU) 2. The purpose of this letter is to present an analysis of the extent of the combined capture zone provided by extraction wells EWM and EWS in order to confirm that containment is provided between these two extraction wells and to show the extent of capture to the south. As discussed further below, all lines of evidence demonstrate that hydraulic containment is being provided between extraction wells EWM and EWS. Additionally, the preliminary evaluations indicate that capture extends to the south of groundwater monitor well EW06 at a minimum and potentially to the south of NW09-D in the Basin Fill deposits.

Consistent with the USEPA's Fact Sheet entitled: Elements for Effective Management of Operating Pump and Treat Systems (2002), three lines of evidence for evaluating plume capture were considered as part of this analysis:

- A flow net was manually drawn based on observed groundwater elevation contours to illustrate the extent of capture provided by EWM and EWS in the Salt River Gravels and in Basin Fill;
- A simple capture zone analysis using the computer code RESSQ was done for each hydrostratigraphic unit, then superimposed on a map to demonstrate that capture is being provided between the two extraction wells and to indicate the extent of capture to the south; and
- Groundwater chemistry concentration trends at specific monitoring wells were evaluated to evaluate the effect of the extraction system on water quality conditions in the area.

The methods, assumptions, calculations, and analysis of results for each of these lines of evidence are presented below. First, background information relevant to this evaluation is presented. Then, the flow net analysis, capture zone width analysis and chemical concentration trends providing evidence for hydraulic containment by extraction wells EWM and EWS are presented in turn.

BACKGROUND

Extraction wells EWM and EWS are screened over two different hydrostratigraphic units. The upper hydrostratigraphic unit is an unconfined aquifer unit that is referred to as the Salt River Gravel, and generally consists of coarse sand and gravel deposits. Based on geologic logs and the 2000 pumping tests conducted by Errol Montgomery & Associates (EMA) at EWM and EWS, the hydraulic conductivity of the Salt River Gravel portion of the alluvial aquifer (Salt River Gravel) is substantially higher at EWM than at EWS.

The lower hydrostratigraphic unit is referred to as the Basin Fill portion of the alluvial aquifer unit (Basin Fill), and is characterized by the presence of abundant silt and sand with lesser amounts of clay and gravel. The hydraulic conductivity of the Basin Fill is lower than the hydraulic conductivity of the Salt River Gravel.

Hydraulic Conductivity of Salt River Gravels at EWM

The range of hydraulic conductivities observed in the Salt River Gravels is variable. Previous studies have reported hydraulic conductivity values between 20 and 250 ft/day for the upper alluvial unit sediments, which includes the Salt River Gravels and Basin Fill (Corell and Corkhill, 1994,). Previously, as reported in the Final (100%) Design Report (CRA, 1999), a hydraulic conductivity of 450 ft/day was used for the Salt River Gravels. However, since the design was completed, water levels have declined in the OU2 area by at least 25 feet and essentially de-watered the most conductive zone of the Salt River Gravels. Therefore, in order to reflect current conditions, we have chosen a value of 250 ft/day to represent the hydraulic conductivity for the Salt River Gravels at EWM.

Hydraulic Conductivity of Salt River Gravels at EWS

Attachment A presents the methods used to estimate the hydraulic conductivity in the Salt River Gravels at EWS, based on the measured recovery at nearby monitoring wells after the cessation of pumping at EWN, EWM, and EWS on January 9, 2004. The estimated hydraulic

conductivity at EWS is 105 ft/day. This value is consistent with the conceptual model that indicates the Salt River Gravel portion of the aquifer at EWS has a lower hydraulic conductivity than the portion of the aquifer surrounding EWM.

Hydraulic Conductivity of Basin Fill at EWM and EWS

Based on the abundance of silt and sand in the Basin Fill portion of the alluvial aquifer, it is expected that the hydraulic conductivity in this unit is on the order of $1x10^{-2}$ cm/s (i.e. 28 ft/day). This value is an average range of hydraulic conductivity estimated from slug tests at monitoring wells in the OU2 completed in the Basin Fill (Dames and Moore, 1993).

FLOW NET ANALYSIS

A flow net consists of two components: potentiometric surface (i.e. groundwater elevation) contours and streamlines that indicate flow direction. In an isotropic aquifer, the streamlines are perpendicular to the potentiometric surface contours.

Groundwater elevation contours were drawn manually based on the April 6, 2004 monitoring well data (Figure 1), and were based on estimated groundwater elevations in the immediate vicinity of EWS and EWM, which were pumping on April 6, 2004. Because the groundwater extraction system was shutdown for a short time two days earlier, another round of water levels was collected on April 26, 2004 and these water level contours (Figure 2) were compared to the April 6, 2004 data.

The water levels measured during both events were relatively similar. However, it appears that more groundwater capture is provided south of EWS on April 26 based on the larger difference in groundwater elevations measured between EWS-PZ1 and EW06 relative to measurements made on April 6 (i.e., two days after pumping restarted). On April 6, the groundwater elevation at EW06 (i.e. 1004.03 ft AMSL) was measured to be 0.18 feet higher than the groundwater elevation at EWS-PZ1 (i.e. 1003.85 feet AMSL). On April 26, this difference had increased to 0.72 feet between EW06 and EWS-PZ1, indicating that there was a steeper cone of depression around EWS on April 26. In order to be conservative, this flow net analysis utilized the data collected on April 6, which still demonstrates that containment was provided between EWM and EWS, as well as south of EWS beyond the EW06 well location. The southern extent of capture after April 6 has increased beyond what was determined in this analysis. Streamlines were drawn perpendicular to the groundwater elevation contours to show flow direction and the extent of capture by combined pumping at EWS and EWM. The methods used to conduct this analysis are described below.

Measured Groundwater Elevations

Table 1 presents the groundwater elevations measured at monitoring wells and the two extraction wells (corrected values) for April 6 and April 26, 2004.

Estimated Groundwater Elevations at EWS and EWM

The groundwater elevations measured inside EWM and EWS (991 and 994 ft AMSL, respectively) are not considered representative of groundwater elevations outside the well casing because of well efficiency effects. Attachment B presents the method used to evaluate the theoretical groundwater elevations that occurred directly outside the casings for extraction wells EWM and EWS, on April 6, 2004. The results of this evaluation are summarized as follows:

- Theoretical groundwater elevation at EWM of 996.0 ft AMSL (estimated well efficiency of 68%); and
- Theoretical groundwater elevation at EWS of 998.7 ft AMSL (estimated well efficiency of 65%).

Flow Net Analysis

Figures 3a and 3b present the April 6, 2004 groundwater elevation contours and streamlines for the Salt River Gravels and Basin Fill, respectively. As shown on Table 1, the groundwater elevations in the Salt River Gravels and Basin Fill at nested well locations are very similar. The difference in groundwater elevation between these two hydrostratigraphic units is typically between 0.05 to 0.1 feet. The groundwater elevation at EW19D has historically been anomalous, and thus the water level data was not used when interpreting groundwater elevation contours for the Basin Fill.

The streamlines were drawn perpendicular to the groundwater elevation contours, and thus represent the groundwater flow paths based on the assumption that horizontal hydraulic conductivity is isotropic. The groundwater elevation contours and streamlines were developed manually based on professional judgement and consistent with standard industry practice.

The flow nets shown on Figures 3a and 3b indicate that containment is provided between EWM and EWS and that the southern capture boundary extends beyond EW06 to the south. The capture limits based on this flow net analysis are similar for the Salt River Gravels and Basin Fill because groundwater elevations in these units are very similar.

THEORETICAL CAPTURE ZONE ANALYSIS

The RESSQ model was used to evaluate the extent of capture that is provided by simultaneous pumping of extraction wells EWM and EWS. RESSQ is based on the semi-analytical solution developed by Javandel et al. (1984).

RESSQ calculates streamlines (i.e. flow paths) in a homogeneous, isotropic confined aquifer of uniform thickness with superposition of a regional horizontal hydraulic gradient. RESSQ is capable of representing multiple wells with different pumping rates, and can be used to determine whether capture is provided between extraction wells.

RESSQ is a Fortran program that outputs coordinates of each segment of the streamlines determined by the program. The user enters starting coordinates of a streamline and the program will determine whether the streamline is captured by one of the extraction wells or whether it will migrate past the extraction well network.

RESSQ was run for two scenarios: one to evaluate capture extent provided by pumping at EWM and EWS in the Salt River Gravels portion of the alluvial aquifer, and the other to evaluate the extent of capture provided in the Basin Fill portion of the alluvial aquifer. Input parameters used for the RESSQ model simulations are shown below.

Salt River Gravels Aquifer RESSQ Model Input Parameters

- EWM pumping rate: 1317 gpm
- EWS pumping rate: 147 gpm
- Hydraulic conductivity: 250 ft/day
- Average saturated thickness: 40 ft
- Regional gradient: 0.0025 ft/ft
- Effective porosity: 0.20

Basin Fill Aquifer RESSQ Model Input Parameters

- EWM pumping rate: 283 gpm
- EWS pumping rate: 53 gpm
- Hydraulic conductivity: 28 ft/day

- Average saturated thickness: 65 ft
- Regional gradient: 0.0025 ft/ft
- Effective porosity: 0.20

RESSQ Model Results

Figures 4 and 5 present the simulated streamlines for the Salt River Gravels and Basin Fill aquifers, based on total extraction rates of 1,600 gallons per minute (gpm) at EWM and 200 gpm at EWS. These figures clearly indicate that hydraulic containment is provided between extraction wells EWM and EWS in both the Salt River Gravel and Basin Fill portions of the alluvial aquifer. Additionally, the RESSQ evaluations indicate that capture extends to the south of NW09-D in the Basin Fill.

GROUNDWATER CHEMISTRY CHANGES

Another line of evidence supporting groundwater capture is decreasing Volatile Organic Compound (VOC) concentrations since commencement of groundwater pumping. Water quality data from monitoring wells located at various locations throughout the OU2 Area have shown significant declines (i.e., greater than a factor of two) in total VOC concentrations since September 2001 in both the Salt River Gravel and Basin Fill portion of alluvial aquifer (Table C.1). VOC time series graphs are presented in Attachment C. The observed decline in VOC concentrations in the down gradient monitoring wells demonstrate that the plume has been contained by operation of the OU2 Area Groundwater Extraction System.

CONCLUSIONS

Multiple lines of evidence were used to analyze the extent of the combined capture zone provided by extraction wells EWM and EWS. This analysis evaluated capture separately for the Salt River Gravel and the Basin Fill. All lines of evidence demonstrate that hydraulic containment is being provided between EWM and EWS. Additionally, preliminary evaluations indicate that capture extends at a minimum to the south of EW-6 and potentially to the south of NW09-D in the Basin Fill.

In addition, at our April 28 meeting, the Arizona Department of Environmental Quality (ADEQ) presented a water level contour map for December 2003 that appeared to show extensive capture in both the Salt River Gravels and Basin Fill. We look forward to receiving a copy of the figure that we understand ADEQ will soon be providing.

CONESTOGA-ROVERS
& ASSOCIATES

The Companies look forward to meeting with EPA and ADEQ on June 8 to discuss this evaluation.

If you have any questions, please do not hesitate to contact us.

Sincerely,

CONESTOGA-ROVERS & ASSOCIATES

Manfred Plaschke

BS/MP/ma/70
Enc.

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Karen O'Regan (City of Phoenix
Brian Sandberg (CRA)
Steve Whillier (CRA)
Steve Quigley (CRA)
David Hilliard (Site Copy)

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TABLE 1

GROUNDWATER ELEVATION LEVELS - APRIL 2004
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Well ID	*Easting*	*Northing*	*April 6, 2004 Groundwater Elevation (ft.AMSL)*	*April 26, 2004 Groundwater Elevation (ft.AMSL)*
ASE-76B	466346	889253	1010.14	NM
ASE-77B	464927	890548	1007.41	NM
ASE-78B	464216	889597	1006.43	NM
ASE-86A	466982	890993	1013.21	NM
ASE-87A	470140	888962	1016.54	NM
ASE-88B	464891	888243	1007.22	NM
CRA01	463136	894254	1010 44	1010.26
EW06	463031	889883	1004.03	1003.74
EW07	463123	893133	1006.60	1006.14
EW22-S	459644	892218	1000.37	1000.2
EWM	463149	891836	996.00	991.42*
EWS	462804	890786	998.70	994.38*
EWS-PZ1	462940	890712	1003 85	1003.02
NW01	465406	894323	1023.30	1023.32
NW02	462611	892290	1003.61	1002.93
NW03	462590	891406	1003.22	1002.35
NW04-S	461225	892232	1003.94	1003.53
NW05-S	462215	891834	1004.20	1003.47
NW06-S	462239	890972	1003.67	1003.25
NW07-S	461547	889966	1002.40	1002.21
NW08-M	463075	891038	1004.71	1004.09
NW09-D	463002	889027	1004.13	1003.95
OU3-12M	459600	890700	1000.09	999.92
OU3-13M	459536	892217	1000.44	1000.25
PZ01-S	463124	892170	1003.36	1002.694
PZ02-S	463139	892306	1003.84	1003.22
TEW01	463111	892203	1003.36	1002.731

Notes:
* Indicates non-corrected pumping water level
NM = Not Measured

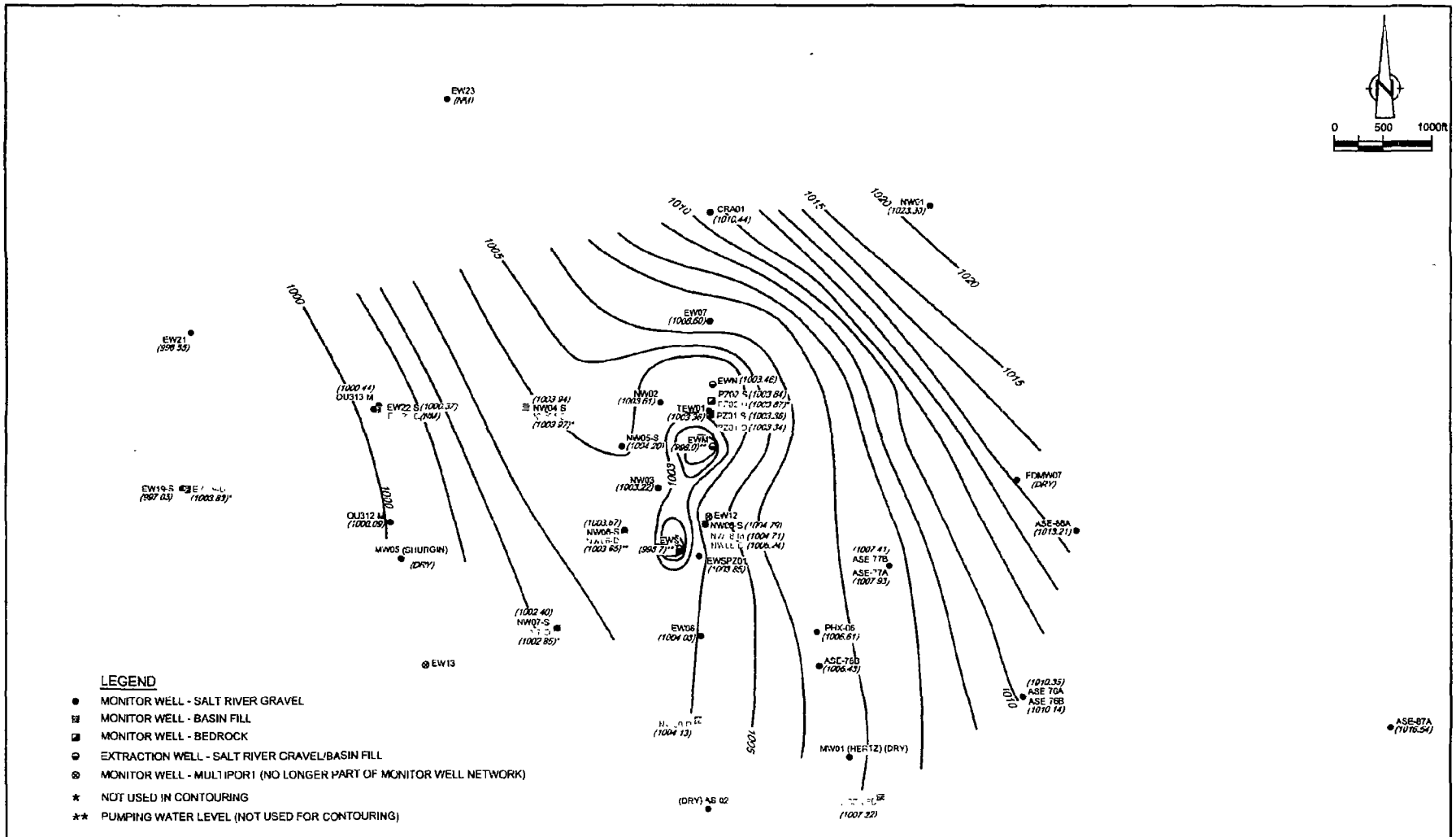


figure 1

GROUNDWATER ELEVATIONS, APRIL 6, 2004
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-131(000)GN-PX001_fig1 MAY 28/2004

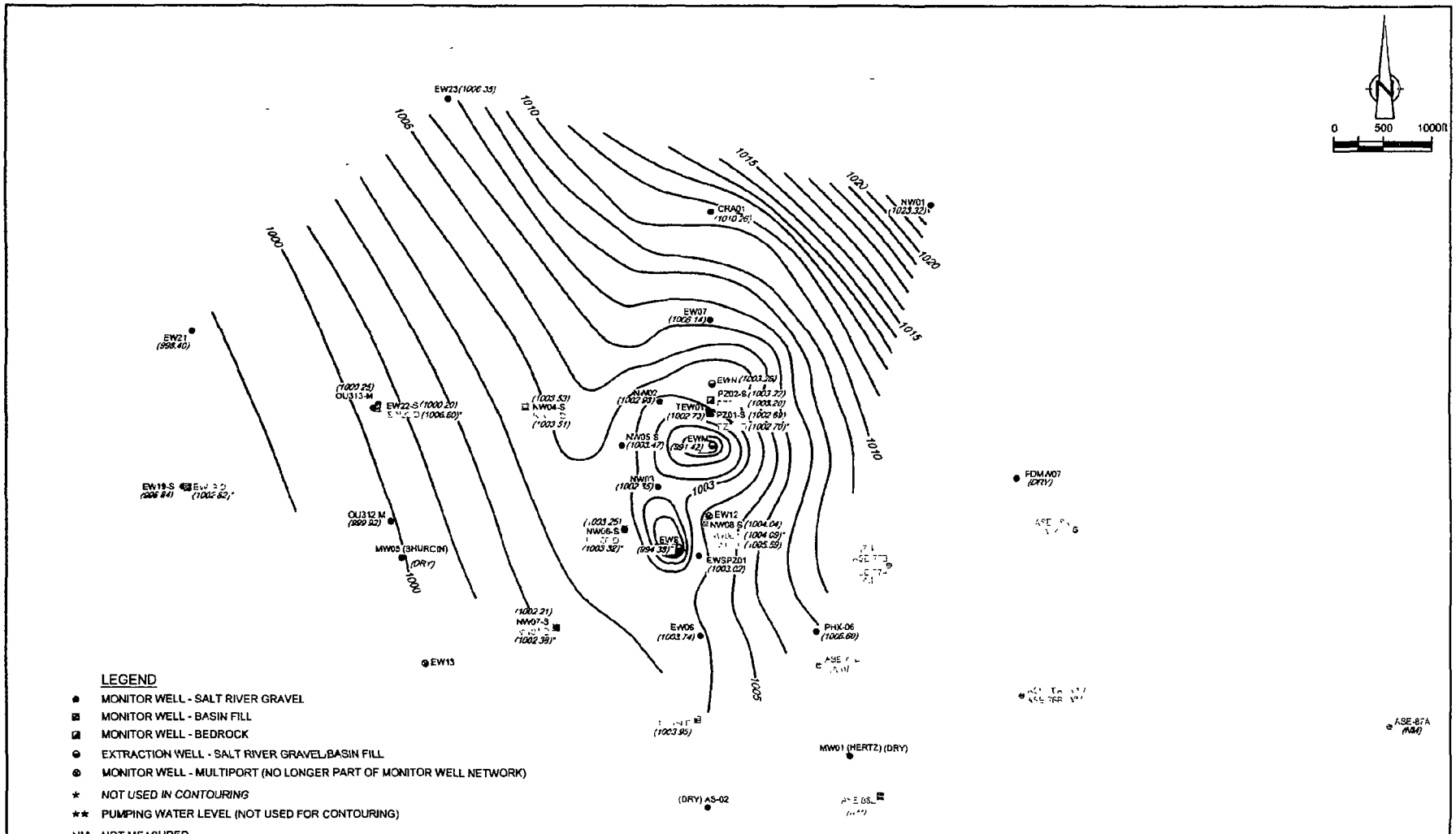


figure 2

GROUNDWATER ELEVATIONS, APRIL 26, 2004
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-131(000)GN-PX002_fig2 MAY 28/2004

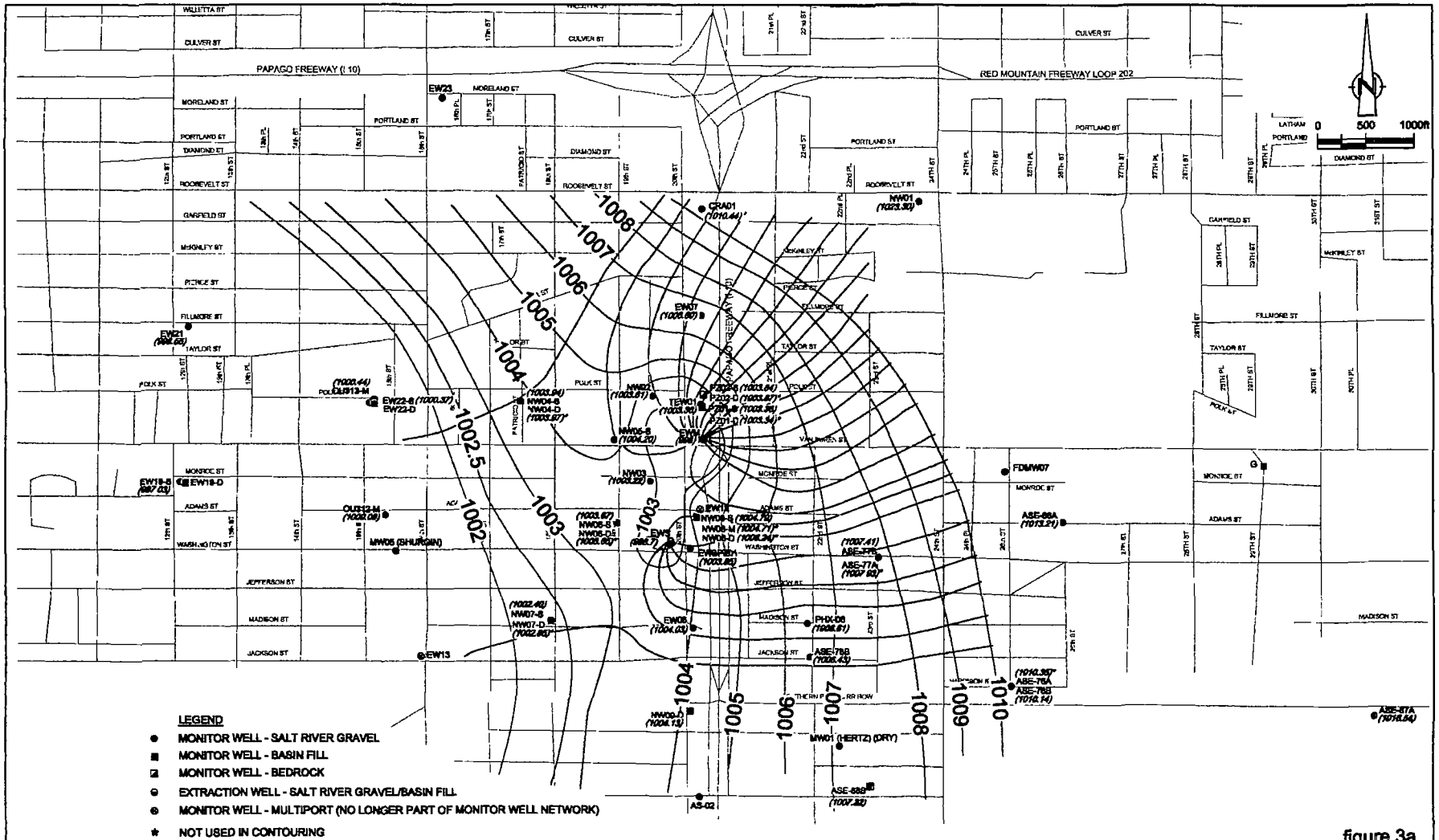


figure 3a

FLOW NET AND GROUNDWATER ELEVATION CONTOURS (SALT RIVER GRAVEL), APRIL 6, 2004
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-00(PRES001)GN-OT005 MAY 28/2004

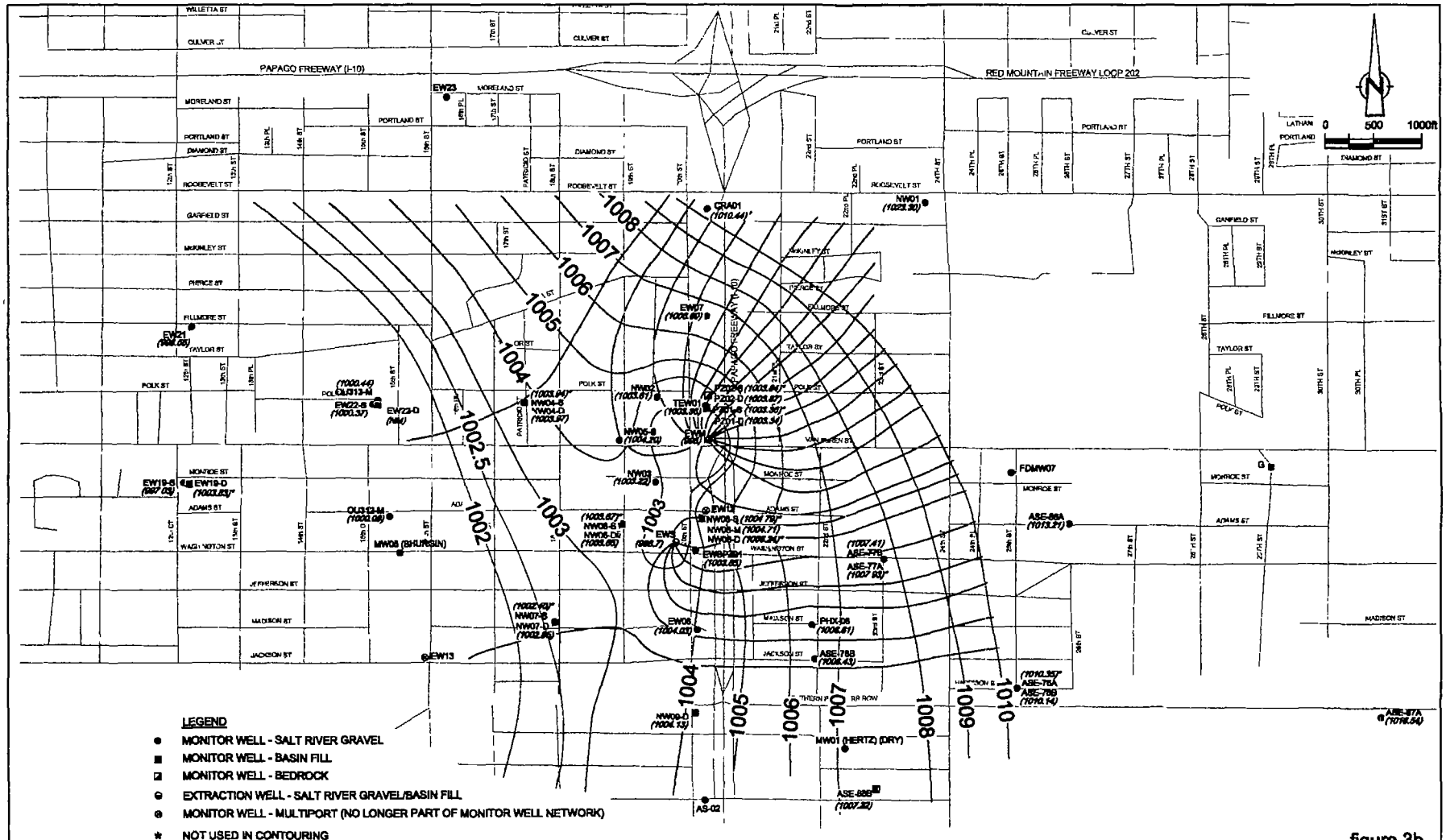


figure 3b

FLOW NET AND GROUNDWATER ELEVATION CONTOURS (BASIN FILL), APRIL 6, 2004
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-00(PRES001)GN-OT008 MAY 27/2004

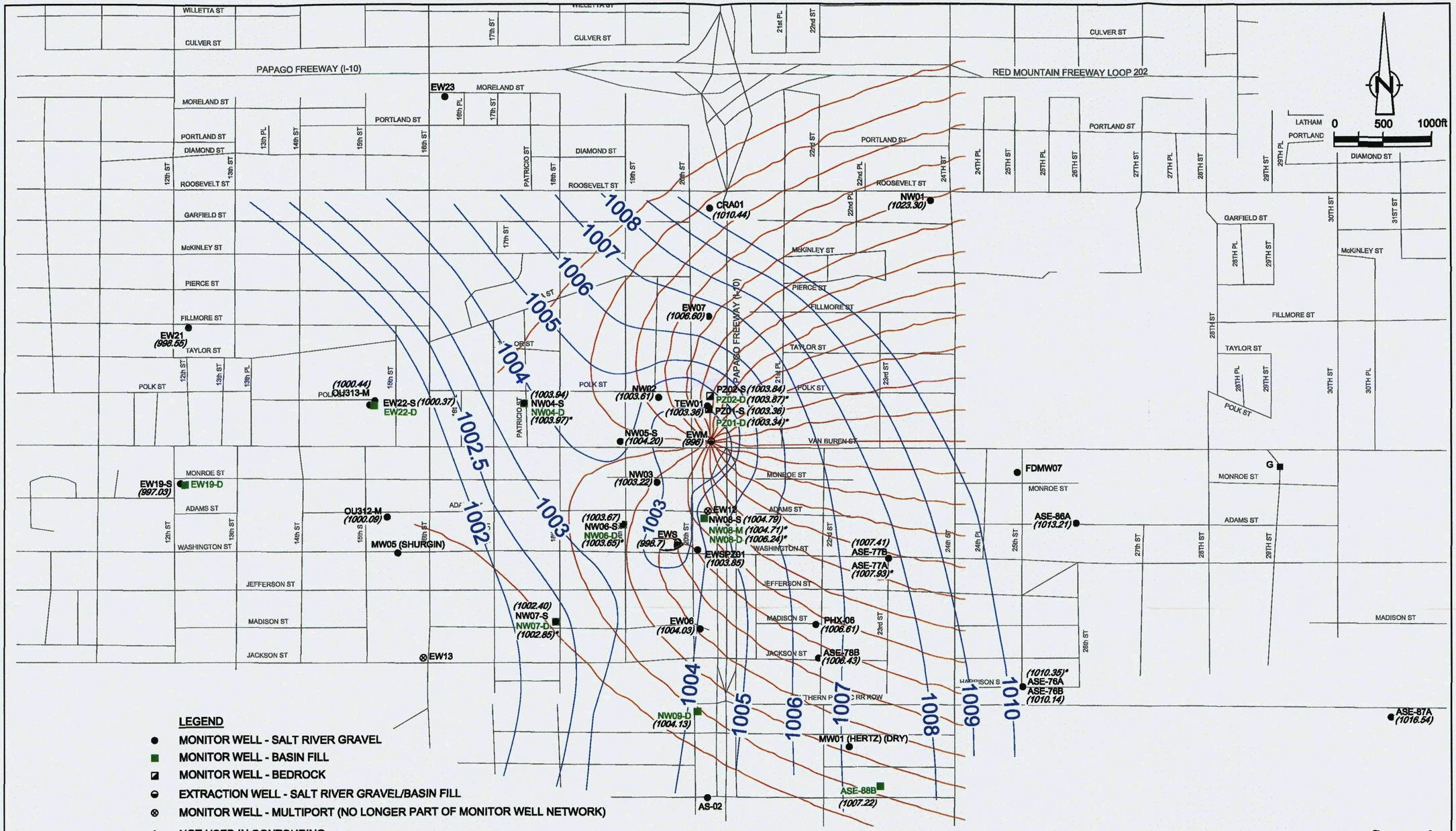


figure 4

RESSQ SIMULATED CAPTURE ZONE, SALT RIVER GRAVEL, APRIL 6, 2004
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-00(PRES001)GN-OT007 MAY 28/2004

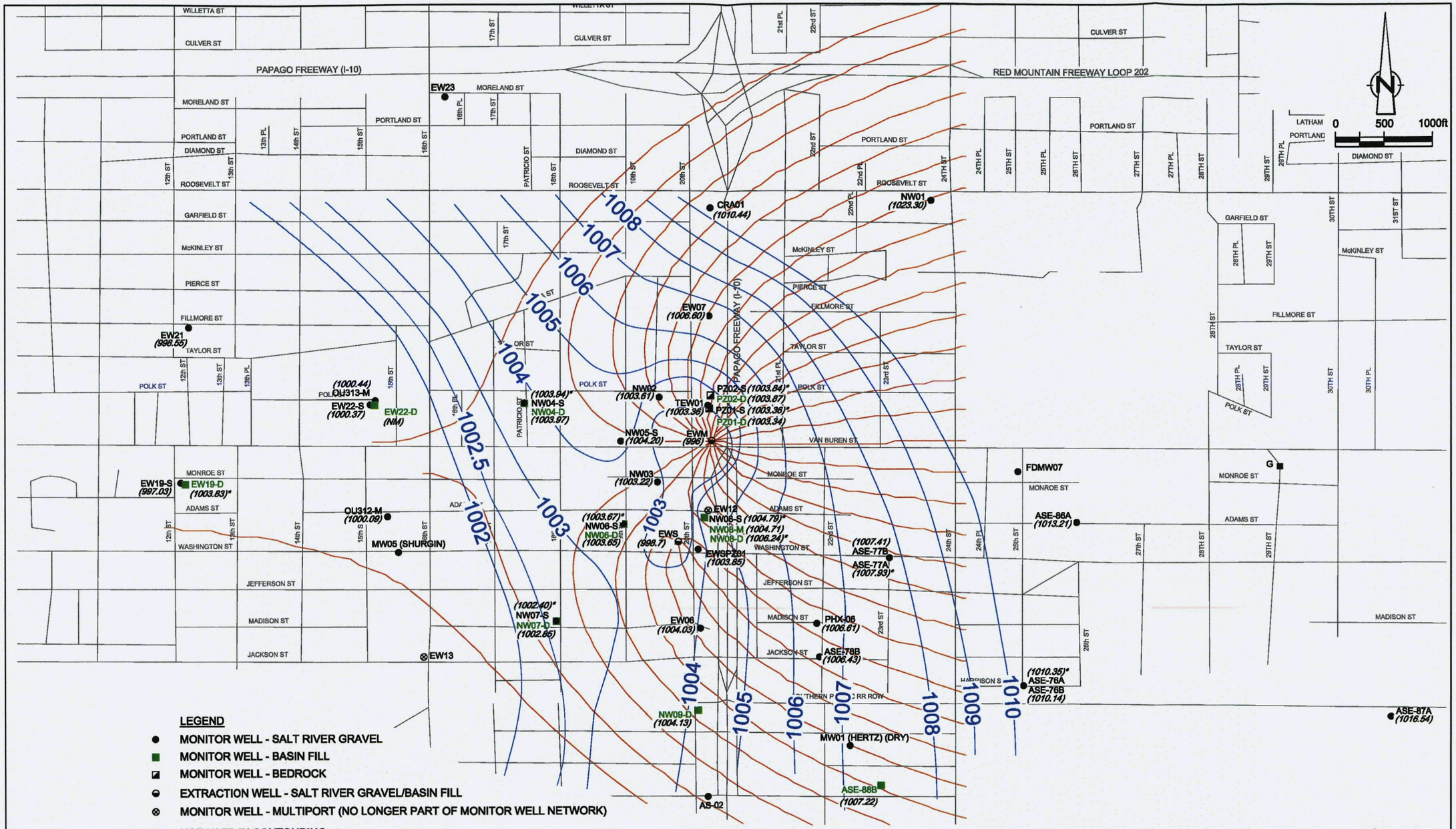


figure 5

RESSQ SIMULATED CAPTURE ZONE, BASIN FILL, APRIL 6, 2004
OPERABLE UNIT 2 AREA
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-00(PRES001)GN-OT008 MAY 28/2004

ATTACHMENT A

ESTIMATE OF HYDRAULIC CONDUCTIVITY AT EWS

ATTACHMENT A

A.1 INTRODUCTION

The purpose of the analysis presented in this attachment was to estimate the hydraulic conductivity of the Salt River Gravel portion of the alluvial aquifer (henceforth referred to as the Salt River Gravel) in the vicinity of extraction well EWS. This parameter was used to support the estimation of capture zone width around EWS. Section A.2 presents the methodology, and Section A.3 presents a discussion of the results of this analysis.

A.2 METHODOLOGY

The difference in recovery observed at two monitoring wells near EWS (after cessation of pumping at this well on January 9, 2004) was used to estimate the hydraulic conductivity of the Salt River Gravel in the vicinity of EWS.

Figure A.1 shows the recovery observed at EWS-PZ1 and EW06 during the cessation of pumping that occurred at EWN, EWM, and EWS between January 9 and February 11, 2004. This figure shows that there was approximately 4.0 ft of recovery observed at EWS-PZ1, and only 1.9 ft of recovery observed at EW06. The difference in recovery observed at EWS-PZ1 (155 ft from the pumping well) and EW06 (930 ft from the pumping well) was 2.1 ft.

It was assumed that the observed difference in recovery between EWS-PZ1 and EW06 is equal to the difference in drawdown that would occur at these two wells under steady-state conditions, with EWS pumping at a constant rate of 250 gpm. This ignores the potential influence that pumping at EWM (total rate of 1,450 gpm at a distance of 1,105 ft from EWS) and EWN (total rate of 650 gpm at a distance of 1,730 ft from EWS) would have on the relative drawdown observed at EWS-PZ1 and EW06.

A simple analytical model was used to calibrate the value of hydraulic conductivity for the Salt River Gravel that would cause a difference in drawdown at EWS-PZ1 and EW06 of 2.1 feet to occur during steady-state pumping at a rate of 250 gpm at EWS. A smaller value of hydraulic conductivity in the model will result in a larger slope in the drawdown cone that extends around EWS, and will also result in a larger difference in the relative drawdown that will occur between EWS-PZ1 and EW06 during steady pumping at EWS. The value of hydraulic conductivity was adjusted in the simple analytical model until a match was achieved between the observed and calculated difference in drawdown of 2.1 feet between EWS-PZ1 and EW06.

The analytical model is based on the Dupuit formulation for steady-state radial flow to a pumping well in an unconfined aquifer (Chow, 1964). The Dupuit model may be used to estimate hydraulic conductivity in an unconfined aquifer, based on the difference in saturated thickness observed at different radial distances from a fully-penetrating pumped well. The equation for this version of the Dupuit model is

$$K = \left[\frac{Q}{\pi(h_2^{\,2} - h_w^{\,2})}\right] \ln\left(r_2 / r_w\right) \qquad \text{(Eq. A.1)}$$

where K = hydraulic conductivity (ft/day);
Q = pumping rate (ft^3/day);
h_2 = saturated thickness at well 2 (ft);
h_w = saturated thickness at the pumped well (ft);
r_2 = distance of Well 2 from the pumped well (ft); and
r_w = distance from center of pumped well to outside of casing (0.83 ft).

Figure A.2 illustrates the parameters used in this equation.

This equation was re-arranged to solve for h_2 as follows:

$$h_2 = \sqrt{\frac{Q[\ln(r_2/r_w)]}{K\pi} + h_w^{\,2}} \qquad \text{(Eq. A.2)}$$

The calibration of hydraulic conductivity using the Dupuit model is a non-linear approach because it requires matching two parameters which are inter-dependent:

- The difference in hydraulic head modeled to occur at EWS-PZ1 and EW06; and
- The theoretical groundwater elevation estimated to occur at EWS, which is used as a reference to calculate the hydraulic heads at EWS-PZ1 and EW06.

The step-by-step approach for calibrating the value of hydraulic conductivity in the Salt River Gravel is described below.

Approach for Calibrating Hydraulic Conductivity

The value of hydraulic conductivity in the Salt River Gravel in the vicinity of EWS was estimated using the following methodology:

1. Estimate the initial hydraulic conductivity to be used at the start of the calibration process for the Salt River Gravel at EWS (e.g. 200 ft/day);

2. Estimate the theoretical groundwater elevation that occurred outside the well casing at EWS just prior to pump shutdown (e.g. 1,000 ft AMSL);

3. Estimate the saturated thickness at EWS based on the difference between the theoretical groundwater elevation at EWS (see Step 2) and the bottom of the Salt River Gravel at EWS, which is 959 ft AMSL (i.e. saturated thickness of 41 ft at EWS);

4. Calculate the transmissivity of the Basin Fill at EWS based on a hydraulic conductivity of 28 ft/day (10^{-2} cm/s) and a saturated thickness of 54 ft (i.e. transmissivity in Basin Fill of 1,512 ft^2/day);

5. Calculate the groundwater extraction rate at EWS just prior to pump shutdown on January 9, 2004, based on a total extraction rate of 250 gpm, estimated transmissivity in the Salt River Gravel of 8,200

ft^2/day (based on a saturated thickness of 41 ft and an estimated hydraulic conductivity of 200 ft/day), the transmissivity calculated for the Basin Fill at EWS (see Step 4), and the equation

$$Q_{SRG} = Q_T \frac{T_{SRG}}{T_{SRG} + T_{BF}} \qquad \text{(Eq. A.3)}$$

where Q_{SRG} = extraction rate in the Salt River Gravel (ft^3/day);
Q_T = total rate extracted from the Salt River Gravel and the Basin Fill aquifer (ft^3/day);
T_{SRG} = transmissivity of the Salt River Gravel (ft^2/day); and
T_{BF} = transmissivity of the Basin Fill aquifer (ft^2/day).

Using the estimated parameters presented above, this would result in a Salt River Gravel extraction rate of 211 gpm relative to the total pumping rate of 250 gpm observed at EWS prior to pump shutdown on January 9, 2004.

6. Calculate h_w based on the difference between the theoretical groundwater elevation at EWS (see Step 2) and the bottom elevation of the Salt River Gravel (see Step 3), such that h_w=41.1 ft;

7. Calculate h_2 at EWS-PZ1 at a radial distance of 155 ft from EWS using Equation A.2 (i.e. h_2 = 44.9 ft);

8. Calculate h_2 at EW06 at a radial distance of 930 ft from EWS using Equation A.2 (i.e. h_2 = 46.2 ft);

9. Calculate the difference in h_2 between EWS-PZ1 and EW06 (i.e. Δh = 1.3 ft);

10. Compare the calculated difference in elevation between EWS-PZ1 and EW06 to the measured difference in recovery (i.e. 2.1 ft) between these two wells, based on the assumption that EWS-PZ1 and EW06 would have the same groundwater elevation if pumping was not being conducted at EWS;

11. Calculate the difference between the theoretical groundwater elevation at EWS (e.g. 1,000 ft AMSL - see Step 2) and the measured elevation at EWS-PZ1 (i.e. 1001.7 ft AMSL) measured just prior to the shutdown of the pump at EWS on January 9, 2004 (i.e. difference of 1.7 ft between the theoretical elevation at EWS and the measured elevation at EWS-PZ1);

12. Calculate the difference between h_w and h_2 at EWS-PZ1 (i.e. 3.8 ft);

13. Compare the difference in groundwater elevations calculated in Step 11, to the estimated difference that should occur based on the Dupuit model (see Step 12), based on the assumption that the elevations at EWS and EWS-PZ1 should be similar if EWS were not being pumped; and

14. Adjust the theoretical groundwater elevation and estimated hydraulic conductivity at EWS and repeat steps 3 through 13 until:

- the difference between h_w and h_2 at EWS-PZ1 equals the difference between the theoretical groundwater elevation at EWS and the measured groundwater elevation at EWS-PZ1; and

- the difference between h_2 at EWS-PZ1 and h_2 at EW06 equals the measured difference in recovery between these two wells when the pump at EWS was shutdown on January 9, 2004 (i.e. 2.1 ft).

The assumptions of the Dupuit model include:

- steady-state conditions;
- uniform hydraulic conductivity;
- flat bottom surface of the aquifer;
- non-stratified aquifer; and
- saturated thickness is constant prior to pumping.

A.3 RESULTS

Based on the above methodology, it was determined that the theoretical groundwater elevation at EWS would be 995.1 ft AMSL, based on the following parameters: h_2 (EWS-PZ1) = 42.7 ft., h_2 (EW06) = 44.8 ft., and h_w (EWS) = 36.1 ft. The resultant hydraulic conductivity of the Salt River Gravel in the vicinity of EWS is calculated as 105 ft/day.

Based on this theoretical groundwater elevation and the measured elevation of 963 ft AMSL at EWS, the well efficiency of EWS was calculated to be 25% on January 9, 2004.

The transmissivity at EWS was estimated to be 3,800 ft^2/day, which is significantly lower than the transmissivity that occurred at EWM at the same time.

REFERENCES

Chow, V.T., 1964, Handbook of Applied Hydrology, McGraw-Hill Book Company, New York, NY.

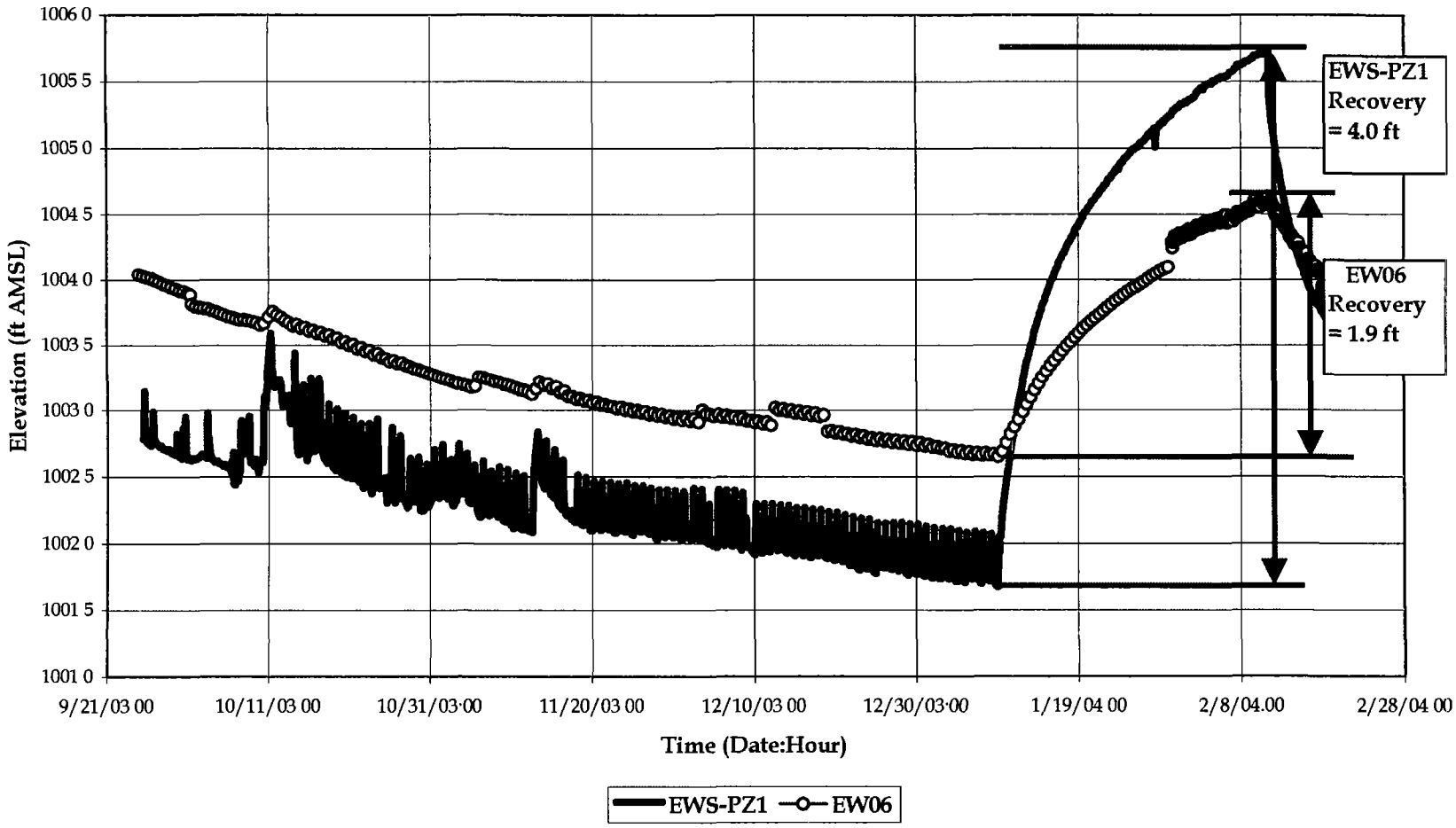


figure A.1

RECOVERY AT EWS-PZ1 AND EW06 BETWEEN JANUARY 9 AND FEBRUARY 11, 2004

52nd STREET SUPERFUND SITE

Phoenix, Arizona

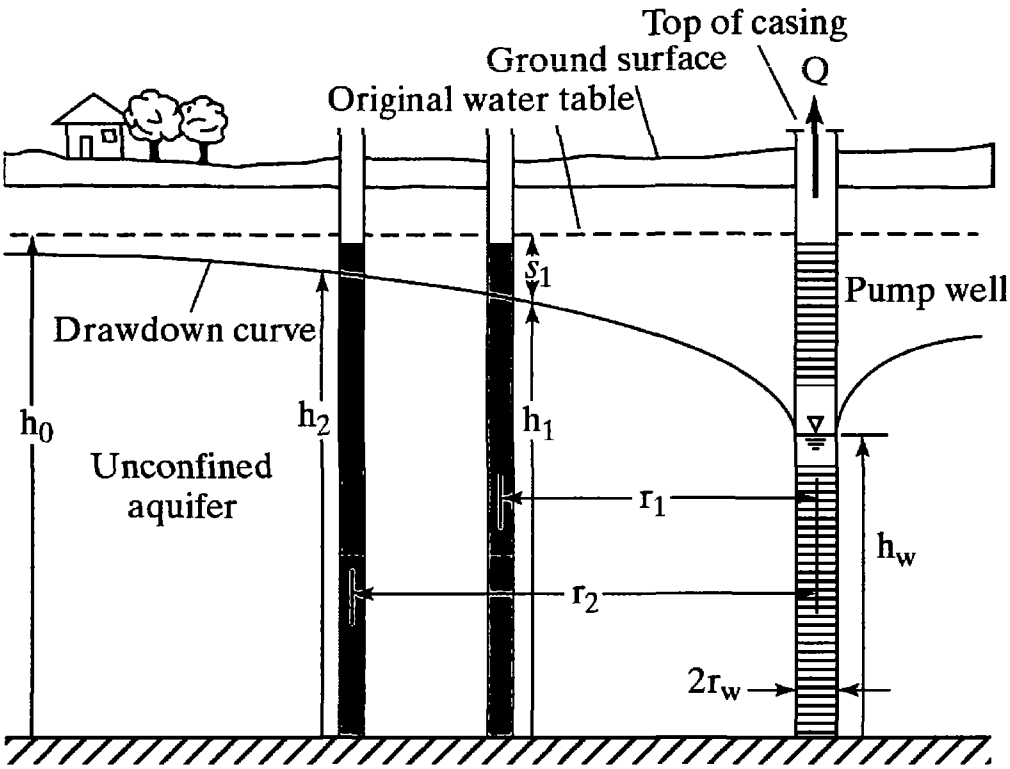


Figure A.2 - Dupuit Model of Radial Flow to a Well Penetrating an Unconfined Aquifer

ATTACHMENT B

THEORETICAL GROUNDWATER ELEVATION AT EWM AND EWS

ATTACHMENT B

B.1 INTRODUCTION

The purpose of the analysis presented in this attachment is to estimate the theoretical groundwater elevations that occurred directly outside the well casings of extraction wells EWM and EWS on April 6, 2004. The theoretical groundwater elevation is the level that occurs in the formation adjacent to each extraction well. The groundwater elevations measured within the well casing are influenced by well efficiency, and thus do not represent the levels that exist in the formation itself.

These theoretical groundwater elevations were used as part of the flow net analysis discussed in the May 28, 2004 letter to the USEPA. Sections B.2 and B.3 present the methodology and calculation of theoretical groundwater elevations at EWM and EWS, respectively.

B.2 THEORETICAL GROUNDWATER ELEVATION AT EWM

EMA (2002) presented estimates of well efficiency for extraction well EWM corresponding to different extraction rates. The estimated well efficiency at EWM for an extraction rate of 1,400 gpm was 65%, and the estimated well efficiency of EWM was 56% corresponding to an extraction rate of 1,800 gpm.

Based on this relationship between well efficiency and extraction rate, and based on the April 6, 2004 extraction rate of 1600 gpm, the well efficiency for EWM was interpreted to be 61%.

Figure A.1 presents measured recovery at various wells during the shutdown that occurred between January 9 and February 11, 2004. Based on the static water levels that occurred in these wells during the recovery period, it is assumed that the static groundwater elevation that would occur in the vicinity of EWM in the absence of groundwater production is approximately 1006 ft AMSL.

The groundwater elevation measured inside the EWM well casing on April 6, 2004, was approximately 991 ft AMSL. Based on the static groundwater elevation of 1006 ft AMSL, this corresponds to a measured drawdown in the well casing of 15 ft. The theoretical drawdown that occurs in the formation adjacent to the EWM well casing was determined to be 9.2 ft (based on the estimated well efficiency of 61%). This results in a theoretical groundwater elevation in the formation of 996.8 ft AMSL adjacent to extraction well EWM.

B.3 THEORETICAL GROUNDWATER ELEVATION AT EWS

Attachment A presents the methodology and calculations used to estimate the hydraulic conductivity of the Salt River Gravel in the vicinity of extraction well EWS. The well efficiency at EWS is expected to have changed significantly over time, thus a different method was used to estimate the theoretical groundwater elevation in the formation outside EWS.

This method is based on the use of the Dupuit Model, which predicts the drawdown expected at monitoring wells situated at various distances from the pumped well in an unconfined aquifer. Refer to Attachment A for a detailed description of the Dupuit Model.

The objective of this method was to calculate the difference in drawdown expected to occur in the formation outside EWS, and the nearby piezometer EWS-PZ1 which is located approximately 155 ft from EWS. The difference in drawdown expected to occur between these two locations, based on the Dupuit model, was then subtracted from the measured groundwater elevation at EWS-PZ1 to determine the theoretical groundwater elevation at EWS.

This approach for estimating theoretical groundwater elevation is based on the following assumptions:

- The groundwater elevation at EWS would be similar to the measured groundwater elevation at EWS-PZ1 if EWS production was zero;
- Steady-state conditions;
- Uniform hydraulic conductivity;
- Non-stratified aquifer;
- Saturated thickness is constant prior to pumping; and
- Extraction well fully penetrates the aquifer.

Given that the hydraulic conductivity of the Salt River Gravel portion of alluvial aquifer is significantly higher than the Basin Fill hydraulic conductivity, and given that EWS is screened across both hydrostratigraphic units, this analysis focused on groundwater flow in the Salt River Gravels.

It was assumed that the rate of groundwater extraction from the Salt River Gravel portion of alluvial aquifer at EWS is proportional to the weighted ratio of the transmissivity in the Salt River Gravel and the Basin Fill portions of alluvial aquifer. The transmissivity of the Basin Fill portion of alluvial aquifer was calculated at EWS based on an estimated hydraulic conductivity of 28 ft/day (i.e. 10^{-2} cm/s) and saturated thickness of 54 feet.

The theoretical groundwater elevation outside the casing of each extraction well (EWM and EWS) was calculated based on estimated drawdown at the extraction well and nearest piezometer using the Dupuit model. The difference between estimated drawdown at the extraction well and piezometer was then subtracted from the measured groundwater elevation at the piezometer. The result is the theoretical groundwater elevation estimated to occur outside the well casing of the extraction well.

The transmissivity of the Salt River Gravel portion of alluvial aquifer at EWS was calculated based on:

- A saturated thickness of 44.9 feet calculated by taking the difference between groundwater elevation of 1003.9 observed on April 6, 2004 at EWS-PZ1, and the bottom elevation of the Salt River Gravel portion of alluvial aquifer observed at EWS (i.e. 959 feet AMSL); and
- Estimated hydraulic conductivity of 105 ft/day (refer to Attachment A).

Table B.1 presents the data used to calculate the theoretical groundwater elevation in the formation outside EWS. Based on this analysis, the theoretical groundwater elevation at EWS was calculated to be 998.7 ft AMSL. Based on the groundwater elevations measured inside the EWS well casing (994 ft AMSL), the well efficiency for EWS was calculated to be 65%. EMA originally estimated the well efficiency of EWS at approximately 25% (EMA, 2002). Since that time, EWS has been redeveloped and the line shaft turbine

pump replaced with a smaller, 200 gpm submersible pump set deeper in the well. These changes, combined with the lower flow rate, resulted in a substantial improvement of the well efficiency.

B.4 REFERENCES

EMA. 2002. Results of Hydrogeologic and Construction Services for Installation of Extraction and Monitor Wells, 52nd Street Superfund Site, Operable Unit 2, Phoenix, Arizona. Two Volumes. Report date August 29, 2002.

TABLE B.1

CALCULATION OF GROUNDWATER ELEVATION AT EWS - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Steady Radial Flow
Dupuit Equation for Steady State Wells; Unconfined (taken from Bedient et.al, 1994)

K = [Q / pi*(h2^2 - hw^2)] * ln(r2/rw)

where:

Q = well yield / pumping rate
h2 = sat thickness / head at obs Well
hw = steady state head at pumping well
r2 = radius from pumping well to obs Well
rw = radius of pumping well

Dupuit Equation Assumptions:

Steady State Conditions
Uniform Hydraulic Conductivity
Non Stratified Aquifer
Flat bottom surface at SRG Aquifer
Saturated thickness is constant prior to pumping
100% efficient pumping well
Intake portion of well penetrates entire aquifer

ASSUMPTIONS:

EWS Head (measured) =	994	ft AMSL
EWS Head (theoretical) =	**998.7**	ft AMSL
Bottom of SRG at EWS =	959	ft AMSL
EWS-PZ1 Head (measured) =	1003 9	ft AMSL
Distance from EWM to PZ01-S =	155	ft
Total Q =	200	gpm
Basin Fill K =	28	ft/day
Basin Fill Saturated Thickness =	54	ft
Transmissivity-SRG =	4714 5	ft^2/day
Transmissivity-BF =	1512	ft^2/day
Radius of Influence =	5000	ft

also

Pumping rate from SRG based on T ratio

CALCULATIONS:

Well Yield / pumping rate from SRG (Q)	**151**	gpm	825 5 m3/day	
rw (=r1 since pumping well is obs Well 1)	10	inches	0 254 metres	
Hydraulic conductivity (K)	**105**	ft/day	32 0 m/day	*(CALIBRATED)*
Delta-h, *PZ-01D* to EWS-theoretical	5 2	ft		*(CALCULATED)*
hw (= h1 since pumping well is obs Well 1)	**12.104**	**m (assumed)**		

r2 (ft)

well	*r2 (m)*	*Estimated h2 (m)*	*h2 (ft)*	*s (ft)*	*Delta-h (ft)*	
1	0 3048	12 2	39 9	9 1	**5.2**	*(CALIBRATED)*
155	47 244	13.8	45.1	3 9	**1.7**	
931	283 7688	14.3	46 9	2 2		
10000	3048	15.0	49.0	0 0		

EWS Efficiency = 66%

TABLE B.1

CALCULATION OF GROUNDWATER ELEVATION AT EWS - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Knowing the static water elevation and drawdown at pumping well, and knowing hw and h2, drawdown expected at the observation well can be estimated

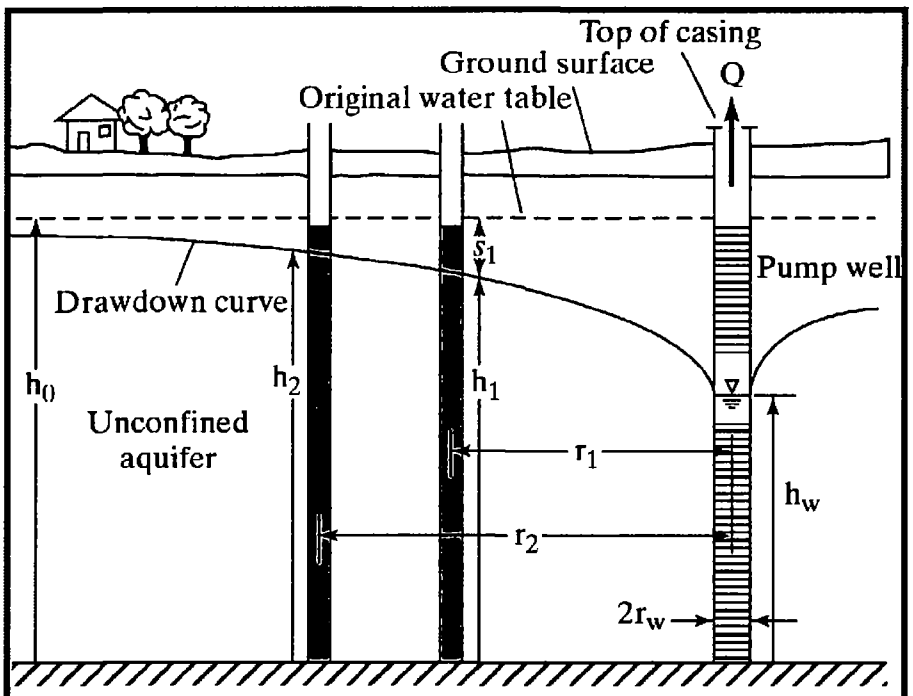


Figure 8.15

Radial flow to a well penetrating an unconfined aquifer.

ATTACHMENT C

VOC TREND IN SELECT OU2 MONITOR WELLS

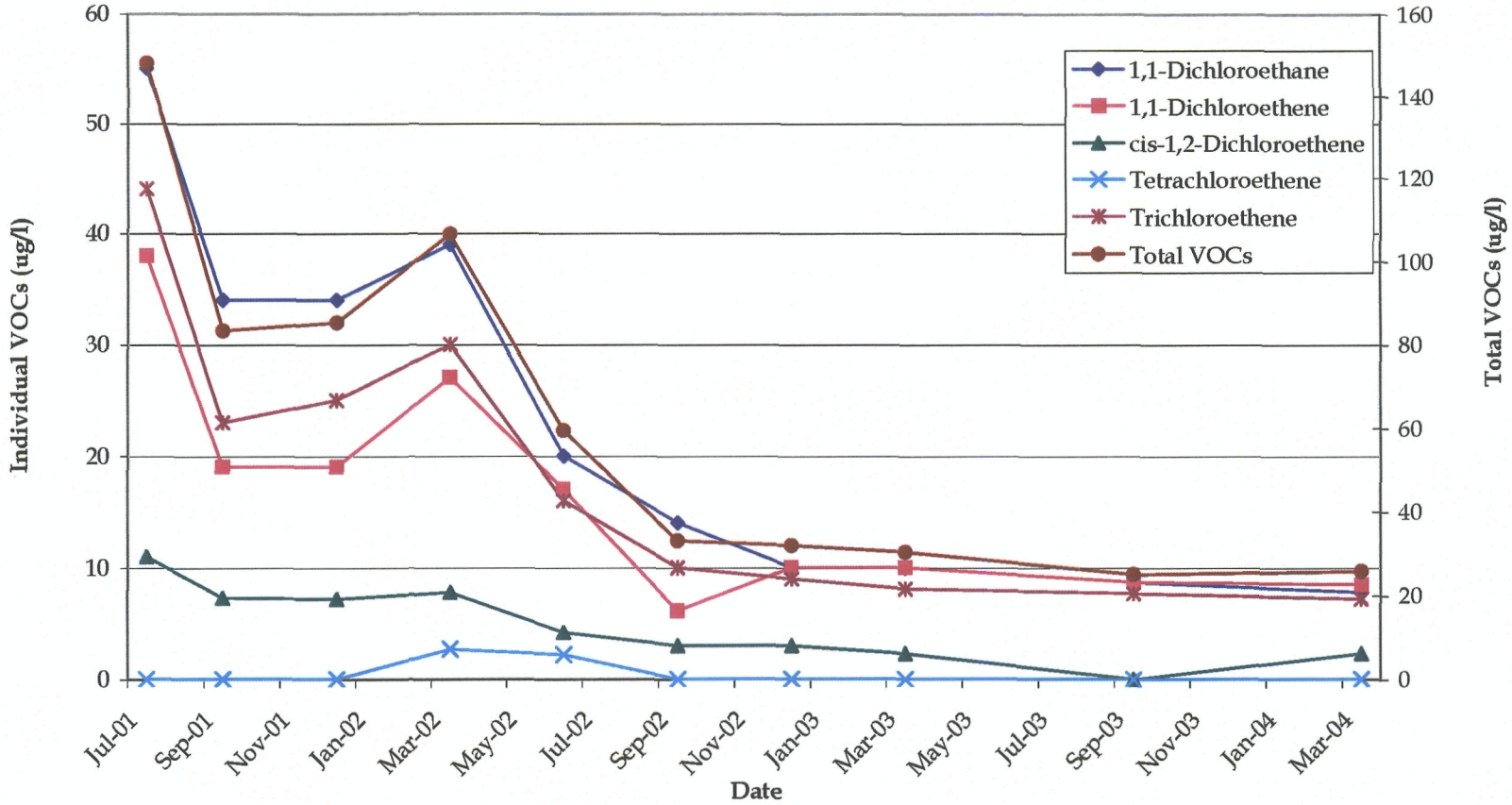
TABLE C-1

TOTAL SELECT VOC CONCENTRATION DECLINES
(SEPTEMBER 2001 THROUGH MARCH 2004)
52nd STREET SUPERFUND SITE - OU2 AREA
PHOENIX, ARIZONA

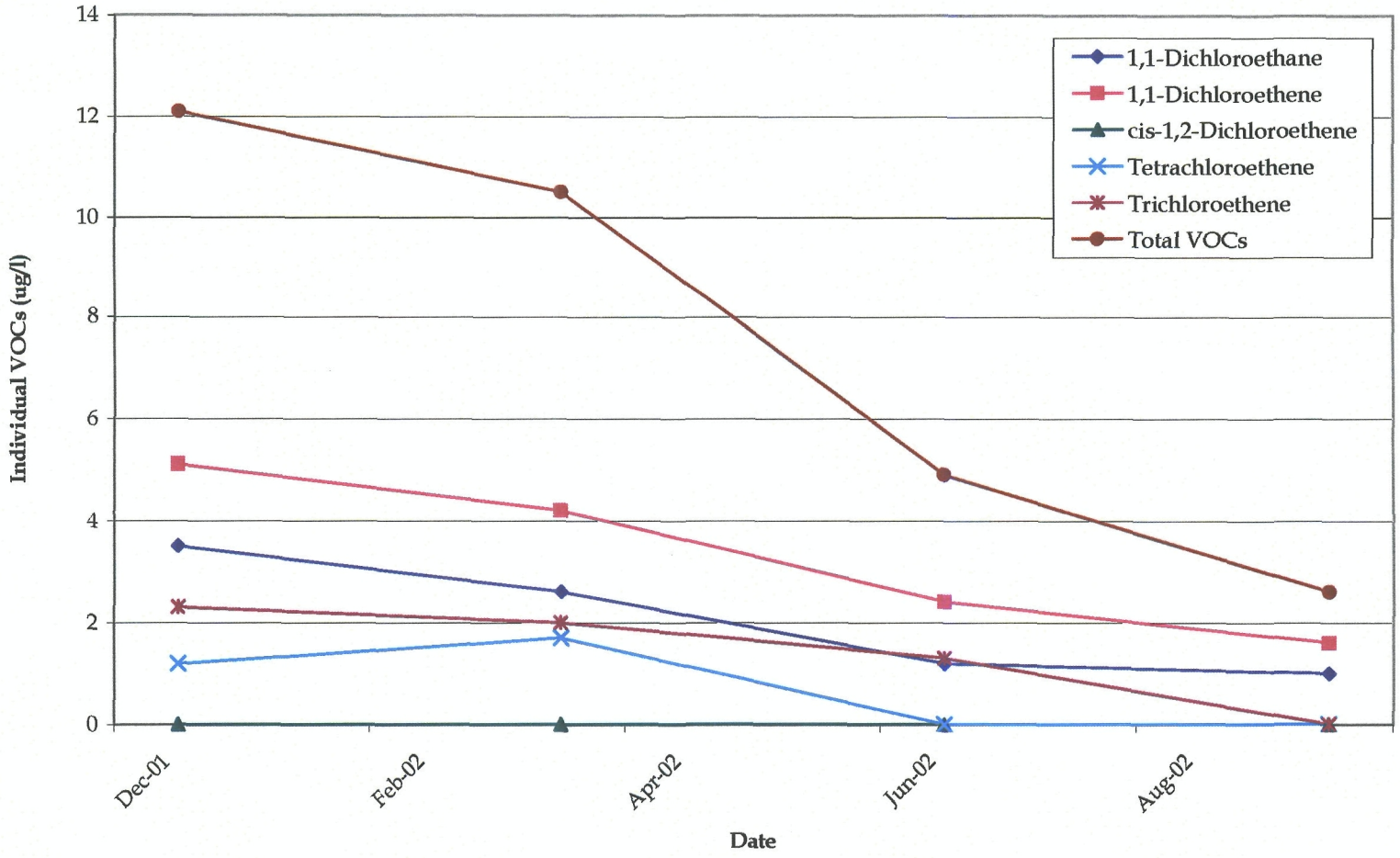
Well	*Screened Interval*	*Total VOCs* 2001 (µg/L)*	*Total VOCs* 2004 (µg/L)*
MW01 (Hertz)	SRG	12 2	2 6[a]
MW05 (Shurgin)	SRG	327	147 5[b]
NW02	SRG	229 5	53 6
NW03	SRG	657 4	118 4
NW05-S	SRG	211[c]	102 2
EW06	SRG	148	25 8
EW07	SRG	13	ND
EW12-093	SRG	542 9	136 5[d]
EW12-128	SRG	605 8	78 1[d]
EW12-227	BF	454.21	ND[d]
EW13-118	SRG	22 5	1 4[d]
EW-22	SRG	232 3	113 6

Notes:
* Select VOCs include 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, and trichloroethene
[a] Well dry in September 2003, last sample collected was November 2002
[b] Well dry in September 2003, last sample collected was March 2003
[c] Well installed in June 2003, first sample collected July 2003
[d] Well removed from monitor well network, last sampled in September 2003 or earlier if port dry
SRG - salt river gravel
BF - basin fill
ND = No target analytes detected above individual detection limits

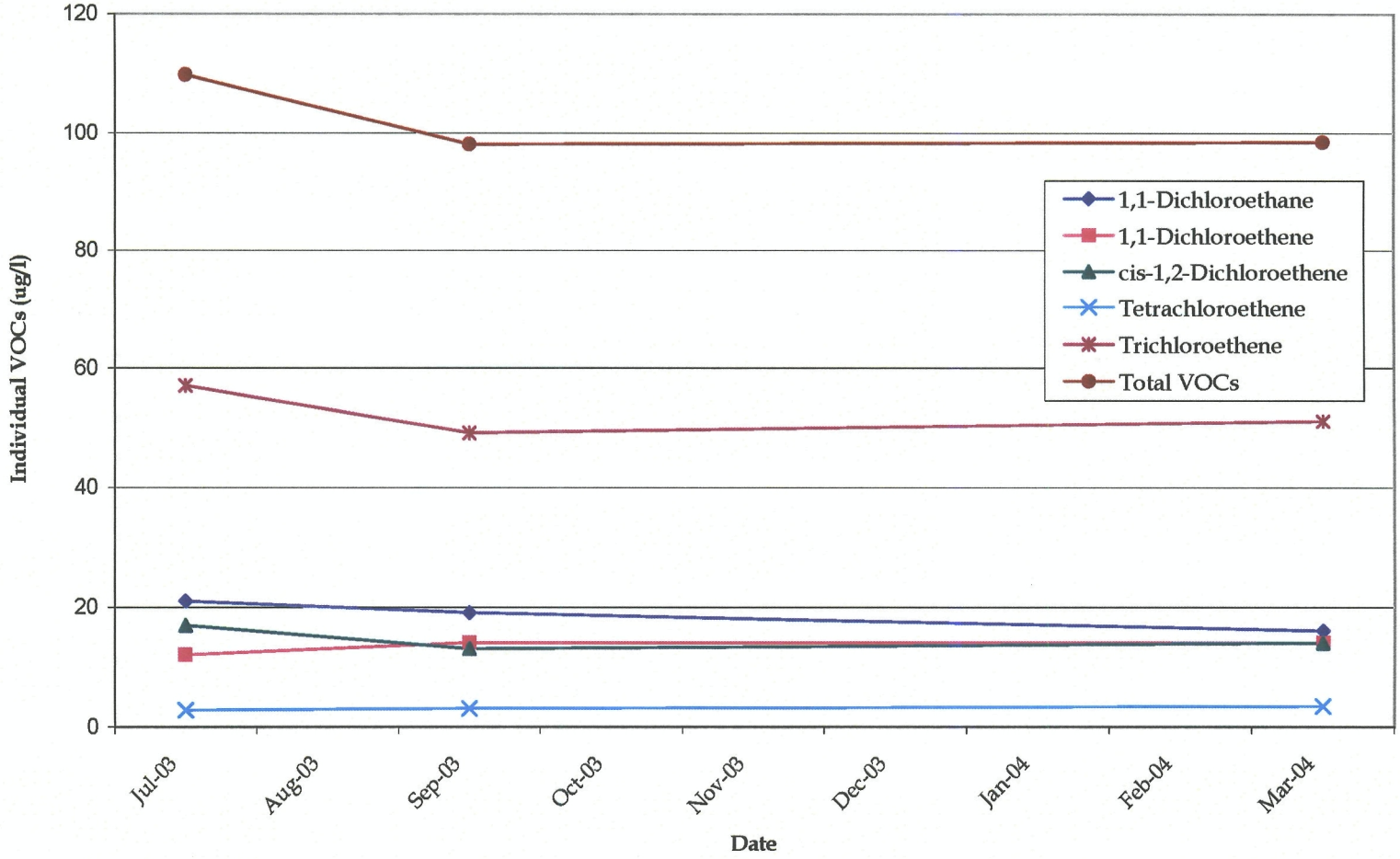
EW06 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



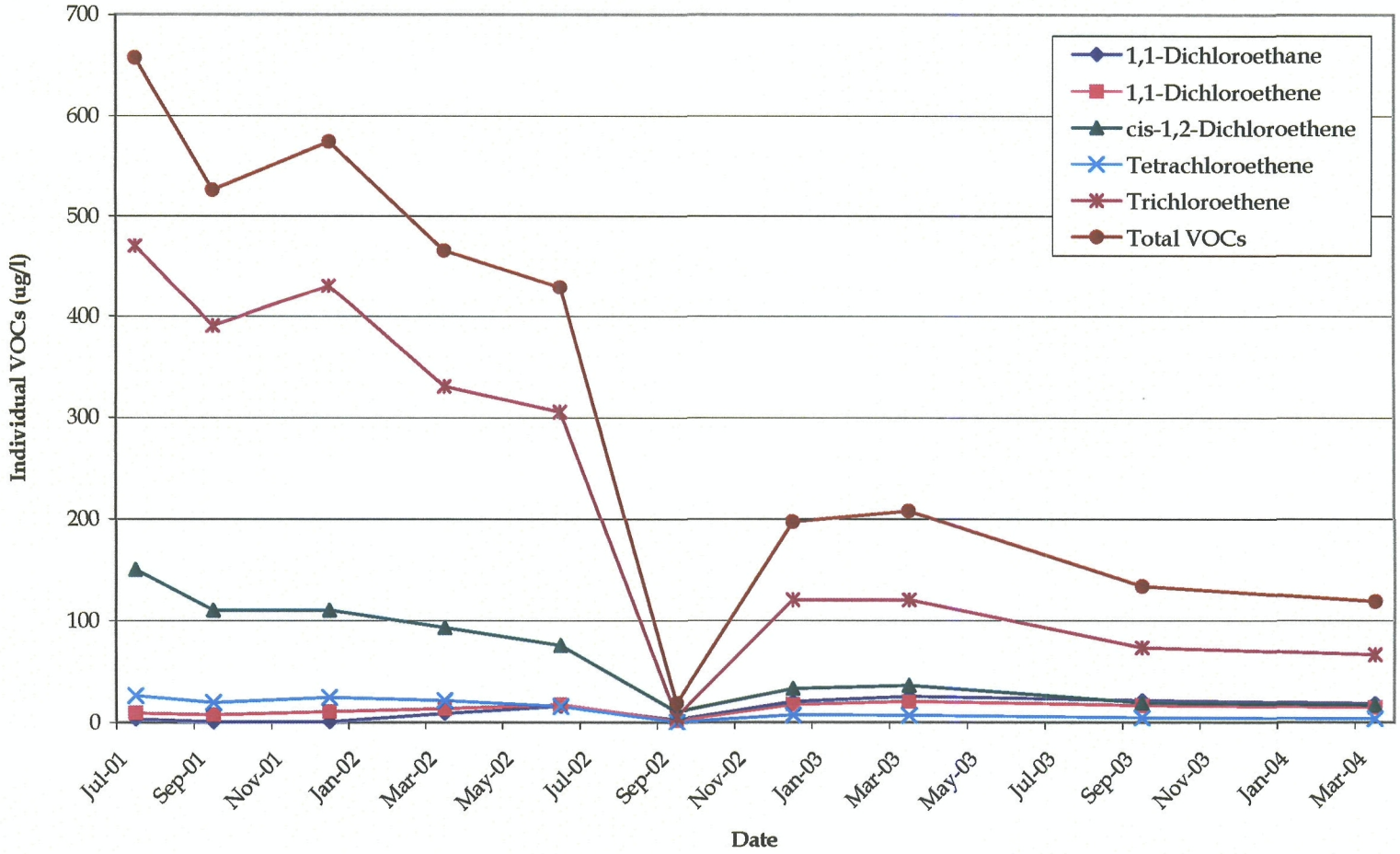
MW01 (Hertz) SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



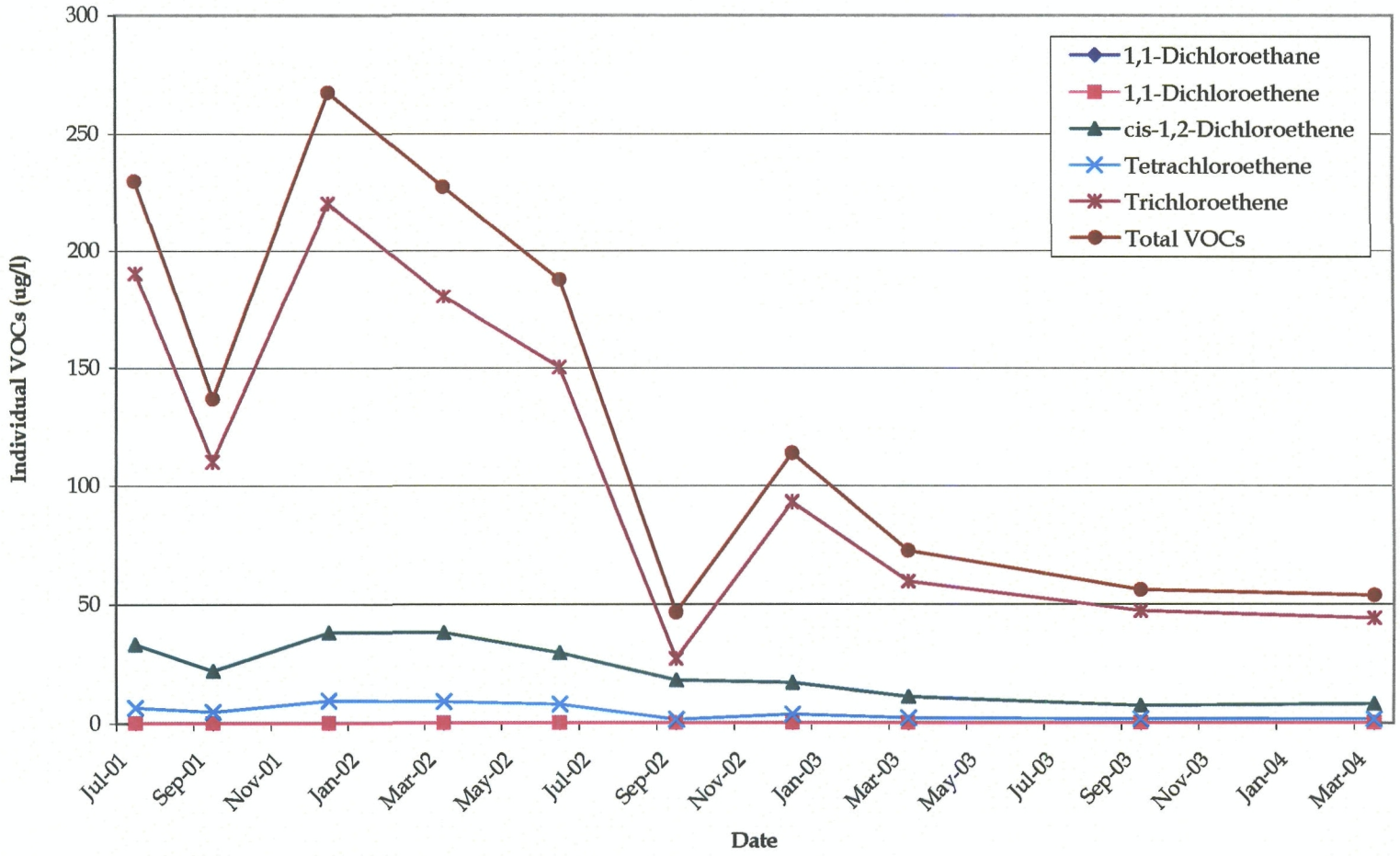
NW08-S SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



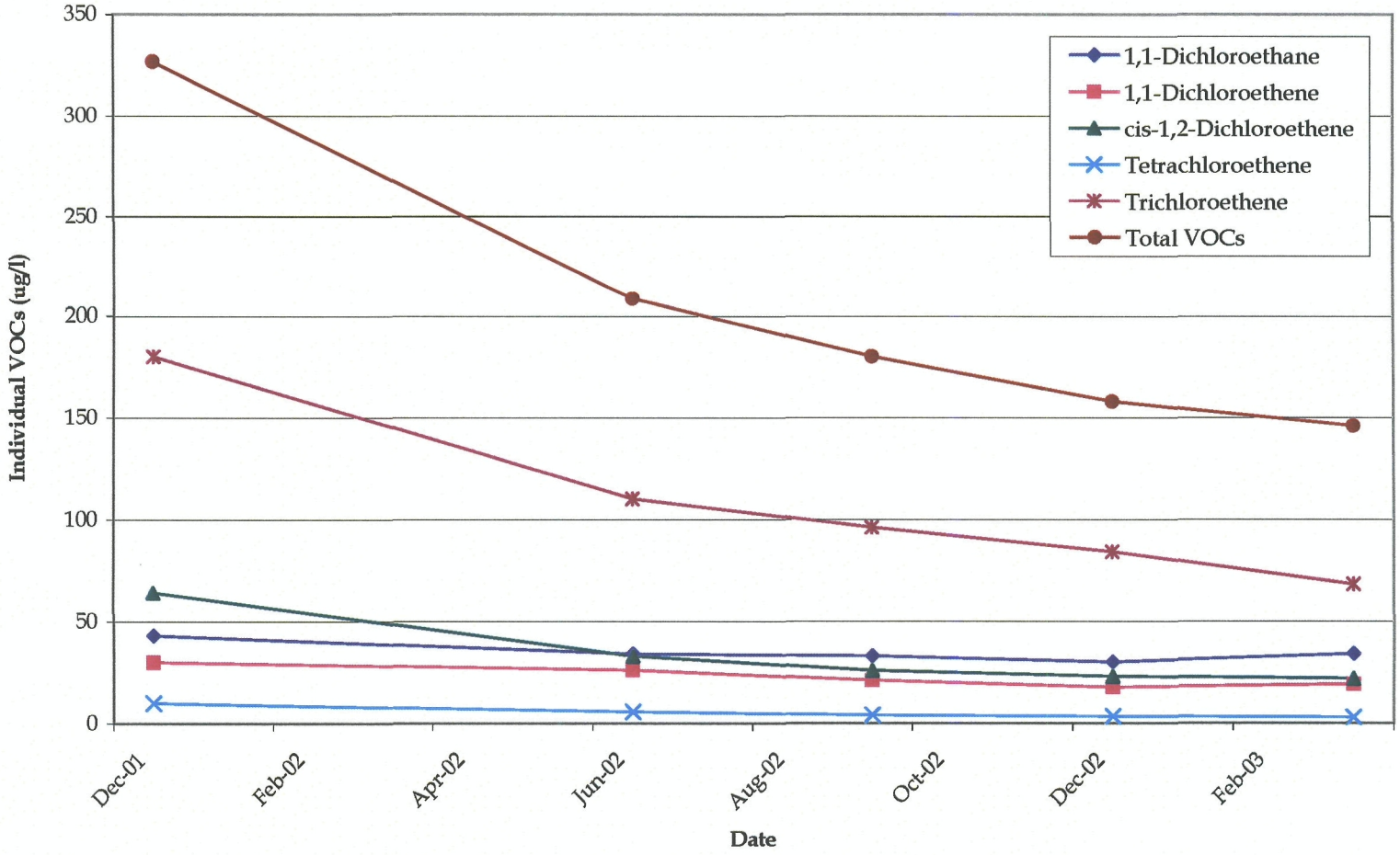
NW03 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



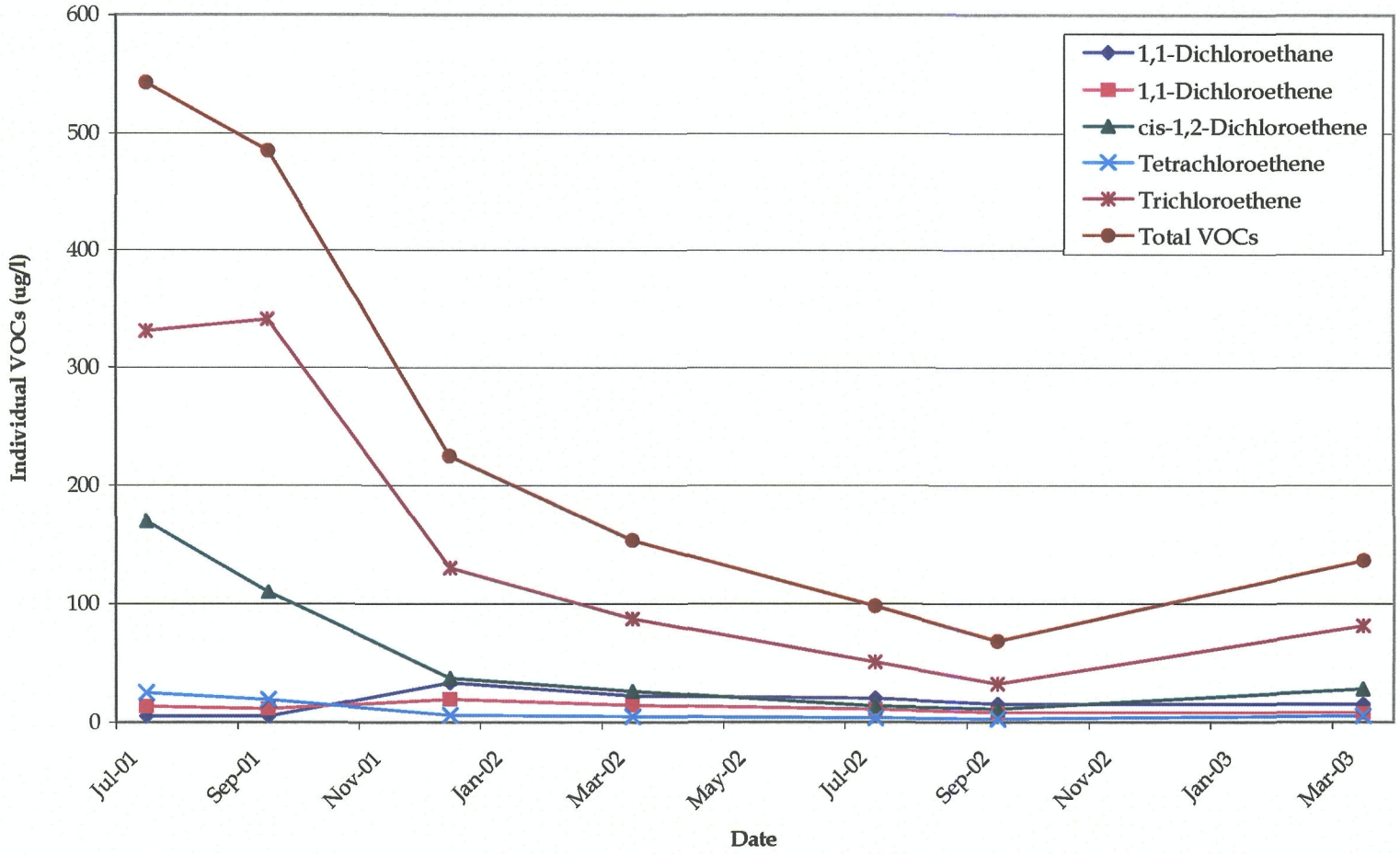
NW02 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



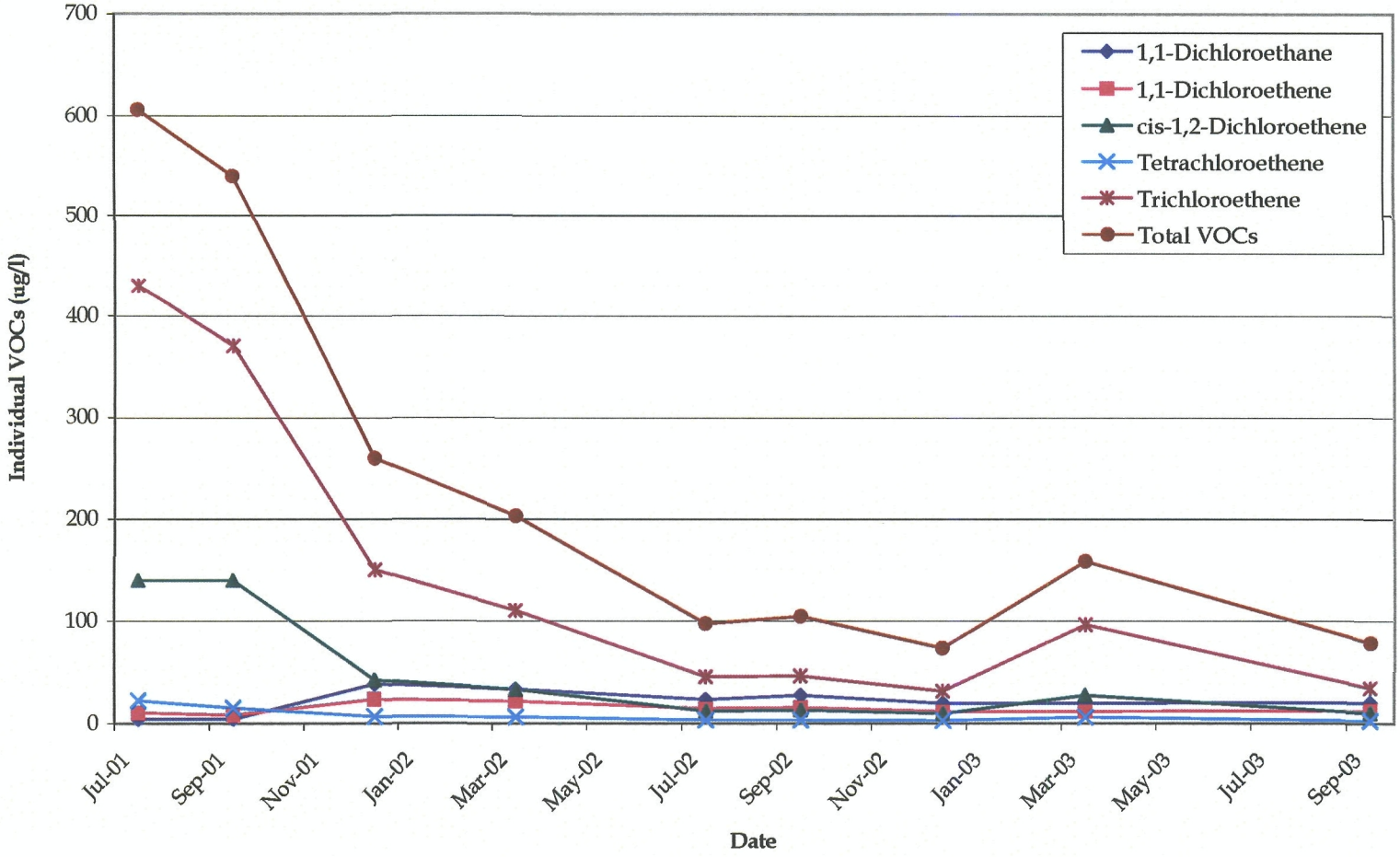
MW05 (Shurgin) SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



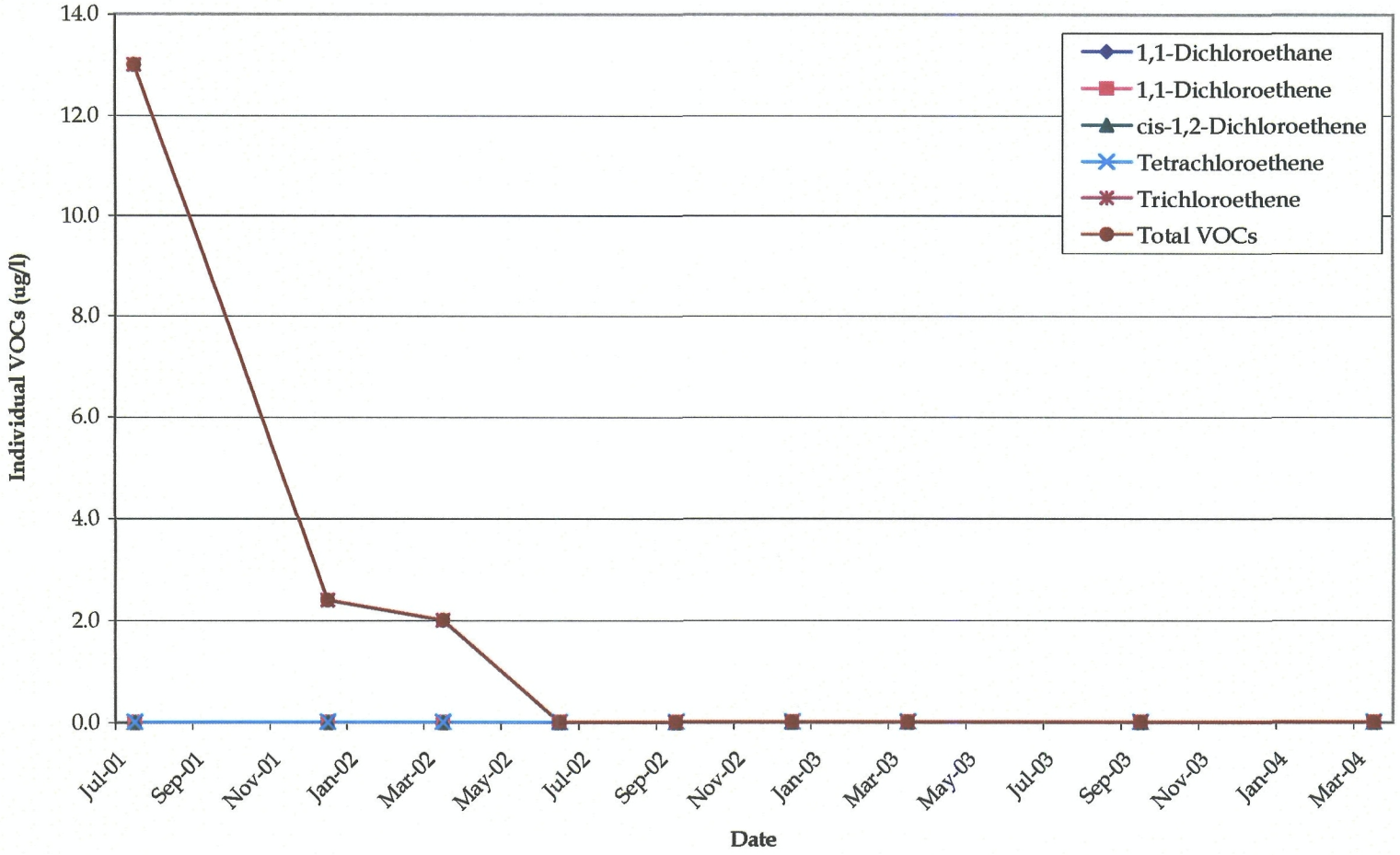
EW12-093 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



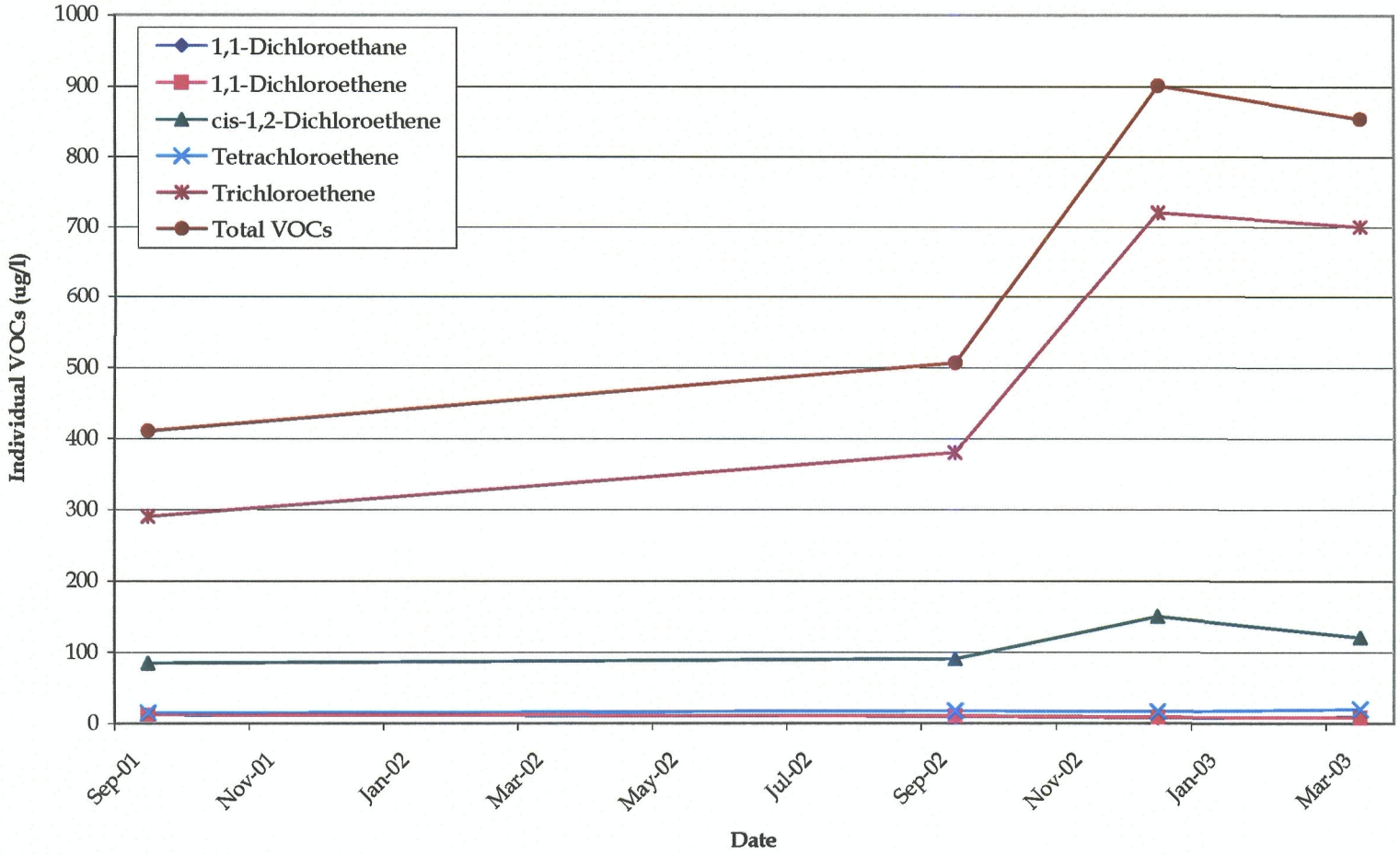
EW12-128 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



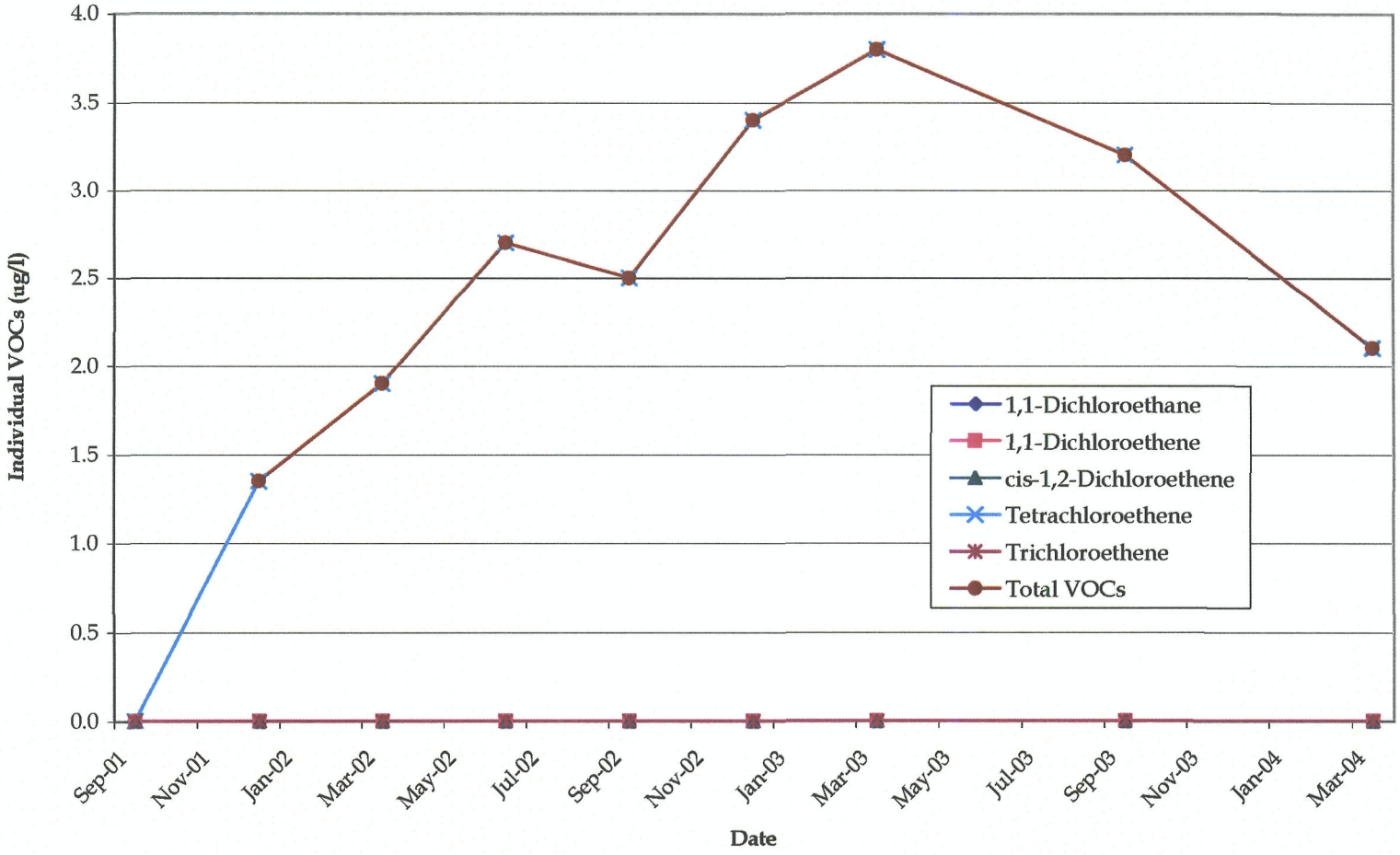
EW07 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



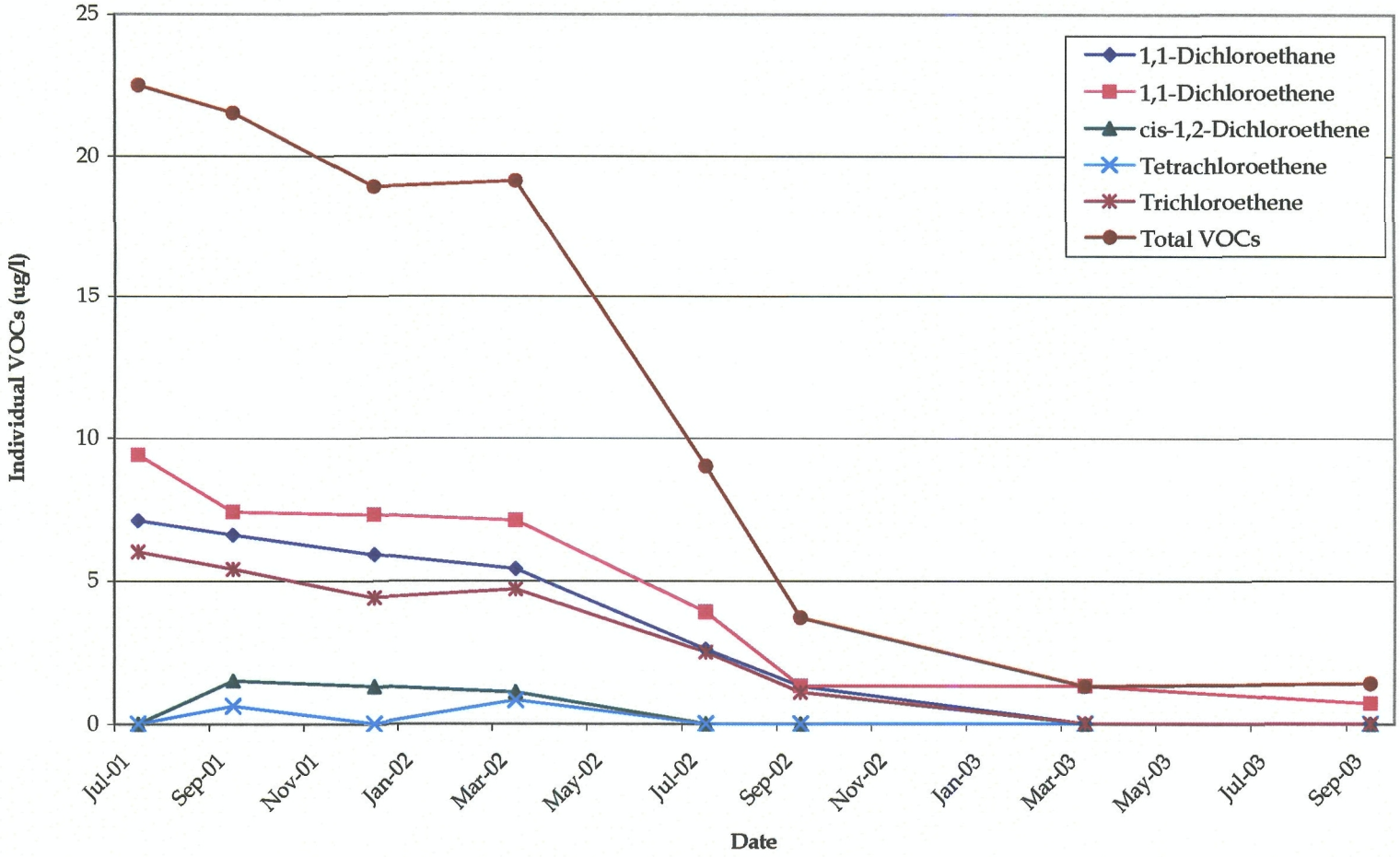
EW19S SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



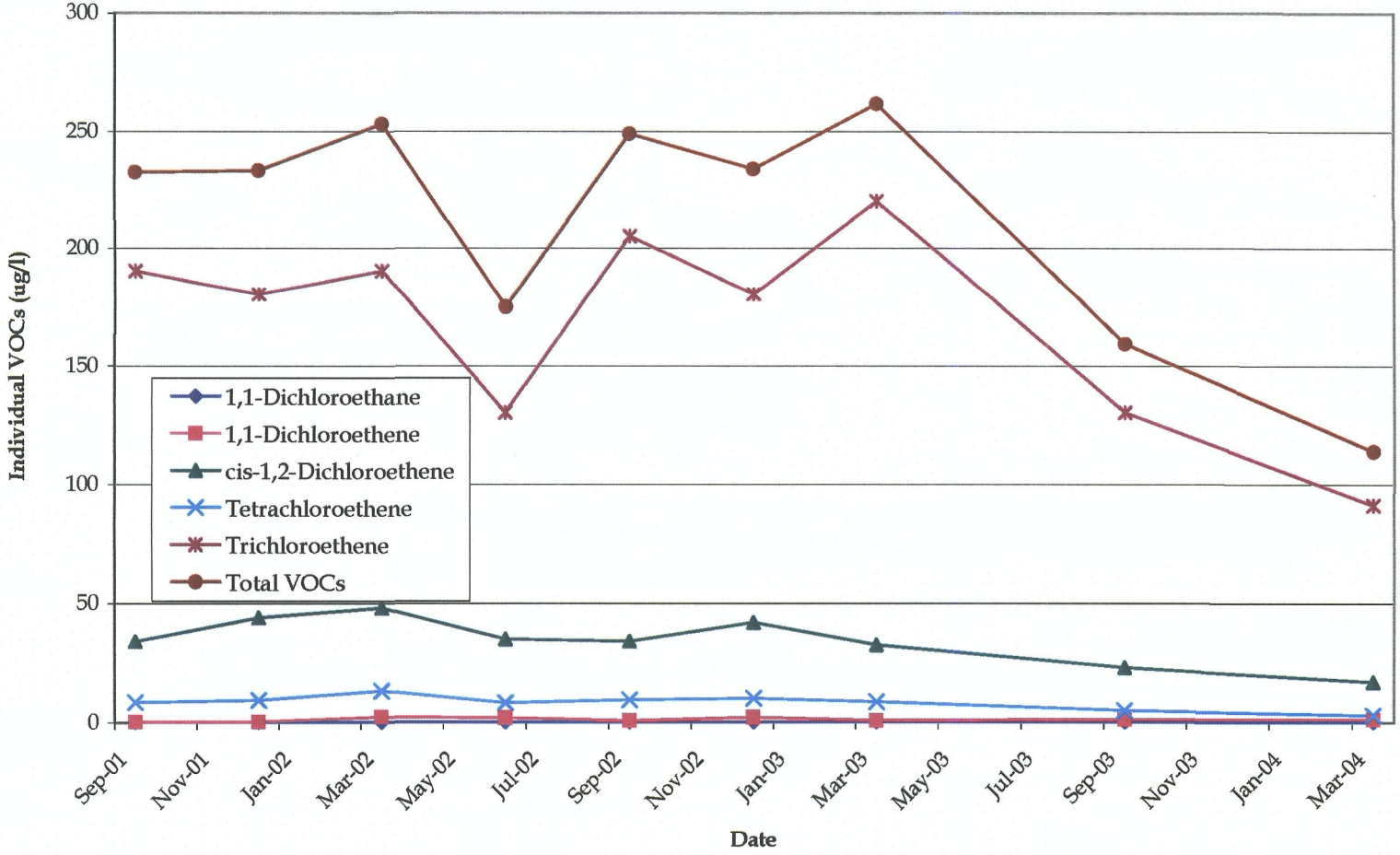
EW23 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



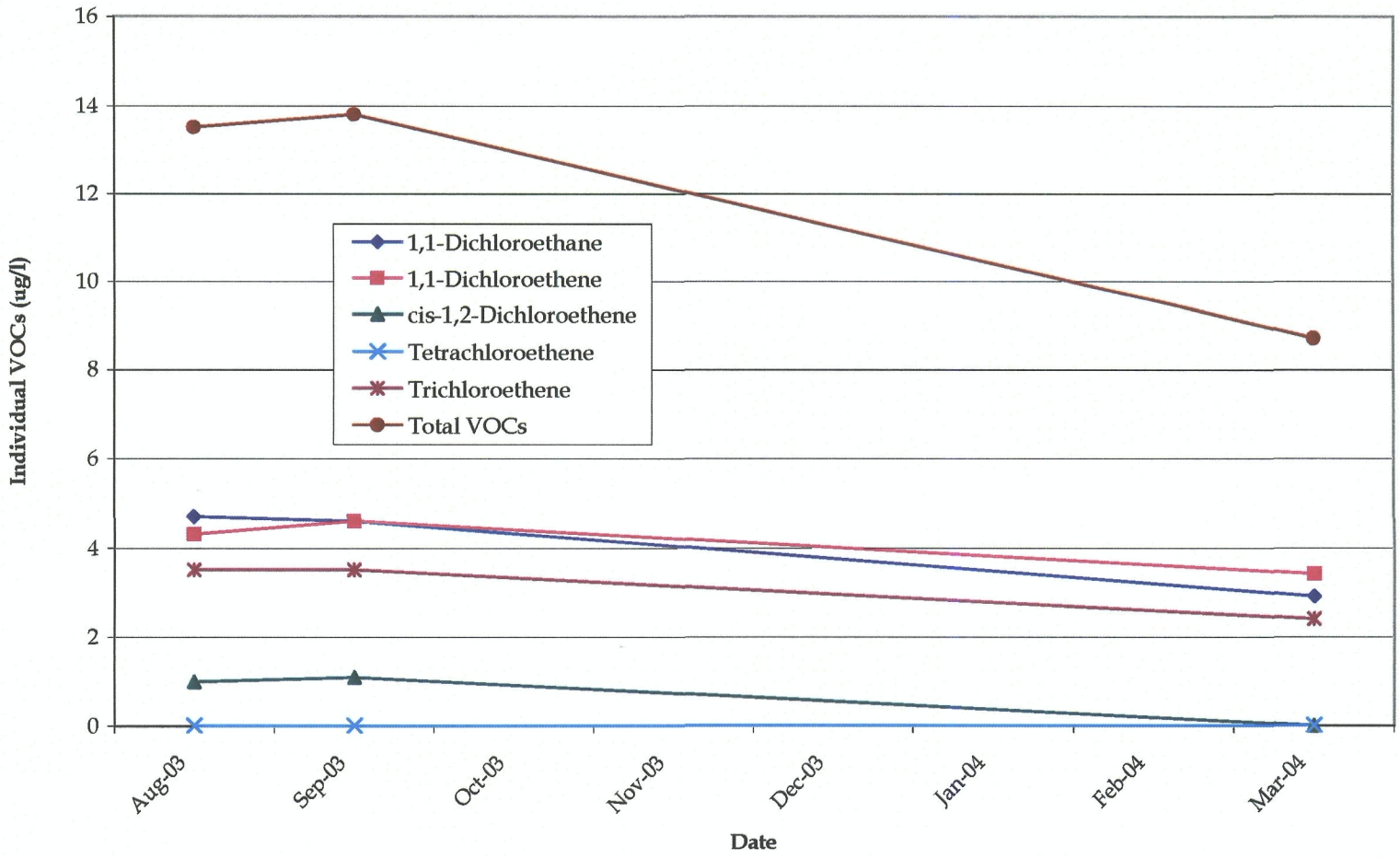
EW13-118 SELECT VOC CONCENTRATION
TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA



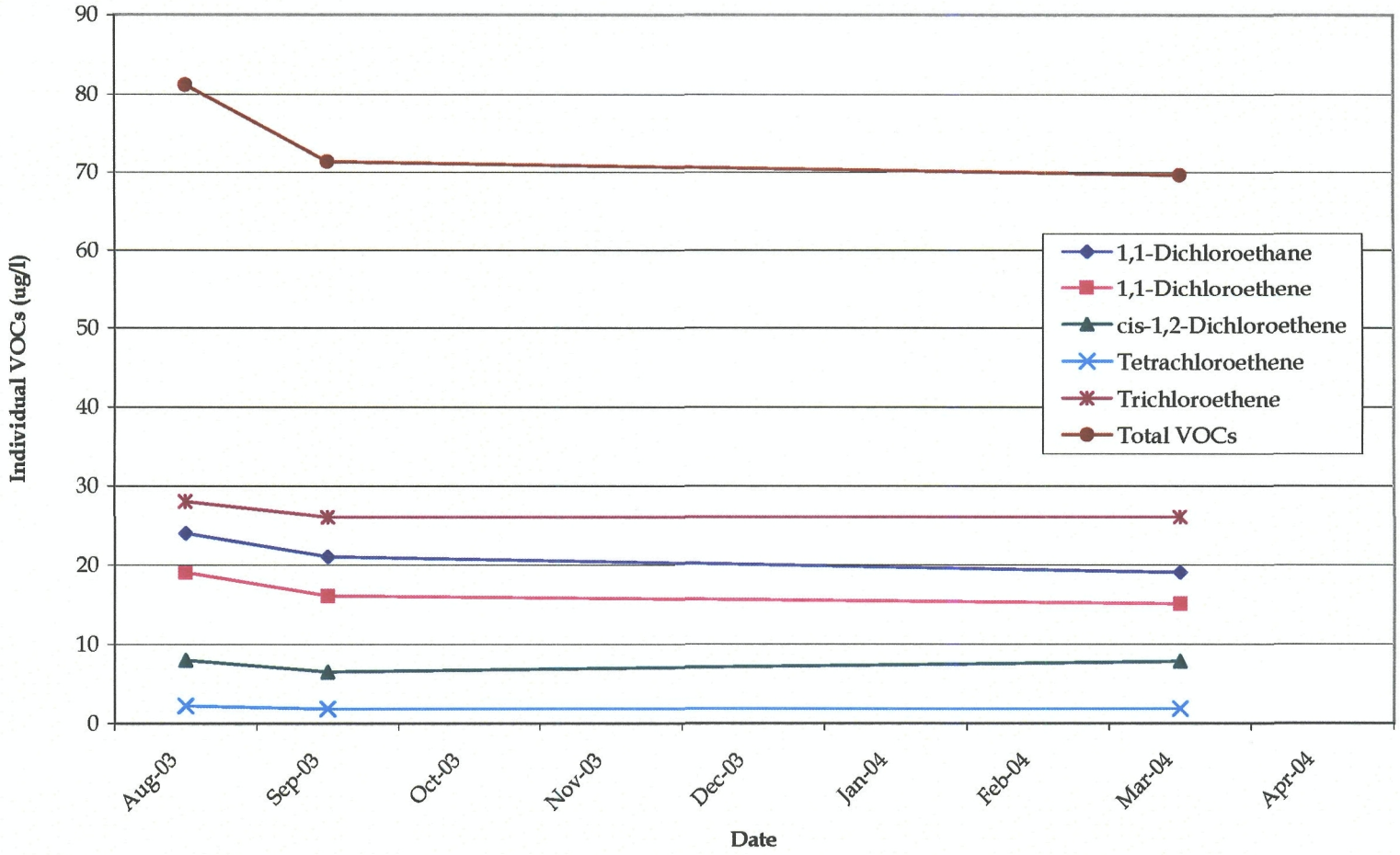
EW22S SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



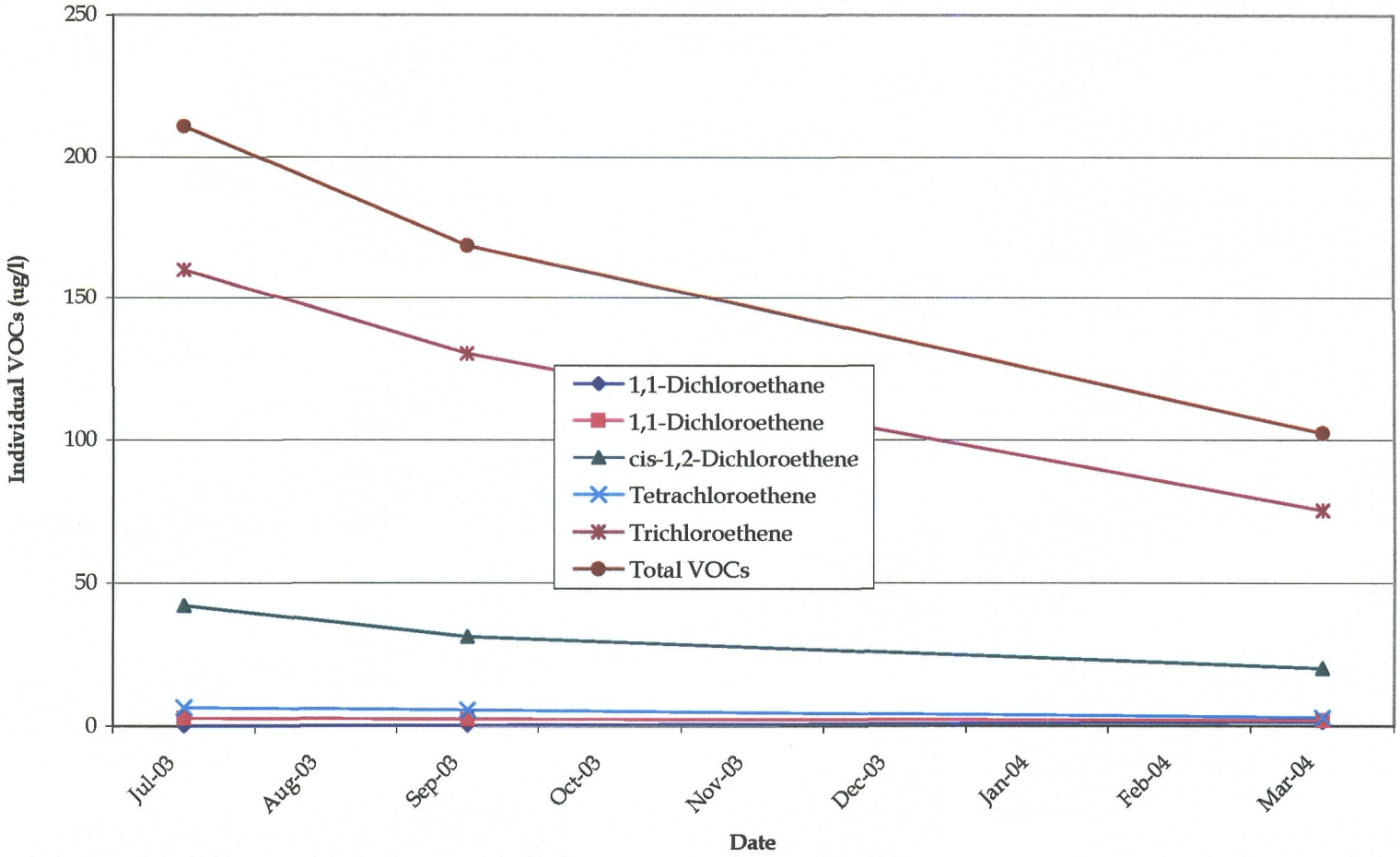
NW07-S SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



NW06-S SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



NW05-S SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



NW04-S SELECT VOC CONCENTRATION TRENDS
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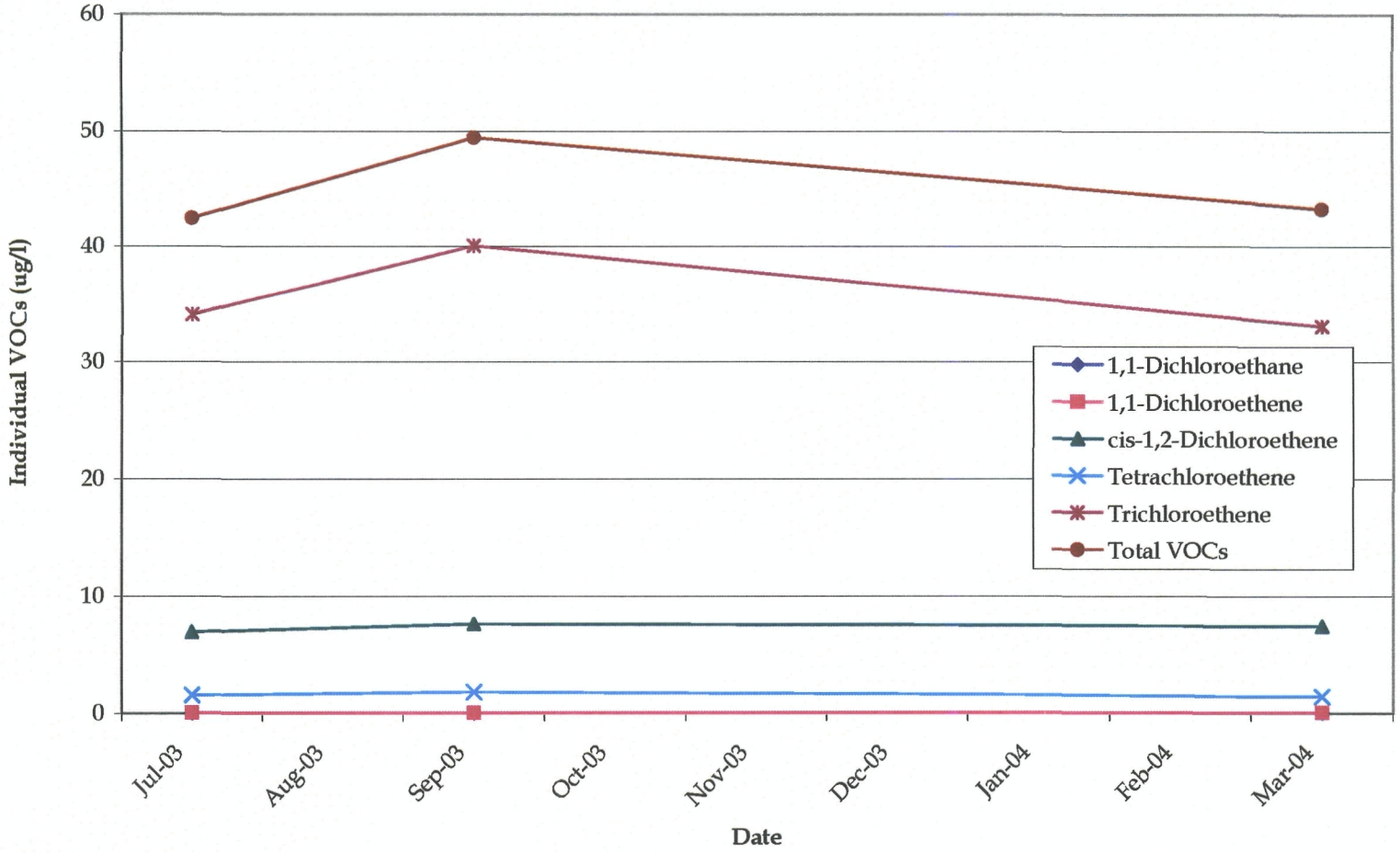
PHOENIX, ARIZONA



NW04-D SELECT VOC CONCENTRATION TRENDS
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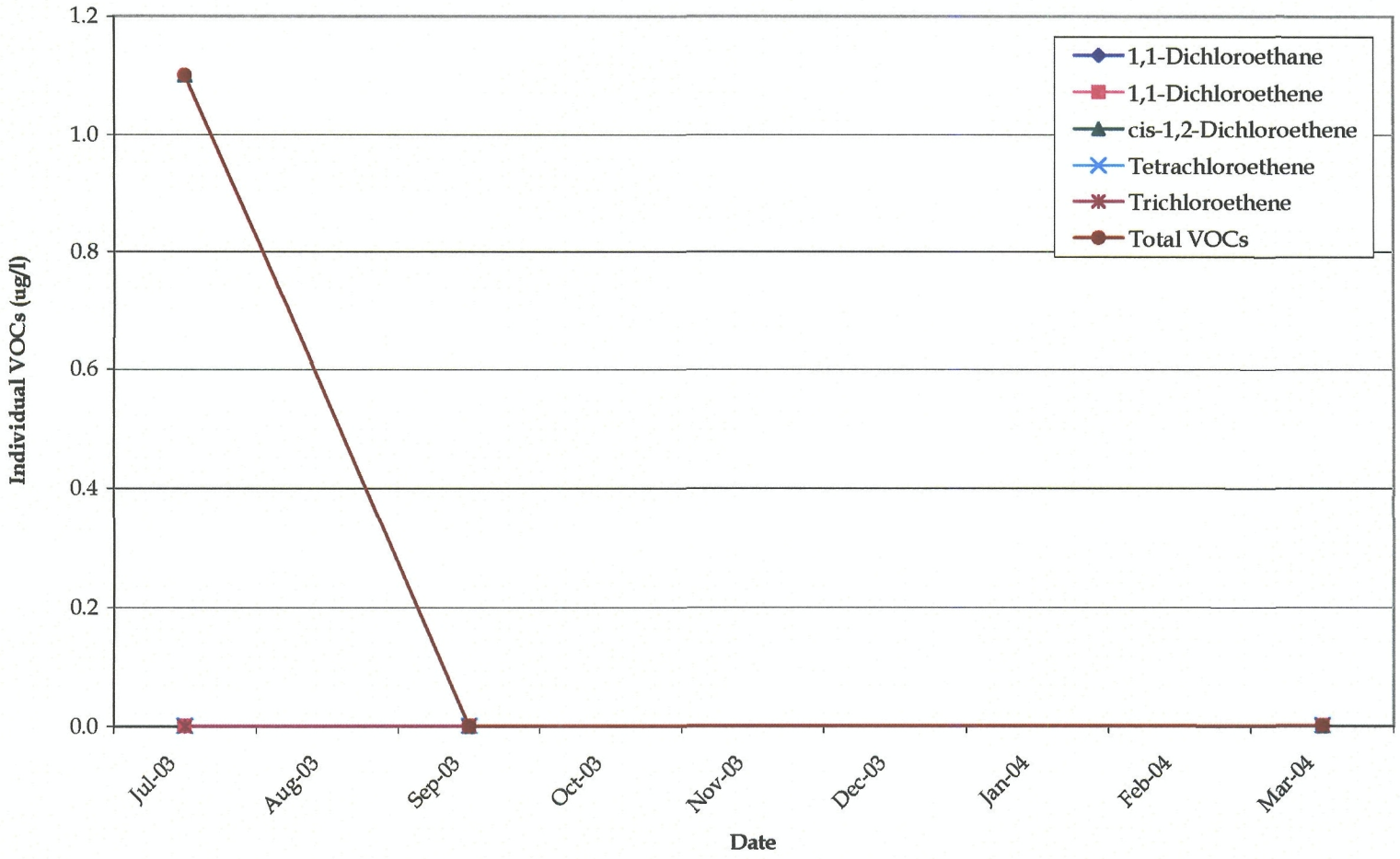

NW08-M SELECT VOC CONCENTRATION TRENDS
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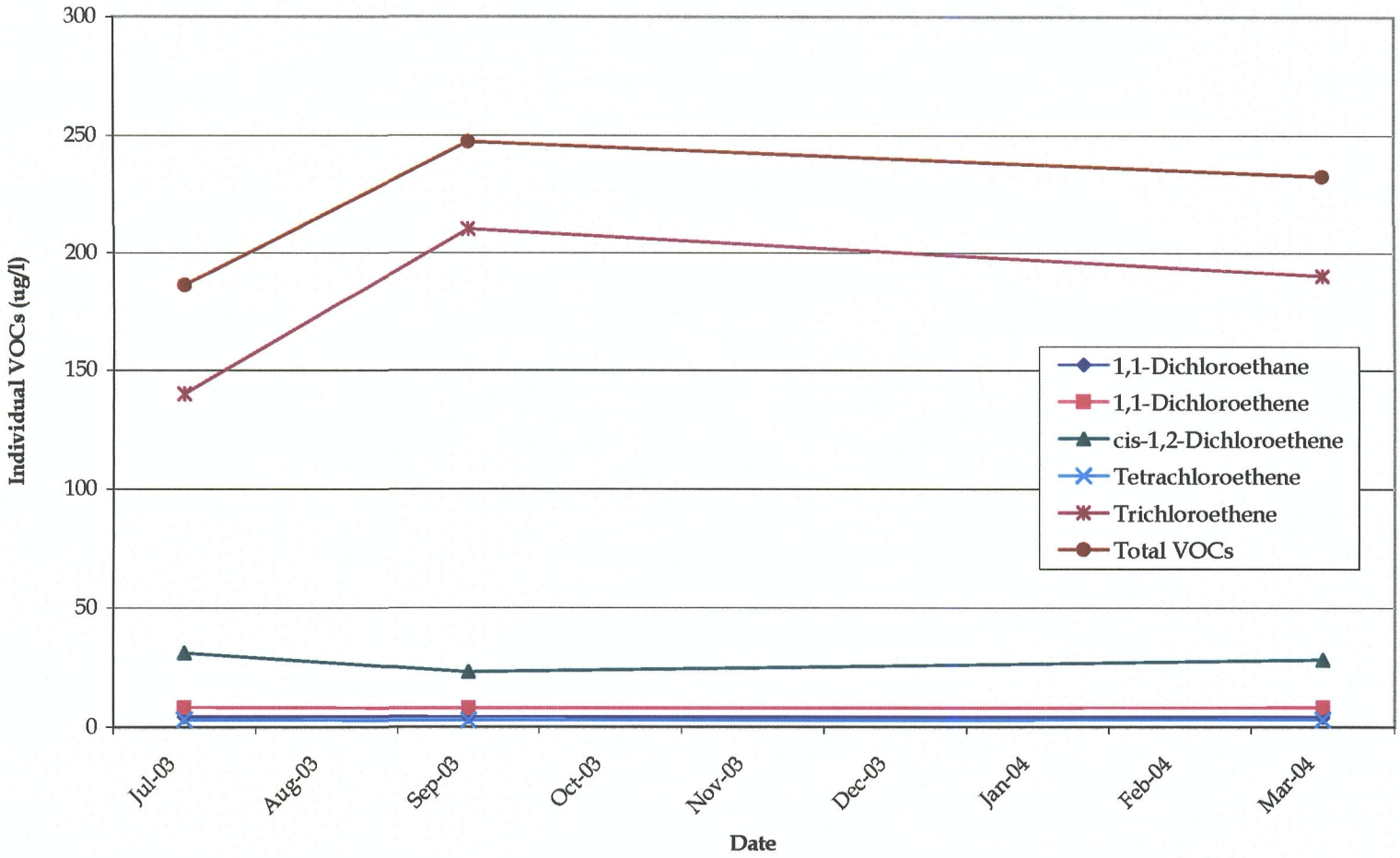

NW08-D SELECT VOC CONCENTRATION TRENDS
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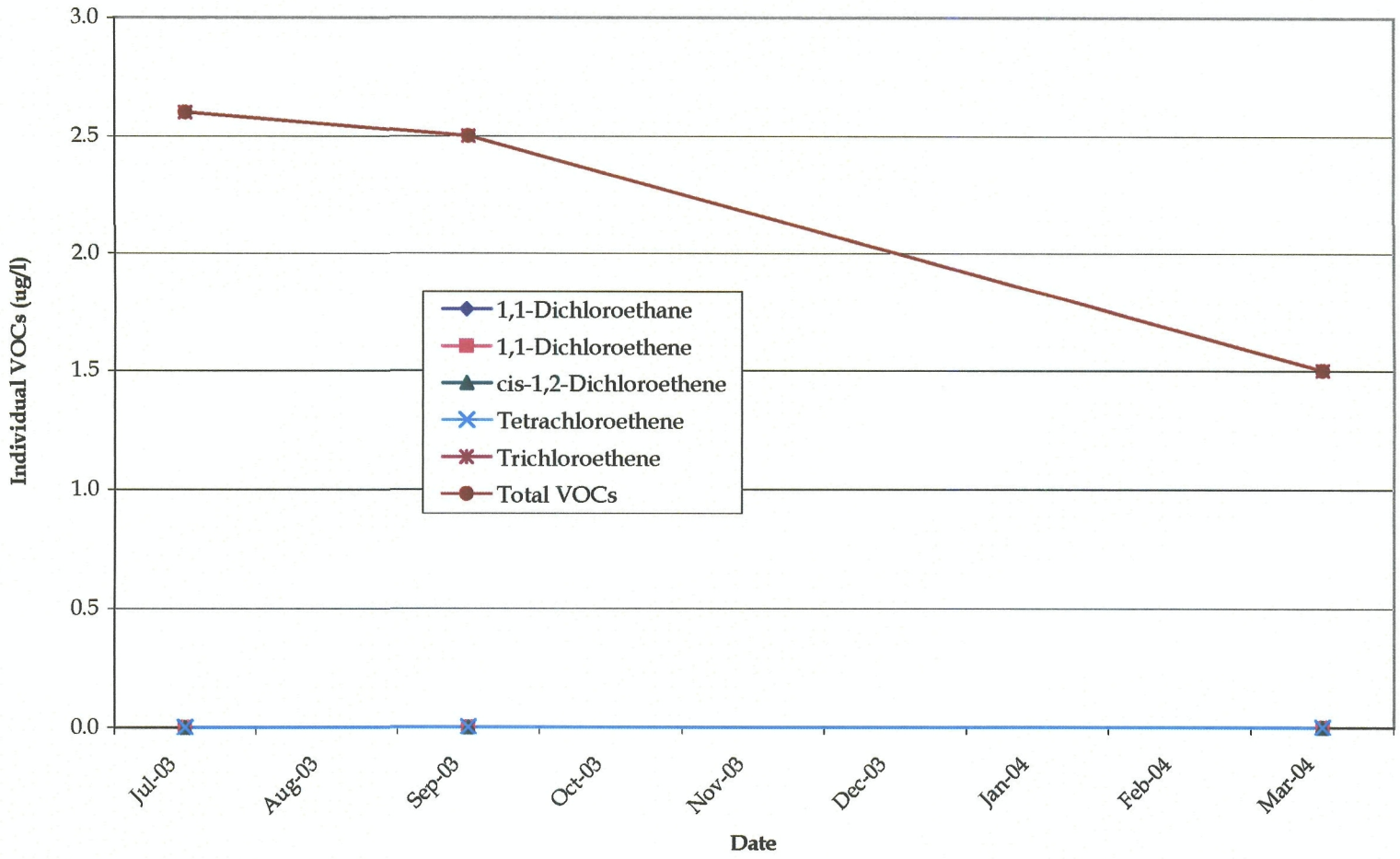
PHOENIX, ARIZONA



EW12-227 SELECT VOC CONCENTRATION TRENDS
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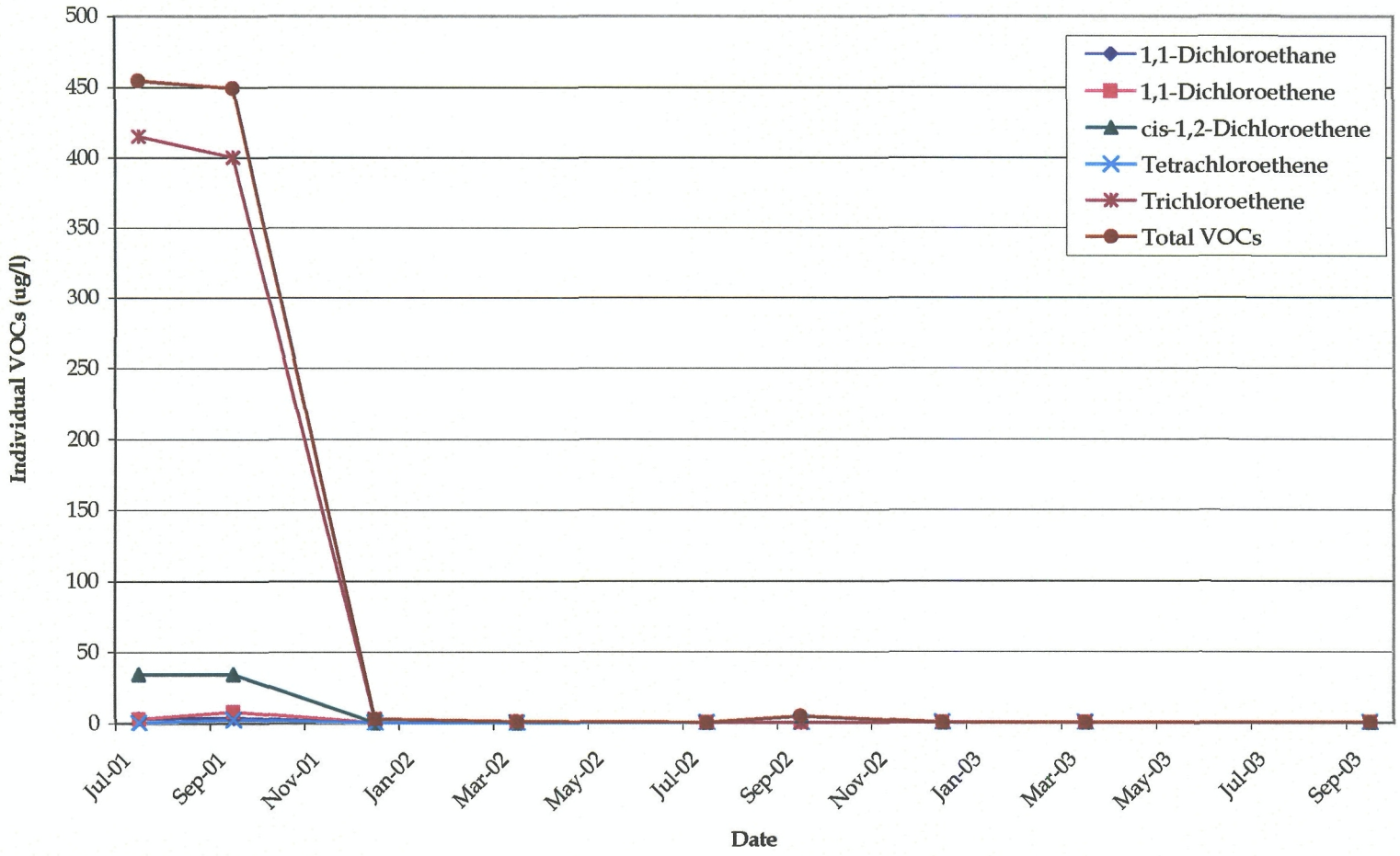
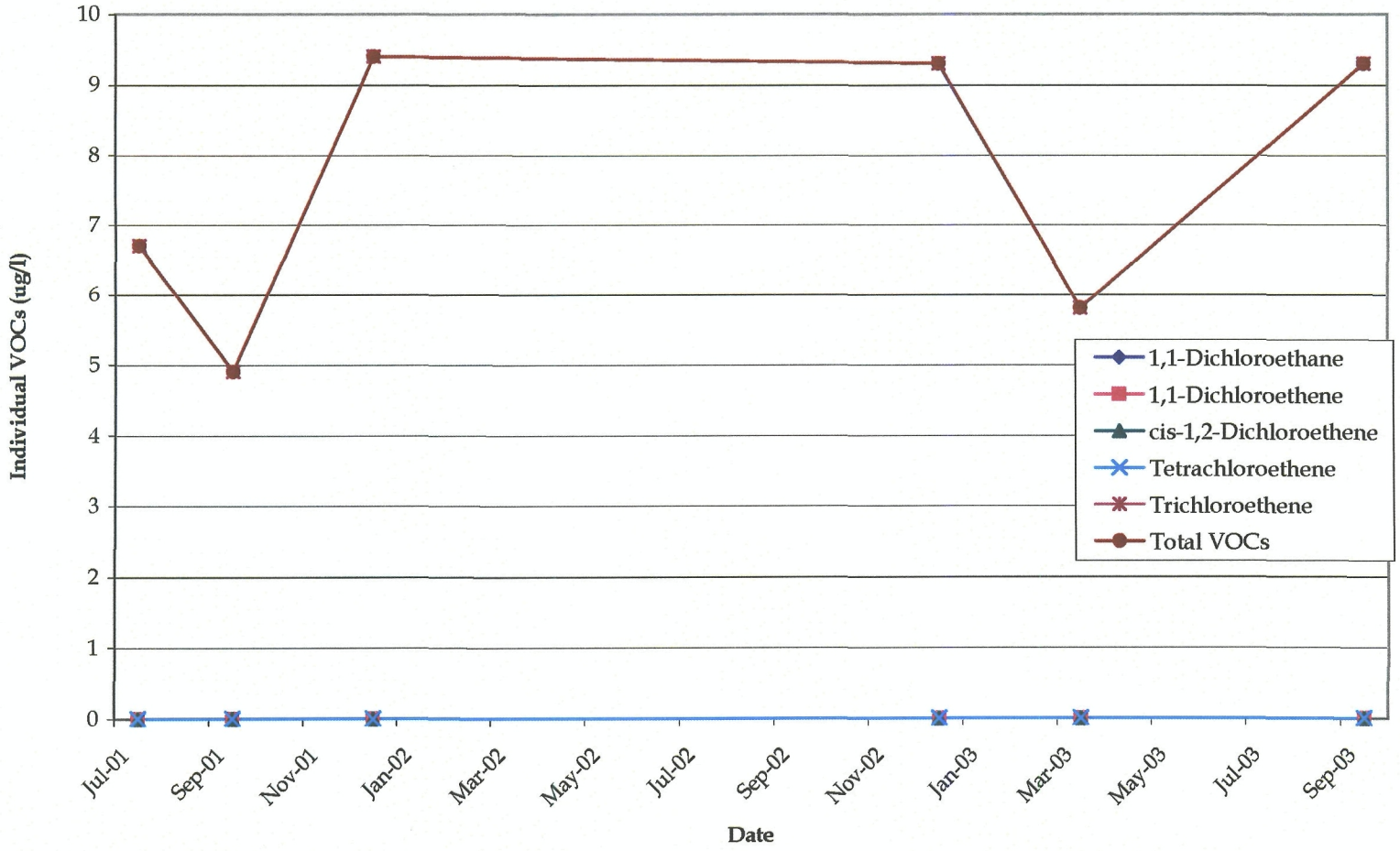
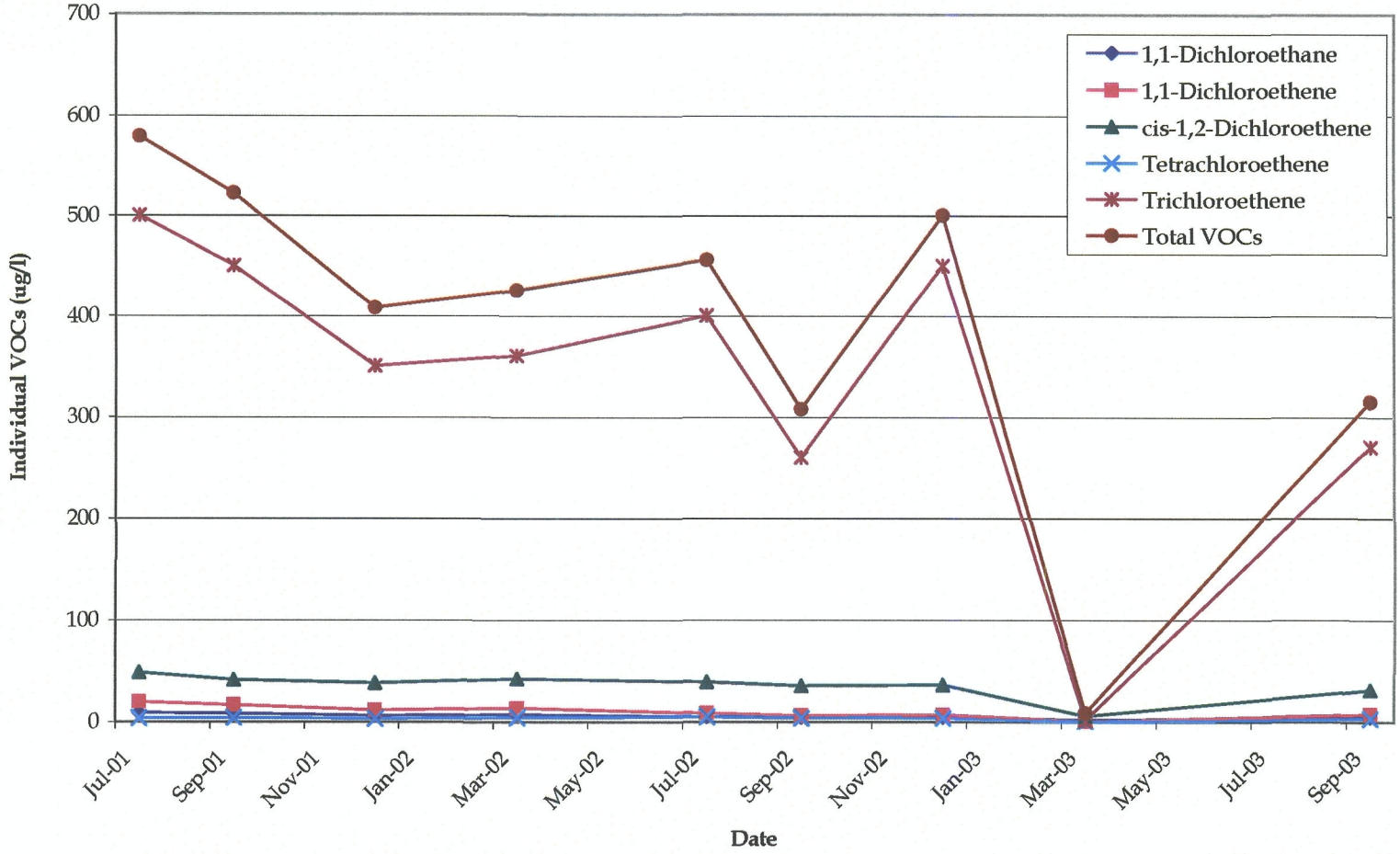


EW12-239 SELECT VOC CONCENTRATION
TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA



EW12-180 SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



NW07-D SELECT VOC CONCENTRATION TRENDS
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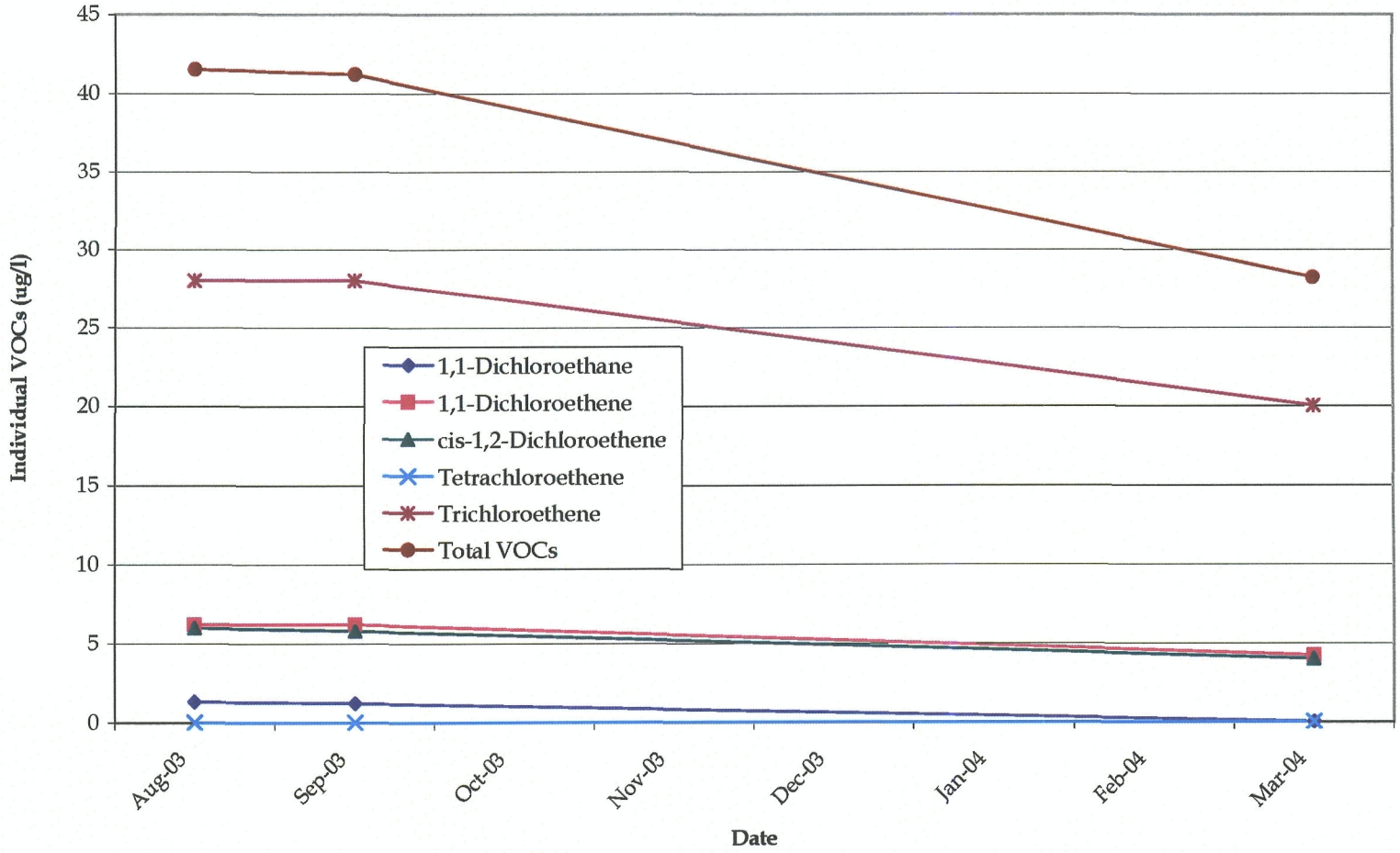
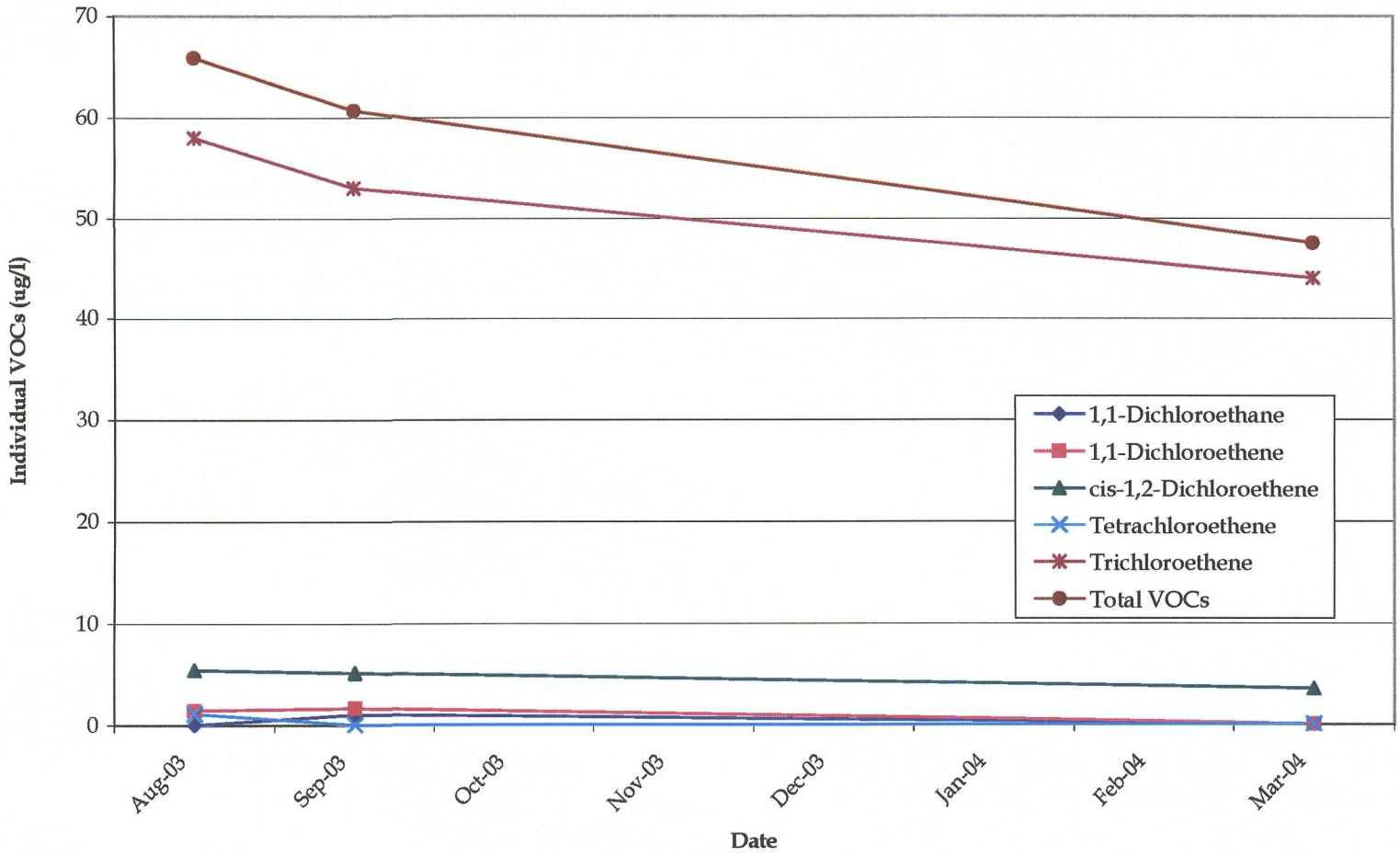
PHOENIX, ARIZONA



NW06-D SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA



2005 OU2 Effectiveness Report

APPENDIX A

CAPTURE ZONE EVALUATION

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1.0 INTRODUCTION

[illegible] hydraulic containment is provided between these three extraction wells and to show the extent of capture to the south and north provided by operation of extraction wells EWN, EWM, and EWS.

The following sections in this appendix include background and methods, discussion and results. This evaluation updates the May 2004 capture zone evaluation (CRA, 2004) to include the results from numerous additional groundwater monitor wells and piezometers that the Companies installed in 2004 and 2005.

2.0 METHODS AND BACKGROUND

Consistent with the EPA's Fact Sheet entitled: Elements for Effective Management of Operating Pump and Treat Systems (2002), several lines of evidence for evaluating plume capture were considered as part of this analysis. The following converging lines of evidence were considered in determining that capture is achieved by the OU2 groundwater extraction system (GES):

- Streamlines were manually overlain on observed groundwater elevation contour maps to illustrate the extent of capture provided by EWN, EWM, and EWS in all three alluvial aquifer hydrographic units including Subunits "A, B, and D";
- A simple capture zone analysis using the computer code RESSQ was done for each hydrostratigraphic unit, then superimposed on a map to demonstrate that capture is being provided between the three extraction wells and to indicate the extent of capture to the south; and
- Groundwater level and chemistry concentration trends at specific monitoring wells were evaluated to demonstrate the effect of the extraction system on water level and water quality conditions in the area.

Extraction wells EWN, EWM, and EWS are screened over hydrostratigraphic Subunits "A, B, and D". The upper hydrostratigraphic unit is an unconfined aquifer unit that is referred to as Subunit "A" (previously referred to as Salt River Gravel), and generally consists of coarse sand and gravel deposits. Based on geologic logs and the 2000 pumping tests conducted by Errol Montgomery & Associates (EMA) at EWM and EWS, the hydraulic conductivity of Subunit "A" is substantially higher at EWM than at EWS.

Subunit "B" underlies Subunit "A" and represents the upper portion of the Basin Fill alluvial aquifer unit. Subunit "B" is characterized by the presence of abundant silty sand with lesser amounts of clay and gravel. ADEQ/LFR have indicated that Subunit "B" is characterized by two coarser units and two finer grained units. This sequence is not laterally continuous throughout the 52nd Street Superfund Site, nor is the thickness consistent. The hydraulic conductivity of Subunit "B" is lower than the hydraulic conductivity of Subunit "A".

The lowermost alluvial aquifer Subunit "D" was previously referred to as the lower portion of the Basin Fill, and is characterized by the presence of an upper finer grained "marker" bed. This unit has locally abundant silt and sand with lesser amounts of clay

and gravel. The hydraulic conductivity of Subunit "D" is lower than the hydraulic conductivity of the Subunit "A".

3.0 2006 AQUIFER TEST RESULTS

As part of the Technical Memorandum included in the Work Plan to Install Additional Groundwater Monitor Wells/Piezometers at Four Locations that was submitted to EPA/ADEQ on October 17, 2005 (CRA, 2005), the Companies proposed to conduct short-term single response aquifer tests to gain an understanding of the relative hydraulic conductivities in Subunits "B and D" for purposes of the capture zone evaluation. The Companies conducted an aquifer test on Subunit "B" at NW11M and on Subunit "D" at NW09D. The details of the aquifer test has been documented in the Addendum to the Construction Completion Report (CRA, 2006b) and summarized in Section 2.2 of the text of this report.

Based on the aquifer testing results, Subunit "B" has a lower permeability than Subunit "D" by approximately an order of magnitude. The average hydraulic conductivity for Subunit "D" at well NW09-D is estimated at 17.2 ft/day (128.9 gpd/ft^2). For Subunit "B" at well NW11-M, the average hydraulic conductivity is 2.6 ft/day (17.95 gpd/ft^2). These values do not appear to be representative of the Subunit "A and D" (former Basin Fill) and were not used as part of this capture evaluation.

4.0 HYDRAULIC CONDUCTIVITIES OF HYDROSTRATIGRAPHIC SUBUNITS "A, B, AND D"

4.1 HYDRAULIC CONDUCTIVITY OF SUBUNIT "A" AT EWN AND EWM

The range of hydraulic conductivities observed in Subunit "A" (previously Salt River Gravels) is variable. Previous studies have reported hydraulic conductivity values between 20 and 250 ft/day for the upper alluvial unit sediments, which includes the Salt River Gravels and Basin Fill (Corell and Corkhill, 1994,). A hydraulic conductivity of 450 ft/day was used for Subunit "A" during design as reported in the Final (100%) Design Report (CRA, 1999). Due to the regional water level declines, the uppermost portion of Subunit "A", which has the highest conductivity values, has been dewatered. Therefore, consistent with CRA (2004), a hydraulic conductivity value of 250 ft/day was selected to represent the current conditions for Subunit "A" at EWN and EWM.

4.2 HYDRAULIC CONDUCTIVITY OF SUBUNIT "A" AT EWS

CRA (2004) estimated a hydraulic conductivity of 105 ft/day at EWS. This value is consistent with the site conceptual model that indicates the Subunit "A" portion of the aquifer at EWS has a lower hydraulic conductivity than the portion of the aquifer surrounding EWM. For this study, the same hydraulic conductivity value of 105 ft/day at EWS was used for Subunit "A".

4.3 HYDRAULIC CONDUCTIVITY OF SUBUNITS "B AND D" AT EWN, EWM, AND EWS

The aquifer tests performed by CRA on early 2006 provide hydraulic conductivities for Subunits "B and D" of 2.6 ft/day and 17.2 ft/day, respectively. The derived hydraulic conductivities, especially for Subunit "B", are probably at the lower end of the literature values. To be more representative, the slug test values by Dames and Moore (1993) were also considered. An average hydraulic conductivity of 28 ft/day was used for this study, which is consistent with the value used in 2004.

5.0 CONVERGING LINES OF EVIDENCE TO DEMONSTRATE CAPTURE

5.1 FLOW PATH ANALYSIS

A flow path analysis consists of two components: potentiometric surface (i.e., groundwater elevation) contours and flowpaths or streamlines that indicate flow direction. In an isotropic aquifer, the streamlines are perpendicular to the potentiometric surface contours.

Groundwater elevation contours were drawn manually based on the January 4, 2006 monitoring well data, and were based on estimated groundwater elevations in the immediate vicinity of the extraction wells (EWS, EWM, and EWN), which were pumping on January 4, 2006.

Streamlines were drawn manually perpendicular to the groundwater elevation contours to show flow direction and the extent of capture by combined pumping at EWS, EWM, and EWN. The methods used to conduct this analysis are described below.

5.1.1 MEASURED GROUNDWATER ELEVATIONS

Table A.1 presents the groundwater elevations measured at monitoring wells on January 4, 2006 and the three extraction wells corrected to account for well efficiencies for the same date.

5.1.2 ESTIMATED GROUNDWATER ELEVATIONS AT EXTRACTION WELLS

The directly measured groundwater elevations at the extraction wells EWS, EWM, and EWN on January 4, 2006 were 997.57, 994.98, and 997.23 feet above mean sea level (ft AMSL), respectively. The groundwater elevations measured directly in an extraction well are not representative of the groundwater elevation outside the well casing because of the well efficiency effects. Therefore, the measured groundwater elevations at the extraction wells have to be corrected before use in groundwater contouring and capture zone analysis.

To estimate a theoretical groundwater elevation at a pumping well, the well efficiency of the pumping well is needed. The well efficiencies of EWM and EWS are available from EMA (2002) for given pumping rates. The well efficiencies of EWM from EMA (2002)

were used as a basis for this study. However, the estimated well efficiency for EWS was not considered representative due to the well redevelopment afterward as described in Section 5.1.2.2, therefore a different method was used for this well. The same method used for EWS was used for EWN.

The details of theoretical groundwater elevations at the extraction wells are presented in the following sections.

5.1.2.1 THEORETICAL GROUNDWATER ELEVATION AT EWM

EMA (2002) presented estimates of well efficiency for extraction well EWM corresponding to different extraction rates. The estimated well efficiency at EWM for an extraction rate of 1,400 gallons per minute (gpm) was 65 percent, and the estimated well efficiency of EWM was 56 percent corresponding to an extraction rate of 1,800 gpm.

Based on this relationship between well efficiency and extraction rate, and based on the January 4, 2006 extraction rate of 1,350 gpm, the well efficiency for EWM was interpreted to be 66 percent. Previous study indicates that the approximate static water elevation is 1,006 ft AMSL in the vicinity of EWM in the absence of groundwater production.

The groundwater elevation measured inside the EWM well casing on January 6, 2006, was approximately 994.98 ft AMSL. Based on the estimated static groundwater elevation of 1,006 ft AMSL, this corresponds to a measured drawdown in the well casing of 11 ft. The theoretical drawdown that occurs in the formation adjacent to the EWM well casing was determined to be 7.3 ft (based on the estimated well efficiency of 66 percent). This results in a theoretical groundwater elevation in the formation of 998.7 ft AMSL adjacent to extraction well EWM.

5.1.2.2 THEORETICAL GROUNDWATER ELEVATIONS AT EWS AND EWN

Due to the fact that a static (non-pumping) groundwater elevation cannot be established at extraction wells EWN and EWS, a different method to establish the corrected pumping water level was required. This method is based on the use of the Dupuit Model (Bedient et.al, 1994), which predicts the drawdown expected at monitoring wells situated at various distances from the pumping well in an unconfined aquifer. The extraction wells are separated over a distance of more than 200 meters so that the

hydraulic superposition by different pumping wells were considered to be minimum. Also, the monitoring wells selected for the correction of water levels at the extraction wells were in the closest vicinity of the extraction wells, therefore, the superposition of the drawdown at the target extraction well and the associated monitoring well by various pumping wells, if any, should be similar. Therefore, the Dupuit model can still be used for a close approximation.

The objective of this method was to calculate the differences in drawdown expected to occur in the formation outside the extraction wells (EWS and EWN) and the nearby monitoring wells (EWS-PZ-1 and PZ02-S), respectively. EWS-PZ1 is located approximately 155 ft from EWS; and PZ02-S is approximately 310 ft from EWN. The differences in drawdown expected to occur between the casings of the pumping wells and the corresponding monitoring wells can be calculated using the Dupuit model; and thus the theoretical groundwater elevations at the extraction wells can be calculated by subtracting from the measured groundwater elevation at the selected monitoring wells by the calculated drawdown differences accordingly.

This approach for estimating theoretical groundwater elevation is based on the following assumptions:

- The groundwater elevation at EWS would be similar to the measured groundwater elevation at EWS-PZ1 if EWS production was zero;
- The groundwater elevation at EWN would be similar to the measured groundwater elevation at PZ02-S if EWN production was zero;
- Steady-state groundwater flow conditions;
- Uniform hydraulic conductivity;
- Non-stratified aquifer;
- Saturated thickness is constant prior to pumping; and
- Extraction well fully penetrates the aquifer.

Given that the hydraulic conductivity of Subunit "A" is significantly higher than Subunits "B or D", and given that EWS and EWN are both screened across multiple hydrostratigraphic units, this analysis focused on groundwater flow in the Subunit "A".

It was assumed that the rate of groundwater extraction from Subunit "A" at EWS/EWN is proportional to the weighted ratio of the transmissivity in Subunit "A" and Subunits "B and D". The transmissivity of the Subunits "B and D" portions of alluvial aquifer was

calculated based on an estimated hydraulic conductivity of 28 ft/day and saturated thickness of 54 ft and 60 ft at EWS and EWN, respectively.

The transmissivity of Subunit "A" at EWS was calculated based on:

- A saturated thickness of 47.6 ft calculated by taking the difference between groundwater elevation of 1,006.57 observed on January 4, 2006 at EWS-PZ1, and the bottom elevation of the Salt River Gravel portion of alluvial aquifer observed at EWS (i.e., 959 ft AMSL);
- A saturated thickness of 44.5 ft calculated by taking the difference between groundwater elevation of 1,004.45 observed on January 4, 2006 at PZ02-S, and the bottom elevation of Subunit "A" observed at EWN (i.e., 960 ft AMSL); and
- Estimated hydraulic conductivity of 105 ft/day for the Sand and Gravels of Subunit "A" (CRA, 2004).

Table A.2 presents the data used to calculate the theoretical groundwater elevation in the formation outside EWS. Based on this analysis, the theoretical groundwater elevation at EWS was calculated to be 1001.6 ft AMSL. Based on the groundwater elevations measured inside the EWS well casing (997.57 ft AMSL), the well efficiency for EWS was calculated to be 66.1 percent. EMA originally estimated the well efficiency of EWS at approximately 25 percent (EMA, 2002). Since that time, EWS has been redeveloped and the line shaft turbine pump replaced with a smaller, 200 gpm submersible pump set deeper in the well. These changes, combined with the lower flow rate, resulted in a substantial improvement of the well efficiency.

Table A.3 presents the data used to calculate the theoretical groundwater elevation in the formation outside EWN. Based on this analysis, the theoretical groundwater elevation at EWN was calculated to be 997.4 ft AMSL. Based on the groundwater elevations measured inside the EWN well casing (997.23 ft AMSL), the well efficiency for EWN was calculated to be 99 percent.

5.1.2.3 SUMMARY OF THEORETICAL GROUNDWATER ELEVATIONS

The results of the theoretical evaluations are summarized as follows:

- Theoretical or corrected groundwater elevation at EWS of 1001.6 ft AMSL (estimated well efficiency of 68percent);

- Theoretical groundwater elevation at EWM of 998.7 ft AMSL (estimated well efficiency of 66 percent); and
- Theoretical groundwater elevation at EWN of 997.40 ft AMSL (estimated well efficiency of 99 percent).

Vertical Gradients

As shown in Table A.1, the groundwater elevations in Subunit "A" and Subunits "B and D" at nested well locations are very similar in the vicinity of the extraction wells and upgradient of this area. The difference in groundwater elevation between these hydrostratigraphic units is not significant, indicating that the vertical hydraulic gradient is not significant.

In the downgradient area (west of the extraction wells), groundwater elevations observed in Subunit "D" at EW19-D, EW22-D OU3-12D, OU3-13D, OU3-14D have been consistently higher than those observed in shallower units (e.g., Subunits "A and B"). This may be caused by the presence of a bedrock high between this area and the extraction wells, or a different groundwater recharge source, or a possibly lower permeability of the materials in the areas, the combination of those, or others. The real cause is not fully understood at this stage. If these high observed groundwater elevations were considered for groundwater contouring for Subunit "D", groundwater flow from that area back to the extraction wells would be expected, which may result in the capture zone analysis being less conservative (by showing a capture zone from a large area downgradient of the extraction wells). To be conservative for Subunit "D" capture zone analysis, the water level data for the above monitoring wells were not used when interpreting groundwater elevation contours.

5.1.3 FLOW PATH ANALYSIS CONCLUSIONS

Though the extraction wells of EWS, EWM, and EWN are screened in multiple units, the theoretically corrected groundwater elevations within the extraction wells were used for all units when developing the groundwater elevation contours by hand since the vertical hydraulic gradient was not significant. Streamlines were drawn perpendicular to the groundwater elevation contours, and thus represent groundwater flowpaths based on the assumption that horizontal hydraulic conductivity is isotropic. The manual groundwater elevation contours and streamlines were developed based on professional judgment and consistent with standard industry practice.

Consistent with the agreement with the ADEQ/EPA, groundwater elevation contours for Subunits "A and B" were merged due to the lack of aquitard between the two units. Figures A.1 and A.2 present the January 4, 2006 groundwater elevation contours and streamlines for Subunits "A and B", and Subunit "D", respectively.

Figure A.1 shows that contaminants have been effectively captured by extraction wells of EWN, EWM, and EWS in the Subunits "A and B". The southern capture boundary extends in the vicinity of NW09-M and ASE76-A to the south; and the northern capture boundary extends beyond CRA01 to the north in Subunits "A and B".

Figure A.2 shows that contaminants have been effectively captured by extraction wells of EWN, EWM, and EWS in Subunit "D". The southern capture boundary extends in the vicinity of NW09-M to the south; and the northern capture boundary extends beyond CRA01 to the north in the Subunit "D".

5.2 THEORETICAL CAPTURE ZONE ANALYSIS

The RESSQ model was used to evaluate the extent of capture that is provided by simultaneous pumping of extraction wells EWN, EWM, and EWS. RESSQ is based on the semi-analytical solution developed by Javandel et al. (1984).

RESSQ calculates streamlines (i.e., flowpaths) in a homogeneous, isotropic confined aquifer of uniform thickness with superposition of a regional horizontal hydraulic gradient. RESSQ is capable of representing multiple wells with different pumping rates, and can be used to determine whether capture is provided between extraction wells.

RESSQ is a Fortran program that produces coordinates of each streamline segment determined by the program. The user enters starting coordinates of a streamline and the program will determine whether the streamline is captured by one of the extraction wells or whether it will migrate past the extraction well network.

Because RESSQ can only simulate one hydraulic conductivity unit, therefore Subunits "A" and "B" were separated. RESSQ was run for three scenarios: one to evaluate capture extent provided in Subunit "A"; one in Subunit "B", and another to evaluate the extent of capture provided in Subunit "D". Input parameters used for the RESSQ model simulations are shown below.

Subunit "A" RESSQ Model Input Parameters

- EWN pumping rate: 515.9 gpm
- EWM pumping rate: 1160.9 gpm
- EWS pumping rate: 172.0 gpm
- Hydraulic conductivity: 250 ft/day
- Average saturated thickness: 55 ft
- Regional gradient: 0.0025 ft/ft
- Effective porosity: 0.20

Subunit "B" RESSQ Model Input Parameters

- EWN pumping rate: 52.5 gpm
- EWM pumping rate: 118.2 gpm
- EWS pumping rate: 17.5 gpm
- Hydraulic conductivity: 28 ft/day
- Average saturated thickness: 40 ft
- Regional gradient: 0.0025 ft/ft
- Effective porosity: 0.20

Subunit "D" RESSQ Model Input Parameters

- EWN pumping rate: 31.5 gpm
- EWM pumping rate: 70.9 gpm
- EWS pumping rate: 10.5 gpm
- Hydraulic conductivity: 28 ft/day
- Average saturated thickness: 30 ft
- Regional gradient: 0.0025 ft/ft
- Effective porosity: 0.20

RESQQ Model Results

The flow nets shown on Figure A.3 demonstrate that containment is provided between extraction wells of EWN, EWM, and EWS in Subunit "A". The southern capture

boundary extends to the vicinity of NW09-M to the south; and the northern capture boundary extends to the vicinity of CRA01 to the north in Subunit "A".

The flow nets shown on Figure A.4 demonstrate that containment is provided between extraction wells of EWN, EWM, and EWS in Subunit "B". The southern capture boundary extends to the vicinity of NW09-M to the south; and the northern capture boundary extends to the vicinity of CRA01 to the north in Subunit "B".

The flow nets shown on Figure A.5 demonstrate that containment is provided between extraction wells of EWN, EWM, and EWS as well as in Subunit "D". Though the capture zone is slightly smaller in Subunit "D" than in Subunits "A and B", the southern capture boundary still extends to the vicinity of NW09-D to the south; and the northern capture boundary extends to the vicinity of NW12-D to the north in Subunit "D".

These figures clearly indicate that hydraulic containment is provided between extraction wells in all units.

5.3 GROUNDWATER CHEMISTRY CHANGES

Another line of evidence supporting groundwater capture is decreasing VOC concentrations since commencement of groundwater pumping. Water quality data from monitoring wells located at various locations throughout the OU2 Area have shown significant declines (i.e., greater than a factor of two) in total VOC concentrations since September 2001 in Subunits "A, B, and D" (Table A.4). VOC time series graphs of these selected monitoring wells are presented in Appendix B. The observed decline in VOC concentrations in the down gradient monitoring wells demonstrates that the plume has been contained by operation of the OU2 GES.

Due to the Salt River flood events in the winter of 2005 (flood flows in the Salt River occurred during the period between December 31, 2005 and April 9, 2006), water level elevations in the wells within the OU2 monitor well network rose in response to flood water recharge to the aquifer. Groundwater elevation rises in OU2 monitor well network wells ranged from 5.58 ft (NW06) to a maximum of 7.52 ft (ASE-76A). Since November 2005 impacts of the flood water on the aquifer recharge appears to have stopped in these wells. A more detailed discussion of the water level trends is included in Section 3.3.1 of this report. Localized increases in the total VOC and TCE concentrations in March and June 2005 may be due in part to the major rain/flood events that occurred in the winter of 2005. During that period surface water recharged the aquifer system and the impacts from the recharge event can be seen in the OU2

monitoring well network area, including impacts in all Subunits "A, B, and D" wells within the OU2 monitor well area. A more detailed discussion of the contaminant concentration trends is included in Section 3.3.2 of the text of this report.

6.0 CONCLUSIONS

Multiple lines of evidence were used to analyze the extent of the combined capture zone provided by extraction wells EWN, EWM, and EWS. This analysis evaluated capture separately for Subunits "A, B, and D" (formerly Salt River Gravel and the Basin Fill). All of the multiple lines of evidence outlined herein demonstrate that hydraulic containment is being provided by these three extraction wells through the entire thickness of the alluvial aquifer to the 5 µ/l TCE plume boundary (based on September 2005 water quality data).

The three lines of evidence are summarized as follows:

- Manual flow nets demonstrate that the hydraulic containment is being provided by the three extraction wells in all three Subunits. In Subunits "A and B", the OU2 GES capture zone extends from south of EW06 and north of NW09 to the north of CRA01 (Figure A.1). In Subunit "D", the OU2 GES capture zone extends from south NW09-M/D to at least NW12-D to the north (Figure A.2);
- RESSQ simulated flow nets demonstrate that the hydraulic containment is being provided by the three extraction wells in all three Subunits. In Subunit "A", the OU2 GES capture zone extends from at least NW09M/D/D2 to the south of CRA01 (Figure A.3). In Subunit "B", the OU2 GES capture zone extends from NW09 to the south of CRA01 (Figure A.4). In Subunit "D", the OU2 GES capture zone extends from south of EW06 to at least NW12-D to the north (Figure A.5);
- The general declining trends of VOCs indicate that the well extraction system has been providing the hydraulic containment in the area and has stopped the VOC plumes migrating further downgradient.

Based on these evaluations, the OU2 GES capture zone in the Subunits "A and B" extends from south of EW06 and north of NW09 to the north of CRA01. In Subunit "D", the OU2 GES capture zone extends from south of EW06 to at least NW12-D to the north.

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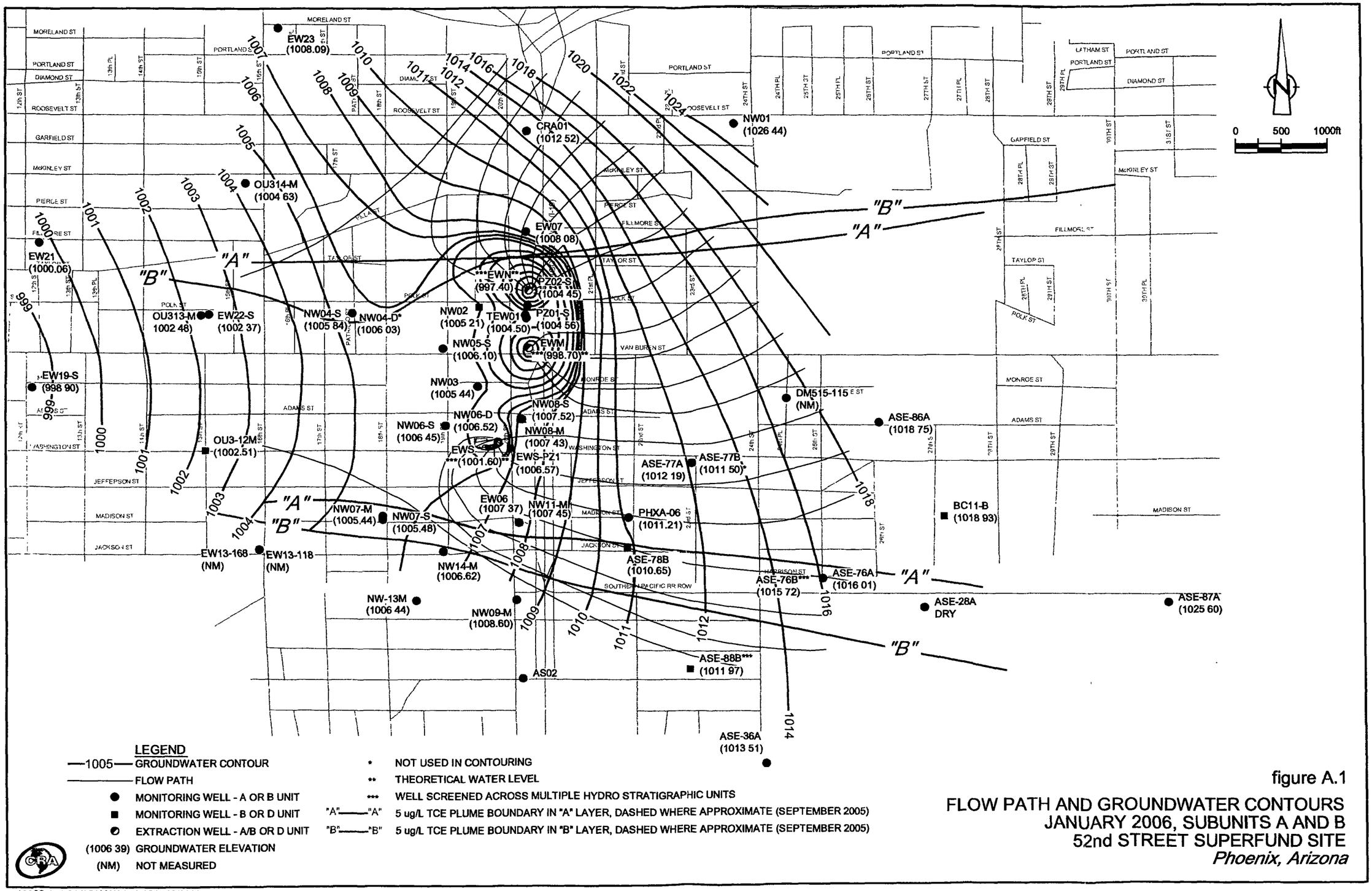


LEGEND

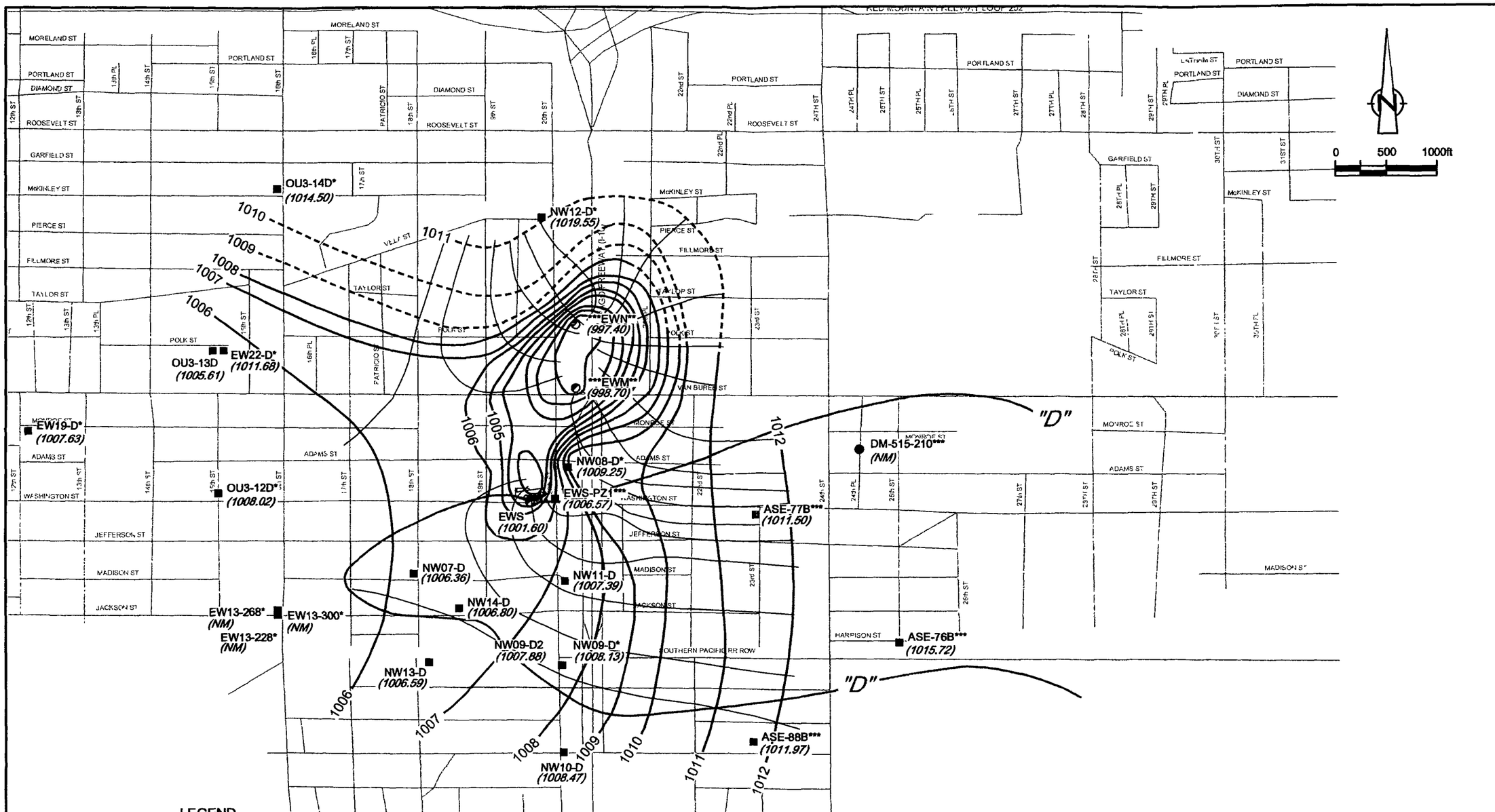
—1005— GROUNDWATER CONTOUR
——— FLOW PATH
● MONITORING WELL - A OR B UNIT
■ MONITORING WELL - B OR D UNIT
◐ EXTRACTION WELL - A/B OR D UNIT
(1006 39) GROUNDWATER ELEVATION
(NM) NOT MEASURED

* NOT USED IN CONTOURING
** THEORETICAL WATER LEVEL
*** WELL SCREENED ACROSS MULTIPLE HYDRO STRATIGRAPHIC UNITS
"A"——"A" 5 ug/L TCE PLUME BOUNDARY IN "A" LAYER, DASHED WHERE APPROXIMATE (SEPTEMBER 2005)
"B"——"B" 5 ug/L TCE PLUME BOUNDARY IN "B" LAYER, DASHED WHERE APPROXIMATE (SEPTEMBER 2005)

figure A.1

FLOW PATH AND GROUNDWATER CONTOURS
JANUARY 2006, SUBUNITS A AND B
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GN-WA001 APR 12/2006



LEGEND

—1005—	GROUNDWATER CONTOUR, DASHED WHERE APPROXIMATE
———	FLOW PATH
■	MONITORING WELL - B OR D UNIT
◐	EXTRACTION WELL - A/B OR D UNIT
(1006 39)	GROUNDWATER ELEVATION
*	NOT USED IN CONTOURING
**	THEORETICAL WATER LEVEL
***	WELL SCREENED ACROSS MULTIPLE HYDRO STRATIGRAPHIC UNITS
(NM)	NOT MEASURED
"D"——"D"	5 ug/L TCE PLUME BOUNDARY IN "D" LAYER, DASHED WHERE APPROXIMATE (SEPTEMBER 2005)

figure A.2

FLOW PATH AND GROUNDWATER CONTOURS
JANUARY 2006, SUBUNIT D
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GN-WA003 APR 12/2006

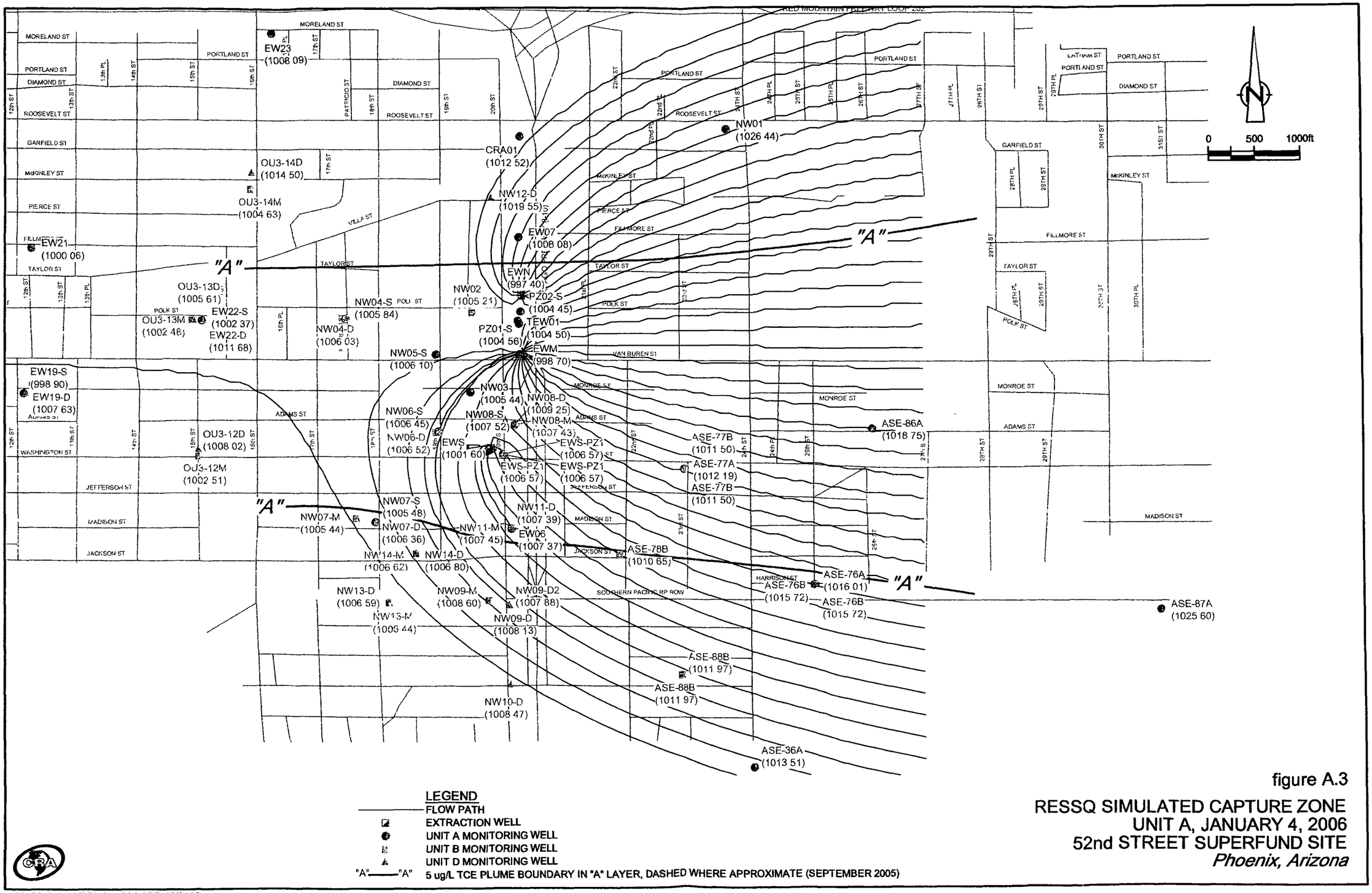
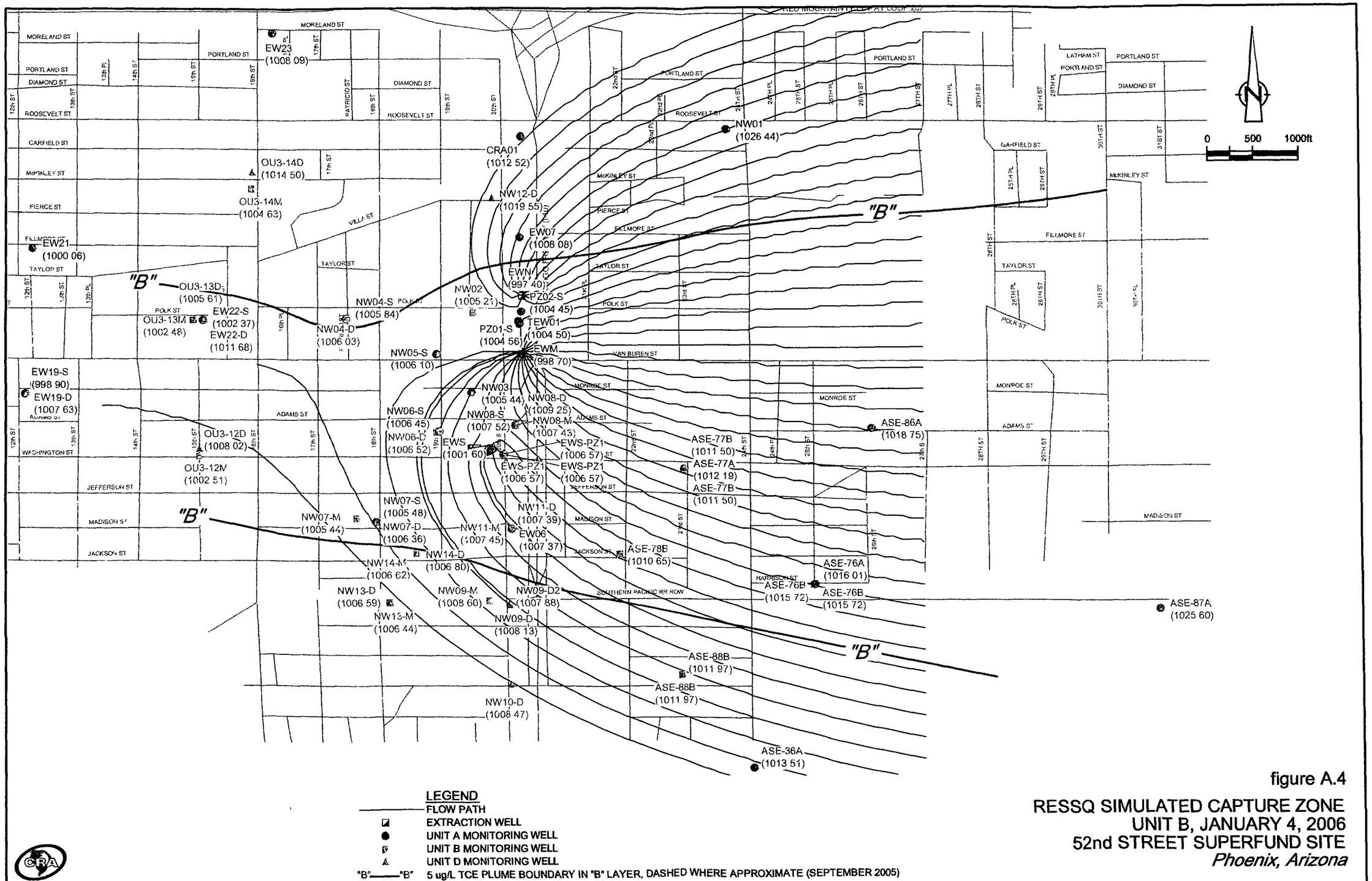


figure A.3

RESSQ SIMULATED CAPTURE ZONE
UNIT A, JANUARY 4, 2006
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GN-WA004 APR 12/2006



LEGEND

- FLOW PATH
- EXTRACTION WELL
- UNIT A MONITORING WELL
- UNIT B MONITORING WELL
- UNIT D MONITORING WELL
- "B"——"B" 5 ug/L TCE PLUME BOUNDARY IN "B" LAYER, DASHED WHERE APPROXIMATE (SEPTEMBER 2005)

figure A.4

RESSQ SIMULATED CAPTURE ZONE
UNIT B, JANUARY 4, 2006
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GN-WA005 APR 12/2006

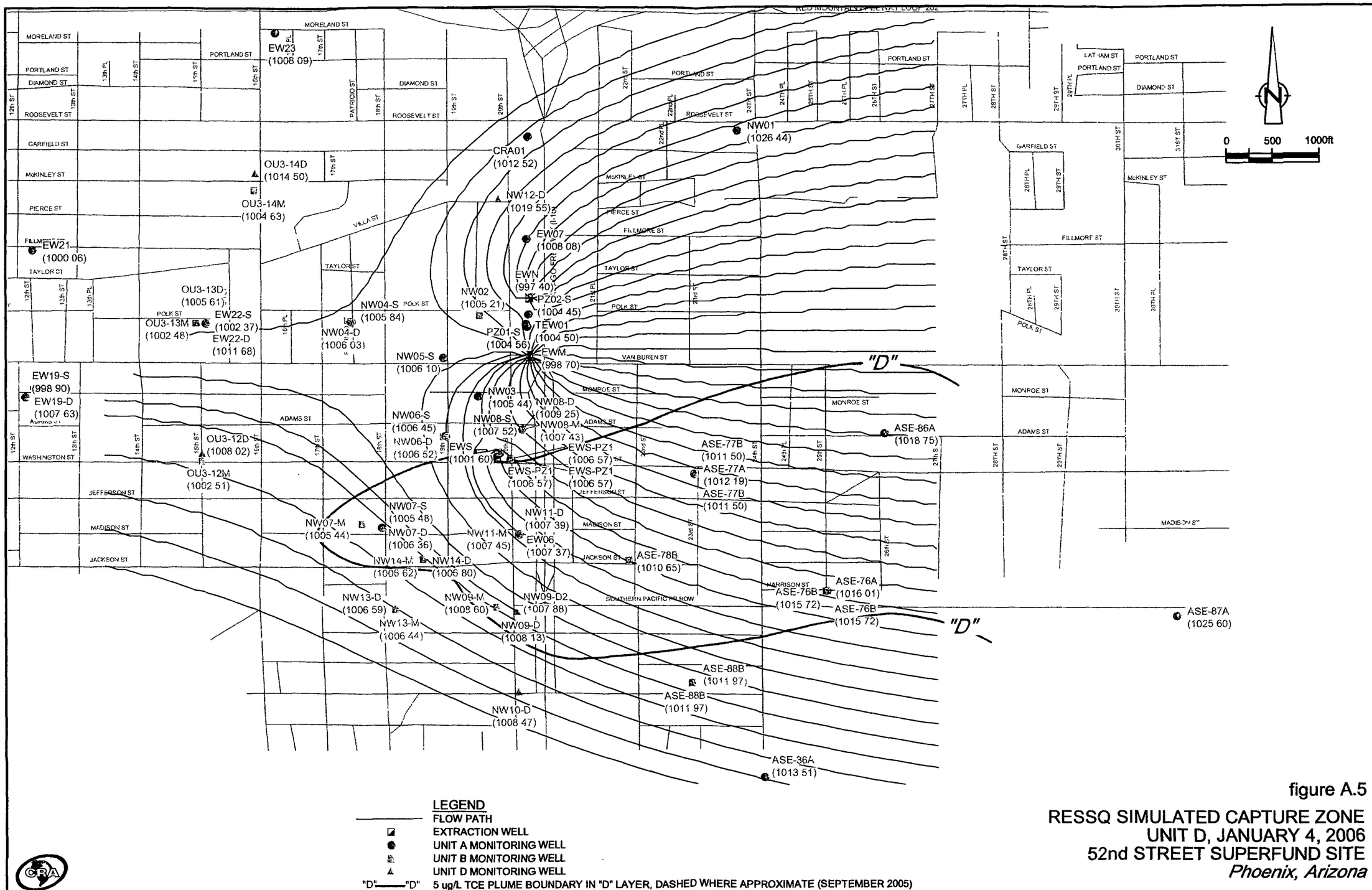


figure A.5

RESSQ SIMULATED CAPTURE ZONE
UNIT D, JANUARY 4, 2006
52nd STREET SUPERFUND SITE
Phoenix, Arizona

13932-151(014)GN-WA006 APR 12/2006

TABLE A.1

SUMMARY OF GROUNDWATER LEVEL MEASUREMENTS
52nd STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA

		Monitoring Date		*12/6/2005*		*12/23/2005*		*1/4/2006*	
Well ID	*Hydrogeologic Unit Sampled*	*NEW ADEQ Hydrostrati-graphic Unit Screened*	*Reference Elevation (ft AMSL)*	*Depth to Water (ft)*	*Ground water Elevation (ft.AMSL)*	*Depth to Water (ft)*	*Ground water Elevation (ft.AMSL)*	*Depth to Water (ft)*	*Ground water Elevation (ft.AMSL)*
AS02	Salt River Gravel	A	1099 67	-	-	-	-	dry	-
ASE-28A	Salt River Gravel	A	1108 20	dry	-	dry	-	dry	-
ASE-36A	Salt River Gravel	A	1101 70	87 90	1013 80	-	-	88 19	1013 51
ASE-76A	Salt River Gravel	A	1105 42	89 35	1016 07	-	-	89 41	1016 01
ASE-76B	Basin Fill	B/D	1105 34	89 53	1015 81	-	-	89 62	1015 72
ASE-77A	Salt River Gravel	A	1101 86	89 82	1012 04	-	-	89 67	1012 19
ASE-77B	Basin Fill	B/D	1101 76	90 29	1011 47	-	-	90 26	1011 50
ASE-78B	Basin Fill	D	1099 97	89 35	1010 62	-	-	89 32	1010 65
ASE-86A	Salt River Gravel	A	1106 07	87 37	1018 70	-	-	87 32	1018 75
ASE-87A	Salt River Gravel	A	1113 84	87 83	1026 01	-	-	88 24	1025 60
ASE-88B	Basin Fill	B/D	1103 08	91 00	1012 08	-	-	91 11	1011 97
CRA01	Salt River Gravel	A	1106 43	94 33	1012 10	93 71	1012 72	93 91	1012.52
EW06	Salt River Gravel	A	1097 75	90 60	1007 15	90 15	1007 60	90 38	1007 37
EW07	Salt River Gravel	A	1104 96	97 42	1007 54	96 41	1008 55	96 88	1008 08
EW19-D	Basin Fill	D	1087 48	80 29	1007 19	80 02	1007 46	79 85	1007 63
EW19-S	Salt River Gravel	A	1087 42	89 11	998 31	88 65	998 77	88 52	998 90
EW21	Salt River Gravel	A	1094 11	94 55	999 56	94 16	999 95	94 05	1000 06
EW22-D	Basin Fill	D	1095 75	84 29	1011 45	84 10	1011 65	84 07	1011 68
EW22-S	Salt River Gravel	A	1095 72	93 79	1001 93	93 31	1002 41	93 35	1002 37
EW23	Salt River Gravel	A	1101 51	93 75	1007 76	93 35	1008 16	93 42	1008 09
EWM	SRG/BF	A/B/D	1103 61	109 67	993 94	107 42	996 19	108 63	994 98
EWN	SRG/BF	A/B/D	1110 78	114 05	996 73	113 88	996 90	113 55	997 23
EWS	SRG/BF	A/B/C	1100 37	103 55	996 82	102 70	997 67	102 80	997 57
EWS-PZ1	SRG/BF	A/B/D	1098 26	92 05	1006 21	91 32	1006 94	91 69	1006 57
NW01	Salt River Gravel	A	1112 22	85 85	1026 37	85 75	1026 47	85 78	1026 44
NW02	Salt River Gravel	B	1101 83	97 15	1004 68	96 18	1005 65	96 62	1005 21
NW03	Salt River Gravel	A	1097 16	92 25	1004 91	91 26	1005 90	91 72	1005 44
NW04-D	Salt River Gravel	B	1099 92	94 29	1005 63	93 62	1006 30	93 89	1006 03
NW04-S	Salt River Gravel	A	1099 96	94 56	1005 40	93 78	1006 18	94 12	1005 84
NW05-S	Salt River Gravel	A	1099 98	94 40	1005 58	93 45	1006 53	93 88	1006 10
NW06-D	Basin Fill	B	1096 92	90 75	1006 17	90 17	1006 75	90 40	1006 52
NW06-S	Salt River Gravel	A	1096 82	90 22	1006 60	90 15	1006 67	90 37	1006 45
NW07-D	Basin Fill	D	1094 21	88 10	1006 11	87 80	1006 41	87 85	1006 36
NW07-M	Salt River Gravel	B	1093 94	Not Developed		88 35	1005 59	88 50	1005 44
NW07-S	Salt River Gravel	A	1094 19	87 95	1006 24	88 55	1005 64	88 71	1005 48
NW08-D	Basin Fill	D	1098 72	89 78	1008 94	89 15	1009 57	89 47	1009 25
NW08-M	Basin Fill	B	1098 65	91 67	1006 98	90 82	1007 83	91 22	1007 43
NW08-S	Salt River Gravel	A	1098 45	91 36	1007 09	90 46	1007 99	90 93	1007 52
NW09-D	Basin Fill	D	1099 58	Rig Tire on Well		91 49	1008 09	91 45	1008 13
NW09-D2	Basin Fill	D	1099 30	Rig Tire on Well		91 32	1007 98	91 42	1007 88
NW09-M	Salt River Gravel	A/B	1099 92	Not Installed		91 12	1008 80	91 32	1008 60
NW10-D	Basin Fill	D	1098 91	90 45	1008 46	90 30	1008 61	90 44	1008 47
NW11-D	Basin Fill	D	1097 69	90 47	1007 22	90 12	1007 57	90 30	1007 39
NW11-M	Salt River Gravel	B	1097 59	90 32	1007 27	89 92	1007 67	90 14	1007 45
NW12-D	Basin Fill	D	1104 10	Car Parked on Well		84 30	1019 80	84 55	1019 55
NW13-D	Basin Fill	D	1096 61	Not Developed and/or Installed				90 02	1006 59
NW13-M	Salt River Gravel	A/B	1096 67	Not Developed and/or Installed				90 23	1006 44
NW14-D	Basin Fill	D	1096 11	Not Developed		89 18	1006 93	89 31	1006 80
NW14-M	Salt River Gravel	A/B	1096 11	Not Developed		89 32	1006 79	89 49	1006 62
OU3-12D	Basin Fill	D	1090 77	83 05	1007 72	82 80	1007 97	82 75	1008 02
OU3-12M	Salt River Gravel	B	1090 79	88 72	1002 07	88 29	1002 50	88 28	1002 51
OU3-13D	Basin Fill	D	1095 71	90 60	1005 11	90 32	1005 39	90 10	1005 61
OU3-13M	Salt River Gravel	B	1095 75	93 66	1002 09	93 23	1002 52	93 27	1002 48
OU3-14D	Basin Fill	D	1099 14	84 74	1014 40	84 52	1014 62	84 64	1014 50
OU3-14M	Salt River Gravel	B	1099 05	94 86	1004 19	94 28	1004 77	94 42	1004 63
PHXA-06	Salt River Gravel	A	1100 44	89 52	1010 92	89 05	1011 39	89 23	1011 21
PZ01-D	Bedrock	C	1102 69	98 65	1004 04	97 55	1005 14	98 10	1004 59
PZ01-S	Salt River Gravel	A	1102 69	98 70	1003 99	97 61	1005 08	98 13	1004 56
PZ02-D	Bedrock	C	1107 95	104 50	1003 45	102 95	1005 00	103 50	1004 45
PZ02-S	Salt River Gravel	A	1107 95	104 09	1003 86	103 00	1004 95	103 50	1004 45
TEW01	Salt River Gravel	A	1103 56	99 63	1003 93	99 56	1004 00	99 06	1004 50

NOTES
- = Not Measured

TABLE A.2

CALCULATION OF GROUNDWATER ELEVATION AT EWS - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Steady Radial Flow
Dupuit Equation for Steady State Wells; Unconfined (taken from Bedient et.al, 1994)

K = [Q /pi*(h2^2 - hw^2)] * ln(r2/rw)

where:
Q = well yield / pumping rate
h2 = sat thickness / head at obs Well
hw = steady state head at pumping well
r2 = radius from pumping well to obs. Well
rw = radius of pumping well

Dupuit Equation Assumptions:
Steady State Conditions
Uniform Hydraulic Conductivity
Non Stratified Aquifer
Flat bottom surface at SRG Aquifer
Saturated thickness is constant prior to pumping
100% efficient pumping well
Intake portion of well penetrates entire aquifer

ASSUMPTIONS:

EWS Head (measured) =	997 57	ft AMSL
EWS Head (theoretical) =	**1001.6**	ft AMSL
Bottom of SRG at EWS =	959	ft AMSL
EWS-PZ1 Head (measured) =	1006 57	ft AMSL
Distance from EWM to PZ01-S =	155	ft
Total Q =	200	gpm
Basin Fill K =	28	ft/day
Basin Fill Saturated Thickness =	54	ft
Transmissivity-SRG =	4994 85	ft^2/day
Transmissivity-BF =	1512	ft^2/day
Radius of Influence =	5000	ft

also:
Pumping rate from SRG based on T ratio

CALCULATIONS:

Well Yield / pumping rate from SRG (Q):	**154** gpm	836 9 m3/day	
rw (=r1 since pumping well is obs Well 1)	10 inches	0.254 metres	
Hydraulic conductivity (K)	**105** ft/day	32 0 m/day	*(CALIBRATED)*
Delta-h, *PZ-01D* to EWS-theoretical	5 0 ft		*(CALCULATED)*
hw (= h1 since pumping well is obs Well 1)	**12.988 m (assumed)**		

r2 (ft)

well	*r2 (m)*	*Estimated h2 (m)*	*h2 (ft)*	*s (ft)*	*Delta-h (ft)*
1	0 3048	13 0	42 8	8.7	**5.0**
155	47.244	14.6	47.8	3.8	**1.7**
931	283.7688	15 1	49.4	2.1	
10000	3048	15 7	51 5	0 0	

(CALIBRATED)

EWS Efficiency = 68%

TABLE A.2

CALCULATION OF GROUNDWATER ELEVATION AT EWS - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Knowing the static water elevation and drawdown at pumping well, and knowing hw and h2, drawdown expected at the observation well can be estimated

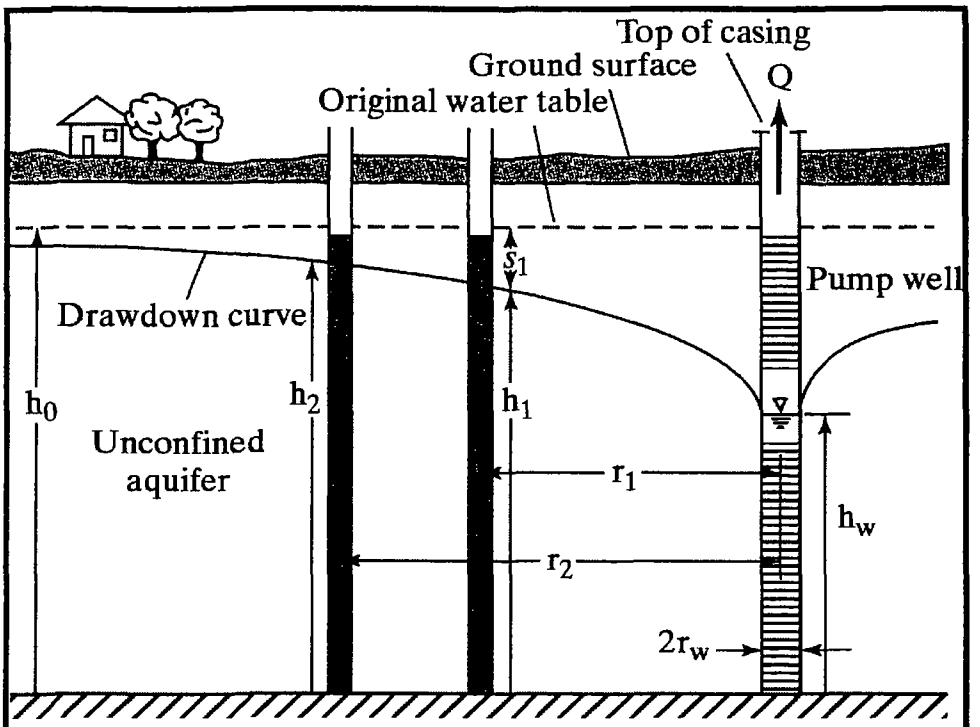


Figure 8.15

Radial flow to a well penetrating an unconfined aquifer.

TABLE A.3

CALCULATION OF GROUNDWATER ELEVATION AT EWN - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Steady Radial Flow
Dupuit Equation for Steady State Wells; Unconfined (taken from Bedient et.al, 1994)

K = [Q /pi*(h2^2 - hw^2)] * ln(r2/rw)

where:
Q = well yield / pumping rate
h2 = sat thickness / head at obs Well
hw = steady state head at pumping well
r2 = radius from pumping well to obs. Well
rw = radius of pumping well

Dupuit Equation Assumptions:
Steady State Conditions
Uniform Hydraulic Conductivity
Non Stratified Aquifer
Flat bottom surface at SRG Aquifer
Saturated thickness is constant prior to pumping
100% efficient pumping well
Intake portion of well penetrates entire aquifer

ASSUMPTIONS:

EWN Head (measured) =	997 23	ft AMSL
EWN Head (theoretical) =	**997.4**	ft AMSL
Bottom of SRG at EWN =	900	ft AMSL
PZ02-S Head (measured) =	1005 084	ft AMSL
Distance from EWN to PZ01-S =	310	ft
Total Q =	600	gpm
Basin Fill K =	28	ft/day
Basin Fill Saturated Thickness =	60	ft
Transmissivity-SRG =	11033.82	ft^2/day
Transmissivity-BF =	1680	ft^2/day
Radius of Influence =	5000	ft

also:
Pumping rate from SRG based on T ratio

CALCULATIONS:

Well Yield / pumping rate from SRG (Q):	**521** gpm	2838.4 m3/day	
rw (=r1 since pumping well is obs Well 1)	10 inches	0.254 metres	
Hydraulic conductivity (K)	**105** ft/day	32.0 m/day	*(CALIBRATED)*
Delta-h, *PZ-01D* to EWN-theoretical	7.7 ft		*(CALCULATED)*
hw (= h1 since pumping well is obs Well 1)	**29.695 m (assumed)**		

r2 (ft)

well	*r2 (m)*	*Estimated h2 (m)*	*h2 (ft)*	*s (ft)*	*Delta-h (ft)*
1	0 3048	29.8	97.7	13 4	7.7
173	52.7304	32.1	105.4	5.7	1.9
655	199.644	32 7	107.3	3.8	
10000	3048	33 9	111.1	0 0	

(CALIBRATED)

EWS Efficiency = 99%

TABLE A.3

CALCULATION OF GROUNDWATER ELEVATION AT EWN - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Knowing the static water elevation and drawdown at pumping well, and knowing hw and h2, drawdown expected at the observation well can be estimated

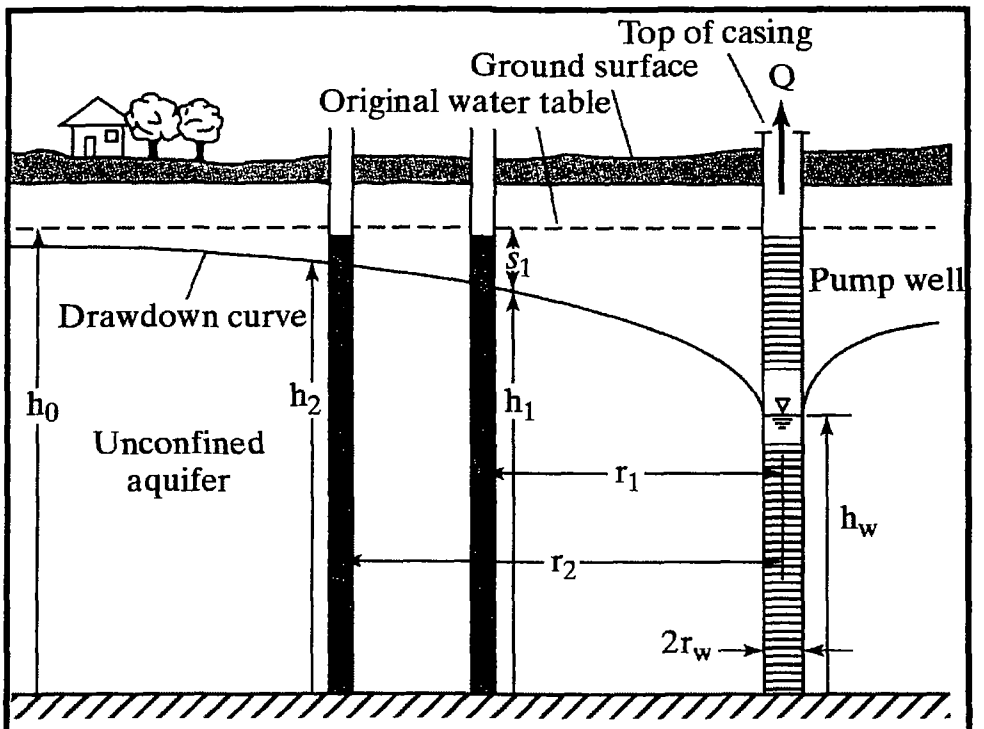


Figure 8.15

Radial flow to a well penetrating an unconfined aquifer.

TABLE A.4

TOTAL SELECT VOC CONCENTRATION DECLINES
(SEPTEMBER 2001 THROUGH DECEMBER 2005)
52nd STREET SUPERFUND SITE - OU2 AREA
PHOENIX, ARIZONA

Well ID	*Screen Interval*		*Total VOCs**	*Total VOCs**
	Old Unit Name	*Subunit ID*	*2001 (µg/L)*	*2005 (µg/L)*
EW06	Salt River Gravel	A	148	18.1
EW07	Salt River Gravel	A	13	ND
EW13-118	Salt River Gravel	A	22.5	1.64
EW19-S	Salt River Gravel	A	410	229.8
EW22-S	Salt River Gravel	A	232.3	47.7
NW02	Salt River Gravel	B	229.5	60.8
NW03	Salt River Gravel	A	657.4	143.2
NW04-D	Salt River Gravel	B	1.1	ND
NW04-S	Salt River Gravel	A	42.4	16
NW05-S	Salt River Gravel	A	211[a]	59.6
NW06-D	Basin Fill	B	65.9	54.4
NW06-S	Salt River Gravel	A	81.2	64
NW07-D	Basin Fill	D	41.5	39.4
NW07-S	Salt River Gravel	A	13.5	3.9

Notes:

* Select VOCs include 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, and trichloroethene

[a] Well installed in June 2003, first sample collected July 2003

ND = No target analytes detected above individual detection limits

APPENDIX A

CAPTURE ZONE EVALUATION

TABLE A.1

SUMMARY OF GROUNDWATER LEVEL MEASUREMENTS
52nd STREET SUPERFUND SITE, OU2 AREA
PHOENIX, ARIZONA

		Monitoring Date		*12/6/2005*		*12/23/2005*		*1/4/2006*	
Well ID	*Hydrogeologic Unit Sampled*	*NEW ADEQ Hydrostrati-graphic Unit Screened*	*Reference Elevation (ft AMSL)*	*Depth to Water (ft)*	*Ground water Elevation (ft.AMSL)*	*Depth to Water (ft)*	*Ground water Elevation (ft.AMSL)*	*Depth to Water (ft)*	*Ground water Elevation (ft.AMSL)*
AS02	Salt River Gravel	A	1099 67	-	-	-	-	dry	-
ASE-28A	Salt River Gravel	A	1108 20	dry	-	dry	-	dry	-
ASE-36A	Salt River Gravel	A	1101 70	87 90	1013 80	-	-	88 19	1013 51
ASE-76A	Salt River Gravel	A	1105 42	89 35	1016 07	-	-	89 41	1016 01
ASE-76B	Basin Fill	B/D	1105 34	89 53	1015 81	-	-	89 62	1015 72
ASE-77A	Salt River Gravel	A	1101 86	89 82	1012 04	-	-	89 67	1012 19
ASE-77B	Basin Fill	B/D	1101 76	90 29	1011 47	-	-	90 26	1011 50
ASE-78B	Basin Fill	D	1099 97	89 35	1010 62	-	-	89 32	1010 65
ASE-86A	Salt River Gravel	A	1106 07	87 37	1018 70	-	-	87 32	1018 75
ASE-87A	Salt River Gravel	A	1113 84	87 83	1026 01	-	-	88 24	1025 60
ASE-88B	Basin Fill	B/D	1103 08	91 00	1012.08	-	-	91 11	1011 97
CRA01	Salt River Gravel	A	1106 43	94 33	1012.10	93 71	1012 72	93 91	1012.52
EW06	Salt River Gravel	A	1097 75	90 60	1007 15	90 15	1007 60	90 38	1007 37
EW07	Salt River Gravel	A	1104 96	97 42	1007 54	96 41	1008 55	96 88	1008 08
EW19-D	Basin Fill	D	1087 48	80 29	1007 19	80 02	1007 46	79 85	1007 63
EW19-S	Salt River Gravel	A	1087 42	89 11	998 31	88 65	998 77	88 52	998 90
EW21	Salt River Gravel	A	1094.11	94 55	999 56	94 16	999 95	94 05	1000 06
EW22-D	Basin Fill	D	1095 75	84 29	1011 45	84 10	1011 65	84 07	1011 68
EW22-S	Salt River Gravel	A	1095 72	93 79	1001 93	93 31	1002 41	93 35	1002 37
EW23	Salt River Gravel	A	1101 51	93 75	1007 76	93 35	1008 16	93 42	1008 09
EWM	SRG/BF	A/B/D	1103 61	109 67	993 94	107 42	996 19	108 63	994 98
EWN	SRG/BF	A/B/D	1110 78	114 05	996 73	113 88	996 90	113 55	997 23
EWS	SRG/BF	A/B/C	1100 37	103 55	996 82	102 70	997 67	102.80	997 57
EWS-PZ1	SRG/BF	A/B/D	1098.26	92 05	1006.21	91 32	1006 94	91 69	1006.57
NW01	Salt River Gravel	A	1112.22	85 85	1026 37	85 75	1026 47	85 78	1026 44
NW02	Salt River Gravel	B	1101 83	97 15	1004 68	96 18	1005 65	96 62	1005.21
NW03	Salt River Gravel	A	1097 16	92 25	1004 91	91 26	1005 90	91 72	1005 44
NW04-D	Salt River Gravel	B	1099 92	94 29	1005 63	93 62	1006 30	93 89	1006 03
NW04-S	Salt River Gravel	A	1099 96	94.56	1005 40	93 78	1006 18	94 12	1005 84
NW05-S	Salt River Gravel	A	1099 98	94 40	1005 58	93 45	1006 53	93 88	1006 10
NW06-D	Basin Fill	B	1096 92	90 75	1006 17	90 17	1006 75	90 40	1006 52
NW06-S	Salt River Gravel	A	1096.82	90 22	1006 60	90 15	1006 67	90 37	1006 45
NW07-D	Basin Fill	D	1094 21	88 10	1006 11	87 80	1006 41	87 85	1006 36
NW07-M	Salt River Gravel	B	1093 94	Not Developed		88 35	1005 59	88 50	1005 44
NW07-S	Salt River Gravel	A	1094 19	87 95	1006 24	88 55	1005 64	88 71	1005 48
NW08-D	Basin Fill	D	1098 72	89 78	1008 94	89 15	1009 57	89 47	1009 25
NW08-M	Basin Fill	B	1098 65	91 67	1006 98	90 82	1007 83	91 22	1007 43
NW08-S	Salt River Gravel	A	1098 45	91 36	1007 09	90 46	1007 99	90 93	1007.52
NW09-D	Basin Fill	D	1099 58	Rig Tire on Well		91 49	1008 09	91 45	1008 13
NW09-D2	Basin Fill	D	1099 30	Rig Tire on Well		91 32	1007 98	91 42	1007 88
NW09-M	Salt River Gravel	A/B	1099 92	Not Installed		91 12	1008 80	91 32	1008 60
NW10-D	Basin Fill	D	1098 91	90 45	1008 46	90 30	1008 61	90 44	1008 47
NW11-D	Basin Fill	D	1097 69	90 47	1007 22	90 12	1007 57	90 30	1007 39
NW11-M	Salt River Gravel	B	1097 59	90 32	1007 27	89 92	1007 67	90 14	1007 45
NW12-D	Basin Fill	D	1104 10	Car Parked on Well		84 30	1019 80	84.55	1019 55
NW13-D	Basin Fill	D	1096 61	Not Developed and/or Installed				90 02	1006 59
NW13-M	Salt River Gravel	A/B	1096 67	Not Developed and/or Installed				90 23	1006 44
NW14-D	Basin Fill	D	1096 11	Not Developed		89 18	1006 93	89 31	1006 80
NW14-M	Salt River Gravel	A/B	1096 11	Not Developed		89 32	1006 79	89 49	1006 62
OU3-12D	Basin Fill	D	1090 77	83 05	1007 72	82.80	1007 97	82 75	1008 02
OU3-12M	Salt River Gravel	B	1090 79	88 72	1002.07	88 29	1002 50	88 28	1002 51
OU3-13D	Basin Fill	D	1095 71	90 60	1005 11	90 32	1005 39	90 10	1005 61
OU3-13M	Salt River Gravel	B	1095 75	93 66	1002 09	93 23	1002 52	93 27	1002 48
OU3-14D	Basin Fill	D	1099 14	84 74	1014 40	84 52	1014 62	84 64	1014 50
OU3-14M	Salt River Gravel	B	1099 05	94 86	1004 19	94 28	1004 77	94 42	1004 63
PHXA-06	Salt River Gravel	A	1100 44	89.52	1010 92	89 05	1011 39	89 23	1011 21
PZ01-D	Bedrock	C	1102 69	98 65	1004 04	97 55	1005 14	98 10	1004 59
PZ01-S	Salt River Gravel	A	1102 69	98 70	1003 99	97 61	1005 08	98 13	1004 56
PZ02-D	Bedrock	C	1107 95	104 50	1003 45	102 95	1005 00	103 50	1004 45
PZ02-S	Salt River Gravel	A	1107 95	104 09	1003 86	103 00	1004 95	103 50	1004 45
TEW01	Salt River Gravel	A	1103 56	99 63	1003 93	99 56	1004 00	99 06	1004 50

NOTES
- = Not Measured

TABLE A.2

CALCULATION OF GROUNDWATER ELEVATION AT EWS - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

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K = [Q /pi*(h2^2 - hw^2)] * ln(r2/rw)

where:

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h2 = sat thickness / head at obs Well
hw = steady state head at pumping well
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Dupuit Equation Assumptions:

Steady State Conditions
Uniform Hydraulic Conductivity
Non Stratified Aquifer
Flat bottom surface at SRG Aquifer
Saturated thickness is constant prior to pumping
100% efficient pumping well
Intake portion of well penetrates entire aquifer

ASSUMPTIONS:

EWS Head (measured) =	997 57	ft AMSL
EWS Head (theoretical) =	**1001.6**	ft AMSL
Bottom of SRG at EWS =	959	ft AMSL
EWS-PZ1 Head (measured) =	1006.57	ft AMSL
Distance from EWM to PZ01-S =	155	ft
Total Q =	200	gpm
Basin Fill K =	28	ft/day
Basin Fill Saturated Thickness =	54	ft
Transmissivity-SRG =	4994 85	ft^2/day
Transmissivity-BF =	1512	ft^2/day
Radius of Influence =	5000	ft

also:

Pumping rate from SRG based on T ratio

CALCULATIONS:

Well Yield / pumping rate from SRG (Q):	**154** gpm	836 9 m3/day	
rw (=r1 since pumping well is obs. Well 1)	10 inches	0.254 metres	
Hydraulic conductivity (K):	**105** ft/day	32.0 m/day	*(CALIBRATED)*
Delta-h, *PZ-01D* to EWS-theoretical·	5 0 ft		*(CALCULATED)*
hw (= h1 since pumping well is obs Well 1)·	**12.988 m (assumed)**		

r2 (ft)

well	*r2 (m)*	*Estimated h2 (m)*	*h2 (ft)*	*s (ft)*	*Delta-h (ft)*	
1	0.3048	13.0	42 8	8.7	**5.0**	*(CALIBRATED)*
155	47.244	14.6	47.8	3.8	**1.7**	
931	283.7688	15.1	49.4	2.1		
10000	3048	15 7	51 5	0.0		

EWS Efficiency = 68%

TABLE A.2

CALCULATION OF GROUNDWATER ELEVATION AT EWS - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

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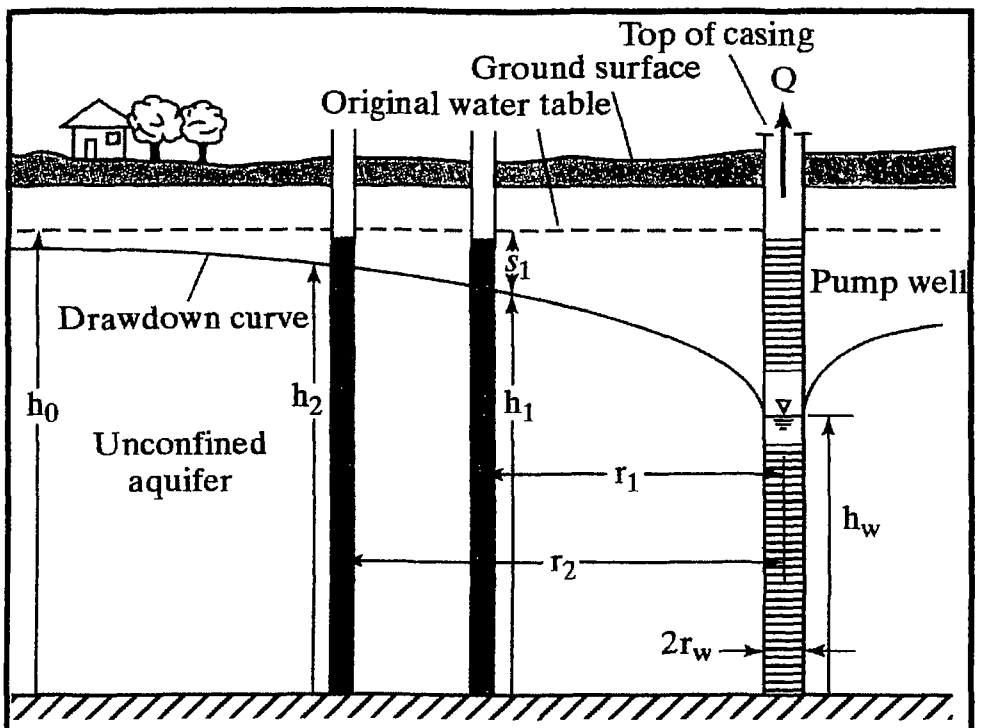

Figure 8.15

Radial flow to a well penetrating an unconfined aquifer.

TABLE A.3

CALCULATION OF GROUNDWATER ELEVATION AT EWN - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

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Flat bottom surface at SRG Aquifer
Saturated thickness is constant prior to pumping
100% efficient pumping well
Intake portion of well penetrates entire aquifer

ASSUMPTIONS:

EWN Head (measured) =	997 23	ft AMSL
EWN Head (theoretical) =	**997.4**	ft AMSL
Bottom of SRG at EWN =	900	ft AMSL
PZ02-S Head (measured) =	1005.084	ft AMSL
Distance from EWN to PZ01-S =	310	ft
Total Q =	600	gpm
Basin Fill K =	28	ft/day
Basin Fill Saturated Thickness =	60	ft
Transmissivity-SRG =	11033.82	ft^2/day
Transmissivity-BF =	1680	ft^2/day
Radius of Influence =	5000	ft

also:
Pumping rate from SRG based on T ratio

CALCULATIONS:

Well Yield / pumping rate from SRG (Q).	**521** gpm	2838.4 m3/day	
rw (=r1 since pumping well is obs. Well 1)	10 inches	0.254 metres	
Hydraulic conductivity (K)	**105** ft/day	32.0 m/day	*(CALIBRATED)*
Delta-h, *PZ-01D* to EWN-theoretical	7.7 ft		*(CALCULATED)*
hw (= h1 since pumping well is obs Well 1)	**29.695 m (assumed)**		

r2 (ft)

well	*r2 (m)*	*Estimated h2 (m)*	*h2 (ft)*	*s (ft)*	*Delta-h (ft)*	
1	0.3048	29.8	97 7	13 4	7.7	*(CALIBRATED)*
173	52.7304	32.1	105.4	5.7	1.9	
655	199.644	32.7	107.3	3.8		
10000	3048	33.9	111.1	0 0		

EWS Efficiency = 99%

TABLE A.3

CALCULATION OF GROUNDWATER ELEVATION AT EWN - DUPUIT EQUATION
CAPTURE ZONE CALCULATIONS
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Knowing the static water elevation and drawdown at pumping well, and knowing hw and h2, drawdown expected at the observation well can be estimated.

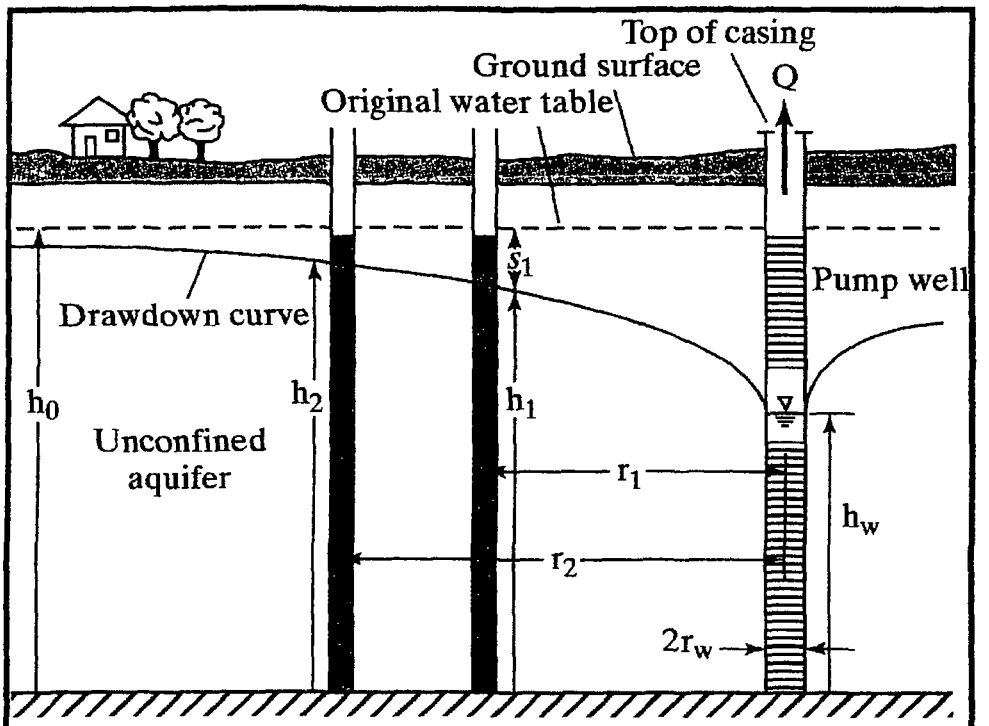


Figure 8.15

Radial flow to a well penetrating an unconfined aquifer.

TABLE A.4

TOTAL SELECT VOC CONCENTRATION DECLINES (SEPTEMBER 2001 THROUGH DECEMBER 2005) 52nd STREET SUPERFUND SITE - OU2 AREA PHOENIX, ARIZONA

Well ID	*Screen Interval*		*Total VOCs**	*Total VOCs**
	Old Unit Name	*Subunit ID*	*2001 (µg/L)*	*2005 (µg/L)*
EW06	Salt River Gravel	A	148	18.1
EW07	Salt River Gravel	A	13	ND
EW13-118	Salt River Gravel	A	22.5	1.64
EW19-S	Salt River Gravel	A	410	229.8
EW22-S	Salt River Gravel	A	232.3	47.7
NW02	Salt River Gravel	B	229.5	60.8
NW03	Salt River Gravel	A	657.4	143.2
NW04-D	Salt River Gravel	B	1.1	ND
NW04-S	Salt River Gravel	A	42.4	16
NW05-S	Salt River Gravel	A	211[a]	59.6
NW06-D	Basin Fill	B	65.9	54.4
NW06-S	Salt River Gravel	A	81.2	64
NW07-D	Basin Fill	D	41.5	39.4
NW07-S	Salt River Gravel	A	13.5	3.9

Notes.

* Select VOCs include 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, and trichloroethene

[a] Well installed in June 2003, first sample collected July 2003

ND = No target analytes detected above individual detection limits

APPENDIX D

PUBLIC NOTICE OF FIVE-YEAR REVIEW

ADEQ
Arizona Department of Environmental Quality
Janet Napolitano, Governor
Stephen A. Owens, ADEQ Director

PUBLIC COMMENT FOR 5-YEAR REVIEW

Motorola 52nd Street Superfund Site April 2006

Operable Units 1 and 2, Public Notice of Five-Year Review

The Arizona Department of Environmental Quality (ADEQ) and the United States Environmental Protection Agency (EPA) are announcing the start of the third Five-Year Review for the Motorola 52nd Street Federal Superfund Site and are soliciting input from the community regarding the cleanup. ADEQ is conducting the Five-Year Review of the two interim groundwater cleanup remedies at the Site. The purpose of a five-year review is to evaluate whether the ***remedies at a site are protective of human health and the environment;*** *or in other words, whether the cleanup methods are working as designed. ADEQ will also assess if any factors suggest that the remedies may not continue to be protective in the future. During the five-year review process, ADEQ would like to address any concerns from the public specifically regarding the cleanup activities being conducted at the Motorola 52nd Street Site.*

FIVE-YEAR REVIEW

These are the U.S. laws that govern the Five-Year Review:

Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) state that a remedial action that resulted in hazardous substances, pollutants, or contaminants remaining at the site shall be reviewed no less frequently than every five years. It requires that the EPA make a determination whether the remedial actions are protective. Thus, the Motorola 52nd Street Superfund Site requires a five-year review of the selected remedies. ADEQ will provide a Five-Year Review Report with a protectiveness statement for EPA's review and approval.

In order to determine the protectiveness of the remedy, ADEQ will conduct studies, perform inspections of the treatment systems, and review existing operation and maintenance information. ADEQ will also interview key project personnel, evaluate any changes of site conditions, and review federal and state requirements.

BACKGROUND

The Motorola 52nd Street Site is located in a residential and commercial area in eastern and central Phoenix. The site boundaries are approximately 52nd Street to the east, Seventh Avenue to the west, Palm Lane to the north and Buckeye Road to the south. The site encompasses a large plume of groundwater contamination which, to facilitate the clean up of the site, has been divided into three separate areas, or operable units (OUs). The focus of this notice is Operable Unit 1 (OU1) and Operable Unit 2 (OU2). See map for location of the OU1 and OU2 boundaries and the groundwater remedies.

The contamination at the Motorola 52nd Street Site is a result of historic commercial and industrial solvent disposal throughout the area. The primary groundwater contaminants are trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (TCA). The Motorola 52nd Street Site was placed on the National Priorities List (NPL) in September 1989. Since the site was discovered, ADEQ has had the lead enforcement role at the site.

More detailed information on this site can be found on the ADEQ Web page at: http://www.azdeq.gov/environ/waste/sps/download/phoenix/m52.pdf.

OPERABLE UNIT 1

In 1989, Motorola signed a Consent Order (a legal agreement between ADEQ and Motorola) with ADEQ to construct and operate a groundwater treatment system to contain and treat groundwater contaminated with chlorinated solvents for OU1. The OU1 remedy involves the cleanup of both soil and groundwater. Three areas at the former Motorola 52nd Street Facility are required to be cleaned up by soil vapor extraction (SVE). The soil remedy is currently not in operation; one area has been completed and the other two areas are being evaluated.

The groundwater treatment system at OU1 has been in operation since 1992 and consists of three

separate well fields (two on the Facility and one along the Old Cross Cut Canal) and a treatment plant located at the Facility. The groundwater is pumped at a rate of 230 gallons per minute (gpm) from these well fields and conveyed via an underground dual-wall pipe to the treatment plant. The contaminated groundwater then enters the air stripper towers where the contaminants are moved from the water into the air. The air then moves through a vapor phase granular activated carbon system to trap the contamination within the carbon filter. The treated water is used in plant operations at the 52nd Street Facility.

OPERABLE UNIT 2

In 1998, the EPA issued a Unilateral Administrative Order (a legal document requiring work) to Motorola and Honeywell to construct and operate a groundwater treatment system. The system is designed to contain and treat groundwater contaminated with chlorinated solvents within OU2. The system became fully operational in September 2001 and currently extracts groundwater at approximately 2000 gallons per minute from a series of three extraction wells located along 20th Street. The water is treated by pumping the contaminated water through a liquid phase granular activated carbon system to trap the contamination within the carbon filter. The treated water is then discharged to the Salt River Project (SRP) Grand Canal.

COMMUNITY INVOLVEMENT

In an effort to better involve and inform the community, ADEQ would like to interview people who have knowledge of operations of the cleanup systems as well as members of the public who have information or concerns about on-going cleanup activities. Please contact:

Linda Mariner
ADEQ Community Involvement Coordinator
(602) 771-4294
e-mail: mariner.linda@azdeq.gov
Hearing impaired persons call
ADEQ's TDD line: (602) 771-4829

before May 15, 2006 to schedule an interview.

ADEQ initiated the five-year review process in February 2006 and plans to complete the review and submit a report to EPA by September 2006. The findings of the five-year review will be available to the public at the local information repositories listed below in October 2006.

MOTOROLA 52ND STREET SITE INFORMATION REPOSITORIES:

ADEQ Records Center
1110 West Washington Street
Phoenix, AZ 85007
(602) 771-4420

U.S. EPA
Superfund Records Center
95 Hawthorne Street, Ste. 403S
San Francisco, CA 94105-3901
(415) 536-2000

City of Phoenix Public Library
Saguaro Branch
2808 North 46th Street
Phoenix, AZ 85008
(602) 262-6801

City of Phoenix Public Library
Burton Barr Branch
1221 North Central Avenue
Phoenix, AZ 85004
(602) 262-4636

Documents in electronic form (pdf) are available to be emailed or mailed to you on a CD from EPA or ADEQ. Electronic versions will also be in the libraries on CD and can be copied.

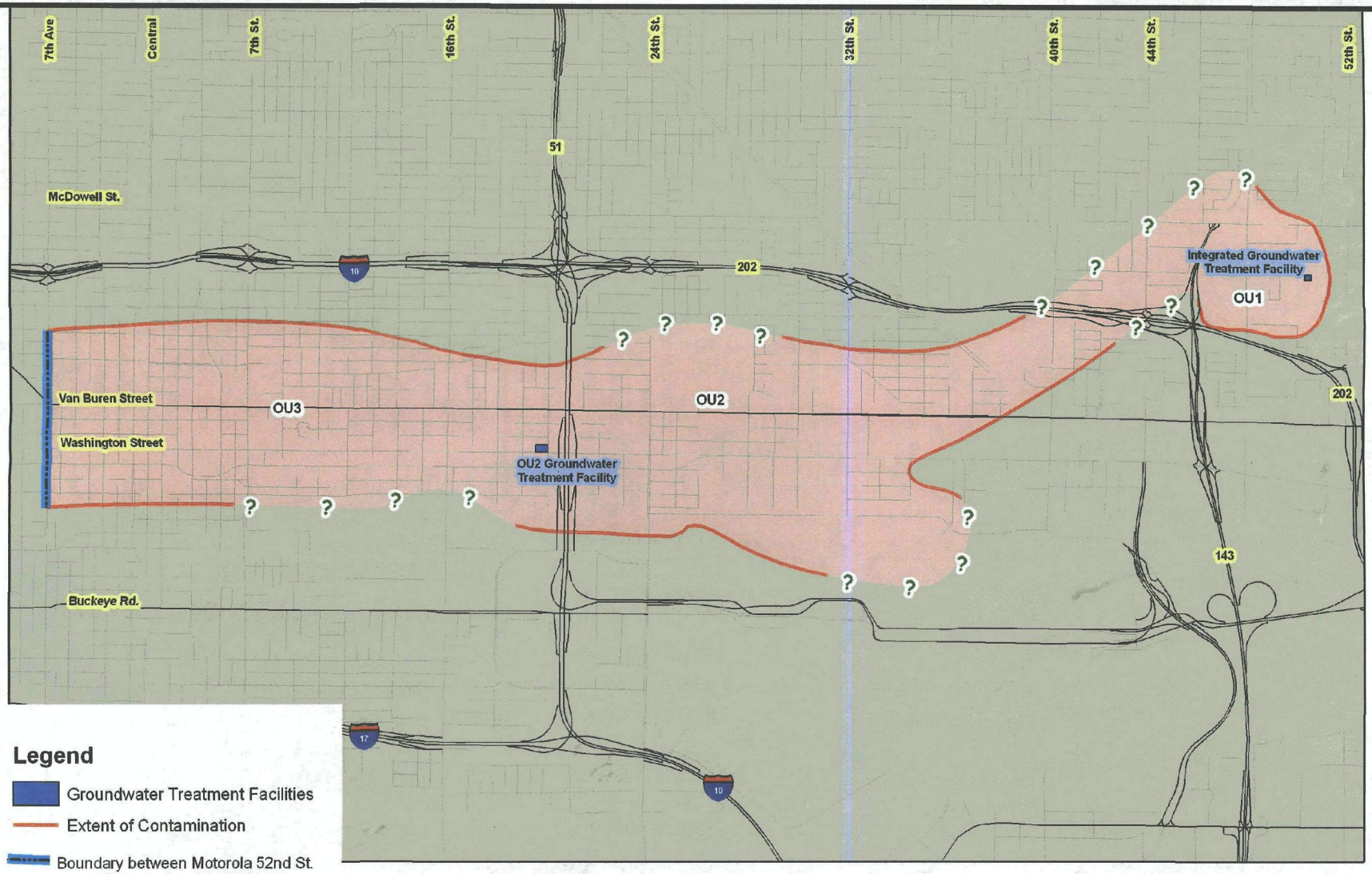
If you would like further information regarding the Motorola 52nd Street site, please contact:
Linda Mariner
ADEQ Community Involvement Coordinator
(602) 771-4294
e-mail: mariner.linda@azdeq.gov
Hearing impaired persons call
ADEQ's TDD line: (602) 771-4829

For general comments and questions regarding the Five-Year Review for the Motorola 52nd Street Site, please contact:
Kris Paschall
ADEQ Project Manager
(602) 771-4193
e-mail at paschall.kris@azdeq.gov

In Arizona, outside the Phoenix area, call 1(800) 234-5677. Hearing impaired may call TDD line at (602) 771-4829.

Web site: www.azdeq.gov

Motorola 52nd Street Superfund Site



Legend

- Groundwater Treatment Facilities
- Extent of Contamination
- Boundary between Motorola 52nd St. and West Van Buren WQARF Site
- ? = plume Boundary inferred.

Contour represents area of volatile organic compounds in alluvial and bedrock groundwater that exceed the Aquifer Water Quality Standards.

0 0.5 1 2 Miles

N

Samples collected September 2005

ADEQ
Arizona Department of Environmental Quality
Janet Napolitano, Governor
Stephen A. Owens, ADEQ Director

Linda Mariner,
Community Involvement Coordinator
1110 W. Washington Street, 4415B-1
Phoenix, AZ 85007-9973

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GLOSSARY

Air strippers - Air Stripping is a treatment system that removes volatile organic compounds (VOCs) from contaminated groundwater or surface water by forcing an airstream through the water and causing the compounds to move from the water into the air within the stripping tower.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - CERCLA is a federal law passed in 1980 that created a special tax that funds a trust fund, commonly known as Superfund, to be used to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can pay for cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or take legal action to force parties responsible for contamination to clean up the site or reimburse the federal government for the cost of the cleanup.

Contamination - Any hazardous or regulated substance released into the environment.

Extraction Well - An extraction well is a well specifically designed to withdraw groundwater or soil gas for treatment.

Groundwater - Water found beneath the earth's surface that fills pores between materials such as sand, clay, or gravel and that often supplies wells and springs.

Liquid Phase Granulated Activated Carbon - Liquid phase carbon adsorption is a full-scale technology in which ground water is pumped through one or more vessels containing activated carbon to which dissolved organic contaminants adsorb.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) - The NCP is the major regulatory framework that guides the Superfund response effort. The NCP is a comprehensive body of regulations that outlines a step-by-step process for implementing Superfund responses and defines the roles and responsibilities of EPA, other federal agencies, states, private parties, and the communities in response to situations in which hazardous substances are released into the environment.

National Priorities List (NPL) - The NPL is EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response under Superfund. Inclusion of a site on the list is based primarily on the score the site receives under the Hazard Ranking System. Money from Superfund can be used for cleanup only at sites that are on the NPL. EPA is required to update the NPL at least once a year.

Soil Gas – Soil gas and soil vapor are the gaseous elements and compounds that occur in the small spaces between soil particles. Such gases can move through or leave the soil or rock, depending on changes in pressure.

Soil Vapor Extraction (SVE) – A commonly used technique for cleaning up contaminated soils. SVE draws gases from contaminated soils and through the extraction system for treatment. The term soil vapor extraction is often used interchangeably with soil gas extraction.

Solvent – A substance, usually a liquid that is capable of dissolving or dispersing one or more other substances.

Trichloroethene – TCE is a nonflammable, colorless solvent that readily evaporates at room temperature. TCE is used mainly for degreasing/drying of metals and electronic components. TCE is a potential occupational carcinogen.

Trichloroethane – TCA is a solvent similar to TCE and used mainly for degreasing/drying of metals and electronic components.

Tetrachloroethene – PCE is a clear, colorless, nonflammable liquid with a sweet odor and a low boiling point. It is a solvent used for dissolving waxes, greases, oils, fats, gums, and widely used for dry cleaning of fabrics and degreasing/drying of metals. PCE is a potential occupational carcinogen.

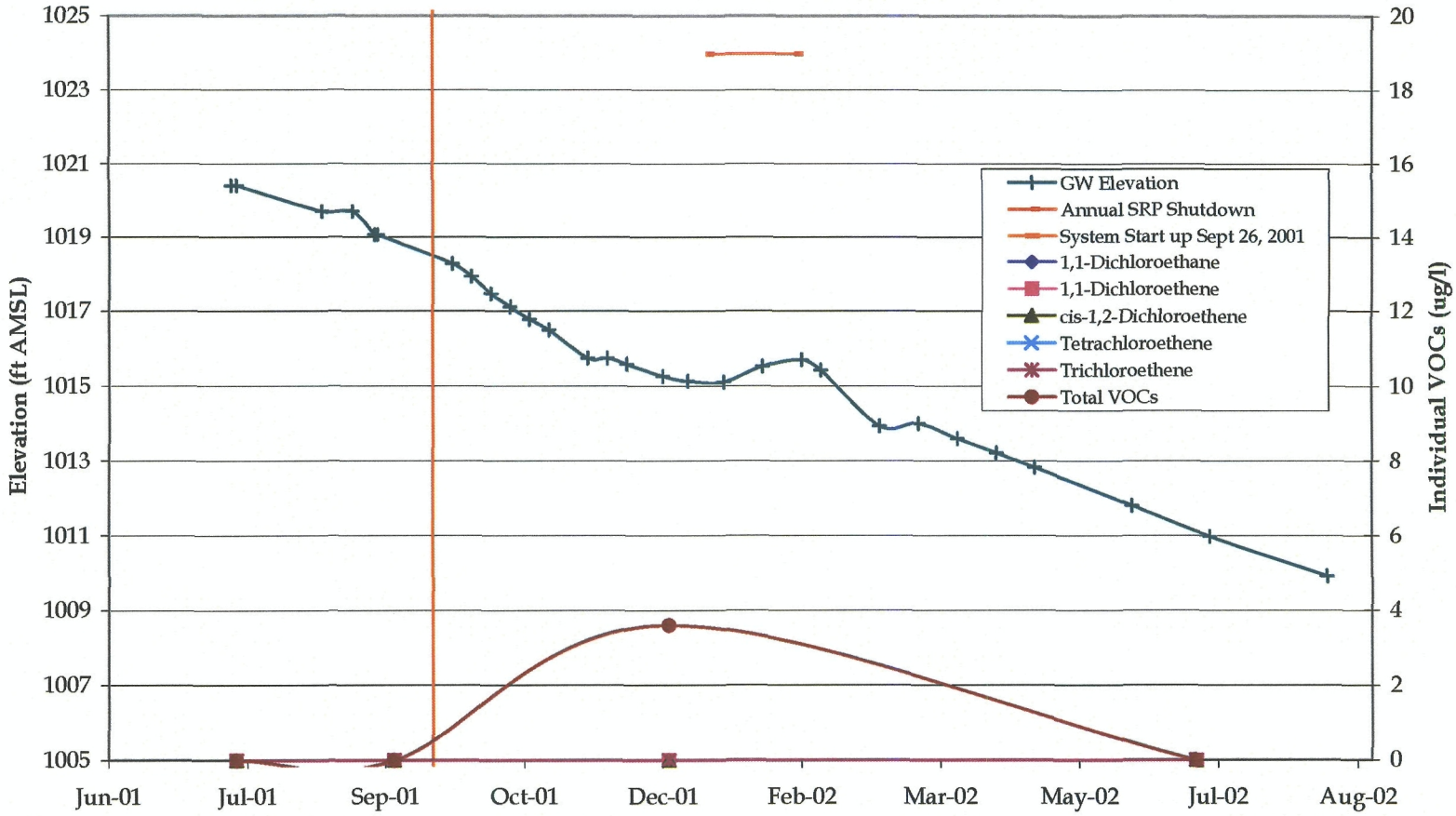
Vapor Phase Granulated Activated Carbon – Vapor-phase carbon adsorption is a remediation technology in which pollutants are removed from air by physical adsorption onto activated carbon grains.

APPENDIX E

GROUNDWATER ELEVATION AND CONCENTRATION HYDROGRAPHS FOR SELECTED WELLS

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

AS02

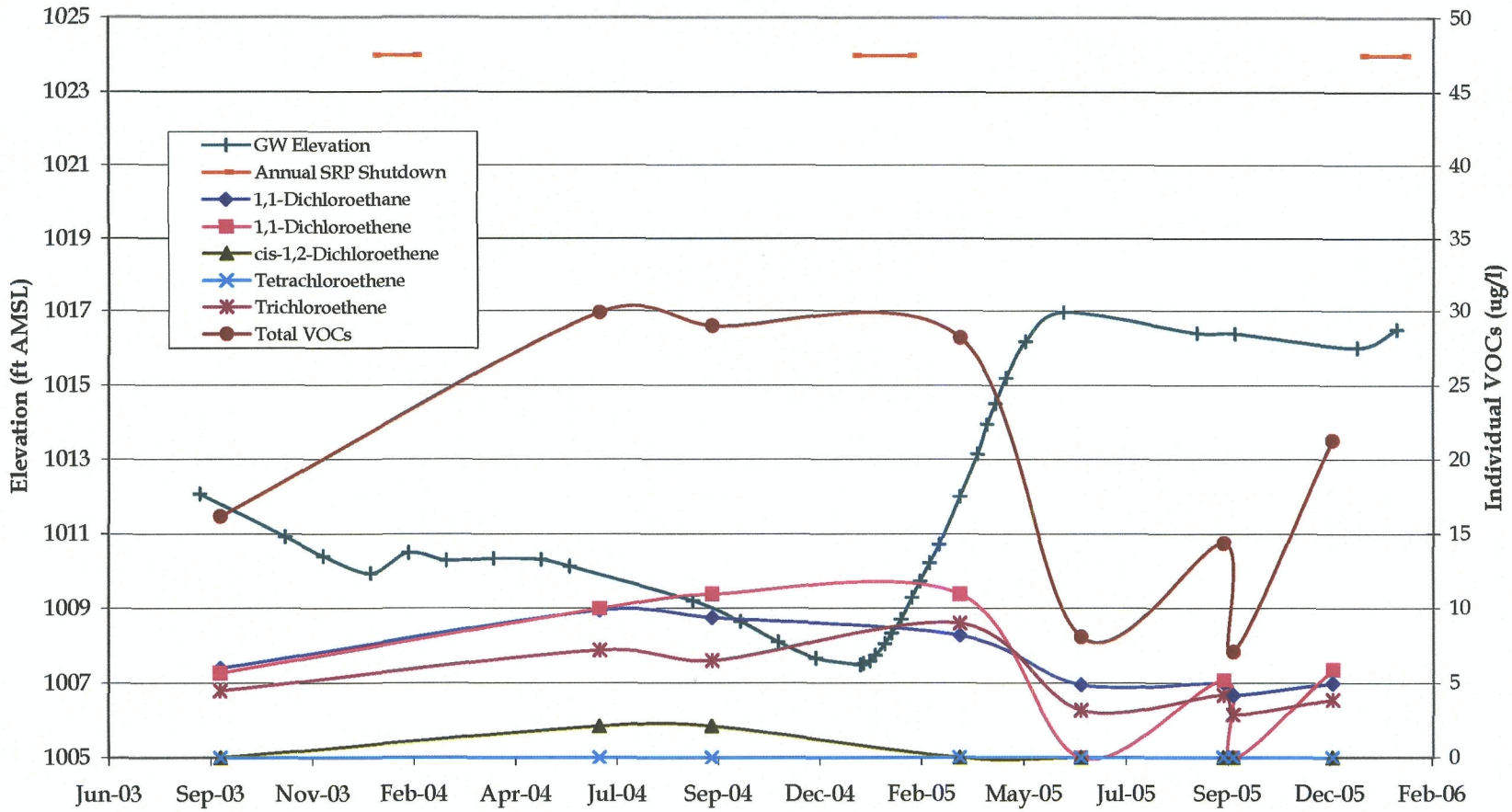


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

ASE76-A



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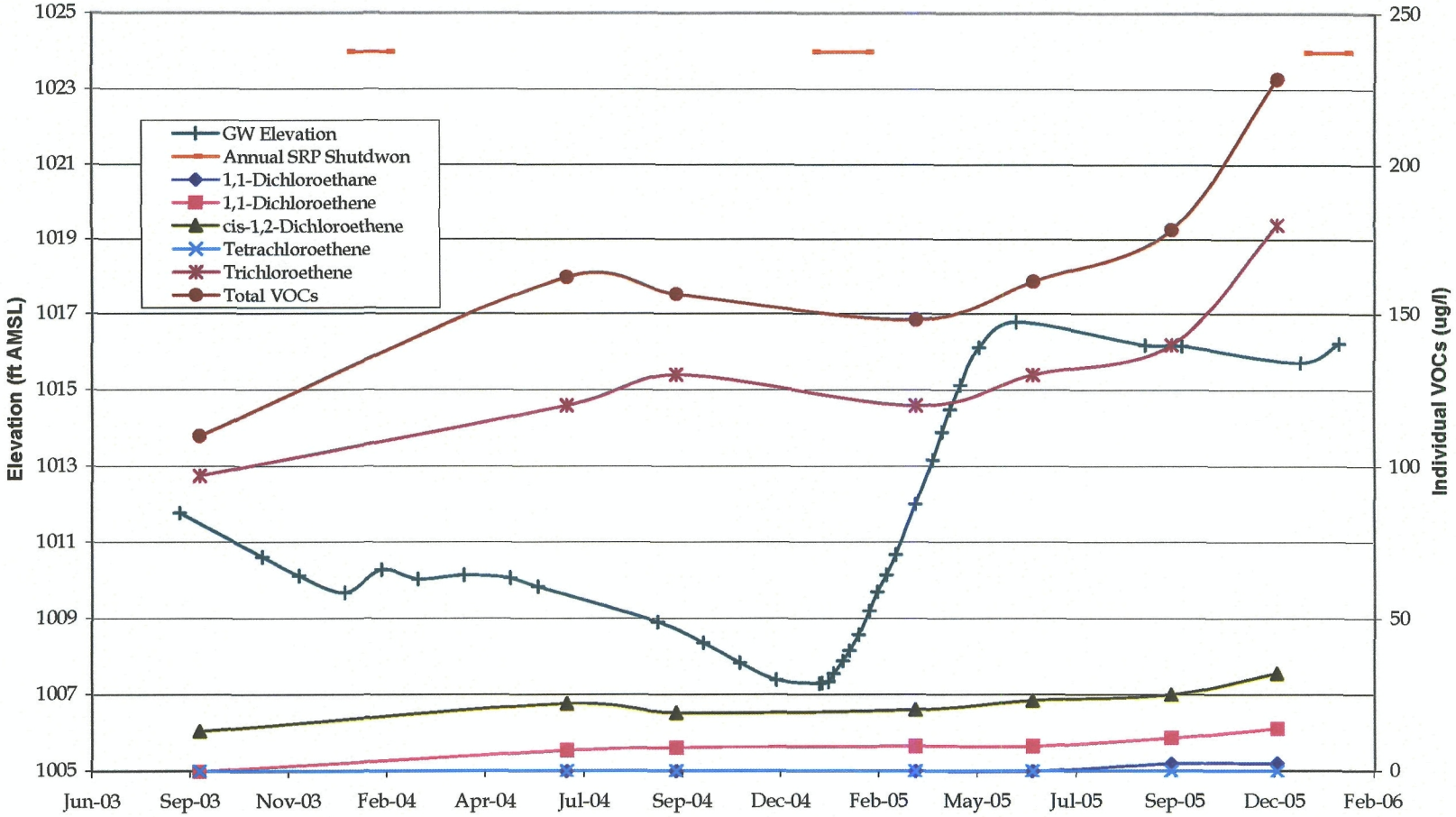
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

ASE76-B

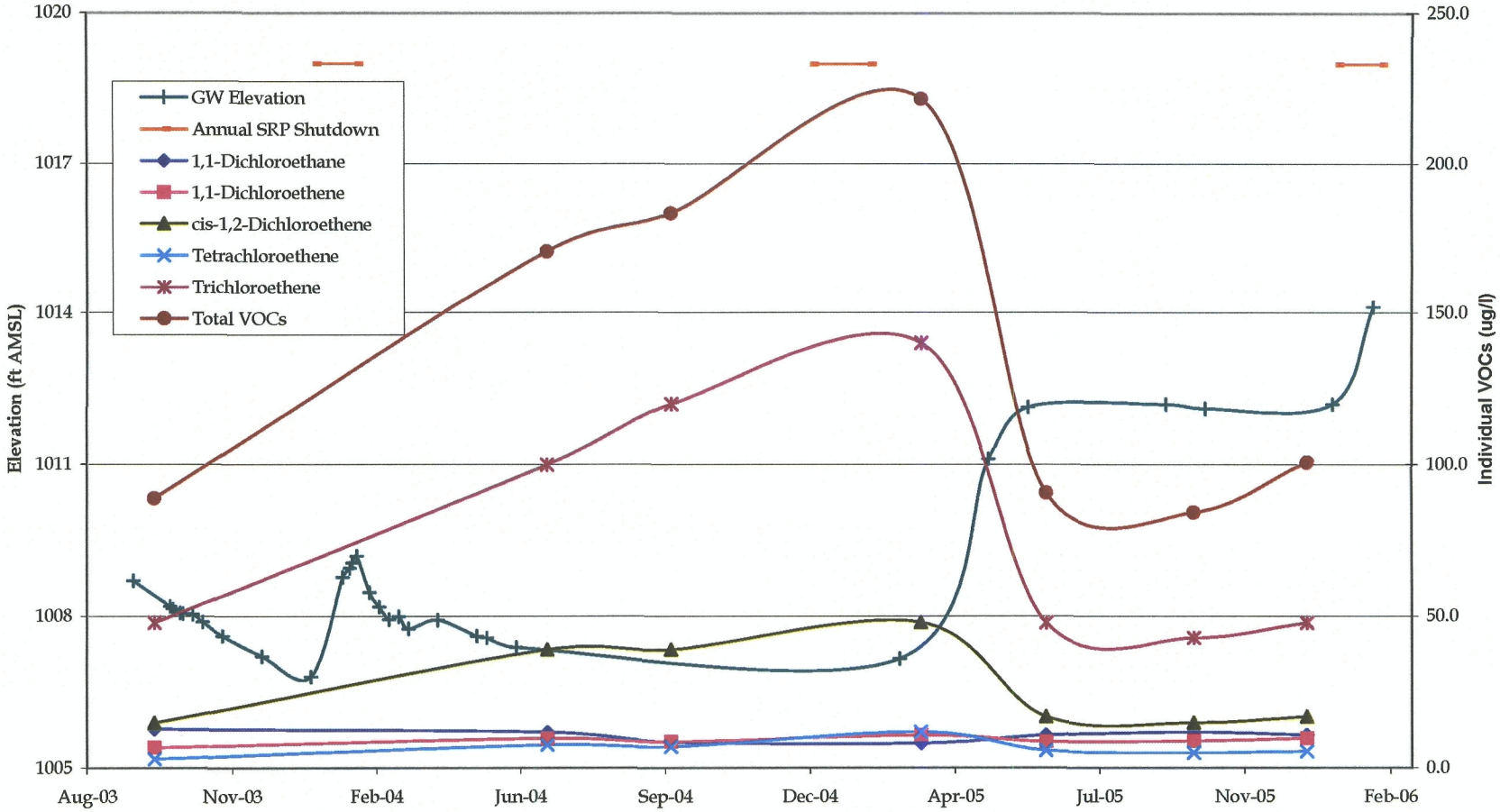


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

ASE77-A



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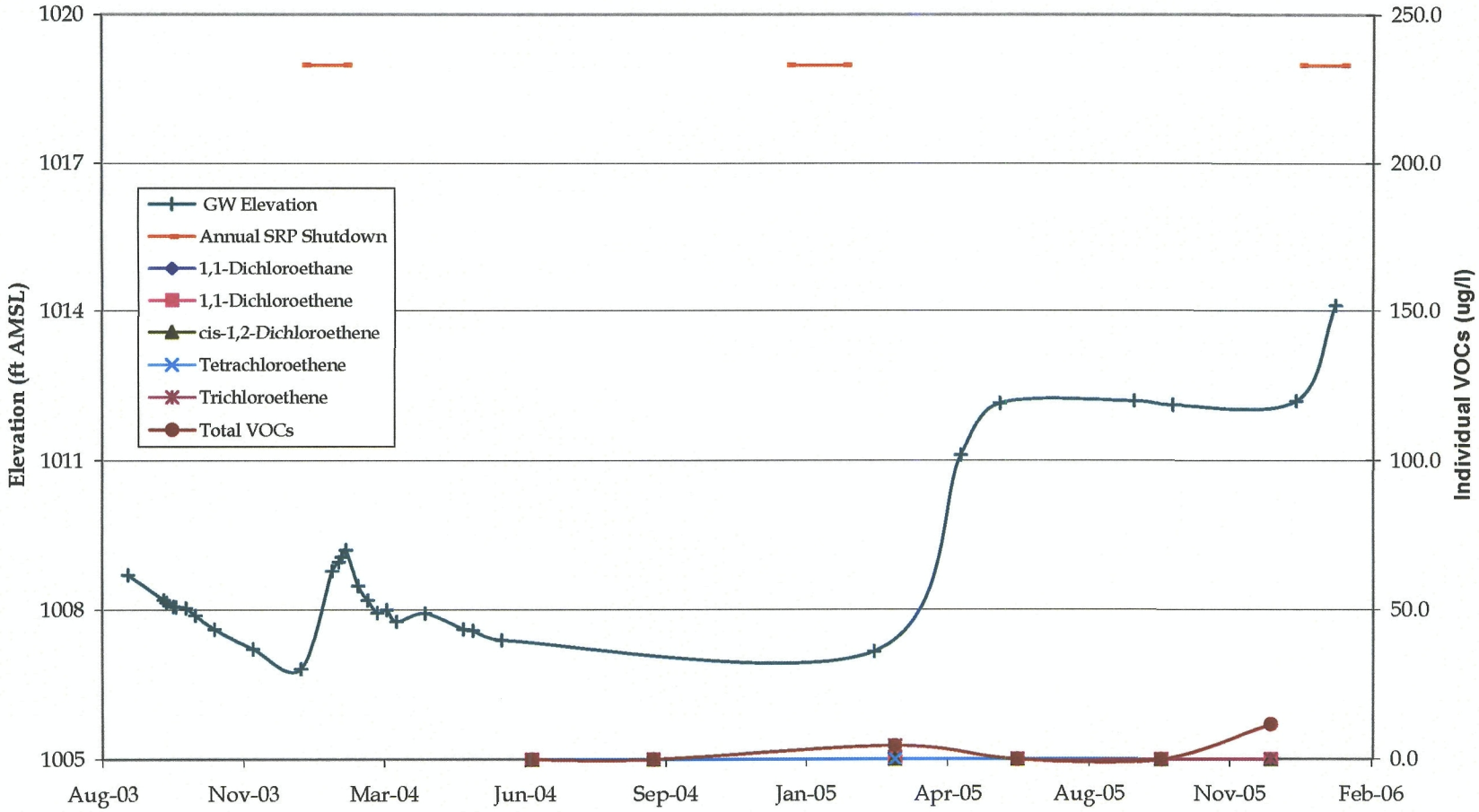
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

ASE77-B

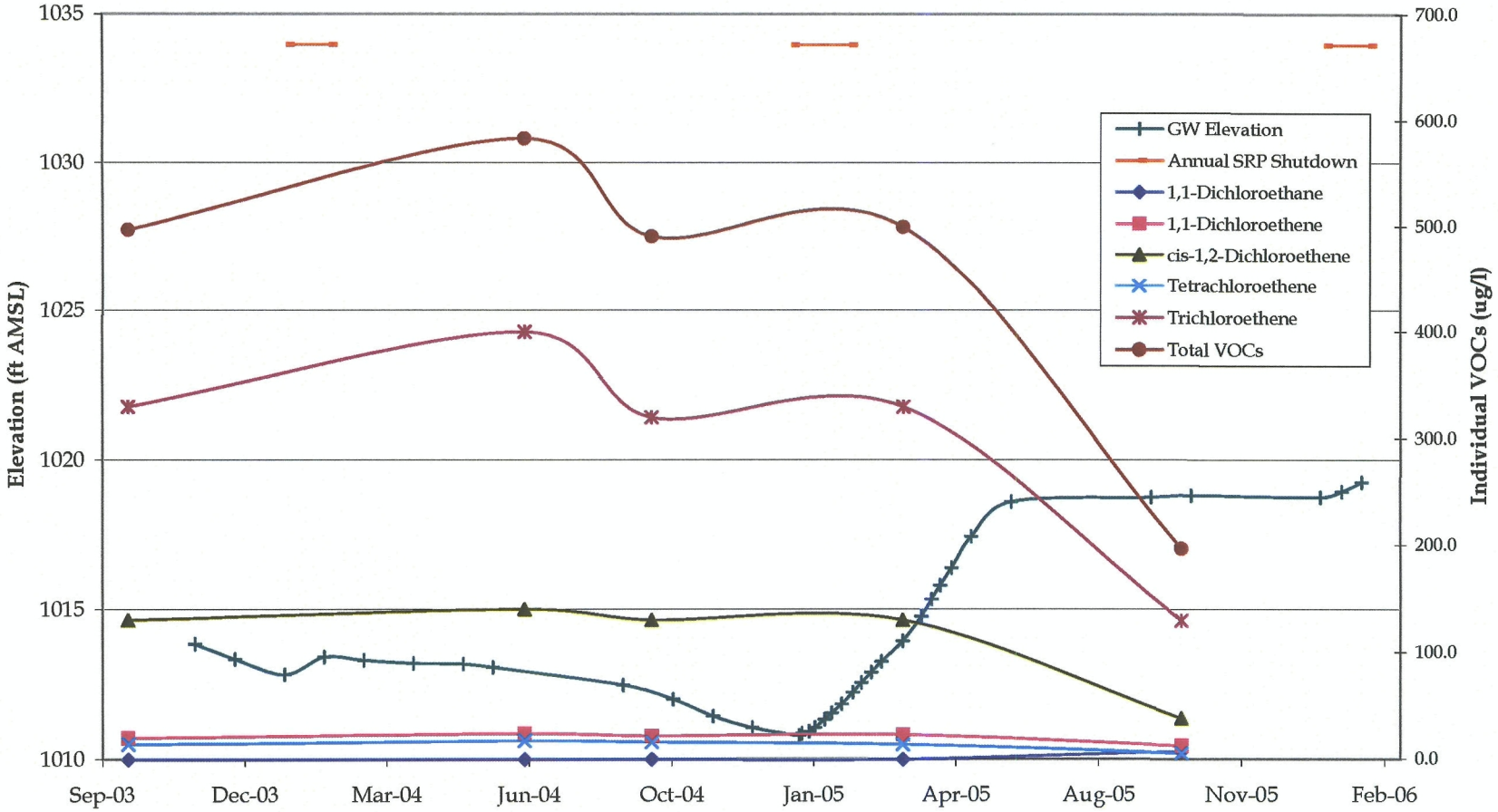


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

ASE86-A

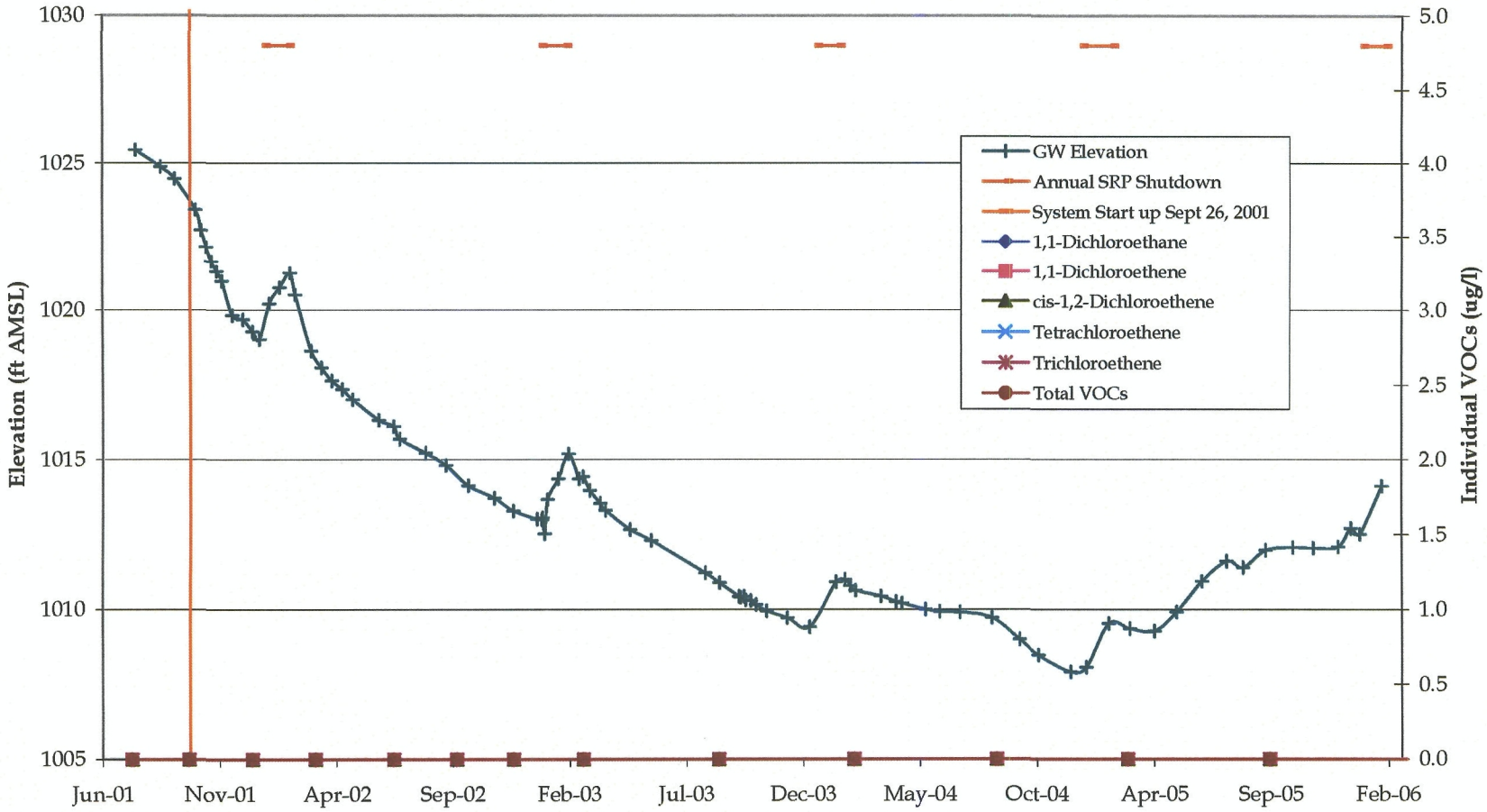


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

CRA01



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

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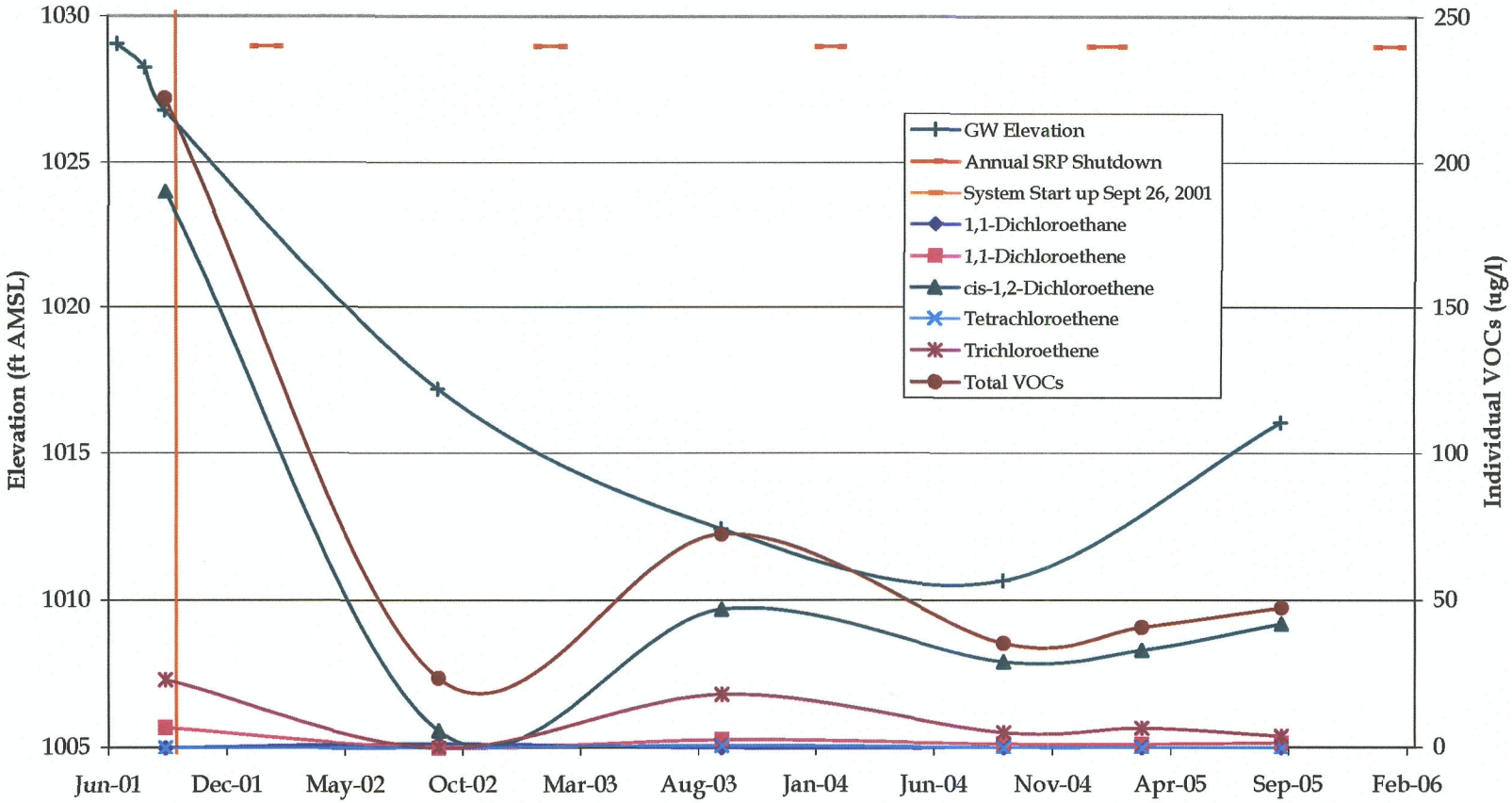
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

DM515-115



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
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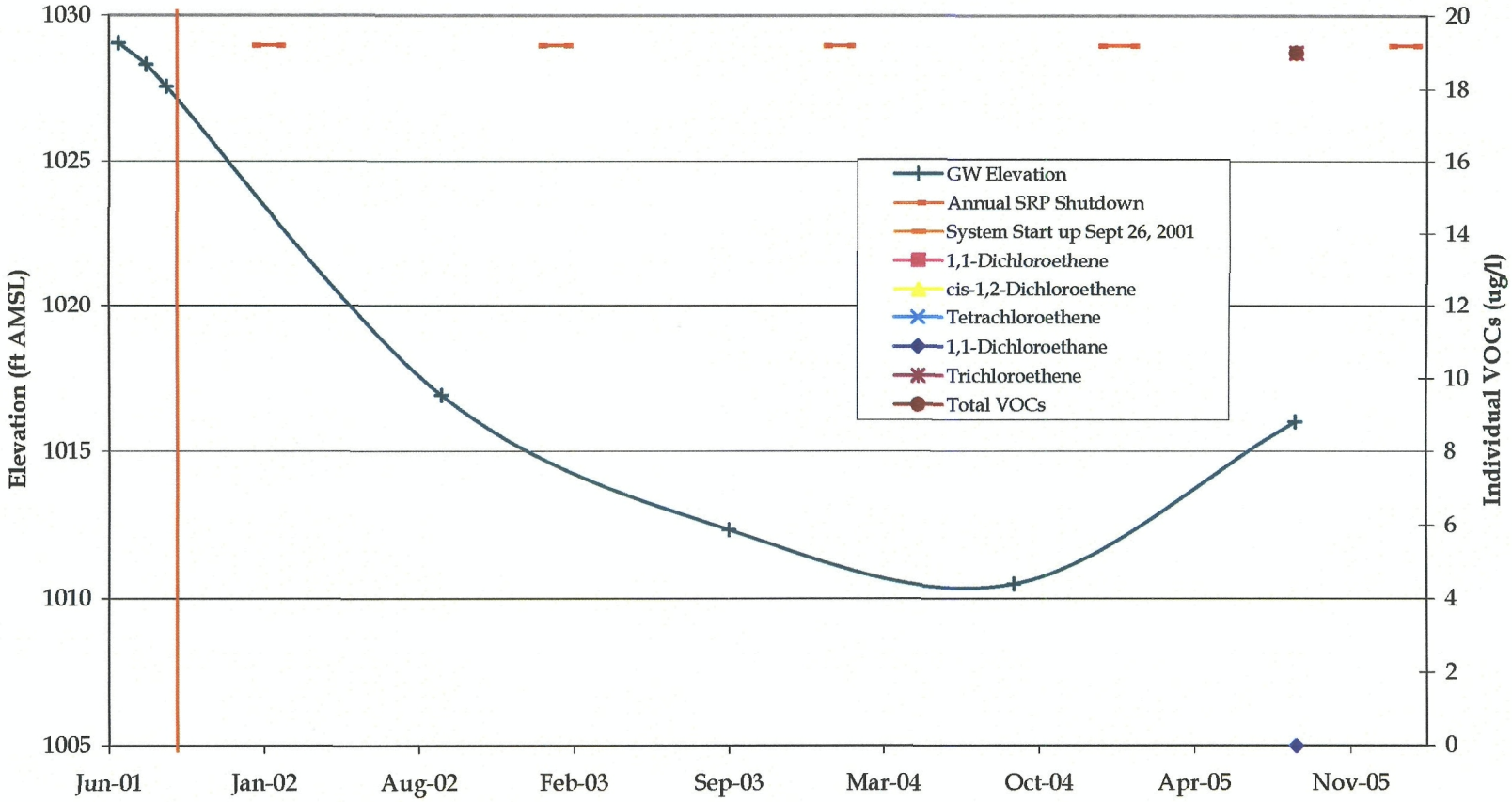
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

DM515-210

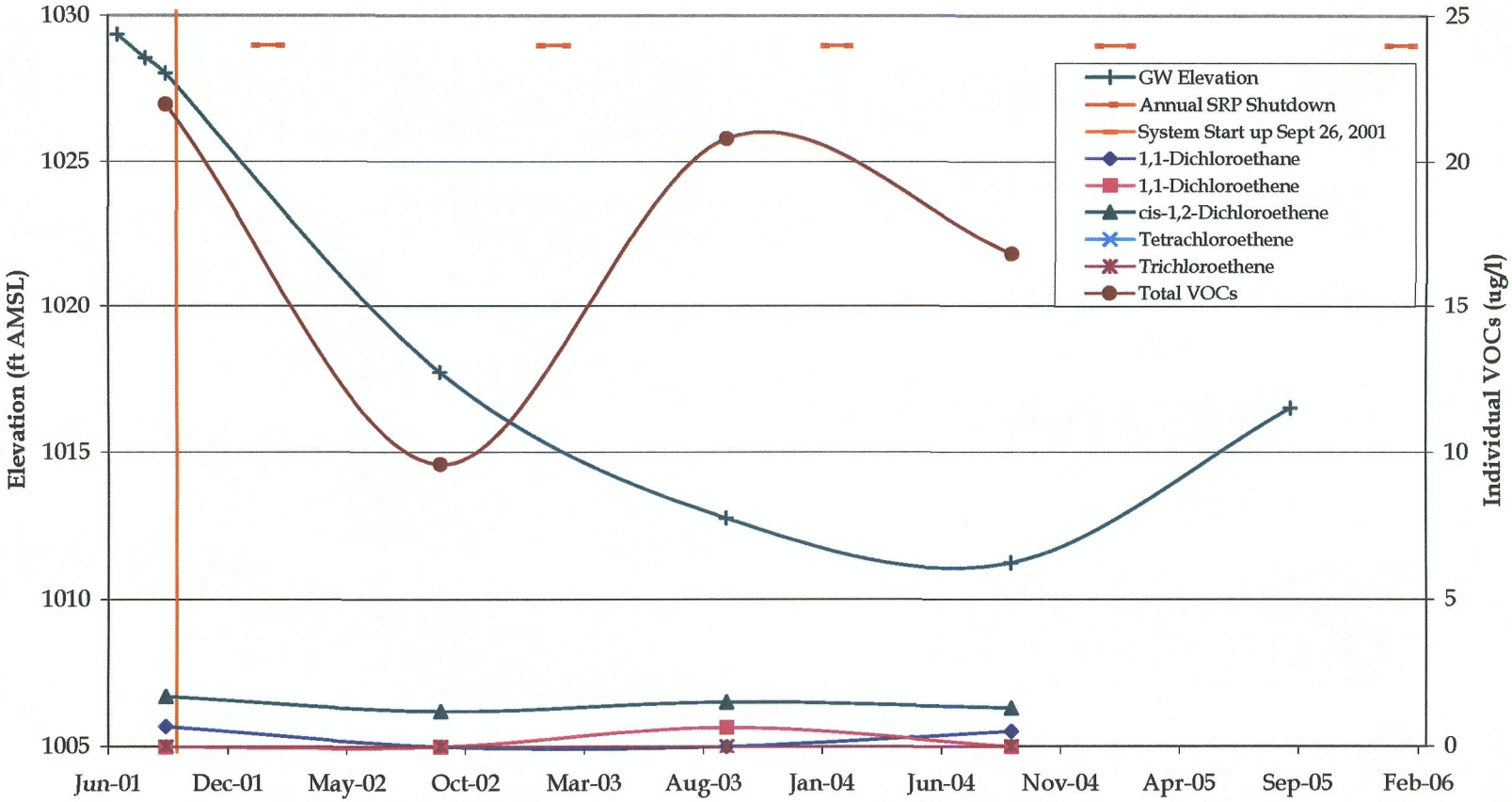


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

DM515-265



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

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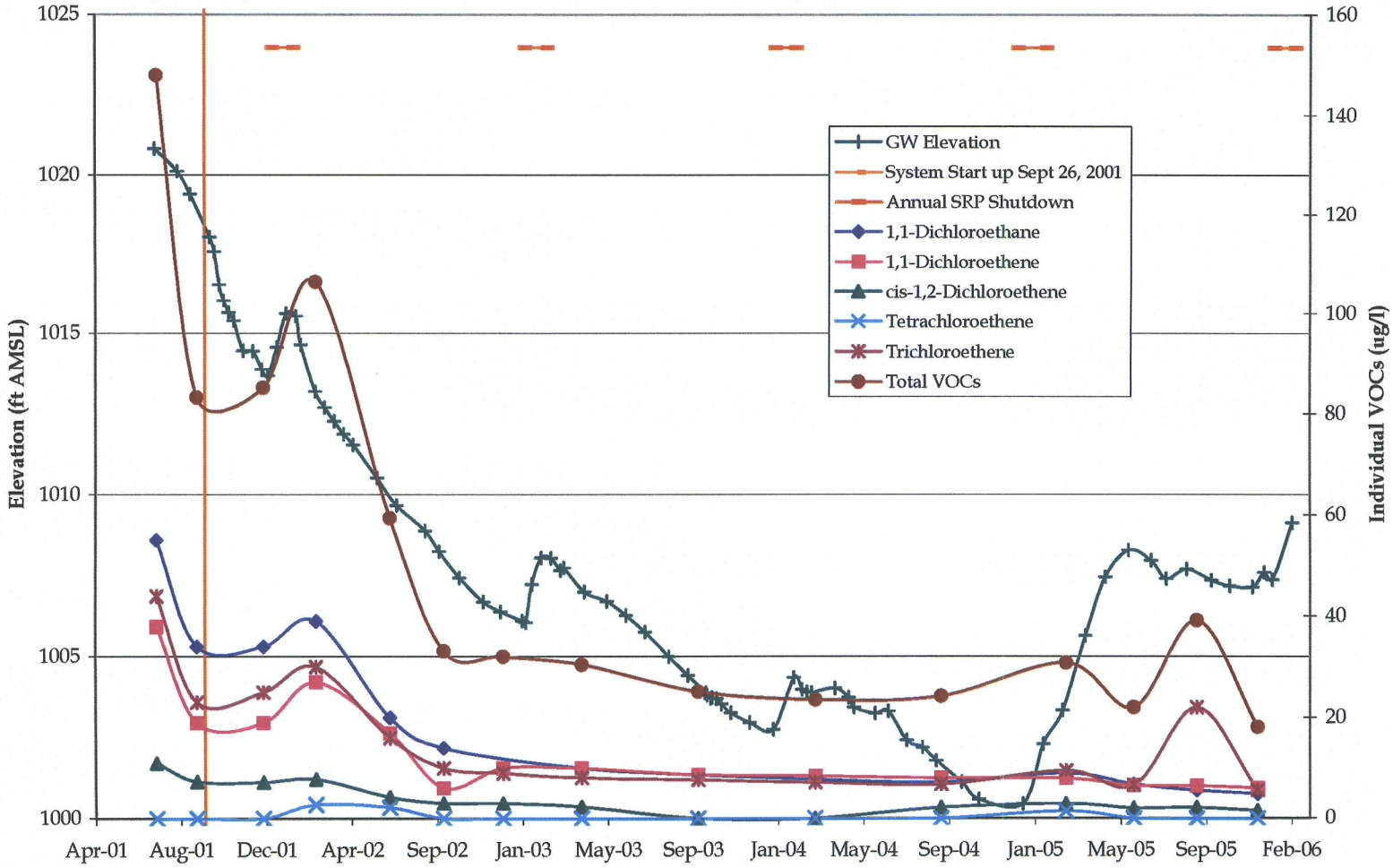
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW06



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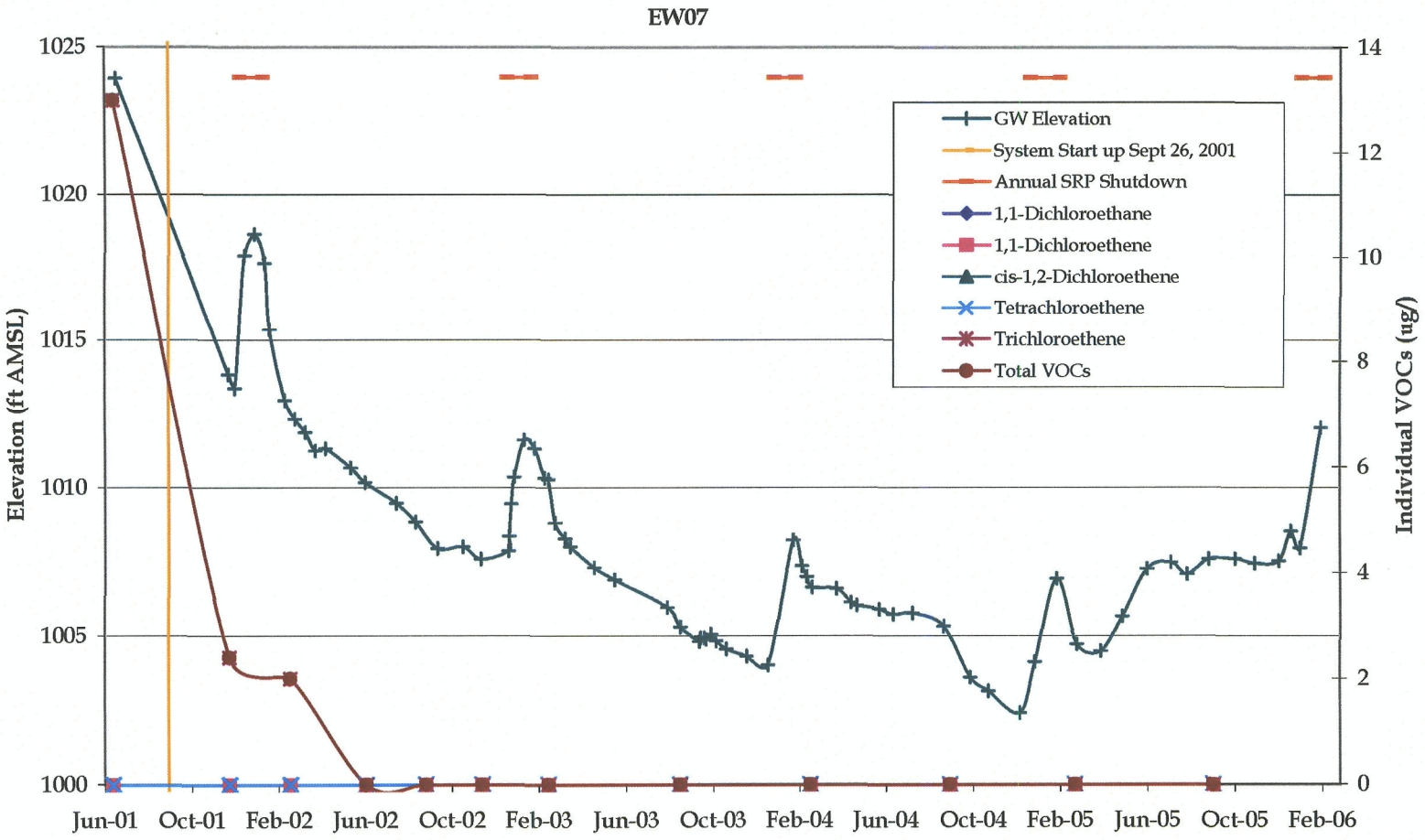
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



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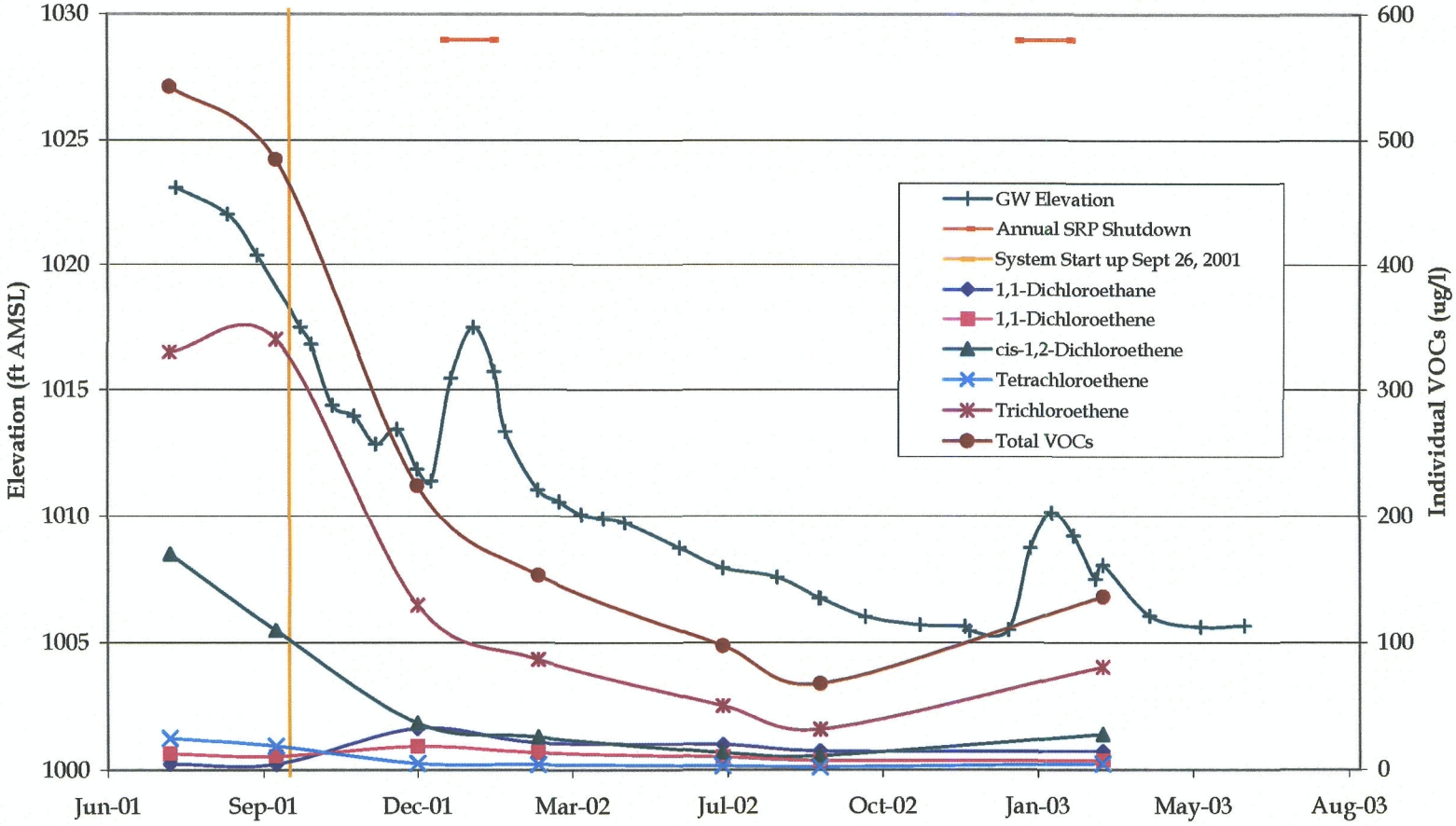
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW12-093



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
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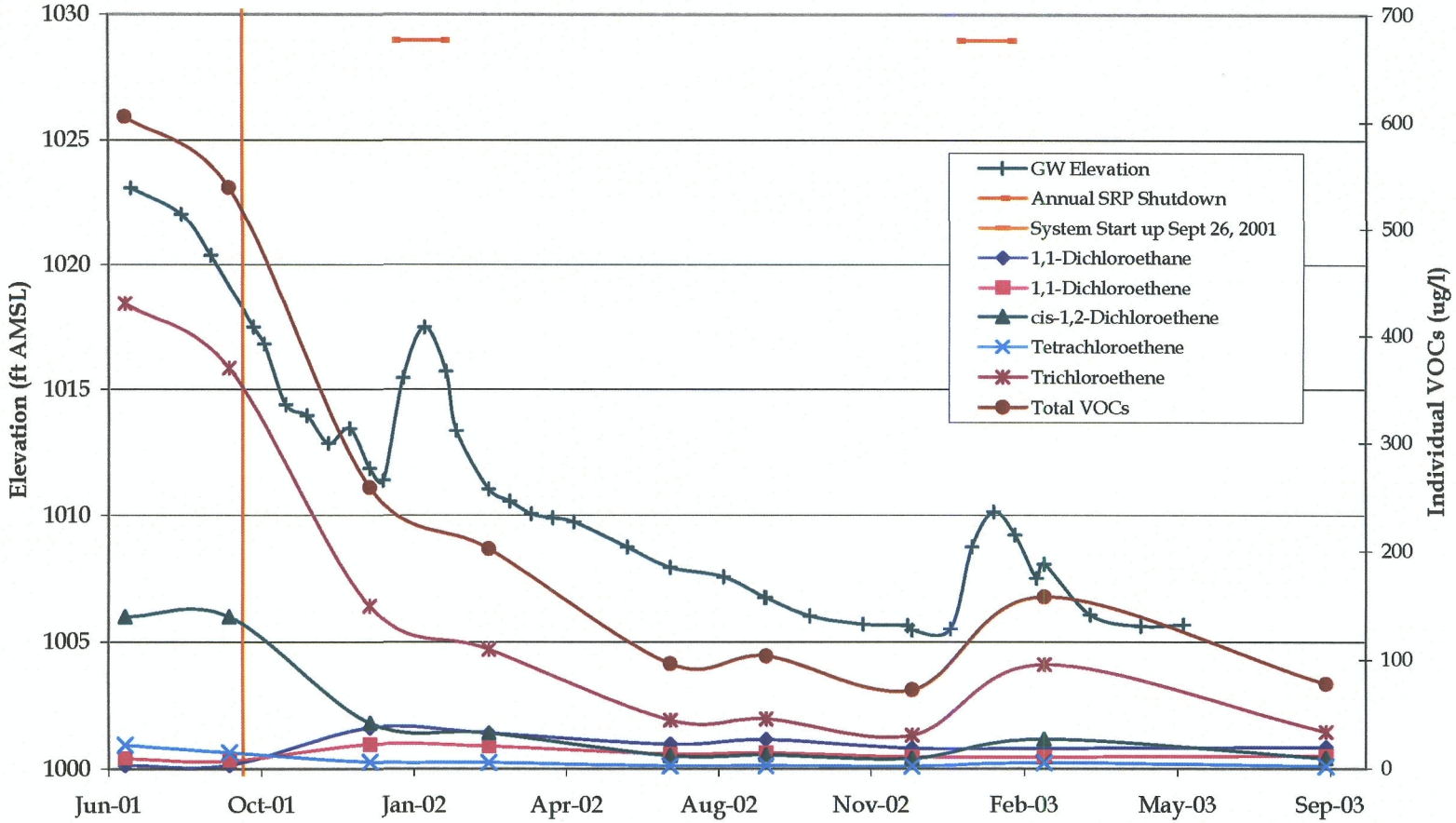
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW12-128

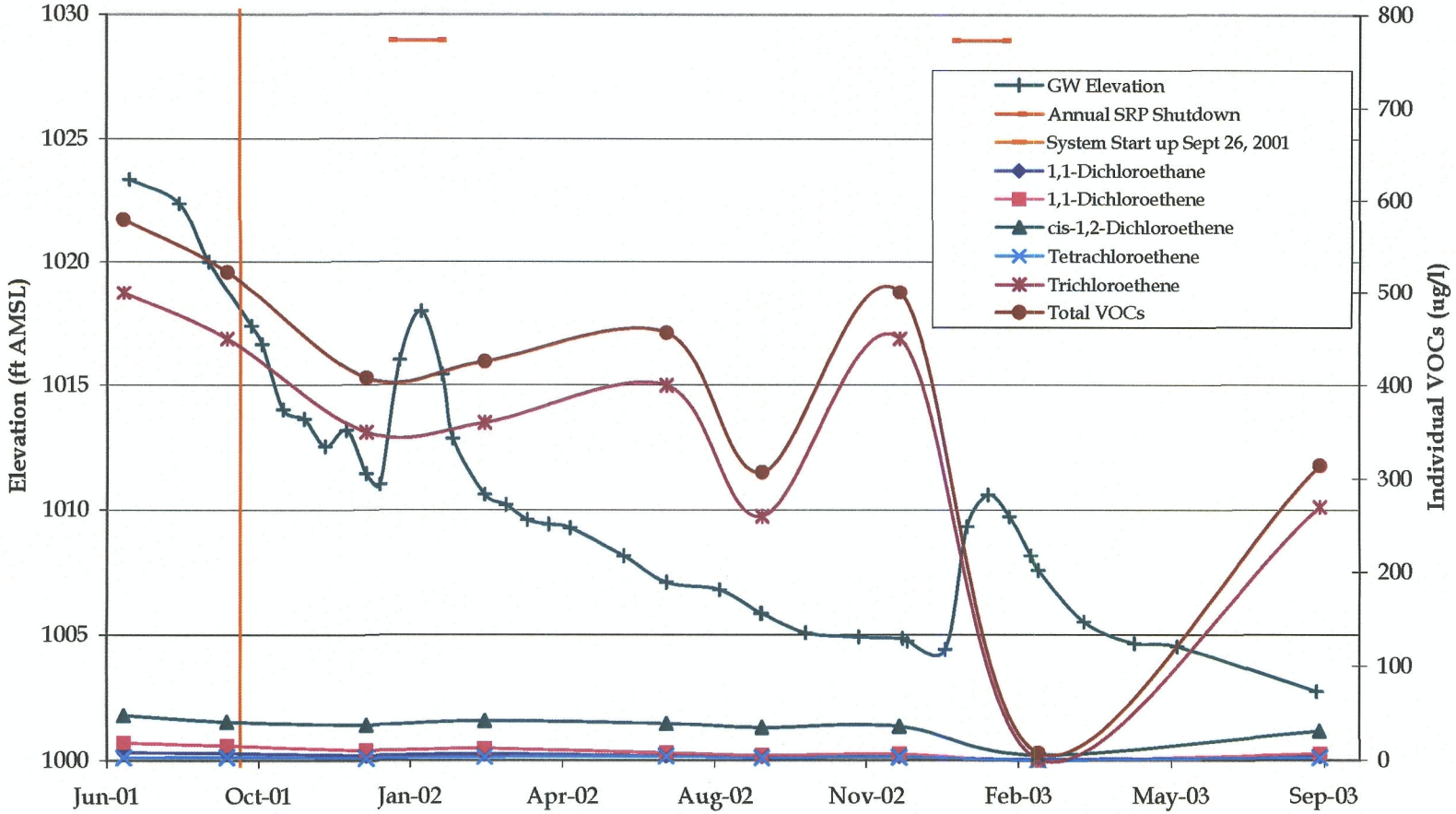


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW12-180



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

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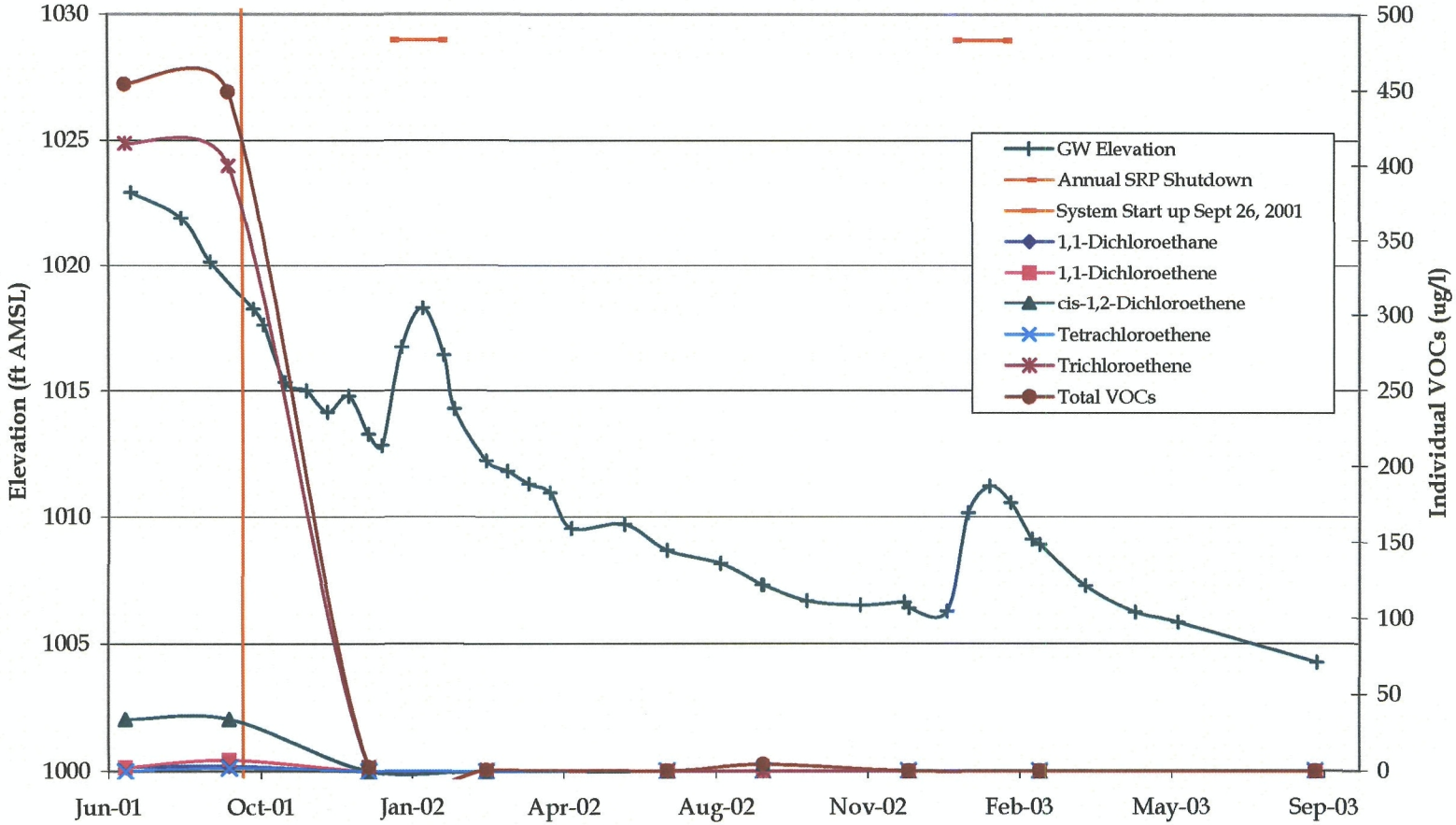
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW12-227



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

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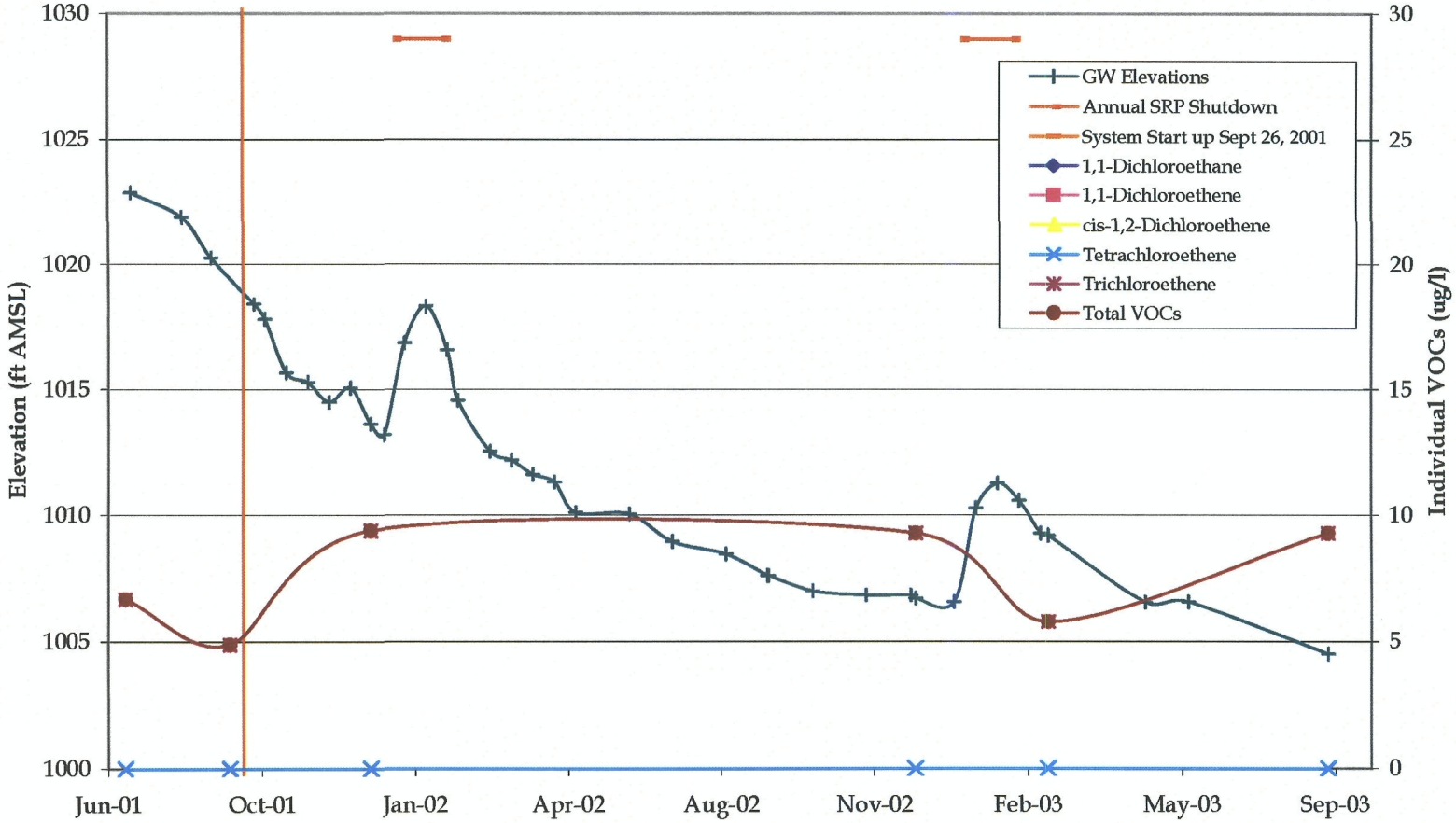
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW12-239

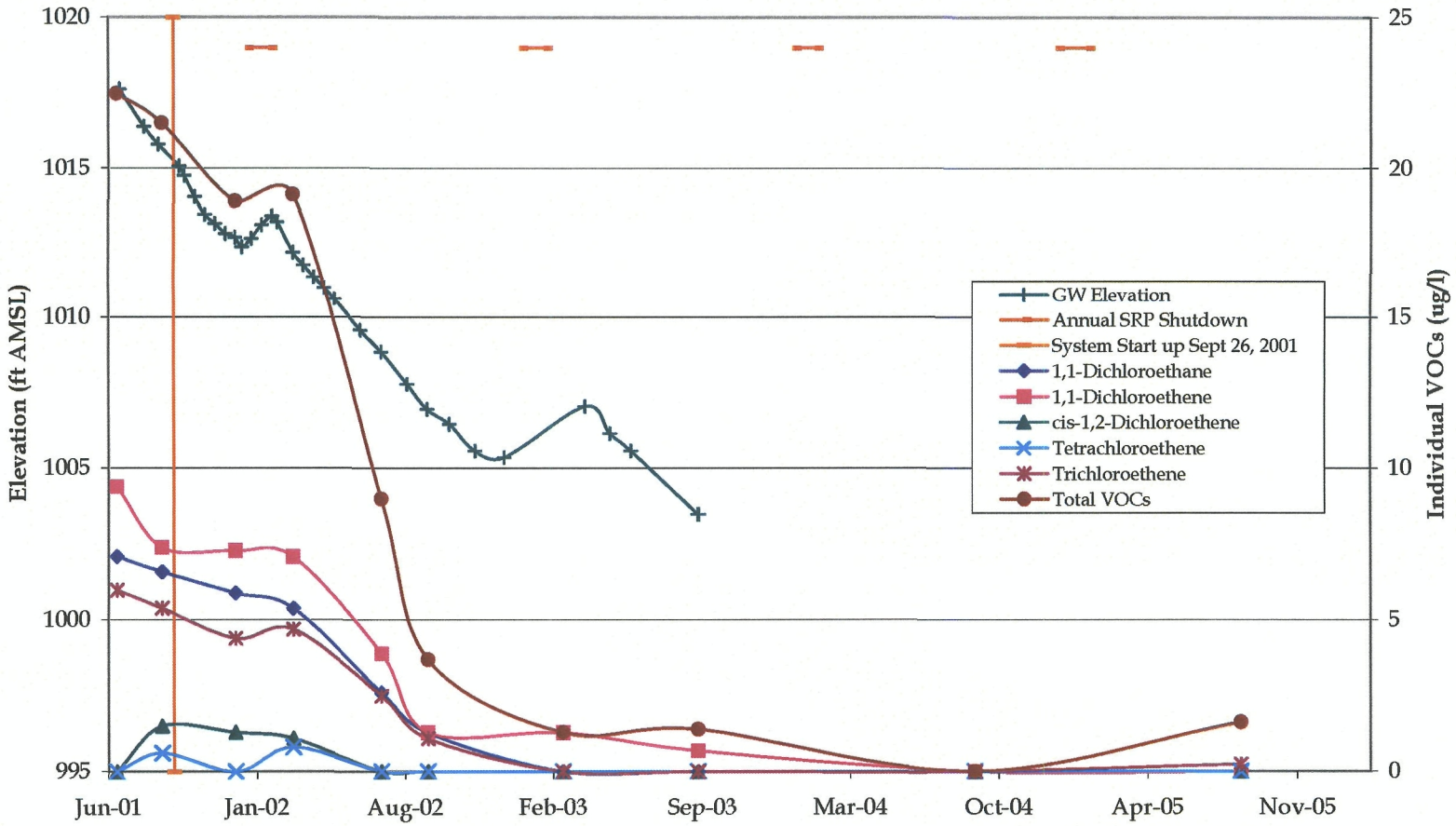


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW13-118



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

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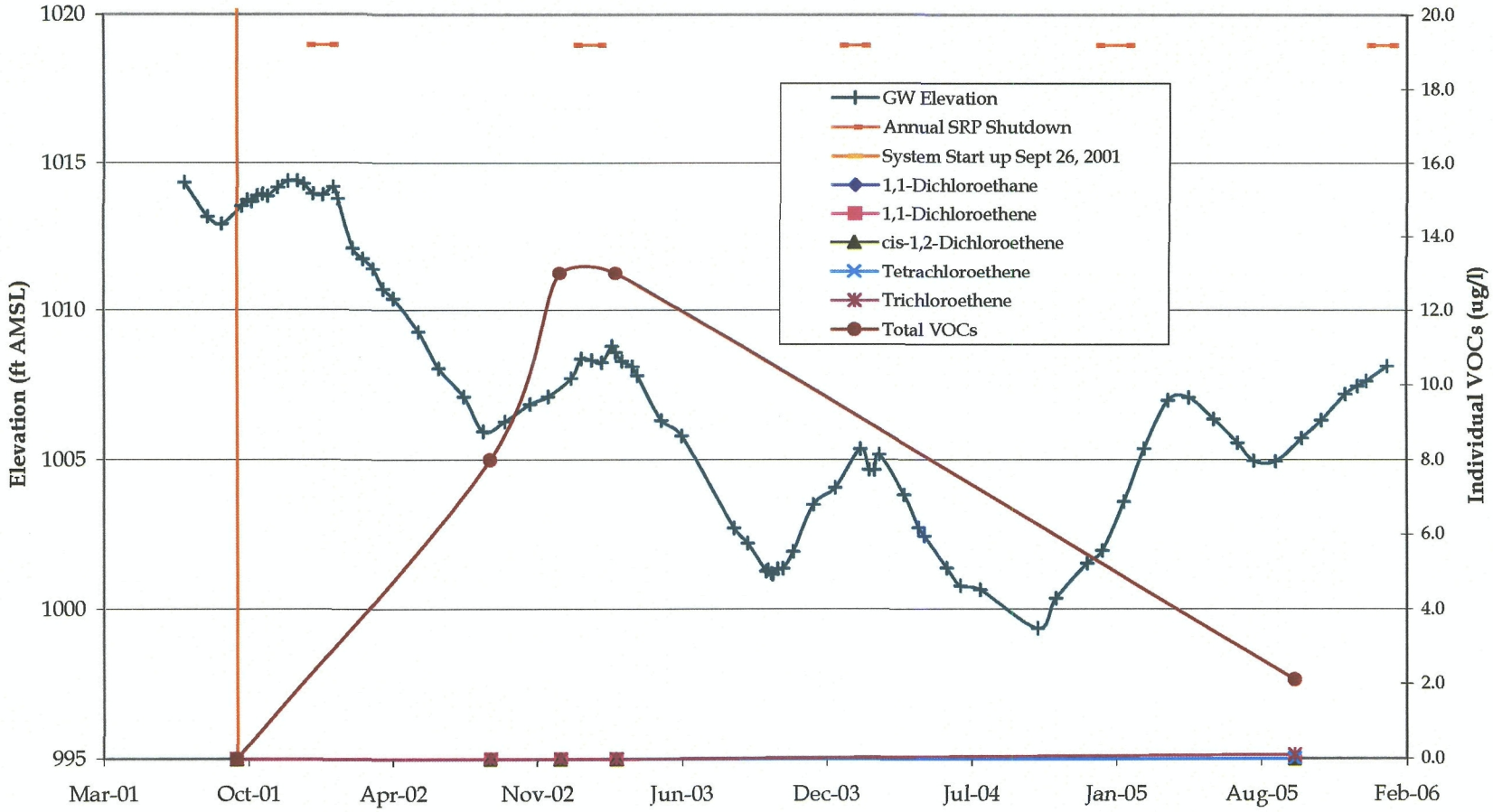
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW19-D

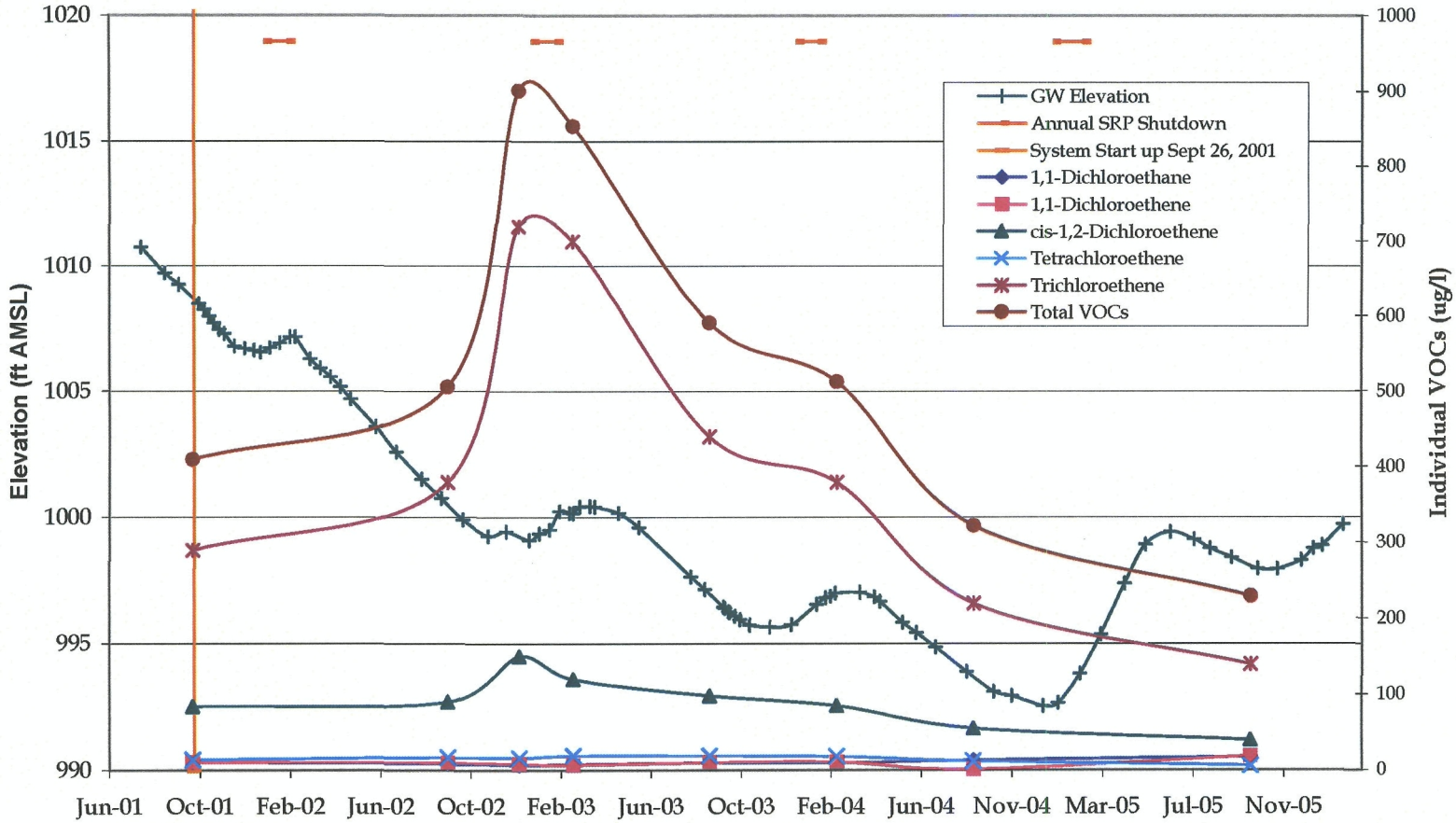


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW19-S

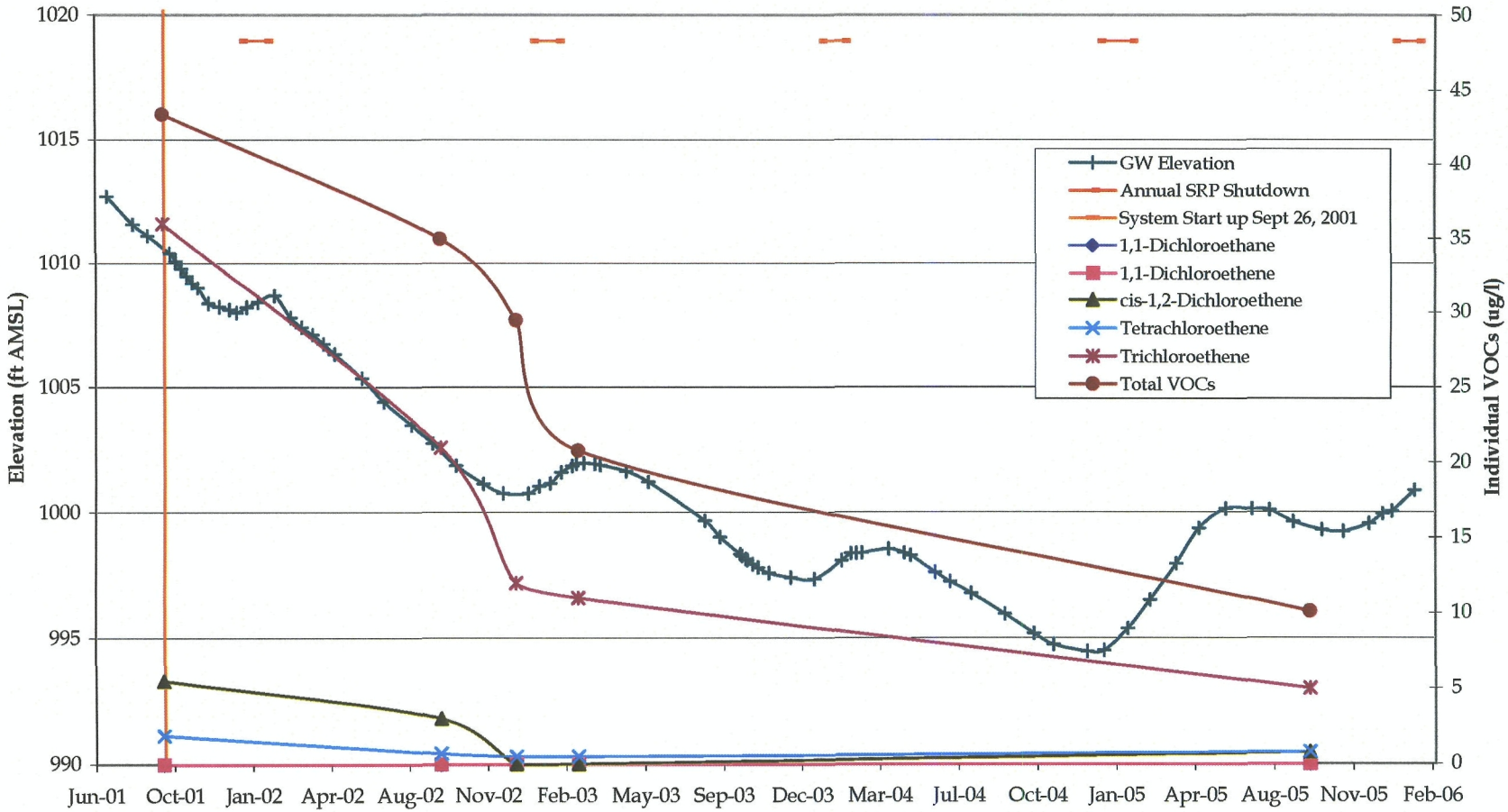


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW21

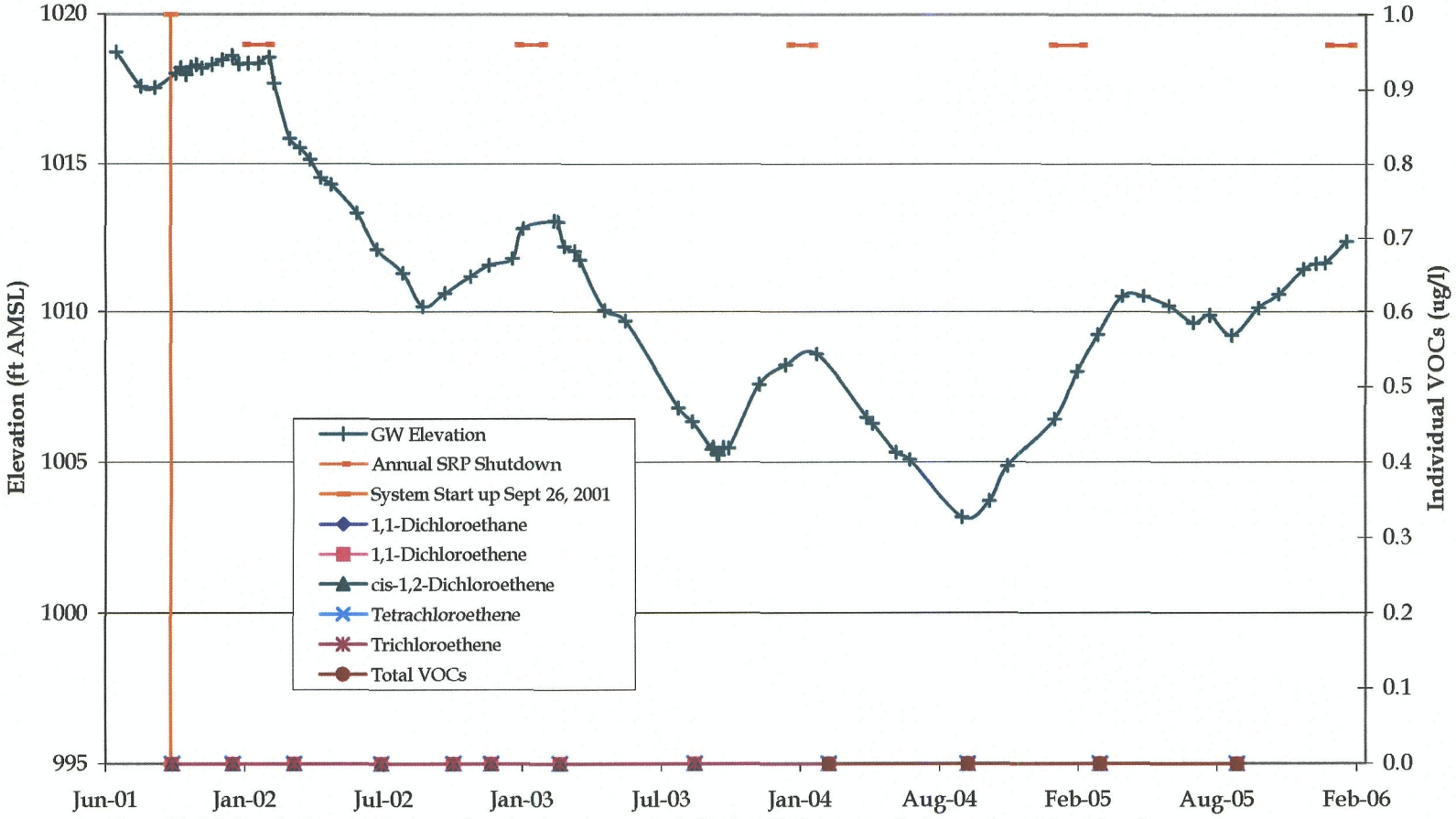


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW22-D

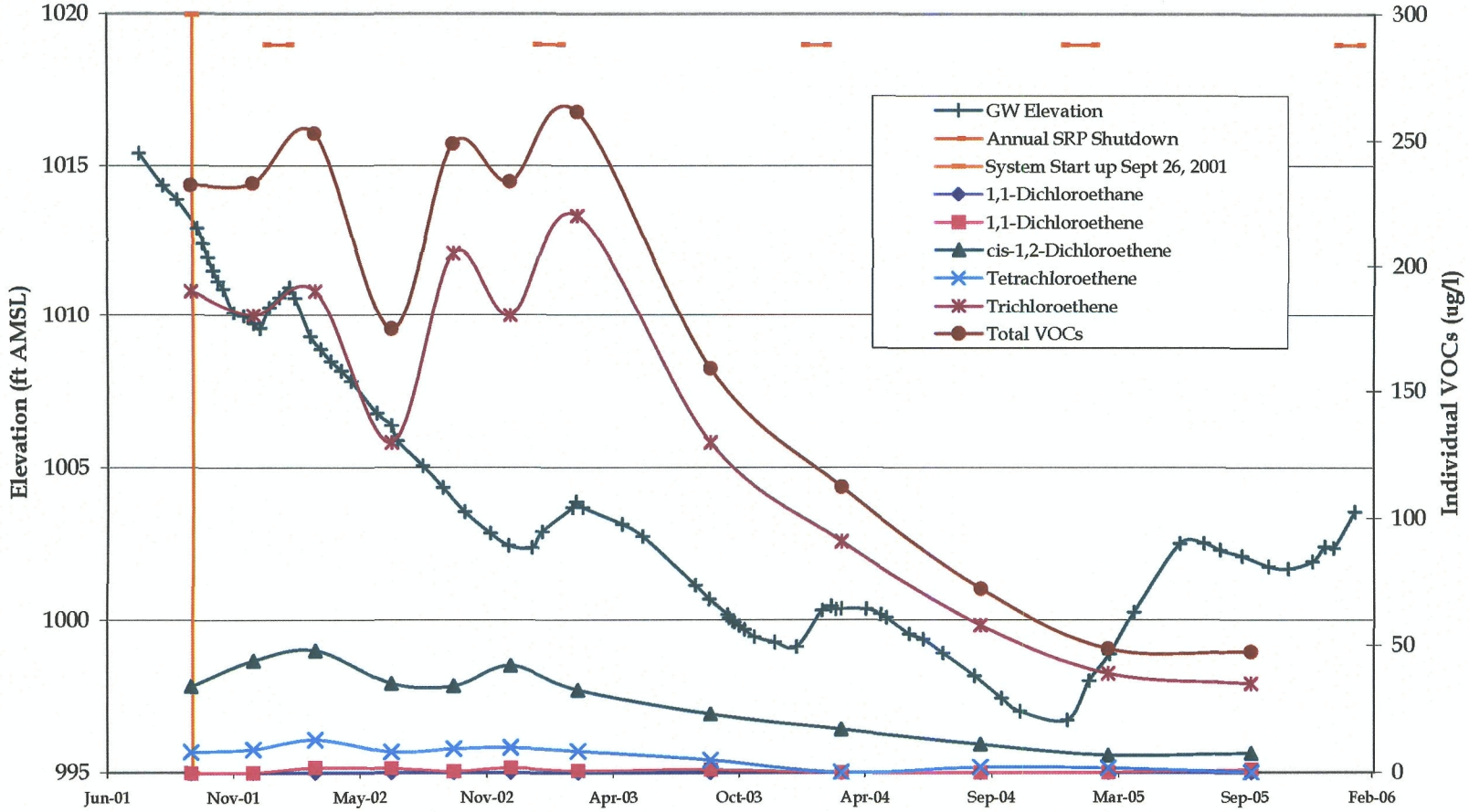


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW-22S

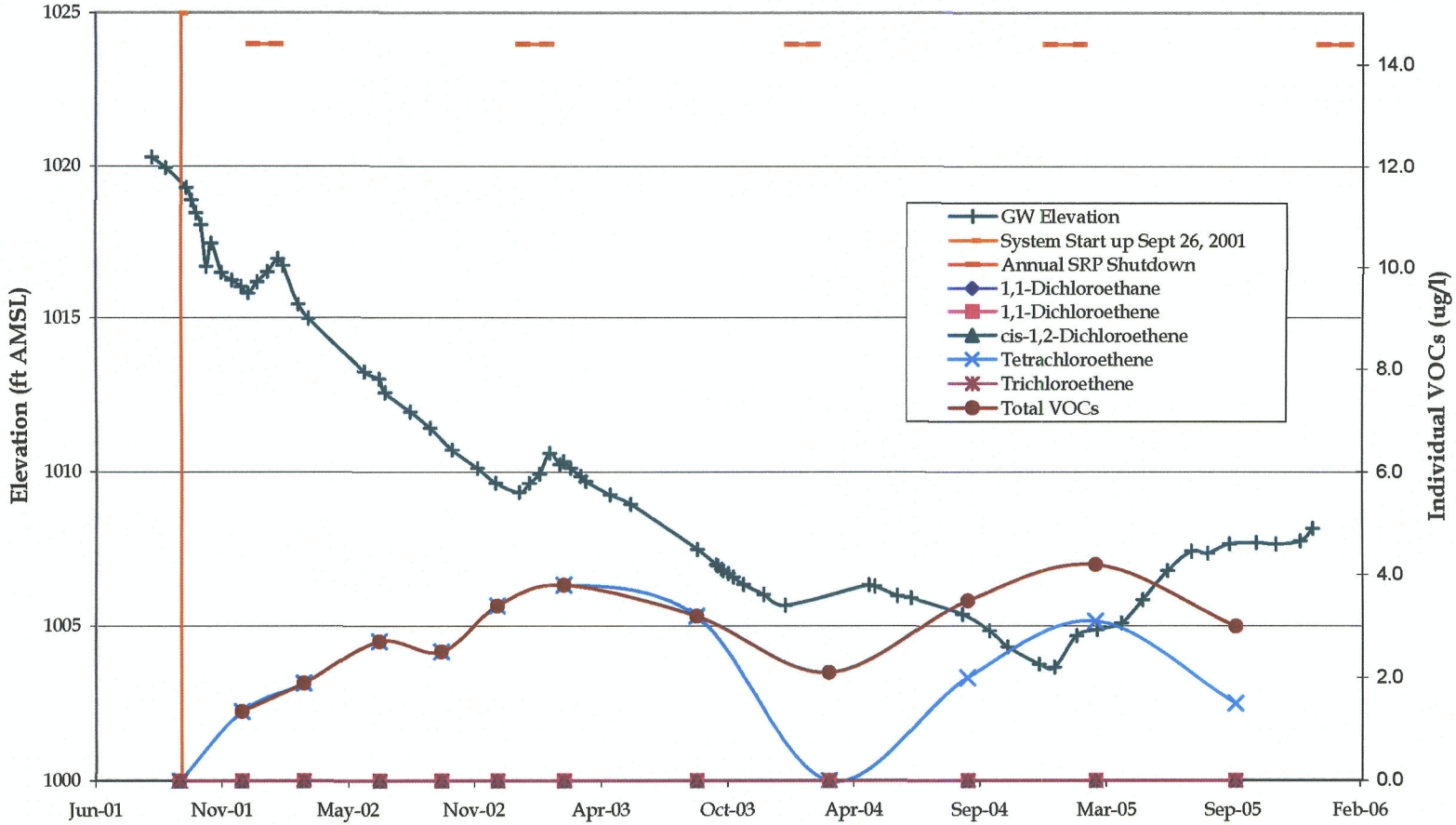


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

EW23

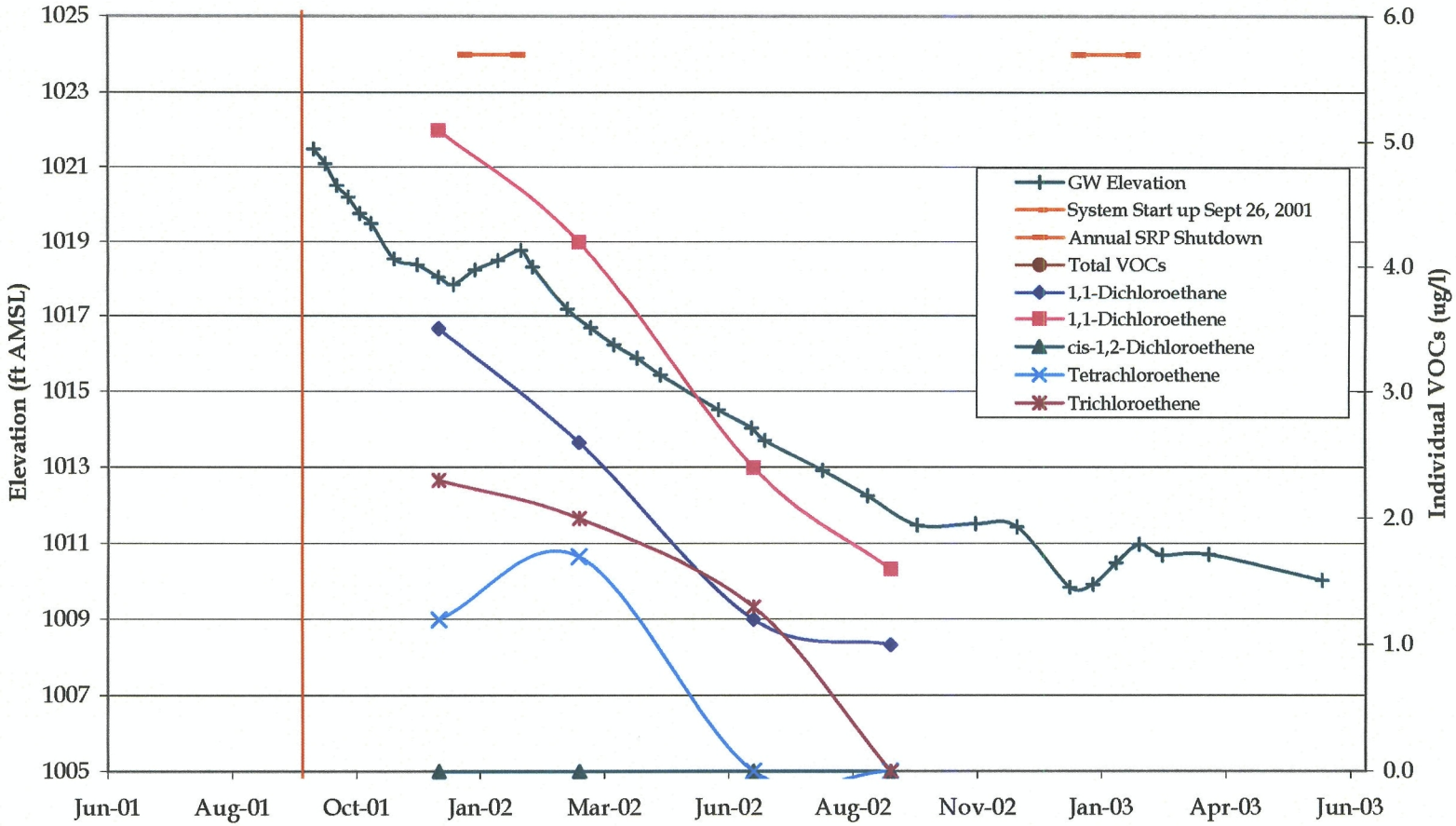


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

MW01 HERTZ

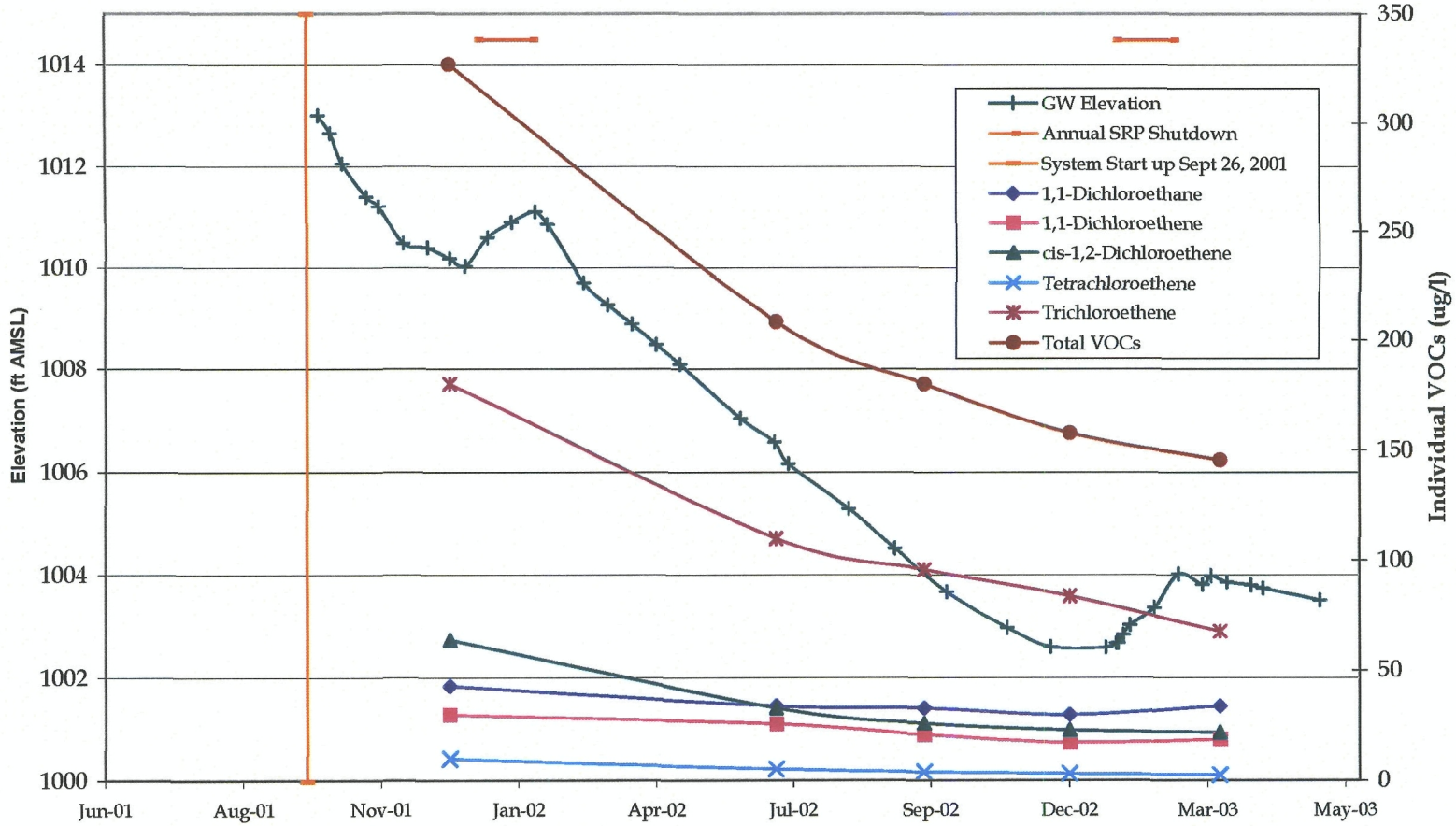


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

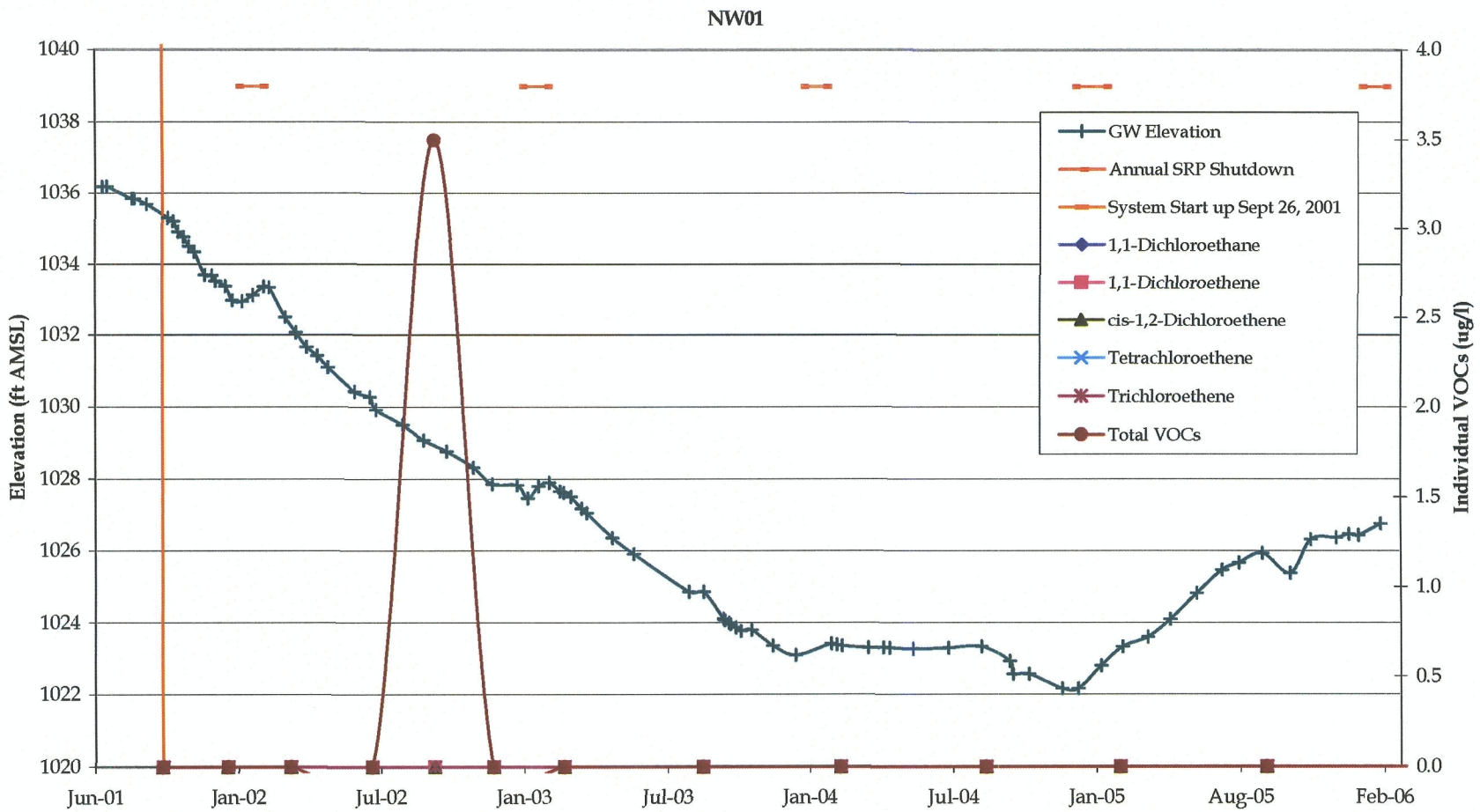
MW05 SHURGIN



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

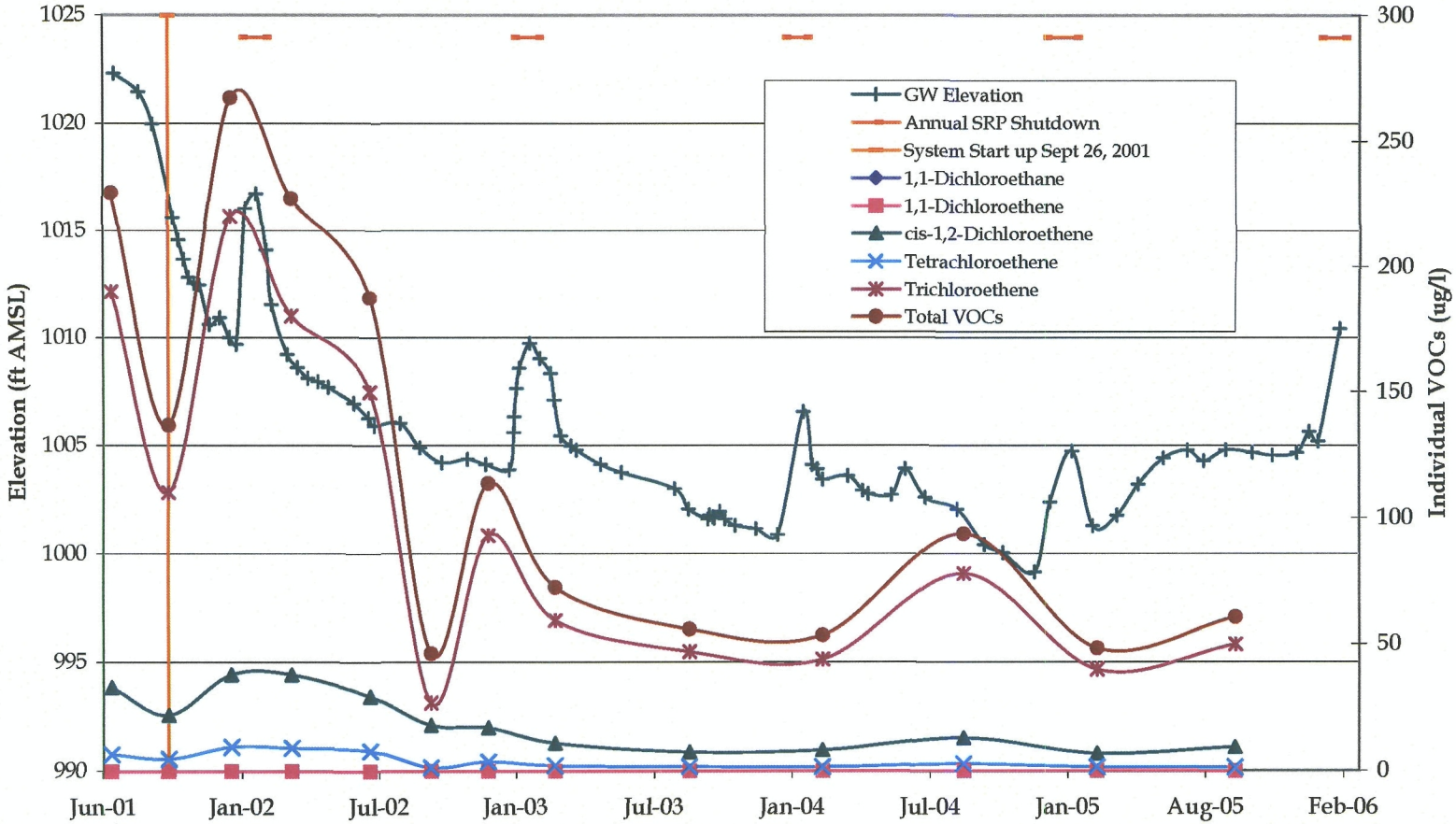


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW02

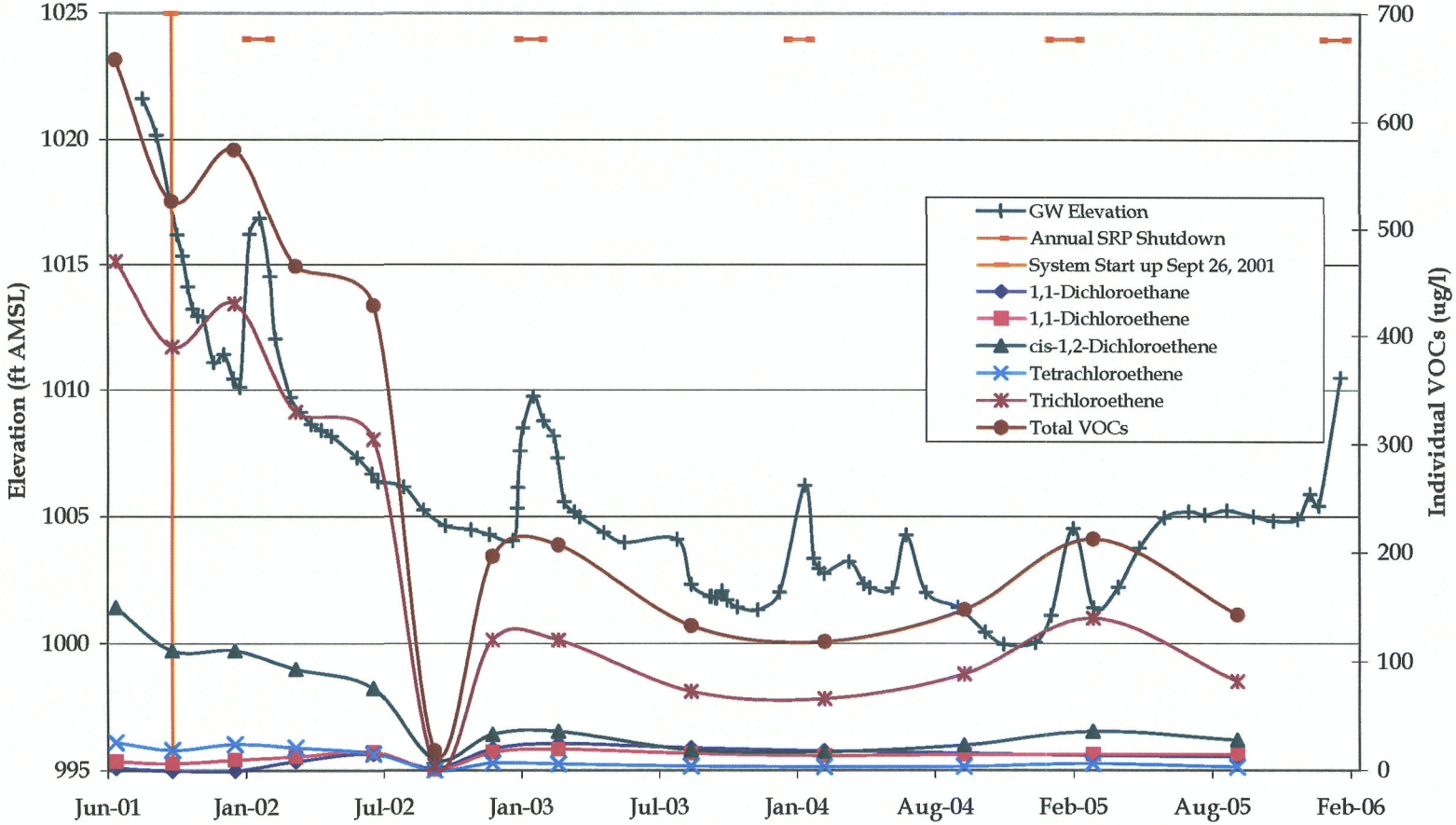


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW03

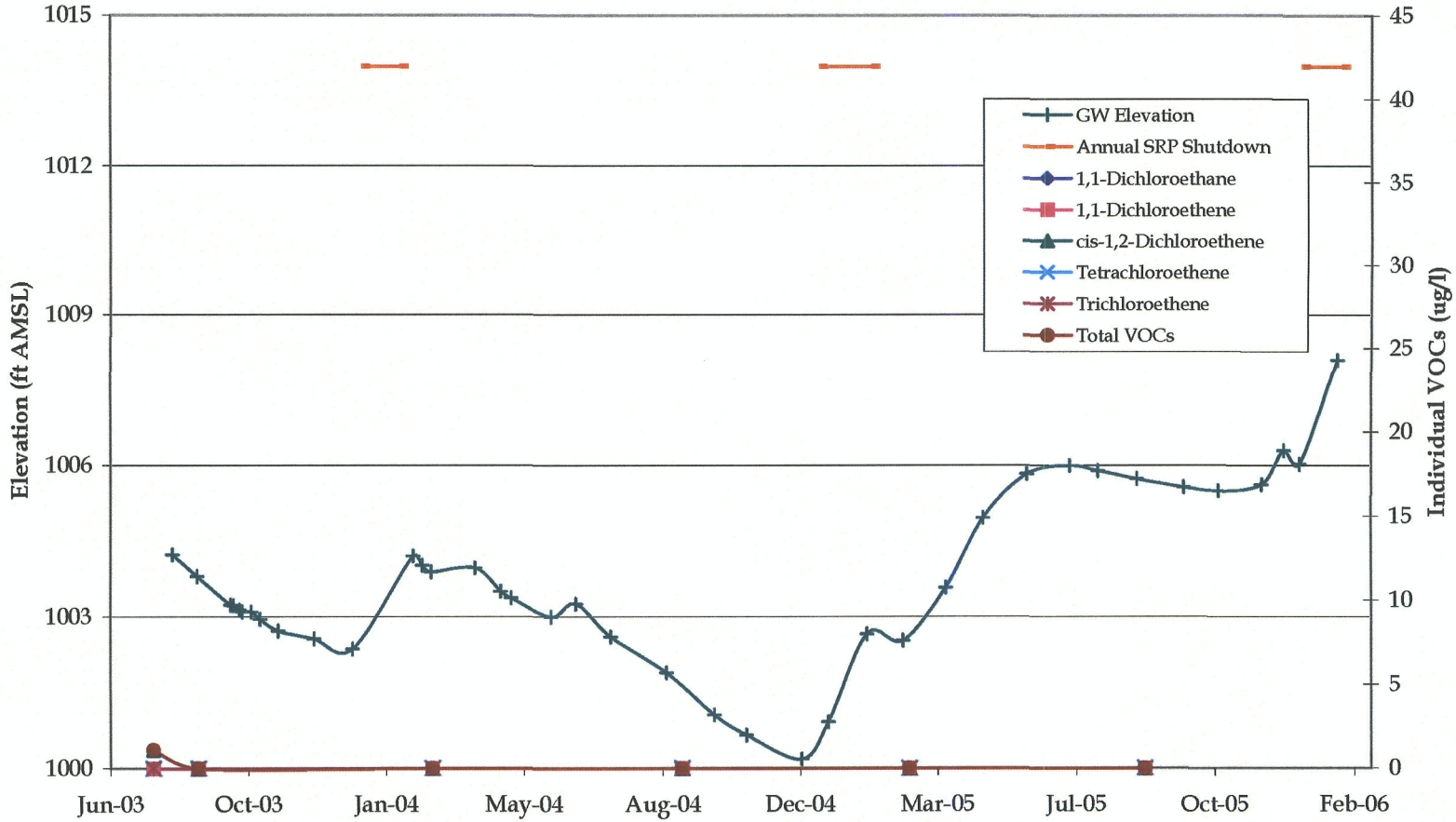


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW04-D

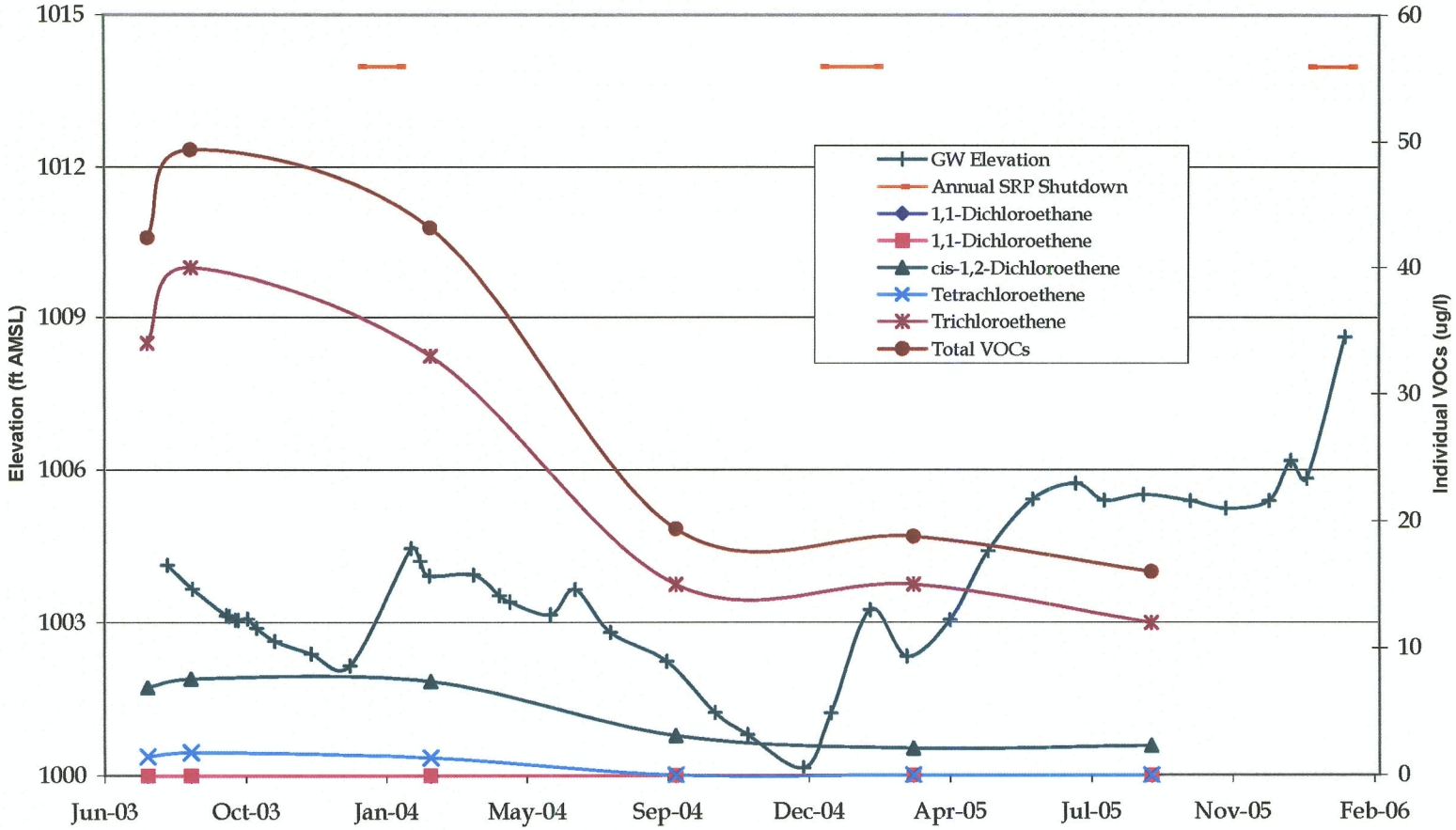


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW04-S

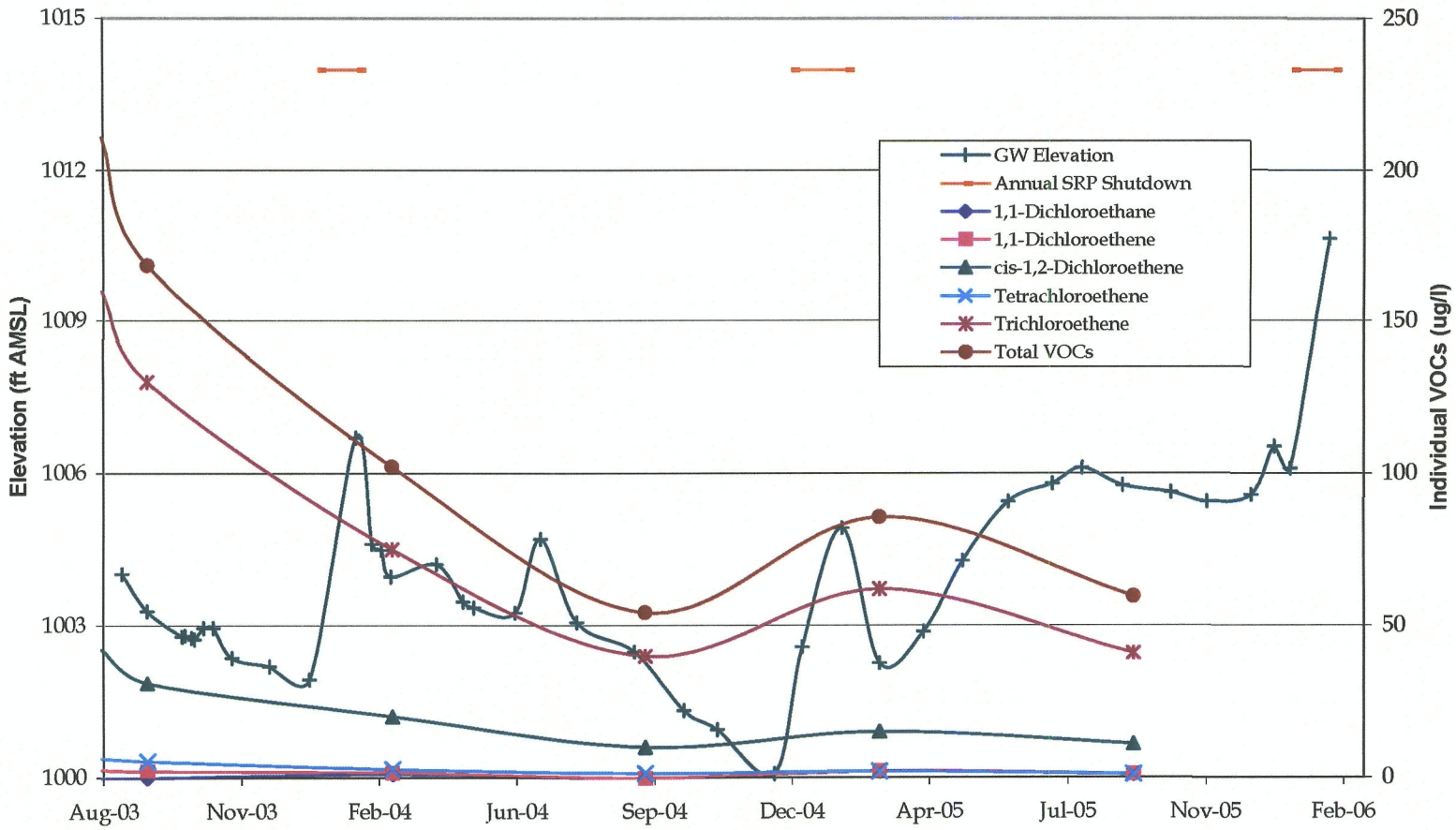


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW05-S

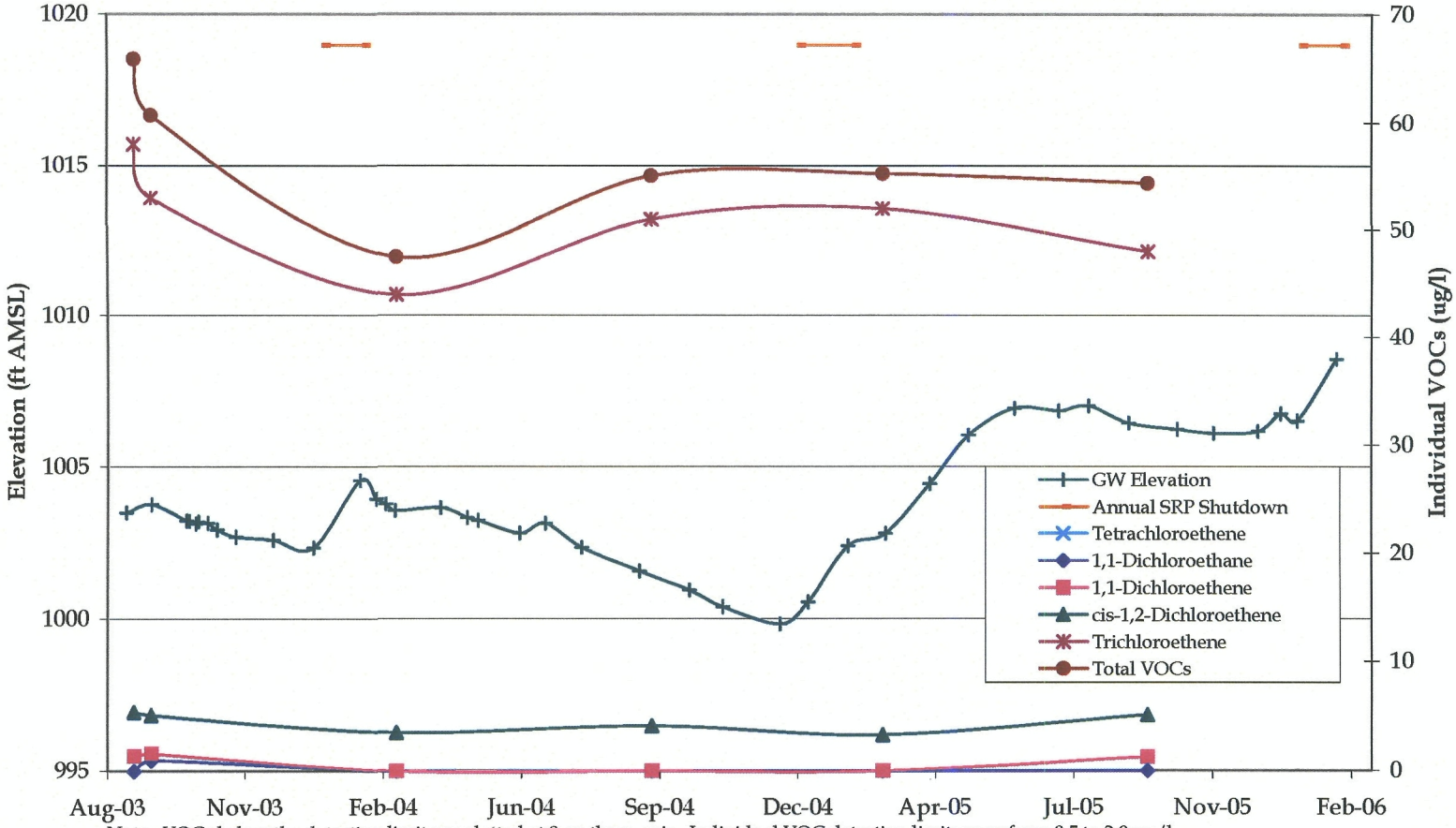


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

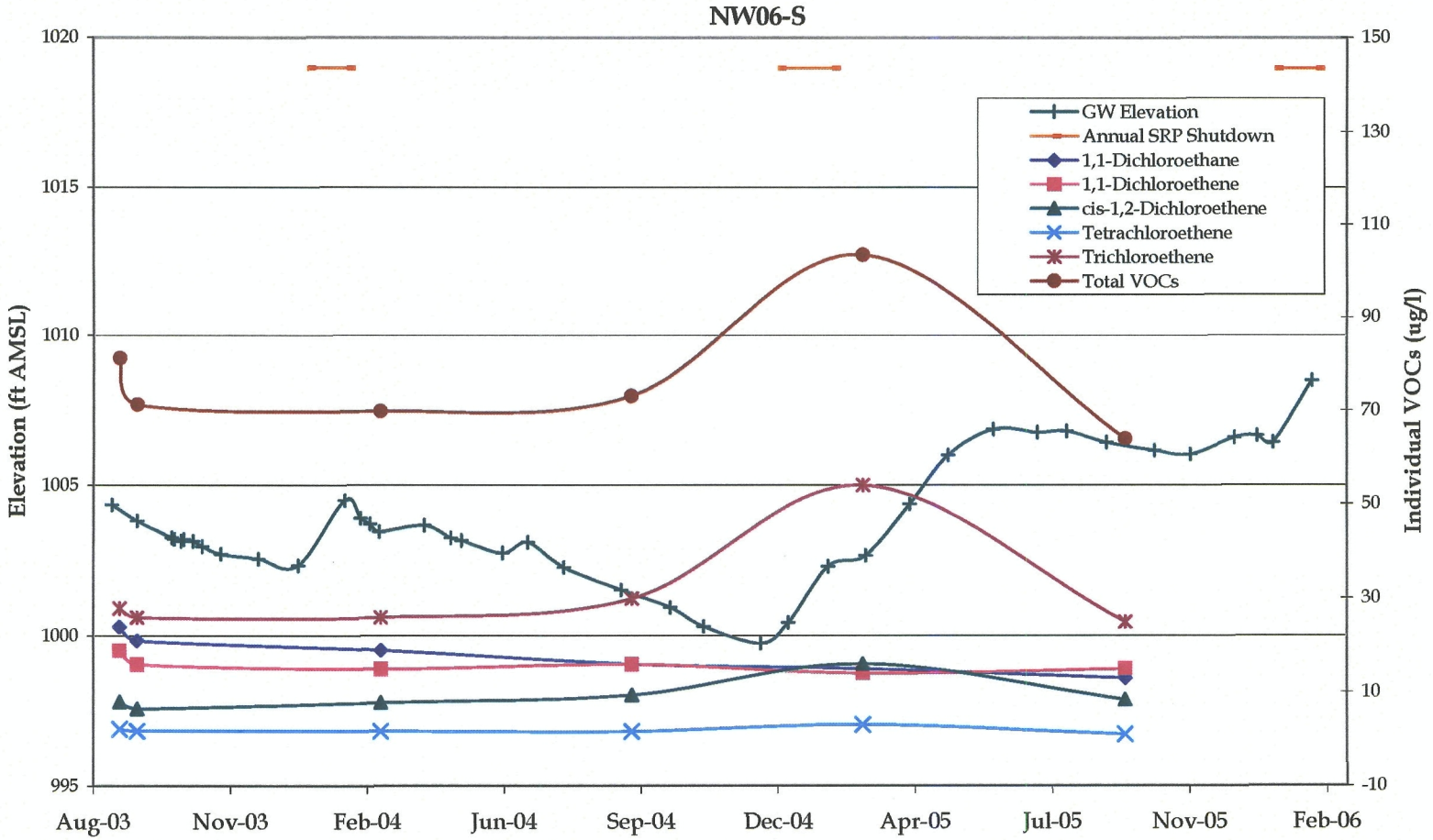
NW06-D



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

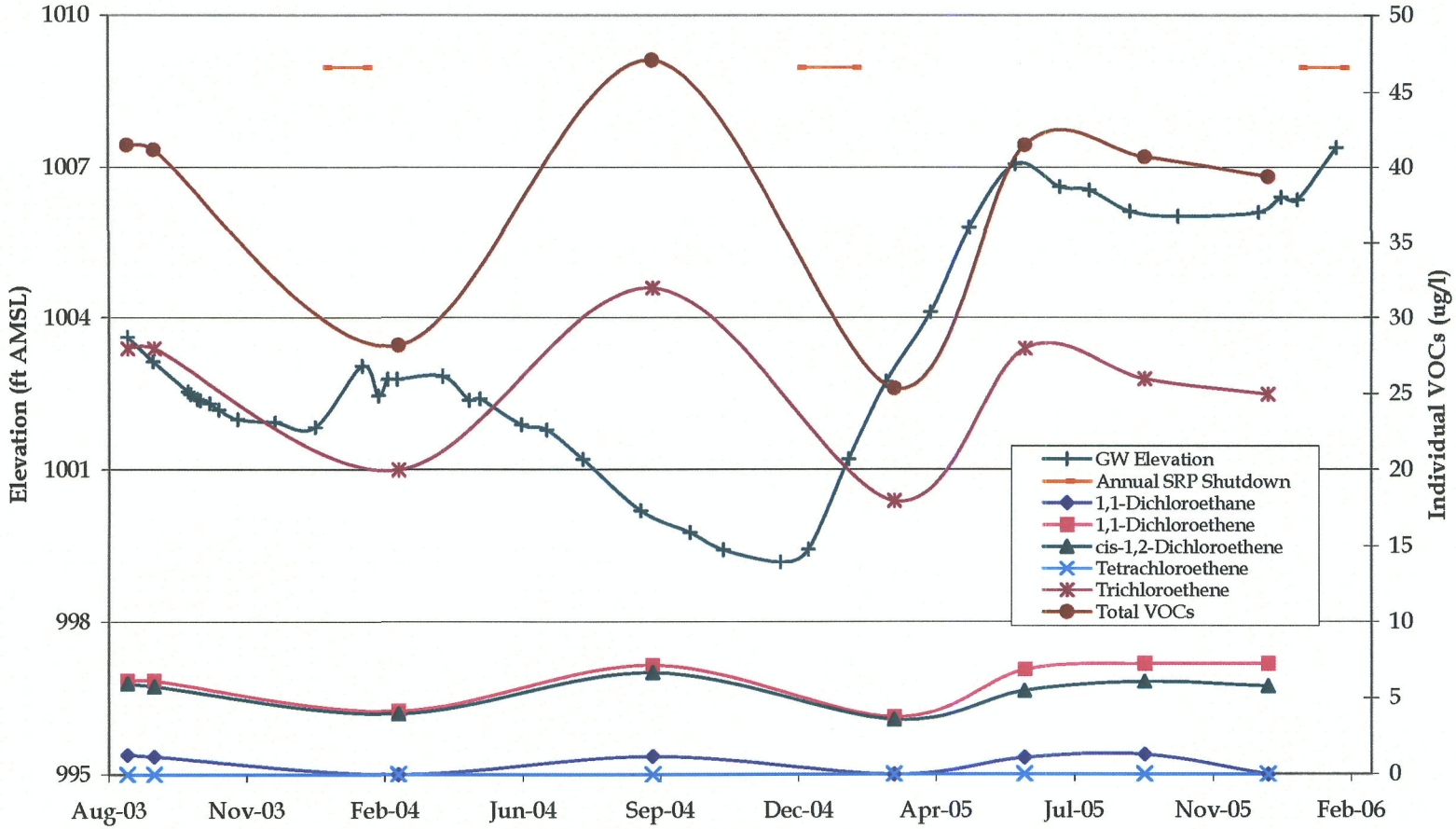


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW07-D

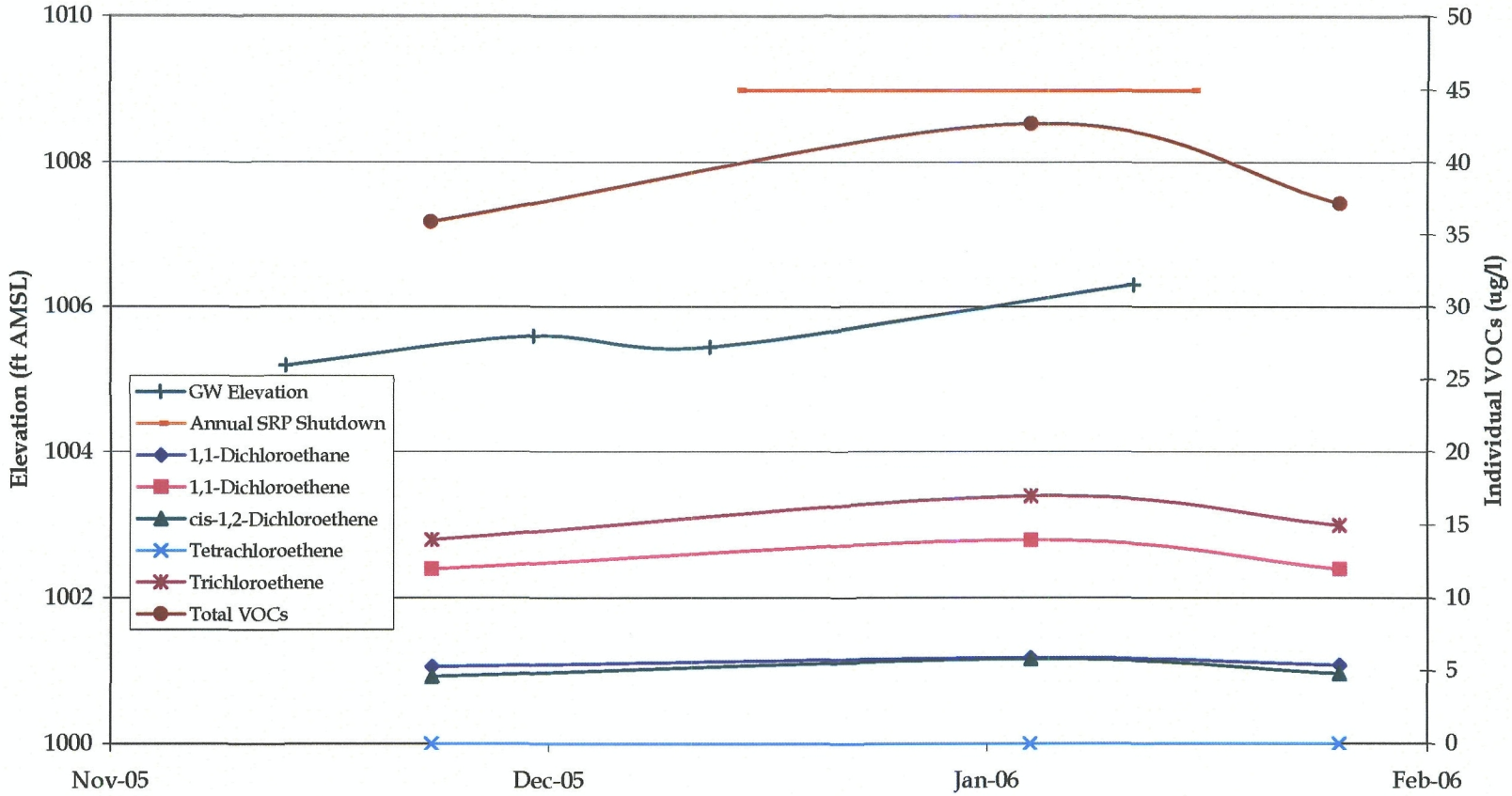


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW07-M

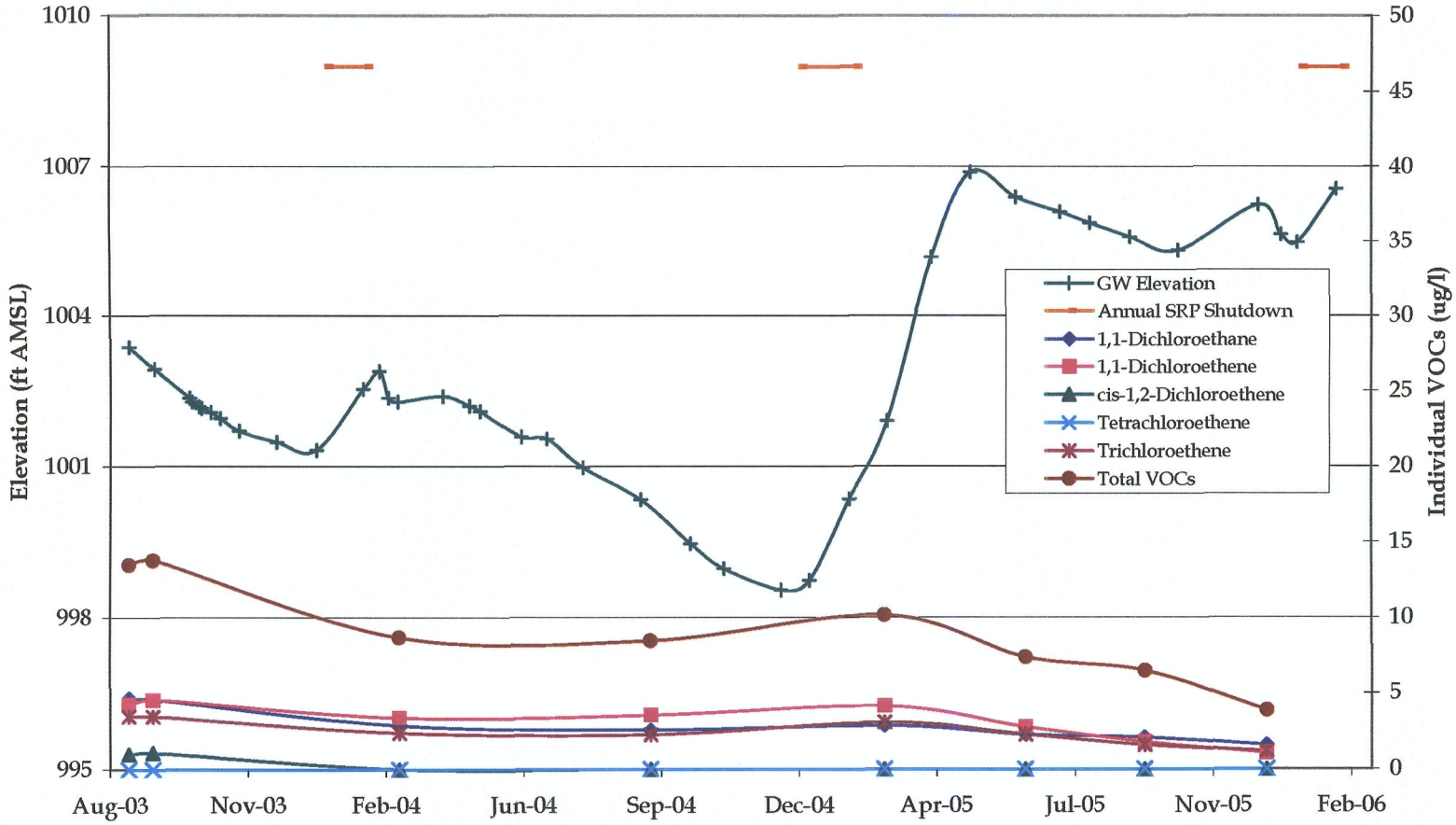


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW07-S

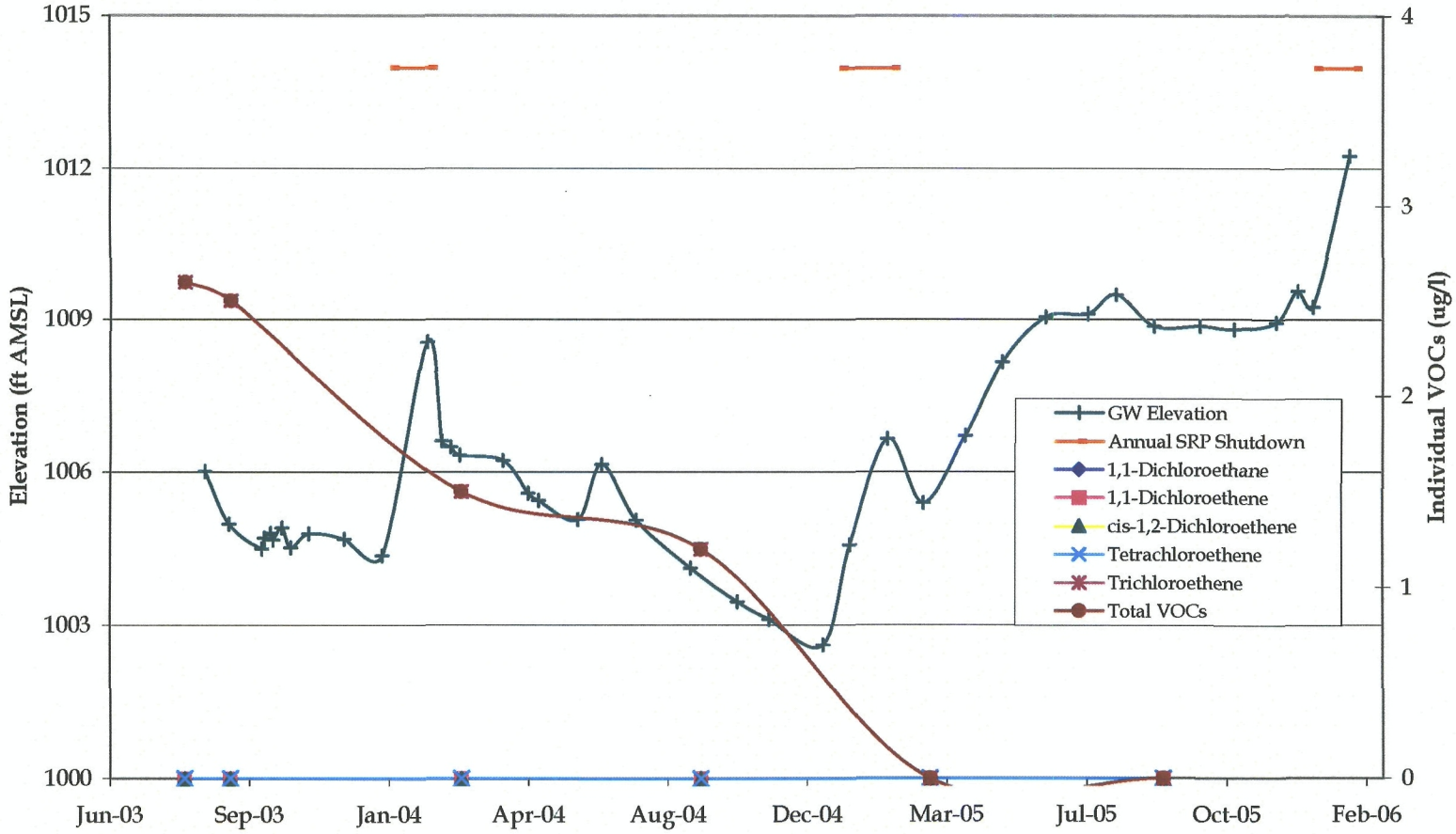


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW08-D

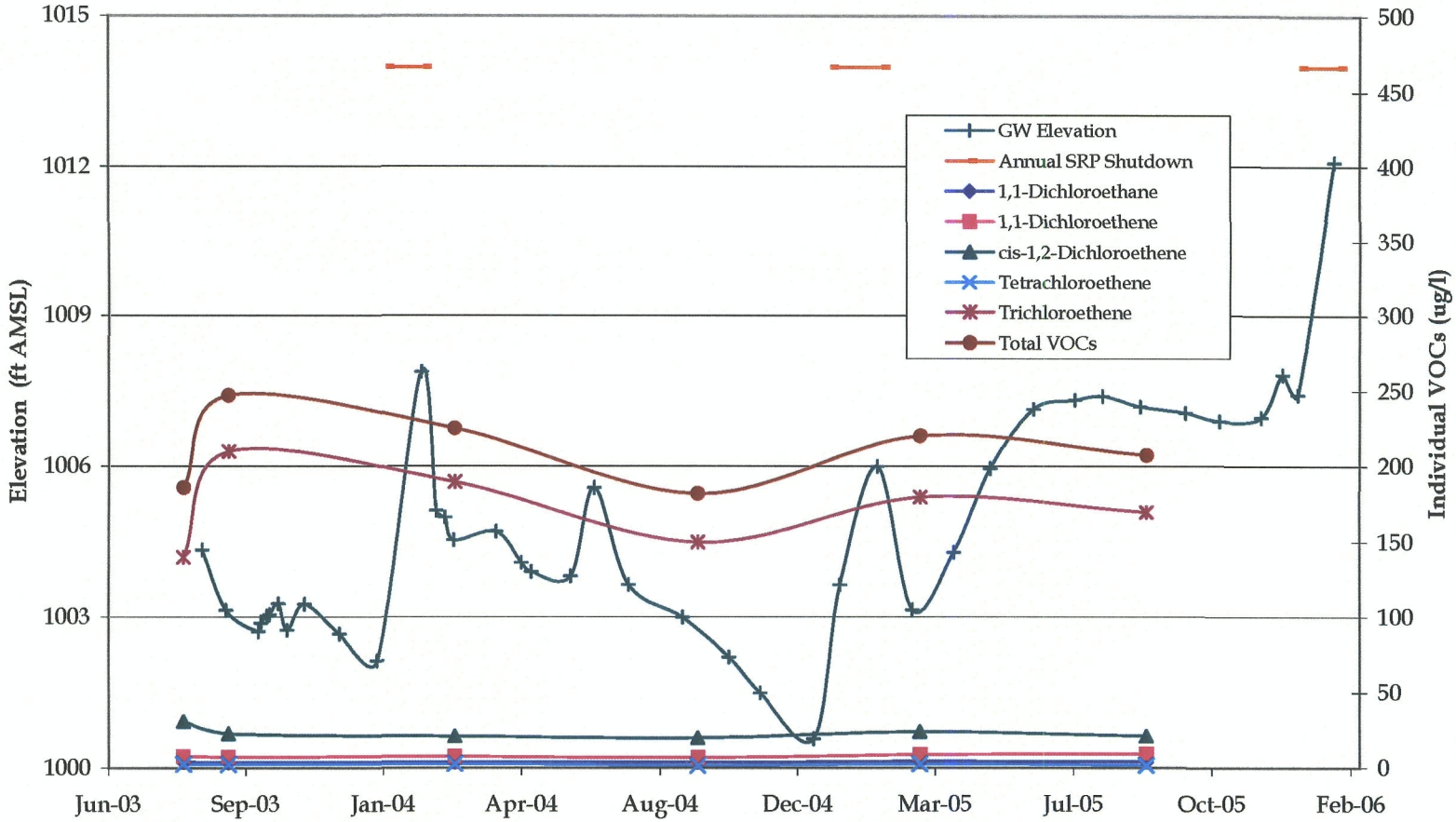


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW08-M

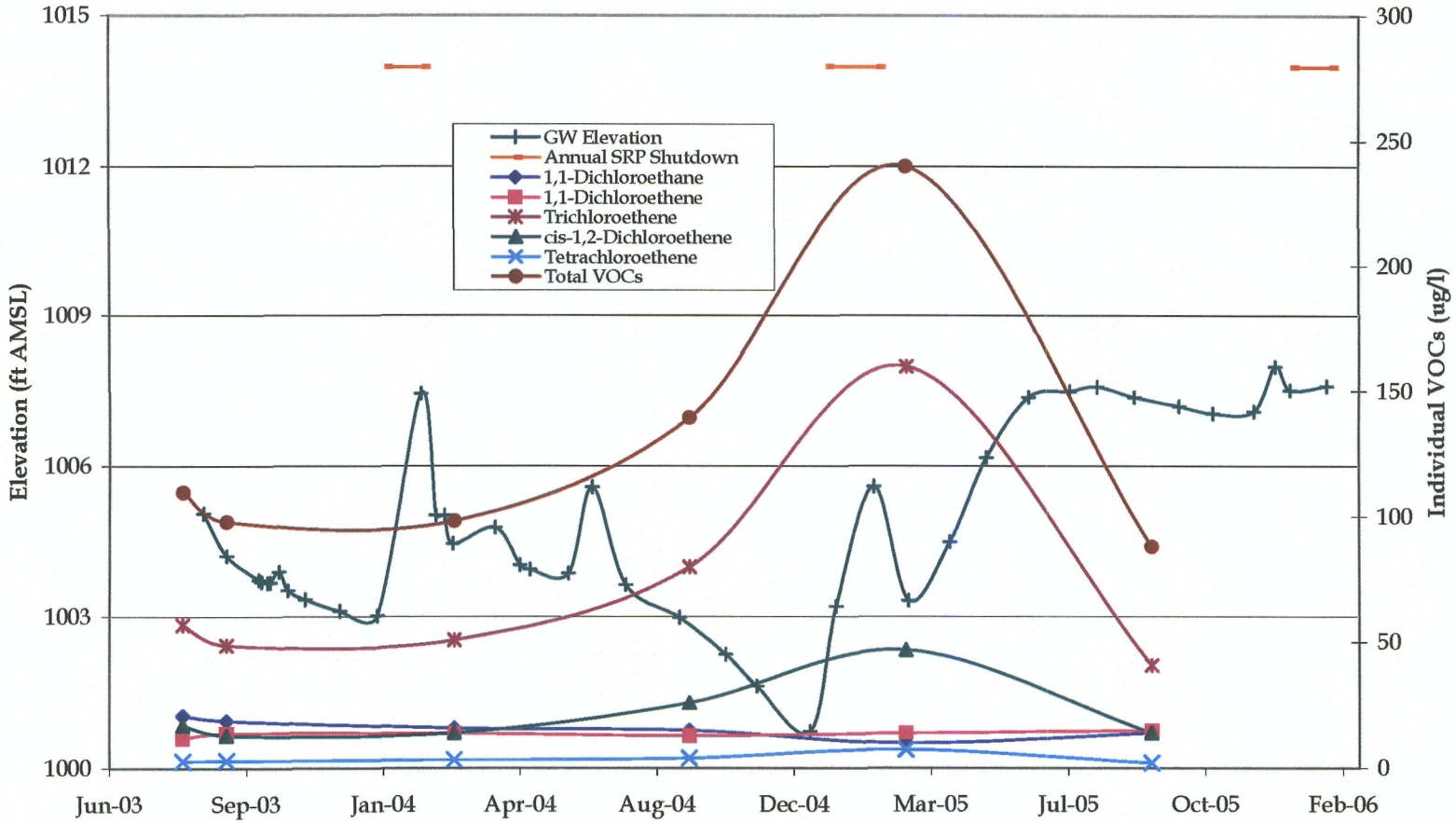


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW08-S

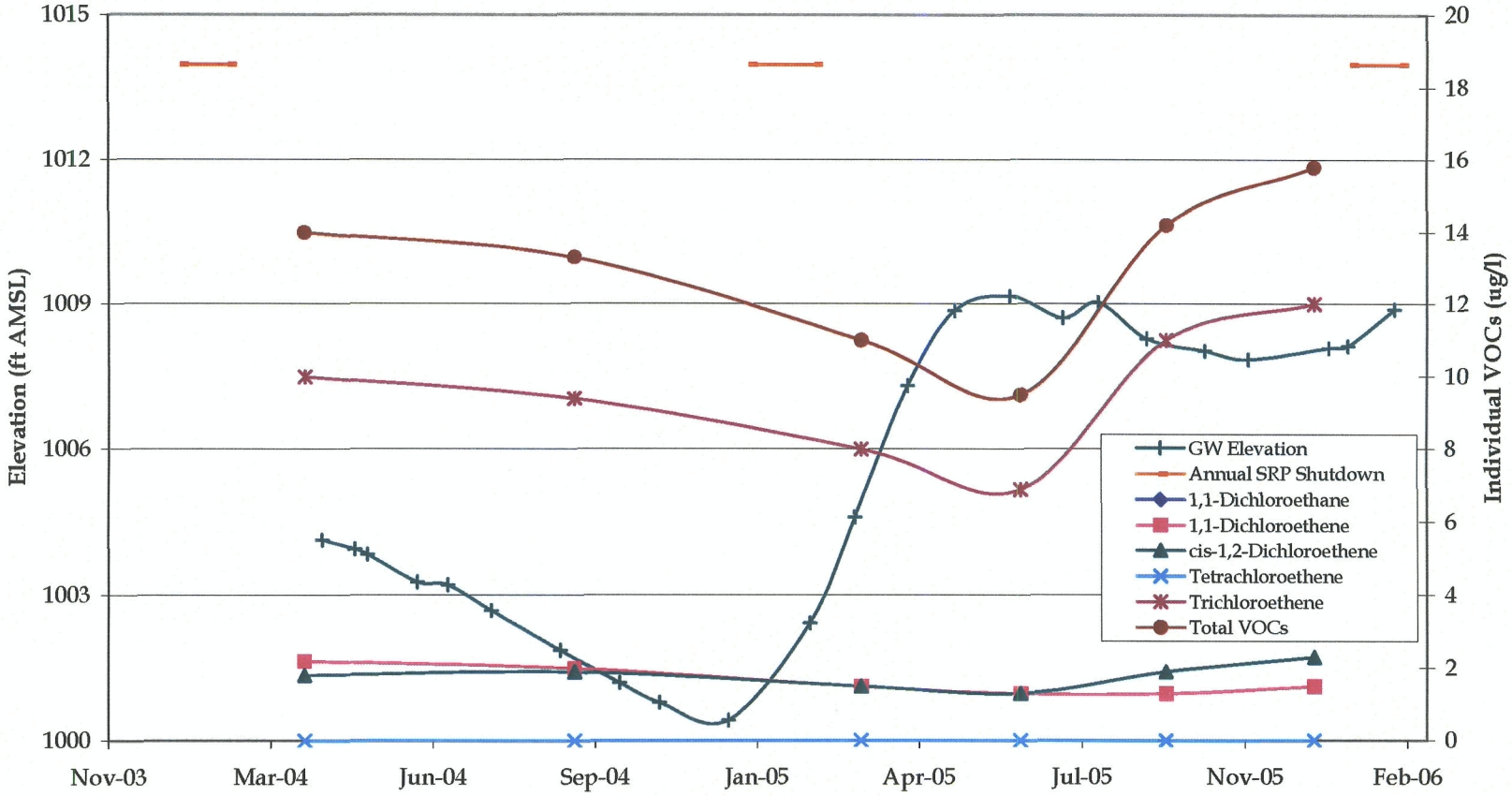


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW09-D

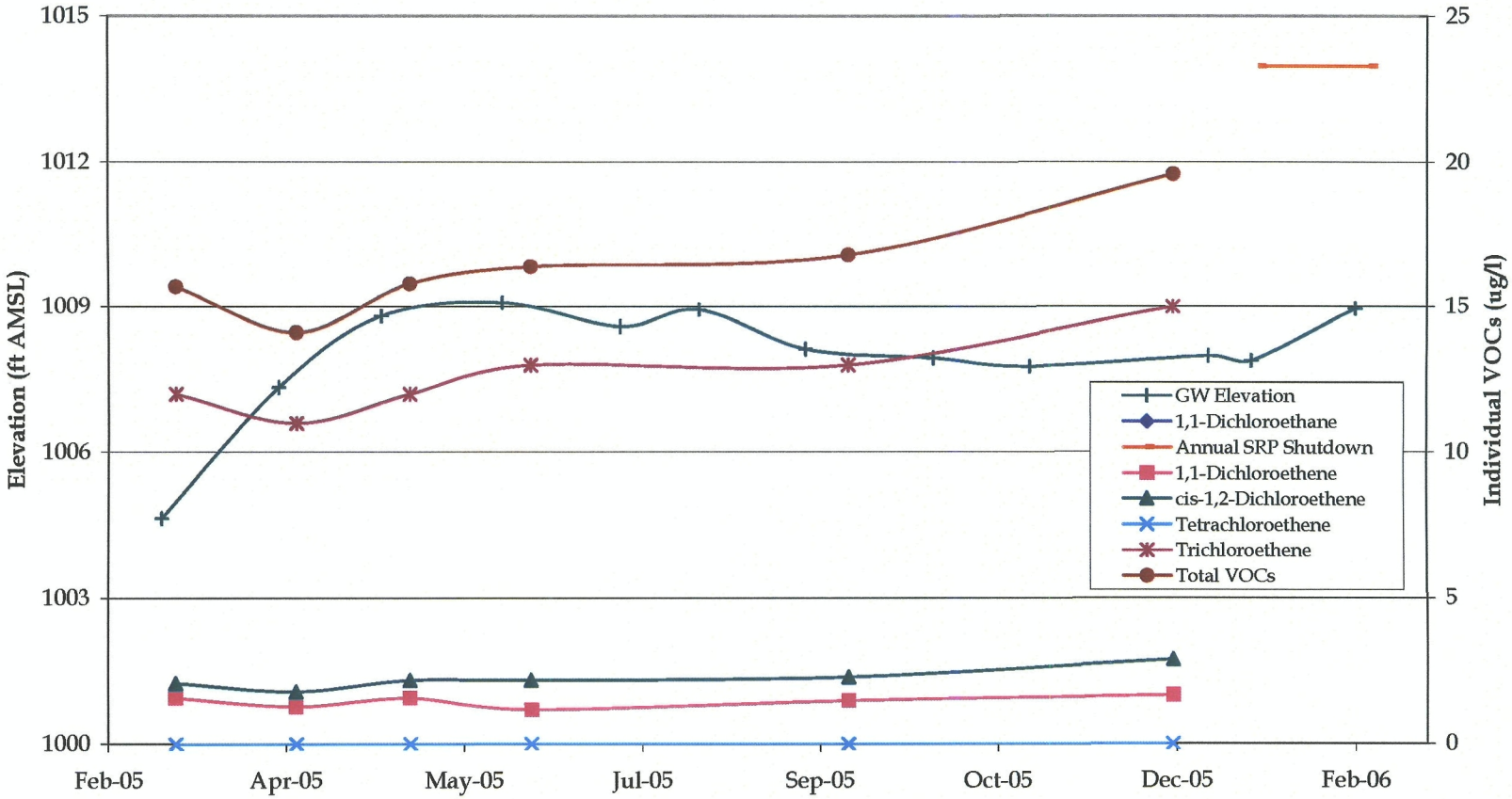


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW09-D2

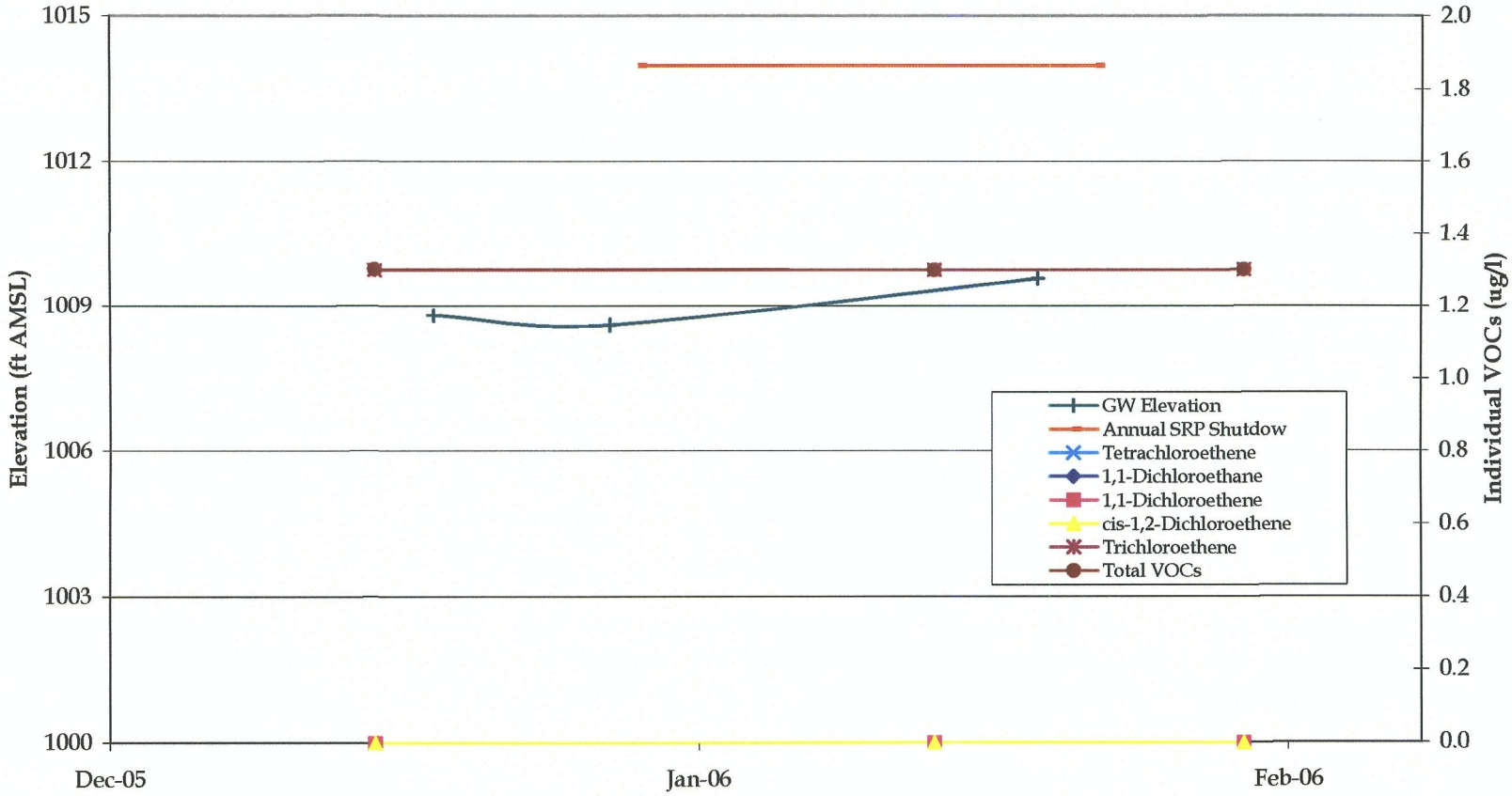


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW09-M

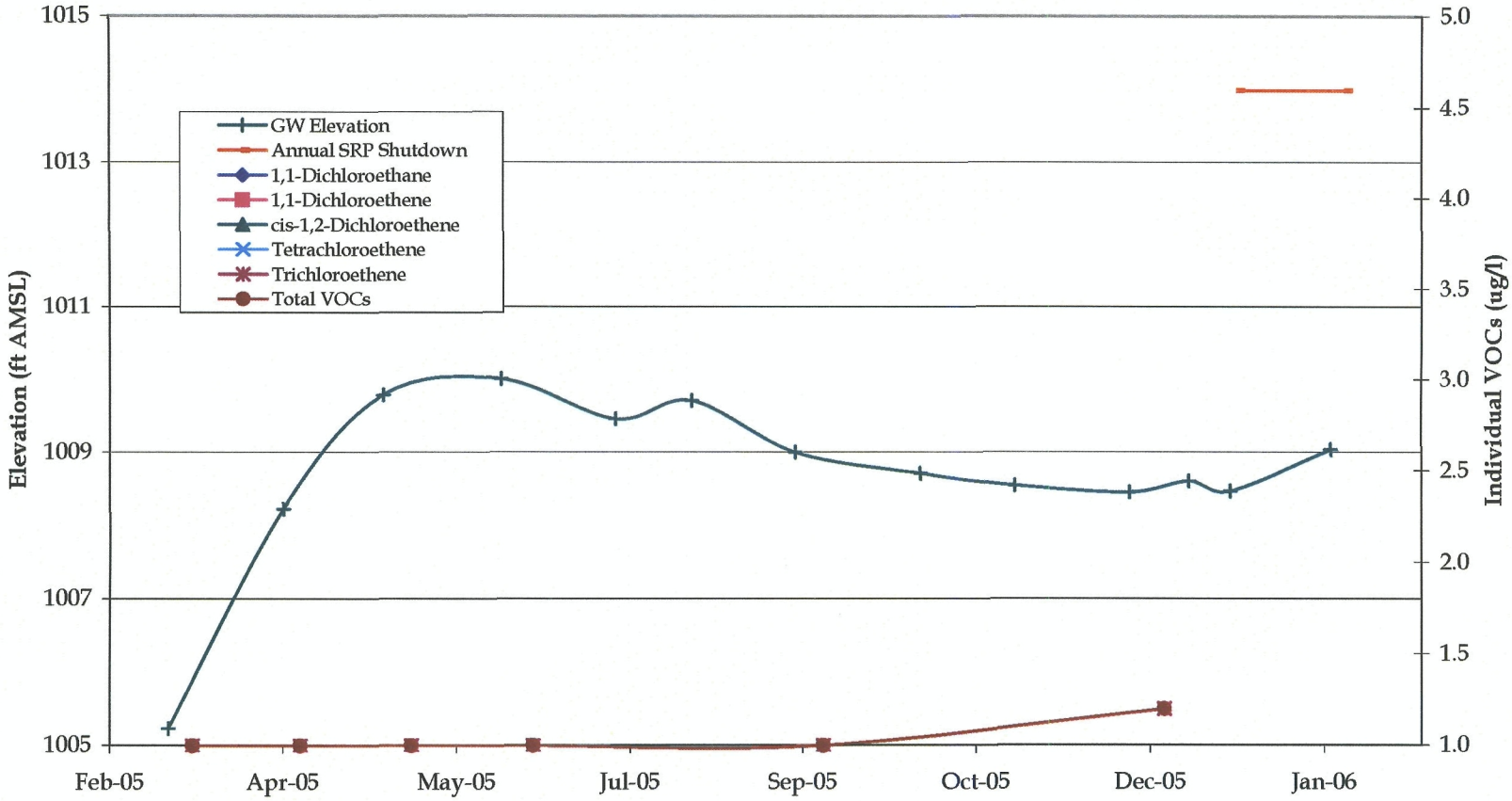


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW10-D

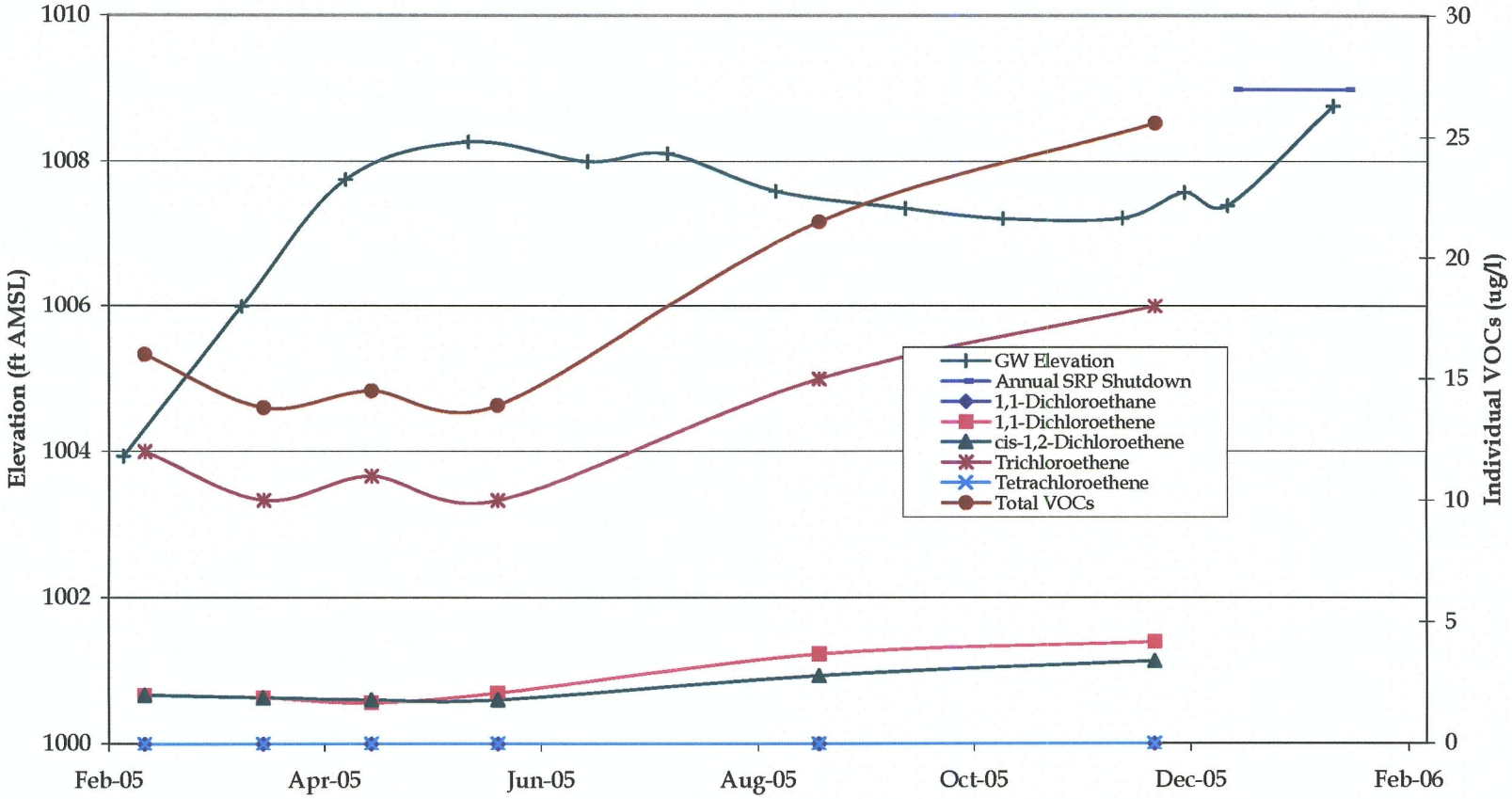


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW11-D

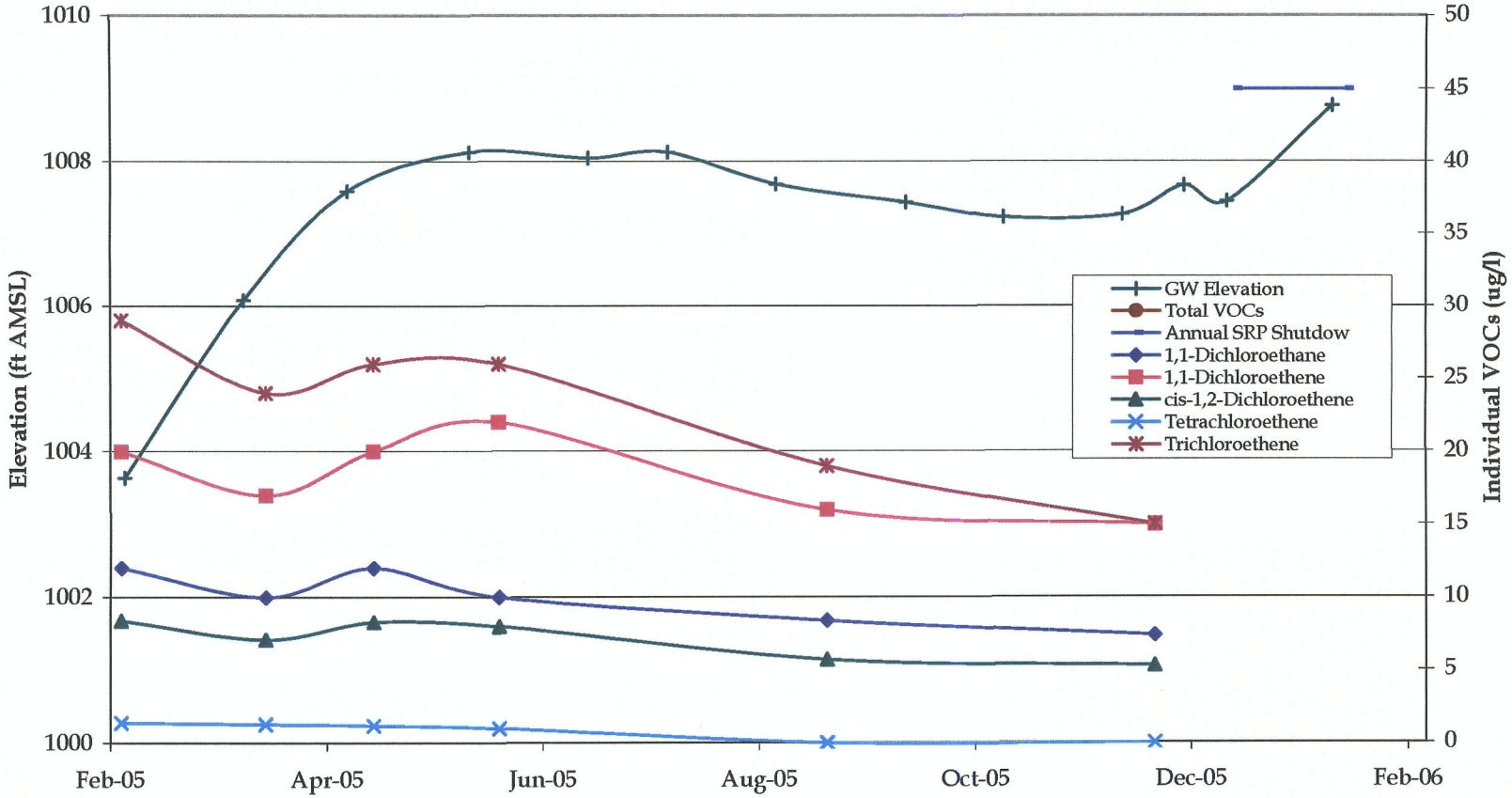


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW11-M

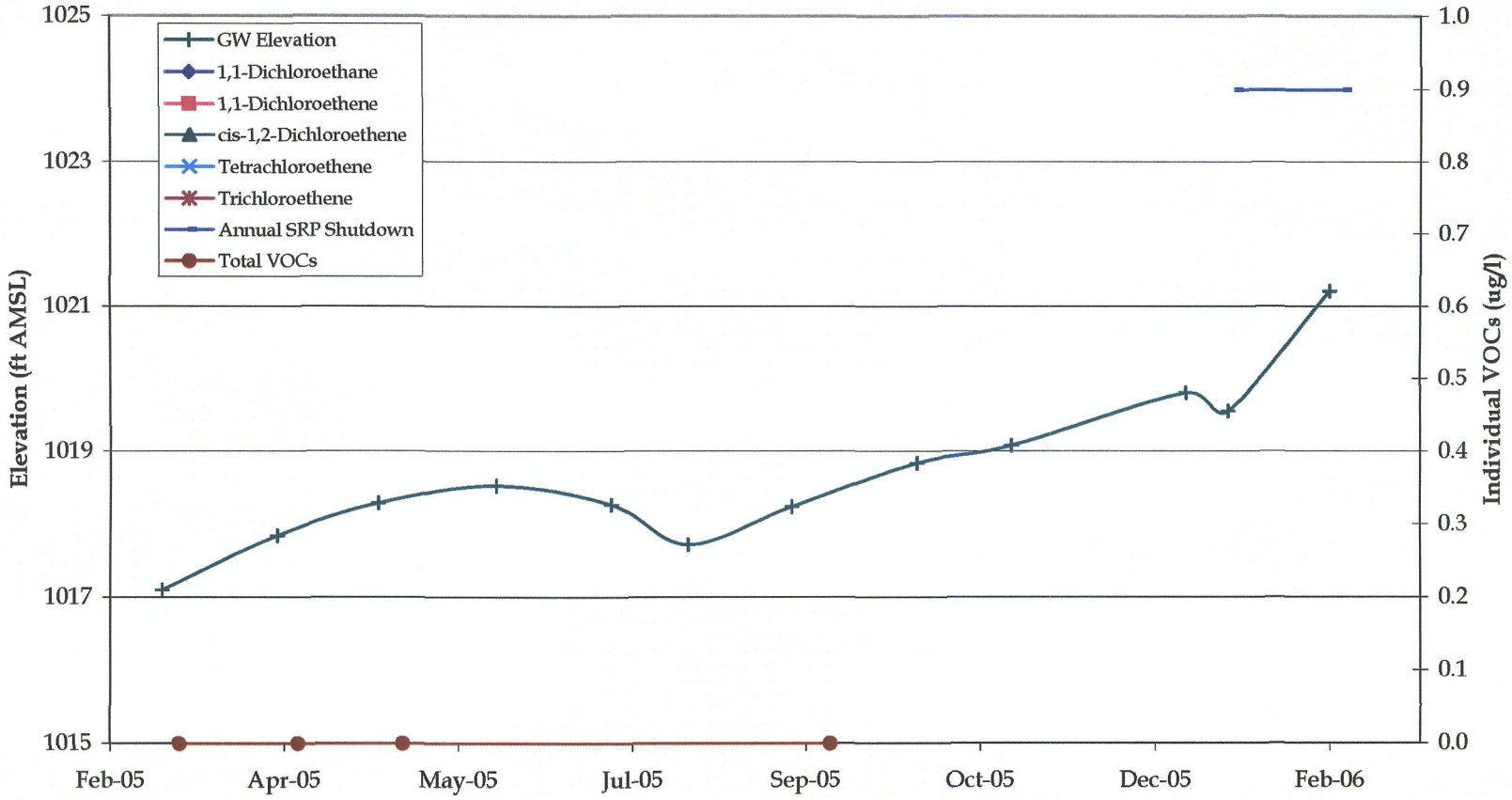


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

NW12-D

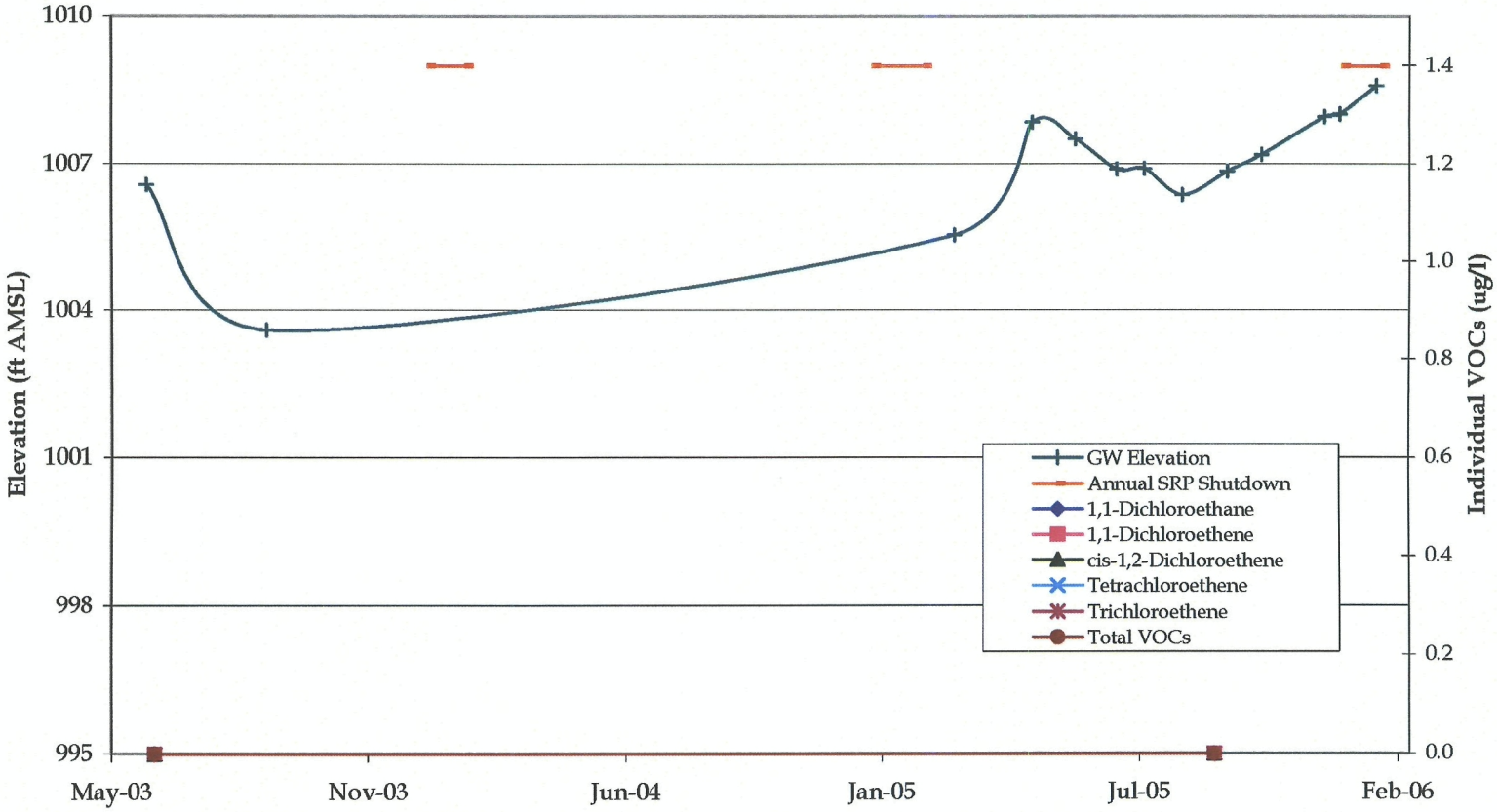


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

OU3-12D

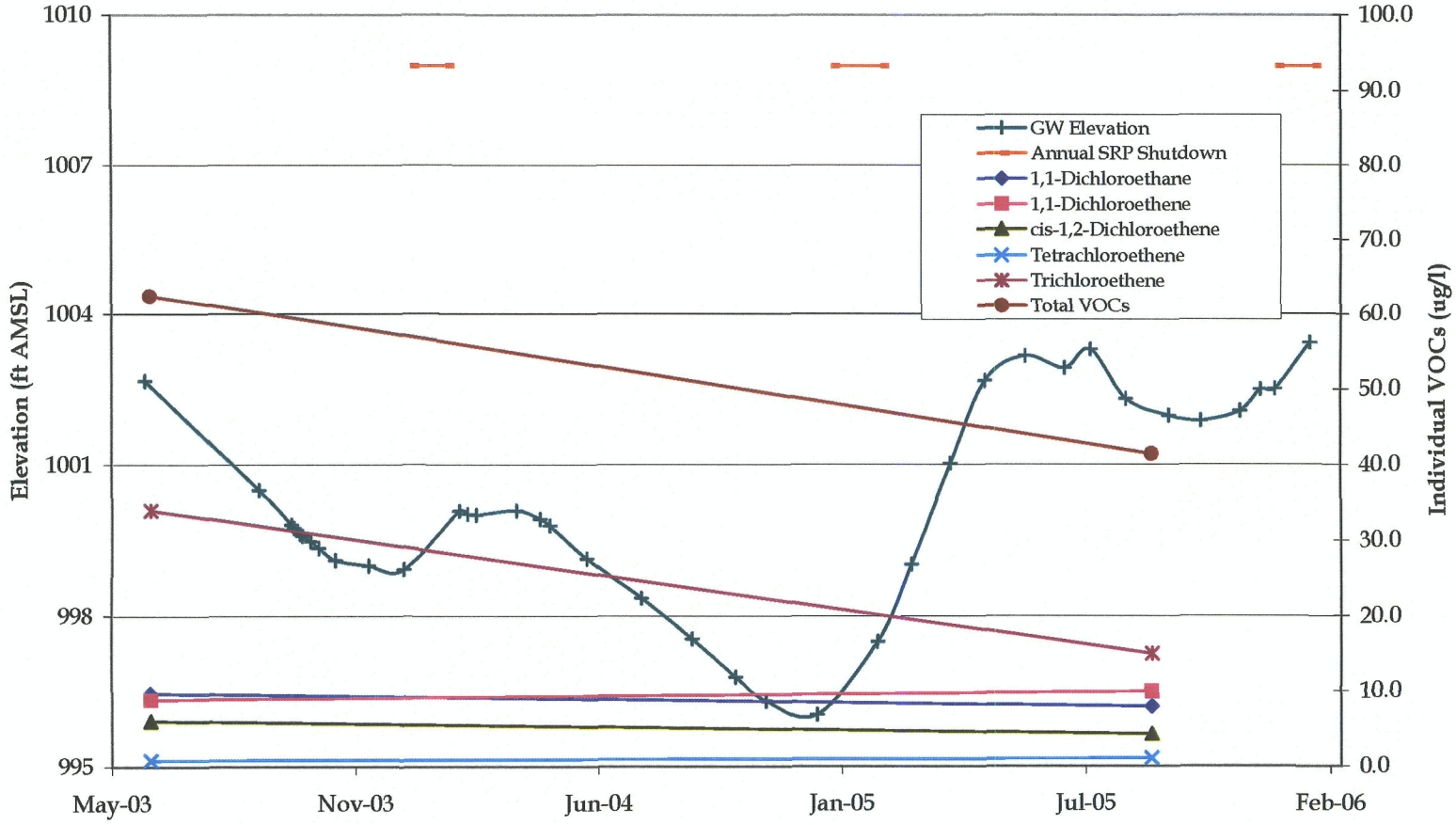


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

OU3-12M

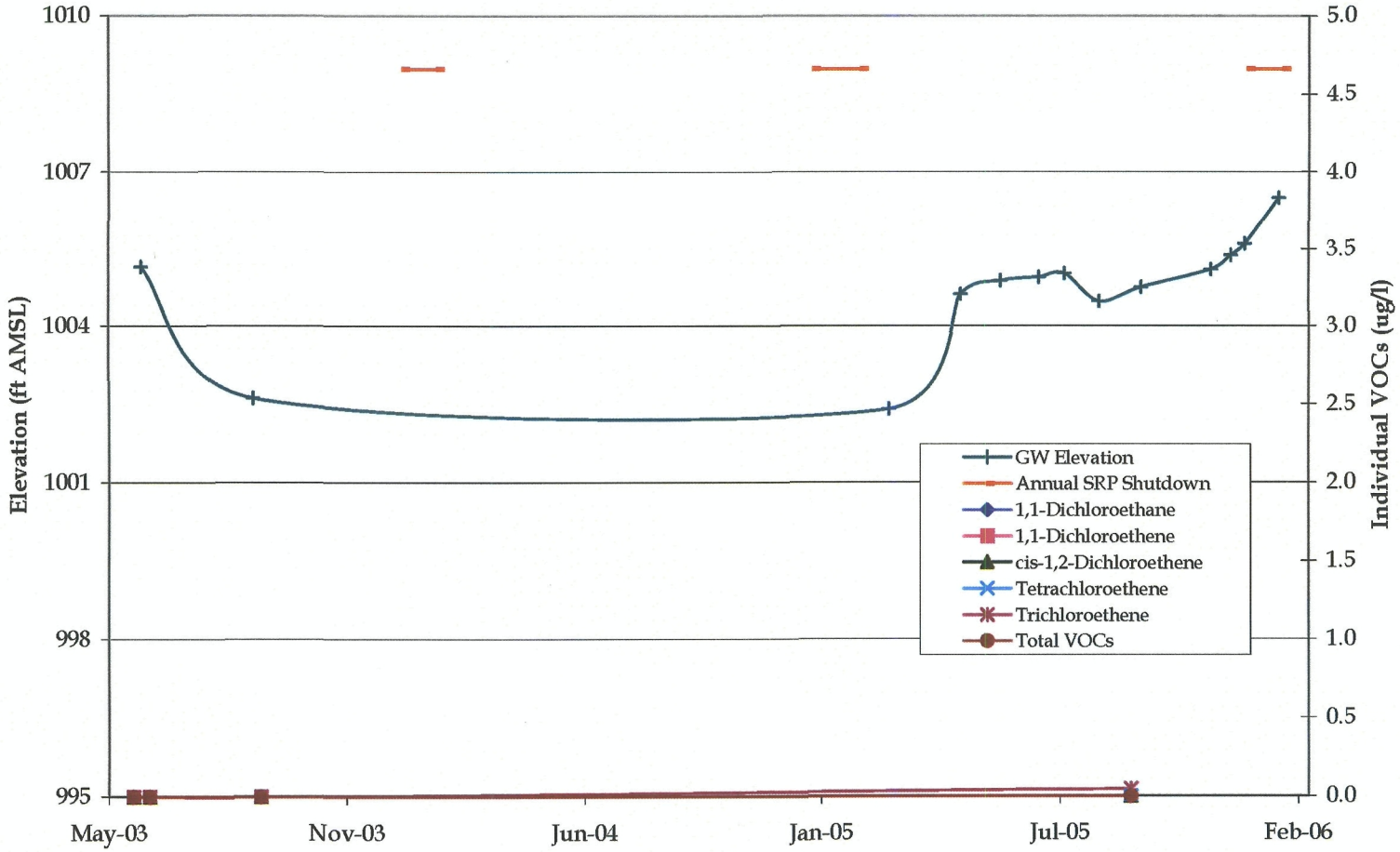


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

OU3-13D

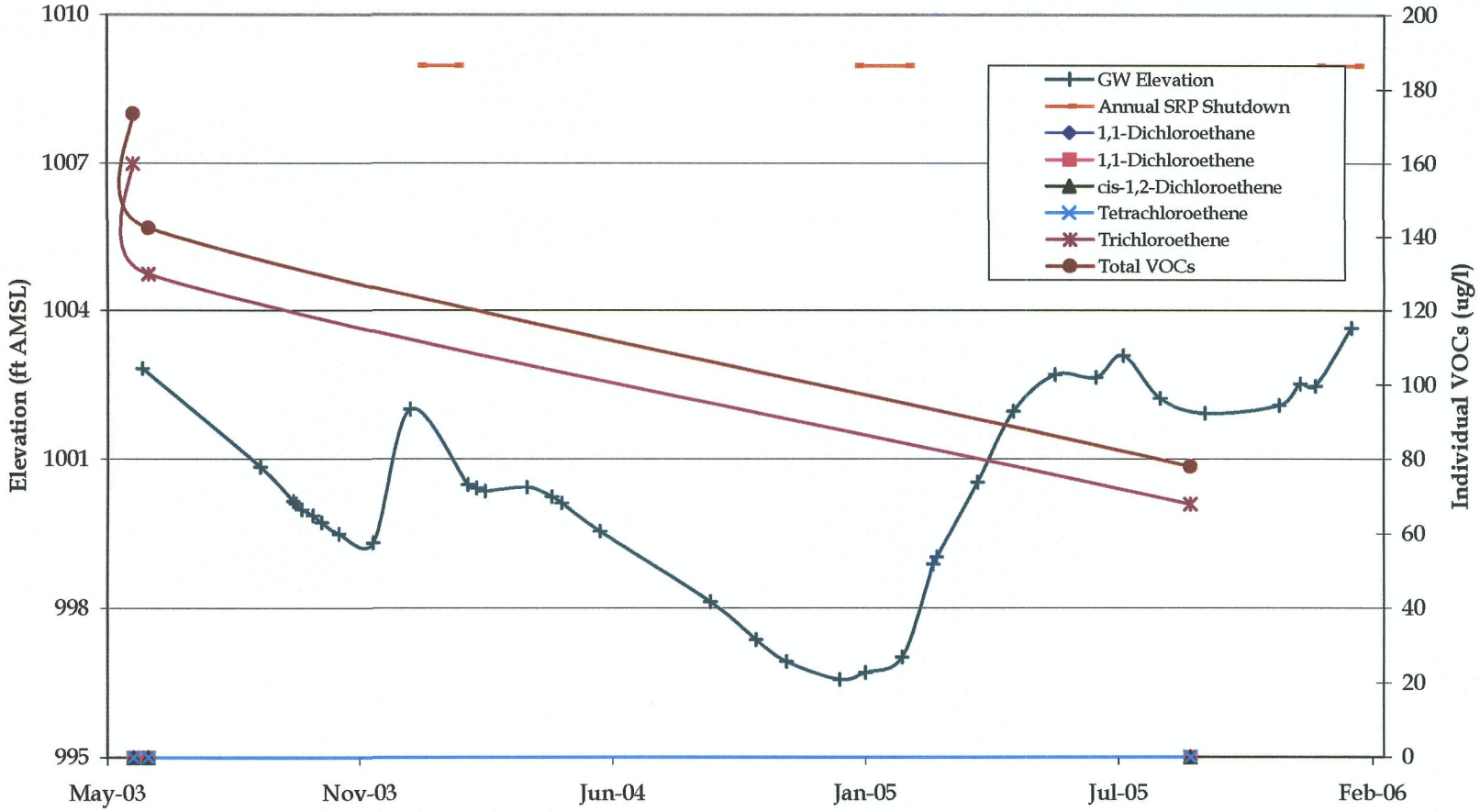


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

OU3-13M

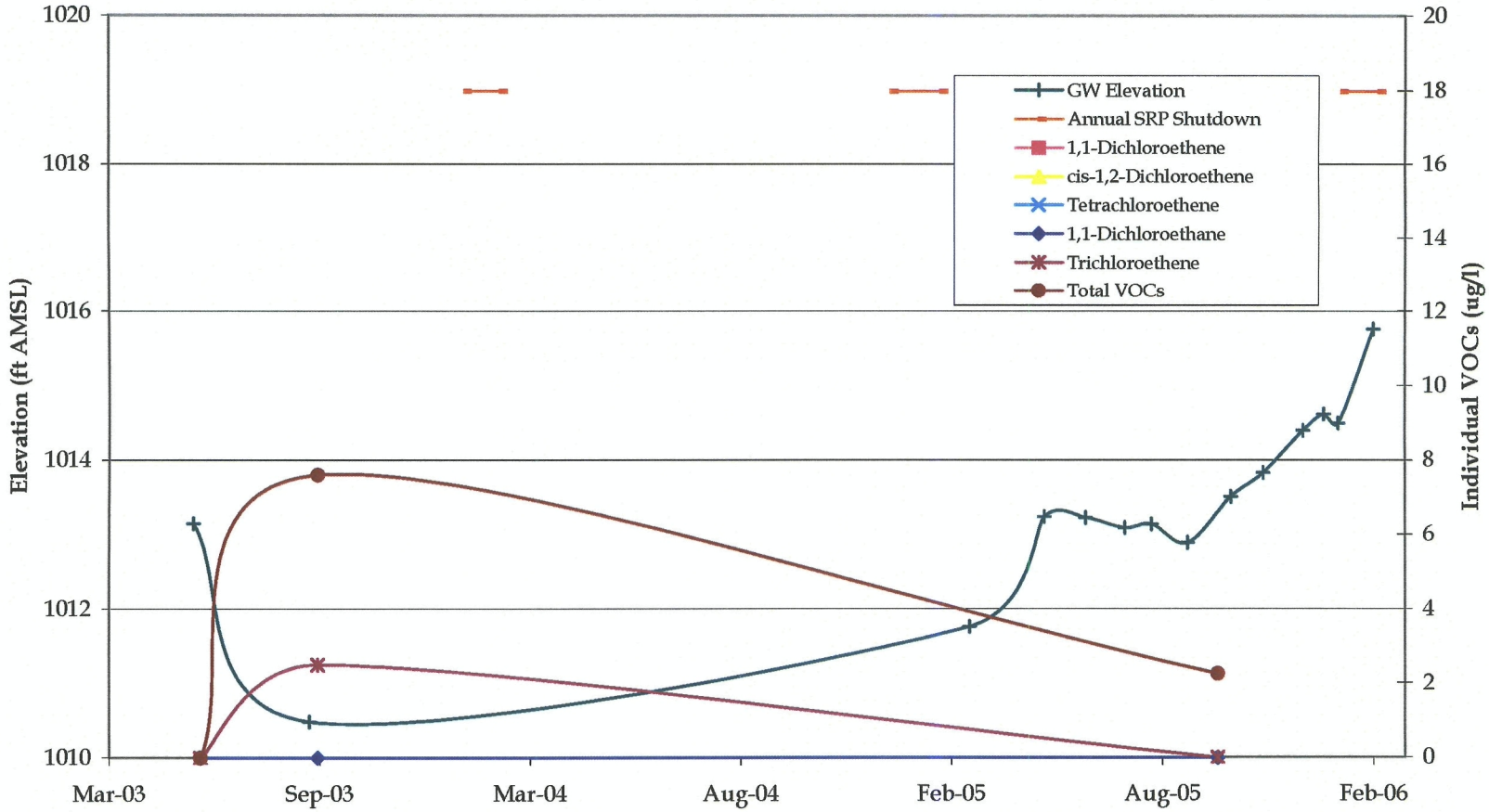


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

OU3-14D

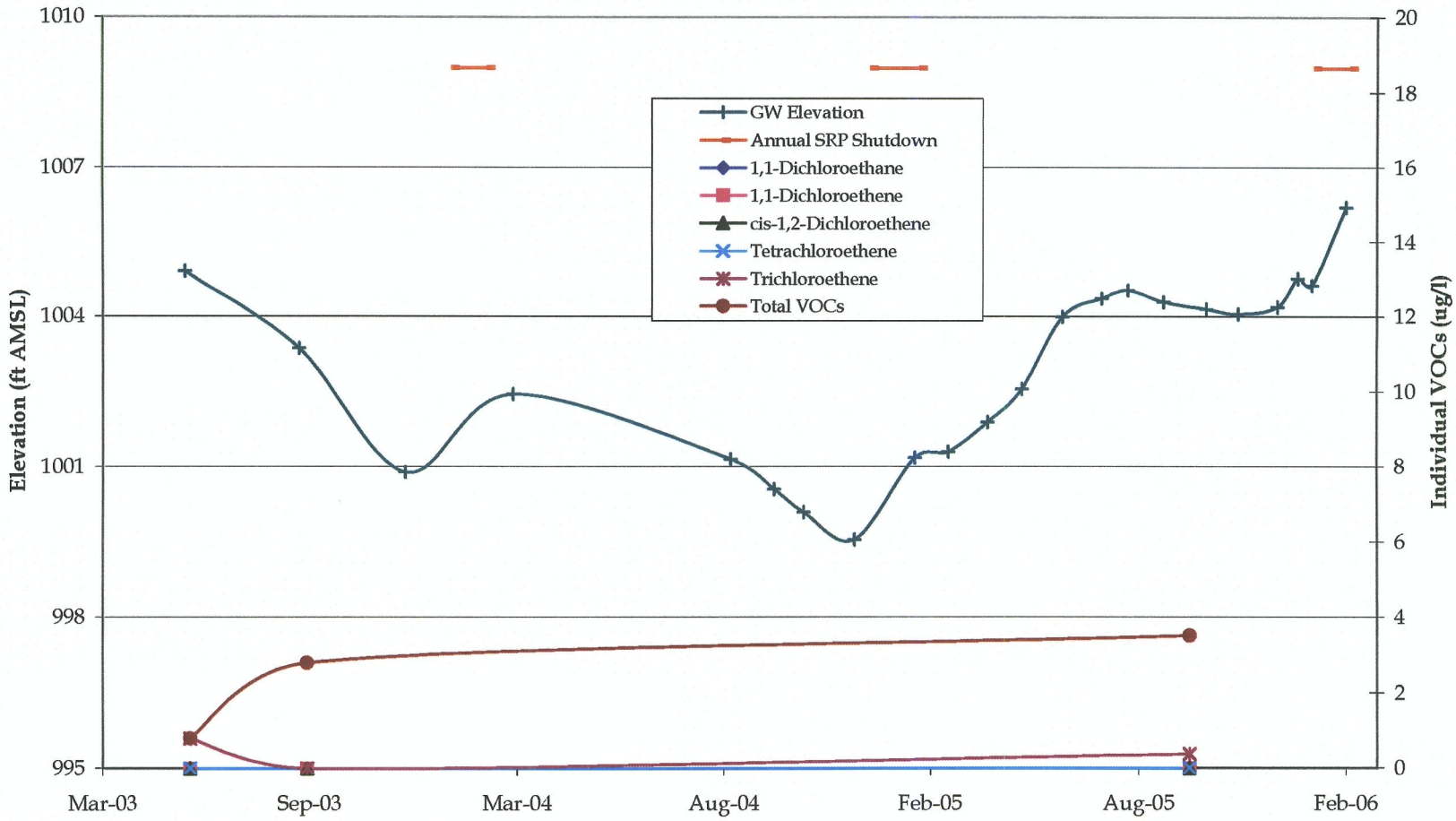


Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ

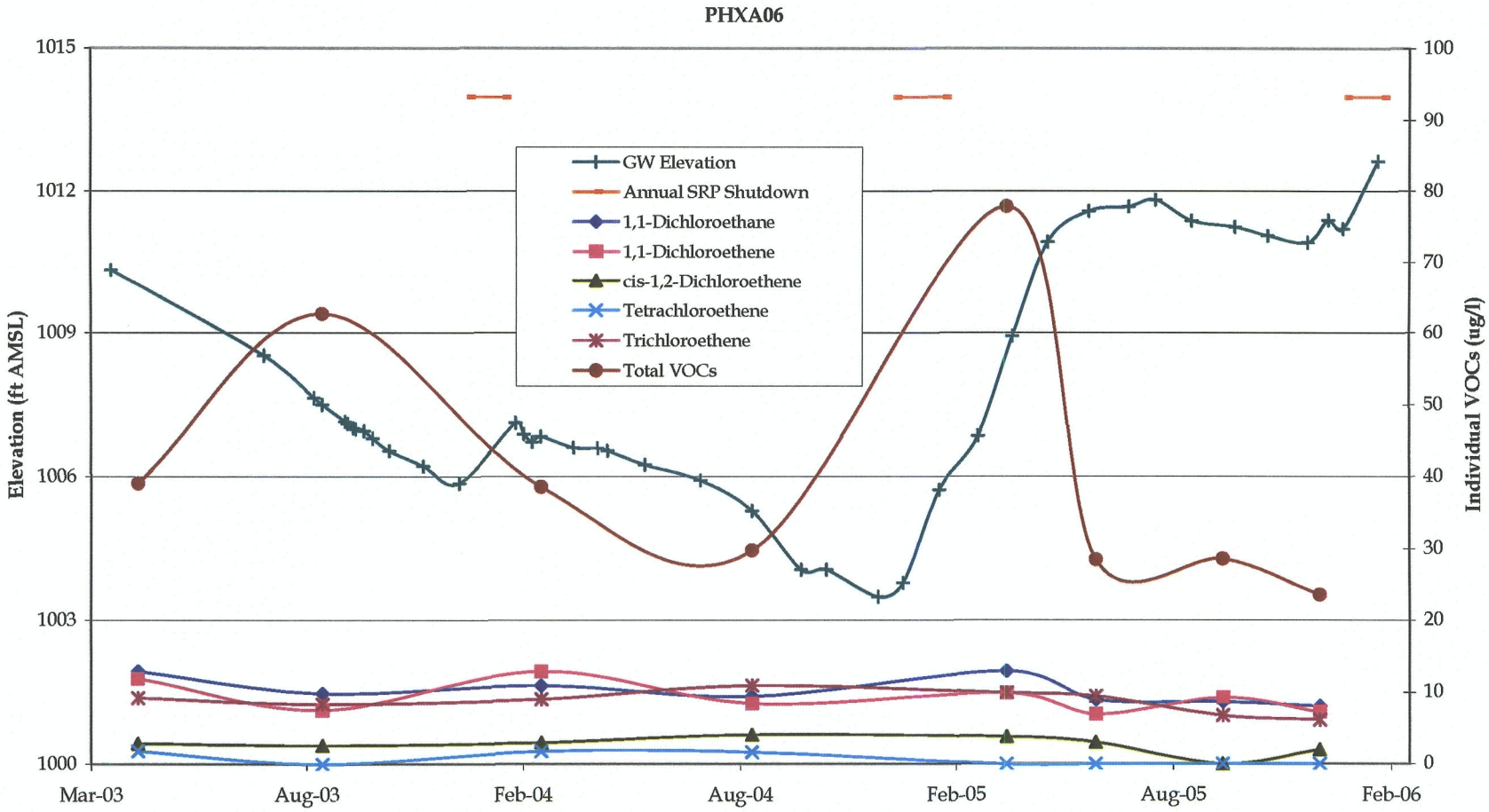
OU3-14M



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



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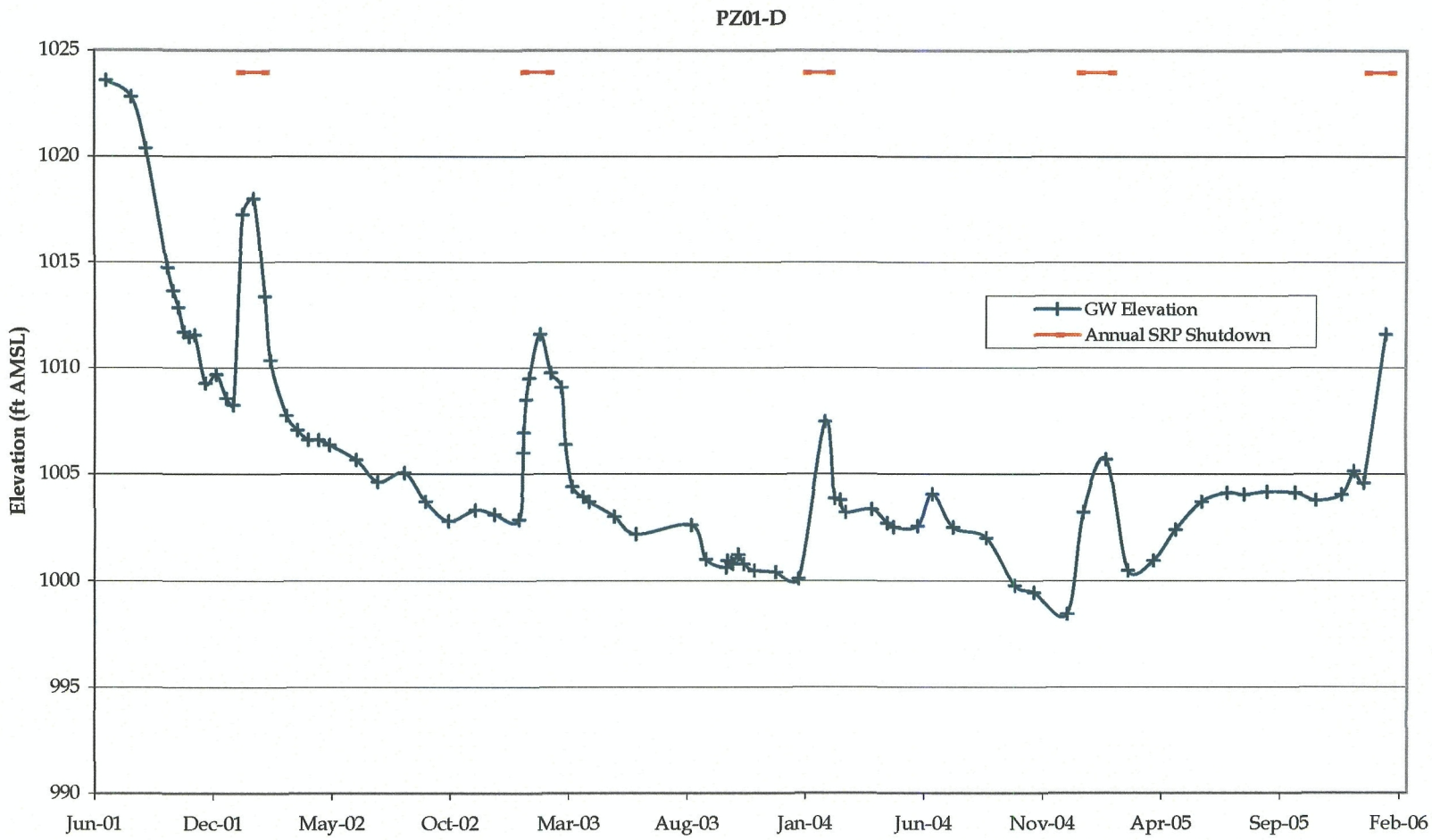
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



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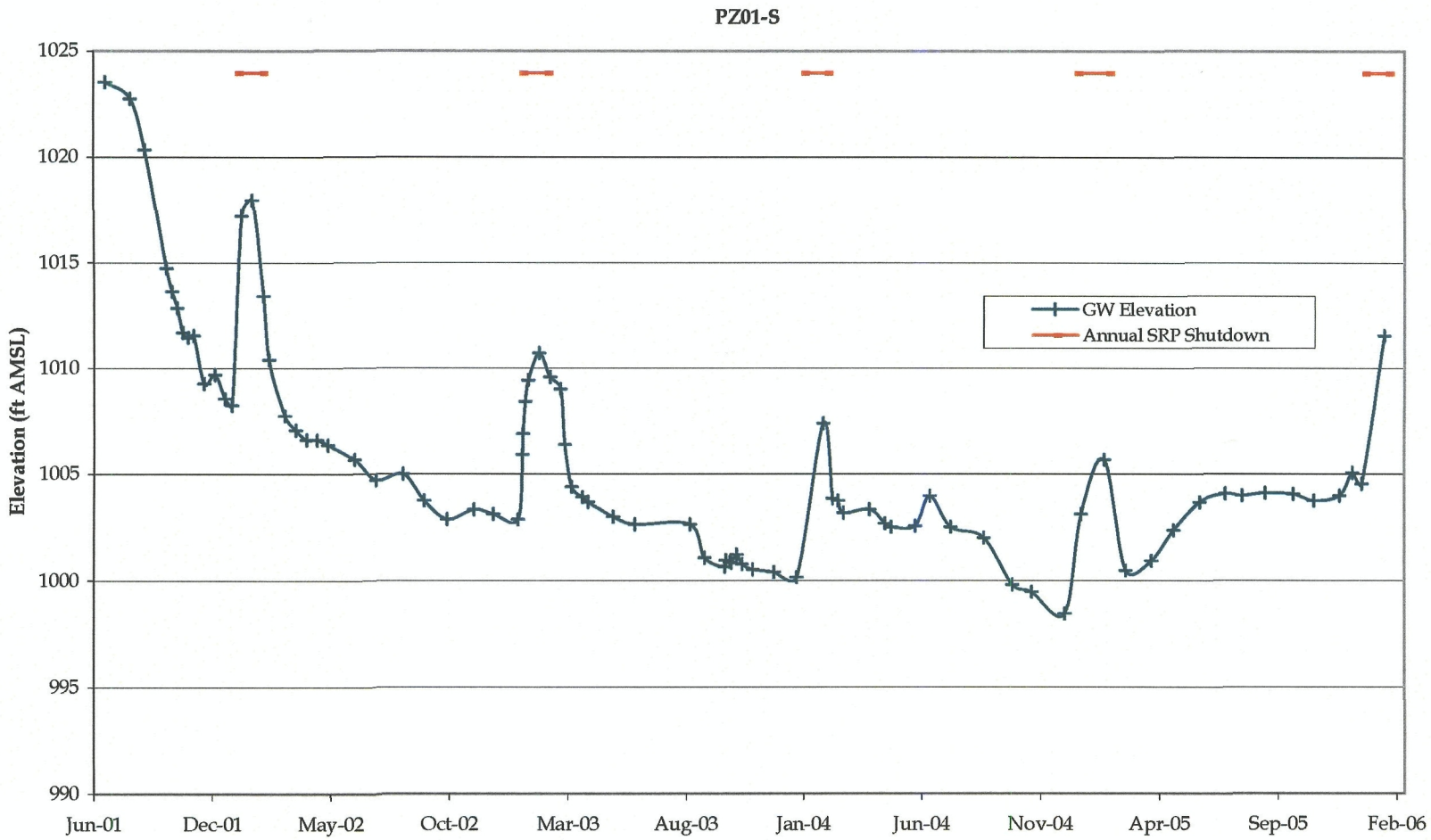
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



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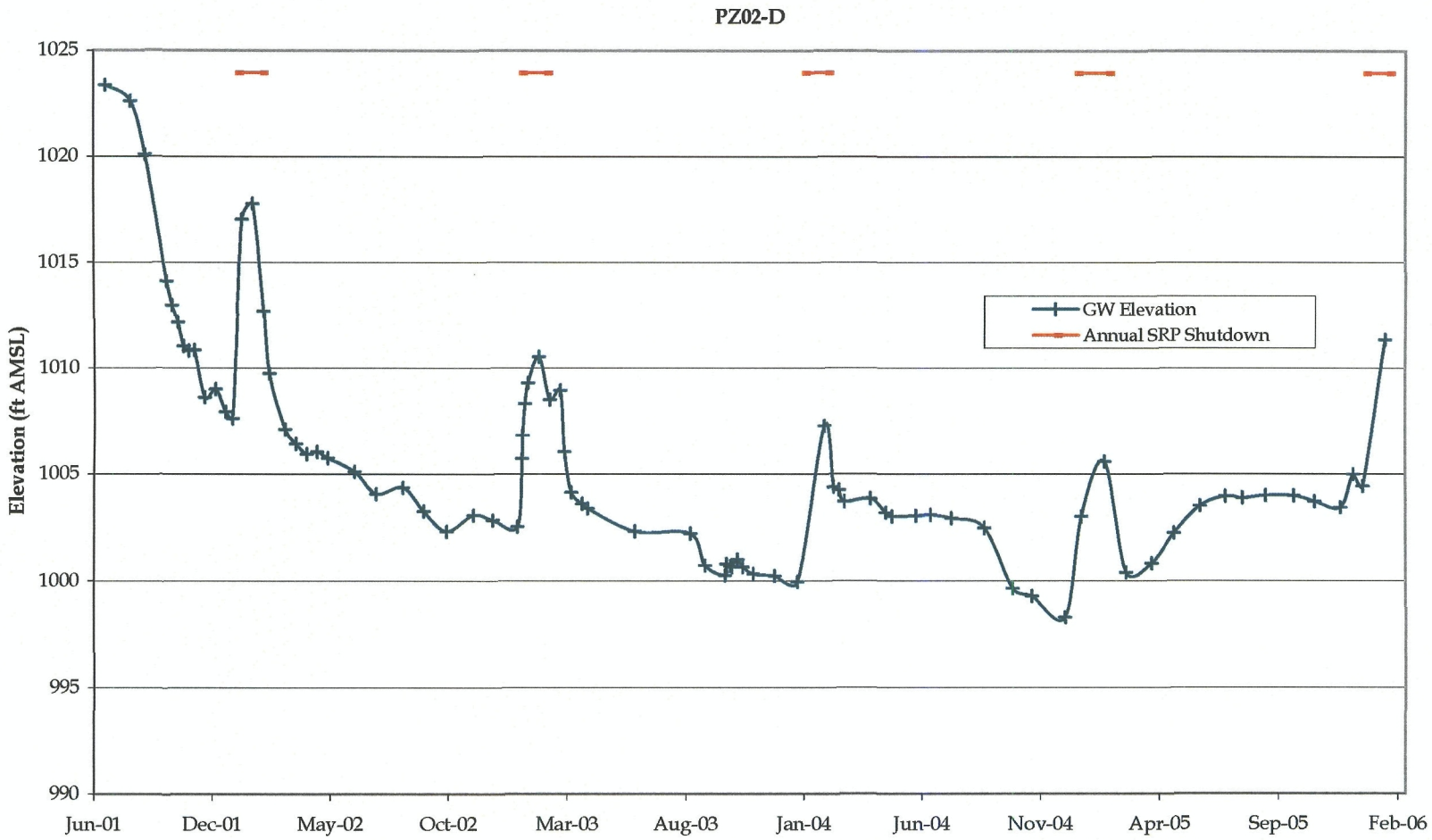
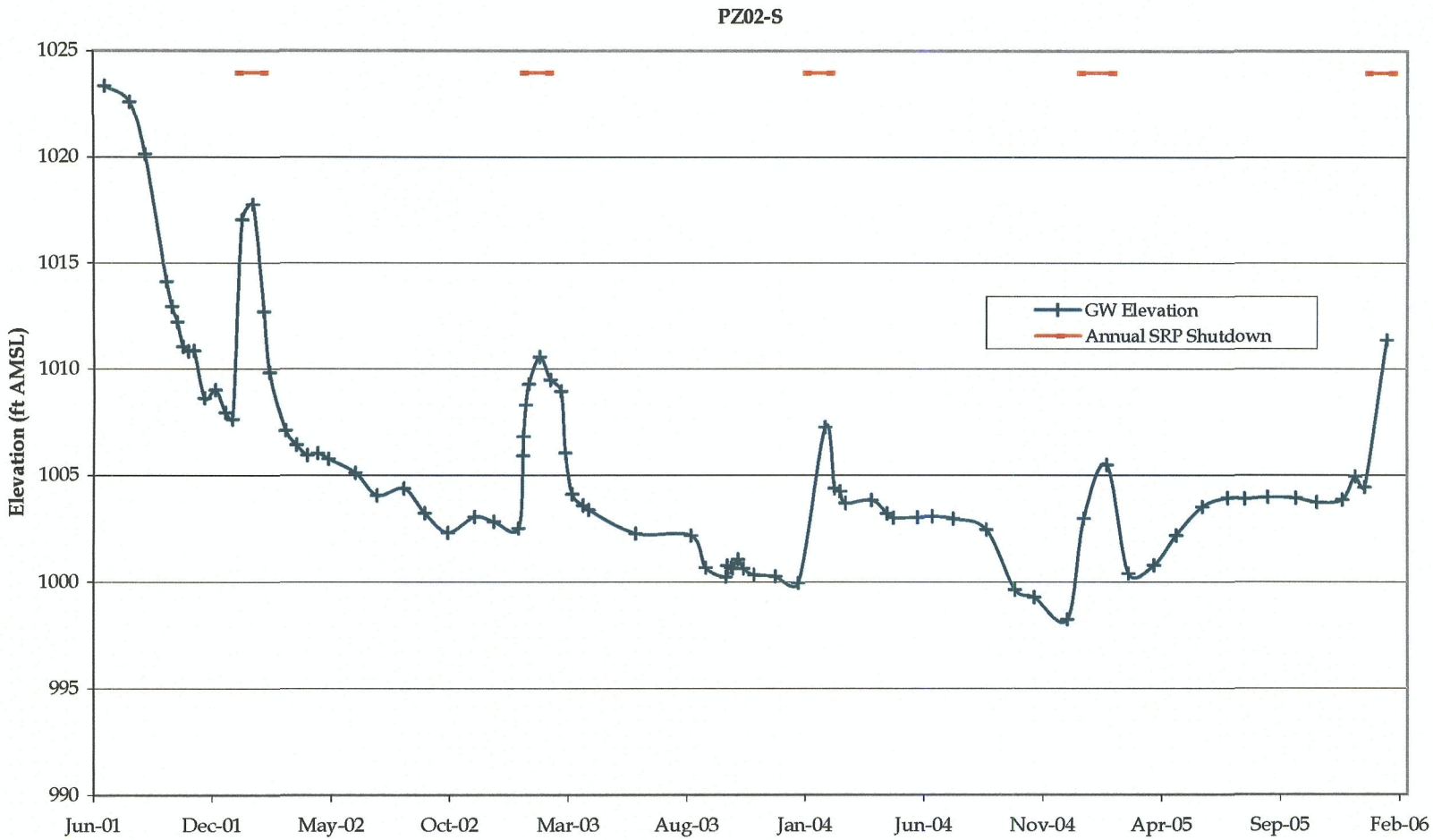
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level

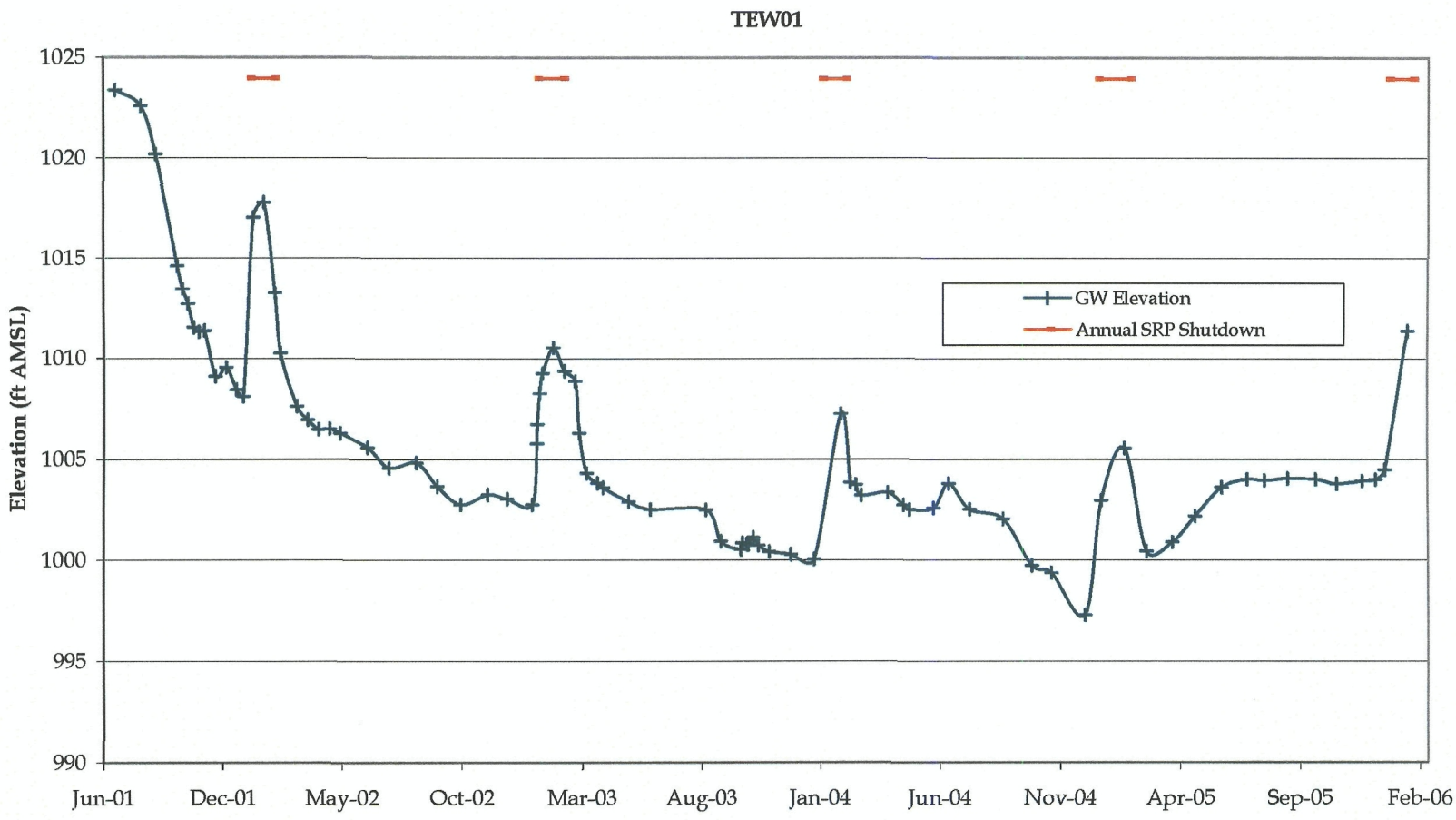
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

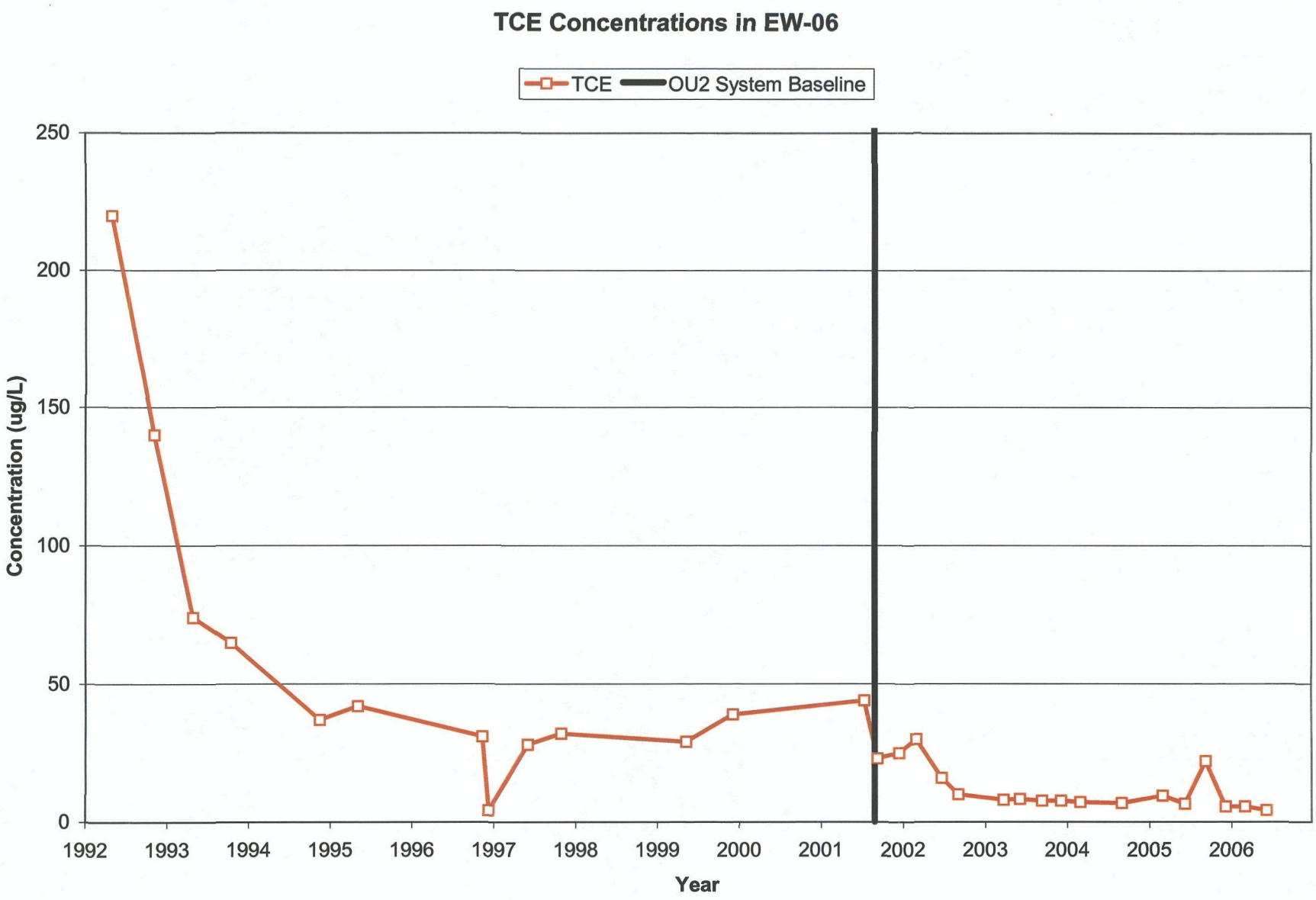
Note:
ft AMSL: Feet Above Mean Sea Level

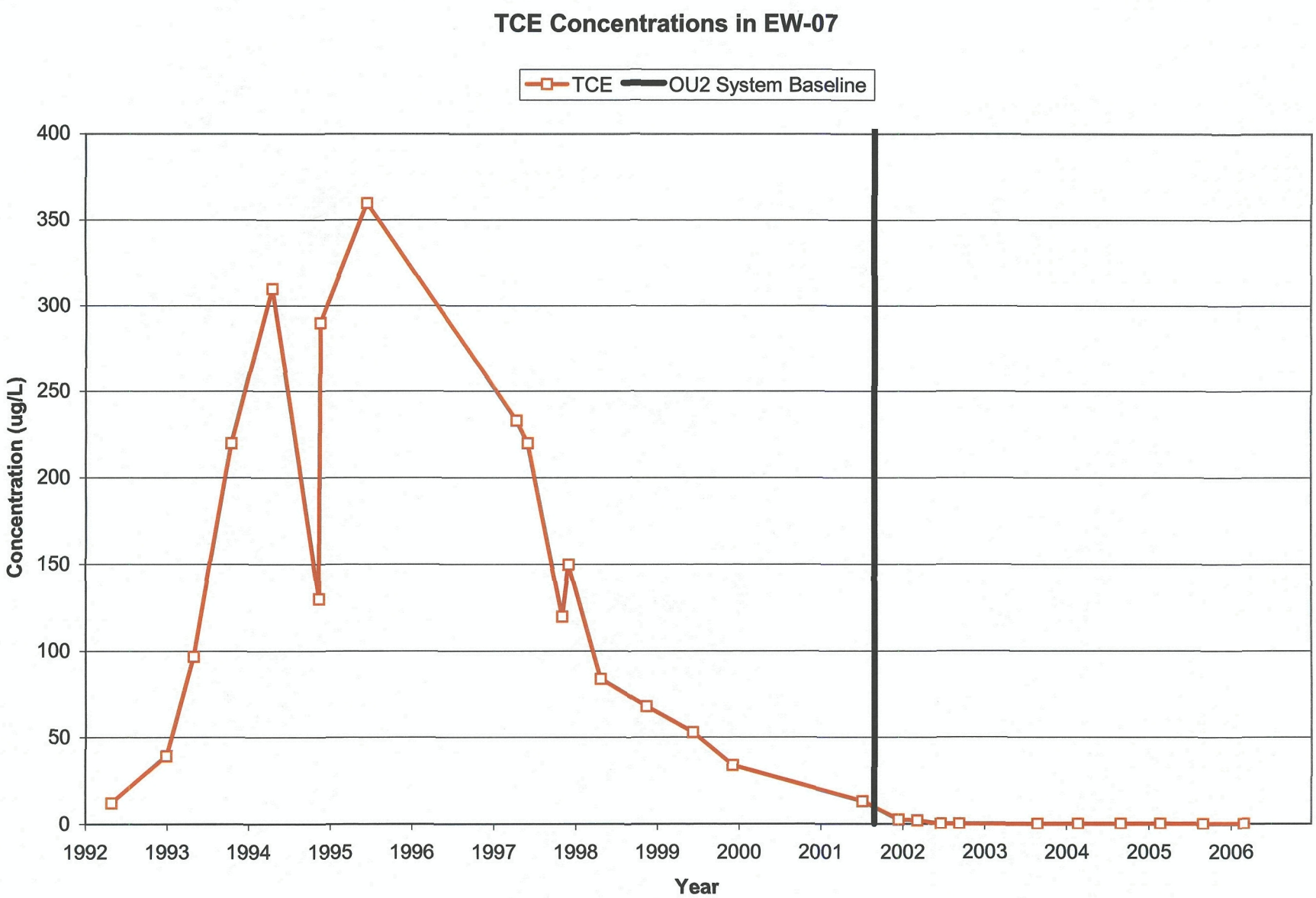
GROUNDWATER ELEVATION AND SELECT VOC CONCENTRATION TRENDS
52ND STREET SUPERFUND SITE, OU2 AREA
PHOENIX, AZ



Note: VOCs below the detection limit are plotted at 0 on the x- axis. Individual VOC detection limits vary from 0.5 to 2.0 ug/l.

Note:
ft AMSL: Feet Above Mean Sea Level


TCE Concentrations in EW-06
TCE
OU2 System Baseline
Concentration (ug/L)
250
200
150
100
50
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year


TCE Concentrations in EW-07
TCE
OU2 System Baseline
Concentration (ug/L)
400
350
300
250
200
150
100
50
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year

APPENDIX F

INTERVIEW DOCUMENTATION

INTERVIEW DOCUMENTATION FORM – OU2

The following is a list of individuals that were interviewed during the implementation of the five-year review conducted during the period from: 2001 to: 2005.

Name	Title/Position	Organization	Date
TOM SURIANO	REM. PROJ. MGR	FREESCALE	5/10/06
NADIA HOLLAN	PROJ. MGR	EPA R9	5/10/06
MARTHA BRETTENBACH	CAB MEMBER	CAB	5/23/06
KAREN O'REGAN	ENV. MANAGER	CITY OF PHX	5/25/06
DAVE GORDON CHRIS MATTISON	PROJ. MGR ATTORNEY	MALCOLM PIRNIE HALL & EVANS	5/25/06
STEVE WHILLIER MANFRED PLASCHKE DAVID HILLIARD	HYDROGEOLOGISTS	CRA	6/1/06
GEORGE RING	HYDROGEOLOGIST	CH2M HILL-HONEYWELL	6/9/06
DONN STOLZFUS	ENV. PROG. SPECIALIST	CITY OF PHX	7/21/06

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): _____
DATE: June 1, 2006 ; **INTERVIEW METHOD:** _____

TOPIC: **SITE OPERATIONS, MAINTENANCE & MONITORING: SITE MANAGER, O&M MANAGER, SITE STAFF, & CONSULTANTS**

INTERVIEWEE: S WHILLIER, M PLASCHKE, D HILLIARD ; **TITLE:** Supervising Contractor
REPRESENTING: CONESTOGA-ROVERS & ASSOCIATES, INC.
ADDRESS: 4050 E. COTTON CENTER BLVD #49 ; **PHONE:** (602)749-9400
PHOENIX, ARIZONA 85040

1. What is/was your understanding of the overall remedy (OU2) at the Site?
The interim remedy for OU2 was implemented on September 26, 2001, is a groundwater extraction and treatment system (GWETS). The system objectives of the GWETS fully contain the entire north-south width and depth of the VOC contaminated plume (5ppb TCE plume) in the vicinity of 20th Street. Hydraulic containment is maintained by pumping 3 extraction wells. The treated groundwater meets discharge standards.

2. What is your impression of the implemented remedy (OU2) at the Site?
Since system startup in 2001, the remedy has been effective in capturing and containing the groundwater plume at approximately 20th Street. Over the past five years of operation the GWETS has treated approximately 4.8 billion gallons of groundwater through December 31, 2005 and has removed over 7,369 pounds of VOCs. The remedy is workin as designed. System uptime has consistently been greater than 98%.

3. What is your responsibility at the site (i.e., Management, O&M, Monitoring)?
Conestoga-Rovers & Associates has been retained as the supervising contractor by the Companies to oversee all O&M and monitoring activities as well as supervision and management of all subcontracted work for the project. CRA also prepares the annual effectiveness report on behalf of the Companies.

4. Please describe the O&M and Monitoring responsibilities of other staff and contractors directly under your supervision.
Calgon Carbon- Responsible for supplying and regeneration of granular activated carbon.
MP Environmental/Waste Management - Responsible for transporting and disposal of offsite generated wastes (spent carbon or investigation derived waste soils from well drilling).
Boart Longyear - Responsible for drilling, monitor well development, and aquifer testing activities.

5. Describe any significant changes (or planned changes) to OU2 that are not addressed in the appropriate O&M manuals or plans.

Changes to the OU2 groundwater monitoring network and extraction well flow set point changes have been documented in other reports.

A new City of Phoenix (COP) Polluted Groundwater Discharge Permit was issued in February 2006 by COP.

6. Describe any O&M problems or difficulties, within the last 5-years, that may have affected the protectiveness or effectiveness of the remedy to meet remedial objectives.

There have been no issues that have adversely impacted the effectiveness of the remedy. The 20th Street GWETS has maintained capture (and thus effectiveness of the remedy has been maintained.

A single process discharge sample had elevated levels of TCE, but below discharge standards, the GWETS was shutdown while the granular activated carbon in the four lead GAC vessels was changed (December 2005).

7. Describe any activities implemented since the start-up of OU2 to optimize O&M.

The flowrate set points of the extraction wells have been reduced since the initial startup in 2001 to alleviate air entrainment in the system and maximize efficiency of the groundwat extraction. This was necessary as the groundwater level has dropped due to the extended regional drought. CRA installed isolation valves on GAC outlets to minimize downtime for changing/cleaning the cone filters. The number of GAC vessels in the treatment train has been reduced from 18 to 10. The UV oxidation is not being utilized because the overall VOC concentrations have been dropping and no vinyl chloride has been detected in any extraction or monitoring wells within the OU2 monitor well network.

8. Describe any activities implemented since start-up of OU2 to optimize on-site monitoring activities.

Since the initial startup in 2001, 7 monitoring wells have been removed (went dry) and 28 wells have been added to the network. Of the 28 wells added, 22 of them were installed by the Companies. Transducers have been installed in 6 monitoring wells to increase data collection frequency in key points within the OU2 monitoring well network over time as affected by groundwater pumping activities, major rain events, shutdowns and other chang within the aquifer. Due to and expansion of the monitoring well network and changes in the flow regime, monitoring has actually increased in both location and frequency from the original plan. As the system stabilizes, optimization of the monitoring program can be done

9. Are the annual O&M costs for the past 5-years consistent with the original estimated cost? If significantly higher or lower, please describe why the annual cost varied from the estimated cost. (Note: Obtain written annual cost data, if available).

yes

10. Do you have any comments, suggestions, or recommendations to improve the site's operations, maintenance, or monitoring activities?

The Companies and Supervising Contractor make recommendations in each annual effectiveness report for the next year of O&M. For 2006, these recommendation included: maintain semi-annual groundwater sampling frequency; continue quarterly groundwater sampling for a subset of the OU2 wells south of EWS for one year; continue increased groundwater monitoring monthly for 2006; conduct two sampling events of newly installed piezometers NW13 and NW14M/D; and continue to have operational flexibility of the system to allow adjustments as needed to optimize the GWETS performance and maintain plume capture.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Kris Paschall (ADEQ) and Laura Malone (LFR)
DATE: June 9, 2006 **INTERVIEW METHOD:** In person at ADEQ

TOPIC: **SITE OPERATIONS, MAINTENANCE & MONITORING: SITE MANAGER, O&M MANAGER, SITE STAFF, & CONSULTANTS**

INTERVIEWEE: George Ring **TITLE:** Consultant
REPRESENTING: CH2MHill on behalf of Honeywell
ADDRESS: 2625 South Plaza Drive, Suite 300 **PHONE**: 480-966-8188
Tempe, Arizona 85282

1. **What is/was your understanding of the overall remedy (OU2) at the Site?**

   OU2 is an interim remedy and it's in the process of the feasibility study to develop what the final remedy would be. The interim remedy consists of 3 extraction wells and the groundwater treatment system. It's our understanding that the remedy is functioning and is capturing the flow and treating the water that is captured by the system and treating the standards that apply.

2. **What is your impression of the implemented remedy (OU2) at the Site?**

   It's been in operation since 2001 and functioning as designed and it has pumped approximately 5 billion gallons of groundwater and treated that water. It appears to be functioning as designed and capturing. As a remedy goes they don't have any issues or problems with it.

3. **What is your responsibility at the site (i.e., Management, O&M, Monitoring)?**

   CH2MHill is a consultant to Honeywell and consult to them on the 34th Street facility as well OU2.

4. **Please describe the O&M and Monitoring responsibilities of other staff and contractors directly under your supervision.**

   Hargis & Associates is a technical subcontractor to CH2MHill for OU2.

5. **Describe any significant changes (or planned changes) to OU2 that are not addressed in the appropriate O&M manuals or plans.**

   Don't see any significant changes. There are some changes that have come about, the biggest being the monitoring well network. The network has been expanded in order to answer some questions as they relate to capture. Not sure if this constitute

a significant change to overall operations. It is a significant change to the manuals and the plans. Minor systems changes but not viewed as significant.

6. **Describe any O&M problems or difficulties, within the last 5-years, that may have affected the protectiveness or effectiveness of the remedy to meet remedial objectives.**

Have seen some problems/difficulties that are just part of routine operations and maintenance. Don't feel that these have been an issue for effectiveness. The system design is fairly robust so that things like change out of pumps or failures of piping have been able to be addressed in a timely manner. These would not constitute protectiveness or effectiveness issues for the system. Robust system and don't think there are not major flaws as far as the way the operation and maintenance has occurred over the last several years.

7. **Describe any activities implemented since the start-up of OU2 to optimize O&M.**

Some operational changes that relates to some of the fine details of the system and haven't impacted effectiveness and/or protectiveness Biggest issue is the declining water levels in the region. Declining water levels have caused changes to the pumping flow rates and not due to things that weren't unanticipated as fars as the aquifer characteristics When the water levels drops the flow rates have to drop too. Has been some work on optimization related to responding to the flow rates.

Question: Do you feel the south well is yielding a lower amount than what was projected just because of the drought or any geological reasons?

Answer: There may be geologic considerations. They would have liked to have gotten more pumping or more influence from that well, but there are some geologic considerations but those were seen rapidly (recognized) when the well was turned on, so they went ahead and made adjustments to the system. Wouldn't call it optimizing the system, just operating the system at whatever level it could be operated at. When the water drops, it's affecting the south more and they are getting more pumping coming from the north than they would like. Changing the flow rates to the north, optimizing what goes through the system so cleaner water isn't being run through the system, or extending the capture zone beyond what it needs to be.

Question: Do you think there is a future protectiveness concern based on the shift in water levels?

Answer: This is probably the biggest issue with the system as to whether or not there will be an issues. As to the modeling that has been done, the fact that the system has been changing, as the water levels decreased and then have risen, it

makes making that kind of long term decision difficult because we don't have the years of operation. From the modeling done, we think we will be able to maintain capture down there. One of the other issues, is a lack of data in that area as far as having the wells at the correct depths and proper locations to provide a full coverage for decision making purposes. The wells are more recent. It's difficult to extrapolate the one or two sampling events into the future. What they have seen, it definitely will maintain capture down there.

Question: In the modeling, is there a threshold where the declining water levels and pumping rates will create a point where capture is not occurring?

Answer: Haven't gotten to that point yet.

8. **Describe any activities implemented since start-up of OU2 to optimize on-site monitoring activities.**

Biggest one would be taking a look at where issues were relating to capture, and that is to the south and then recognizing that additional wells needed to be added and putting those wells in. There's another issue that relates to the monitoring network and that there are existing Honeywell wells that were installed for a particular purpose, and that the purpose was not looking at how well OU2 was functioning or the capture but rather looking at nature and extent issues from the 34th Street facility. They have looked at those wells and based on recommendations from ADEQ, are looking at these wells from a different hydrostratigraphic unit perspective. The wells have been questioned as to their completion and they are completed across hydrostratigraphic units. Through the effectiveness study, they have done a couple of additional studies to look at that and looking at discrete sampling and the effects of the sampling. Honeywell doesn't think the cross screening issue isn't as big an issue with those wells as far as being able to use the data constructively. They may actually add in to the overall understanding and gives them more data points to use. They would like to see these added back in the system, to the extent they can be. ADEQ looking at this issue.

9. **Are the annual O&M costs for the past 5-years consistent with the original estimated cost? If significantly higher or lower, please describe why the annual cost varied from the estimated cost. (Note: Obtain written annual cost data, if available).**

Consistent from the order of magnitude. There have been variance and probably have been a little bit lower than original estimates. Attributed to operation going smoother than they thought. Less change outs on the pumps, equipment etc.

10. **Do you have any comments, suggestions, or recommendations to improve the site's operations, maintenance, or monitoring activities?**

Overall things are going well. All the parties have a fairly good relationship and things are fairly responsive as problems are noted and corrected. Looking at he monitoring points to the south, and looking at other data points.

Question: Concern from other interviews is that the plume is growing. Do you want to address that?

Answer: Issue has been brought up at technical meetings and whether they are capturing to the south. There are some elements of the plume (in levels of ppb) that have past the current capture zone. It is a question that needs to be decided on what has passed the capture zone to the south Capture from the east to the west, they are capturing that and they don't have any concerns on that. The capture zone is not going to grow a great deal larger than it currently is.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Kris Paschall (ADEQ) and Laura Malone (LFR)
DATE: May 10, 2006 **INTERVIEW METHOD:** In person at ADEQ

TOPIC: **SITE OPERATIONS, MAINTENANCE & MONITORING: SITE MANAGER, O&M MANAGER, SITE STAFF, & CONSULTANTS**

INTERVIEWEE: Tom Suriano **TITLE:** Remediation Program Manager
REPRESENTING: Freescale Semiconductor
ADDRESS: 2100 E. Elliot Road **PHONE:** 480-413-5182
Tempe, Arizona 85284

1. **What is/was your understanding of the overall remedy (OU2) at the Site?**

   OU2 is a containment remedy that captures the contaminates in the vicinity of I-10. OU2 includes all the PRPs that have contributed.

2. **What is your impression of the implemented remedy (OU2) at the Site?**

   OU2 is effective at achieving the objectives.

3. **What is your responsibility at the site (i.e., Management, O&M, and Monitoring)?**

   Responsible for Freescale's involvement and coordinate with Honeywell on the OU2 remedy.

4. **Please describe the O&M and Monitoring responsibilities of other staff and contractors directly under your supervision.**

   Freescale and Honeywell both use Conestoga Rovers for O&M, reporting and effectiveness reporting.

5. **Describe any significant changes (or planned changes) to OU2 that are not addressed in the appropriate O&M manuals or plans.**

   Unilateral order from EPA to Consent order and negotiations on going.

   Most recent monitoring wells are not part of the O&M plan and have been reported to ADEQ. These will be incorporated.

6. **Describe any O&M problems or difficulties, within the last 5-years, that may have affected the protectiveness or effectiveness of the remedy to meet remedial objectives.**

None regarding effectiveness and protectiveness. Regional drought has decreased water levels and studies have been performed to show that remedy is still capturing.

7. **Describe any activities implemented since the start-up of OU2 to optimize O&M.**

   Adjustments have been made to flow rates/pumping regime due to the lower water levels. They are back to using all the wells.

8. **Describe any activities implemented since start-up of OU2 to optimize on-site monitoring activities.**

   Due to the decrease in the water table – discussions needed on degree of capture. Monitoring is more intensive than originally anticipated – more wells are being monitored more frequently. Parameter list did not change.

9. **Are the annual O&M costs for the past 5-years consistent with the original estimated cost? If significantly higher or lower, please describe why the annual cost varied from the estimated cost. (Note: Obtain written annual cost data, if available).**

   If the unanticipated costs (i.e., additional wells, monitoring and evaluations), were backed out, then costs are consistent with expectations. Oversight is fairly high at OU2 and this is an area that can be improved upon.

   Written cost data will be provided.

10. **Do you have any comments, suggestions, or recommendations to improve the site's operations, maintenance, or monitoring activities?**

    - Complete the O&M Consent Decree
    - Existing remedy is functioning fine
    - Advantageous for the overall remedy for PRP evaluation to be completed and any necessary corrective action to be implemented.
    - Since last 5-year review – additional rules/regulations (i.e. ADWR and maybe City of Phoenix) have inhibited things.
    - Freescale would like to opportunity to review and comment on the information provided by Honeywell and City of Phoenix.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Kris Paschall (ADEQ) and Laura Malone (LFR)
DATE: May 25, 2006 **INTERVIEW METHOD:** Via phone

TOPIC: **SITE BACKGROUND INFORMATION, NEIGHBORS & CAB REPRESENTATIVE**

INTERVIEWEE: Dave Gordon and Chris Mattison **TITLE:**
REPRESENTING: Malcolm Pirnie and Hall & Evans (Representing Joray)
ADDRESS: Malcolm Pirnie
4646 East Van Buren, #400
Phoenix, AZ 85008
602-797-4625

Mr. Chris Mattison, Attorney at Law
Hall & Evans
1125 17th Street, Suite 600
Denver, Colorado 80202
303-628-3335

1. **What is/was your understanding of the overall remedy (OU2) at the Site?**

   Interim remedy that consists of a pump and treat system west of the airport near 24th Street. Intent was to provide hydraulic capture while the rest of the investigations were ongoing.

2. **What is your impression of the completed remedy (OU2) at the Site?**

   Has not reviewed the capture reports, but seems to be "fairly sufficient". Not sure of the AAFC fuel problem at the airport was considered.

3. **Please describe your involvement or participation at the Site (if any).**

   Dave Gordon is a consultant assisting Chris Mattison with the Research Report and work plan issues.

4. **Do your feel that you were kept well informed about all phases of the project?**

   Yes

5. **What effects have the operation of OU2 had on you (or the surrounding community)?**

   Has not affected his work to date.

6. **During the past 5-years that OU2 has been in operation, were you aware (or informed) of any events, incidents, problems or activities that affected you (or the surrounding community)?**

   Not aware of any notices received. Some information has been conveyed at the open house meetings.

7. **Are you aware of any other community concerns regarding the site, the operation of OU2, and administration that have not been resolved?**

   His sense is that folks would like to see more rapid progress on things.

8. **Do you have any comment, suggestions, or recommendations regarding the effectiveness of OU2 in protecting human health or the environment?**

   No thoughts to be shared at this point.

9. **Can you recommend any additional community members that we should talk to?**

   Other PRPs for OU2.

10. **Do you have any comments, suggestions, or recommendations to improve the site's operations, maintenance, or monitoring activities?**

    No thoughts at this point.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Laura Malone (LFR)
DATE: July 21, 2006 **INTERVIEW METHOD:** Telephone

TOPIC: **STATE & LOCAL CONSIDERATION, STATE AGENCIES & LOCAL AUTHORITIES**

INTERVIEWEE: Donn Stoltzfus **TITLE:** Env. Program Specialist
REPRESENTING: City of Phoenix
ADDRESS: 200 W. Washington Street, 14th Floor **PHONE:** 602-256-5681
Phoenix, AZ 85003

1. **What is/was your understanding of implementation of the remedy (OU2) at the Site?**

   OU2 remedy is solely a groundwater containment system. The remedy is pretty successful.

2. **What is your impression of the implemented remedy (OU2 at the Site?**

   OU2 is relatively successful at managing the contamination.

3. **Have there been routine communications or activities conducted by your office related to the site?**

   His office has provided briefings to council members and department heads within the City of Phoenix.

4. **Have there been any complaints or other incidents related to the site requiring any response by your office?**

   No.

5. **Are you aware of any current or planned changes to your regulations/ordinances, or current/future land development that may impact the operations or remedies that the site?**

   No.

6. **In your opinion, have appropriate O&M and monitoring activities been implemented for OU2, in accordance with approved manuals and plans?**

   Yes.

7. **Are you aware of any community concerns regarding the site or its operation and administration?**

   No.

8. **Do you feel that you were kept well informed about all phases of the projects?**

   Yes.

9. **Do you have any comments, suggestions, or recommendations regarding the O&M and/or effectiveness of OU2 to be protective of human health and the environment?**

   - The City has been dealing with the fuel releases in and around Sky Harbor Airport and the possible impact on OU2.
   - Long-term water resources continue to be a concern.
   - Vapor intrusion continues to be an issue.
   - Would like to better coordination between ADEQ's Superfund and Tank programs. These programs have different approaches, philosophies and objectives. Central coordination and communication would be very helpful.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Kris Paschall (ADEQ) and Laura Malone (LFR)
DATE: May 25, 2006 **INTERVIEW METHOD:** In person at ADEQ

TOPIC: **STATE & LOCAL CONSIDERATION, STATE AGENCIES & LOCAL AUTHORITIES**

INTERVIEWEE: Karen O'Regan **TITLE:** Env. Programs Manager
REPRESENTING: City of Phoenix
ADDRESS: 200 W. Washington Street, 14th Floor **PHONE:** 602-256-5654
Phoenix, AZ 85003

1. **What is/was your understanding of implementation of the remedy (OU2) at the Site?**

   OU2 remedy pretty much the same as OU1 and is a containment remedy.

2. **What is your impression of the implemented remedy (OU2 at the Site?**

   OU2 is capturing the contamination. There are boundary issues associated with OU2 and OU2 is dewatering the aquifer.

3. **Have there been routine communications or activities conducted by your office related to the site?**

   City of Phoenix is copied on reports.

4. **Have there been any complaints or other incidents related to the site requiring any response by your office?**

   General questions on "What is that thing on Washington Street?

5. **Are you aware of any current or planned changes to your regulations/ordinances, or current/future land development that may impact the operations or remedies that the site?**

   Light rail line currently being constructed and expects the area to see redevelopment. Hasn't heard of any new regulations or guidance.

6. **In your opinion, have appropriate O&M and monitoring activities been implemented for OU2, in accordance with approved manuals and plans?**

   Defer to ADEQ and EPA since they are keeping on top of the issues.

7. **Are you aware of any community concerns regarding the site or its operation and administration?**

   Vapor intrusion is an issue with the City, EPA and the community. There aren't any standards and the guidance is controversial. Would like to get appropriate guidance on how to handle this issue.

8. **Do you feel that you were kept well informed about all phases of the projects?**

   Yes

9. **Do you have any comments, suggestions, or recommendations regarding the O&M and/or effectiveness of OU2 to be protective of human health and the environment?**

   - Issue with Honeywell and how the on-site plume was determined
   - Pilot test for air emissions and how it affects residents in the area.

   Ms. O'Regan suggested that Councilman Mattox, Cynthia Parker and Donn Stoltzfus be contacted for an interview.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Laura Malone (LFR)
DATE: May 23, 2006 **INTERVIEW METHOD:** Via phone

TOPIC: **SITE BACKGROUND INFORMATION, NEIGHBORS & CAB REPRESENTATIVE**

INTERVIEWEE: Martha Breitenbach **TITLE:** Citizen and CAB member
REPRESENTING: _____
ADDRESS: On file **PHONE:** On file

1. **What is/was your understanding of the overall remedy (OU2) at the Site?**

   Pump and treat system similar to OU1. The only difference is jet fuel. Very disappointed that the resolution is so slow. Should be more aggressive action taken to cleanup the site. OU2 is only dealing with the groundwater. Doesn't understand why the soil contamination hasn't been dug up to remove source areas. Soil is still leaching into groundwater.

2. **What is your impression of the completed remedy (OU2) at the Site?**

   The plume (Dragon) is growing. Issue with groundwater flow Stated as NE-SE, but since the plume is growing, this defies the previous groundwater flow information.

3. **Please describe your involvement or participation at the Site (if any).**

   CAB member and attends meetings.

4. **Do your feel that you were kept well informed about all phases of the project?**

   Yes, on the monitoring well information. Only been involved for last 5 years. Written materials are always helpful. Would prefer not to get summarized data and would like to see raw data.

5. **What effects have the operation of OU2 had on you (or the surrounding community)?**

   No appreciable effects. Would like to see the groundwater placed back into the ground.

6. **During the past 5-years that OU1 has been in operation, were you aware (or informed) of any events, incidents, problems or activities that affected you (or the surrounding community)?**

   Aware of a big gas spill by Honeywell. They were informed when the flow decreased in OU1.

7. **Are you aware of any other community concerns regarding the site, the operation of OU2, and administration that have not been resolved?**

   Placement of wells around Honeywell. Honeywell is not amenable to anyone describing where they place their wells. They drilled their own wells without approval. This action bothered her "a whole bunch", because it can skew the results.

8. **Do you have any comment, suggestions, or recommendations regarding the effectiveness of OU2 in protecting human health or the environment?**

   Would like to see raw data of what's coming out of the Honeywell plant. No averaging of data. Wants data points on a graph showing concentrations and what's left. Also more information on when and how much was released.

9. **Can you recommend any additional community members that we should talk to?**

   No, doesn't know too many folks in that area.

INTERVIEW QUESTIONNAIRE
MOTOROLA 52ND STREET SUPERFUND SITE, 5-YEAR REVIEW

INTERVIEWER(S): Laura Malone - LFR
DATE: May 10, 2006 **INTERVIEW METHOD:** In person at ADEQ

TOPIC: **STATE & LOCAL CONSIDERATION, STATE AGENCIES & LOCAL AUTHORITIES**

INTERVIEWEE: Nadia Hollan **TITLE:** Project Manager
REPRESENTING: Environmental Protection Agency (EPA)
ADDRESS: USEPA Region IX **PHONE:** 415-972-3187
75 Hawthorne Street, Mail Code SFD-2
San Francisco, CA 94105

1. **What is/was your understanding of implementation of the remedy (OU2) at the Site?**

   EPA is lead for OU2 and is overseeing the implementation and operations. There is a unilateral Admin order with Honeywell and Freescale. OU2 is an interim groundwater containment remedy.

2. **What is your impression of the implemented remedy (OU2) at the Site?**

   OU2 has been doing was intended to do. There are questions on capture which need to be resolved and have resulted from:
   - Groundwater levels have declined which has decreased pumping – rate of cleanup is slower
   - South side of system with unknown areas of contamination

   Currently evaluation the capture within OU2 on the south side of the system. OU2 working well with the exception of the south side.

3. **Have there been routine communications or activities conducted by your office related to the site?**

   - Fact Sheets
   - Public Meetings
   - Phone calls
   - Working with Arizona Department of Environmental Quality (ADEQ)
   - Communications with companies

4. **Have there been any complaints or other incidents related to the site requiring any response by your office?**

   Not that required a response from EPA. Aware of the system shut down due to elevated TCE discharge EPA reviews the monthly operations reports.

5. **Are you aware of any current or planned changes to your regulations/ordinances, or current/future land development that may impact the operations or remedies that the site?**

   Haven't heard of any new regulations or guidance. Land use has seen typical development.

6. **In your opinion, have appropriate O&M and monitoring activities been implemented for OU2, in accordance with approved manuals and plans?**

   For the most part yes. Any issues are reflected in the public record

7. **Are you aware of any community concerns regarding the site or its operation and administration?**

   Yes, general concerns on water resources and whether the treated levels are safe. Capture remains an issue. The public record reflects community concerns.

8. **Do you feel that you were kept well informed about all phases of the projects?**

   EPA is lead. Companies are keeping EPA informed. Always working on continual improvement on communications

9. **Do you have any comments, suggestions, or recommendations regarding the O&M and/or effectiveness of OU2 to be protective of human health and the environment?**

   - Potential for new COCs – 1,4 Dioxane may be an issue
   - Follow up on vapor intrusion assessment
   - Comments in Effectiveness Report outlines comments/suggestions before the 5-year review period

APPENDIX G

SITE INSPECTION DOCUMENTATION

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

I. GENERAL SITE INFORMATION

Site Name	Motorola 52nd Street Superfund Site	**Date of Inspection.**	June 6-7, 2006
Location and Region:	Phoenix, Arizona	**EPA I D**	
Agency and Consultant Conducting Five-Year Review	ADEQ and LFR Inc	**State I D ·**	
		Weather Condition:	Sunny, 105 °F

Remedy Includes (Check all that apply)

- ☐ Soil Vapor Extraction
- ☑ Groundwater Pump and Treatment
- ☐ Air Sparging (voluntary)
- ☐ Institutional Controls
- ☐ Security Access Controls
- ☐ Surface Water Collection and Treatment
- ☑ Groundwater Monitoring
- ☑ Treated Effluent Monitoring
- ☐ Other _____

Attachments ☐ Inspection Team ☐ Site Map (Figure A)

II. INTERVIEWS

1 *Project Manager* Manfred Plaschke (Name) | Senior Hydrogeologist (Title) | June 1, 2006 (Date)

Interviewed ☐ at Site ☑ at Office ☐ by Phone Phone No _____

Interview Summary ☑ Interview Summary Report/Questionnaire Attached

2. O & M Supervisor Steve Whillier (Name) | Senior Engineer (Title) | June 1, 2006 (Date)

Interviewed ☐ at Site ☑ at Office ☐ by Phone Phone No _____

Interview Summary ☑ Interview Summary Report/Questionnaire Attached

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

II. INTERVIEWS (Continued)

3. O & M On-Site Staff

Name	Title	Date
David Hilliard	Operator	June 1, 2006

Interviewed ☐ at Site ☑ at Office ☐ by Phone Phone No _____

Interview Summary ☑ Interview Summary Report/Questionnaire Attached

4. Regulatory Agencies and Local Authorities

(i e., ADEQ, EPA, City of Phoenix, Maricopa County Department of Environmental Services, etc) *Fill in all that apply*

Agency Environmental Protection Agency (EPA)

Contact	Name	Title	Date	Phone No
	Nadia Hollan	Project Manager	May 10, 2006	415-972-3187

Interview Summary ☑ Interview Summary Report/Questionnaire Attached

Representing City of Phoenix

Contact	Name	Title	Date	Phone No
	Karen O'Regan	Env Programs Manager	May 25, 2006	602-256-5654

Interview Summary ☑ Interview Summary Report/Questionnaire Attached

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

II. INTERVIEWS (Continued)

5. The Community (i e , Community Advisory Board, Surrounding Residence, Environmental Conservation Groups)
Fill in all that apply

Representing: Malcolm Pirnie and Hall & Evans (Representing Joray)

Contact	Name	Title	Date	Phone No.
	Dave Gordon, Chris Mattison		May 25, 2006	602-797-4625

Interview Summary: ☑ Interview Summary Report/Questionnaire Attached

Representing: CH2MHill on behalf of Honeywell

Contact	Name	Title	Date	Phone No
	George Ring	Consultant	June 9, 2006	480-966-8188

Interview Summary: ☑ Interview Summary Report/Questionnaire Attached

Representing: Freescale Semiconductor

Contact	Name	Title	Date	Phone No
	Tom Suriano	Remediation Program Manager	May 10, 2006	480-413-5182

Interview Summary: ☑ Interview Summary Report/Questionnaire Attached

Representing: Community Advisory Board and Surrounding Residents

Contact	Name	Title	Date	Phone No
	Martha Breitenbach	CAB member	May 23, 2006	

Interview Summary: ☑ Interview Summary Report/Questionnaire Attached

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

III. ONSITE DOCUMENT AND RECORDS VERIFICATION

1. On-Site Documents

☑ GWTP System O & M Manual	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Groundwater Monitoring Plan (SAP)	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Treated Effluent Monitoring Plan (SAP)	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Health and Safety Plan	☑ Readily Available	☑ Up to Date	☐ N/A
☐ Ambient Air Monitoring Plan	☐ Readily Available	☐ Up to Date	☑ N/A
☐ Storm Water Pollution Prevention Plan	☐ Readily Available	☐ Up to Date	☑ N/A
☑ Contingency/Emergency Response Plan	☑ Readily Available	☑ Up to Date	☐ N/A
☑ As-Built Drawings	☑ Readily Available	☑ Up to Date	☐ N/A

Remarks The 20th Street Groundwater Teatment Facility Operation & Maintenance Manual incorporates record drawings, health & safety plan, sampling and analysis plan, and all system equipment specifications and maintenance procedures via volumes within the manual

2. Permits and Service Agreements

☐ ADOT Agreements	☐ Readily Available	☐ Up to Date	☑ N/A
☐ NP DES	☐ Readily Available	☐ Up to Date	☑ N/A
☐ PQGWWP Permit	☐ Readily Available	☐ Up to Date	☑ N/A
☑ City of Phoenix Agreements/Permits	☑ Readily Available	☐ Up to Date	☐ N/A
☑ SRP	☑ Readily Available	☑ Up to Date	☐ N/A
☐ Others _____	☐ Readily Available	☐ Up to Date	☑ N/A

Remarks

3. Operations, Maintenance, and Inspection Logs

☑ GWTP Daily Activities Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ GWTP Monthly Operations Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ GWTP Pump Maintenance Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ GWTP Instrumentation Calibration Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Peripheral Equipment Maintenance Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Extraction Wells Maintenance Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ GW Monitoring Well Maintenance Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Liquid Phase Carbon Changeout Logs	☑ Readily Available	☑ Up to Date	☐ N/A
☑ UV Oxidation Maintenance Logs	☐ Readily Available	☐ Up to Date	☑ N/A
☑ Chemical Feed Systems Maintenance Logs	☐ Readily Available	☐ Up to Date	☑ N/A

Remarks UV Oxidation and chemical feed systems not in use

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

III. ONSITE DOCUMENT AND RECORDS VERIFICATION (Continued)

4 Records

☑ Employee O & M Training Records	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Employee OSHA Certification Records	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Site Incident Records	☑ Readily Available	☑ Up to Date	☐ N/A
☑ GWTP Effluent Monitoring Records	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Liquid Phase Carbon Changeout Records	☑ Readily Available	☑ Up to Date	☐ N/A
☐ Sulfuric Acid Usage Records	☐ Readily Available	☐ Up to Date	☑ N/A
☐ Hydrogen Peroxide Usage Records	☐ Readily Available	☐ Up to Date	☑ N/A

Remarks UV Oxidation and chemical feed systems not in use

5. Monitoring Data

☑ Groundwater Monitoring Data	☑ Readily Available	☑ Up to Date	☐ N/A
☑ Treated Groundwater Effluent Data	☑ Readily Available	☑ Up to Date	☐ N/A
☑ pH Monitoring Data	☑ Readily Available	☑ Up to Date	☐ N/A
☐ Ambient Air Monitoring Data	☐ Readily Available	☐ Up to Date	☑ N/A
☑ Waste Analysis/Characterization Data	☑ Readily Available	☑ Up to Date	☐ N/A

Remarks

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

IV. O & M COST EVALUATION

1. O & M Implementation Organization

- [ ] Agency
- [ ] Agency Contractor
- [ ] PRP
- [x] PRP Contractor
- [ ] Other Supervising contracotr Conestoga-Rovers & Assocdiates, Inc

2. O & M Cost Records

- [ ] Readily Available
- [ ] Up to Date
- [x] Funding Mechanism/Agreement in Place

Original O & M Cost Not Provided

- [ ] Breakdown Attached

Actual Annual O & M Costs for Review Period

2001		[ ] Breakdown Attached	[x] Not Available
2002		[ ] Breakdown Attached	[x] Not Available
2003		[ ] Breakdown Attached	[x] Not Available
2004		[ ] Breakdown Attached	[x] Not Available
2005		[ ] Breakdown Attached	[x] Not Available

3 Identification of Unanticipated or Unusually High/Low O & M Cost During Review Period

Describe Applicable Cost(s) and Reason(s) for Each Year *Not Provided*

Year 2001

Year 2002

Year 2003

Year 2004

Year 2005

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

V. GENERAL SITE CONDITIONS INSPECTION

1 **Access Restrictions** ☑ Applicable ☐ Not Applicable

Perimeter Fencing ☑ Good Condition ☐ Bad Condition

Remarks _____

Access Gates ☑ Good Condition ☐ Bad Condition

Remarks _____

Perimeter Signs ☑ Good Condition ☐ Bad Condition

Remarks _____

Evidence of Vandalism/Tresspassing ☑ Good Condition ☐ Bad Condition

Remarks _____

2 **Institutional Controls** ☐ Applicable ☑ Not Applicable

Deed Restrictions in Place ☐ No ☐ Yes ☑ Not Applicable

Remarks _____

Evidence of Land Use Changes On-Site ☐ No ☐ Yes ☑ Not Applicable

Remarks _____

Evidence of Land Use Changes Off-Site ☐ No ☐ Yes ☑ Not Applicable

Remarks _____

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

VI GWTP VISUAL INSPECTION

1. Overall Control/Monitoring System

Was system in operation?	☐ No	☑ Yes	☐ Not Applicable
Were all control/monitoring systems functioning properly?	☐ No	☑ Yes	☐ Not Applicable

Remarks:

2. Chemical Feed Pumps

Are pumps in good condition?	☐ No	☐ Yes	☑ Not Applicable
Are pump seals intact and free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are pumps operating smoothly (no excessive vibration)?	☐ No	☐ Yes	☑ Not Applicable
Are pumps operating quietly (no excessive noise)?	☐ No	☐ Yes	☑ Not Applicable
Are all piping connections and valves free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are pumps' operating controls functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is pumps' instrumentation functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Has secondary containment been provided?	☐ No	☐ Yes	☑ Not Applicable

Remarks: Chemical feed pumps not in use

3. GAL Backwash Wastewater Tank

Tank Capacity: 48,000 Gallons Construction Material: Reinforced Concrete

Is tank in good condition?	☐ No	☑ Yes	☐ Not Applicable
Is tank free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Is the piping connected to the tank free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Are levels monitored at the tank?	☐ No	☑ Yes	☐ Not Applicable
Are the tank's control systems functioning properly?	☐ No	☑ Yes	☐ Not Applicable
Is the tank's instrumentation functioning properly?	☐ No	☑ Yes	☐ Not Applicable
Does the tank have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Does the tank have leak detection systems?	☐ No	☐ Yes	☑ Not Applicable
Does the tank's piping have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Does the tank's piping have a leak detection system?	☐ No	☐ Yes	☑ Not Applicable
Does the tank have appropriate signs?	☐ No	☑ Yes	☐ Not Applicable
Are fugutive emissions from the tank controlled?	☐ No	☑ Yes	☐ Not Applicable

Remarks:

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

VI. GWTP VISUAL INSPECTION (Continued)

4 Static Mixer

Is mixer in good condition?	☐ No	☐ Yes	☑ Not Applicable
Is mixer free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is all piping connected to the mixer free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is mixer's control system functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is mixer's instrumentation functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Does mixer have secondary containment?	☐ No	☐ Yes	☑ Not Applicable

Remarks: Chemical feed system not in use

5 Acid Feed System

Tank Capacity: 3,000 Gallons Construction Material: _____

Is acid bulk tank in good condition?	☐ No	☐ Yes	☑ Not Applicable
Is acid bulk tank free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is all piping connected to the acid bulk tank free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is acid bulk tank's control system functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is acid bulk tank's instrumentation functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Does acid bulk tank have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Does acid unloading area have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Does acid piping have secondary containment?	☐ No	☐ Yes	☑ Not Applicable

Remarks: Acid feed not in use

6. H_2O_2 Feed System

Tank Capacity: 3,000 Gallons Construction Material: _____

Is H_2O_2 bulk tank in good condition?	☐ No	☐ Yes	☑ Not Applicable
Is H_2O_2 bulk tank free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is all piping connected to the tank free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is tank's control system functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is tank's instrumentation functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Does tank have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Secondary containment at H_2O_2 unloading area?	☐ No	☐ Yes	☑ Not Applicable
Does H_2O_2 piping have secondary containment?	☐ No	☐ Yes	☑ Not Applicable

Remarks: H_2O_2 feed not in use

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

VI. GWTP VISUAL INSPECTION (Continued)

7. UV Oxidation System

Are reactors in good condition?	☐ No	☐ Yes	☑ Not Applicable
Are reactors free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is all piping connected to the UV/OX free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Are control systems functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Are instrumentation systems functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is UV/OX electrical system functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Do reactors have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Do reactors have leak detection systems?	☐ No	☐ Yes	☑ Not Applicable
Does UV/OX piping have secondary containment?	☐ No	☐ Yes	☑ Not Applicable
Are Quartz sleeves clean/transparent?	☐ No	☐ Yes	☑ Not Applicable
Are Quartz sleeve wipers operating properly?	☐ No	☐ Yes	☑ Not Applicable

Remarks UV/OX not in use

8. Liquid Phase GAC Units

Are vessels in good condition?	☐ No	☑ Yes	☐ Not Applicable
Are vessels free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Is all piping connected to the vessels free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Is carbon breakthrough monitored at each tank?	☐ No	☑ Yes	☐ Not Applicable
Are vessels' control systems functioning properly?	☐ No	☑ Yes	☐ Not Applicable
Is vessels' instrumentation functioning properly?	☐ No	☑ Yes	☐ Not Applicable
Do vessels have secondary containment?	☐ No	☑ Yes	☐ Not Applicable
Do vessels have leak detection systems?	☐ No	☐ Yes	☑ Not Applicable
Does vessels' piping have secondary containment?	☐ No	☑ Yes	☐ Not Applicable
Does vessels' piping have leak detection system?	☐ No	☐ Yes	☑ Not Applicable
Are sample ports provided at each vessel?	☐ No	☑ Yes	☐ Not Applicable

Remarks

9. Process Piping (Liquid)

Is piping in good condition?	☐ No	☑ Yes	☐ Not Applicable
Is piping free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Does piping have secondary containment?	☐ No	☑ Yes	☐ Not Applicable
Does piping have leak detection systems?	☐ No	☐ Yes	☑ Not Applicable

Remarks

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

VI. GWTP VISUAL INSPECTION (Continued)

10 Collection Sumps

For each collection sump, where does the collected liquid go? Sumps discharge to the backwash tank, which subsequently discharges to the sanitary sewer Backwash is pumped via manual control

Are sumps in good condition?	☐ No	☑ Yes	☐ Not Applicable
Are pumps functioning properly?	☐ No	☑ Yes	☐ Not Applicable
Is leak detection system provided?	☐ No	☐ Yes	☑ Not Applicable

Remarks

11. Electrical Enclosures and Panels

Are system(s) in good condition?	☐ No	☑ Yes	☐ Not Applicable
Are system(s) properly rated?	☐ No	☑ Yes	☐ Not Applicable
Are system(s) functional?	☐ No	☑ Yes	☐ Not Applicable

Remarks

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

VII. GWTP VISUAL INSPECTION (UV/OX SYSTEM)

1. Air Compressor and Receiver

Is compressor in good condition?	☐ No	☑ Yes	☐ Not Applicable
Is compressor seal intact and free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Compressor operating smoothly (no excessive vibration)?	☐ No	☑ Yes	☐ Not Applicable
Is compressor operating quietly (no excessive noise)?	☐ No	☑ Yes	☐ Not Applicable
Is compressor operating as designed?	☐ No	☑ Yes	☐ Not Applicable
Is compressor connection and valve free of leaks?	☐ No	☑ Yes	☐ Not Applicable
Are compressor operating controls functioning properly?	☐ No	☑ Yes	☐ Not Applicable
Is compressor instrumentation functioning properly?	☐ No	☑ Yes	☐ Not Applicable

Remarks approx 105 psi

2. Air Compressor Oil/Condensate/Filters

Is oil changed according to manufacturer?	☐ No	☑ Yes	☐ Not Applicable
Is oil level maintained?	☐ No	☑ Yes	☐ Not Applicable
Are fluid traps drained regularly/automatically?	☐ No	☑ Yes	☐ Not Applicable
Are fluid receiving tanks drained regularly/automatically?	☐ No	☑ Yes	☐ Not Applicable
Are inlet filters clean?	☐ No	☑ Yes	☐ Not Applicable
Are motor belts tightened properly?	☐ No	☑ Yes	☐ Not Applicable
Is oil system and condensate draint free of leaks?	☐ No	☑ Yes	☐ Not Applicable

Remarks

3. Air Dryer

Is dryer in good condition?	☐ No	☐ Yes	☑ Not Applicable
Are all flanges and valve stem seals free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is all piping connected to the dryer free of leaks?	☐ No	☐ Yes	☑ Not Applicable
Is dryer functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is dryer control system functioning properly?	☐ No	☐ Yes	☑ Not Applicable
Is dryer instrumentation functioning properly?	☐ No	☐ Yes	☑ Not Applicable

Remarks

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

VIII GROUNDWATER EXTRACTION WELLS INSPECTION

Extraction Well Locations.

List of Wells Inspected EW-S, EW-N inspected and photographed

Vaults in place?	☐ No	☑ Yes	☐ Not Applicable
Properly secured?	☐ No	☑ Yes	☐ Not Applicable
Vault in good condition?	☐ No	☑ Yes	☐ Not Applicable
Wellhead in good condition?	☐ No	☑ Yes	☐ Not Applicable
Wellhead plumbing in good condition?	☐ No	☑ Yes	☐ Not Applicable
System piping, valves, and valve boxes in good condition?	☐ No	☑ Yes	☐ Not Applicable
Spare parts and equipment readily available?	☐ No	☑ Yes	☐ Not Applicable

Remarks

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

IX GROUNDWATER MONITORING WELLS INSPECTION

Groundwater Monitoring Well Locations

List of Wells Inspected NONE

Vaults in place?	☐ No	☐ Yes	☑ Not Applicable
Vaults properly secured?	☐ No	☐ Yes	☑ Not Applicable
Vaults in good condition?	☐ No	☐ Yes	☑ Not Applicable
Wells in good condition?	☐ No	☐ Yes	☑ Not Applicable
Bollards present?	☐ No	☐ Yes	☑ Not Applicable
Routinely monitored?	☐ No	☐ Yes	☑ Not Applicable

Remarks

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

X OVERALL OBSERVATIONS

1. **Adequacy of Remedy**

GWTP and Extraction Wells

Groundwater Monitoring

Treated Effluent Monitoring

X. OVERALL OBSERVATIONS (continued)

2. Adequacy of O & M

GWTP and Extraction Wells

Groundwater Wells

Effluent Monitoring Systems

X. OVERALL OBSERVATIONS (continued)

3 **Early Indicators of Potential Remedy Failure**

GWTP and Extraction Wells The need to reduce the capacity of the pump installed in EW-S is an early indication of improper well construction, a reduction in groundwater elevations, or loss of production capacity due to competing pumping nearby Such a loss of production could result in remedy failure

Groundwater Wells

Effluent Monitoring Systems

X. OVERALL OBSERVATIONS (continued)

4. Opportunities for Optimization of O & M/Monitoring Activities

GWTP and Extraction Wells

Groundwater Monitoring

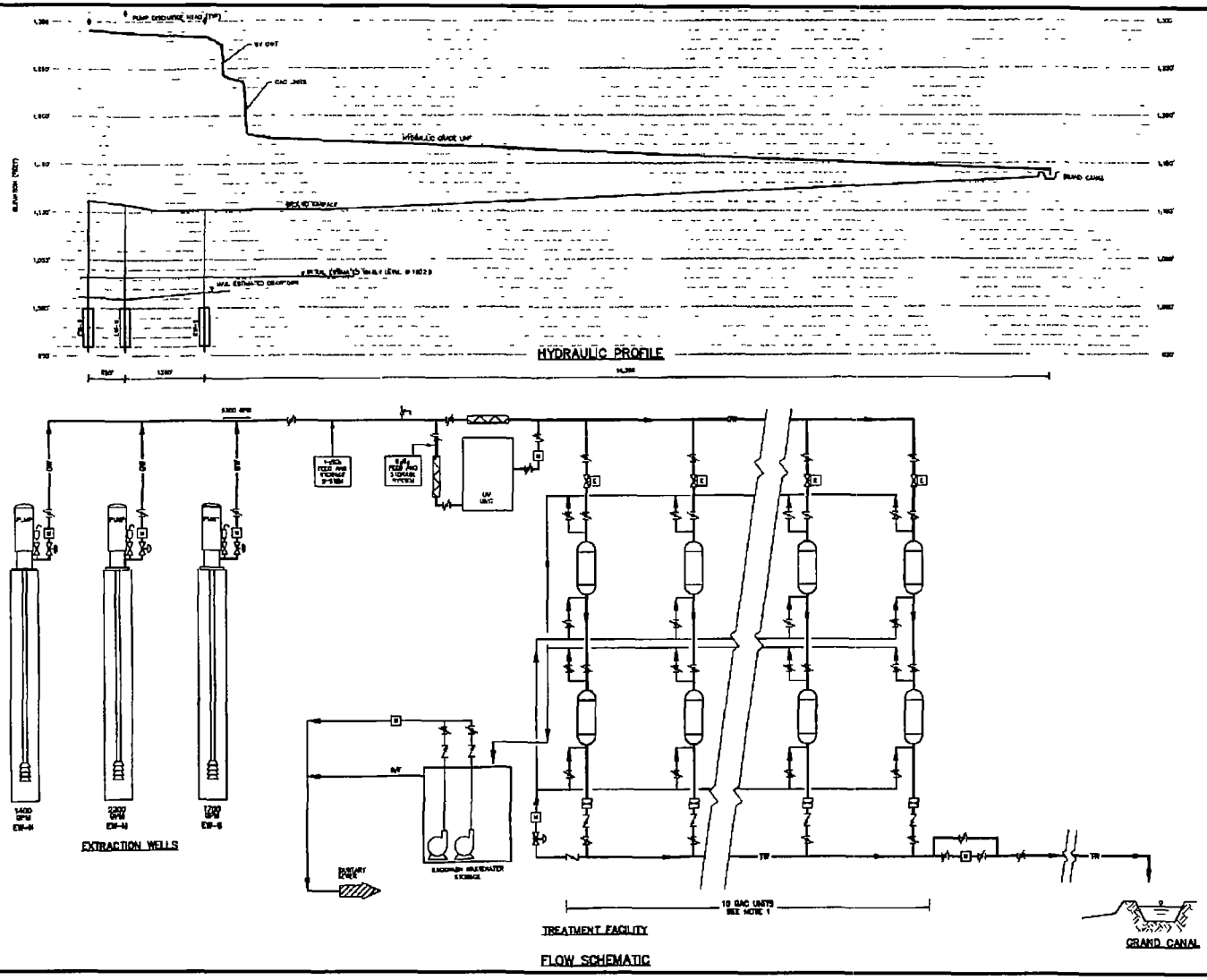
Effluent Monitoring Systems

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

SUPPLEMENTAL COMMENTS SHEETS (Attach to Appropriate Sections)

FIVE-YEAR REVIEW MOTOROLA 52ND STREET OU2
SITE INSPECTION CHECKLIST

HAND DRAWN DIAGRAM SHEET (Attach to Appropriate Section of Checklist)
See Attached Figures

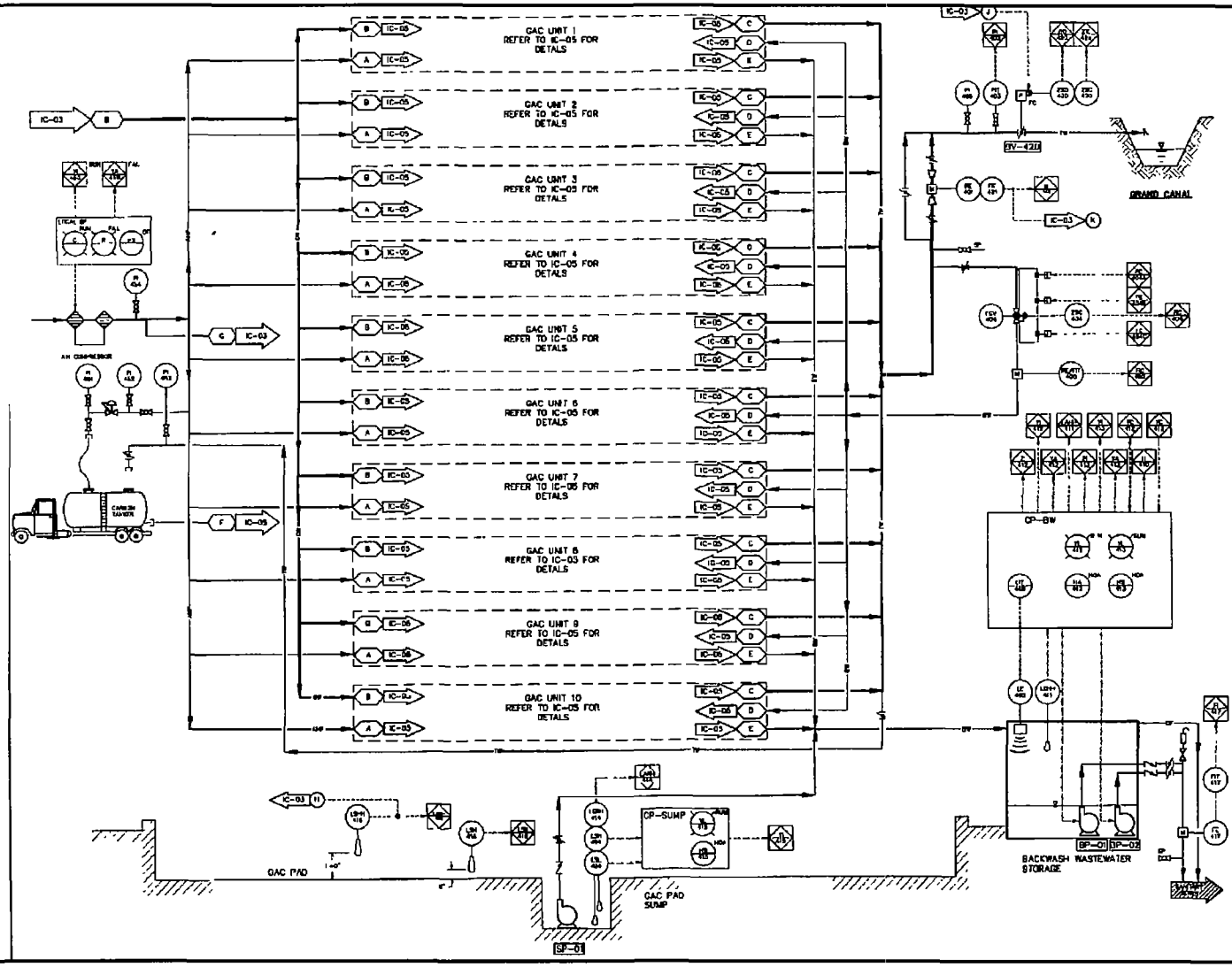


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 4

OU2 Flow Schematic
and Hydraulic Profile

LFR

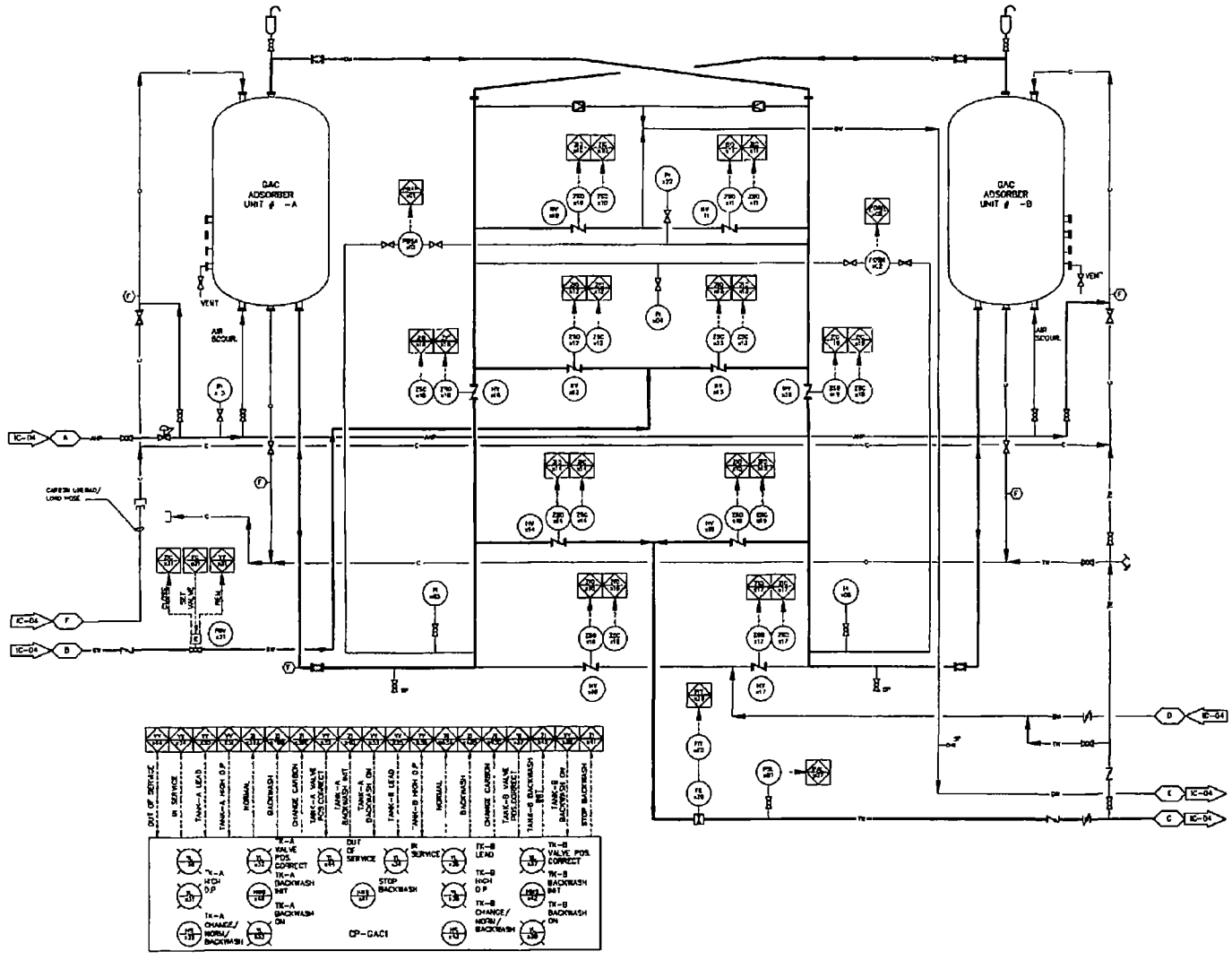


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 5

OU2 GAC System

LFR

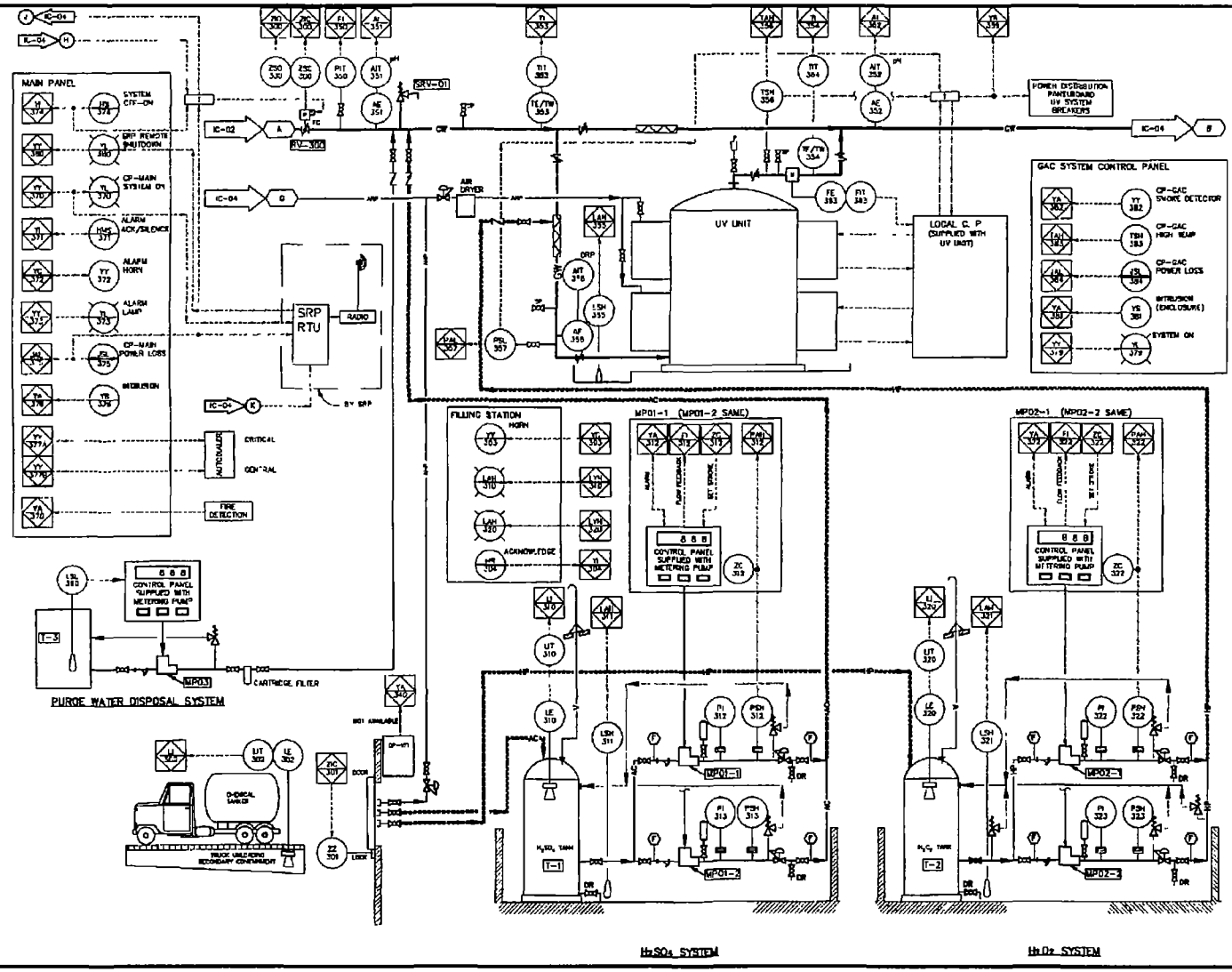


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 6

OU2 Typical GAC Unit

LFR

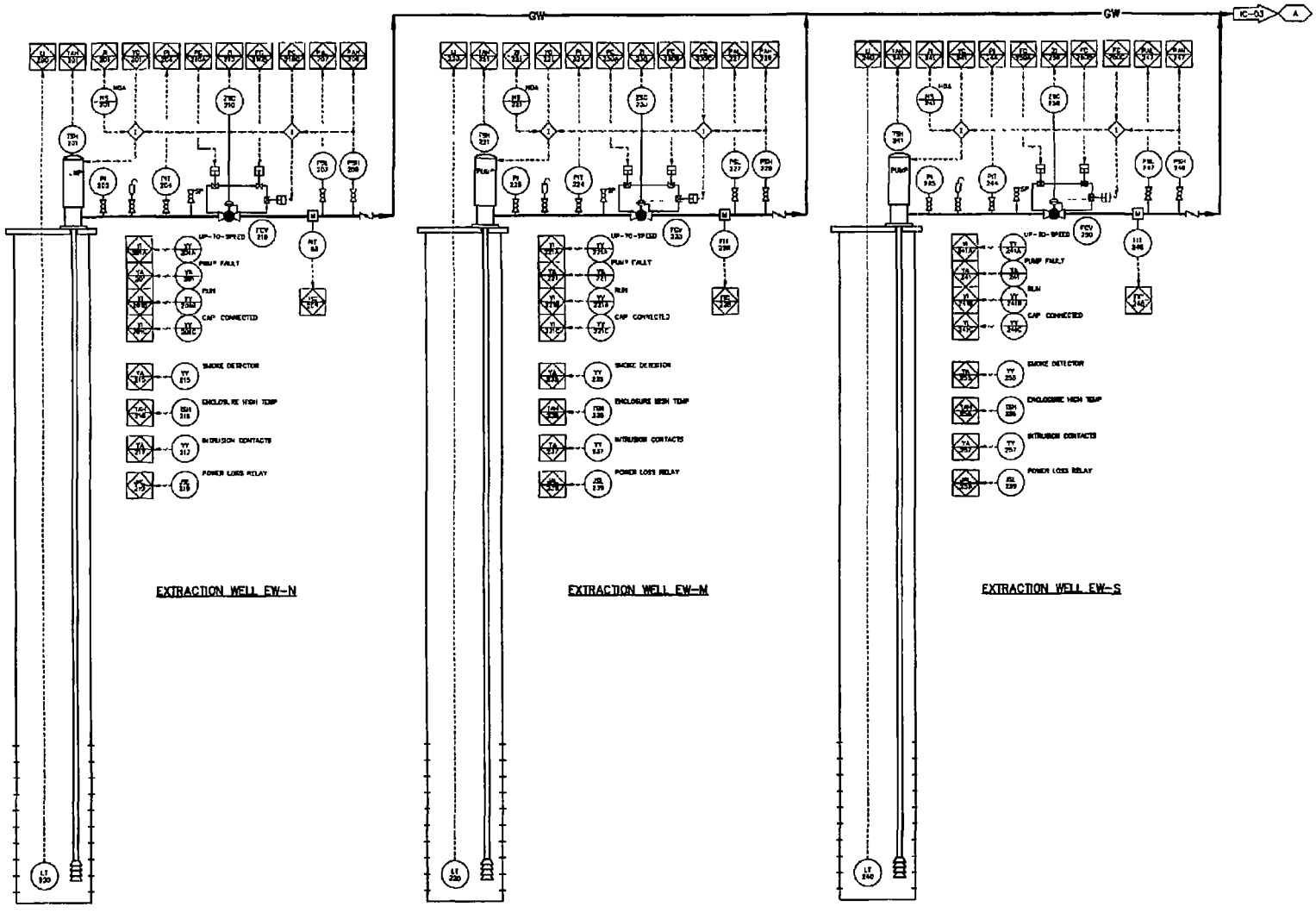


MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

Figure 7

OU2 UV Unit - Chemical Storage

LFR



MOTOROLA 52ND STREET SUPERFUND SITE
PHOENIX, ARIZONA

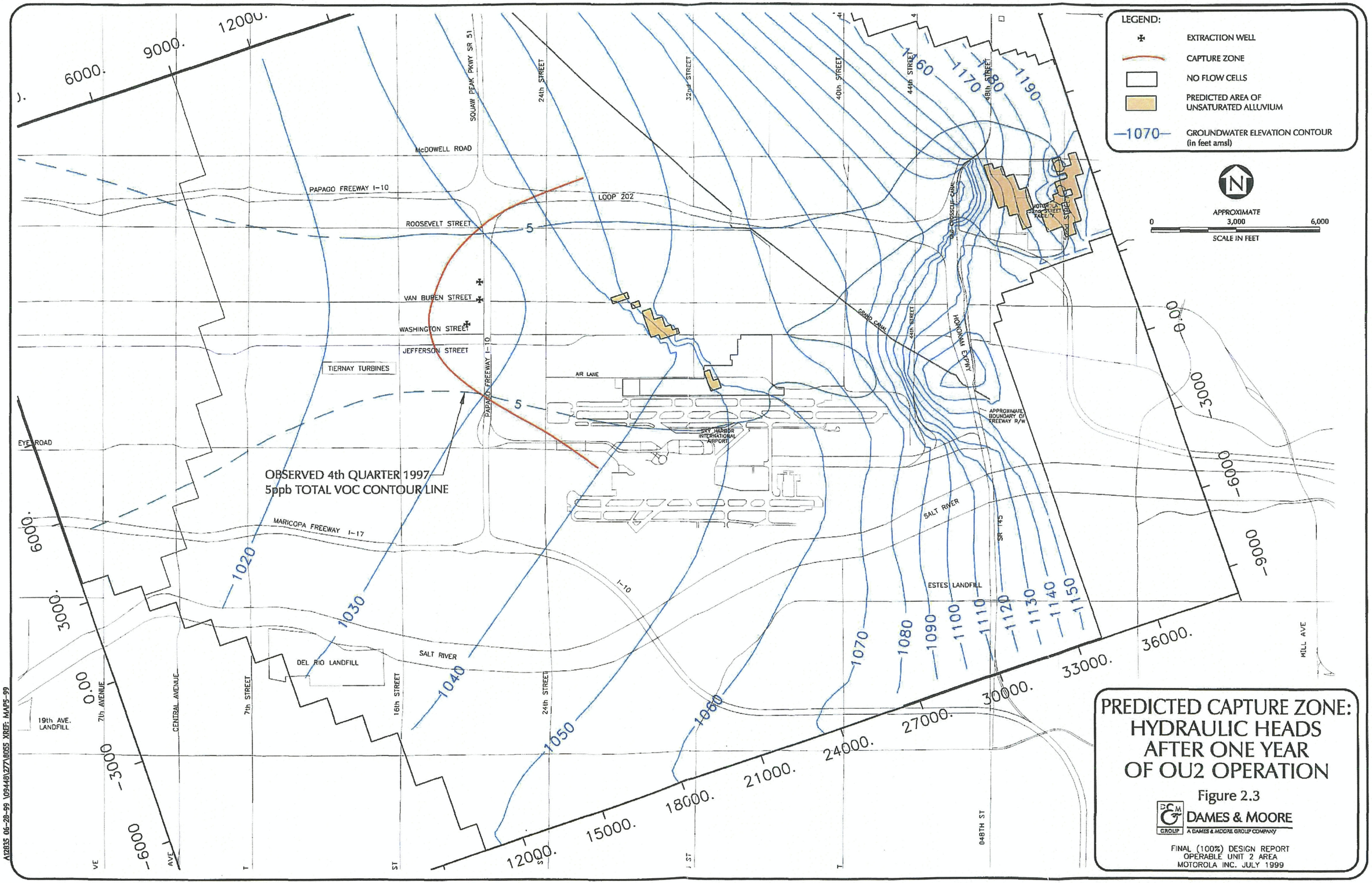
Figure 8

OU2 Extraction Well Diagram

LFR

APPENDIX H

100% DESIGN REPORT FIGURE 2.3



PREDICTED CAPTURE ZONE: HYDRAULIC HEADS AFTER ONE YEAR OF OU2 OPERATION

Figure 2.3

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FINAL (100%) DESIGN REPORT
OPERABLE UNIT 2 AREA
MOTOROLA INC. JULY 1999

A12835 06-28-99 \09448\277\8055 XREF: MAP5-99