RECORD OF DECISION

for the

Boundary Operable Unit OU-6

AEROJET SUPERFUND SITE, RANCHO CORDOVA, CALIFORNIA

U.S. Environmental Protection Agency
Region IX
San Francisco, California

Final

EPA ID: CAD980358832

August 4, 2015

FINAL

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San Francisco, California

August 2015

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Acronyms and Abbreviations

°F	degree(s) Fahrenheit
µg/dL	microgram(s) per deciliter
µg/L	microgram(s) per liter
$\mu g/m^3$	microgram(s) per cubic meter
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
1,1,2,2-PCA	1,1,2,2-tetrachloroethane
1,2-DCA	1,2-dichloroethane
4,4'-DDD	4,4'-dichlorodiphenyldichloroethane
4,4'-DDE	4,4'-dichlorodiphenyldichloroethene
4,4'-DDT	4,4'-dichlorodiphenyltrichloroethane
Aerojet	Aerojet Rocketdyne, Inc.
APN	Assessor's Parcel Number
ARAR	applicable or relevant and appropriate requirement
ARGET	American River Groundwater Extraction and Treatment
AST	aboveground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
BEHP	bis(2-ethyhexyl)phthalate
bgs	below ground surface
BMP	best management practice
BTEX	benzene, toluene, ethylbenzene, and xylene
CAG	Community Advisory Group
Cal-EPA	California Environmental Protection Agency
CCR	*California Code of Regulations*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	*Code of Federal Regulations*
cis-1,2-DCE	cis-1,2-dichloroethene
CL	cleanup level
COC	contaminant of concern
COPC	contaminant of potential concern
COPEC	contaminant of potential ecological concern
Cr6	hexavalent chromium
CSM	conceptual site model
d-BHC	d-benzene hexachloride
DLM	designated level methodology
DnBP	di-n-butyl phthalate

DSA	Drum Storage Area
DTSC	Department of Toxic Substances Control
EC	engineering control
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERM	Environmental Resources Management
ESA	Endangered Species Act
ESL	ecological screening level
FS	feasibility study
FSP	field sampling plan
FSTP	former sewage treatment plant
FYR	Five-year review
GET	groundwater extraction and treatment
GIS	geographic information system
gpd	gallons per day
GW	groundwater
HEAST	Health Effects Assessment Summary Tables
HH	human health
HHERA	human health and ecological risk assessment
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HVAC	heating, ventilation, and air conditioning
IC	institutional control
ILCR	incremental lifetime cancer risk
IRCTS	Inactive Rancho Cordova Test Site
IRIS	Integrated Risk Information System
LANL	Los Alamos National Laboratory
LUC	land use control
MA	management area
MCL	maximum contaminant level
mg/kg	milligram(s) per kilogram
MW	molecular weight
NC	no carcinogenic compounds of interest in a sample
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDMA	n-nitrosodimethylamine
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List

O&M	operation and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
ORNL	Oakridge National Laboratory
OS	open space
OU	operable unit
OU-3	Western Groundwater Operable Unit
OU-5	Perimeter Operable Unit
OU-6	Boundary Operable Unit
OU-7	Island Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCD	Partial Consent Decree
PCE	tetrachloroethene
PHG	Public Health Goal
ppm	parts per million
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RCRB	Redding-Corning-Red Bluff
RfD	reference dose
RI	remedial investigation
ROD	Record of Decision
RSL	Regional Screening Level
RWQCB	Regional Water Quality Control Board
SLERA	Screening-Level Ecological Risk Assessment
SMAQMD	Sacramento Metropolitan Air Quality Management District
SPCC	Spill Prevention, Control, and Countermeasures
SPZ	Special Planning Zone
SSD	subslab depressurization
SSV	subslab venting
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWRCB	State Water Resources Control Board
TBC	to be considered criteria
TCDD	2,3,7,8-tetrachlorodibenzodioxin
TCE	trichloroethene
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons as diesel
TPH-G	total petroleum hydrocarbons as gasoline
TPH-Mo	total petroleum hydrocarbons as motor oil
TSCA	Toxic Substances Control Act

USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compound
Westborough Plan	Westborough at Easton Specific Plan

PART 1: THE DECLARATION

1.1 Site Name and Location

Aerojet Rocketdyne, Inc., (Aerojet)[1] Superfund Site (Site), Sacramento County, California, Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number ***CAD980358832***.

The Site consists of approximately 5,900 acres, along with the footprint of the contaminated groundwater that extends beyond the Aerojet Property, and is located about 15 miles east of Sacramento, California. The Aerojet Superfund Site is divided into nine operable units (OUs) because of the overall size of the remediation effort and to expedite the remediation. The scope and definition of the current Aerojet OUs were pursuant to a 2002 modification of the 1989 Partial Consent Decree (PCD) for the Site. This Record of Decision (ROD) addresses OU-6 (Boundary OU).

The OU-6 ROD addresses 81 areas that have been identified as areas requiring an action (referred to as remedial action areas). The 81 remedial action areas are shown on Figures 2-23 to 2-31 and include:

AE-R-1	AE-SV-R-6	AW-R-12	L2-R-9	BC-R-1	CP2-R-10
AE-R-2	AE-SV-R-7	AW-R-13	L2-R-10	BC-R-2	CP2-R-11
AE-R-3	AE-SV-R-8	AW-R-14	L2-R-11	WL-R-1	CP2-R-12
AE-R-4	AW-R-1	AW-R-15	L2-SV-R-1	MA-R-1	CP2-SV-R-1
AE-R-5	AW-R-2	AW-R-16	L2-SV-R-2	MA-SV-R-1	CP2-SV-R-2
AE-R-6	AW-R-3	AW-SV-R-1	L2-SV-R-3	CP2-R-1	CP2-SV-R-3
AE-R-7	AW-R-4	L2-R-1	L5-R-1	CP2-R-2	CP2-SV-R-4
AE-R-8	AW-R-5	L2-R-2	L5-R-2	CP2-R-3	CP2-SV-R-5
AE-R-9	AW-R-6	L2-R-3	L5-R-3	CP2-R-4	CP2-SV-R-6
AE-SV-R-1	AW-R-7	L2-R-4	L5-R-4	CP2-R-5	DPEB-R-1
AE-SV-R-2	AW-R-8	L2-R-5	L5-R-5	CP2-R-6	DPEB-SV-R-1
AE-SV-R-3	AW-R-9	L2-R-6	L5-SV-R-1	CP2-R-7	
AE-SV-R-4	AW-R-10	L2-R-7	L5-SV-R-2	CP2-R-8	
AE-SV-R-5	AW-R-11	L2-R-8	L5-SV-R-3	CP2-R-9	

1 - Aerojet General Corporation acquired Rocketdyne, Inc. in 2013, and is now operating as Aerojet Rocketdyne, Inc.

The Remedial Investigation/Feasibility Study (RI/FS) for OU-6 evaluated all identified potential source sites and many were deemed to not pose a risk or require a remedial action. Those were designated as "not retained" areas. Further information for these not retained areas is provided in Section 2.8 and Table 2-11 of this ROD and in the FS (Shaw, 2012).

1.2 Statement of Basis and Purpose

This decision document presents the U.S. Environmental Protection Agency's (EPA's) selected soil and soil vapor cleanup remedies for OU-6 at the Aerojet Superfund Site, which were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (USC) §§ 9601 *et seq.*, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 *Code of Federal Regulations* (CFR) Part 300. This decision is based on EPA's Administrative Record file. The Proposed Plan (PP) (EPA, 2013) and ROD address the community involvement requirements of CERCLA.

The State of California Environmental Protection Agency (Cal-EPA), represented by the Department of Toxic Substances Control (DTSC) and the Central Valley Regional Water Quality Control Board (RWQCB) (collectively, the "State"), has been the supporting agency during the RI and FS process for the Aerojet Site. In accordance with 40 CFR 300.430, the State of California has been involved in the review of this document, actively participated in the decision-making process, and has provided EPA with invaluable input. The State of California generally agrees with the cleanup approach for this ROD[2] and concurred with the selected remedies in a letter from DTSC to EPA, dated June 2, 2015.

This ROD addresses volatile organic compounds (VOCs) in soil vapor within OU-6 that may present a threat to human or ecological health or groundwater quality, and non-VOCs in soil that may present a threat to human or ecological health or that may present a threat to surface water or groundwater quality. VOCs include many chlorinated solvents and petroleum-related compounds, including trichloroethene (TCE), tetrachloroethene (PCE), and benzene among others. Non-VOCs include semivolatile organic compounds (SVOCs), metals, perchlorate, and petroleum hydrocarbons. SVOCs include polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans, and pesticides. Petroleum hydrocarbons include three primary classes of compounds: total petroleum hydrocarbons (TPH) as diesel (TPH-D), as gasoline (TPH-G), and as motor oil (TPH-Mo). Petroleum product contamination is exempt from CERCLA; however, EPA guidance states that if petroleum product contamination is commingled with CERCLA hazardous substances, the petroleum contamination is also addressable under CERCLA. Because the TPH contamination in OU-6 soils is commingled with other CERCLA hazardous substances, the TPH contamination is addressed in this ROD.

This ROD addresses soil and soil vapor contaminated areas. Although this ROD is not intended to address groundwater contamination, groundwater contamination is present beneath the OU-6 area. Because there is currently no sitewide land use covenant for groundwater, this ROD will implement the same institutional controls (ICs) as those adopted by OU-3 and OU-5 RODs, as

2 - See Section 2.11 State Acceptance and Table 2-13 for details concerning differences in approach to the remedy between EPA and the State.

well as ICs placed on the Carveout Lands to restrict access and use of groundwater. As stated in the OU-5 Interim ROD for Groundwater, "These [institutional] controls will include Sacramento County review of new well drilling permits and prohibitions on access to groundwater on the land overlaying the contaminated groundwater to restrict use of untreated groundwater within the contaminated portions of the aquifer until the final water quality objectives have been attained." (see Appendix A for the Aerojet sitewide groundwater plume locations). In addition, the OU-3, OU-5, and OU-6 RODs will require ICs enforceable through State land use controls (LUCs) whenever Aerojet-owned property above a groundwater contaminant plume is transferred. These restrictions will be implemented through a recorded covenant pursuant to California Civil Code Section 1471 and other applicable California law, whereby Aerojet covenants to impose these restrictions. These land use covenants will be binding to Aerojet's successors and assigns as covenants running with the land. The State of California and EPA (as a third-party beneficiary) will have the right to enforce these restrictions. Any lease or sale of Aerojet property overlying the contaminated groundwater in OU-6 shall be subject to the following restrictions:

- No recharge of groundwater unless and until expressly permitted in writing by EPA and the RWQCB
- No injection into the groundwater unless approved in writing by EPA and the RWQCB
- No sustained extraction of groundwater encountered during excavation for construction without written approval by EPA and the RWQCB
- No drilling or use of wells for the purpose of extracting water for any use, including domestic, municipal, potable, irrigation or industrial uses; this restriction does not apply to wells used for site remediation, as approved by EPA and the RWQCB

Aerojet shall give written notice of the groundwater contamination to each buyer, lessee, renter, and mortgagee of any of these lands; and every lease, deed, mortgage, or instrument conveying any part of these lands shall expressly provide that it is subject to this Declaration of Covenants and Environmental Restrictions.

The contaminated groundwater beneath the Aerojet Superfund Site (see Appendix A), including groundwater beneath OU-6, is being addressed as part of the ongoing interim and final remedial actions to provide hydraulic containment and remediation of the contamination associated with releases from Aerojet. As described in the proposed plan, groundwater remediation is being conducted on an Aerojet sitewide basis. These final and interim remedies for the groundwater are managed under the OU-3 ROD (EPA, 2001) and OU-5 Interim ROD for Groundwater (EPA, 2011). The Sitewide ROD (OU-1) will integrate the final remedies for all groundwater, soil and source OUs, and it will document the aquifer restoration goals for the entire site. The Remedial Action Objectives established in final and interim remedies will be reviewed for protectiveness and compliance with applicable or relevant and appropriate requirements (ARARs). A ROD amendment or explanation of significant differences (ESD) can be used for necessary revisions. Five Year Reviews will evaluate the remedies to determine if they are still protective and may recommend modification of the cleanup goals prior to the Sitewide ROD.

In addition to the groundwater ICs already in place, other restrictions already applied to the OU-6 area include the Sacramento Consultation Zone policy, the environmental covenant for the

Carve-Out lands, the PCD identifying areas subject to excavation restrictions, and Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements.

1.3 Assessment of Site

As a result of past industrial activities within OU-6, releases of hazardous substances have contaminated surface soils, the vadose zone, and groundwater. The response actions selected in this ROD are necessary to protect the public health or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of Selected Remedies

The selected remedies and their major components are summarized in this section. The selected remedies provide the best approach for cost-effective risk reduction. They will provide protection to human health and the environment by either removing contaminants from the site, thereby reducing any residual risk, or by limiting exposure to human receptors and/or ecological receptors by implementing the selected remedies discussed below. Aerojet retains responsibility for the operation and maintenance (O&M) of all the selected remedies, including, but not limited to, permanently covered areas (caps), wells, and ICs.

The selected remedies for OU-6 are as follows:

- Alternative 2 – Institutional Controls (ICs)
- Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs
- Alternative 4 – Source Removal/Reduction

The following sections describe how these selected remedies are applicable for the contaminated soil, sediment, and soil vapor within OU-6.

1.4.1 Alternative 2 – Institutional Controls

EPA has selected Alternative 2 (ICs) for all soil areas where the risk to human health is the result of vapor intrusion and to prevent unacceptable exposures to contamination remaining onsite. ICs will be implemented to restrict unacceptable land uses, require environmental evaluations, and establish protection of engineered controls. EPA considers ICs to include "non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and/or protect the integrity of a response action". ICs typically are designed to work by limiting land or resource use, or by providing information that helps modify or guide human behavior at a site. Some common examples of ICs include zoning restrictions, building or excavation permits, well drilling prohibitions, easements, and covenants.

Alternative 2 (ICs) was selected for the following three areas. These areas are shown on Figures 2-28 to 2-31, and are included in Appendix B.

MA-SV-R-1	CP2-SV-R-6	DPEB-SV-R-1

1.4.2 Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs

EPA has selected Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs) to address the soil and sediment contamination requiring action in OU-6.

Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs) consists of the following:

- Placement of capping materials (pavement, gravel layer, etc.) over areas with chemicals posing potential risks above commercial/industrial use levels;
- Monitoring the presence, thickness, and maintenance of new and existing capping materials (e.g., buildings, foundations, roadways, and parking lots) that currently overlie areas of contaminants of concern (COCs) within OU-6 to ensure the integrity of the capping materials;
- Modification and monitoring of the heating, ventilation, and air conditioning (HVAC) systems of existing buildings to ensure that there are sufficient air exchange rates to limit vapor intrusion and reduce indoor air concentrations to safe levels based on the Johnson and Ettinger Model (1991) or an alternative industry-accepted standard calculation;
- Construction and operation of foundation venting systems around and/or beneath **existing** buildings, and adoption of engineering or management controls requiring vapor mitigation to reduce or prevent VOC intrusion into buildings through vapor barriers (synthetic membrane) and subslab venting (SSV) systems and/or subslab depressurization (SSD) systems or alternative system designed to prevent intrusion of contaminants to indoor air; and
- Construction and operation of foundation venting systems around and/or beneath **new** construction and adoption of engineering or management controls requiring vapor mitigation to reduce or prevent VOC intrusion into buildings through the installation of vapor barriers (synthetic membrane) such as SSD, SSV or alternative system designed to prevent intrusion of contaminants to indoor air.

Alternative 2 ICs, as described in Section 2.10.2, are incorporated as part of Alternative 3 and would be implemented as part of this alternative to protect the integrity of the cap and vapor intrusion mitigation systems, to identify the presence of engineering controls in place, and for long-term protection and maintenance requirements. These long-term requirements refer to the activities necessary to ensure that engineering controls are maintained and that ICs continue to be enforced. If additional characterization demonstrates that there is no remaining risk from soil contaminants in the vadose zone to any receptors above acceptable levels, then ICs under Section 2.10.3 would continue to apply only where groundwater contaminants continue to pose a risk.

Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs) was selected for the following 11 areas. These areas are shown on Figures 2-23 through 2-31, and included in Appendix B.

AE-R-1	AE-R-2	AE-R-3
AE-R-4	AE-R-5	AE-R-6
AE-SV-R-3	AW-SV-R-1	L2-SV-R-1
L5-SV-R-3	DPEB-R-1	

1.4.3 Alternative 4 – Source Removal/Reduction

EPA has selected Alternative 4 (Source Removal/Reduction) for most areas in OU-6. Alternative 4 consists of two main components: (1) excavation and offsite disposal of soil containing site-related chemicals at concentrations greater than acceptable levels for future use; and (2) soil vapor exaction (SVE) to remove as much contaminated soil vapor associated with the source area as possible. ICs may be implemented in areas where contamination remains in place at concentrations greater than acceptable levels for unrestricted use, such as areas inaccessible for excavation (i.e., beneath building foundations or around utilities). ICs will also mitigate unacceptable exposures and protect the SVE system. The areas selected for Alternative 4 are shown on Figures 2-23 to 2-31, and included in Appendix B.

Alternative 4 (Source Removal/Reduction) (Excavation or Excavation with Soil Flushing and Air Stripping) was selected for the following 51 areas in OU-6:

AE-R-7	AE-R-8	AE-R-9
AW-R-1	AW-R-2	AW-R-3
AW-R-4	AW-R-5	AW-R-6
AW-R-7	AW-R-8	AW-R-9
AW-R-10	AW-R-11	AW-R-12
AW-R-13	AW-R-14	AW-R-15
AW-R-16	L2-R-1	L2-R-2
L2-R-3	L2-R-4	L2-R-5
L2-R-6	L2-R-7	L2-R-8
L2-R-9	L2-R-10	L2-R-11
L5-R-1	L5-R-2	L5-R-3
L5-R-4	L5-R-5	BC-R-1
BC-R-2	WL-R-1	MA-R-1
CP2-R-1	CP2-R-2	CP2-R-3
CP2-R-4	CP2-R-5	CP2-R-6
CP2-R-7	CP2-R-8	CP2-R-9
CP2-R-10	CP2-R-11	CP2-R-12

Alternative 4 (Source Removal/Reduction) (SVE) was selected for the following 16 areas in OU-6:

AE-SV-R-1	AE-SV-R-2	AE-SV-R-4
AE-SV-R-5	AE-SV-R-6	AE-SV-R-7
AE-SV-R-8	L2-SV-R-2	L2-SV-R-3
L5-SV-R-1	L5-SV-R-2	CP2-SV-R-1
CP2-SV-R-2	CP2-SV-R-3	CP2-SV-R-4
CP2-SV-R-5		

1.5 Statutory Determinations

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are applicable or relevant and appropriate to the remedial action, are cost-effective, and use permanent solutions to the maximum extent practicable. The selected remedies comply with the offsite disposal requirements of CERCLA and the NCP.

These remedies also satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment) for the contaminated soil and soil vapor.

The selected remedies will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that would allow for unlimited use and unrestricted exposure. Therefore, a statutory review (i.e., a CERCLA 5-year review) will be conducted within 5 years after initiation of remedial action, and every 5 years thereafter, to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD Data Certification Checklist

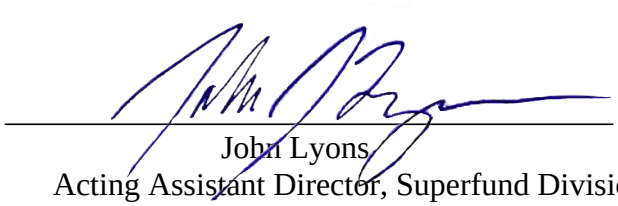
The following information is included in Part 2: The Decision Summary of this ROD (additional information can be found in the Administrative Record file and Administrative Record Index [Appendix C] for OU-6):

- COCs and their respective health-based concentrations – Table 2-1 and Appendix B;
- Summary of Site Risks – Section 2.7 (page 71);
- Performance Standards (cleanup or containment levels) established for the COCs and the basis for these levels – Tables 2-2 and 2-3;
- How source materials constituting principal threats are addressed – Section 2.12 (page 134);
- Current and reasonable anticipated future land use assumptions – Section 2.6.1 (page 61), and Figures 2-19 to 2-22;

- Estimated capital, O&M, and total present value costs, discount rate, and the number of years over which the remedy cost estimates are projected – Section 2.11 (page 127), Table 2-12, and Appendix D; and
- Key factors that led to selecting the remedy – Section 2.13 (page 143).

This ROD was prepared consistent with guidance published by EPA for preparation of RODs (EPA, 1999).

1.7 Authorizing Signature



7/22/15

John Lyons
Acting Assistant Director, Superfund Division
California Site Cleanup Branch
U.S. Environmental Protection Agency Region IX

Date

PART 2: THE DECISION SUMMARY

2.1 Site Name, Location, and Description

The Aerojet Superfund Site is located within Sacramento County, approximately 15 miles east of Sacramento, California (see Figure 2-1). It is bounded on the west and north by the cities of Rancho Cordova and Folsom along with the communities of Carmichael, Fair Oaks, and Gold River – with a combined population of approximately 237,000 residents. Unincorporated Sacramento County lies to the south and east of Aerojet.

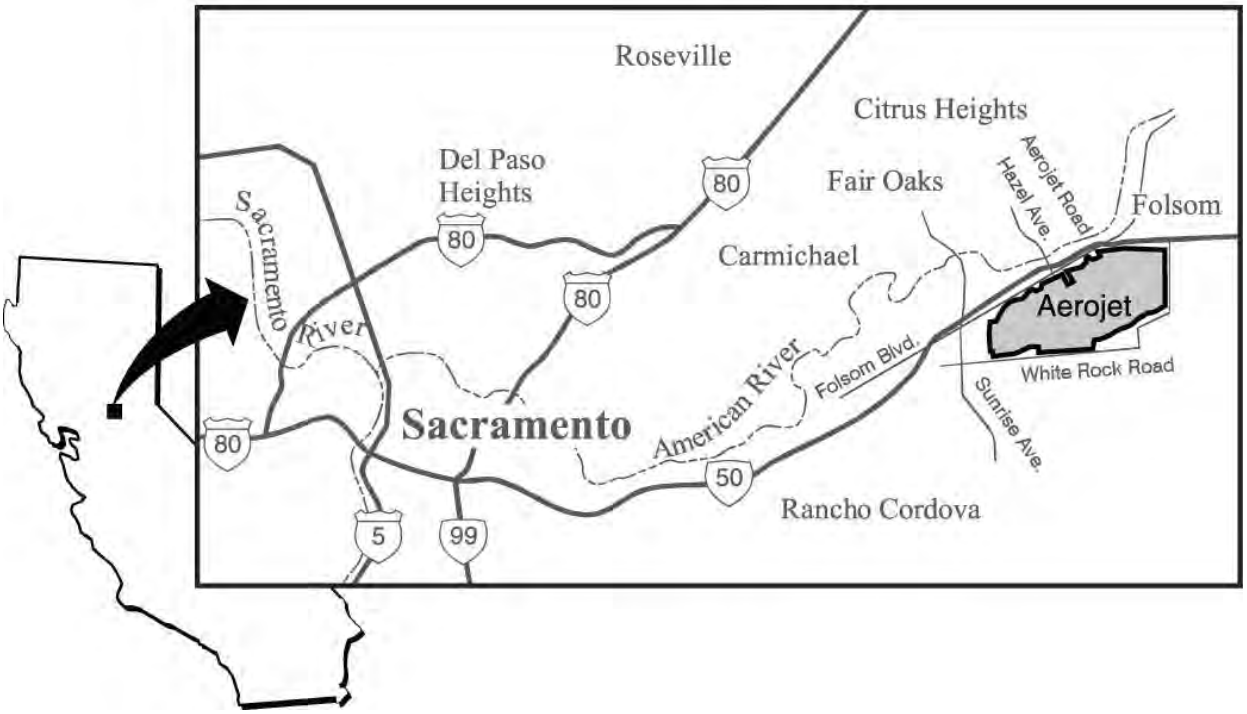


Figure 2-1: Aerojet Superfund Site Map – Location

OU-6 is generally located along the western and northern boundaries of the Aerojet Superfund Site, and total acreage for OU-6 is 701 acres.

Because of the complex history of past operations and size of OU-6, it was sub-divided into nine Management Areas (MAs) and seven Open Space (OS) areas to focus the remedial investigations on sources with the potential for releases to the environment. A brief description of each of the source areas within OU-6 are shown in Table 2-11. As discussed in greater detail later in Section 2.8, contaminated areas within each of the MAs that require remediation (Remedial Action areas) have been identified and a preferred remedy has been selected.

The nine MAs and seven OS areas are described below and are also shown on Figure 2-2.

- **Administration Area:** The Administration Area is the historical liquid rocket manufacturing area, and historical and current administration area at the Aerojet propulsion facility. Potential source areas within the Administration Area are associated with liquid rocket manufacturing and the drainage system extending from the manufacturing buildings within the Administration Area to the West Lakes Area. Locations where piping discharged to ditches were identified as potential source areas. The primary chemicals associated with liquid rocket manufacturing were chlorinated solvents and metals. The following subareas have been defined for the Administration Area:

  - **Administration Area East:** Source Areas 3D, 4D, 11D, 50D, and 51D; Building 20034, Resource Conservation and Recovery Act (RCRA) Units B (Bldg. 20037), C (Bldg. 20029), and X (Bldg. 20873) (all closed under RCRA) (see Figure 2-3), and associated septic tanks, PCB transformers, and underground storage tanks;

  - **Administration Area West:** Source Areas 5D, 6D, 9D, 12D, 50D, 52D FWOT, 52TB, D(b), and D(c); RCRA Units W and Y (closed under RCRA) (see Figure 2-4) and associated septic tanks, PCB transformers; and

  - **Former Sewage Treatment Plant:** Source Areas 8D and D(d) (see Figure 2-4).

- **Line 2 Region:** The Line 2 Region (Source Areas 28E, 29E, 59E, E[d], E[e], E[m], E[n]; Drum Storage Area (DSA); associated septic systems; and RCRA Units T and Z) includes various features such as collection systems, floor drains, sumps, storage areas, and a cleaning slab associated with the drum-cleaning activities in the DSA; drainage ditches; tanks; and septic tanks and leach fields (see Figure 2-5).

- **Line 5 North:** The Line 5 North Area encompasses three source areas (Source Areas 51E, 52E, and E[l]) and various other features including sumps, a possible missile test stand, test cells and associated blast areas, a material storage area, and drains associated with former activities conducted at Building 05087 (see Figure 2-6). Building 05087 is identified as a former engineering test laboratory where solid propellants, liner materials, 1,1,1-trichloroethane (1,1,1-TCA), and TCE were handled.

- **West Lakes Area/OS-6:** The West Lakes Area receives stormwater runoff from various areas of the Aerojet facility via the Main Administration Area Ditch and Buffalo Creek. No source areas have been identified within the West Lakes Area. However, the OU-6 Field Sampling Plan (FSP) identified the West Lakes Area as a feature to investigate because the potential exists for chemicals from various parts of the Aerojet Superfund Site to have been carried into and deposited within the West Lakes Area via surface water and sediment transport through the Main Administration Area Ditch and Buffalo Creek (see Figure 2-7). Because of this, the West Lakes Area was included in the OU-6 RI Report.

- **Buffalo Creek:** Although Buffalo Creek was not identified as a source area, the OU-6 FSP identified it as an investigation area because of the potential for stormwater from many source areas in Area 00, Line 1, Line 2, Line 6, and Zone 3 to discharge into Buffalo Creek (see Figure 2-8). Within OU-6, Buffalo Creek comprises three principal drainages referred to in this report as “Upper,” “Lower,” and “Cutoff.” Upper Buffalo Creek includes its current

channel beginning just east of the OU-6 to the point of discharge into West Lakes Area. Lower Buffalo Creek includes the current channel that receives surface water discharges from the West Lakes Area and from the American River Groundwater Extraction and Treatment (ARGET) facility. Buffalo Creek Cutoff refers to a section of drainage adjacent to Line 2 that formerly connected Buffalo Creek and the Main Administration Area Ditch. This section of the channel was abandoned following construction of the portion of Buffalo Creek that runs adjacent to Line 2.

- **Chemical Plant 2 Area:** Chemical Plant 2 was originally operated as a nitroplasticizer manufacturing facility by Aerojet. The plant was shut down in 1968 and later reactivated in 1975 by Cordova Chemical Company for other chemical manufacturing activities. Chemical Plant 2 encompasses Source Areas 59F, 60F, 61F, 62F, CP2-07, CP2-08, and F(c); associated septic systems; and RCRA Units E and I (see Figure 2-9). Additionally, two deep injection wells associated with historical waste operations are present within the Chemical Plant 2 Area; however, these injection wells are under a post closure permit administered by the DTSC under the corrective action program (RCRA) and, therefore, were not included in this evaluation. Various features at Chemical Plant 2 include former offices, control rooms, laboratories (Building 15001) associated with the chemical plant, chemical manufacturing facilities, collection systems, waste lines, floor drains, sumps, former hazardous waste and material storage areas, holding basins, aboveground storage tanks (ASTs), underground storage tanks (USTs), septic tanks and leachfields, drainage ditches, and low-lying areas. Chemicals used or manufactured at Chemical Plant 2 included chemicals used in the nitroplasticizer process, solvents, diesel, pesticides, and oil containing PCBs.

- **Magazine Area (Area 48)/OS-3:** The Magazine Area/OS-3 consists of storage bunkers, shipping and transfer facilities, a low area, and safety shelters (see Figure 2-10). In the Magazine Area/OS-3, two septic systems and a former RCRA Unit (RCRA-C) were identified as features to investigate in the OU-6 FSP.

- **Dredge Pit and Eastern Basin:** Two historical dredge pits are located approximately 2,400 feet (0.5 mile) northeast of Chemical Plant 2. The westernmost dredge pit (Source Area 25F) is referred to as the Dredge Pit, and the easternmost pit is referred to as the Eastern Basin (see Figure 2-11). Although the Eastern Basin was not identified as a source area, the OU-6 FSP identified it as an investigation area.

- **OS Areas 1, 2, 4, 5, and 7 (OS-1, OS-2, OS-4, OS-5, and OS-7):** Large areas of contiguous land (buffer land between the MAs) within OU-6, not encompassed by Aerojet-defined MAs or source areas, were identified as OS Areas to manage the CERCLA process for these lands. During the development of the OU-6 FSP, Aerojet conducted site walks, reviewed current and historical aerial photographs, interviewed employees, and researched documents in an attempt to identify any features within these OS Areas that had a potential for chemicals to be released to the environment (see Figures 2-2, 2-9, 2-10, and 2-12). In addition, these areas were investigated to evaluate the risk from chemicals present in groundwater beneath the OS Area land from upgradient sources.

  – OS-1 consists of buffer lands between Chemical Plant 2 and areas west of the Aerojet Superfund Site. No source areas have been identified within OS-1, but a railroad line

transects the southern portion of OS-1 from east to west. Reconnaissance of this section of rail line as part of the Carve-Out work performed in 1999 and 2000 identified no potential areas of environmental concern (Environmental Resources Management [ERM], 2000 and 2001). However, during the development of the FSPs, a reported plasticizer spill in the railroad ballast west of the Chemical Plant 2 fence line and a pond receiving discharge from the Spill Prevention, Control, and Countermeasures (SPCC) sump and Chemical Plant 2 Source Area 59F (Figure 2-9) were identified as features to investigate. RI samples were collected to evaluate these features.

- OS-2 consists of buffer lands between Chemical Plant 2, the Magazine Area, and Line 3. No source areas have been identified within OS-2, and no indications of historical industrial activities were observed during site reconnaissance performed as part of the OU-6 RI. However, during the development of the FSP, a debris pile, drums, and a pond located east of the Chemical Plant 2 fence were identified as features to investigate. RI samples were collected to investigate these features.

- OS-4 consists of buffer lands between the Magazine Area and Chemical Plant 1. No source areas have been identified within OS-4, and no indications of historical industrial activities were observed during site reconnaissance performed as part of the OU-6 RI. No RI samples were collected at OS-4.

- OS-5 consists of buffer lands between Line 2 and Line 5 North. No source areas have been identified within OS-5, but a storage yard and two former tanks are present in the southeast corner of the site near the dirt road west of Buffalo Creek. RI samples were collected to evaluate these features.

- OS-7 consists of buffer lands west of Line 5 North. No source areas have been identified within OS-7, and no indications of historical industrial activities were observed during site reconnaissance performed as part of the OU-6 RI. No RI samples were collected at OS-7.

- **Area 39:** Aerojet Area 39 encompasses approximately 90 acres within the 835-acre Prairie City State Vehicular Recreation Area (located approximately 1 mile southeast of Aerojet) that is owned and operated by the State of California. Rocket test facilities were constructed within Area 39 by Aerojet in the 1960s, but the programs were halted and the facilities were never used. Area 39 was used between 1970 and 1972 for burning chemical wastes generated by Aerojet. Area 39 was not evaluated for remedial action because the Screening-Level Ecological Risk Assessment (SLERA) recommended a Baseline Ecological Risk Assessment for the area. Based on this recommendation, the Agencies agreed that the Area 39 Baseline Ecological Risk Assessment and resulting FS would be deferred to the Island Operable Unit (OU-7) and is not discussed further in this ROD.

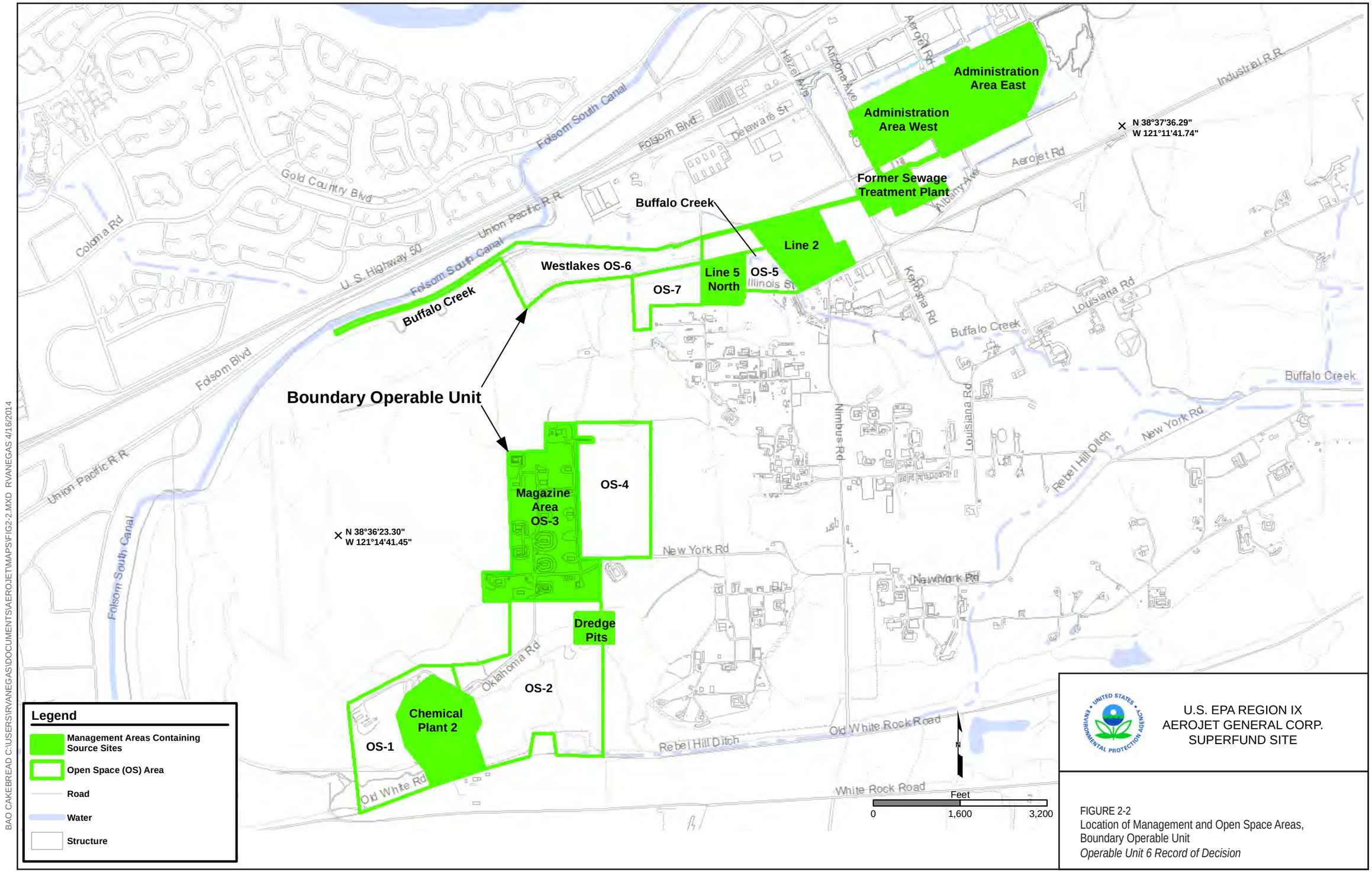


FIGURE 2-2
Location of Management and Open Space Areas, Boundary Operable Unit
Operable Unit 6 Record of Decision

BAO CAKEBREAD C:\USERS\RVANEGAS\DOCUMENTS\AEROJET\MAPS\FIG2-2.MXD RVANEGAS 4/16/2014

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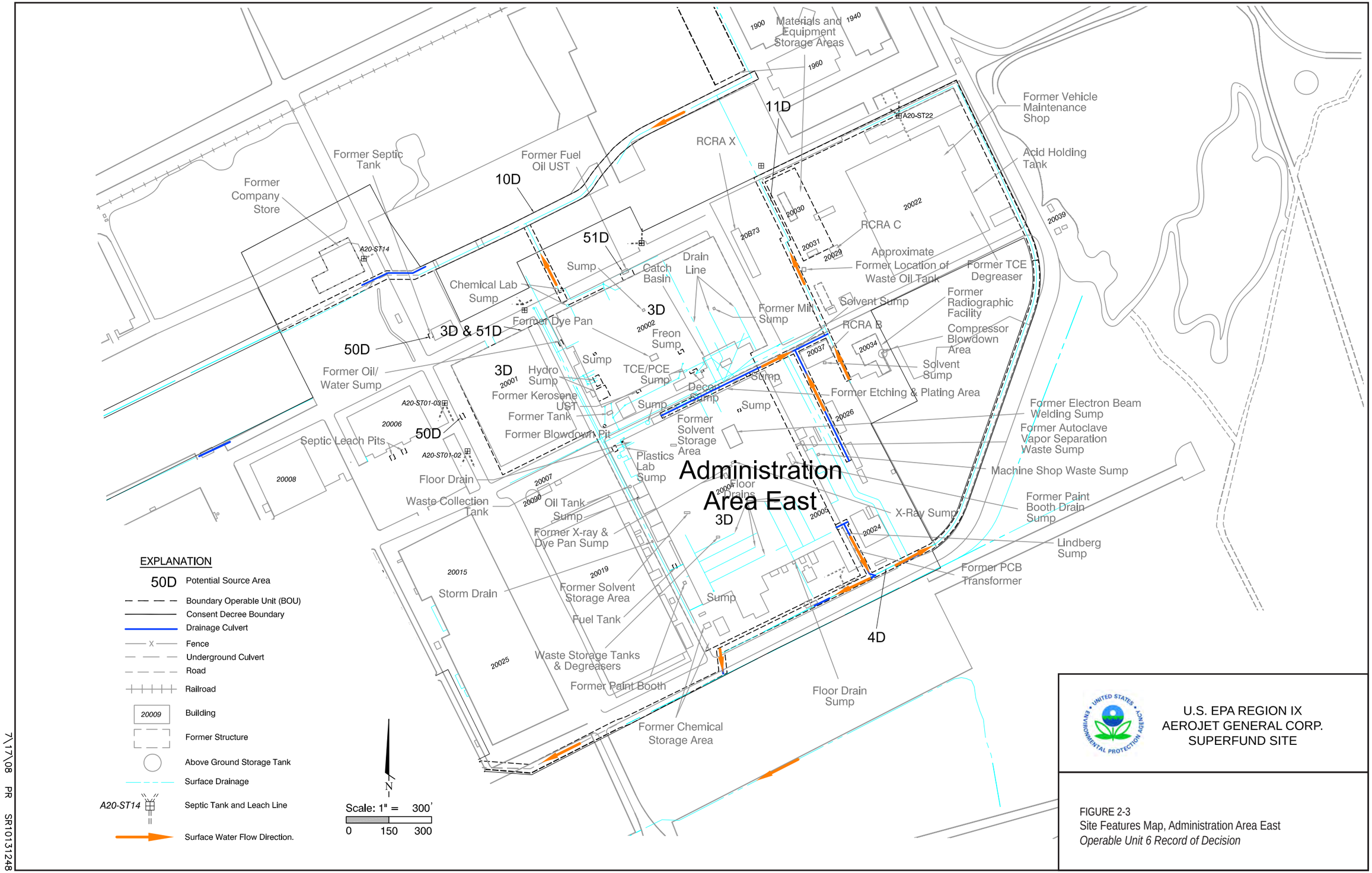

FIGURE 2-3
Site Features Map, Administration Area East
Operable Unit 6 Record of Decision

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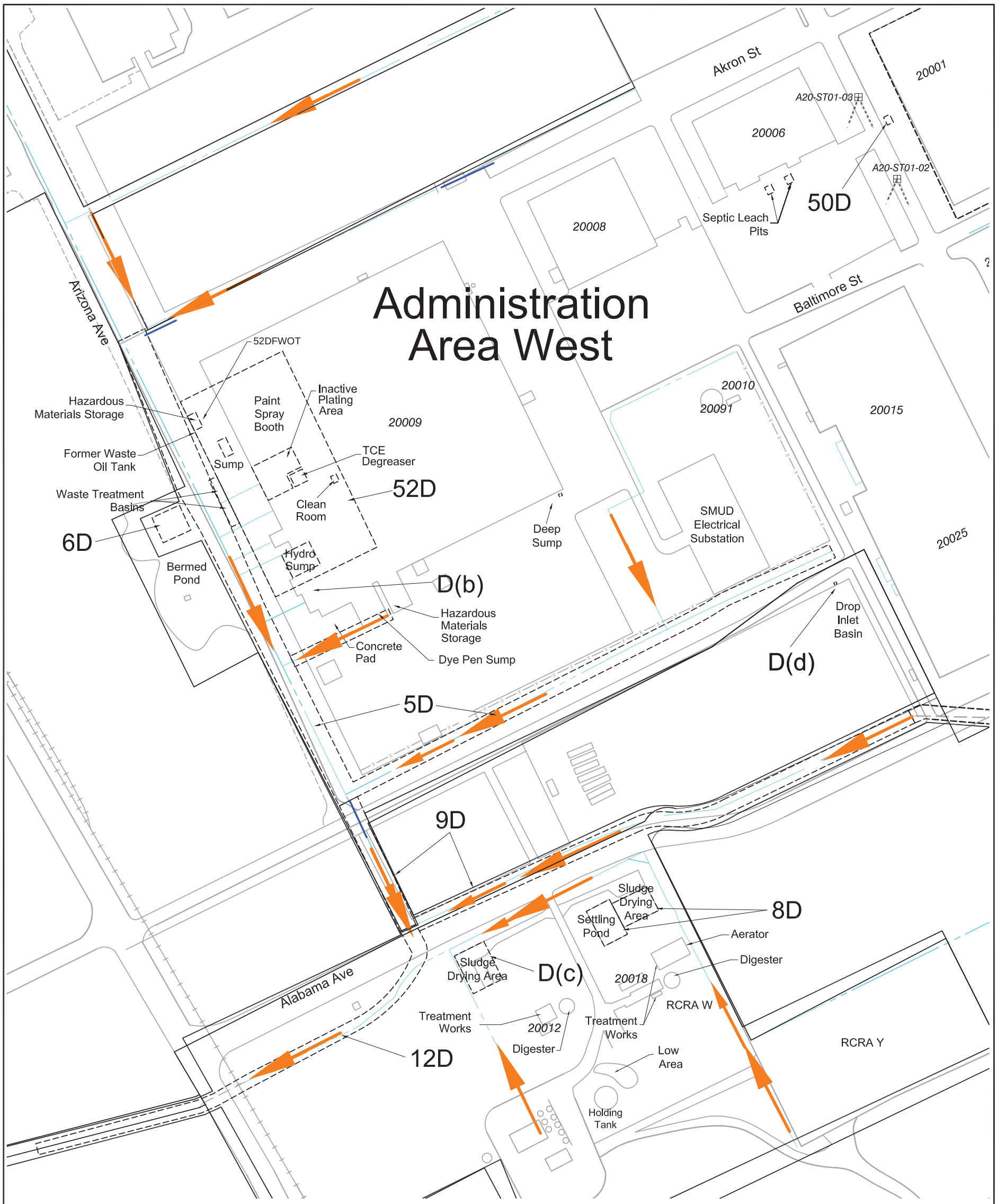

EXPLANATION

52D Potential Source Area

Boundary Operable Unit (BOU)

Consent Decree Boundary

Drainage Culvert

Fence

Underground Culvert

Road

Railroad

20009 Building

Former Structure

Above Ground Storage Tank

Surface Drainage

ST26 Septic Tank and Leach Line

Surface Water Flow Direction.

N

Scale: 1" = 200'

0 100 200

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FIGURE 2-4
Site Features Map, Administration Area West
Operable Unit 6 Record of Decision

7/17/08 PR SR10131248

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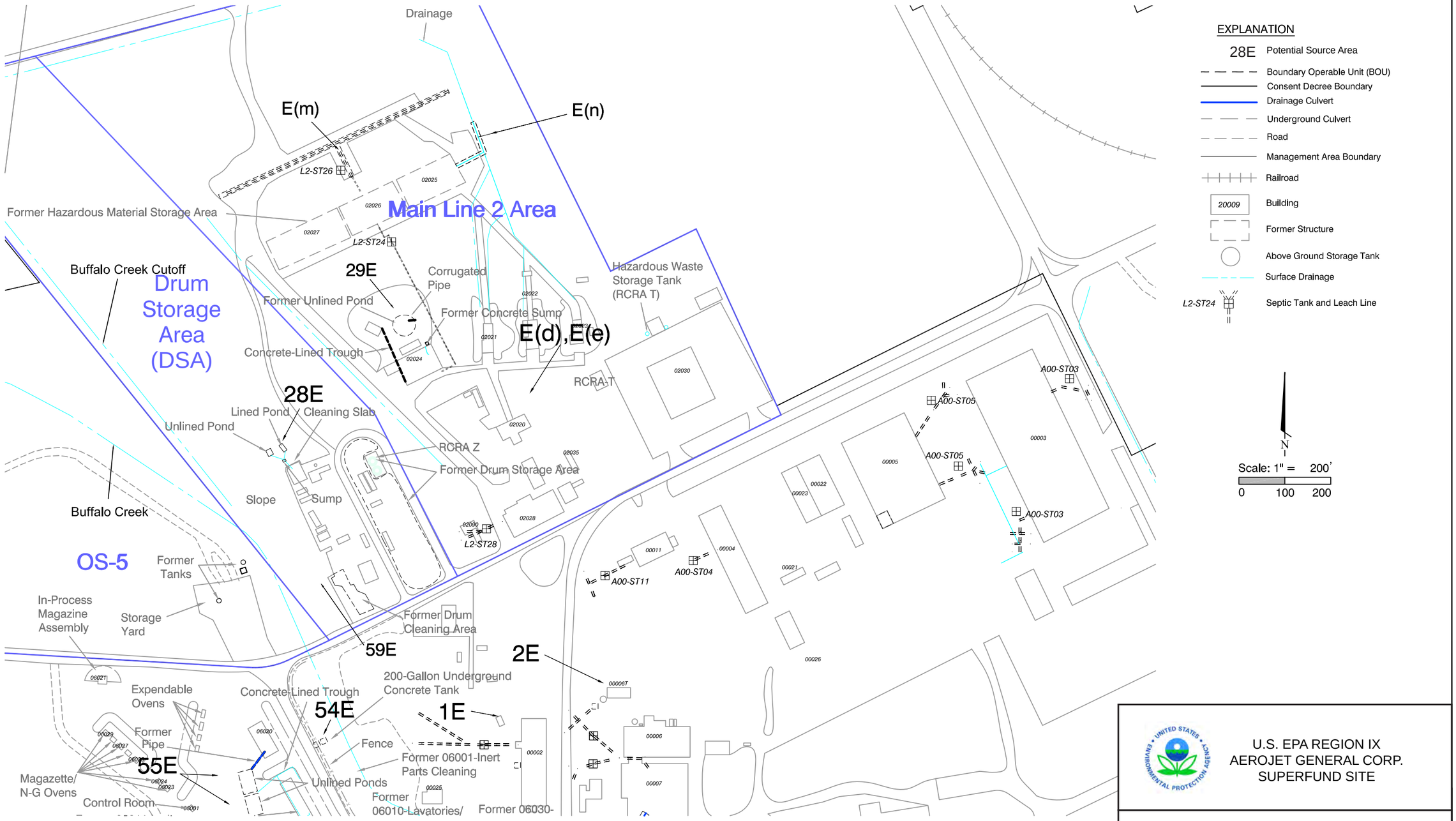

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FIGURE 2-5
Site Features Map, Line 2 Region
Operable Unit 6 Record of Decision

09/15/10 PER SR10131248

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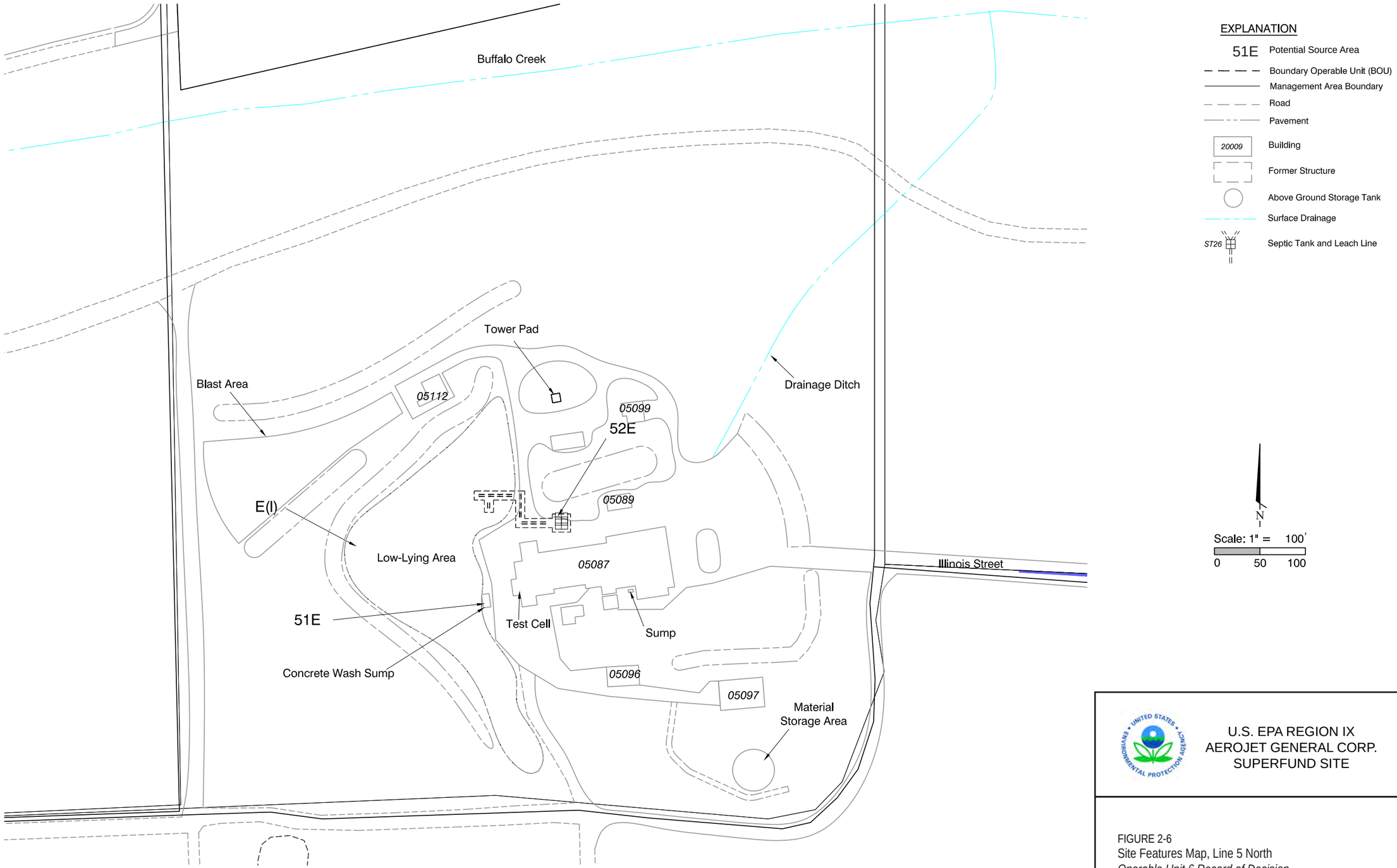

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FIGURE 2-6
Site Features Map, Line 5 North
Operable Unit 6 Record of Decision

7/22/08 PER SR10131248

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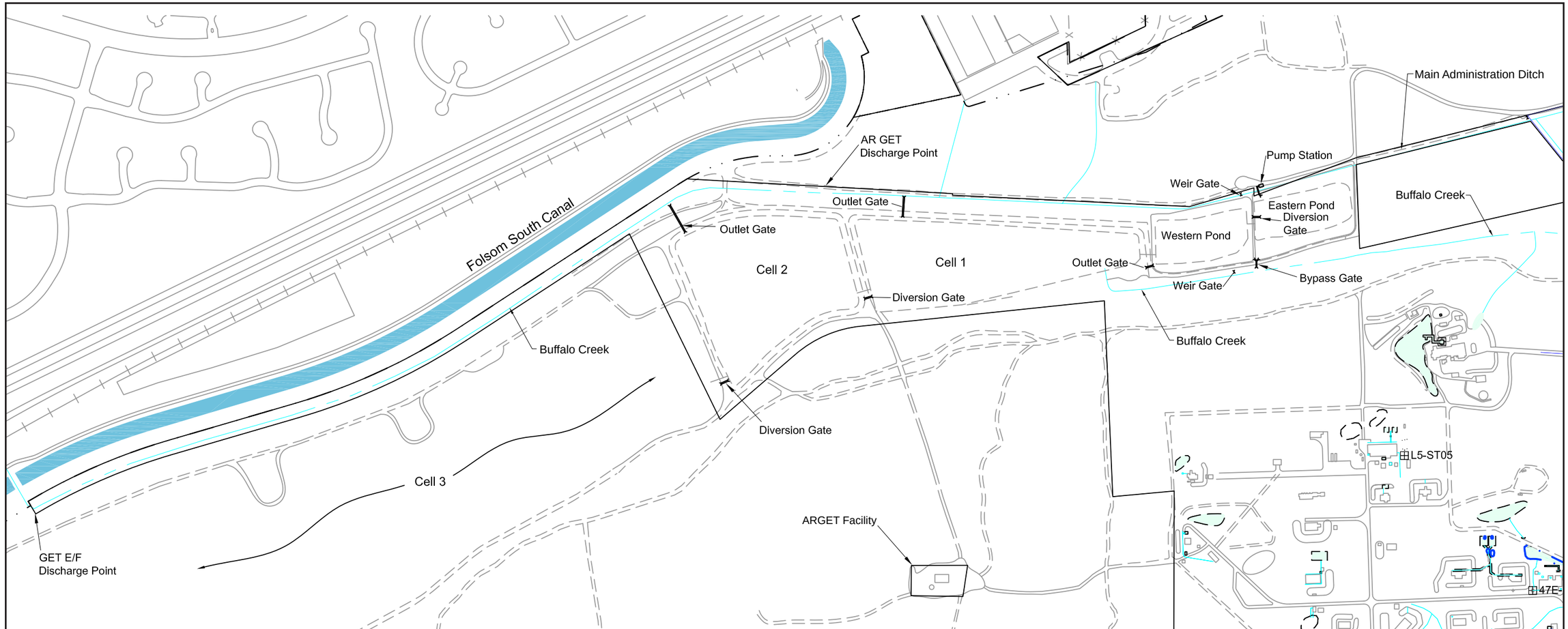

EXPLANATION

- Potential Source Area
- Boundary Operable Unit (BOU)
- Consent Decree Boundary
- Drainage Culvert
- Road
- Railroad
- 20009 Building
- Above Ground Storage Tank
- Surface Drainage
- Septic Tank and Leach Line
- AR American River
- GET Groundwater Extraction and Treatment

N

Scale: 1" = 500'

0 250 500

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FIGURE 2-7
Site Features Map, Westlakes and Open Space Area 6
Operable Unit 6 Record of Decision

9/8/08 PER SR10131248

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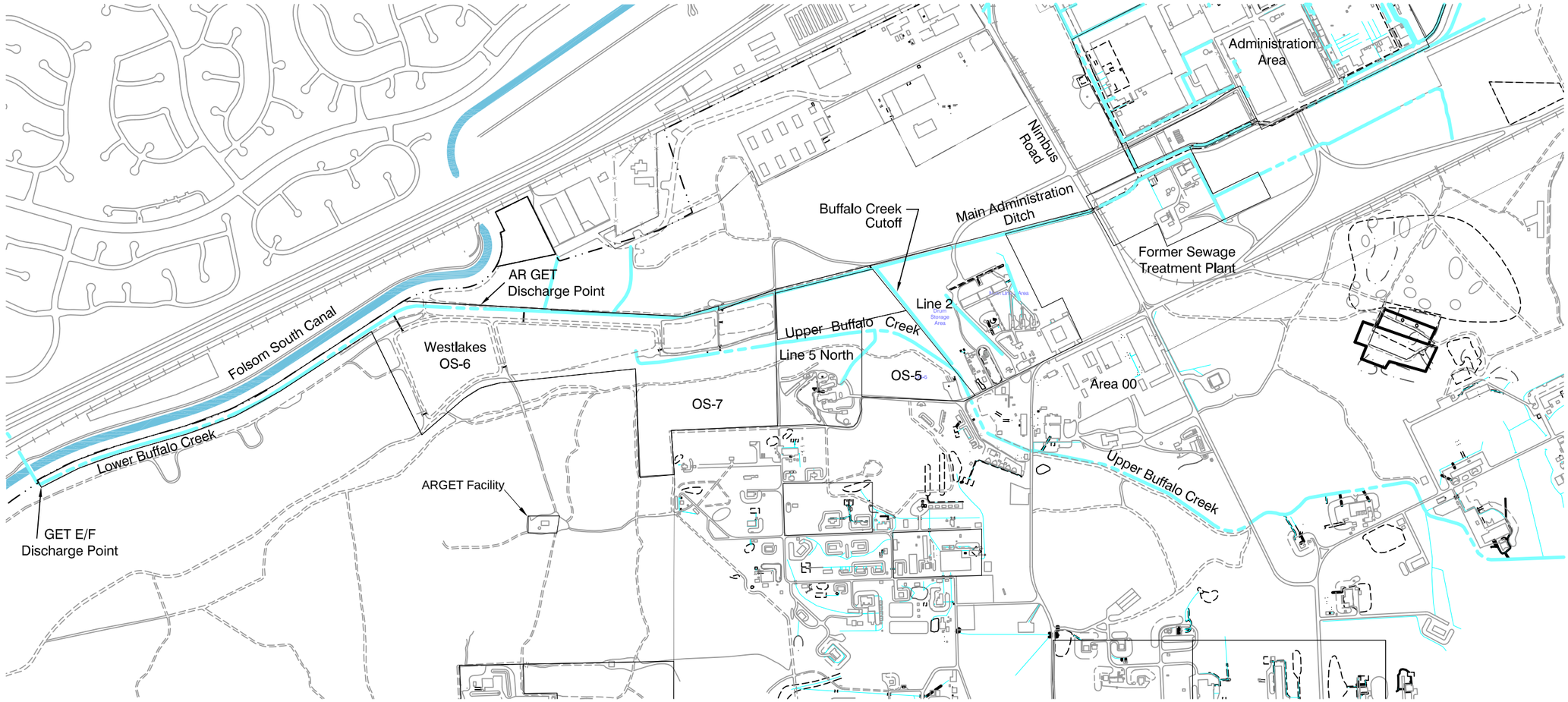

EXPLANATION

Buffalo Creek	Potential Source Area
	Boundary Operable Unit (BOU)
	Consent Decree Boundary
	Drainage Culvert
	Underground Culvert
	Fence
	Road
	Railroad
AR	American River
GET	Groundwater Extraction and Treatment
20009	Building
	Former Structure
	Above Ground Storage Tank
	Surface Drainage
L2-ST24	Septic Tank and Leach Line

N

Scale: 1" = 1000'

0 500 1000

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FIGURE 2-8
Site Features Map, Buffalo Creek
Operable Unit 6 Record of Decision

09/10/10 PR SR10131248

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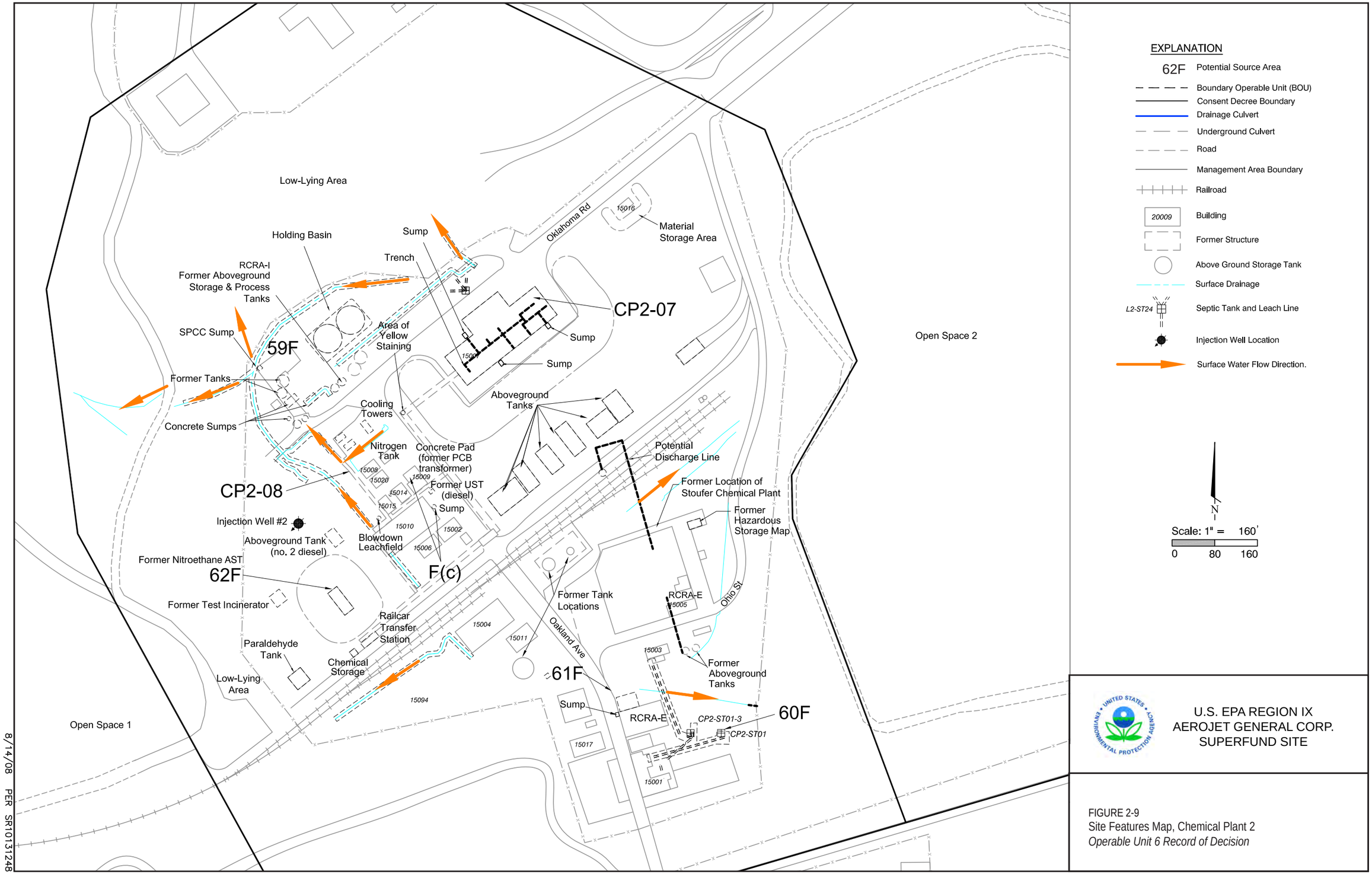

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FIGURE 2-9
Site Features Map, Chemical Plant 2
Operable Unit 6 Record of Decision

8/14/08 PER SR10131248

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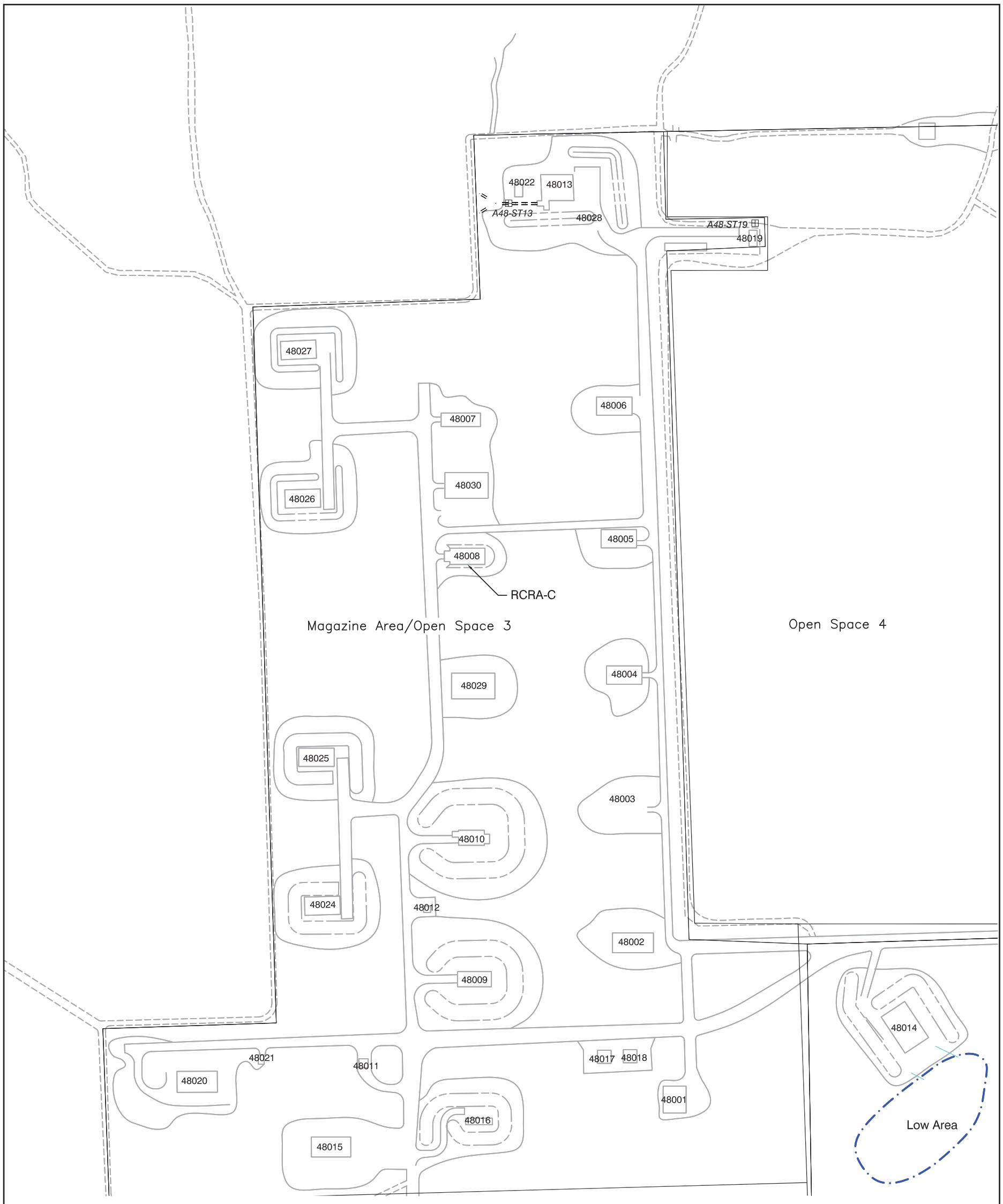

EXPLANATION

- Boundary Operable Unit (BOU)
- Consent Decree Boundary
- Management Area Boundary
- Road
- Berm
- 40815 Building
- Surface Drainage
- Low Area
- ST26 Septic Tank and Leach Line

N

Scale: 1" = 300'

0 150 300

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FIGURE 2-10
Site Features Map, Magazine Area and Open Space 3
Operable Unit 6 Record of Decision

8/14/08 pr SR101311248

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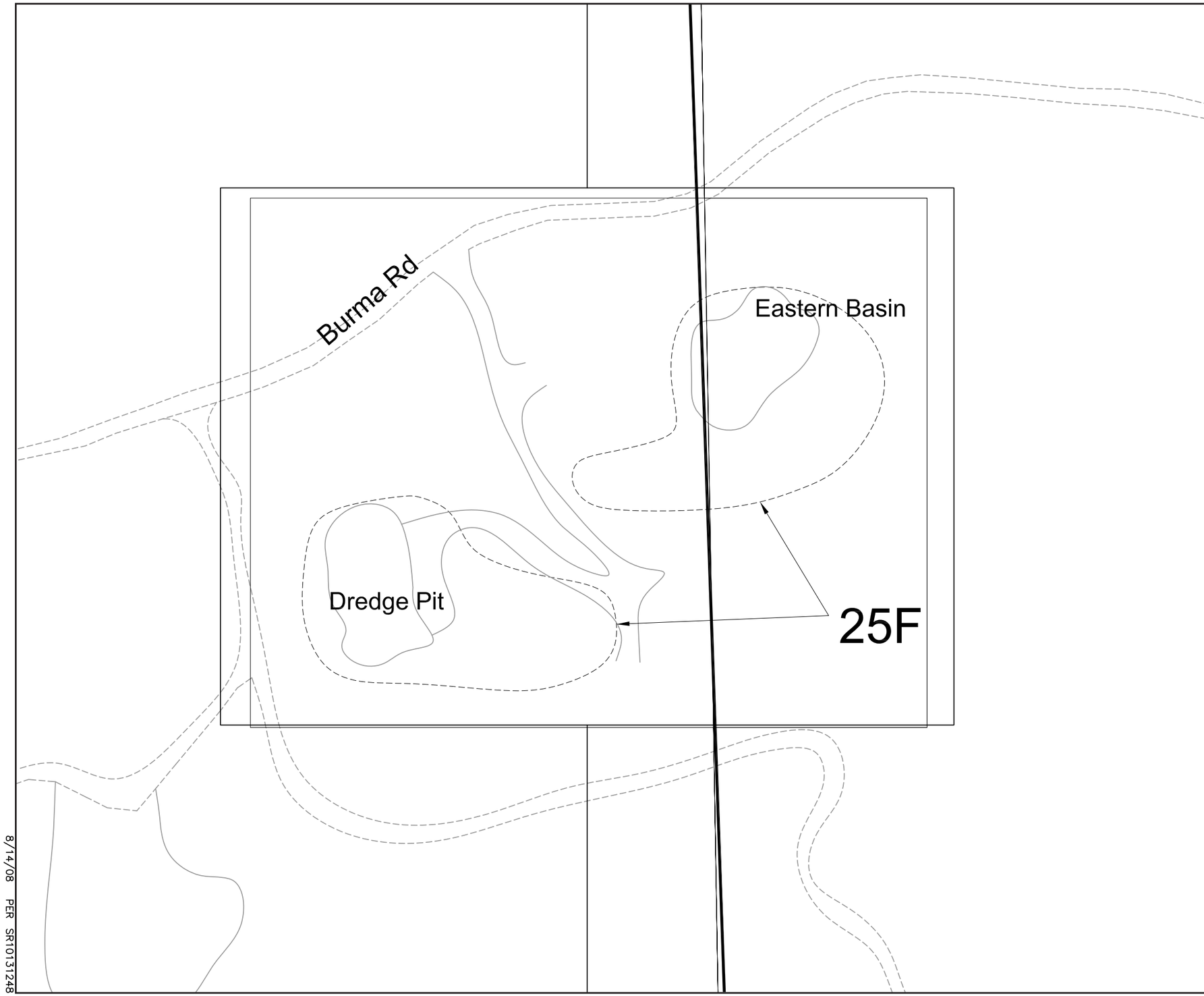

EXPLANATION

52D Potential Source Area

Boundary Operable Unit (BOU)

Consent Decree Boundary

Road

Management Area Boundary

N

Scale: 1" = 100'

0 50 100

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FIGURE 2-11
Site Features Map, Dredge Pit and Eastern Basin
Operable Unit 6 Record of Decision

8/14/08 PER SR10131248

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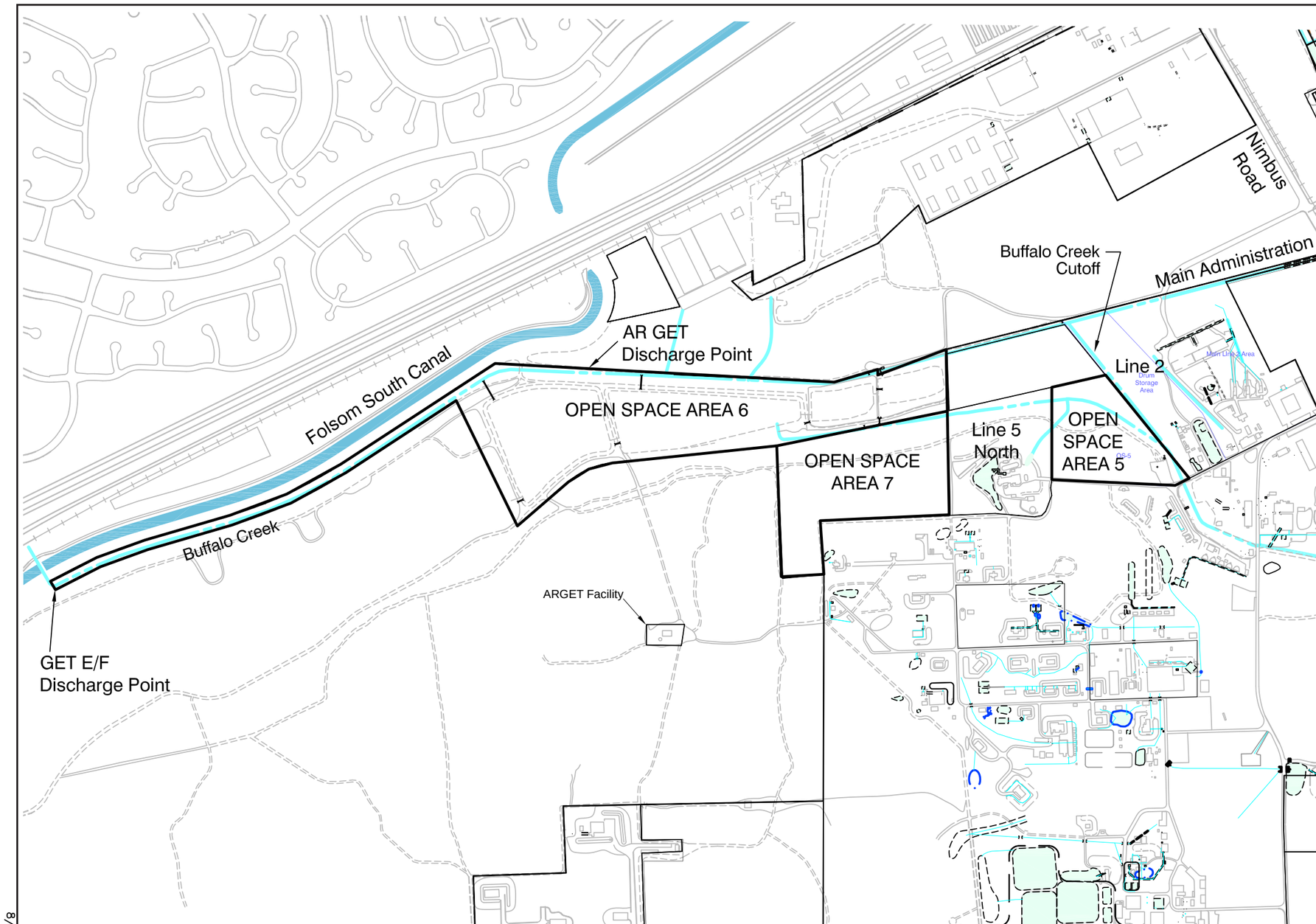

EXPLANATION

- Boundary Operable Unit (BOU)
- Consent Decree Boundary
- Drainage Culvert
- Road
- Management Area Boundary
- 20009 Building
- Former Structure
- Above Ground Storage Tank
- Surface Drainage
- AR American River
- GET Groundwater Extraction and Treatment

N

Scale: 1" = 800'

0 400 800

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FIGURE 2-12
Site Features Map, Open Space Areas 5, 6, and 7
Operable Unit 6 Record of Decision

8/14/08 pr SR10131248

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2.2 Site History and Enforcement Activities

Aerojet Rocketdyne, Inc. (formerly known as Aerojet General Corporation), a subsidiary of Aeroject Rocketdyne Holdings, Inc. (formerly known as GenCorp, Inc.) (referred to as Aerojet in this document) began operations in Rancho Cordova, near Sacramento, California after acquiring approximately 8,500 acres in December 1950. Operations included manufacturing and testing liquid and solid rocket engines and motors for military and commercial applications, and formulating and producing a number of chemicals, including rocket propellant agents, agricultural pesticides, pharmaceuticals, and other industrial chemicals. The State of California issued waste discharge requirements to Aerojet in May 1952. The Cordova Chemical Company operated chemical manufacturing facilities on the Aerojet complex from 1974 to 1979. It was announced on June 14, 2013, that Aerojet completed the acquisition of the Pratt & Whitney Rocketdyne business (Rocketdyne). Aerojet combined Rocketdyne with Aerojet General Corporation and currently operates as Aerojet Rocketdyne, Inc. However, for EPA tracking and recording purposes, this ROD will to refer to Aerojet Rocketdyne, Inc., as Aerojet.

Throughout Aerojet's operational history, some wastes were disposed of on the property in surface impoundments, landfills, deep injection wells, septic tanks and associated leach fields, and open burn areas. Although numerous chemicals were used on the Aerojet Superfund Site, TCE, PCE, perchlorate, and n-nitrosodimethylamine (NDMA) are the most prevalent chemicals encountered. Historical operations at the Aerojet Superfund Site have resulted in the discharge of some of these chemicals to the vadose zone and percolation into the underlying groundwater. Since 1979, Aerojet has investigated the site to determine the nature and extent of the chemicals present, and to identify and implement mitigation measures to protect public health and the environment.

The Aerojet Superfund Site was placed on the National Priorities List (NPL) on August 8, 1983. Portions of the state-led Inactive Rancho Cordova Test Site (IRCTS) are considered part of the Aerojet NPL site where hazardous substances originally on the Aerojet facility migrated to or otherwise came to be located on the IRCTS. On June 23, 1989, a PCD was entered by the U.S. District Court for the Eastern District of California. The PCD obligates Aerojet to complete an RI/FS for the 8,500-acre main facility, portions of the 3,820-acre IRCTS area, and three other smaller parcels (Areas 39, 40, and 41) near the main Aerojet facility, where open burning was conducted. The parties to the PCD are Aerojet General Corporation, DTSC, RWQCB, and EPA. Aerojet constructed five groundwater extraction and treatment (GET) systems prior to the PCD. Requirements for the operation, maintenance, and effectiveness evaluation of the GET systems were incorporated in the PCD.

The PCD established specified procedures and obligations toward achieving the goals delineated in the CERCLA of 1980 (referred to as Superfund) and the NCP. Exhibit II of the PCD outlines the OU RI/FS Program Plan. This exhibit contained a plan for completing a facility-wide RI/FS in three phases: Scoping Phase, Phase I RI/FS, and Phase II RI/FS. Prior to 2002, Aerojet had completed the Scoping Phase and a majority of the Phase I RI/FS.

Exhibit II of the PCD was modified in 2002 by Stipulation and Order Modifying Partial Consent Decree[3] (EPA, 2002) to allow the completion of the RI/FS through an OU approach and the exclusion of 2,600 acres from the boundaries of the Aerojet Superfund Site. The 2,600 acres were removed (carved out) from the Superfund Site following the completion of a thorough review that indicated that the lands were not used for industrial purposes, and were deemed appropriate for carve out (hereinafter, "Carve-Out Lands").

Exhibit III of the PCD identified five initial OUs and 317 potential source areas that are described as "location[s] above the water table where soils or other materials potentially contain hazardous substances of such character and quantity as to warrant evaluation in a Remedial Investigation [RI]." Initial investigations identified 14 additional potential source areas for a total of 331 potential source area sites. Thirty-eight of the potential source areas are addressed under the five initial OUs identified in Exhibit III.

In 2002, EPA issued to Aerojet a Unilateral Administrative Order (UAO) for Remedial Design and Remedial Action for the Western Groundwater Operable Unit (OU-3). Under the Order, Aerojet was directed to contain and remediate contaminated groundwater on the western side of the Site.

In 2004, Aerojet prepared a *Program Plan Modification Report* (Aerojet, 2004) in accordance with the PCD, which grouped the remaining 293 potential source areas into the following four OUs:

- OU-6 (Boundary OU)
- OU-7 (Island OU)
- OU-8 (Eastern OU)
- OU-9 (Central OU)

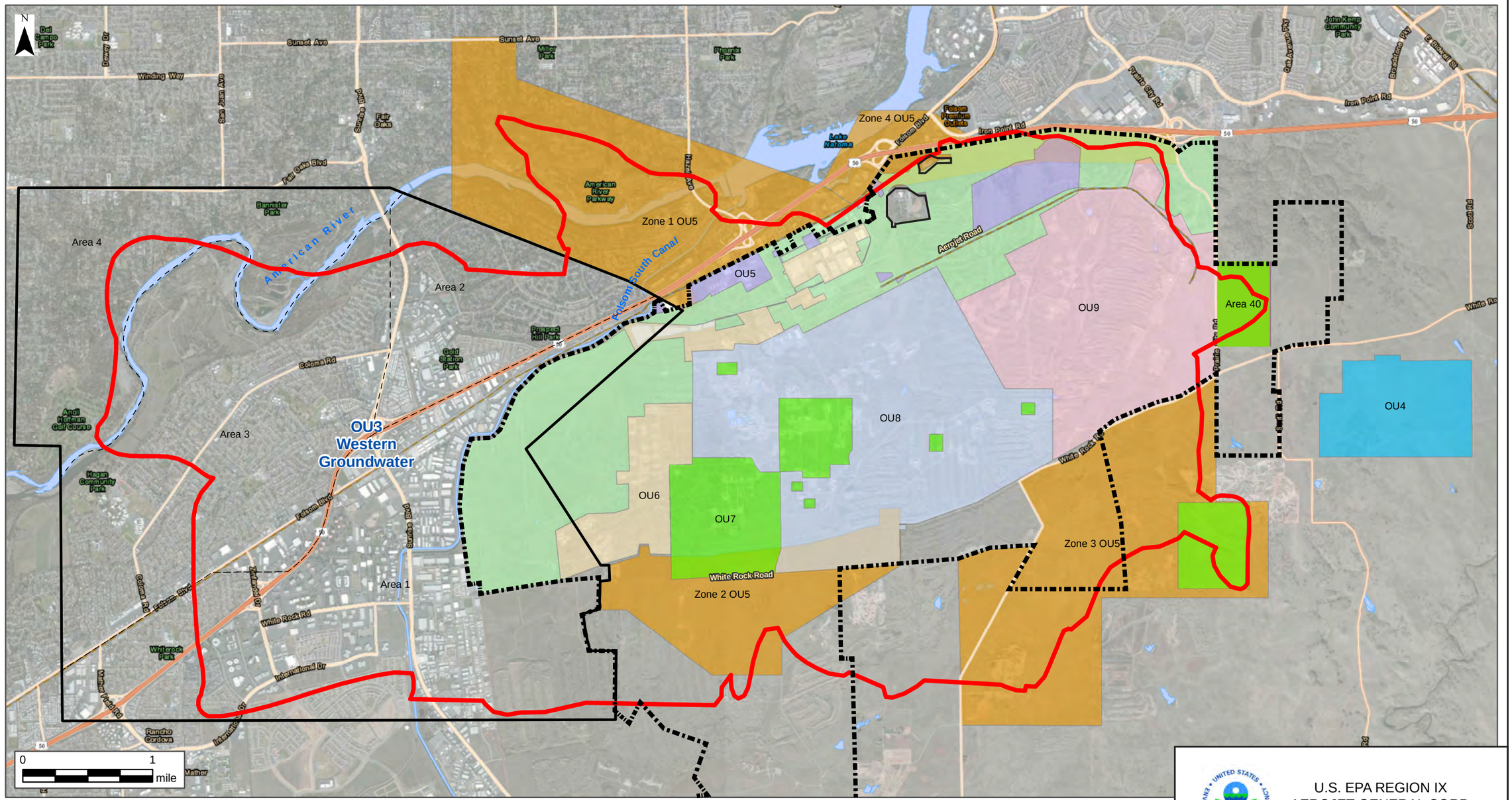
Figure 2-13 shows the locations of each OU and the groundwater plume extent.

In 2011, EPA issued to Aerojet, a UAO for the Performance of Remedial Design and Final Remedial Action for Soil within the Perimeter Operable Unit (OU-5) and a UAO for the Performance of Remedial Design and Interim Remedial Action for Groundwater at OU-5. The OU-6 Remedial Design and Remedial Action will also be performed by Aerojet.

Aerojet maintains a RCRA post closure permit for the underground deep injection wells in OU-6 and a RCRA permit for two units outside of OU-6. With the exception of injection wells, all RCRA units in OU-6 have been closed by DTSC. The post closure monitoring of the RCRA units themselves is conducted by DTSC. Any residual contamination in the environment as a result of releases from the units is addressed under this ROD. Additionally, septic tanks and underground storage tanks identified during the Scoping Evaluation are included in the investigation of the source area in which they are located.

The CERCLIS Identification Number is ***CAD980358832***. The Lead Agency is EPA, supported by the California RWQCB, Central Valley Region and by DTSC.

3 - Pursuant to the Paragraph 18 of the Stipulation and Order, this document is referred to as the "2001 Stipulation and Order Modifying Partial Consent Decree" even though the executed Order was not filed with the Court until 2002.



Composite plume
Aerojet Property Line 2008
OU3 Western Groundwater
OU3 partition
OU7
OU4
OU5
OU6
OU8
OU9
carveout
OU5 Zone Areas

Notes:
1.The chemical data used to prepare the contours were collected from 2008 to 2011.
2. The contours represent the maximum extent of the contaminants across the six aquifer layers based on available data.

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FIGURE 2-13
Composite Plume Map, May 2014
Operable Unit 6 Record of Decision

2.3 Community Participation

Community concern about the site began in 1979, when contamination was discovered in groundwater. Community members reached out to the RWQCB out of concern over VOC contaminants in the river, and a dialogue over contamination from the site began. Community interest surrounding the Aerojet Superfund Site grew through the 1980s and again in the mid-1990s as knowledge of perchlorate contamination became more widespread. Through a collaborative effort among regulators, Aerojet, local water agencies, and concerned community members, the EPA Aerojet Community Advisory Group (CAG) was formed in 2001. Since its formation, the CAG has met regularly with EPA, Aerojet, DTSC, RWQCB and others to discuss issues related to the site and comment on cleanup plans. Site information and assistance has been provided to the CAG primarily by the EPA site team, Aerojet, DTSC, and RWQCB since 2001.

In 2013 and leading up to the release of the OU-6 Proposed Plan, the CAG began to focus on development plans for the Aerojet lands and concern over the potential effects of contamination on future residents. Furthermore, the CAG expressed specific interest in the following overarching topics:

- Understanding the cleanup process and long-term strategies to maintain site remedies
- Understanding contamination as it relates to land development
- Enhancing community outreach and education

The RI/FS Report and Proposed Plan for OU-6 were made available to the public in September 2012 and May 8, 2013, respectively. These documents can be found in the Administrative Record file of the information repositories maintained at EPA Region IX Superfund Records Center at 95 Hawthorne Street in San Francisco and at the California State University Sacramento Library Reference Desk, 2000 State University Drive East, Sacramento, California. The notice of availability of the RI/FS Report and Proposed Plan, and date and location for the public meeting and public comment period (May 8 through June 7, 2013) was published the week prior to the start of the public comment period in the Sacramento Bee newspaper and sent to the Aerojet mailing list. The public meeting was held May 15, 2013. Transcripts of the public meeting are part of the Administrative Record file at the repositories, and EPA's response to comments received at the public meeting and written comments are part of this ROD (see Appendix E).

An overview of the Proposed Plan was presented by EPA at the public meeting, and questions were taken prior to acceptance of formal public comments. The Aerojet CAG has been active in discussions with EPA throughout the development of the OU-6 RI/FS Report and Proposed Plan. The CAG also requested additional time to submit comments on the Proposed Plan due to the complexity of the document. The public comment period was extended out an additional 120 days, making the entire public review period May 8 through September 20, 2013.

EPA spent considerable effort interviewing and meeting with land use planning officials from Sacramento County, Rancho Cordova, and Folsom. A great deal of planning has already been approved by local jurisdictions for the development of the Aerojet property near and including parts of OU-6. EPA prepared a report on the land use plans based on the March 2010

information. The draft report was presented to the local officials and to the community for review. This information was also presented during the CAG meeting in December 2012. The information, still current, is summarized in Section 2.6.

2.4 Scope and Role of the Operable Unit or Response Action

The Aerojet Superfund Site is a large facility with groundwater contamination that has migrated off Aerojet property. EPA and the State of California have negotiated with Aerojet to organize the site into OUs through a modification to the PCD, as follows:

- **OU-1:** OU-1 is reserved for the sitewide final ROD integrating remedial actions for all of the OUs.

- **OU-2:** OU-2 has been merged into OU-5. OU-2 was initiated in 1995 pursuant to a Unilateral Administrative Order for control of off-property VOC-contaminated groundwater on the north side of the Aerojet Superfund Site. OU-2 is also referred to as the American River OU. The UAO was withdrawn, and work for this part of the site was accomplished under RWQCB Order 96-230 and Order 500-718 (for perchlorate treatment in Zone 1). In July 1998, the ARGET became operational as an interim groundwater action to contain VOCs not captured on the north side of the Aerojet Superfund Site by the formerly active GET D.

- **OU-3:** Western Groundwater OU (OU-3) contains and remediates groundwater contamination on the western side of the Aerojet Superfund Site, including groundwater beneath OU-6. A number of water supply wells have been lost to groundwater contamination, and it had been projected that approximately 20 public water supply wells could be lost over the next 25 years without a successful OU-3 remedial action. Although all adversely impacted public water supplies around the Aerojet Superfund Site have been replaced with uncontaminated water, ingestion of untreated groundwater extracted from the aquifer would pose a current and potential risk to human health that exceeds EPA's acceptable risk range. The Western Groundwater OU (OU-3) has a groundwater ROD that was finalized in 2001. The remedy includes ICs prohibiting use of contaminated groundwater on Aerojet property overlying the plume within OU3. Construction of remedial actions selected in the 2001 ROD for OU-3 is nearly complete.

- **OU-4:** OU-4 will address remediation of soil and groundwater in Area 41 caused by Aerojet's burning of industrial wastes on 500 acres of property leased from others. Area 41 has VOC and perchlorate contamination in groundwater; as well as metals, and perchlorate contamination in soil.

- **OU-5:** Perimeter Groundwater OU (OU-5) will contain and remediate groundwater around the remaining three sides of Aerojet (north, east, and south) not addressed by OU-3. OU-5 includes Aerojet's GETs A, B, D; the ARGET; and groundwater for Area 39. EPA and the State of California have a long history of collaboration in addressing the Aerojet Superfund Site, and this cooperation is particularly evident in groundwater contamination portions of OU-5. The work performed under interim RWQCB Orders 96-230, 96-259, and 500-718 will be incorporated in OU-5 actions. Order 96-259 was rescinded on January 25, 2008, with the

issuance of Order No. R5-2008-0025. Aerojet demonstrated to the RWQCB that they had complied with the order. Certain contaminated soil areas were also included in OU-5 as a result of terms included in the 2002 modification of the PCD. The Perimeter Groundwater OU (OU-5) final ROD for soil and interim ROD for groundwater was finalized on February 11, 2011. The remedy includes ICs prohibiting use of contaminated groundwater and ICs for soil and soil vapor issues, where appropriate

- **OU-6 through OU-9:** OU-6 through OU-9 will address remediation of soil and portions of groundwater contamination related to source control located on the Aerojet property**. In addition, this OU-6 ROD addresses soil and soil vapor and restricts access to contaminated groundwater underneath OU-6.** Groundwater and soil studies are currently underway at OU-7 through OU-9.

2.5 Site Characteristics

The land to the north of Aerojet's property has multiple uses including residential, recreational, office, commercial, and industrial. The land to the south of Aerojet's property is used for recreation, ranching, agriculture, and mining, and is also undergoing planning for a mixed use development. Section 2.6 discusses plans for future land use of the Aerojet property.

2.5.1 Conceptual Site Model

The conceptual site model (CSM) for OU-6 consists of spills and releases to the surface and subsurface soil from drums, USTs, ASTs, sumps, and ponds. Subsurface contamination, including contamination in groundwater, is the result of infiltration and percolation of contamination from releases from ponds, septic tanks, and waste disposal facilities. Surface soil/sediment, subsurface soil, soil vapor, and groundwater contamination have been identified within OU-6. The COCs for soil and soil vapor are listed in Table 2-1, the cleanup levels for each COC in soil are listed in Table 2-2, and COCs in soil vapor are listed in Table 2-3. The CSM for the human health risk assessment (HHRA) was based on contact and inhalation – including potential vapor intrusion into structures – and various potential ingestion pathways in residential scenarios including uptake into garden vegetables. The potential exists for development of these contaminated areas for various residential, commercial, or industrial uses in the future. Therefore, the CSM considered current and potential future land use scenarios, which include resident, commercial worker, construction worker, and future recreation receptors. Because it is not feasible to individually evaluate every ecological species that may occur on the Aerojet Superfund Site, ecological receptors were grouped into taxonomic and trophic guilds in the ecological receptor CSM. Human and ecological receptor CSMs are provided on Figures 2-14 through 2-17, and the conceptual regional geologic model is shown on Figure 2-18.

Table 2-1: Contaminants of Concern in Soil and Soil Vapor

Soil			
1,1,2,2-PCA	Benzo(b)fluoranthene	Endrin	Perchlorate
4,4'-DDD	Benzo(k)fluoranthene	Endrin aldehyde	Phenanthrene
4,4'-DDE	Boron	Hexavalent chromium	Phenol
4,4'-DDT	Cadmium	Ideno(1,2,3-c,d)pyrene	Prowl
Aluminum	Chromium	Iron	Selenium
Antimony	Chrysene	Lead	Silver
Aroclor-1248	Copper	Manganese	TCE
Aroclor-1254	d-BHC	Mercury	Thallium
Aroclor-1260	Dibenz(a,h)anthracene	Molybdenum	Toluene
Barium	Dieldrin	Naphthalene	TPH-D
BEHP	Dimethyl phthalate	NDMA	TPH-Mo
Benzo(a)anthracene	Di-n-octyl phthalate	Nickel	Zinc
Benzo(a)pyrene	DnBP	PCE	
Soil Vapor			
1,1-DCE	Chloroform	PCE	Toluene
1,2-DCA	cis-1,2-DCE	TCE	Vinyl chloride
Benzene			

Notes:
1,1,2,2-PCA = 1,1,2,2-tetrachlorethane
1,1-DCE =1,1-dichloroethene
1,2-DCA =1,2-dichloroethane
4,4'-DDD = 4,4'-dichlorodiphenyldichloroethane
4,4'-DDE = 4,4'-dichlorodiphenyldichloroethene
4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane
BEHP = bis(2-ethyhexyl)phthalate
cis-1,2-DCE = cis-1,2-dichloroethene
d-BHC = d-benzene hexachloride
DnBP = di-n-butyl phthalate

1,1-DCE, cis-1,2-DCE, and toluene are not shown in Appendix B, as TCE is the main driver for risk, but they are still COCs.

Table 2-2: Performance Standards for Soil[a]

COC	Residential Soil CL for the Protection of HH (mg/kg)	Industrial Soil CL for the Protection of HH (mg/kg)	Source	Soil CL for the Protection of GW (mg/kg)	Source	Soil CL for the Protection of Ecological Receptors (mg/kg)	Primary Source
1,1,2,2-PCA	0.60	2.7	RSL	--	--	--	--
4,4'-DDD	2.2	9.6	RSL	1.5	DLM	0.021	EcoSSL
4,4'-DDE	1.6	6.8	RSL	1.0	DLM	0.021	EcoSSL
4,4'-DDT	1.9	8.6	RSL	1.0	DLM	0.021	EcoSSL
Aluminum	77,000	1,000,000	RSL	40,976	Background threshold value (UTL95) (RCRB soils)	pH <5.5	EcoSSL
	--	--	--	54,000	Background threshold value (UTL95 and Max) (Xerorthents soils)	--	--
Antimony	31	470	RSL	60	DLM	0.42	Background threshold value (UTL95) (RCRB soils)
	--	--	--	--	--	0.46	Background threshold value (UTL95) (Xerorthents soils)
Aroclor-1248	0.24	1.0	RSL	0.034	DLM	0.0072	LANL
Aroclor-1254	0.24	1.0	RSL	0.034	DLM	0.041	LANL
Aroclor-1260	0.24	1.0	RSL	0.034	DLM	0.88	LANL
Barium	15,000	220,000	RSL	10,000	DLM	274	Background threshold value (UTL95) (RCRB soils)
	--	--	--	--	--	320	Background threshold value (Max) (Xerorthents soils)
Benzo(a)anthracene	0.15	2.9	RSL	0.03	DLM	1.1	EcoSSL/high MW
Benzo(a)pyrene	0.015	0.29	RSL	0.029	DLM	1.1	EcoSSL/high MW

Table 2-2: Performance Standards for Soil[a]

COC	Residential Soil CL for the Protection of HH (mg/kg)	Industrial Soil CL for the Protection of HH (mg/kg)	Source	Soil CL for the Protection of GW (mg/kg)	Source	Soil CL for the Protection of Ecological Receptors (mg/kg)	Primary Source
Benzo(b)fluoranthene	0.15	2.9	RSL	0.029	DLM	1.1	EcoSSL/high MW
Benzo(k)fluoranthene	1.5	29	RSL	0.29	DLM	1.1	EcoSSL/high MW
Bis(2-ethylhexyl)phthalate	38	160	RSL	4	DLM	0.02	LANL
Boron	16,000	230,000	RSL	140	DLM	19	Mean CA background (Kearney Foundation 1996)
Cadmium	4.6	6.4	DTSC Note 3	70	RSL	0.72	Background threshold value (UTL95) (RCRB soils)
	--	--	--	--	--	1.2	Background threshold value (Max) (Xerorthents soils)
Chromium	110	110	Background threshold value (Max) (RCRB soils)	500	DLM	110	Background threshold value (Max) (RCRB soils)
	118	118	Background threshold value (UTL95) (Xerorthents soils)	500	DLM	118	Background threshold value (UTL95) (Xerorthents soils)
Chrysene	15	290	RSL	2.9	DLM	1.1	EcoSSL/high MW
Copper	3,100	47,000	RSL	3,000	DLM	63	Background threshold value (UTL95 and Max) (RCRB soils)
	--	--	--	--	--	76	Background threshold value (Max) (Xerorthents soils)

Table 2-2: Performance Standards for Soil[a]

COC	Residential Soil CL for the Protection of HH (mg/kg)	Industrial Soil CL for the Protection of HH (mg/kg)	Source	Soil CL for the Protection of GW (mg/kg)	Source	Soil CL for the Protection of Ecological Receptors (mg/kg)	Primary Source
d-BHC				0.2	DLM	6.4	EPA Region 3 Freshwater Sediment Screening benchmark, 2014
Dibenz(a,h)anthracene	0.015	0.29	RSL	0.009	DLM	1.1	EcoSSL/high MW
Dieldrin	0.033	0.14	RSL	0.002	DLM	0.0049	EcoSSL
Dimethyl phthalate	--	--	--	313,000	DLM	10	LANL
Di-n-butyl phthalate	6,200	82,000	RSL	700	DLM	0.011	LANL
Di-n-octyl phthalate	620	8,200	RSL	--	--	0.91	LANL
Endrin	18	250	RSL	1.8	DLM	0.0014	LANL
Endrin aldehyde[b]	18	250	RSL	1.8	DLM	0.0014	LANL
Hexavalent chromium	0.30	6.3	RSL	0.2	Background threshold value	0.34	LANL
Indeno(1,2,3-c,d)pyrene	0.15	2.9	RSL	0.029	DLM	1.1	EcoSSL/high MW
Iron	55,000	820,000	RSL	42,000	Background threshold value (RCRB and Xerorthents soils)	pH<5.0	EcoSSL
Lead	80	320	DTSC HHRA Note 3	42	Background threshold value (UTL95 and Max) (RCRB soils)	42	Background threshold value (UTL95 and Max) (RCRB soils)
	80	320	DTSC HHRA Note 3	23	Background threshold value (UTL95) (Xerorthents soils)	23	Background threshold value (UTL95) (Xerorthents soils)

Table 2-2: Performance Standards for Soil[a]

COC	Residential Soil CL for the Protection of HH (mg/kg)	Industrial Soil CL for the Protection of HH (mg/kg)	Source	Soil CL for the Protection of GW (mg/kg)	Source	Soil CL for the Protection of Ecological Receptors (mg/kg)	Primary Source
Manganese	1,800	26,000	RSL	1,100	Background threshold value (Max) (RCRB soils)	1,100	Background threshold value (Max) (RCRB soils)
	--	--	--	1,500	Background threshold value (UTL95 and Max) (Xerorthents soils)	1,500	Background threshold value (UTL95 and Max) (Xerorthents soils)
Mercury	9.4	40	RSL	1.2	DLM	0.87	Background threshold value (UTL95) (RCRB soils)
	9.4	40	RSL	1.2	DLM	0. 13	Background threshold value (UTL95) (Xerorthents soils)
Molybdenum	390	5,800	RSL	350	DLM	0.52	Background threshold value (UTL95) (RCRB soils)
	--	--	--	--	--	0.63	Background threshold value (UTL95) (Xerorthents soils)
Naphthalene	3.8	17	RSL	0.140	DLM	29	EcoSSL/low MW
NDMA	0.0023	0.045	RSL	0.00003	DLM	--	--
Nickel	1,500	26,000	RSL	120	DLM	75	Background threshold value (Max) (RCRB soils)
	--	--	--	140	Background threshold value (UTL95 and Max) (Xerorthents soils)	140	Background threshold value (UTL95 and Max) (Xerorthents soils)

Table 2-2: Performance Standards for Soil[a]

COC	Residential Soil CL for the Protection of HH (mg/kg)	Industrial Soil CL for the Protection of HH (mg/kg)	Source	Soil CL for the Protection of GW (mg/kg)	Source	Soil CL for the Protection of Ecological Receptors (mg/kg)	Primary Source
PCE	0.55	2.6	Cal-mod RSL	--	--	0.18	LANL
Perchlorate	0.060	820	EPA[c]	0.06	DLM	0.61 (surface soil) 20.3 (subsurface soil)	Back-calculated
Phenanthrene	--	--	--	--	--	29	EcoSSL/low MW
Phenol	18,000	250,000	RSL	1	DLM	30	ORNL
Prowl (Pendimethylin)	2,500	33,000	RSL	280	DLM	0.624	EcoSSL
Selenium	6.57	6.57	Background threshold value (both RCRB and Xerorthents soils)	300	DLM	6.57	Background threshold value (both RCRB and Xerorthents soils)
Silver	390	5,800	RSL	1,000	DLM	4.2	EcoSSL
TCE	0.94	6	RSL	--	--	42	LANL
Thallium	0.78	12	RSL	2,000	DLM	1	EcoSSL
	--	--	--	--	--	3.3	Background threshold value (Xerorthents soils)
Toluene	4,900	47,000	RSL	150	DLM	23	LANL
TPH-D	--	--	--	100	DLM	--	--
TPH-Mo	--	--	--	500	DLM	--	--

Table 2-2: Performance Standards for Soil[a]

COC	Residential Soil CL for the Protection of HH (mg/kg)	Industrial Soil CL for the Protection of HH (mg/kg)	Source	Soil CL for the Protection of GW (mg/kg)	Source	Soil CL for the Protection of Ecological Receptors (mg/kg)	Primary Source
Zinc	23,000	350,000	RSL	50,000	DLM	100	Background threshold value (Max) (RCRB soils)
	--	--	--	--	--	89	Background threshold value (UTL95 and Max) (Xerorthents soils)

Background soil notes:

Xerorthents soils = These soil types are found in areas of dredge tailings near the American River. The soils formed in material that has a high content of gravels and cobbles derived from mixed rock sources. The material was deposited as tailings during mining activities with slopes ranging from 0 to 50 percent.

RCRB soils = Redding-Corning-Red Bluff soils. Moderately well drained soils that are moderately deep over a cemented hard pan. This unit is found on intermediate and high terraces, terrace remnants, and the side slopes of terraces in the eastern part of Sacramento County. The soils form in alluvium that is derived from mixed rock sources. For more details on Xerorthent or RCRB soil types, see the OU-6 RI/FS Report (Shaw, 2012).

Notes:

[a] The soil cleanup levels for protection of human health and ecological receptors also apply to sediments in those areas where a remedial action is being taken.

[b] Endrin used as a surrogate for endrin aldehyde.

[c] Perchlorate exposure through the home-gardening pathway (EPA, 2012) (See Appendix F)

[d] Additional analysis conducted for selenium by Aerojet in 2014.

-- = No COCs were identified that posed a risk for this pathway.

CL = cleanup level

COC = contaminant of concern

DLM = designated level methodology (*Designated Level Methodology for Waste Classification and Cleanup Level Determination* [RWQCB, 1989])

DTSC HHRA Note 3= California Department of Toxic Substances Control, Human Health Risk Assessment Note 3, July 14, 2014

EcoSSL = ecological soil screening levels (White Paper – Ecological Risk Assessment [Aerojet, 2015])

GW = groundwater

HH = human health

LANL = Los Alamos National Laboratory

Max = Maximum detected value from Appendix C – Concentrations in Background Soils, BOU Final RI (ERM-West, 2010)

mg/kg = milligrams per kilogram

MW = molecular weight

ORNL = Oak Ridge National Laboratory

RCRB = Redding-Corning-Red Bluff

RSL = Regional Screening Level (EPA, January 2015) UTL95 = Upper threshold limit (95th percentile) value from Appendix C – Concentrations in Background Soils, BOU RI (ERM-West, 2010)

Table 2-3: Performance Standards for Soil Vapor in Ambient Air

COC	Residential Use CL ($\mu g/m^3$)	Risk Basis	Industrial Use CL ($\mu g/m^3$)	Risk Basis
Benzene	0.084	DTSC HHRA Note 3 July 2014	0.42	DTSC HHRA Note 3 July 2014
Chloroform	0.12	Cancer 10^{-6} risk level	0.53	Cancer 10^{-6} risk level
1,1-Dichloroethene	73	DTSC HHRA Note 3 July 2014	310	DTSC HHRA Note 3 July 2014
cis-1,2-Dichloroethene	7.3	DTSC HHRA Note 3 July 2014	31	DTSC HHRA Note 3 July 2014
1,2-Dichloroethane	0.11	Cancer 10^{-6} risk level	0.47	Cancer 10^{-6} risk level
Toluene	310	DTSC HHRA Note 3 July 2014	1,300	DTSC HHRA Note 3 July 2014
Trichloroethene	0.48	Cancer 10^{-6} risk level	3	Cancer 10^{-6} risk level
Tetrachloroethene	0.41	DTSC HHRA Note 3 July 2014	2.08	DTSC HHRA Note 3 July 2014
Vinyl chloride	0.031	DTSC HHRA note 3 July 2014	0.16	DTSC HHRA Note 3 July 2014

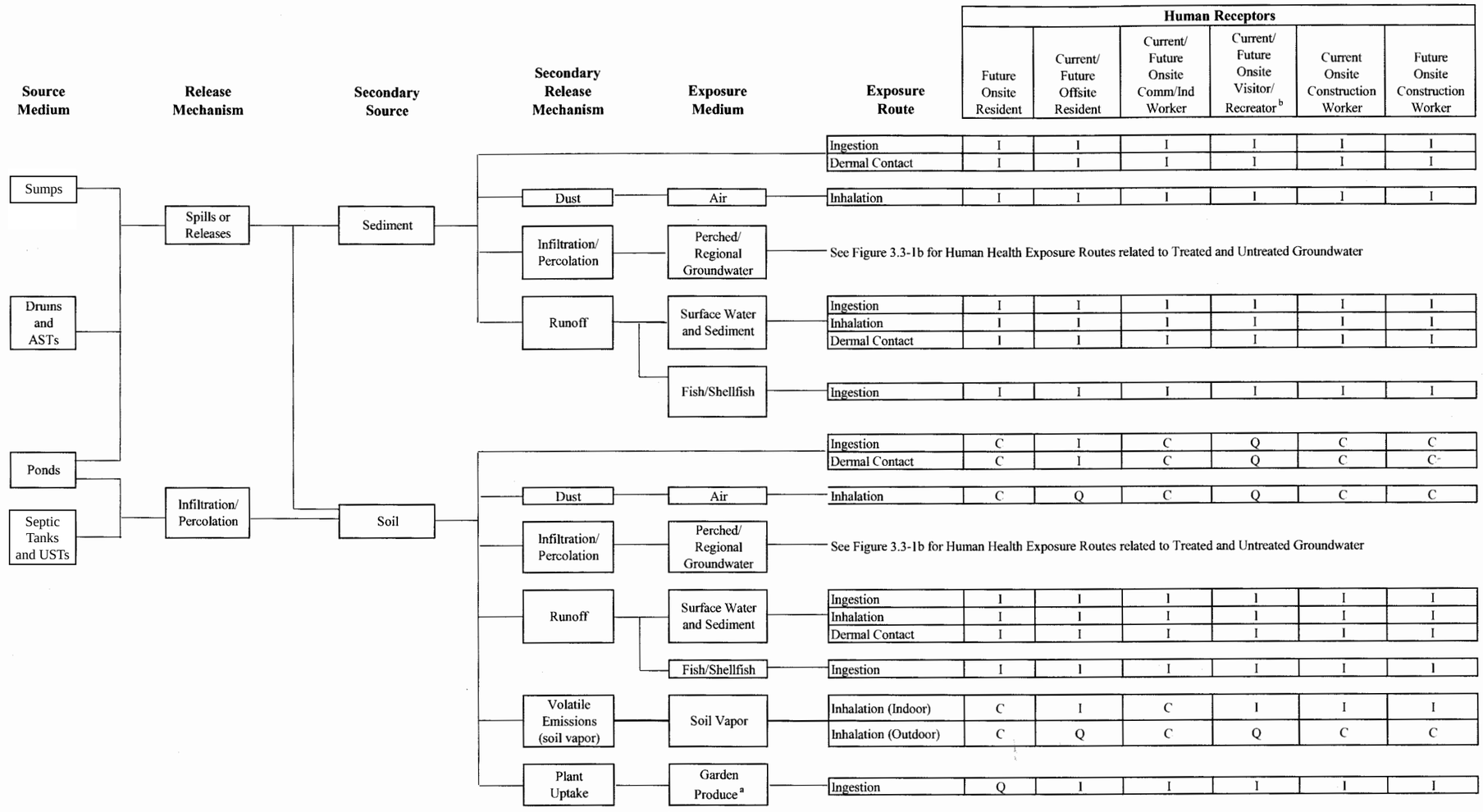
Notes:

Protective soil vapor levels in subsurface soil are decreased by location- and depth-specific attenuation factors.

DTSC Note 3 regarding modified Air RSLs, July 14, 2014

$\mu g/m^3$ = microgram(s) per cubic meter

CL = cleanup level



Notes and Key:

a Projected residential redevelopment at Aerojet is not likely to include land-intensive pathways, such as in-situ gardening. The naturally occurring soil at Aerojet is not suited for this type of activity. Significant land preparation activities (i.e., addition of topsoil and nutrients) would be required prior to growing fruits or vegetables.

b Since a residential and/or commercial/industrial soil exposure will be evaluated for all the source sites, there is no need to quantify a separate visitor/recreational exposure for all areas. However, a recreational exposure scenario will be evaluated for Area 39 and Buffalo Creek. Exposures to fish on the Aerojet property are highly unlikely, and are dependent upon the presence of edible species that are of large enough size to be filleted.

ASTs	Above-ground Storage Tank	I	Incomplete exposure pathway
C	Complete exposure pathway evaluated quantitatively	USTs	Underground Storage Tank
Comm/Ind	Commercial/Industrial	Q	Qualitative (not quantitative) evaluation conducted for this potentially complete exposure pathway

Source: ERM, 2011

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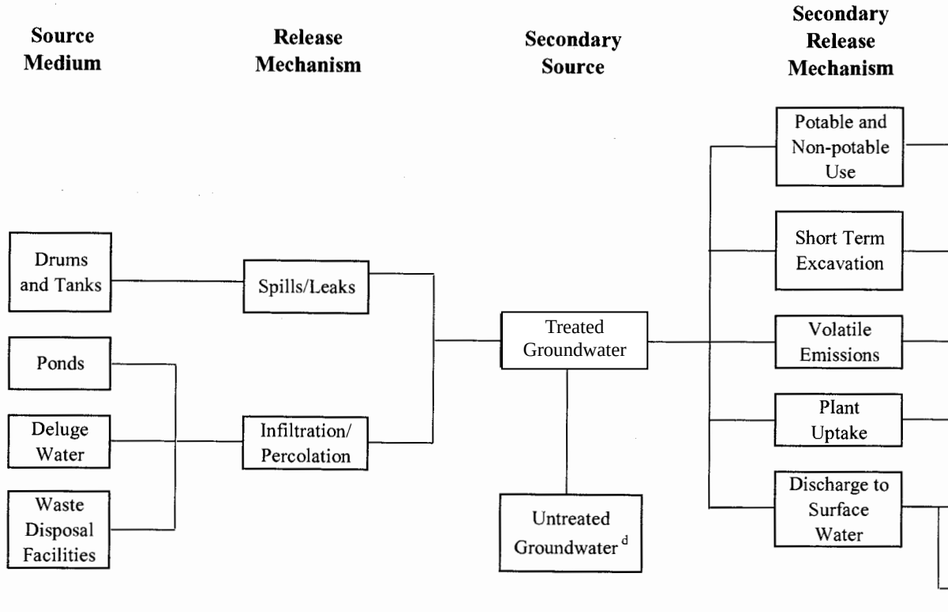
FIGURE 2-14
Conceptual Site Model
Soil Exposure Pathways for Human Receptors
Operable Unit 6 Record of Decision



Secondary Release Mechanism	Exposure Medium	Exposure Route	Human Receptor: Future Onsite Resident	Current/ Future Offsite Resident	Current/ Future Onsite Comm/Ind Worker	Current/ Future Onsite Visitor/ Recreator c	Current Onsite Construction Worker	Future Onsite Construction Worker
Potable and Non-potable Use		Ingestion	H	H	I	I	I	I
		Inhalation	H	H	I	I	I	I
		Dermal Contact	H	H	I	I	I	I
Short Term Excavation	Water in Trench b	Ingestion	I	I	I	I	Q	Q
		Inhalation	I	I	I	I	Q	Q
		Dermal Contact	I	I	I	I	Q	Q
Volatile Emissions	Soil Vapor	Inhalation (Indoor)	C	C	C	I	I	I
		Inhalation (Outdoor)	Q	Q	Q	Q	Q	Q
Plant Uptake	Garden Produce a	Ingestion	Q	Q	I	I	I	I
Discharge to Surface Water	Surface Water and Sediment	Ingestion	Q	I	Q	Q	Q	Q
		Inhalation	I	I	I	I	I	I
		Dermal Contact	Q	I	Q	C	Q	Q
	Fish / Shellfish	Ingestion	Q	I	Q	Q	Q	Q

Notes and Key:

a Projected residential redevelopment at Aerojet is not likely to include land-intensive pathways, such as in-situ gardening. The naturally occurring soil at Aerojet is not suited for this type of activity. Significant land preparation activities (i.e., addition of topsoil and nutrients) would be required prior to growing fruits or vegetables.

b Although construction workers may briefly encounter the shallow water table in some OUs, construction activities in saturated trench conditions are generally avoided and dewatering is performed to avoid work in a wet and slippery trench. Dermal exposures to contaminants in trench water would be incomplete as steady state absorption and penetration of the skin is unlikely, given short exposure times.

c Recreational exposure will be evaluated on a site-specific basis; if a residential and/or commercial/industrial soil exposure has already been evaluated, there is no need to quantify a separate recreational exposure to soil unless the property may be transferred solely for recreational use. Exposures to fish on the Aerojet property are highly unlikely, and are dependent upon the presence of edible species that are of large enough size to be filleted.

d No discharge of untreated groundwater to surface water bodies identified in BOU.

C	Complete exposure pathway evaluated quantitatively
Comm/Ind	Commercial/Industrial
H	Hypothetically complete in absence of institutional controls
I	Incomplete exposure pathway
Q	Qualitative (not quantitative) evaluation conducted for this potentially complete exposure pathway

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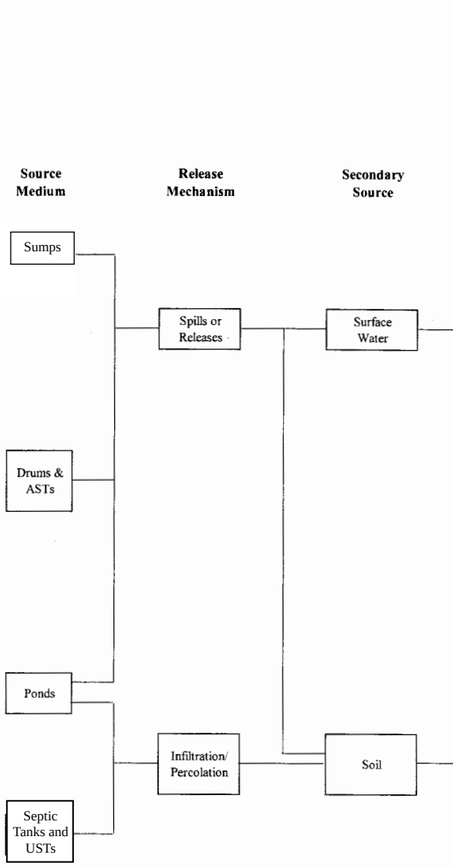
FIGURE 2-15
Conceptual Site Model
Groundwater and Surface Water Exposure Pathways for Human Receptors
Operable Unit 6 Record of Decision

Source: ERM, 2011



Trophic Level -	Ecological Receptors																	
	Producers			Primary Consumers				Secondary Consumer							Tertiary Consumers			
Functional Group/Feeding Guild -	Aquatic Vegetation	Trees/ Shrubs	Forbs/ Grasses	Soil Invertebrates/ Herbaceous Insects	Benthic and Aquatic Invertebrates	Herbivorous Mammals	Herbivorous/ Granivorous Birds	Snakes & Lizards	Turtles	Amphibians	Fish	Omnivorous/ Insectivorous Mammals	Omnivorous/ Insectivorous Birds	Water Fowl	Raptors	Piscivorous Mammals	Carnivorous Mammals	Piscivorous Birds
Secondary Release Mechanism / Exposure Medium / Exposure Route																		
Surface Water and Sediment[a] — Ingestion	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Surface Water and Sediment[a] — Dermal Contact	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Surface Water and Sediment[a] — Uptake[c]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Infiltration/ Percolation — Perched/ Regional Groundwater	See Figure 3.3-1d for Ecological Exposure Routes related to Treated and Untreated Groundwater																	
Surface transport — Surface Water and Sediment — Ingestion	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Surface transport — Surface Water and Sediment — Dermal Contact	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Surface transport — Surface Water and Sediment — Uptake[a]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Surface transport — Aquatic Food Chain — Ingestion	NE	-	-	-	NE	-	-	I	I	I	NE	I	I	I	I	I	-	I
Ingestion	I	NE	NE	NE	I	C	C	Q	Q	Q	I	C	C	I	C	I	C	I
Dermal Contact	I	NE	NE	NE	I	C	C	N	N	N	I	C	C	I	C	I	C	I
Uptake[a]	I	C	C	C	I	-	-	-	-	-	-	-	-	-	-	-	-	-
Dust — Air — Inhalation[b]	-	NE	NE	NE	I	N	N	N	N	N	I	N	N	N	N	N	N	N
Infiltration/ Percolation — Perched/ Regional Groundwater	See Figure 3.3-1d for Ecological Exposure Routes related to Treated and Untreated Groundwater																	
Runoff — Surface Water and Sediment — Ingestion	NE	I	I	I	NE	C	C	Q	Q	Q	NE	C	C	C	C	C	I	C
Runoff — Surface Water and Sediment — Dermal Contact	NE	I	I	I	NE	N	N	N	N	N	NE	N	N	C	N	C	N	C
Runoff — Surface Water and Sediment — Uptake[a]	C	I	I	I	C	-	-	-	-	-	C	-	-	-	-	-	-	-
Runoff — Aquatic Food Chain — Ingestion	NE	-	-	-	NE	-	-	I	I	I	NE	I	I	I	I	I	-	I
Volatile Emissions — Soil Vapor — Inhalation[b] (Indoor)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Emissions — Soil Vapor — Inhalation[b] (Outdoor)	-	N	N	N	I	Q	I	Q	I	Q	I	Q	I	I	Q	I	Q	I
Plant and Soil Invertebrate Uptake — Terrestrial Food Chain — Ingestion	-	NE	NE	NE	-	C	C	Q	I	Q	-	C	C	I	C	I	C	I

Notes:

a Uptake applies only to plants, invertebrates, and fish and includes respiration, dermal uptake, and ingestion by these receptors.
b Inhalation includes vapor uptake by plants and respiration by invertebrates
ASTs Above-ground Storage Tank
USTs Underground Storage Tank

Designations:

C Complete exposure pathway evaluated quantitatively
I Incomplete exposure pathway
N Negligible or insignificant (though hypothetically potentially complete) pathway that will not be evaluated
NE Exposure route is evaluated as part of the uptake pathway
Q Qualitative (not quantitative) evaluation planned for this potentially complete exposure pathway
- Not applicable

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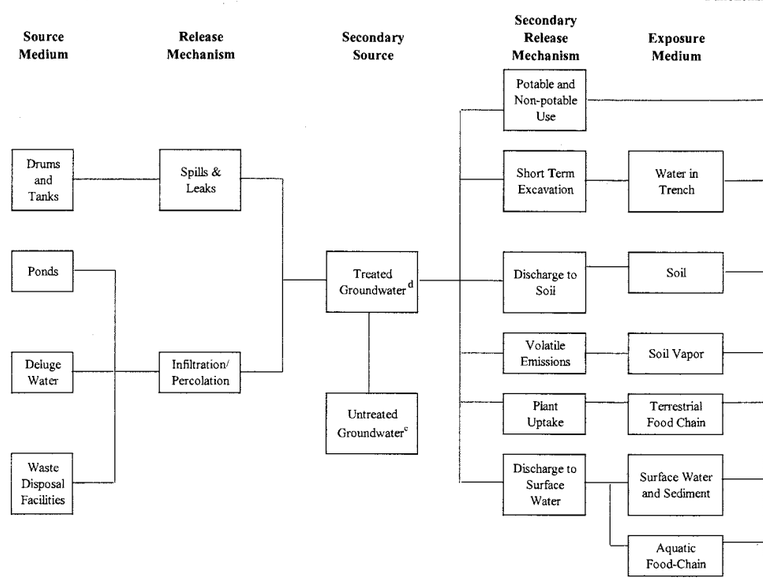
FIGURE 2-16
Conceptual Site Model
Soil Exposure Pathways for Ecological Receptors
Operable Unit 6 Record of Decision

Source: ERM, 2011



Trophic Level -	Ecological Receptors																	
	Producers			Primary Consumers				Secondary Consumer							Tertiary Consumer			
Functional Group/Feeding Guild -	Aquatic Vegetation	Trees/ Shrubs	Forbs/ Grasses	Soil Invertebrates/ Herbivorous Insects	Benthic and Aquatic Invertebrates	Herbivorous Mammals	Herbivorous/ Granivorous Birds	Snakes & Lizards	Turtles	Amphibians	Fish	Omnivorous/ Insectivorous Mammals	Omnivorous/ Insectivorous Birds	Water Fowl	Raptors	Piscivorous Mammals	Carnivorous Mammals	Piscivorous Birds
Exposure Route																		
Ingestion	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Dermal Contact	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Uptake[a]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Ingestion	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Dermal Contact	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Uptake[a]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Ingestion	I	NE	NE	NE	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Dermal Contact	I	NE	NE	NE	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Uptake[a]	I	I	I	I	I	-	-	-	-	-	-	-	-	-	-	-	-	-
Inhalation[b] (Indoor)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inhalation[b] (Outdoor)	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Ingestion	-	NE	NE	I	-	I	I	I	I	I	-	I	I	I	I	I	I	I
Ingestion	NE	I	I	I	NE	N	N	N	N	N	NE	N	N	N	N	N	N	N
Dermal Contact	NE	I	I	I	NE	N	N	N	N	N	NE	N	N	N	N	N	N	N
Uptake[a]	C	I	I	I	C	-	-	-	-	-	C	-	-	-	-	-	-	-
Ingestion	NE	-	-	-	NE	-	-	I	Q	Q	NE	N	N	N	N	N	-	N

Notes:

a Uptake applies only to plants, invertebrates, and fish and includes respiration, dermal uptake, and ingestion by these receptors.
b Inhalation includes vapor uptake by plants and respiration by invertebrates.
c Untreated groundwater does not discharge to surface water within the Boundary Operable Unit.
d Treated groundwater is from the groundwater treatment facilities.

Designations:

C Complete exposure pathway evaluated quantitatively
I Incomplete exposure pathway
N Negligible or insignificant (though hypothetically potentially complete) pathway that will not be evaluated
NE Exposure route is evaluated as part of the uptake pathway
Q Qualitative (not quantitative) evaluation planned for this potentially complete exposure pathway
- Not applicable

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FIGURE 2-17
Conceptual Site Model
Groundwater and Surface Water Exposure Pathways for Ecological Receptors
Operable Unit 6 Record of Decision

Source: ERM, 2011

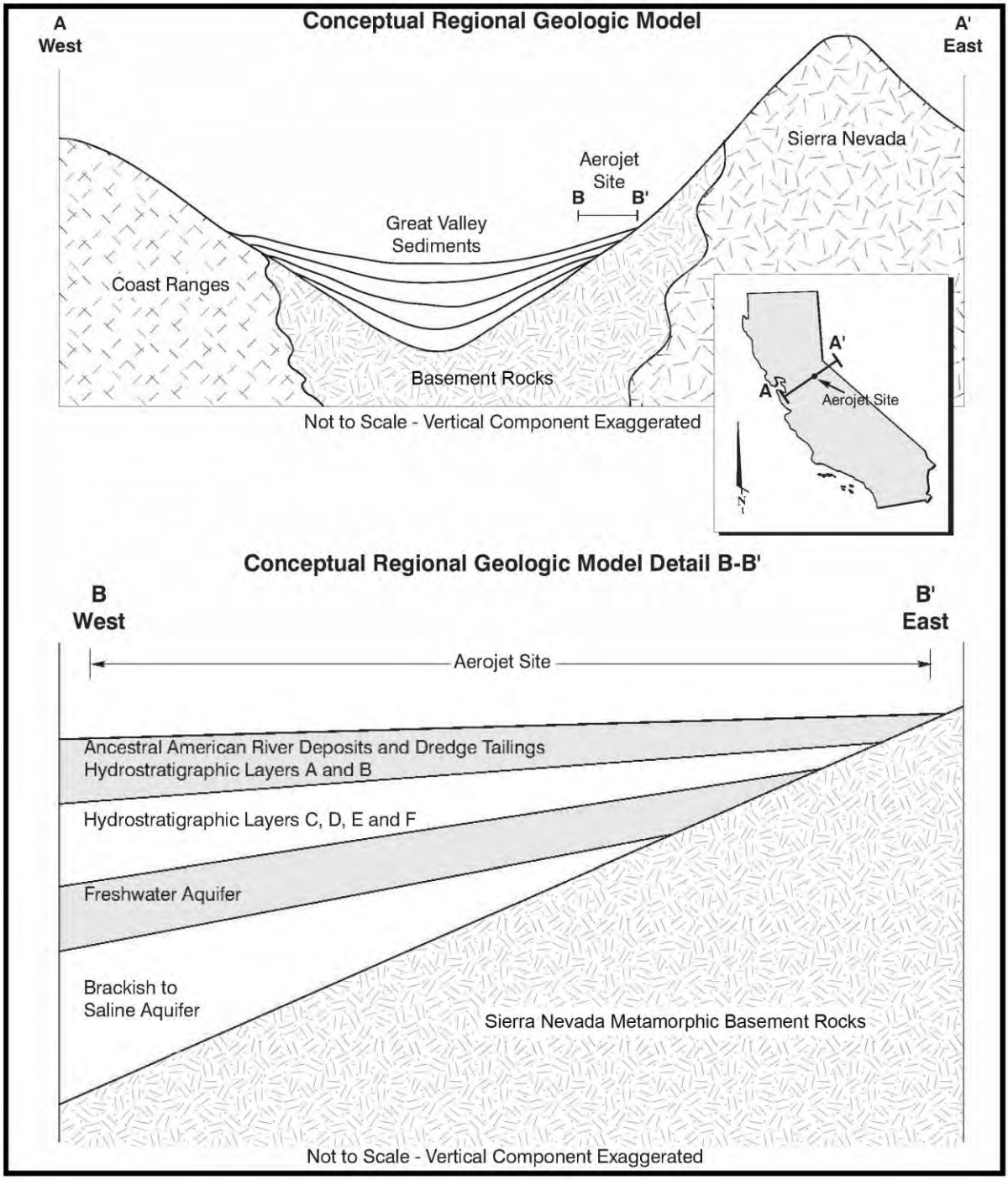

Figure 2-18: Conceptual Model of Groundwater Structure

2.5.2 Overview of OU-6

Since the 1950s, the Aerojet facility has primarily been used for the design, development, and testing of solid- and liquid-fuel rocket propulsion systems. Industrial activities conducted in support of this work included solid rocket motor manufacturing, testing, and rehabilitation; liquid rocket engine manufacturing and testing; and chemical development and manufacturing. Chemicals used at the site included solvents, propellants, fuels, lubricants, oxidizers, and metals.

The Aerojet Superfund Site is characterized by a relatively flat topographic surface gently sloping to the west. Most of the onsite topography is dominated by rows of dredge tailings left from gold mining operations that began in the early 1900s. The dredge tailings consist of alternating rows of cobble piles separated by low areas filled with silt and clay (slickens). The depth of dredging ranged from approximately 10 to 90 feet below ground surface (bgs).

The Sacramento area has a mild, subtropical climate with abundant sunshine most of the year. Climatic information for the area was originally obtained from *Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1951-1980, California* (National Oceanic and Atmospheric Administration [NOAA], 1982), and *Local Climatological Data 1992, Annual/Monthly Summary* (NOAA, 1993), but has been updated based on data obtained from the Western Regional Climate Center (www.wrcc.dri.edu). The mean annual temperature in Sacramento is a relatively mild 62.2 degrees Fahrenheit (°F). Maximum average temperatures during the summer range from 87.1 to 93.1°F. Temperatures may occasionally exceed 100°F during hot spells. Winter temperature maximums vary from 54.5 to 60.6°F. Average lows in the winter are 40.2 to 43.7°F. Temperatures in the winter rarely drop below freezing. Average annual precipitation is 18.33 inches, with about 80 percent of the total rainfall occurring from November through March. The highest rainfall generally occurs in January, which averages 3.80 inches of precipitation. The driest month is August, averaging only 0.03 inch of rain.

The Aerojet-owned property within the Superfund boundary is presently zoned for industrial use. The facilities that support industrial operations are grouped into manufacturing areas comprising multiple buildings. Large areas of undeveloped land are located within and between the manufacturing areas, and between the property boundaries. The majority of land between active manufacturing areas and the property boundary served as “buffer space” between operations and neighboring properties. Approximately 2,600 acres of buffer lands located along the northern and northwestern property boundaries were removed from the Aerojet Superfund Site in 2002, and may be developed with a wide variety of land uses, including residential, commercial/industrial, and recreational.

2.6 Current and Potential Future Land Site and Resources Uses

The Aerojet Superfund Site is designated as a Special Planning Zone (SPZ) with multiple uses from propulsion systems testing to office use. The SPZ has a provision for future development under the Sacramento County Land Use Master Plan that would allow for residential use. The contaminated soil areas of OU-6 and open spaces free of soil contamination, but underlain by contaminated groundwater, are proposed for development as mixed residential and commercial. The land immediately adjacent to Aerojet is entirely zoned as heavy and light industrial. The area farther to the west and south of the El Dorado Freeway (Highway 50) is designated as an industrial-office park zone. The area north of Highway 50, south of the American River and west

of Sunrise Boulevard is zoned approximately 90 percent residential and 10 percent commercial. The area to the east of Sunrise Boulevard, south of the American River and north of Highway 50, is approximately 40 percent industrial and 60 percent residential. The American River floodplain and the edges of the adjacent bluffs are designated as recreational zones. The cities of Rancho Cordova and Folsom, along with the communities of Carmichael, Fair Oaks and Gold River are generally fully developed with residential, commercial, and industrial properties. The Assessor's Parcel Numbers (APNs) for the OU-6 area are all or portions of ***072-0231-116, 072-0231-119, 072-0231-120, 072-0231-128, 072-0231-129, and 072-0231-134***.

2.6.1 Current Land Uses

Currently, Aerojet uses some portions of the facility for ongoing industrial operations. In addition, some portions of the facility are leased for use as rangeland where sheep and other livestock may graze. However, much of the facility is currently vacant and provides habitat for a wide variety of plant and wildlife species. Properties surrounding Aerojet have been developed for mixed purposes, and include residential, commercial/industrial, and recreational land uses.

2.6.2 Future Land Uses

Development of the Aerojet facility is planned to include residential, commercial/industrial, and recreational properties in some areas of OU-6. A large portion of OU-6 will remain undeveloped, and a portion of the facility will continue to be used by Aerojet for commercial operations. Figures 2-19 through 2-22 present the current land ownership and current land use plans for OU-6. Based on a review and analysis of Aerojet's proposed land use plans and municipal development approvals, planned future land uses have been identified within OU-6. The proposed Easton project include five boroughs; Easton Place, Hillsborough, Glenborough, Westborough, and Rio del Oro. Easton Place development and portions of the Westborough Phase 2 development are located in Sacramento County, and fall within the Aerojet Special Planning District. Portions of Westborough Phase 2 are located in the City of Rancho Cordova. Both proposed developments overlap with OU-6 source areas. The future uses anticipated for Easton Place and Westborough Phase 2 and associated OU-6 remedial considerations are outlined as follows:

- Easton Place (Figure 2-21):
  - In January 2009, the Sacramento County Board of Supervisors approved General Plan and Zoning Amendments, and Tentative Large and Small Lot Subdivision Maps for Easton Place.
  - County approvals for Easton Place allow for the development of a 183-acre transit-oriented community featuring high-density residential, retail, and commercial office uses. High-density residential uses are approved for a portion of the Aerojet Superfund Site affected by OU-6 source areas, including the Administration Area West and former sewage treatment plant (FSTP) areas.
  - Remedial alternatives to address soil and soil vapor impacts at source areas were evaluated in the OU-6 FS. Potential remedial alternatives include a combination of ICs, containment (e.g., capping), soil vapor intrusion controls, and excavation to address

potential human and ecological health risks in Administration Area West and FSTP areas where county approvals would allow for high-density residential, mixed-use commercial, office, and public uses.

  - ICs are proposed for Administration Area West and FSTP areas where county approvals would allow for commercial mixed use, high-density residential, public, and park uses. ICs would include restricted residential and commercial/industrial land use where residual COCs would remain in place at concentrations above levels that would allow for unrestricted use or commercial/industrial use; required soil vapor mitigation measures until concentrations meet allowable limits for soil vapor; and required health and safety and materials management procedures for any excavations in areas with residual COCs.

- Westborough Phase 2 (Figure 2-22):

  - General Corporation has submitted an application to the City of Rancho Cordova for the development of the Westborough at Easton Specific Plan (Westborough Plan). The proposed Westborough Phase 2 development is on hold pending the evaluation of source areas and potential remedial alternatives for OU-6.

  - The proposed Westborough Plan envisions the phased development of a 1,695-acre mixed-use community with low- and medium-density residential uses, retail and commercial office uses, and natural preserve areas. The Westborough Plan area is primarily located within the City of Rancho Cordova's Aerojet Special Planning District; a small portion of the Westborough Plan is located in an area of Sacramento County proposed for annexation by the City of Rancho Cordova.

  - Aerojet proposes residential, commercial mixed-use, and OS uses for OU-6 source areas, including West Lakes; Line 2; Line 5; Buffalo Creek; and OS Areas 5, 6, and 7. These areas are currently approved for industrial use only.

  - Remedial actions evaluated in the OU-6 FS for the West Lakes; Line 2; Line 5; Buffalo Creek; and OS Areas 5, 6 and 7 areas include ICs, capping, and excavation to address soil and soil vapor risks to human health and groundwater, and to address ecological risks. SVE may also be used to address soil vapor risks.

  - Institutional and engineering controls are anticipated for portions of the Line 2 and Line 5 areas proposed for commercial mixed use, OS, and low-density residential uses. ICs include restricted residential and commercial/industrial use where residual contamination remains in place, required soil vapor mitigation measures until concentrations meet allowable limits for soil vapor, and required health and safety and materials management.

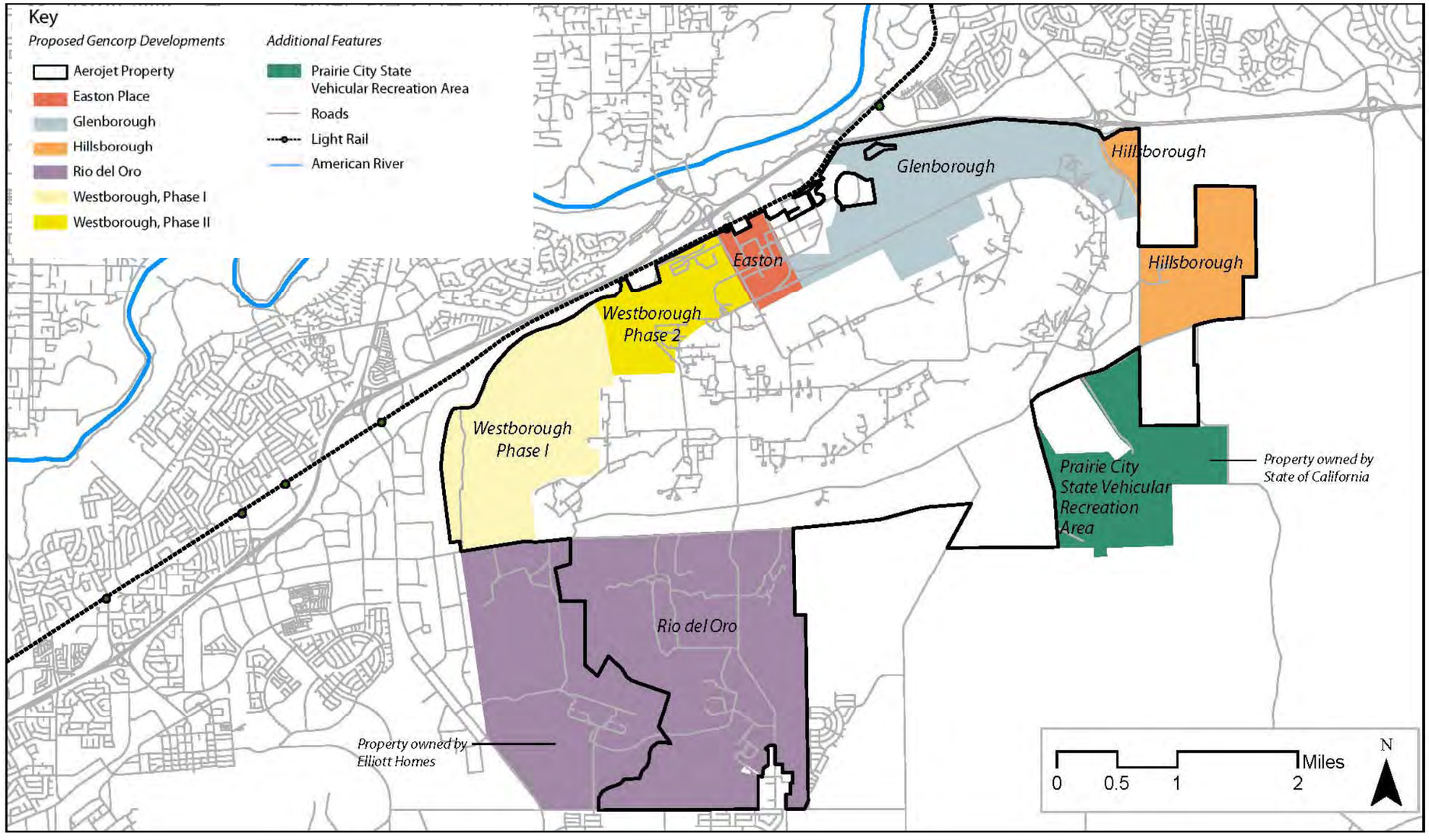

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FIGURE 2-19
Ownership and Proposed Use at Aerojet
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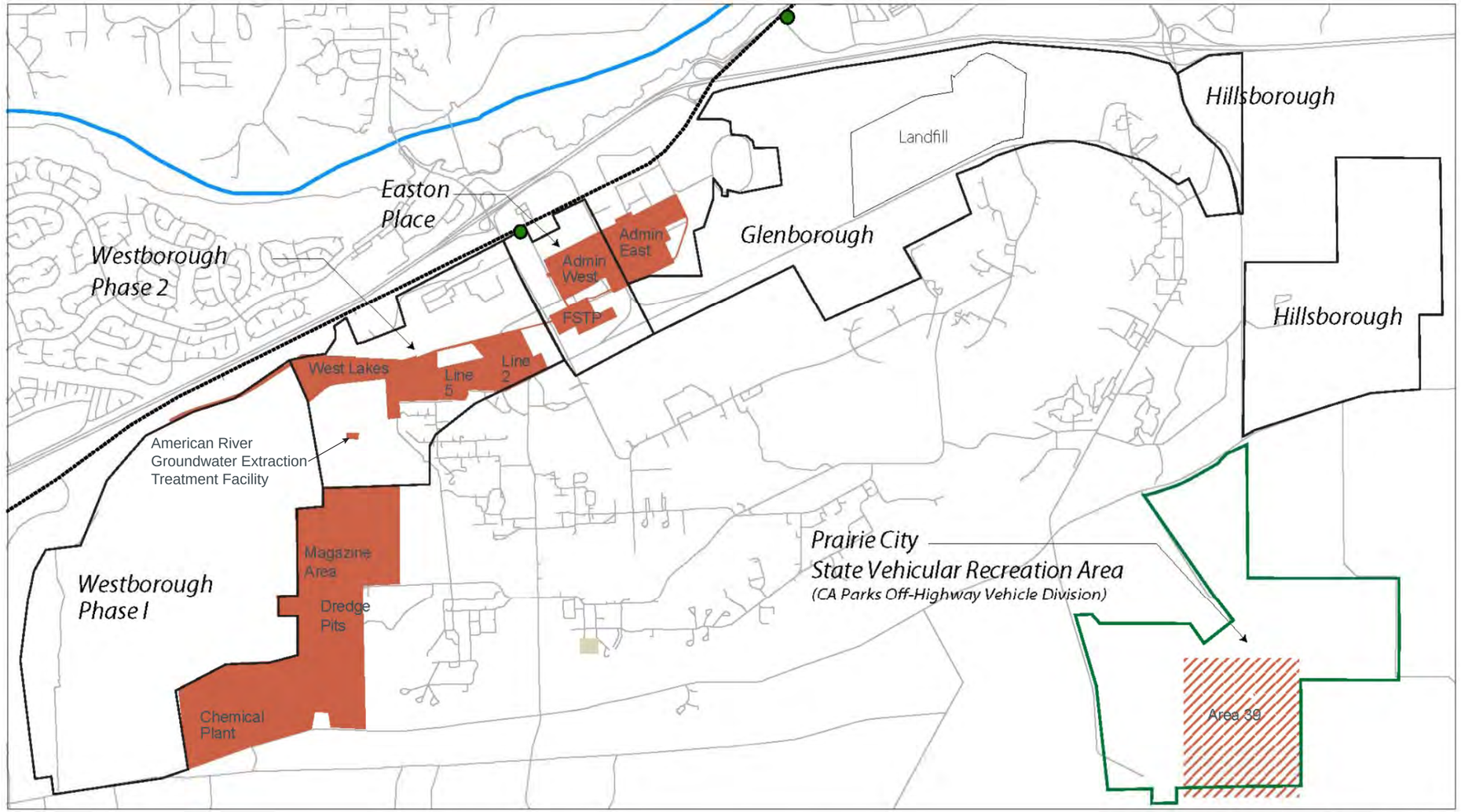

0 .5 1 Mile

N

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Key

General Features

- Proposed Developments
- Roads
- PCSVRA (in continued Use)
- Light Rail
- American River

Soil Medium Operable Units

- OU6 Boundary
- Area 39 (evaluated in OU6 Remedial Investigation; now part of OU7)

FIGURE 2-20
Current and Proposed Uses
Operable Unit 6 Record of Decision

Key

General Features

- Aerojet Boundary
- Light Rail

Operable Units

- OU5 Perimeter Groundwater *(Soil Medium)*
- OU6 Boundary

Proposed Land Uses

- Commercial Mixed Use
- Commercial
- Community Resource
- High Density Residential
- Low Density Residential
- Medium Density Residential
- Major Road
- Office
- Open Space
- Open Space/Alder Creek
- Public/Quasi-Public
- Park
- Parkway
- School

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FIGURE 2-21
Proposed Developments - Easton Place
Operable Unit 6 Record of Decision

Key

General Features

- Aerojet Boundary
- Light Rail

Operable Units

- OU5 Perimeter Groundwater *(Soil Medium)*
- OU6 Boundary
- OU7 Island
- OU9 Central

Proposed Land Uses

- Commercial Mixed Use
- Commercial
- Community Resource
- High Density Residential
- Low Density Residential
- Medium Density Residential
- Major Road
- Open Space
- Open Space/Alder Creek
- Public/Quasi-Public
- Park
- Parkway
- School

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FIGURE 2-22
Westborough Phase 2
Operable Unit 6 Record of Decision

2.7 Summary of Site Risks

Human health and ecological risk assessments were performed to identify and estimate potential risks to people and the environment from contamination of soil, soil vapor, sediment, and surface water at the eight MAs and OS areas encompassed by OU-6. The HHRA evaluated the use of untreated groundwater for residential supply and the potential for migration of VOCs from soil, soil vapor, and groundwater into indoor and ambient air, under both current and future land use scenarios. The SLERA evaluated the potential ecological risks due to exposure to constituents in soil, soil vapor, sediment, and surface water by aquatic and terrestrial habitat and receptors (biota) of concern. The results of the SLERA are presented in Section 2.7.5. The conclusions from the two risk assessments provide the basis for taking action, and identify the contaminants and exposure pathways that need to be addressed by the remedial action. This information is presented and summarized in Appendix B.

The response action selected in this ROD is necessary to protect public health, welfare, or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment.

This section of the ROD summarizes the results of the HHRA and SLERA for OU-6.

2.7.1 Identification of Contaminants of Concern

COCs are chemicals that are present at concentrations high enough to present a risk to human health or ecological receptors. Based on the data collected during the RI, COCs were identified that drive the need for remedial action. Chemical data from each media were compared with human health and ecological screening levels and screening levels for the protection of groundwater, and considered potential COCs if they exceeded these levels. Results of the background screening demonstrated that five of the metals (aluminum, arsenic, manganese, thallium, and vanadium) are statistically comparable to background and were not considered potential COCs.

The data for the OU-6 risk assessments were obtained from two Aerojet databases, the OU-6 database and the historical database. The OU-6 database contains analytical data for soil, sediment, soil vapor, surface water, and groundwater samples collected from areas within OU-6 between July 2005 and April 2007. The historical database contains analytical data for soil, soil vapor, and groundwater samples collected during site investigations between January 1990 and June 2006. Due to age of the historical soil vapor data and because the analyses included only a selected number of VOCs with detection limits much higher than present, the OU-6 RI included re-sampling of soil vapor for VOCs between 2005 and 2007. The VOC soil vapor data collected during the OU-6 RI are more representative and accurate than the historical soil vapor data; and, therefore, only soil vapor data collected during the OU-6 RI were evaluated in the risk assessments. However, as noted later in Section 2.8, further delineation will be conducted during the remedial design phase.

2.7.2 Exposure Assessment

Exposure refers to the potential contact of an individual with a contaminant. The exposure assessment evaluates the magnitude, frequency, duration, and route of potential exposure.

This section describes which populations may be exposed, the exposure pathways, and how much exposure to the contaminants is present. A complete discussion of all the scenarios and exposure pathways is presented in the final human health and ecological risk assessment (HHERA) for OU-6 (ERM, 2011).

Exposure pathways for the human health risk evaluation for soil (0 to 12 feet bgs) include the following:

- Direct contact (incidental ingestion and dermal contact)
- Inhalation of fugitive dust
- Volatilization of VOCs from soil and soil vapor into ambient (outdoor and indoor) air

Exposure pathways for the human health risk evaluation for sediment (generally 0 to 1 feet bgs) include the following:

- Dermal contact with sediment during recreational (wading) activity
- Incidental ingestion of sediment during recreational (wading) activity

Exposure pathways for the human health risk evaluation for surface water include the following:

- Dermal contact with surface water during recreational activity
- Incidental ingestion of surface water during recreational activity

Exposure pathways for the human health risk evaluation for groundwater include the following:

- Use of groundwater for future hypothetical residential water supply
- Migration of VOCs from groundwater through the unsaturated zone into ambient (outdoor and indoor) air
- Contact with groundwater during excavation or other intrusive activities

For each selected contaminant of potential concern (COPC) for each media, the detected concentration at each location and depth was used in the calculation of estimated hazards and incremental cancer risks, resulting in a sample-by-sample risk estimate. For soil, analytical results from samples collected from 0 to 12 feet bgs were used as potential exposure point concentrations. Soil vapor analytical results from samples collected from 10 to 40 feet bgs were used as potential fate and transport model inputs for deriving ambient (indoor and outdoor) air exposure point concentrations. For indoor and outdoor air, concentrations were based on modeling of individual location-depth concentrations from bulk soil (outdoor air), soil vapor measurements (both indoor and outdoor air), and groundwater measurements (indoor air).

To understand the areal extent of potential risk and to create maps of these potential risks, part of the HHRA methodology was to calculate risk estimates based on the chemical results at each sampling location. This “point-by-point” approach was followed because at the time the HHRA was being prepared, a development plan was not formally established for the entire OU-6, and there was potential variability in the exposure units by which future receptors could be exposed. This approach is representative in that receptors are not exposed to concentrations from a single location for the entire duration of their exposure period, especially in the case of outdoor air exposures. Receptor behavior is more likely to result in composite exposures to multiple locations and chemical concentrations.

2.7.3 Toxicity Assessment

Several EPA and Cal-EPA sources were used to obtain toxicity criteria (i.e., cancer slope factors and noncarcinogenic reference doses) in this risk assessment. The following sources for selecting toxicity criteria were used, and EPA (2003a) hierarchy was generally followed:

- Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database
- Integrated Risk Information System (IRIS)
- EPA's Provisional Peer-Reviewed Toxicity Values
- National Center for Environmental Assessment (NCEA, or other current EPA sources)
- Health Effects Assessment Summary Tables (HEAST)
- EPA criteria documents (e.g., drinking water criteria documents, drinking water Health Advisory summaries, ambient water quality criteria documents, and air quality criteria documents)
- Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles
- EPA's Environmental Criteria and Assessment Office

The exception to the hierarchy is if both Cal-EPA and EPA toxicity criteria exist for a given COPC, the most conservative value was used.

The most recent RSLs (January 2015) and DTSC's HHRA Note 3 (July 2014) are included in this ROD. DTSC's HHRA Note 3 adopts EPA RSLs.

Table 2-4 provides the noncancer toxicity criteria, and Table 2-5 provides the carcinogenic toxicity criteria used in the HHRA.

This Risk Assessment evaluated petroleum hydrocarbon mixtures through quantitative evaluation of the risks associated with exposure to petroleum constituents such as benzene, toluene, ethylbenzene, and xylenes (BTEX) and PAHs.

Quantifying lead exposure is accomplished using different procedures than for other COPCs. Unlike for other chemicals, substantial evidence has been compiled allowing correlation of cause-and-effect relationships in humans with blood concentrations of lead. DTSC's Lead Risk Assessment Spreadsheet model (Version 7) (DTSC, 2011) was incorporated into the assessment. In July 2014, DTSC released HHRA Note 3 that establishes a revised toxicity assessment approach, using an incremental increase of 1 micrograms per deciliter (µg/dL) in blood lead as a benchmark. This benchmark is a more conservative approach to the assessment of lead exposures, resulting in a change for residential and commercial receptors from 150 and 3,500 mg/kg to 80 and 320 mg/kg, respectively.

2.7.4 Risk Characterization

For carcinogens, risks are generally expressed as the probability of an individual developing cancer over a lifetime as a result of exposure to site-related contaminants. This is described as "excess lifetime cancer risk" because it is in addition to the risk of cancer from other causes. Risk is expressed in scientific notation, that is, 1E-06 or 1×10^{-6}. A risk result of 1E-06 means an

individual has a 1 in 1,000,000 chance of developing cancer from site-related exposure. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. The EPA's generally acceptable risk range for site-related exposures is between 1E-06 and 1E-04 (in effect, 1 in 1,000,000 to 1 in 10,000). An excess lifetime cancer risk greater than 1 in 10,000 (1E-04) is the point at which action is generally required at a site. The $1x10^{-6}$ risk level is used as the point of departure for determining remediation action goals; it expresses EPA's preference for remedial actions that reduce risks to the most protective end of the risk range.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level, over a specified time period (e.g., a lifetime), with a reference dose (RfD), a safe dose including safety factors where no adverse effects would be expected. The exposure level is also expressed as an average daily exposure dose. This comparison represents a ratio of the exposure dose to the RfD, and is called the hazard quotient (HQ). A HQ of less than 1 means the receptor (individual) is exposed to a dose *less than* the RfD and is not expected to experience any harmful effects. The hazard index (HI) is the sum of all the HQs that affect the same target organ (i.e., liver) or organ system. HQs are combined for pollutants that cause adverse effects by the same toxic mechanism. An HI less than 1 means that, based on the sum of HQs from different contaminants and exposure routes, toxic effects are unlikely.

Tables 2-6 through 2-9 provide risk, HI, and lead results by exposure area for exposure to surface water, groundwater, soil and sediment, and soil vapor, respectively. Lead concentrations in soil and sediment are also provided in Table 2-8. The following subsections summarize the risk, hazard, and blood lead results by media.

2.7.4.1 Surface Water

The exposure pathways evaluated for surface water include ingestion of surface water during recreational use and dermal contact with surface water during recreational use. Three exposure areas were evaluated for exposure to surface water. These include the following:

- Administration Area (East and West) (the east and west Administration Area were evaluated separately for soil and soil vapor exposure but grouped into one exposure area for surface water and groundwater exposure)
- West Lakes, Line 2, Line 5 North Area
- Chemical Plant 2

Residential exposure to surface water in the exposure areas indicated HIs are less than the target HI of 1. The concentration of lead in surface water exceed the California regulatory action level for lead of 15 micrograms per liter (µg/L) at two of the three exposure areas. The incremental lifetime cancer risk (ILCR) is below the cumulative risk level of 1E-06 at two of the three exposure areas. At West Lakes, Line 2, and Line 5 North Area, the ILCR of 2E-06 slightly exceeds the lower end of the risk management range of 1E-06. The primary contributor to the risk is BEHP (Table 2-6).

Chemical	CAS Number	Inhalation - Chronic Value[5]	Inhalation - Chronic Reference	Inhalation - Subchronic Value[5]	Inhalation - Subchronic Reference	Oral[(1)] - Chronic Value[5]	Oral[(1)] - Chronic Reference	Oral[(1)] - Subchronic		Oral BIO	Dermal ABS[(2)]	% GI ABS	Dermal Chronic Value
Aluminum	7429-90-5	1.4 E-3	PPRTV	4.4 E-3	Chronic (4)	1.0 E+0	PPRTV	1.0 E+0	Chronic	1.0	NA		
Antimony	7440-36-0	4.0 E-4	route-to-route	4.0 E-4	Chronic	4.0 E-4	USEPA, 2008	4.0 E-4	Chronic	1.0	NA	15%	6.0 E-5
Arsenic	7440-38-2	8.6 E-6	OEHHA, 2008	8.6 E-6	Chronic	3.0 E-4	USEPA, 2008	3.0 E-4	Chronic	0.6	0.03		
Barium	7440-39-3	1.4 E-4	USEPA, 1997	1.4 E-4	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA	7%	1.4 E-2
Beryllium	7440-41-7	5.7 E-6	USEPA, 2008	5.7 E-6	Chronic	2.0 E-3	USEPA, 2008	2.0 E-3	Chronic	1.0	NA	0.7%	1.4 E-5
Boron		5.7 E-3	USEPA, 1997	5.7 E-3	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Cadmium	7440-43-9	1.0 E-3	route-to-route	1.0 E-3	Chronic	1.0 E-3	USEPA, 2008	1.0 E-3	Chronic	1.0	0.001	2.5%	2.5 E-5
Cadmium - Water	7440-43-9											5.0%	5.0 E-5
Chromium	16065-83-1	1.5 E+0	route-to-route	1.5 E+0	Chronic	1.5 E+0	USEPA, 2008[(3)]	1.5 E+0	Chronic	1.0	NA	1.3%	2.0 E-2
Chromium VI	18540-29-9	2.2 E-6	USEPA, 2008	2.2 E-6		3.0 E-3	USEPA, 2008	3.0 E-3	Chronic	1.0	NA	2.5%	7.5 E-5
Cobalt	7440-48-4	5.7 E-6	PPRTV	5.7 E-6	Chronic	2.0 E-2	PPRTV	2.0 E-2	Chronic	1.0	NA		
Copper	7440-50-8	3.7 E-2	route-to-route	3.7 E-2	Chronic	3.7 E-2	USEPA 1997b	3.7 E-2	Chronic	1.0	NA		
Iron	7439-89-6	NA		NA		7.0 E-1	PPRTV	7.0 E-1		1.0	NA		
Lead	7439-92-1	NA		NA		NA		NA	Chronic	0.44	NA		
Lithium	7439-93-2	NA		NA		2.0 E-2	R9PRG	2.0 E-2	Chronic	1.0	NA		
Manganese	7439-96-5	1.4 E-5	USEPA, 2008	1.4 E-5	Chronic	2.4 E-2	USEPA, 2008	2.4 E-2	Chronic	1.0	NA	4.0%	9.6 E-4
Mercury	7439-97-6	8.6 E-5	USEPA, 2008	8.6 E-5	Chronic	3.0 E-4	USEPA, 2008	3.0 E-4	Chronic	1.0	NA	7.0%	2.1 E-5
Molybdenum	7439-98-7	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	USEPA, 2008	5.0 E-3	Chronic	1.0	NA		
Nickel	7440-02-0	1.4 E-5	OEHHA, 2008	1.4 E-5	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	NA	4%	8.0 E-4
Nitrate as NO3		NA		NA		1.6 E+0	USEPA, 2008	1.6 E+0	Chronic	1.0	NA		
Nitrate plus Nitrite (as N)		NA		NA		1.6 E-1	R9PRG nitrite as surrogate	1.6 E-1	Chronic	1.0	NA		
Nitrite as NO2		NA		NA		1.6 E-1	R9PRG	1.6 E-1	Chronic	1.0	NA		
Perchlorate	14797-73-0	7.0 E-4	route-to-route	7.0 E-4	Chronic	7.0 E-4	USEPA 2008	7.0 E-4	Chronic	1.0	NA		
Selenium	7782-49-2	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	USEPA, 2008	5.0 E-3	Chronic	1.0	NA		
Silver	7440-22-4	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	USEPA, 2008	5.0 E-3	Chronic	1.0	NA	4%	2.0 E-4
Strontium		6.0 E-1	route-to-route	6.0 E-1	Chronic	6.0 E-1	USEPA, 2008	6.0 E-1	Chronic	1.0	NA		
Thallium	7446-18-6	6.6 E-5	route-to-route	6.6 E-5	Chronic	6.6 E-5	USEPA, 2008	6.6 E-5	Chronic	1.0	NA		
Titanium	7440-32-6	8.6 E-3	NCEA	8.6 E-3	Chronic	4.0 E+0	NCEA	4.0 E+0	Chronic	1.0	NA		
Vanadium	7440-62-2	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	NCEA	5.0 E-3	Chronic	1.0	NA	2.6%	1.3 E-4
Zinc	7440-66-6	3.0 E-1	route-to-route	3.0 E-1	Chronic	3.0 E-1	USEPA, 2008	3.0 E-1	Chronic	1.0	NA		
1,1,1-Trichloroethane	71-55-6	1.4 E+0	USEPA 2008	1.4 E+0	Chronic	2.0 E+0	USEPA, 2008	2.0 E+0	Chronic	1.0	NA		
1,1,2,2-Tetrachloroethane	79-34-5	6.0 E-2	route-to-route	6.0 E-2	Chronic	6.0 E-2	USEPA, 2008	6.0 E-2	Chronic	1.0	NA		
1,1,2-Trichloroethane	79-00-5	4.0 E-3	route-to-route	4.0 E-3	Chronic	4.0 E-3	USEPA, 2008	4.0 E-3	Chronic	1.0	NA		
1,1-Dichloroethane	75-34-3	2.0 E-1	route-to-route	2.0 E-1	Chronic	2.0 E-1	PPRTV	2.0 E-1	Chronic	1.0	NA		
1,1-Dichloroethene	75-35-4	2.0 E-2	OEHHA 2008	2.0 E-2	Chronic	5.0 E-2	USEPA 2008	5.0 E-2	Chronic	1.0	NA		
1,2,4-Trimethylbenzene	95-63-6	2.0 E-3	PPRTV	2.0 E-3	Chronic	2.0 E-3	PPRTV	2.0 E-3	Chronic	1.0	NA		
1,2-Dichlorobenzene		6.9 E-3	NCEA	6.9 E-3	Chronic	9.0 E-2	USEPA, 2008	9.0 E-2	Chronic	1.0	NA		
1,2-Dichloroethane	107-06-2	1.4 E-3	NCEA	1.4 E-3	Chronic	2.0 E-2	NCEA	2.0 E-2	Chronic	1.0	NA		
1,2-Dichloroethene (cis/trans)		1.0 E-2	route-to-route	1.0 E-2	Chronic	1.0 E-2	PPRTV	1.0 E-2	Chronic	1.0	NA		
1,3,5-Trimethylbenzene	108-67-8	1.7 E-3	PPRTV	1.7 E-3	Chronic	5.0 E-2	PPRTV	5.0 E-2	Chronic	1.0	NA		
1,3-Butadiene	106-99-0	5.7 E-4	USEPA 2008	5.7 E-4	Chronic	5.7 E-4	Route to route	5.7 E-4	Chronic	1.0	NA		
1,4-Dichlorobenzene		2.3 E-1	USEPA, 2008	2.3 E-1	Chronic	3.0 E-2	NCEA	3.0 E-2	Chronic	1.0	NA		
1,4-Dioxane	123-91-1	8.6 E-1	OEHHA, 2008	8.6 E-1	Chronic	NA		NA		1.0	NA		
2,2,4-Trimethylpentane	540-84-1	2.9 E-2	surrogate: xylene	2.9 E-2	Chronic	2.0 E-1	surrogate: xylene	2.0 E-1	Chronic	1.0	NA		
2,3,7,8-TCDD TEQ	1746-01-6	NA		NA		NA		NA		1.0	0.03		
2-Butanone (Methyl ethyl ke	78-93-3	1.4 E+0	USEPA, 2008	1.4 E+0	Chronic	6.0 E-1	USEPA, 2008	6.0 E-1	Chronic	1.0	NA		
2-Hexanone	591-78-6	8.6 E-1	PA 2008; MIBK Surrog	9.0 E-1	Chronic	8.0 E-2	PA, 1997; MIBK as surrog	8.0 E-2	Chronic	1.0	NA		
2-Methylnaphthalene		NA		NA		4.0 E-3	USEPA, 2008	4.0 E-3	Chronic	1.0	0.13		
2-Propanol	67-63-0	2.6 E-3	R9PRG	2.6 E-3	Chronic	1.0 E-1	A 2007c, butanol as surro	1.0 E-1	Chronic	1.0	NA		
4,4'-DDD	72-54-8	NA		NA		NA		NA		1.0	0.03		
4,4'-DDE	72-55-9	NA		NA		NA		NA		1.0	0.03		
4,4'-DDT	50-29-3	5.0 E-4	route-to-route	5.0 E-4	Chronic	5.0 E-4	USEPA, 2008	5.0 E-4	Chronic	1.0	0.03		
4-Ethyltoluene	622-96-8	2.9 E-2	xylene surrogate	2.9 E-2	Chronic	2.0 E-1	xylene surrogate	2.0 E-1	Chronic	1.0	NA		
4-Methyl-2-pentanone		8.6 E-1	USEPA, 2008	8.6 E-1	Chronic	8.0 E-2	USEPA, 2008	8.0 E-2	Chronic	1.0	NA		
4-Methylphenol	106-44-5	5.0 E-3	route-to-route	5.0 E-3	Chronic	5.0 E-3	USEPA, 1997b	5.0 E-3	Chronic	1.0	0.10		
Acetone	67-64-1	9.0 E-1	route-to-route	9.0 E-1	Chronic	9.0 E-1	USEPA, 2008	9.0 E-1	Chronic	1.0	NA		
Acrolein	107-02-8	5.7 E-6	USEPA, 2008	5.7 E-6	Chronic	5.0 E-4	USEPA, 2008	5.0 E-4	Chronic	1.0	NA		
Aldrin	309-00-2	3.0 E-5	route-to-route	3.0 E-5	Chronic	3.0 E-5	USEPA, 2008	3.0 E-5	Chronic	1.0	0.04		
alpha-BHC	319-84-6	NA		NA		NA		NA		1.0	0.04		
Alpha-chlordane	57-74-9	2.0 E-4	USEPA, 2008	2.0 E-4	Chronic	5.0 E-4	USEPA, 2008	5.0 E-4	Chronic	1.0	0.04		
Anthracene		3.0 E-1	route-to-route	3.0 E-1	Chronic	3.0 E-1	USEPA, 2008	3.0 E-1	Chronic	1.0	0.13		
Benzene	71-43-2	8.6 E-3	USEPA, 2008	8.6 E-3	Chronic	4.0 E-3	USEPA, 2008	4.0 E-3	Chronic	1.0	NA		
Benzo (a) anthracene	56-55-3	NA		NA		NA		NA		1.0	0.13		
Benzo (a) pyrene	50-32-8	NA		NA		NA		NA		1.0	0.13		
Benzo (b & k) fluoranthene (	205-99-2	NA		NA		NA		NA		1.0	0.13		
Benzo (ghi) perylene	191-24-2	3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13		
Benzo(a)anthracene	56-55-3	NA		NA		NA		NA		1.0	0.13		
Benzo(b)fluoranthene	205-99-2	NA		NA		NA		NA	Chronic	1.0	0.13		
Benzo(k)fluoranthene	207-08-9	NA		NA		NA		NA	Chronic	1.0	0.13		
bis(2-Ethylhexyl)phthalate	117-81-7	2.0 E-2	route-to-route	2.0 E-2	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	0.10		
Bromodichloromethane	75-27-4	2.0 E-2	route-to-route	2.0 E-2	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	NA		
Bromoform		2.0 E-2	route-to-route	2.0 E-2	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	NA		
Carbon disulfide	75-15-0	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0 E-1	USEPA, 2008	1.0 E-1	Chronic	1.0	NA		
Carbon tetrachloride	56-23-5	1.1 E-2	OEHHA, 2008	1.1 E-2	Chronic	7.0 E-4	USEPA, 2008	7.0 E-4	Chronic	1.0	NA		
Chloroethane	75-00-3	2.9 E+0	USEPA 2008	2.9 E+0	Chronic	4.0 E-1	NCEA	4.0 E-1	Chronic	1.0	NA		
Chloroform	67-66-3	1.3 E-2	PPRTV	1.3 E-2	Chronic	1.0 E-2	USEPA, 2008	1.0 E-2	Chronic	1.0	NA		
Chrysene	218-01-9	NA		NA		NA		NA	Chronic	1.0	0.13		

Chemical	CAS Number	Inhalation - Chronic Value[5]	Inhalation - Chronic Reference	Inhalation - Subchronic Value[5]	Inhalation - Subchronic Reference	Oral[(1)] - Chronic Value[5]	Oral[(1)] - Chronic Reference	Oral[(1)] - Subchronic		Oral BIO	Dermal ABS[(2)]	% GI ABS	Dermal Chronic Value
cis-1,2-Dichloroethene	156-59-2	1.0 E-2	route-to-route	1.0 E-2	Chronic	1.0 E-2	PPRTV	1.0 E-2	Chronic	1.0	NA		
Cumene	98-82-8	1.1 E-1	USEPA 2008	1.1 E-1	Chronic	1.0 E-1	USEPA 2008	1.0 E-1	Chronic	1.0	NA		
Cyclohexane	110-82-7	1.7 E+0	USEPA, 2008	1.7 E+0	Chronic	1.7 E+0	route-to-route	1.7 E+0	Chronic	1.0	NA		
delta-BHC	319-86-8	3.0 E-4	route-to-route	3.0 E-4	Chronic	3.0 E-4	EPA, 2008 Lindane surrog	3.0 E-4	Chronic	1.0	0.04		
Dibenz (a,h) anthracene	53-70-3	NA		NA		NA		NA	Chronic	1.0	0.13		
Dibromochloromethane		2.0 E-2	route-to-route	2.0 E-2	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	NA		
Dichlorodifluoromethane		5.7 E-2	USEPA, 1997	5.7 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Dieldrin	60-57-1	5.0 E-5	route-to-route	5.0 E-5	Chronic	5.0 E-5	USEPA, 2008	5.0 E-5	Chronic	1.0	0.04		
Di-n-butyl phthalate	84-74-2	1.0 E-1	route-to-route	1.0 E-1	Chronic	1.0 E-1	USEPA 2008	1.0 E-1	Chronic	1.0	0.1		
Endosulfan I	115-29-7	6.0 E-3	route-to-route	6.0 E-3	Chronic	6.0 E-3	USEPA, 2008	6.0 E-3	Chronic	1.0	0.10		
Endosulfan II	115-29-7	6.0 E-3	route-to-route	6.0 E-3	Chronic	6.0 E-3	USEPA, 2008	6.0 E-3	Chronic	1.0	0.10		
Endrin	72-20-8	3.0 E-4	route-to-route	3.0 E-4	Chronic	3.0 E-4	USEPA, 2008	3.0 E-4	Chronic	1.0	0.04		
Ethanol	64-17-5	5.0 E-1	route-to-route	5.0 E-1	Chronic	5.0 E-1	USEPA 2008	5.0 E-1	Chronic	1.0	NA		
Ethylbenzene	100-41-4	2.9 E-1	USEPA 2008	2.9 E-1	Chronic	1.0 E-1	USEPA 2008	1.0 E-1	Chronic	1.0	NA		
Fluoranthene	206-44-0	4.0 E-2	route-to-route	4.0 E-2	Chronic	4.0 E-2	USEPA 2008	4.0 E-2	Chronic	1.0	0.13		
Fluorene		4.0 E-2	route-to-route	4.0 E-2	Chronic	4.0 E-2	USEPA, 2008	4.0 E-2	Chronic	1.0	0.13		
Freon 11	75-69-4	5.7 E-2	USEPA, 1997	5.7 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Freon 113	76-13-1	8.6 E+0	USEPA, 1997	8.6 E+0	Chronic	3.0 E+1	USEPA, 2008	3.0 E+1	Chronic	1.0	NA		
Freon 12	75-71-8	5.7 E-2	USEPA 1997b	5.7 E-2	Chronic	2.0 E-1	USEPA 2008	2.0 E-1	Chronic	1.0	NA		
gamma-BHC (Lindane)	58-89-9	3.0 E-4	route-to-route	3.0 E-4	Chronic	3.0 E-4	USEPA, 2008	3.0 E-4	Chronic	1.0	0.04		
gamma-chlordane	57-74-9	2.0 E-4	USEPA, 2008	2.0 E-4	Chronic	5.0 E-4	USEPA, 2008	5.0 E-4	Chronic	1.0	0.04		
Heptachlor	76-44-8	5.0 E-4	route-to-route	5.0 E-4	Chronic	5.0 E-4	USEPA, 2008	5.0 E-4	Chronic	1.0	0.04		
Heptachlor epoxide	1024-57-3	1.3 E-5	route-to-route	1.3 E-5	Chronic	1.3 E-5	USEPA, 2008	1.3 E-5	Chronic	1.0	0.04		
Heptane	142-82-5	2.0 E-1	Hexane as surrogate	2.0 E-1	Chronic	1.1 E+1	Hexane as surrogate	1.1 E+1	Chronic	1.0	0.1		
Hexachlorobutadiene		1.0 E-3	route-to-route	1.0 E-3	Chronic	1.0 E-3	PPRTV	1.0 E-3	Chronic	1.0	NA		
Hexane	110-54-3	2.0 E-1	USEPA 1997b	2.0 E-1	Chronic	1.1 E+1	R9PRG	1.1 E+1	Chronic	1.0	0.1		
Hexanedioic Acid, dioctyles	103-23-1	6.0 E-1	route-to-route	6.0 E-1	Chronic	6.0 E-1	USEPA 2008	6.0 E-1	Chronic	1.0	0.1		
Indeno(1,2,3-cd)pyrene	193-39-5	NA		NA		NA		NA	Chronic	1.0	0.13		
m,p-Xylene	1330-20-7	2.9 E-2	USEPA, 2008	2.9 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Methyl tert-butyl ether	1634-04-4	8.6 E-1	USEPA 2008	8.6 E-1	Chronic	8.6 E-1	route-to-route	8.6 E-1	Chronic	1.0	NA		
Methylene chloride	75-09-2	8.6 E-1	USEPA 1997b	8.6 E-1	Chronic	6.0 E-2	USEPA, 2008	6.0 E-2	Chronic	1.0	NA		
m-Xylene		2.9 E-2	USEPA, 2008	2.9 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Naphthalene	91-20-3	8.6 E-4	USEPA, 2008	8.6 E-4	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	0.13		
n-Butylbenzene		1.0 E-2	route-to-route	1.0 E-2	Chronic	1.0 E-2	PPRTV	1.0 E-2	Chronic	1.0	NA		
N-Nitrosodimethylamine	62-75-9	8.0 E-6	route-to-route	8.0 E-6	Chronic	8.0 E-6	PPRTV	8.0 E-6	Chronic	1.0	0.10		
o-Xylene	95-47-6	2.9 E-2	USEPA 2008	2.9 E-2	Chronic	2.0 E-1	USEPA 2008	2.0 E-1	Chronic	1.0	NA		
PCB-1248	12672-29-6	2.0 E-5	route-to-route	2.0 E-5	Chronic	2.0 E-5	USEPA 2008	2.0 E-5	Chronic	1.0	0.14		
PCB-1254	11097-69-1	2.0 E-5	route-to-route	2.0 E-5	Chronic	2.0 E-5	USEPA, 2008	2.0 E-5	Chronic	1.0	0.14		
PCB-1260	11096-82-5	2.0 E-5	route-to-route	2.0 E-5	Chronic	2.0 E-5	USEPA, 2008	2.0 E-5	Chronic	1.0	0.14		
Pendimethalin (Prowl)	40487-42-1	4.0 E-2	route-to-route	4.0 E-2	Chronic	4.0 E-2	USEPA 2008	4.0 E-2	Chronic	1.0	0.10		
Pentachlorophenol	87-86-5	3.0 E-2	route-to-route	3.0 E-2	Chronic	3.0 E-2	USEPA 2008	3.0 E-2	Chronic	1.0	0.10		
Phenanthrene	85-01-8	3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	3.0 E-2	pyrene as surrogate	3.0 E-2	Chronic	1.0	0.13		
Phenol	108-95-2	5.7 E-2	OEHHA, 2008	5.7 E-2	Chronic	3.0 E-1	USEPA, 2008	3.0 E-1	Chronic	1.0	0.10		
p-Isopropyltoluene		NA		NA		NA		NA		1.0	NA		
Propylbenzene	103-65-1	1.0 E-2	route-to-route	1.0 E-2	Chronic	1.0 E-2	NCEA	1.0 E-2	Chronic	1.0	NA		
p-Xylene		2.9 E-2	USEPA, 2008	2.9 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Pyrene		3.0 E-2	USEPA, 2008	3.0 E-2	Chronic	3.0 E-2	USEPA, 2008	3.0 E-2	Chronic	1.0	0.13		
sec-Butylbenzene		1.0 E-2	route-to-route	1.0 E-2	Chronic	1.0 E-2	PPRTV	1.0 E-2	Chronic	1.0	NA		
Styrene	100-42-5	2.6 E-1	OEHHA, 2008	2.6 E-1	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Tetrachloroethene	127-18-4	1.0 E-2	route-to-route	1.0 E-2	Chronic	1.0 E-2	USEPA, 2008	1.0 E-2	Chronic	1.0	NA		
Tetrahydrofuran	109-99-9	8.6 E-2	NCEA	8.6 E-2	Chronic	2.0 E-1	NCEA	2.0 E-1	Chronic	1.0	NA		
Toluene	108-88-3	8.6 E-2	OEHHA 2008	8.6 E-2	Chronic	8.0 E-2	USEPA 2008	8.0 E-2	Chronic	1.0	NA		
trans-1,2-Dichloroethene		1.7 E-2	PPRTV	1.7 E-2	Chronic	2.0 E-2	USEPA, 2008	2.0 E-2	Chronic	1.0	NA		
Trichloroethene	79-01-6	1.7 E-1	OEHHA, 2008	1.7 E-1	Chronic	3.0 E-4	NCEA	3.0 E-4	Chronic	1.0	NA		
Trichlorofluoromethane		5.7 E-2	USEPA, 1997	5.7 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		
Vinyl Chloride	75-01-4	2.9 E-2	USEPA 2008	2.9 E-2	Chronic	3.0 E-3	USEPA 2008	3.0 E-3	Chronic	1.0	NA		
Xylenes (total)	1330-20-7	2.9 E-2	USEPA, 2008	2.9 E-2	Chronic	2.0 E-1	USEPA, 2008	2.0 E-1	Chronic	1.0	NA		

Source: ERM, 2011

All toxicity values in units of mg/Kg-day

Notes and Key:

ABS = Dermal absorption efficiency

BIO = Bioavailability

mg/kg = Milligrams per kilogram

NA = Not applicable. Data is either not applicable for this chemical (*e.g.*, not carcinogenic) or not available.

NCEA = National Center for Environmental Assessment (USEPA), as referenced in Multi-Region PRG Table (USEPA 2008b).

PPRTV = Provisional Peer Reviewed Toxicity Values, National Center for Environmental Assessment (USEPA), as referenced in USEPA 2008b.

(1) Only cadmium required the adjustment of the oral toxicity criteria for the dermal soil exposure pathway (USEPA 2004e).

(2) Dermal absorption factors obtained from USEPA 2004e.

(3) Total chromium is assessed using Cr(III) toxicity criteria.

(4) The provisional RfD is based upon TWA correction of occupational data for application to non-occupational exposures. For the construction worker, the occupational data (with the TWA correction removed) are utilized with the application of the same uncertainty factors utilized to derive the provisional RfD.

(5) All toxicity values in units of mg/Kg-day

U.S. EPA REGION IX
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TABLE 2-4
Noncancer Toxicity Criteria
Operable Unit 6 Record of Decision

Chemical	CAS Number	Inhalation Value[4]	Inhalation Reference	Oral[(1)] Value[4]	Oral[(1)] Reference	Cancer Weight of Evidence	Oral BIO	Dermal ABS[(2)]
Aluminum	7429-90-5	NA		NA		D	1.0	NA
Antimony	7440-36-0	NA		NA		D	1.0	NA
Arsenic	7440-38-2	1.5 E+1	USEPA, 2008	9.45 E+0	OEHHA, 2008	A	0.6	0.03
Barium	7440-39-3	NA		NA		D	1.0	NA
Beryllium	7440-41-7	8.4 E+0	OEHHA, 2008	NA		B1	1.0	NA
Boron		NA		NA			1.0	NA
Cadmium	7440-43-9	1.5 E+1	OEHHA 2008	NA		B1	1.0	0.001
Chromium	16065-83-1	NA		NA		D	1.0	NA
Chromium VI	18540-29-9	5.1 E+2	OEHHA 2008	NA		A	1.0	NA
Cobalt	7440-48-4	9.8 E+0	PPRTV	NA		D	1.0	NA
Copper	7440-50-8	NA		NA		D	1.0	NA
Iron	7439-89-6	NA		NA		D	1.0	NA
Lead	7439-92-1	NA		NA		B2	0.44	NA
Lithium	7439-93-2	NA		NA		D	1.0	NA
Manganese	7439-96-5	NA		NA		D	1.0	NA
Mercury	7439-97-6	NA		NA		D	1.0	NA
Molybdenum	7439-98-7	NA		NA		D	1.0	NA
Nickel	7440-02-0	NA		NA		D	1.0	NA
Nitrate as NO3		NA		NA		D	1.0	NA
Nitrate plus Nitrite (as N)		NA		NA		D	1.0	NA
Nitrite as NO2		NA		NA		D	1.0	NA
Perchlorate	14797-73-0	NA		NA		D	1.0	NA
Selenium	7782-49-2	NA		NA		D	1.0	NA
Silver	7440-22-4	NA		NA		D	1.0	NA
Strontium		NA		NA		D	1.0	NA
Thallium	7446-18-6	NA		NA		D	1.0	NA
Titanium	7440-32-6	NA		NA		D	1.0	NA
Vanadium	7440-62-2	NA		NA		D	1.0	NA
Zinc	7440-66-6	NA		NA		D	1.0	NA
1,1,1-Trichloroethane	71-55-6	NA		NA		D	1.0	NA
1,1,2,2-Tetrachloroethane	79-34-5	2.0 E-1	OEHHA 2008	2.7 E-1	OEHHA 2008	C	1.0	NA
1,1,2-Trichloroethane	79-00-5	5.7 E-2	OEHHA 2008	7.2 E-2	OEHHA 2008	C	1.0	NA
1,1-Dichloroethane	75-34-3	5.7 E-3	OEHHA 2008	5.7 E-3	OEHHA 2008	C	1.0	NA
1,1-Dichloroethene	75-35-4	NA		NA		D	1.0	NA
1,2,4-Trimethylbenzene	95-63-6	NA		NA		D	1.0	NA
1,2-Dichlorobenzene		NA		NA		D	1.0	NA
1,2-Dichloroethane	107-06-2	9.1 E-2	USEPA 2008	9.1 E-2	USEPA 2008	B2	1.0	NA
1,2-Dichloroethene (cis/trans)		NA		NA		D	1.0	NA
1,3,5-Trimethylbenzene	108-67-8	NA		NA		D	1.0	NA
1,3-Butadiene	106-99-0	6.0 E-1	OEHHA 2008	3.4 E+0	OEHHA 2008	B2	1.0	NA
1,4-Dichlorobenzene		2.2 E-2	NCEA	2.4 E-2	USEPA, 1997		1.0	NA
1,4-Dioxane	123-91-1	2.7 E-2	OEHHA 2008	2.7 E-2	OEHHA 2008	B2	1.0	0.1
2,2,4-Trimethylpentane	540-84-1	NA		NA		D	1.0	NA
2,3,7,8-TCDD TEQ	1746-01-6	1.5 E+5	USEPA, 1997	1.5 E+5	USEPA, 1997		1.0	0.03
2-Butanone (Methyl Ethyl Ketone)	78-93-3	NA		NA		D	1.0	NA
2-Hexanone	591-78-6	NA		NA		D	1.0	NA
2-Methylnaphthalene		NA		NA		NA	1.0	0.13
2-Propanol	67-63-0	NA		NA		D	1.0	NA
4,4'-DDD	72-54-8	3.4 E-1	OEHHA, 2008	3.4 E-1	OEHHA, 2008	B2	1.0	0.03
4,4'-DDE	72-55-9	3.4 E-1	OEHHA, 2008	3.4 E-1	OEHHA, 2008	B2	1.0	0.03
4,4'-DDT	50-29-3	3.4 E-1	OEHHA, 2008	3.4 E-1	OEHHA, 2008	B2	1.0	0.03
4-Ethyltoluene	622-96-8	NA		NA		D	1.0	NA
4-Methyl-2-pentanone	108-10-1	NA		NA		D	1.0	NA
Acetone	67-64-1	NA		NA		D	1.0	NA
Acrolein	107-02-8	NA		NA		D	1.0	NA
Aldrin	309-00-2	1.7 E+1	OEHHA, 2008	1.7 E+1	OEHHA, 2008	B2	1.0	0.04
alpha-BHC	319-84-6	6.3 E+0	USEPA, 2008	6.3 E+0	USEPA, 2008	B2	1.0	0.04
Alpha-chlordane	57-74-9	1.2 E+0	OEHHA, 2008	1.3 E+0	OEHHA, 2008	B2	1.0	0.04
Anthracene		NA		NA		D	1.0	0.13
Benzene	71-43-2	1.0 E-1	OEHHA 2008	1.0 E-1	OEHHA 2008	A	1.0	NA
Benzo (a) anthracene	56-55-3	7.3 E-1	route-to-route	7.3 E-1	NCEA	B2	1.0	0.13
Benzo (a) pyrene	50-32-8	3.9 E+0	OEHHA, 2008	1.2 E+1	OEHHA, 2008	B2	1.0	0.13
Benzo (b & k) fluoranthene (total)	205-99-2	3.9 E-1	OEHHA, 2008	1.2 E+0	OEHHA, 2008	B2	1.0	0.13
Benzo (b) fluoranthene	205-99-2	3.9 E-1	OEHHA, 2008	1.2 E+0	OEHHA, 2008	B2	1.0	0.13
Benzo(a)pyrene	50-32-8	3.9 E+0	OEHHA 2008	1.2 E+1	OEHHA 2008	B2	1.0	0.13
Benzo(b&k)fluoranthene (total)		3.9 E-1	OEHHA 2008	1.2 E+0	OEHHA 2008	B2	1.0	0.13
Benzo(b)fluoranthene	205-99-2	3.9 E-1	OEHHA 2008	1.2 E+0	OEHHA 2008	B2	1.0	0.13
Benzo(ghi)perylene	191-24-2	NA		NA		D	1.0	0.13
Benzo(k)fluoranthene	207-08-9	3.9 E-1	OEHHA 2008	1.2 E+0	OEHHA 2008	B2	1.0	0.13
bis(2-Ethylhexyl)phthalate	117-81-7	1.4 E-2	route-to-route	1.4 E-2	USEPA, 2008	B2	1.0	0.1
Bromodichloromethane	75-27-4	1.3 E-1	OEHHA 2008	1.3 E-1	OEHHA 2008	B2	1.0	NA
Bromoform		3.9 E-3	USEPA, 2008	7.9 E-3	USEPA, 2008	B2	1.0	NA
Carbon Disulfide	75-15-0	NA		NA		D	1.0	NA
Carbon Tetrachloride	56-23-5	1.5 E-1	OEHHA 2008	1.5 E-1	OEHHA 2008	B2	1.0	NA
Chloroethane	75-00-3	NA		NA		D	1.0	NA
Chloroform	67-66-3	8.1 E-2	USEPA 2008	3.1 E-2	OEHHA 2008	B2	1.0	NA
Chrysene	218-01-9	3.9 E-2	OEHHA 2008	1.2 E-1	OEHHA 2008	B2	1.0	0.13
cis-1,2-Dichloroethene	60-57-1	NA		NA		D	1.0	NA
Cumene	98-82-8	NA		NA		D	1.0	NA
Cyclohexane	110-82-7	NA		NA		D	1.0	NA
delta-BHC	319-86-8	1.3 E+0	route-to-route	1.3 E+0	2008 Lindane as surrogate		1.0	0.04
Dibenz(a,h)anthracene	53-70-3	4.1 E+0	OEHHA 2008	7.3 E+0	OEHHA 2008	B2	1.0	0.13
Dibromochloromethane	124-48-1	9.4 E-2	OEHHA 2008	9.4 E-2	OEHHA 2008	C	1.0	NA
Dichlorodifluoromethane		NA		NA		D	1.0	NA
Dieldrin	60-57-1	1.6 E+1	OEHHA, 2008	1.6 E+1	OEHHA, 2008	B2	1.0	0.04
Di-n-butyl phthalate	84-74-2	NA		NA		D	1.0	0.1
Endosulfan I	115-29-7	NA		NA		D	1.0	NA
Endosulfan II	115-29-7	NA		NA		D	1.0	0.1
Endrin	72-20-8	NA		NA		D	1.0	0.04
Ethanol	64-17-5	NA		NA		D	1.0	NA
EthylBenzene		8.7 E-3	OEHHA, 2008	1.1 E-2	OEHHA, 2008	D/B2	1.0	NA
Fluoranthene	206-44-0	NA		NA		D	1.0	0.13
Fluorene		NA		NA		D	1.0	0.13
Freon 11	75-69-4	NA		NA		D	1.0	NA
Freon 113	76-13-1	NA		NA		D	1.0	NA
Freon 12	75-71-8	NA		NA		D	1.0	NA
gamma-BHC (Lindane)	58-89-9	1.3 E+0	route-to-route	1.3 E+0	USEPA 1997b	B2	1.0	0.04
gamma-chlordane	57-74-9	1.2 E+0	OEHHA, 2008	1.3 E+0	OEHHA, 2008	B2	1.0	0.04
Heptachlor	76-44-8	4.6 E+0	USEPA, 2008	4.5 E+0	USEPA, 2008	B2	1.0	0.04
Heptachlor epoxide	1024-57-3	9.1 E+0	USEPA, 2008	9.1 E+0	USEPA, 2008	B2	1.0	0.04
Heptane	142-82-5	NA		NA		D	1.0	NA
Hexachlorobutadiene		7.8 E-2	USEPA, 2008	7.8 E-2	USEPA, 2008	C	1.0	NA
Hexane	110-54-3	NA		NA		D	1.0	NA
Hexanedioic Acid, dioctylester	103-23-1	1.2 E-3	route-to-route	1.2 E-3		C	1.0	0.1
Indeno(1,2,3-cd)pyrene	193-39-5	3.9 E-1	OEHHA 2008	1.2 E+0	OEHHA 2008	B2	1.0	0.13
m,p-Xylene	1330-20-7	NA		NA		D	1.0	NA
Methyl tert-butyl ether	1634-04-4	9.1 E-4	OEHHA 2008	1.8 E-3	OEHHA 2008		1.0	NA
Methylene chloride	75-09-2	3.5 E-3	OEHHA 2008	1.4 E-2	OEHHA 2008	B2	1.0	NA
4-Methylphenol	106-44-5	NA		NA		C	1.0	0.1
m-Xylene		NA		NA		D	1.0	NA
Naphthalene	91-20-3	1.2 E-1	OEHHA 2008	NA		D	1.0	0.13
n-Butylbenzene		NA		NA		D	1.0	NA
N-Nitrosodimethylamine	62-75-9	4.9 E+1	USEPA, 2008	5.1 E+1	USEPA, 2008	B2	1.0	0.1
o-Xylene	95-47-6	NA		NA		D	1.0	NA
PCB-1248	12672-29-6	2.0 E+0	OEHHA 2008	5.0 E+0	OEHHA 2008	B2	1.0	0.14
PCB-1254	11097-69-1	2.0 E+0	OEHHA 2008	5.0 E+0	OEHHA 2008	B2	1.0	0.14
PCB-1260	11096-82-5	2.0 E+0	OEHHA, 2008	5.0 E+0	OEHHA, 2008	B2	1.0	0.14
Pendimethalin (Prowl)	40487-42-1	NA		NA		D	1.0	0.1
Pentachlorophenol	87-86-5	1.8 E-2	OEHHA 2008	1.2 E-1	USEPA, 2008	B2	1.0	0.1
Phenanthrene	85-01-8	NA		NA		D	1.0	0.13
Phenol	108-95-2	NA		NA		D	1.0	0.1
p-Isopropyltoluene		NA		NA		NA	1.0	NA
Propylbenzene	103-65-1	NA		NA		D	1.0	NA
p-Xylene		NA		NA		D	1.0	NA
Pyrene	129-00-0	NA		NA		D	1.0	0.13
sec-Butylbenzene		NA		NA		D	1.0	NA
Styrene	100-42-5	NA		NA		D	1.0	NA
Tetrachloroethene	127-18-4	2.1 E-2	OEHHA, 2008	5.4 E-1	OEHHA, 2008	B2	1.0	NA
Tetrahydrofuran	109-99-9	6.8 E-3	NCEA	7.6 E-3	NCEA	B2	1.0	NA
Toluene	108-88-3	NA		NA		D	1.0	NA
trans-1,2-Dichloroethene	156-60-5	NA		NA		D	1.0	NA
Trichloroethene	79-01-6	7.0 E-3	OEHHA, 2008	1.3 E-2	OEHHA, 2008	B2	1.0	NA
Trichlorofluoromethane		NA		NA		D	1.0	NA
Vinyl chloride		2.7 E-1	OEHHA, 2008	1.5 E+0	USEPA, 2008	A	1.0	NA
Xylenes (total)	1330-20-7	NA		NA		D	1.0	NA

Notes and Key:

NA = Not applicable. Data is either not applicable for this chemical (*i.e.*, not carcinogenic) or not available.

Cancer weight of evidence classification:

A - human carcinogen

B1/B2 - probable human carcinogen

C - possible human carcinogen

D - not classifiable as to human carcinogenicity

ABS = dermal absorption efficiency

BIO = bioavailability

mg/kg = Milligrams per kilogram

NCEA = National Center for Environmental Assessment (USEPA), as referenced in Multi-Region PRG Table (USEPA 2008b).

(1) No COPCs required oral toxicity criteria adjustment for the dermal soil exposure pathway (USEPA 2004e).

(2) Dermal absorption factors obtained from USEPA 2004e.

(3) Carcinogenic via inhalation only.

Source: ERM, 2011

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TABLE 2-5
Carcinogenic Toxicity Criteria
Operable Unit 6 Record of Decision

Table 2-6: Summary of Risks from Exposure to Surface Water by Exposure Area

Exposure Area	Residential						
	Hazard Index		Lead Concentrations in Surface Water (µg/L)		ILCR		Contaminant of Concern
	Min	Max	Min	Max	Min	Max	
Administration Area (East and West)	0.0000097	0.015	0.2	14	4E-08	3E-07	None
West Lakes, Line 2, Line 5 North Area	0.0006	0.015	0.49	140	8E-09	2E-06	BEHP
Chemical Plant 2	0.003	0.08	0.18	28	4E-07	2E-06	None

Table 2-7: Summary of Risks from Exposure to Groundwater by Exposure Area

Exposure Area	Domestic Use						Vapor Intrusion											
							Residential						Commercial					
	Hazard Index		Primary Contributors	ILCR		Primary Contributors	Hazard Index		Number of Locations that Exceed 1	ILCR		Number of Locations that Exceed 1E-06	Hazard Index		Number of Locations that Exceed 1	ILCR		Number of Locations that Exceed 1E-06
	Min	Max		Min	Max		Min	Max		Min	Max		Min	Max		Min	Max	
Administration Area (East and West)																		
Perched (Layer Y)	1.5	4,700	VOCs, metals, perchlorate	6E-05	1E-01	VOCs, PAHs, PCBs, BEHP, NDMA	0.015	30	1 out of 8 locations	8E-06	1E-03	8 out of 9 locations	0.005	5	1 out of 8 locations	4E-07	3E-04	7 out of 9 locations
First Water Bearing Zone (Layer S)	0.45	770	VOCs, metals, perchlorate	1E-06	7E-02	VOCs, PAHs, BEHP, arsenic, NDMA	0.004	46	7 out of 18 locations	1E-07	3E-03	17 out of 20 locations	0.002	7	3 out of 18 locations	3E-08	8E-04	15 out of 20 locations
Layer C	0.2	2,100	VOCs, metals, perchlorate	5E-07	4E-03	VOCs, PCBs, BEHP, NDMA												
Layer D	0.002	930	VOCs, metals, perchlorate	6E-07	2E-03	VOCs, BEHP, arsenic												
Layer E	0.005	6	VOCs, metals	2E-05	2E-05	TCE												
Layer F	0.002	0.004	None	NA	NA	NA												
West Lakes, Line 2, Line 5 North Area																		
First Water Bearing Zone (Layer S)	1	740	PCE, TCE, perchlorate	9E-06	2E-03	VOCs, NDMA	0.0008	0.7	None	5E-07	1E-04	3 out of 4 samples	0.0003	0.1	None	1E-07	2E-05	2 out of 4 samples
Layer C	50	120	VOCs, perchlorate	2E-05	2E-05	Arsenic, VOCs												
Layer D	0.4	16	Perchlorate, TCE	1E-06	4E-05	TCE, NDMA												
Layer E	0.2	2	TCE	1E-06	7E-06	TCE												
Layer F	0.3	0.6	None	5E-06	5E-06	TCE, NDMA												
Chemical Plant 2																		
Perched (Layer Y)	0.015	100	VOCs, metals, perchlorate	1E-06	3E-04	VOCs	0.003	0.085	None	1E-07	2E-05	5 out of 8 samples	0.000009	0.01	None	3E-08	4E-06	1 out of 8 samples
First Water Bearing Zone (Layer S)	0.04	1,000	VOCs, metals, perchlorate	3E-05	2E-02	VOCs, BEHP, NDMA	0.005	4	1 out of 18 samples	9E-07	1E-04	14 out of 18 samples	0.0007	0.6	None	2E-07	3E-05	6 out of 18 samples
Layer A	3	120	VOCs, metals, perchlorate	8E-05	2E-03	VOCs, NDMA												
Layer B	0.3	25	VOCs, metals, perchlorate	1E-06	1E-04	VOCs, arsenic, pesticides												
Layer C	0.005	5,100	VOCs, metals, perchlorate	2E-07	2E-02	VOCs, BEHP, NDMA												
Layer D	0.4	3,700	VOCs, metals, perchlorate	1E-06	1E-02	VOCs, NDMA												
Layer E	2	2,200	VOCs, metals, perchlorate, acrolein	1E-05	3E-04	VOCs, BEHP												

Note:
NC = no carcinogenic compounds of interest in a sample

Table 2-8: Summary of Risks from Exposure to Soil and Sediment by Exposure Area

Exposure Area	Residential								Construction Worker						Commercial/Industrial Worker								Recreational					
	Hazard Index		Primary Contributors	Lead Concentrations in Soil (mg/kg)		ILCR		Primary Contributors	Hazard Index		Primary Contributors	ILCR		Primary Contributors	Hazard Index		Primary Contributors	Lead Concentrations in Soil (mg/kg)		ILCR		Primary Contributors	Hazard Index		Primary Contributors	ILCR		Primary Contributors
	Min	Max		Min	Max	Min	Max		Min	Max		Min	Max		Min	Max		Min	Max	Min	Max		Min	Max		Min	Max	
Soil																												
Administration Area (East)	0.00005	42	PCBs and iron	1.9	379	3E-10	2E-03	PCBs, PAHs, VOCs	0.000013	11	PCBs and iron	7E-11	7E-05	PCBs, PAHs	0.000004	4.4	PCBs	1.9	379	1E-10	7E-04	PCBs, PAHs, VOCs	NA	NA	NA	NA	NA	NA
Administration Area (West)	2E-07	4.3	Metals, PCBs	2	640	2E-10	4E-05	PCBs, PAHs, VOCs, Cr6	4E-07	33	Metals, PCBs	3E-11	5E-04	Cadmium, Cr6	0.0000002	0.3	None	2	640	8E-11	2E-05	PCBs, PAHs, Cr6	NA	NA	NA	NA	NA	NA
Line 2	1E-07	1	Aluminum, iron	NA	NA	1E-09	1E-05	PAHs	3E-07	3	Aluminum, nickel	4E-11	4E-07	None	0.0000001	0.1	None	NA	NA	4E-10	4E-06	Benzo(b&k)-fluoranthene	NA	NA	NA	NA	NA	NA
Line 5 North	0.00003	0.07	None	NA	NA	2E-10	5E-06	Benzo(a)pyrene	0.00007	0.02	None	2E-09	2E-07	None	0.00002	0.006	None	NA	NA	8E-11	1E-06	None	NA	NA	NA	NA	NA	NA
West Lakes	1E-07	0.03	None	NA	NA	1E-09	5E-07	None	2E-07	0.009	None	4E-11	1E-08	None	0.000001	0.004	None	NA	NA	3E-10	1E-07	None	NA	NA	NA	NA	NA	NA
Chemical Plant 2	1E-07	110	Metals, PCBs, pendimethalin	0.5	295	3E-10	1E-03	PAHs, pesticides, PCBs	2E-07	28	Metals, PCBs, pendimethalin	2E-11	4E-05	PCBs	0.00000009	11	PCBs, pendimethalin	0.5	295	2E-10	4E-04	Benzo(a)pyrene, PCBs	NA	NA	NA	NA	NA	NA
Magazine Area	3E-07	0.00007	None	NA	NA	2E-09	9E-09	None	7E-07	0.00002	None	7E-11	3E-10	None	0.000003	0.000007	None	NA	NA	7E-10	3E-09	None	NA	NA	NA	NA	NA	NA
Open Space Areas 1,2,3, and 4	0.00002	0.0002	None	NA	NA	NC	NC	None	0.000045	0.000045	None	NC	NC	None	0.000015	0.000015	None	NA	NA	NC	NC	None	NA	NA	NA	NA	NA	NA
Open Space Areas 5 and 7	0.00001	0.0001	None	NA	NA	NC	NC	None	0.00003	0.00003	None	NC	NC	None	0.00001	0.00001	None	NA	NA	NC	NC	None	NA	NA	NA	NA	NA	NA
Sediment																												
Buffalo Creek	0.00004	1	None	5.6	72	3E-10	1E-05	PCB	0.00009	11	Manganese	8E-12	4E-07	None	0.00003	0.11	None	5.6	72	6E-11	4E-06	PCBs	0.00000003	0.1	None	6E-06	2E-05	Arsenic, PCBs

Notes:

Shaded values exceed target levels. Refer to Tables 2-2, 2-3, and Appendix B for target levels.
Cr6 = hexavalent chromium
NA = not applicable
NC = no carcinogenic compounds of interest in a sample

Table 2-9: Summary of Risks from Exposure to Soil Vapor by Exposure Area

Exposure Area	Residential						Construction Worker						Commercial/Industrial Worker					
	Hazard Index		Number of Locations that Exceed 1	ILCR		Number of Locations that Exceed 1E-06	Hazard Index		Number of Locations that Exceed 1	ILCR		Number of Locations that Exceed 1E-06	Hazard Index		Number of Locations that Exceed 1	ILCR		Number of Locations that Exceed 1E-06
	Min	Max		Min	Max		Min	Max		Min	Max		Min	Max		Min	Max	
Administration Area (East)	0.00011	860	25 out of 197 samples	NC	4E-02	84 out of 197 samples	0.0000005	3.4	1 out of 197 samples	NC	1E-05	1 out of 197 samples	0.000045	130	12 out of 197 samples	NC	1E-02	56 out of 197 samples
Administration Area (West)	0.000007	0.03	None	3E-09	5E-06	4 out of 81 samples	0.00000006	0.0001	None	2E-11	3E-08	None	0.000002	0.005	None	7E-10	1E-06	None
Line 2	0.000005	43	2 out of 126 samples	NC	6E-03	33 out of 126 samples	0.00000004	0.17	None	1E-10	2E-06	1 out of 126 samples	0.000002	6.7	2 out of 126 samples	NC	1E-03	15 out of 126 samples
Line 5 North	0.00003	0.06	None	6E-09	9E-06	2 out of 29 samples	0.0000003	0.0002	None	1E-12	2E-09	None	0.00001	0.01	None	1E-09	2E-06	1 out of 29 samples
Chemical Plant 2	0.000007	1,300	13 out of 104 samples	NC	4E-02	27 out of 104 samples	0.00000008	5	1 out of 104 samples	NC	9E-06	1 out of 104 samples	0.000003	200	9 out of 104 samples	NC	1E-02	18 out of 104 samples
Magazine Area	0.000005	0.05	None	NC	3E-06	1 out of 27 samples	0.00000006	0.0002	None	NC	7E-10	None	0.000002	0.008	None	NC	7E-07	None
Open Space Areas 1,2,3, and 4	0.006	0.01	None	7E-07	7E-07	None	0.00005	0.00005	None	2E-10	2E-10	None	0.002	0.002	None	2E-07	2E-07	None
Open Space Areas 5 and 7	0.007	0.02	None	6E-07	6E-07	None	0.00007	0.00007	None	2E-10	2E-10	None	0.002	0.002	None	1E-07	1E-07	None

Notes:
Shaded values exceed target levels.
NC = no carcinogenic compounds of interest in a sample

2.7.4.2 Groundwater

There is no known current use of groundwater for residential water supply from unmonitored or untreated wells either at or beyond the property boundary. However, recognizing the State's designation of the aquifer as a potential drinking water source, the analysis included the hypothetical use of untreated groundwater for residential water supply. This analysis considered hypothetical exposure to groundwater constituents via the following routes: ingestion, dermal contact, and inhalation of VOCs released during household non-ingestion use (i.e., showering, cooking, laundering, and dishwashing). Although this ROD is not intended to address groundwater contamination, groundwater contamination is present beneath the OU-6 area. Because there is currently no sitewide land use covenant for groundwater, this ROD will implement ICs similar to those adopted by OU-3 and OU-5 RODs, as well as ICs placed on the Carveout Lands to restrict access and use of groundwater.

2.7.4.3 Soil and Sediment

Potential soil exposure pathways may include the following:

- Direct contact with soil (incidental ingestion and dermal contact)
- Inhalation of fugitive dust
- Volatilization of COPCs from soil and soil vapor into ambient (outdoor and indoor) air

Potential sediment exposure pathways may include the following:

- Dermal contact with sediment during recreational (wading) activity
- Incidental ingestion of sediment during recreational (wading) activity

Nine soil exposure areas were evaluated and one sediment exposure area (Buffalo Creek) was evaluated. The 10 soil exposure areas include the following:

- Administration Area East
- Administration Area West
- Line 2
- Line 5 North
- West Lakes
- Chemical Plant 2
- Magazine Area
- OS Areas 1, 2, 3, and 4
- OS Areas 5 and 7

The following subsections summarize the risk, hazard, and blood lead results for each of these exposure areas by receptor.

Residential

Exposure to soil by future hypothetical residents at Administration Area East, Administration Area West, and Chemical Plant 2 indicates HIs that are greater than the target level of 1 at 3 of the 10 soil exposure areas. Lead concentrations exceed the target level of 80 mg/kg at

Administration Area East, Administration Area West, Line 2, Line 5 North, and Chemical Plant 2. PCBs, metals, and pendimethalin are the primary contributors to HI where there are exceedances. ILCRs are greater than the cumulative risk level of 1E-06 at six of the soil and sediment exposure areas. These include Administration Area East, Administration Area West, Line 2, Line 5 North, Chemical Plant 2, and Buffalo Creek. The primary contributors to the ILCR at these sites include PCBs, PAHs, VOCs, hexavalent chromium, pesticides, and 2,3,7,8-tetrachlorodibenzodioxin (TCDD).

Construction Worker

Exposure to soil by construction workers at Administration Area East, Administration Area West, Line 2, and Chemical Plant 2 indicates HIs that are greater than the target level of 1 at six of the soil and sediment exposure areas. PCBs, metals, and pendimethalin are the primary contributors to HI at the exposure areas where there are exceedances. ILCRs are greater than the cumulative risk level of 1E-06 at three of the soil and sediment exposure areas. These include Administration Area East, Administration Area West, and Chemical Plant 2. The primary contributors to the ILCR at these sites include PCBs, PAHs, VOCs, cadmium, hexavalent chromium, and TCDD.

Commercial/Industrial

Exposure to soil by commercial/industrial workers at Administration Area East and Chemical Plant 2 indicates HIs that are greater than the target level of 1 at two of the soil and sediment exposure areas. PCBs and pendimethalin are the primary contributors to HI at the exposure areas where there are exceedances. Lead concentrations exceed the target level of 320 mg/kg at the Administration Area East and Administration Area West. ILCRs are greater than the cumulative risk level of 1E-06 at six of the soil and sediment exposure areas. These include: Administration Area East, Administration Area West, Line 2, Chemical Plant 2, and Buffalo Creek. The primary contributors to the ILCR at these sites include PCBs, PAHs, hexavalent chromium, and TCDD.

2.7.4.4 Soil Vapor

Soil vapor results were used to evaluate the vapor intrusion into indoor air pathway.
The following soil vapor exposure areas were evaluated:

- Administration Area East
- Administration Area West
- Line 2
- Line 5 North
- Chemical Plant 2
- Magazine Area
- OS Areas 1, 2, 3, and 4
- OS Areas 5 and 7

The following subsections summarize the risk and hazard for each of these exposure areas by receptor.

Residential

HIs are greater than the target level of 1 under a residential scenario at Administration Area East (25 of 197 locations), Line 2 (2 of 126 locations), and Chemical Plant 2 (13 of 104 locations). ILCRs are greater than the cumulative risk level of 1E-06 at seven of nine soil vapor exposure areas. These include Administration Area East (84 of 197 locations), Administration Area West (4 of 81 locations), Line 2 (33 of 126 locations), Line 5 North (2 of 29 locations), Chemical Plant 2 (27 of 104 locations), and Magazine Area (1 of 27 locations).

Construction Worker

HIs are greater than the target level of 1 under a construction worker scenario at Administration Area East (1 of 197 locations) and Chemical Plant 2 (1 of 104 locations). ILCRs are greater than the cumulative risk level of 1E-06 at three of the nine soil vapor exposure areas. These include Administration Area East (1 of 197 locations), Line 2 (1 of 126 locations), and Chemical Plant 2 (1 of 104 locations).

Commercial Industrial/Worker

HIs are greater than the target level of 1 under a construction worker scenario at Administration Area East (12 of 197 locations), Line 2 (2 of 126 locations) and Chemical Plant 2 (9 of 104 locations). ILCRs are greater than the cumulative risk level of 1E-06 at four of nine soil vapor exposure areas. These include Administration Area East (56 of 197 locations), Line 2 (15 of 126 locations), Line 5 North (1 of 29 locations), and Chemical Plant 2 (18 of 104 locations).

2.7.5 Summary of Ecological Risk Assessment

The SLERA considered potentially exposed ecological receptors in each MA, including the following terrestrial habitats: terrestrial plant and soil invertebrate communities; and bird (including burrowing species), mammal (including burrowing mammals), and reptile and amphibian populations and the following aquatic habitats: aquatic plant, invertebrate, and sediment-dwelling invertebrate communities, and fish, amphibian, bird, and mammal populations. Soil (collected between 0 and 6 feet bgs), soil vapor, sediment (generally collected between 0 and 1.5 feet bgs), and surface water chemical data from the OU-6 RI were compared to ecological screening levels (ESLs) developed for the SLERA and considered potential ecological COCs if they exceeded these levels. Agency-recognized screening levels were used to conservatively represent exposure concentrations that are protective of all receptors potentially exposed to a given medium.

The results of the SLERA for each of these MAs are summarized on Table 2-10. No/negligible ecological risks were identified at five of the MAs, for the following reasons:

- No contaminants of potential ecological concern (COPECs) exceeding ESLs were identified in OS Areas 5 and 7; and
- The COPECs and their exceedances of ESLs identified in habitat areas were considered to be limited in magnitude, number, and areal extent at Magazine Area and OS Areas 1, 2, and 4.

For the remaining MAs, the following conclusions were reached:

- For the Admin Area (Admin East and Admin West), no significant ecological risk within the MA was identified under current or future land use due to the presence of poor-quality habitat. However, COPECs were identified in drainage ditches leading from these MAs with the potential for migration to downgradient habitats.
- For the West Lakes MA, potential ecological risks under current conditions were identified based on multiple COPECs occurring within habitat areas. However, these areas may undergo residential development in the future, which is expected to mitigate or eliminate ecological risk as a result of removing existing habitat.
- For the remaining MAs (Buffalo Creek, Chemical Plant 2, and Dredge Pit and Eastern Basin), potential ecological risks under current conditions were identified based on multiple COPECs occurring within habitat areas; and future development is unplanned or unknown.

2.7.6 Conclusions

Human health and ecological risk estimates are based on reasonable maximum exposure scenarios and considered various conservative assumptions about frequency and duration of exposure as well as the toxicity of the COPCs.

Areas potentially requiring cleanup were identified by calculating the human health and ecological risks under the current and planned future land use, and by estimating the potential risks from exposure to surface water, soil and sediment, and soil vapor contamination. Other potential areas requiring a cleanup action were identified based on potential groundwater impacts from contaminated soil. A detailed description of the modeling and procedures used to estimate the risks can be found in the HHERA, which is in Volume 2 of the OU-6 RI/FS (ERM, 2011).

Management Area	Media Evaluated	Habitat COPECs	Habitat Quality	Future Land Use	Exposure Potential	Recommendation
Admin Area East						
	Soil	Phthalates PCBs Inorganics	Poor	Commercial	Current - Moderate Future - Moderate	SMDP: potential downgradient migration (drainage ditch)
	Surface Water	Inorganics	Poor	Commercial	Current - Low Future - Low	SMDP: potential downgradient migration (drainage ditch)
	Soil Vapor	Toluene	Poor	Commercial	Current - Low Future - Low	No further action
Admin Area West						
	Soil	Phthalates PCBs Inorganics	Moderate	Commercial	Current - Moderate Future - Moderate	SMDP: potential downgradient migration (drainage ditch)
	Surface Water	Inorganics	Poor	Commercial	Current - Low Future - Low	SMDP: potential downgradient migration (drainage ditch)
	Soil Vapor	None	Poor	Commercial	Current - Low Future - Low	No further action
Line 02						
	Soil	Phthalates Inorganics	Good	Mixed Commercial/ Residential	Current – High Future – Low	No further action
	Soil Vapor	VOCs	Good	Mixed Commercial/ Residential	Current – High Future – Low	No further action
Line 05 North						
	Soil	Cadmium Di-n-octyl phthalate	Fair (tailings)	Residential	Current – Medium Future – Low	SMDP to determine if further action necessary
	Soil Vapor	None	Fair (tailings)	Residential	Current – Medium Future – Low	No further action
Westlakes						
	Soil	PCBs Inorganics	Fair	Residential, Open/Preserves, Parks	Current – High Future – Low	SMDP to determine if further action necessary
	Surface Water	Phthalates Inorganics	Fair (intermittent)	Residential, Open/Preserves, Parks	Current – High Future – Low	SMDP to determine if further action necessary
	Sediment	Inorganics	Fair (intermittent)	Residential, Open/Preserves, Parks	Current – High Future – Low	SMDP to determine if further action necessary
Buffalo Creek						
	Soil	PCBs Inorganics	Fair	Unknown	Current – High Future – Medium	SMDP to determine if further action necessary
	Surface Water	Pesticides Inorganics	Fair (intermittent)	Unknown	Current – High Future – Medium	SMDP to determine if further action necessary
	Sediment	Pesticides PCBs Inorganics	Fair (intermittent)	Unknown	Current – High Future – Medium	SMDP to determine if further action necessary
Open Space Areas 5 and 7						
	Soil	None	Good	Residential	Current – Medium Future – Low	No further action
	Soil Vapor	None	Good	Residential	Current – Medium Future – Low	No further action

Notes:

ESL = Ecological screening level
PCB = Polychlorinated biphenyl
SMDP = Scientific/Management Decision Point
VOC = Volatile Organic Compound
Habitat COPECs = Chemicals above guild-specific ESLs and, for inorganics, above both ESLs and background concentrations in habitat areas; does not include those constituents lacking screening levels

Management Area	Media Evaluated	Habitat COPECs	Habitat Quality	Future Land Use	Exposure Potential	Recommendation
Chemical Plant 2						
	Soil	Phthalates Pesticides PCBs Inorganics	Good	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Surface Water	Pesticides Inorganics	Fair (intermittent)	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Sediment	Misc. Organics PAHs Pesticides PCBs Inorganics	Fair (intermittent)	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Soil Vapor	None	Good	Not currently planned	Current – Low Future – Low	No further action
Dredge Pit and Eastern Basin						
	Soil	Phthalates Pesticides Inorganics	Good	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Surface Water	Pesticides Inorganics	Fair (intermittent)	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Sediment	Misc. Organics Pesticides Inorganics	Fair (intermittent)	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
Magazine Area						
	Soil	Inorganics	Fair	Not currently planned	Current – Low Future – Low	No further action
	Soil Vapor	None	Fair	Not currently planned	Current – Low Future – Low	No further action
Open Space Areas 1, 2, and 4						
	Soil	Inorganics	Fair	Not currently planned	Current – Medium Future – Medium	No further action
	Soil Vapor	Toluene	Fair	Not currently planned	Current – Medium Future – Medium	No further action
Area 39						
	Soil	Phthalates Dioxins Furans Inorganics	Fair (high human activity)	Not currently planned	Current – Medium Future – Medium	SMDP to determine if further action necessary
	Surface Water	Inorganics	Good	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Sediment	Inorganics	Good	Not currently planned	Current – High Future – High	SMDP to determine if further action necessary
	Soil Vapor	VOCs	Fair (high human activity)	Not currently planned	Current – Medium Future – Medium	SMDP to determine if further action necessary

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TABLE 2-10
SLERA Summary Table
Operable Unit 6 Record of Decision

ES042114142800SAC

Risk management decisions may consider no further action, further investigation, and/or implementing risk management action(s). These areas were then evaluated to determine if cleanup was required. The following criteria, along with professional judgment, were used to determine if a contaminated area (identified by the estimated risks) required cleanup:

- If the potential human health risk was just above 1E-06, the HI was greater than 1.0, or modeled blood lead concentration is greater than 1 µg/dL from soil or sediment lead concentration, then the area was recommended for cleanup evaluation.
- If ecological risk exceeded screening levels, and the SLERA recommended further evaluation for an action, then the area was recommended for cleanup.
- If the risk of contaminating the groundwater was considered moderate (as defined in the OU-6 FS), then the area may have been recommended for cleanup, depending on the compound mobility and solubility, and depth and extent of contamination.
- If the risk to groundwater was considered high (as defined in the OU-6 FS), the area was recommended for cleanup.
- If the risk to groundwater was based on the concentrations of TPH-D or TPH-Mo, then the area was only recommended for retention if the concentrations were increasing, or if TPH was encountered at depth and had already affected the groundwater.

2.7.7 Uncertainties

Some uncertainty is inherent in risk assessments. Uncertainty exists in the exposure assessment, toxicity values, and the risk characterization. In the HHRA, exposure and the toxicity assessments are the most significant sources of uncertainty and variability. The following uncertainties could lead to overestimation of the risk of (1) modeling of contaminant uptake – chemical concentrations were assumed to remain constant over the exposure period; (2) use of the detected concentration of COPCs at each location as exposure point concentrations (EPC) – EPCs assume that receptors are exposed to a single location through duration of their tenure at the property as opposed to the more likely scenario of being exposed to an area averaged concentration; (3) the use of upperbound values for ingestion, inhalation, and dermal contact rates; and (4) the use of default values for exposure duration that are likely to overestimate exposures.

The following uncertainties could lead to over- or underestimation of the risk from the site:

1. The concentrations of the chemicals in the sample results may have been over- or underestimated. The sampling locations were selected to identify the areas with the greatest likelihood of containing chemicals of interest; therefore, the sampling and analysis data are sufficient to characterize chemical concentrations and distributions and, subsequently, the associated potential risks.

2. Toxicity information was not available for some of the elements or compounds detected, so the toxicity data from elements or compounds with similar chemical structures were used. Because the surrogates chosen are generally considered more toxic, the risk estimates for these constituents are likely health protective.

3. Dose-response information from animal studies was used to predict effects in humans. Uncertainties related to differences in uptake, metabolism, and distribution of chemicals in the body of test species and target species are addressed through use of conservative assumptions (such as uncertainty factors) in establishing reference toxicity values, which results in the likelihood that the risk is overstated.

2.8 Development and Selection of Remedial Action Areas

Several investigations within OU-6 have been conducted, and the findings were documented in the OU-6 RI Report (ERM-West, 2010). The purpose of RI was to determine if activities within OU-6, such as the development of propulsion systems and chemical manufacturing, resulted in the discharge of chemicals into the environment at concentrations that pose, or could pose, an unacceptable risk to human and ecological receptors or could impact beneficial use of groundwater.

Because of the complex history of past operations and size of OU-6, source areas were identified to focus the investigations on those areas with the potential for releases to the environment. Source areas were identified as those areas where past industrial operations took place, and OUs were assigned as part of the 2001 Stipulation and Order Modifying Partial Consent Decree (EPA, 2002) and the Program Plan Modification Report (Aerojet, 2004). The source areas in OU-6 are listed in Section 2.1, and a brief description of the source areas are in Table 2-11. More details regarding the source areas are in the OU-6 RI Report (ERM-West, 2010). In addition, significant portions of the facility were used as buffer zones between operating areas and have no history of chemical use or disposal.

Soil and soil vapor samples were collected from the source areas in accordance with the Field Sampling and Analysis Plan (Tetra Tech, 2006), and the analytical data were compared to applicable screening levels based on risk to human health, ecological receptors, and for the protection of groundwater. The results were subsequently documented in the RI Report, Sections 4 through 6, for each of the seven MAs. Those areas – including individual sample locations – with concentrations of contaminants greater than screening levels were then further evaluated for potential risks to human and ecological health, and potential impacts to groundwater. Generally, areas were evaluated in the FS for a remedial action that had an ILCR of greater than $1x10^{-4}$, an HI greater than 1, posed a risk to groundwater quality, and/or posed a risk to ecological receptors. In several areas where the ILCR was within EPA's risk management range (an ILCR between $1x10^{-4}$ and $1x10^{-6}$), these areas were evaluated for alternatives because there was some uncertainty in the characterization of the area, such as the lateral or vertical extent were not defined or there was evidence to suggest the maximum concentrations of COCs had not been identified. In these cases, a conservative approach was taken so that these areas were evaluated and remedies were selected in order to address the uncertainties and mitigate the risks.

Based on the results of the risk evaluation, the areas with contamination that pose a potential risk were assigned a remedial action area number, such as AE-R-1 and AE-SV-R-1, to track further evaluation. Generally, the areas labeled with a MA identifier followed by "R-[number]" [e.g., AE-R-1] are areas with soil contamination; and areas labeled "SV-R-[number]" are areas with soil vapor contamination. In addition to the areas identified using the methods described above, seven soil vapor areas were identified based on the potential risk to ambient air from VOCs in

groundwater. Groundwater contamination is present beneath a large portion of OU-6 and VOCs migrating through the vadose zone into ambient air could pose a potential risk to human health.

To determine if the groundwater contamination could result in indoor air concentrations above acceptable levels for unrestricted use, the DTSC version of the J&E model was used to determine a vapor intrusion screening level for TCE. TCE was used in the model because it has the largest lateral extent and is most frequently detected contaminant in groundwater. For an unrestricted use scenario and target ILCR of $1x10^{-6}$, the J&E model predicts an exposure concentration of 11 µg/L for TCE in groundwater. Groundwater contamination is generally mapped or contoured using the groundwater maximum contaminant level (MCL) concentration. The MCL for TCE in groundwater is 5 µg/L, which results in an approximate ILCR of 5×10^{-7} with an HQ of 0.15. Using a conservative approach to account for variations in groundwater movement, different groundwater contouring techniques, and variations in well spacing, any location where TCE was present in groundwater at a concentration ≥ 5 µg/L with an additional 100-foot buffer mapped around that area was further evaluated in the FS for remedial alternatives. Seven areas were identified and include AE-SV-R-3, AW-SV-R-1, L2-SV-R-1, L5-SV-R-3, MA-SV-R-1, CP2-SV-R-6, and DPEB-SV-R-1. For more details on how these remedial action areas were identified, please see Section 1.5.4 of the OU-6 FS.

These remedial action areas were then evaluated in the OU-6 FS (Shaw, 2012) for applicable remedial alternatives that would best mitigate the risks associated with the remedial action area. Tables 1-3 through 1-20 of the FS summarize the nature and extent of contamination and the risk evaluation for each remedial action area.

The preferred remedy for each remedial action area was selected and presented in the Proposed Plan. The source areas with corresponding soil remedial action areas are presented in Table 2-11. The remedial action areas for soil vapor are not included in the table because the soil vapor areas encompass several source areas. In many cases, these soil vapor remedial action areas are likely the result of releases from multiple source areas, and/or the lateral extent of the contamination encompasses multiple source areas. Soil and soil vapor remedial action areas are best represented on Figures 2-23 through 2-31, and descriptions appearing in Appendix B. Because some of the areas do not tie to known sources areas, they have been described in general/geographic terms instead. It should be noted that the areas for each remedial action area shown on the figures have been approximated, based on information gathered during the RI and the scale of figures. In most areas, the lateral extent of contamination is sufficiently known such that remedial alternatives can be evaluated and selected. However, further delineation of the extent of many of these areas will be required to efficiently design and implement the remedy. Further delineation, will be conducted during the remedial design phase.

Table 2-11: Source Areas and Soil Remedial Action Areas

Management Area		Original Source Area Designation	Description	Remedial Action Area Designation[a]
Administration Area	Administration Area East	3D	Liquid rocket engine manufacturing – sumps in Building 20002 and 20004, former 5,000-gallon fuel oil tank southwest of Building 20002.	AE-R-1 to AE-R-9
		4D	Area 20 surface water drainage system – ditch system south of Building 20004 and east of Building 20024. Source Area 4D also include septic tanks A20-ST05-1 and A20-ST05-2.	--
		11D[b]	Area 20 surface water drainage system – Former 5,000-gallon acid holding tank associated with Building 20022. Septic tank A20-ST22.	--
		50D	Boiler fuel oil storage – former 4,000-gallon underground fuel oil tank west of Building 20001. Source Area 50D also includes septic tanks A20-ST01-1; A20-ST01-2; A20-ST01-3; A20-ST01-4; and A20ST01-5.	--
		51D	Former 3,000-gallon waste tank north of Building 20002.	--
		Building 20034	X-ray facility.	--
		RCRA Unit B (20037 Container Storage) RCRA Unit C (20029 Treatment Unit) RCRA Unit X (20073 Storage Tanks)	The closure and monitoring of the RCRA units themselves (i.e., storage containers, storage tanks, etc.) is conducted by DTSC. These RCRA units have been closed per DTSC documentation.	--
	Administration Area West	5D	Area 20 surface water drainage system – ditch system and waste treatment ponds near Building 20009.	AW-R-1 to AW-R-3, AW-R-10 to AW-R-13
		6D	Building 20009 drainage – abandoned pond.	AW-R-8, AW-R-9
		8D	Sewage treatment – sewage treatment ponds.	--
		9D	Area 20 surface water drainage system – ditch system south of Building 20009.	AW-R-10
		12D	Area 20 surface water drainage system – ditch system west of Sites 8D and D(c).	AW-R-10
		52D	Waste oil storage – former underground waste oil tank west of Building 20009.	AW-R-6

Table 2-11: Source Areas and Soil Remedial Action Areas

Management Area		Original Source Area Designation	Description	Remedial Action Area Designation[a]
		52D FWOT	Waste oil storage – former waste oil tank near Building 20009.	AW-R-7
		52D TB	Waste oil storage – former waste oil tank near Building 20009.	AW-R-14
		D(b)	Building 20009 surface water drainage system – ditch system west of Building 20009.	AW-R-4, AW-R-5, AW-R-15
		D(c)	Sewage treatment plant – treatment plant sludge drying area.	--
		D(d)	Storm drain sump – sump west of Building 20025.	--
		RCRA Unit W (20018 Storage and Treatment Tank) RCRA Unit Y (20025 Storage)	The closure and monitoring of the RCRA units themselves (i.e., storage containers, storage tanks, etc.) is conducted by DTSC. These RCRA units have been closed per DTSC documentation Any contamination in the environment as a result of releases from the units is addressed under this ROD.	AW-R-16
Line 2 Region / Open Space 5		28E	Drum cleaning facility – wash slab and 2 gunite lined ponds 600 feet northwest of Building 02028.	L2-R-4, L2-R-5, L2-R-9
		29E	Crawford Bomb Station – pond north of Building 02024. Source Area 29E also includes septic tank L2-ST24.	L2-R-11
		59E	Drum cleaning facility – low area approximately 500 feet west of Building 02028.	--
		E(d)	Grind station – drainage area north of Building 02020. Source Area E(d) also includes septic tank L2-ST20.	L2-R-2, L2-R-3, L2-R-7, L2-R-8
		E(e)	Grind station – dry well at Building 02020.	--
		E(m)	Unknown operation – pond north of Buildings 02027, 02026, and 02025. Source Area E(m) also includes septic tank L2-ST26 (and associated leachfield).	L2-R-10
		E(n)	Office building – waste line east of Building 02025. Source Area E(n) also include septic tank L2-ST25.	--
		DSA	Drum storage area. The DSA also includes septic tanks L2-ST28 and L2-ST90.	L2-R-6

Table 2-11: Source Areas and Soil Remedial Action Areas

Management Area	Original Source Area Designation	Description	Remedial Action Area Designation[a]
	RCRA Unit T (02030 Tank Storage) RCRA Unit Z (20045 Storage Treatment Tanks and Crystalizer)	The closure and monitoring of the RCRA units themselves (i.e., storage containers, storage tanks, etc.) is conducted by DTSC. These RCRA units have closed per DTSC documentation.	--
	NA	Line 2 drainage from Building 02023.	L2-R-1
Line 5 North / Open Space 7	51E, 52E, and E(l)	Laboratory – concrete wash sump, low areas, septic tank (Building 05087).	L5-R-3, L5-R-4, L5-R-5
	NA	Line 5 solid rocket test stand associated with Building 05112.	L5-R-2
	NA	Line 5 drainage from Buildings 05089 and 05099 to Buffalo Creek.	L5-R-1
Buffalo Creek	NA	Buffalo Creek transects the Aerojet Superfund Site and receives stormwater from many source areas in Area 00, Line 1, Line 2, Line 6, and Zone 3.	BC-R-1, BC-R-2
West Lakes / Open Space 6	NA	The West Lakes receives stormwater runoff from various areas of the Aerojet facility via the Main Administration Area ditch and Buffalo Creek.	WL-R-1
Magazine Area / Open Space 3	NA	The Magazine Area consists of storage bunkers, shipping and transfer facilities, and safety shelters.	MA-R-1
	RCRA Unit C (Building 48008 Container Storage)	The closure and monitoring of the RCRA units themselves (i.e., storage containers, storage tanks, etc.) is conducted by DTSC. These RCRA units have closed per DTSC documentation.	--
Chemical Plant 2 / Open Spaces 1, 2, and 4	59F	Chemical manufacturing – lined holding basin, sumps, steel tank, low area (unlined pond) and septic tank.	CP2-R-1 to CP2-R-6 CP2-R-10, CP2-R-11, CP2-R-12
	60F	Wastewater from Buildings 15001 and 15003 – Septic tank CP2-ST01/03.	--
	61F	Drum storage area – concrete sump associated with Building 15001N.	--
	62F	Chemical storage – Stainless steel paraldehyde tank.	--
	CP2-07	Suspect area near Building 15007 – area of soil discoloration discovered during Stage 1 RI.	--
	CP2-08	Chemical storage – drum storage (potentially pump oil containing PCBs).	CP2-R-9

Table 2-11: Source Areas and Soil Remedial Action Areas

Management Area	Original Source Area Designation	Description	Remedial Action Area Designation[a]
	F(c)	Sump – boiler blowdown sump.	CP2-R-8
	RCRA Unit E (15001N, 15005 Container Storage) RCRA Unit I (700 Area Storage and Treatment Tanks)	The closure and monitoring of the RCRA units themselves (i.e., storage containers, storage tanks, etc.) is conducted by DTSC. These RCRA units have been closed per DTSC documentation.	--
	25F	Dredge pit and eastern basin – chemical waste disposal pit – unlined dredge pit and eastern drainage basin. Source Area 25F also include septic tanks A48-ST13 and A48-ST19.	DPEB-R-1
	NA	Low area – drainage for northern portion of Chemical Plant 2.	CP2-R-7

Notes:

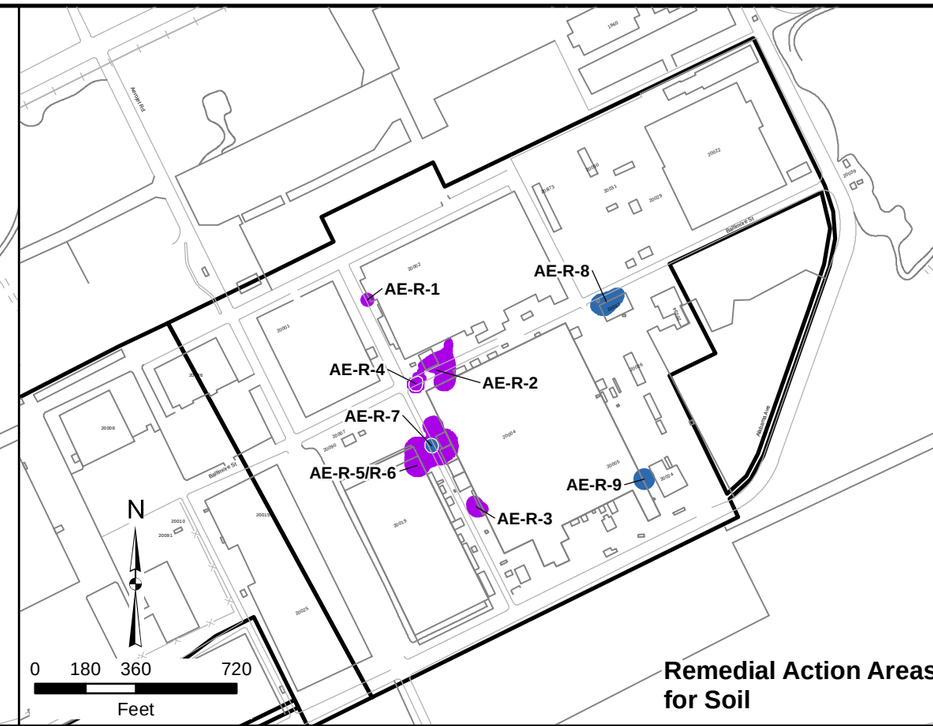
[a] This table presents only the remedial action areas for soil. The remedial action areas for soil vapor are not included in the table because the soil vapor areas are likely the result of releases from multiple source areas, In addition, the lateral extent of the soil vapor remedial action areas overlap and encompass multiple source areas.

[b] The cleanup of 11D drainage ditch (Area 20) was previously completed under OU-5.

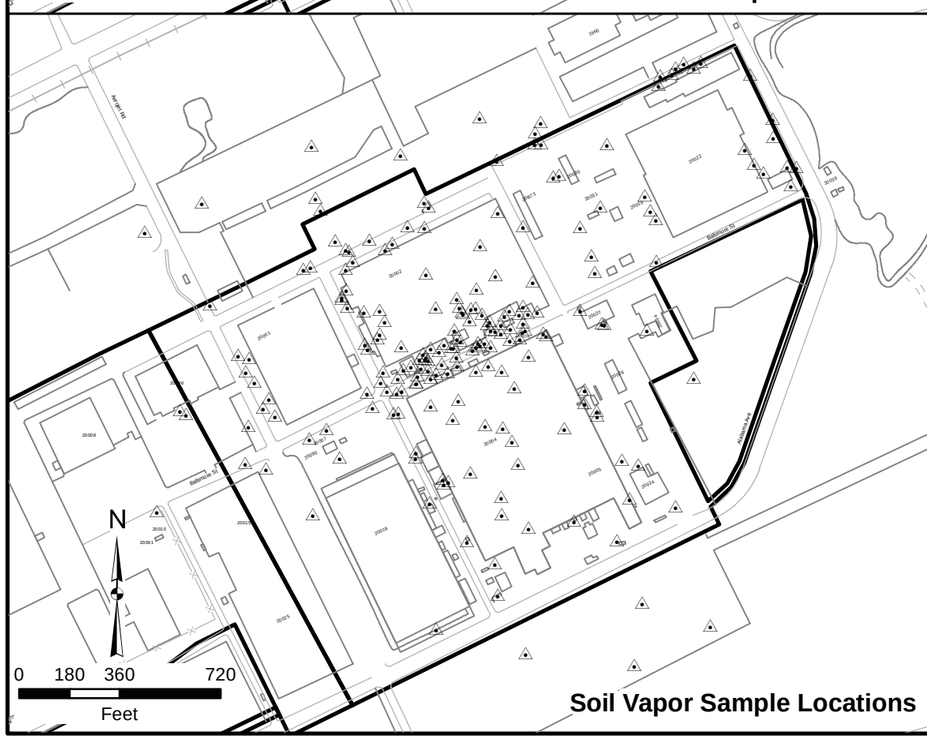
-- = no remedial action areas for soil were identified in these source areas. These sources were evaluated but determined to be of no concern.

NA = not applicable; remedial action area is not associated with a specific source area

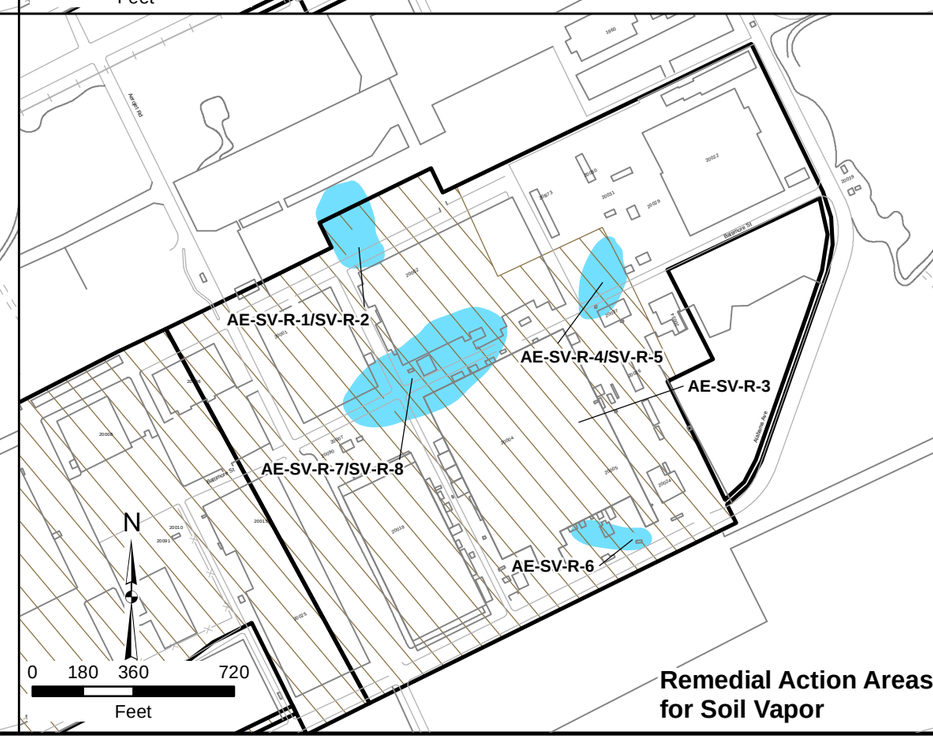
Soil Sample Locations



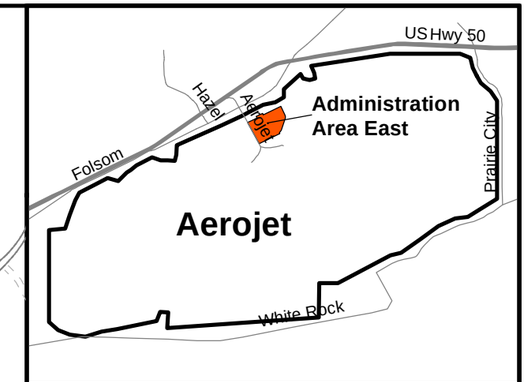
Remedial Action Areas for Soil



Soil Vapor Sample Locations



Remedial Action Areas for Soil Vapor



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 3 (Engineering Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-23
Remedial Action Areas for Administration Area East
Operable Unit 6
Record of Decision

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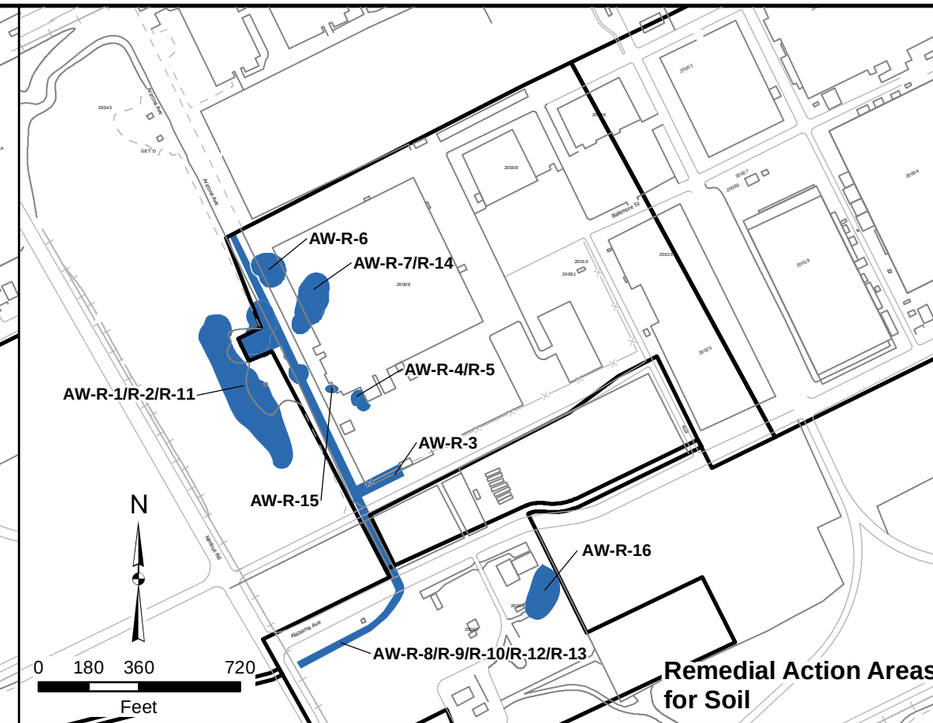
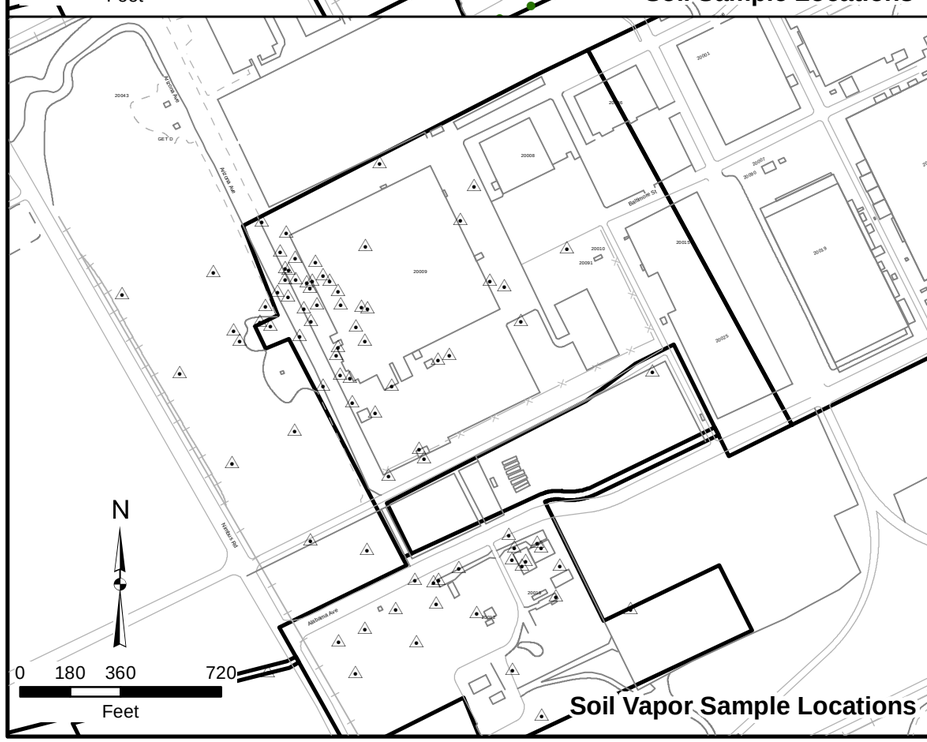
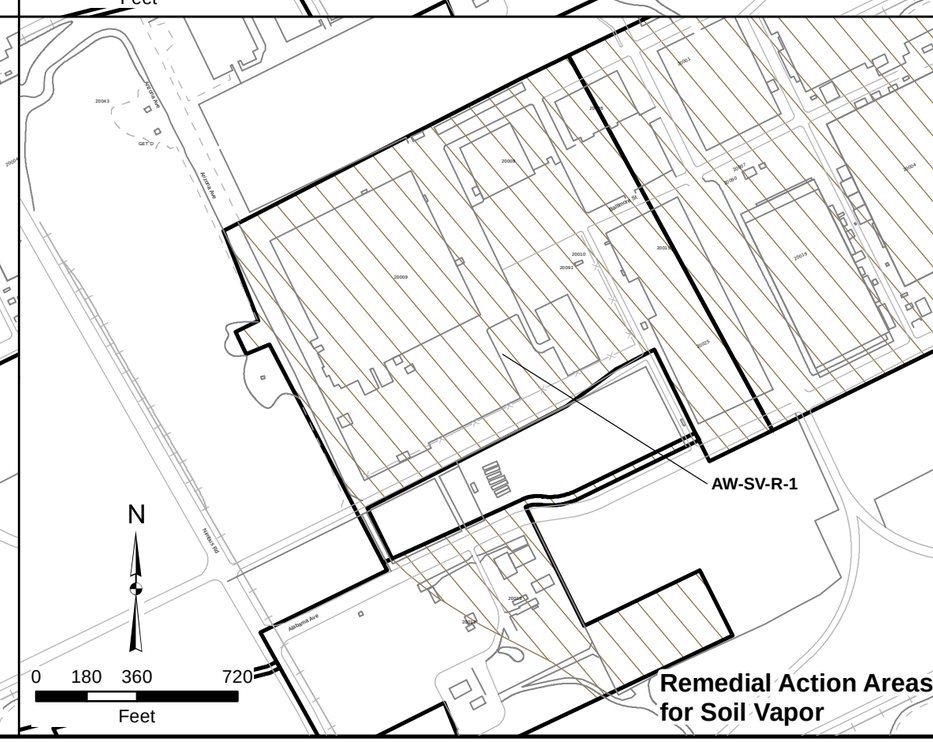
Soil Sample Locations



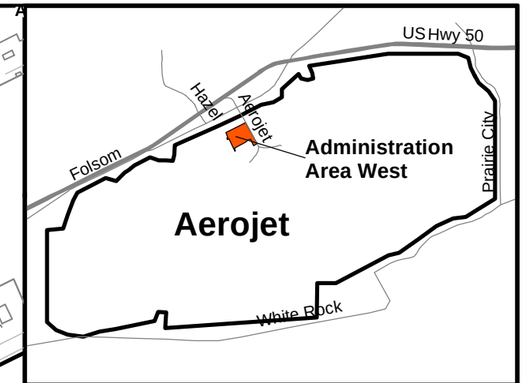
Remedial Action Areas for Soil



Soil Vapor Sample Locations



Remedial Action Areas for Soil Vapor



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 3 (Engineering Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-24
Remedial Action Areas for Administration Area West
Operable Unit 6
Record of Decision

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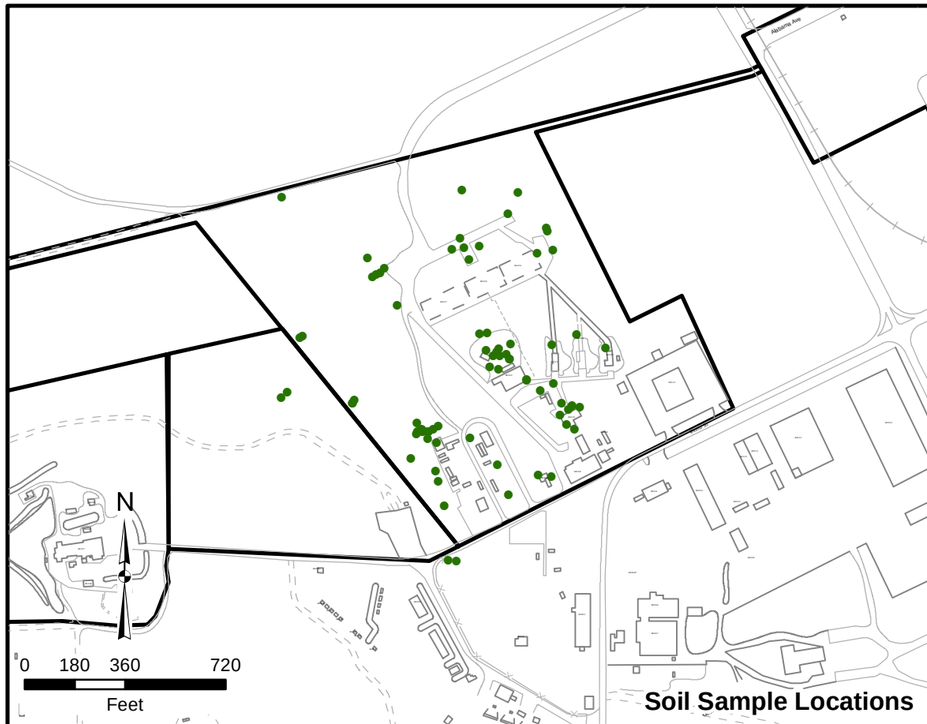
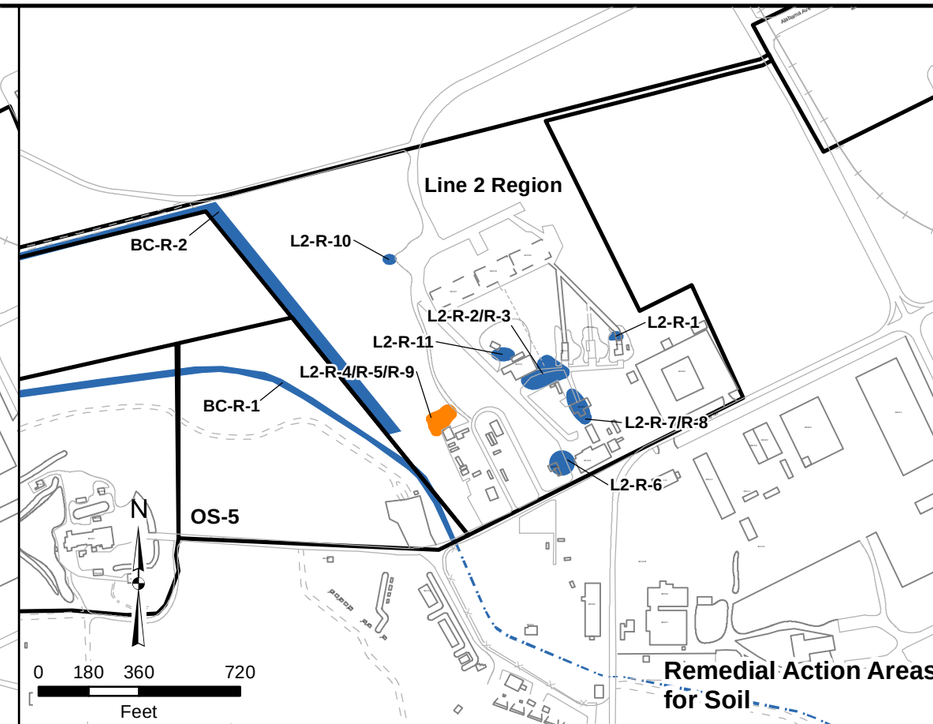
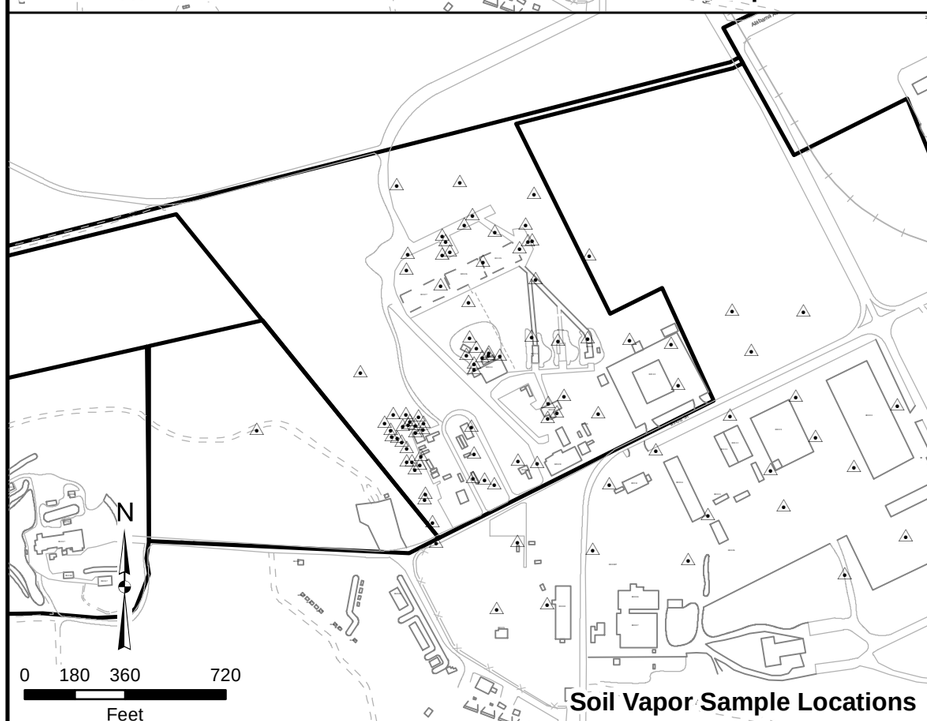


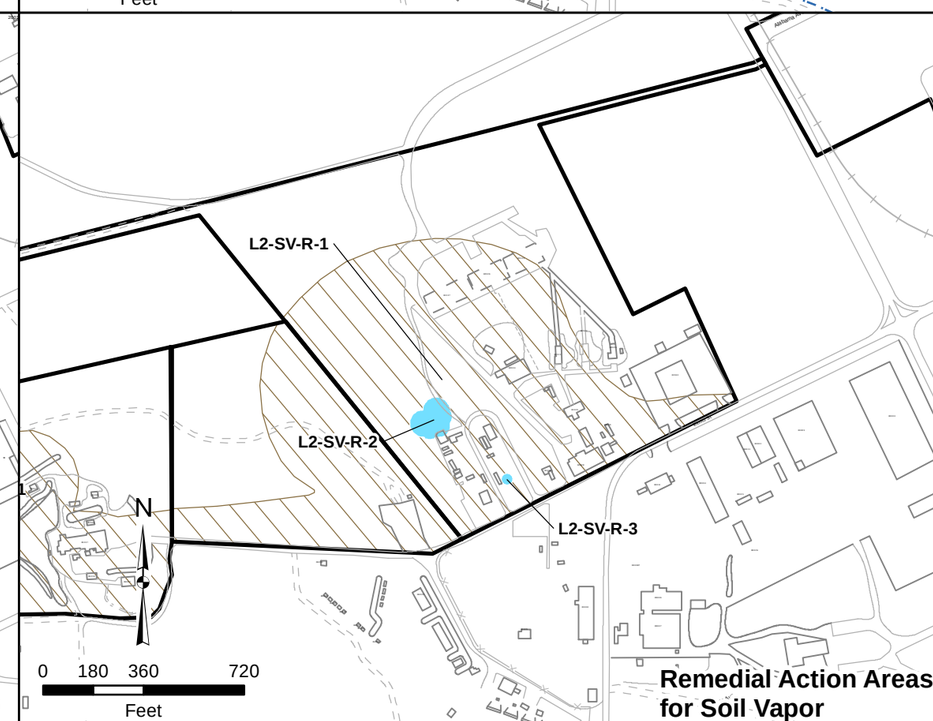
Soil Sample Locations



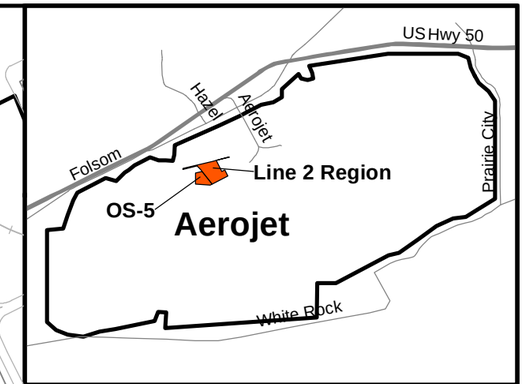
Remedial Action Areas for Soil



Soil Vapor Sample Locations



Remedial Action Areas for Soil Vapor



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 3 (Engineering Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Alternative 4 (Excavation with Soil Flushing and Air Stripping)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location
- Buffalo Creek

Note: Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-25
Remedial Action Areas for Line 2 Region
Operable Unit 6
Record of Decision

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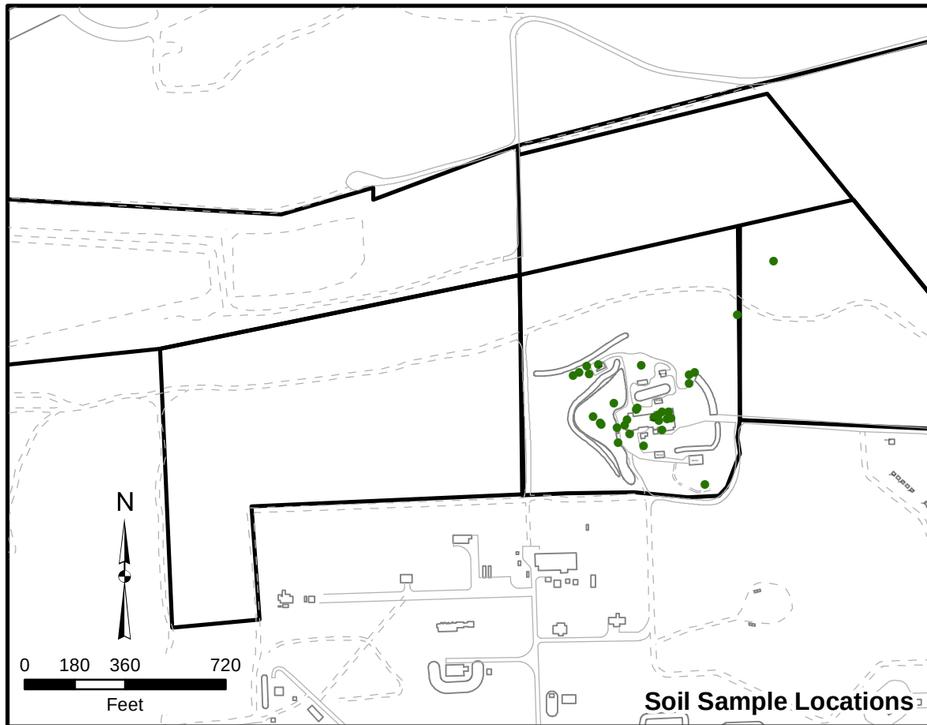

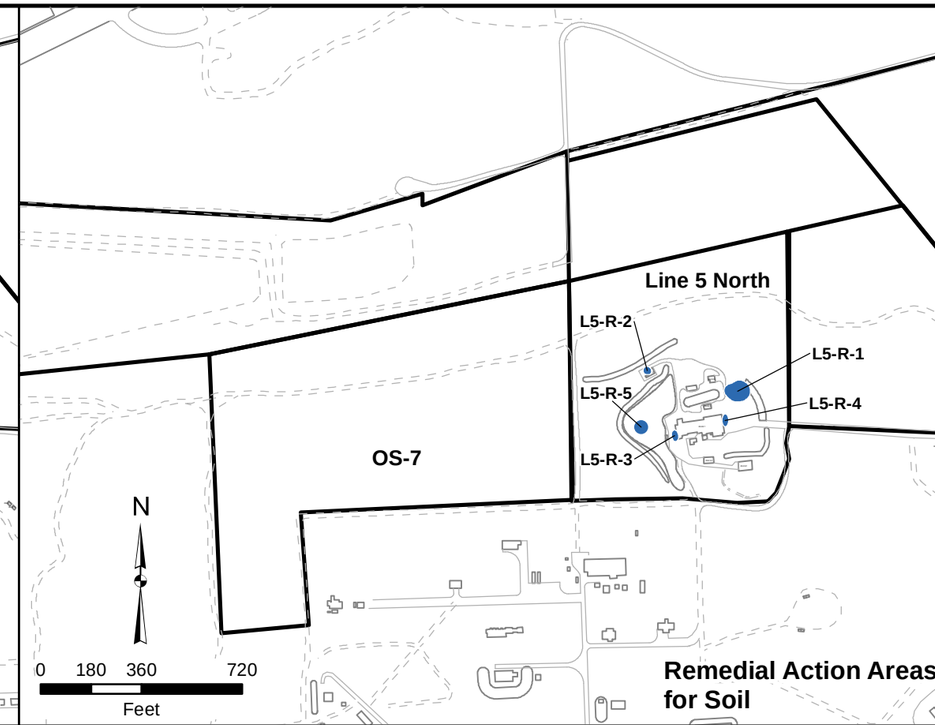

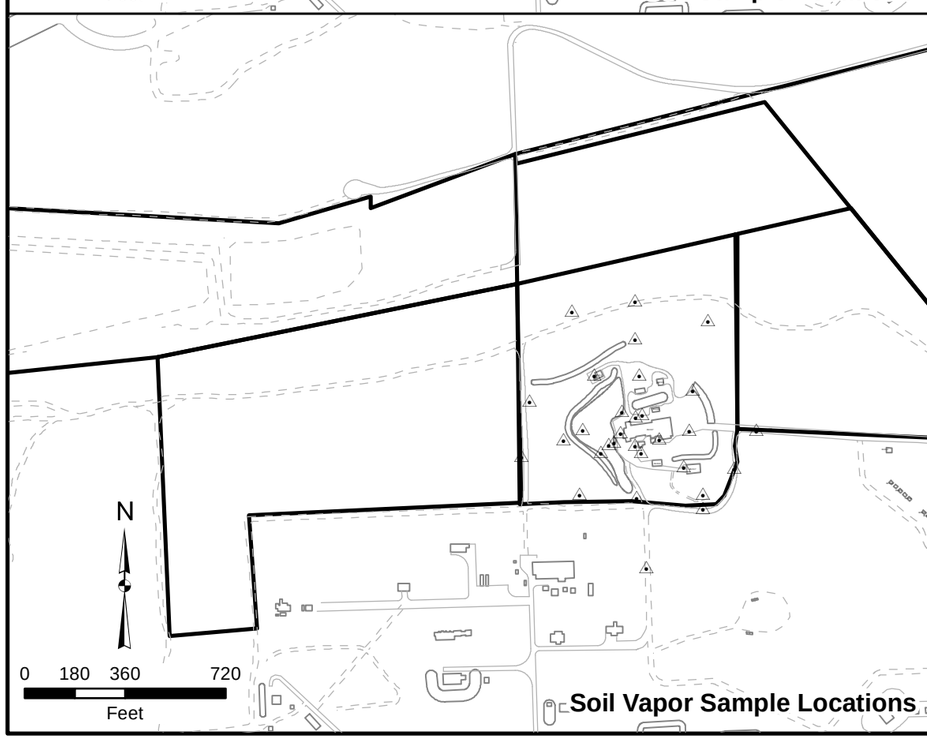

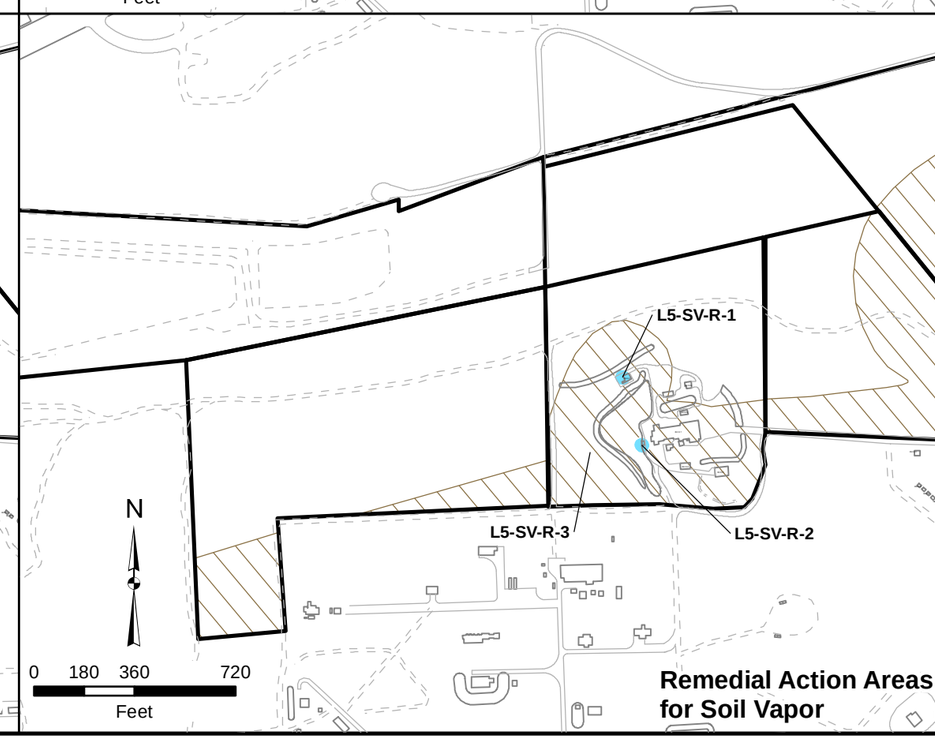

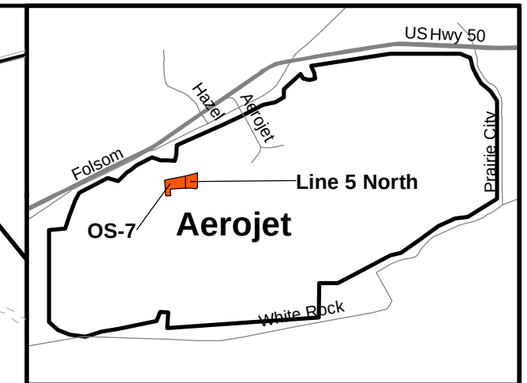

Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 3 (Engineering Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-26
Remedial Action Areas for Line 5 North
Operable Unit 6
Record of Decision

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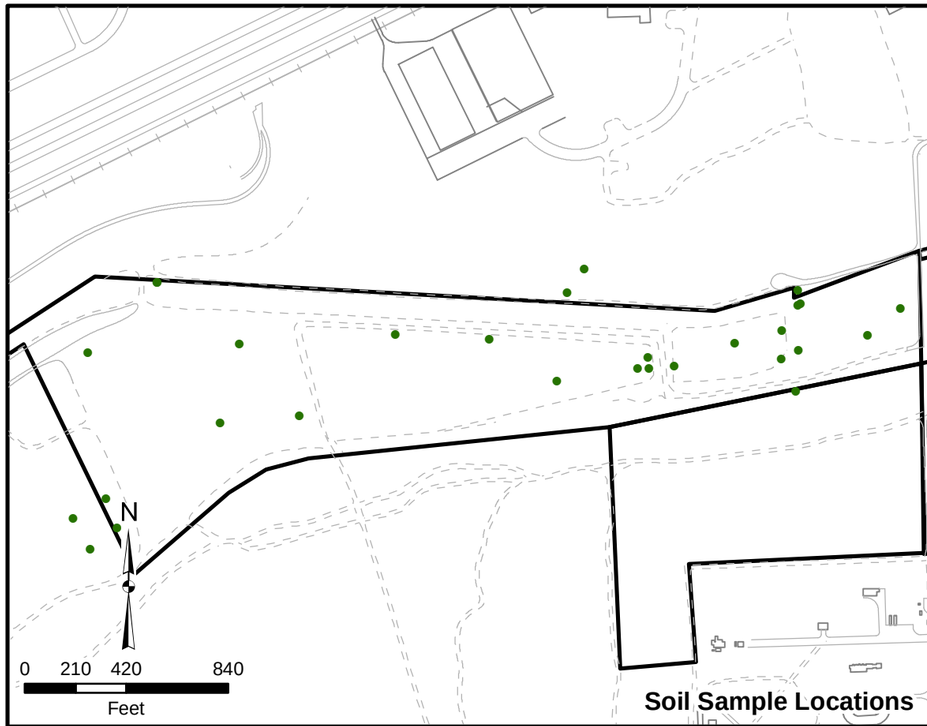
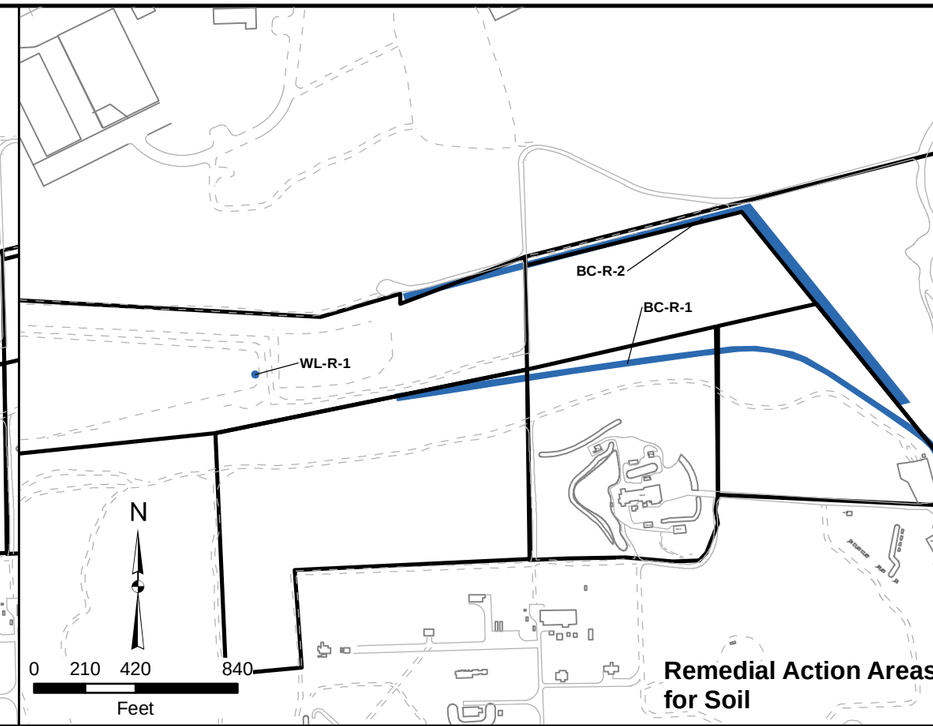
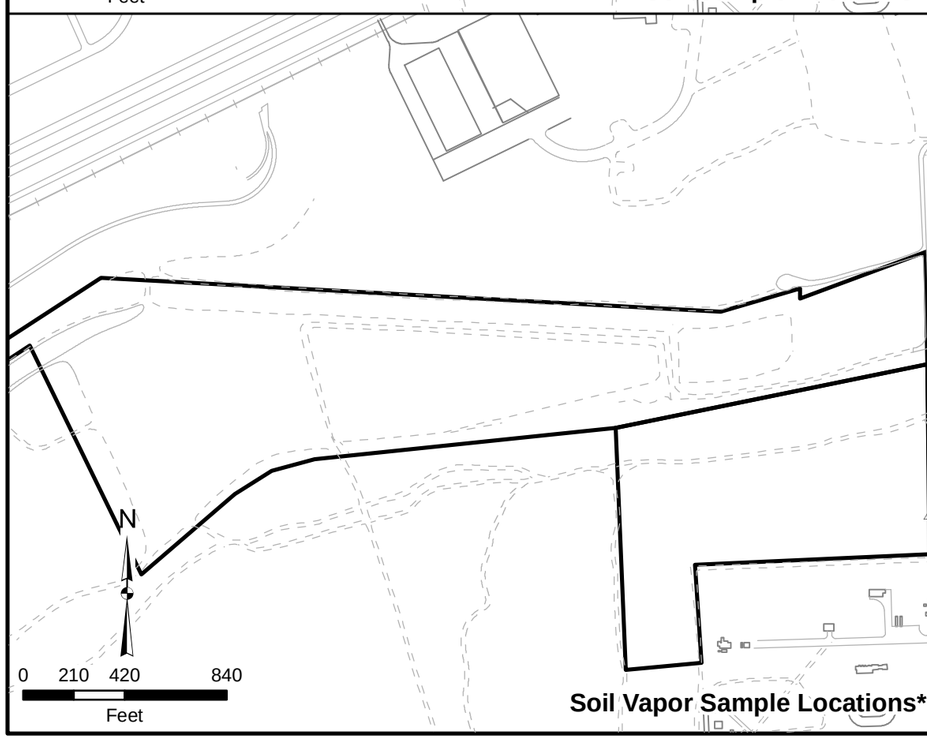
ES042114142800SAC



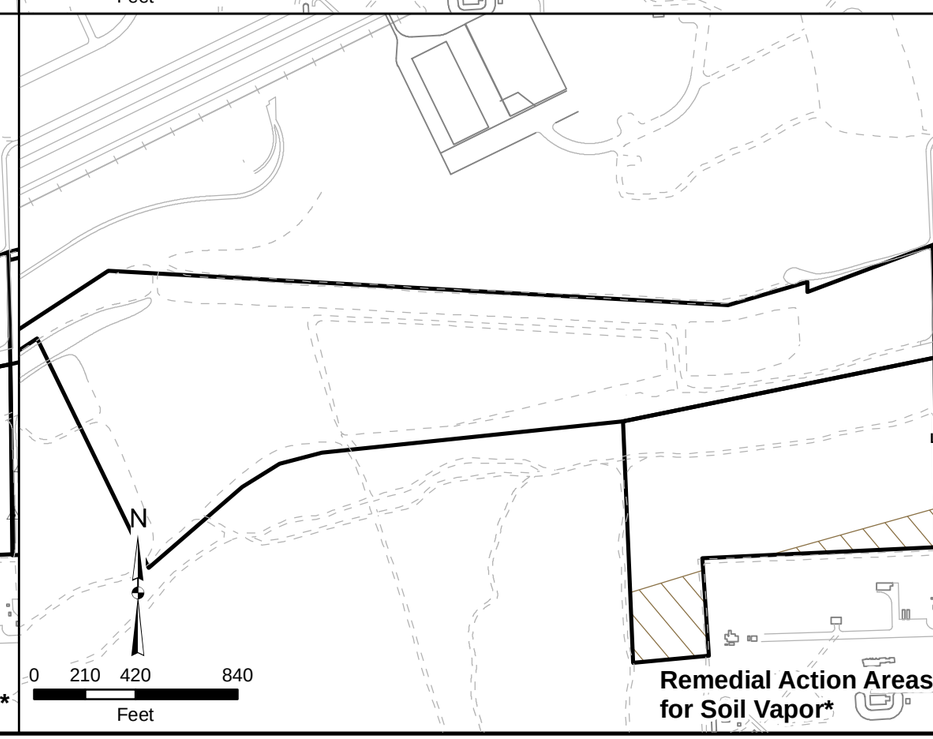
Soil Sample Locations



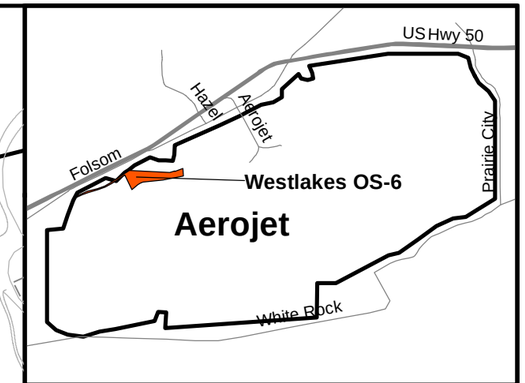
Remedial Action Areas for Soil



Soil Vapor Sample Locations*



Remedial Action Areas for Soil Vapor*



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 3 (Engineering Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).
* No soil vapor samples were collected from the Westlakes area or Buffalo Creek.

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Figure 2-27
Remedial Action Areas for Buffalo Creek and Westlakes Areas
Operable Unit 6
Record of Decision

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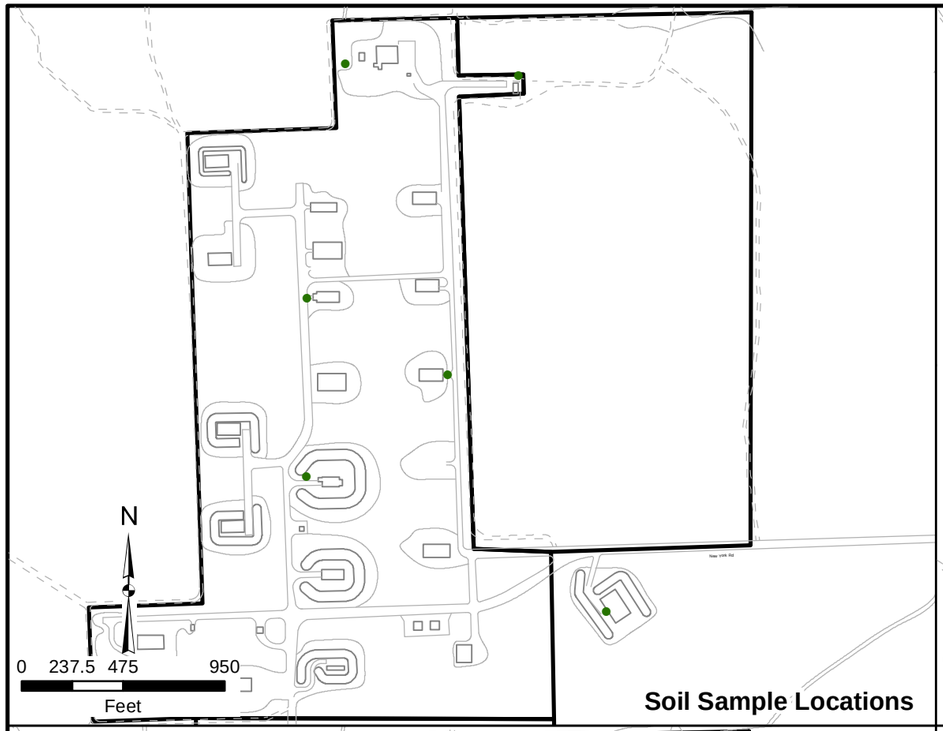
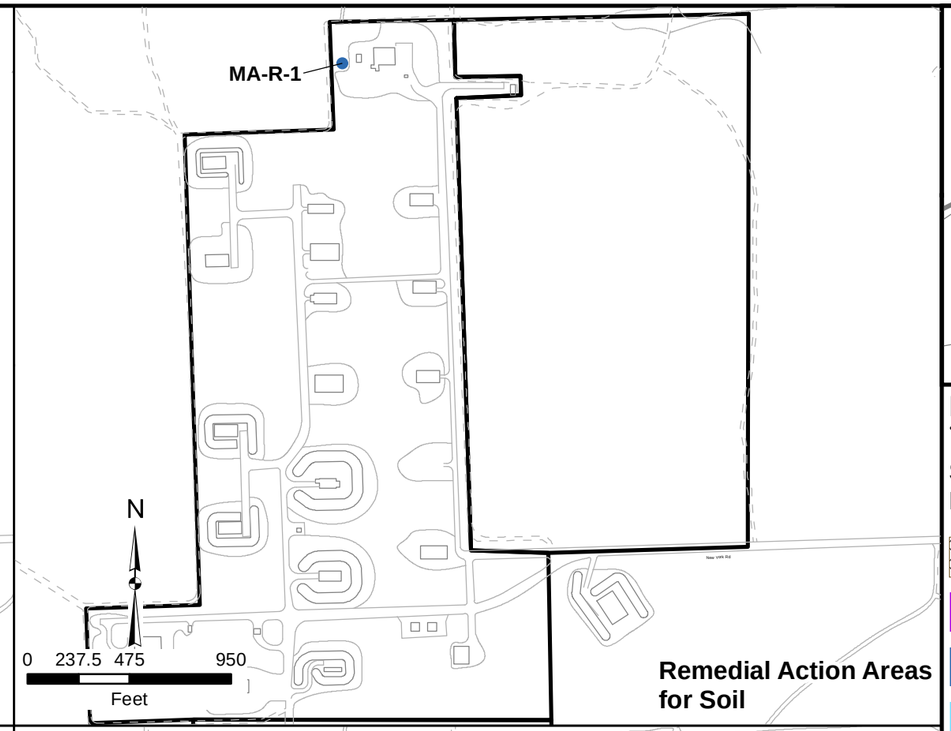
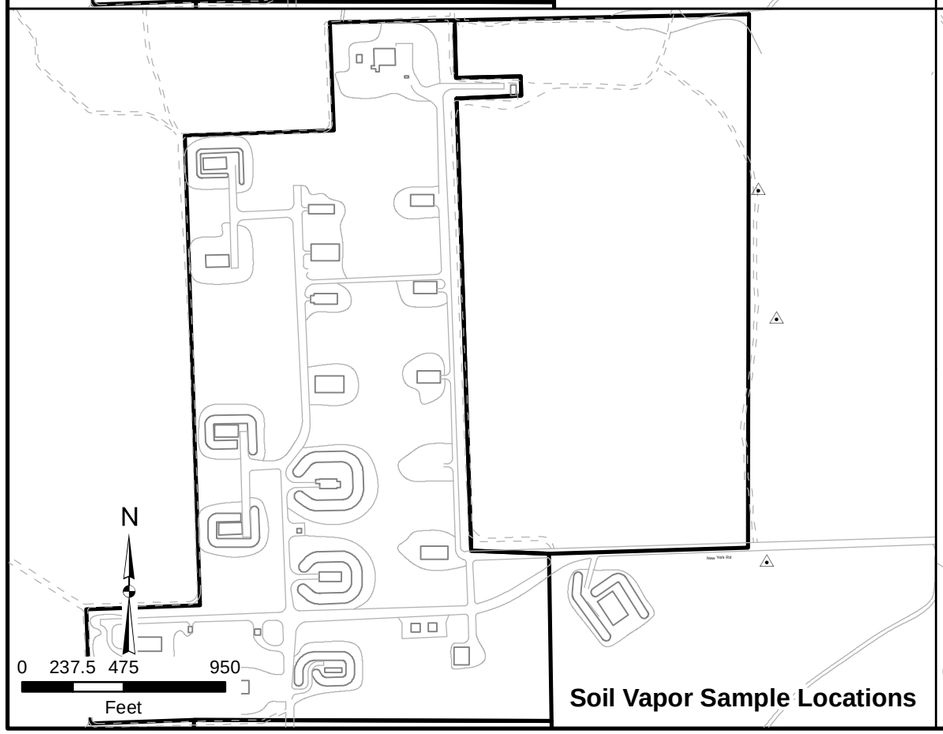
ES042114142800SAC



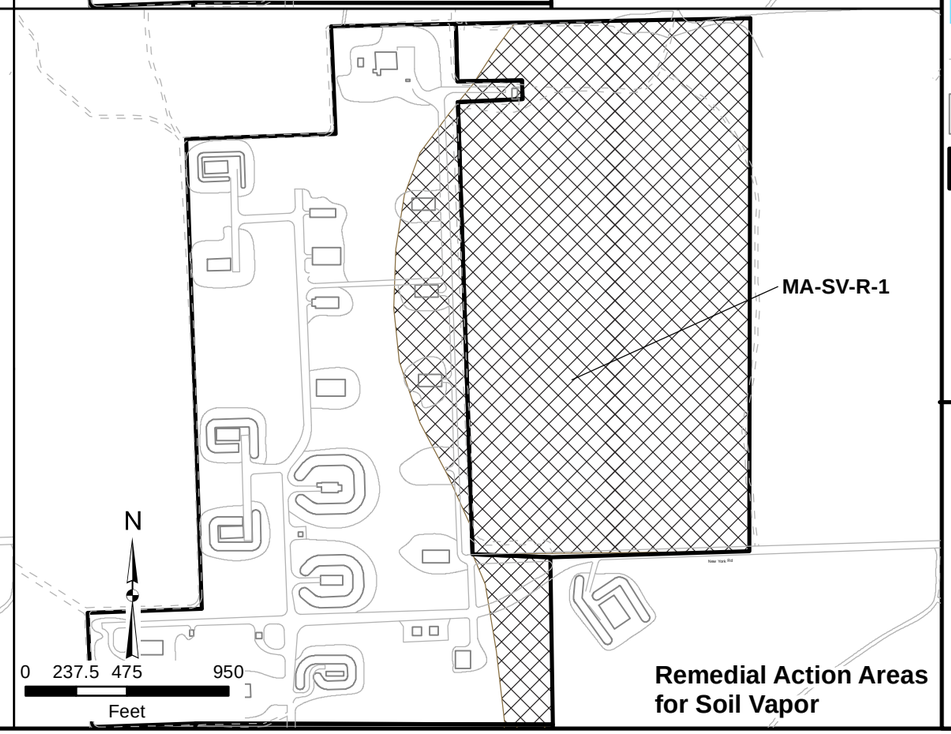
Soil Sample Locations



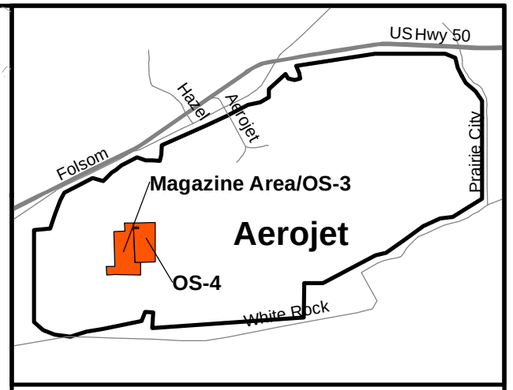
Remedial Action Areas for Soil



Soil Vapor Sample Locations



Remedial Action Areas for Soil Vapor



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 2 (Institutional Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-28
Remedial Action Areas for Magazine Area/OS-3 and OS-4
Operable Unit 6
Record of Decision

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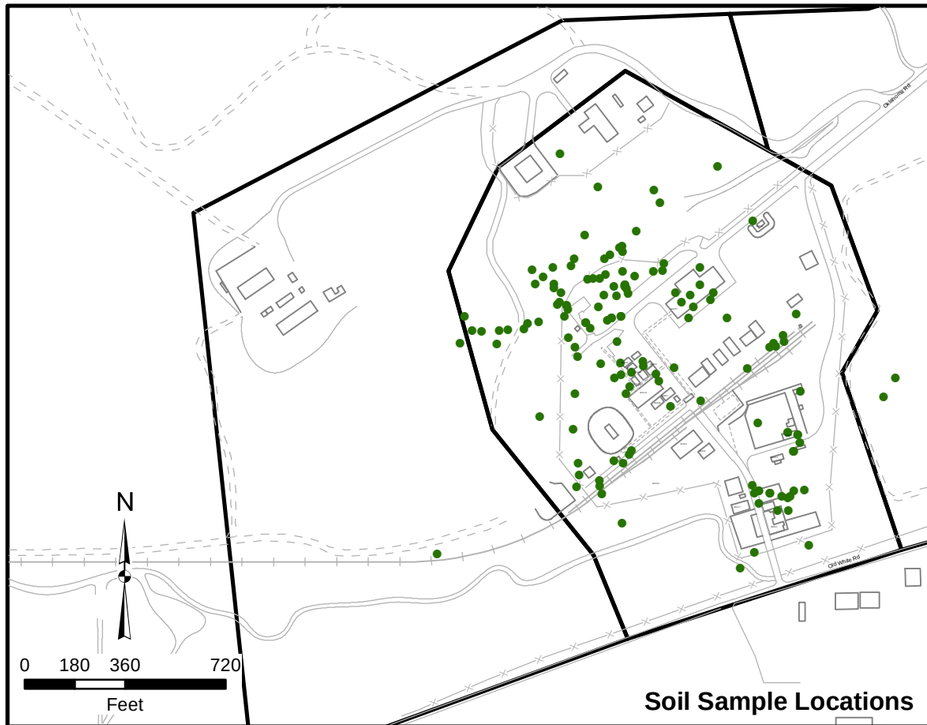
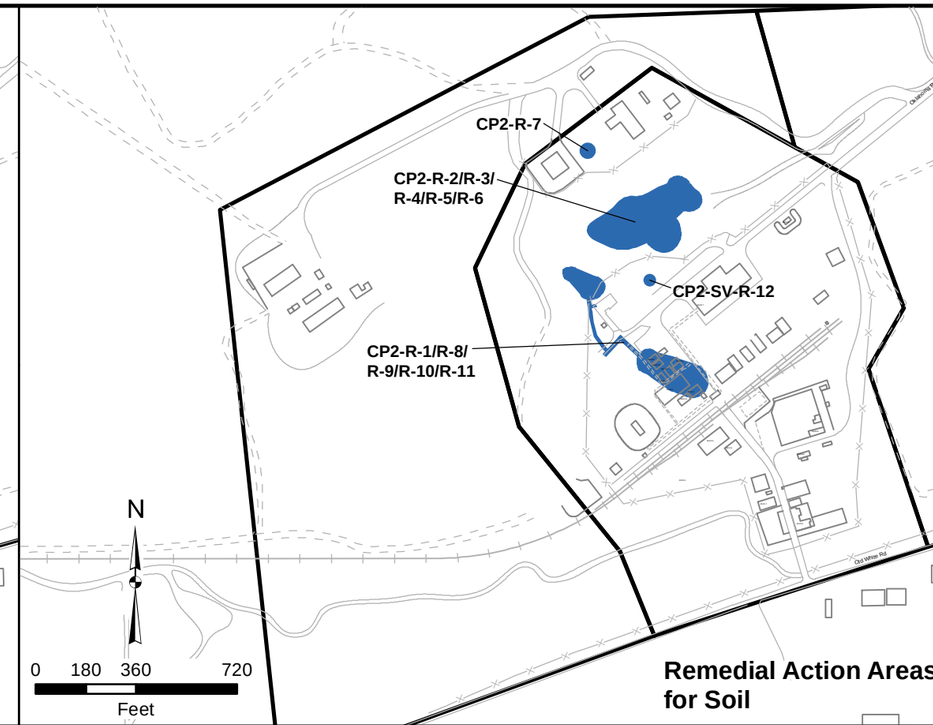
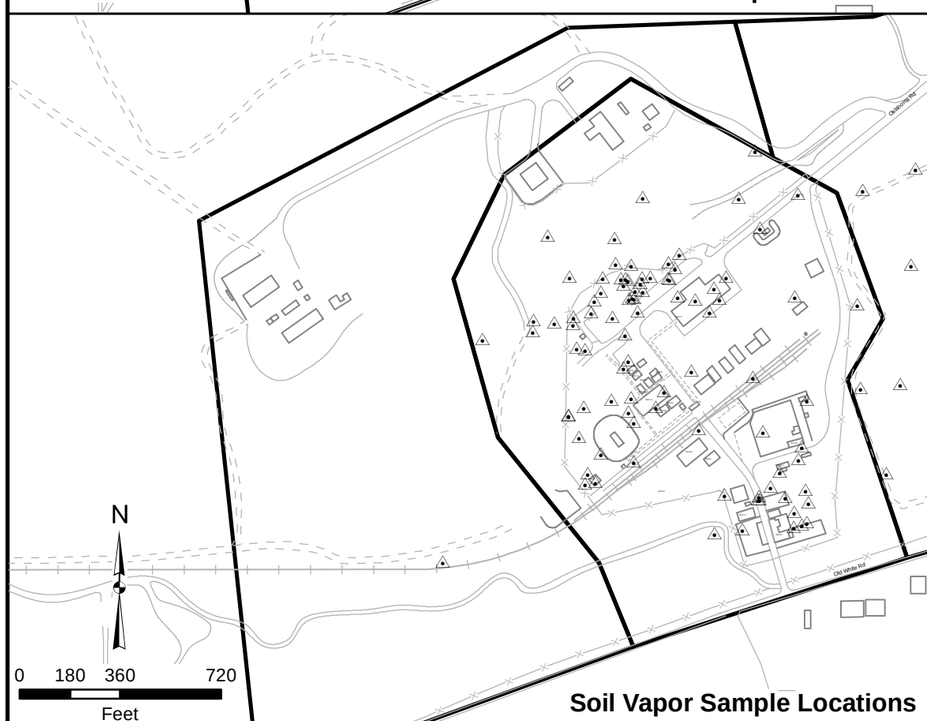


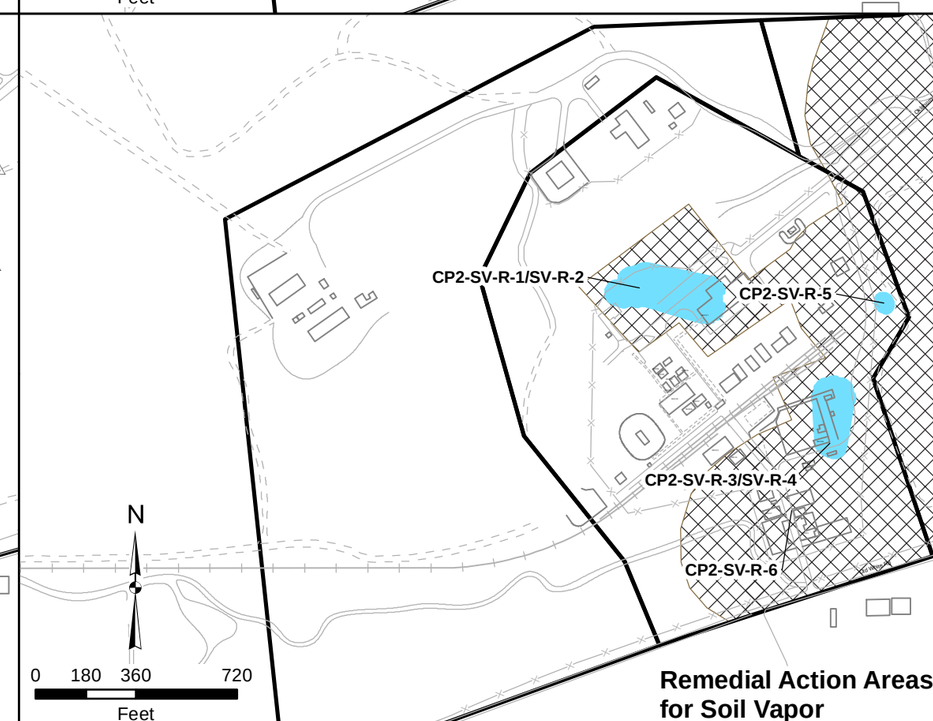
Soil Sample Locations



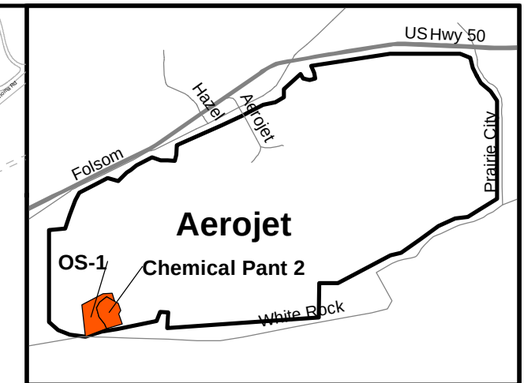
Remedial Action Areas for Soil



Soil Vapor Sample Locations



Remedial Action Areas for Soil Vapor



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 2 (Institutional Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-29
Remedial Action Areas for Chemical Plant 2 and OS-1
Operable Unit 6
Record of Decision

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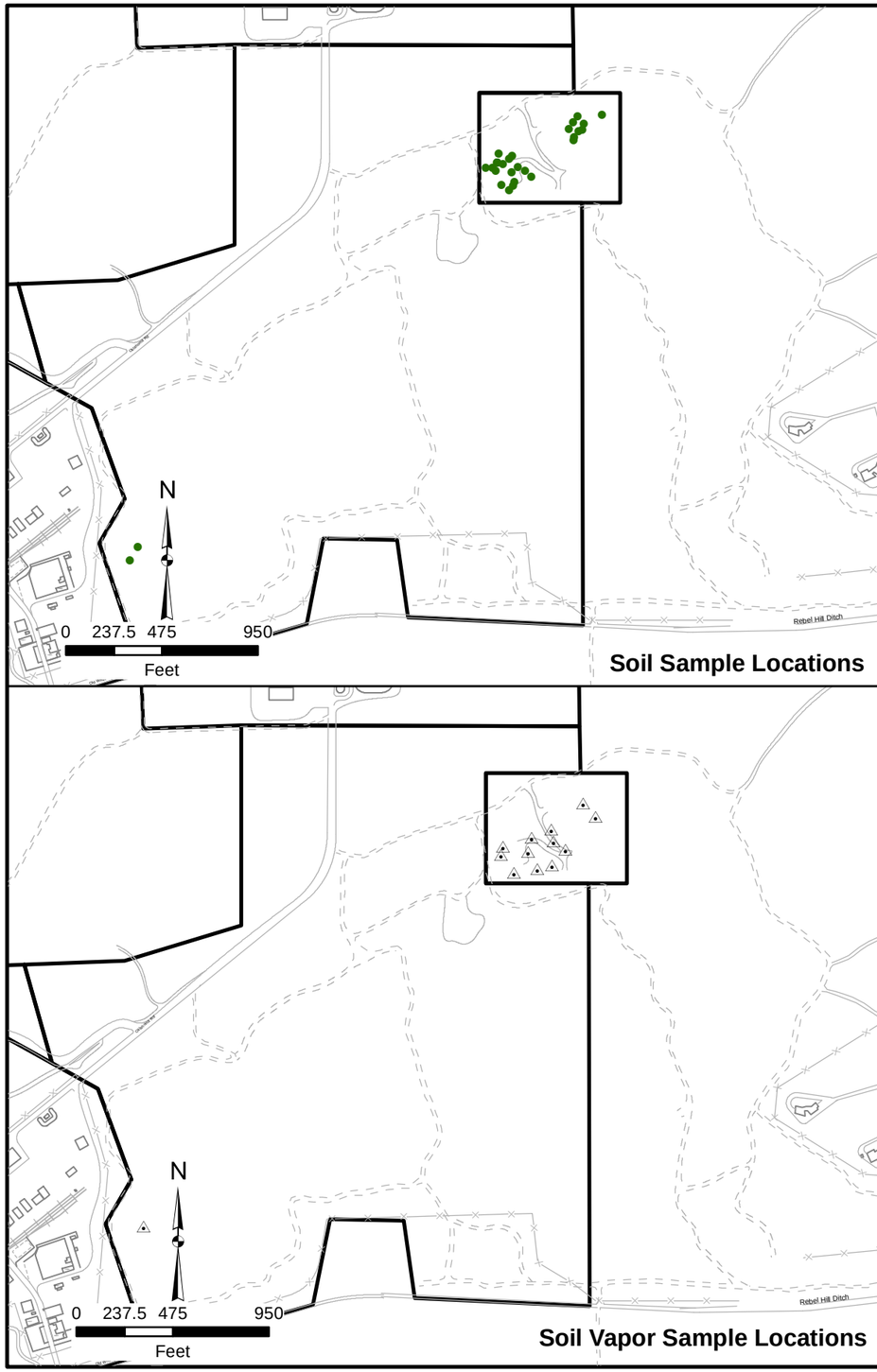
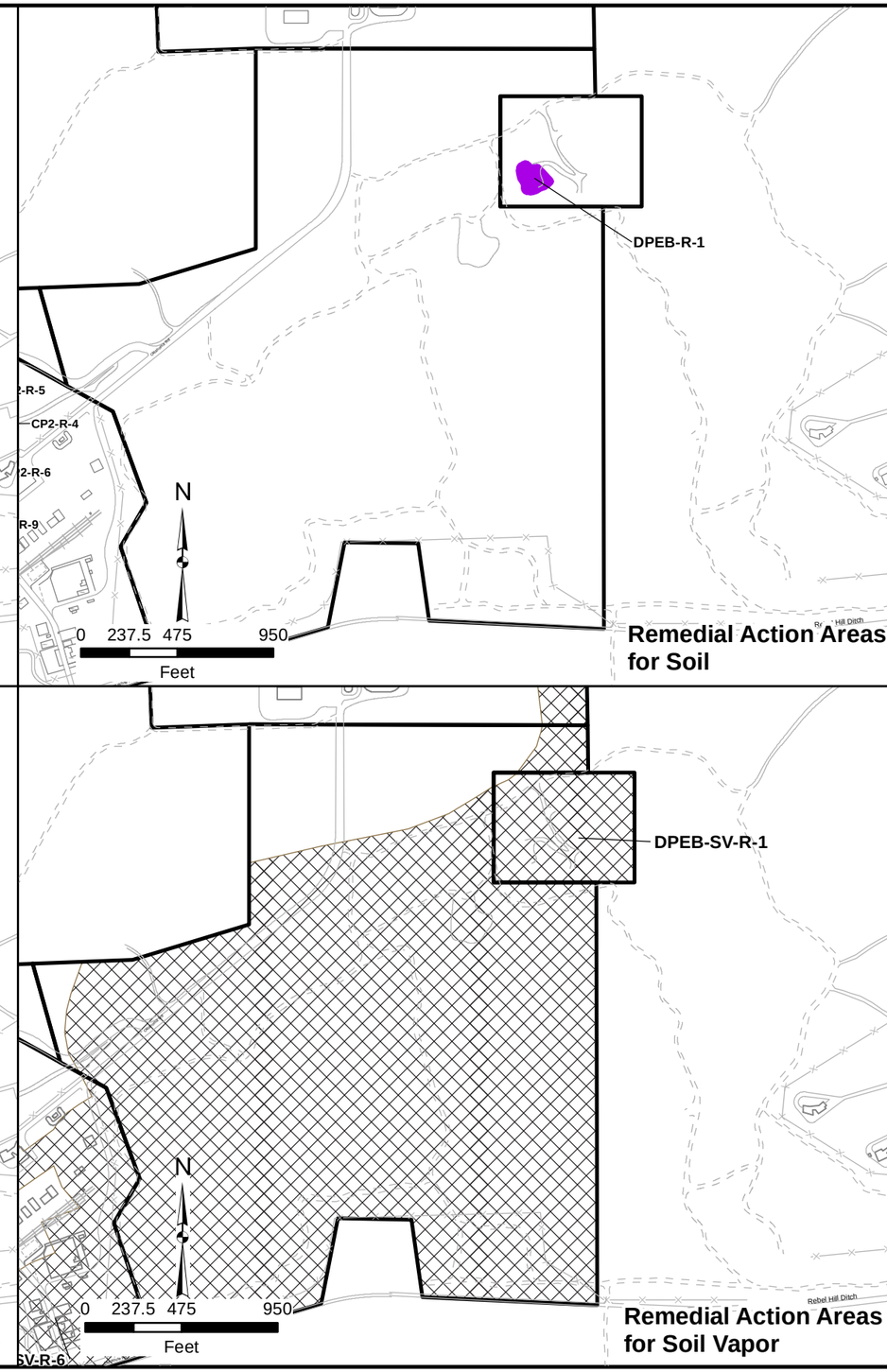


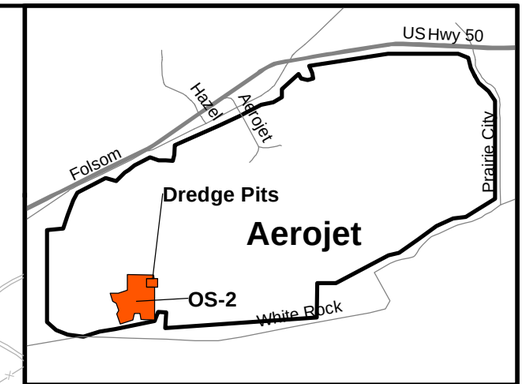
Soil Sample Locations



Remedial Action Areas for Soil

Soil Vapor Sample Locations

Remedial Action Areas for Soil Vapor



Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 2 (Institutional Controls)
- Alternative 3 (Capping)
- Alternative 4 (Excavation)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary
- Soil Boring Location
- Soil Vapor Location

Note:
Additional details regarding the soil or soil vapor sample locations are in the Boundary OU RI (ERM, 2010).

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Figure 2-30
Remedial Action Areas for Dredge Pit, Eastern Basin and OS-2
Operable Unit 6
Record of Decision

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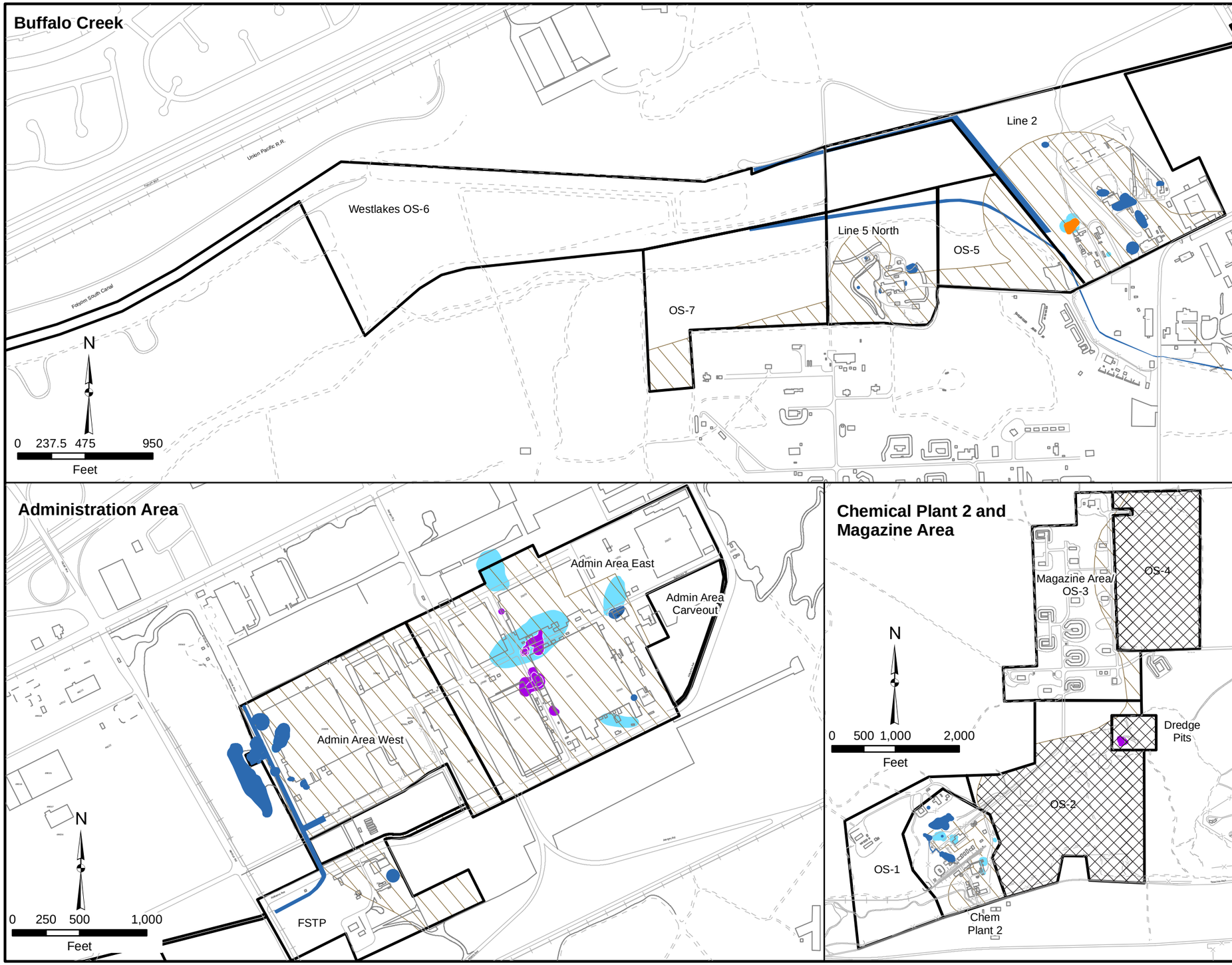
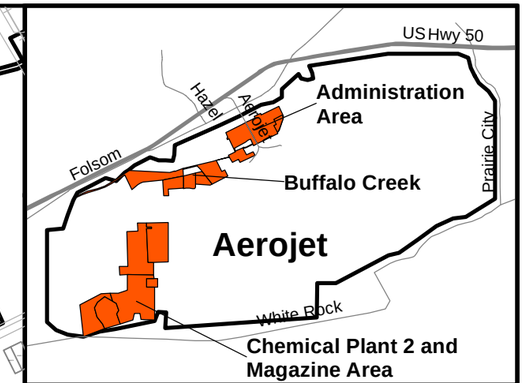
ES042114142800SAC





Legend

Selected Alternative for Retained Remedial Areas:

- Alternative 2 (Institutional Controls)
- Alternative 3 (Capping)
- Alternative 3 (Engineering Controls)
- Alternative 4 (Excavation)
- Alternative 4 (Excavation with Soil Flushing and Air Stripping)
- Alternative 4 (SVE)
- Road
- Structure
- Management Area/Open Space Boundary

Note:

For more detail on retained areas, see Appendix B and Figures 2-23 through 2-30.

OS = Open Space

FSTP = Former Sewage Treatment Plant

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Figure 2-31
Remedial Action Areas for Operable Unit 6
Operable Unit 6
Record of Decision

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2.9 Remedial Action Objectives

The remedial action objectives (RAOs) describe what the selected remediation effort is expected to accomplish. The following RAOs have been identified for OU-6:

- Prevent present and future worker and resident exposure to COCs in soils within the upper 12 feet and ecological receptors within the upper 6 feet that pose an unacceptable risk for areas identified in Table 2-11.
- Prevent migration of COCs in soil and soil vapor to groundwater for areas identified in Table 2-11 that could impair beneficial uses and to be consistent with current and future sitewide groundwater remedies.
- Prevent exposure to VOCs in ambient air at levels exceeding the health-based ambient air screening levels for the current and planned future land use.
- For contaminated soil and soil vapor, the RAOs are based on site-specific potential exposure information as used in the HHRA and ERA and on current values for the hazards posed by the COCs. The soil and soil vapor cleanup levels (Tables 2-2 and 2-3) are calculated to reduce human health and ecological risks to protective levels for unrestricted future land use.

There may still be some uncertainty in the characterization of the contamination within OU-6 in some areas, such as the lateral or vertical extent not being fully defined or the maximum concentrations of COCs not having been identified. To ensure that all contamination is addressed at each remedial action area, during remedial design additional data will be collected and all COCs identified for each area will be screened against all three cleanup levels (protection of human health, ecological receptors, and groundwater), where applicable, regardless of the pathway that is triggering the action. For example, if TCE was identified as COC for the protection of groundwater, during the remedial design, TCE concentrations would be compared to cleanup levels for human health and ecological receptors, in addition to the cleanup levels for the protection of groundwater. This will help eliminate any unexpected exposures and ensure that the remedy for the remedial action area meets all cleanups levels prior to completing the remedial action and closing the site.

Furthermore, if additional characterization demonstrates that there is no remaining risk to any receptor above acceptable levels, and the RAOs have been met, the remedial action areas can be evaluated for closure.

2.10 Description of Alternatives

The RI, along with the human and ecological risk evaluations, identified areas that required action to prevent exposure. The FS assessed a range of possible actions needed to prevent unacceptable human and ecological exposure. Representative process options were screened and assembled into the following four remedial alternatives that address a broad range of site conditions and contaminant types:

Alternative 1 – No Action
Alternative 2 – ICs

Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs
Alternative 4 – Source Removal/Reduction

EPA is required by law to consider a No Action Alternative and to evaluate viable cleanup or containment alternatives against nine criteria. The OU-6 remedial alternatives were compared against all of the nine regulatory evaluation criteria found in the National Contingency Plan, 40 CFR § 300.430(e)(9), including community acceptance, which was solicited during the public comment period. For an alternative to be considered as a possible final remedy, it must meet EPA's two threshold criteria, which are (1) to protect human health and the environment and (2) to comply with specific State and federal regulations known as applicable or relevant and appropriate requirements (ARARs). Appendix B presents a summary of the remedial actions along with the selected remedies and rationale for the actions.

2.10.1 Alternative 1 – No Action

No engineered measures, ICs, or monitoring would be implemented in OU-6 to reduce source area concentrations, prevent chemical migration, restrict or eliminate potential exposures to site chemicals, or reduce exposure of chemical concentrations to potential human or ecological receptors. The No Action Alternative is required by the NCP to provide a baseline for evaluation/ comparison of the costs and benefits of other alternatives. The No Action Alternative for OU-6 is not a viable remedy alternative because it does not meet either of EPA's threshold criteria.

2.10.2 Alternative 2 – Institutional Controls

Alternative 2 consists of ICs for all areas where the risk to human health is the result of vapor intrusion and to prevent unacceptable exposures to contamination remaining onsite. EPA considers ICs to include "non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and/or protect the integrity of the response action". ICs typically are designed to work by limiting land or resource use or by providing information that helps modify or guide human behavior at a site. Some common examples of ICs include zoning restrictions, building or excavation permits, well drilling prohibitions, easements, and covenants. At sites where contamination is left in place such that unrestricted land use and unlimited exposure would not be warranted, ICs should be considered to ensure that unacceptable exposure from residual soil, or soil vapor containing COCs does not occur.

This ROD addresses soil and soil vapor contaminated areas. Although this ROD is not intended to address groundwater contamination, groundwater contamination is present beneath the OU-6 area. Because there is currently no sitewide land use covenant for groundwater, this ROD will implement ICs similar to those adopted by OU-3 and OU-5 RODs, as well as ICs placed on the Carveout Lands to restrict access and use of groundwater.

The objectives of ICs that may be applied to OU-6 include the following:

- Notice and, as appropriate, restrictions on residential land use (through management controls or use restrictions) where residual COCs would remain in place at concentrations that are above the levels that would allow for unrestricted use;

- Notice, and as appropriate, restrictions on commercial/industrial land use (through management controls or use restrictions) in areas where existing chemical concentrations exceed risk-based levels for commercial/industrial uses;
- Notice and, as appropriate, requirements for appropriate health and safety and materials management procedures for excavations in areas of residual COCs.

The mechanisms that may be used for implementation of ICs for OU-6 may include governmental controls, proprietary controls, and information devices.

Governmental controls involve obligations under which a government has direct enforcement rights. Governmental controls that could be applied to OU-6 include the following:

- Land use restrictions imposed by the local agencies (e.g., zoning restrictions) that specify and control allowable land uses and restrict residential uses to areas meeting standards for unrestricted use;
- Building permit notifications and restrictions; and
- Restrictions on development as contained in environmental deed restrictions or covenants running with the land that are enforceable by one or more state agencies.

Proprietary controls include environmental covenants or environmental easements that are recorded against a particular piece of property and run with the land. For OU-6, an environmental covenant will need to be developed to meet each of the IC objectives. The covenants and environmental restrictions would restrict future use of contaminated soil and groundwater areas that have not attained residential cleanup objectives, whereby Aerojet would covenant to impose these restrictions. These covenants and environmental restrictions will be binding to Aerojet's successors and assigns as covenants running with the land. EPA and Cal-EPA will have the right to enforce these restrictions. Aerojet would be required to give written notice of the soil, soil vapor, or groundwater contamination to each buyer, lessee, renter and mortgagee of any of these lands and every lease, deed, mortgage or instrument conveying any part of these lands shall expressly provide that it is subject to this declaration of covenants and environmental restrictions.

Both Sacramento County and City of Rancho Cordova have restrictions that require permits and evaluations for any wells that are within 2,000 feet of any known groundwater contaminant plume. This special "consultation zone policy" review by appropriate regulatory agencies (including, but not limited to, Sacramento County Environmental Management Department and RWQCB) are detailed in Sacramento County Code Number 1455, Section 6.28.000 and Rancho Cordova Municipal Code 6.28.000 - Wells and Pumps.

In addition to environmental covenants, environmental easements could be recorded over areas subject to restricted uses. The environmental easements could be developed and granted to the state or local agencies to ensure adherence to environmental covenants and governmental controls, and to provide the agencies with a mechanism for legal enforcement of the covenants and controls against future property owners. In this respect, the easement/covenant has a "governmental" control aspect that would not be present if the easement were entirely between landowners.

Information devices may also be part of the ICs to be used for OU-6 and the site as a whole. These could include deed notices identifying presence of COCs, land use restrictions, and requirements for land use (which were included in the deed restrictions for the Carve-Out Lands). Information devices also consist of inclusion of the site on the state registries of hazardous waste/contaminated sites. In this regard, the site is currently listed in the Geo-Tracker database and geographic information system (GIS) of environmental data. Geo-Tracker was developed by the State Water Resources Control Board pursuant to a mandate by the California State Legislature. Geo-Tracker tracks various sites, including Spills-Leaks-Investigations-Cleanups sites such as the Aerojet Superfund Site. Currently, the site is also listed in the DTSC EnviroStor Data Management System (database) and GIS registry of hazardous waste sites and sites that have known COCs. In addition, DTSC is required to maintain on the internet a list of all land use restrictions recorded under its statutes. DTSC maintains a contract with Terradex which notifies DTSC when risky activities occur above contaminated sites which contain these recorded restrictions.

At the local level, the presence of COCs and restrictions on land uses and groundwater use at the Aerojet Superfund Site are identified in various planning documents prepared by Sacramento County and municipalities in the area of the site.

2.10.2.1 Soil ICs

With respect to future use of contaminated soil areas that have not attained residential cleanup objectives, EPA, DTSC and the RWQCB would seek LUCs, such as a declaration of covenants and environmental restrictions to be recorded by Aerojet that would be binding on Aerojet's successors and any new buyer, lessee, renter, mortgagee of any of these soil areas. A declaration of covenants and environmental restrictions would restrict use in such areas. In addition, if there is a constructed cap or SVE system, protections of these systems may be included in the LUCs.

Also, in some of the OU-6 MAs, residual COCs are present beneath existing buildings, utility corridors, landscaped areas, and other infrastructure features at levels that could potentially pose a health risk under residential or, in some cases, to commercial/industrial uses. Soils remaining in place at levels greater than the planned use, including soils at depth, will be managed under ICs and/or engineering controls until such time as the overlying feature is removed and the contaminated material can be remediated.

The presence of these buildings and infrastructure features present physical limitations to the implementation and/or potential effectiveness of various engineered controls that might otherwise be applicable for removing or reducing the COCs. For example, the presence of a large office or warehouse building overlying residual non-VOC COCs in shallow, unsaturated soil would prevent, or at a minimum greatly restrict, the applicability of active engineered measures such as soil excavation and disposal or soil treatment. Consequently, the available remedial technologies are unlikely to remove or reduce COCs beneath these buildings to levels that would allow for unrestricted use. Therefore, ICs would be appropriate to prevent exposure and ensure remedial action is taken when the building is removed. In addition, ICs will be implemented to assure protectiveness throughout OU-6.

2.10.2.2 Soil Vapor ICs

Large portions of OU-6 have underlying groundwater containing COCs. VOCs in groundwater can be a source of VOCs in the vadose zone with a potential to migrate into overlying buildings (vapor intrusion). In addition, releases of VOC contaminants from source areas in OU-6 may also result in VOC migration from the subsurface into overlying buildings. The HHERA evaluated risks posed by the VOC migration. In areas that the HHERA indicated a potential significant risk from vapor intrusion from COCs, and the COCs are unlikely to be remedied in the near future to levels below that risk level, ICs would be warranted to restrict property use or would be used in conjunction with containment or engineering controls (e.g., vapor barriers) that would allow for restricted use.

ICs for soil vapor intrusion could include:

- Notice of the existing conditions known to the environmental agency that may cause potential unacceptable risks from vapor intrusion or underlying groundwater;
- Prohibition against specific uses of the property without authorization;
- Prohibition against activities that may interfere with the integrity or performance of vapor intrusion mitigation or groundwater remediation systems;
- Right of access to the property for agencies to inspect, monitor, and perform other activities relative to such systems;
- Right of access to the property for the person responsible for implementing the O&M activities relative to such systems; and
- Inspection and reporting requirements for the owner of the property.

Appropriate monitoring and land use covenants are required for either residential or commercial use of OU-6 locations until the potential threat of vapor intrusion is removed.

2.10.2.3 Groundwater ICs

As stated before, although this ROD is not intended to address groundwater contamination, groundwater contamination is present beneath the OU-6 area. Because there is currently no sitewide land use covenant for groundwater, this ROD will implement ICs similar to those adopted by OU-3 and OU-5 RODs, as well as ICs placed on the Carveout Lands to restrict access to groundwater. As stated in the OU-5 Interim ROD for Groundwater, "These [institutional] controls will include Sacramento County review of new well drilling permits and prohibitions on access to groundwater on the land overlaying the contaminated groundwater to restrict use of untreated groundwater within the contaminated portions of the aquifer until the final water quality objectives have been attained." (See Appendix A for the groundwater plume locations.) In addition, the OU-6 ROD will require ICs enforceable through State land use controls whenever any portion of Aerojet-owned property above a groundwater contaminant plume is transferred. These restrictions will be implemented through a recorded covenant pursuant to 22 *California Code of Regulations* (CCR) Section 67391.1(a), (d) and other applicable California law, whereby Aerojet covenants to impose these restrictions. These land use covenants will be binding on Aerojet's successors and assigns as covenants running with the land. The State of California and EPA (as a third-party beneficiary) will have the right to enforce these restrictions.

Any lease or sale of Aerojet property overlying the contaminated groundwater in OU-6 shall be subject to the following restrictions:

- No recharge of groundwater unless and until expressly permitted in writing by EPA and the RWQCB;
- No injection into the groundwater unless approved in writing by EPA and the RWQCB;
- No sustained extraction of groundwater encountered during construction without written approval by EPA and the RWQCB.

Aerojet shall give written notice of the groundwater contamination to each buyer, lessee, renter, and mortgagee of any of these lands; and every lease, deed, mortgage, or instrument conveying any part of these lands shall expressly provide that it is subject to this Declaration of Covenants and Environmental Restrictions.

In addition to the groundwater ICs already in place, other restrictions already applied to the OU-6 area include the Sacramento Consultation Zone policy, the PCD identifying areas subject to excavation restrictions, and Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements for Soil Excavation and Grading Requirements.

2.10.3 Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs

The third alternative consists of construction of new containment systems, maintenance of existing barriers to COC exposure, and development and implementation of engineering controls to reduce or prevent exposure to existing and future building occupants that may be subject to vapor intrusion or exposed to contaminants in soils. Engineering controls encompass a variety of engineered and constructed physical barriers (e.g. soil capping, sub-surface venting systems, mitigation barriers, fences) to contain and/or prevent exposure to contamination on a property. Examples of containment and engineering control technologies that may be implemented for OU-6 include the following:

- Placement of capping materials (pavement, gravel layer, etc.) over areas with chemicals posing potential risks above commercial/industrial levels;
- Placement of backfill materials (clean soil, etc.) over areas with chemicals posing potential risks above human and ecological levels;
- Monitoring the presence and thickness and maintenance of new and existing capping materials (e.g., buildings, foundations, roadways, and parking lots) that currently overlie areas of COCs within OU-6 to ensure the integrity of the capping materials;
- Modification and monitoring of the HVAC systems of existing buildings to ensure sufficient air exchange rates to limit vapor intrusion and reduce indoor air concentrations to safe levels based on the Johnson and Ettinger Model (1991) or an alternative industry-accepted standard calculations;
- Construction and operation of foundation venting systems around and/or beneath **existing** buildings, and adoption of engineering or management controls requiring vapor mitigation

to reduce or prevent VOC intrusion into buildings through the installation of SSV and/or SSD systems or alternative system designed to prevent intrusion of contaminants to indoor air;

- Construction and operation of foundation venting systems around and/or beneath **new** construction and adoption of engineering or management controls requiring vapor mitigation to reduce or prevent VOC intrusion into buildings through the installation of vapor barriers (synthetic membrane) SSDs, SSVs, or alternative systems designed to prevent intrusion of contaminants to indoor air.

Alternative 2 ICs, as described in Section 2.10.2, are incorporated as part of Alternative 3 and would also be implemented as part of this alternative to protect the integrity of the cap and vapor intrusion mitigation systems, to identify the presence of engineering controls in place, and for long-term protection and maintenance requirements. These long-term requirements refer to the activities necessary to ensure that engineering controls are maintained and that ICs continue to be enforced. If additional characterization demonstrates that there is no remaining risk from soil contaminants in the vadose zone to any receptors above acceptable levels, then ICs under Section 2.10.3 would continue to apply only where groundwater contaminants continue to pose a risk.

2.10.4 Alternative 4 – Source Removal/Reduction

This alternative would include actions taken to remove either source materials or environmental COCs so as to reduce COC concentrations to allow for unrestricted use or to levels that would allow for restricted uses. Examples of source removal/reduction actions that would be taken as part of this alternative include the following:

- Excavation and offsite disposal of soil containing site-related chemicals at concentrations above levels for unrestricted use;
- Excavation of soil containing VOCs at concentrations that present an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality; and
- SVE for VOCs in soil vapor at concentrations that present an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality;
- Soil Flushing (with air stripping to remove VOCs also present in soils) may be employed as a treatment technology to remove perchlorate from soils in areas where the risks to groundwater are high, but excavation is infeasible due to depth;
- Monitor groundwater at existing and new monitoring wells, drinking water wells, irrigation wells and up-gradient sentinel wells, to evaluate the effectiveness of the remedy. Additional monitoring wells may be required as necessary to evaluate the effectiveness of this remedy; and
- Manage groundwater within OU6 in coordination with the OU-3 and OU-5 groundwater management plan to maintain water levels and to prevent adverse impacts on the remedy.

Excavated or removed materials would be disposed of in an offsite, permitted and regulated disposal facility, in compliance with waste characterization and appropriate State and Federal disposal regulations.

Under this alternative, SVE will be performed to the extent possible to remove VOCs above cleanup levels that present an unacceptable risk from soil vapor migration into indoor air under an unrestricted or commercial/industrial use scenario. If the remedy performance evaluation demonstrates that the SVE system will not reach RAOs, engineering controls from Alternative 3 would be implemented to prevent and mitigate unacceptable exposure.

ICs and engineering controls will also be established to protect the SVE system.

Under this alternative, where source removal/reduction is selected, remedial action will be accomplished to the extent possible to remove all impacted soils above cleanup levels. As COCs would remain beneath some of the buildings within OU-6 and it may take some time to implement and complete the source removal/reduction activities included in this alternative, this Source Removal/Reduction Alternative would also include the ICs, containment and engineering controls described under the previous two alternatives. Examples would include actions taken with respect to existing occupied buildings such as HVAC operational modifications and/or foundation venting around/beneath existing occupied buildings located over areas that pose a potential risk for commercial use.

ICs as described above in Section 2.10.2 (Alternative 2) would also be implemented as part of this Alternative to restrict unacceptable land uses, require environmental evaluations, and establish protection of engineered controls. This alternative will require source removal/ reduction in the future in conjunction with building demolition or redevelopment if the environmental evaluation demonstrates the COCs still exist above cleanup levels.

Figures 2-23 through 2-31 show the retained areas where Alternative 4 was the selected remedy.

2.10.5 Common Elements and Distinguishing Features of Each Alternative

These alternatives include common elements, as well as distinguishing features unique to each option. The following discussion summarizes the common elements and distinguishing features of Alternatives 1, 2, 3, and 4. As previously noted, not all of the alternatives were evaluated for every site.

2.10.5.1 Common Elements

Common elements for the alternatives are as follows:

- All of the alternatives, except for Alternative 1, include ICs and monitoring
- All of the alternatives, except for Alternative 1, are compatible with intended site use and reuse
- Alternatives 2, 3, and 4 may result in restricted (i.e., industrial) land use

2.10.5.2 Distinguishing Features

The distinguishing features of Alternative 1 (No Action) are that no remedial action would take place under this alternative and there is no cost associated with this alternative.

The distinguishing feature of Alternative 2 (ICs) is that several sitewide ICs (including groundwater ICs, areas subject to excavation restrictions, and Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements for Soil Excavation and Grading Requirements) are already in place throughout Aerojet and within OU-6; and adding additional ICs to further protect human health and the environment is considered easily implementable, with no risks to the community or site workers.

For Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs), implementation of the remedy would result in restricted land use (industrial) and long-term O&M. Under this alternative, surface cover (e.g., asphalt, concrete, or building foundations) would provide a physical barrier to prevent direct contact with contaminated soil and prevent erosion and associated impacts to surface water. Subslab venting systems and/or subslab depressurization systems foundation venting systems around and/or beneath existing buildings, would reduce or prevent VOC intrusion into buildings. Sediment collection systems would also prevent direct contact and surface water impacts because contaminated sediment would be collected and removed. These will support the overall protectiveness of the remedy.

Under Alternative 4 (Source Removal/Reduction), unrestricted land use (residential) could be obtained. The distinguishing feature of Alternative 4 (Source Removal/Reduction) is the contamination is removed from the subsurface and in many cases, disposed offsite. Excavation would remove impacted soil, SVE would be applied to areas containing elevated VOCs, soil flushing and air sparging/SVE would be used in combination to also remove impacted soil where excavation may not be feasible because of depth. The long-term reliability of this alternative and treatment technologies is high because the waste is treated ex-situ or is removed from the site and shipped offsite for disposal at an appropriate facility.

2.11 Summary of Comparative Analysis of Alternatives

In accordance with the NCP, the alternatives were evaluated by EPA using the nine criteria (40 CFR, Section 300.430(e)(9)). For an alternative to be an acceptable remedy it must pass EPA's two threshold criteria: (1) overall protection of human health and the environment, and (2) compliance with ARARs. The No Action Alternative does not comply with the threshold criteria and is not discussed beyond the threshold criteria. The comparative analysis of alternatives based on the CERCLA criteria is included below and summarized in Table 2-12.

Table 2-12: Comparative Analysis Summary for OU-6

Criteria	Alternative 1 – No Action	Alternative 2 – Institutional Controls	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs	Alternative 4 – Source Removal/Reduction
Protection of Human Health and Environment	Would not reduce risk to human health or the environment.	Would reduce the potential for direct exposure to contamination, but contamination is left in place, so some potential for direct contact and impacts to groundwater remain. With the exception of the protection of groundwater, ICs would be sufficiently protective of human health.	Would reduce the potential risks to human health and the environment and is considered sufficiently protective. However, potential risks from COCs would not be eliminated because contamination would remain in place. Migration of VOCs to groundwater will still occur.	Provides a higher level of protection than Alternatives 2 and 3 because contamination is removed or treated. Alternative 4 is considered the most protective.
Compliance with ARARs	Does not comply with ARARs.	Partially meets criterion.	Partially meets criterion.	Meets criterion.
Long-Term Effectiveness and Permanence	Does not provide long-term effectiveness or permanence.	Alternative 2 relies on the restriction or control of the land use by the implementation, monitoring and enforcement of ICs. The risk would be reduced; however, concentrations of COCs in soil and groundwater would not be reduced.	Alternative 3 relies on both engineered barriers and ICs to ensure that unacceptable risks do not occur and is therefore considered to be more effective and permanent than Alternative 2.	Would provide greater long-term effectiveness and permanence than Alternatives 2 and 3 because contamination would be removed.
Reduction in Toxicity, Mobility, and Volume	Would not actively reduce toxicity, mobility, or volume. Reduction by natural degradation processes only.	Would not actively reduce toxicity, mobility, or volume. Reduction by natural degradation processes only.	No reduction in toxicity or volume through treatment. However, the presence of engineered caps, vapor barriers, and foundation venting and SVE systems would reduce the mobility of COCs.	Would permanently remove the majority of COCs, thereby reducing toxicity, mobility, and volume.
Short-Term Effectiveness	Not applicable for No Action.	No short-term risks to the community or site workers would occur due to the implementation of this alternative.	Construction and operation of the passive or active remediation measures included in Alternatives 3 and 4 would pose minimal short-term risks to workers and/or the community.	Construction and operation of the passive or active remediation measures included in Alternatives 3 and 4 would pose minimal short-term risks to workers and/or the community. Alternatives could be designed to minimize short-term risk to workers through health and safety measures.

Table 2-12: Comparative Analysis Summary for OU-6

Criteria	Alternative 1 – No Action	Alternative 2 – Institutional Controls	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs	Alternative 4 – Source Removal/Reduction
Implementability	Not applicable for No Action.	Readily implementable. There are no technical difficulties associated with implementing ICs. Least difficult alternative to implement.	Readily implementable. The presence of buildings over contaminated areas would prevent the implementation of containment technologies (Alternative 3) for several years. All of the containment/operational controls technologies are commercially available and use standard construction equipment and labor.	Readily implementable. The presence of buildings over contaminated areas would prevent the implementation of some source reduction/removal technologies (Alternative 4) for several years. Excavation and SVE are commercially available demonstrated technologies that involve the use of standard construction equipment and labor. Compared to Alternatives 2 and 3, Alternative 4 is the most difficult alternative to implement.
Cost[a]	$0	$107,000	$8,160,000	$20,727,000
State Acceptance	Not acceptable.	Acceptable	Acceptable	Acceptable
Community Acceptance	See Responsiveness Summary (Appendix E) This option is not generally acceptable to the Community	See Responsiveness Summary (Appendix E)	See Responsiveness Summary (Appendix E)	See Responsiveness Summary (Appendix E)

Note:

[a] Not all retained areas were evaluated for every alternative. For example, in the areas with risks to due vapor intrusion from contaminated groundwater, excavation (Alternative 4) was not evaluated because excavation would not be applicable and implementable for this type of contamination.

- **Overall Protection of Human Health and the Environment:** Because ICs are a component of Alternatives 2, 3, and 4, risks to human health and the environment (with the exception of risks to groundwater) would be reduced and controlled through the implementation, monitoring, and enforcement of ICs. With the exception of protection of groundwater, the ICs component of Alternatives 2, 3, and 4 would be sufficiently protective of human health with respect to this threshold criterion. Although COCs would remain in place and potential risks to human health and the environment (including risks to groundwater) from soil and groundwater COCs would not be eliminated under Alternative 3, the risk of exposure or release would be significantly reduced or eliminated through engineered barriers and/or operational controls. Alternative 4 would include actions to remove source materials or reduce COCs to levels that would allow for restricted or unrestricted use and protection of groundwater. Therefore, Alternative 4 would be the most protective of human health and the environment (including groundwater).

  Alternative 2 relies solely on ICs to achieve the additional protectiveness; therefore, it is not considered to meet the NCP expectation of relying on engineered measures to reduce or eliminate potential risks. Both Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs) and Alternative 4 (Source Removal/Reduction) include remedial actions and would, therefore, meet the NCP expectation.

- **Compliance with ARARs:** Cleanup actions for the all contaminated soil areas can be designed and constructed to comply with ARARs. Where applicable, ICs will be effective in limiting future land use.

- **Long-Term Effectiveness and Permanence:** Although the concentrations of COCs in soil and soil vapor would not be reduced under Alternative 2 (ICs), human health risk would be reduced by restricting or controlling the land use. As Alternative 2 relies solely on implementation, monitoring, and enforcement of ICs to ensure that unacceptable human health risks do not occur, EPA has not generally considered ICs to be as effective or permanent as alternatives that use engineered measures to ensure protectiveness. Under Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs), soil containing PCBs, metals, and VOCs (soil vapor) would remain; and, therefore, residual risk would remain. However, engineered barriers combined with implementation, monitoring, and enforcement of additional ICs to control land uses would prevent exposure to concentrations exceeding acceptable human exposure criteria and reduce risk. Under Alternative 4 (Source Removal/ Reduction), the soil containing COCs exceeding acceptable human and ecological criteria would be excavated and disposed of offsite, VOCs exceeding acceptable criteria in soil sites would be addressed with SVE systems, and areas where other COCs may be acting as a source to groundwater would be remediated using similar source removal/reduction technologies, thereby permanently eliminating or reducing the potential risks to acceptable levels. However, due to the presence of existing buildings and infrastructure, some source materials and soil containing COCs cannot be removed or remedial actions cannot be immediately implemented; and, therefore, residual risk would remain until such time as the buildings/ infrastructure are removed prior to redevelopment. ICs would be used to control land uses until such time as redevelopment allows for removal of the remaining source materials and media containing concentrations of chemicals above risk-based levels.

Alternatives 2, 3, and 4 all include ICs. Several ICs have already been established, implemented, and effective in restricting exposure for a number of years. These include the Sacramento Consultation Zone Policy, the environmental covenant for the Carve-Out lands, the PCD identifying areas subject to excavation restrictions, Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements for Soil Excavation and Grading Requirements, and the sitewide groundwater restriction ICs. Combining engineered barriers with ICs that control land uses under Alternative 3 would provide overlapping and redundant methods of protection. Long-term protection would be further ensured through ongoing monitoring and maintenance of the presence and performance of the engineered barriers and the effectiveness of the ICs. Excavation and offsite disposal under Alternative 4 provides a permanent means of eliminating risks from source materials and media containing concentrations of chemicals above risk-based levels. Assuming implementation, monitoring, and enforcement of additional ICs, Alternative 2 would meet process effectiveness and permanence. Alternative 3 relies on both engineered barriers and ICs to ensure that unacceptable risks do not occur and is, therefore, considered to be more effective and permanent than Alternative 2. Because Alternative 4 includes a mass reduction/removal component, it would provide greater long-term effectiveness and permanence than Alternatives 2 and 3.

- **Reduction of Toxicity, Mobility, or Volume through Treatment:** Because Alternative 2 would not involve any new remediation systems, it would not provide any reduction in toxicity beyond the natural attenuation of COCs that may occur in the unsaturated soil and groundwater environments.

  There would also be no reduction in toxicity or volume through treatment under Alternative 3. However, the presence of engineered caps, vapor barriers, and foundation venting systems would reduce the mobility of COCs. In addition, operation of foundation venting systems would result in a minor reduction in the volume of VOCs. As there would be no reduction in the toxicity, mobility, or volume through treatment under Alternative 2 and no reduction of toxicity or volume under Alternative 3, no treatment residuals would be generated. Vapor withdrawn by foundation venting systems is expected to contain only very low to minimal concentrations of VOCs.

  With respect to Alternative 4, excavation and disposal is the EPA's Presumptive Remedy for soils containing non-volatile COCs and SVE is the Presumptive Remedy for soils containing VOCs. As evaluated in the FS, these treatment technologies met the technical implementability screening evaluation in the FS and would permanently remove the majority of COCs, thereby reducing toxicity, mobility, and volume. As the excavated materials would be disposed of in an offsite, permitted disposal facility, excavation would not result in treatment residuals. If SVE is attempted for source removal/reduction, discharge from SVE systems may require treatment to remove or reduce levels of VOCs that would otherwise be discharged to the atmosphere. If vapor phase granular activated carbon is used, it would be shipped to an offsite facility for regeneration or destruction.

- **Short-Term Effectiveness:** Because no remedial action other than implementation of additional ICs would be taken under Alternative 2, no additional short-term risks to the community or to workers from implementation of this action would occur. Similarly, no environmental impact from construction activities would occur. Construction and operation

of the passive or active remediation measures that might be included in Alternatives 3 and 4 would pose minimal short-term risks to workers and/or the community. Standard Occupational Safety and Health Administration precautions necessary to protect worker safety during construction would be employed. Short-term environmental impact from construction activities is expected to occur.

Implementation, monitoring, and enforcement of ICs limiting properties to land uses that would not result in exposure greater than risk-based levels (Alternatives 3 and 4) would ensure that the RAOs 1 and 2 are met.

With respect to the time until RAOs would be achieved, it is estimated that it would take approximately 6 months to 1 year to implement additional ICs (Alternatives 2, 3, and 4) and approximately 2 to 3 years to conduct the necessary evaluations, prepare remedial designs, and construct the engineered barriers (Alternative 3) or implement source reduction/ removal measures (Alternative 4). Operation of source reduction measures such as SVE might require additional time to implement if treatability studies or pilot testing are needed.

- **Implementability:** Technically, ICs (Alternative 2) would be easily implemented, as would the ICs component of Alternatives 3 and 4. There are no technical difficulties associated with implementing additional ICs as no physical facilities would be constructed, and Aerojet and the regulatory agencies have already negotiated ICs for the Carve-Out lands. For those portions of OU-6 under Aerojet's ownership, there would appear to be no institutional impediments to reaching agreement on acceptable language. From an administrative implementability perspective, there are several areas within OU-6 where existing buildings or structures would remain in service or would not be demolished until future development plans are implemented. Their presence would prevent the implementation of containment technologies (Alternative 3) and some source reduction/removal technologies (Alternative 4) for several years, though the building itself will help prevent unacceptable exposure and provide some containment.

  For Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs), construction and maintenance of engineered barriers is technically feasible. Construction of asphalt or concrete caps and maintenance of existing asphalt and concrete over areas having COCs in the vadose zone can easily be performed. Construction of subslab depressurization, subslab venting, or alternative system designed to prevent intrusion to indoor air as part of new construction is a standard technology that does not pose any technical issues relative to implementability. Installation of foundation venting systems around or beneath existing buildings may be constrained by the presence of extensive underground utilities and landscaping, but these conditions are not expected to prevent or otherwise limit the implementability or effectiveness of these technologies. All of the containment and engineering controls technologies are commercially available and use standard construction equipment and labor. The necessary materials and specialist personnel are easily attainable.

  Excavation and offsite disposal of soil containing COCs and/or implementation of SVE systems under Alternative 4 (Source Reduction/Removal) are technically feasible. SVE for mass removal would be more complicated to implement under and around existing buildings because of extensive foundation systems and numerous underground existing utilities. To evaluate soil conditions and vapor permeability, pilot testing of SVE systems may be needed

to assess design parameters of SVE for mass reduction/removal. Alternative 4 would present few administrative difficulties and would require minor coordination with other agencies. Excavation, offsite disposal in a permitted and regulated disposal facility and SVE are all commercially available, demonstrated technologies that involve the use of standard construction equipment and labor.

In summary, from both the administrative and technical perspectives, Alternative 2 (ICs) would be the easiest to implement, followed by Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs). Alternative 4 (Source Reduction/Removal) would be the most difficult to implement.

- **Cost:** A summary of the estimated costs associated with each alternative is presented in Table 2-12. The basis for the costs, and the methodology and information used to develop the costs are provided in Appendix D.

  The cost estimates for each alternative were prepared in accordance with current EPA guidance with respect to level of accuracy and discount rate (i.e., 1.9 percent). For comparison purposes, the estimated total capital cost, estimated annual monitoring costs, estimated annual O&M costs, and estimated 30-year present worth cost estimates are presented in Table 2-12 and in the tables in Appendix D for each of the alternatives. The 30-year present worth costs for Alternative 2 (ICs) are less than the other two alternatives. In general, for most of the MAs within OU-6, 30-year present worth costs for Alternative 3 (Containment and Engineering Controls, incorporating Alternative 2 ICs) are less than those for Alternative 4 (Source Reduction/Removal).

- **State Acceptance:** The DTSC and Central Valley RWQCB support the selection of the remedial alternatives for the 81 areas addressed by this ROD. DTSC and the RWQCB provided invaluable input to EPA throughout the RI, FS, and this ROD review. EPA addressed certain State comments by DTSC and RWQCB regarding final human health and ecological cleanup standards. For example, EPA adopted DTSC HHRA Note 3, portions of CCR Title 27 and Title 23, State Water Resources Control Board Resolution No. 92-49, the Porter-Cologne Water Quality Control Act, and the Central Valley RWQCB DLM for Waste Classification and Cleanup Level Determination. EPA has adopted only portions of the ARARs identified by DTSC and the Central Valley RWQCB, and it is the position of DTSC and the Central Valley RWQCB that there are a number of additional ARARs that are applicable requirements. State ARARs based on CCR Titles 23 and 27 that have been accepted by EPA in this ROD have been included as ARARs based on limited application to certain site-specific portions of the OU-6 selected remedy. Table 2-13 outlines the site-specific ARARs adopted by EPA, and DTSC or RWQCB's position concerning why certain ARARs are considered applicable for this particular ROD. DTSC and RWQCB claim that these applicable requirements include, but are not limited to, certain provisions of Titles 23 and 27 as outlined in Table 2-13, and as referenced in the Administrative Record. For example, the Central Valley RWQCB maintains that a waste left in place following remediation within OU-6 may constitute a "waste management unit" for the purposes of CCR Title 23 concerning the discharge of hazardous waste to land for treatment, storage, or disposal; and CCR Title 27 as applicable to discharges of designated waste, which includes nonhazardous solid waste that could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters

of the State. DTSC and the Central Valley RWQCB reserve any and all rights to assert any state law provisions referenced in this ROD without any waiver and no prejudice to DTSC or the Central Valley RWQCB.

The EPA disagrees with DTSC and the Central Valley RWQCB about the applicability of certain state law provisions as noted above and as referenced in Table 2-13 for the remedial actions being selected in this ROD. However, DTSC and the Central Valley RWQCB agree that there is no substantive technical dispute as to the selected remedies and cleanup levels for this ROD. Accordingly, DTSC and the Central Valley RWQCB agree to concur with this ROD.

- **Community Acceptance:** The CAG has regularly met with EPA, Aerojet, DTSC, RWQCB and others to discuss issues related to the site and comment on cleanup plans. The CAG has actively participated in discussions with EPA throughout the development of the BOU OU6 RI/FS Report and Proposed Plan and is in general agreement with the selected remedies. The CAG requested additional time to submit comments on the Proposed Plan due to the complexity of the document. The public comment period was extended out an additional 120 days, making the entire public review period May 8 through September 20, 2013. Comments received by EPA reflect general concerns with the use of conservative cleanup goals, especially for perchlorate; conservative measures to ensure that future residents are not exposed to site contaminants; and appropriate groundwater monitoring and ICs.

2.12 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. The principal threat concept applies to source materials that are highly mobile or highly toxic and cannot be reliably controlled in place or that would present a significant risk to human health or the environment should exposure occur. A source material includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air or that act as a source for direct exposure.

None of the OU-6 remedial action areas have liquid or highly mobile wastes; however, several areas have high concentrations of toxic compounds that may be considered principal threat wastes. Examples of areas with high concentrations of toxic compounds include (but are not limited to): AE-R-2 (Aroclor-1254 concentrations resulting in a residential child HI of 42), AE-R-3 and AE-R-6 (PAH concentrations resulting in a residential ILCR greater than 10^{-3}), AE-SV-R-2 and AW-SV-R-1 (VOC concentrations resulting in an ILCR greater than 10^{-3} and an HI of 46), CP2-R-7 (various COC concentrations resulting in an HI of 14), and CP2-SV-R-2 (1,2-DCA concentrations resulting in a residential ILCR of greater than 10^{-2} and an HI of 1,300).

The Alternative 4 will reduce the volume, toxicity, and/or mobility of contaminants, meeting the statutory preference for treatment as a principal element. Actions, such as ICs and engineering controls, to prevent exposure will be required until the contamination remaining on site is remediated.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
Chemical-Specific ARARs					
Federal	Soil	EPA Regional Screening Levels (RSLs) (2015)	TBC	EPA has developed RSLs, which are risk-based levels that are used to screen sites that may require additional investigation or possible remediation. RSLs also may be considered in setting soil cleanup levels or groundwater cleanup levels in the absence of promulgated values for contaminants.	RSLs are considered in setting soil cleanup levels, including soil vapor levels, to be protective for residential, commercial, or industrial land use scenarios, as set forth in Table 2-2. Groundwater cleanup values are based on MCLs, California PHGs or California Drinking Water Notification Levels.
Federal	Soil	Toxic Substances Control Act (TSCA), 15 USC Section2605(e)(1)(A); 40 CFR 761.61	Applicable	Sets cleanup and disposal requirements for PCB spills.	TSCA establishes federal minimum requirements for PCB soil cleanup for protection of human health. Site-specific cleanup levels were derived through a risk assessment approach, based on RSLs, which are lower than the TSCA minimum cleanup requirement of 1 ppm for unrestricted use in high-occupancy areas.
State	Groundwater/ Surface Water	Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins (2009 revisions), adopted in accordance with California Water Code, Division 7, Sections 13240 and 13050 (Porter-Cologne Act); Chaps. II and III	Relevant and Appropriate	Those portions of the Basin Plan that set out the designated uses (i.e., beneficial uses) and the water quality objectives for surface waters.	The designated use for the aquifer at the Aerojet Site is municipal and aquatic water supply. The cleanup levels for the contaminated surface water comply with the Basin Plan's water quality objectives based upon such use. The aquifer designation is used to determine applicable soil cleanup levels that will allow for the groundwater to eventually attain the water quality objectives in the Basin Plan in the final groundwater remedy.
State	Groundwater and Soil	SWRCB Resolution No. 88-63 (Sources of Drinking Water Policy)	Applicable	Designates all ground and surface waters of the State as drinking water except where TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.	The aquifers under the Aerojet Site have been identified as sources of drinking water by this resolution. Federal and State MCLs are being used to derive the site-specific soil cleanup levels for protection of groundwater.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
State	Soil for Protection of Groundwater	Staff Report of the RWQCB, Central Valley Region DLM for Waste Classification and Cleanup Level Determination	TBC	Provides guidance on how to classify wastes according to Title 27, CCR, Division 2, Subdiv.1/ Title 23, CCR, Division 3, Chapter 15, Article 10.	Performance standard to be considered in determining the classification of wastes and contaminated soils, as set forth in Table 2-2.
State	Soil for Protection of Groundwater	SWRCB Resolution No. 92-49 III.G (As amended April 21, 1994) Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240, 13260, 13263, 13267, 13300, 13304, 13307)	Relevant and Appropriate	Promotes attainment of either background water quality, or the best water quality that is reasonable if background levels of water quality cannot be restored.	Relevant and appropriate to cleanup of discharges to soil that may affect water quality. *Comment: EPA recognizes 92-49 III.G only as relevant and appropriate. The RWQCB maintains that all of 92-49 is applicable or relevant and appropriate.*
State	Soil and Soil Vapor in Ambient Air	Minimum Standards for Health and Ecological Risk Assessments; California Health & Safety Code §25356.1.5(b) DTSC HHRA Note 3	Relevant and Appropriate	Risk assessments for remedy selection must not only meet NCP requirements, but also must include most current sound scientific methods, knowledge, and practices of public health and environmental professionals.	Use when determining the soil and soil vapor in ambient air cleanup levels, as set forth in Table 2-3.
State	Vapor Intrusion	DTSC Vapor Intrusion Mitigation Advisory, California Health and Safety Code §25356. 1.5(b) October 1, 2011	TBC	The Advisory provides guidance concerning engineering controls and response actions designed to interrupt or monitor the vapor intrusion pathway and to ensure public safety until the source of volatile chemical concentrations causing the vapor intrusion risk has been restored to concentrations at or below levels considered safe for human exposure. The Advisory provides a framework that guides the process for selecting a site-specific mitigation technology such as SSD or SSV systems or an alternate mitigation system that may prove to have results equal to or better than those of SSD or SSV systems.	Consider in the selection, design, and long-term monitoring of vapor intrusion technologies to reach vapor intrusion mitigation objectives.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
State	Soil and Groundwater	Title 27, CCR, § 20430 Title 23, CCR, § 2550.10 Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Relevant and Appropriate	Requires implementation of corrective action measures that ensure cleanup levels (i.e., water quality protection standard established under Section 2550.2) are achieved throughout the zone affected by the release by removing the waste constituents or treating them in place. Source control may be required. Also requires monitoring to determine the effectiveness of the corrective actions.	If water quality is threatened, this section applies to all soil cleanup activities. *Comment: Although EPA has identified certain selected sections of Titles 23 and 27 as relevant and appropriate to this remedy, the RWQCB maintains that Titles 23 and 27 apply broadly to this cleanup. Specifically, the RWQCB cites the following as either applicable or relevant and appropriate to this remedy: 23 CCR §§ 2510, 2511, 2520, 2521, 2550.0-2550.8, & 2580; 27 CCR §§ 20080, 20090, 20200, 20210, 20220, 20230, 20385-20435, 20950 & 22207. EPA does not agree that all of these provisions are ARARs for this remedy.*
State	Soil	Title 27, CCR, § 20430 Title 23, CCR, § 2550.10 Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Relevant and Appropriate	Requires an assessment of the nature and extent of the release, including a determination of the spatial distribution and concentration of each constituent.	Applies to sites at which monitoring results show statistically significant evidence of a release.
Location-Specific ARARs					
Federal	Floodplain and wetland protection	Executive Order Nos. 11990 and 11988	TBC	Require avoidance of adverse effects, minimization of potential harm, and restoration and preservation of natural and beneficial values of floodplains.	Constructing groundwater treatment facilities in a 100-year flood plain will be avoided. If it cannot be avoided, the potential harm to the flood plain shall be minimized.
Federal	Within 100-year flood plain	40 CFR Section 264.18(b) (2010) and 22 CCR Section 66264.18(b)	Applicable	A RCRA facility located in a 100-year flood plain must be designated, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood.	Because any new treatment facilities in OU-6 may generate hazardous waste, any such facility constructed within a 100-year flood plain must comply with this requirement.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
Federal	Sites in or Eligible for Inclusion in the National Register of Historic Places	Substantive portions of the National Historic Preservation Act, 16 USC Sections 470, *et seq.*; 36 CFR Part 800 (2010)	Applicable	Provides for protection of sites with historic places and structures. Federal agencies are required to take into account their undertakings on historic properties and afford the State Historic Preservation Office a reasonable time to comment.	Applicable if a federal undertaking (cleanup) could adversely affect historic properties that are included in or eligible for inclusion in the National Register of Historic Places. The proposed remedial alternatives are not expected to alter or destroy any known prehistoric or historic archeological features in OU-6 of the Aerojet Site. However, because there is always a possibility that buried historic or prehistoric remains could be discovered during such actions, this requirement would include action to address such areas.
Federal	Endangered Species or Threatened Species	Substantive portions of the Endangered Species Act of 1973, 16 USC 1531 *et seq.*; 50 CFR Parts 200 and 402 (2010)	Applicable	Federal agencies are required under Section 7 of the ESA to ensure that their actions do not jeopardize the continued existence of a listed species or result in destruction or adverse modification of its critical habitat (16 USC 1536). If the proposed action may affect the listed species or its critical habitat, consultation with the USFWS may be required (50 CFR 402.14). Additionally, Section 9 of the ESA prohibits the illegal taking of a listed species (16 USC 1538(a)(1).	Any action that may impact or threaten to impact Federal threatened or endangered species shall comply with this requirement.
State		California Endangered Species Act, Cal. Fish and Game Code Section 2080	Applicable	Prohibits the illegal taking of plant and animal species designated as either threatened or endangered in the state of California.	Any action that may impact or threaten to impact State threatened or endangered species shall comply with this requirement. For EPA's risk assessment purposes, all State-designated special-status species are treated as if listed as threatened or endangered. Applicable to state-listed species that are not protected under the Federal ESA.
Federal	Listed Migratory Birds	Migratory Bird Treaty Act; 16 USC Sections 703, *et seq.*	Applicable	Prohibits the illegal taking of migratory birds.	The Aerojet Site may be a habitat for the Burrowing Owl, a species of concern in California.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
Federal	Areas Affecting Streams or Rivers	Fish and Wildlife Coordination Act,16 USC 661 *et seq*.	Applicable	Requires Federal agencies that construct, license, or permit water resource development projects that modify any streams or water bodies to first consult with the USFWS (and the National Marine Fisheries Service in some instances) and State fish and wildlife agency regarding the impacts on fish and wildlife resources and measures to mitigate these impacts.	Applicable if a water body will be controlled or modified as a result of a federal agency action, license, or permit.
State	Streambed or Riverbed Alterations	Substantive Requirements of Cal. Fish and Game Code Section 1602	Applicable	Prohibits substantial diversion or obstruction of the natural flow of, or a substantial change of the bed or channel of, a river, stream or lake. Prohibits the deposit or disposal of debris or waste where it may pass into any river, stream, or lake.	Applies to grading and filling activity.
State	Restrictions Relating to Land and Groundwater	California Civil Code Section 1471; 22 CCR Section 67391.1(a), (d) (2010)	Relevant and Appropriate	Substantive requirements for placing an environmental restrictive covenant on contaminated land in the state of California.	Requires Aerojet to record environmental restrictive covenants on contaminated land and to name EPA as a third-party beneficiary in the covenants. *Comment: EPA specifically identifies subsections (a) and (d) of 22 CCR 67391.1 as relevant and appropriate for this ROD. DTSC's position is that the provisions of the entire 22 CCR 67391.1 are applicable requirements at this Site.*
Action-Specific ARARs					
Federal	Dredge and Fill	33 USC Sections 1251, *et seq.* and 40 CFR Parts 230 and 231 (2010)	Relevant and Appropriate	Regulates discharge of dredged or fill material into waters of the U.S., including wetlands.	Substantive portions applicable. Permit is not required for onsite activities.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
Federal	Generation of Waste from Construction and Operation due to Remedial Action Selected	40 CFR Part 261 Subparts A, B, C, and D (2014) and 22 CCR Section 66261.3 (2010)	Applicable	Establishes procedures and numeric limits for identification and management of characteristic hazardous wastes, listed hazardous wastes, and State-only (non-RCRA) hazardous wastes.	These requirements are applicable to management of waste materials generated as a result of construction of the selected remedial action or operation of a groundwater treatment plant. Consistent with prior RODs at this Site, the hazardous wastes at this Site are RCRA characteristic hazardous wastes. Based on the information available to EPA, no RCRA-listed hazardous wastes have been generated at this Site.
Federal	Generation of Waste from Construction and Operation due to Remedial Action Selected	40 CFR Section 262.11 (2010) and 22 CCR Section 66262.11 (2010)	Applicable	Requires waste generators to determine if wastes are hazardous wastes, and establishes procedures for such determinations.	These requirements are applicable to management of waste materials generated as a result of construction of the selected remedial action or operation of a groundwater treatment plant.
Federal	Storage of Hazardous Wastes for Treatment or Disposal Offsite	40 CFR Section 262.34 and 22 CCR Section 66262.34 (2010)	Applicable	Specifies maximum amounts and maximum periods for accumulation of hazardous waste onsite under generator status.	These requirements are potentially applicable to management of waste materials generated as a result of construction of the remedial action and operation of any groundwater treatment plant. To the extent that the wastes are located in an existing area of contamination, these provisions may not be triggered, as provided by EPA guidance.
Federal	Discharge to Inland Surface Water	National Toxics Rule, 40 CFR Sections 131.6 and 131.38 (2010) (California Toxics Rule)	Applicable	Establishes the appropriate aquatic and human health criteria for priority toxic pollutants in inland surface waters and enclosed bays and estuaries. Included in the National Rule are EPA-promulgated specific criteria for certain water bodies in California, the presence or discharge of which could reasonably be expected to interfere with maintaining designated uses.	Applicable for offsite discharge subject to NPDES permits and for onsite discharge subject to substantive requirements of a NPDES permit.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
State	Discharge to Surface Water	Section IV-16 (Policy for Application of Water Quality Objectives) of the Basin Plan for Sacramento River and San Joaquin River Basins (2009 rev.)	TBC	Allows for the use of mixing zones as part of a determination of whether water quality is being maintained in the receiving water.	By considering mixing zones, the point of compliance for evaluating the achievement of RAOs may be modified as part of the remedy.
Federal	Discharge to Surface Water	NPDES Permit, 40 CFR Parts 122 and 125 and 23 CCR Sections 2235 *et seq*.	Applicable	Establishes treatment and monitoring requirements for discharges to surface water.	Discharge to surface water onsite will comply with the substantive requirements of a NPDES Permit. Discharge to surface water offsite will require a NPDES Permit.
Federal	Stormwater Management	40 CFR Part 122.26 (2010) and 23 CCR Section 2235 *et seq.* (2010)	Applicable	Establishes, monitoring, and pollutant control requirements for stormwater from industrial activities.	The substantive requirements would be applicable if construction activities associated with the remedial action disturb an area of 1 acre or more.
Federal	Air	Air Emission Standards for Process Vents; 40 CFR Sections 265.1030-1035 (2010); 22 CCR Sections 66265.1030-66265.1035	Relevant and Appropriate	Applies to treatment, storage, and disposal facilities with process vents associated with solvent extraction or air or steam stripping operations managing RCRA hazardous wastes with organic concentrations of at least 10 ppm. These operations must reduce total organic emissions below specified device to reduce total organic emissions by 95 percent by weight.	The requirements are relevant and appropriate for groundwater extraction and air-stripping operations for the remedy where organic concentrations are at least 10 ppm.
State	Air	Sacramento Metropolitan Air Quality Management District Rules Cal. Health and Safety Code, 39602, 39606, 40001 Rule 402 Nuisance Rule 403 Fugitive Dust Rule 404 Particulate Matter Rule 441 Organic Solvents	Applicable	Limits emissions of dust, particulates, and organic solvents to the air.	Substantive aspects of SMAQMD Rules 402, 403, 404, or 441 may apply to remedial actions involving ground-disturbing activities, and to emissions from treatment facilities.

Table 2-13: Description of ARARs for Selected Remedies

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
State	Surface Water	SWRCB Resolution No. 68-16 ("Antidegradation Policy")	Applicable	Requires that high-quality surface and ground waters be maintained to the maximum extent possible.	May apply to discharges of waste to surface waters of the State that may be impacted by the cleanup where substantive NPDES requirements have not been met.
State	Surface Water	Title 27, CCR, Section 21400 Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 1323, 13269).	Relevant and Appropriate	Requires surface impoundments to be closed by removing and treating all free liquid and either removing all remaining contamination or closing the surface impoundment as a landfill.	If water quality is threatened, this section is relevant and appropriate for excavations and diked areas where wastes containing free liquids were discharged.

ESA = Endangered Species Act
gpd = gallons per day
MCL = maximum contaminant level
NPDES = National Pollutant Discharge Elimination System
PHG = Public Health Goal
ppm = parts per million
SMAQMD = Sacramento Metropolitan Air Quality Management District
TDS = total dissolved solids
TSCA = Toxic Substances Control Act
USFWS = U.S. Fish and Wildlife Service

2.13 Selected Remedies

Based on current information, EPA is selecting ICs (Alternative 2), Containment and Engineering Controls, incorporating Alternative 2 ICs (Alternative 3), and Source Removal/ Reduction (Alternative 4) as the remedies for the contamination in OU-6. EPA believes these alternatives meet the threshold criteria and provide the best balance of tradeoffs among the alternatives. EPA expects the preferred alternatives to satisfy the following statutory requirements of CERCLA Section 121 (b): (1) to be protective of human health and the environment; (2) to comply with ARARs; (3) to be cost-effective; (4) to use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) to satisfy the preference for treatment as a principal element.

2.13.1 Alternative 2 – Institutional Controls

The principal factors considered in selecting Alternative 2 for three remedial action areas in OU-6 (Appendix B) were that by limiting exposure to contaminants through the implementation of ICs, the overall protection of human health at the sites would be increased. This alternative will comply with state and federal human health requirements, provide both long- and short-term effectiveness, and is considered implementable for the nine remedial action areas proposed.

2.13.2 Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs

The principal factors considered in selecting Alternative 3 for 11 remedial action areas in OU-6 (Appendix B) were that with containment and the application of engineering controls, contaminant exposure would be limited. This would greatly reduce the risk and increase the overall protection of human health and the environment at the sites through containment and engineered controls, along with ICs. This alternative complies with state and federal environmental requirements; it provides both long- and short-term effectiveness; and it is considered implementable for those seven remedial areas.

2.13.3 Alternative 4 – Source Removal/Reductions

The principal factors considered in selecting Alternative 4 for 67 of the 81 remedial action areas in OU-6 (Appendix B) were the removal or reduction of source material, which would greatly improve the overall protection of human health and the environment at the sites. Excavating contaminated soils and offsite disposal, as well as SVE and along with ICs, reduces exposure to contaminants by limiting toxicity, mobility, and/or volume. This alternative complies with state and federal environmental requirements, provide both long- and short-term effectiveness, and are considered implementable.

2.13.4 Summary of Additional Rationale for the Selected Remedies

In addition to the rationale presented in Section 2.13, Appendix B presents other principal factors considered for the rationale at each of the remedial action areas in OU-6. EPA believes that once the selected remedies are implemented, property(ies) will be suitable for reuse. Although the

selected remedies are not always the least expensive, the selected remedies are cost-effective, and the additional cost is generally supported by a greater degree of protectiveness at each site.

2.13.5 Expected Outcomes of the Selected Remedies

The expected outcomes of the selected remedies are the removal or containment of soil and soil vapor contamination to protect human and ecological receptors from unacceptable exposure, mitigation of further impacts to groundwater, and the restoration of the contaminated areas to levels protective of expected future land uses. Additionally, the remedy will monitor and control remaining contamination.

2.13.6 Greener Cleanups Considerations

Consistent with EPA Region IX's Greener Cleanups Policy (EPA, 2009b), Aerojet should evaluate a range of practices, strategies, and technologies to support the implementation of Greener Cleanups. The Greener Cleanups approach should reflect the following core elements:

- Reduce total energy use and apply renewable energy sources
- Reduce air pollutants and greenhouse gas emissions
- Reduce water use and impacts to water resources
- Reduce, reuse, and recycle materials and waste
- Protect and restore land and ecosystems

As part of the Greener Cleanups approach, the PRP will prepare a Greener Cleanups Assessment for submittal and approval, as part of the Remedial Design Plan. This assessment will evaluate opportunities to apply Greener Cleanup best management practices (BMPs) and reduce the environmental footprint throughout all remedial actions.

The Greener Cleanups Assessment shall consider and outline, at a minimum, the following touchstone practices:

- Renewable energy to power the cleanup remedy
- Clean diesel fuels and technologies for onsite equipment and transport
- Reuse or recycling of demolition debris
- Water from recycled sources and recycling of treated water

The assessment should make use of resources such as EPA's Greener Cleanup Principles (EPA, 2009a), EPA's Green Remediation Strategy (EPA, 2010), the ASTM Greener Cleanups Standard Guide (ASTM, 2013), the Region IX Greener Cleanups Policy (EPA, 2009b), and resources on cluin.org (EPA, 2015), in considering these touchstone practices and in identifying any additional Greener Cleanups best management practices at the site.

The implementation of the touchstone practices, or any additional Greener Cleanups BMPs, does not change cleanup goals, or how and why cleanup decisions are made, but calls for more environmentally friendly methods of implementing the cleanup. The cleanup at the Aerojet Superfund Site must meet all statutory and regulatory requirements of our cleanup programs,

such as satisfying threshold requirements for protectiveness and meeting other site-specific cleanup objectives.

2.14 Statutory Determinations

Under CERCLA Section 121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and treatment or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against offsite disposal of untreated wastes. The following sections discuss how the selected remedies meet these statutory requirements and explain the 5-year review requirements for the selected remedies.

2.14.1 Protection of Human Health and the Environment

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment.

The selected remedies of ICs, containment and engineering operation controls, and source removal/reduction reduce or eliminate unacceptable human and ecological exposure to contamination remaining onsite.

If no action is taken on contaminated soil and soil vapor areas, potential exposure for either residents or workers would exceed acceptable risk levels, and impacts to groundwater may continue to occur, increasing the eventual cost, difficulty, and time required to restore the aquifer.

2.14.2 Compliance with Applicable or Relevant and Appropriate Requirements

Remedial actions selected under CERCLA must comply with all ARARs under federal environmental laws or, where more stringent than the federal requirements, state environmental or facility siting laws. Where a state has delegated authority to enforce a federal statute, such as RCRA, the delegated portions of the statute are considered to be a federal ARAR unless the state law is broader in scope than the federal law. ARARs are identified on a site-specific basis from information about site-specific chemicals, specific actions that are being considered, and specific features of the site location. There are three categories of ARARs: (1) chemical-specific requirements; (2) location-specific requirements and (3) action-specific requirements.

Chemical-specific ARARs are health- or risk-based numerical cleanup or containment values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values for COCs at the site. These values establish the acceptable amount or concentration of a COC that may be found in or discharged to the ambient environment.

Location-specific ARARs are restrictions placed on concentrations of hazardous substances or the conduct of activities because of the special locations, which have important geographical, biological or cultural features. Examples of special locations include wetlands, flood plains, sensitive ecosystems and seismic areas.

Action-specific ARARs are technology-based or activity-based requirements or limitations on actions to be taken to handle hazardous wastes. They are triggered by the particular remedial activities selected to accomplish a remedy.

Where no ARARs exist for a given chemical, action or location, EPA may consider non-promulgated federal or State advisories and guidance as To Be Considered criteria (TBC). Although consideration of a TBC is not required, if standards are selected based on TBC, those standards are legally enforceable as performance standards. TBCs selected in Tables 2-2 and 2-3 are performance standards.

Table 2-13 provides a complete list of ARARs for OU-6. Performance standards in the contaminated soil areas for soil contaminants and soil vapor are the risk-based soil concentrations for unrestricted use listed in Tables 2-2 and 2-3. Restrictions on the future use of contaminated soil areas that have not attained residential cleanup objectives will be implemented through a recorded declaration of Covenants and Environmental restrictions pursuant to 22 California Code of regulations, section 67391.1 (a) & (d), whereby Aerojet covenants to impose these restrictions.

2.14.3 Cost Effectiveness

EPA must consider the cost-effectiveness of the proposed remedy. The NCP defines a cost-effective remedy as one whose "costs are proportional to its overall effectiveness." More than one remedial alternative can be cost-effective, and EPA is not required to select the most cost-effective alternative. Overall effectiveness is determined by evaluating three of the balancing criteria: long-term effectiveness; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness.

The costs associated with each of the selected alternatives for each of the retained areas are presented on Tables D-1 through D-3 in Appendix D. The total present worth cost for the selected remedies is $25,318,000 (see Table D-4 in Appendix D).

EPA judges the No Action Alternatives as neither protective of human health nor cost-effective.

2.14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedies represent the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected alternatives provide the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element in addition to state and community acceptance. SVE operations in areas with VOCs will reduce concentrations of contamination in the vadose zone and will effectively reduce the mobility and volume of VOCs remaining onsite.

2.14.5 Preference for Treatment as a Principal Element

The SVE and excavation components of Alternative 4 will reduce the volume, toxicity, and/or mobility of contaminants, meeting the statutory preference for treatment as a principal element.

The soil and vadose zone contaminated with VOCs will be treated to remove the contamination where possible. Actions to prevent exposure will be required until the sources of VOCs in shallow groundwater originating in upgradient OUs can be remediated. Relatively immobile contaminants in surface soils will be removed (e.g., metals and PCBs) to meet future land use designation.

Though, not considered a Principal Threat Waste, elevated VOC levels in soil gas, in portions of Chemical Plant 2, will be treated, thus satisfying the statutory preference for treatment as a principal element.

2.14.6 Five-Year Review Requirements

Because remedies (Alternatives 2, 3, and 4) may result in hazardous substance, pollutants, or contaminants remaining onsite above levels that allow for unrestricted use and unrestricted exposure, a statutory Five-year review (FYR) will be required. A FYR will be conducted within five years after initiation of the remedial action, and every five years thereafter, to ensure that the remedy is, or will be, protective of human health and the environment.

2.15 Documentation of Significant Changes

Following many comments during the public meeting regarding the public review period of the Proposed Plan, EPA extended the deadline for the public comment period from June 7 to September 20, 2013.

The Proposed Plan fact sheet incorrectly listed the State of California values for several compounds for the protection of human health and groundwater from contamination in soils in the preliminary cleanup level table included in the Proposed Plan. A revised cleanup level table was included in an updated fact sheet submitted in June 2013.

In July 2014, DTSC issued HHRA Note 3 which includes specific contaminants including lead in soil. It establishes risk-based soil concentration for a residential use (i.e., unrestricted use) scenario exposure point concentration, calculated as the 95 percent upper confidence limit on the arithmetic mean of 80 mg/kg or less, soil lead and an industrial/commercial use 95 percent upper confidence limit of 320 mg/kg or less soil lead. The lead detections identified during the RI were re-screened using the updated Note 3 value for lead. Based on this evaluation, two areas were identified as having lead concentrations greater than 80 mg/kg that were not already included in a remedial action area. These two areas were numbered L2-R-10 and L2-R-11 and are included in the summary table in Appendix B and associated figures. The selected remedy for these two areas is Alternative 4 (Source Removal/Reduction) (Excavation).

Four additional remedial action areas were added to the ROD to address concerns regarding concentrations of perchlorate in soil that could potentially impact groundwater. These areas were added with concurrence from DTSC and RWQCB. These areas and their selected remedy are AW-R-16 (Alternative 3), L5-R-5 (Alternative 4), MA-R-1 (Alternative 4), and CP2-R-12 (Alternative 4). These areas are included in Appendix B and associated figures.

The remedies for two remedial action areas were changed. For AW-R-14, the proposed remedy was Alternative 3; however, upon further evaluation, it was decided that Alternative 4 would be more appropriate and more protective.

PART 3: RESPONSIVENESS SUMMARY

3.1 Stakeholder Issues and EPA Responses

There was significant community response received at the public meeting and provided in writing during the comment period. Many concerns from the CAG were raised regarding the limited amount of information provided in the Proposed Plan when compared to the size of OU-6, the complexity of the area, and the number of remedial action areas to be addressed. Several concerns regarding the groundwater were included in the CAG's comments, such as how the groundwater beneath OU-6 is being addressed, how upgradient sources that continue to contribute to the groundwater contamination beneath OU-6 are being addressed, and how the groundwater remedies are monitored and enforced. Sitewide and OU-6 groundwater was also brought up by local water purveyors. The extent of contamination, cleanup levels, and land reuse concerns were other primary topics brought up during the public comment. The comments and EPA responses are included in the Responsiveness Summary as Appendix E of this document.

3.2 Technical and Legal Issues

3.2.1 Technical Issues

RSLs were last updated in January 2015. Site cleanup goals selected for this ROD are based on these new RSLs. The updated RSLs do not adversely affect the selected remedies in this ROD. However, if new RSLs are issued, the Five-year review will reevaluate cleanup goals to ensure that the selected remedies are protective of human health and the environment.

3.2.2 Legal Issues

Sacramento County and Aerojet have not completely resolved issues over water replacement.

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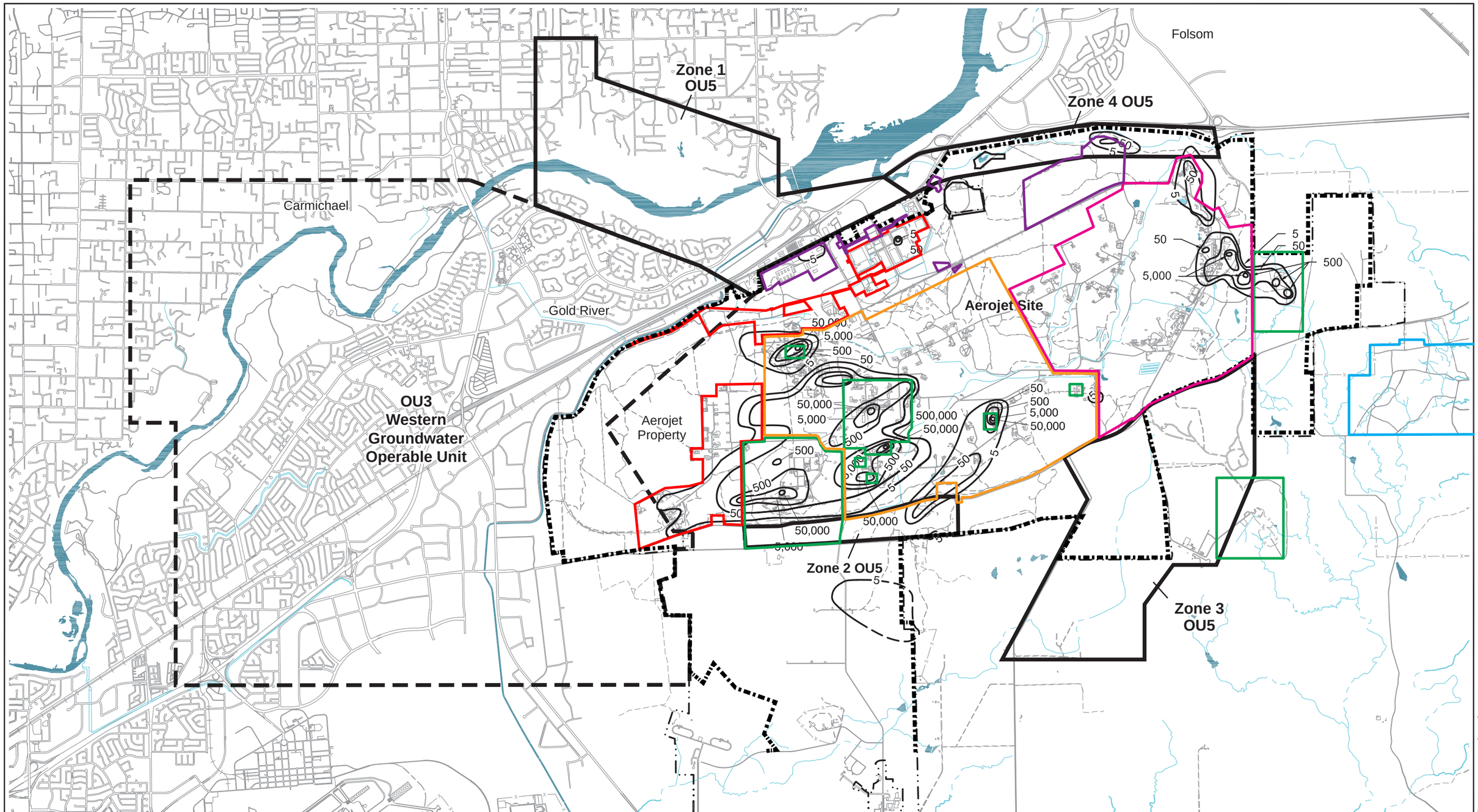
Appendix A
Groundwater Plume Maps from OU-5 ROD



EXPLANATION

- 5 — TCE Isoconcentration Contour in ppb
- Aerojet Property Boundary
- Perimeter Groundwater Operable Unit Boundary-OU5
- Western Groundwater Operable Unit Boundary-OU3
- Aerojet Property Boundary
- Operable Unit Boundary-OU4
- Operable Unit Boundary-OU5
- Operable Unit Boundary-OU6
- Operable Unit Boundary-OU7
- Operable Unit Boundary-OU8
- Operable Unit Boundary-OU9

N

Scale: 1" = 4,000'

0 2,000 4,000

USEPA REGION IX
AEROJET OU5

FIGURE 1
Layer A
TCE Iso-Concentration Contour
2007 - 2010
APPENDIX A – OVERLAY

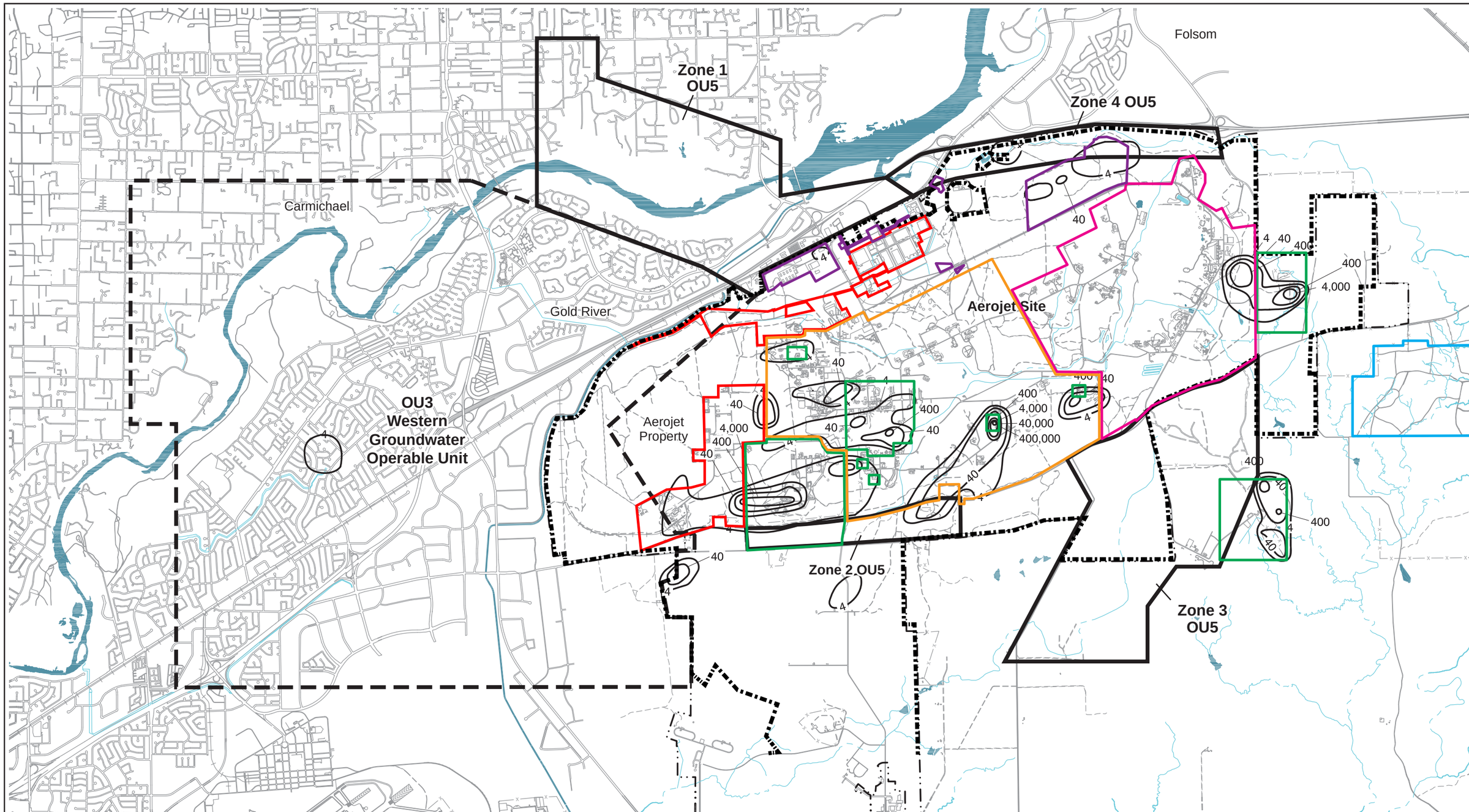
FIGURE 3-1

3/16/10

Costello, Stephen C

SR10130834

10-0022



EXPLANATION

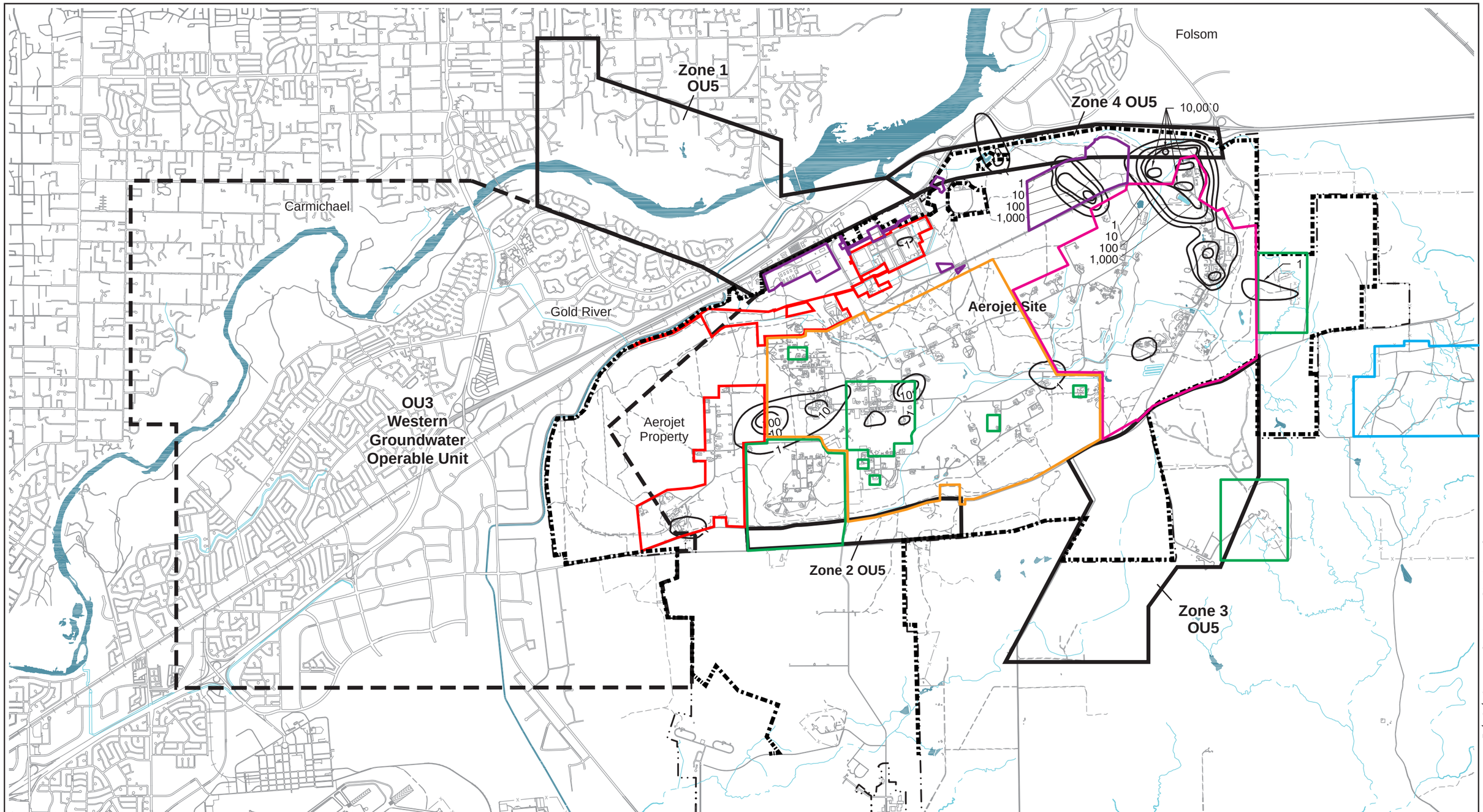
- 4 — Perchlorate Isoconcentration Contour in ppb
- Aerojet Property Boundary
- Perimeter Groundwater Operable Unit Boundary-OU5
- Western Groundwater Operable Unit Boundary-OU3
- Aerojet Property Boundary
- Operable Unit Boundary-OU4
- Operable Unit Boundary-OU5
- Operable Unit Boundary-OU6
- Operable Unit Boundary-OU7
- Operable Unit Boundary-OU8
- Operable Unit Boundary-OU9

USEPA REGION IX
AEROJET OU5

FIGURE 2
Layer A
Perchlorate Iso-Concentration Contour Map
2007 - 2010
APPENDIX A – OVERLAY

FIGURE 3-2
3/16/10
Costello, Stephen C
SR10130840

10-0022



EXPLANATION

- 1 NDMA Isoconcentration Contour in ppt
- Aerojet Property Boundary
- Perimeter Groundwater Operable Unit Boundary-OU5
- Western Groundwater Operable Unit Boundary-OU3
- Aerojet Property Boundary
- Operable Unit Boundary-OU4
- Operable Unit Boundary-OU5
- Operable Unit Boundary-OU6
- Operable Unit Boundary-OU7
- Operable Unit Boundary-OU8
- Operable Unit Boundary-OU9

N

Scale: 1" = 4,000'

0 2,000 4,000

USEPA REGION IX
AEROJET OU5

FIGURE 3

Layer A
NDMA Iso-Concentration Contour Map
2007 - 2010
APPENDIX A – OVERLAY

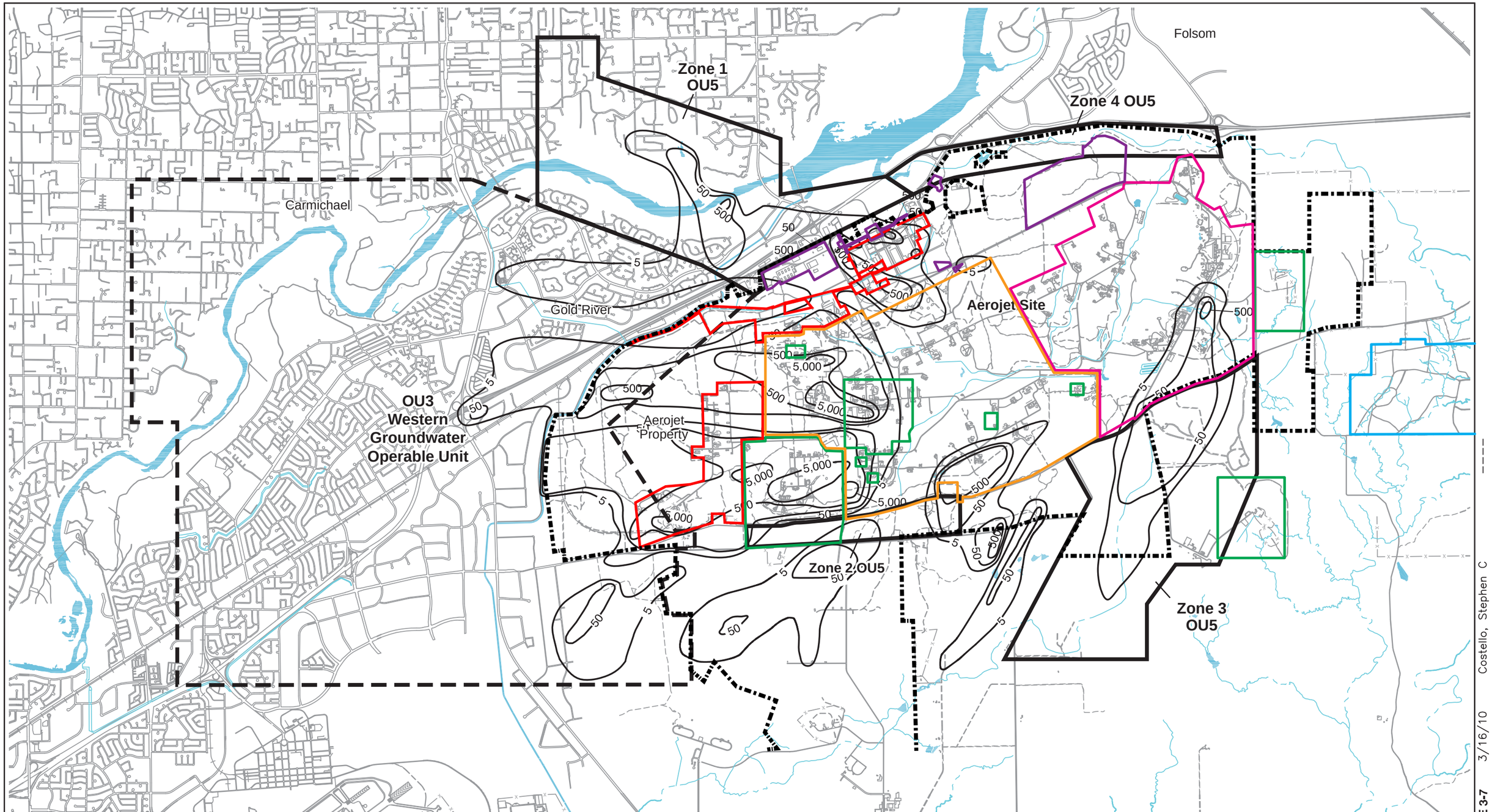
FIGURE 3-3

3/16/10

Costello, Stephen C

SR10130845

10-0022



EXPLANATION

- 5 — TCE Iso-Concentration Contour in ppb
- Aerojet Property Boundary
- Perimeter Groundwater Operable Unit Boundary-OU5
- Western Groundwater Operable Unit Boundary-OU3
- Aerojet Property Boundary
- Operable Unit Boundary-OU4
- Operable Unit Boundary-OU5
- Operable Unit Boundary-OU6
- Operable Unit Boundary-OU7
- Operable Unit Boundary-OU8
- Operable Unit Boundary-OU9

N

Scale: 1" = 4,000'

0 2,000 4,000

USEPA REGION IX
AEROJET OU5

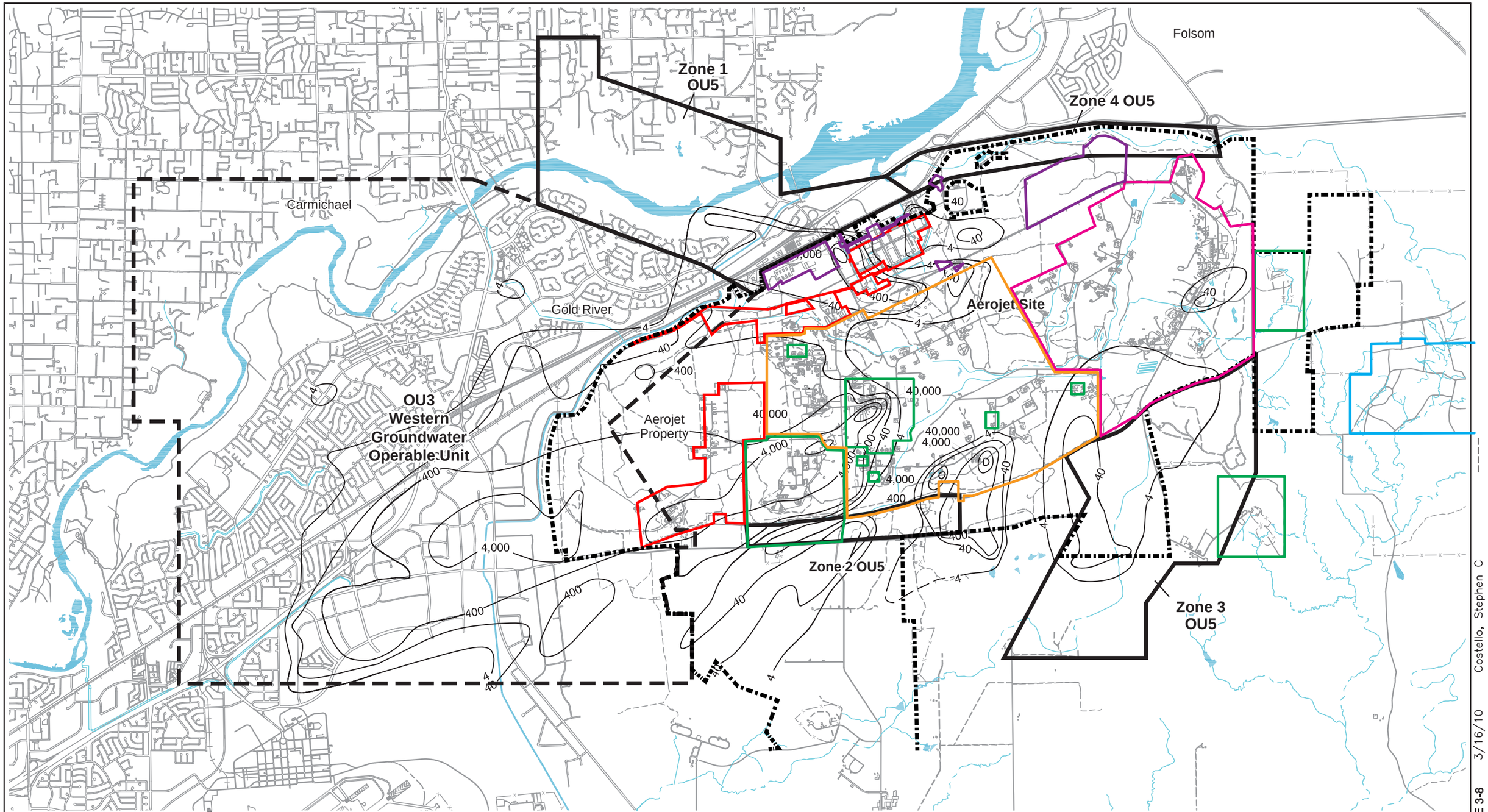
FIGURE 4

Layer C
TCE Iso-Concentration Contour Map
2007 - 2010
APPENDIX A – OVERLAY

FIGURE 3-7 3/16/10 Costello, Stephen C

SR10130836

10-0022



EXPLANATION

- 4 — Perchlorate Iso-Concentration Contour in ppb
- Aerojet Property Boundary
- Perimeter Groundwater Operable Unit Boundary-OU5
- Western Groundwater Operable Unit Boundary-OU3
- Aerojet Property Boundary
- Operable Unit Boundary-OU4
- Operable Unit Boundary-OU5
- Operable Unit Boundary-OU6
- Operable Unit Boundary-OU7
- Operable Unit Boundary-OU8
- Operable Unit Boundary-OU9

N

Scale: 1" = 4,000'

0 2,000 4,000

USEPA REGION IX
AEROJET OU5

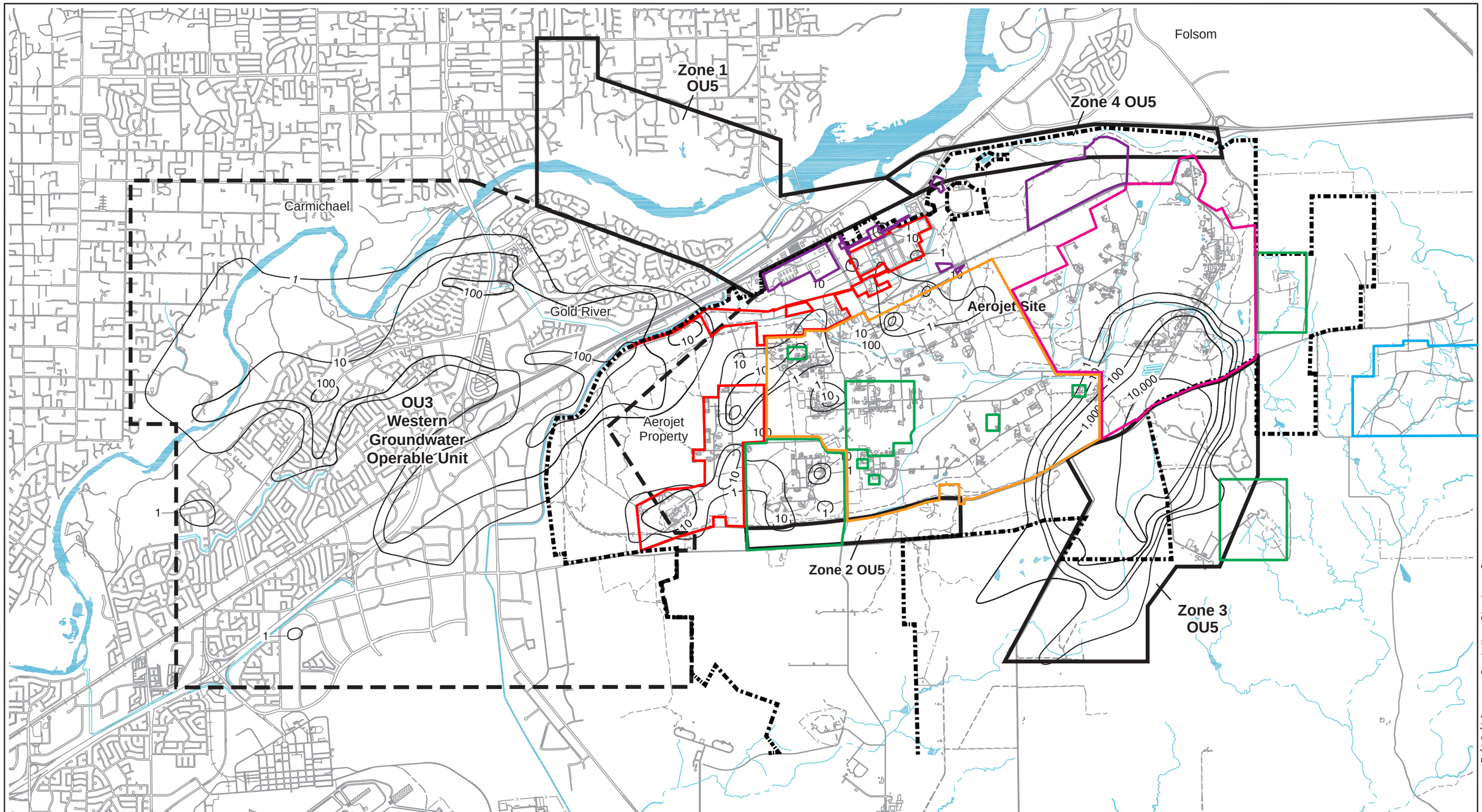
FIGURE 5

Layer C
Perchlorate Iso-Concentration Contour Map
2007 - 2010
APPENDIX A – OVERLAY

FIGURE 3-8 3/16/10 Costello, Stephen C

SR10130851

10-0022



EXPLANATION

- 1 NDMA Iso-Concentration Contour in ppt
- Aerojet Property Boundary
- Perimeter Groundwater Operable Unit Boundary-OU5
- Western Groundwater Operable Unit Boundary-OU3
- Aerojet Property Boundary
- Operable Unit Boundary-OU4
- Operable Unit Boundary-OU5
- Operable Unit Boundary-OU6
- Operable Unit Boundary-OU7
- Operable Unit Boundary-OU8
- Operable Unit Boundary-OU9

N

Scale: 1" = 4,000'

0 2,000 4,000

USEPA REGION IX
AEROJET OU5

FIGURE 6

Layer C
NDMA Iso-Concentration Contour Map
2007 - 2010
APPENDIX A – OVERLAY

FIGURE 3-9

SR10130847 3/16/10 Costello, Stephen C

10-0022

Appendix B
Summary of Remedial Action Areas

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
Administration Area East												
AE-R-1	This area is located on the west side of Building 20002, which is a rocket engine manufacturing facility.	Soil contamination may extend beneath Building 20002. Contamination status is based on samples from one boring. The extent of contamination has not been fully defined.	Commercial	--	--	Benzo(a)anthracene (0.045 mg/kg) TPH-D (970 mg/kg) TPH-Mo (2,100 mg/kg)	NA	NA	NA	NA	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs (Capping)	Action is warranted due to the risks to groundwater. Because of the complexity of the area (multiple underground utility lines and buildings), capping is the selected remedy, which will protect human health and the environment by providing a protective barrier that, along with ICs, will mitigate unacceptable exposures and protect the cap system.
AE-R-2	This retained area is located between Buildings 20002 and 20004, and is collocated with AE-R-4. Both buildings are rocket engine manufacturing facilities.	Soil contamination may extend beneath both buildings. Volume of contamination is not well defined. This area overlaps with AE-R-4.	Commercial	1,1,2,2-PCA (2.0 mg/kg) Aroclor-1254 (47 mg/kg) Iron (206,000 mg/kg)	--	Aroclor-1254 (47 mg/kg) Iron (206,000 mg/kg)	NA	ILCR = 5E-04 HI = 42	NA	ILCR = 2E-04 HI = 4	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs (Capping)	Action is warranted due to the risks to human health (HI >1) and protection of groundwater. Due to the complexity of the area (multiple underground utility lines and buildings), capping is the selected remedy, which will protect human health and the environment by providing a protective barrier that, along with ICs, will mitigate unacceptable exposures and protect the cap system. The 1,1,2,2-PCA contamination will be addressed by the SVE system at AE-SV-R-7.
AE-R-3	The contaminated area is located along the southwest side of Building 20004, which is a rocket engine manufacturing facility.	Soil contamination may extend beneath building 20004. The lateral extent of contamination has not been fully defined.	Commercial	Benzo(a)anthracene (88.4 mg/kg) Benzo(a)pyrene (61.7 mg/kg) Benzo(b)fluoranthene (47.5 mg/kg) Benzo(k)fluoranthene (55.5 mg/kg Chrysene (92.8 mg/kg) Dibenz(a,h)anthracene (6.44 mg/kg) Indeno(1,2,3-c,d)pyrene (20.8 mg/kg)	--	Benzo(a)anthracene (88.4 mg/kg) Benzo(a)pyrene (61.7 mg/kg) Benzo(b)fluoranthene (47.5 mg/kg) Benzo(k)fluoranthene (55.5 mg/kg Chrysene (92.8 mg/kg) Dibenz(a,h)anthracene (6.44 mg/kg) Indeno(1,2,3-c,d)pyrene (20.8 mg/kg)	NA	ILCR = 2E-03 HI = 0.5	NA	ILCR = 7E-04 HI = 0.07 (CW)	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs (Capping)	While the human health risks are within the risk management range, the actual source of the contamination is unknown but is likely related to activities in the southwest portions of Building 20004. Because of the uncertainties associated with the lateral and vertical extent, this area is retained for action. The maximum concentrations may not have been identified; higher concentrations may be located beneath the building foundation. Action is also warranted because of the risk to groundwater quality. Due to the complexity of the area (multiple underground utility lines and buildings), capping is the selected remedy, which will protect human health and the environment by providing a protective barrier that, along with ICs, will mitigate unacceptable exposures and protect the cap system.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
AE-R-4	The contaminated area is located outside the western corner of Building 20004 and the southern corner of Building 20002.	The lateral and vertical extents of the PCB contamination has not been defined. This area overlaps with AE-R-2.	Commercial	Aroclor-1254 (47 mg/kg)	--	Aroclor-1254 (47 mg/kg)	NA	ILCR = 5E-04 HI = 42	NA	ILCR = 2E-04 HI = 4	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs (Capping)	Action is warranted because of the risks to human health (HI>1) and protection of groundwater. Due to the complexity of the area (multiple underground utility lines and buildings), capping is the selected remedy, which will protect human health and the environment by providing a protective barrier that, along with ICs, will mitigate unacceptable exposures and protect the cap system.
AE-R-5 and AE-R-6	The area is located between the northern corner of Building 20019 (former engineering building) and the western edge of Building 20004.	The lateral and vertical extent of contamination has not been defined, but likely extends beneath the buildings. This remedial area overlaps with AE-R-7.	Commercial	Aroclor-1254 (11 mg/kg) Benzo(a)anthracene (109 mg/kg) Benzo(a)pyrene (67 mg/kg) Benzo(b)fluoranthene (59.5 mg/kg) Benzo(k)fluoranthene (62.6 mg/kg) Chrysene (110 mg/kg) Indeno(1,2,3-c,d)pyrene (21.9 mg/kg)	--	Aroclor-1254 (11 mg/kg) Benzo(a)anthracene (109 mg/kg) Benzo(a)pyrene (67 mg/kg) Benzo(b)fluoranthene (59.5 mg/kg) Benzo(k)fluoranthene (62.6 mg/kg) Chrysene (110 mg/kg) Indeno(1,2,3-c,d)pyrene (21.9 mg/kg)	NA	ILCR = 2E-03 HI = 10	NA	ILCR = 7E-04 HI = 1	Alternative 3 – Containment and Engineering Controls, incorporating Alternative 2 ICs (Capping)	Action is warranted because of the protection of groundwater. Due to the complexity of the area (multiple underground utility lines and buildings), capping is the selected remedy, which will protect human health and the environment by providing a protective barrier that, along with ICs, will mitigate unacceptable exposures and protect the cap system.
AE-R-7	The area is located between the northern corner of Building 20019 and the western edge of Building 20004.	The lateral and vertical extent of contamination has not been defined. This remedial area is collocated with AE-R-5 and AE-R-6.	Commercial	--	--	Naphthalene (1.9 mg/kg) Aroclor-1254 (11 mg/kg) TPH-D (9,100 mg/kg) TPH-Mo (12,000 mg/kg)	NA	NA	NA	NA	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted because of the risk to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AE-R-8	This remedial area is located northeast of the northern corner of Building 20004.	The lateral and vertical extent of contamination has not been defined. This area overlaps with AE-SV-R-4.	Commercial	Aroclor-1254 (3.1 mg/kg) Lead (210 mg/kg)	--	Aroclor-1254 (3.1 mg/kg) Lead (210 mg/kg)	NA	ILCR = 4E-05 HI = 3	NA	ILCR = 7E-06 HI = 0.5 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted because of the protection of groundwater. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AE-R-9	This area is located at the southeast corner of Building 2004 within a drainage inlet.	The extent of contamination is limited to the drainage inlet where the sample was collected.	Commercial	Aroclor-1254 (0.42 mg/kg) Aroclor-1260 (1.5 mg/kg) Hexavalent chromium (4 mg/kg) Lead (110 mg/kg)	Zinc (1,200 mg/kg) Dimethyl phthalate (2.6 mg/kg) Aroclor-1254 (0.42 mg/kg) Aroclor-1260 (1.5 mg/kg)	Aroclor-1254 (0.42 mg/kg) Aroclor-1260 (1.5 mg/kg) Hexavalent chromium (4 mg/kg) Lead (110 mg/kg)	NA	ILCR = 2E-05 HI = 2	NA	ILCR = 7E-06 HI = 0.7 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the ecological receptors and protection of groundwater. The sediment in this area is easily accessible for removal. The sediment in the drainage inlet will be removed. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
AE-SV-R-1 and AE-SV-R-2	This remedial area is located at the northwest corner of Building 20002 and extends north along a drainage channel.	The lateral and vertical extent of the soil vapor contamination has not been defined. This soil vapor contamination likely extends beneath Building 20002.	Commercial	PCE (70,000 µg/m^3) Vinyl chloride (170,000 µg/m^3) TCE (10,000 µg/m^3) Benzene (2,600 µg/m^3)	--	--	ILCR = 2E-03 HI = 3	NA	ILCR = 5E-04 HI = 0.5	NA	Alternative 4 – Source Removal/ Reduction (SVE)	SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air and/or present a threat to groundwater quality. ICs will mitigate unacceptable exposures and protect the SVE system.
AE-SV-R-3[c]	AE-SV-R-3 consists of the area where a potential residential human health risk is identified in ambient air from the VOCs in the contaminated groundwater.	The extent of contamination is defined by the extent of TCE contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Commercial	TCE (12,000 µg/L)	--	--	GW to IA: ILCR = 3E-03 HI =46	NA	GW to IA: ILCR = 8E-04 HI =7	NA	Alternative 3 – Engineering Controls, incorporating Alternative 2 ICs	Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs and ECs will mitigate any unacceptable exposure by restricting property use or to establish management controls (e.g., subslab depressurization, subslab venting, or an alternate mitigation system that may prove to have results equal to or better than those of SSD or SSV systems to prevent intrusion to indoor air) that would allow unrestricted use.
AE-SV-R-4 and AE-SV-R-5	This remedial area is located at the northwest corner of Building 20037, a chemical and hazardous waste storage building, and extends along the surface drainage system associated with Building 20022.	The lateral and vertical extent of the soil vapor contamination has not been defined. This area may overlap with AE-R-8.	Commercial	PCE (73,000 µg/m^3)	--	PCE (73,000 µg/m^3)	ILCR = 8E-06 HI = 2	NA	ILCR = 2E-05 HI = 0.2	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted in this area due to the risk to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air or present a threat to groundwater quality. If contamination remains in place after the SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposure and to protect the SVE system.
AE-SV-R-6	This area is located in the southern portion of Administration Area West, which includes the rocket engine manufacturing facilities associated with Buildings 20002 and 20004.	The lateral and vertical extent of contamination has not been defined. Groundwater has likely been impacted.	Commercial	--	--	TCE (700,000 µg/m^3)	NA	NA	NA	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted because of the risk to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air or present a threat to groundwater quality. If contamination remains in place after the SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposure and to protect the SVE system.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
AE-SV-R-7 and AE-SV-R-8	This area is located along the southern edge of Building 20002 and south of the southwest corner of Building 20002.	The lateral and vertical extent of contamination has not been defined. Groundwater has likely been impacted.	Commercial	1,1,2,2-PCA (2 mg/kg) TCE (14,000 µg/m^3)	--	PCE (30,000,000 µg/m^3) TCE (260,000 µg/m^3)	GW to IA: ILCR = 4E-02 HI =360	NA	GW to IA: ILCR = 1E-02 HI =130	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted because of the risk to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air or present a threat to groundwater quality. The 1,1,2,2-PCA contamination in soil is associated with AE-R-2 and will be addressed by the SVE system at AE-SV-R-7. If contamination remains in place after the SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposure and to protect the SVE system.
Administration Area West												
AW-R-1, AW-R-2, and AW-R-11	This area is located west of Building 20009, in area that likely received surface water runoff from the Administration Area West.	The lateral and vertical extent of contamination has not been defined.	Mixed use	Aroclor-1260 (2.5 mg/kg)	Cadmium (9.6 mg/kg) Chromium (670 mg/kg) Mercury (0.24 mg/kg) Aroclor-1254 (2.5 mg/kg)	Aroclor-1260 (2.5 mg/kg) Cadmium (9.6 mg/kg) Chromium (670 mg/kg)	NA	ILCR = 3E-05 HI = 2.5	NA	ILCR = 8E-06 HI = 1 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area due to the risk to human health (HI>1), protection of groundwater, the uncertainties in the lateral and vertical extent of contamination, and the risks to ecological receptors. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AW-R-3	The area is located within the Administration Area West Open Ditch System.	The lateral extent of contamination within the Open Ditch System in this area has not been defined.	Mixed use	Aroclor-1260 (0.1 mg/kg)	Mercury (0.23 mg/kg)	Aroclor-1260 (0.1 mg/kg) Benzo(a)pyrene (0.014 mg/kg) Benzo(b&k)fluoranthene (0.038 mg/kg) Cadmium (1.7 mg/kg) Lead (62 mg/kg)	NA	ILCR = 2E-06 HI = 0.2	NA	ILCR = 5E-07 HI = 0.4 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted because of the risks to human health (lead concentrations exceed the PTGW value of 23 mg/kg [most conservative value for Xerorthents soils]), the risk to groundwater quality, and the risk to ecological receptors. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AW-R-4 and AW-R-5	This area is located near the southwest corner of Building 20009. AW-R-4 is located within a lined culvert along the southern edge of Building 20009.	The lateral and vertical extent of contamination has not been defined.	Mixed use	Aroclor-1260 (0.17 mg/kg)	Cadmium (1.1 mg/kg) Zinc (75 mg/kg) Aroclor-1260 (0.17 mg/kg)	Aroclor-1260 (0.17 mg/kg TPH-D (240 mg/kg) TPH-Mo (730 mg/kg)	NA	ILCR = 3E-06 HI = 0.5	NA	ILCR = 8E-07 HI = 0.3 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area because of the risk to groundwater quality, ecological risks, and the uncertainties in the lateral and vertical extent of contamination. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures. Excavation within the culvert will be limited to the soil and sediment within the culvert (the liner will not be removed).

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
AW-R-6	This area is located just outside the northwest corner of Building 20009. Building 20009 was previously owned by the U.S. Air Force (USAF) and has been identified as a manufacturing building that generated waste material	The lateral and vertical extent of contamination has not been defined. The contamination may extend beneath Building 20009.	Mixed use	Nickel (2,090 mg/kg) Benzo(a)pyrene (0.089 mg/kg)	--	Nickel (2,090 mg/kg) Benzo(a)pyrene (0.089 mg/kg)	NA	ILCR = 3E-07 HI = 3	NA	ILCR = 3E-07 (CW) HI = 2 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in the area because of the risk to human health (HI>1) and protection of groundwater. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AW-R-7 and AW-R-14	This remedial area is located within the western side of Building 20009.	The lateral and vertical extent of contamination has not been defined.	Mixed use	Benzo(a)pyrene (0.52 mg/kg) Benzo(b&k)fluoranthene (0.5 mg/kg) Hexavalent chromium (720 mg/kg) Lead (640 mg/kg) Nickel (1,600 mg/kg)	--	Benzo(a)pyrene (0.52 mg/kg) Benzo(b&k)fluoranthene (0.5 mg/kg) Hexavalent chromium (720 mg/kg) Lead (640 mg/kg) Nickel (1,600 mg/kg)	NA	ILCR = 4E-05 HI = 3.3	NA	ILCR = 5E-04 (CW) HI = 33 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area due to the risks to human health (HI>1) and protection of groundwater. In addition, lead concentrations exceed the unrestricted use cleanup level of 80 mg/kg. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AW-R-8, AW-R-9, AW-R-10, AW-R-12, and AW-R-13	This remedial area consists of the bermed pond area west of Building 20009 and the area along the Administration Area West Open Ditch System.	The lateral and vertical extent of contamination has not been defined.	Mixed use	Antimony (49 mg/kg) Hexavalent chromium (720 mg/kg) Lead (640 mg/kg) Nickel (1,600 mg/kg) Perchlorate (1.9 mg/kg) Benzo(a)pyrene (0.089 mg/kg)	Mercury (31.1 mg/kg) Cadmium (190 mg/kg) Antimony (49 mg/kg) Boron (164 mg/kg) Chromium (43,000 mg/kg) Copper (960 mg/kg) Manganese (10,100 mg/kg) Nickel (1,600 mg/kg) Zinc (6,410 mg/kg) Lead (285 mg/kg) Molybdenum (15 mg/kg)) Silver (160 mg/kg)	TPH-D (230 mg/kg) TPH-Mo (640 mg/kg) Benzo(a)pyrene (0.041 mg/kg) Benzo(b&k)fluoranthene (0.16 mg/kg) Perchlorate (1.9 mg/kg) Cadmium (190 mg/kg) Chromium (43,000 mg/kg) Hexavalent chromium (720 mg/kg) Lead (640 mg/kg) Manganese (10,100 mg/kg) Nickel (1,600 mg/kg) Mercury (31.1 mg/kg)	NA	ILCR = 4E-04 HI = 4	NA	ILCR = 4E-04 (CW) HI = 29 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in the area because of the risk to human health (HI>1), the risk to ecological receptors, and the risks to groundwater quality. In addition, lead concentrations exceed the unrestricted use cleanup level of 80 mg/kg. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AW-R-15	This area is designated as Air Force Plant 70 and is located along the west side of Building 20009. PCB soil contamination in this area was partially excavated by the Air Force in 2005 to meet the previous cleanup level of 25 mg/kg.	The extent of the PCB soil contamination has not been defined to the current unrestricted use cleanup level of 0.089 mg/kg.	Mixed use	Arochlor-1260 (1,060 mg/kg)	--	Arochlor-1260 (1,060 mg/kg)	NA	ILCR = 2E-05 HI = 2	NA	ILCR = 7E-06 HI = 0.5 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area because of the risks to human health (HI>1) and to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
AW-R-16	This area is located in southern portion of Administration Area West, near the former sewage treatment plant.	The lateral extent of the contamination has not been defined. The contamination in this area is shallow; perchlorate concentrations were found above the cleanup levels in the upper 5 feet bgs.	Mixed Use	Perchlorate (0.099 mg/kg)	--	Perchlorate (0.099 mg/kg)	NA	HI = 1.7	NA	HI = 1.1	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area because of the risks to human health (HI>1) and to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
AW-SV-R-1[c]	AW-SV-R-1 consists of the area where a potential residential human health risk is identified in ambient air from the VOCs in the contaminated groundwater.	The extent of contamination is defined by the extent of VOC contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Mixed use	TCE (230 µg/L)	--	--	GW to IA: ILCR = 2E-05 HI = 0.2	NA	GW to IA: ILCR = 5E-06 HI = 0.03	NA	Alternative 3 – Engineering Controls, incorporating Alternative 2 ICs	Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs and ECs will mitigate any unacceptable exposure by restricting property use or to establish management controls (e.g., subslab depressurization, subslab venting, or an alternate mitigation system that may prove to have results equal to or better than those of SSD or SSV systems to prevent intrusion to indoor air) that would allow unrestricted use.
Line 2 Region / Open Space 5												
L2-R-1	This remedial area is located just north of Building 02023 (a process laboratory).	The lateral and vertical extent of contamination has not been defined.	Commercial mixed use	Perchlorate (0.55 mg/kg)	--	Perchlorate (0.55 mg/kg)	NA	HI = 9	NA	HI = 6	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risk to groundwater quality and to address the uncertainties in the extent (the perchlorate is from one soil boring). This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L2-R-2 and L2-R-3	This area is on the southeast side of Building 02024 (Crawford Bomb Station), which handled propellants and discharged wastewater potential containing solvents, perchlorate, and beryllium to the pond through a concrete lined trough.	The lateral and vertical extent of contamination has not been defined. Contamination may extend beneath the building.	Commercial mixed use	Benzo(a)pyrene (0.32 mg/kg) Benzo(b&k)fluoranthene (0.74 mg/kg) Perchlorate (0.14 mg/kg)	--	Benzo(a)pyrene (0.32 mg/kg) Benzo(b&k)fluoranthene (0.74 mg/kg Perchlorate (0.14 mg/kg) TPH-D (110 mg/kg)	NA	ILCR = 1E-05 HI = 0.3	NA	ILCR = 4E-06 HI = 0.8 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted because of the risk to groundwater quality and to address uncertainties associated with the lateral and vertical extent of contamination. The maximum concentrations may not have been identified; higher concentrations may be located beneath the building foundation. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
L2-R-4, L2-R-5, and L2-R-9	This remedial area is located around a concrete lined pond and an unlined pond, which are part of the former drum and equipment cleaning area	The lateral and vertical extent of contamination has not been defined. Perchlorate has been detected in groundwater in this area.	Commercial mixed use	Perchlorate (5.1 mg/kg)	--	Perchlorate (10 mg/kg) Manganese (2,200 mg/kg) Nickel (130 mg/kg) Thallium (5.61 mg/kg) Aluminum (53,000 mg/kg) NDMA (0.0013 mg/kg)	NA	HI = 85	NA	HI = 57	Alternative 4 – Source Removal/ Reduction (Excavation with Soil Flushing and Air Stripping)	Action is warranted due to the risks to human health and groundwater quality. Due to the complexity of these overlapping sites (L2-R-4, L2-R-5, L2-R-9, L2-SV-R-2) and the variety of COCs present, a combination of excavation with soil flushing and air stripping is the selected remedy. The details and order of implementation of these cleanup methods will be described during the RD/RA phase. If contamination remains in place after source removal/reduction, The selection of ICs and ECs will be required to mitigate any unacceptable exposure by restricting property use or to establish management controls (e.g., subslab depressurization, subslab venting, or an alternate mitigation system that may prove to have results equal to or better than those of SSD or SSV systems to prevent intrusion to indoor air) that would allow unrestricted use.
L2-R-6	This area is located between Buildings 02090 and 02028 and likely associated with the septic tank in this area.	The lateral and vertical extent of contamination has not been defined and may extend beneath the buildings.	Commercial mixed use	Perchlorate (0.14 mg/kg)	--	Perchlorate (0.14 mg/kg)	NA	HI = 2.3	NA	HI = 1.6	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risk to human health and groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L2-R-7 and L2-R-8	This contaminated area is located around (and likely beneath) Building 02020, which has been identified as an oxidizer grind station.	The lateral and vertical extent of contamination has not been defined and the contamination may extend beneath Building 02020.	Commercial mixed use	Perchlorate (0.29 mg/kg)	--	Perchlorate (1.7 mg/kg)	NA	HI = 28	NA	HI = 19	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risk to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L2-R-10	This remedial area is located north of Buildings 02027, 02026, and 02025, along the west side of Source Area E(m).	The lateral and vertical extent of the soil contamination has not been defined.	Commercial mixed use	Lead (120 mg/kg)	--	Lead (120 mg/kg)	NA	ILCR=NA HI=0.42	NA	ILCR=NA HI=0.9 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area because lead concentrations exceeded the unrestricted use cleanup level of 80 mg/kg. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L2-R-11	This remedial area is located west of Building 02024.	The lateral and vertical extent of the soil contamination has not been defined.	Commercial mixed use	Lead (240 mg/kg)	--	Lead (240 mg/kg)	NA	ILCR=2E-07 HI=0.63	NA	ILCR=5E-08 HI=1.2	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area because lead concentrations exceeded the unrestricted use cleanup level of 80 mg/kg. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
L2-SV-R-1[c]	L2-SV-R-1 consists of the area where a potential residential human health risk is identified in ambient air from the VOCs in the contaminated groundwater.	The extent of contamination is defined by the extent of VOC contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Commercial mixed use	TCE (1,100 µg/L)	--	--	GW to IA: ILCR=1E-04 HI=0.3	NA	GW to IA: ILCR=2E-05 HI=0.1	NA	Alternative 3 – Engineering Controls, incorporating Alternative 2 ICs	Action is warranted because this area covers the area where a residential human health risk is identified due to modeled VOC migration from groundwater to indoor air based on VOC concentrations detected in groundwater. Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs and ECs will mitigate any unacceptable exposure by restricting property use or to establish management controls (e.g., subslab depressurization, subslab venting, or an alternate mitigation system that may prove to have results equal to or better than those of SSD or SSV systems to prevent intrusion to indoor air) that would allow unrestricted use. If additional characterization demonstrates that there is no remaining risk to any receptors above acceptable levels, then Alternative 2 would apply.
L2-SV-R-2	This remedial area is located in the western portion of Line 2, immediately adjacent to the former location of the concrete-lined and unlined sump and ponds comprising Source Area 28E (a former drum and equipment cleaning area).	The lateral and vertical extent of contamination has not been defined. This area overlaps with L2-R-4, L2-R-5, and L2-R-9.	Commercial mixed use	TCE (10,000,000 µg/m^3)	TCE (10,000,000 µg/m^3) PCE (800,000 µg/m^3) Toluene (5,900 µg/m^3)	TCE (10,000,000 µg/m^3)	ILCR = 5E-3 HI = 18	NA	ILCR = 1E-3 HI = 2.9	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted due to the risks to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. The implementation and design of the remedy would be coordinated with the design of the remedies for L2-R-4, L2-R-5, and L2-R-9. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and to protect the SVE system.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
L2-SV-R-3	This remedial area is located in the southern portion of the Former Drum Storage Area.	The lateral and vertical extent of contamination has not been defined.	Commercial mixed use	--	--	TCE (160,000 µg/m^3)	NA	NA	NA	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted due to the risks to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and to protect the SVE system.
Line 5 North / Open Space 7												
L5-R-1	This remedial area is within a drainage swale in the northeast corner of the Line 5 North Area that potentially received surface water runoff from the area surrounding Building 05087. Chemicals that may have been used or handled at Building 05087 include solid propellant, liner materials, and solvents.	The lateral extent of contamination has not been defined.	Residential use	Benzo(a)pyrene (0.13 mg/kg)	Cadmium (4.8 mg/kg) Di-n-octyl phthalate (1.2 mg/kg)	Benzo(a)pyrene (0.13 mg/kg) Cadmium (4.8 mg/kg)	NA	ILCR = 5E-06 HI = 0.7	NA	ILCR = 1E-06 HI = 0.02 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks to ecological receptors, the uncertainties in the lateral extent of contamination, and protection of groundwater. Further assessment would remove the uncertainties in the extent of the contamination and excavation would eliminate risks to ecological and human receptors, allowing for the planned residential use. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L5-R-2	This area is located on the western corner of Building 05112, which consists of a test cell and blast area.	The lateral and vertical extent of contamination has not been defined. This area overlaps with L5-SV-R-1.	Residential use	Perchlorate (0.52 mg/kg)	--	Perchlorate (0.52 mg/kg)	NA	HI = 9	NA	HI = 6	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L5-R-3	This remedial area is located on the west side of Building 05087 where solid propellant, liner materials, and solvents may have been used or handled.	The lateral and vertical extent of contamination has not been defined. This area overlaps with area L2-SV-R-2.	Residential use	Perchlorate (0.26 mg/kg)	--	Perchlorate (0.26 mg/kg) Benzo(b&k)fluoranthene (0.18 mg/kg) TPH-D (2,200 mg/kg) TPH-Mo (5,700 mg/kg) Perchlorate (0.26 mg/kg) Cadmium (1.8 mg/kg) Lead (52 mg/kg)	NA	HI = 4	NA	HI = 3	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L5-R-4	This remedial area is located on the east side of Building 05087.	The lateral and vertical extent of contamination has not been defined.	Residential use	Perchlorate (0.077 mg/kg)	--	Perchlorate (0.077 mg/kg) Lead (43 mg/kg) Cadmium (0.63 mg/kg)	NA	HI = 1.3	NA	HI = 0.9	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
L5-R-5	This area is located in the western portion of the Line 05 area.	The lateral extent of contamination has not been defined.	Residential use	Perchlorate (0.086 mg/kg)	--	Perchlorate (0.086 mg/kg)	NA	HI = 1.4	NA	HI = 0.96	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area due to the protection of groundwater, risk to human health, and the uncertainly in lateral extent of the contamination. Further assessment would remove the uncertainties in the extent of contamination and excavation would eliminate risks to human receptors, allowing for the planned residential use. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
L5-SV-R-1	This remedial area is located at Building 05112, which consists of a test cell and blast area.	The lateral extent of contamination has not been defined.	Residential use	--	--	TCE (27,000 µg/m^3) PCE (2,300 µg/m^3)	NA	NA	NA	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted due to the risks to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and protect the SVE system.
L5-SV-R-2	This remedial area is located at a concrete wash area.	The lateral extent of contamination has not been defined.	Residential use	--	--	TCE (7,800 µg/m^3)	NA	NA	NA	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted due to the risks to groundwater quality. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and protect the SVE system.

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Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
L5-SV-R-3[c]	This remedial area covers the area where a residential human health risk is identified due to modeled VOC migration from groundwater to indoor air based on VOC concentrations detected in groundwater.	The extent of contamination is defined by the extent of VOC contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Residential use	TCE (42 µg/L)	--	--	GW to IA: (TCE) ILCR=4E-05 HI=0.2	NA	GW to IA: (TCE) ILCR=2E-06 HI=0.004	NA	Alternative 3 – Engineering Controls, incorporating Alternative 2 ICs	Action is warranted because this area covers the area where a residential human health risk is identified due to modeled VOC migration from groundwater to indoor air based on VOC concentrations detected in groundwater. Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs and ECs will mitigate any unacceptable exposure by restricting property use or to establish management controls (e.g., subslab depressurization, subslab venting, or an alternate mitigation system that may prove to have results equal to or better than those of SSD or SSV systems to prevent intrusion to indoor air) that would allow unrestricted use. If additional characterization demonstrates that there is no remaining risk to any receptors above acceptable levels, then Alternative 2 would apply.
Buffalo Creek												
BC-R-1	This area consists of Upper Buffalo Creek, north of Line 5 North and was identified as a remedial area to address ecological risks.	The lateral and vertical extent of contamination has not been defined. Contamination likely extends upstream of the OU-6 boundary.	Open space drainage	Aroclor-1254 (1.1 mg/kg)	Aroclor-1254 (1.1 mg/kg) Lead (721 mg/kg) Mercury (0.31 mg/kg) Silver (77.2 mg/kg) Zinc (174 mg/kg)	Aroclor-1254 (1.1 mg/kg) Lead (721 mg/kg)	NA	ILCR = 1E-06 HI = 0.5	NA	ILCR = 4E-06 HI = 4 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks associated with ecological receptors, the uncertainties in the extent of contamination of Aroclor-1260, and protection of groundwater. The extent of Aroclor-1260 has not been defined and higher concentrations of Aroclor-1260 may be present and would therefore require remediation. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
BC-R-2	This area consists of the Buffalo Creek cutoff and was identified as a remedial area to address ecological risks.	The lateral and vertical extent of contamination has not been defined.	Open space drainage	Aroclor-1254 (0.360 mg/kg)	Aroclor-1254 (0.36 mg/kg) Chromium (905 mg/kg) Lead (455 mg/kg) Mercury (0.28 mg/kg) Nickel (511 mg/kg) Silver (35 mg/kg) Zinc (196 mg/kg)	Aroclor-1254 (0.36 mg/kg) Chromium (905 mg/kg) Lead (455 mg/kg) Nickel (511 mg/kg)	NA	ILCR = 2E-06 HI = 0.2	NA	ILCR = 7E-07 HI = 2 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks associated with ecological receptors, the uncertainties in the extent of contamination of Aroclor-1260, and protection of groundwater. The extent of Aroclor-1260 has not been defined and higher concentrations of Aroclor-1260 may be present and would therefore require remediation. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
West Lakes / Open Space 6												
WL-R-1	This area is located in Open Space 6, in the eastern portion of Cell 1 near the outlet gate.	The lateral and vertical extent of contamination has not been defined.	Open space	Perchlorate (9 mg/kg)	--	Perchlorate (9 mg/kg)	NA	HI = 150	NA	HI = 100	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks to groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
Magazine Area / Open Space 3												
MA-R-1	This area is located in the northwestern portion of the Magazine Area (soil boring A48-ST13-SB01).	The lateral and vertical extent of contamination has not been defined.	Not currently planned	Perchlorate (0.33 mg/kg)	--	Perchlorate (0.33 mg/kg)	NA	HI = 5.5	NA	HI = 3.6	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risks to human health and groundwater quality. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
MA-SV-R-1[c]	This remedial area covers the area where a residential human health risk is identified due to modeled VOC migration from groundwater to indoor air based on VOC concentrations detected in groundwater.	The extent of contamination is defined by the extent of VOC contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Not currently planned	TCE (410 µg/L)	--	--	GW to IA: ILCR=6E-05 HI=0.2	NA	GW to IA: ILCR=1E-05 HI=0.04	NA	Alternative 2 – Institutional Controls	Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs will mitigate any unacceptable exposure by restricting property use. If the land use plan changes, the selected alternative may need to be revisited.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
Chemical Plant 2 / Open Spaces 1, 2, and 4												
CP2-R-1, CP2-R-8, CP2-R-9, CP2-R-10, and CP2-R-11	This area consists of a drainage ditch located in the western portion of the Chemical Plant 2 area, areas around Buildings 15004, 15011, 15008, 15010, and encompasses various facilities in proximity to Building 15008.	The lateral and vertical extent of contamination has not been defined.	Not currently planned	Aroclor-1248 (120 mg/kg) Aroclor-1254 (1.9 mg/kg) Lead (295 mg/kg)	Antimony (1.1 mg/kg) Nickel (77 mg/kg) Selenium (1.2 mg/kg) 4,4'-DDD (2.3 mg/kg) 4,4'-DDE (0.042 mg/kg) 4,4'-DDT (1.2 mg/kg) Aroclor-1248 (120 mg/kg) Aroclor-1254 (0.48 mg/kg) d-BHC (0.51 mg/kg) Endrin (0.22 mg/kg) Prowl (49 mg/kg) Phenol (14 mg/kg) Barium (4,620 mg/kg) Boron (225 mg/kg) Cadmium (1 mg/kg) Lead (295 mg/kg) Zinc (540 mg/kg)	Aroclor-1248 (120 mg/kg) Aroclor-1254 (1.9 mg/kg) Barium (4,620 mg/kg) Boron (225 mg/kg) Cadmium (1 mg/kg) 4,4'-DDD (2.3 mg/kg) 4,4'-DDT (1.2 mg/kg) d-BHC (0.51 mg/kg) Lead (295 mg/kg) Nickel (77 mg/kg) Phenol (14 mg/kg)	NA	ILCR=1E-03 HI=110	NA	ILCR=4E-04 HI=28 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risk to human health (HI>1 and lead concentrations greater than the cleanup level of 80 mg/kg), the risks to ecological receptors, and protection of groundwater. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
CP2-R-2, CP2-R-3, CP2-R-4, CP2-R-5, and CP2-R-6	This area is located in the northern portion of Chemical Plant 2 in a low-lying area that likely received runoff from the Chemical Plant 2 area.	The lateral and vertical extent of contamination has not been defined.	Not currently planned	Aroclor-1254 (2.8 mg/kg) Aroclor-1248 (0.54 mg/kg)	4,4'-DDE (0.0069 mg/kg) 4,4'-DDT (0.013 mg/kg) Endrin (0.063 mg/kg) Phenanthrene (0.43 mg/kg) BEHP (1.3 mg/kg) Dieldrin (0.0054 mg/kg) Endrin aldehyde (0.014 mg/kg) Aroclor-1254 (2.8 mg/kg) Chromium (114 mg/kg) Copper (71 mg/kg) Nickel (94 mg/kg)	Aroclor-1254 (2.8 mg/kg) Aroclor-1248 (0.54 mg/kg) Dieldrin (0.0054 mg/kg) Nickel (94 mg/kg)	NA	ILCR = 3E-05 HI = 2.5	NA	ILCR = 9E-06 HI = 0.7 (CW)	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the uncertainties in the extent of contamination of Aroclor, risk to ecological receptors, and protection of groundwater. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
CP2-R-7	This remedial area is located in the northern most section of Chemical Plant 2.	The lateral and vertical extent of contamination has not been defined.	Not currently planned	Prowl (0.034 mg/kg)	Aroclor-1254 (0.16 mg/kg)	Aroclor-1254 (0.16 mg/kg)	NA	ILCR = 3E-05 HI = 0.2	NA	ILCR = 3E-05 HI = 0.04	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted due to the risk to ecological receptors, the uncertainties in the lateral and vertical extent of contamination, and protection of groundwater. The data for this retained action area is from one boring. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
CP2-R-12	This area is located within Source Area 59F, in the holding basin area.	The extent of contamination has not been defined.	Not currently planned	Perchlorate (0.095 mg/kg)	--	Perchlorate (0.095 mg/kg)	NA	HI = 1.6	NA	HI = 1	Alternative 4 – Source Removal/ Reduction (Excavation)	Action is warranted in this area due to the risk to groundwater. This area is relatively accessible for excavation. If contamination remains in place after excavation, ICs will be required to prevent unacceptable exposures.
CP2-SV-R-1 and CP2-SV-R-2	This remedial area is located around the holding basins in Source Area 59F, the Chemical Plant 2 deep well injection headworks, and associated area.	The lateral and vertical extent of contamination has not been defined.	Not currently planned	1,2-Dichloroethane (310,000 µg/m^3) Vinyl chloride (830 µg/m^3) Chloroform (120,000 µg/m^3)	--	--	ILCR = 4E-02 HI = 1300	NA	ILCR = 1E-04 HI = 200	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted in this area due to the risk to human health (HI>1). SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and to protect the SVE system.
CP2-SV-R-3	This area is located southeast of the rail road tracks, along a potential discharge line that was connected to the Former Stouffer Chemical Plant.	The lateral and vertical extent of contamination has not been defined. Contamination is present beneath the building foundation. This contamination likely overlaps with the soil vapor contamination at CP2-SV-R-4.	Not currently planned	1,2-Dichloroethane (300,000 µg/m^3)	--	--	ILCR = 2E-03 HI = 82	NA	ILCR = 6E-04 HI = 13	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted in this area due to the risk to human health (HI>1). SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and to protect the SVE system.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
CP2-SV-R-4	This area is located south of CP2-SV-R-3, at the southeastern corner of the Former Stouffer Chemical Plant.	The lateral and vertical extent of contamination has not been defined. Contamination is present beneath the building. This contamination likely overlaps with the soil vapor contamination at CP2-SV-R-3.	Not currently planned	1,2-Dichloroethane (300,000 µg/m^3)	--	--	ILCR = 3E-04 HI = 10	NA	ILCR = 7E-05 HI = 2	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted in this area due to the risk to human health (HI>1). SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario or present a threat to groundwater quality. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and to protect the SVE system.
CP2-SV-R-5	This remedial area is located along the eastern portion of the Chemical Plant 2 area.	The lateral and vertical extent of contamination has not been defined.	Not currently planned	1,2-Dichloroethane (12,000 µg/m^3)	--	--	ILCR = 1E-04 HI =3	NA	ILCR = 3E-08 HI = 0.5	NA	Alternative 4 – Source Removal/ Reduction (SVE)	Action is warranted in this area due to the risk to human health (HI>1) and the uncertainties in the extent of contamination. SVE is the selected remedy for VOCs in soil vapor that are present at concentrations that pose an unacceptable risk from soil vapor migration into indoor air under an unrestricted use scenario. If contamination remains in place after SVE that does not allow for unrestricted use, ICs will be required to prevent unacceptable exposures and/or to protect the SVE system.
CP2-SV-R-6[c]	This remedial area covers the area where a residential human health risk is identified due to modeled VOC migration from groundwater to indoor air based on VOC concentrations detected in groundwater.	The extent of contamination is defined by the extent of VOC contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Not currently planned	TCE (1,800 µg/L)	--	--	GW to IA: ILCR=1E-04 HI=2	NA	GW to IA: ILCR=3E-05 HI=0.6	NA	Alternative 2 – Institutional Controls	Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs will mitigate any unacceptable exposure by restricting property use. If the land use plan changes, the selected alternative may need to be revisited.
Dredge Pit and Eastern Basin												
DPEB-R-1	This remedial area is located in the Dredge Pit, south of Burma Road and west of the Eastern Basin. The Dredge pit is roughly 1 acre in size, approximately 40 feet bgs at its deepest point, and has an estimated capacity of roughly 6,000,000 gallons.	The contaminated soil is in an excavated depression.	Not currently planned	Mercury (42 mg/kg) Prowl (17,000 mg/kg)	Boron (656 mg/kg) Cadmium (0.91 mg/kg) Mercury (42 mg/kg) Molybdenum (0.95 mg/kg) Nickel (856 mg/kg) Thallium (6.7 mg/kg) Zinc (116 mg/kg) DnBP (7.52 mg/kg) Prowl (17,000 mg/kg)	Boron (656 mg/kg) Cadmium (0.91 mg/kg) Mercury (42 mg/kg) Nickel (856 mg/kg) Prowl (17,000 mg/kg) Thallium (6.7 mg/kg)	NA	ILCR = 7E-07 HI = 1.5	NA	ILCR = 2E-07 HI = 0.08 (CW)	Alternative 3 – Containment and Engineering (Backfilling)	Action is warranted in this area due to the risk to ecological receptors and protection of groundwater. Backfilling this area is the selected remedy. The area will be backfilled with a minimum of 10 feet of clean soil. This will eliminate the exposure pathway for human and ecological receptors. The IC component will protect the backfill remedy and address future land uses.

Appendix B: Summary of Remedial Action Areas

Retained Area[a]	Description of Remedial Action Area	Status of Contamination	Planned Use	Contaminants of Concern[b] (Maximum Concentrations)			Human Health Risk Summary				Selected Alternative	Rationale for Action and Selected Remedy
							Unrestricted Use		Industrial Use			
				HH COCs	Ecological COPECs	Protection of Groundwater COCs	Soil Vapor	Soil	Soil Vapor	Soil		
DPEB-SV-R-1[c]	This remedial area covers the area where a residential human health risk is identified due to modeled VOC migration from groundwater to indoor air based on VOC concentrations detected in groundwater.	The extent of contamination is defined by the extent of VOC contaminated groundwater beneath the site, with an additional 100-foot buffer around the area.	Not currently planned	TCE (1,800 µg/L)	--	Boron (656 mg/kg) Cadmium (0.91 mg/kg) Mercury (42 mg/kg) Nickel (856 mg/kg) Prowl (17,000 mg/kg) Thallium (6.7 mg/kg)	GW to IA: ILCR=3E-06 HI=0.02	NA	GW to IA: ILCR=7E-07 HI=0.007	NA	Alternative 2 – Institutional Controls	Because the remediation of the groundwater is ongoing and not yet complete, the risk of vapor intrusion from the groundwater is still present. The selection of ICs will mitigate any unacceptable exposure by restricting property use. If the land use plan changes, the selected alternative may need to be revisited.

Notes:

[a] Some remedial action areas were combined because the areas are located adjacent to each other, they overlap each other, and/or they have the same remedial action planned. Combining areas allows for all COCs in the areas to be addressed and helps to facilitate the remedial design.

[b] For each contaminant identified as a COC for an exposure pathway (risk to human health, ecological receptors, or groundwater), each COC will be evaluated against cleanup levels for all three pathways, where applicable, during the design and implementation of remedial action and to determine if the action is complete. See Section 2.8 for more details.

[c] These remedial action areas for soil vapor were identified as an area to be addressed because they overlie a groundwater plume. See Section 2.8 for more details on how these areas were identified.

-- = No COCs were identified that posed a risk for this pathway.

µg/L = micrograms per liter
µg/m^3 = micrograms per meter cubed
AE = Administration East
AW = Administration West
BC = Buffalo Creek
COC = contaminant of concern
COPEC = contaminant of potential ecological concern
CP2 = Chemical Plant 2
CW = construction worker
DPEB = Dredge Pit/Eastern Basin
EC = engineering control
GW to IA = soil vapor from groundwater contamination to indoor air
HH = human health
HI = hazard index
IC = institutional control
ILCR = incremental lifetime cancer risk
L2 = Line 2
L5 = Line 5
mg/kg = milligram per kilogram
NA = not applicable
RD = remedial design
SVE = soil vapor extraction
VOC = volatile organic compound
WL = West Lakes

Appendix C
Administrative Record Index

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Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
95601	7/20/2001	Record of decision (ROD), western gw OU (OU-3), w/app A (response summary)	Keith Takata / EPA, Region IX			231
1137732	6/20/2003	Article: Uptake of perchlorate in terrestrial plants (Ecotoxicology and Environmental Safety, v58 (2004) pp. 44-49)	Lu Yu / Institute of Environmental and Human Health		6	6
2069877	4/11/2005	Ltr: Status and path forward for removal of PCB impacted soil at former Air Force Plant 70 – plans for continued remedial construction and site closure, w/attchs	Randal Rose / CH2M HILL, Inc.	Charles Berrey / EPA, Region IX	6	7
2069873	4/14/2005	Email: Provisional approval of amended work plan for closure of AFP 70 (former Air Force Plant 70), w/history	Charles Berrey / EPA, Region IX	Randal Rose / CH2M HILL, Inc.	6	1
2069861	5/10/2005	Ltr: Response to agency comments on 3/5/05 memo, Background metals response and recommendations	Cindy Caulk / Aerojet General Corp	Charles Berrey / EPA, Region IX Ed Cargile / Cal-EPA, DTSC Alexander MacDonald / CA RWQCB, Central Valley Region	05 06 07 08 09	3
2085609	6/1/2005	Field sampling plan for validation of Johnson and Ettinger model, w/TL to C. Berrey, et al. fr C. Caulk 6/27/05	Aerojet General Corp		04 05 06 07 08 09	27
2069878	6/13/2005	Email: Chemical plant 2 proposed sampling locations and rationale, w/attchs (Chem Plant 2 proposed Figs and Chem Plant 2 Sample Design Tables)	Chris Fennessy / Aerojet General Corp	Charles Berrey / EPA, Region IX Ed Cargile / Cal-EPA, DTSC Alexander MacDonald / CA RWQCB, Central Valley Region	6	27
2239152	6/17/2005	Final RI/FS workplan – source area OUs, updated through 11/4/05 (oversize map only)	Aerojet General Corp Geosyntec Consultants, Inc. Tetra Tech E M, Inc.	CA RWQCB, Central Valley Region EPA, Region IX Cal-EPA, DTSC	04 06 07 08 09	2

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Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
2244751	6/17/2005	Final RI/FS workplan – source area OUs, updated through 11/4/05, w/Apps A-D and TL to C Berrey, et al. fr C Caulk, w/o oversize map	Tetra Tech E M, Inc. Geosyntec Consultants, Inc. Aerojet General Corp	Cal-EPA, DTSC EPA, Region IX CA RWQCB, Central Valley Region	04 06 07 08 09	295
2085604	7/1/2005	Workplan to determine background metals in surface soils at site main plant, w/TL to C Berrey, et al. fr C Caulk 7/22/05	Robert Borch / Geosyntec Consultants, Inc. Scott Neville / Aerojet General Corp, Environmental Operations		05 06 07 08 09	11
2085601	7/21/2005	Ltr: Comments on and provisional approval of final RI/FS work plan for source area OUs	Charles Berrey / EPA, Region IX	Cindy Caulk / Aerojet General Corp	04 06 07 08 09	4
2244752	7/21/2005	Ltr: Comments on Final RI/FS workplan – source area OUs	Charles Berrey / EPA, Region IX	Cindy Caulk / Aerojet General Corp	04 06 07 08 09	4
2119562	8/1/2005	Removal action rpt for former Air Force Plant 70 at Bldg 20-009, revision 0, w/Apps A-I, Apps J2 O, TL to C Berrey fr D Weir 8/9/05 and sticky note	CH2M HILL, Inc.	U.S. Air Force, Center for Environmental Excellence	6	485
2119563	8/1/2005	Appendix J-1, analytical results – raw data (Removal action rpt for former Air Force Plant 70 at Bldg 20-009)	CH2M HILL, Inc.	U.S. Air Force, Center for Environmental Excellence	6	828
2119566	8/23/2005	Ltr: Response to Removal action rpt for former Air Force Plant 70 at Bldg 20-009 – discusses remaining requirements	Charles Berrey / EPA, Region IX	Cindy Caulk / Aerojet General Corp Corey Lam / US Air Force, Aeronautical Systems Center	6	2
2119564	9/20/2005	Memo: Building 20-009 remediation area survey results, w/attchs	Corey Lam / US Air Force, Aeronautical Systems Center	Cindy Caulk / Aerojet General Corp	6	10

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Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
2096937	7/1/2006	Background metals in xerorthents and Redding-Corning-Red Bluff surface soils at site main plant, w/TL to P McDaniel, et al. fr C Caulk 7/26/06 (compact disc only – appendices)	Ray Bienert / Tetra Tech E M, Inc. Robert Borch / Geosyntec Consultants, Inc. Scott Neville / Aerojet General Corp, Environmental Operations	Aerojet General Corp	05 06 07 08 09	1
2107833	7/1/2006	Background metals in xerorthents and Redding-Corning-Red Bluff surface soils at site main plant, w/TL to P McDaniel, et al. fr C Caulk 7/26/06, w/o compact disc (Appendices A-C)	Ray Bienert / Tetra Tech E M, Inc. Robert Borch / Geosyntec Consultants, Inc. Scott Neville / Aerojet General Corp, Environmental Operations	Aerojet General Corp	05 06 07 08 09	83
2140614	7/1/2006	Compact Disc: Background metals in xerorthents and Redding-Corning-Red Bluff surface soils at site main plant (Adobe pdf format)	Aerojet General Corp, Environmental Remediation Department		01 05 06 08 09	1
2140617	7/31/2006	Compact Disc: Final RI/FS field sampling plan for boundary OU (complete except Appendix G) (Adobe pdf format)	Aerojet General Corp Geosyntec Consultants, Inc. Tetra Tech E M, Inc.		6	1
2140618	7/31/2006	Compact Disc: Final RI/FS field sampling plan for boundary OU, figures only (Adobe pdf format)	Tetra Tech E M, Inc. Aerojet General Corp Geosyntec Consultants, Inc.		6	1
2200448	7/31/2006	Final RI/FS field sampling plan for boundary OU, v1 of 2, w/TL to P McDaniel, et al. fr C Caulk 8/8/06 and sticky note	Tetra Tech E M, Inc. Geosyntec Consultants, Inc. Aerojet General Corp		6	754
2200449	7/31/2006	Final RI/FS field sampling plan for boundary OU, v2 of 2 (Appendices A-G)	Geosyntec Consultants, Inc. Tetra Tech E M, Inc. Aerojet General Corp		6	1,006

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Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
1129056	8/11/2006	Final RI/FS QAPP addendum for source area OUs	Tetra Tech E M, Inc. Geosyntec Consultants, Inc. Aerojet General Corp	Cal-EPA, DTSC EPA, Region IX CA RWQCB, Central Valley Region	04 06 07 08 09	93
2140585	8/11/2006	Compact Disc: Final RI/FS QAPP addendum for source area OUs (Adobe pdf format)	Geosyntec Consultants, Inc. Tetra Tech E M, Inc. Aerojet General Corp		01 04 06 07 08 09	1
2141577	9/25/2006	Final white paper – ecological risk assessment, w/appendices and TL to N Black and J M Eichelberger fr C Caulk	Aerojet General Corp		04 06 07 08 09	47
2244750	7/20/2007	Final RI/FS QAPP addendum for source area OUs – replacement pages	Tetra Tech E M, Inc. Aerojet General Corp Geosyntec Consultants, Inc.	EPA, Region IX Cal-EPA, DTSC CA RWQCB, Central Valley Region	04 06 07 08 09	19
2185589	7/22/2008	Ltr: Request for extension on submittal date for draft RI/FS for Boundary OU, w/attch	Cindy Caulk / Aerojet General Corp	Gary Riley / CA RWQCB, San Francisco Bay Region Ed Cargile / Cal-EPA, DTSC Alexander MacDonald / CA RWQCB, Central Valley Region	6	3
2246152	9/29/2010	Ltr: Approval of removal action proposal – Buffalo Creek vegetation and sediment near ARGET discharge	Gary Riley / EPA, Region IX	Cindy Caulk / Aerojet General Corp	6	2
1133067	10/28/2010	Boundary OU RI/FS rpt, v 2 – final human health and ecological risk assessment for Boundary OU (OU-6), w/o Apps A-L	E R M-West, Inc.	Aerojet General Corp	6	2,200

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Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
1133068	10/28/2010	Boundary OU RI/FS rpt, v 1 – final RI rpt for Boundary area OU (OU-6), w/o Apps A-N	E R M-West, Inc. Central Valley Environmental, Inc.	Aerojet General Corp	6	1,117
1137728	1/5/2011	Ltr: Comments on final boundary OU-6 RI and risk assessment, w/attch	Allen Tsao / NONE	Gary Riley / EPA, Region IX Alexander MacDonald / CA RWQCB, Central Valley Region Ed Cargile / Cal-EPA, DTSC	6	6
2246168	2/3/2011	Ltr: Buffalo Creek soil and vegetation removal rpt, w/o compact disc (Attchs A-C)	Chris Fennessy / Aerojet General Corp	Alexander MacDonald / CA RWQCB, Central Valley Region Gary Riley / CA RWQCB, San Francisco Bay Region Ed Cargile / Cal-EPA, DTSC	6	6
2259423	2/3/2011	Ltr: Buffalo Creek soil and vegetation removal rpt (compact disc only)	Chris Fennessy / Aerojet General Corp	Alexander MacDonald / CA RWQCB, Central Valley Region Ed Cargile / Cal-EPA, DTSC Gary Riley / CA RWQCB, San Francisco Bay Region	6	1
1125069	2/15/2011	Interim record of decision (ROD) for groundwater and final record of decision (ROD) for soil for perimeter groundwater operable unit, OU 5, w/Apps A-D	EPA, Region IX			199
1133069	9/1/2011	Boundary OU RI/FS rpt, v 3 – FS rpt for Boundary area OU (OU-6), w/Apps A-D	Shaw Environmental, Inc.	Aerojet General Corp	6	369
1137720	9/21/2011	EPA informational response to 1/5/11 comments submitted by A Tsao on 10/2010 final boundary OU RI and risk assessment	EPA, Region IX	Allen Tsao / NONE	6	8
1137716	12/6/2011	Overheads (24): Aerojet Boundary OU feasibility study (FS) update, community advisory group mtg	EPA, Region IX	Aerojet Community Advisory Group	6	24

Appendix C: Administration Record Index

Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
1137731	3/22/2012	Ltr: Comments on necessity of quantitatively evaluating home produce pathway for boundary OU human health risk assessment (HHRA), presented at Aerojet Community Advisory Group (CAG) mtg 3/21/12	Allen Tsao / Aerojet Community Advisory Group Janis Heple / Aerojet Community Advisory Group Jimmy Spearow / Aerojet Community Advisory Group	Gary Riley / EPA, Region IX Alexander MacDonald / CA RWQCB, Central Valley Region Ed Cargile / Cal-EPA, DTSC	6	3
1137735	3/22/2012	Email: Figs to assist with lead interpretation, location and concentration, w/attchs	Chris Fennessy / Aerojet General Corp	Alexander MacDonald / CA RWQCB, Central Valley Region Ed Cargile / Cal-EPA, DTSC Gary Riley / EPA, Region IX	6	5
1137725	4/30/2012	Email: Discusses and transmits 2 maps of site showing soil vapor risk areas, w/attchs	Chris Fennessy / Aerojet General Corp	Gary Riley / EPA, Region IX	6	4
1137734	6/15/2012	Email: Discusses and transmits figs to respond to Community Advisory Group comments on perchlorate uptake in home grown produce, w/attchs	Chris Fennessy / Aerojet General Corp	Gary Riley / EPA, Region IX	6	3
1137729	7/5/2012	Ltr: Comments on final boundary OU-6 RI and risk assessment, w/attch	Aerojet Community Advisory Group	Gary Riley / EPA, Region IX	6	9
1137722	7/24/2012	Ltr: Agrees with 7/5/12 email fr chair of Community Advisory Group re perchlorate in home-grown produce and concern with slow pace of cleanup	Stephen Green / Save the American River Assn, Inc.	Gary Riley / EPA, Region IX	6	3
1136593	9/1/2012	Rev final feasibility study (FS) for boundary area operable unit (OU6), v3	Shaw Environmental, Inc.	Aerojet General Corp	6	414
1137723	11/21/2012	Email: Calculates concentration of TCE in soil vapor and transmits figs 1-29 through 1-36 to determine risk at site	Chris Fennessy / Aerojet General Corp	Gary Riley / EPA, Region IX	6	10
1137719	12/4/2012	Responses to Community Advisory Group comments on final boundary OU6 RI and human health and ecological risk assessment, w/TL to J Heple fr P Kvam	Aerojet General Corp	Aerojet Community Advisory Group	6	15

Appendix C: Administration Record Index

Doc ID	Doc Date	Title	Author	Addressee	OU	Pgs
1136590	12/10/2012	Perchlorate uptake in home garden produce	Intertox, Inc.	Intertox, Inc.	6	21
2275811	12/31/2012	Ltr: Review of final FS for boundary area OU-6, v 3, w/attchs	Alexander MacDonald / CA RWQCB, Central Valley Region	Chris Fennessy / Aerojet General Corp	6	11
2276027	4/30/2013	List of US EPA guidance documents consulted during development and selection of response action for site	EPA, Region IX		6	7
1137869	5/1/2013	Fact Sheet: Proposed plan for Boundary OU cleanup – EPA requests public comment on proposed plan for Boundary OU of site (06 CF 005)	EPA, Region IX		6	20
1138429	5/15/2013	Overheads (24): PowerPoint presentation on Boundary Operable Unit (OU-6) proposed plan	Gary Riley / EPA, Region IX		6	24
1137733	01/01/1111	PowerPoint presentation – Exposure pathways of perchlorate in vegetables, and complexity of measurement	EPA, Region IX		6	13

Appendix D
Detailed Description and Cost Data

TABLE D-1

Summary of Estimated Costs for Alternative 2 - Institutional Controls

Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
Capital Costs						
Institutional Controls	1	LS	$14,000	$14,000	$14,000	From Final Boundary OU FS (Shaw, 2012). Total capital cost of $83,000 divided equally among 6 OUs. Includes 20% contingency.
Subtotal - Capital Costs				$14,000	$14,000	
Annual Costs						
Institutional Controls	29	LS	$3,000	$87,000	$66,000	From Final Boundary OU FS (Shaw, 2012). Total annual cost of $20,000 divided equally among 6 OUs. Includes 20% contingency.
Subtotal - Annual Costs				$87,000	$66,000	
Periodic Costs						
Institutional Controls	6	LS	$6,000	$36,000	$27,000	From Final Boundary OU FS (Shaw, 2012). Periodic costs are incurred every 5 years. Total periodic cost of $36,000 divided equally among 6 OUs. Includes 20% contingency.
Subtotal - Periodic Costs				$36,000	$27,000	
Total				**$137,000**	**$107,000**	

[a] The discount rate used for the calculations was 1.9 percent and was taken from Appendix C of the Office of Management and Budget Circular A-94 (December 2013) for real discount rates over a 30-year period.

TABLE D-2

Summary of Estimated Costs for Alternative 3 - Containment and Engineering Controls

Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
Capital Costs						
Institutional Controls	1	LS	$14,000	$14,000	$14,000	From Final Boundary OU FS (Shaw, 2012). Total capital cost of $83,000 divided equally among 6 OUs. Includes 20% contingency.
Vapor Barriers[b]	2,404,000	ft^2	$0.50	$1,202,000	$924,000	From Final Boundary OU FS (Shaw, 2012). Assumes development occurs in 15 years.
Ventilation	1	LS	$1,053,000	$1,053,000	$1,053,000	From Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Capping	13.033	acre	$124,000	$1,616,000	$1,616,000	Based on average unit cost from Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Backfilling at DPEB-R-1	1	LS	$213,000	$213,000	$213,000	Based on unit cost from Final Boundary OU FS (Shaw, 2012). Assumes area will be backfilled so that the contaminated soil is approximately 10 feet bgs. Includes 45% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Soil Sampling at AW-R-14	1	LS	$15,000	$15,000	$15,000	From Final Boundary OU FS (Shaw, 2012). Assumes 6 borings. Includes 25% contingency.
Subtotal - Capital Costs				$4,113,000	$3,835,000	
Annual Costs						
Institutional Controls	29	LS	$3,000	$87,000	$66,000	From Final Boundary OU FS (Shaw, 2012). Total annual cost of $20,000 divided equally among 6 OUs. Includes 20% contingency.
Ventilation OM&M	29	LS	$148,000	$4,292,000	$3,277,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency.
Subtotal - Annual Costs				$4,379,000	$3,343,000	
Periodic Costs						
Institutional Controls	6	LS	$6,000	$36,000	$27,000	From Final Boundary OU FS (Shaw, 2012). Periodic costs are incurred every 5 years. Total periodic cost of $36,000 divided equally among 6 OUs. Includes 20% contingency.
Capping O&M	6	LS	$216,000	$1,296,000	$955,000	Based on average unit cost of $16,600 per acre per year from Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency. Incurred every 5 years.
Subtotal - Periodic Costs				$1,332,000	$982,000	
Total				**$9,824,000**	**$8,160,000**	

[a] The discount rate used for the calculations was 1.9 percent and was taken from Appendix C of the Office of Management and Budget Circular A-94 (December 2013) for real discount rates over a 30-year period.

[b] As presented in the Final Boundary OU FS (Shaw, 2012), it is assumed that for any future residential development that would require vapor intrusion controls, the developer would install a moisture barrier with taped seams as part of any new construction and the costs of the materials and installation for the moisture barrier would be borne by the developer. It is further assumed that the only difference between a moisture barrier and a vapor barrier is that seals/taping be provided around any utility penetrations (e.g., plumbing piping) of the moisture barrier. Based on a verbal quotation from Regenesis, the estimated cost to install a moisture barrier under a future residential scenario is $3.00 per square foot. For purposes of estimating costs for the FS, it was assumed that the incremental material and labor cost for sealing/taping utility penetrations is $0.50 per square foot.

TABLE D-3

Summary of Estimated Costs for Alternative 4 - Source Removal/Reduction

Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
Capital Costs						
Institutional Controls	1	LS	$14,000	$14,000	$14,000	From Final Boundary OU FS (Shaw, 2012). Total capital cost of $83,000 divided equally among 6 OUs. Includes 20% contingency.
Excavation	3,392,000	ft^3	$4.08	$13,839,000	$13,839,000	Based on average unit cost from Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for Admin Area (AE-SV-R-4/AE-SV-R-5, AE-SV-R-6, and AE-SV-R-7/ AE-SV-R-8)	1	LS	$1,620,000	$1,620,000	$1,620,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 12 shallow (10 ft) and 18 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for Admin Area (AE-SV-R-1/AE-SV-R-2)	1	LS	$460,000	$460,000	$460,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 4 shallow (10 ft) and 8 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for WLLO Area, Line 2 (L2-SV-R-1 and L2-SV-R-2)	1	LS	$390,000	$390,000	$390,000	From Final Boundary OU FS (Shaw, 2012). Assumes 1 shallow (10 ft) and 8 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for WLLO Area, Line 5 (L5-SV-R-1 and L5-SV-R-2)	1	LS	$110,000	$110,000	$110,000	From Final Boundary OU FS (Shaw, 2012). Assumes 1 shallow (10 ft) and 1 deeper (20 ft) well at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for Chemical Plant 2 (CP2-SV-R-1/CP2-SV-R-2)	1	LS	$490,000	$490,000	$490,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 2 shallow (10 ft) and 12 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for Chemical Plant 2 (CP2-SV-R-3/CP2-SV-R-4/CP2-SV-R-5)	1	LS	$410,000	$410,000	$410,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 3 shallow (10 ft) and 6 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Soil Flushing at WLLO Area, Line 2 (L2-R-4, L2-R-5, and L2-R-9)	1	LS	$170,000	$170,000	$170,000	From Final Boundary OU FS (Shaw, 2012). Assumes 4 extraction wells. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Water Jetting Culvert at AE-R-9	1	LS	$8,000	$8,000	$8,000	From Final Boundary OU FS (Shaw, 2012). Assumes 200 ft of culvert. Includes 25% contingency.
Subtotal - Capital Costs				$17,511,000	$17,511,000	

TABLE D-3

Summary of Estimated Costs for Alternative 4 - Source Removal/Reduction

Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
Annual Costs						
Institutional Controls	29	LS	$3,000	$87,000	$66,000	From Final Boundary OU FS (Shaw, 2012). Total annual cost of $20,000 divided equally among 6 OUs. Includes 20% contingency.
SVE OM&M for Admin Area (AE-SV-R-4/AE-SV-R-5, AE-SV-R-6, and AE-SV-R-7/ AE-SV-R-8)	7	LS	$77,000	$539,000	$500,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for Admin Area (AE-SV-R-1/AE-SV-R-2)	7	LS	$77,000	$539,000	$500,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for WLLO Area, Line 2 (L2-SV-R-1 and L2-SV-R-2)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for WLLO Area, Line 5 (L5-SV-R-1 and L5-SV-R-2)	7	LS	$53,000	$371,000	$344,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for Chemical Plant 2 (CP2-SV-R-1/CP2-SV-R-2)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for Chemical Plant 2 CP2-SV-R-3/CP2-SV-R-4/CP2-SV-R-5)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
Soil Flushing OM&M	9	LS	$34,000	$306,000	$279,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 9.
Subtotal - Annual Costs				$3,459,000	$3,189,000	
Periodic Costs						
Institutional Controls	6	LS	$6,000	$36,000	$27,000	From Final Boundary OU FS (Shaw, 2012). Periodic costs are incurred every 5 years. Total periodic cost of $36,000 divided equally among 6 OUs. Includes 20% contingency.
Subtotal - Periodic Costs				$36,000	$27,000	
Total				**$21,006,000**	**$20,727,000**	

[a] The discount rate used for the calculations was 1.9 percent and was taken from Appendix C of the Office of Management and Budget Circular A-94 (December 2013) for real discount rates over a 30-year period.

[b] As presented in the Final Boundary OU FS (Shaw, 2012), it is assumed that for any future residential development that would require vapor intrusion controls, the developer would install a moisture barrier with taped seams as part of any new construction and the costs of the materials and installation for the moisture barrier would be borne by the developer. It is further assumed that the only difference between a moisture barrier and a vapor barrier is that seals/taping be provided around any utility penetrations (e.g., plumbing piping) of the moisture barrier. Based on a verbal quotation from Regenesis, the estimated cost to install a moisture barrier under a future residential scenario is $3.00 per square foot. For purposes of estimating costs for the FS, it was assumed that the incremental material and labor cost for sealing/taping utility penetrations is $0.50 per square foot.

TABLE D-4
Summary of Estimated Costs for Selected Remedy
Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
Capital Costs						
Institutional Controls	1	LS	$14,000	$14,000	$14,000	From Final Boundary OU FS (Shaw, 2012). Total capital cost of $83,000 divided equally among 6 OUs. Includes 20% contingency.
Vapor Barriers[b]	2,404,000	ft^2	$0.50	$1,202,000	$924,000	From Final Boundary OU FS (Shaw, 2012). Assumes development occurs in 15 years.
Ventilation	1	LS	$1,053,000	$1,053,000	$1,053,000	From Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Excavation	3,134,400	ft^3	$4.08	$12,788,000	$12,788,000	Based on average unit cost from Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Capping	1.295	acre	$124,000	$161,000	$161,000	Based on average unit cost from Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Backfilling at DPEB-R-1	1	LS	$213,000	$213,000	$213,000	Based on unit cost from Final Boundary OU FS (Shaw, 2012). Assumes area will be backfilled so that the contaminated soil is approximately 10 feet bgs. Includes 45% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Soil Sampling at AW-R-14	1	LS	$15,000	$15,000	$15,000	From Final Boundary OU FS (Shaw, 2012). Assumes 6 borings. Includes 25% contingency.
SVE for Admin Area (AE-SV-R-4/AE-SV-R-5, AE-SV-R-6, and AE-SV-R-7/ AE-SV-R-8)	1	LS	$1,620,000	$1,620,000	$1,620,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 12 shallow (10 ft) and 18 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for Admin Area (AE-SV-R-1/AE-SV-R-2)	1	LS	$460,000	$460,000	$460,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 4 shallow (10 ft) and 8 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for WLLO Area, Line 2 (L2-SV-R-1 and L2-SV-R-2)	1	LS	$390,000	$390,000	$390,000	From Final Boundary OU FS (Shaw, 2012). Assumes 1 shallow (10 ft) and 8 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for WLLO Area, Line 5 (L5-SV-R-1 and L5-SV-R-2)	1	LS	$110,000	$110,000	$110,000	From Final Boundary OU FS (Shaw, 2012). Assumes 1 shallow (10 ft) and 1 deeper (20 ft) well at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
SVE for Chemical Plant 2 (CP2-SV-R-1/CP2-SV-R-2)	1	LS	$490,000	$490,000	$490,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 2 shallow (10 ft) and 12 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.

TABLE D-4
Summary of Estimated Costs for Selected Remedy
Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
SVE for Chemical Plant 2 (CP2-SV-R-3/CP2-SV-R-4/CP2-SV-R-5)	1	LS	$410,000	$410,000	$410,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Assumes 3 shallow (10 ft) and 6 deeper (20 ft) wells at 30 cfm per well. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Soil Flushing at WLLO Area, Line 2 (L2-R-4, L2-R-5, and L2-R-9)	1	LS	$170,000	$170,000	$170,000	From Final Boundary OU FS (Shaw, 2012). Assumes 4 extraction wells. Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency.
Water Jetting Culvert at AE-R-9	1	LS	$8,000	$8,000	$8,000	From Final Boundary OU FS (Shaw, 2012). Assumes 200 ft of culvert. Includes 25% contingency.
Subtotal - Capital Costs				$19,104,000	$18,826,000	
Annual Costs						
Institutional Controls	29	LS	$3,000	$87,000	$66,000	From Final Boundary OU FS (Shaw, 2012). Total annual cost of $20,000 divided equally among 6 OUs. Includes 20% contingency.
Ventilation OM&M	29	LS	$148,000	$4,292,000	$3,277,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency.
SVE OM&M for Admin Area (AE-SV-R-4/AE-SV-R-5, AE-SV-R-6, and AE-SV-R-7/ AE-SV-R-8)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for Admin Area (AE-SV-R-1/AE-SV-R-2)	7	LS	$77,000	$539,000	$500,000	Based on unit costs from Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for WLLO Area, Line 2 (L2-SV-R-1 and L2-SV-R-2)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for WLLO Area, Line 5 (L5-SV-R-1 and L5-SV-R-2)	7	LS	$53,000	$371,000	$344,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for Chemical Plant 2 (CP2-SV-R-1/CP2-SV-R-2)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
SVE OM&M for Chemical Plant 2 CP2-SV-R-3/CP2-SV-R-4/CP2-SV-R-5)	7	LS	$77,000	$539,000	$500,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 7.
Soil Flushing OM&M	9	LS	$34,000	$306,000	$279,000	From Final Boundary OU FS (Shaw, 2012). Includes 25% contingency. Cost incurred years 1 through 9.
Subtotal - Annual Costs				$7,751,000	$6,466,000	

TABLE D-4

Summary of Estimated Costs for Selected Remedy

Boundary OU Record of Decision

Description	Quantity	Unit	Unit Cost	Estimated Cost	Present Worth Cost[a]	Assumptions
Periodic Costs						
Institutional Controls	6	LS	$6,000	$36,000	$27,000	From Final Boundary OU FS (Shaw, 2012). Periodic costs are incurred every 5 years. Total periodic cost of $36,000 divided equally among 6 OUs. Includes 20% contingency.
Capping O&M	6	LS	$21,000	$126,000	$93,000	Based on average unit cost of $16,600 per acre per year from Final Boundary OU FS (Shaw, 2012). Includes 33% indirect capital costs (project management, engineering design, and construction management) and 25% contingency. Incurred every 5 years.
Subtotal - Periodic Costs				$36,000	$27,000	
Total				**$26,891,000**	**$25,319,000**	

[a] The discount rate used for the calculations was 1.9 percent and was taken from Appendix C of the Office of Management and Budget Circular A-94 (December 2013) for real discount rates over a 30-year period.

[b] As presented in the Final Boundary OU FS (Shaw, 2012), it is assumed that for any future residential development that would require vapor intrusion controls, the developer would install a moisture barrier with taped seams as part of any new construction and the costs of the materials and installation for the moisture barrier would be borne by the developer. It is further assumed that the only difference between a moisture barrier and a vapor barrier is that seals/taping be provided around any utility penetrations (e.g., plumbing piping) of the moisture barrier. Based on a verbal quotation from Regenesis, the estimated cost to install a moisture barrier under a future residential scenario is $3.00 per square foot. For purposes of estimating costs for the FS, it was assumed that the incremental material and labor cost for sealing/taping utility penetrations is $0.50 per square foot.

TABLE D-5
Summary of Remedial Action Areas
Boundary OU Record of Decision

Remedial Action Area	Selected Alternative	Alternatives Evaluated in ROD	Area (acres)	Area (ft^2)	Depth (ft bgs)	Remedy Evaluation: Capping Area (acres)	Remedy Evaluation: Excavation Volume (ft^3)	Selected Remedy: Capping Area (acres)	Selected Remedy: Excavation Volume (ft^3)
Administration Area East									
AE-R-1	Alternative 3 - Containment and Engineering (Capping)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping)	0.051	2,223		0.051	0	0.051	0
AE-R-2	Alternative 3 - Containment and Engineering (Capping)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.418	18,210	6	0.418	109,300	0.418	0
AE-R-3	Alternative 3 - Containment and Engineering (Capping)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.119	5,199	4	0.119	20,800	0.119	0
AE-R-4	Alternative 3 - Containment and Engineering (Capping)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.050	2,160	6	0.05	13,000	0.05	0
AE-R-5/AE-R-6	Alternative 3 - Containment and Engineering (Capping)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.657	28,628	4	0.657	114,500	0.657	0
AE-R-7	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.046	2,004	12	0.046	24,000	0	24,000
AE-R-8	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.213	9,278	2	0	18,600	0	18,600
AE-R-9	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)			1	0	0	0	0
AE-SV-R-1/AE-SV-R-2	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (SVE)	1.913	83,312		0	0	0	0
AE-SV-R-3	Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)				0	0	0	0
AE-SV-R-4/AE-SV-R-5	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	0.926	40,335		0.926	0	0	0
AE-SV-R-6	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	0.810	35,280		0.81	0	0	0
AE-SV-R-7/AE-SV-R-8	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	4.605	200,584		4.605	0	0	0

TABLE D-5
Summary of Remedial Action Areas
Boundary OU Record of Decision

Remedial Action Area	Selected Alternative	Alternatives Evaluated in ROD	Area (acres)	Area (ft^2)	Depth (ft bgs)	Remedy Evaluation: Capping Area (acres)	Remedy Evaluation: Excavation Volume (ft^3)	Selected Remedy: Capping Area (acres)	Selected Remedy: Excavation Volume (ft^3)
Administration Area West									
AW-R-1/AW-R-2/ AW-R-11	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.258	80,802	2	0.258	161,600	0	161,600
AW-R-3	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.025	8,390	1.5	0.025	12,600	0	12,600
AW-R-4/AW-R-5	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.042	1,830	2	0.042	3,700	0	3,700
AW-R-6	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.289	12,589	2	0.289	25,200	0	25,200
AW-R-7/AW-R-14	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.459	30,480	6	0.459	182,900	0	182,900
AW-R-8/AW-R-9/ AW-R-10/ AW-R-12/AW-R-13	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.410	95,863	12	0.41	1,150,400	0	1,150,400
AW-R-15	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.048	2,082	15	0	31,200	0	31,200
AW-R-16	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.355	15,472	2	0	30,900	0	30,900
AW-SV-R-1	Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)				0	0	0	0
Line 2 Region / Open Space 5									
L2-R-1	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.040	1,742	3.5	0.04	6,100	0	6,100
L2-R-2/L2-R-3	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.226	15,294	4	0.226	61,200	0	61,200
L2-R-4/L2-R-5/ L2-R-9	Alternative 4 - Source Removal/Reduction (Excavation with Soil Flushing and Air Stripping)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation with Soil Flushing and Air Stripping)	0.082	15,830	12	0.082	190,000	0	190,000
L2-R-6	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.042	7,539	5.5	0.042	41,500	0	41,500
L2-R-7/L2-R-8	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.030	14,028	12	0.03	168,300	0	168,300
L2-R-10	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.021	900	5	0	4,500	0	4,500
L2-R-11	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.064	2,800	5	0	14,000	0	14,000
L2-SV-R-1	Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)				0	0	0	0
L2-SV-R-2	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	0.065	2,831		0.065	0	0	0
L2-SV-R-3	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	0.029	1,263		0.029	0	0	0

TABLE D-5
Summary of Remedial Action Areas
Boundary OU Record of Decision

Remedial Action Area	Selected Alternative	Alternatives Evaluated in ROD	Area (acres)	Area (ft^2)	Depth (ft bgs)	Remedy Evaluation: Capping Area (acres)	Remedy Evaluation: Excavation Volume (ft^3)	Selected Remedy: Capping Area (acres)	Selected Remedy: Excavation Volume (ft^3)
Line 5 North / Open Space 7			0.000						
L5-R-1	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.129	5,619	1.5	0.129	8,400	0	8,400
L5-R-2	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.011	479	12	0.011	5,700	0	5,700
L5-R-3	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.015	663	3	0	2,000	0	2,000
L5-R-4	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.015	663	3	0	2,000	0	2,000
L5-R-5	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.032	1,385	2	0	2,800	0	2,800
L5-SV-R-1	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	0.057	2,483		0.057	0	0	0
L5-SV-R-2	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	0.057	2,483		0.057	0	0	0
L5-SV-R-3	Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Vapor Mitigation)				0	0	0	0
Buffalo Creek									
BC-R-1	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	2.647	115,303	2.5	0	288,300	0	288,300
BC-R-2	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	1.209	52,664	2	0	105,300	0	105,300
West Lakes / Open Space 6									
WL-R-1	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.026	1,133	6	0.026	6,800	0	6,800
Magazine Area / Open Space 3									
MA-R-1	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.052	2,270	12	0	27,200	0	27,200
MA-SV-R1	Alternative 2 - Institutional Controls	Alternative 2 - Institutional Controls				0	0	0	0
Chemical Plant 2 / Open Spaces 1, 2, and 4									
CP2-R-1/CP2-R-8/ CP2-R-9/CP2-R-10/ CP2-R-11	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	1.056	46,021	2	0	92,000	0	92,000
CP2-R-2/CP2-R-3/ CP2-R-4/CP2-R-5/ CP2-R-6	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (Excavation)	0.184	73,871	6	0.184	443,200	0	443,200
CP2-R-7	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.069	3,006	1	0	3,000	0	3,000
CP2-R-12	Alternative 4 - Source Removal/Reduction (Excavation)	Alternative 2 - Institutional Controls Alternative 4 - Source Removal/Reduction (Excavation)	0.069	3,006	7	0	21,000	0	21,000
CP2-SV-R-1/CP2-SV-R-2	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	1.847	80,460		1.847	0	0	0
CP2-SV-R-3/CP2-SV-R-4/CP2-SV-R-5	Alternative 4 - Source Removal/Reduction (SVE)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Capping) Alternative 4 - Source Removal/Reduction (SVE)	1.043	45,451		1.043	0	0	0
CP2-SV-R-6	Alternative 2 - Institutional Controls	Alternative 2 - Institutional Controls				0	0	0	0

TABLE D-5

Summary of Remedial Action Areas

Boundary OU Record of Decision

Remedial Action Area	Selected Alternative	Alternatives Evaluated in ROD	Area (acres)	Area (ft^2)	Depth (ft bgs)	Remedy Evaluation: Capping Area (acres)	Remedy Evaluation: Excavation Volume (ft^3)	Selected Remedy: Capping Area (acres)	Selected Remedy: Excavation Volume (ft^3)
Dredge Pit and Eastern Basin									
DPEB-R-1	Alternative 3 - Containment and Engineering (Backfilling)	Alternative 2 - Institutional Controls Alternative 3 - Containment and Engineering Controls (Backfilling)	0.549	23,928	10	0	0	0	0
DPEB-SV-R-1	Alternative 2 - Institutional Controls	Alternative 2 - Institutional Controls				0	0	0	0
					TOTAL	**13.033**	**3,392,000**	**1.295**	**3,134,400**

Notes:

ft bgs = feet below ground surface

ft^2 - square feet

ft^3 - cubic feet

SVE = soil vapor extraction

Appendix E
Responsiveness Summary to OU-6 Proposed Plan Comments

Appendix E: Responsiveness Summary to OU-6 Proposed Plan Comments
Responses to Comments from the Community Advisory Group

Comment #	Comment	Response
Public Comments Made Verbally During the Public Meeting for the Proposed Plan for OU-6 Cleanup on May 15, 2013 These comments were consolidated from the transcript of the meeting. The transcript of the meeting are in the Administrative Record.		
1.	**Commenter: Mr. Rick Bettis** This is part of the Central Groundwater Basin and there's, you know, significant changes in land use land and there's changes in water supply unless they implement the, you know, the (inaudible) project and all. Are those sorts of things being monitored? Because when you start changing the groundwater levels outside of the project area that could impact movements within the area.	The contaminated groundwater beneath the Aerojet Superfund Site, including groundwater beneath OU-6, is being addressed as part of the ongoing interim and final remedial actions to provide hydraulic containment and remediation of the contamination associated with releases from Aerojet. As described in the proposed plan, groundwater remediation is being conducted on an Aerojet sitewide basis. These final and interim remedies for the groundwater are managed under the OU-3 ROD (EPA, 2001) and OU-5 Interim ROD for Groundwater (EPA, 2011). The final groundwater remedy with aquifer restoration goals, will be documented in the sitewide ROD (OU-1 ROD). The OU-3 and OU-5 RODs include more details on the ongoing remedial actions for groundwater. Evaluations will consider the actual performance of the remedy and incorporate water level monitoring that considers other uses of groundwater in the area. EPA will continue these evaluations as required. It is not expected that remediation of groundwater sources within OU-6 will impact groundwater levels outside of OU-6.
2.	**Commenter: Mr. Jimmy Spearow** Just a quick comment. That it's not clear at all in terms of what cleanup levels are in various portions of the proposed plan, it's just not enough detail to see the different sections there. Which sections would be cleaned up to unrestricted residential, for example, versus -- there needs to be a lot more detail.	Cleanup levels for industrial/commercial land use and unrestricted use were presented in Table 2 of the Proposed Plan for over 50 COCs. Current and future land uses for OU-6 were evaluated in accordance with EPA's Reuse Directive, and an assessment of these uses was presented in the Reuse Assessment for OU-5 and OU-6, dated July 24, 2012. This document was presented at a CAG meeting, and is located in the Administrative record for OU-6. The cleanup levels adopted in the Selected Remedy are consistent with the target risk levels specified in the Proposed Plan for the reasonably anticipated future land use for each Remedial Action Area. See Tables 2-2 and 2-3 of this ROD.
3.	**Commenter: Mr. Dan Waligora** I'm confused on that because typically if contamination is removed from the site then land use controls, restrictions, and it could be -- the site is then -- can be considered clean. So I'm -- the way you're describing that, it confuses me a lot more because if it's removed, the site then can be opened for unrestricted use, therefore, it would meet the criteria. So can you explain the confusion?	The commenter is correct that, for any areas where contamination is not present above, or is remediated to risk levels that are suitable for unrestricted use, no land use controls or restrictions would be required. However, OU-6 overlies impacted groundwater that is being investigated and remediated under other OUs of the Aerojet site. Therefore, institutional controls are being selected as a remedy throughout the Boundary OU for groundwater. These restrictions include a prohibition on well installation or use of groundwater from the OU-6 area without regulatory Agency approval. In those areas where VOCs in groundwater present a potential unacceptable risk from the vapor intrusion pathway, land use controls will include requirements for engineering controls (e.g., vapor mitigation systems).

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Comment #	Comment	Response
4.	**Commenter: Mr. Jimmy Spearow** I think one of the real deficiencies of this is that it only addresses and talks quite specifically here, for example on page 17: "The preferred alternatives will remove or control sources of contamination from Boundary OU source areas to protect current and future human and ecological receptors, as well as prevent migration from these sources to groundwater at concentrations that may impair beneficial use." It only addresses contaminants that are, are in -- are from Boundary OU source areas and the real problem is the contamination from other source areas. And if you look at your own data set of the size of the source areas, of the contamination plumes, that over the last 50 years or so they've migrated both TCE, NDMA and perchlorate have migrated large distances, okay, very long distances. And so even if you were to address these contaminants in Boundary OU, if there was regulatory failure and that for some reason the contaminants in Island were not addressed, then they are going to continue to migrate. They are going to come right back in these areas and they are going to go further. So I think that there really needs to be a coupling of the cleanup at Boundary with Island and other source units that have multiple contaminants. That's one major point that's a flaw of this because it's not going to address if there's regulatory failure. For some reason it's not carried through, the cleanups in the other areas.	OU-6 ROD is intended to address soil contamination and potential sources of contaminant migration to groundwater within the OU-6 land areas. Consistent with EPA's policy for administratively managing complex sites, the Aerojet Site was divided into a total of 9 OUs in a 2001 Partial Consent Decree to manage the cleanup at the site. This approach allowed for a prioritized response to groundwater containment and restoration under the Western Groundwater OU-3 and the Perimeter Groundwater OU-5 under RODs issued in 2001 and 2010, respectively. The groundwater remedy associated with these operable units has been constructed and is currently operating. The final groundwater remedy with aquifer restoration goals, will be documented in the sitewide ROD (OU-1 ROD). An extensive monitoring well network is used to monitor the effectiveness of containment, restoration, and capture of this system. Annual Effectiveness Evaluations consider the performance of this system and evaluate any migration of plumes. The more than 30-year record of groundwater monitoring data for the Aerojet Site provides the Agencies with extensive information on the location of groundwater plumes. The groundwater extraction and treatment systems installed as part of OU-3 and OU-5 are required to be operated in an effective manner by enforcement orders or consent decrees issued by EPA to Aerojet. In addition, the Site is subject to Five Year Reviews that will evaluate the short- and long-term protectiveness of the remedial actions in place at the Site. EPA, the RWQCB, and DTSC provide oversight to this site through a Partial Consent Decree and Orders that require Aerojet to comply with Agency requirements. All remedies selected for the site will be evaluated for performance and a lack of protectiveness will be corrected.
5.	**Commenter: Mr. Jimmy Spearow** The second area I want to talk about is the cleanups, the cleanup levels. Now, the CAG was not happy with the screening levels for contaminants in the RI in terms of our comments not being addressed there. And that both oral and written, but particularly the oral comments, not being addressed. MaryJo told us that they would take and - rather than go back and even put an addendum on the RI or the RIFS, that they would present the cleanup levels in the proposed plan. And yet when I look at - that they would use current toxicity criteria for that. But when I look at this and look at your Table 2a I see all kinds of examples where the toxicity criteria are incorrect, they are not the current toxicity criteria. I'll just give a few examples where that -- there's plenty more but I'll just give a few examples of where the toxicities here are really off, okay.	Cleanup levels presented in the Proposed Plan Table 2 presented risk levels appropriate for future industrial/commercial or unrestricted use. EPA identified errors in several of the values that were presented in the May 2013 Proposed Plan that was the version available to commenters at the Public Meeting. The revised PP, issued in June 2013, corrected these values. The cleanup levels have been updated further since the Proposed Plan and are shown in Table 2-2 and 2-3 of the ROD. Naphthalene in OU-6 did not exceed screening levels for contact with soil for industrial or unrestricted use. This COC does pose a potential risk to groundwater, so the cleanup level presented in the updated Proposed Plan and in the ROD is for that pathway.

Appendix E: Responsiveness Summary to OU-6 Proposed Plan Comments
Responses to Comments from the Community Advisory Group

Comment #	Comment	Response
		The commenter cites the current DTSC guidance for lead in soil (80 ppm for unrestricted use and 320 ppm for industrial/commercial use).
	For example, under hexavalent chromium. The soil cleanup level for the protection of groundwater, this is on page 11. That you have it as -- the cleanup level as being 1,090 mg/kg. Well, the RSL for the protection of groundwater, the risk level is 5.9 x 10-4. So you're only off by seven orders of magnitude, okay. That's really unacceptable, okay. It's much, much too high levels. When we come to lead, there's statements in here that they will clean up lead to 10 micrograms per -- levels that would increase blood levels by no more than 10 micrograms per deciliter. No, it should be to increase by no more than one microgram per deciliter, which is going to be 80 milligrams of lead in the soil. And when it comes to naphthalene. There you list the screen level, the ERA ESL cleanup at being 29 mg/kg. But under the soil cleanup level for the protection of groundwater you list it as being 1.4 mg/kg, while the RSL is 4.7 x 10-4, so it's off by four orders of magnitude. Your cleanup levels are four orders of magnitude too high. Also there was no cleanup level for naphthalene in soil. Two more examples are for TPH-diesel you've got it down as a soil cleanup level of 1,000 mg. Well, the soil cleanup level for the protection of groundwater for the Regional Water Quality Control Board is 100 mg/kg. There's also issues -- it should be 83 mg there for the protection of human health and soil. That's not listed. Also for TCE. There was nothing listed there for soil protection, for protection of groundwater, whereas the RSL is 1.6 x 10-4. Instead all you have listed is the 42. The same thing for the protection of residential use should be .91 mg/kg of TCE. So what I'm getting at is that this document goes into too little detail, it has a number of inaccuracies in it, particularly in regard to cleanup levels. And this really needs to be resolved and we need to have these addressed properly so that human health is protected. As it is it's just not acceptable. Under perchlorate, there you have it as being .6 milligrams as being the soil cleanup level for the protection of groundwater and the cleanup level that was actually in the RI for the protection of groundwater is .06 or 60 micrograms or .06 mg/kg. Now, on the basis of that .06 the CAG had calculated a hazard index of 55 for perchlorate to home gardening, in terms of the consumption of vegetables, okay. That would be assuming that you would have about 50 percent other soil amendments brought in, okay. And yet, you know, it talks in here about cleaning up to a hazard of not greater than one. Well that's much, much higher. That's assuming at .06. At .6 it would be a hazard of 550, okay, which is really not acceptable.	The proposed cleanup level for the protection of groundwater was incorrectly listed in the proposed plan, and a corrected version of Table 2 was issued to provide the corrected levels. Please see the response to CAG written comment 10 regarding perchlorate in home-grown produce. EPA notes the referenced DTSC import fill guidance specifies best practices for soils imported to school sites. EPA does not consider this to be an ARAR for the OU-6 cleanup and will not require special procedures for soils removed from areas of OU-6 that are suitable for unrestricted reuse. The PP is a summary of EPA's evaluation of OU-6 and the presentation of the Preferred Alternative. As a summary document, some information is incorporated into the plan as part of the Administrative Record that forms the basis for EPA's decision at this site. The TPH screening level was corrected to 100 in the revised proposed plan Table 2a. EC is the selected remedy for areas containing COCs in soil at levels that present an unacceptable risk for unrestricted reuse will be set forth in detail as part of the RD. Restrictions will include provisions for managing excavation and movement of these soils to ensure they are handled appropriately. These restrictions would include sampling and notification requirements if soils are moved. The cleanup levels have been updated further since the Proposed Plan and are shown in Table 2-2 and 2-3 of the ROD.

Appendix E: Responsiveness Summary to OU-6 Proposed Plan Comments
Responses to Comments from the Community Advisory Group

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	And furthermore, this is going to affect not only areas that might be used for residential use on the Aerojet site but any soils that might be exported, let's say once an area is approved for use, they might be exported elsewhere. So I think we really have a problem and I'm really against having soils being exported elsewhere. If you look at the DTSC 2001 clean import fill guidance, it says very specifically that import fill should not be coming from cleanup sites, from contaminated sites.	
6.	**Commenter: Mr. Allen Tsao** I have a lot of comments but I just want to preface it that these comments are geared toward the general readability of the document, the proposed plan. [a] The proposed plan covers over 50 sites, 78 to be exact by my count of Table 1, the number of remedial action areas. There's separate and individual EPA-preferred alternatives for each of these remedial action areas but Table 3 doesn't specifically tie it to any single remedial action areas. In other words, you need to run the nine NCP criteria against each of these remedial action areas for the general public to understand and make some sense and provide some meaningful recommendation or concurrence inaton [*inaudible*] the EPA's recommended plan. Let me put it in a more concrete way. When you have a proposed plan for a remedial action area and the proposed plan is to do Alternative X, we cannot tell what the other potential, viable alternatives are. It is really difficult in this proposed plan because I can't tell, there is no table for it. I can't tell what the cost of the remedy will be had there been an IC or what the cost would be had there been soil vapor extraction plus soil excavation versus capping. There is no way for me to be able to tell. The only table that provides the cost is on one table that lumps everything together into three or four different groups. So for me and I believe other members of the public to make a meaningful comparison, there is no way for us to tell whether, you know, for example, $2 million for excavation is worth it, versus $2.5 million for capping. I can't make a -- I can't make a meaningful recommendation without that information. I strongly recommend EPA to provide each table, a table of alternatives for each remedial action area based on the reason I just stated. And also break this proposed plan into smaller proposed plans because there are over 78 remedial action areas. It's just -- I think it's -- you're asking the public too much. By putting this proposed plan in front of them and asking them to make some sensible and meaningful comments is just -- I don't think it's doable and I think you're asking them too much for it. So I would strongly recommend that we break this proposed plan up to smaller pieces and that way we can look at each of the remedial action areas or each four or five management areas. It just makes it easier that way.	[a] The Proposed Plan is a summary of the Preferred Alternatives for OU-6. Because this OU is a complex component of a large NPL site, it is impractical to include a specific evaluation of every remedial action area in the PP while retaining the summary nature of the proposed plan. Detailed information on the development and screening of Alternatives was presented in the FS, part of the Administrative Record supporting EPA's decision for this site. In particular, Table 6-3 in the FS report provides detailed cost estimates for each Alternative as it would be applied to each Remedial Action Area. The entire Aerojet Superfund site has been divided into nine Operable Units (OUs) to manage the investigation and remediation of the site in accordance with the Partial Consent Decree, and EPA is managing the selection of remedies on an OU-by-OU basis. As with the prior OU-3 and OU-5 Proposed Plans, it is necessary to group the remedial areas throughout OU-6 into a single Proposed Plan. [b] EPA provided information on the definitions of technical terms within the Proposed Plan but understands that additional definitions would be helpful. While these technologies were defined in the FS report included in the Administrative Records, EPA will consider defining additional technical terms in future Proposed Plans. [c] The table of Proposed Actions [Table 1] in the Proposed Plan includes the planned use for a given remedial action area. The Preferred Alternative in the proposed plan includes a cleanup level consistent with the future land use presented. The "SLERA ESL" column presented proposed cleanup levels protective of ecological receptors. The cleanup levels adopted in the ROD for those areas requiring cleanup to protect ecological receptors are detailed in the ROD Tables 2-2 and 2-3. [d] The Human Health Risk Assessment used sampling results on the nature and extent of potential contaminants of concern to conduct a conservative, point-by-point risk assessment at each sampling location. This information was presented in graphical and tabular form in the HHRA, showing those areas that presented a

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		potential risk to human health under residential/unrestricted or commercial/industrial exposure scenarios.
	[b] Other readability issues. I would strongly recommend that EPA add additional technical terms in the glossary. For example, soil flushing, mixed use. Define soil flushing, define mixed use, define institutional control, define operational controls. Those are a few examples. These came up when I was talking with Janis Heple, our Chairwoman, who had different ideas on what institutional control is. And we are both college graduates. If we had this misunderstanding on what those are I believe other people would too. And bold those terms that are in the glossary, it just makes it for easier reading of this complex proposed plan. [c] Another readability issue. It is not clear in Tables 2a and 2b, which cleanup level were referred -- will be used. And I think Jimmy Spearow touched on that. Because for any given chemical there could be like three or four cleanup levels. It's really difficult to be able to tell which cleanup level is being used for the specific remedial action area. And by the way, the ecological number, it is not clear to me that those numbers under SLERA, S-L-E-R-A, ESL column, are those cleanup numbers for eco-receptors? It doesn't say "cleanup level" as opposed to other columns where it says specifically "soil cleanup levels." So it's not clear whether those would be cleanup levels. [d] Okay. And so -- and also page 13 on the proposed plan. The second bullet item it states: "If eco risk exceeded screening levels and the Screening Level Eco Risk Assessment recommended further evaluation for an action, then the area was recommended for cleanup." Okay, that's an accent, I understand accents. The bullet right above that states: "If the potential human health risk was just above 1 x 10-6, the HI was greater than 1.0, or an estimated blood lead level was great than 10 micrograms per deciliter, then the area may have been recommended for cleanup evaluation." So does this mean that the area may not have been recommended for evaluation as well? It's not clear. And the same thing for the third bullet on page 13. [e] This is a general comment. There is no lat/long on the maps. George Waetell, that's spelled G-E-O-R-G-E, W-A-E-T-E-L-L and I, and especially George, requested the lat/long information be posted on all maps. The EPA promised to have this information on the maps but to this day there is no lat/long on any of the figures. Please put the lat/long information on the figures.	[e] EPA recognizes the need for detailed coordinates and attempted to balance readability of the figures and clarity given the size limitations of the Proposed Plan. A key figure in the ROD, Figure 2-2, has latitude and longitude information to assist the reader. [f] EPA appreciates the comment and notes that soil and sediment were evaluated in the OU-6 RI and risk assessment. Therefore, the ROD does note that the soil cleanup levels for protection of human health and ecological receptors also apply to sediments in those areas where a remedial action is being taken (see Footnote a on Table 2-2). [g] Institutional Controls do not reduce toxicity, mobility or volume through treatment. This component of the OU-6 preferred alternatives was presented in the Proposed Plan for those areas where ICs are required as a portion of the remedy for prevention of exposure to contamination that remains in place. While the preference for treatment was considered in the Selected Remedy, ICs were selected for contamination where ICs best met the NCP criteria. These include areas of groundwater contamination through OU-6 which are being addressed under other OUs at the Aerojet Site. These ICs will be emplaced using Land Use Covenants administered by the DTSC. [h] the HHRA evaluated risks to potential future residential or unrestricted use for all management areas in the BOU. The PP Table was intended to identify a summary of planned future uses for individual remedial areas to aid the reader. There was not a separate exposure pathway or scenarios identified for mixed use areas. [i] EPA expects the completion of SVE remedies before making property available for unrestricted reuse. All remedial system components (such as SVE well, piping, and treatment systems) will be expected to operate effectively and without interference from development or unacceptable exposures to site occupants. This approach will be clarified in the Remedial Design that follows the ROD and lays out the specific approach and sequencing for remediation.

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	[f] On page 14, Remedial Action Objectives. First bullet: "Prevent exposure to COCs in soils that pose an unacceptable risk for present and future workers and residents on the property and ecological receptors on the property." Please add "sediment" in addition to soils. Because clearly for the Buffalo Creek area the sediment in the creek are being cleaned up. Also please extend your wording not just on the property but off-property as well because contaminants may very well have migrated off-property. A related comment to that is that this proposed plan doesn't address potential contaminants that may migrate off-property and contaminants that may migrate on to OU-6 from Island OU or other areas. [g] Page 16, Table 1. I'm sorry, that's page 16, Table 3. Under Alternative 2, Institutional Controls. It indicates in this table that this particular alternative does not reduce toxicity, mobility or volume through treatment. So therefore I don't see why this alternative is being proposed for some of the remedial action areas. I do not support this alternative for any of the remedial action areas. [h] Going back to Table 1. Please explain the difference between commercial versus industrial versus mixed use and residential in terms of exposure scenario for human receptors. [i] And a final comment is that it does not appear that the proposed -- some of the proposed actions by EPA are protective, especially those that are proposed for Alternative 2 as well as Alternative 4. Specifically, those are proposed for doing soil vapor extraction under a mixed use or residential use. If I were to buy homes I would be concerned about having pipes underneath my property and having it run. And if that is not the case please, please do indicate so. Because it sounded like from earlier discussion that the cleanup will be done using SVE. Until then, residents won't be able to build houses. But as it stands right now the proposed plan does not accommodate that since appropriate -- it tells me that when I buy property in the areas that that's designated as mixed use or residential, there will be, depending on where we are, the remedial action area that will be source vapor extraction equipment. Thank you.	

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7.	**Commenter: Ms. Alta Tura** Habitat 2020 and ECOS have taken a look at the proposed plan and feel that the summary is not adequate, more information is needed. We are particularly interested in knowing how the proposed cleanup relates to the planned land uses. We want to see information on the levels of concentration of the chemicals of concern and more time is needed to review the plan. Thank you.	EPA extended the Public Comment period on this proposed plan to September 20, 2013 in order to afford the public additional time for review. The complete RI, Human Health Risk Assessment, and Ecological Risk Assessment were made available as part of the Administrative Record for the OU-6 proposed plan for review by interested members of the public. In addition, EPA provided technical support through the Technical Assistance for Superfund Communities (TASC) program from June through September 2013 to provide additional information and clarity regarding information in the PP and Administrative Record. The Selected Remedy for OU-6, and detailed in the ROD, includes cleanup that supports the future land use in each areas. Future land uses were determined in accordance with EPA's land use directive, and assessed in a Reuse Assessment performed in 2010.
8.	**Commenter: Ms. Janis Heple** I just -- I wanted to come up and be able to see everybody when I spoke because in reviewing this plan I really concur with the comments that have been made by the other speakers that there just isn't enough information for us here to really be able to speak out on this plan, except perhaps not in support of it. Allen mentioned 78 areas, remedial action areas. I for some reason had counted 75. But then it's further kind of grouped into 16 management areas and then one of those management areas is pulled out into three parts, the Admin area. They all need a much more complete presentation in order for the community to be able to weigh in on their cleanup. And also more time. I mean, we just have until June 7th right now and we really don't have the information that we would need at this point in time. Even -- I know that we have the information from the remedial investigation feasibility study and I know that we've had six or so meetings that involved discussions of the Operational Unit 6. However, those meetings never really got to what we're now seeing glimpses of in this proposed plan information. I went back and kind of purposefully looked at some of your presentations, Gary. It's like, was I, you know, was I missing things? But actually we just didn't really have the information that was going to tell us what would actually be happening if this proposed plan was to move forward. And I'm glad that we were able to make some of the comments that we did make last year, the letter that we wrote in July from the CAG. But, you know, now there's a real sense of criticalness about this issue. The objective for the OU-6 remedy is to do no harm to future owners of the land to be developed, based on what I believe is a one in a million risk for residential or unrestricted use. And given the multiple	EPA considered public input regarding the complexity of OU-6 and extended the end of the public comment period on the PP from June 7, 2013 until September 20, 2013. While EPA presented on the OU-6 FS and Proposed Plan at the December 2012, January 2013, and April 2013 CAG meetings, EPA agreed with the commenter that additional time and resources were needed for the public to interpret the information in the Proposed Plan and make meaningful comments. EPA provided technical assistance to the CAG using EPA's Technical Assistance to Superfund Communities (TASC) program. The assistance included discussions with CAG members through the summer, and presentations of specific information requested at the July and September CAG meetings. Recognizing that the full Administrative Record for the site incorporated into the OU-6 Proposed Plan by reference is very large, the technical assistance expanded on the explanation of remedial technologies included in the proposed plan, such as soil vapor extraction, soil flushing, and air stripping. The TASC contractor also provided extensive support regarding the institutional and engineering controls used to mitigate potential risk from vapor intrusion. EPA notes the commenter's support for source removal as a component of the Selected Remedy for OU-6. The Selected Remedy for OU-6 is required to be protective into the future as long as waste remains at the site at levels not suitable for unrestricted use. The protectiveness of this remedy will be evaluated every Five Years as required by statute, and this evaluation will include an analysis of changes in regulatory standards for the COCs at the site. If a Five Year Review identifies problems with the protectiveness of the remedy for OU-6, recommendations will be made, tracked, and implemented to ensure protectiveness.

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	contaminations and continuing technical and scientific improvements that will change the risk assessment over the 100-plus years length of the remedy, the CAG feels strongly that it is critical that the remedy is reasonably conservative. Because if it can go wrong, it will go wrong. We discussed at one of the meetings on the IRCTS, the other hazardous waste site nearby, we discussed -- something came up about, oh, well we're only planning for the next 30 years. And as you might remember if you were there, and most of you were, I was somewhat incensed because I have been involved working on this site for 34 years at this point. And 30 years is nothing when it comes to these sites. And what I think those of us on the CAG are concerned about is the degree to which these remedies will be put in place and will be carefully followed. And if there's people in homes who have vapor extraction systems underneath their residences and they're not -- I mean, I'm very, very concerned. It's like it's raised the bar. We're not just dealing with cleanup, we're dealing with this potential movement of citizens onto this property and I feel a real heavy responsibility over that issue. The CAG supports source reduction removal to the maximum extent possible in OU-6. This will reduce OU-3 and OU-5 operation time and be protective of human health. Alternative 4, you know, talked about on page 16, only partially meets this criteria. Now we have had some discussions on that tonight and I may have been misinterpreting. Again there is a need for more in-depth information. I may have been misinterpreting some of the way that that was intended when it talked about a partial remedy. But it's mentioned that the soil vapor extraction is listed to partially meet the need for reduction of toxicity mobility or volume through treatment. And I guess this was asked earlier tonight, what remedy would fully meet the need for treatment of contamination. And then I believe Allen mentioned that the proposed plan does not define the remedy terms for air stripping and the flushing that are mentioned in the selected remedy sites. So we do want to have an explanation of these, the terms. And also the combination of using the soil vapor extraction, the air stripping and the flushing together to meet the remedy objectives. I am not positive, again, because the information is slim here. And of course you guys all know how big the RIFS is. We really needed a bigger volume. Seventeen pages just really isn't enough for the magnitude, the 75, 78, whatever it is, the entire number of sites that we're dealing with here.	The Five Year Review is in addition to the requirement for effective operation and maintenance of any systems installed as part of the OU-6 remedy. An operation and maintenance plan will be required as part of the Remedial Design that will follow this ROD. The plan will include requirements to inspect, maintain, and operate remedial systems including those for vapor mitigation. The controls selected in the OU-6 ROD to prevent exposure to contaminated groundwater and unacceptable risk from vapor intrusion from groundwater beneath OU-6 will be effective. This remedy will manage potential risk posed by sources in other operable units (such as OU-7) to protect site occupants in OU-6.

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	But in terms of the institutional controls, how are they fully protective of human health for the six areas listed in the proposed plan? The six areas include two commercial areas, two of mixed use, one of residential and one industrial site. And it's a little confusing in reading the document because in the Summary of Remedial Alternatives listing it mentions Alternative 2 as not acceptable for family homes, day care centers, health care centers or schools. But in the selected remedy table, Table 1, Alternative 2 is listed as the remedy for mixed designated sites AW-SV-R-1, L2-SV-1 and residential designation L5-SV-R-3. We need a much better explanation of how the criteria becomes acceptable as a stand-alone remedy. Earlier Jimmy talked about the source areas, predominantly, I believe, in OU-7. If development of the Easton and Westborough areas was to move forward as soon as this cleanup remedy, if you guys were to move forward against the way the community is feeling right now and start getting cleanup going and then it -- you know, development would follow on the heels of that, it would be placing residents over the groundwater contamination that has still not been addressed that is moving out of OU-7, out of the major source area. Thank you.	
9.	**Commenter: Mr. Burt Hodges** At the end with respect to the deadline for comments being June the 7th. My concern is with respect to the CAG membership. The next meeting of CAG isn't until July. And I guess echoing Janis' comments about time to consider things and have some additional information as others members of the CAG have talked about here, to consider. I would -- my comment is that June 7th is too early. It seems to me as a member of the CAG I wouldn't be prepared to feel I could add anything significant as a comment now until I learned more from the CAG members, such as after the next -- at least after the next CAG meeting. So I would propose that your deadline really ought to be, say, August instead of June. So that's my comment, I think it's too early.	EPA considered public response to the PP and extended the public comment period to September 20, 2013. The extended deadline allowed two CAG meetings for additional discussion of the PP prior to the extended comment deadline. EPA also provided resources through the Technical Assistance for Superfund Communities (TASC) program for direct support to the CAG in interpreting the PP and developing comments.
10.	**Commenter: Mr. Allen Tsao** I just wanted to add that I had commented earlier to break the proposed plan into smaller pieces and add more information to it. Now if that proposal is not acceptable by EPA please let me know right away because I know that our oral comments and written comments won't be responded to until the ROD is signed. So if that is not a viable option I would like to know as soon as EPA can tell that. Thank you.	EPA considered public response to the PP and extended the public comment period to September 20, 2013. The extended deadline allowed two CAG meetings for additional discussion of the PP prior to the extended comment deadline. EPA also provided resources through the Technical Assistance for Superfund Communities (TASC) program for direct support to the CAG in interpreting the PP and developing comments.

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11.	**Commenter: Mr. Burt Hodges** Just to add a little bit to my previous comment about thinking that there really ought to be a delay until -- for your deadline on comments to things. Part of my request would be with respect to Save the American River Association, which we have commented previously with respect to the residential development and things. And part of my comments related to giving the rest of our Save the American River Association Board time to consider whether they wanted to make additional comments to something like this. June the 7th would be too early for that to be accomplished.	EPA considered public response to the PP and extended the public comment period to September 20, 2013. The extended deadline allowed two CAG meetings for additional discussion of the PP prior to the extended comment deadline. EPA also provided resources through the Technical Assistance for Superfund Communities (TASC) program for direct support to the CAG in interpreting the PP and developing comments.
12.	**Commenter: Mr. Jimmy Spearow** Just to follow up on my comment. On Table 2a there really needs to be the concentration of contaminants presented there, both the exposure point of concentrations that have been presented. And it needs to be for each of the different exposure units, okay. For example, if you've got a region that's going to be residential where you are going to have, say, a lot size of an eighth of an acre or so, it's the exposure point concentration of percent UCL that would be within that exposure unit that would be present there. And there just really isn't space for that here, okay. And there really needs to be for you to understand the contaminants that different receptors could be exposed to, whether it be residential receptors or industrial or aquatic receptors that are present there. That's, I think, an important thing that we need a lot more information and needs to be expanded because you have so many different exposure units and so many different areas that are being addressed in the site.	Table 2a presented the proposed cleanup levels for non-VOCs in soils in OU-6, and the ROD Tables 2-2 and 2-3 specifies the selected cleanup levels. The remedial design will specify how the cleanup goals, selected in this ROD, will be achieved. The remedial actions will then be evaluated to ensure they achieve the cleanup levels selected in the ROD.
13.	**Commenter: Mr. Allen Tsao** I wanted to just add on to Jimmy's comment that I agree with Jimmy's comments. It is not unusual to have a concentration, maximum concentration, a 95 UCL concentration in the proposed plan. I'm pulling a proposed plan from Moffett Airfield, Site 26 from the Navy, and it's a joint -- I believe it's a joint proposed plan from the Navy and EPA and they have a table of their concentrations in the proposed plan.	Individual remedial action area risks are summarized in the Proposed Plan Table 1 for brevity, presenting the COCs and pathways driving risk. The OU-6 Human Health Risk Assessment, incorporated into the Proposed Plan by reference, presents the numeric risk characterization for each individual area in detail.

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14.	**Commenter: Mr. Jimmy Spearow** Previously the CAG has asked for the contaminants concentration in the Islands so this is the region that the contaminants would be migrating from. And without that information it's hard to evaluate what the real risk would be over time to the Boundary operational unit and the receptors in that. And not just the contaminants but also the migration of groundwater and also the contaminant failure. Until those are provided it's really hard to evaluate the, I'm going to say, future risk to the Boundary operational unit in terms of the receptors that would be there. So I think that really needs to be included in order to look at this. Here again we need to think about -- or the proposed plan needs to think about coupling the cleanup to other upstream source areas that are still releasing contaminants. Thank you.	While the RI for the Island OU is currently in preparation, soil and groundwater data have been collected from these areas to characterize the nature and extent of contamination. These data are incorporated into annual plume maps provided by Aerojet to the Agencies, and EPA has combined these individual plumes into a composite plume map that is provided at EPA's Aerojet Site Page and routinely to the CAG. Detailed plume maps are also included in Appendix A of this ROD. The contamination present in the Islands OU that could potentially migrate to OU-6 through the groundwater pathway is subject to regular groundwater monitoring and an annual effectiveness evaluation of current OU-3 and OU-5 remedial systems. The institutional controls that are a part of the OU-5 ROD will protect receptors from contamination migrating from the Island OU. Aerojet is currently preparing the final Island OU-7 RI report and EPA anticipates the CAG's review of this document in the near future.
Written Comments submitted by the CAG on the Proposed Plan for the OU-6 Cleanup (Comments dated September 20, 2013)		
1.	**The CAG recommends that development on land in OU-6 (also known as the Boundary OU) continue to be restricted until the public processes for Operational Units with plumes extending under OU-6 have been completed and any related institutional controls addressing ground water vapor are in place.**	
	A. Given that the Remedial Investigation/Feasibility Study (RI/FS), Risk Assessment and Proposed Plans for other OUs have not yet been through a public vetting process, selecting a remedial alternative for OU6 appears to be premature. The OU6 Proposed Plan does not adequately disclose that EPA proposes to permit residential use in OU6 in areas subject to the migration of contaminated groundwater from other OUs.	Aerojet entered into a Partial Consent Decree with EPA, the RWQCB, and the Department of Health Services in 1989 to meet Superfund cleanup obligations. The Proposed Plan notes "The cleanup will also prevent COCs in Boundary OU soil sources from migrating to groundwater, and provide controls to prevent exposure to VOCs volatilizing from groundwater that is being cleaned up as a part of other OUs." The preferred alternative to address potential exposure above groundwater plumes migrating from other OUs is through the use of Institutional Controls that will require engineering control measures to prevent exposure. These areas are shown on Figures 3 through 5 as part of the preferred alternative. The preferred alternative accords with the reasonably anticipated future land use for OU-6. The Reuse Assessment, included in the proposed plan as part of the administrative record, provides further details regarding the land planning process undertaken by the property owner and local reuse authorities.

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	B. It is also unclear in reading the Proposed Plan, whether EPA would allow engineering controls, such as vapor mitigation/barriers (Alternative 3), as either a stand-alone or part of another alternative in residential areas. If EPA were to allow residential homes to be built with engineering controls (Alternative 3), we do not believe this is disclosed in the Proposed Plan. Because such engineering control is not disclosed in the Proposed Plan, the CAG believes that the EPA should seriously consider vetting this proposal formally with the public, per CERCLA requirements.	EPA discussed the proposed plan at the two CAG meetings preceding the public meeting for the PP. The meetings included attendance by Dr. Dan Stralka, regional toxicologist of EPA. At these meetings, discussion included the use of engineering controls in residential areas where there is a potential risk from vapor intrusion from groundwater into structures.
	C. The OU6 Proposed Plan does not adequately disclose the extent of the institutional controls intended to address groundwater vapor (due to an omission connecting Remedial Action Areas in Table 1 to Figures 3 and 4).	The proposed plan describes the preferred alternative to include ICs and engineering controls to prevent migration of VOCs into indoor air above those areas of impacted groundwater with potential vapor intrusion concern. The extent of these controls will be defined in the remedial design, and are shown in ROD Figures 2-23 to 2-31.
	D. The Proposed Plan does not provide the clean-up levels for soil vapor. It appears that if EPA selects the engineering control to reduce or prevent human exposure to contaminated vapors that may be present in existing or future commercial-use buildings, cleanup levels for soil vapor has to be presented in the Proposed Plan and the ROD.	Table 2 of the proposed plan presented target ambient air risk levels; the performance of SVE for remediation will be assessed using soil gas samples collected at a range of depths. The results of these samples will be adjusted using site specific-depth and attenuation factors to ensure the ambient air VOC cleanup levels will be met. This is the approach being used in the OU-5 cleanup at the site, currently in progress.
	E. The proposed plan has also not considered the potential for groundwater with elevated levels of TCE migrating from OU9 (and other OUs) into OU6, or from its current location in OU6 further down gradient in OU6. For example, Boundary OU Feasibility Study figure 6-1 (September, 2012) shows TCE isoconcentrations exceeding 500 µg/L in groundwater in OU6 – Line 2, as well as further to the south in OU9. The proposed plan has considered institutional controls, including restricting residential use or requiring vapor barrier/subslab vapor mitigation system for regions currently exceeding 11 µg/L TCE in groundwater, and the CAG strongly supports these institutional controls. However, Skeo-Solutions Figure "Recommended Remedial Alternative and Proposed Residential Land Use Alternatives – Buffalo Creek, Line 2, Line 5 and West Lakes Open Space Areas" and Proposed Plan Figure 4, show several regions proposed for Low, Medium or High Density Residential use in Line 5, OS-7, OS-6 and OS-5 where institutional controls would not be required. Many of these regions seem to be downgradient of TCE plumes.	The Proposed Plan included a preferred alternative of institutional and engineering controls to prevent migration of VOCs into indoor air until groundwater is remediated under other operable units. The Selected Remedy defines the areas subject to these controls, based on groundwater monitoring data that extend back to the early 1980s. Regular groundwater monitoring has defined the location of plumes in groundwater, and this information was used in the proposed plan to show the areas where vapor intrusion potential risk exists. The ROD selects these controls, and the extent of these controls is shown on Figures 2-23 to 2-31. Groundwater will continue to be monitored, and the performance of these controls will be evaluated to ensure they are protective. The plumes are not currently shown to be expanding, but sitewide monitoring will continue to ensure the remedy remains protective. The performance of the entire OU-6 remedy will be reviewed every five years to ensure it remains protective, and legal enforcement instruments will be created to ensure this remains the case.

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	These groundwater TCE plumes are migrating and will need to be addressed for approximately 200 years. Although Aerojet and EPA are currently working to address TCE and other groundwater contaminant plumes, the CAG is concerned that the commitment for funding and effort may not continue for the lengthy time needed to remediate these plumes. Since the eventual extent of the TCE plume cannot be entirely predicted, the CAG is concerned that institutional controls are not being required for all of the residential use regions that are down gradient of TCE plumes with substantially greater than 11 µg/L TCE. Since the eventual extent of the TCE groundwater plumes cannot be fully predicted, the CAG recommends greatly expanding the regions where residential use structures in OU6 would be required to have engineering controls or systems to prevent vapor intrusion, e.g. at least a vapor membrane and a passive subslab depressurization/venting system (that could be converted to an active system if needed at a later date). Since the eventual extent of the TCE groundwater plumes cannot be fully predicted, the CAG recommends greatly expanding the regions where residential use structures in OU6 would be required to have engineering controls or systems to prevent vapor intrusion, e.g. at least a vapor membrane and a passive subslab depressurization/venting system (that could be converted to an active system if needed at a later date).	
2.	**The CAG recommends prohibiting residential developments on areas where SVE remedies will be operational until SVE is complete.** The remedy selected, particularly the SVE remedy, for Mixed Use and Residential Area needs to have more explanation. Would the EPA allow buildings such as housing to be built on top of SVE systems or would there be land use restrictions where no buildings can be built until the SVE remedy is considered complete and meets the Remedial Action Objectives (RAOs) for VOCs for the specified land use? Either way, this has to be explained because many community members interpret this SVE system to be built in a way that would allow buildings constructed on top of the SVE system and this would include housing units. The CAG does not support SVE systems in operation or retained as a backup with housing units. The self-monitoring program seems extremely complex and invites strong conflicts of interest for the housing association or the home-owners or its contractors. The CAG urges the US EPA and DTSC to not allow residences to be built in the proximity of SVE remedy systems due to potential contaminants in SVE effluents.	EPA expects the active portion of an SVE remedy will be completed in areas planned for residential use prior to development. Appropriate monitoring and land use covenants are required for either residential or commercial use of BOU locations until the potential threat of vapor intrusion is removed.

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3.	**Lands redeveloped in OU6 should have deed restrictions to prevent human exposure to groundwater. These restrictions would specifically prevent wells for drinking water or be used in a way that would be a potentially complete exposure pathway for human or wildlife.** There should be a deed restriction in all areas of OU6 to prevent people from digging a well for drinking and irrigation purposes. The contamination in OU6 is well documented and there should be a deed restriction for the use of groundwater for the purpose of health protectiveness. There may be a restriction to prevent groundwater for drinking and irrigation due to other reasons; however, the deed restriction should be specifically to prevent humans and/or wildlife from exposed to groundwater.	The OU-6 ROD describes the groundwater ICs that are applicable to OU-6, which include restrictions on well installation to prevent exposure to contaminated drinking water and/or interference with the groundwater remedy.
4.	**The following sites that are designated as "Areas Not Retained" must be evaluated fully for remedial action. The CAG's understanding in allowing these sites as "Areas Not Retained" means that no further action and, therefore, no ICs or other remedial action will be taken. This designation is unacceptable unless the risk is at the low end of the 10-6 to 10-4 cancer risk management range and that the lateral and vertical extent of contaminants are well characterized.** The following six Remedial Area Number that Aerojet has categorized for no further action (No Action Sites) are as follows: • AE-N-10 Ok, with no remedy. PCBs in shallow soil only, not at 11 feet bgs. • AW-N-11 captured under AW-R-3 • AW-N17 overlaps with AW-R-3 with same COCs so it will be addressed. • AW-N-18 added to AW-R-6 and AW-R-10 so it will be addressed • DPEB-N-2 captured under DPEB-R-1 • DPEB-N-3 same as above. The reasons for no further action for these sites is because Aerojet believes the likelihood for residential re-use is low and therefore, Aerojet believes that no further action is necessary.	Some of the areas identified as "Not Retained" received this designation because these smaller areas of contamination overlap or were within other areas retained for evaluation and remediation. In these cases, the COCs presenting possible risks from these areas were captured using the identifier of the retained area(s). Details of this evaluation are documented in a series of tables in Section 1 of the FS. All areas of OU-6 overlying groundwater contamination, including the non-retained areas, will be, at a minimum, included within the groundwater ICs that prohibit use of groundwater (see Section 1.2 of this ROD for more details). • AE-N-10: This location will be encompassed by ICs limited future use to industrial or commercial • AW-N-11: This location is included within Remedial Area AW-R-7/R-14 • AW-N-17: This location was not retained for further action due to low concentration, small volume, and low risk. However, the adjacent AW-R-4/R-5 area may include this general area, once the design and remedial area has been established. • AW-N-18: This location is included within AW-R-6 and AW-R-8/R-9/R-10/R-12/R-13, and contamination will be addressed in the selected remedy. • DPEB-N-2 and DPEB-N-3: These locations are captured within Remedial Area DPEB-R-1.

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	A. We echo's US EPA's comments made in the FS (see p. 314 of 414, Final OU6 FS, US EPA's Specific Comment 21) that the anticipated or likely future use of an area should not be used to support a "not retained" designation (as for not retained for feasibility of cleanup analysis) because future use can change; furthermore, contamination appears to exceed unrestricted use (as an example, see Figure 1-31 of the FS for the Dredge Pit and Eastern Basin-also designated as DPEB-N-2 and DPEB-N-3).	The referenced EPA comment on the OU-6 FS reflects EPA's position that anticipated future use alone should not be used as the sole determinant of remedial evaluation and action. For those areas where COCs will remain at levels that present an unacceptable risk for unrestricted use, the selected remedy requires ICs that prohibit sensitive uses.
	B. In response to US EPA's comment, Aerojet replied that "As Aerojet plans to continue doing business at this location into the future, we believe that these statements are appropriate and should remain. Institutional Controls will be in place to prevent inappropriate use in the future including deed restrictions." Aerojet continues, "Aerojet will prepare figures identifying areas with deed restrictions or other institutional controls. Aerojet's Site Remediation Group reviews and approves all authorization requests for soil excavation or building demolitions. The review of these figures will be included in existing and future authorizations requests." Although US EPA appears to be satisfied with this response, the CAG finds the response from Aerojet unacceptable for the following reasons: i. It seems the "future authorizations requests" would be seeking authorization from the Aerojet Remediation Group and not subject to review by state or federal agencies. ii. The Institutional Controls and deed restrictions mentioned in the quoted text above does not appear in the proposed plan for those 6 sites. iii. No regulatory oversight is provided on the Aerojet's Remediation Group, and as such those decisions made by Aerojet regarding those 6 sites circumvents the CERCLA process. CERCLA requires that the 9 NCP criteria must be considered. Such consideration includes formally solicit public comments and evaluation of remedial alternatives. Without proper regulatory oversight, CAG finds it difficult to accept those 6 sites as protective.	ICs required as part of the OU-6 selected remedy will include provisions that future use be restricted in accordance with a Land Use Covenant developed with DTSC. EPA concurs that review by the PRPs site remediation group does not constitute an enforceable IC. The six sites identified earlier in this comment are being addressed through remedial actions described earlier in the response to this comment.
	C. Aerojet states that leaving those 6 sites outside the Feasibility consideration is because the re-use of the sites is very low. And claims that "…If reused, the area of this sample location will be backfilled, which will remove the exposure pathway." Aerojet does not specify the amount or extent of backfill and how the integrity of the backfill material will remain in place. Simply put, there is no regulatory oversight in areas that receive "not retained" designation since the area exits the CERCLA process; in fact, it receives an "unrestricted use" designation. This type of "remedy" in not protective of the human health,	The six sites identified earlier in this comment are being addressed through remedial actions described earlier in the response to this comment.

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	commercial or residential or suitable for building schools. Under the current proposal, the soil there can be moved without any restriction and re-used for other proposes.	
	D. Are there any other sites like those mentioned above that receive a "not retained" designation because future residential use is highly unlikely? Please provide a list of additional sites that falls under this category. The CAG strongly recommends that the EPA and State regulators provide additional information to support these locations as areas "not retained" for feasibility study.	No sites were designated "not retained" because future use was unlikely. EPA considered reasonably anticipated future land use for the entire OU-6. Areas where COCs remain at levels that present unacceptable risks for future unrestricted use are identified as remedial action areas where a remedy was selected to prevent or eliminate such exposures.
5.	**The CAG recommends the US EPA and state regulatory agencies conduct a post-removal ERA to adequately capture the extent of contamination, including areas offsite, and determine whether additional action is needed.** The following two sites are the subject of the comments that follows: • AE-C-1 • Buffalo Creek Aerojet states that a removal action completion was conducted in 2010 to achieve its Time-Critical Removal Action (TCRA). Please note that a TCRA does not necessarily need to achieve preliminary remedial cleanup goals (PRGs). It is unclear to the CAG what was the removal action goal in 2010, and whether the PRGs would be the same as the removal action goals (side note: removal action goals are often much higher than the remedial cleanup goal). While it is possible that the TCRA confirmation sampling result meet the preliminary remedial action goal, the FS lacks detail on whether areas outside the excavation have been sufficiently delineated and meet the PRGs. It appears that a post-removal action ecological risk assessment (ERA) would be needed in order to make this determination. Without a post-removal action ERA, we think it's premature to draw a no further action conclusion.	The August 2009 Proposed Plan for the Perimeter Groundwater OU of the site included a proposed remedy of soil excavation to remediate PCBs and metals in the 10(D) and 11(D) source areas. Review of the comments received during the public comment period did not identify any comments that would change the proposed action to remove soil containing metals and PCBs from source area 10(D) and portions of 11(D), the subsequent offsite disposal of these soils, and the backfill of the source areas with clean material. A time critical removal action was implemented to remove these materials from drainage areas ahead of the upcoming rainy season. The removal action included source removal from upstream drainage areas that were a part of OU-6 in order to prevent contamination of downstream background material. The designation AE-C-1 in the OU-6 FS reflects the outcome that the removal action achieved cleanup goals and post-excavation assessment indicates no further action is required. The Buffalo Creek vegetation and sediment removal maintenance actions were conducted to maintain the discharge from the ARGET groundwater treatment facility as required under permit from the RWQCB. This action is described in the Administrative Record for OU-6, including a May 3, 2011 completion report. A sitewide Ecological Risk Assessment is planned as part of the sitewide ROD (OU 1) following completion of all other RODs for Aerojet. Remedial actions conducted under the OU-6 ROD (and other RODs) will be assessed from protectiveness of human health and the environment in the Five Year Review process.

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6.	**Should the benchmark used for lead exposure concentrations be 1 µg/dL, instead of 10 µg/dL?** OU6 Feasibility Study. Table 1-2. Descriptions of Graphical Risk Summary Figures. The blood lead level for protection of school children and fetuses (OEHHA, 2007) for source-specific incremental change should be 1 µg/dL, not 10 µg/dL, as the table and other parts of the report and figures have incorrectly shown. Using 10 µg/dL would underestimate the benchmark for lead blood concentration, and would not be protective for school children and fetuses under California regulatory standard. Therefore, the change in blood lead that is health protective must be re-evaluated and therefore, additional areas of remediation are likely. The CAG recommends correcting this source-specific incremental change to 1 µg/dL, lead on Proposed Plan Page 13 (See Comment 11d).	The corrected Table 2a from the Proposed Plan issued in June, 2013 (subsequent to the public meeting) includes lead cleanup levels based on the DTSC model of 80 mg/kg for unrestricted reuse and 320 mg/kg for industrial or commercial use.
7.	**For regions proposed for no action, the CAG recommends the Proposed Plan address the potential risk of exposure to contaminants in soil, including deeper soils, if such soils were excavated and reused.**	
	A. The CAG raised concerns at a previous CAG meeting over discussions of the potential unrestricted reuse of soil from no action areas. The CAG is concerned that soils, including deep soils in regions proposed for no action that are impacted with contaminants at the present time (or by future migration of contaminants) could be excavated and used as "clean fill" in an unrestricted manner both on and off the Aerojet site. See Comment 8 below.	The Selected Remedy includes ICs to prevent unrestricted reuse of soils containing COCs that could present risk under future exposure scenarios. These ICs include the requirement to follow Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements which are already in place sitewide. In areas where an action is taken to meet remedial action objectives via excavation, soils with contamination at depths greater than the maximum excavation depth that could present a risk to unrestricted reuse will be managed through Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements and ICs. In all areas of OU-6 where COCs remain at levels that present an unacceptable risk to potential unrestricted use for soils deeper than 10 feet, the Selected Remedy will include ICs. Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements will be followed to ensure these soils are tracked as part of the ICs. Soils in areas not identified for Remedial Action in the OU-6 ROD were determined to not present an unacceptable risk to future users of the property. Protectiveness of the OU-6 remedy will be assessed in Five Year Reviews.

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	B. The CAG is also concerned that deeper soils may contain elevated levels of contaminants including TCE, perchlorate, NDMA and 1,4-dioxane. The CAG recommends that Comment 8 be followed. If Comment 8 is not followed, the CAG recommends that most contaminants in soil be evaluated according to residential soil RSLs, including 0.91 mg/kg TCE, 0.0023 mg/kg NDMA, and 4.9 mg/kg 1,4-dioxane. However, the CAG recommends a soil screening level of 50 mg/kg perchlorate for the protection of the consumption of home grown produce.	As described in the response to the prior comment, those remaining soils with COCs exceeding levels appropriate for unrestricted reuse, the selected remedy will include ICs. Aerojet's Soil Excavation or Grading, or Construction Debris Movement Notification Requirements will incorporate the cleanup levels identified in the ROD on Table 2-2 for soils. Note the response to the perchlorate level in comment 10 below.
8.	**The CAG recommends AJ follow the recommendation of the DTSC import fill guidance,** which states: "Selecting fill Material: In general, the fill source area should be located in nonindustrial areas, and not from sites undergoing an environmental cleanup…. Undesirable sources of fill material include industrial and/or commercial sites where hazardous materials were used, handled or stored as part of the business operations, or unpaved parking areas where petroleum hydrocarbons could have leaked into the soil…. Undesirable industrial facilities including metal processing shops, manufacturing facilities, aerospace facilities, oil refineries, waste treatment plants, etc." (DTSC, 2001; Information Advisory Clean Imported Fill Material. (Available at http://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf). The Clean Imported Fill Advisory also contains sampling recommendations. **The CAG recommends the recommendations of the DTSC Clean Imported fill Advisory be considered to ensure that materials used as fill do not pose a risk to human health both on AJ properties and if considered for reuse off the AJ site.**	EPA notes the CAG's recommendation; however, EPA does not impose controls on those soils that do not pose an unacceptable risk for unrestricted use. As such, the DTSC advisory is not included as an ARAR in the OU-6 ROD. It is assumed that any imported fill material brought to the site has previously been determined to be from a documented clean source (virgin material) that is free from contamination.
9.	**More information should be provided in the Proposed Plan on ICs and Capping, including vapor barrier depressurizations systems.** The EPA has previously described plans to use a vapor barrier membrane to mitigate vapor intrusion (VI) to indoor air. The CAG pointed out at a CAG meeting that DTSC does not agree that a vapor barrier is sufficient, and recommends that a subslab vapor depressurization system be installed to ensure that VI in to indoor air can be addressed. Yet these are not even mentioned in the Proposed Plan as part of a remedy. The Proposed Plan needs to discuss Institutional Controls and Capping and if and how the vapor barrier and subslab vapor depressurization systems will serve in these designs.	The ROD documents EPA's selected remedy, which includes the use of engineering controls to mitigate potential vapor intrusion. Consistent with EPA's practice, specific details of these systems will be set forth in the remedial design. Additional details regarding the vapor control systems required as part of the selected remedy are found in the ROD Sections 2.10.2 and 2.10.3.

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10.	**The CAG requests that the US EPA consider using the corrected value of 50 µg/kg rather than 60 µg/kg as a perchlorate cleanup value in areas that are planned for residential or mixed use.** Table 2a. Exposure of Perchlorate via home-grown produce. Perchlorate is known to have high propensity to bioaccumulate in vegetation. In response to CAG's concern regarding perchlorate exposure via home-grown produce, US EPA responded to CAG's in its December 2012 letter (US EPA, 2012). In the letter, the US EPA quantitatively modeled residential exposure of perchlorate and the soil-concentration above which would be a concern. In that letter, the US EPA determined that a soil-screening level of 60 µg/kg (ppb) perchlorate in soil would be protective of a child, assuming 40% of his total vegetation consumption would come from a home-garden.	Thank you for the reevaluation, however, the previous EPA response is correct and no mathematical error was made. In EPA's calculation, we cited the 2011 Exposure Factors Handbook, http://www.epa.gov/ncea/efh/report.html, for the consumption of lettuce and leafy vegetables. The values used are derived from Table 9-6, Consumer-Only Intake of Individual Fruits and Vegetables Based on the 2003−2006 NHANES (g/kg-day, edible portion, uncooked weight). The combined body weighted average consumption for both lettuce and leafy vegetables are 1.5 grams/ kg-day for children 3-5 years and 1.1 grams/kg-day for females 13-49 years. The comment refers to Table 9-16 which is similar in methodology but is calculated to present produce as an "agricultural commodity" which is defined as the produce as it leaves the farm including stems and parts that may not be consumed. The values are similar but in order to combine the different female age groups spanning different year brackets, as is the case in Table 9-17, a time weighting needs to be employed, not a simple addition. Using this calculation to derive the average per kg-day consumption also yields 1.1 gram/kg-day for the combined age brackets of females 13-19 and 20-49. Therefore, the previously calculated soil screening levels will be applied. SSLchild = 0.060 mg/kg or 60 µg/kg perchlorate SSLwoman = 0.090 mg/kg or 90 µg/kg perchlorate. See the Administrative Record for further information.
	A. We appreciate the work that US EPA and other regulatory agencies have put in to respond to CAG's concern. As part of CAG's Technical Assistance Grant, the human health risk assessor from Skeo's Solution identified a calculation error; if the error were corrected, the soil-screening level would be lowered from 60 µg/kg to 50 µg/kg for the protection of 13-49 year old women. The CAG agrees with the Skeo solutions calculations. The CAG feels that a 20% difference in value [(50-60)/50=0.20] is significant. The CAG requests that the US EPA consider using the corrected value of 50 µg/kg rather than 60 µg/kg as a perchlorate cleanup value in areas that are planned for residential or mixed use.	Please see the response to Comment 10 above.
	B. The CAG also notes that if a greater proportion of vegetables were home produced, the screening level for protection of 13-49 year old women for perchlorate would be even lower, with soil screening levels of 40 µg/kg perchlorate if 50% of the vegetables consumed were home grown, and with soil screening levels of 25 µg/kg perchlorate if 80% of the vegetables consumed were home grown. For these reasons, the CAG considers that that a screening level of no greater than 50 µg/kg perchlorate should be used for the protection of women and children in the home gardening pathway.	Please see the response to Comment 10 above.

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	C. The CAG recommends that 50 µg/kg for perchlorate should be added under "Residential Cleanup Level for the Protection of Human Health" column. The cleanup value of 60 µg/kg should be continued to be used in areas that are not designated as residential for the protection of groundwater. However, in areas that are designated as residential, the CAG strongly recommends the US EPA use 50 µg/kg as the soil cleanup level (for the protection of women and children eating home-grown vegetables not exceeding 40% of its diet).	Please see the response to Comment 10 above.
11.	**The CAG recommends that EPA follow the correct Regional Screening Levels (RSLs) or California Modified PRGs for these Chemicals of Concern (COCs) and modify remedial alternatives accordingly as needed:**	
	A. **TPH-diesel and TPH-motor oil:** Cleanup levels for TPH-diesel and TPH-motor oil in the Proposed Plan were above the California RWQCB screening levels for protection of ground water. The CAG agrees with using California RWQCB screening levels of 100 mg/kg TPH-diesel and 500 mg/kg TPH-motor oil. However, if these levels are exceeded, the CAG also recommends also screening for components including naphthalene, BTEX, and PAHs using residential RSLs.	The revised version of Table 2a issued in June uses the noted California RWQCB screening levels as proposed cleanup values. The RI and Human Health Risk Assessment for OU-6 considered the petroleum constituents stated in this comment, and identified them as COCs if required.
	B. **Trichloroethylene (TCE):** The CAG recommends that Proposed Plan provide the Residential Soil Regional Screening Level (RSL) of 0.91 mg/kg TCE and the risk based soil cleanup level of 1.6E-04 mg/kg TCE for the protection of groundwater as cleanup levels in Table 2a. Since AJ did provide a SERA ESL of 42 mg/kg TCE, it also needs to provide the much lower current soil screening levels for the protection of direct exposure to soil and for the protection of groundwater.	Cleanup levels for volatile organic compounds (VOCs) were presented in the proposed plan and are adopted as performance standards in the ROD based on target ambient air levels. This is consistent with the approach used for the prior operable unit at the Aerojet Site (OU-5, the Perimeter Groundwater OU).
	C. **Cadmium:** The CAG recommends Table 5a report the California Modified non-cancer screening level of 4.0 mg/kg cadmium for residential use and 5.1 mg/kg for commercial/industrial use (See Human Health Risk Note 3, DTSC, 2013) and the RSL for the protection of groundwater of 0.52 mg/kg cadmium rather than the 7 mg/kg listed in the table.	No risk to human health or environmental receptors was identified for cadmium in OU-6. The protection of groundwater screening level was corrected in the revised PP issued in June, 2014.

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	D. **Lead:** The CAG recommends the cleanup be protective of a 1 µg/dL increase in blood lead in children and in fetuses of pregnant women (See Human Health Risk Note 3, DTSC, 2013). The CAG does not agree with the lead exposures that result in 10 µg/dL as stated on Proposed Plan page 13 since it is not health protective. The CAG does support the cleanup level of 42mg/kg lead for the protection of groundwater (which is more stringent than residential, and some cases 23 mg/kg depending on the soil type) for the entire area of OU6 where lead exceeds this value (see Table 2a, published in June 2013 as an addendum to the May 2013 Boundary OU Proposed Plan).	The selected remedy in the OU-6 ROD includes soil lead cleanup levels of 80 mg/kg and 320 mg/kg for unrestricted and industrial/commercial use, respectively. These levels are protective of a 1-µg/dL increase in blood lead level.
	E. **Naphthalene, nitrosodimethylamine (NDMA), perchlorate, hexavalent chromium and polycyclic aromatic hydrocarbons:** The CAG recommends that current RSLs for residential use be listed, and used as Cleanup screening levels for soil in Table 2a as an additional measure in preventing OU6 soil being moved onsite or offsite. Using NDMA as an example, the CAG recognizes that the screening levels protective of groundwater for this compound is very low (1x10-7 mg/kg); and thus, it is likely not detectable with standard analytical instrumentation. We do support the EPA's proposed use of 3x10-5 mg/kg for protection of groundwater instead. The CAG would like to see some mechanism to prevent movement of soil onsite or offsite, which may ultimately be sold for residential or gardening purposes. Thus, the CAG would greatly appreciate more levels of safeguard by adding in soil residential RSLs for NDMA and other chemicals as an additional measure to prevent inappropriate use or allow unrestricted use of soil.	Naphthalene, NDMA, and perchlorate were only identified as risks to groundwater in OU-6; therefore, only cleanup levels for the protection of groundwater were provided. Hexavalent chromium and various PAHs pose risks to human health and groundwater and therefore, unrestricted use, industrial use, and protection of groundwater cleanup levels for soil were provided. See response to Comment 8 regarding movement of soils within or off the Site.
12.	**The CAG recommends that dredge mine tailings be evaluated for human health and ecological risks.** The Proposed Plan and the RI for the Boundary OU suggested that dredge tailings from past mining operations occurred. It is unclear if the Superfund site includes protection to ecological and human health from past mining operations. However, Aerojet, by acquiring the property, has inherited the liability of any potential contaminant hazard from past mining operations. The CAG strongly recommends that the US EPA, DTSC, and the Water Board evaluate contaminants from past mining operations and whether the proposed remedy are protective of future and current land use and wildlife in the open space areas of the Boundary OU.	The entirety of OU-6 – including areas mined in the past – has been assessed for human health and ecological risk through the risk assessment process described in the Human Health and Ecological Risk Assessments for OU-6. Under oversight from EPA, DTSC, and RWQCB, the risk assessments were conducted in accordance with agency guidance and policy. Identified risks were evaluated in the FS and remedial actions are selected in this ROD. The selected actions are protective of human health and the environment. Protectiveness will be periodically reviewed as part of the Five Year Review process.

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13.	**The CAG recommends that EPA improve the Proposed Plan document for future OUs by addressing the process comments outlined in the attached table.** The CAG does not believe that the OU6 Proposed Plan provides a sufficient level of explanation for the public to provide informed comments, without a tremendous amount of investment in understanding the RI/FS. For future Proposed Plans, the CAG recommends providing the level of detail recommended in the US EPA Guide to Preparing Superfund Proposed Plans, Records of Decision (RODs), and Other Remedy Selection Decision Documents (the Guidance), dated July 1999. Because the Proposed Plan is an invitation for community involvement, we urge the US EPA to provide enough understandable information to allow for meaningful public comment as a stand-alone document. Please refer to the attached table for more detailed recommendations.	EPA is committed to continually improving the RI, FS, and PP process and community engagement throughout the process. EPA incorporated feedback from the community on the OU-3 and OU-5 Proposed Plans in preparation of the OU-6 Proposed Plan. We appreciate the feedback on this proposed plan and will work with the CAG to incorporate this feedback into future proposed plans for other OUs at the Aerojet Site. The Proposed Plan for OU-6 is a summary of EPA's preferred alternative for the entire operable unit, and struck a balance between including as much information as possible while maintaining a useful and readable "summary" format for the public. Information from the entirety of the Administrative Record for OU-6 was incorporated by reference, but EPA understands the community requests additional information in future proposed plans. EPA will continue working with the CAG to ensure meaningful community input that leads to improved proposed plans in the future.

Appendix E: Public Participation and Issues Related to the Presentation of the Proposed Plan

Recommendation	Supporting Comment	Response
A. The CAG recommends using the NCP criteria for future Proposed Plans.	NCP Section 300.430(e)(9)(iii) requires that "The criteria noted in paragraph (e)(9)(iii) of this section are used to select a remedy." The Feasibility Study and the Proposed Plan do not compare the site against the NCP criteria but use the Management Area; The CAG feels that this is the incorrect use of comparison because the decision for selecting one alternative over the other is based on Remedial Action Area.	EPA appreciates the CAG's input to make future proposed plans clearer and more useful to the public and will consider this input for future proposed plans. The proposed plan summarizes the analysis of the remedial alternatives against NCP criteria that was conducted in the administrative record (including the Feasibility Study).
B. The CAG recommends using the regulatory guidance for writing of future Proposed Plans.	While the Guidance is not legally binding, certain elements are required by law to be in the Proposed Plan (such as a list of preferred alternatives and reasons for them).	EPA appreciates the CAG's input to make future proposed plans clearer and more useful to the public and will consider this input for future proposed plans.
C. The CAG recommends EPA scale down their scope of remedial action into smaller Proposed Plans.		EPA appreciates this comment and understands the site is complex. The division of the Aerojet site into 9 OUs was directed in the Partial Consent Decree and EPA will propose remedies on this basis.

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Recommendation	Supporting Comment	Response
D. The CAG recommends EPA include the cost for each remedial action area in future Proposed Plans.	The Guidance states "a total present worth cost for each alternative allows the public to compare different alternatives that have varying amount of O&M costs." The grouping of costs by Management Area is also not helpful in making such comparison.	EPA will work with the CAG to present information more clearly in the future.
E. The CAG recommends EPA follow its own guidance for newspaper notifications, found in Section 2.6.1 of the Guidance [US EPA, 1999].		Comment noted.
F. The CAG recommends that future Proposed Plans describe the nature and extent of contamination in greater depth.	More information on the levels of each contaminant of concern and its extent would be helpful for public understanding and comment.	EPA will work with the CAG to discuss the nature and extent of contaminants of concern through the RI/FS process.
G. The CAG recommends that EPA update the risk assessment in the RI/FS with up to date human health toxicity criteria.	The CAG understood that EPA, if not planning to update this information in the RI/FS, would include up to date human health toxicity criteria in the OU6 Proposed Plan. The CAG would also like to see more information on the following in future Aerojet OU Proposed Plans: • Maximum level of contaminants or the 95%UCL exposure point concentration of contaminants on the site or in each exposure unit. • Clean up levels for all contaminants in soil. • Correct contaminant screening levels (more health protective of RSLs and OEHHA/California-modified screening levels) for all contaminants of potential concern. • Detailed human health risk calculations.	EPA's intent was to provide proposed cleanup levels in the Proposed Plan that were consistent with current regulatory guidance and human health toxicity criteria. These cleanup levels were reviewed following the proposed plan, and the cleanup levels provided in the ROD are selected based on current human health and ecological toxicity information EPA will work with the CAG to include useful information in future proposed plans that is responsive to this request. We note that the OU-6 PP included cleanup levels for all COCs, as requested by the CAG in discussions prior to issuance of the PP. The cleanup goals and performance standards selected in the OU-6 ROD reflect current risk screening levels appropriate for the site. It will likely be infeasible to present all risk assessment calculations in future PPs for the site given the complexity and scope of the OUs. The human health risk assessment is available as part of the Administrative Record for OU-6 and will be made available as part of the Administrative Records for future OUs.

Appendix E: Public Participation and Issues Related to the Presentation of the Proposed Plan

Recommendation	Supporting Comment	Response
H. The CAG recommends future Proposed Plans go into greater detail in the Summary of Site Risks.	The CAG recommends the following details be included in future Proposed Plans: • The estimated carcinogenic and non-carcinogenic risks associated with exposure pathways for chemicals of concern (COC). • Summary of risk assessment for each remedial action area. • Human health risks that explain if human health risks levels exceed a cancer risk of 1 x 10-6 or Hazard Index of 1 for an industrial scenario or residential scenario or both.	EPA will work with the CAG to include as much of the requested information as possible into future proposed plans, while maintaining brevity that allows for the PP to be widely distributed and used by the public. All information will be included in the Administrative Record for this and future OUs.
I. The Proposed Plan should include a summary of site risks, other than a description of how risks were determined.	There is no summary of site risks (human health or ecological health) other than a description of how risks are determined. The Proposed Plan discusses, to a very limited extent, US EPA's preferred alternatives. However, without a description of site risk (exceeding industrial, exceeding residential, and/or exceeding ecological health), the reader is left to speculate on the magnitude and level of risk for each Remedial Action Area. As noted above, the US EPA neglected to discuss Remedial Action Areas for which No Action is selected. In other words, US EPA does not provide a link on the level of risk/hazard (not significant - cancer risk 1 x 10-6 and Hazard Index of 1.0 or significant – cancer risk 1 x 10-6 to 1 x 10-4 or Hazard Index > 1.0) and type of use (industrial, commercial, residential, or ecological) from contaminants for each Remedial Action Area. The CAG emphasizes Remedial Action Areas because the Preferred Alternatives are made by Remedial Action Areas, not Management Areas.	Table 1 in the proposed plan was intended to summarize the types of COCs that present risks under planned future use scenarios for each of the Remedial Action Areas. Detailed risk summary information was derived in the human health risk assessment and summarized in the FS, which are incorporated by reference into the PP as part of the Administrative Record. EPA recognizes that the CAG requests more detailed information to be include as part of future PPs.
J. Previous cleanup action conducted at Buffalo Creek should have been disclosed as a part of the Proposed Plan.	Previous cleanup action conducted at Buffalo Creek is not disclosed. As described by the Regional Water Quality Control Board project manager via telephone on May 17, 2013, there was a previous cleanup action immediate downstream from the Proposed remedial action for Buffalo Creek. The subject document does not describe this nor does it propose ways to evaluate likely re-contamination from upstream Buffalo Creek, where contamination levels are so high that US EPA proposes a remedial action.	The cleanup alternative selected for Buffalo Creek will meet the required cleanup goals and is expected to remove COCs that could migrate downstream in Buffalo Creek. The effectiveness of the cleanup will be documented in a post-construction report, and any future monitoring of Buffalo Creek will be described in the RD. A prior maintenance action conducted by Aerojet under its NPDES permit for treated groundwater is in the May 3, 2011 completion report included in the Administrative Record for OU-6.

Appendix E: Responsiveness Summary to OU-6 Proposed Plan Comments
Responses to Comments from the Community Advisory Group

Comment #	Comment	Response
Written Comments submitted by Mr. Allen Tsao, a member of the CAG, on the Proposed Plan for the OU-6 Cleanup (Comments dated September 20, 2013)		
General Comments		
1.	Please specify the total acreage of OU6 property. I was not able to find this information in the RI/FS or the Proposed Plan.	The total acreage for OU-6 is 701 acres and is included in the ROD.
2.	Institutional Controls as a stand-alone remedy	
	A. According to an US EPA's policy (http://www.epa.gov/superfund/policy/ic/), it indicates that the National Contingency Plan (NCP) emphasizes that ICs are meant to supplement engineering controls (Alternative 3 for OU6 Proposed Plan) and that ICs will rarely be the sole remedy at a site. However, US EPA indicated for a number of sites under OU6, the preferred remedy is IC alone as the sole remedy. It is my understanding that once an IC is selected, the enforcement goes to the state (and perhaps local municipalities). Is there a reimbursement mechanism for passing the burden to the State to enforce and monitor IC compliance?	ECs are the preferred remedy for the areas of OU-6 for risk due to vapor intrusion and the groundwater ICs are applicable to all Aerojet properties that overlie groundwater contamination (as described in the OU-5 ROD). Restrictions on the installation of wells and use of groundwater are the only feasible methods to prevent exposure to contaminated groundwater or interference with the groundwater remedies from other OUs at the site. ICs will be enforced by the land owner and PRP entering into an enforceable Land Use Covenant with DTSC. As a third-party beneficiary, EPA will also have the ability to enforce this agreement. The *California Code of Regulations* (CCR) provides a mechanism for cost recovery by the State for ICs.
	B. How does US EPA ensure that ICs do not fail, especially when property are sold for private housing development.	EPA will continue to review the remedy for all areas of the Aerojet site at a minimum of once every five years as part of the five year review process. In addition, the LUC between the PRP and DTSC will require annual reporting to ensure appropriate ICs and engineering controls are in place.
	C. As Table 3 in the Proposed Plan indicates, ICs may not be compliance with ARARs and not protective of the overall protection of human health and the environment for areas identified with risk to groundwater (or with PCB contamination).	The selected ICs for OU-6 comply with ARARs for the selected remedy. The referenced Table in the Proposed Plan was intended as a summary of the relative ability of each potential remedial alternative to meet NCP criteria. In the analysis of the lead and support agencies, the selected alternative will meet threshold NCP criteria.
	D. It also states that ICs alone would only partially achieve long-term effectiveness and permanence. Therefore, I am not convinced that ICs is a compelling choice for residential, mixed used, or commercial land-use.	The referenced Table in the Proposed Plan was intended as a summary of the relative ability of each potential remedial alternative to meet NCP criteria. Where selected in the OU-6 ROD, ICs (and, where necessary, in conjunction with engineering controls such as vapor barriers and other mitigation measures), will be effective over the long term. The protectiveness of these measures will be periodically reviewed by EPA to ensure they remain protective.

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Comment #	Comment	Response
Specific Comments		
1.	AW-SV-R-1 and L2-SV-R-1: These two sites are designated as mixed use. Please explain why the US EPA preferred alternative, Alternative 2 - ICs - would alone be protective or consider to revise this to another active remedy that has long term permanence. Risks at AW-SV-R-1 and L2-SV-R-1 are from VOC migration from groundwater to indoor air. As Table 3 in the PP indicates, ICs alone is not protective of the overall protection of human health and the environment for areas identified with risk to groundwater.	EPA appreciates the opportunity to clarify the selected remedy for these areas. The selected remedy for AW-SV-R-1 and L2-SV-R-1 has been changed to Alternative 3 (ECs). ECs have been selected for these remedial areas to prevent potential migration of VOCs from contaminated groundwater to indoor air.
2.	L5-SV-R-3: This site is designated as residential. Please explain why Alternative 2 - ICs - would alone be protective or consider to revise this to another active remedy that has long term permanence. Risks at this residential area, L5-SV-R3, is from VOC migration from groundwater to indoor air. As Table 3 in the PP indicates, ICs alone is not protective of the overall protection of human health and the environment for areas identified with risk to groundwater.	The EPA appreciates the opportunity to clarify the selected remedy for this area. The selected remedy for L5-SV-R-3 has been changed to Alternative 3 – ECs. ECs have been selected for these remedial areas to prevent potential migration of VOCs from contaminated groundwater to indoor air.

Appendix E: Responsiveness Summary to OU-6 Proposed Plan Comments
Responses to Comments from DTSC, Carmichael Water District, CVRWQCB, Engineering & Water Resources, and Aerojet Rocketdyne

Comment #	Comment	Response
Commenter: Mr. Steve Ross, DTSC, comments dated June 10, 2013		
1.	Thank you for providing an opportunity to provide input to a draft version of the Plan. The Department of Toxic Substances Control (DTSC) concurs with the Unites States Environmental Protection Agency (EPA's) effort to proceed towards a remedy decision for the Boundary Operable Unit (BOU). The comments provided here are aimed towards those elements of the Plan that were revised and not made available for DTSC review and to provide information regarding State Applicable Relevant and/or Appropriate Standards (ARARs) under DTSC purview which were missing in BOU feasibility study, Appendix A. Also, elements of DTSC guidance documents may serve as To Be Considered (TBC) standards that prove useful as performance standards for EPA's development of the Record of Decision (ROD).	Comment noted.
2.	State ARAR: Institutional Controls (ICs) include the use of land use covenants (LUCs) as described in 22 CCR 67391.1(a)(b)(d)(g)(i) CA Civil Code Section 1471(a). CCR Title 22, section 67391.1 is an environmental covenant type regulation. The ROD needs to contain sufficient detail regarding the use of ICs. DTSC is unable to concur in a response action decision document (e.g. ROD) which includes limitations on land use or other ICs unless the limitations or controls are clearly set forth and defined in the decision document. The ROD should specify the limitations or controls that are to be incorporated into an appropriate LUC for the protection human health and the environment. LUCs are recorded in the county recorder's office and run with the land. This will allow the Agencies to ensure the long-term protectiveness of the land and help to establish a) the prohibited sensitive uses and b) the prohibited activities on the property subject to restrictions.	ARARs for OU-6 are included in the OU-6 ROD (Table 2-13).
3.	The Assessor Parcel Numbers (APNs) in the BOU are undefined in the feasibility study. If the information is provided in the ROD, it will assist the Agencies in defining which written legal descriptions may be useful and which will require surveys to define Remedial Action Area (RAA) boundaries subject to land use restrictions. From review of Sacramento County Assessor parcel viewer, APNs 072-0231-129-0000, 072-0231-128-0000, 072-0231-079-0000, 072-0231-125-0000, 072-0231-102-0000, 072-0231-081-0000, 072-0231-126-0000, 072-0231-116-0000, and 072-0231-134-0000 appear to overlay in whole or in part the RAAs in the BOU.	The APNs, as provided in the comment, are included in the OU-6 ROD, Section 2.6. Aerojet provided the following APNs for OU-6 as follows: • 072-0231-116 • 072-0231-119 • 072-0231-120 • 072-0231-128 • 072-0231-129 • 072-0231-134 The total acreage of OU-6 is 701 acres.

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Comment #	Comment	Response
4.	The lateral extent of the properties subject to land-use restrictions would be confirmed by a survey with written legal description. For vapor intrusion (VI) mitigation requirements, LUCs may include ICs with prescribed notifications, prohibitions, restrictions and requirements that must be utilized to ensure O&M and disclosure of the risks, restrictions, and requirements to future buyers and occupants. Provisions in the LUC may include 1) notice of the existing conditions known to the environmental agency that may cause potential unacceptable risk from VI; 2) prohibition against specific uses of the property; 3) prohibition against interference with the VI mitigation system; 4) prohibition against activities that will disturb impacted soil without DTSC approval; 5) right of access to the property for Agencies to inspect, monitor, and perform other activities relative to the VI mitigation system; 6) right of access to the property for the person responsible for implementing the O&M activities relative to the VI mitigation system; and 7) inspection and reporting requirements for the owner of the property.	Comment noted. Details regarding the LUCs, ICs, and ECs are included in the OU-6 ROD in Sections 2.10.2 and 2.10.3. Additional details will be set forth in the Remedial Design.
5.	TBC: Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling from property subject to a County recorded LUC restriction shall not be conducted without a plan approved by the appropriate lead agency. EPA should consider outlining the performance standards of this plan and activities which trigger its development. Possible elements to consider are 1) introduction, site background, purpose of plan, notification requirements, etc.; 2) identification of activities subject to this plan (e.g. soil excavation, soil removal, etc.); 3) description of soil excavation and management procedures; 4) procedures of sampling and analysis where excavated soil is to be relocated onsite or shipped offsite; and 5) preparation of a report and submittal within x days of the completion of the work to include description of excavation activities, deviations from plans, sample results, disposition of soil, photos, figures, field notes, copies signed manifests, copies of chain of custody forms, and copies of weight tickets, if applicable.	ARARs for OU-6 are included in the OU-6 ROD, Table 2-13.
6.	TBC: DTSC has issued the Vapor Intrusion Mitigation Advisory (VIMA or Advisory) for use on sites that may be impacted by soil vapor intrusion into indoor air. The mitigation alternative described in the Advisory are response actions designed to interrupt or monitor the vapor intrusion pathway and to ensure public safety until the source of volatile chemical concentrations causing the vapor intrusion risk has been restored to concentrations at or below levels considered safe for human exposure. The Advisory describes mitigation technologies such as subslab depressurization (SSD) or subslab venting (SSV) systems. EPA may want to consider elements from this Advisory as performance standards in the ROD.	ARARs for OU-6 are included in the OU-6 ROD, Table 2-13.

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Comment #	Comment	Response
7.	TBC: The Advisory identifies VI mitigation as a preemptive solution for a perceived rather than actual threat for a site where no building yet exists and fate and transport modeling indicates an acceptable risk (determined to be at or less than a 1 x 10-6 risk level or a hazard index (HI) of 1) to future building occupants. In such instances and as a prudent measure, a developer may choose to install VI mitigation measures despite the apparent low risk. However, for such preemptive applications, DTSC will neither approve nor enforce the preemptive mitigation application and will not be involved in the O&M for the VI mitigation system.	ARARs for OU-6 are included in the OU-6 ROD, Table 2-13.
8.	The proposal for RAA AE-R-1 through AE-R-6 is Containment/Operational Controls through Capping (Alternative 3) with planned commercial use. For Alternative 3 (Capping), engineering controls (ECs) and ICs will be necessary to prohibit unauthorized activities that would disturb the integrity of the cap remedial system and prohibit unauthorized activities that would bring contaminants to the surface.	Engineering controls and institutional controls are included as a component of the selected remedy [Alternative 3, incorporating Alternative 2 ICs (Capping)]. The ECs and ICs will prohibit unauthorized activities that would disturb the integrity of the cap remedial system and prohibit unauthorized activities that would bring contaminants to the surface.
9.	The proposal for RAA AW-R-14 is Containment/Operational Controls through Capping (Alternative 3) with a planned mixed use setting. As mixed use may include sensitive uses (e.g. residents), the ECs and ICs must be protective of the remedial system and sensitive groups.	The selected remedy for AW-R-14 has been changed from Alternative 3, Capping (as described in the OU-6 PP) to Alternative 4 (Source Removal/Reduction – Excavation) and is documented in Appendix B of the OU-6 ROD.
10.	Dredge Pit and Eastern Basin is planned for industrial use. For RAA DPEB-R-1, Containment/Operational Controls through Backfilling is proposed (Alternative 3). ICs on future land uses would be necessary for cleanup completed to these levels.	The institutional control component of the selected remedy [Alternative 3, incorporating Alternative 2 ICs (Backfilling)] will address future land uses for this site.
11.	The proposal for RAA AE-R-7 through AE-R-9 is Source Removal/Reduction through Excavation (Alternative 4) in a planned commercial use setting. The proposal for RAA CP2-R-1 through CP2-R-11 is Source Removal/Reduction through Excavation (Alternative 4) in a planned industrial use setting. For Alternative 4 where residual contamination is left in place that does not allow for unrestricted use, ICs would become necessary on future land uses for cleanup to these levels.	Institutional controls that restrict land uses in areas where contamination remains in place are a component of the selected remedy.
12.	The proposal for RAA AW-R-1 through AW-R-13, AW-R-15, and L2-R-1 through L2-R-8 is Source Removal/Reduction through Excavation (Alternative 4) in a planned mixed use setting. As mixed use may include sensitive uses (e.g. residents), the ICs must be protective of these sensitive groups.	Institutional controls that restrict land uses in areas where contamination remains in place are a component of the selected remedy (Alternative 4).

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Comment #	Comment	Response
13.	The proposal for RAA L2-SV-R-2 and L2-SV-R-3 is Source Removal/Reduction through SVE (Alternative 4) in a planned mixed use setting. For Alternative 4 (SVE) where residual contamination is left in place that does not allow for unrestricted use, ECs and ICs will be necessary 1) to prohibit unauthorized development and 2) prohibit unauthorized activities that would disturb the integrity of the SVE remediation and monitoring system and 3) prohibit unauthorized activities that would bring contaminated soil the surface. As mixed use may include sensitive uses (e.g. residents), the ECs and ICs must be protective of these sensitive groups.	The ECs and ICs component of the Alternative 4 remedy will prohibit unauthorized development, unauthorized activities that would disturb the integrity of the SVE remediation and monitoring system, and unauthorized activities that would bring contaminated soil the surface. In addition, the ECs and ICs will protective of sensitive groups (e.g., residents).
14.	Line 5 North is planned for residential use. The proposed excavations for L5-R-1 through L5-R-4 would need to meet standards for residential use.	Agreed.
15.	The proposal for RAA AE-SV-R-2, AE-SV-R-4 through AE-SV-R-8, is Source Removal/Reduction through SVE (Alternative 4) in a planned commercial use setting. The proposal for RAA CP2-SV-R-1 through CP2-SV-R-5 is Source Removal/Reduction through SVE (Alternative 4) in a planned industrial use setting. For Alternative 4 (SVE) where residual contamination is left in place that does not allow for unrestricted use, ECs and ICs will be necessary.	Agreed. The selected remedy (Alternative 4) includes an EC and IC component.
16.	The proposal for RAA L5-SV-R-1 and L5-SV-R-2 is Source Removal/Reduction through SVE (Alternative 4) in a planned residential use setting. Where residual contamination is left in place that does not allow for unrestricted use, ECs and ICs will be necessary 1) to prohibit unauthorized development and 2) prohibit unauthorized activities that would disturb the integrity of the SVE remediation and monitoring system and 3) prohibit unauthorized activities that would bring contaminated soil to the surface.	The EC and IC component of the Selected Remedy (Alternative 4) will address the issue of contamination remaining in place.
17.	RAA AE-SV-R-1 is relatively close to AE-SV-R-2 and may be indistinguishable given the similar VOCs in this area (e.g. vinyl chloride). Source Removal/Reduction (SVE) similar to AE-SV-R-2 appears warranted for this area.	Agreed. These two areas are now combined and the contamination will be addressed under AE-SV-R-1/R-2.
18.	The proposal for RAA AE-SV-R-3, AW-SV-R-1, L2-SV-R-1, MA-SV-R-1, DPEB SV-R-1, and CP2-SV-R-6 is ICs due to modeled VOC migration from groundwater attributing to possible risk to human health in indoor air in a residential setting. To ensure the long-term protectiveness, specific limitations or controls would need to be in place before allowing sensitive uses.	Agreed.

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Comment #	Comment	Response
19.	RAA L5-SV-R-3 is planned for residential use. ICs are proposed due to modeled VOC migration from groundwater attributing to possible risk to human health in indoor air in a residential setting. To ensure the long-term protectiveness, specific limitations or controls would need to be in place before allowing sensitive uses.	Agreed.
20.	RAA L5-R-2, L5-R-3, L5-R-4, L5-SV-R-1, and L5-SV-R-2 are identified as threats to groundwater. ICs for residual contaminants which pose a continuing threat to groundwater would become necessary.	Agreed. After the remedial action, if contamination remains in place that continues to pose a threat to groundwater, ICs will be required.
21.	Buffalo Creek and West Lakes are planned for open space or drainage. For excavation where residual contamination is left in place that does not allow unrestricted use, ICs would become necessary.	Agreed. After the remedial action, if contamination remains in place that does not allow for unrestricted use, ICs will be required.
22.	There are no vapor cleanup levels in Table 2b as the clean-up is designed to meet ambient air levels. There is a footnote about protective soil vapor levels in subsurface being decreased by location and depth specific attenuation factors. If the purpose is to reduce the level of contamination in subsurface that is acting as a source of potential indoor air vapors, response action based goals should be considered or a mechanism defined to reach these values. It is unclear how the ROD will establish specific soil vapor values as performance stands in this media for deciding when to run a soil vapor extraction system off or to gauge success.	The cleanup levels selected in the ROD are to attain these specified protective levels in indoor air. Cleanup levels for SVE in soil will be depth- and site-specific, and the method for calculating these levels will follow DTSC guidance in the remedial design and remedial work plans. This approach is consistent with the method currently being implemented in OU-5 at the Site.
23.	For the RAAs that propose ICs (Alternative 2) only, limitations or controls as performance standards are not clear. For the ROD, consider performance standards that 1) describe the mitigation technology most likely to be chosen (subslab depressurization (SSD) or subslab venting (SSV) systems); 2) provide general guidance and design detail for installation of SSD and SSV systems and other mitigation technologies; 3) provide guidance for establishing operation and maintenance (O&M) requirements for VI mitigation technologies; and 4) provide guidance for implementation measures.	The ROD clarifies that ICs must prevent exposure and/or maintain the integrity of remedial systems. Specific technologies will be set forth in the Remedial Design for OU-6.
24.	The Aerojet RCRA units in the BOU are unclear in the Plan. Consider consolidating the RCRA units that are closed and those that are operating and those that have been deferred to CERCLA for the BOU. For instance, the deep underground injection wells are subject to post closure permit requirements.	There are ten RCRA units located within OU-6. All ten units have been closed under the RCRA program, and none of them have been deferred to CERCLA.
25.	For lead, OEHHA has replaced the 10 µg/dL "level of concern" with a source-specific "benchmark change" of 1 µg/dL.	The OU-6 ROD presents the updated level of concern for lead of 80 mg/kg for unrestricted and 320 mg/kg for industrial/commercial use.

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Comment #	Comment	Response
26.	The mercury industrial soil RSL is 43 mg/kg instead of 180 mg/kg value provided in Table 2a of the PP.	The cleanup levels have been updated and corrected and were re-issued as part of the OU-6 PP Extension notice (dated June 2013). The mercury cleanup level was further corrected to 40 mg/kg (2015 RSL value).
27.	The trichloroethylene residential soil RSL is 0.91 mg/kg.	TCE in soil within OU-6 does not pose a risk to human health, only ecological receptors. Therefore, a cleanup level for the protection of human health is not required.
28.	The trichloroethylene industrial soil RSL is 6.4 mg/kg.	TCE in soil within OU-6 does not pose a risk to human health, only ecological receptors. Therefore, a cleanup level for the protection of human health is not required.
29.	Pentachlorophenol human health soil values for residential and industrial are not included in Table 2a. This COC is present at Chemical Plant 2.	While pentachlorophenol may be present in soils at Chemical Plant 2, the concentrations identified do not pose a risk to human health, ecological receptors, or groundwater. Therefore, it was not identified as a COC and does not require a cleanup level.
30.	1,1,1-Trichloroethene should be 1,1,1-Trichloroethane.	The correction was made in the OU-6 ROD.
31.	Naphthalene soil cleanup level for protection of human health is not included in Table 2a.	The soil cleanup level for naphthalene for the protection of groundwater will be added to the cleanup level table to be included in the OU-6 ROD (naphthalene in soil does not pose a risk to human health, only to groundwater). See Table 2-2 in the OU-6 ROD.
32.	Freon 113 ambient level is not included in Table 2b.	Cleanup levels for VOCs in ambient air were only provided for VOCs that posed a risk. These VOCs include: • 1,1-DCE • 1,2-DCA • Benzene • Chloroform • cis-1,2-DCE • PCE • TCE • Toluene • Vinyl chloride The cleanup levels for these VOCs are presented on Table 2-3 in the OU-6 ROD.
33.	1,1-Dichloroethene ambient level in included in Table 2b.	See the response to comment #32.
34.	Trans-1,2-dichloroethene ambient level is not included in Table 2b.	See the response to comment #32.

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Comment #	Comment	Response
35.	Hexane ambient level is not included in Table 2b.	See the response to comment #32
36.	Carbon tetrachloride is ambient level is not included in Table 2b.	See the response to comment #32
37.	1,3-Butadiene ambient level is not included in Table 2b.	See the response to comment #32
38.	1,2,4-Trimethylbenzene ambient level is not included in Table 2b.	See the response to comment #32
39.	Tetrahydrofuran ambient level is not included in Table 2b.	See the response to comment #32
40.	State ARAR: California Health & Safety Code, Div. 20, Chapter 6.5, Sec 25100 et seq.; Statutes governing hazardous waste control, management and control of hazardous waste facilities, transportation, laboratories, classification of extremely hazardous, hazardous and non-hazardous waste; applicable hazardous waste standards.	ARARs for OU-6 are included in the OU-6 ROD.
41.	State ARAR: California Health & Safety Code, Div. 20, Chapter 6.8, Sec 25300 et seq.; California "Superfund" Law, Hazardous Substance Account Act/Hazardous Substances Cleanup Bond Act. Certain portions may be relevant or appropriate or TBC standards for assessing the completeness of response actions where hazardous substances remain which does not allow for unrestricted use.	ARARs for OU-6 are included in the OU-6 ROD.
42.	State ARAR: *California Code of Regulations* (CCR), Title 22, Division 4.5, Chapter 33; Sections 67384.1-67384.11; Perchlorate Best Management Practices; establishes the best management practices for perchlorate materials as described in section 67384.2. (see original comments for link to document)	ARARs for OU-6 are included in the OU-6 ROD.
43.	State ARAR: The California legislature passed Assembly Bill 422 (AB 422) in October 2007, amending Section 25356.1.5 of the California Health and Safety Code, and adding Section 13304.2 to the Water Code. AB 422 requires that the exposure assessment of any health or ecological risk assessment prepared in conjunction with a response action taken or approved pursuant to eh California Superfund Act include the development of reasonable maximum estimates of exposure to volatile chemicals that may enter structures that are on the site, or that are proposed to be constructed on the site, and may cause exposure due to the accumulation of volatile chemical in the indoor air of these structures.	ARARs for OU-6 are included in the OU-6 ROD.

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Comment #	Comment	Response
Commenter: Mr. Steve Nugent, Carmichael Water District, comments dated June 5, 2013		
1.	The Proposed Plan does not address groundwater cleanup goals for existing contaminated groundwater in OU6. Table 2 provides cleanup levels for soil and ambient air, but not for groundwater. Although groundwater cleanup is identified as part of the larger Aerojet sitewide cleanup; groundwater cleanup and treatment goals should be restated here, and the goals need to consider the regulatory authority of the California Department of Public Health with regard to beneficial use and permitting as a drinking water supply. This includes the consideration of clean up levels to below the Maximum Contaminant Levels.	The contaminated groundwater beneath the Aerojet Superfund Site, including groundwater beneath OU-6, is being addressed as part of the ongoing interim and final remedial actions to provide hydraulic containment and remediation of the contamination associated with releases from Aerojet. As described in the proposed plan, groundwater remediation is being conducted on an Aerojet sitewide basis. These final and interim remedies for the groundwater are managed under the OU-3 ROD (EPA, 2001) and OU-5 Interim ROD for Groundwater (EPA, 2011). The final groundwater remedy with aquifer restoration goals, will be documented in the sitewide ROD (OU-1 ROD). The OU-3 and OU-5 RODs include more details on the ongoing remedial actions for groundwater. Evaluations that consider the actual performance of the remedy and incorporate water level monitoring that considers other uses of groundwater in the area. EPA will continue these evaluations as required. It is not expected that remediation of groundwater sources within OU-6 will impact groundwater levels outside of OU-6.
2.	The Proposed Plan needs to state that groundwater contamination exists at levels exceeding the regulated Maximum Contaminant Levels for several contaminants of concern for groundwater below the OU6 areas and there is no foreseeable beneficial use scenarios for groundwater present within OU6 that involve direct domestic use as defined in Policy Memo 9-005 — Policy Guidance for Direct Domestic Use of Extremely Impaired Sources.	The Proposed Plan and ROD are intended to show those areas requiring remedial action within OU-6. However, there are plumes exceeding drinking water standards that extend beyond OU-6. These are shown on a composite plume map **Figure 2-13** with detailed maps in **Appendix A** in the ROD.
3.	The Human Health and Ecological Risk Assessment, Volume 2, Boundary QU RI/FS (Aerojet 2012) considered that if the "...risk of contaminating groundwater was considered moderate, than the area may have been recommended for cleanup depending on the compound mobility and solubility, and depth and extent of contamination." Priority of reduction of groundwater contaminant source areas such as Chemical Plant 2 Area and the Dredge Pit and Eastern Basin areas needs to be given a high priority to protect from increasing contaminant levels in the groundwater moving offsite. The District therefore supports Alternative 4 Source Removal/Reduction as the preferred alternative.	Comment noted. The Selected Remedy does include Source Reduction/Removal in the Chemical Plant 2 area. Capping was selected as the remedy for the Dredge Ponds/Eastern Basin, because the identified risk was to direct contact and not to groundwater.
Commenter: Mr. Alex MacDonald, CVRWQCB (comments dated May 3, 2013)		
1.	Page 2, Column 2, Site Background, first paragraph. Aerojet acquired the Rancho Cordova site in December 1950. Aerojet received waste discharge requirements in May 1952.	This correction was made in Section 2.3 of the ROD.

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2.	Page 3, Table 1, Source Area AE-R-2. The soil vapor contamination beneath this source area should be removed with SVE. The area requiring remediation extends along nearly the entire corridor between Buildings 20002 and 20004 and can include areas beneath those two buildings. This would extend from AE-SV-R-8 to near AE-SV-R-5 and encompass AE-SV-R-7. One of the problems was that the figures used to delineate the source areas do a very poor job of showing the extent of contamination that is being addressed. See comment below on the Figures XXX.	The soil vapor contamination at AE-R-2 will be captured by the SVE remedy associated with AE-SV-R-7/R-8. The excavation remedy is still needed at AE-R-2 to address the soil contamination (iron and Aroclor-1254 are the soil COCs associated with AE-R-2). The extent of the soil vapor contamination will be defined during the remedial design, and will include the soil vapor contamination identified at AE-R-2. The 1,1,2,2,-PCA contamination identified as a COC for AE-R-2 has been added as a COC for AE-SV-R-7 to ensure that this contamination is also addressed in this area.
3.	Pages 7, 8 and 9. The reader should be informed that the delineation of the source areas likely does not represent the extent of contamination at each location that is part of the remedy due to the extent needs further delineation in many cases. In addition, the interpolation program that was used does not do a very good job of interpolation of the contaminant concentrations.	The ROD text has been clarified to explain that the RAAs presented on the figures do not represent the actual extents of contamination and that further delineation in most areas is needed as part of the Remedial Design and the Remedial Action for OU-6.
4.	Page 10, second column, second sentence. The proposed remedy will not prevent COCs from migrating to groundwater. What is being done is removing COCs from the vadose zone to allow return of the groundwater to meet beneficial uses. COCs will migrate to groundwater but at concentrations that would cause impairment of beneficial uses.	Comment noted. The selected remedy is to prevent COCs from continuing to groundwater at concentrations that would impair beneficial uses.
5.	Page 10, second column, third paragraph. Sediments were also evaluated for potential adverse impacts on human health.	The text in the ROD has been clarified, in Section 2.7, that sediments were also evaluated for potential adverse impacts on human health.
6.	Page 11, Table 2a. The protection of groundwater value for hexavalent chromium should be 0.2 mg/L using the DLM and the PHG of 0.02 µg/L, while allowing for a 1000 fold attenuation factor. I do not know how the value presented in the table was obtained.	The cleanup levels have been updated and corrected and were re-issued as part of the OU 6 PP Extension notice (dated June 2013). The cleanup level for hexavalent chromium for the protection of groundwater has been corrected to 0.2 mg/kg. See Table 2-2 in the ROD.
7.	Page 12, Table 2a. The value for perchlorate for protection of groundwater should be 0.06 mg/kg.	The cleanup levels have been updated and corrected and were re-issued as part of the OU 6 PP Extension notice (dated June 2013). The cleanup level for perchlorate for the protection of groundwater is 0.06 mg/kg. See Table 2-2 in the ROD.
8.	Pages 11-12, Table 2a. It is not clear how many of the values in the fourth column for metals were derived for protection of groundwater. The fifth column provides the source and there are instances where the reference is "background threshold value." If one looks at the background values for those metals as established in 2006 by Aerojet, the values are significantly different. Many are off by a factor of ten. In addition, the maximum concentration of cadmium in background soils is 0.2 mg/kg, so it is difficult to find where the 7 (of 0.7) mg/kg value was from.	The cleanup levels have been updated and corrected and were re-issued as part of the OU 6 PP Extension notice (dated June 2013). See Table 2-2 in the ROD.

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9.	Page 13, Table 2-b. Sufficient information has not been provided to reader on how these values will be used. The values are for the protection of human health from the listed VOCs in ambient air. Location specific values will be used to determine site specific values that will not cause ambient air (indoors and outdoors) to contain concentrations of the listed VOCs to exceed the values listed in the table. In addition, is it correct to state that protective soil vapor levels in the subsurface soil are decreased by location and depth specific attenuation factors? From what concentration will they be decreased from? Are trying to say that in applying the values in the table site-specific attenuation factors will be used to establish cleanup values in the subsurface and in doing so the subsurface cleanup values will be greater than those shown in the table?	The commenter is correct that the proposed cleanup levels represent target indoor air concentrations. The cleanup levels selected in the ROD (Table 2-3) are to attain these specified protective levels in indoor air. Cleanup levels for SVE in soil will be depth- and site-specific, and the method for calculating these levels will follow DTSC guidance in the remedial design and remedial work plans. This approach is consistent with the method currently being implemented in OU-5 at the Site.
10.	Page 13, second column, first bullet. The text in this bullet causes us to ask the question — Under what circumstances would a site meeting the criteria not be recommended for cleanup evaluation?	The non-retained areas that presented an unacceptable risk to HH, ecological receptors, or groundwater are captured under the remedy for the overlapping retained area. For example, the COCs for AW-N-11 posed a risk to groundwater but this area overlaps with AW-R-7/R-14. Therefore, the COCs that pose a risk to groundwater at AW-N-11 were included in the COC list for the protection of groundwater at AW-R-7/R-14. Only the non-retained identification number of AW-N-11 was not carried through to the PP and ROD, but the contamination and risks associated with that non-retained area will be addressed. In non-retained areas where it was agreed that the area did not pose a risk to HH, ecological receptors, or groundwater, these areas and any areas within Aerojet that overly groundwater contamination are required to have groundwater ICs. These groundwater ICs are described in Section 2.10 of this ROD and are expected to be included as part of the sitewide OU-1 ROD. There are no areas within OU-6 that are considered "No Action" areas. Either Alternatives 2, 3, or 4 were selected for an area, or the area will be covered by the sitewide ICs.
11.	Page 14, first column, second bullet. What is meant by increasing concentrations? Increasing with time, with depth, with distance….?	The text should have stated, "increasing with depth."

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12.	Page 14, Remedial Action Objectives. How will achievement of these Remedial Action Objectives be determined? The objectives should be improved by applying SMART criteria (ITRC, Integrated DNAPL Site Strategy, November 2011) to them. The goal of applying the SMART criteria is to make the Remedial Action Objectives specific, measureable, attainable, relevant and time-bound. In so doing, it is clear if/when the objective has been complied with. Taking the first Remedial Action Objective as an example, it was initially written in the Proposed Plan as "Prevent exposure to COCs in soils that pose an unacceptable risk for present and future workers and residents on the property and ecological receptors on the property. This Remedial Action Objective lacks several of the SMART criteria. Rewording the objective to: Prevent the exposure of present and future workers and residents of the property to concentrations of contaminants in the upper ten feet of soil exceeding those values found in Table 2a at the Source Areas listed in Table 1. This will be done by excavating the soils or capping and land use controls to prevent exposure. This meets all of the SMART criteria except time-bound. As there is no timeframe established at this time, that criteria can be added later. A similar objective would be established for ecological receptors and contaminants in soil.	Remedial action objectives are specified in the ROD in Section 2.9. These performance standards are also included in the ROD, and will be evaluated during the completion report for the individual remedial action areas.
Commenter: Mr. Bill Busath, Engineering & Water Resources Manager, City of Sacramento (comments dated September 17, 2013)		
1.	American River Cumulative Risk: EPA has previously indicated that there will be a sitewide assessment completed once each Operable Unit has been individually assessed, which will include an analysis of impacts to the America River. This will evaluate the impacts of the various groundwater treatment discharges, in addition to stormwater, seep flows, and perched groundwater from the Aerojet site. Cumulative impacts on the American River are already occurring from both the Western Groundwater and Perimeter Groundwater remedies. If any remedy implementation from the BOU results in additional impacts to the American River then it needs to be included in the cumulative analysis.	EPA will conduct a sitewide evaluation of the Aerojet site as part of the final, sitewide Operable Unit 1. This evaluation will include human health and ecological risk. The OU-6 ROD addresses risk to human and ecological receptors from contaminated soils within the boundaries of OU-6. The OU-6 ROD also evaluates soil sources for their potential to impact groundwater and, where necessary, selects remedial actions to reduce migration of contaminants to groundwater.
2.	American River Cumulative Risk: The City recommends incorporating minimum river flows when determining suitability of increased discharges. We also recommend that EPA evaluate surface water discharges and suitable river conditions using quantifiable conditions such as river flow, precipitation, reservoir releases, and other operational and hydrologic information rather than a general approach assuming flows are higher during winter months, which is not always the case on the American River.	No new discharges to the American River are proposed as part of the Selected Alternative for OU-6. Treated groundwater is discharged as part of the remedial action for the Western Groundwater (OU-3) and Perimeter Groundwater (OU-5) OUs under permits issued by the Regional Water Quality Control Board.

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3.	American River Cumulative Risk: There continue to be areas of groundwater contamination or surface runoff that are not well characterized for water quality. Well development water and surface runoff from the Aerojet site should be monitored appropriately to characterize its risk and not automatically classified as a "low-threat" discharge under the Aerojet National Pollutant Discharge Elimination System (NPDES) permit for the Groundwater Extraction and Treatment facilities (GETs) and low threat discharges. Based on pages 6-7 of the Proposed Plan, it appears that there is significant potential exposure of constituents of concern to runoff. The City recommends that these flows be managed so as to not result in contamination of storm water and non-storm water discharges.	GET effluent and industrial storm water from the Aerojet facilities are subject to NPDES permit requirements under RWQCB **Order No. R5-2013-0156**. The requirements are ARARs for the Selected Remedy.
4.	Exposure Pathways: The Plan and its supporting documents (Remedial Investigation, Human Health Risk Assessment, and Feasibility Study) have identified recreational use as the only exposure pathway from the surface water on the Aerojet site, and all assessments were conducted based on that pathway. Many of the surface waters on the Aerojet site are tributary to the American River which has a significantly broader list of beneficial uses, including municipal and domestic use. The risk assessment did not evaluate potential downstream, offsite impacts to municipal and other uses of the American River. We are concerned that our offsite municipal use has not been considered as part of the BOU risk assessment and identification of remedy options.	Discharges of treated groundwater effluent from the Aerojet site are regulated under Waste Discharge Requirements and an NPDES permit issued by the RWQCB **Order No. R5-2013-0156**. Table 4 of this permit identifies Basin Plan Beneficial Uses applicable to Buffalo Creek and Alder Creek, and the permit requirements are protective of these beneficial uses.
5.	Exposure Pathways: In addition, the recreational exposure pathway was not quantitatively addressed since the projected activity was seasonal wading. This minimized the potential impacts identified to risks for surface water exposure in the BOU, including the final list of constituents of concern (COCs), and may underestimate the impacts of surface water and proposed remedy options.	Surface water screening levels were developed in the OU-6 RI Section 3.1.4. The selected SWSL for each compound was the lowest of the following: • The tapwater PRG (EPA, 2004); • The federal maximum contaminant level (MCL); • The California MCL; or • Dissolved concentration limits cited in the *Revised Waste Discharge Requirements for Aerojet General Corporation and Aerojet Fine Chemicals* (NPDES Permit No. CA0004111) (RWQCB Order No. R5-1999-0016- R01, revised 2002). These SWSLs included exposure pathways beyond seasonal wading.
6.	Exposure Pathways: Finally, the assessments for the Buffalo Creek and West Lakes action areas only addressed soil and sediment media impacts, not the potential surface water impacts. This seems to be a significant exclusion since the surface water has great potential to be impacted by contact with the soils in the waterbodies as well as the runoff flows from the site. Since these waterbodies are tributaries to the American River, we are concerned about their lack of inclusion for exposure pathways.	RWQCB **Order No. R5-2013-0156** includes provisions for monitoring water quality in Buffalo Creek and the West Lakes area to ensure protection of beneficial uses of the receiving water.

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7.	Selected Remedies: The Plan includes various remedies, one being soil flushing. This remedy was selected for three areas in the Line 2 Region. The Feasibility Study indicates that the soil flushing remedy would target deeper contamination areas that have the potential to impact groundwater and cannot be easily remediated from the surface. The Feasibility Study indicates that this process involves flushing water to extract constituents which is then recover from the aquifer and treated at a GET facility. Based on the Proposed Plan and the supporting documents the treated water is expected to be recharged to groundwater locally. However, if this treated water is discharged to surface water we request that a monitoring program be implemented to identify the constituents of potential concern (COPCs) and ensure that adequate treatment is in place to remove any compounds potentially impacting the American River municipal and domestic beneficial use. The COPCs could include constituents included in the supporting documents for the Proposed Plan, as well as newly identified constituents of interest for drinking water.	In the event that extracted or treated groundwater is discharged to surface water, a monitoring program that complies with the substantive requirements of NPDES will be implemented.
8.	Constituents of Concern: The EPA's stated primary objective for this Proposed Plan is "to protect public health and the environment from contaminants found in soils and soil gas from sources within the BOU". We agree that this is the intent of the remedy, but if drinking water Maximum Contaminant Levels (MCLs) are the basis for cleanup levels, then the remedy is actually only meeting acceptable levels of risk in drinking water as defined by EPA. Whenever feasible it is preferred to further reduce the risk to public health, so we support the use of California Public Health Goals (PHGs) and EPA Maximum Contaminant Level Goals (MCLGs) where appropriate for the Superfund cleanup.	Comment noted.
9.	Exposure Pathways: The Remedial Investigation identified COPCs for human health. Seventy-five constituents were excluded from the investigation because they were non-detectable, but they had reporting limits higher than the human health screening levels. We are concerned that these constituents may be present in the waters at levels of concern, and we recommend that they should be monitored in the future as part of the remedy implementation. Moreover, due to the long length of time for the cleanup it is important that requirements are kept up-to-date with the latest drinking water standards, analytical detection limits, and new information on contaminants.	The Selected Remedy will be subject to a review process every five years in accordance with CERCLA that includes a review of site monitoring data and evaluates whether the Selected Remedy remains protective.

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10.	Monitoring and Reporting: The City acknowledges the helpfulness and information provided by Aerojet staff over the past years in providing notification of NPDES permit exceedances for the GETs. The Proposed Plan should require continued notification procedures to contact downstream water purveyors of permit exceedances, monitoring results that exceed MCLs, detects found in the American River, or any significant problems or failures with the discharge or remediation activities. The notification needs to occur in a timely manner to allow water utilities the ability to respond to changes in source water quality to protect public health. The discharge also should be suspended immediately if potential significant issues arise, until the risk is removed. This is essential to ensure protection of public health.	The NPDES discharge requirements applicable to the GETs are not affected by the ROD and are not changed by the OU-6 selected remedy.
11.	Monitoring and Reporting: Detection limits, methods, constituents or other factors should be reviewed to ensure that collected data provides appropriate information to assess impacts to human health. These parameters should be adjusted to keep current with future water quality standards and guidelines and available laboratory technology. The monitoring program should include an expanded list of all COPCs, including those removed for nondetectability if analytical methods can provide data at lower levels, on a reasonable frequency to ensure that if present at levels of concern additional chemicals of concern are identified and addressed as part of the current remedy.	OU-6 (and the entire Aerojet Site) will be subject to a Five Year Review that will periodically evaluate the protectiveness of the selected remedy. This evaluation will include an assessment of changes in standards that could affect short- or long-term protectiveness and recommend necessary actions.
12.	Monitoring and Reporting: The implementation of the remedy should include ongoing monitoring, inspections, evaluation of site conditions, including the physical equipment utilized for the cleanup to ensure that it is functioning correctly, and safety assurances such as alarms and backup power.	Ongoing monitoring and inspection of physical components of the remedy is required as part of the Selected Remedy.
Commenter: Mr. Peter Kvam, Project Coordinator, Aerojet Rocketdyne (comments dated September 20, 2013)		
General Comment	It is unclear why the Line 2 and Line 5 actions were proposed for excavation rather than no action or capping to the extent of protection of groundwater. We note that it is possible that the agency may have considered the potential that the areas might be subject to development in the future which might make capping a less feasible alternative. The description of the "planned use" in the proposed plan was based upon preliminary land use planning that has not undergone local agency review or final land use planning. Accordingly, future land use may not involve "mixed use" or "residential" use in the locations but may involve roadways or open space which can more easily accommodate capping or require no action. Accordingly, the remedy selected for these areas should not assume a particular use, but provide for institutional controls that establish the action (e.g., excavation or capping, or no further action) when the property is being developed.	EPA is required by policy to consider the Reasonably Anticipated Future Land Use in remedy selection. This assessment was conducted in part using information from the OU-5 and OU-6 Reuse Assessment (2010) that indicates the Line 2 and Line 5 North areas are located in areas proposed for future residential and mixed-use development as part of the Westborough Phase 2 development. Given the uncertainties associated with the location of specific features of future development such as roadways and other infrastructure, EPA is selecting the excavation alternative to remove the contamination and eliminate the need for long-term tracking and management of these areas used engineering and/or institutional controls.

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1.	Administration Area East – AE-SV-R-4 and AE-SV-R-5: Table 1 identifies the selected remedy for AE-SV-R-4 and AE-SV-R-5 as Alternative 4 – Source Removal/Reduction (SVE). AE-SV-R-4 – PCE was detected in soil vapor at location A20-RC29-SP01 at concentrations that indicate a potential high risk to groundwater; however, PCE is not present in groundwater beneath this area at concentrations that exceed beneficial uses. This area is currently capped with an asphalt parking lot (except for the north-south trending drainage ditch). Any release in this area is estimated to have occurred over 30 years ago. Therefore, although PCE is present in soil vapor, PCE is not migrating to groundwater under current conditions (capped). Alternative 3, (institutional controls and capping) is appropriate for this area and should be proposed to protect groundwater from becoming impacted by PCE in soil vapor. AE-SV-R-5 – The remedial action proposed appears to be based upon the detection of two chemicals [tetrachloroethene (PCE) and trichloroethene (TCE)] in soil vapor. However, soil vapor samples were collected from three depths at this location. Concentrations of both compounds decreased with depth. The concentrations of both compounds detected in the deepest soil vapor samples (30 feet bgs) did not pose a risk to groundwater. In addition, neither TCE nor PCE were detected in groundwater at concentrations indicating an impact to groundwater from the release of TCE or PCE from this location. This data suggests that as long as the areas remains capped, the chemicals in soil vapor are not likely to migrate vertically and impact groundwater. While the incremental lifetime cancer risk to commercial/industrial workers was calculated, it was less than 1 x 10-4 (maximum 2x10-5) and the building is only used for storage of supplies and is not occupied continuously. Accordingly, this is a location where the evaluation of risk clearly supports Alternative 3 (capping and institutional controls).	The preferred alternative is mass removal using SVE. This method is preferred for VOCs because it eliminates the source to groundwater. FS Table 1-14 summarizes results of the risk assessment for these locations. Both indicate a potential risk to groundwater based on soil vapor sampling results and groundwater contours. The table in Appendix B of the ROD summarizes the risk and rationale for remedial action in these areas. The distance between the R-4 and R-5 sampling locations does not allow discernment of whether these sources are contiguous. Pre-design sampling as part of the remedial design will be used to determine the specific extent of SVE in this area. Additionally, the 2×10^{-5} risk to HH for commercial/industrial warranted an evaluation of remedial alternatives at this location, and the selected remedy would use SVE to permanently remove VOCs to reduce risk to future site occupants. In addition, the extent of contamination is not fully defined at this time. The current use of a storage/supply building cannot be guaranteed as part of a capping remedy.
2.	Line 2: L2-R-4, L2-R-5, and L2-R-9 Table 1 identifies the selected remedy for L2-R-4, L2-R-5, and L2-R-9 as Alternative 4 – Source Removal/Reduction (Excavation with Flushing and Air Stripping). It is not clear what EPA is proposing in the PP. Soil flushing for perchlorate, with down-gradient groundwater extraction with treatment for perchlorate and VOCs is an appropriate remedy. It appears, however, that the remedy being proposed may require excavation (not clear whether excavation occurs before or after flushing of the soil column) in the same locations as the soil flushing. There is no basis for requiring excavation down to 12 feet bgs before the soil flushing. Soil flushing, if a viable remedy for soils deeper than 12 feet, should also be a viable remedy for soils from the surface to 12 feet bgs. Perhaps, EPA	The extent of contamination for soil and soil vapor has not been defined in these areas and the soil retained areas (R-4, R-5, and R-9) are all in close proximity to one another – less than 100 feet apart. L2-SV-R-2 completely overlies all three soil areas. The commenter is correct that EPA intends to use a combination of methods to meet remedial goals in these areas. The specific approach and sequencing will be set forth in the remedial design, but it is anticipated excavation would be used to the extent necessary to allow for effective implementation of the soil flushing method. Remediation of VOCs from soil gas would be accomplished using SVE until remedial goals are met.

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	anticipated that there would be some excavation (e.g., first 2 feet bgs) to create a berm so as to allow ponding of water for soil flushing. The extent of such excavation for flushing would be based upon site specifics and would be specifically described in the remedial design. However, there would be no basis for excavation to 12 feet below ground surface for the protection of groundwater, when the intent is to flush the chemical to groundwater. Requiring excavation, when unnecessary, does not simply add a monetary cost. For example, using EPA's carbon footprint calculator, excavation to 12 feet bgs over a 0.25 acre area (roughly the size of L2-R-4, L2-R-5, and L2-R-9) results in over 180 tons of CO2 into the environment (the equivalent of the average annual CO2 emissions from over 15 homes) (http://www.epa.gov/cpd/pdf/brochure.pdf). The proposed passive remedy with minimum excavation would result in less than 10% of the tons of CO2 into the environment. AR recommends allowing the flexibility to evaluate flushing for perchlorate, with downgradient groundwater extraction with treatment for perchlorate and VOCs prior to making a decision whether to excavate or cap thereafter. The decision to excavate or cap would be based upon the success of soil flushing in reducing the perchlorate concentration to a concentration that poses an acceptable risk to human health and the environment.	
3.	Line 5N – L5-R-3 and L5-R-4 Table 1 identifies the selected remedy for L5-R-3 and L5-R-4 as Alternative 4 – Source Removal/Reduction (Excavation). It further identifies the risk driver as threat to groundwater. The remedy is not appropriate for the following reasons. L5-R-3 is represented by one sample location (52E-SB05). Soil samples were collected from depths of 1.0 foot, 5.5 feet, and 11 feet bgs from this location. The 1.0 foot bgs samples contained 260 µg/Kg perchlorate, which is above the protection of groundwater screening level of 60 µg/Kg; however, concentrations decrease with depth. The 5.5 foot bgs soil sample contained 56 µg/Kg, which is below the protection of groundwater screening level and the 11 foot bgs samples did not contain perchlorate above the detection limit (5.3 µg/Kg). Therefore, perchlorate is not migrating vertically toward groundwater and is not posing a risk to groundwater. Please also see our introductory note on land use and remedy selection. Because the area is within an area that is ultimately planned for development that could include new uses and activities, the remedy here should be institutional controls to establish evaluations/actions to be taken should such development occur.	The planned future use for this area includes mixed use and residential use. The community has expressed a great deal of concern during the public comment period on the PP regarding removal of perchlorate in shallow soils in areas that may be used for residential reuse. In light of this concern, and the presence of COCs above cleanup goals, this area is selected for excavation to permanently remove these COCs. Institutional controls are not appropriate for this area given the accessibility of the contaminated soils and redevelopment plans.

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4.	Line 5N – L5-SV-R-1 and L5-SV-R-2 Table 1 identified the selected remedy for L5-SV-R-1 and L5-SV-R-2 as Alternative 4 – Source Removal/Reduction (SVE). It further identifies that risk driver as threat to groundwater. Each of these locations is represented by a single sample location 52E-SP07 and 51E-SP11, respectively. Each of these locations exceeds the protection of groundwater screening level by a factor between 10x and 100x. However, the concentration of VOCs in groundwater is low (maximum concentration is 13 µg/L) and there are 10 locations surrounding these two samples. None of the samples (total of 15 samples) collected from these 12 locations contained VOCs above the groundwater screening level. Additionally, the release in this area occurred over 30 years ago. Since this area is not capped, it is not likely that current VOC concentrations would result in higher groundwater concentrations in the future. Therefore, since the extent of soil vapor impact is small, the VOCs have been in soil for over 30 years, the concentrations of VOCs in groundwater are low, and the groundwater is captured downgradient by PGOU extraction systems, SVE is not warranted in this area. It is possible that the Agencies took future development plans into their evaluation when determining the need for remedial action in these areas. Both of these remedial areas are encompassed by L5-SV-R-3, which requires institutional controls if land use changes to residential in the future; therefore, these institutional controls are appropriate and SVE is not appropriate.	Because this area has been identified as planned for residential development, EPA believes SVE is warranted based on the currently available data even though GW has not been impacted. As stated, the release is many decades old, it may be prudent to collect additional characterization data to further delineate the lateral extent and confirm the presence of contamination. If, after additional data are collected, the VOCs are shown to not pose an unacceptable risk to human health and the environment, then the selected remedy may be reassessed.
5.	Chemical Plant 2 – CP2-SV-R-1 through CP2-SV-R-5 Table 1 identifies the selected remedy for CP2-SV-R-1 through CP2-SV-R-5 as Alternative 4 – Source Removal/Reduction (SVE). It further identifies the risk driver as human health. Chemical Plant 2 is not within any current proposed development planning area. There is no evidence of any near term construction of new facilities on this site. AR currently anticipates that the former Chem Plant 2 area will be used as buffer/open space between AR and future development areas. Accordingly, institutional controls are appropriate and SVE not appropriate.	COCs in this area present high levels of risk to industrial/commercial and residential use. SVE (Alternative 4) was selected to meet EPA's preference for treatment.

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6.	Administration Area East – AE-R-8 Table 1 identifies the selected remedy for AE-R-8 as Alternative 4 - Source Removal/Reduction (Excavation). It further identifies the risk driver as human health. Excavation under the building would disrupt ongoing operations. Additionally, the area around the building is currently capped. Since excavation of soils outside the building would still require a deed restriction to maintain the building as a cap and excavate the soils at the time the building is destroyed, AR recommends an institutional control that requires capping and requires excavation only should the building is demolished. The existing cap should be enhanced and maintained to reduce infiltration of surface water.	In the ROD, EPA finds that removing the contamination in this area to remedial goals protective of industrial/commercial use is preferable to capping. It is understood the removal of contamination that is under or near the existing structure will not be accomplished until the building is removed.
Specific Comments on the PP from Mr. Peter Kvam, Project Coordinator, Aerojet Rocketdyne (an attachment to the comments dated September 20, 2013)		
1.	Page 6, second paragraph – It is inaccurate to state that 5900 acres of the 8500 acre property are potentially contaminated. Most of the land is open space between operating areas and is not impacted by chemicals released during Aerojet operations. Aerojet suggests that should EPA require a description in the ROD, it would be more accurate to state: *As part of the 2001 Stipulation and Order Modifying Partial Consent Decree, the site was divided into OUs to expedite remedy implementation and through operable unit Remedial Investigations/Feasibility Studies and remedy selection as to potentially contaminated areas of surface and surface soil within the remaining 5,900 acre NPL site.*	The text in Section 2.3 of the ROD includes revised text as suggested.
2.	Page 6, Site Characteristics, 4th paragraph, last sentence. Population is underestimated. According to 2010 census data, the population of Rancho Cordova (64,776) and Folsom (72,203) totals approximately 137,000.	The surrounding cities and communities population data have been updated in the ROD in Section 2.1.
3.	Page 6, Site Characteristics, 5th paragraph, first sentence. The Boundary Operable Unit is located along the northern and western boundaries of the Aerojet Superfund Site, not the Aerojet property.	The text in Section 2.1 of the ROD includes this corrected description.
4.	Page 10, Site Characteristics, Chemical Plant 2 Area, 3rd sentence. Should state that pesticides were manufactured at this chemical plant. This will help support the statement that episodic wastewater disposal from the Chemical Plant 2 area resulted in the presence of pesticides in the Dredge Pit and Eastern Basin.	The text in Section 2.1 of the ROD includes this information, as suggested.

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Comment #	Comment	Response
5.	Page 10, Site Characteristics, 2nd paragraph, last sentence. The sentence does not make sense. It should be removed. "High concentrations of VOCs in soil gas in portions of the Chemical Plant 2 area are the only principal threat wastes identified in the Boundary Operable Unit".	The ROD text will not repeat this sentence.
6.	Page 10, 5th paragraph. Open Space Areas within the BOU were evaluated to determine the potential that there might be a source through the use of aerial photograph reviews. If aerial photography showed the potential for activities within open space areas, soil and soil vapor samples were collected.	Text has been added to Section 1.1 that states all potential sources of contamination were investigated during the RI.
7.	Page 10, 6th paragraph, "Chemical Plant 2 Are" should be "Chemical Plant 2 Area".	The typographical error will not be repeated in the ROD.
8.	Page 10, Summary of Site Risk, first paragraph, 5th sentence. To bound the risk to human health, the text could be more accurate by stating "…from direct contact with contaminated soils <u>from 0-12 feet below ground surface</u>…"	This information is included in the ROD in section 2.7.2.
9.	Page 10, Summary of Site Risk, first paragraph, 5th sentence. To bound the risk to ecological receptors, the text could be more accurate by stating "…evaluated risks to ecological receptors from exposure to constituents in soil <u>from 0-6 feet below ground surface</u>…"	This information is included in the ROD in section 2.7.5.
10.	For areas where soil vapor extraction is the preferred alternative, the PP needs to state that due to the presence of VOCs in groundwater up-gradient of the BOU source, cleanup to the cleanup levels for ambient air (Table 2) may not be achievable until after the remedy of up-gradient sources.	Text in Section 2.10.4 of the ROD clarifies that ECs will be required if RAOs are not met by SVE.
11.	AE-SV-R-3 is not shown on Figure 3	This area is now shown on figures in the ROD.
12.	AW-SV-R-1 is not shown on the Figure 3.	This area is now shown on figures in the ROD.
13.	L2-SV-R-1 is not shown on the Figure 4.	This area is now shown on figures in the ROD.

Appendix E: Responsiveness Summary to OU-6 Proposed Plan Comments
Responses to Comments from DTSC, Carmichael Water District, CVRWQCB, Engineering & Water Resources, and Aerojet Rocketdyne

Comment #	Comment	Response
Comment from Mr. Ronald Keil, Ph.D. in a letter dated May 12, 2013.		
1.	I am writing in reference to the Aerojet General cleanup site in Rancho Cordova, CA. I have information on just one significant spill of TCE at the site and am writing on the chance that the information will have some bearing on the Aerojet Boundary Operable Unit 6 Proposed Plan. I just happened to have thought of the Aerojet site today and while searching the Web came upon the ongoing cleanup. I started work at the Sacramento plant in July of 1963, a Mechanical Engineer fresh out of San José State and after a brief introductory rotation was assigned to the Solid Rocket Plant. In 1964 or 1965 there was a strike by the Machinists' Union and many of us engineers were reassigned temporarily to production duties. I worked for these several weeks at a motor insulating facility in Building 10, at the far northwest corner of the Aerojet property. In this facility the motor casings received both molded insulation caps and poured rubber insulation. In the process the casings were cleaned in a TCE vapor-degreasing vat located below ground level. This operation left the TCE contaminated with pigment from the primer coating and needed periodically to be sent to a facility to be re-refined. When the used chemical was to be sent out it was supposed to be pumped into a holding tank and later transferred to drums on the loading dock. That is what the process documentation stated, but apparently the regular workers had changed the plumbing to direct the flow directly to the loading dock. Unfortunately they had not changed the documentation. As our crew pumped the TCE supposedly into the holding tank there came a hue and cry from outside; the chemical was being pumped into a drum, which overflowed for several minutes before being discovered. We shut down the pump and checked outside to see the entire parking lot covered by a layer of red primer-laden TCE. I estimate that several hundred gallons of the chemical were thus spilled. That was the only chemical spill to which I was a witness, and of course at the time nobody appreciated the toxic effects of the material. It was just left to soak "harmlessly" into the tailings. I've thought about it a number of times through the years and now am glad to report the spill to an agency that cares. I took a leave of absence from Aerojet in 1966 to return to school at UCD, then the next year left permanently. I have had nothing to do with Aerojet since then, though some of my fellow students worked summer internships there.	Based on the information in this comment, EPA believes the referenced process occurred at Line 03, Building 03010 (Final Assembly and Palletizing Building). This area is located in the Island OU, Source Area 11F, and will be investigated in the RI/FS for the Island OU.

Appendix F
EPA Letter to Community Advisory Group (December 5, 2012)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

December 5, 2012

Ms. Janis Hepel, Chair
Community Advisory Group
Aerojet General Corp. Superfund Site
4507 Marion Court
Sacramento, CA 95822

SUBJECT: Community Advisory Group Comments, Final Boundary OU RI Report

Dear Ms. Hepel:

We thank you and members of the Community Advisory Group (CAG) for reviewing and providing comments to the Final Remedial Investigation report for the Boundary Operable Unit at the Aerojet Superfund Site. The remedial response for this site is being conducted by the potentially responsible party under a Consent Decree with EPA and the State of California. As such, EPA directed Aerojet to provide the CAG with a response to your comments. This response is transmitted under separate cover by Aerojet.

Two specific issues have been raised in discussions at prior CAG meetings, and members of the community requested that the Agencies (EPA, California Department of Toxic Substances Control, and the Regional Water Quality Control Board) provide clarification and a response to these specific comments. These areas concern:

- Comment 2 and Comment 3 regarding the vapor intrusion pathway and trichloroethylene, and
- Comment 11 regarding calculating the potential (or "estimated") perchlorate exposure through the home gardening pathway.

The Agencies' project managers and toxicologists have reviewed the comments, conducted additional discussions with the CAG, and provide the attached responses.

We appreciate CAG members' interest and expertise as it informs the Superfund remedial process at this site, and value such input as the process moves forward. As you are aware, there will also be a formal public comment period on EPA's forthcoming Proposed Plan for the Boundary Operable Unit.

Should you have any questions on this correspondence, please contact me at (415) 972-3003, Alex Macdonald at (916) 464-4625, or Steve Ross at (916) 255-3694.

Sincerely,

Gary J. Riley, P.E.
Remedial Project Manager

cc: Steve Ross, DTSC
Alex Macdonald, RWQCB
Chris Fennessy, Aerojet

Comment 11. Perchlorate Exposure through the Home-Gardening Pathway: The CAG has concerns with the US EPA response regarding the quantitative evaluation of exposure to perchlorate via the home gardening pathway.

EPA/ Regulatory Response: Since the March 2012 AJ CAG meeting, EPA/regulatory agencies have been researching this issue further, and have identified a field study that could be used to estimate a bioaccumulation factor (BAF) for leafy vegetables. When we met in March, the biggest concern with the studies that were discussed were that the artificial conditions in a laboratory setting made it difficult to extrapolate these results to the field. In these lab studies, plants were not exposed to a continuous perchlorate concentration (a single spiking was used) and were grown in artificial media containing hydrosol, a colloidal suspension that is different than soil.

More recently, a literature search identified a study (Ellington et al., 2001) that was conducted in the field, included a continuous source of perchlorate in soils (loamy sand), and exposed plants throughout the growing season. This study noted that leafy plants provided the greatest estimate of a BAF (282 or 300 rounded), consistent with the lab studies (Yu et al., 2004).

To estimate a consumption rate (CR) for lettuce and other leafy vegetables, the agencies referred to the most recent version of EPA's Exposure Factors Handbook (2011) http://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252 . The CR for lettuce and leafy vegetables was summed for "consumers" of lettuce and leafy vegetables. For a 70 kilogram adult, the CR is estimated to be 540 grams (70kg x 1.1 g/kg-day x 7 days) or 1.2 pounds per week. Similarly, for a 15 kilogram child, the CR is estimated to be 160 grams (15kg x 1.5 g/kg-day x 7 days) or approximately 1/3 pounds per week. This is a total consumption rate. For home gardeners, a high-end dietary fraction of 0.40 is recommended in EPA Exposure Factors Handbook and EPA Soil Screening Guidance http://www.epa.gov/superfund/health/conmedia/soil/index.htm.

Although the agencies recognize that there are still significant uncertainties with respect to an Aerojet-specific plant BAF for perchlorate, we have calculated a soil-screening level that we believe will be protective of the home-gardening pathway. Please find the calculations in the attachment. **Using available guidance, EPA/regulatory agencies derived a residential soil screening level for the soil-plant-human exposure pathway of 60 ppb perchlorate for children and 90 ppb perchlorate for women of child-bearing years.**

Literature Cited

Ellington, JJ, NL Wolfe, AW Garrison, JJ Evans, JK Avants, and Q Teng, 2001. Determination of Perchlorate in Tobacco Plants and Tobacco Products. Environmental Science and Technology, Vol. 35, 3213-3218.

Yu, L, JE Canas, GP Cobb, WA Jackson, and TA Anderson, 2004. Uptake of Perchlorate in Terrestrial Plants. Ecotoxicology and Environmental Safety, Vol 58, Issue 1 pp. 44-49.

Calculation of a Perchlorate Screening Level for Soil-Plant-Human Exposure Pathway

Acceptable daily intake (I)

$$I\ (mg/kg\text{-}day) = \frac{HQ \times RfD \times AT \times 365\ days/yr}{ED \times EF}$$

Parameter (unit)	**Value (reference)**
HQ/target hazard quotient (unitless)	1 (USEPA RAGS)
AT/averaging time (years)	2 (3 - 5 year old child) 36 (13 - 49 year old female)
ED/exposure duration (years)	2 (3 - 5 year old child) 36 (13 - 49 year old female)
EF/exposure frequency (days/yr)	350 (USEPA RAGS)
RfD/oral reference dose	7×10^{-4} mg/kg-day (USEPA IRIS)

$$I = \frac{1 \times 7 \times 10^{-4}\ mg/kg\text{-}day \times 2\ (or\ 36)yr \times 365\ day/yr}{2\ (or\ 36)\ yr \times 350\ day/yr} = 7.3 \times 10^{-4}\ mg/kg\text{-}day$$

Soil Screening Level (SSL)

$$SSL\ (mg/kg) = \frac{I \times 1000\ g/kg}{F \times CR \times DW \times BAF}$$

Parameter (unit)	**Value (reference)**
I/acceptable daily intake (mg/kg-day)	7.3×10^{-4}
F/fraction of vegetables assumed to be contaminated (unitless)	0.4 ("high end", EPA SSL Guidance 1996)
CR/vegetable consumption rate (g/kg-day)	1.5 (3 -5 year child "consumer" of lettuce + leafy vegetables in EPA Exposure Factors Handbook 2011) 1.1 (13 – 49 year female "consumer" of lettuce + leafy vegetables in EPA Exposure Factors 2011)
DW/wet to dry weight conversion factor	0.063 (average of lettuce + spinach in EPA SSL Guidance 1996)
BAF/soil-to-plant bioaccumulation factor	300 (Ellington et al. 2001)

SSL_{child} = 0.060 mg/kg or 60 ug/kg perchlorate **SSL_{woman} = 0.090 mg/kg or 90 ug/kg perchlorate**

Comment 2. **The CAG is concerned that the proposed soil gas to indoor air attenuation factor of 0.001 (RI Section 3.1.1.1 and RI Table 3.1-1) is not sufficiently conservative to represent residential buildings. EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings, shows that an attenuation factor of 0.001 is sufficient to cover only about 20 to 40% of existing residential structures, depending on the database screen used (EPA, 2012; Available at http://www.epa.gov/oswer/vaporintrusion/documents/OSWER_2010_Database_Report_03-16-2012_Final.pdf, See Table 8 and Figures 17 to 20). A soil gas to indoor air attenuation factor of about 0.3 (range of 0.097 to 0.6) would be required to include 95% of existing residential structures (see Table 8). The relatively coarse soils on much of the Boundary OU site would also tend to decrease the attenuation of vapors from soil gas to indoor air. Attenuation of vapors from soil gas to indoor air would likely be greater where ground water is deep but less where ground water is shallow. While these estimates are for existing residential structures, as new construction ages it will also develop foundation cracks and other points of entry for vapors from the soil below.**

These empirical studies by EPA show less attenuation of vapors from soil gas into indoor air than the default DTSC soil gas to indoor air attenuation factor of 0.001, e.g. 1E-03, used in the RI. The CAG recommends using multiple lines of evidence to establish soil gas to indoor air attenuation factors that are protective of at least 90% of the residential structure population to calculate Soil Vapor RI Screening Levels (RISL). The CAG has raised this issue at previous CAG meetings.

Also note that the U.S. EPA's Vapor Intrusion Database shows that a groundwater to indoor air attenuation factor of 1E-04 is protective of only about 50% of the population (Figure 5, Data Set 2). A soil gas to indoor air attenuation factor of about 1E-03 would be required to be protective of about 90% of the population (EPA, 2012, Figure 9, Data Set 2).

Comment 3. **Since AJ used a soil gas to indoor air attenuation factor (of 0.001) that studies by US EPA show to be overly optimistic to calculate Soil Vapor RISL, the CAG has concerns with the Soil Vapor RISLs shown in Table 3.1-1. The CAG recommends that these be recalculated with attenuation factors that are protective of at least 90% of the population as shown in the EPA's 2008 study or use multiple lines of evidence to establish soil gas to indoor air attenuation factors for the site.**

a) **Trichloroethylene (TCE): The CAG does not agree with the RI Soil gas Screening level of 961 ug/m3 TCE. The CAG is concerned that the protective Soil vapor screening level is far lower than the soil vapor SL**

used in the RI. EPA published new toxicity criteria for TCE September 28, 2011 (See http://www.epa.gov/IRIS/subst/0199.htm#refinhal), and has also published updated RSLs for TCE (See http://www.epa.gov/region9/superfund/prg/). EPA now classifies TCE as a mutagen. The residential air RSL (0.43 ug/m3) for TCE is less than half of the Cal-Modified PRG of 0.96 ug/m3 used by AJ. See comment 5a. The CAG recommends AJ use the residential air screening level of 0.43 ug/m3 for TCE and a soil vapor to indoor air attenuation factor which is protective of a least 90% of the population to establish indoor air screening levels. AJ should use the updated EPA toxicity criteria and RISLs in establishing screening levels for the RI and FS, and in the Human Health Risk Assessment (HHRA).4

EPA/Agency Response:

The agencies share the CAG's concerns regarding the potential for TCE and other soil gas plumes to move from the subsurface (soil and shallow groundwater) to overlying buildings, known as the vapor intrusion pathway (VIP). This prompted a 3-year Aerojet site study to better understand the ability of TCE/VOCs to migrate to the surface from deeper soils and shallow groundwater.

As recommended by the CAG, this Aerojet site-specific study evaluated multiple lines of evidence. This evidence included collecting and evaluating vertical soil cores down to the water table at several locations throughout Aerojet. For each location, soil types at different depths were logged, soil parameters that affect vapor migration were measured (e.g. total porosity, moisture content, grain size etc.), and TCE/VOC concentrations at multiple depths were analyzed. These measurements, known as vertical profiling, provided empirical evidence that helped inform site decision-making at Aerojet.

In parallel with the empirical studies of vapor migration, site-specific modeling was performed to assess the potential for TCE/VOCs to move from deeper soils and shallow groundwater. A comparison of empirical findings with the modeling data provided compelling evidence that risk estimates contained in the Human Health Risk Assessment are conservative (health-protective) and more likely to over-state actual risks due to vapor intrusion.

Based on these site-specific studies, the agencies disagree with the statement that an attenuation factor of 0.001 is "overly optimistic". EPA recommends that Aerojet share these site-specific VI studies with the CAG so that they have access to the same information. The agencies believe that site-specific VI studies are more relevant to Aerojet than a generic database of attenuation factors. The intent of EPA's VI attenuation database http://www.epa.gov/oswer/vaporintrusion/documents/OSWER_2010_Database_Report_03-16-2012_Final.pdf is to serve as a screening tool that encourages further investigations at sites across the country. It is not the intent of EPA's national database to discourage or replace site-specific study.

Further, it is noted that there are regional differences in vapor intrusion which are not accounted for in EPA's national database. According to California DTSC guidance (2011, Appendix B) DTSC averaged the OEHHA attenuation factors for 16 volatile organic compounds, including ethyl benzene (Cal/EPA, 2010) but excluding mercury and tetraethyl lead. The average attenuation factors for existing and future residential buildings are 0.002 and 0.001, respectively.

As Aerojet has indicated, the residential risk of VI is primarily due to contaminated shallow groundwater. In general, soil gas screening values are used at locations where VOCs were observed at "source areas" where VOCs were spilled on the ground. To prevent vapor intrusion in existing and future residential structures, the feasibility study will evaluate controls for vapor intrusion that will be required in areas where the TCE concentration in shallow groundwater exceeds 5 ppb plus a 100-foot buffer.

EPA's recent health risk assessment of TCE concluded that TCE is more toxic than previously believed. It is understandable that given this new information, that the CAG would question whether the 5 ppb level for TCE in groundwater plus a 100-foot buffer is still protective for indoor air exposures. Taking into account the new toxicity/mutagenicity information for TCE, both DTSC HERO and EPA Region 9 used the default Johnson and Ettinger (J&E) model with residential parameters to estimate potential indoor risks and concluded that a groundwater concentration of 5 ppb TCE at 30-foot depth (the shallowest depth observed at Aerojet site) would be unlikely to pose a lifetime risk greater than one in a million.

Recently, Aerojet has updated some of its risk estimates for the Boundary OU, taking into account EPA's new health risk assessment of TCE toxicity. The agencies are currently reviewing this information. It is further noted that Aerojet has updated the White Paper on how to perform Human Health Risk Assessments. Within that document it is stated that future risk assessments will utilize the most current toxicity criteria, including the recent update to TCE.