MATHER AFB
CALIFORNIA

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 602287

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER

MEMORANDUM FOR SEE DISTRIBUTION

September 10, 2020

FROM: AFCEC/CIBW
3237 Peacekeeper Way, Suite 205
McClellan, CA 95652

SUBJECT: Final Fifth Five-Year Review Report, former Mather Air Force Base (AFB),

Attached is the Final Fifth Five-Year Review Report, former Mather Air Force Base, Sacramento County, California. This report evaluates the environmental cleanup remedies at the former Mather AFB to determine if they remain protective of human health and the environment. Comments to the Draft Final version of this report and the responses to those comments are contained in Appendix F of this document. The electronic copy of this report will be emailed or be available for download per instructions from the Air Force's contractor, CAPE Environmental. The Air Force will distribute hard copies and CDs as requested for your records.

The Fifth Five-Year Review assesses remedial actions taken at the former Mather AFB, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decision documents for Operable Units 1 through 6. In addition, it documents the actions taken in response to recommendations made for the Fourth Five-Year Review report. This report covers the period October 2014 through September 2019, supplemented by site inspections conducted in November 2019.

If you have any questions or concerns, please contact me at (916) 643-0830 ext. 202, or Ms. Molly Enloe at ext. 231.

Sincerely,

DOUGLAS L. SELF
Remedial Project Manager

Attachment: Final Fifth Five-Year Review Report, former Mather Air Force Base (CAPE, September 2020)

DISTRIBUTION (electronic copies only):
AFCEC/CIBP BRAC AR, Attn: Monico Luna
AFCEC/CIBW-Lackland, Attn: Jose Reyna III
CAPE Environmental, Attn: John Thomas
Co. of Sacramento, Office of Economic Development and Marketing, Attn: Mr. Rick Balazs
CV-RWQCB, Attn: Marcus Pierce
DTSC, Attn: Franklin Mark
Sacramento Co. Airport System, Attn: Mr. John Pires
Sacramento Co. Airport System, Attn: Mr. Ron Ogle
Sacramento Co. Airport System, Attn: Chad Willis
U.S. EPA Region IX, Attn: Ms. Sarah Watson

FINAL

FIFTH FIVE-YEAR REVIEW REPORT

FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

Prepared for:

AFCEC/CIBW
Roy Willis
2261 Hughes Avenue, Suite 155
JBSA Lackland, Texas 78236-9853

In Support of:

AFCEC/CIBW
3237 Peacekeeper Way, Suite 205
McClellan CA 95652

Prepared by:

Cape Environmental Management Inc
500 Pinnacle Court, Suite 100
Norcross, Georgia 30071

September 2020

TABLE OF CONTENTS

Section **Page**

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AC&W	Aircraft Control and Warning
ACL	aquifer cleanup level
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film-forming foam
AFRPA	Air Force Real Property Agency
AGE	aerospace ground equipment
Air Force	United States Air Force
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
ATC	Air Training Command
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
BV	bioventing
Cal Am	California American Water Company
Cal/EPA	California Environmental Protection Agency
CalRecycle	California Department of Resources Recycling and Recovery
CAPE	Cape Environmental Management Inc
CBRA	comprehensive baseline risk assessment
CCR	California Code of Regulations
CCl_4	carbon tetrachloride
CDFW	California Department of Fish and Wildlife
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHHSL	California human health screening level
COC	contaminant of concern
Contingency Plan	Mather AFB Off-Base Water Supply Contingency Plan
CVWB	Central Valley (Regional) Water (Quality Control) Board
cy	cubic yard
DCA	dichloroethane
DCE	dichloroethene
DD	drainage ditch (IRP site designation)
DoD	Department of Defense
DoI	United States Department of the Interior
DTSC	California Department of Toxic Substances Control
EA Engineering	EA Engineering, Science, and Technology
EPA	United States Environmental Protection Agency

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

ESD	explanation of significant difference(s)
FFA	Federal Facility Agreement
FS	feasibility study
FT	fire training (IRP site designation)
GAC	granular activated carbon
gpm	gallons per minute
IC	institutional control
ID	identification
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
JP-4	jet propellant fuel #4
lb(s)./day	pound(s) per day
LF	landfill (IRP site designation)
Mather	the former Mather Air Force Base
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MWH	Montgomery Watson Harza Americas, Inc.
NCBI	NOREAS-CB&I Joint Venture
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OEHHA	Office of Environmental Health Hazard Assessment
O&M	operations and maintenance
OPS	operating properly and successfully
OT	other (IRP site designation)
OU	Operable Unit
OWS	oil-water separator
PAH	polycyclic aromatic hydrocarbon
PCE	perchloroethene (a.k.a. tetrachloroethene)
PFAS	per- and polyfluoroalkyl substances
PFC	perfluorinated compound

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PHG	public health goal
POL	petroleum, oil, and lubricant
ppmv	parts per million by volume
RAB	Restoration Advisory Board
RAO	remedial action objective
RI	remedial investigation
ROC	reactive organic compound
ROD	record of decision
RPM	remedial project manager
RSL	regional screening level
RW	radioactive waste (IRP site designation)
SAC	Strategic Air Command
SD	storm drain (IRP site designation)
SL	screening level
SLUC	state land use covenant
SMAQMD	Sacramento Metropolitan Air Quality Management District
SNARL	suggested no-adverse-response level
SS	sanitary sewer (IRP site designation)
ST	storage tank (IRP site designation)
SVE	soil vapor extraction
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons reported as diesel
TPH-g	total petroleum hydrocarbons reported as gasoline
UCL	upper confidence limit
URS	URS Group, Inc.
UST	underground storage tank
VOC	volatile organic compound
WP	waste pit (IRP site designation)
µg/L	micrograms per liter
§	section
4Q18	fourth quarter 2018 (quarter, year)

Five Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Former Mather Air Force Base		
EPA ID: CA8570024143		
Region: 9	**State:** CA	**City/County:** Rancho Cordova (partially)/Sacramento

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency ***[If "Other Federal Agency", enter Agency name]*:** US Air Force
Author name (Federal or State Project Manager): Douglas Self
Author affiliation: AFCEC/CIBW
Review period: 3/13/2019 - 9/30/2020
Date of site inspection: 11/8/2018
Type of review: Statutory
Review number: 5
Triggering action date: 9/30/2015
Due date *(five years after triggering action date)*: 9/30/2020

Five Year Review Summary Form (continued)

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
Soil OU (OU 3), Landfill OU (OU 4), Supplemental Basewide OU (OU 6)

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU2 – Groundwater – Main Base/SAC Area and Site 7 Plumes	**Issue Category: Changed Site Conditions**			
	Issue: The influent concentrations at the treatment plants are above the EPA Lifetime Health Advisory (LHA) level for the sum of concentrations of PFOA and PFOS of 70 ng/L. Long-term protectiveness is deferred pending the outcome of further investigation, risk assessment, and potential response actions associated with these emerging contaminants.			
	Recommendation: Continue to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of PFAS at the Main Base/SAC Area and Site 7 treatment systems.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	9/1/2025
OU(s): OU1 – AC&W and OU2 – Groundwater – AC&W, Main Base/SAC Area and Site 7 Plumes	**Issue Category: Monitoring**			
	Issue: Prior sampling results for 1,2,3-TCP at Mather have been non-detect, but detection limits exceeded the State MCL of 5 ppt.			
	Recommendation: Collect samples from the AC&W, Main Base/SAC Area, and Site 7 treatment plant influents to determine whether 1,2,3-TCP is present above the MCL.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	9/1/2025
OU(s): OU5 – Basewide – Site OT-23C	**Issue Category: Other**			
	Issue: The vapor intrusion remedy for the site is currently in dispute. The protectiveness determination for the site has been deferred pending the outcome of the dispute.			
	Recommendation: Implement any data collection and/or vapor intrusion risk analysis required by the final dispute resolution agreement. An addendum to this Five-Year Review will be prepared to document the outcome of the dispute, present the results of any new sampling or site characterization performed, and update the protectiveness determination based on the findings.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	EPA/State	3/31/2023

Five Year Review Summary Form (continued)

Protectiveness Statement(s)		
Operable Unit: OU 1 – AC&W, Site WP-12	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedy at OU 1 (AC&W OU) is currently protective of human health and the environment and is expected to remain so in the future due to the observed effectiveness of the selected remedies. For the remedy to be protective in the long-term, samples must be collected from the AC&W treatment plant influent to determine whether 1,2,3-TCP is present above the MCL.		

Operable Unit: OU 2 – Groundwater, Main Base/SAC Area Plume, Northeast Plume, Site 7 Plume	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies at OU 2 (Groundwater OU) are protective of human health and the environment in the short term due to already existing ICs. For the remedy to be protective in the long term, the following actions need to be taken: the presence and magnitude of PFAS in groundwater must be determined; potential risks from exposure to PFAS must be evaluated; and appropriate remedies must be selected in response to identified risk in decision documents. Additionally, samples must be collected from the Main Base/SAC Area, and Site 7 treatment plant influents to determine whether 1,2,3-TCP is present above the MCL.		

Operable Unit: OU 3 – Soil, Sites WP-07, FT-11, ST-37, ST-39, SS-54, SD-57, SD-59, OT-69	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies at OU 3 (Soil OU) are currently protective of human health and the environment and are expected to remain so in the future due to the observed effectiveness of the selected remedies.		

Operable Unit: OU 4 – Landfill, Sites LF-03, LF-04	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies at OU 4 (Landfill OU) are currently protective of human health and the environment and are expected to remain so in the future due to the observed effectiveness of the selected remedies.		

Five Year Review Summary Form (continued)

Protectiveness Statement(s)		
Operable Unit: OU 5 – Basewide, Sites FT-10C, LF-18, OT-23, ST-68, OT-87	*Protectiveness Determination:* Protectiveness Deferred	*Planned Addendum Completion Date:* 3/31/2023
Protectiveness Statement: With the exception of Site OT-23C, the remedies at OU 5 (Basewide OU) are protective of human health and the environment. The protectiveness determination for Site OT-23C has been deferred pending the outcome of the ongoing dispute at the site.		

Operable Unit: OU 6 – Supplemental, Site OT-89	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedy at OU 6 (Supplemental Basewide OU) is currently protective of human health and the environment and is expected to remain so in the future due to the observed effectiveness of the selected remedies.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* 3/31/2023
Protectiveness Statement: With the exception of Site OT-23C, the remedial actions at Mather AFB are short-term protective of human health and the environment. For the remedies to be protective in the long term, presence and magnitude of PFAS in groundwater must be determined; potential risks from exposure to PFAS must be evaluated; and appropriate remedies must be selected in response to identified risk in decision documents. The protectiveness determination for Site OT-23C has been deferred pending the outcome of the ongoing dispute at the site concerning the vapor intrusion remedy.	

EXECUTIVE SUMMARY

This five-year review evaluates the environmental cleanup remedies at the former Mather Air Force Base (AFB) in California, to determine if the remedies are protective of human health and the environment. This five-year review has determined that, with the exception of Site OT-23C, all of the remedies are protective in the short term, and that most are protective in the long term. For two sites -- the Main Base/Strategic Air Command (SAC) Area plume and the Site 7 Plume -- the determination of long-term protectiveness has been deferred pending the outcome of further investigation, risk assessment and potential response actions for emerging contaminants. The protectiveness determination for Site OT-23C has been deferred pending the outcome of a regulatory agency dispute.

Mather AFB, originally called Mather Field, is located on approximately 5,722 acres which are partially in unincorporated Sacramento County and partially in the city of Rancho Cordova, California. The Air Force Base was first activated in 1918 as a combat pilot training school and operated intermittently until the start of World War II. After World War II, Mather AFB was the sole aerial navigation school for the United States military and its allies. On 30 September 1993, the base was decommissioned under the Base Realignment and Closure Act. Since its closure, the former base has been in transition to civilian use, and by the end of 2018, transfer of all of the Air Force property was complete. About one-half of the base is now used as a cargo-focused and general aviation airport, and about one-third is used as parkland, including an 18-hole golf course. The former military housing has been replaced by larger, single-family homes. Much of the rest of Mather has been transferred or sold for business development and government use.

To perform its mission, Mather's military workforce used chemicals, including fuels, solvents and oils. Over the years while the base was open, some chemicals leaked into the ground from storage tanks. Some were washed down drains or spilled during transportation and use. Chemical disposal also contributed to soil and groundwater contamination.

In 1979, contamination was detected in water supply wells near Mather. The primary source was solvents such as tetrachloroethene (PCE), trichloroethene (TCE), and carbon tetrachloride (CCl_4). More extensive testing followed in the 1980s, and 89 sites were identified as needing further study or cleanup, including four areas of groundwater contamination. Part of Mather was added to the United States Environmental Protection Agency's (EPA) National Priorities List (NPL) in July of 1987, and the remainder was added in June of 1989. Adding Mather to the NPL resulted in the entry of a Federal Facility Agreement in 1989 that clarified the roles and involvement of both the EPA California Department of Toxic Substances Control. The Air Force is the lead CERCLA agency and is financially and legally responsible for the cleanup to protect human health and the environment, and conducts cleanup activities under its Installation Restoration Program (IRP). EPA and the State agree to provide guidance and technical support relevant to the cleanup.

The 89 Mather IRP sites have been grouped into six Operable Units (OUs), based on similarities in contaminants, affected media, and/or timing of cleanup decisions.

- OU 1 (referred to as the Aircraft Control and Warning, or AC&W OU) consists of a contaminated groundwater plume, as well as three sites where underground storage tanks (USTs) were removed.
- OU 2 (referred to as the Groundwater OU) consists of three contaminated groundwater plumes.
- OU 3 (referred to as the Soil OU) comprises contaminated soil associated with waste disposal pits, oil-water separators (OWS), gas stations, USTs, fire training areas, and other contaminated soil sites.

- OU 4 (referred to as the Landfill OU) consists of six sites where municipal waste was buried.

- OUs 5 and 6 (referred to as the Basewide OU and Supplemental Basewide OU, respectively) consist of the contaminated soil sites not included in other OUs.

This is the fifth five-year review report for remedial actions performed at Mather. This five-year review has been prepared pursuant to the Records of Decision (RODs) for OUs 1 through 6, as modified by one memorandum of post-ROD changes and nine explanations of significant difference(s) (ESDs). All of the OUs were evaluated. The triggering action for this review is the date of submittal of the fourth five-year review, which was 30 September 2015.

This Executive Summary focuses on the remedies where there has been an issue identified associated with site protectiveness. For more detailed information about the status of the remedies in each OU at Mather, the reader is encouraged to review the entire document.

Protectiveness Determinations

The purpose of a five-year review is to evaluate the implementation and performance of the remedies, to determine if they are protective of human health and the environment and if they are expected to remain so in the future. The process used to review each OU is consistent with the 2001 EPA Comprehensive Five-Year Review Guidance, OSWER No. 9355.7-03B-P (EPA, 2001). That guidance document outlines the process that is used to assess the protectiveness of the implemented remedies and ensures community participation in the development of the five-year review. In order to assess the protectiveness of the remedy, site inspections, along with document and data review are necessary. The three questions examined during the technical assessment of each remedy are:

A. Is the remedy functioning as intended by the decision documents?
B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection valid?
C. Has any other information been identified that could call into question the protectiveness of the remedy?

The outcome of each five-year review is a statement of protectiveness as well as a list of issues, recommendations, and follow-up actions for each OU.

Operable Units with Issues

This five-year review evaluates the remedies in all of the OUs at Mather, using data collected from 1 October 2014 through 30 September 2019. These data include data reported and evaluated in the monthly, quarterly, semiannual, and/or annual progress monitoring reports, which are cited throughout this document, where appropriate.

With the exception of Site OT-23C, all of the remedies and OUs have been determined to currently be protective of human health and the environment and are expected to remain so in the future. The groundwater extraction and treatment systems are operating properly and successfully (OPS); the ROD- and ESD-required soil vapor extraction (SVE) systems have completed operation; and the post-closure landfill monitoring is ongoing. Institutional controls (ICs) are in place to prevent human exposure to contaminants and to protect remedial/monitoring systems as well as any associated infrastructure.

This fifth five-year review identifies three issues that need to be addressed at the following sites:

- Main Base/SAC Area Groundwater Plume and Site 7 Groundwater Plume: Site Impacts from per- and polyfluoroalkyl substances (PFAS). PFAS have been determined to be pollutants and contaminants under CERCLA. These compounds had not been identified as chemicals of potential concern at the time of the RODs and ESDs, but have "emerged" as chemicals in the environment that present real or potential unacceptable human health or environmental risks.

- AC&W Groundwater Plume, Main Base/SAC Area Groundwater Plume, and Site 7 Groundwater Plume: Site Impacts from 1,2,3-trichloropropane (1,2,3-TCP). During the period of this Five-Year Review, the State of California established a Maximum Contaminant Level (MCL) for 1,2,3-TCP. Prior sampling results have not achieved detections limits capable of determining whether this chemical is present in groundwater above the MCL.

- Site OT-23C: During the period of this Five-Year Review, a dispute was initiated by EPA/DTSC/ CVWB regarding the protectiveness of ICs for vapor intrusion risk at Site OT-23C. The protectiveness determination for this site has been deferred pending the outcome of the dispute.

The following table summarizes the OUs, selected remedies, remedial action status, and the protectiveness determinations made in this five-year review.

Table ES-1. Operable Units Evaluated in this Five-Year Review

OU	Other Federal Agency Name	Site ID/ Description	Selected Remedy	Remedial Action Status/ Protectiveness
1	AC&W OU	WP-12 AC&W Plume	• Groundwater extraction, treatment, and discharge • Groundwater ICs	• OPS • ICs in place to prevent exposure to groundwater above established cleanup levels • Protective of human health and the environment
2	Groundwater OU	Main Base Plume/SAC Area Plume	• Groundwater extraction, treatment, and discharge • Groundwater ICs	• OPS • ICs in place to prevent exposure to groundwater above established cleanup levels • Evaluation of long-term protectiveness is deferred pending the outcome of further investigation, risk assessment, and potential response actions associated with per-and polyfluoroalkyl substances (PFAS)
		Site 7 Plume	• Groundwater extraction, treatment, and discharge • Groundwater ICs	• OPS • ICs in place to prevent exposure to groundwater above established cleanup levels • Evaluation of long-term protectiveness is deferred pending the outcome of further investigation, risk assessment, and potential response actions associated with PFAS
		Northeast Plume	• Long-term groundwater monitoring • Groundwater ICs	• OPS • ICs in place to prevent exposure to groundwater above established cleanup levels • Protective of human health and the environment
3	Soil OU	WP-07/FT-11	• Fill depression • Treat contaminated shallow and deep soils by BV/ SVE • Install engineered cap • Landfill ICs	• In situ treatment (SVE and BV) complete • Landfill remedy ongoing • OPS • ICs in place to prevent disturbing the landfill cap or constructing new buildings in the buffer area • Protective of human health and the environment
		Sites ST-37/ ST-39/ SS-54	• Excavation • Ex situ treatment of soil by bioremediation • In situ treatment of shallow and deep soils by BV/ SVE • Soil and Indoor Air ICs	• Remedy complete • ICs in place to prevent unacceptable exposure to residual soil vapor contamination • Protective of human health and the environment
		SD-57 OWS 7019	• SVE • Soil and Indoor Air ICs	• Remedy complete • ICs in place to prevent unacceptable exposure to residual soil vapor contamination • Protective of human health and the environment

Table ES-1. (Continued)

OU	Other Federal Agency Name	Description	Selected Remedy	Remedial Action Status/ Protectiveness
3 (cont.)	Soil OU (cont.)	SD-59	• Excavation • Ex situ treatment of soil by bioremediation • SVE/BV to treat residual contamination • Soil and Indoor Air ICs	• Remedy complete • ICs in place to prevent unacceptable exposure to residual soil vapor contamination • Protective of human health and the environment
4	Landfill OU	LF-03	• Engineered cap • Groundwater and landfill gas monitoring • Access restrictions • Landfill ICs	• Remedy in place • OPS • ICs in place to prevent disturbing the landfill cap or constructing new buildings in the buffer area • Protective of human health and the environment
		LF-04	• Engineered cap • Flood control measures • Groundwater and landfill gas monitoring • Access restrictions • Landfill ICs	• Remedy in place • OPS • ICs in place to prevent disturbing the landfill cap or constructing new buildings in the buffer area • Protective of human health and the environment
5	Basewide OU	FT-10C/ST-68	• SVE and/or BV • Excavation and off-site disposal of lead-contaminated soil • Soil and Indoor Air ICs	• Remedy complete • ICs in place to prevent unacceptable exposure to residual soil vapor contamination • Protective of human health and the environment
		LF-18	• SVE • Soil and Indoor Air ICs	• Remedy complete • ICs in place to prevent unacceptable exposure to residual soil vapor contamination • Protective of human health and the environment
		OT-23	• SVE • Soil and Indoor Air ICs for a portion of subsite OT-23C	• Remedy for subsites OT-23A, B, and D addressed with SVE for other sites • SVE remedy for Site OT-23C determined to have met RAO for protection of groundwater • ICs in place to prevent unacceptable exposure to residual soil vapor contamination • IC boundary for Site OT-23C expanded by Air Force based on evaluation of vapor intrusion risk • Regulatory agencies invoked dispute regarding the protectiveness of the IC for vapor intrusion risk • Evaluation of protectiveness deferred pending outcome of dispute

Table ES-1. (Continued)

OU	Other Federal Agency Name	Description	Selected Remedy	Remedial Action Status/ Protectiveness
5 (cont.)	Basewide OU (cont.)	OT-87	• Excavation/backfill • Separation of lead shot • Treatment of soil containing lead • Disposal at Site WP-07 • Soil ICs • Confirmatory small mammal monitoring • Reporting of dead waterfowl	• Excavation complete • ICs in place to protect human health from exposure to residual contamination in soil • Confirmatory small mammal monitoring completed • No dead waterfowl have been observed • Protective of human health and the environment
6	Supplemental Basewide OU	OT-89	• Soil ICs	• ICs in place to prevent exposure to lead in soil • Protective of human health and the environment

AC&W = Aircraft Control and Warning
BV = bioventing
FT = fire training
IC = institutional control
LF = landfill
OPS = operating properly and successfully
OT = other
OU = operable unit
PFAS = per-and polyfluoroalkyl substances
ROD = Record of Decision
SAC = Strategic Air Command
SD = storm drain
SS = sanitary sewer
ST = storage tank
SVE = soil vapor extraction
WP = waste pit

Issues of Concern/Next Steps

This five-year review identifies three issues that need to be addressed and makes recommendations for follow-up actions.

Main Base/SAC Area Plume and Site 7 Plume Issue (OU 2, Groundwater OU)

PFAS are chemicals that have been classified as emerging environmental contaminants. They are associated with aqueous film-forming foam (AFFF) that was used in past fire training practices at Air Force Bases. In 2016, the EPA published Lifetime Health Advisories (LHA) for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in drinking water. The LHA level is 70 nanograms per liter (ng/L), to be applied individually or to the sum of PFOS and PFOA concentrations. In response to the advisories, the Air Force conducted site investigations to identify AFFF release areas and determine whether PFOS and PFOA in groundwater had the potential to impact drinking water. Groundwater samples were found to contain concentrations of PFOS/PFOA above the LHA. Effluent from the Site 7 and Main Base/SAC Area groundwater treatment plants also contained PFOS/PFOA above the LHA. Because effluent from the treatment plants is re-injected into the groundwater aquifer, granular-activated carbon (GAC) treatment systems were installed at both treatment plants for treatment of PFAS compounds.

The Air Force also conducted sampling of off-base drinking water wells that could potentially be impacted by PFOS/PFOA in groundwater at Mather. One well, owned and operated by California American Water (CalAm), was found to contain PFOS/PFOA above the LHA. CalAm added a GAC treatment system to the well and has been negotiating a Memorandum of Agreement with the Air Force to pay for ongoing operation and maintenance (O&M) as well as monitoring of the GAC system. No other off-base drinking water wells contained PFOS/PFOA above the LHA.

As of the time period of this Five-Year Review, there are no completed pathways for groundwater with PFOS/PFOA above the LHA to drinking water receptors. The Site 7 and Main Base/SAC Area groundwater remedies are therefore considered protective in the short-term. A determination regarding long-term protectiveness is deferred due to the presence of the emerging contaminants and the need to undertake further investigation, risk assessment, and potential response actions associated with these emerging contaminants. The recommendation is to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and to continue GAC operations for treatment of PFOS and PFOA at the Site 7 and Main Base/SAC Area groundwater sites.

AC&W Groundwater Plume, Main Base/SAC Area Groundwater Plume, and Site 7 Groundwater Plume Issue (OU 1, AC&W OU and OU2, Groundwater OU)

During the period of this Five-Year Review, the State of California established a Maximum Contaminant Level (MCL) for 1,2,3-TCP. Prior sampling results have not achieved detections limits capable of determining whether this chemical is present in groundwater above the MCL. The recommendation is to collect samples from the AC&W, Main Base/SAC Area, and Site 7 treatment plant influents to determine whether 1,2,3-TCP is present above the MCL.

Site OT-23C (OU 5, Basewide OU)

During the time period of this Five-Year Review, the regulatory agencies invoked a dispute regarding the protectiveness of the ICs for vapor intrusion risk at Site OT-23C. The protectiveness determination for Site OT-23C is deferred pending outcome of this dispute. The recommendation is to implement any data collection and/or vapor intrusion risk analysis required by the final dispute resolution agreement.

An addendum to this Five-Year Review will be prepared to document the outcome of the dispute, present the results of any new sampling or site characterization performed, and update the protectiveness determination based on the findings.

Protective Operable Units

With the exception of Site OT-23C, all of the OUs and remedies at Mather were determined to be protective of human health and the environment, and are expected to remain so in the future. Three issues were identified for OU1 (AC&W OU), OU2 (Groundwater OU) and OU 5 (Basewide OU). This five-year review found no outstanding issues related to protectiveness for the following OUs:

- OU 3, the Soil OU
- OU 4, the Landfill OU
- OU 6, the Supplemental Basewide OU

More information on each of these OUs can be found in the body of the text of this document, in the subsections referenced for each.

The remainder of the 89 sites originally identified at Mather do not require an evaluation in the five-year review because remedial actions removed contaminants to a level that allowed for unlimited use and unrestricted exposure. See Site List in Appendix A.

1.0 INTRODUCTION

This is the fifth five-year review report for remedial actions performed at the former Mather Air Force Base (Mather) pursuant to the Records of Decision (RODs) for Operable Units (OUs) 1 through 6, as modified by one memorandum of post-ROD changes and eight explanations of significant difference(s) (ESDs). The Air Force is providing this five-year review report in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section (§)121(c), and consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Title 40, Code of Federal Regulations (CFR), §300.430(f)(4)(ii).

1.1 Purpose and Statement of Authority

A five-year review determines whether the remedial response actions are and will continue to be protective of human health and the environment and, as necessary, provides recommendations for attaining and/or maintaining protectiveness. Five-year reviews of remedial actions at Mather are required under CERCLA because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

Executive Order 12580 delegates review responsibility to the Secretary of Defense with respect to release(s) or threatened releases where either the release is on or the sole source of the release is from any facility under the jurisdiction, custody or control of Department of Defense. This five-year review for Mather was conducted by the United States Air Force (Air Force), using Cape Environmental Management Inc (CAPE) under contract to the Air Force Civil Engineer Center (AFCEC). This report will become part of the Administrative Record for Mather.

The Air Force is responsible for managing the Installation Restoration Program (IRP) at Mather. The IRP at Mather is managed in accordance with the Federal Facilities Agreement (FFA) developed specifically for Mather. The FFA ensures that environmental impacts are thoroughly investigated and that appropriate cleanup actions are taken to protect human health, welfare, and the environment. As described in the FFA, authority for IRP decision making rests with a team of remedial project managers (RPMs) from the Air Force, United States Environmental Protection Agency (EPA), and the State of California. The State of California is represented by the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), in coordination with the Central Valley Regional Water Quality Control Board (CVWB), Department of Resources Recycling and Recovery (CalRecycle), and other state agencies as appropriate. The Air Force is the lead agency responsible for funding and implementing remedial actions. The Air Force and EPA jointly select remedies. EPA and the state also provide regulatory oversight, including technical support, review, and comments on all CERCLA investigative and remedial work at Mather.

In accordance with 42 U.S.C. Section 9621(c) and Section 27 of the FFA, reviews are required to be conducted every five years, counting from the initiation of the remedial action at the first operable unit, to assure human health and the environment are being protected. To synchronize the five-year reviews, the FFA specifies that the separate review of each OU will be consolidated into a single Five-Year Review process and report following initiation of the final remedial action at the site. Per EPA's Comprehensive Five-Year Review Guidance (EPA, 2001), the federal lead agency at a National Priorities List (NPL) site, such as Mather, has responsibility for preparing the five-year review. EPA may either concur with the final Federal agency protectiveness determination, or EPA may provide independent findings. Disputes related to protectiveness determinations or independent findings by EPA may be resolved through formal dispute resolution procedures established in the FFA.

1.2 Previous Five-Year Review Reports

Five-year reviews were conducted in 1999, 2004, 2009, and 2014. The timing of the first review was dictated by the start of construction on the remedial action for the AC&W Operation Unit in 1994. The first review was documented in the *Five-Year Review of Remedial Actions* (AFBCA, 1999a); the second review was documented in the *Second Five-Year Review of Remedial Actions* (AFRPA, 2005); the third review was documented in the *Third Five-Year Review Report* (URS, 2010); and the fourth review was documented in the *Fourth Five-Year Review Report* (URS, 2015d). These reports can be accessed at http://afcec.publicadmin-record.us.af.mil/Search.aspx. Note that the draft final version of the *Third Five-Year Review Report* is posted on EPA's website; this is the version of the report for which EPA provided their concurrence.

1.3 Fifth Five-Year Review Report

This fifth five-year review was prepared using the guidelines provided in the *Comprehensive Five-Year Review Guidance* (EPA, 2001) and supplements (EPA, 2011; 2012a; 2012b, 2016). The report evaluates changes in remedy performance or implementation during the five-year review period, and documents actions taken in response to recommendations in the *Fourth Five-Year Review Report* (URS Group, Inc. [URS], 2015d). In accordance with EPA's *Correction to the Memorandum "Program Priorities for Federal Facility Five-Year Reviews"* (EPA, 2012c), the triggering action for this review is the planned completion date of the fourth five-year review, which was 30 September 2015. In general, data collected from 1 October 2014 through 30 September 2019 were reviewed for this fifth five-year review. This follows from the dataset (1 January 2009 through 30 September 2014) covered by the fourth five-year review. Data collected after 30 September 2019 will be included in the sixth five-year review.

This five-year review identifies Mather sites that fit EPA's definitions for statutory or policy reviews. The five-year review is the same, however, regardless of whether it is required by statute, or identified in EPA guidance as a site to be reviewed as a matter of policy. Table 1-1 lists the Mather's IRP sites evaluated in this five-year review and whether the review is required by statute or policy. A complete site list is found in Appendix A, including Mather IRP sites that do not require a five-year review because contaminants do not remain at those sites at concentrations that preclude UU/UE.

Several suspected or known military munitions sites and areas of concern (AOCs) have been investigated at Mather. Some of these sites and AOCs (e.g., small arms range at Site OT-86 and skeet/trap ranges at Sites OT-87 and OT-89) were investigated and remediated under the IRP and have been included in past five-year reviews for Mather. This fifth five-year review report presents information both on sites and AOCs investigated and remediated as part of the IRP at Mather.

Table 1-1. Installation Restoration Program Sites that Require a Five-Year Review

Site ID	Site Description	OU	Requirement for Review	
			Statutory	Policy
LF-03	NE Perimeter Landfill No. 1	4	X	
LF-04	NE Perimeter Landfill No. 2	4	X	
WP-07	"7100" Waste Pit Area Disposal Site	3	X	
FT-10C	Former Fire Training Area 3 (revised location)	5	X	
FT-11	Existing Fire Training Area (used from 1958 to 1993)	3	X	
WP-12	AC&W Site	1		X
LF-18	Old Burial Site (north of Facility 4120)	5	X	
OT-23	Main Base Sanitary Sewer System	5	X	
ST-37	Five Former USTs at Bioenvironmental Storage Yard, Facility 3389	3	X	
ST-39	Eight Former USTs at Hazardous Waste Storage Facility 4305	3	X	
SS-54	Hazardous Waste Accumulation Point at AGE Shop, Facility 4348	3	X	
SD-57	OWS at Facility 7019	3	X	
SD-59	OWS at ATC Wash Rack, Facility 4251	3	X	
ST-68	Eighteen USTs for SAC Area JP-4 Hydrant System	5	X	
OT-69	Ordnance Burning and Detonation Area	3	X	
OT-87	Rod and Gun Club Skeet and Trap Range (Facility 10330)	5	X	
OT-89	Old Trap Range	6	X	
	Main Base/SAC Area Plume	2		X
	Northeast Plume	2		X
	Site 7 Plume	2		X

AC&W = Aircraft Control and Warning
AGE = aerospace ground equipment
ATC = Air Training Command
FT = fire training
ID = identification
JP-4 = jet propellant fuel
LF = landfill
NE = northeast
No. = number
OT = other
OU = operable unit
OWS = oil-water separator
SAC = Strategic Air Command
SD = storm drain
SS = sanitary sewer
ST = storage tank
UST = underground storage tank
WP = waste pit

1.4 Site Background

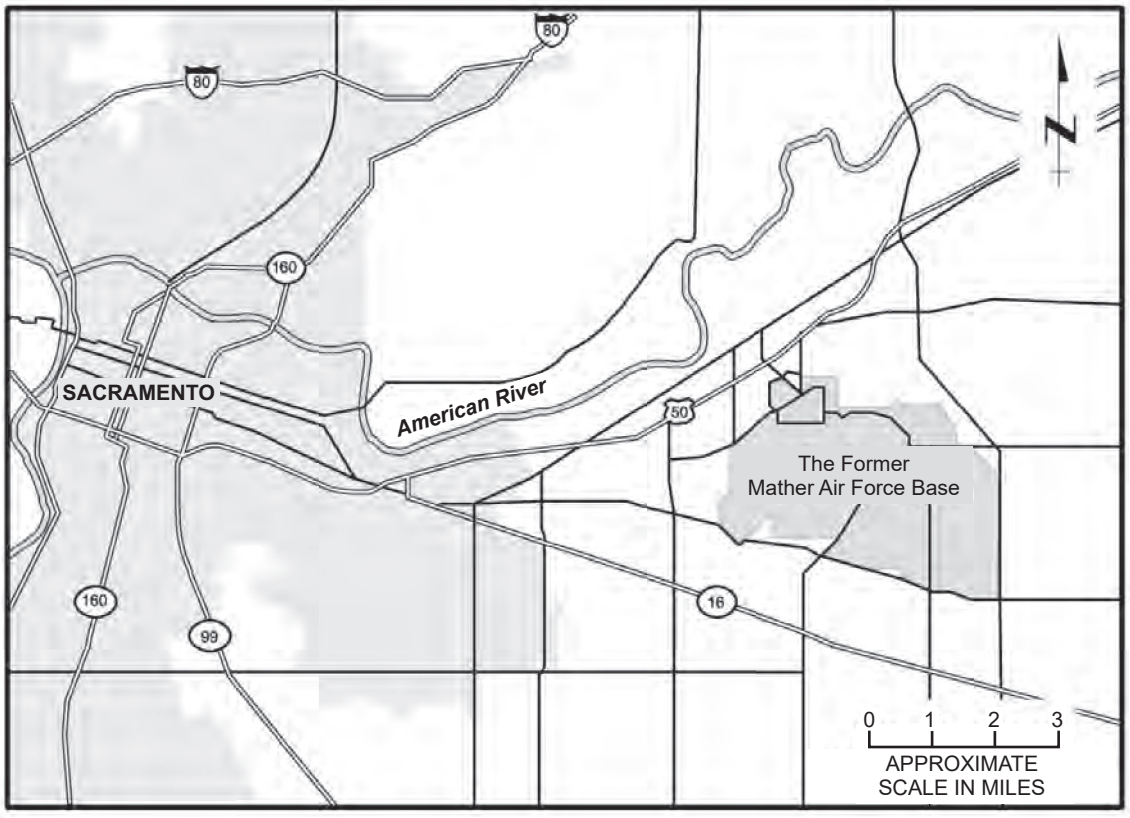
The former Mather Air Force Base (AFB), or Mather, is in the Sacramento Valley of Northern California (Figure 1-1). The former base is in Sacramento County, partially within the limits of the City of Rancho Cordova, a community that was incorporated in 2003. The north Mather boundary is approximately 0.25 mile south of U.S. Highway 50, a major highway connecting Sacramento and South Lake Tahoe. The former base encompassed approximately 5,722 acres at the time of closure in an unsurveyed part of Township 8 North, Ranges 6 East and 7 East.

Mather Air Force Base (AFB) was constructed in 1918, primarily to serve as a flight training school. The base operated continuously as a training base for aviators from 1942 until 1993. Fulfillment of the military missions involved the use and generation of a wide range of toxic and hazardous chemicals and

substances, including industrial chemicals (e.g., chlorinated solvents), aviation fuels, and a variety of oils and lubricants. The use and disposal of these chemicals resulted in contamination of soil and groundwater at many locations at Mather through a variety of migration processes. In addition, landfills were operated at Mather for the disposal of garbage and trash generated on base. Much of this was household waste, including household hazardous waste; however, industrial waste that was generated also may have been taken to these landfills. A dry cleaning plant was located at Mather in the 1950s and 1960s, and discharges from the plant to the sanitary sewer apparently leaked into soil. Contaminants dissolved in groundwater have migrated more than 2 miles beyond Mather's western boundary. The routine application of pesticides resulted in contamination of sediments. Aviation and other fuels stored in tanks and conveyed in pipelines leaked hydrocarbons into the soil. VOCs also entered soil vapor in soil pores above the water table. As environmental awareness and regulation increased in the 1970s and 1980s, the Air Force mobilized to change the practices that caused release of contamination into the environment and to address contamination that had resulted from past practices.

On 30 September 1993, the base was decommissioned under the Base Realignment and Closure Act. Since its closure in September 1993, the former base has transitioned to civilian use, with of all of the Air Force property transferred by the end of 2014. Approximately one-half of the base was transferred for use as a cargo-focused and general aviation airport. Approximately one-third of the base was transferred for use as parkland, including an 18-hole golf course. The former military housing was replaced by larger, single-family homes. Much of the rest of Mather was transferred or sold for business development and government use. Land uses at Mather include a National Guard station, a Veterans Affairs hospital, a residential job training facility, a day care facility, a Federal Aviation Administration radar facility, churches, and elementary schools.

Land surrounding Mather is used for a variety of purposes, including agricultural, residential, commercial, and industrial uses. Residential developments lie to the north, east, and northwest of Mather adjacent to major retail centers and other businesses. This area includes schools and outdoor public recreation facilities. To the west are gravel processing, business office and industrial properties, and rural residences, although further west, land is used for more suburban residential and business purposes. Land to the southwest and south has been extensively excavated for gravel mining operations. Also, south of Mather land is used for agricultural and some commercial activities. To the east and northeast, land use includes industrial with some agricultural areas and recently constructed residential developments.



Modified from: MWH, 2010. *Annual Fourth Quarter 2009 Groundwater Monitoring Program, Mather Air Force Base, Sacramento County, California*. Final. January.

Figure 1-1. Regional Location Map, Former Mather Air Force Base, Sacramento County, California

2.0 RESPONSE ACTION SUMMARY

Environmental studies have been underway at Mather since 1979 when groundwater contamination (TCE) was first detected in the water supply well serving the AC&W area. The IRP began in 1982 and identified locations at Mather where hazardous substances or other pollutants might have been released to the environment. These investigations confirmed the presence of VOCs and other hydrocarbons at several of the IRP sites. Based on this evidence, the AC&W Site was listed on the Superfund (CERCLA) National Priorities List (NPL) in 1987, and the entire base was placed on the NPL on 21 November 1989. In July 1989, the Air Force, EPA, and State of California signed the FFA for Mather (Air Force, 1989) under CERCLA §120 to ensure that environmental impacts from past and present operations are thoroughly investigated and appropriate cleanup actions are taken to protect human health, welfare, and the environment (Air Force, 1989). The FFA sets enforceable deadlines for documents, defines roles and responsibilities of each signatory party, and provides a vehicle for dispute resolution. The Air Force is the owner (or past owner) of the site, the principal responsible party, and lead agency for conducting investigative and cleanup activities. There have been no CERCLA enforcement actions (issuance of orders) related to any of the sites at Mather.

2.1 Basis for Taking Action

Cleanup is required for contaminant concentrations that exceed promulgated thresholds or chemical-specific applicable or relevant and appropriate requirements (ARARs), or for which concentrations exceed risk-management criteria developed or accepted by the regulatory agencies and the Air Force. The over-riding basis for cleanup at Mather is protection of human health and the environment, as required by CERCLA. If a cleanup is required, remedial activities must also meet location-specific and action-specific ARARs.

A comprehensive baseline risk assessment (CBRA), including human health and ecological risk assessments, was completed in 1996 for 85 IRP sites (IT Corporation, 1996). Chemicals of potential concern for human health and ecological risk included solvents, fuel constituents, chlorinated pesticides, PAHs, polychlorinated biphenyls, dioxins/furans, metals, and explosive residues. The CBRA quantified the potential impacts on human health and the environment for a no remedial action scenario. Potentially exposed human populations included then-current on-base workers, future on-base workers, and future on-base and off-base residents. Potentially exposed base environments included vegetation, wildlife, and aquatic organisms associated with 18 IRP sites, each exhibiting completed exposure pathways, and related drainage areas. The risk estimates in the CBRA are considered highly conservative and protective of potentially exposed human and ecological populations as described in the current and future land-use scenarios (IT Corporation, 1996). Equally conservative human health and ecological risk assessments were conducted for IRP sites that were identified after the CBRA was completed, including Sites OT-86 and OT-87 (AFBCA, 1998c), and Site OT-89 (IT Corporation, 2000).

Environmental contaminants requiring cleanup at Mather have been discovered in soil, sediment, surface water, and groundwater. Table 2-1 provides a list of COCs and cleanup levels for each site requiring a five-year review. COCs and cleanup levels for each site are established in the various RODs, ESDs and/or Action Memoranda.

Table 2-1. COCs and Cleanup Levels for Mather IRP Sites Requiring a Five-Year Review

IRP Site Number	COCs	Cleanup Levels
LF-03	NA[a]	NA[a]
LF-04	NA[a]	NA[a]
WP-07/FT-11	**Subsurface Soil** TPH as diesel TPH as gasoline	Narrative[b]
FT-10C	**Subsurface Soil** Carbon tetrachloride Benzene Toluene Ethylbenzene Xylenes TPH as diesel TPH as gasoline	Narrative[c, d]
ST-68	**Subsurface Soil** TPH as gasoline	Narrative[d]
FT-10C/ST-68	**Soil** Lead Lead Lead	**mg/kg and mg/L** 800 mg/kg (industrial use) 151 mg/kg (unrestricted) 15 mg/L (soluble)
WP-12 (AC&W Plume)	**Groundwater** Trichloroethene	**µg/L** 5
LF-18	**Subsurface Soil** Trichloroethene 1,2-Dichloroethene	Narrative[d]
OT-23	**Subsurface Soil** Tetrachloroethene Trichloroethene 1,2-Dichloroethene Xylenes	Narrative[d]
ST-37	**Subsurface Soil** TPH as diesel TPH as gasoline Oil and grease	Narrative[b]
ST-39	**Surface Soil** TPH as diesel Oil and grease **Subsurface Soil** Benzene Toluene Ethylbenzene Xylene TPH as diesel TPH as gasoline	Narrative[b] Narrative[b]
SS-54	**Subsurface Soil** Benzene TPH as gasoline	Narrative[b]
SD-57	**Subsurface Soil** Trichloroethene	Narrative[b]

Table 2-1. COCs and Cleanup Levels for Mather IRP Sites Requiring a Five-Year Review

IRP Site Number	COCs	Cleanup Levels
SD-59	**Subsurface Soil**	Narrative[b, e]
	TPH as diesel	
	TPH as gasoline	
OT-87	**Sediments (and pellet removal)**	**ppm**
	Arsenic	9.6
	Lead	15.5
	Surface Soil	**ppm**
	Lead	700
	Benzo(a)pyrene	0.33
	Benzo(g,h,i)perylene	0.33
	Dibenzo(a,h)anthracene	0.33
	Fluoranthene	0.33
	Phenanthrene	0.33
OT-89	**Soil**	
	Lead[d]	NA[f]
Main Base/SAC Area Plume	**Groundwater**	**µg/L**
	Tetrachloroethene	5
	Trichloroethene	5
	1,1-Dichloroethene	6
	cis-1,2-Dichloroethene	6
	1,2-Dichloroethane	0.5
	Carbon tetrachloride	0.5
	TPH as diesel	100
	TPH as gasoline	50
	Benzene	1
	Xylenes	17
	Chloromethane	3
	Lead	15
Northeast Plume	**Groundwater**	**µg/L**
	Tetrachloroethene	5
	cis-1,2-Dichloroethene	6
	Carbon tetrachloride	0.5
	Chloromethane	3
	1,2-Dichloropropane	5
Site 7 Plume	**Groundwater**	**µg/L**
	Tetrachloroethene	5
	Trichloroethene	5
	1,1-Dichloroethene	6
	cis-1,2-Dichloroethene	6
	Vinyl chloride	0.5
	1,2-Dichloroethane	0.5
	1,4-Dichlorobenzene	5
	Benzene	1
	Chloromethane	3
	TPH as diesel	100

[a] See Northeast Plume.
[b] 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a).
[c] 2010 Basewide OU ESD (AFRPA, 2010b).
[d] 1998 Basewide OU ROD (AFBCA, 1998c).

Table 2-1. COCs and Cleanup Levels for Mather IRP Sites Requiring a Five-Year Review

IRP Site Number	COCs	Cleanup Levels

[e] An ESD is in preparation to formally add chlorinated solvents as COCs for Site 59. The remedial action for Site 59 addressed chlorinated solvents in accordance with the narrative cleanup goals in the 2010 Soil OU and Groundwater OU ESD.

[f] Selected remedy is Institutional Controls.

AC&W	=	Aircraft Control and Warning	NA	=	not applicable
AFCEC	=	Air Force Civil Engineer Center	OT	=	other
AFRPA	=	Air Force Real Property Agency	OU	=	operable unit
COC	=	contaminant of concern	ppm	=	parts per million
ESD	=	explanation of significant difference	SAC	=	Strategic Air Command
FT	=	fire training	SD	=	storm drain
IRP	=	Installation Restoration Program	SS	=	sanitary sewer
LF	=	landfill	ST	=	storage tank
mg/kg	=	milligrams per kilogram	TPH	=	total petroleum hydrocarbons
mg/L	=	milligrams per liter	WP	=	waste pit
µg/L	=	micrograms per liter			

For all sites listed in Table 2-1 that have narrative soil cleanup levels established in the Soil OU and Groundwater OU ESD or Basewide OU ESD (AFRPA, 2010a; 2010b), the following apply:

The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate-and-transport modeling, trend analysis, mass balance, and/or other means. This demonstration will include examination of the effects of the residual vadose zone contamination in the groundwater using VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate-and-transport model, to predict the resulting concentration from this residual vadose zone contamination in the nearest groundwater wells monitoring the site.

This demonstration can be made prior to the cessation of groundwater remediation. The Air Force shall provide verification, through data, that the above standard has been met. The signatory parties to the RODs will jointly make the decision that the soil cleanup standard has been met.

The Air Force shall operate the SVE system until it makes the demonstration that the cleanup standard, set forth above, has been met. The Air Force shall continue to operate the SVE system, if appropriate, after considering the following factors:

a) Whether the predicted concentration of the leachate from the vadose zone (using VLEACH or another appropriate vadose zone model that interprets soil gas data) will exceed the groundwater cleanup standard;

b) Whether the mass removal rate is approaching asymptotic levels after temporary shutdown periods and appropriate optimization of the SVE system;

c) The additional cost of continuing to operate the SVE system at concentrations approaching asymptotic mass levels;

d) The predicted effectiveness and cost of further enhancements to the SVE system (e.g., additional vapor extraction wells);

e) Whether the cost of groundwater remediation will be significantly more if the residual vadose zone contamination is not addressed;

f) Whether residual mass in the vadose zone will significantly prolong the time to attain the groundwater cleanup standard; and

g) The incremental cost over time of vadose zone remediation compared to the incremental cost over time for groundwater remediation on the basis of a common unit (e.g., cost per pound of TCE removed) provided that the underlying groundwater has not reached aquifer cleanup levels.

In addition to establishing narrative soil cleanup levels as described above, the ESDs established Institutional Controls (ICs) as the remedy for vapor intrusion and provided clarifying detail regarding implementation of ICs. The ICs for each site are described in further detail in Section 2.2 below.

2.2 Response Actions

There are 89 IRP sites at Mather, as shown on Figure 2-1. There are also four major volatile organic compound (VOC) groundwater plume areas (Figure 2-1). The 89 IRP sites have been grouped into six OUs, based on similarities in contaminants, affected media, and/or timing of cleanup decisions. OU 1 (referred to as the AC&W OU) consists of a contaminated groundwater plume, as well as three sites where underground storage tanks (USTs) were removed. OU 2 (referred to as the Groundwater OU) consists of three other contaminated groundwater plumes. OU 3 (referred to as the Soil OU) comprises contaminated soil associated with waste disposal pits, oil-water separators (OWS), gas stations, USTs, fire training areas, and other contaminated soil sites. OU 4 (referred to as the Landfill OU) consists of six sites where municipal waste was buried. OUs 5 and 6 (referred to as the Basewide OU and Supplemental Basewide OU, respectively) consist of the contaminated soil sites not included in other OUs.

For some IRP sites, cleanup activities were conducted prior to a final remedial action being selected by a signed ROD. Several removal actions were conducted as either time-critical (Sites LF-02 and FT-10C) or non-time critical (evaluated via an engineering evaluation/cost analysis [Sites ST-20, SD-80, SD-85, DD-88, and OT-89]). The time-critical removal actions were conducted to allow for excavation and consolidation of waste into Site LF-04 (AFBCA, 1996c; 1996d). The non-time critical actions were used to take early actions (IT Corporation, 1994; AFBCA, 1997b; 1999b; 2001a; 2001b; MWH, 2002a; 2002b). The decision and authorization to conduct a removal action is documented in an Action Memorandum rather than a ROD, although the final remedy (and cleanup standards, if further action is necessary) is then selected in a ROD.

The response actions selected for the sites and OUs addressed in this five-year review are summarized below. Further detail can be found in the following RODs and ESDs:

Operable Unit 1

Superfund Record of Decision: Aircraft Control and Warning Site (AC&W), *Mather Air Force Base, Sacramento County, California* (Air Force Base Conversion Agency [AFBCA], 1993), referred to as the AC&W OU ROD.

Explanation of Significant Difference to the AC&W OU Record of Decision: Discharge of Treated Groundwater to Mather Lake (AFBCA, 1997a).

Explanation of Significant Difference: Institutional Controls for Groundwater Remedy, Site WP-12, Aircraft and Control Warning Site, Mather, California (Air Force Real Property Agency [AFRPA], 2008a).

Operable Units 2 and 3

Superfund Record of Decision, Soil Operable Unit Sites and Groundwater Operable Unit Plumes, Mather Air Force Base, Sacramento County, California (AFBCA, 1996a), referred to as the Soil OU and Groundwater OU ROD.

Explanation of Significant Differences from the Record of Decision, Disposal of Contaminated Soil at Site 7/11 (AFBCA, 1998a).

Explanation of Significant Differences, Soil Operable Unit Sites and Groundwater Operable Unit Plumes Record of Decision for Sites 56, 59, and 60 (AFBCA, 1998b).

Explanation of Significant Difference from the Record of Decision for the Soil Operable Unit Sites and Groundwater Operable Unit Plumes: Soil Sites WP-07/FT-11, ST-37/ST-39/SS-54, SD-57, SD-59, OT-69; Main Base/SAC Area Plume, Site 7 Plume, Northeast Plume, Mather, California (AFRPA, 2010a), referred to as the 2010 Soil OU and Groundwater OU ESD.

Documentation of Nonsignificant Change to the Record of Decision for Site 23B, Former Mather Air Force Base, California – Expansion of Institutional Control Boundary (AFCEC, 2018).

Operable Unit 4

Superfund Record of Decision, Landfill Operable Unit Sites, Mather Air Force Base, Sacramento County, California (AFBCA, 1995), herein referred to as the Landfill OU ROD.

Explanation of Significant Difference from the Record of Decision, Consolidation of Additional Refuse & Debris into Landfill Site 4 (AFBCA, 1996b).

Memorandum of Post-ROD Changes: Clarification of Institutional Controls for the Landfill Operable Unit Remedies, Mather, California (AFRPA, 2009), referred to as the Memorandum of Post-ROD Changes.

Operable Unit 5

Record of Decision, Basewide Operable Unit Sites, Mather Air Force Base, California (AFBCA, 1998c), referred to as the Basewide OU ROD.

Explanation of Significant Difference from the Record of Decision Excavation of Shallow Soil Contaminated with Lead at Site 10C/68 (AFRPA, 2008b).

Explanation of Significant Difference from the Record of Decision for the Basewide Operable Unit Sites: Sites FT-10C/ST-68, LF-18, OT-23C, and OT-87, Mather, California (AFRPA, 2010b), referred to as the 2010 Basewide OU ESD.

Operable Unit 6

Record of Decision for the Supplemental Basewide Operable Unit Sites, Mather Air Force Base, Sacramento County, California (AFRPA, 2006), referred to as the Supplemental Basewide OU ROD.

2.2.1 OU 1 (AC&W OU)

The AC&W OU ROD was signed in December 1993 by AFBCA, EPA, and DTSC to address contaminated groundwater at Site WP-12 (AC&W Site) at Mather. The RAOs are to remove contaminant mass from the groundwater plume and remediate the plume to the aquifer cleanup level (ACL) of 5 µg/L for TCE, comply with the discharge standard for disposing of the treated water, and comply with air emission requirements (AFBCA, 1993).

The selected remedy for the AC&W Plume includes groundwater extraction and air stripping with on-site injection of treated water (effluent) into the aquifer. The discharge component of the remedy was modified via an ESD to surface water discharge into Mather Lake (AFBCA, 1997a). In addition, the remedy includes vapor-phase carbon adsorption of TCE from the stripped vapor, if required to meet Sacramento Metropolitan Air Quality Management District (SMAQMD) ARARs, and off-site regeneration of spent activated carbon, if necessary.

In 2008, ICs were added to the AC&W OU groundwater remedy through a second ESD (AFRPA, 2008a). The 2008 ESD included temporary groundwater use restrictions as a component of the AC&W groundwater remedial action until the ACL for TCE is met for the AC&W groundwater plume. The RAOs for the ICs are: (1) preventing human exposure to groundwater with concentrations of TCE exceeding the ACL of 5 µg/L; (2) protecting the integrity of the remedial system, including the associated monitoring system; and (3) protecting necessary access to the remedial system, including the associated monitoring system. The ICs prohibit the transferee from:

- Installing any wells for the extraction of groundwater from affected properties for any purpose other than remediation or monitoring;
- Constructing or creating any groundwater recharge area, unlined surface impoundments, or disposal trenches that cause the alteration of groundwater conditions;
- Conducting or allowing others to conduct activities that would cause disturbance of any systems, equipment, or components of systems associated with groundwater remediation or monitoring; or
- Conducting or allowing others to conduct activities that would limit access to any systems, equipment, or components of systems associated with groundwater remediation or monitoring.

2.2.2 OU 2 (Groundwater OU) – Main Base/SAC Area, Site 7, and Northeast Plumes

The Soil OU and Groundwater OU ROD was signed in 1996 by AFBCA, EPA, and DTSC and addresses contaminated groundwater in the Main Base/SAC Industrial Area, Site 7, and Northeast Plume areas (OU 2). For the purpose of selecting a remedial alternative, the ROD combined the Main Base and SAC Industrial Area Plumes.

Main Base/SAC Area and Site 7 Plumes: The RAOs identified in the Soil OU and Groundwater OU ROD for the Main Base/SAC Area and Site 7 Plumes are to achieve the ACLs throughout the contaminated aquifer, and comply with the discharge standards for disposing of the treated water. In addition, the remedial action calls for land-use restrictions on Air Force property, as appropriate, and groundwater monitoring. The remedial action included the following components:

- Groundwater extraction to achieve ACLs (see Table 2-1)
- Treatment of the extracted groundwater through air stripping with off-gas treatment as needed
- Groundwater injection in compliance with discharge standards (see Table 6-7, AFBCA, 1996b), in combination with other discharge options (to be evaluated during remedial design) that are (a) consistent with attainment of cleanup standards, and (b) cost-effective
- Land-use restrictions implemented on Air Force property as appropriate, to preclude installation of groundwater wells that would not be compatible with protection of public health and the environment
- Groundwater monitoring.

Northeast Plume: The RAO identified in the Soil OU and Groundwater OU ROD for the Northeast Plume is to protect the public from inadvertent significant exposure to contaminated groundwater. The ROD determined that active remediation of the Northeast Plume was not warranted because action was being taken to remediate the source (Landfill Site LF-04) and because removing the low-concentration contaminants from the groundwater would provide little benefit while incurring high costs. The remedial action contained the following components:

- ICs prohibiting the installation of groundwater supply wells on Mather or in off-base areas that could result in exposure to contaminated groundwater from the Northeast Plume
- Long-term groundwater monitoring pursuant to Title 23, California Code of Regulations (CCR), § 2550.10 (Corrective Action Monitoring) and 23 CCR 2550.8 (Detection Monitoring)
- Predictive modeling to assess whether the contaminants will meet the ACLs within a reasonable time (within 40 years from the date of the ROD) and whether contaminant concentrations above ACLs could migrate off-base.

2010 Soil OU and Groundwater OU ESD: An ESD, finalized in 2010, established additional ICs and clarified the implementation of land-use restrictions on Air Force property (AFRPA, 2010a). The RAOs for the ICs are: (1) preventing human exposure to groundwater with concentrations exceeding the ACLs that are specified in the Soil OU and Groundwater OU ROD; (2) protecting the integrity of the groundwater remedial actions and systems, including the associated monitoring systems; and (3) preserving access for the Air Force, EPA, and the State of California to the site, the remedial systems, and associated monitoring systems. The ICs prohibit the transferee from:

- Damaging/disturbing/tampering with, or allowing others to damage/disturb/tamper with, the remediation system components, including but not limited to the extraction and injection systems, treatment systems, conveyance pipes, electrical, gas, or fiber optic lines, or monitoring wells, until such time as remediation is complete or components are no longer to be used for remediation
- Engaging in, or allowing others to engage in, activities that interfere with the effectiveness of any remediation system component

- Engaging in, or allowing others to engage in, activities that would limit access for the Air Force, EPA, or the State of California to the site or to any equipment or component associated with the groundwater remediation systems

- Conducting, or allowing others to conduct, any surface activities that introduce or allow infiltration of water/other fluids into the groundwater (e.g., construction/creation of any groundwater recharge area, percolation ponds, unlined surface impoundments/trenches, or irrigation for agricultural purposes), unless specifically approved in writing by the Air Force, EPA, and the State of California

- Installing wells or extracting groundwater, or allowing others to install wells or extract groundwater, for any purpose other than remediation or monitoring.

In addition, the Soil OU and Groundwater OU ROD required the development of a Mather-specific, off-base water supply contingency plan (AFBCA, 1996a). The Contingency Plan describes the Air Force's plan for addressing the impact or the threat of impact to public water supply wells from groundwater contamination migrating from Mather. Key elements of the Contingency Plan include:

- Providing an ongoing monitoring plan of supply wells and their guard wells

- Evaluating the short-term and long-term options for providing alternate water supplies if needed

- Developing a "trigger" for ascertaining when option(s) should be implemented

- Determining the impact of supply well pumping on the plume(s) and recommend action(s) to minimize plume migration

- Determining when the monitoring can be terminated.

The original Contingency Plan was finalized in February 1998 (AFBCA, 1998e). Two subsequent revisions, each which supersede the prior version, were finalized in November 2008 (AFRPA, 2008c) and July 2013 (AFCEC, 2013).

2.2.3 OU 3 (Soil OU)

The Soil OU and Groundwater OU ROD signed in 1996 also addresses contaminated soil sites in the Site 7, Main Base and Sac Industrial Areas (OU 3).

Site WP-07/FT-11. The RAOs identified in the Soil OU and Groundwater OU ROD for Site WP-07/FT-11 are to achieve cleanup standards for the COCs, to mitigate any residual source of groundwater contamination that may be present, and to comply with ARARs for the Site WP-07 solid waste disposal site. The remedial action was modified by an ESD (AFBCA, 1998a) that changed the prescriptive landfill cover to allow use of contaminated soil from other sites to build up the cap foundation (AFBCA, 1998a). The major components of the remedy include:

- Filling in the depression at Site WP-07 with inert fill or soils meeting acceptance criteria in the ESD

- Treating contaminated shallow and deep soils at Sites WP-07 and FT-11 by in situ bioremediation and possibly SVE

- Installing a prescriptive landfill cover over the Site WP-07 impacted area using inert soils and/or non-designated soils to construct the foundation for the cap/cover

- Monitoring groundwater if contamination remains in place that threatens groundwater quality

- Land-use restrictions to protect the landfill cap at Site WP-07.

An ESD, finalized in 2010, clarified the ICs and augmented the remedy by establishing additional ICs at Site WP-07 (AFRPA, 2010a). The ESD also replaced the Site WP-07/FT-11 numeric soil cleanup levels for TPH-d and TPH-g with narrative soil cleanup levels. The RAOs for the ICs are: (1) protecting the integrity of the soil remedial actions and systems, including the associated monitoring systems, and (2) preserving access for the Air Force, EPA, and the State of California to the site, the remedial systems, and associated monitoring systems. The ICs prohibit the transferee from:

- Damaging/disturbing/tampering with, or allowing others to damage/disturb/tamper with, the remediation system components, including but not limited to the extraction and injection systems, treatment systems, conveyance pipes, electrical, gas, or fiber optic lines, or monitoring wells, until such time as remediation is complete or components are no longer to be used for remediation.

- Engaging in, or allowing others to engage in, activities that interfere with the effectiveness of any remediation system component.

- Engaging in, or allowing others to engage in, activities that would limit access for the Air Force, EPA, or the State of California to the site or to any equipment or component associated with the soil remediation systems.

- Interfering with the remedial action or damaging/disturbing/penetrating the engineered landfill cap or damaging/disturbing/ tampering with/removing or interfering with any associated remedial system components (e.g., containment system, drainage systems, erosion control systems for the landfill cap, survey monuments, gas vents, gas migration monitoring wells, groundwater monitoring system, access roads, settlement monuments, fencing, signage), or allowing others to do so, until such time as remediation is complete or the component is no longer used for the remedial action.

- Engaging in, or allowing others to engage in, activities that interfere with the effectiveness of the landfill cap or any associated remedial system component.

- Engaging in, or allowing others to engage in, activities that would limit access for the Air Force, EPA, or the State of California to the landfill cap or any associated remedial system component.

- Using, or allowing others to use, the property within the landfill cap outline identified in Figure 3 of the ESD for residential purposes (including mobile or modular homes), hospitals for human, public or private schools for persons under 18 years of age, nursery schools, or for day care centers for children.

Site WP-07 also has the following institutional controls:

- Controls to minimize potential for completing the inhalation exposure pathway for methane and other gasses potentially migrating from the landfill sites require future landowners to obtain approval from the State of California for any changes in land use or site improvements within 1,000 feet of a landfill, until and unless it is demonstrated that the landfill is no longer a threat to human health and the environment. This requirement is based on regulations at 27 CCR 21190 that apply to landfill properties. The ESD applied this 1,000-foot buffer only to property within the boundaries of the former Mather AFB.

Site ST-37/ST-39/SS-54. The RAOs identified in the Soil OU and Groundwater OU ROD for Site ST-37/ ST 39/SS-54 are to achieve cleanup standards for the COCs and to mitigate any potential or residual source of groundwater contamination that may be present. The remedial action selected in the Soil OU and Groundwater OU ROD for Site ST-37/ST-39/SS-54 includes these major components:

- Excavating approximately 220 cubic yards (cy) of contaminated surface soils to remove all contamination above acceptable levels
- Transporting excavated soils to the on-base ex situ bioremediation facility
- Treating excavated soils by ex situ bioremediation as appropriate
- Transporting treated soils to, and consolidating them with, landfill cap foundation materials at Site WP-07, as appropriate
- Treating contaminated shallow and deep soils by in situ bioremediation and possible SVE
- Monitoring groundwater if contamination that threatens groundwater quality remains at the site.

An ESD, finalized in 2010, added ICs to the remedy at Site ST-37/ST-39/SS-54 (AFRPA, 2010a). The ESD also replaced Site ST-37/ST-39/SS-54 numeric soil cleanup levels for BTEX, TPH-d, and TPH-g with narrative soil cleanup levels. The RAOs for the ICs are: (1) preventing unacceptable human exposure to soil vapor or residual contamination; (2) protecting the integrity of the soil remedial actions and systems, including the associated monitoring systems; and (3) preserving access for the Air Force, EPA, and the State of California to the site, the remedial systems, and associated monitoring systems. The ICs prohibit the transferee from:

- Damaging/disturbing/tampering with, or allowing others to damage/disturb/tamper with, the remediation system components, including but not limited to the extraction and injection systems, treatment systems, conveyance pipes, electrical, gas, or fiber optic lines, or monitoring wells, until such time as remediation is complete or components are no longer to be used for remediation.
- Engaging in, or allowing others to engage in, activities that interfere with the effectiveness of any remediation system component.
- Engaging in, or allowing others to engage in, activities that would limit access for the Air Force, EPA, or the State of California to the site or to any equipment or component associated with the soil remediation systems.

In addition to the ICs identified above, the following ICs were to be imposed as needed to prevent health risks from exposure to VOC-contaminated shallow soils.

The property recipient will be prohibited from:

- Engaging in any surface or shallow soil disturbance (in the geographic area subject to the IC), until and unless it is demonstrated that VOC contamination at these site(s) is no longer a threat to human health and the environment.
- Constructing any structures for human occupation (in the geographic area subject to the IC) without evaluating or addressing the risks posed by vapor intrusion.

Site SD-57. The RAOs identified in the Soil OU and Groundwater OU ROD for Site SD-57 are to achieve cleanup standards for the COCs and to mitigate any potential or residual source of groundwater contamination that may be present. The remedial action included the following major components:

- Treating contaminated shallow and deep soils by in situ SVE
- Monitoring groundwater if contamination that threatens groundwater quality remains at the site.

An ESD, finalized in 2010, added ICs to the remedy at Site SD-57 (AFRPA, 2010a). The RAOs and components of the ICs for Site SD-57 are the same as those described for Site ST-37/ ST-39/SS-54 and are not repeated here.

Site SD-59. The RAOs identified in the Soil OU and Groundwater OU ROD for Site SD-59 are to achieve cleanup standards for the COCs and to mitigate any potential or residual source of groundwater contamination that may be present. The remedial action includes the following major components:

- Excavating approximately 1,200 cy of contaminated shallow soils to remove all contamination above acceptable levels
- Transporting excavated soils to the on-base ex situ bioremediation facility
- Treating excavated soils by ex situ bioremediation as appropriate
- Transporting treated soils to, and consolidating them with, landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate
- Monitoring groundwater if contamination that threatens groundwater quality remains at the site.

An ESD was prepared to add in situ treatment (SVE/BV) to the remedy (AFBCA, 1998b). The following components were added:

- Installation of injection/extraction wells and monitoring points
- Removal of contaminated surface soil with off-site disposal as appropriate
- Pilot test to optimize the efficiency and cost of the SVE and/or the BV system
- Startup, operation, and maintenance of the system (including a potential switch from SVE to BV)
- Closure of the site after remedial goals have been met.

A second ESD, finalized in 2010, added ICs to the remedy at Site SD-59 (AFRPA, 2010a). This ESD also replaced Site SD-59 numeric soil cleanup levels for TPH-d and TPH-g with narrative soil cleanup levels. The RAOs and components of the ICs for Site SD-59 are the same as those described for Site ST-37/ST-39/SS-54 and are not repeated here. Note that the ICs for protection of remedy components also apply to the SVE components at Site LF-18 (Basewide OU), which was remediated with Site SD-59.

2.2.4 OU 4 (Landfill OU)

The Landfill OU ROD signed in 1995 selected remedial actions for landfill sites LF-03 and LF-04 at the former Mather AFB (OU 4).

Site LF-03. The RAOs identified in the Landfill OU ROD for Site LF-03 are to close the landfill in compliance with ARARs and, thereby, protect human health and the environment. The major components of the selected remedy include:

- Installing an engineered cap
- Installing passive gas vent wells
- Monitoring of groundwater and landfill gas for at least 5 years
- Invoking access restrictions (i.e., fencing and deed restrictions).

A memorandum of post-ROD changes, finalized in 2009, clarified and supplemented the ICs at Site LF-03 (AFRPA, 2009). The RAOs for the ICs are: (1) preventing human exposure to methane in structures that may be built within 1,000 feet of the site; (2) protecting the integrity of the remedial system(s), including the associated monitoring system; and (3) protecting necessary access to the site and to the remedial system(s), including the associated monitoring system. The ICs include:

- Controls to minimize potential for completing the inhalation exposure pathway for methane and other gasses potentially migrating from the landfill sites, require future landowners to obtain approval for any changes in land use or site improvements within 1,000 feet of a landfill from the state, until and unless it is demonstrated that the landfill is no longer a threat to human health and the environment. This requirement is based on regulations at 27 CCR 21190 that apply to landfill properties. The memorandum of post-ROD changes applied this 1,000-foot buffer only to property within the boundaries of the former Mather AFB.

- Controls to prohibit the destruction or disturbance of, or interference with, the remedial action, including the landfill caps and associated remediation system components, drainage systems, erosion control systems for the landfill cap, survey monuments, gas vents, gas migration monitoring wells, groundwater monitoring wells, fencing, signage, and access roads, until such time as remediation is complete or components are no longer to be used for remediation.

- Controls to prohibit any activities that would limit access to the site or to any equipment or systems associated with the remedial action, including the landfill caps and drainage structures and systems, gas monitoring wells, groundwater monitoring wells, gas venting equipment, survey monuments, fences and signage, and any other component of the remedial action.

Site LF-04. The RAOs identified in the Landfill OU ROD for Site LF-04 are to close the landfill in compliance with ARARs and to, thereby, protect human health and the environment. The major components of the selected remedy are:

- Installing an engineered cap
- Installing flood control measures (e.g., embankment)
- Installing passive gas vent wells
- Monitoring of groundwater and landfill gas for at least 5 years
- Invoking access restrictions (i.e., fencing and deed restrictions).

The Landfill OU ROD also included consolidation at Site LF-04 of wastes excavated from Sites LF-05 and LF-06. Additional material from Site FT-10C and Site LF-02 was consolidated into LF-04 as authorized in removal action memoranda in 1996 (AFBCA, 1996c; 1996d). In addition, the *Explanation*

of Significant Difference from the Record of Decision, Consolidation of Additional Refuse & Debris into Landfill Site 4 (AFBCA, 1996b) was prepared to modify the remedy at Site LF-02 to include consolidation of waste at Site LF-04 and also included use of soil from Site OT-69 for foundation material at Site LF-04.

A memorandum of post-ROD changes, finalized in 2009, clarified and supplemented the ICs at Site LF-04 (AFRPA, 2009). The RAOs and components of the ICs for Site LF-04 are the same as those described for Site LF-03 and are not repeated here.

2.2.5 OU 5 (Basewide OU)

The Basewide OU ROD signed in 1998 selected remedial actions for sites not addressed in the previous RODs.

Site FT-10C/ST-68. The RAOs identified in the Basewide OU ROD for Site FT-10C/ST-68 are to achieve cleanup standards for the COCs, and to mitigate any potential or residual source of groundwater contamination that may be present. The remedial action includes the following major components:

- In situ treatment of the fuel contaminated subsurface soils at Sites FT-10C and ST-68
- Treatment of off-gas by granular-activated carbon (GAC) or more cost-effective means of best available control technology as necessary to comply with ARARS
- Monitoring any thermal treatment effluent for dioxins.

An ESD added excavation to the remedy for Site FT-10C/ST-68 after lead-contaminated soil was discovered in 2002 (AFRPA, 2008b). The RAOs for the lead excavation portion of the remedy are, at a minimum, to eliminate the concentrations incompatible with industrial land use (800 milligrams per kilogram [mg/kg]) and protect water quality in the underlying aquifer at or less than the MCL (15 µg/L) for lead by excavating soil with soluble lead concentrations greater than 15 milligrams per liter (mg/L).

An ESD for Site FT-10C/ST-68, finalized in 2010, added ICs to the remedy at Site FT-10C/ST-68 (AFRPA, 2010b). The ESD also replaced the numeric soil cleanup levels for TPH-d and TPH-g with narrative soil cleanup levels. The RAOs for the ICs are: (1) preventing unacceptable human exposure to soil vapor or residual contamination; (2) protecting the integrity of the remedial system, including the associated monitoring system; and (3) preserving access to the site, the remedial system, and associated monitoring system. The ICs prohibit the transferee from:

- Damaging/disturbing/tampering with, or allowing others to damage/disturb/tamper with, the remediation system components, including but not limited to the extraction and injection systems, treatment systems, conveyance pipes, electrical, gas, or fiber optic lines, or monitoring wells, until such time as remediation is complete or components are no longer to be used for remediation.
- Engaging in, or allowing others to engage in, activities that interfere with the effectiveness of any remediation system component.
- Engaging in, or allowing others to engage in, activities that would limit access for the Air Force, EPA, or the State of California to the site or to any equipment or systems associated with the soil remediation system components.

In addition to the ICs identified above, the following ICs were to be imposed as needed to prevent health risks from exposure to VOC-contaminated shallow soils.

The property recipient will be prohibited from:

- Engaging in any surface or shallow soil disturbance (in the geographic area subject to the IC), until and unless it is demonstrated that VOC contamination at this site is no longer a threat to human health and the environment.

- Constructing any structures for human occupation (in the geographic area subject to the IC) without evaluating or addressing the risks posed by vapor intrusion.

Site LF-18. The RAO identified in the Basewide OU ROD for Site LF-18 is to mitigate any potential or residual source of groundwater contamination that may be present. The selected remedial action includes the following major components:

- Installing an in situ SVE system comprising extraction wells and possibly passive injection wells

- Treatment of off-gas by GAC or more cost-effective means of best available control technology as necessary to comply with ARARs

- Monitoring any thermal treatment effluent for dioxins.

An ESD, finalized in 2010, added ICs to the remedy to prevent health risks from exposure to VOC-contaminated soils (AFRPA, 2010b). Because Site LF-18 (including Subsite-OT-23A) was remediated with Soil OU Site SD-59, the protection of SVE piping and wells associated with Site LF-18 was included with the Site SD-59 ICs in the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a). The RAOs and the ICs related to preventing unacceptable human exposure to soil vapor and preserving access to the site and the remedial system are the same as those described for Site FT-10C/ST-68, and the RAOs and the ICs related to protection of remaining remedial system components and preserving access are the same as those described for Site ST-37/ST-39/SS-54; therefore, they are not repeated here.

Site OT-23C. The RAO identified in the Basewide OU ROD for Site OT-23C is to mitigate any potential or residual source of groundwater contamination that may be present. The selected remedial action includes the following major components:

- Installing an in situ SVE system comprising extraction wells and passive injection wells

- Treatment of off-gas by GAC or more cost-effective means of best available control technology

- Monitoring any thermal treatment effluent for dioxins.

Note that Subsite OT-23A was addressed by the SVE remedial action at Site LF-18, which has been completed, and Subsites OT-23B and OT-23D are addressed by the SVE remedial action at Site ST-37/ ST-39/SS-54, which has been completed.

An ESD, finalized in 2010, added ICs to the remedy at Site OT-23C (AFRPA, 2010b). The RAOs of the ICs were to: 1) prevent unacceptable human exposure to soil vapor or residual contamination, 2) protect the integrity of the remedial systems, and 3) preserve necessary access to the remedial systems. The ESD stated: “Because the land parcels associated with Site OT-23C have already been transferred by the USAF, imposing ICs by amending the deed and/or executing a SLUC may only be accomplished with the

property owner's agreement." The ESD required ICs to be applied only to the last remaining parcel related to Site OT-23C that had not been previously transferred, known as Parcel P-2, which was located away from the source area and near the periphery of the area of concern for vapor intrusion. The ESD specified that the ICs would be imposed only if necessary, and that the Air Force should determine if ICs were necessary nearer the time of transfer. The ESD states, "If the site soil gas data demonstrates that all of the soil gas concentrations for each contaminate of concern are compatible with unrestricted land use, then the USAF will not impose these ICs." At the time of property transfer, shallow soil vapor concentrations on Parcel P-2 were non-detect. Therefore, only the ICs pertaining to protection of remedial systems were included in the deed for Parcel P-2. The ICs prohibit the transferee from:

- Damaging/disturbing/tampering with, or allowing others to damage/disturb/tamper with, the remediation system components, including but not limited to the extraction and injection systems, treatment systems, conveyance pipes, electrical, gas, or fiber optic lines, or monitoring wells, until such time as remediation is complete or components are no longer to be used for remediation.

- Engaging in, or allowing others to engage in, activities that interfere with the effectiveness of any remediation system component.

- Engaging in, or allowing others to engage in, activities that would limit access for the Air Force, EPA, or the State of California to the site or to any equipment or systems associated with the soil remediation system components.

Site OT-87. Although no specific RAOs are identified in the Basewide OU ROD for Site OT-87, the basis for cleanup is protection of human health, groundwater quality, surface-water quality, and ecological receptors. The selected remedial action includes the following major components:

- Excavating approximately 28,000 cy of contaminated sediments and surface soils to a 6-inch depth through the fall zone of the lead shot.

- Stabilizing (if needed for disposal) approximately 28,000 cy of contaminated sediments and surface soils.

- Transporting the soil, stabilized as necessary, to Site WP-07 for use as foundation material in construction of a cap, or an off-base facility if sample screening indicates that Site WP-07 acceptance criteria are not met.

- Backfilling the excavated areas with uncontaminated soils and/or recontouring to create effective drainage.

- Implementing ICs with the goal of protecting human health.

The Basewide OU ROD also required monitoring to ensure that the residual levels of lead left in place at Site OT-87 do not pose a hazard to small mammals and waterfowl. To accomplish this task, monitoring of lead levels in small mammal tissue was required on an annual basis for up to 3 years. In addition, any dead waterfowl found in the area of Site 87 were to be reported to the regulatory agencies, and necropsied by a certified laboratory for signs of lead toxicity.

An ESD, finalized in 2010, clarified the implementation of ICs at Site OT-87 (AFRPA, 2010b). The RAO for the ICs is to prevent unacceptable human exposure to residual lead contamination at Site OT-87. The ICs prohibit the transferee from:

- Engaging in any surface or shallow soil disturbance activities at Site OT-87, where it may contain elevated lead concentrations, without prior approval from the ROD signatory agencies to ensure that the activity will not compromise protection of human health and the environment. This includes any activities that would alter drainage or sub-drainage in the area.

- Using, or allowing others to use, Site OT-87 for residential development, or construction of schools, day care facilities for children, or hospitals for human care, and that any uses of the site that would allow exposure to the buried contaminated soils by the public will be prohibited.

2.2.6 OU 6 (Supplemental Basewide OU)

The Supplemental Basewide OU ROD was signed in 2006 and addresses one additional site evaluated in this five-year review.

Site OT-89. The RAOs identified in the Supplemental Basewide OU ROD for Site OT-89 are: (1) prevent unrestricted human exposure to lead concentrations greater than 192 mg/kg; (2) prevent plant exposure to lead concentrations greater than 700 mg/kg; and (3) prevent disturbance of subsurface soil that could threaten water quality. The selected remedy is ICs that prohibit the transferee from:

- Engaging in any surface or shallow soil disturbance activities at Site OT-89 (including any activities that would alter drainage, or sub-drainage, in the area), until and unless it is demonstrated that the lead concentrations in the soils at this site are no longer a threat to human health and the environment.

- Using, or allow others to use, Site OT-89 for residential purposes (including mobile or modular homes), hospitals for human care, public or private schools for persons under 18 years of age, nursery schools, or for daycare centers for children.

2.3 Status of Implementation

Response actions from each of the RODs and ESDs identified in Section 2.2 have been implemented and are either complete or operating properly and successfully. Detailed descriptions of remedial activities can be found in the operations and maintenance (O&M) manuals, monitoring reports, reports of proper and successful operation, response complete and closure reports, and other technical reports listed in Section 5.0.

Groundwater remedies at the AC&W site (OU 1) and the Main Base/SAC Area, Site 7, and Northeast plumes (OU 2) and are all operating properly and successfully. Groundwater extraction and treatment systems are in place at the Main Base/SAC Area, Site 7, and AC&W plumes, and all sites have an active groundwater monitoring program. ICs have been implemented as required by the AC&W OU ESD and 2010 Soil OU and Groundwater OU ESD.

For the Soil OU sites (OU 3), all soil removal, SVE and BV remedies have been completed as applicable for each site. Associated soil vapor treatment systems have been decommissioned, and ICs for the protection of remedial equipment and components are no longer required. ICs required by the 2010 Soil OU and Groundwater OU ESD have been implemented to prevent unacceptable exposure to residual soil vapor contamination. The landfill remedy for Site WP-07/FT-11 has been implemented and associated ICs are in place.

For the Landfill OU (OU 4), remedies are complete at LF-02, LF-05, and LF-06, and the sites have been closed. Landfills and associated facilities are in place at LF-03 and LF-04 and are operating properly and

successfully. ICs required by the Landfill OU ESD have been implemented, and landfill maintenance and monitoring is ongoing.

SVE and BV remedies are also complete for the Basewide OU sites (OU 5). With the exception of Site OT-23C, the treatment systems have been decommissioned and ICs are in place to prevent unacceptable exposure to residual soil vapor contamination. For Site OT-23C, the Air Force expanded the IC boundary beyond what was initially imposed in response to the 2010 Basewide OU ESD RAO to prevent unacceptable human exposure to soil vapor or residual contamination; the protectiveness of this expanded IC boundary is currently in dispute by the regulatory agencies. Excavation and treatment of contaminated soil at OT-87 was conducted, the excavation was backfilled, and ICs are in place to protect human health. Confirmatory small mammal monitoring was conducted and met the criteria established in the ROD, and no dead waterfowl have been found at the site since the ROD was signed. During this five-year review period, the California Department of Fish and Wildlife (CDFW) conducted focused surveys for dead waterfowl at Site OT-87 in 2019, and none were found.

For the Supplemental Basewide OU (OU 6), the pre-ROD lead removal action resulted in soil concentrations protective of plants and other ecological receptors (AFRPA, 2006). ICs have been implemented as required to prevent unacceptable human exposure to lead in soil.

2.4 Institutional Controls

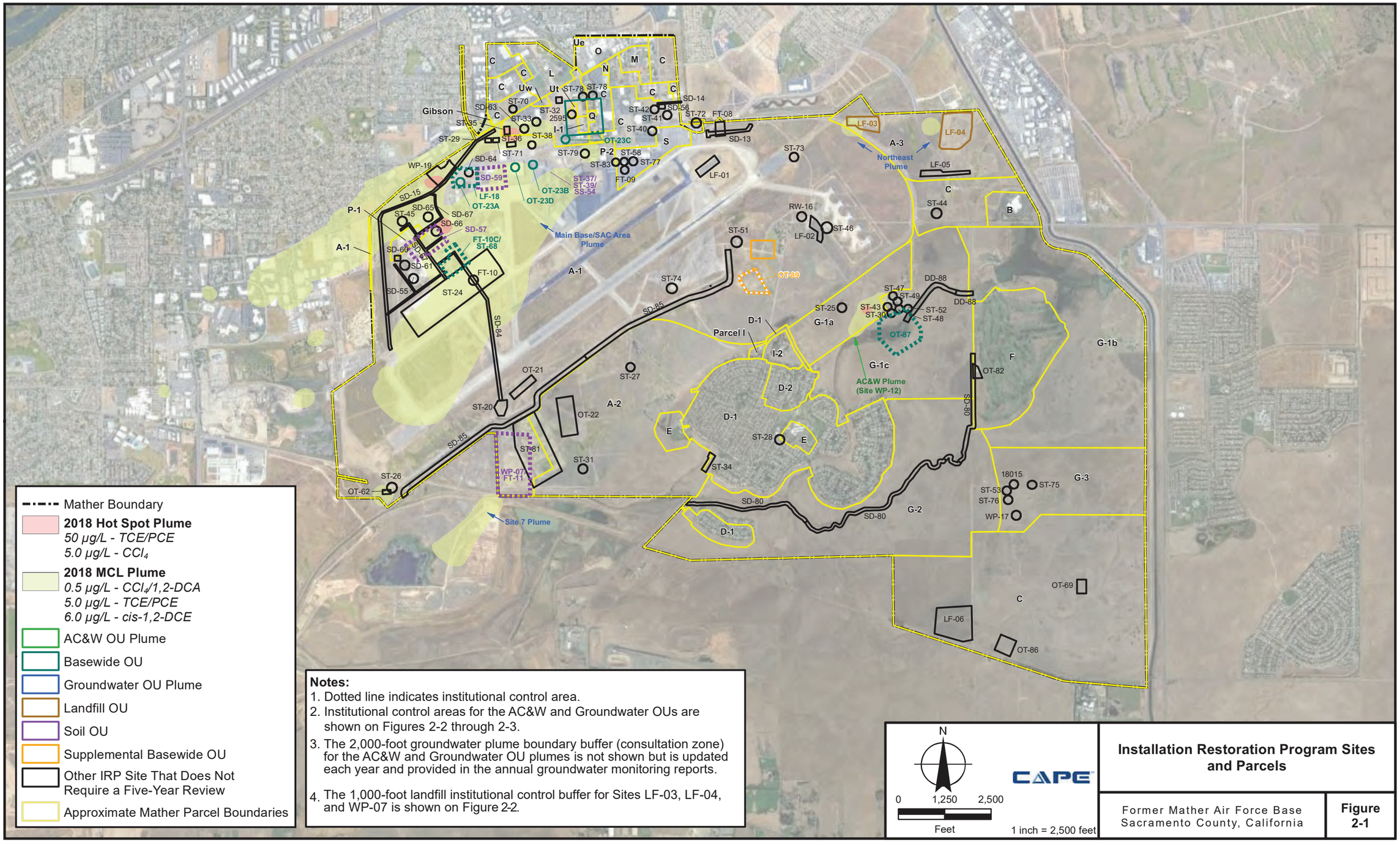
Monitoring of ICs has been conducted on an annual basis during the period of this five-year review. Although site inspections were conducted to verify compliance with required ICs, annual IC compliance reports were not prepared for 2014, 2015 or 2016. The Air Force had anticipated that IC compliance reviews would be conducted by property owners pursuant to State Land Use Covenants (SLUCs), as described in the RODs and ESDs. However, SLUCs are not yet in place for some properties at Mather, and for properties with SLUCs, property owners have not provided compliance reports. In 2017 the Air Force re-initiated its annual report of compliance with ICs, and reports were prepared for 2017, 2018 and 2019. Those reports document that ICs are in place and effective. Through 2019, no deficiencies have been observed during the IC inspections (CAPE, 2020). Figures 2-2 and 2-3 show the IC boundaries for each site with ICs in place at Mather.

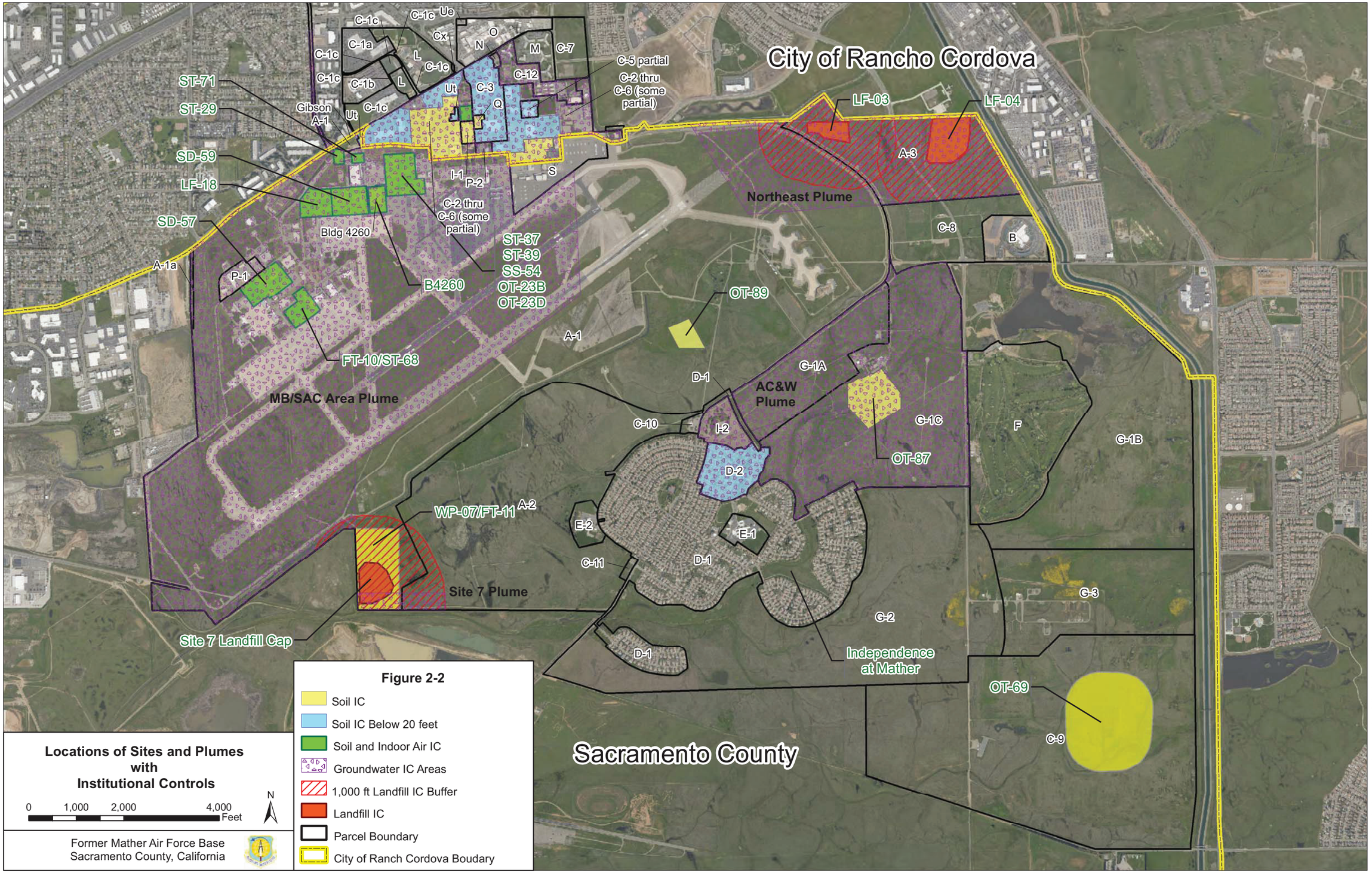
It is noted that a shallow excavation occurred on Parcel Q in 2017 without Air Force approval, as required by the Air Force's Quitclaim Deed (recorded in October 2007). The Air Force received notification of the excavation work after it had taken place. The available data indicate there is not an unacceptable human health risk associated with exposure to shallow soil vapor on Parcel Q, and the Site 23C SVE Completion Report recommends removal of the soil-related ICs in this area. The 2007 SLUC for this parcel does not contain soil-related ICs. The Air Force will continue to work with the State of California and local agencies with regard to IC compliance reporting and dig notifications, and will continue to track IC compliance.

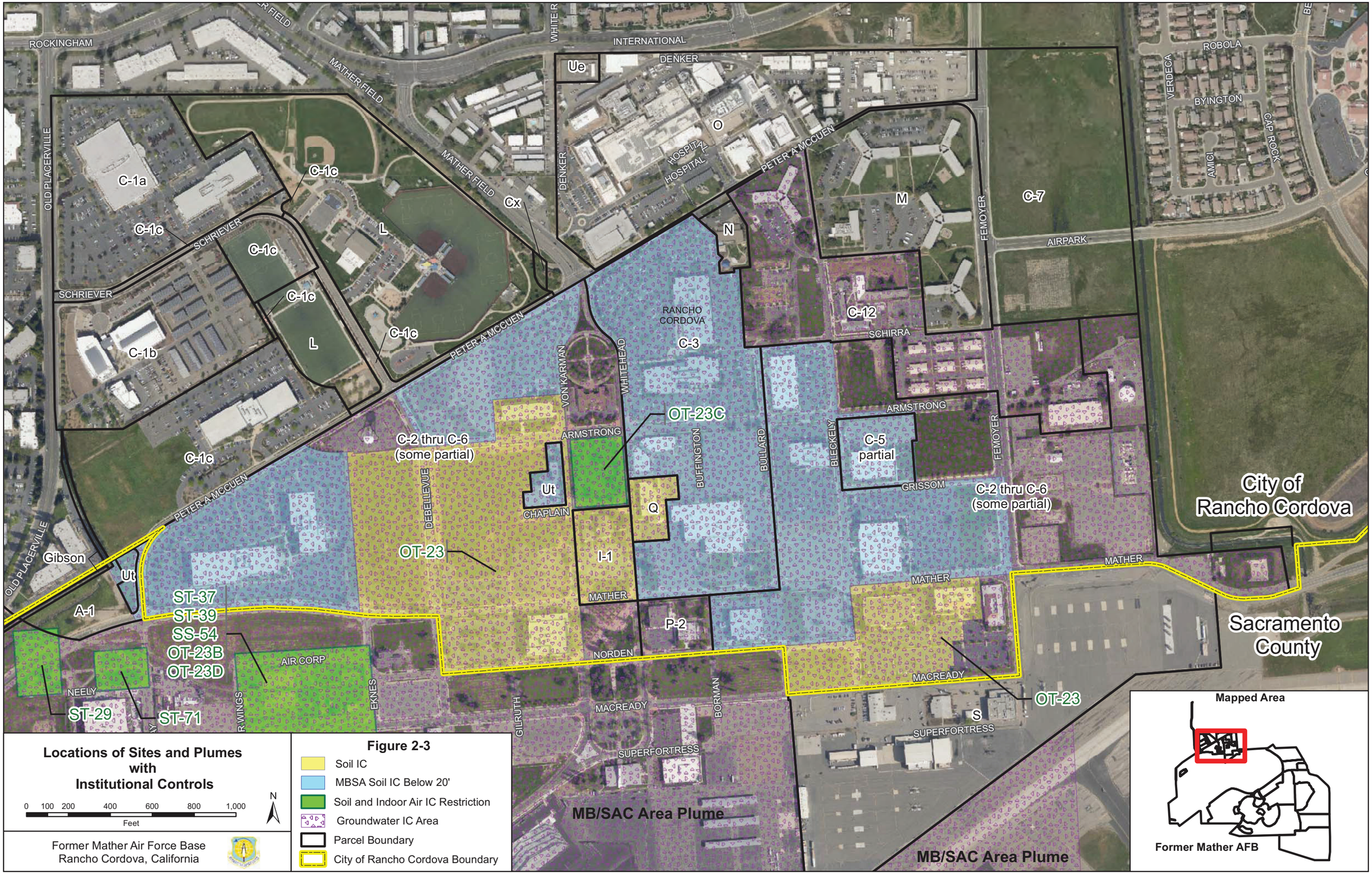
2.5 Systems Operations & Maintenance

The groundwater remedies are operated in accordance with the O&M manuals for the AC&W OU, Main Base/SAC Area Plume, and the Site 7 Plume, which describe procedures to operate and maintain the three groundwater treatment systems at Mather (EA Engineering, 1995; Montgomery Watson, 1997a; 1999c; MWH, 2003). Modifications to the groundwater treatment systems, such as the installation of new extraction wells for refinement of plume control, are planned and implemented independently of the groundwater treatment system O&M program. Accordingly, the decision-making criteria and guidance for long-term management of the groundwater treatment systems are evaluated in the annual groundwater monitoring reports versus the O&M manuals.

During the period of this five-year review, per- and polyfluoroalkyl substances (PFAS) were identified as emerging contaminants. PFAS are associated with aqueous film-forming foam (AFFF) that was used in past fire training practices at Air Force Bases. In 2016, the EPA published Lifetime Health Advisories (LHA) for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in drinking water. The LHA level is 70 nanograms per liter (ng/L), to be applied individually or to the sum of PFOS and PFOA concentrations. In response to the advisories, the Air Force conducted a basewide Site Investigation to identify AFFF release areas and determine whether PFOS and PFOA in groundwater had the potential to impact drinking water. Groundwater from five AFFF use areas were found to contain concentrations of PFOS/PFOA above the LHA. In addition, effluent from the Site 7 and Main Base/SAC Area groundwater treatment plants, which use air strippers to treat for VOCs, also contained PFOS/PFOA above the LHA. Because effluent from the treatment plants is re-injected into the groundwater aquifer, GAC treatment systems were installed at both treatment plants for treatment of PFAS. O&M of those GAC systems is ongoing, including carbon change-outs as needed to ensure PFOS+PFOA concentrations in the system effluent do not exceed the LHA. System components and operations are described in the O&M manual updates and the annual groundwater monitoring reports (NCBI, 2017, NCBI, 2018, CAPE 2018d, CAPE, 2019a).


Gibson
Ue
O
M
C
N
L
Uw
Ut
ST-78
ST-70
SD-63
ST-32
2595
ST-33
ST-35
ST-29
ST-36
ST-38
I-1
OT-23C
ST-79
P-2
ST-58
ST-83
ST-77
FT-09
ST-42
ST-41
SD-56
SD-14
ST-72
FT-08
ST-40
S
SD-13
ST-73
LF-01
WP-19
SD-64
SD-59
ST-37/
ST-39/
SS-54
LF-18
OT-23A
OT-23B
OT-23D
SD-15
P-1
A-1
ST-45
SD-65
SD-67
SD-66
SD-57
FT-10C/
ST-68
SD-60
SD-61
FT-10
SD-55
ST-24
SD-84
Main Base/SAC Area
Plume
ST-51
RW-16
LF-02
ST-46
OT-89
ST-74
SD-85
D-1
Parcel I
I-2
D-2
ST-27
OT-21
ST-20
OT-22
A-2
SD-85
ST-81
ST-31
WP-07/
FT-11
ST-26
OT-62
Site 7 Plume
E
ST-28
ST-34
SD-80
G-2
D-1
LF-03
LF-04
A-3
Northeast
Plume
LF-05
C
ST-44
B
ST-47
ST-49
DD-88
DD-88
ST-25
ST-43
ST-30
ST-52
ST-48
G-1a
OT-87
G-1c
AC&W Plume
(Site WP-12)
G-1b
F
OT-82
SD-80
18015
ST-75
G-3
ST-53
ST-76
WP-17
OT-69
C
LF-06
OT-86
Mather Boundary
2018 Hot Spot Plume
50 µg/L - TCE/PCE
5.0 µg/L - CCl4
2018 MCL Plume
0.5 µg/L - CCl4/1,2-DCA
5.0 µg/L - TCE/PCE
6.0 µg/L - cis-1,2-DCE
AC&W OU Plume
Basewide OU
Groundwater OU Plume
Landfill OU
Soil OU
Supplemental Basewide OU
Other IRP Site That Does Not Require a Five-Year Review
Approximate Mather Parcel Boundaries
Notes:
1. Dotted line indicates institutional control area.
2. Institutional control areas for the AC&W and Groundwater OUs are shown on Figures 2-2 through 2-3.
3. The 2,000-foot groundwater plume boundary buffer (consultation zone) for the AC&W and Groundwater OU plumes is not shown but is updated each year and provided in the annual groundwater monitoring reports.
4. The 1,000-foot landfill institutional control buffer for Sites LF-03, LF-04, and WP-07 is shown on Figure 2-2.
N
0
1,250
2,500
Feet
1 inch = 2,500 feet
CAPE
Installation Restoration Program Sites and Parcels
Former Mather Air Force Base
Sacramento County, California
Figure 2-1


City of Rancho Cordova
Sacramento County
ST-71
ST-29
SD-59
LF-18
SD-57
A-1a
P-1
FT-10/ST-68
MB/SAC Area Plume
Gibson
A-1
C-1c
C-1a
C-1b
L
Ut
Ue
Cx
O
N
M
C-7
C-12
C-5 partial
C-2 thru
C-6 (some
partial)
C-3
Q
I-1
P-2
S
Bldg 4260
B4260
ST-37
ST-39
SS-54
OT-23B
OT-23D
A-1
OT-89
D-1
C-10
I-2
D-2
AC&W
Plume
C-1A
G-1C
OT-87
LF-03
LF-04
A-3
Northeast Plume
C-8
B
F
G-1B
WP-07/FT-11
A-2
E-2
E-1
C-11
D-1
Site 7 Plume
Site 7 Landfill Cap
G-3
G-2
Independence
at Mather
OT-69
C-9
Locations of Sites and Plumes
with
Institutional Controls
0
1,000
2,000
4,000
Feet
N
Former Mather Air Force Base
Sacramento County, California
Figure 2-2
Soil IC
Soil IC Below 20 feet
Soil and Indoor Air IC
Groundwater IC Areas
1,000 ft Landfill IC Buffer
Landfill IC
Parcel Boundary
City of Ranch Cordova Boudary
Document Path: P:\GIS Files\Projects\Mather_Proj_2020\SY_Review_IC_map\Mather_IC_Rpt_w_Parcels_v02282020.mxd



Locations of Sites and Plumes with Institutional Controls

0 100 200 400 600 800 1,000 Feet

N

Former Mather Air Force Base
Rancho Cordova, California

Figure 2-3

- Soil IC
- MBSA Soil IC Below 20'
- Soil and Indoor Air IC Restriction
- Groundwater IC Area
- Parcel Boundary
- City of Rancho Cordova Boundary

Document Path: P:\GIS Files\Projects\Mather_Proj_2020\5Yr_Review_IC_map\Mather_IC_Rpt_w_Parcels_v02282020.mxd

3.0 PROGRESS SINCE LAST REVIEW

This section describes the progress since the Fourth Five-Year Review, including a description of the protectiveness statements, the status of recommendations and follow-up actions presented in the *Fourth Five-Year Review Report* (URS, 2015d), and the status of any other prior issues.

3.1 Protectiveness Statements from Previous Review

The protectiveness statements for each OU in the *Fourth Five-Year Review Report* are presented in Table 3-1 below.

Table 3-1 Protectiveness Determinations/Statements from the Fourth Five Year Review

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy at OU1 (AC&W OU) is protective of human health and the environment.
2	Short-term Protective	The remedies at OU2 (Groundwater OU) are protective of human health and the environment in the short term due to already existing ICs. For the remedy to be protective in the long-term, the following actions need to be taken: the presence and magnitude of PFCs in groundwater must be determined; potential risks from exposure to PFCs must be evaluated; and appropriate remedies (if any) must be determined and documented in appropriate decision documents.
3	Short-term Protective	The remedies at OU3 (Soil OU) are protective of human health and the environment in the short term. However, for the Soil OU remedies to be protective in the long term, the IC boundary at Site SD-59 needs to be expanded to the south and east to address the potential risk to human health from the vapor intrusion pathway. Investigation and risk assessment activities are also needed at Building 4260, where a new source area may have been discovered.
4	Protective	The remedies at OU4 (Landfill OU) are protective of human health and the environment.
5	Protective	The remedies at OU5 (Basewide OU) are protective of human health and the environment.
6	Protective	The remedy at OU6 (Supplemental Basewide OU) is protective of human health and the environment.
Sitewide	Short-term Protective	The remedial actions at Mather AFB are short-term protective of human health and the environment. For the remedies to be protective in the long term, the IC boundary at Site SD-59 needs to be expanded to the south and east to address the potential risk to human health from the vapor intrusion pathway and additional investigation and risk assessment activities are needed at Building 4260 (which may be a new site). For groundwater, presence and magnitude of PFCs in groundwater must be determined; potential risks from exposure to PFCs must be evaluated; and appropriate remedies (if any) must be determined and documented in appropriate decision documents.

The recommendations and follow-up actions presented in the fourth five-year review were implemented. The technical assessment of the remedial actions in Section 5.0 of this report describe the evaluations conducted and the remedial system modifications made over the past 5 years to address the protectiveness concerns described in the *Fourth Five-Year Review Report* (URS, 2015d). The results of this assessment were used to develop the protectiveness statements presented in Section 7.0 of this fifth five-year review.

3.2 Recommendations and Follow-Up Actions from Fourth Five-Year Review

3.2.1 OU 2 (Groundwater OU) and OU 3 (Soil OU)

The issues and recommendations identified for each OU in the *Fourth Five-Year Review Report* are presented in Table 3-2 below, along with a description of the current implementation status.

Table 3-2 Status of Recommendations from the Fourth Five Year Review

Issue	Recommendations	Current Implementation Status Description
OU 2: Main Base/SAC Area and Site 7 Plumes: Influent and effluent samples collected from the Main Base/SAC Area and Site 7 groundwater treatment plant contained concentrations of perfluorinated compounds (PFCs). One sample, from the Main Base/SAC Area plant, contained concentrations of perfluoroocane sulfonate (PFOS) at concentrations slightly greater than EPA's Provisional Health Advisory Level.	Conduct follow-up groundwater sampling for PFC analysis in the Main Base/SAC Area and Site 7 plumes.	At the time this issue was identified, EPA's Provisional Health Advisory levels for PFOS and PFOA in drinking water were 0.2 and 0.4 µg/L, respectively. During the period of this five-year review, the EPA established an LHA level of 70 ng/L for the sum of PFOS and PFOA in drinking water. The CVWB also established a "response level" of 70 ng/L for total PFOS+PFOA, applicable to local water agencies. The Air Force conducted a basewide Site Investigation to identify areas where AFFF containing PFAS had been used, handled, stored or released at Mather, and determine the presence or absence of PFOS and PFOA in groundwater, surface water, soil and sediment. Releases of PFOS to soil above the screening level were confirmed at three AFFF Areas. PFOS+PFOA was detected in groundwater at the Main Base/SAC Area and Site 7 plumes above the LHA. GAC treatment systems were installed at both groundwater treatment plants to remove PFAS from the system effluent prior to reinjection. One off-base water supply well was found to contain PFOS/PFOA above the LHA, and it was equipped with a GAC treatment system by the well operator. As of the time period of this Five-Year Review, monitoring of off-base wells is continuing and an Expanded Site Inspection is underway to further investigate drinking water pathways. A Remedial Investigation is planned for 2021.
OU3: Site SD-59: TCE concentrations in the new shallow vadose zone wells southeast of the site and outside of the IC area may pose an unacceptable threat to human health via the vapor intrusion pathway.	Further assess the extent of VOCs near Building 4260, possibly designating a new site, and expand the IC boundary to the south and east via an appropriate decision document.	During the period of this five-year review, the Air Force confirmed the presence of a new soil vapor source area at Building 4260 and designated it as Site "B4260." The CVWB and the Air Force conducted indoor air sampling in August 2016 and February 2017, respectively, and the Air Force prepared a Human Health Risk Assessment (URS, 2017b), which determined that there was no completed pathway to indoor air from soil vapor contaminants at B4260 under current conditions. ICs were imposed in a notification letter to the County of Sacramento prohibiting modifications to the building or its foundation without addressing potential for increased risk to building occupants due to vapor intrusion. The Air Force prepared and signed an Action Memorandum selecting a non-time-critical removal action consisting of SVE and ICs for B4260. The B4260 SVE system was installed and has been

Table 3-2 Status of Recommendations from the Fourth Five Year Review		
Issue	**Recommendations**	**Current Implementation Status Description**
		operating since August 2018. SVE has been successful at reducing contaminant concentrations in soil vapor, and no modifications to Building 4260 have occurred that would pose a potential vapor intrusion risk. A decision document will be prepared to document the final remedy for the site, including permanent ICs if needed.

3.3 Issues Raised After Completion of the Fourth Five-Year Review

After finalization of the *Fourth Five-Year Review Report* (URS, 2015d), DTSC in their comments on the final report expressed a concern about data gaps and uncertainties in the protection of indoor air at Building 4260. EPA also noted in their concurrence letter that the Air Force should collect indoor air samples at Building 4260. The CDFW expressed concerns regarding the sufficiency of small mammal monitoring and dead waterfowl surveys at Site OT-87. EPA noted in their letter that there was not agreement between the Air Force and regulatory agencies regarding the results of the small mammal monitoring at Site OT-87.

Concern: Potential vapor intrusion into existing buildings from SVE sites is a concern, specifically at Site B4260.

Status: The Air Force has conducted indoor air sampling in Building 4260 and prepared a Human Health Risk Assessment (URS, 2017b), which determined that there was no complete pathway to indoor air from soil vapor contaminants beneath B4260. The risk assessment concludes there is no site related vapor intrusion human health risk to building occupants under current conditions. An IC was imposed in a notification letter to the County of Sacramento prohibiting modifications to the building or its foundation without addressing potential for increased risk to building occupants due to vapor intrusion.

Concern: For Site OT-87, CDFW believes the current method of monitoring for dead waterfowl is insufficient and that an additional year of small mammal monitoring should be conducted. EPA deferred their determination of long-term protectiveness pending resolution of the small mammal monitoring issue.

Status: In May 2016, per request from the regulatory agencies, the Air Force prepared a position paper providing the rationale for the Air Force's determination that the conditions of the ROD for Site OT-87 had been met and that the remedy in place was protective of human health and the environment. No comments or responses to the position paper were received from any of the regulatory agencies. On 6 June 2019, CDFW prepared a "Dead Waterfowl Monitoring Program Work Plan for Former Mather Air Force Base Site OT-87" and performed dead waterfowl surveys at the site in June and September of 2019. No dead waterfowl have been found by either the Air Force or CDFW during the last Five-Year Review period. Subsequent waterfowl survey results will be presented in the Sixth Five-Year Review Report.

4.0 FIVE-YEAR REVIEW PROCESS

This section describes the activities performed during the Mather five-year review process, including identification of the five-year review team, notification of the local community, review of relevant documents and data, inspection of current site conditions, and performance of interviews to assist in determining site status.

4.1 Administrative Components

The Mather fifth five-year review team includes the following RPMs:

Douglas Self	AFCEC
John Lucey	EPA (Region 9)
Sarah Watson	EPA (Region 9)
Franklin Mark	DTSC
Marcus Pierce	CVWB

Note that the list of RPMs does not include all those who have contributed to this program over the last 5 years. Each RPM has support staff that has made contributions to project management or implementation. As of 2019, other contributors to the Mather IRP include:

Gary Yuki	Cherokee Nation Business Services, Environmental Support Contractor
Molly Enloe	Cherokee Nation Business Services, Technical Support to AFCEC
Linda Geissinger	AFCEC Public Affairs Manager
Diane Nordstrom-Lamkin	CalRecycle Remedial Project Manager
Jeffrey Yang	SMAQMD Representative
Rick Balazs	Sacramento County Department of Economic Development
Ron Ogle	Sacramento County Airport System
John Thomas	Cape Environmental Management Inc, Performance Based Remediation Contractor Program Manager

Members of the review team were notified of the initiation of the fifth five-year review for Mather at the September 2018 Base Realignment and Closure Cleanup Team meeting and briefed on the schedule at the March 2019 Base Realignment and Closure Cleanup Team meeting. Table 4-1 presents the schedule for this fifth five-year review report.

Table 4-1. Fifth Five-Year Review Schedule

	Draft			Draft Final			
Document Title	Submission Date	Review Period	Comments Due Date	Submission Date	Comment Response Confirmation Review Period	Comment Confirmation Due Date	Final Date, if Comments Not Received
Fifth Five-Year Review Report	06 March 2020	60 days	29 May 2020	30 June 2020	43 days	12 August 2020	30 September 2020

4.2 Community Involvement and Notification

A public notice of the fifth five-year review was published on 22 March 2019 in the *Sacramento Bee*. The notice provided an overview of the five-year review process, outlined the five-year review schedule, and invited the public to submit any comments to the Air Force.

As part of the fifth five-year review process, AFCEC solicited regional stakeholders for feedback regarding ongoing environmental restoration activities at Mather. Stakeholders asked to participate in interviews included a cross-section of public and private entities. Section 4.5 includes a summary of the interviews, and Appendix C contains the interview records.

A public notice will be published in the *Sacramento Bee* to notify the community of the completion of the review process and finalization of the fifth five-year review. This notice will briefly summarize the review, note how and where the public can view the report, and list points of contact for community members who would like to obtain more information or ask questions about the results of the fifth five-year review.

This fifth five-year review report for Mather will be available for viewing by the public in the Mather Administrative Record, located online at http://afcec.publicadmin-record.us.af.mil/Search.aspx.

4.3 Document and Data Review

The five-year review process included a review of documents relevant to the Mather IRP Program, including RODs for each OU, subsequent ESDs, and previous five-year reviews. Documents relevant to the implementation and performance of the groundwater, vadose zone (i.e., soil), landfill, and ICs remedies were also reviewed in the preparation of this five-year review. These documents include monthly, quarterly, semiannual, and/or annual monitoring reports, as well as various closure reports, and remedial action completion reports. Documents relevant to the performance of the various treatment systems were reviewed to ensure the systems are operating in accordance with their O&M manuals. In addition, RI/FS and risk assessment documents were reviewed as needed. Documents that were consulted during the preparation of this report are cited throughout this document and included in the reference list in Section 9.0 of this report.

For groundwater remedy performance assessments, hydraulic and analytical data reviewed include groundwater level changes, gradients, flow directions, capture zones, groundwater quality data, including trends, mass removal data, and effluent compliance data. For SVE/BV remedy performance assessments, data reviewed include analytical concentration data from both field measurements and laboratory analysis of vapor samples, extraction and emission rate data, mass removal data, compliance data, and operational data (e.g., uptime, electrical usage, and destruction rate efficiency). For the landfill remedy performance assessments, data reviewed include gas monitoring data, compliance data, site inspection reports, and the results from the topographic surveys conducted every 5 years.

4.4 Site Inspections

The annual IC site inspections conducted on 13 to 14 November 2019 served as the site inspections for this five-year review, as the sites requiring IC inspection are included in this five-year review. The 2019 site inspection was attended by Mr. Douglas Self from the Air Force, Mr. Franklin Mark and Mr. Marcus Pierce from the State of California, Ms. Sarah Watson from the EPA, and Mr. Rick Balazs from Sacramento County. The purpose of the inspection was to assess the protectiveness of the remedy. No compliance issues were observed. The results of the inspections are reported in the *2019 Annual Report of Compliance with Institutional Controls at the Former Mather Air Force Base* (CAPE, 20120). In addition, AFCEC staff and technical support contractors, located at McClellan, California, approximately 10 miles from Mather, have maintained familiarity with the physical condition of the sites and remedial systems through approximately weekly inspection visits to Mather. Through these personnel, remedial action contractors that are on site on a daily basis conducting O&M tasks and sampling activities, and periodic regulatory agency visits, the Air Force and regulatory agencies have maintained familiarity with environmental remediation activities and site conditions at Mather.

4.5 Site Interviews

As part of the five-year review process, a series of interviews were conducted to evaluate opinions and concerns regarding the environmental restoration activities at Mather. The interview process included two components – interviews with stakeholders, and interviews with O&M representatives, including the RPMs and O&M contractor for Mather.

In July 2019, five stakeholders who were contacted responded to the Air Force's request for input. They were interviewed in person or over the phone by Air Force contractor, CAPE, and Air Force staff. Interviewees included the Sacramento County Deputy Director of Economic Development, the Mather Airport Manager, the Director of Maintenance for Mather Aviation, and the External Affairs representative for California American Water Company (Cal Am) along with the Senior Director of Water Quality and Environmental Compliance for Cal Am. All five expressed some general knowledge of Mather's environmental operations. However, most stakeholders did not feel well-informed about the cleanup program at Mather. The stakeholders interviewed suggested continuing outreach efforts to explain what work is being done at Mather and how it impacts and benefits the community. The majority of the interviewees were not aware of any current community concerns regarding the cleanup at Mather. The exceptions were the Cal Am representatives who expressed concern regarding the Mather cleanup process and said there are concerns from customers about contamination in the water. Cal Am representatives also expressed concerns that the groundwater remedy at Mather might be moving PFAS contaminants towards their drinking water supply well.

For the O&M representatives, all potential interviewees were initially contacted by email to request their participation in the interview process by completing a survey. Of the 8 O&M representatives asked to participate in the interview process, 6 responded and completed surveys by email. Four of the six responders are current or former O&M contractors and the other two responders are current or former representatives for AFCEC. In general, the overall impression of the remedial actions selected for Mather's IRP was favorable; the remedies are appropriate and functioning as expected; and where unexpected conditions were encountered, remedies were modified or ICs were added. The O&M contractor also noted that in regards to the treatment systems, the age of the equipment and obsolete technology and equipment result in costly repairs and difficulty in obtaining replacement parts. For example, the fiber optic communications scheme that allows the supervisory control and data acquisition system and programmable logic controller to communicate with the extraction wells is obsolete and communication failures occur frequently. Other unexpected O&M difficulties or costs during the last 5 years noted by the O&M representatives include discovery of a new soil vapor source area at Building 4260 and PFAS groundwater contamination requiring installation of GAC treatment. In general, the AFCEC and O&M representatives stated that the treatment systems and monitoring programs are being optimized and are fairly efficient. AFCEC and O&M representatives also commented that PFAS contaminants are emerging COCs related to fire-training facilities at Air Force bases and that the Air Force is being proactive in response to these emerging contaminants by implementing GAC treatment at the treatment systems.

The responses from the five-year review interviews will be taken into account as AFCEC moves forward with the community involvement program and continues its environmental restoration activities at Mather. Appendix C includes the interview records.

5.0 TECHNICAL ASSESSMENT

The technical assessment for remedial and removal actions at Mather consists of determining whether those actions are, and will continue to be, protective of human health and the environment. To reach a protectiveness determination, EPA guidance recommends that the following three questions be addressed for each action (EPA, 2001):

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

Answers to these three questions help ensure that all relevant issues are considered when determining the protectiveness of the remedy.

Questions A and C are addressed on a site-by-site basis in Sections 5.2 through 5.7. Question B is discussed in Section 5.1. The technical assessment for each site focuses on the performance of the remedial actions during the period of this fifth five-year review.

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

Question B is discussed here because the same discussion applies to the RAOs for most of the remedial actions.

5.1.1 Are the exposure assumptions used at the time of the remedy still valid?

The exposure assessments included in the risk assessments for all sites were based on current and future land use. In evaluating the future land use scenario, reasonable maximum exposure was assessed using residential use. These exposure assumptions remain valid for this five-year review.

Sites OT-87, OT-89, and the landfills (Sites LF-03, LF-04, and WP-07) have remedies that are incompatible with unrestricted land use; therefore, they each have ICs prohibiting residential or sensitive uses as a part of their remedies. No land use changes have occurred that would change the exposure assumptions for these sites.

ICs to prevent potential unacceptable exposure to VOCs in indoor air are in place at Sites FT-10C/ST-68, LF-18, ST-37/ST-39/SS-54, OT-23C, and SD-59. The ICs are described in Section 2.2 and prohibit the property recipient from constructing any structures for human occupation (in the geographic area subject to the IC) without evaluating or addressing the risks posed by vapor intrusion. Since the last five-year review, the IC boundaries were expanded at Sites ST-37/ST-39/SS-54 and OT-23C in response to findings in the respective SVE completion or closure reports (URS, 2016d; URS 2019). These changes increase the protectiveness of the remedies with regard to indoor air exposure. Further discussion is provided in Section 5.4.2 and 5.6.3.

An evaluation of the potential risk from the vapor intrusion pathway from VOCs in groundwater was presented in the *Third Five-Year Review Report* (URS, 2010). Cumulative risk or hazard estimates were evaluated for both residential and commercial land use scenarios. There are no completed, new, or

previously unconsidered exposure pathways relevant to this evaluation. Evaluation of the vapor intrusion pathway from vadose zone sources is discussed below in Section 5.1.2.

No other exposure assumptions have changed or otherwise become invalid since the risk assessments and remedy selections.

5.1.2 Are the toxicity data used at the time of the remedy still valid?

Groundwater. None of the ACLs established for groundwater contaminants have been revised since the RODs were signed. ACLs for groundwater COCs were established as the contaminant-specific California or federal MCL, if an MCL existed. If an MCL did not exist, a health-based guideline was used to establish the ACL. Since approval of the Soil OU and Groundwater OU ROD, federal and California MCLs for total xylenes have been promulgated; total xylenes are a COC for the Main Base/SAC Area Plume. However, the ACL (17 µg/L) is still more stringent than either the federal (10,000 µg/L) or state (1,750 µg/L) MCLs. Consequently, a review of ARARs indicates that no new standards have been promulgated or proposed since the RODs were signed that would call into question the protectiveness of the remedy for groundwater.

Since some of the groundwater ACLs were selected based on health risk criteria, those ACLs were re-evaluated with the latest toxicity data. The primary source for toxicity data for a five-year review is the EPA Integrated Risk Information System (IRIS) database (EPA, 2019). During the period covered by this fifth five-year review, no COCs received any major updates in IRIS. Some regional screening levels (RSLs) were revised due to other factors, but changes in the RSLs have not resulted in new enforceable standards (i.e., MCLs). Therefore, the groundwater ACLs for Mather remain protective of human health because the values of the ACLs are generally equal to, or less than, a corresponding MCLs and/or they do not exceed the NCP's risk management range.

In September 2018, the State of California adopted the *Toxicity Criteria for Human Health Risk Assessments, Screening Levels, and Remediation Goals* rule (Toxicity Criteria Rule). In April 2019, DTSC's Health and Ecological Risk Office (HERO) issued *HHRA Note 3* containing "DTSC-modified screening levels" (DTSC-SLs) based on the Toxicity Criteria Rule and recommending that they be used in preference to the EPA RSLs to evaluate chemical concentrations in environmental media (OEHHA, 2019b). As set forth in *HHRA Note 3,* the DTSC-SLs are risk-based levels, derived at a target risk level of $1x10^{-6}$.

Table 5-1 compares the ACLs for COCs in the AC&W OU and Soil OU and Groundwater OU RODs to EPA RSLs (EPA, 2019), Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) public health goals (PHGs) (OEHHA, 2019a), and the new DTSC-SLs. The RSLs and PHGs include concentrations in drinking water that correspond to a de minimus (inconsequential) cancer risk of 1E-06 (equivalent to the "per million" notation on Table 5-1), assuming a 30-year exposure time and life span of 70 years. Table 5-1 also lists the incremental lifetime cancer risk (ILCR) estimated for each ACL using the RSL, PHG, and DTSC-SL. To evaluate protectiveness of the ACLs, the associated ILCR estimates are compared to the risk management range defined in the NCP (40 CFR 300). As cited in 40 CFR 300.430(e)(2)(i)(A)(*2*), "For known or suspected carcinogens, acceptable exposure levels are generally concentrations that represent an excess upper bound lifetime cancer risk to an individual of between 1E-06 to 1E-04," which is equivalent to 1 per million to 100 per million.

Table 5-1. Comparison of Mather Groundwater Aquifer Cleanup Levels, California Public Health Goals, and California DTSC-modified Screening Levels to EPA RSLs

Contaminant of Concern	ACL (µg/L)	Current MCL (µg/L)	EPA RSL (µg/L)	ILCR of ACL	PHG (µg/L)	ILCR of PHG	DTSC -SL (µg/L)	ILCR of DTSC-SL
Benzene	1	1	0.46	2.2	0.15	6.7	0.15	6.7
Carbon tetrachloride	0.5	0.5	0.46	1.1	0.1	5.0	0.46	1.1
Chloromethane	3	NA	19	0.2	NA	NC	NA	NC
1,1-Dichloroethene	6	6	28	0.2	10	0.6	NA	NC
1,2-Dichloroethane	0.5	0.5	0.17	2.9	0.4	1.3	NA	NC
cis-1,2-Dichloroethene	6	6	3.6	1.7	13	0.46	NA	NC
1,2-Dichloropropane	5	5	0.82	6.1	0.5	10.0	NA	NC
1,4-Dichlorobenzene	5	5	0.48	10	6	0.8	NA	NC
Tetrachloroethene	5	5	4.1	1.2	0.06	83	0.084	59.5
Trichloroethene	5	5	0.28	18	1.7	2.9	NA	NC
Xylenes, total	17	1,750	19	0.89	1,800	0.01	NA	NC
Vinyl chloride	0.5	0.5	0.019	26	0.05	10	0.0098	51.0
TOTAL				**71**		**121**		**118**

ACL = Aquifer Cleanup Level
DTSC = Department of Toxic Substances Control
EPA = United States Environmental Protection Agency
ILCR = incremental lifetime cancer risk
MCL = maximum contaminant level
NA = not available
NC = not calculated
PHG = public health goal
PRG = preliminary remediation goal
RSL = regional screening level
SL = screening level
µg/L = micrograms per liter

Note: ILCR values are calculated based on the EPA RSL and presented in parts per million. The acceptable risk range, per 40 CFR 300.430(e)(2)(i)(A)(*2*), is 1 to 100 parts per million.

The Mather groundwater plumes consist of various mixtures of the COCs. The health risk of some or all of the contaminants in these mixtures may be cumulative, or may contribute in an additive way to the cancer risk. At the time of the third five-year review, the sum of the estimated risks associated with all the groundwater ACLs based on EPA RSL risk assumptions was approximately 112 in 1 million (URS, 2010), which was greater than the risk management range. The cumulative ACL risk estimate for the fourth five-year review was approximately 64 in 1 million (URS, 2015d), which is within the risk management range. The cumulative ACL risk estimate for this five-year review based on EPA RSL risk assumptions is approximately 71 in 1 million, which is still within the risk management range.

The cumulative risk using the PHG risk assumptions is approximately 121 in 1 million, of which PCE contributes approximately 69 percent. The cumulative risk using the DTSC-SL risk assumptions is approximately 118 in 1 million, of which vinyl chloride contributes approximately 43 percent. This evaluation assumes that concentrations in a hypothetical water sample consist of all of the COCs at ACL concentrations and that this is the sole drinking water source for the assumed exposure. However, some of the COCs are rarely detected in groundwater at Mather and not all of the COCs listed in Table 5-1 are COCs for each of the four groundwater plumes. For example, in the Site 7 Plume, vinyl chloride was not detected in any well in 2018. If vinyl chloride is excluded, the cumulative risk estimates for Site 7 are 36 in 1 million, 96 in 1 million, and 66 in 1 million using the RSL, PHG, and DTSC-SL risk assumptions, respectively. These estimates are within the risk management range. For the other three plumes (AC&W, MBS/SAC Area, and Northeast), the cumulative risk estimates for the COCs for those plumes are all less than 100 in 1 million regardless of whether the RSL, PHG or DTSC-SL risk assumptions are used. See Table 2-1 for a list of COCs by plume.

Soil. The cleanup levels for lead in soil at Sites FT-10C/ST-68, OT-87, and OT-89 are 800 mg/kg (15 mg/L soluble), 700 mg/kg, and 192 mg/kg, respectively. ICs restricting residential or sensitive land uses are in place as a part of the remedies for Sites OT-87 and OT-89. At Site FT-10C/ST-68, additional excavation was performed in 2008 pursuant to the 2010 Basewide OU ESD. Following excavation, the maximum lead concentration remaining in soil was 127 mg/kg with an average concentration of 44 mg/kg and a median concentration of 19 mg/kg. These concentrations were determined to be compatible with UU/UE (MWH, 2009), and no residential use restriction was imposed at the site.

No changes to the EPA RSLs for lead in soil have occurred during the last five-year review period. The RSLs (800 mg/kg for industrial use and 400 mg/kg for residential use) provided the basis for the cleanup levels at these sites, and the remedies remain protective based on these screening levels.

In 2009, DTSC issued revised industrial and residential screening levels (known as California Human Health Screening Levels [CHHSLs]) for lead in soil of 320 mg/kg and 80 mg/kg, respectively. During the fourth five-year review, a 95th upper confidence limit (95th UCL) of the mean was calculated for lead concentrations remaining in soil at FT-10C/ST-68, OT-87, and OT-89 (see Table 5.2). The 95th UCL concentrations were used to evaluate the remedies with respect to the revised CHHSLs and to assess blood lead levels (using the DTSC LEADSPREAD 8 model). The evaluation was based on the permissible land uses for each site, as dictated by site ICs. The remedies were determined to be protective of human health and the environment (see Appendix D in URS, 2015d).

Table 5-2. 95th UCL Lead Concentrations (mg/kg)

FT-10C/ST-68	OT-87 Inside IC	OT-87 Outside IC	OT-89 Inside IC	OT-89 Outside IC to North	OT-89 Outside IC to South
101.4	256.7	41.1	16.3 [a]	57.27	75.4

Notes:
[a] = Too few sample points to calculate a 95th UCL; value represents the maximum concentration detected.
IC = Institutional Control
mg/kg = milligrams per kilogram
UCL = Upper Confidence Limit

During the period of this five-year review, the State of California adopted the Toxicity Criteria Rule (as described above for groundwater), and DTSC's *HHRA Note 3* published in April 2019 provided updated DTSC-SLs. The DTSC-SLs for lead of 320 mg/kg and 80 mg/kg for industrial and residential use, respectively, did not change. The LEADSPREAD model used to evaluate the remedies during the fourth five-year review also has not changed. Consequently, no new standards have been promulgated or proposed since remedy selection that would call into question the protectiveness of the remedy for soil at Site FT-10C/ST-68.

Soil Vapor. During the period of this five-year review, the State of California adopted an updated inhalation cancer unit risk factor for PCE in September 2016, approved the Toxicity Criteria Rule (as described above for groundwater) in September 2018, and published DTSC's *HHRA Note 3* in April 2019 providing updated DTSC-SLs for indoor air. As set forth in *HHRA Note 3,* the DTSC-SLs are risk-based screening levels, derived at a target risk level of $1x10^{-6}$ and a target hazard quotient level of 1 using generic exposure assumptions.

In 2012, an update to an IRIS value resulted in a significant increase in the USEPA RSL value for PCE from 0.41 micrograms per cubic meter ($\mu g/m^3$) to 47 $\mu g/m^3$. No other significant changes to the RSLs for indoor air have occurred since establishing vapor intrusion ICs for soil vapor sites at Mather.

Sites for which soil vapor ICs are in place include FT-10C/ST-68, LF-18, OT-23C, ST-37/ST-39/SS-54, SD-57, and SD-59. The IC boundaries were established in the 2010 ESDs for each respective site. The IC for Site OT-23C was limited to a small portion of the site that had not yet been transferred. The ICs were re-evaluated in the remedial action completion reports for each site based on an assessment of vapor intrusion risk, including cumulative risk, using either vapor intrusion modeling or comparison of residual shallow soil vapor concentrations with residential and industrial use screening levels (USEPA RSLs and DTSC-SLs) (MWH, 2010a; 2010b; URS, 2016c; 2017d; 2017g; 2019). Table 5-3 presents a comparison of the current USEPA RSLs and DTSC-SLs for indoor air for COCs at Mather. The table also shows the calculated soil gas screening levels in parts per million by volume based on the DTSC recommended attenuation factor of 0.001 from soil gas to indoor air.

In June 2015, EPA published its vapor intrusion guidance, which identifies 0.03 as a medium-specific attenuation factor for "near-source exterior soil gas." Use of this attenuation factor would result in a three-fold reduction in the screening levels for soil gas and a three-fold increase in residential indoor air risk. The EPA guidance identifies the attenuation factor as a "generic value" and states that "use of this attenuation factor for estimating indoor air concentrations is contingent upon site conditions fitting the generic model…" The generic model that provides the basis for EPA's 0.03 "near-source exterior soil gas" screening value is the paired exterior soil gas and indoor air measurements in EPA's Vapor Intrusion Database (March 2012). The generic model was evaluated for its applicability to Mather soil vapor sites, and the findings are as follows:

- Only 8 percent of the paired values in the database have exterior soil gas measurements.
- Of these 8 percent, only 1 out of 17 sites has a vadose zone source area.
- The one site with a vadose zone source area was located in an area of surficial beach sands and a "coarse" soil type.
- Of the 17 total sites with exterior soil gas measurements, only 4 had "fine" soil; 12 had "coarse" or "very coarse" soil and 1 was unknown.
- The total number of exterior soil gas samples from the 4 sites with fine soil comprise less than 10% of the total exterior soil gas measurements in the database (16 out of 181 samples), with more than 50% of the measurements coming from sites with "very coarse" soils.
- Exterior soil vapor samples from the 4 sites with fine soil were generally collected at depths of approximately 2 to 3 feet bgs (or below basement level) due to the presence of shallow groundwater.

Based on this generic model, EPA's vapor intrusion guidance recommends an exterior soil gas attenuation factor that is equivalent to the sub-slab attenuation factor. Thus, the model assumes zero attenuation as vapor moves through the soil. The site-specific conditions at Mather do not fit this generic model. The uppermost geologic unit at Mather is characterized by a low-permeability surficial soil layer composed predominantly of silt and clay, extending from the ground surface to approximately 5 to 15 feet bgs. As described in the EPA's Vapor Intrusion Database, smaller attenuation factors, which indicate greater reduction in vapor concentration, would be expected in vadose zones with finer grained (i.e., lower permeability) soils. In addition, EPA notes that higher attenuation is associated with thicker vadose zones, due to the reduction in concentrations that occurs as vapors migrate upward from the subsurface to the sub-slab. At Mather, shallow soil vapor samples have been collected at 8 to 20 feet bgs, which would also result in greater attenuation than represented by the generic model.

The 95th UCL attenuation factor cited in EPA's Vapor Intrusion Database for sites with soils classified as "fine" is 1.5E-04 (i.e., 0.00015). This attenuation factor was developed based on soil vapor concentrations from groundwater source areas. However, as described above, the database does not include any sites with fine soils overlying a vadose zone source area. Therefore, this is the most applicable attenuation factor available in the guidance.

The attenuation factor of 0.001 used at Mather is also supported by Mather-specific soil vapor attenuation data. During the last Five-Year Review period, soil gas, sub-slab, and indoor air data were collected from a nearby site (B4260) with similar geology. The data from this sampling indicate that significant soil vapor attenuation occurred between the shallow (8- to 10-foot depth) and sub-slab soil vapor concentrations (URS, 2017b). At B4260, the soil vapor source area is immediately adjacent to the building and the interpreted soil vapor plume extends under the building itself. During the baseline sampling event (prior to initiation of SVE), the shallow soil vapor TCE concentration was measured at 160 parts per million by volume (ppmv). This is equivalent to 859,877 $\mu g/m^3$. Four sub-slab samples were collected, and the highest detected concentration was 1,400 $\mu g/m^3$. This equates to an attenuation factor of 0.0016 between the shallow vapor and sub-slab vapor concentrations. Additional attenuation occurs between the sub-slab and indoor air. This additional attenuation is estimated by the U.S. EPA vapor intrusion guidance as 0.03. Applying both factors, the total attenuation between shallow soil vapor and indoor air at B4260 would be 0.00005 (note, lower attenuation factor values indicate greater dilution and lower vapor intrusion risk).

Thus, both the EPA guidance and the Mather-specific soil attenuation data support the use of the 0.001 attenuation factor and demonstrate that use of this value provides a conservative estimate of vapor intrusion risk.

With the exception of Site OT-23C, the established IC boundaries encompass all areas where shallow soil gas concentrations exceed the current USEPA RSL or DTSC-SL for residential use. As noted above, both the EPA RSL and DTSC-SL for PCE in indoor air changed during the Five-Year Review period. The EPA RSL for resident indoor air increased, which would result in lower potential vapor intrusion risk. The change in the DTSC-SL for residential indoor air results in a calculated soil vapor screening level only 0.002 mg/kg lower than the prior screening level. This change does not affect the estimated risk or protectiveness of the IC remedies.

For Site OT-23C, the existing data show that the IC encompasses all residual shallow soil gas concentrations exceeding the USEPA RSL for residential use, and vapor intrusion risk is within the 1E-06 to 1E-04 risk management range based on the DTSC-SLs for residential use. The protectiveness determination for Site OT-23C has been deferred due to the pending dispute as discussed in Section 5.6.3.1.

Table 5-3. Soil Vapor Screening Criteria

Analyte	Molecular Weight	DTSC Note 3 Indoor Air Screening Value ($\mu g/m^3$)	Soil Gas Screening Value (ppmv)*	US EPA RSL Indoor Air Screening Value ($\mu g/m^3$)	Soil Gas Screening Value (ppmv)*
Commercial / Industrial Screening Levels					
1,1-DCA	98.97	7.7 [a]	1.9	7.7 [b]	1.9
Benzene	78.11	0.42 [b]	0.13	1.6 [b]	0.50
cis-1,2-DCE	96.94	35	8.8	--	--
CTCL	153.84	2 [a]	0.32	2 [b]	0.32
Ethylbenzene	106.16	--	--	4.9 [b]	1.1
PCE	165.83	2 [b]	0.29	47 [b]	6.9
TCE	131.4	--	--	3 [b]	0.56
Toluene	92.13	1300	350	22000	5800
m-Xylene	106.17	--	--	440	100
o-Xylene	106.17	--	--	440	100
p-Xylene	106.17	--	--	440	100
Residential Screening Levels					

Table 5-3. Soil Vapor Screening Criteria

Analyte	Molecular Weight	DTSC Note 3 Indoor Air Screening Value (µg/m^3)	Soil Gas Screening Value (ppmv)*	US EPA RSL Indoor Air Screening Value (µg/m^3)	Soil Gas Screening Value (ppmv)*
1,1-DCA	98.97	1.8 [a]	0.44	1.8 [b]	0.44
Benzene	78.11	0.097 [b]	0.030	0.36 [b]	0.11
cis-1,2-DCE	96.94	8.3	2.1	--	--
CTCL	153.84	0.47 [a]	0.075	0.47 [b]	0.075
Ethylbenzene	106.16	--	--	1.1 [b]	0.25
PCE	165.83	0.46 [b]	0.07	11 [b]	1.6
TCE	131.4	--	--	0.48 [b]	0.089
Toluene	92.13	310	82	5200	1400
m-Xylene	106.17	--	--	100	23
o-Xylene	106.17	--	--	100	23
p-Xylene	106.17	--	--	100	23

Notes:
[a] = DTSC Screening Value based on USEPA RSL for carcinogenic risk
[b] = based on carcinogenic risk
* = Calculated at standard temperature of 25 degrees Celsius and pressure of 1 atmosphere and showing value to two significant figures. Based on the default attenuation factor of 0.001 for future residential buildings, as discussed in DTSC's Vapor Intrusion Guidance document Table 2 (https://dtsc.ca.gov/wp-content/uploads/sites/31/2018/01/Final_VIG_Oct_2011.pdf): ppmv = ((µg/m^3)*24.45/(Molecular Weight))*.001*1000.

PFAS. PFAS are chemicals that have been classified as emerging environmental contaminants and are associated with the use of aqueous film-forming foam during past fire training practices at Air Force Bases. During the period of this five-year review, Air Force site investigations confirmed PFAS contamination in extracted groundwater from the MBSA/SAC Area plume and the Site 7 plume. The influent concentrations at the treatment plants are above the EPA LHA level for the sum of concentrations of PFOA and PFOS of 70 ng/L in drinking water. GAC treatment was added to the Main Base/SAC Area and Site 7 groundwater treatment plants to remove PFAS contaminants before treated groundwater is reinjected. The Air Force also conducted sampling for PFOS/PFOA in off-base drinking water wells that could potentially be impacted by the Main Base/SAC Area plume or Site 7 plume. One well, OFB-32, owned and operated by CalAm, was found to contain PFOS/PFOA above the LHA. The MBSA injection wells were identified as the likely source of this contamination. CalAm added a GAC treatment system to the well and has been negotiating a Memorandum of Agreement with the Air Force to pay for ongoing O&M as well as monitoring of the GAC system. With the two GAC systems in place, there are currently no completed pathways for groundwater with PFOS/PFOA above the LHA to drinking water sources. The Air Force will continue to monitor PFOS/PFOA in groundwater to ensure drinking water wells are not impacted.

PFOS was also detected in soil above the screening level at three AFFF Areas – Area 3, 5 and 11. AFFF Areas 3 and 5 had low exceedances, with concentrations of 1,550 and 1,780 µg/kg compared to the screening level of 1,260 µg/kg. This is a residential screening level that was calculated using the USEPA Regional Screening Level calculator and an oral reference dose of 0.00002 milligrams per kilogram per day derived by USEPA in their Drinking Water Health Advisories for PFOS and PFOA (U.S. Department of Defense, 2019). The industrial screening level based on this same methodology is 16,000 µg/kg. PFOS was detected at 13,600 µg/kg at AFFF Area 11. AFFF Areas 3 and 4 are within the Mather Airport parcel, and ground-disturbing activities are coordinated with the Air Force as needed to identify possible contamination issues and ensure remediation facilities are not impacted. Additionally, all ground-disturbing activities in the area are reviewed by the Air Force via the USA North 811 Dig Alert system. AFFF Area 11 is protected by the existing soil IC at Site WP-07/FT-11. The potential for exposure to

PFOS in soil is therefore limited and would not represent a human health risk under current use conditions. PFOS and PFOA were not detected in sediment or surface water at Mather, although there is the potential for PFOS in soil to migrate to surface water features during heavy rain events. With the exception of the drinking water pathway, limited toxicity data and/or promulgated cleanup standards were available to assess risk associated with exposure to PFAS as of the time period of this Five-Year Review. The Air Force is planning to conduct an Expanded Site Inspection in 2020 and a Remedial Investigation in 2021. These investigations will further define the nature and extent of contamination, evaluate pathways of exposure, and assess potential risks to human and ecological receptors.

1,2,3-TCP. During the period of this Five-Year Review, the State of California established a Maximum Contaminant Level (MCL) for 1,2,3-TCP of 5 parts per trillion (ppt). Potential sources of 1,2,3-TCP include cleaning and degreasing solvents and pesticide products. Prior groundwater sampling results for 1,2,3-TCP at Mather have been non-detect; however, the detection limits were two orders or magnitude or more above the MCL. The Air Force will sample the influent at the AC&W, Main Base/SAC Area, and Site 7 groundwater treatment plants to confirm this chemical is not present in groundwater beneath Mather at concentrations greater than the MCL.

5.1.3 Are the cleanup levels used at the time of the remedy still valid?

This section evaluates ARARs promulgated or modified after remedy selection to ensure that the remedies remain protective of human health and the environment (40 CFR 300.430(f)(1)(ii)(B)(1)).

Chemical-Specific ARARs. The AC&W Plume and Groundwater OU remedial goals (ACLs) were established through available environmental or health-based standards. These standards were presented as ARARs in the RODs and include state or federal MCLs for most groundwater contaminants; secondary MCLs for petroleum hydrocarbons; and the suggested no-adverse response level (SNARL) for chloromethane.

During the period covered by this fifth five-year review, there were no revisions to MCLs or other enforceable standards for groundwater. Groundwater ACLs remain protective of human health because the values of the ACLs are generally equal to, or less than, a corresponding MCL and they do not exceed the NCP's risk management range.

As discussed in Section 5.1.2, the cleanup levels for lead in soil at Site FT-10C/ST-68, Site OT-87, and Site OT-89 are still valid and protective of human health and the environment.

Action- and Location-Specific ARARs. Action-specific ARARs are usually technology- or activity-based requirements, while location-specific ARARs are restrictions placed on the chemical contaminant or the remedial activities based on the site's geographic or ecological features.

Relative to landfills, the ARARs from CCR Titles 14 and 23 have been revised since they were selected as ARARs when the Landfill OU and Soil OU and Groundwater OU RODs were prepared. These regulations have been combined, revised, and recodified into Title 27 of the CCR. The ARARs remain applicable or relevant and appropriate, and they remain so as long as waste is left in place. The Title 27 ARARs were evaluated in the fourth Five-Year Review and the remedy was found to be protective.

The action-specific and location-specific ARARs presented in the RODs and ESDs were re-evaluated during this five-year review for protectiveness. No new ARARs or changes to the action-specific ARARs or location-specific ARARs were identified that affect the protectiveness of the remedies.

5.1.4 Are the remedial action objectives used at the time of the remedy still valid?

None of the RAOs used at the time of remedy selection have changed and all are still valid. The RAOs for each site are listed in Section 2.0, including the additional RAOs that were established for the sites where ICs were later added to the remedies.

5.2 OU 1 (AC&W OU)

5.2.1 AC&W Plume

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

The remedy is functioning as intended by the AC&W OU ROD (AFBCA, 1993), as modified by two ESDs (AFBCA, 1997a; AFRPA, 2008a).

Remedy Performance. The AC&W groundwater extraction and treatment system is successfully operating to remove mass from the groundwater contaminant plume. Water level and concentration data from the AC&W wells are used to define the TCE and plume and conclude that the plume is captured by AC&W extraction wells. Detailed information is provided in the annual groundwater monitoring reports (URS, 2015c; 2016a; 2017f; CAPE, 2018d; 2019a). Figure 5-1 shows the entire area of the AC&W plume greater than the ACL lies within the area of contoured drawdown created by the extraction wells and indicates lateral hydraulic capture of the plume in 2018. A visual comparison of the extent of the TCE plume in 4Q13 and 4Q18 shows a decrease in plume area from 18 acres in 2013 to 13.6 acres in 2018 (Figure 5-1). This 24 percent reduction in plume area indicates capture and continued progress of the remedial action. Groundwater samples collected from Unit D wells have not contained detectable concentrations of TCE, indicating vertical capture of the plume has been successful.

During the period of this five-year review, concentrations have increased within the upgradient portion of the plume at extraction wells ACW AT-1 and ACW AT-2. Monitoring wells MAFB-453 and ACW PZ-10C also had new maximum concentrations in 2017 and 2019, respectively. These increased concentrations are believed to be associated with a decrease in groundwater elevation, which has reduced extraction flow rates. Increasing concentrations within the upgradient portion of the plume will continue to be monitored. However, based on annual capture zone evaluation, these increased concentrations are expected to be captured before they arrive downgradient. In the downgradient portion of the plume, concentration trends have been generally stable or decreasing since approximately 2002 and, as of 4Q18, no wells had concentrations greater than the ACL (Figure 5-1).

Remedy performance at the AC&W Plume is being affected by declining groundwater levels. Throughout 2018, extraction well ACW AT-1 operated at a maximum pumping rate of approximately 4.0 gpm due to the declining water levels. Flows at ACW AT-2 and ACW EW-1 have been reduced in an attempt to optimize extraction rates at ACW-AT-1. The Air Force will continue to evaluate remedy performance and assess whether further optimization or changes in the remedy components are needed.

System Operations. From 2014 through 2018, effluent samples from the AC&W treatment system met the total VOC discharge treatment standards (total monthly median of 0.5 µg/L and daily maximum of 1.0 µg/L). The treatment system was also in compliance with the air emissions ARARs from 2014 through 2018. Discharge monitoring results are presented in the annual groundwater monitoring reports (URS, 2015c; 2016a; 2017f; CAPE, 2018d; 2019a).

The AC&W groundwater treatment system operates in a manner that provides protectiveness and maintains effectiveness of the remedy. When interruptions occur, the system is able to be repaired without

interruption of the remedy. The Air Force will continue to evaluate treatment system operation and will upgrade the system as necessary to maintain the effectiveness of the remedy.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The results of performance monitoring of the AC&W remedial action for the last 5 years indicate continued success in removing TCE from groundwater and with meeting the discharge standards for the treated groundwater. Progress has been made toward meeting the TCE ACL, although concentrations have been increasing in the upgradient portion of the plume during the last 5 years. If the increasing trends continue, additional monitoring or extraction wells may be necessary to define the ACL plume and supplement the current extraction well network. The Air Force is currently evaluating the optimization needs at the AC&W groundwater plume. Nevertheless, the AC&W OU remedy remains protective of human health and the environment because ICs to prevent human exposure to groundwater with concentrations of TCE exceeding the ACL are in place and effective. ICs are monitored annually for compliance with the RAOs. Through 2018, no deficiencies have been observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.3 OU 2 (Groundwater OU)

5.3.1 Main Base/SAC Area Plume

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by the 2010 Soil OU and GW OU ESD (AFRPA, 2010a).

Remedy Performance. The Main Base/SAC Area groundwater extraction and treatment system is successfully implementing the remedy and achieving the objectives of the remedial action (CAPE, 2019a). Extraction well flow rates are continuing to be optimized and evaluated in order to improve capture and remediation of the plume. Detailed information is provided in the annual groundwater monitoring reports (URS, 2015c; 2016a; 2017; CAPE, 2018d; 2019a).

During the time period of this five-year review, the extent of the COC plume in the Main Base/SAC Area decreased as a result of continued removal of COCs by the groundwater extraction system. Figures 5-2, 5-3, and 5-4 show a comparison of the plume boundaries in 4Q13 and 4Q18 in each hydrostratigraphic unit: Unit A/Water Table, Unit B, and Unit D, respectively. The water table plume area has decreased from 183 acres in 2013 to 114 acres in 2018 (a decrease of 38 percent). The B unit plume area has decreased from 723 acres in 2013 to 469 acres in 2018 (a decrease of 35 percent). The D unit plume area has

decreased from 286 acres in 2013 to 261 acres in 2018 (a decrease in 9 percent). This reduction in plume area indicates continued progress of the remedial action.

System Operations. Between 2014 and 2018, the treatment system complied with the discharge standards established in the Soil OU and Groundwater OU ROD. In addition, the Main Base/SAC Area groundwater treatment system was in compliance with the air emissions ARARs (based on the substantive requirements of rules promulgated by SMAQMD). Discharge monitoring results are presented in the annual groundwater monitoring reports (URS, 2015c; 2016a; 2017; CAPE, 2018d; 2019a).

The Main Base/SAC Area groundwater treatment system operates in a manner that provides protectiveness and maintains effectiveness of the remedy. When interruptions occur, the system is able to be repaired without substantial impacts to remedy performance. However, in recent years the system has had several unplanned shutdowns due to power failures/surges, mechanical failures, communications and electrical faults. The Main Base/SAC Area treatment system has been recently upgraded with new communications. The Air Force recommends continued upgrades by updating the main computer, installing surge protection and installing an uninterruptable power supply. These items will allow the system to have greater uptime and be protected from power outages and voltage spikes. The treatment system will continue to be evaluated for opportunities to upgrade the system in order to maintain the effectiveness of the remedy.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Mather Off-Base Water Supply Contingency Plan.

Two carbon adsorption treatment systems were installed, consistent with the Contingency Plan, at water supply wells OFB-04 and OFB-51/OFB-52. COCs have not been detected in any effluent samples from the OFB-51/OFB-52 treatment system during this five-year review period. The OFB-04 well has been non-operational during most of the five-year review period; however, COCs were not detected in the OFB-04 well during any of the sampling events. Final termination of treatment at the OFB-04 wellhead is scheduled for December 2019 in accordance with the criteria established in the Contingency Plan.

Between 2014 and 2018, Mather COCs detected in samples collected from the other wells in the Contingency Plan have been less than their respective MCLs, and further action has not been required (AFCEC, 2013).

During the period of this five-year review, detections of various COCs were reported in groundwater samples collected from the privately owned wells downgradient of Mather; however, none of the detections exceeded an MCL or were at wells used for potable purposes, such as drinking, cooking, or bathing (URS, 2015c; 2016a; 2017f; CAPE, 2018d; 2019a).

Progress Toward Meeting RAOs. The results of performance monitoring of the Main Base/SAC Area Plume remedial action since the last five-year review have demonstrated effective COC removal from the aquifer, progress toward meeting COC ACLs, and capture of the majority of the plume. However, the eastern portion of the B Unit plume, defined by MAFB-451 and MAFB-423B have shown overall increasing trends and have recently exceeded the ACLs. This indicates some migration of the plume towards the east and southeast. The 2018 Groundwater Monitoring Report shows the expansion of the TCE plume in that area along with the interpreted capture zones (CAPE, 2019a). Through the process of annual reporting with the regulatory stakeholders, recommendations for expanded monitoring and/or

remedial system optimization will be made to address any deficiencies identified in the annual reports. Continued monitoring will confirm trends and future plume capture.

ICs have been implemented for the Main Base/SAC Area Plume and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies or inconsistent land uses were observed during the IC inspections.

In addition, the Air Force has maintained protectiveness by providing wellhead treatment on affected drinking water supply wells in compliance with the Contingency Plan that was revised in 2013 (AFCEC, 2013).

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

Yes (see Section 5.1).

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

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

5.3.2 Site 7 Plume

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by the 2010 Soil OU and GW OU ESD (AFRPA, 2010a).

Remedy Performance. The Site 7 groundwater extraction and treatment system is successfully operating to remove mass from the groundwater contaminant plume (CAPE, 2019a). Progress is being made toward achieving the objectives of the remedial action at Site 7. Detailed information is provided in the annual groundwater monitoring reports (URS, 2015c; 2016a; 2017f; CAPE, 2018d; 2019a).

During the time period of this five-year review, the extent of the COC plume at Site 7 decreased as a result of continued removal of COCs by the groundwater extraction system. Figure 5-5 shows a comparison of the plume boundaries in 4Q13 and 4Q18. The Site 7 Plume has decreased from 66 acres in 2018 to 45 acres in 2018. This 32 percent reduction in plume area indicates continued progress of the remedial action.

In 2018, the TCE concentration at MAFB-372B, just downgradient of 7-EW-1 increased to above the ACL, making it the furthest downgradient monitoring well with a concentration above the ACL. Capture zones developed using groundwater potentiometric surface data show capture of this part of the plume by 7-EW-1 (CAPE, 2019a). Plume capture in this area will continue to be monitored.

System Operations. Between 2014 and 2018, the treatment system complied with the discharge standards established in the Soil OU and Groundwater OU ROD. In addition, the Site 7 groundwater treatment system was in compliance with the air emissions ARARs (based on the substantive requirements of rules promulgated by SMAQMD). Discharge monitoring results are presented in the annual groundwater monitoring reports (URS, 2015c; 2016a; 2017f; CAPE, 2018d; 2019a).

The Site 7 groundwater treatment system operates in a manner that provides protectiveness and maintains effectiveness of the remedy. When interruptions occur, the system is able to be repaired without

interruption of the remedy. The Site 7 treatment system has been recently upgraded with new communications. However, the Air Force will continue to evaluate treatment system operation and will upgrade the system as necessary to maintain the effectiveness of the remedy.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. Performance monitoring of the Site 7 Plume remedial action since the system was restarted in December 2006 has demonstrated COC removal from groundwater, progress toward meeting COC ACLs, capture of the plume, and compliance with discharge standards. Continued monitoring will help to confirm trends and demonstrate plume capture.

ICs have been implemented for the Site 7 Plume and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies or inconsistent land uses were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.3.3 Northeast Plume

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a).

Remedy Performance. Groundwater monitoring data collected between 2014 and 2018 demonstrate there have been no new releases from the landfill. Since the fourth five-year review, the plume area has decreased from 15 to 6 acres (a decrease of 60 percent), and since implementation of the Northeast Plume remedy, the areal extent has decreased by 95 percent (133 acres in 1996). A visual comparison of the plume contours in 4Q13 and 4Q18 shows the reduction in plume area (Figure 5-6). The areas where COCs currently exceed ACLs are beneath and downgradient of landfill Sites LF-03 and LF-04. Monitoring results also indicate there has not been a significant downward movement of COCs in the Northeast Plume.

Due to declining groundwater levels, MAFB-132 in the central portion of the plume contained insufficient water for sampling from 2017 through 2019. In July 2019, a new groundwater monitoring well, MAFB-467, was installed near MAFB-132 to monitor this area of the northeast plume. The well was constructed with a deeper screen interval and will allow continued monitoring of concentration trends and plume containment.

Predictive Modeling. As documented in the *Third Five-Year Review Report* (URS, 2010) and the memorandum *Predictive Trend Analysis for the Northeast Plume Contaminants of Concern* (AFRPA, 2010c), decreasing COC concentration trends in 2007 and 2008 allowed a projection of when ACLs may be achieved in the Northeast Plume (approximately 2025 based on extrapolation of a best-fit exponential

trend line). While COC concentrations (specifically, PCE and cis-1,2-DCE) at most Northeast Plume wells have continued to decrease since 2009, there is no real trend at MAFB-398C and MAFB-132 has contained insufficient water for sampling 2017 through 2019; therefore, an updated prediction of when ACLs may be achieved based on trend analysis cannot be made at this time (Figure 5-7). Once there are sufficient data points obtained from the replacement well, MAFB-467, the statistical trend will be evaluated and a prediction of when ACLs may be achieved will be presented in the annual monitoring report.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The RAO identified in the Soil OU and Groundwater OU ROD for the Northeast Plume to protect the public from inadvertent significant exposure to contaminated groundwater is being achieved. Data from the well network indicates the Northeast Plume is within the boundary of the former base property. ICs are in place to protect the public from unacceptable exposure to contaminated groundwater. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.4 OU 3 (Soil OU)

5.4.1 Site WP-07/FT-11

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by two ESDs (AFBCA, 1998a; AFRPA, 2010a).

Remedy Performance. The SVE/BV response action was completed in 2011 and met the narrative cleanup standard of remediating the vadose zone contamination such that it no longer posed a future unacceptable threat to groundwater (URS, 2011). ICs are in place to prevent unacceptable exposure to residual soil vapor.

Landfill WP-07. Quarterly inspections of Site WP-07 were performed during the period of this five-year review. Overall, the cap and drainage system were observed to be in good condition. In 2018, several small rodent burrows were observed and backfilled. Potholes or ruts were commonly observed in the all-weather access road from Excelsior Road to the landfill and were filled and compacted as necessary. In addition, stopcocks, valves, and sample ports damaged by wildlife or the sun were replaced as necessary.

In June 2018, an aerial survey of Site WP-07 was conducted in accordance with the post-closure landfill requirement (Montgomery Watson, 1999d; MWH, 2010d). The elevation data measured during the survey were compared to elevation data from the 2013 survey to identify areas of settlement. Results of

the 2018 survey indicate that a single area of the Site WP-07 landfill cap displayed a negative elevation change of 0.5 foot or greater near the southern edge of the landfill (CAPE, 2018b). This elevation change has not had noticeable impact on drainage based on field inspections conducted quarterly during 2018 and 2019, but will continue to be monitored. More information can be found in Appendix C of the 2018 annual post-closure landfill inspection and gas monitoring report.

Landfill Gas Monitoring. During (and prior to) the period of this five-year review, post-closure gas monitoring indicates that little methane is being produced at the Site WP-07 landfill. From 2014 through 2018, methane concentrations measured at the four gas migration probes and the nine passive gas vents did not exceed the compliance level of 5 percent by volume in air. VOC emissions from the gas vents were also monitored from 2014 through 2018, and all results were less than the 15 ppmv action level for VOCs that would trigger sampling for laboratory analysis. Compliance monitoring results are reported in the annual post-closure landfill inspection and gas monitoring reports (URS, 2015c; 2016a; 2017f; CAPE, 2018d; 2019a).

Groundwater Monitoring. Ten metals detected between 2014 and 2018 exceeded a calculated background concentration. None of these detections was considered to be the result of a release from the landfill (URS, 2015a; 2016b; 2017a; CAPE, 2018a; 2018b). TPH-d was not detected at concentrations exceeding its ACL. PAHs and pesticides were not detected in any sample collected at Site WP-07 between 2014 and 2018:

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The SVE/BV system at Site WP-07/FT-11 achieved the RAO of mitigating the residual source of vadose zone contamination that posed an unacceptable threat to groundwater quality. Consequently, the vadose zone portion of the Site WP-07/ FT-11 active remedy (i.e., SVE/BV) was closed, and the SVE/BV system was decommissioned.

The post-closure maintenance of the landfill cap and landfill gas monitoring at Site WP-07 are meeting the RAO of compliance with ARARs established in the Soil OU and Groundwater OU ROD, including portions of the CFR 40, Part 258, and CCR Titles 14 and 23.

ICs have been implemented at Site WP-07/FT-11 and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies or inconsistent land uses were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.4.2 Site ST-37/ST-39/SS-54

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a).

Remedy Performance. During the period of this five-year review, the SVE response action was completed and a report was prepared demonstrating that residual soil vapor does not pose a future unacceptable threat to groundwater (URS, 2016d). ICs as described in the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a) are in place to prevent unacceptable exposure to residual soil vapor. In 2016, the IC area was expanded to 50 feet beyond a site 23B boring, SLB-MBF-10A, where the shallow soil vapor concentrations exceeded the DTSC-SL for residential indoor air, as recommended in the SVE Completion Report (URS, 2016c). Between September 2016 to May 2017, the SVE/BV wells, soil vapor monitoring wells, SVE/BV system, and pipelines were decommissioned (URS, 2017e).

SVE System Operations. During the period of this five-year review, the Site ST-37/ST-39/SS-54 SVE did not operate, and was decommissioned between 2016 and 2017.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The SVE/BV system at Site ST-37/ST-39/ SS-54, which includes remediation of Subsites OT-23B and OT-23D, achieved the RAO of mitigating the residual source of vadose zone contamination such that it no longer poses an unacceptable threat to groundwater quality. The vadose zone portion of the Site ST-37/ST-39/ SS-54 active remedy (i.e., SVE/BV) was closed, and the SVE/BV system was decommissioned.

ICs have been implemented at Site ST-37/ST-39/SS-54 and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.4.3 Site SD-57

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a).

Remedy Performance. During the period of this five-year review, the Site SD-57 SVE system was shut down in February 2015 for rebound because of low vapor VOC concentrations and mass removal rates

(URS, 2017d). The rebound sampling confirmed that the SVE response had met the objective of protecting groundwater. The system was not restarted.

In 2017, an SVE completion report was prepared demonstrating that closure of the vadose zone portion of the active remedy (i.e., SVE) was appropriate (URS, 2017d). The report also identified that continued implementation of the ICs established in the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a) was necessary to prevent unacceptable exposure to residual soil vapor. In July 2017, the SVE wells, soil vapor monitoring wells, SVE system, and pipelines were decommissioned (URS, 2017c).

SVE System Operations. During the period of September 2014 to its shut down in February 2015, the Site SD-57 SVE system operated as designed and was in compliance with the air emissions ARARs (based on the substantive requirements of rules promulgated by SMAQMD). Operational data and compliance monitoring results are reported in the annual SVE/BV report (URS, 2015b) and Site 57 Completion Report (URS, 2017d).

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The SVE/BV system at Site SD-57 achieved the RAO of mitigating vadose zone contamination such that it no longer posed an unacceptable threat to groundwater quality. During the period of this five-year review, the vadose zone portion of the Site SD-57 active remedy (i.e., SVE) was closed, and the SVE system was decommissioned.

ICs have been implemented at Site SD-57 and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.4.4 Site SD-59

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

The remedy is functioning as intended by the Soil OU and Groundwater OU ROD (AFBCA, 1996a), as modified by two ESDs (AFBCA, 1998b; AFRPA, 2010a). During the period of this Five-Year Review, a dispute was raised by EPA and DTSC on the Site 59 SVE Completion Report. In the dispute resolution, the Air Force agreed to treat the new Building 4260 source area adjacent to Site 59 as a separate site under CERCLA, and to prepare an ESD identifying VOCs as contaminants of concern for Site 59 (DTSC, 2017). The agencies and Air Force agreed that the SVE remedy at the site had met the RAOs for protection of groundwater for all site contaminants, including VOCs, but that an ESD would be prepared to document the COCs for the Administrative Record. The ESD is still in preparation and is targeted for completion by 31 March 2021.

Remedy Performance. The SVE system at Site SD-59 did not operate during the period of this five-year review. In 2017, the Air Force prepared an SVE completion report documenting that the SVE response at Site SD-59 had met the narrative cleanup standards for protecting groundwater quality (URS, 2017). The report also identified that continued implementation of the ICs established in the 2010 Soil OU and Groundwater OU ESD (AFRPA, 2010a) was necessary to prevent unacceptable exposure to residual soil vapor.

In August to September 2017, the Site SD-59 SVE infrastructure, including wells and conveyance piping, was decommissioned. The SVE treatment system was left in place for the planned future use of conducting SVE at the new B4260 site.

SVE System Operations. During the period of this five-year review, the Site SD-59 SVE did not operate.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The SVE/BV system at Site SD-59 achieved the RAO of mitigating vadose zone contamination such that it no longer posed an unacceptable threat to groundwater quality. The vadose zone portion of the SD-59 active remedy (i.e., SVE) was closed, and the SVE wells and conveyance lines were decommissioned.

ICs have been implemented at Site SD-59 and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.5 OU 4 (Landfill OU)

This section of the five-year review addresses only Sites LF-03 and LF-04, where landfill caps were constructed over waste disposal areas and continue to be maintained and monitored. The Landfill OU remedy also requires groundwater monitoring, some of which is satisfied as part of the Groundwater OU remedy for the Northeast Plume (see Section 5.3.3).

5.5.1 Site LF-03

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

The remedy is functioning as intended by the Landfill OU ROD (AFBCA, 1995), as modified by the ESD (AFBCA, 1996b) and Memorandum of Post-ROD Changes (AFRPA, 2009).

Remedy Performance. Quarterly inspections and maintenance at Site LF-03 were performed during the period of this five-year review. Overall, the cap and drainage system remain in good condition. In 2015, a

depression with pooling water was observed and was filled in with top soil (URS, 2015a; 2016b). In 2018, a burrowing owl and burrow was observed near the edge of the landfill cap (CAPE, 2018b); the burrow was monitored until it was no longer occupied and was then backfilled in coordination with the CDFW. Additional routine maintenance and repairs were conducted as documented in the annual landfill monitoring reports (URS, 2015a, URS, 2017a; CAPE, 2018a; 2018b).

In June 2018, an aerial survey of Site LF-03 was conducted in accordance with the post-closure landfill requirement for the completion of an aerial survey every 5 years (Montgomery Watson, 1996; MWH, 2010e). The purpose of the aerial survey was to measure elevation data across the landfill cap at Site LF-03. The elevation data were compared to elevation data from the 2013 survey to identify areas of settlement. Results of the 2018 survey indicate that no areas of the Site LF-03 landfill cap have any significant settlement of 0.5 foot or greater (CAPE, 2018b). The areas that indicate decreased elevations less than 0.5 feet have not had a noticeable impact on drainage, and no erosion was observed during quarterly inspections (URS, 2015a; 2016b; 2017a; CAPE, 2018a, 2018b).

Landfill Gas Monitoring. During the period of this five-year review, post-closure gas monitoring indicates that little methane is being produced at LF-03. From 2014 through 2018, methane concentrations measured at the six gas migration probes with screen intervals that extend to the elevation of the bottom of the waste and the four passive gas vents did not exceed the compliance level of 5 percent by volume in air. VOC emissions from the gas vents were also monitored from 2014 through 2018, and all results were less than the 15 ppmv action level for VOCs that would trigger sampling for laboratory analysis. Compliance monitoring results are reported in the quarterly and annual post-closure landfill inspection and gas monitoring reports (URS, 2015a; 2016b; 2017a; CAPE, 2018a, 2018b).

Groundwater Monitoring. VOC monitoring near Site LF-03 satisfies the dual requirements for detection and corrective action monitoring for VOCs. A discussion regarding VOCs at Site LF-03 is presented in Section 5.3.3.1. Detection and evaluation monitoring as appropriate for non-VOCs is also part of the post-closure monitoring program at Site LF-03. Non-VOCs analyzed at Site LF-03 include metals, general minerals, and TPH.

Several metals were occasionally detected exceeding upper background concentrations at Site LF-03 wells between 2014 and 2018; however, concentrations were close to upper background concentrations and not indicative of a release from the landfill. No general minerals were detected at concentrations greater than calculated upper background concentrations during the period of this five-year review.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The post-closure maintenance of the landfill cap and landfill gas monitoring at Site LF-03 are meeting the RAO of compliance with ARARs established in the Landfill OU ROD, including portions of the CFR 40, Part 258, and the CCR Titles 14 and 23 (since recodified in Title 27).

ICs have been implemented at Site LF-03 and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies or inconsistent land uses were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.5.2 Site LF-04

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

The remedy is functioning as intended by the Landfill OU ROD (AFBCA, 1995), as modified by the ESD (AFBCA, 1996b) and Memorandum of post-ROD Changes (AFRPA, 2009).

Remedy Performance. Quarterly inspections and maintenance at Site LF-04 were performed during the period of this five-year review. Overall, the cap and drainage system were observed to be in good condition. In 2014 and 2015, there were some shallow depressions that pooled water after rain events noted. These areas were filled with top soil (URS, 2015a; 2016b). In 2018, several gopher burrows were observed throughout the landfill and were subsequently backfilled (CAPE, 2018b). Additional routine maintenance and repairs were conducted as documented in the annual landfill monitoring reports (URS, 2015a; CAPE, 2018a, CAPE, 2018b).

In June 2018, an aerial survey of Site LF-04 was conducted in accordance with the post-closure landfill requirement for the completion of an aerial survey every 5 years (Montgomery Watson, 1996; MWH, 2010e). The purpose of the aerial survey was to measure elevation data across the landfill cap at Site LF-04. The elevation data were compared to elevation data from the 2013 survey to identify areas of settlement. Results of the 2018 survey indicate settling has occurred at maximum depths of 0.8 foot in the northeastern portion of LF-04 based on a comparison of the elevation data between 2013 and 2018 (CAPE, 2018b). This was confirmed by an inspection performed during 4Q18 in which an area of ponded water was observed after a rain event in this northeastern area of the landfill. No erosion was observed and in December 2019, the depression was remediated by adding compacted root zone rill to the proper elevation and slope, and replacing the top soil layer in accordance with the final closure and post-closure maintenance plan (MWH, 2010e). This corrective action will be documented in the 2019 post-closure landfill inspection and gas monitoring report.

Landfill Gas Monitoring. During 1Q17, the methane concentration measured at MW-29C (14.5-24.5 ft bgs) exceeded the compliance level of 5 percent by volume in air (CAPE, 2018a). A sample was collected using a summa canister for laboratory analysis. The results did not confirm an exceedance. There were no other methane concentrations measured above the 5 percent by volume in air in any other gas migration probes located along the alternate facility (compliance) boundary during the five-year review period.

VOC emissions from the gas vents were also monitored from 2014 through 2018, and all results were less than the 15 ppmv action level for VOCs that would trigger sampling for laboratory analysis. Compliance monitoring results are reported in the quarterly and annual post-closure landfill inspection and gas monitoring reports (URS, 2015a; 2016b; 2017a; CAPE, 2018a, 2018b).

Groundwater Monitoring. VOC monitoring near Site LF-04 satisfies the dual requirements for detection and corrective action monitoring for VOCs. A discussion regarding VOCs at Site LF-04 is presented in Section 5.3.3. Detection and evaluation monitoring as appropriate for non-VOCs is also part of the post-closure monitoring program at Site LF-04. Non-VOCs analyzed at Site LF-04 include metals, general minerals, and TPH.

Several metals were occasionally detected exceeding upper background concentrations at Site LF-04 wells between 2014 and 2018; however, results were close to upper background concentrations and not indicative of a release from the landfill. No general minerals were detected at concentrations greater than calculated upper background concentrations during the period of this five-year review.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020). In 2018, personal items, believed to be associated with a homeless camp, were observed in a ditch inside the landfill fencing near the south gate entrance. This appears to be an isolated event; no corrective action was recommended (CAPE, 2018b).

Progress Toward Meeting RAOs. The post-closure maintenance of the landfill cap and landfill gas monitoring at Site LF-04 are generally meeting the RAO of compliance with ARARs established in the Landfill OU ROD, including portions of CFR 40, Part 258, and CCR Titles 14 and 23 (since recodified in Title 27). Quarterly landfill inspections revealed no major issues; however, occasional exceedances of the 5 percent compliance concentration for methane have occurred.

ICs have been implemented at Site LF-04 and are monitored annually for compliance with the RAOs. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.6 OU 5 (Basewide OU)

5.6.1 Site FT-10C/ST-68

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

The remedy is functioning as intended by the Basewide OU ROD (AFBCA, 1998c), as modified by two ESDs (AFRPA, 2008b; 2010b).

Remedy Performance. The Site FT-10C/ST-68 SVE/BV system met the narrative cleanup objectives for protection of groundwater by 2008, and a report was prepared in 2010 documenting that closure of the vadose zone portion of the active remedy (i.e., SVE/BV) was appropriate (MWH, 2010a). The report also identified that continued implementation of the ICs established in the Basewide OU ESD (AFRPA, 2010b) was necessary to prevent potential exposure to contaminants in indoor air in any new buildings. The SVE/BV system and components were decommissioned in 2012 (ADVENT Environmental, Inc., 2012).

Soil Excavation. Prior to this fifth five-year review period, lead-contaminated ashy debris and soil discovered beneath and north of Truemper Way was excavated such that ICs related to residual lead were not required (i.e., residual lead concentrations met the 151 mg/kg unrestricted use level designated in the ESD). Further discussion of this issue is provided in Section 5.1.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. The SVE/BV system at Site FT-10C/ST-68 achieved the RAO of mitigating vadose zone contamination such that it no longer posed an unacceptable threat to groundwater quality. The vadose zone portion of the Site FT-10C/ST-68 active remedy (i.e., SVE/BV) was closed, and the SVE/BV system was decommissioned. In addition, lead-contaminated soil was removed to a level consistent with unrestricted use.

ICs have been implemented at Site FT-10C/ST-68 and are monitored annually to meet the RAOs. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.6.2 Site LF-18

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

The remedy is functioning as intended by the Basewide OU ROD (AFBCA, 1998c), as modified by the 2010 Basewide OU ESD (AFRPA, 2010b).

Remedy Performance. In November 2008, soil vapor treatment at Site LF-18 ceased. A report was prepared in 2010 documenting that the RAOs for protection of groundwater had been met and that closure of the vadose zone portion of the active remedy (i.e., SVE) was appropriate (MWH, 2010b). The report also identified that continued implementation of the ICs established in the 2010 Basewide OU ESD (AFRPA, 2010b) was necessary to prevent potential exposure to contaminants in indoor air in any new buildings. The aboveground piping manifold and well components were decommissioned in 2012 (ADVENT Environmental, Inc., 2012). (Note: Vapor extracted from Site LF-18 wells was treated by the Site SD-59 SVE system, which was not decommissioned because SVE continued at that site.)

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. At Site LF-18, the RAO of mitigating vadose zone contamination such that it no longer poses an unacceptable threat to groundwater quality has been achieved. The vadose zone portion of the Site LF-18 active remedy (i.e., SVE) was closed, and the SVE piping and wells were decommissioned.

ICs have been implemented at Site LF-18 and are monitored annually to meet the RAOs. Through 2018, no deficiencies were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.6.3 Site OT-23C

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

At the time of this Five-Year Review, there is an unresolved dispute as to whether the remedy is functioning as intended by the Basewide OU ROD (AFBCA, 1998c), as modified by the 2010 Basewide OU ESD (AFRPA, 2010b).

Remedy Performance. Beginning in October 2014, focused SVE at 23-PW-01 (all four screened intervals) and 23-SVED-001 (one screened interval) continued until April 2015 when the SVE system was shut down to assess rebound and evaluate termination of SVE operations. The *Site 23C Former Laundry and Cleaning Plant Soil Vapor Extraction (SVE) Completion Report*, finalized in 2019, documented that SVE had achieved the RAO of protecting groundwater quality and that no further treatment of the vadose zone was necessary at Site OT-23C (URS, 2019). EPA and DTSC initiated informal dispute on the Air Force's Response Complete Determination for the site, which was based on the findings of the SVE Completion Report, citing concerns primarily related to the adequacy of the IC remedy for addressing of potential vapor intrusion risk from residual soil vapor. The SVE system and components are not decommissioned as of September 2019.

SVE System Operations. During the period of this five-year review, the Site OT-23C SVE system operated as designed and was in compliance with the air emissions ARARs (based on the substantive requirements of rules promulgated by SMAQMD). Operational data and compliance monitoring results are reported in the annual SVE/BV report (URS, 2015b) and in the Site OT-23C SVE Completion Report (URS, 2019).

Institutional Controls. Following completion of SVE activities, the Air Force identified that the portion of Site OT-23C where the former laundry plant had been located (now a County park) contained shallow soil vapor concentrations exceeding levels of concern for vapor intrusion. The *Site 23C Former Laundry and Cleaning Plant Soil Vapor Extraction Completion Report* (URS, 2019) recommended that ICs be established for the Sacramento County-owned park property on Parcels C2-C6 to prevent unacceptable human exposure to residual soil vapor contamination. The ICs would prohibit the transferee from:

- Engaging in any surface or shallow soil disturbance (in the geographic area subject to the IC), until and unless it is demonstrated that VOC contamination at this site is no longer a threat to human health and the environment.

- Constructing any structures for human occupation (in the geographic area subject to the IC) without evaluating or addressing the risks posed by vapor intrusion.

In accordance with recommendations in the SVE completion report, the Air Force voluntarily prepared a supplemental deed for the park property establishing ICs to address vapor intrusion risk. The supplement deed was provided to the County for signature in August 2019.

During the period of this Five-Year Review, an informal dispute was initiated by EPA/DTSC/CVWB regarding the protectiveness of the ICs, specifically whether the IC boundary should be expanded to include adjacent properties. DTSC believes the IC boundary should be defined using the DTSC-SL for resident indoor air as derived from the 2018 Toxicity Criteria Rule, which is based on a $1x10^{-6}$ risk threshold, and that additional data should be collected to confirm the shallow soil vapor concentrations at the site. The Air Force does not agree that the DTSC-SL must be used in favor of the EPA RSL to define the IC boundary, and the Air Force believes the existing data are sufficient to assess vapor intrusion risk. As shown in Figure 5-8, the available shallow soil vapor data indicate that potential vapor intrusion risk on properties outside the IC area is within the 10^{-4} to 10^{-6} risk management range based on the DTSC-SL and is less than 10^{-6} based on the EPA RSL for resident indoor air. The protectiveness determination for this site has been deferred pending the outcome of the dispute.

Progress Toward Meeting RAOs. The SVE system at Site OT-23C achieved the RAO of mitigating vadose zone contamination such that it no longer posed an unacceptable threat to groundwater quality. Consequently, the vadose zone portion of the Site OT-23C active remedy (i.e., SVE/BV) was closed.

ICs were voluntarily imposed by the Air Force in accordance with the SVE Completion Report to address potential vapor intrusion risk associated with residual soil vapor VOCs. Through 2018, no new uses other than as a County park have been observed within the IC area during the ICs inspections.

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

Yes (see Section 5.1).

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

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

5.6.4 Site OT-87

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

The remedy is functioning as intended by the Basewide OU ROD (AFBCA, 1998c), as modified by the 2010 Basewide OU ESD (AFRPA, 2010b).

Remedy Performance. Prior to the period of this five-year review, lead-contaminated soil was excavated in accordance with the Basewide OU ROD remedy. Concentrations of lead left in place are not compatible with unrestricted use of the site. Therefore, ICs to prohibit residential-type development and to prohibit disturbance of soil that may contain elevated lead concentrations are in place.

Small Mammal Monitoring. During the period of the fourth five-year review, the small mammal monitoring requirement of the Basewide OU ROD was completed and demonstrated that residual lead concentrations in soil do not indicate the potential for adverse effects on small mammal populations (MWH, 2010c).

Dead Waterfowl Monitoring. No dead waterfowl have been observed at the site during Air Force site visits and monitoring events, or during surveys conducted by the CDFW. The dead waterfowl monitoring program is ongoing and is expected to be completed in 2021 when staff at the CDFW complete two-years of quarterly monitoring.

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

Progress Toward Meeting RAOs. Although no specific RAOs are identified in the Basewide OU ROD for Site OT-87, the basis for cleanup is protection of human health and the environment. Excavation of lead-contaminated soils achieved the cleanup level specified in the ROD. ICs are in place and are monitored annually to ensure compliance with the RAO of preventing unacceptable human exposure to residual lead contamination at Site OT-87. Through 2018, no deficiencies or inconsistent land uses were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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

5.7 OU 6 (Supplemental Basewide OU)

5.7.1 Site OT-89

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

The remedy is functioning as intended by the Supplemental Basewide OU ROD (AFRPA, 2006).

Institutional Controls. ICs are in place and effective. Inspections are documented in the 2017, 2018 and 2019 Annual Reports of Compliance with Institutional Controls (CAPE, 2018c; CAPE, 2019b; CAPE, 2020).

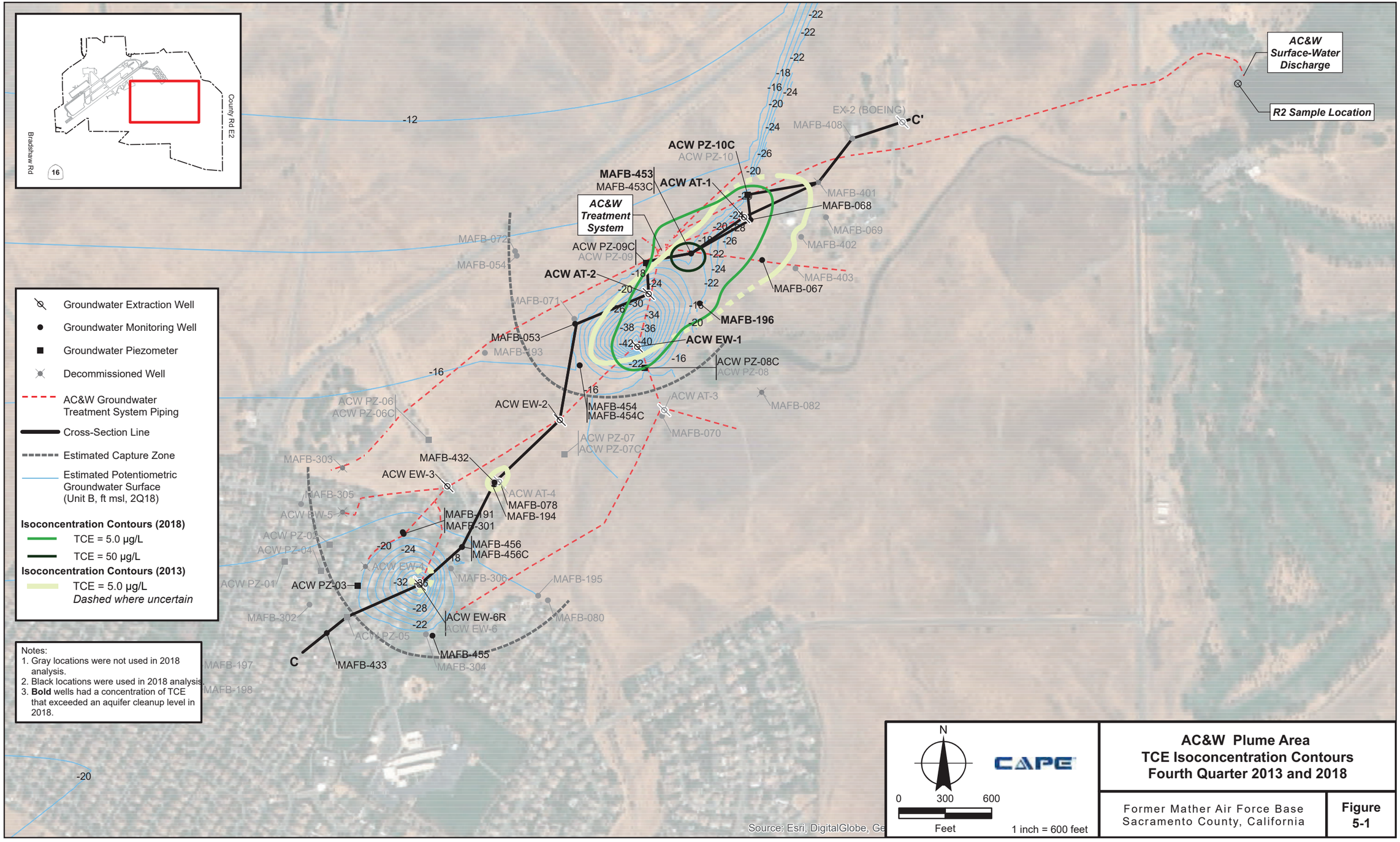
Progress Toward Meeting RAOs. ICs have been implemented at Site OT-89 and are monitored annually to ensure compliance with the RAO of preventing unacceptable human exposure to residual lead contamination. Through 2018, no deficiencies or inconsistent land uses were observed during the IC inspections.

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

Yes (see Section 5.1).

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

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



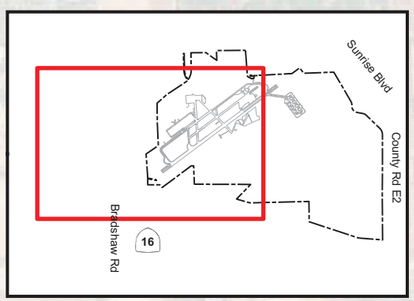
AC&W Plume Area
TCE Isoconcentration Contours
Fourth Quarter 2013 and 2018

Former Mather Air Force Base
Sacramento County, California

Figure 5-1

Groundwater Extraction Well
Groundwater Monitoring Well
Groundwater Piezometer
Private Well
Soil Vapor Well in Groundwater Program
Temporarily Abandoned Well
Decommissioned Well
Cross-Section Line
Estimated Capture Zone
Estimated Water Table Surface (Unit WT/A, ft msl, 2Q18)
Installation Restoration Program Site
Mather Boundary
Unit A/Water Table ACL Composite Plume (2018)
Unit A/Water Table ACL Composite Plume (2013)

Notes:
1. Gray locations were not used in 2018 analysis.
2. Black locations were used in 2018 analysis.
3. **Bold** values had one or more COC concentrations that exceeded an aquifer cleanup level in 2018.

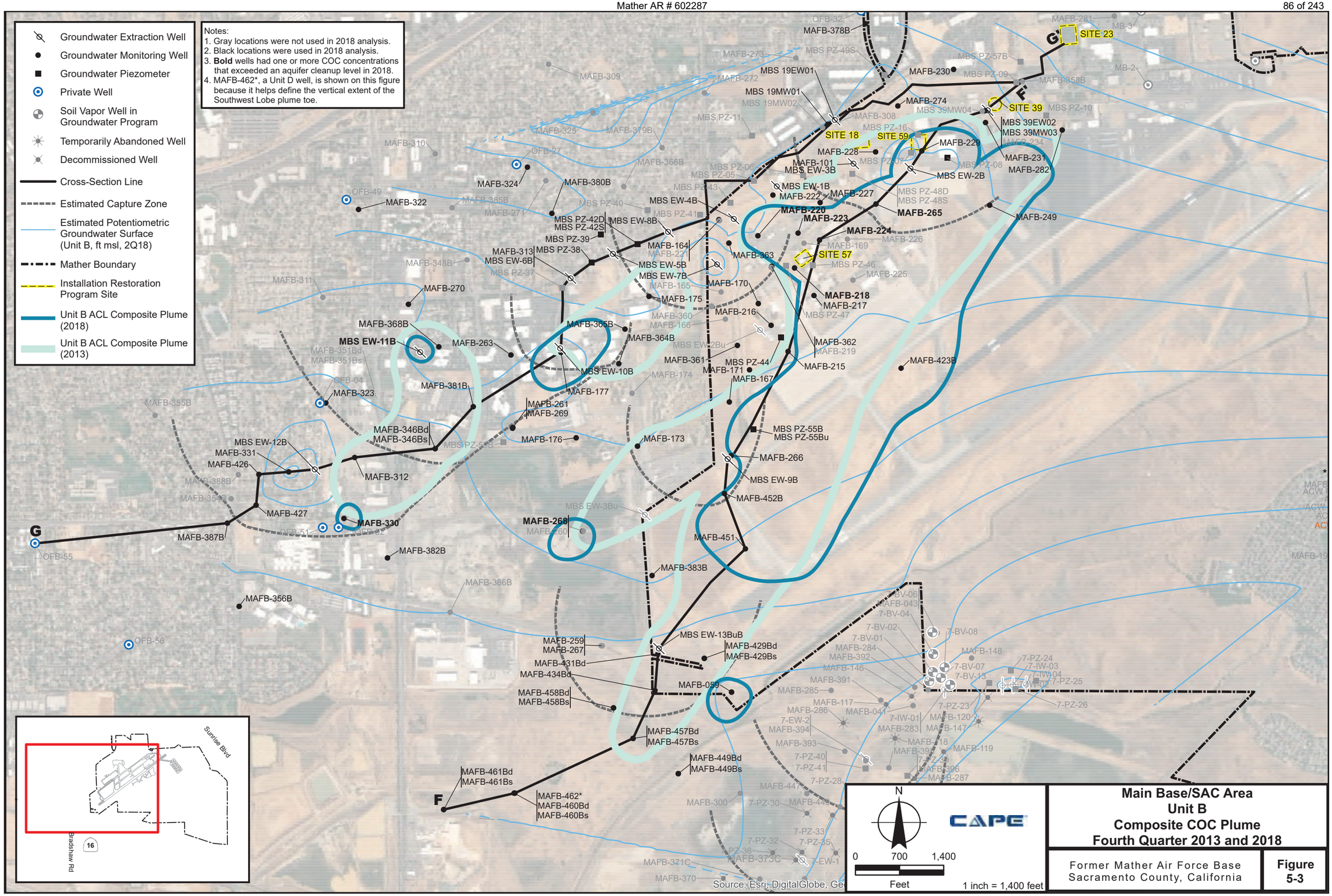


N
0 700 1,400
Feet
1 inch = 1,400 feet

Main Base/SAC Area
Unit A/Water Table
Composite COC Plume
Fourth Quarter 2013 and 2018

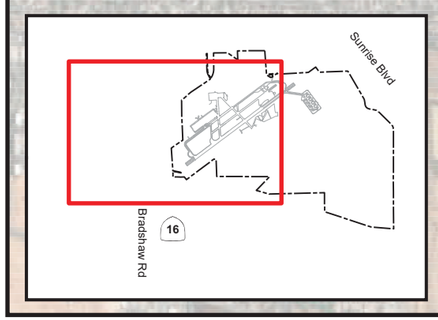
Former Mather Air Force Base
Sacramento County, California

Figure 5-2


Groundwater Extraction Well
Groundwater Monitoring Well
Groundwater Piezometer
Private Well
Soil Vapor Well in Groundwater Program
Temporarily Abandoned Well
Decommissioned Well
Cross-Section Line
Estimated Capture Zone
Estimated Potentiometric Groundwater Surface (Unit B, ft msl, 2Q18)
Mather Boundary
Installation Restoration Program Site
Unit B ACL Composite Plume (2018)
Unit B ACL Composite Plume (2013)
Notes:
1. Gray locations were not used in 2018 analysis.
2. Black locations were used in 2018 analysis.
3. Bold wells had one or more COC concentrations that exceeded an aquifer cleanup level in 2018.
4. MAFB-462*, a Unit D well, is shown on this figure because it helps define the vertical extent of the Southwest Lobe plume toe.
SITE 23
SITE 39
SITE 18
SITE 59
SITE 57
MAFB-378B
MAFB-230
MAFB-274
MAFB-308
MAFB-229
MAFB-228
MAFB-101
MBS EW-3B
MBS EW-2B
MBS EW-1B
MAFB-222
MAFB-227
MAFB-220
MAFB-223
MAFB-224
MAFB-265
MAFB-249
MAFB-226
MAFB-169
MAFB-225
MAFB-218
MAFB-217
MAFB-362
MAFB-219
MAFB-215
MAFB-423B
MAFB-363
MAFB-170
MAFB-216
MAFB-164
MBS EW-4B
MBS EW-8B
MBS EW-5B
MBS EW-7B
MAFB-165
MAFB-175
MAFB-360
MAFB-166
MAFB-365B
MAFB-364B
MAFB-361
MAFB-171
MAFB-167
MAFB-174
MAFB-177
MBS EW-10B
MBS PZ-44
MBS PZ-47
MBS PZ-46
MBS PZ-48D
MBS PZ-48S
MBS PZ-55B
MBS PZ-55Bu
MAFB-266
MBS EW-9B
MAFB-452B
MAFB-451
MAFB-173
MAFB-176
MAFB-261
MAFB-269
MAFB-381B
MAFB-323
MAFB-263
MBS EW-11B
MAFB-368B
MAFB-270
MAFB-311
MAFB-348B
MBS PZ-39
MBS PZ-38
MBS EW-6B
MBS PZ-37
MBS PZ-42D
MBS PZ-42S
MAFB-322
OFB-49
MAFB-324
MAFB-380B
MAFB-385B
MAFB-271
MBS PZ-40
MBS PZ-41
MAFB-310
OFB-27
MAFB-366B
MAFB-325
MAFB-379B
MAFB-309
MAFB-273
MAFB-272
MBS PZ-49S
MBS 19EW01
MBS 19MW01
MBS 19MW02
MBS PZ-11
MBS PZ-06
MBS PZ-05
MBS PZ-43
MBS PZ-57B
MBS PZ-09
MAFB-358B
MBS 39MW04
MBS PZ-10
MBS 39EW02
MBS 39MW03
MAFB-234
MAFB-231
MAFB-282
MBS PZ-08
MBS PZ-16
MBS PZ-07
MAFB-281
MB-3
MB-2
MAFB-355B
MAFB-346Bd
MAFB-346Bs
MBS EW-12B
MAFB-331
MAFB-426
MAFB-312
MAFB-427
MAFB-387B
MAFB-330
OFB-55
OFB-51
OFB-52
MAFB-382B
MAFB-388B
MAFB-354B
MAFB-356B
OFB-56
MAFB-386B
MAFB-268
MAFB-260
MBS EW-3Bu
MAFB-383B
MBS EW-13BuB
MAFB-429Bd
MAFB-429Bs
MAFB-259
MAFB-267
MAFB-431Bd
MAFB-434Bd
MAFB-458Bd
MAFB-458Bs
MAFB-059
MAFB-457Bd
MAFB-457Bs
MAFB-449Bd
MAFB-449Bs
MAFB-461Bd
MAFB-461Bs
MAFB-462*
MAFB-460Bd
MAFB-460Bs
MAFB-371C
MAFB-370
MAFB-373C
MAFB-300
MAFB-447
MAFB-448
7-EW-1
7-PZ-30
7-PZ-32
7-PZ-33
7-PZ-35
7-PZ-36
7-PZ-28
7-PZ-40
7-PZ-41
7-PZ-39
7-PZ-23
7-PZ-24
7-PZ-25
7-PZ-26
7-IW-03
7-IW-04
7-IW-02
7-BV-01
7-BV-02
7-BV-04
7-BV-06
7-BV-07
7-BV-08
7-BV-13
7-EW-2
7-IW-01
MAFB-043
MAFB-284
MAFB-392
MAFB-146
MAFB-391
MAFB-285
MAFB-117
MAFB-286
MAFB-041
MAFB-394
MAFB-283
MAFB-147
MAFB-120
MAFB-148
MAFB-118
MAFB-119
MAFB-393
MAFB-395
MAFB-396
MAFB-287
MAFB-19
ACW-1
ACW-2
ACW-3
AC
AC
G
F
G'
F'
N
0
700
1,400
Feet
1 inch = 1,400 feet
CAPE
Source: Esri, DigitalGlobe, Ge
Sunrise Blvd
Bradshaw Rd
16
Main Base/SAC Area
Unit B
Composite COC Plume
Fourth Quarter 2013 and 2018
Former Mather Air Force Base
Sacramento County, California
Figure
5-3

Groundwater Extraction Well
Groundwater Injection Well
Groundwater Monitoring Well
Groundwater Piezometer
Private Well
Cross-Section Line
Estimated Capture Zone
Estimated Potentiometric Groundwater Surface (Unit D, ft msl, 2Q18)
Installation Restoration Program Site
Mather Boundary
Unit D ACL Composite Plume (2018)
Unit D ACL Composite Plume (2013)

Notes:
1. Gray locations were not used in 2018 analysis.
2. Black locations were used in 2018 analysis.
3. **Bold** wells had one or more COC conentration that exceeded an aquifer cleanup level in 2018.



Source: Esri, DigitalGlobe, Ge

N

0 700 1,400

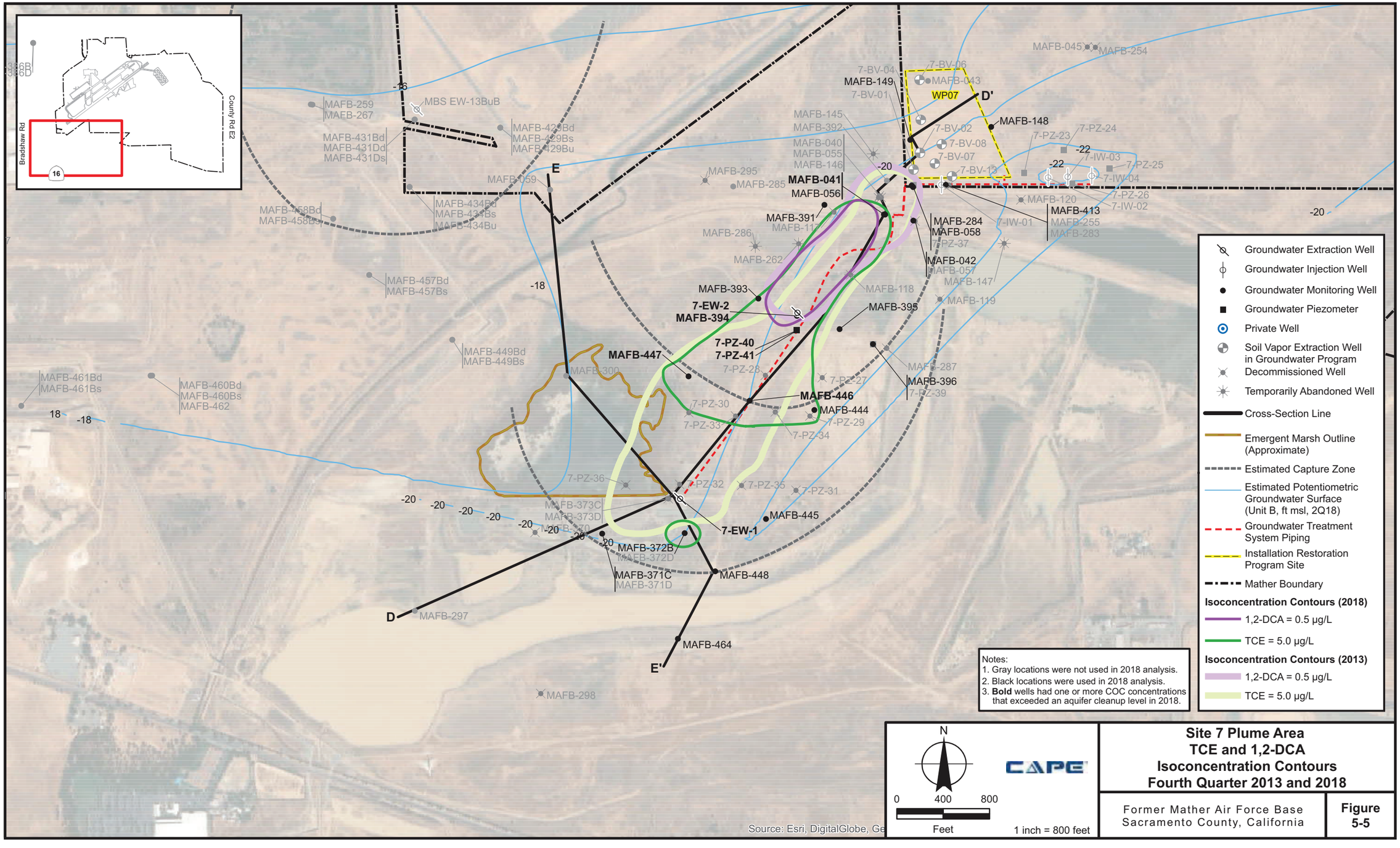
Feet

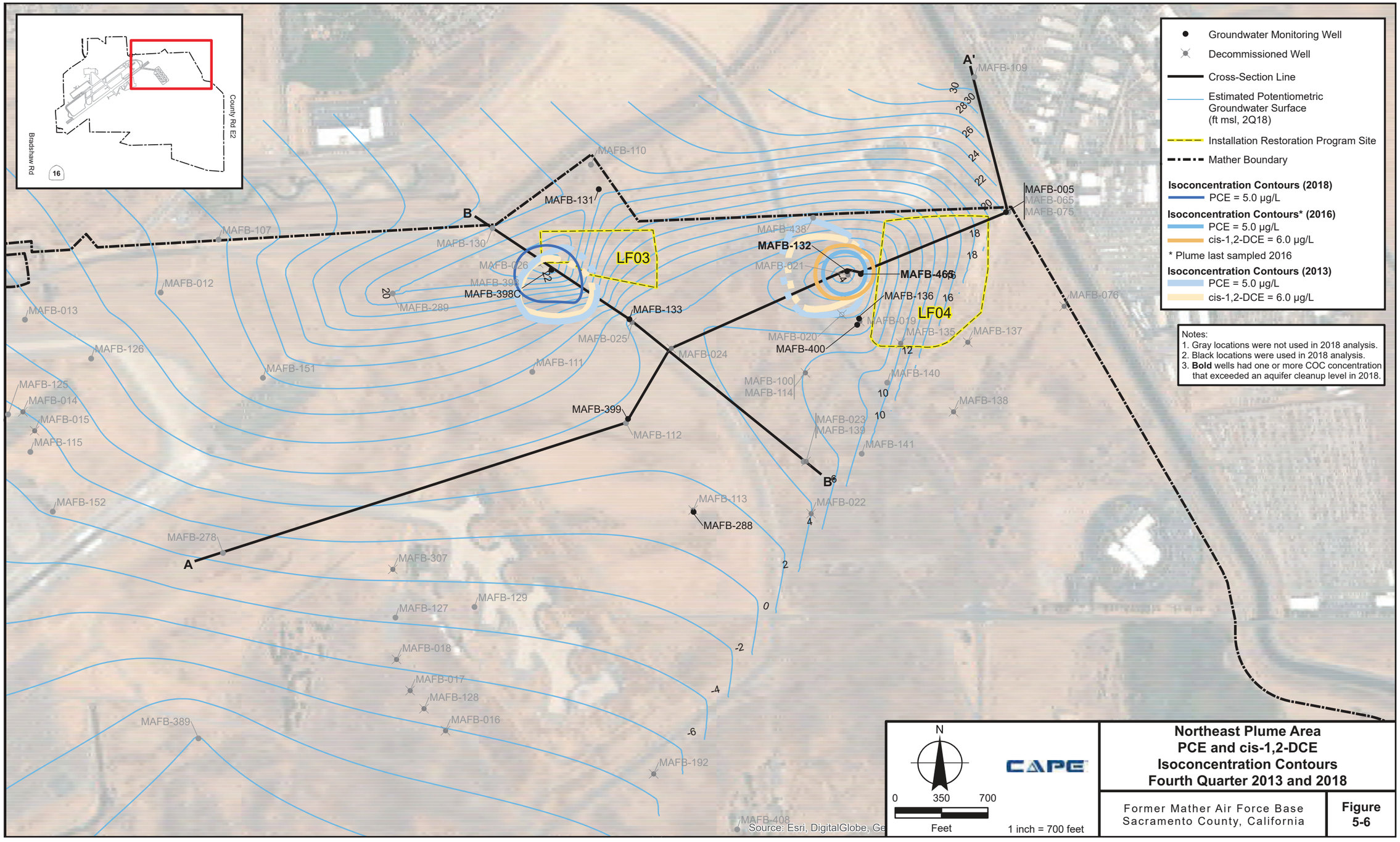
1 inch = 1,400 feet

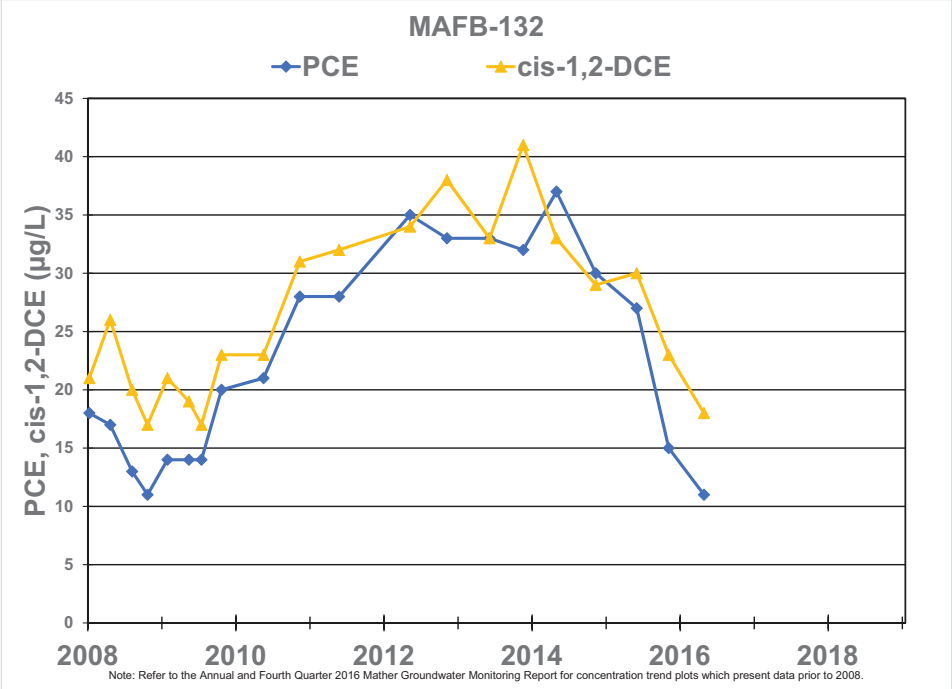
Main Base/SAC Area
Unit D
Composite COC Plume
Fourth Quarter 2013 and 2018

Former Mather Air Force Base
Sacramento County, California

Figure 5-4


Bradshaw Rd
County Rd E2
16
MAFB-259
MAFB-267
MBS EW-13BuB
MAFB-431Bd
MAFB-431Dd
MAFB-431Ds
MAFB-429Bd
MAFB-429Bs
MAFB-429Bu
MAFB-434Bd
MAFB-434Bs
MAFB-434Bu
MAFB-458Bd
MAFB-458Bs
MAFB-457Bd
MAFB-457Bs
MAFB-449Bd
MAFB-449Bs
MAFB-461Bd
MAFB-461Bs
MAFB-460Bd
MAFB-460Bs
MAFB-462
MAFB-300
MAFB-045
MAFB-254
7-BV-04
7-BV-06
MAFB-043
MAFB-149
7-BV-01
WP07
D'
MAFB-148
MAFB-145
MAFB-392
MAFB-040
MAFB-055
MAFB-146
7-BV-02
7-BV-08
7-BV-07
7-BV-13
7-PZ-23
7-PZ-24
7-IW-03
7-PZ-25
7-IW-04
7-PZ-26
7-IW-02
MAFB-120
MAFB-413
MAFB-255
MAFB-283
7-IW-01
MAFB-295
MAFB-285
MAFB-041
MAFB-056
MAFB-391
MAFB-117
MAFB-286
MAFB-262
MAFB-284
MAFB-058
7-PZ-37
MAFB-042
MAFB-057
MAFB-147
MAFB-118
MAFB-119
MAFB-393
7-EW-2
MAFB-394
MAFB-395
7-PZ-40
7-PZ-41
MAFB-447
7-PZ-28
7-PZ-27
MAFB-287
MAFB-396
7-PZ-39
MAFB-446
MAFB-444
7-PZ-30
7-PZ-33
7-PZ-29
7-PZ-34
E
-16
-18
-20
-22
18
7-PZ-36
7-PZ-32
7-PZ-35
7-PZ-31
MAFB-373C
MAFB-373D
MAFB-370
MAFB-445
7-EW-1
MAFB-372B
MAFB-372D
MAFB-371C
MAFB-371D
MAFB-448
D
MAFB-297
MAFB-464
E'
MAFB-298
Groundwater Extraction Well
Groundwater Injection Well
Groundwater Monitoring Well
Groundwater Piezometer
Private Well
Soil Vapor Extraction Well in Groundwater Program
Decommissioned Well
Temporarily Abandoned Well
Cross-Section Line
Emergent Marsh Outline (Approximate)
Estimated Capture Zone
Estimated Potentiometric Groundwater Surface (Unit B, ft msl, 2Q18)
Groundwater Treatment System Piping
Installation Restoration Program Site
Mather Boundary
Isoconcentration Contours (2018)
1,2-DCA = 0.5 µg/L
TCE = 5.0 µg/L
Isoconcentration Contours (2013)
1,2-DCA = 0.5 µg/L
TCE = 5.0 µg/L
Notes:
1. Gray locations were not used in 2018 analysis.
2. Black locations were used in 2018 analysis.
3. Bold wells had one or more COC concentrations that exceeded an aquifer cleanup level in 2018.
N
0
400
800
Feet
1 inch = 800 feet
CAPE
Source: Esri, DigitalGlobe, Ge
Site 7 Plume Area
TCE and 1,2-DCA
Isoconcentration Contours
Fourth Quarter 2013 and 2018
Former Mather Air Force Base
Sacramento County, California
Figure
5-5


Bradshaw Rd
County Rd E2
16
Groundwater Monitoring Well
Decommissioned Well
Cross-Section Line
Estimated Potentiometric Groundwater Surface (ft msl, 2Q18)
Installation Restoration Program Site
Mather Boundary
Isoconcentration Contours (2018)
PCE = 5.0 µg/L
Isoconcentration Contours* (2016)
PCE = 5.0 µg/L
cis-1,2-DCE = 6.0 µg/L
* Plume last sampled 2016
Isoconcentration Contours (2013)
PCE = 5.0 µg/L
cis-1,2-DCE = 6.0 µg/L
Notes:
1. Gray locations were not used in 2018 analysis.
2. Black locations were used in 2018 analysis.
3. Bold wells had one or more COC concentration that exceeded an aquifer cleanup level in 2018.
A
A'
B
B'
LF03
LF04
MAFB-005
MAFB-065
MAFB-075
MAFB-076
MAFB-107
MAFB-110
MAFB-109
MAFB-130
MAFB-131
MAFB-132
MAFB-133
MAFB-136
MAFB-138
MAFB-139
MAFB-140
MAFB-141
MAFB-151
MAFB-152
MAFB-278
MAFB-288
MAFB-289
MAFB-307
MAFB-389
MAFB-399
MAFB-400
MAFB-408
MAFB-438
MAFB-465
MAFB-012
MAFB-013
MAFB-014
MAFB-015
MAFB-016
MAFB-017
MAFB-018
MAFB-019
MAFB-020
MAFB-021
MAFB-022
MAFB-023
MAFB-024
MAFB-025
MAFB-026
MAFB-100
MAFB-111
MAFB-112
MAFB-113
MAFB-114
MAFB-115
MAFB-125
MAFB-126
MAFB-127
MAFB-128
MAFB-129
MAFB-135
MAFB-137
MAFB-192
MAFB-398
MAFB-398C
30
28
26
24
22
20
18
16
12
10
6
4
2
0
-2
-4
-6
N
0
350
700
Feet
1 inch = 700 feet
CAPE
Source: Esri, DigitalGlobe, Ge
Northeast Plume Area
PCE and cis-1,2-DCE
Isoconcentration Contours
Fourth Quarter 2013 and 2018
Former Mather Air Force Base
Sacramento County, California
Figure
5-6



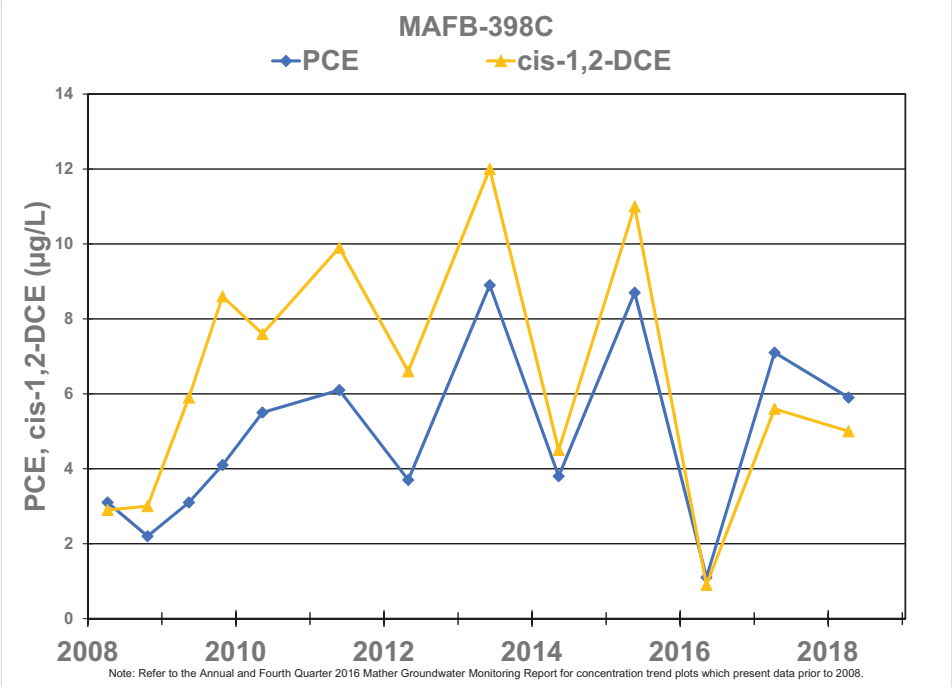
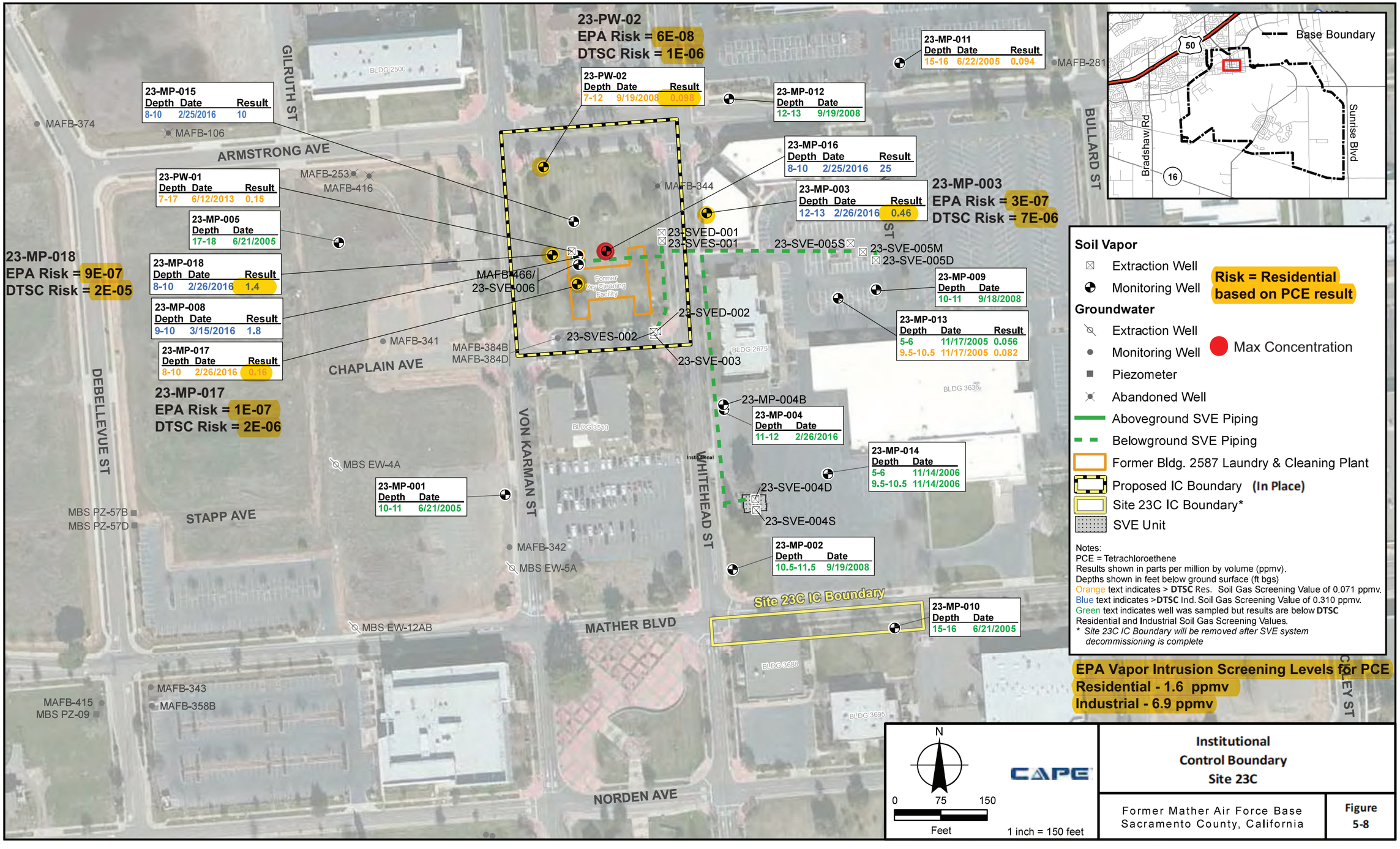


Figure 5-7. Concentration Trend Graphs for PCE and cis-1,2-DCE at MAFB-132 and MAFB-398C


23-PW-02
EPA Risk = 6E-08
DTSC Risk = 1E-06
23-PW-02
Depth Date Result
7-12 9/19/2008 0.098
23-MP-015
Depth Date Result
8-10 2/25/2016 10
23-PW-01
Depth Date Result
7-17 6/12/2013 0.15
23-MP-005
Depth Date
17-18 6/21/2005
23-MP-018
EPA Risk = 9E-07
DTSC Risk = 2E-05
23-MP-018
Depth Date Result
8-10 2/26/2016 1.4
23-MP-008
Depth Date Result
9-10 3/15/2016 1.8
23-MP-017
Depth Date Result
8-10 2/26/2016 0.16
23-MP-017
EPA Risk = 1E-07
DTSC Risk = 2E-06
23-MP-012
Depth Date
12-13 9/19/2008
23-MP-011
Depth Date Result
15-16 6/22/2005 0.094
23-MP-016
Depth Date Result
8-10 2/25/2016 25
23-MP-003
Depth Date Result
12-13 2/26/2016 0.46
23-MP-003
EPA Risk = 3E-07
DTSC Risk = 7E-06
23-MP-009
Depth Date
10-11 9/18/2008
23-MP-013
Depth Date Result
5-6 11/17/2005 0.056
9.5-10.5 11/17/2005 0.082
23-MP-004
Depth Date
11-12 2/26/2016
23-MP-014
Depth Date
5-6 11/14/2006
9.5-10.5 11/14/2006
23-MP-001
Depth Date
10-11 6/21/2005
23-MP-002
Depth Date
10.5-11.5 9/19/2008
23-MP-010
Depth Date
15-16 6/21/2005
23-SVED-001
23-SVES-001
23-SVE-005S
23-SVE-005M
23-SVE-005D
23-SVED-002
23-SVES-002
23-SVE-003
23-MP-004B
23-SVE-004D
23-SVE-004S
MAFB466/
23-SVE-006
Former Dry Cleaning Facility
Site 23C IC Boundary
GILRUTH ST
ARMSTRONG AVE
DEBELLEVUE ST
CHAPLAIN AVE
VON KARMAN ST
WHITEHEAD ST
BULLARD ST
STAPP AVE
MATHER BLVD
NORDEN AVE
CLEY ST
MAFB-374
MAFB-106
MAFB-253
MAFB-416
MAFB-344
MAFB-281
MAFB-341
MAFB-384B
MAFB-384D
MAFB-342
MAFB-343
MAFB-358B
MAFB-415
MBS EW-4A
MBS EW-5A
MBS EW-12AB
MBS PZ-57B
MBS PZ-57D
MBS PZ-09
BLDG 2500
BLDG 2675
BLDG 3636
BLDG 3510
BLDG 3698
BLDG 3695
Institutional
Base Boundary
50
16
Bradshaw Rd
Sunrise Blvd
Soil Vapor
Extraction Well
Monitoring Well
Risk = Residential based on PCE result
Groundwater
Extraction Well
Monitoring Well
Piezometer
Abandoned Well
Max Concentration
Aboveground SVE Piping
Belowground SVE Piping
Former Bldg. 2587 Laundry & Cleaning Plant
Proposed IC Boundary (In Place)
Site 23C IC Boundary*
SVE Unit
Notes:
PCE = Tetrachloroethene
Results shown in parts per million by volume (ppmv).
Depths shown in feet below ground surface (ft bgs)
Orange text indicates > DTSC Res. Soil Gas Screening Value of 0.071 ppmv.
Blue text indicates >DTSC Ind. Soil Gas Screening Value of 0.310 ppmv.
Green text indicates well was sampled but results are below DTSC Residential and Industrial Soil Gas Screening Values.
* Site 23C IC Boundary will be removed after SVE system decommissioning is complete
EPA Vapor Intrusion Screening Levels for PCE
Residential - 1.6 ppmv
Industrial - 6.9 ppmv
N
0 75 150
Feet
1 inch = 150 feet
CAPE
Institutional
Control Boundary
Site 23C
Former Mather Air Force Base
Sacramento County, California
Figure
5-8

6.0 ISSUES IDENTIFIED DURING FIVE-YEAR REVIEW, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

This section discusses the issues identified during this five-year review period and provides recommendations and follow-up actions to address those issues. Table 6-1 summarizes the issues, recommendations, and follow-up actions. No issues that affect protectiveness of the remedies were identified for the sites not listed below, so there are no recommendations or follow-up actions for those sites.

Main Base/SAC Area Plume Issue. The influent concentrations at the treatment plant are above the EPA LHA level for the sum of concentrations of PFOA and PFOS of 70 ng/L. Long-term protectiveness is deferred pending the outcome of further investigation, risk assessment, and potential response actions associated with these emerging contaminants.

Recommendation. Continue to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of PFAS at the Main Base/SAC Area treatment system.

Site 7 Plume Issue. The influent concentrations at the treatment plant are above the EPA LHA level for the sum of concentrations of PFOA and PFOS of 70 ng/L. Long-term protectiveness is deferred pending the outcome of further investigation, risk assessment, and potential response actions associated with these emerging contaminants.

Recommendation. Continue to conduct remedial investigations, monitoring and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of PFAS at the Site 7 treatment system.

1,2,3-TCP Issue. Prior sampling results for 1,2,3-TCP at Mather have been non-detect, but detection limits exceeded the State MCL of 5 ppt.

Recommendation: Collect samples from the AC&W, Main Base/SAC Area, and Site 7 treatment plant influents to determine whether 1,2,3-TCP is present above the MCL.

Site OT-23C Issue. The vapor intrusion remedy for the site is currently in dispute. The protectiveness determination for the site has been deferred pending the outcome of this dispute.

Recommendation. Implement any data collection and/or vapor intrusion risk analysis required by the final dispute resolution agreement. An addendum to this Five-Year Review will be prepared to document the outcome of the dispute, present the results of any new sampling or site characterization performed, and update the protectiveness determination based on the findings.

Table 6-1. Issues Identified During This Five-Year Review, Recommendations, and Follow-Up Actions

Issues	Recommendations and Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protective-ness (Yes/No)	Affects Future Protective-ness (Yes/No)
Groundwater OU – Main Base/SAC Area Plume. The influent concentrations at the treatment plant are above the EPA LHA level for the sum of concentrations of PFOA and PFOS of 70 ng/L. Long-term protectiveness is deferred pending the outcome of further investigation, risk assessment, and potential response actions associated with these emerging contaminants.	Continue to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of PFAS at the Main Base/SAC Area treatment system.	AFCEC	EPA, DTSC, CVWB	9/1/2025	No	Yes
Groundwater OU – Site 7 Plume. The influent concentrations at the treatment plant are above the EPA LHA level for the sum of concentrations of PFOA and PFOS of 70 ng/L. Long-term protectiveness is deferred pending the outcome of further investigations, risk assessments, and potential response actions associated with these emerging contaminants.	Continue to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of PFAS at the Site 7 treatment system.	AFCEC	EPA, DTSC, CVWB	9/1/2025	No	Yes
AC&W OU and Groundwater OU (Main Base/SAC Area and Site 7 Plumes). Prior sampling results for 1,2,3-TCP had detections limits greater than the State MCL.	Collect samples from the AC&W, Main Base/SAC Area, and Site 7 treatment plant influents to determine whether 1,2,3-TCP is present above the MCL.	AFCEC	CVWB	9/1/2025	No	Yes
Basewide OU – Site OT-23C. The protectiveness of the IC remedy is currently in dispute.	Implement any data collection and/or vapor intrusion risk analysis required by the final dispute resolution agreement. Prepare an addendum to this Five-Year Review to document the outcome of the dispute, present the results of any new sampling or site characterization performed, and update the protectiveness determination based on the findings.	AFCEC	EPA, DTSC, CVWB	3/31/2023	Yes	Yes

Table 6-1. Issues Identified During This Five-Year Review, Recommendations, and Follow-Up Actions

Issues	Recommendations and Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protective-ness (Yes/No)	Affects Future Protective-ness (Yes/No)

1,2,3-TCP = 1,2,3-trichloropropane
AFCEC = Air Force Civil Engineer Center
CVWB = Central Valley Regional Water Quality Control Board
DTSC = California Department of Toxic Substances Control
EPA = United States Environmental Protection Agency
IC = institutional control
LHA = Lifetime Health Advisory
OU = operable unit
PFASs = perfluorinated compound
SAC = Strategic Air Command
SD = storm drain
TCE = trichloroethene
VOCs = volatile organic compounds

7.0 PROTECTIVENESS STATEMENT

The following statements address the protectiveness of the remedial actions taken at Mather for each OU.

7.1 OU 1 (AC&W OU)

The remedy at OU 1 (AC&W OU) is currently protective of human health and the environment and is expected to remain so in the future due to the observed effectiveness of the selected remedies. For the remedy to be protective in the long-term, samples must be collected from the AC&W treatment plant influent to determine whether 1,2,3-TCP is present above the MCL

7.2 OU 2 (Groundwater OU)

The remedies at OU 2 (Groundwater OU) are protective of human health and the environment in the short term due to already existing ICs. For the remedy to be protective in the long-term, the following actions need to be taken: the presence and magnitude of PFAS in groundwater must be determined; potential risks from exposure to PFAS must be evaluated; and appropriate remedies must be selected in response to identified risk in decision documents. Additionally, samples must be collected from the Main Base/SAC Area, and Site 7 treatment plant influents to determine whether 1,2,3-TCP is present above the MCL.

7.3 OU 3 (Soil OU)

The remedies at OU 3 (Soil OU) are currently protective of human health and the environment and are expected to remain so in the future due to the observed effectiveness of the selected remedies.

7.4 OU 4 (Landfill OU)

The remedies at OU 4 (Landfill OU) are currently protective of human health and the environment and are expected to remain so in the future due to the observed effectiveness of the selected remedies.

7.5 OU 5 (Basewide OU)

With the exception of Site OT-23C, the remedies at OU 5 (Basewide OU) are protective of human health and the environment. The protectiveness determination for Site OT-23C has been deferred pending the outcome of the ongoing dispute at this site.

7.6 OU 6 (Supplemental Basewide OU)

The remedy at OU 6 (Supplemental Basewide OU) is currently protective of human health and the environment and is expected to remain so in the future due to the observed effectiveness of the selected remedies.

7.7 Comprehensive Protectiveness Statement for Mather

With the exception of Site OT-23C, the remedial actions at Mather AFB are short-term protective of human health and the environment. For the remedies to be protective in the long term, presence and magnitude of PFAS in groundwater must be determined; potential risks from exposure to PFAS must be evaluated; and appropriate remedies must be selected in response to identified risk in decision documents. The protectiveness determination for Site OT-23C has been deferred pending the outcome of the ongoing dispute at this site concerning the vapor intrusion remedy.

AUTHORIZING SIGNATURE

TERMAATH.STEPHEN.G.1129220852 Digitally signed by TERMAATH.STEPHEN.G.1129220852 Date: 2020.09.28 18:53:32 -05'00'

28 September 2020

STEPHEN G TERMAATH, P.E., Ph.D. GS-15, DAF
Chief, BRAC Program Management Division
Installations Directorate

Date

8.0 NEXT FIVE-YEAR REVIEW

The sixth five-year review for Mather will span the time period from the completion of this fifth five-year review, which is planned to be no later than 30 September 2020, until the report preparation. The final sixth five-year review report will be due no later than five years after the planned completion date of this five-year review, and will be due on 30 September 2025. Actions taken in response to recommendations in this fifth five-year review and any future optimization of or modifications made during the review period to the remedies selected in the five RODs will be evaluated in the sixth five-year review to ensure that the remedies continue to be protective of human health and the environment.

9.0 REFERENCES

ADVENT Environmental, Inc., 2012. *Technical Project Report: Well and System Decommissioning, Former Mather AFB, Sacramento County, California*. Final. September. (AR No. 3318)

Aerostar, 2020. *Final Site Inspection Report for Aqueous Film Forming Foam Areas, former Mather Air Force Base, California*. April.

Air Force Base Conversion Agency (AFBCA), 1993. *Superfund Record of Decision: Aircraft Control and Warning Site, Mather Air Force Base, Sacramento County, California*. December. (AR No. 3323)

AFBCA, 1995. *Superfund Record of Decision, Landfill Operable Unit Sites, Mather Air Force Base, Sacramento County, California*. July. (AR No. 844)

AFBCA, 1996a. *Superfund Record of Decision, Soil Operable Unit Sites and Groundwater Operable Unit Plumes, Mather Air Force Base, Sacramento County, California*. April. (AR No. 799)

AFBCA, 1996b. *Explanation of Significant Difference from the Record of Decision, Consolidation of Additional Refuse & Debris into Landfill Site 4*. Draft Final. October. (AR No. 1186)

AFBCA, 1996c. *Removal Action Memorandum Mather AFB IRP Basewide Operable Unit, Site 10C: Fire Training Area Number 3, Time-Critical Removal*. September. (AR No. 1150)

AFBCA, 1996d. *Removal Action Memorandum, Mather AFB IRP Landfill Operable Unit Site 2: The '8150' Area Landfill, Time-Critical Removal*. September.

AFBCA, 1997a. *Explanation of Significant Difference to the AC&W OU Record of Decision: Discharge of Treated Groundwater to Mather Lake.* June. (AR No. 1319)

AFBCA, 1997b. *Removal Action Memorandum, Mather Air Force Base, Basewide Operable Unit, Site 85: South Ditch*. October. (AR No. 1417)

AFBCA, 1998a. *Explanation of Significant Differences from the Record of Decision, Disposal of Contaminated Soil at Site 7/11*. Final. September. (AR No. 1746)

AFBCA, 1998b. *Explanation of Significant Differences, Soil Operable Unit Sites and Groundwater Operable Unit Plumes Record of Decision for Sites 56, 59, and 60*. December. (AR No. 1109)

AFBCA, 1998c. *Record of Decision, Basewide Operable Unit Sites, Mather Air Force Base, California*. August. (AR No. 1135)

AFBCA, 1998d. *Aircraft Control and Warning Site, Groundwater Pump-and-Treat System, Report of Proper and Successful Operation*. September. (AR No. 1767)

AFBCA, 1998e. *Mather AFB Off-Base Water Supply Contingency Plan*. Final. February. (AR No. 1505)

AFBCA, 1999a. *Five-Year Review of Remedial Actions*. September. (AR No. 1863)

AFBCA, 1999b. *Removal Action Memorandum, Mather Air Force Base Supplemental Basewide Operable Unit, Site 80: Morrison Creek and Site 88: Golf Course Maintenance Area Ditch*. July. (AR No. 2518)

AFBCA, 2001a. *Removal Action Memorandum (RAM) to Change Scope of Continued Response for Non-Time-Critical Removal Actions Initiated Under the 1997 RAM for Site 85 and 1999 RAM for Site 80 and Site 88, Mather Air Force Base, California*. June. (AR No. 1951)

AFBCA, 2001b. *Removal Action Memorandum Mather Air Force Base Supplemental Basewide Operable Unit, Site 89: Old Trap Range*. June. (AR No. 1953)

Air Force Civil Engineer Center (AFCEC), 2013. *Mather Air Force Base, Off-Base Water Supply Contingency Plan*. Revision 2. Final. July. (AR No. 3374)

AFCEC, 2018. *Documentation of Nonsignificant Change to the Record of Decision for Site 23B, Former Mather Air Force Base, California – Expansion of Institutional Control Boundary*. September. (AR No. 577597)

Air Force Real Property Agency (AFRPA), 2005. *Second Five-Year Review of Remedial Actions*. Final. July. (AR No.2157)

AFRPA, 2006. *Record of Decision for the Supplemental Basewide Operable Unit Sites, Mather Air Force Base, Sacramento County, California*. Final. October. (AR No. 2646)

AFRPA, 2008a. *Explanation of Significant Difference: Institutional Controls for Groundwater Remedy, Site WP-12, Aircraft and Control Warning Site, Mather, California*. Final. November. (AR No. 2728)

AFRPA, 2008b. *Explanation of Significant Difference from the Record of Decision Excavation of Shallow Soil Contaminated with Lead at Site 10C/68*. Final. August. (AR No. 2709)

AFRPA, 2008c. *Mather AFB Off-Base Water Supply Contingency Plan*. Revision 1. Final. November. (AR No. 2718)

AFRPA, 2009. *Memorandum of Post-ROD Changes: Clarification of Institutional Controls for the Landfill Operable Unit Remedies, Mather, California*. Final. August. (AR No. 2738)

AFRPA, 2010a. *Explanation of Significant Difference from the Record of Decision for the Soil Operable Unit Sites and Groundwater Operable Unit Plumes: Soil Sites WP-07/FT-11, ST-37/ST-39/SS-54, SD-57, SD-59, OT-69; Main Base/SAC Area Plume, Site 7 Plume, Northeast Plume, Mather, California*. Revised Final. February (signatures completed in August 2010). (AR No. 2971)

AFRPA, 2010b. *Explanation of Significant Difference from the Record of Decision for the Basewide Operable Unit Sites: Sites FT-10C/ST-68, LF-18, OT-23C, and OT-87, Mather, California*. Final. June (signatures completed in August 2010). (AR No. 2972)

AFRPA, 2010c. *Predictive Trend Analysis for the Northeast Plume Contaminants of Concern (COCs), Former Mather Air Force Base.* August. (AR No. 3021)

California Department of Toxic Substances Control (DTSC), 2017. Joint Letter from DTSC and EPA to Mr. Philip H. Mook, AFCEC, Regarding Resolution of Informal Dispute at Site 59, the Oil-Water Separator 4251 and Wash Rack Source Area Vadose Zone, Mather Air Force Base, California. 19 May. (AR No. 553203)

CAPE, 2018a. *2017 Annual Post-Closure Landfill Inspection and Gas Monitoring Report at the Former Mather Air Force Base, California*. January. (AR No. 570187)

CAPE, 2018b. *2018 Annual Post-Closure Landfill Inspection and Gas Monitoring Report at the Former Mather Air Force Base, California*. December. (AR No. 593392)

CAPE, 2018c. *2017 Annual Report of Compliance with Institutional Controls at the Former Mather Air Force Base, California*. July. (AR No. 575802)

CAPE, 2018d. *Annual and fourth Quarter 2017 Mather Groundwater Monitoring Report, Former Mather Air Force Base, California*. March. (AR No. 571549 and 571549.1)

CAPE, 2019a. *Annual and Fourth Quarter 2018 Mather Groundwater Monitoring Report, Former Mather Air Force Base, California*. April. (AR No. 597548 and 597548.1)

CAPE, 2019b. *2018 Annual Report of Compliance with Institutional Controls at the Former Mather Air Force Base, California*. April. (AR No. 586304)

CAPE, 2020. *2019 Annual Report of Compliance with Institutional controls at the Former Mather Air Force Base, California*. April. (AR No. 598981)

EA Engineering, Science, and Technology (EA Engineering), 1995. *Operations and Maintenance Manual, AC&W Site Pump and Treat System*. July. (AR No. 2751)

Human and Ecological Risk Office (HERO), 2019. *Human Health Risk Assessment*. Online information: http://dtsc.ca.gov/human-health-risk-hero/ (last accessed September 2019).

IT Corporation, 1994. *Removal Action Memorandum for Sites 20, 29, and 32, Mather Air Force Base, California.* September. (AR No. 972)

IT Corporation, 1996. *Comprehensive Baseline Risk Assessment for Mather Air Force Base, California*. Final. October. (AR No. 626, 627 and 628)

IT Corporation, 2000. *Supplemental Basewide Operable Unit Focused Feasibility Study Report, Mather Air Force Base, California*. Final. September. (AR No. 1703)

Montgomery Watson, 1996. *Closure and Post-Closure Maintenance Plan for the Landfill Operable Unit.* April. (AR No. 2834)

Montgomery Watson, 1997a. *Addendum to the Operations and Maintenance Manual, AC&W Site Pump and Treat System.* July. (AR No. 1344)

Montgomery Watson, 1997b. *Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62*. April. (AR No. 1359)

Montgomery Watson, 1999a. *Informal Technical Information Report and Preliminary Engineering Report for Vadose Zone Source Removal at Sites 18, 23, and 59*. August. (AR No. 1838, 1839.1 and 1839.2)

Montgomery Watson, 1999b. *Informal Technical Information Report for the Installation of Guard Wells.* August. (AR No. 1837)

Montgomery Watson, 1999c. *Operations and Maintenance Manual for the Groundwater Extraction and Treatment System for the Site 7 Plume*. March. (AR No. 1303)

Montgomery Watson, 1999d. *Closure and Post-Closure Maintenance Plan for the Engineered Cap at Remedial Action Site 7*. Final. July. (AR No. 2753)

MWH Americas, Inc. (MWH), 2002a. *Informal Technical Information Report for Additional Excavation at Site 89*. June. (AR No. 3102)

MWH, 2002b. *Informal Technical Information Report for Additional Excavations at Installation Restoration Program Sites 80, 85, and 88*. July. (AR No. 2028)

MWH, 2003. *Operations and Maintenance Manual for the Groundwater Extraction and Treatment System Main Base/SAC Plume (Phase I, Phase II, Phase III, and Phase IV)*. Final. February. (AR No. 2130)

MWH, 2009. *Lead Excavation Completion Report, Site 10C/68, Mather Air Force Base, California*. Final. November.

MWH, 2010a. *Site 10C/68 Closure Report, Former Mather Air Force Base, Sacramento County, California*. Final. May. (AR No. 3042)

MWH, 2010b. *Site 18 and 23A Closure Report, Former Mather Air Force Base, Sacramento County, California*. Final. October. (AR No. 3090)

MWH, 2010c. *Results of 2009 Small Mammal Monitoring at Site 87, Former Mather Air Force Base, Sacramento County, California.* Final. September. (AR No. 2969)

MWH, 2010d. *Closure and Post-Closure Maintenance Plan for the Engineered Cap at Remedial Action Site 7 (Previously Issued July 1999)*. Final. March. (AR No. 2833)

MWH, 2010e. *Closure and Post-Closure Maintenance Plan for the Landfill Operable Unit (Previously Issued April 1996)*. Final. March. (AR No. 2834)

NCBI, 2017. *Addendum No. 1, Final Operations and Maintenance Manual, Granular Activated Carbon (GAC) Treatment System for Site 7 Plume Groundwater Extraction and Treatment System, Former Mather Air Force Base, California*. February. (AR No. 547801)

NCBI, 2018. *Final Operations and Maintenance Manual Addendum No. 2, Granular Activated Carbon Treatment System for Main Base/SAC Area Groundwater Extraction and Treatment Plan, Former Mather Air Force Base, California*. April.

OEHHA, 2019a. *Public Health Goals*. Online information: http://oehha.ca.gov/water/phg/allphgs.html (last accessed September 2019).

OEHHA, 2019b. *California Department of Toxic Substances Control (DTSC) Human And Ecological Risk Office (HERO) Human Health Risk Assessment (HHRA) Note: HERO HHRA Note Number: 3, DTSC-Modified Screening Levels (DTSC-SLs).* Online information: https://dtsc.ca.gov/wp-content/uploads/sites/31/2019/04/HHRA-Note-3-2019-04.pdf. April.

United States Air Force, 1989. Interagency Agreement for Mather Air Force Base. Also called the Federal Facility Agreement. July. (AR No. 1830)

United States Environmental Protection Agency (EPA), 1998. Memorandum from Daniel D. Opalski, Chief, Federal Facilities Cleanup Branch, U.S. EPA, Region IX, to Anthony Wong, BRAC Environmental Coordinator, AFBCA, Mather, California, 25 November. (AR No. 1555)

EPA, 2001. *Comprehensive Five-Year Review Guidance.* OSWER 9355.7-03B-P. June.

EPA, 2011. *Recommended Evaluation of Institutional Controls: Supplement to the 'Comprehensive Five-Year Review Guidance'*. OSWER Directive 9355.7-18. September.

EPA, 2012a. *Memorandum: Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews*. OSWER Directive 9200.2-111. September.

EPA, 2012b. *Memorandum: Assessing Protectiveness at Sites for Vapor Intrusion: Supplement to the 'Comprehensive Five-Year Review Guidance'*. OSWER Directive 9200.2-84. November.

EPA 2012c. *Correction to the Memorandum "Program Priorities for Federal Facility Five-Year Reviews."* 22 February 2012.

EPA, 2016. *Five-Year Review Recommended Template*. OLEM 9200.0-89EPA, 2019. *Integrated Risk Information System (IRIS) Database*. National Center for Environmental Assessment, U.S. Environmental Protection Agency, Washington, D.C. Online database: http://www.epa.gov/iris (last accessed September 2019).

United States Department of Defense, 2019. Letter from the Assistant Secretary of Defense regarding "Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program." October.

URS Group, Inc. (URS), 2010. *Third Five-Year Review Report, Former Mather Air Force Base, Sacramento County, California*. Final. October. (AR No. 3039)

URS, 2011. *Site 7/11 Soil Vapor Extraction/Biovent System Closure Report, Former Mather Air Force Base, California*. Final. August. (AR No. 3083)

URS, 2015a. *2014 Annual Post-Closure Landfill Inspection and Gas Monitoring Report, Former Mather Air Force Base, Sacramento County, California*. January. (AR No. 451277)

URS, 2015b. *2014 Soil Vapor Extraction/Bioventing Annual Monitoring Report, Former Mather Air Force Base, California*. March. (AR No. 452850)

URS, 2015c. *Annual and Fourth Quarter 2014 Mather Groundwater Monitoring Report, Former Mather Air Force Base, California*. April. (AR No. 45991)

URS, 2015d. *Fourth Five Year Review Report, Former Mather Air Force Base, Sacramento County, California*. August. (AR No. 467610)

URS, 2016a. *Annual and Fourth Quarter 2015 Mather Groundwater Monitoring Report, Former Mather Air Force Base, California*. March. (AR No. 475290)

URS, 2016b. *2015 Annual Post-Closure Landfill Inspection and Gas Monitoring Report, Former Mather Air Force Base, Sacramento County, California*. January. (AR No. 473066)

URS, 2016c. *Revised Final Site ST-37/ST-39/SS-54, OT-23B, and OT-23D SVE/BV Completion Report*. June. (AR No. 538331)

URS, 2016d. *Final Site ST-37/ST-39/SS-54, OT-23B, and OT-23D Vadose Zone Closure Report*. February. (AR No. 473068)

URS, 2017a. *2016 Annual Post-Closure Landfill Inspection and Gas Monitoring Report, Former Mather Air Force Base, Sacramento County, California*. January. (AR No. 546732)

URS, 2017b. *Former Mather Air Force Base, Building 4260 Human Health Risk Assessment*. September. (AR No. 564638)

URS, 2017c. *Final Well Decommissioning and Treatment System Removal Report, SVE Site 57 (Oil-Water Separator [OWS] 7019), Former Mather Air Force Base*. December. (AR No. 569053)

URS, 2017d. *Site 57 Soil Vapor Extraction Completion Report*. June. (AR No. 581750)

URS, 2017e. *Well Decommissioning and Treatment System Removal Report, SVE Sites 29/71, 37/39/54, OT-23B, and OT-23D and Damaged Groundwater Wells MAFB-392B/7-PZ-38P*. June. (AR No. 554833)

URS, 2017f. *Annual and Fourth Quarter 2016 Mather Groundwater Monitoring Report, Former Mather Air Force Base, California*. March. (AR No. 549310)

URS, 2017g. *Site 59 Former Oil-Water Separator 4251 and Wash Rack Source Area Soil Vapor Extraction Completion Report*. June. (AR No. 595137)

URS, 2018a. *Building 4260 SVE System Design and Operations and Maintenance Plan*. July.

URS, 2018b. *Building 4260 SI Report and EE/CA*. July. (AR No. 575470)

URS, 2019. *Final Site 23C Former Laundry and Cleaning Plant Soil Vapor Extraction (SVE) Completion Report, and the Response Complete Determination for Site 23C Former Laundry and Cleaning Plant, Former Mather Air Force Base (AFB), California*. February. (AR No. 584812)

APPENDIX A

Site Lists

Appendix A

Site List

Table 1. Installation Restoration Program Sites that Require a Five-Year Review

Site ID	Site Description	OU	Requirement for Review		Comments
			Statutory	Policy	
LF-03	NE Perimeter Landfill No. 1	4	X		Cap in place; LTO&M; ICs.
LF-04	NE Perimeter Landfill No. 2	4	X		Cap in place; LTO&M; ICs.
WP-07	"7100" Waste Pit Area Disposal Site	3	X		Cap in place; LTO&M; ICs. SVE/BV response complete..
FT-10C	Former Fire Training Area 3 (revised location)	5	X		Excavation and SVE responses complete; ICs in place.
FT-11	Existing Fire Training Area (used from 1958 to 1993)	3	X		SVE/BV response complete; ICs in place.
WP-12	AC&W Site	1		X	Groundwater extraction and treatment since 1994; ICs. OPS concurrence by EPA in 1998.
LF-18	Old Burial Site (north of Facility 4120)	5	X		SVE response complete; ICs in place.
OT-23C	Main Base Sanitary Sewer System	5	X		SVE response complete; ICs in place.
ST-37	Five Former USTs at Bioenvironmental Storage Yard, Facility 3389	3	X		SVE response complete; ICs in place.
ST-39	Eight Former USTs at Hazardous Waste Storage Facility 4305	3	X		SVE response complete; ICs in place.
SS-54	Hazardous Waste Accumulation Point at AGE Shop, Facility 4348	3	X		SVE response complete; ICs in place.
SD-57	OWS at Facility 7019	3	X		SVE response complete; ICs place.
SD-59	OWS at ATC Wash Rack, Facility 4251	3	X		Excavation and SVE response complete; ICs in place.
ST-68	Eighteen USTs for SAC Area JP-4 Hydrant System	5	X		SVE response complete (remediated with FT-10C); ICs in place.
OT-87	Rod and Gun Club Skeet and Trap Range (Facility 10330)	5	X		Excavation response and small mammal monitoring complete; ICs in place.
OT-89	Old Trap Range	6	X		ICs in place.
SD-57	Main Base/SAC Area Plume	2		X	Phased groundwater extraction and treatment since 1998; ICs. OPS concurrence by EPA in 2011.

Table 1. Installation Restoration Program Sites that Require a Five-Year Review

Site ID	Site Description	OU	Requirement for Review		Comments
			Statutory	Policy	
LF-04	Northeast Plume	2		X	Long-term groundwater monitoring since 1996; ICs. OPS concurrence by EPA in 2011.
WP-07	Site 7 Plume	2		X	Groundwater extraction and treatment since 1999; ICs. OPS concurrence by EPA in 2011.

AC&W = Aircraft Control and Warning
AGE = aerospace ground equipment
ATC = Air Training Command
BV = bioventing
EPA = United States Environmental Protection Agency
ESD = explanation of significant difference
FT = fire training
IC = institutional control
ID = identification
JP-4 = jet propellant fuel
LF = landfill
LTO&M = long-term operations and maintenance
NE = northeast
No. = number
OT = other
OPS = operating properly and successfully
OU = operable unit
OWS = oil-water separator
SAC = Strategic Air Command
SD = storm drain
SS = sanitary sewer
ST = storage tank
SVE = soil vapor extraction
UST = underground storage tank
WP = waste pit

Table 2. Installation Restoration Program Sites that Do Not Require a Five-Year Review

Site ID	Site Description	OU	Comments
LF-01	Runway Overrun Landfill	4	NFA in Landfill OU ROD.
LF-02	"8150" Area Landfill	4, 5	Landfill waste moved to Site LF-04 as removal action; confirmed as selected remedy in Basewide OU ROD; closed with agency concurrence in September 2000.
LF-05	NE Perimeter Landfill No. 3	4	Landfill waste moved to Site LF-04; clean closure certified in 1997; groundwater monitoring associated with LF-05 remedy completed.
LF-06	Firing Range Area Landfill Sites	4	Landfill waste moved to Site LF-04; clean closure certified in 1997; groundwater monitoring completed in 2002; regulatory agency concurrence in April 2003.
FT-08	Former Fire Training Area 1	5	NFA in Basewide ROD.
FT-09	Former Fire Training Area 2 (used from 1945 to 1947)	3	NFA in Soil OU and Groundwater OU ROD.
FT-10	Former Fire Training Area 3 (used from 1947 to 1958)	3	NFA in Soil OU and Groundwater OU ROD.
SD-13	Drainage Ditch No. 1 (east of Facility 2950)	3	Excavation of ditch sediment and surface soils; closed with agency concurrence in September 2000.
SD-14	Drainage Ditch No. 2 (northeast of Facility 3975)	3	NFA in Soil OU and Groundwater OU ROD.
SD-15	Drainage Ditch No. 3 (West), includes OWS Facility 7039	3	Excavation of ditch sediment; closed with agency concurrence in September 2001.
RW-16	Electron Tube Burial Site under Facility 8170	3	NFA in Soil OU and Groundwater OU ROD.
WP-17	Weapons Storage Area Septic Tank (south of Facility 18080)	5	NFA in Basewide OU ROD.
WP-19[a]	Fuel Tank 4015 and Sludge Burial Site (near Facility 4012)	3	NFA in Soil OU and Groundwater OU ROD; closed by CVWB letter in February 2002.
ST-20	Sewage Treatment Plant UST and Sludge Drying Beds	3/5	Closed with agency concurrence in May 2012 following completion of ROD-required groundwater sampling for phthalates in 2009; phthalates were not detected. UST closure letters from SCEMD in June 1987 and June 1998; UST also closed by CVWB letter in May 1998.
OT-21	Asphalt Rubble Storage Site (northeast of Facility 7125)	3	NFA in Soil OU and Groundwater OU ROD.
OT-22	Asphalt Rubble Storage Site	3	NFA in Soil OU and Groundwater OU ROD.
ST-24	JP-4 Spill Site at SAC Aircraft Parking Apron	3	NFA in Soil OU and Groundwater OU ROD.
ST-25	Former UST for Emergency Generator, Facility 10100	1	NFA in AC&W ROD; also closed by CVWB letter in November 2001.
ST-26	Former UST for ILS Localizer Emergency Generator, Facility 10072	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in November 2001.
ST-27	Former UST for Communications Transmitter Emergency	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in August 2001.

Table 2. Installation Restoration Program Sites that Do Not Require a Five-Year Review

Site ID	Site Description	OU	Comments
	Generator, Facility 10060		
ST-28	Former UST for Water Supply Emergency Generator, Facility 16100	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in November 2001.
ST-29[a]	Four Former USTs at Military Gas Station, Facility 3167	3	Site closed with ICs. SVE system shut down in December 2013; ICs. SVE system and components decommissioned between 2016-2017 (remediated with ST-71 by treatment system for Sites 37/39/54).
ST-30	Former UST Security Police Emergency Generator, Facility 10300	1	NFA in AC&W ROD; also closed by CVWB letter in November 2001.
ST-31	Former UST Transmitter Emergency Generator, Facility 10090	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in November 2001.
ST-32[a]	Six Former USTs at AAFES Service Station, Facility 2410	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in April 1997.
ST-33	Six Former USTs at Civil Engineering Paint Shop, Facility 3308	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in August 2001.
ST-34[a]	Five Former USTs at AAFES Service Station, Facility 21030	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in November 2000.
ST-35[a]	Four Former USTs at POL Yard 1, Facility 3226	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in February 2005.
ST-36 [a]	Four Former USTs at Old Rail Yard 2, Facility 3286	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in February 2005.
ST-38	Two Former USTs at Bioenvironmental Storage Yard, Facility 3388	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in November 2001.
ST-40	Former UST for Training Classroom Boiler, Facility 3875	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in January 1991 and CVWB letter in August 2001.
ST-41	Two Former USTs at Old Motor Pool, Facility 2995	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in January 1991and CVWB letter in August 2001.
ST-42	Former UST at Old Motor Pool, Facility 2898	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in January 1991and CVWB letter in August 2001.
ST-43	Two Former USTs Water Supply Emergency Generator, Facility 10150	3	NFA in Soil OU and Groundwater OU ROD; closed by SCEMD letters in January 1991and October 1996.
SD-44	Former OWS at old Weapons Storage Area, Facility 8540	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in January 1991.
ST-45	Former Ammonia UST for Missile Facility, Facility 7003	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in January 1991.

Table 2. Installation Restoration Program Sites that Do Not Require a Five-Year Review

Site ID	Site Description	OU	Comments
ST-46	Former UST for Alert Crew Emergency Generator, Facility 8158	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996.
ST-47	Former UST near Security Police Facility 10400B	1	NFA in AC&W ROD; also closed by SCEMD letter in October 1996.
ST-48	Former UST for Security Police Facility 10410	3	NFA in Soil OU and Groundwater OU ROD.
ST-49	Former UST for Security Police Facility 10450	3	NFA in Soil OU and Groundwater OU ROD; also closed by CVWB letter in November 2001.
ST-50	Same as ST-34	NA	
ST-51	Former UST for ILS Glide Slope Emergency Generator Facility 10030	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996.
ST-52	Former UST for Security Police Emergency Generator Facility 10400A	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996.
ST-53	Former UST for Weapons Storage Area Boiler, Facility 18051	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996.
SD-55	OWS at Facility 7038	3	NFA in Soil OU and Groundwater OU ROD.
SD-56	OWS at former Motor Pool Wash Rack, Facility 2989	3	Excavation followed by SVE and BV; closed with agency concurrence in October 2002.
SD-58	OWS at Army Helicopter Wash Rack, Facility 4771	3	NFA in Soil OU and Groundwater OU ROD.
SD-60	OWS at Facility 6900 (north side of Facility 7005)	3	Excavation followed by SVE; closed with agency concurrence in February 2002.
SD-61	OWS at Facility 6905 (south side of Facility 7005)	3	NFA in Soil OU and Groundwater OU ROD.
OT-62	OWS at Facility 7110 (Jet Engine Test Stand Facility 7099)	3	Excavation of surface and shallow subsurface soil; closed with agency concurrence in June 2001.
SD-63	OWS and two USTs at former Auto Hobby Shop, Facility 3320	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in October 1996.
SD-64	OWS at Fuel Truck Wash Rack, Facility 4120	3	NFA in Soil OU and Groundwater OU ROD.
SD-65	OWS at Facility 6910 (north corner of Facility 7009)	3	Excavation of surface and shallow subsurface soils; closed with agency concurrence in September 2000.
SD-66	OWS at Facility 6915 (north corner of Facility 7024)	3	NFA in Soil OU and Groundwater OU ROD.
SD-67	Sanitary Sewer System in the SAC Area	5	NFA in Basewide OU ROD.
OT-69	Ordnance Burning and Detonation Area	3	Excavation and munitions clearance activities complete; site closed with EPA concurrence in 2012.
ST-70	Former UST at Dining Hall, Facility 1226	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in August 1994 (referred to as Site A in ROD).

Table 2. Installation Restoration Program Sites that Do Not Require a Five-Year Review

Site ID	Site Description	OU	Comments
ST-71[a]	Five Former USTs at AVGAS Pumping Station, Facility 3271	3	Site closed with ICs. SVE system shut down in December 2013; ICs. SVE system and components decommissioned between 2016-2017 (remediated with ST-29 by treatment system for Sites 37/39/54). ST-71 referred to as Site B in ROD.
ST-72	Former UST at Water Plant, Facility 3975	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996 (referred to as Site C in ROD).
ST-73	Former UST for ILS Localizer Emergency Generator Facility 10015	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996 (referred to as Site E in ROD).
ST-74	Former UST for Utility Vault Emergency Generator Facility 10065	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996 (referred to as Site F in ROD).
ST-75	Former UST at Weapons Storage Area, Facility 18018	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letters in June 1996 (referred to as Site G in ROD).
ST-76	Former UST at Weapons Storage Area, Facility 18011 and 18020	3	NFA in Soil OU and Groundwater OU ROD; 18011 also closed by SCEMD letters in June 1996; 18011 and 18020 referred to as Site H in ROD.
ST-77	Former UST Army Helicopter Pad, Facility 4853	3	NFA in Soil OU and Groundwater OU ROD; also closed by SCEMD letter in October 1996 (referred to as Site I in ROD).
ST-78	Two USTs East of Facility 2527 (2527 and 2527B)	NA	Closed by SCEMD letters in June 1987, July 1997, and June 1998; 2527B also closed by CVWB letter in May 1998.
ST-79	UST East of Facility 4540	NA	Closed by SCEMD letters in June 1987 and June 1998; also closed by CVWB letter in May 1998.
SD-80	Golf Course Maintenance Area Drainage	6	NFA in Supplemental Basewide OU ROD.
ST-81	Sewage Oxidation Ponds	5	NFA in Basewide OU ROD.
OT-82[a]	Golf Course Maintenance Area (near Facility 8869)	5	NFA in Basewide OU ROD; also closed by CVWB letter in August 1999.
SD-83[a]	Army Aviation Helicopter Washrack (Facility 4771)	5	NFA in Basewide OU ROD, but remains to be closed under other regulations.
SD-84	Sewer Lines SAC Area to Sewage Treatment Plant	5	NFA in Basewide OU ROD.
SD-85	South Ditch (NE Morrison Creek Tributary from Facility 10030 to 10085)	6	NFA in Supplemental Basewide OU ROD.
OT-86	Military Small Arm Firing Range (Facility 12500)	5	Excavation and soil stabilization; closed with agency concurrence in October 2003.
DD-88	Drainage Ditch Morrison Creek from Mather Lake to AC&W Area	6	NFA in Supplemental Basewide OU ROD.

[a] Petroleum-only, non-CERCLA sites.

AAFES = Army Air Force Exchange Service
AC&W = Aircraft Control and Warning
AVGAS = aviation gasoline
BV = bioventing
No. = number
OT = other
OU = operable unit
OWS = oil-water separator

Table 2. Installation Restoration Program Sites that Do Not Require a Five-Year Review

Site ID	Site Description	OU	Comments

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CVWB = Central Valley Regional Water Quality Control Board
DD = drainage ditch
FT = fire training
ID = identification
ILS = instrumented landing system
JP-4 = jet propellant fuel
LF = landfill
NA = not applicable
NE = northeast
NFA = no further action
POL = petroleum, oil, and lubricant
ROD = record of decision
RW = radioactive waste
SAC = Strategic Air Command
SCEMD = Sacramento County Environmental Management Department
SD = storm drain
ST = storage tank
SVE = soil vapor extraction
UST = underground storage tank
WP = waste pit

APPENDIX B

Site Chronologies

Appendix B

Summary of Mather Site Chronologies
Former Mather Air Force Base
Sacramento County, California

Date	Activity
OU1 - AC&W	
December 1993	AC&W OU ROD was signed in December 1993 by AFBCA, EPA, and DTSC to address contaminated groundwater at Site WP-12 (AC&W Site) at Mather.
January 1995	The pump-and-treat system for the AC&W OU began operating in January 1995.
June 1997	ESD allows for discharge of treated groundwater to Mather Lake.
September 1998	AFBCA issued an OPS report for the AC&W Plume remedial action (AFBCA, 1998d), which received EPA concurrence in November 1998 (EPA, 1998).
November 2008	ICs were added to the groundwater remedy through a second ESD for the AC&W OU.
July 2009	Injection wells decommissioned.
September 2013	Extraction well ACW EW-2 determined to be no longer needed for groundwater cleanup. Decommissioned.
July 2014	Extraction well ACW EW-3 determined to be no longer needed for groundwater cleanup. Decommissioned.
OU2 - Main Base/SAC Area Plume	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
April 1998	Phase I extraction wells, addressing hot spots of groundwater contamination on the former base, began operating.
January 2000	Phase II and Phase III extraction wells began operating.
3Q 2001	Three additional extraction wells installed and began operating.
September 2002	Phase IV extraction wells began operating, expanding plume capture off base and further augmenting plume capture on Mather.
2005	Additional extraction well, addressing capture of the off-site leading edges of the plume, began operating.
2008	Additional extraction well, addressing capture of the off-site leading edges of the plume, began operating.
August 2010	ESD elaborates upon and clarifies the Groundwater OU land-use restrictions with respect to their implementation and identifies the areas subject to ICs.
March 2011	Air Force issued an OPS report for the Main Base/SAC Area Plume remedial action; received EPA concurrence in July 2011.
April 2014	Discharge to the West Ditch was suspended after several extraction wells were shut down and Sacramento County began using more of the treated groundwater for irrigation.
February 2018	GAC treatment system was installed to remove PFAS compounds from the treated water prior to reinjection. The system consists of four 30,000-lb GAC vessels.
February 2018	Air Force was notified that Notice of Applicability coverage had expired. The Air Force decided not to renew coverage for
OU2 - Site 7 Plume	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
October 1998	Construction of the Site 7 treatment system was completed.
1998-2006	Between 1998 and 2006, the Site 7 system operated intermittently as a result of interruptions by off-base aggregate mining
July 1999	FFS EW7-1 destroyed due to gravel mining operations.
April 2001	7 EW-1 installed near the leading edge of the Site 7 plume in 4Q 2000. Operating Began operating in April 2001.
2Q 2002	7 EW-2 installed in 1Q 2002 and began operating in 2Q 2002.
August 2010	ESD elaborates upon and clarifies the Groundwater OU land-use restrictions with respect to their implementation and identifies the areas subject to ICs.
June 2011	Air Force issued an OPS report for the Site 7 Plume remedial action; received EPA concurrence in July 2011.
December 2016	GAC treatment system was installed to remove PFAS compounds from the treated water prior to reinjection. The system consists of two 1,000-lb GAC vessels.
OU2 - Northeast Plume	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
August 2010	ESD elaborates upon and clarifies the Groundwater OU land-use restrictions with respect to their implementation and identified the areas subject to ICs.
March 2011	Air Force issued the revised final OPS report for the Northeast Plume remedial action; EPA concurrence received in July 2011.
OU3 - Site WP-07/FT-11 (See Table 1)	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
September 1998	ESD addresses disposal of contaminated soil at Site 7/11.
1998	VOCs in the vadose zone at Site WP-07/ FT-11 were remediated by separate SVE systems, which were later combined and
1999	An engineered cap was constructed over the disposal area.
April 2007	SVE treatment system was converted to a BV system.
May 2009	BV system permanently shut down.
August 2010	ESD, finalized in 2010, clarifies the implementation of ICs required by the landfill ARARs.
June 2011	Air Force issued an OPS report for the Site WP-07/FT-11 remedial actions; received EPA concurrence in July 2011.

Appendix B

Summary of Mather Site Chronologies
Former Mather Air Force Base
Sacramento County, California

Date	Activity
2011	Closure report was finalized documenting that no further treatment of the vadose zone is necessary at Site WP-07/FT-11.
2012	SVE/BV system and components decommissioned.
OU3 - Site ST-37/ST-39/SS-54 (See Table 2)	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
December 1998	SVE system constructed and began operation. SVE operated until January 2010.
August 2010	ESD, finalized in 2010, adds ICs to the remedy for Site ST-37/ST-39/SS-54 (as well as Subsites OT-23B and OT-23D from the
October 2010	SVE system converted to a BV system.
March 2011	Air Force issued an OPS report for the Site ST-37/ST-39/SS-54 remedial action; received EPA concurrence in July 2011.
December 2013	BV system shut down for respiration testing and remained down.
2016	SVE system closed with regulatory concurrence.
2016-2017	System decommissioned.
September 2018	Documentation of Nonsignificant Change to the ROD for Site 23B signed.
OU3 - Site SD-57 (See Table 3)	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
August 1997	SVE system began operating at Site SD-57.
2001	Dual-phase extraction initiated at three water table groundwater extraction wells.
August 2010	ESD adds ICs to the remedy for Site SD-57.
March 2011	Air Force issued an OPS report for the Site SD-57 remedial action; received EPA concurrence in July 2011.
July 2013	SVE system shut down for rebound monitoring.
April 2014	Draft vadose zone closure report submitted.
August 2014	Confirmation soil vapor samples collected from soil vapor wells. Results prompted resumption of SVE operations.
September 2014	SVE operations resumed.
February 2015	SVE system shut down for rebound monitoring. System was not restarted.
2017	SVE system shut down and decommissioned.
June 2017	Site 57 Vadose Zone Completion Report received regulatory concurrence.
OU3 - Site SD-59 (See Table 4)	
April 1996	Soil OU and Groundwater OU ROD was signed in April 1996 by AFBCA, EPA, and DTSC to address contaminated soil and groundwater at Mather.
Aug - Sep 1996	OWS and surrounding soil excavated.
December 1998	SVE pilot test.
December 1998	ESD prepared to add in situ treatment (SVE/BV) to the remedy.
February 2000	SVE system installed and began operating.
August 2010	ESD adds ICs to the remedy for Site SD-59 and replaces TPH-g and TPH-d numeric cleanup levels with narrative cleanup levels.
March 2011	Air Force issued an OPS report for the Site SD-59 remedial action; received EPA concurrence in July 2011.
July 2013	SVE system shut down for further investigation and evaluation.
2014	Data from additional vapor wells installed suggest that the original Site SD-59 source area has been remediated, but another source area may exist near Building 4260.
Aug - Sep 2017	SD-59 SVE wells and piping decommissioned with planned future use of repurposing SD-59 SVE remedial components for the
OU4 - Site LF-03	
July 1995	Landfill OU ROD was signed in July 1995 by AFBCA, EPA, and DTSC to address landfill sites at Mather.
1996	Site was capped.
August 2009	Memorandum of post-ROD changes clarifies and supplements the ICs for Site LF-03.
OU4 - Site LF-04	
July 1995	Landfill OU ROD was signed in July 1995 by AFBCA, EPA, and DTSC to address landfill sites at Mather.
October 1996	ESD addressess consolidation of additional refuse and debris into LF04.
1996	Site was capped.
1997	Site planted with vegetation.
August 2009	Memorandum of post-ROD changes clarifies and supplements the ICs for Site LF-04.
OU5 - Site FT-10C/ST-68	
1997	Pilot SVE system installed.
August 1997	SVE and BV operations.
August 1998	Basewide OU ROD was signed in August 1998 by AFBCA, EPA, and DTSC to address sites at Mather.
2002	Additional lead-contaminated soil was discovered.

Appendix B

Summary of Mather Site Chronologies
Former Mather Air Force Base
Sacramento County, California

Date	Activity
August 2008	System permanently shut down.
November 2008	ESD prepared to add excavation of lead-contaminated soil to the remedy for Site FT-10C/ST-68.
Nov - Dec 2008	Lead-contaminated soil excavated and disposed at an appropriately permitted off-site landfill.
2010	Closure report was finalized documenting that no further treatment of the vadose zone is necessary at Site FT-10C/ST-68.
August 2010	ESD adds ICs to the remedy at Site FT-10C/ST-68.
2012	EPA concurrence received on closure report.
2012	SVE/BV system and components decommissioned.
OU5 - Site LF-18	
1993	SVE pilot test conducted.
1995	SVE pilot test conducted.
August 1998	Basewide OU ROD was signed in August 1998 by AFBCA, EPA, and DTSC to address sites at Mather.
1998	SVE pilot test conducted.
2000	SVE system began operation.
November 2008	SVE system permanently shut down.
August 2010	ESD adds ICs to the remedy at Site LF-18.
2010	Closure report documented that no further treatment of the vadose zone is necessary at Site LF-18.
OU5 - Site OT-23C (See Table 5)	
August 1998	Basewide OU ROD was signed in August 1998 by AFBCA, EPA, and DTSC to address sites at Mather.
1998	Site OT-23C further defined near the site of a former dry cleaning plant.
1999	SVE system constructed.
2000	SVE system began operation.
April 2009	SVE system shut down for brief rebound period and reconfiguration of operating well field.
April 2009	SVE system restarted.
May 2009	SVE system shut down for extended rebound period.
July 2009	SVE system restarted.
July 2010	SVE system shut down for rebound monitoring.
August 2010	ESD adds ICs to the remedy at Site OT-23C.
November 2010	SVE system restarted, extracting from 23-PW-01 only.
March 2011	Air Force issued an OPS report for the Site OT-23C remedial action; received EPA concurrence in July 2011.
June 2011	SVE system shutdown for rebound monitoring.
January 2012	SVE system restarted.
June 2012	SVE system shut down for rebound monitoring.
January 2013	SVE system restarted.
October 2014	Focused SVE at 23-PW-01.
April 2015	Site OT-23C SVE system shut down to assess rebound and evaluate termination of SVE operations.
OU5 - Site OT-87	
August 1998	Basewide OU ROD was signed in August 1998 by AFBCA, EPA, and DTSC to address sites at Mather.
Aug 1998 - Jul 1999	Contaminated soil, clay pigeon material, and lead shot were excavated.
September 2009	Remedial Action Report finalized and received EPA concurrence.
2007	Small mammal monitoring initiated.
2009	Third year of small mammal monitoring completed.
August 2010	ESD clarifies the ICs and their implementation at Site OT-87.
OU6 - Site OT-89	
July 1999	Pilot study case activities completed.
Jul 2001 - Dec 2001	Excavation of contaminated sediment conducted.
October 2006	Supplemental Basewide OU ROD was signed in October 2006 by AFBCA, EPA, and DTSC to address additional sites at Mather.

Notes:
AC&W = Aircraft Control and Warning
AFBCA = Air Force Base Conversion Agency
AFRPA = Air Force Real Property Agency
B4260 = Building 4260
BV = bioventing
DTSC = California Department of Toxic Substances Control
EPA = United States Environmental Protection Agency
LF = landfill (IRP site designation)
OPS = operating properly and successfully
OT = other (IRP site designation)
OU = Operable Unit
OWS = oil-water separator
PFAS = per- and polyfluoroalkyl substances
ROD = record of decision

Appendix B

Summary of Mather Site Chronologies
Former Mather Air Force Base
Sacramento County, California

Date	Activity

ESD = explanation of significant difference(s)
EW = extraction well
FFS = focused feasibility study
FT = fire training (IRP site designation)
GAC = granular activated carbon
IC = institutional control
SAC = Strategic Air Command
SD = storm drain (IRP site designation)
SS = sanitary sewer (IRP site designation)
ST = storage tank (IRP site designation)
SVE = soil vapor extraction
WP = waste pit (IRP site designation)

OPERATIONAL AND REMEDIAL HISTORY
SITE WP-07/FT-11 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 1 of 4)

	Event	Start Date	End Date
1)	Construction Bids and Procurement	15-Jul-97	3-Oct-97
2)	SVE System Procurement	28-Jul-97	3-Oct-97
3)	Well Drilling and Installation	29-Aug-97	1-Jan-98
4)	Perched Zone Dewatering	1-Jan-98	1-Apr-98
5)	SVE Pilot Test	1-Apr-98	1-Jun-98
6)	SVE System Installation	29-Jun-98	28-Sep-98
7)	SVE System Startup and Proveout	21-Sep-98	19-Feb-99
8)	SVE System Operation (Catalytic Mode)	4-Mar-99	13-May-99
9)	SVE System Shut Down and Aboveground Piping Removed During Construction of Engineered Landfill Cap	14-May-99	25-Oct-99
10)	Aboveground Piping Reinstallation	26-Oct-99	17-Dec-99
11)	Rotary Lobe Blower Repair	26-Nov-99	1-Jan-00
12)	SVE System was Restarted for Compliance and Wellhead Sampling, then Shut Down	4-Feb-00	8-Feb-00
13)	SVE System was Restarted for Compliance and Wellhead Sampling, then Shut Down	28-Feb-00	8-Mar-00
14)	SVE System was Restarted and Optimized	31-Mar-00	18-Apr-00
15)	SVE System was Shut Down for Rebound Test	19-Apr-00	15-May-00
16)	Catalyst was Removed and SVE System Operated in Thermal Mode	16-May-00	22-May-00
17)	SVE System was Shut Down for Respiration Test	23-May-00	12-Jun-00
18)	SVE System Operation (Thermal Mode)	13-Jun-00	28-Jun-00
19)	SVE System was Shut Down for Rebound Test	29-Jun-00	7-Jul-00
20)	SVE System Operation (Thermal Mode)	7-Jul-00	11-Aug-00
21)	SVE System was Shut Down for Weekly Cycling and Repairs to Pressure Switch	11-Aug-00	29-Aug-00
22)	SVE System Operation Cycled (4 days on, 3 days off)	20-Aug-00	30-Nov-00
23)	SVE System was Shut Down for Rebound Test	30-Nov-00	14-Dec-00
24)	SVE System Operation (Thermal Mode)	14-Dec-00	22-Dec-00
25)	SVE System was Shut Down for Rebound Test	22-Dec-00	3-Jan-01
26)	SVE System Operation (Thermal Mode)	3-Jan-01	1-Feb-01
27)	SVE System was Shut Down for Rebound Test	1-Feb-01	6-Mar-01

OPERATIONAL AND REMEDIAL HISTORY
SITE WP-07/FT-11 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 2 of 4)

	Event	Start Date	End Date
28)	SVE System Operation (Thermal Mode)	6-Mar-01	4-Sep-01
29)	SVE System was Shut Down for Gas Migration Sampling at Landfill Site 7	4-Sep-01	13-Sep-01
30)	SVE System was Restarted for Compliance Sampling	13-Sep-01	14-Sep-01
31)	SVE System was Shut Down for Gas Migration Sampling at Landfill Site 7	14-Sep-01	28-Sep-01
32)	SVE System Operation (Thermal Mode)	28-Sep-01	1-Oct-01
33)	SVE System was Shut Down Due to Propane Refueling Issues (heightened airport security)	1-Oct-01	10-Oct-01
34)	SVE System Operation Cycled (4 days off, 3 days on)	10-Oct-01	5-Nov-01
35)	SVE System was Shut Down Due to Propane Refueling Issues (Heightened Airport Security)	5-Nov-01	14-Nov-01
36)	SVE System Operation Cycled (4 days off, 3 days on)	14-Nov-01	8-Mar-02
37)	SVE System was Shut Down for Rebound Test	8-Mar-02	1-Apr-02
38)	SVE System Operation Cycled (4 days off, 3 days on)	1-Apr-02	18-Jun-02
39)	SVE System was Shut Down for Rebound Test	18-Jun-02	3-Jul-02
40)	SVE System Operation Cycled (4 days off, 3 days on)	3-Jul-02	23-Aug-02
41)	SVE System was Shut Down for Rebound Test	23-Aug-02	4-Sep-02
42)	SVE System Operation Cycled (4 days off, 3 days on)	4-Sep-02	7-Oct-02
43)	Installation of Horizontal Extraction Well 7-HBV-16	20-Sep-02	20-Sep-02
44)	Aspiration Test at 7-MP-5	17-Sep-02	22-Oct-02
45)	SVE System was Shut Down for Rebound Test	7-Oct-02	22-Oct-02
46)	SVE System Operation Cycled (4 days off, 3 days on)	22-Oct-02	21-Nov-02
47)	Shut Down for SMAQMD Substantive Requirement Compliance Issue	5-Nov-02	6-Nov-02
48)	SVE System was Shut Down for Rebound Test	21-Nov-02	11-Dec-02
49)	SVE System Operation Cycled (4 days off, 3 days on)	11-Dec-02	6-Jan-03
50)	SVE System Operation Cycled (4 days on 3 days off)	6-Jan-03	7-Mar-03
51)	SVE System was Shut Down for Quarterly Landfill Monitoring	7-Mar-03	20-Mar-03
52)	SVE System Operation Cycled (4 days off, 3 days on)	20-Mar-03	23-May-03

OPERATIONAL AND REMEDIAL HISTORY
SITE WP-07/FT-11 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 3 of 4)

	Event	Start Date	End Date
53)	SVE System was Shut Down for Rebound Test and Quarterly Landfill Monitoring	23-May-03	30-Jun-03
54)	SVE System Operation Cycled (4 days off, 3 days on)	30-Jun-03	2-Aug-03
55)	SVE System Shut Down for Quarterly Landfill Monitoring	2-Aug-03	13-Aug-03
56)	SVE System Operation Cycled (4 days off, 3 days on)	13-Aug-03	26-Aug-03
57)	SVE System Operation on Continuous Schedule	26-Aug-03	18-Nov-03
58)	SVE System Shut Down for Rebound Test, Quarterly Landfill Monitoring, and Blower Motor Repairs	18-Nov-03	13-Apr-04
59)	SVE System Operation on Continuous Schedule	13-Apr-04	11-May-04
60)	SVE System Shut Down Due to System Vibrations	11-May-04	19-May-04
61)	SVE System Operation on Continuous Schedule	19-May-04	11-Jun-04
62)	SVE System Shut Down for Rebound Testing	11-Jun-04	13-Jul-04
63)	SVE System Operational on Continuous Schedule	13-Jul-04	13-Aug-04
64)	SVE System Shut Down for Rebound Testing at Site 11, Site 7 Third and Fourth Quarter Landfill Monitoring, and to Evaluate Conversion to Bioventing at Site 7/11	13-Aug-04	28-Dec-04
65)	SVE System Diagonosed with Faulty Thermal Couple, Motor Conductor, Secondary Thermal Couple. Repairs Being	28-Dec-04	25-Jan-05
66)	Optimal Operating Schedule Testing Being Performed	25-Jan-05	8-Mar-05
67)	SVE System Operation Cycled (4 days off, 3 days on)	8-Mar-05	8-Jun-05
68)	SVE System Shut Down for Respiration Testing	8-Jun-05	6-Jul-05
69)	SVE System Operation Cycled (4 days off, 3 days on)	6-Jul-05	25-Aug-05
70)	SVE System Shut Down for 3rd Quarter Landfill Monitoring	25-Aug-05	8-Sep-05
71)	SVE System Operation Cycled (4 days off, 3 days on)	8-Sep-05	13-Sep-05
72)	SVE System Shut Down for Respiration Testing	13-Sep-05	26-Sep-05
73)	SVE System Operation Cycled (4 days off, 3 days on)	26-Sep-05	4-Nov-05
74)	SVE System Shut Down for 4th Quarter Landfill Monitoring	4-Nov-05	14-Nov-05
75)	SVE System Operation Cycled (4 days off, 3 days on)	14-Nov-05	30-Dec-05
76)	SVE System Shut Down for Rebound Testing	30-Dec-05	6-Feb-06
77)	SVE System Operation Cycled (4 days off, 3 days on)	6-Feb-06	16-Mar-06
78)	SVE System Shut Down for System Evaluation (Evaluation samples collected Oct-06)	16-Mar-06	31-Dec-06

OPERATIONAL AND REMEDIAL HISTORY
SITE WP-07/FT-11 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 4 of 4)

	Event	Start Date	End Date
79)	SVE System Shut Down for System Evaluation and Biovent System Maintenance (Maintenance performed 6-Apr-07)	31-Dec-06	10-Apr-07
80)	Biovent System Operation Begins (1,200-cfm blower)	10-Apr-07	8-May-07
81)	Biovent System Shut Down for Well Network Reconfiguration	8-May-07	15-May-07
82)	Biovent System Operational	15-May-07	23-May-07
83)	Biovent System Shut Down due to Clogged Air Filters	23-May-07	1-Jun-07
84)	Biovent System Operational	1-Jun-07	3-Jul-07
85)	Biovent System Shut Down for Rebound, Blower Maintenance	3-Jul-07	13-Jul-07
86)	Biovent System Operational	13-Jul-07	22-Jul-07
87)	Biovent System Shut Down for High Vacuum Alarm	22-Jul-07	26-Jul-07
88)	Biovent System Operational	26-Jul-07	3-Aug-07
89)	Biovent System Shut Down for Rebound Testing	3-Aug-07	8-Aug-07
90)	Biovent System Operational	8-Aug-07	23-Aug-07
91)	Biovent System Shut Down due to a Leaky Gasket	23-Aug-07	6-Sep-07
92)	Replaced Gasket, System not Restarted	6-Sep-07	11-Sep-07
93)	Biovent System Operational	11-Sep-07	27-Sep-07
94)	Biovent System Shut Down for Rebound, Drilling Activities, and Landfill Cap Regrading	27-Sep-07	12-Feb-08
95)	Biovent System Operational	12-Feb-08	30-May-08
96)	Biovent System Shut Down for Blower Maintenance	30-May-08	2-Jun-08
97)	Biovent System Operational	2-Jun-08	8-Aug-08
98)	Biovent System Shut Down for Rebound Testing	8-Aug-08	4-Nov-08
99)	Biovent System Operational	4-Nov-08	8-Dec-08
100)	Biovent System Shut Down for Maintenance Repairs	8-Dec-08	10-Dec-08
101)	Biovent System Operational	10-Dec-08	5-May-09
102)	Biovent System Shut Down for Rebound Testing and Respiration	5-May-09	6-Aug-09
103)	Biovent Discontinued	6-Aug-09	31-Dec-10

Notes:
SVE - soil vapor extraction
SMAQMD - Sacramento Metropolitan Air Quality Managment District

TABLE 2

OPERATIONAL AND REMEDIAL HISTORY
SITE 37/39/54 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 1 of 5)

	Event	Start Date	End Date
1)	Construction Bids and Procurement	15-Sep-97	3-Oct-97
2)	Well Drilling and Installation	20-Oct-97	2-Feb-98
3)	SVE System Pilot Test	16-Feb-98	31-Mar-98
4)	Mobilization of Equipment	29-Jun-98	29-Jun-98
5)	SVE System Installation	20-Jul-98	9-Dec-98
6)	SVE System Startup and Testing	9-Dec-98	28-May-99
7)	SVE System Operation	29-May-99	15-Sep-99
8)	SVE System Temporary Shutdown	16-Sep-99	14-Nov-99
9)	SVE System Operation	15-Nov-99	7-Dec-99
10)	SVE System Shut Down for Pulsing Test	8-Dec-99	12-Dec-99
11)	SVE System Operation	13-Dec-99	3-Mar-00
12)	SVE System Shut Down for Blower Motor Repair	3-Mar-00	30-Apr-00
13)	SVE System Operation	1-May-00	2-May-00
14)	SVE System Shut Down to Conduct Rebound Testing	3-May-00	22-May-00
15)	SVE System Operation	23-May-00	27-Jun-00
16)	SVE System Shut Down to Support Site 35/36 Respiration Test	28-Jun-00	12-Jul-00
17)	SVE System Operation	12-Jul-00	18-Jul-00
18)	SVE System Shut Down to Evaluate Cycling Schedule	18-Jul-00	31-Jul-00
19)	SVE System Operation Cycled (4 days on, 3 days off)	31-Jul-00	5-Dec-00
20)	SVE System Shut Down to Conduct Rebound Testing	5-Dec-00	19-Dec-00
21)	SVE System Operation Cycled (4 days on, 3 days off)	19-Dec-00	15-Jan-01
22)	SVE System Shut Down for Long-Term Rebound Testing	15-Jan-01	16-Mar-01
23)	SVE System Operation (4 days on, 3 days off)	16-Mar-01	27-Sep-01
24)	SVE System Shut Down for SMAQMD Substantive Requirement Compliance	27-Sep-01	14-Nov-01
25)	SVE System Operation Cycled (4 days on, 3 days off)	14-Nov-01	26-Feb-02
26)	SVE System Shut Down for SMAQMD Substantive Requirement Compliance Issue (Rebound test Conducted)	26-Feb-02	18-Mar-02
27)	SMAQMD Grants MWH Permission to Restart SVE System	8-Mar-02	8-Mar-02
28)	SVE System Operation Cycled (4 days on, 3 days off)	18-Mar-02	29-Mar-02
29)	SVE System Shut Down to Conduct Rebound Testing	29-Mar-02	28-Jun-02
30)	SMAQMD Amended the Original Substantive Requirement on April 10, 2002, to Include New Air Emission Requirements of Less Than 10 lbs/day of ROC or Controlled by 95% or Greater Destruction Efficiency.	10-Apr-02	10-Apr-02

TABLE 2

OPERATIONAL AND REMEDIAL HISTORY
SITE 37/39/54 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 2 of 5)

	Event	Start Date	End Date
31)	SVE System Operation Cycled (4 days on, 3 days off)	28-Jun-02	6-Sep-02
32)	SVE System Shut Down for SMAQMD Substantive Requirement Compliance Issue	6-Sep-02	13-Sep-02
33)	SVE System Operation Cycled (4 days on, 3 days off)	13-Sep-02	7-Oct-02
34)	SVE System Shut Down to Conduct Rebound Testing	7-Oct-02	22-Oct-02
35)	SVE System Operation Cycled (4 days on, 3 days off)	22-Oct-02	8-Nov-02
36)	SVE System Shut Down to Conduct Rebound Test	8-Nov-02	12-Dec-02
37)	SVE System Operation Cycled (4 days on, 3 days off)	12-Dec-02	6-Jan-03
38)	SVE System Operation Cycle Changed (3 days on, 4 days off)	6-Jan-03	23-May-03
39)	SVE System Shut Down to Conduct Rebound Testing	23-May-03	30-Jun-03
40)	SVE System Operation Cycle Changed (3 days on, 4 days off)	30-Jun-03	25-Aug-03
41)	SVE System Operating on Continuous Schedule	25-Aug-03	17-Oct-03
42)	SVE System Shut Down to Perform System Blower and Motor Repairs and for Rebound Testing	17-Oct-03	23-Mar-04
43)	SVE System Operating on Continuous Schedule	23-Mar-04	5-Apr-04
44)	SVE System Shut Down to Perform System Adjustments and Tuning	5-Apr-04	9-Apr-04
45)	SVE System Operating on Continuous Schedule	9-Apr-04	15-Jun-04
46)	SVE System Shut Down to Conduct Rebound Testing	15-Jun-04	22-Jul-04
47)	SVE System Operational on Continuous Schedule	22-Jul-04	4-Aug-04
48)	System Shut Down Due to July Compliance Results	4-Aug-04	16-Aug-04
49)	SVE System Operational on Continuous Schedule	16-Aug-04	5-Oct-04
50)	System Shut Down Due to September Compliance Results and for Rebound Testing	5-Oct-04	3-Dec-04
51)	SVE System Operational on Continuous Schedule	3-Dec-04	21-Jan-05
52)	SVE System Shut Down for System Troubleshooting	21-Jan-05	28-Jan-05
53)	SVE System Operating on Cycled Schedule (4 days on, 3 days off)	28-Jan-05	13-Mar-05
54)	SVE System Shut Down to Conduct Rebound Testing	13-Mar-05	4-Apr-05
55)	SVE System Operating on Cycled Schedule (4 days on, 3 days off)	4-Apr-05	27-May-05
56)	SVE System Shut Down to Conduct Rebound Testing	27-May-05	20-Jun-05
57)	SVE System Operating on Cycled Schedule (4 days on, 3 days off)	20-Jun-05	27-Jul-05
58)	SVE System Shut Down due to a Failed Gas Valve	27-Jul-05	1-Aug-05
59)	SVE System Operating on Cycled Schedule (4 days on, 3 days off)	1-Aug-05	5-Aug-05
60)	System Shut Down for Long-Term Rebound Testing and for the Soil and Soil Gas Survey	5-Aug-05	7-Dec-05

TABLE 2

OPERATIONAL AND REMEDIAL HISTORY
SITE 37/39/54 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 3 of 5)

	Event	Start Date	End Date
61)	SVE System Operating on Cycled Schedule (4 days on, 3 days off)	7-Dec-05	12-Dec-05
62)	SVE System Shut Down due to AWS Tank Pump Failure	12-Dec-05	15-Dec-05
63)	SVE System Operating Continuously for Testing at Site 29/71	15-Dec-05	30-Dec-05
64)	SVE System Operating on Cycled Schedule (4 days on, 3 days off)	30-Dec-05	13-Jan-06
65)	SVE System Shut Down Due to Poor Destruction Efficiency (New system purchased third quarter 2006, which arrived December 2006)	13-Jan-06	31-Dec-06
66)	SVE System Shut Down - New Soil Therm SVE System Set up	31-Dec-06	12-Feb-07
67)	SVE System Operating (500-scfm thermal oxidizer)	12-Feb-07	18-Mar-07
68)	SVE System Operating Intermittently due to Gas Pressure Adjustments	18-Mar-07	23-Mar-07
69)	SVE System Operational	23-Mar-07	27-Mar-07
70)	SVE System Shut Down for Maintence	27-Mar-07	28-Apr-07
71)	SVE System Operational	28-Apr-07	3-Jul-07
72)	SVE System Shut Down for Maintence	3-Jul-07	16-Jul-07
73)	SVE System Operating Intermittently due to a Leak in the Natural Gas Line	16-Jul-07	19-Jul-07
74)	SVE System Operational	19-Jul-07	29-Aug-07
75)	SVE System Shut Down for Modification and Replacement of the Sytem's Exhaust Stack	29-Aug-07	31-Aug-07
76)	SVE System Operational	31-Aug-07	27-Dec-07
77)	SVE System Shut Down for Rebound and Drilling Activities	27-Dec-07	11-Mar-08
78)	Vacuum Pressure Influence Testing Performed at Site 29/71 SVE Wells (29-PW- 04, -05, -06)	11-Mar-08	12-Mar-08
79)	SVE System Shut Down after Vacuum Pressure Influence Testing at Site 29/71	12-Mar-08	20-Mar-08
80)	Vacuum Pressure Influence Testing Performed on Shallow SVE Wells (29-PW- 04, -05, -06)	20-Mar-08	20-Mar-08
81)	SVE System Shut Down after Vacuum Pressure Influence Testing at Site 29/71	20-Mar-08	4-Apr-08
82)	Restart SVE System to Collect Compliance Samples	4-Apr-08	4-Apr-08
83)	SVE System ShutDown after Compliance Sampling	4-Apr-08	8-Apr-08
84)	SVE System Operational	8-Apr-08	1-May-08
85)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	1-May-08	2-May-08
86)	SVE System Operational	2-May-08	5-May-08
87)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	5-May-08	7-May-08
88)	SVE System Operational	7-May-08	7-May-08
89)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	7-May-08	9-May-08
90)	SVE System Operational	9-May-08	9-May-08

OPERATIONAL AND REMEDIAL HISTORY
SITE 37/39/54 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 4 of 5)

	Event	Start Date	End Date
91)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	9-May-08	12-May-08
92)	SVE System Operational	12-May-08	15-May-08
93)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	15-May-08	16-May-08
94)	SVE System Operational	16-May-08	28-May-08
95)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	28-May-08	2-Jun-08
96)	SVE System Operational	2-Jun-08	4-Jun-08
97)	SVE System Shut Down due to Flame-out Alarm (Insuffiecent Oxygen)	4-Jun-08	6-Jun-08
98)	SVE System Operational	6-Jun-08	16-Jun-08
99)	SVE System Shut Down for Instrument Calibrations	16-Jun-08	17-Jun-08
100)	SVE System Operational	17-Jun-08	5-Jul-08
101)	SVE System Shut Down for Well Field Maintenance at Site 29/71	5-Jul-08	23-Jul-08
102)	SVE System Operational	23-Jul-08	24-Jul-08
103)	SVE System Shut Down for Rebound	24-Jul-08	12-Nov-08
104)	SVE System Operational	12-Nov-08	5-Dec-08
105)	SVE System Shut Down for Vacuum Pressure Influence Testing	5-Dec-08	5-Dec-08
106)	SVE System Operational only with SVE Site 29/71 Wells	5-Dec-08	28-May-09
107)	SVE System Shut Down for Rebound	28-May-09	15-Jul-09
108)	SVE System Operational	15-Jul-09	5-Oct-09
109)	SVE System Operational only with SVE Site 37/39/54 Wells	5-Oct-09	31-Dec-09
110)	SVE System Operational only with SVE Site 37/39/54 Wells	31-Dec-09	21-Jan-10
111)	SVE System Offline	21-Jan-10	13-Oct-10
112)	SVE System reconfigured for bioventing (BV) (air injection). BV System operational.	13-Oct-10	31-Dec-10
113)	BV System Operational	1-Jan-11	23-Mar-11
114)	Power Outage	23-Mar-11	24-Mar-11
115)	BV System Operational	24-Mar-11	18-Jul-11
116)	BV System Shut Down for Rebound	18-Jul-11	31-Dec-11
117)	BV System Operational	1-Jan-12	9-Feb-12
118)	Increased air flow to all site wells	9-Feb-12	7-Mar-12
119)	Shutdown system to repair break in piping at site 29	7-Mar-12	8-Mar-12
120)	BV System Operational	8-Mar-12	20-Mar-12
121)	Shutdown system to attach 37-PW-03 to the system	20-Mar-12	21-Mar-12

OPERATIONAL AND REMEDIAL HISTORY
SITE 37/39/54 SVE/BV SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 5 of 5)

	Event	Start Date	End Date
122)	Restart system without the South leg of Site 37 (39-SVE-01C, 37-PW-03, 37-PW- 06)	21-Mar-12	23-May-12
123)	Shutdown system to repair break	23-May-12	23-May-12
124)	BV System Operational	23-May-12	29-Jun-12
125)	Restarted South leg of Site 37	2-Apr-12	29-Jun-12
126)	Shutdown for rebound	29-Jun-12	22-Feb-13
127)	SVE System Operational	22-Feb-13	14-Oct-13
128)	Power Outage	14-Oct-13	17-Oct-13
129)	SVE System Operational	17-Oct-13	18-Dec-13
130)	System Shut Down for Respiration and Rebound Testing	18-Dec-13	31-Dec-13
131)	System Shut Down, Site Closed	31-Dec-13	present

Notes:
AWS = air/water separator BV = biovent/ bioventing lbs/day = pounds per day MWH = MWH Americas, Inc.
ROC = reactive organic compound
SMAQMD = Sacramento Metropolitan Air Quality Management District SVE = soil vapor extraction

TABLE 3

OPERATIONAL AND REMEDIAL HISTORY
SITE 57 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 1 of 4)

	Event	Start Date	End Date
1)	Notice to Proceed	17-Mar-97	-----
2)	Mobilization of Equipment	2-Mar-97	6-Mar-97
3)	Well Drilling Program (Phase I)	17-Mar-97	28-Mar-97
4)	Pilot Test	3-Apr-97	4-Apr-97
5)	SVE System Installation (Phase I)	7-May-97	15-Aug-97
6)	SVE System Startup and Proveout	19-Aug-97	17-Oct-97
7)	SVE System Operation (Catalytic Mode)	17-Oct-97	12-Jan-98
8)	Rebound Test Conducted	12-Jan-98	20-Feb-98
9)	Installed four Monitoring Points (Phase II): MPMP-4 through MPMP-7	11-Mar-98	1-Apr-98
10)	SVE System Shut Down when Vapor Cooling Water Backflushed into the Burner	17-Jul-98	3-Sep-98
11)	SVE System Operation (Catalytic Mode)	3-Sep-98	10-Dec-98
12)	Installed One Monitoring Point (Phase III): MPMP-8	1-Dec-98	2-Dec-98
13)	SVE System Shut Down, Electrical Problems	11-Dec-98	28-Feb-99
14)	SVE System Operation (Catalytic Mode)	1-Mar-99	15-Apr-99
15)	SVE System Shut Down, Troubleshooting	16-Apr-99	13-May-99
16)	SVE System Operation (Catalytic Mode)	14-May-99	30-Jun-99
17)	SVE System Shut Down for Operation Study by Praxis	14-Jul-99	30-Jul-99
18)	SVE System Operation (Catalytic Mode)	2-Aug-99	5-Oct-99
19)	SVE System Shut Down for Converting to GAC Mode	6-Oct-99	1-Nov-99
20)	SVE System Operation (GAC Mode)	2-Nov-99	22-Jul-00
21)	SVE System Shut Down for Rebound Study and Concurrent Warranty Repairs	22-Jul-00	1-Nov-00
22)	SVE System Operation (GAC Mode)	1-Nov-00	3-Feb-01
23)	SVE System Shut Down for Rebound Study and Concurrent Warranty Repairs	3-Feb-01	30-Mar-01
24)	SVE System Operation (GAC Mode)	30-Mar-01	17-Apr-01
25)	SVE System Shut Down for Sound Enclosure Construction	17-Apr-01	23-Apr-01
26)	SVE System Operation (GAC Mode)	23-Apr-01	14-Sep-01
27)	SVE System Shut Down for Dual Phase Extraction Activities	14-Sep-01	18-Sep-01
28)	SVE System Operation (GAC Mode)	18-Sep-01	27-Sep-01
29)	SVE System Shut Down for Dual Phase Extraction Activities	27-Sep-01	1-Oct-01
30)	SVE System Operation (GAC Mode)	1-Oct-01	9-Jul-03

OPERATIONAL AND REMEDIAL HISTORY
SITE 57 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 2 of 4)

	Event	Start Date	End Date
31)	SVE System Shut Down for System Blower Repairs	9-Jul-03	20-Aug-03
32)	SVE System Operation (GAC Mode)	20-Aug-03	30-Dec-03
33)	SVE System Shut Down SMAQMD Compliance Issue and to Perform a Rebound Test	30-Dec-03	8-Mar-04
34)	SVE System Operation (GAC no longer required, permission granted by SMAQMD 19 February 2004)	8-Mar-04	14-Jun-04
35)	SVE System Shut Down for Rebound Testing	14-Jun-04	12-Jul-04
36)	System Operational on Continuous Schedule	12-Jul-04	10-Dec-04
37)	System Shut Down to Perform Rebound Testing	10-Dec-04	4-Jan-05
38)	System Operational on Continuous Schedule	4-Jan-05	20-Apr-05
39)	SVE System Shut Down for 57-SVE-7A Tie-in	20-Apr-05	21-Apr-05
40)	System Operational on Continuous Schedule	21-Apr-05	3-Aug-05
41)	Installed One Multi-probe Monitoring Well	16-May-05	17-May-05
42)	57-SVE-7A brought Online to SVE System	18-May-05	18-May-05
43)	System Shut Down to Replace Blower Belt, for Long-Term Rebound Testing, and for the Soil and Soil Gas Survey	3-Aug-05	6-Dec-05
44)	System Operational on Continuous Schedule	6-Dec-05	8-Dec-05
45)	System Shut Down for Compliance Issue	8-Dec-05	28-Apr-06
46)	System Operational on Continuous Schedule	28-Apr-06	24-May-06
47)	System Shut Down awating Compliance Sample Results	24-May-06	5-Jun-06
48)	System Operational on Continuous Schedule	5-Jun-06	12-Jun-06
49)	System Shut Down awating Compliance Sample Results	12-Jun-06	30-Jun-06
50)	System Operational on Continuous Schedule	30-Jun-06	5-Oct-06
51)	System Shut Down for Rebound Testing	6-Oct-06	13-Dec-06
52)	System Operational Intermittently for Radius of Influence Testing	13-Dec-06	15-Dec-06
53)	System Shut Down for System Evaluation	15-Dec-06	4-Jan-07
54)	System Restarted and Operational on Continuous Schedule	4-Jan-07	14-Jan-07
55)	System Shut Down Due to High AWS Discharge Water Levels	14-Jan-07	16-Jan-07
56)	System Restarted and Operational on Continuous Schedule	16-Jan-07	19-Jan-07
57)	System Shut Down Due to High AWS Discharge Water Levels	19-Jan-07	22-Jan-07
58)	System Restarted and Operational on Continuous Schedule	22-Jan-07	26-Jan-07
59)	System Shut Down Due to High AWS Discharge Water Levels and Waiting for Carbon	26-Jan-07	5-Mar-07
60)	System Restarted and Operational on Continuous Schedule	5-Mar-07	9-Jul-07

OPERATIONAL AND REMEDIAL HISTORY
SITE 57 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 3 of 4)

	Event	Start Date	End Date
61)	System Shut Down Due to Blower Motor Failure	9-Jul-07	31-Jul-07
62)	System Restarted and Operational on Continuous Schedule	31-Jul-07	17-Aug-07
63)	System Shut Down Due to Low Air Flow at the System's Blower	17-Aug-07	21-Aug-07
64)	System Restarted and Operational on Continuous Schedule	21-Aug-07	8-Oct-07
65)	System Shut Down for Rebound and Drilling Activities	8-Oct-07	19-Feb-08
66)	System Restarted for Compliance Sampling	19-Feb-08	19-Feb-08
67)	System Shut Down after Compliance Sampling	19-Feb-08	25-Feb-08
68)	SVE System Operational	25-Feb-08	5-Aug-08
69)	System Shut Down for Rebound, Connection of 57-PW-01 and 57-PW-02 to the SVE System, and Replacement of Water-to-Air Heat Exchanger with Air-to-Air Heat Exchanger	5-Aug-08	1-Oct-08
70)	SVE System Operational with GAC	1-Oct-08	2-Dec-08
71)	System Shutdown due to Failed Blower and Motor	2-Dec-08	25-Feb-09
72)	System Offline for Air Emissions Compliance Verification	25-Feb-09	16-Mar-09
73)	SVE System Operational without GAC	16-Mar-09	27-May-09
74)	SVE System Shutdown for Rebound	27-May-09	15-Jul-09
75)	SVE System Operational without GAC	15-Jul-09	22-Jan-10
76)	SVE System Offline	22-Jan-10	6-Dec-11
77)	SVE System Operational with GAC	6-Dec-11	28-Dec-11
78)	SVE System Operational without GAC	28-Dec-11	21-Jan-12
79)	System shutdown due to high AWS tank level	21-Jan-12	23-Jan-12
80)	Restarted system	23-Jan-12	31-Jan-12
81)	Shutdown system for 1 hour to replace AWS flowmeter	31-Jan-12	31-Jan-12
82)	Restarted system	31-Jan-12	17-Mar-12
83)	System shutdown due to High AWS tank level	17-Mar-12	21-Mar-12
84)	Restarted system	21-Mar-12	13-Apr-12
85)	Shutdown due to High AWS tank	13-Apr-12	13-Apr-12
86)	Restarted system	13-Apr-12	29-Jun-12
87)	System Shut Down for Rebound Testing	29-Jun-12	10-Jan-13
88)	Restarted system	10-Jan-13	11-Jan-13
89)	Shutdown to preform repairs	11-Jan-13	11-Jan-13
90)	Restarted system	11-Jan-13	17-Jan-13

OPERATIONAL AND REMEDIAL HISTORY
SITE 57 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 4 of 4)

	Event	Start Date	End Date
91)	Shutdown due to High AWS	17-Jan-13	21-Jan-13
92)	Restarted system	21-Jan-13	29-Jan-13
93)	Shutdown due to High AWS	29-Jan-13	29-Jan-13
94)	Restarted system	29-Jan-13	31-Jan-13
95)	Shutdown due to High AWS	31-Jan-13	4-Feb-13
96)	Restarted system	4-Feb-13	14-Apr-13
97)	Shut down until new heat exchanger motor installed	14-Apr-13	1-May-13
98)	Restarted system with new motor	1-May-13	3-May-13
99)	Shut down, system heat exhanger fan broken	3-May-13	6-May-13
100)	Restarted system with new fan	6-May-13	10-Jun-13
101)	Bypassed carbon unit	10-Jun-13	30-Jul-13
102)	System shut down for rebound testing	30-Jul-13	31-Dec-13
103)	System shut down for rebound testing	31-Dec-13	23-Sep-14
104)	Restarted system with GAC	23-Sep-14	28-Oct-14
105)	Bypassed carbon unit	28-Oct-14	3-Nov-14
106)	Shut Down due to blower oil leak	3-Nov-14	16-Dec-14
107)	Blower repaired and reinstalled; Restarted SVE system; Repeated intermittent shut downs and restarts 16 December through 31 December, due to high AWS	16-Dec-14	31-Dec-14
108)	Repeated intermittent shut downs and restarts 31 December through 1 February, due to high AWS	31-Dec-14	1-Feb-15
109)	System Shut Down, Site Closed	1-Feb-15	present

Notes:
AWS = Air Water Separator GAC = granular-activated carbon
SMAQMD = Sacramento Metropolitan Air Quality Management District
SVE = soil vapor extraction

OPERATIONAL AND REMEDIAL HISTORY
SITE 59 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 1 of 4)

	Event	Start Date	End Date
1)	First Phase SVE Well & SVMP Drilling Program	14-Oct-98	6-Nov-98
2)	Pilot Test	10-Dec-98	16-Dec-98
3)	Second Phase SVE Well & SVMP Drilling Program	10-Jun-99	7-Jul-99
4)	SVE System Installation	27-Oct-99	1-Nov-99
5)	Utility Installation	2-Nov-99	21-Jan-99
6)	SVE System Startup and Proveout	8-Feb-00	16-Aug-00
7)	SVE System Operation (Catalytic Oxidation Mode	16-Aug-00	13-Oct-00
8)	System Shut Down as a Result of Scrubber Problems	13-Oct-00	14-Dec-00
9)	SVE System Operation (Catalytic Oxidation Mode	14-Dec-00	3-Feb-01
10)	System Shut Down as a Result of Scrubber Problems	3-Feb-01	20-Feb-01
11)	SVE System Operation (Catalytic Oxidation Mode	20-Feb-01	18-Jun-01
12)	System Shut Down for Long-Term Rebound Test	18-Jun-01	26-Oct-01
13)	Catalytic Oxidizer Removed from Service. Soil Vapor Re-routed to the Site 18 SVE GAC System	2-Aug-01	2-Aug-01
14)	SVE System (GAC Mode) Operational, Cycled Operation Beginning 2/8/02	26-Oct-01	18-Jun-02
15)	SVE System Shutdown for Rebound Test	18-Jun-02	28-Jun-02
16)	SVE System Operation (GAC Mode) cycled (4 days on, 3 days off)	28-Jun-02	16-Nov-02
17)	SVE System Shut Down for Rebound Test	16-Nov-02	2-Dec-02
18)	SVE System Operation cycled (4 days on, 3 days off	2-Dec-02	31-Dec-02
19)	SVE System Operation Cycle Changed (3 days on, 4 days off)	1-Jan-03	23-May-03
20)	SVE Cat-OX System Removed for Use at Castle AFB	21-Mar-03	21-Mar-03
21)	SVE System Shut Down for Rebound Test	23-May-03	30-Jun-03
22)	SVE System Operation Cycle Changed (3 days on, 4 days off)	30-Jun-03	17-Jul-03
23)	SVE System Shut Down for Rebound Test	17-Jul-03	22-Aug-03
24)	SVE System Operating on Continuos Schedule	22-Aug-03	5-Dec-03
25)	SVE System Shut Down for Rebound Test	5-Dec-03	9-Mar-04
26)	SVE System Operating on Continuos Schedule	9-Mar-04	23-Mar-04
27)	SVE System Shut Down to Repair Blower	23-Mar-04	31-Mar-04
28)	SVE System Operating on Continuous Schedule	31-Mar-04	2-Apr-04
29)	SVE System Shut Down Due to System Electrical Problem	2-Apr-04	8-Apr-04
30)	SVE System Operating on Continuous Schedule	8-Apr-04	16-Apr-04
31)	SVE System Shut Down to Perform Pilot Study at Site 59, Addition of MAFB-105.	16-Apr-04	19-Apr-04

OPERATIONAL AND REMEDIAL HISTORY
SITE 59 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 2 of 4)

	Event	Start Date	End Date
32)	SVE System with GAC Operational on Continuous Schedule	19-Apr-04	17-May-04
33)	SVE System Shut Down for Drilling and Installation of Additional Vadose Zone Wells at Site 59	17-May-04	16-Jun-04
34)	Site 59 Rebound Testing, Tie-in Newly Installed SVE Wells to SVE System, Perform System Carbon Changeout	16-Jun-04	31-Aug-04
35)	SVE System with GAC Operational on Continuous Schedule	31-Aug-04	3-Sep-04
36)	System Shut Down to Await Results from Confirmation Compliance Sample Collected on 9/3/04	3-Sep-04	13-Sep-04
37)	SVE System with no GAC Operational on Continuous Schedule. GAC removed based on substantive requirements met according to	13-Sep-04	15-Oct-04
38)	System Shut Down because Field Readings from October Compliance Sample Indicated System Not Operating Properly	15-Oct-04	29-Oct-04
39)	SVE System Operational with GAC on Continuous Schedule	29-Oct-04	29-Nov-04
40)	SVE System Shut Down Due to Broken System Blower Belt	29-Nov-04	2-Dec-04
41)	SVE System Operational with GAC on Continuous Schedule	2-Dec-04	3-Dec-04
42)	SVE System to Perform Repairs to System Blower	3-Dec-04	4-Jan-05
43)	SVE System Operational with GAC on Continuous Schedule	4-Jan-05	30-Jan-05
44)	SVE System Shut Down due to High AWS Discharge Tank Level	30-Jan-05	3-Feb-05
45)	SVE System Operational with GAC on Continuous Schedule	3-Feb-05	3-Mar-05
46)	SVE System Shut Down for Rebound Test	3-Mar-05	2-May-05
47)	SVE System Operational with GAC on Continuous Schedule	2-May-05	20-Jun-05
48)	System Shut Down due to Water Line Tie-in	20-Jun-05	24-Jun-05
49)	SVE System Operational with GAC on Continuous Schedule	24-Jun-05	1-Aug-05
50)	System Shut Down for Long-Term Rebound Testing and for the Soil	1-Aug-05	28-Feb-06
51)	SVE System Operational on Continuous Schedule; GAC Abatement Removed (Numerous shutdowns due to High AWS Discharge Tank)	28-Feb-06	28-Apr-06
52)	SVE System Operational	28-Apr-06	5-Oct-06
53)	SVE Shut Down for Rebound Testing	5-Oct-06	8-Dec-06
54)	SVE System Restarted for Radius of Influence Testing	8-Dec-06	11-Dec-06
55)	SVE System Shut Down for System Evaluation	11-Dec-06	1-Jan-07
56)	SVE System Operational	1-Jan-07	15-Jan-07
57)	SVE System Shut Down due to High AWS Discharge Tank Level	15-Jan-07	17-Jan-07
58)	SVE System Operational	17-Jan-07	15-Mar-07
59)	SVE System Operational; Vapor Extraction Well 18-SVE-004 Brought	15-Mar-07	17-Mar-07
60)	SVE System Operational	17-Mar-07	8-Oct-07
61)	SVE System Shut Down for Rebound and Drilling Activities at Site 59	8-Oct-07	9-Apr-08
62)	SVE System Operational	9-Apr-08	5-Jun-08

OPERATIONAL AND REMEDIAL HISTORY
SITE 59 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 3 of 4)

	Event	Start Date	End Date
63)	SVE System Shut Down for Utility Service Interruption	5-Jun-08	9-Jun-08
64)	SVE System Operational	9-Jun-08	4-Aug-08
65)	Performed Pilot Vacuum Extraction Test at 59-PW-02	4-Aug-08	4-Aug-08
66)	SVE System Operational	4-Aug-08	15-Aug-08
67)	SVE System Shut Down for Rebound	15-Aug-08	1-Oct-08
68)	SVE System Operational	1-Oct-08	12-Nov-08
69)	SVE System Shut Down for AWS Pump and Heat Exchanger Replacement	12-Nov-08	9-Jan-09
70)	SVE System Operational with New Heat Exchanger	9-Jan-09	12-Jan-09
71)	SVE System Shut Down as Blower and Motor Failed	12-Jan-09	22-Jul-09
72)	SVE System Operational after Replacement of Blower and Motor	22-Jul-09	25-Aug-09
73)	SVE System Shut Down for Drilling Activities at the Site	25-Aug-09	9-Dec-09
74)	SVE System Operational	9-Dec-09	29-Jan-10
75)	SVE System Shut Down for Rebound Sampling	29-Jan-10	18-Nov-10
76)	SVE System Operational	18-Nov-10	31-Dec-10
77)	Shut Down for Rebound Sampling	30-Jun-11	6-Dec-11
78)	Down for Additional wells to be added to the System	6-Dec-11	31-Dec-11
79)	Down for new pipeline to be installed	1-Jan-12	13-Mar-12
80)	SVE System Operational with VGAC	13-Mar-12	19-Mar-12
81)	Est. time: Belts broke and system stopped treating	19-Mar-12	22-Mar-12
82)	Replaced belts and restarted the system	22-Mar-12	4-May-12
83)	System shutdown due to high SVE Temp	4-May-12	10-May-12
84)	SVE System Operational with VGAC	10-May-12	28-Jun-12
85)	Shut Down for Rebound Sampling	28-Jun-12	9-Feb-13
86)	SVE System Operational with VGAC	9-Feb-13	28-Feb-13
87)	SVE System Shut Down due to High AWS Alarm	28-Feb-13	1-Mar-13
88)	SVE System Operational with VGAC	1-Mar-13	18-Apr-13
89)	Shut down the system to clean out filters	18-Apr-13	29-Apr-13
90)	SVE System Operational with VGAC	29-Apr-13	3-May-13
91)	System shut down	3-May-13	6-May-13
92)	SVE System Operational with VGAC	6-May-13	3-Jun-13
93)	System shutdown electrical issue	3-Jun-13	4-Jun-13
94)	SVE System Operational with VGAC	4-Jun-13	10-Jun-13

OPERATIONAL AND REMEDIAL HISTORY
SITE 59 SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 4 of 4)

	Event	Start Date	End Date
95)	Bypassed carbon (VGAC) unit	10-Jun-13	30-Jul-13
96)	Shut Down for Rebound Sampling	30-Jul-13	31-Dec-13
97)	System Shut Down, Site Closed	31-Dec-13	present

Notes:
AWS = air/water separator SVE = soil vapor extraction
SVMP = soil vapor monitoring point
VGAC = vapor-phase granular-activated carbon

OPERATIONAL AND REMEDIAL HISTORY
SITE 23C SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 1 of 4)

	Event	Start Date	End Date
1)	First Phase SVMP Drilling Program	19-Oct-98	13-Nov-98
2)	First Phase SVE Well Drilling Program	4-Jan-99	12-Jan-99
3)	Second Phase SVE Well & SVMP Drilling Program	23-Jun-99	20-Jul-99
4)	SVE System Installation	25-Oct-99	25-Feb-00
5)	Utility Installation	28-Feb-00	29-Mar-00
6)	CAT-OX System Startup and Proveout	12-Apr-00	28-Aug-00
7)	SVE System Operation	28-Aug-00	28-Nov-00
8)	System Shut Down Due to Water Accumulation in the Conveyance Piping	28-Nov-00	23-Jan-01
9)	SVE System Operation	23-Jan-01	18-Mar-01
10)	SVE Shut Down Due to Mechanical Problems	18-Mar-01	26-Mar-01
11)	SVE System Operation	26-Mar-01	1-Apr-01
12)	SVE Shut Down for Sound Insulation Installation	1-Apr-01	5-Apr-01
13)	SVE System Operation	5-Apr-01	24-Apr-01
14)	SVE Shut Down Due to pH Controller Problems	24-Apr-01	15-May-01
15)	SVE System Operation	15-May-01	31-May-01
16)	SVE Shut Down Due to Recirculation Pump Problems	31-May-01	11-Jun-01
17)	SVE System Operation	11-Jun-01	14-Jun-01
18)	SVE Shut Down Due to pH Problems	14-Jun-01	6-Jul-01
19)	SVE Shut Down for Rebound Testing	6-Jul-01	27-Aug-01
20)	SVE System Operation	27-Aug-01	2-Sep-01
21)	SVE Shut Down Due to Throwing Blower Drive Belt	2-Sep-01	26-Sep-01
22)	SVE System Operation	26-Sep-01	8-Oct-01
23)	SVE Shut Down Due to Recirculation Pump Problems	8-Oct-01	25-Oct-01
24)	SVE System Operation	25-Oct-01	11-Nov-01
25)	SVE Shut Down Due to Scrubber Problem	11-Nov-01	15-Nov-01
26)	SVE System Operation	15-Nov-01	19-Nov-01
27)	SVE Shut Down Due to Sight Glass Fouling	19-Nov-01	28-Nov-01
28)	SVE System Operation	28-Nov-01	1-Dec-01
29)	SVE Shut Down Due to Flame out problem and to clean combustion chamber	1-Dec-01	6-Dec-01
30)	SVE System Operation	6-Dec-01	24-Dec-01
31)	SVE Shut Down Due to Flame out problem and to clean UV sensor.	24-Dec-01	31-Dec-01

OPERATIONAL AND REMEDIAL HISTORY
SITE 23C SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 2 of 4)

	Event	Start Date	End Date
32)	SVE System Operation	31-Dec-01	28-Jan-02
33)	System Shut Down due to system conversion to GAC mode	28-Jan-02	13-Feb-02
34)	SVE System Operation	13-Feb-02	15-Mar-02
35)	SVE System Shut Down for Rebound Testing	15-Mar-02	23-Apr-02
36)	SVE System Operation	23-Apr-02	26-Mar-03
37)	SVE System Shut Down for Carbon Changeout	26-Mar-03	26-Mar-03
38)	SVE System Operation	26-Mar-03	9-Jun-03
39)	SVE Shut Down for Rebound Testing	9-Jun-03	24-Jun-03
40)	SVE System Operation	24-Jun-03	26-Nov-03
41)	SVE Shut Down due to SMAQMD Compliance Issue and for Rebound Testing	26-Nov-03	7-Jan-04
42)	SVE System Operation	7-Jan-04	17-Jun-04
43)	SVE System Shut Down for Rebound Testing	17-Jun-04	1-Jul-04
44)	SVE System Operation	1-Jul-04	17-Nov-04
45)	SVE System Shut Down for Rebound Testing	17-Nov-04	8-Dec-04
46)	SVE System Operation	8-Dec-04	2-Jun-05
47)	SVE System Shut Down for Carbon Changeout	13-Jan-05	13-Jan-05
48)	SVE System Shut Down for Rebound Testing	2-Jun-05	22-Jun-05
49)	SVE System Operation	22-Jun-05	5-Aug-05
50)	Soil Gas Survey Performed	27-Oct-05	27-Oct-05
51)	SVE System Shut Down for Long-Term Rebound Testing and for the Soil and Soil Gas Survey	5-Aug-05	4-Jan-06
52)	SVE System Operation	4-Jan-06	16-Jan-06
53)	SVE System Shut Down for System Evaluation	16-Jan-06	26-Jan-06
54)	SVE System Operation	26-Jan-06	3-Feb-06
55)	SVE System Shut Down for Carbon Changeout	3-Feb-06	3-Feb-06
56)	SVE System Operation	3-Feb-06	4-Apr-06
57)	SVE System Shut Down for System Evaluation	4-Apr-06	20-Apr-06
58)	SVE System Operation	20-Apr-06	5-Oct-06
59)	SVE Sytem Shut Down for Rebound Testing	5-Oct-06	21-Dec-06
60)	SVE System Restarted for Radius of Influence Testing	22-Dec-06	27-Dec-06
61)	SVE Sytem Shut Down for System Evaluation	28-Dec-06	31-Dec-06

OPERATIONAL AND REMEDIAL HISTORY
SITE 23C SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 3 of 4)

	Event	Start Date	End Date
62)	SVE Sytem Shut Down for System Evaluation	31-Dec-06	2-Feb-07
63)	SVE System Operation	2-Feb-07	8-Oct-07
64)	SVE System Shut Down for Rebound and Drilling Activities	8-Oct-07	2-Apr-08
65)	SVE System Operational	2-Apr-08	21-Apr-08
66)	SVE System Shut Down	21-Apr-08	1-May-08
67)	SVE System Operational	1-May-08	15-Aug-08
68)	SVE System Shut Down for Rebound	15-Aug-08	1-Oct-08
69)	SVE System Operational	1-Oct-08	25-Dec-08
70)	SVE System Shut Down for AWS Maintenance	25-Dec-08	31-Dec-08
71)	SVE System Operational	31-Dec-08	27-May-09
72)	SVE System Shut Down for Rebound, GAC change-out)	26-May-09	15-Jul-09
73)	SVE System Operational	15-Jul-09	3-Sep-09
74)	SVE System Shut Down to Replace Heat Exchanger Motor	3-Sep-09	14-Sep-09
75)	SVE System Operational	14-Sep-09	22-Jul-10
76)	SVE System Shut Down for Rebound	22-Jul-10	19-Nov-10
77)	SVE System Operational	19-Nov-10	31-Dec-10
78)	Various Shutdowns/ Troubleshooting/Repair	1-Jan-11	10-Jan-11
79)	SVE System Operational	10-Jan-11	30-Jun-11
80)	System Down for Rebound	30-Jun-11	6-Dec-11
81)	SVE System Operational	6-Dec-11	31-Dec-11
82)	SVE System Operational	1-Jan-12	27-Apr-12
83)	Shutdown system to tighten the belts	27-Apr-12	27-Apr-12
84)	SVE System Operational	27-Apr-12	29-Jun-12
85)	System Down for Rebound	29-Jun-12	10-Jan-13
86)	SVE System Operational	10-Jan-13	25-Jul-13
87)	SVE System Shut Down, no alarms	25-Jul-13	13-Sep-13
88)	SVE System Operational	13-Sep-13	14-Oct-13
89)	SVE System Shut Down due to Power Outage	14-Oct-13	17-Oct-13
90)	SVE System Operational	17-Oct-13	23-Dec-13
91)	VGAC Change-Out	23-Dec-13	23-Dec-13
92)	SVE System Operational	23-Dec-13	31-Dec-13

OPERATIONAL AND REMEDIAL HISTORY
SITE 23C SVE SYSTEM
FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

(Page 4 of 4)

	Event	Start Date	End Date
93)	SVE System Operational	1-Jan-14	25-Oct-14
94)	SVE System Shut Down due to Failed VFD	25-Oct-14	31-Oct-14
95)	SVE System Operational	31-Oct-14	31-Dec-14
96)	SVE System Operational	1-Jan-15	30-Apr-15
97)	System Shut Down, Site Closed	30-Apr-15	present

Notes:
AWS = air water seperator
CAT-OX = catalytic oxidizer
GAC = granular-activated carbon
pH = potential hydrogen
SMAQMD = Sacramento Metropolitan Air Quality Management District
SVE = soil vapor extraction
SVMP = soil vapor monitoring point
UV = ultraviolet
VFD = variable-frequency drive

APPENDIX C

Interview Records

TABLE OF CONTENTS

List of Interviewees

Former Mather Air Force Base Operations and Maintenance Representatives

1 Molly Enloe, Air Force Environmental Support Contractor, Cherokee Nation Business Services
2 Gary Yuki, Air Force Environmental Support Contractor, Cherokee Nation Business Services
3 Paul Graff, Project Manager, Former Mather AFB Previous Performance Based Remediation Contract, AECOM
4 John Thomas, Project Manager, Former Mather AFB Performance Based Remediation Contract, Cape Environmental Management Inc
5 Catherine McMillen, Project Manager, Former Mather AFB Contractor, Aerostar SES LLC
6 Marcos Arias, Operations and Maintenance Field Technician, Former Mather AFB, Performance Based Remediation Contract, Cape Environmental Management Inc

Community Representatives

1 Rick Balazs, County Representative, Economic Development, Sacramento County
2 Ron Ogle, Mather Airport Manager, Sacramento County
3 Evan Jacob, External Affairs Department, California American Water
4 Tim Miller, Senior Director of Water Quality and Environmental Compliance, California American Water
5 Quentin House, Director of Maintenance, Mather Aviation

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 8/15/19**

Molly Enloe
Air Force Environmental Support Contractor
Cherokee Nation Business Services
3237 Peacekeeper Way, Suite 205, McClellan, CA 95652

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

My overall impression is the selected remedies are appropriate and protective.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

For the most part, the remedies are functioning as expected. In some areas, site conditions have affected the expected performance of the remedy. For example, declining water tables have resulted in lowered extraction rates at the AC&W groundwater plume, requiring evaluation of alternative remedial technologies and responses. However, the remedy remains protective of human health and the environment. The TCE plume is captured by the existing AC&W extraction wells, and there are no completed pathways of exposure to human or ecological receptors. At Site 23C, a diffusion-limited soil layer resulted in asymptotic mass removal rates. However, soil vapor and groundwater modeling showed that the SVE remedy had achieved the ROD objective of protecting groundwater. The groundwater monitoring data for the site support the results of the model (i.e., groundwater samples have been non-detect for PCE for four consecutive years since shut-down of the SVE system). There are no existing buildings on the property overlying the residual shallow soil vapor plume (now a County park), and shallow soil vapor concentrations indicate a vapor intrusion risk of less than 1x10-4 at existing buildings on properties adjacent to the park.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Groundwater monitoring data show that contaminant concentrations are generally stable or decreasing, and target reductions in the concentrations of contaminants of concern and in plume size are being achieved in most locations. Monitoring data have not been consistently collected over the last five year in all locations due to declining water tables. A replacement well was recommended in at least one location. Declining water table levels at AC&W have resulted in lower extraction rates, which inhibits treatment of the contaminant plume. Evaluation of alternative remedial technologies and responses is being conducted.

Soil vapor monitoring is occurring only at B4260. The data show that the remedy is operating effectively. TCE concentrations in soil vapor monitoring wells showed significant reductions after start-up of the SVE system, particularly in the immediate vicinity of the source area. The maximum

site concentration has been reduced from 2,400 parts per million by volume (ppmv) to 0.35 ppmv. TCE concentrations have also decreased at monitoring wells over 200 feet from the SVE well. The system has removed almost 64 pounds of TCE from the subsurface. Mass removal rates have substantially declined since start-up of the system, indicating the need for a rebound assessment in the near future.

4. Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.

Unexpected O&M costs have resulted from two primary events: the discovery of a new soil vapor source area at B4260, and the need to add treatment systems for emerging contaminants at the Main Base/Sac Area and Site 7 groundwater treatment plants. At B4260, an SVE removal action was implemented to address the new soil vapor source area. The system was completed and began operating in August 2018, and the system has continued to operate since then. In 2016, the USEPA established lifetime health advisories (HA) for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in drinking water. Effluent streams from the Main Base/Sac Area and Site 7 groundwater treatment plants were sampled and exceeded the HA levels. Because the effluent from both treatment plants is re-injected into an aquifer that is used in off-base areas for drinking water supply wells, the treatment plants were retro-fitted with granular-activated carbon (GAC) treatment to remove PFOA and PFOS prior to re-injection. The discovery of these emerging contaminants and installation of two GAC treatment systems resulted in significant unexpected O&M costs. In addition to these unexpected costs, there were some unexpected difficulties in keeping extraction wells and groundwater treatment systems consistently operating during the transition from one O&M contractor to the next.

5. Has the former Mather AFB been in compliance with permitting and reporting requirements?

Yes, I believe Mather AFB is in compliance with all permitting and reporting requirements.

6. Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?

The institutional control (IC) remedies at Mather require transferees and subsequent land owners to conduct site inspections for IC compliance and to submit annual monitoring reports on the status of the ICs. The major landowner, Sacramento County, has conducted annual IC compliance inspections each year with the Air Force and regulatory agencies; however, no documentation of these inspections has been provided to the Air Force. In 2017, the Air Force began preparing its own annual IC compliance report to document the status of the ICs. To my knowledge, no violations of ICs have been noted during the annual inspections over the last 5 years.

7. Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?

In general, I believe the IRP remedies have been implemented in compliance with the RODs and are achieving their intended purpose.

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

My only comment or recommendation regarding future effectiveness of operations is that system controls and equipment need to be regularly maintained and updated to avoid unexpected shut-downs and facilitate smooth transitions between O&M contractors.

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

My greatest concern is the difficulties that have been encountered in the groundwater cleanup due to the declining water table.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

Yes. In 2016, the USEPA established lifetime HAs for PFOS and PFOA in drinking water. The Main Base/Sac Area and Site 7 groundwater treatment plants were retro-fitted with GAC treatment systems to remove PFOS and PFOA prior to re-injection into the groundwater aquifer. The installation of these treatment systems has not impacted the effectiveness of the selected groundwater remedies in terms of their ability to contain and remediate VOCs in groundwater. Both treatment plants continue to remove VOCs in groundwater using an air stripper prior to GAC treatment. The GAC treatment has been effective in removing PFOS and PFOA to below HA levels prior to re-injection.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

To my knowledge the O&M and sampling efforts have been optimized to the extent feasible and appropriate.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 8/14/19**

Gary Yuki
Air Force Environmental Support Contractor
Cherokee Nation Business Services
3237 Peacekeeper Way, Suite 205, McClellan, CA 95652

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

My overall impression is the selected remedies are adequate and protective to human health and environment.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

I have no concerns regarding the function and adequacy of the remedies.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

The groundwater data show mostly stable and decreasing concentrations of contaminants of concern. The SVE system installed at B4260 appears to be an effective remedy in treating TCE concentrations in the vadose zone.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

No input

5. **Has the former Mather AFB been in compliance with permitting and reporting requirements?**

It is my understanding that Mather AFB has been in compliance with permitting and reporting.

6. **Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?**

Annual IC compliance reporting has been conducted and no deficiencies have been noted.

7. Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?

I have no comments, suggestions or recommendations

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

I have no comments or recommendations

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

I have no concerns as it applies to the ongoing performance of the IRP remedies.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

PFAS/PFOA have been identified as emerging contaminants that appear to have negligible impact on effectiveness of the GW remedy. The GAC units installed at MB/SAC and Site 7 treatment systems are effectively removing PFAS/PFOA from plant effluent prior to re-injection into to the aquifer.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

I have no comment or input.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 8/22/19**

Paul Graff
Project Manager
AECOM
3237 Peacekeeper Way, Suite 205, McClellan, CA 95652

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

They seem to be appropriate and working as designed.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

As well as can be expected. Pump and treat can be a slow process for groundwater remediation. No.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Groundwater and soil gas data show contaminant levels are decreasing.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

Yes, the electronic control system for the groundwater extraction wells is very outdated, goes down frequently and is difficult to repair. It needs to be upgraded although that will be a significant cost.

5. **Has the former Mather AFB been in compliance with permitting and reporting requirements?**

Yes.

6. **Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?**

Yes, although some of the reports have been late. Annual site walks and perhaps daily general observations. Not that I know of.

7. **Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?**

No.

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

May want to look into monitored natural attenuation as part of the groundwater remedy.

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

That pump and treat will operate for decades and possibly not achieve the groundwater cleanup levels.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

Yes, PFOS/PFOA. Additional groundwater treatment is required, but the effectiveness of the ongoing remedy seems unimpacted.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

Probably, although I'm not sure. I believe some wells are sampled less frequently and I know the contractor is looking at ways to optimize.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 8/13/19**

John Thomas
Project Manager
Cape Environmental Management Inc
500 Pinnacle Court, Suite 100, Norcross, GA 30071

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

Based on our experience over the last three years (2016 – 2019) the CAPE Team has become familiar with each of the remedies in-place at the 19 IRP sites. CAPE has performed the system operation and maintenance (O&M), routine compliance monitoring and data analysis, site inspections and regulatory compliance reporting for all sites. Each selected remedy has been found to be properly applied and proactive of human health and the environment.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

CAPE is responsible for monitoring and documentation related to the protectiveness and performance of the remedies and/or remediation systems. CAPE has found that the government has implemented relatively robust, large scale treatment of the known areas of interest, and has operated those systems for over a decade. The Air Force and its contractors have ensured that the systems meet or exceed the established clean-up requirements.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Vapor monitoring data and groundwater data are reflective of the type of data trends seen for systems that have been operated for an extended period. Generally, significant amounts contaminant mass is removed from the environment early in the operational life and the rate of clean-up slows in later years. Continued operation of the systems will, at some time in the future, reduce soil and groundwater contamination to levels where active treatment can be terminated.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

No. There have been no significant O&M challenges or additional cost to the Government.

5. **Has the former Mather AFB been in compliance with permitting and reporting requirements?**

Yes. Meeting the reporting and compliance requirements is Air Force and BRAC Western Region's priority. BRAC Western Region have open and clear communication mechanisms with State and Federal Regulators and regularly host meetings to update regulators and community representatives.

6. Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?

Institutional controls are in-place at 16 sites at the former Mather AFB. Each site is visually inspected and the existing conditions of the site are documented in accordance with each specific Record of Decision Document. If deficiencies are noted (e.g. damage to fencing, cap repair or missing signage) those deficiencies are corrected in a timely manner.

7. Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?

The BRAC Western Region Staff are immersed in and committed to safe and effective implementation and operation of the remediation systems and Institutional Controls at the former Mather AFB. The staff has significant institutional knowledge and work effectively with contractors, regulators, and community.

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

Based on groundwater data the current active remedies continue to be protective of human health and the environment and with the appropriate O&M will continue to be protective in the future. In general, the systems are sufficiently robust and have operated long enough to significantly impact contaminant concentration. Future in-situ optimization options would have to be studied to evaluate if the return is worth the investment.

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

I have no concerns with the ongoing performance of IRP remedies. As a contractor to the Government, CAPE works closely with BRAC Western Region staff and fully understands the performance and compliance requirements. The Air Force is committed to the environmental restoration of the sites(s) and looks forward to returning the property over to the community once remediation is completed.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

The Air Force is generally out in-front of evaluation and reporting of emerging contaminants and coordinating study and reporting of these constituents as they are observed. In this case, emerging contaminants have been noted but in no way impact the effectiveness of the remedies in place at the site(s).

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

Yes. Current and previous contractors have worked with the former Mather AFB IRP Team and BRAC Western Region to continuously evaluate what efforts can be made to optimize remediation operations. Over time, day-to-day maintenance schedules, sampling routines, and reporting have been streamlined to lower operational costs. The Mather team has consistently evaluated groundwater monitoring well data and well locations to recommend discontinuing sample of groundwater monitoring wells where appropriate. The IRP team has also optimized the regulatory review and approval process to some extent by hosting semi-annual meetings with State and Federal regulators.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 8/19/19**

Catherine McMillen
Project Manager
Aerostar SES LLC
1006 Floyd Culler Court, Oak Ridge, TN, 37830

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

I have not been involved with the Mather IRP program and do not have much knowledge of the effectiveness of the remedies.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

No input– I am not involved with these programs.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

No input – I am not involved with these programs.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

No input – I am not involved with these programs.

5. **Has the former Mather AFB been in compliance with permitting and reporting requirements?**

No input – I am not involved with these programs.

6. **Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?**

No input – I am not involved with these programs.

7. **Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?**

No input – I am not involved with these programs.

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

No input – I am not involved with these programs.

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

Prior to reinjection, groundwater should continue to be treated with GAC to treat PFOS and PFOA in groundwater.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

PFOS and PFOA have been identified in groundwater at concentrations exceeding the USEPA lifetime health advisory (LHA). Their presence in groundwater have not impacted the effectiveness of any existing remedies for the contaminants being treated per the ROD. The Site 7 and MBSA treatment systems were upgraded in 2016 and 2018, respectively, to include GAC to remove PFOS and PFOA from groundwater prior to reinjection. The inclusion of GAC into the treatment systems has not impacted the effectiveness of the existing remedies.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

To remove PFOS and PFOA from groundwater, both the Site 7 and the MBSA treatment plants have been retrofitted to include GAC. This has likely resulted in additional O&M and sampling requirements at these facilities.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 8/21/19**

Marcos Arias
Operations and Maintenance Field Technician
Cape Environmental Management Inc
500 Pinnacle Court, Suite 100, Norcross, GA 30071

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

I have had first-hand experience with the operations of the systems this last year. I feel the monitoring and the pre planning has a great deal of expertise involved and the results should show how effective the IRP is evolving with the changing conditions of the natural elements involved. With the continuous control I do feel the remedies will have a grand effect on the area of treatment.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

The remedies are having favorable results, and with the steady checking of the system sampling, and overview of the process, we will see the effects.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

The data show how we are obtaining favorable results at a pace unable to be compared to any other, simply because there is not an Identical system available for comparison. I really don't see or have compared results for a comment on decreased level trends.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

Yes, we have had several unplanned shut downs because of power failures/surges, mechanical failures, communications and electrical faults that have hindered our efforts to run safely, effectively, and continuously.

We have had more than 4 power surges/failures in the last 12 months. This has had damaging effects on the main computer, which was replaced from rebuilt. Since the programs and system is not supported any longer, we have had to reach into the e-waste recycle bin and piece together system we have now. The process of doing this cost time with an outside contractor, time loss of production, man hours trouble shooting, and hardware costs, which is not guaranteed because of the age of the hardware and software (both no longer supported or made).

The ripple effect of the power surges/failures ran across the plant with the Influent flow meter also failing. We replace the 8" inline flowmeter. The flow meter was no longer supported (for repair) and

no longer made. Time loss for trouble shooting, and installation. Along with down time. Recently we have had a surge/failure that has shut down the plant because of a blown fuse. This was a lengthy investigation of what was the issue. Time loss of production, cost of an outside contractor.

I need to mention the communications was partially influenced by the power surge/failure. The uplink portion of the transmission of the plant through the cell towers had stopped working during one of these events. The discovery of the non-communications was trouble shot by CAPE and a couple of outside contractors. We uncovered two problems. 1. The cell towers in October of 2018 were no longer supporting the 3G network and we were on that network (discussion of why the system failed in November and not in October is still ongoing and considered a mystery). 2. The uplink system or device was outdated, no longer built or supported. Thus, we had purchased a new 4G supported device to enable us communications from the plant to the Technician (for better control of the process).

Along with the communications there is a SCADA (Supervisory Control and Data Acquisition) used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation. With the continuous use of the SCADA we discovered the program was outdated and not letting us maintain constant control and or have the ability to obtain and respond to events at the plant. This is costly with man hours of close physical monitoring, trouble shooting, and upgrading.

Fiber optic communications problem of the supporting wells to the treatment plants. These communications drop off periodically at different places at various times of the day. Making it difficult to run and chase down the faults.

5. Has the former Mather AFB been in compliance with permitting and reporting requirements?

I have experienced meetings with the orchestrators of the project and they seem very in tune with acquiring, the proper permitting and reporting of the project.

6. Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?

There have been reporting regularly and continued collaboration that indicates the proper reporting and monitoring procedures are strictly followed.

7. Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?

No, I do not have any comment.

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

If we can tackle one issue at a time and update the outdated material needed to safely operate and control over the operations, we can bank on the continued desired effects of the planned project.

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

The general condition of the components that run the systems on how they are slowly needing replacement. The outdated material is very costly to keep the systems running and this hinders our efforts, so replacement of parts is in our future.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

I have not viewed the results in comparison to make an educated answer.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

Yes, we (project team members) are continually reviewing and updating the procedures for operations and maintenance. Where we have adjusted the sampling procedures to maintain a controlled environment on the ever-changing conditions, and requirements to get the most out of the events.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 7/30/19**

Rick Balazs
Senior Project Manager
Sacramento County Office of Economic Development
700 H Street, Suite 6750, Sacramento, CA 95814

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

They seem to be appropriate remedies that have gotten us to OPS. It has cleaned up some parcels that have allowed the county to market and develop where we needed to. From my perspective, there hasn't been a lot of surprises. Any parcel that has a burden on it, we are well aware of it. It's not like we get into discussion with somebody and then we get to the planning stage and then we find out that there is something such as a dig restriction or land use restriction. So, time frame wise, it takes a long time and we were made well aware of that. Any time that I need any information or assistance to understand what is going on, not only the Air Force, but also our regulatory partners have been there to bring information to the table.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

Yes. I don't have concerns. When we go to the BCT meetings and sometimes there is a philosophical difference or a regulatory interpretation difference between the regulatory agencies and the Air Force, but it all seems to stay in a manner that allows us to work through these types of issues. I haven't seen anything that has been extremely difficult or obstinate. From where I sit, it seems like the differences of opinion are more on a smaller focus scale and it doesn't ever seem to be a "Y" in the road where if we agree with the Air Force or if we agree with the regulators that there would be a dramatic change to what the county can do with assets or property. Sometimes there is a difference of opinion about screening size or how many gallons per minute and we go through those things in the BCT or in the Technical Working Groups. But, to answer the question, I don't think there is anything at Mather that has been just a complete shut down of the county trying to move forward on certain projects.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

No input.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

Not that I'm aware of. For example, at the Veterans Village, an underground tank was discovered and that got resolved pretty quickly and we were able to remobilize the construction folks. If there is

something unexpected, it seems to get resolved, but I don't think there has been anything groundbreaking. What else goes on along those items, is in that situation, I would talk to the Air Force, DTSC, Water Board and EPA for clarification and I've never had an experience where I receive two dramatically different responses from Party A and Party B. If there is a difference in information or the data that comes to me, it's not that far apart. If we were to put it on a large spectrum, we are usually in discussion or disagreement about a small part on that large spectrum. When you look at that from my position, it won't reach that Y in the road. I don't see anything that is overly prohibitive. When we do come to the Air Force with something out of left field, the Air Force is always very clear and responsive and will produce maps showing monitoring well locations. And then we sit down and talk about it and the Air Force has always been very supportive saying that they could consider removing wells or consolidating sampling to accommodate the proposed plan. It has always been solution oriented. The Air Force starts a lot of sentences by saying that "part of our responsibility is to help you get Mather to where the county wants it to be." So, we have had a pretty good interaction and relationship. A good example of that was when we were looking at the large 400-acre parcel south of the airport and we had time frames that were very challenging. Even though I came in with some things that were pretty aggressive, the Air Force didn't just laugh me out of the room and say it was impossible. The Air Force responded by saying that they would do what they can and if we have to put more resources into it, then okay. And that has been consistent with all of the Air Force personnel.

5. **Has the former Mather AFB been in compliance with permitting and reporting requirements?**

No input.

6. **Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?**

Not on the county's behalf that I am aware of, but I do know that there are somethings that do come up whether in the Rancho Cordova portion. I'm not aware of any violations of ICs.

7. **Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?**

No recommendations, just to continue the responsiveness if we get some odd development-type items that come in.

8. **Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?**

Nothing at this time.

9. **What is your single greatest concern regarding the ongoing performance of the IRP remedies?**

There are no real concerns right in front of us. The only change would be if we have other items that come out of nowhere, such as the Building 4260 issue that we didn't anticipate. That didn't cause us any problems to this point so far because of how the hangar situation is working out. Just some unknown issues that haven't been captured and defined and have an approved treatment plan in place. With the current sites, there is no concern. We are moving through them well and as fast as these things work. It is the response that is important, just to get it worked out and do what we have to do to allow the project that is a part of any unknown issue to continue to move forward.

Another concern is if a standard changes or a detection limit changes or a new risk analysis comes out that determines that the Air Force has to remediate down to a different level, that would be a primary concern. Just the change in the standards and either what has to be remediated or any risk level changes. The program was architected and implemented to a certain cleanup standard and if that changes, then now it would have a downstream effect of taking a parcel that was previously deemed clean or that was allowable for certain uses, but then changes.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

Not that I'm aware of.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

That question is beyond the scope of where I stand.

12. Are there any other concerns or topics in general with your interaction with Mather that you would like to discuss?

Not at this time, but perhaps there will be a different answer in about 24 months when we have a better sample size of different types of projects along the runway.

13. From your perspective, do you feel that the tenants are (1) well informed and (2) pleased with the way things are going at Mather? Are there any perceptions they have that we could help with in regard to environmental and human health protectiveness?

The handful of tenants that we do have out here, they just want to know that the areas that they are in are safe. It's a former military base, so the people just instinctively do not drink the water. If the tenants have a question, they either go to the Department of Airports or myself and if we can't answer then we come to the Air Force with the question. They don't drink water from the tap because there is a conception that it is coming from under the base.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 7/31/19**

Ron Ogle
Mather Airport Manager
Sacramento County Department of Airports
10425 Norden Avenue, Mather, CA 95655

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

With my experience, I have no issues. I am satisfied with what is going on. They have been compliant with our rules as an airport.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

From my perspective, no concerns whatsoever.

3. **What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?**

No input.

4. **Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.**

It seems like recently the problem area has been next to our big hangar, so I would say it has been the inconvenience. The tenants are still operating in there, so we have had to coordinate whether the wells next to hangar doors, where the aircraft is coming in and out, and doing the work at odd times so that it doesn't inconvenience the tenants so much. We have always tried to work around those things, but there has been some inconvenience sometimes where we have had to provide escorts from our staff to help facilitate that work when it is near sensitive areas or areas with security or movement areas, those are the times that have added costs on our side, but we are doing this the right way.

What rattled the cage the most, was that there was some interior work that had to be done in the large hangar. In the beginning, people didn't know the scope of the work at first because the project was presented so that it wouldn't be a bother, but then they were drilling wells inside the building and the tenant stopped the work because it was so disruptive. We made arrangements for them to come at night.

5. **Has the former Mather AFB been in compliance with permitting and reporting requirements?**

Yes.

6. **Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?**

Yes.

7. **Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?**

There is a concern regarding potential contamination from runoff that could be being picked up from nearby entities to the Sacramento County Department of Airports and ending up in the storm drains of the Airports.

8. **Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?**

No recommendations.

9. **What is your single greatest concern regarding the ongoing performance of the IRP remedies?**

I just wonder why so many wells are located in one area and also the proximity to runways and taxiways. When a well is located in those areas, we have to take the time to provide escorts.

10. **Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?**

No input.

11. **Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?**

With providing escorts, I provided a training to anyone sampling in the areas of runways and taxiways. We have tried to make this efficient as possible.

12. **Are there any other concerns or topics in general with your interaction with Mather that you would like to discuss?**

No further issues. The main thing is just with proximity to taxiways and runways. As far as the airports concern, the more we can stay away from taxiways and runways, it makes it easier for aviation community, but we do work with the Air Force.

Former Mather AFB – Fifth Five-Year Review Interview Questionnaire

Provided by: **Date: 7/31/19**

Evan Jacobs
Director of Regulatory Policy and Case Management
California American Water
4701 Beloit Drive, Sacramento, CA 95838

Tim Miller
Senior Director of Water Quality and Environmental Compliance
California American Water
4701 Beloit Drive, Sacramento, CA 95838

1. **What is your overall impression of the remedies selected for the former Mather AFB's Installation Restoration Program (IRP) (e.g., excavation, SVE, groundwater extraction and treatment, landfill cap, and institutional controls)?**

Tim Miller: We are probably not familiar with much of the remedies other than the groundwater extraction and treatment. From that perspective, I think a treatment system that contributes to the spread of emerging contaminants is a problem. I think that there are examples of groundwater extraction remedies that don't rely on reinjection and then eliminate the potential for plumes to be moved, etc. as part of the remedy.

2. **Are the remedies functioning as expected? How well are the remedies performing? Do you have any concerns regarding the function of the remedies?**

Evan Jacobs: Yes, it appears that the current remedy is moving emerging contaminants into a drinking water supply.

Tim Miller: I understand that the remedy has changed to some extent in that it is no longer relying solely on air stripping and that the GACs have been added in the past 18 months or so. From the perspective that that is an improvement because GAC, as far as I know, removes more contaminants than air stripping does. That's good. We also know that GAC doesn't control everything, particularly when it comes to PFAS, which I understand is outside of CERCLA. But, to the extent that there may be short-chained perfluroinated compounds that are not being controlled by GAC and are being moved by a system that extracts and reinjects, that would be a concern that we would have on the remedy.

Reinjection combined with a system that does not remove all of the contaminants is a concern because the reinjection, as far as we can tell from our data, is moving contaminants from one part of the base where they're outside of our well capture zone and moving them to a part of the aquifer that are within, or certainly closer to, our well capture zones. Now, if that was done, with a broader sweep of contaminant removal, maybe ion exchange, or advanced oxidation, or something along those lines, that might remove the emerging contaminants, we would be less concerned, but when we know that military related plumes can have contaminants that aren't controlled by GAC, then a remedy that reinjects water closer to drinking water sources is a concern.

3. What do the groundwater and soil vapor monitoring data show? Are there any trends that show contaminant levels are decreasing?

Tim Miller: We do not routinely review the data that we are provided on either groundwater monitoring or soil vapor monitoring from CAPE. At this point, it is my understanding, that as far as a CERCLA substance, something that is on the listed list, I don't know that we have any issues with any of our wells, but I also don't know if we are monitoring our sources for the full suite of contaminants that may be sourced from former military operations. For example, I don't know if we are monitoring for 1,4-Dioxane or MDNA, or other things that either may have been used or may be daughter products from substances that were used in such operations. My organization isn't staffed to be able to do detailed review and monitoring of plumes in the area outside of the monitoring we do for our wells.

Evan Jacobs: I would tell you that there is the Sustainable Groundwater Management Act of California, which requires groundwater management, and in the area that includes Mather, there is the Sacramento Central Groundwater Authority, of which I am one of 13 or 14 board members, and I don't think that there is a great communication structure at this point, not just with the Air Force, but between all of the parties that are doing the cleanups at Mather and the groundwater management agency that is tasked with, among other things, preventing declining water quality due to groundwater use. So, I think that is an area that could be improved over the next couple of years. That probably goes both ways. The SCGA needs to engage more with the parties out there.

4. Have there been unexpected operation and maintenance (O&M) difficulties or costs at the former Mather AFB in the last five years? If so, please provide details.

Tim Miller: Yes. We have perfluorinated compounds, again I understand that is not a CERCLA substance, at over twice the US EPA Lifetime Health Advisory and I think at this point we are all in agreement, that is sourced from the AFFF use at Mather. We also have data at this point, that is preliminary, that shows that we are going to have PFOA contamination above the impending 5.1 ppt notification level at other wells in the area and as far as we know, the only source of PFOA in the area would be the AFFF usage at Mather. As for the details on those costs, we incurred $1.3 million in capital costs to install a GAC treatment plant at our Nut Plains well. I don't have all of the cost details in front of me, but we have groundwater monitoring costs that, at this point, are in the thousands of dollars, both at Nut Plains and we have been ordered to do additional testing in the area by the Division of Drinking Water, so we are incurring costs to conduct that required monitoring as well. That additional monitoring includes a select number of wells in the vicinity of Mather.

5. Has the former Mather AFB been in compliance with permitting and reporting requirements?

Tim Miller: I don't know. I'm not familiar with the details of the permitting and reporting requirements to comment on that.

6. Has the status of institutional controls been reported as required? What type of monitoring is currently being conducted or has been conducted to determine institutional control compliance? Have any deficiencies or violations of the institutional controls occurred?

Tim Miller: I'm not sufficiently familiar with the requirements to comment on the sufficiency of those activities.

7. Do you have any comments, suggestions or recommendations regarding the general implementation of the IRP remedies or how the program has been conducted in general?

Tim Miller: As we noted before, we remain concerned about the potential for contaminants of emerging concern to be contained in the plume and to be moved from one part of the base to closer to drinking water sources. I can also tell you that we are quite perplexed at the engagement between the Air Force and California American Water when it came to the UCMR3 data and our outreach on Nut Plains well. It sure looked to us, like the Air Force was well aware that there was AFFF contamination at the base and that it could be spreading. When we sent a letter saying "hey, we need to look into this" and it took the regional board to order the Air Force to engage with us before we got communication or really any kind of engagement in what was going on here. From the perspective that we needed to make sure our customers remained in drinking water, there was, what sure looked like to us, a decent amount of data of where this contamination was coming from, the almost two years, if not more, of flat out silence form the Air Force on that was, I guess I'll say disappointing.

8. Do you have any comments or recommendations about the operations of the IRP remedies related to future effectiveness or optimization of operations?

Tim Miller: I would be interested in understanding how testing of groundwater within the remedy wells compares to Unregulated Contaminant Monitoring Rule sampling to see if we are looking at the same contaminants in those wells so that we know what's happening on the base compared to what's going on outside the base. So, I certainly recommend that there be a good comparison of what's being sampled in the remedy versus what we're required to sample for drinking water wells.

The Contaminant Candidate List, which is what is used for the Unregulated Contaminant Monitoring Rule, changes frequently. The unregulated contaminant monitoring happens about every three to five years by EPA order. Drinking water utilities are given a list every three to five years and we are told that we have to go out and monitor for them and those change. From the perspective that you have got multiple systems large enough that that monitoring is required by federal law, I think it would be helpful if we understand if any of those contaminants are also located in remedy wells so that we've got consistency in the data gap. UCRM4 is underway currently.

Evan Jacobs: Globally as I've discussed, I think better coordination with the Sacramento Central Groundwater Authority on these issues, or using them as a coordinating body. All of the area water utilities, Sacramento County, all of the cities, are all on that board and active.

9. What is your single greatest concern regarding the ongoing performance of the IRP remedies?

Tim Miller: The potential for migration of contaminants within the basin.

10. Have any new or emerging contaminants been identified? If so, have they impacted the effectiveness of the remedies?

Tim Miller: The remedies limited to hazardous substances is designated by CERCLA. No, it hasn't impacted the effectiveness of the remedies. From the perspective that it caused a great deal of concern about public health in the area and continues to generate a lot of public concern, the discovery of PFOS and PFOA is certainly a new contaminant that has been identified.

11. Would you say that O&M and/or sampling efforts have been optimized? Please describe how improved efficiency has or has not occurred?

Tim Miller: I'm not familiar with the specifics of the sampling program to know if it could be further optimized or whether or not it is optimized. We are certainly happy to understand more of what sampling is being done and to look for synergies there to make sure we've all got the same data and that we are looking at what is important in terms of groundwater contamination in the area.

Evan Jacobs: …with the goal of public health

12. Are there any other concerns or topics in general with your interaction with Mather that you would like to discuss?

Tim Miller: I think it is important to make sure that the Air Force is aware that we are expecting the Division of Drinking Water to announce revised state notification levels and state response levels. We expect any time now that the notification level for PFOA will drop to 5.1 ppt and the notification level for PFOS will be dropped to 6.5 ppt. We're not exactly sure when. We have heard it might be as late as October. There may be revisions to the response levels, and that is the level at which wells would have to be taken out of service. Those levels, as I understand, would be 10 ppt for PFOA and 40 ppt for PFOS. The state of California will no longer be recognizing the combined EPA Health Advisory as the limit for response. They will be lowering that. We also understand that, sitting on the governor's desk, but we don't know exactly what the status of that will be, is State Law 8756. That will require us to directly notify customers if we have a "confirmed detection" of PFOS or PFOA. We haven't completed our analysis of that legislation to determine exactly what constitutes a "confirmed detection," if that is supposed to be equivalent with the response level. At this point, if 8756 becomes law, where we currently have to only notify the public utilities commission and cities and counties within our jurisdiction, we would now be required to do much more targeted outreach to our customers if we have those substances in our drinking water. From the public health perspective and many other aspects, there are major implications of that from our perspective based on the data we have on the extent of perfluorinated compound occurrences in drinking water wells in the vicinity of Mather.

Evan Jacobs: We would like to have the Air Force as a partner to help us address this. I think it is going to be a very big regional concern in the near future.

INTERVIEW RECORD

Site Name: Mather AFB		**Date:** 7/29/19
Individual Contacted:		
Name: Quentin House	**Title:** Director of Maintenance	**Organization:** Mather Aviation

Summary of Conversation

Mr. House is the Director of Maintenance at Mather Aviation.

He gave input on how the ongoing cleanup at Mather has affected Mather Aviation from a business standpoint. He said there have been times recently during the investigation work at Building 4260 when wells were being installed inside the hangar and the planes inside had to be staged out of the way for the work to take place. He said that the Air Force and contractors did a good job of communicating with him regarding scheduling for upcoming work. However, he didn't say he felt like he had a good understanding of what work was actually being done and would like to be more informed in the future regarding why the work is being done. He said that initially the information was communicated better, but he never knew specifically what the contaminants were that were being investigated.

He stated that generally there haven't been any operations and maintenance difficulties or cost associated with Mather. He stated that especially once the sampling activities became routine, it was much easier to manage. He said that the more heads up time the better in regards to accessing sample locations that could be parked over by planes or automobiles.

He said that if there is anything that he and his coworkers could learn from, such as, what he and his employees are being exposed to. He stated that more information early on would be best.

APPENDIX D

Public Notice

Former Mather Air Force Base Environmental Cleanup Five-Year Review Begins

The former Mather Air Force Base, located 10 miles east of downtown Sacramento, and partially within the city of Rancho Cordova, closed in 1993. The military used chemicals, fuels, solvents and oils in support of national defense activities while Mather was an active facility. Some of these chemicals entered the soil and groundwater from leaking pipes or underground storage tanks, and from former activities and disposal practices. In 1979, the presence of contamination was detected in water supply wells. Environmental cleanup began in the mid-1980s to ensure drinking water remains safe.

The Five-Year Review is a formal evaluation of ongoing environmental cleanup activities at Mather. The State of California and the U.S. Environmental Protection Agency will review the Five-Year Review report, which will include a determination of whether the cleanup remedies in place are protective of human health and the environment. The report will also provide recommendations if any deficiencies are found. The last Five-Year Review for Mather was completed in 2015. It found that all remedies were protective in the short term, and that most were protective in the long term. For three sites, the determination of long-term protectiveness was deferred pending the results of additional sample collection.

The Five-Year Review is scheduled to be completed in early 2020 and another public notice will be issued informing the community the review is complete. The Five-Year Review will then be made available for public review.

If you have any issues or concerns about Mather's cleanup program, or for more information, call Air Force Civil Engineer Center Community Relations at (916) 643-1250, ext. 257

APPENDIX E

Institutional Controls Summary Table

Summary of Institutional Controls at Mather Calendar Year 2019							
Site	**Parcel**	**References**	**Status of Property Transfer**	**Annual Self-Reporting Required in Decision Document?**	**SLUC**	**Compliant?**	**Institutional Controls**
All Sites Listed Below	See below	See each row below				See each row below	Activities limiting access to, interfering with, or otherwise impairing remedial equipment operation, components, or systems are prohibited.
All Sites Listed Below	See below	See each row below				See each row below	Air Force, EPA, and the State of California shall be allowed access to the site for purposes on monitoring ICs.
LF-03	A-3	Landfill OU ROD; Landfill Memorandum of Post-ROD Changes; A-3 Deed; SLUC	Parcel A-3 transferred by deed, 14 November 2012	Yes	Yes	Yes	Landfill ICs
LF-03	A-1 and A-3	Landfill OU ROD; Landfill Memorandum of Post-ROD Changes; A-1 and A-3 Deeds; SLUC	Parcels A-3 and A-1 transferred by deed, November 2012	Yes	A-1 In Prep. A-3 Yes	Yes	Landfill ICs
LF-04	A-3	Landfill OU ROD; Landfill Memorandum of Post-ROD Changes; A-3 Deed; SLUC	Parcel A-3 transferred by deed, 14 November 2012	Yes	Yes	Yes	Landfill ICs
Northeast Plume	A-1 and A-3	2010 Soil and Groundwater OU ESD; A-1 and A-3 Deeds; SLUC	Parcel A-1 deeded November 2012; Parcel A-3 transferred by deed, 14 November 2012	Yes	A-1 In Prep. A-3 Yes	Yes	Groundwater ICs
Site 7 GW Plume	A-1	1996 ROD; 2010 Soil and Groundwater OU ESD; A-1 Deed	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Groundwater ICs
Site 7 GW Plume	A-2	1996 ROD; 2010 Soil and Groundwater OU ESD; A-2 Deed	Parcel A-2 assigned to DOI, NPS, January 2013. Deed from NPS to Sac County 19 July 2016.	Yes	No	Yes	Groundwater ICs
WP-07 / FT-11	A-1	1996 ROD; 2010 Soil and Groundwater OU ESD; A-1 Deed	Parcel A-1 deeded November 2012	Yes	In prep.	Yes	Landfill ICs
WP-07 / FT-11	A-2	1996 ROD; 2010 Soil and Groundwater OU ESD; A-2 Deed	Parcel A-2 assigned to DOI, NPS, in January 2013. Deeded to Sac County 19 July 2016	Yes	No	Yes	Landfill ICs
FT-10C / ST-68	A-1	2010 Basewide OU ESD; A-1 Deed	A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Soil ICs and Indoor Air ICs (including residential land use restriction)
WP-12; AC&W Plume	G-1a, G-1b, G-1c, I-2	2008 AC&W OU ESD; respective parcel assignments and deeds; SLUCs	Parcel G-1a deeded 03 May 2013. Parcel G-1b deeded 07 May 2013. Parcel G-1c assigned to DOI, NPS in January 2013. Deed from NPS to Sac County 19 July 2016.	Yes	G-1a and G-1c Only	Yes	Groundwater ICs (note GW ICs applied to entire parcel G-1a, G-1c and I-2; larger than required by the ESD); IC on Parcel G-1b limited to protection of AC&W treatment plant outfall at Mather Lake.
WP-12; AC&W Plume	D-2	2008 AC&W OU ESD; Early transfer deed	Parcel D-2 transferred by deed 3 June 1999	Yes	No	Yes	Groundwater ICs and Soil ICs (below 20 feet bgs)
LF-18	A-1	2010 Basewide OU ESD; A-1 Deed	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Soil ICs and Indoor Air ICs (including residential land use restriction)
OT-23	C, I, Q, Ut	FOSET #2, early transfer deeds, and SLUCs	Relevant portions of Parcel C deeded in 2000; Parcel I-1 and Parcel Q deeded in 2007; Parcel Ut deeded in 2004	No	Parcels C, Q, and I-1	Yes	Soil ICs

Summary of Institutional Controls at Mather Calendar Year 2019							
Site	**Parcel**	**References**	**Status of Property Transfer**	**Annual Self-Reporting Required in Decision Document?**	**SLUC**	**Compliant?**	**Institutional Controls**
OT-23C	C-2 through C-6	2010 Basewide OU ESD; early transfer deeds; Site 23C Final SVE Completion Report (Feb. 2019); SLUC	Relevant portions of Parcel C in EDC deeds 1998 and 2000.	No	Yes	Yes	Soil ICs and Indoor Air ICs
ST-29 / ST-71	A-1	1996 ROD; Site ST-29/ST-71 Closure Report (Sept. 2015)	Parcel A-1 transferred by deed, 28 November 2012	No	In prep.	Yes	Soil ICs and Indoor Air ICs (including residential land use restriction) required by site closure report but not in current deed; IC to be added to SLUC.
ST-37 / ST-39 / SS-54 and OT-23B/ OT-23D	A-1	2010 Soil and Groundwater OU ESD; A-1 Deed; Site ST-37/ST-39/SS-54, OT-23B and OT-23D Vadose Zone Closure Report; Documentation of Nonsignificant Change to ROD for Site 23B	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Soil ICs and Indoor Air ICs (including residential land use restriction); per Vadose Zone Closure Report and Site 23B ROD change memo
SD-57	A-1	2010 Soil and Groundwater OU ESD; A-1 Deed	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Soil ICs and Indoor Air ICs (including residential land use restriction)
Building 4260	A-1	Action Memorandum for SVE at Building 4260; Letter conveying use restrictions to Sacramento County, June 2018	Parcel A-1 deeded November 2012	N/A	No	Yes	Prohibit modifications to Building 4260 or its foundation without evaluating and addressing potential for increased risk due to vapor intrusion. No trenching or digging except for shallow excavations (e.g., for landscaping purposes) permitted without evaluating and addressing protection of workers from vapor inhalation
SD-59	A-1	2010 Soil and Groundwater OU ESD; A-1 Deed	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Soil ICs and Indoor Air ICs (including residential land use restriction)
OT-87	G-1c	1998 ROD and 2010 Basewide OU ESD; Parcel G-1c Deed; SLUC	Parcel deeded from NPS to Sac County on 19 July 2016.	Yes	Yes	Yes	Soil ICs and residential land use restriction
OT-89	A-1	2006 ROD; A-1 Deed	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Soil ICs and residential land use restriction
MBSA GW Plume	A-1	1996 ROD; 2010 Soil and Groundwater OU ESD; A-1 Deed	Parcel A-1 transferred by deed, 28 November 2012	Yes	In prep.	Yes	Groundwater ICs
MBSA GW Plume	A-1a	1996 ROD; 2010 Soil and Groundwater OU ESD; A-1a Deed; SLUC	Parcel A-1a transferred by deed, 10 January 2013	Yes	Yes	Yes	Groundwater ICs
MBSA GW Plume	C, I-1, P-1, Q, Ut	FOSET #1, FOSET#2, early transfer deeds, and SLUCs	Relevant portions of Parcel C in EDC deeds 1998 and 2000; Parcel I-1 and Parcel Q deeded in 2007; Parcel Ut deeded in 2004	No	Parcels C, Q, and I-1	Yes	Groundwater ICs and Soil ICs (below 20 feet bgs, as indicated on Figure 2)
MBSA GW Plume	P-2	2010 Soil and Groundwater OU ESD; Parcel P-2 Deed; SLUC	Parcel P-2 transferred by deed 31 January 2013	Yes	Yes	Yes	Groundwater ICs
GR405	G-1b	2011 NFA ESS; G-1b Deed	Parcel G-1b deed 07 May 2013	No	No	No	Military Munitions ICs

APPENDIX F

Responses to Regulatory Agency Comments

Regulatory Comments on Draft Five-Year Review

Comments from US EPA
Sarah Watson, Remedial Project Manager
May 28, 2020

General Comments

1. The Fifth FYR text, tables and figures are not fully searchable. Text cannot be copied and pasted which was extremely inconvenient and required extra time for review of this draft document. Additionally, the pdf file should be bookmarked. Please revise the Fifth FYR to make the document searchable and include bookmarks in the PDF file.

   Air Force Response
   Noted. The Fifth FYR text, tables and figures have been revised to be fully searchable and the PDF has been bookmarked.

2. EPA's *Comprehensive Five Year Review Guidance*, OSWER 9355.7-03B-P, July 2001 (the FYR Guidance) notes that system operations and operation and maintenance (O&M) requirements should be discussed in further detail than what is provided in Section 2.5, System Operations & Maintenance, of the Draft Fifth Five-Year Review Report, Former Mather Air Force Base, California, dated March 2020 (the Fifth FYR). For example, the Fifth FYR should discuss whether there were any problems with the implementation of system operations or O&M, originally estimated annual O&M costs versus actual costs, and reasons for any unanticipated or unusually high O&M costs at the sites, etc. An example table to document O&M costs can be found in Table 2, Annual System Operations/O&M Costs, of Appendix D in the FYR Guidance. Please revise the Fifth FYR to provide additional information regarding O&M issues and costs.

   Air Force Response
   The Five-Year Review was prepared to be consistent with EPA's recommended template released January 2016. EPA's stated purpose in preparing this template was to promote national consistency, reduce non-essential information, and decrease repetitiveness in the report. As cited by EPA, the basic purpose of the Five-Year Review is to determine if the remedy is or will be protective of human health and the environment. Based on EPA's template, the discussion of O&M should include: whether operating procedures are working in a manner that will continue to maintain the effectiveness of the remedy, whether frequent equipment breakdowns or changes indicate a potential issue affecting protectiveness, or whether large variances in O&M costs could indicate a potential remedy problem. The Air Force has further addressed those issues in Sections 5.2.1.1, 5.3.1.1 and 5.3.2.1 under the section "System Operations" of the Five-Year Review. There is no requirement in EPA's January 2016 Five-Year Review template to provide a table detailing O&M costs.

3. Many of the sites documented in the Fifth FYR have institutional controls (ICs) that are mentioned in the site-specific descriptions in Section 2.2, Response Actions; however, it may be helpful to provide a summary table for each site listing the ICs outlined in the decision documents and the instruments in place to address the relevant ICs. An example summary table is provided in Section 3.5, Additional IC-Related Information, in EPA's *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance,"* September 2011 (the FYR IC Guidance). Please revise the Fifth FYR to include additional information regarding the ICs in place at each site.

   Air Force Response
   The ICs are described in detail in Section 2.2 of the FYR. Section 2.3 identifies that all of the required ICs have been implemented, and Section 2.4 describes the monitoring that has been conducted to verify compliance with the ICs. Further detail regarding the compliance inspections and instruments in place at each site be found in the Annual IC Compliance Reports referenced in the FYR.

4. The remedial action objectives (RAOs) for each site should be summarized in a table for clarity. For example, adding a column to Table ES-1, Operable Units Evaluated in this Five-Year Review, to describe the RAOs and how they were met would provide a comprehensive summary. Please revise Table ES-1 to include a column for RAOs.

   Air Force Response
   The Executive Summary portion of the Five-Year Review is an optional element and was prepared to provide a brief, concise overview of the conclusions of the Five-Year Review. The RAOs for each site, along with a

discussion of how the RAOs have been met, are provided in text of the document as required by the EPA 2016 guidance.

5. The Fifth FYR does not include any site inspection information. While the text provides a brief description in Section 4.4, Site Inspections, no supporting documentation was provided in the Fifth FYR. Section 3.5.3 of the FYR Guidance indicates that an inspection checklist should be used to plan and document site inspections and provides a template. Please revise the Fifth FYR to provide additional information and documentation, including site inspection checklists, regarding the site inspections conducted.

Air Force Response
Based on the 2016 EPA guidance, site inspection checklists are an optional item that may be provided as an appendix. Site inspection checklists are available for review in the 2018 Annual IC Compliance Report, which is cited as a reference in the Fifth Five-Year Review.

6. There is an O&M issue for the groundwater treatment plant according to the Fifth Five-Year Review Interview Questionnaire (the Interview) provided by Marcos Arias in Appendix C, Interview Records. The Interview notes that there were "several unplanned shutdowns due to power failures/surges, mechanical failures, communications and electrical faults" that destroyed the main computer and communications systems. Additionally, the Interview notes that the main computer is obsolete, and it takes time and resources to find obsolete replacement parts and rebuild it. However, these unexpected O&M difficulties are not discussed in the Fifth FYR as an issue. A recommendation should be made to update the system so that it can be repaired or replaced quickly when O&M issues occur. In addition, surge protection should be considered for critical systems; this could be done using an uninterruptable power supply that would alert staff and force an orderly shutdown of the computer system(s) in the event of a power failure. Please revise the Fifth FYR text to discuss the O&M issue at the groundwater treatment plant, and ensure a recommendation is made to update the main computer and add surge protection that would allow an orderly shutdown of the computer system.

Air Force Response
The Five-Year Review has been updated to include information about the unexpected O&M difficulties. Recommendations have been added to update the main computer, install surge protection, and install an uninterruptable power supply at the Main Base/SAC treatment system.

7. The protectiveness statement for Site OT-23C should be revised to protectiveness deferred. While the protectiveness statement in the Five Year Review Summary Form indicates that the remedies at OU 5 (Basewide OU), including Site OT-23, are protective of human health and the environment, disputes are ongoing regarding the adequacy of the IC boundary and the protectiveness of ICs regarding potential vapor intrusion risk from residual soil vapor as discussed in Section 5.6.3.1 (Question A, Is the Remedy Functioning as Intended by the Decision Documents, Page 5-20). As there are data gaps and issues associated with the current protectiveness of the ICs for Site OT-23, the protectiveness statement for Site OT-23C should be revised. Additionally, this information should be added to the "Issues/Recommendations Identified in the Five-Year Review" table as part of the Five-Year Review Summary Form. Please revise the Fifth FYR to defer the protectiveness of Site OT-23C due to uncertainty in the protectiveness of the ICs related to the potential vapor intrusion risk from residual soil vapor.

Air Force Response
The document has been revised to indicate that the protectiveness determination for Site OT-23C has been deferred pending the outcome of the ongoing regulatory agency dispute regarding the protectiveness of ICs for vapor intrusion risk.

8. The report does not appear to contain information, data, or narrative regarding all relevant off-base wells, specifically OFB-40A and OFB-40B. Please add these and any other missing off-base wells to the Report.

Air Force Response
The document has been revised to state that, "As of the time period of this Five-Year Review, there are no completed pathways for groundwater with PFOS/PFOA above the LHA to drinking water receptors."

9. Building 4260 is described in the Report as a "new site". However, it does not have its own section as all the other sites do. It should have its own section to discuss what progress has been made in this Five-Year Review Period and

discuss what actions need to be taken. The Fourth FYR said that Site 59 needed more investigation and possibly a new site. However, the Draft Fifth FYR does not discuss that this site has been created or what investigation has been done. Please add a section detailing this information.

Air Force Response
The Air Force established a new CERCLA site for Building 4260 (B4260), and cleanup activities are being conducted under a Non-Time-Critical Removal Action. A final remedy has not been selected; therefore, a Five-Year Review of the site is not required by statute or policy. Section 3.2.1 provides a brief discussion of activities at B4260 to understand how the issue from the Fourth FYR was addressed.

10. Each time that Question A is answered, ICs are mentioned, but no detail is provided. "ICs are in place and effective" provides no information about the ICs. In other words, please mention what the specific ICs are utilized at each site (e.g. dig restriction, deed, etc.). Additionally, please provide the results from the 2019 IC Inspection.

Air Force Response
The ICs for each site are described in detail in Section 2.2. To avoid redundancy and repetitiveness within the document, the ICs are not re-iterated in Section 5. The 2019 IC inspection was conducted after the cut-off this Five-Year Review. The most recent IC compliance inspection during the term of this Five-Year Review was conducted in November 2018.

11. Given the historical issues regarding shutdown of SVE systems, related Vapor Intrusion, and implementation of ICs at these sites, please provide more narrative regarding Sites OT-23C, Site 59/Building 4260, WP-07, FT-11, ST-37, ST-39, SS-54, and ST-57. Please include the specific data that was used to shutdown SVE systems as well as data that was used to either determine protectiveness of human health and the environment or establish a continued need for ICs. Please also describe the IC boundaries, the specific mechanism by which they are implemented (e.g. deed or State Land Use Covenant), and whether the ICs apply to all property or just property not yet transferred at the time the IC was implemented, and all structures, or just structures built after the IC was implemented. Please also provide an assessment of the IC implementation mechanism. Where applicable, please refer to relevant documents such as associated Remedial Action Completion Reports.

Air Force Response
The narrative cleanup goals for SVE are detailed in Section 2.1 of the FYR. The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. As described, "The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate-and-transport modeling, trend analysis, mass balance, and/or other means." The ICs for each site are described in Section 2.2, and the areas to which the ICs apply are presented in Figures 2-2 and 2-3 of the FYR.

Section 5.4 references the completion reports prepared to document achievement of the narrative cleanup goals for each soil vapor site. Further detail regarding the specific data used in these analyses, fate-and-transport modeling results, etc., can be referenced in those documents. The completion reports also provided an analysis of the protectiveness of the IC boundaries with regard to vapor intrusion risk. At two sites, Site 23B and Site 23C, the SVE Completion Reports made a recommendation to expand the IC boundary. At Site 23B, the boundary was expanded based on a shallow soil vapor concentration exceeding the DTSC-SL for residential indoor air. This information has been added to Section 5.4.2.1 of the FYR. At Site 23C, the SVE Completion Report recommended the addition of ICs to a County park parcel overlying the residual soil vapor plume. Shallow soil vapor concentrations in the park parcel exceed the DTSC-SL and the EPA RSL for resident indoor air. A discussion of this is provided in Section 5.6.3.1.

The Annual IC Compliance reports, referenced in Section 5.4 of the FYR, provide detail concerning IC implementation. These reports list the specific deeds that contain the relevant ICs for each property, and identify whether a SLUC is in place.

Specific Comments

1. **PDF Page 11 (SF-1), FYR Summary Form:** "Date of Site Inspection: 11/20/2018" This is almost 2 years before the FYR due date of September 30, 2020. According to EPA's Comprehensive [FYR] Guidance "Your five-year

review should include a recent site inspection. For purposes of conducting site inspections for five-year reviews, 'recent' generally means no more than nine months from the expected signature date of the review."

Air Force Response
Section 1.3 of the FYR states, "In general, data collected from 1 January 2014 through 30 September 2019 were reviewed for this fifth five-year review. This follows the dataset (January 2009 through September 2014) covered by the fourth five-year review. Data collected after 30 September 2019 will be included in the sixth five-year review." The most recent site inspections during the review period of this FYR were performed in November 2018. Therefore, those site inspections represent the applicable data set for this FYR. The site inspections conducted in November 2019 fall outside of the review period but will be included in the sixth FYR.

2. **PDF Page 12 (SF-2), FYR Summary Form, Issues/Recommendations, OU(s) without Issues/Recommendations:** Both OU 3 (Soil) and OU 5 (Basewide OU) are not listed in this section of the FYR Summary Form despite issues that have arisen during the review period for the Fifth FYR.
With regard to OU 3, the summary form does not reference the Vapor Intrusion (VI) issue related to the newly identified site Building 4260 (linked to Site 59 in terms of extending its IC boundaries to encompass Building 4260; linked to Site 57 by virtue of the 5/17/2019 New Site Memo). Although the AF chose to address Building 4260 in conjunction with Site 57 (see the AF's 5/17/19 "New Site Memo"), in the 4th FYR the AF proposed that ICs for Site 59 be extended to encompass the area near Building 4260 that the AF believes is the source of vapor contaminants found in shallow wells drilled as part of the Site 59 rebound study Given this proposed link between the Site 59 ICs and the suspected source area near Building 4260, the AF decision to link Building 4260 to Site 57 raises questions. Please revise the forms to note VI as an issue, the recommendation(s) for responding to the issue, and add/modify the protectiveness determination to reflect the VI issue.
With regard to OU 5, the summary form does not accurately reflect the VI issue related to Site 23C. Please revise the form to note VI as an issue, the recommendation(s) for responding to the issue, and add/modify the protectiveness determination to reflect the VI issue.

Air Force Response
As identified in the FYR, Site SD-057 consists of the Oil-Water Separator (OWS) 7019. This is consistent with the description of Site 57 in the Soil OU and Groundwater OU ROD. Building 4260 is "linked" to Site 57 only as a funding line item within the Air Force's internal Work Information Management System (WIMS). The Air Force has designated Building B4260 as a separate CERCLA site, assigned it a site identifier of B4260, established an administrative record for the site, and is conducting a Non-Time-Critical Removal Action. As previously noted, a final remedy has not been selected for B4260; therefore, a Five-Year Review of the site is not required by statute or policy. The B4260 action does not affect the protectiveness determination for Site 57 or Site 59, and no change was made. The Summary Form was revised to indicate that the protectiveness determination for Site 23C is deferred pending resolution of the ongoing dispute regarding vapor intrusion risk.

3. **PDF Page 12 (SF-2), FYR Summary Form, Protectiveness Statement(s), OU 1:** Please revise the narrative protectiveness statement to reference both short-term and long-term protectiveness and the basis for such, as for example: "The remedies at OU 1 (AC&W OU) currently are protective of human and health and the environment and are expected to remain so in the future due to [specify reason, e.g., ICs]." This comment applies to all four of the protectiveness statements on PDF Page SF-2/SF-3, if appropriate/applicable based on the facts.

Air Force Response
The protectiveness statements in the FYR Summary Form have been revised to address both short-term and long-term protectiveness and the basis for those determinations for OUs 1, 3, 4 and 6.

4. **PDF Page 13 (SF-3), FYR Summary Form, Protectiveness Statement(s), OU 3:** Per previous comment, I recommend that protectiveness statements reference both short-term and long-term protectiveness, and the basis for such (given the VI issue in relation to Building 4260, it isn't clear that the remedy is protective in the short-term, much less the long-term). Also, please confirm that the issue raised in the 4th FYR about potential VI impacting Buildings 7022 and 7044 has been resolved to demonstrate there is no threat to human health and the environment.

Air Force Response
The protectiveness statements have been revised as suggested. The Fourth Five-Year Review stated that concentrations of PCE and TCE in shallow soil vapor at well 57-SVE-06A, near Building 7022, represented an approximate 3E-06 excess cancer risk, which is within the 1E-06 to 1E-04 risk management range. For Building

7024, it stated that shallow soil vapor VOC concentrations indicated no excessive indoor air risk. No further action was recommended.

5. **PDF Page 13 (SF-3), FYR Summary Form, Protectiveness Statement(s), OU 5:** Site OT-23 includes sub-site OT-23C, the subject of the potentially on-going dispute about the risk of vapor intrusion. Consistent with the issues in dispute, the AF protectiveness statement regarding the Site is inaccurate and inappropriate. Pending further investigation, a protectiveness determination for Site 23C must be deferred both for short-term and long-term protectiveness.

   Air Force Response
   The protectiveness statement for Site OT-23C has been deferred and the Summary Form has been revised accordingly.

6. **PDF Page 13 (SF-3), FYR Summary Form, Sitewide Protectiveness Statement:** This statement does not reflect the VI issues at Building 4260 and Site 23C which call into question the protectiveness of the remedies at these Sites and necessitate a deferred protectiveness determination both as to the short- and long-term due to the lack of adequate data.

   Air Force Response
   The sitewide protectiveness determination in the Summary Form has been revised to indicate that the protectiveness for Site OT-23C has been deferred. Please refer to the response to EPA's General Comment #9 and Specific Comment #2 regarding Building 4260.

7. **PDF Page 14 (ES-1), Executive Summary (ES), 1st paragraph, 2nd sentence:** As noted in relation to the summary forms, the statement that "all of the remedies are protective in the short term" is not supported by the situation with regard to VI at Sites Building 4260 and 23C. Please revise the text to indicate that both short- and long-term protectiveness determinations regarding the remedies at these two sites must be deferred pending the development of adequate data.

   Air Force Response
   The sentence has been revised to state, "with the exception of Site OT-23C, all of the remedies…." Please refer to the response EPA's General Comment #9 and Specific Comment #2 regarding Building 4260.

8. **PDF Page 14 (ES-1), ES, 4th paragraph, 4th sentence, text beginning "EPA and the State:"** Please revise the text to clarify its meaning, as the AF is the lead CERCLA agency (although EPA co-selects remedies), while EPA is the lead regulatory agency, and DTSC is the only state agency involved at the Mather AFB under the FFA.

   Air Force Response
   Further detail concerning the roles of the different regulatory agencies is provided in Section 1.1 of the FYR.

9. **PDF Page 15 (ES-2), ES, Section "Protectiveness Determinations," 1st sentence:** As previously requested in comments on the FYR Summary Form, please revise the text to capture both the short-term and long-term aspects of a protectiveness determination; the questions to be addressed in FYRs for remedies already in place are whether the remedy currently is protective and whether it is expected to continue to be so (i.e., whether the remedy is protective in the short-term and the long-term). The question of whether a remedy will be protective is appropriate in the case of remedies that have not been fully implemented at the time of the FYR; so the question is once the remedy is completed will it be (or is it expected to be) protective once it is completed?

   Air Force Response
   The sentence has been revised to state, "…to determine if they are protective of human health and the environment and if they are expected to remain so in the future."

10. **PDF Page 15 (ES-2), ES, Section "Operable Unites with Issues," 2nd paragraph, 1st sentence:** This statement is at odds with the conditions at Site 23C and Site Building 4260. Please revise to be consistent with the absence of data to confirm whether the existing remedies at these Sites are protective in the short or long term (i.e., deferred protectiveness determinations). In addition, the text should note that the Site 23C and Building 4260 remedies do not include ICs in relation to existing structures present at both sites.

Air Force Response
The text has been revised to identify the regulatory agency dispute as an issue for Site OT-23C. Please refer to the response to EPA's General Comment #9 and Specific Comment #2 regarding Building 4260.

11. **PDF Page 15 (ES-2), ES, Section "Operable Unites with Issues," 2nd paragraph, 3rd sentence:** This statement is untrue with regard to both Sites 23C and Building 4260 because the ICs in place do not apply to existing structures (or to property transferred prior to implementation of the ICs. Please revise the text to accurately describe the ICs situation at these two sites.

Air Force Response
The text in this paragraph has been revised to identify the regulatory agency dispute regarding vapor intrusion as an issue for Site OT-23C. Please refer to the response to EPA's General Comment #9 and Specific Comment #2 regarding Building 4260.

12. **PDF Page 17 (ES-4), Table ES-1, Columns 4 (Selected Remedy) and 5 (RA Status/Protectiveness):** Please include a brief description of the ICs with regard to each referenced site in Table ES-1 for which ICs are a remedy component, except if the ICs already are described (as in column 5, row 6, about Sites ST-37/ST-39/SS-54: "ICs to prevent unacceptable exposure to residual soil vapor in place").

Air Force Response
Columns 4 and 5 in Table ES-1 have been revised to provide a brief description of the ICs.

13. **PDF Page 17 (ES-4), Table ES-1, Column 5 (RA Status/Protectiveness), Row 7, 2nd and 3rd bullet points:** Please revise the text in the table to reflect changes made in the narrative text, if any, in relation to the potential of VI impacting Buildings 7022 and 7044 discussed in the 4th FYR.

Air Force Response
Please refer to the response to EPA Specific Comment #4.

14. **PDF Page 17 (ES-4), Table ES-1, Column 5 (RA Status/Protectiveness), Row 8, 2nd and 3rd bullet points:** As noted in an earlier comment, the VI issue at Building 4260 is not identified in FYR Summary Form; please revise the text in the table to reflect any changes made to the narrative text in response to comments about Building 4260.

Air Force Response
Please refer to the response to EPA General Comment #9.

15. **PDF Page 18 (ES-5), Table ES-1, Column 5 (RA Status/Protectiveness), Row 4, 2nd and 3rd bullet points:** Please revise the text to reflect, as noted in earlier comments, that 1) the ESD ICs do not apply to property transferred prior to the ESD's issuance or to pre-existing structures (the majority of buildings at Site 23C); and 2) the lack of sufficient data related to VI risk on which to base a protectiveness determination.

Air Force Response
The RA Status/Protectiveness description for Site OT-23C has been revised.

16. **PDF Page 19 (ES-6):** "There are currently no completed pathways for groundwater with PFOS/PFOA above the LHA to drinking water receptors". Please revise the language to current the current reality to something like "During this Five-Year Review period, there were no known completed pathways for groundwater with PFOS/PFOA above the LHA to drinking water receptors" due to the recent exceedance of the LHA at OFB-40.

Air Force Response
The text has been revised to indicate, "As of the time period of this Five-Year Review.."

17. **PDF Page 19 (ES-6), "Protective Operable Units," 2nd and 3rd bullet points:** The 5th FYR needs to address VI in relation to Buildings 7702 and 7704 (Sites 57) and Building 4260 (59), including the adequacy/inadequacy of ICs (like the ESD that addressed Site 23C, the ESD that addresses Sites 57 and 59 is limited in scope).

Air Force Response
Please refer to the response to EPA General Comment #9 and Specific Comment #4.

18. **PDF Page 21 (1-1), Section 1.1, 1st paragraph, 1st sentence:** Please insert the phrase ", and will continue to be," between the terms “are protective.” Please also explain the meaning of the phrase “sustainable protection.” Absent a compelling explanation, please replace the phrase with the term “protectiveness.”

Air Force Response
The text of Section 1.1 has been revised as requested.

19. **PDF Page 21 (1-1), Section 1.1, 2nd paragraph, 1st sentence:** The language of EO 12580 does not refer to a federal facility "controlling the source of the release(s)," but to a release being on, or the sole source of a release being from, a facility under the jurisdiction, custody or control of a federal agency. Please revise the text to accurately reflect EO 12580.

Air Force Response
The text of Section 1.1 has been revised as requested.

20. **PDF Page 21 (1-1), Section 1.1, 4th paragraph, 1st sentence:** There is a disconnect between this partial characterization of Section 27 and the description in Section 1.2 below. Please explain the relationship between the conduct of FYRs for individual OUs prior to the final RA.

Air Force Response
Changes have been made to Section 1.1 and 1.2 to address this comment.

21. **PDF Page 26 (2-0), Section 2.0, last sentence:** Please explain what the reference to "enforcement actions" means.

Air Force Response
The text in Section 2.0 has been revised to clarify that enforcement actions involve issuance of orders.

22. **PDF Page 26 (2-0), Section 2.1, 1st paragraph, 1st sentence:** Please revise this statement so that it is clear that whether or not clean-up is required is not related, at least generally, to location-specific and action-specific ARARs, but to chemical-specific limits (promulgated standards or risk-based standards) on contaminant levels, and the existence of potential exposure pathways. Of course, if cleanup is required, then the cleanup action must achieve chemical, location, and action specific ARARs.

Air Force Response
The paragraph has been revised as requested.

23. **PDF Page 29 (2-3), 1st full paragraph after Table 2-1:** Please revise the sentence to read “For all . . . Groundwater OU ROD or ESD, or the Basewide OU ROD . . . .”

Air Force Response
For consistency within the document, the sentence has been revised to “For all sites… 2010 Soil OU and Groundwater ESD and 2010 Basewide OU ESD.”

24. **PDF Pages 29-30 (2-3 and 2-4), indented text:** The text appears to be a quotation, though not so marked, but the source of the text is not identified. If so, please mark as a quotation and identify the text’s source.

Air Force Response
Quotation marks have been added around the cited text.

25. **PDF Page 29 (2-3), 1st indented paragraph, 1st sentence:** Though apparently a quotation, the statement seems inaccurate in this context as it does not reflect the ESDs issued to address the risk posed by VI, and the potential need to clean up the vadose zone to address VI risks.

Air Force Response
The cited text is an accurate quotation from the 2010 Soil OU and Groundwater OU ESD and 2010 Basewide OU ESD. It describes the requirements for the sites in Table 2-1 identified as having a “narrative” cleanup level. There is no requirement to clean up the vadose zone to address vapor intrusion risk at any of the sites addressed in this Five-Year Review. The selected remedy for addressing vapor intrusion risk is ICs. The ICs are described in Section 2.2.3 of the Five-Year Review.

26. **PDF Page 29, (2-3), 2nd indented paragraph, 3rd sentence:** This statement is inconsistent with the actions of the AF, as it shut down the SVE system for a rebound study, and then unilaterally decided to keep the system shut off. Therefore, EPA and DTSC did not have the opportunity to make an assessment on the adequacy of the soil cleanup to ensure against further groundwater contamination or VI risks.

    Air Force Response
    The cited text is an accurate quotation from the Soil OU and Groundwater OU ROD ESD and Basewide OU ROD ESD. Section 5.6.3.1 of the Five-Year Review has been revised to clarify the ongoing dispute between the Air Force and the regulatory agencies with regard to remedial action completion at Site OT-23C.

27. **PDF Page 30 (2-4) "Response Actions" 2nd paragraph:** This page references time-critical and non-time-critical removal actions at Mather, but there was an Engineering Evaluation and Cost Analysis (EECA) and a Non-Time-Critical Removal Action at the new site Building 4260 which is not included. Please add this to the list and provide a narrative when Building 4260 is discussed in its own site section (per previous comment).

    Air Force Response
    Please refer to the responses to EPA's General Comment #9 and Specific Comment #2.

28. **PDF Page 37 (2-11), Section 2.2.3, OU 3 (Soil OU), Site SD-59, and PDF Page 67 (5-15), Section 5.4.4.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Remedy Performance:** Section 2.2.3 states that part of the remedial action included excavation, transportation, and treatment of soils, but the status of this part of the remedial action is not discussed in the Remedy Performance subsection of Section 5.4.4.1 for Site SD-59. The Remedy Performance section should be revised to discuss the status of all parts of the remedial action. Alternatively, Section 2.2.3 could be revised to clarify the remedy components that were completed during previous Five-Year Review periods. Please revise Section 5.4.4.1, Remedy Performance, to discuss the excavation, transportation, and treatment of soils as it pertains to the remedy performance. Alternatively, please revise Section 2.2.3 to summarize the remedy components that were completed during previous Five-Year Reviews.

    Air Force Response
    The purpose of Section 2.2.3 is to describe the selected remedial actions. Section 2.3 "Status of Implementation" has been modified to clarify that all soil removal, SVE and BV activities have been completed for each site as applicable. Also, as noted in Section 2.3 of the FYR, detailed descriptions of remedial activities can be found in the O&M manuals, monitoring reports, reports of proper and successful operation, response complete and closure reports, and other technical reports listed in Section 5.0.

29. **PDF Page 38 (2-12) Section 2.2.4, OU 4 (Landfill OU), Site LF-04, and PDF Page 69 (5-17) Section 5.5.2.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Remedy Performance**: Section 2.2.4 states that part of the selected remedy included the installation of flood control measures, but these measures are not discussed in the Remedy Performance subsection of Section 5.5.2.1 for Site LF-04. Measures completed as part of the remedy should be summarized in Section 5.5.2.1. Alternatively, Section 2.2.4 could be revised to summarize completed remedy components. Please revise Section 5.5.2.1, Remedy Performance, to discuss whether the installation of flood control measures was conducted as part of the remedy. Alternatively, please revise Section 2.2.4 to summarize completed remedy components.

    Air Force Response
    The purpose of Section 2.2.4 is to describe the selected remedial actions. Section 2.3 "Status of Implementation" identifies that the Landfills are in place at LF-03 and LF-04 and are operating properly and successfully. As noted in Section 2.3 of the FYR, detailed descriptions of remedial activities can be found in the O&M manuals, monitoring reports, reports of proper and successful operation, response complete and closure reports, and other technical reports listed in Section 5.0.

30. **PDF Page 40 (2-14), Site OT-23C, 2nd paragraph after 1st 3 bullet points, 2nd sentence:** Please revise the sentence to make clear that the narrow scope of the ICs selected in the ESD is what limited the application of ICs to the last remaining (i.e., not yet transferred) property parcel, not an evaluation of VI risk.

    Air Force Response

Section 2.2.5 has been revised to clarify the IC requirements in the ESD and to state that only ICs relating to restriction of groundwater use and protection of remedial systems were implemented at Parcel P-2.

31. **PDF Page 40 (2-14), Site OT-23C, 1st paragraph after 3 bullet points at bottom of page, 1st sentence:** This sentence is inaccurate in that the SVE Completion Report is not a decision document and may not "require" any response action. Moreover, as previously noted, the ESD expressly notes that it does not apply to previously transferred property. Therefore, ICs put in place in relation to property transferred prior to the ESD are not subject to the ESD and are not part of the selected remedy. In addition, the ICs are only prospective, yet at Site 23C there are multiple pre-existing structures that may be impacted by VI which are not covered by the ESD. Grammar: This sentence is missing a period at the end. Finally, the data presented in the SVE Completion Report is inadequate to establish which properties are at risk of VI. Please revise the text to accurately reflect the status of the SVE Completion Report vis a vis decision documents, and the fact that the data is inadequate.

Air Force Response
Information regarding the ICs implemented pursuant to the *Site 23C Former Laundry and Cleaning Plant Soil Vapor Extraction Completion Report* (URS, 2019) has been moved to Section 5.6.3.1 of the FYR. The Air Force does not agree with the agencies' assessment of the adequacy of the data. To clarify the agencies' position as well as the Air Force's position in the ongoing dispute, the text in Section 5.6.3.1 was revised to indicate, 1) that the agencies believe additional data should be collected to confirm the shallow soil vapor concentrations at the site, 2) that the Air Force believes the existing data are sufficient to assess vapor intrusion risk, and 3) that the "available shallow soil vapor concentrations … indicate vapor intrusion risk is within the risk management range..."

32. **PDF Page 41 (2-15) Section 2.2.5, OU 5 (Basewide OU), Site OT-87, and PDF Page 73 (5-21) Section 5.6.4.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Remedy Performance:** The Remedy Performance subsection of Section 5.6.4.1 for Site OT-87 states that contaminated soil was excavated in accordance with the 2010 Basewide OU Record of Decision (ROD) but does not discuss the remainder of the remedial action components discussed in Section 2.2.5. For example, Section 2.2.5 states that soils would be stabilized as necessary, transported to Site WP-07, and backfilled, but these components are not discussed in Section 5.6.4.1. Alternatively, Section 2.2.5 could be revised to specify the components of the remedy that were completed. Please revise Section 5.6.4.1, Remedy Performance, to discuss whether all components of the remedy for OT-87 were completed in accordance with the 2010 Basewide OU ROD. Alternatively, please revise Section 2.2.5 to summarize the components of the remedy that were completed during a previous five-year review period.

Air Force Response
The purpose of Section 2.2.5 is to describe the selected remedial actions. The Air Force has revised the text in Section 2.3 "Status of Implementation" to indicate that the other remedial action components have been completed.

33. **PDF Page 42 (2-16) Section 2.2.5, OU 6 (Supplemental Basewide OU), Site OT-89, and PDF Page 74 (5-22), Section 5.7.1.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Progress Towards Meeting RAOs:** The Progress Towards Meeting RAOs section for Site OT-89 states that compliance with RAOs for preventing unacceptable human exposure is being monitored annually but does not discuss how plant exposure to elevated lead concentrations were prevented as listed in Section 2.2.5. The text should discuss how the OU 6 remedy is protective of the environment or the protectiveness statements need to be revised. Please revise the Progress Towards Meeting RAOs section for Site OT-89 to summarize progress for each RAO, including that for plant exposure to lead concentrations. Alternatively, please revise the protectiveness statement for OU 6 if the objective of preventing plant exposure to elevated lead concentrations has not been achieved.

Air Force Response
Section 2.3 of the FYR, which discusses the status of remedy implementation, has been revised to indicate that the pre-ROD lead removal action resulted in soil concentrations protective of plants and other ecological receptors.

34. **PDF Page 42 (2-16), Section 2.3, 4th paragraph and PDF Page 44 Figure Notes #4:** What is the status of the 1000' use restriction for methane and existing structures? Does it apply to structures at the time of transfer as well as future structures? What is the status of its implementation? Please amend the text to provide this information.

Air Force Response
The ICs for the landfills are described in Sections 2.2.3 and 2.2.4. The ICs require "future landowners to obtain approval for any changes in land use or site improvements within 1,000 feet of a landfill." The landfill buffers were

applied only to property within the boundaries of the former Mather AFB, as shown in Figures 2-1 and 2-2 (AFRPA, 2009a; AFRPA, 2010a). Sections 2.2.3 and 2.2.4 were revised to indicate that the1,000-foot buffer was applied only to property within the boundaries of the former Mather AFB.

35. **PDF Page 42 (2-16), Section 2.3, 5th paragraph, 2nd sentence:** This statement is inaccurate in relation to Site 23C (and Building 4260) because, as noted previously, the revised deed that the AF negotiated with the County of Sacramento is not part of the remedy, so it does not qualify as an IC in place.

Air Force Response
Section 2.3 has been revised for clarification regarding Site OT-23C. Please refer to the response to EPA's General Comment #9 and Specific Comment #2 regarding Building 4260.

36. **PDF Page 43 (2-17), Section 2.4, 3rd sentence:** As drafted the sentence may be read to mean that the RODs and ESDs "stipulated" that the AF anticipated property owners to conduct LUC compliance reviews. Please revise so that the text is clear that the AF anticipated the compliance reviews would be conducted by the property owners as described in the RODS and ESDs.

Air Force Response
The text in Section 2.4 has been revised as requested.

37. **PDF Page 43 (2-17), Section 2.4:** This section describes an issue with ICs. For properties that have transferred ownership, the current property owner should be doing annual IC inspections, according to SLUCs. What measures have or will be taken to address this issue? Why was this not identified as an issue in the Executive Summary? As the AF has stepped in to fill that void in 2017 and 2018, do they plan to continue doing that? If so, does this call for an ESD and/or ROD amendment(s)?

Air Force Response
Text was added to Section 2.4 to indicate that Air Force will continue to work with the State of California and local agencies with regard to IC compliance reports and dig notifications, and will continue to track IC compliance.

38. **PDF Page 43 (2-17), Section 2.4, last sentence:** The figures are incorrect with regard to Site 23C because the ESD did not identify the park area as subject to ICs as it already had been transferred (see, Figure 4 of the ESD which shows the area of Site 23C subject to ICs pursuant to the ESD).

Air Force Response
The figures provide an accurate depiction of properties for which ICs are in place. The text of text of the document has been revised to clarify that ICs in place at Site OT-23C are in addition to what was required under the 2010 Basewide OU ESD.

39. **PDF Page 43 (2-17), last paragraph:** When discussing PFAS investigations, the preliminary Site Investigation is referred to as a "basewide Site Investigation", which is misrepresentative of what it was. There were only approximately 10 sites which were considered in this study and as the AF's response to comments described, it was not intended to be comprehensive. Please change to "basewide Site Investigation" to "preliminary Site Investigation". It would also be beneficial to mention the planned Expanded SI study as well as the planned Remedial Investigation.

Air Force Response
Site investigations included a basewide Preliminary Assessment to identify areas where AFFF containing PFAS had been used, handled, stored or released at Mather, and Site Inspections to determine the presence or absence of in PFOS, PFOA, and perfluorobutanesulfonic acid (PFBS), in groundwater, surface water, soil and sediment at these AFFF Areas. As part of the SI, a receptor and exposure pathway evaluation was completed. Due to the lack of toxicity values or promulgated cleanup values for these constituents, the focus of this receptor and pathway evaluation was limited to human exposure via drinking water. When additional toxicological information and promulgated cleanup standards become available, these exposure pathways will be reevaluated. Further detail concerning the site investigations, including the planned Expanded SI and Remedial Investigation, has been added to Table 3-2 and Section 5.1.2. The text in Section 2 was retained since it is focused on groundwater treatment system O&M.

40. **PDF Pages 47-49 (3-1 through 3-3), Section 3:** A brief summary of PFAS sampling and response actions should be added to Section 3, as this section addresses progress since the last review. The entry in Table 3-2 provides an insufficient level of detail. Please provide background on sampling, including a summary of sampling rounds, ranges of detections, impacted well systems, and response actions undertaken since the date of last review.

Air Force Response
Table 3-2 has been revised to provide additional information regarding PFAS site investigations and response actions. Further detail concerning the sampling methods and results can be found in the Preliminary Assessment and Site Inspection reports.

41. **PDF Pages 45-46, Figures 2-1 and 2-2:** The Landfill 1,000-foot buffer is mentioned in Figures 2-1 and 2-2 but not mentioned in the text. Please provide an update on the status of this IC in the text of the document. Additionally, does this IC cover all land or existing structures within 1,000 feet, or only new construction?

Air Force Response
The ICs for the landfills are described in Sections 2.2.3 and 2.2.4. The ICs require "future landowners to obtain approval for any changes in land use or site improvements within 1,000 feet of a landfill." The landfill buffers were applied only to property within the boundaries of the former Mather AFB, as shown in Figures 2-1 and 2-2 (AFRPA, 2009a; AFRPA, 2010a). Sections 2.2.3 and 2.2.4 were revised to indicate that the1,000-foot buffer was applied only to property within the boundaries of the former Mather AFB.

42. **PDF Page 47 (3-1), beginning of the last paragraph:** The text states "The recommendations and follow-up actions presented in the fourth five-year review were implemented." However, several issues highlighted have not been fully resolved including the following items:
    a. PFCs, i.e. PFAS. Although the recommendations described are underway, they are yet to be completed.
    "Protectiveness Statement:
    The remedies at OU 2 (Groundwater OU) are protective of human health and the environment in the short term due to already existing ICs. For the remedy to be protective in the long-term, the following actions need to be taken: the presence and magnitude of PFCs in groundwater must be determined; potential risks from exposure to PFCs must be evaluated; and appropriate remedies (if any) must be determined and documented in appropriate decision documents."
    Please add a similar recommendation and discuss the near-term actions (e.g. Expanded SI and Remedial Investigation) that will be implemented in order to work towards long-term protectiveness with respect to this issue.

Air Force Response

The statements in Table 3-1 are taken directly from the prior Five-Year Review. Table 3-2 was revised to include a description of the additional work being planned to address PFAS at Mather. In addition, Section 6 includes a recommendation to: "Continue to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of PFAS at the Main Base/SAC Area treatment system."

    b. Site 59/Building 4260. Although this recommendation has been initiated, it has not been completed.
    "The remedies at OU 3 (Soil OU) are protective of human health and the environment in the short term. However, for the Soil OU remedies to be protective in the long term, the IC boundary at Site SD-59 needs to be expanded to the south and east to address the potential risk to human health from the vapor intrusion pathway. Investigation and risk assessment activities are also needed at Building 4260, where a new source area may have been discovered."
    Please add a recommendation and discuss the near-term actions that will be implemented in order to work towards protectiveness at Building 4260.

Air Force Response
The statements in Table 3-1 are taken directly from the prior Five-Year Review. Table 3-2 includes a description of the actions that have been taken and are still underway at B4260.

43. **PDF Page 47 (3-1), Table 3-1, row 3 (OU 3), column 3:** As noted previously, the ICs for Site SD-59 do not address existing construction; therefore extending the ICs from that site to the recently designated site Building

4260, which is an existing structure, will not provide any remedial benefit as the restrictions will not apply to it. Please explain the purpose of the expansion of the Site 59 ICs, and how the AF intends to ensure that the remedy is protective for occupants of existing structures.

Air Force Response
The statements in Table 3-1 are taken directly from the prior Five-Year Review. Table 3-2 been revised to describe the IC imposed at B4260 to protect occupants of the building.

44. **PDF Page 47 (3-1), Table 3-1, row 5 (OU 5), column 3:** As noted previously, the ICs for Site 23C do not address property transferred prior to issuance of the ESD, nor do they apply to existing structures. Given that the AF itself recommends that ICs be implemented on a portion of Site 23 (the so-called "park property"), but does not have a basis in a remedial decision document for implementing ICs on the park property, and that it has yet to establish that there is no VI risk to properties adjacent to the park property, the "Protectiveness Statement" is incorrect and must be revised.

Air Force Response
The statements in Table 3-1 are taken directly from the prior Five-Year Review. The protectiveness statements for Site 23C have been revised in other sections of the document.

45. **PDF Page 47 (3-1), Table 3-1, row 7 (Sitewide), column 3, 2nd sentence:** See comment no. 43 concerning ICs at Site SD-59.

Air Force Response
Please see the response to EPA Specific Comment 42.

46. **PDF Page 47, first sentence after Table 3-1:** This statement is not true as the follow-up actions regarding Site 59/Building 4260, including adequate characterization of the building including the office spaces, has not been completed. Please revise this sentence accordingly.

Air Force Response
As described in Table 3-2, the recommendations from Table 3-1 for B4260 have been implemented.

47. **PDF Page 48 (3-2), Table 3-2, first line, last column:** Please mention the California Water Board PFOA and PFOS response levels as a reference point.

Air Force Response
A statement regarding the Water Board's response level for PFOA+PFOS was added to Table 3-2.

48. **PDF Page 48 (3-2), Table 3-2, second line, last column, second sentence:** This sentence is misleading. To say that "The Air Force conducted indoor air sampling" implies that *comprehensive* indoor air sampling was conducted, but there was only one sampling event conducted by the Air Force. Due to seasonal variability influences on vapor intrusion, one indoor air sampling event is insufficient to completely negate any indoor air issues. Therefore, the narrative that states "there was no completed pathway to indoor air from soil vapor contaminants at B4260 and therefore, no site related vapor intrusion human health risk to building occupants" is premature. Please revise accordingly.

Air Force Response
The Air Force does not agree with EPA's assessment of the indoor air sampling. Two sampling events were conducted, one by the Air Force in February and one by the Central Valley Water Board in August. No soil vapor contaminants were detected in indoor air during either sampling event, despite a detection of TCE (the primary contaminant of concern) in one sub-slab sample at a concentration substantially above its screening level. The detection limits for TCE in indoor air were two orders of magnitude below the indoor air screening level during both sampling events. In addition, background levels of carbon tetrachloride were successfully detected in indoor air by both the Air Force and the Water Board. While the Water Board's sampling and quality assurance protocols may not be as rigorous as the Air Force's, there is no basis for concluding their data are not valid. The two sets of indoor air sampling data provide substantial evidence for concluding there is not a completed pathway to indoor air from soil vapor contaminants under current conditions. Table 3-2 was revised to indicate that two rounds of indoor air sampling were performed, one by the Air Force and one by the Water Board, and to identify that the Air Force imposed an IC prohibiting modifications to the building or its foundation to address human health risk to building

occupants. The Air Force has been conducting soil vapor extraction at B4260 since August 2018, which has significantly reduced concentrations of TCE in soil gas, further minimizing the likelihood of a potential vapor intrusion risk to occupants of the building.

49. **PDF Page 48 (3-2), Section 3-3, last line and first paragraph on page 49:** Same comment as above. Please revise the language accordingly.

Air Force Response
Section 3-3 was revised to indicate there is no site related vapor intrusion human health risk to building occupants under current conditions, and that an IC was imposed by the Air Force to prohibit modifications to the building or its foundation to address potential human health risks to building occupants.

50. **PDF Page 50 (3-4), Section 4.1, list of RPM names:** Please revise the list to include John Lucey as well, as he was EPA's RPM on Mather through December 2019.

Air Force Response
John Lucey was added to the list of RPMs.

51. **PDF Page 50 (3-4), Table 4-1:** Please revise this table to reflect the actual date of submission and comments due dates (including extensions).

Air Force Response
Table 4-1 has been revised as requested.

52. **PDF Pages 50-51 (4-1 through 4-2) Section 4.2, Community Involvement and Notification:** Section 4.2 states that a public notice was published in the *Sacramento Bee* on March 22, 2019; however, a copy of this public notice was not provided in the Fifth FYR. Please revise the Fifth FYR to include a copy of the public notice published in the *Sacramento Bee*.

Air Force Response
A copy of the public notice has been added to Appendix D.

53. **PDF Page 51 (4-2), Section 4.4, Site Inspections:** Section 4.4 should include additional information as outlined in Appendix E of the FYR Guidance (pages E-6 and E-7). Specifically, the site inspection section should discuss the inspection participants, scope and procedures, results and conclusions, and provide a checklist. Please revise Section 4.4 to provide additional information regarding the site inspections conducted in November 2018.

Air Force Response
Section 4.4 has been revised to add additional information regarding the Site Inspections. Based on the 2016 EPA guidance, site inspection checklists are an optional item that may be provided as an appendix. Site inspection checklists are available for review in the 2018 Annual IC Compliance Report, which is cited as a reference in the Fifth Five-Year Review.

54. **PDF Pages 51-52 (4-2 through 4-3), Section 4.5, Site Interviews:** Section 4.5 should include additional information as outlined in Appendix E of the FYR Guidance (page E-6). The FYR Guidance suggests including the interview date(s) and location(s) and participants (including name, title, etc.). Additionally, the last paragraph in Section 4.5 states that Appendix B includes the interview records, but they are found in Appendix C in the Fifth FYR. Please revise Section 4.5 to provide additional information about the site interviews conducted. Additionally, please revise Section 4.5 to reference Appendix C for the interview records.

Air Force Response
The content of Section 4.5 complies with the 2016 EPA guidance on preparing Five-Year Reviews, which states, "Include a brief summary (roughly two paragraphs) of the interview results here." Much of the information requested in the comment, including interview date, participant name, etc., is included on the interview records in Appendix C. The document has been revised to reference Appendix C.

55. **PDF Page 52 (4-3), Section 4.5, Site Interviews:** The second paragraph of Section 4.3 states that five community members responded to the Air Force request for input and later states that "All four expressed some general

knowledge." However, the fifth interviewed community member was not represented by using the phrase "all four." Please revise Section 4.5 to include the fifth community member, or revise the text to clarify the statement (e.g., instead of "All four expressed," revise to "Four expressed…").

Air Force Response
The requested change has been made in Section 4.5, Site Interviews.

56. **PDF Page 52 (4-3), second paragraph (and repeated at various points in the documents):** The persons interviewed are referred to as "community members"; however, no community members were interviewed throughout this Five-Year Review. Please change the word "community members" to "stakeholders". Those interviewed are stakeholders or active participants because they have a direct relationship to the site.

Air Force Response
The requested change has been made in Sections 4.2 and 4.5.

57. **PDF Pages 53-82, Section 5:** Since PFAS needs to be included under Question B, it may be appropriate to keep the Question B discussion as a separate section. Please consider moving Section B back to the Technical Assessment for each site.

Air Force Response
Information has been added to Question B to address PFAS. However, because the information in Question B is relevant to multiple sites, moving it to Section 5.2 would result in significant redundancy within the document. Therefore, Question B was left in Section 5.1.

58. **PDF Pages 53-82, Section 5:** The technical assessment of PFAS contamination was undertaken as part of Question C. Existing guidance and best practices dictate that emerging contaminants be addressed under Question B, as the presence of new and emerging contaminants calls into questions assumptions regarding exposure. Please move the discussion of PFAS from Question C to Question B.

Air Force Response
The assessment of PFAS contamination was moved to Question B as requested.

59. **PDF Page 53 (5-1), Section 5.0, 1st paragraph, 1st sentence:** Please revise the phrase "actions are" to reference both short- and long-term protectiveness- "actions are and will continue to be."

Air Force Response
The requested change has been made to Section 5.0.

60. **PDF Page 53 (5-1), Section 5.1.1, 4th paragraph, last sentence:** Please revise this statement to reflect the regulators' concerns about the VI risk in relation to existing structures at Site 23C which apparently was not considered in the course of preparing the 2010 ESD as it did not apply to existing structures. (The situation at Buildings 4260, 7022 and 7044 raises similar concerns.)

Air Force Response
The statement in the 4th paragraph of Section 5.1.1 relates specifically to potential risk from the vapor intrusion pathway from VOCs in groundwater. Potential vapor intrusion risk at Site 23C is associated with residual soil vapor contamination. Therefore, this change was not made.

61. **PDF Page 54 (5-2), Section 5.1.2, 2nd paragraph, last sentence:** The narrative implies that all MCLs do not exceed the NCP's risk management range. MCLs are not risk-based numbers. Please adapt the language to something like: "Therefore, the groundwater ACLs for Mather remain protective of human health because the values are generally equal to, or less than, a corresponding MCL and/or they do not exceed the NCP's risk management range".

Air Force Response
The requested change to Section 5.1.2 was made.

62. **PDF Page 54 (5-2), Section 5.1.2, 3rd paragraph:** The text states that DTSC-SLs are "not enforceable standards or ARARs for use in decision-making at contaminated sites." Leaving aside the issue of whether or not the DTSC-SLs

are ARARs, although they are promulgated as the State of California's Toxicity Criteria Rule, DTSC-SLs may be enforceable standards and used in decision-making at contaminated sites if they are identified in a decision document as TBC.
The EPA Hierarchy Memorandum cites a preference for using IRIS (Tier 1) toxicity values but allows that "EPA and state personnel may use and accept other technically sound approaches." In the development of the toxicity criteria for PCE, CA confirmed that their toxicity value included considerations to ensure protection of sensitive subpopulations consistent with State statute and science policy. EPA R9 agrees that while the IRIS PCE toxicity criteria is protective generally, R9 did not find that the CA PCE toxicity criteria derivation was technically unsound. At this time, EPA has not made a determination regarding whether California's TCR is an ARAR but recognizes the toxicity values in the rule as values to be considered in decision documents. As such, the relevant values derived from the rule can be used as remedial objectives in RODs, consistent with CERCLA guidance. This approach has been used for RODs in CA including military bases such as the recent (2018 and 2019) McClellan AFB RODs, and a (2019) Travis AFB ROD Amendment. Please revise the language accordingly.
Grammatical comment: Additionally, the last sentence in the third paragraph in Section 5.1.2 starts "As set forth in *HHRA Note 3*," which implies that all statements in the sentence describe the determinations in *HHRA Note 3*, so the last clause "are not enforceable standards or ARARs for use in decision-making at contaminated sites" is incorrect as it implies that *HHRA Note 3* says that the Toxicity Criteria Rule is not an ARAR, which it does not (*HHRA Note 3* does not mention the term ARAR).

Air Force Response
The words "and are not enforceable standards or ARARs for use in decision-making at contaminated sites" have been deleted from the text.

63. **PDF Page 56 (5-4), 1st sentence in the "Soil" section:** Please briefly describe the origin of the different cleanup levels for lead in soil for Sites FT-10C/ST-68, OT-87, and OT-89. What cleanup levels did the AF agree to and where are these decisions documented (e.g. ROD, ESD?)?

Air Force Response
The decision documents for each site are listed in Section 2.2. The RAOs and cleanup levels for these sites are provided in Sections 2.2.5 and 2.2.6.

64. **PDF Page 56 (5-4), "Soil" section, 1st paragraph, 4th and 5th sentences**: If the maximum lead concentration at Site FT-10C/ST-68 exceeds the California Human Health Screening Levels, how were they determined to be compatible with UU/UE, and why were no residential use restrictions imposed at the site?

Air Force Response
As stated in this section of the current Five-Year Review, the average concentration at the site is 44 mg/kg and the median concentration is 19 mg/kg, which are below the California Human Health Screening Level of 80 mg/kg for residential use. The document also explains "During the fourth five-year review, the Air Force presented a 95th upper confidence limit (95th UCL) of the mean calculated for lead concentrations remaining in soil at FT-10C/ST-68, OT-87, and OT-89. The 95th UCL concentrations were used to evaluate the remedies with respect to the revised CHHSLs and to assess blood lead levels (using the DTSC LEADSPREAD 8 model). The remedies were determined to be protective of human health and the environment (see Appendix D in URS, 2015d)." The full analysis is provided in the fourth five-year review.

65. **PDF Page 56 (5-4), 3rd paragraph in the "Soil" section:** This paragraph is a bit confusing. When in the fourth FYR, the 95th upper confidence limit was calculated for Sites FT-10C/ST-68, OT-87, and OT-89, and the text says that "The remedies were determined to be protective of human health and the environment," but it is unclear what levels are being utilized to make this protectiveness determination. Was each compared to the California Human Health Screening Levels for industrial or residential use, or was Site FT-10C compared to the residential screening level and Sites OT-87 and OT-89 compared to the industrial screening level? Please edit the text to clarify.

Air Force Response
The text was revised to indicate that the evaluation was based on the permissible land uses for each site, as dictated by site ICs.

66. **PDF Page 56 (5-4), last sentence of first paragraph in the "Soil Vapor" section:** Please see comment 62.

Air Force Response

The words "and are not enforceable standards or ARARs for use in decision-making at contaminated sites" have been deleted from the text.

67. **PDF Page 56 (5-4), Section titled "Soil Vapor," 3rd paragraph, 2nd sentence:** This sentence is not accurate with regard to the Basewide OU ESD; the IC boundaries are limited by the terms of the ESD to property not transferred prior to issuance of the ESD, so the only Site 23C property that was subject to ICs was a small rectangular parcel where there was no VI risk, but remedial infrastructure was located that was subject to the remedy protection component of the ICs. The fact that the ICs are solely prospective, by definition applying only to future construction, not existing structures, also indicates that the IC boundaries were not based on an assessment of VI risk. Please revise this sentence to account for the situation at Site 23C and explain whether similar issues exist at other sites with VI issues.

Air Force Response
The document was revised to indicate that the IC for Site OT-23C was limited to a small portion of the site that had not yet been transferred. This condition is not applicable to other sites.

68. **PDF Page 56 (5-4), last paragraph:** The text references that various sites have remedial action completion reports. This is not the case for Site 23C and may not be the case for others. An SVE Completion Report or a Response Complete Determination are not equivalent to a Remedial Action Completion Report. Please edit the text for clarification as necessary.

Air Force Response
The SVE Completion Reports were prepared in accordance with EPA guidance for Remedial Action Completion Reports (RACRs) and have served as such. The Site 23C SVE Completion Report was also prepared based on the EPA guidance for RACRs. However, the Air Force agreed to prepare an updated "Remedial Action Completion Report" per the Site 23C dispute resolution agreement. Because this agreement was made after the time period of this Five-Year Review, it is not discussed therein.

69. **PDF Page 57 (5-5), last sentences before Table 5-2 and PDF Page 72 (5-20) last paragraph, next-to-last sentence:** This statement is not accurate because: 1) the IC remedy does not apply to property transferred prior to issuance of the Basewide OU ESD, so does not apply to the so-called park property and the supplemental deed recorded by the AF therefore is not part of the remedy; 2) the IC remedy does not apply to existing structures, only to future construction, so the properties with existing structures adjacent to the park property are not subject to ICs; and 3) the data currently available is inadequate to determine that there is no VI risk to the adjacent properties. Please revise the statement to reflect these comments.

Air Force Response
The document has been revised to indicate that ICs were not required by the ESD but were voluntarily applied to the park property by the Air Force to address vapor intrusion risk on that property. The comment is correct that the IC does not extend to adjacent properties with existing structures; no revision to the document is required. The Air Force does not agree that the available data are not adequate to assess the protectiveness of the VI remedy. A discussion of the ongoing dispute over this issue has been added to the document.

70. **PDF Page 58 (5-6), Section titled "Action and Location-Specific ARARs," 2nd paragraph, 3rd sentence:** Please revise this sentence to accurately reflect that ARARs remain part of the remedy-applicable, or relevant and appropriate-as long as waste is left in place (even if an ARAR is modified because of a change that affects protectiveness).

Air Force Response
The requested change was made.

71. **PDF Page 58 (5-6), Section 5.2.1.1, 3rd paragraph, 1st sentence:** Please explain whether this information suggests additional contaminant releases from the/a source area, and whether these increased concentrations are expected to be reflected in downgradient wells or are expected to be captured or attenuated before they arrive downgradient?

Air Force Response
Section 5.2.1.1 has been revised to further explain this issue.

72. **PDF Pages 59 (5-7), 60 (5-8), 62 (5-10) - 68 (5-16), 70 (5-18) – 74 (5-22), paragraphs titled "Institutional Controls:"** The discussion of ICs is inadequate; the discussion should reference the goal of the ICs (e.g., groundwater use restrictions), and confirm that inspections have not identified any violations of the restrictions (e.g., no well drilling permits issued, no GW wells drilled).

Air Force Response
The RAOs of the ICs are described in detail in Section 2. Re-stating those in Section 5 would result in significant redundancy in the document. Full details of the IC inspections and findings can be found in the annual IC compliance reports, which are cited as references in the Fifth Five-Year Review.

73. **PDF Page 60 (5-8), Section 5.3.1.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Mather Off-Base Water Supply Contingency Plan:** The end of the first paragraph states that monitoring and treatment at the Moonbeam wellhead was scheduled to be terminated by the end of 2019, but it is now 2020. Please revise the text to provide an updated status of scheduled Moonbeam wellhead activities.

Air Force Response
Because the cut-off date for this Five-Year Review was September 2019, the text was not revised.

74. **PDF Page 61 (5-9), paragraph titled "Progress Toward Meeting RAOs," 1st sentence:** Please explain what the AF is doing to ensure full plume capture.

Air Force Response
The text has been revised to provide further explanation of this issue.

75. **PDF Page 61 (5-9), Section 5.3.1.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Progress Toward Meeting RAOs, and Figure 5-3, Main Base/SAC Area Unit B Composite COC Plume, Fourth Quarter 2013 and 2018:** The Progress Toward Meeting RAOs section for OU 2 states that a majority of the plume has been captured but does not discuss future plans for capture of the Unit B Composite Plume that appears to be uncaptured, as shown on Figure 5-3. Figure 5-3 appears to indicate the plume is migrating towards the east and southeast, but no additional monitoring wells are located beyond MAFB-423B and MAFB-451 to delineate the extent of the plume. It is unclear how this potential migration will be addressed and how current monitoring activities are sufficient to meet RAOs if the plume extends beyond well MAFB-423B and MAFB-451. Further it appears that MBS EW-2Bu and MBS EW-9B, the nearest extraction wells to the east and southeast portions of the plume, are located outside the plume boundary to the west and are not capturing the plume. An extraction well is needed in the center of the large plume shown on Figure 5-3. Please discuss the progress towards meeting RAOs for the Main Base/SAC Area plume considering that the eastern and southeastern edges of the plume have not been defined or captured, as shown on Figure 5-3.

Air Force Response
The text has been revised to provide further explanation of this issue.

76. **PDF Page 62 (5-10), Section 5.3.2.1, 4th paragraph (1st full paragraph on PDF Page 62 (5-10)):** Please explain the significance of this exceedance.

Air Force Response
The text has been revised to explain the significance of the exceedance.

77. **PDF Page 62 (5-10) Section 5.3.2.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Progress Toward Meeting RAOs:** According to Section 2.2.2, OU 2 (Groundwater OU), three RAOs were identified in the 1996 Soil OU and Groundwater OU ROD for Site 7 Plumes, including compliance with discharge standards for disposing of treated water; however, Section 5.3.2.1 only states that discharge monitoring results are presented in the annual groundwater monitoring reports. Please revise Section 5.3.2.1 to address the progress towards meeting all RAOs for the Site 7 Plume, including whether discharge standards are being met.

Air Force Response
The text was revised to indicate that the remedy has complied with discharge standards.

78. **PDF Page 62 (5-10), Section 5.3.3.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Remedy Performance and Figure 5-6, Northeast Plume Area, PCE and cis-1,2-DCE Isoconcentration Contours, Fourth Quarter 2013 and 2018:** The Remedy Performance section for the Northeast Plume states that MAFB-467 was installed near MAFB-132, but MAFB-467 does not appear to be included on Figure 5-6. Additionally, on Figure 5-6, the 2013 Isoconcentration Contours cover a well label, presumably MAFB-132, which is discussed in Section 5.3.3.1. Please revise Figure 5-6 to include the location of MAFB-467 and to bring the well label in front of the 2013 Isoconcentration Contours.

Air Force Response
MAFB-467 was installed during 3rd quarter 2019. Because Figure 5-6 shows the 2013 plume compared to the 2018 plume, MAFB-467 is not included on this figure since the well was not installed during either of those sampling events. Figure 5-6 has been revised to bring all of the well ID labels to the front.

79. **PDF Page 63 (5-11), paragraph titled "Institutional Controls," 2nd sentence:** Please explain why this information included in the section on ICs.

Air Force Response
This information was included because the ICs prohibit the installation of groundwater wells. However, because the IC relates specifically to the installation of groundwater supply wells, the sentence was removed.

80. **PDF Page 64 (5-12), Section 5.4.1.1, Question A, Is the Remedy Functioning as Intended by the Decision Documents, Landfill WP-07:** The final sentence of the Landfill WP-07 section references Appendix C of a 2018 report, but a complete formal reference was not provided. Please revise the text to provide a reference to the 2018 Annual Post-Closure Landfill Inspection and Gas Monitoring Report.

Air Force Response
The sentence is referring to the annual IC compliance reports, which are referenced 3 paragraphs up from sentence, under the heading of Institutional Controls. Because this sentence is a summary of that information, the references were not re-iterated.

81. **PDF Page 65 (5-13), Section 5.4.2.1, sub-heading "Remedy Performance," 1st paragraph, 3rd sentence:** Please describe the risk addressed by the enlargement of the IC area, and how the expansion of the IC area addresses that risk.

Air Force Response
Text was revised to indicate that the IC area was expanded based on the shallow soil vapor concentration at SLB-MBF-10A exceeding the DTSC-SL for residential indoor air.

82. **PDF Page 68 (5-16), Section 5.5.1.1, sub-heading "Groundwater Monitoring," 1st paragraph, 2nd sentence:** Please check the cross-reference to Section 5.3.3, and confirm that it is correct.

Air Force Response
The cross-reference was revised to Section 5.3.3.1.

83. **PDF Pages 70-71 (5-18 and 5-19):** Are there existing buildings in the area of Sites LF-04 and LF-18 that are not be covered by current ICs? Please amend the text to provide more information about the existing ICs.

Air Force Response
Sections 2.2.4 and 2.2.5 describe the ICs for these sites. There are no existing buildings within the IC areas of LF-04 or LF-18. Details regarding IC compliance can be found in the annual IC compliance reports, referenced in the Five-Year Review.

84. **PDF Page 71 (5-19), sub-heading "Soil Excavation," 1st sentence:** The text appears to be missing the term "not" between the terms "were" and "required;" please revise the sentence so that the clause "such that . . . required" is consistent with the parenthetical.

Air Force Response
The word "not" has been added to the text.

85. **PDF Page 72 (5-20)**: This page references the Site 23C informal dispute. However, in the Section about Site 59, the informal dispute is not described, and neither are the follow-up actions from the informal dispute that have yet to be completed. Please add this narrative.

Air Force Response
A discussion was added to Section 5.4.4.1 regarding the Site 59 dispute.

86. **PDF Page 72 (5-20), Section 5.6.3.1, sub-heading "Remedy Performance, 3rd sentence:** This text is not accurate in that the ICs established in the ESD do not apply to any property that already had been transferred prior to the ESD, or to existing structures. Given that the source area was transferred prior to the ESD and the fact that structures were in place prior to the ESD, the issue of the IC boundary is subsidiary.

Air Force Response
The text was revised to address this comment.

87. **PDF Page 72 (5-20), Section 5.6.3.1, sub-heading "Institutional Controls," 1st paragraph, 2nd sentence:** Please revise the text to reflect that the supplemental deed is a voluntary action that is not part of the remedy, as the ESD did not provide for ICs in relationship to already-transferred property.

Air Force Response
The text was revised to indicate the supplemental deed adding ICs to the park property was prepared voluntarily by the Air Force.

88. **PDF Page 72 (5-20), Section 5.6.3.1, sub-heading "Institutional Controls," 2nd paragraph:** Please see comment 62.

Air Force Response
The words "and are not enforceable standards or ARARs for use in decision-making at contaminated sites" have been deleted from the text.

89. **PDF Page 72 (5-20) Section 5.6.3.1, sub-heading "Institutional Controls," 2nd paragraph, 5th sentence:** The Regulators have consistently disputed the adequacy of the data relied on by the Air Force; the data set is inadequate in scope and some of the data is outdated. Please delete this sentence.

Air Force Response

The Air Force does not agree with the agencies' assessment of the adequacy of the data. To clarify the agencies' position as well as the Air Force's position in the ongoing dispute, the text in this paragraph was revised to indicate, 1) that the agencies believe additional data should be collected to confirm the shallow soil vapor concentrations at the site, 2) that the Air Force believes the existing data are sufficient to assess vapor intrusion risk, and 3) that the "available shallow soil vapor concentrations … indicate vapor intrusion risk is within the risk management range..."

90. **PDF Page 73 (5-21) Section 5.6.3.2:** The answer to Question B should recognize any updates to EPA RSLs and DTSC SLs within this FYR period for relevant constituents of concern (including but not limited to PCE) and assess potential impacts on remedy protectiveness. Please revise as necessary.

Air Force Response
Section 5.1 addresses updates to EPA RSLs and DTSC SLs.

91. **PDF Page 73 (5-21), sub-heading "Progress Toward Meeting RAOs," 2nd paragraph:** Please revise the text to reflect that the RAO is prevention of exposure to VI, and the implementation of the ESD does not satisfy this goal because it does not provide for ICs in relation to already-transferred property (so the supplemental deed recorded by the AF does not qualify as a part of the remedy), or for existing structures.

Air Force Response
The text has been revised to indicate that the ICs discussed in the paragraph were voluntarily imposed by the Air Force.

92. **PDF Page 82:** The Figure does not contain the complete results, i.e. some sampling points have a sampling depth and date but have removed the sampling result from that date. Please fill in the complete data for the Figure.

Air Force Response
As noted in the legend of this figure, the sample results associated with these locations (shown in green) are below the DTSC residential and industrial soil gas screening values.

93. **PDF Page 83 (6-1), Section 6.0:** Please revise the text to include a discussion of Site 23C at a minimum, and sites Buildings 4260, 7022 and 7044, as appropriate based on prior comments.

Air Force Response
The text was revised to include a discussion of Site 23C.

94. **PDF Page 84 (6-2):** PFAS contamination of Drinking Water supply was appropriately identified as an issue, with follow-on needs including RI, monitoring and response actions as need. EPA concurs with this determination.

Air Force Response
Comment noted.

95. **PDF Page 85 (7-1):** This document appropriately considers the impact of PFAS on protectiveness. OU 2 is protective in the short-term. Long-term protectiveness is deferred for OU2, pending outcome of PFAS investigation. Sitewide is protective in the short-term with respect to PFAS. EPA concurs with this determination.

Air Force Response
Comment noted.

96. **PDF Page 85 (7-1), Section 7.3:** Please revise the text to reflect EPA's comments on the VI issue at Building 4260.

Air Force Response
Please refer to the responses to EPA's General Comment #9 and Specific Comment #2.

97. **PDF Page 85 (7-1), Section 7.5:** Please revise the text to reflect EPA's comments on the VI issue at Site 23C.

Air Force Response
The text in Section 7.5 was revised to indicate that the protectiveness determination for Site 23C has been deferred pending the outcome of the ongoing dispute at this site.

98. **PDF Page 85 (7-1), Section 7.7:** Please revise the text to reflect EPA's comments on protectiveness and VI (i.e., that a remedy with ICs may be protective in the long-term even if not all contaminants have been addressed, and that both short-term and long-term protectiveness determinations must deferral in situations in which there is inadequate data to confirm whether or not there is a risk).

Air Force Response
The text in Section 7.7 was revised to indicate that the protectiveness determination for Site 23C has been deferred pending the outcome of the ongoing dispute at this site concerning the vapor intrusion remedy.

99. **Appendix B, Summary of Mather Site Chronologies:** The chronology summary is missing some information. For example, the relevant RODs and other decision documents are not included for each site. Additionally, the chronology for the Site 7 Plume does not provide the date when the granular activated carbon (GAC) treatment was added to the Site 7 groundwater treatment plant. Please revise Appendix B to include additional information, including the date the RODs and other decision documents were signed for each site and the date when the GAC treatment system was installed for the Site 7 Plume.

Air Force Response
Appendix B has been revised as requested.

100. **Appendix C, Interview Records:** It is unclear why the remedial project managers (RPMs) from the Regulatory Agencies were not interviewed, as they possess knowledge of the site's status and progress and are typically

interviewed as part of the FYR process. Please interview the RPMs and include in the Draft Final and Final versions or discuss why RPMs from the Regulatory Agencies were not interviewed.

Air Force Response
The RPMs were not interviewed for this Five-Year Review or the prior ones because their comments on the status of the remedies are evaluated and addressed as part of the document review process.

Minor Comments

1. If possible to represent in one or two figures, It would be helpful if there were a figure with a map with all Operable Units (similar to the Figures which distinguish Site numbers)—it is difficult to distinguish them based on narrative alone, especially since many of them refer to the same media.

   Air Force Response
   Figure 2-1 shows the boundaries of each OU outlined in a different color.

2. **Table 5-1, Groundwater Aquifer Cleanup Levels Compared to EPA Regional Screening Levels, California Public Health Goals, and DTSC-modified Screening Levels, Page 5-3:** Table 5-1 should modify the column heading for "RSL [regional screening level]" to "EPA RSL" for clarity. Please revise the Table 5-1 column heading for "RSL" to read "EPA RSL."

   Air Force Response
   The column headings have been revised as requested.

3. **Section 5.5.1.2, Question B, Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid, Page 5-17 and Section 5.5.1.3, Question C, Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy. Page 5-17:** The formatting for Sections 5.5.1.2 and 5.5.1.3 should be reviewed. Section 5.5.1.2 currently reads "75.5.1.2" and the response of "Yes (see Section 5.1)" is on the same line as Section 5.5.1.3. A similar issue exists for Sections 5.6.2.2 and 5.5.2.3. Please revise the formatting for Sections 5.5.1.2 and 5.5.1.3.

   Air Force Response
   These formatting issues have been corrected.

4. **Appendix C, Interview Records:** It is unclear why the interview format was different for Quentin House compared to the other interviewees, where the format was a series of 11-13 questions. Please discuss why the format varied between Quentin House and the other interviewees.

   Air Force Response
   Quentin House was sent the list of interview questions prior to meeting for an in-person interview, and at the beginning of the interview he mentioned that he would not have comments for a majority of the questions. The interview was performed in a manner that allowed him to provide any input he had, voice concerns, and ask questions regarding the status of the cleanup at Mather and how it may or may not affect Mather Aviation.

Grammatical Comments

1. **PDF Page 15 (ES-2), ES, Section "Protectiveness Determinations," 2nd sentence:** Please revise the text to replace the term "insures" with the term "ensures."
2. **PDF Page 15 (ES-2), ES, Section "Operable Unites with Issues," 2nd paragraph, 1st sentence:** Please insert a "d" at the end of the term "determine."
3. **PDF Page 21 (1-1), Section 1.0, 2nd sentence:** Please insert the term "and" between the comma and the term "consistent."
4. **PDF Page 47 (3-1), 1st sentence beneath Table 3-1:** The phrase "fourth five-year review" should be capitalized so as to indicate the reference is to the specific document titled, "Fourth Five-Year Review." Any mention of Five-Year Review should be capitalized or referenced by its acronym, FYR.
5. **PDF Page 56 (5-4), 4th paragraph 2nd sentence un "Soil" section:** Please change "80 mk/kg" change to 80 mg/kg.
6. **PDF Page 66 (5-14), Section 5.4.3.1, sub-heading "Remedy Performance," 2nd sentence:** Please replace the term "was" with the term "is."

Air Force Response

These changes were all made, with the exception of #4 and #6. The acronym FYR was not used in anywhere in the document, and FYR was not established as an acronym. The word “was” is not found in the referenced sentence.

Comments from DTSC
Franklin Mark, Remedial Project Manager
May 29, 2020

General Comments

1. The Department of Toxic Substances Control (DTSC) staff disagree that the remedy for Site OT-23C is protective with respect to vapor intrusion risk. The Air Force (AF) has not conducted adequate soil vapor testing to demonstrate protectiveness from vapor intrusion to occupied buildings. The residual PCE plume at Site OT-23C remains undelineated to the south and west of the Sacramento County park property and the AF's conclusion of protectiveness relies on data from existing soil vapor wells ranging up to fifteen years old. The vapor intrusion pathway was never adequately evaluated for occupied buildings adjacent to the Sacramento County park property.

   Air Force Response
   Please see response to EPA General Comment #7 and Specific Comment #31.

2. DTSC staff does not concur that the AF has conducted sufficient indoor air sampling to conclude that there was no completed pathway to indoor air from soil vapor contaminants at Building 4260 (B4260, formerly referred to as Site 59B). In the Human Health Risk Assessment (URS, 2017b), only one round of indoor air samples was collected by the AF at B4260 and while that round indicated no current risk from the vapor intrusion to indoor air pathway for building occupants, the soil vapor mass still exists beneath the building and there is uncertainty in the soil vapor data due to a perched water zone impacting soil vapor wells. B4260 has a storm water drain piping system with integrity issues that runs south of the building and can act as a conduit for soil gas into the building.

   Air Force Response
   Please see responses to EPA General Comment #9 and EPA Specific Comments #48 and #49.

3. DTSC staff is concerned that per- and polyfluoroalkyl substances (PFAS) contaminated soils (detected at concentrations that exceed the Air Force's soil screening level of 1,260 µg/kg) are not properly discussed or identified in this FYRR. The AF would be responsible for any future remediation of these areas, ifnecessary, but currently there are no access or use controls to prevent human exposure identified to the current property owners, Sacramento County. Surface water run-off from these sites could impact nearby surface waters and sensitive habitat.

   Air Force Response
   Further detail concerning the PFAS in soil and the planned Expanded SI and Remedial Investigation has been added to Table 3-2 and Section 5.1.2.

Specific Comments

1. Executive Summary, last paragraph, page ES-2: Sites SD-57 and WP-07 are not associated with the Main Base/SAC Area Plume and Site 7 Plume, respectively, in the Soil OU Sites and Groundwater OU Plumes Record of Decision (ROD, AFBCA, April 1996).

   Air Force Response
   The paragraph has been revised to address this comment.

2. Table ES-1, pages ES-4 to ES-5: The following deficiencies in the table should be responded to and/or addressed.
   a. All of the sites have an IC component identified as part of the "Selected Remedy" column but not all of the sites have identified that ICs are in place in the "Remedial Action Status/Protectiveness" column.

   Air Force Response
   Please see response to EPA Specific Comment # 12. Table ES-1 has been revised to specify that the ICs are in place.

   b. For the Groundwater OU, reference to Site ID SD-57, WP-07 and LF-04 should be removed since they have their own respective remedy that is not associated with the Groundwater OU ROD. Also for consistency, please replace "emerging contaminants" with per- and polyfluoroalkyl substances (PFAS).

Air Force Response
The Groundwater OU section of Table ES-1 has been revised as requested.

c. For Site WP-07/FT-11, please qualify what "Landfill remedy ongoing" means. Also there is no mention of the discovery of PFAS soil contamination above the AF's 1260 µg/kg soil screening levels.

Air Force Response
The table was revised to say "Landfill remedy in place." A discussion of PFAS soil contamination was added to Section 5.1.2.

d. For SD-59, please provide a footnote with regards to the non-time critical removal action associated with Bldg. 4260 (formerly Site 59B) and progress on the ESD as part of the Site 59 Informal Dispute Resolution (EPA/DTSC, May 2017).

Air Force Response
Regarding Site Building 4260, please see response to EPA General Comment #9. Regarding Site SD-59 ESD, please see response to the EPA Specific Comment #85.

e. The "OU" and "Other Federal Agency Name" columns for Sites LF-03 and LF- 04 are blank.

Air Force Response
Table ES-1 has been revised to identify the OU number (OU 4) and name (Landfill OU) for LF-03 and LF-04.

f. For Site LF-18, please revise the following statement, "ICs to prevent unacceptable exposure to residual soil vapor ~~remain~~ **are in place**."

Air Force Response
The requested revision has been made

g. A row separator is needed between Site LF-18 and OT-23C.

Air Force Response
The requested revision has been made.

3. Executive Summary, paragraph 3, page ES-6: The following statements, "CalAm … has been negotiating a Memorandum of Agreement with the Air Force to pay for ongoing operation and maintenance (O&M) as well as monitoring of the GAC system" and "No other off-base drinking water wells contained PFOS/PFOA above the LHA,'" are factually incorrect and should be revised or removed. California American Water (CalAM) is currently suing the federal government with regard to PFAS impacts on their drinking water well, and OFB-40A is impacted above the EPA Lifetime Health Advisory (LHA).

Air Force Response
The comment is incorrect. The Air Force is in the process of negotiating an agreement with CalAm to pay for the O&M of the treatment system at its impacted well. The detections at OFB-40-A as of the time period of this FYR were not above the EPA LHA.

4. Executive Summary, paragraph 4, page ES-6: The following statement is factually incorrect and should be revised or removed: "There are currently no completed pathways for groundwater with PFOS/PFOA above the LHA to drinking water receptors." DTSC staff considers a completed pathway when the groundwater with PFOS/PFOA above LHA is detected at a well that is used for drinking water and that has occurred at OFB-32 and OFB-40A.

Air Force Response
The pathway to the drinking water receptor at the CalAm well is incomplete because wellhead treatment removes PFAS prior to water being distributed to consumers. The detections at OFB-40-A as of the time period of this FYR were not above the EPA LHA. No change was made to the document.

5. Table 1-1, page 1-3: The table indicates ST-68 and OT-69 as sites that requires a Five-Year review but the sites are not discussed or evaluated in this document. Also, the site ID associated with the Main Base/SAC Area Plume, Northeast Plume, and Site 7 Plume should be left blank or associated with Groundwater OU (see Specific Comment 1).

Air Force Response
Site ST-68 is evaluated with Site FT-10C. Regarding OT-69, all CERCLA actions were completed at OT-69 prior to the period of this FYR. Temporary ICs were implemented at the site and were removed in 2012, triggering a required review for the Fourth Five Year Review. Table 1-1 has been revised to remove Site OT-69 from the table. Additionally, Appendix A has been revised to remove Site OT-69 from Table 1 and to add Site OT-69 to Table 2. Table 1-1 has been revised to remove the Site ID associated with the Main Base/SAC Area Plume, Northeast Plume, and Site 7 Plume.

6. Table 2-1, page 2-2: The contaminants of concern (COCs) for Site SD-59 need to be amended to include VOCs that were treated with the SVE system. The Site 59 Informal Dispute Resolution letter, (EPA/DTSC, May 2017), stipulated that the AF prepare an ESD for Site 59 to specify chlorinated solvents including TCE as COCs and soil vapor intrusion cleanup goals.

   Air Force Response
   Please see response to EPA Specific Comment #85.

7. Operable Units 2 and 3 and/or Operable Unit 5, page 2-5: References should include Documentation of Nonsignificant Change to the Record of Decision for Site 23B (AFCEC, September 2018).

   Air Force Response
   The reference has been added as requested.

8. Site SD-59, paragraph 3, page 2-11: The paragraph should reference and discuss the Site 59 Informal Dispute Resolution letter, dated 19 May 2017, and progress made on initiating a new site ID for B4260 (former Site 59B) and the Site SD-59 ESD. Note: There has been some confusion with site name associated with B4260 (former Site 59B). In Mather BCT meetings B4260 has been routinely associated with Site SD-57. In the DSMOA Joint Execution Plan (JEP), B4260 has been associated with Site WL509. Site B4260 should be tracked with Site SD-59 until additional clarification is provided on the new site ID and documented in the administrative record.

   Air Force Response
   Please see response to EPA General Comment #9 and Specific Comments #2 and #85.

9. Site OT-23C, paragraph 3, page 2-14: The paragraph states, "An ESD, finalized in 2010, added ICs to the remedy at Site OT-23C (AFRPA, 2010b). The ICs were applied only to the last remaining parcel related to the Site OT-23C (Parcel P-2) that had not previously transferred." A review of the recorded Parcel P-2 deed and state land use covenant indicated that the ICs to prevent unacceptable human exposure to soil vapor contamination (shown on top of page 2-15) were never applied. Please explain.

   Air Force Response
   Please see response to EPA Specific Comment #30.

10. Site OT-23C, last paragraph, page 2-14: The paragraph states, "In addition to the ICs identified above, the *Site 23C Former Laundry and Cleaning Plant Soil Vapor Extraction Completion Report* (URS, 2019) **required** appropriate ICs be established for the Sacramento County park property on Parcels C2-C6 to prevent unacceptable human exposure to residual soil vapor contamination." A completion report cannot require appropriate ICs on a property only a CERCLA appropriate decision document. The Basewide OU ESD (referenced in the preceding comment) applied ICs to the last remaining parcel related to Site OT-23C (Parcel P-2) and not the Sacramento County park property which was transfer in 2000. In addition, it should be stated that the completion report has been subject to informal and formal dispute with DTSC, Central Valley Regional Water Quality Control Board (CVWB), and the EPA.

    Air Force Response
    Please see response to EPA Specific Comments #31 and #69.

11. Section 2.4, page 2-17: DTSC staff did notify the AF, EPA, and CVWB (via email)of excavation and new construction work at the former Credit Union Building across from the Site OT-23C Sacramento County park

property on 30 March 2017. The former Credit Union Building resides on Parcel Q. The property contains a Surface and Subsurface Soil Disturbance Notification in which the property owner needs to provide sixty (60) days advance written notice of all proposals for any alterations or activities to be undertaken within the Property per the Quitclaim deed and State Land Use Covenant recorded in 2000. The email information can be provided upon request.

Air Force Response
Text has been added to Section 2.4 to discuss this issue.

12. Table 3-2, page 3-2: The Current Implementation Status Description for SD-59 does not identify and discuss the Site 59 Informal Dispute Resolution letter,(EPA/DTSC, May 2017), which stipulated that the AF prepare an ESD for Site 59 to specify chlorinated solvents including TCE as COCs and soil vapor intrusion cleanup goals. The description does not explain why soil vapor intrusion cleanup goals were not included in the B4260 non-time critical removal action (NTCRA).

Air Force Response
The purpose of Table 3-2 is to provide an update on the status of the issues identified in the last FYR. However, a discussion was added to Section 5.4.4.1 regarding the Site 59 dispute. Regarding B4260, please see response to EPA General Comment #9.

13. Section 3.3, paragraph 1, page 3-3: Please state that DTSC disagrees with the conclusion in the risk assessment (see General Comment 2).

Air Force Response
Please see response to EPA Specific Comments #48 and #49.

14. Section 5.1.2, Soil Vapor, paragraph 3, page 5-4: The sentence, "The IC boundaries were established in the remedial action completion reports for each site based on either vapor intrusion modeling or comparison of residual shallow soil vapor concentrations with residential and industrial use screening levels (USEPA RSLs and DTSC-SLs)," is factually incorrect. The soil vapor ICs and IC boundaries were established for the various sites in either the Basewide OU ESD or the Soil OU and Groundwater OU ESD. The ESDs had language with regard to soil vapor ICs as follows: "These ICs will be imposed only if necessary. If the site soil gas data demonstrates that all of the soil gas concentrations for each COC are compatible with unrestricted land use, then the USAF will not impose these ICs." When the Parcel A-1 property transferred to Sacramento County in 2012 the soil vapor ICs were established with their respective IC boundary for the various sites per the ESDs in the Quitclaim deed (except for OT-23C/Parcel P-2). The SVE completion reports determine whether the soil vapor ICs were necessary or could be removed. DTSC staff only noted one change in IC boundary as documented in the *Documentation of Nonsignificant Change to the Record of Decision for Site 23B* (AFCEC, Sept 2018). Also, please research and verify whether both USEPA RSLs and DTSC-SLs were used in the SVE completion reports to support your statement.

Air Force Response
The text was revised to indicate that IC boundaries were established in the ESDs for each respective site, and were re-evaluated in the completion reports. The text is clear as to how the ICs were modified with respect to the different screening levels.

15. Section 5.6.3.1, Remedy Performance, page 5-20: The paragraph did not indicate that DTSC initiated informal dispute on 30 December 2016 (via email) on the draft final completion report per Section 12.3 of the Mather Federal Facility Agreement (FFA, AFRPA, July 1989). DTSC letter dated 1 February 2017 details the specific issues of the informal dispute.

Air Force Response
The text in Section 5.6.3.1 has been revised to indicate that EPA and DTSC initiated informal dispute on the Air Force's Response Complete Determination for the site, which was based on the findings of the SVE Completion Report. The text has also been revised to provide further explanation of the dispute issues and each party's positions in the dispute. The discussion focuses on the status of the dispute as of the time period of the Five-Year Review, which extended through September 2019. The Air Force believes further discussion of the history of the dispute would not provide substantial additional information relevant to the protectiveness determination.

16. Section 5.6.3.1, Institutional Controls, paragraph 1, last sentence, page 5-20: Please provide the date and document number for the recorded supplemental deed.

Air Force Response
The date and document number for the recorded supplemental deed have been added to the text in Section 5.6.3.1.

17. Section 5.6.3.1, Institutional Controls, paragraph 2, page 5-20: This paragraph is inaccurate and provides a false narrative regarding the Site OT-23C informal dispute issues (see General Comment 1). The informal dispute was initiated in December 2016 (before the 2018 Toxicity Criteria Regulation). The basis of the informal dispute is that residual PCE plume at Site OT-23C remains undelineated to the south and west of the County park property and the AF's conclusion of protectiveness relies on data from existing soil vapor wells ranging up to fifteen years old. The vapor intrusion pathway was never adequately evaluated for occupied buildings adjacent to the park property. Therefore, DTSC cannot agree that Site OT-23C is protective of human health and the environment without additional soil vapor data.

Air Force Response
This paragraph has been revised to clarify the ongoing dispute between the Air Force and the regulatory agencies.

Minor Comments

1. The FYRR has several typographical and pagination errors that will need to be corrected before the document is finalized.

Air Force Response
Comment noted. All observed errors have been corrected.

2. Table 4-1, page 4-1: Please update the FYRR schedule.

Air Force Response
The schedule has been updated.

3. Section 9, page 9-1: The Site 59 Informal Dispute Resolution letter, (EPA/DTSC, May 2017) should be included as a reference and administrative record (AR) numbers should be provided for all references.

Air Force Response
The dispute resolution letter has been added to the list of references. AR numbers will be provided for all references in the Final version of the Five-Year Review Report.

Comments from DTSC
Human and Ecological Risk Office (HERO)
Franklin Mark, Remedial Project Manager
May 29, 2020

General Comments

1. Toxicity Criteria Rule – Section 5.1.2. The text on page 5.2 discusses Title 22, California Code of Regulations sections 69021-69022 Toxicity Criteria for Human Health Risk Assessments, Screening Levels, and Remediation Goals rule (Toxicity Criteria Rule), however the risk assessment results presented in the Records of Decision (RODs) for each site in this FYR Report need to be re-assessed, and if necessary, re-evaluated using the required toxicity criteria under the Toxicity Criteria Rule. To determine if the risk presented in the respective RODs reflect the current risk at each site please present and discuss in the FYR Report the soil and soil vapor risk results from the re-assessment and/or re-evaluation. A detailed discussion on the cumulative risk from exposure to groundwater is presented on page 5-3, this same level of detail needs to be provided for soil and soil vapor along with the total cumulative risk for the sites from all media.

   Air Force Response
   Based on the EPA Five-Year Review guidance (2016), the analysis for Question B should identify whether new standards, toxicity factors, risk assessment methods, or exposure pathways could call into question the protectiveness of the remedy. Section 5.1.2 does this. Conducting new risk assessments to identify the cumulative risk for each site from all media is beyond the scope of the Five-Year Review.

2. There are several places in the text of Section 5.1.2, pages 5-2 and 5-3 that state the DTSC-SLs "are not enforceable standards or ARARs [applicable or relevant and appropriate requirements] for use in decision-making at contaminated sites". HERO does not concur with the above text as the toxicity criteria used to derive the screening levels are enforceable standards since they are written in regulation. Additionally, the Navy at several sites has agreed and accepted the toxicity criteria listed in the 2018 Toxicity Criteria Rule as an ARAR. Please also see General Comment 10, below.

   Air Force Response
   The extent of applicability of the Toxicity Criteria Rule to Air Force response actions under CERCLA is under review, and is the subject of an ongoing dispute at Edwards Air Force Base. The words "are not enforceable standards or ARARs for use in decision-making at contaminated sites" have been deleted from the Five-Year Review, pending the outcome of this dispute.

3. Per- and polyfluoroalkyl substances (PFAS) - Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA). HERO has the following comments on PFOS and PFOA.

   a. Please include in the text when discussing the USEPA Lifetime Health Advisories (LHA) levels for PFOA and PFOS that California has also established notification levels and response levels for PFOA and PFOS. For completeness and transparency, the concentrations of PFOA and PFOS detected need to be compared and discussed with respect to California's NLs and RLs. The RL for PFOA is 10 parts per trillion (ppt) and 40 ppt for PFOS. The NL for PFOA is 5.1 ppt and 6.5 ppt for PFOS. Please revise the text in the following sections, including but not limited to: Executive Summary, Sections 5.3.1.3 and 5.3.2.3, Table 3-2.

   Air Force Response
   The California response level within the time period of this Five-Year Review was 70 ppt. The response level was added to Table 3-2. Further discussion of the RL would create redundancy in the document and would not affect the protectiveness evaluations.

   b. The FYR Report needs to include a discussion regarding PFAS detected in soil. The text should include a discussion including but not limited to the sites with detections of PFAS in soil above screening levels; the sites with PFAS soil detections and lack land use controls (LUCs); and the lack of horizontal and vertical delineation of PFAS in soil. As HERO has previously noted in our most recent memorandum dated February 19, 2020 (K. Gettmann to F. Mark), HERO is concerned that there is a complete exposure pathway for soil and there are no restrictions preventing exposure to the PFAS impacted soil.

Air Force Response
Information regarding PFAS in soil has been added to Section 5.1.2.

c. The FYR Report should be updated to include the forthcoming PFAS work that will be conducted at Mather AFB during the next several years. This information was presented at the March 26, 2020 BCT meeting and included a forthcoming remedial investigation and human health risk assessment.

Air Force Response
This information was added to Table 3-2.

d. Section 5.4.1.3. The risk from exposure to soil at FT-11P, aqueous film forming foam (AFFF) Areas 3 and 4 (Buildings 7015 and 7040), and AFFF Area 5 (Fire Station Building 7075) should be re-evaluated due to the detection of PFAS in soil at concentrations greater than the screening levels.

Air Force Response
Section 5.1.2. was revised to indicate that risk assessments will be conducted as part of the Remedial Investigation.

4. Section 2.1 – Cleanup Levels for subsurface soil. Table 2-1 lists the cleanup levels for the subsurface soil as narrative. The text on pages 2-3 and 2-4 lists factors that are considered with respect to operating the soil vapor extraction (SVE) system, however, protection of human health through the vapor intrusion to indoor air pathway is not a factor as to whether or not the SVE system should continue to operate or be shut off. Please address how the vapor intrusion to indoor air pathway will be addressed when considering whether to continue to operate the SVE systems.

Air Force Response
Vapor intrusion is not a factor in determining whether or not an SVE system should continue to operate. Please see response to EPA General Comment #11 and EPA Specific Comment #25.

5. OU3 Site SD-59, Building 4260. HERO has the following comments regarding Site SD-59, Building 4260.

a. Section 3.2.1 – Table 3-2 – OU3 Site SD-59, Building 4260. HERO does not concur with the text in Table 3-2 under "Current Implementation Status Description" for Building 4260 that states, "The Air Force conducted indoor air sampling and prepared a Human Health Risk Assessment (URS, 2017b), which determined that there was no completed pathway to indoor air from soil vapor contaminants at B4260 and therefore, no site related vapor intrusion human health risk to building occupants." Only one round of indoor air samples have been collected at Building 4260 and while that round indicated **no current risk** from the vapor intrusion to indoor air pathway for building occupants, the soil vapor mass still exists beneath the building, and thus, there is still a potential risk to building occupants in the long term. Please revise the text that states, "…therefore, no site related vapor intrusion human health risk to building occupants" to accurately reflect the site conditions and address long-term stewardship.

Air Force Response
Please see response to EPA Specific Comment #48.

b. Section 3.3, page 3-3. The text states, "The Air Force conducted indoor air sampling and prepared a Human Health Risk Assessment (URS, 2017b), which determined that there was no completed pathway to indoor air from soil vapor contaminants at B4260. The risk assessment concludes there is no site related vapor intrusion human health risk to building occupants." Please see HERO's General Comment 5a, above, and revise the text to accurately reflect the current site conditions.

Air Force Response
Please see response to EPA Specific Comment #49.

6. Section 5.1.1, 3rd Paragraph. HERO has the following comments on the text found in the third paragraph of Section 5.1.1.

a. Please add additional text to the third paragraph on page 5-1 that discusses what the institutional controls (ICs) are to prevent unacceptable exposure to VOCs via the indoor air pathway at Sites FT-10C/ST-68, LF-18, ST-37/ST- 39/SS-54, OT-23C, and SD-59. The current text is vague and provides no detail.

Air Force Response
Please see response to EPA General Comment #11 and Specific Comment #72.

b. Please add additional text explaining how the IC boundaries were expanded at Sites ST-37/ST-39/SS-54 and OT-23C and how the new boundaries are protective of human health.

Air Force Response
Please see response to EPA General Comment #11 and Specific Comment #72.

7. Section 5.1.1, 4th Paragraph. The text on page 5-1, fourth paragraph states, "An evaluation of the potential risk from the vapor intrusion pathway from VOCs in groundwater was presented in the *Third Five-Year Review Report* (URS, 2010). Cumulative risk or hazard estimates were evaluated for both residential and commercial land use scenarios. There are no completed, new, or previously unconsidered exposure pathways relevant to this evaluation." While there might not be new or previously unconsidered exposure pathways, if VOCs from groundwater was the only line of evidence used in the vapor intrusion to indoor air pathway risk evaluation, than other lines of evidence need to be evaluated in this Fifth FYR Report, such as soil vapor data and any indoor air data. If no other lines of evidence exist, then this is a data gap and it should be discussed in the FYR Report. The cumulative cancer risk and noncancer hazards should be re-evaluated using multiple lines of evidence for both the residential and commercial land use scenarios.

Air Force Response
The cited text in Section 5.1.1 was not intended to imply that vapor intrusion from VOCs from groundwater was the only pathway that has been evaluated. Soil vapor and indoor air data have been used to evaluate the vapor intrusion pathway, as described in various other sections of the FYR.

8. Section 5.1.2 – Soil, page 5-4. The third paragraph states that during the fourth FYR, a 95th upper confidence limit of the mean was calculated for lead using the concentrations of lead that remain in the soil at Sites FT-10C/ST-68, OT-87, and OT-89. Please include those values in this FYR Report.

Air Force Response
The values are provided in Appendix D of the referenced report as noted.

9. Section 5.1.2 – Soil Vapor, page 5-4. HERO has the following comments on the text in Section 5.1.2 discussing soil vapor.

a. Please include in the FYR Report that OEHHA updated the inhalation unit risk factor for PCE in September 2016, resulting in revised indoor air DTSC-SLs for the residential and commercial receptor. The text discusses the revised IRIS PCE toxicity criteria but fails to discuss OEHHA's toxicity criteria. Please revise the text.

Air Force Response
Text has been added to Section 5.1.2 to identify that the OEHHA inhalation cancer unit risk factor for PCE was updated in September 2016.

b. Site OT-23C. The proposed IC boundaries for vapor intrusion at Site OT-23C have not been accepted by DTSC/HERO. HERO has previously recommended for transparency and completeness that a cumulative risk assessment be presented and discussed to justify the IC. Additionally, there are outstanding issues regarding the delineation of the PCE soil vapor plume to the north, east, west, and south of the park boundary. One cannot just assume and expect that the PCE soil vapor concentrations will be lower near the church as stated previously and actually soil vapor data is needed to justify no IC past the park boundary. The soil vapor plume needs to be fully delineated to ensure that there is no potential risk to occupants of the surrounding buildings.

Air Force Response
Please refer to the response to EPA Specific Comment #31.

c. Please include a discussion in the text regarding USEPA's 2015 vapor intrusion attenuation factor of 0.03. The discussion should include but not be limited to how screening levels would differ using the 0.03 attenuation factor, how cumulative cancer risk and noncancer hazard would change, and whether the new recommended attenuation factor would affect the protectiveness of the site(s).

Air Force Response
Section A.3.2 of EPA's 2015 publication titled "OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air" states that, for groundwater, the recommended generic attenuation factor is 0.001. The document further clarifies its intent by stating that this value is considered to apply for any soil type in the vadose zone in cases where the groundwater is greater than five feet below the ground surface. At Mather, the groundwater is approximately 90 to 100 feet below ground surface. Thus, the soil gas screening levels in Section 5.1.2. appropriately use an attenuation factor of 0.001.

d. Table 5-2 – Soil Vapor Screening Criteria. DTSC and USEPA recommend using an attenuation factor of 0.03 to develop soil gas screening levels. Please update Table 5-2 with the screening levels based on an attenuation factor of 0.03.

Air Force Response
Please see the response to comment 9.c. above.

e. Table 5-2. HERO has the following comments on Table 5-2.

i. For 1,1-DCA the commercial and residential indoor air DTSC-SL should be based on the cancer risk and not noncancer hazard as listed in Table 5-2. DTSC recommends using the USEPA residential and commercial indoor air RSL for 1,1-DCA. Please revise the table.

Air Force Response
The requested change to Table 5-2 has been made.

ii. For carbon tetrachloride the commercial and residential indoor air DTSC-SL should be based on the cancer risk and not noncancer hazard as listed in Table 5-2. DTSC recommends using the USEPA residential and commercial indoor air RSL for carbon tetrachloride. Please revise the table.

Air Force Response
The requested change to Table 5-2 has been made.

10. Section 5.6.3.1 – Site OT-23C – Institutional Controls. The text on page 5-20, second paragraph states that "DTSC believes the IC boundary should be defined using DTSC-SLs for indoor air as derived from the 2018 Toxicity Criteria Rule, which are based on a $1x10^{-6}$ risk threshold. The Air Force's position is that the DTSC-SLs are risk-based levels and are not enforceable standards or ARARs to be used for decision-making at contaminated sites. The Air Force also does not agree that the DTSC-SLs should be used in favor of the EPA RSLs." HERO has the following comments on this text:

a. The Site 23C Former Laundry and Cleaning Plant, Soil Vapor Extraction Completion Report, which was submitted as a final document in 2019 to DTSC used soil vapor screening levels based on DTSC-SLs and not USEPA RSLs. Prior to this submitted document, the USEPA RSLs were not used on any other SVE site. Thus, this FYR Report is the only document for Mather AFB that has refuted the use of the PCE soil vapor DTSC-SL. HERO does not concur with using the soil vapor screening levels for PCE based on the USEPA RSLs. HERO recommends continuing to use the PCE soil vapor DTSC-SL.

Air Force Response
The statement that soil vapor screening levels based on DTSC-SLs have been used at Mather rather than USEPA RSLs is not accurate. A past practice has been to initially compare the DSTC-SLs with the USEPA RSLs, and then to use the lower of the two values to assess vapor intrusion risk. This same approach was used in the Site 23C SVE Completion Report. For most sites at Mather, this analysis concluded that the IC boundary encompasses all soil vapor concentrations below both sets of values, or that a minor change in the boundary could achieve that. However, at Site 23C, the 2010 Basewide OU ESD did not require an IC over the central portion of the soil vapor plume (now a County park). Recognizing that the imposition of use restrictions would be considered a taking of private property, the Air Force conducted a more thorough evaluation of vapor intrusion risk for this site. The evaluation concluded that potential vapor intrusion risk for properties adjacent to the County park would be less than the EPA RSLs for residential indoor air and at the lower end of the CERCLA risk range based on the DTSC-SLs. The report recommended an IC for the County park property only. Sacramento County agreed to accept this IC, and it was implemented through a Supplemental Deed.

There is currently an ongoing dispute over the protectiveness of the vapor intrusion remedy for Site 23C. The Air Force's position is that the DTSC-SLs are not actionable standards, and that there is no requirement to ensure an IC remedy is protective to the 10^{-6} excess cancer risk level as represented by either the DTSC-SLs or the EPA RSLs. The Toxicity Criteria Rule explicitly states that the California OEHHA toxicity criteria (i.e., DTSC-SLs) are to be used in setting "risk-based remediation goals" that attain a level of human health protection consistent with the NCP. Under the NCP, for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}.

The Air Force further directs attention to the State of California's publication titled "Initial Statement of Reasons, Rule Establishing Toxicity Criteria for Risk Assessments, Screening Levels and Remediation Goals" (2017-07-28). This document clearly establishes the role of the OEHHA toxicity criteria for use in establishing remediation goals in accordance with the Toxicity Criteria Rule. It states, "The NCP is referenced in the proposed rule because of numerous concerns expressed regarding loss of discretion to choose remediation goals within the risk management range of 10^{-4} to 10^{-6}. This rule does not replace the NCP in any way, but provides clarity on the limited issue of toxicity criteria for hazardous substances release cleanups in California."

The Five-Year Review presents the vapor intrusion risk levels for Site 23C based on both the EPA RSLs and DTSC-SLs. It states, "The IC imposed by the Air Force at Site 23C encompasses all residual shallow soil gas concentrations exceeding the USEPA RSL for residential use, and vapor intrusion risk is within the 10^{-4} to 10^{-6} risk management range based on the DTSC-SL for residential use." No change was made to the document

b. HERO does not concur with the Air Force that the DTSCL-SL is not enforceable or an ARAR as the toxicity criteria used to derive the screening levels are enforceable standards since they are written in regulation. Additionally, the Navy at several sites has agreed and accepted the toxicity criteria listed in the 2018 Toxicity Criteria Rule as an ARAR.

Air Force Response
Please see responses to HERO General Comment #10a.

c. HERO cannot concur with the long-term protectiveness of Site OT-23C until the soil vapor plume is fully delineated to ensure that there is no potential risk to occupants of the surrounding buildings.

Air Force Response
Please see response to EPA General Comment #7. The protectiveness determination for this site has been deferred.

d. Please also see HERO's General Comments 2 and 9b, above.

Air Force Response
Please see response to HERO's General Comments #2 and #9b.

11. Figure 5-8

a. The EPA and DTSC "HQ" (hazard quotient) listed on the figure should state "risk" and not "HQ". Please replace "HQ" with "risk", as the cancer risk values are actually listed and not the noncancer hazard values.

Air Force Response
The figure has been updated as requested.

b. Please also include the risk values for wells 23-MP-016, 23-PW-01, and 23- MP-05, for completeness and transparency.

Air Force Response
The purpose of this figure is to inform the reader of the risk values associated with the four sample locations closest to the IC boundaries to the north, east, south and west. Therefore, no change was made to the document. It is noted that wells 23-MP-016 and 23-PW-01 are within the IC area, and are therefore protected by the vapor intrusion IC. The figure shows that the PCE concentration at well 23-MP-05 is less than 0.07 ppmv; therefore, the risk level would be less than 10^{-6} under both the EPA RSL and the DSTC-SL.

12. Section 7.0 Protectiveness Statements. HERO cannot concur with the long-term protectiveness at the following sites:

    a. Site OT-23C until the soil vapor plume is fully delineated and a risk assessment is conducted for the buildings surrounding the park property. Please also see General Comment 10c;

Air Force Response
Please see response to EPA General Comment #7.

    b. Site SD-59 until additional indoor air sampling is conducted and the TCE mass is reduced at the site; and

Air Force Response
Please see response to EPA General Comment #9.

    c. Soil sites with detected concentrations of PFAS at levels greater than the screening levels until the PFAS soil detections have been delineated and a risk assessment has been conducted. Please also see General Comment 3d

Air Force Response
Information has been added to Section 5.1.2.

Comments from DTSC
Geological Services Unit (GSU)
Jeff Brown, Chief, Sacramento GSU
Janine Brinkman, Engineering Geologist
May 29, 2020

Comments

1. **Building 4260, Newly Discovered Site/TCE Release.** Section 5.0 of the Report mentions Building 4260 in one portion of one sentence under Section 5.4.4.1 referring to the future use of the soil vapor extraction (SVE) system "at the new B4260 site." No other discussion or mention of Building 4260, is included in the Report. Its relevance to the cleanup program is not described, the threat it poses to receptors is not described, its relationship to an informal dispute at Site 59 is not described, and finally, the commitments from the Air Force regarding this new site are not described in the Report.

   GSU is concerned with these omissions and their scope. The Report should be revised to correct these issues and disclose to the stakeholders, which includes the public, the following descriptions and information, which are germane to the mandate of the Five-Year Report purpose and federal regulations:

   a. State a new source of contamination was discovered during this Five-Year Review cycle and describe the nature and extent of the source of the release and the contamination discovered.

   Air Force Response
   Please see response to EPA General Comment #9.

   b. State a new site number is formally being established and the site will be remediated pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements to address the Building 4260 contamination.

   Air Force Response
   Please see response to EPA Specific Comment #2.

   c. Refer to, and/or include, the informal dispute resolution letter prepared and signed by the Air Force, the EPA and the DTSC on May 19,2017.

   Air Force Response
   This reference has been added.

   d. Acknowledge the contamination associated with Building 4260 poses a threat to groundwater and indoor air. The lack of a completed exposure pathway does not exempt the Air Force from the responsibility of acknowledging, in the Report, a threat exists to both groundwater and building occupants/workers via indoor air vapor intrusion from Building 4260 contamination.

   Air Force Response
   Please see response to EPA Specific Comment #48.

   e. State an SVE system was put in place via an Engineering Evaluation/Cost Analysis (EE/CA) mechanism and comprises one well.

   Air Force Response
   Please see response to EPA General Comment #9.

   f. State several of the vapor wells installed in an attempt to delineate the TCE plume at the Building are flooded. GSU does not concur that data from these wells can be used as they currently are (water pumped out, then sampled) to evaluate soil vapor plume extent, SVE effectiveness, or protectiveness. Accordingly, this technical concern is part of an issue that should be captured in Sections 5.0, 6.0, and 7.0 of the Report.

   Air Force Response
   Please see response to EPA General Comment #9.

   g. Evaluate Building 4260 as a site pursuant to the Five-Year Review process:
      - A technical assessment is necessary for the new site in Section 5.0 and Table 1-1;

- Recommendations to resolve the issues and threats is necessary for the new site in Section 6.0;
- Issuance of a protectiveness statement for the new site is necessary in Section 7.0; and,
- The Executive Summary and associated tables should be updated

The lack of a new site number for the newly discovered contamination and site does not exempt the Air Force from including this evaluation in this Five- Year Review Report cycle

Air Force Response
Please see response to EPA General Comment #9.

2. **Site 23C.** GSU disagrees with several of the claims, statements, and analyses of the technical assessment and protectiveness statements specific to Site 23 and related contamination. Items in the Report of specific concern include, but are not limited to those described below:

   a. *Section 5.6.3.1, 1st Paragraph, 1st Sentence.*
   In contrast to claims of this opening sentence, data show the remedy is not functioning as intended or required per the *Explanation of Significant Difference* (ESD). The ESD remedial action objective (RAO) #1 requires the Air Force (AF) demonstrate protectiveness to vapor intrusion and indoor inhalation threat. Work has not been completed to support this demonstration. Vapor intrusion threats cannot be shown to be protective because the plume at Site 23C remains undelineated to the south and west of the park, and data from existing soil vapor wells in the area, which are relied on by the Report to suggest protectiveness, are too old (ranging up to fifteen years old).

Air Force Response
Please see response to EPA General Comment #7 and EPA Specific Comment #31.

   b. *Section 5.6.3.1, 3rd Paragraph, SVE System Operation.*
   The sentence referring to the SVE completion report is an unqualified statement incorrectly suggesting to the reader of this Five-Year Review Report that the completion report is approved by the agencies. This paragraph should be revised to state the SVE completion report is neither considered final, nor approved, by the agencies, and is under formal dispute by the regulatory agencies for the reasons stated in item #2a above.

Air Force Response
Please see response to EPA General Comment #7 and DTSC Specific Comment #15.

   c. *Section 5.6.3.1, 4th Paragraph, Institutional Controls (ICs).*
   The text in this section is unnecessarily biased toward the AF position in the dispute and neglects to state the following:
   - The IC boundaries defined in the ESD for Site 23C do not encompass the soil vapor plume or the site where contaminant releases occurred (the IC boundary was incorrectly placed several hundred feet south of the plume and the park boundary); and,
   - The agencies basis for dispute is, in part, because of this IC boundary error and because the plume remains unbounded to the west and south. IC boundaries should be delineated and documented in decisions documents based on the knowledge of plume extent, which has not yet been established.

Air Force Response
Section 5.6.3.1 has been revised to provide further information about the ICs and to describe the ongoing dispute. Please refer also to the response to EPA Specific Comment #69.

   d. *Section 5.6.3.1, 5th Paragraph, Progress Toward Meeting RAOs.*
   This paragraph neglects to refer to RAO #1 of the ESD which requires the AF demonstrate protectiveness specific to vapor intrusion via indoor air inhalation. This omission distorts the obligation and the importance of this issue, warranting revisions. The revisions should state the agency opinion and the AF position in this regard and cite the disagreement between the two, and the fact this disagreement is currently being pursued in the ongoing formal dispute for Site 23C.

Air Force Response
Section 5.6.3.1 has been revised to provide further information about the ICs imposed by the Air Force at Site 23C and the RAO for those ICs, and to describe the dispute in process.

e. *Section 5.6.3.3, Question C: Is there any new information which calls into question the protectiveness of the remedy?*

The one sentence that comprises the extent of text in this section is incorrect. A significant amount of information has been introduced since the last Five- Year Reporting cycle that calls into question the protectiveness of the remedy. At a minimum, this section should be revised to acknowledge the agencies non-concurrence regarding the AF claims of remedy effectiveness and protectiveness of the remedy at Site 23C. IC boundaries not positioned in the correct location within the ESD, a lack of plume delineation to the west and south of the park, and the old age of the soil vapor data from existing soil vapor wells each call into question the protectiveness of the remedy, in particular protectiveness to indoor air receptors (as required pursuant to RAO #1 of the ESD). Each of these items are key components forming the basis of the ongoing formal dispute for this site.

Air Force Response
The EPA Five-Year Review Guidance states, "To avoid unnecessary duplication and redundancies, the information included in Question C normally should be different from information which has already been covered in Questions A & B. This question normally covers whether there are impacts from natural disasters. This question may address site changes or vulnerabilities that may be related to climate change impacts not apparent during remedy selection, remedy implementation or O&M." No change was made to the document.

f. *Sections 6.0 and 7.0, Specific to Site 23C Issues.* Sections 6.0 and 7.0 do not address the concerns or differing conclusions reached by the agencies regarding the actions/recommendations needed or the protectiveness of the remedy at Site 23C. Revisions are needed to remove this bias and communicate to the public a dispute is underway at Site 23C, which may affect the next steps and protectiveness evaluation of the remedy. In this regard, GSU suggests the statement of protectiveness should be revised to "protectiveness deferred", pursuant to USEPA criteria for protectiveness statements, until resolution of the dispute is reached.

Air Force Response
Please see responses to EPA General Comment #7 and EPA Specific Comments #93 and #97. The text has been revised to describe the ongoing dispute and the protectiveness determination has been deferred for Site 23C.

3. **New Response Levels for PFOS and PFOA in Groundwater.** The Report references the Environmental Protection Agency (EPA) Lifetime Health Advisory numbers for a combined perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) as 70 nanograms per liter (ng/L). However, under a new law that went into effect January 1, 2020 (Assembly Bill No. 756 codified as California Health and Safety Code Section 116378), new advisory numbers have been established and adopted by the State Water Resources Control Board. The response levels (RLs) have been lowered for PFOA and PFOS from 70 parts per trillion (ppt) combined to 10 ppt for PFOA and 40 ppt for PFOS based on a running four quarter average. The State of California considers meeting each of these screening these levels necessary to demonstrating protectiveness to human health and the environment.

Accordingly, Sections 5.0 and 6.0 of the Report should be revised to 1) acknowledge the more stringent State RLs and 2) generate recommendations regarding how the Air Force will respond to ensure field activities will prevent contamination from reaching receptors.

Air Force Response
Please see response to DTSC General Comment #3a.

4. **Reinjection of Water not Treated for PFAS.** During a PFAS stakeholders meeting on 30 August 2018 and follow-up conference call on 6 November 2018, concerns were raised regarding reinjection plumes of PFAS that were created during the injection of VOC-treated water, which had not yet been treated for PFAS. At this meeting,

the AF stated a work plan is underway to evaluate the presence and extent of any PFAS plume created by reinjection of VOC-treated groundwater.

Accordingly, the technical assessment and recommendations section of the Report should be revised to: 1) account for PFAS-contaminated water that was injected into the subsurface and the potential for PFAS plumes to have been generated and 2) reflect the actions the AF has taken or plans to take to address this issue.

Air Force Response
The re-injection of water from the MBSA and Site 7 treatment systems, as well as the addition of GAC systems at both treatment plants to address PFAS contamination, is described in Section 2.5 and 5.1.2. Table 3-2 describes the planned Expanded Site Inspection and Remedial Investigation.

5. **Ongoing PFAS Source Investigation Status.** A PFAS investigation was conducted and reported in the document titled *Draft Final Site Inspection for Aqueous Film Forming Foam Areas*, prepared by Aerostar SES LLC (Aerostar), dated November 2019. The findings are discussed in Sections 5.0 and 6.0.

   Section 5.0 should be revised to include the specific findings of the PFAS investigation report produced by Aerostar and provide actions being taken to define the sources, and recommendations for future investigations of source areas and extent. With the newly established response levels for PFOA and PFOS, wells that were previously sampled may now exceed the new RLs. Sections 5.0 and 6.0 should be revised to include actions to be taken for wells with concentrations that exceed the lowered RLs.

   Air Force Response
   Please see the responses to DTSC Specific Comment #3a and GSU Comment #4. The Final Site Inspection for Aqueous Film Forming Foam Areas was not completed within the time period of this Five-Year Review, and is therefore not referenced therein. However, the information provided is sufficient to support the protectiveness determination and make recommendations for future investigations.

Comments from CVWB
Marcus Pierce, Remedial Project Manager
May 20, 2020

General Comments

1. At the request of Central Valley Water Board staff, the Air Force provided the available 1,2,3-trichloropropane (1,2,3-TCP) results for Mather wells in August 2017. All of the results were below detection. However, the samples that were tested had reporting limits that were two orders of magnitude or more above the State Maximum Contaminant Level (MCL) of 5 parts per trillion (ppt). Revise the Draft 5YRR to identify this as an issue and recommend sampling to confirm this emergent chemical is not present in groundwater beneath Mather. At a minimum, the Air Force needs to test influent samples at each groundwater treatment plant. State guidance on analytical methods and other relevant information on 1,2,3-TCP can be found here:

   https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.html

   Air Force Response
   Information regarding 1,2,3-TCP has been added to the Executive Summary, Summary Form, Section 5.1.2, Section 6.0, Section 7.1 and Section 7.2.

2. Central Valley Water Board staff appreciate the Air Force's proactive recommendation "to conduct remedial investigations, monitoring, and response actions as needed to ensure ongoing protectiveness and continue GAC operations for treatment of per- and polyfluoroalkyl substances (PFAS) at the Main Base/SAC Area and Site 7 treatment systems." We request that the Air Force also augment the existing *Off-Base Water Supply Contingency Plan* to include PFAS and use response levels consistent with the State of California. Currently the response levels for perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are 40 and 10 parts per trillion (ppt), respectively, for large drinking water systems. Please revise the Draft 5YRR to include these additional recommendations. The latest information on PFAS in California drinking water systems can be found here:

   https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html

   Air Force Response
   The cut-off date for this Five-Year Review was September 2019, prior to the published date of the response levels listed above. A statement regarding the Water Board's response level for PFOS+PFOS as of September 2019 was added to Table 3-2. As noted in the Five-Year Review, the Air Force is planning an Expanded Site Inspection and a Remedial Investigation for PFAS. The need for and appropriateness of updating of the *Off-Base Water Supply Contingency Plan* to include PFAS will be determined based on the results of those investigations. It is noted that monitoring of PFAS at off-base drinking water supply wells was added to the 2020 Annual Groundwater Monitoring Program Sampling Plan.

3. PFAS was detected at concentrations that exceed the Air Force's soil screening level of 1,260 µg/kg in investigation areas 3 and 5 in the Main Base/SAC area and in the former fire training area. These detections occurred in samples collected from surficial soils that pose a potential surface water runoff risk during heavy rainfall events. Furthermore, the impacted soils in the former fire training are adjacent to vernal pools and a drainage ditch that discharges into Morrison Creek. Central Valley Water Board staff are concerned that residual PFAS poses an on-going threat to surface water quality and may also pose a direct exposure hazard to humans and the local ecosystem if these soils are disturbed. Revise the Draft 5YRR to identify PFAS in shallow soils as an issue and provide recommendations to address it.

   Air Force Response
   Further detail concerning the PFAS soil results and the planned Expanded SI and Remedial Investigation has been added to Table 3-2 and Section 5.1.2.

4. Central Valley Water Board staff disagree that the remedy for Site 23C is protective. The Air Force has not conducted adequate soil vapor testing to demonstrate the proposed institutional controls (ICs) are protective. In addition, it is unknown if PCE concentrations are rebounding to levels that may warrant additional actions such as long-term monitoring and/or resumption of soil vapor extraction at Site 23C.

The Air Force has relied too much on older soil vapor data to demonstrate ICs will be protective at Site 23C. The existing monitoring network does not have adequate coverage west and south of the former base dry cleaners. The Air Force needs to install additional monitoring points west and south of former base dry cleaners and analyze samples from these new wells and from existing wells inside and adjacent to the park parcel. Until these actions are completed, and the results confirm the surrounding properties are not at risk from vapor intrusion and rebound in the park parcel is not significant, Central Valley Water Board staff cannot agree the remedy is protective.

Air Force Response
Please see response to EPA General Comment #7 and EPA Specific Comment #31.

5. The existing remedies for Mather sites with residual soil vapor protect human health by restricting new construction and intrusive activities. Potential health risks to existing buildings on or adjacent to sites with residual soil vapor are not adequately addressed by the existing decision documents. This oversight is one of several issues that has prevented Site 23C from receiving regulatory concurrence on closure and is likely to be a point of contention if and when Building 4260 is proposed for closure. This issue should be addressed early in the sixth five-year review period. Revise the Draft 5YRR to recognize this as an issue and provide a recommendation to address it.

Air Force Response
Please see responses to EPA General Comments #7, #9, and #11.

6. Central Valley Water Board staff are concerned that the Air Force has not done enough indoor air sampling at the new Building 4260 site to confirm there is no vapor intrusion risk to building occupants. A limited number of indoor air samples have been collected to date including one event conducted by Central Valley Water Board staff that we consider more qualitative than quantitative. Most, if not all, indoor air samples may have been collected under shallow perched groundwater conditions that could have temporarily restricted upward movement of vapors into the sub-slab area beneath Building 4260. Revise the Draft 5YRR to identify indoor air sampling at Building 4260 as an issue and provide a recommendation to collect additional indoor air and sub-slab samples early in the sixth five-year review period.

Air Force Response
Please see response to EPA General Comment #9 and EPA Specific Comment #48.

7. The evaluation of groundwater remedy performance includes a comparison of plume extent data from 4Q13 and 4Q18. Central Valley Water Board staff recommend augmenting this assessment of groundwater remedy performance with an estimate of restoration time (total time to reach ROD cleanup levels) for each groundwater plume and a statement on whether the Air Force is on-track with original estimates of restoration time that were calculated when the groundwater remedy began operation.

Air Force Response
The EPA guidance states that the purpose of the Five-Year Review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment. Conducting a restoration life cycle assessment for each groundwater plume is beyond the scope of the Five-Year Review.

Specific Comments

1. Page ES-5, Table ES-1, Operable Units Evaluated in this Five-Year Review: The operable unit for LF-3 and LF-4 is not identified in this table. Add this information.

Air Force Response
Table ES-1 has been revised as requested.

2. Page ES-6, Executive Summary, Issues of Concern/Next Steps, Main Base/SAC Area Plume and Site 7 Plume Issues (OU 2, Groundwater OU): The LHA was exceeded in PW-40A in 2Q20, so the statement at the end of second paragraph is misleading. Add “during this review period” to the end of the second paragraph.

Air Force Response
Please see response to EPA General Comment #8.

3. Page 1-3, Section 1.4, Site Background: The first paragraph in this section indicates the former Mather AFB encompasses 5,845 acres and the Executive Summary indicates the base is 5,717 acres. Correct this discrepancy.

   Air Force Response
   Section 1.4 has been revised to provide the most accurate number available at this time, which is 5,722 acres.

4. Page 2-1, Table 2-1, COCs and Cleanup Levels for Mather IRP Sites Requiring a Five-Year Review: Add the contaminants of concern (CoCs) for landfills 3 and 4, or a footnote that directs the reader to the Northeast Plume for this info. Add a footnote to SD-59 that indicates an ESD is in preparation that will add solvents to CoCs for this site.

   Air Force Response
   The requested revisions have been made to Table 2-1. A statement about the Site SD-59 ESD has also been added to section 5.4.4.1.

5. Page 3-2, Table 3-2, Status of Recommendations from the Fourth Five-Year Review: The recommendations implemented at Site SD-59 are confusing. The description only discusses actions taken for the new Building 4260 site. Revise this table to briefly explain how the issue of IC boundary expansion at Site SD-59 (identified in Table 3-1) was addressed.

   Air Force Response
   Table 3-2 has been revised. Please see response to EPA Specific Comment #48.

6. Page 4-1, Table 4-1, Fifth Five-Year Review Schedule: Correct the dates in this table.

   Air Force Response
   The dates in Table 4-1 have been revised as requested.

7. Page 4-2, Section 4.4, Site Inspections: Identify the agencies that participated in the 2018 IC inspection used for this five-year review.

   Air Force Response
   Section 4.4 has been revised to identify the participants in the 2018 IC inspection.

8. Page 5-8, Section 5.3.1.1, Question A: Is the remedy functioning as intended by the decision documents?, Mather Off-Base Water Supply Contingency Plan: Use the unique Mather well identification numbers (instead of the water purveyor names) in the discussion of impacted off-site supply wells.
   The first paragraph indicates the final termination of the treatment and monitoring at OFB-4 is scheduled for the end of December 2019. Revise this paragraph to clarify concurrence on termination of treatment occurred in 2020 and monitoring of the well will still be conducted as long as it is being operated by the water purveyor.

   The fourth paragraph discusses PFAS in OFB-32, but does not provide any information on the likely Air Force source of these emergent chemicals. Revise this section to identify the likely source of PFAS that reached OFB-32 was the Main Base/SAC area injection wells.

   Air Force Response
   Section 5.3.1.1 has been revised as requested to use the unique Mather well identification numbers instead of the water purveyor well names. The first paragraph was revised to clarify termination of treatment only will occur in December 2019. The 2020 concurrence received is outside of the date range for this Five-Year Review. Regarding PFAS at OFB-32, please see response to EPA Specific Comment #58. The PFAS discussion has been moved to Section 5.1.2. The paragraph was revised to identify the Main Base/SAC Area injection wells as a likely source.

9. Page 5-12, Section 5.4.1.1, Is the remedy functioning as intended by the decision documents?, Landfill WP-07: Identify the general area of the landfill where settlement occurred.

   Air Force Response
   Section 5.4.1.1 was revised as requested.

10. Page 5-17, Sections 5.5.1.2 and 5.5.1.3: Fix the formatting errors with these subsections.

Air Force Response
The formatting errors have been revised as requested.

11. Page 5-18, Sections 5.5.2.2 and 5.5.2.3: Fix the formatting errors with these subsections.

Air Force Response
The formatting errors have been revised as requested.

12. Page 5-20, Section 5.6.3.1, Question A: Is the remedy functioning as intended by the decision documents?, Institutional Controls: Provide the date the supplemental deed was recorded and remove the extra period.

Air Force Response
Section 5.6.3.1 has been revised as requested.

Comments from CDFW-OSPR
Allen Tsao, Associate Toxicologist
May 5, 2020

Specific Comments

1. *Page 3-3, Section 3.3 Issues Raised During Completion of the Fourth Five-Year Review*. The text states, "On 6 June 2019, CDFW prepared a "Dead Waterfowl Monitoring Program Work Plan for Former Mather Air Force Base Site OT-87" and performed dead waterfowl surveys at the site in June and December of 2019." CDFW-OSPR conducted dead waterfowl surveys in June, September and December 2019. Please revise the text accordingly.

   Air Force Response
   The report has been revised to indicate that dead waterfowl surveys were conducted by CDFW in June, September, and December 2019.

2. *Page 5-4. Section 5.1.2 Are the toxicity data used at the time of the remedy still valid?* The text cites the Fourth 5-YRR (URS, 2015) that the remedies were determined to be protective of human health and the environment.
   a. For the administrative record, CDFW-OSPR would like to provide additional background on the protectiveness statement for the small mammal component of the remedy for OT-87. CDFW-OSPR did not agree with the statement from the 2015 Fourth 5-YRR that the remedy is protective of the environment (Nakahara and Tsao, 2015). The U.S. Environmental Protection Agency (US EPA) also did not agree that the remedy is protective of the environment based on the results of the small mammal monitoring (Herrera, 2015). Comments and recommendations based on the small mammal monitoring results were provided in a memorandum to DTSC dated September 28, 2015 (Nakahara and Tsao, 2015); DTSC subsequently forwarded it to the Air Force on October 1, 2015 (Mark, 2015). The comments are briefly summarized below with updated development since 2015:

   Air Force Response
   Thank you for your comments. The Air Force would like to take the opportunity to respond for the Administrative Record.

      1) ***The ROD Does Not Specify an Appropriate Small Mammal-Toxicity Benchmark.***
      The Air Force and CDFW-OSPR cooperatively worked out a detailed small mammal monitoring work plan (MWH, 2008). In the work plan, the Air force and CDFW-OSPR agreed that the kidney tissue concentrations will serve as indicators of toxicity; the Air Force and the regulatory agencies agreed with a toxicity benchmark level for the kidney (1.6 mg/kg wet weight kidney lead concentration with a range of 1.1-2.1 mg/kg). Based on two trapping events, the overall kidney concentrations from the field mice (which represent the omnivorous food guild) exceeded the upper end of the toxicity benchmark. However, after the trapping results became available, the Air Force decided that it no longer agrees with the toxicity benchmark (MWH, 2010). Under this condition, CDFW-OSPR went back to the ROD to determine if there is language in the ROD to provide some resolution on this matter.

      The Record of Decision for OT-87 referenced Eisler (1998) as the source for obtaining the adverse-effect toxicity benchmark (AFBCA, 1998). Upon a more detailed review, the only kidney or liver effects-based tissue level was for cattle (Bos spp.). In Eisler (1998), it stated that greater than 40 mg/kg lead kidney is indicative of "poisoned" cattle, while less than 1.2 mg/kg lead in kidney as "unstressed" cattle. For OT-87, the 95 UCL values on the mean (2.3 mg/kg and 4.0 mg/kg, depending on the statistical distribution) for the kidney from field mice at OT-87 fall in between the "unstressed" and the "poisoned" benchmark values for cattle. CDFW-OSPR believes the usefulness and appropriateness of an acute toxicity benchmark developed for cattle is not informative in protecting small mammals from lead to reproductive-, developmental-, and nephro-toxicity.

   Air Force Response

   The *Final Small Mammal Monitoring Work Plan for IRP Site OT-87* (MWH, 2008; AR #2761) does not discuss the use of a toxicity benchmark level of 1.6 mg/kg wet weight kidney lead concentration. It states, "The potential for residual soil-lead concentrations at Site 87 to represent a hazard to small mammals will be evaluated by comparison of liver and kidney lead concentrations to comparative data in the literature relating to lead tissue concentrations in

small mammals associated with potentially toxic levels (Eisler, 1988, 2000; Ma, 1992, 1996; Chmiel and Harrison, 1981; Getz et al, 1977)."

An extensive discussion of the available literature and the findings from the small mammal trapping at Site 87 can be found in the *Final Results of 2009 Small Mammal Monitoring at Site 87* (MWH, 2010; AR #2969). The most appropriate reference values from the available literature were used to evaluate Site 87 lead tissue results. Toxicity benchmarks and reference values were obtained from several sources and included studies of shrews, mice, and voles. For example, threshold effect levels for kidney tissue concentrations were obtained from Ma, 1996, based on somatic kidney index values in bank voles and wood mice. Small mammal liver and kidney samples collected at Site 87 were below these threshold effect levels. In addition, liver and kidney tissue lead concentrations from Site 87 were found to be similar to background levels of lead in small mammal organs, as presented in the available literature. Please review the 2009 small mammal monitoring report for further information.

It is also valuable to note that, as described in the 2008 Work Plan, small mammal sampling grids were sited to target the areas of greatest residual lead concentrations at Site 87. The locations and shapes of the sampling grids were adjusted to avoid sampling areas with low residual lead concentrations. Therefore, the small mammal monitoring represents the worst-case conditions at Site 87 and demonstrates the protectiveness of the remedy.

2) ***The ROD Did Not Establish a Remedial Action Objective (RAO) for Ecological Receptors.*** As we have stated in our review of the Fourth Five-Year Review Report, the RAO for Site OT-87 was not established (e.g., was the objective intended to protect the reproductive growth of small mammals of was the objective indented to protect cattle from short-term adverse effects from residual lead?). The Air force offers the following statement from the ROD as equivalent to the RAO as follows: "The basis for cleanup is protection of human health, groundwater and surface water quality, and ecological receptors." However, this statement does not appear to meet the specificity required by the US EPA (US EPA, 1999) because it does not specify the goal of the remedy and its end use (e.g., prevent ingestion or uptake of lead by ecological receptors at concentrations that could cause reproductive/developmental/renal effects to them or to animals that consume them). Without the specificity of the RAO, it is not possible to determine if the RAO has been met by the remedy.

Air Force Response

As correctly cited by CDFW, the ROD states the basis for cleanup of Site 87 is "protection of human health, groundwater and surface water quality, and ecological receptors." The ROD was signed by the U.S. Air Force, U.S. Environmental Protection Agency, and California Department of Toxic Substances Control. While further specificity concerning the remedial action objectives may have been desirable in hindsight, the Air Force believes the monitoring data provide sufficient information to make a determination regarding the protectiveness of the remedy. Please refer to the other responses to comments for further detail.

3) ***The Toxicity Benchmark used in the 1996 Ecological Risk Assessment is No Longer Valid.*** Although the presentation of the ecological risk assessment is difficult to follow and relevant components such as dose-based toxicity reference value for mammals appear to be missing (IT, 1996), the toxicological profile for lead presents a No Observed Adverse Effects Level (NOAEL) of 19.9 ng/kg/d. In 2002, DTSC published EcoNote #5, which recommends a NOAEL of 1.0 mg/kg/d for lead for mammals; for the upper risk-range, it recommends a Lowest Observed Effect Level (LOAEL) of 5.6 mg/kg/d be used (DTSC, 2002). In addition, the 1996 ecological risk assessment did not appear to have conducted a hotspot analysis. In 1999, DTSC published EcoNote #2 that recommends a hotspot analysis be conducted (DTSC, 1999). Furthermore, it is also unclear from reading the ROD and 1996 ecological risk assessment why a lead cleanup value of 700 mg/kg is relevant to ecological receptors when greater emphasis of the ecological risk assessment was placed on the protection of terrestrial plant community at 50 mg/kg lead.

In summary:

- The ROD does not contain a small mammal-specific toxicity benchmark to which small mammal tissue can be compared.
- The ROD does not specify a RAO for ecological receptors.
- The initial 1996 ecological risk assessment is out-of-date and not in conformance with the current ecological risk assessment guidelines.

- Residual lead concentrations are high and poorly characterized.

If any other site at former Mather AFB uses the out-of-date toxicity value, the corresponding cleanup value may not be protective. CDFW-OSPR does not intent to dispute the subject document, but would like to document our disagreement for the administrative record.

Air Force Response

A Phase II Detailed Ecological Risk Assessment was conducted for Site 87 that included collection and analysis of small mammals and plants from IRP Site 20 and a reference location at Mather. The 95 percent upper confidence limit (UCL) on the mean concentration of lead in surface soil at Site 20 was 700 mg/kg. The assessment found that small mammal tissue lead concentrations at Site 20 were within the range of tissue concentrations in small mammals from uncontaminated sites, as presented in Eisler 1998. Plant biomass assays did not indicate ecological risk to terrestrial receptors at Site 20 when compared to the reference location. Therefore, 700 mg/kg was selected as the cleanup level for Site 87 to be achieve protection of ecological receptors. The Air Force agreed to conduct post-remedial action monitoring to ensure the protectiveness of the remedy.

The Air Force does not agree that "residual lead concentrations [at Site 87] are high and poorly characterized." The site is well characterized by extensive sampling, as shown in Figure 2 of the *Final Results of 2009 Small Mammal Monitoring at Site 87* (MWH, 2010; AR #2969). Residual levels of lead in soil at Site 87 range from <10 mg/kg to approximately 760 mg/kg. Only three isolated sampling points contain lead concentrations greater than 700 mg/kg, each representing an approximately 50-square-foot area. The 90% UCL lead value for soil at Site 87 is less than 300 mg/kg.

As noted above, small mammal sampling targeted the areas of highest residual lead concentrations in soil at Site 87. The results showed that small mammal liver and kidney tissue samples from Site 87 were below the relevant and applicable toxicity benchmarks. In addition, liver and kidney tissue lead concentrations from small mammals collected at Site 87 were consistent with background levels of lead in small mammal organs as presented in the literature. On this basis, the remedy was determined to be protective.

4) At a meeting between DTSC and CDFW-OSPR management on October 25, 2018, it was agreed that a dead waterfowl monitoring program had not been established by the Air Force. According to the ROD, a monitoring protocol should have been collaboratively worked out between the Air Force and the agencies (AFBCA, 1998). CDFW-OSPR proposed to conduct dead waterfowl surveys over a two-year period with one survey conducted each quarter for a total of 8 surveys. At the end of the two-year monitoring period, if no dead waterfowl are identified, the remedy for OT-87 would be considered protective and complete. A dead waterfowl work plan prepared by CDFW-OSPR was reviewed and approved by DTSC and the Air Force with the first quarter of monitoring starting in the 2nd quarter of the 2019 calendar year. The target completion date of the dead waterfowl monitoring field survey at the present is the end of the 2021 calendar year (LaBonty, 2019).

For waterfowl, it is premature to state that the remedy is protective since the dead waterfowl monitoring program, a component of the remedy, is still on-going. Thus, CDFW-OSPR recommends that the text be revised to state that the protectiveness statement is pending upon the completion of the dead waterfowl monitoring program in 2021.

Air Force Response

The ROD requirement for waterfowl stated "any dead waterfowl found in the area of Site 87 must be reported to the regulatory agencies, and necropsied by a certified laboratory for signs of lead toxicity." The 2008 Work Plan explains that this ROD requirement was not intended to involve formal biological surveys or risk assessment. The waterfowl monitoring requirement was intended as a notification requirement; that is, the Air Force is required to inform resource agencies in the event that dead waterfowl are discovered at the site.

The Air Force is cooperating with CDFW's proposal to conduct a dead waterfowl monitoring program at Site 87. However, this monitoring is not a component of the remedy.

3. *Page 5-12, Section Landfill WP-07*. The text states, "*In 2018, several small rodent burrows were observed and backfilled*." Please clarify whether these burrows were inspected for Burrowing Owls prior to backfilling to prevent take of this protected species.

Air Force Response

The small rodent burrows were inspected by the field technician prior to backfilling, but were not inspected by a certified biologist. The burrows were observed during fourth quarter 2018, outside of the burrowing owl nesting season. None of the burrow openings were found to be more than approximately 2 to 3 inches wide.

4. *Page 5-17, Section 5.5.2.1 Question A: Is the remedy functioning as intended by the decision documents?* The text states, "*In 2018, several gopher burrows were observed throughout the landfill and were subsequently backfilled CAPE, 2018b)*." Please see Specific Comment 3.

Air Force Response
The burrows were inspected by the field technician prior to backfilling, but were not inspected by a certified biologist. The gopher burrows were observed at LF04 during 1Q18 inspections and none of the burrow openings were found to be more than approximately 2 to 3 inches wide. Additionally, the burrowing owl at LF03 was not observed until November 2018. Therefore, it was not a known concern in the area.

5. *Page 5-21, Section 5.6.4.1 Question A: Is the remedy functioning as intended by the decision documents? Under sub-header "Small Mammal Monitoring*," the text states:

No dead waterfowl have been observed at the site during Air Force visits and monitoring events, or during surveys conducted by the California Department of Fish and Game.

a. Please revise the "California Department of Fish and Game" to the "California Department of Fish and Wildlife" throughout the document.

Air Force Response
Concur, the requested change has been made.

b. Please add a sub-header titled "Dead Waterfowl Monitoring" so that the discussion of dead waterfowl surveys would not be under the "Small Mammal Monitoring" subsection.

Air Force Response
Concur, the requested change has been made.

c. Please add a sentence at the end of the Air Force's statement italicized above to indicate that the dead waterfowl monitoring program is on-going and is slated to be completed in 2021 when staff at CDFW-OSPR complete two-years of quarterly monitoring.

Air Force Response
Concur, the requested change has been made.

d. The text under "Progress Toward Meeting RAOs" [Remedial Action Objectives] does not mention the dead waterfowl monitoring program is on-going with a target completion date of 2021. The dead waterfowl monitoring program is a component of the remedy for OT-87. Please add a statement to state that per the ROD, the Air Force and the agencies have worked out a dead waterfowl monitoring program cooperatively. The two-years of dead waterfowl surveys will be completed in 2021.

Air Force Response
The Air Force is cooperating with CDFW's proposal to conduct a dead waterfowl monitoring program at Site 87. However, this monitoring is not a component of the remedy. No change to the document was made. If dead waterfowl are found at the site and the results of the necropsy indicate lead as a cause of death, the protectiveness determination can be evaluated in the next Five-Year Review.

Regulatory Comments on Draft Final Five-Year Review

Comments from US EPA
Sarah Watson, Remedial Project Manager
August 12, 2020

Comments

1. PDF page 12, bottom of the table. "Unknown" is not an acceptable answer for the protectiveness questions. Since protectiveness is being deferred, the answer to both "Affect Current Protectiveness" and "Affect Future Protectiveness" should be Yes. Per the 2016 EPA OLEM FYR template, the only answers are "Yes" or "No." Additionally, the "Milestone Date" should be sooner—a Milestone Date that is very near to the next FYR deadline does not fulfill the purpose of a FYR Addendum. Therefore, we recommend a Milestone Date of 3/31/2023.

   Air Force Response
   The comment appears to address the protectiveness determination for OU5; however, corresponding changes were made for OU1, OU2, and OU5, as appropriate. The responses for "Affect Future Protectiveness" were revised to "yes" for OU1, OU2, and OU5. The milestone date was changed to 3/31/2023 for OU5 only, as this is the only OU for which an addendum to the Five-Year Review is specified. The response for current protectiveness was retained as "no" for OU1 and OU2. There are no drinking water receptors exposed to groundwater with PFAS above the LHA and no known detections of 1,2,3-TCP; therefore, the remedies for OU1 and OU2 are currently protective. The response for "Affect Current Protectiveness" was changed to "yes" for OU5, as the protectiveness determination was deferred for OT-23C.

2. PDF page 13, Site 59 Protectiveness Determination. For Site 59, because the follow-up actions from the Site 59 informal dispute resolution from May 19, 2017 have not been completed, this site cannot be determined to be protective. The terms of the informal dispute resolution are "1. Prepare an ESD for Site 59 to specify chlorinated solvents including TCE as chemicals of concern, identifying soil vapor intrusion cleanup goals and retaining the institutional control remedy for the site. 2. Open a new site number for the chlorinated solvent source area near Building 4260 and follow the CERCLA process for the new site." The ESD has not been finalized. The new site has not followed the CERCLA process.

   Air Force Response
   The Air Force acknowledges that the ESD has not yet been finalized. It is noted that the Air Force has attempted to prepare the ESD, but there has been a lack of consensus regarding the applicable compliance levels for vapor intrusion. The Five-Year Review determined that remedy as implemented is protective of human health and the environment. Therefore, no change was made to the protectiveness determination.

3. PDF page 14. For Site 23C Addendum, please fill in the "Planned Addendum Completion Date" field. For Sitewide Protectiveness Statement, please fill in the "Planned Addendum Completion Date" field.

   Air Force Response
   The "Planned Addendum Completion Date" for the Site OT-23C and Sitewide Protectiveness Statements was entered as 3/31/2023.

4. PDF page 43, redline text regarding Parcel P-2. This narrative is off-topic. The text clearly states that "Air [Force] should determine if ICs were necessary nearer [to] the time of transfer," which was never done. This is an outstanding issue that relates to protectiveness. A decision document must be created or amended to include the supplemental deed in the Park Parcel, and perhaps more, dependent on the actions following the resolution of the dispute.

   Air Force Response
   The discussion in Section 2.2.5 is a clarification requested by EPA in the comments to the Draft Five-Year Review. It describes the requirements of the ESD and the corresponding actions taken by the Air Force when transferring the property at Parcel P-2. The Park Parcel is a different property than Parcel P-2; the ESD did not require ICs on the Park Parcel because it had already been transferred from Air Force ownership at the time the ESD was prepared. The ESD states: "Because the land parcels associated with Site OT-23C have already been transferred by the USAF, imposing ICs by amending the deed and/or executing a SLUC may only be accomplished with the property owner's agreement." The text in Section 2.2.5 has been revised for clarification of these requirements.

5. PDF page 46, first full paragraph, second sentence. This sentence implies that the OU boundary is the only aspect of the Site 23C dispute. Please revise the text to say "the protectiveness of this expanded IC boundary is currently part of the dispute".

Air Force Response
The purpose of this statement is specifically to address the protectiveness of the IC boundary as expanded by the Air Force. Therefore, the suggested change was not made.

6. PDF page 51 and 52, Section 3.1, "Progress Since Last Review." This section is incomplete with respect to Sites 59 and OT-87. Each FYR should include issues raised and protectiveness determinations from the last FYR from both the Air Force and the Regulatory Agencies. The Air Force did not fully describe the independent findings from the EPA from the Fourth FYR. Please revise the document to include this information including the protectiveness determinations which differ from the Air Force. Furthermore, the EPA concurred with the California Department of Fish and Wildlife with respect to concerns at Site OT-87. Please revise the text accordingly

Air Force Response
The protectiveness statements, issues, and recommendations in Sections 3.1 and 3.2 are presented exactly as written in Sections 8.0 and 9.0 of the Fourth Five-Year Review. Section 3.3 of the Fifth Five Year Review has been revised to address this comment. The title was changed to "Issues Raised After Completion of the Fourth Five-Year Review" and the discussion was revised to include EPA's comments on Site OT-87.

7. PDF page 59, last two sentences and PDF page 60 first paragraph last sentence. The description of the risk range is incomplete. Additionally, the ACLs are largely MCLs, which are not risk-based numbers, so it is inappropriate to discuss the risk implications. The remedy is protective when achieving the RAOs. Please delete this text.

Air Force Response
It is not clear from the comment how the description of the risk range is incomplete. The description provides context for the risk estimates presented in Table 5-1. The Air Force acknowledges that most of the ACLs are equivalent to the MCLs. However, Table 5-1 also provides information as to how the ACLs compare to California public health goals and DTSC screening levels. To clarify the description of the risk range, the text in the first sentence has been revised as follows: "As cited in 40 CFR 300.430(e)(2)(i)(A)(*2*), "For known or suspected carcinogens, acceptable exposure levels are generally concentrations that represent an excess upper bound lifetime cancer risk to an individual of between 1E-06 to 1E-04," which is equivalent to 1 per million to 100 per million." The title of the Table 5-1 was changed for clarification, and a note was added at the bottom of the table to provide context for the risk values in the table. Because the ACLs are mostly MCLs, the second sentence was deleted as requested.

8. PDF page 60. "The cumulative ACL risk estimate for this five-year review based on EPA RSL risk assumptions is approximately 70 in 1 million, which is still within the risk management range." This number has no calculation or reference to report. Furthermore, as described in the previous comment, the ACLs are mostly the MCLs, which are not risk-based numbers. Please delete the text which discusses the associated risk.

Air Force Response
The cumulative risk estimate of 71 is presented in the "Total" row at the bottom of Table 5-1. The introduction to the table provides the context for this number, as described in the response to EPA comment #7 above. The purpose of the cumulative risk estimate is to evaluate potential additive cancer risk from multiple contaminants. Therefore, the text was retained.

9. PDF page 62, first paragraph, last two sentences. The data set by which the Air Force uses to make protectiveness claims is insufficient. Therefore, the protectiveness claims cannot be supported. This is currently under dispute. Please revise the text accordingly.

Air Force Response

The document was revised to say "based on the existing data.." and to indicate that the protectiveness determination has been deferred due to the pending dispute.

10. PDF page 62, Table 5-2 and PDF page 90, Figure 5-8. EPA RSLs using a 0.001 attenuation factor are incorrect, including but not limited to the RSL for PCE. The table uses EPA toxicity with DTSC attenuation factor which is mixing and matching EPA and DTSC guidance documents and is incorrect. For example, the EPA RSL for soil gas for PCE, residential, is 0.054 ppmv. Please correct any numbers in the table which do not use the proper attenuation factor of 0.03.

Air Force Response
Table 5-2 applies the same attenuation factor to both the DTSC and EPA indoor air screening values. This is an appropriate application of the attenuation factor, which is a numerical estimate of the attenuation that occurs between a subsurface vapor source and indoor air, versus a policy-driven value. EPA's vapor intrusion guidance document identifies 0.03 as a "generic value" for "near-source exterior soil gas" and states that "use of this attenuation factor for estimating indoor air concentrations is contingent upon site conditions fitting the generic model…" (page 110). The site-specific conditions at Mather do not fit this generic model. Section 5.1.2 was revised to include a discussion the 0.03 attenuation factor from the EPA guidance document. The analysis provided in Section 5.1.2 was prepared based on the presentation of this issue in the McClellan Fifth Five-Year Review.

11. PDF page 63, second paragraph. The screening levels referenced, please be more specific regarding where they come from and/or reference the Table in the FYR which contains this information. Additionally, what is the mechanism by which the airport coordinates with the Air Force regarding ground-disturbing activities?

Air Force Response
The document was revised to clarify source of the screening levels and how they were calculated. The Five-Year Review was also revised to clarify that the specified screening level is applicable to residential uses, and that none of the sites contain PFOS or PFOA in soil above the industrial use screening level. Additional information was provided regarding coordination that occurs between the airport and Air Force regarding ground-disturbing activities.

12. PDF page 66, fourth paragraph, second sentence. This is misleading. When the remedy is a GW treatment, and the GW treatment goes offline, the remedy is interrupted. Please rephrase to "When interruptions occur, the system is able to be repaired without substantial impacts to remedy performance."

Air Force Response
The document was revised as requested.

13. PDF page 176, General Comment #2. The 2016 FYR template and the 2001 FYR guidance are not mutually exclusive and the 2001 guidance is still the most comprehensive FYR guidance document. However, the additional narrative addressed the substantive issue of O&M costs, even if not providing full O&M cost details.

Air Force Response
Comment noted.

14. PDF page 176, General Comment #3. The 2016 EPA OLEM template contains an Institutional Control summary table. This would be valuable and concisely presented information to have in the FYR.

Air Force Response
An Institutional Controls Summary Table has been included as Appendix E of the Final Fifth Five Year Review.

15. PDF page 178, General Comment #11. It is insufficient for the AF to refer to other documents, which it does consistently in its RTCs. The FYR should include sufficient information that the reader may obtain a full understanding of remedy implementation and site conditions from it as a stand-alone document.

Air Force Response
The Air Force generally agrees; however, the Air Force does not believe the Five-Year Review is intended to provide exhaustive detail on information contained in prior documents. The Air Force has attempted to provide sufficient information to fully understand the remedy implementation and site conditions, and has referred to prior documents for information such as site data, fate-and-transport modeling, etc.

16. PDF pages 178-9, Specific Comment #1. Per the EPA FYR Guidance, the inspection for the FYR should be no sooner than 9 months before FYR signature date. More broadly, the AF needs to reset its FYR program so that the reporting period actually coincides with the nominal FYR period. Please incorporate into the text of the current FYR an acknowledgment that for the next FYR the AF will include the time period 9/30/19 through 12/31/2024, including reports submitted after the closing date of the reporting period, but based on data collected before the closing date.

Air Force Response
The next Five-Year Review is due five years after completion of this review. The Air Force's Five-Year Review reporting period starts at the end of the prior Five-Year Review reporting period. This ensures there are no breaks in the reporting periods, and that information is not duplicated in subsequent Five-Year Reviews. It is noted that the text in Section 1.3 inaccurately stated "data collected from 1 January 2014 through 30 September 2019 were reviewed for this fifth five-year review." The dataset covered by the previous five-year review ended on 30 September 2014. Therefore, the reporting period for this five-year review began on 1 October 2014. Section 1.3 and the Executive Summary were corrected to indicate this. This change did not affect any of the information or analyses provided in the Draft or Draft Final reports. To address the concern regarding the timing of the site inspections, the Air Force has revised the Five-Year Review to include the November 2019 site inspections. In future years, the Air Force will conduct site inspections prior to September 30.

17. PDF page 180, Specific Comment #8. The AF response is inadequate because the referenced text is still unclear/misleading in stating that the FFA clarified that both EPA and DTSC are the lead agency.

Air Force Response
The fourth paragraph in the Executive Summary has been revised to clarify the roles of the agencies as described in the FFA.

18. PDF pages 180-1, Specific Comment #10. The revised text states that "most [remedies and OUs] are expected to remain so [protective] in the future." Given that Site 23C is the only one identified as having a remedy that is not currently protective, the AF use of the term "most" suggests that there may be others. Please clarify.

Air Force Response
The word "most" was removed from this sentence.

19. PDF page 181, Specific Comments #12 and #15. The AF response regarding Site 23C is problematic in that it includes statements that are the subject of the dispute such as that ICs are "in place to prevent unacceptable exposure," even though the remedy decision document for VI expressly excludes the property subject to the referenced ICs from the selected ICs remedy. Please delete the bullet points beginning "ICs in place" and "IC boundary."

Air Force Response
The ESD establishes an RAO for the IC remedy of preventing unacceptable human exposure to soil vapor or residual contamination. Further, the ESD states "Because the land parcels associated with Site OT-23C have already been transferred by the USAF, imposing ICs by amending the deed and/or executing a SLUC may only be accomplished with the property owner's agreement." Thus, it is inaccurate to state that the decision document "expressly excludes the property subject to the referenced ICs from the selected ICs remedy." It is more accurate to state that the ESD did not require an ESD on the Park property, but did establish an RAO for the selected IC remedy of preventing unacceptable vapor intrusion risk. The Air Force identified an unacceptable vapor intrusion risk on the Park property, and the property owner agreed to an IC. The current IC on the Park property is therefore consistent with the requirements and intent of the ESD.

20. PDF page 182, Specific Comment #20. Please further revise the text to make it clearer: ". . . the FFA specifies that the separate review of each OU will be consolidated into a single Five-Year Review process and report following . . .."

Air Force Response

The suggested revision to Section 1.1 was made.

21. PDF page 182, Specific Comment #23. The AF added a footnote "e" to Table 2-1 which is unclear in that the first sentence states that an ESD is being prepared to add chlorinated solvents as COCs for Site 59, and the second sentence states that the Site 59 RA addressed chlorinated solvents. Please clarify.

    Air Force Response
    Footnote "e" in Table 2-1 was revised to state that "An ESD is in preparation to formally add chlorinated solvents as COCs for Site 59." Chlorinated solvents were addressed by the remedy, as documented in the SVE Completion Report.

22. PDF page 182, Specific Comment #24. The AF response is incomplete in that the source of the quotation is not clearly identified. This is important because the text from the two ESDs referenced in text is slightly different in formatting and organization.

    Air Force Response
    The two sources for the narrative soil cleanup levels are identified. Although the text of the two ESDs is exactly the same, there are minor differences in format and organization as noted in the comment. Therefore, the quotation marks were removed.

23. PDF page 182, Specific Comment #25. The AF response is inaccurate in that it is overbroad in its description of the scope of the referenced ESDs: the ESDs application of a narrative cleanup level in lieu of numeric cleanup standards is limited to two COCs, TPH-D and TPH-G at Site FT-10C/ST-68 in the Basewide OU ESD and, as stated in the Soil and Groundwater ESD, "This ESD applies the following narrative soil cleanup levels to Site 7/11 for the remediation of TPH-d/g; to Site 37/39/54 for the remediation of BTEX as well as TPH-d/g and oil & grease; and to Site 59 for the remediation of TPH-d/g." In addition as noted in EPA's reply to the AF RT Specific Comment 24, the indented text is not an "accurate quotation" of both referenced ESDs, but instead is an accurate quotation just of the Soil OU and Groundwater OU ESD (this point also applies the AF RT Specific Comment 26).

    Air Force Response
    The comment raised in Specific Comment #25 on the Draft Final report was as follows: "the statement seems inaccurate in this context as it does not reflect the ESDs issued to address the risk posed by VI, and the potential need to clean up the vadose zone to address VI risks." The response clarified that there is no requirement to "clean up" the vadose zone to address vapor intrusion, and that the selected remedy for vapor intrusion is ICs. To provide further clarification on this issue, Section 2.1 has been revised to address the IC elements of the ESDs. Please see the response to EPA comment #22 regarding the quoted text.

24. PDF pages 183-4, Specific Comment #30. The AF response is inadequate as the revised text remains misleading by focusing on a discussion of Parcel P-2, which is far away from the soil vapor source area, and by leaving unclear whether the discussion relates only to Parcel P-2 or the Park Parcel too. At a minimum, please add a reference to "Parcel P-2" at the end of the last sentence of the revised text to clarify that the discussion relates only to Parcel P-2: "were included in the deed for Parcel P-2." Recommend also adding the following text to the parenthetical reference to "Parcel P-2" in the second sentence: ", which is located away from the source area and near the periphery of the area of concern for vapor intrusion."

    Air Force Response
    The suggested changes were made; the text was also revised to clarify the requirements of the ESD with regard to other parcels.

25. PDF pages 179-80, Specific Comment #31. The description of the dispute is incomplete—it implies that the dispute is only about IC boundaries. It is also about the inadequacy of the data set. Therefore, the sentence that says the available data falls into the risk range is misleading. Additionally, the risk calculations are based on an incorrect application of EPA's RSL (based on 1.6 ppmv instead of 0.054 ppmv), which alters the interpretation of the existing data set in a manner that substantially favors the AF position. Please delete all text in the FYR regarding Site 23C that asserts the existing remedy is protective in relation to soil vapor because the FYR is deferring protectiveness based on the on-going dispute about Site 23C, and asserting that the remedy is protective in the document is contrary to the deferral of a protectiveness determination.

Air Force Response
The text notes that the dispute is primarily related to the adequacy of the IC remedy. The report clearly states, "DTSC believes the IC boundary should be defined using the DTSC-SL for resident indoor air as derived from the 2018 Toxicity Criteria Rule, which is based on a $1x10^{-6}$ risk threshold, and that additional data should be collected to confirm the shallow soil vapor concentrations at the site." The context that "the Air Force believes the existing data are sufficient to assess vapor intrusion risk" is clearly provided prior to the statement that the available data fall within the risk range. The Air Force does not see how this is misleading.

Please refer to the response to EPA comment #10 above regarding the use of a 0.03 attenuation factor to derive the EPA RSL. The EPA RSL of 1.6 ppmv was derived using a 0.001 attenuation factor, which is supported by the EPA guidance as well as site-specific conditions and data. The 0.03 attenuation factor identified in the EPA vapor intrusion guidance document for "near-source exterior soil gas" sources was derived using a generic site model that does not fit the Mather site-specific conditions, and which does not accurately estimate attenuation. Further, the conclusion does not state that the remedy is protective. It states, "The protectiveness determination for this site has been deferred pending the outcome of the dispute."

Finally, it is noted that the EPA did not assert their position that the EPA RSL should be calculated based on an attenuation factor of 0.03 until May 2020. This occurred outside the review period of this Five-Year Review. Nevertheless, Section 5.1.2 has been revised to provide a discussion of the attenuation factors in the EPA vapor intrusion guidance.

26. PDF page 185, Specific Comment #38. The language in the Draft Final FYR regarding ICs at Site 23C is misleading. The November 2019 supplemental deed for the Park Parcel, which is described as "voluntary," is a mischaracterization. That supplemental deed/IC is not part of the remedy, and in order to be considered for protection of human health and the environment under CERCLA, it must be part of a decision document.

Air Force Response
Please refer to the response to EPA comment #4 above. The ESD specifically states, "Because the land parcels associated with Site OT-23C have already been transferred by the USAF, imposing ICs by amending the deed and/or executing a SLUC may only be accomplished with the property owner's agreement." Thus, it is clear that the ESD did not intend to preclude the Air Force from establishing ICs on additional properties beyond those specifically identified in the ESD.

27. PDF pages 184 and 186, Specific Comments #34 and #41. The AF response is inadequate in that it does not clearly state that the ICs apparently are only prospective in nature--applicable to "any changes in land use or site improvements." This may not be an issue if there are no existing structures or uses within the 1000' zone that are at risk from methane, but the situation remains unclear based on the revision described. Also, the limit to on-base properties may not be sufficient if the 1000' zone extends beyond the property boundary. Another issue, though not mentioned in the original comment, is whether the 1000' zone only applies to property not yet transferred at the time the decisional document was issued. In addition, the text added to Section 2.2.4 regarding a memorandum of post-ROD changes raises questions as to whether an appropriate decisional basis exists for the 1000' zone in relation to LF-03.

Air Force Response
The document was previously revised to clarify that the 1000' buffer applied only to property within the former base boundary. Since there was no exception regarding previously transferred property, none was identified. Section 2.3 has been revised to state, "no structures have been built within the designated 1,000 foot buffer areas." The decision to place the 1,000-foot buffer only on Air Force property was made in the Records of Decision for the landfill sites and was deemed sufficiently protective at that time. The protectiveness of the landfills in the Five-Year Review is supported by the post-closure landfill compliance monitoring, which shows that the landfills are protective. During the period of this Five-Year Review, there were no confirmed exceedances of the action levels of 5 percent methane by volume (50,000 ppmv-v) in air or 15 ppm-v for VOCs at any of the compliance gas migration probes at any of the landfills. In 2017, there was a single field reading at a LF04 compliance gas migration probe detected above the action level of 50,000 ppm-v. As required, a summa canister sample was collected and the exceedance was not confirmed. The summa canister sample indicated a detection of 1 percent methane by volume in air.

28. PDF page 185, Specific Comment #35. The revised text is not accurate in that it does not reference that the "expan[sion of] the IC boundary beyond what was initially imposed" is not supported by the terms of the 2010 ESD. The description of the dispute is not accurate either in that it only references the issue of whether the AF proposed IC boundary is protective, not that the Regulators also dispute that the voluntary recordation of a LUC in relation to the Park Parcel is part of the remedy.

Air Force Response
Please refer to the responses to EPA comments #4 and #19.

29. PDF page 185, Specific Comment #38. The AF response is inadequate; the AF may not rely on a control measure that is not part of the remedy in describing the remedy or its implementation.

Air Force Response
Please refer to the response to EPA comments #4 and #19.

30. PDF page 187, Specific Comment #46. The follow-up actions for Site 59/Building 4260 have not been completed. The action items described in the Site 59 informal dispute resolution document from May 19, 2017 have yet to be completed. With respect to Site 59, the ESD has not been completed. Please provide a timeline for completion. With respect to creation of the new site Building 4260, please describe the relevant and necessary completed and pending follow-up actions. Because Building 4260 was identified as an issue in the Fourth FYR, it must be described fully in this FYR. Also as an NTCRA is an interim response, the AF still needs to select a remedy for the site and, based on the AF description of the current status of cleanup efforts at B4260, the AF already should be working on a decision document for the remedy.

Air Force Response

The issues and recommendations in Table 3-2 are presented exactly as written in the Fourth Five-Year Review. The completed and pending follow-up actions for B4260 are fully described in Table 3-2. Table 3-2 was revised to state that a decision document will be prepared for Site B4260. The ESD for Site 59 is discussed in Section 5.4.4.1, and a target date for completion of the ESD has been added. 31. PDF page 187, Specific Comment #48. EPA disagrees that adequate indoor air sampling has been completed. Additionally, continuing to not include SLs or cleanup goals in decision documents with respect to VI is not an adequate approach to VI characterization or determinations of protectiveness.

Air Force Response
Comment noted. The subject of cleanup goals for the B4260 decision document is a new comment not previously raised on the Draft FYR and is not relevant to the discussions therein.

32. PDF page 191, Specific Comment #68. The AF response is not acceptable; the SVE Completion Report is not a RACR.

Air Force Response
The response to Specific Comment #68 is a statement of fact. The SVE Completion Report for each soil vapor site at Mather was prepared in accordance with EPA guidance for Remedial Action Completion Reports (RACRs), and with the exception of Site OT-23C, have served as such. SVE is the selected Remedial Action, and the SVE Completion Report is the documentation of the completion of that remedial action. Only the Site 23C SVE Completion Report was disputed by the agencies as not meeting the requirements for a RACR.

33. PDF page 191, Specific Comment #69. The AF response is inadequate because the AF did not revise the narrative text in the "last sentences before Table 5-2;" in particular, the penultimate sentence before Table 5-2 is incorrect and must be revised or, at a minimum, the text must note that the assertions are the subject of dispute.

Air Force Response
The last sentence before Table 5-2 was revised to state “The protectiveness determination for Site OT-23C has been deferred due to the pending dispute as discussed in Section 5.6.3.1”

34. PDF page 191, Specific Comment #70. The AF response is inadequate because ARARs selected in a remedy always remain such as long as the remedy is in place, not just those that may impact the current phase of implementation (e.g., post-closure care) and need to be updated due to post-ROD changes. Please revise the text accordingly.

Air Force Response
The text was revised as requested.

35. PDF page 194, Specific Comment #87. The AF response is inadequate because it does not clarify that the AF's voluntary action is not part of the remedy.

Air Force Response
Please refer to the responses to EPA comments #4 and #19.

36. PDF page 194, Specific Comment #89. The AF response is inadequate in part because it mis-describes the dispute as limited to the scope of ICs necessary to ensure protectiveness, when the dispute also involves the lack of a decisional basis for the supplemental deed recorded by the AF and the inadequacy of the AF data (which the text does reference).

Air Force Response
Please refer to the response to EPA comment #4.

37. PDF page 194, Specific Comment #91. The point about voluntary is that they are not part of the remedy, which the text revision made by the AF does not convey. Please revise to indicate that the supplemental deed is not part of the remedy.

Air Force Response
Please refer to the responses to EPA comments #4 and #19.

38. PDF pages 217-220, California Fish and Wildlife comments. The EPA, including the EPA Superfund Ecologist, agrees with the eco-risk protectiveness concerns presented by the California Department of Fish and Wildlife in the Draft FYR comment round and during the Technical Working Group meeting. The EPA made similar comments in the Fourth FYR and deferred protectiveness based on insufficient data for Site OT-87. These concerns have not been addressed during this FYR period.

Additionally, the EPA notes that since the last FYR, the beaver dam has altered the watershed and related ecological impacts at the site and therefore impacts the conceptual site model. The ponding behind the beaver dam changes the conceptual site model we used to evaluate ecological risk. Specifically, areas of OT 87 that were addressed only as soil for exposure to terrestrial receptors could now be considered sediments with an exposure pathway to aquatic receptors. This would be significant if the toxicity benchmark(s) for lead in sediments are lower than the benchmarks for soil. As best I can tell, after the removal action at OT 87 the residual lead 90% UCL was below but about 300 mg/kg. In Table 4-22 of the Final Baseline Risk Assessment for Mather (October 1996) the sediment benchmarks for aquatic receptors range from 31 to 46.7 mg/kg. Thus, it's possible that if it is appropriate for a Five-Year Review to evaluate a major change in exposure pathway due to major changes in site conditions, then we might have an additional reason to declare the remedy is not protective.

Air Force Response

CDFW comments were extensively addressed during preparation of the Fourth Five-Year Review. In addition, as noted in Section 3.3 of this Five-Year Review, the Air Force prepared a position paper in May 2016, per request from the regulatory agencies, providing the rationale for the Air Force's determination that the conditions of the ROD for Site OT-87 had been met and that the remedy in place was protective of human health and the environment. No comments or responses to the position paper were received.

With regard to the areas along Morrison Creek that are now seasonally inundated due to beaver activity, the *Draft Final Informal Technical Information Report for Remedial Actions at Sites 15, 20, 85, 86, and 87* (Montgomery Watson, 1999; AR #2188) shows that the post-remedial action lead concentrations in soil and sediment within these

areas range from 1.2 to 849.9 milligrams per kilogram (mg/kg), with a mean of 68.4 mg/kg. The mean concentration is substantially below the probable effect concentration (PEC) of 128 mg/kg for lead as presented in MacDonald et al. (2000). The PEC represents the level above which harmful effects to sediment-dwelling organisms are expected to occur.

The four highest concentrations of lead in soil are located within a narrow strip of land east of the pond, with the highest concentration located in a former picnic area immediately adjacent to an asphalt turnout. The area represented by these four samples is approximately 0.68 acre in size, compared to the total size of the inundated area of approximately 10 acres (less than 10%). Excluding these four sample results, the average residual lead concentration is 28.8 mg/kg. This is below the soil screening level for protection of surface water as calculated for McClellan Air Force Base of 29 mg/kg. It is also below the consensus-based threshold effect concentration (TEC) for lead of 35.8 mg/kg from MacDonald et al. (2000). The TEC represents the level below which harmful effects on sediment-dwelling organisms are not expected. Thus, evaluation of the post-remedial action soil lead levels indicates that sediment toxicity is unlikely within the inundated area.

Surface water samples were collected during the site characterization and are presented in the *Site Characterization Report for IRP Sites 86 and 87* (IT Corporation, 1997; AR #1231). The samples were collected in the pond, which is in the western (downstream) portion of the former range and is fed by Morrison Creek. Lead was not detected in surface water, despite concentrations in sediment of up to 6,800 mg/kg. Given the significantly lower levels of lead in soil and sediment within the area now subject to inundation, risk to surface water quality under current conditions is unlikely. However, the Air Force will agree to re-sample surface water in the pond to confirm that seasonal inundation of the adjacent upland areas has not resulted in a surface water impact.

Comments from DTSC
Franklin Mark, Remedial Project Manager
August 14, 2020

Comments

1. Response to General Comment 2: The Air Force response uses the Central Valley Water Boards (CVWB) indoor air sampling results to justify that an adequate number of indoor air sampling has been completed and the conclusion that there is no completed pathway to indoor air from soil vapor contaminants at Building 4260 (B4260). The Air Forces indoor air sampling was done in accordance to the Final Site 59B Remedial Investigation (RI) Work Plan (AFCEC, February 2017) in order to meet the data quality assurance needed for a Human Health Risk Assessment (HHRA) and RI. Six months prior, due to contractual delay by the Air Force for the Site 59B RI work plan and field work, the CVWB indoor air sampling was done to ensure that there was not an immediate unacceptable exposure of TCE to workers given the high TCE soil gas concentrations outside Building 4260. The CVWB did not follow the same sampling, quality assurance, and data validation protocols as the Final Site 59B Remedial Investigation Work Plan. The indoor air sampling results were never intended to be used in a HHRA or RI. DTSC does not agree that the indoor air samples collected by the CVWB should be used, in concert with the Air Forces indoor air sampling, to conclude that additional indoor air sampling at B4260 is not warranted.

   Air Force Response
   Comment noted. Discussion of the limitations associated with the CVWB indoor air sampling were provided in the prior response to this comment.

2. Response to Specific Comments 3 and 4 (Executive Summary, page ES-7): DTSC is concerned that some statements made within the Five Year Review Report (FYRR) are incorrect and misleading to the public stakeholders in light of recent news articles (see hyperlinks on Cal Am lawsuit and LA Times article on impacts to drinking water wells). The Air Force response uses the time period of the FYRR as a technicality for not discussing or correcting misinformation. DTSC staff suggest that the statements be revised or removed because they are not relevant considering the recent data that shows impacts to OFB-40A above the EPA LHA. The Air Force used the same rationale for not including regulatory agencies' concerns for Site SD-59/Building 4260 during the Fourth Five-Year Review Report. Note: In the Air Forces' response to Specific Comment 16, they indicated that the supplemental deed that incorporated ICs for the Sacramento Park Property/Site 23C was recorded on November 8, 2019, which is technically outside of the January 2014 – September 2019 time period of the FYRR, and, per their rationale, should not be included in this document.

   Air Force Response
   The Air Force acknowledges that the Five-Year Review is snapshot in time, and that due to the time required to prepare, review and respond to comments on the document, it is not feasible for the final report to capture data beyond the review period. However, please note that the Five-Year Reviews are timed such that there are no gaps in review periods. In addition, the Five-Year Review clearly identifies the time period that is covered by the review, and frequently clarifies that the information provided therein is "as of the time period of this Five-Year Review." Hence, the Air Force does not agree that the document contains incorrect or misleading information. The Air Force notes the comment regarding the date of recordation of the supplemental deed for Site OT-23C, and the document has been revised to indicate that the supplemental deed was provided to the County for signature in August 2019.

3. Response to Specific Comment 17 (Section 5.6.3.1 Institutional Controls): The Air Force response did not address our comment and provides a false narrative regarding the technical issues and basis of the Site 23C dispute. The final FYRR is a public document and DTSC is concerned that statements made within Section 5.6.3.1 Institutional Controls (last paragraph, page 5-22 and 1st paragraph, page 5-23) are incorrect and misleading to the public and stakeholders. The paragraphs in question appear to present the Air Forces' arguments within the Site 23C dispute from their perspective and is inaccurate. The EPA and DTSC have provided several written correspondences from the last 4 years that the Air Force can cite as the rationale for the Site 23C dispute. DTSC doesn't understand why this dispute discussion is needed in the institutional control section. Also, the EPA RSL that the Air Force references in this section (and on Figure 5-8) does not use the EPA's default soil gas attenuation factor of 0.03 and is currently part of the Site 23C dispute discussion. The Air Forces Site 23C dispute discussion needs to be removed from this section because it is not relevant with respect to whether institutional controls are in place.

Air Force Response
The discussion in Section 5.6.3.1 is a clarification requested by DTSC in the comments to the Draft Five-Year Review. The discussion presents the positions and perspectives of both the Air Force and the regulatory agencies with regard to the dispute. Please refer to EPA Comment #10 regarding the use of a 0.03 attenuation factor to derive the EPA RSL.

New Comments

1. Table ES-1, page ES-4: There is only a Groundwater IC associated with the selected remedy for the AC&W OU. Please revise the information in the Selected Remedy and Remedial Action Status column.

   Air Force Response
   The requested changes have been made.

2. Table 3-3, page 3-2: For Site SD-59, it states that "ICs were imposed at the site to prevent modifications to the buildings or its foundation to address human health risk to building occupants." Institutional controls (ICs) are normally environmental restrictions placed in a property deed or state land use covenant. DTSC is only aware of an Air Force letter (dated June 4, 2018) regarding Use Restrictions for Building 4260 sent to Sacramento County who is the property owner. Please clarify whether the letter notification is equivalent to property deed restrictions. Comment also applies to Section 3-3, page 3-3.

   Air Force Response
   The text was revised in Table 3-2 and Section 3.3 to indicate the ICs were imposed via notification letter to the County of Sacramento.

3. Section 9.0, page 9-3: The reference to the Site 59 Informal Dispute Resolution letter needs to indicate that it was a joint EPA and DTSC letter.

   Air Force Response
   The requested change has been made.

Comments from DTSC
Human and Ecological Risk Office (HERO)
Kimberly Gettman, Staff Toxicologist
July 30, 2020

General Comments

1. Response to General Comment 1 – Section 5.1.2. HERO does not concur with the response. While Section 5.1.2 discusses the changes in or new toxicity factors, risk assessment methods, or exposure pathways, it also needs to address how these changes affect the protectiveness of the remedy for each site and each media. This was done for exposure to groundwater; however, the Report fails to give this same level of detail to the media of soil and soil vapor. HERO continues to recommend that the cumulative risk for the soil and soil vapor sites be re-evaluated/re-assessed with respect to changes discussed in Question B and in Section 5.1.2. This information is imperative to determining whether the current remedy is still protective.

   Air Force Response
   Cumulative risk evaluations are performed as part of the remedial investigation, and in some cases the remedial action completion reports. Section 5.1.2 of the Five-Year Review addresses only those aspects of the evaluations that may have been impacted by changes in toxicity factors, etc. This has been done for soil, where there was a change in the DTSC-SL for lead. Section 5.1.2 has been revised to describe the impact of the revised toxicity values for PCE in indoor air on the risk estimates.

2. Response to General Comment 2 – HERO concurs and appreciates the response to General Comment 2 to remove the words "are not enforceable standards or ARARs [applicable or relevant and appropriate requirements] for use in decision-making at contaminated sites" when referencing the DTSC-SLs form this Report. The text has been removed from the Report and HERO has no additional comments.

   Air Force Response
   Comment noted.

3. Response to General Comments 3a, 3b, 3c, and 3d - Per- and polyfluoroalkyl substances (PFAS) - Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA).

   a. Response to General Comment 3a. HERO acknowledges the response; however, we disagree that further discussion of the RL would create redundancy as the Report already discusses the USEPA Lifetime Health Advisories (LHA) levels and it should also discuss California's RLs and NLs. A reviewer might not read the entire Report and thus, it is important to discuss the concentrations of PFOA and PFOS with respect to California's RLs and NLs in all applicable sections in the Report. While the RL for PFOA and PFOS might have been 70 ppt during the review period for this Report, the Report should still acknowledge the revised RLs (February 2020) and NLs (August 2019) and that these values are lower than the previous values. HERO continues to recommend revisions to the text in the following sections, including but not limited to: Executive Summary, Sections 5.3.1.3 and 5.3.2.3, Table 3-2. Additionally, the Report should recognize the complete exposure pathway from the off-base well OFB-40 and that this will be addressed in the next FYR Report.

   Air Force Response
   The Air Force notes that the State of California did publish notification limits for PFOS and PFOA within the time period of this five-year review. However, as described in the State Water Board's Fact Sheet, the notification level is a non-regulatory measure for concentrations of chemicals in drinking water that "warrant notification and further monitoring and assessment." The Fact Sheet identified that the State's recommended response level, or the level at which they recommend that water systems consider taking a water source out of service, was the same as the USEPA's Health Advisory (HA) Level of 70 ppt. The Five-Year Review identifies this response level in Table 3-2. Pursuant to EPA's Five-Year Review guidance, Sections 5.3.1.3 and 5.3.2.3 are generally reserved for impacts from natural disasters or climate change. Therefore, no changes were made to those sections.

   At the time of this Five-Year Review, there was not a complete exposure pathway to off-base well OFB-40. Please note that, although the well is not discussed in this Five-Year Review, the Air Force immediately took action at this well when levels of PFOS/PFOA rose above the HA. The owner has been provided bottled water continually since

that time, and the Air Force has been working to provide a long-term drinking water source. Also, please note that a public notice was published in the local newspaper regarding this exceedance and the Air Force's response action.

b. Response to General Comments 3b, 3c, and 3d. HERO Concurs with the responses to General Comments 3b, 3c, and 3d. The text in the Report was revised as stated in the responses. HERO has no further comments.

Air Force Response
Comment noted.

4. Response to General Comment 4 – Section 2.1 – Cleanup Levels for subsurface soil. HERO acknowledges the response that "[t]here is no requirement to clean up the vadose zone to address vapor intrusion risk at any of the sites addressed in this Five-Year Review. The selected remedy for addressing vapor intrusion risk is ICs [institutional controls]." HERO defers to the DTSC Project manager with respect to whether the appropriate ICs are in place at all of the soil vapor sites with or that had operating soil vapor extraction (SVE) systems, particularly Sites 23C and SD-59.

Air Force Response
Comment noted.

5. Responses to General Comments 5a and 5b – OU3 Site SD-59, Building 4260.

a. Response to General comment 5a. Section 3.2.1 – Table 3-2 – OU3 Site SD-59, Building 4260. HERO's comment was partially addressed. HERO appreciates the revised text to Table 3-2 that includes both the Central Valley Regional Water Board and the Air Force have collected indoor air samples at Building 4260 and that ICs have been imposed to prevent modifications to the building or its foundation. However, the response fails to address HERO's concern regarding long-term stewardship and indoor air monitoring. Additionally, HERO does not concur that the indoor air samples collected by the Water Board can be substituted as the second sampling event, as that event occurred to ensure that there was not an immediate unacceptable exposure of TCE to workers given the high TCE soil gas concentrations outside Building 4260. That sampling event did not follow the same sampling and quality assurance protocols as expected from all other indoor air sampling events at federal facility sites. Please address long-term stewardship for Building 4260.

Air Force Response
The details of the Water Board's indoor air sampling event are discussed in the prior response to this comment. Requirements for long-term stewardship, such as a permanent IC, will be addressed in the decision document for B4260. The following text was added to Table 3-2: "A decision document will be prepared to document the final remedy for the site, including permanent ICs if needed.

b. Response to General Comment 5b. Section 3.3, page 3-3. HERO concurs with the response and the text was revised to accurately reflect the current site conditions. HERO has no additional comments.

Air Force Response
Comment noted.

6. Response to General Comments 6a and 6b – Section 5.1.1, 3rd Paragraph.

a. Response to General Comment 6a. The response did not address HERO's comment. The text in the third paragraph of Section 5.1.1 is vague and there is no reference in the text to where additional information on how the ICs in place are preventing unacceptable exposure to VOCs through the vapor intrusion to indoor air pathway. HERO recommends expanding the text to clearly state how the ICs are preventing unacceptable exposure to VOCs via the indoor air pathway at Sites FT-10C/ST-68, LF-18, ST-37/ST-39/SS-54, OT-23C, and SD-59.

Air Force Response
Section 5.1.1 has been updated to expand the text to state how the ICs are preventing unacceptable exposure to VOCs via the indoor air pathway.

b. Response to General Comment 6b. HERO acknowledges the response; however, the comment was not completely addressed. Please add additional text to Section 5.1.1 or at least add text referencing the

Sections in the Report that explain how the IC boundaries were expanded at Sites ST-37/ST-39/SS-54, and OT-23C and how the new boundaries are protective of human health.

Air Force Response
Section 5.1.1 was revised to clarify the IC requirements and to reference the discussions in Sections 5.4.2 and 5.6.3.

7. Response to General Comment 7 – Section 5.1.1, 4th Paragraph. HERO acknowledges the response that the text in the fourth paragraph of "Section 5.1.1 was not intended to imply that vapor intrusion from VOCs from groundwater was the only pathway that has been evaluated." However, no revisions were made to the text to clarify that soil vapor and indoor air data were also used to evaluate the vapor intrusion indoor air pathway. Please include this information in the fourth paragraph of Section 5.1.1.

Air Force Response
Section 5.1.1 has been revised as requested.

8. Response to General Comment 8 – Section 5.1.2 – Soil, page 5-4. HERO does not concur with the response. For completeness, the 95th upper confidence limit of the mean that was calculated for lead using the concentrations of lead that remain in the soil at Sites FT-10C/ST-68, OT-87, and OT-89 should be included in the Report and not require readers to search for this information in another document. Please include those values in this Report

Air Force Response
The document was revised to include a table showing the 95th UCL lead concentrations.

9. Response to General Comments 9a, 9b, 9c, 9d, and 9e – Section 5.1.2 – Soil Vapor, page 5-4.
    a. Response to General Comment 9a. HERO concurs with and appreciates the response. The text in Section 5.1.2 was revised accordingly and HERO has no additional comments.

Air Force Response
Comment noted.

    b. Response to General Comment 9b. Site OT-23C. HERO acknowledges the response; however, the response does not adequately address HERO's original comment. The text in Section 5.1.2 was not revised and does not refer to threader to the revisions in Section 5.6.3.1 regarding the IC boundary at OT-23C.

Air Force Response
The text in Section 5.1.2 regarding the protectiveness determination for Site OT-23C has been revised and a statement has been added to refer the reader to Section 5.6.3.1.

    c. Response to General Comment 9c. HERO does not concur with the response. In the response, the Air Force states that according to the USEPA 2015 *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to the Indoor Air* the groundwater generic attenuation factor is 0.001 and that the document then clarifies that "this value is considered to apply for any soil type in the vadose zone in the cases where the groundwater is greater than five feet below the ground surface. Thus, the soil gas screening levels in Section 5.1.2 appropriately use an attenuation factor of 0.001." The Air Force has misinterpreted the 2015 USEP Vapor Intrusion guidance document. While it is correct to use the 0.01 attenuation factor to predict the indoor air concentration when the sampling media is groundwater (Table 6-1 and Appendix A of the 2015 USEPA Vapor Intrusion guidance document), when the sampling media is soil gas, either near source exterior soil gas or sub-slab, the appropriate attenuation factor to use is 0.03 (Table 6-1 and Appendix A of the 2015 USEPA Vapor Intrusion guidance document). The 0.03 soil gas attenuation factor is based on empirical data collected from field observations and thus the groundwater attenuation factor of 0.001 does not apply to vadose zone sources as in the case of sites at Mather, particularly Site OT-23C. Additionally, in other Five-Year Review Reports reviewed by HERO, the Air Force (Fifth Five-Year Review Report, Former McClellan Air Force Base, dated 2019) and Navy (Fourth Five-Year Review Report for Marine Corps Base Camp Pendleton, dated March 2019) have acknowledged 0.03 as the current USEP recommended soil gas attenuation factor and discussed in those Five-Year Review documents how the revised attenuation factor would affect the protectiveness of the sites. Finally, the

Air Force has correctly applied the 0.03 attenuation factor in the Draft Final Site 59 Explanation of Significant Differences (ESD).

HERO repeats our original comment to please include a discussion in the text regarding USEPA's 2015 vapor intrusion attenuation factor of 0.03. The discussion should include but not be limited to how screening levels would differ using the 0.03 attenuation factor, how cumulative cancer risk and noncancer hazard would change, and whether the new recommended attenuation factor would affect the protectiveness of the site(s).

Air Force Response
Section 5.1.2 was revised to include a discussion of the 0.03 attenuation factor from the EPA's vapor intrusion guidance document. The analysis provided in Section 5.1.2 was prepared based on the presentation of this issue in the McClellan Fifth Five-Year Review.

d. Response to General Comment 9d – Table 5-2 – Soil Vapor Screening Criteria. HERO does not concur with the response and reiterates our original comment to update Table 5-2 with the screening levels based on an attenuation factor of 0.03. Please see HERO response to General Comment 9c as to why the 0.03 attenuation factor is applicable for sites at Mather.

Air Force Response
Please see the response to comment 9c above and the revised text in Section 5.1.2.

e. Response to General Comments 9ei and 9eii. Table 5-2. HERO concurs with the response and the appropriate changes were made to the Draft Final Report. HERO has no additional comments.

Air Force Response
Comment noted.

10. Response to General Comments 10a, 10b, 10c, and 10d – Section 5.6.3.1 – Site OT-23C – Institutional Controls. HERO appreciates that the Air Force has removed the following text from Section 5.6.3.1, "The Air Force's position is that the DTSC-SLs are risk-based levels and are not enforceable standards or ARARs to be used for decision-making at contaminated sites." Below, HERO addresses the responses to General Comments 10a, 10b, 10c, and 10d.

a. Response to General Comment 10a. HERO acknowledges the response and we continue to recommend the PCE DTSC-SL as the soil gas screening level for Site 23C. However, HERO acknowledges that this issue is currently under discussion in the Site 23C dispute. The text in Section 5.6.3.1 has been revised to remove the language that HERO most objected to, as stated above, and the text does discuss both the DTSC-SL and USEPA RSL for PCE. HERO has no additional comments.

Air Force Response
Comment noted.

b. Response to General Comment 10b. HERO acknowledges the response and please see our response to General Comment 10a.

Air Force Response
Comment noted.

c. Response to General Comment 10c. HERO acknowledges the response and concurs with deferring the long-term protectiveness as Site OT-23C. No additional response is necessary.

Air Force Response
Comment noted.

d. Response to General Comment 10d. Comment noted. HERO's original comment referenced General Comments 2 and 9b. HERO has addressed responses to these comments above. No additional response is necessary.

Air Force Response
Comment noted.

11. Response to General Comments 11a and 11b – Figure 5-8

    a. Response to General Comment 11a. HERO concurs with the Air Force response to General Comment 11a. Figure 5-8 was revised as recommended. HERO has no further comment.

Air Force Response
Comment noted.

    b. Response to General Comment 11b. HERO acknowledges but does not concur with the response to General Comment 11b. HERO continues to recommend that for completeness and transparency the risk values for wells 23-MP-008, 23-MP-016, 23-PW-01, and 23-MP-15 be presented in Figure 5-8. The distribution risk, including the highest risk on the site at 23-MP-016, provides the project managers with information as to whether the recommended IC boundary is protective at Site 23C. Please note, in HERO's April 30, 2020 comments we mistakenly identified well 23-MP-05 instead of 23-MP-15.

Air Force Response
The purpose of the figure is to compare the concentrations at the perimeter of the IC area with residential screening levels for indoor air to evaluate remedy protectiveness with regard to sensitive uses outside the IC area. Evaluation of shallow soil vapor PCE concentrations in the interior of the IC area based on residential screening levels would not be appropriate, because the area is controlled by an IC that would require mitigation to prevent unacceptable vapor intrusion risk.

    c. NEW COMMENT – HERO does not concur with the screening levels based on USEPA's PCE RSL that are listed in Figure 5-8. The incorrect attenuation factor was applied to the USEPA air RSL to derive the soil gas screening levels. An attenuation factor of 0.03 should be used and not 0.001. Please note that the Air Force has correctly applied the 0.03 attenuation factor in the Draft Final Site 59 ESD.

Air Force Response
Please see response to comment 9c above and the revised text in Section 5.1.2.

12. Response to General Comments 12a, 12b, and 12c – Section 7.0 Protectiveness Statements.

    a. Response to General Comment 12a. Site OT-23C. HERO concurs with the response to defer protectiveness determination for the site at this time. No additional response is necessary.

Air Force Response
Comment noted.

    b. Response to General Comment 12b. Site SD-59. HERO acknowledges the response that since a "final remedy has not been selected…a Five-Year Review of the site is not required by statute or policy." HERO does not concur with the response and cannot concur with the long-term protectiveness at SD-59 until additional indoor air sampling is conducted and the TCE mass is removed at the site.

Air Force Response
The comment refers to Site SD-59. Since completion of the last Five-Year Review, the TCE soil vapor source area at Building 4260 has been designated as a separate site (B4260) and has been undergoing the CERCLA process as a separate site. The Air Force has not made a protectiveness determination regarding B4260 with regard to groundwater or indoor air.

    c. Response to General Comment 12c. HERO concurs with and appreciates the response. No additional response is necessary.

Air Force Response
Comment noted.

Comments from DTSC
Geological Services Unit (GSU)
Jeff Brown, Chief, Sacramento GSU
Janine Brinkman, Engineering Geologist
August 11, 2020

Comments

1. **Building 4260 (Newly Discovered Site) Omitted from Five-Year Review Report (GSU Comment #1).** The Air Force responses to GSU comment #1 indicate they believe the contamination and activities associated with Building 4260 do not need to be evaluated in the technical assessment or protectiveness portion of the Five-Year Review Report. The Air Force suggests they are exempt from doing so because a remedy has not yet been selected for Building 4260.

   GSU disagrees with the response and cites the following bases for this disagreement:

   - Building 4260 is a newly discovered site (with a history associated with Site 59(. Trichloroethene (TCE) and other contaminants of concern (COCs) were released under the building at very shallow depths and remain present at high concentrations. The site and release were never identified in the 1990s Remedial Investigation nor reported in the last (fourth) Five-Year Review Report.
   - The TCE contamination threatens groundwater below the building and workers in the building, which overlies to contaminant source, via vapor intrusion pathways. Concentrations of TCE in soil vapor at shallow depths (approximately 10 feet below ground surface) continue to exceed 200,000 micrograms per cubic meter ($\mu g/m^3$) and remain unbounded.
   - The Air Force has completed work on the site warranting evaluation in the Five-Year Review Report. This work includes vapor well installations, indoor air sampling, and a non-time critical removal action (NTCRA) implemented via an Engineering Evaluation/Cost Analysis (EE/CA) mechanism, which included the installation of an SVE system that continues to operate.
   - Significant debate and disagreement exist regarding the adequacy/effectiveness of the NTCRA work including the adequacy of the plume delineation, flooded soil vapor wells causing unbiased results, and the overall ability of the SVE system operation to meet future or expected cleanup criteria. This work and the uncertainty in the data warrants disclosure to the public in the Five-Year Review Report and, pursuant to Five-Year Review and associated USEPA guidance, warrants a protectiveness evaluation.
   - The EE/CA Report and NTRCRA Action Memorandum for Building 4260 did not include soil vapor intrusion cleanup goals that are protective of human health form the soil vapor intrusion to indoor air pathway. This directly affects claims of protectiveness to workers posed by the Air Force in other documents and is, therefore, germane to report on in the Five-Year Review view a technical assessment and protectiveness evaluation.
   - The basis to exclude Building 4260 from the Five-Year Review, as suggested by the Air Force, in part relies on a flawed logic and reasoning which is inconsistent with the public expectations of the Five Year Review. The argument posed by the Air Force to exclude any analysis of protectiveness for the site was that Building 4260 has no selected remedy and could, therefore, be omitted. However, in the Building 4260 NTCRA document text contradicts this and stating a remedy was selected. If a remedy was selected via the NTCRA, then per Air Force logic, the Building 4260 site should be formally evaluated in this Five-Year Review Report. Sacramento County, who owns the property, and the public and workers which work at, and near the property, should be afforded the opportunity of knowing is the site protective and whether the regulatory agencies agree with such a conclusion.
   - Finally, Building 4260 was a central component of a dispute action initiated by DTSC at Site 59. The dispute resolution letter for Site 59, dated May 19, 2017, required an explanation of significant differences document (ESD) with soil vapor intrusion cleanup goals for chlorinated solvents be completed for Site 59 to formally extricate Building 4260 contamination, and associated threats to receptors, from Site 59's closure evaluation.
     - The Air Force has not completed the ESD, hence, Building 4260 contamination and its threat to

receptors is still part of Site 59 and should at a minimum, be evaluated as part of Site 59 in the Five-Year Review Report.

Air Force Response
SVE is being conducted at B4260 as a non-time-critical removal action (NTCRA) versus a final remedy. The NTCRA included two elements – SVE for protection of groundwater and ICs to address vapor intrusion. The Engineering Evaluation/Cost Analysis (EE/CA) for the NTRCA was made available to the public for review, and the Air Force published a notice in the local newspaper requesting public input on the EE/CA (AR #576035). The EE/CA, as well as the agency comment letters on the EE/CA, are available for review on the Air Force's public Administrative Record website. These documents provide full disclosure to the public on contaminant concentrations, potential threats to groundwater, vapor intrusion pathways, and protectiveness to workers. Table 3-2 of the Five-Year Review provides a description of the work conducted to date. The following sentence has been added to Table 3-2: "SVE has been successful at reducing contaminant concentrations in soil vapor, and no modifications to Building 4260 have occurred that would pose a potential vapor intrusion risk."

The Air Force has attempted to complete the Site 59 ESD; however, it has been delayed due to a lack of consensus regarding IC compliance levels. The disposition of the ESD for Site 59 does not affect the protectiveness determination for the site. The agencies' concern regarding Site 59, as stated in the dispute resolution letter, is the "inability to enforce institutional controls at Site 59 since chlorinated solvents were not included as COCs in the selected document." The analysis in the Five-Year Review confirms the protectiveness of the remedy as implemented. Section 5.4.4.1 has been revised to include a target completion date for the ESD.

2. **Site 23C, Unsupported Claims/Statements (GSU Comment #2).** GSU identified six subsections in the Five-Year Review Report (GSU comments 2a through 2f) specific to Site 23C warranting revision due to claims and/or statements made that were unsupported, did not acknowledge regulatory dispute positions, and/or distorted the efficacy of the Site 23C remedy and its protectiveness conclusion.

   GSU comments 2b and 2f were adequately addressed. However, comments 2a and 2c through 2e did not include sufficient "agree-to-disagree" language or other revisions needed to address the concerns or subjectivity in the text we identified.

   Air Force Response
   The Air Force provided revisions to the Five-Year Review Report based on GSU comments 2a and 2c through 2e. The document does not incorporate "agree-to-disagree" language because, to date, there has been no consensus on such language. The document does present both the agency and Air Force positions on the dispute. No further changes were made to the document.

3. **New Response Levels for PFOS and PFOA in Groundwater (GSU Comment #3).** GSU requested the Report reference a new law that went into effect January 1, 2020 (Assembly Bill no. 756 codified as California Health and Safety Code Section 116378), wherein new advisory concentrations for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) contaminants have been established and adopted by the State Water Resources Control Board. The new response levels (RLs) have been lowered for PFOA and PFOS from 70 parts per trillion (ppt) combined to 10 ppt for PFOA and 40 ppt for PFOS based on a running four quarter average. The State of California considers meeting each of these screening levels necessary to demonstrate protectiveness to human health and the environment.

   The Air Force did not agree to include this change stating, 1) a claim it would not change the protectiveness evaluation and 2) the RL change occurred outside of the five-year report reporting timeframe (which the Air Force stated ended in September 2019) and does not qualify for inclusion. GSU does not concur with the decision to exclude this new RL based on these responses.

   The Air Force should include, and acknowledge, the lowered RLs for PFOA and PFOS because, within the next five-year period, activities the Air Force has planned, foremost of which includes a PFOS/PFOA groundwater remedial investigation, will depend on the application of these new, lower criteria.

   GSU defers to DTSCs Human and Ecological Risk Office (HERO) and the Regional Water Quality Control Board

staff for additional feedback on this issue.

Air Force Response
Comment noted.

4. **Reinjection of Water and Ongoing Per- and Polyfluoroalkyl Substances (PFAS) Investigation Status (GSU Comments #4 and 5).** The revisions made to Section 5.1.2 and the responses provided to these two comments adequately address the concerns raised.

Air Force Response
Comment noted.

Comments from CVWB
Marcus Pierce, Remedial Project Manager
August 12, 2020

General Comments

1. As we discussed during the 28 July 2020 conference call, Central Valley Water Board staff are concerned that Site OT-87 has the potential to impact surface water quality in Morrison Creek. The beaver dam has restricted water flow in the creek and potentially submerged portions of Site OT-87 that have elevated concentrations of residual lead. Please identify the range of lead concentrations that are now within the footprint of Morrison Creek and evaluate whether these concentrations pose a risk to surface water quality. If there is a potential risk to surface water quality, then add a recommendation to the Final 5YRR to collect surface water samples for lead analysis early in the next five-year review period.

   Air Force Response

   Please see response to EPA comment #38.

Comments from CDFW-OSPR
Allen Tsao, Associate Toxicologist
August 14, 2020

Topics that Require Further Resolution

1. *Site 20 is not an appropriate reference site to develop cleanup goals for Site 87 for the following reason [Response to Specific Comment #2(a)(3)]:*

    - The sources of lead contamination for Site 20 are from sewage sludge and diesel spill. The type of lead from these sources are not comparable to the lead from shot pellets; therefore, the bioavailability of lead from these sources may be very different.
    - The surface soil concentration of lead from Site 20 is significantly above that of the ambient surface soil at Air Force Bases in California (59.2 mg/kg lead at 95th percentile; Hunter et. Al., 2005), indicating that Site 20 is contaminated.
    - The small sample size of three for Site 20 over 2.8 acres is now unequivocally considered insufficient to make a "no risk" conclusion. Site 20 included collection and analysis of whole-body burden of small mammals, plant bioassays, and surface soils, all with only a sample size of three for each category (IT, 1996). The Air Force reported that the mean surface soil concentration for lead at Site 20 was 365 mg/kg (based on 151, 241, 703 mg/kg). Such small sample size is no longer considered acceptable. As documented in the 2015 ProUCL guidance document, the US EPA has since explicitly required a minimum sample size of 8-10 (US EPA, 2015).
    - The residual lead in soil at Site 87 is poorly characterized (see Attachment 1). Because lead pellets continue to serve as source of contamination, the 95% Upper Confidence Limit on the mean (95% UCL) using the existing surface soil concentrations provides significantly biased low estimate[1], especially in areas where residual lead pellets remain because residual lead pellets can generate up to 9,200 mg/kg lead (see Attachments 4 and 5). The spatial extent of the residual pellets in the western and eastern areas of the subject site is relevant (2.5 acres and 3.5 acres, respectively) because these areas are significantly larger than the home range of small mammals and other sessile receptors such as benthic macroinvertebrates, including the federally listed vernal pool crustaceans. The Interstate Technology and Regulatory Council (ITRC) guidance document for closed small arms range sites recommends estimating soil concentrations from small arms by gravimetric analysis (ITRC, 2003). This approach uses a known contaminant mass of small arms in the sample and divides it by the total mass of the sample, both of which are available from the lead pellet count conducted by the Air Force. (IT, 1997).

      As a side note, the Air Force recently stated that soil lead concentrations in the "*low shot count areas*" averaged approximately 27 mg/kg lead in soil; and that the Air Force expects this to represent the most realistic assessment of soil lead concentrations in the "*low shot count areas*." CDFW-OSPR has evaluated the additional information provided by the Air Force. CDFW-OSPR has determined that while the soil samples in Trench 3 are generally low (in the range of 52.8 mg/kg to 74.6 mg/kg), the "low lead shot count" near Trench 3 approximates the 10 lead shot contour line, whereas the areas that are currently inundated under Morrison Creek have a significantly larger amount of lead shot. Therefore, the average value of 27 mg/kg lead cannot be representative of the residual lead shot areas that are currently and seasonally inundated (see Attachments 4 and 5).

    Air Force Response

    The decision to use Site 20 as a reference site was a decision made and agreed to by all regulatory agencies and it is embodied in a Record of Decision. Similarly, there were no comments from the agencies on the methodology used to calculate the 95% UCL soil lead concentrations in the remedial action report for Site 87. Please refer to the response to EPA comment #38 regarding residual lead concentrations in the seasonally inundated areas along Morrison Creek.

2. *The Lack of Remedial Action Objective in the Record of Decision (ROD) should be formally addressed because it does not cover new information that has since come up to evaluate the protectiveness of the remedy [Response to Specific Comment #2(a)(2)].*

[1] The Air Force incorrectly stated that the maximum lead in soil concentration is 760 mg/kg. This value is based on XRF reading. The actual soil concentration reported usine EPA Method 6010 is 939.9 mg/kg (Sample ID: CNFB14-SO. See p. 232 of 249; MW, 1999; AR#2118).

The lack of a remedial action objective in the ROD presents a flaw that should be addressed. The Air Force claims that "the basis for cleanup is protection of human health, groundwater, surface water quality, and ecological receptors." This statement does not appear to meet the guideline required by the US EPA for the following reasons:

- CERCLA only broadly requires the remedy to be protective of human health and the environment. However, it does not describe what the site cleanup is expected to accomplish (e.g., prevent contamination from reaching surface water or prevent contaminated upland surface soil from becoming sediment or cleanup of vernal pools to levels suitable for the federally listed vernal pool crustaceans). This goal is embodied in the Remedial Action Objective (RAO).
- Without an RAO, new issues such as contaminants in the vernal pools, in the sediment bottom, and contaminant source (i.e., lead pellets) are not addressed.
- Furthermore, the absence of an RAO precludes any basis for making a protectiveness statement.

Air Force Response
The ROD is a final document signed by the U.S. Air Force, U.S. Environmental Protection Agency, and California Department of Toxic Substances Control. It contains cleanup requirements for soil and sediment based on protection of ecological receptors. The Air Force calls attention to the letter from the California Department of Fish and Game (now CDFW), dated 13 August 1998, which states: "The rationale for the proposed clean-up level at Site 87 in the latest revision of the ROD is now acceptable to DFG" (AR #1731). Additional analysis has been performed to evaluate residual soil lead concentrations within the seasonally inundated areas adjacent to Morrison Creek. Please refer to the response to EPA comment #38.

3. *There is not an agreement on (1) the tissue-based toxicity benchmark and (2) the Air Force's use of literature-based "control studies" for the Air Force to justify "no risk" conclusion from residual contamination* [Response to Specific Comment #2(a)(1)]. Our reasoning is as follows:

   - The somatic kidney index values that the Air Force cited are not a metric discussed in Eisler (1998 [Eisler, 1988]). This was developed after the small mammal work plan was finalized.
   - The ROD did not reference the control studies cited in Eisler (1998/1988) as a point of departure in assessing impacts to small mammals, even though those studies are described in Eisler (1998/1988). Rather, the ROD requires Eisler (1998/1988) to be used as a source for obtaining tissue lead levels to cause adverse effects.
   - CDFW-OSPR maintains that Air Force must delete the discussion of literature-based "control studies" (i.e., comparative data in the literature as described in the response to comments and in the Final 2009 Small Mammal Monitoring Report [MWH, 2010]) or acknowledge that they are of very limited value. We believe deleting this discussion is vital because comparison to rodents collected at sites with different soil structures, chemistries and sources of lead is incommensurable with Site 87. The US EPA also maintains the same position (Lucey, 2009).
   - It is important to note that the Air Force, the US EPA and CDFW-OSPR agree that Eisler (1998/1988) does not contain a benchmark suitable for use. In fact, at a comment resolution meeting held on March 16, 2010, Dr. Bruce Narloch, the Air Force consultant, stated "*Eisler does not have a specific effect level one can use.*" CDFW-OSPR believes this is why the Air Force concurred with CDFW-OSPR's recommendation (MWH, 2008) and included the agreed-upon benchmark from Fowler et al. (1980) in its draft 2008 small mammal monitoring report (MWH, 2009; Fortun, 2009).
   - CDFW-OSPR maintains our on-going recommendation that the small mammal monitoring needs to continue for one more year per the ROD, and that the Air Force should continue to honor its agreement to use the Lowest Observed Effect Concentration (LOEC) toxicity benchmark for lead kidney benchmark of 1.2 mg/kg wet-weight (Gary and Stanton, 2006; MWH, 2008; Fortun, 2009; Fowler et. al., 1980). To assist in interpreting the elevated kidney lead level, CDFW-OSPR encourages the Air Force to re-consider adding a reference site for the small mammal monitoring study.

Air Force Response
These comments were addressed in the responses to comments on the Draft Five-Year Review, and were discussed in detail in the responses to comments on the Fourth Five-Year Review. In addition, the Air Force prepared a position paper in May 2016, per request from the regulatory agencies, providing the rationale for the Air Force's determination that the conditions of the ROD for Site OT-87 had been met and that the remedy in place was

protective of human health and the environment (AR #475304). No response or comments to the position paper were received from any of the regulatory agencies.

4. *The dead waterfowl monitoring is not simply a notification requirement. The dead waterfowl monitoring is a component of the remedy for Site 98 [Response to Specific Comment #2(a)(4) and #5(d)]*. CDFW-OSPR disagrees that the dead waterfowl monitoring is simply a notification requirement (i.e., notify the agencies when dead waterfowl were found without the agencies agreeing to any specific monitoring duration, frequency, and method of such monitoring *apriori*). The collaborative nature of the agreement between the Air Force and the regulatory agencies is stressed as a vital component of the remedy in the ROD (AFBCA, 1998). CDFW-OSPR disagrees with the Air Force that the dead waterfowl monitoring requirement is not a component of the remedy because if it had simply been a component in a typical operation and maintenance plan, it would have been described under the Remedial Action Operation and Maintenance (Section 2.2.10) of the ROD rather than under the main description of the remedy where the cleanup number for lead in soil is also described.

   Air Force Response
   As the Air Force stated in the response to Specific Comment #2(a)(4) on the Draft Five-Year Review Report, the Air Force is cooperating with CDFW-OSPR's proposal to conduct a dead waterfowl monitoring program at Site 87. However, this is not a component of the remedy. The Air Force notes CDFW's disagreement on this issue.

5. *Response to Specific Comment #3*.The Air Force responded, "*The small rodent burrows were inspected by the field technician prior to backfilling, but were not inspected by a certified biologist. The burrows were observed during the fourth quarter of 2018, outside of the burrowing owl nesting season*." Due to the presence of a Burrowing Owl at Landfill 3 in November 2018 (during the fourth quarter, outside of nesting season), CDFW-OSPR requests that all burrows be inspected for Burrowing Owls and their sign, by a qualified biologist immediately prior to backfilling to ensure Burrowing Owls are not present within the burrows, at all landfills at Mather. Burrowing Owls use burrows all year round, not just during nesting season, and there is potential for take an owl if a burrow is backfilled while the owl is inside. If Burrowing Owls are present on site, a Burrowing Owl exclusion plan (CDFW, 2012) should be submitted to CDFW-OSPR for review and concurrence, prior to backfilling the burrows.

   In addition, CDFW-OSPR provided information to the Air Force on July 14, 2020, regarding ground squirrels chewing through the geotextile fabric at Moffett Federal Airfield Site 1 Landfill (Earth Resources Technology, Inc., 2020). CDFW-OSPR requests the Air Force address the potential for burrowing animals such as ground squirrels and gophers to chew through the geotextile liner at the Mather landfills during the next Five-Year Review period. The Air Force should consider excavating some burrows down to the geotextile liner to inspect for damage from burrowing animals as part of their annual inspections of the Mather landfills, as was done at Moffett, since visual inspections of the landfill surface alone did not detect damage to the geotextile fabric at Moffett.

   Air Force Response
   According to the California Department of Fish and Game "Staff Report on Burrowing Owl Mitigation" (CDFW, 2012), suitable burrows for burrowing owl are greater than 11 cm (4.3 inches) in diameter. The Air Force has and will continue to have a qualified biologist inspect all burrows greater than 11 cm in diameter before backfilling to ensure burrowing owls are not present. The Air Force will evaluate the potential for burrowing animals to chew through the geotextile liner at the Mather landfills during the next Five-Year review period.

6. *Response to Specific Comment #4*. The Air Force responded, "*The burrows were inspected by the field technician prior to backfilling, but were not inspected by a certified biologist. The gopher burrows were observed at LF04 during 1Q18 inspections and none of the burrow openings were found to be more than approximately 2 to 3 inches wide*." Please see CDFW-OSPR's response to Specific Comment #3 above.

   Air Force Response
   Please see the response to CDFW-OSPR Specific Comment #3.

7. *Response to Specific Comment #5(a), 5(b), and 5(c)*. The response is acceptable.

   Air Force Response
   Comment noted.

Topics that Would Only Require Minor Modifications to the Draft Final 5-Year Review Report

8. *Dead waterfowl survey dates should be revised to match the time covered by the subject report (Response to Specific Comment #1).* Since the subject report covers data collected from 1 January 2014 through 30 September, 2019, CDFW-OSPR recommends the text be revised to indicate that dead waterfowl surveys were conducted by CDFW-OSPR in June and September, 2019, and that subsequent dead waterfowl survey results will be presented in the Sixth Five-Year Review Report in 2025.

   Air Force Response
   The requested revision has been made.

NEW COMMENT (provided in an email dated 16 July 2020 and during the comment resolution call on 28 July 2020, paraphrased below for clarity).

9. *The ROD stipulates that the lead cleanup goal for sediment is 15.5 mg/kg. Due to the change in the surface water hydrology, additional contaminated sediment that contains lead significantly above this level has now been created. CDFW-OSPR estimates this additional sediment covers 6 acres in size. Therefore, the remedy may no longer be protective of sediment macroinvertebrates.*

   a. During the course of CDFW-OSPR's dead waterfowl surveys in 2019, CDFW-OSPR staff noticed that a new beaver dam has been constructed in the western portion of Morrison Creek. Due to the dam blocking stream flow, the footprint of Morrison Creek (also called Marilyn Evans pond) has now significantly been expanded which fundamentally changed the surface water hydrology of the area (approximately 6 acres in total) is now underwater, making these areas effectively sediment bottom. These areas have very high levels of residual lead shot within 300 yards of the firing line (estimated lead in sediment ranges from 400 mg/kg to 9,200 mg/kg). These concentrations of lead shot have the potential to impair water quality and be deleterious to aquatic receptors. CDFW-OSPR recommends the Air Force address this by collecting and analyzing surface water sediment samples for lead to assess the protectiveness of the remedy. CDFW-OSPR created the following figures to depict the relationship between the new sediment footprint and the lead shot sample results from 1996 (IT, 1997):

      - Attachment 2: Shows the new footprint of Morrison Creek[2]
      - Attachment 3: Gridded lead shot pellet sampling location within the 300-yard radius from the firing line
      - Attachment 4: Residual soil lead concentrations, estimated from lead shot in the western portion of Site 87
      - Attachment 5: Residual soil lead concentrations, estimated from lead shot in the eastern potion of Site 87. Note that there is a vernal pool delineated by the Air Force that contains 30 lead shot pellets.

      These figures (i.e., Attachments 2 through 5) were transmitted to the Air Force in an email dated 16 July 2020. The Air Force responded that the area that CDFW-OSPR indicated as being flooded "*was almost entirely excavated during the site cleanup*" and referred CDFW-OSPR to Figure 6-5 through 6-13 of the Draft Final Informal Technical Information Report for Remedial Actions at Sites 15, 20, 85, 86, and 87 (MW, 1999). CDFW-OSPR agrees that if these areas were excavated during the site cleanup, it would satisfy our comment. However, the attachments we provided already incorporated the footprint of sediment and soil excavation by directly "rubbersheeting" the final sediment and soil cleanup footprint figures (Figures 6-10 and 6-13) from the Remediation Action Report (MW, 1999). Based on the available information, CDFW-OSPR does not consider the flooded area to have been almost entirely excavated during the site cleanup.

   b. One vernal pool (approximately 0.15 – 0.20 acres in size) was discovered to be present within the lead shot fall area during CDFW-OSPR's spatial analysis of the residual shot area. In particular, 30 lead pellets were found at this vernal pool (see Attachment 5). The estimated lead concentration in vernal pool sediment is 3,000 mg/kg (using the gravimetric method as described in ITR (ITRC, 2003). Lead levels below the consensus-based Threshold Effects Concentration (35.8 mg/kg). The estimated lead concentration at this vernal pool is potentially greater than 80 times the Threshold Effect Concentration (TEC) toxicity benchmark. The level of lead in sediment should be quantitated and vernal pool

[2] The extent of Morrison Creek is not shown outside Site 87 boundary because the deadwaterfowl survey did not go beyond Site 87 boundary.

crustacean surveys should be conducted there to determine if the federally listed vernal pool crustaceans is present; it may be necessary to conduct a toxicity bioassay on the contaminated sample to see if surrogate benthic invertebrate can survive.

Air Force Response

The issue of soil lead concentrations in seasonally inundated areas along Morrison Creek is addressed in EPA comment #38. The soil lead concentrations provided in the remedial action report for Site 87 (Montgomery Watson, 1999; AR #2118) are based on measured concentrations obtained through laboratory analysis of soil samples collected from the site. These measured concentrations show that the average soil lead concentration in the low shot count areas is 27 mg/kg, which is below the consensus-based Threshold Effects Concentration for sediment-dwelling organisms. Further, it is noted that based on overlay of the site with the vernal pool using the Air Force's geographic information system (GIS), the vernal pool is located almost entirely beyond the boundary of the site, behind the firing line. Further analysis, surveys and toxicity studies are therefore not warranted.

Review of Draft Final Fifth 5-Year Review Report

CDFW-OSPR has no additional comments other than that the Draft Final version of the subject document should address the comments above.

Air Force Response

Comment noted.

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE