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Five-Year Review Report

Second Five-Year Review Report

for

San Gabriel Valley Area 1 Superfund Site
Whittier Narrows Operable Unit

Los Angeles County, California

September 2011

PREPARED BY:

United States Environmental Protection Agency
Region 9
San Francisco, California

Approved by:

Kathleen Salyer
Assistant Director, Superfund Division
U.S. Environmental Protection Agency Region 9

Date: 9/14/11

Executive Summary

The remedy for the Whittier Narrows Operable Unit (OU) of the San Gabriel Valley (Area 1) Superfund Site in Los Angeles County, California is to protect groundwater in the Whittier Narrows and the Montebello Forebay portion of the Central Basin from upgradient groundwater contamination. The trigger for the commencement of this five-year review was the completion of the first five-year review in September 2006. This is the second five-year review for the Whittier Narrows OU.

EPA's remedy is intended to provide groundwater containment to prevent further migration of contamination above state or federal drinking water standards into the Central Basin. The major components of the remedy include groundwater extraction in the vicinity of Whittier Narrows Dam, treatment of the extracted water and discharge of the treated water for use by local water purveyors or for groundwater recharge.

The remedy is functioning as intended although additional data collection is required to determine if modifications to the groundwater extraction scheme may be needed to ensure long-term protectiveness.

The Whittier Narrows OU currently protects human health and the environment because there is no exposure to contaminated groundwater and groundwater containment is occurring. Additional monitoring wells are planned to help determine whether adjustments to the groundwater extraction systems are warranted to optimize groundwater containment.

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	chemicals of concern
DTSC	California Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
FS	Feasibility Study
gpm	gallons per minute
IC	institutional control
IROD	Interim Record of Decision
LARWQCB	Los Angeles Regional Water Quality Control Board
LGAC	liquid-phase granular activated carbon
MCL	maximum contaminant level
µg/L	micrograms per liter
NCP	National Contingency Plan
NDMA	n-Nitrosodimethylamine
NL	notification level
NPL	National Priorities List
O&M	Operation and Maintenance
ORD	EPA's Office of Research and Development
OU	Operable Unit
PCE	perchloroethylene
µg/L	micrograms per liter
RA	Remedial Action
RI	Remedial Investigation
RPM	Remedial Project Manager
RAO	Remedial Action Objective

RSE	Remedial System Evaluation
RD	Remedial Design
TCE	trichloroethylene
TBC	To Be Considered
THM	trihalomethane
TMDL	total maximum daily load
USACE	United States Army Corps of Engineers
VFD	variable frequency drive
VOC	volatile organic compound

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: San Gabriel Valley (Area 1) – Whittier Narrows OU		
EPA ID *(from WasteLAN)*: CAD980677355		
Region: 9	**State: CA**	**City/County: South El Monte/Los Angeles**
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:** N/A	
Has site been put into reuse? N/A		
REVIEW STATUS		
Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _DTSC_____		
Author name: Bella Dizon		
Author title: Remedial Project Manager	**Author affiliation: U.S. EPA Region 9**	
Review period: February to August 2011		
Date(s) of site inspection: 3/10/2011		
Type of review: ☒ Statutory ☒ Post-SARA		
Review number: ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specify) _____		
Triggering action: ☐ Actual RA Onsite Construction at OU #_____ ☐ Actual RA Start at OU#____ ☐ Construction Completion ☒ Previous Five-Year Review Report		
Triggering action date *(from WasteLAN)*: 9/28/2006		
Due date *(five years after triggering action date)*: 9/28/2011		

Five-Year Review Summary Form (continued)

Issues:

1) Low levels of contamination exists in the deeper aquifer (>400 feet below ground surface [bgs]) near the eastern extraction wells (EW4-5 and EW4-6). This contamination is below the extraction well screens. Additional monitoring is required to determine if migration of this deeper contamination is occurring past these wells.

Recommendations and Follow-up Actions:

1a) Review monitoring well program and determine the number and location of additional monitoring wells needed.

1b) Evaluate whether additional pumping or new extraction wells are needed to address the deeper (> 400 feet bgs) intermediate zone contamination and, if necessary, install wells and pipelines.

Protectiveness Statement(s):

The Whittier Narrows OU currently protects human health and the environment because there is no exposure to contaminated groundwater and groundwater containment is occurring. The additional monitoring described above will help determine whether adjustments to the groundwater extraction systems are warranted to optimize groundwater containment.

Other Comments:

In addition to the Issues and Recommendations, the following areas of improvement, which do not affect protectiveness, were identified during the five-year review:

1) The shallow zone and intermediate zone target extraction rates are not optimized to current contaminant conditions. Based on recent contaminant transport modeling, revised target extraction rates are needed.

2) Because the CDPH Notification Level for 1,4-dioxane has recently been lowered, a contingency plan with appropriate 1,4-dioxane trigger levels for initiating additional action(s) should be developed.

3) DTSC and EPA should finalize development of the Whittier Narrows OU Performance Evaluation Plan to provide routine evaluation of the remedy, including data collection, annual data evaluation and annual reporting.

4) A TMDL for nitrogen loading to Legg Lakes, as is currently proposed, could potentially impact discharges of treated water to the lakes. After a new TMDL is promulgated, EPA can submit a request to the RWQCB for alternative concentration-based wasteload allocations along with a Lake Management Plan.

5) If the revised extraction rates for the remedy developed while resolving the Issue identified above exceed the City of Whittier's water demands, EPA will need to re-engage potential treated water recipients and finalize arrangements for an additional end user.

Five-Year Review Report

I. Introduction

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and recommendations to address them.

The Agency is preparing this five-year review pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The agency interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The United States Environmental Protection Agency (EPA) Region 9 has conducted a five-year review of the interim remedy implemented at the Whittier Narrows OU of the San Gabriel Valley (Area 1) Superfund Site in Los Angeles County, California. This review was conducted from February 2011 through August 2011 by the Remedial Project Manager (RPM), the EPA Region 9 Technical Support Program and EPA RA Contractor CH2M Hill. The EPA RPM and CH2M HILL conducted the site inspection on March 10. This report documents the results of the review.

This is the second five-year review for the San Gabriel Valley (Area 1) Superfund Site. The triggering action for the initial statutory review was the start date of actual RA on-site construction at the Whittier Narrows OU, as shown in EPA's WasteLAN database: June 11, 2001. The trigger for this second five-year review was completion of the first five-year review in September 2006. The five-year review is required due to the fact that the interim remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure.

The San Gabriel Valley (Area 1) Superfund Site, which includes the Whittier Narrows OU, is one of four San Gabriel Valley groundwater sites listed on the National Priorities List (NPL). The other San Gabriel Valley sites are San Gabriel Valley Area 2 (which includes the Baldwin Park OU), San Gabriel Valley Area 3, and San Gabriel Valley Area 4 (which includes the Puente Valley OU). This five-year review only addresses the interim remedy implemented for the Whittier Narrows OU of the San Gabriel Valley (Area 1) Superfund Site. This review does not address the other OUs in Area 1,

including the El Monte OU, Richwood OU, Suburban OU and South El Monte OU. The El Monte and South El Monte OUs are located upgradient of Whittier Narrows OU and have various remedy components in both the RD and RA stages. The contamination in the southern South El Monte OU, immediately adjacent to the Whittier Narrows OU, is described in Attachment 6.

II. Site Chronology

Table 1: Chronology of Site Events

Event	Date
Initial discovery of contamination	1979
NPL listing	May 8, 1984
Remedial Investigation (RI)/Feasibility Study (FS) complete	September 1992
Monitoring-only Interim Record of Decision (IROD) signed for the Whittier Narrows OU	March 31, 1993
Increasing volatile organic compound (VOC) concentrations prompt additional investigation	1997-1998
FS Addendum and Proposed Plan	October 1998
Remedial Design start	April 5, 1999
IROD Amendment signed for the Whittier Narrows OU	November 10, 1999
Remedial Action start	September 27, 2000
Design completed for the wellheads, well pumps, and conveyance pipelines	January 2001
Design completed for the groundwater treatment plant	March 2001
Start of on-site construction	June 11, 2001
EPA and the State conduct pre-final inspection of the RA	January 24, 2002
CH2M HILL determines contractor has completed construction	March 31, 2002
EPA and the State conduct final inspection of the RA	May 16, 2002
Full-scale, 11,000 gallons per minute (gpm) system operations test	June to August 2002
Treatment plant modifications to split shallow and intermediate zones; construction of pipeline to City of Whittier	September 2002
Begin interim system operations and maintenance (O&M)	October 23, 2002
Detection of n-Nitrosodimethylamine (NDMA) in shallow zone	December 2002
Remedy becomes operational and function one year after final inspection	May 16, 2003
California Department of Public Health (CDPH) issues permit to City of Whittier for use of treated intermediate zone water as municipal drinking water supply	September 5, 2003
RA complete (Interim RA Report signed)	September 30, 2003
Construction of final connection to City of Whittier	October 2003
Transfer of O&M responsibilities from CH2MHill to City of Whittier	November 2004
Treated intermediate zone water delivered to the City of Whittier system	December 14, 2005
First Whittier Narrows OU five-year review completed	September 2006
Remediation System Evaluation completed by U.S. Army Corps of Engineers	May 2008
Work on second five-year review initiated	January 2011

III. Background

Physical Characteristics

San Gabriel Valley (Area 1) Superfund Site is located in eastern Los Angeles County. The Whittier Narrows OU encompasses approximately four square miles in the southern portion of the San Gabriel Basin (See Figure 1) and is the primary discharge point for groundwater and surface water flow exiting the Basin. Whittier Narrows is a 1.5-mile gap in the low-lying hills that separate the San Gabriel Basin from the downgradient Central Basin. The Whittier Narrows OU is bounded to the north by the Pomona Freeway (Highway 60) and to the south by the Montebello Forebay portion of the Central Basin near the Whittier Narrows Dam.

EPA designated Whittier Narrows as an OU specifically to address groundwater contamination flowing out of the San Gabriel Basin, through Whittier Narrows, into the Montebello Forebay portion of the Central Basin. The Montebello Forebay is critical to the Central Basin groundwater aquifers because this is where the aquifers are closest to the ground surface and receive most of their recharge.

Land and Resource Use

Groundwater in the Whittier Narrows OU flows primarily from northeast to southwest from the San Gabriel Basin into the Central Basin. There are drinking water wells located within Whittier Narrows and immediately downgradient in the Central Basin. The drinking water wells closest to the remedy within Whittier Narrows belong to the City of Whittier and are no longer in routine use because the City receives treated water from the EPA remedy. Drinking water wells in the Central Basin are located within 2,000 and 4,500 feet of the remedy. Analytical sampling data collected from the Central Basin drinking water supply wells currently contain only trace levels of contamination.

Most of the Whittier Narrows OU is undeveloped land dedicated to flood control and outdoor recreational uses. Densely populated residential, commercial and light industrial areas are immediately adjacent to the Whittier Narrows OU. This includes extensive industrial areas in the upgradient South El Monte OU. Industrial activities within the Whittier Narrows OU are generally limited to the far eastern portion of the Narrows.

History of Contamination

Groundwater contamination was first detected in the San Gabriel Valley in 1979. This contamination was most likely the result of decades of improper chemical handling and disposal practices at hundreds of industrial sites through the San Gabriel Valley. Although many of the laws regulating the handling and disposal of hazardous chemicals went into effect after 1970, historical documents demonstrate that local officials were concerned about the potential for groundwater contamination by industrial activities in the San Gabriel Valley as early as the 1950s. By 1984, high levels of VOC contamination was detected in 59 San Gabriel Valley water supply wells. Since that time, additional wells have been determined to be contaminated with VOCs along with other contaminants, including 1,4-dioxane, perchlorate, and NDMA.

The shallow and intermediate VOC contamination found in Whittier Narrows is migrating into the area from upgradient industrial contaminant sources. EPA has not found any significant sources of VOC contamination within the Whittier Narrows OU. Remediation of upgradient contaminant sources is occurring and will continue to occur as part of remedial activities in other San Gabriel Basin OUs, particularly the directly adjacent and upgradient South El Monte OU.

Initial Response

Since the late 1980s, EPA has conducted field investigations and evaluated remedial actions in Whittier Narrows. EPA signed an IROD on March 31, 1993, specifying that remedial action would be limited to groundwater monitoring only throughout Whittier Narrows. EPA implemented the monitoring-only IROD, which included installation of several monitoring wells and routine quarterly monitoring of wells in the area for VOCs. For several years, contaminant concentrations were relatively low throughout Whittier Narrows and groundwater resources in the Central Basin were not threatened. However, starting in 1997, a significant increase in VOC contaminated groundwater was detected migrating from upgradient areas into the western side of Whittier Narrows. The increases in contaminant concentrations suggested an imminent threat to groundwater resources in the Central Basin and EPA subsequently prepared an IROD Amendment (signed on November 10, 1999) for additional remedial actions.

Basis for Taking Action

VOCs are the primary chemicals of concern (COCs) that have been found above state and federal drinking water standards in the Whittier Narrows OU and upgradient areas. The VOCs found in the Whittier Narrows OU are mobile in groundwater and are probable and/or potential carcinogens. The primary route of potential exposure for the public would be through domestic use of untreated groundwater. Tetrachloroethylene (PCE) and trichloroethylene (TCE) are the most frequently detected COCs in groundwater analytical samples.

Elevated VOC contamination occurs primarily in the western half of the Whittier Narrows and PCE is the VOC detected at the highest concentrations. Exceedances of the drinking water standard (5.0 micrograms per liter [µg/L]) for PCE in this area have been detected up to 500 feet bgs. Prior to remedy implementation, PCE concentrations just above drinking water standards were present in isolated locations in the Montebello Forebay, downgradient of Whittier Narrows. This confirmed that groundwater contamination was flowing out of the San Gabriel Basin through Whittier Narrows and into the Montebello Forebay portion of the Central Basin. The Montebello Forebay area is the primary source of recharge for the Central Basin's drinking water aquifers.

Continuing groundwater contamination migrating from the San Gabriel Basin into this area could impact the water supply for millions of people.

IV. Remedial Actions

Remedy Selection

The remedial action selected in the 1993 IROD was limited to conducting groundwater monitoring in Whittier Narrows. EPA issued an IROD Amendment for the Whittier Narrows OU on November 11, 1999. As stated in the IROD Amendment, the Remedial Action Objective (RAO) for Whittier Narrows OU is:

> "To the extent technically and economically feasible, EPA intends to control contaminant migration in Whittier Narrows so that contamination originating from industrial activities in the San Gabriel Basin will not cause production wells in Whittier Narrows and the Central Basin to exceed drinking water standards."

EPA's objective for the Whittier Narrows OU is to protect groundwater resources in Whittier Narrows and the Montebello Forebay portion of the Central Basin from contamination emanating from the San Gabriel Valley. At the time of the IROD Amendment, groundwater contaminated with PCE at levels

above the drinking water standard had been detected just south of Whittier Narrows Dam in the Central Basin. EPA's remedy is intended to prevent further migration of contamination above state or federal drinking water standards into the Central Basin.

Table 2 provides a list of the COCs and the associated ARARs as listed in the 1999 IROD Amendment.

Table 2: ARARs for Chemicals of Concern[1]

Compound	ARAR (ug/L)	Source
1,1-Dichloroethane	5	California MCL
1,1-Dichloroethene	6	California MCL
1,1,1-Trichloroethane	200	Federal MCL
1,2-Dichloroethane	0.5	California MCL
Chloroform[2]	100	Federal MCL
Cis-1,2-Dichloroethene	6	California MCL
1,4-Dioxane	3	California Notification Level
Ethylbenzene	700	Federal MCL
Styrene	100	Federal MCL
Tetrachloroethene	5	Federal MCL
Trichloroethene	5	Federal MCL
Toluene	150	California MCL
Xylenes, total	1,750	California MCL

[1]As presented in the 1999 IROD Amendment

[2]This chemical is a trihalomethane (THM); the MCL listed is for the four THMs combined: chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

The major components of the Whittier Narrows remedy include:

- Groundwater containment through extraction in the vicinity of Whittier Narrows Dam near the downgradient limit of contaminant concentrations exceeding maximum contaminant levels (MCLs) or other relevant and appropriate standards;
- Groundwater treatment using two-stage liquid-phase granular activated carbon (LGAC) treatment;
- Conveyance systems (i.e., pipelines, booster pumps) to transport contaminated groundwater from the wells to the treatment plant and treated water from the plant to the designated end use;
- Treated water end-use by local water purveyors (for municipal supply or recreational use), potentially combined with recharge of some treated water back to the aquifer; and
- Groundwater monitoring to help measure the performance of the containment system and provide early warning of upgradient conditions that could affect the remedy.

Remedy Implementation

Groundwater flow modeling indicated that four shallow wells, extracting a total average flow rate of 5,000 gpm, would provide complete shallow-zone containment and that three intermediate-depth extraction wells, extracting a total average of 6,000 gpm, would provide complete intermediate-zone

containment. EPA installed the groundwater extraction wells during two phases of well drilling in May/June 1999 and August/September 2000.

Installation of the conveyance pipelines from the extraction wells to the treatment plant and from the treatment plant to the initial surface water discharge points (Legg Lakes, Nature Center Lake, and the Zone 1 Ditch-see Figure 2) began on June 11, 2001. Construction of the treatment plant began in July 2001 (see Figure 3). Construction was completed in March 2002 and EPA and California Department of Toxic Substances Control (DTSC) conducted the final construction inspection on May 16, 2002.

In 2002 and 2003, minor treatment plant piping modifications were completed and an additional conveyance pipeline was installed to allow for connection to the City of Whittier's system. This resulted in the current system configuration where the shallow zone water is kept separate from the intermediate zone water throughout the system and can only be discharged to Legg Lakes. The treated intermediate zone water is permitted for potable use and currently can only be distributed to the City of Whittier system.

In September 2003, the City of Whittier obtained a permit from CDPH that allows the City to use the treated intermediate zone water from the Whittier Narrows treatment plant as drinking water. Production of shallow zone water and discharge of the treated water to Legg Lakes is conducted in accordance with a three party Water Production Agreement that was executed by EPA, the Main San Gabriel Basin Watermaster and Los Angeles County.

System Operations/Operation and Maintenance (O&M)

EPA entered into a Cooperative Agreement with the City of Whittier to operate and maintain the Whittier Narrows groundwater treatment system. CH2M Hill began transferring the treatment plant operations to the City of Whittier in November 2004. Pursuant to the CDPH permit, the City modified the extraction wellheads and constructed flush lines at each well. In addition, the City changed out the carbon for all the potable vessels and conducted additional monitoring for CDPH. Since December 14, 2005, the City has distributed the treated intermediate zone water to its residents.

Routine system procedures and requirements are outlined in the Operations and Maintenance (O&M) Manual for the Whittier Narrows Operable Unit Remedial Action, dated September 2003, prepared for EPA by CH2M HILL and the Revised Operations, Maintenance, and Monitoring Plan for the Whittier Narrows Operable Unit Remedial Action, dated September 2003, prepared for EPA by CH2M HILL. Both of these documents were approved by CDPH. Use of the treated intermediate zone water as a drinking water supply for the City adds significant operational requirements pursuant to the CDPH permit, including daily operator involvement and extensive water quality monitoring.

Daily operator activities include driving around the project site to visually inspect the extraction wells, the wellfield power/control platforms, and the treatment plant. The operator also visually inspects the LGAC vessels and checks the pressure drop across each LGAC vessel. In addition, the operators routinely record meter readings, conduct sampling, perform required maintenance, and make minor system repairs.

The groundwater extraction and treatment systems are setup with a large number of automated alarm conditions to alert the operator. Examples include failure of a system component (e.g., a booster pump) or detection of a parameter outside of the designated operational range (e.g., elevated pressure differential across an LGAC vessel). The operator performs system checks to confirm the readings recorded by the operating system.

The primary measurement of treatment system performance is water quality monitoring. The CDPH permit contains extensive monitoring requirements to verify system performance and ensure that all treated water meets permit requirements. Monitoring locations include: upgradient monitoring wells, operating extraction wells, in-plant water from each LGAC vessel, and treatment plant effluent. All treated water analytical sampling results have been non-detect for all VOCs.

In general, system O&M is relatively straightforward. Although the system capacity is much larger than most groundwater remediation systems, the technologies employed (groundwater pumping, carbon adsorption treatment and conveyance) are not complicated and require relatively minimal oversight.

One operational issue raised in the first five-year review was an electrical system failure observed in 2005/2006. As described in the first five-year review report, in an attempt to remedy the problem, electrical cables running to several of the extraction wells were replaced, cable splices and connections were raised above-grade, and variable frequency drives (VFDs) were adjusted. There have not been any further failures or significant electrical issues since the work was completed in 2006.

Annual O&M Costs

Table 3 provides a summary of the O&M costs incurred to operate the system over the last five years. The actual costs are also compared to the estimated O&M costs from the IROD Amendment (adjusted to match current conditions).

The O&M costs incurred over most of the last four and one-half years have been consistent with the IROD cost estimate (after adjustment for inflation through 2006) on a per acre-foot extracted basis. The one year where costs were substantially higher than the IROD estimates (October 2008 through September 2009) was the result of an extended system downtime experienced during the carbon changeout that year, which lowered extraction rates, combined with the large costs associated with the periodic carbon change outs. As shown in Table 3, the costs per acre-foot of extracted water in the other years have ranged from $69 to $113, compared to the adjusted IROD cost estimate of $102.

Table 3: Annual System Operations/O&M Costs

Dates		Volume Extracted (acre-feet)	O&M Costs	Cost per Acre-Foot of Extracted Water
From	To			
Annual O&M Cost Estimate from IROD[1]		12,100	$1,238,000 (2006 dollars)	$102
October 2006	September 2007	8,428	$634,000	$75
October 2007	September 2008	5,968	$546,000	$91
October 2008	September 2009	5,473	$1,085,000[2]	$198
October 2009	September 2010	7,818	$886,000	$113
October 2010	March 2011	3,685	$255,000	$69

[1] The O&M costs from the IROD Amendment have been revised to a purveyor reimbursement of $10/ac-ft (instead of $40/ac-ft), which is applied only to the intermediate water (73% of the IROD volume). Also, the ROD costs have been escalated from 1999 to 2006 assuming a 3.5% annual increase.
[2] Includes large carbon changeout cost, which also resulted in considerable downtime and lower extraction volumes

V. Progress since the Last Five-Year Review

The last five-year review concluded:

The remedy at Whittier Narrows OU is protective of human health and the environment.

In addition, a number of issues were raised and most of the recommendations and follow-up actions needed to address these issues have either been completed or they were determined through further evaluation to be unnecessary. A brief summary of each issue, its recommendation(s)/follow-up action(s), and status is presented below:

Issue	Recommendation(s)/Follow-up Action(s)	Status
Shallow zone extraction and long-term end-use	1) Evaluate contaminant transport within shallow zone to determine minimum extraction rate; permanently reduce shallow zone extraction rate as appropriate. 2) Finalize agreements for long-term end-use.	Contaminant transport evaluations completed and permanent reductions in shallow-zone target rates are planned. Agreements for long-term end use were finalized in 2008.
Annual O&M Costs	1) Conduct Remedy System Evaluation (RSE) to identify optimization opportunities and cost savings. 2) Negotiate reduced CDPH permit monitoring.	The USACE completed the RSE in May 2008. Some optimization/cost saving actions implemented with more expected after revised target pumping rates are finalized. Multiple reductions in CDPH permit monitoring have been approved.
Electrical system failures	USACE investigation into electrical cable and system failures.	USACE evaluation did not resolve the specific cause of failures. However, failed cables were replaced and upgraded and VFDs were adjusted. There have been no additional failures even after additional wellfield flooding.
Downgradient monitoring	After conducting September 2006 monitoring event, re-evaluate monitoring frequency.	After the 2006 event, it was determined that annual OU-wide monitoring should be performed. There are current efforts underway to evaluate appropriate data requirements needed to support remedy performance evaluation.

VI. Five-Year Review Process

Administrative Components

The Whittier Narrows OU five-year review team was led by Bella Dizon of EPA, Remedial Project Manager (RPM) for the Whittier Narrows OU and EPA RA Contractor CH2MHILL. The five-year review report was reviewed by the California Department of Toxic Substances Control (DTSC).

Community Notification and Involvement

Public Notice of the upcoming 2011 five-year review was published in the *San Gabriel Valley Tribune* on February 3, 2011.

Document Review

This five-year review consisted of a review of relevant documents (Attachment 1), O&M records, and monitoring data (see Attachment 6). Applicable groundwater cleanup standards (Attachment 2) and risk factors (Attachment 5) were also reviewed for comparison to the assumptions used in 1999 when the IROD Amendment was prepared.

Data Review

PCE is both the most widely detected VOC chemical contaminant and is the only VOC that regularly exceeds its MCL in the Whittier Narrows OU. Of the remaining COCs listed in Table 2, only TCE and

1,4-dioxane are regularly detected; however, these detections are generally below the MCL or notification level, respectively. PCE analytical sampling results from upgradient monitoring wells, remedy extraction wells, and downgradient monitoring and extraction wells were reviewed (see Figure 4 for locations of wells in Whittier Narrows) and these data, as well as data on other site contaminants, are discussed briefly below and in more detail in Attachment 6.

The current extent of PCE contamination in the Whittier Narrows OU and southern South El Monte OU is depicted in Attachment 6 Figures 1 through 4. These recent maps of PCE contamination are drawn using a more refined set of concentration contour intervals than prior maps of VOC contamination prepared for the area. Changes in the extent of contamination are discussed in the following text.

Shallow Zone Contamination

Shallow zone PCE concentrations have consistently declined over the last five years (2006 to 2010). As shown in Attachment 6 Figure 1, there are currently no shallow zone MCL exceedances within the Whittier Narrows OU. This continuing lack of an MCL exceedance indicates that continued extraction is not likely needed to meet the hydraulic containment remedial action objective for the shallow zone. The current extent of shallow contamination represents a dramatic reduction in the extent of shallow zone contamination since 2002 (Attachment 6, Figure 13) when there was a large area of groundwater contamination in the western portion of the narrows above 25 µg/L and smaller areas in excess of 50 and 100 µg/L surrounding wells MW4-72 and MW4-15.

A number of factors likely contributed to this observed reduction in contamination in the shallow zone in Whittier Narrows, including a reduction in contaminant mass loading from upgradient sources in the South El Monte OU, groundwater dilution, vertical migration of contamination into the intermediate zone and contaminant mass removal from Whittier Narrows OU remedy well pumping. Although there are persistent areas of elevated shallow zone groundwater contamination in the southern South El Monte OU (Attachment 6, Figure 1), these areas do not appear to be generating enough contaminant mass (load) to significantly affect the shallow groundwater migrating into Whittier Narrows.

Further, the below average water-level elevations that have persisted for much of the last decade in the region may also be contributing to a reduction in the contaminant mass loading available to enter the Whittier Narrows groundwater system. However, following record rainfall in the winter of 2005, shallow water levels rose dramatically (Attachment 6, Figures 19 and 20), yet there was not an associated spike in shallow zone concentrations observed in South El Monte source area groundwater. This may also indicate that shallow zone PCE concentrations within the Whittier Narrows OU are unlikely to increase due to these upgradient South El Monte sources areas.

As shown below in Table 4, the PCE concentrations in the shallow zone monitoring wells downgradient of the Whittier Narrows OU extraction wells have been consistently very low to non-detect from 2004 to present, despite the reduced extraction rates from the shallow zone extraction wells (Attachment 6, Table 12).

Additionally, based on review of the available data presented in Attachment 6, it does not appear that any of the emerging chemical contaminants (i.e., 1,4-dioxane, perchlorate and NDMA) will require remedial action in the near-term for Whittier Narrows OU shallow zone groundwater.

Based on these observations, EPA will evaluate, with State's input, the possibility of stopping or reducing the target rates for shallow zone extraction. If shallow extraction is stopped or reduced, an appropriate monitoring program will need to be developed to ensure that rising shallow zone

Table 4: Downgradient PCE Water Quality Data

Well	Screen Interval	Aug-04	Sep-06	Jan-08	Jan-09	Jan-10	Jan-11
		(μg/L)					
Shallow Zone							
Wells located between the extraction wells and Whittier Narrows Dam							
MW4-21B	70-90	1.3	ND	0.12	ND	ND	ND
MW4-23	70-90	ND, ND	ND	1.1	ND	ND	ND
MW4-25	25-50	ND	ND	---	ND	ND	ND
MW4-26	27-52	ND	---	---	ND	ND	ND
Wells located along Whittier Narrows Dam							
4-18-4	95-105	1.9	0.8	0.15	ND	ND	ND
4-19-5	40-50	ND	ND	ND	ND	ND	NS
4-20-2	70-80	ND	ND	ND	ND	ND	ND
WN01-9	95-105	ND*	NS	NS	ND	NS	1
Intermediate Zone							
Well located between the extraction wells and Whittier Narrows Dam							
MW4-21A	266-296	**8.3**	4.9	4.9	2.6	**5.5, 5.4**	3.6
Wells located along Whittier Narrows Dam or just south into the Central Basin							
MW441	285-295	ND, ND	ND	ND	---	---	ND
MW442	225-235	ND	ND	ND	---	---	ND
MW451	270-280	0.66	ND	ND	ND	ND	ND
MW452	200-210	1.5	ND	ND	ND	ND	ND
MW461	251-261	**5.6**	ND	ND	0.41	ND	ND
MW462	140-150	ND	ND	ND	ND	ND	ND
4-12-2	315-325	1.2	ND	0.33	ND	ND	ND
4-12-3	225-235	**9.2**	**5.6, 5.9**	**5.9**	1.6	2.3	0.99, 1.3
4-18-1	280-290	3.2	2.7	3.1	1.7, 1.7	4.2	3.1
4-18-2	230-240	3.6, 4.5	2.1	1.5	0.43	0.64	0.4
4-18-3	135-145	2.3	1.4	0.47	ND	ND	ND
4-19-1	295-305	3.7	ND	ND	ND	ND	ND, ND
4-19-2	230-240	3.3, 2.7	0.53	0.51	0.21	0.57	0.18
4-19-3	160-170	0.12	ND	ND	ND	ND	ND
4-20-1	350-360	0.82	3.2	2.3, 2.5	0.68	0.55	0.13
WN01-3	462-482	0.7*	NS	0.94	0.39, 0.41	NS	ND
WN01-4	392-402	0.9*	NS	0.6	0.31	NS	ND
WN01-5	334-344	ND*	NS	0.25	ND	NS	ND
WN01-6	273-283	ND*	NS	NS	ND	NS	ND
WN01-7	233-243	ND*	NS	NS	ND	NS	ND
WN01-8	163-173	ND*	NS	NS	ND	NS	1
Well located east of EPA extraction wells, upgradient of Whittier production wells							
4-22-1	430-440	2.9	**6.1**	**7.7, 9**	4.3	**9.9**	**10, 10**
4-22-2	385-395	**26**	**18, 12**	**25**	**13**	**19**	**16**
4-22-3	315-325	**11**	**11**	**6.5**	**7.1**	**8.9, 12**	**5.2**
4-22-4	215-225	0.18	3	4.3	0.5	0.57	0.67

Notes: duplicate samples are separated by comma and bolded numbers denote concentrations greater than the PCE MCL of 5 μg/L

ND = PCE not detected above detection limit

* Sample is from August '05

concentrations in the future would be detected in sufficient time to re-adjust the shallow zone extraction rates.

Intermediate Zone Contamination

The current extent of PCE contamination in the intermediate zone is shown in three maps (Attachment 6, Figures 2, 3 and 4), with each map drawn to cover a specific 150-foot thick depth interval. On review of the new maps, several observations are apparent regarding current intermediate zone contamination compared to 2002 when the remedy first began operations:

- The areal extent of the high PCE concentration areas towards the southern end of the South El Monte OU is somewhat smaller now compared to the area in 2002, but the changes do not appear to be significant.
- The extent of contamination above the PCE MCL upgradient of the Whittier Narrows OU extraction wells has not changed dramatically. The area with PCE contamination above the MCL is only slightly narrower. However, the width of the higher concentrations has shrunk more substantially and also extends a little further downgradient.
- In the vicinity of the extraction wells, the western edge of contamination has shifted towards the east.
- The Whittier Narrows OU extraction wells have significantly reduced the downgradient extent of intermediate zone contamination above the MCL. Only a small area of contamination above the PCE MCL remains in the 150- to 300-foot deep interval (Attachment 6, Figure 2).
- There is an area of deeper (450- to 600-feet below ground as shown on Attachment 6, Figures 4 and 10) intermediate zone contamination in the vicinity of the Whittier Narrows OU extraction wells EW4-5 and EW4-6 and towards the northeast (MW4-22). However, based on the existing water quality data (which are limited for these deeper intervals), it appears to be a relatively isolated area suggesting that the amount of contaminant mass migrating into the deeper intermediate zone horizons may be relatively small. Although additional downgradient monitoring is needed to confirm this, the deep contamination does not yet appear to have migrated as far as the Whittier Narrows Dam based on analytical sampling data collected at WN-01, which are all nondetect.

In general, downgradient PCE concentrations have continued to decline over the last five years. This decline has occurred despite intermediate zone extraction rates averaging less than 3,300 gpm over the last five years (Attachment 6, Table 12). This provides strong evidence that the remedial objective (to prevent exceedance of drinking water standard in Whittier Narrows and Central Basin production wells) can be met at a lower flow rate than the current intermediate zone target extraction rate of 6,000 gpm.

The changes in the distribution of contamination observed in groundwater sampling analytical data indicate that intermediate pumping should likely be focused on EW4-5 (center well) and EW4-6 (eastern well) rather than EW4-7.

The deep intermediate zone PCE contamination in excess of the MCL appears to extend to depths of greater than 400 feet bgs near and to the east/northeast of the extraction wells (see Attachment 6,

Figures 4 and 10). This contamination is below the extraction well screens. It is not clear how significant of a threat this potentially limited extent of deeper contamination represents to downgradient areas or nearby water purveyor production wells. As noted above, the closest wells belong to the City of Whittier and are not currently used regularly because the City receives treated water from the Whittier Narrows OU project. Additionally, other downgradient production wells in the Central Basin continue to have very low PCE concentrations. New, deeper intermediate zone monitoring wells located downgradient from the intermediate zone extraction wells are necessary to evaluate this issue.

Site Inspection

The five-year review site inspection was conducted on March 10, 2011 by EPA and CH2M HILL. Representatives from DTSC's engineering section also participated in the inspection. The City of Whittier's O&M manager, Dan McKenna, provided information on the status of the treatment systems and various facilities. The purpose of the inspection was to assess the integrity of the extraction and treatment system, including the extraction wells, electrical and control systems and the treatment plant. The inspection included a review of O&M activities, site conditions, equipment conditions and documenting observations. A copy of the site inspection checklist is included in Attachment 3.

The inspection found the system and site to be in generally good condition. There are a few minor items requiring repair, but nothing that impacts system operation or performance. Some of the past operational issues, such as frequent VFD failures and problems with submersible pumps, have been addressed through replacement or upgrades to more reliable equipment.

Interviews

The EPA RPM interviewed Dan Wall, Assistant Public Work Director for the City of Whittier, on March 8, 2011 and David Towell, CH2M HILL project manager, on May 5, 2011. The interview records for both of these interviews are included in Attachment 4. Through his role with the City of Whittier, Mr. Wall is fairly familiar with the project and the City's role in operating the system for EPA. He had an overall positive impression of the project and indicated that there had not been any concerns with the project raised by City residents. Mr. Towell is intimately familiar with the project through his long-term role in providing technical support to EPA in the Whittier Narrows OU. He described some of the improved conditions in the OU, both in contaminant distribution and system operations, and highlighted some technical issues that are the subject of ongoing evaluation and that may lead to increased cost savings in future remedy operations.

VII. Technical Assessment

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

The data review and evaluation, document review, ARARs review, risk assumptions review, and the results of the site inspection indicate that the remedy is functioning as intended by the IROD Amendment. The remedy has generally achieved the remedial objective of minimizing migration of contaminants into the Central Basin and potential impacts on production wells.

Shallow zone contamination is no longer present above the MCLs in the Whittier Narrows OU. Although the shallow zone extraction rates averaged only about 1,200 gpm over the past five years, which is well below the target rates, full containment of contaminant migration has been achieved as evidenced by the current shrinking extent of shallow groundwater contamination. As discussed above, there are likely a number of contaminant and hydrogeologic factors that have combined to reduce

shallow contamination in Whittier Narrows. Additionally, contaminant concentrations downgradient of the OU extraction wells remain low. Further, contaminant mass loads entering the Whittier Narrows OU from upgradient source areas appear to have declined and these conditions appear unlikely to change in the near-term. Significant reductions in the target rates for shallow zone extraction appear warranted.

For the intermediate zone, the average extraction rate over the past five years has been just under 3,300 gpm, which is only 55% of the target rate of 6,000 gpm. However, the downgradient extent of intermediate zone contamination and downgradient PCE concentrations (Table 4), have declined since 2006. This observed trend has continued relatively consistently since the start of remedy operations in 2002. These downgradient decreases indicate that the remedy has provided reasonable containment of contaminant migration and is operating in general accordance with remedial objectives. However, the small amount of downgradient contamination remaining, combined with the deeper intermediate zone contamination present near EW4-6 and MW4-22, indicate that containment should be further evaluated. Additional monitoring in the deeper portion of the intermediate zone (including new monitoring points) is required to determine if migration of this deeper contamination is occurring past these wells.

The predictive contaminant transport modeling that EPA is currently conducting, combined with the data evaluation presented in Attachment 6, should be used to select lower overall target extraction rates for the Whittier Narrows remedy and to determine whether supplemental pumping is needed to address the deeper intermediate contamination.

Although the evaluations conducted in support of this five-year review have indicated that the remedy is meeting the remedial objectives, a more formal process for evaluating remedy performance on an annual basis should be implemented. To facilitate this, EPA and DTSC are developing a Remedy Performance Evaluation Plan that identifies:

- the specific remedial objectives of the remedy;
- how compliance with those objectives will be determined;
- the data that needs to be collected to support remedy performance evaluations; and,
- the technical evaluations to be conducted each year to evaluate remedy performance.

An Annual Remedy Performance Evaluation Report should be prepared summarizing the available monitoring data, summarizing remedy performance and describing any upcoming technical evaluations or proposed changes to the remedy.

A comprehensive Groundwater Monitoring Plan should be included as an attachment to the Remedy Performance Evaluation Plan to ensure that sufficient data are collected to detect changing contaminant or hydrologic conditions that could impact remedy performance, to facilitate implementation of the Remedy Performance Evaluation Plan and to allow for preparation of the Annual Report.

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

There have been no significant changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in RAOs or Standards

The RAOs used at the time of remedy selection are still valid. There have been no changes in ARARs that affect the protectiveness of the remedy. However, there have been minor changes to some of the chemical-specific ARARs (listed above in Table 2) since the 1999 IROD Amendment (see Attachment 2):

- The federal MCL for chloroform (100 µg/L in the 1999 IROD) was lowered to 80 µg/L in 2002.
- The federal MCL for ethylbenzene of 700 µg/L was identified in the 1999 IROD. California adopted an MCL of 300 µg/L in 2003.
- The CDPH 1,4-dioxane notification level (NL) of 3 µg/L was identified as the standard in the IROD (see Table 2). CDPH lowered the 1,4-dioxane NL to 1 µg/L in November 2010.

The EPA Region 9 Water Division is supporting the Los Angeles Regional Water Quality Control Board (LARWQCB) in developing total maximum daily loads (TMDLs) for Legg Lakes. Legg Lakes is impacted by nutrients impairments (as characterized by periodic occurrences of elevated chlorophyll *a*). The TMDLs are being developed to address these impairments with the goal of reducing chlorophyll *a* such that it consistently meets target levels in the Lakes. The TMDLs are expected to reduce nutrient loads to Legg Lakes and nitrogen is one of the targeted nutrients. As described previously, the shallow zone groundwater extracted from the Whittier Narrows OU wells is treated and discharged to Legg Lakes. The nitrate levels in the treated shallow water (1.5 to 2 mg/L as nitrogen) are very low compared to most shallow groundwater in the San Gabriel Valley. The effluent concentrations are well below the drinking water MCL of 10 mg/L and the basin plan objective for surface water discharges of 8 mg/L. However, the TMDL limits being considered are in the 1.0 mg/L range.

It is not yet clear what the final TMDL limit will be for nitrogen or how soon it will be promulgated. However, the low limits being considered could potentially impact EPA's ability to discharge treated shallow water from the Whittier Narrows OU remedy directly to Legg Lakes without additional treatment. As noted above, significant reductions in shallow extraction may be warranted which would make discharge to Legg Lakes less critical. Regardless, alternative discharge options (e.g., discharge to other surface water bodies, reinjection, or recharge) may need to be considered in the future.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The original risk assessments identified the exposure pathways at Whittier Narrows as domestic use of groundwater including ingestion, inhalation, and dermal exposure. This five-year review qualitatively assessed the potential for vapor intrusion and determined that this exposure pathway is currently incomplete in Whittier Narrows (see Attachment 5 for further discussion).

Since the 1997 risk assessment addendum and 1998 supplemental risk analysis, there have been a number of changes to the toxicity values for certain contaminants of concern at the Whittier Narrows OU. Some revisions to the toxicity values indicate a lower risk from exposure to these chemicals than previously considered. On the other hand, evaluation of the toxicity values for 1,1-DCA, ethylbenzene, PCE and xylenes may indicate higher risks from exposure than previously considered. PCE is the only one of these commonly detected in Whittier Narrows OU groundwater.

The greatest uncertainty with toxicological changes for the Whittier Narrows OU 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." In 2009, EPA harmonized Region's 3, 6 and 9 similar risk-based screening levels into a single table: "Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites." The RSLs are developed using risk assessment guidance from the EPA Superfund program. They are risk-based levels derived from standardized equations combining exposure information assumptions with EPA toxicity data. The current RSL for TCE in tap water is 2.5 µg/L. TCE concentrations in Whittier Narrows OU extraction wells generally range from non-detect up to about 3 µg/L. TCE risk levels will need to be reviewed again in the 2016 five-year review.

The IROD also identified 1,4-dioxane as a COC, although it was not evaluated in the risk assessment. 1,4-Dioxane has been detected in the upgradient South El Monte OU at concentrations exceeding the CDPH drinking water NL of 1 µg/L. The treatment process at Whittier Narrows (LGAC adsorption) is not effective at removing 1,4-dioxane from groundwater. During the past five years, 1,4-dioxane has been detected at concentrations slightly above the CDPH NL in two extraction wells (EW4-5 [intermediate zone] and EW4-8 [shallow zone]), however, concentrations in these wells have not been above the NL since January 2009. The effluent from the treatment plant has never reached the NL of 1 µg/L and for the last two years has generally been between 0.6 µg/L and 0.8 µg/L.

As was noted in the first five-year review for Whittier Narrows, NDMA has been detected in Whittier Narrows above the CDPH NL of 0.01 µg/L. During past five years, NDMA has been detected in Whittier Narrows above the state NL in groundwater from two extraction wells (shallow zone wells EW4-3 and EW4-8) and two monitoring wells (MW4-24 shallow zone, MW4-13 shallow and intermediate zone). The primary source of NDMA in Whittier Narrows is the effluent from two Los Angeles County Sanitation District water reclamation plants, including one located just upgradient of the EW4-3 and EW4-8 shallow extraction wells. In mid-2010, the Sanitation District started a full-scale ultraviolet disinfection system at the Whittier Narrows Reclamation Plant that provides for greatly reduced NDMA concentrations in the plant effluent. This in turn should lead to declining NDMA concentrations in shallow groundwater in western Whittier Narrows.

During the past five years, perchlorate has been detected infrequently in Whittier Narrows OU monitoring and extraction wells and only at concentrations well below the California MCL of 6 µg/L.

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

As noted in the first five-year review, the original assessment of the site concluded that there would be no ecological receptors because it is a groundwater remedy with the preferred end-use of the treated water to be drinking water. However, as currently implemented, the extracted shallow zone water is treated and discharged on-site into Legg Lakes. The Whittier Narrows OU treatment system employs carbon adsorption (LGAC), which does not remove NDMA. Any NDMA present in groundwater from the shallow extraction wells is discharged directly to Legg Lakes after the water is treated for VOCs. However, NDMA concentrations in water discharged to Legg Lakes are in the low parts per trillion range which is orders of magnitude below concentrations that have the potential to effect aquatic life (in the parts per billion to parts per million range).

As described in the first five-year review, the 1999 IROD Amendment discusses governmental controls that affect extraction and use of groundwater. The portions of the Whittier Narrows OU that contain contaminated groundwater is generally undeveloped and is used as park, nature center and flood-control areas. There are no specifically tailored institutional control (IC) instruments in place at the site. However, there is very limited likelihood for uncontrolled extraction and use of contaminated

groundwater due to government controls. The governmental controls in place at the site act as effective institutional controls because the governmental agencies that manage the land are familiar with the administrative constraints on groundwater extraction. The primary governmental control is provided by the Amended Judgment of August 24, 1989 (including Amendments through February 24, 1992) in the matter of Upper San Gabriel Valley Municipal Water District v. City of Alhambra, et. al., amending the original judgment entered on January 4, 1973, by the Superior Court of California, County of Los Angeles. This judgment establishes the entity known as "Watermaster" with full authority to allocate water resources throughout the San Gabriel Valley. In addition, governmental controls on the use of groundwater as drinking water include EPA and California promulgated MCLs and related standards that require drinking water limits to be met prior to serving the water. These drinking water controls and the Watermaster's authority to regulate and allocate water resources essentially eliminate unregulated use of area groundwater; therefore, the remedy is currently protective.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and the site inspection, the remedy is functioning as intended by the IROD Amendment although further evaluation is needed of the the deeper zone contamination. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. The remedy is meeting all ARARs in the IROD Amendment, and there have been no changes in ARARs affecting the protectiveness of the remedy.

Although there have been some changes in the toxicity factors for the contaminants of concern that were used in the previous risk assessments, as detailed in Attachment 5, these do not impact risk levels or protectiveness. There have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

VIII. Issues

Table 5: Issues

Issues	Affects Current Protectiveness?	Affects Future Protectiveness?
Low levels of contamination exists in the deeper aquifer (>400 feet bgs) near the eastern extraction wells (EW4-5 and EW4-6). This contamination is below the extraction well screens. Additional monitoring is required to determine if migration of this deeper contamination is occurring past these wells.	No	Yes

IX. Recommendations and Follow-up Actions

Table 6: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Milestone Date
Potential need for additional/new pumping to address deeper contamination. Additional monitoring needed first.	1) Review monitoring well program and determine the number and location of additional monitoring wells needed.	EPA	2/2012
	2) Evaluate whether additional pumping or new extraction wells are needed to address the deeper (> 400 feet bgs) intermediate zone contamination and, if necessary, install wells and pipelines.	EPA	3/2013

In addition to the Issues and Recommendations, the following areas of improvement, which do not affect protectiveness, were identified during the five-year review

- The shallow zone and intermediate zone target extraction rates are not optimized to current contaminant conditions. Based on recent contaminant transport modeling, revised target extraction rates are needed.
- Because the CDPH Notification Level for 1,4-dioxane has recently been lowered, a contingency plan with appropriate 1,4-dioxane trigger levels for initiating additional action(s) should be developed.
- DTSC and EPA should finalize development of the Whittier Narrows OU Performance Evaluation Plan to provide routine evaluation of the remedy, including data collection, annual data evaluation and annual reporting.
- A TMDL for nitrogen loading to Legg Lakes, as is currently proposed, could potentially impact discharges of treated water to the lakes. After a new TMDL is promulgated, EPA can submit a request to the RWQCB for alternative concentration-based wasteload allocations along with a Lake Management Plan.
- If the revised extraction rates for the remedy developed while resolving the Issue identified above exceed the City of Whittier's water demands, EPA will need to re-engage potential treated water recipients and finalize arrangements for an additional end user.

X. Protectiveness Statement

The Whittier Narrows OU currently protects human health and the environment because there is no exposure to contaminated groundwater and groundwater containment is occurring. The additional monitoring described above will help determine whether adjustments to the groundwater extraction systems are warranted to optimize groundwater containment.

XI. Next Review

The next five-year review for the Whittier Narrows OU, San Gabriel Valley (Area 1) Superfund Site is required by September 2016, five years from the date of this review.

Figures

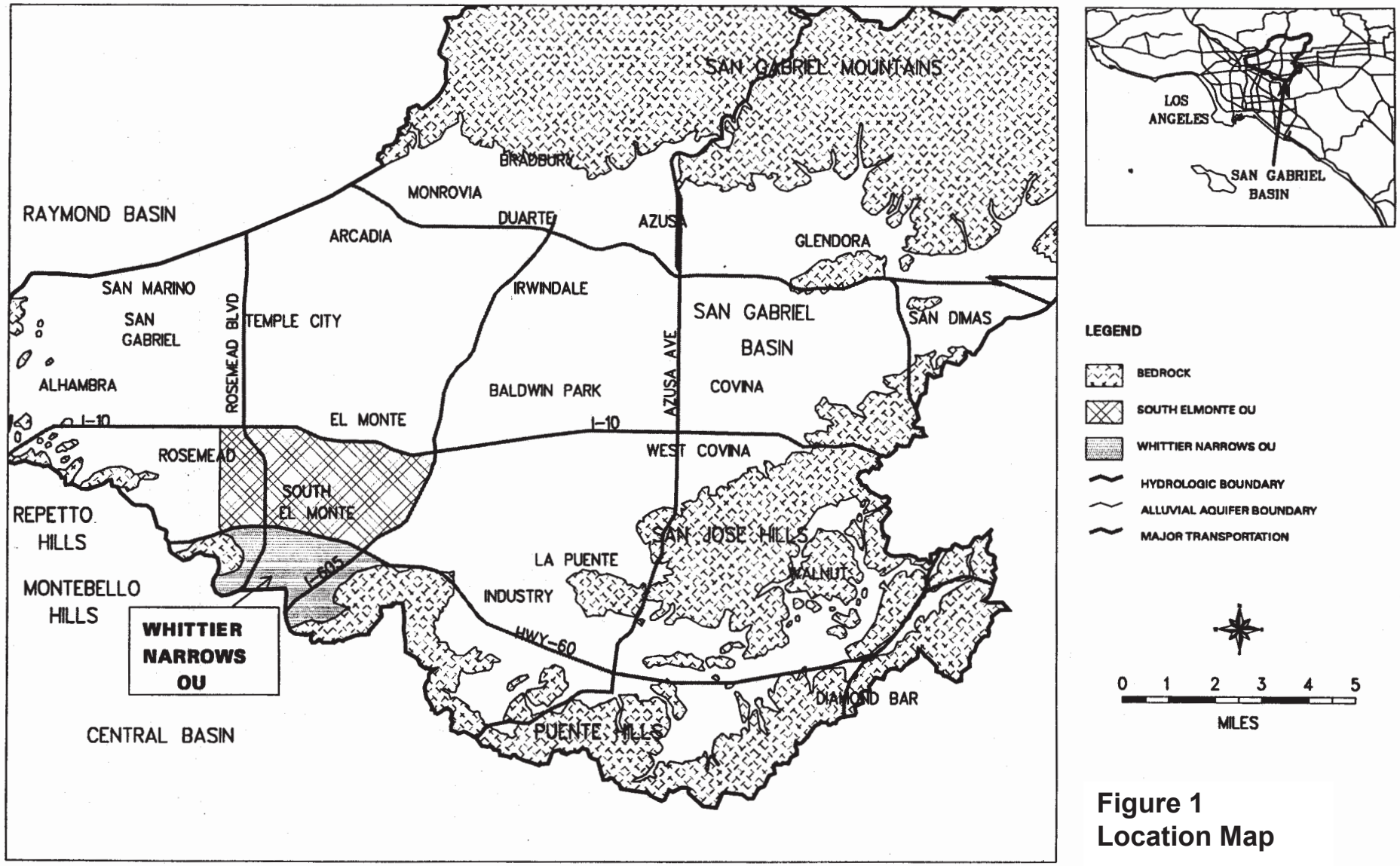

Figure 1
Location Map

Whittier Narrows Five Year Review

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Explanation

- Shallow Depth Extraction Well
- Intermediate Depth Extraction Well
- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Groundwater Influent Line
- Zone 1 Ditch, Nature Center Lakes, and Legg Lakes Discharge Line
- Centralized Groundwater Treatment Facility
- Whittier Narrow Dam
- Bedrock

N

1,250 0 1,250 Feet

Figure 2
Project Components for the Whittier Narrows OU Remedy Five-year Review

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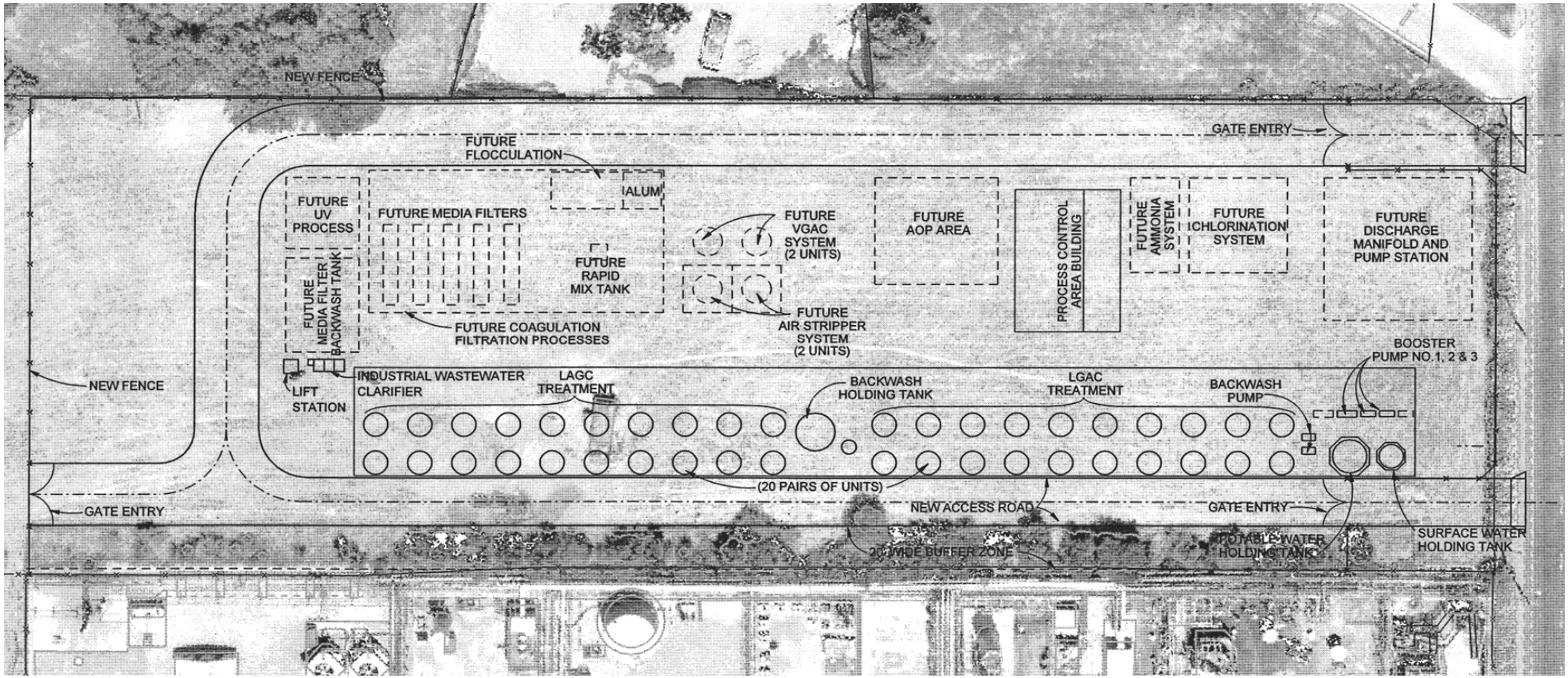

FIGURE 3
WHITTIER NARROWS TREATMENT PLANT LAYOUT
WHITTIER NARROWS FIVE-YEAR REVIEW

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Whittier Narrow Dam
- Bedrock

N

1,250 0 1,250 Feet

Figure 4
Whittier Narrows Monitoring Wells
Five-year Review

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Attachment 1
Documents Reviewed

Whittier Narrows Five-Year Review
List of Documents Reviewed

Interim Record of Decision Amendment, San Gabriel Valley Superfund Site, Whittier Narrows Operable Unit, U.S. Environmental Protection Agency, November 10, 1999

Interim Remedial Action Report, San Gabriel Valley Area 1 Superfund Site – OU 2, Whittier Narrows Operable Unit, U.S. Environmental Protection Agency, September 30, 2003

First Five-Year Review Report, San Gabriel Valley Area 1 Superfund Site – OU 2, Whittier Narrows Operable Unit, U.S. Environmental Protection Agency, September 2006

Data Review and Remedy Performance Evaluation Technical Memorandum – Whittier Narrows OU Five-Year Review, CH2M HILL, May 10, 2011 (Attachment 6)

Whittier Narrows Supplemental Risk Assessment to the 1992 Baseline Risk Assessment – Risk-Based Evaluation of 1997 Groundwater Data, CH2M HILL, July 24, 1998

Whittier Narrows Operable Unit Quarterly Progress Reports, City of Whittier. 2008-2011.

U.S. Army Corps of Engineers. Remediation System Evaluation, San Gabriel Valley Superfund Site, Whittier Narrows Operable Unit, Whittier, California. Final Report. May 2008.

Attachment 2
Five-Year Review ARARs Evaluation TM

5-Year Review – Applicable or Relevant and Appropriate Requirements (ARARs) Evaluation for the Whittier Narrows OU, San Gabriel Valley Superfund Sites

PREPARED FOR: Bella Dizon/EPA Region IX

PREPARED BY: CH2M HILL

DATE: April 21, 2011

PROJECT NUMBER: 381400.OM.04

This technical memorandum presents an evaluation of the Applicable or Relevant and Appropriate Requirements (ARARs) at the Whittier Narrows OU (WNOU) of the San Gabriel Valley Superfund Sites (site).

Purpose of ARARs Review

The purpose of an ARARs review is to determine whether laws, regulations, or guidance promulgated since approval of site decision documents alter the remedy's protectiveness of human health and the environment. This review evaluates changes to ARARs since the last 5-year review was conducted in 2006.

ARARs are established in the Record of Decision (ROD). Changes to ARARs, where necessary, can be memorialized in ROD Amendments or Explanation of Significant Differences (ESDs).

The preamble to the National Contingency Plan (NCP) states that remedy selection decisions are not to be reopened unless new or modified requirements call into question the protectiveness of the selected remedy (55 CFR 8757, March 8, 1990). This is interpreted to mean generally that ARARs are frozen at the time of remedy approval, unless updated by additional decision documents.

ARARs Background

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that remedial actions implemented at CERCLA sites are carried out in compliance with any Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be ARARs.

CERCLA response actions are exempted by law from the requirement to obtain Federal, State or local permits related to any activities conducted completely on-site. However, this does not remove the requirement to meet the substantive provisions of permitting regulations that are ARARs.

Applicable. Applicable requirements are cleanup standards, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. A requirement is applicable if the jurisdictional prerequisites of the environmental standard show a direct correspondence when objectively compared with the conditions at the site.

Relevant and appropriate. If a requirement is not legally applicable, the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well suited to the conditions of the site. The criteria for determining relevance and appropriateness are listed in 40 CFR 300.400(g) (2).

To be considered (TBC). TBC criteria are requirements that may not meet the definition of an ARAR, but still may be useful in determining whether to take action at a site or to what degree action is necessary. TBC criteria, as defined in 40 CFR 300.400(g) (3), are non-promulgated advisories or guidance issued by federal or state government that are not legally binding but may provide useful information or recommended procedures for remedial action. Although TBC criteria do not have the status of ARARs, they are considered together with ARARs to establish the required level of cleanup for protection of human health and the environment.

Pursuant to EPA guidance, ARARs generally are classified into three categories: chemical-specific, location-specific, and action-specific requirements. These categories of ARARs are identified below:

- **Action-specific ARARs** are requirements that apply to specific actions that may be associated with site remediation. Action-specific ARARs often define acceptable handling, treatment, and disposal procedures for hazardous substances. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Examples of action-specific ARARs include requirements applicable to landfill closure, wastewater discharge, hazardous waste disposal, and emissions of air pollutants.

- **Chemical-specific ARARs** include those laws and regulations that regulate the release to the environment of materials possessing certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limits for specific hazardous substances.

- **Location-specific ARARs** are those requirements that relate to the geographical or physical location of the site, rather than the nature of the contaminants or the proposed site remedial actions. These requirements may limit the placement of remedial action, and may impose additional constraints on the cleanup action. For example, location-specific ARARs may refer to activities in the vicinity of wetlands, floodplains, endangered species habitat, and areas of historical or cultural significance.

Whittier Narrows OU Background

The WNOU is located within the San Gabriel Valley Superfund Site, Area 1 (CAD980677355), in Los Angeles County, California. The San Gabriel Valley Area 1 site is part of a larger area of groundwater contamination located near the San Bernardino County border, in Los Angeles County, California. The site is situated to the south of the Pomona Freeway and to the west of the San Gabriel Freeway, and consists of low lying hills. Much of WNOU is utilized for flood control, and the Whittier Narrows Flood Control Dam serves as a boundary between the adjacent San Gabriel and Central Basins. Two major rivers located within WNOU boundaries are the San Gabriel and Rio Hondo Rivers. Land use in the area is a mix of residential, commercial, recreational, and light industrial. The nearest residential areas are South El Monte and South San Gabriel to the north and Montebello and Pico Rivera to the south. Groundwater from onsite production wells is used for domestic, industrial, and agricultural purposes. Whittier Narrows is the only location where groundwater flows out of the San Gabriel Basin into the adjoining Central Basin.

The San Gabriel Valley has been the subject of environmental investigation since 1979 when groundwater contaminated with volatile organic compounds (VOCs) was first identified. Subsequent investigation by EPA and others revealed the extent of groundwater contamination in the aquifers of the San Gabriel Valley (the San Gabriel Valley groundwater system is known as the San Gabriel Basin). In May 1984, four broad areas of contamination within the basin were listed as San Gabriel Areas 1 through 4, and the San Gabriel Valley was listed on EPA's NPL.

WNOU is officially part of the San Gabriel Valley Area 1 Superfund Site. EPA divided the San Gabriel Basin into eight operable units (OUs) to provide a means of planning remedial activities in the basin. WNOU is one of eight OUs within the San Gabriel Valley Superfund Site. The other OUs identified by EPA are Alhambra, Baldwin Park, El Monte, Puente Valley, Richwood, South El Monte and Suburban.

The groundwater contamination in the San Gabriel Basin results from the historic use and improper handling and disposal of tetrachloroethene (PCE), trichloroethene (TCE), and other chemicals. These chemicals were used in large quantities at industrial facilities across much of the San Gabriel Valley as early as the 1940s, and by hundreds of businesses in the 1960s, 1970s and 1980s for degreasing, metal cleaning, and other purposes. The chemicals were released to the ground by a combination of disposal, careless handling, leaking tanks and pipes, and other means.

EPA conducted Remedial Investigation/Feasibility Study (RI/FS) activities in the WNOU beginning in the late 1980s. The RI/FS approach is a methodology that the Superfund program has established for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites to evaluate potential remedial options. The RI serves as a mechanism to collect data for site characterization. The FS serves as the mechanism for development, screening, and evaluation of potential remedial alternatives. An Operable Unit Feasibility Study (OUFS) Report for the WNOU was completed and issued for public review in September 1992. At that time, contaminant concentrations were low and posed a minimal threat to human health and groundwater supplies in the Central Basin.

EPA has issued the following decision documents for the WNOU:

- Record of Decision (ROD), issued March 31, 1993

- ROD Amendment, issued November 10, 1999

The WNOU 1993 ROD focused on evaluation of groundwater contamination potentially flowing from upgradient areas in the San Gabriel Basin into the Whittier Narrows Area and subsequently into the Central Basin. The selected remedial action, as stated in the ROD, was no action, with groundwater monitoring.

Initially, contaminant concentrations were relatively low throughout Whittier Narrows and groundwater resources in the Central Basin were not threatened. Then contaminated groundwater from upgradient areas began migrating into the western side of Whittier Narrows causing significant increases in contaminant concentrations. The increases in contaminant concentrations posed an imminent threat to groundwater resources in the Central Basin. This threat prompted EPA to initiate additional data collection activities and evaluation of active remedial actions.

In 1997, EPA initiated additional groundwater monitoring and further characterization of the hydrogeology in western Whittier Narrows. New monitoring wells were installed, and large-scale aquifer tests were conducted using City of Whittier, Pico Rivera, and Texaco production wells. Results of EPA's investigations in Whittier Narrows were presented in the Site Characterization Report for Whittier Narrows (EPA, 1998a).

The 1999 ROD Amendment specified containment of groundwater exceeding drinking water standards in the vicinity of Whittier Narrows Dam as the site remedy. The selected remedial actions included groundwater containment near the Whittier Narrows Dam by extraction, treatment and discharge.

The system was designed to contain groundwater with chemical contaminant concentrations above primary drinking water standards and consisted of five key components:

- Groundwater extraction system located near the downgradient limit of contaminant concentrations exceeding maximum contaminant levels (MCLs).
- Centralized treatment to reduce contaminant concentrations to acceptable levels.
- Conveyance systems, such as pipelines and booster pumps, to transport contaminated groundwater from the wells to the treatment plant and to transport treated water from the plant to the designated end use.
- Discharge of the treated water; discharge options include use by a local water purveyor, recharge of the water back to the aquifer using existing Montebello Forebay spreading grounds or other recharge facilities.
- Groundwater monitoring to help optimize system design; measure the performance of the containment system and provide early warning of upgradient conditions that could affect the system.

The remedy was configured to meet ARARs. This includes ARARs related to protection of the drinking water supply, treatment of extracted groundwater, and discharge of the treated water (either to water purveyors or to the San Gabriel River and/or Rio Hondo).

Chemical-specific ARARs were identified for the following chemicals of concern (COCs) at

the site in the 1999 ROD Amendment:

- Chloroform
- cis-1,2-Dichloroethene (cis-1,2-DCE)
- 1,1-Dichloroethane (1,1-DCA)
- 1,1-Dichloroethene (1,1-DCE)
- 1,2- Dichloroethane (1,2-DCA)
- 1,4-Dioxane
- Ethylbenzene
- Styrene
- Tetrachloroethene (PCE)
- Toluene
- Trichloroethene (TCE)
- 1,1,1-Trichloroethane (1,1,1-TCA)
- Xylenes

The ROD identified MCLs as groundwater cleanup standards for the site.

Whittier Narrows OU ARARs Review

The following three tables list the ARARs established in the 1999 ROD Amendment, summarize the requirement for each ARAR, cite the regulatory basis for each ARAR, state the evaluated status of each ARAR, and comment on regulatory changes for each ARAR where applicable.

Table 1 contains action–specific ARARs, Table 2 contains chemical–specific ARARs, and Table 3 contains location-specific ARARs. The tables provide the applicable requirements and citation for each established ARAR; and describe whether any updates have occurred for each ARAR in the previous five years. Current versions of the California Code of Regulations (CCR), and the Code of Federal Regulations (CFR) were consulted to review pertinent updates of laws, regulations, or guidance.

Action-specific ARARs and TBCs

Actions identified in the 1999 ROD Amendment include:

- groundwater extraction, treatment, and treated water discharge
- management and disposal of hazardous waste

Table 1 presents the action-specific ARARs and TBCs for the site. As stated in the 1999 ROD Amendment, Subsection III.G of the California State Water Resources Control Board (SWRCB) Resolution 92-49 "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304" requires attainment of background water quality or, if background levels cannot be restored, the best quality of water that is reasonable. Resolution 92-49 is not an ARAR because this is a remedial action intended to contain the spread of contamination, rather than a final action intended to restore groundwater in the WNOU.

Chemical-specific ARARs and TBCs

Table 2 presents the chemical-specific ARARs and TBCs for the site.

The 1999 ROD Amendment specified MCLs as groundwater cleanup standards for the site. Based on the Safe Drinking Water Act (SDWA), and pursuant to 40 CFR Section 300.430(e)(2)(i)(B), MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) are relevant and appropriate as in-situ aquifer standards for groundwater that is used, or may be used, as drinking water.

As stated in the 1999 ROD Amendment, EPA has determined that the federal MCLs are ARARs for any groundwater that is treated and used for domestic, municipal, industrial, or agricultural purposes, and for any groundwater that is discharged to the environment. In addition, these MCLs are ARARs for currently uncontaminated groundwater in the Montebello Forebay downgradient of Whittier Narrows Dam.

California has established state MCLs for sources of public drinking water, under the California Safe Drinking Water Act of 1976, Health and Safety Code (H&SC) Section 4010.1 and 4026(c), CCR Title 22, Sections 64431 and 64444. Some state MCLs are more stringent than the corresponding federal MCLs. EPA has determined that the more stringent state MCLs are relevant and appropriate for the WNOU.

There are also some chemicals that lack federal MCLs. Where state MCLs exist for chemicals that lack federal MCLs, EPA has determined that the state MCLs are relevant and appropriate for the WNOU.

Since the ROD was published in 1999 the following changes to MCLs and MCLGs for the site COCs have occurred:

- The federal MCL for chloroform (100 ug/L in the 1999 ROD) was lowered to 80 ug/L in 2002. An MCLG of 70 ug/L was established in 2004.
- The federal MCL for ethylbenzene of 700 ug/L was identified in the 1999 ROD. California adopted an MCL of 300 ug/L in 2003.

Retaining the levels identified in the 1999 ROD will not provide a level of protection to human health equivalent to the more recent values cited above.

One chemical of concern detected in the WNOU groundwater, 1,4-dioxane, does not have an MCL or nonzero MCLG. For contaminants lacking MCLs and MCLGs, EPA refers to other available criteria and guidance (TBCs). The California Department of Public Health (CDPH) established a notification level (formerly called an action level) of 3 ug/L for 1,4-dioxane in 1998. A notification level is the concentration of a contaminant in drinking water, at which CDPH has determined, based on available scientific information, that there is an adequate margin of safety to prevent potential risks to human health. California Health and Safety Code section 116455 requires operators of public water systems to notify local governments when a drinking water well exceeds an action level. In practice, drinking water wells that exceed action levels are almost always shut down or have treatment added.

The 1999 ROD Amendment stated that: "EPA has determined that all treated groundwater that is served as drinking water or discharged to the environment shall meet the state action level of 3 ppb for 1,4-dioxane."In November 2010 CDPH lowered the notification level to 1 ppb. Retaining the level identified in the 1999 ROD will not provide a level of protection to

human health equivalent to the revised notification level adopted in 2010.

As stated in the 1999 ROD Amendment, because the selected remedy is an interim measure to contain contaminant migration, EPA has not established chemical-specific ARARs for restoration of the contaminated portions of the WNOU; therefore, ARARs for restoration will be addressed in the Final ROD for the San Gabriel Valley Superfund Sites.

Location-specific ARARs and TBCs

Table 3 presents location-specific ARARs and TBCs for the site. The table shows that revisions in the state and federal regulations did not affect the location-specific ARARs and TBCs in the ROD.

TABLE 1
Action Specific ARARs

Action	Requirement	Citation	Origin	Determination	Status	Comments
Groundwater Extraction, Treatment, and Treated Water Discharge	Protect water quality objectives as identified in the Water Quality Control Plan for the Los Angeles Region (Basin Plan).	CWA; SDWA; and Porter-Cologne	1999 ROD Amendment	Applicable	No Change	Porter-Cologne Water Quality Act incorporates the requirements of the federal Clean Water Act and implements additional standards and requirements for surface and groundwater of the state.
Groundwater Extraction, Treatment, and Treated Water Discharge	Any activity that may increase the volume or concentration of a waste discharged to surface or groundwater is required to use the "best practicable treatment or control."	State Water Resource Control Board Resolution 68-16	1999 ROD Amendment	Applicable	No Change	Resolution 68-16 is applicable if the remedy discharges treated groundwater to either the Rio Hondo or the San Gabriel River.
Groundwater Extraction, Treatment, and Treated Water Discharge	Site investigation activities removal actions meet best available technology economically achievable for treatment and disposal of discharges.	CERCLA Section 104(b)	1999 ROD Amendment	Applicable	No Change	Site investigation activities undertaken pursuant to CERCLA § 104(b) are considered to be removal actions (e.g., discharges from aquifer testing and spinner logging/depth specific sampling of water supply wells).
Management and disposal of hazardous waste	Land disposal requirements	RCRA; and CCR Title 22, Division 4.5	1999 ROD Amendment	Applicable	No Change	Land disposal requirements are applicable to the disposal of spent carbon generated during the treatment of groundwater for removal of VOCs.
Management and disposal of hazardous waste	Manifest requirements.	RCRA; and CCR Title 22, Division 4.5	1999 ROD Amendment	Applicable	No Change	Manifest requirements are ARARs in the event that the remedial action involves multiple water treatment units at different locations and requires the movement of hazardous wastes (e.g., spent carbon) between these locations.
Vadose zone extraction and treatment	New source (air contaminant units) review requirements.	CAA; and SCAQMD Rules 1301 through 1313	1999 ROD Amendment	Applicable	No Change	Rule 1303 requires that all new sources of air pollution in the district use best available control technology and meet appropriate offset requirements. Emissions offsets are required for all new sources that emit in excess of one pound per day.
Vadose zone extraction and treatment	New source (air contaminant units) review requirements.	CAA; and SCAQMD Rule 1401	1999 ROD Amendment	Applicable	No Change	SCAQMD Rule 1401 requires that best available control technology for toxics be employed for new stationary operating equipment, so that the cumulative carcinogenic impact from air toxics does not exceed the maximum individual cancer risk limit of 10 in 1 million (1 x 10-5). Many of the contaminants found in the WNOU groundwater are air toxics subject to Rule 1401.

TABLE 1
Action Specific ARARs

Action	Requirement	Citation	Origin	Determination	Status	Comments
Vadose zone extraction and treatment	New source (air contaminant units) review requirements.	CAA; and SCAQMD Rules 401 through 403	1999 ROD Amendment	Applicable	No Change	SCAQMD Rules 401 through 403 are also ARARs for construction and operation of remedial action facilities. SCAQMD Rule 401 limits visible emissions from a point source. Rule 402 prohibits discharge of material that is odorous or causes injury, nuisance, or annoyance to the public. Rule 403 limits downwind particulate concentrations.

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

CCR = California Code of Regulations

CFR = Code of Federal Regulations

EPA = U. S. Environmental Protection Agency

Porter-Cologne = CA Porter-Cologne Water Quality Act

RCRA = Resource Conservation and Recovery Act

SCAQMD = Couth Coast Air Quality Management District

SDWA = Safe Drinking Water Act

VOCs = Volatile Organic Compounds

TABLE 2
Chemical-Specific ARARs

Contaminant	Requirement	Citation	Origin	Determination	Status	Comments
Chemicals of Concern (COCs) (Chloroform, 1,1-DCE, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, Ethylbenzene, Styrene, PCE, 1,1,1-TCA, TCE, Toluene, and Xylenes)	MCLs and MCLGs are applicable to water treatment standards.	SDWA; 40 CFR Section 300.430(e)(2)(i)(B) CA H&SC Section 4010.1 and 4026(c), CCR Title 22, Sections 64431 and 64444	1999 ROD Amendment	Applicable	Federal MCL for chloroform lowered to 80 ug/L in 2002, and MCLG of 70 ug/L adopted in 2004. California MCL of 300 ug/L adopted for ethylbenzene in 2003. No Change (i.e., MCLs and MCLGs remain applicable as aquifer standards	Federal MCLs and MCLGs, or California MCLs are relevant and appropriate as treatment standards for groundwater that is or may be used as drinking water. Retaining the levels cited in the 1999 ROD for chloroform and ethybenzene will not provide a level of protection to human health equivalent to the values adopted in 2004 and 2003, respectively..
Chemicals of Concern (COCs) (1,4-Dioxane,)	California Notification Levels are applicable to public water systems	CA H&SC Section 116455	1999 ROD Amendment	To Be Considered	Notification level (formerly called action level) was lowered to 1 ug/L in November 2010. It had been set at 3 ug/L when the 1999 ROD Amendment was signed and at the time of the 2006 5 year review	The 1999 ROD Amendment stated that EPA has determined that all treated groundwater that is served as drinking water or discharged to the environment shall meet the state action level of 3 ppb for 1,4-dioxane. Retaining the level cited in the 1999 ROD will not provide a level of protection to human health equivalent to the notification level adopted in November 2010.

Notes:
CA H&SC = California Health and Safety Code
CFR = Code of Federal Regulations
COCs = Chemicals of Concern
EPA = U. S. Environmental Protection Agency
MCLs = Maximum Contaminant Levels
MCLGs = Maximum Contaminant Level Goals
SDWA = Safe Drinking Water Act

TABLE 3
Location-Specific ARARs

Location	Requirement	Citation	Origin	Determination	Status	Comments
Locations that may impact listed threatened or endangered species	Avoid adverse impacts to listed threatened or endangered species, or conduct appropriate mitigation.	ESA; 15 USC Sections 1531 through 1544; 40 CFR Section 6.302(h) and 50 CFR Parts 17, 222 and 402	1999 ROD Amendment	Applicable	No Change	Any remedial actions that impact a proposed or listed threatened or endangered species or destroy or adversely modify the critical habitat of a listed species must comply with ESA.
Discharge to locations that may deleteriously affect fish, wildlife, or plant life	Prohibit the discharge of harmful quantities of hazardous materials into places that may deleteriously affect fish, wildlife, or plant life.	CA F&GC Sections 2080, 5650(a), 5650(b), 5650(f), 12015, and 12016	1999 ROD Amendment	Applicable	No Change	These provisions are applicable if the remedial action will result in the discharge of treated groundwater to surface waters.
Location of Hazardous Waste Treatment, Storage and Disposal Facilities (TSDFs)	Prohibits the placement of TSDFs within 200 feet of a fault displaced during the Holocene epoch; and requires that TSDFs located within a 100-year floodplain be capable of withstanding a 100-year flood.	22 CCR Section 66264.18	1999 ROD Amendment	Applicable	No Change	These standards are applicable to the construction of any new groundwater treatment facilities used as part of this remedial action.
Preserve historic and archaeological resources	Establishes requirements for the evaluation and preservation of historical and archaeological data that may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	16 USC Section 469; and 40 CFR Part 6.301(c)	1999 ROD Amendment	Applicable	No Change	There are several documented archeological sites within the Whittier Narrows Flood Control Basin. These requirements are applicable if the remedial action will interfere with any of these facilities.
Preserve historic sites	Requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	16 USC Sections 461 through 467; and 40 CFR Part 6.301(a)	1999 ROD Amendment	Applicable	No Change	The remedial action is not anticipated to affect any of the facilities regulated under the act. However, during any additional preliminary designs, a complete review shall be made of impacted areas.

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

CFR = Code of Federal Regulations

ESA = Endangered Species Act of 1973

FR = Federal Register

TSDF = Hazardous Waste Treatment, Storage and Disposal Facilities

USC = United States Code

USFWS = U.S. Fish and Wildlife Service

Attachment 3
Site Inspection Report

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Whittier Narrows Operable Unit	**Date of inspection:** March 10, 2011
Location and Region: Los Angeles County, California	**EPA ID:** CAD980677355
Agency, office, or company leading the five-year review: U. S. Environmental Protection Agency, Region 9 (with CH2M HILL support)	**Weather/temperature:** Clear, around 74°F

Remedy Includes: (Check all that apply)

Landfill cover/containment	Monitored natural attenuation
Access controls	Groundwater containment
Institutional controls	Vertical barrier walls
√ Groundwater pump and treatment	
Surface water collection and treatment	

II. INTERVIEWS

1. **O&M site manager** Ken Kittredge (Name) Whittier Water Manager (Title) March 10, 2011 (Date)

Interviewed X at site

Problems, suggestions: Ken indicated that O&M was proceeding fine with no particular problems. He noted that the City is continuing to investigation the air vacs on the non-potable site as a source of the high pressures.

2. **O&M staff** Dan McKenna (Name) Whittier Operations Manager (Title) March 10, 2011 (Date)

Interviewed X at site

Problems, suggestions: Dan said that there were no particular problems of note currently. He indicated that backwash operations are now much better, which should help during the next carbon changeout.

II. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

O&M manual	X Readily available	X Up to date (See remarks)	
As-built drawings	X Readily available	X Up to date (See remarks)	
Maintenance logs	Readily available	Up to date	X N/A

Remarks: The O&M Manual and as-built drawings are both available and are reasonably up-do-date. However, both need to be updated to incorporate system changes implement over the last 5 to 6 years.

2. **Permits and Service Agreements**

Effluent discharge	X Readily available	X Up to date	N/A

Remarks: The City's amended water supply permit from CDPH serves as the equivalent of an effluent discharge permit and provides the effluent monitoring requirements.

3.	**Groundwater Monitoring Records** **X** Readily available X Up to date Remarks: The City monitors either monthly, quarterly or annually depending on their permit requirements. EPA conducts OU-wide monitoring annually to monitor overall plume conditions.
4.	**Discharge Compliance Records** Water (effluent) X Readily available X Up to date Remarks: The City conducts discharge monitoring monthly and e-mails the results to CDPH and EPA monthly. Quarterly reports are also distributed that provide discharge information.

IV. O&M COSTS	
1.	**O&M Organization** Other: The City of Whittier provides system O&M under a cooperative agreement with EPA.
2.	**O&M Cost Records** Funding mechanism/agreement in place: A grant is in place that funds the City's O&M costs. The main body of the Five-Year Review Report includes a table with the annual O&M costs and a comparison to the original O&M cost estimate from the IROD.
3.	**Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons: There were several submersible pump/motor failures resulting in increased O&M costs. Ultimately, the decision was made to replace the submersible pumps with above-ground motors and line shaft pumps. More extensive repairs than expected were required to the internal of the LGAC vessels during carbon changeout because of corrosion associated with the sample ports.

III. ACCESS AND INSTITUTIONAL CONTROLS Applicable √ N/A	
A. General	
1.	**Vandalism/trespassing** Location shown on site map X No vandalism evident Remarks: Previously, there were multiple incidents of vandalism and stolen property. The City now has a security service that periodically patrols the project area. There have not been any problems observed for several years now.
2.	**Land use changes off site** Remarks: There was previously a large industrial facility (a Texaco research facility) adjacent to the treatment plant. That property has now changed over to a trucking facility.

IV. GROUNDWATER/SURFACE WATER REMEDIES X Applicable N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines X Applicable N/A	

1. **Pumps, Wellhead Plumbing, and Electrical**
X Good condition X All required wells properly operating X Needs Maintenance
Remarks:
Six of the seven extraction wells (4 shallow and 3 intermediate) are operable and in good condition. One of the shallow wells, EW4-9, has an issue with the pump not producing the expected volume. However, this well is not critical and there are no plans to pump that well.

Several of the attached photos show the extraction wells and associated electrical and control facilities.

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
X Good condition Needs Maintenance
Remarks:
The conveyance pipelines are all operating as expected and have not caused any operational issues or required unexpected maintenance.

3. **Spare Parts and Equipment**
X Readily available Good condition Requires upgrade Needs to be provided
Remarks: Although there are minimal spare parts and equipment kept on-site, nearly all parts and equipment are readily available locally.

C. Treatment System X Applicable

1. **Treatment Train** (Check components that apply)
Metals removal Oil/water separation Bioremediation
Air stripping X Carbon adsorbers
Filters_____
Additive (*e.g.*, chelation agent, flocculent)_____
Others_____
X Good condition X Needs Maintenance The treatment plant is generally in good condition. However the carbon vessels, tanks and some of the piping are starting to show external signs of weathering and rust. The entire system should be repainted to head-off potential future problems.
X Sampling ports properly marked and functional
Sampling/maintenance log displayed and up to date
X Equipment properly identified
Remarks: If chlorination is going to continue at the plant, it may be advisable to provide a 2nd chlorine injector to improve reliability.
_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
X Good condition Needs Maintenance
Remarks_____
_____

3. **Tanks, Vaults, Storage Vessels**
X Good condition X Proper secondary containment Needs Maintenance
Remarks: As noted above, the tanks should be repainted.
_____

4. **Discharge Structure and Appurtenances**

X Good condition Needs Maintenance

Remarks: The flow meter on the shallow discharge to the south Legg Lakes is not working properly. However, discharge is not currently flowing that direction so the meter is not needed.

_____

5. **Treatment Building(s)**

X Good condition (esp. roof and doorways) Needs repair

Chemicals and equipment properly stored

Remarks_____

_____

6. **Monitoring Wells** (pump and treatment remedy)

X Properly secured/locked X Functioning X Routinely sampled X Good condition

X All required wells located Needs Maintenance

Remarks: Although the wells were not all visited during the inspection. All wells had been monitored in January 2011. The only significant issue is at MW1-MP where the Westbay casing has failed so the well is inoperable. However, there is a surrounding well cluster that provides multi-depth monitoring at many of the same intervals as the Westbay well.

_____

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with statement of what the remedy is to accomplish (i.e., to contain contaminant plume).

This is a large-scale groundwater containment remedy. However, the system itself is very straightforward employing groundwater extraction, conveyance and treatment of low-level VOCs with carbon adsorption. O&M of this type of system is not complex. The City staff appears to be quite capable of operating the system effectively.

_____

Photo 1: Extraction Well EW4-3 Wellhead

Photo 2: EW4-3 and EW4-8 VFDs

Photo 3: EW4-3/EW4-8 Electrical Platform

Photo 4: EW4-7 Wellhead (and flushline)

Photo 5: Electrical Platform – EW4-4, EW4-5, EW4-6, EW4-7, EW4-9

Photo 6: Treatment Plant Carbon Vessels – Front Half

Photo 7: Treatment Plant Carbon Vessels – Back Half

Photo 8: Close-up on Carbon Vessels Showing Need for Painting

Photo 9: Treatment Plant Influent Tanks and Effluent Piping

Photo 10: Disinfection System and Treatment Plant VFDs

Attachment 4
Interview Reports

INTERVIEW RECORD

Site Name: San Gabriel Valley Area 1 - Whittier Narrows OU		**EPA ID No.:** CAD980677355
Subject: 5 Year Review Interviews		**Time:** 2:00 p.m. **Date:** 3/8/11
Type: Telephone Visit X Other **Location of Visit:** City of Whittier City Hall		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: Bella Dizon/EPA and David Towell/CH2M HILL	**Title:** Remedial Project Manager	**Organization:** EPA/CH2M HILL
Individual Contacted:		
Name: Dan Wall	**Title:** Assistant Public Works Director	**Organization:** City of Whittier
Telephone No: 562-464-3545 **E-Mail Address:** dwall@cityofwhittier.org	**Street Address:** City Hall, 13230 Penn Street **City, State, Zip:** Whittier, CA	

Summary Of Interview

1. What is your overall impression of the project? (general sentiment)

Response: Dan feels that it is a needed project. He said it appeared to be accomplishing its goals and is a successful project.

2. What effects have site operations had on the surrounding community?

Response: Because the project site is in a relatively isolated location, Dan does not think the project is having any negative effects on the surrounding community. He said the discharge to Legg Lakes appears to have a positive effect. The project does not have any impacts on the City of Whittier residents and he is not aware of any complaints.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

Response: Most City residents are probably not aware that the water from the Whittier Narrows OU project is a component of the City's water supply. New City council members are always surprised to learn of the existence of the project. The City's state-mandated (CCR) distribution of water quality data always raises general questions about water quality, but not specific to the EPA project.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

Response: There have not been any incidents of trespassing or vandalism for several years. The City has security company the periodically patrols the entire project area (wells and treatment plant) at night.

5. Do you feel well informed about the site's activities and progress?

Response: Dan fells well informed about the project's intent and progress. He has read background documents regarding the project. He is aware that PCE concentrations are being reduced and overall mass loading is going down. He is aware of the ongoing system improvements, including replacement of submersible pumps and upgrading the VFD controllers.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Response: Dan feels it would be beneficial if there was another end user for the project so the extraction rates were not limited solely by the City's water demands. He also believes that the project's reliability has increased and that current operations are in good shape.

He thinks that there should be some relief from the amount of sampling that the City is required to do for the project in accordance with the operating permit issued by the state (California Department of Public Health or DPH). For example, monthly sampling of every carbon vessel does not appear to be necessary if the effluent remains clean. Also, Dan does not believe that 24-hour staffing of the project is needed. This is something that DPH has raised as a possibility.

INTERVIEW RECORD

Site Name: San Gabriel Valley Area 1 - Whittier Narrows OU		**EPA ID No.:** CAD980677355
Subject: 5 Year Review Interviews		**Time:** 2:30 p.m. **Date:** 5/5/11
Type: Telephone X Visit Other **Location of Visit:**		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: Bella Dizon	**Title:** Remedial Project Manager	**Organization:** EPA
Individual Contacted:		
Name: David Towell	**Title:** Remedial Project Manager	**Organization:** CH2M HILL
Telephone No: 213-228-8285 **E-Mail Address:** david.towell@ch2m.com		**Street Address:** 1000 Wilshire 21st floor **City, State, Zip:** Los Angeles CA 90017

Summary Of Interview

1. What is your overall impression of the project?
   Response: David's overall impression is that the treatment plant is operating and it is in pretty good shape. For the most part, operations have become more reliable over the last couple of years. As of the last 5-year Review there were still some operational issues with the City getting the plant up and running, problems with electrical cabling, and issues with some wells. These technical and operational issues have been worked on and the resolutions have led to less operational constraints on the project.

2. Is the remedy functioning as expected? How well is the remedy performing?
   Response: David replied that the remedy's basic components, a pump and treat system, are functioning as expected. On the performance side, pumping rates are less than what was targeted which resulted in not meeting 100% containment goals. In the deeper zones there have been limited detections of contaminants moving outside the containment zone, which means that there is not full containment. Based on the cleanup goals identified in the ROD, there are no contaminant or containment issues in the shallow zones.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
   Response: David noted that there are significant decreasing trends in contaminant levels downgradient of the remedy where concentrations have dropped dramatically. Upgradient there have been significant reductions in the shallow zone and reductions in deeper zone, but not as dramatic as the shallow zone. Monitoring data show that NDMA is not an issue mainly due to changes in NDMA levels in discharges from L.A. County's Water Reclamation Plant. Perchlorate is non-detect or detected at only trace levels within Whittier Narrows. 1,4-Dioxane is frequently detected but the data show that its levels are not changing. Because the drinking water standards for 1,4-dioxane have changed recently the constituent could potentially be a concern in the future. The Data Review and Remedy Performance Evaluation Technical Memorandum, which is included as an attachment to the 5-year Review, discusses the monitoring data in more detail.

4. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
   Response: David replied that no, there is not continuous onsite O&M staff, but there is continuous offsite monitoring of the plant and control system and daily site visits. The site visit activities include data collection, system checks, and taking required readings to verify electronic control system accuracy and performance. Operational staff are always available on call.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.
   Response: David responded that the basic O&M system requirements have not changed since plant start up. It is a straightforward system to operate. There have been changes that have led to efficiencies, increased reliability, and decreased costs. Monitoring requirements have changed and resulted in decreased operational costs. Carbon change out requirements from the State have also changed which improves use of the carbon and reduces the likelihood of large scale downtimes associated with future carbon change outs.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.
   Response: David noted that there have been two unexpected O&M issues at the treatment plant. Two years ago, the city encountered administrative and technical issues during the last carbon changeout which resulted in essentially an eight month shut off of the intermediate zone treatment system. To likelihood of this occurring again is minimal because of: better understanding of the State's requirements, changes in the permit requirements for carbon changeout, and reduced chance of changing the type of carbon being used at the plant. The second issue was the excessive failure of submersible pumps that were installed in the extraction wells and the excessive down time required when trying to change them out. To solve this problem they have switched to above ground pumps that provide the same services but are more reliable and easier to service. This change has decreased downtime, lowered O&M costs and increased reliability and consistency over the last couple of years.

7. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
   Response: David responded that for sampling program, there are two components, the treatment plant sampling and the aquifer sampling. Aquifer sampling in the OU should increase. Treatment plant sampling frequencies should decrease. While the decrease in one sampling program balances out the increase in the other sampling program, efficiencies have been realized and there are still efficiencies that can be made. There have not been many opportunities to reduce costs in O&M due to nature of the system, but there are potential opportunities for optimization that could be realized depending on the target rates for containment. If EPA lowers the target rates, then there might be opportunities to make the system more efficient at the treatment plant. Additionally any reductions in the amount of water being pumped would lead to lower operating costs and increased cost savings in all phases of the remedy.

8. Comments, suggestions or recommendations.
   Response: David provided three recommendations: 1. Complete the evaluation of whether target contaminant rates can be reduced so you can realize the benefits. 2. There should be a more formal and routine process for evaluating remedy performance. The initial steps towards this have begun. 3. There is a data gap that needs to be resolved. There might be contamination that is migrating deeper than the current extractions wells. Install additional monitoring points to determine flow and direction of contamination. All of these ideas are explored further in the Data Review and Remedy Performance Evaluation Technical Memorandum attached to the 5 year review. There are currently activities under way to address these recommendations.

Attachment 5
Risk Assessment and Toxicology Analysis Technical Memorandum

Risk Assessment and Toxicology Analysis for the Whittier Narrows OU, San Gabriel Valley Superfund Sites

PREPARED FOR: Bella Dizon/EPA Region IX

PREPARED BY: CH2M HILL

DATE: April 28, 2011

PROJECT NUMBER: 381400.OM.04

This technical memorandum (TM) presents a risk assessment and toxicology analysis to support the second five-year review of the Whittier Narrows Operating Unit (OU) of the San Gabriel Valley Superfund Sites, Los Angeles County, California. The baseline screening level human health risk assessment was conducted in September, 1992 for the Whittier Narrows OU (EPA 1992). An addendum to 1992 baseline risk assessment was prepared in November 1997 (EPA, 1997). In addition, there was a supplemental risk assessment to the 1992 baseline risk assessment which evaluated 1997 groundwater data (EPA, 1998). The first five year review of the Whittier Narrows OU was conducted in September 2006 (EPA 2006). The Interim Record of Decision (IROD) selecting the remedy for the Whittier Narrows OU was issued by EPA in March 1993 and an amendment to the IROD was issued in November, 1999.

As described in the guidance for EPA's Comprehensive Five-Year Reviews (EPA, 2001), a key purpose of the five-year review process for a site is to determine if the remedy is, or upon completion will be, protective of human health and the environment. Protectiveness is generally defined in the National Contingency Plan (NCP) by the risk range and the Hazard Index (HI). The following three questions are part of the technical assessment of the protectiveness of the remedy, as outlined in the EPA five-year review guidance document:

- Question A – Is the remedy functioning as intended by the decision documents?
- Question B - Are the exposure assumptions, toxicity data, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
- Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

To determine whether the remedy at the Whittier Narrows OU remains protective of human health, the sections below evaluate changes in site conditions, changes in exposure pathways, changes in toxicity for the chemicals of concern, and changes in cleanup levels since completion of the Risk Assessment and selection of the Site remedy. The risk assessment prepared by EPA in 1992 and addendum and supplemental risk assessment prepared by CH2M HILL in 1997 and 1998 were reviewed as part of these evaluations.

1.1 Changes in Site Conditions

There has been no significant change in site conditions since the risk assessment in 1997. The site is mainly flood control land with a Nature Center, parks and a few administrative offices and maintenance buildings.

1.2 Changes in Exposure Pathways

The 1997 Risk Assessment Addendum and 1998 Supplemental Risk Analysis identified the exposure pathways at Whittier Narrows OU as domestic use of groundwater including ingestion, inhalation of volatiles from water used for bathing, cooking and laundering, and dermal exposure. The additional exposure pathway of vapor intrusion is discussed below.

Since 1999, the understanding of the fate and transport of chemicals in the subsurface has evolved, with greater concern over the vapor intrusion pathway, particularly at sites with existing buildings and past releases of TCE. The Whittier Narrow OU area is predominately open space with a few administrative or maintenance buildings. EPA's draft Vapor Intrusion Screening Guidance issued November 2002 states that the vapor intrusion pathway should be investigated if the levels of TCE or PCE exceed 5 µg/L[1] (MCL for PCE and TCE) in the shallow zone groundwater (less than 150 feet). During the past five years, TCE has been detected at concentrations of less than 5 µg/L in the shallow zone groundwater of the Whittier Narrows OU. PCE has been detected at concentrations above 5 µg/L in the shallow zone groundwater at three monitoring wells (MW4-8, MW2-5 and MW4-15); however, PCE concentrations have been declining. Since mid-January 2009, PCE has only been detected at concentrations less than 5 µg/L in the shallow zone groundwater within the Whittier Narrows OU. Therefore, currently vapor intrusion is not a concern at Whittier Narrows OU. However, monitoring of PCE and TCE levels should be continued to detect any MCL exceedance that may result in the need for a future soil vapor intrusion pathway evaluation.

1.3 Changes in Toxicity

The toxicity of the chemicals of concern was evaluated using health-based and regulatory criteria. Table 1 provides a direct comparison between the 1997 and 1998 screening levels and current EPA Region 9 Tap Water Regional Screening Levels (RSLs).

Since the risk assessment addendum and supplemental risk analysis were completed, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site. Revisions to the toxicity values for 1,1,1- trichloroethane; 1,1-dichloroethylene; 1,2-dichloroethylene (cis); chloroform; toluene; and TCE indicate a lower risk from exposure to these chemicals than previously considered. On the other hand, evaluation of the toxicity values for 1,1-dichloroethane, ethylbenzene, PCE, xylenes (mixed) indicate higher risks from exposure than previously considered.

The greatest uncertainty with toxicological changes for Site contaminants are anticipated for TCE, one of contaminant of concern at the Site. In August 2001, EPA's Office of Research and Development (ORD) released "*Trichloroethylene Health Risk Assessment: Synthesis and*

[1]Table 2 (c) Generic Groundwater Screening Table, draft Vapor Intrusion Screening Guidance

Table 1
Comparison of Screening Levels
Whittier Narrows Operable Unit, Los Angeles County, California

	1997 Risk Assessment Addendum		2011 Values	
Chemical[1]	**MCL (ug/L)**	**Tap Water PRG**	**MCL (ug/L)**	**Tap Water RSL[2]**
1 ,1 ,1 -Trichloroethane	2.0E+02	7.9E+02	2.0E+02	9.1E+03
1,1-Dichloroethane	NA	8.1E+02	NA	2.4E+00
1 ,1 -Dichloroethylene	7.0E+00	4.6E-02	7.0E+00	3.4E+02
1 ,2-Dichloroethylene (cis)	7.0E+01	6.1E+01	7.0E+01	7.3E+01
Chloroform	1.0E+02	1.6E-01	8.0E+01	1.9E-01
Ethylbenzene	7.0E+02	1.3E+03	7.0E+02	1.5E+00
Styrene	1.0E+02	1.6E+03	1.0E+02	1.6E+03
Tetrachloroethylene (PCE)	5.0E+00	1.1E+00	5.0E+00	1.1E-01
Toluene	1.0E+03	7.2E+02	1.0E+03	2.3E+03
Trichloroethylene (TCE)	5.0E+00	1.6E+00	5.0E+00	2.0E+00
Xylenes (mixed)	1.0E+04	1.4E+03	1.0E+04	2.0E+02

Notes:
[1] The chemicals listed are compiled from Table 27 in the Risk Assessment Addendum.
[2] Region 9 Tap Water RSL, November, 2010

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 online at: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249.

EPA's ORD and Office of Solid Waste and Emergency Response have requested additional external peer review of the draft TCE Health Risk Assessment by the National Academy of Sciences. 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.

1.4 New Contaminants

The Interim ROD also identified 1,4-dioxane as a chemical of concern, although it was not evaluated in the risk assessment. The chemical 1,4-dioxane is a semivolatile organic compound (SVOC) that has been detected in other areas of the San Gabriel Basin, including the upgradient South El Monte OU, at concentrations exceeding the and California Department of Public Health (CDPH) drinking water notification level [NL] of 1 µg/L). The treatment process at Whittier Narrows (LGAC adsorption) is not effective at removing 1,4-dioxane from groundwater. There is no federal standard for 1,4-dioxane. However, EPA now provides a tap water RSL of 0.67 µg/L for 1,4-dioxane (EPA, 2010) and, as noted above, CDPH has the 1 µg/L NL. During the past five years, 1,4-dioxane has been detected at concentrations above the state NL in two extraction wells (EW4-5 [intermediate zone] and EW4-8 [shallow zone]), however, concentrations in these wells have not been above the NL since January 2009. 1,4-dioxane has also been detected sporadically above the tap water RSL in monitoring wells; however, these concentrations have generally been below the NL.

At the time of the Interim ROD, only the VOCs listed in Table 1 and 1,4-dioxane were commonly detected within Whittier Narrows. However, the Interim ROD acknowledged that other contaminants, such as perchlorate and N-nitrosodimethylamine (NDMA) had been detected in the San Gabriel Valley upgradient of the Whittier Narrows OU. EPA provides a tap water RSL of 0.00042 µg/L for NDMA and CDPH has a NL of 0.01 µg/L for NDMA. During past five years, NDMA has been detected above the state NL of 0.01 ug/L in the groundwater from two extraction wells (shallow zone wells EW4-3 and EW 4-8) and two monitoring wells (MW4-24 shallow zone, MW4-13 shallow and intermediate zone) in the Whittier Narrows OU. The primary source of the NDMA is the effluent from two nearby water reclamation plants. In mid-2010, the Sanitation District started a full-scale ultraviolet (UV) disinfection system that will result in greatly reduced NDMA concentrations in the effluent from the closest reclamation plants. This in turn should lead to declining NDMA concentrations in shallow groundwater in western Whittier Narrows where EW4-3, EW4-8, and MW4-24 are located. Monitoring well MW4-13 is located in the upgradient area where NDMA had consistently been either not detected or present at very low concentrations. The recent isolated concentration increase at MW4-13 is a departure from past results. The treatment system at Whittier Narrows was not designed to treat NDMA. Any groundwater from the shallow extraction wells that contains NDMA is treated for VOCs and discharged to surface water (Legg Lakes). NDMA concentrations in water discharged to surface water are at levels below the concentrations that produce any effect to aquatic life (ranging from 8 ppb for algae to 3.54 ppm for rainbow trout.)

EPA provides a tap water screening level of 26 µg/L for perchlorate and the California MCL for perchlorate is 6 µg/L. During the past five years, perchlorate has been detected infrequently in Whittier Narrows OU monitoring and extraction wells and only at concentrations well below the MCL.

The table below compares the range of concentration in past five years to the current screening levels for the new contaminants.

Table 2

Comparison of Concentrations Found at the Site to Current Screening Levels

Whittier Narrows Operable Unit, Los Angeles County, California

Chemical	**Current Tap Water RSL 2011(**µg/L)	**MCL/Notification Level 2011 (**µg /**L)**	**Range of Detection from 2006 to 2011 (**µg/L)
1,4-Dioxane	0.67	1	ND to 1.5
Perchlorate	26	6	ND to 3.7
NDMA	0.00042	0.01	ND to 0.15

1.5 Conclusions

The remedial actions in the Whittier Narrows OU are currently protective of human health and the environment based on a review of current site conditions, exposure pathways, and screening levels. In general, potential sources of exposure that could result in unacceptable risks are being controlled.

1.6 References

U.S. Environmental Protection Agency (EPA). 1992. P*ublic Review Draft Whittier Narrows Operable Unit Feasibility Study, San Gabriel Basin, Los Angeles County, California*. September.

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EPA. 2006. First Five Year Review Report for San Gabriel Valley Area 1 Superfund Site, Whittier Narrows Operable Unit. September.

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Attachment 6
Data Review and Remedy Performance Evaluation
Technical Memorandum

Data Review and Remedy Performance Evaluation Technical Memorandum – Whittier Narrows OU Five-Year Review

PREPARED FOR: Bella Dizon/U.S. EPA

PREPARED BY: David Towell/CH2M HILL
Leena Joshi/CH2M HILL

DATE: May 10, 2011

PROJECT NUMBER: 381400.OM.04

1 Introduction

This memorandum provides an evaluation of the data collected in the Whittier Narrows Operable Unit (OU) and the performance of the remedy over the five-year review period. Water quality trends are described, remedy performance issues are identified and recommendations presented.

The primary performance standard for the Whittier Narrows remedy is to provide sufficient hydraulic containment to control migration of contaminated groundwater in the San Gabriel Basin so that groundwater extracted from Whittier Narrows and Montebello Forebay production wells will not exceed drinking water standards. To ensure that this performance standard is met, the Whittier Narrows OU remedy was designed to capture all groundwater contaminated in excess of drinking water standards, such as maximum contaminant levels (MCLs), migrating through Whittier Narrows. However, groundwater monitoring data suggest that complete capture of all water migrating through the interpreted extent of contamination in Whittier Narrows does not appear to be necessary to meet the primary performance standard, particularly in the shallow zone. There are other physical factors and contaminant transport processes that help to limit contaminant migration through Whittier Narrows. These observations are supported by the results of contaminant transport simulations described below in the Remedy Performance Evaluation section.

Groundwater modeling conducted as part of the remedy evaluation efforts for the Interim Remedial Action Report (EPA, 2003) had indicated that extraction of 6,000 gallons per minute (gpm) from the intermediate zone and 5,000 gpm from the shallow zone would be required to capture all contaminated water migrating through the Narrows. Although extraction of 11,000 gpm (6,000 gpm from intermediate extraction wells and 5,000 gpm from shallow extraction wells) has been the goal of systems operation, various limitations on discharge locations and end use options and, as a minor component, mechanical and operational difficulties, have resulted in actual production being much lower than 11,000 gpm. Each of these factors is discussed in more detail below in the Remedy Performance Evaluation section (Section 3).

The Whittier Narrows OU remedy is focused on containment of VOC contamination migrating through Whittier Narrows. Tetrachloroethene or perchloroethylene (PCE) has always been the most widely detected VOC in Whittier Narrows and is consistently detected at the highest concentration. Further, PCE is the only VOC that commonly exceeds MCLs in the Whittier Narrows OU (the PCE MCL is 5 microgram per liter [µg/L]). Trichloroethylene (TCE) (along with 1,4-dioxane, discussed below) is the other VOC that is commonly detected in the OU, but TCE is rarely present at concentrations above 2 to 3 µg/L (the TCE MCL is 5 µg/L) .

Data on three other contaminants (1,4-dioxane, n-nitrosodimethylamine [NDMA] and perchlorate) commonly referred to as "emerging contaminants" are also reviewed in this Technical Memorandum (TM). Of these, 1,4-dioxane is detected much more frequently and over a broader area. However, most of the 1,4-dioxane detections are at concentrations below 1 µg/L (1 µg/L is the notification level [NL] identified by California Department of Public Health [CDPH] above which water utilities are required to inform their governing agency of the contaminant's presence).

2 Data Review

There are five primary monitoring programs that generate water quality data in the Whittier Narrows area, as described in the following list. Some of the programs also produce water level data. Water quality results are included in the tables attached to this TM for PCE (Tables 1, 3 and 9), 1,4-dioxane (Tables 2 and 4), perchlorate (Tables 5 and 6) and NDMA (Tables 7, 8 and 10).

1) Whittier Narrows OU-wide monitoring well sampling: Over the five-year review period, EPA conducted OU-wide sampling events in August/September 2006 and then on an annual basis each January from 2008 through 2011. These events primarily include analyses for VOCs, with 1,4-dioxane analyses included periodically at some locations. The PCE and 1,4-dioxane results from the OU-wide monitoring events are included in Tables 1 and 2, respectively. Water levels are collected from all zones or wells sampled. Table 13 contains the 2011 water level data and Table 14 contains the older data.

2) Whittier Narrows OU extraction well sampling: The Whittier Narrows OU extraction wells include shallow zone wells EW4-3, EW4-4, EW4-8, and EW4-9 and intermediate zone wells EW4-5, EW4-6, and EW4-7. The intermediate zone extraction wells are also called the potable wells because these are the three wells that have been permitted by CDPH for use as drinking water supply wells. The CDPH permit issued to the City of Whittier for operation of the Whittier Narrows OU treatment plant and use of the treated effluent as a potable water supply requires routine monitoring of both the shallow and intermediate extraction wells. The extraction well monitoring results are included in the following tables: Table 3 (PCE), Table 4 (1,4-Dioxane), Table 6 (perchlorate) and Table 8 (NDMA)

3) CDPH early-warning well sampling: As part of the City's CDPH permit, eight monitoring locations are currently sampled on a semiannual basis (this sampling was required quarterly during the first portion of this five-year review period [2006-2007]). The permit designates as early warning wells the following seven multi-port

monitoring well zones: MW4-9 zone 8, MW4-13 zones 3 and 4, MW4-15 zones 3 and 5, and SEMW-06 zones 2 and 4. One conventional monitoring well, MW4-72 is also identified as an early-warning well. The early-warning well monitoring data is summarized in Table 1 (PCE), Table 2 (1,4-dioxane), Table 5 (perchlorate) and Table 7 (NDMA).

4) South El Monte OU (SEMOU) routine multi-port monitoring well sampling: On a semiannual basis, EPA conducts monitoring at the multi-port monitoring wells installed in the SEMOU, north of the Whittier Narrows OU. Monitoring results from the multi-port monitoring wells located towards the southern end of the SEMOU are included in this TM. This includes SEMW-03 and SEMW-06 and, in some cases SEMW-02 and SEMW-05 which are located further upgradient. Data from the southern SEMOU multi-port monitoring wells are included in Table 1 (PCE), Table 2 (1,4-dioxane), Table 5 (perchlorate) and Table 7 (NDMA). Water level data are also typically collected as part of the SEMOU sampling. The 2011 data (SEMW-03 only) are in Table 13 and the older data are included in Table 14.

5) Central Basin Municipal Water District (CBMWD) operates two production wells (CB-1 and CB-2) just south of the Whittier Narrows Dam as part of a project called the Central Basin Water Quality Protection Project (WQPP). The WQPP was installed outside of the CERCLA process to address contamination that had migrated downgradient of the EPA extraction wells before EPA's Whittier Narrows OU remedy began operation. Although there is very little contamination currently present downgradient of EPA's extraction wells, the WQPP continues to operate. Sample results from the CB-1 and CB-2 production wells are summarized in Table 9 (PCE) and Table 10 (NDMA). The other two emerging contaminants, 1,4-dioxane and perchlorate, are generally not detected at the WQPP wells and no data summary tables have been prepared.

2.1 Concentration Distribution and Trends

2.1.1 PCE

As described above, the primary contaminant in Whittier Narrows is PCE. Analytical data results from shallow zone sampling conducted in January/February, 2011 indicate that PCE concentrations are below the MCL throughout the Whittier Narrows OU and are typically non-detect or less than 0.5 µg/L. The extent of PCE contamination in the shallow zone in the Whittier Narrows OU and southern South El Monte OU is presented in Figure 1. Note that the PCE contamination maps presented in this TM (Figures 1 through 4) include additional concentration categories than the VOC contamination maps previously prepared by EPA to provide a more refined illustration of the extent of contamination.

The PCE concentrations detected in the Whittier Narrows OU shallow zone during the recent January/February 2011 OU-wide monitoring event ranged from non-detect to 1.1 µg/L (Table 1). Overall, shallow zone PCE concentrations have continued to decline throughout the Whittier Narrows OU since 2006. As shown in Tables 1 and 3, in 2006, a number of shallow monitoring points within the Whittier Narrows OU still had PCE concentrations near or slightly above the MCL, but in recent monitoring events there are very few PCE detections above 0.5 µg/L. This is in contrast to the shallow zone concentrations at the SEMW-03 and SEMW-06 monitoring wells in the SEMOU. At those

locations (Table 1), shallow zone concentrations have remained elevated in the 10 to 100 µg/L range. The fact that these persistent high concentrations, particularly in SEMW-03, have not resulted in elevated concentrations moving into Whittier Narrows indicates that the amount of mass being loaded into the shallow zone in the southern South El Monte area must not be sufficient to overcome the contaminant transport properties acting to inhibit contaminant migration. Although the specific processes that are most important in limiting downgradient migration into Whittier Narrows are not known, there are likely several contributing factors, including:

- Relative magnitude of sources in the South El Monte OU. Many of the PRP facilities identified in the South El Monte OU are relatively small industrial operations that changed hands several times over the years. These operations may not have resulted in large residual vadose zone sources.
- Mass removal from the vadose zone and shallow aquifer. Several facilities conducted vadose zone remediation using soil vapor extraction. In addition, the San Gabriel Basin Water Quality Authority's former hydraulic barrier project, which operated for several years ending in April 2004, removed considerable mass from the shallow aquifer.
- Hydrogeologic factors reducing loading or inhibiting downgradient migration. Shallow zone water levels have been fairly low for most of the last 10 years resulting in reduced potential for direct loading of residual vadose zone contamination into the shallow groundwater. The lower water levels have also lowered the gradient in the shallow zone, providing more opportunity for vertical migration into the intermediate aquifer. Also, considerable recharge occurs in the Whittier Narrows OU in Legg Lakes, the Rio Hondo, San Gabriel River and the cross-over channel providing both dilution and an additional driving force for downward migration of contaminant mass into the intermediate zone.

PCE concentrations in the shallow zone extraction wells (Table 3) and at monitoring wells located downgradient of the remedy (see Table 11) are mostly nondetect. The low upgradient shallow zone concentrations, combined with these very low downgradient concentrations, support a conclusion that active pumping in the shallow zone may not currently be needed for the Whittier Narrows OU remedy to meets its objectives. This is discussed further below in the Conclusions and Recommendations section.

There is one monitoring point within the Whittier Narrows OU that continues to contain significantly elevated PCE concentrations: MW4-15 Zone 4. This zone is screened at the very top of the intermediate zone (145 to 155 feet below ground surface [bgs]) and the most recent results were 110 and 160 µg/L in duplicate samples (Table 1). The contamination observed in this well is a continuation of a plume migrating southward from the South El Monte OU. However, based on the lack of elevated PCE concentrations at other monitoring points in the vicinity of this location (both laterally and vertically), the high concentration plume observed at MW4-15 Zone 4 does not appear to be laterally or vertically extensive within the Whittier Narrows OU as illustrated on Figures 2, 6 and 7.

Except for MW4-15 Zone 4, PCE concentrations have generally been declining in the intermediate zone in the upgradient portions of the Whittier Narrows OU (see MW4-8,

MW4-9, MW4-10, MW4-13 and MW4-15 on Table 1). However, the concentration reductions have been less consistent in the intermediate zone compared to the shallow zone and several upgradient zones remain near or slightly above the MCL.

Similar to the shallow zone, the intermediate zone monitoring points in the southern portion of the SEMOU have remained high, particularly in SEMW-03. However, unlike the shallow zone, elevated PCE intermediate zone concentrations, in the range of 25 to 50 µg/L, do persist well into Whittier Narrows. To provide a more detailed assessment of the extent of intermediate zone PCE contamination, contour maps have been prepared illustrating the contamination present within three separate intermediate zone depth intervals: 150 to 300 feet below ground (Figure 2), 300 to 450 feet below ground (Figure 3) and 450 to 600 feet below ground (Figure 4). As Figures 2 and 3 illustrate, elevated PCE concentrations extend as far south as extraction well EW4-5 and nearby monitoring wells MW1-3 and MP1-5 (the MW1 monitoring well cluster and adjacent multiport well EPAMW1-MP share several of the same monitoring zones and are completed within a few tens of feet of each other). Table 3 shows that although PCE concentrations remain high in extraction well EW4-5, concentrations in the other two intermediate zone extraction wells, EW4-6 and EW4-7, are now less than the MCL.

One key observation is that intermediate zone PCE concentrations downgradient of the remedy (Table 11), have consistently decreased between 2006 and 2011. This downward concentration trend has continued relatively consistently since the start of remedy operations in 2002. The continuing concentration decreases are of particular note considering that extraction from the intermediate zone extraction wells has continued to be well below the target rates (Table 12).

PCE data from the two Central Basin MWD production wells associated with the WQPP project, CB-1 (located near monitoring well 4-20) and CB-2 (located near monitoring well 4-12), located just south of the Whittier Narrows Dam are shown on Table 9. PCE concentrations in these active production wells are now typically between non-detect levels and 1 µg/L.

Two areas of intermediate zone PCE concentrations that may be of concern as they relate to Whittier Narrows OU remedy performance are the concentrations in the deeper intervals at MW4-22 and at the MW1 cluster (located near EW4-5 and EW4-6). PCE concentrations in the deepest three ports at MW4-22 have remained fairly consistent or increased slightly since 2006 (Table 1). Based on particle tracking simulations conducted in 2003 to evaluate the effectiveness of remedy extraction wells (conducted in support of the Interim Remedial Action Report [EPA, 2003]), MW4-22 appears to be near the eastern edge of the capture zone provided by the Whittier Narrows OU extraction wells. The deepest port in MW4-22 is screened to 440 feet below ground which is 50 feet deeper than the extraction wells. Monitoring wells MW1-3 (390 feet deep) and MW1-2 (510 feet deep) had PCE concentrations of 26 and 9.3 µg/L, respectively, in the recent monitoring event (Table 1). The deeper MW1-2 well is completed 120 feet deeper than nearby extraction well EW4-6. It should be noted that PCE concentrations in the deeper monitoring intervals at the downgradient WN01 well remain non-detect. However, it appears that additional deeper downgradient monitoring points are needed in this general area.

2.1.2 1,4-Dioxane

The recent data included in Table 2 (monitoring wells) and Table 4 (extraction wells) show that 1,4-dioxane concentrations in the shallow zone remain consistently low in the Whittier Narrows OU and southern South El Monte OU and are generally non-detect or less than 1 µg/L (see Figure 17 for postings of the latest 1,4-dioxane results in shallow zone wells). The only shallow monitoring location with a concentration above 1 µg/L is SEMW3-4 and at that location concentrations have declined from 6.2 to 1.7 µg/L since 2006 (Table 2).

The intermediate zone 1,4-dioxane data shown in Table 2 indicate that low-level detections are fairly prevalent in the upgradient portions of the Whittier Narrows OU and southern portion of the South El Monte OU. Concentrations are consistently below 1 µg/L, as shown in Figure 18 which presents recent 1,4-dioxane data. The only monitoring location where the latest concentration exceeds 1 µg/L is SEMW3-3. Similar to the shallow zone, the concentrations at this location have declined considerably since February 2006, declining from 8.3 µg/L down to 1.8 µg/L in the recent monitoring event. 1,4-Dioxane is present in all three intermediate zone extraction wells (Table 4) at concentrations that typically range from nondetect to 0.9 µg/L. EW4-5 is the only intermediate depth extraction well that has had 1,4-dioxane above the CDPH notification of 1 ug/L. The most recent concentration above 1 µg/L was reported as 1.1 µg/L in December 2008 (Table 4). 1,4-Dioxane concentrations in monitoring wells in the vicinity of EW4-5 and EW4-6, also indicate concentrations less than 1 ug/L. Concentrations ranging from 0.56 to 0.67 were detected in wells MW-1-3 (380 to 390 feet bgs) and MW1-4 (234 to 240 feet bgs).

The consistently low 1,4-dioxane concentrations present in upgradient shallow and intermediate zone monitoring wells over the last several years suggest that it is unlikely that significant additional migration of 1,4-dioxane into the intermediate zone (potable) extraction wells would be expected in the near term. 1,4-Dioxane levels in individual extraction wells will likely continue over the next several years to remain in the same 0.5 to 1.2 µg/L range that has been observed over the last few years (Table 4). This suggests that the Whittier Narrows OU treatment plant potable effluent will probably not reach 1.5 µg/L in the near term. The 1.5 µg/L value is the concentration required in the effluent for there to be an official exceedance of the CDPH notification level of 1 µg/L.

2.1.3 Perchlorate

Perchlorate monitoring within the Whittier Narrows OU is primarily limited to the early-warning monitoring wells and the extraction wells (Tables 5 and 6). In addition, the southern SEMOU monitoring wells are regularly sampled for perchlorate (Table 5). Perchlorate is infrequently detected within the Whittier Narrows OU and when it is detected, the concentrations are typically in the 1 to 3 µg/L range (the perchlorate MCL is 6 µg/L). Perchlorate is generally nondetect in Whittier Narrows OU extraction wells (Table 6).

Perchlorate is detected on a much more consistent basis in the southern SEMOU monitoring wells. Detected concentrations remain low in the 1 to 4 µg/L (Table 5) with no exceedances of the 6 µg/L MCL detected.

At this point, based on the available perchlorate data shown in Tables 5 and 6, it does not appear likely that perchlorate will be an issue that requires attention in the Whittier Narrows OU in the near future.

2.1.4 NDMA

NDMA monitoring in the upgradient portions of the Whittier Narrows OU is limited to the early-warning monitoring locations. In 2010, NDMA concentrations at the two zones (one shallow and one intermediate) in both the MW4-13 well and SEMW-06 well were reported to be above the CDPH notification level of 0.010 µg/L (Table 7). These recent, isolated concentration increases are a departure from past results, which were consistently nondetect or very low in these upgradient areas.

Shallow NDMA concentrations in the western portion of the Whittier Narrows OU have historically been strongly influenced by high-concentration NDMA discharges from the Whittier Narrows Reclamation Plant operated by the County Sanitation Districts of Los Angeles County (the Sanitation District). Since 2004, the Sanitation District has attempted to minimize direct discharges to the Rio Hondo which appear to have the greatest influence on NDMA concentrations in EPA's shallow extraction wells EW4-3 and EW4-and nearby shallow monitoring wells MW4-23 and MW4-24. In mid-2010, the Sanitation District started a full-scale ultraviolet (UV) disinfection system that will result in greatly reduced NDMA concentrations in the reclamation plant effluent. This in turn should lead to declining NDMA concentrations in shallow groundwater in western Whittier Narrows. Over the last few years, NDMA concentrations in the EW4-3 and EW4-8 wells have ranged from nondetect up to 0.1 µg/L (10 times the CDPH notification level) (Table 8).

As shown in Table 8, low-level NDMA detections (below the notification level) were detected consistently through August 2006 in EW4-7, the westernmost Whittier Narrows intermediate extraction well. This well is screened a bit shallower than the other intermediate wells (up to 160 feet below ground) and is located more directly down-gradient of the elevated shallow zone concentrations of NDMA observed in the EW4-8 vicinity. However, concentrations have been nondetect since 2007. These concentrations are expected to remain very low or nondetect as long as the shallow NDMA levels don't increase significantly.

NDMA data from the two Central Basin WQPP project production wells CB-1 (located near MW4-20) and CB-2 (located near MW4-12) are included in Table 10. The NDMA data from these two active production wells show that concentrations have consistently been at or below the notification level of 0.010 µg/L. NDMA concentrations have declined somewhat since 2006 and have been nondetect for the last two quarters of 2010.

The lower effluent NDMA concentrations that should be maintained from the Whittier Narrows Reclamation Plant combined with the generally low concentrations in upgradient areas indicate that NDMA is not likely to be a significant issue in Whittier Narrows in the near term.

2.1.5 Vertical Distribution of PCE Contamination

Figure 5 shows the locations of five cross sections running through the Whittier Narrows and southern South El Monte OU areas. These cross sections were originally prepared more than 10 years ago to illustrate generalized hydrostratigraphic information for the aquifers in

the OU area and the interpreted vertical extent of contamination. The cross sections have been updated with the latest PCE concentration data and contaminant concentration contours and are included as Figures 6 through 10. Three of the cross sections run generally east-west across the Whittier Narrows OU. Cross-section A-A′ (Figure 6) is located near the 60 Freeway at the upgradient end of Whittier Narrows. Cross-section E-E′ (Figure 10) extends through the Whittier Narrows OU extraction well field. Cross-section D-D′ (Figure 9) runs approximately along the Whittier Narrows Dam at the downgradient end of the OU. Two of the cross-sections run from northeast to southwest starting in the South El Monte OU and extending through Whittier Narrows and beyond Whittier Narrows Dam. These include Cross-Section B-B′ (Figure 7) that runs along the western side of the Whittier Narrows OU contamination and Cross-Section C-C′ (Figure 8) that runs along the eastern side of the Whittier Narrows OU contamination. The distribution of PCE contamination shown on each section is summarized below. The PCE contamination shown in the cross sections uses the same concentration ranges and color schemes as the plan view contamination maps shown in Figures 1 through 4.

Cross-Section A-A′ (Figure 6)- This cross section illustrates the contamination moving into the Whittier Narrows OU from the upgradient South El Monte OU. As the figure shows, there is a relatively limited lateral and vertical extent of high-level PCE contamination surrounding MW4-15 Zone 3. The only other PCE MCL exceedances are for the top four intermediate zone monitoring points at MW4-8. Shallow zone concentrations entering Whittier Narrows are low.

Cross-Section B-B′ (Figure 7)- This long cross section illustrates the high-level contamination that is still present in the South El Monte OU and the relatively limited extent of contamination along the western side of the Whittier Narrows OU (except the high concentration at the MW4-15 Zone 3 location). The figure shows the four different shallow zone hot spots located along the trace of the cross section in the South El Monte OU, but no shallow zone contamination above the MCL within Whittier Narrows. Similarly, high levels of PCE contamination are present down to a depth of over 400 feet below ground at SEMW-03 in the South El Monte OU, but high concentrations of PCE in the Whittier Narrows OU portion of the cross section only extend down to less than 200 feet below ground.

Cross-Section C-C′ (Figure 8)- This is another long cross section that starts in the eastern portion of the South El Monte OU and extends through the eastern portion of the Whittier Narrows OU contamination on past the Whittier Narrows Dam. This section shows that low concentrations of PCE are present throughout the vertical profile of MW4-9 located at the upgradient end of the Whittier Narrows OU. In fact, no shallow zone PCE contamination is present along this entire cross section. The highest PCE concentrations detected along the section are found at depth in monitoring well MW1-3 (co-located with the EPAMP01 well), located near extraction wells EW4-5 and EW4-6. The presence of higher PCE concentrations towards the downgradient portion of this cross section is the result of southerly to slightly southeasterly migration of the intermediate zone contamination that enters Whittier Narrows near the Rosemead Boulevard/60 Freeway intersection as illustrated in Figures 2 and 3. As shown in Figure 8, it does not appear that PCE contamination above the MCL currently extends downgradient as far as the Whittier Narrows Dam.

Cross-Section D-D' (Figure 9)- Cross-Section D-D' confirms that no PCE contamination in excess of the MCL is currently migrating past the Whittier Narrows Dam into the Montebello Forebay portion of the downgradient Central Basin. Even the extent of PCE in excess of 0.5 µg/L is limited. Preventing migration of contamination into the Central Basin is one of the key performance evaluation factors for the Whittier Narrows OU remedy.

Cross-Section E-E' (Figure 10)- This cross section runs through all 7 of the Whittier Narrows OU extraction wells, from west (shallow wells EW4-8 and EW4-3) to east (intermediate well EW4-6). Cross-section E-E' highlights two areas of potential concern for the Whittier Narrows OU remedy:

1) There is deep contamination present more than 100 feet deeper than the bottom of the extraction well screens in the vicinity of EW4-6. It is not likely that the remedy extraction wells can capture all of this contamination.

2) There are MCL exceedances present at depth in MW4-22. As noted above, particle-tracking simulations conducted in 2003 (EPA, 2003) indicate that MW4-22 is likely very near the eastern edge of the capture envelope provided by operation of the remedy extraction wells at the target rates of 6,000 gpm . The location and depth of the contamination make it difficult for the remedy extraction wells to contain.

2.2 Groundwater Elevations

The water levels measured during the recent OU-wide monitoring event and the associated groundwater elevations are presented in Table 13. Table 14 provides a listing of groundwater elevations from measurements collected between 2006 and early 2011. As described below and illustrated in Table 14, the groundwater elevations have not changed dramatically over the last 5 years. Groundwater elevation contours based on data from the 2011 monitoring event are shown in Figure 11 (shallow zone) and Figure 12 (intermediate zone). In general, the groundwater elevation contours are consistent with prior contour maps constructed in 2002/2003. Figures 19 and 20 are representative hydrographs of two shallow zone monitoring points. Figures 21 and 22 are intermediate zone hydrographs.

For shallow zone wells monitored in both 2006 and 2011, the groundwater elevations have increased by 1 to 2 feet in about half of the wells and decreased by 2 to 3 feet in half of the wells. In general, prior to December 2010, conditions had been relatively dry and water levels in the San Gabriel Basin have been near historic lows. The significant influence of ongoing shallow zone extraction at the EW4-3 and EW4-4 wells is apparent in the 188 and 190 foot contours that form a pumping depression around these wells. This is likely the cause of the declining water levels observed at many locations. The record setting rainfall that took place in Southern California in December 2010 and the significant amount of recharge occurring behind Whittier Narrows Dam as high storm flows were retained had already began to influence some of the shallow groundwater elevations by the 2nd half of January 2011 when the monitoring event was initiated. This recent recharge would be a contributing factor in some of the groundwater elevation increases and is leading to a small mound developing in the shallow water table behind Whittier Narrows Dam as evidenced by the elevations measured in MW4-23 and MW4-26 (Figure 11). One anomaly is the shallow groundwater elevations is at SEMW-03, which appears to be several feet lower than would have been expected in comparison to historic groundwater elevation observations.

The cause of this anomaly is unclear, but the upcoming field investigations in the South El Monte OU should shed more light on shallow flow conditions in the vicinity of this well.

In the intermediate zone, groundwater elevations between 2006 and 2011 have in general decreased by around 1 to 3 feet in most wells, although similar to the shallow zone there are locations where water levels have increased slightly. The overall decline is the result of the extended drought conditions that have impacted groundwater levels throughout the San Gabriel Basin. When monitored in early 2011, these intermediate wells would not yet be responding to the increased recharge that occurred in December 2010. The groundwater elevation contours shown in Figure 12 follow a very similar pattern to contour maps prepared in the past. Some influence from intermediate extraction well pumping is apparent in the 186 and 188 foot contours, although the impacts are limited. It should be noted that the December and January intermediate zone extraction rates were quite low (~2,400 gpm) because of the wet weather and the normal low demands for potable water during that time of year. Groundwater data collected during the late summer peak pumping periods would likely show additional influence from the intermediate zone extraction. However, even during the full-scale pumping test conducted in the summer of 2002, the impact of the extraction on intermediate zone water levels are relatively localized. As is shown in Figure 12, the groundwater flow divide that typically occurs in the South El Monte OU and separates flow towards Whittier Narrows from flow towards South El Monte OU extraction wells appears to be situated quite far to the south compared to most times. The location of the flow divide is transient and it generally moves towards the south during low-water level conditions as have been present in the San Gabriel Basin for a number of years.

The intermediate zone groundwater contours are based on data generally collected between approximately 250 and 350 feet bgs, so they are not necessarily representative of what may be happening in deeper portions of the intermediate zone. As is discussed elsewhere in this TM, the water quality data and contaminant transport modeling results indicate that deeper intermediate zone contamination may be moving towards the southeast, while the contours in Figure 12 indicate a southwesterly flow direction.

3 Remedy Performance Evaluation

A general evaluation of Whittier Narrows OU remedy performance is presented in this section.

3.1 Extraction Rates from Remedy Wells

Average annual extraction rates for the Whittier Narrows OU extraction wells for the five-year review evaluation period of 2006 to 2010 are presented in Table 12. The annual averages (in gpm) shown in Table 12 were calculated by taking the total volume of water extracted from each well during the calendar year (in gallons) and dividing that by the number of minutes in the year. As shown in the table, extraction rates have generally been well below the target rates. Figures 23 and 24 provide graphs of monthly production from September 2006 through 2010 for the shallow and intermediate zone extraction wells, respectively.

3.1.1 Shallow Zone Extraction

For the shallow zone, extraction over the five-year period averaged only about 1,165 gpm, well below the interim target rate of 2,000 gpm. One contributing factor to the reduced average extraction rate was the halting of shallow extraction for 8 months beginning in July 2007 because a modified three-party water production agreement was being developed between EPA, the Main San Gabriel Basin Watermaster and Los Angeles County Parks Department. A water production agreement is required because EPA does not have pumping rights in the San Gabriel Basin. In addition, the persistent occurrence of elevated back pressures across the liquid-phase granular activated carbon (LGAC) vessels being used to treat the shallow groundwater has limited the system's operational capacity. It appears that air has been getting entrained within the carbon in the LGAC vessels contributing to the increased pressures. Since August 2010, supplemental operational procedures have been implemented where the air is routinely bled off from the vessels and recent extraction rates have been closer to the 2,000 gpm target rate.

The 2,000 gpm shallow target rate had been selected to address several factors influencing shallow extraction, including:

- The limited extent of shallow zone contamination in Whittier Narrows which indicated that minimal extraction was required to meet remedy objectives- Currently, there are no shallow zone MCL exceedances within the Whittier Narrows OU so shallow extraction is not required to meet remedy objectives.
- Treatment plant booster pump capacity- In addition to the elevated back pressures noted above, shallow zone discharge is currently to the Los Angeles County Parks Department's historic irrigation distribution system so the treated water can be transported to both the southern and northern Legg Lakes and make use of decorative water features installed by the County. Discharging to the irrigation system has increased the back pressure on the shallow zone booster pump.
- The water production agreement requirement that all shallow discharge that overflows from Legg Lakes (only about 800 gpm, on average, are required to keep the lakes full) infiltrates back into the ground within Mission Creek before the water reaches San Gabriel Boulevard- Increased shallow zone extraction rates would make it harder to ensure that all water is recharged.

3.1.2 Intermediate Zone Extraction

Intermediate zone extraction rates over the five-year review period (2006 to 2010) averaged about 3,257 gpm. This is just over half (54%) of the 6,000 gpm intermediate zone target rate. One significant factor in lowering the average extraction rate was the 8-month period (from August 2008 through April 2009) when the treatment plant was essentially shutdown to facilitate a carbon changeout. The changeout took many months longer than anticipated due to a number of factors, including interaction with CDPH because of changing the type of carbon to be used, delays in receipt of analytical data from the carbon supplier, scheduling delays associated with the carbon replacement contractor and the finding that repairs were required to fix damaged or corroded sample port materials and the surrounding lining on the inside of many LGAC vessels.

Although there have also been several operations and maintenance issues related to booster pumps, well pumps and variable frequency drives (VFDs) that have periodically limited the available capacity for the intermediate (potable) portion of the extraction and treatment system, the primary factors impacting intermediate extraction rates are related to reductions in the City of Whittier's water demand and the need for the City to use their own Central Basin water rights to meet a portion of the City's demand.

Prior to completing system modifications in 2003 that resulted in the only discharge option for the treated potable water being to the City of Whittier's system, it was known that the City's water demand was such that the maximum annual average pumping rate from the potable wells would be approximately 5,200 gpm (consistent with City demand of approximately 8,300 acre-feet per year), compared to the target rate of 6,000 gpm. It was anticipated that the ability to supply water to an additional water purveyor would be added to reach the 6,000 gpm target rate. However, another purveyor has not been added. Further, the City's water demand has recently declined by approximately 10%, likely because of regional publicity regarding water conservation combined with a depressed economy. The City of Whittier also owns approximately 900 acre-feet of pumping rights in the Central Basin that must be used on an annual basis because there is limited ability to "bank" Central Basin water rights for future use and there is little demand for leasing the rights. Previously, the City was selling water to some of the neighboring cities such as Pico Rivera and Santa Fe Springs that had water supply limitations. However, with the availability of treated water from the Central Basin's WQPP project, these neighboring purveyors no longer need to buy water from the City.

This combination of factors impacting City water demand had resulted in a condition where the maximum annual average intermediate zone pumping rate available is likely in the 4,000 gpm range unless another end user is added or City demand increases.

As is described in the following sections, despite the average intermediate zone extraction rate being only around 3,250 gpm over the last 5 years, the magnitude and extent of downgradient contamination have continued to decline. This implies that intermediate zone extraction at rates well below the current 6,000 gpm target rate may be able to meet remedy performance objectives. As an activity separate from the five year review, additional model simulations are being conducted using the updated groundwater flow and transport model to evaluate potentially lowering the target pumping rates. The results of these simulations will be documented in a separate technical memorandum.

3.2 Changes in the Extent of Contamination

The current extent of PCE contamination in the Whittier Narrows OU and southern South El Monte OU is depicted in Figure 1 for the shallow zone and Figures 2 through 4 for different depth intervals within the intermediate zone. These recent maps of PCE contamination are drawn using a more refined set of concentration contour intervals than prior maps of VOC contamination prepared for the area. To allow for a more direct comparison of changes in the distribution of contamination between 2002 (when remedy construction was completed) and present, updated 2002 contamination maps were prepared using the more refined contour intervals that were applied to the 2011 contamination maps. These are shown in Figure 13 (shallow zone) and Figure 14 (intermediate zone). Changes in the extent of contamination are discussed in the following text.

3.2.1 Shallow Zone Contamination Changes

As shown in Figure 1, there are currently no shallow zone MCL exceedances within the Whittier Narrows OU. This is a dramatic change from the extent of shallow contamination existing in 2002 (Figure 13) where there was a large area of contamination in the western portion of the narrows where concentrations exceeded 25 µg/L, including areas in excess of 50 and 100 µg/L surrounding wells MW4-72 and MW4-15. A number of factors likely combined to result in this much contamination disappearing from the shallow zone in Whittier Narrows, including significant reductions in loading from the upgradient South El Monte OU, dilution from the significant recharge occurring within Whittier Narrows, vertical migration into the intermediate zone and mass removal from remedy well pumping. Although there are persistent areas of elevated shallow zone contamination in the South El Monte OU, the mass loading to the aquifer in these areas does not appear to be large enough to generate high concentration plumes migrating into Whittier Narrows. As described in more detail above in Section 2.1.1, there are likely several contributing factors to the reduced mass loading, including: the relative magnitude of sources in the South El Monte OU; mass removal from the vadose zone and shallow aquifer; and hydrogeologic factors reducing loading or inhibiting downgradient migration.

3.2.2 Intermediate Zone Contamination Changes

The current extent of contamination in the intermediate zone has been divided into three maps (Figures 2, 3 and 4), with each covering a specific 150-foot thick vertical horizon. Because the 2002 intermediate zone contamination is shown on a single composite map, it is not as easy to do a straightforward comparison of changes in the extent of contamination. However, several conclusions are apparent:

- The areal extent of high concentration areas towards the southern end of the South El Monte OU is somewhat smaller now compared to 2002, but the changes are not dramatic.
- The extent of above MCL contamination upgradient of the Whittier Narrows OU extraction wells has not changed dramatically. The area with contamination above the MCL is only slightly narrower. However, the width of the higher concentrations has shrunk more substantially and also extends a little further downgradient.
- In the vicinity of the extraction wells, the western edge of contamination has shifted towards the east. This indicates that extraction from intermediate well EW4-7 is now less important than extraction from EW4-5 and the easternmost well EW4-6.
- The extent of intermediate zone contamination above the MCL has greatly diminished downgradient of the Whittier Narrows OU extraction wells. This is likely the result of remedy well pumping combined with extraction from the WQPP wells CB-1 and CB-2. Only a small area of above MCL contamination remains in the 150- to 300-foot deep interval.
- The area of deep (450- to 600-feet below ground) contamination shown on Figure 4 will be difficult to capture because the Whittier Narrows OU extraction wells are only screened down to 390 feet. However, based on the existing water quality data (which are limited for these deeper intervals), it appears to be a relatively isolated area suggesting that the amount of mass migrating into the deeper horizons may be

relatively small. Although additional downgradient monitoring is needed, the deep contamination does not yet appear to have migrated as far as the Whittier Narrows Dam because the deeper zones at WN-01 remain nondetect.

3.3 Contaminant Transport Simulations of Plume Capture

Because of the significant changes observed in the extent of contamination in Whittier Narrows, particularly in the shallow zone throughout the OU and in the intermediate zone downgradient of the remedy extraction wells, EPA decided to conduct additional groundwater modeling intended to support potential reductions in the target remedy extraction rates. In mid-2010 EPA tasked CH2M HILL with initiating the modeling effort, including updating the existing groundwater flow model and developing a contaminant transport model. The model update will be described in a separate CH2M Hill technical memorandum that is currently under preparation. The primary components of the modeling effort have included the following:

- Updating the existing basinwide groundwater flow model with available data through June 2009. The basinwide model previously ended June 2001.
- Incorporating the refinements made to the models in the Whittier Narrows and South El Monte areas back into the basinwide model.
- Reviewing the calibration results for the updated model, particularly focusing on the calibration results (scatter plots, hydrographs and water budgets) for the Whittier Narrows area.,
- Developing a contaminant transport model to assess contaminant movement in the Whittier Narrows and southern South El Monte OU areas.
- Calibrating the contaminant transport model so that it can reasonably well simulate the observed changes in PCE distribution during operation of the Whittier Narrows remedy between 2002 and 2009 (the end of the model period).
- Using the calibrated contaminant transport model to simulate predicted future migration of the current contamination (Figures 1 through 4) under a variety of hydraulic (e.g., high-water level and low-water level) conditions and remedy operational scenarios that represent new target rates. This final step is ongoing at the present time.

The 2002 to 2009 contaminant transport simulations are considered an appropriate tool to support conclusions about past remedy performance for this five-year review. These simulations start with the observed extent of contamination in 2002 (Figures 13 and 14), then simulate movement of that contamination through the end of the model period in 2009. The simulations reflect actual conditions for this period, including recorded extraction rates (for remedy wells and non-remedy wells), reported recharge rates, hydraulic heads and other input parameters included in the calibrated model for this period. The results of the contaminant transport simulations for the shallow and intermediate zones are shown in Figures 15 and 16, respectively. Note that the Slice 3 results shown on Figure 15 are heavily influenced by the elevated PCE concentrations present at the very top of the intermediate zone and may not be representative of shallow zone conditions. Observations from the transport simulations include:

- The simulated extent of shallow zone contamination in 2009 shows no migration beyond the extraction well locations which is consistent with historical and recent observations. The simulation does indicate a relatively large area of shallow zone MCL exceedances upgradient of the extraction wells. However, by 2009 the actual extent of shallow zone contamination above the MCL within Whittier Narrows is minimal. The dramatic decline in shallow zone concentrations observed in Whittier Narrows between 2002 and 2009 is very difficult to simulate without assuming unreasonable contaminant conditions (e.g., initial contaminant distribution that is significantly less than measured concentrations) and transport parameters that would not be consistent with known conditions in Whittier Narrows (e.g., high degradation rates even though no degradation by-products have been detected).

- The simulated extent of intermediate zone contamination shown in Figure 16 matches very well the 2009 contamination contours shown in light brown in the background, particularly for the upper reaches of the intermediate zone (Slice 4). The Slice 4 simulation results show a relatively small plume of above MCL contamination extending to just beyond the Whittier Narrows Dam, similar to the observed 2009 conditions. The extent of higher level contamination simulated for Slice 4 (shown in yellow) also matches well with the mapped area of high concentrations. Finally, the overall shapes of the simulated and observed areas of above MCL contamination are consistent.

- The simulated extent of contamination in Slice 5 is reasonably similar to the mapped 2009 conditions, although the simulated results somewhat overpredict the extent of above MCL contamination migrating past the remedy extraction wells. It should be noted that the mapped 2009 intermediate zone contamination represents a composite of the maximum concentration detected from any of the available intermediate zone depth intervals, which covers several hundred feet of the aquifer. So, the depth-specific simulation results are not necessarily expected to match the mapped contours particular moving deeper (i.e., Slice 6) where the mapped contours likely overstate the actual extent of contamination.

- The simulated migration of deeper intermediate zone contamination (Slice 6) towards the southeast beyond the Whittier Narrows extraction wells highlights an area of concern based on recent monitoring results. Although no significant migration beyond the extraction wells has been detected to date in monitoring well WN-01, the simulation confirms that this is an area that warrants additional scrutiny.

  As is illustrated in the cross sections shown in Figures 7, 8 and 9, the alluvial aquifer thins considerably to less than 350' deep in the vicinity of the Whittier Narrows Dam in the western half of Whittier Narrows. This means that the deeper contamination (i.e., in the 450 to 600 foot depth interval) present near the extraction wells would need to move into shallower depths for it to migrate towards the south or southwest. This physical constraint makes it much more likely that the deep contamination would either head towards the southeast where the alluvial aquifer remains deep (i.e., in the vicinity of WN-01) or be drawn into deep production wells to the east (City of Whittier wells or Suburban Water System wells located east of the San Gabriel River).

4 Conclusions

4.1 Shallow Zone

In the shallow zone, the extent of contamination has shrunk dramatically since remedy construction was completed in 2002 and PCE concentrations have continued to decline consistently over the last five years (2006 to 2010). There are currently no shallow zone MCL exceedances in the Whittier Narrows OU, indicating that continued extraction is not needed to meet the goals of this hydraulic containment remedy.

There are likely several factors that have combined to lead to the current conditions. The largest factor is reduced migration of shallow zone contamination from the upgradient South El Monte OU into Whittier Narrows. Although high levels of shallow contamination remain in the southern portion of the South El Monte OU (Figure 1), these hot spots must not be loading sufficient mass to the shallow aquifer to produce high concentration plumes migrating downgradient. The general low water-level conditions that have persisted for much of the last decade may be contributing to the reduced mass loading, however, following record rainfall in the winter of 2005 shallow water levels rose dramatically. There has not been an associated spike in shallow zone concentrations observed in the South El Monte source areas. This indicates that shallow zone PCE concentrations within the Whittier Narrows OU are unlikely to increase significantly in the next several years.

Based on the available data, it does not appear that any of the emerging contaminants discussed above (1,4-dioxane, perchlorate and NDMA) will be a near-term issue in the shallow zone in Whittier Narrows.

Significant reductions in the target rates for shallow zone extraction appear warranted and completely eliminating shallow zone extraction should also be considered. If shallow extraction is curtailed, an appropriate monitoring program will need to be developed and implemented to ensure that rising shallow zone concentrations in the future would be detected in sufficient time to re-activate the shallow extraction system. Note that shallow zone concentrations downgradient of the Whittier Narrows OU extraction wells have always remained low regardless of how much shallow zone extraction has been occurring.

4.2 Intermediate Zone

The extent of intermediate zone contamination downgradient of the Whittier Narrows OU extraction wells has declined dramatically since remedy extraction began in 2002. In general, downgradient PCE concentrations have continued to decline over the five-year period evaluated for this report. These continued concentration declines have occurred despite intermediate zone extraction averaging less than 3,300 gpm over the last five years. This provides strong evidence that the remedial objectives (hydraulic control of migrating contamination) can be met at a lower flow rate than the current intermediate zone target extraction rate of 6,000 gpm.

Intermediate zone contaminant concentrations upgradient of the extraction wells have remained elevated, although the overall width of the contaminated area has shrunk and shifted a bit to the east (Figures 2 and 3). The changes in the distribution of contamination migrating towards the extraction wells indicate that intermediate pumping should likely be focused on EW4-5 (center well) and EW4-6 (eastern well) rather than EW4-7.

One area of potential concern has been identified in the intermediate zone. Deep contamination in excess of the MCL has been detected in a monitoring well cluster near EW4-6 (MW1) and at MW4-22 located to the northeast of the extraction wells (see Figures 4 and 10). It is unlikely that the existing extraction wells can capture all of this contamination, even with increased pumping from EW4-6. However, it is not clear how significant of a threat the contamination potentially not being captured represents to downgradient areas or nearby water purveyor production wells. Additional contaminant transport simulations will help in evaluating this issue; however, it appears that new, deep monitoring downgradient of the intermediate zone extraction wells is also necessary.

5 Recommendations

The predictive contaminant transport modeling that EPA is currently conducting, combined with the data evaluation presented in this technical memorandum, should be used to select lower target extraction rates for the Whittier Narrows remedy shallow and intermediate extraction wells (and whether additional pumping is needed to address the deeper intermediate contamination). This should include consideration of completely eliminating shallow extraction.

If the decision is made to suspend shallow extraction, the shallow aquifer monitoring program should be evaluated as part of the Remedy Performance Evaluation Plan (see below) to enable early detection of shallow aquifer contamination migrating from the South El Monte OU. The existing shallow extraction wells should be maintained, thus allowing for timely reactivation should the need arise.

The location and depth of an additional deep monitoring well (or wells) to be installed downgradient of the eastern end of the Whittier Narrows extraction well field should be determined and arrangements made for well installation. In addition, arrangements should be made for sampling of the deepest well (MW1-1) at the monitoring well cluster located between EW4-5 and EW4-6 (this well could not be sampled in the 2011 event because the well was inaccessible).

A Remedy Performance Evaluation Plan should be developed that identifies:

- the specific remedial objectives of the remedy;
- how compliance with those objectives will be determined;
- the data that needs to be collected to support remedy performance evaluations; and,
- the technical evaluations to be conducted each year to evaluate remedy performance.

An Annual Remedy Performance Evaluation Report should be prepared summarizing the available monitoring data, summarizing remedy performance and describing any upcoming technical evaluations or proposed changes to the remedy.

A comprehensive Groundwater Monitoring Plan should be included as an attachment to Remedy Performance Evaluation Plan to ensure that sufficient data are collected to detect changing contaminant or hydrologic conditions that could impact remedy performance, to facilitate implementation of the Remedy Performance Evaluation Plan and to allow for preparation of the Annual Report.

Once the new lower target extraction rates for the shallow and intermediate zones are approved by EPA and DTSC and the Remedy Performance Evaluation Plan is complete, opportunities for additional system optimization should be evaluated, including the remaining recommendations from the U.S. Army Corps of Engineers Remediation System Evaluation Report (U.S. Army Corps of Engineers, 2008).

6 References

EPA. 2003. Interim Remedial Action Report, San Gabriel Valley Area 1 Superfund Site – OU 2, Whittier Narrows Operable Unit. September 30.

U.S. Army Corps of Engineers. 2008. Remediation System Evaluation, San Gabriel Valley Superfund Site, Whittier Narrows Operable Unit, Whittier, California. Final Report. May.

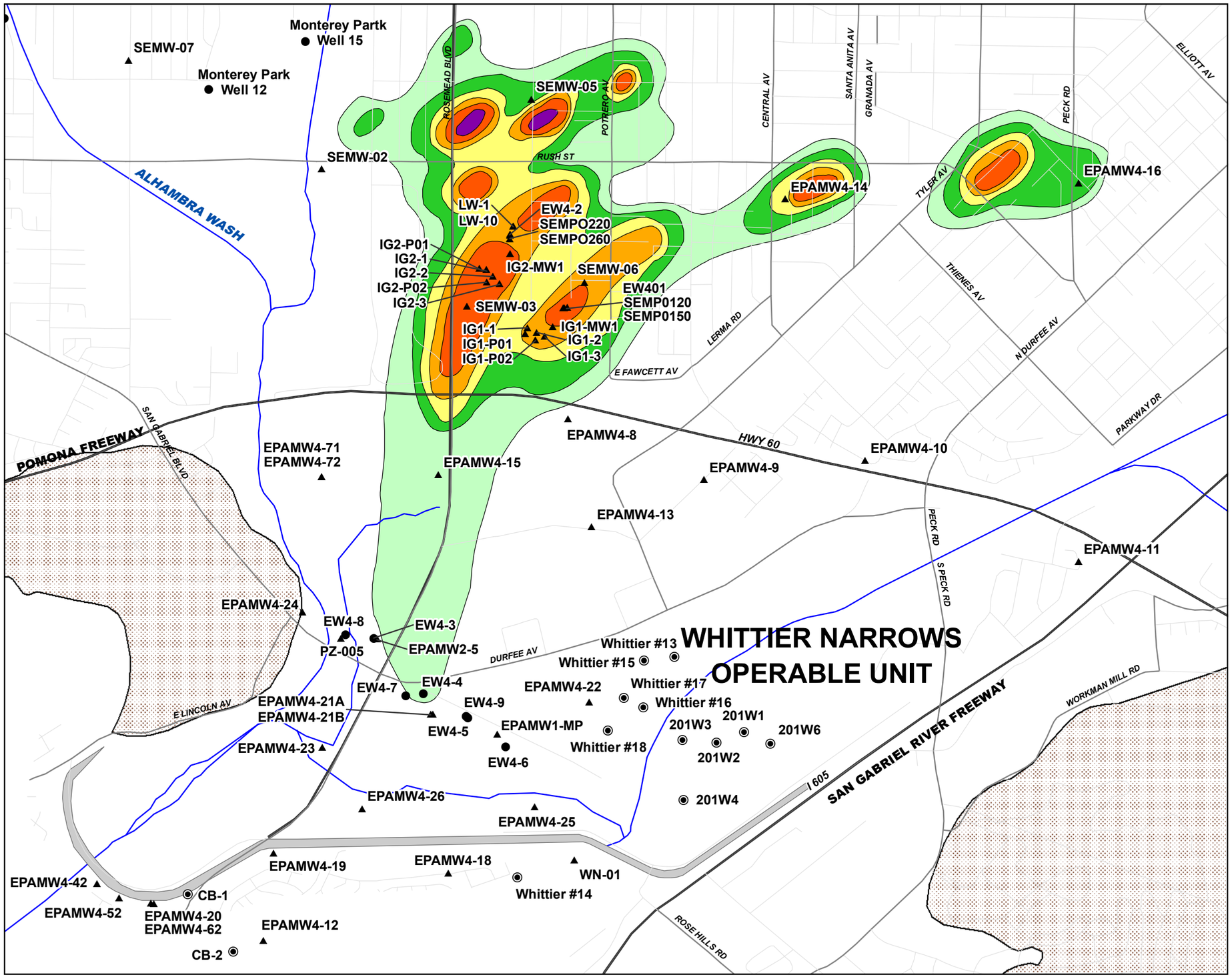

Figure 1
Shallow Zone PCE Contamination
(Through January 2011)
Whittier Narrows Operable Unit

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SOUTH EL MONTE OPERABLE UNIT

WHITTIER NARROWS OPERABLE UNIT

SEMW-02
LW-1
LW-10
EW4-2
SEMPO220
SEMPO260
IG2-P01
IG2-1
IG2-2
IG2-P02
IG2-3
IG2-MW1
SEMW-06
EW401
SEMP0120
SEMP0150
SEMW-03
IG1-1
IG1-P01
IG1-P02
IG1-MW1
IG1-2
IG1-3
EPAMW4-14
EPAMW4-71
EPAMW4-72
EPAMW4-15
EPAMW4-8
EPAMW4-10
EPAMW4-9
EPAMW4-13
EPAMW4-24
EW4-8
EW4-3
PZ-005
EPAMW2-5
EW4-7
EW4-4
EW4-9
EPAMW4-21A
EPAMW4-21B
EW4-5
EPAMW4-22
EPAMW1-MP
EPAMW4-23
EW4-6
Whittier #13
Whittier #15
Whittier #17
Whittier #16
Whittier #18
201W1
201W3
201W6
201W2
201W4
EPAMW4-26
EPAMW4-25
EPAMW4-19
EPAMW4-18
WN-01
Whittier #14
EPAMW4-42
EPAMW4-52
CB-1
EPAMW4-20
EPAMW4-62
EPAMW4-12
CB-2

ROSEMEAD BLVD
RUSH ST
POTRERO AV
CENTRAL AV
SANTA ANITA AV
TYLER AV
THIENES AV
N DURFEE AV
LERMA RD
E FAWCETT AV
SAN GABRIEL BLVD
POMONA FREEWAY
HWY 60
PECK RD
S PECK RD
E LINCOLN AV
DURFEE AV
SAN GABRIEL RIVER FREEWAY
I 605
WORKMAN MILL RD
ROSE HILLS RD

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Whittier Narrow Dam
- Bedrock
- PCE Contamination Ranging from 0.5 to 5 µg/L
- PCE Contamination Ranging from 5 to 10 µg/L
- PCE Contamination Ranging from 10 to 25 µg/L
- PCE Contamination Ranging from 25 to 50 µg/L
- PCE Contamination Ranging from 50 to 100 µg/L
- PCE Contamination Ranging greater than 100 µg/L

N

1,500 0 1,500 Feet

Figure 2
Intermediate Zone PCE Contamination
Between ~ 150 and 300 feet bgs
(Through January 2011)
Whittier Narrows Operable Unit

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SOUTH EL MONTE OPERABLE UNIT

WHITTIER NARROWS OPERABLE UNIT

SEMW-02
LW-1
LW-10
EW4-2
SEMPO220
SEMPO260
IG2-P01
IG2-1
IG2-2
IG2-P02
IG2-3
IG2-MW1
SEMW-06
EW401
SEMPO120
SEMPO150
SEMW-03
IG1-1
IG1-P01
IG1-P02
IG1-MW1
IG1-2
IG1-3
EPAMW4-14
EPAMW4-71
EPAMW4-72
EPAMW4-15
EPAMW4-8
EPAMW4-10
EPAMW4-9
EPAMW4-13
EPAMW4-24
EW4-8
PZ-005
EW4-3
EPAMW2-5
EW4-7
EW4-4
EW4-9
EW4-5
EW4-6
EPAMW4-21A
EPAMW4-21B
EPAMW4-23
EPAMW4-26
EPAMW4-25
EPAMW4-19
EPAMW4-18
EPAMW4-42
EPAMW4-52
CB-1
EPAMW4-20
EPAMW4-62
EPAMW4-12
CB-2
Whittier #13
Whittier #15
Whittier #17
Whittier #16
EPAMW4-22
EPAMW1-MP
Whittier #18
201W3
201W1
201W6
201W2
201W4
WN-01
Whittier #14

ROSEMEAD BLVD
RUSH ST
POTRERO AV
CENTRAL AV
SANTA ANITA AV
TYLER AV
THIENES AV
N DURFEE AV
LERMA RD
E FAWCETT AV
SAN GABRIEL BLVD
POMONA FREEWAY
HWY 60
PECK RD
S PECK RD
E LINCOLN AV
DURFEE AV
I 605
SAN GABRIEL RIVER FREEWAY
WORKMAN MILL RD
ROSE HILLS RD

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Whittier Narrow Dam
- Bedrock
- PCE Contamination Ranging from 0.5 to 5 µg/L
- PCE Contamination Ranging from 5 to 10 µg/L
- PCE Contamination Ranging from 10 to 25 µg/L
- PCE Contamination Ranging from 25 to 50 µg/L
- PCE Contamination Ranging from 50 to 100 µg/L
- PCE Contamination Ranging greater than 100 µg/L

N

1,500 0 1,500 Feet

Figure 3
Intermediate Zone PCE Contamination
Between ~ 300 and 450 feet bgs
(Through January 2011)
Whittier Narrows Operable Unit

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SOUTH EL MONTE OPERABLE UNIT

WHITTIER NARROWS OPERABLE UNIT

SEMW-02
LW-1
LW-10
EW4-2
SEMPO220
SEMPO260
IG2-P01
IG2-1
IG2-2
IG2-P02
IG2-3
IG2-MW1
SEMW-06
EW401
SEMP0120
SEMP0150
SEMW-03
IG1-1
IG1-P01
IG1-P02
IG1-MW1
IG1-2
IG1-3
EPAMW4-14
EPAMW4-8
EPAMW4-71
EPAMW4-72
EPAMW4-15
EPAMW4-10
EPAMW4-9
EPAMW4-13
EPAMW4-24
EW4-8
EW4-3
PZ-005
EPAMW2-5
Whittier #13
Whittier #15
Whittier #17
Whittier #16
EW4-4
EW4-7
EPAMW4-22
EW4-9
EPAMW4-21A
EPAMW4-21B
EW4-5
EPAMW1-MP
201W1
201W3
201W6
201W2
Whittier #18
EW4-6
EPAMW4-23
EPAMW4-26
EPAMW4-25
201W4
EPAMW4-19
EPAMW4-18
WN-01
Whittier #14
EPAMW4-42
CB-1
EPAMW4-52
EPAMW4-20
EPAMW4-62
EPAMW4-12
CB-2

ROSEMEAD BLVD
RUSH ST
POTRERO AV
CENTRAL AV
SANTA ANITA AV
TYLER AV
THIENES AV
N DURFEE AV
LERMA RD
E FAWCETT AV
SAN GABRIEL BLVD
POMONA FREEWAY
HWY 60
PECK RD
S PECK RD
E LINCOLN AV
DURFEE AV
SAN GABRIEL RIVER FREEWAY
I 605
WORKMAN MILL RD
ROSE HILLS RD

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Whittier Narrow Dam
- Bedrock
- PCE Contamination Ranging from 0.5 to 5 µg/L
- PCE Contamination Ranging from 5 to 10 µg/L
- PCE Contamination Ranging from 10 to 25 µg/L
- PCE Contamination Ranging from 25 to 50 µg/L
- PCE Contamination Ranging from 50 to 100 µg/L
- PCE Contamination Ranging greater than 100 µg/L

N

1,500 0 1,500 Feet

Figure 4
Intermediate Zone PCE Contamination
Between ~ 450 and 600 feet bgs
(Through January 2011)
Whittier Narrows Operable Unit

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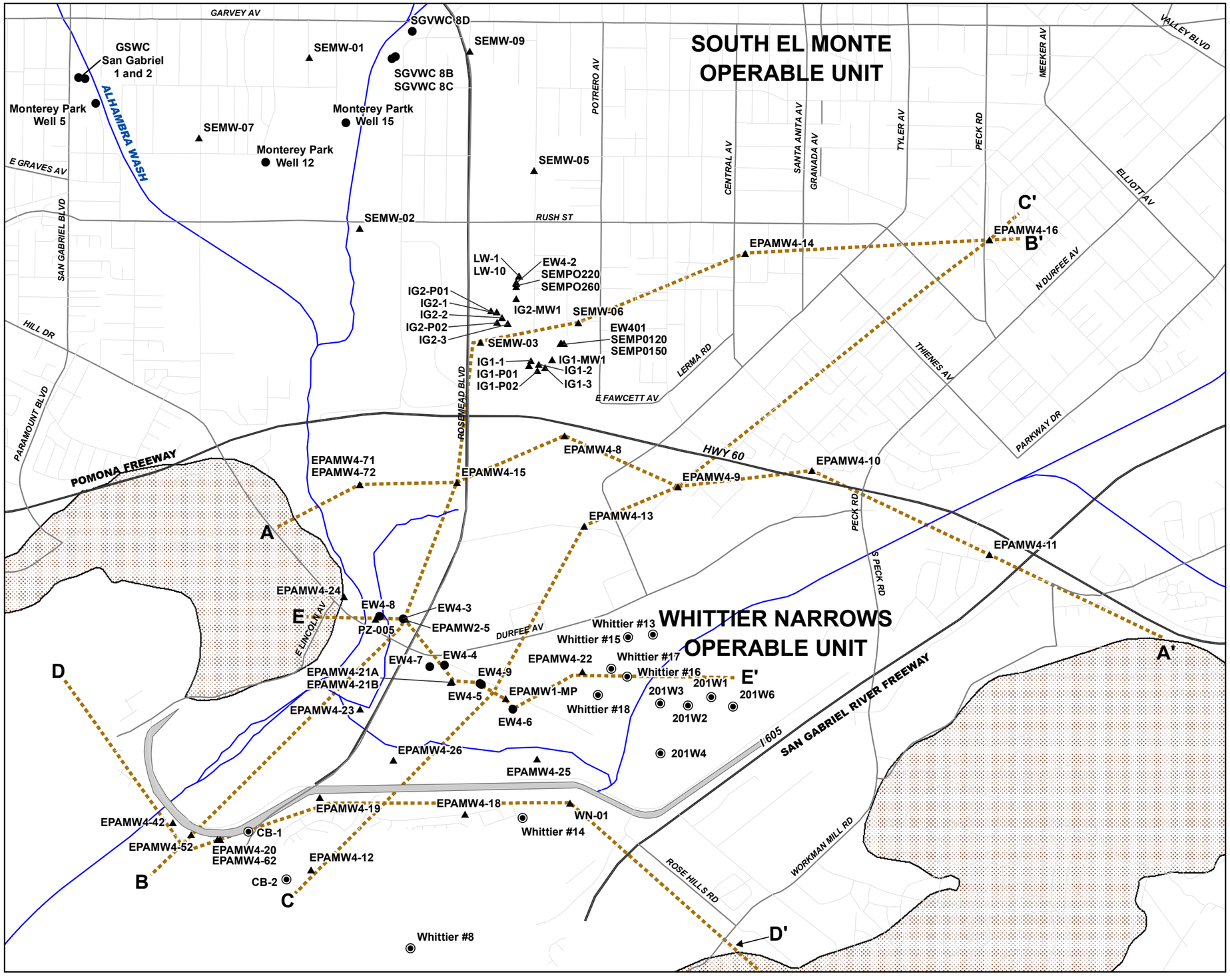

Figure 5
Locations of PCE Distribution Cross Sections
Whittier Narrows Operable Unit

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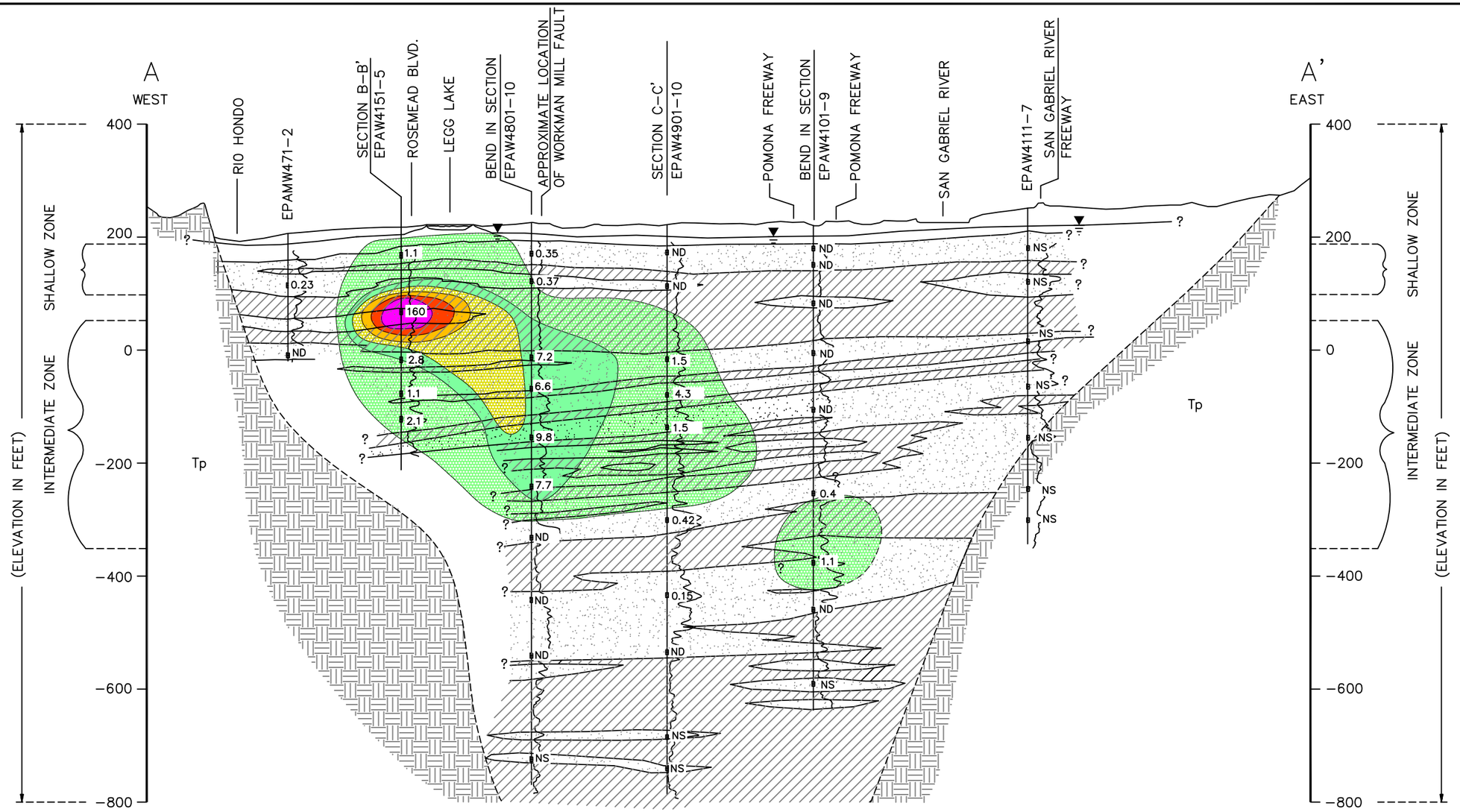

LEGEND

HYDROSTRATIGRAPHIC UNITS
- Predominantly Gravel and Sand
- Predominantly Sand with Silt and Clay

GEOLOGIC UNITS
- Tp Pico Unit

EPAMW471 Well ID

- Short (16") Normal Resistivity Log
- ? Contact/Water Level Uncertain
- EPAMW471 Well ID
- 7 8 Screen Interval of Single-Point or Multiple-Port Well with PCE Concentration in Groundwater (ug/L)
- Approximate Water Table
- NS Not Sampled

- PCE Contamination Ranging from 0.5 to 5 ug/L
- PCE Contamination Ranging from 5 to 10 ug/L
- PCE Contamination Ranging from 10 to 25 ug/L
- PCE Contamination Ranging from 25 to 50 ug/L
- PCE Contamination Ranging from 50 to 100 ug/L
- PCE Contamination Above 100 ug/L

NOTES: PCE data collected in 2010 or 2011
Concentration contour dashed where questioned.

DISTANCE IN FEET
0 500 1,000
SCALE VE=5X

Figure 6
Cross-Section A-A'
PCE Distribution
Whittier Narrows OU

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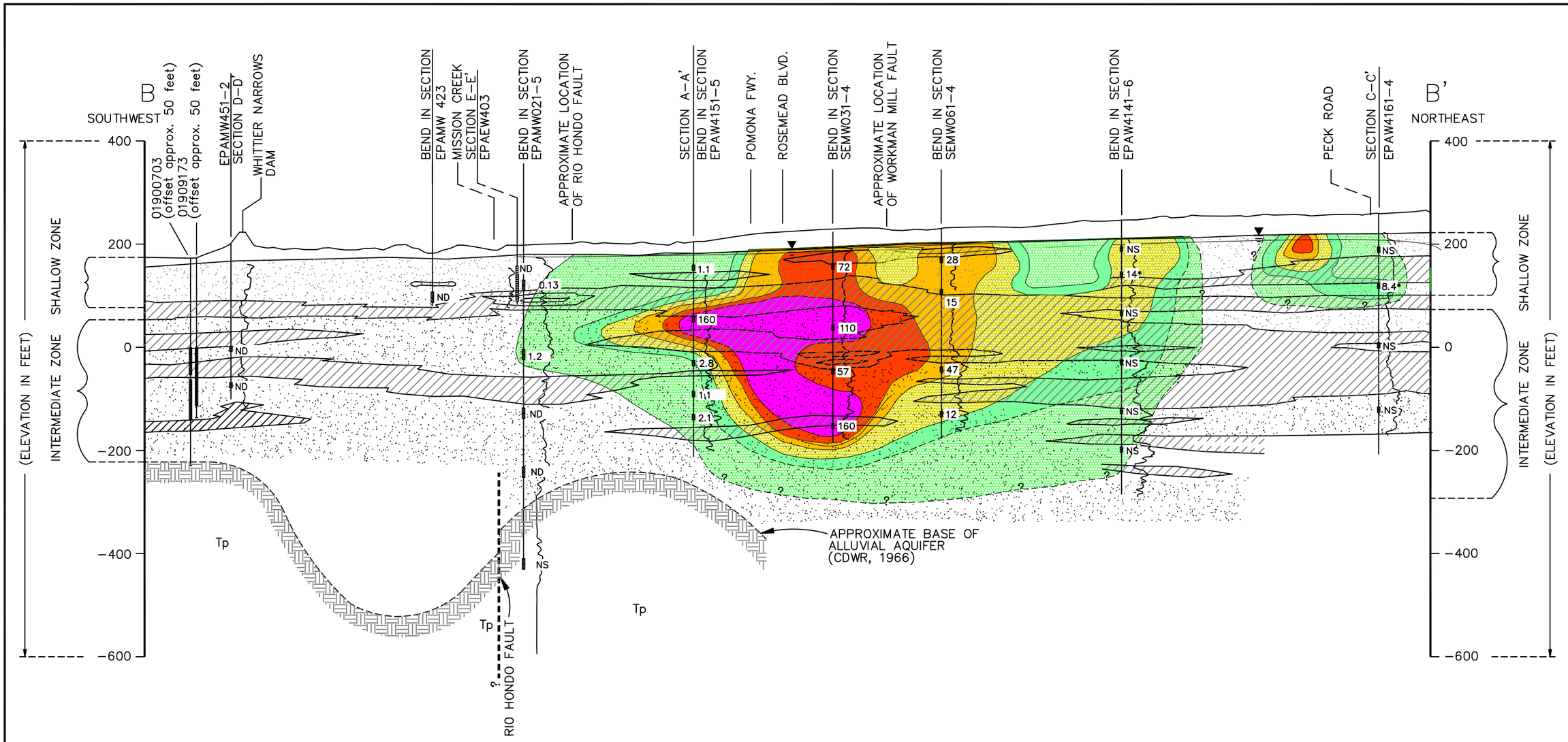

LEGEND

HYDROSTRATIGRAPHIC UNITS

- Predominantly Gravel and Sand
- Predominantly Sand with Silt and Clay

GEOLOGIC UNITS

- Tp — Pico Unit

- Short (16") Normal Resistivity Log
- ? — Contact/Water Level Uncertain
- EPAMW471 — Well ID
- Screen Interval of Single-Port, Multiple-Port, or Production Well with PCE Concentration in Groundwater (ug/L)
- Approximate Water Table
- NS — Not Sampled

- PCE Contamination Ranging from 0.5 to 5 ug/L
- PCE Contamination Ranging from 5 to 10 ug/L
- PCE Contamination Ranging from 10 to 25 ug/L
- PCE Contamination Ranging from 25 to 50 ug/L
- PCE Contamination Ranging from 50 to 100 ug/L
- PCE Contamination Above 100 ug/L

NOTES: PCE data collected in 2010 and 2011 unless noted otherwise.
Concentration contour dashed where questioned.

X* Sample collected in 2009

DISTANCE IN FEET
0 1,000 2,000
SCALE VE=10X

Figure 7
Cross-Section B-B'
PCE Distribution
Whittier Narrows OU

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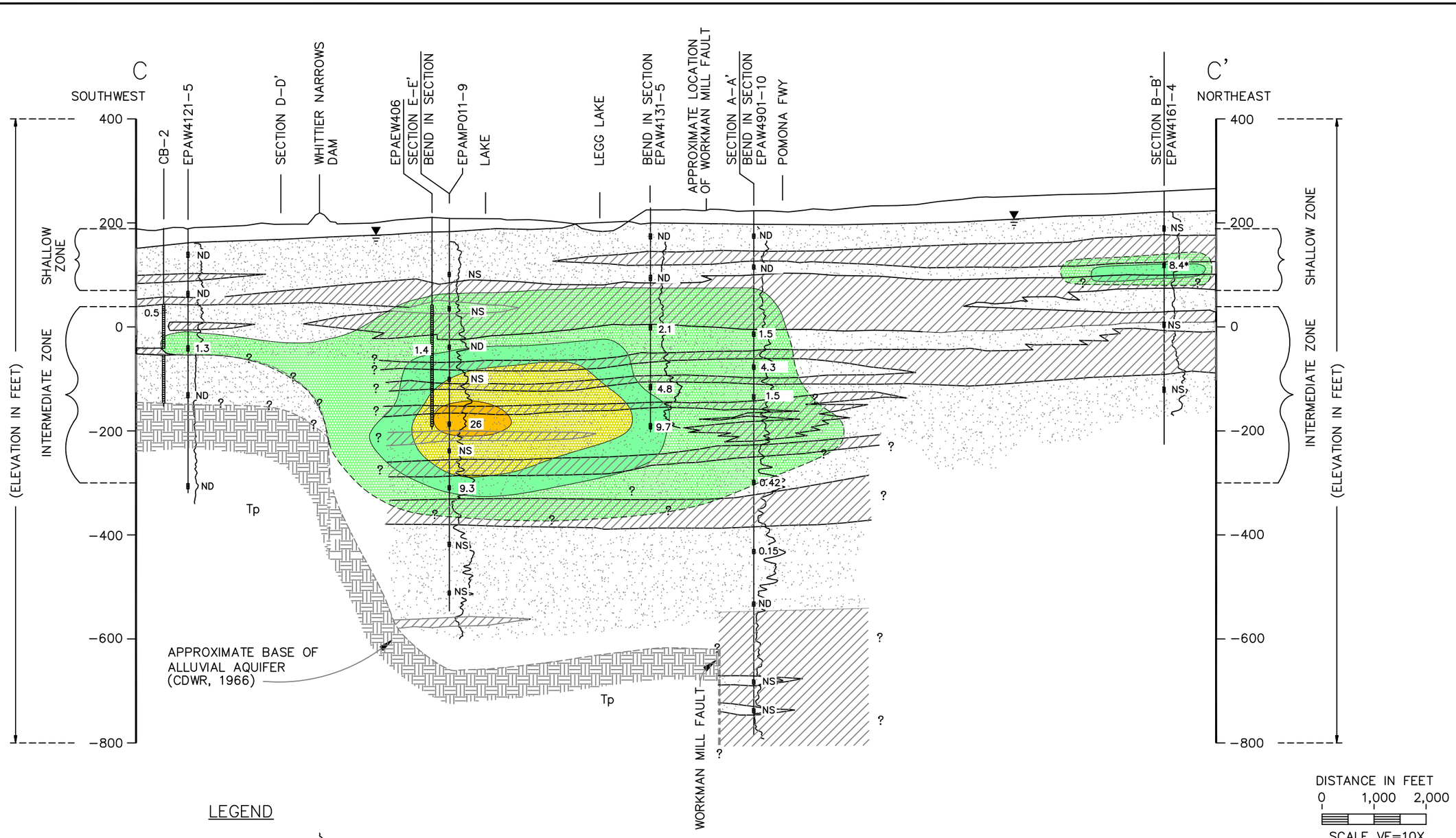

LEGEND

HYDROSTRATIGRAPHIC UNITS
- Predominantly Gravel and Sand
- Predominantly Sand with Silt and Clay

GEOLOGIC UNITS
- Tp — Pico Unit

- Short (16") Normal Resistivity Log
- ? — Contact/Water Level Uncertain
- EPAMW471 — Well ID
- 7 8 — Screen Interval of Single-Port, Multiple-Port, or Production Well with PCE Concentration in Groundwater (ug/L)
- Approximate Water Table
- NS — Not Sampled

- PCE Contamination Ranging from 0.5 to 5 ug/L
- PCE Contamination Ranging from 5 to 10 ug/L
- PCE Contamination Ranging from 10 to 25 ug/L
- PCE Contamination Ranging from 25 to 50 ug/L

NOTES: PCE data collected in 2010 and 2011 unless noted otherwise.
Concentration contour dashed where questioned.

X* Sample collected in 2009

Figure 8
Cross-Section C-C'
PCE Distribution
Whittier Narrows OU

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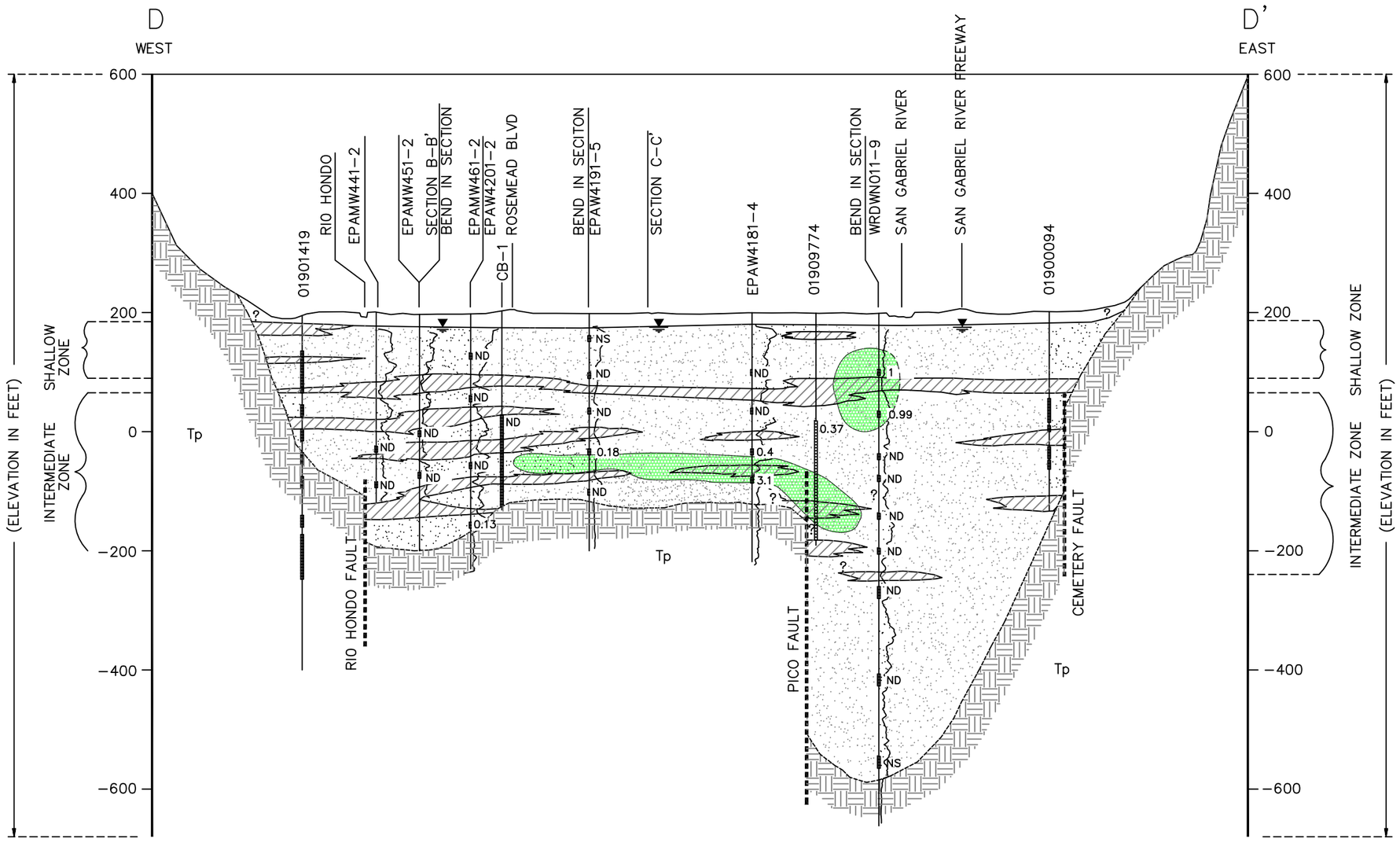

LEGEND

HYDROSTRATIGRAPHIC UNITS

- Predominantly Gravel and Sand
- Predominantly Sand with Silt and Clay

GEOLOGIC UNITS

- Tp — Pico Unit

- Short (16") Normal Resistivity Log
- ? — Contact/Water Level Uncertain
- EPAMW471 — Well ID
- Screen Interval of Single−Port, Multiple−Port, or Production Well with PCE Concentration in Groundwater (ug/L)
- Approximate Water Table
- NS — Not Sampled

PCE Contamination Ranging from 0.5 to 5 ug/L

NOTES:

PCE data collected in 2010 and 2011 unless noted otherwise.
Concentration contour dashed where questioned.

Figure 9
Cross−Section D−D'
PCE Distribution
Whittier Narrows OU

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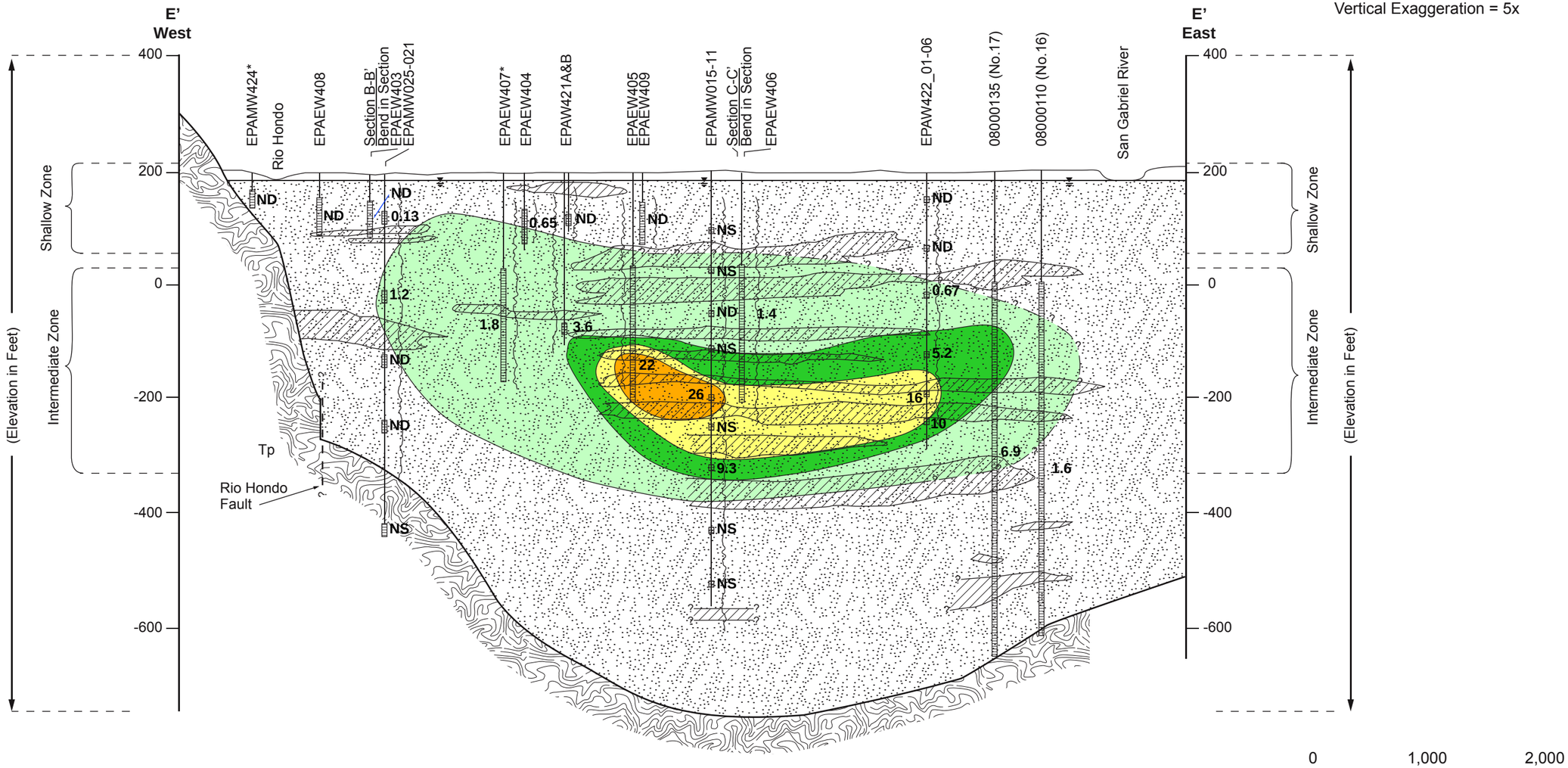
Scale
1” = 1,000 FT Horizontal
1” = 200 FT Vertical
Vertical Exaggeration = 5x



0 1,000 2,000
Scale (H) in Feet

Predominantly Gravel Sand

Predominantly Sand with Silt and Clay

GEOLOGICAL UNITS

Tp Pico Unit

Short (16”) Normal Resistivity Log

? Contact/Water Level Uncertain

EPAEW403 Well ID

8 Screen Interval of Single-Port, Multiple-Port, or Production Well, with PCE Concentration in Groundwater (µg/L)

Approximate Water Table

PCE Contamination Ranging from 0.5 to 5 µg/L

PCE Contamination Ranging from 5 to 10 µg/L

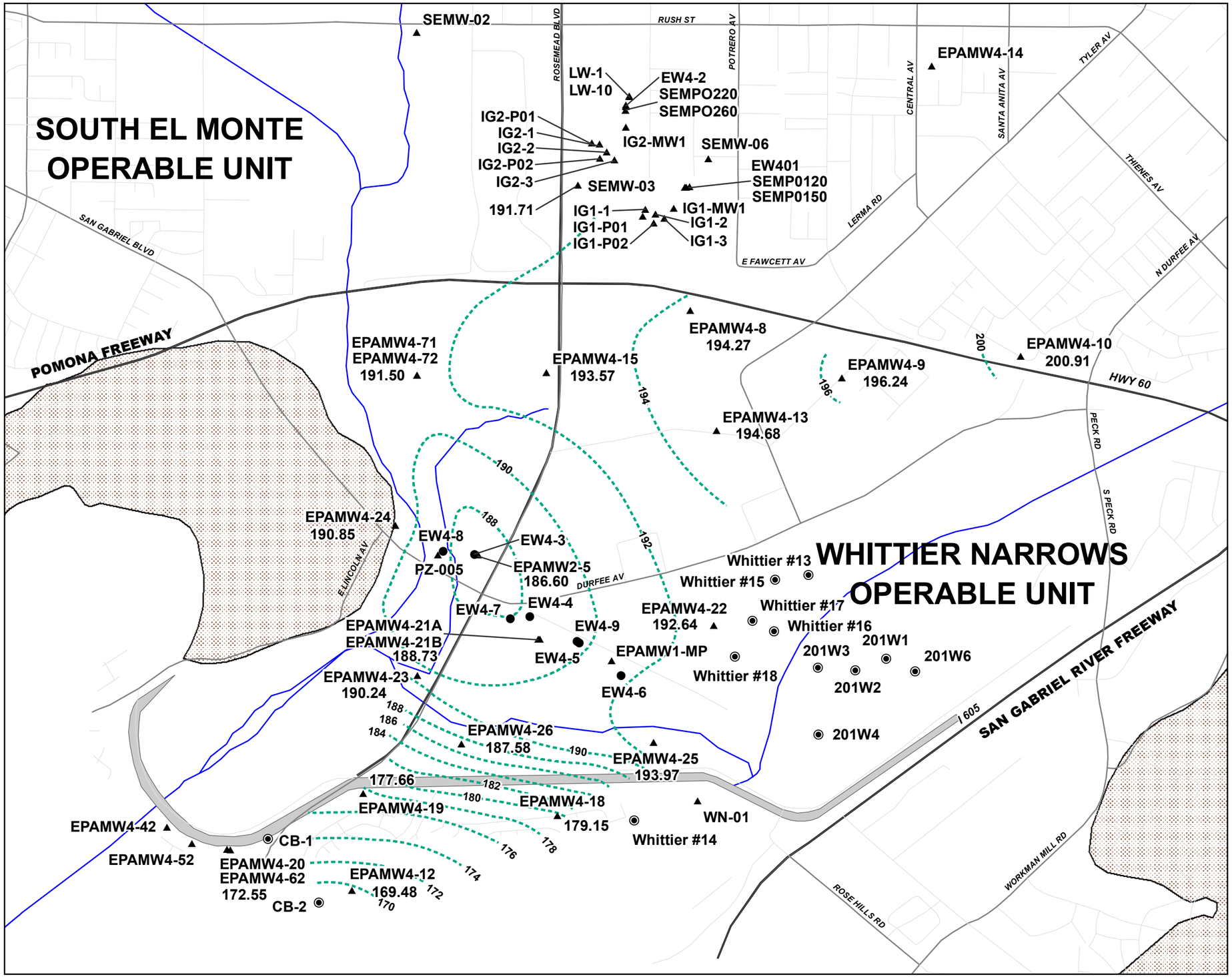
PCE Contamination Ranging from 10 to 25 µg/L

PCE Contamination Ranging from 25 to 50 µg/L

<1 PCE data Collected in 2010 or 2011 unless otherwise noted

* Well projected onto cross section; See Figure 5 for well locations.

Figure 10
Cross-Section E-E’
PCE Distribution
Whittier Narrows OU



Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Water Level Contours
- Whittier Narrow Dam
- Bedrock

Note:
Groundwater elevations (in feet above mean sea level) are posted on the map for the wells used in contouring shallow water levels.

N

1,500 0 1,500 Feet

Figure 11
Shallow Zone Groundwater Elevation Contours (Jan/Feb 2011)
Whittier Narrows Operable Unit

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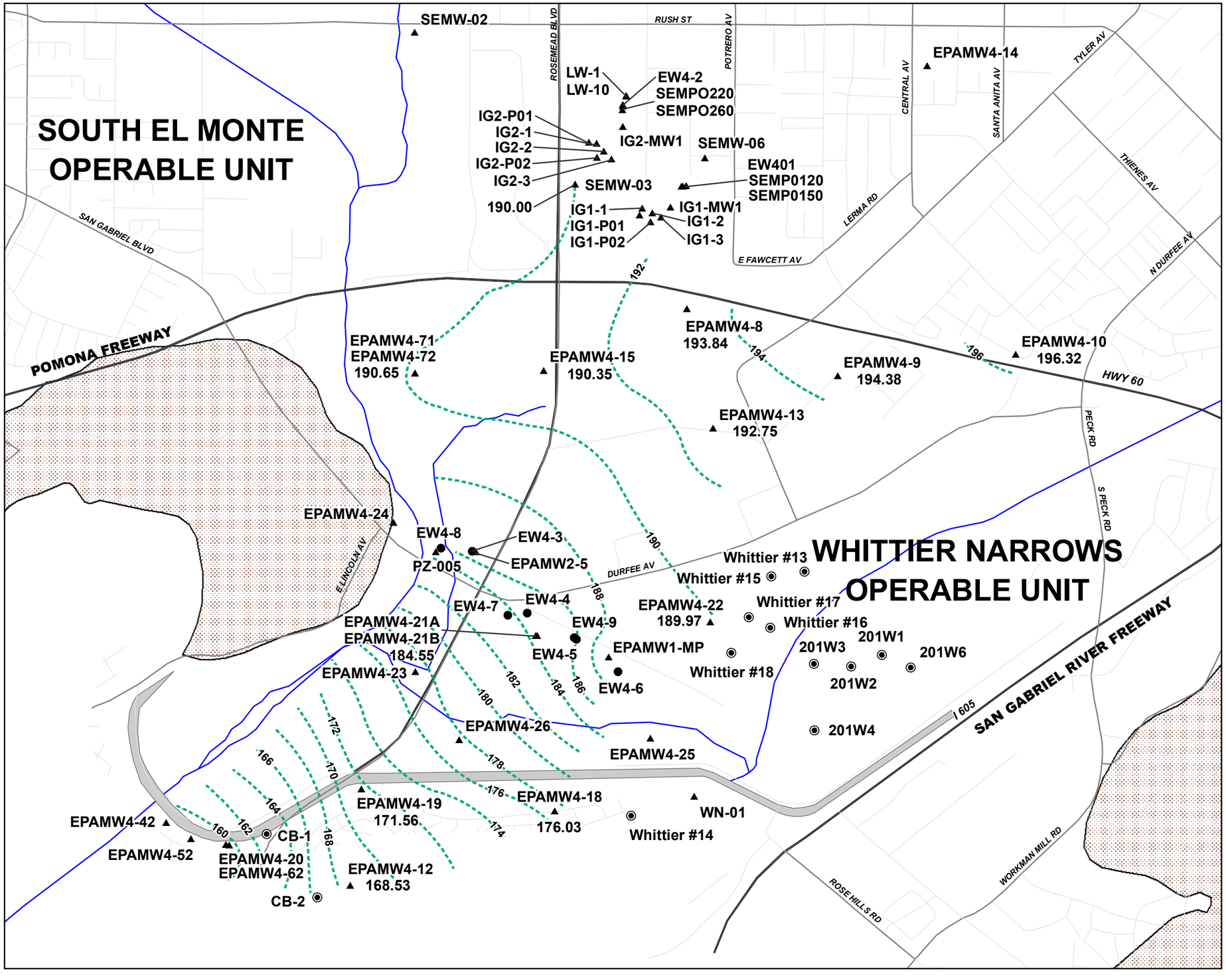

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- Water Level Contours
- Whittier Narrow Dam
- Bedrock

Note:
Groundwater elevations (in feet above mean sea level) are posted on the map for the wells used in contouring intermediate water levels.

N

1,500 0 1,500 Feet

Figure 12
Intermediate Zone Groundwater Elevation Contours (Jan/Feb 2011)
Whittier Narrows Operable Unit

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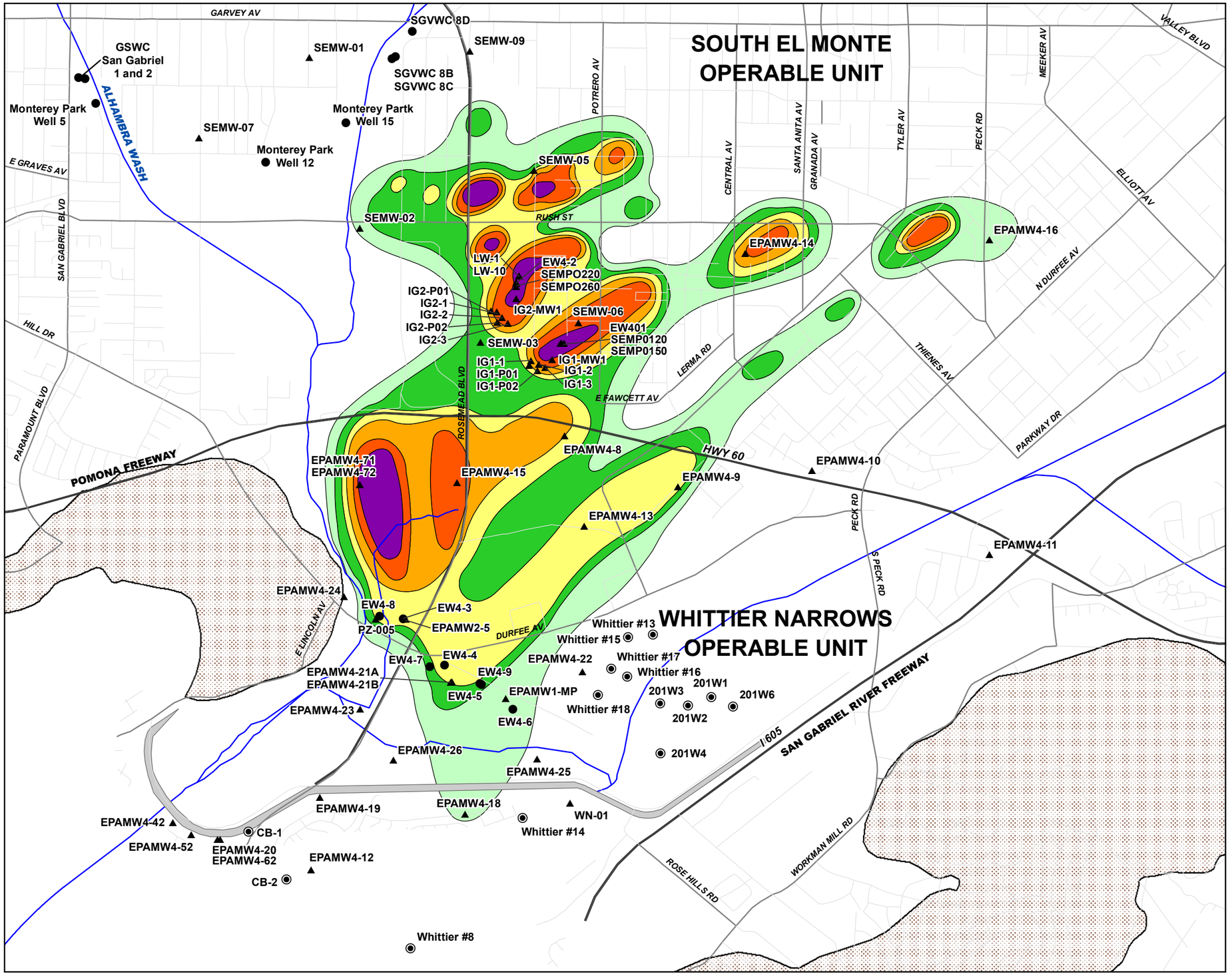

Figure 13
2002 Shallow Zone PCE Contamination
Whittier Narrows Operable Unit

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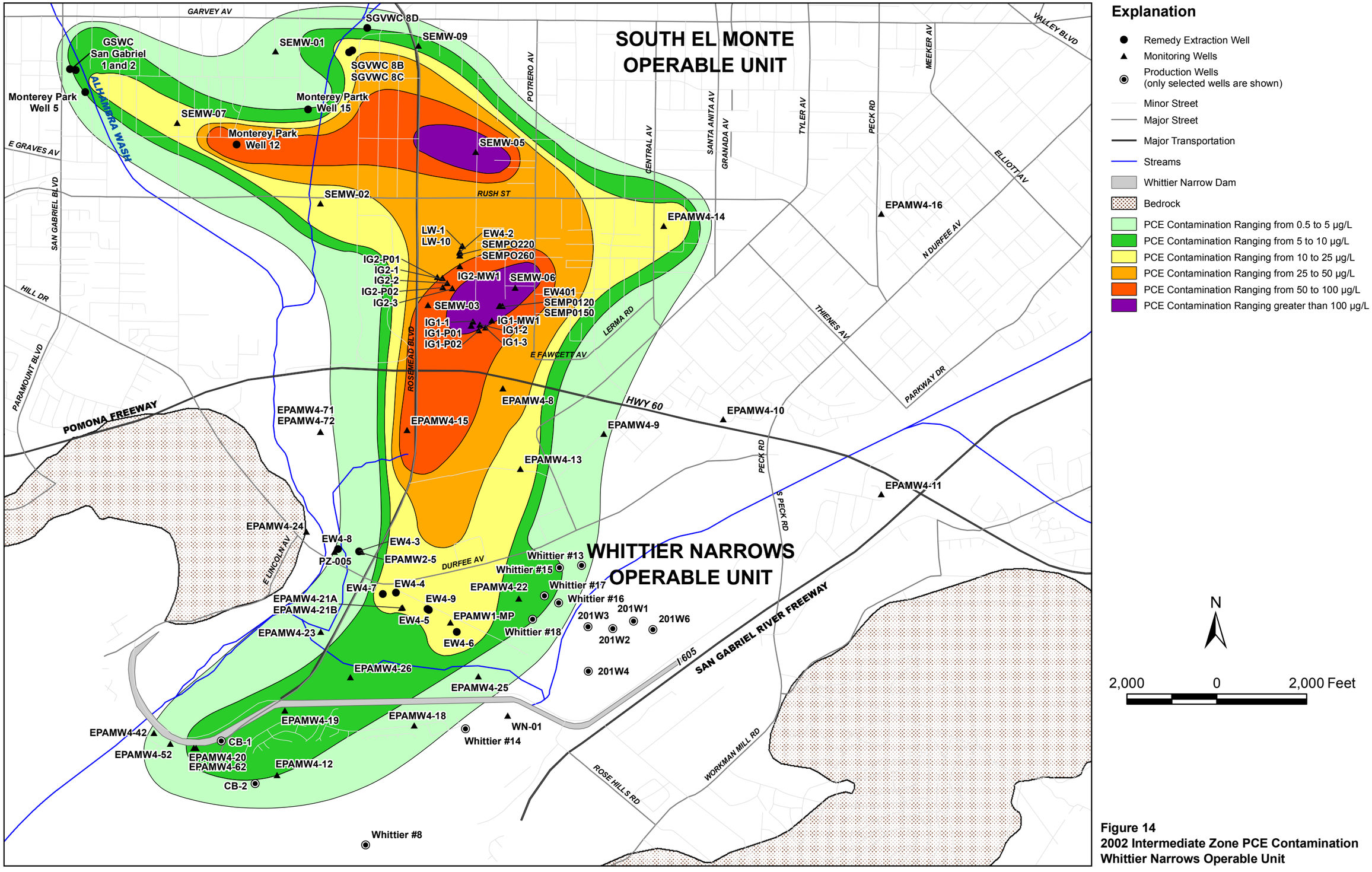

Figure 14
2002 Intermediate Zone PCE Contamination
Whittier Narrows Operable Unit

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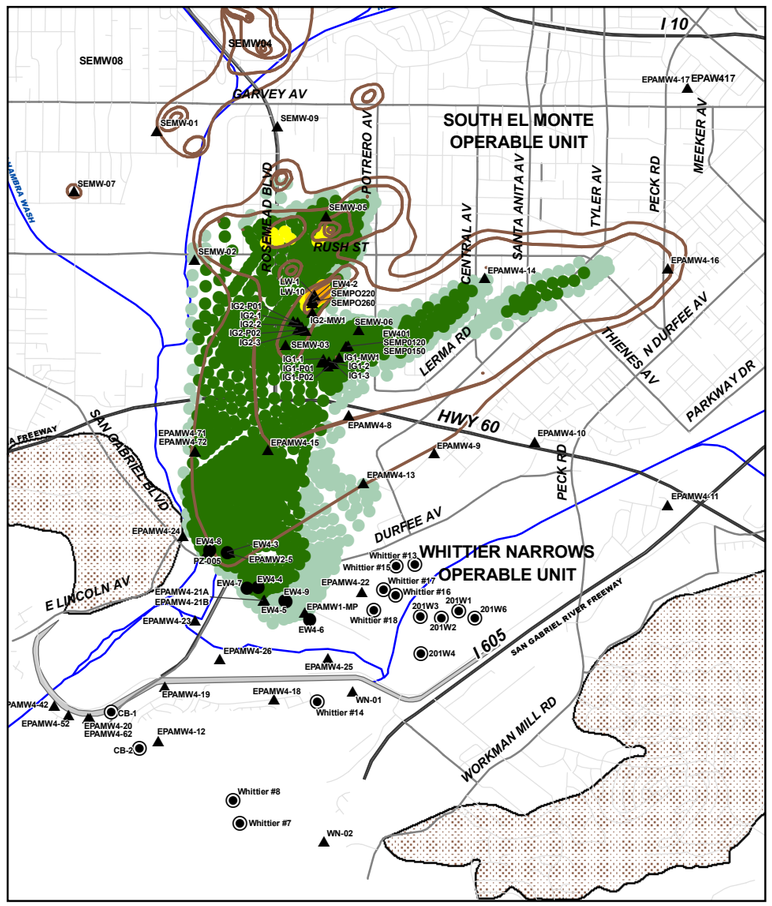
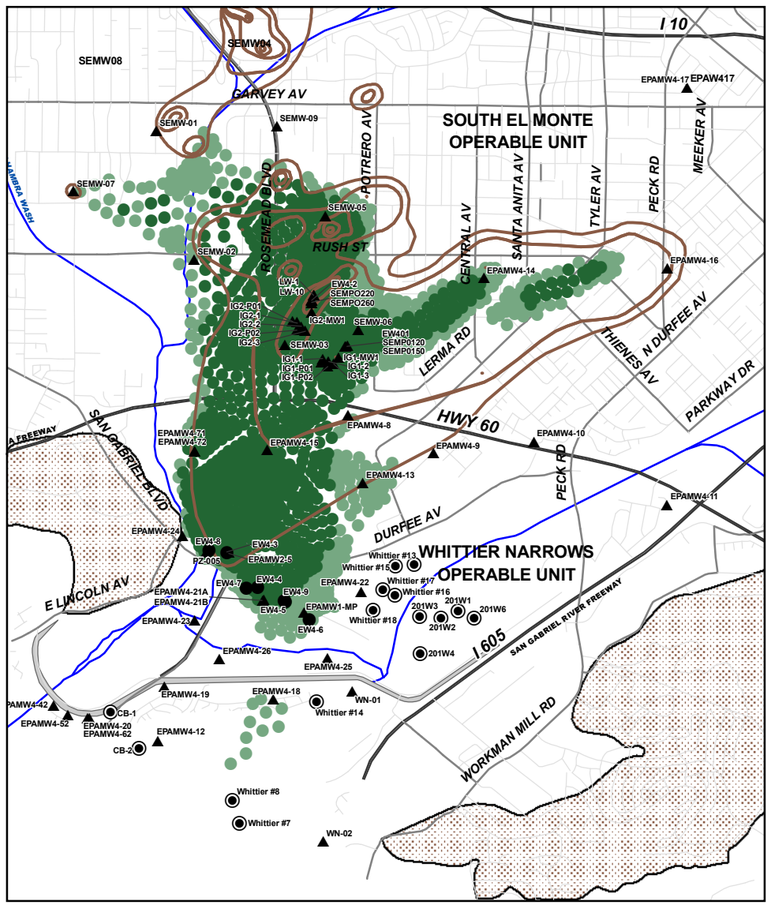
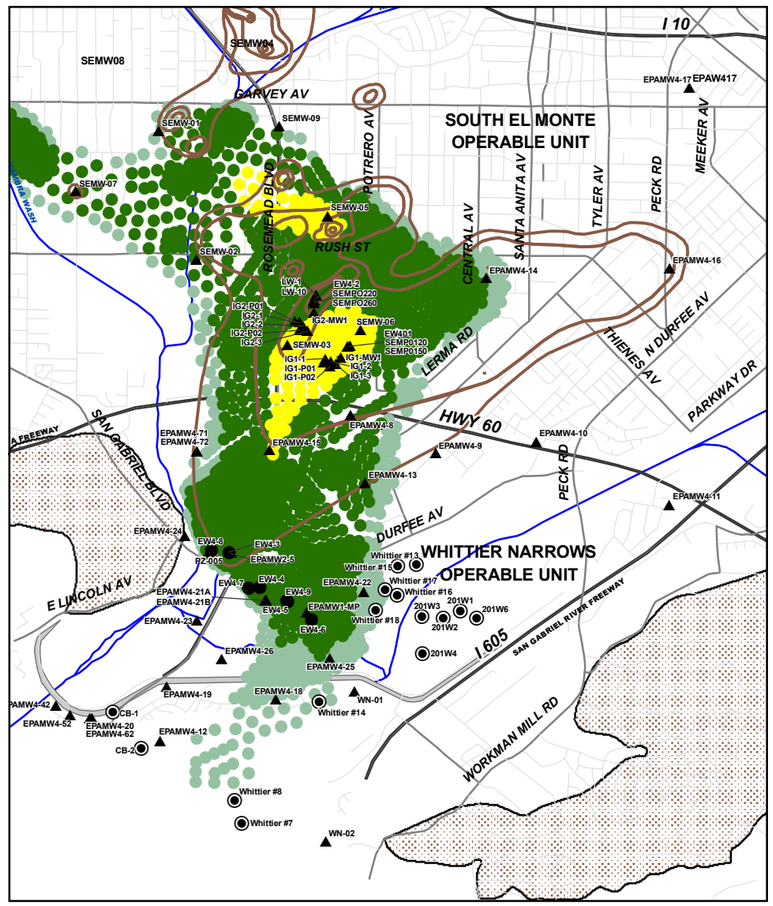


Scenario 60
Slice 1



Scenario 60
Slice 2



Scenario 60
Slice 3

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- PCE Contamination Ranging less then 5 MCL
- PCE Contamination Ranging from 5 to 50 MCL
- PCE Contamination Ranging from 50 to 100 MCL
- PCE Contamination Ranging greater than 100 MCL
- Minor Street
- Major Street
- Major Transportation
- Streams
- PCE Shallow Contour
- Whittier Narrow Dam
- Bedrock

Note:
Observed 2009 shallow zone contamination contours shown in the background.

N

2,000 0 2,000 Feet

Figure 15
Simulated PCE Transport in the Shallow Zone (2002-2009)
Whittier Narrows Operable Unit

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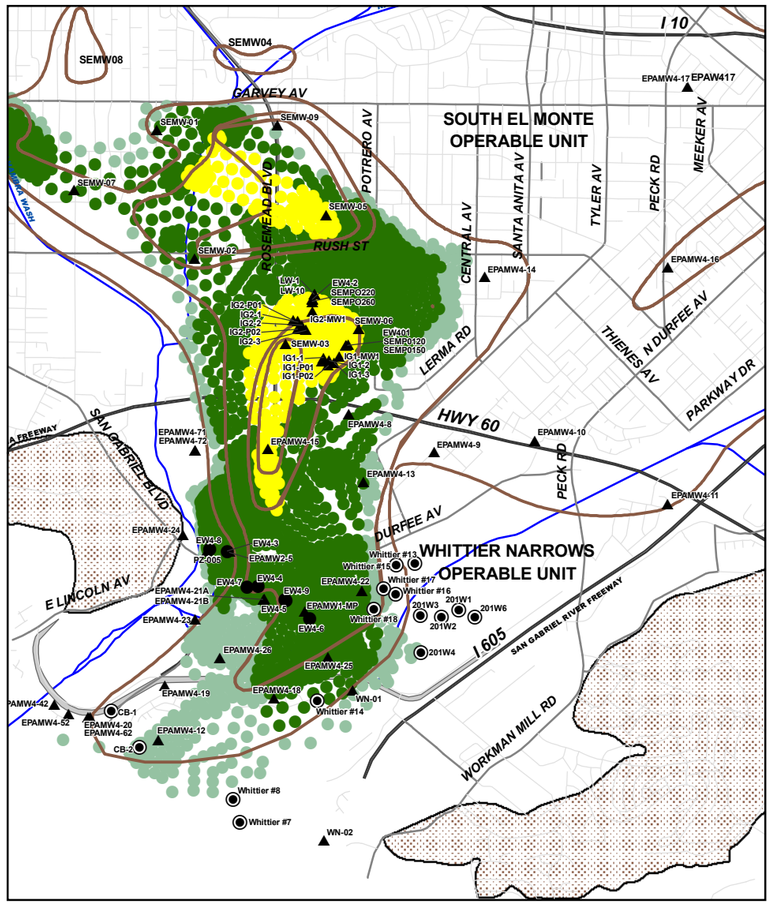
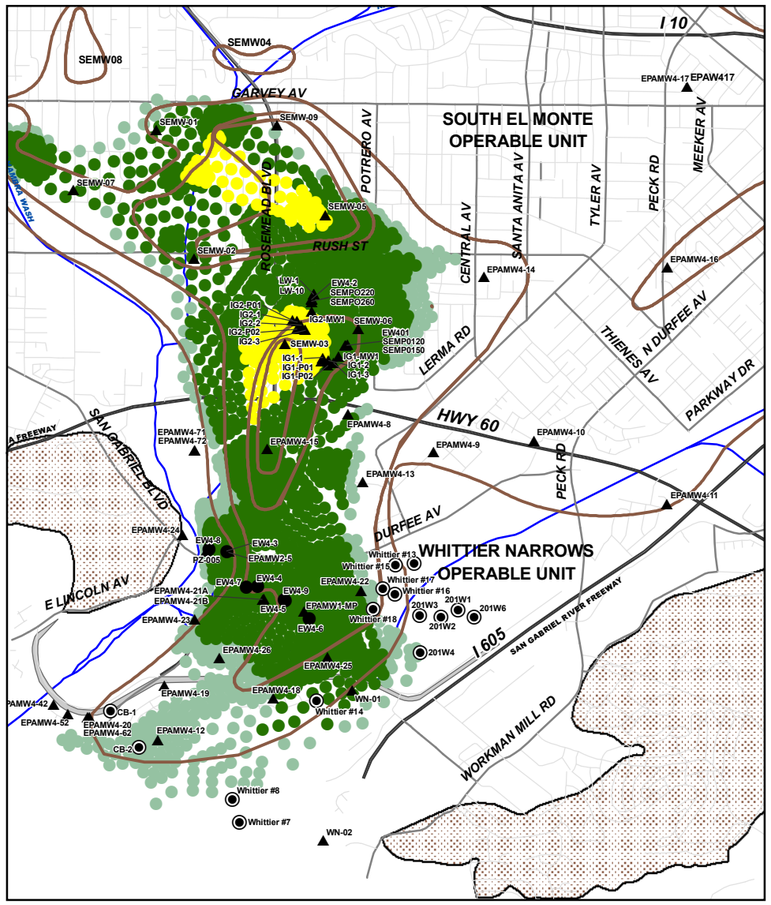
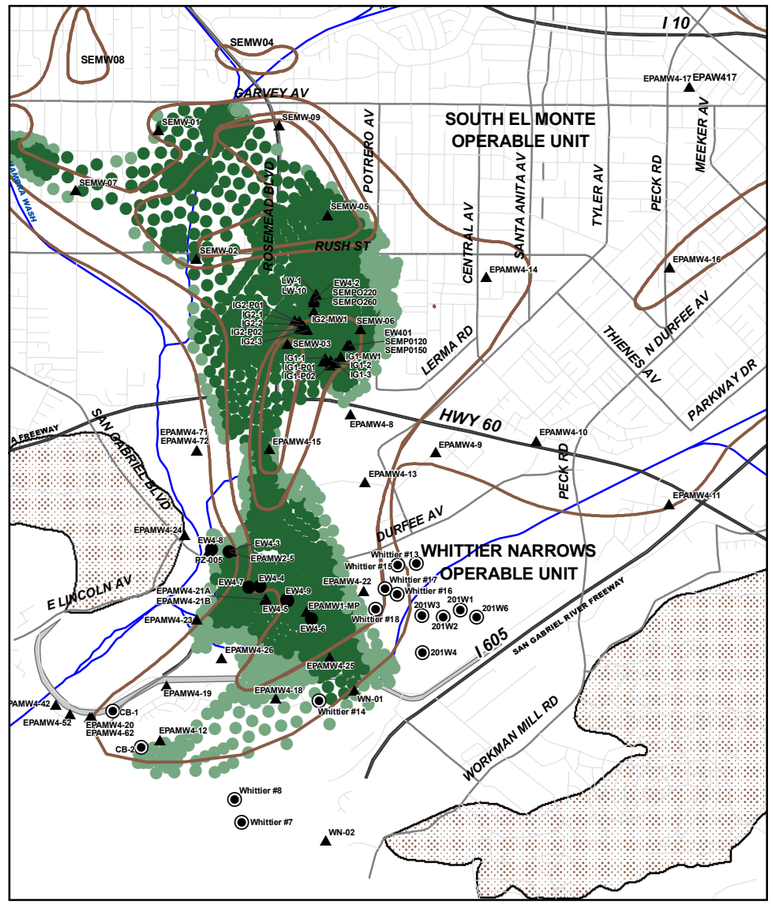


Scenario 60
Slice 4



Scenario 60
Slice 5



Scenario 60
Slice 6

Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- PCE Contamination Ranging less then 5 MCL
- PCE Contamination Ranging from 5 to 50 MCL
- PCE Contamination Ranging from 50 to 100 MCL
- Minor Street
- Major Street
- Major Transportation
- Streams
- PCE Intermediate Contour
- Whittier Narrow Dam
- Bedrock

Note:
Observed 2009 Intermediate zone contamination contours shown in the background.

N

2,000 0 2,000 Feet

Figure 16
Simulated PCE Transport in the Intermediate Zone (2002-2009)
Whittier Narrows Operable Unit

\\GALT\PROJ\EPAF\SEOU\MAPFILES\SEOU_PCE_INTERMEDIATE_SCENARIO.MXD DDODS 3/28/2011 08:36:42

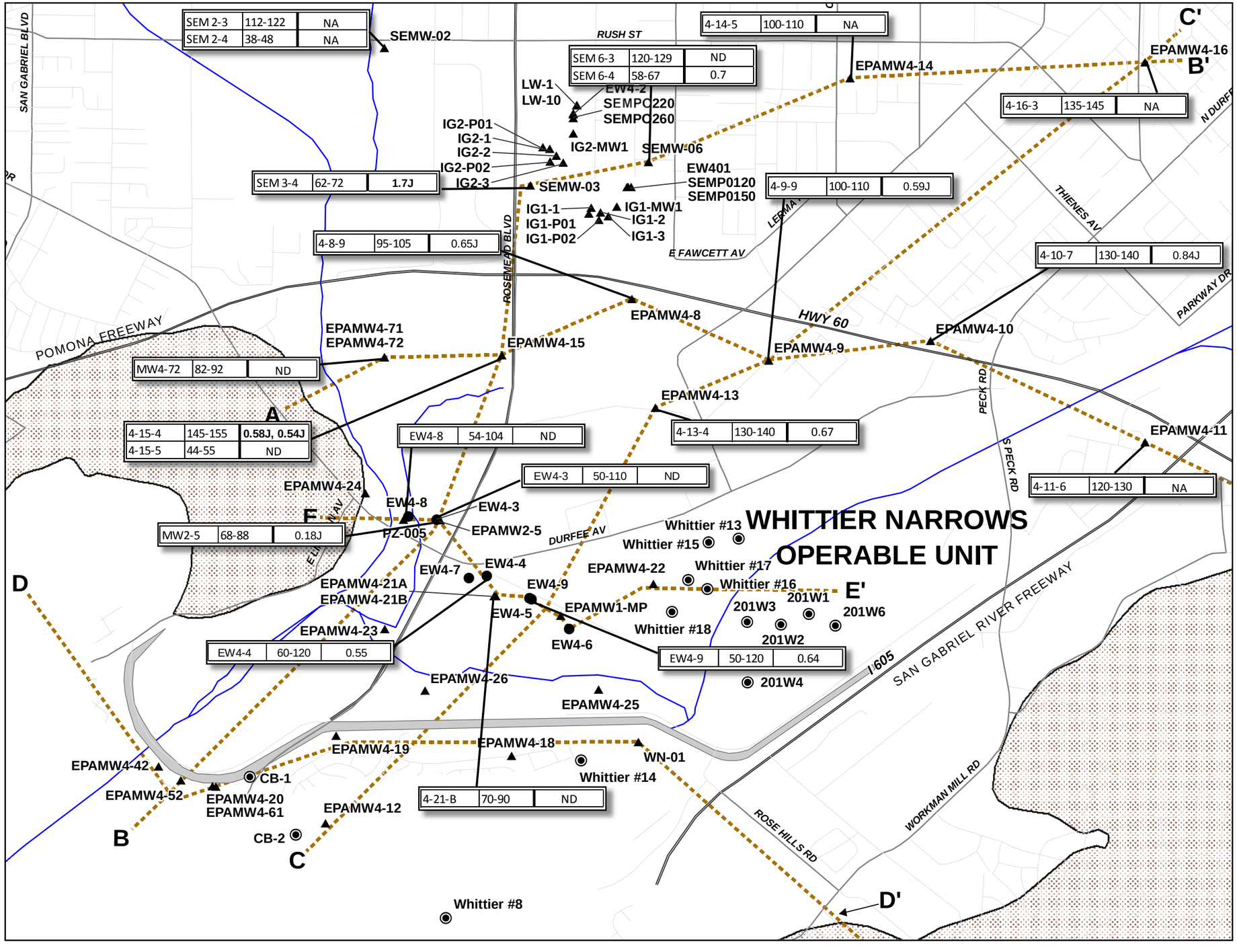
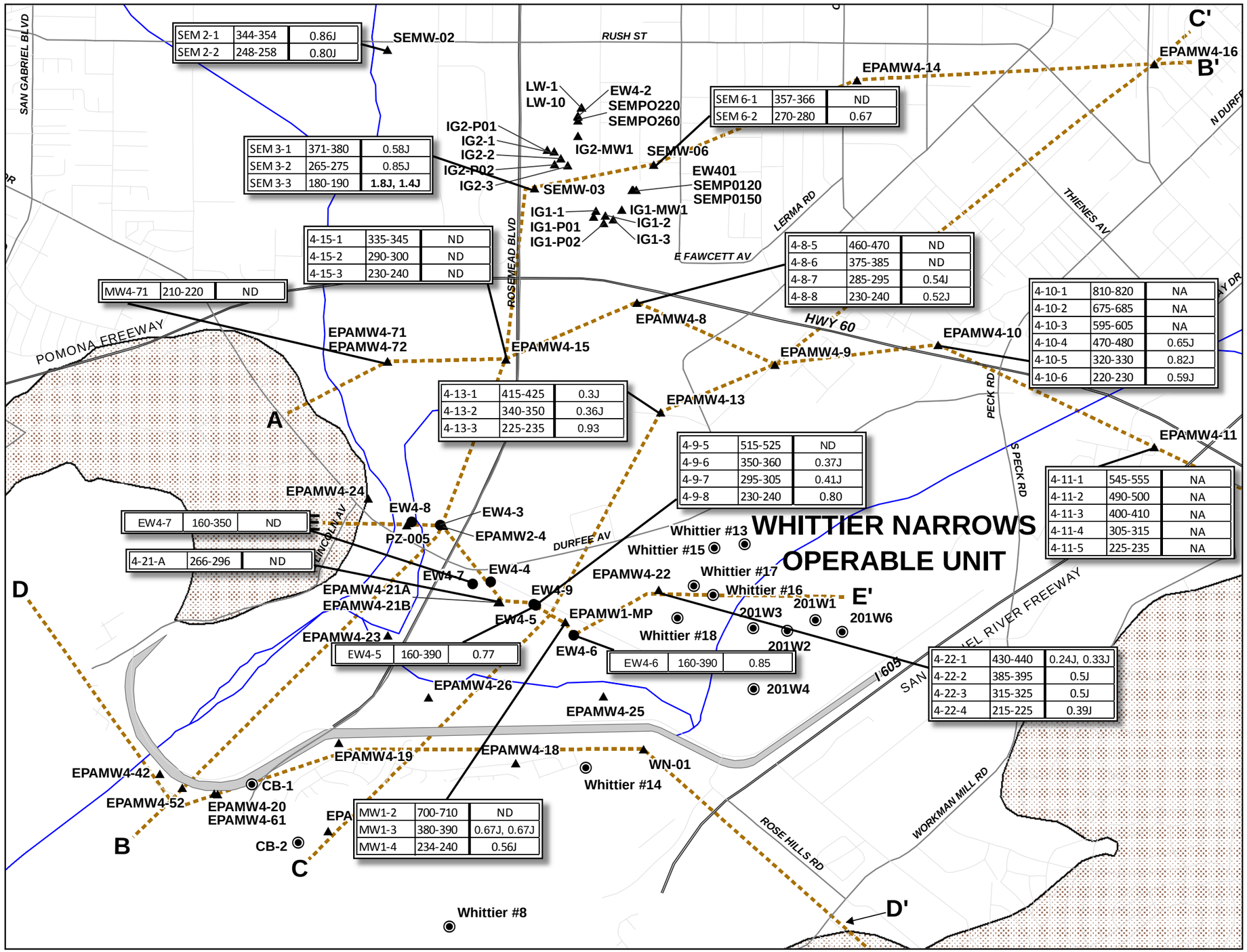


Figure 17
Shallow Zone 1,4-Dioxane Concentrations
2010/2011
Whittier Narrows Operable Unit

SCO381400.OM.04 shallow_wells_rev2.ai 5/11

\\GALT\PROJ\EPAF\SEOU\MAPFILES\SEOU_PCE_CROSSSECTIONS.MXD DDODS 3/28/2011 12:50:38



Explanation

- Remedy Extraction Well
- Monitoring Wells
- Production Wells (only selected wells are shown)
- Minor Street
- Major Street
- Major Transportation
- Streams
- PCE Distribution Cross Section
- Whittier Narrow Dam
- Bedrock

Well	Screen Interval	2010/2011 1,4-dioxane (µg/l)
4-8-5	460-470	ND
4-8-6	375-385	ND
4-8-7	285-295	0.54J
4-8-8	230-240	0.52J

NA = Not Applicable

Figure 18
Intermediate Zone 1,4-Dioxane Concentrations
2010/2011
Whittier Narrows Operable Unit

SCO381400.OM.04 intermediate_wells_rev2.ai 5/11

\\GALT\PROJ\EPAF\SEOU\MAPFILES\SEOU_PCE_CROSSSECTIONS.MXD DDODS 3/28/2011 12:50:38

Figure 19
SEMW03 Shallow Zone Hydrograph - 2002 to Present

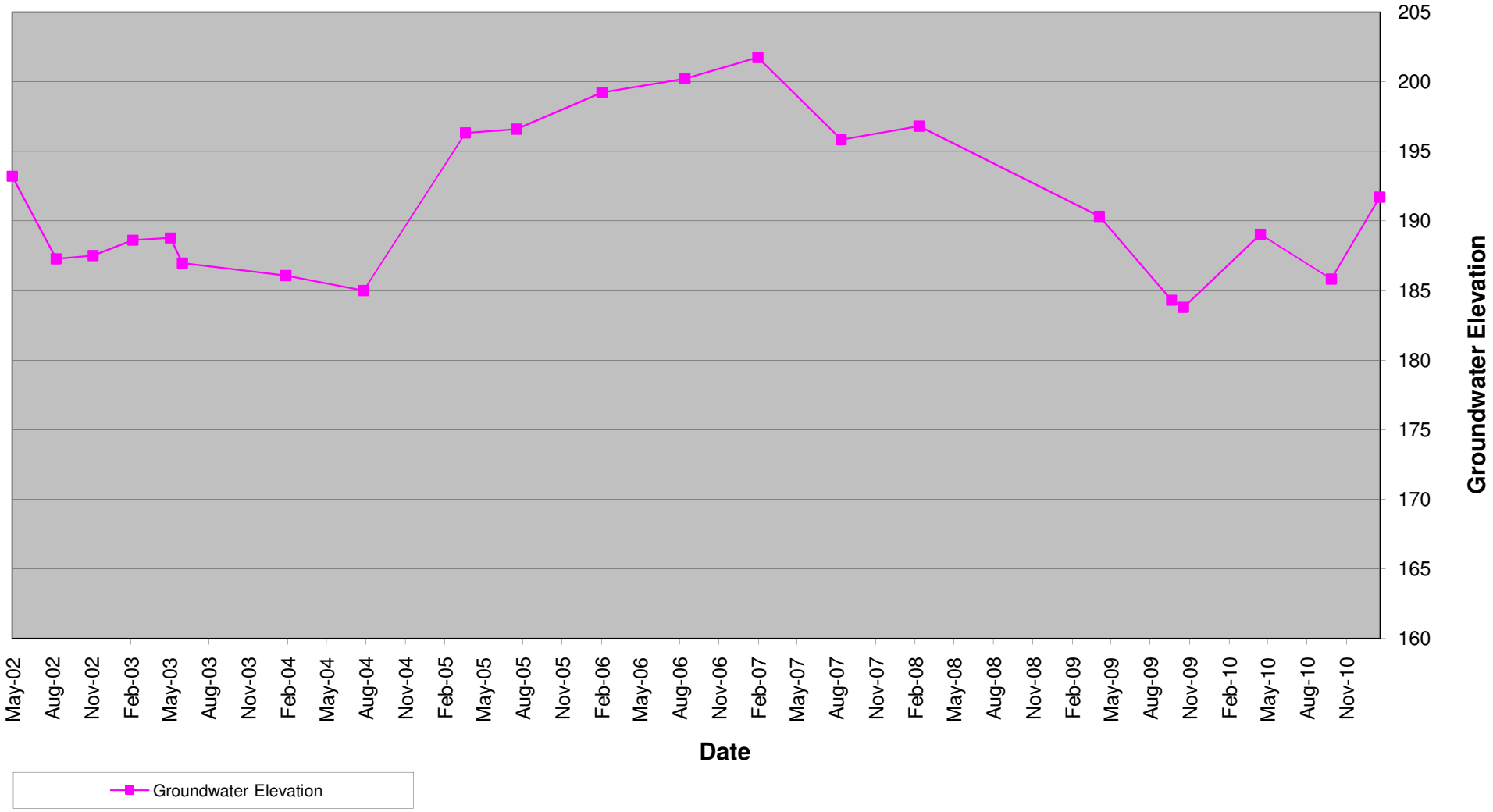


Figure 20
MW4-19 Shallow Zone Hydrograph - 2002 to Present

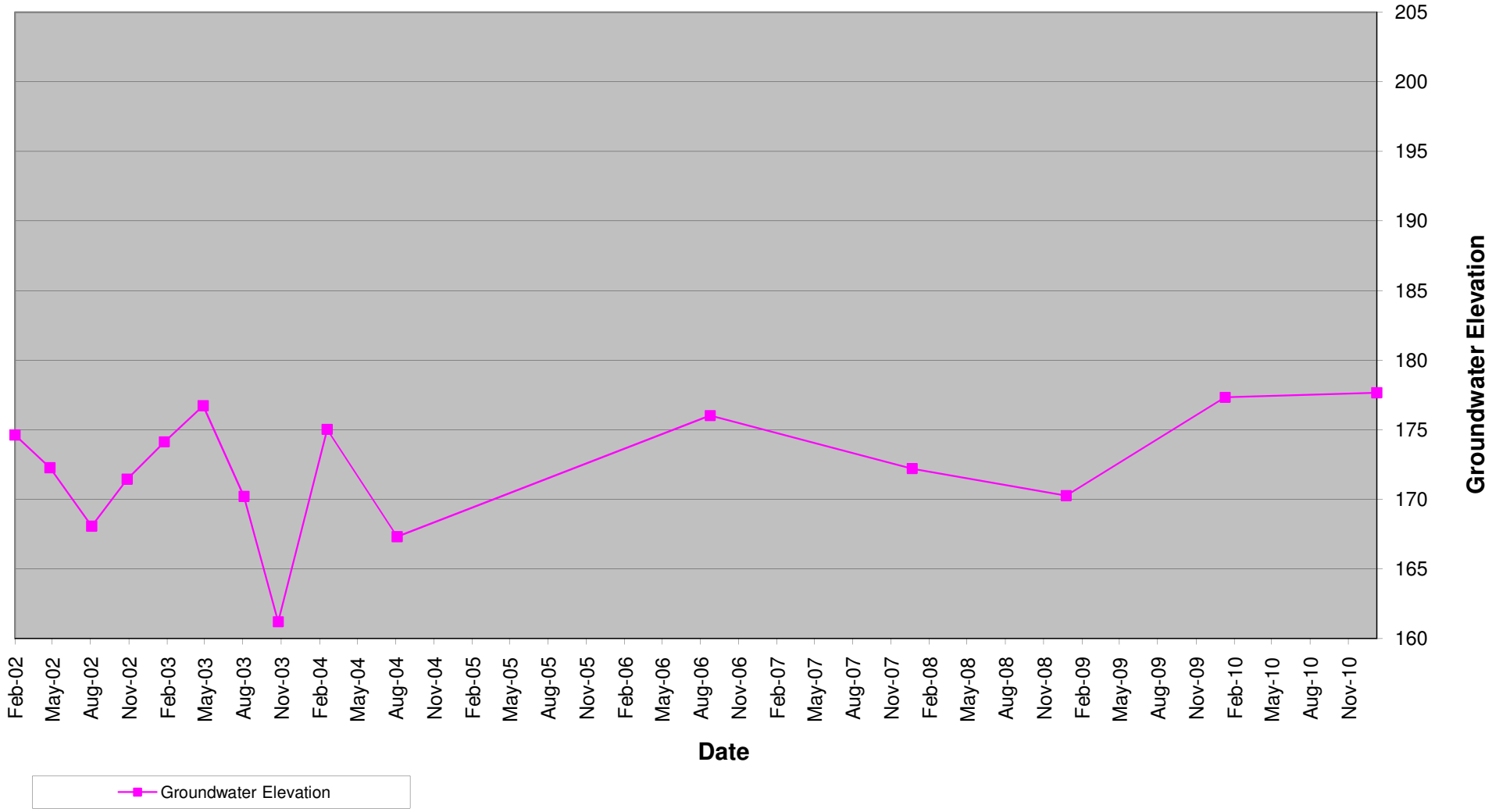


Figure 21
SEMW03 Intermediate Zone Hydrograph - 2002 to Present

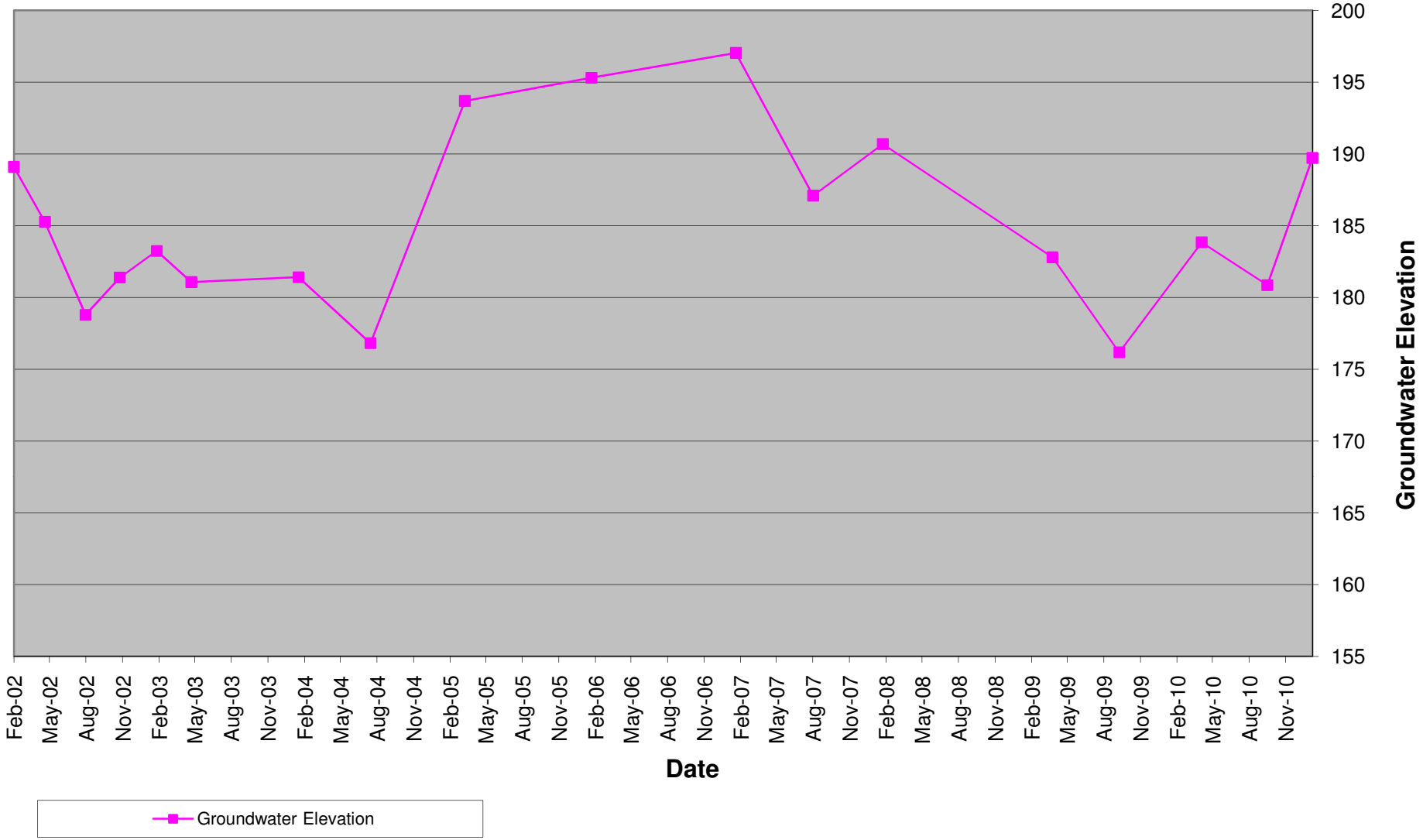


Figure 22
MW4-19 Intermediate Zone Hydrograph - 2002 to Present

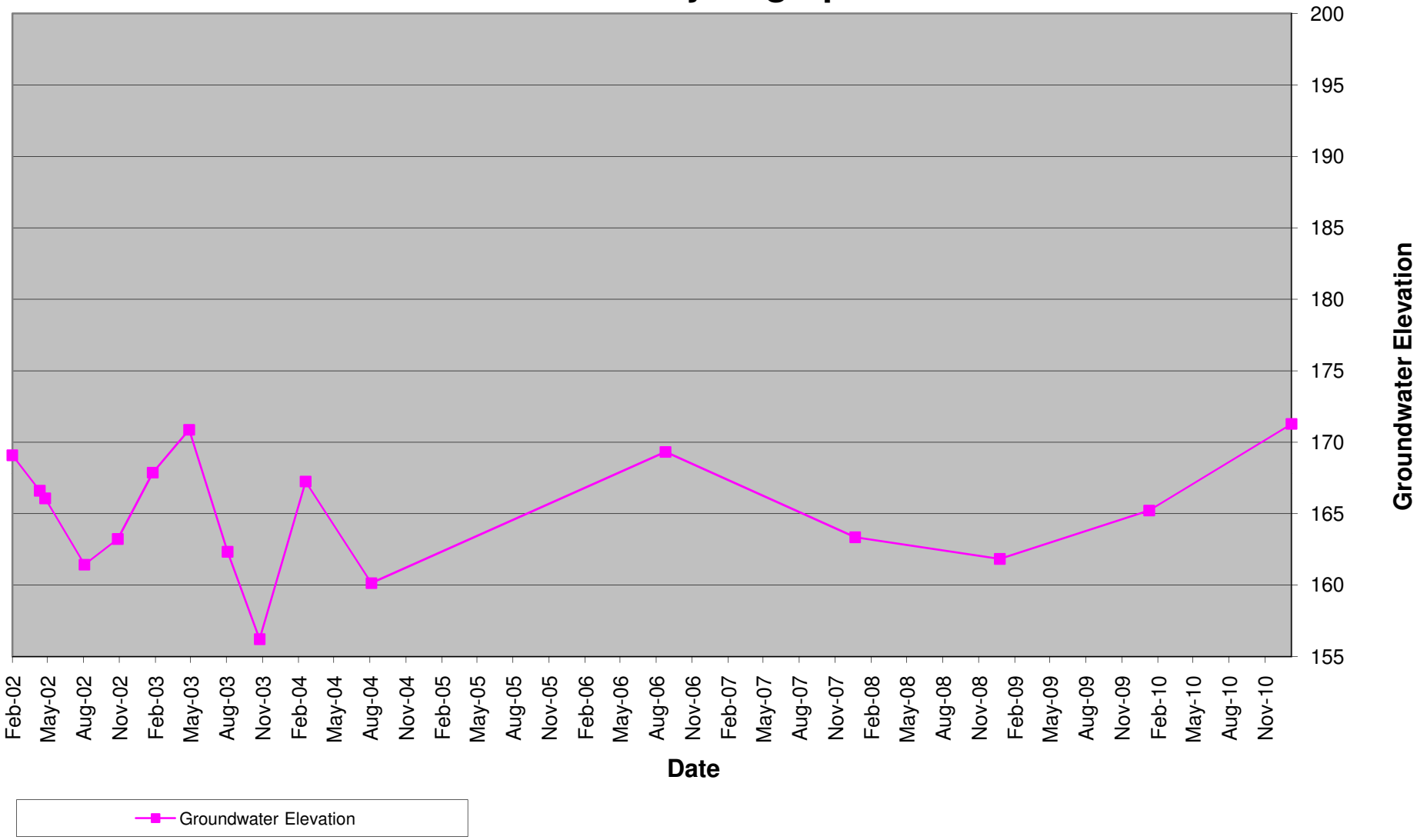


Figure 23
EPA Shallow Zone Extraction Wells - 09/06 through 12/10

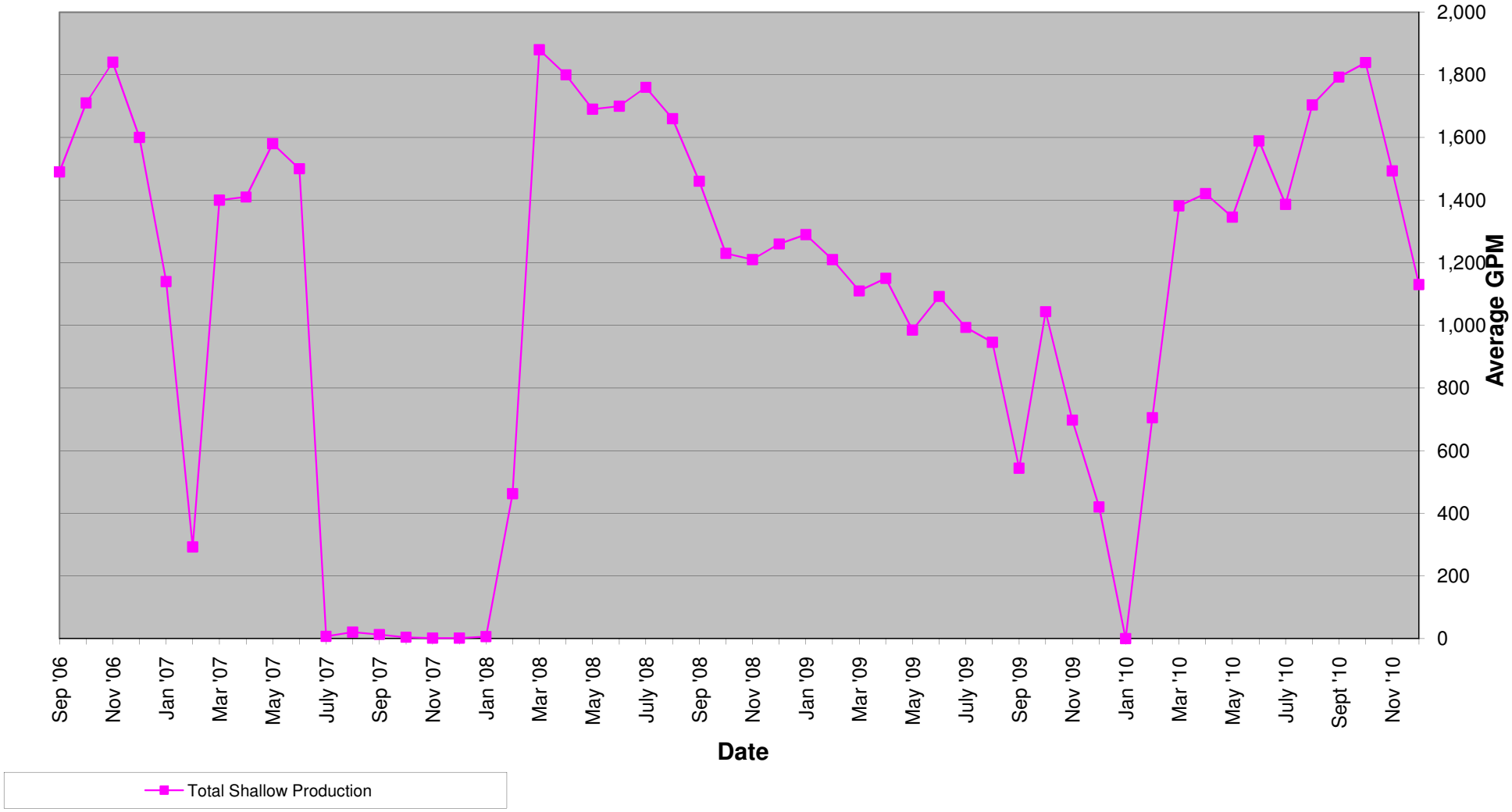


Figure 24
EPA Intermediate Zone Extraction Wells - 9/06 through 12/10

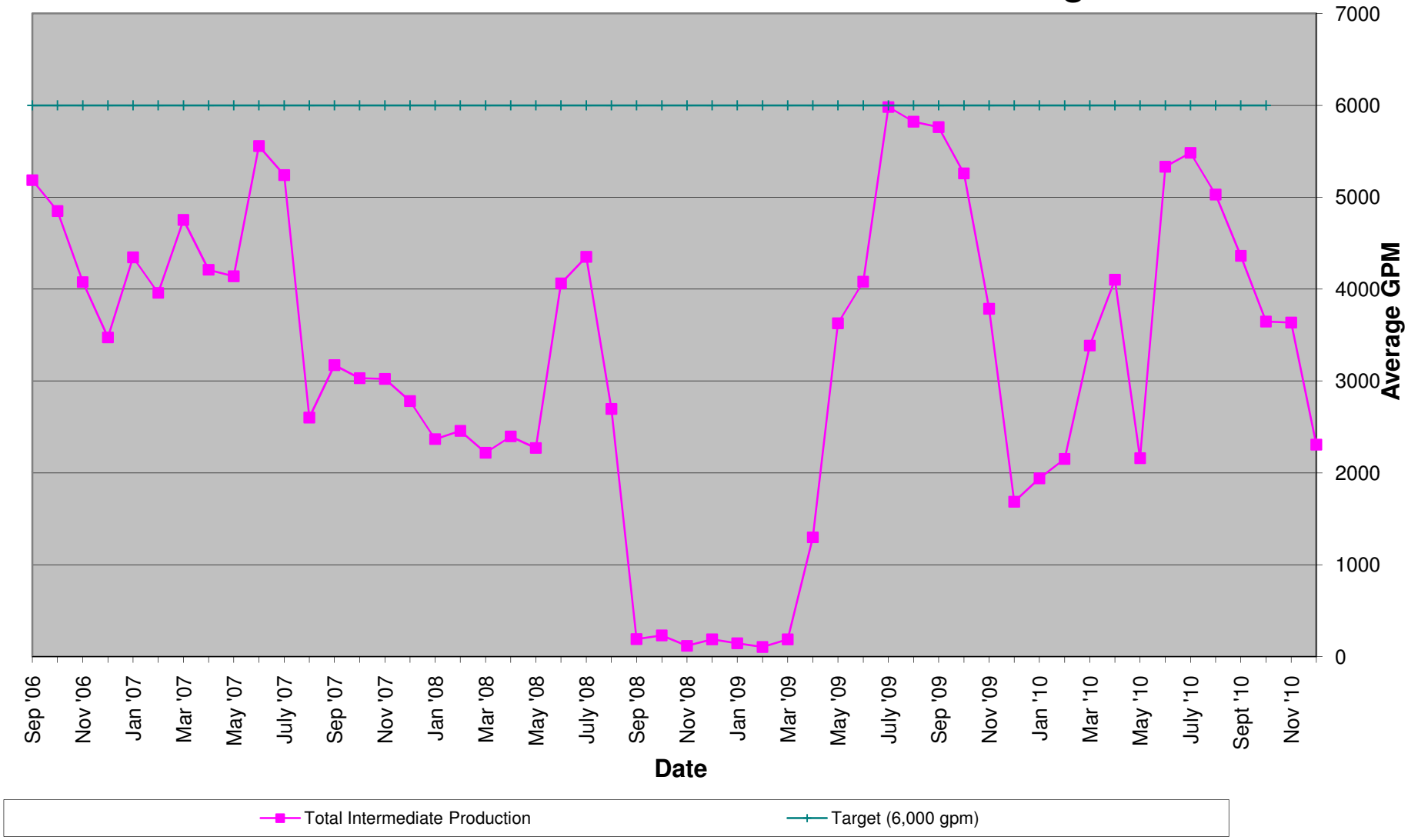


Table 1
PCE Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through February 2011)

Well ID	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Dec-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Jan/Feb-2008	Apr-2008	Sept/Oct-2008	Jan-2009	Apr-2009	Oct/Nov-2009	Jan-2010	Apr/May-2010	Oct-2010	Jan/Feb-2011
Pomona Fwy West																			
4-8-2	760-770																		ND
4-8-3	660-670																		ND
4-8-4	550-560												ND						ND, ND
4-8-5	460-470									**14**			4.7			**7.5**			**7.7**
4-8-6	375-385			**6**						**15**			**5.4**			**8.8, 10**			**9.8**
4-8-7	285-295			**17**						**15**			3.9			**7.6**			**6.6**
4-8-8	230-240			**13**						**8.5**			3.9			**6.1**			**7.2**
4-8-9	95-105			0.93						**17**			**5.4, 5.9**			1.3, 1.6			0.37J
4-8-10	45-55			1.6									4.5			1.5			0.35J
Pomona Fwy West-Central																			
4-9-3	750-760																		ND
4-9-4	650-660																		0.15J
4-9-5	515-525												ND						0.42J
4-9-6	350-360			0.77									0.34J			1.5			1.5
4-9-7	295-305			ND									0.49J			4.2			4.3
4-9-8	230-240	ND	**5.6**	**5.1**	**6.8**	**7.3**	**6.2**	4.3	**7.1**		**7.8**	4.9		4.8	3.7		2	1.4	1.5/1.4
4-9-9	100-110			1.8									ND			0.1J			ND
4-9-10	40-50			ND									ND			ND			ND
Pomona Fwy East-Central																			
4-10-2	675-685		ND					ND				ND							ND
4-10-3	595-605		1.1					1.2				1.3				1.3			1.1
4-10-4	470-480		2.2, 1.0					3.3				1.7				0.67			0.4J
4-10-5	320-330		0.56					ND				ND				ND			ND
4-10-6	220-230		ND					ND				ND				ND			ND
4-10-7	130-140		ND					ND, ND				ND, ND							ND
4-10-8	65-75																		ND
4-10-9	35-45																		ND
Central Basin nr. Rosemead																			
4-12-1	490-500			ND															ND
4-12-2	315-325			ND						0.33J			ND			ND			ND
4-12-3	225-235			**5.6, 5.9**						**5.9**			1.6			2.3			0.99/1.3
4-12-4	120-130			ND												ND			ND
4-12-5	45-55			ND															ND
Legg Lake																			
4-13-1	415-425			**19**						**12, 15**			**5**			**10, 12**			**9.7**
4-13-2	340-350			**14, 13**						**13**			**5.4**			**9**			4.8
4-13-3	225-235	**9.7**	**7.4**	**14**	**14**	**6.2**	**10**	**12**	**10**		**9.8**	**7.5**		**7.7**	**5.2**		3.3	ND	2.1
4-13-4	130-140	ND	ND	0.98	1.6	1.8	2.2	2.1	1.7		0.75	0.58		0.52	ND		ND	4.4	ND, ND
4-13-5	50-60			ND									ND			ND			ND
Gun Range																			
4-15-1	335-345			3.5						3.7			1.4			2.8			2.1
4-15-2	290-300			1.2						1.9			0.48J			1.4			1.1
4-15-3	230-240	**29**	**43**	**33**	**36**	**31**	**18**	**48**	**38**		**30**	**22**		**13**	**9.1**		4.1	3.8	2.8
4-15-4	145-155			**160**						**300**			**99, 130**			**210**			**160, 110**
4-15-5	44-55	**6.3**	**21**	**6.8**	**9**	**6.2**	**5.2**	**5.6**	4.5		4	1.2		2.3	4.7		0.85	3	1.1

Table 1
PCE Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through February 2011)

Well ID	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Dec-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Jan/Feb-2008	Apr-2008	Sept/Oct-2008	Jan-2009	Apr-2009	Oct/Nov-2009	Jan-2010	Apr/May-2010	Oct-2010	Jan/Feb-2011
Pachmayr Gun Range																			
471	210-220			ND						ND			ND			ND			ND
472	82-92	ND	**6.4**	3.1	2.7	2.4	2.5	1.9	1.4		2.7	1.3		0.85	0.73			ND	0.23J
WN Dam East																			
4-18-1	280-290			2.7						3.1			1.7, 1.7			4.2			3.1
4-18-2	230-240			2.1						1.5			0.43J			0.64			0.4J
4-18-3	135-145			1.4						0.47J			ND			ND			ND
4-18-4	95-105			0.8						0.15J			ND			ND			ND
WN Dam Central																			
4-19-1	295-305			ND						ND			ND			ND			ND, ND
4-19-2	230-240			0.53						0.51			0.21J			0.57			0.18J
4-19-3	160-170			ND						ND			ND			ND			ND
4-19-4	100-110			ND						ND			ND			ND			ND
4-19-5	40-50			ND						ND			ND			ND			
S. of Siphon Road on Zone 1 Ditch																			
4-21-A	266-296			4.9						4.9			2.6			**5.5, 5.4**			3.6
4-21-B	70-90			ND						0.12J			ND			ND			ND
N.E. of Wildlife Ponds																			
4-22-1	430-440			**6.1**						**7.7, 9**			4.3			**9.9**			**10, 10**
4-22-2	385-395			**18, 12**						**25**			**13**			**19**			**16**
4-22-3	315-325			11						**6.5**			**7.1**			**8.9/12**			**5.2**
4-22-4	215-225			3						4.3			0.5			0.57			0.67
4-22-5	130-140			ND									ND			ND			ND
4-22-6	45-55			ND									ND						ND
Rosemead & San Gabriel																			
MW2-2	430-450												ND						ND
MW2-3	316-336												ND						ND
MW2-4	202-222			ND, ND						ND			ND			0.69			1.2, 1.1
MW2-5	68-88			13						1.8, 2.2			2.9			ND			0.13J
Siphon Road																			
MP1-3	500-510			**7.5**															
MP1-4	430-440			**6.8**															
MP1-5	380-390			**13, 12**															
MP1-6	290-300			2															
MP1-7	230-240			1.7															
MP1-8	155-165			1.1															
Same as MP1 zones																			
MW1-2	500-510																		**9.3**
MW1-3	380-390															**26**			**25, 26**
MW1-4	230-240												0.26J			ND/ND			ND
MW1-5	90-100			ND						ND			ND						

Table 1
PCE Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through February 2011)

Well ID	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Dec-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Jan/Feb-2008	Apr-2008	Sept/Oct-2008	Jan-2009	Apr-2009	Oct/Nov-2009	Jan-2010	Apr/May-2010	Oct-2010	Jan/Feb-2011
Along WN Dam W. of Rosemead																			
MW461	251-261			ND						ND			0.41			ND			ND
MW462	140-150			ND						ND			ND			ND			ND
MW451	270-280			ND						ND			ND			ND			ND
MW452	200-210			ND						ND			ND			ND			ND
MW441	285-295			ND						ND									ND
MW442	225-235			ND						ND									ND
4-20-1	350-360			3.2						2.3, 2.5			0.68			0.55			0.13J
4-20-2	70-80			ND						ND			ND			ND			ND
South El Monte OU																			
SEM 3-1	371-380	**76**				**160**		**190, 190**		**130**				**130**	**100**		**200**	**230**	**160**
SEM 3-2	265-275	**110**				**220**		**270**		**170**				**98**	**46**		**68**	**130**	**57**
SEM 3-3	180-190	**273, 96**		**230**		**66**				**140**				**110**	**73**		**110**		**110, 100**
SEM 3-4	62-72	**18, 18**		**69**		**68, 49**		**100**		**50**				**54**	**32**		**67**	**82**	**72**
SEM 5-1	381-391	**52**				**130**		**190**		**170**				**130**	**58**		**94, 85**		
SEM 5-2	299-309			**190, 200**		**280**		**260**						**150**	**71**		**110**	**130, 160**	
SEM 5-3	209-218	**468**				**170**		**410**		**260**				**190**	**110**		**220**	**190**	
SEM 5-4	98-107			**6.9**										**14**	4.8		3.4		
SEM 5-5	65-74			3.1				**42**		**30, 25**				**5.1, 5.2**	1.8			**6.9**	
SEM 6-1	357-366			**35, 41**		**29**				**13**				**29**	**15**		**12**		
SEM 6-2	270-280	**89**	**70**	**95**	**69**	**61**	**48**	**53**	**87**	**30**	**91**	**83**		**58**	**78**		**79**	**47**	
SEM 6-3	120-129	**60**				**65**				**98**				**29**	**12**		**15**		
SEM 6-4	58-67	ND	**37**	**41**	**36**	**14**	**11**	**15**	**28**	**24**	**22**	**25**		**19**	**22**		**25**	**28**	
WN Dam and SG River																			
WN01-2	609-629																		ND
WN01-3	462-482									0.94			0.39J, 0.41J						ND, ND
WN01-4	392-402									0.6			0.31J						ND
WN01-5	334-344									0.25J			ND						ND
WN01-6	273-283												ND						ND
WN01-7	233-243												ND						ND
WN01-8	163-173												ND						0.99
WN01-9	95-105												ND						1
Central Basin, E. of SG River																			
WN02-1	659-679																		ND
WN02-2	579-599																		ND
WN02-3	469-489																		0.52
WN02-4	418-428																		0.2J
WN02-5	329-339																		0.22J
WN02-6	263-273																		ND
WN02-7	213-233																		ND
WN02-8	136-146																		ND
WN02-9	91-101																		ND
SG Blvd. Near west. Hills																			
4-24	24-45			ND, ND						ND						ND			ND

Table 1
PCE Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through February 2011)

Well ID	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Dec-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Jan/Feb-2008	Apr-2008	Sept/Oct-2008	Jan-2009	Apr-2009	Oct/Nov-2009	Jan-2010	Apr/May-2010	Oct-2010	Jan/Feb-2011
Rio Hondo Bypass																			
4-23	70-90			ND						1.1			ND			ND			ND
4-25	25-50			ND									ND			ND			ND
4-26	27-52												ND			ND			ND

Notes:
ND = analyte not detected above detection limit
J = qualified as "estimated" by the laboratory
duplicate samples separated by comma
sampling dates may vary slightly from months shown
bolded numbers denote concentrations greater than the maximum contaminant level (MCL) of 5 µg/l for PCE

Table 2
1,4-Dioxane Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through February 2011)

Well	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Dec-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Apr-2008	Sept/Oct-2008	Apr-2009	Oct/Nov-'09	Apr/May-'10	Oct-2010	Jan/Feb-2011
Pomona Fwy West																
4-8-5	460-470															ND
4-8-6	375-385															ND
4-8-7	285-295															0.54J
4-8-8	230-240															0.52J
4-8-9	95-105															0.65J
Pomona Fwy West-Central																
4-9-5	515-525															ND
4-9-6	350-360															0.37J
4-9-7	295-305															0.41J
4-9-8	230-240	0.51	ND	ND	0.71	0.58	0.67	ND	ND	0.76	0.66	**2.5**	0.79	0.74	0.80	
4-9-9	100-110															0.59J
Pomona Fwy East-Central																
4-10-1	810-820		ND					ND			ND					
4-10-2	675-685		ND					ND			ND					
4-10-3	595-605		ND					ND			ND					
4-10-4	470-480		0.5J, 0.6J					0.52J			ND					0.65J
4-10-5	320-330		0.7J					0.35J			ND					0.82J
4-10-6	220-230		ND					ND			ND					0.59J
4-10-7	130-140		0.8J					0.39J, 0.47J			ND, ND					0.84J
Pomona Fwy East- @605																
4-11-1	545-555		ND													
4-11-2	490-500		ND													
4-11-3	400-410		**1.1**													
4-11-4	305-315		0.9J													
4-11-5	225-235		0.8J													
4-11-6	120-130		0.8J													
Legg Lake																
4-13-1	415-425															0.3J
4-13-2	340-350															0.36J
4-13-3	225-235	0.68	ND	ND	ND	0.68	0.65	0.59	ND	0.85	0.68	0.81	0.67	0.73	0.93	
4-13-4	130-140	0.64	0.59	ND	ND	0.64	0.67	ND	ND	0.68	ND	ND	ND	ND	0.67	
SEM Maint. Yard																
4-14-5	100-110												ND			
Gun Range																
4-15-1	335-345															ND
4-15-2	290-300															ND
4-15-3	230-240	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.51**	**0.95**	ND	ND	ND	
4-15-4	145-155															0.58J, 0.54J
4-15-5	44-55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.9**	ND	ND	ND	
Pachmayr Gun Range																
MW4-71	210-220															ND
MW4-72	82-92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.71**	ND		ND	

Table 2
1,4-Dioxane Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through February 2011)

Well	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Dec-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Apr-2008	Sept/Oct-2008	Apr-2009	Oct/Nov-'09	Apr/May-'10	Oct-2010	Jan/Feb-2011
Northeastern SEM																
4-16-3	135-145												ND			
S. of Siphon Road on Zone 1 Ditch																
4-21-A	266-296															ND
4-21-B	70-90															ND
N.E. of Wildlife Ponds																
4-22-1	430-440															0.24J, 0.33J
4-22-2	385-395															0.5J
4-22-3	315-325															0.5J
4-22-4	215-225															0.39J
Rosemead & San Gabriel																
MW2-5	68-88															0.18J
Siphon Rd (Same as MP1 zones)																
MW1-2	700-710															ND
MW1-3	380-390															0.67J, 0.67J
MW1-4	234-240															0.56J
South El Monte OU																
SEM 2-1	344-354			ND											0.86J	
SEM 2-2	248-258	ND				0.62J				0.81J		1J		**1.8J, 1.9J**	0.80J	
SEM 2-3	112-122			0.52J				ND				0.87J	ND			
SEM 2-4	38-48			ND									ND			
SEM 3-1	371-380					0.64J				0.66J		0.8J		0.8J		0.58J
SEM 3-2	265-275					0.64J				0.62J		**1.1J**	ND	**1.2J**	**1.9J**	0.85J
SEM 3-3	180-190	**8.3, 7.7**		ND		**2.0, 2.4**				**1.5J, 1.5J**		**2.3**	**3.2**	**2.5**		**1.8J, 1.4J**
SEM 3-4	62-72	**6.2**		ND		**1.5J, 1.5J**				**1.3J**		**1.5J**	**1.6J**	**1.6J**		**1.7J**
SEM 5-1	381-391					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
SEM 5-2	299-309			ND, ND												
SEM 5-3	209-218	ND				0.37J	0.37J	0.37J	0.37J	0.37J	0.37J	0.37J	0.37J	0.37J	0.37J	
SEM 5-4	98-107	**5.1**				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
SEM 5-5	65-74			ND												
SEM 6-1	357-366									ND		0.15J		ND		
SEM 6-2	270-280	ND	ND	ND	ND	ND	ND	ND	ND	0.67	0.58	0.65	0.68	0.74	0.67	
SEM 6-3	120-129			0.47J						0.53J		0.65J			ND	
SEM 6-4	58-67	0.79	0.66	0.91	**1.4**	**1.1**	**1.2**	ND	**2**	**2**	**4.8**	**2.5**	**2.5**	0.82	0.70	

Notes:
ND = analyte not detected above detection limit
J = qualified as "estimated" by the laboratory
duplicate samples separated by comma
sampling dates may vary slightly from months shown
bolded numbers denote concentrations greater than the California Department of Public Health Notification Level of 1 µg/l for 1,4-dioxane
(CDPH Notification Levels - http://www.cdph.ca.gov/certlic/drinkingwater/Pages/NotificationLevels.aspx; Accessed March 7,

TABLE 3
Summary of PCE
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	PCE MCL - 5 µg/L
Shallow Wells				
EW4-3	120	50-110	Mar-06	3.2
			Jun-06	3.3
			Sep-06	**9**
			Dec-06	4.6
			Mar-07	**6.3**
			May-07	**6.4**
			Aug-07	1.3
			Dec-07	1.2
			Mar-08	**5.1**
			Jun-08	4.2
			Sep-08	2.3
			Nov-08	1.7
			Dec-08	2.4
			Mar-09	ND
			Jun-09	NA
			Dec-09	ND
			Mar-10	ND
			Jun-10	1.6
			3Q-2010	ND
			Nov-10	ND
EW4-4	130	60-120	1Q-2006	3.6
			2Q-2006	0.88
			3Q-2006	3.4
			4Q-2006	1.6
			1Q-2007	2.6
			2Q-2007	2.2
			3Q-2007	2.2
			4Q-2007	2
			1Q-2008	2.9
			2Q-2008	2.4
			3Q-2008	1.7
			4Q-2008	2.6
			1Q-2009	1.7
			2Q-2009	1.4
			3Q-2009	NA
			4Q-2009	1.1
			1Q-2010	0.83
			2Q-2010	1.4
			3Q-2010	0.55
			4Q-2010	0.64
EW4-8	110	54-104	1Q-2006	0.5 U
			2Q-2006	**6.8**
			3Q-2006	1.5
			4Q-2006	1.6
			1Q-2007	1.9
			2Q-2007	1.5
			3Q-2007	1.2
			4Q-2007	ND
			1Q-2008	ND
			2Q-2008	ND
			3Q-2008	ND
			4Q-2008	ND
			1Q-2009	ND
			2Q-2009	ND
			3Q-2009	ND
			4Q-2009	ND
			1Q-2010	ND
			2Q-2010	ND
			3Q-2010	ND
			4Q-2010	ND

TABLE 3
Summary of PCE
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	PCE MCL - 5 µg/L
EW4-9	125	50-120	1Q-2006	**2**
			3Q-2006	ND
			4Q-2006	ND
			1Q-2007	ND
			2Q-2007	ND
			3Q-2007	ND
			4Q-2007	ND
			1Q-2008	ND
			2Q-2008	ND
			3Q-2008	ND
			4Q-2008	ND
			1Q-2009	ND
			2Q-2009	ND
			3Q-2009	ND
			4Q-2009	ND
			1Q-2010	ND
			2Q-2010	ND
			3Q-2010	0.5
			4Q-2010	ND
Intermediate Wells				
EW4-5	400	160-390	Jan-06	**19**
			Feb-06	**18**
			Mar-06	**18**
			Aug-06	**13**
			Sep-06	**26**
			Oct-06	**29**
			Nov-06	**28**
			Dec-06	**24**
			Jan-07	**35**
			Mar-07	**33**
			Apr-07	**29**
			Apr-07	**41**
			May-07	**27**
			Jun-07	**38**
			Jul-07	**24**
			Aug-07	**29**
			Sep-07	**7.2**
			Sep-07	**35**
			Oct-07	**29**
			Nov-07	**27**
			Dec-07	**30**
			Jan-08	**39**
			Feb-08	**19**
			Mar-08	**35**
			Apr-08	**40**
			Jul-08	**9.4**
			Aug-08	**28**
			Sep-08	**29**
			Oct-08	**33**
			Nov-08	**31**
			Nov-08	**31**
			Dec-08	**26**
			Jan-09	**30**
			Feb-09	**12**
			Mar-09	**5.6**
			Apr-09	**19**
			May-09	**26**
			Jun-09	**28**
			Jul-09	**32**
			Aug-09	**7.4**
			Sep-09	**22**

TABLE 3
Summary of PCE
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	PCE MCL - 5 µg/L
EW4-5	400	160-390	Oct-09	**21**
			Nov-09	3.5
			Dec-09	**14**
			Jan-10	3.8
			Feb-10	3.8
			Mar-10	**25**
			Apr-10	1.6
			May-10	NA
			Jun-10	**6.6**
			Jul-10	**24**
			Aug-10	**51**
			Sep-10	**42**
			Oct-10	**40**
			Nov-10	3.8
			Dec-10	**21**
EW4-6	400	160-390	May-06	3.8
			Jun-06	**8.1**
			Jul-06	**6.5**
			Aug-06	**5.3**
			Sep-06	**5.2**
			Oct-06	**6.4**
			Nov-06	**5.6**
			Dec-06	**5.9**
			Jan-07	**6.4**
			Mar-07	**8.3**
			Apr-07	**6.6**
			Apr-07	**8.2**
			May-07	**6.1**
			Jun-07	**7.3**
			Jul-07	**5.5**
			Aug-07	0.55
			Sep-07	**5.5**
			Sep-07	2.8
			Oct-07	1.2
			Nov-07	**5.1**
			Dec-07	4.3
			Jan-08	**7.4**
			Feb-08	5
			Mar-08	**5.4**
			Apr-08	**12**
			May-08	**6.2**
			Jun-08	**5.7**
			Jul-08	**5.7**
			Aug-08	4.1
			Sep-08	ND
			Oct-08	ND
			Nov-08	ND
			Nov-08	ND
			Dec-08	0.5
			Jan-09	2.6
			Feb-09	ND
			Mar-09	ND
			Apr-09	ND
			May-09	ND
			Jun-09	3.7
			Jul-09	5
			Aug-09	3.9
			Sep-09	3.6
			Oct-09	ND
			Nov-09	3.1
			Dec-09	ND

TABLE 3
Summary of PCE
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	PCE MCL - 5 µg/L
EW4-6	400	160-390	Jan-10	ND
			Feb-10	NA
			Mar-10	ND
			Apr-10	2.3
			May-10	3.9
			Jun-10	ND
			Jul-10	0.59
			Aug-10	3.8
			Sep-10	3.8
			Oct-10	3.7
			Nov-10	3.8
			Dec-10	ND
EW4-7	360	160-350	Jan-06	**8.2**
			Feb-06	**8.1**
			Mar-06	**7.4**
			Apr-06	**7.0**
			May-06	**6.4**
			Jun-06	**7.0**
			Jul-06	**5.4**
			Aug-06	**6.0**
			Sep-06	**5.3**
			Oct-06	**6.1**
			Nov-06	4.0
			Dec-06	4.7
			Jan-07	**5.1**
			Mar-07	4.8
			Apr-07	**5.3**
			Apr-07	**6.1**
			May-07	**5.0**
			Jun-07	**5.4**
			Jul-07	4.6
			Aug-07	**5.6**
			Sep-07	**5.2**
			Sep-07	**5.2**
			Oct-07	**5.6**
			Nov-07	**5.3**
			Dec-07	4.7
			Jan-08	**6.1**
			Feb-08	4.9
			Mar-08	4.8
			Apr-08	**5.1**
			May-08	4.7
			Jun-08	4.3
			Aug-08	4.1
			Oct-08	2.5
			Oct-08	3.8
			Nov-08	3.6
			Nov-08	3.6
			Dec-08	4.1
			Jan-09	4.2
			Feb-09	**5.4**
			Mar-09	2.7
			Apr-09	4.2
			May-09	4.1
			Jun-09	**5.2**
			Jul-09	4.7
			Aug-09	3.8
			Sep-09	3.4
			Oct-09	ND
			Nov-09	3.1
			Dec-09	NA

TABLE 3
Summary of PCE
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	PCE MCL - 5 µg/L
EW4-7	360	160-350	Jan-10	3.4
			Feb-10	3.4
			Mar-10	2.4
			Apr-10	2
			May-10	2.9
			Jun-10	2.3
			Jul-10	0.59
			Aug-10	1.8
			Sep-10	1.8
			Oct-10	1.8
			Nov-10	1.8
			Dec-10	1.8

Notes-
All data reported in µg/L.
NA - Sample not collected
bolded numbers denote concentrations greater than the maximum contaminant level (MCL) of 5 µg/l for PCE

Table 4

Summary of 1,4-Dioxane Data

Shallow and Intermediate Depth Extraction Wells

Whittier Narrows Operable Unit, Los Angeles County, California

	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	1,4-Dioxane Notification Level - 1 ug/L
EW4-3	120	50-110	15-Mar-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			8-Mar-07	ND
			30-May-07	ND
			13-Aug-07	ND
			05-Dec-07	ND
			11-Mar-08	ND
			05-Jun-08	ND
			03-Sep-08	ND
			13-Nov-08	ND
			02-Dec-08	0.55
			05-Mar-09	ND
			03-Jun-09	ND
			03-Dec-09	ND
			03-Mar-10	ND
			02-Jun-10	ND
			03-Nov-10	ND
			4Q-2010	ND
EW4-4	130	60-120	15-Mar-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			08-Mar-07	ND
			30-May-07	0.52
			13-Aug-07	ND
			05-Dec-07	0.50
			11-Mar-08	0.59
			05-Jun-08	0.53
			03-Sep-08	ND
			13-Nov-08	ND
			02-Dec-08	ND
			05-Mar-09	ND
			03-Jun-09	0.51
			03-Dec-09	ND
			03-Mar-10	ND
			02-Jun-10	0.67
			03-Nov-10	0.69
			4Q-2010	0.55
EW4-8	110	54-104	19-Jan-06	**1.1**
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND

Table 4

Summary of 1,4-Dioxane Data

Shallow and Intermediate Depth Extraction Wells

Whittier Narrows Operable Unit, Los Angeles County, California

	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	1,4-Dioxane Notification Level - 1 ug/L
EW4-8	110	54-104	08-Mar-07	ND
			30-May-07	ND
			13-Aug-07	ND
			06-Dec-07	ND
			11-Mar-08	ND
			05-Jun-08	ND
			03-Sep-08	0.66
			13-Nov-08	0.76
			02-Dec-08	**1.5**
			05-Mar-09	0.53
			03-Jun-09	0.59
			03-Sep-09	ND
			03-Dec-09	1
			03-Mar-10	0.51
			02-Jun-10	0.90
			03-Nov-10	ND
			4Q-2010	ND
EW4-9	125	50-120	01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			08-Mar-07	0.52
			30-May-07	ND
			13-Aug-07	ND
			06-Dec-07	0.70
			11-Mar-08	0.77
			05-Jun-08	0.67
			03-Sep-08	0.60
			13-Nov-08	0.70
			02-Dec-08	0.80
			05-Mar-09	0.59
			03-Jun-09	0.81
			03-Sep-09	0.63
			03-Nov-09	0.63
			03-Mar-10	0.68
			02-Jun-10	0.82
			03-Nov-10	0.69
			4Q-2010	0.64
Intermediate Wells				
EW4-5	400	160-390	10-Jan-06	0.92
			09-Feb-06	0.95
			24-Feb-06	0.96
			28-Feb-06	0.65
			14-Mar-06	0.80

Table 4

Summary of 1,4-Dioxane Data

Shallow and Intermediate Depth Extraction Wells

Whittier Narrows Operable Unit, Los Angeles County, California

	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	1,4-Dioxane Notification Level - 1 ug/L
EW4-5	400	160-390	16-Aug-06	ND
			13-Sep-06	ND
			04-Oct-06	ND
			14-Nov-06	**1.2**
			13-Dec-06	0.83
			09-Jan-07	0.88
			06-Mar-07	0.79
			02-Apr-07	0.83
			11-Apr-07	0.77
			03-May-07	0.89
			04-Jun-07	0.90
			03-Jul-07	0.74
			07-Aug-07	0.84
			04-Sep-07	ND
			01-Oct-07	0.68
			05-Nov-07	ND
			04-Dec-07	ND
			02-Jan-08	ND
			05-Feb-08	0.82
			03-Mar-08	**1.1**
			01-Apr-08	**1.2**
			07-Jul-08	0.72
			05-Aug-08	0.82
			03-Sep-08	0.78
			07-Oct-08	0.78
			04-Nov-08	0.87
			03-Dec-08	**1.1**
			06-Jan-09	0.92
			03-Feb-09	0.80
			03-Mar-09	0.72
			08-Apr-09	0.82
			05-May-09	0.77
			02-Jun-09	0.84
			07-Jul-09	0.77
			04-Aug-09	0.70
			01-Sep-09	0.69
			07-Oct-09	0.76
			04-Nov-09	ND
			01-Dec-09	0.60
			05-Jan-10	0.61
			02-Feb-10	0.58
			02-Mar-10	0.80
			07-Apr-10	0.66
			01-Jun-10	0.72

Table 4

Summary of 1,4-Dioxane Data

Shallow and Intermediate Depth Extraction Wells

Whittier Narrows Operable Unit, Los Angeles County, California

	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	1,4-Dioxane Notification Level - 1 ug/L
EW4-5	400	160-390	08-Jul-10	0.74
			03-Aug-10	0.79
			07-Sep-10	0.73
			07-Oct-10	0.85
			02-Nov-10	0.69
			07-Dec-10	0.77
EW4-6	400	160-390	25-May-06	ND
			18-Jul-06	ND
			02-Aug-06	ND
			13-Sep-06	ND
			14-Nov-06	0.79
			13-Dec-06	0.84
			09-Jan-07	ND
			06-Mar-07	0.54
			02-Apr-07	0.57
			11-Apr-07	0.63
			03-May-07	ND
			04-Jun-07	ND
			03-Jul-07	0.58
			07-Aug-07	ND
			04-Sep-07	ND
			01-Oct-07	ND
			05-Nov-07	ND
			04-Dec-07	ND
			02-Jan-08	ND
			05-Feb-08	0.63
			03-Mar-08	0.83
			01-Apr-08	0.92
			05-May-08	0.74
			03-Jun-08	0.72
			02-Jul-08	0.62
			05-Aug-08	0.67
			03-Sep-08	0.60
			07-Oct-08	0.58
			04-Nov-08	0.65
			03-Dec-08	0.82
			06-Jan-09	0.70
			03-Feb-09	0.68
			03-Mar-09	0.66
			08-Apr-09	0.68
			05-May-09	0.58
			02-Jun-09	0.71
			07-Jul-09	0.66
			04-Aug-09	0.70

Table 4

Summary of 1,4-Dioxane Data

Shallow and Intermediate Depth Extraction Wells

Whittier Narrows Operable Unit, Los Angeles County, California

	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	1,4-Dioxane Notification Level - 1 ug/L
EW4-6	400	160-390	01-Sep-09	0.64
			07-Oct-09	0.69
			04-Nov-09	ND
			01-Dec-09	0.51
			05-Jan-10	0.57
			02-Mar-10	0.69
			07-Apr-10	0.68
			04-May-10	0.82
			01-Jun-10	0.75
			08-Jul-10	0.76
			03-Aug-10	0.67
			07-Sep-10	0.75
			07-Oct-10	0.81
			02-Nov-10	0.74
			07-Dec-10	0.85
EW4-7	360	160-350	10-Jan-06	0.68
			09-Feb-06	0.70
			24-Feb-06	0.66
			28-Feb-06	ND
			14-Mar-06	ND
			19-Apr-06	0.87
			18-Jul-06	ND
			02-Aug-06	ND
			13-Sep-06	ND
			14-Nov-06	ND
			13-Dec-06	ND
			09-Jan-07	ND
			06-Mar-07	ND
			02-Apr-07	ND
			11-Apr-07	0.65
			03-May-07	ND
			04-Jun-07	ND
			03-Jul-07	ND
			07-Aug-07	ND
			04-Sep-07	ND
			01-Oct-07	ND
			05-Nov-07	ND
			04-Dec-07	ND
			02-Jan-08	ND
			05-Feb-08	ND
			03-Mar-08	0.70
			01-Apr-08	0.62
			05-May-08	0.54
			03-Jun-08	0.52

Table 4

Summary of 1,4-Dioxane Data

Shallow and Intermediate Depth Extraction Wells

Whittier Narrows Operable Unit, Los Angeles County, California

	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	1,4-Dioxane Notification Level - 1 ug/L
EW4-7	360	160-350	01-Oct-08	ND
			07-Oct-08	ND
			04-Nov-08	0.50
			03-Dec-08	0.64
			06-Jan-09	0.51
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	0.57
			07-Jul-09	ND
			04-Aug-09	ND
			01-Sep-09	ND
			07-Oct-09	ND
			04-Nov-09	ND
			01-Dec-09	ND
			05-Jan-10	ND
			02-Feb-10	ND
			02-Mar-10	0.51
			07-Apr-10	0.55
			04-May-10	0.59
			01-Jun-10	0.62
			08-Jul-10	0.57
			03-Aug-10	0.52
			07-Sep-10	0.53
			07-Oct-10	0.57
			02-Nov-10	0.51
			07-Dec-10	ND

Notes-

All data reported in µg/L.

bolded numbers denote concentrations greater than the California DPH Notification Level of 1 µg/l for 1,4-dioxane

(CDPH Notification Levels - http://www.cdph.ca.gov/certlic/drinkingwater/Pages/NotificationLevels.aspx; Accessed March 7, 2011)

Table 5

2006 - 2010 Perchlorate Data for Whittier Narrows/Southern SEMOU Monitoring Wells

Whittier Narrows Operable Unit, Los Angeles County, California

Well ID	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Feb-2008	Sept/Oct-2008	Apr-2009	Oct/Nov-2009	Apr/May-2010	Oct-2010
Pomona Fwy West-Central														
4-9-8	230-240	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			ND
Pomona Fwy East-Central														
4-10-1	810-820		ND				ND			ND				
4-10-2	675-685		ND				ND			ND				
4-10-3	595-605		ND				ND			ND				
4-10-4	470-480		ND, ND				ND			ND				
4-10-5	320-330		ND				ND			ND				
4-10-6	220-230		1.5 J				1.6J			ND				
4-10-7	130-140		ND				ND, ND			ND, ND				
Legg Lake														
4-13-3	225-235	ND	ND	ND	ND	0.13	0.13	ND	ND	ND	ND			ND
4-13-4	130-140	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			3.7
SEM Maint. Yard														
4-14-5	100-110											ND		
Gun Range														
4-15-3	230-240	ND	ND	ND	ND	2.2	ND	ND	ND	ND	ND			ND
4-15-5	44-55	3	ND	ND	ND	ND	ND	ND	ND	ND	ND			ND
Pachmayr Gun Range														
472	82-92	ND	ND	ND	ND	2.2	ND	ND	ND	ND	ND			ND
Northeastern SEM														
4-16-3	135-145											ND		
South El Monte OU														
SEM 2-1	344-354			3.2			3, 3.8			2.8	2.8	3	2.2	1.8
SEM 2-2	248-258	4.2			4.2				4.3		3.2		2.6, 3.2	4
SEM 2-3	112-122						ND					ND		
SEM 2-4	38-48			ND								ND		
SEM 3-1	371-380				2				1.9J		1.5J		1.6	
SEM 3-2	265-275				1.3				1.3J		1.5J	ND	1.1	1.1
SEM 3-3	180-190	2.1, 1.8J			2.2				2.2		2	2.4	2.4	
SEM 3-4	62-72	2			1.5				1.2		1.8J	ND	1.6	
SEM 5-1	381-391				2.3				2.6		2	2.2	1.9, 2.0	
SEM 5-2	299-309			2.3, 2.4			2.2				2.1		1.3	
SEM 5-3	209-218	2.1			1.9				1.8J		2.3	3.7	2.6	3.1
SEM 5-4	98-107				ND				ND		ND			
SEM 5-5	65-74											ND		

Table 5

2006 - 2010 Perchlorate Data for Whittier Narrows/Southern SEMOU Monitoring Wells

Whittier Narrows Operable Unit, Los Angeles County, California

Well ID	Screen Interval	Feb/Mar-2006	Jun-2006	Aug/Sep-2006	Feb-2007	May-2007	Aug/Sept-2007	Nov-2007	Feb-2008	Sept/Oct-2008	Apr-2009	Oct/Nov-2009	Apr/May-2010	Oct-2010
South El Monte OU														
SEM 6-1	357-366								1.8J		1.8J		ND	
SEM 6-2	270-280	2.2	2.2	2.1	ND	ND	ND	ND	ND	ND	ND			ND
SEM 6-3	120-129			1J					1.1J		2J	1J	ND	
SEM 6-4	58-67	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND

Notes:

All data reported in µg/L.

duplicate samples separated by comma

MCL= Maximum Contaminant Level of 6 mg/l for perchlorate.

Table 6
Summary of Perchlorate Data
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	Perchlorate CA MCL - 6 ug/L
Shallow Wells				
EW4-3	120	50-110	15-Mar-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			08-Mar-07	ND
			30-May-07	ND
			13-Aug-07	ND
			05-Dec-07	ND
			11-Mar-08	ND
			05-Jun-08	ND
			03-Sep-08	ND
			02-Dec-08	ND
			05-Mar-09	ND
			03-Jun-09	ND
			01-Dec-09	ND
EW4-4	130	60-120	15-Mar-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			08-Mar-07	ND
			30-May-07	ND
			13-Aug-07	ND
			05-Dec-07	ND
			11-Mar-08	ND
			05-Jun-08	ND
			03-Sep-08	ND
			02-Dec-08	ND
			05-Mar-09	ND
			03-Jun-09	ND
			01-Dec-09	ND
EW4-8	110	54-104	19-Jan-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			08-Mar-07	ND
			30-May-07	ND
			13-Aug-07	ND
			06-Dec-07	ND
			11-Mar-08	ND
			05-Jun-08	ND
			03-Sep-08	ND
			02-Dec-08	ND
			05-Mar-09	ND
			03-Jun-09	ND
			03-Sep-09	ND
			01-Dec-09	ND
EW4-9	125	50-120	01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			08-Mar-07	ND
			30-May-07	ND
			13-Aug-07	ND
			06-Dec-07	ND
			11-Mar-08	ND
			05-Jun-08	ND
			03-Sep-08	ND
			02-Dec-08	ND
			05-Mar-08	ND
			05-Mar-09	ND
			03-Jun-09	ND
			03-Sep-09	ND
			01-Dec-09	ND
Intermediate Wells				
EW4-5	400	160-390	10-Jan-06	ND
			09-Feb-06	ND
			16-Aug-06	ND
			29-Jan-07	2.1
			11-Apr-07	ND
			10-Jul-07	ND
			09-Oct-07	ND
			07-Jan-08	ND
			08-Apr-08	ND

Table 6
Summary of Perchlorate Data
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Wells	Well Depth (ft bgs)	Screened Interval (ft bgs)	Sample Date	Perchlorate CA MCL - 6 ug/L
EW4-5	400	160-390	07-Jul-08	ND
			09-Jul-08	ND
			05-Aug-08	ND
			03-Sep-08	ND
			07-Oct-08	ND
			04-Nov-08	ND
			03-Dec-08	ND
			06-Jan-09	ND
			03-Feb-09	ND
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	ND
			07-Jul-09	ND
			04-Aug-09	ND
			01-Sep-09	ND
			02-Nov-10	ND
EW4-6	400	160-390	25-May-06	ND
			02-Aug-06	ND
			29-Jan-07	ND
			11-Apr-07	ND
			10-Jul-07	ND
			09-Oct-07	ND
			07-Jan-08	ND
			08-Apr-08	ND
			09-Jul-08	ND
			05-Aug-08	ND
			03-Sep-08	ND
			07-Oct-08	ND
			04-Nov-08	ND
			03-Dec-08	ND
			06-Jan-09	ND
			03-Feb-09	ND
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	ND
			07-Jul-09	ND
			04-Aug-09	ND
			01-Sep-09	ND
			02-Nov-10	ND
EW4-7	360	160-350	10-Jan-06	ND
			09-Feb-06	ND
			19-Apr-06	ND
			29-Jan-07	2.3
			11-Apr-07	ND
			10-Jul-07	ND
			09-Oct-07	ND
			07-Jan-08	ND
			08-Apr-08	ND
			01-Oct-08	ND
			07-Oct-08	ND
			04-Nov-08	ND
			03-Dec-08	ND
			06-Jan-09	ND
			03-Feb-09	ND
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	ND
			07-Jul-09	ND
			04-Aug-09	ND
			01-Sep-09	ND
			02-Nov-10	ND

Notes:
MCL= Maximum Contaminant Level 6 mg/l for perchlorate.

Table 7
NDMA Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through October 2010)

Well ID	Screen Interval	Jan-2006	Feb-2006	Mar-2006	Apr-2006	May-2006	Jun-2006	Jul-2006	Aug-2006	Sep-2006	Oct-2006	Nov-2006	Dec-2006	Jan-2007	Feb-2007	Mar-2007	Apr-2007
Pomona Fwy West-Central																	
4-9-8	230-240			ND			ND			ND			ND		ND		
Legg Lake																	
4-13-3	225-235			ND			ND			ND			ND		ND		
4-13-4	130-140			ND			ND			0.002			ND		ND		
Gun Range																	
4-15-3	230-240			ND			ND			ND			ND		ND		
4-15-5	44-55			ND			ND			ND					ND		
Pachmayr Gun Range																	
472	82-92			ND			ND			ND			ND		ND		
S. of Siphon Road on Zone 1 Ditch																	
4-21-A	266-296	ND	ND	ND	ND	ND	ND	0.001	0.0029	ND	ND			ND		ND	
4-21-B	70-90	ND	ND	ND	ND	ND		ND	0.0025	0.00089	0.00181	0.0025	0.0032	ND		0.002, ND	0.0021
Rosemead & San Gabriel																	
MW2-5	68-88	ND						ND	ND		ND						
South El Monte OU																	
SEM 3-3	180-190		ND, 0.0008J												ND		
SEM 3-4	62-72																
SEM 5-3	209-218		ND												ND		
SEM 5-5	65-74																
SEM 6-2	270-280			ND		ND	ND			ND			ND		ND		
SEM 6-4	58-67			ND			ND			ND			ND		ND		
SG Blvd. Near west. Hills																	
4-24	24-45	**0.12**		**0.055**	**0.038**	**0.016**	**0.01**	0.0036	0.0022	0.002	0.00117	0.00058	0.0017	ND		**0.053**	**0.029**
Rio Hondo Bypass																	
4-23	70-90			0.0032			0.00091			**0.037**			**0.022**				
4-26	27-52									**0.09**							

Notes:
ND = analyte not detected above detection limit
J = qualified as "estimated" by the laboratory
duplicate samples separated by comma
sampling dates may vary slightly from months shown
bolded numbers denote concentrations greater than the notification level (NL) of 10 ng/l for NDMA

Table 7
NDMA Data for Selected Wells in the Whittier Narrows and South El Monte Operable Units
(Updated through October 2010)

Well ID	Screen Interval	May-2007	Jun-2007	Jul-2007	Aug-2007	Nov-2007	Feb-2008	Apr-2008	Oct-2008	Apr-2009	Oct/Nov-2009	May-2010	Oct-2010
Pomona Fwy West-Central													
4-9-8	230-240	ND			ND	ND		0.002	ND	ND		0.009	0.008
Legg Lake													
4-13-3	225-235	ND			ND	ND		0.0062	ND	0.004		**0.038**	**0.015**
4-13-4	130-140	ND			0.0068	ND		0.0037	0.0038	0.0042		**0.032**	**0.028**
Gun Range													
4-15-3	230-240	0.0041			0.0028	ND		0.0033	ND	0.0064		0.0067	0.0051
4-15-5	44-55	ND			ND	ND		0.0027	0.0025	0.0026		0.0052	0.0058
Pachmayr Gun Range													
472	82-92	ND		ND	ND	ND		ND	ND	ND			ND
S. of Siphon Road on Zone 1 Ditch													
4-21-A	266-296	ND	ND	ND	ND								
4-21-B	70-90	ND	ND	ND	ND								
Rosemead & San Gabriel													
MW2-5	68-88	ND	ND		ND								
South El Monte OU													
SEM 3-3	180-190						ND			ND		ND	
SEM 3-4	62-72										ND		
SEM 5-3	209-218						ND			ND		ND	
SEM 5-5	65-74										0.0021		
SEM 6-2	270-280	ND			ND	ND		ND	ND	ND	0.002	**0.014**	**0.016**
SEM 6-4	58-67	ND			ND	ND		ND	0.0032	ND	0.0028, 0.0029	0.0071	**0.012**
SG Blvd. Near west. Hills													
4-24	24-45		0.0029	**0.14**	**0.15**								
Rio Hondo Bypass													
4-23	70-90												
4-26	27-52												

TABLE 8
Summary of NDMA
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Wells	Well (ft bgs)	Screened (ft bgs)	Date	NDMA
			CA DPH NL - 0.01 µg/L	
EW4-3	120	50-110	15-Mar-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			01-Mar-07	ND
			01-Jun-07	ND
			01-Sep-07	ND
			01-Dec-07	ND
			01-Mar-08	ND
			01-Jun-08	ND
			01-Sep-08	ND
			01-Dec-08	0.0084
			01-Mar-09	0.0057
			01-Jun-09	ND
			01-Dec-09	**0.018**
			01-Mar-10	**0.03**
			01-Jun-10	0.0022
			01-Sep-10	0.0058
			01-Dec-10	0.0029
EW4-4	130	60-120	15-Mar-06	ND
			01-Jun-06	0.0029
			19-Sep-06	ND
			12-Dec-06	ND
			01-Mar-07	ND
			01-Jun-07	ND
			01-Sep-07	ND
			01-Dec-07	ND
			01-Mar-08	ND
			01-Jun-08	ND
			01-Sep-08	ND
			01-Dec-08	ND
			01-Mar-09	ND
			01-Jun-09	ND
			01-Dec-09	ND
			01-Mar-10	ND
			01-Jun-10	ND
			01-Sep-10	0.0086
			01-Dec-10	ND
EW4-8	110	54-104	19-Jan-06	ND
			01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			01-Mar-07	ND
			01-Jun-07	ND
			01-Sep-07	ND
			01-Dec-07	**0.012**
			01-Mar-08	ND
			01-Jun-08	0.0058
			01-Sep-08	ND
			01-Dec-08	**0.078**
			01-Mar-09	**0.01**
			01-Jun-09	**0.01**
			01-Sep-09	**0.028**

TABLE 8
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Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Wells	Well (ft bgs)	Screened (ft bgs)	Date	NDMA
			CA DPH NL - 0.01 µg/L	
EW4-8	110	54-104	01-Dec-09	**0.1**
			01-Mar-10	**0.045**
			01-Jun-10	**0.075**
			01-Sep-10	0.002
			01-Dec-10	**0.016**
EW4-9	125	50-120	01-Jun-06	ND
			19-Sep-06	ND
			12-Dec-06	ND
			01-Mar-07	ND
			01-Jun-07	ND
			01-Sep-07	ND
			01-Dec-07	ND
			01-Mar-08	ND
			01-Jun-08	ND
			01-Sep-08	ND
			01-Mar-09	ND
			01-Jun-09	ND
			01-Sep-09	ND
			01-Dec-09	ND
			01-Mar-10	ND
			01-Jun-10	ND
			01-Sep-10	0.009
			01-Dec-10	ND
Intermediate Wells				
EW4-5	400	160-390	05-Jan-06	ND
			17-Jan-06	ND
			02-Feb-06	ND
			14-Feb-06	ND
			28-Feb-06	ND
			14-Mar-06	ND
			29-Mar-06	ND
			12-Apr-06	ND
			16-Aug-06	ND
			16-Aug-06	ND
			28-Aug-06	ND
			13-Sep-06	ND
			25-Sep-06	ND
			04-Oct-06	ND
			16-Oct-06	ND
			31-Oct-06	ND
			14-Nov-06	ND
			28-Nov-06	ND
			13-Dec-06	ND
			26-Dec-06	ND
			09-Jan-07	ND
			29-Jan-07	ND
			06-Feb-07	ND
			21-Feb-07	ND
			06-Mar-07	ND
			19-Mar-07	ND
			02-Apr-07	ND
			11-Apr-07	ND
			03-May-07	ND

TABLE 8
Summary of NDMA
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Wells	Well (ft bgs)	Screened (ft bgs)	Date	NDMA
			CA DPH NL - 0.01 µg/L	
EW4-5	400	160-390	04-Jun-07	ND
			03-Jul-07	ND
			07-Aug-07	ND
			04-Sep-07	ND
			26-Sep-07	ND
			01-Oct-07	ND
			05-Nov-07	ND
			04-Dec-07	ND
			02-Jan-08	ND
			05-Feb-08	ND
			03-Mar-08	ND
			01-Apr-08	ND
			05-May-08	ND
			07-Jul-08	ND
			05-Aug-08	ND
			03-Sep-08	ND
			07-Oct-08	ND
			04-Nov-08	ND
			12-Nov-08	ND
			03-Dec-08	ND
			06-Jan-09	ND
			03-Feb-09	ND
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	ND
			07-Jul-09	ND
			04-Aug-09	ND
			01-Sep-09	ND
			07-Oct-09	ND
			04-Nov-09	ND
			01-Dec-09	ND
			05-Jan-10	ND
			02-Feb-10	ND
			02-Mar-10	ND
			07-Apr-10	ND
			01-Jun-10	ND
			08-Jul-10	ND
			03-Aug-10	ND
			07-Sep-10	ND
			07-Oct-10	ND
			02-Nov-10	ND
			07-Dec-10	ND
EW4-6	400	160-390	25-May-06	ND
			06-Jun-06	ND
			21-Jun-06	ND
			05-Jul-06	0.0024
			18-Jul-06	ND
			16-Aug-06	ND
			28-Aug-06	ND
			13-Sep-06	ND
			25-Sep-06	ND
			04-Oct-06	ND

TABLE 8
Summary of NDMA
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Wells	Well (ft bgs)	Screened (ft bgs)	Date	NDMA
			CA DPH NL - 0.01 µg/L	
EW4-6	400	160-390	16-Oct-06	0.002
			31-Oct-06	ND
			14-Nov-06	ND
			28-Nov-06	ND
			13-Dec-06	ND
			26-Dec-06	ND
			09-Jan-07	ND
			29-Jan-07	ND
			06-Feb-07	ND
			21-Feb-07	ND
			06-Mar-07	ND
			19-Mar-07	ND
			02-Apr-07	ND
			11-Apr-07	ND
			03-May-07	ND
			04-Jun-07	ND
			03-Jul-07	ND
			07-Aug-07	0.0023
			04-Sep-07	ND
			26-Sep-07	ND
			01-Oct-07	ND
			05-Nov-07	ND
			04-Dec-07	ND
			02-Jan-08	ND
			05-Feb-08	ND
			03-Mar-08	ND
			01-Apr-08	ND
			05-May-08	ND
			03-Jun-08	ND
			02-Jul-08	ND
			05-Aug-08	ND
			03-Sep-08	ND
			07-Oct-08	ND
			04-Nov-08	ND
			03-Dec-08	ND
			06-Jan-09	ND
			03-Feb-09	ND
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	ND
			07-Jul-09	0.0038
			04-Aug-09	ND
			01-Sep-09	ND
			07-Oct-09	ND
			04-Nov-09	ND
			01-Dec-09	ND
			05-Jan-10	ND
			02-Mar-10	ND
			07-Apr-10	ND
			04-May-10	ND
			01-Jun-10	ND
			08-Jul-10	ND

TABLE 8
Summary of NDMA
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Wells	Well (ft bgs)	Screened (ft bgs)	Date	NDMA
			CA DPH NL - 0.01 µg/L	
EW4-6	400	160-390	03-Aug-10	ND
			07-Sep-10	ND
			07-Oct-10	ND
			02-Nov-10	ND
			07-Dec-10	ND
EW4-7	360	160-350	05-Jan-06	0.0043
			17-Jan-06	ND
			02-Feb-06	0.004
			14-Feb-06	0.0036
			28-Feb-06	0.0037
			14-Mar-06	0.0038
			29-Mar-06	0.0037
			12-Apr-06	0.0032
			19-Apr-06	0.004
			25-Apr-06	0.0037
			09-May-06	0.003
			22-May-06	0.0043
			06-Jun-06	ND
			21-Jun-06	0.0022
			05-Jul-06	0.0032
			18-Jul-06	0.0023
			02-Aug-06	0.0022
			16-Aug-06	0.002
			13-Sep-06	ND
			04-Oct-06	ND
			14-Nov-06	ND
			13-Dec-06	ND
			09-Jan-07	ND
			06-Feb-07	ND
			21-Feb-07	ND
			02-Apr-07	ND
			11-Apr-07	ND
			03-May-07	ND
			04-Jun-07	ND
			03-Jul-07	ND
			07-Aug-07	ND
			04-Sep-07	ND
			26-Sep-07	ND
			01-Oct-07	ND
			05-Nov-07	ND
			04-Dec-07	ND
			02-Jan-08	ND
			05-Feb-08	ND
			03-Mar-08	ND
			01-Apr-08	ND
			05-May-08	ND
			03-Jun-08	ND
			01-Oct-08	ND
			07-Oct-08	ND
			04-Nov-08	ND
			12-Nov-08	ND
			03-Dec-08	ND
			06-Jan-09	ND

TABLE 8
Summary of NDMA
Shallow and Intermediate Extraction Wells
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Wells	Well (ft bgs)	Screened (ft bgs)	Date	NDMA
			CA DPH NL - 0.01 µg/L	
EW4-7	360	160-350	03-Feb-09	ND
			03-Mar-09	ND
			08-Apr-09	ND
			05-May-09	ND
			02-Jun-09	ND
			07-Jul-09	ND
			04-Aug-09	ND
			01-Sep-09	ND
			07-Oct-09	ND
			04-Nov-09	ND
			01-Dec-09	ND
			05-Jan-10	ND
			02-Feb-10	ND
			02-Mar-10	ND
			07-Apr-10	ND
			04-May-10	ND
			01-Jun-10	ND
			08-Jul-10	ND
			03-Aug-10	ND
			07-Sep-10	ND
			07-Oct-10	ND
			02-Nov-10	ND
			07-Dec-10	ND

Notes-
All data reported in µg/L.
Bolded - Concentration exceeds the California DPH Notification Level for NDMA (0.01 υg/L)

Table 9

Central Basin WQPP Extraction Wells - PCE Data

Whittier Narrows Operable Unit, Los Angeles County, California

	Extraction Wells	
	PCE MCL - 5 ug/L	
	CB-1	CB-2
Screens:	175-335	150-330
Date	ug/L	
January-06	1.2	1.2
February-06	2.6	1.8
March-06	2.2	1.5
April-06	2.7	1.6
May-06	1.8	1.2
June-06	2.0	1.1
July-06	1.2	0.9
August-06	1.2	0.62
September-06	0.80	0.53
October-06	0.88	ND
November-06	0.90	0.72
December-06	0.70	0.83
January-07	0.76	0.87
February-07	0.82	0.93
March-07	0.74	1.5
April-07	0.63	0.71
May-07	--	--
June-07	1.1	1.3
July-07	0.76	1.0
August-07	0.63	0.79
September-07	0.67	0.80
October-07	0.72	1.0
November-07	0.68	0.78
December-07	0.51	0.82
January-08	1.1	1.5
February-08	0.88	1.1
March-08	0.84	0.96
April-08	0.56	0.50
May-08	1.0	1.1
June-08	0.84	0.87
July-08	0.65	0.86
August-08	0.83	0.97
September-08	1.1	0.99
October-08	0.74	0.66
November-08	0.93	0.76
December-08	1.0	0.72
January-09	0.69	0.70
February-09	ND	0.64
March-09	ND	ND
April-09	ND	ND
May-09	0.79	ND
June-09	0.80	0.55
July-09	1.5	ND
August-09	ND	0.62
September-09	ND	0.05
October-09	0.55	0.66
November-09	ND	ND
December-09	ND	0.52

Table 9

Central Basin WQPP Extraction Wells - PCE Data

Whittier Narrows Operable Unit, Los Angeles County, California

	Extraction Wells	
	PCE MCL - 5 ug/L	
	CB-1	CB-2
Screens:	175-335	150-330
Date	ug/L	
January-10	ND	ND
February-10	0.58	ND
March-10	0.74	0.62
April-10	0.83	ND
May-10	ND	ND
June-10	ND	ND
July-10	ND	ND
August-10	ND	ND
September-10	ND	0.52
October-10	1.2	0.51
November-10	0.59	ND
December-10	ND	0.50

Table 10

Central Basin WQPP Extraction Wells - NDMA Data

Whittier Narrows Operable Unit, Los Angeles County, California

	Extraction Wells	
	NDMA NL - 0.010 ug/L	
	CB-1	CB-2
Screens:	175-335	150-330
Date	NDMA - ug/L	
March-06	0.0078	0.0041
May-06	0.0061	0.0034
August-06	0.0030	ND
November-06	0.0035	0.0022
March-07	0.0033	0.0020
June-07	0.0100	0.0032
August-07	0.0038	0.0025
November-07	0.0027	ND
April-08	0.0027	0.0019
May-08	0.0073	0.0038
September-08	0.0061	0.0040
December-08	0.0064	0.0053
March-09	0.0045	0.0026
June-09	0.0063	0.0036
September-09	0.0037	0.0022
December-09	0.0026	0.0019
March-10	0.0031	0.0027
June-10	0.0023	0.0020
September-10	ND	ND
December-10	ND	ND

Table 11

Downgradient PCE Water Quality Data

Whittier Narrows Operable Unit, Los Angeles County, California

Well	Screen Interval	Aug-04	Sep-06	Jan-08	Jan-09	Jan-10	Jan-11
Shallow Zone							
Wells located between the extraction wells and Whittier Narrows Dam							
MW4-21B	70-90	1.3	ND	0.12	ND	ND	ND
MW4-23	70-90	ND, ND	ND	1.1	ND	ND	ND
MW4-25	25-50	ND	ND	---	ND	ND	ND
MW4-26	27-52	ND	---	---	ND	ND	ND
Wells located along Whittier Narrows Dam							
4-18-4	95-105	1.9	0.8	0.15	ND	ND	ND
4-19-5	40-50	ND	ND	ND	ND	ND	NS
4-20-2	70-80	ND	ND	ND	ND	ND	ND
WN01-9	95-105	ND*	NS	NS	ND	NS	1
Intermediate Zone							
Well located between the extraction wells and Whittier Narrows Dam							
MW4-21A	266-296	**8.3**	4.9	4.9	2.6	**5.5, 5.4**	3.6
Wells located along Whittier Narrows Dam or just south into the Central Basin							
MW441	285-295	ND, ND	ND	ND	---	---	ND
MW442	225-235	ND	ND	ND	---	---	ND
MW451	270-280	0.66	ND	ND	ND	ND	ND
MW452	200-210	1.5	ND	ND	ND	ND	ND
MW461	251-261	**5.6**	ND	ND	0.41	ND	ND
MW462	140-150	ND	ND	ND	ND	ND	ND
4-12-2	315-325	1.2	ND	0.33	ND	ND	ND
4-12-3	225-235	**9.2**	5.6, 5.9	5.9	1.6	2.3	0.99, 1.3
4-18-1	280-290	3.2	2.7	3.1	1.7, 1.7	4.2	3.1
4-18-2	230-240	3.6, 4.5	2.1	1.5	0.43	0.64	0.4
4-18-3	135-145	2.3	1.4	0.47	ND	ND	ND
4-19-1	295-305	3.7	ND	ND	ND	ND	ND, ND
4-19-2	230-240	3.3, 2.7	0.53	0.51	0.21	0.57	0.18
4-19-3	160-170	0.12	ND	ND	ND	ND	ND
4-20-1	350-360	0.82	3.2	2.3, 2.5	0.68	0.55	0.13
WN01-3	462-482	0.7*	NS	0.94	0.39, 0.41	NS	ND
WN01-4	392-402	0.9*	NS	0.6	0.31	NS	ND
WN01-5	334-344	ND*	NS	0.25	ND	NS	ND
WN01-6	273-283	ND*	NS	NS	ND	NS	ND
WN01-7	233-243	ND*	NS	NS	ND	NS	ND
WN01-8	163-173	ND*	NS	NS	ND	NS	1
Well located east of EPA extraction wells, upgradient of Whittier wells (near edge of EPA capture zone)							
4-22-1	430-440	2.9	**6.1**	**7.7, 9**	4.3	**9.9**	**10, 10**
4-22-2	385-395	**26**	**18, 12**	**25**	**13**	**19**	**16**
4-22-3	315-325	**11**	**11**	**6.5**	**7.1**	**8.9, 12**	**5.2**
4-22-4	215-225	0.18	3	4.3	0.5	0.57	0.67

Notes:

ND = analyte not detected above detection limit

* Sample is from August '05

duplicate samples separated by comma

bolded numbers denote concentrations greater than the maximum contaminant level (MCL) of 5 μg/l for PCE

Table 12
Whittier Narrows OU Extraction Wells
Annual Average Pumping Rates - 2006 to 2010
Whittier Narrows Operable Unit, Los Angeles County, California

Shallow Extraction Wells						
Year	**EW4-3**	**EW4-4**	**EW4-8**	**EW4-9**	**Annual Average**	**Target[(1)]**
	(gpm)					
2006	728	392	239	237	1,596	2,000
2007	168	178	133	135	614	2,000
2008	1,339	0.8	4.4	0.4	1,345	2,000
2009	488	51	410	4.4	953	2,000
2010	612	389	317	-	1,318	2,000
Intermediate Extraction Wells						
Year	**EW4-5**	**EW4-6**	**EW4-7**		**Annual Average**	**Target**
	(gpm)					
2006	1,076	663	1,923		3,663	6,000
2007	1,356	1,175	1,343		3,874	6,000
2008	380	784	798		1,962	6,000
2009	1,076	952	1,135		3,163	6,000
2010	770	1,127	1,729		3,625	6,000

Notes:
(1) Provisional target based on system limitations and limited VOC contamination

Table 13

January/February 2011 Sampling Event - Groundwater Elevation Data

Whittier Narrows Operable Unit, Los Angeles County, California

WELL_ID	Well Number	Station ID	Screen Interval	Date	Ref. Point Elev. (ft msl)	Depth to Water (ft)	Water Elevation (ft msl)
EPAMW012	MW1-2	EPAMW012	500-510	07-Feb-11	211.4	20.80	190.6
EPAMW013	MW1-3	EPAMW013	380-390	01-Feb-11	211.3	21.70	189.6
EPAMW014	MW1-4	EPAMW014	230-240	01-Feb-11	211.2	21.50	189.7
EPAMW022	MW2-2	EPAMW022	430-450	21-Jan-11	206.4	20.35	186.1
EPAMW023	MW2-3	EPAMW023	316-336	21-Jan-11	206.7	21.92	184.8
EPAMW024	MW2-4	EPAMW024	202-222	24-Jan-11	206.1	25.00	181.1
EPAMW025	MW2-5	EPAMW025	68-88	24-Jan-11	206	19.40	186.6
EPAMW423	MW4-23	EPAMW423	70-90	07-Feb-11	198.74	8.50	190.2
EPAMW424	MW4-24	EPAMW424	25-45	17-Jan-11	209.95	19.10	190.9
EPAMW425	MW4-25	EPAMW425	25-50	17-Jan-11	213.92	19.95	194.0
EPAMW426	MW4-26	EPAMW426	27-52	17-Jan-11	207.73	20.15	187.6
EPAMW441	MW4-41	EPAMW441	285-295	20-Jan-11	193.41	35.09	158.3
EPAMW442	MW4-42	EPAMW442	225-235	20-Jan-11	193.4	35.07	158.3
EPAMW451	MW4-51	EPAMW451	270-280	21-Jan-11	193.96	36.18	157.8
EPAMW452	MW4-52	EPAMW452	200-210	20-Jan-11	194.09	35.80	158.3
EPAMW461	MW4-61	EPAMW461	251-261	21-Jan-11	195.45	36.80	158.7
EPAMW462	MW4-62	EPAMW462	140-150	21-Jan-11	195.21	36.35	158.9
EPAMW471	MW4-71	EPAMW471	210-220	21-Jan-11	210.6	19.95	190.7
EPAMW472	MW4-72	EPAMW472	82-92	21-Jan-11	211.4	19.90	191.5
EPAW410	MW4-10	EPAW410_02	675-685	31-Jan-11	235.3	39.75	195.6
		EPAW410_03	595-605	31-Jan-11	235.3	39.43	195.9
		EPAW410_04	470-480	31-Jan-11	235.3	38.88	196.4
		EPAW410_05	320-330	31-Jan-11	235.3	38.98	196.3
		EPAW410_06	220-230	31-Jan-11	235.3	38.24	197.1
		EPAW410_07	130-140	31-Jan-11	235.3	34.93	200.4
		EPAW410_08	65-75	31-Jan-11	235.3	34.39	200.9
		EPAW410_09	35-45	31-Jan-11	235.3	33.91	201.4
EPAW412	MW4-12	EPAW412_01	490-500	27-Jan-11	195	31.52	163.5
		EPAW412_02	315-325	27-Jan-11	195	28.56	166.4
		EPAW412_03	225-235	27-Jan-11	195	26.47	168.5
		EPAW412_04	120-130	27-Jan-11	195	26.11	168.9
		EPAW412_05	45-55	27-Jan-11	195	25.52	169.5
EPAW413	MW4-13	EPAW413_01	415-425	24-Jan-11	222.3	29.90	192.4
		EPAW413_02	340-350	24-Jan-11	222.3	29.55	192.8
		EPAW413_03	225-235	24-Jan-11	222.3	29.36	192.9
		EPAW413_04	130-140	24-Jan-11	222.3	27.99	194.3
		EPAW413_05	50-60	24-Jan-11	222.3	27.62	194.7
EPAW415	MW4-15	EPAW415_01	335-345	03-Feb-11	215.1	24.75	190.3
		EPAW415_02	290-300	03-Feb-11	215.1	23.58	191.5
		EPAW415_03	230-240	03-Feb-11	215.1	23.16	191.9
		EPAW415_04	145-155	03-Feb-11	215.1	22.50	192.6
		EPAW415_05	45-55	03-Feb-11	215.1	21.53	193.6
EPAW418	MW4-18	EPAW418_01	280-290	27-Jan-11	197.7	22.28	175.4
		EPAW418_02	230-240	27-Jan-11	197.7	21.67	176.0
		EPAW418_03	160-170	27-Jan-11	197.7	21.43	176.3
		EPAW418_04	95-105	27-Jan-11	197.7	18.55	179.2
EPAW419	MW4-19	EPAW419_01	295-305	26-Jan-11	192.4	21.12	171.3
		EPAW419_02	230-240	26-Jan-11	192.4	20.84	171.6
		EPAW419_03	160-170	26-Jan-11	192.4	20.67	171.7
		EPAW419_04	100-110	26-Jan-11	192.4	14.74	177.7
EPAW420	MW4-20	EPAW420_01	350-360	01-Feb-11	194.67	21.80	162.4
		EPAW420_02	70-80	01-Feb-11	194.67	11.65	172.6

Table 13

January/February 2011 Sampling Event - Groundwater Elevation Data

Whittier Narrows Operable Unit, Los Angeles County, California

WELL_ID	Well Number	Station ID	Screen Interval	Date	Ref. Point Elev. (ft msl)	Depth to Water (ft)	Water Elevation (ft msl)
EPAW421A	MW4-21A	EPAW421A	266-286	17-Jan-11	206.98	22.43	184.6
EPAW421B	MW4-21B	EPAW421B	70-90	17-Jan-11	207.43	18.70	188.7
EPAW422	MW4-22	EPAW422_01	430-440	28-Jan-11	218.12	25.08	188.9
		EPAW422_02	385-395	28-Jan-11	218.12	23.98	190.0
		EPAW422_03	315-325	28-Jan-11	218.12	23.90	190.0
		EPAW422_04	215-225	28-Jan-11	218.12	23.00	190.9
		EPAW422_05	130-140	28-Jan-11	218.12	21.44	192.5
		EPAW422_06	45-55	28-Jan-11	218.12	21.31	192.6
EPAW48	MW4-8	EPAW48_02	760-770	18-Jan-11	220.9	27.19	193.7
		EPAW48_03	660-670	18-Jan-11	220.9	27.19	193.7
		EPAW48_04	550-560	18-Jan-11	220.9	27.02	193.9
		EPAW48_05	460-470	18-Jan-11	220.9	26.73	194.2
		EPAW48_06	375-385	18-Jan-11	220.9	27.06	193.8
		EPAW48_07	285-295	18-Jan-11	220.9	27.30	193.6
		EPAW48_08	230-240	18-Jan-11	220.9	28.12	192.8
		EPAW48_09	95-105	18-Jan-11	220.9	26.64	194.3
		EPAW48_10	45-55	18-Jan-11	220.9	26.63	194.3
EPAW49	MW4-9	EPAW49_03	750-760	25-Jan-11	227.7	34.40	193.3
		EPAW49_04	650-660	25-Jan-11	227.7	34.38	193.3
		EPAW49_05	515-525	25-Jan-11	227.7	33.36	194.3
		EPAW49_06	350-360	25-Jan-11	227.7	33.32	194.4
		EPAW49_07	295-305	25-Jan-11	227.7	33.55	194.2
		EPAW49_08	230-240	25-Jan-11	227.7	33.57	194.1
		EPAW49_09	100-110	25-Jan-11	227.7	31.49	196.2
		EPAW49_10	40-50	25-Jan-11	227.7	31.46	196.2
WRDWN01	WN-01	WRDWN01_02	609-629	04-Feb-11	199	243.43	-44.4*
		WRDWN01_03	463-483	04-Feb-11	199	206.96	-8*
		WRDWN01_04	392-402	04-Feb-11	199	179.46	19.5*
		WRDWN01_05	334-344	04-Feb-11	199	94.80	104.2*
		WRDWN01_06	273-283	04-Feb-11	199	45.53	153.5*
		WRDWN01_07	233-243	04-Feb-11	199	53.48	145.5*
		WRDWN01_08	163-173	04-Feb-11	199	61.52	137.5*
		WRDWN01_09	95-105	04-Feb-11	199	35.35	163.6*
WRDWN02	WN-02	WRDWN02_01	659-679	26-Jan-11	209	-57.98	267.0*
		WRDWN02_02	479-599	26-Jan-11	209	0.03	209.0*
		WRDWN02_03	468-488	26-Jan-11	209	33.86	175.1
		WRDWN02_04	418-428	02-Feb-11	209	52.22	156.8*
		WRDWN02_05	328-338	02-Feb-11	209	18.81	190.2
		WRDWN02_06	263-273	02-Feb-11	209	11.69	197.3
		WRDWN02_07	213-223	02-Feb-11	209	1.83	207.2*
		WRDWN02_08	135-145	02-Feb-11	209	-5.28	214.3*
		WRDWN02_09	90-100	02-Feb-11	209	17.73	191.3
SEMW03	MW-3	SEMW03_01	371-380	02-Feb-11	223.1	33.10	190.0
		SEMW03_02	265-275	02-Feb-11	223.1	33.38	189.7
		SEMW03_03	180-190	02-Feb-11	223.1	31.54	191.6
		SEMW03_04	62-72	02-Feb-11	223.1	31.39	191.7

Notes:

*The water level data from these zones are not consistent with historical results and appear anomalous. However, the field readings have

Green highlights denotes wells used in contouring water levels in the shallow zone

Blue highlights denotes wells used in contouring water levels in the intermediate zone

ft msl - feet above medan sea level

Table 14

Groundwater Elevation Data - 2006-2011

Whittier Narrows Operable Unit, Los Angeles County, California

WELL_ID	Station ID	Screen Interval	Sep-06 (ft msl)	Apr-07 (ft msl)	Aug-07 (ft msl)	Jan-08 (ft msl)	Jan-09 (ft msl)	Apr-09 (ft msl)	Oct/Nov-2009 (ft msl)	Jan-10 (ft msl)	Apr-10 (ft msl)	Oct-10 (ft msl)	Jan/Feb-2011 (ft msl)
EPAMW012	EPAMW012	500-510											190.60
EPAMW013	EPAMW013	380-390								198.26			189.60
EPAMW014	EPAMW014	230-240					186.71			186.11			189.70
EPAMW022	EPAMW022	430-450					183.84						186.05
EPAMW023	EPAMW023	316-336					183.97						184.78
EPAMW024	EPAMW024	202-222	180.79			184.39	184.72			189.20			181.10
EPAMW025	EPAMW025	68-88	189.00			190.48	184.08			190.95			186.60
EPAMW423	EPAMW423	70-90	184.28			187.76	182.90						190.24
EPAMW424	EPAMW424	25-45	190.35			191.42							190.85
EPAMW425	EPAMW425	25-50	189.86				188.62						193.97
EPAMW426	EPAMW426	27-52	186.33			187.58	184.52			182.08			187.58
EPAMW441	EPAMW441	285-295	153.37			147.91							158.32
EPAMW442	EPAMW442	225-235	153.15			147.97							158.33
EPAMW451	EPAMW451	270-280	150.29			149.23	149.71						157.78
EPAMW452	EPAMW452	200-210	149.90			149.23	149.81						158.29
EPAMW461	EPAMW461	251-261	152.25			150.76	151.63						158.65
EPAMW462	EPAMW462	140-150	152.27			150.90	151.87						158.86
EPAMW471	EPAMW471	210-220				188.90	186.80			186.55			190.65
EPAMW472	EPAMW472	82-92	191.98		188.50								191.50
EPAW410	EPAW410_02	675-685											195.55
	EPAW410_03	595-605								186.37			195.87
	EPAW410_04	470-480								188.00			196.42
	EPAW410_05	320-330								188.52			196.32
	EPAW410_06	220-230								188.77			197.06
	EPAW410_07	130-140											200.37
	EPAW410_08	65-75											200.91
	EPAW410_09	35-45											201.39
EPAW412	EPAW412_01	490-500	165.68										163.48
	EPAW412_02	315-325	164.37			151.40	152.09			156.15			166.44
	EPAW412_03	225-235	166.82			156.10	156.63			160.62			168.53
	EPAW412_04	120-130	167.60							161.51			168.89
	EPAW412_05	45-55	168.65										169.48
EPAW413	EPAW413_01	415-425	194.55			193.00	187.58						192.40
	EPAW413_02	340-350	194.85			192.73	187.93						192.75
	EPAW413_03	225-235	195.67					187.98	181.04		188.24		192.94
	EPAW413_04	130-140	198.51		195.03			191.84	183.75		190.87		194.31
	EPAW413_05	50-60	199.04				191.66			190.27			194.68
EPAW415	EPAW415_01	335-345	192.91			189.50	183.91			184.56			190.35
	EPAW415_02	290-300	193.69			191.36	186.17			186.65			191.52
	EPAW415_03	230-240	193.71		188.59			187.69	180.33		186.72		191.94
	EPAW415_04	145-155	195.09			193.61	188.91			188.35			192.60
	EPAW415_05	45-55	196.52		192.21			190.25	182.33		189.05		193.57
EPAW418	EPAW418_01	280-290	174.70			167.83	167.25			170.97			175.42

Table 14

Groundwater Elevation Data - 2006-2011

Whittier Narrows Operable Unit, Los Angeles County, California

WELL_ID	Station ID	Screen Interval	Sep-06 (ft msl)	Apr-07 (ft msl)	Aug-07 (ft msl)	Jan-08 (ft msl)	Jan-09 (ft msl)	Apr-09 (ft msl)	Oct/Nov-2009 (ft msl)	Jan-10 (ft msl)	Apr-10 (ft msl)	Oct-10 (ft msl)	Jan/Feb-2011 (ft msl)
	EPAW418_02	230-240	175.43			168.97	168.30			171.74			176.03
	EPAW418_03	160-170	175.90			169.24	168.64			172.17			176.27
	EPAW418_04	95-105	178.97			172.88	172.44			175.39			179.15
EPAW419	EPAW419_01	295-305	169.32			163.35	161.83			165.22			171.28
	EPAW419_02	230-240	169.66			163.16	162.10			165.72			171.56
	EPAW419_03	160-170	169.51			163.22	162.13			165.62			171.73
	EPAW419_04	100-110	176.02			172.21	170.27			177.33			177.66
EPAW420	EPAW420_01	350-360	161.16			150.64	150.02			154.28			162.40
	EPAW420_02	70-80	168.91			165.08	162.82			172.69			172.55
EPAW421A	EPAW421A	266-286	188.33			185.21							184.55
EPAW421B	EPAW421B	70-90	189.13			189.17							188.73
EPAW422	EPAW422_01	430-440	189.60			190.73	184.18			187.50			188.87
	EPAW422_02	385-395	189.92			191.07	184.78			188.58			189.97
	EPAW422_03	315-325	190.05			191.25	183.89			188.73			190.05
	EPAW422_04	215-225	190.99			192.03	185.85			189.47			190.95
	EPAW422_05	130-140	192.58				188.15			191.20			192.51
	EPAW422_06	45-55	193.01				188.19						192.64
EPAW48	EPAW48_02	760-770											193.71
	EPAW48_03	660-670											193.71
	EPAW48_04	550-560					187.70						193.88
	EPAW48_05	460-470				193.27	189.14			185.43			194.17
	EPAW48_06	375-385	196.96			193.41	189.16			185.45			193.84
	EPAW48_07	285-295	197.06			193.44	188.99			185.34			193.60
	EPAW48_08	230-240	197.41			193.65	188.42			185.44			192.78
	EPAW48_09	95-105	201.11			196.54	192.39			187.75			194.26
	EPAW48_10	45-55	201.12				192.38			187.56			194.27
EPAW49	EPAW49_03	750-760											193.30
	EPAW49_04	650-660											193.32
	EPAW49_05	515-525					188.39						194.34
	EPAW49_06	350-360					189.03			187.55			194.38
	EPAW49_07	295-305					188.62			188.13			194.15
	EPAW49_08	230-240			191.98			188.80	181.60		188.57		194.13
	EPAW49_09	100-110					194.30			191.37			196.21
	EPAW49_10	40-50					194.39			191.62			196.24
WRDWN01	WRDWN01_02	609-629											-44.43*
	WRDWN01_03	463-483				176.81	164.77						-8*
	WRDWN01_04	392-402				179.08	171.84						19.5*
	WRDWN01_05	334-344				179.19	172.07						104.2*
	WRDWN01_06	273-283					172.34						153.5*
	WRDWN01_07	233-243											145.5*
	WRDWN01_08	163-173											137.5*
	WRDWN01_09	95-105											163.6*
WRDWN02	WRDWN02_01	659-679											267.0*

Table 14

Groundwater Elevation Data - 2006-2011

Whittier Narrows Operable Unit, Los Angeles County, California

WELL_ID	Station ID	Screen Interval	Sep-06 (ft msl)	Apr-07 (ft msl)	Aug-07 (ft msl)	Jan-08 (ft msl)	Jan-09 (ft msl)	Apr-09 (ft msl)	Oct/Nov-2009 (ft msl)	Jan-10 (ft msl)	Apr-10 (ft msl)	Oct-10 (ft msl)	Jan/Feb-2011 (ft msl)
	WRDWN02_02	479-599											209.0*
	WRDWN02_03	468-488											175.10
	WRDWN02_04	418-428											156.8*
	WRDWN02_05	328-338											190.20
	WRDWN02_06	263-273											197.30
	WRDWN02_07	213-223											207.2*
	WRDWN02_08	135-145											214.3*
	WRDWN02_09	90-100											191.30
SEMW03	SEMW03_01	371-380		196.90	187.19	190.56		182.92	176.25		183.84	181.51	190.00
	SEMW03_02	265-275		197.03	187.09	190.68		182.80	176.18		183.84	180.86	189.72
	SEMW03_03	180-190	197.58	199.49		194.19		187.36	181.18		187.25	184.15	191.56
	SEMW03_04	62-72	200.22	201.75	195.84	196.81		190.33	184.31		189.04	185.83	191.71

Notes:

*The water level data from these zones are not consistent with historical results and appear anomalous. However, the field readings have been verified and the calculations confirmed.

ft msl - feet above medan sea level