FOURTH FIVE-YEAR REVIEW REPORT FOR

HEWLETT-PACKARD (620-640 PAGE MILL ROAD) SUPERFUND SITE

PALO ALTO, SANTA CLARA COUNTY, CALIFORNIA

PREPARED BY

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9/10/15

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Executive Summary

This is the fourth Five-Year Review of the Hewlett-Packard 620-640 Page Mill Road Superfund Site (HP 620-640 PMR Site) and off-Property Area (together, the Site) located in Palo Alto, Santa Clara County, California. The purpose of this Five-Year Review is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this Five-Year Review was the signing of the previous Five-Year Review on September 30, 2010.

The Site is located south of Highway 101 and near the southeastern edge of Stanford University in Palo Alto, California. The Site is managed by the State of California together with several neighboring source sites that are not listed on the National Priorities List (NPL) – the Hewlett Packard 395 Page Mill Road Site (395 PMR Site) and the Varian 601 California Avenue Site (601 CA Site). All three sites contributed contaminants to the groundwater plume which underlies these properties as well as the adjacent mixed residential/commercial neighborhood. This neighborhood is termed the off-Property Area and consists of the California-Olive-Emerson (COE) Study Area (for the streets which bound this area) and Perimeter Area (areas south of Olive Avenue to Margarita Avenue). Remediation of the overall groundwater plume is managed as a combined project, however the Site includes the off-Property Area only (COE Study Area and Perimeter Area), but not the 395 PMR Site or 601 CA Site.

Hewlett-Packard manufactured optoelectronic equipment at the HP 620-640 PMR Site from 1962 to 1986. In 1981, soil investigations began at the Site after the discovery that at least 300 gallons of waste solvents had leaked from a 1,000 gallon underground storage tank (UST) that stored the used solvent. The primary contaminants of concern include trichloroethene (TCE) and tetrachloroethene (PCE).

In 1995, to protect long-term human health and the environment and address the presence of contaminants in soil and groundwater, EPA selected the following remedies for the Site:

- Soil vapor extraction and treatment
- Groundwater extraction and treatment
- Groundwater monitoring
- Institutional controls

The remedy is functioning as intended and there have been no changes to exposure assumptions. Groundwater extraction continues to remove contaminant mass and prevent the further migration of the contaminant plume. The treatment plant is successfully removing contaminants to below the effluent or receiving water limitations. Institutional controls prohibit construction of drinking water wells, which prevents current exposure to contaminated groundwater.

The detection of 1,4-dioxane in the system effluent suggests its presence in the aquifer, but there is no information regarding its distribution in the subsurface. It is recommended that 1,4-dioxane be analyzed in a future sampling event to determine subsurface 1,4-dioxane concentrations and distribution. California adopted a new Maximum Contaminant Level (MCL) for 1,2,4-trichorobenzene that is more stringent than the Record of Decision (ROD) cleanup level; this change affects future protectiveness because a) future groundwater ingestion is an exposure pathway; and b) the remedy calls for a deed restriction that prohibits the use of on-site groundwater for drinking water until final cleanup standards are achieved. Removal of

the deed restriction prior to achievement of the current California MCL would not be protective with respect to ingestion of groundwater.

Past and currently operating remedial actions have reduced contaminant concentrations in many wells on the HP 620-640 PMR Site. However, TCE concentrations in 24 wells on the HP 620-640 PMR Site still remain above cleanup levels.

Vapor intrusion was noted as a potential change in the exposure assumptions used at the time of remedy selection, and an extensive vapor intrusion assessment conducted in the last five years has concluded that the pathway is complete for subgrade structures in certain buildings within the study area. However, the sampling shows that there is no unacceptable risk to indoor air in the breathing zone of any continuously occupied living or work spaces sampled within both the residential and commercial Off-Site Study Area.

The 2014 vapor intrusion study included sampling 10 single-family and duplex residential buildings, 6 multi-family residential or mixed use properties, and 8 commercial properties. The study shows no evidence of vapor intrusion in the breathing zone of continuously occupied spaces.

However, elevated levels of vapor intrusion were detected in certain subsurface structures. Information collected so far shows TCE vapor intrusion occurring in certain pathway samples, including the following: indoor air in sub-grade garages; near floor drains and from within utility rooms in sub-grade garages; and from elevator shafts. However, no unacceptable vapor intrusion was found to be currently occurring in occupied living or work spaces.

Future or long-term unacceptable exposure scenarios could include sub-grade garage renovations that convert a portion of vapor intrusion-affected sub-grade garage space to continuously occupied work space, such as staffing offices for parking attendants.

It is recommended that significant changes in Site conditions that may occur in the future, such as a rise in shallow groundwater levels or significant on- or off-property development, be reviewed so as to determine whether the vapor intrusion pathway should be reassessed.

The annual National Pollutant Discharge Elimination System (NPDES) reports show that 1,4-dioxane is analyzed for and detected in the treatment system effluent. 1,4-Dioxane was commonly used as a stabilizer for chlorinated solvents, particularly 1,1,1-trichloroethane, which is a site Contaminant of Concern (COC). The detection of 1,4-dioxane in the system effluent suggests its presence in the aquifer, but there is no information regarding its distribution in the subsurface.

The remedy at the Hewlett-Packard 620-640 Page Mill Road Site currently protects human health and the environment because there are no current exposure pathways for groundwater consumption, and the vapor intrusion study has not detected vapor intrusion in currently occupied living or work spaces above levels of concern. However, to be protective in the long-term, a new cleanup level for 1,2,4-trichlorobenzene considering the new state MCL should be evaluated, an evaluation of the need for a remedy which considers the potential for future vapor intrusion exposures should be completed, and 1,4 dioxane should be analyzed in future site sampling to determine its distribution and whether it should be considered a site COC.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Hewlett-Packard (620-640 Page Mill Road)		
EPA ID: CAD980884209		
Region: 9	**State:** CA	**City/County:** Palo Alto / Santa Clara County

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: State of California, San Francisco Bay Regional Water Quality Control Board **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): Roger Papler
Author affiliation: San Francisco Bay Regional Water Quality Control Board (Lead Agency)
Review period: November 2014 – September 2015
Date of site inspection: February 24, 2015
Type of review: Policy
Review number: 4
Triggering action date: 9/30/2010
Due date *(five years after triggering action date)*: 9/30/2015

Five-Year Review Summary Form (continued)

ISSUES/RECOMMENDATIONS				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Changed Site Conditions**			
	Issue: Recent vapor intrusion investigations have demonstrated that a complete pathway does exist in subgrade structures. However, there have not been unacceptable exposures or exceedances of the risk range in currently occupied locations.			
	Recommendation: Evaluate the need for revisions to the current remedy to address potential future unacceptable vapor intrusion.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	Sept 2019
OU(s): N/A	**Issue Category: Monitoring**			
	Issue: The California MCL for 1,2,4-trichlorobenzene has decreased since the signing of the ROD and is more stringent than the current ROD cleanup level.			
	Recommendation: Evaluate whether the cleanup level for 1,2,4-trichlorobenzene should to be changed to the new state MCL and include in a decision document modification as necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	Sept 2020
OU(s): N/A	**Issue Category: Monitoring**			
	Issue: The Annual NPDES reports show that 1,4-dioxane is analyzed for and detected in the treatment system effluent. 1,4-Dioxane was commonly used as a stabilizer for chlorinated solvents, particularly 1,1,1-trichloroethane (Mohr, 2001), which is a site COC. The detection of 1,4-dioxane in the system effluent suggests its presence in the aquifer, but there is no information regarding its distribution in the subsurface.			
	Recommendation: Analyze for 1,4-dioxane in a future sampling event to determine subsurface 1,4-dioxane concentrations and distribution, and to assess whether 1,4-dioxane should be considered as a site COC.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	Enter date.

PROTECTIVENESS STATEMENT	
Protectiveness Determination: Short-term Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy at the Hewlett-Packard 620-640 Page Mill Road Site currently protects human health and the environment because there are no current exposure pathways for groundwater consumption, and the vapor intrusion study has not detected vapor intrusion in currently occupied living or work spaces above levels of concern. However, to be protective in the long-term, a new cleanup level for 1,2,4-trichlorobenzene considering the new state MCL should be evaluated, an evaluation of the need for a remedy which considers the potential for future vapor intrusion exposures should be completed, and 1,4 dioxane should be analyzed in future site sampling to determine its distribution and whether it should be considered a site COC.	

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List of Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BPHE	Baseline Public Health Evaluation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COE	California-Olive-Emerson Study Area
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
DCA	dichloroethane
DCE	dichloroethene
EISB	enhanced *in situ* bioremediation
EPA	United States Environmental Protection Agency
ESL	environmental screening level
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallon per minute
GWET	groundwater extraction and treatment
HP	Hewlett-Packard
ISCO	in-situ chemical oxidation
IRIS	Integrated Risk Information System
MCL	maximum contaminant level
mg/kg	milligram per kilogram
µg/L	microgram per liter
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OEU	Oregon Expressway Underpass
O&M	operation and maintenance
PCE	tetrachloroethene
PMR	Page Mill Road
ppm	parts per million
RA	remedial action
RAO	remedial action objective
Regional Water Board	San Francisco Bay Regional Water Quality Control Board
ROD	Record of Decision
RSL	regional screening level
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SCR	soil cleanup requirements
SVET	soil vapor extraction and treatment
SVOC	semi-volatile organic compound
TCA	trichloroethane

TCE	trichloroethene
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
Varian	Varian Medical Systems, Inc.
VOC	volatile organic compound

Fourth Five-Year Review Report

for

Hewlett-Packard (620-640 Page Mill Road) Superfund Site

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of FYRs are documented in five-year review reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 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.*"

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which 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 actions no less often than every five years after the initiation of the selected remedial action*."

The U.S. Army Corps of Engineers (USACE), Seattle District conducted the FYR and prepared this report regarding the remedy implemented at the Hewlett-Packard (HP) 620-640 Page Mill Road Superfund Site (HP 620-640 PMR Site) and off-Property Area (together, the Site) in Palo Alto, Santa Clara County, California. The State of California is the lead agency for the Site.

This is the fourth FYR for the Site. The triggering action for this statutory review is the previous FYR. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The Site consists of one Operable Unit (OU) which covers the soil and groundwater contamination at the HP 620-640 PMR Site as well as the area-wide groundwater contamination (off-Property Area). The Site is managed by the State of California together with several neighboring source sites that are not listed on the National Priorities List (NPL) – the Hewlett Packard 395 Page Mill Road Site (395 PMR Site) and the Varian 601 California Avenue Site (601 CA Site).

All three sites contributed contaminants to the groundwater plume which underlies these properties as well as the adjacent mixed residential/commercial neighborhood. This neighborhood is termed the off-Property Area and consists of the California-Olive-Emerson (COE) Study Area (for the streets which bound this area) and Perimeter Area (areas south of Olive Avenue to Margarita Avenue). Remediation of the overall groundwater plume is managed as a combined project, however the Site includes the off-Property Area only (COE Study Area and Perimeter Area), but not the 395 PMR Site or 601 CA Site.

2. Site Chronology

Table 1 lists the dates of important events for the Site.

Table 1. Chronology of Site Events

Event	Date
Hewlett-Packard (HP) began soil and groundwater investigation after discovery of a leaking underground solvent storage tank	1981
HP began initial groundwater remediation	1982
HP conducted soil excavations	1987-1992
HP expanded groundwater remediation	1988
The HP 620-640 Page Mill Road Site (HP 620-640 PMR Site) and off-Property Area (together, the Site) was listed on the National Priorities List (NPL)	1990
Additional soil excavation was conducted	1994
HP began soil vapor extraction	1994
San Francisco Bay Regional Water Quality Control Board (Regional Water Board) Order 94-130 approved remedies that include soil vapor extraction and treatment (SVET) and groundwater extraction and treatment (GWET) and discharge to sanitary sewer and surface water under National Pollutant Discharge Elimination System (NPDES) permit	1994
EPA issued a Record of Decision (ROD) for the Site	1995
The SVET system at the HP 620-640 PMR Site was abandoned due to rising groundwater levels	1997
Regional Water Board and EPA completed the first Five-Year Review (FYR)	2000
Regional Water Board approved a work plan for chemical oxidation and decommissioning groundwater monitoring and extraction wells at the former Mayfield School site and northeast end of the HP 620-640 PMR Site	2005
HP conducted chemical oxidation treatment in the combined A1/A2 zone in the area south and southwest of well F44A and permanently decommissioned extraction wells EW-1, EW-2 and EW-6	2005
Regional Water Board and EPA completed the second FYR	2005

Event	Date
Stanford University completed redevelopment of the former Mayfield School site and northeast portion of HP 620-640 PMR Site as the Stanford/Palo Alto Community Playing Fields soccer complex	2006
HP completed a one-time chemical oxidation treatment in extraction well EW-14; the well was then permanently decommissioned	2006
HP decommissioned extraction well EW-9, permanently shut down extraction well EW-12, and shut down (on a trial basis) well EW-13	2007
HP shut down extraction wells EW-4, EW-5 and EW-10 for approved hydraulic testing	2007
HP conducted a preliminary assessment of in-situ remedial technologies, and conducted additional characterization investigations of the A Zones using high-resolution technologies	2007-2008
HP conducted soil gas sampling in the off-property down-gradient area	2008
Regional Water Board approved permanent shut-off of wells EW-4 and EW-5	2008
Regional Water Board and EPA completed the third FYR	2010
HP submitted findings of 2010 extraction well EW-10 study; recommended continued operation of EW-10	May 2011
HP completed a study in the COE Area to define the lateral extent of volatile organic compounds (VOCs) in groundwater and study trichloroethene (TCE) concentrations in first-encountered groundwater to support vapor intrusion studies	Oct 2011
HP completed a study evaluating remedial options for chlorinated hydrocarbons	Nov 2011
HP upgraded the 620-640 PMR Site GWET system: New extraction wells TW-1 and TW-2 were connected (these wells replaced well EW-7) and the treatment system was upgraded to increase capacity and add additional treatment methods and equipment	2013
HP completed a vapor intrusion study in the off-Property COE Study Area. No contaminants attributable to vapor intrusion were found in the breathing zone, but the Regional Water Board required additional assessment based on some elevated pathway and sub-grade sample results.	Sept 2014
HP completed trial shutdown of extraction wells EW-15 and EW-16; the final report recommended continued shutdown	Dec 2014

3. Background

3.1. Physical Characteristics

The Site is located in Palo Alto, California south of Highway 101 near the corner of Page Mill Road and El Camino Real (Figure 1). The city of Palo Alto has a population of approximately 66,600 (as of 2013), is located on the west side of Silicon Valley in Santa Clara County, and is part of the San Francisco Bay metropolitan region.

The Site, which includes the 10-acre HP 620-640 PMR Site and off-Property Area (COE Study Area and Perimeter Area), is located south of Highway 101 and near the southeastern edge of Stanford University in Palo Alto, California. The off-Property Area is located north and east of the HP 620-640 PMR Site.

Within the off-Property Area, the COE Study Area is bounded by California Avenue to the west, Olive Avenue to the east, Emerson Avenue to the north, and the southernmost extent of the HP 620-640 PMR Site to the south. Adjacent to and east of the COE Study Area lies the Perimeter Area, which is bounded by Emerson Street to the north, Fernando Avenue to the east, and State Highway 82 and Hansen Way to the south.

Groundwater contamination from the HP 620-640 PMR Site commingled with similar contaminant releases from two other neighboring sites – a former HP facility located northeast of the HP 620-640 PMR Site at 395 Page Mill Road (395 PMR Site) and the former Varian Medical Systems, Inc. (Varian) facility located adjacent to and northwest of the HP 620-640 PMR Site at 601 California Avenue (601 CA Site). The off-Property Area volatile organic chemical (VOC) plume extends approximately 1,500 feet down-gradient (northeast) of the HP 620-640 PMR Site, where it is captured by the Oregon Expressway Underpass (OEU) subdrain.

HP first occupied the 620-640 Page Mill Road property in 1962, ceased operations in 1986, and began redevelopment in 1992 with the construction of a new office building. HP constructed the majority of the new building over a basement parking garage and the remaining on-grade portion of the building over a vapor barrier. HP sold the building and associated land lease in May 2007 to Stanford University. According to the Santa Clara County website, the current occupant of the building is Wilson Sonsini Goodrich & Rosati, a legal firm.

No portion of the HP 620-640 PMR Site, COE Study Area or Perimeter Area is in or near an environmentally sensitive area.

Figure 1. Location Map for the Hewlett-Packard (620-640 Page Mill Road) California-Olive-Emerson (COE) Superfund Site

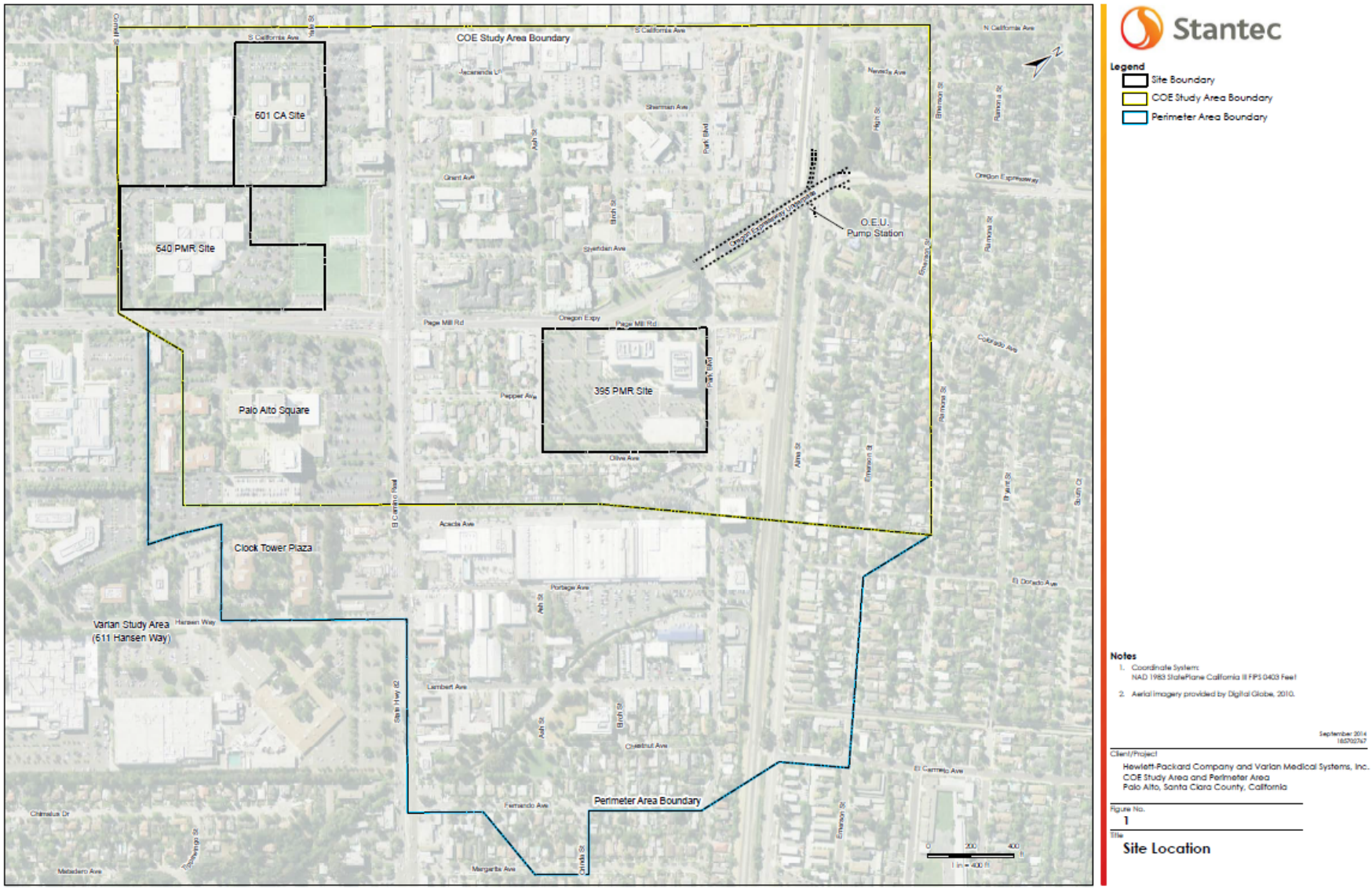

Figure 2. Detailed Map of the Hewlett-Packard (620-640 Page Mill Road) Superfund Site and Other Sites Located Nearby

3.2. Hydrogeology

The Site is underlain by alluvial fan deposits associated with San Francisquito Creek to the west and Matadero Creek to the east. Two primary water-bearing zones were identified within the alluvial fan deposits and are known as the following: the A Zone, the saturated portion of which extends approximately 13 to 55 feet below ground surface (bgs); and the B Zone, which extends approximately 60 to 120 feet bgs. A third aquifer, the C Zone, begins about 150 feet bgs. The aquitard between the B and C Zones is 30 to 50 or more feet thick. Shallow groundwater is not currently used as a source of potable water within the area of the groundwater plume.

The A Zone is further subdivided into the A1 Upper (A1U) Zone, A1, A2, and A2 Deeper (A2D) Zones. Coarse-grained sediments that comprise the A1U Zone generally occur between approximately 10 to 30 feet bgs. The A1U Zone is saturated beneath the northeastern portion of the Site and is unsaturated in the southwestern portion of the Site. The A1 Zone typically occurs between approximately 30 and 40 feet bgs, and the A2 Zone generally occurs between approximately 40 and 55 feet bgs. Within the western portion of the Site, the A1 and A2 sands are in direct contact and form a single A1/A2 Zone. The A2D Zone comprises thin sandy lenses that extend into the upper portion of the aquitard that separates the A and B Zones. Within the A Zone, aquitards vary from 1 to 22 feet thick and the thinner aquitards allow some hydraulic connection between the water-bearing zones.

Above the B Zone, the aquitard ranges from 5 to 23 feet in thickness. The B Zone is further subdivided into the B1 and B2 Zones. Within the B Zone, the aquitard separating the B1 and B2 Zones is approximately 20 feet thick.

The regional groundwater flow direction is generally to the northeast from the hills toward San Francisco Bay. Local variations in the distribution of coarse and fine-grained deposits appear to cause localized refraction of groundwater flow, which affects the distribution and migration paths of chemicals in groundwater. Groundwater extraction also appears to cause localized refraction of groundwater flow. Approximately 1,500 feet north of the HP 620-640 PMR Site, the OEU subdrain captures the majority of the Site's plume and creates a preferential pathway toward the subdrain near and at the distal end of the plume.

The OEU passes under the Southern Pacific Railroad tracks, Alma Street, and Park Boulevard and extends approximately 24 feet bgs and into the A1U Zone. To prevent flooding of the OEU, a subdrain system was installed to control groundwater flow of the A1U Zone. The OEU subdrain probably also affects the A1 and A2 Zones based on non-detectable to near-trace VOC levels in monitoring wells located down-gradient from the OEU.

3.3. Land and Resource Use

Land use in the vicinity and down-gradient of the Site is predominantly commercial, with smaller areas of residential development. A soccer complex occupies the property located immediately down-gradient of the HP 620-640 PMR Site. Neighborhood drinking water does not come from contaminated groundwater in the area. The City of Palo Alto's drinking water for this region is supplied by the San Francisco Water Department's Hetch Hetchy System. Five municipal backup water supply wells located within three miles of the HP 620-640 PMR Site draw water from a deeper aquifer that is not affected by Site-related

contamination. HP manufactured optoelectronic equipment at the HP 620-640 PMR Site from 1962 to 1986. In 1981, soil investigations began at the Site after the discovery that at least 300 gallons of waste solvents had leaked from a 1,000 gallon underground storage tank (UST). The most frequently detected contaminants in soil included arsenic, gallium, trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene (1,1,-DCE), tetrachloroethene (PCE), 1,2,4-trichlorobenzene, and phenol.

The solvent UST release also contaminated groundwater. The chemicals most frequently detected in the groundwater beneath the Site included TCE, 1,1,1-TCA, 1,1-DCE and PCE. Contamination is mostly confined to the A-Zone; in the B Zone, the VOC contamination is below maximum contaminant levels (MCLs). Between the B and C zones there is a 30 to 50-foot aquitard. It was determined that C Zone monitoring was not needed because of non-detectable to trace levels of VOCs in the B Zone and the thickness of the B-C aquitard.

The Site was listed on the NPL on February 21, 1990.

3.4. Initial Response

The leaking UST was excavated and removed later in 1981. HP ceased operations at the Site in 1986.

Groundwater extraction and treatment (GWET) as an interim remedial measure began at the HP 620-640 PMR Site in 1982 and operated through 1993. The extraction system was expanded throughout the 1980s and 1990s. The expanded GWET system began full time operation in 1994 and originally included three on-Property and six off-Property extraction wells. The original three on-Property wells included EW-4 and EW-5 respectively installed in the A1 and A2 Zones, and EW-7 in the A1 Zone. The original six off-Property wells included EW-1, EW-2, and EW-9 in the A1U Zone, EW-6 in the combined A1/A2 Zone, and EW-8 and EW-10 in the A1 Zone.

Groundwater interim remedial measures in the Perimeter Area began in March 1993 with construction of extraction well EW-13 (A1 zone).

Soil excavations between 1987 and 1992 removed soil containing semi-volatile organic compounds (SVOCs) at levels above 10 parts per million (ppm). HP operated an on-Property soil vapor extraction and treatment (SVET) system full time from 1994 to 1995 to remediate soil containing residual VOCs in the upper portion of the vadose zone until remaining VOC levels were at or below the cleanup standard of 1 ppm. The SVET system included a total of 28 soil vapor extraction (SVE) wells that were screened in the upper, intermediary, and lower intervals of the then-unsaturated vadose zone.

3.5. Basis for Taking Action

The Site overlies the Santa Clara Valley groundwater basin. The primary contaminants of concern (COCs) for the HP 620-640 PMR Site were TCE, 1,1,1,-TCA, 1,1-DCE, and PCE. The primary threats to human health were posed by potential future ingestion of or dermal contact with groundwater or inhalation of contaminated groundwater vapors.

4. Remedial Actions

4.1. Remedy Selection

The Remedial Action Objectives (RAOs) for the Site, as specified in the 1994 Feasibility Study (FS), are as follows:

- Prevent human exposure by ingestion of groundwater containing chemicals of concern (COCs) in excess of MCLs
- Prevent human exposure by ingestion of, inhalation of, or dermal contact with groundwater for all COCs such that cancer risks do not exceed 10^{-4} to 10^{-6} in aggregate for all COCs and such that the non-cancer hazard index is less than 1.0 for all COCs
- Mitigate migration of groundwater that contains COCs at levels above MCLs

The San Francisco Bay Regional Water Quality Control Board (Regional Water Board) adopted Final Site Cleanup Requirements (SCR) Order No. 94-130 in September 1994 and EPA issued a Record of Decision (ROD) in March 1995. The final cleanup remedy selected in the ROD for the Site consisted of the following:

- Continued operation of the existing 15-well SVE system at the Site until final cleanup standards are achieved
- Expansion and continued operation of the current on-Property and off-Property GWET system until final cleanup standards are achieved
- Long-term groundwater monitoring
- A deed restriction for the HP 640 PMR site prohibiting use of on-site groundwater for drinking water until final cleanup standards are achieved

The ROD selected cleanup standards for both soil and groundwater as defined in the Regional Water Board's SCR Order. The groundwater cleanup standards for all contaminants were set to the more stringent of the federal or state MCLs, except for acetone for which no MCLs existed. For acetone, the cleanup standard was based on the reference dose and hypothetical maximum exposure rate found in the 1992 EPA Health Effects Assessment Summary Tables (USEPA, 1992). Table 2 presents the groundwater cleanup standards specified in the ROD.

For soil, the cleanup standards selected in the ROD are 1.0 milligram per kilogram (mg/kg) for total VOCs and 25 mg/kg for acetone. The Regional Water Board set the 1 mg/kg total VOC standard based on guidance within the 1992 Ground Water Basin Plan Amendments, and set the 25 mg/kg acetone standard based on the chemical transport model described in the Feasibility Study.

Table 2. Groundwater Cleanup Standards Selected in ROD

Contaminants of Concern	1995 ROD Selected Cleanup Level (µg/L)
Acetone	3,500
Benzene	1
1,1-Dichloroethane (1,1-DCA)	5
1,2-Dichloroethane (1,2-DCA)	0.5

Contaminants of Concern	1995 ROD Selected Cleanup Level (µg/L)
1,1-Dichloroethene (1,1-DCE)	6
cis-1,2-Dichloroethene	6
trans-1,2-Dichloroethene	10
Methylene Chloride	5
Tetrachloroethene (PCE)	5
1,1,1-Trichloroethane (1,1,1-TCA)	200
1,1,2-Trichloroethane (1,1,2-TCA)	3
Trichloroethene (TCE)	5
Freon 113	1,200
1,2-Dichlorobenzene	600
1,2,4-Trichlorobenzene	70

Table 3. Soil Cleanup Standards Selected in ROD

Contaminants of Concern	1995 ROD Selected Cleanup Level (mg/kg)
Total VOCs	1
Acetone	25

4.2. Remedy Implementation

4.2.1. Soil Vapor Extraction and Treatment

HP periodically shut down and re-started the existing SVET system from 1995 until 1997 to allow for VOC rebound. An effectiveness evaluation conducted in 1995 concluded that the SVET system influent concentrations had decreased by approximately 99 percent and that remediation goals for VOCs and acetone had likely been achieved in the upper zone soil. Recommendations were made to operate the SVET system using only the lower zone wells; however, rising groundwater levels at that time had resulted in the re-saturation of soil surrounding the lower zone SVET wells. The SVET has not been operated for any significant time since August 1997 due to saturated conditions surrounding the lower zone SVET wells.

4.2.2. Groundwater Extraction and Treatment

HP 620-640 Page Mill Road Site

The GWET system existing at the time of the ROD continues to operate, but the extraction well locations have been modified on several occasions.

Currently EW-8, EW-10, TW-1 and TW-2 are the only operating extraction wells. Extracted groundwater is pumped through a pipeline from these wells to the northwest corner of the HP 620-640 PMR Site where the treatment system is located (Figure 3).

For treatment, the water is treated using an advanced oxidation process that utilizes hydrogen peroxide and ozone followed by two liquid-phase granular activated carbon (GAC) tanks for polishing. Following treatment, water is discharged to Matadero Creek via the City of Palo Alto storm drain. Annual NPDES Reports submitted by HP for 2010 – 2014 indicate that there have been no unacceptable exceedances from the effluent to receiving waters over that period.

Oregon Expressway Underpass (OEU)

The OEU subdrain dewatering system captures groundwater from the surrounding areas and helps limit plume migration. Historically, the VOC-impacted water collected at the OEU pump was discharged to the sanitary sewer system (under permit), and during high-flow times, water was pumped to a box culvert which discharged to Matadero Creek. In 2002, the current treatment system was installed consisting of vacuum air stripping that discharges to a box culvert, followed by passive air stripping as water flows approximately 2,200 feet in the box culvert toward Matadero Creek.

Perimeter Area

EW-14 (A1 zone) was later installed in 1995 and EW-12 (A1U zone) was installed in 1996. These wells were connected to a treatment system at 611 Hanson Way which began full-time operation in December 1996. EW-12 was shutdown in January 2006 due to flooding of the control vault. The 611 Hanson Way treatment system continued operation until March 2006 when the system was damaged and taken offline. Wells EW-13 and EW-14 were subsequently shutdown. An in-situ chemical oxidation (ISCO) treatment was conducted at EW-14 in July 2006 just prior to decommissioning of the well, as authorized by the Regional Water Board. EW-13 remains shutdown at present.

Two additional extraction wells, EW-15 (A1U zone) and EW-16 (A1 zone), were installed in 1995 and began full-time operation in 1996. Groundwater from these wells is discharged directly to the public sewer system without treatment (under permit). These two wells were recently shut down because VOCs at EW-15 and EW-16 does not currently appear to originate at the HP and Varian sites, ongoing extraction at EW-15 and EW-16 is not expected to substantially accelerate the remediation timeframe for groundwater in the EW-15 and EW-16 portion of the Perimeter Area, and the downgradient OEU dewatering system is expected to provide capture of water from the location of EW-15 and EW-16 (Stantec, 2013a).

4.3. Operation and Maintenance (O&M)

The treatment system at the HP 620-640 PMR Site is monitored remotely and personnel are on-site at least once per week for inspections and regular maintenance. There were no unexpected operations and maintenance (O&M) difficulties in the last five years, and updates to the O&M procedures were completed when the GWET system was updated in 2013. HP has estimated that O&M expenses are around $100,000-$200,000 per year.

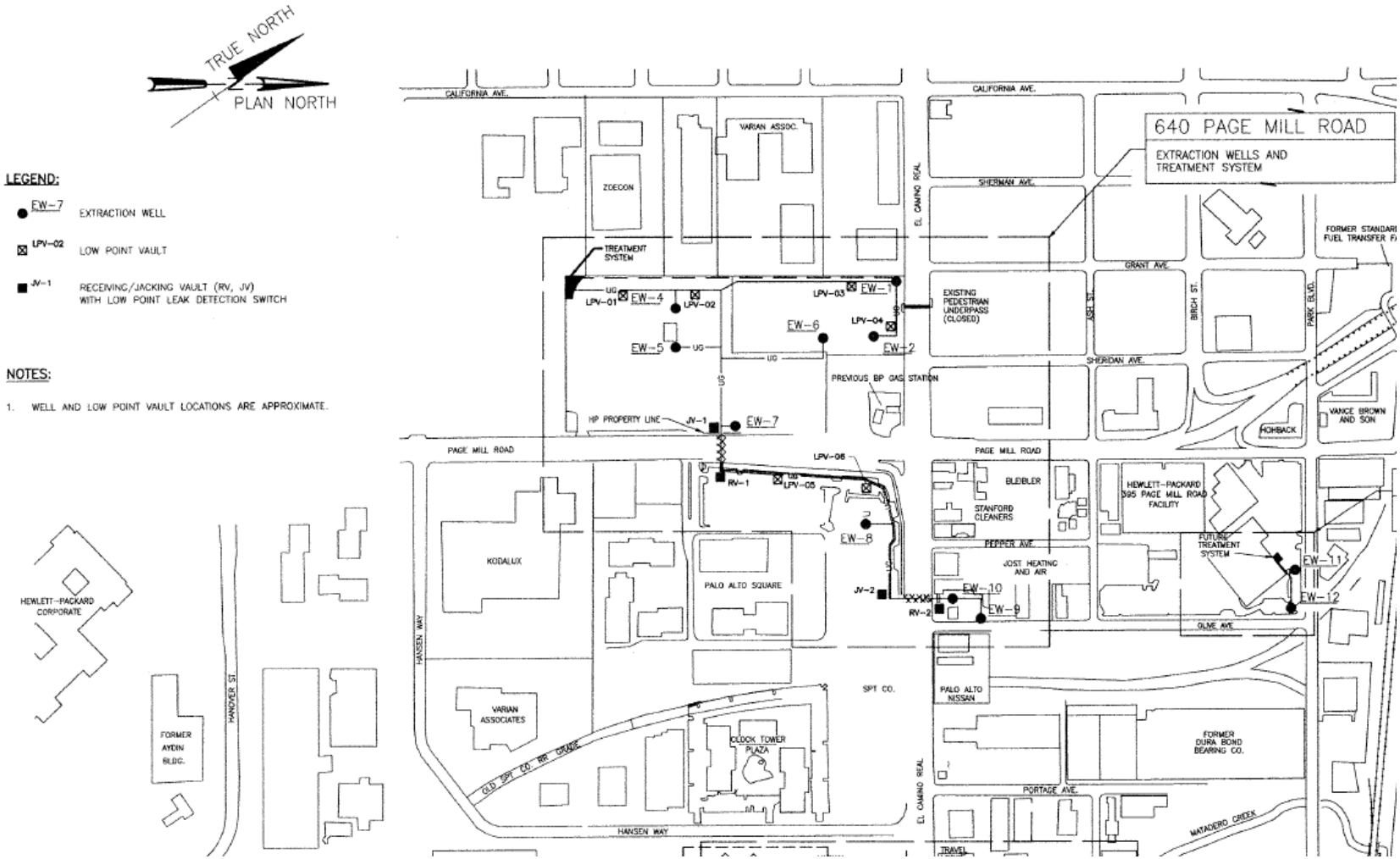

Figure 3. HP 620-640 Page Mill Road Groundwater Extraction and Treatment System

NOTE: Wells TW-1 and TW-2 are not shown. They are located just northwest of EW-7.

5. Progress Since the Last Five-Year Review

5.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2010 FYR for the Hewlett-Packard 620-640 Page Mill Road Superfund Site stated the following:

> *A protectiveness determination of the remedy at the Site cannot be made until potential vapor intrusion is re-evaluated in the Off-Property Study Area and the extent of the contamination in the A1 Upper, A1 and A2 Zones is defined. All other exposure pathways that could result in unacceptable risks are being controlled, and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater. The groundwater monitoring program in the Off-Property Study Area should be expanded to characterize the extent of TCE contamination in the A1U, A1 and A2 Zones. In the off-Property Study Area, the vapor intrusion exposure pathway will be reevaluated over the next 18 months. In order to make a protectiveness determination, an addendum to the 2010 Five-Year Review is required. The Five-Year Review addendum should be completed by October 30, 2012.*

The 2010 FYR included three issues and recommendations. Each recommendation and its current status is discussed below.

Issue 1

Issue 1 from the previous FYR:

> *The extent of the contamination in the A1 Upper, and A2 Zones should be fully defined. The A1U zone should be defined enough to determine if the area on the west side of the Off-Property Study Area is still unsaturated. There should be enough groundwater monitoring to determine the 100 µg/L and 50 µg/L TCE contour lines in order to identify all areas where vapor intrusion potential may be a concern. In areas where the A1U zone is still unsaturated, the A1 zone should be defined enough to determine 100 µg/L and 50 µg/L TCE contour lines.*

Recommendation:

> *Expand the groundwater monitoring program in the Off-Property Study Area to characterize the extent of TCE contamination in the A1U and A1 Zone.*

Status:

HP and Varian conducted a study to: (a) further define the lateral extent of VOCs that are at levels above drinking water standards, and (b) further refine the isoconcentration contours (iso-contours) of TCE in first-encountered groundwater (Stantec, 2011d). The conclusions of the study were the following:

- The lateral extent of TCE in groundwater at levels above MCLs has been defined for the A1U and A1 Zones for HP/Varian-related sources.
- The lateral extent of groundwater TCE in the A2 Zone has not been fully defined south-southeast of well O67A2 on the HP 620-640 PMR Site.

- The extent of the 50 µg/L and 100 µg/L iso-contours for TCE in the first encountered groundwater in the A1U Zone are not fully defined south-southeast of the 395 PMR Site and on the east side of Palo Alto Square, and may be due to other sources.
- Several other potential sources of groundwater TCE exist within the COE plume and should be considered when evaluating data.

The study also recommended additional work:

- Installing and sampling an A2 Zone monitoring well south-southeast of well O67A2 to more fully define the lateral extent of VOCs in the A2 zone.
- To fully define the 50 and 100 µg/L iso-contours for TCE, install two wells (well Q in the A1 Zone and well S in the A1U Zone) in Palo Alto Square after arranging for property access, and redevelop and sample the A1U Zone E-series wells located at the former Durabond-Mercer Site.

The Regional Water Board approved the recommendations and the conclusions except that the A1U Zone had been fully defined. Therefore, the Regional Water Board required HP and Varian to submit a report documenting the following:

- Installation of an additional A2 Zone well south/southeast of well O67A2.
- Planned monitoring well installations at Palo Alto Square (wells Q and S) to complete characterization of the first encountered groundwater.
- Redevelopment of remaining A1U zone E-series wells at the former Durabond-Mercer Site.

HP and Varian documented installation of well F168A1U in Palo Alto Square, completed January 23, 2012, and installation of well 169A2 at 775 Page Mill Road, completed March 17, 2012 (Stantec, 2012d). They also indicated that the E-series wells could not be located, and had likely been destroyed. These actions fulfilled the requirements of the Regional Water Board.

Issue 2

Issue 2 from the previous FYR:

> *The potential for indoor air vapor intrusion in the off-Property Study Area cannot be determined until the extent of contamination in the A1 Upper and A1 Zones is defined. Several buildings in the off-Property Study Area likely overly [sic] TCE shallow groundwater contamination. Also, TCE groundwater concentrations have increased in the shallow A1 zone in the off-Property area at the northwest corner of El Camino Real and Pepper Avenue.*

Recommendation:

> *Evaluate the potential subsurface to indoor air (vapor intrusion) pathway by conducting a vapor intrusion investigation using multiple lines of evidence in the Off-Property Study Area.*

Recommendation Status:

HP and Varian conducted a study of vapor intrusion within the COE Study Area and Perimeter Area (Stantec, 2014b). The investigation demonstrated that there have not been any unacceptable exceedances in currently occupied living or work spaces. However, a complete pathway does exist in certain buildings. Information collected showed TCE vapor intrusion occurring in certain pathway samples, including the following: indoor air in sub-grade garages; near floor drains and from within utility rooms in sub-grade garages; and from elevator shafts.

It is recommended that significant changes in Site conditions that may occur in the future, such as a rise in shallow groundwater levels or significant on- or off-property development, be reviewed so as to determine whether the vapor intrusion pathway should be reassessed.

Indoor air samples were collected from 10 single-family and duplex residential buildings (of 26 total contacted), 6 multi-family residential or mixed use properties (of 7 total contacted), and 8 commercial properties (of 11 total contacted). Air samples were collected from breathing zone locations in routinely occupied spaces and from locations and spaces that are not routinely occupied for extended periods of time (e.g. outdoor, crawlspaces, and sub-grade garages). The samples were analyzed for chlorinated volatile organic compounds, including trichloroethene (TCE).

Breathing zone samples (82 total) collected from the 16 off-Property residential properties yielded the following results:

- Tetrachloroethene (PCE) was detected in 5 samples at levels up to 0.55 $\mu g/m^3$ (micrograms per cubic meter) with one sample exceeding the California environmental screening level (ESL) of 0.41 $\mu g/m^3$. The single PCE exceedance was attributed to a source of PCE in the indoor air space unrelated to vapor intrusion.

- Trichloroethene (TCE) was detected in 8 samples at levels up to 1.9 $\mu g/m^3$ with three samples from building R7 (one of which was a duplicate) exceeding the EPA regional screening level (RSL) of 0.48 $\mu g/m^3$. The three samples with RSL exceedances were attributed to a source of TCE in the indoor space unrelated to vapor intrusion.

- 1,1,1-trichloroethane (1,1,1-TCA) was detected in 8 samples at levels up to 0.39 $\mu g/m^3$, none of which exceeded the RSL of 5,200 $\mu g/m^3$.

- 1,1-dichloroethene (1,1,-DCE) was detected in one sample at 0.073 $\mu g/m^3$, which did not exceed the RSL of 210 $\mu g/m^3$.

- 1,1-dichloroethane (DCA) was detected in one sample at 0.18 $\mu g/m^3$, which did not exceed the RSL of 1.8 $\mu g/m^3$.

Most of the above detections were not considered to originate from subsurface vapor intrusion. All chlorinated VOC detections in breathing zone samples were below the applicable ESL or RSL except where attributable to an indoor source.

Preferential pathway samples collected from these off-Property residential buildings yielded the following results:

- TCE was detected in three of the nine crawlspaces at levels up to 0.36 $\mu g/m^3$. With the exception of building R7 where an indoor TCE source was found and removed, TCE was not detected in the concurrently collected indoor air samples at the two other crawlspace locations.

- TCE was detected in three of five sub-grade garages tested, at concentrations of up to 1.3 $\mu g/m^3$ in one residential building – R20. In this same building, grab samples collected from the bottom of the elevator shaft during two different sampling events showed TCE concentrations of 6.8 $\mu g/m^3$ and 10 $\mu g/m^3$.

In summary, chlorinated VOCs were detected in some of the preferential pathways (crawlspaces, sub-grade garages, elevator shafts) in the off-Property residential area, demonstrating that the vapor intrusion pathway is complete in certain buildings. Excluding the residential buildings where a confounding source of PCE or TCE was identified (see above discussion), concentrations in living space breathing zone samples from these buildings were either below laboratory reporting limits (non-detect) or below applicable screening levels.

Breathing zone samples (66 total) collected from the eight off-Property commercial buildings yielded the following results:

- PCE was detected in 3 samples at levels up to 1.1 $\mu g/m^3$, none of which exceeded the ESL of 2.0 $\mu g/m^3$.
- TCE was detected in 15 samples at levels up to 0.96 μg/m3, none of which exceeded the RSL of 3.0 $\mu g/m^3$.
- 1,1,1-TCA was detected in 4 samples at levels up to 0.26 $\mu g/m^3$, none of which exceeded the RSL of 22,000 $\mu g/m^3$.
- Freon 113 was detected in 1 sample at 4.7 $\mu g/m^3$, which did not exceed the RSL of 130,000 $\mu g/m^3$.

Preferential pathway samples (30 total) collected from the off-Property commercial buildings yielded the following results:

- TCE was detected at a concentration of 51 $\mu g/m^3$ in one occasionally occupied electrical utility ("meter") room in the sub-grade garage of building C23 during a building and garage ventilation-off sampling event. During a subsequent garage ventilation-on sampling event, this same meter room showed a TCE concentration of 130 $\mu g/m^3$.
- Indoor air samples from the building C23 garage ranged from 9.4 $\mu g/m^3$ TCE during a ventilation-on sampling event and up to 23 $\mu g/m^3$ TCE during a ventilation-off sampling event.
- Total VOC readings from drainage sumps in the building C23 garage obtained using a field photoionization detector were elevated above background readings, ranging up to 370 parts per billion (ppb) at one sump (dry with exposed earth, around 10 feet deep).
- A grab sample collected from the building C23 elevator shaft showed a TCE concentration of 27 $\mu g/m^3$.
- Contemporaneously collected indoor air samples from the first floor tenant suites directly above the meter room did not exceed any applicable TCE screening values.

HP and Varian subsequently installed a portable air purifying unit in the building C23 meter room to reduce the levels of TCE. The TCE concentration in a sample from the meter room collected after the air purifying unit was put into operation was 16 $\mu g/m^3$, an 88% reduction in TCE levels.

In summary, chlorinated VOCs were detected in some of the preferential pathways (sub-grade garages, sub-grade utility rooms, elevator shafts) in the off-Property commercial area, demonstrating that the vapor intrusion pathway is complete in certain buildings. However, concentrations in work space breathing zone samples from these buildings were either below laboratory reporting limits (non-detect) or below all applicable short-term and long-term screening levels.

Based on the results of the indoor air study, no unacceptable short-term or long-term health risks are expected for residential and commercial building occupants from the vapor intrusion pathway, however, evidence of vapor intrusion in certain subsurface structures was found.

Future or long-term unacceptable exposure scenarios could include a renovation of buildings similar to C23 – with up to 130 $\mu g/m^3$ in the sub-grade utility/meter room and 27 $\mu g/m^3$ in the elevator shaft – that converts a portion of the sub-grade garage space to continuously occupied work space, such as a staffing office for a parking attendant.

EPA and the Regional Water Board thus required additional work in order to fully evaluate vapor intrusion in buildings in the off-Property Area: other buildings with potential preferential pathways (such as sub-grade areas) or buildings in the original testing area whose residents did not previously sign up for sampling. HP and Varian submitted this work plan on January 30, 2015 (Stantec, 2015b). Additional sampling was conducted at two commercial use properties and four residential properties (Stantec, 2015c). There were no exceedances of the short- or long-term screening levels for any COCs in any samples.

Issue 3

Issue 3 from the previous FYR:

> *Groundwater-VOC levels have increased in the on-Property A1 Zone and in the Off- Property Study Area to east/northeast of the Property in the areas around and between extraction wells EW-7 and EW-10. There are insufficient data to determine vertical plume capture as well as capture of the northeast portion of the TCE plume in the A1 Zone.*

Recommendation:

> *Expand the groundwater monitoring system in the A1 Zone for the on- and off-Property areas around and between extraction wells EW-7 and EW-10 to ensure vertical plume capture and to determine if the GWET capture zone includes the northeast portion of the TCE plume in the A1 Zone.*

Recommendation Status:

HP and Varian evaluated: (a) the capture zone around two Off-Property extraction wells (EW-8 and EW-10), and (b) potential cross-contamination between A1 and A1U Zones at well F42A1. The report documenting this evaluation (Stantec, 2012b) reported the following:

- Installation of two A1 Zone wells (F165A1 and F166A1) northwest of EW-8 and wells F127A1 and F129A1.

- Collection of groundwater level measurements in the two new wells (F165A1 and F166A1) and other A1 Zone wells, including extraction wells EW-7 and EW-10, between June 2011 and March 2012.
- Calculation of respective capture zone widths of 1,560 and 150 feet around EW-8 and EW-10.
- Plotting of concentration trends that indicate the following:
    - Substantial decrease in VOC levels in wells near EW-8.
    - No increase in VOC levels in wells in or just outside the capture zone.

HP and Varian concluded that the VOC plume in the vicinity of extraction well EW-8 is adequately captured (Stantec, 2012b), and in the same report presented the following findings:

- The boring log for well F42A1showed no A1U Zone sediments in the area of well F42A1U.
- No upward vertical gradient exists between the A1 and A1U Zones.
- Lithologic interconnectivity between the A1 and A1U Zones is a more likely source of groundwater-TCE impacts.

HP and Varian concluded the F42A1 well is not a preferential vertical conduit for cross-contamination between the A1 and A1U Zones (Stantec, 2012b). The Regional Water Board disagreed that well F42A1 is not a potential vertical conduit between A1 and A1U Zones. Therefore, HP and Varian reconstructed F42A1 in March 2013 to discretely screen the A1 zone.

New extraction wells TW-1 and TW-2 were installed in 2012 (Stantec, 2012c). Extraction from EW-7 was suspended in 2013 based on the hydraulic influence and effective capture zone of well TW-1.

5.2. Other Work Completed at the Site During this Five Year Review Period

Extraction Well EW-10 Study

HP completed a pumping study for well EW-10, which was historically part of the remedy for VOCs, but has gone through periods of shut-off (Stantec, 2011c). The report included a recommendation to operate EW-10 at a rate of 5 gallons per minute (gpm), which was implemented.

Evaluation of Remedial Options

HP evaluated several remedial technologies and concluded that two remedial options would likely meet the RAOs (Stantec, 2011b):

- Enhanced GWET and injection of agents [enhanced *in situ* bioremediation (EISB)]
- Enhanced GWET using existing and new wells

Further work completed with these remedial technologies is described in the following two summaries "EISB Pilot Test" and "Hydraulic Testing."

EISB Pilot Test

In 2012, HP submitted work plans for an EISB pilot. Based on the results of the hydraulic testing study (described next), HP, with approval from the Regional Water Board, deferred conducting the EISB pilot study.

Hydraulic Testing

HP conducted a hydraulic testing study (Stantec, 2012c). The study report documented several activities, including:

- Shutting down extraction well EW-7 to allow groundwater levels to recover to equilibrium conditions.
- Installing test extraction wells TW-1 in the A1 Zone and TW-2 in the A2 Zone using mud rotary drilling technology.
- Developing the wells using compounds to enhance removal of the drilling mud cake.
- Conducting step-drawdown pump tests in well TW-1 with a peak drawdown of 5 feet and in well TW- 2 with a peak drawdown of 24 feet.
- Collecting (a) water-depth data during the pump testing with pressure transducers installed in the surrounding nearby A1 and A2 Zone wells and (b) hand-measured groundwater-depth data in the pumping wells.
- Collecting and analyzing groundwater samples during the pump test, with results showing groundwater-TCE levels up to 1,900 micrograms per liter (μg/L) in well TW-1 and up to 16,000 μg/L in well TW-2.

The study report concluded that hydraulic influence of TW-1 and TW-2 captures elevated groundwater-TCE areas near wells O119A1 and O67A2 and the current A1-Zone extraction well EW-7.

The study report recommended the following:

- Suspending extraction from EW-7 based on the hydraulic influence and effective capture zone of well TW-1,
- Pumping from TW-1 at 15 gpm and TW-2 at 30 gpm based on the pump test results, and
- Deferring the EISB pilot test for two years based on the calculated mass removed in the course of providing hydraulic capture of the A1- and A2-Zone plumes.

GWET Upgrade

On October 14, 2013, the GWET system was shut down so it could be enhanced and upgraded. The two new extraction wells, TW-1 and TW-2, were connected to the treatment system, replacing the extraction well EW-7. TW-1 is screened in the A1 zone, and TW-2 is screened in the A2 zone. The treatment system was also upgraded to increase capacity and add treatment methods and equipment. The GWET system restarted operation on January 6, 2014. Following the upgrade, groundwater is now treated using an advanced oxidation process which consists of ozone and hydrogen peroxide pre-treatment, and use of GAC as a polish. (Stantec, 2014a).

Trial Shutdown of EW-15 and EW-16

HP and Varian conducted a trial shutdown of wells EW-15 and EW-16, the purpose of which was to determine if groundwater in this area would be captured by the OEU dewatering system (Stantec, 2014c). The results indicate that the OEU dewatering system will capture the groundwater in the area and it was, therefore, recommended that EW-15 and EW-16 remain shut down.

6. Five-Year Review Process

6.1. Administrative Components

EPA Region 9 initiated the FYR in November 2014 and scheduled its completion for September 2015. The review team, consisting of Aaron King, (environmental engineer), Kayla Patten (environmental engineer), David Sullivan (geologist), and Robert Wilkins (civil engineer) from the U.S. Army Corps of Engineers (USACE) Seattle District, was led by Melanie Morash, EPA Region 9, and Roger Papler, California Regional Water Control Board. In October 2014, EPA held a scoping call with the review team to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in place.

6.2. Community Involvement

On August 29, 2015, a public notice was published in the *Palo Alto Daily Newspaper* announcing the commencement of the Five-Year Review process for the Hewlett-Packard 620-640 PMR Site, providing Melanie Morash, EPA Region 9, and Roger Papler, California Regional Water Control Board's contact information, and inviting community participation. The press notice is available in Appendix B. No one contacted EPA as a result of this advertisement.

The Five-Year Review report will be made available to the public once it has been finalized. The document will also be available online at www.epa.gov/region9/Hewlett-Packard and at DTSC's online information website: Envirostar. Copies will also be available at the EPA Superfund Records Center, located at: 95 Hawthorne Street, Suite 403 S, San Francisco, California 94105.

6.3. Document Review

6.3.1. ARARs Review

Applicable or Relevant and Appropriate Requirements (ARARs). are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance at a CERCLA site.

Chemical-specific ARARs identified in the selected remedy within the ROD for the groundwater at this Site and considered for this FYR for continued groundwater treatment and monitoring are listed in Table 4. Since the ROD was issued, only one groundwater chemical-specific ARAR has changed; the California MCL for 1,2,4-trichlorobenzene was changed to a more stringent value on June 12, 2003.

Table 4. Summary of Groundwater ARAR Changes

Contaminants of Concern	1995 ROD ARARs (µg/L)	Current Regulations (µg/L)	ARARs Changed?
Acetone	3,500*	3,500*	No
Benzene	1	1†	No
1,1-Dichloroethane (1,1-DCA)	5	5†	No
1,2-Dichloroethane (1,2-DCA)	0.5	0.5†	No

Contaminants of Concern	1995 ROD ARARs (µg/L)	Current Regulations (µg/L)	ARARs Changed?
1,1-Dichloroethene (1,1-DCE)	6	6†	No
cis-1,2-Dichloroethene	6	6†	No
trans-1,2-Dichloroethene	10	10†	No
Methylene Chloride	5	5‡	No
Tetrachloroethene (PCE)	5	5‡	No
1,1,1-Trichloroethane (1,1,1-TCA)	200	200‡	No
1,1,2-Trichloroethane (1,1,2-TCA)	3	5‡	No
Trichloroethene (TCE)	5	5‡	No
Freon 113	1,200	1,200†	No
1,2-Dichlorobenzene	600	600‡	No
1,2,4-Trichlorobenzene	70	5†	More stringent
*Derived from EPA *Health Effects Assessment Summary Table* (USEPA, 1992; USEPA, 2011) †California MCL ‡California and Federal MCL			

Federal and state laws and regulations other than the chemical-specific ARARs that have been promulgated or changed since the ROD was signed are described in Table 5. This table does not include those ARARs identified in the ROD that are no longer pertinent, now that the response action has transitioned from construction to long-term O&M phase work. For example, ARARs that related to remedial design and construction are not included in the table if they do not continue into long-term O&M.

Table 5. Applicable or Relevant and Appropriate Requirements (ARAR) Evaluation

Requirement And Citation	Description	Effect on Protectiveness	Comments	Amendment Dates (since ROD)
Federal Maximum Contaminant Levels *National Primary Drinking Water Regulations: Maximum Contaminant Levels and Maximum Residual Disinfectant Levels* 40 C.F.R. §§ 141.60 – 141-66	These regulations set chemical concentration limits for drinking water for the nation.	Changes to this requirement do not affect protectiveness.		30 Jan 1991 7 Dec 2000 1 Jul 1991 16 Jan 2001 17 Jul 1992 22 Jan 2001 1 July 1994 25 Mar 2003 29 Jun 1995 29 Jun 2004 16 Dec 1998 4 Jan 2006
State Maximum Contaminant Levels *Maximum Contaminant Levels – Organic Chemicals* C.C.R., Title 22, Division 4, Chapter 15, Article 5.5, § 64444	These regulations set chemical concentration limits for drinking water for the state of California.	Changes to this regulation may affect protectiveness because the California MCL for 1,2,4-trichlorobenzene is more stringent.		17 May 2000 12 June 2003
Bay Area Air Quality Management District (BAAQMD) Rules and Regulation *Air Stripping and Soil Vapor Extraction Operations* Regulation 8, Rule 47	This rule sets emissions limits of organic compounds from air stripping and soil vapor extraction equipment.	Changes to this requirement do not affect protectiveness.		15 June 2005

Requirement And Citation	Description	Effect on Protectiveness	Comments	Amendment Dates (since ROD)
EPA Office of Solid Waste and Emergency Response (OSWER) Directive *Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites* Directive No. 9355.0-28 (June 15, 1989)	This memorandum establishes guidance on the methods and implementation procedures for control of VOC air emissions from air strippers and soil vapor extraction systems used at Superfund sites.	There have been no changes; protectiveness is not affected.		None
Hazardous waste regulations *Identification and Listing of Hazardous Waste* *Maximum Contaminant Levels – Organic Chemicals* 40 C.F.R. § 261	This regulation identifies solid wastes that are subject to regulations under 40 C.F.R. Parts 262 through 265, and Part 268.	Changes to this requirement do not affect protectiveness.	This ARAR applies to the disposal of treatment residuals that are classified as hazardous waste.	11 May 1995 13 Mar 2002 1 Jul 1996 30 Jul 2003 12 Feb 1997 4 Mar 2005 12 May 1997 14 Jun 2005 6 May 1998 5 Aug 2005 26 May 1998 8 Sept 2005 14 Jul 1998 4 Oct 2005 6 Aug 1998 14 Jul 2006 11 May 1999 30 Oct 2008 6 Jul 1999 1 Dec 2008 16 May 2001 18 Mar 2010 3 Oct 2001 15 Jun 2010
Hazardous waste regulations *Standards Applicable to Generators of Hazardous Waste* 40 C.F.R. § 262	This regulation establishes standards for generators of hazardous waste.	Changes to this requirement do not affect protectiveness.	This ARAR applies to the disposal of treatment residuals that are classified as hazardous waste.	11 May 1995 21 Jun 2006 12 Apr 1996 14 Jul 2006 12 Feb 1997 1 Dec 2008 12 Jul 1999 25 Jun 2009 28 Sept 1999 8 Jan 2010 12 Mar 2004 18 Mar 2010 4 Mar 2005 20 Dec 2010 24 May 2005 22 Jun 2011 16 Jun 2005 7 Feb 2014

Requirement And Citation	Description	Effect on Protectiveness	Comments	Amendment Dates (since ROD)
Hazardous waste regulations *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities* 40 C.F.R. § 264	This regulation establishes national standards for acceptable management of hazardous waste.	Changes to this requirement do not affect protectiveness.	This ARAR applies to the disposal of treatment residuals that are classified as hazardous waste.	29 Sept 1995 21 Jan 1999 13 Nov 1995 30 Sep 1999 9 Feb 1996 3 Jul 2001 12 Apr 1996 22 Jan 2002 5 Jun 1996 13 Feb 2002 25 Nov 1996 26 Apr 2004 13 Jun 1997 14 Jun 2005 8 Oct 1997 12 Oct 2005 8 Dec 1997 4 Apr 2006 6 Mar 1998 14 Jun 2006 22 Apr 1998 16 Jun 2006 15 Sep 1998 14 Jul 2006 7 Oct 1998 8 Apr 2008 22 Oct 1998 8 Jan 2010 30 Nov 1998 18 Mar 2010
Hazardous waste regulations *Standards for Owners and Operators of Hazardous Waste Facilities Operating Under a Standardized Permit* 40 C.F.R. § 267	This regulation establishes national standards for acceptable management of hazardous waste under a 40 C.F.R. Part 270, Subpart J standardized permit.	Changes to this requirement do not affect protectiveness.	This ARAR applies to the disposal of treatment residuals that are classified as hazardous waste.	14 July 2006

6.3.2. Human Health Risk Assessment Review

A human health risk assessment was completed for the Site in the September 1992 *Baseline Public Health Evaluation* (BPHE) (ICF Technology Incorporated, 1992). The exposure pathways identified were domestic use of groundwater including ingestion of groundwater, inhalation of VOCs while showering, dermal exposure to groundwater, and inhalation of VOCs in indoor air. Potential risks associated with exposure to contaminated soil were not evaluated because all areas of soil contamination had been remediated.

Since groundwater at the Site was not used as a potable water source, it was concluded that the only potentially complete pathway was the inhalation of VOCs migrating from the groundwater into indoor air (i.e., vapor intrusion). However, the remaining three pathways were considered for the potential future site condition where groundwater might be used for domestic purposes.

The BPHE concluded that VOCs did pose carcinogenic and non-carcinogenic risk to residents via inhalation of indoor air, but did not pose a risk to workers in the area. For potential future site conditions where domestic use of groundwater is possible, ingestion of groundwater was the pathway expected to be responsible for most of the risk. The chemicals most often expected to contribute to carcinogenic risk for all exposure pathways were vinyl chloride, arsenic, TCE, and PCE.

Based on current site conditions, there are no changes to the exposure pathways that would affect protectiveness. Current institutional controls have prevented installation of domestic water wells within the contaminant-plume area. Therefore, inhalation of indoor air still remains the only potentially complete pathway.

Toxicity values: EPA's Integrated Risk Information System (IRIS) has a program to update toxicity values used by the Agency in risk assessment when newer scientific information becomes available, which was used in this review. In the past five years, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site. The Regional Screening Levels (RSLs) are chemical-specific concentrations for individual contaminants that correspond to a lifetime excess cancer risk level of $1x10^{-6}$ (or a Hazard Quotient of 1 for non-carcinogens), and they have been developed for a variety of exposure scenarios (e.g. residential, commercial/industrial). Although RSLs are not de facto cleanup standards for a Superfund site, they do provide a good indication of whether actions may be needed. Table 6 summarizes the toxicity review for the COCs identified in the ROD.

Table 6. Summary of Tapwater RSLs (2014) for COCs at the Site

Contaminant of Concern	ROD cleanup level (µg/L)	EPA RSLs, Residential Tapwater, all pathways (µg/L)			State MCL (µg/L)	Federal MCL (µg/L)	Is ROD cleanup level protective?
		Cancer	Cancer Protective Range	Non-cancer			
Acetone	3,500	--	--	14,000		3,500*	Yes
Benzene	1	**0.45**	0.45 - 45	33	1	5	Yes
1,1-Dichloroethane (1,1-DCA)	5	**2.7**	2.7 - 270	3,800	5	--	Yes
1,2-Dichloroethane (1,2-DCA)	0.5	**0.17**	0.17 - 17	13	0.5	5	Yes
1,1-Dichloroethene (1,1-DCE)	6	--	--	280	6	7	Yes
cis-1,2-Dichloroethene	6	--	--	36	6	70	Yes
trans-1,2-Dichloroethene	10	--	--	360	10	100	Yes

Contaminant of Concern	ROD cleanup level (µg/L)	EPA RSLs, Residential Tapwater, all pathways (µg/L)			State MCL (µg/L)	Federal MCL (µg/L)	Is ROD cleanup level protective?
		Cancer	Cancer Protective Range	Non-cancer			
Methylene Chloride	5	11	11 – 1,100	110	5	5	Yes
Tetrachloroethene (PCE)	5	11	11-1,100	41	5	5	Yes
1,1,1-Trichloroethane (1,1,1-TCA)	200	--	--	8,000	200	200	Yes
1,1,2-Trichloroethane (1,1,2-TCA)	5	**0.28**	0.28 - 28	**0.41**	5	5	Yes
Trichloroethene (TCE)	5	**0.49**	0.49 - 49	**2.8**	5	5	Yes
Freon 113	1,200	--	--	55,000	1,200	--	Yes
1,2-Dichlorobenzene	600	--	--	**300**	600	600	Yes
1,2,4-Trichlorobenzene	70	**1.1**	1.1 - 110	**4**	**5**	70	No[†]

Note: **Bold** values are less than the ROD cleanup level.

* No federal or state MCLs exist for acetone. This value is derived from EPA *Health Effects Assessment Summary Table* (USEPA, 2011).

[†] Institutional controls prevent current exposure to contaminated groundwater.

A review of IRIS information indicates that there have been several recent toxicity value revisions for seven groundwater COCs: benzene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1,2-trichloroethane, trichloroethene, 1,2-dichlorobenzene, and 1,2,4-trichlorobenzene. The impact of toxicity value revisions on protectiveness is evaluated by comparing ROD cleanup standards to the January 2015 EPA tapwater multi-pathway RSLs in Table 6.

For cancer risk, EPA uses a range of lifetime excess cancer risk between 10^{-4} and 10^{-6} for assessing potential exposure. For five of the COCs, their cleanup levels are above their respective cancer RSL, set at 10^{-6} lifetime excess cancer risk (benzene, 1,1-dichloroethane, 1,2-dichloroethane, trichloroethene, 1,2,4-trichlorobenzene); however, all five of those cleanup levels are still within EPA's protective range for excess cancer risk of 10^{-4} to 10^{-6}.

For non-cancer risk, four COCs (1,1,2-trichloroethane, trichloroethene, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene) have cleanup levels above the associated non-cancer RSL. Any concentration below the non-cancer RSL indicates that no adverse health effect from exposure is expected. Concentrations slightly above the non-cancer RSL may indicate an increased potential of non-cancer effects. Although the cleanup levels set for these four constituents are above the respective non-cancer RSLs, EPA considers the MCL for each constituent as promulgated under the Safe Drinking Water Act to be protective for non-cancer effects. All four of the current cleanup levels are equivalent to their respective federal MCLs; however, for 1,2,4-trichlorobenzene, the cleanup level is above the state MCL.

In 2011, EPA conducted an updated assessment for TCE which included a risk of fetal cardiac malformations due to short-term *in utero* exposures to TCE as a result of inhalation - September 2011 *Toxicological Review of Trichloroethylene in Support of the Integrated Risk Information System* (2011 Toxicological Review for TCE). The 2011 Toxicological Review for TCE set a reference concentration (RfC) of 2 µg/m3. In 2014 EPA Region 9 issued a memorandum regarding *EPA Region 9 Interim Action Levels and Response Recommendations to Address Potential Developmental Hazards Arising from Inhalation Exposures to TCE in Indoor Air from Subsurface Vapor Intrusion* and EPA's Office Of Superfund Remediation and Technology Innovation issued a memorandum to the EPA Regional

Superfund offices on *Compilation of Information Relating to Early/Interim Actions at Superfund Sites and the TCE IRIS Assessment*. Due to the lower action levels recommended to address a vapor intrusion risk, follow-up vapor intrusion sampling was conducted in both on- and off-property areas, which concluded that the pathway is complete in certain buildings however there is no current unacceptable risk from vapor intrusion.

EPA's 2011 Toxicological Review for TCE also developed safe levels that include at least a 10-fold margin of safety for health effects other than cancer. Any concentration below the noncancer RSL indicates that no adverse health effect from exposure is expected. Concentrations significantly above the RSL may indicate an increased potential of noncancer effects. The noncancer screening level for TCE is 0.0028 mg/L. EPA considers the TCE MCL of 0.005 mg/L protective for both cancer and noncancer effects.

6.3.3. Ecological Review

The 1995 ROD does not discuss ecological exposure pathways or receptors. The HP 620-640 PMR Site currently contains a commercial building with landscaping, a large parking lot, and a portion of the adjacent community playing fields soccer complex. Because the remaining contamination is primarily in groundwater, terrestrial and avian receptors, if present, would not be exposed to Site contamination.

6.4. Data Review

Soil Gas/Indoor Air

The on-Property SVET system has been shut down since 1997. The Regional Water Board approved shut-down of the SVET system based on collected data. There was no additional soil extraction or treatment done during the period of this review. Refer to previous Five Year Reviews and Groundwater Monitoring Reports for further information.

Indoor air (vapor intrusion) is discussed in detail in Section 5.1 of this document. Briefly, vapor intrusion assessments conducted in the last five years have concluded that the pathway is complete for certain buildings within the study area. However, the sampling shows that there is no unacceptable risk to indoor air in the breathing zone of any continuously occupied living or work spaces sampled within both the residential and commercial off-property Study Area.

It is recommended that significant changes in Site conditions that may occur in the future, such as a rise in shallow groundwater levels or significant on- or off-property development, be reviewed so as to determine whether the vapor intrusion pathway should be reassessed.

Groundwater

Groundwater monitoring data collected from 2010 through 2014 were reviewed to evaluate progress in remediating the contaminants in the groundwater plume. During this period, the GWET system continued to remove VOC mass from saturated soils, resulting in a reduction in concentration of VOCs in groundwater for the majority of the HP 620-640 PMR Site. The Site GWET system and the OEU dewatering system together have succeeded in controlling migration of the groundwater plume.

From 2010 to 2014, 46,136,654 gallons of groundwater were extracted and treated by the on-site GWET system, resulting in the removal of an estimated 1,116 pounds of VOCs. Two new extraction wells, TW-1 and TW-2, came online in early 2014 and have increased VOC mass removed about 300 percent compared to recent years. Annual NPDES Reports submitted by HP for 2010 – 2014 indicate that there have been no excursions from the effluent or receiving water limitations over that period.

Per the approved groundwater monitoring plan, 26 wells are sampled annually for chlorinated VOCs, and 102 wells are sampled every other year for VOCs (Figure 4 shows the well locations). Figures 5, 6, and 7 present iso-contour maps for PCE and TCE, and compare concentrations from 2009 to concentrations in 2014.

In the last five years, 1,2,4-Trichlorobenzene has been detected at least once above its current California MCL (5 µg/L) in wells EW-5, EW-7, F165A1, O67A2, O68A1, O116A1, O119A1, O120A2, T1A, and TW-1; of these, only O67A2, O119A1, and TW-1 had concentrations above the ROD cleanup level for 1,2,4-trichlorobenzene (70 µg/L).

The Annual NPDES reports show that 1,4-dioxane is analyzed for and detected in the treatment system effluent. However, 1,4-dioxane has not been reported for the system influent or for any of the monitoring wells. 1,4-Dioxane was commonly used as a stabilizer for chlorinated solvents, particularly 1,1,1-trichloroethane (Mohr, 2001), which is a site COC. The detection of 1,4-dioxane in the system effluent suggests its presence in the aquifer, but there is no information regarding distribution in the subsurface. It is recommended that 1,4-dioxane be analyzed in a future sampling event to determine subsurface 1,4-dioxane concentrations and distribution, and to assess whether it should be considered a site COC.

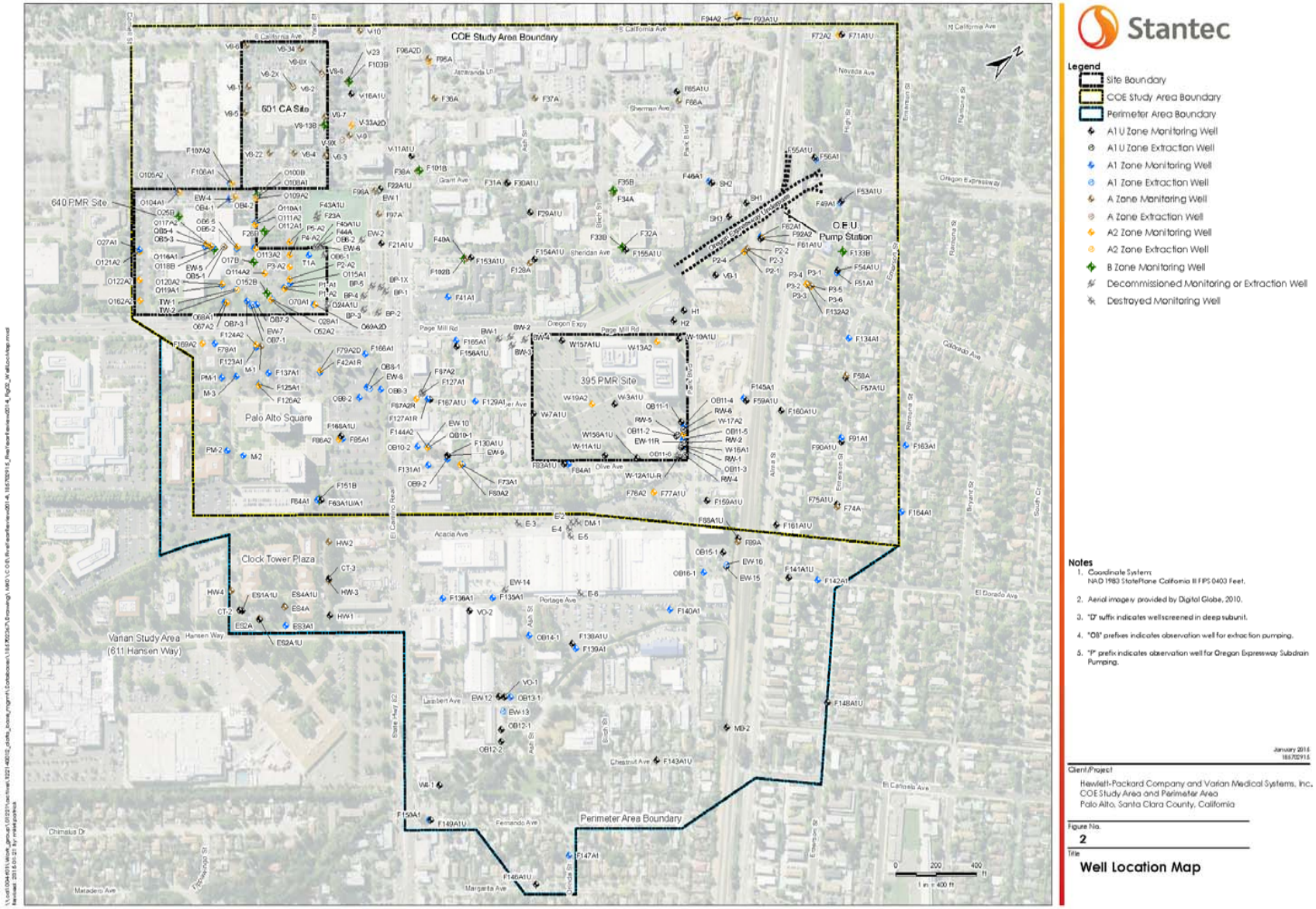

Figure 4. HP 620-640 Page Mill Road and overall Study area monitoring wells

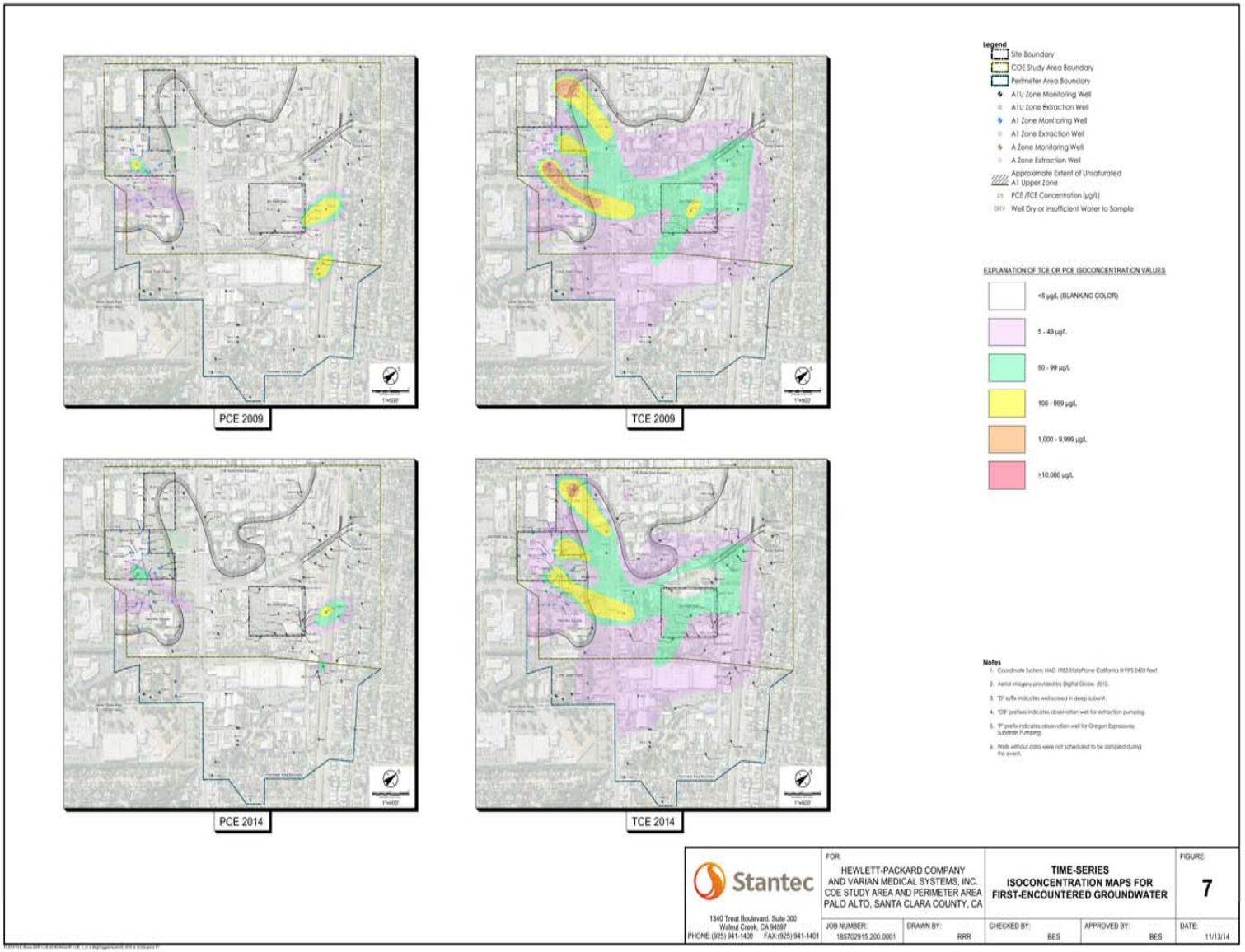

Figure 5. Iso-concentration map of PCE and TCE in first-encountered groundwater

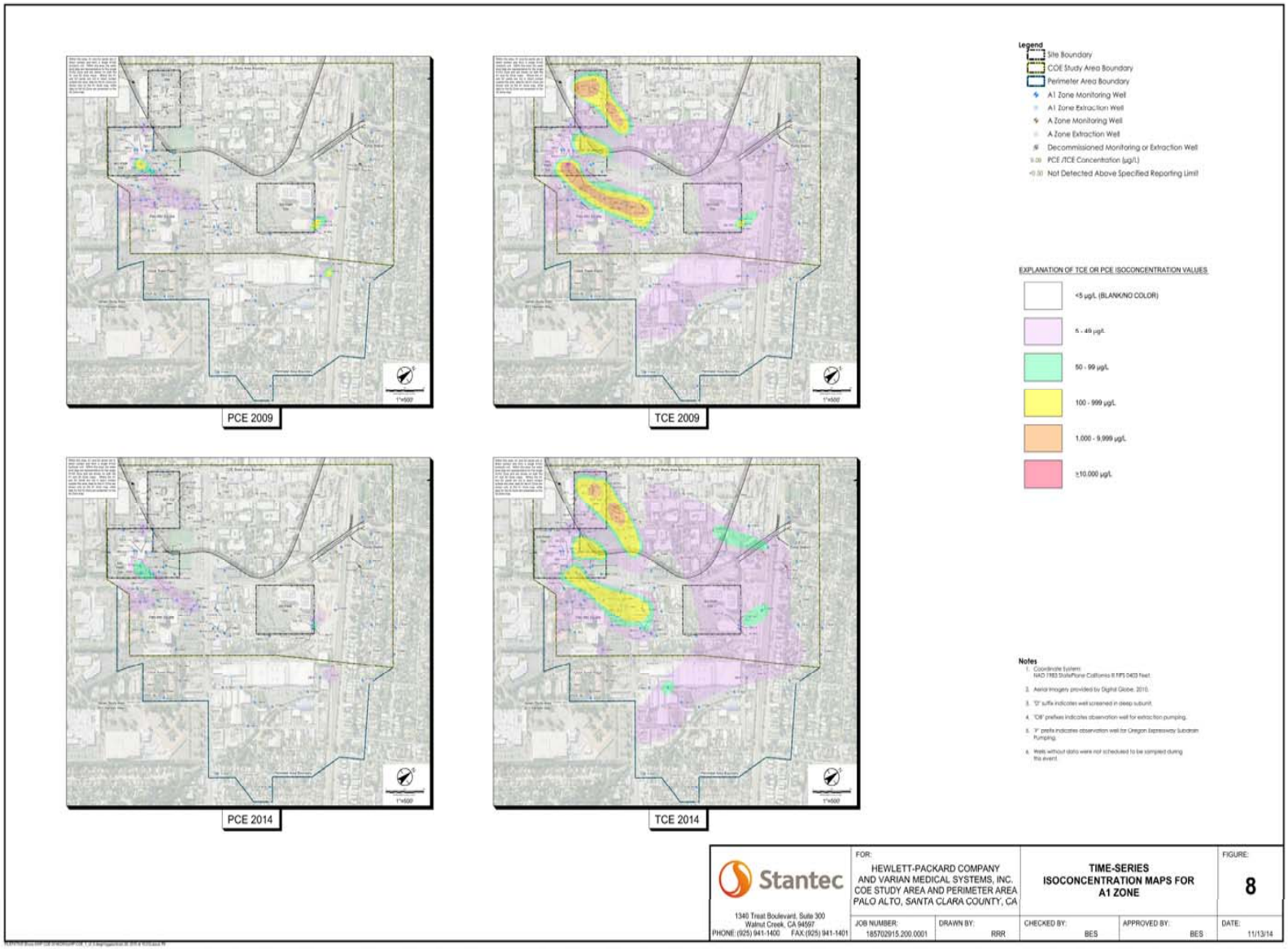

Figure 6. Iso-concentration map of PCE and TCE in A1 Zone

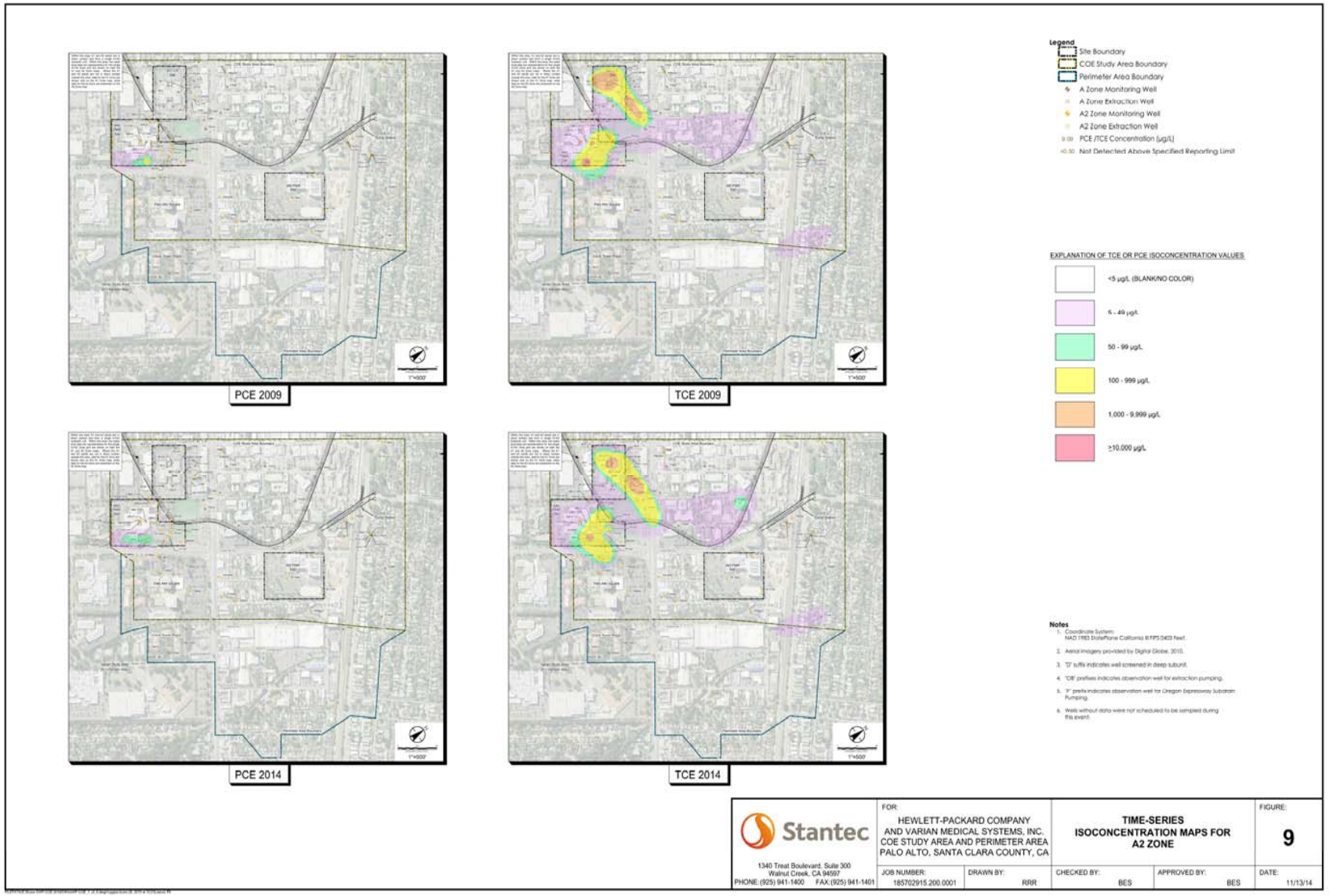

Figure 7. Iso-concentration map of PCE and TCE in A2 Zone

HP and Varian conducted trend analysis on available groundwater monitoring data from 2006-2014 using the GSI Mann-Kendall Toolkit (Stantec, 2015). The trend analysis included 158 wells or screened intervals within wells in the Site area, either as individual wells or wells screened in different zones (first-encountered groundwater, A1 Zone and A2 Zone). Of the wells evaluated in the trend analysis, about 92 percent showed decreasing, stable, or no significant trend.

Of 29 wells on the Site, the only one with an increasing trend for TCE is the extraction well, EW-4 (Table 7). Many of the wells with concentrations above the cleanup levels have a stable trend or no trend. Of the numerous Perimeter Area and COE Study Area wells, only three COE Study Area wells show increasing trends for TCE. Two of these wells are down-gradient of and associated with the 601 CA Site (Figure 4); TCE concentrations in these wells are expected to stabilize and decrease now that EISB has been fully implemented at the 601 CA Site. In the other well, TCE is not believed to be associated with VOC sources at the Site.

With several wells on the Site showing an increasing trend, no trend, or a stable trend for TCE and concentrations remaining above TCE cleanup goal, it is not possible to estimate when the TCE concentrations will decrease to or below current cleanup goal of 5 µg/L.

Table 7. Trends in the HP 620-640 PMR Site Wells (Stantec, 2015)

Area	Flow Zone	Well	COC	Period	Number of Samples	Mann-Kendall S Statistic	Confidence Factor (CF)	Coefficient of Variation (COV)	Trend [1]
640 Page Mill Road	A1	EW-4	TCE	2007-2013	4	6	95.8%	0.32	Increasing
			PCE	2007-2013	4	5	89.6%	0.39	No Trend
		EW-5	TCE	2007-2013	5	-4	75.8%	0.35	Stable
			PCE	2007-2013	5	-8	95.8%	0.37	Decreasing
		EW-7	TCE	2006-2014	9	-2	54.0%	0.52	Stable
			PCE	2007-2014	8	1	50.0%	0.45	No Trend
		O28A1	TCE	2007-2013	5	4	75.8%	0.79	No Trend
		O68A1	TCE	2006-2014	9	-10	82.1%	0.70	Stable
			PCE	2007-2014	8	4	64.0%	1.07	No Trend
		O104A1	TCE	2007-2013	4	-5	89.6%	0.78	Stable
		O108A1	TCE	2007-2013	4	-2	62.5%	0.47	Stable
		O110A1	TCE	2007-2014	5	-8	95.8%	0.61	Decreasing
		O112A1	TCE	2007-2014	5	2	59.2%	0.66	No Trend
		O115A1	TCE	2007-2013	4	-2	62.5%	0.34	Stable
		O119A1	TCE	2006-2014	9	-14	91.0%	0.88	Decreasing
			PCE	2006-2014	9	-16	94.0%	0.64	Decreasing
		P1-A1	TCE	2007-2014	8	-6	72.6%	0.25	Stable
		T1A	TCE	2006-2014	8	0	45.2%	0.83	Stable
	A2	O52A2	TCE	2006-2014	9	-27	99.8%	0.28	Decreasing
		O67A2	TCE	2006-2014	9	-28	99.9%	1.14	Decreasing
			PCE	2006-2014	9	-28	99.9%	0.86	Decreasing
		O109A2	TCE	2007-2013	4	3	72.9%	0.20	No Trend
		O111A2	TCE	2007-2014	5	-10	99.2%	0.40	Decreasing
		O113A2	TCE	2007-2013	5	0	40.8%	0.18	Stable
		O114A2	TCE	2006-2014	9	-30	100.0%	0.61	Decreasing
		O117A2	TCE	2006-2013	6	-3	64.0%	0.37	Stable
			PCE	2006-2013	6	-2	57.0%	0.78	Stable
		O120A2	TCE	2006-2014	9	-32	>99.9%	0.45	Decreasing
			PCE	2006-2014	9	-26	99.7%	0.66	Decreasing
		O121A2	TCE	2007-2014	5	6	88.3%	0.30	No Trend
		O122A2	TCE	2007-2013	4	-4	83.3%	0.20	Stable
			PCE	2007-2013	4	2	62.5%	0.08	No Trend
		O162A2	TCE	2011-2014	4	0	37.5%	0.11	Stable
			PCE	2011-2014	4	0	37.5%	0.18	Stable
		P1-A2	TCE	2007-2014	8	-5	68.3%	0.74	Stable
		P2-A2	TCE	2007-2014	8	-20	99.3%	1.42	Decreasing
		P3-A2	TCE	2007-2014	8	7	76.4%	0.24	No Trend
		P4-A2	TCE	2007-2014	8	-21	99.6%	0.67	Decreasing
		P5-A2	TCE	2007-2014	8	-27	>99.9%	0.39	Decreasing

6.5. Site Inspection

The site inspection was conducted on February 25, 2015. Participants included Melanie Morash with EPA Region 9; Roger Papler with the Regional Water Board; Wendy Chen, Mark Becker, Angus McGrath, and Bruce Scarbrough with Stantec; Paul Paschke with HP; John Buchanan with Varian; and Bridget Floyd and Heather Jackson with USACE Sacramento District. The site inspection checklist is presented in Appendix D. The site trip report, including photos from the site inspection, is presented in Appendix E. The site visit team toured the GWET system at the Site, along with the treatment systems at the 601 CA and 395 PMR Sites.

The updated groundwater treatment system at the Site that came online in January 2014 was in good condition. The site visit team observed the holding tank for untreated groundwater, the hydrogen peroxide and ozone treatment, and the GAC polishing. The site visit team also observed the extraction wells TW-1 and TW-2 as well as monitoring wells P1-A1 and P1-A2. All wells were in good working order with proper caps and locks in place.

6.6. Interviews

During the FYR process, interviews were conducted with parties impacted by the Site. The purpose of the interviews was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy that have been implemented to date. Three of the interviews were conducted during the Site visit on February 24, 2015. Three interviews with community members were conducted via phone; one on March 4, 2015, one on March 19, 2015, and one on May 4, 2015. Interviews are summarized below and complete interview reports are included in Appendix C.

Interviews during the site visit were conducted with Mark Becker, Principal Scientist for Stantec, John Buchanan, Environmental Affairs Manager for Varian, and Paul Paschke, Engineering Geologist for HP. All of these individuals believed that the treatment system was working well, particularly since the treatment system was upgraded. Mr. Becker noted that a vast majority of wells were showing a decreasing trend. New extraction wells were installed to address the area with an increasing trend. Although O&M costs were not disclosed, Mr. Paschke indicated that there were no unexpected costs. O&M procedures were changed due to the upgraded treatment system.

Phone interviews were also conducted with community members Robert Moss, Member of the Board of Directors for the Barron Park Association Foundation; Lenny Siegel, Executive Director for the Center for Public Environmental Oversight; and Ms. Anne Steinle, Member of the Board of Directors for the Birch Court Homeowners Association. Mr. Moss was most concerned that there was not enough information being provided to the community. He would like to see the Regional Water Board communicate directly with the Palo Alto council as well as hold meetings for community members to provide updates on the Site's progress. Mr. Moss is also concerned about possible future sub-grade structures as they are not regulated within the City of Palo Alto and are susceptible to vapor intrusion. Mr. Siegel was most concerned that the vapor intrusion pathway was not receiving enough attention. He would like to see a comprehensive vapor intrusion investigation of residential and commercial buildings above and around the TCE plume and revisit old investigations with the new guidelines in mind. Additionally, he recommended that EPA establish a working relationship with the City of Palo Alto to evaluate new developments on or near the plume for vapor intrusion; for example, EPA representatives

could occasionally attend city council meetings and advise on TCE vapor intrusion issues. Ms. Steinle was grateful for the work being done by the Regional Water Board and EPA, saying it was the nicest government experience she has had. Ms. Steinle recommended more frequent engagement and communication from the state with the public about the COE plume.

6.7. Institutional Controls

Stanford Management Company, who currently owns the property at the Site, recorded a covenant and environmental restriction (deed restriction) on the property that became effective May 28, 2003. The Deed Restriction includes the requirement that no owners or occupants of the property shall construct a well for the purpose of extracting contaminated water for any use, unless expressly permitted in writing by the Regional Water Board.

7. Technical Assessment

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

The GWET system is working as intended by the ROD. Groundwater extraction continues to remove contaminant mass and prevent the further migration of the contaminant plume. The treatment plant is successfully removing contaminants to below the effluent or receiving water limitations. Although the SVET has not been operational since 1997 due to rising groundwater levels, the soil cleanup standards were reached. Institutional controls prohibit installation of groundwater extraction wells for any purpose unless permitted by the Regional Water Board; this prevents exposure to contaminated groundwater.

There may be an opportunity to eliminate the GAC polishing step from the treatment system, but this would require assessment of contaminant concentrations following the advanced oxidation portion of the system; at this time, it is unknown if this data exists.

7.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

The original Baseline Public Health Evaluation indicated that current exposure pathways only included vapor intrusion; however, future pathways may also include domestic use of groundwater if drinking water wells were to be placed within the plume area. Currently, there are no drinking water wells in the area, and institutional controls prohibit drilling such wells. Therefore, the exposure assumptions in the ROD are still valid.

However, the detection of 1,4-dioxane in the groundwater treatment system effluent suggests its presence in the aquifer, but there is no information regarding distribution in the subsurface. It is recommended that 1,4-dioxane be analyzed in a future sampling event to determine subsurface 1,4-dioxane concentrations and distribution.

Toxicity factors for several COCs have changed since the ROD was issued. For five of the COCs the cancer Regional Screening Level is now below their applicable cleanup level. However, the cleanup levels are still within EPA's acceptable range of lifetime excess cancer risk and, therefore, are considered protective. For four of the COCs, the non-cancer RSL is below the applicable cleanup level. All of these cleanup levels are equivalent to their respective federal MCLs; however, the 1,2,4-trichlorobenzene cleanup level is above the state MCL.

The ROD dictates that the cleanup standards are either the federal MCL or the California MCL, whichever is more stringent. Since the ROD was signed, California adopted an MCL for 1,2,4-trichlorobenzene more stringent than the ROD cleanup level and the federal MCL.

The remedy is progressing toward meeting the RAOs outlined in the 1994 Feasibility Study.

- *Prevent human exposure by ingestion of groundwater COCs in excess of MCLs*. There are no drinking water wells within the plume area and a deed restriction has been placed on the property prohibiting construction of new drinking water wells.
- *Prevent human exposure by ingestion of, inhalation of, or dermal contact with groundwater*. There are no groundwater extraction wells within the plume area that would lead to ingestion or dermal contact. The recent vapor intrusion study showed no evidence of vapor intrusion at unacceptable levels in the continuously occupied spaces tested; however, evidence of vapor intrusion was found in sub-surface structures and some additional evaluation is ongoing.
- *Mitigate migration of groundwater that contains COCs at levels above MCLs*. According to the 2015 Five-Year Status and Effectiveness Evaluation (Stantec 2015), hydraulic evaluations indicate that the capture area of the OEU dewatering system captures the groundwater and COCs in the A aquifer (the aquifer of concern), thereby controlling plume migration.

7.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No other information has been discovered that could call into question the protectiveness of the remedy.

7.4. Technical Assessment Summary

The remedy is functioning as intended and there have been no changes to exposure assumptions. Groundwater extraction continues to remove contaminant mass and prevent the further migration of the contaminant plume. The treatment plant is successfully removing contaminants to below the effluent or receiving water limitations. Institutional controls prohibit construction of drinking water wells, which prevents current exposure to contaminated groundwater. The detection of 1,4-dioxane in the system effluent suggests its presence in the aquifer, but there is no information regarding distribution in the subsurface. It is recommended that 1,4-dioxane be analyzed in a future sampling event to determine subsurface 1,4-dioxane concentrations and distribution. California adopted a new MCL for 1,2,4-trichorobenzene that is more stringent than the ROD cleanup level; this change affects future protectiveness because a) future groundwater ingestion is an exposure pathway; and b) the remedy calls for a deed restriction that prohibits the use of on-site groundwater for drinking water until final cleanup standards are achieved. Removal of the deed restriction after the cleanup standards are achieved but prior to achievement of the current California MCL would not be protective with respect to ingestion of

groundwater. Past and currently operating remedial actions have reduced contaminant concentrations in many wells on the Site. However, TCE concentrations in 24 wells on the Site still remain above cleanup levels.

The 2014 vapor intrusion study included sampling 10 single-family and duplex residential buildings, 6 multi-family residential or mixed use properties, and 8 commercial properties. This work is on-going. Information collected so far shows TCE vapor intrusion occurring in pathway samples, including the following: indoor air in sub-grade garages; near floor drains and from within utility rooms in sub-grade garages; and from elevator shafts. However, no unacceptable vapor intrusion was found to be currently occurring in occupied living or work spaces.

Future or long-term unacceptable exposure scenarios could include sub-grade garage renovations that convert a portion of vapor intrusion-affected sub-grade garage space to continuously occupied work space, such as staffing offices for parking attendants.

EPA and the Regional Board thus required additional work in order to fully evaluate vapor intrusion in buildings in the off-Property Area: other buildings with potential preferential pathways (such as sub-grade areas) or buildings in the original testing area whose residents did not previously sign up for sampling.

8. Issues

Table 8 summarizes the current issues for the Hewlett-Packard 620-640 Page Mill Road Site.

Table 8. Current Issues for the Hewlett-Packard (620-640 Page Mill Road) Site

Issue	Affects Current Protectiveness (Yes or No)	Affects Future Protectiveness (Yes or No)
1) Recent vapor intrusion investigations have demonstrated that a complete pathway does exist in subgrade structures. However, there have not been unacceptable exposures or exceedances of the risk range in currently occupied locations.	No	Yes
2) The California MCL for 1,2,4-trichlorobenzene has decreased since the signing of the ROD and is more stringent than the current ROD cleanup level.	No	Yes
3) The Annual NPDES reports show that 1,4-dioxane is analyzed for and detected in the treatment system effluent. 1,4-Dioxane was commonly used as a stabilizer for chlorinated solvents, particularly 1,1,1-trichloroethane (Mohr, 2001), which is a site COC. The detection of 1,4-dioxane in the system effluent suggests its presence in the aquifer, but there is no information regarding its distribution in the subsurface.	No	Yes

9. Recommendations and Follow-up Actions

Table 9 provides recommendations to address the current issues at the Hewlett-Packard 620-640 Page Mill Road Site.

Table 9. Recommendations to Address Current Issues at the Hewlett-Packard 620-640 Page Mill Road Superfund Site

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Yes or No)	
					Current	Future
1	Evaluate the need for revisions to the current remedy to address potential future unacceptable vapor intrusion.	EPA/State	EPA/State	September 2019	No	Yes
2	Evaluate whether the cleanup level for 1,2,4-trichlorobenzene should to be changed to the new state MCL and include in a decision document modification as necessary.	EPA/State	EPA/State	September 2020	No	Yes
3	Analyze for 1,4-dioxane in a future sampling event to determine subsurface 1,4-dioxane concentrations and distribution, and to assess whether 1,4-dioxane should be considered as a site COC.	EPA/State	EPA/State	September 2016	No	Yes

In addition, the following recommendations that improve technical management of the project but do not affect current or future protectiveness have been identified during the FYR:

- In-situ chemical oxidation (ISCO) successfully decreased TCE and other chlorinated volatile organic compounds (CVOCs) immediately downgradient of the source property at 640 Page Mill Road and may be a good candidate to accelerate cleanup of the Site. It is recommended that the plans for the EISB testing submitted in 2012 by HP be implemented if the current groundwater extraction remedy declines in effectiveness and is determined to be inadequate to reaching the cleanup goals established for the Site.

10. Protectiveness Statements

The remedy at the Hewlett-Packard 620-640 Page Mill Road Site currently protects human health and the environment because there are no current exposure pathways for groundwater consumption, and the vapor intrusion study has not detected vapor intrusion in currently occupied living or work spaces above levels of concern. However, to be protective in the long-term, a new cleanup level for 1,2,4-trichlorobenzene considering the new state MCL should be evaluated, an evaluation of the need for a remedy which considers the potential for future vapor intrusion exposures should be completed, and 1,4 dioxane should be analyzed in future site sampling to determine its distribution and whether it should be considered a site COC .

11. Next Review

This is a policy FYR, which is required at this Site as long as waste is left on-site at levels that does not allow for unlimited use and unrestricted exposure. The next FYR will be due within five years of the signature date of this FYR.

Appendix A: List of Documents Reviewed

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List of Documents Reviewed

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Appendix B: Press Notice

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PUBLIC NOTICE
FOURTH FIVE-YEAR REVIEW OF COE SUPERFUND SITE CLEANUP

The California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) and the U.S. Environmental Protection Agency (USEPA) began the fourth Five-Year Review (FYR) of cleanup actions at the COE Superfund Site (Site), 640 Page Mill Road, Palo Alto, CA. The review evaluates whether cleanup actions for the Site remain protective of human health and the environment.

FYR Process: When a cleanup remedy leaves some waste in place or a remedy takes longer than five years to complete, Superfund law requires evaluation of the protectiveness of remedy every five years. The FYR process continues until the Site has been cleaned up to allow unrestricted access. The purpose is to understand how the remedy operates and to measure progress towards achieving the Site's cleanup standards.

The Regional Water Board and USEPA reviews the movement and breakdown of remaining contaminants at the Site; operation of the groundwater treatment systems; the application and monitoring of the deed restrictions; and changes in scientific knowledge about the Site contaminants and exposure pathways. Company representatives, other regulatory authorities, and interested members of the public are also interviewed. The review will be completed by September 30, 2015.

Cleanup Remedy: To achieve Site cleanup, Hewlett-Packard was originally required to build and operate a soil vapor extraction and groundwater treatment system; file a deed restriction to prohibit any use of the groundwater and institute a long-term groundwater monitoring program. More recently, Hewlett-Packard has been required to implement focused groundwater extraction, in-situ chemical oxidation and enhanced in-situ bioremediation.

Get Involved: The Regional Water Board and USEPA are interested in hearing from the public. As part of the FYR process, we are interviewing people who would like to discuss any issues or information about the Site cleanup. Please contact Roger Papler, Regional Water Board at roger.papler@waterboards.ca.gov or call 510-622-2435 or Melanie Morash, USEPA at morash.melanie@epa.gov or 415-972-3050 **no later than September 15, 2015**.

For a copy of the report and other Site documents, go to the Regional Water Board's website at https://Geotracker.waterboards.ca.gov, click on 'Advanced Search' and input file number 43S0051. If you wish to be added to the Regional Water Board and USEPA's mailing lists, please contact us at the emails above.

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Appendix C: Interview Forms

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Five-Year Review Interview Record			
Site:	Hewlett-Packard (620-640 Page Mill Road)	**EPA ID No:**	CAD009122540

Interview Type: Site Visit
Location of Visit: 650 Page Mill Road, Palo Alto, CA 94304
Date: February 24, 2015/February 26, 2015
Time: 10:30 am/9:00 am

Interviewers

Name	Title	Organization
Heather Jackson	Environmental Engineer	USACE
Bridget Floyd	Geologist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
John Buchanan	Varian Medical Systems	Environmental Affairs Manager	650-424-6103	John.buchanan@varian.com

Summary of Conversation

1) What is your overall impression of the project?
The pump and treat system is operating well.

2) Is the remedy functioning as expected? How well is the remedy performing?
The contractor, Stantec, has done a good job of staying on top of things.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
The recent groundwater monitoring data shows decreasing concentrations.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
Yes. Staff and activities were described by Stantec.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
John had nothing to add to HP and Stantec's comments.

6) What are the annual operating costs for your organization's involvement with the site?
Varian, HP, and Stantec review the estimated budgets every year and there were no exceedances of these budgets in the last five years. However, if the treatment system must discharge to the Publicly Owned Treatment Works (POTW), then there are additional costs.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.
The upgrade to the 640 PMR system was an increased cost, but not unexpected. He can't think of any unexpected additional costs.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Stantec has optimized their sampling program efficiency—changing sampling methods and managing purge water differently.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
No. The City of Palo Alto is updated redevelopment laws, which the project is trying to stay ahead of, but with regards to protectiveness, John is not aware of any changes.

10) Do you have any comments, suggestions, or recommendations regarding the project?
John wanted to add that although they are automating O&M procedures, they're not just letting the system run. They are proactive about keeping the system running.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record			
Site:	Hewlett-Packard (620-640 Page Mill Road)	**EPA ID No:**	CAD009122540

Interview Type: Site Visit
Location of Visit: 650 Page Mill Road, Palo Alto, CA 94304
Date: February 24, 2015
Time: 10:30 am

Interviewers

Name	Title	Organization
Heather Jackson	Environmental Engineer	USACE
Bridget Floyd	Geologist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Mark Becker	Stantec	Principal Scientist	408-827-3874	Mark.becker@stantec.com

Summary of Conversation

1) What is your overall impression of the project?
The project is working well. The plume size is still there, but concentrations in the plume have been reduced. There are two new wells in the A2 zone. The O&M is well done. The upgrades to the treatment system were completed in January 2014 and have made a difference in efficiency as well as safety. Secondary source issues are being addressed with in situ bioremediation.

2) Is the remedy functioning as expected? How well is the remedy performing?
Yes. Stantec has reacted to any issues that have come up and the improvements have enhanced the remedy. The vapor intrusion issues have been addressed and "put to bed".

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
Now a "vast majority" of wells are mostly stable to decreasing as demonstrated by Mann Kendall statistics (evaluated data from 2006 – 2014). The installation of the new extraction well, TW-2, has been addressing the increasing trend noted in the last five year review.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
Yes. A representative from Stantec is on site at least once per week. All inspection forms, procedures, etc. are conducted in accordance with the O&M manual which is kept on site at the treatment system. Stantec hires a contractor to do the daily "wrench turning". Annual preventative maintenance is performed as described in the O&M manual.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
The upgrades to the treatment system have required a few changes in the O&M, but these changes have been documented and activities adjusted accordingly. Mark stated that Stantec has demonstrated that vapor intrusion is not an issue. Melanie Morash from the EPA stated that they are evaluation further vapor intrusion monitoring for existing structures. The goal is to have a ROD amendment that discusses precautions for new construction over the groundwater plume.

6) What are the annual operating costs for your organization's involvement with the site?
Representatives from Stantec deferred to Paul Paschke from HP on any questions regarding operating costs.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.
No. The only changes in O&M costs have been due to the upgrades to the system.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Yes, after the last five year review, there have been upgrades to the treatment system. New extraction wells (TW-1 and TW-2) were installed and hydrogen peroxide and an upgraded ozone generator were added to the treatment system. In addition, at the 601 CA site, the in situ bioremediation necessitated shutting down some wells. The results of the bioremediation have been favorable.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
Regarding vapor intrusion, the city of Palo Alto has become more aggressive with new development. For new development near the groundwater plume, coordinating with Palo Alto is taking place.

10) Do you have any comments, suggestions, or recommendations regarding the project?
Mark stated that the regulator agency review time has caused some delays in the progress of the project. Stantec and HP would like to review the five year review report in order to verify the facts presented.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record

Site:	Hewlett-Packard (620-640 Page Mill Road)	EPA ID No:	CAD009122540

Interview Type: Site Visit
Location of Visit: 650 Page Mill Road, Palo Alto, CA 94304
Date: February 24, 2015
Time: 10:30 am

Interviewers

Name	Title	Organization
Heather Jackson	Environmental Engineer	USACE
Bridget Floyd	Geologist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Paul Paschke	Hewlett-Packard	Engineering Geologist	970-898-0573	Paul.paschke@hp.com

Summary of Conversation

1) What is your overall impression of the project?
The pump and treat system is very advanced and is working well. HP is working with the best consultants (referring to Stantec).

2) Is the remedy functioning as expected? How well is the remedy performing?
Yes. Paul has been working on the project for about five years. HP and Stantec have been improving the pump and treat system to curb expansion of the groundwater plume. They were having issues with breakthrough of Freon, TCA, and DCA in the GAC, but have reacted and solved these issues. There have been no discharge exceedances except for Manganese, which was addressed right away. In 2014, the pump and treat system began running with improvements such as a larger ozone generator and added hydrogen peroxide treatment with more contact time.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
The Mann Kendall statistics for groundwater monitoring data from 2006 – 2014 show decreasing concentrations. In 2005-2007, these statistics showed some increasing trends, but HP and Stantec made improvements to the pump and treat system (such as new extraction wells and modifications to treatment). These improvements lead to the decreasing trends observed since the last five year review.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
The pump and treat system is computer-controlled. Stantec's office is only half a mile away. The system can be remotely monitored, but staff are onsite periodically for inspections. The computer system is set up with an auto dialer in case there are any issues with the system. The system operates reliably and Paul is comfortable with the way Stantec runs the system. Stantec's maintenance approach is preventative and predictive.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
Paul noted no significant changes. However, semivolatiles were added to the NPDES (the pump and treat system discharge permit) monitoring requirements, but Stantec incorporated those as necessary. There have been upgrades to the groundwater treatment system, and there are associated changes in monitoring and maintenance due to these upgrades. Paul stated that these changes do not affect the protectiveness of the remedy; the plume is under control.

6) What are the annual operating costs for your organization's involvement with the site?
Paul was advised by his lawyer not to provide us with this information. However, he stated that HP has a bond with DTSC of $7 million for financial insurance. The annual O&M costs were estimated to cost between $100k and $200k. There are a number of variables that can make it difficult to pin down the actual cost each year. Some of the fees included in this annual O&M estimate are county water use fees and the NPDES permit ($11-$12k per year).

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.
No, nothing unexpected. There was an increase in cost to make the improvements to the pump and treat system, but those costs were planned.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
HP and Stantec have made a number of improvements to the treatment system and monitoring program (adding extraction wells and monitoring wells) in response to the last five year review. One specific cost saving improvement was the addition of the hydrogen peroxide treatment which helped to reduce the number of carbon change outs which are approximately $20k each. The carbon change outs are now required approximately every other month.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
Paul noted some changes in the vapor intrusion laws and regulations. The monitoring procedures and screening levels are evolving. Vapor intrusion sampling efforts have been made by HP and Stantec, but regulatory concurrence has not yet been achieved.

10) Do you have any comments, suggestions, or recommendations regarding the project? Paul is happy with the progress made in the last five years. The addition of the bio-remediation treatment at the 601 CA site has made a difference. The new wells were placed where necessary. No rebound has been observed.
Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record			
Site:	Hewlett-Packard (620-640 Page Mill Road)	**EPA ID No:**	CAD009122540

Interview Type: Phone
Location of Visit: Remote
Date: March 4, 2015
Time: 3:30 pm

Interviewers

Name	Title	Organization
Bridget Floyd	Geologist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Robert Moss	Barron Park Association Foundation	Member, Board of Directors	(650) 493-2178	Bmoss33@att.net

Summary of Conversation

1) What is your overall impression of the project?
It's making progress but there isn't enough information going out to the community to make a judgment. There needs to be more residential indoor air sampling in case of unexpected contamination beyond the extent of the plume as occurred in Mountain View. New proposals for sub grade structures in the vicinity of COE are troubling.

2) Is the remedy functioning as expected? How well is the remedy performing?
It's functioning but at some point the cleanup productivity becomes asymptotic. Without more frequent data sharing of what the plume looks like with the community, we won't know when that happens. New techniques like injecting microbes into the plume should be looked at. (Interviewer note: Bob was unaware of the in situ bioremediation occurring at the site).

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
I expect the trends are the clean-up is leveling off but without data from the last five years I can't know for sure.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
Bob does not know about the status of operation and maintenance of the remedy. He is frustrated about lack of information provided to public.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
Bob has not heard of any differences or changes to the remedy or sampling routine. (Interviewer note: Bob was unaware of the major upgrades to the groundwater treatment system.)

6) What are the annual operating costs for your organization's involvement with the site?
Bob has no information about this.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.
Bob has not heard of any O&M difficulties or costs.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Bob has not heard of any optimization efforts.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
No. There have been no changes in city laws. The city defers to the Regional Water Quality Control Board (RWQCB) in environmental decisions.

10) Do you have any comments, suggestions, or recommendations regarding the project?
Bob has stressed the following issues with the site:

- There is little communication of site developments with the community. Bob believes there should be a two pronged community outreach effort by the RWQCB—address the Palo Alto city council directly on developments with the COE site as well as hold meetings for community members to update them on the site's progress. Bob volunteers to be a liaison between the RWQCB and the Palo Alto city council. Apparently, HP and Varian used to have monthly meetings with BPAF in the early to mid 1990's.
- There needs to more residential indoor air sampling conducted around the outside of the plume. Bob is concerned a secondary source might be providing a potential pathway beyond boundaries of the plume. Bob believes communication with stakeholders is important is important to inform them of potential risks as wells as gain access to residences for air monitoring.
- Sub grade structures are not regulated within the city of Palo Alto. Bob believes the RWQCB should take a more proactive approach in working with the City of Palo Alto to restrict new sub grade structures in areas where there may be a potential

pathway. He is particularly concerned with a three story underground parking garage which would extend into the impacted aquifer area. He wants it known that no underground garages have been built at the Middlefield-Ellis-Whisman (MEW site in Mountain View for more than 20 years.
Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record			
Site:	Intersil-Siemens	**EPA ID No:**	CAD009122540
Interview Type: Teleconference Location of Visit: Interviewee lives in Palo Alto within the COE plume Date: May 4, 2015 Time: 3:30 PM			

Interviewers		
Name	**Title**	**Organization**
Roger Papler, P.G.	Engineering Geologist	SFBRWQCB

Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Anne Steinle	Birch Court Homeowners Association	Member – Board of Directors	650-269-0883	Anne.steinle@gmail.com

Summary of Conversation

Anne is very grateful that the Regional Water Board and USEPA engaged the Birch Court Homeowners Association after the local environmental activist raised their health concerns considerably. The government regulators have been a delight to work with and it meant a lot to them. It was the nicest government experience in her life because she and her neighbors can now sleep at night.

She wants to be more educated about the COE plume with greater communication and to be allowed more ways to be included more often than every five years. An annual public notice with a link to a place to get more information would be helpful. During the last Five Year Review, they found out about the COE site status from the Palo Alto Weekly and the local environmental activist and found the input alarming. She wants the State to fund more staff to engage and inform the public of the truth without sensationalism. It's her impression that the City of Palo Alto and developers cut corners to profit and does not trust them. She wants her underground parking structure tested.

I indicated that the City of Palo Alto has consistently been contacting the Regional Water Board for input regarding environmental concerns. The USEPA the Regional Water Board have been overseeing indoor air testing of the COE plume considers indoor air safe in the breathing zone.

Additional Site-Specific Questions

Appendix D: Site Inspection Checklist

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I. SITE INFORMATION	
Site name: Hewlett-Packard (620-640 Page Mill Road)	**Date of inspection:** February 24, 2015
Location: 650 Page Mill Road, Palo Alto, CA, 94304	**EPA ID:** CAD009122540
Agency, office, or company leading the five-year review: US Army Corps of Engineers	**Weather/temperature**: Sunny, 68°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Groundwater Monitoring
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Mark Becker (Name) Principal Scientist (Title) 24FEB2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☒ Report attached _____

2. **O&M staff** Wendy Chen (Name) Associate Scientist (Title) 24FEB2015 (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached Not interviewed during the site visit, but added to Mark Becker's interview (see report) and lead the overview of the pump and treat system at the site.

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:
Contact: _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

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

Paul Paschke, Engineering Geologist, HP

John Buchanan, Environmental Affairs Manager, Varian

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

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks_____
_____

2.	**Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A Remarks: Discussed with group before entering treatment system area.	
3.	**O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐N/A Remarks: No formal certifications are required to operate and maintain the pump and treat system according to Stantec. All of Wendy Chen's training certificates were available on site and she is in charge of on-the-job training for any other personnel who perform O&M.	
4.	**Permits and Service Agreements** ☐ Air discharge permit ☐ Readily available ☐ Up to date ☐ N/A ☒ Effluent discharge ☒ Readily available ☒Up to date ☐ N/A ☒ Waste disposal, POTW ☒Readily available ☒ Up to date ☐ N/A ☒ Other permits: Hydrogen peroxide ☒ Readily available ☒Up to date ☐ N/A Remarks: The hydrogen peroxide permit is issued by the City of Palo Alto. Stantec also has an Environmental Health Permit.	
5.	**Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks_____ _____	
6.	**Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks_____ _____	
7.	**Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐N/A Remarks_____ _____	
8.	**Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks_____ _____	
9.	**Discharge Compliance Records** ☐ Air ☐ Readily available ☐ Up to date ☐ N/A ☒ Water (effluent) ☒Readily available ☒ Up to date ☒ N/A Remarks_____ _____	
10.	**Daily Access/Security Logs** ☒Readily available ☒ Up to date ☐ N/A Remarks: A key is required to access the groundwater treatment system. Only Wendy and a few other Stantec employees have the key.	

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records**

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

Total annual cost by year for review period if available

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

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

Describe costs and reasons: Paul Paschke from HP was advised by his legal counsel not to provide any O&M cost information to us. However, he did state that HP has a bond with DTSC for $7 million of financial insurance for the site and the estimated annual O&M costs are between $100k and $200k.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A
Remarks_____
_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ 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 ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☐ N/A

Other problems or suggestions: ☐ Report attached

Remarks: There is a Deed Restriction on the property stating that no owners or occupants may construct a well to extract contaminated groundwater for any use without written permission from the Regional Water Board. The enforcement of this deed restriction was not discussed during the site visit. However, there were no visual indications of new, prohibited wells. Only extraction and monitoring wells that are part of the remedy were observed. Also, none of the members on the site visit mentioned any issues with construction of new wells or use of contaminated groundwater at the site.

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks_____

_____

_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks_____

_____

2. **Land use changes on site** ☒ N/A

Remarks_____

_____

3. **Land use changes off site** ☒ N/A

Remarks_____

_____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks_____

_____

B. Other Site Conditions

Remarks: The site is located in a commercial park. All parking lots, landscaped areas, etc. are in good condition. The treatment system is located in the western corner of the 640 PMR Site and is locked to prevent public access. Wells are located in landscaped areas and parking lots and appear to be in good condition and secured. However, the label stating the name of the well is not visible on all the wells visited.

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks_____

_____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident

Lengths_____ Widths_____Depths_____

Remarks_____

_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident

Areal extent_____ Depth_____

Remarks_____

_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident

Areal extent_____ Depth_____

Remarks_____

_____

5. **Vegetative Cover** ☐ Grass ☐Cover properly established ☐ No signs of stress

☐ Trees/Shrubs (indicate size and locations on a diagram)

Remarks_____

_____

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

Remarks_____

_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Height_____

Remarks_____

_____

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

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

B. Benches ☐ Applicable ☐ 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** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

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

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

C. Letdown Channels ☐ Applicable ☐ 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** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

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

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

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

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

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

D. Cover Penetrations ☐ Applicable ☐ N/A

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

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

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

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

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

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

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

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

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

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks_____
_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
Remarks_____
_____

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

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

2. **Erosion** Areal extent_____ Depth_____
☐ Erosion not evident
Remarks_____
_____

3. **Outlet Works** ☐ Functioning ☐ N/A
Remarks_____
_____

4. **Dam** ☐ Functioning ☐ N/A
Remarks_____
_____

H. Retaining Walls ☐ Applicable ☐ N/A

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

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

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

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

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

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

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

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

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

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

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

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

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

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

Remarks: There is one central treatment system location. The treatment system components, operation, and maintenance are detailed in Stantec's O&M manual. In general, water is extracted from two on site wells and two off site wells at approximately 75 gallons per minute (gpm) and stored in a 2,500 gal tank for treatment. The water is then pumped through a basket strainer. An acid wash system is also set up at this point and is used if necessary to remove metals such as manganese. Hydrogen peroxide and ozone (generated on site) is then injected into the water and mixed using a static mixer. The water, hydrogen peroxide, and ozone are in contact for a specified amount of time and then the ozone is destroyed. The water then flows through two granular activated carbon (GAC) tanks, each 7500 lbs. The water is then discharged in compliance with the NPDES permit.

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐N/A ☒ Good condition G Needs Maintenance
Remarks_____
_____

3. **Tanks, Vaults, Storage Vessels**

☐N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks_____
_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks_____
_____

5. **Treatment Building(s)**

☒ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks: The treatment system is in an enclosed area, but it is open to the atmosphere (no roof). There is a small desk that is enclosed with a roof that is in good condition.

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

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

☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: Not all wells in the groundwater monitoring program were visited during this site visit. The ones visited are listed in the Trip Report. However, the ones that were visited were in good condition and secured or locked. However, some of the well name labels had worn away and were no longer readable.

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

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

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

☐All required wells located ☐Needs Maintenance ☒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.

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.).

The remedy at this site currently includes a groundwater extraction and treatment system that will operate until final cleanup standards are achieved. All treatment system components and wells that were visited appeared to be in good working condition. The computer in control of the treatment system indicated all components were operating. All operations and maintenance logs appeared to be up to date.

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.

No O&M issues were observed or indicated by any attendee during the site visit.

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. No early indicators of potential remedy problems were observed during the site visit.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. HP and Stantec optimized the groundwater treatment system in the last five years in order to improve on some of the issues identified in the last five year review. Improvements include upgraded the ozone generation tank, adding hydrogen peroxide treatment, and installing new extraction and monitoring wells. No data gaps have been identified by Stantec since the upgrades were completed in January 2014. At this point, the optimization techniques already implemented need to be monitored to determine whether additional optimization opportunities exist.

Site Inspection Team Roster

Paul Paschke, HP
John Buchanan, Varian Medical Systems
Mark Becker, Stantec
Bruce Scarbrough, Stantec
Angus McGrath, Stantec
Wendy Chen, Stantec
Pete (O&M Personnel), Stantec
Melanie Morash, USEPA
Roger Papler, SFBRWQCB
Bridget Floyd, USACE
Heather Jackson, USACE

Appendix E: Site Visit Trip Report

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MEMORANDUM 27 February 2015

FROM: Bridget Floyd, Geologist, Sacramento District, CESPK-ED-ED and
Heather Jackson, Environmental Engineer, Sacramento District, CESPK-ED-EE

TO: Kayla Patten, Environmental Engineer, Seattle District, CENWS-EN-TS-ET and
Dave Sullivan, Geologist, Seattle District, CENWS-EN-TS-GE

SUBJECT: Trip Report for Hewlett-Packard 640 Page Mill Road Site Visit, 24 February 2015

1. INTRODUCTION

a. Date of Visit: 24 February 2015

b. Location: 650 Page Mill Road, Palo Alto, CA (Site name differs from site address)

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the fourth Five-Year Review Report.

d. Participants:

Bridget Floyd	USACE Sacramento District Geologist	916.557.7328
Heather Jackson	USACE Sacramento District Environmental Engineer	916.557.6886
Melanie Morash	USEPA Region 9	415.972.3050
Roger Papler	SFRWQCB	510.622.2435
Wendy Chen	Stantec Associate Scientist	408.827.3878
Mark Becker	Stantec Principal Scientist	408.827.3874
Angus McGrath	Stantec Principal Geochemist	925.296.2134
Bruce Scarbrough	Stantec Principal Geologist	925.296.2115
Paul E. Paschke	Hewlett-Packard Environmental Program Manager	970.898.0573
John Buchanan	Varian Medical Systems Environmental Affairs Manager	650.424.6103

2. SUMMARY

A site visit to the Hewlett-Packard 640 Page Mill Road Superfund Site (HP 640 PMR) was conducted on 24 February 2015. The participants toured the groundwater treatment plant and other remediation areas after an overview of the site and the remedial history. HP 640 PMR houses an updated groundwater treatment plant that came online in January 2014. The groundwater treatment plant is managed remotely via computer system and is subject to a routine preventative and predictive maintenance schedule. Adjacent and associated sites at 601 California Street (601 CA) and 395 Page Mill Road (395 PMR) employ various different remediation techniques. 601 CA and 395 PMR are not part of this five year review but are contributors to the comingled plume. This five year review includes the comingled plume in the off-property study areas of the California-Olive-Emerson (COE) Study Area and the Perimeter Area.

3. DISCUSSION

On 24 February, Heather Jackson and Bridget Floyd drove to Palo Alto, California and met the rest of the site visit participants at Varian Medical Systems. The weather was sunny and warm (temperature in the 60s). The site is accessed from Page Mill Road and is located less than a mile west of Stanford University.

Ms. Jackson and Ms. Floyd arrived in Palo Alto around 10:15 am and met the other participants in the Kaplan Conference room on the Varian Medical Systems campus. A brief overview of the site was presented and introductions and interviews were conducted at this time.

After the initial meeting, the team drove to 640 PMR for a tour of the groundwater treatment plant by Ms. Chen. There is one central treatment system which is recently updated and in good repair. The groundwater enters the compound from two on site wells and two off site wells at approximately 75 gallons per minute (gpm) and is stored in a 2500 gallon holding tank before treatment. The water is then pumped through a basket strainer. An acid wash system is also set up at this point and is used if necessary to remove metals such as manganese. Hydrogen peroxide and ozone (generated on site) are then injected into the water and mixed using a static mixer. The water, hydrogen peroxide, and ozone are in contact for a specified amount of time and then the ozone is destroyed. The water then flows through two granular activated carbon (GAC) tanks, each 7500 lbs, for polishing. Ms. Chen reports the GAC tanks are switched out approximately every two months. The water is then discharged to Matadero Creek via the City of Palo Alto storm drain in compliance with their NPDES permit and periodically discharged instead to the sanitary sewer under a groundwater discharge permit issued by the Palo Alto Public Works Department (PAPWD). All systems are computer controlled and monitored.

After touring the groundwater treatment plant, the team inspected extractions wells TW-1 and TW-2. These wells were installed to combat a local increase in concentrations. The wells appear to be in good repair and working order. Monitoring wells P1-A1 and P1-A2 were also inspected. The wells boxes showed no signs of wear and were properly closed. The well caps were in place and locked. From the location of the monitoring wells, the sports complex that comprises the northern half of the site could be seen.

The team then viewed the 601 CA site. On the walk over, Ms. Morash pointed out a building where the EPA has concerns about vapor intrusion risks. According to Ms. Morash, the basement parking garage has concentrations in the breathing zone above EPA screening levels. The team then visited the site of the in situ bioremediation. Current tenants resist more aggressive remediation systems because construction would negatively affect their business. 601 CA is not a Superfund site and is not part of this five year review.

The team then drove to 395 PMR and viewed monitoring wells and the location of the old groundwater treatment system. Also visible from this location was the Oregon Expressway Underpass (OEU) pump station. The pump station is used to dewater the underpass and has been in operation for many decades. The OEU now is a part of the remediation of the plume—it limits the spread of the plume to the North. The water passes through an air stripper before being discharged to a culvert and eventually Matadero Creek. 395 PMR is not a Superfund site and is not part of this five year review.

The site visit ended at approximately 1330.

4. ACTIONS

The USACE will incorporate information obtained from the site visit into the Five Year Review report.

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Heather Jackson, P.E.
Environmental Engineer
SPK-ED-EE

FLOYD.BRIDGET.MARIE.1505585964 Digitally signed by FLOYD.BRIDGET.MARIE.1505585964 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=FLOYD.BRIDGET.MARIE.1505585964 Date: 2015.02.26 16:59:31 -08'00'

Bridget Floyd
Geologist
SPK-ED-ED

Site Visit Photos

Groundwater Treatment Plant Facility (GWTP)

GAC Tank

GWTP piping

Peroxide tank and flow meter

	
Ozone injector	Untreated groundwater and primary GAC tank
	
GWTP piping and bypass valves	Groundwater extraction wells TW-1 and TW-2 and meter vault
	
Extraction well TW-1	Extraction well TW-2

	
Monitoring well P1-A1	Monitoring well P1-A1
	
Monitoring well P1-A2	Series of monitoring wells in parking lot at 601 CA
	
Wells for in-situ bio remediation at 601 CA	Monitoring wells in parking garage at 395 PMR

	
Out-of-service extraction wells EW15 and EW 16 near 395 PMR	Oregon Expressway Underpass
	
O.E.U. Pump House (air stripper not visible)	