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FINAL

DEFENSE LOGISTICS AGENCY
DEFENSE DISTRIBUTION DEPOT SAN JOAQUIN–SHARPE SITE

EXPLANATION OF SIGNIFICANT DIFFERENCES TO THE RECORD OF DECISION OPERABLE UNIT 1

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This report was prepared by the staff of URS under the supervision of registered professionals. The data interpretation, conclusions, and recommendations presented in the report were governed by URS' experience and professional judgment. This report has been prepared based on data current at the time of preparation. Assumptions based on this data, although believed reasonable and appropriate based on the data provided herein, may not prove to be true in the future as new data are collected. The conclusions and recommendations of URS are conditioned upon these assumptions.

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ACRONYMS AND ABBREVIATIONS

ACL	aquifer cleanup level
AHA	Administration and Housing Area
ARAR	applicable or relevant and appropriate requirements
Army	Department of the Army
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CCl_4	carbon tetrachloride
COC	contaminant of concern
CPT	cone penetrometer test
CVWB	Central Valley Regional Water Quality Control Board
DCA	dichloroethane
DCE	dichloroethene
DLA	Defense Logistics Agency
DoD	United States Department of Defense
DTSC	Department of Toxic Substances Control
EHC	Redox (EH) compound
EOS	emulsified oil substrate
EPA	United States Environmental Protection Agency
ESD	explanation of significant differences
ESE	Environmental Science and Engineering, Inc.
FFA	Federal Facility Agreement
FFS	focused feasibility study
HI	hazard index
$KMnO_4$	potassium permanganate
LUC	land use control
MCL	maximum contaminant level
NCP	National Contingency Plan
NPL	National Priority List
OU	operable unit
PCE	tetrachloroethene
ppbv	parts per billion by volume
RAO	remedial action objective
RD/RA	remedial design/remedial action
ROD	Record of Decision
RSL	regional screening level

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SJVAQMD	San Joaquin Valley Air Quality Management District
TCE	trichloroethene
URS	URS Group, Inc.
VOC	volatile organic compound
WDR	waste discharge requirement
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
§	Section
3Q13	third quarter 2013

1.0 INTRODUCTION AND STATEMENT OF PURPOSE

The purpose of this explanation of significant differences (ESD) to the Operable Unite (OU) 1 Record of Decision (ROD) is to document significant modifications to the groundwater remedy for the Defense Distribution Depot San Joaquin–Sharpe Site (Sharpe Site), which is extraction, treatment, and discharge of treated groundwater. This ESD adds in situ treatment (consisting of fracturing and amendment injection, in high-concentration areas) and land use controls (LUCs) on government property.

The Defense Logistics Agency (DLA) Sharpe Site is located in San Joaquin County, within the city limits of the City of Lathrop (Figure 1-1). DLA has been the lead agency for Sharpe Site environmental investigation and restoration since 1990. During the preparation of this ESD, a transition in the lead agency from DLA to the Department of the Army (Army) was occurring. Therefore, implementation of the ESD will begin under DLA and proceed to completion under the Army.

The unincorporated community of French Camp borders Lathrop to the northwest, and the City of Manteca borders Lathrop to the east. A larger urban community near the Sharpe Site is the City of Stockton, approximately 9 miles north.

Land surrounding the Sharpe Site is used for a variety of purposes, including agricultural, residential, commercial, and light industrial uses (Figure 1-2). Union Pacific Railroad rights-of-way border the Sharpe Site on the east and west. Agricultural lands lie to the east of the Union Pacific property. Mixed light industrial areas lie to the north, northwest, and south of the depot; residential developments lie to the west. Land use on the Sharpe Site is controlled by the *Defense Distribution Depot San Joaquin Real Property Master Plan Digest* (formerly the Installation Master Plan), which effectively manages the land use as industrial.

Since the 1940s, the Sharpe Site has operated as an active distribution depot supplying military services with the equipment needed to fulfill their missions. In 1987, the Sharpe Site was identified as the Sharpe Army Depot when it was added to the National Priorities List (NPL), also known as the Superfund list. The Sharpe Site National Superfund Database Identification Number is CA8210020832. The source of cleanup monies is the Defense Environmental Restoration Account. The first ROD executed for the Sharpe Site was signed in 1993 and documents the remedial action for OU 1 that consists of the volatile organic compound (VOC)-contaminated groundwater plumes, beneath and emanating from the Sharpe Site. The *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site Record of Decision* (OU 1 ROD) (Environmental Science & Engineering, Inc. [ESE], 1993) identified eight plumes of contaminants of concern (COCs) in OU 1 groundwater. The second ROD executed for the Sharpe Site documents remedies selected for OU 2 that consists of metal, pesticide, and VOC-contaminated soil and soil vapor. This ESD to the OU 1 ROD is being executed to add components to the groundwater remedy that will enhance it and increase protectiveness. This ESD addresses contamination in the saturated zone only. Therefore, soil and vadose zone remedies are not addressed in this ESD.

The United States Environmental Protection Agency (EPA), the California Department of Toxic Substances Control (DTSC), and the California Central Valley Regional Water Quality Control Board (CVWB) provide oversight under the 1989 Federal Facilities Agreement (FFA) for the site. This ESD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §117, as amended. This ESD is also in compliance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) §300.435(c)(2)(i). This ESD is prepared and issued by the DLA and EPA. The DLA and EPA jointly select the remedy enhancements described in Section 4.0 of this ESD. The State of California (DTSC and CVWB) also concur with the remedy.

1.1 Basis for Explanation of Significant Differences

The current remedy for OU 1 is groundwater extraction, treatment by air stripping, and discharge of treated water to surface water percolation ponds or injection wells. This ESD adds two new remedial additions to the OU 1 groundwater remedy at the Sharpe Site: (1) In situ treatment of high levels of subsurface contamination; and (2) LUCs, such as restrictions on future construction to minimize the potential for exposure to contaminated indoor air inhalation related to vapor intrusion from subsurface contamination. In addition, LUCs will be used to prohibit on-site use of contaminated groundwater at the Sharpe Site.

In Situ Treatment. The Army determined that it is beneficial and cost effective to supplement the original OU 1 groundwater remedy with in situ treatment of areas with high concentrations of subsurface contamination that create a continuing source of groundwater contamination at the Sharpe Site. Three pilot studies were conducted to determine which type of in situ treatment is the most effective for site conditions at the Sharpe Site. There are many types of in situ treatment available, and selection of the most effective treatment depends on site-specific conditions such as the type and concentration of contamination and hydrogeologic characteristics. This ESD selects in situ treatment in two high-concentration areas designated Central Area and South Balloon but it allows flexibility for the Army to identify other areas with conditions suitable for in situ treatment as well. If other areas are considered suitable, the Army will submit a remedial design/remedial action (RD/RA) work plan for regulatory concurrence with the treatment. The RD/RA work plan will explain how and where in situ treatment will be implemented, as described in Section 4.3.

The remedial objective for in situ treatment is to reduce high levels of contamination that are slowly releasing VOC mass to dissolved groundwater at the Sharpe Site. In situ treatment will reduce the time required to remediate groundwater plumes and will be cost effective in the long run. The RD/RA work plan will describe the remediation goals of the treatment for each area.

The Army will initially implement in situ treatment at the Central Area and South Balloon where high (greater than 1,000 microgram per liter [µg/L]) concentrations of VOCs in groundwater are present, as described in Section 4.3.1. This ESD also allows the Army flexibility to implement in situ treatment in other areas with high concentrations of contamination that may be determined in the future. If the Army determines that in situ treatment is beneficial and cost effective in another area, then a new RD/RA work plan will be submitted to the regulatory agencies for concurrence.

LUCs. LUCs are instruments such as administrative, legal, engineered, or physical barriers that help minimize the potential for exposure to contamination. LUCs are described in Section 4.3.2.

This ESD establishes LUCs to minimize the potential for inhalation exposure to contaminated indoor air that may be present because of vapor intrusion into occupied work spaces or residences from shallow groundwater plumes at the Sharpe Site. LUCs for vapor intrusion from soil VOC contamination at the Sharpe Site were established in the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution Depot San Joaquin–Sharpe Site (Operable Unit 2 – Soils)* (OU2 ROD Amendment) (URS Group, Inc. [URS], 2011a). In addition, this ESD establishes LUCs to prohibit on-site use of contaminated groundwater at the Sharpe Site.

The proposed additions to the remedy are significant but not fundamental; “A significant change involves a change to a component of a remedy that does not fundamentally alter the overall cleanup approach; a fundamental change involves an appreciable change or changes in the scope, performance and/or cost” (EPA, 1999). An ESD is appropriate for OU 1 because components are being added to the existing groundwater extraction and treatment cleanup approach without fundamentally changing it. This ESD

was prepared in accordance with *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (EPA, 1999).

1.2 Administrative Record

An information repository has been created to give the public access to documents related to the investigation and cleanup of contaminants in the environment. The repository contains the Administrative Record for the Sharpe Site. The Sharpe Information Repository is located at the Defense Distribution Depot San Joaquin–Tracy Site, 25600 South Chrisman Road in Tracy, California. The Administrative Record is available between the hours of 7 a.m. and 3 p.m., Monday through Friday. To arrange viewing of documents in the repository, call the Public Affairs Office at (209) 839-4226. This ESD will become part of the Administrative Record file in accordance with NCP §300.825(a)(2).

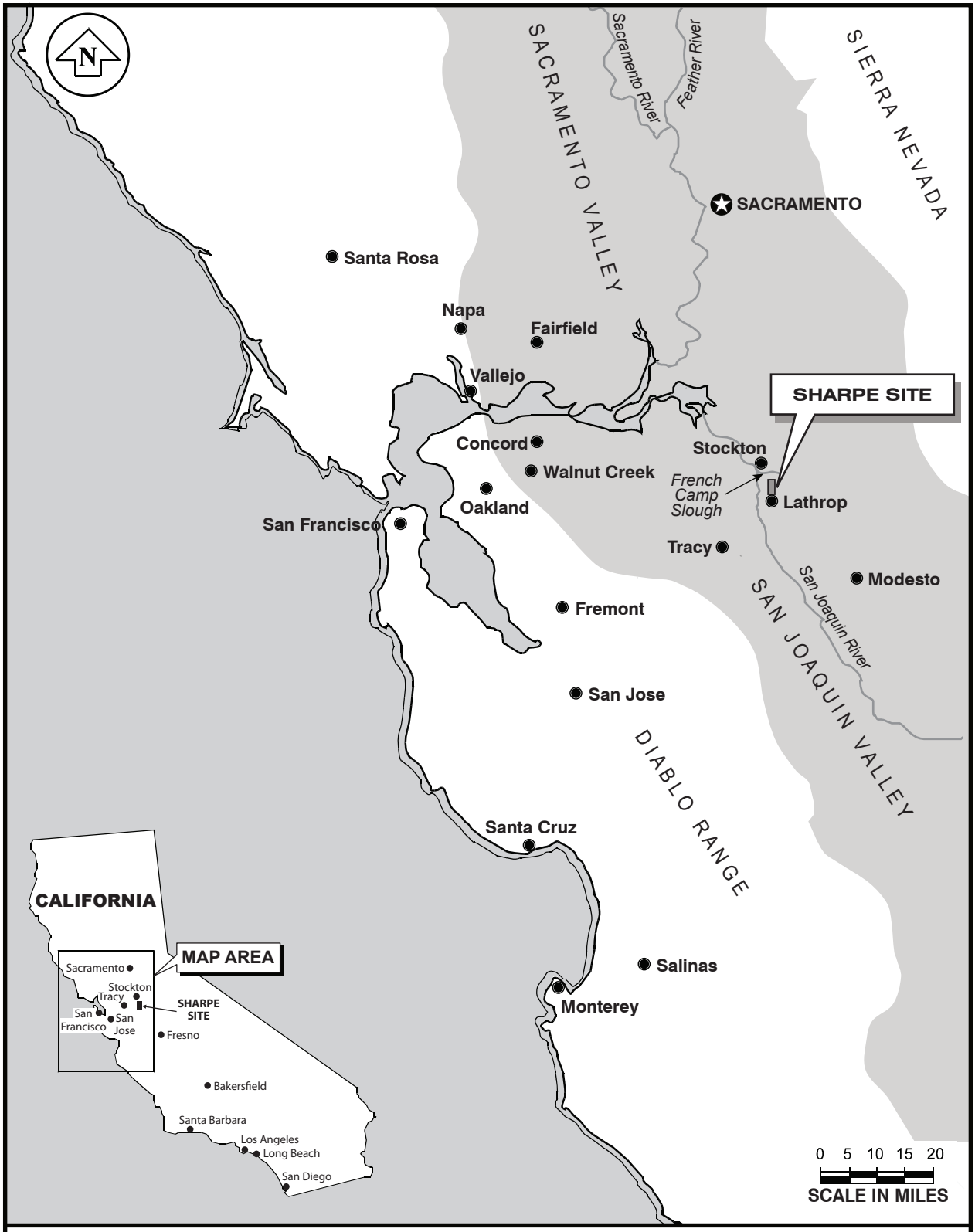

Figure 1-1. Location of Sharpe Site

Sharpe\sharpe-loc-map-ESD.ai LCT 09.18.14 SAC

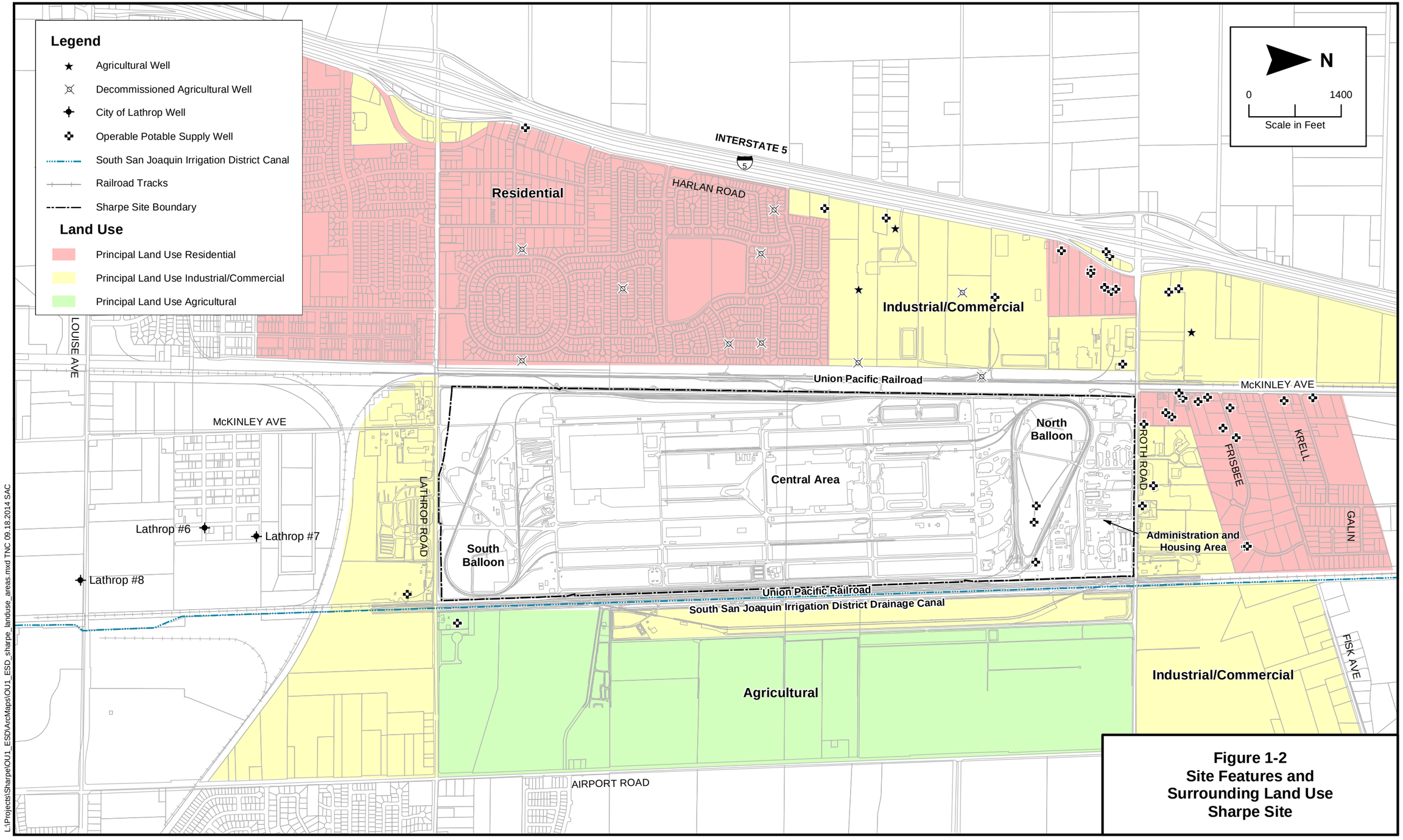

Figure 1-2
Site Features and Surrounding Land Use
Sharpe Site

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2.0 SITE HISTORY, CONTAMINANT EXTENT, AND CURRENT REMEDY

2.1 Overview of the Sharpe Site

The Sharpe Site forms an approximate rectangle 0.5 mile wide (east-west) and 2 miles long (north-south) (Figure 1-2). The area encompasses approximately 720 acres and ranges in elevation from 5 to 23 feet above mean sea level. The Sharpe Site is an active distribution depot supplying military services with the equipment needed to fulfill their missions. The installation is composed of four major areas: the Administration and Housing Area (AHA) at the northern end of the installation; the North Balloon, just south of the AHA; the Central Area, south of the North Balloon; and the South Balloon, which adjoins the Central Area on the south and extends to the southern depot boundary (Figure 1-2). Mission-related activities occur in each of the major areas.

Since the 1940s, the Sharpe Site has operated as a storage and distribution depot for military services in the western United States and the Pacific Region. The Sharpe Site has also operated as a maintenance facility for military equipment. These activities required the use and handling of potentially hazardous materials, such as petroleum hydrocarbon fuels and degreasing solvents. Past use and disposal practices resulted in the release of these chemicals into the environment.

2.2 History of Remedial Activities at the Sharpe Site

In 1979, DLA initiated its Installation Restoration Program to investigate potential environmental contamination. Investigation results revealed that previous mission activities were likely to have contaminated portions of the Sharpe Site's soil and groundwater with degreasing solvents, petroleum fuels, metals, and pesticides. Table 2-1 provides a chronological list of key documents related to the discovery of contamination in groundwater, selection and implementation of the OU 1 remedy, and pilot study results leading to the development of this ESD.

Table 2-1. Chronological List of Key Documents for OU 1 on the Sharpe Site

1980	U.S. Army Toxic and Hazardous Materials Agency, 1980. *Installation Assessment of Sharpe Army Depot*. Report No. 145.
1983	Battelle Pacific, 1983. *Environmental Contamination Survey of Sharpe Army Depot, Report DRXTH-AS-CR-82184*.
1985	Environmental Science and Engineering, Inc., 1985. *Groundwater Remediation Plan for the South Balloon Area at Sharpe Army Depot*. Draft.
1986	Environmental Science and Engineering, Inc., 1986. *Environmental Contamination Survey at Sharpe Army Depot, Final Report.*
1988	Environmental Science and Engineering, Inc., 1988. *Conceptual Design for the Interim Groundwater Remediation System for the North Balloon Area at Sharpe Army Depot.* Draft.
1989	United States Army, 1989. *Federal Facilities Agreement for Defense Distribution Region West-Sharpe*. Effective Date: March 16.
1991	Environmental Science and Engineering, Inc., 1991. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site: Remedial Investigation.* Final.
1991	Environmental Science and Engineering, Inc., 1991. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site: Groundwater Feasibility Study Report*. Final.
1991	Environmental Science and Engineering, Inc., 1991. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site: Risk Assessment Report*. Final.
1993	Environmental Science and Engineering, Inc., 1993. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site Record of Decision, Operable Unit 1*. Final.

Table 2-1. (Continued)

1996	Environmental Science and Engineering, Inc., 1996. *Record of Decision, Basewide Remedy for DDRW-Sharpe Site*. Final.
2001	URS Group, Inc., 2001. *DDJC-Sharpe Site, Operable Unit 1, Interim Remedial Action Report*. Final.
2002	URS Group, Inc., 2002. *Installation-Wide Preliminary Close Out Report, DDJC-Sharpe.* Final.
2004	URS Group, Inc., 2004. *DDJC-Sharpe Five-Year Review Report*. Final.
2006	URS Group, Inc., 2006. *Treatment Technology Investigation Results Technical Memorandum, DDJC-Sharpe*. Final.
2009	URS Group, Inc., 2009. *DDJC-Sharpe Second Five-Year Review Report.* Final.
2010	URS Group, Inc. 2010. *DDJC-Sharpe Hydraulic Fracturing and Injection of EHC Pilot Study Results Report.* Final.
2010	URS Group, Inc. 2010. *DDJC-Sharpe Potassium Permanganate Pilot Study Results Report*. Final.
2010	URS Group, Inc. 2010. *DDJC-Sharpe Enhanced Reductive Dechlorination Technology Emulsified Oil Pilot Study Results Report.* Final.
2010	URS Group, Inc., 2010. *DDJC-Sharpe Final Off-Depot Potable Well Contingency Plan*. Final.
2011	URS Group, Inc., 2011. *Defense Distribution Depot San Joaquin–Sharpe Site, Operable Unit 1 Remedy Enhancement Focused Feasibility Study.* Final.
2011	URS Group, Inc., 2011. *Proposed Plan to Enhance the Effectiveness of the Remedy for Contaminated Groundwater, Defense Distribution Depot San Joaquin–Sharpe Site*. Final.
2013	URS Group, Inc., 2013. *Third Five-Year Review Report, Defense Distribution Depot San Joaquin–Sharpe Site.* Draft.

OU = operable unit

Groundwater contamination was identified in 1981, resulting in remedial investigations of the sources and extent of the groundwater contamination.

In 1989, the United States Army (as the lead federal agency) entered into an agreement, called the FFA, with three regulatory oversight agencies: the EPA, DTSC, and CVWB. In 1990, DLA became the lead federal agency at the Sharpe Site when a memorandum of agreement between the Army and DLA was executed to transfer responsibilities of mission and functions of the Sharpe Site from the Army to DLA. The FFA required DLA to conduct environmental studies and perform cleanup activities to protect the health and safety of the community and the environment. These activities follow a prescribed process, in accordance with federal and state requirements. DLA worked closely with the regulatory oversight agencies to plan and conduct these activities, which are documented in plans and reports reviewed by the regulatory agencies and available for public review at the Information Repository located at the Tracy Site.

2.2.1 Remedial Investigation and Interim Groundwater Remedial Actions

DLA began groundwater cleanup activities at the Sharpe Site in 1987 through an interim remedial action while the remedial investigation was continuing (ESE, 1985). The action included installation and operation of extraction wells and a treatment system in the South Balloon; extraction and treatment began there in March 1987. That same year, the Sharpe Site was placed on the federal NPL. As a result, activities that could affect the environment at the Sharpe Site are subject to the requirements established by the federal government in CERCLA, as amended.

A second interim groundwater remedial action was implemented in the North Balloon area of the Sharpe Site (ESE, 1988). Extraction wells and a treatment system were installed and began operating in October 1990.

2.2.2 OU 1 Record of Decision

The culmination of the remedial investigation/feasibility study of OU 1 at the Sharpe Site was the OU 1 ROD (ESE, 1993). The ROD established the remedial action objectives (RAOs): protect human health and the environment and mitigate potential long-term contaminant migration. To attain the RAOs, the ROD selected the final remedies for the South Balloon and the North Balloon plumes, as well as for the Central Area plumes. The 1993 OU 1 ROD identified 26 COCs for groundwater, and established aquifer cleanup levels (ACLs) for 21 COCs (Table 2-2).

Table 2-2. Remedial Performance Standards – Aquifer Cleanup Levels, Sharpe Site

Constituent	Aquifer Cleanup Level (µg/L)	Basis
Benzene	—	Not established in ROD
Bromacil	—	Not established in ROD
Bromodichloromethane	0.5	HHRA
Bromoform	0.5	HHRA
Carbon tetrachloride	0.5	HHRA
Chloroform	0.5	HHRA
Dibromochloromethane	0.5	HHRA
ortho-Dichlorobenzene	10	California DHS Action Level
para-Dichlorobenzene	5	California Primary MCL
1,2-Dichloroethane	0.5	HHRA
1,1-Dichloroethene	0.5	HHRA
cis-1,2-Dichloroethene	6	California Primary MCL
trans-1,2-Dichloroethene	10	California Primary MCL
1,1-Dichloroethane	5	California Primary MCL
1,2-Dichloropropane	0.5	HHRA
1,3-Dichloropropene	0.5	HHRA
Methylene chloride	0.5	HHRA
1,1,1-Trichloroethane	200	California Primary MCL
1,1,2-Trichloroethane	0.5	HHRA
1,1,2,2-Tetrachloroethane	0.5	HHRA
Tetrachloroethene	0.5	HHRA
Toluene	—	Not established in ROD
Trichloroethene	5	EPA and California Primary MCL
Vinyl chloride	0.5	HHRA
Xylene	—	Not established in ROD

DHS = Department of Health Services
EPA = United States Environmental Protection Agency
HHRA = human health risk assessment
MCL = maximum contaminant level
ROD = Record of Decision
µg/L = micrograms per liter
Source: Environmental Science and Engineering, Inc., 1993.

The remedy selected in the 1993 OU 1 ROD consists of:

- Groundwater extraction wellfield and associated piping network

- Air stripping treatment systems consisting of countercurrent packed towers to remove VOC contamination

- Disposition of treated groundwater via surface water discharge, water reuse, or evaporation/ infiltration ponds with connector/injection wells

- Gas-phase carbon adsorber for treatment of off-gas at a groundwater treatment system

2.2.3 Post-OU 1 ROD Actions

As constructed, the OU 1 remedy included 56 groundwater extraction wells installed between 1986 and 2011, associated groundwater conveyance piping, 4 air stripping systems, effluent discharge piping, 2 percolation ponds, and 10 injection wells. The injection wells were taken out of service in 2000 because they did not accept the volume of treated groundwater necessary to be viable discharge points. The gas-phase carbon adsorber for off-gas treatment in the Central Area was taken out of service in 1996 because the VOC emission rate did not exceed the threshold criterion (i.e., 2 lbs/day) for requiring treatment/ control per the San Joaquin Valley Air Quality Management District (SJVAQMD) requirements.

Thirty-eight extraction wells have been shut down for a variety of reasons: groundwater COC concentrations at the well decreased to less than ACLs; groundwater at the well had high background concentrations of arsenic that could not be released to surface water; the well was not effective in capturing plumes as intended or the well screen failed and the well was replaced. In December 2006, an extraction well optimization test was begun at the Sharpe Site. The test was based on the premise that a reduced number of extraction wells combined with natural attenuation mechanisms were capable of preventing off-depot plume migration. Long-term containment of VOC plumes with 15 operating wells was supported with results from groundwater modeling during the optimization effort (URS, 2006a; 2006b). After the test period, DLA successfully continued extraction with only 15 wells until 2010. Two extraction wells, EWB4 and EWCB6, were added to the extraction system as a component of the remedy enhancement documented in this ESD, and one existing extraction well, EWCB2, was restarted, resulting in a total of 18 extraction wells operating. In 2013, 21 extraction wells are operating across the Sharpe Site; however, none are operating in two high-concentration areas described in the following paragraph.

A Cone Penetrometer Testing (CPT)/HydroPunch investigation conducted in 2007 and 2008 identified areas with concentrations of trichloroethene (TCE) greater than approximately 200 µg/L in a groundwater aquitard at three areas: the western North Balloon historical source area; Site P-5A in the Central Area; and adjacent to Site P-1G in the South Balloon (URS, 2009a). Two of these areas, Site P-5A and the area adjacent to Site P-1G, contain high-concentration areas in which TCE exceeds 1,000 µg/L. The identification of the high concentrations at two sites and the results of the pilot studies prompted the in situ component of the significant differences in the remedy addressed in this document. In 2008 and 2009, pilot studies of three in situ treatment technologies were conducted in areas with TCE concentrations between 200 and 1,800 µg/L.

The identification of the high-concentration areas and their potential impacts on the time to achieve cleanup prompted the performance of a focused feasibility study (FFS) for OU 1. The original feasibility study performed for OU 1 (ESE, 1991a) considered only groundwater extraction and treatment remedies; it was not updated to include in situ technologies. Therefore, the *Operable Unit 1 Focused Feasibility Study* (URS, 2011a) evaluated in situ technologies and other remedial alternatives for groundwater. A number of technology options were considered in the FFS, including focused groundwater extraction, physical treatment, chemical treatment, biological treatment, combination treatments, vertical barriers, and encapsulation. Some of the process options considered chemical reduction, chemical oxidation,

hydraulic and pneumatic fracturing, air sparging, and permeable reductive barriers. Details of these options and the development of the alternatives are described in detail in the FFS (URS, 2011a).

The results of three pilot studies contributed to the alternative selection in the FFS. Pilot studies of three in situ treatment technologies were conducted between 2008 and 2009 in areas of the Sharpe Site where concentrations of TCE exceeded 200 µg/L. The three pilot studies performed in areas with the greatest TCE groundwater concentrations were: fracturing followed by solid potassium permanganate ($KMnO_4$) injection to destroy COC mass under aerobic (oxidizing) conditions; fracturing followed by injection of a redox compound (EHC) to destroy COC mass biologically and chemically under anaerobic conditions; and low-pressure injection of an emulsified oil substrate (EOS) via injection wells to destroy COC mass under anaerobic conditions. Pilot studies for the three technologies were initiated in 2008, and the 12-month test period for each of the pilot studies concluded during the 2009 monitoring period; however, additional groundwater samples were collected during the 2010, 2011, and 2012 monitoring periods to continue monitoring the effectiveness of the $KMnO_4$ and EHC pilot tests. No additional sampling was recommended in the EOS pilot study area after the 2010 monitoring period because cis-1,2-dichlorethene (DCE) concentrations had decreased and there was evidence of TCE rebound or influx indicating that the majority of reductive dechlorination had occurred.

$KMnO_4$. The $KMnO_4$ pilot study was conducted approximately 60 feet north of Building 649 in the South Balloon. The pilot study emplaced solid $KMnO_4$ using hydraulic fracturing, and then evaluated its distribution and effectiveness in reducing TCE groundwater concentrations greater than 1,000 µg/L in fine-grained and sand layers of the saturated zone between 40 and 75 feet below ground surface (bgs). The general conclusions of the study reported in *DDJC–Sharpe Potassium Permanganate Pilot Study results Report* (URS, 2010a) were as follows:

- $KMnO_4$ distribution in low-permeability layers is increased by use of hydraulic fracturing and diffusion. However, the hydraulic fracturing method did not produce predictable or uniform fractures.

- $KMnO_4$ effectively oxidizes COCs (and all other carbon sources) in the fracture area to concentrations below ACLs. However, because $KMnO_4$ was not evenly distributed within the entire soil matrix, rebound in COC concentrations may occur after $KMnO_4$ dissipates.

EHC. The pilot study of the chemical- and biological-reducing reagent EHC was conducted in the residual mass in the saturated zone of the Site P-5A source area in the Central Area. In the pilot study, EHC was emplaced into fine-grained soils (silts and clays) via hydraulic fracturing with the intention of destroying TCE in situ through chemical (abiotic) reduction and enhanced biological degradation mechanisms. The general conclusions of the study reported in the *DDJC–Sharpe Hydraulic Fracturing and Injection of EHC Pilot Study Results Report* (URS, 2010b) and the 2010 through 2012 sampling results are summarized below:

- TCE Destruction: EHC-enhanced reductive dechlorination of TCE and its byproducts in the fracture area. TCE concentrations were reduced between 99 and 100 percent in wells where EHC was distributed. TCE concentrations decreased to less than 5 µg/L (ACL) within 18 to 24 months following injection. TCE concentrations continued to decline at two monitoring wells, but increased at a third well. cis-1,2-DCE concentrations showed an increasing trend through the 24-month sampling period, cis-1,2-DCE stall is occurring within the pilot study area as indicated by fluctuating, but high, concentrations.

- DHC Bacteria. DHC bacteria were detected at low concentrations in the native microbial population. However, data indicate biologically mediated reductive dechlorination was facilitated by sulfate-reducing and methanogenic bacteria.

EOS. An emulsified vegetable oil pilot study, using EOS 598B42 emulsion manufactured by EOS Remediation, Inc., was conducted in the North Balloon portion of the Sharpe Site In the pilot study, EOS was injected at low pressure into fine-grained (low-permeability) and coarser-grained (high-permeability) soils via injection wells to enhance anaerobic reductive dechlorination of TCE in groundwater. The pilot study evaluated EOS's distribution in the aquifer after injection and its effectiveness in reducing TCE groundwater concentrations greater than 200 μg/L in fine-grained and sand layers of the saturated zone between 50 and 60 feet bgs.

Based on the pilot study results, the following conclusions were reached as reported in *DDJC–Sharpe Enhanced Reductive Dechlorination Technology Emulsified Oil Pilot Study Results Report* (URS, 2010c). In groundwater that EOS entered, EOS effectively enhanced anaerobic reductive dechlorination of TCE and its breakdown products to concentrations less than ACLs. Some rebound or influx of TCE in results from the 12-month monitoring event was indicated; therefore, additional EOS injection events may be necessary as TCE desorbs and diffuses from the fine-grained layers of the saturated zone where EOS was not distributed. EOS can be effectively distributed using injection wells in higher permeability units and in thin sand lenses within the thicker, low-permeability units. More cost-effective options, such as temporary direct-push injection borings, also may be effective in the higher permeability units versus installed injection wells.

Each amendment was effective in destroying COCs in groundwater where they were introduced. TCE was reduced to ACLs in the EOS and $KMnO_4$ pilot studies. In the EHC pilot study, TCE concentrations were reduced to less than ACLs within 18 to 24 months after injection, and the percent reduction in TCE concentrations was 99 to 100 percent where EHC was distributed (URS, 2011b). Only $KMnO_4$ was effective in completely destroying COCs without formation of intermediates or daughter products. In addition, $KMnO_4$ was the only amendment shown to effectively diffuse both vertically and laterally, following introduction into the subsurface. Though all the amendments resulted in short-term increases in the concentrations of some metals and other water quality parameters, data collected in the years after the treatment indicate that these increases were restricted to the immediate treatment (and possibly transition) areas and were transient in nature.

Any one or all of the amendments tested may be used to enhance the OU 1 remedy because each was effective in reducing TCE concentrations and none had detrimental impacts on groundwater.

Fracturing. Aquifer cleanup times can be shortened if COC mass in the aquitard can be reduced in situ without extraction. Results of the in situ treatability study indicated that COC mass in the A/B aquitard can be destroyed or concentrations can be reduced to less than ACLs when amendments make contact with COCs (URS, 2010a; 2010b; 2010c). To improve the potential for any amendment to make contact with COC mass, the aquitard must be artificially fractured with fluid or gas before the amendment is injected or the amendment must be injected through multiple boreholes or wells in the aquitard. Low-pressure fracturing with either water or nitrogen gas that will be used at each in situ treatment target area is a widely accepted component of in situ treatment remedies in California and differs substantially from the technology used to fracture rock in the petroleum industry.

One of the target areas where fracturing could occur is adjacent to Building 649 that is no longer occupied (Figure 4-1), and in the other area, the nearest occupied building is more than 100 feet from the treatment area. It is unlikely that fracturing could affect these buildings or increase the potential for vapor intrusion because the shallowest fracturing will be performed at approximately 40 feet bgs in the saturated zone. A water mixture or nitrogen gas under pressure would be injected to induce fractures in a horizontal plane with an expected fracture radius of 10 to 15 feet. Based on past experience at the Sharpe Site, fractures are unlikely to reach the vadose zone at approximately 15 to 20 feet bgs where VOCs could be volatilized and migrate upward toward building foundations. Areas where fracturing is being considered are

upgradient from extraction wells, which would extract any dissolved VOCs that are not destroyed by amendments and could migrate along new fractures in the aquitard. Therefore, contaminants in the treatment zones are unlikely to migrate into exposure pathways to potential receptors, and fracturing for in situ treatment at the Sharpe Site will not increase health or ecological risks.

2.3 Conceptual Site Model

2.3.1 Sources and Release Mechanisms

Past operations at the Sharpe Site resulted in contamination in the soil, groundwater, and vadose zone. Other RODS address soil and vadose zone contamination; this ESD and the OU 1 ROD address only groundwater contamination.

COCs in groundwater at the site are mostly VOCs released in historical source areas during mission-related industrial activities. Data collected during remedial investigations and the 2007-2008 CPT/HydroPunch investigation suggest that release mechanisms on the Sharpe Site were leaking wastewater pipelines, leaking chemical storage containers, spillage during fire training exercises, disposal of wastes in landfill pits or trenches, and runoff from wash racks or degreasing facilities. Figure 2-1 identifies groundwater COC source areas. Table 2-3 lists the principal source areas and the plumes that have emanated from those groundwater COC source areas.

2.3.2 Potential Secondary Sources and Migration Pathways

Beneath source areas, COC liquids migrated vertically downward into soils of the vadose zone and through soil pores to the saturated zone. A fraction of the liquids was adsorbed on soil particles or was trapped in pore spaces of fine-grained soils. Where these residual liquids were in contact with soil vapor, a fraction of the VOCs volatilized, became mobile, and formed vapor plumes. Soil vapor plumes that developed near source areas have been remediated or are undergoing remediation at the Sharpe Site by soil vapor extraction under the OU 2 ROD (ESE, 1996).

COC liquids that were not residual in the vadose zone entered groundwater and began migrating as dissolved compounds forming groundwater plumes. The plumes migrated into sands or gravel deposits and were transported horizontally and vertically downgradient by advection and dispersion. Where the COC plumes entered fine-grained deposits, migration was retarded by sorption and very low hydraulic conductivities. This retardation was most severe downgradient from several source areas where the plume entered an aquitard layer (see Section 2.3.3). COC liquids retarded in the aquitard are very slowly released to groundwater that is migrating very slowly through small pores. Where plumes of COCs are being retarded by the aquitard, high-concentration areas occur because much of the COC mass in the pores has not migrated downgradient with groundwater. Dense non-aqueous phase liquids have not been detected in the high-concentration areas or any other location on the Sharpe Site.

2.3.3 Hydrogeology

In the Sharpe Site area, there is one complex, heterogeneous aquifer system in which four hydro-stratigraphic zones have been identified in the hydrogeologic system between 14 and 270 feet bgs (ESE, 1991a). These hydrostratigraphic zones are considered monitoring zones for the purposes of monitoring hydraulic gradients and contaminant migration. The zones include several saturated transmissive layers (sands) 5 to 12 feet thick in the following depth intervals:

- A Zone – water table to 40 feet bgs
- B Zone – 40 to 90 feet bgs

- C Zone – 90 to 170 feet bgs
- D Zone – 170 to 270 feet bgs

Subsurface soils vary from clay and silt to coarse sand. Within each of the zones, deposits containing each of the soil types can be found; however, the deposits vary in thickness vertically and horizontally across the Sharpe Site. Silt and clay are the dominant soil types beneath the Sharpe Site, and locally those deposits are interbedded with sands. The deposit that apparently has the greatest continuity consists of a mix of clay and silt with thin silty sands in the lower A Zone and the Upper B Zone (approximately 30 feet bgs to 70 feet bgs). This fine-grained deposit (also known as the A/B aquitard) slows the horizontal and vertical migration of groundwater and contaminants. Sands are generally thicker and more abundant in the C and D Zones. Because the transmissivities of the sands in those zones allow groundwater to move at higher velocity, agricultural and domestic supply wells were installed in those two zones, and in some cases, deeper zones in the area of the Sharpe Site.

In the A Zone, groundwater is generally unconfined; however, the fine-grained deposits in the lower A Zone and upper B Zone (also known as the A/B aquitard) locally create confining conditions. Even though there is good continuity of the confining layer across the Sharpe Site, groundwater and dissolved contaminants can move from the A Zone through the B Zone and into the C Zone because the confining layer in some areas is thinner and contains more sand and because there have been strong vertical hydraulic gradients caused by pumping of on-depot and off-depot water supply wells. The B, C, and D Zones have hydraulic characteristics of leaky confined aquifers.

2.3.4 Current Extent of Groundwater Contamination

Of the groundwater COCs that originated from a source on the Sharpe Site, TCE is the most widespread and frequently detected, followed by cis-1,2-DCE, tetrachloroethene (PCE), and carbon tetrachloride (CCl_4). Figures 2-2, 2-3, and 2-4 provide the third quarter 2013 (3Q13) maximum extent of plumes for six COCs in groundwater at concentrations above ACLs in the A Zone, B Zone, and C Zone, respectively. Plume extents of COCs other than TCE are much smaller than TCE plume extents.

Table 2-3 summarizes spatial and chemical details of TCE, PCE, and CCl_4 plumes identified at the Sharpe Site; recent maximum concentrations; estimated residual TCE mass in the A/B aquitard, if any; concentration trends in monitoring wells; and the distance from the toe of the plume to the nearest off-depot potable water supply well. Residual TCE mass refers to TCE sorbed or occluded in the pores of fine-grained deposits in the saturated zone; the highest concentrations in groundwater occur in these deposits. The lowest concentrations of plumes occur in distal portions farthest downgradient from sources.

In the past 14 years, COCs have not been detected in D Zone wells at concentrations greater than ACLs. The deepest detections of TCE, PCE, and/or CCl_4 generally occur near extraction wells along the western boundary of the Sharpe Site and off depot (west) near former agricultural pumping wells. In some areas, the vertical and horizontal extents of the Sharpe Site plumes have been strongly influenced by the historical operation of former agricultural pumping wells (URS, 2010d; 2009a). The operation of on-depot Sharpe Site water supply wells has also influenced the migration of COC plumes in the North Balloon.

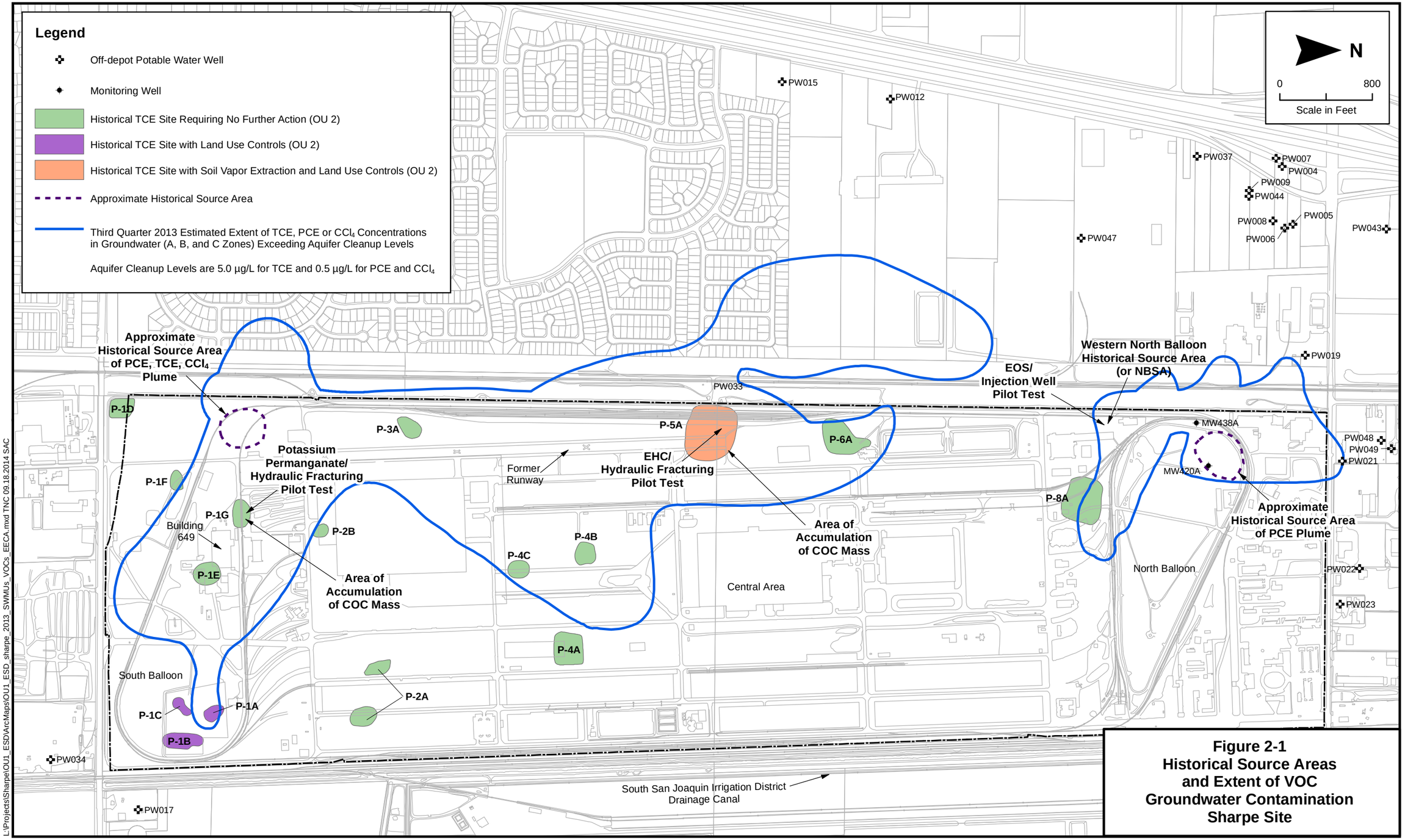

Figure 2-1
Historical Source Areas and Extent of VOC Groundwater Contamination Sharpe Site

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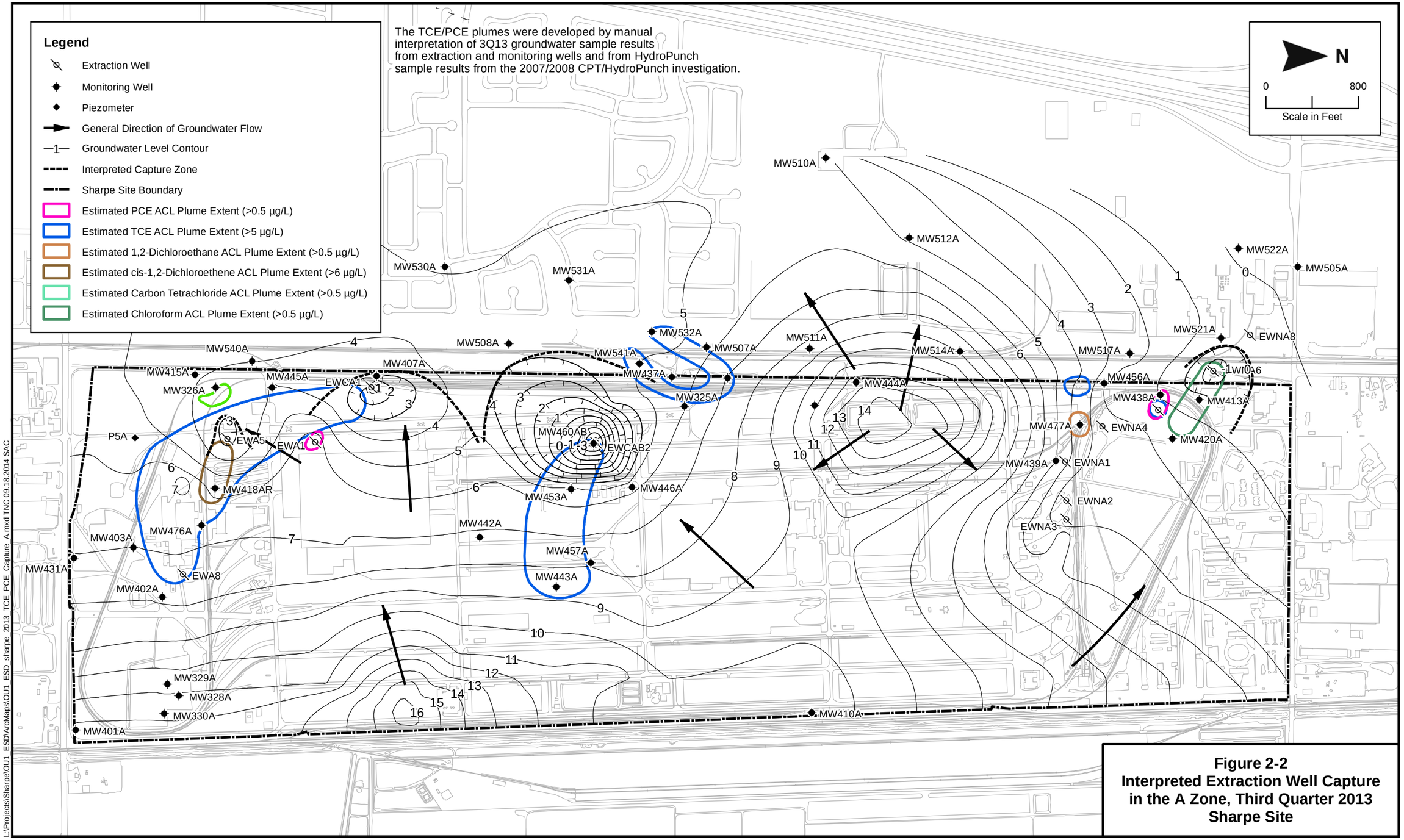

Figure 2-2
Interpreted Extraction Well Capture in the A Zone, Third Quarter 2013 Sharpe Site

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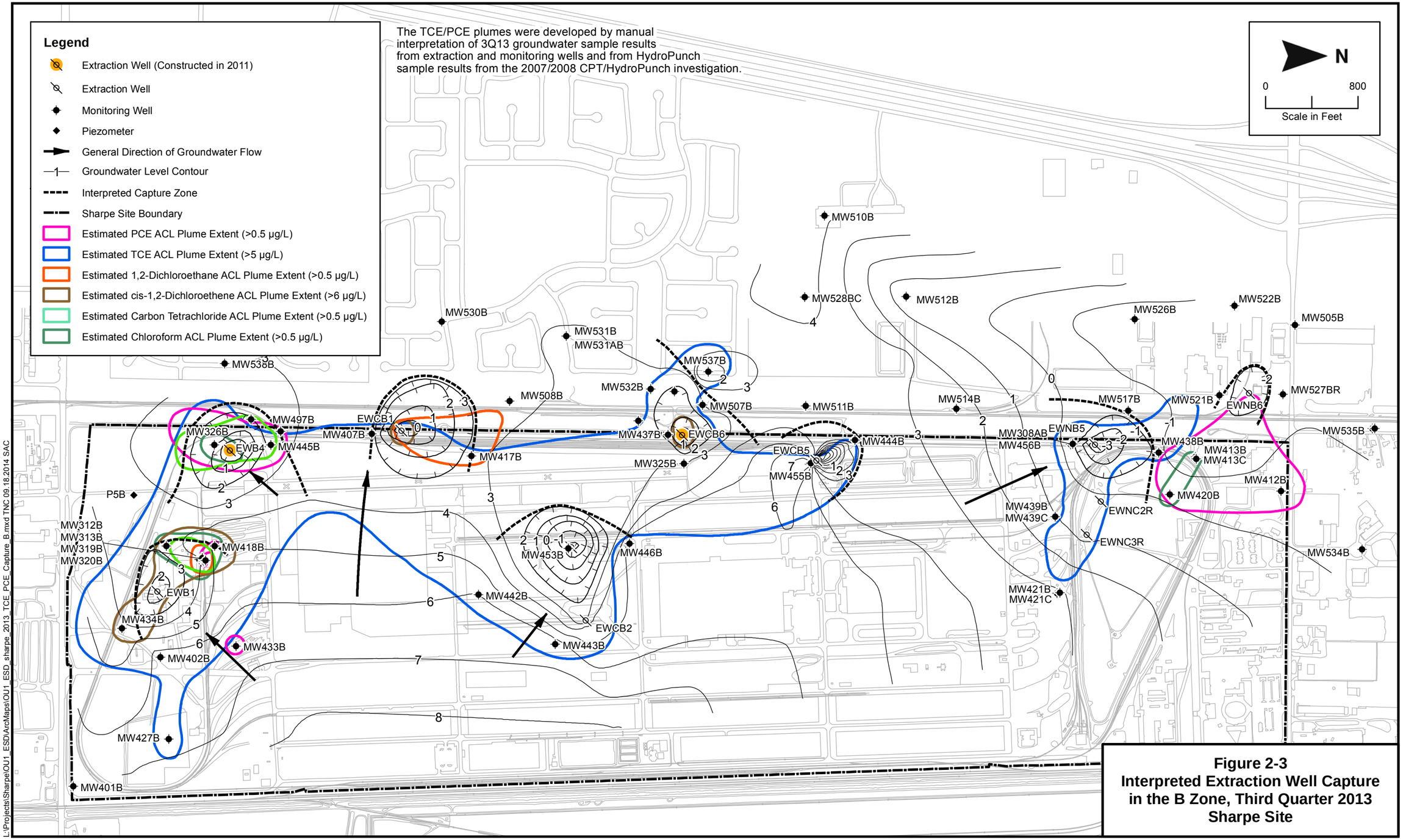

Figure 2-3
Interpreted Extraction Well Capture in the B Zone, Third Quarter 2013
Sharpe Site

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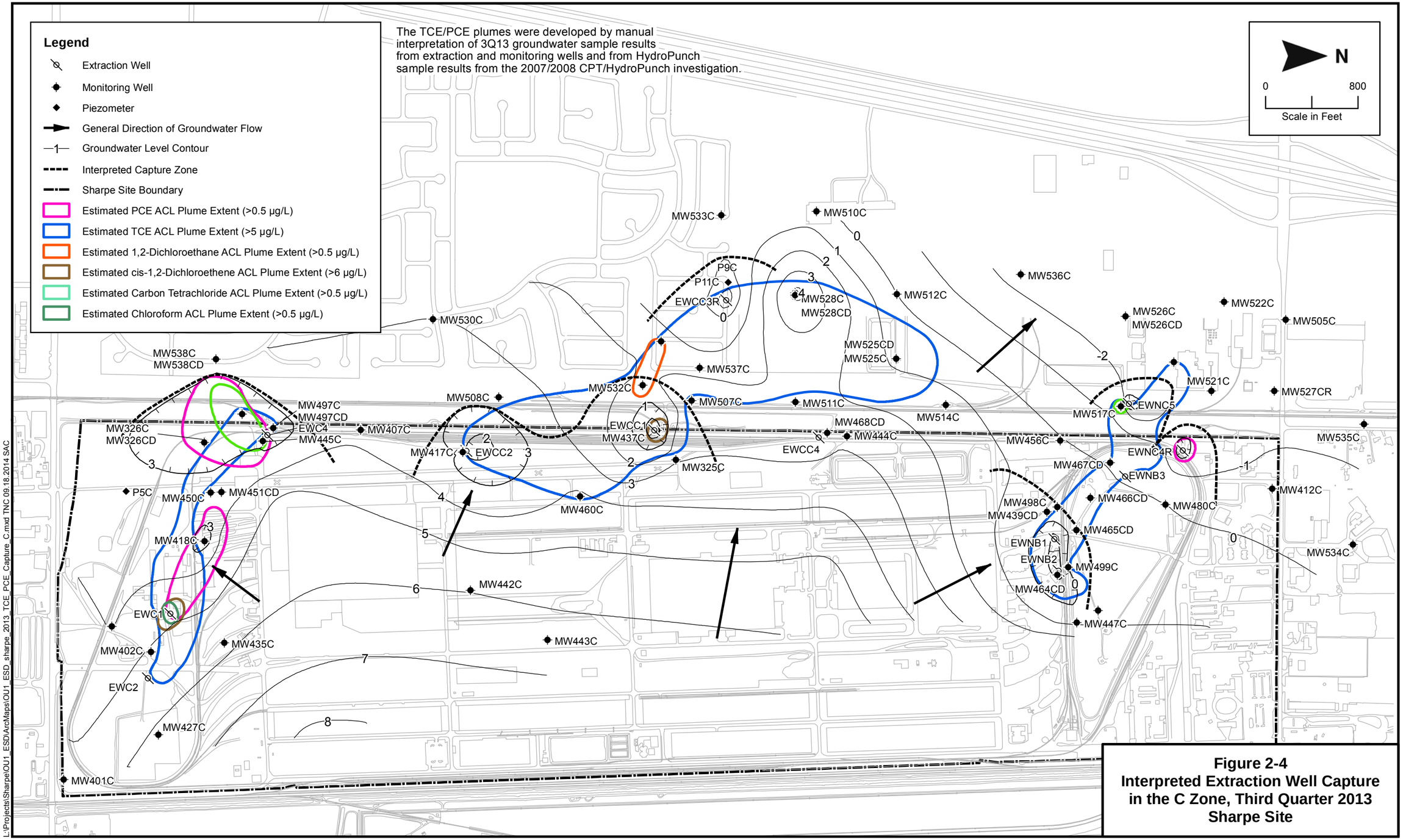

Figure 2-4
Interpreted Extraction Well Capture in the C Zone, Third Quarter 2013
Sharpe Site

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Table 2-3. Summary of the Sharpe Site Groundwater Plumes

Source Information	Plume Information				Primary COC Concentration Trend Within Plume[a]		Extent Information		
Historical Source Areas for Groundwater Plumes	Primary COC and Recent Maximum Concentration (2008-2011)		Other COCs[b]	Estimated TCE Mass Remaining in A/B Aquitard[c] (lbs)	Plume Core	Down-gradient of Plume Core	Zones with Concen-trations >ACLs	Historical Off-depot Migration	Nearest Downgradient or Cross-gradient Potable Well (distance in feet)
North Balloon									
Western North Balloon Historical Source Area	TCE	73.9 µg/L (MW456B)	PCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, 1,2-DCA, chloroform, vinyl chloride	3.8	Decreasing	Decreasing	A,B	Yes	PW019 (~350 feet); PW020 (~875 feet)
Site P-8A	TCE	112 µg/L (EWNB1)	—	NRM	Mixed	Increasing[d]	A, B, C	No	PW038 (~125 feet)
Approximate Historical Source of PCE Plume	PCE	3 µg/L (MW412B)	TCE	NRM	Decreasing	Decreasing	A, B	Yes	PW021 (in PCE plume); PW019 (~50 feet)
Central									
Sites P-3A, P-4A, P-4B, P-4C	TCE	89.5 µg/L (EWCB2)	1,2-DCA, cis-1,2-DCE	NRM	Mixed	Decreasing	A, B, C	Yes	PW015 (~2,600 feet)
Site P-5A	TCE	350 µg/L (MW437C)	1,1,2,2-PCA, PCE, cis-1,2-DCE, 1,2-DCA, chloroform, methylene chloride	98	Mixed	Decreasing	A, B, C	Yes	PW047 (~2,200 feet)
Site P-6A	TCE	52.5 µg/L (EWCB5)	cis-1,2-DCE	NRM	Decreasing	Decreasing	B	No	PW047 (~2,300 feet)
South Balloon									
Sites P-1A, B, C; P-1E	TCE	194 µg/L (EWB1)	cis-1,2-DCE	NRM	Mixed	Decreasing	B, C	No	PW015 (~6,100 feet)
Site P-1G	TCE	1,020 µg/L (MW319B)	PCE, cis-1,2-DCE, 1,1-DCE, 1,2-DCA, chloroform, methylene chloride	172	Mixed	Decreasing	A, B, C	No	PW015 (~4,500 feet)

Table 2-3. (Continued)

Source Information	Plume Information				Primary COC Concentration Trend Within Plume[a]		Extent Information		
Historical Source Areas for Groundwater Plumes	Primary COC and Recent Maximum Concentration (2008-2011)		Other COCs[b]	Estimated Residual TCE Mass Remaining in A/B Aquitard[c] (lbs)	Plume Core	Down-gradient of Plume Core	Zones with Concen-trations >ACLs	Historical Off-depot Migration	Nearest Downgradient or Cross-gradient Potable Well (distance in feet)
South Balloon (cont'd)									
Approximate Historical Source of PCE/CCl_4/TCE Plume	PCE/CCl_4/ TCE	10.7/83.4/ 20.5 µg/L	cis-1,2-DCE, chloroform, 1,2-DCA	NRM	Mixed	Increasing	A, B, C	Yes	PW015 (~4,900 feet)

[a] Trends are verified, statistically significant in the 2011 annual monitoring report (URS, 2012) and are specific to the primary COC in each plume.
[b] COCs listed are only those that were detected at concentrations exceeding their respective ACLs.
[c] Mass calculated with groundwater concentrations greater than ACL for TCE.
[d] Increasing trend in C Zone and CD transition may be caused by the migration of plume toward Sharpe Site potable wells. EWNB1 and EWNB2 were restarted in April 2010 to stop the migration and capture the plume.

ACL = aquifer cleanup level
CCl_4 = carbon tetrachloride
COC = contaminant of concern
DCA = dichloroethane
DCE = dichloroethene
lbs = pounds
Mixed = Concentration trend of the primary COC may be either increasing or decreasing depending on the well.
NRM = no residual mass identified
PCA = tetrachloroethane
PCE = tetrachloroethene
TCE = trichloroethene
URS = URS Group, Inc.
µg/L = micrograms per liter
— = No other COCs have been detected at concentrations greater than their ACLs.
> = greater than
~ = approximate

Progress is being made toward the RAOs established in the OU 1 ROD partially through implementation of the extraction and treatment remedy. Since December 2006, 15 to 21 extraction wells have been operating to contain COC plumes from the Sharpe Site. Although fewer extraction wells have been operating than before December 2006, there is no evidence that plumes have expanded laterally during the period in which the 15 to 21 wells have been operating. Two extraction wells, EWB4 and EWCB6, were installed and began operating in 2011 to capture on-depot portions of plumes. Capture zones for the operating extraction wells are identified with two lines of evidence: potentiometric contours, and the tracks of groundwater particle movement simulated with the Sharpe Site groundwater model. Figures 2-2 through 2-4 show the estimated capture zones relative to COC plume extents for three monitoring zones as they were interpreted with data collected in 3Q11. As shown on these figures, portions of the COC plumes do not appear to be within the estimated capture zones of the operating wells. However, evidence gathered over the last 11 years indicates that the plumes are stable (i.e., either not expanding or contracting). Data collected at the Sharpe Site since 2008 suggest that the distal portions of plumes on the downgradient sides of capture zones are not continuing to migrate, potentially because the COCs are being naturally attenuated (URS, 2011b).

2.3.5 Potential Receptors and Summary of Site Risks

There is the potential for risks to human health and to ecological receptors (such as plants, birds, or other animals) if exposed to COCs in groundwater at the Sharpe Site. The following subsections summarize the potential risks.

2.3.5.1 Human Health Risks

Human health risks from exposure to groundwater were evaluated in *Remedial Investigation/Feasibility Study at Sharpe Site: Risk Assessment Report* (ESE, 1991b). The potential human health risks for OU 1 are posed by VOCs dissolved in groundwater that could be brought to the surface with a well and used for drinking, cooking, and/or bathing. For the original OU 1 ROD, the *Remedial Investigation/Feasibility Study at Sharpe Site: Risk Assessment Report* (ESE, 1991b) stated that the risk assessment for OU 1 used standard EPA methods to determine what human health risks could be if contaminated groundwater from the site was used for those purposes in a residence, even though the Sharpe Site is likely to remain an industrial/commercial site for the foreseeable future. Receptors evaluated in the 1991 risk assessment for their potential exposure to groundwater primarily through ingestion and inhalation from groundwater daily over a 70-year lifetime included on-site workers and residents and off-site residents (ESE, 1991b). Skin exposures were not directly included in the evaluation because it was concluded that their effect was inconsequential. Vapor intrusion through the foundation of a residence by COCs from shallow groundwater was not considered a migration pathway of concern in 1991, when the risk assessment was being performed, and, therefore, was not included in the OU 1 ROD. However, the potential for unacceptable human health risk from vapor intrusion of COCs is acknowledged by DLA. Because of that potential, LUCs are being added to the remedy in areas of the Sharpe Site that are above the A Zone groundwater plume. This ESD establishes LUCs for protection of receptors from indoor air exposure as described in Section 4.3.2.

The risk assessment considered both carcinogenic risks and non-carcinogenic health effects that could result from long-term exposure to the COCs. Carcinogenic risks were calculated for multiple COC concentrations detected in seven plumes on the Sharpe Site. For each plume, two conditions were selected to represent potential exposure of a receptor. The first condition was considered to be the worst-case scenario, calculating risk with a reasonable maximum concentration, and the second condition, considered the most likely exposure used mean concentration. A cancer risk value represents the chance that a resident individual using groundwater from one of the Sharpe Site plumes will develop cancer.

The estimated risks for a resident using contaminated Sharpe Site groundwater range from a low of 2.47 chances in 10 million to a high of 2.2 chances in 10,000 of developing cancer. Expressed in scientific notation the carcinogenic risk range is 2.47×10^{-7} to 2.2×10^{-4}. The risk values are the sum of all COCs detected in samples from a plume. However, concentrations of TCE account for most of the risk.

A non-carcinogenic health hazard is an estimate of the damage other than cancer to human internal organs caused by exposure to a COC. The value used to estimate the potential health hazard is the hazard index (HI). An HI less than 1 indicates minimal hazard, whereas a HI greater than 1 indicates potential for health hazard from groundwater use. The HI values calculated for use of Sharpe Site groundwater range from a low of 0.00378 to a high of 2.77 and are a sum of HIs for all detected COCs.

The human health risk assessment (ESE, 1991b) has not been updated since 1991; however, the potential for increased human health risks resulting from considering the vapor intrusion pathway, changes in toxicity benchmark values, or changes in risk assessment methods were evaluated in the First, Second, and Third Five-Year Review Reports (URS, 2004; 2009b; 2013).

The highest estimated values of carcinogenic risk and non-carcinogenic health effects indicate groundwater at the Sharpe Site is not suitable for unrestricted use. To protect potential future users of groundwater, DLA decided to enhance the OU 1 remedy with the significant differences described in this document.

2.3.5.2 Vapor Intrusion Pathway

Inhalation exposure to volatile compounds that have migrated from the subsurface into indoor air (vapor intrusion pathway) is a now well-recognized exposure pathway that was not well understood, nor evaluated, during development of the original risk assessment for groundwater contamination in the OU 1 ROD (ESE, 1991b). The vapor intrusion pathway was also not addressed in the original 1996 OU 2 ROD (ESE, 1996) for contaminated soil, but was subsequently addressed in the OU 2 ROD Amendment (URS, 2011c). Therefore, this ESD only addresses vapor intrusion from volatilization of VOCs from groundwater contamination plumes and does not address vapor intrusion from residual soil contamination in the vadose zone.

The vapor intrusion pathway is potentially complete in structures overlying A Zone groundwater contaminated with VOCs. Horizontal migration of the A Zone groundwater plumes, from which VOCs could volatilize have been relatively stable in recent years. There has been some vertical downward migration of VOC contamination from the A Zone to the deeper B and C Zones; however, these deeper zones are overlain by uncontaminated or less-contaminated groundwater that impedes the upward migration of VOC vapors from the deeper B and C Zones. Therefore, VOCs in groundwater of the B and C Zones are not a threat to human health through the vapor intrusion pathway.

Building 649, a large industrial building, is the only building at the Sharpe Site that overlies a shallow (A Zone) groundwater TCE plume. In October 2009, soil vapor samples were collected to investigate potential vadose zone contamination beneath Building 649. Soil vapor samples were collected beneath Building 649 from two borings at two depths. TCE was detected in one sample at a concentration of 38 parts per billion by volume (ppbv) at 11.5 feet bgs, which is less than the OU 2 ROD cleanup standard for TCE contamination in soil. TCE was not detected in the other three samples. The results of the investigation are summarized in the Site P-1E summary in Appendix A of the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution San Joaquin-Sharpe Site (Operable Unit 2 –Soils)* (URS, 2011c).

Soil vapor sample results indicate that no VOC source exists in the vadose zone beneath the building where the samples were collected. The one detection of TCE in the soil vapor sample from beneath the northeastern portion of Building 649 suggests that volatilization from the shallow (A Zone) groundwater plume may be occurring. However, the concentration in soil vapor is less than the 56 ppbv industrial screening level (at a risk level of 1E-06) for soil vapor greater than 5 feet bgs[1]. Consequently, there is no unacceptable risk to any potential industrial workers at Building 649. In addition, Building 649 is vacant and there are no plans to occupy the building.

Vapor intrusion LUCs will be implemented for A Zone groundwater where levels of TCE, PCE, CCl_4, 1,2-dichloroethane (DCA), cis-1,2-DCE, bromodichloromethane or chloroform exceed the commercial/industrial Target Groundwater Concentrations (Table 2-4). The criteria for selecting these seven contaminants were based on sampling detections within the last four years at concentrations exceeding ACLs in at least two A Zone wells. Twelve additional COCs have historically been detected in A Zone well samples; however, none have been detected within the last four years at concentrations exceeding ACLs. Target Groundwater Concentrations were calculated for a carcinogenic health risk of greater than 1×10^{-6} or a non-carcinogenic hazard quotient greater than 1 (EPA, 2002). The Target Groundwater Concentrations were calculated using indoor air RSLs (EPA, 2012a) or California alternate air screening levels (DTSC, 2013) for the COCs of interest, a default attenuation factor (α) of 0.001, chemical-specific Henry's Law constants, and unit conversion factors (EPA, 2012a). The estimated A Zone areas where TCE, PCE, CCl_4, 1,2-DCA, cis-1,2-DCE, bromodichloromethane, and chloroform concentrations exceed the Target Groundwater Concentrations are shown on Figure 4-3. The isopleths were drawn using 3Q13 monitoring well sample analysis results plus a 100-foot buffer zone.

LUCs will be implemented for protection of human health from potential exposure to contaminated indoor air caused by vapor intrusion. There is currently no unacceptable risk from vapor intrusion because no occupied buildings overlie an A Zone groundwater plume. However, to protect against potential exposure in the future, A Zone groundwater will be monitored until ACLs are attained to ensure that contaminant concentrations do not exceed levels that could result in unacceptable risk of exposure from vapor intrusion in current or future buildings. In addition, this ESD includes LUCs that restrict construction of new buildings over contaminated groundwater. There are no chemical-specific cleanup levels or applicable or relevant and appropriate requirements (ARARs) for vapor intrusion and therefore, LUCs will be implemented above shallow groundwater with contaminant concentrations that exceed the Target Groundwater Concentrations in Table 2-4, which were derived from risk-based calculations. The Army will review the LUCs area annually and will revise the LUCs area, if necessary, as described in Section 4.3.2.1 of this ESD.

[1] The EPA Regional Screening Level (RSL) for the concentration of TCE in ambient air in a commercial/industrial setting is 3.0 micrograms per cubic meter ($\mu g/m^3$) (EPA, 2014). Based on EPA default screening attenuation factor for soil greater than 5 feet bgs (a dimensionless value of 0.01 [EPA, 2002]), the equivalent screening level concentration at those depths would be 300 $\mu g/m^3$. Converting the measurement units (assuming standard temperature [25 degrees Celsius] and pressure [1 atmosphere]: 300 $\mu g/m^3$ = 56 ppbv.

Table 2-4. Target Groundwater Concentrations for LUCs Protective of the Vapor Intrusion Pathway for Industrial/Commercial Uses, Sharpe Site

VOC	Indoor Air Regional Screening Level ($\mu g/m^3$)	Henry's Law Constant (dimensionless)	Attenuation Factor (α) Assumed	Target Groundwater Concentration[a] (µg/L)
Trichloroethene (TCE)	3	0.403	0.001	7.4
Tetrachloroethene (PCE)	2.08	0.723	0.001	2.9
Bromodichloromethane	0.33	0.0867	0.001	3.8
Carbon tetrachloride (CCl_4)	0.29	1.13	0.001	0.26
Chloroform	0.53	0.15	0.001	3.6
cis-1,2-Dichloroethene (cis-1,2-DCE)	31	0.167	0.001	185.6
1,2-Dichloroethane (1,2-DCA)	0.47	0.0482	0.001	9.8

[a] Target Groundwater Concentrations are calculated with the following equation (EPA, 2002):

$C_{GW} = C_{ia}/(\alpha \times H' \times 1{,}000\ L/m^3)$

Where:

C_{Gw} = target concentration in groundwater (µg/L)
C_{ia} = indoor air Regional Screening Level ($\mu g/m^3$)
α = attenuation factor (dimensionless)
H´ = Henry's law constant (dimensionless)

EPA = United States Environmental Protection Agency
L = liter
LUC = land use control
MCL = maximum contaminant level
VOC = volatile organic compound
µg/L = micrograms per liter
$\mu g/m^3$ = micrograms per cubic meter

2.3.5.3 Ecological Risk

An ecological risk assessment was not performed for groundwater during the remedial investigation/ feasibility study because of the unlikelihood of ecological exposure; a description of potential ecological receptors on the Sharpe Site and sensitive habitat is presented in the risk assessment for soils (ESE, 1994). There is no unacceptable risk to ecological receptors from exposure to COCs in groundwater. Groundwater occurs 3 to 19 feet bgs. Contaminated groundwater is brought to the surface for treatment via pipelines, and no plants, fish, birds, or other animals can come in contact with groundwater until after it is treated and discharged to percolation ponds.

There are burrowing animals, including colonies of burrowing owls (which are members of a California species of special concern), living in unused parts of the Sharpe Site. Although there is potential that the burrowing animals could breathe vapors of COCs rising from shallow groundwater, a DTSC evaluation found that the animals are unlikely to be harmed by the vapors (Lauren, D.J. and C. Rech, 2010). The Sharpe Site has a burrowing owl management plan (Albion Environmental, Inc., 1997) in place, and burrowing owl census surveys are conducted annually. The RD/RA work plan will further describe preventive measures that will be taken to assure that owls do not inhabit burrows at the South Balloon or Central Area in situ treatment areas when treatment is occurring.

3.0 BASIS FOR REMEDY MODIFICATION

Based on new information obtained about OU 1, modifications to the original OU 1 remedy are being made to enhance its effectiveness and to ensure long-term protection of human health.

3.1 New Information

Significant changes in the OU 1 remedy were considered after new information regarding the distribution of VOC mass became available and the three pilot tests were performed (See Section 2.2.3). The new information warranted a new FFS for OU 1.The original feasibility study performed for OU 1 (ESE, 1991a) only considered groundwater extraction and treatment remedies and did not consider in situ technologies. The *Operable Unit 1 Focused Feasibility Study* (URS, 2011a) evaluated in situ technologies and other remedial alternatives for groundwater remediation. All three of the in situ technologies evaluated during the pilot studies are cost effective, and each is predicted to reduce cleanup time because each removes VOC mass by degradation. Fracturing of the A/B aquitard in high-concentration target areas (greater than 1,000 µg/L) will ensure that the injected amendments make contact with VOC mass. These technologies, when properly applied to the areas identified in this ESD, are considered safe for human health and the environment.

Groundwater modeling was performed to simulate the effects that the VOC masses may have on the time necessary to cleanup groundwater with an extraction well field and air stripping treatment alone. The model results indicated that the masses in high-concentration areas would extend the cleanup time estimated in the OU 1 ROD because the mass is in the A/B aquitard and is released very slowly to migrate to extraction wells. In situ technologies were evaluated with pilot studies because the technologies offered the potential for removing mass from the A/B aquitard and, thereby, decreasing the cleanup time.

3.2 Increasing Protectiveness

LUCs are also being added as a component of the OU 1 remedy. LUCs address the long-term protectiveness of the remedy by preventing unacceptable health risks to potential users of contaminated groundwater or potential receptors of COC vapors in indoor air by eliminating or mitigating exposure.

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4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES

The components of the groundwater remedy selected in the 1993 OU 1 ROD are being retained with one exception: Significant components are being added to the remedy to increase protectiveness and shorten the cleanup time.

4.1 Components of Remedy to be Retained

Major components of the OU 1 remedy being retained are the:

- Groundwater extraction wellfield and associated piping network for the pump and treat system
- Air stripping treatment systems consisting of countercurrent packed towers to remove VOC contamination
- Disposition of treated groundwater via surface water discharge, water reuse, evaporation/infiltration ponds, or injection wells

4.2 Component of Remedy Not Retained

The gas-phase carbon adsorber for treatment of off-gas at a groundwater treatment system can be removed from the remedy because it is not required to maintain compliance. The adsorber was taken out of service in 1996 because the VOC emission rate did not exceed the threshold criterion (i.e., 2 lbs/day) for requiring treatment/control per the SJVAQMD requirements.

4.3 Components to be Added to the Remedy

4.3.1 In Situ Treatment

The following describes in detail the components to be added to the remedy:

The Army concludes that flexibility would be beneficial in the implementation of in situ treatment on the Sharpe Site. Effectiveness of the treatment may be enhanced by the selection of the most appropriate amendment for creating either oxidizing conditions or reducing conditions locally in the treatment area depending on biogeochemical conditions in the aquifer and aquitard at the time of treatment. The Army will maintain flexibility using pre-determined criteria for selection of amendments to be used at each treatment site. Those criteria and the outcomes expected include the following:

Any area considered for in situ treatment will have the following characteristics:

1. Fine-grained, low permeability saturated deposits at least 10 feet in thickness (e.g., the A/B aquitard near historical source areas).
2. VOC concentrations greater than 1,000 µg/L, unless the Army determines that treatment in a target area with 1,000 µg/L or less of VOC concentrations would substantially expedite remediation and be cost effective.

Characteristics of a target area for fracturing and injection of an oxidizing amendment (e.g., $KMnO_4$):

1. VOC mass to be treated may be beneath or adjacent to a regularly occupied work space because an oxidizing amendment will destroy PCE and TCE, as well as their breakdown products

1,2-DCE and vinyl chloride, thereby eliminating the possibility of their upward migration along fractures and potential for vapor intrusion.

2. Either the treatment area and the nearest downgradient depot boundary are separated by at least 300 feet or there is an operational downgradient B Zone extraction well within 300 feet to allow for control (via extraction or treatment) or natural stabilization of any increased inorganic constituent (e.g., hexavalent chromium, selenium) concentrations exceeding the respective maximum contaminant levels (MCLs) mobilized by in situ oxidation.

The expected outcome of this treatment at a site with these characteristics is rapid, complete destruction of chlorinated ethene compounds that are contacted (through fractures and diffusion) by the amendment instead of gradual reductive degradation.

Characteristics of a target area for fracturing and injection of an amendment to biologically (e.g., EOS) or biologically and chemically (e.g., EHC) reduce groundwater to enhance anaerobic biodegradation:

1. Geochemical parameters (e.g., total organic carbon, dissolved oxygen, oxidation-reduction potential, and pH) of the target area indicate a reductive environment that published studies have shown to be conducive for VOC degradation.

2. Either the treatment area and the nearest downgradient depot boundary are separated by at least 300 feet or there is an operational, downgradient, B Zone extraction well within 300 feet to allow for control (via extraction or treatment) or natural stabilization of any increased inorganic constituent (e.g., hexavalent chromium, selenium) concentrations exceeding the respective MCLs mobilized by in situ oxidation.

3. VOC mass is not beneath or directly upgradient from a regularly occupied work place (avoiding potential for vapor intrusion of degradation products), unless fracturing occurs deeper than 50 feet bgs.

4. There is potential for multiple injections of the amendment.

The expected outcome of this treatment at a site with these characteristics is gradual reductive dechlorination of VOCs.

The Army will make the decision on the most appropriate amendment to use in each area and will submit the decision to regulatory agencies for approval prior to implementing in situ treatment (including fracturing and injection of amendments in the fractured aquitard). The treatment to be applied in each of the target areas will be identified in an RD/RA work plan. Target areas that have a COC concentration equal to or less than 1,000 µg/L will be considered for in situ treatment, if there is evidence that treatment of the area will decrease the predicted time to remediate and/or will be cost effective.

Remedial Objectives. The remedial objective of in situ treatment at the Sharpe Site is reduction in the mass of VOCs in high-concentration areas to expedite groundwater remediation at the site. The RAOs of the OU 1 remedy are: to protect human health and the environment and mitigate the potential for long-term contaminant migration. These RAOs are not revised by this ESD. The components added by the ESD in conjunction with groundwater extraction and treatment address the second RAO. In situ treatment will reduce the potential for long-term VOC migration. The cleanup goals for the groundwater remedy are the ACLs established in the OU 1 ROD (Section 2.2.2); however, those goals are unlikely to be achieved with in situ treatment efforts alone.

Implementation of in situ remediation in the South Balloon and Central Area

- Target remediation area in South Balloon: A/B aquitard where TCE concentrations are greater than 1,000 µg/L in the target area in the depth interval of approximately 40 to 65 feet bgs. (See the Area of Accumulation of COC Mass in the South Balloon on Figure 2-1.) A closer view of the target area is shown on Figure 4-1.

- Target remediation area in Central Area (Site P-5A): A/B aquitard where TCE concentrations are greater than 1,000 µg/L in the target area in the depth interval of approximately 40 to 70 feet bgs. (See the Area of Accumulation of COC Mass in the Central Area on Figure 2-1.) A closer view of the target area is shown on Figure 4-2.

- Drill fracture borings or injection points and/or construct injection wells in the aquitard.

- Inject the appropriate amendment in target areas within the Central Area and the South Balloon.

The Army will prepare an RD/RA work plan addressing the in situ treatments in both the South Balloon and Central Area target areas. The work plan will describe the purpose of the treatment, the fracturing effort (including the fracturing medium to be used), the specific amendments selected and why they were selected, the amounts of amendments to be injected, the estimated number of injection locations, and the monitoring planned in and downgradient from treatment areas. A single remedial action report will be submitted after the completion of the injection and the initial post-treatment monitoring.

4.3.2 Land Use Controls

LUCs are instruments, such as administrative, legal, engineered, or physical barriers (such as fences and security guards) that help to minimize the potential for exposure to contamination or to protect the integrity of a response action (EPA, 2012b). For the Sharpe Site, the Army will implement administrative and legal LUCs and physical barriers to minimize exposure to COCs in indoor air and groundwater.

The LUCs for OU 1 include the following:

- Vapor intrusion LUCs will prevent human exposure to breathing indoor air with VOC concentrations that pose an unacceptable health risk as indicated by the EPA or California screening levels for the industrial indoor air pathway. VOCs can potentially migrate from contaminated groundwater up through the vadose zone and into buildings. The Sharpe Site is an industrial facility and the LUCs will ensure the property use remains industrial and prohibit future land uses such as residential development and on-site company day-care centers.

- On-depot groundwater LUCs will restrict groundwater use and prevent human consumption of contaminated groundwater. These LUCs will be included as property deed restrictions if land is transferred to nonfederal entities in the future.

These LUCs will be implemented through modifications to the *Defense Distribution Depot San Joaquin Real Property Master Plan Digest*, which requires environmental review of proposed land use changes at the Sharpe Site. These LUCs will also be included as property deed restrictions if land is transferred to nonfederal entities in the future. These LUCs, described more fully in Subsection 4.3.2.3 and Appendix A, include: prohibiting construction of water supply wells within a contaminant plume or a 2,000-foot buffer area around the plume, engineering control requirements for any structure proposed for

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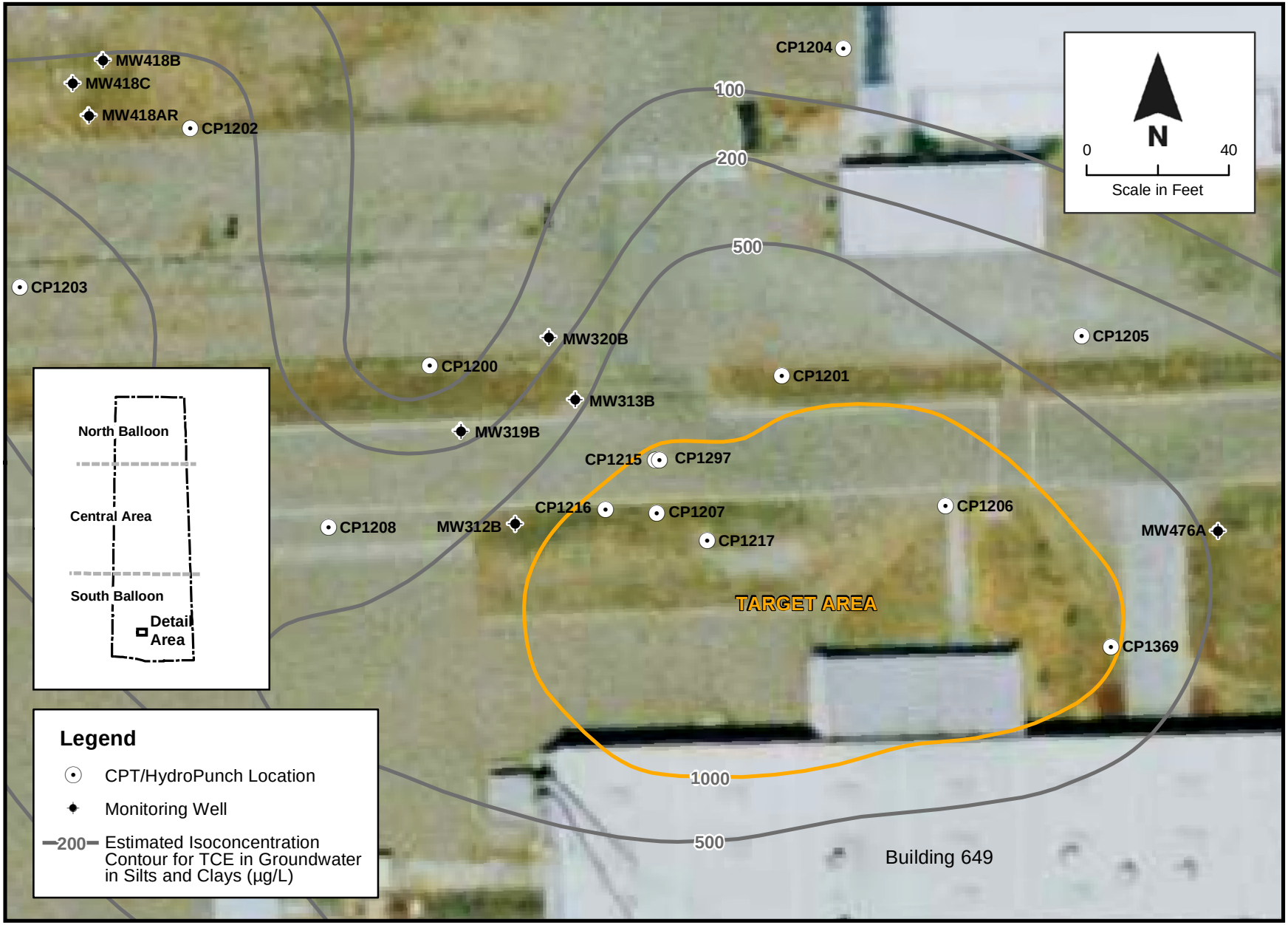

Figure 4-1. Target Area for In Situ Treatment in South Balloon, Sharpe Site

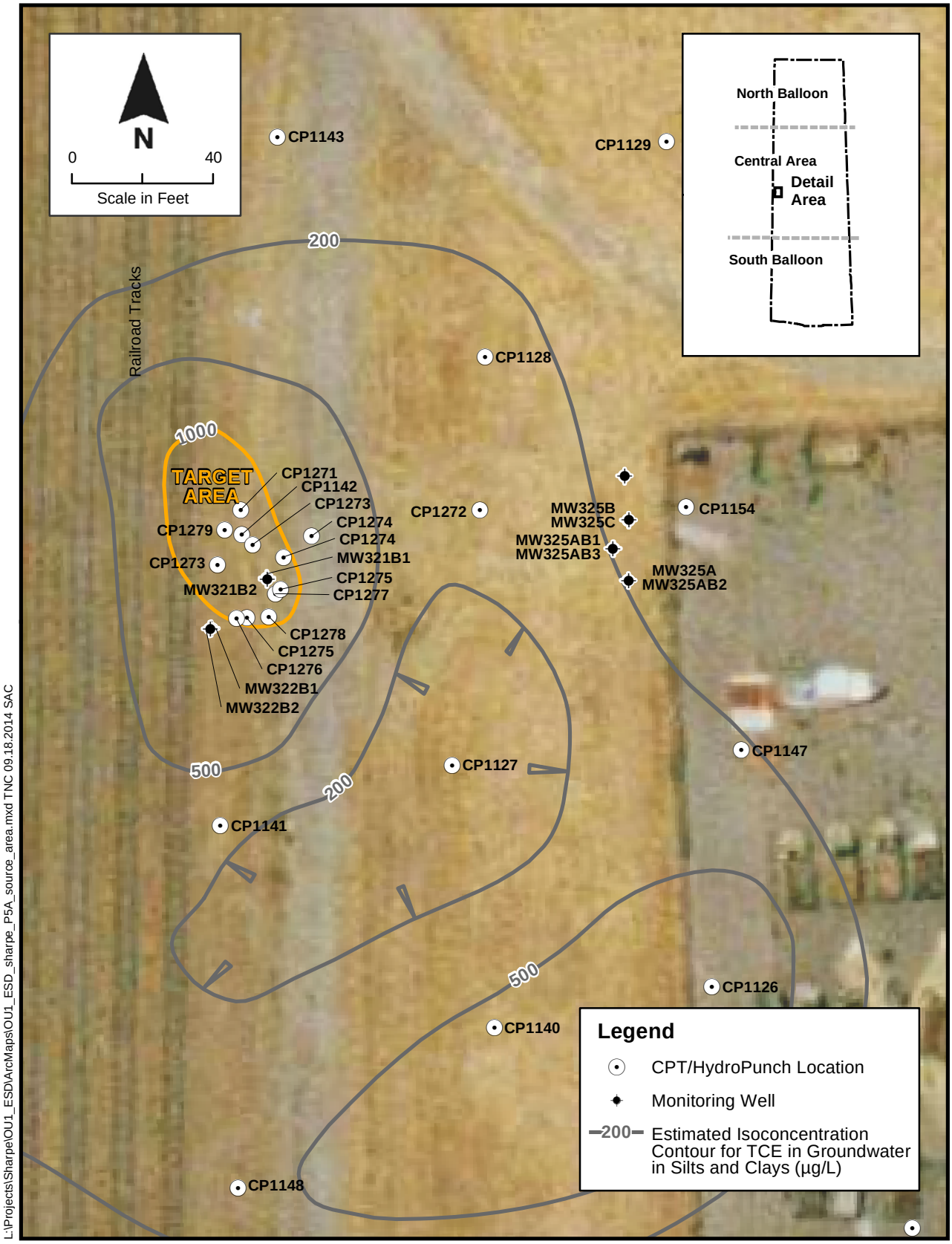

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Figure 4-2. Target Area for In Situ Treatment at Central Area Sharpe Site

construction that will be regularly used as a workspace over or within a 100-foot buffer area around an A Zone plume with contaminant concentrations exceeding Target Groundwater Concentrations; notification and review procedures for proposed changes in land use; and annual reviews to ensure compliance with the LUCs.

The LUCs objectives for OU 1 are:

- To protect human health from vapor intrusion by preventing human exposure to indoor air with VOC concentrations that pose an unacceptable health risk as indicated by the EPA or California screening levels for the industrial indoor air pathway

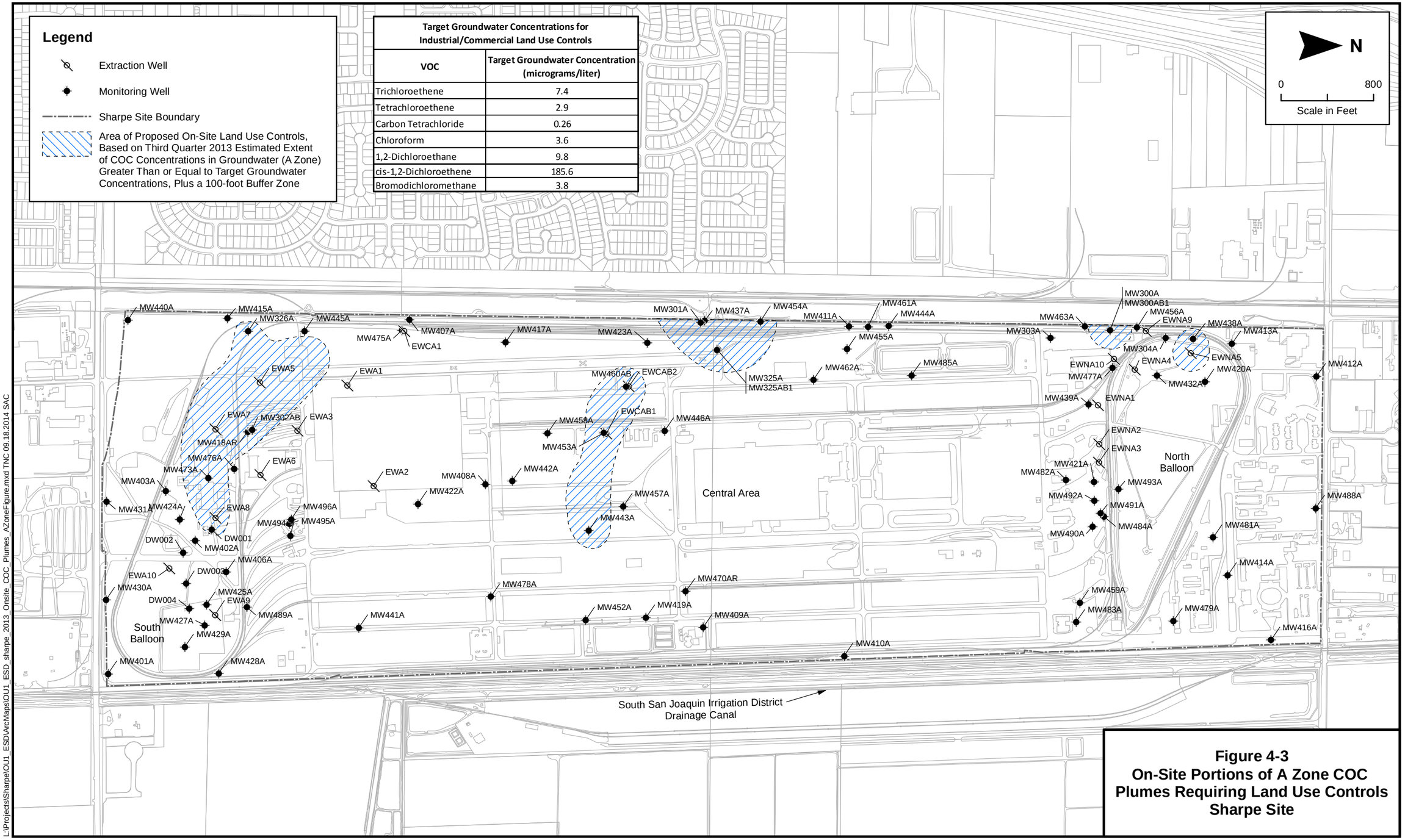
- To prevent access or use of on-depot groundwater with COC concentrations exceeding the ACLs specified in the OU 1 ROD

- Maintain the integrity of any current or future remedial or monitoring system, such as monitoring wells

4.3.2.1 Vapor Intrusion

Land use at the Sharpe Site is currently industrial, and the anticipated future land use for the site is industrial/commercial. Therefore, the areas subject to LUCs for the vapor intrusion pathway were determined based on the assumption of the current and future industrial land use. The LUCs prohibit future land uses such as residential development and on-site company day-care centers. The LUCs preclude unrestricted use and unlimited exposure in areas where COC plumes occur in the A Zone. The LUCs for vapor intrusion are applicable to on-depot areas that are within a 100-foot buffer around an A Zone COC groundwater plume that contains concentrations that equal or exceed Target Groundwater Concentrations (Table 2-4). There are no chemical-specific cleanup levels or ARARs for vapor intrusion, therefore the Target Groundwater Concentrations were derived from risk based calculations as described above in Section 2.3.5.2.

Figure 4-3 depicts the VOC plume areas in the A Zone on the Sharpe Site that equal or exceed Target Groundwater Concentrations plus the 100-foot buffer. The LUCs area will be reviewed annually and will be revised, if necessary, based on new analytical data. If construction of a new structure is considered within the VOC plume plus buffer area, construction must include implementation of appropriate engineering controls, such as ventilation/sub-slab depressurization and/or vapor intrusion barriers, or the structure must be relocated to an area outside of the plume plus its buffer. Building 649 is the only building at the Sharpe Site that overlies a shallow groundwater contaminant plume. A previous investigation determined that there is no unacceptable risk to potential industrial workers at Building 649, as described in Subsection 2.3.5.2. In addition, Building 649 is vacant and there are no plans to occupy the building. In the future, if A Zone groundwater contaminant concentrations increase to greater than the Target Groundwater Concentrations beneath any existing building at the Sharpe Site, then an investigation will be performed to determine if there is a risk from vapor intrusion to potential building occupants. If there is an unacceptable risk from vapor intrusion at any existing building, the Army will propose an appropriate remedial action, which may include, but not be limited to, occupant relocation, building demolition or engineering controls to mitigate vapor intrusion into the building.



Target Groundwater Concentrations for Industrial/Commercial Land Use Controls

VOC	Target Groundwater Concentration (micrograms/liter)
Trichloroethene	7.4
Tetrachloroethene	2.9
Carbon Tetrachloride	0.26
Chloroform	3.6
1,2-Dichloroethane	9.8
cis-1,2-Dichloroethene	185.6
Bromodichloromethane	3.8

Figure 4-3
On-Site Portions of A Zone COC Plumes Requiring Land Use Controls
Sharpe Site

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4.3.2.2 On-Depot Groundwater

Prevent access or use of groundwater in the area shown on Figure 4-4 until ACLs are met. COC plumes have penetrated to greater than 160 feet bgs beneath the site. Operating wells hydraulically may draw COC plumes toward their screens if there is no aquitard between the plume and the well's screen. The LUCs will prohibit the construction of a water supply well within a known COC plume or within a 2,000-foot radius of the plume, unless the well is screened completely beneath the Corcoran-equivalent aquitard that underlies the site. When established, LUCs will also maintain the integrity of any current or future remedial or monitoring systems, such as wells, treatment equipment, conveyance equipment, or discharge locations. The LUCs area will be reviewed annually and will be revised, if necessary, based on new analytical data.

4.3.2.3 The Army will implement, monitor, maintain, and enforce LUCs as follows:

- The Sharpe Site is in transition from DLA operation to Army operation. The Army's equivalent of the DLA real property master plan has not been developed and until it is, the DLA plan will be the repository of the LUCs. DLA's *Defense Distribution Depot San Joaquin Real Property Master Plan Digest* will be modified with an addendum (Appendix A of this ESD) that describes the OU 1 LUCs and includes a map showing the areas of the Sharpe Site with LUCs. The Addendum to the Real Property Master Plan Digest will refer to the DLA Installation Support at San Joaquin Environmental Program Manager if more information is needed. The addendum will be incorporated into the Real Property Master Plan Digest within 90 days of the final signature on this ESD. DLA or the Army will notify EPA, DTSC, and CVWB in advance of any changes to internal procedures that affect LUCs.

- The DLA Installation Support at San Joaquin Environmental Office (and after Sharpe Site operation transition, the equivalent Army organization), will review all proposed construction projects at the Sharpe Site and issue a record of environmental consideration. As part of a standard operating procedure at the Sharpe Site for all proposed construction projects, an Environmental Checklist detailing the specifics of the project, a statement of work, and any other plans must be completed and submitted to the DLA Installation Support at San Joaquin Environmental Office or the Army equivalent organization for its comments and applicable regulatory requirements. If any component of a proposed project is inconsistent with the LUC objective, the Environmental Office will require the applicant to modify the project plans to be consistent with LUCs.

- The Army will address any activity inconsistent with the LUC objective or use restriction, or any other action that may interfere with the effectiveness of LUCs, as soon as practicable. In no case will the process be initiated later than 10 days after the date that the Army becomes aware of the inconsistency.

The Army will notify EPA, DTSC, and CVWB as soon as practicable but no later than 10 days after discovery of any activity inconsistent with the LUC objective or use restriction, or any other action that may interfere with the effectiveness of LUCs. Within 10 days of sending the initial notification related to the inconsistency, the Army will provide notification explaining how the inconsistency was or will be addressed.

- The Army will notify EPA, DTSC, and CVWB at least 45 days in advance of any proposed land use change inconsistent with the LUC objective, any anticipated action that may disrupt or interfere with the effectiveness of LUCs, any action that might alter or negate the need for LUCs, or any anticipated transfer of the property subject to LUCs.

- The Army will maintain administrative controls (e.g., review of proposed construction projects) while LUCs are in place. LUCs will be maintained until concentrations of hazardous substances in groundwater are at such levels to allow for unlimited use and unrestricted exposure. An initial risk assessment was completed for the OU 1 Remedial Investigation/Feasibility Study. That risk assessment, including any additional sampling data obtained during active pumping, will be used to determine if the site is suitable for unlimited use and unrestricted exposure. If it is determined the site is suitable for unlimited use and unrestricted exposure, LUCs will no longer be needed, and a memorandum to the site file will be prepared to terminate LUCs. The Army will not modify or terminate LUCs without approval from EPA, DTSC, and CVWB. The Army will seek prior concurrence before any anticipated action that may disrupt the effectiveness of LUCs or any action that may alter or negate the need for LUCs.

- Monitoring of the environmental use restrictions and controls will be conducted annually by the Army. The monitoring results will be included in the FFA Annual Progress Report or as a section of another environmental report, if appropriate, and provided to EPA, DTSC, and CVWB. The Annual Progress Reports will be used in preparation of the five-year reviews to evaluate the effectiveness of the remedy. The Annual Progress Report, submitted to the regulatory agencies by the Army, will evaluate the status of LUCs and how any LUC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated in the deed(s) if a parcel including COC contamination was sold or transferred, whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed to such restrictions and controls.

- The Army will notify EPA, DTSC, and CVWB at least 6 months prior to any transfer or sale of any property subject to LUCs so that the agencies can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the Army to notify the agencies at least 6 months prior to any transfer or sale, then the Army will notify the agencies as soon as possible but no later than 60 days prior to transfer or sale of any property subject to LUCs. In addition to these land transfer notice and discussion provisions, the Army will provide the agencies with similar notice, within the same timeframes, for federal-to-federal transfers of property. The Army will provide a copy of the executed deed or transfer assembly to the agencies.

The Army is responsible for implementing, monitoring, maintaining, reporting on, and enforcing the identified LUCs. Although the Army may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Army will retain ultimate responsibility for remedy integrity.

Land Use Changes. The following restrictions will apply in the event that land use changes are considered:

Deed Restrictions: Each transfer of fee title from the United States will include a CERCLA 120(h)(3) covenant which will have a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives. The environmental restrictions are included in a section of the CERCLA 120(h)(3) covenant that the United States is required to include in the deed for any property that has had hazardous substances stored for 1 year or more, known to have been released or disposed of on the property.

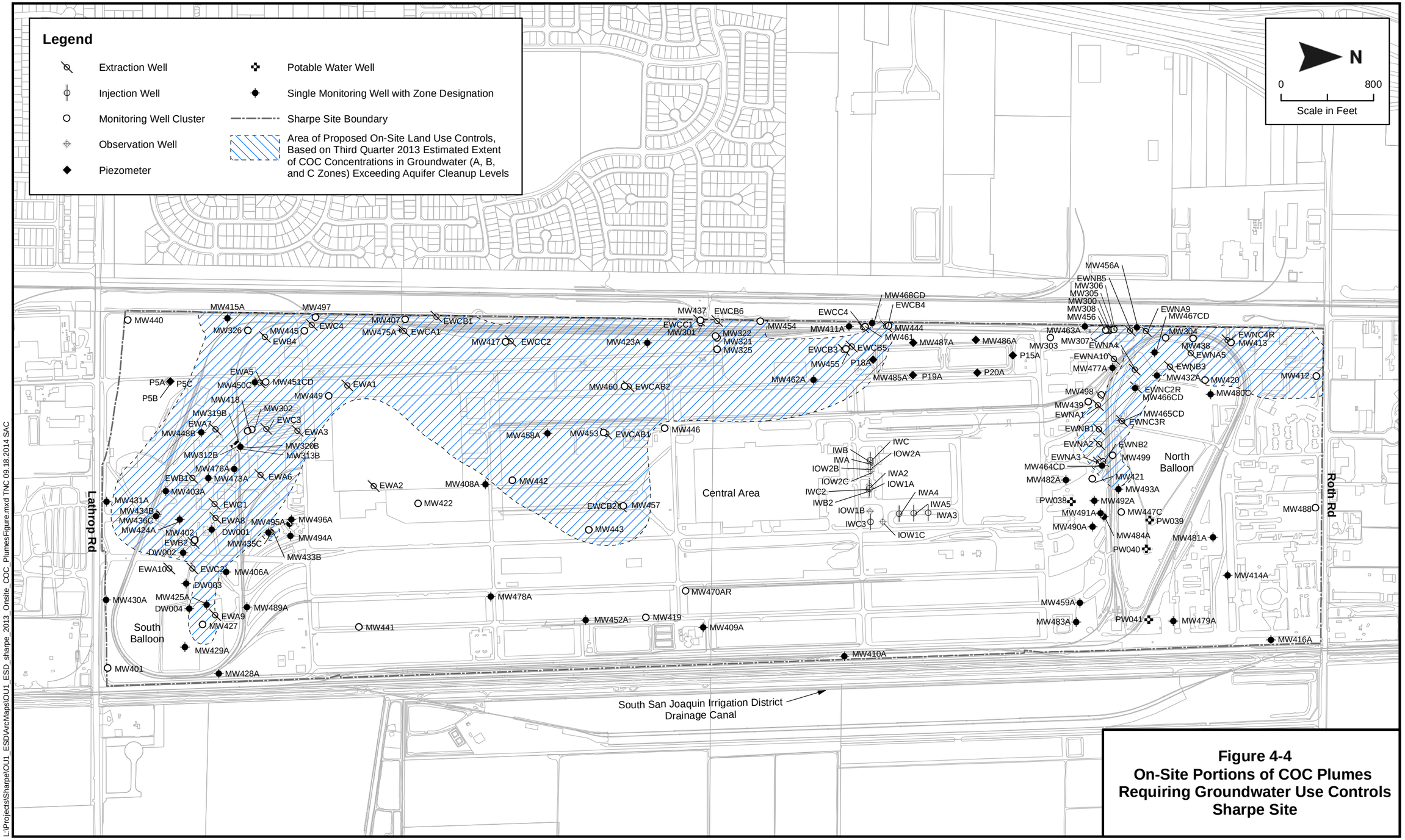

Figure 4-4
On-Site Portions of COC Plumes Requiring Groundwater Use Controls
Sharpe Site

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Each deed will also contain a reservation of access to the property for Army, EPA, CVWB, and DTSC, and their respective officials, agent, employees, contractors, and subcontractors for purposes consistent with the Army Installation Restoration Program or the FFA. The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by Army.

Lease Restrictions: During the time between the adoption of this ESD and deeding of the property, equivalent restrictions are being implemented by lease terms, which are no less restrictive than the use restrictions and controls described above in this ESD. These lease terms shall remain in place until the property is transferred by deed, at which time they will be superseded by the LUCs described in this ESD.

Notice: Concurrent with the transfer of fee title from the Army to transferee, information regarding the environmental use restrictions and controls will be communicated in writing to the property owners and to appropriate state and local agencies to ensure such agencies can factor such conditions into their oversight and decision-making activities regarding the property.

Any future land use changes for property associated with the COC plumes requires site characterization (prior data may be used) and the appropriate National Environmental Policy Act document in accordance with the applicable policies of the Army proposing the action (as the lead agency) and EPA regulations in place at the time of the change. In general, a change in land use must be evaluated to ensure that contamination left in place at these sites will not pose an unacceptable risk to human health or the environment under the new exposure scenario.

Nonclosure transfers of United States Department of Defense (DoD) property are guided by community input on land use, as provided for by the local government land use planning agency. In the event that no community land use plan is available at the time of property transfer, DoD will consider a range of reasonably anticipated future land uses in the transfer process. These assumptions allow the DoD (in conjunction with regulatory agencies) to determine the need for LUCs. Environmental process requirements and restrictions (including LUCs) at installations subject to transfer are described in United States §Code Title 42 9620(h) [CERCLA §120(h)]. This statute establishes hazardous substance notification and deed content requirements. Code of Federal Regulations Title 40 Part 373 establishes the requirements for reporting hazardous substance activity when transferring federal real property. DoD policy, as set forth in the Base Redevelopment and Realignment Manual (DoD, 2006), currently requires an environmental condition of property and a finding of suitability to transfer prior to the transfer of properties subject to the NCP. In accordance with California Code of Regulations Title 22 §67391.1(e)(1), DTSC cannot consider property owned by the federal government to be suitable for transfer to nonfederal entities where hazardous wastes/constituents/ substances remain at levels not suitable for unrestricted land use, unless appropriate land use covenants have been executed and recorded with the county of record.

If the depot is closed, the Army will implement the appropriate regulatory process and actions (e.g., legally enforceable restrictions) to ensure continued protection of human health and the environment. In addition, notification of appropriate regulatory agencies will occur at the initiation of the process.

4.4 Cost and Performance Comparison

The cost to implement the in situ treatment remedy is approximately $1.5 million ($900,000 at the South Balloon Area and $600,000 at the Central Area). The estimated total undiscounted life-cycle cost of the original groundwater remedy is $152 million. Groundwater modeling results lead to estimates of $10 million in savings from implementing the in situ treatment remedy by reducing the total resources necessary to clean up the groundwater.

Groundwater modeling currently projects more than 100 years to complete the on-going pump and treat remedial action. Assuming a 100-year remedy implementation period, the estimated range of undiscounted life-cycle cost for continuing extraction and treatment and adding the new remedy components is $142 million to $143.4 million. Estimated implementation costs occur in a range because they will vary with the type of amendment and emplacement method chosen for in situ mass removal. The highest estimated cost in the range is less than the estimated undiscounted life-cycle cost of continuing the current pump-and-treat remediation system, $152 million over the same 100-year implementation period. In terms of remedy performance, groundwater modeling results indicate that implementation of the in situ treatment remedy described in this ESD will reduce the overall cost to clean up the groundwater at the Sharpe Site. Cost savings will result from an accelerated cleanup time in the areas where the in situ treatment remedy is administered and will result in a reduction in long-term operation and maintenance activities such as groundwater monitoring and treatment. Furthermore, implementation of the remedy will increase long-term protectiveness for groundwater.

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5.0 SUPPORT AGENCY COMMENTS

The Army, EPA, and State of California concur that the OU 1 remedy for the Sharpe Site may be modified with the significant differences identified in this ESD.

Comments received from EPA and the State of California regulatory agencies on the draft and draft final ESD are addressed and incorporated, as warranted, in this final ESD. Appendix B includes responses to comments received.

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6.0 STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP, the selected remedy must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), be cost effective, and utilize permanent solutions and alternative treatment technologies 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 off-site disposal of untreated wastes. The following subsections discuss how the selected remedy compares to these statutory requirements.

6.1 Protection of Human Health and the Environment

Human receptor exposure to groundwater contaminants at the Sharpe Site will be limited by implementation of LUCs on groundwater use and in areas above A Zone groundwater plumes where buildings may be constructed and occupied.

Beyond the boundaries of the Sharpe Site, monitoring of water quality and the implementation of the *Off-Site Potable Well Contingency Plan* will protect human health. The Army will continue implementation of the *DDJC-Sharpe Off-Depot Potable Well Contingency Plan* (URS, 2010e) for off-depot potable wells. The Army will confer and cooperate with the City of Lathrop and San Joaquin County to implement institutional controls (e.g., in the form of county or city ordinances incorporated into the permitting process) to restrict/prevent off-depot property owners from installing new residential supply wells north or west of the depot boundary if there is a chance of human exposure to impacted groundwater (i.e., by only allowing wells that are to be screened below the Corcoran-equivalent E-Clay, which has been identified at depths of approximately 240 feet bgs). The cooperation with the City of Lathrop and County of San Joaquin is not a remedy component but an interim measure taken as beneficial uses of groundwater are restored.

The selected remedy will also reduce health risks by removing COC mass from the groundwater to the extent technically and economically feasible. Implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts. In September 2011, EPA revised its TCE non-cancer toxicity values. In November 2011, the non-cancer reassessment resulted in a new RSL value of 2.6 µg/L for domestic use of tap water (i.e., drinking, washing), which is less than the 1993 OU 1 ROD-specified ACL of 5 µg/L. DLA will evaluate the protectiveness of this ACL in the *Third Five-Year Review Report* (URS, 2013), which is currently being prepared.

6.2 Compliance with ARARs

Remedial actions selected under CERCLA must comply with ARARs under federal environmental laws or, where more stringent than the federal requirements, state environmental or facility siting laws, unless ARARs are waived. The selected alternative provides substantive compliance with the federal and California ARARs cited in the OU 1 ROD (ESE, 1993).

6.2.1 ARARs for In Situ Treatment

The new in situ component of the remedy includes actions not covered by the ARARs in the OU 1 ROD (e.g., injection of amendments into the saturated zone); therefore, the pertinent California regulation to be added to the ARARs is CVWB Order R5-2008-0149 regarding waste discharge requirements (WDRs) for in situ groundwater remediation. This order is applicable pursuant to California Water Code Section 13263 Subdivision (i). Before implementation of any in situ injection, i.e., when the remedial action plan is submitted for review, the Army will submit a list of WDRs that are in substantive compliance with

CVWB Order R5-2008-0149. The selected remedy components will comply with the chemical-specific, action-specific, and location-specific ARARs.

No ARAR waivers are being sought for the in situ treatment remedy.

6.2.2 Risk-Based Target Groundwater Concentrations for Vapor Intrusion

LUCs will be implemented for protection of human health from potential exposure to contaminated indoor air caused by vapor intrusion. There is currently no unacceptable risk from vapor intrusion because no occupied buildings overlie the A Zone groundwater contaminant plume. However, to protect against potential exposure in the future, A Zone groundwater will be monitored until ACLs are attained to ensure that contaminant concentrations do not exceed levels that could result in unacceptable risk of exposure from vapor intrusion in current or future buildings. In addition, this ESD includes LUCs that restrict construction of new buildings over contaminated groundwater. There are no chemical-specific cleanup levels or ARARs for vapor intrusion, and therefore, LUCs will be implemented above shallow groundwater with contaminant concentrations that exceed Target Groundwater Concentrations (Table 2-4), which were derived from risk-based calculations as described in Section 2.3.5.2.

6.3 Cost Effectiveness

The cost to implement the in situ treatment remedy is approximately $1.5 million ($900,000 at the South Balloon Area and $600,000 at the Central Area). The estimated total undiscounted life-cycle cost of the original groundwater remedy is $152 million. The savings from implementing the in situ treatment remedy is estimated to be $10 million by reducing the total resources necessary to clean up the groundwater. Groundwater modeling currently projects more than 100 years to complete the on-going pump and treat remedial action. Modeling shows that after in situ treatment is implemented the extraction and treatment operations can be optimized, resulting in a cost savings of $10 million for the overall groundwater cleanup. Cost savings will result from an accelerated cleanup time in the areas where the in situ treatment remedy is administered and will result in a reduction in operation and maintenance activities such as groundwater monitoring and treatment.

The selected remedy is cost effective and represents a reasonable value for the money required to implement the remedy. In making this determination, the following definition was used: “A remedy shall be cost-effective if its costs are proportional to its overall effectiveness.” (NCP §300.430(f)(1)(ii)(D)). The determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedy was determined to be proportional to its costs; hence, the selected remedy represents a reasonable value for the expense to be invested in its implementation.

6.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The selected remedy maximizes use of permanent solutions and treatment technologies in a practicable manner. Of those alternatives that are protective of human health and the environment and that comply with ARARs, the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria. It also considers the statutory preference for treatment as a principal element with a bias against off-site treatment and disposal.

The selected remedy satisfies the criteria for long-term effectiveness by removing COC mass from groundwater and implementing LUCs. The selected remedy does not present short-term risks different from the other treatment alternative. There are no special implementability issues that set the selected remedy apart from any of the other alternatives evaluated.

6.5 Preference for Treatment as a Principal Element

By incorporating in situ and ex situ treatments as a component of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

6.6 Five-Year Review Requirements

This remedy will result in COC concentrations remaining above those which allow for unlimited use and unrestricted exposure. As long as COC concentrations remain above those concentrations, a statutory review will be conducted within five years after initiation of the remedial action to evaluate whether the remedy is protective of human health and the environment.

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7.0 PUBLIC PARTICIPATION COMPLIANCE

The DLA will publish a notice of availability and a brief description of this ESD in a major local newspaper in compliance with NCP Section300.435(c)(2)(i)(B).

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8.0 SIGNATURE PAGE

DLA and EPA jointly select the remedy enhancements described in Section 4 of this ESD for Operable Unit 1 of the Sharpe Site. This ESD may be executed and delivered in any number of counterparts, each of which when executed and delivered shall be deemed to be an original, but all such counterparts shall together constitute one and the same document. Each of the respective parties may sign this ESD in counterparts.

24 SEP 14

JONATHAN E. MATHEWS DATE
Site Director
DLA Installation Support at San Joaquin

Phillip R. Dawson Sept 26, 2014

PHILLIP R. DAWSON DATE
Staff Director
DLA Installation Support Environmental Management

ANGELES HERRERA DATE
Assistant Director
Federal Facilities and Site Cleanup Branch
Region 9
United States Environmental Protection Agency

ALLEN WOLFENDEN DATE
Performance Manager
Brownfields and Environmental Restoration
Sacramento Cleanup Branch
Department of Toxic Substances Control
California Environmental Protection Agency

DUNCAN AUSTIN DATE
Site Cleanup Program Manager
Central Valley Regional Water Quality Control Board
California Environmental Protection Agency

8.0 SIGNATURE PAGE

DLA and EPA jointly select the remedy enhancements described in Section 4 of this Explanation of Significant Differences for Operable Unit 1 of the Sharpe Site.

Jonathan Mathews — Date
Site Director
DLA Installation Support at San Joaquin
Defense Logistics Agency

Phillip Dawson — Date
Staff Director
DLA Installation Support Environmental Management
Defense Logistics Agency

09-30-14
Angeles Herrera — Date
Assistant Director
Federal Facilities and Site Cleanup Branch
Region 9
United States Environmental Protection Agency

Allen Wolfenden — Date
Performance Manager
Brownfields and Environmental Restoration
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Department of Toxic Substances Control
California Environmental Protection Agency

Duncan Austin — Date
Site Cleanup Program Manager
Central Valley Regional Water Quality Control Board
California Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street

San Francisco, CA 94105

SEP 30 2014.

Maurice Benson
Defense Logistics Agency
Defense Distribution Depot San Joaquin
P.O. Box 960001
Stockton, CA 95296-0320

Re: EPA Approval of Final DDJC-Sharpe OU1 Explanation of Significant Differences

Dear Mr. Benson:

Pursuant to the Federal Facilities Agreement for the Defense Distribution Depot San Joaquin – Sharpe Site EPA has reviewed and approves the Defense Logistics Agency's Final Explanation of Significant Differences to the Record of Decision for Operable Unit 1.

Please contact John Lucey of my staff at (415) 972-3145 if you have any questions.

We look forward to working with you as you implement this ESD.

Sincerely,

Angeles Herrera
Assistant Director
Federal Facilities and Site Cleanup Branch

Encl.

cc: Allen Wolfenden DTSC
Duncan Austin CVRWQCB

8.0 SIGNATURE PAGE

DLA and EPA jointly select the remedy enhancements described in Section 4 of this Explanation of Significant Differences for Operable Unit 1 of the Sharpe Site.

DLA Signed Separate Signature Page

Jonathan Mathews — Date
Site Director
DLA Installation Support at San Joaquin
Defense Logistics Agency

DLA Signed Separate Signature Page

Phillip Dawson — Date
Staff Director
DLA Installation Support Environmental Management
Defense Logistics Agency

EPA Signed Separate Signature Page

Angeles Herrera — Date
Assistant Director
Federal Facilities and Site Cleanup Branch
Region 9
United States Environmental Protection Agency

4/25/14
Allen Wolfenden — Date
Branch Chief
Legacy Landfills Office
Brownfields and Environmental Restoration Program
Department of Toxic Substances Control
California Environmental Protection Agency

4/30/14
Duncan Austin — Date
Site Cleanup Program Manager
Central Valley Regional Water Quality Control Board
California Environmental Protection Agency

9.0 REFERENCES

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APPENDIX A

Addendum to the Real Property Master Plan Digest

ADDENDUM TO THE REAL PROPERTY MASTER PLAN DIGEST

This addendum to the *Defense Distribution Depot San Joaquin Real Property Master Plan Digest* (formerly Installation Master Plan) describes land use controls (LUCs) for Operable Unit (OU) 1 (groundwater) at the Sharpe Site that are being added to the OU 1 remedial action through the *Explanation of Significant Differences to the Record of Decision, Operable Unit 1* (URS Group, Inc., 2014). LUCs are instruments, such as administrative, legal, engineered, or physical barriers (such as fences and security guards) that help to minimize the potential for exposure to contamination or to protect the integrity of a response action (United States Environmental Protection Agency [EPA], 2012a). At the Sharpe Site, the objectives of the LUCs for OU 1 are to protect human health by preventing human exposure to indoor air with volatile organic compound (VOC) concentrations that pose an unacceptable health risk and to prevent exposure to groundwater with VOC contaminant of concern (COC) concentrations exceeding the OU 1 aquifer cleanup levels. LUCs are necessary to prohibit the installation of water supply wells with screen intervals in the on-site portions of the OU 1 contaminant plumes at the Sharpe Site, to protect workers from potential exposure to contaminated indoor air, and to protect infrastructure associated with the OU 1 groundwater monitoring, extraction, treatment, and disposal system.

Figure 1 shows the on-depot portions of the composite (A, B, and C Zones) OU 1 contaminant plumes where water supply well restrictions are required because concentrations of VOC COCs are greater than drinking water standards. Figure 2 shows the on-depot portions of the shallow (A Zone) OU 1 contaminant plumes that contain concentrations that equal or exceed commercial/industrial Target Groundwater Concentrations (see table on Figure 2) plus a 100-foot buffer where LUCs are required because of the potential risk associated with inhalation of VOCs via the vapor intrusion pathway. The Target Groundwater Concentrations were developed in accordance with the *Vapor Intrusion Screening Level (VISL) Calculator User's Guide* (EPA, 2012b). The plumes shown on both figures are based on data collected through the third quarter of 2013. In the future, if groundwater concentrations increase to greater than the Target Groundwater Concentrations beneath any existing building, then an investigation will be performed to determine whether there is a risk from vapor intrusion to potential building occupants. If there is unacceptable risk from vapor intrusion at any existing building, the Army will propose an appropriate remedial action, which may include, but not be limited to, occupant relocation, building demolition or engineering controls to mitigate vapor intrusion into the building.

If additional information is needed (e.g., current contaminant plume maps), the Defense Logistics Agency (DLA) Installation Support at San Joaquin Environmental Office Program Manager should be contacted.

The Sharpe Site is in transition from DLA operation to Army operation. The Army's equivalent of the DLA real property master plan has not been developed and until it is, the DLA plan will be the repository of the LUCs. DLA's *Defense Distribution Depot San Joaquin Real Property Master Plan Digest* will be modified with an addendum (Appendix A of this ESD) that describes the OU 1 LUCs and includes a map showing the areas of the Sharpe Site with LUCs. The Addendum to the Real Property Master Plan Digest will refer to the DLA Installation Support at San Joaquin Environmental Program Manager if more information is needed. The addendum will be incorporated into the Real Property Master Plan Digest within 90 days of the final signature on this ESD. DLA or the Army will notify EPA, DTSC, and CVWB in advance of any changes to internal procedures that affect LUCs.

IMPLEMENTATION REQUIREMENTS

This addendum will be incorporated into the *Defense Distribution Depot San Joaquin Real Property Master Plan Digest*. In addition, the DLA Installation Support at San Joaquin Environmental Office or the Army's equivalent will review all proposed construction projects, evaluate the proposed project with respect to the land use restriction, and issue a record of environmental consideration with the findings of the evaluation. As part of a standard operating procedure at the Sharpe Site for all proposed construction

projects, an Environmental Checklist detailing the specifics of the project, a statement of work, and any other plans must be completed and submitted to the DLA Installation Support at San Joaquin Environmental Office, or Army equivalent for its comments and applicable regulatory requirements. If any component of a proposed project is inconsistent with the LUC objective, the Environmental Office will require the applicant to modify the project plans to be consistent with the LUCs.

The Army will address any activity that is inconsistent with the LUC objective or use restriction, or any other action that may interfere with the effectiveness of the LUCs, as soon as practicable. In no case will the process be initiated later than 10 days after the date the Army becomes aware of the inconsistency.

AGENCY NOTIFICATION REQUIREMENTS

The Army is required to notify the regulatory agencies (EPA, California Department of Toxic Substances Control [DTSC], and the California Central Valley Regional Water Quality Control Board [CVWB]) regarding discovery of any activity or proposal for a land use change that is inconsistent with the LUCs or transfer or sale of any property subject to the LUCs. Notification requirements include the following:

- The Army will notify EPA, DTSC, and CVWB as soon as practicable, but no later than 10 days after discovery of any activity that is inconsistent with the LUC objective or use restriction, or any other action that may interfere with the effectiveness of the LUCs. Within 10 days of sending the initial notification related to the inconsistency, the Army will provide notification explaining how the inconsistency was or will be addressed.

- The Army will notify EPA, DTSC, and CVWB at least 45 days in advance of any proposed land use change that is inconsistent with the LUC objective, any anticipated action that may disrupt or interfere with the effectiveness of the LUCs, any action that might alter or negate the need for the LUCs, or any anticipated transfer of the property subject to the LUCs.

- The Army will notify EPA, DTSC, and CVWB at least six months prior to any transfer or sale of any property subject to the LUCs so that the agencies can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for DLA to notify the agencies at least six months prior to any transfer or sale, then DLA will notify the agencies as soon as possible but no later than 60 days prior to transfer or sale of any property subject to LUCs. In addition to these land transfer notice and discussion provisions, DLA will provide the agencies with similar notice, within the same time-frames, for federal-to-federal transfers of property. The Army will provide a copy of the executed deed or transfer assembly to the agencies.

LAND USE CONTROL MAINTENANCE REQUIREMENTS

The Army is required to maintain existing administrative controls (e.g., review of proposed construction projects) while the LUCs are in place. LUCs will be maintained until concentrations of hazardous substances in groundwater are at such levels that allow for unlimited use and unrestricted exposure. The Army will not modify or terminate the LUCs without approval from EPA, DTSC, and CVWB. The Army will seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for the LUCs.

LAND USE CONTROL MONITORING AND REPORTING REQUIREMENTS

Monitoring of the environmental use restrictions and controls will be conducted annually by the Army. The monitoring results will be included in the Federal Facility Agreement (FFA) Annual Progress Report or as a section of another environmental report, if appropriate, and provided to EPA, DTSC, and CVWB. The Annual Progress Reports will be used in preparation of five-year reviews to evaluate the

effectiveness of the remedy. The Annual Progress Report, submitted to the regulatory agencies by the Army, will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated in the deed(s) if a parcel including COC contamination was sold or transferred, whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed to such restrictions and controls.

CHANGES IN LAND USE

The following restrictions will apply in the event that land use changes are considered:

Deed Restrictions: Each transfer of fee title from the United States will include a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 120(h)(3) covenant which will have a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives. The environmental restrictions are included in a section of the CERCLA 120(h)(3) covenant that the United States is required to include in the deed for any property that has had hazardous substances stored for one year or more, known to have been released or disposed of on the property. Each deed will also contain a reservation of access to the property for the Army, EPA, DTSC, and CVWB, and their respective officials, agent, employees, contractors, and subcontractors for purposes consistent with the Army Installation Restoration Program or the FFA. The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the Army.

Lease Restrictions: Prior to deeding of the property, equivalent restrictions are being implemented by lease terms, which are no less restrictive than the use restrictions and controls described above. These lease terms shall remain in place until the property is transferred by deed, at which time they will be superseded by the LUCs described in this addendum.

Notice: Concurrent with the transfer of fee title from the Army to transferee, information regarding the environmental use restrictions and controls will be communicated in writing to the property owners and to appropriate state and local agencies to ensure such agencies can factor such conditions into their oversight and decision-making activities regarding the property.

Any future land use change for property associated with the on-site portions of the OU 1 contaminant plumes requires site characterization (prior data may be used) and the appropriate National Environmental Policy Act document in accordance with the applicable policies of the U.S. Department of Defense (DoD) component proposing the action (as the lead agency) and EPA regulations in place at the time of the change. In general, a change in land use must be evaluated to ensure that contamination left in place will not pose an unacceptable risk to human health or the environment under the new exposure scenario.

Nonclosure transfers of DoD property are guided by community input on land use, as provided for by the local government land use planning agency. In the event that no community land use plan is available at the time of property transfer, DoD will consider a range of reasonably anticipated future land uses in the transfer process. These assumptions allow the DoD (in conjunction with regulatory agencies) to determine the need for the LUCs. Environmental process requirements and restrictions (including LUCs) at installations subject to transfer are described in Title 42 United States Code §9620(h) (Comprehensive Environmental Response, Compensation, and Liability Act §120(h)). This statute establishes hazardous substance notification and deed content requirements. Title 40 Code of Federal Regulations §373 et seq. establishes the regulatory notification and reporting requirements. DoD policy, as set forth in the *Base Redevelopment and Realignment Manual*, currently requires documenting the environmental condition of the property and a finding of suitability to transfer prior to the transfer of properties subject to the National Oil and Hazardous Substances Pollution Contingency Plan. In accordance with Title 22 California Code of Regulations §67391.1(e)(1), DTSC cannot consider property owned by the federal

government to be suitable for transfer to nonfederal entities where hazardous wastes/constituents/ substances remain at levels that are not suitable for unrestricted land use, unless appropriate land use covenants have been executed and recorded with the county of record.

If the depot is closed, the Army will implement the appropriate regulatory process and actions (e.g., legally enforceable restrictions) to ensure continued protection of human health and the environment. In addition, notification of appropriate regulatory agencies will occur at the initiation of the process.

LAND USE CONTROL SITES

The portions of the OU 1 contaminant plumes (based on data collected through third quarter of 2013) requiring LUCs are shown on Figures 1 and 2. The areas with LUCs will be reviewed annually and will be revised, if necessary, based on new analytical data. Contact the Sharpe Site Environmental Office Program Manager for the most recent maps showing the portions of the plumes requiring LUCs.

Purpose of Controls:

- Prevent exposure to on-depot groundwater and indoor air contaminated with VOCs.

Land Use Control Requirements:

- Prohibit construction of a water supply well within a known COC plume or within a 2,000-foot radius of the plume, unless the well is screened completely beneath the Corcoran-equivalent aquitard that underlies the site.

- Protect any current or future infrastructure associated with OU 1 groundwater monitoring, extraction, treatment, and disposal systems (any damage to infrastructure must be promptly repaired).

- Implement engineering controls, such as ventilation/sub-slab depressurization and/or vapor intrusion barriers, or relocate any structure to be regularly used as a workspace that is proposed for construction within a 100-foot buffer around an A Zone COC groundwater plume that contains concentrations greater than or equal to Target Groundwater Concentrations.

- Implement notification procedure for construction activities or land use changes.

- Maintain administrative controls (i.e., Real Property Master Plan Digest addendum and notification procedures).

- Perform annual reviews to ensure compliance with instituted controls and to correct any deficiencies in the notification procedure.

- Follow defined procedures in the event of a change in land use.

Actions to Date:

- Groundwater cleanup activities have been ongoing since 1987 and include groundwater extraction and treatment by air-stripping. Treated groundwater is discharged to on-depot percolation ponds.

Contaminants of Concern:

- Trichloroethene, tetrachloroethene, carbon tetrachloride, cis-1,2-dichloroethene, chloroform, 1,2-dichloroethane, bromoform, bromodichloromethane, dibromochloromethane, 1,1-dichloroethene, trans-1,2-dichloroethene, 1,2-dichloropropane, methylene chloride, and vinyl chloride.

Site Characteristics:

Past Site Activities

- Past use and waste disposal practices have resulted in groundwater contamination beneath the Sharpe Site.

Current Activities

- The distribution of contaminants in groundwater is assessed each year by the Well Monitoring Program and reported in the FFA Annual Report.

Conclusions:

- The selected remedy for OU 1 is continued groundwater extraction and treatment with discharge to on-depot percolation ponds, in situ mass removal, and LUCs to maintain protectiveness while remedial action objectives are being achieved.

- Groundwater extraction and treatment is underway, and in situ mass removal and LUCs will be implemented upon finalization of the *Explanation of Significant Differences to the Record of Decision, Operable Unit 1* (URS Group, Inc., 2014).

References:

United States Environmental Protection Agency (EPA), 2012a. *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites.* OSWER 9355.0-89, EPA-540-R-09-001. December.

EPA, 2012b. *Vapor Intrusion Screening Level (VISL) Calculator User's Guide*. Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation, Washington, D.C. December.

URS Group, Inc., 2014. *Explanation of Significant Differences to the Record of Decision, Operable Unit 1, Defense Distribution Depot San Joaquin-Sharpe Site*. Final. September.

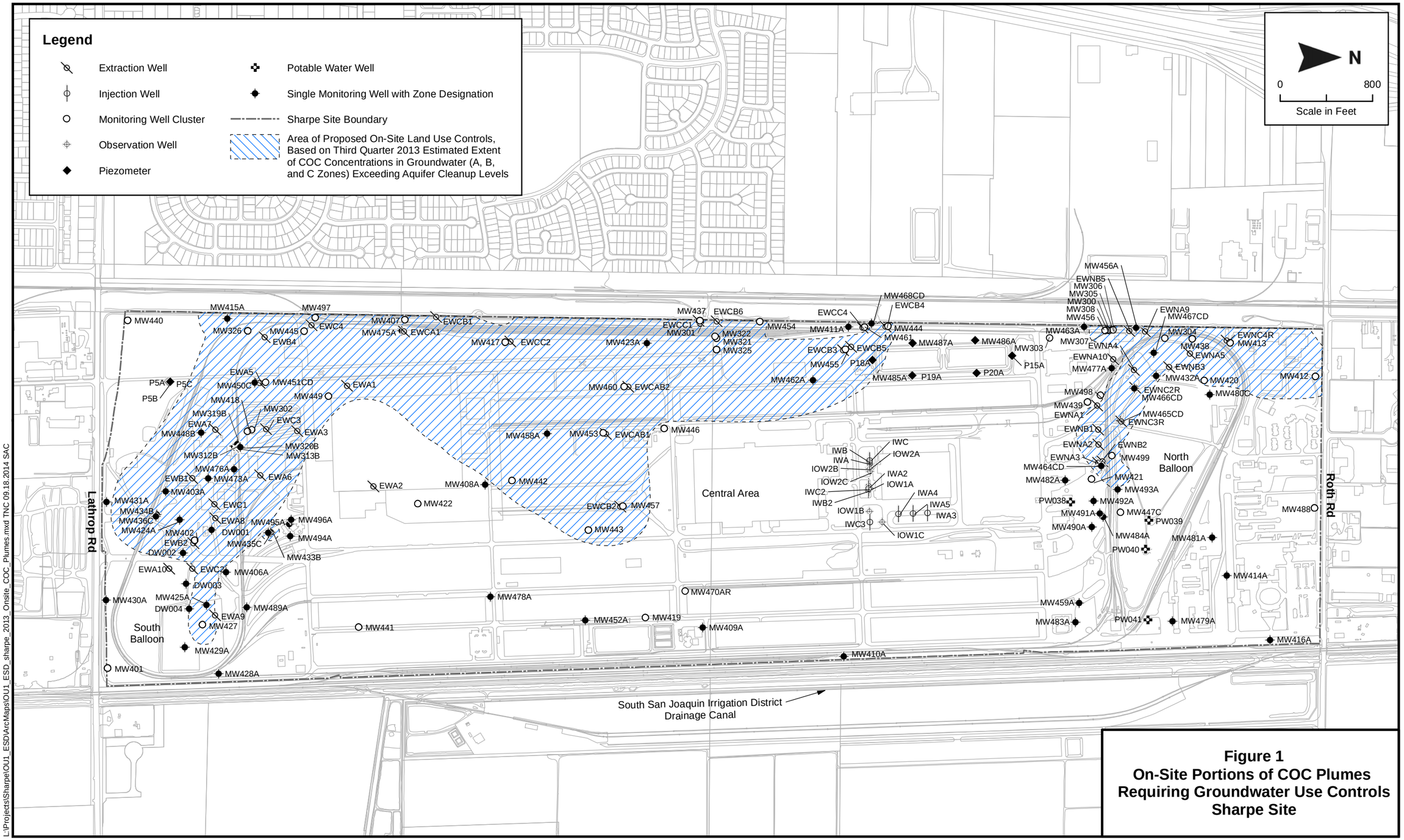

Figure 1
On-Site Portions of COC Plumes Requiring Groundwater Use Controls
Sharpe Site

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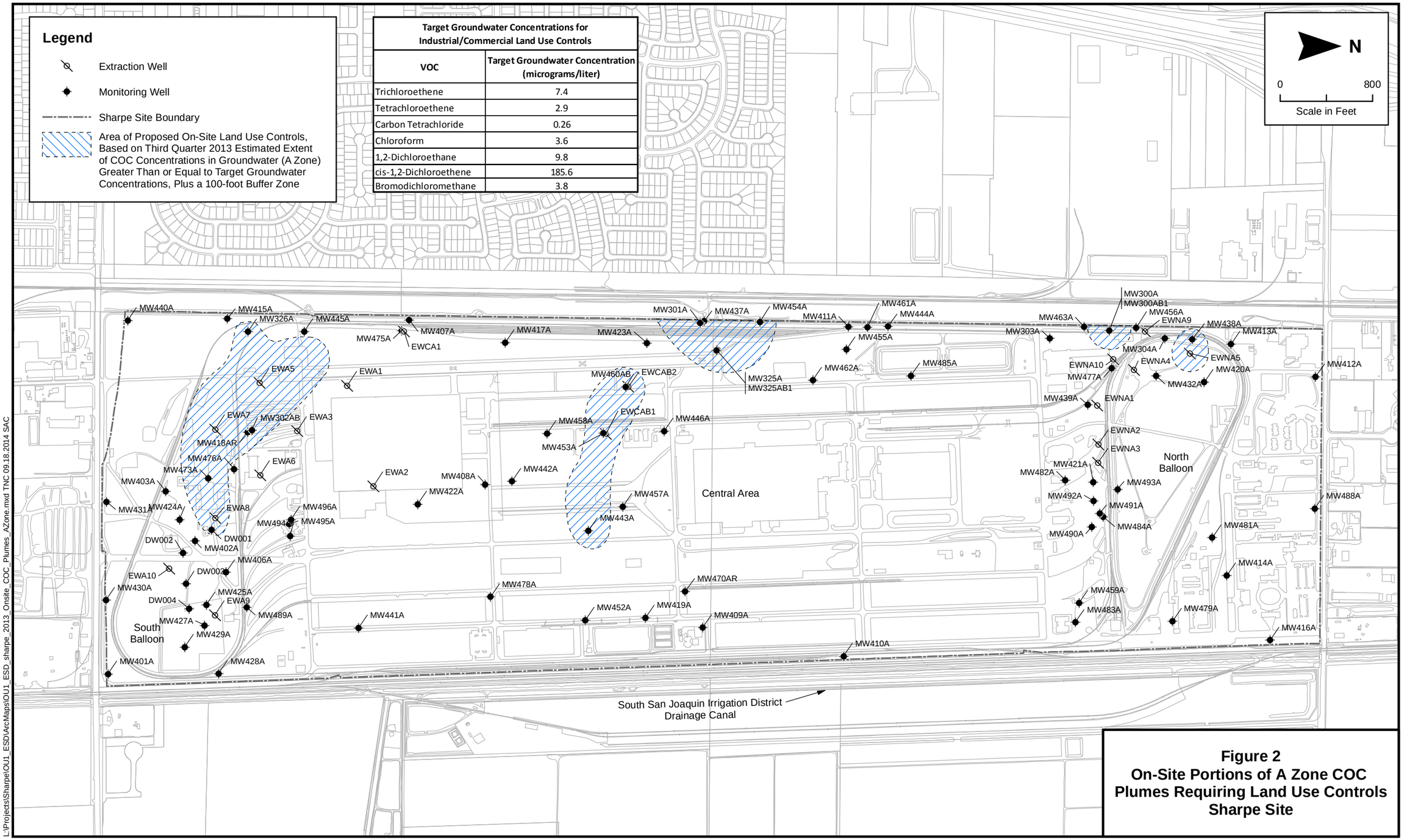

Target Groundwater Concentrations for Industrial/Commercial Land Use Controls	
VOC	Target Groundwater Concentration (micrograms/liter)
Trichloroethene	7.4
Tetrachloroethene	2.9
Carbon Tetrachloride	0.26
Chloroform	3.6
1,2-Dichloroethane	9.8
cis-1,2-Dichloroethene	185.6
Bromodichloromethane	3.8

Figure 2
On-Site Portions of A Zone COC Plumes Requiring Land Use Controls
Sharpe Site

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APPENDIX B

Responses to Comments

UNITED STATES ARMY CORPS OF ENGINEERS (USACE) – TULSA DISTRICT

DESIGN REVIEW COMMENTS Project: Draft Explanation of Significant Differences to the Record of Decision, Operable Unit 1, Sharpe Site

☒ SITE DEV & GEO	☐ MECHANICAL	☐ SAFETY	☐ SYSTEMS ENG	REVIEW Draft
☐ ENVIR PROT & UTIL	☐ MFG TECHNOLOGY	☐ ADV TECH	☐ VALUE ENG	DATE 13 February 2013
☐ ARCHITECTURAL	☐ ELECTRICAL	☐ ESTIMATING	☐ OTHER	NAME James Brownell, CVWB
☐ STRUCTURAL	☐ INST & CONTROLS	☐ SPECIFICATIONS		

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.		The ESD indicates that the amendments could mobilize inorganic soil constituents, such as hexavalent chromium (chromium VI) or selenium, into groundwater. Also, it indicates that concentrations of mobilized constituents would subsequently need to be lowered to less than their respective maximum contaminant levels (MCLs). However, the Central Valley Water Board will require mobilized constituents to be returned to background concentrations or, if not feasible, water quality objectives that are protective of groundwater beneficial uses. For example, the in situ injection of $KMnO_4$ or other strongly oxidizing agents into groundwater have the potential, in some geologic settings, to convert naturally-occurring chromium to soluble chromium VI. Currently there is no MCL for chromium VI. If DLA were to lower the concentration back to the MCL for chromium (50 µg/L), the beneficial use of groundwater would remain impacted because chromium VI is toxic at that concentration as well as much lower concentrations. The California Office of Environmental and Human Health Assessment have determined that chromium VI is a toxic substance, and has issued a draft public health goal of 0.02 µg/L. General Order R5-2008-0149 prohibits the creation of conditions of pollution, contamination, or nuisance, and treatment technologies that convert naturally-occurring chromium to chromium IV may be deemed in violation of this prohibition. If chromium IV byproducts are created during treatment, the Central Valley Water Board may require the cleanup and abatement of the pollution attributable to those byproducts.	Comment acknowledged. Hexavalent chromium was detected in Sharpe Site groundwater from the 1990s until sampling for hexavalent chromium analysis was discontinued in 2007 with approval of the CVWB. A background concentration of CrVI has not been established. The DLA will establish pre-treatment baseline concentrations and monitor for any post-treatment concentration trends outside of treatment zones wherever $KMnO_4$ treatment is used. DLA will only use $KMnO_4$ for in situ oxidation in a location where mobilized CrVI or selenium can be remediated.

UNITED STATES ARMY CORPS OF ENGINEERS (USACE) – TULSA DISTRICT

DESIGN REVIEW COMMENTS Project: Draft Explanation of Significant Differences to the Record of Decision, Operable Unit 1, Sharpe Site

☒ SITE DEV & GEO	☐ MECHANICAL	☐ SAFETY	☐ SYSTEMS ENG	REVIEW Draft
☐ ENVIR PROT & UTIL	☐ MFG TECHNOLOGY	☐ ADV TECH	☐ VALUE ENG	DATE 13 February 2013
☐ ARCHITECTURAL	☐ ELECTRICAL	☐ ESTIMATING	☐ OTHER	NAME James Brownell, CVWB
☐ STRUCTURAL	☐ INST & CONTROLS	☐ SPECIFICATIONS		

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
2.		The ESD does not list the legal requirements for injection of in situ remediation materials. After the ESD becomes final, but before implementation of the in situ groundwater treatment technologies, DLA must submit a list of substantive waste discharge requirements (WDRs) set forth in the California water code and the Central Valley Water Board basin plan. Such requests must be in substantive compliance with General Discharge Order R5-2008-0149. Central Valley Water Board approval of the submittal will be required before DLA can implement the technologies.	DLA has added Discharge Order R5-2008-0149 as a new ARAR in the OU 1 ESD. The third sentence under Section 6.2 Compliance with ARARs has been replaced with: "The new in situ component of the remedy includes actions not covered by the ARARs in the OU 1 ROD (e.g., injection of amendments into the saturated zone); therefore, the pertinent California regulation to be added to the ARARs is CVWB Order R5-2008-0149 regarding waste discharge requirements (WDRs) for in situ groundwater remediation. This order is applicable pursuant to California Water Code Section 13263 Subdivision (i). Before implementation of any in situ injection, i.e., when the remedial action plan is submitted for review, DLA will submit a list of WDRs that are in substantive compliance with CVWB Order R5-2008-0149." WDRs will be submitted with the remedial action plan because DLA has not selected which amendment(s) will be used for in situ treatment at each of the sites. When DLA has selected the amendment(s) it will use, it will request CVWB assistance in identifying waste discharge requirements and will comply with the substantive requirements of the state water code.
3.		In November 2011, Region 9 of the United States Environmental Protection Agency (USEPA) published a new Regional Screening Level (RSL) for TCE in tap water, which is equivalent to 2.6 µg/L. USEPA based this concentration on a non-cancer hazard index equal to 1. Therefore, the ACL of 5 µg/L established in the Sharpe OU 1 ROD may not be protective of human health, and 2.6 µg/L or less would be protective. In light of this information, Central Valley Water Board finds that the ACL for TCE cleanup may not be protective if local groundwater is ingested and that 2.6 µg/L may now be the appropriate health protective level for TCE in tap water.	At this time, the recommended cleanup value of 2.6 µg/L for TCE is not promulgated; therefore, the DLA is not establishing it as an ACL for the Sharpe Site. If the MCL for TCE is revised, the DLA will consider revising the ACL for OU 1.

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3. (cont'd)		Although the purpose of the ESD is to enhance the pump and treat groundwater cleanup remedy, DLA must include a statement in the ESD acknowledging the USEPA publication, and the new RSL for TCE in tap water. Also, DLA must evaluate the protectiveness of the ACL in the next Five-Year Review scheduled to commence in 2013.	DLA has added the following statement to the ESD, "In September 2011, the EPA revised its TCE non-cancer toxicity values. In November 2011, the non-cancer reassessment resulted in a new RSL value of 2.6 µgL for domestic use of tap water (i.e., drinking, washing), which is less than the 1993 OU 1 ROD-specified ACL of 5 µg/L. DLA will evaluate the protectiveness of this ACL in the Third Five-Year Review Report, which is currently being prepared."
4.		The second bullet item of the section titled LUCs on page 26 of the ESD addresses the potable use of off-depot groundwater. DLA states that it will "Confer and cooperate with the City of Lathrop and San Joaquin County to implement institutional controls…." While such actions will be helpful in protecting human health, they are not remedies to be included in the ROD. They are interim measures being taken while aquifer cleanup proceeds and beneficial uses are restored. DLA should make this clear in the final ESD.	DLA has removed the off-depot groundwater paragraph from the LUCs section. However, it will retain this paragraph in the discussion of protectiveness (Section 6.1) and add, "The cooperation with the City of Lathrop and County of San Joaquin is not a remedy component but an interim measure taken as beneficial uses of groundwater are restored."
5.		The following Central Valley Water Board staff member will sign the ESD: Duncan Austin, P.E. Site Cleanup Program Manager Central Valley Regional Water Quality Control Board	DLA has made the requested change.

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1.	Ex. Sum.	The ESD should include an executive summary that reiterates the main points found within the body of the document, including the following topics: • Describe the current remedy • Describe how the remedy will be changed • Identify the sites where the remedies will be applied • Provide a new table that shows a chronological list of all of the major decision documents at the site; FFA, PA/SI, RI/FS, Risk Assessments, RODs, ESDs, RD/RA, Site closure documents, PCOR, Pilot Studies, etc. • Describe the results of the pilot studies and the rationale for the new remedy	The 1999 EPA Guidance on preparation of ESDs and ROD Amendments does not indicate that an executive summary is necessary for either of those types of decision document. DLA will follow the format for an ESD shown in the guidance without an executive summary. The format used for the Sharpe OU 1 ESD has been acceptable to EPA in the recent past, for example, in the Tracy Site ESD (2011) and the Riverbank Army Ammunition Site ESD (2012), each of which is in Region 9. The chronological list of key documents has been added to Section 2.0 and is the new Table 2-1.
2.	Sec. 1.1	This section should be expanded to describe the original remedy from the OU1 ROD and also describe the new remedy in detail. Describe the in situ treatment, the LUCs and explain why the new remedies are protective. Describe the results of the pilot studies as use this as your rationale to show that in situ treatment is effective and protective. Explain why an ESD should be used to document this remedy change rather than a ROD Amendment and use the criteria from EPA's ROD Guidance that addresses when an ESD is the appropriate.	The first three sentences of the section have been replaced with the following: "The purpose of this ESD to the OU 1 ROD is to document significant modifications to the groundwater remedy for the Sharpe Site, which is extraction, treatment, and discharge of treated groundwater. This ESD adds in situ treatment, consisting of fracturing and amendment injection, in high concentration areas and land use controls on government property. The proposed additions to the remedy are significant but not fundamental and, therefore, they can be addressed with an ESD." DLA selected the ESD format because the modifications to the groundwater remedy are significant but not fundamental. In situ treatment and LUCs are being added to the remedy; however, the original main remedy, groundwater extraction and treatment, is retained as the main remedy.

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3.	Sec. 1.2	Is there an online source for the public to review site documents? Is there a phone number or contact person to get more information on the Administrative Record? Please revise this section.	DLA has added the following text to Section 1.2: "To arrange viewing of documents in the repository, call the Public Affairs Office at (209) 839-4226."
4.	Sec. 2.2	This section should be revised. The last paragraph is redundant with section 1.0 and 1.2 and should be deleted. Add the chronological table (from the executive summary) to this section.	Only the first sentence of the paragraph in Section 2.2 is slightly redundant with one sentence in Section 1.0. Additional clarifying text has been added, and the remainder of the paragraph will be retained for the additional information it presents. A chronological table of key documents has been added to Section 2.2.
5.	Sec. 2.2.1	Please reference the titles of the two interim reports described in this section.	The titles of the two interim remedial action reports have been presented in the new chronological table and have been referenced in Section 2.2.1.
6.	Sec. 2.2.3	This section could use a better title, please reference the associated reports. Is this section describing the current site conditions? Does this section apply to all of Sharpe or to the ESD sites? It is not clear.	The title of the section has been changed to "Post-OU 1 ROD Actions." This section presents the historical transition of the groundwater extraction system and information obtained about VOC concentrations that led to the pilot studies. A sentence has been added to the first paragraph stating, "In 2013, 21 extraction wells are operating across the Sharpe Site; however, none are operating in two high concentration areas described in the next paragraph." The following sentence will be added to the second paragraph of the section. "The identification of the high concentrations at two sites and the results of the pilot studies prompted the in situ component of the significant differences in the remedy addressed in this document."
		The first paragraph mentions natural attenuation. Is natural attenuation part of the selected remedy for groundwater at the site?	Natural attenuation mechanisms are occurring in groundwater at the Sharpe Site. Monitored natural attenuation is not a component of the remedy at this time.

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7.	Sec. 2.2.4	This section should be moved to section 4.0 where you describe the current remedy and the new modified remedy.	The 1999 EPA Guidance on preparation of ESDs and ROD Amendments indicates that the description of the original remedy should occur in the second component of the report following site history and site contamination and that the description of the proposed remedy should occur in the fourth component of the report. Therefore, the 1993 OU 1 ROD remedy is presented in Section 2.2.4, and components to be added to the remedy are presented in Section 4.3.
8.	Sec. 2.3	This section should be expanded and could be referred to as the Conceptual Site Model (CSM) and include a description of the fate and transport of contamination in all media (soil, soil gas, and groundwater).	The 1999 EPA guidance on ESDs does not include a CSM; however, Sections 2.3 through 2.6 in the draft (now Section 2.3.2) have been combined into a CSM.
9.	Sec. 2.4 and 2.4.1	These sections seem to have information that could be part of the CSM.	Sections 2.3 through 2.6 have been combined into a CSM.
10.	Sec. 2.5	This could be retitled “Current Groundwater Conditions” and describe the current soil or soil gas conditions.	The DLA has changed the title of the subsection (now 2.3.4) to “Current Extent of Groundwater Contamination.” However, a description of soil and soil gas conditions has not been added because this ESD addresses only the groundwater remedy.
11.	Sec. 2.6.1 and 2.6.2	Please reference the risk assessment reports.	DLA concurs and has added the following sentence to the first paragraph: “Human health risks from exposure to groundwater were evaluated in *Remedial Investigation/Feasibility Study at Sharpe Site: Risk Assessment Report* (ESE, 1991).” The reference for the ecological risk was provided in the draft text.

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12.	Sec. 3.0	This section should reference the Feasibility Study (FS) that was performed and describe how the three pilot studies relate to the FS. Was the original FS revised or updated to evaluate in situ technologies?	The focused feasibility study was referenced in the last paragraph of Section 3.1. The following text has been added to the first paragraph of Section 3.1: "The original feasibility study performed for OU 1 (ESE, 1991) considered only groundwater extraction and treatment remedies; it was not updated to include in situ technologies. However, the *Operable Unit 1 Focused Feasibility Study* (URS, 2011b) addressed in situ technologies and other remedial alternatives for groundwater."
13.	Sec. 3.1	This is an important section and should have a descriptive section title like "Summary of Three In Situ Treatment Pilot Studies". This section should be revised to describe the results of the three pilot studies in more detail. The results of the pilot studies provide the rationale for why the new remedy is effective and protective. Please provide the report titles in addition to the reference situation in Section 9. Describe the results of the CPT investigation, the modeling report, the pilot studies and the FS. Provide rationale to show that hydraulic fracturing is protective of human health and the environment. Describe the potential for hydraulic fracturing to increase contaminate migration an vapor intrusion into existing buildings. Will fracturing the aquitard create a new pathway for contaminant migration in the groundwater or in the vadose zone? Summarize and reference the report where this is evaluated. What type of fluid will be used for fracturing (water, air)?	DLA has divided Section 3.1 into two sections: Section 3.1 New Information and Section 3.2 Summary of Three In Situ Treatment Pilot Studies. Section 3.1 describes the results of the CPT investigation (results are further described in Section 2.2.3) and results of the modeling. Section 3.2 provides additional detail about the results of the three pilot studies and provides the report titles that document these results. The following text has been added to Section 3.2 following the description of the pilot studies: "One of the target areas where fracturing could occur is adjacent to a building that is occupied approximately

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13. (cont'd)	Sec. 3.1		(continued) one hour per day (Figure 4-1). It is unlikely that fracturing could affect the building or increase the potential for vapor intrusion because the shallowest fracturing will be performed approximately 40 feet bgs in the saturated zone. Hydraulic fluid or nitrogen gas under pressure would be injected to induce fractures in a horizontal plane with an expected fracture radius of 10 to 15 feet. Therefore, no fractures are likely to reach the vadose zone at approximately 15 to 20 feet bgs where VOCs could be volatilized and migrate upward toward building foundations. Areas where fracturing is considered are upgradient from extraction wells, which would extract any VOCs that are not destroyed by amendments and could migrate along new fractures in the aquitard. Therefore, contaminants in the treatment zones will not migrate into exposure pathways to receptors." DLA did not specify the fluid to be used for fracturing with the intent of maintaining some degree of flexibility in choice of fracture fluid until the remedial action work plan is prepared.
14.	Sec. 4.1	Retitle this "Original Remedy from the OU1 ROD". Describe the current remedy here (including any subsequent modifications by previous ESDs or ROD Amendments).	The original remedy was described in Section 2.2.5; a full description here would be redundant. However, the components of the remedy that will be retained are addressed here as suggested by the 1999 EPA guidance on ESD preparation. DLA has deleted "Major" from the title of the section.

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15.	Sec. 4.2	Is there a reason that you want to remove this from the remedy. If it is OK to leave it in the remedy will it give you more flexibility in the future? Is the original remedy written in a way that requires treatment of off-gas with carbon? If not you could leave it in. This section says the adsorber was taken out of service in 1996. Is there a report to documenting how this was done? Did the agencies approve it?	DLA wants to remove the carbon adsorber from the remedy because it has not been needed since 1996. It is unlikely to be needed in the future because VOC concentrations in the off-gas from the treatment system will decrease with time as groundwater concentrations decrease. There is no report on disconnecting the adsorber from the air strippers. DLA obtained regulatory agency concurrence for the action. DLA has deleted “minor” from the title of the section.
16.	Sec. 4.3	Retitle this “New Modified Remedy”. Describe the new remedy in its entirety. This description should reiterate the portions of the original ROD that will be retained, and describe the new parts of the remedy. Then after you have described the new modified remedy you can identify the portions of the original remedy that will be discontinued.	The ESD is not intended to present a “new” remedy; it is intended to explain *significant* additions or subtractions from the existing remedy. Section 4.3 is intended to identify the addition of components to the remedy. If components of the original remedy are repeated here, the differences from the original ROD would be less clear. The retained portions of the original remedy are addressed in Section 4.1.
		• The new remedy should describe where LUCs will be implemented and show each area on a site map.	In the bullets titled “Vapor intrusion” and “On-depot groundwater” under the heading “LUCs” (now Section 4.3.2), text has been added that references new Figures 4-3 and 4-4, respectively, which show the on-depot areas affected by LUCs.
		• The new remedy description should identify the sites where the in situ remedy will be implemented and show it on a map.	The following text was added to the bullets titled “Target remediation area in South Balloon” and “Target remediation area in Central Area:” (see the Area of Accumulation of COC Mass in the South Balloon on Figure 2-1) and (see the Area of Accumulation of COC Mass in the Central Area on Figure 2-1).Those bullets already reference Figures 4-1 and 4-2.

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16. (cont'd)	Sec. 4.3	• The group of bullet items and the end of the section mention the South Balloon and Site P-5A in the Central Area. Are these the only sites where in situ treatment will be implemented? If these are the site names where the remedy will be implemented then they should also have a description and should be labeled on the map.	The only two sites to be affected by the in situ treatment are the South Balloon and Site P-5A in the Central Area, which are shown in detail and in the inset maps on Figures 4-1 and 4-2.
		• The remedy description should specify that each site will require site specific work plan that will be submitted for regulatory approval during the subsequent RD/RA. The work plan will describe the in situ remedy will implemented.	Before the heading LUCs in Section 4.3, the following text has been inserted: "DLA will submit a remedial action work plan (RAWP) to the regulatory agencies before performing the in situ treatment component of the remedy. The RAWP will describe the implementation of the remedy in detail for both sites."
		• The new in situ treatment remedy should be written to explain how DLA will evaluate the characteristics at a site, select the most appropriate of the three in situ treatments given the site characteristics, and allow for flexibility to use any of the other in situ treatments if needed.	The criteria for selection of the most appropriate remedy are provided in Section 4.3.1.
		• The remedy should say that a combination of the three in situ remedies (KMnO4, EHC, and EOS) could be used at each site. It should say that fracturing may or may not be used and each site in addition to the in situ treatment.	DLA will not combine remedies at either of the sites. The conditions created by the amendments are not suitable for use of more than one of the amendments. Hydraulic or pneumatic fracturing must be done at both sites to provide pathways for amendments to reach VOC mass within the aquitard.
		• The three in situ remedies (KMnO4, EHC, and EOS) and hydraulic fracturing should be described in detail in the remedy section, or at least reference another section in the ESD where they are described in detail.	DLA will provide more detail on the amendment to be used at each site and the hydraulic/pneumatic fracturing scheme in the RAWP. DLA has added text explaining the technologies in Section 3.2.

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16. (cont'd)	Sec. 4.3	• It is unclear how the FS was performed or if other remedial alternatives (such as bio remediation or enhanced bio) were evaluated in the FS. It is not clear if the description of EOS includes enhanced bio. Enhanced bio is a general term for adding nutrients and biota which is often economical and effective for high concentrations of TCE in soil and groundwater.	The following text has been added to the end of the first paragraph of Section 3.1: "A number of technology options including focused groundwater extraction, physical treatment, chemical treatment, biological treatment, combination treatments, vertical barriers, and encapsulation were considered in the focused feasibility study. Some of the process options considered chemical reduction, chemical oxidation, hydraulic and pneumatic fracturing, air sparging, and permeable reductive barriers. Details of these options and the development of the alternatives are described in detail in the focused feasibility study (URS, 2011b)." This is adequate detail on the content of the focused feasibility study for an ESD.
		• Important – The remedy should clearly describe if it is intended to remediate the soil, the vadose zone, submerged soil contamination, and/or groundwater. The remedy should clearly explain which of these media the remedy is intended to clean up.	The third sentence in the first paragraph of Section 1.0 states that Operable Unit 1 (OU 1) consists of the VOC-contaminated groundwater plumes, and the fifth sentence states that OU 2 consists of VOC-contaminated soil and soil vapor. The last sentences states: "This explanation of significant differences (ESD) to the OU 1 ROD is being executed to add components to the groundwater remedy…" Therefore, soil and vadose zone remedies are not addressed in the ESD. Additional clarifying text has been added to the end of the paragraph: "This ESD addresses contamination in the saturated zone only. Therefore, soil and vadose zone remedies are not addressed in the ESD."
		• The remedy should clearly describe the cleanup criteria and describe the procedure that will be used to close the remedial action after cleanup goals are achieved.	A table will be added to Section 2.2 listing the aquifer cleanup levels (ACLs) established in the OU 1 ROD that must be met before the remedial action is closed.

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16. (cont'd)	Sec. 4.3	• The last bullets in Section 4.3 describe installing extraction wells, shutting down extraction wells, and sampling wells. These last bullets do not need to be included in this ESD because it is already routinely performed under your groundwater monitoring program. Is there any reason it should be part of this ESD remedy?	The installation of new extraction wells is part of the new components of the remedy addressed in the ESD. DLA agrees that the shutdown of extraction wells and the sampling of wells is not part of the remedy, and those bullets have been deleted.
17.	Sec. 6.2	The ARARs discussion says "if the new remedy components include actions not covered by the ARARs in the OU 1 ROD…those regulations will be identified during the preparation of the remedial action plan for in situ mass removal". This ESD should identify the ARARs for the new remedy.	DLA concurs and an action-specific ARAR addressing the injection of materials into groundwater has been added to the ESD.
18.	Sec. 6.2	The ARARs section should evaluate the California Regional Water Quality Control Board, Central Valley Region Order No. R5-2008-0149. This order pertains to waste discharge requirements for in situ groundwater remediation and may also pertain to fracking.	DLA concurs and Order No. R5-2008-0149 has been added as an ARAR in the ESD.
19.	Sec. 2.6	Potential Receptors and Summary of Site Risks: Please revise this section as follows:	
		Section 2.6 Modification of the Human Health Risk Assessment Section 2.6.1 Human Health Risk Assessment in the original OU1 ROD • *Describe and reference the original HH risk assessment and any updates.* • *Explain how and why the original HH risk assessment only addressed exposure from groundwater contamination and indoor air/vapor intrusion was not addressed.* • *Explain that the potential for indoor air exposure from vapors off gassing from groundwater contamination was unknown and not included in the original ROD.*	To address comments on Section 2.6 which is now Section 2.3.5, the following changes to text have been made in Section 2.6.1 (now 2.3.5.1). The following text replaces the second, third, and fourth sentences of the first paragraph: "For the original OU 1 ROD, the *Remedial Investigation/ Feasibility Study at Sharpe Site: Risk Assessment Report* (ESE, 1991) stated that the risk assessment for OU 1 used standard EPA methods to determine what human health risks could be if contaminated groundwater from the site was used for those purposes in a residence, even though the Sharpe Site is likely to remain an industrial/ commercial site for the foreseeable future. Receptors that were evaluated in the 1991 risk assessment for their potential exposure to groundwater primarily

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19. (cont'd)	Sec. 2.6		(continued) through ingestion and inhalation from groundwater daily over a 70-year lifetime included on-site workers and residents and off-site residents. Skin exposures were not directly included in the evaluation because it was concluded that their effect was inconsequential." The following text was added to the fifth sentence: "…and, therefore, was not included in the OU 1 ROD." The following text was added to the end of the first paragraph of Section 2.6.1 (now 2.3.5.1): "This ESD establishes LUCs for protection of receptors from indoor air exposure as described in Section 4.3.2." A new paragraph has been inserted before the last paragraph of Section 2.6.1 (now 2.3.5.1); that states: "The human health risk assessment (ESE, 1991) has not been updated since 1991; however, the potential for increased human health risks resulting from considering the vapor intrusion pathway, changes in toxicity benchmark values, or changes in risk assessment methods were evaluated in the First, Second, and Third Five-Year Review Reports (URS, 2003; 2009b; 2013)."
		Section 2.6.2 Human Health Risk Assessment modification to address Indoor Air/Vapor Intrusion • *Describe and explain the following items:* • *This section of the ESD presents information and rationale to modify the original HHRA and evaluate the Indoor Air/Vapor Intrusion pathway.*	To address comments on the vapor intrusion pathway, a new Subsection 2.3.5.2 has been inserted; the new text states: "Inhalation exposure to volatile compounds that have migrated from the subsurface into indoor air (vapor intrusion pathway) is a now well-recognized exposure pathway that was (continued)

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19. (cont'd)	Sec. 2.6	• *A total revision of the Risk Assessment is not needed because DLA acknowledges the risk and is implementing LUCs for protection of Indoor Air/Vapor Intrusion exposure.* • *The indoor air screening level is defined as the current air RSL.* • *DLA has projected the indoor air values to a ground water level of concern using the attenuation coefficient of 0.001 and a Henry's law conversion as presented in EPA Vapor Intrusion guidance 2002.* • *The ground water level of concern at Sharpe Depot is xxx* • *This ESD establishes LUCs for protection from indoor air exposure as described in Section xxx.* • *Indoor Air LUCs will include an additional buffer area of 100 feet surrounding the plumes.*	(continued) not well understood, nor evaluated, during development of the original risk assessment for the OU 1 ROD (ESE, 1991). Both the *First Five-Year Review Report* (URS, 2003) and the *Second Five-Year Review Report* (URS, 2009b) provided quantitative analyses of the vapor intrusion pathway within the framework of evaluating remedy protectiveness. In the second five-year review, the conclusion was that the OU 1 remedy was protective of human health and the environment in the short-term, pending future analysis of potential plume migration. There are some indications of deeper-zone plume migration, but the extent of A Zone groundwater plumes from which VOCs could volatilize and enter soil vapor has been relatively stable. The vapor intrusion pathway remains potentially complete in the presence of overlying structures, which is not true for most of the area overlying contaminated A Zone groundwater. An A Zone groundwater plume with TCE concentrations ranging from approximately 5 to less than 100 µg/L underlies OU 2 Site P-1E and Building 649, but analyses presented in the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution Depot San Joaquin–Sharpe Site* (Operable Unit 2 – Soils) (URS, 2011a) demonstrated that the vapor intrusion pathway was insignificant for the expected use conditions at Building 649 (i.e., occupied approximately 1 hour per day). (continued)

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
19. (cont'd)	Sec. 2.6		(continued) A total revision of the health risk assessment is not warranted because DLA acknowledges the potential pathway and is implementing LUCs for protection of receptors from vapor intrusion exposure. LUCs will be implemented for areas of A Zone groundwater that have concentrations exceeding commercial/ industrial Target Groundwater Concentrations of TCE, PCE, CCl_4, 1,2-dichloroethane (DCA), or chloroform (Table 2-4). (Table 2-4 is attached to this table of responses.) Target Groundwater Concentrations were determined for only the five named compounds because they are known to occur in plumes of the A Zone and have regional screening levels (RSLs) for indoor air. cis-1,2-DCE, the other COC forming a plume in the A Zone, currently has no RSL for indoor air and, therefore, no Target Groundwater Concentration. Target Groundwater Concentrations are calculated for a carcinogenic health risk of greater than 1×10^{-6} or a non-carcinogenic hazard quotient greater than 1 (EPA, 2002). The Target Groundwater Concentrations were calculated using the most recently published (2012) indoor air RSLs for the VOCs of interest, a default attenuation factor (α) of 0.001, chemical-specific Henry's Law constants, and unit conversion factors (EPA, 2012a). The estimated areas of plumes in the A zone in which TCE, PCE, CCl_4, 1,2-DCA, and chloroform concentrations exceed the Target Groundwater Concentrations are within isopleths drawn using third quarter 2012 monitoring well sample analysis results plus a (continued)

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19. (cont'd)	Sec. 2.6	Section 2.7 History of Ecological Risk Assessment *(Describe and reference the previous Eco risk assessments and clarify that they are not modified by this ESD)*	(continued) 100-foot buffer zone (see Figure 4-3). DLA will review the LUCs area annually and will revise the LUCs area, if necessary, based on new analytical data." To address comments on ecological risk assessment, text from Subsection 2.6.2 has been moved to the new Subsection 2.3.5.3, and the following new text was added to the beginning of the paragraph. "An ecological risk assessment was not performed for groundwater during the remedial investigation/ feasibility study because of the unlikelihood of ecological exposure; a description of potential ecological receptors on the Sharpe Site and sensitive habitat is presented in the risk assessment for soils (ESE, 1992)."

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20.	Sec. 4.3, pg. 26	LUCs: LUCs are described on page 26-28. This should be a separate section that shows up on the table of contents. Spell out the acronym and define what LUCs are. I suggest that you reorganize the LUC section into the following subsections: Definition of LUCs LUC Objectives LUC Description Off-depot Groundwater On-depot groundwater On-depot vapor intrusion LUC Implementation Plan Landuse Change Property Transfer Reporting Regarding the new LUC descriptions section above: The LUC should not be confused with the LUC objectives. The term LUC refers to the actual LUC instrument which is used to accomplish the objectives. The LUCs are likely to be a legal mechanism or administrative measure used to impose use restrictions (e.g. permits, orders, restrictive covenants, zoning), but they may also include measures such as fences and guards.	The description of LUCs has been moved to the new Subsection 4.3.2, and the subsection will begin with the following text: "LUCs are instruments, such as administrative, legal, engineered, or physical barriers (such as fences and security guards) that help to minimize the potential for exposure to contamination or to protect the integrity of a response action (EPA, 2012b). For the Sharpe Site, DLA will implement administrative and legal LUCs and physical barriers to minimize exposure to COCs in indoor air and groundwater. The LUCs objectives for OU 1 are: • To protect human health by preventing human exposure to indoor air with VOC concentrations that pose an unacceptable health risk • To prevent exposure to groundwater with COC concentrations exceeding the ACLs specified in the OU 1 ROD" Under the subheading "On-depot groundwater," the following text replaced the existing sentence: "Prevent access or use of groundwater in the area shown on Figure 4-4 until ACLs are met. COC plumes have penetrated to greater than 160 feet bgs beneath the site. Operating wells hydraulically may draw COC plumes toward their screens if there is no (continued)

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
20. (cont'd)	Sec. 4.3, pg. 26		(continued) aquitard between the plume and the well's screen. The LUCs must prohibit the construction of a water supply well within a known COC plume or within a 2,000-foot radius of the plume, unless the well is screened completely beneath the Corcoran-equivalent aquitard that underlies the site. When established, LUCs must also maintain the integrity of any current or future remedial or monitoring systems, such as wells, treatment equipment, conveyance equipment, or discharge locations. The LUCs area will be reviewed annually and will be revised, if necessary, based on new analytical data." In response to Comment #4 from the Central Valley Water Board, the text under the subheading "Off-Depot groundwater" has been removed. However, the text will be retained in the discussion of protectiveness (Section 6.1).
21.	Pg. 26	LUCs: First bullet on page 26 • Clarify that LUCs for VI are for the on-depot portion of the plume. • The first sentence should not says you will evaluate the health risk for any new building • The last sentence should not say you will model and do a risk assessment • State that the ground water level of concern at Sharpe Depot is xxx • Indoor Air LUCs will include an additional buffer area of 100 feet surrounding the plumes.	Under the subheading "Vapor intrusion," the text has been revised to state: "**Vapor intrusion:** The LUCs for vapor intrusion are applicable to on-depot areas that are within a 100-foot buffer around a COC groundwater plume that contains concentrations that equal or exceed Target Groundwater Concentrations (Table 2-4). Figure 4-3 depicts the VOC plume areas on the Sharpe Site that equal or exceed Target Groundwater Concentrations plus the 100-foot buffer. The LUCs area will be reviewed annually and will be revised, if necessary, based on new analytical data. If construction of a structure to be (continued)

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21. (cont'd)	Pg. 26		(continued) regularly used as a workspace is considered within the VOC plume plus buffer area, construction must include implementation of engineering controls, such as ventilation/sub-slab depressurization and/or vapor intrusion barriers or the structure must be relocated to an area outside of the plume plus its buffer."
22.	Pg. 26	LUCs: Third bullet on page 26: add the following from EPA's LUC checklist 4.1 and 4.2. 1. Prevent access or use of the groundwater until cleanup levels are met. 2. Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells, impermeable reactive barrier.	See revised text for "On-depot groundwater" in the response to Comment 20.
23.	Pg. 26	LUCs: Fifth bullet on page 26: Describe the existing system in more detail. How will the environmental office find out about building projects, is there a digging permit process or construction permitting process? Do all new building projects need to be approved by the environmental office?	The following text providing additional detail on the process has been added to the second bullet in the LUCs subsection: "As part of a standard operating procedure at the Sharpe Site, all proposed construction projects must complete and submit an Environmental Checklist detailing the specifics of the project, a statement of work and any other plans to the DLA Installation Support at San Joaquin Environmental Office for their approval. The proposed project will not be able to continue without the approval from the Environmental Office. If any component of a proposed project is inconsistent with the LUC objective, they will be required to modify the project plans to be consistent with LUCs."
24.	Pg. 26	LUC section: The LUC section should reference the Figure that shows where the LUCs will be implemented.	Figures 4-3 and 4-4, depicting areas where the LUCs will be implemented, have been added to the LUCs discussion in Section 4.3.2.

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25.	Pg. 26	LUC section: Explain how and when DLA will update and revise the LUCS as the groundwater plume changes its configuration over time.	The following text has been added under the subheadings “Vapor intrusion” and “On-depot groundwater:” “The LUCs area will be reviewed annually and will be revised, if necessary, based on new analytical data.”
26.	Pg. 26	LUC section: EPA’s LUC checklist item 12 should be addressed in the new Landuse Change section. Please add the following text: Prior to seeking approval from EPA and the State the recipient of the property must notify and obtain approval from DLA of any proposals for a land use change at a site inconsistent with the use restrictions and assumptions described in this ROD.	Disagree. The suggested text from the checklist is specifically for closing bases. The Sharpe Site is not closing. The checklist for an active base is included in the existing text (fifth bullet of checklist in this ESD).
27.	Pg. 26	LUC section: LUC check list Item 18 should be addressed in the new Property Transfer section. Please add the following text: a. “Deed Restrictions: “Each transfer of fee title from the United States will include a CERCLA 120(h)(3) covenant which will have a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives. The environmental restrictions are included in a section of the CERCLA 120(h)(3) covenant that the United States is required to include in the deed for any property that has had hazardous substances stored for one year or more, known to have been released or disposed of on the property. Each deed will also contain a reservation of access to the property for the [federal agency], USEPA, and [the State], and their respective officials, agent, employees, contractors, and subcontractors for purposes consistent with the [federal agency] Installation Restoration Program (“IRP”) or the Federal Facility Agreement (“FFA”). The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the [federal agency].”	The new text recommended in the comment has been added to the new Land Use Change section text; however, “ROD” has been replaced with “ESD” in the new text.

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27. (cont'd)	Pg. 26	b. "Lease Restrictions: "During the time between the adoption of this ROD and deeding of the property, equivalent restrictions are being implemented by lease terms, which are no less restrictive than the use restrictions and controls described above in this ROD. These lease terms shall remain in place until the property is transferred by deed, at which time they will be superseded by the institutional controls described in this ROD." c. "Notice: "Concurrent with the transfer of fee title from the [federal agency] to transferee, information regarding the environmental use restrictions and controls will be communicated in writing to the property owners and to appropriate state and local agencies to ensure such agencies can factor such conditions into their oversight and decision-making activities regarding the property."	

Table 2-1. Chronological List of Key Documents for OU 1 on the Sharpe Site	
1980	U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1980. *Installation Assessment of Sharpe Army Depot*. Report No. 145.
1983	Battelle Pacific, 1983. *Environmental Contamination Survey of Sharpe Army Depot, Report DRXTH-AS-CR-82184*.
1985	Environmental Science and Engineering, Inc., 1985. *Groundwater Remediation Plan for the South Balloon Area at Sharpe Army Depot*. Draft.
1986	Environmental Science and Engineering, Inc., 1986. *Environmental Contamination Survey at Sharpe Army Depot, Final Report.*
1988	Environmental Science and Engineering, 1988. *Conceptual Design for the Interim Groundwater Remediation System for the North Balloon Area at Sharpe Army Depot.* Draft.
1989	United States Army, 1989. *Federal Facilities Agreement for Defense Distribution Region West-Sharpe*. Effective Date: March 16.
1991	Environmental Science and Engineering, Inc., 1991. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site: Remedial Investigation.* Final.
1991	Environmental Science and Engineering, Inc., 1991. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site: Groundwater Feasibility Study Report.* Final.
1991	Environmental Science and Engineering, Inc., 1991. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site: Risk Assessment Report*. Final.
1993	Environmental Science and Engineering, Inc., 1993. *Remedial Investigation/Feasibility Study at DDRW-Sharpe Site Record of Decision, Operable Unit 1*. Final.
1996	Environmental Science and Engineering, Inc., 1996. *Record of Decision, Basewide Remedy for DDRW-Sharpe Site*. Final.
2001	URS Group, Inc., 2001. *DDJC-Sharpe Site, Operable Unit 1, Interim Remedial Action Report*. Final.
2002	URS Group, Inc., 2002. *Installation-Wide Preliminary Close Out Report, DDJC-Sharpe.* Final.
2004	URS Group, Inc., 2004. *DDJC-Sharpe Five-Year Review Report*. Final.
2006	URS Group, Inc., 2006. *Treatment Technology Investigation Results Technical Memorandum, DDJC-Sharpe*. Final.
2009	URS Group, Inc., 2009. *DDJC-Sharpe Second Five-Year Review Report.* Final.
2010	URS Group, Inc. 2010. *DDJC-Sharpe Hydraulic Fracturing and Injection of EHC Pilot Study Results Report.* Final.
2010	URS Group, Inc. 2010. *DDJC-Sharpe Potassium Permanganate Pilot Study Results Report*. Final.
2010	URS Group, Inc. 2010. *DDJC-Sharpe Enhanced Reductive Dechlorination Technology Emulsified Oil Pilot Study Results Report.* Final.
2010	URS Group, Inc., 2010. *DDJC-Sharpe Final Off-Depot Potable Well Contingency Plan.* Final.
2011	URS Group, Inc., 2011. *Defense Distribution Depot San Joaquin–Sharpe Site, Operable Unit 1 Remedy Enhancement Focused Feasibility Study.* Final.
2011	URS Group, Inc., 2011. *Proposed Plan to Enhance the Effectiveness of the Remedy for Contaminated Groundwater, Defense Distribution Depot San Joaquin–Sharpe Site*. Final.
2013	URS Group, Inc., 2013. *Third Five-Year Review Report, Defense Distribution Depot San Joaquin–Sharpe Site*. Draft.

OU = operable unit

Table 2-4. Target Groundwater Concentrations for Industrial/Commercial LUCs
Sharpe Site

VOC	Indoor Air Regional Screening Level ($\mu g/m^3$)	Henry's Law Constant (dimensionless)	Attenuation Factor (α) Assumed	Target Groundwater Concentration[a] (µg/L)
Trichloroethene (TCE)	3	0.403	0.001	7.4
Tetrachloroethene (PCE)	47	0.723	0.001	65
Carbon tetrachloride (CCl_4)	2	1.13	0.001	1.8
Chloroform	0.53	0.15	0.001	(3.6) 80 default[b]
1,2-Dichloroethane (1,2-DCA)	0.47	0.0482	0.001	9.8

[a] Target Groundwater Concentrations are calculated with the following equation (EPA, 2002):

$C_{GW} = C_{ia}/(\alpha \times H' \times 1{,}000\ L/m3)$

Where:

C_{Gw} = target concentration in groundwater (µg/L)
C_{ia} = indoor air Regional Screening Level ($\mu g/m^3$)
α = attenuation factor (dimensionless)
H´ = Henry's law constant (dimensionless)

[b] EPA guidance suggests defaulting to the MCL level if the calculated Target Groundwater Concentration is less than the MCL (EPA, 2012).

EPA = United States Environmental Protection Agency
L = liter
LUC = land use control
MCL = maximum contaminant level
VOC = volatile organic compound
µg/L = micrograms per liter
$\mu g/m^3$ = micrograms per cubic meter

3.2 Summary of Three Recent In Situ Pilot Studies

Pilot studies of three in situ treatment technologies were conducted between 2008 and 2009 in areas of the Sharpe Site where concentrations of TCE exceeded 200 µg/L. The three pilot studies performed in areas with the greatest TCE groundwater concentrations were: fracturing followed by solid potassium permanganate ($KMnO_4$) injection; fracturing followed by injection of a redox compound (EHC); and injection of an emulsified oil substrate via injection wells under low pressure. Pilot studies for the three technologies were initiated in 2008, and the 12 month test period for each of the pilot studies concluded during the 2009 monitoring period; however, additional groundwater samples were collected during the 2010, 2011, and 2012 monitoring periods to continue monitoring the effectiveness of the KMnO4 and EHC pilot tests. No additional sampling was recommended in the EOS pilot study area after the 2010 monitoring period because cis-1,2-DCE concentrations had decreased and there was evidence of TCE rebound or influx indicating that the majority of reductive dechlorination had occurred.

$KMnO_4$. The $KMnO_4$ pilot study was conducted approximately 60 feet north of Building 649 in the South Balloon. The pilot study emplaced solid $KMnO_4$ using hydraulic fracturing, and then evaluated its distribution and effectiveness in reducing TCE groundwater concentrations greater than 1,000 µg/L in fine-grained and sand layers of the saturated zone between 40 and 75 feet bgs. The general conclusions of the study reported in *DDJC-Sharpe Potassium Permanganate Pilot Study Results Report* (URS, 2010b) were as follows:

- $KMnO_4$ distribution in low permeability layers is increased by use of hydraulic fracturing and diffusion. However, the hydraulic fracturing method did not produce predictable or uniform fractures.
- $KMnO_4$ effectively oxidizes COCs (and all other carbon sources) in the fracture area to concentrations below ACLs. However, because $KMnO_4$ was not evenly distributed within the entire soil matrix, rebound in COC concentrations may occur after $KMnO_4$ dissipates.

EHC. The pilot study of the chemical- and biological-reducing reagent EHC was conducted in the residual mass in the saturated zone of the Site P-5A source area in the Central Area. In the pilot study, EHC was emplaced into fine-grained soils (silts and clays) via hydraulic fracturing with the intention of destroying TCE in situ through chemical (abiotic) reduction and enhanced biological degradation mechanisms. The general conclusions of the study reported in *DDJC-Sharpe Hydraulic Fracturing and Injection of EHC Pilot Study Results Report* (URS, 2010c) and the 2010 through 2012 sampling results were as follows:

- TCE Destruction. EHC enhanced reductive dechlorination of TCE and its byproducts in the fracture area. TCE concentrations were reduced between 99 and 100 percent in wells where EHC was distributed. TCE concentrations decreased to less than 5 µg/L (ACL) by 18 to 24 months following injection. TCE concentrations continued to decline at two monitoring wells, but increased at a third well. cis-1,2-DCE concentrations showed an increasing trend through the 24-month sampling period, cis-1,2-DCE stall is occurring within the pilot study area as indicated by fluctuating, but high, concentrations.
- DHC Bacteria. DHC bacteria were detected at low concentrations in the native microbial population. However, data indicate biologically mediated reductive dechlorination was facilitated by sulfate-reducing and methanogenic bacteria.

EOS. An emulsified vegetable oil pilot study, using EOS 598B42 emulsion manufactured by EOS Remediation, Inc., was conducted in the North Balloon portion of the Sharpe Site. In the pilot study, EOS was injected at low pressure into fine-grained (low-permeability) and coarser-grained (high-permeability) soils via injection wells to enhance anaerobic reductive dechlorination of TCE in groundwater. The pilot study evaluated EOS's distribution in the aquifer after injection and its effectiveness in reducing TCE groundwater concentrations greater than 100 µg/L in fine-grained and sand layers of the saturated zone between 50 and 60 feet bgs.

Based on the pilot study results, the following conclusions were reached as reported in *DDJC-Sharpe Enhanced Reductive Dechlorination Technology Emulsified Oil Pilot Study Results Report* (URS, 2010d). In groundwater that EOS entered, EOS effectively enhanced anaerobic reductive dechlorination of TCE and its breakdown products to concentrations less than ACLs. Some rebound or influx of TCE in results from the 12-month monitoring event was indicated; therefore, additional EOS injection events may be necessary as TCE desorbs and diffuses from the fine-grained layers of the saturated zone where EOS was not distributed. EOS can be effectively distributed using injection wells in higher permeability units and in thin sand lenses within the thicker low-permeability units. More cost-effective options, such as temporary direct push injection borings, may also be effective in the higher permeability units versus installed injection wells.

Each amendment was effective in destroying COCs in groundwater where they were introduced. TCE was reduced to ACLs in the EOS and $KMnO_4$ pilot studies. In the EHC pilot study, TCE concentrations were reduced to less than ACLs 18 to 24 months after injection, and the percent reduction in TCE concentrations was 99 to 100 percent where EHC was distributed (URS, 2011a). Only $KMnO_4$ was effective in completely destroying COCs without formation of intermediates or daughter products. In addition, $KMnO_4$ was the only amendment shown to effectively diffuse both vertically and laterally, following introduction into the subsurface. Though all the amendments resulted in short-term increases in the concentrations of some metals and other water quality parameters, data collected in the years after the treatment indicate that these increases were restricted to the immediate treatment (and possibly transition) areas and were transient in nature.

Aquifer cleanup times can be shortened if COC mass in the aquitard can be reduced in situ without extraction. Results of the in situ treatability study indicated that COC mass in the A/B aquitard can be destroyed or concentrations can be reduced to less than ACLs when amendments make contact with COCs (URS, 2010b, 2010c, 2010d). To improve the potential for any amendment to make contact with COC mass, the aquitard must be artificially fractured before the amendment is injected or the amendment must be injected through multiple boreholes or wells in the aquitard.

One of the target areas where hydraulic fracturing could occur is adjacent to a building that is occupied approximately one hour per day (Figure 4-1). It is unlikely that fracturing could affect the building or increase the potential for vapor intrusion because the shallowest fracturing will be performed approximately 40 feet bgs in the saturated zone. Hydraulic fluid under pressure will be injected to induce fractures in a horizontal plane with an expected fracture radius of 10 to 15 feet. Therefore, no fractures are likely to reach the vadose zone at approximately 15 to 20 feet bgs where VOCs could be volatilized and migrate upward toward building foundations. Areas where fracturing will occur are upgradient from extraction wells, which would extract any VOCs that are not destroyed by amendments and migrate along new fractures in the aquitard. Therefore, contaminants in the treatment zone will not migrate into exposure pathways to receptors.

Any one or all of the amendments tested may be used to enhance the OU 1 remedy because each was effective in reducing TCE concentrations and none had detrimental impacts on groundwater.

Results of the groundwater modeling and the three pilot studies were two key elements in the focused feasibility study performed for OU 1 (URS, 2011c). The feasibility study recommended an alternative that included in situ reduction of COC mass in high concentration areas.

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1.	Sec. 1	Please add a new subsection to describe the purpose of the ESD, including the following: • Describe the current remedy • Describe the new remedy • Describe the purpose (objective) of the in situ remedy • Identify the two sites where in situ will be applied • Explain how DLA can elect to use the in situ remedy if new sites are discovered • Describe the ICs for vapor intrusion Please provide a better description of the new remedy. Explain that in situ treatment will be implemented at two sites with soil contamination (Central Area and South Balloon Area). The objective of the in situ treatment is to reduce the impact on groundwater. The ESD allows DLA to use in situ treatment if new contamination is discovered in the future	The following text has been inserted below the heading for Section 1.1 of the ESD. "The current remedy for OU 1 is groundwater extraction, treatment by air stripping, and discharge of treated water to surface water percolation ponds or injection wells. This ESD adds two new remedial alternatives to the OU 1 groundwater remedy at the Sharpe Site: (1) In situ treatment of high levels of subsurface contamination; and (2) land use controls (LUCs) to minimize the potential for exposure to contaminated indoor air inhalation related to vapor intrusion from subsurface contamination and exposure to contaminated groundwater. **In Situ Treatment.** The Army determined that it is beneficial and cost effective to supplement the original OU 1 groundwater remedy with in situ treatment of areas with high concentrations of subsurface contamination that create a continuing source of groundwater contamination at the Sharpe Site. Three pilot studies were conducted to determine which type of in situ treatment is the most effective for site conditions at the Sharpe Site. There are many types of in situ treatment available, and selection of the most effective treatment depends on site specific conditions such as the type and concentration of contamination and hydrogeologic characteristics. This ESD selects in situ treatment in two high concentration areas designated Central Area (CA) and South Balloon (SB) but it allows flexibility for the Army to identify other areas with conditions suitable for in situ treatment as well. If other areas are considered suitable, the Army (continued)

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1. (cont'd)	Sec. 1		(continued) will submit a remedial design/remedial action (RD/RA) work plan for regulatory concurrence with the treatment. The RD/RA work plan will explain how and where in situ treatment will be implemented as described in Section 4.3. The remedial objective for in situ treatment is to reduce high levels of contamination that are slowly releasing VOC mass to dissolved groundwater at the Sharpe Site. In situ treatment will reduce the time required to remediate groundwater plumes and will be cost effective in the long run. The RD/RA work plan will describe the remediation goals of the treatment for each area. The Army will initially implement in situ treatment at CA and SB where high (greater than 1,000 micro-grams per liter [µg/L]) concentrations of VOCs in groundwater are present as described in Section 4.3.1. This ESD also allows the Army flexibility to implement in situ treatment in other areas with high concentrations of contamination that may be determined in the future. If the Army determines that in situ treatment is beneficial and cost effective in another area, then a new RD/RA work plan will be submitted to the regulatory agencies for concurrence. **LUCs.** LUCs are instruments such as administrative, legal, engineered, or physical barriers that help minimize the potential for exposure to contami-nation. LUCs are described in Section 4.3.2. (continued)

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1. (cont'd)	Sec. 1		(continued) This ESD establishes LUCs to minimize the potential for inhalation exposure to contaminated indoor air that may be present because of vapor intrusion into occupied work spaces or residences from shallow groundwater plumes at the Sharpe Site. LUCs for vapor intrusion from soil VOC contamination at the Sharpe Site were established in the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution Depot San Joaquin–Sharpe Site (Operable Unit 2 – Soils)* (OU2 ROD Amendment) (URS Group, Inc. [URS], 2011a). This ESD also establishes LUCs to restrict on-site use of groundwater at the Sharpe Site. The paragraph above was modified slightly from text proposed by Mr. John Lucey, EPA remedial project manager. The text was changed to indicate that only one RD/RA work plan will be prepared to address both of the high-concentration areas designated in the ESD, and the text addressing the "criteria used to shut down the in situ treatment system" was deleted. The DoD component intends to prepare one RD/RA work plan for in situ treatment of the Central Area and South Balloon target areas, and there will be no in situ treatment system to shut down. After injection of the amendments, treatment will automatically run its course.

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2.	Sec. 1	Section 1.0 should have a new sub section for "Summary of other RODs with Institutional Controls for Vapor Intrusion". This new section should explain that vapor intrusion can emanate from soil and groundwater contamination and ICs for vapor intrusion from soil is already addressed in the 1996 ROD and the 2011 ROD Amendment.	ICs for vapor intrusion from soil were not addressed in the 1996 OU 2 ROD for the Sharpe Site. Only the 2011 OU 2 ROD Amendment addressed LUCs for vapor intrusion from soil. The need for LUCs for the vapor intrusion pathway for both groundwater and soil is addressed in the new second paragraph after the LUCs subheading in Section 1.1 provided in the response to Item #1.
3.	Sec. 1.1	This section mentions the terms "significant" and "fundamental". Provide a detailed definition of these terms and reference the EPA guidance document that defines significant and fundamental changes to the ROD. Explain why the changes are significant rather than fundamental and why an ESD is appropriate rather than a ROD amendment.	The terms cited in the comment are now in the sixth paragraph of Section 1.1 and the following text was added to Section 1.1 after "…but not fundamental" in the third sentence. " 'A significant change involves a change to a component of a remedy that does not fundamentally alter the overall cleanup approach; a fundamental change involves an appreciable change or changes in the scope, performance and/or cost' (EPA, 1999). An ESD is appropriate for OU 1 because components are being added to the existing groundwater extraction and treatment cleanup approach without fundamentally changing it." The portion of the sentence that originally followed "…but not fundamental." in the draft final ESD has been deleted.
4.	Sec. 2.2.3	**Post ROD Actions.** This section should include all of the post ROD actions including the three pilot tests.	The text that was included under the heading **3.2 Summary of Three In Situ Pilot Studies** has been moved to the end of Section 2.2.3.
5.	Sec. 2.2.4	**Remedy Selected in the OU1 ROD.** This section should be moved to precede Section 2.2.3 Post ROD Actions. The last paragraph in Section 2.2.4 should be moved into Section 2.2.3 Post ROD Actions.	As requested in the comment, the text, excluding the last paragraph, that had been in **Section 2.2.4** was moved to Section 2.2.2 OU 1 Record of Decision, and Section 2.2.4 was deleted. The last paragraph was inserted as the introductory paragraph into **Section 2.2.3**. The original first sentence of Section 2.2.3 was deleted.

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6.	Sec. 2.3	**Conceptual Site Model.** It would be helpful to describe the contaminated media at Sharpe. This includes: 1) vadose zone soil; 2) saturated zone soil; 3) dissolved groundwater contamination; 4) soil gas (vapor intrusion) emanating from soil and groundwater contamination. Please clarify if there is any DNAPL contamination below the water table.	The contaminated media are adequately described in Section 2.3.2 and 2.3.4. The following sentence has been added to the second paragraph under Section 2.3.2: "Dense non-aqueous phase liquids have not been detected in the high concentration areas or any other location on the Sharpe Site." Additional text on soil vapor or soil contamination is not necessary because this is an ESD for a groundwater-only remedy.
7.	Sec. 2.3.5.2	**Vapor Intrusion Pathway.** This section should clarify that vapor intrusion emanating from residual soil contamination is addressed in the 1996 ROD and the 2011 ROD Amendment.	The following text has been inserted as the new second sentence of the first paragraph under Section 2.3.5.2: "The vapor intrusion pathway was also not addressed in the 1996 OU 2 ROD (ESE, 1996) for contaminated soil, but was subsequently addressed in the OU 2 ROD Amendment (URS, 2011c)." Additional text is unwarranted.
8.	Sec. 2.3.5.2, 1st para.	**Vapor Intrusion Pathway.** The first paragraph says "There are some indications of deeper plume migration …" Please clarify if there is any risk associated with vapor intrusion from the deeper plumes.	The last sentence of the first paragraph has been replaced with the following: "The extents of A Zone groundwater plumes from which VOCs could volatilize and enter soil vapor have been relatively stable. There has been migration of VOC plumes to the deeper B and C Zones; however, these plumes are overlain by uncontaminated or less-contaminated groundwater that impedes the upward migration of VOCs to the vadose zone. Therefore, VOCs in groundwater of the B and C Zones are not a threat to human health through the vapor intrusion pathway."

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9.	Sec. 2.3.5.2, 2nd para.	**Vapor Intrusion Pathway.** The second paragraph is confusing and should be revised. It seems to be saying that Building 649 is the only building at Sharpe that currently overlies a plume. Was a risk calculation ever performed for Building 649 and if so what was the result? If the building is occupied more than one hour a day is there a significant risk? If the land use restriction is to only occupy the building for one hour a day how will this be enforced by DLA. This does not appear to be addressed in the LUC description. Please clarify in the text.	The following text replaces the entire second paragraph of Section 2.3.5.2: "The vapor intrusion pathway is potentially complete in structures overlying A Zone groundwater contaminated with VOCs. Building 649 is the only building at the Sharpe Site that overlies a shallow (A Zone) groundwater plume. Soil vapor samples were collected beneath Building 649 from two borings at two depths each in October 2009 to address a concern expressed by DTSC regarding the presence of a vadose zone source for groundwater contamination beneath the building. TCE was detected in one sample at a concentration of 38 parts per billion by volume (ppbv) at 11.5 feet bgs, which is less than the OU 2 ROD cleanup standard. TCE was not detected in the other three samples (see the Site P-1E summary in Appendix A of the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution San Joaquin-Sharp Site (Operable Unit 2 –Soils)* [URS, 2011b] for sample locations and results). Soil vapor sample results indicate that no VOC source exists in the vadose zone beneath the building where the samples were collected. The detection of TCE in the soil vapor sample from beneath the northeastern portion of Building 649 suggests that volatilization from the shallow (A Zone) groundwater plume may be occurring. However, the concentration in soil vapor is less than the 56 ppbv generic industrial (continued)

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9. (cont'd)	Sec. 2.3.5.2, 2nd para.		(continued) screening level (at a risk level of 1E-06) for soil vapor greater than 5 feet bgs[1]. Consequently, there is no unacceptable risk to current industrial receptors at Building 649." The part-time occupants of Building 649 have moved out of the building. Therefore, it is not necessary for the LUCs to limit building occupancy.
10.	Sec. 2.3.5.2	**Vapor Intrusion Pathway.** This section should summarize the previous vapor intrusion investigations that have been performed. Explain the results from any indoor air or below slab sampling and reference the reports. Explain the difference between soil VI which was addressed in the OU2 ROD Amendment and groundwater VI addressed in this ESD. Perhaps two separate bold text sub-headings would help emphasize the soils and groundwater VI differences.	The only investigation addressing the potential effects of groundwater on the vapor intrusion pathway is discussed in text to be inserted in response to Item #9. Potential vapor intrusion from soil VOC contamination is not an issue in this groundwater ESD. Additional text on soil contamination could confuse readers of the ESD and is not warranted.
11.	Tbl. 2-4, pg. 2-19	California has different toxicity criteria for 2 of the COCs, PCE and carbon tetrachloride. Incorporating California's toxicity values into the VISL (vapor intrusion screening level) calculator the groundwater screening levels should be Industrial Indoor Air / Groundwater PCE 2.10 ug/m3 / 2.90 ppb CCl4 0.29 ug/m3 / 0.26 ppb	Comment noted, but text was not revised. As a federal CERCLA site, the LUCs for the Sharpe Site are based on the toxicity-value hierarchy adopted for the Superfund program. It should be noted that California has different cancer-based toxicity values for all five of the listed COCs, not just the two. Also, EPA's much more recent toxicological reviews resulted in a recognition of decreased potencies for PCE and CCl4, in contrast to the older data and methods used in derivation of the listed California values.

[1] The EPA Regional Screening Level for the concentration of TCE in ambient air in a commercial/industrial setting is 3.0 micrograms per cubic meter (µg/m^3) (EPA, 2012a). Based on EPA's generic screening attenuation factor for soil greater than 5 feet bgs (a dimensionless value of 0.01; EPA, 2002), the equivalent soil vapor concentration at those depths would be 300 µg/m^3. Then, converting the measurement units (assuming standard temperature [25 degrees Celsius] and pressure [1 atm]): 610 µg/m^3 = 56 ppbv.

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12.	Tbl. 2-4, pg. 2-19	The footnote b in Table 2-4 should be deleted since the MCL for chloroform applies to disinfection by-products and not source water, so the screening level should be 3.6 ppb.	The footnote and the default screening level of 80 µg/L have not been deleted because it is likely that the some of the chloroform in groundwater at the Sharpe Site originated as a groundwater disinfection by-product that reentered groundwater from leaking sewer lines. Note, also, that the table title has been modified from "Target Groundwater Concentrations for Industrial/Commercial LUCs" to "Target Groundwater Concentrations for LUCs Protective of the Vapor Intrusion Pathway for Industrial/Commercial Uses."
13.	Sec. 2.3.5.3	**Ecological Risk.** This section should describe how DLA will ensure that implementation of the in situ remedy does not adversely impact the burrowing owls. Burrowing owls may need to be relocated if they have burrows at the locations where in situ systems will be constructed. This should also be reiterated in the RD work plan.	The following text has been added to Section 2.3.5.3: "The Sharpe Site has a burrowing owl management plan (Albion Environmental, Inc., 1997) in place, and burrowing owl census surveys are conducted annually. The RD/RA work plan will further describe preventive measures that will be taken to assure that owls do not inhabit burrows at the South Balloon or Central Area in situ treatment areas when treatment is occurring."
14.	Sec. 3.1	**New Information.** Please move the CPT and FS details to Section 2.2.3 Post ROD Actions. This section should have a more descriptive title (i.e. New Data Collected) and explain that DLA reviewed the new data and the results from the three pilot tests. Based on the data review, DLA believes that in-situ treatment is cost effective and will help clean up the sites faster, better etc. Please emphasize that the type of fracking that will be used during the implementation of in-situ treatment is not dangerous and will not spread contamination to uncontaminated areas or aquifers. Explain that pilot tests were performed at three sites but only two sites will require full scale in situ treatment. Explain why full scale in situ treatment is not needed at the North Balloon Site. Please clarify if any existing ICs are in place for vapor intrusion from residual soil contamination at the North Balloon site?	It is the position of the DoD component that the title of the section is appropriate and in accordance with EPA guidance on preparing ESDs. The change in the remedy was not based on data collection alone. A substantial amount of non-data information including groundwater modeling results were applied in the evaluation. The information presented on the CPT/HydroPunch investigation has been moved; however, the description of the FS sets up the rationale for the pilot testing and the selection of the in situ remedy. In EPA comments on the draft ESD, information on the FS was requested in this section. Therefore, the description of the CPT/HydroPunch

(continued)

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14. (cont'd)	Sec. 3.1		(continued) investigation has been deleted and a brief FS discussion will be retained in Section 3.1. The following brief text was added to Section 2.2.3 to describe the post-ROD FS: "The identification of the high-concentration areas and their potential impacts on the time to achieve cleanup prompted the performance of a focused feasibility study for OU 1. The original feasibility study performed for OU 1 (ESE, 1991a) considered only groundwater extraction and treatment remedies; it was not updated to include in situ technologies. Therefore, the *Operable Unit 1 Focused Feasibility Study* (URS, 2011a) addressed in situ technologies and other remedial alternatives for groundwater. A number of technology options were considered in the FFS, including focused groundwater extraction, physical treatment, chemical treatment, biological treatment, combination treatments, vertical barriers, and encapsulation. Some of the process options considered chemical reduction, chemical oxidation, hydraulic and pneumatic fracturing, air sparging, and permeable reductive barriers. Details of these options and the development of the alternatives are described in detail in the FFS (URS, 2011a)."
15.	Sec. 3.2	**Summary of 3 Pilot Studies.** For continuity the main description of how the three pilot studies were conducted should be moved to Section 2.2.3 Post ROD Actions.	Text from this section, which was requested by EPA in its comments on the draft ESD, has been moved to Section 2.2.3. After removal of the text of Section 3.2, the text of Section 3.3 was moved into Section 3.2 and Section 3.3 was deleted.

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16.	Sec. 3.2	**Summary of 3 Pilot Studies.** Please add a new sub section for the discussion of fracturing. Do you anticipate that fracturing will be used at the two sites? Provide rationale to show that hydraulic fracturing is protective of human health and the environment. Describe the potential for hydraulic fracturing to increase migration and vapor intrusion into existing buildings. Will fracturing the aquitard create a new pathway for contaminant migration in the groundwater or in the vadose zone? Summarize and reference the report where this was evaluated. What type of fluid will be used for fracturing (water, air)? This section should provide more detailed information on the previous use of fracturing for SVE and during the pilot study and explain how the proposed low pressure fracturing is safe from an environmental perspective.	A new subsection consisting of the following text has been added to **2.2.3 Post ROD Actions** to describe fracturing. "Fracturing. Aquifer cleanup times can be shortened if COC mass in the aquitard can be reduced in situ without extraction. Results of the in situ treatability study indicated that COC mass in the A/B aquitard can be destroyed or concentrations can be reduced to less than ACLs when amendments make direct contact with COCs (URS, 2010a, 2010b, 2010c). To improve the potential for any amendment to make contact with COC mass, the aquitard must be artificially fractured with fluid or gas before the amendment is injected or the amendment must be injected through multiple boreholes or wells in the aquitard. Low pressure fracturing with either water or nitrogen gas that will be used at each in situ treatment target area is a widely accepted component of in situ treatment remedies in California and differs substantially from the technology used to fracture rock in the petroleum industry. One of the target areas where fracturing could occur is adjacent to Building 649 that is no longer occupied, and in the other area, the nearest occupied building is more than 100 feet from the treatment area. It is unlikely that fracturing could affect these buildings or increase the potential for vapor intrusion because the shallowest fracturing will be performed at approximately 40 feet bgs in the saturated zone. A water mixture or nitrogen gas under pressure would be injected to induce fractures in a horizontal plane with an expected fracture radius of 10 to 15 feet. Based on past experience at (continued)

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16. (cont'd)	Sec. 3.2		(continued) the Sharpe Site, fractures are unlikely to reach the vadose zone at approximately 15 to 20 feet bgs where VOCs could be volatilized and migrate upward toward building foundations. Areas where fracturing is considered are upgradient from extraction wells, which would extract any VOCs that are not destroyed by amendments and could migrate along new fractures in the aquitard. Therefore, contaminants in the treatment zones are unlikely to migrate into exposure pathways to potential receptors, and fracturing for in situ treatment at the Sharpe Site will not increase health or ecological risks. Results of groundwater modeling and the three pilot studies were two key elements in the FFS performed for OU 1 (URS, 2011a). The FFS recommended an alternative that included in situ reduction of COC mass in high-concentration areas."
17.	Sec. 3.2	**Summary of 3 Pilot Studies.** The basis for the ESD should summarize the results of the pilot studies and state that in situ with fracking is safe, cost effective and successfully reduced contamination.	The content of this section has been moved to Section 2.2.3. Therefore, the following text has been added in a paragraph under 3.1: "Each in situ technology pilot tested is considered cost effective, and each is predicted to reduce the time to cleanup because each removes VOC mass by degradation. Fracturing of the A/B aquitard in high-concentration target areas (greater than 1,000 µg/L) will be conducted to ensure that the injected amendments make contact with VOC mass. One of the in situ technologies along with fracturing will be applied (continued)

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17. (cont'd)	Sec. 3.2		(continued) in the aquitard of the South Balloon and the Central Area; however, the technologies will not be used for in situ treatment in the North Balloon source area because the treatment would not be cost effective there. These technologies, when properly applied to the areas identified in this ESD, are considered safe for human health and the environment."
18.	Sec. 3.2	**Summary of 3 Pilot Studies.** The basis for the ESD should explain how additional in situ treatment is needed at two sites (the Central Area and South Balloon) but no additional treatment is needed at the North site. Please provide rationale to support this decision.	This issue is addressed in the new text added under Item #17.
19.	Sec. 4.3	**Components to be added to the Remedy.** Add a new sub section (Implementation of In Situ Treatment at the Central Area Site and the South Balloon Site). This section should simply say that in situ treatment will be implemented at these two sites and that a separate RA Work Plan will be submitted for each site.	It is the position of DLA and the Army that more detail is warranted in this section to explain what the new remedy components are. The text under the subheading **In situ remediation in high concentration areas in South Balloon and Central Area** will be inserted in Subsection 4.3.1 with a new title **Implementation of In Situ Treatment at the South Balloon and Central Area**. The text in Section 4.3 that described groundwater extraction and treatment in the South Balloon and the Central Area has been deleted.

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20.	Sec. 4.3	**Components to be added to the Remedy**. Add a new sub section (Implementation of In Situ Treatment at Other Unknown Sites). This section should describe DLA's decision making process to determine if in situ treatment is appropriate for any new contamination discovered at Sharpe. If DLA feels it is important to include a criteria such as 1000 ppb contamination to consider in situ treatment then it should be discussed in detail here. I suggest you have flexible language to allow DLA the option to consider in situ treatment as an alternative at any site regardless of the type of contamination or the concentration. For example, if DLA or the Army discovered carbon-tet or vinyl chloride in the soil, what concentration would indicate that in situ treatment is appropriate?	A new subsection is not warranted; the issue of applying the treatment to other sites can be addressed with text already presented in Section 4.3.1. However, the organization of Section 4.3.1 has been changed. The subject of applying the remedy to sites other than the South Balloon and the Central Area has been addressed with the following text in Section 4.3.1. "The Army concludes that flexibility would be beneficial in the implementation of in situ treatment on the Sharpe Site. Effectiveness of the treatment may be enhanced by the selection of the most appropriate amendment for creating either oxidizing conditions or reducing conditions locally in the treatment area depending on biogeochemical conditions in the aquifer and aquitard at the time of treatment. The Army will maintain flexibility using pre-determined criteria for selection of amendments to be used at each treatment site. Those criteria and the outcomes expected include the following: Any area considered for in situ treatment will have the following characteristics: 1. Fine-grained, low permeability saturated deposits at least 10 feet in thickness, e.g., the A/B aquitard near historical source areas. 2. VOC concentrations greater than 1,000 µg/L, unless the Army determines that treatment in a target area with 1,000 µg/L or less of VOC concentrations would substantially expedite remediation and be cost effective. (continued)

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20. (cont'd)	Sec. 4.3		(continued) Characteristics of a target area for fracturing and injection of an oxidizing amendment (e.g., KMnO4): 1. VOC mass to be treated may be beneath or adjacent to a regularly occupied work space because an oxidizing amendment will destroy PCE and TCE, as well as their breakdown products 1,2-DCE and vinyl chloride, thereby eliminating the possibility of their upward migration along fractures and potential for vapor intrusion. 2. Either the treatment area and the nearest downgradient depot boundary are separated by at least 300 feet or there is an operational, downgradient, B Zone extraction well within 30 feet to allow for control (via extraction or treatment) or natural stabilization of any increased inorganic constituent (e.g., hexavalent chromium, selenium) concentrations exceeding the respective maximum contaminant levels (MCLs) mobilized by in situ oxidation. The expected outcome of this treatment at a site with these characteristics is rapid, complete destruction of chlorinated ethene compounds that are contacted (through fractures and diffusion) by the amendment instead of gradual reductive degradation. Characteristics of a target area for fracturing and injection of an amendment to biologically (e.g., EOS) (continued)

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☐ STRUCTURAL	☐ INST & CONTROLS	☐ SPECIFICATIONS			

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
20. (cont'd)	Sec. 4.3		(continued) or biologically and chemically (e.g., EHC) reduce groundwater to enhance anaerobic biodegradation: 1. Geochemical parameters (e.g., total organic carbon, dissolved oxygen, oxidation-reduction potential, and pH) of the target area indicate a reductive environment that published studies have shown to be conducive for VOC degradation. 2. Either the treatment area and the nearest downgradient depot boundary are separated by at least 300 feet or there is an operational, downgradient, B Zone extraction well within 300 feet to allow for control (via extraction or treatment) or natural stabilization of any increased inorganic constituent (e.g., hexavalent chromium, selenium) concentrations exceeding the respective MCLs mobilized by in situ oxidation. 3. VOC mass is not beneath or directly upgradient from a regularly occupied work place (avoiding potential for vapor intrusion of degradation products), unless fracturing occurs deeper than 50 feet bgs. 4. There is potential for multiple injections of the amendment. The expected outcome of this treatment at a site with these characteristics is gradual reductive dechlorination of VOCs. (continued)

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☐ ARCHITECTURAL	☐ ELECTRICAL	☐ ESTIMATING	☐ OTHER	NAME John Lucey, EPA
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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
20. (cont'd)	Sec. 4.3		(continued) The Army will make the decision on the most appropriate amendment to use in each area and will submit the decision to regulatory agencies for approval prior to implementing in situ treatment (including fracturing and injection of amendments in the fractured aquitard). The treatment to be applied in each of the target areas will be identified in an RD/RA work plan. Target areas that have a COC concentration equal to or less than 1,000 µg/L will be considered for in situ treatment, if there is evidence that treatment of the area will decrease the predicted time to remediate and/or will be cost effective."
21.	Sec. 4.3	**Components to be added to the Remedy.** Add a new sub section (Remedial Objectives for Implementing In Situ Treatment). This section should describe the cleanup objects of the in situ treatment. Describe the objective and remediation goals for in situ treatment. Is the objective to cleanup soil and groundwater to ACLs or to reduce the impact of soil contamination on the groundwater?	A new paragraph under Section 4.3.1 entitled Remedial Objectives has been inserted with the following text: "The remedial objective of in situ treatment at the Sharpe Site is reduction in the mass of VOCs in high-concentration areas to expedite groundwater remediation at the site. The RAOs of the OU 1 remedy are: to protect human health and the environment and mitigate the potential for long-term contaminant migration. These RAOs are not revised by this ESD. The components added by the ESD in conjunction with groundwater extraction and treatment address the second RAO. In situ treatment will reduce the potential for long-term VOC migration. The cleanup goals for the groundwater remedy are the ACLs established in the OU 1 ROD (Section 2.2.2); however, those goals are unlikely to be achieved with in situ treatment efforts alone."

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
22.	Sec. 4.3	**Components to be added to the Remedy.** Add a new sub section (In Situ Treatment System Shutdown Criteria). This section should describe the shut down criteria for the in situ treatment system. How will DLA determine that the remediation goals have been achieved?	The remediation goal for in situ treatment is reduction of VOC mass in high-concentration areas. No more specific goal will be established in the ESD. There is no in situ treatment system to shut down. After the amendments are injected, treatment will automatically run its course.
23.	Sec. 4.3	**Components to be added to the Remedy.** Add a new sub section (Submittal of Remedial Action Work Plans). This section should say that DLA will submit an RA work plan for each site where in situ treatment will be performed. Provide a brief description of the work plan contents and purpose. The work plan should include DQOs for the in situ treatment, describe how the system is expected to operate, describe the phased approach to injecting amendments, and describe the procedure used to shut down the system. Describe how results of the ongoing treatment will be reported to the regulators. The work plan should describe how a RA Report will be prepared to document completion of the remedial action.	The following text has been added to Section 4.3.1: "The Army will prepare an RD/RA work plan addressing the in situ treatments in both the South Balloon and Central Area target areas. The work plan will describe the purpose of the treatment, the fracturing effort (including the fracturing medium to be used), the specific amendments and their amounts to be injected, the estimated number of injection locations, and the monitoring planned in and downgradient from treatment areas. A single remedial action report will be submitted after the completion of the injection and the initial post-treatment monitoring."
24.	Sec. 4.3.2	**LUCs.** This title should be spelled out. This section should say that the new LUCs in this ESD are for restricting the use of groundwater within the boundaries of the Sharpe Site and VI related to shallow groundwater contamination within the boundaries of the Sharpe Site. Explain that the OU2 ROD includes LUCs for VI related to soil contamination. Explain that this ESD describes LUCs for VI related to shallow groundwater contamination plumes. Also explain that modeling shows that groundwater contamination in the deeper aquifers is not a significant risk.	The section title has been spelled out. The text in the first paragraph of this section addresses most of the issues requested in the comment. The presence of LUCs for soil in the OU 2 ROD was described in Section 2.3.5.2 as requested in another comment; redundant text here is not warranted. The issue of VOCs in the deeper aquifer zones was also addressed in Section 2.3.5.2 as requested and will not be repeated here. No modeling was necessary to address vapor intrusion from deep plumes.

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25.	Sec. 4.3.2	**LUCs.** The second bullet on page 4-3 says the LUCs objective is "To prevent exposure to groundwater with COC concentrations exceeding the ACLs specified in the OU1 ROD. EPA's preferred language is "To prevent access or use of groundwater until cleanup levels are met". Does DLA expect to access and use groundwater, and if so, the ESD should explain what groundwater and show it will be accessed or used.	Text in the second LUC objective bullet has been changed to the following: "To prevent access or use of groundwater with COC concentrations exceeding the ACLs specified in the OU 1 ROD."
26.	Sec. 4.3.2	**LUCs.** There are two bullets for LUCs objectives on page 4-3. Please add the following as a third bullet. • Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells, impermeable reactive barrier	The bullet has been added to LUCs objectives with the exception of "impermeable reactive barrier", which will not be a component of the OU 1 remedy.
27.	Sec. 4.3.2	**LUCs.** There are three bold sub sections for "Vapor Intrusion", "On-Depot groundwater", and "DLA will implement, monitor…" These sub sections should have section numbers that appear in the table of contents.	Numbers have been added to the subsections and appear in the table of contents.
28.	Sec. 4.3.2	**LUCs.** The bold sub section for "Vapor Intrusion", says "If construction of a structure to be regularly used as a workspace is considered within the VOC plume plus buffer area, construction must include implementation of engineering controls, such as ventilation/sub-slab depressurization and/or vapor intrusion barriers or the structure must be relocated to an area outside of the plume plus its buffer." Please describe how DLA will determine if a new structure will be "regularly used as a workspace". Will a risk assessment be performed for new construction projects? Please describe how the engineering controls requirement will be implemented and enforced. Please revise the ESD to describe these issues.	The following text has been added following the paragraph heading "Vapor Intrusion": "Land use at the Sharpe Site is currently industrial, and the anticipated future land use for the site is industrial/commercial. Therefore, the areas subject to LUCs for the vapor intrusion pathway were determined based on the assumption of the current and anticipated future land use. The LUCs preclude unrestricted use and unlimited exposure in areas where COC plumes occur in the A Zone." The Army will not perform a risk assessment for new industrial/commercial construction projects because there will either be no construction over a VOC plume or engineering controls will be implemented to (continued)

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28. (cont'd)	Sec. 4.3.2		(continued) prevent exposure. The text "regularly used as a workspace" has been deleted. The engineering controls will be implemented by the procedures described in the second, sixth and seventh bullets under "DLA will implement…", which will be changed to "Army will implement..."
29.	Sec. 4.3.2	**LUCs.** The discussion of LUCs is confusing in the sub sections for "vapor intrusion" and "on-depot groundwater". The titles for figures 4-3 and 4-4 should be revised. Is Figure 4-3 the area for VI LUCs based on the A zone aquifer? Is Figure 4-4 the areas where groundwater use and drilling will be restricted? Does Figure 4-4 show a combination of shallow and deeper aquifers? Please clarify.	The title for Figure 4-3 has been revised to the following: "On-Site portions of A Zone COC Plumes Requiring Land Use Controls to Prevent Vapor Intrusion". The title of Figure 4-4 has been changed to the following: "On-Site Portions of COCs in the A, B, and C Aquifer Zones Requiring Groundwater Land Use Controls."
30.	Sec. 4.3.2	**LUCs.** The sub section for On-Depot groundwater should be revised. Please change "The LUC must prohibit" to "The LUC will prohibit". Please change "When established, LUCs must also maintain" to "The LUCs will maintain"	The proposed word changes will be made as requested.
31.	Sec. 4.3.2	**LUCs.** Add a new subsection for off base groundwater. The last sentence in the section (on page 4-12) says that the City of Lathrop and/or San Joaquin County will be responsible for enforcing off-depot ordinances. This section should be expanded to describe the ordinances and how they are enforced. Also describe if there are any off base plumes and if there are any off base wells that are impacted. Explain how the off base wells are monitored, if at all, by DLA.	In its 13 February 2013 comments on the draft OU 1 ESD, the Central Valley Water Board specifically requested that working with City of Lathrop and county government on off-base groundwater issues be left out of the LUCs because they are not part of the remedy, only interim measures until ACLs established in the original OU 1 ROD are attained. City and County ordinances are not under the jurisdiction of the DoD component or this ESD and the sentence that refers to ordinances has been deleted. The sampling of off-site groundwater is not (continued)

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
31. (cont'd)	Sec. 4.3.2		(continued) a part of the OU 1 remedy and should not be included in Section 4.3.2. Off-site groundwater monitoring is addressed in Section 6.1, Protection of Human Health and the Environment.

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.		EPA comment No. 9 on the Draft Final ESD was not addressed adequately: ***9. Section 2.3.5.2 Vapor Intrusion Pathway.*** *The second paragraph is confusing and should be revised. It seems to be saying that Building 649 is the only building at Sharpe that currently overlies a plume. Was a risk calculation ever performed for Building 649 and if so what was the result? If the building is occupied more than one hour a day is there a significant risk? If the land use restriction is to only occupy the building for one hour a day how will this be enforced by DLA. This does not appear to be addressed in the LUC description. Please clarify in the text.* The ESD has LUCs that describe how vapor intrusion will be addressed for new construction above groundwater contamination, but the ESD does not include LUCs to describe actions that will be taken if a groundwater plume migrates below an existing building at Sharpe.	With the west-northwest and west-southwest hydraulic gradients that exist where there are A Zone groundwater plumes, it is highly unlikely that a groundwater plume exceeding the Target Ground-water Concentration will migrate under an existing Sharpe Site building that is in use. However, the following text has been added to paragraph 4.3.2.1 in the LUCs Section: "If a plume with concentrations exceeding a Target Groundwater Concentration plus the 100-foot buffer migrates under an existing building that is in use, the Army will conduct subsurface soil vapor and first groundwater sampling to verify the concentrations and compare those results to current soil vapor and groundwater regional screening levels (RSLs) from U.S. EPA or California Alternate Screening levels to evaluate the potential risks to building occupants. Contingent on the results of the assessment, the Army will take the steps necessary to ensure that building occupants are not exposed to excess risk or will take no action."
2.		EPA comment No. 11 on the Draft Final ESD was not addressed adequately: ***11. Table 2-4. Page 2-19.*** *California has different toxicity criteria for 2 of the COCs, PCE and carbon tetrachloride. Incorporating California's toxicity values into the VISL (vapor intrusion screening level) calculator the groundwater screening levels should be* *Industrial Indoor Air* / *Groundwater* *PCE 2.10 ug/m3 2.90 ppb* *CCl4 0.29 ug/m3 0.26 ppb* The State screening levels are applicable ARARS and should be used.	Groundwater Target Concentrations calculated with 2013 California Alternate Screening Levels for tetrachloroethene, carbon tetrachloride, and cis-1,2-dichloroethene have been added to Table 2-4.

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.		**EPA's previous comment 26 on the Draft ESD was addressed adequately. It is appropriate to add this paragraph and avoid revising the ESD in a few months when the base closure and property transfer begins.** **26) LUC section on page 26 -** EPA's LUC check list Item 12 should be addressed in the new Landuse Change section. Please add the following text: Prior to seeking approval from EPA and the State the recipient of the property must notify and obtain approval from DLA of any proposals for a land use change at a site inconsistent with the use restrictions and assumptions described in this ROD.	DLA/Army concurs. The requested text, with revisions, has been inserted after the first bullet on page 4-11. "If the Army closes the property or a portion the property, prior to seeking approval from EPA, DTSC, and CVWB, the recipient of the property must notify and obtain approval from the Army of any proposals for a land use change at a site inconsistent with the use restrictions and assumptions described in this ESD."
2.		**New text (and removal of text) in section 2.3.5.2. This new text is cut and paste from the old text and replaces all of the old text.** **2.3.5.2 Vapor Intrusion Pathway** Inhalation exposure to volatile compounds that have migrated from the subsurface into indoor air (vapor intrusion pathway) is a now well-recognized exposure pathway that was not well understood, nor evaluated, during development of the original risk assessment for groundwater contamination in the OU 1 ROD (ESE, 1991b). The vapor intrusion pathway was also not addressed in the original 1996 OU 2 ROD (ESE, 1996) for contaminated soil, but was subsequently addressed in the OU 2 ROD Amendment (URS, 2011c). Therefore, this ESD only addresses vapor intrusion migrating from groundwater contamination plumes and does not address vapor intrusion from residual soil contamination in the vadose zone. (continued)	DLA/Army concurs. The requested text, with revisions, has replaced the original text of Section 2.3.5.2. The primary revision was stating that DTSC California Alternate Air screening levels were used to define the Target Groundwater Concentrations. **"2.3.5.2Vapor Intrusion Pathway** Inhalation exposure to volatile compounds that have migrated from the subsurface into indoor air (vapor intrusion pathway) is a now well-recognized exposure pathway that was not well understood, nor evaluated, during development of the original risk assessment for groundwater contamination in the OU 1 ROD (ESE, 1991b). The vapor intrusion (continued)

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
2. (cont'd)		(continued) The vapor intrusion pathway is potentially complete in structures overlying A Zone groundwater contaminated with VOCs. Horizontal migration of the A Zone groundwater plumes, from which VOCs could volatilize have been relatively stable in recent years. There has been some vertical downward migration of VOC contamination from the A Zone to the deeper B and C Zones; however, these deeper zones are overlain by uncontaminated or less-contaminated groundwater that impedes the upward migration of VOC vapors from the deeper B and C Zones. Therefore, VOCs in groundwater of the B and C Zones are not a threat to human health through the vapor intrusion pathway. Building 649 is a large warehouse building and is the only building at the Sharpe Site that currently overlies a shallow (A Zone) groundwater TCE plume. In October 2009 soil vapor samples were collected to investigate potential vadose zone contamination beneath Building 649. Soil vapor samples were collected beneath Building 649 from two borings at two depths. TCE was detected in one sample at a concentration of 38 parts per billion by volume (ppbv) at 11.5 feet bgs, which is less than the OU 2 ROD cleanup standard for TCE contamination in soil. TCE was not detected in the other three samples. The results of the investigation are summarized in the Site P-1E summary in Appendix A of the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution San Joaquin-Sharp Site (Operable Unit 2 –Soils)* [URS, 2011c]. Soil vapor sample results indicate that no VOC source exists in the vadose zone beneath the building where the samples were collected. The one detection of TCE in the soil vapor sample from beneath the northeastern portion of Building 649 suggests that volatilization from the shallow (A Zone) groundwater plume may be occurring. However, the (continued)	(continued) pathway was also not addressed in the original 1996OU 2 ROD (ESE, 1996) for contaminated soil, but was subsequently addressed in the OU 2 ROD Amendment (URS, 2011c). Therefore, this ESD only addresses vapor intrusion from volatilization of VOCs from groundwater contamination plumes and does not address vapor intrusion from residual soil contamination in the vadose zone. The vapor intrusion pathway is potentially complete in structures overlying A Zone groundwater contaminated with VOCs. Horizontal migration of the A Zone groundwater plumes, from which VOCs could volatilize have been relatively stable in recent years. There has been some vertical downward migration of VOC contamination from the A Zone to the deeper B and C Zones; however, these deeper zones are overlain by uncontaminated or less-contaminated groundwater that impedes the upward migration of VOC vapors from the deeper B and C Zones. Therefore, VOCs in groundwater of the B and C Zones are not a threat to human health through the vapor intrusion pathway. Building 649 is a large warehouse building and is the only building at the Sharpe Site that currently overlies a shallow (A Zone) groundwater TCE plume. In October 2009 soil vapor samples were collected to investigate potential vadose zone (continued)

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
2. (cont'd)		(continued) concentration in soil vapor is less than the 56 ppbv industrial screening level (at a risk level of 1E-06) for soil vapor greater than 5 feet bgs[1]. Consequently, there is no unacceptable risk to any potential industrial workers at Building 649. In addition, Building 649 is currently vacant and may eventually be torn down. LUCs will be implemented for areas of A Zone groundwater that have concentrations exceeding commercial/industrial Target Groundwater Concentrations of TCE, PCE, CCl_4, 1,2-dichloroethane (DCA), or chloroform (Table 2-4). Target Groundwater Concentrations were determined for only the five named compounds because they are known to occur in plumes of the A Zone and have regional screening levels (RSLs) for indoor air. cis-1,2-DCE, the other COC forming a plume in the A Zone, currently has no RSL for indoor air and, therefore, no Target Groundwater Concentration. Target Groundwater Concentrations are calculated for a carcinogenic health risk of greater than 1×10^{-6} or a non-carcinogenic hazard quotient greater than 1 (EPA, 2002). The Target Groundwater Concentrations were calculated using the most recently published (2012) indoor air RSLs for the VOCs of interest, a default attenuation factor (α) of 0.001, chemical-specific Henry's Law constants, and unit conversion factors (EPA, 2012a). The estimated areas of plumes in the A Zone in which TCE, PCE, CCl_4, 1,2-DCA, and chloroform concentrations exceed the Target Groundwater Concentrations are within isopleths drawn using 3Q12 monitoring well sample analysis results plus a 100-foot buffer zone (see Figure 4-3). The Army will review the LUCs area annually and will revise the LUCs area, if necessary, as described in Section 4.3.2.1 of this ESD.	(continued) contamination beneath Building 649. Soil vapor samples were collected beneath Building 649 from two borings at two depths. TCE was detected in one sample at a concentration of 38 parts per billion by volume (ppbv) at 11.5 feet bgs, which is less than the OU 2 ROD cleanup standard for TCE contamination in soil. TCE was not detected in the other three samples. The results of the investigation are summarized in the Site P-1E summary in Appendix A of the *Amendment to the Record of Decision Basewide Remedy for Defense Distribution San Joaquin-Sharpe Site (Operable Unit 2 –Soils)* [URS, 2011c]. Soil vapor sample results indicate that no VOC source exists in the vadose zone beneath the building where the samples were collected. The one detection of TCE in the soil vapor sample from beneath the northeastern portion of Building 649 suggests that volatilization from the shallow (A Zone) groundwater plume may be occurring. However, the concentration in soil vapor is less than the 56 ppbv industrial screening level (at a risk level of 1E-06) for soil vapor greater than 5 feet bgs[1]. Consequently, there is no unacceptable risk to any potential industrial workers at Building 649. In addition, Building 649 is currently vacant and there are no plans to occupy the building. (continued)

[1] The EPA Regional Screening Level for the concentration of TCE in ambient air in a commercial/industrial setting is 3.0 micrograms per cubic meter ($\mu g/m^3$) (EPA, 2012a). Based on EPA's generic screening attenuation factor for soil greater than 5 feet bgs (a dimensionless value of 0.01; EPA, 2002), the equivalent soil vapor concentration at those depths would be 300 $\mu g/m^3$. Then, converting the measurement units (assuming standard temperature [25 degrees Celsius] and pressure [1 atm]): 6.10 $\mu g/m^3$ = 56 ppbv.

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☐ STRUCTURAL	☐ INST & CONTROLS	☐ SPECIFICATIONS			

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
2. (cont'd)			(continued) LUCs will be implemented for areas of A Zone groundwater that have concentrations exceeding commercial/industrial Target Groundwater Concentrations of TCE, PCE, CCl_4, 1,2-dichloroethane (DCA), cis-1,2-DCE, or chloroform (Table 2-4). Target Groundwater Concentrations were determined for only the six named compounds because they are known to occur in plumes of the A Zone and have regional screening levels (RSLs) for indoor air. Target Groundwater Concentrations are calculated for a carcinogenic health risk of greater than 1×10^{-6} or a non-carcinogenic hazard quotient greater than 1 (EPA, 2002). The Target Groundwater Concentrations were calculated using indoor air RSLs (EPA, 2012a) or California alternate air screening levels (DTSC, 2013) for the VOCs of interest, a default attenuation factor (α) of 0.001, chemical-specific Henry's Law constants, and unit conversion factors (EPA, 2012a). The estimated areas of plumes in the A Zone in which TCE, PCE, CCl_4, 1,2-DCA, cis-1,2-DCE, and chloroform concentrations exceed the Target Groundwater Concentrations are within isopleths drawn using 3Q13 monitoring well sample analysis results plus a 100-foot buffer zone (see Figure 4-3). The Army will review the LUCs area annually and will revise the LUCs area, if necessary, as described in Section 4.3.2.1 of this ESD."
3.		**Signature Page, page 8-1** Replace "Michael Montgomery" with "Angeles Herrera"	DLA/Army concurs.

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☐ STRUCTURAL	☐ INST & CONTROLS	☐ SPECIFICATIONS		

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.		The California DTSC HERO (Office of Human and Ecological risk) issued HHRA Note 3 on May 21, 2013 to incorporate DTSC's recommendations based on review of the November 2012 USEPA RSL tables. HERO has calculated DTSC-modified residential and industrial air screening levels for some chemicals presented at Table 3 in the HHRA-Note-3. The industrial air screening values for Carbon Tetrachloride and PCE listed in Table 3 are significantly lower than the USEPA RSLs. Thus, the more restrictive HERO number is to be used to calculate the target GW concentration and resulting LUC boundaries. The ESD Table 2-4, "Target GW Concentrations for LUCs…." must be changed to incorporate the DTSC HERO numbers. The pertinent LUCs must be re-drawn if needed to reflect the lower industrial air screening number and thus a lower allowable GW concentration. The USEPA's comment #11 dated 4 September 2013 must be addressed accordingly. The DLA response does not address the comment adequately given the above information.	Groundwater Target Concentrations calculated with 2013 California Alternate Screening Levels for tetrachloroethene, carbon tetrachloride, and cis-1,2-dichloroethene have been added to Table 2-4 of the ESD and the LUC boundaries have been re-drawn to reflect those revisions.

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☐ ENVIR PROT & UTIL	☐ MFG TECHNOLOGY	☐ ADV TECH	☐ VALUE ENG	DATE 4 June 2014
☐ ARCHITECTURAL	☐ ELECTRICAL	☐ ESTIMATING	☐ OTHER	NAME John Lucey, EPA
☐ STRUCTURAL	☐ INST & CONTROLS	☐ SPECIFICATIONS		

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		New text is shown in red italics. Deleted text is shown in redline-strikeout.	
1.	Sec. 1.0, pg. 1-1	The United States Environmental Protection Agency (EPA), the California Department of Toxic Substances Control (DTSC), and the California Central Valley Regional Water Quality Control Board (CVWB) provide oversight under the 1989 Federal Facilities Agreement (FFA) for the site. This ESD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §117, as amended. This ESD is also in compliance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) §300.435(c)(2)(i). *This ESD is prepared and issued by the Army and EPA. The Army and EPA jointly select the remedy enhancements described in Section 4 of this ESD. The state of California (DTSC and CVWB) also concur with the remedy.*	The text in italics has been added to the final ESD. However in the added text, the Army has been replaced with DLA. Currently, DLA is the lead agency and has signature authority.
2.	Sec. 4.3.2 and 4.3.2.1, pg. 4-3	*The LUCs for OU1 include the following:* • *Vapor Intrusion LUCs will prevent human exposure to breathing indoor air with VOC concentrations that pose an unacceptable health risk as determined in the Human Health Risk Assessment. VOCs can potentially migrate from contaminated groundwater up through the vadose zone and into buildings. Sharpe Army Depot is an industrial facility and the LUCs will ensure the property use remains industrial and prohibits future land uses such as residential development, on-site company day-care centers and recreation areas. These LUCs will be included as property deed restrictions if land is transferred in the future.* • *On-Depot Groundwater LUCs will restrict groundwater use and prevent human consumption of contaminated groundwater. These LUCs will be included as property deed restrictions if land is transferred in the future.* The LUCs objectives for OU 1 are: • To protect human health from vapor intrusion by preventing human exposure to indoor air with VOC concentrations that pose an unacceptable health risk *as determined in the Human Health Risk Assessment.*	The text in italics has been added with the following changes or deletions: In the first sentence of the first and the third bullets in the comment, "Health Risk Assessment" has been replaced with "EPA or California screening levels for the industrial indoor air pathway". The vapor intrusion pathway was not included in the original Sharpe Site OU 1 risk assessment. In the third sentence of the first bullet "and recreational areas" has been deleted from the sentence. There is no evidence of soil contamination that would preclude use of the site for recreational uses as long as the areas covered by LUCs remain industrial, and no regional screening levels are developed for recreational exposure to air. The following text has been inserted in the last sentence of the first bullet and the last sentence of the second bullet: "transferred to nonfederal entities". (continued)

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
2. (cont'd)		(continued) 4.3.2.1 Vapor Intrusion Land use at the Sharpe Site is currently industrial, and the anticipated future land use for the site is industrial/commercial. Therefore, the areas subject to LUCs for the vapor intrusion pathway were determined based on the assumption of the current and ~~anticipated~~ future *industrial* land use. *The LUCs prohibit future land uses such as residential development, on-site company day-care centers and recreation areas.* The LUCs preclude unrestricted use and unlimited exposure in areas where COC plumes occur in the A Zone…	(continued) In the paragraph addressing vapor intrusion, the recommended text changes have been made with the exception that "and recreation areas" has been deleted for the reason provided above in this item. Revised text is provided below: **4.3.2 Land Use Controls** LUCs are instruments, such as administrative, legal, engineered, or physical barriers (such as fences and security guards) that help to minimize the potential for exposure to contamination or to protect the integrity of a response action (EPA, 2012b). For the Sharpe Site, the Army will implement administrative and legal LUCs and physical barriers to minimize exposure to COCs in indoor air and groundwater. The LUCs for OU 1 include the following: • Vapor Intrusion LUCs will prevent human exposure to breathing indoor air with VOC concentrations that pose an unacceptable health risk as indicated by the EPA or California screening levels for the industrial indoor air pathway. VOCs can potentially migrate from contaminated groundwater up through the vadose zone and into buildings. The Sharpe Site is an industrial facility and the LUCs will ensure the property use remains industrial and prohibits future land uses such as residential development and on-site company day-care centers. These LUCs will be included as property deed restrictions if land is transferred to nonfederal entities in the future. (continued)

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
2. (cont'd)			(continued) • On-Depot Groundwater LUCs will restrict groundwater use and prevent human consumption of contaminated groundwater. These LUCs will be included as property deed restrictions if land is transferred to nonfederal entities in the future. The LUCs objectives for OU 1 are: • To protect human health from vapor intrusion by preventing human exposure to indoor air with VOC concentrations that pose an unacceptable health risk as indicated by the EPA or California screening levels for the industrial indoor air pathway. • To prevent access or use of on-depot groundwater with COC concentrations exceeding the ACLs specified in the OU 1 ROD • Maintain the integrity of any current or future remedial or monitoring system, such as monitoring wells **4.3.2.1 Vapor intrusion** Land use at the Sharpe Site is currently industrial, and the anticipated future land use for the site is industrial/commercial. Therefore, the areas subject to LUCs for the vapor intrusion pathway were determined based on the assumption of the current and future industrial land use. The LUCs prohibit future land uses such as residential development and on-site company day-care centers. The LUCs preclude unrestricted use and unlimited exposure in areas where COC plumes occur in the A Zone.

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
3.	Sec. 4.3.2.3, pg. 4-11	~~• If the Army closes the property or a portion the property, prior to seeking approval from EPA, DTSC, and CVWB, the recipient of the property must notify and obtain approval from the Army of any proposals for a land use change at a site inconsistent with the use restrictions and assumptions described in this ESD.~~	The text in the bullet has been deleted as recommended in the comment.
		The Army is responsible for implementing, monitoring, maintaining, reporting on, and enforcing the identified LUCs. Although the Army may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Army will retain ultimate responsibility for remedy integrity. ~~If the Army determines that it cannot meet specific LUC requirements, it is understood that the remedy may be reconsidered and that additional measures may be required to ensure the protection of human health and the environment.~~	The text recommended for deletion in the paragraph has been deleted.
4.	Sec. 8.0, pg.8-1	~~DLA~~ *The Army* and EPA jointly select the remedy enhancements described in Section 4 of this Explanation of Significant Differences for Operable Unit 1 of the Sharpe Site.	Disagree. Currently, DLA is the lead agency and has signature authority.