EPA Superfund
Third Five-Year Review Report

PACIFIC COAST PIPELINE
EPA ID: CAD980636781
FILLMORE, CA

Approved by:

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Date:

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LIST OF ACRONYMS AND ABBREVIATIONS

1,2-DCA	1,2-dichloroethane
ARAR	Applicable or Relevant and Appropriate Requirement
BTEX	benzene, toluene, ethylbenzene and xylenes
bgs	below ground surface
CDPH	California Department of Public Health
CFR	Code of Federal Regulations
COC	contaminant of concern
DHS	California Department of Health Services
DTSC	California Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
GWTS	groundwater extraction and treatment system
IC	institutional control
LNAPL	light non-aqueous phase liquid
MCL	maximum contaminant level
MNA	monitored natural attenuation
MWP	main waste pit
µg/L	microgram per liter (part per billion)
mg/m^3	milligrams per cubic meter
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
O&M	Operations & Maintenance
ORC®	Oxygen Release Compound
PAH	polycyclic aromatic hydrocarbons
PCPL	Pacific Coast Pipeline
PP	Proposed Plan
RAO	remedial action objective
RI/FS	Remedial Investigation / Feasibility Study
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SVE	soil vapor extraction
UAO	unilateral administrative order
VOC	volatile organic compound

EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) has completed this third five-year review of the remedy for the Pacific Coast Pipeline (PCPL) site in Fillmore, Ventura County, California. The Site is a former petroleum refinery that operated from circa 1915 until 1950, and then a crude oil pumping station until 2002. The groundwater beneath the Site is contaminated with benzene and toluene.

Groundwater contamination was first discovered at the Site in 1983. In 1986, 38,000 tons of waste material and contaminated soils were removed from the main waste pit and other small disposal areas. Contaminants found during the initial groundwater investigation included benzene, toluene, ethylbenzene, and 1,2-dichloroethane. EPA added the Site to the National Priorities List (NPL) in 1989.

On March 31, 1992, EPA signed the Record of Decision (ROD) for the PCPL Site. The remedy included:

- Construction and operation of a groundwater extraction and treatment system;
- Discharge of treated groundwater to the aquifer or reuse in a beneficial manner;
- Soil vapor extraction (SVE) for those soil areas that threaten to contaminate groundwater;
- Groundwater monitoring to demonstrate that the extraction system is effectively capturing the contaminant plume; and
- Maintenance of perimeter fencing at the Site until cleanup standards are achieved.

The groundwater treatment system began operating in December 1993. In November 2002 the groundwater pump and treat system was shut down after reaching asymptotic concentrations for the ROD contaminants of concern (COCs). The SVE system began operation in 1994; it reached the shut-off criterion, i.e., benzene less than 100 milligrams per cubic meter (mg/m^3) in January 2002 and was shut down in April 2002. Currently only benzene and toluene are present above the cleanup goal (drinking water standards). In January 2011, EPA completed a focused remedial investigation/feasibility study (RI/FS), which evaluates alternative remedial actions to achieve the objectives of the groundwater remedy. In June 2011 EPA released a Proposed Plan for a ROD amendment that identifies EPA's preferred method to clean up the groundwater and soil.

The remedy at the Pacific Coast Pipeline Superfund Site is currently protective of human health and the environment. There is currently no exposure to the contaminated groundwater as no one is drinking or using groundwater from this area. Access to the property is restricted, so exposure to contaminated soil is limited. For long-term protectiveness and to make the property ready for reuse, the ROD will be amended to implement final soil and groundwater remedies, as evaluated in the 2011 FS and recommended in the 2011 Proposed Plan.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Pacific Coast Pipeline		
EPA ID *(from WasteLAN)*: CAD980636781		
Region: IX	**State: CA**	**City/County: Fillmore/Ventura County**

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:** 09 / 27 / 1996
Has site been put into reuse? ☐ YES ☑ NO	

REVIEW STATUS	
Lead agency: ☑ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____	
Author name: Holly Hadlock	
Author title: Remedial Project Manager	**Author affiliation:** EPA Region IX
Review period:** 9/28/06 to 9/27/11	
Date(s) of site inspection: 2/14/11	
Type of review: ☑ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion	
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 ☐ Other (specify)	
Triggering action date *(from WasteLAN)*: 9/27/06	
Due date *(five years after triggering action date)*: 9/27/11	

* "OU" refers to operable unit.
** Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.

Five-Year Review Summary Form, cont'd.

Issues:

1. Soil – make property ready for industrial/recreational use using risk-based cleanup levels
2. Groundwater – selection and implementation of final remedy to meet state maximum contaminant levels (MCLs) established in the ROD
3. Institutional controls – to ensure long-term protectiveness

Recommendations and Follow-up Actions:

Issue 1. Amend ROD to select soil remedy, in accordance with the 2011 Proposed Plan.

Issue 2. Amend ROD to select final groundwater remedy, in accordance with the 2011 Proposed Plan.

Issue 3. Establish institutional controls for commercial / industrial land use and to restrict groundwater use.

Protectiveness Statement(s):

The remedy at the Pacific Coast Pipeline Superfund Site is currently protective of human health and the environment. There is currently no exposure to the contaminated groundwater as no one is drinking or using groundwater from this area. Access to the property is restricted, so exposure to contaminated soil is limited. For long-term protectiveness and to make the property ready for reuse, the ROD will be amended to implement final soil and groundwater remedies, as evaluated in the 2011 FS and recommended in the 2011 Proposed Plan.

Other Comments:

None.

I. INTRODUCTION

EPA Region 9 has conducted this third five-year review of the protectiveness of the remedial actions implemented at the Pacific Coast Pipeline (PCPL) Site in Fillmore, Ventura County, California. Former Site facilities included a petroleum refinery that operated until 1950 and a crude oil pumping station that operated until 2000. The purpose of the five-year review is to determine whether the remedy at the Site is functioning as intended and is protective of human health and the environment.

This five-year review was conducted by the EPA. This is the third five-year review and is a policy review. The Agency is preparing this five-year review pursuant to 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 triggering action for the first five-year review was five years after the signature of the preliminary Close-Out Report. The triggering action for this review is the date of the previous five-year review, September 28, 2006. This is a post-SARA remedial action. The review covers the entire site and includes a review of the technical reports and documents prepared since the second five-year review, an ARARs review, a site inspection, and outreach to the local community.

II. SITE CHRONOLOGY

The following table presents a site chronology.

Table 1. Chronology of Site Events

Event	Date
Investigation requested by Regional Water Quality Control Board (RWQCB)	1980
Groundwater and soil assessment conducted by Texaco under direction of California Department of Health Service (DHS) and RWQCB	1983 through 1989
Removal of 38,000 tons of waste and contaminated soil from former main waste pit and eight smaller disposal areas.	1986
NPL Listing	September 1989

Event	Date
Remedial Investigation / Feasibility Study (RI/FS) completed	1990 through 1992
ROD signature (groundwater pump and treat and SVE selected remedy)	March 1992
Consent Decree with Texaco entered	1993
Phase I Design Report completed	1993
Phase I groundwater extraction startup with treatment by granular activated carbon and discharge to Pole Creek under NPDES permit	December 1993
Phase I soil vapor extraction and treatment	1994
Final Phase 2 Design Report completed, approved	1994
Final Phase 2 Remedial Action Work Plan completed, approved	1995
Preliminary Closeout Report (Construction Completion)	September 1996
First Five Year Review completed	September 2001
Shut-off of soil vapor extraction and groundwater treatment systems	2002
Enhanced Bioattenuation (ORC®) Study completed	2003 through 2005
Phase I Shallow Soil Investigation completed	2006
Second Five Year Review completed	September 2006
Natural Attenuation Characteristics & Soil Vapor Characteristics study completed	2006 through 2007
Phase 2 Shallow Soil Investigation completed	2007 through 2008
Phase 3 Shallow Soil Investigation & Human Health Risk Assessment completed	2008 through 2009
UAO issued	September 2009
Remedial Investigation / Focused Feasibility Study (RI/FS) completed	2009 through 2010
Final RI/FS Report submitted	January 2011
Proposed Plan issued	June 1, 2011

III. BACKGROUND

SITE OPERATIONS AND PHYSICAL CHARACTERISTICS

The Pacific Coast Pipeline (PCPL) Site is located just east of the City of Fillmore in Ventura County, California (Figure 1). The Site is a former petroleum refinery that operated from circa 1915 until 1950. Texaco Inc., now a subsidiary of Chevron Corporation, acquired the existing refinery in 1928. The refinery was shut down in 1950, largely dismantled by 1951 (approximately eight above-ground storage tanks remained), and converted to a crude oil pumping station by 1952. The PCPL pumping station was a collection point for crude oil piped or trucked from oilfields surrounding Fillmore. Crude oil was pumped via pipeline from PCPL to Newhall, California. At the time of the ROD, the Site was still used by Texaco and/or its affiliates as a crude oil pumping station. Nearly all of the remaining facilities were dismantled and removed by July 2002. In 2004 the last remaining above-ground tank was removed and pumping station operations were discontinued.

The vacant property is bounded on the west by the concrete channel of Pole Creek, on the south by the railroad tracks, and on the north and east by a steep hillside (Figure 2). Active facilities include a deep water supply well, water storage tank, water pipelines, and electrical utilities. Remaining infrastructure from former operations include inactive (subsurface) crude oil pipelines, concrete foundations, and containment berms. Environmental remediation facilities include numerous groundwater monitoring wells, storage units, a small field office trailer, and an inactive groundwater treatment system. Perimeter fencing restricts access to the property.

The PCPL Site lies at the eastern end of the Fillmore Groundwater Basin. Alluvial Deposits and the underlying San Pedro Formation are the major water-bearing units. The Santa Clara River is approximately one half mile to the south of the Site. The Site slopes generally to the south and west toward the Santa Clara River. The San Cayetano Thrust Fault follows the toe of the steep slope along the eastern hillside. Fracturing of bedrock along the fault has resulted in extensive landslides and also provided a conduit for naturally-occurring petroleum hydrocarbons. Crude oil seeps and tar sands are common features in the vicinity. Groundwater flow under the Site is northwesterly, then turns west after passing under Pole Creek. Two water-bearing zones lie beneath the PCPL Site: Aquifer I (unconfined to partially confined) at approximately 80 to 100 feet below ground surface (bgs), and Aquifer II (partially confined to confined below Aquifer I).

LAND AND RESOURCE USE

Neighboring land uses are open space, rural residential, and agricultural to the north and east, low density residential and an elementary school to the west, and industrial/commercial to the south and southwest. A Reuse Assessment (Chevron, 2010 – Appendix B) determined that light industrial/commercial and recreational uses are the reasonably anticipated future uses for the property based on input from the City of Fillmore and other stakeholders.

No municipal water wells are located downgradient of the Site. One deep private well is located on-site. Water from this well is used for agricultural irrigation and for remedial construction purposes (dust control, compaction). The well is completed in Aquifer II, and is not affected by contamination observed in Aquifer I.

The section of Pole Creek that is adjacent to the property is maintained primarily for flood control and is not considered to be aquatic habitat for use by ecological receptors. Land use immediately west of Pole Creek is residential. With the exception of the hillside on the east edge of the property, the PCPL property remains sparsely vegetated and has limited habitat quality for terrestrial or avian receptors (URS RI/FS, 2011 – Appendix B). The assessment concluded that the only areas on the PCPL property where ecological habitat may exist are the hillside and the northernmost part of the Site. The hillside is very steep, sloping up toward the east, with shrub vegetation (85%) consisting primarily of Venturan Coastal Sage Scrub. The northernmost part of the Site contains a combination of ruderal vegetation (40%), shrubby native scrub (30%), and sparse native and non-native trees (30%). The disturbed areas are mainly bare and weeds are chemically-treated on a routine basis with Roundup® to comply with the Ventura County Fire Department's requirement to minimize brush fire hazards on the property.

HISTORY OF CONTAMINATION

The refinery operated from circa 1915 to 1950. Wastes from the refinery process are believed to have consisted primarily of tank bottoms, filter clays, and sludges. These refinery wastes were disposed of on-site in a large unlined main waste pit (MWP) located on the Site's western edge and in eight smaller unlined sumps and pits, primarily along the southwestern edge. It is believed that no new waste was disposed of in the on-site pits after the refinery was decommissioned and dismantled in 1951. The facility operated as a crude oil pumping station from 1952 until 2002.

In 1980, the Los Angeles Regional Water Quality Control Board (RWQCB) requested Texaco to conduct an initial site investigation. From 1983 through 1989, Texaco conducted a voluntary groundwater assessment under the California Department of Health Services (DHS, predecessor to the Department of Toxic Substances Control, DTSC) and the RWQCB. Groundwater contamination was discovered in 1983 after the installation of three monitoring wells. Water quality data from these wells indicated volatile organic compounds (VOCs) were present in the groundwater, with a maximum benzene concentration detection of 5.8 parts per million.

INITIAL RESPONSE

In 1986, under the direction of the DHS, Texaco removed 38,000 tons of waste material and contaminated soils considered by DHS to be hazardous from the MWP and other small disposal areas. Post-excavation samples indicated that the clean-up levels required by DTSC were achieved. The pits were backfilled with clean soil. This removal completed the soil excavation activities required at that time.

BASIS FOR TAKING ACTION

There are two distinct plumes of groundwater contaminated with dissolved VOCs: one beneath the former MWP (northern plume) and one in the southwest part of the Site (southern plume). The key source of groundwater contamination was refinery wastes disposed in these pits. After the removal of the refinery wastes in 1986, the concentrations in groundwater decreased. The majority of groundwater contamination in the former waste areas is the result of groundwater levels that have risen 30 feet since the early 1990s and 50 feet since the 1920s. The saturated zone is contaminated by light non-aqueous phase liquid (LNAPL) petroleum hydrocarbons trapped in soil pores and sorbed to soils within a smeared zone below the water table. Submerged, residual LNAPL is the ongoing source of dissolved phase contamination in groundwater.

Historic agricultural wells that were downgradient of the Site were once thought to be at risk. Texaco sampled these private production wells within a one-mile radius of the Site during the remedial investigation and no contaminants were detected.

IV. REMEDIAL ACTIONS

REMEDY SELECTION

On March 31, 1992, EPA signed the ROD for the PCPL Site. The objectives of the remedial action are to control further migration of the contaminated groundwater, to prevent further migration of vadose zone contamination to groundwater, and to extract and treat contaminated groundwater until contaminant concentrations are below drinking water standards and the aquifer is restored. The ROD identified five COCs that required cleanup (see Table 2, 1992 ROD Cleanup Goals for Groundwater).

EPA selected a remedy that includes the following:

- Construction and operation of a groundwater extraction and treatment system;
- Discharge of treated groundwater to the aquifer by injection or provision of the treated groundwater to beneficial users of the treated groundwater;
- Soil vapor extraction for those areas that threaten to contaminate groundwater;
- Groundwater monitoring to demonstrate that the extraction system is effectively capturing the contaminant plume and achieving the cleanup standards; and
- Maintenance of perimeter fencing at the Site until cleanup standards are met.

At the time the ROD was signed, EPA anticipated that the groundwater would be restored to the cleanup standards in a minimum of 30 years.

Table 2. 1992 ROD Cleanup Goals for Groundwater

Contaminant	ROD Cleanup Standard micrograms per liter (µg/L)
Benzene	1
Toluene	100
Ethylbenzene	680
1,2-Dichloroethane	0.5
Methylene Chloride	5

REMEDY IMPLEMENTATION

The remedial work was conducted in two phases, Phase 1 to begin remediation and conduct more groundwater and SVE studies, and Phase 2 to implement the results of the Phase 1 studies. The Phase 1 groundwater treatment system (GWTS) began operating in December 1993. The extracted groundwater was treated with granular activated carbon and discharged to Pole Creek under a NPDES permit. The Phase 1 SVE system operations began in 1994. Several types of soil vapor treatment systems were operated at the Site to evaluate the optimum equipment for Phase 2 operations. Equipment tested at the Site included a regenerative thermal oxidation unit, internal combustion engines (VR Systems), and thermal oxidation units (King Buck/Hasstech and Baker Furnace).

The Phase 2 GWTS was similar to the Phase 1 system, but with an increased capacity and several operational modifications to improve performance. It began operating in November 1995. The Phase 2 SVE commenced in May 1995. SVE wells were used in the three target areas evaluated in Phase 1 and the Baker Furnace thermal oxidation unit was selected for the soil vapor treatment. The Site achieved construction completion status when the Preliminary Close Out Report was signed on September 27, 1996.

SYSTEM OPERATIONS

Groundwater

Starting in December 1993, contaminated groundwater was extracted from on-site wells and treated with granular activated carbon. In 2002 EPA determined that the GWTS had reached its limit of effectiveness and approved Texaco's request to shut off the system although the ROD cleanup levels had not been reached. Texaco began investigating other means of treatment to achieve MCLs. Overall, 140,734,290 gallons of water were treated, with approximately 4,902 pounds of total petroleum hydrocarbons and 301 pounds of benzene removed. Groundwater monitoring continues according to the schedule in Table 3.

LNAPL occasionally accumulates in three southern plume wells, primarily former groundwater extraction wells (EW-1, EW-4). LNAPL thickness in these wells at times correlates with seasonal fluctuations in the water table. When the water table rises to intercept fine-grained units in the vicinity of these wells, confining conditions develop and the increase in the potentiometric surface drives more LNAPL into the wells. LNAPL is removed from the wells as necessary using a semi-mobile automated recovery pump system (Magnum Spill Buster) and is recycled off-site. Oil-absorbing bag filters also have been used periodically to remove LNAPL. The used LNAPL filters are transported to an approved off-site disposal and treatment facility. From 1994 through 2010, a total of 1,309 gallons of LNAPL have been recovered. LNAPL accumulation in wells has generally declined since 2005.

The groundwater treatment and SVE systems operated as designed. From 1994 to 1997 all groundwater monitoring wells were sampled quarterly. In 1997 the frequency of groundwater monitoring in some wells was reduced to semi-annual sampling due to the stability of contaminant concentrations. The reduction in frequency still provided adequate information to characterize the plume and to meet the goals of the sampling program.

System operations for the Site are reported in quarterly project status reports and in quarterly groundwater monitoring reports. Table 3 shows the current groundwater sampling schedule. Figure 3 shows the locations of the groundwater monitoring wells.

Table 3. Current Groundwater Monitoring Schedule

Well	First Quarter	Second Quarter		Third Quarter	Fourth Quarter		
	Quarterly Parameters	Quarterly Parameters	Semi-annual Parameters	Quarterly Parameters	Quarterly Parameters	Semi-annual Parameters	Annual Parameters
MW-1S		☑	☑		☑	☑	
MW-2S		☑	☑		☑	☑	
MW-3S		☑	☑		☑	☑	
MW-6S	☑	☑	☑	☑	☑	☑	☑
MW-8S		☑	☑		☑	☑	
MW-9S		☑	☑		☑	☑	
MW-11S		☑	☑		☑	☑	
MW-14S		☑	☑		☑	☑	
MW-17S		☑	☑		☑	☑	
MW-18S		☑	☑		☑	☑	
MW-19S		☑	☑		☑	☑	
MW-20S		☑	☑		☑	☑	
MW-25S		☑	☑		☑	☑	
MW-28S		☑	☑		☑	☑	
MW-29S		☑	☑		☑	☑	
MW-30S		☑	☑		☑	☑	
MW-35S	☑	☑	☑	☑	☑	☑	
MW-37S		☑	☑		☑	☑	
MW-38S		☑	☑		☑	☑	
MW-39S	☑	☑	☑	☑	☑	☑	☑
MW-40S		☑	☑		☑	☑	
MW-41S	☑	☑	☑	☑	☑	☑	
MW-42S	☑	☑	☑	☑	☑	☑	☑
MW-43S		☑	☑		☑	☑	
MW-44S	☑	☑	☑	☑	☑	☑	
MW-45S	☑	☑	☑	☑	☑	☑	☑
MW-48S	☑	☑	☑	☑	☑	☑	
MW-49S	☑	☑	☑	☑	☑	☑	
MW-50S	☑	☑	☑	☑	☑	☑	☑
EW-P2	☑	☑	☑	☑	☑	☑	
EW-1	☑	☑	☑	☑	☑	☑	
EW-2		☑	☑		☑	☑	
EW-4	☑	☑	☑	☑	☑	☑	
EW-5	☑	☑	☑	☑	☑	☑	

Quarterly Parameters: total petroleum hydrocarbons as gasoline (TPHG) by EPA Method 8015M; benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8021B; dissolved oxygen (DO), oxidation reduction potential (ORP), pH, conductivity, and temperature by field measurement with a flow-through cell.

Semi-annual Parameters: sulfate by EPA Method 300

Annual Parameters: BTEX, methylene chloride, 1,2-dichloroethane (1,2-DCA) by EPA Method 8260B

Soil Vapor Extraction (SVE)

The SVE system operated in those areas where EPA determined that volatile fuel hydrocarbons and BTEX in the vadose zone posed a threat to the underlying groundwater. The SVE system reached the shut-off criteria, i.e., benzene less than 100 mg/m^3 (31 parts per million by volume [ppmv]), in January 2002. Soil gas concentrations were monitored monthly for eight months following SVE system shutoff. No rebound above 100 mg/m^3 was observed and soil vapor monitoring was discontinued in November 2002. Overall, 1,387,229 pounds of total petroleum hydrocarbons and 2,191 pounds of benzene were removed.

Remedial Action O&M Costs

Because both the groundwater treatment and SVE systems were shutoff in 2002, there are no associated costs to report for these completed remedial actions. Annual O&M costs are comprised primarily of groundwater monitoring program activities, LNAPL recovery, and property maintenance expenses (see Table 4).

Table 4. Annual System Operations/O&M Costs

Dates		Total Cost rounded to nearest $1,000
From	To	
January 2010	December 2010	$306,000

V. PROGRESS SINCE THE LAST REVIEW

SECOND FIVE-YEAR REVIEW PROTECTIVENESS STATEMENT

The 2006 Five-Year Review Report made the following statement regarding the protectiveness of the selected remedy for the Site:

> *A protectiveness determination regarding the remedy for Pacific Coast Pipeline site cannot be made until further information is obtained about the potential for vapor intrusion at the Site. Vapor intrusion is the migration of volatile compounds from the groundwater up through the subsurface and into the ambient air. Further information will be obtained by implementing the soil gas sampling and analysis plan approved in August 2006. It is expected that these actions will take approximately six months to complete, at which time a protectiveness determination will be made. Additionally, MNA will be evaluated and an amendment to the groundwater remedy in the ROD will be prepared. In order to ensure the long-term protectiveness of the Site, institutional controls regarding the use of the property and groundwater will also be included in the ROD amendment.*

On April 20, 2010, EPA issued a Five-Year Review Addendum. The Addendum concluded:

> *The remedy at the Pacific Coast Pipeline Site is protective of human health and the environment in the short-term, as the vapor intrusion study indicates that shallow soil vapor does not present a risk. As the 2006 Five-Year Review Report indicates, however, institutional controls likely will be necessary to ensure protectiveness in the long term. EPA continues to assess alternatives for what type of institutional controls might be needed to ensure long-term protectiveness.*

Table 5. Actions Taken Since the Last Five-Year Review

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Soil Gas	Collect soil gas samples as approved in the sampling and analysis plan to study soil vapor characteristics above the dissolved-phase benzene plumes.	Chevron	9/2007	Soil gas sampling of the vadose zone above the benzene plumes show that there is no risk to nearby residents through a subsurface vapor-to-indoor-air pathway	2006 through 2007
Groundwater	Incorporate naphthalene analyses into ongoing groundwater sampling for two years, so that an assessment of potential health risks can be completed in the event that regulatory limits for naphthalene are revised.	Chevron	11/2006 through 11/2008	For eight consecutive quarters of groundwater sampling, naphthalene was predominantly non-detect and intermittent, very low detections in two wells did not exceed the State's 17 µg/L notification level.	2007 through 2008
Groundwater	Continue groundwater monitoring and implement the sampling and analysis plan to study natural attenuation characteristics to evaluate the effectiveness of natural attenuation and trends of dissolved benzene plumes.	Chevron	Ongoing	Completed natural attenuation study and conducted compound-specific isotope analysis to confirm biodegradation of benzene in groundwater	2006 through 2009
	Consider MNA or other appropriate remedy and add institutional controls (ICs) in a ROD amendment.	Chevron	2008-2009	Completed RI/FS which considers MNA, ICs, and other potential groundwater remedies.	2009 through 2010
Land Use	Conduct Phase 2 soil investigation. Investigate feasibility for commercial / light industrial land use.	Chevron	9/2009	Completed Phase 2 and Phase 3 soil investigations and human health risk assessment.	2007 through 2009
	Establish institutional controls (ICs) regarding the use of the property in an appropriate decision document.			Developed and presented appropriate ICs in RI/FS for ROD amendment.	2009 through 2010

WORK COMPLETED AT THE SITE DURING THIS REVIEW PERIOD (2006 – 2011)

Because the selected remedy did not achieve the cleanup levels established in the ROD, EPA evaluated other cleanup options as part of a focused RI/FS. Activities included extensive analysis of groundwater characteristics and evaluation of natural attenuation at the Site. EPA determined that natural attenuation is occurring in the groundwater and that dissolved benzene is biodegrading, both aerobically and anaerobically

To determine if soil vapor intrusion could pose a threat to residents near the groundwater plumes, vadose zone sampling was conducted from 2006 to 2007 at multiple depths above the groundwater plumes during two seasons, rainy and dry. The results show that there is no risk to nearby residents through a subsurface vapor-to-indoor-air pathway. Benzene in soil vapor is naturally attenuating and concentrations decrease rapidly as the subsurface vapor rises upward from groundwater.

In 2004 the California Department of Public Health established a 170 microgram per liter (µg/L) notification level for naphthalene (Appendix B). Two years of monitoring (2007-2008) for naphthalene confirms that it does not exceed the California notification level.

The 1992 RI/FS did not focus on shallow soil and the ROD did not include a remedy for shallow soils. To address this, EPA conducted a three-phased investigation to characterize shallow soils within the upper 10 feet bgs. The first phase was a general survey of the shallow soil to determine what contaminants were in the soil, the second phase was to determine the extent of contamination, and the third phase was to fill data gaps in order to prepare a risk assessment. COCs in soil are inorganic lead and polycyclic aromatic hydrocarbons (PAHs). COCs in soil gas are benzene, 1,2-dichloroethane (1,2-DCA), and naphthalene.

Inorganic lead was detected at 37 locations across the Site: 16 detections were at one foot bgs, 14 at five feet bgs, and 7 at ten feet bgs. The maximum concentration detected was 34,000 mg/kg. PAHs were also detected at depths from one to ten feet bgs across the Site. The maximum concentration of benzo(a)pyrene, the PAH considered to be the primary carcinogen, was 80 mg/kg. The soil gas COCs were detected at five and ten feet bgs in five locations near the former naphtha treating plant in the southwest corner of the property (the area associated with the southern groundwater plume). The soil results were used in human and ecological risk assessments to establish remedial action objectives and cleanup goals.

EPA issued a Proposed Plan for a ROD amendment on June 1, 2011, held a public meeting on June 16, and had a public comment period from June 1 to July 15. The Proposed Plan identifies EPA's preferred remedial actions to clean up the Site:

Groundwater: air sparging, enhanced bioremediation with sulfate, and monitored natural attenuation (MNA)

Soil: excavation, on-site disposal, and a cap

Institutional controls (ICs) are proposed to prevent use of groundwater until cleanup levels are attained and to limit future Site use to commercial and recreational purposes.

VI. FIVE-YEAR REVIEW PROCESS

ADMINISTRATIVE COMPONENTS

EPA notified Chevron, the sole responsible party, of the 2011 five-year review in November 2010 and requested participation in the process. Chevron assisted with the research and provided the figures and Appendix C and D. DTSC reviewed this report and concurred with the protectiveness determination.

COMMUNITY INVOLVEMENT

EPA interviewed select City officials and members of the community. A notice of the preparation and availability of this report was published in the *Fillmore Gazette* and the *La Vida* on July 21, 2011 (Appendix A). The Third Five-Year Review Report will be made available to the public at the PCPL Fillmore repository at City Hall and on EPA's website at www.epa.gov/region09/pacificcoastpipeline.

DOCUMENT REVIEW

For this five-year review, relevant documents were examined, including status reports, groundwater monitoring reports, technical memoranda, remedial investigations, and the focused RI/FS (Appendix B). Applicable groundwater cleanup standards were also reviewed (Appendix C).

DATA REVIEW

Groundwater Monitoring

Groundwater monitoring has continued since the treatment systems were shut down in 2002 after reaching the limit of their effectiveness. This monitoring indicates that the footprints of the groundwater plumes remain stable and that contamination is not spreading. Currently 34 wells are monitored; 14 are monitored quarterly and 20 are monitored semi-annually. Of the five COCs identified in the ROD (see Table 6, Groundwater Contaminant Concentrations), only benzene and toluene remain above the cleanup levels. Methylene chloride and 1,2-DCA have not been detected since 1991. Ethylbenzene was never above the ROD cleanup level of 680 µg/L.

Table 6. Groundwater Contaminant Concentrations (maximum), [µg/L]

Chemical	ROD Cleanup Level	1st 5-Yr Review	2nd 5-Yr Review	3rd Five-Yr Review
Benzene	1	650	430	380
Toluene	100	180	150	190
Ethylbenzene	680	190	130	30
1,2-Dichloroethane	0.5	ND	ND	ND
Methylene Chloride	5	ND	ND	ND

Since the last five-year review, concentrations have declined in the northern plume and have remained steady in the southern plume. In the northern plume the maximum concentration of toluene is now below both the ROD cleanup goal of 100 µg/L and the current (revised in 1994) California drinking water standard of 150 µg/L. The maximum concentration of benzene is now 80 µg/L. In the southern plume toluene is above the cleanup level in one well and the maximum concentration of benzene has fluctuated

between 250 and 400 µg/L. These maximum concentrations represent a reduction of benzene concentrations of greater than 90% compared to pre-treatment concentrations.

Groundwater monitoring data 1st Quarter 2011 were evaluated against site cleanup standards established in the ROD. As of Feb 2011, benzene results exceeded the cleanup standard of 1 µg/L in the following groundwater monitoring wells:

- Northern plume: EW-P2 (80 µg/l), MW-42S (19 µg/l), MW-28S (1.2 µg/l)
- Southern plume: MW-39S (340 µg/l), MW-50S (380 µg/l), MW-20S (79 µg/l), MW-17S (33 µg/l), MW-19S (29 µg/l), MW-8S (18 µg/l), EW-5 (33 µg/l), MW-45S (2.5 µg/l), MW-9S (3.4 µg/l), MW-30S (2 µg/l), MW-41S (11 µg/l).

- There is currently a small gap in monitoring data for the southern edge of the southern plume. This area had been monitored by the RWQCB as part of the Ultramar (now Valero) gas station cleanup. Wells were abandoned in 1996 when the RWQCB approved closure of the Ultramar cleanup. The concentrations last detected were below 10 µg/L. Because groundwater flow is to the west and the downgradient sentinel well has clean groundwater, this gap in data does not have an effect on the protectiveness of the remedy. A new monitoring well will be installed in order continue with full plume monitoring.

- As part of the groundwater sampling and analysis conducted during this five-year review period (in response to a groundwater recommendation in the Second Five-Year Review Report), extensive work was done to ascertain if natural attenuation is occurring in the groundwater at the Site. Appendix D presents groundwater data analyses, including review of temporal and spatial trends, and describes multiple lines of evidence that natural attenuation is effectively managing the groundwater plumes:

- Time series plots demonstrate continued decline in dissolved benzene concentrations over time.
- Time series isopleth maps demonstrate the dissolved plumes are stable and shrinking.
- Benzene mass calculations demonstrate the dissolved plumes are stable and shrinking.
- Geochemical indicators demonstrate biodegradation; specifically sulfate reduction across both dissolved plumes.
- Stable isotope tracers, sulfur and oxygen, demonstrate sulfate reducing conditions are participating in hydrocarbon biodegradation.
- Stable isotope ratios for carbon (13C/12C) vs. hydrogen (2H/1H) demonstrate a biodegradation signature.
- Vertical concentration profiles of soil vapor demonstrate natural attenuation within the vadose zone above the groundwater plumes such that a subsurface vapor migration exposure pathway does not present a risk.
- Benzene mole fraction measurements in LNAPL in the smear zone demonstrate a reduction over time.

SITE INSPECTION

EPA conducted a site inspection on June 16, 2011 (See Appendix E, Site Inspection Checklist). The conditions at the Site are similar to those observed during the last five-year review. All refinery and pumping station equipment has been removed. The only regular activity conducted at the Site is quarterly groundwater monitoring. The inspection included confirmation that the perimeter fencing still restricts access to the Site. Each groundwater monitoring well was inspected. Photographs were taken by URS

Corporation in February 2011 and are included in Appendix E. Appendix E also documents well repairs since the previous five-year review.

INTERVIEWS

Since the previous five-year review, EPA met with city staff in July 2009, and interviewed city officials and members of the community in September 2009, April 2011, and August 2011. City officials and community members support EPA's continued efforts to clean up the groundwater and were interested in the proposed cleanup of the Site soil. Community members stated that EPA should keep them informed on a more regular basis (Appendix B, Community Involvement Plan).

VII. TECHNICAL ASSESSMENT

QUESTION A

Is the remedy functioning as intended by the decision documents?

No. The remedy selected in the ROD was implemented and succeeded in removing 301 pounds of benzene from groundwater and 2,191 pounds of benzene from the vadose zone. The selected remedy was unable to reach the cleanup goals for benzene and toluene established in the ROD. The treatment systems have not been operating since EPA approved Chevron's request to suspend groundwater and soil vapor extraction in 2002. EPA's decision was based on its determination that the remedy had achieved asymptotic concentrations for benzene and toluene.

Since the ROD was written, the limitations of pump and treat technology in achieving cleanup standards are better understood, especially when residual LNAPL is smeared and submerged beneath the water table. Nevertheless, the remedial action is currently protective of human health and the environment for the following reasons:

- Natural attenuation continues to destroy benzene and maintain plume stability. The preferential biodegrading pathway is dominated by sulfate-reducing conditions and sulfate is naturally abundant in the aquifer.
- Drinking water for the area is supplied by the City of Fillmore municipal supply wells, which are in a different drinking water sub-basin and are not threatened by the groundwater contamination.

Although the remedy is protective in the short-term, for long-term protectiveness the ROD should be amended. EPA issued a Proposed Plan for a ROD amendment on June 1, 2011, with the preferred alternative for the southern plume a three-phase cleanup: air sparging followed by bioremediation with sulfate followed by MNA. For the northern plume EPA has proposed MNA only.

An optimized groundwater monitoring network is recommended that includes an additional monitoring well to fill a data gap and reduction of monitoring wells to eliminate redundant data points or data points that are no longer useful (i.e., well locations that have met cleanup goals for many years) (Figure 4). The optimized monitoring network defined in the RI/FS also incorporates replacement locations for northern plume wells that will be eliminated when the Pole Creek concrete channel is widened, as planned by Ventura County Watershed Protection District, to increase its flood control capacity. The frequency of groundwater monitoring should be reduced to semi-annually for the southern plume and annually for the northern plume. Groundwater monitoring at the Site was performed semi-annually prior to shut down of the GWTS in 2002 and increased to quarterly pending further evaluation of MNA. Multiple lines of evidence presented in Appendix D demonstrate that quarterly monitoring is no longer necessary.

QUESTION B

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

Standards for two COCs have changed since the 1992 ROD. California reduced the drinking water standard for ethylbenzene from 680 µg/L to 300 µg/L in 2003. However, the new standard has no effect on the protectiveness of the remedy because ethylbenzene has not been detected above 300 µg/L in any monitoring wells since 1999 and has never been detected above the 1992 ROD cleanup goal. California established a drinking water standard of 150 µg/L for toluene in 1994, which is less stringent than the 1992 ROD-specified cleanup goal of 100 µg/L.

Naphthalene does not have an established maximum contaminant level (MCL) but it does have a 17 µg/L notification level established by the California Department of Public Health (Appendix B). (Notification levels are typically precursors to MCLs). Naphthalene has not been detected above this notification level.

QUESTION C

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

There is no other information that calls into question the protectiveness of the remedy. The 1992 ROD did not address ICs or soil contamination. The Site was still utilized as a crude oil pumping station at the time. The Site is secured and there are no municipal water wells at risk. The City of Fillmore Municipal Code, Title 8, Chapter 8.12, Section 100 (Standards) mandates that construction of new water wells follow standards set forth within the California Department of Water Resources (CDWR) Bulletins No. 74. The CDWR Bulletin states that "all water wells shall be located an adequate horizontal distance from known or potential sources of pollution or contamination." In addition, "where possible a well shall be located up the groundwater gradient from potential sources of pollution or contamination" (CDWR Bulletin 74-81, Chapter II, Part II, Section 8). Both the City Planning and Public Works Departments are aware of the PCPL Superfund Site and will not install any municipal water wells nearby. For long-term protectiveness of the PCPL Site, appropriate and enforceable ICs should be required.

TECHNICAL ASSESSMENT SUMMARY

The remedy described in the ROD functioned successfully as designed. However, the remedy was not as effective as expected in cleaning up dissolved benzene to the cleanup level of 1 µg/L, due to the limitations of pump and treat technology. There have been no changes to the physical conditions of the Site that would affect the protectiveness of the remedy. The changes in applicable or relevant and appropriate requirements (ARARs) for ethylbenzene, toluene, and naphthalene do not affect the groundwater remediation.

The plumes are stable and benzene and toluene concentrations continue to decline due to natural attenuation. Other COCs are below cleanup standards. The 2011 RI/FS presents preferred final remedies for groundwater. The northern plume already meets performance goals put forth in the RI/FS for transition to MNA with institutional controls. The recommended alternative for the southern plume is sequential implementation of air sparging to treat the LNAPL smear zone, followed by circulation of existing sulfate-rich groundwater to enhance biodegradation of the dissolved plume, and MNA with ICs as the final remedy. This sequential approach takes advantage of the strengths of each technology in

concert with site-specific conditions in the southern plume. An optimized groundwater monitoring network will fill a data gap and eliminate data points that are no longer useful. The frequency of groundwater monitoring should be reduced to semi-annually for the southern plume and annually for the northern plume. ICs should also be included as part of a ROD amendment.

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

VIII. ISSUES

Table 7. Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Soil – clean up soil for future commercial, recreational uses.	N	Y
Groundwater – final remedies to achieve RAO.	N	Y
Institutional controls for future use of the property.	N	Y
Optimize groundwater monitoring network.	N	Y

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 8. Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Dates	Affects Protectiveness (Y/N)	
					Current	Future
Soil – clean up soil for future commercial, recreational uses	Amend ROD for final soil remedy as evaluated in RI/FS and recommended in PP.	EPA	–	2011	N	Y
	Complete soil remedy.	Chevron	EPA	2012	N	Y
Groundwater – final remedies to achieve RAO	Amend ROD for final groundwater remedies as evaluated in RI/FS and recommended in PP.	EPA	–	2011	N	Y
	Implement air sparging pilot test in southern plume.	Chevron	EPA	2012 - 2013	N	Y
Future land use	Establish institutional controls for commercial / industrial land use and to restrict groundwater extraction, per amended ROD.	EPA, DTSC	EPA	2013	N	Y

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Dates	Affects Protectiveness (Y/N)	
					Current	Future
Optimize Groundwater Monitoring Network	Implement optimized groundwater monitoring and reduce sampling frequency to semi-annual for the southern plume and annual for the northern plume as evaluated in the RI/FS and recommended in the PP.	Chevron	EPA	2012	N	Y

X. PROTECTIVENESS STATEMENT

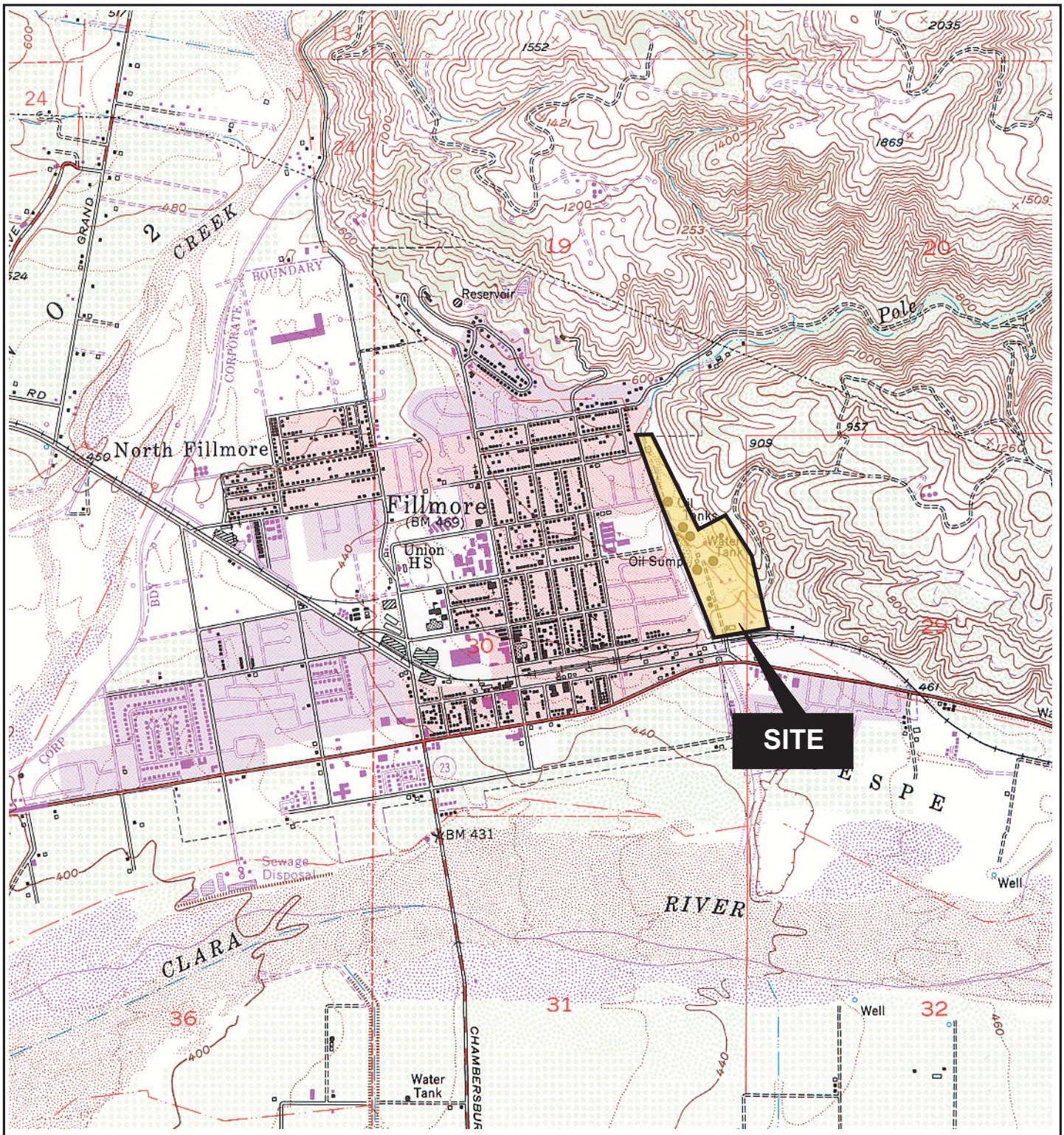
The remedy at the Pacific Coast Pipeline Superfund Site is currently protective of human health and the environment. There is currently no exposure to the contaminated groundwater as no one is drinking or using groundwater from this area. Access to the property is restricted, so exposure to contaminated soil is limited. For long-term protectiveness and to make the property ready for reuse, the ROD will be amended to implement final soil and groundwater remedies, as evaluated in the 2011 FS and recommended in the 2011 Proposed Plan.

XI. NEXT REVIEW

The next five-year review will be five years from the date of this Five-Year Review Report.

Figures

Pacific Coast Pipeline Superfund Site
Third Five-Year Review Report



REFERENCE: USGS 7.5 Minute Series Fillmore, CA Quad, Photorevised 1988

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Scale in Miles

SITE LOCATION MAP

Project No.: 29869533	Date: AUGUST 2005	Project: CHEVRON PCPL (FILLMORE REFINERY)	Figure 1

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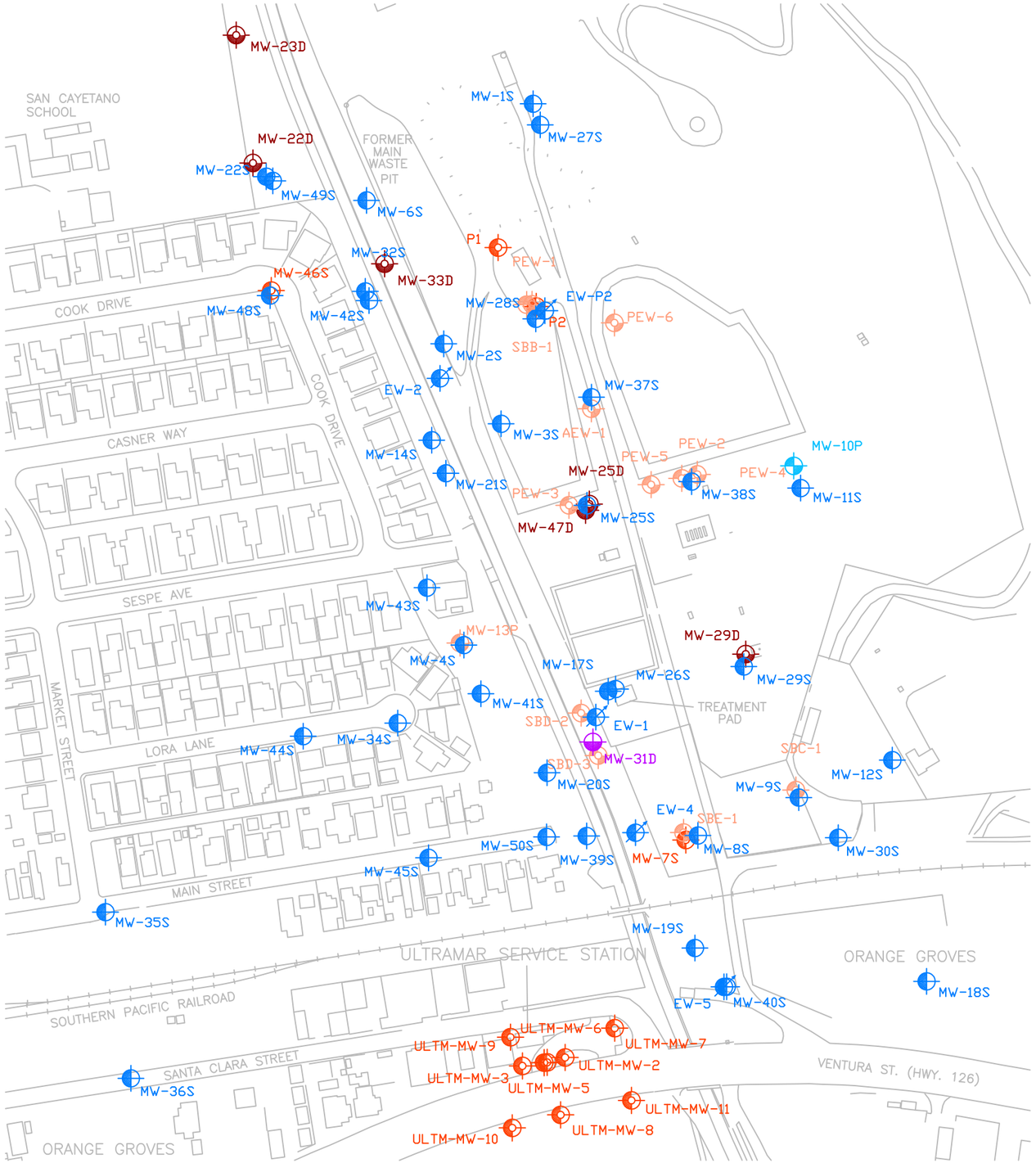
500 feet

PCPL Fillmore Superfund Site

Figure 2



LEGEND:

MW-10P	EXISTING PERCHED MONITORING WELL
MW-11S	EXISTING AQUIFIER I MONITORING WELL
MW-31D	EXISTING AQUIFIER II MONITORING WELL
EW-1	EXISTING AQUIFIER I EXTRACTION/MONITORING WELL
AEW-1	DESTROYED PERCH MONITORING WELL
MW-5S	DESTROYED AQUIFIER I MONITORING WELL
MW-33D	DESTROYED AQUIFIER II MONITORING WELL

N

0 125 250 500

SCALE: IN FEET

URS Corporation

GROUNDWATER MONITORING WELL LOCATIONS

Proj. No.: 29874660		Date: March 2011	
Project: CHEVRON PCPL (Fillmore, Ca)		CAD ID.: ---	
Drawn by: AS	Checked by: BP	Figure: 3	

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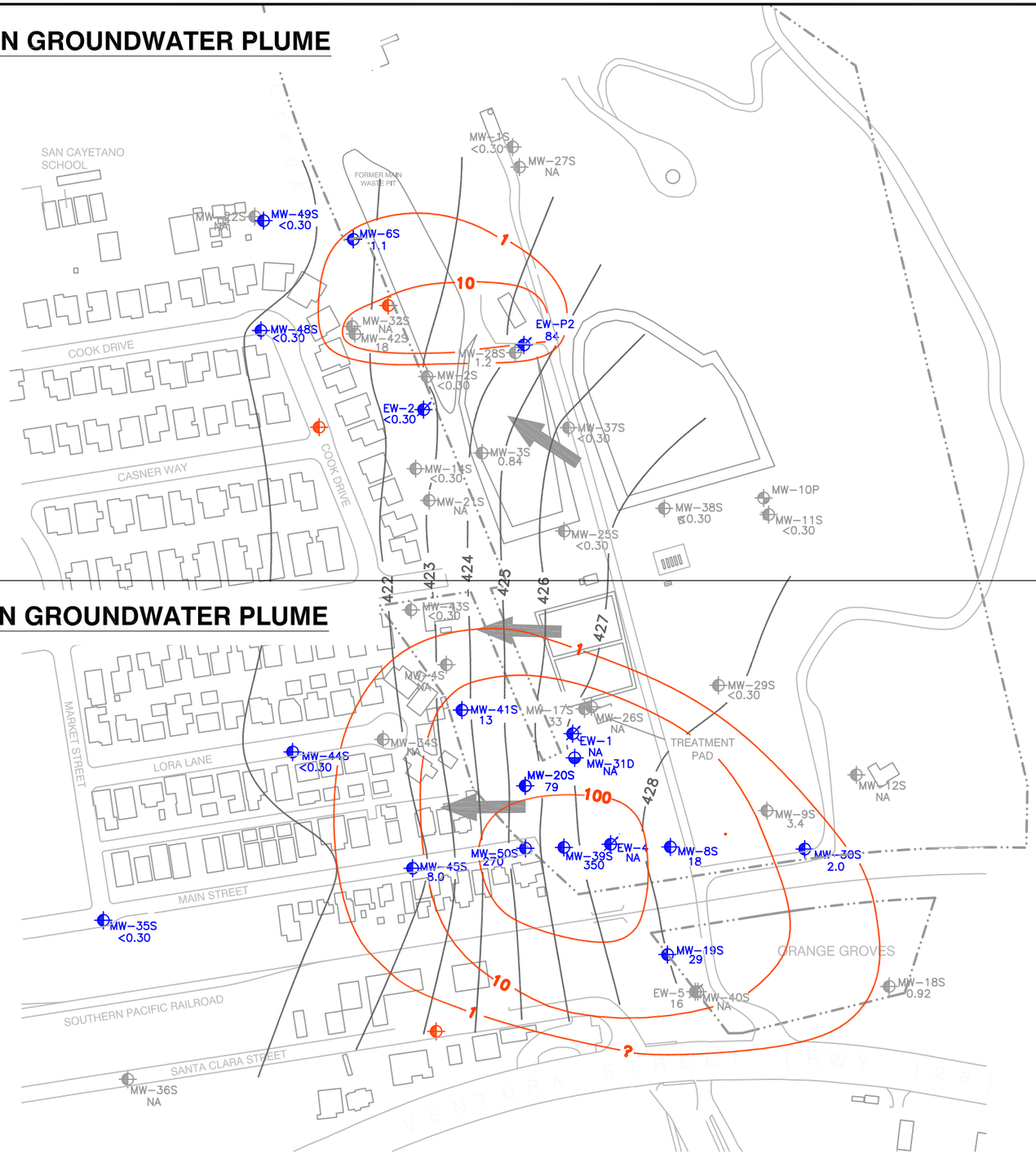
NORTHERN GROUNDWATER PLUME

SOUTHERN GROUNDWATER PLUME



EXPLANATION

MW-6S	RETAIN EXISTING AQUIFIER I MONITORING WELL
EW-P2	RETAIN EXISTING AQUIFIER I EXTRACTION / MONITORING WELL
MW-31D	RETAIN EXISTING AQUIFIER II MONITORING WELL
MW-6S	DESTROY EXISTING AQUIFIER I MONITORING WELL
EW-5	DESTROY EXISTING AQUIFIER I EXTRACTION/MONITORING WELL
MW-10P	DESTROY EXISTING PERCHED MONITORING WELL
	ADD AQUIFER I MONITORING WELL
31	BENZENE CONCENTRATION (MICROGRAMS PER LITER) (Q4 2010)
< 0.30	ANALYTE NOT DETECTED ABOVE LABORATORY REPORTING LIMIT (Q4 2010)
100 ?	BENZENE ISOCONCENTRATION CONTOUR, DASHED WHERE INFERRED, QUERIED WHERE UNCERTAIN (Q4 2010)
427	GROUNDWATER ELEVATION CONTOUR, DASHED WHERE INFERRED, QUERIED WHERE UNCERTAIN (Q4 2010)
	GROUNDWATER FLOW DIRECTION (APPROXIMATE)
NA	GROUNDWATER MONITORING WELL NOT PART OF SAMPLING PROGRAM

N

0 125 250 500

SCALE: IN FEET

URS Corporation

OPTIMIZED GROUNDWATER MONITORING NETWORK

Proj. No.:	29874893	Date:	March 2011
Project:	CHEVRON PCPL (Fillmore, Ca)	CAD ID.:	---
Drawn by: GN	Checked by: JS	Figure:	4

Z:\Gis_Proj\Chevron PCPL (Fillmore Refinery)\!Figures\5 Year Review\2011\2011\Figure 4 - Optimized GW Network.dwg

Appendices

Pacific Coast Pipeline Superfund Site
Third Five-Year Review Report

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Library

Community Li-
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large showing of
"A Group Show"
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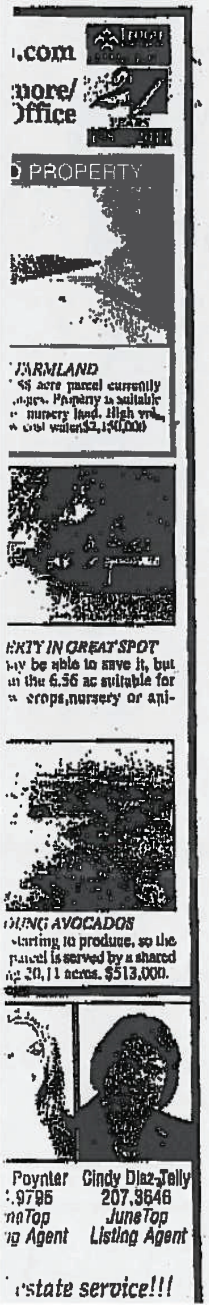

PUBLIC NOTICE

The United States Environmental Protection Agency Begins Third Five-Year Review of Cleanup at the Pacific Coast Pipeline Superfund Site

The U.S. Environmental Protection Agency (EPA) is in the process of the third five-year review of the original, 1992, cleanup actions undertaken at Pacific Coast Pipeline (PCPL) Superfund Site in Fillmore, California. Under this remedy a system that pumped and treated groundwater, as well as a treatment system that extracted and treated soil vapors, operated from 1995-2002. A fence was installed for site security, and a monitoring plan to measure progress was also put in place and continues to operate. Currently, the EPA is amending this 1992 cleanup decision to implement a final cleanup plan that would allow for future development on the site.

THE REVIEW PROCESS

The purpose of the five-year review is to understand how the constructed remedy is operating and to measure the progress towards meeting the Site's cleanup goals in order to protect human health and the environment. Because hazardous substances remain onsite above [illegible] levels that prevent unrestricted use and [illegible] EPA will be conducting this review [illegible]cally, EPA will be looking into the movement or breakdown of site contaminants, the operation of mechanical components, the application of property restrictions, the integrity of the fence, changes in scientific knowledge about site contaminants, and changes in exposure pathways and changes in regulations.

COMMUNITY INVOLVEMENT

EPA will publish the results when they become available in October 2011. The report will be available on the Pacific Coast Pipeline website and at the Local Site Repository (see below).

SITE HISTORY

The PCPL site is a former petroleum refinery that was built in 1915 and operated until [illegible]. The primary products of the refinery were [illegible] line, diesel, and fuel oil. Refinery wastes primarily consisted of tank bottoms, filter clays, and sludges. These wastes were disposed of onsite in a large main waste pit located along the western boundary of the site and eight smaller unlined sumps and pits distributed throughout the site. In 1950 Texaco shut down and dismantled the refinery and converted it into a crude oil pumping station. In 1986 Texaco removed 38,000 tons of contaminated soils from the Site and installed 34 additional monitoring wells. EPA undertook cleanup lead under the Superfund Program in 1989 and has will make a final cleanup decision on both the groundwater and remaining soil contamination this year.

FOR MORE INFORMATION

Please [illegible] EPA's website for the Pacific Coast Pipeline Site: www.epa.gov/region09/pacificcoastpipeline. Or visit the information repositories to review the administrative record or contact EPA representatives.

INFORMATION REPOSITORIES

Fillmore City Hall, 2nd floor
250 Central Avenue
Fillmore, CA 93015
(805) 5[illegible]-3355

[illegible]erfund Records Center
95 Hawthorne Street
San Francisco, CA 94105
(415) 820-4700

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Fillmore Gazette, July 21, 2011

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AVISO PÚBLICO

La Agencia de Protección Ambiental de los Estados Unidos ha Comenzado la Tercera Revisión de Cinco Años de Limpieza en el Sitio Superfund Pacific Coast Pipeline

La Agencia de Protección Ambiental de los Estados Unidos (EPA, por sus siglas en inglés) esta en el proceso de la tercera revisión de cinco años para las acciones de limpieza originales de 1992, en el Sito Superfund Pacific Coast Pipeline (PCPL) en Fillmore, CA. Bajo este remedio un sistema que bombeó y trató agua subterránea y vapores de la tierra operó de 1995 hasta 2002. Una barda fue instalada para seguridad del sitio y un plan de monitoreo para medir el progreso, también se implemento y continúan funcionando. Actualmente, la EPA esta enmendando este plan de limpieza de 1992 para implementar un plan final con el fin de permitir el desarrollo futuro de este sitio.

EL PROCESO DE REVISIÓN

El propósito de la revisión de cinco años es para entender como el remedio construido sigue operando, y para medir el progreso hacia llegar a los objetivos de limpieza del Sitio para proteger la salud humana y el medio ambiente. A raíz de que sustancias peligrosas siguen en el sitio sobre niveles de riesgo que prohíben el uso y exposición sin restricciones, la EPA conducirá esta revisión. Específicamente, la EPA estará investigando el movimiento o descomposición de contaminantes del sitio, la operación de componentes mecánicos, la aplicación de restricciones a propiedades, la integridad de la barda y de la estructura de almacenamiento, cambios en el conocimiento científico sobre los contaminantes del sitio, cambios en vías de exposición y cambios en reglamentos.

PARTICIPACIÓN COMUNITARIA

La EPA publicará los resultados cuando sean disponibles en octubre, 2011. El informe será disponible en la página de la EPA para el Sitio Pacific Coast Pipeline y en el depósito de información local (lea a continuación).

HISTORIA DEL SITIO

El Sitio PCPL es una refinería de petróleo que fabricada en 1915 y que operó hasta 1950. Los productos principales de la refinería fueron gasolina, diesel y combustibles. Deshechos de la refinería erán los pies de tanques, filtres de barro y los resuiduos de petróleo. Estos deshechos fueron depositados en un hoyo grande y central dentro del sitio ubicado junto a la frontera occidental del sitio y en ocho sumideros más pequeños, sin revestimiento, y repartidos por todo el sitio. En 1950 Texaco (que hoy es Chevron) cerro y desmantelo la refineria y la convirtio a una estación de bombear petróleo crudo. En 1986 Texaco eliminó 38,000 toneladas de tierra contaminada del sitio e instalo 34 pozos de moitoreo addicionales. La EPA se adueño de la limpieza en 1989 y esté año hará una decision de limpieza final en las tierras y agua subterráneas contaminadas.

PARA MÁS INFORMACIÓN

Por favor visita a la página de la EPA para el Sitio Pacific Coast Pipeline:
www.epa.gov/region09/pacificcoastpipeline,
o visita los depósitos de información para revisar el registro administrativo o póngase en contacto con los representantes de la EPA.

DEPOSITOS DE INFORMACIÓN

Fillmore City Hall, 2do piso
250 Central Avenue
Fillmore, CA 93015
(805) 524-3355

Centro de Registros Superfund
95 Hawthorne Street
San Francisco, CA 94105
(415) 820-4700

CONTACTOS DE LA EPA

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(415) 972-3242
diaz.alejandro@epa.gov

Holly Hadlock
Gerente del Proyecto
75 Hawthornes St., SFD 8-2
San Francisco, CA 94105
(415) 972-3171
hadlock.holly@epa.gov

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Periodico Vida 07/21/11

APPENDIX B. DOCUMENTS REVIEWED

California Department of Public Health (CDPH), 2010. *Drinking Water Notification Levels and Response Levels: An Overview*. http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Notificationlevels/notificationlevels.pdf December 14, 2010.

Chevron Environmental Management Company (Chevron), 2006. *Status Report for Third Quarter 2006, PCPL Superfund Site*. October 17, 2006.

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_____, 2007d. *Status Report for Third Quarter 2007, PCPL Superfund Site*. October 17, 2007.

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Appendix C
Summary of ARARs Review
3rd Five-Year Review, 2011
PCPL Superfund Site

Requirement	Source	Description	Application
Chemical-Specific	*Federal* Safe Drinking Water Act [42USCA 300 and 40 CFR 141.11-141.16, 141.50-141.51] (Relevant and appropriate, chemical-specific)	Establishes treatment standards for current potential drinking water sources by setting Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Goals (MCLGs), which may be used for cleanup standards at site	Chemicals of interest (COIs) in groundwater should be reduced to concentrations no higher than MCLs in reasonable time frame.
	State: State Water Resources Control Board (SWRCB) Resolution 92-49 (Relevant and appropriate, chemical-specific)	Establishes requirements for the investigation and cleanup and abatement of discharges.	Final cleanup standards for groundwater should be equal to background concentrations unless such levels are technically and economically infeasible to achieve.
	Cal. Safe Drinking Water Act [California Health and Safety Code Section 4010.1 et. seq., Title 22, CCR, DIV. 4, Chapt. 15] (Relevant and appropriate, chemical-specific)	Establishes treatment standards for current potential drinking water sources by setting MCLs which are used as cleanup standards for groundwater.	COIs in groundwater should be reduced to concentrations no higher than MCLs in reasonable time frame. This time frame should consider likelihood of groundwater at study area to be used for beneficial use.
	Chapter 15, California Code of Regulations (CCR),Title 23, Sections 2550.7, 2550.10 (Relevant and appropriate, chemical-specific)	Requires monitoring of the effectiveness of the remedial actions.	Concentrations of COIs in in-situ groundwater will be measured.
	Water Quality Control Plan (Basin Plan) for Los Angeles RWQCB (Relevant and appropriate, chemical-specific)	Establishes beneficial uses and water quality objectives for groundwater and surface waters in the Los Angeles Region as well as implementation plans to meet water quality objectives and protection of beneficial uses.	Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies and water quality objectives to protect those uses. Any activity, including, but not limited to, the discharge of impacted soil or waters or in-situ treatment.
	State: Water Quality Control Plan (Basin Plan) for Los Angeles RWQCB (Applicable, chemical-specific)	Establishes beneficial uses and water quality objectives for groundwater and surface waters in the Los Angeles Region as well as implementation plans to meet water quality objectives and protection of beneficial uses.	Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies and water quality objectives to protect those uses. Any activity, including, but not limited to, the discharge of impacted soil or waters or in-situ treatment.
	Chapter 15, California Code of Regulations (CCR),Title 23, Sections 2550.7, 2550.10 (Relevant and appropriate, chemical-specific)	Requires monitoring of the effectiveness of the remedial actions.	Concentrations of COIs in in-situ and extracted soil vapor will be measured.
	Water Quality Control Plan (Basin Plan) for Los Angeles RWQCB (Applicable, chemical-specific)	Establishes beneficial uses and water quality objectives for groundwater and surface waters in the Los Angeles Region as well as implementation plans to meet water quality objectives and protection of beneficial uses.	Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies and water quality objectives to protect those uses. Any activity, including, but not limited to, the discharge of impacted soil or waters or in-situ treatment.

Requirement	Source	Description	Application
Action-Specific	SWRCB Resolution 88-63 (Applicable, action-specific)	Designates all groundwater and surface water in the State as drinking water sources with specific exceptions.	COIs in groundwater should be reduced to levels protective of beneficial uses within reasonable time frame. This time frame should consider potential of affected groundwater being used as drinking water supply.
	SWRCB Resolution 68-16 (Antidegradation policy) (Applicable, action-specific)	Requires that high quality surface and groundwater be maintained to the maximum extent possible.	This applies to enhanced bioremediation technologies. Residual injected materials or by-products should be below water quality objectives.
	Federal: 40 CFR 122 (The National Pollutant Discharge Elimination System (NPDES): 40 CFR 122.41(d), (e), (j)(1),(j)(3), (j)(4),(1)(6), (m) and (n); 40 CFR 122.44(d), (g), and i); 40 CFR 122.45, (d) (e), (f), and (g); and 40 CFR 122.48(a) and (b) (action-specific)	These sections are the substantive requirements of NPDES permits. The RWQCB may issue an actual NPDES permit for some off-site discharges.	Will be applied to point source discharges of treated groundwater to surface water drainages.
	State: SWRCB Resolution 68-16 (Antidegradation policy) (Applicable, chemical- and action-specific)	Requires that high quality surface and groundwater be maintained to the maximum extent possible.	Applies to discharge of treated groundwater.
	Local: Ventura County Air Pollution Control District Rules 26.2 (action-specific)	Regulates stationary sources of air contaminants and limits emissions from the excavation and treatment of contaminated soil.	A permit is required for any remedial action that has actual or potential to emit air contaminants. The compliance standards for treated soil vapor are contained in the Authority to Construct/Permit to Operate issued by Ventura County Air Pollution Control District Rules 26.2.

APPENDIX D. GROUNDWATER DATA REVIEW

EXECUTIVE SUMMARY

In support of the third five-year review for the PCPL Fillmore site, groundwater data through Fourth Quarter 2010 were reviewed and temporal and spatial trends analyzed for both dissolved benzene plumes. The evaluation concludes that:

- Time series plots demonstrate continued decline in dissolved benzene concentrations over time.
- Time series isopleth maps demonstrate the dissolved plumes are stable and shrinking.
- Benzene mass calculations demonstrate the dissolved plumes are stable and shrinking.
- Geochemical indicators demonstrate biodegradation, specifically sulfate reduction across both dissolved plumes.
- Stable isotope tracers, sulfur and oxygen demonstrate that sulfate reducing conditions are participating in hydrocarbon biodegradation.
- Stable isotope ratios for carbon ($^{13}C/^{12}C$) vs. hydrogen ($^{2}H/^{1}H$) demonstrate a biodegradation signature.
- Vertical concentration profiles of soil vapor demonstrate natural attenuation within the vadose zone above the groundwater plumes such that a subsurface vapor migration exposure pathway does not present a risk.
- Benzene mole fraction measurements in light non-aqueous phase liquid (LNAPL) in the smear zone demonstrate a reduction over time.

The multiple lines of evidence provided in this Appendix, lend strong support for the recommended groundwater remedies for each plume discussed in Section VII, Technical Assessment.

CONCENTRATION VS. TIME

Time series plots of dissolved benzene concentrations (1992-2010) demonstrate declining trends in groundwater monitoring wells (Attachment A). Currently, the maximum benzene concentration is 350 µg/L in the southern plume and 84 µg/L in the northern plume. These maximum concentrations represent a reduction of greater than 90% compare to dissolved benzene concentrations prior to the groundwater treatment system (GWTS) and soil vapor extraction (SVE).

PLUME STABILITY

Time series isopleth maps (1994-2010) demonstrate that the dissolved plumes are stable and shrinking (Attachment B). Natural attenuation is maintaining the footprint and the dissolved plumes have not migrated since the treatment systems were shut off in 2002. Applying a methodology similar to Ricker (2008), isopleth map grid files were used to calculate average dissolved benzene concentration, benzene mass, and location of the center of mass for each plume (Attachment C). Concentration and mass for the

northern plume have significantly declined over time and the plume center of mass has migrated upgradient in recent years along the plume centerline (Attachment C-2). Concentration and mass for the southern plume have been relatively stable over time and the plume center of mass has remained stable (Attachment C-3). A temporary upswing in dissolved benzene concentration occurred in the southern plume in 2005 due to heavy rainfall that raised the water table to the historic high and increased the smear zone. However, concentrations subsequently declined and the average benzene concentration in the southern plume is currently less than it was in 2002 when the treatment systems were shut off.

BIODEGRADATION – SULFATE REDUCTION

Biodegradation of petroleum hydrocarbons occurs when naturally occurring microorganisms metabolize the hydrocarbons for growth. Microorganisms obtain energy by catalyzing oxidation-reduction (redox) reactions between chemical compounds that produce electrons (electron donors) and compounds that consume electrons (electron acceptors). Groundwater geochemical indicator parameters (i.e. electron acceptors) demonstrate that sulfate reduction is the dominant biodegradation mechanism across both dissolved plumes. Sulfate distribution maps and transect plots (Attachment D) clearly show sulfate depleted within the dissolved plumes relative to groundwater upgradient and downgradient.

Chevron partnered with the University of California Davis (UC Davis) to research the microbial community in groundwater within the dissolved benzene plumes. Bio-Traps® provided by Microbial Insights Inc were deployed in several wells to collect biomass from the impacted aquifer over several weeks for study with molecular biological tools. UC Davis concluded that the native microbial community is able to metabolize benzene (Mackay & North 2011). UC Davis did not identify a clear relationship between sulfate concentration and the bio-trap results, however, their results will provide a baseline to compare changes during and post remediation.

BIODEGRADATION – COMPOUND SPECIFIC ISOTOPE ANALYSIS (CSIA)

Compound Specific Isotope Analysis (CSIA) is a method to measure isotope ratios to evaluate the occurrence of biodegradation (USEPA 2008). Stable isotope ratios can change as a result of destructive processes (biological and chemical transformations), causing isotopic fractionation. Degradative reactions commonly proceed faster for a lighter isotope compared to its heavier isotope, because the lighter isotope is more rapidly metabolized by microorganisms. As a result, the remaining compound becomes enriched in the heavier isotope. Some non-destructive or physical processes (dissolution, dispersion, sorption, dilution, volatilization) can result in measurable changes in carbon isotope ratios, however the magnitude of such changes is insignificant compared to the signatures of biodegradation. Therefore, CSIA can distinguish contaminant mass loss due to biological transformation versus loss due to physical processes.

Groundwater samples from transects along the centerlines of both dissolved plumes at the Fillmore site were collected in August 2006, May 2007, February 2008, and November 2010, and sent to the University of Oklahoma for CSIA. Carbon ($^{13}C/^{12}C$) and hydrogen ($^{2}H/^{1}H$) isotope ratios measured for benzene demonstrated a biodegradation signature (Attachment E) with enrichment shifts (slope of the plot) consistent with literature values for anaerobic biodegradation (Fischer et al. 2007, Mancini et al. 2003, Van Breukelen 2007).

VAPOR INTRUSION POTENTIAL

An investigation was conducted in 2006 and 2007 to characterize subsurface vapor conditions above the dissolved benzene plumes (URS 2007). Vertical profiles of soil vapor concentrations from groundwater to ground surface demonstrated natural attenuation occurring in the vadose zone (Attachment F). Vapor concentrations at depths near the surface (i.e., 7 feet below ground surface) were also compared against California Human Health Screening Levels (CHHSLs, DTSC 2004) for shallow soil gas and none exceeded the corresponding CHHSLs (URS 2007). Therefore, soil vapor results demonstrate natural attenuation within the vadose zone above the groundwater plumes such that a subsurface vapor migration exposure pathway does not present a risk.

Chevron partnered with the University of British Columbia (UBC) to study CO_2 effluxes in surficial soil—an innovative method for delineating vadose zone hydrocarbon sources at a site. UBC measured CO_2 effluxes along three transects within the southern plume area and at background locations (Sihota & Mayer 2010). The results did not indicate elevated vadose zone contamination at the site and UBC concluded that there is limited risk from vapor intrusion in the vicinity of the southern groundwater plume.

SMEAR ZONE

The source of the dissolved benzene is light non-aqueous phase liquid (LNAPL) in the smear zone that is estimated to be near a residual saturation (% of pore volume). The mole fraction of benzene in the LNAPL analyzed from well EW-4 in the southern plume has declined from about 1.5% in 1994 to 0.21% in 2009 (Attachment G); a significant reduction in source strength.

CONCLUSIONS

The groundwater data review supports the findings and recommendations in the RI/FS (URS 2011). As noted in Section VII (Technical Assessment), the northern plume already meets the performance goal (maximum benzene concentration <100 µg/L) put forth in the RI/FS for transition to MNA with institutional controls as the final remedy. Ongoing, sufficient electron acceptor flux (ex. sulfate) in groundwater and the CSIA biodegradation signature suggest the sustainability of MNA at the site (ASTM 1998, Wiedemeier et al. 1999, Van Ras et al. 2007). The recommended alternative in the RI/FS for the southern plume is sequential implementation of air sparging to treat the LNAPL smear zone, followed by circulation of existing sulfate-rich groundwater to enhance biodegradation of the dissolved plume, and MNA as the final remedy. This sequential approach takes advantage of the strengths of each technology in concert with site-specific conditions in the southern plume.

An optimized, performance-oriented groundwater monitoring network is recommended in the RI/FS that includes additional monitoring wells to fill data gaps and reduction of monitoring wells to eliminate redundant data points or data points that are no longer useful (i.e., well locations that have met cleanup goals for many years). Based on the data review and trend analysis, the frequency of groundwater monitoring should be reduced to semi-annually for the southern plume and annually for the northern plume.

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ATTACHMENTS

A. Dissolved Benzene Time Series Plots – 1992-2010

B. Dissolved Benzene Isopleth Maps – 1994-2010

C. Dissolved Benzene Mass Calculations – 1999-2010

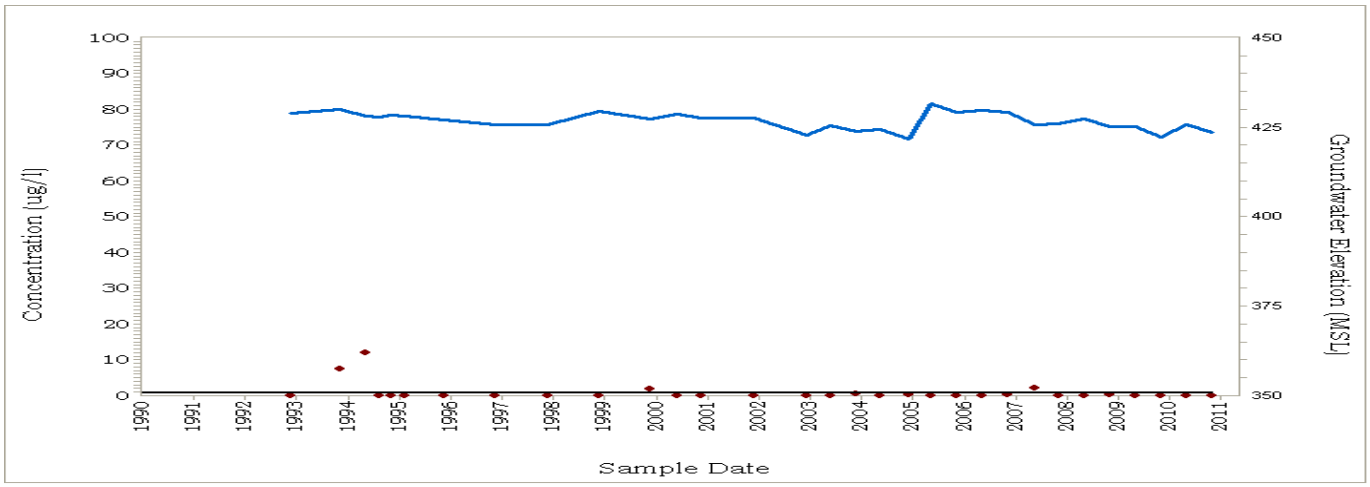
D. Sulfate Distribution Plots – 2010

E. CSIA – carbon ($^{13}C/^{12}C$) vs. hydrogen ($^{2}H/^{1}H$) Results – 2006-2010

F. Vertical Soil Vapor Concentration Profiles – 2007

G. LNAPL Benzene Mole Fraction Plot – 1994-2009

MW-01S



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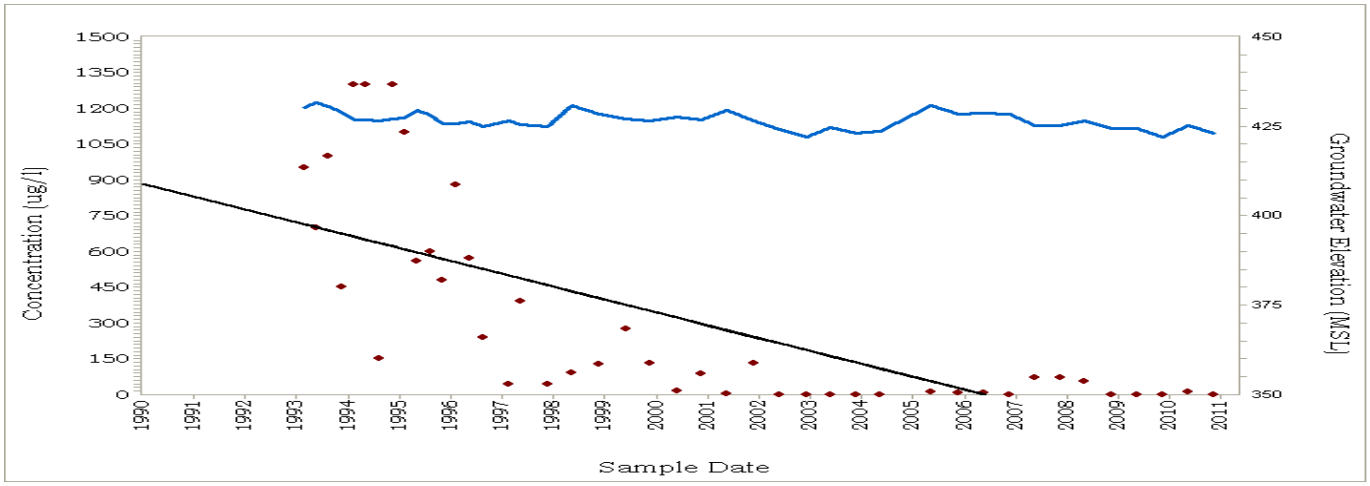

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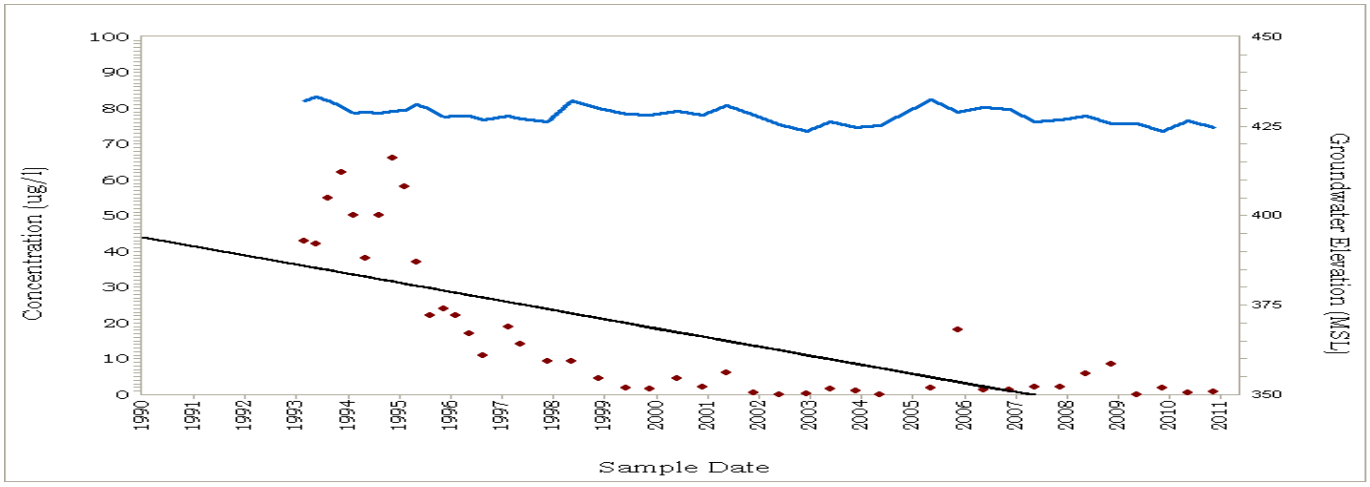
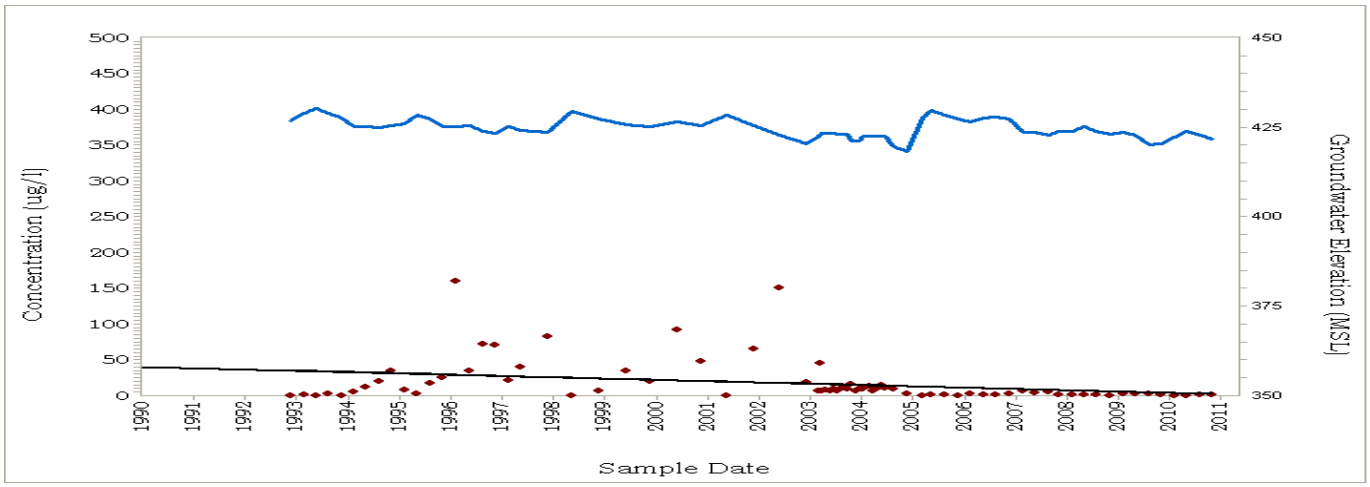


Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6a. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site

MW-06S



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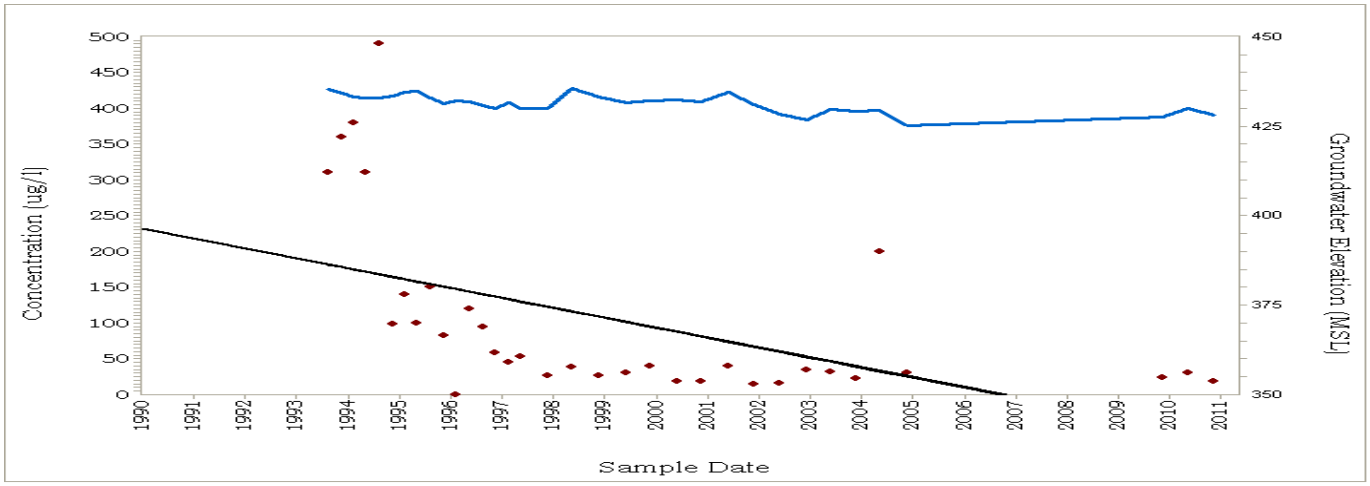

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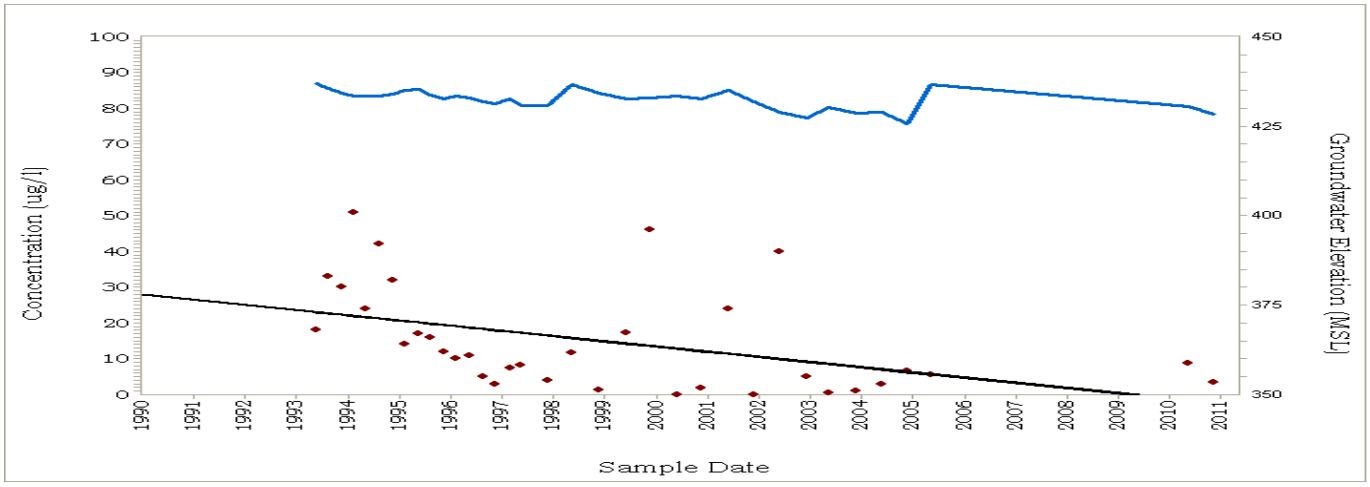
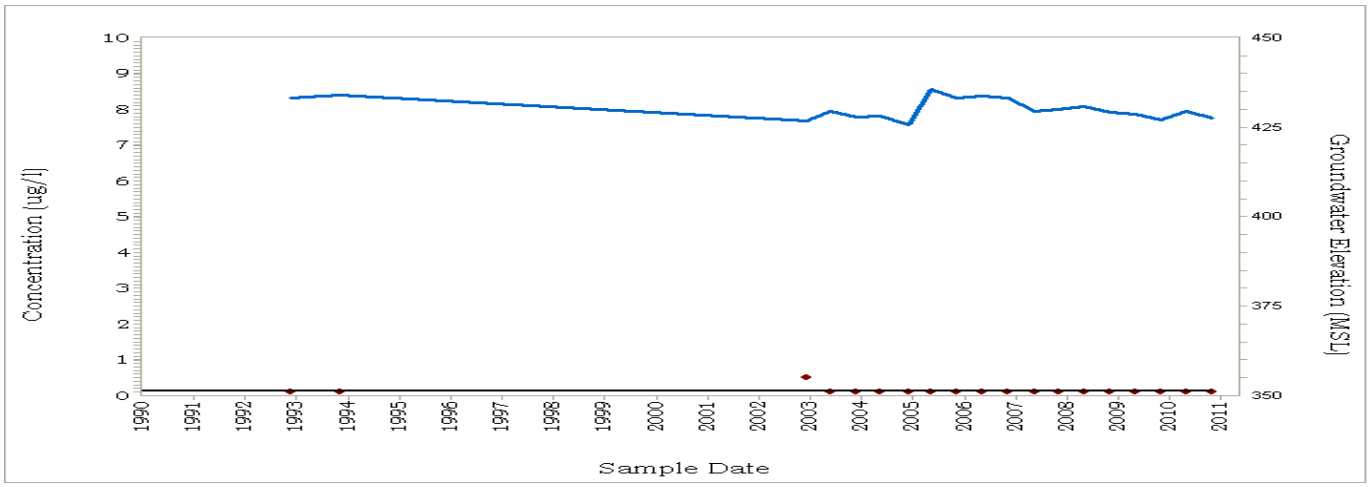


Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6b. Historical Benzene Results for Fillmore Pacific Coast Pipeline Site

MW-11S



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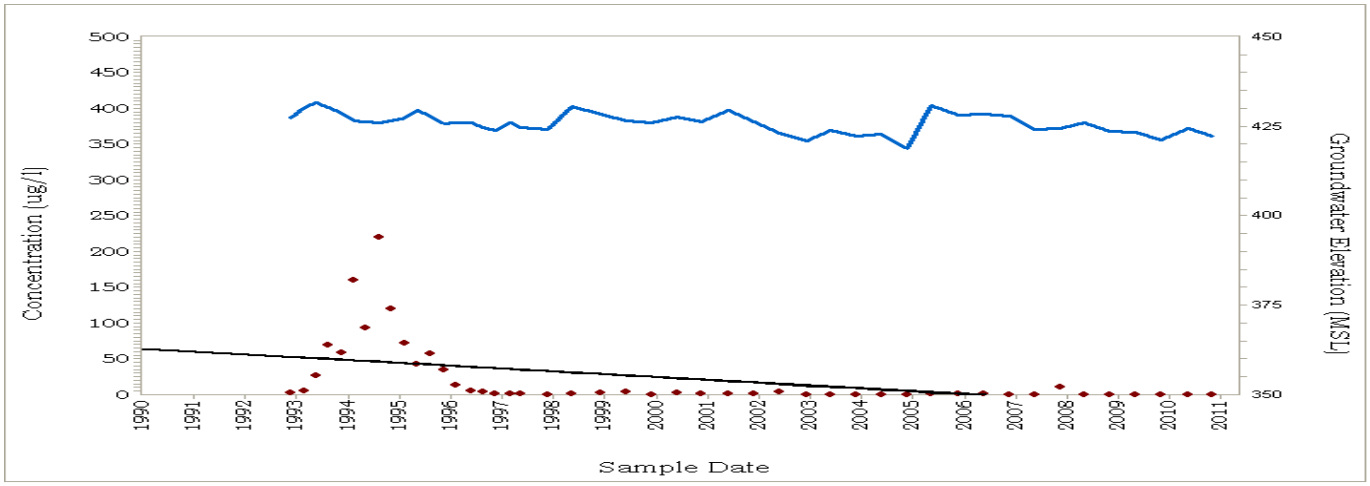

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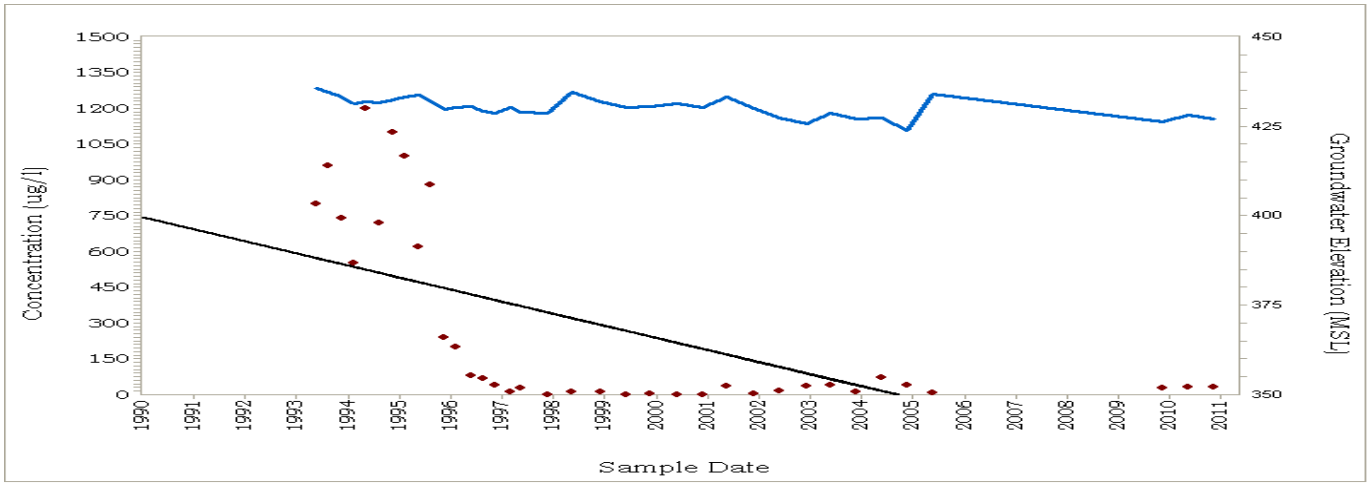

Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6c. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site

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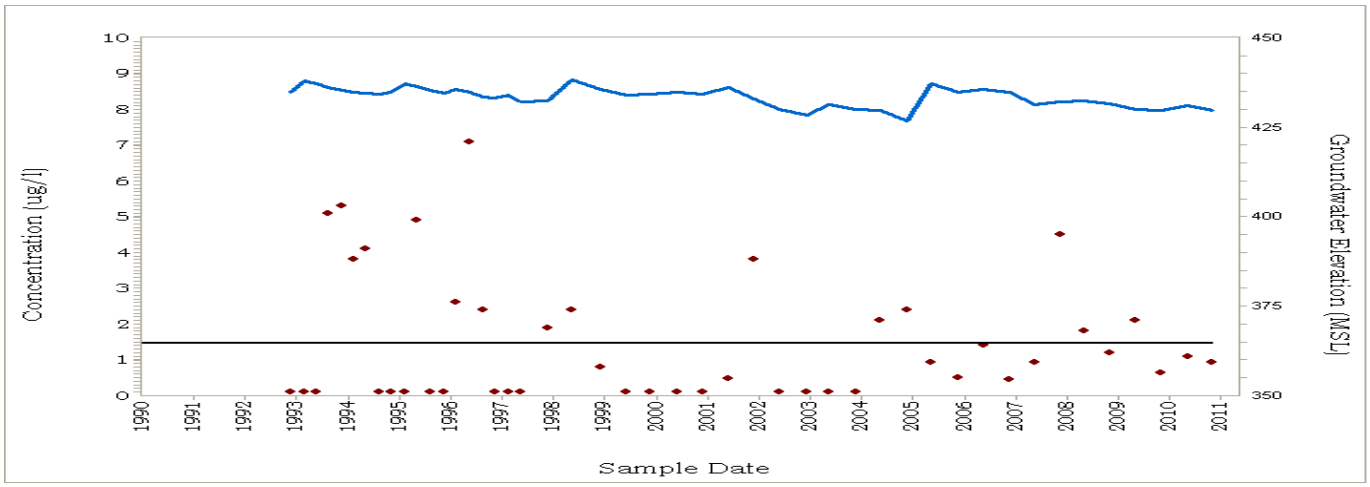

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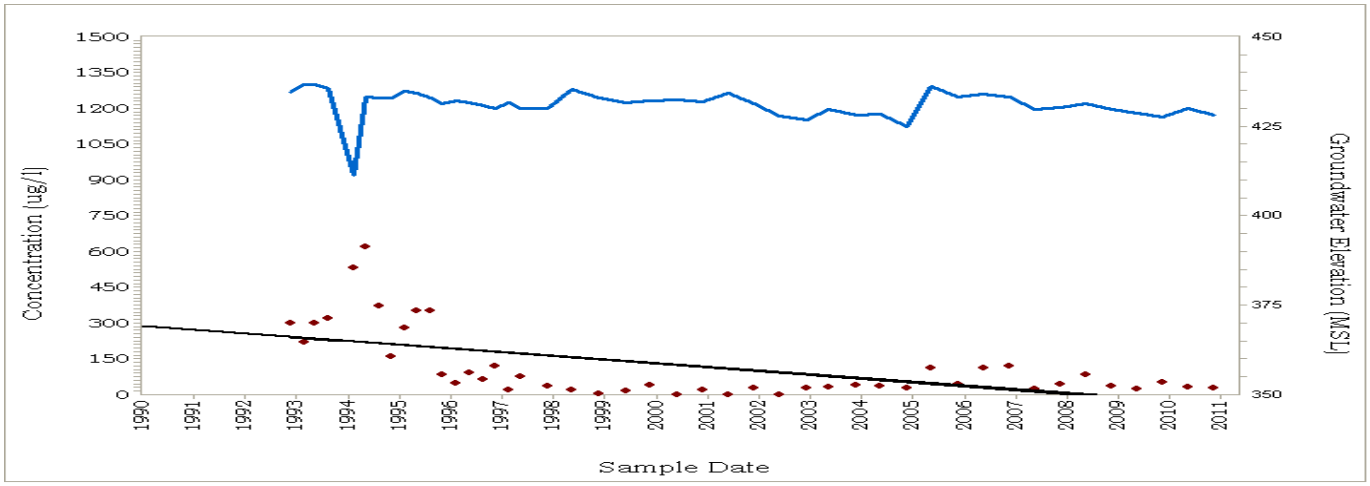

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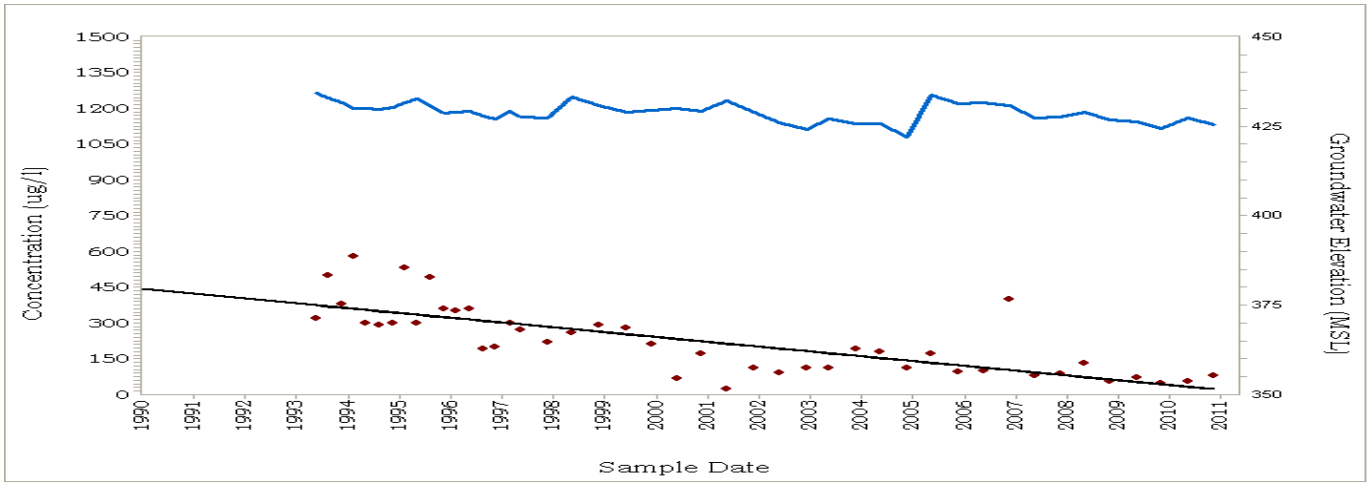
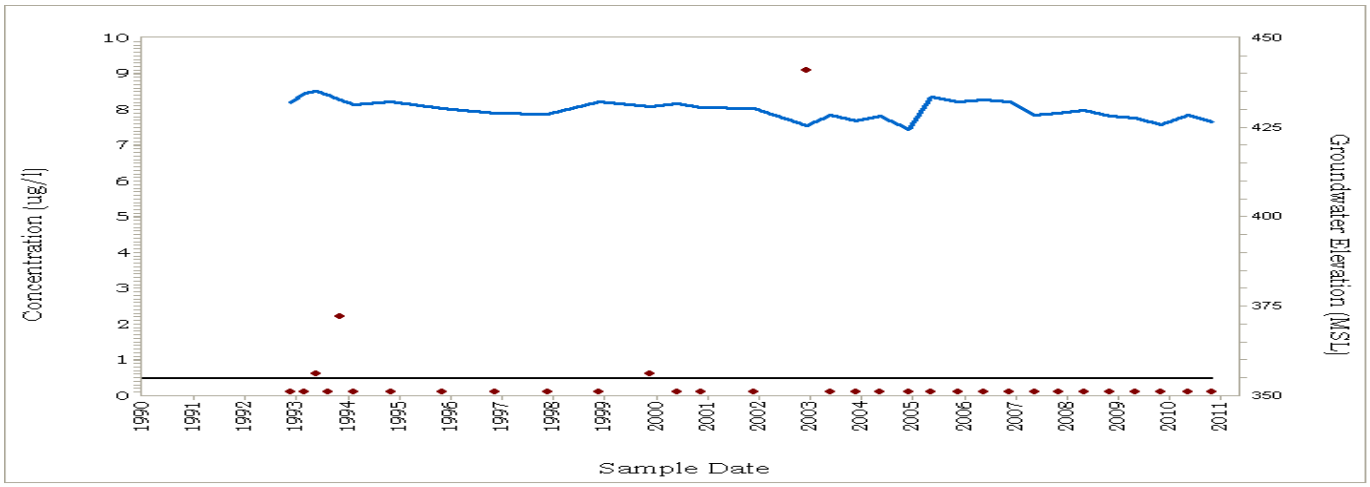


Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6d. Historical Benzene Results for Fillmore Pacific Coast Pipeline Site

MW-25S



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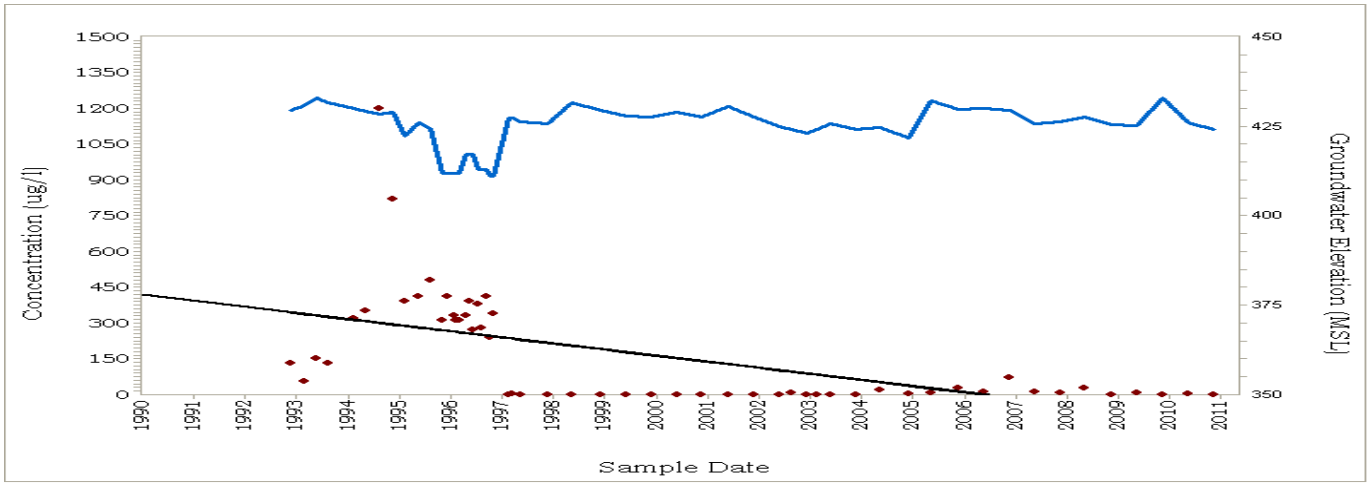

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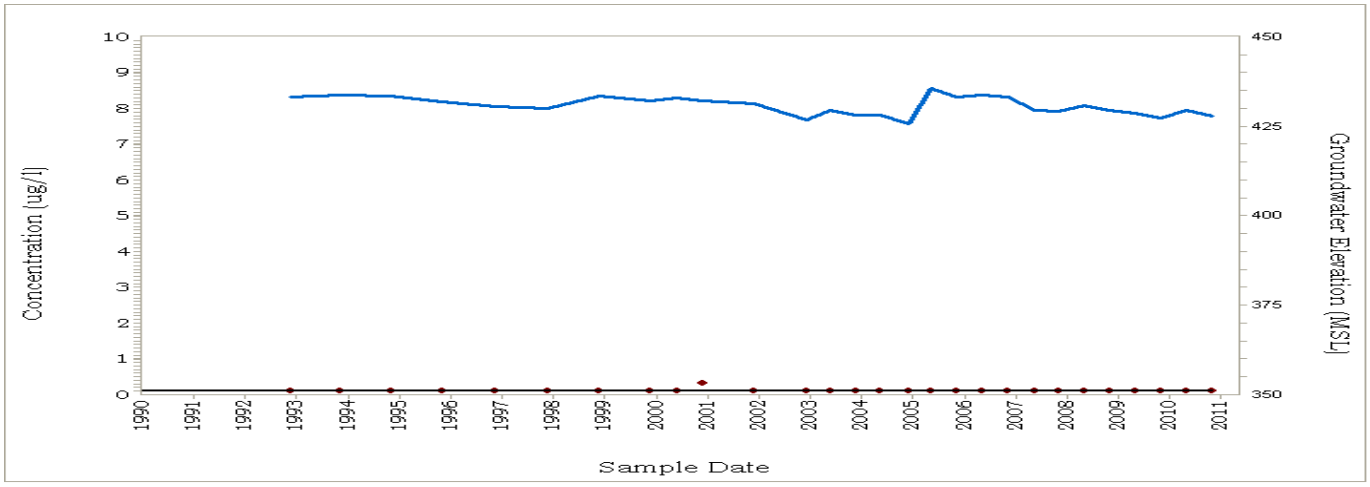
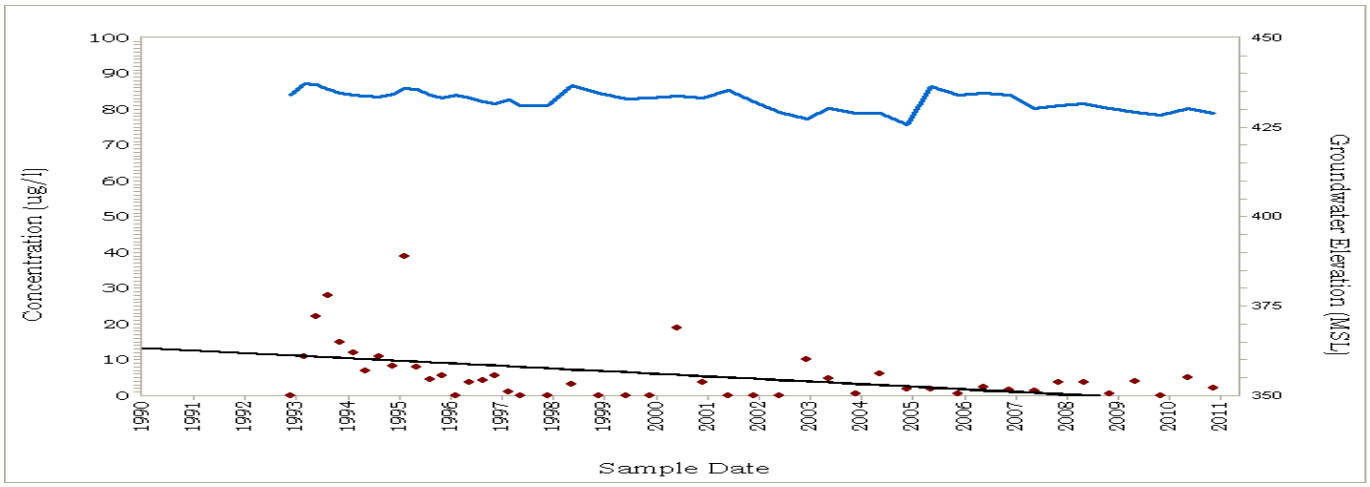


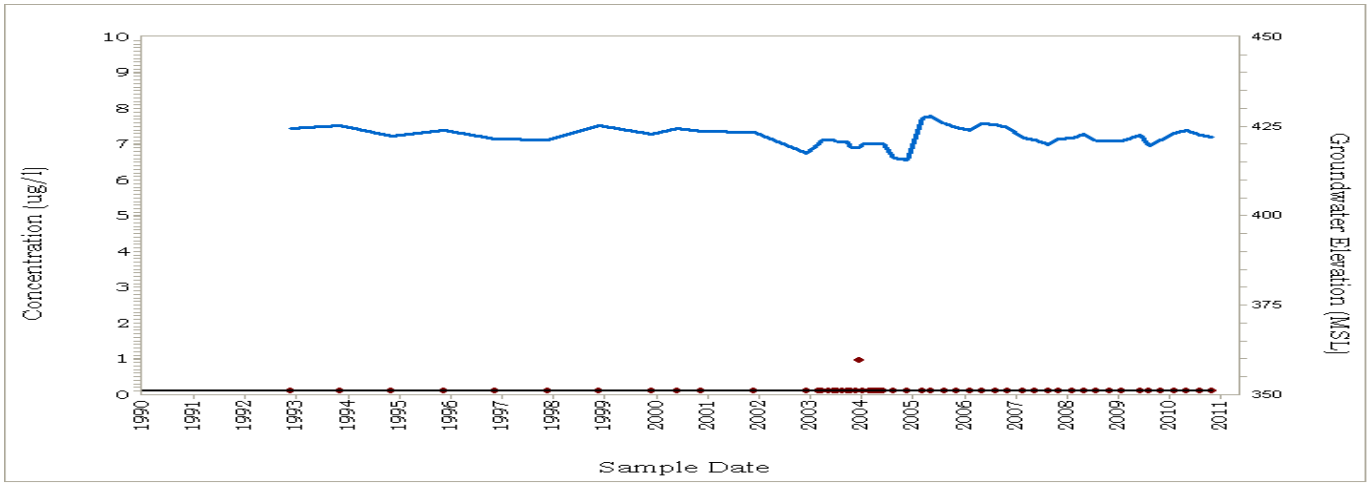
Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6e. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site

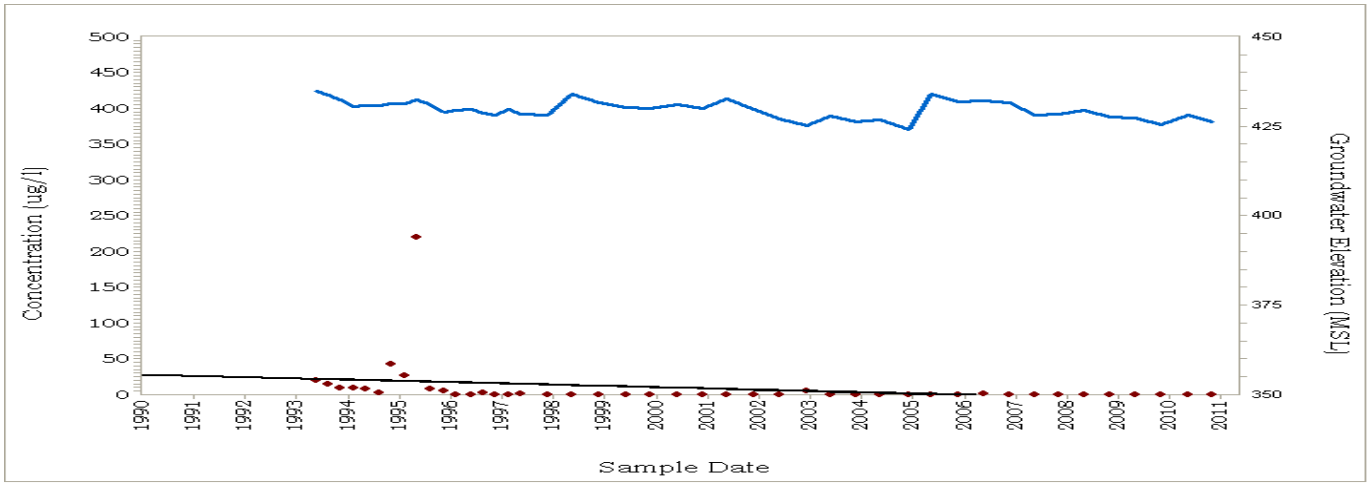
MW-30S



MW-35S



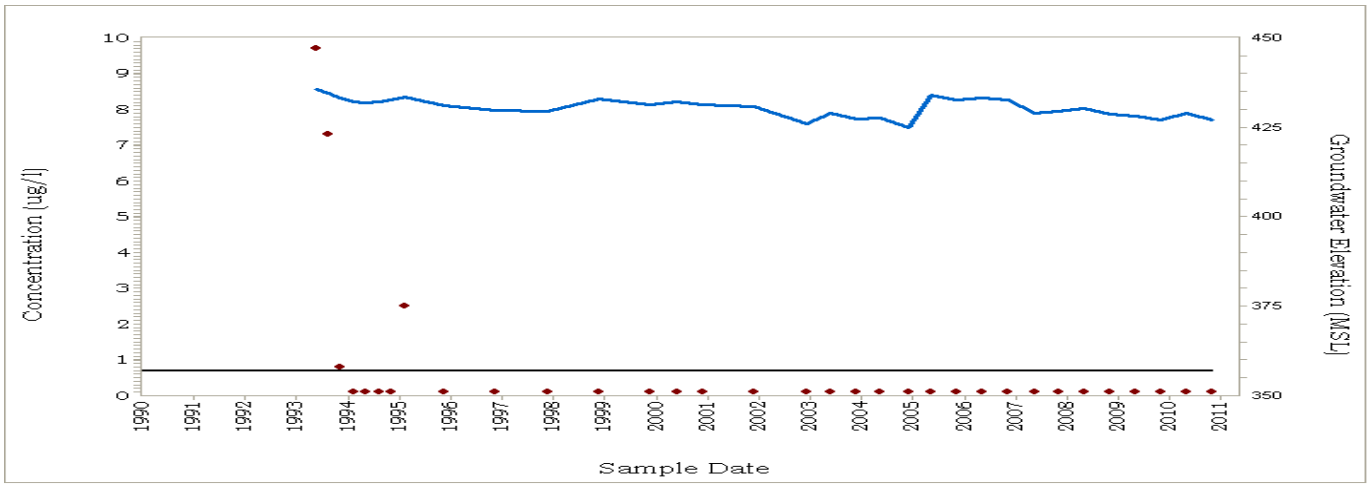
MW-37S



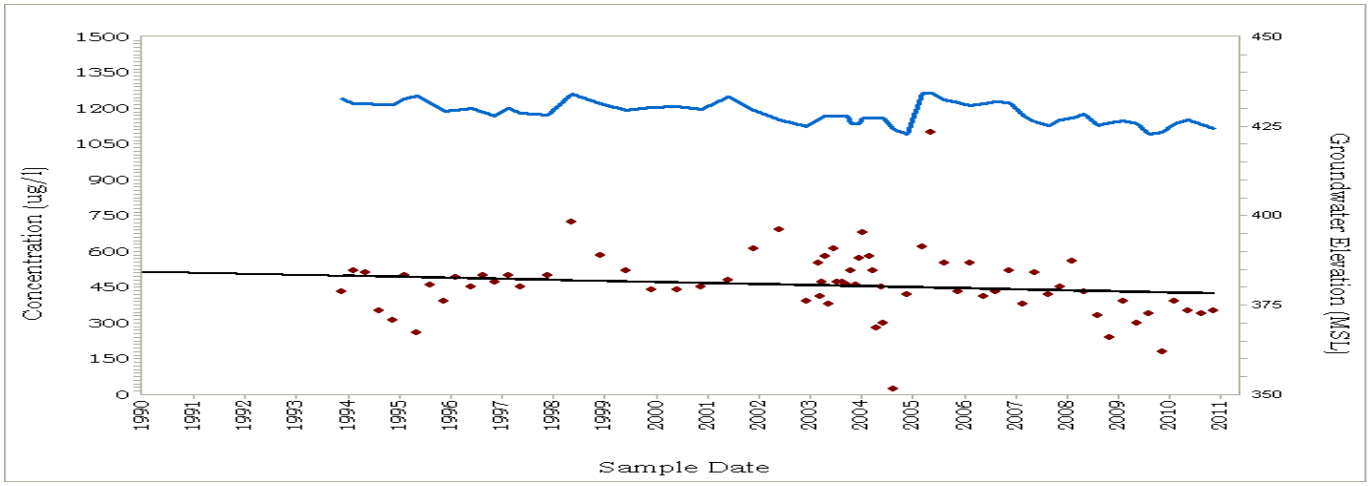
Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6f. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site

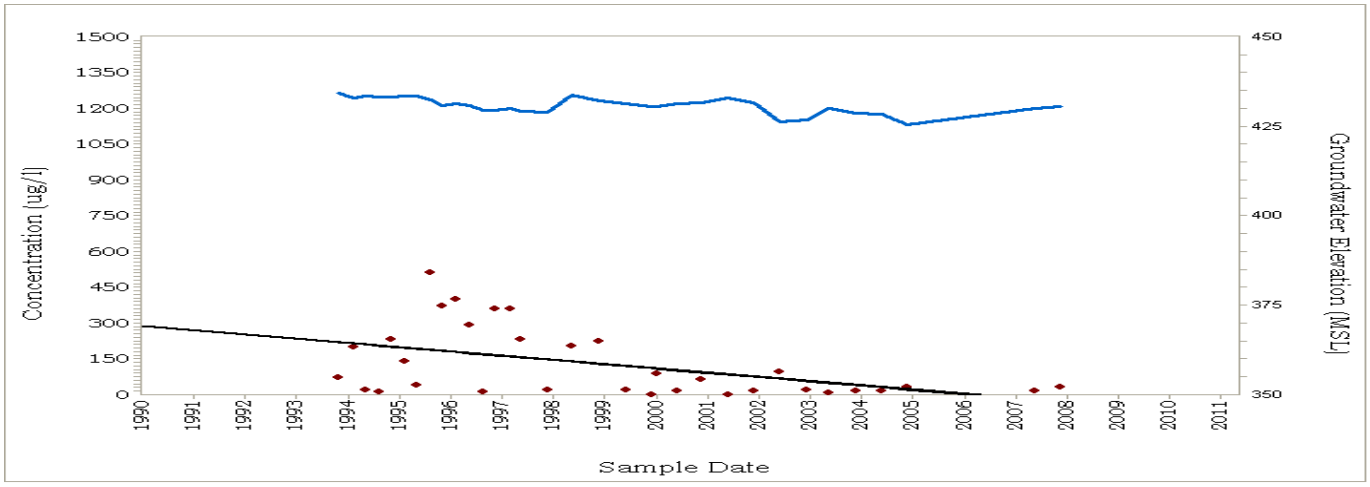
MW-38S



MW-39S



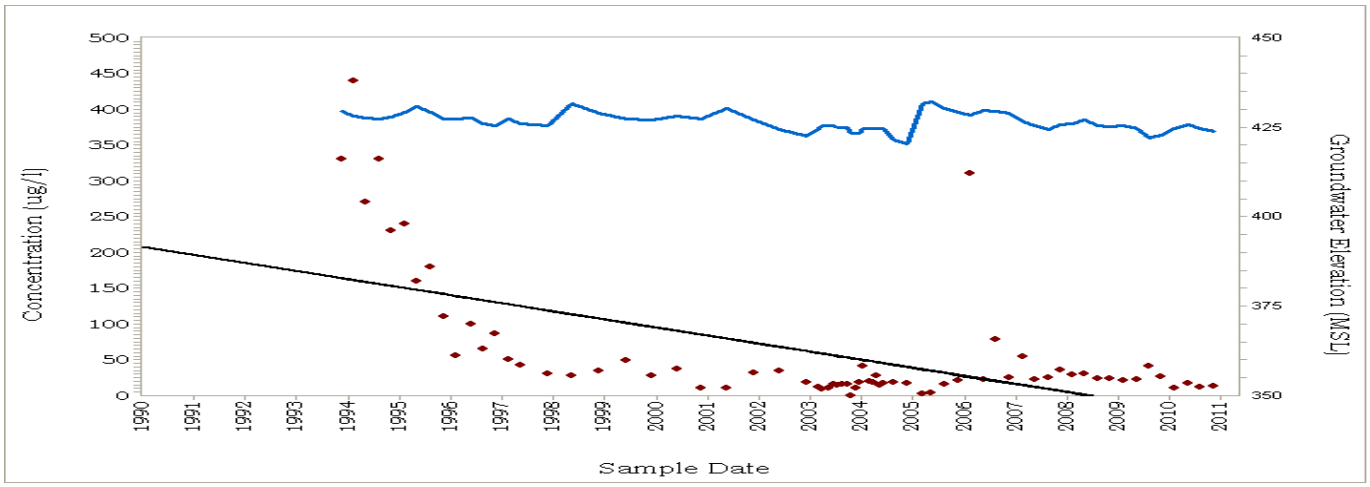
MW-40S



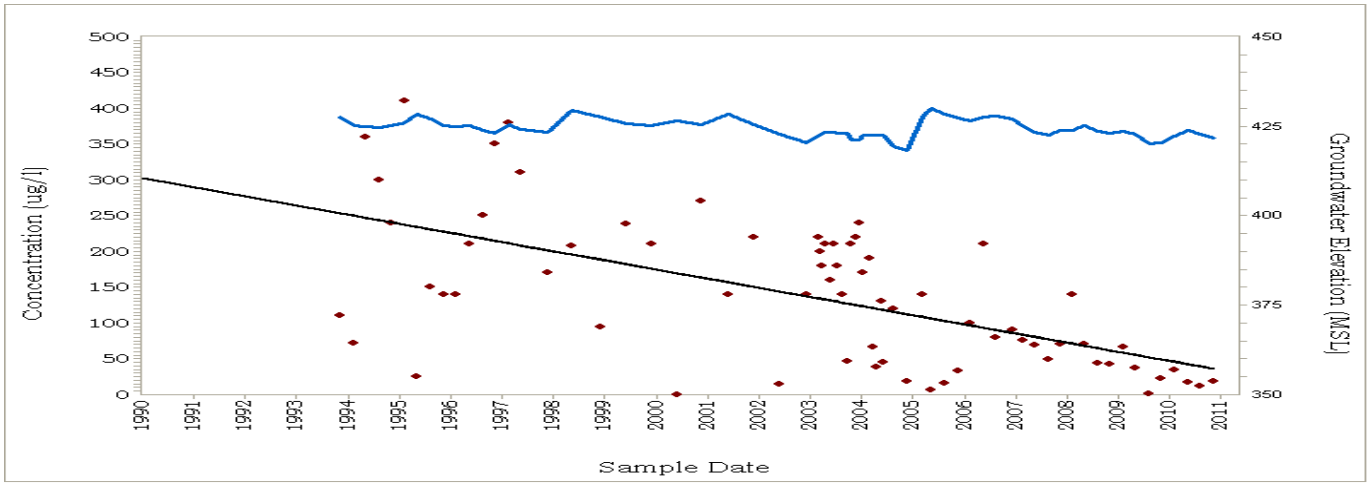
Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6g. Historical Benzene Results for Fillmore Pacific Coast Pipeline Site

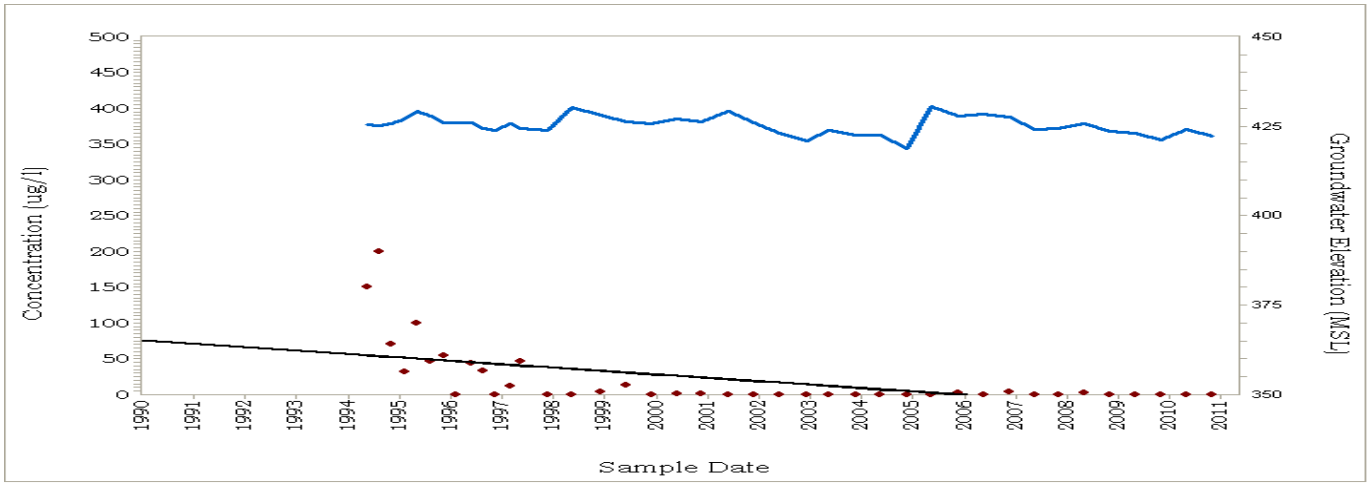
MW-41S



MW-42S



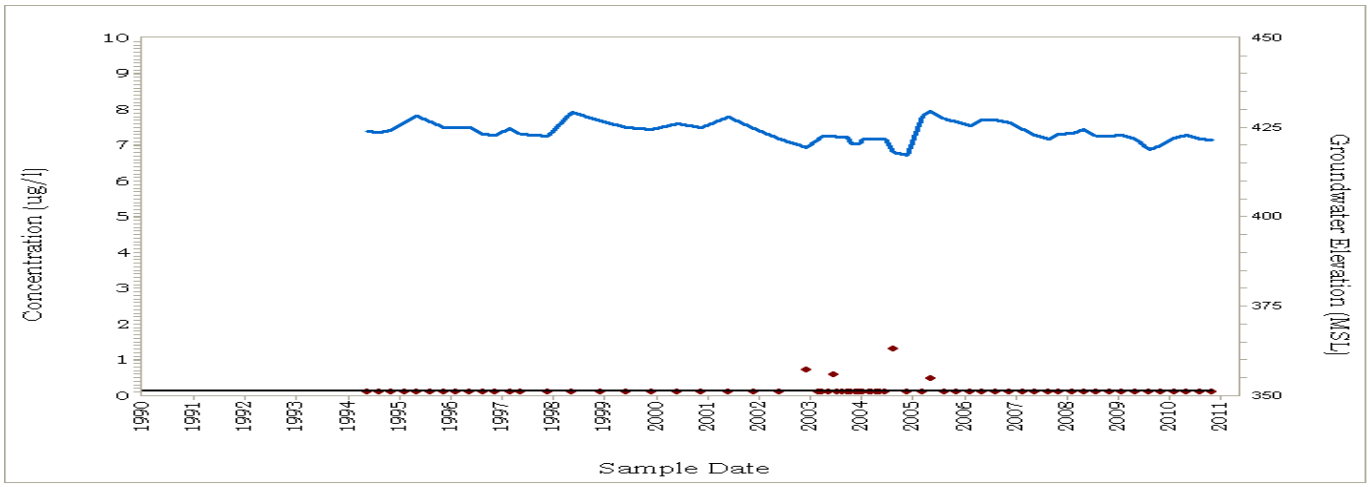
MW-43S



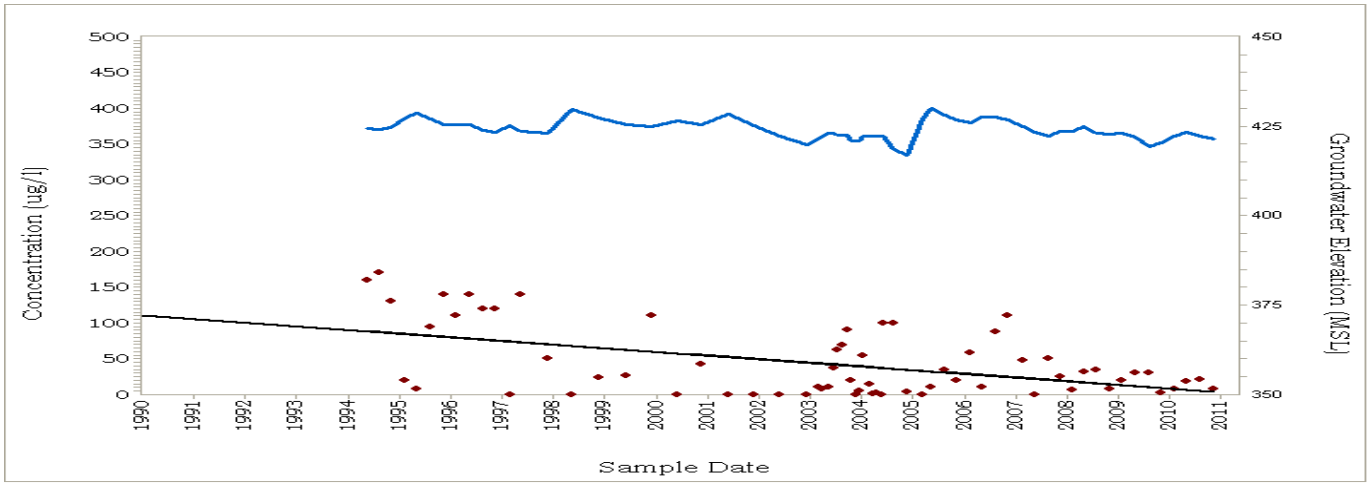
Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6h. Historical Benzene Results for Fillmore Pacific Coast Pipeline Site

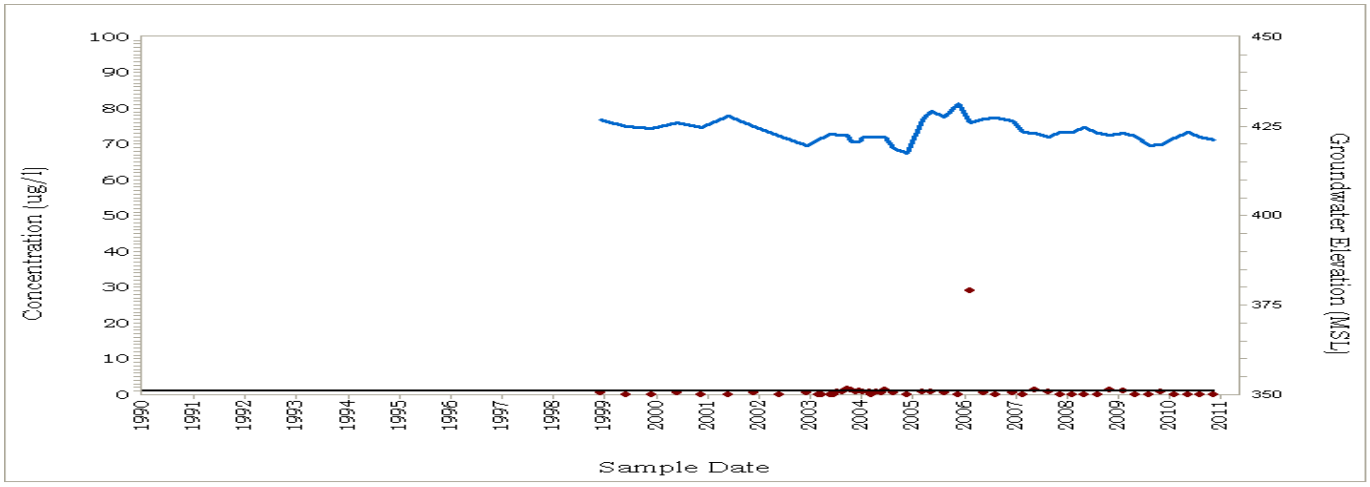
MW-44S



MW-45S



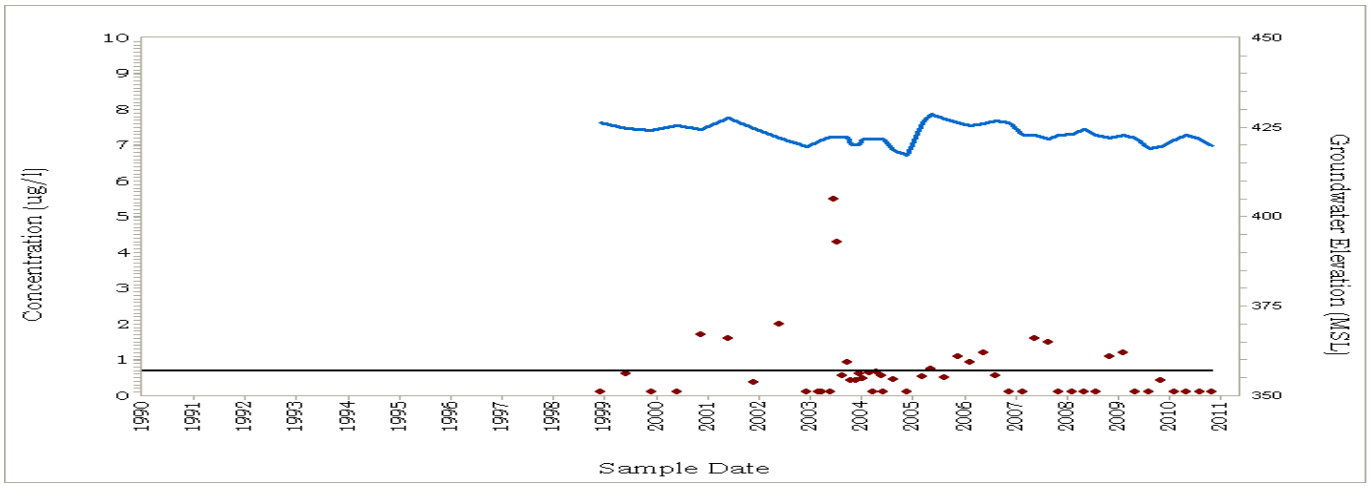
MW-48S



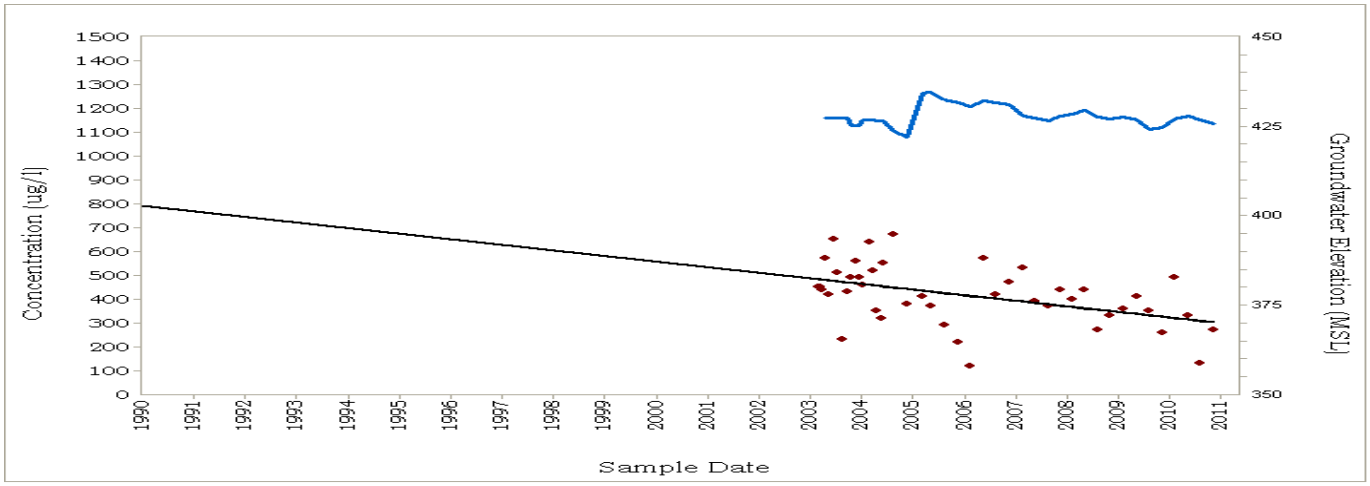
Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6i. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site

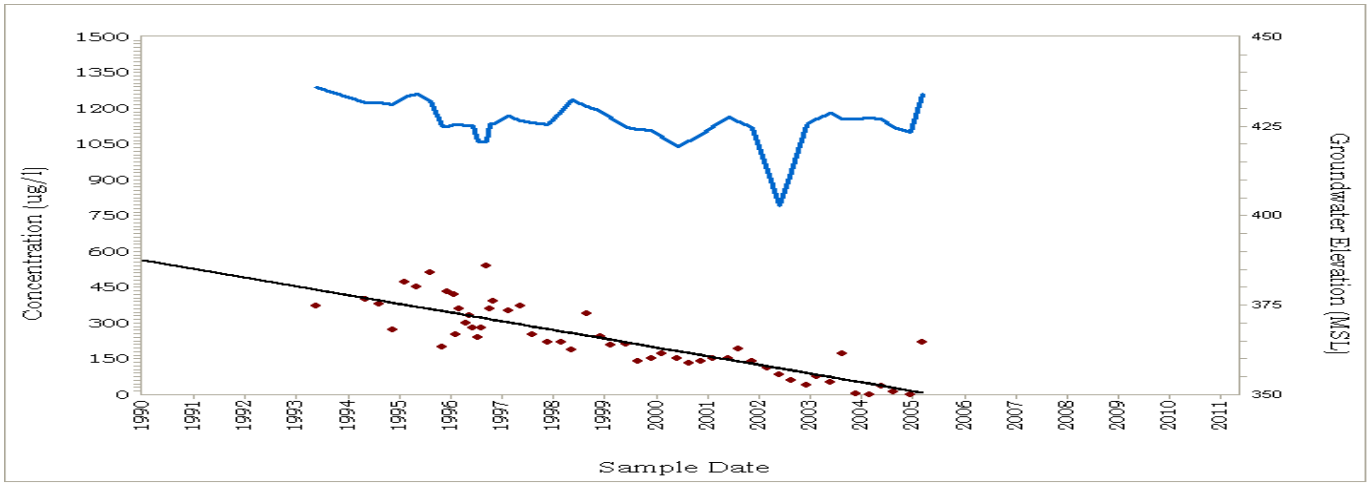
MW-49S



MW-50S



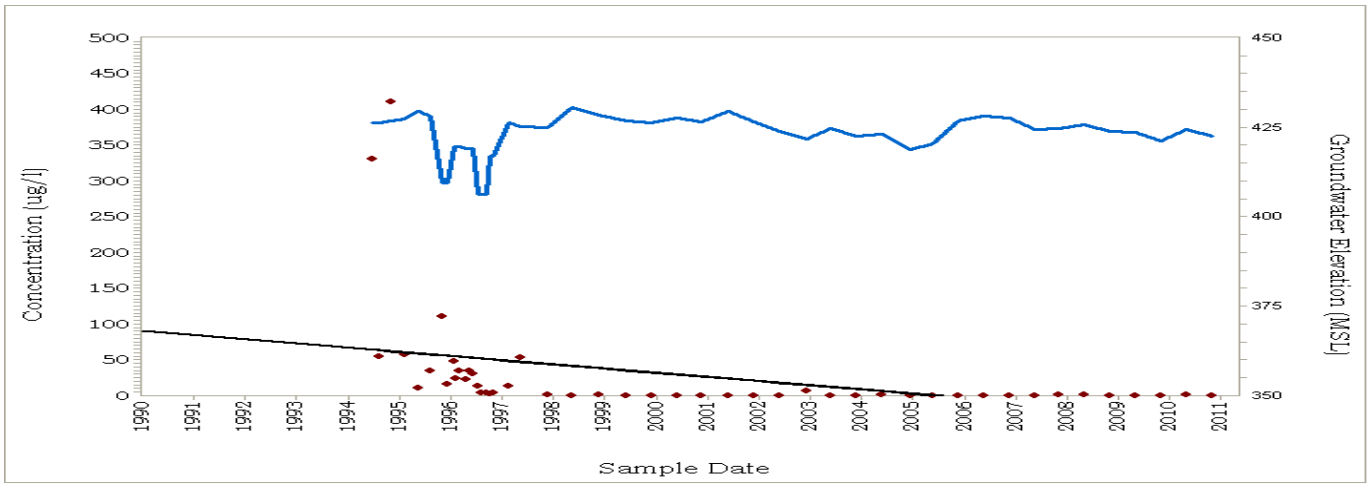
EW-01



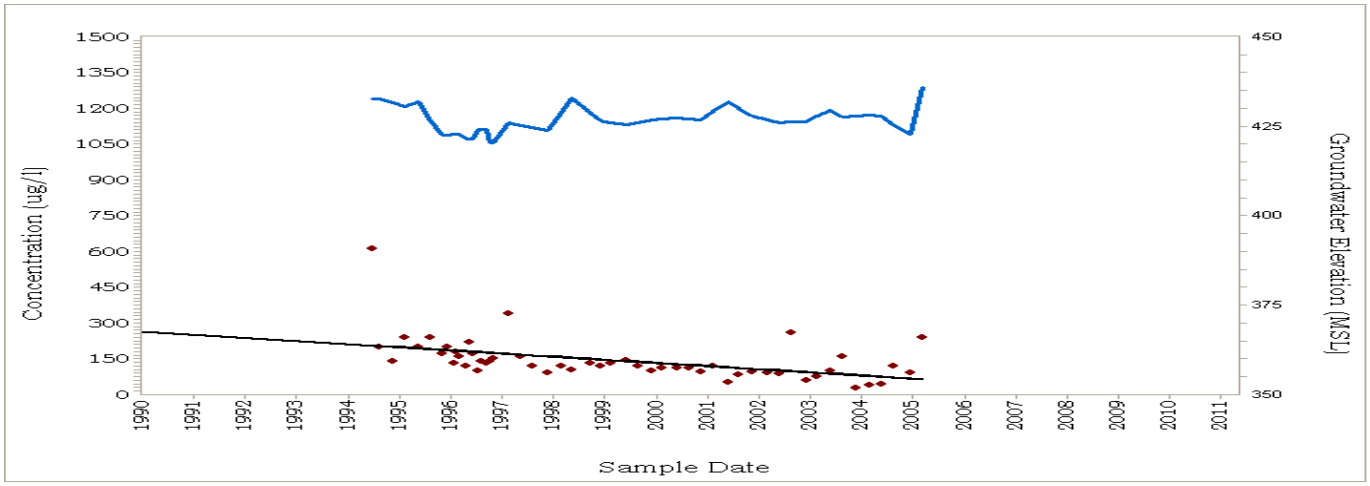
Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 6j. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site

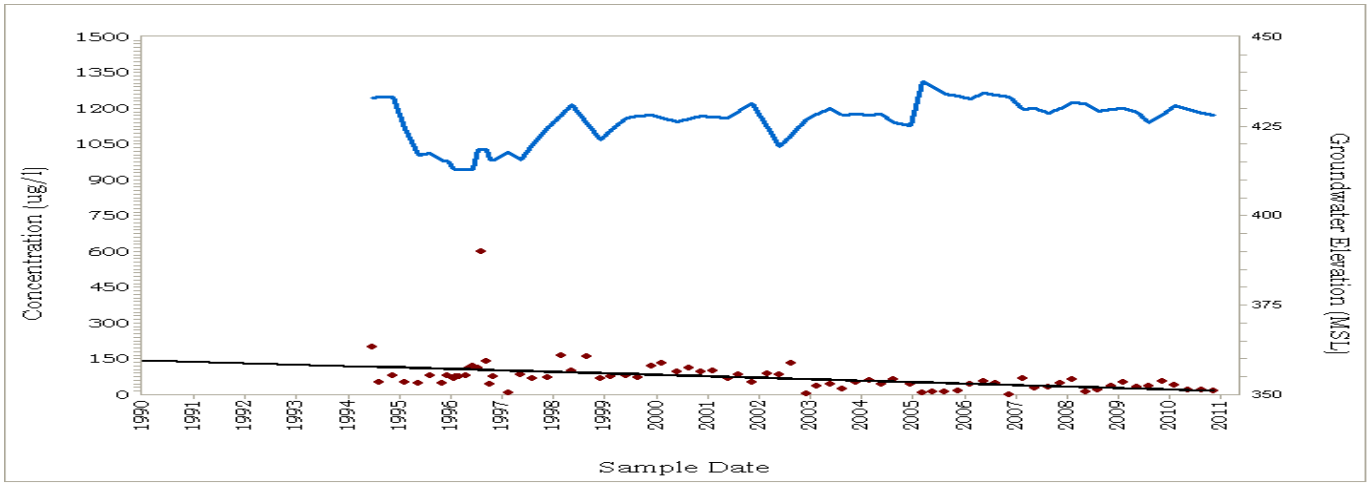
EW-02



EW-04



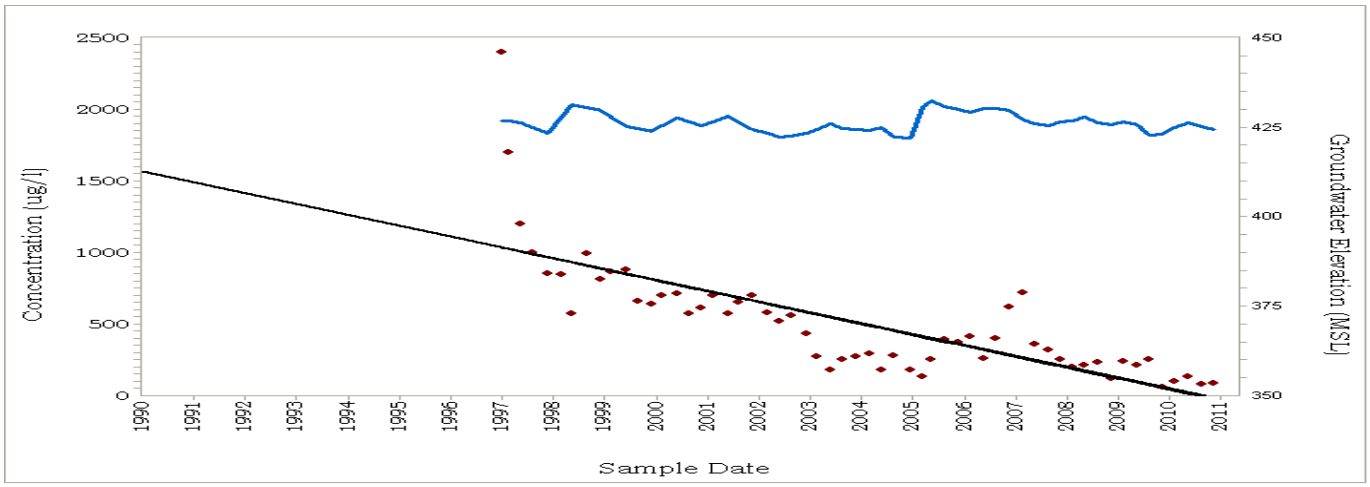
EW-05



Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

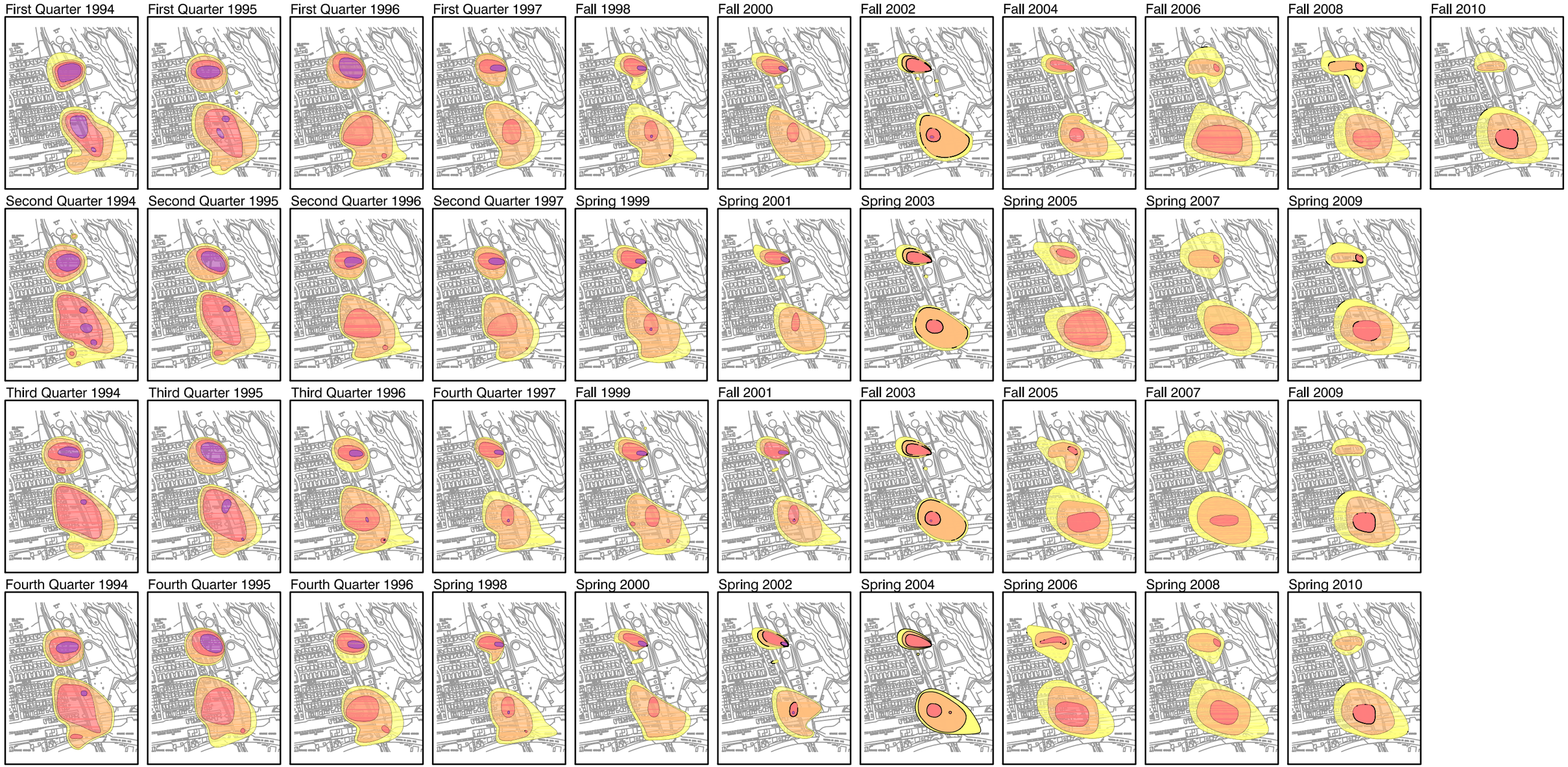
Figure 6k. Historical Benzene Results for Fillmore Pacific Coast Pipeline Site

EW-P2



Measured Groundwater Elevation (MSL)
Calculated Benzene Trend
Benzene Concentration

Figure 61. Historical Benzene Results
for Fillmore Pacific Coast Pipeline Site



EXPLANATION

- Benzene Concentration Greater than 500 ppb
- Benzene Concentration Between 100 and 500 ppb
- Benzene Concentration Between 10 and 100 ppb
- Benzene Concentration Between 1 and 10 ppb

ppb = parts per billion

NOTES

Computer assisted contouring replaced hand-drawn contours beginning in Spring 2005. Although the low-level (yellow) contour appears to have changed, actual well concentrations have remained consistent and continue to decline (see Attachment A).

0 750 1,500
SCALE IN FEET

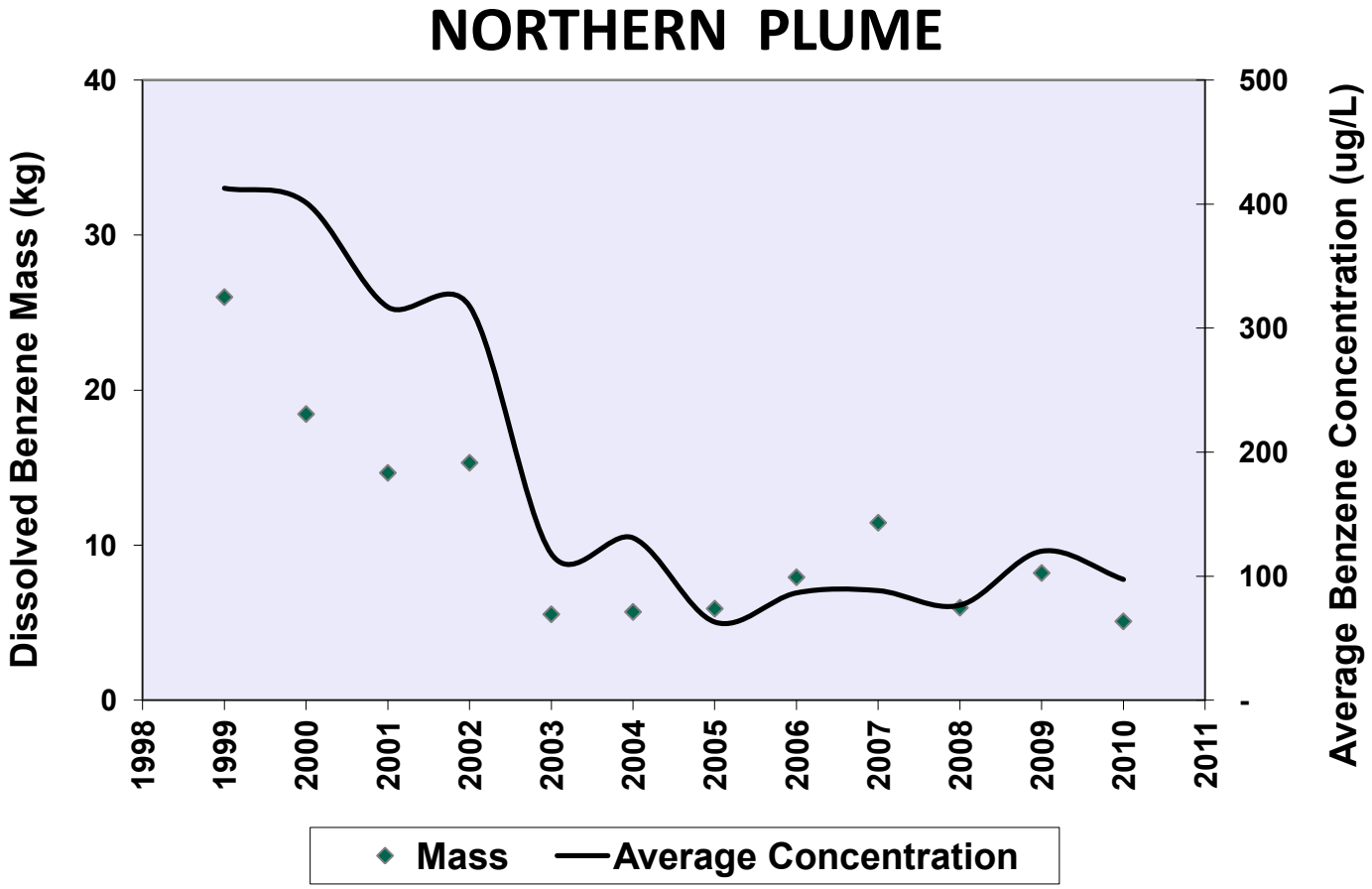
N

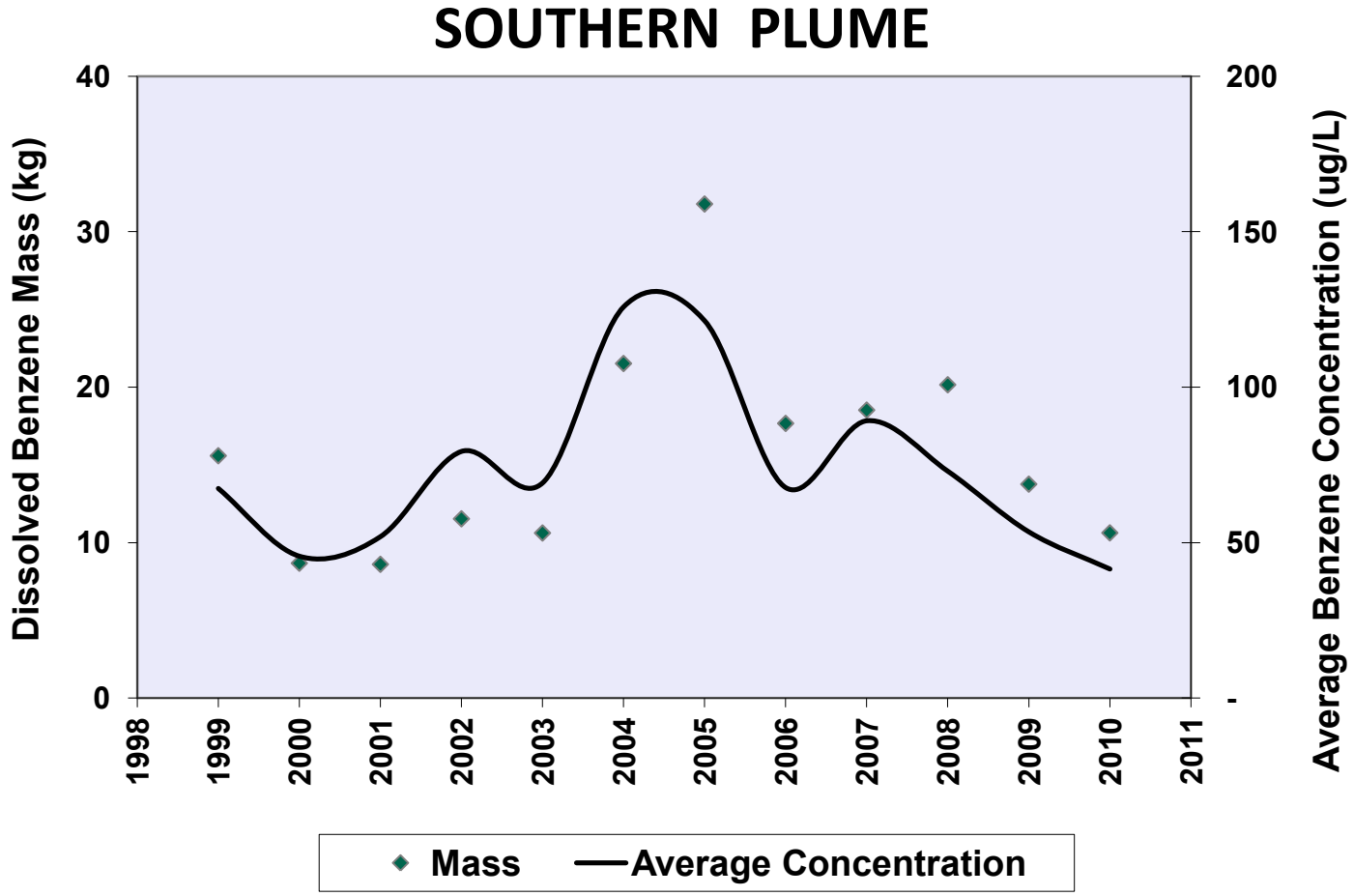
URS

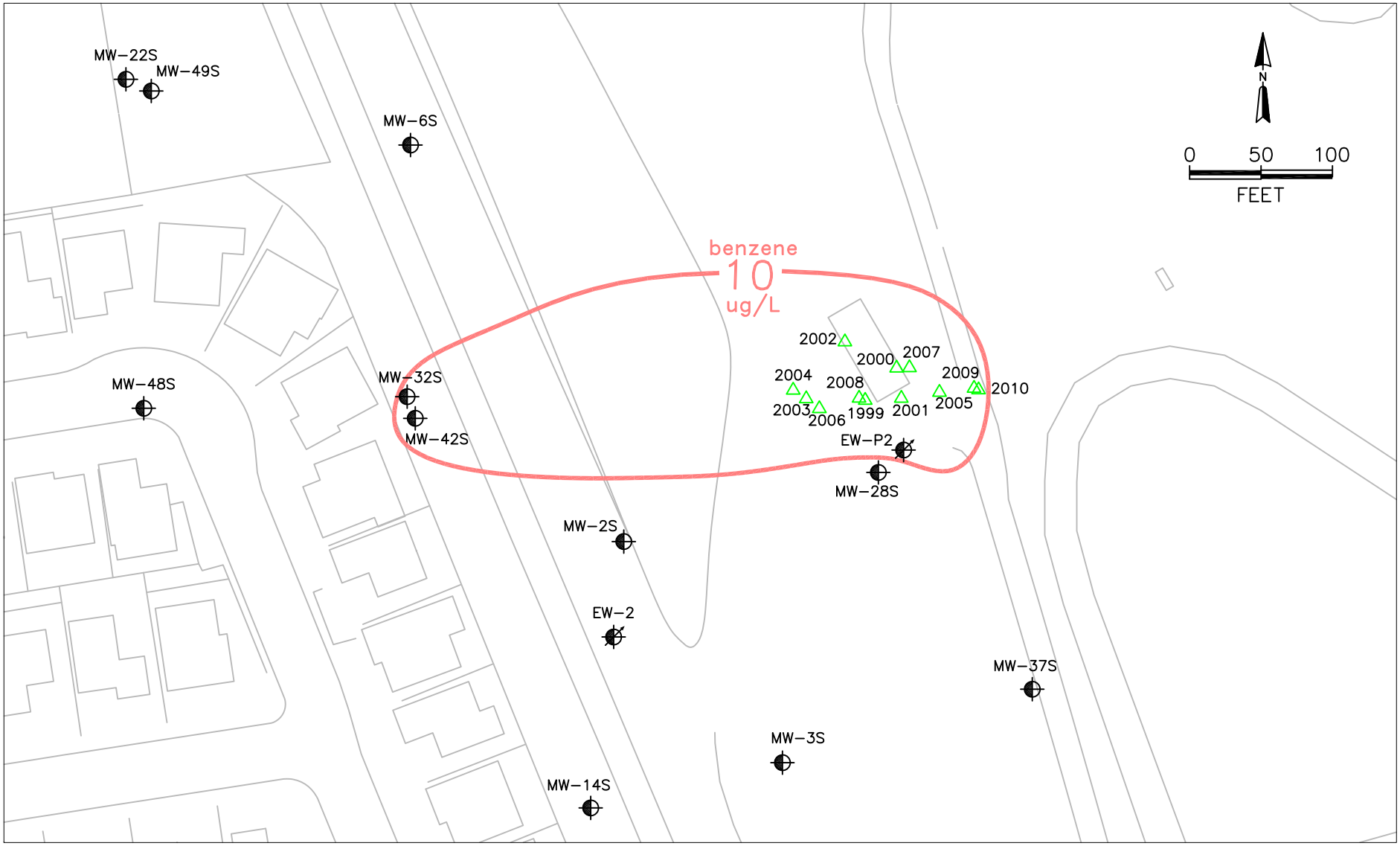
BENZENE IN GROUNDWATER
1994 - 2010

Proj. No.:	29874660	Date:	FEBRUARY 2011
Project:	CHEVRON PCPL FILLMORE, CALIFORNIA	Figure:	ATT. B

Z:\Gis_Proj\Chevron PCPL (Fillmore Refinery)\!Figures\5 Year Review\2011\2011\Benzene Plumes.dwg , File date: 2/22/2011 3:35 PM, Print date: 2/22/2011 3:36 PM by: Jonathan Sanks


NORTHERN PLUME
Dissolved Benzene Mass (kg)
Average Benzene Concentration (ug/L)
0
10
20
30
40
-
100
200
300
400
500
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Mass
Average Concentration

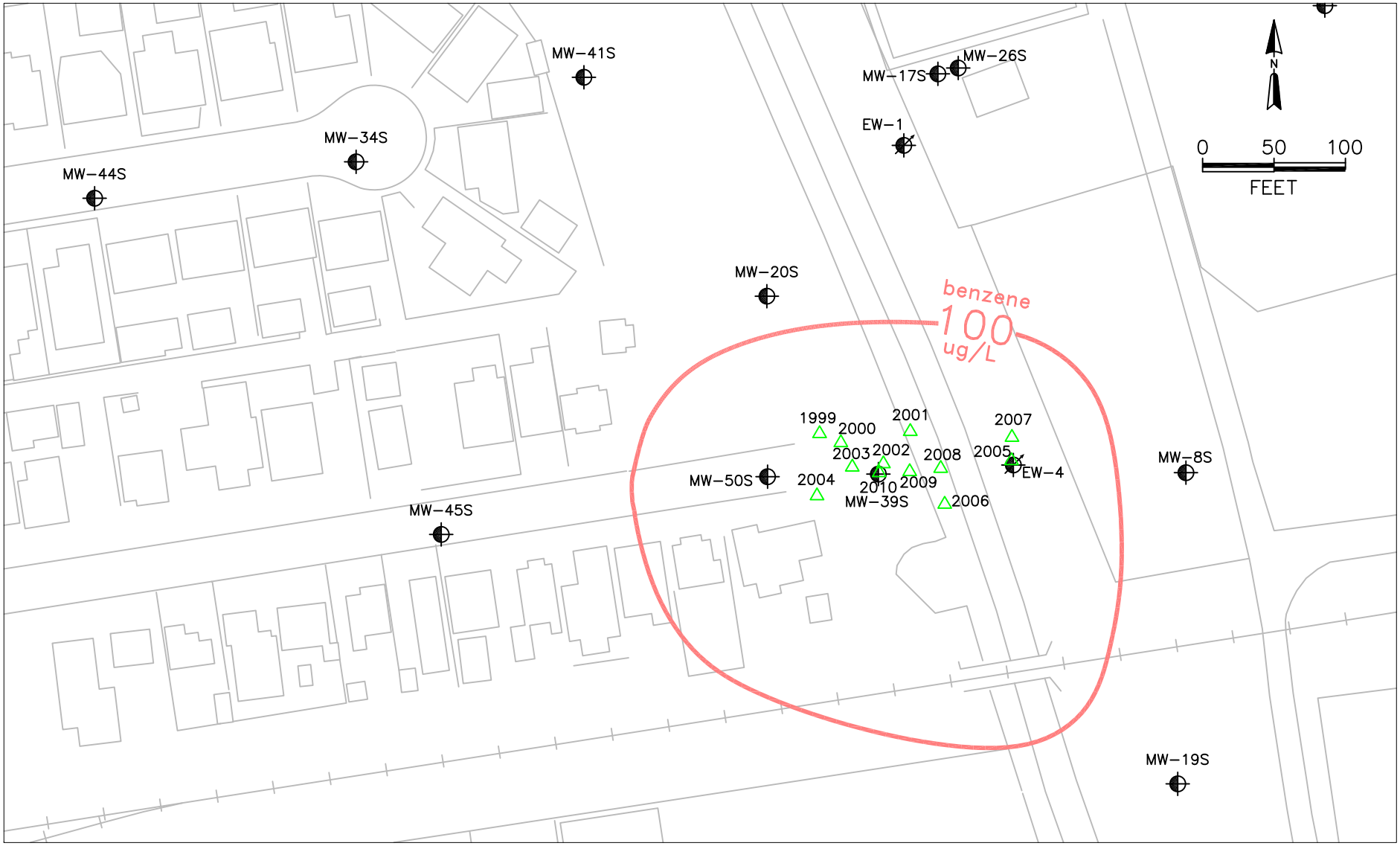

SOUTHERN PLUME
Dissolved Benzene Mass (kg)
Average Benzene Concentration (ug/L)
0
10
20
30
40
-
50
100
150
200
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Mass
Average Concentration



Chevron

TITLE:
PCPL Fillmore
Northern Plume Center of Mass Over Time
Q4 2010 Benzene Contour

DWN: LAK	DES.:	PROJECT NO.: EMC
CHKD:	APPD:	FIGURE NO.: C-2
DATE: 3/2011	REV.:	

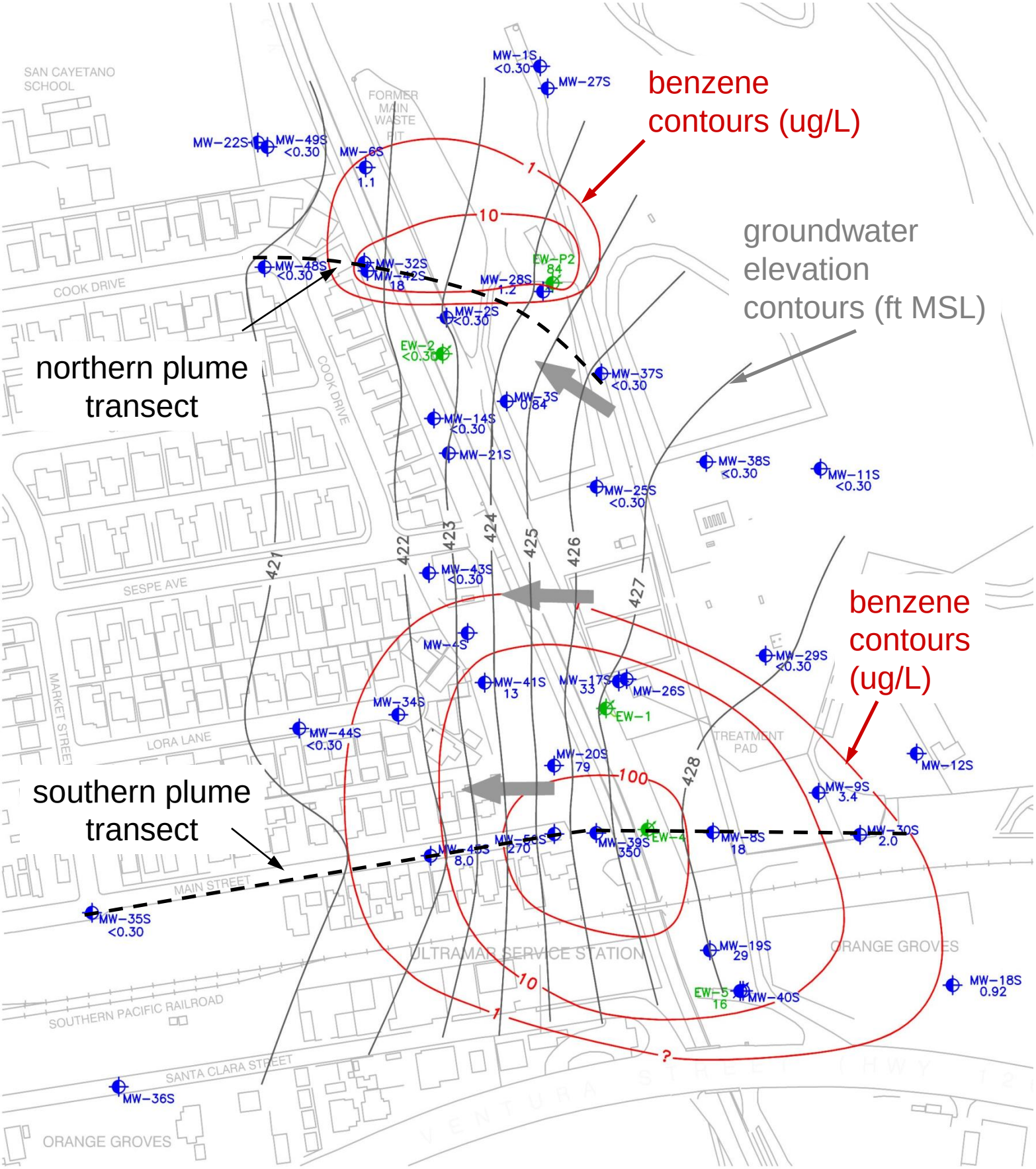


Chevron

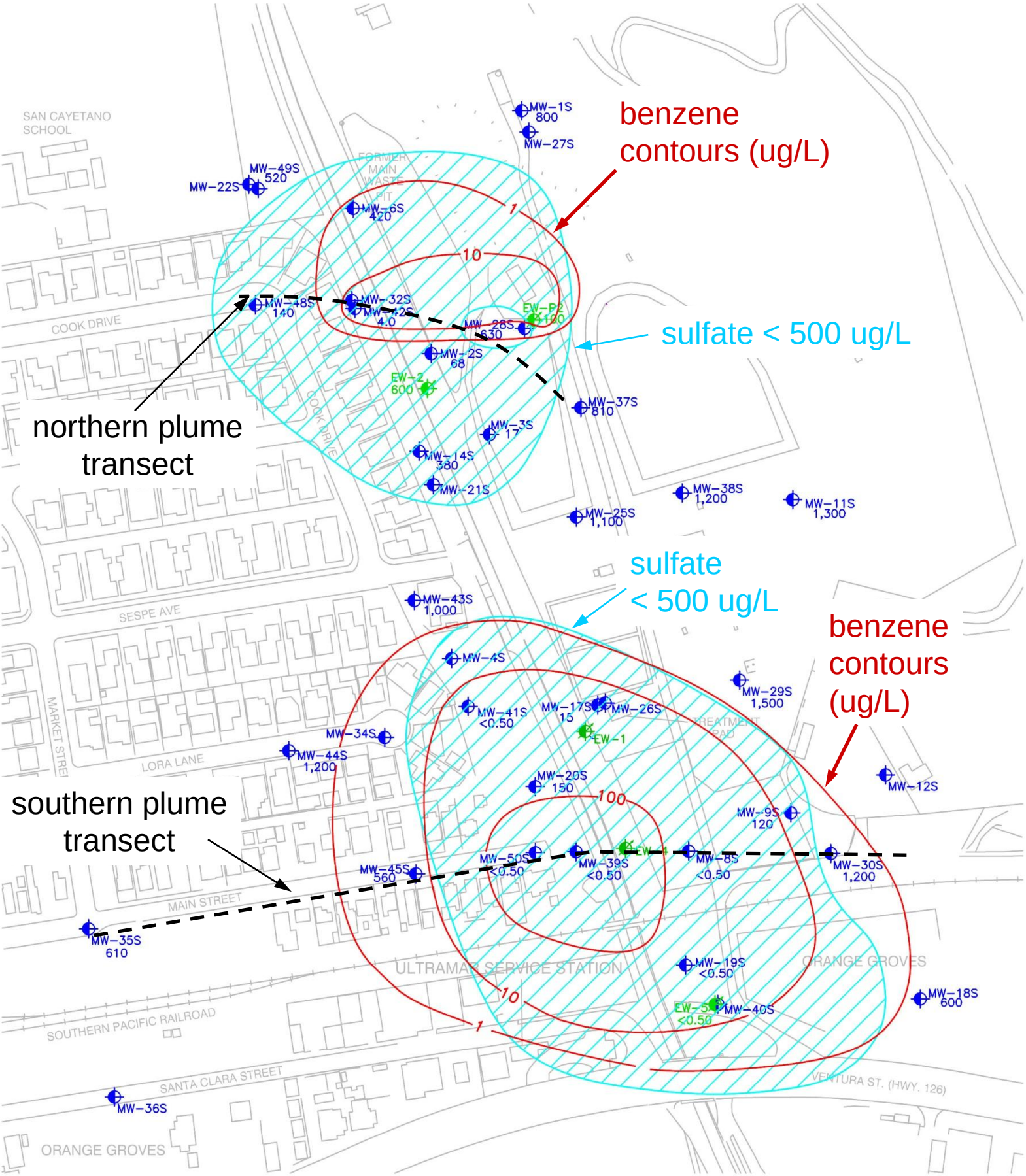
TITLE:
PCPL Fillmore
Southern Plume Center of Mass Over Time
Q4 2010 Benzene Contour

DWN: LAK	DES.:	PROJECT NO.: EMC
CHKD:	APPD:	FIGURE NO.: C-3
DATE: 3/2011	REV.:	

PCPL Fillmore – 4Q 2010

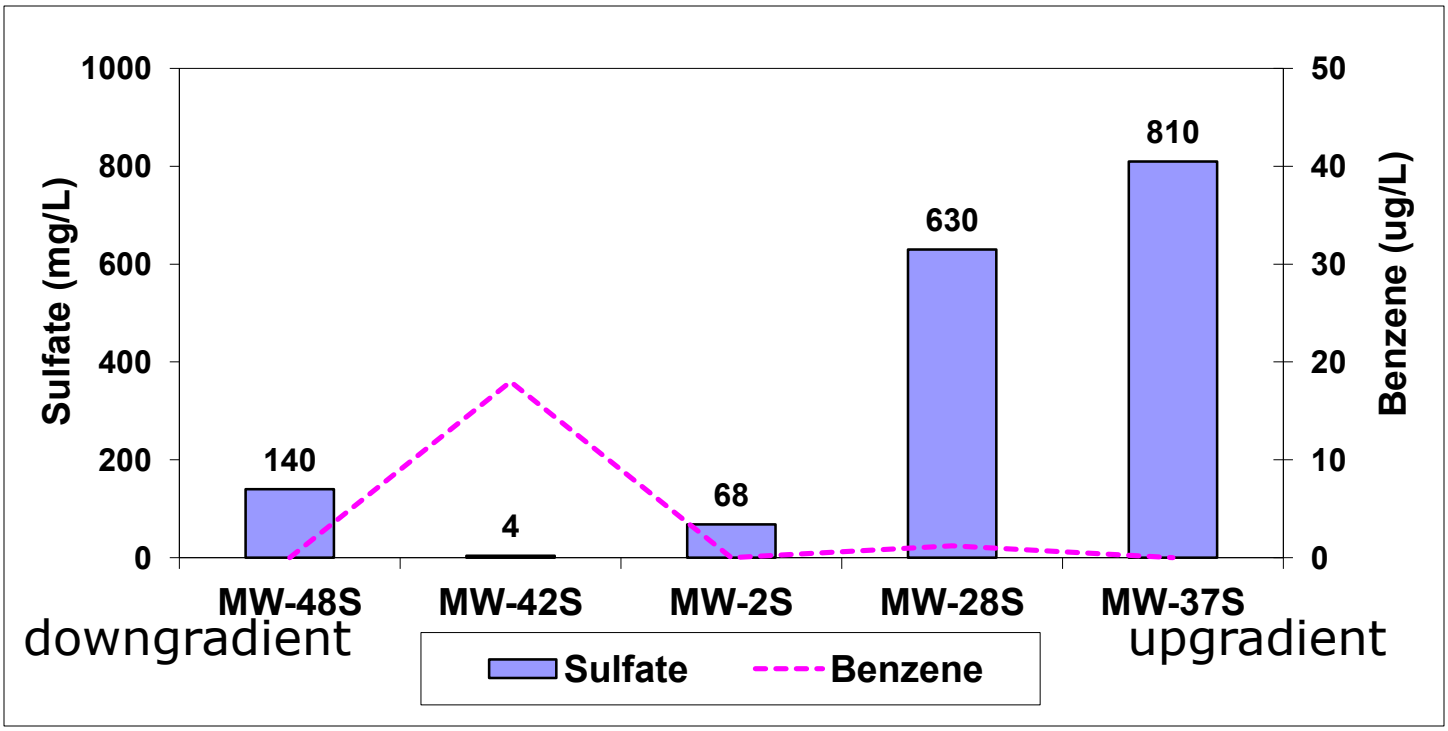


PCPL Fillmore – 4Q 2010

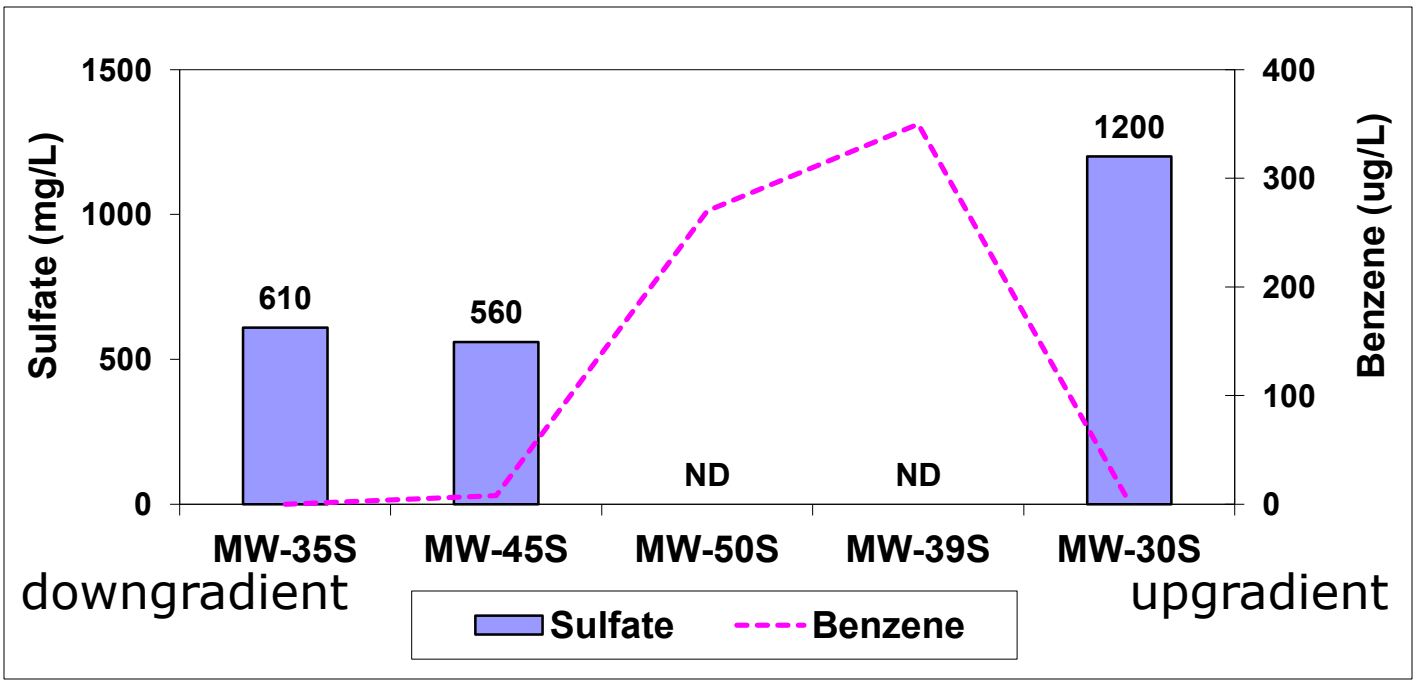


PCPL Fillmore – 4Q 2010

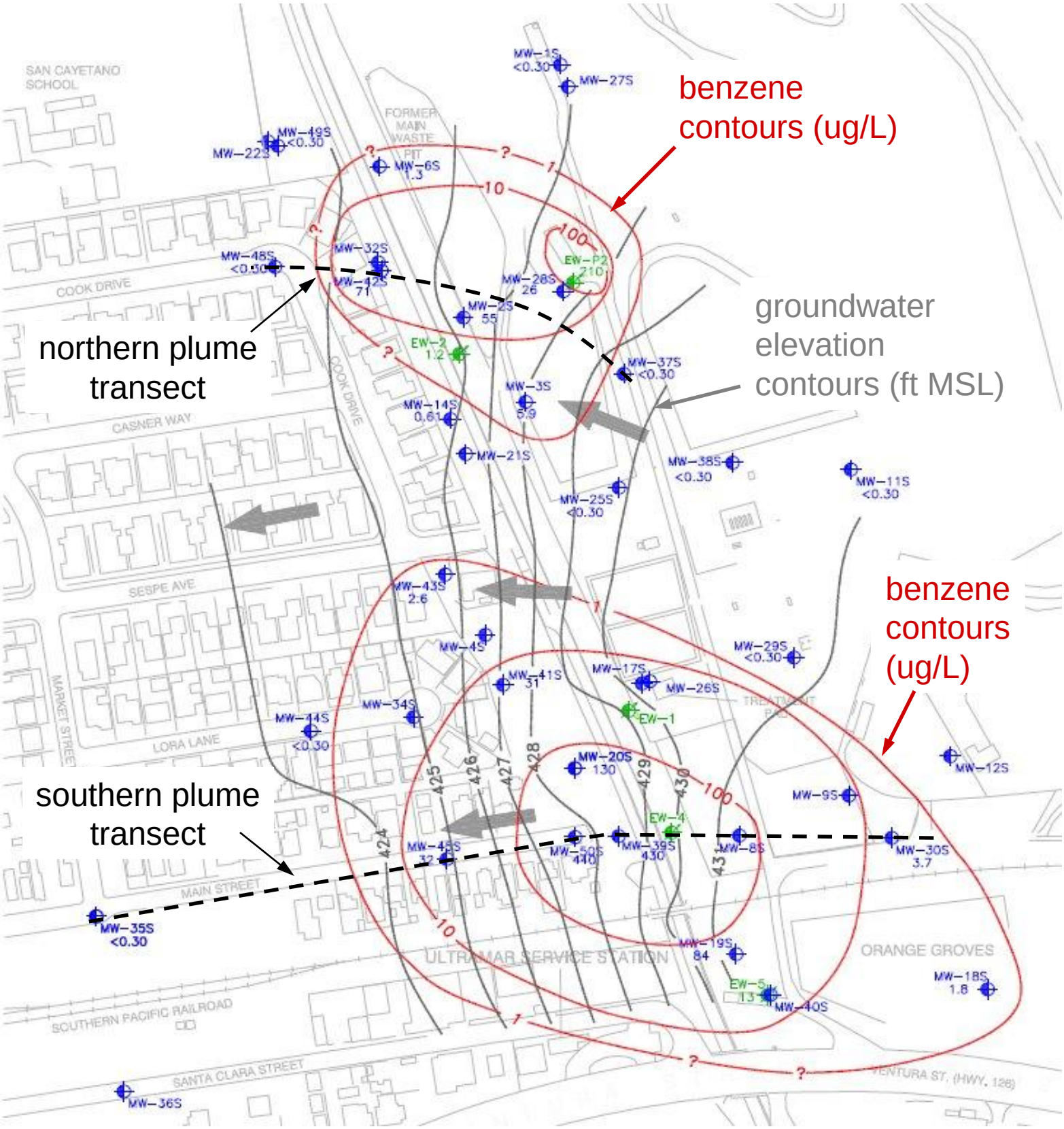
Northern Plume Transect



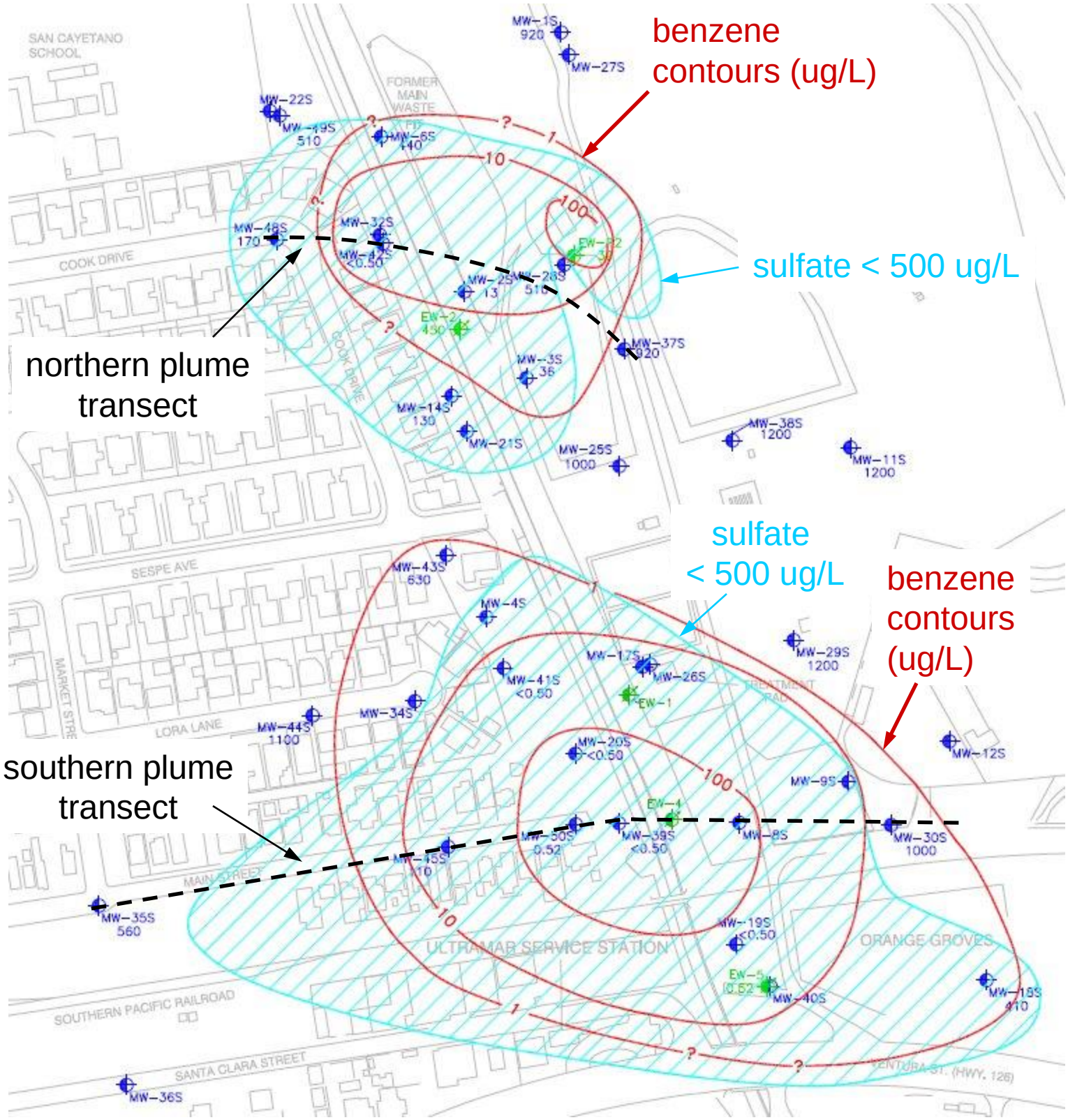
Southern Plume Transect



PCPL Fillmore – 2Q 2008

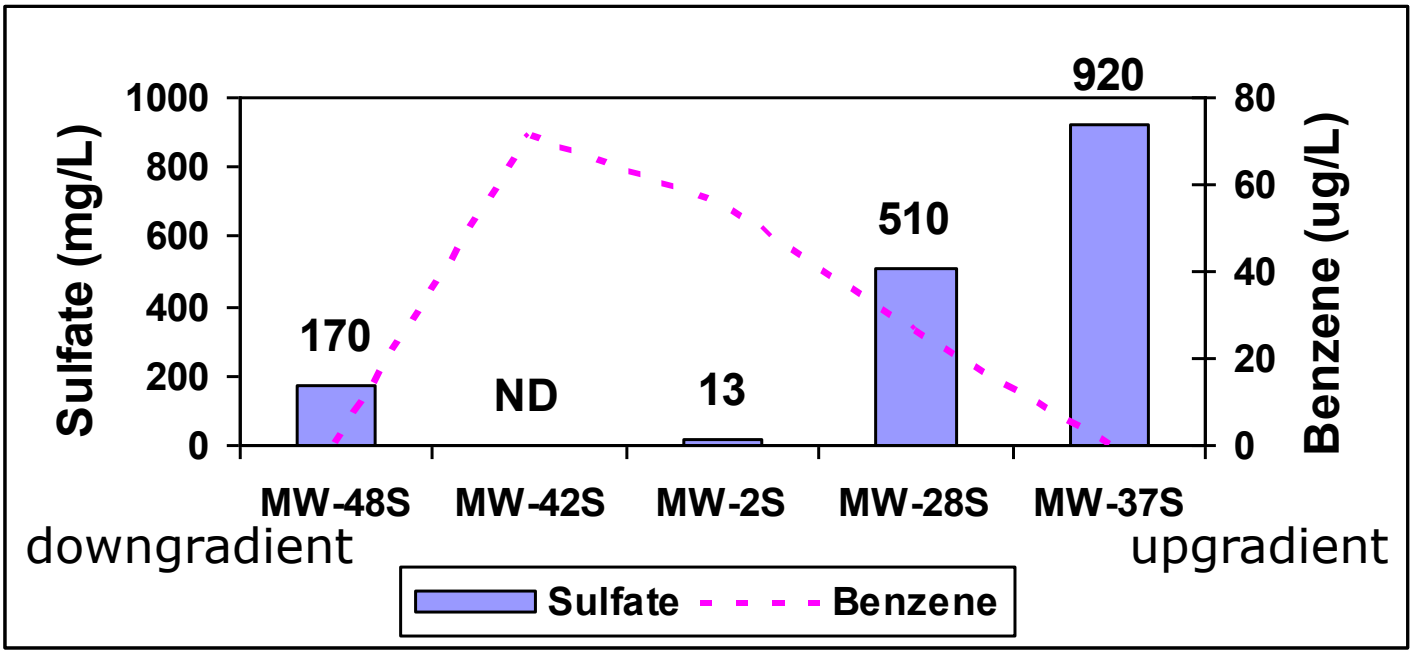


PCPL Fillmore – 2Q 2008

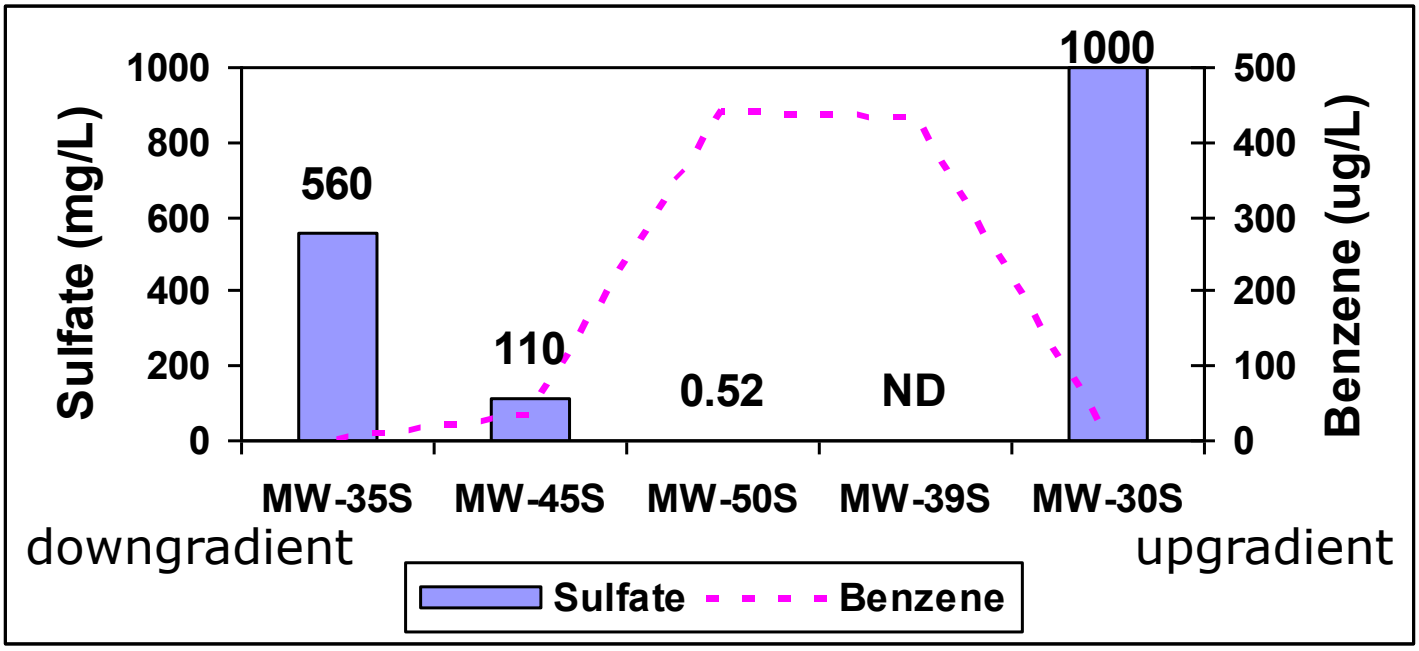


PCPL Fillmore – 2Q 2008

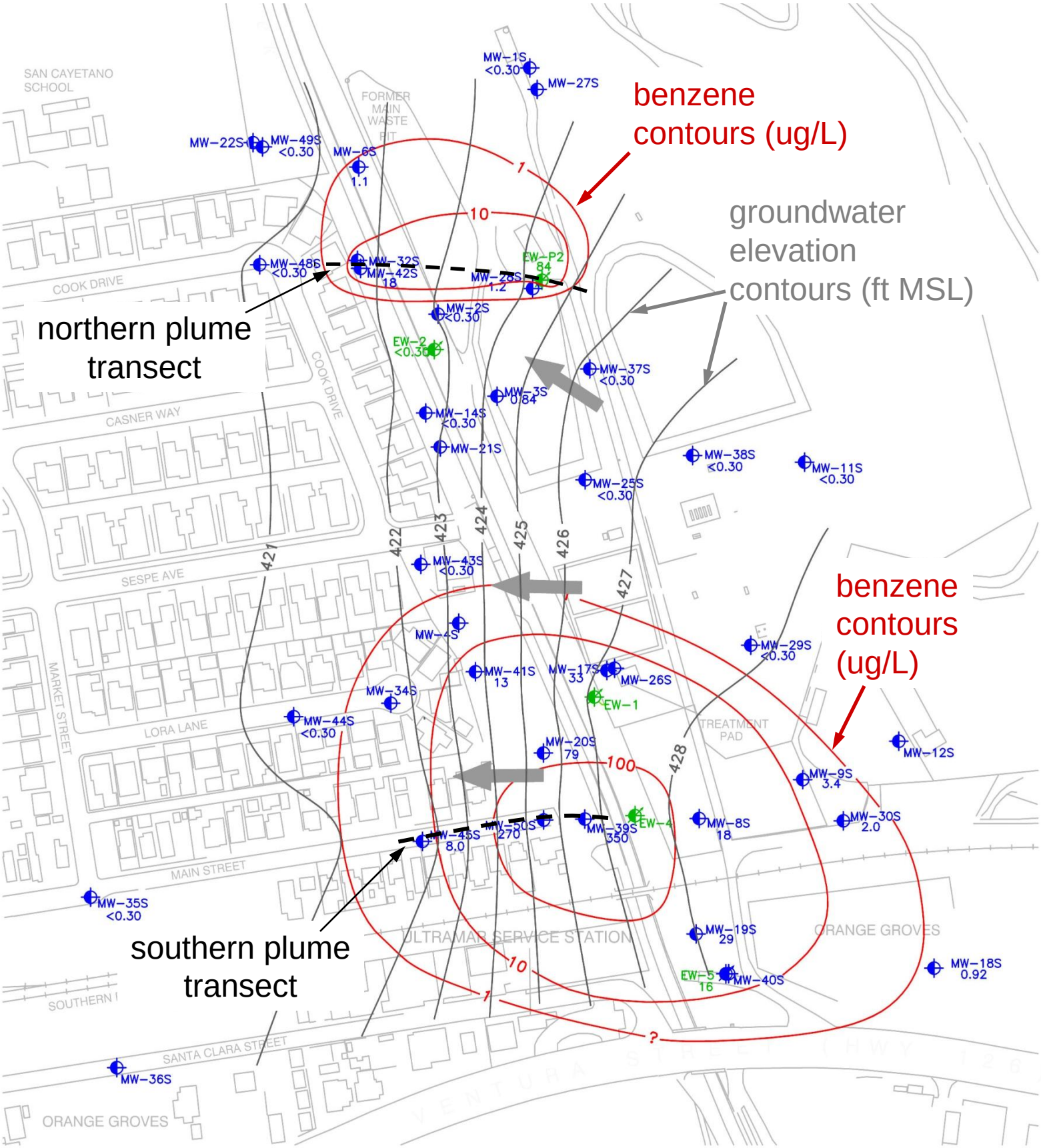
Northern Plume Transect



Southern Plume Transect



PCPL Fillmore
Compound Specific Isotope Analysis (CSIA)



Appendix D - Attachment E

Compound Specific Isotope Analysis and Stable Isotope Tracers for the Fillmore PCPL Site
2006-2010 Results

Groundwater samples were collected from the Fillmore site in August 2006 and sent to the University of Oklahoma for Compound Specific Isotope Analysis (CSIA). Carbon and hydrogen isotope ratios were measured for benzene. Six wells were sampled in the southern and northern plumes:

- southern plume wells: MW-39S, MW-45S, and MW-50S
- northern plume wells: MW-48S, EW-P2 and MW-42S

In May 2007, seven wells were sampled and sent to the Univ. of OK for CSIA:

- southern plume wells: MW-39S, MW-45S, and MW-50S
- northern plume wells: EW-P2, MW-28S, MW-2S and MW-42S

In February 2008, five wells were sampled and sent to the Univ. of OK for CSIA:

- southern plume wells: MW-9S, MW-20S, MW-30S, and MW-45S
- northern plume wells: EW-P2 and MW-42S

In November 2010, seven wells were sampled and sent to the Univ. of OK for CSIA:

- southern plume wells: MW-9S, MW-20S, MW-30S and MW-45S
- northern plume wells: EW-P2, MW-28S, and MW-42S

CSIA was conducted to improve our understanding of the contribution of biodegradation to monitored natural attenuation. Enrichment in the heavy isotopes (^{13}C and ^{2}H) occurs as a result of biodegradation. Physical processes, such as dilution and dispersion, do not result in significant isotopic enrichment.

Stable isotope tracers, sulfur and oxygen, were analyzed for the sulfate in November 2010 for the first time. These isotopes were used to understand how sulfate reduction is related to biodegradation of hydrocarbons.

Carbon ($\delta^{13}C$**)** and hydrogen ($\delta^{2}H$**)** isotope values are plotted for August 2006 in Figure 1 for five monitoring wells (isotope ratios could not be detected for one well). The units for these values are permil. Figure 1 shows smaller shifts in carbon isotope ratios and more significant shifts in hydrogen isotope ratios. The slope of the plot for hydrogen versus carbon isotope values is consistent with the literature for anaerobic biodegradation (Fischer et al., 2007). The relationship between carbon and hydrogen is very good (R^2=0.8986). Monitoring wells from the southern and northern plumes are combined in Figure 1, and subsequent figures, because only two monitoring wells were available (due to lack of benzene detections) for one or both of the plumes. It is likely the hydrocarbons in both plumes originated from similar refinery sources in the same timeframe. Moreover, Kuder et al. (2005) plot carbon and hydrogen isotope values on the same figure for two different field sites (and a microcosm study for one of the sites), to illustrate the progression of degradation. Our data interpretation method is therefore consistent with Kuder et al. (2005).

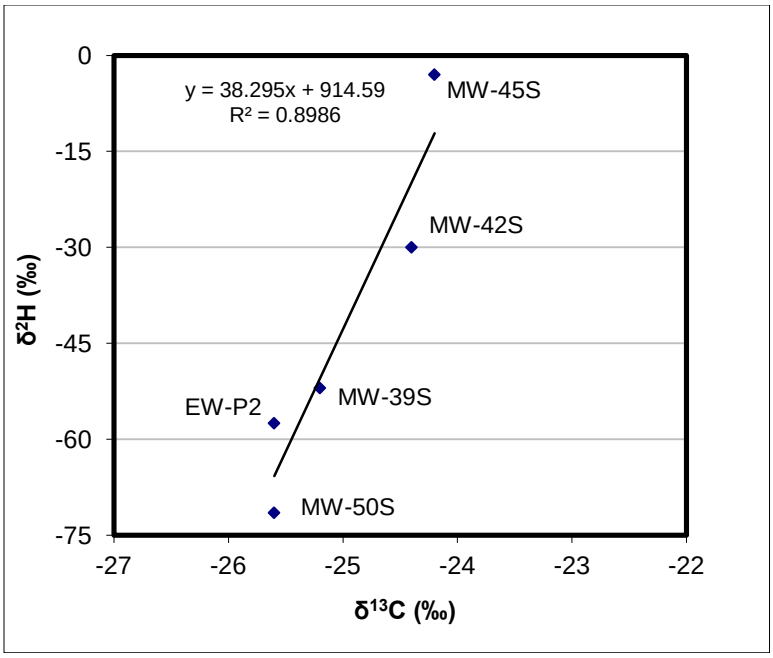


Figure 1. All Monitoring Wells - August 2006: Hydrogen ($\delta^{2}H$) versus Carbon ($\delta^{13}C$) Isotope Values

Carbon and hydrogen isotope values were generated for five of the seven wells sampled in May 2007. Carbons versus hydrogen isotope values are plotted for May 2007 in Figure 2. The slope of the line in this figure is not as steep as the line in Figure 1, but still well within the range of literature values for anaerobic biodegradation (Van Breukelen, 2007). Figure 3 is a similar plot, which only includes the three northern plume wells for May 2007. The slope of the line is not as steep as Figures 2, but within the range of literature values for anaerobic biodegradation.

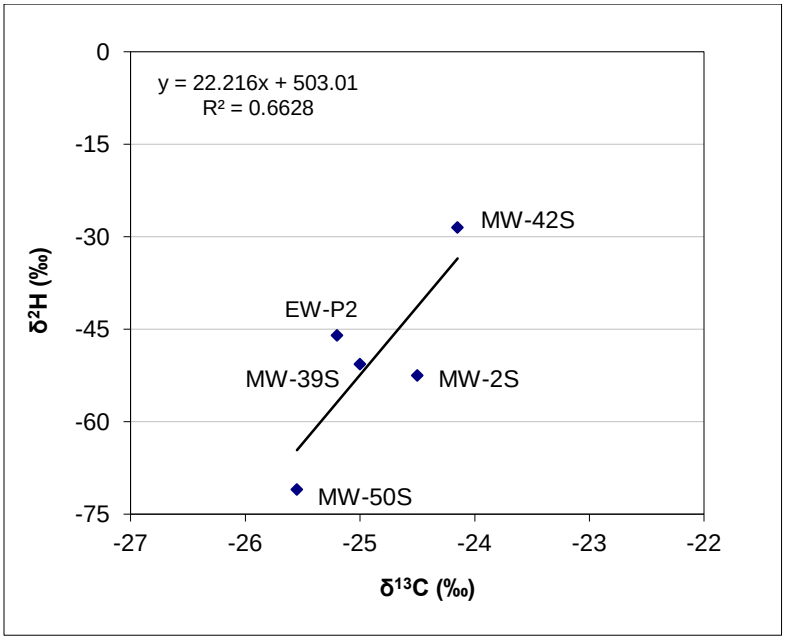


Figure 2. All Monitoring Wells – May 2007: Hydrogen ($\delta^{2}H$) versus Carbon ($\delta^{13}C$) Isotope Values

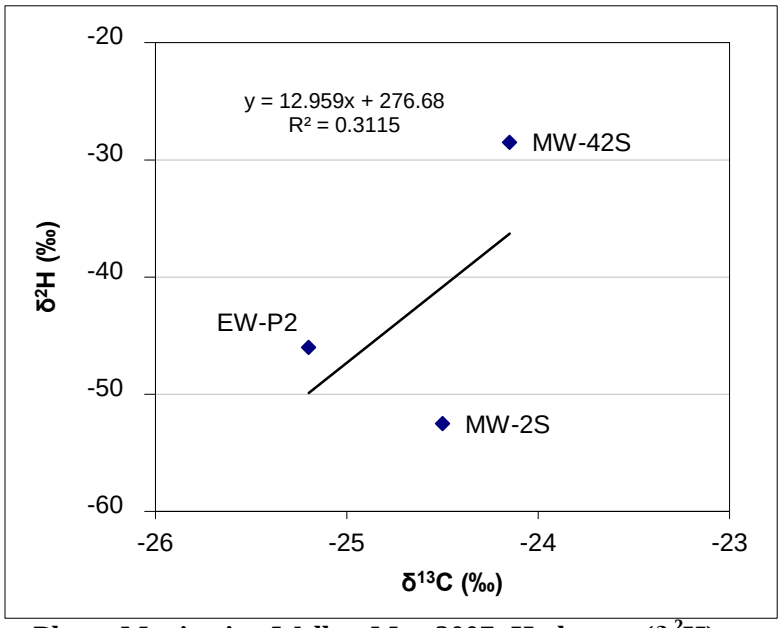


Figure 3. Northern Plume Monitoring Wells – May 2007: Hydrogen (δ ^{2}H) versus Carbon (δ ^{13}C) Isotope Values

Figure 4 illustrates February 2008 carbon versus hydrogen for three southern plume wells and one northern plume well. The slope of the line is very similar to the slope for the August 2006 data.

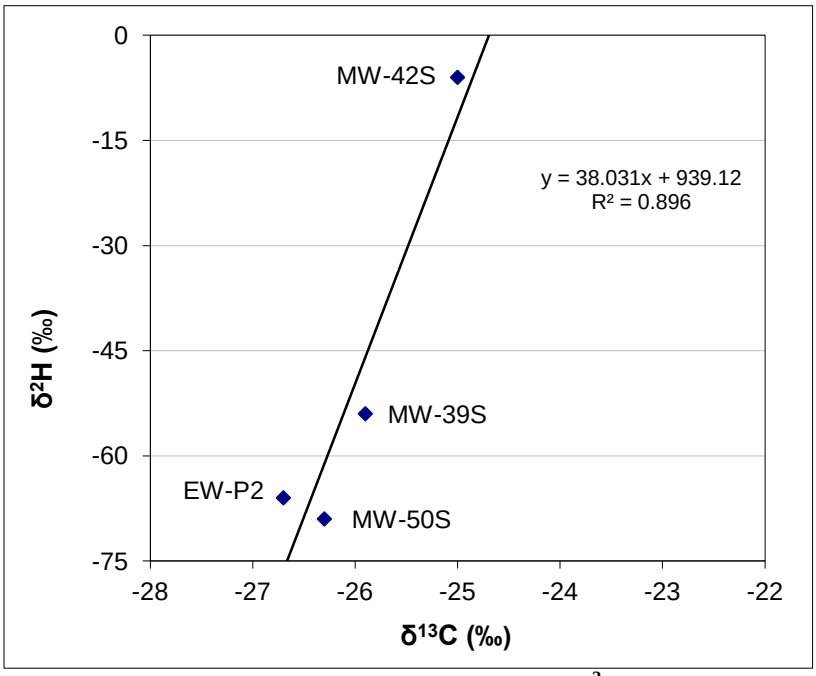


Figure 4. All Monitoring Wells – February 2008: Hydrogen (δ ^{2}H) versus Carbon (δ ^{13}C) Isotope Values

Figure 5 illustrates November 2010 carbon versus hydrogen for two southern plume wells and two northern plume wells. Benzene concentrations in three of the seven wells were too low to measure hydrogen isotope ratios. As a result of these low or nondetectable benzene concentrations, we were not able to generate enrichment plots for November 2010.

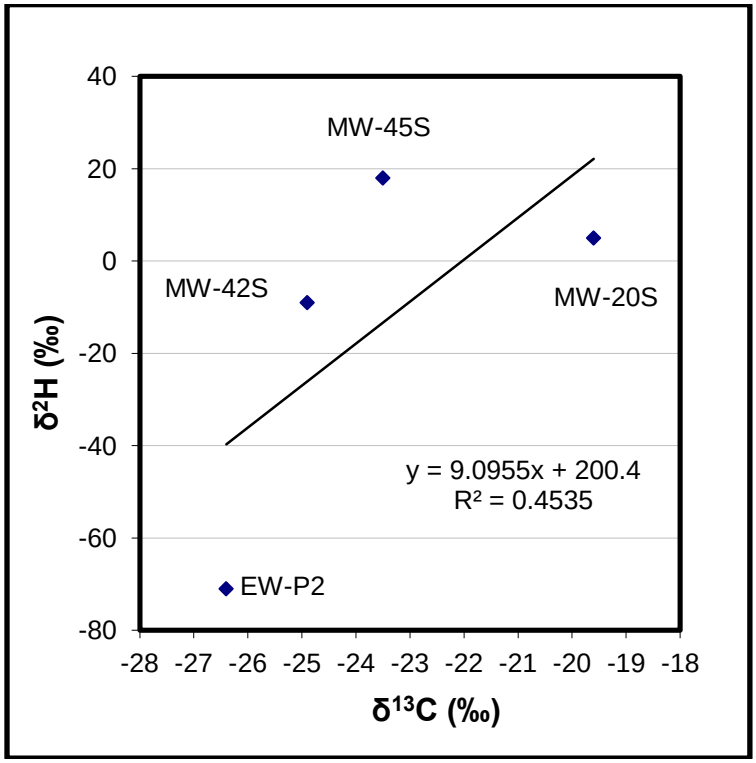


Figure 5. All Monitoring Wells – November 2010: Hydrogen ($\delta^{2}H$) versus Carbon ($\delta^{13}C$) Isotope Values

<u>2006 Enrichment Plots</u>

The three southern plume wells were selected to form a transect aligned with the groundwater flow direction. August 2006 hydrogen and carbon isotope values for the southern plume transect are plotted in Figures 6 and 7, respectively. In these figures a regression for $\delta^{2}H$ and $\delta^{13}C$ versus the log of <u>decreasing</u> benzene concentration yields the slope of the line, which is the enrichment factor. These plots are intended to provide qualitative proof for biodegradation and to compare enrichment factors to literature values. There is no attempt to calculate a biodegradation rate, primarily because there are not an adequate number of wells. Figure 6 illustrates a hydrogen enrichment factor of -37‰, consistent with literature values for anaerobic biodegradation (-31 to -79‰) (Mancini et al., 2003). Figure 7 illustrates a carbon enrichment factor less than -1‰, slightly below published values (Mancini et al., 2003). Field-generated enrichment factors are typically less than laboratory values because of the contribution of dispersion and dilution in the field. In addition, these enrichment plots are highly dependent on the selection of transect monitoring wells and the assumed groundwater flow direction. If a well is not aligned with the groundwater flow direction, smaller concentrations resulting solely from transverse dispersion, in the absence of biodegradation, will not contribute to isotopic enrichment. Based on the hydrogen and carbon enrichment factors, there is strong isotopic evidence for benzene biodegradation in the southern plume. Biodegradation clearly contributes to natural attenuation and the configuration of the benzene plume.

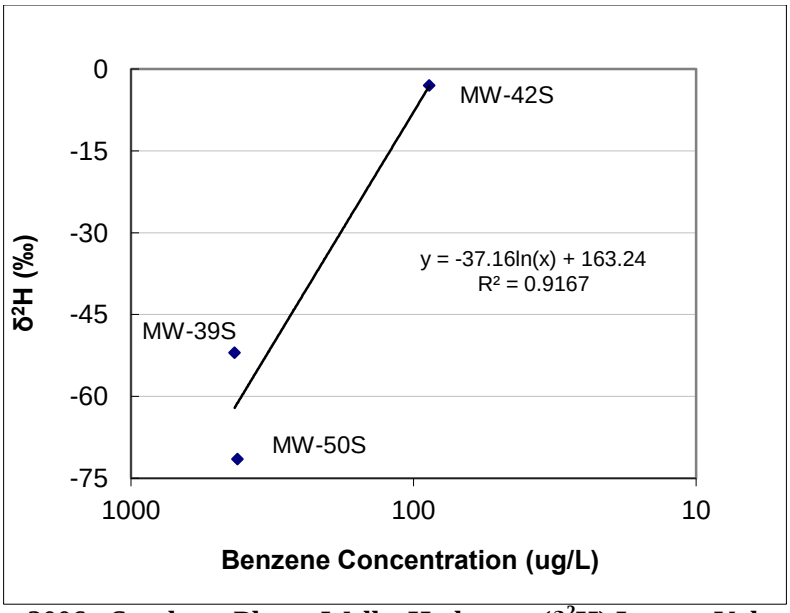


Figure 6. August 2006 - Southern Plume Wells: Hydrogen (δ^2H) Isotope Value versus Benzene Concentration

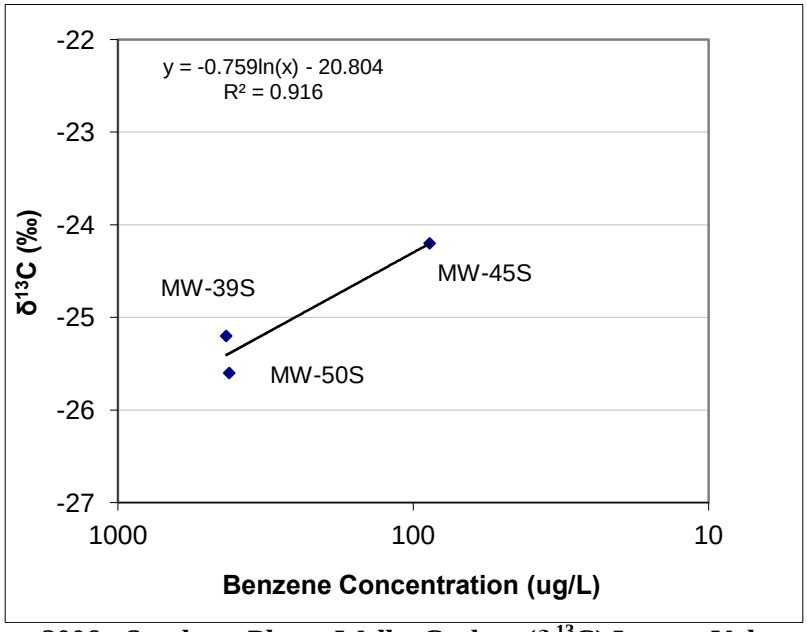


Figure 7. August 2006 - Southern Plume Wells: Carbon ($\delta^{13}C$) Isotope Value versus Benzene Concentration

Benzene was not detected in one of the three northern plume wells, MW-48S, and isotope ratios could not be detected. Two wells are not sufficient to conduct a regression for enrichment factors; therefore, no plots are presented for the northern plume August 2006 sampling event.

2007 Enrichment Plots

In the May 2007 sampling event, benzene as not detected in MW-45S in the southern plume. With CSIA results for only two wells, we could not regress enrichment factors and compare the 2006 and 2007 sampling events.

As noted above, we were unable to estimate enrichment factors for the northern plume August 2006 sampling event. The May 2007 sampling event did provide sufficient CSIA results to estimate hydrogen and carbon enrichment factors for the northern plume. One of the four wells, MW-28S, could not be analyzed for hydrogen isotopes because the benzene concentration was only 13 ug/L. In fact, MW-28S was not included in the regression for carbon enrichment factor because it is not oriented with the direction of groundwater flow. Therefore, three wells were used for both the hydrogen and carbon plots, below.

May 2007 hydrogen and carbon isotope values for the northern plume transect are plotted versus benzene concentration in Figures 8 and 9, respectively. In Figure 8 the hydrogen enrichment factor is -3.5‰, which is considerably smaller than published enrichment factors based on anaerobic biodegradation laboratory experiments (Mancini et al., 2003). The regression yields a very low R^2 value, suggesting there is little significant hydrogen enrichment across the three wells.

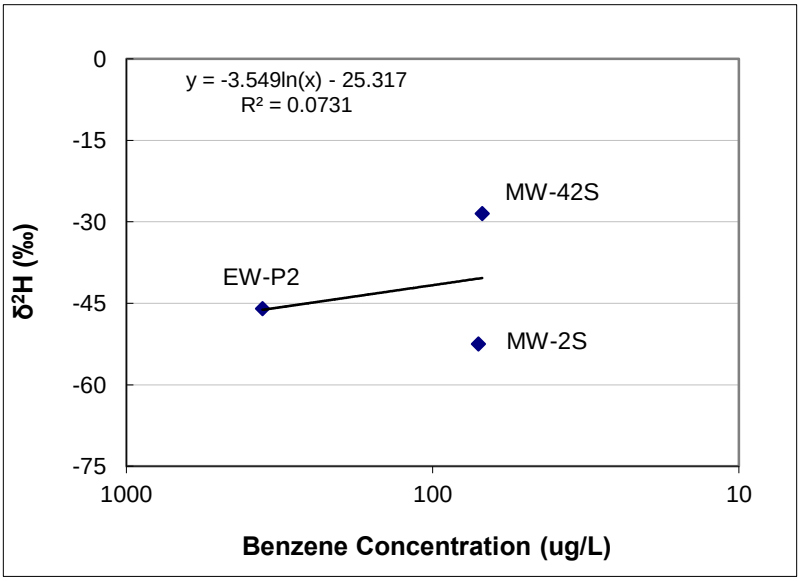


Figure 8. May 2007 - Northern Plume Wells: Hydrogen (δ^2H) Isotope Value versus Benzene Concentration

In Figure 9 the carbon enrichment factor is less than -1‰, also below published values (-1.8 to -3.6‰) (Mancini et al., 2003). Dispersion and dilution in the field likely cause the observed decrease in contaminant concentrations. The contribution of transverse dispersion is to be expected; MW-2S is cross-gradient, not directly downgradient, of EW-P2.

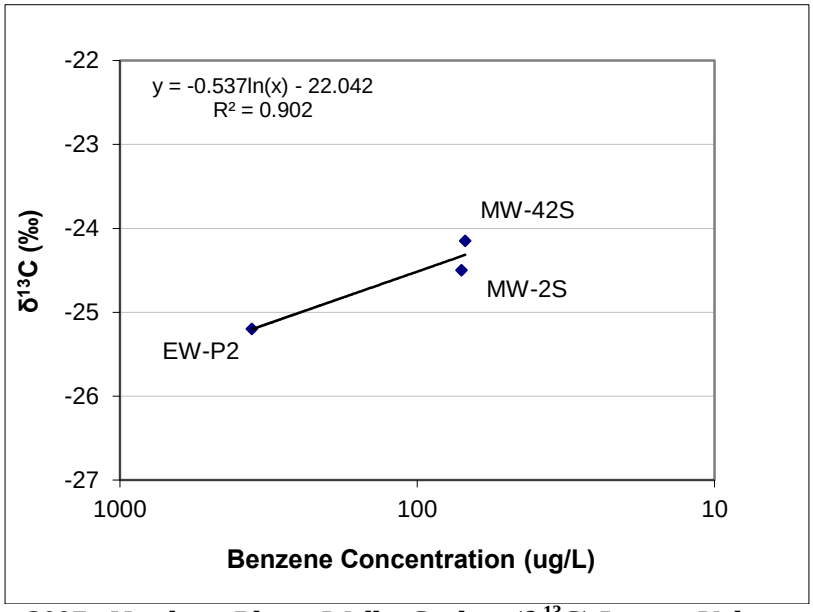


Figure 9. May 2007 - Northern Plume Wells: Carbon (δ ^{13}C) Isotope Value versus Benzene Concentration

<u>2008 Enrichment Plots</u>

There were only two northern plume wells with hydrogen and carbon isotope results, so enrichment plots could not be made. One of the southern plume wells, MW-45S, could not be analyzed for hydrogen isotope ratios because of the low benzene concentration. Therefore, only carbon isotope values could be plotted versus concentration, illustrated in Figure 10. The carbon enrichment factor is similar to that calculated for 2007 and slightly less than 2006.

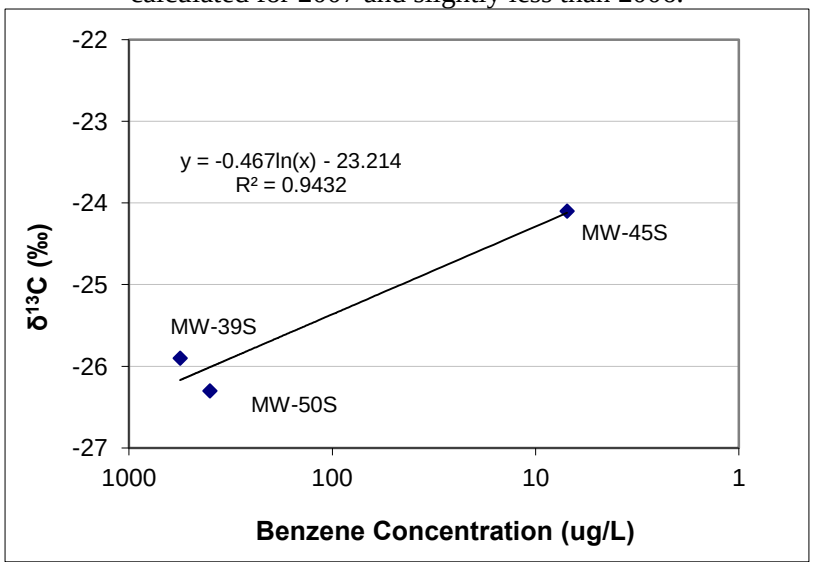


Figure 10. February 2009 - Southern Plume Wells: Carbon ($\delta^{13}C$) Isotope Value versus Benzene Concentration

2010 Stable Isotope Tracers: Sulfur and Oxygen Isotopes

Stable isotope tracers have been applied to assess bacterial sulfate reduction for several decades. Recently, this technique has seen increased application because sulfate reducing bacteria can contribute extensively to the degradation of organic contaminants and bacterial sulfate reduction is recognized as one of the most important processes controlling anaerobic biodegradation (Knoller et al. 2008).

In November 2010, groundwater samples were collected from 10 monitoring wells in the northern and southern plumes. Wells were selected to represent a range of sulfate concentrations (4 mg/L to 1200 mg/L). Groundwater samples were sent to ZymaX Laboratory, where stable isotope ratios of sulfur ($^{34}S/^{32}S$ expressed as $\delta^{34}S$) and oxygen ($^{18}O/^{16}O$ expressed as $\delta^{18}O$) were measured for sulfate (SO_4). Figure 11 is a plot for $\delta^{34}S$ versus sulfate (declining log concentration) and Figure 12 is $\delta^{18}O$ versus sulfate concentration. These figures are similar to plots for $\delta^{13}C$ and $\delta^{2}H$ versus benzene concentration. The enrichments observed in $\delta^{34}S$ and $\delta^{18}O$ with declining sulfate concentration suggest sulfate reducing conditions are participating in hydrocarbon biodegradation. Both figures show statistically significant enrichment factors for sulfur (-4.323‰) and oxygen (-1.293‰) in spite of the data scatter (low R^2). These enrichment factors are lower than those reported in the literature, but field values typically are smaller. The enrichment in sulfur is more significant than observed for oxygen, consistent with studies conducted by Knoller et al. (2008). Figures 11 and 12 provide a strong indication of active sulfate reducing conditions.

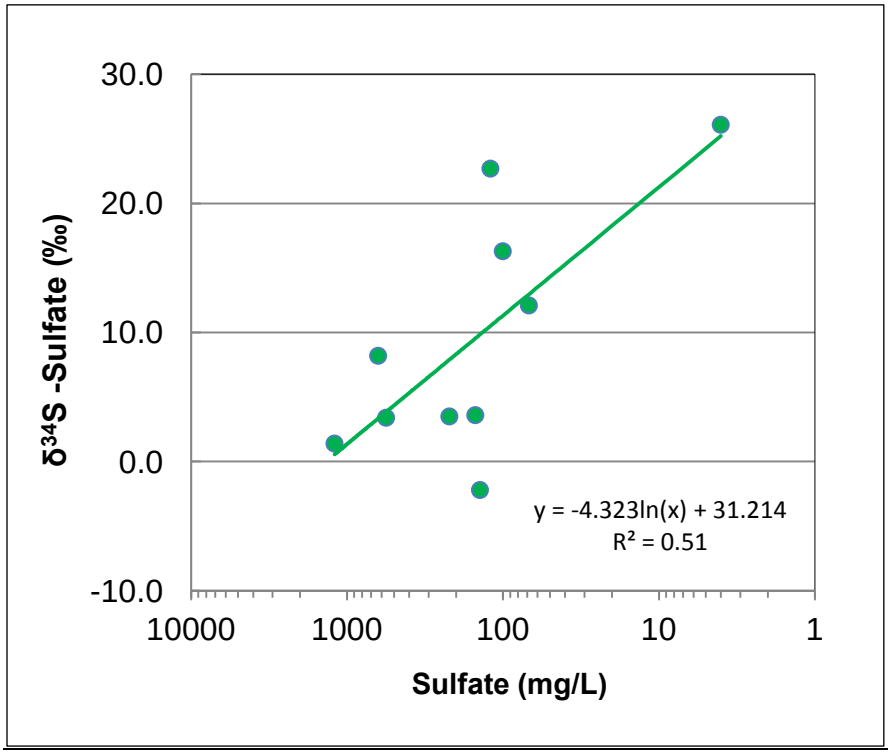


Figure 11. November 2010 – All Wells: Sulfur Isotope Values (δ^{34}S-Sulfate) versus Sulfate Concentration

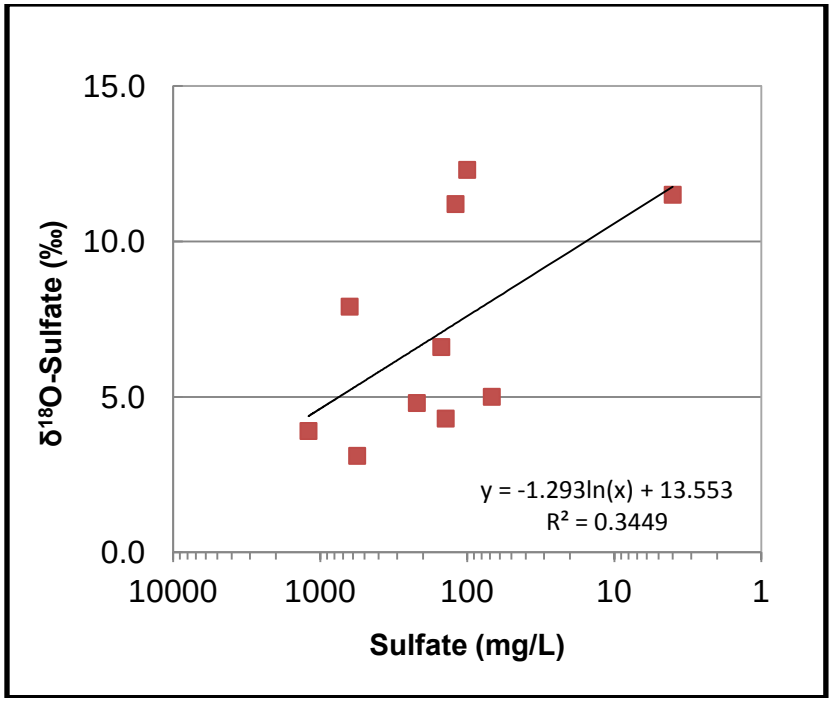


Figure 12. November 2010 – All Wells: Oxygen Isotope Values (δ^{18}O-Sulfate) versus Sulfate Concentration

Summary

The CSIA data provide strong evidence for the contribution of biodegradation to monitored natural attenuation for benzene in the southern plume. The hydrogen enrichment factor in the southern plume hydrogen is consistent with published literature for anaerobic biodegradation. The carbon enrichment factors in the northern and southern plume are somewhat smaller (-0.5‰) than published laboratory values. While these values are small, dispersion and dilution are expected to influence these types of field estimates. Both the hydrogen and carbon enrichment factors illustrate the contribution of biodegradation in the benzene plumes.

In 2010 stable isotope tracers, sulfur and oxygen, were measured for sulfate to assess the contribution of sulfate reduction to hydrocarbon biodegradation. Enrichment plots for sulfur and oxygen isotope ratios provide good evidence for active sulfate reducing conditions in the northern and southern plumes.

References

Fischer, A., K. Theuerkorn, N. Stelzer, M. Gehre, M. Thullner, and H.H. Richmow. 2007. Applicability of Stable Isotope Fractionation Analysis for the Characterization of Benzene Biodegradation in a BTEX-contaminated Aquifer. Environ. Sci. Technol., 41(10): 3689–3696.

Knoller, K., C. Vogt, S. Feisthauer, S.M. Weise, H. Weiss, and H. Richnow. 2008. Sulfur Cycling and Biodegradation in Contaminated Aquifers: Insights from Stable Isotope Investigations. Environ. Sci. Technol. 42(21):7807-7812.

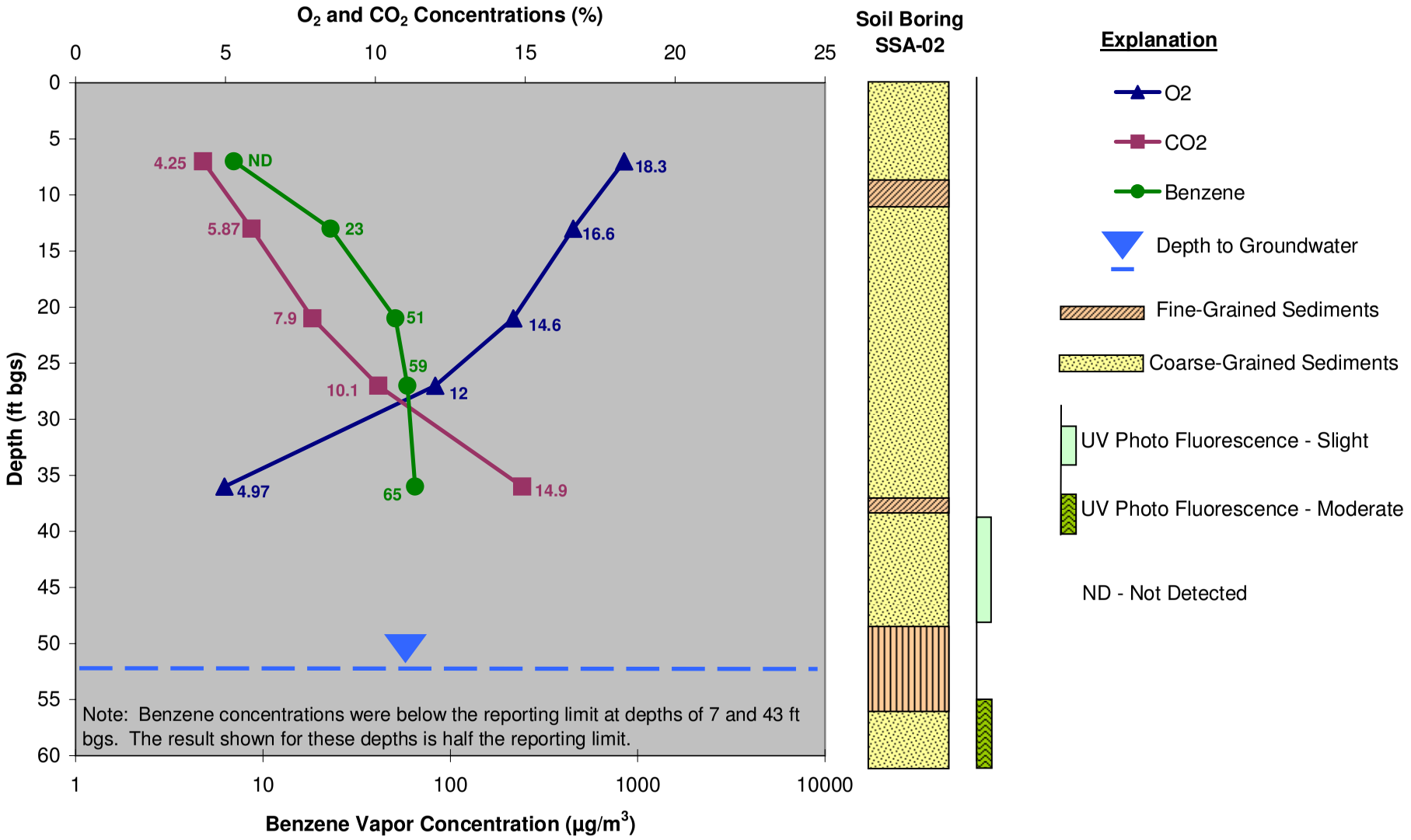
Kuder, T., J.T. Wilson, P. Kaiser, R. Kolhatkar, P. Philp, and J. Allen. 2005. Enrichment of Stable Carbon and Hydrogen Isotopes during Anaerobic Biodegradation of MTBE: Microcosm and Field Evidence. Environ. Sci. Technol. 39: 213-220.

Mancini, S.A., A.C. Ulrich, G. Lacrampe-Couloume, B. Sleep, E.A. Edwards, and B. Sherwood Lollar. 2003. Carbon and Hydrogen Isotopic Fractionation during Anaerobic Biodegradation of Benzene. Appl. Environ. Microbiol. 69:191-198.

Van Breukelen, B.M. 2007. Extending the Raleigh Equation to Allow Competing Isotope Fractionating Pathways to Improve Quantification of Biodegradation. Environ. Sci. Technol., 41(11): 4004–4010.

FIGURE 12

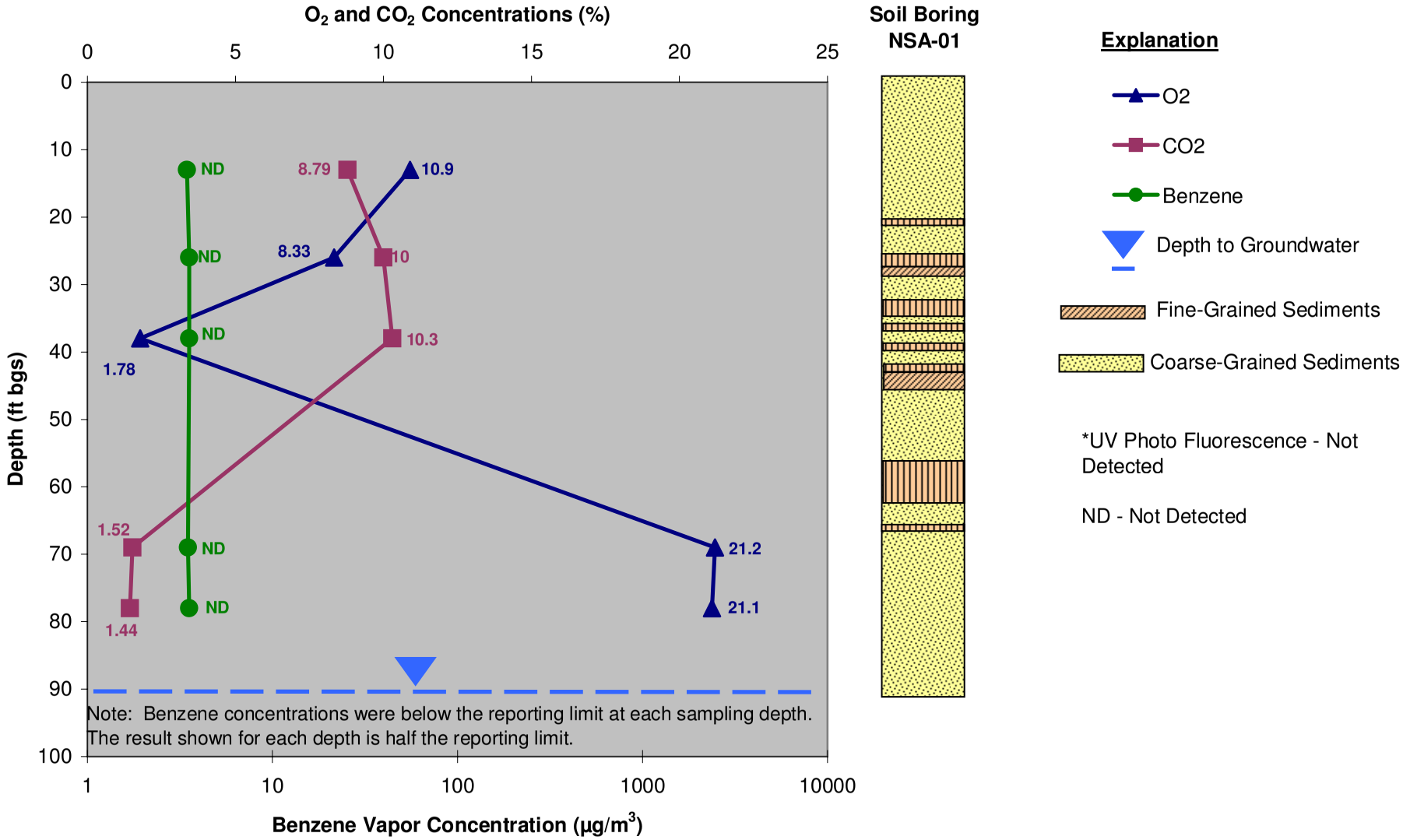
Depth Profile of Benzene, O2, and Co2
CMT Vapor Probe Location SSA-11 (March 2007)
Chevron PCPL - Fillmore, California



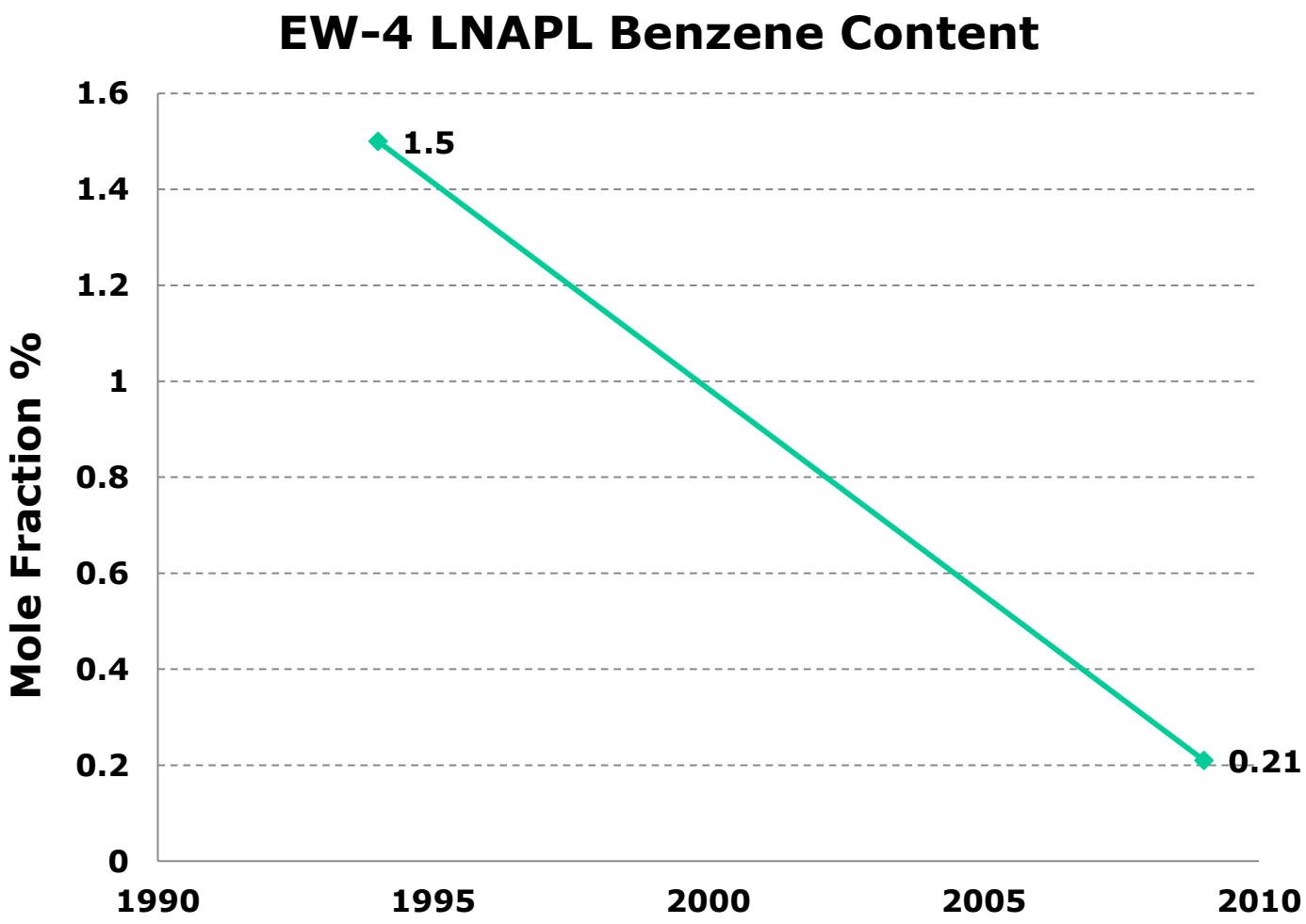
T:\2004\Chevron PCPL (Fillmore Refinery)\Deliverables (Finals in El Seg)\Reports\Vapor Report\Depth Profile - Benzene Rd1 (final - v2) Graph SSA-11

FIGURE 18

Depth Profile of Benzene, O2, and Co2
CMT Vapor Probe Location NSA-03 (August 2007)
Chevron PCPL - Fillmore, California



T:\2004\Chevron PCPL (Fillmore Refinery)\Deliverables (Finals in El Seg)\Reports\Vapor Report\Depth Profile - Benzene Rd2 (final - v2) Graph NSA-03


EW-4 LNAPL Benzene Content
Mole Fraction %
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1.5
0.21
1990
1995
2000
2005
2010

Appendix E

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Pacific Coast Pipeline	**Date of inspection: June 16, 2011**
Location and Region: Fillmore, CA Region 9	**EPA ID: CAD980636781**
Agency, office, or company leading the five-year review: US EPA	**Weather/temperature:** overcast / mid 60's

Remedy Includes: (Check all that apply)

- G ~~Landfill cover/containment~~
- G Access controls
- G Institutional controls
- ✓ G Groundwater pump and treatment
- G Surface water collection and treatment
- G Other _____
- G ~~Monitored natural attenuation~~
- G Groundwater containment
- G Vertical barrier walls

Attachments: G Inspection team roster attached G Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Roger Hardester (Name) Env. Technician (Title) 6/16/11 (Date)
   Interviewed G at site G at office G by phone Phone no. 661-865-7946 cell
   Problems, suggestions; G Report attached 5-6 gal/mo of LNAPL w/ Spillbuster, sometimes less. Wells checked for LNAPL once a month. GW monitored quarterly

2. **O&M staff** LeeRoy Young (Name) Health & Safety Officer (Title) 6/16/11 (Date)
   Interviewed G at site G at office G by phone Phone no. _____
   Problems, suggestions; G Report attached no problems, suggestions

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency City of Fillmore
Contact Kevin Mc Sweeney (Name) Community Development (Title) Director (Date) 805-524-1500 x116 (Phone no.)
Problems; suggestions; G Report attached No problems with current status.
#1 Concern is Pole Creek hydrology + flood protection
#2 Contam; spec. liability if City annexes PCPL property

Agency (soil)
Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; G Report attached _____

Agency _____
Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; G Report attached _____

Agency _____
Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; G Report attached _____

4. **Other interviews** (optional) G Report attached.

As part of the development of the updated (May 2011) Community Involvement Plan, citizens are concerned and want the contamination cleaned up, per several interviews.

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

1. **O&M Documents**
   - ✓ G O&M manual — G Readily available — G Up to date — G N/A
   - G As-built drawings — G Readily available — G Up to date — G N/A
   - G Maintenance logs — G Readily available — G Up to date — G N/A
   - Remarks: manual @ URS office

2. **Site-Specific Health and Safety Plan** — ✓ G Readily available — ✓ G Up to date — G N/A
   - ✓ G Contingency plan/emergency response plan — G Readily available — G Up to date — G N/A
   - Remarks:

3. **O&M and OSHA Training Records** — ✓ G Readily available — ✓ G Up to date — G N/A
   - Remarks:

4. **Permits and Service Agreements**
   - G Air discharge permit — G Readily available — G Up to date — G N/A
   - G Effluent discharge — G Readily available — G Up to date — G N/A
   - G Waste disposal, POTW — G Readily available — G Up to date — G N/A
   - ✓ G Other permits Grading — ✓ G Readily available — ✓ G Up to date — G N/A
   - Remarks:

5. **Gas Generation Records** — G Readily available — G Up to date — G N/A
   - Remarks:

6. **Settlement Monument Records** — G Readily available — G Up to date — G N/A
   - Remarks:

7. **Groundwater Monitoring Records** — ✓ G Readily available — ✓ G Up to date — G N/A
   - Remarks: only semi-annual; includes all wells

8. **Leachate Extraction Records** — G Readily available — G Up to date — G N/A
   - Remarks:

9. **Discharge Compliance Records**
   - G Air — G Readily available — G Up to date — G N/A
   - G Water (effluent) — G Readily available — G Up to date — G N/A
   - Remarks:

10. **Daily Access/Security Logs** — ✓ G Readily available — ✓ G Up to date — G N/A
    - Remarks:

IV. O&M COSTS

1. **O&M Organization**

G State in-house
G PRP in-house
G Federal Facility in-house
G Other_____

G Contractor for State
G Contractor for PRP
G Contractor for Federal Facility

2. **O&M Cost Records** - in Chevron offices

G Readily available G Up to date
G Funding mechanism/agreement in place
Original O&M cost estimate_____ G Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS G Applicable G N/A

A. Fencing

1. **Fencing damaged** G Location shown on site map G Gates secured G N/A

Remarks_____

B. Other Access Restrictions

1. **Signs and other security measures** G Location shown on site map G N/A

Remarks_____

C. Institutional Controls (ICs) – no ICs

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented G Yes G No G N/A
Site conditions imply ICs not being fully enforced G Yes G No G N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date G Yes G No G N/A
Reports are verified by the lead agency G Yes G No G N/A

Specific requirements in deed or decision documents have been met G Yes G No G N/A
Violations have been reported G Yes G No G N/A
Other problems or suggestions: G Report attached

2. **Adequacy** G ICs are adequate G ICs are inadequate G N/A
Remarks ICs needed for gw use

D. General

1. **Vandalism/trespassing** G Location shown on site map ✓ G No vandalism evident
Remarks

2. **Land use changes on site** G N/A
Remarks

3. **Land use changes off site** G N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads G Applicable G N/A

1. **Roads damaged** G Location shown on site map ✓ G Roads adequate G N/A
Remarks

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS G Applicable G N/A

A. Landfill Surface

1. **Settlement** (Low spots) G Location shown on site map G Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Cracks** G Location shown on site map G Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____

3. **Erosion** G Location shown on site map G Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Holes** G Location shown on site map G Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** G Grass G Cover properly established G No signs of stress
G Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** G N/A
Remarks_____

7. **Bulges** G Location shown on site map G Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** G Wet areas/water damage not evident
G Wet areas G Location shown on site map Areal extent_____
G Ponding G Location shown on site map Areal extent_____
G Seeps G Location shown on site map Areal extent_____
G Soft subgrade G Location shown on site map Areal extent_____
Remarks_____

9. **Slope Instability** G Slides G Location shown on site map G No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches G Applicable G N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** G Location shown on site map G N/A or okay
Remarks_____

2. **Bench Breached** G Location shown on site map G N/A or okay
Remarks_____

3. **Bench Overtopped** G Location shown on site map G N/A or okay
Remarks_____

C. Letdown Channels G Applicable G N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** G Location shown on site map G No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** G Location shown on site map G No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** G Location shown on site map G No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** G Location shown on site map G No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ G No obstructions
G Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
G No evidence of excessive growth
G Vegetation in channels does not obstruct flow
G Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations G Applicable G N/A

1. **Gas Vents** G Active G Passive
G Properly secured/locked G Functioning G Routinely sampled G Good condition
G Evidence of leakage at penetration G Needs Maintenance
G N/A
Remarks_____

2. **Gas Monitoring Probes**
G Properly secured/locked G Functioning G Routinely sampled G Good condition
G Evidence of leakage at penetration G Needs Maintenance G N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
G Properly secured/locked G Functioning G Routinely sampled G Good condition
G Evidence of leakage at penetration G Needs Maintenance G N/A
Remarks_____

4. **Leachate Extraction Wells**
G Properly secured/locked G Functioning G Routinely sampled G Good condition
G Evidence of leakage at penetration G Needs Maintenance G N/A
Remarks_____

5. **Settlement Monuments** G Located G Routinely surveyed G N/A
Remarks_____

E. Gas Collection and Treatment G Applicable G N/A

1. **Gas Treatment Facilities**
   G Flaring G Thermal destruction G Collection for reuse
   G Good condition G Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   G Good condition G Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   G Good condition G Needs Maintenance G N/A
   Remarks_____

F. Cover Drainage Layer G Applicable G N/A

1. **Outlet Pipes Inspected** G Functioning G N/A
   Remarks_____

2. **Outlet Rock Inspected** G Functioning G N/A
   Remarks_____

G. Detention/Sedimentation Ponds G Applicable G N/A

1. **Siltation** Areal extent_____ Depth_____ G N/A
   G Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   G Erosion not evident
   Remarks_____

3. **Outlet Works** G Functioning G N/A
   Remarks_____

4. **Dam** G Functioning G N/A
   Remarks_____

H. Retaining Walls G Applicable G N/A

1. **Deformations** G Location shown on site map G Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____

2. **Degradation** G Location shown on site map G Degradation not evident
Remarks_____

I. Perimeter Ditches/Off-Site Discharge G Applicable G N/A

1. **Siltation** G Location shown on site map G Siltation not evident
Areal extent_____ Depth_____
Remarks_____

2. **Vegetative Growth** G Location shown on site map G N/A
G Vegetation does not impede flow
Areal extent_____ Type_____
Remarks_____

3. **Erosion** G Location shown on site map G Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Discharge Structure** G Functioning G N/A
Remarks_____

VIII. VERTICAL BARRIER WALLS G Applicable G N/A

1. **Settlement** G Location shown on site map G Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Performance Monitoring** Type of monitoring_____
G Performance not monitored
Frequency_____ G Evidence of breaching
Head differential_____
Remarks_____

System shut off in 2002

IX. GROUNDWATER/SURFACE WATER REMEDIES G Applicable G N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines G Applicable G N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
G Good condition G All required wells properly operating G Needs Maintenance G N/A
Remarks no electrical, use portable generator

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
G Good condition G Needs Maintenance ~~NO~~ NA
Remarks

3. **Spare Parts and Equipment**
✓ G Readily available G Good condition G Requires upgrade G Needs to be provided
Remarks spare pump; most wells dedicated pump monitoring

B. Surface Water Collection Structures, Pumps, and Pipelines G Applicable G N/A

1. **Collection Structures, Pumps, and Electrical**
G Good condition G Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
G Good condition G Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
G Readily available G Good condition G Requires upgrade G Needs to be provided
Remarks

C. Treatment System G Applicable G N/A

1. **Treatment Train** (Check components that apply)
   G Metals removal G Oil/water separation G Bioremediation
   G Air stripping G Carbon adsorbers
   G Filters_____
   G Additive (*e.g.*, chelation agent, flocculent)_____
   G Others_____
   G Good condition G Needs Maintenance
   G Sampling ports properly marked and functional
   G Sampling/maintenance log displayed and up to date
   G Equipment properly identified
   G Quantity of groundwater treated annually_____
   G Quantity of surface water treated annually_____
   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   G N/A G Good condition G Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   G N/A G Good condition G Proper secondary containment G Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   G N/A G Good condition G Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   G N/A G Good condition (esp. roof and doorways) G Needs repair
   G Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   G Properly secured/locked G Functioning G Routinely sampled G Good condition
   G All required wells located G Needs Maintenance G N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   ✓ G Is routinely submitted on time ✓ G Is of acceptable quality

2. Monitoring data suggests:
   ✓ G Groundwater plume is effectively contained ✓ G Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

√G Properly secured/locked √G Functioning √G Routinely sampled √G Good condition
√G All required wells located √G Needs Maintenance G N/A

Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. — no longer operating

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 a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Current monitoring is adequate*; no concerns or issues, protectiveness of remedy not affected.

* one additional well needed at south edge of southern plume

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. See comment in B re. one additional well. Some gw that have been clean for many years can be shut down.

Site Photos

Pacific Coast Pipeline Superfund Site
Third Five-Year Review Report

Site looking south **February 2011**

Site looking southwest **February 2011**

Site looking west **February 2011**

Site looking west **February 2011**

Site looking southwest **February 2011**

Site looking northeast **February 2011**

PCPL Fillmore
Well Inspections

Monument													
Well ID	**Casing Diameter**	**Date Inspected**	**Monument**	**Lid**	**Concrete Pad**	**Casing Top**	**Crash Posts**	**Paint**	**Well Label**	**Lock**	**Well Cap**	**Date Repaired**	**Comment**
MW-1S	4	2/14/11	OK	OK	Cracks Secure	OK	NA	Chipping	OK	OK	Dedicator	04/12/11	
MW-2S	4	2/14/11	OK	OK	OK	OK	NA	Chipping	OK	OK	Dedicator	04/12/11	
MW-3S	4	2/14/11	OK	OK	OK	OK	NA	OK	OK	OK	Dedicator	NA	
MW-4S	2	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	OK	NA	
MW-6S	4	2/14/11	OK	OK	OK	OK	NA	OK	OK	OK	Dedicator	NA	Well damaged/repaired 11/07
MW-8S	4	2/14/11	OK	OK	Cracks Secure	OK	NA	OK	OK	OK	Dedicator	NA	
MW-9S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	OK	NA	
MW-10P	4	2/14/11	OK	OK	OK	OK	NA	OK	OK	OK	Dedicator	NA	
MW-11S	4	2/14/11	OK	OK	OK	OK	NA	OK	OK	OK	Dedicator	NA	
MW-12S	4	2/14/11	Dented	OK	OK	OK	NA	Chipping	OK	OK	OK	04/12/11	
MW-17S	4	2/14/11	OK	OK	OK	OK	NA	OK	OK	OK	Dedicator	NA	
MW-18S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	Dedicator	NA	
MW-20S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	Dedicator	NA	
MW-25S	4	2/14/11	OK	OK	OK	OK	OK	Chipping	OK	OK	Dedicator	04/12/11	
MW-26S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	OK	NA	
MW-27S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	OK	NA	
MW-29S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	Dedicator	NA	
MW-30S	4	2/14/11	OK	OK	OK	OK	OK	Chipping	OK	OK	Dedicator		
MW-31D	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	Dedicator	NA	
MW-37S	4	2/14/11	OK	OK	Cracks Secure	OK	NA	OK	Missing	OK	Dedicator	04/12/11	Well label attached to dedicator
MW-38S	4	2/14/11	OK	OK	OK	OK	NA	OK	OK	OK	Dedicator	04/12/11	Well label attached to dedicator
MW-39S	4	2/14/11	OK	NA	OK	OK	Fence	OK	OK	OK	Dedicator	04/12/11	Has Vapor Scrubber, well label attached to dedicator
MW-41S	4	2/14/11	OK	OK	OK	OK	OK	OK	Missing	OK	Dedicator	04/12/11	Well label attached to dedicator
MW-42S	4	2/14/11	OK	OK	OK	OK	OK	OK	OK	OK	Dedicator	04/12/11	Well label attached to dedicator
EW-1	6	2/14/11	Cage	NA	OK	OK	Fence	NA	OK	OK	Product Pump	NA	
EW-4	6	2/14/11	Cage	NA	OK	OK	Fence	NA	Missing	OK	Product Pump	04/12/11	

Flush Mount													
Well ID	**Casing Diameter**	**Date Inspected**	**Lid**	**Concrete Pad**	**Casing Top**	**Gasket**	**Bolts**	**Threads**	**Well Label**	**Lock**	**Well Cap**	**Date Repaired**	**Comment**
MW-14S	4	2/14/11	OK	OK	Cut	None	NA	NA	Missing	NA	Dedicator	4/12/2011	Inside Utilitity Box
MW-19S	4	2/14/11	Paint	Replace	OK	NA	NA	NA	Missing	NA	Dedicator	04/12/11	Vault replaced; well label attached to dedicator
MW-21S	4	2/14/11	Paint	OK	OK	Missing	OK	Stripped	Missing	OK	OK	04/12/11	
MW-22S	4	2/14/11	OK	OK	OK	OK	OK	Stripped	OK	OK	OK	04/12/11	
MW-28S	4	2/14/11	OK	OK	OK	NA	NA	NA	Missing	NA	Dedicator	04/12/11	
MW-32S	4	2/14/11	Paint	OK	OK	OK	OK	OK	OK	OK	OK	04/12/11	
MW-34S	4	2/14/11	OK	OK	OK	Missing	OK	Stripped	OK	OK	OK	04/12/11	
MW-35S	4	2/14/11	OK	OK	OK	OK	NA	NA	Missing	NA	Dedicator	04/12/11	Well damaged/repaired 06/09
MW-36S	4	2/14/11	Paint	OK	OK	OK	OK	OK	OK	OK	OK	04/12/11	
MW-40S	4	2/14/11	OK	OK	OK	Missing	OK	Stripped	Missing	OK	OK	04/12/11	
MW-43S	4	2/14/11	OK	Cracks Secure	OK	Missing	Worn	OK	Missing	NA	Dedicator	04/12/11	Well label attached to dedicator
MW-44S	4	2/14/11	Paint	OK	OK	Missing	OK	OK	Missing	NA	Dedicator	04/12/11	Well label attached to dedicator
MW-45S	4	2/14/11	Paint	OK	OK	Missing	OK	Stripped	Missing	NA	Dedicator	04/12/11	
MW-48S	4	2/14/11	Paint	OK	OK	Water	Worn	Stripped	Missing	NA	Dedicator	04/12/11	
MW-49S	4	2/14/11	Paint	OK	OK	Missing	OK	OK	Missing	NA	Dedicator	04/12/11	Well label attached to dedicator
MW-50S	4	2/14/11	Paint	OK	OK	OK	Worn	Stripped	Missing	NA	Dedicator	04/12/11	
EW-2	6	2/14/11	Paint	OK	OK	NA	EW Cover	NA	OK	NA	Dedicator	04/12/11	Well label attached to dedicator
EW-P2	6	2/14/11	Paint	OK	OK	NA	NA	NA	Missing	NA	EW Pump	04/12/11	
EW-5	6	2/14/11	Bent	Vault damaged	OK	NA	NA	NA	Missing	NA	EW Pump	04/12/11	Vault secured (well scheduled for decommissioning per RI/FS.

Chevron PCPL Fillmore - Photo Log Sheet

MW-1S (February 2011)

WELL MAINTENANCE PERFORMED

- Painted for Corrosion Protection

Chevron PCPL Fillmore - Photo Log Sheet

MW-02S (February 2011)

WELL MAINTENANCE PERFORMED

- Painted for Corrosion Protection

Chevron PCPL Fillmore - Photo Log Sheet

MW-03S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-04S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-06S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-08S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-09S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-10P (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-11S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-12S (February 2011)

WELL MAINTENANCE PERFORMED

- Painted for Corrosion Protection

Chevron PCPL Fillmore - Photo Log Sheet

MW-14S (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Attached

Chevron PCPL Fillmore - Photo Log Sheet

MW-17S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-18S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-19S (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Concrete Pad and Well Vault Replaced
- Well Label Added

Chevron PCPL Fillmore - Photo Log Sheet

MW-20S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-21S (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Gasket and Well Label Replaced
- Threads for Bolts Retapped

Chevron PCPL Fillmore - Photo Log Sheet

MW-22S (February 2011)

WELL MAINTENANCE PERFORMED

- Threads for Bolts Retapped

Chevron PCPL Fillmore - Photo Log Sheet

MW-25S (February 2011)

WELL MAINTENANCE PERFORMED

- Painted for Corrosion Protection

Chevron PCPL Fillmore - Photo Log Sheet

MW-26S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-27S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-28S (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-29S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-30S (February 2011)

WELL MAINTENANCE PERFORMED

- Painted for Corrosion Protection

Chevron PCPL Fillmore - Photo Log Sheet

MW-31D (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-32S (February 2011)

WELL MAINTENANCE PERFORMED

- Painted for Visibility

Chevron PCPL Fillmore - Photo Log Sheet

MW-34S (February 2011)

WELL MAINTENANCE PERFORMED

- Gasket Replaced
- Threads for Bolt Retapped

Chevron PCPL Fillmore - Photo Log Sheet

MW-35S (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-36S (June 2006)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility

Chevron PCPL Fillmore - Photo Log Sheet

MW-37S (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-38S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-39S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-40S (February 2011)

WELL MAINTENANCE PERFORMED

- Gasket and Well Label Replaced
- Bolt Hole Threads Retapped

Chevron PCPL Fillmore - Photo Log Sheet

MW-41S (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-42S (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

MW-43S (February 2011)

WELL MAINTENANCE PERFORMED

- Gasket and Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-44S (June 2006)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Gasket and Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-45S (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Gasket and Well Label Replaced
- Bolt Hole Threads Retapped

Chevron PCPL Fillmore - Photo Log Sheet

MW-48S (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Gasket and Well Label Replaced
- Bolts Replaced and Threads Retapped

Chevron PCPL Fillmore - Photo Log Sheet

MW-49S (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Gasket and Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

MW-50S (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Well Label Replaced
- Bolts Replaced and Threads Retapped

Chevron PCPL Fillmore - Photo Log Sheet

EW-1 (February 2011)

WELL MAINTENANCE PERFORMED

- None Required

Chevron PCPL Fillmore - Photo Log Sheet

EW-2 (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility

Chevron PCPL Fillmore - Photo Log Sheet

EW-P2 (February 2011)

WELL MAINTENANCE PERFORMED

- Lid Painted for Visibility
- Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

EW-4 (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Replaced

Chevron PCPL Fillmore - Photo Log Sheet

EW-5 (February 2011)

WELL MAINTENANCE PERFORMED

- Well Label Replaced
- Vault Secured (Well Scheduled for Decommissioning)