FINAL

Third Five-Year Review Report

for

Sacramento Army Depot

Sacramento

Sacramento County, California

April 2008

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
BRAC	Base Realignment and Closure
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Cis-DCE	cis-1,2-dichloroethene
CVRWQCB	Central Valley Regional Water Quality Control Board
EW	Extraction Well
DTSC	Department Toxic Substances Control
EPA	Environmental Protection Agency
ESD	Explanation of Significant Difference
gpm	Gallons Per Minute
IDW	Investigation-Derived Waste
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MW	Monitoring Well
NCP	National Contingency Plan
NPL	National Priorities List
OU	Operable Unit
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
ROD	Record of Decision
RPM	Remedial Project Manager
SAAD	Sacramento Army Depot, also known as Sacramento Army Depot Activity (abbreviated as SADA in earlier project documents)
SRCSD	Sacramento Regional County Sanitation District
TCE	Trichloroethene
VOC	Volatile Organic Compound
µg/L	micro-grams per liter

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Executive Summary

The U.S. Department of the Army (Army) completed the third five-year review of the Sacramento Army Depot (SAAD) Site in Sacramento, California with the purpose of determining whether the remedial actions implemented at the site are protective of human health and the environment. This five-year review is required because hazardous substances remain onsite above the risk-based levels determined in the Record of Decision (ROD), thereby preventing unlimited use and unrestricted exposure. The methods, findings, and conclusions of the review are documented in this report. In addition, this report summarizes issues identified during the review and includes recommendations and follow-up actions for them. Progress on the recommendations from the previous five-year review is discussed. The triggering action for this review was the completion of the second five-year review report in February 2002.

The depot is located approximately 7 miles southeast of downtown Sacramento. The former depot consisted of approximately 486.9 acres of land and was bounded on the north by Fruitridge Road, on the east by Florin Perkins Road, on the south by Elder Creek Road, and on the west by the Southern Pacific Railroad tracks. In 1995 the SAAD was closed as a part of the Base Realignment and Closure (BRAC) process. Most of the former depot is now owned by commercial firms and the City of Sacramento, with smaller parcels retained by the Army, the U.S. Navy/Marines, and the California National Guard. All properties in the former depot are zoned commercial/industrial or agricultural/open space.

The former depot was an electronics and maintenance facility and was established in 1945. Residues from metal plating and painting operations were disposed of in oxidation lagoons and burn pit sites. Contaminated media includes site soils and the groundwater beneath the southwestern portion of the site extending down gradient some 2,000 feet to the south.

Chemical contaminants detected in the soil and groundwater includes metals and volatile organic compounds (VOCs), including; carbon tetrachloride, trichloroethene (TCE), tetrachloroethene, 1,2-dichloroethane, and cis-1,2-dichloroethene (cis-DCE).

The remedies selected for SAAD addressed soil and groundwater contamination. The South Post Burn Pits Operable Unit (OU) was remediated with a combination of soil vapor extraction and soil excavation/stabilization. The Corrective Action Management Unit (CAMU) is sited at the South Post Burn Pits OU and it received soils from this site, as well as the others sites described below. Soil excavation, stabilization, and consolidation in the CAMU were also the remedy chosen for the Oxidation Lagoons OU, the Battery Disposal Well (Investigation-Derived Waste), and Building 300 Burn Pits. The Parking Lot 3 Groundwater site was remediated with a combination of air sparging, dual-phase extraction, and groundwater extraction with wellhead treatment via carbon adsorption. Groundwater extraction with ultraviolet light and chemical oxidation treatment was the remedy selected for the South Post Groundwater OU.

The soil remedies are complete with all stabilized soils consolidated within the CAMU. Groundwater extraction and treatment has ceased at the Parking Lot 3 Groundwater site, although discussion and evaluation continues regarding the success in meeting the remedial action objectives. Groundwater extraction continues at the South Post Groundwater OU. The extracted water is discharged directly to the sanitary sewer under permit. Ongoing evaluations are continuing on the following issues; 1) optimization of the groundwater treatment plant, 2) effectiveness of the present remedy and 3) evaluation of alternatives to the present remedy that would prove more effective at meeting the ROD requirements. Institutional controls are in place and currently enforced.

A five-year review site inspection took place on July 11, 2006. The groundwater treatment plant operator was interviewed during the site inspection. The regulatory agency Remedial Project Managers (RPM) and the Restoration Advisory Board (RAB) community co-chair have been interviewed for their views regarding the project and current issues.

The various remedies are considered protective in the short and long term because there is no evidence of complete exposure pathways to contaminated soils and groundwater, there are no receptors, and all institutional controls, as outlined in Section 3.2, are being maintained.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)*****:** Sacramento Army Depot		
EPA ID ***(from WasteLAN)*****:** CA0210020780		
Region: 9	**State:** CA	**City/County:** Sacramento/Sacramento County
SITE STATUS		
NPL status: √**Final** ~~Deleted~~ ~~Other~~ (specify)		
Remediation status (choose all that apply): ~~Under Construction~~ √**Operating** √**Complete**		
Multiple OUs? √**YES** ~~NO~~	**Construction completion date:** 11/1996	
Has site been put into reuse? √**YES** ~~NO~~		
REVIEW STATUS		
Lead agency: ~~EPA~~ ~~State~~ ~~Tribe~~ √**Other Federal Agency** **U.S. Army**		
Review period: 07/1/2006 to 04/30/2007		
Date(s) of site inspection: 07/11/2006		
Type of review: √**Post-SARA** ~~Pre-SARA~~ ~~NPL-Removal only~~ ~~Non-NPL Remedial Action Site~~ ~~NPL State/Tribe-lead~~ ~~Regional Discretion~~		
Review number: ~~1 (first)~~ ~~2 (second)~~ √**3 (third)** Other (specify) _____		
Triggering action: ~~Actual RA Onsite Construction at OU~~ #____ ~~Actual RA Start at OU#~~____ ~~Construction Completion~~ √**Previous Five-Year Review Report** Other (specify)		
Triggering action date ***(from WasteLAN)*****:** 2/6/2002		
Due date ***(five years after triggering action date)*****:** 2/6/2007		

Five-Year Review Summary Form, cont'd.

Issues:

1. Some of the final soil action levels have not been established in a decision document. The California Maximum Contaminant Level (MCL) for cis-DCE was incorrectly identified as the Federal value.
2. VOCs remain above Remedial Action Objectives (RAOs) in Parking Lot 3 Groundwater and the current situation is not in accordance with the guidance outlined in the PL3 Closure Report.
3. Consensus has not been achieved regarding groundwater contamination fate and transport, and plume capture effectiveness.
4. The South Post Groundwater remedy did not achieve RAOs within predicted timeframes.
5. Closeout procedures have not yet been established for the South Post Groundwater.
6. Changes to the Basewide ROD groundwater remedies have not been documented in a decision document. An Optimization plan for the present remedy is currently being reviewed.

Recommendations and Follow-up Actions:

1. In an amendment to the Basewide ROD or an Explanation of Significant Difference (ESD), incorporate final soil cleanup levels and the basis for their selection. Clarify the origin of the cis-DCE MCL.
2. Continue to monitor contamination at Parking Lot 3. Address ongoing issues during review of the Optimization Report and develop an amendment or ESD for the Basewide ROD after a decision is made on optimization of the current remedy.
3. Continue operations of the groundwater treatment plant, complete evaluation of the present remedy, and implement recommendations from the Optimization Report. Develop an amendment or ESD for the Basewide ROD after a decision is made on optimization of the current remedy.
4. Work on an optimization of the present remedy or propose a new remedy in an ESD or ROD amendment.
5. Prepare a document establishing closeout procedures for the South Post Groundwater remedy.
6. Identify a logical timeframe to develop an amendment or ESD for the Basewide ROD with an ESD or ROD Amendment, as appropriate. Include all groundwater remedy changes/updates.

Protectiveness Statement(s):

The remedy is considered protective in the short and long-term because there is no evidence of currently complete exposure pathways to contaminated soils and groundwater, there are no receptors, and all institutional controls are being maintained. Institutional controls must continue to be enforced for the remedy to remain protective.

Five-Year Review Report

1.0 INTRODUCTION

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and recommendations to address them.

The Army is preparing this five-year review pursuant to Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The U.S. Environmental Protection Agency (EPA) interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The Army conducted a review of the remedial actions implemented at the Sacramento Army Depot (SAAD), Sacramento, California from June to September 2006 and this report documents the results of the review.

This is the third five-year review for the SAAD site. The first five-year review report was triggered by the South Post Groundwater Operable Unit (OU) interim Record of Decision (ROD) and initiation of the groundwater response action within the SAAD boundary that began in 1989. Statutory review is required for sites where the selected remedy does not allow unlimited use and unrestricted exposure after the ROD clean-up actions are completed and the clean-up goals have been met. The second five-year review report followed the Basewide ROD, which was signed in January 1996, and it addressed the entire site and all remedial actions associated with SAAD. The Basewide ROD addressed groundwater contamination that had migrated beyond the SAAD boundary as well as soil actions.

2.0 SITE CHRONOLOGY

Table 1. Chronology of Site Events

Event	**Date**
Initial Installation Assessment by Army Environmental Health Agency.	1979
Groundwater well installation began.	1981
Initial Community Relations Plan (updated in 1998 and 1992).	August 1986
SAAD placed on National Priorities List.	August 1987
Federal Facility Agreement signature.	December 1988
South Post Groundwater Interim ROD – extraction & treatment begins in November.	October 1989
SAAD placed on BRAC list.	1991
Tank 2 Interim ROD and remedy implementation.	December 1991
South Post Burn Pit Interim ROD – soil vapor treatment the following year.	March 1993
Oxidation Lagoons Interim ROD.	September 1993
SAAD Reuse Plan.	June 1994
Restoration Advisory Board (RAB) established.	June 1994
Remedial Investigation/Feasibility Study complete.	November 1994
Final Basewide Proposed Plan.	November 1994
Basewide ROD – amends South Post Groundwater, Oxidation Lagoons, and South Post Burn Pit interim remedies.	January 1995
SAAD closed.	March 1995
Army transferred 306 acres to the City of Sacramento.	March 1995
Completion of Remedial Design.	July 1995
Soil remedial action associated with the Corrective Action Management Unit (CAMU).	July 1995 – November 1996
1st Five-Year Review report.	January 1996

Event	Date
Army Independent Review Team groundwater remedy evaluation (a.k.a. Groundwater Extraction Treatment System Effectiveness Review, GWETER).	June 1999
South Post extracted groundwater no longer treated after concentrations fall below sewer permit discharge limits.	January 2000
Groundwater remedy meeting with focus on Parking Lot 3. Decision process established to determine when ROD provisions had been achieved.	March 2000
2nd Five-Year Review report.	December 2001
Horizontal wells Extraction Well (EW)-12 and EW-13 properly abandoned.	January 2002
Army transfers Parcel 2A to the City of Sacramento	March 2002
Parking Lot 3 extraction wells (EW-8, EW-9) turned off after concentrations fall below ROD provisions (concentrations subsequently rebound).	June 2002
EPA and DTSC conditionally concur with the Closeout and Monitoring Report, Parking Lot 3.	August 2002
Groundwater purged from Monitoring Well (MW)-50 at Parking Lot 3, no sustained reduction in Volatile Organic Compound (VOC) concentrations.	July and September 2003
Remedial Design Addendum prepared to clarify ROD implementation.	March 2004
Fate & Transport Model updated.	November 2004
Correspondence between DTSC and the Army regarding the Parking Lot 3 groundwater remedy.	January to March 2005
FEDEX property groundwater investigation.	October 2005
Army transfers Parcel 2B to the City of Sacramento	April 2006
Groundwater Cleanup Optimization Report (including updated Fate & Transport Model) proposes comprehensive revision to the groundwater remedies.	March 2007

3.0 BACKGROUND

3.1 Physical Characteristics

SAAD is located approximately 7 miles southeast of downtown Sacramento, California (Plates 1 and 2). It occupied approximately 486.9 acres of land and is bounded on the north by Fruitridge Road, on the east by Florin Perkins Road, on the south by Elder Creek Road, and on the west by the Southern Pacific Railroad tracks. The depot was established in 1942 as an electronics maintenance facility primarily responsible for equipment receipt, storage, issue, repair and disposal. SAAD was placed on the Base Realignment and Closure List in 1991 and closed in 1995. Portions of the property have been transferred at different times after closure for a combination of commercial, state and federal related reuse. See Plate 2 for a map of the transfers.

The topography of SAAD is virtually flat, with a southwesterly slope from the northeastern corner of the site of approximately 0.1 to 0.2 percent. The topographic relief is 6.5 feet across the site and varies from an elevation of 42.5 feet above mean sea level in the northeast corner to 36 feet above mean sea level in the southwest corner.

Natural drainage is generally from the northeast to the southwest. Morrison Creek enters the depot from the east and was diverted south, west, and then north around the main compound (outside the fence) in 1946. The old channel of Morrison Creek ("Old Morrison Creek") bisects the facility from east to west and is dry during most of the year. The creek flows west after leaving the depot and then southwest until it discharges into Beach Lake.

The site is located in the Central Valley of California and overlies a thick sequence of alluvial sediments consisting of silt, sand, gravel, and hardpans. These sediments are laterally and vertically discontinuous. In general, the shallow site soils have moderate to very low permeability.

The water-bearing zones beneath SAAD are composed of a series of sand, silty sand, and sandy silt units. These units have been grouped into three general water-bearing zones, informally designated as the "A/B", "C", and "D" hydrogeologic zones. The A/B-zone consists of the upper A and the lower B zones which are commonly interconnected. The vadose zone above the shallowest water-bearing zone and the aquitards between the water-bearing zones consist primarily of silt, silty clay, and clay. The approximate depths of the primarily water-bearing zones from ground surface are:

Zone	Depth (feet)
A/B	78 to 148
C	156 to 188
D	195 to 230

The three aquifer zones can be subdivided into two depositional regimes. The upper regime comprising the A/B-zone is heterogeneous, and laterally and vertically discontinuous. This regime is composed of silt with interbedded fine grained arkosic sand lenses. The lower regime is composed of apparently laterally continuous units comprising two distinct water-bearing zones, C and D. These two zones are typically highly productive, consisting of fine to coarse grained, moderately graded sand interbedded with silt and clay.

Depth to groundwater beneath the site ranges from approximately 80 to 85 feet. The groundwater in the A/B-zone appears to be present under unconfined to semi-confined conditions, and groundwater in the C and D zones is semi-confined to confined.

The general groundwater flow direction is to the south/southwest and the gradient has consistently been approximately 0.1 percent. The gradient direction in the southwest corner of the depot was altered in 1990 when groundwater extraction began. After the system was activated, the gradient increased as a cone of depression was formed.

3.2 Land and Resource Use

The site was the old California State Fairgrounds prior to establishing SAAD. It is not known if any contamination pre-dates the depot. The site is currently used for commercial/industrial purposes, as well as by Department of Defense (Navy/Marine and Army) and California Army National Guard.

SAAD is bounded on all sides by land currently zoned as industrial/commercial. Residential neighborhoods lie to the west of Power Inn Road, approximately ¼ to ½-mile west of the site. There have been no changes to the land use since preparation of the risk assessment and no changes are anticipated in the future. There have been no changes to the receptors considered in the original risk assessment.

The former depot is currently fenced with a limited number of controlled entry points. All of the environmental sites and the water treatment plant lie within the fenced area. Land use restrictions at the South Post Burn Pits place limits on the potential development options.

Regional groundwater is used as a drinking water source. The Florin County Water District extracts groundwater down gradient of SAAD. The water district's 10 municipal supply wells are screened in water bearing zone D, or deeper, and lie south of the former depot (the closest is approximately 0.8 miles away from the southern edge of SAAD).

The following table from the *Remedial Design Addendum for SAAD*, March 2004, delineates the land use restrictions associated with the former installation. These Land Use Covenants are further delineated in the *2-A & 2-B Finding of Suitability to Transfer (FOSTs) Reports*, dated December 2000 and March 2004 respectively.

Table 2. SAAD Land Use Restrictions

Land Use Covenant	Prohibited Activity
Parking Lot 3 & South Post Groundwater Covenant	Construction of any well Extraction, use or consumption of groundwater from wells within the boundary of the Property Use of any groundwater within the boundary of the property Construction or creation of any groundwater recharge area, unlined surface impoundment or disposal trenches Any activity that could interfere with or adversely affect the groundwater treatment system, extraction wells, piping system or groundwater treatment plant
Burn Pits/Oxidation Lagoons Stabilized Mass Covenant	Any construction of improvements over the Stabilized Mass and associated monitoring system. The monitoring system includes lysimeters and monitoring wells No residential structures shall be allowed on the cover including any mobile home or factory-built housing, constructed or installed for use as residential human habitation, hospital for humans, or public or private school for persons Construction of improvements above either of the stabilized masses that do not meet the following conditions: • The surface drainage shall not be adversely affected in such a way as to cause surface water to pond or to drain improperly • Any change in grading plans shall be subject to review and approval by the Parties and USEPA • Improvements are not to disturb the subsurface Stabilized Mass • Disturbance of the lysimeters is prohibited, unless replacements are installed and approved by the regulatory agencies • Significant surface loads (e.g., construction of buildings or facilities that would normally require a soils report) on the cover shall not be allowed unless a detailed analysis is performed that determines the magnitude and extent of allowable surface loading, if any, that can be tolerated • Vehicle access to the cover area shall be limited to those periods of the year (May through October) when the cover soil can adequately support wheel loading (i.e., access shall not be allowed during and directly after periods of precipitation when the cover soil may be too saturated to adequately support a vehicle as evidence by the formation of tire tracks) • Planting of landscaping on or adjacent to the cover that requires irrigation is to be avoided. However, such materials can be planted (e.g., ball fields) if the irrigation system is properly designed and operated so that it provides adequate moisture for plant growth without adding significantly to the amount of percolation that would be expected from precipitation • Vegetation having root systems that might penetrate the cover to the depth of the Stabilized Mass are prohibited • Groundwater recharge areas (i.e., ponds) are prohibited near, or on top of, the Stabilized Mass
Lead-based Paint Covenant	Residential uses including any mobile home or factory-built housing constructed or installed for use as a residential human habitation, hospital for humans, or public or private school for persons Day care centers Playgrounds or recreational uses

3.3 History of Contamination

Soil and groundwater on site have been impacted by the former depot's repair, maintenance, and storage activities. Plate 3 shows a facility map of the former depot.

Contamination was released from underground and above ground storage tanks, burn pits, unlined wastewater lagoons, and a battery disposal area. Metal plating and painting operations were the primary on-site waste generating activities. The Army conducted the initial contamination assessments in 1979. SAAD was placed on the Federal National Priority List (the "Superfund" list or NPL) in August 1987.

3.4 Initial Response

Investigations conducted in 1981 by the Army Environmental Health Agency identified the South Post Burn Pits as a source of volatile organic compound contamination in groundwater. Subsequent groundwater sampling performed by the Central Valley Regional Water Quality Control Board (CVRWQCB) southwest of the depot discovered that contamination had moved beyond the boundaries of SAAD. The Army then conducted additional investigations with emphasis on sites with the highest potential for releases to the environment. The four sites determined to represent the greatest threat were the South Post Groundwater, Tank 2, the Oxidation Lagoons, and the South Post Burn Pits. To expedite cleanup, these four sites were addressed as OUs under separate interim RODs. In 1989 a groundwater extraction and treatment system was installed to address the South Post Groundwater OU. As stipulated in the ROD for the South Post Burn Pits, soil vapor extraction was implemented in 1994. A soil washing pilot test was conducted at the Oxidation Lagoons in 1993, however this was not found to be an effective treatment method at this site. Soil vapor extraction was performed at the Tank 2 OU in 1992, cleanup goals were met, and no further action was deemed necessary for this site.

3.5 Basis for Taking Action

The following chemical contaminants were detected in the soil: volatile and semi-volatile organic compounds, pesticides, polychlorinated biphenyls, and metals. Prior to implementation of the soil remedies, the following potentially complete exposure pathways were identified in the site risk assessment; incidental ingestion, dermal adsorption and inhalation of vapors. No receptors are currently exposed to soil or groundwater contamination. Soil contaminants associated with SAAD include:.

Metals:

- Antimony (Burn Pits, Building 300)
- Arsenic and Cadmium (Oxidation Lagoons, Burn Pits, Building 300)
- Chromium VI (Burn Pits)
- Lead (Burn Pits, Battery Disposal Well, Building 300)

Organic Compounds:

- Benzo(a)pyrene (Battery Disposal Well)
- Chlordane and 4,4'-DDT (Pesticide Mix Area)

- Chrysene and Dieldrin (Tank 2)
- Polychlorinated biphenyls (Burn Pits, Building 300)

In addition to soil contaminates, the following is a list of groundwater contaminants associated with SAAD:

- Chloroform (South Post Groundwater)
- Carbon Tetrachloride (South Post Groundwater, Parking Lot 3)
- Trichloroethene (South Post Groundwater, Parking Lot 3)
- Tetrachloroethene (South Post Groundwater, Parking Lot 3)
- cis-1,2-Dichloroethene (South Post Groundwater)
- 1,2-Dichloroethane (South Post Groundwater, Parking Lot 3)

4.0 REMEDIAL ACTIONS

The Remedial Investigation and Feasibility Study was completed in November 1994. Human health and ecological risk assessments were also prepared for SAAD. This work was followed by the Basewide ROD (January 1995), which addressed all sites and amended three prior interim RODs (South Post Groundwater, South Post Burn Pits, and the Oxidation Lagoons). The locations of these sites are found on Plate 3. The Basewide ROD determined that the remedy for the Tank 2 OU was complete and indicated that no further action was required. The Basewide ROD also addressed the three remaining areas of concern at SAAD including the South Post Burn Pits, Parking Lot 3 Groundwater, and the South Post Groundwater.

It should be noted that two sets of soil cleanup levels are shown in this report, those from the Basewide ROD and those identified as “final” remediation cleanup levels. The final remediation levels were established after the Basewide ROD was signed and during preparation of work plans for the remedial action. The Second Five-Year Review determined that, except for the stabilized mass, all contaminated soil has been remediated and no longer needs to be included during subsequent five-year reviews. The final soil cleanup levels and the basis for their selection should be included in the next decision document update for SAAD. The land-use covenants established for SAAD provide authority to state regulatory agencies (the Department of Toxic Substances Control (DTSC) and the CVRWQCB) to enforce environmental-based land use restrictions and are outlined in Table 2 and Section 3.2, 4.1.2, 4.2.2, and 4.3.2 of this report and further referenced in the *2A & 2B FOSTs*.

4.1 Operable Unit – South Post Burn Pits

4.1.1 Remedy Selection

The 1993 interim ROD for the South Post Burn Pits OU identified two remedial actions: in situ soil vapor extraction for volatile organic compounds, and excavation/stabilization of soil containing non-volatile compounds. The Basewide ROD amended the original remedy by removing the soil vapor extraction cleanup goal as unattainable and shutting off the system. The soil vapor extraction system was successful in removing a large percentage of the volatile organic compound mass present in the vapor phase. The soil stabilization portion of the interim ROD was changed to include soils from other SAAD sites (Oxidation Lagoons, Building 300

Old Burn Pit, and the Battery Disposal Well Investigation Derived Waste). In addition, the South Post Burn Pits would be designated as a CAMU in which the stabilized soil from these sites would be consolidated under a 10-foot thick cover of clean soil. Post excavation in-situ soil concentrations were not to exceed the following:

	ROD	Final
Cadmium	88 mg/kg	same
Total Chromium	112 mg/kg	same
Chromium (VI)	16 mg/kg	same
Arsenic	7.3 mg/kg	same
Lead	500 mg/kg	174 mg/kg

The stabilized soil was to be treated so that the waste extract as measured by a Toxic Characteristic Leaching Procedure would not exceed the standards specified in 22 CCR §66268.45. In addition, the Army agreed to perform De-Ionized Water Waste Extraction Tests on the stabilized material and to consult with the regulatory agencies should the test fail a comparison with groundwater MCL concentrations.

4.1.2 Remedy Implementation

The following cleanup activities have occurred at the South Post Burn Pits:

- Soil vapor extraction began in May 1994 and concluded on January 1995, and was conducted again from March 1995 to September 1995. Approximately 138 pounds of VOCs were removed from the soil.
- Contaminated soil was excavated in 1995 and placed temporarily on a storage pad.
- Stabilization of all soil identified for placement in the CAMU was completed by Fall 1996.

After two rounds of soil excavation, some confirmation samples indicated that arsenic and lead concentrations still exceeded the agreed upon cleanup levels but were either below the level established in the ROD or were consistent with background concentrations. With the approval of the regulatory agencies, excavation was discontinued and response complete was attained. Debris found in the soil was cleaned and disposed off site. A total of 16,998 cubic yards of soil were removed from the South Post Burn Pits. The CAMU had received all designated soil and the site was re-graded in October 1996. Four pairs of lysimeters were installed north of the CAMU to monitor for the leaching of metals from the stabilized soil. The EPA approved the closure of the South Area Burn Pits. The land use covenant established for the soil at this site prohibits: 1) construction improvements over the stabilized soils or monitoring system, 2) residential homes, schools, or hospitals, 3) construction that results in ponding water, 4) significant surface loads on the stabilized soils, 5) vehicle use during wet weather, 6) planting of vegetation requiring significant irrigation, 7) planting of vegetation with deep roots, and 8) establishing groundwater recharge areas. In addition, as part of the Parcel 2B transfer, groundwater related land-use restrictions are the same as those shown below for South Post Groundwater OU.

4.1.3 Systems Operations/Operation and Maintenance

Activities conducted after the soil excavation and CAMU construction was complete include the following:

- Semiannual monitoring of the lysimeters.
- Inspection and maintenance of the CAMU soil cover.
- Establishing institutional controls that prohibit drilling or excavation in the CAMU area.

The results of the lysimeters monitoring has shown that the metals in the CAMU stabilized soils are not migrating into the groundwater. The quarterly inspections of the cover have found that it remains in good repair and there is no evidence of settlement, heaving, cracking, or erosion. Inspection records are kept on file. The controlled access to the site has prevented any prohibited excavation or other activity that could release contamination to the environment. The costs associated with monitoring, inspecting, and maintaining the CAMU are included with those for the South Area Groundwater OU as described in Section 4.3.3 below.

4.2 Parking Lot 3 Groundwater

4.2.1 Remedy Selection

The Basewide ROD established groundwater extraction and treatment as the remedy for the Parking Lot 3 Groundwater. Groundwater was to be extracted from the A/B zone with the ultimate goal of restoring the aquifers to the beneficial use of a potential drinking water source. Approximately 0.5 pounds of chlorinated solvent contamination (carbon tetrachloride, trichloroethene, tetrachloroethene, and 1,2-dichloroethane) were calculated to be in the groundwater. Trichloroethene was the predominant contaminant. The goal of the remedy is to restore groundwater to its beneficial use of drinking water by reducing concentrations to below MCLs (the more stringent of either the Federal or state levels). These levels as presented in the Basewide ROD are as follows:

Trichloroethene	5 µg/L, Federal Law
Tetrachloroethene	5 µg/L, Federal Law
1,2-Dichloroethane	0.5 µg/L, State Law
Carbon Tetrachloride	0.5 µg/L, State Law

The extracted water was to be treated at the wellhead using carbon adsorption and the treated water discharged to the sanitary sewer.

4.2.2 Remedy Implementation

Groundwater monitoring began at Parking Lot 3 in 1981. The monitoring network (Plate 4) expanded steadily until 1997 when the last two down gradient wells were installed to monitor the progress of the groundwater remedy.

Contaminated soil at Parking Lot 3 was treated during an air sparging pilot test that took place from August 1993 to March 1994. A dual-phase extraction pilot test was conducted from October 1994 to January 1995. Approximately 460 pounds of TCE were removed from the soil and groundwater during these tests.

Two A/B-zone groundwater extraction wells, EW-8 and EW-9, were installed at Parking Lot 3 in 1994. Plate 5 shows the extraction well locations. They began operation in March 1996 with the wellhead treatment system described above. The combined extraction rate was approximately 80 gallons per minute and plume capture was inferred from the cone of depression that developed in the groundwater. The land use covenant established for this site prohibits: 1) construction of any well, 2) extraction and use or consumption of groundwater from wells within the parcel boundary, 3) construction of any groundwater recharge areas, or similar, and 4) any activity that could interfere with the groundwater extraction and treatment system. Groundwater restrictions end upon determination by the Army and regulatory agencies that cleanup standards have been met.

4.2.3 System Operations/Operation and Maintenance

The extraction wells were operated from March 1996 until June 2002 when they were shut-off after meeting the following criteria. Trichloroethene concentrations in the extraction wells had been below the MCLs since June 2000 and had been near or below the MCLs in the monitoring wells since early 2000. Beginning in June 2000, the extraction well carbon vessels were bypassed (i.e., treatment was stopped) and the extracted water was discharged directly to the sanitary sewer after the contaminant concentrations fell below the Sacramento Regional County Sanitation District (SRCSD) discharge requirements. Over 200 million gallons of groundwater have been extracted from the site. The extraction wells are operated quarterly for sampling to maintain the SRCSD permit.

In 2001 the Army began developing criteria and procedures for stopping groundwater extraction and monitoring for the Parking Lot 3 site. Groundwater extraction was to stop after contaminant concentrations at all points of compliance (defined as the monitoring and extraction wells) were below MCLs for four consecutive sampling events. After extraction well shutdown, the post-shutdown monitoring schedule begins.

The post-shutdown monitoring data would be evaluated within the context of specific decision logic established in a team meeting that took place in March 2000. If contaminant concentrations rebounded (concentrations exceeding MCLs for 3 consecutive quarters), then specific extraction wells were to be reactivated. The report documenting closure of the Parking Lot 3 groundwater extraction system was accepted by the regulatory agencies in 2002.

Monitoring results collected from MW-50 and -73 (both A-zone), after extraction well shutdown, showed an increase of TCE concentrations above the MCL. TCE concentrations in these two wells have generally been above the MCL, except during the operation of the extraction wells. Contaminant concentrations in B-zone monitoring wells have not exceeded the MCL. In an attempt to lower TCE concentrations in the A-zone, the Army purged 5,000-gallons of groundwater directly from MW-50 in July 2003. A second 10,000-gallon extraction was repeated from this same well in September 2003. The two groundwater purge actions appear unsuccessful because subsequent monitoring indicates that TCE concentrations generally have remained near, but above, the MCL.

By the spring of 2003, groundwater monitoring indicated that TCE concentrations exceeded MCLs for the requisite number of events necessary to reactivate the extraction wells. The Army verbally notified the project team that it had decided that reactivating the groundwater system would not attain the remedial action objectives in a cost effective manner. The project team agreed with this decision. In 2005, the state regulatory agencies sent a letter to the Army requesting resumption of groundwater extraction indicating that a failure to do so constituted a violation of the ROD. The state regulatory agencies moved away from this position during subsequent project team meetings and agreed with the Army that resumption of groundwater extraction would not be an effective way of treating the remaining contamination at Parking Lot 3. The Army and the regulators agreed to address the Parking Lot 3 issues along with the overall site remedy in the Groundwater Cleanup Optimization Report which is currently being reviewed. After the path forward has been determined, it will be documented in an amendment to the ROD or an ESD, whichever is appropriate.

Prior to shutdown, the extraction wells were maintained in accordance with the site manual and were periodically inspected. Weekly inspections include reading the total flows at the extraction wells, well pump and controller integrity, and a review of the preventative maintenance requirements to determine any maintenance needs. Maintenance will continue on a preventative basis, with records being maintained by the maintenance contractor. Systems will not be operated without an operator being onsite, or on-call, to make maintenance repairs. When not operating, the extraction wells and treatment system are inspected periodically to ensure the integrity of the system is not compromised.

Security is maintained by enclosing the extraction wells with an 8-foot-high fence and a locked gate. The fence and gate are inspected during normal maintenance to ensure that proper security is maintained.

4.3 Operable Unit – South Post Groundwater

4.3.1 Remedy Selection

The 1989 interim ROD for the South Post Groundwater OU established the remedy of groundwater extraction and treatment. The Basewide ROD amended the original remedy by extending the area of cleanup to include the portion of the plume that extended beyond the SAAD southern boundary. Groundwater was to be extracted from both the A/B and C zones, treated, and then discharged to the sanitary sewer. Approximately 24 pounds of chlorinated solvent contamination (trichloroethene, cis and trans-1,2-dichloroethene, and 1,2-dichloroethane) was calculated to be in the groundwater with trichloroethene the predominant contaminant. The goal of the remedy is to restore groundwater to its beneficial use of drinking water by reducing concentrations to below MCLs (the more stringent of either the Federal or state levels). The levels delineated in the Basewide ROD are as follows:

Trichloroethene	5 µg/L, Federal Law
Tetrachloroethene	5 µg/L, Federal Law
Cis-1,2-dichloroethene	6 µg/L, Federal Law (actually State)
Trans-1,2-dichloroethene	10 µg/L, State Law
1,2-Dichloroethane	0.5 µg/L, State Law

The Basewide ROD incorrectly identified the value of 6 µg/L for cis-1,2-dichloroethene as a Federal MCL when it is actually a State MCL. This should be corrected when either an amendment or ESD for the ROD is developed. The Federal MCL for cis-1,2-dichloroethene is 70 µg/L. The remedial action objectives established to achieve the remedy goals are as follows:

- Reach a maximum pumping rate of 450 gallons per minute for the groundwater remediation system.
- Reduce contaminants in the groundwater to concentrations equal to or less than respective final remediation goals or MCLs;
- Prevent further migration of the VOC plume off site through complete capture of groundwater contamination and reduction of plume size;
- Capture the contamination detected in the C zone more rapidly; and
- Achieve final remediation goals for groundwater in the South Post area in nine years (i.e., 2004).

The remediation goals for the South Post Area were not met by 2004. There are several potential reasons for this.

- The estimated dissolved mass in the ROD was approximately 24 pounds in 1995. The contaminant mass has fluctuated from the time of the ROD to the present and is consistently around the 25-pound level. Based on the data from the August 2006 sampling event, the dissolved contaminant mass is estimated to be 23 pounds. Part of the reason for the fluctuation may be the low level of mass existing in the dissolved phase and the means by which mass calculations are made. At such low levels, mass calculations, which employ assumptions for the entire aquifer zone, may not be sufficiently precise to measure such small changes in mass.

- In addition, from 1994 to present, there exists a general upward trend in the groundwater table elevations which may cause residual TCE in the soil to transport to the dissolved plume. At the present rate of extraction (approximately 400 gallons per minute) and at the current concentrations at the treatment plant (2.4 ug/l), approximately 4.22 pounds of dissolved TCE are being removed each year.
- Finally, the initial pumping rates were too low to fully capture the VOC plume and pumping was increased in 1999. This extended the time required for treatment.

4.3.2 Remedy Implementation

Groundwater monitoring began at the South Post Groundwater OU in 1981. The monitoring network (Plate 4) has expanded with increased understanding of the plume configuration. Eleven extraction wells have been installed (see Plate 5 for locations);

- EW-1 to EW-3 were installed (1989) in the A/B-zone, north of the plume center.
- EW-4 to EW-7 were installed (1989) in the A/B-zone, near the plume center.
- EW-10 was installed (1996) off site in the A/B-zone, southwest of the plume center.
- EW-11 was installed (1996) in the center of the C-zone plume.
- EW-12 and EW-13 (horizontal wells) installed (1995/1996) south of the plume center, beginning on site and extending off site in the A/B-zone to the west.

The South Post Groundwater Treatment Plant was installed in 1989. Contaminated groundwater was treated using ultraviolet light and chemical oxidation. The land use covenant established for this site prohibits: 1) construction of any well, 2) extraction and use or consumption of groundwater from wells within the parcel boundary, 3) construction of any groundwater recharge areas, or similar, and 4) any activity that could interfere with the groundwater extraction and treatment system. All required institutional controls agreed to by the Army, the State, and Federal Regulators are monitored for compliance. In addition, there are also well permit requirements (governmental controls) that are overseen by the Sacramento County Environmental Management Division. Contaminant plume information is provided to the county by the state regulatory agencies and is used to regulate any off-site drilling or water production in this area. Groundwater restrictions end upon determination by the Army and regulatory agencies that cleanup standards have been met.

4.3.3 System Operations/Operation and Maintenance

The treatment plant began operation in 1989 and operated reliably after the initial pump valve problems were resolved. Pumping rates initially ranged from 325 to 340 gallons per minute, and this was increased to approximately 440 gallons per minute in 1999. The rate was increased after investigations indicated that the plume extent was not fully contained. Contaminant concentrations entering the treatment plant decreased to levels below the permitted discharge limit prompting a review, and ultimately, a decision in February 2000 to discharge directly to the sanitary sewer system without treatment. The extracted groundwater TCE concentrations continue to be well below the SRCSD daily maximum discharge limit (69 µg/L) and the MCL (5

µg/L). The annual cost associated with operation of the groundwater extraction and treatment system for the past five years is shown in Table 3.

Table 3. Annual System Operations/O&M Costs

Year	Cost
FY 2002	$2,987,000
FY 2003	$1,193,000
FY 2004	$1,223,000
FY 2005	$977,000
FY 2006	$1,115,973

Extraction well EW-2 was taken out of service (approximately 1999) after an optimization review was performed. Extraction well EW-2 lies close to EW-1, and as contaminant concentrations decreased it was no longer efficient to operate both wells. Pumping from EW-11 was also stopped in January 2003 because the C-zone was successfully remediated. The horizontal extraction wells (EW-12 and -13) experienced biological fouling problems soon after installation, were not successful, and were properly abandoned (November 2001 to January 2002). Well fouling problems have also been experienced with EW-10 (thought to result from silica precipitation and biological growth), which has reduced the pumping capacity by approximately 50% from this location. The maximum pumping capacity at EW-10 is about 100 gallons per minute (gpm). The Army plans on rehabilitating EW-10 if pumping and treatment of the groundwater is continued after completion of the optimization of the remedial action. Pumping rates have been adjusted/optimized as extraction wells have been removed from the system.

Groundwater flow and contaminant transport modeling were conducted to determine the effectiveness of the treatment system in capturing the plume. Groundwater modeling and monitoring reports prepared since the last Five-Year Review by the Army indicate that the groundwater extraction system is effectively controlling the plume. In an attempt to resolve any uncertainty regarding the configuration of the extent of the plume with regard to the established 5 µg/L TCE level outlined in the ROD, the Army investigated the extent of the southern edge the plume in October 2005. The report from this investigation concluded that the earlier modeling was accurately predicting plume behavior and that the monitoring network is adequate.

5.0 PROGRESS SINCE THE LAST REVIEW

Although formal protectiveness statements as identified in the 2001 EPA Guidance, OSWER No. 9355.7-03B-P were not made in the Second Five Year review, the following statement was included which indicates the remedies in place were considered to be protective:

> *"The actions taken to date for soil and groundwater at SADA have eliminated the immediate threat of exposure to contamination and are protective of human health and the environment. All of the remedial objectives specified in the Basewide ROD for vadose zone sites (Building 300 Burn Pits, Oxidation Lagoons, BDW IDW, and South Post Burn Pits) and the Parking Lot 3 groundwater area at SADA have been met. However, all ROD objectives for the South Post groundwater plume have not been completely satisfied. Work continues on satisfying the remaining concerns. The actions recommended from this review are intended to ensure that all specific objectives will be met as planned to achieve long-term and permanent solutions to remediate/eliminate the identified contamination."*

The Second Five Year review recommendations are as follows:

<u>For remedial actions related to soil at the Building 300 Burn Pits, Oxidation Lagoons OU, Battery Disposal Well Investigation-Derived Waste (IDW), and South Post Burn Pits OU:</u>

1. Continue semiannual lysimeter sampling to monitor soil moisture surrounding the South Post Area CAMU.
2. Continue routine maintenance and inspection of the 10-foot cover over the CAMU.
3. Ensure land-use restrictions established in the CAMU Land Use Covenant and Parcel 2B transfer deed are enforced.
4. No further actions are required for the Building 300 Burn Pits, Oxidation Lagoons, or Battery Well IDW. The remedial actions have been verified to meet cleanup levels, remaining concentrations pose no threat of exposure, and the areas have been released or are planned for release for unrestricted use.

<u>For Parking Lot 3 Groundwater and the South Post Groundwater OU remedial actions:</u>

1. Prepare and implement closeout and monitoring plans for the Parking Lot 3 and South Post groundwater plumes that describe the process to be used to complete the groundwater cleanup. The process will include evaluating the groundwater extraction system performance and concentration trends for monitoring wells, conducting rebound studies to determine if and when the cleanup levels have been reached and the systems can be shut down, long-term monitoring requirements, well destruction, and reporting.
2. Continue extraction and monitoring of the Parking Lot 3 groundwater plume following the current schedule and following the forthcoming closeout and monitoring plan once it is completed.

3. Continue the operation and monitoring of the South Post groundwater plume extraction wells following the current monitoring plan and following the forthcoming closeout and monitoring plan once it is completed. Evaluate the forthcoming modeling results and develop recommendations regarding the remedial alternatives for the South Post groundwater plume including the off-site portion of the plume.
4. Complete the work plan for abandoning horizontal extraction wells EW-12 and EW-13 and implement the plan by the end of 2001.
5. The Army Operations and Support Command will provide a letter to the regulators addressing the issue regarding the cessation of treatment of extracted groundwater at both the South Post and Parking Lot 3 areas. The correspondence will include details of the history of the contamination, treatment, and decision to stop treatment. This will be submitted by the end of 2001.
6. Enforce the land-use restrictions established in the South Post Groundwater Land Use Covenant and the Parcel 2A transfer deed.

All of the soil remedial action recommendations as listed above have been implemented. The groundwater recommendations have been partially implemented as further explained below:

1. Only the Parking Lot 3 closeout and monitoring plan has been prepared. The plan for the South Post Groundwater OU is scheduled for completion after finalization of the Groundwater Cleanup Optimization Report which is currently being reviewed.
2. The Army is no longer extracting groundwater at Parking Lot 3. Initial system shut down was performed in accordance with the closeout and monitoring plan but concentrations rebounded after the system was shut down. The Army and regulators concluded that further extraction will not attain the remedial action objectives in a cost effective manner. Further action in this area is being reviewed as part of the Groundwater Cleanup Optimization Report.
3. Groundwater extraction continues at the South Post Groundwater OU. The Army produced several reports since the last 5-Year Review addressing groundwater modeling and contaminant fate and transport. The Final Groundwater Cleanup Optimization Report and a closeout and monitoring plan are planned for FY 2008.
4. Extraction wells EW-12 and 13 have been properly abandoned (January 2002).
5. The project team has used the Parking Lot 3 Groundwater closure and monitoring planning (kickoff meeting in March 2000) to initiate discussion on the Parking Lot 3 closure. These discussions led to the preparation of the *Monitoring and Closeout Plan for Parking Lot 3* (URS, May 2002).
6. All required land-use restrictions are being enforced as established in the South Post Groundwater Land Use Covenants and Parcel transfers.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components, Community Notification, Document Review

This five-year review consisted of the following activities:

- Notified the RAB and the Community Co-Chair that a five-year review was underway;
- A review of relevant documents as listed in Attachment 2;
- Discussions with the operation and maintenance contractor, the EPA RPM, the DTSC RPM, the CVRWQCB RPM, the Army BRAC Environmental Coordinator and
- A site inspection.

The RAOs, Applicable or Relevant and Appropriate Requirements (ARARs), and cleanup levels were obtained from the Basewide ROD. A copy of this completed five-year review report will be available at the Administrative Record located at the U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California, 95814. Notice of the completion of this report will also be announced in the local newspaper.

6.2 Data Review

Data contained in recent groundwater monitoring reports were evaluated as a part of the five-year review process. Lysimeter monitoring data, collected from beneath the stabilized soils at the CAMU, indicates that no metal containing leachate is migrating through the vadose zone to the underlying groundwater. Significant groundwater related trends and issues identified in the evaluation are discussed below.

6.2.1 General Groundwater Observations

Since the last five-year review, the potentiometric surface has risen by about 1.5 to 3.0 feet. This is a slower trend than was observed during the last five-year review period. Plates 6 thru 9 show time series plots of TCE concentrations for key monitoring wells in zones A to D.

6.2.2 Parking Lot 3 Groundwater

The highest concentrations of TCE in the Parking Lot 3 plume occur at A-zone wells, MW-73 and MW-50. MW-73 is located about 110 feet southeast and down gradient of the center of the area of a former incinerator operation, which is thought to be located close to the source of the Parking Lot 3 VOC groundwater contamination. Soil gas survey results suggested the source was located in the area of MW-74, or about 120 to 160 feet west of MW-73. MW-50 is located about 450 feet down gradient and 200 feet cross gradient (to the southeast) of MW-74.

Between January 1993 and February 1995, concentrations of TCE at the up gradient well MW-73 showed a decreasing trend, but were highly variable, ranging from 10 to 70 µg/L. The soil vapor extraction conducted in 1993 and 1994 appears related to the variability of TCE concentrations at MW-73. There was an abrupt decrease in TCE concentrations between March and June 1996 from the 34 to 39 µg/L range to 9 µg/L. This decrease coincides with the March 1996 startup of groundwater extraction at EW-8 and EW-9 which are located 150 feet northwest, and 300 feet southwest of MW-73, respectively. This suggests that MW-73 was along the axis or easterly flank of the plume and that the extraction wells pulled the plume to the west causing less contaminated groundwater to move towards the area of MW-73. TCE concentrations show an overall stable trend from February 1995 to October 2006 (neglecting the groundwater extraction period), with an average of 8.6 µg/L. There was, however, a small increase in concentrations from 3 to 6.2 µg/L when extraction wells EW-8 and EW-9 were shut off on June 26, 2002. The average TCE concentration between July 2002 and October 2006 is 7.6 µg/L.

Concentrations of TCE at the down gradient well MW-50 show an increasing trend from the 5.6-14 µg/L range to the 21-24 µg/L range, from March 1989 to March 1996. The concentration also abruptly dropped at MW-50 (from 23 to 8 µg/L) when EW-8 and EW-9 were started in March 1996. Between November 1996 and April 2002 the concentrations ranged from 0.31 to 4.2 µg/L. When the extraction wells were turned off on June 26, 2002, the TCE concentration increased from 4.2 to 13 µg/L. The concentrations generally increased from July 2002 until April 2005 and have steadily decreased since then. The average concentration between July 2002 and October 2006 is 14.5 µg/L. The average concentration for the entire monitoring period of March 1989 to April 2006 is 11 µg/L.

In summary, TCE concentrations at MW-73 and MW-50 show an overall stable to somewhat increasing trend since 1993 and 1989, respectively. These concentrations were influenced by soil vapor extraction (at MW-73) between August 1993 and December 1994 and groundwater extraction at EW-8 and EW-9 between March 1996 and June 2002. The average TCE concentration at MW-73 since July 2002 is 7.6 µg/L; the average at MW-50, 450 feet down gradient of MW-73, is 11 µg/L. The concentrations in the down gradient well, MW-50, have been higher than those at MW-73 for last 3.5 years except for a relatively small increase in concentrations at MW-73 after the groundwater extraction was ceased in June 2002. This suggests that the soil vapor and groundwater extraction programs were successful in reducing TCE concentrations in the source area.

Observing relatively little change in concentrations over time at MW-73 and MW-50, except for the period when extraction wells EW-8 and EW-9 were operating, suggests the TCE plume extent probably remains approximately the same. However, even if the plume doesn't degrade as expected, it would move with the natural site groundwater gradient slowly to the south where it would be captured by the South Post Groundwater Plume extraction system. In addition, even if the groundwater extraction were to cease, according to the Fate and Transport Report, the Parking Lot 3 groundwater would remain essentially stationary and TCE would be below MCL by 2008 at the earliest. As this groundwater aquifer is not used for drinking water, the current remedy in place is protective of human health and the environment.

Carbon tetrachloride exceeded the California MCL of 0.5 µg/L at MW-50, MW-73, MW-74, and MW-81 (cross gradient to the east) occasionally during the past five years. With the exception of MW-50, carbon tetrachloride trends in these wells are stable to decreasing for the period. Monitoring well MW-50 has shown an increasing carbon tetrachloride trend based upon Mann-Kendall statistical evaluations of the period 2002-2006.

6.2.3 South Post Plume

The up gradient portion of the South Post plume is monitored at MW-16 (A-zone), which is about 225 feet down gradient of the South Post Burn Pits. Overall there has been a significant decrease in TCE concentrations at the well between October 1987 and November 2005 from 25-58 µg/L to 0.7-1.2 µg/L. The TCE concentration dropped below the 5 µg/L MCL in July 1998.

The northern part of the plume, approximate along its centerline, is monitored at nested (B-zone/A-zone) well pairs MW-1004/MW-1005 and MW-1023/MW-1024, which are about 850 feet and 1,125 feet, respectively, down gradient of the South Post Burn Pits source area. The TCE concentrations in these four wells were stable between January 1988 and January 2000 and ranged from 1.4 to 66 µg/L. Concentrations tended to be lower (1.4 to 23 µg/L) in the upper A-zone than in the lower B-zone (10 to 66 µg/L). In October 2000, TCE concentrations began to rise in these wells to peak concentrations ranging from 40 to 53 µg/L. TCE concentrations have been relatively stable to somewhat decreasing from October 2002 to October 2006 (at 20 to 33 µg/L). The average TCE concentration for all four wells for the period January 1988 to April 2006 is 25 µg/L.

Down gradient to the south along the suspected centerline of the South Post Plume, the patterns of the TCE concentration trends differ between the upper A-zone and the lower B-zone, as monitored at the nested well pair MW-1028 and MW-1027, respectively. They are located about 1,700 feet down gradient of the South Post Burn Pits source area. From October 1993 to October 2006, TCE concentrations at the two wells ranged from 5.1 to 37 µg/L and had an average of 20 µg/L. TCE concentrations peaked in the A-zone at 37 µg/L in October 2002; and in July 2003 and again in April 2005 at 31 µg/L in the B-zone. Concentrations appear to be decreasing in the A-zone with an October 2006 concentration of 15 µg/L and slightly decreasing in the B-zone with an October 2006 concentration of 28 µg/L.

The down gradient leading edge portion of the South Post Plume is monitored at well pair MW-1037 (A-zone) and MW-1036 (B-zone) about 2,800 feet down gradient of the South Post Burn Pits, and well pair MW-1035 (A-zone) and MW-1034 (B-zone) which are about 3,000 feet down gradient of the South Post Burn Pits. TCE concentrations between November 1997 and October 2006 show a decreasing trend in all four wells; TCE decreased to below the detection limit (0.5 µg/L) in three wells and from 6.5 to 1.3 µg/L in MW-1036 which is located in the B-zone.

In 2005 the Army conducted an investigation to delineate the down gradient extent of the plume and, specifically, the portion of the plume at or above 5 µg/L for TCE. This work was focused largely on the A- and B-zones located underneath the FedEx facility between the MW-1028 well cluster and MW-1037. The results confirmed modeling predictions based on evaluation of groundwater data obtained from the monitoring well network. The 5 µg/L portion of the plume was delineated at Berry Avenue with the highest detected levels focused at the MW-1028 cluster. The activity also delineated the western and eastern edge of the 5 µg/L plume and it showed that the width of the plume is smaller than originally anticipated (Plate 6 and 7).

In the area of the western flank of the plume, as monitored at MW-1020, TCE concentrations decreased from 28 µg/L in November 1998 to non-detected in January 2000. This suggests that the TCE plume has drawn back to the east away from MW-1020.

In summary, since monitoring began in various portions of the plume (in 1988, 1993, 1997 and 1998), TCE concentrations have decreased in the up gradient and distal areas of the South Post plume with a somewhat increasing trend in the mid-portion of the plume.

Carbon tetrachloride exceeded the California MCL of 0.5 µg/L at MW-16 several times over the past five years and cis-1,2-dichloroethene concentrations have exceeded the California MCL (6 µg/L) in monitoring wells MW-1004, MW-1023, and MW-1024 over the last five years. Cis-1,2-dichloroethene has been at or above the MCL at MW-1004 since January 2003; at MW-1023 it was above the MCL only between July 2002 and July 2004, and at MW-1024 it has generally been less than the MCL except for two monitoring events which appear anomalous. At MW-1004, which is the only well where cis-DCE is currently above the MCL, the concentrations have been stable since January 2003. Statistical evaluations indicate that the concentration of cis-DCE in the other wells has also been stable. The presence of cis-DCE is indicative of TCE or tetrachloroethene degradation.

Extraction well EW-10 is operating at approximately 50% of capacity (of about 100 gpm) due to severe cycling problems caused by suspected well screen fouling. The TCE concentration of extracted groundwater has declined from 62 µg/L (in November 1989) to 2.6 µg/L (in April 2006). Plate 10 shows changes in TCE treatment plant influent concentrations over time. The graph shows an exponentially decreasing trend in TCE concentrations. From January 2001 to August 2006 the rate of TCE concentration decrease has been about 0.4 µg/L per year.

Since the last 5-Year review, potential vapor intrusion issues have increased in visibility across the nation and, when conducting a risk assessment, should be considered as a possible exposure pathway posed by releases of hazardous chemicals into the environment. In the process of completing this 5-Year review, the EPA requested that the Army address potential vapor intrusion issues related to the south post plume and, in response, the Army conducted a screening level investigation to evaluate vapor intrusion.. The Army thoroughly reviewed the EPA Guidance, DTSC Guidance, Army Guidance, and the Johnson & Ettinger model and utilized the DTSC automated screening tool (automated Excel™ spreadsheet) to evaluate vapor intrusion risk with respect to the groundwater plume at SAAD. The screening process and data is delineated in Attachment 8 and, given the depth to contaminates, concentration, geology, and screening

results, the Army does not believe that there are any vapor intrusion concerns associated with groundwater contamination at SAAD.

6.2.4 Potential Changes to Monitoring Programs

Currently, most monitoring wells are sampled on a quarterly or semiannual basis. Low flow sampling procedures are used for all monitoring wells. The current monitoring well network appears to be adequate for the current spatial configuration of the groundwater contamination. The frequency of monitoring utilized to detect significant changes in contaminant concentrations seems overly aggressive given the shear volume of historical data collected and current characteristics of the contaminant plume.

An evaluation of historical trends of TCE for key monitoring wells at SAAD over the past five years was conducted using the Air Force Center for Environmental Excellence Monitoring and Remediation Optimization System software. Output from this program indicates that a substantial number of monitoring wells could have their sampling frequency reduced to annual or biannual.

Given the potential value to the SAAD program it is suggested that chlorinated solvent degradation parameters be added to the monitoring program. This might be performed as a one time event to determine the value; however, the presence of cis-DCE indicates that some form of degradation is occurring.

At this point in the project, over ten years of general chemistry data (major anions and cations) have been collected. Recent evaluations indicate that these groundwater parameters are stable and there is no reason to continue to collect these data.

Chromium analysis is also performed for a number of monitoring wells. Chromium is not a contaminant of concern and there have been no detections higher than expected background values for approximately 10 years. Historical chromium detections exceeding the California MCL (50 µg/L) include the following; 1) five samples collected from MW-05, with concentrations ranging from 60 to 250 µg/L , 2) three samples from MW-74, with concentrations ranging from 57 to 96.3 µg/L, and 3) one sample from MW-77 at 58 µg/L. It should be noted that these samples were collected shortly after the wells were installed and that the samples were not filtered. Current sample collection procedures include field filtering for metals. The chromium concentrations discussed above likely reflect incomplete development of the well resulting in the collection of small soil particles (colloids) along with the groundwater combining to produce erroneous data. Chromium in MW-05, MW-74, and MW-77 has not been detected above the MCL since Fall Quarter 1996.

Given the above discussion, during the development of the ROD amendment or ESD, optimization of the monitoring program will be considered, including: 1) the sampling frequency of wells, 2) removing chromium from the analyte list, 3) removing general chemistry (anions and cations) from the analyte list, and 4) adding chlorinated solvent natural degradation related parameters. Optimizing the monitoring program would allow for cost savings as well as greater focus on wells of interest such as MW-50, MW-73, MW-1028, MW-1029, MW-1036, and MW-1037.

6.3 Site Inspection

The U.S. Army Corps of Engineers conducted a site inspection on July 11, 2006. The site inspection report, checklist, and photographs documenting site conditions are found in Attachments 3 and 4, respectively. The purpose of the site inspection was to obtain familiarity with the site, review the records, examine the treatment systems and associated documentation, assess the protectiveness of the remedies, and conduct an interview with the site operator.

The following areas were visited: 1) South Post Burn Pits, 2) Oxidation Lagoons, 3) Battery Disposal Well, 4) Building 300 Burn Pits, 5) Parking Lot 3 Groundwater, and 6) South Post Groundwater. The inspection team also visited the groundwater treatment plant and shop. The former depot is surrounded by fencing and there are a limited number of controlled entry points. The Army and Marine Reserve centers also have controlled access. The South Post Burn Pits site was vegetated and the soil cover appeared to be intact with no erosion or slope failure. There was no evidence of unauthorized development or construction activities. The lysimeters were observed to be secure. The Parking Lot 3 site remains paved and is used for parking truck trailers. The two extraction wells appeared undamaged and the surrounding fence was in good repair. The extraction wells at the South Post Groundwater site appeared to be well maintained and the fencing was in good repair. Vegetation was controlled in the immediate area surrounding the extraction wells. There was no evidence of unauthorized wells or disturbance to the groundwater treatment system. The groundwater treatment plant systems appear to be in good condition with regular maintenance. Vegetation is controlled adjacent to the plant. The plant and adjacent shop building were clean and orderly. The plant operator maintains records of extraction well flow rates and routine sampling. The shop (8201 Santa Cruz Street) contains records, operations & maintenance documents, spare parts, supplies, tools, and historical project documents.

The institutional controls, identified in Section 3.2, are being enforced. No significant operations and maintenance issues were identified during the site inspection, i.e., there was nothing constructed on the sites, the soil cover was not damaged, and the vegetation was appropriate.

6.4 Interviews

The U.S. Army Corps of Engineers interviewed the BRAC Environmental Coordinator, the RPMs from EPA, DTSC and the CVRWQCB, the RAB community co-chair, the present groundwater sampling contractor, and the treatment system operator to gather information on the site. The site interview forms are found at Attachment 5. The following is a list of those individuals contacted for an interview:

Name	Title	Organization
Scott Armstrong	BRAC Environmental Coordinator	U.S. Army
John Hamill	RPM	EPA
Susan Goss	RPM	DTSC
Brian Taylor	RPM	CVRWQCB
Robert Chambers	Environmental Technician	Johnson Controls
Dick Walker	Community Co-Chair	SAAD RAB
Kenneth Conner	Environmental Contractor	SCA Environmental

7.0 TECHNICAL ASSESSMENT

This section of the five-year review addresses the sites in three sections: 1) the soil remedies, 2) Parking Lot 3 Groundwater, and 3) South Post Groundwater OU.

7.1 Soil Remedies – CAMU and South Post Burn Pits OU

7.1.1 Question A:

Is the remedy functioning as intended by the decision documents?

7.1.1.1 Remedial Action Performance and Operations

The primary remedial focus of the remedies was to consolidate and treat the soil with the highest metal concentrations to both reduce the potential for exposure and impacts to groundwater. The existing CAMU is functioning as designed. Lysimeter monitoring has not indicated any migration of metal contamination from the stabilized soils. The soil cover is in good condition. Containment of the stabilized soil under the soil cover is effective. No issues have been identified in the CAMU at the South Post Burn Pits

7.1.1.2 Opportunities for Optimization

None were identified.

7.1.1.3 Implementation of Institutional Controls

Institutional controls have been set in place through the use of deed restrictions. Soil related institutional controls have been established for the CAMU located at the South Post Burn Pits OU. Institutional controls also restrict the use of VOC contaminated groundwater that underlies the South Post Burn Pits OU. The institutional controls have been enforced and no prohibited activities have occurred.

7.1.1.4 Early Indicators of Potential Issues

No potential issues were identified.

7.1.2 Question B:

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

7.1.2.1 Changes in standards, newly promulgated standards, and items to be considered

All ARARs listed in the ROD (and cleanup levels as modified in subsequent work plans) were complied with during the construction phase associated with soil remediation activities. Currently only those associated with the CAMU require evaluation, as the other listed ARARs do not carry over to current operations. The ARAR evaluation is found in Attachment 6.

As shown in Attachment 7, changes have occurred in toxicity and other contaminant characteristics since the risk assessment was prepared. Toxicity values for some of the metals have changed to reflect somewhat greater estimated risks and hazards. However, the concentrations remaining after completion of the soil excavations are low and it is expected that the remaining risk, even after considering the changes in some toxicity values, would still fall within the EPA risk range for the individual sites. There have been no changes in methodology that would affect the soil cleanup. See Attachment 7, *RISK ASSESSMENT AND TOXICOLOGY EVALUATION* for further information on the analysis and changes.

The short and long-term protectiveness of the soil remedies is based on meeting ARARs and implementation of institutional controls to prevent exposure. Although some of the toxicity values have changed, there is no exposure pathway with the soil cover in place, the site fenced, and the enforcement of the institutional controls on the CAMU at the South Post Burn Pits OU.

7.1.2.2 Changes in Risk Assessment Methods

To date, no standardized risk assessment methodologies have changed in a manner that could affect the protectiveness of the remedy.

7.1.2.3 Expected Progress Toward Meeting RAOs

Soils containing concentrations above the cleanup levels have been removed from across the installation, stabilized, and placed in the CAMU. Institutional controls and the soil cover prevent exposure to stabilized soils in the CAMU. Therefore, the RAOs for the soil remedies have been met.

7.1.3 Question C:

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

The outside physical setting has not changed and there have been no catastrophic weather events that have affected the remedy. There is no other new information that might affect the protectiveness of the remedy.

7.2 Parking Lot 3 Groundwater

7.2.1 Question A:

Is the remedy functioning as intended by the decision documents?

7.2.1.1 Remedial Action Performance and Operations

The primary remedial focus of the Parking Lot 3 groundwater remedy was to reduce VOC concentrations below the action levels (MCLs) and prevent impacts to down gradient private and municipal wells. Monitoring reports indicate that groundwater VOC concentrations had been reduced to below or near the action levels prior to system shut down in June 2002. TCE concentrations rebounded above MCLs at two wells. Overall, the remedy was working as designed and had been reliable prior to system shut down. However, the plume is still under the influence of the present Ground Water Treatment Plant extraction system and there are no exposure pathways or receptors.

7.2.1.2 Opportunities for Optimization

The project team is currently planning to evaluate the suitability of the site for monitored natural attenuation. The outcome of this evaluation will be delineated in the Final Groundwater Cleanup Optimization Report

7.2.1.3 Implementation of Institutional Controls

Institutional controls have been set in place through the use of deed restrictions. The institutional controls are enforced and no well installation, use of groundwater, or disturbance to the treatment system has occurred.

7.2.1.4 Early Indicators of Potential Issues

The emerging issues at this site are: 1) evaluating the need for continued groundwater treatment, and 2) identifying a remedy better suited to achieving remedial objectives in a cost effective manner.

7.2.2 Question B:

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

7.2.2.1 Changes in standards, newly promulgated standards, and items to be considered

The ARARs listed in the ROD were based on meeting the more stringent of Federal or state MCLs. The ARAR evaluation is found in Attachment 6.

Changes have occurred to toxicity standards as shown in Attachment 7. Toxicity values for both TCE and carbon tetrachloride have changed and indicate somewhat greater estimated risks and hazards. However, the MCLs have remained unchanged. The short and long-term protectiveness of the remedy is based on meeting ARARs and implementation of institutional controls to prevent exposure.

7.2.2.2 Changes in Risk Assessment Methods

Risk assessment methodologies have changed to include consideration of the vapor intrusion pathway. Currently there are no buildings located above the original VOC release point or the Parking Lot 3 groundwater plume and there are no receptors or reasonable exposure pathways. If the ROD or other decision documents requiring supporting a risk assessment are amended, this pathway should be addressed. However, given the concentration, depth to contaminants, and the exponentially higher screening levels needed before exposure would be a concern this exposure pathway is extremely unlikely.

7.2.2.3 Expected Progress Toward Meeting RAOs

Action levels had been achieved when the groundwater treatment system was shut down. Contaminant removal rates often decline asymptotically with groundwater pump and treat systems. Concentration increases (rebound) commonly occur after system shut down. Contaminant concentrations have rebounded at this site to above or near MCLs. Groundwater extraction could be resumed if necessary; however this is unlikely given the presence down gradient of the South Post OU groundwater treatment system. Current modeling projections suggest that remedial objectives will be met by 2013 without restarting EW-8 and EW-9.

7.2.3 Question C:

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

The outside physical setting has not changed and there have been no catastrophic weather events that have affected the remedy. There is no other new information that might affect the protectiveness of the remedy.

7.3 South Post Groundwater OU

7.3.1 Question A:

Is the remedy functioning as intended by the decision documents?

7.3.1.1 Remedial Action Performance and Operations

The primary remedial focus of the South Post Groundwater remedy was to reduce VOC concentrations below the action levels (MCLs) and prevent impacts to down gradient private and municipal wells. Overall the remedy is working as designed and has been reliable. In general, the extraction wells and treatment plant appear to be in good working order. Extraction rates have been at the design level and the treatment plant is operating as designed. Monitoring reports show that the aerial extent of the plume appears to have decreased, contaminant concentrations are reduced throughout the site, and the overall mass appears to be significantly reduced.

Considerable cycling problems with EW-10 have forced a reduction in extraction rates from about 85 gpm to around 45 gpm. This extraction well is removing groundwater with the highest concentrations of TCE (13 µg/L – Summer Quarter 2006) of all the South Post Groundwater OU wells. This well, and perhaps others, may need to be redeveloped to clear mineral buildup or biological fouling.

7.3.1.2 Opportunities for Optimization

The groundwater extraction system has been continuously optimized since installation to maximize the pumping rate. Groundwater flow and contaminant transport modeling should be integrated with the optimization work to capture the plume with the minimum pumping rate.

It may be possible to adjust flow rates to improve extraction efficiency. Given the extensive apparent capture zone of the existing extraction well field, it may be possible to shut down some of the extractions wells with low TCE concentrations. The Groundwater Cleanup Optimization Report is presently under review.

7.3.1.3 Implementation of Institutional Controls

Institutional controls are set in place through the use of deed restrictions and land use controls included in all the installation property transfers. These institutional controls are all within the boundary of SAAD. Those institutional controls in place on SAAD are enforced thereby ensuring that no well installation, use of groundwater, or disturbance to the treatment system has occurred. Well permits in this area are issued by the County of Sacramento Water Protection Division. This office is provided with South Post Groundwater OU contaminant plume information to guide their decision making in regard to well installation.

7.3.1.4 Early Indicators of Potential Issues

Fouling of the extraction wells is an issue that should be periodically evaluated. The state regulatory agencies have expressed concern regarding the effectiveness of plume capture although multiple investigations since the last five year review including, fate and transport modeling, and ongoing quarterly monitoring reports, indicate that the plume is being captured and possibly even being pulled back toward the extraction wells. The South Post Groundwater OU will also face the same inherent limitations regarding groundwater extraction and treatment that are evident at Parking Lot 3.

7.3.2 Question B:

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

7.3.2.1 Changes in standards, newly promulgated standards, and items to be considered

The ARARs listed in the ROD were based on meeting the more stringent of Federal or state MCLs. The ARAR evaluation is found in Attachment 6.

Changes have occurred to toxicity standards as shown in Attachment 7. Toxicity values for both TCE and carbon tetrachloride have changed and indicate somewhat greater estimated risks and hazards. However the MCLs have remained unchanged. The short and long-term protectiveness of the remedy is based on meeting ARARs and implementation of institutional controls to prevent exposure.

7.3.2.2 Changes in Risk Assessment Methods

Risk assessment methodologies have changed to include consideration of the vapor intrusion pathway. One off-site building is located above the plume. If the ROD or other decision documents requiring supporting risk assessment are amended, this pathway should be addressed. However, given the concentration, depth to contaminants, and the exponentially higher screening levels outlined in Attachment 8 and Section 6.2.3 of this document, this exposure pathway is extremely unlikely.

7.3.2.3 Expected Progress Toward Meeting RAOs

Groundwater concentrations have been reduced at most of the monitoring wells but the cleanup goals have not yet been achieved. Modeling projections suggest that remedial objectives will be met by 2026 at the current pumping rate. As noted above in the Parking Lot 3 discussion, contaminant removal rates, especially those at very low concentrations, may decline asymptotically and result in longer than anticipated cleanup periods.

7.3.3 Question C:

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

The outside physical setting has not changed and there have been no catastrophic weather events that have affected the remedy. There is no other new information that might affect the protectiveness of the remedy.

8.0 ISSUES

Issues related to the current site operations, conditions, and activities that may prevent the remedy from being protective are listed below in Table 4.

Table 4. Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Some of the final soil action levels have not been established in a decision document. The California MCL for cis-DCE was incorrectly identified as the Federal value.	N	N
2. VOCs remain above RAOs at Parking Lot 3 and the current remedy and closeout procedures are ineffective.	N	N
3. Consensus has not been achieved regarding groundwater contamination fate and transport, and plume capture effectiveness.	N	N
4. The South Post Groundwater remedy has not achieved RAOs within predicted timeframes.	N	N
5. Closeout procedures have not yet been established for the South Post Groundwater.	N	N
6. Changes to the Basewide ROD groundwater remedies have not been documented in a decision document.	N	N

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Required and suggested improvements to current site operations and activities are presented below in Table 5.

Table 5. Recommendations and Follow-up Actions

Issue	Recommendations	Party Responsible	Oversight Agency	Milestone Date
1.	Include final soil cleanup levels and the basis for their selection in the amendment or ESD for the Basewide ROD. Clarify the origin of the cis-DCE MCL.	Army	EPA and DTSC	FY09
2.	Evaluate the risk posed by the remaining contamination at Parking Lot 3. If the level of risk still poses a concern, then evaluate the application of Monitored Natural Attenuation, or other in-situ remedy. Develop an amendment or ESD for Basewide ROD. Revise the closeout procedures. This is presently under review in the Groundwater Cleanup Optimization Report.	Army	EPA, DTSC and CVRWQCB	FY08
3.	Complete ongoing update of groundwater flow and contaminant transport model. Evaluate groundwater contamination issues in context of all available modeling, monitoring, treatment, and source information. Presently under review in the Groundwater Cleanup Optimization Report.	Army	EPA, DTSC and CVRWQCB	FY08
4.	Evaluate the likelihood that the South Post Groundwater remedy will successfully meet RAOs if continued. Evaluate and select another remedy if current remedy will not be successful. Presently under review in the Groundwater Cleanup Optimization Report.	Army	EPA, DTSC and CVRWQCB	FY09
5.	Prepare document establishing closeout procedures for the South Post Groundwater remedy.	Army	EPA, DTSC and CVRWQCB	FY09
6.	Identify logical timeframe to change the Basewide ROD with an Explanation of Significant Differences (ESD) or ROD Amendment, as appropriate. Include all groundwater remedy changes/updates.	Army	EPA, DTSC and CVRWQCB	FY09

10.0 PROTECTIVENESS STATEMENTS

10.1 Operable Unit – South Post Burn Pits

The remedy at OU – South Post Burn Pits currently protects human health and the environment because contaminated soil exceeding cleanup levels has been excavated, stabilized, and placed in the CAMU. However, in order for the remedy to be protective in the long-term, the institutional controls must continue to be enforced and the physical integrity of the soil cover over the CAMU must be maintained.

10.2 Parking Lot 3 Groundwater

The remedy at Parking Lot 3 Groundwater currently protects human health and the environment because institutional controls prevent exposure to contamination remaining above the cleanup goals. However, in order for the remedy to be protective in the long-term, the institutional controls restricting groundwater use must continue to be enforced, or the remedial action must be modified to achieve the cleanup goals.

10.3 Operable Unit – South Post Groundwater

The remedy at OU – South Post Groundwater currently protects human health and the environment because institutional controls prevent exposure to contamination remaining above the cleanup goals. However, in order for the remedy to be protective in the long-term, the institutional controls restricting groundwater use must continue to be enforced, or the remedial action must be modified to achieve the cleanup goals.

11.0 NEXT REVIEW

The next five-year review will be performed in 2011, will address the groundwater remedies at SAAD, and be due in 2012.

ATTACHMENT 1

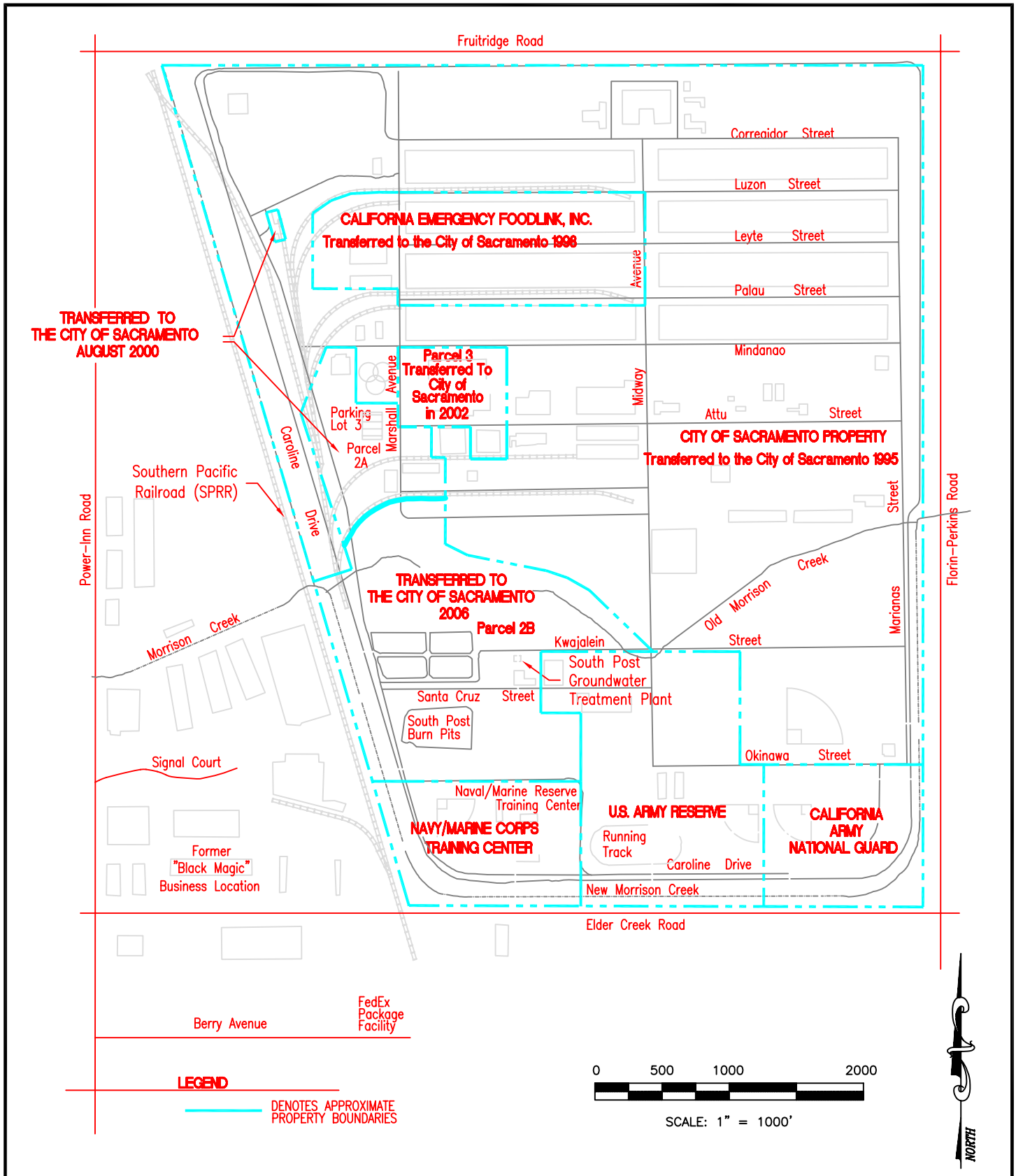
PLATES

0 1 2
APPROXIMATE SCALE IN MILES

PLATE 1

U. S. Army Corps of Engineers
Sacramento District

SITE LOCATION MAP
FORMER SACRAMENTO ARMY DEPOT
SACRAMENTO, CALIFORNIA



SCA

Drawn By: SCA Project No.: B-6774	Date: 8-8-07 Filename: Plate2.dwg	CURRENT FACILITY MAP FORMER SACRAMENTO ARMY DEPOT

PLATE 2

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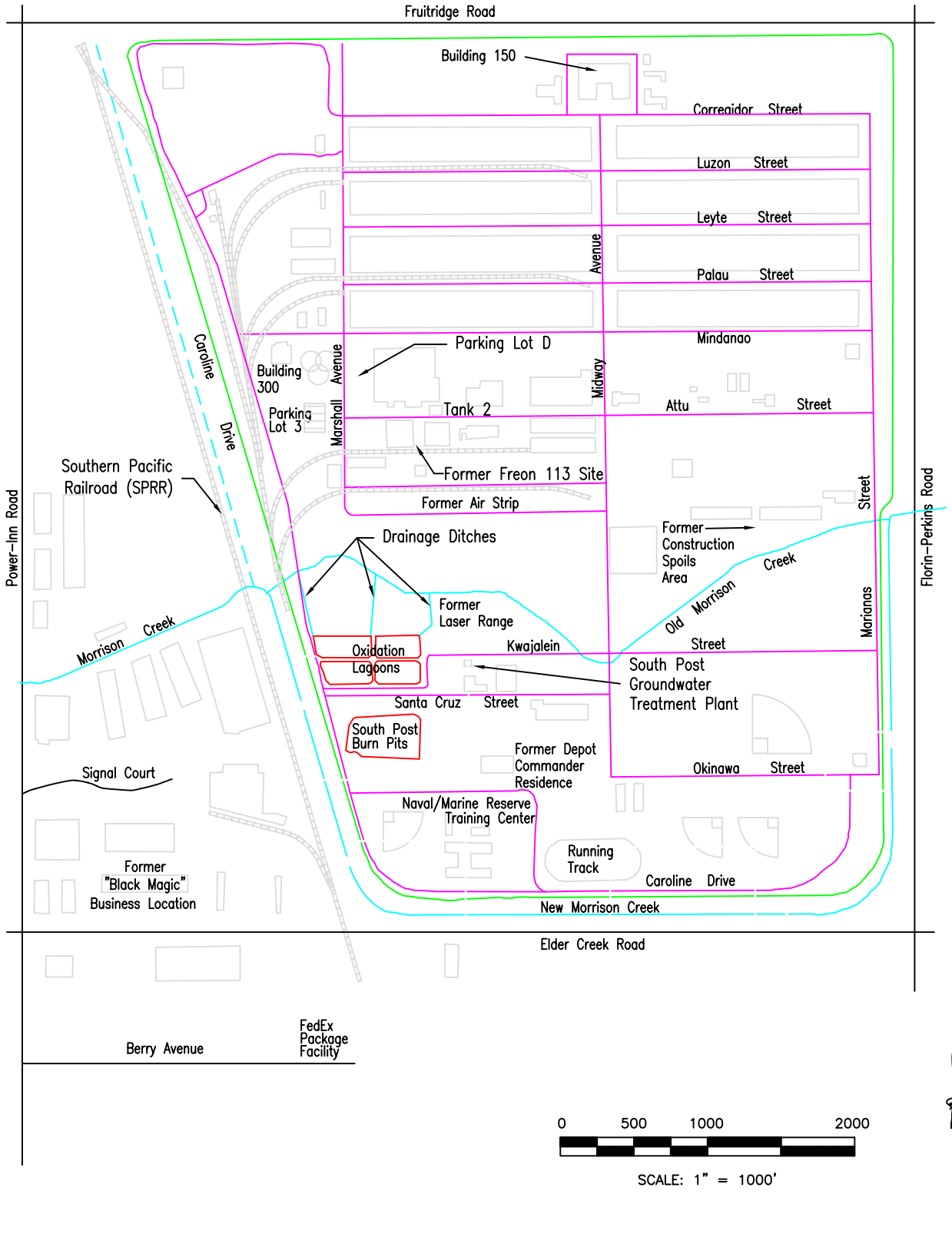


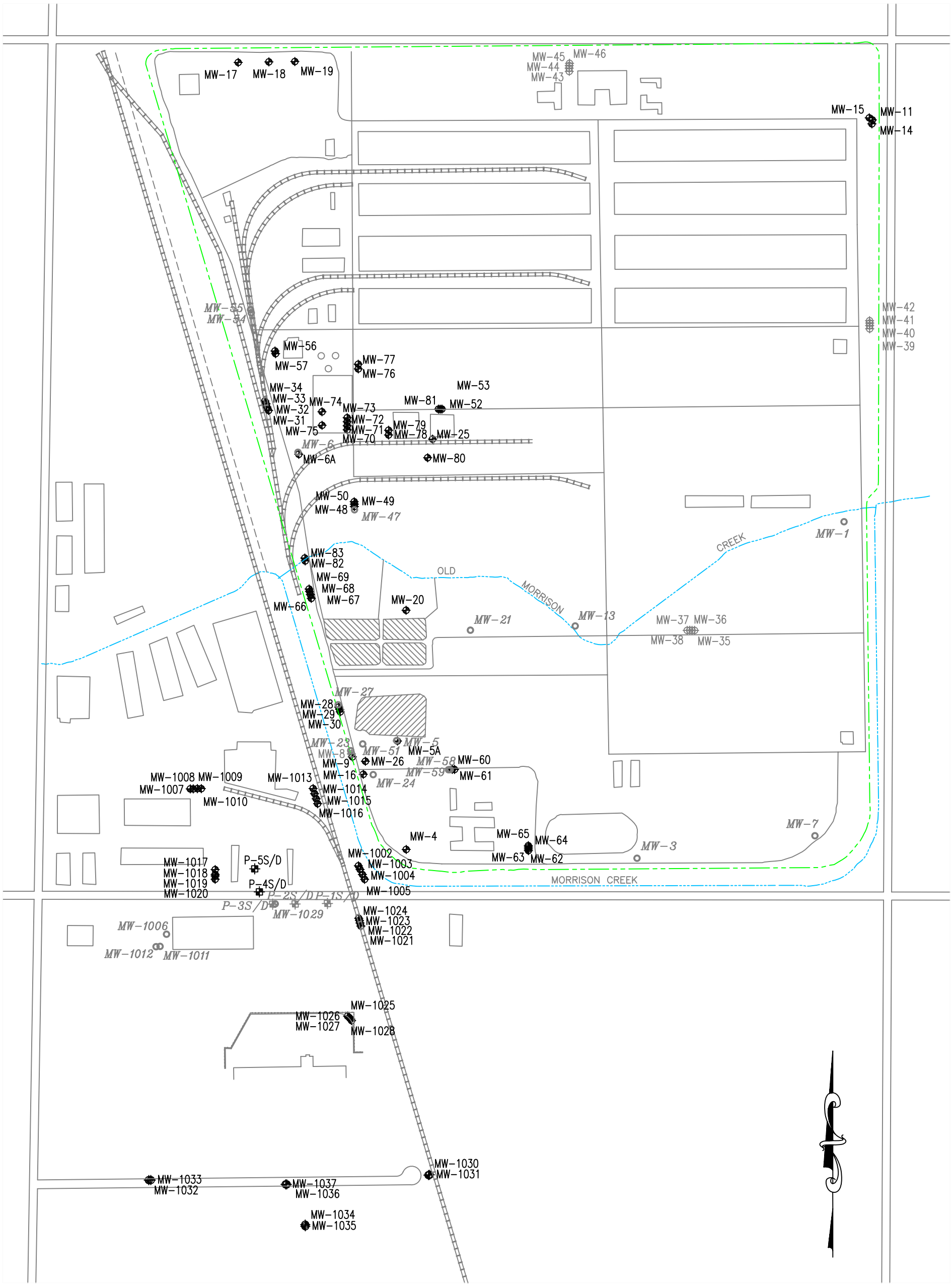
U.S. Army Corps of Engineers
Sacramento District

Edited By: Verne Brown, USACOE

Date: 09/12/05
Filename: Plate3.dwg

FORMER FACILITY MAP FORMER SACRAMENTO ARMY DEPOT SACRAMENTO, CA

PLATE 3



LEGEND

MW-1029	GROUNDWATER MONITORING WELL LOCATION
MW-4	ABANDONED GROUNDWATER MONITORING WELL LOCATION
MW-1	DESTROYED GROUNDWATER MONITORING WELL LOCATION
P-1S	PIEZOMETER LOCATION

600 0 300 600

SCALE: 1 inch = 600 ft.

U.S. Army Corps of Engineers
Sacramento District

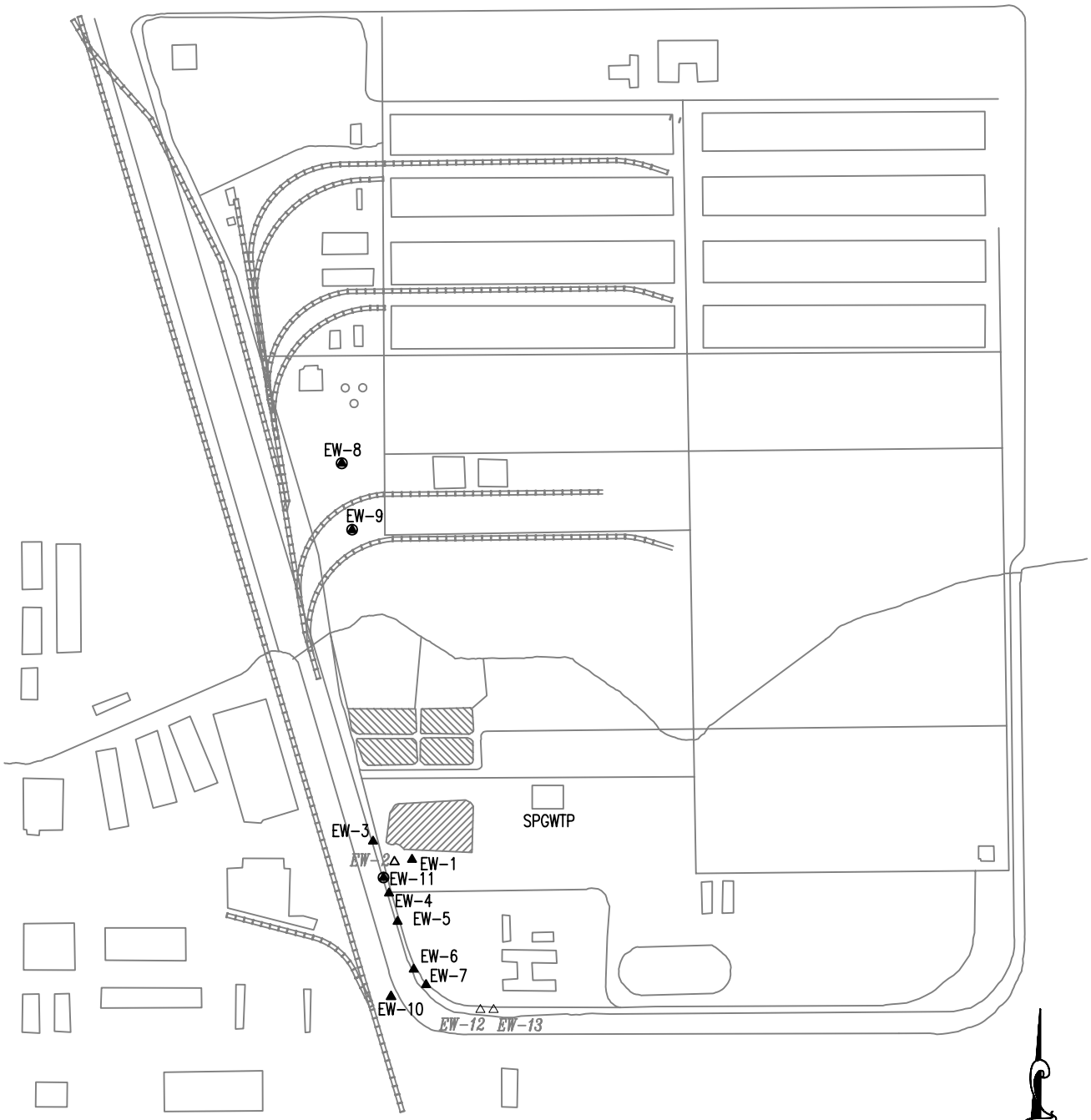
Edited By: Verne Brown, USACOE

Date: 04/25/06
Filename: Plate4.dwg

MONITORING WELL & PIEZOMETER LOCATION MAP
FORMER SACRAMENTO ARMY DEPOT
SACRAMENTO, CA

PLATE
4

©



LEGEND

▲ EW-1	EXTRACTION WELL LOCATION
△ *EW-12*	*DESTROYED/ABANDONED EXTRACTION WELL LOCATION*
● EW-8	EXTRACTION WELL NOT CURRENTLY IN USE
SPGWTP	INDICATES LOCATION OF SOUTH POST GROUNDWATER TREATMENT PLANT

800 0 400 800

SCALE: 1 inch = 800 ft.

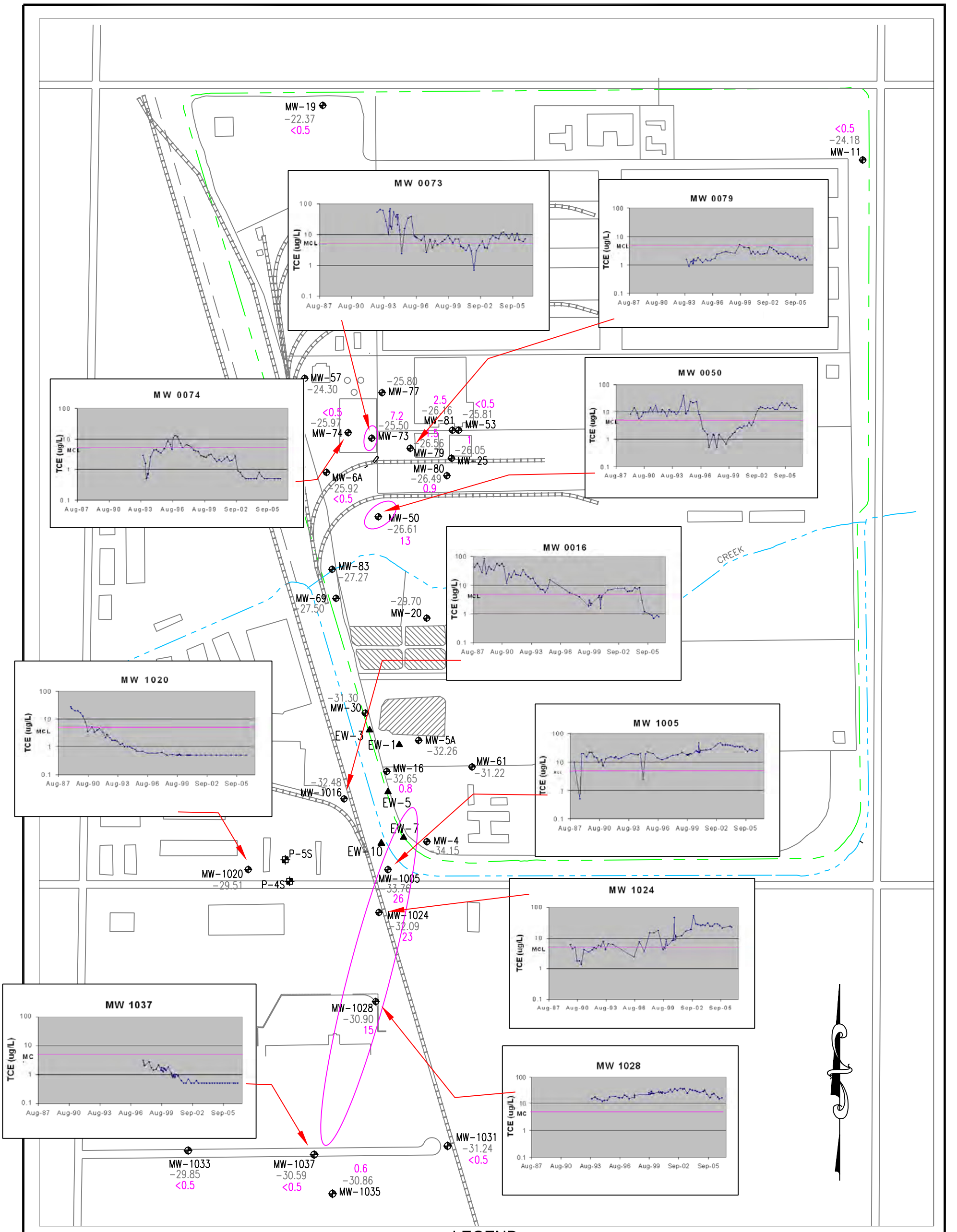
U.S. Army Corps of Engineers
Sacramento District

Edited By: Verne Brown, USACOE

Date: 09/12/05
Filename: Plate5.dwg

EXTRACTION WELL LOCATION MAP
FORMER SACRAMENTO ARMY DEPOT
SACRAMENTO, CA

PLATE
5



LEGEND

MW-1033 -30.71 <0.5	GROUNDWATER MONITORING WELL LOCATION AND DEPTH TO GROUNDWATER AND TCE CONCENTRATION IN PARTS PER BILLION (PPB)
P-4S	PIEZOMETER LOCATION
EW-10	EXTRACTION WELL LOCATION
TCE 5	5 PPB TRICHLOROETHENE ISOCONCENTRATION CONTOUR (PPB)

600 0 300 600

SCALE: 1 inch = 600 ft.

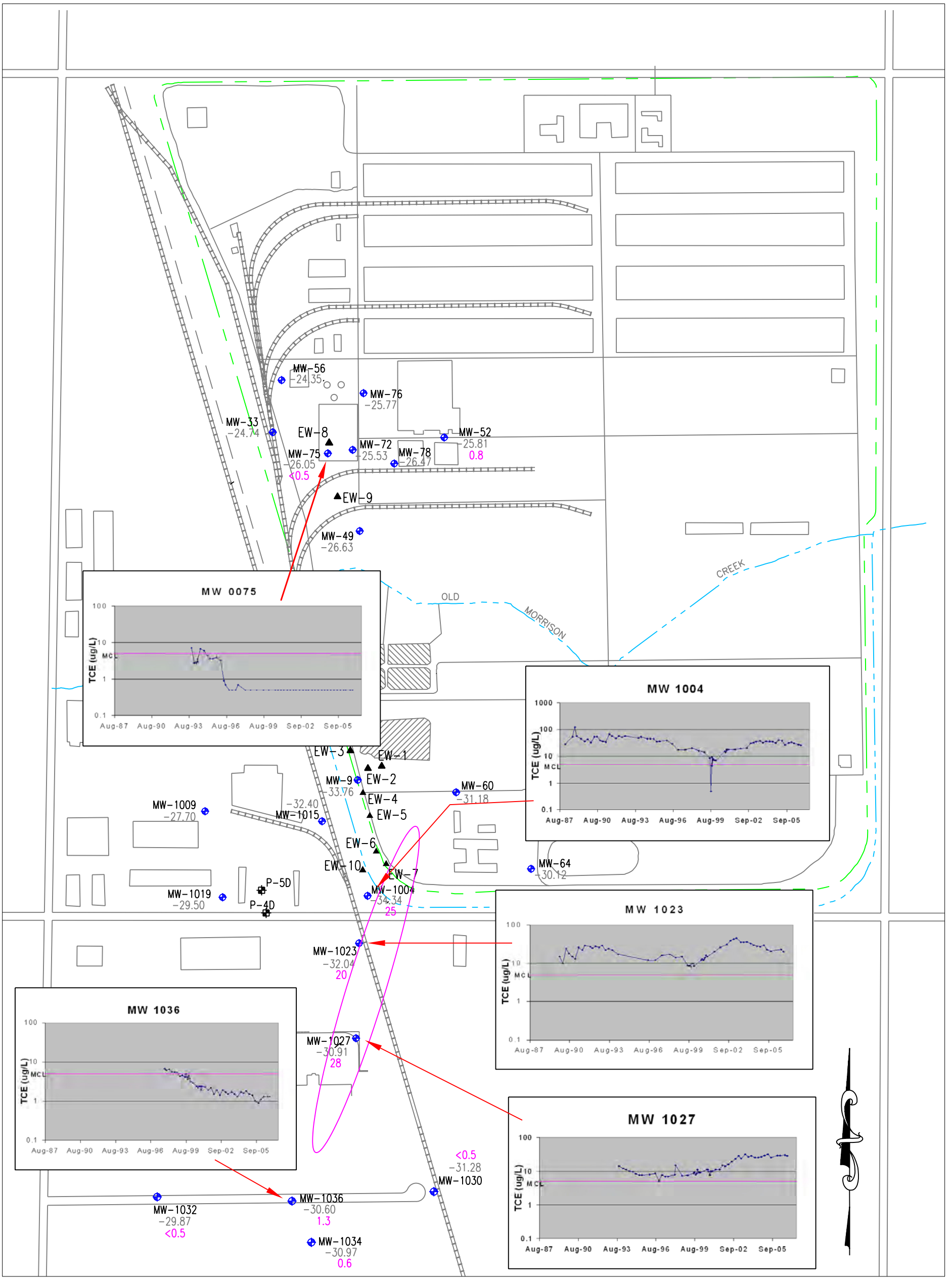
** South Post plume southern delineation was achieved by October 2005 fieldwork; the change in plume boundaries does not reflect plume movement over a brief period of time. The change reflects the additional data obtained in October 2005.

SCA

Drawn By:	SCA
Project No.:	B-7915
Date:	12-26-06
Filename:	FA06AZ-histographs

CURRENT TRICHLOROETHENE (TCE) PLUME EXTENT AND KEY WELL TRENDS A-ZONE FORMER SACRAMENTO ARMY DEPOT

PLATE 6



LEGEND

MW-1032	GROUNDWATER MONITORING WELL LOCATION
-30.72	AND DEPTH TO GROUNDWATER
<0.5	AND TCE CONCENTRATION IN PARTS PER BILLION (PPB)
P-4S	PIEZOMETER LOCATION
EW-10	EXTRACTION WELL LOCATION
TCE 5	5 PPB TRICHLOROETHENE ISOCONCENTRATION CONTOUR (PPB)

600 0 300 600

SCALE: 1 inch = 600 ft.

** South Post plume southern delineation was achieved by October 2005 fieldwork; the change in plume boundaries does not reflect plume movement over a brief period of time. The change reflects the additional data obtained in October 2005.

SCA

Drawn By:	SCA
Project No.:	B-7915
Date:	12-26-06
Filename:	FA06BZ-histographs

CURRENT TRICHLOROETHENE (TCE)
PLUME EXTENT
AND KEY WELL TRENDS
B-ZONE
FORMER SACRAMENTO ARMY DEPOT

PLATE

7

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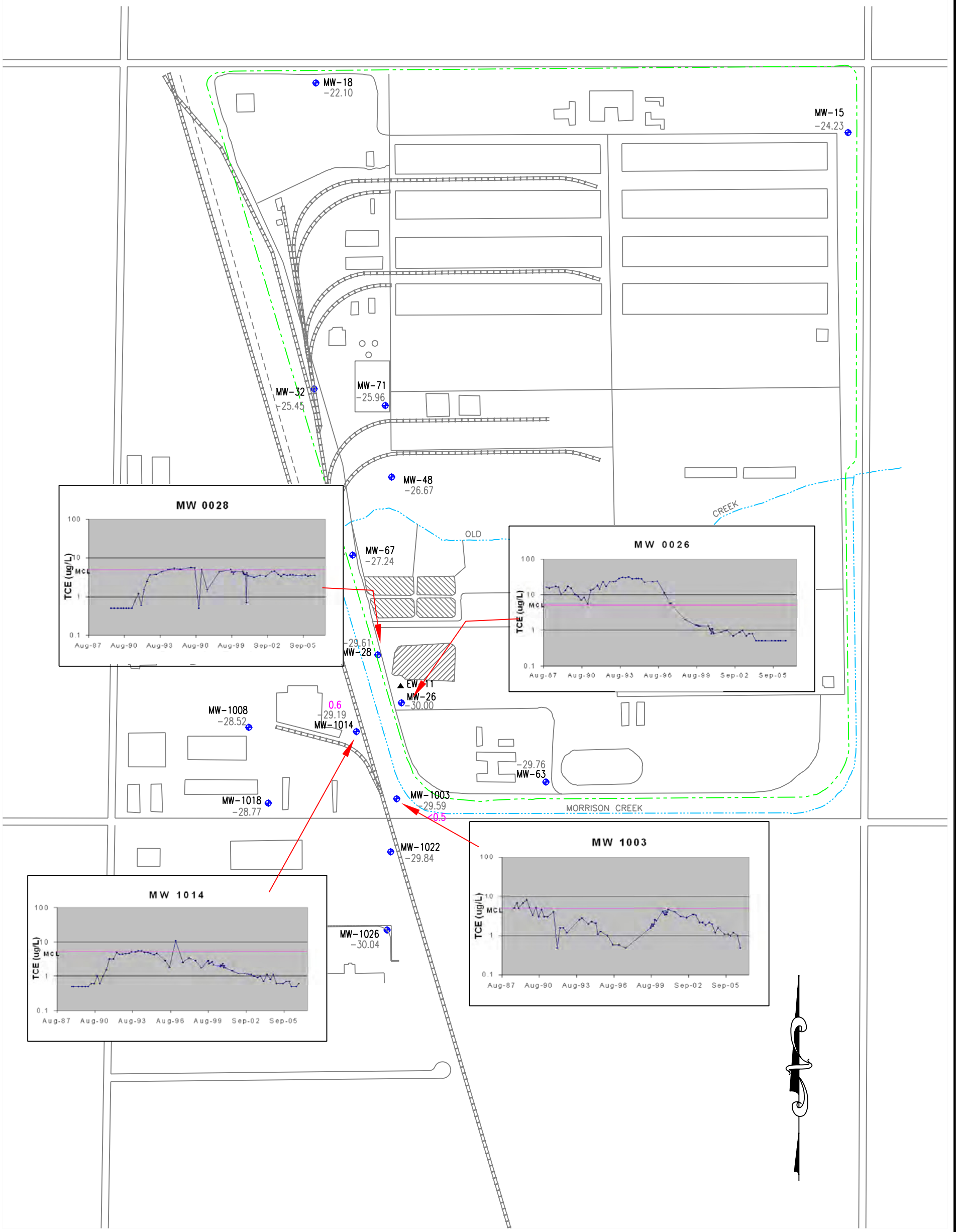

LEGEND

MW-1003 — GROUNDWATER MONITORING WELL LOCATION
-31.85 — AND DEPTH TO GROUNDWATER
2.2 — AND TCE CONCENTRATION IN PARTS PER BILLION (PPB)

NO ISOCONCENTRATION CONTOUR FOR TRICHLOROETHENE (TCE)
DUE TO NO DETECTIONS ABOVE THE MCL OF 5 PPB

600 0 300 600

SCALE: 1 inch = 600 ft.

NOTE: NO 5 PPB PLUME EXISTS FOR TCE IN THE C ZONE.

SCA	Drawn By: SCA	CURRENT TRICHLOROETHENE (TCE)	PLATE
	Project No.: B-7915	PLUME EXTENT	
	Date: 12-26-06	AND KEY WELL TRENDS	8
	Filename: FA06CZ-histographs	C-ZONE	
		FORMER SACRAMENTO ARMY DEPOT	

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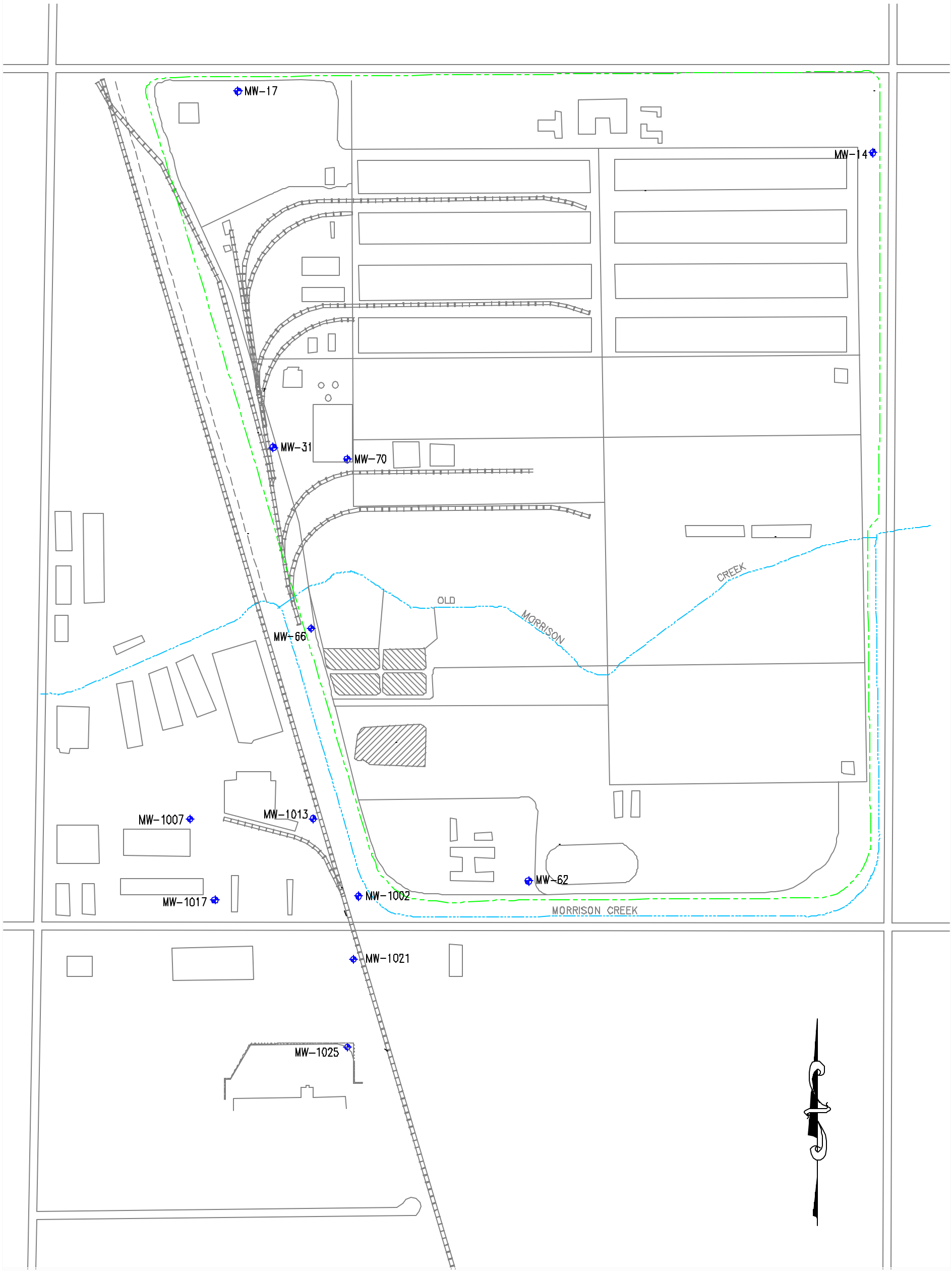

LEGEND

MW-1025 GROUNDWATER MONITORING WELL LOCATION

600 0 300 600

SCALE: 1 inch = 600 ft.

NOTE: NO TRICHLOROETHENE ISOCONCENTRATION CONTOURS ARE SHOWN FOR THE D ZONE AS ALL RESULTS WERE LESS THAN 5 PPB FROM 1990 THROUGH 2006.

SCA	Drawn By: SCA Project No.: B-7915 Date: 12-26-06 Filename: FA06DZ-tmsr.dwg	SOUTH POST GROUNDWATER TRICHLOROETHENE CONCENTRATION CONTOURS FROM 1990 THROUGH 2006 D-ZONE FORMER SACRAMENTO ARMY DEPOT	PLATE 9

© SCA Environmental, Inc. 2000

ATTACHMENT 2

LIST OF DOCUMENTS REVIEWED

DOCUMENTS REVIEWED

City of Sacramento, 2002. *Quitclaim Deed, The Former Sacramento Army Depot Activity, Sacramento County, California, Portions of Tracts 1, 2, and 7.* March 7. (Parcel 2A).

City of Sacramento, 2006. *Quitclaim Deed, The Former Sacramento Army Depot Activity, Sacramento County, California.* April 21. (Parcel 2B).

Kleinfelder, 1996. *Five-Year Review, Sacramento Army Depot, Sacramento, California.* January 30. (First Five-Year Review).

Kleinfelder, 1996. *Base wide Remedial Investigation Report, Sacramento Army Depot, Sacramento, California.* May 24.

Kleinfelder, 1997. *Base wide Human Health Risk Assessment, Sacramento Army Depot, Sacramento, California*. May 14.

Kleinfelder, 1997. *Ecological Risk Assessment, Sacramento Army Depot, Sacramento, California.* Final. December 1.

Plexus Scientific Corporation, 1999. *Review of Pump and Treat Groundwater Remediation Systems at Army BRAC Installations, Independent Review Team Findings and Recommendations, Sacramento Army Depot (SAAD).* July.

Sacramento Army Depot, 2000, *Finding of Suitability to Transfer Former Sacramento Army Depot Study Areas 12, 28, 57, 58, 59, 60, 61, 62, 74, and 75A, Version 0.06 (2-A FOST).* December.

Sacramento Army Depot, 2004, *Finding of Suitability to Transfer Former Sacramento Army Depot Study Areas 78, 80, 81B, 83, 84, 88-89, Version 1.1 (2-B FOST).* March.

Sacramento Regional County Sanitation District, 2004. Letter to Ken Barnes/SAAD, Environmental Project Manager, Subject: Wastewater Discharge Permit GRW011. December 7.

SCA Environmental, 2002. *South Post Plume Capture Evaluation, Former Sacramento Army Depot, Sacramento, California*. January.

SCA Environmental, 2002. *Conceptual Site Model, South Post TCE Groundwater Plume, Former Sacramento Army Depot, Sacramento, California.* Technical Memorandum. December.

SCA Environmental, 2004. *Fate & Transport Model Report, Former Sacramento Army Depot, Sacramento, California*. Final. November.

SCA Environmental, 2006. FEDEX Offsite Sampling Report, Former *Sacramento Army Depot, Sacramento, California*. Draft Final. June.

URS, 2001. *Five Year Review, Former Sacramento Army Depot, Sacramento, California*. Final. December. (Second Five-Year Review).

URS Corporation, 2002. *Monitoring and Closeout Plan for Parking Lot 3, Former Sacramento Army Depot*. Final. July.

U.S. Army Corps of Engineers (USACE), 1995. Memorandum for Commanding Officer, Engineering Field Activity, West, 900 Commodore Drive, San Bruno, CA 94066-5006. Subject: Sacramento Army Depot, CA; Transfer of Land for Naval and Marine Corps Reserve Readiness Center, Sacramento, CA. February 3.

USACE, 2004. *Remedial Design Addendum for the Former Sacramento Army Depot, Sacramento, California*. February.

USACE, 2006. *2006 Winter Quarter and Semi-Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California*. May.

USACE, 2006. Memorandum for Beshara Yared, CESPK-PM-M. Subject: Evaluation of Sampling Frequency at the Sacramento Army Depot. September 7.

U.S. Army Depot System Command, 1995. *Superfund Record of Decision, Sacramento Army Depot Base wide, Sacramento, California*. Sacramento Army Depot, Environmental Management Division. January 8.

U.S. Environmental Protection Agency (USACE), 1995. *Cost and Performance Report, Soil Vapor Extraction at the Sacramento Army Depot Superfund Site, Tank 2 Operable Unit, Sacramento, California*. Technology Innovation Office. March.

ATTACHMENT 3

SITE INSPECTION

Site Inspection Checklist

I. SITE INFORMATION	
Site name: SAC AD	**Date of inspection:** July 11, 2006
Location and Region: Sacramento, CA	**EPA ID:** CA0210020780
Agency, office, or company leading the five-year review: Army	**Weather/temperature:** nice, clear, 80s

Remedy Includes: (Check all that apply)

X Landfill cover/containment
X Access controls
X Institutional controls
X Groundwater pump and treatment
Surface water collection and treatment
Other_____
_____

Monitored natural attenuation
X Groundwater containment
Vertical barrier walls

Attachments: Inspection team (B. Call, G. Benvenuto, V. Brown, J. Lukasko) Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Robert Chambers (Johnson Controls) Env. Technician July 11, 2006
   Name Title Date
   Interviewed at site at office by phone Phone no. 916.388.1352
   Problems, suggestions; Report attached see interview record _____
   _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed at site at office by phone Phone no.
   Problems, suggestions; _____
   _____

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

Agency CA DTSC
Contact Susan Goss RPM
Name Title
Problems; suggestions; Report attached: see interview report_____
_____

Agency CVRWQCB
Contact Brian Taylor RPM
Name Title
Problems; suggestions; Report attached: see interview report_____
_____

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

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

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

See Interview Reports.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	X O&M manual	X Readily available	X Up to date	N/A
	X As-built drawings	X Readily available	X Up to date	N/A
	X Maintenance logs	X Readily available	X Up to date	N/A
	Remarks_____			
2.	**Site-Specific Health and Safety Plan**	X Readily available	X Up to date	N/A
	X Contingency plan/emergency response plan	X Readily available	X Up to date	N/A
	Remarks_____			
3.	**O&M and OSHA Training Records**	X Readily available	X Up to date	N/A
	Remarks: OSHA 8-hr certificate present_____			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	X N/A
	Effluent discharge	Readily available	Up to date	X N/A
	Waste disposal, POTW	X Readily available	X Up to date	N/A
	Other permits_____	Readily available	Up to date	X N/A
	Remarks: Only required treated water discharge requirements per the Sacramento Regional County Sanitation District. Discharge water samples are regularly collected, analyzed, and reported. The permit# GRW011 is effective from December 31, 2004 to December 31, 2007.			
5.	**Gas Generation Records**	Readily available	Up to date	X N/A
	Remarks_____			
6.	**Settlement Monument Records**	Readily available	Up to date	X N/A
	Remarks_____			
7.	**Groundwater Monitoring Records**	X Readily available	X Up to date	N/A
	Remark: Included in reports and logs. _____			
8.	**Leachate Extraction Records**	Readily available	Up to date	X N/A
	Remarks_____			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	X N/A
	Water (effluent)	X Readily available	X Up to date	N/A
	Remarks_____			
10.	**Daily Access/Security Logs**	X Readily available	X Up to date	N/A
	Remarks: At 8201 Santa Cruz Street building. There is site security and fencing.			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — X Contractor for Federal Facility
Other_____

2. **O&M Cost Records**

X Readily available — X Up to date
X Funding mechanism/agreement in place
Original O&M cost estimate included in respective ROD

Total annual cost by year for review period

	Date	Total cost
For	FY01	$2,821,000
For	FY02	$2,987,000
For	FY03	$1,193,000
For	FY04	$1,223,000
For	FY05	$977,000

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

Describe costs and reasons: None noted or discussed during the site inspection._____

V. ACCESS AND INSTITUTIONAL CONTROLS X Applicable N/A

A. Fencing

1. **Fencing** X Location shown on site maps X Gates secured N/A

Remarks: Fencing intact and in good condition.

B. Other Access Restrictions

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

Remarks: Treatment plant and shop building were identified, all wells and vaults were secured (except at MW8 which was missing the latch and lock).

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs properly implemented X Yes No N/A
Site conditions imply ICs being fully enforced X Yes No N/A

Type of monitoring :Deeds, Self-reporting
Frequency Property transfer_____
Responsible party/agency City of Sacramento_____

Reporting is up-to-date X Yes No N/A
Reports are verified by the lead agency X Yes No N/A
Specific requirements in deed or decision documents have been met X Yes No N/A
Violations have been reported Yes X No N/A
Other problems or suggestions: Continue to monitor land use controls
_____
_____

2. **Adequacy** X ICs are adequate ICs are inadequate N/A

Remarks: Land use controls are recorded with deeds for restricted use as appropriate for impacted parcels._____
_____

D. General

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

Remarks: No vandalism was reported._____
_____

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

Remarks: Zoning and reuse have not changed, continued development of warehousing, new buildings and site improvements_____
_____

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

Remarks: No changes, industrial/commercial use
_____

VI. GENERAL SITE CONDITIONS

A. Roads X Applicable N/A

1. Roads damaged X Location shown on site map X Roads adequate N/A

Remarks_____
_____

B. Other Site Conditions

Remarks:

There will be more development at the SAC AD. Offsite use appears to remain industrial/commercial and business zoning.

_____
_____
_____
_____

VII. LANDFILL COVERS X Applicable N/A

A. Landfill Surface

1. **Settlement** Location shown on site map X Settlement not evident
Areal extent_____ Depth_____
Remarks Covered with star thistle. No erosion, disturbances or other problems observed._____
_____

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

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

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

5. **Vegetative Cove** X Star thistle/weeds X Cover properly established X No signs of stress
NoTrees/Shrubs (indicate size and locations on a diagram)
Remarks_____
_____

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

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

8. **Wet Areas/Water Damage** X Wet areas/water damage not evident

Wet areas Location shown on site map Areal extent_____

Ponding Location shown on site map Areal extent_____

Seeps Location shown on site map Areal extent_____

Soft subgrade Location shown on site map Areal extent_____

Remarks_____

_____

9. **Slope Instability** Slides Location shown on site map X No evidence of slope instability

Areal extent_____

Remarks_____

_____

B. Benches Applicable X N/A

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

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

Remarks_____

_____

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

Remarks_____

_____

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

Remarks_____

_____

C. Letdown Channels Applicable X N/A

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

1. **Settlement** Location shown on site map No evidence of settlement

Areal extent_____ Depth_____

Remarks_____

_____

2. **Material Degradation** Location shown on site map No evidence of degradation

Material type_____ Areal extent_____

Remarks_____

_____

3. **Erosion** Location shown on site map No evidence of erosion

Areal extent_____ Depth_____

Remarks_____

_____

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

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

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

D. Cover Penetrations X Applicable X N/A

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

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

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

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

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

E. Gas Collection and Treatment	Applicable X N/A
1.	**Gas Treatment Facilities** Flaring Thermal destruction Collection for reuse Good condition Needs Maintenance Remarks_____ _____
2.	**Gas Collection Wells, Manifolds and Piping** Good condition Needs Maintenance Remarks_____ _____
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Needs Maintenance N/A Remarks_____ _____
F. Cover Drainage Layer	Applicable X N/A
1.	**Outlet Pipes Inspected** Functioning N/A Remarks_____ _____
2.	**Outlet Rock Inspected** Functioning N/A Remarks_____ _____
G. Detention/Sedimentation Ponds	Applicable X N/A
1.	**Siltation** Areal extent_____ Depth_____ N/A Siltation not evident Remarks_____ _____
2.	**Erosion** Areal extent_____ Depth_____ Erosion not evident Remarks_____ _____
3.	**Outlet Works** Functioning N/A Remarks_____ _____
4.	**Dam** Functioning N/A Remarks_____ _____

H. Retaining Walls	Applicable	X N/A	
1.	**Deformations**	Location shown on site map	Deformation not evident
	Horizontal displacement_____	Vertical displacement_____	
	Rotational displacement_____		
	Remarks_____		
2.	**Degradation**	Location shown on site map	Degradation not evident
	Remarks_____		
I. Perimeter Ditches/Off-Site Discharge	Applicable	X N/A	
1.	**Siltation**	Location shown on site map	Siltation not evident
	Areal extent_____	Depth_____	
	Remarks_____		
2.	**Vegetative Growth**	Location shown on site map	N/A
	Vegetation does not impede flow		
	Areal extent_____	Type_____	
	Remarks_____		
3.	**Erosion**	Location shown on site map	Erosion not evident
	Areal extent_____	Depth_____	
	Remarks_____		
4.	**Discharge Structure**	Functioning	N/A
	Remarks_____		
VIII. VERTICAL BARRIER WALLS	Applicable	X N/A	
1.	**Settlement**	Location shown on site map	Settlement not evident
	Areal extent_____	Depth_____	
	Remarks_____		
2.	**Performance Monitoring**	Type of monitoring_____	
	Performance not monitored		
	Frequency_____	Evidence of breaching	
	Head differential_____		
	Remarks_____		

C. Treatment System X Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent)_____
   Others: UV/peroxide oxidation system (not utilized due to low levels)_____
   X Good condition Needs Maintenance
   X Sampling ports properly marked and functional
   X Sampling/maintenance log displayed and up to date
   X Equipment properly identified
   X Quantity of groundwater treated annually: plant average is 410 gpm with 95% uptime
   Quantity of surface water treated annually NA_____
   Remarks: Parking Lot 3 site is shutdown. South Post discharge is to POTW per permit requirements.
   _____

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

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

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

5. **Treatment Building(s)**
   N/A X Good condition Needs repair
   Remarks Chemicals and equipment properly stored
   _____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   X Properly secured/locked X Functioning X Routinely sampled X Good condition
   All required wells located Needs Maintenance N/A
   Remarks: MW8 missing latch and lock.
   _____
   _____

D. Monitoring Data

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

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

D. Monitored Natural Attenuation X N/A

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

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

Remarks_____

_____

X. OTHER REMEDIES

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy was intended to cleanup groundwater contamination and consolidate contaminated soils in a CAMU. The soil actions have been successfully completed. The CAMU is well maintained and no problems were noted. Overall the groundwater treatment has been successful in preventing impacts to down gradient wells. The system has been reliable and may benefit from optimization of the well pumping rates. The Groundwater Cleanup Optimization Report is currently drafted and out for review with a final draft scheduled to be completed in 2007

_____

B. Adequacy of O&M

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

The O&M activities appear to be appropriate in maintaining the treatment systems and monitoring network. As long as the CAMU is secured and monitored and the GWTP and associated groundwater treatment system is maintained, the selected remedy is functioning as intended.

_____

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. Rebounding TCE concentrations slightly above the MCL in the Parking Lot 3 site indicate lingering residual concentrations of TCE in groundwater. At the South Post plume, the regulatory agencies have expressed some concern regarding plume capture. The Army prepared a Groundwater Cleanup Optimization Report to address the present remedy for the groundwater here and at Parking Lot 3. The BRAC Cleanup Team will review this report and finalize the path forward at SAAD. There were no unexpected changes in cost or scope of O&M for the SAAD site.

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. The Groundwater Cleanup Optimization Report contains recommendations for optimizing the remedy. Evaluate monitoring well sampling frequency and analysis as the data suggest the scope of the present sampling regime is no longer necessary.

ATTACHMENT 4

SITE PHOTOGRAPHS

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Photographs Documenting Site Conditions

#1. The Shop Building located at 8201 Santa Cruz Street
#2. Groundwater Treatment Plant (GWTP)
#3. Stabilized Soils CAMU and lysimeters
#4. Previous location of Oxidation Lagoons
#5. View of Extraction Well 3
#6. View of Morrison Creek along southern boundary
#7. Previous location of Battery Disposal Well site
#8. View of Parking Lot 3 and Extraction Well 8

All photographs were taken during the July 11, 2006 site visit.

Photograph 1. The Shop Building located at 8201 Santa Cruz Street

Photograph 2. Groundwater Treatment Plant (GWTP)

Photograph 3. Stabilized Soils CAMU and lysimeters

Photograph 4. Previous location of Oxidation Lagoons

Photograph 5. View of Extraction Well 3

Photograph 6. View of Morrison Creek along southern boundary

Photograph 7. Previous location of Battery Disposal Well site

Photograph 8. View of Parking Lot 3 and Extraction Well 8

ATTACHMENT 5

INTERVIEW FORMS

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
John Hamill	Env. Scientist	EPA Region IX	7/12/06
Susan Goss	Project Manager	DTSC	7/12/06
Brian Taylor	Project Manager	CVRWQCB	7/12/06
Robert Chambers	Environmental Tech.	Johnson Controls	7/11/06
Scott Armstrong	BEC	Army	7/12/06
Dick Walker	RAB Co-Chair	RAB	7/12/06
Kenn Conner	Senior Project Mgr	SCA Environmental	2/22/07

INTERVIEW RECORD

Site Name: SAAD	**EPA ID No.:** CA0210020780	
Subject: 5-yr review	**Time:** 1000	**Date:** 7/12/06
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: James Lukasko	**Title:** Environmental. Engineer	**Organization:** USACE

Individual Contacted:

Name: John Hamill	**Title:** Remedial Project Manager	**Organization:** USEPA

Telephone No: (916) 464-4811 **Fax No: NA** **E-Mail Address:** hamill.john@epa.gov	**Street Address:** 75 Hawthorne St **City, State, Zip:** San Francisco, CA 94105

Summary Of Conversation

Mr. John Hamill is a new PM for this project and he recently visited the site on May 6, 2006 with other regulators. He is very interested in the groundwater optimization report and DTSC and CVRWQCB input, realizes there may be potential problems, and will defer input to evaluate reports and recommendations. He feels well informed about the site, yet desires more interaction among the stakeholders. He felt that other aspects of the project are satisfactory.

The three questions used to determine if a remedy is protective were asked.
Question A. Is the remedy functioning as intended? Answer: Yes, but awaiting reports and recommendations.
Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the site at the time of remedy selection still valid? Answer: Yes.
Question C. Has any other information come to light that could call into question the protectiveness of the remedy? Answer: No.

INTERVIEW RECORD

Site Name: SAAD	**EPA ID No.:** CA0210020780	
Subject: 5-yr review	**Time:** 0945	**Date:** 7/12/06
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: James Lukasko	**Title:** Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Susan Goss	**Title:** Remedial Project Manager	**Organization:** DTSC

Telephone No: (916) 255-6403 **Fax No: NA** **E-Mail Address:** sgoss@dtsc.ca.gov	**Street Address:** 8800 Cal Center Drive **City, State, Zip:** Sacramento, CA 95826-3200

Summary Of Conversation

Ms. Susan Goss felt that the project is moving very slow and is concerned about Army responsiveness and the South Plume groundwater capture. There aren't routine meetings and there has only been one site visit in the last two years (no BCT meetings). Ms. Goss didn't think there had been any complaints or responses required by the DTSC in the last two years. She did indicate that she felt well informed about the site's activities and progress, but would like more meetings and communication.

The three questions used to determine if a remedy is protective were asked.
Question A. Is the remedy functioning as intended? Answer: No.
Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the site at the time of remedy selection still valid? Answer: Yes.
Question C. Has any other information come to light that could call into question the protectiveness of the remedy? Answer: Yes (groundwater capture concern).

INTERVIEW RECORD

Site Name: SAAD	**EPA ID No.:** CA0210020780	
Subject: 5-yr review	**Time:** 1400	**Date:** 7/12/06
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: James Lukasko	**Title:** Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Brian Taylor	**Title:** Remedial Project Manager	**Organization:** CVRWQCB

Telephone No: (916) 464-4811 **Fax No:** NA **E-Mail Address:** betaylor@waterboards.ca.gov	**Street Address:** 11020 Sun Center Drive #200 **City, State, Zip:** Rancho Cordova, CA 95670

Summary Of Conversation

Mr. Brian Taylor indicated there are inconsistencies regarding the site assessment between the Army and CVRWQCB. He questioned groundwater plume capture and wants additional extraction points for the South Post plume. He is also concerned about TCE rebound at the Parking Lot 3 site. He indicated communication has not been a problem, yet wants more frequent meetings. There have been no violations or orders issued. Mr. Taylor feels reasonably well informed, but is concerned about reports being late. He wants quarterly meetings and thinks issues should be more closely tracked to prevent miscommunication among the agencies. There are also conflicting opinions among agencies regarding plumes that should be resolved. Mr. Taylor doesn't believe the project has progressed as it should.

The three questions used to determine if a remedy is protective were asked.
Question A. Is the remedy functioning as intended? Answer: Yes.
Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the site at the time of remedy selection still valid? Answer: Yes.
Question C. Has any other information come to light that could call into question the protectiveness of the remedy? Answer: Yes, the South Post plume has wells with increasing TCE concentrations.

INTERVIEW RECORD

Site Name: SAAD	**EPA ID No.:** CA0210020780	
Subject: 5-yr review	**Time:** 0830	**Date:** 7/11/06
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: James Lukasko	**Title:** Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Robert Chambers	**Title:** Env. Technician	**Organization:** Johnson Controls

Telephone No: (916) 388-1352 **Fax No:** (916) 388-1362 **E-Mail Address:** Robert.Q.Chambers@jci.com	**Street Address:** 8201 Santa Cruz St **City, State, Zip:** Sacramento, CA 95828

Summary Of Conversation

Mr. Robert Chambers indicated there is a plant operator present full-time (Monday to Friday) from 0600-1430 to maintain the groundwater treatment system. He has been at the groundwater treatment plant since 1989. In the last five years, pumping has ceased at EW-8, EW-9, and EW-10. He indicated that the plant has been operating at about 410 to 415 gpm capacity. Approximately once a month there are power outages that shut down the treatment system. There is failure autonotification, yet no there is no response till the following work day. This provides an opportunity for maintenance and cleaning prior to restarting the treatment system. It generally takes 15 minutes to 1 hour to restart the plant. The plant has shut down only once in the past 5 years due to an electrical/mechanical problem. All other shutdowns have been due to power outages. Well EW-10 has decreased its pumping rate from 85 gpm to currently 45 gpm, and is scheduled to be redeveloped. Silica “precipitation” and biofouling are historical maintenance issues at EW-10. EW-10 is the only extraction well with this issue. Mr. Chambers recommended pulling the pump from EW-10 and swabbing the well and bathing the pump in acid. Pumps are pulled when there is a problem, yet electronics and valving get regular service. The flow meters and totalizers are in good working order. He conducts onsite well maintenance. There is quarterly maintenance schedule but most maintenance is conducted on an as-need basis. There is a computer record of appropriate spare parts for pumps and equipment. The logbook contains each well’s performance and maintenance records. If the existing pumps cannot be repaired in the shop, there may be a long lead time to fix or replace the pumps. Mr. Chambers stated that no major piece of equipment has been replaced so there hasn’t been any need to update the Operation & Maintenance manuals. He also stated that vandalism of plant and wellfield equipment has not been a problem.

INTERVIEW RECORD

Site Name: SAAD	**EPA ID No.:** CA0210020780	
Subject: 5-yr review	**Time:** 0100	**Date:** 7/12/06
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: Brad Call	**Title:** Senior Env. Engineer	**Organization:** USACE

Individual Contacted:

Name: Scott Armstrong	**Title:** SAAD BEC	**Organization:** Army/CALBRE

Telephone No: (916) 965-2507 **Fax No:** (916) 965-2507 **E-Mail Address:** Scott.Armstrong@calibresys.com	**Street Address:** 5200 Oleander Drive **City, State, Zip:** Carmichael, CA 95608

Summary Of Conversation

Mr. Scott Armstrong is an employee of CALBRE, working on behalf of the BRACD office and has been with the project for about 1-1/2 years. He suggested we also interview Mr. Dick Walker, the RAB Community Co-Chair. Mr. Armstrong indicated there have been no changes to the land use and the institutional controls are implemented. The project team has discussed the need to update the ROD (ESD or amendment) regarding changes to the remedies, but thinks this should wait until the South Post Groundwater issues are settled. He is not aware of any problems or concerns regarding the South Post Burn Pits, Battery Investigation Derived Waste, Oxidation Lagoons, or the Building 300 Burn Pits. The most important consideration for the soil remedies is to protect the CAMU. All soil issues have been resolved and the only activities are institutional control on the CAMU. Most of the focus for the last few years has been on the groundwater remedies. Work remains to resolve outstanding issues at both Parking Lot 3 and South Post Groundwater. He is aware that the state regulatory agencies have concerns regarding plume capture and rebounding concentrations at Parking Lot 3. The Army has completed fate and transport modeling and stands by the plume capture model. No specific scientific or engineering data have been put forward by the state regulators refuting either the fate and transport model or plume capture. The Army has completed a draft Groundwater Cleanup Optimization Report that evaluates the present remedy and suggests the best path forward. Mr. Armstrong's goals are to guide the project to the most cost effective remedial approach that achieves the objectives at the site.

INTERVIEW RECORD

Site Name: SAAD		**EPA ID No.:** CA0210020780
Subject: 5-yr review		**Time:** 1300 **Date:** 7/12/06
Type: Telephone Visit Other **Location of Visit:**		Incoming Outgoing
Contact Made By:		
Name: Brad Call	**Title:** Senior Env. Engineer	**Organization:** USACE
Individual Contacted:		
Name: Dick Walker	**Title:** RAB Community Co-Chair	**Organization:** SAAD RAB
Telephone No: (916) 383-8877 **Fax No:** NA **E-Mail Address:** NA	**Street Address:** NA **City, State, Zip:** NA	

Summary Of Conversation

Mr. Dick Walker's overall impression is that he felt the project has gone on long enough and should be brought to a conclusion. He did not think that the site represents a hazard and that no further funds should be expended at this site. He said that site operations have never, and are not now, causing any problems to the community. Mr. Walker was not aware of concerns regarding the site or its operation. He was not aware of any incidents, vandalism, or responses from local authorities. Mr. Walker would like to receive a little more information about what is going on, however, in general the managers do a good job of providing information. When asked for any comments or suggestions, he suggested that it was time to bring the clean-up operations to a conclusion. Also, he would like to receive a copy of the Five-Year Review.

INTERVIEW RECORD

Site Name: SAAD	**EPA ID No.:** CA0210020780	
Subject: 5-yr review	**Time:** 1430	**Date:** 2/22/07
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing	

Contact Made By:

Name: Brad Call	**Title:** Senior Env. Engineer	**Organization:** USACE

Individual Contacted:

Name: Kenn Conner	**Title:** Senior Project Manager	**Organization:** SCA Environmental

Telephone No: (510) 267-2712 **Fax No:** NA **E-Mail Address:** kconner@sca-enviro.com	**Street Address:** 334 19th Street **City, State, Zip:** Oakland, CA 94612

Summary Of Conversation

Mr. Conner is a project manager with an environmental consulting company and has provided services on this project for about eight years. Overall he feels that the project is going well.

Question A. Is the remedy functioning as intended? Answer: Mr. Conner is not aware of any soil related problems. He feels that the groundwater remedies at Parking Lot 3 and South Post Groundwater are adequate at this point in time. Eventually the remedy should be changed to natural attenuation. He is aware that the regulatory agencies have asked for additional groundwater extraction wells in the down gradient portion of the South Post Groundwater plume, but he does not feel that this is necessary. No new treatment systems are needed. Mr. Conner is also aware that the regulatory agencies have asked the Army to improve the effectiveness of plume capture. The Army has explained why they do not feel that any changes are needed and there are no receptors at risk. He is also aware that the regulatory agencies have asked the Army to consider another remedial approach at Parking Lot 3, other than the Army allowing the down gradient extraction wells to control this contamination.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the site at the time of remedy selection still valid? Answer: The exposure assumptions are still adequate. The cleanup levels and RAOs should be reevaluated. The cleanup levels are too low and do not take into consideration that fact that the on-post water will not be extracted. The cleanup levels could be increased based on a more realistic evaluation of the exposure pathways. It is not realistic to attempt to achieve the 5 ppt MCL value for TCE with a pump and treat remedy.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy? Answer: No. He does feel that the project team should jointly revisit the ROD. The ROD should be modified to transition the project into Monitored Natural Attenuation, rather than continuing with pump and treat because it is not effective.

ATTACHMENT 6

ARAR EVALUATION

ARAR	Description	Compliance	Evaluation
South Post Groundwater, General			
40 CFR 403 (applicable).	General Pretreatment Regulations for existing and new sources of water pollution.	Groundwater pretreatment at the South Post Groundwater Treatment Plant will be continued in compliance with this chemical-specific regulation. For as long as the discharge continues to the Sacramento Regional Sanitation District, the requirements are described in SAAD's operating permit issued by the District. The higher water discharge rate of 450 gpm will have to be accommodated by allocating a greater portion of the allowable discharge capacity to the District to groundwater discharge.	This ARAR will remain applicable as long as groundwater extraction continues.
South Post Groundwater, RCRA Tanks			
22 CCR 66264.195 (applicable).	Tank inspection schedule and procedures are outlined.	The existing groundwater treatment plant uses hydrogen peroxide, a hazardous material since it is a strong oxidant. The operation of the hydrogen peroxide tank has been and will be in compliance with this regulation. The tank is inspected and there is an emergency response plan to	Extracted groundwater is currently discharged directly to the sanitary sewer and the groundwater treatment plant is not in operation. Therefore this ARAR is not currently applicable.

ARAR	Description	Compliance	Evaluation
		implement in the event of a release or accident.	
22 CCR 66264.196 (applicable).	Emergency Response.	This regulation is applicable to the H_2O_2 tank at the South Post Groundwater Treatment Plant. An approved emergency response plan would be implemented in response to a spill.	Extracted groundwater is currently discharged directly to the sanitary sewer and the groundwater treatment plant is not in operation. H_2O_2 is not currently stored on site. Therefore this ARAR is not currently applicable.
22 CCR 66264.197 (applicable).	This section describes closure and post-closure care requirements for tanks.	This regulation is applicable to the H_2O_2 tank at the South Post Groundwater Treatment Plant. An approved closure plan will be implemented when the tanks are removed from service.	This ARAR is still applicable. No decision has been reached to remove the groundwater treatment plant from the site.
South Post Groundwater, National Primary Drinking Water Regulations			
40 CFR Part 141.61 (relevant & appropriate).	Establishes a maximum contaminant level of 0.005 mg/L for TCE and PCE in water served to people.	The Maximum Contaminant Levels (MCLs) for constituents in drinking water are relevant and appropriate for evaluating final remediation goals for remediation of groundwater. This sub-alternative will comply with this ARAR by restoring the aquifer over time to the Final Remediation Goal, which are set not to exceed the MCLs. This restoration is achieved through pumping of	This ARAR is still relevant and appropriate.

ARAR	Description	Compliance	Evaluation
		groundwater containing contaminants. Federal MCLs are relevant and appropriate for tetrachloroethene (PCE) and trichloroethene (TCE).	
South Post Groundwater, State Primary Drinking Water Regulations.			
22 CCR 64444.5 (relevant & appropriate).	Sets maximum levels for constituents in drinking water supplied to the public.	The Maximum Contaminant Level (MCLs) for constituents in drinking water are relevant and appropriate for evaluating final remediation goals for remediation of groundwater. This sub-alternative will comply with this ARAR by restoring the aquifer over time to the Final Remediation Goals (FRGs), which are set not to exceed the MCLs. This restoration is achieved by pumping of the aquifer in zones of maximum exceedance of the FRGs. State MCLs are relevant and appropriate for 1,2-dichloroethane, cis-1,2-dichloroethene, and carbon tetrachloride.	This ARAR is still applicable.
South Post Groundwater, Groundwater Monitoring Requirements.			
22 CCR 66264.97 (b) and (e)	RCRA Groundwater Monitoring Requirements	The Army will install sufficient monitoring points to	This ARAR is still applicable.

ARAR	Description	Compliance	Evaluation
		fully evaluate the effectiveness of the remedial action and will comply with the general monitoring requirements in this section.	
Water Quality Control Plan (Basin Plan) for the RWQCB, CVR. (applicable). Chapter 2 Beneficial Uses: Municipal and Domestic, Agricultural, and Industrial Supply; Chapter 3 Water Quality Objectives; Chemical Constituents.	Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies and water quality objectives to protect those uses. Any activity, including, for example, a new discharge of contaminated soils or in-situ treatment or containment of contaminated soils, that may affect water quality must not result in water quality exceeding water quality objectives.	The groundwater cleanup standards are set at the most stringent water quality objectives, which protect the groundwater for beneficial use of drinking water.	This ARAR is still applicable.
State Water Resources Control Board Resolution No. 88-63 ("Sources of Drinking Water Policy") (as contained in the RWQCB's Water Quality Control Plan)(applicable)	Determines beneficial uses for waters that may be affected by discharges of waste.	Specifies that, with certain exceptions, all ground and surface waters have the beneficial use of municipal or domestic water supply.	This ARAR is still applicable.
State Water Resources Control Board Resolution No. 92-49 Section IIIG (as amended April 21, 1994)(applicable).	Applies to all cleanups of discharges that may affect water quality (specifically Section IIIG). Establishes requirements for investigation and cleanup and abatement of discharges. Among other requirements, discharger must clean up and abate the effects of discharges in a manner that	The Army demonstrated in the FS Report that it would be economically infeasible to achieve background levels (i.e., non-detect for VOCs) in groundwater. It appears that the groundwater cleanup standards listed in Table 10 are the lowest levels that are technologically and	This ARAR is still applicable.

ARAR	Description	Compliance	Evaluation
	promotes the attainment of either background water quality, or the best water quality that is reasonable if background water quality cannot be restored.	economically achievable. These standards are set at the federal or more stringent state Maximum Contaminant Levels, and will protect the groundwater for its beneficial use of drinking water.	
Title 23, CCR Section 2550.4 (applicable).	Cleanup levels must be set at background concentration levels, or, if background levels are not technologically and economically feasible, then at the lowest levels that are economically and technologically achievable. Specific factors must be considered in setting cleanup levels above background levels.	The Army demonstrated in the FS Report that it would be economically infeasible to achieve background levels (i.e., non-detect for VOCs) in groundwater. It appears that the groundwater cleanup standards listed in Table 10 are the lowest levels that are technologically and economically achievable. These standards are set at the federal or more stringent state Maximum Contaminant Levels, and will protect the groundwater for its beneficial use of drinking water.	This ARAR is still applicable.
Parking Lot 3 Groundwater, General Pretreatment Regulations.			
40 CFR 403 (applicable).	General Pretreatment Regulations for existing and new sources of water pollution.	This chemical specific regulation is applicable to the discharge of groundwater to the Sacramento Regional Sanitation District. Contaminant concentrations in the groundwater at the Parking Lot 3 Area are at levels which	No groundwater extraction or treatment is currently occurring at this site.

ARAR	Description	Compliance	Evaluation
		meet the pretreatment requirements of the Sanitation District. Extracted groundwater will be discharged in compliance with the requirements described in SAAD's current operating permit issued by the Sanitation District.	
Parking Lot 3 Groundwater, National Primary Drinking Water Regulations			
40 CFR Part 141.61 (relevant & appropriate).	Establishes a maximum contaminant level of 0.005 mg/L for TCE and PCE in water served to people.	The Maximum Contaminant Levels (MCLs) for constituents in drinking water are relevant and appropriate for evaluating final remediation goals for remediation of groundwater. This sub-alternative will comply with this ARAR by restoring the aquifer over time to the Final Remediation Goal, which are set not to exceed the MCLs. This restoration is achieved through pumping of groundwater containing contaminants. Federal MCLs are relevant and appropriate for tetrachloroethene (PCE) and trichloroethene (TCE).	This ARAR is still relevant and appropriate.
Parking Lot 3 Groundwater, State Primary Drinking Water Regulations.			

ARAR	Description	Compliance	Evaluation
22 CCR 64444.5 (relevant & appropriate).	Sets maximum levels for constituents in drinking water supplied to the public.	The Maximum Contaminant Level (MCLs) for constituents in drinking water are relevant and appropriate for evaluating final remediation goals for remediation of groundwater. This sub-alternative will comply with this ARAR by restoring the aquifer over time to the Final Remediation Goals (FRGs), which are set not to exceed the MCLs. This restoration is achieved by pumping of the aquifer in zones of maximum exceedance of the FRGs. State MCLs are relevant and appropriate for 1,2-dichloroethane, cis-1,2-dichloroethene, and carbon tetrachloride.	This ARAR is still applicable.
Water Quality Control Plan (Basin Plan) for the RWQCB, CVR. (applicable). Chapter 2 Beneficial Uses: Municipal and Domestic, Agricultural, and Industrial Supply; Chapter 3 Water Quality Objectives; Chemical Constituents.	Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies and water quality objectives to protect those uses. Any activity, including, for example, a new discharge of contaminated soils or in-situ treatment or containment of contaminated soils, that may affect water quality must not result in water quality exceeding water quality objectives.	The groundwater cleanup standards are set at the most stringent water quality objectives, which protect the groundwater for beneficial use of drinking water.	This ARAR is still applicable.

ARAR	Description	Compliance	Evaluation
State Water Resources Control Board Resolution No. 88-63 ("Sources of Drinking Water Policy") (as contained in the RWQCB's Water Quality Control Plan)(applicable)	Determines beneficial uses for waters that may be affected by discharges of waste.	Specifies that, with certain exceptions, all ground and surface waters have the beneficial use of municipal or domestic water supply.	This ARAR is still applicable.
State Water Resources Control Board Resolution No. 92-49 Section IIIG (as amended April 21, 1994)(applicable).	Applies to all cleanups of discharges that may affect water quality (specifically Section IIIG). Establishes requirements for investigation and cleanup and abatement of discharges. Among other requirements, discharger must clean up and abate the effects of discharges in a manner that promotes the attainment of either background water quality, or the best water quality that is reasonable if background water quality cannot be restored.	The Army demonstrated in the FS Report that it would be economically infeasible to achieve background levels (i.e., non-detect for VOCs) in groundwater. It appears that the groundwater cleanup standards listed in Table 10 are the lowest levels that are technologically and economically achievable. These standards are set at the federal or more stringent state Maximum Contaminant Levels, and will protect the groundwater for its beneficial use of drinking water.	This ARAR is still applicable.
Title 23, CCR Section 2550.4 (applicable).	Cleanup levels must be set at background concentration levels, or, if background levels are not technologically and economically feasible, then at the lowest levels that are economically and technologically achievable. Specific factors must be considered in setting cleanup levels above background levels.	The Army demonstrated in the FS Report that it would be economically infeasible to achieve background levels (i.e., non-detect for VOCs) in groundwater. It appears that the groundwater cleanup standards listed in Table 10 are the lowest levels that are technologically and economically achievable. These standards are set at the	This ARAR is still applicable.

ARAR	Description	Compliance	Evaluation
		federal or more stringent state Maximum Contaminant Levels, and will protect the groundwater for its beneficial use of drinking water.	
22 CCR 66264.97 (b) and (e)	RCRA Groundwater Monitoring Requirements	The Army will install sufficient monitoring points to fully evaluate the effectiveness of the remedial action and will comply with the general monitoring requirements in this section.	This ARAR is still applicable.
Building 300 Burn Pit Soil, Battery Disposal Well, and Oxidation Lagoons.			
Rule 402 (applicable)	General guideline, if the operation causes release of contaminants to the atmosphere, then a case-by-case determination of public nuisance potential should be performed to verify compliance. This rule states that discharges to air causing injury, detriment, nuisance, annoyance; or endangering comfort, repose, health, safety, or causing damage to business or property is prohibited.	During excavation at the Building 300 Burn Pit, the Battery Disposal Well IDW, and the Oxidation Lagoons, the contractor shall minimize the potential for emissions using BACT. A health risk assessment has been conducted to evaluate the effect of fugitive emissions on the receptors in the vicinity of the stabilization unit. Workers could come into contact with the contaminated soil during excavation and soil stabilization. Workers will follow all safety guidelines for work on a hazardous waste site, wearing personal protective equipment as	Remedial construction activities at this site are complete and this ARAR is no longer applicable.

ARAR	Description	Compliance	Evaluation
		required and continuously monitoring ambient air quality. The surrounding community of SADA will not be exposed to hazardous materials during remedial activities associated with soil stabilization, with the possible exception of a slight, temporary increase of dust during excavation and soil treatment which will be controlled through the use of dust control technologies and covering of excavated materials. The contractor shall use perimeter air monitoring to verify the success of dust control measures. If the following values are exceeded, the contractor shall stop dust-generating work and undertake all actions necessary to eliminate dust from traveling off-site: Arsenic, 0.042 ug/m^3, Cadmium, 0.034 ug/m^3, Copper, 35 ug/m^3, Nickel, 0.06 ug/m^3, Zinc, 35 ug/m^3, and Lead, 1.5 ug/m^3.	
Rule 403 (applicable).	Fugitive dust.	During excavation at the Building 300 Burn Pit, the Battery Disposal Well IDW, and the Oxidation Lagoons, every reasonable effort will be taken to prevent fugitive dust	Remedial construction activities at this site are complete and this ARAR is no longer applicable.

ARAR	Description	Compliance	Evaluation
		from extending beyond the property line. Dust control measures will include watering with addition of dust control chemicals or foams available if needed.	
Rule 405 (applicable).	Dust and condensed fumes requirements.	No discharges into the atmosphere shall be made from any source whatsoever of dust or condensed fumes in total quantities exceeding the allowable.	Remedial construction activities at this site are complete and this ARAR is no longer applicable.
South Post Burn Pits, RCRA Closure			
22 CCR 66264.97 (d) and (e)	RCRA unsaturated zone monitoring.	The Army will install sufficient monitoring points to fully evaluate the effectiveness of the remedial action and will comply with the general monitoring requirements in this section.	This ARAR is still applicable.
22 CCR 66264.111	Closure performance standards.	The Army will develop a remedial design which complies with the substance of the requirements set forth in this section.	This ARAR is still applicable.
22 CCR 66264.112	Closure plan.	The Army will develop a remedial design which complies with the substance of the requirements set forth in this section.	This ARAR is still applicable.
South Post Burn Pits,, Corrective Action Management Units.			
22 CCR 66264.552 (e) (1) –	CAMU requirements.	The remedial design shall	This ARAR is still applicable.

ARAR	Description	Compliance	Evaluation
(4)		address the following requirements for the South Post Burn Pits CAMU: 1) The areal configuration of the CAMU, 2) Requirements for remediation waste management for those areas of the CAMU that are to be used for treatment or storage of remediation wastes, 3) Monitoring requirements, and 4) Closure and post-closure requirements.	
22 CCR 66264.250 - 253	Waste pile requirements.	The remedial designs shall address the following requirements for South Post Burn Pits CAMU: 1) Waste pile design and operating requirements, 2) Action leakage rate, 3) Response actions, and 4) Monitoring and inspection.	This ARAR is still applicable.
Rule 402 (applicable)	General guideline, if the operation causes release of contaminants to the atmosphere, then a case-by-case determination of public nuisance potential should be performed to verify compliance. This rule states that discharges to air causing injury, detriment, nuisance, annoyance; or endangering comfort, repose, health, safety, or causing damage to business	For the stabilization at the CAMU the Army shall minimize the potential for emissions using BACT. A health risk assessment has been conducted to evaluate the effect of fugitive emissions on the receptors in the vicinity of the CAMU. The contractor shall use perimeter air monitoring to verify the success of dust control measures. If the following	Remedial construction activities at this site are complete and this ARAR is no longer applicable.

ARAR	Description	Compliance	Evaluation
	or property is prohibited.	values are exceeded, the contractor shall stop dust-generating work and undertake all actions necessary to eliminate dust from traveling off-site: Arsenic, 0.042 ug/m^3, Cadmium, 0.034 ug/m^3, Copper, 35 ug/m^3, Nickel, 0.06 ug/m^3, Zinc, 35 ug/m^3, and Lead, 1.5 ug/m^3.	
Rule 403 (applicable).	Fugitive dust.	At the CAMU, every reasonable effort will be taken to prevent fugitive dust from being airborne beyond the property line from which the emissions originate. Reasonable precautions shall include, but are not limited to applying asphalt, oil, water, or suitable chemicals for the control of dust on surfaces which can give rise to airborne matter. Other measures may be taken as approved by the Air Pollution Control Officer. The Army will be required to comply with this rule.	Remedial construction activities at this site are complete and this ARAR is no longer applicable.
Rule 405 (applicable).	Dust and condensed fumes requirements.	No discharges into the atmosphere shall be made from any source whatsoever of dust or condensed fumes in total quantities exceeding the allowable.	Remedial construction activities at this site are complete and this ARAR is no longer applicable.

ATTACHMENT 7

RISK ASSESSMENT AND TOXICOLOGY EVALUATION

TECHNICAL MEMORANDUM
THIRD FIVE-YEAR REVIEW FOR THE
SACRAMENTO ARMY DEPOT SUPERFUND SITE
Prepared by Cory Koger, Sacramento District

This memo is prepared to address Question B of the statement of service, "Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?"

HUMAN HEALTH

Changes in Toxicity

The human health risk assessment method and results for the Sacramento Army Depot site are detailed in, "Basewide Human Health Risk Assessment , Sacramento Army Depot, Sacramento California" (May 14, 1997, Kleinfelder Job No.: 24-150029-A48). Directly comparing toxicity values, then (1993) and now, is an efficient method through which to screen for changes in the level of protectiveness. Table 1 (attached) provides a direct comparison between the 1993 toxicity values and current EPA Region IX values for the 11 chemicals assigned action levels in the Basewide ROD. Additional chemicals were included in the risk assessment (a total of 35). The chemicals listed are compiled from Table 4-11 of the Basewide Health Risk Assessment (Kleinfelder, 1997). Of 11 chemicals listed in Table 1, toxicity values have been revised or newly developed for 6. The revised or newly developed values are shaded on Table 1. Note that in some cases the values used in the risk assessment are more protective than the current USEPA Region IX values. The soil related chemicals are cadmium, total chromium, chromium IV, arsenic and lead. Toxicity values for three of these soil related chemicals have been changed and indicate somewhat greater estimated risks and hazards. However, the concentrations remaining after completion of the soil excavations are low, and it is expected that the remaining risk, even considering the changes in some toxicity values, would still fall within the USEPA risk range for the various sites. One of the soil related chemicals, arsenic, is found in the area naturally at elevated concentrations. The groundwater related chemicals of concern are carbon tetrachloride, cis-1,2-dichloroethene, tetrachloroethene, trans-1,2-dichloroethene, and trichloroethene. As shown in Table 1, toxicity values for two of the groundwater related chemicals have been changed and indicate somewhat greater estimated risks and hazards. It should be noted that the Maximum Contaminant Levels (MCLs) have not changed. Given this situation it is expected that the remaining risk would still fall within the USEPA risk range for the groundwater related chemicals.

Changes in Standards and To Be Considered

The information provided on Table 2 (attached) is pertinent to the remediation objectives stated in the Record of Decision (ROD: Superfund Record of Decision: Sacramento Army Depot Basewide, Sacramento, California, January 8, 1995). Table 2 provides the list of chemicals and the soil cleanup levels as they were established by the 1995 ROD and subsequent modifications. The 1995 groundwater and soil cleanup levels are compared to the current Region IX residential and industrial preliminary remediation goals (PRG) (for soil related chemicals) and MCLs (for groundwater related chemicals). Soil cleanup standards are risk-based and not promulgated. As noted above, arsenic concentrations are naturally elevated at this site and exceed both the

residential and industrial PRGs. The action levels established in the Basewide ROD for chromium VI and total chromium fall below both the residential and industrial PRGs. The action levels for cadmium and lead fall between the residential and industrial PRGs. However the remaining concentrations are low and it is expected that the remaining risk would still fall within the USEPA target risk range for the soil related sites. All of the groundwater related MCLs have remained unchanged.

Changes in Risk Assessment Methods

There are two emerging issues that are noteworthy.

1. It appears that the data for most compounds was assumed to be normally distributed. Current USEPA guidance suggests determining the distribution of the data and then using the appropriate method (parametric, nonparametric) to calculate the exposure point concentration. This change would probably have a small effect on risk based assessments of soil with the remaining low contaminant concentrations.
2. The vapor intrusion pathways of exposure are newly identified since 1995, and the presence of volatile organic compounds among the contaminants of concern suggests this pathway should be considered if the ROD is amended or other decision documents requiring supporting risk assessment are developed. However, given the extremely low concentrations, depth to contaminates, and the exponentially higher screening levels needed before exposure would be a concern, this exposure pathway is extremely unlikely.

Changes in Exposure

The land use is expected to remain industrial. It is important to continue to enforce the present land use restrictions established for the former installation and to supply sampling data to the regulators, as necessary, to facilitate the continued enforcement of groundwater controls.

The emergence of the vapor intrusion pathway since 1995 is relevant at the Sacramento Army Depot since this is an industrial site and volatile organic compounds are among the contaminants of concern. Vapor intrusion into indoor air should be evaluated for the appropriate receptors if the ROD is amended or other decision documents requiring supporting risk assessment are developed.

Significant Finding

The information on human health in this memo indicates that the standards meet today's standards of protectiveness. The toxicity and exposure related aspects of the remedy are considered to provide adequate protectiveness. The significance of the vapor intrusion pathway should be evaluated in future decision documents requiring supporting risk assessment.

ENVIRONMENTAL HEALTH (ECOLOGICAL ASSESSMENT)

Changes in Toxicity and Standards

The ecological risk assessment method and results for the Sacramento Army Depot site are detailed in, "Ecological Risk Assessment , Sacramento Army Depot, Sacramento California" (December 1, 1997, Kleinfelder Job No.: 24-150029-B08). Unlike human health toxicity criteria issued by regulatory agencies, there are no generally accepted toxicity criteria or

standards for ecological receptors. The toxicity criteria are usually agreed upon values. As such, the criteria used at the time the ecological risk assessment was conducted are still valid.

Changes in Risk Assessment Methods

The guidance documents referenced and the methodology used to assess ecological risk at the Sacramento Army Depot are still relevant and appropriate.

Changes in Exposure

The land use is expected to remain industrial. The habitat of disturbed annual grassland has not been expanded, nor have any restoration activities occurred that would provide more or different habitat. The criteria used to select receptors potentially exposed to site constituents are still valid. No changes in exposure or receptors are apparent.

Significant Finding

The information on environmental health in this memo indicates that the standards meet today's standards of protectiveness. The selected remedy is protective of ecological health.

Documents reviewed in the preparation of this Memo

Superfund Record of Decision: Sacramento Army Depot Basewide, Sacramento, California, January 8, 1995
Basewide Human Health Risk Assessment , Sacramento Army Depot, Sacramento California" (May 14, 1997, Kleinfelder Job No.: 24-150029-A48)
Basewide Remedial Investigation Report, Sacramento Army Depot, Sacramento, California, Kleinfelder, May 24, 1996.
Final Ecological Risk Assessment, Sacramento Army Depot, Sacramento, California, Kleinfelder, December 1, 1997.

TABLE 1: Direct comparison between the 1993 toxicity values and current Region IX values
The non-carcinogens' reference dose values for oral (RfDo) and inhalation (RfDi) pathways of exposure and the oral and inhalation cancer potency factors (SFo and SFi, respectively) are listed. The potentially significant changes are shaded.

Chemical	Ingestion Exposure				Inhalation Exposure				Comment
	RfDo mg/kg/day		SFo $(mg/kg/day)^{-1}$		RfDi mg/kg/day		SFi $(mg/kg/day)^{-1}$		
	Table 2-11^	Region IX#	Table 2-11^	Region IX#	Table 2-11^	Region IX#	Table 2-11^	Region IX#	
Arsenic	3E-4	3E-4	1.75	9.5* (Cal Modified)	-	-	15	12** (Cal Modified)	
Cadmium	1E-3	5E-4**	-	-	-	-	15	6.3**	
Carbon Tetrachloride	7E-4	7E-4	0.15	0.13**	5.7E-4	7E-4 **	0.15	0.053**	No change to the MCL
Chromium (total)	1	-**	-	-	-	-	-	42*	The remedy assumed all chromium was in the VI valence state.
Chromium VI	5E-3	3E-3*	0.42	-**	-	2.2E-6 *	510	290**	
Cis-1,2-Dichloroethene	0.01	0.01	-	-	0.01	0.01	-	-	No change to the MCL
1,2-Dichloroethane	-	0.02*	0.09	0.091	-	1.4E-3 *	0.09	0.091	No change to the MCL
Lead	-	-	-	-	-	-	-	-	Lead is evaluated separately.
Tetracloroethene (PCE)	0.01	0.01	0.05	0.54	0.01	0.01	0.05	0.021**	No change to the MCL
Trans-1,2-Dichloroethene	0.01	0.02*	-	-	0.01	0.02*	-	-	No change to the MCL
Trichloroethene (TCE)	6E-3	-	0.015	0.13* (Cal Modified)	0.006	0.17** (Cal Modified)	0.01	0.007** (Cal Modified)	No change to the MCL

^ From Table 4-2 of "Basewide Human Health Risk Assessment, Sacramento Army Depot", Kleinfelder, 1997.
# Toxicity values as they appear on the October 2004 Region IX Table of Preliminary Remediation Goals
* Changes in toxicity values indicate an increase in estimated risks or hazards
** Changes in toxicity values indicate a decrease in estimated risks or hazards

Table 2: Changes in Chemical-Specific Standards

Contaminant	Media	Cleanup Level	Comparison
Arsenic	soil	7.3 mg/kg 1995 ROD, Table 4	0.062 mg/kg Cal Modified Residential PRG 0.25 mg/kg Cal Modified Industrial PRG
Cadmium	soil	Bldg. 300 Burn Pit and South Post Burn Pits (88 mg/kg) Oxidation Lagoons (40 mg/kg) 1995 ROD, Table 4	37 mg/kg Residential PRG 450 mg/kg Industrial PRG
Chromium (VI)	soil	16 mg/kg 1995 ROD, Table 4	0.3 mg/kg Residential PRG 64 mg/kg Industrial PRG
Total Chromium*	soil	112 mg/kg 1995 ROD, Table 4	At a 1:6 ratio of Cr VI/Cr III 210 mg/kg Residential PRG 450 mg/kg Industrial PRG
Lead	soil	174 mg/kg 1995 ROD, Table 4, subsequently modified	150 mg/kg Cal Modified Residential PRG 800 mg/kg Industrial PRG

Contaminant	Media	Cleanup Level	Comparison
Carbon tetrachloride	Groundwater	0.5 ug/L California MCL	0.5 ug/L California MCL 5.0 ug/L US EPA MCL
Cis-1,2-Dichloroethene	Groundwater	6 ug/L California MCL	6 ug/L California MCL 70 ug/L US EPA MCL
1,2-Dichloroethane	Groundwater	0.5 ug/L California MCL	0.5 ug/L California MCL 5.0 ug/L US EPA MCL
Trans-1,2-Dichloroethene	Groundwater	10 ug/L California MCL	10 ug/L California MCL 100 ug/L US EPA MCL
Tetrachloroethene	Groundwater	5 ug/L US EPA MCL	5 ug/L US EPA MCL 5 ug/L California MCL
Trichloroethene	Groundwater	5 ug/L US EPA MCL	5 ug/L US EPA MCL 5 ug/L California MCL

ATTACHMENT 8

VAPOR INTRUSION SCREENING FOR THE SOUTH POST PLUME

This attachment was prepared to address the vapor intrusion (VI) screening process for the South Post OU, Question B, Sec. 7.3.2.2, of the statement of service, "Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**".**

Since the last 5-Year review, potential vapor intrusion issues have increased in visibility across the nation and, when conducting a risk assessment, should be considered as a possible exposure pathway posed by releases of hazardous chemicals into the environment. Vapor intrusion is not recognized as an ARAR in the ROD for SAAD but, in an effort to address this emerging issue, the Army conducted a screening level investigation to determine if vapor intrusion was a viable exposure pathway in relation to the groundwater contamination at SAAD. The Army thoroughly reviewed the EPA Guidance, DTSC Guidance, Army Guidance, and the Johnson & Ettinger model and utilized the DTSC automated screening tool (automated excel spreadsheet) to evaluate vapor intrusion risk with respect to the groundwater in the south post plume at SAAD. The following sections address the general site conditions, screening process and results of the screening investigation for vapor intrusion.

Site Background/Hydrogeology

The installation is located in the Central Valley of California and overlies a thick sequence of alluvial sediments consisting of silt, sand, gravel, and hardpans. These sediments are laterally and vertically discontinuous. In general, the shallow site soils have moderate to very low permeability.

The water-bearing zones beneath SAAD are composed of a series of sand, silty sand, and sandy silt units. These units have been grouped into three general water-bearing zones, informally designated as the "A/B", "C", and "D" hydrogeologic zones. The A/B-zone consists of the upper A and the lower B zones which are commonly interconnected. The vadose zone above the shallowest water-bearing zone and the aquitards between the water-bearing zones consist primarily of silt, silty clay, and clay. The approximate depths of the primarily water-bearing zones from ground surface are:

Zone	Depth (feet)
A/B	78 to 148
C	156 to 188
D	195 to 230

The three aquifer zones can be subdivided into two depositional regimes. The upper regime comprising the A/B-zone is heterogeneous, and laterally and vertically discontinuous. This regime is composed of silt with interbedded fine grained arkosic sand lenses. The lower regime is composed of apparently laterally continuous units comprising two distinct water-bearing zones, C and D. These two zones are typically highly productive, consisting of fine to coarse grained, moderately graded sand interbedded with silt and clay.

For the vapor intrusion assessment, the area of concern deals specifically with the geology in the vadose zone. A fence diagram, Figure 1, and real time data from a previous Cone Penetrometer

Test (CPT), Figure 2, are provided as further reference to the geological conditions in the area specific to the south post plume. The CPT data in Figure 2 comes from a sample location approximately 75 feet to the south of MW1025. In general, there was evidence that clay, silt and sand layers were continuous (when depths are corrected for elevation) at elevations which were comparable to layers and elevations found in boring logs for the MW1025-1028, MW1021-1024, and MW1036-1037 wells.

Vapor Intrusion (VI) Screening

The Army utilized the Department of Toxic Substance Control screening guidelines, *GUIDANCE FOR THE EVALUATION AND MITIGATION OF SUBSURFACE VAPOR INTRUSION TO INDOOR AIR, Rev. February 7, 2005,* to analyze the risk associated with possible vapor intrusion via contaminated groundwater under the Fed Ex property.

The DTSC recommends a step-wise approach, as discussed below, for the evaluation of vapor intrusion. For sites with existing buildings, Steps 1 through 11 apply. For sites with proposed buildings, Steps 1 through 3, 5, 6, 7, and 11 apply.

- *Step 1* –Identify the spill(s) or release(s).
- *Step 2* –Characterize the site.
- *Step 3* – Identify the site as one where vapor intrusion into indoor air may represent a complete exposure pathway (VOCs are detected in the subsurface).
- *Step 4* – For an existing building, identify whether an imminent hazard exists from vapors migrating into indoor air. If none exists,
- *Step 5* – Perform a screening evaluation using the provided default vapor attenuation factors. If a potential risk exists,
- *Step 6* – Collect additional site data.
- *Step 7* – Perform a modeling evaluation using site-specific physical parameters and building parameters as appropriate. If the calculated risk is still significant,
- *Step 8* – For an existing building, prepare an indoor air sampling work plan, which includes an assessment of the utility corridors and the development of a contingency plan for appropriate response actions. Also, conduct appropriate public outreach with the affected community.
- *Step 9* – For an existing building, conduct indoor air sampling.
- *Step 10* –For an existing building, evaluate the data to determine if the indoor air concentrations are acceptable. If they are not,
- *Step 11a*–For an existing building, mitigate indoor air exposure, implement engineering controls, and remediate the VOC contamination as appropriate.
- *Step 11b*-If no building exists on the site, and the calculated risk is significant, remediate subsurface VOC contamination or implement institutional measures to assure that engineering controls are installed in any future buildings.
- *Step 11c*-For both circumstances, institute long-term monitoring at the site.

Figure 3 of this attachment presents the DTSC decision tree to be used when screening a site for VI concerns. The decision tree mirrors the steps above but only steps 1 through 5 are necessary to complete the screening process at SAAD. To completely assess the possibility of VI in Step

5, the Army utilized the DTSC EXCEL™ screening tool based on calculations from the Johnson & Ettinger Model.

The DTSC guidance notes, "Fate and transport models can assist in evaluating the degradation of indoor air quality due to the intrusion of subsurface volatile contaminants……. When used in combination with site-specific information, the results of modeling will add to the overall weight of evidence used to evaluate the exposure pathway. The Johnson and Ettinger (1991) model (J/E) is one of the most commonly used models for evaluating the indoor air exposure pathway. DTSC has selected the J/E model as the recommended approach to evaluate the vapor intrusion pathway in California. USEPA programmed the J/E model into Microsoft EXCEL™ and added a health risk component that calculates the risk from inhaling the specific chemical at the concentration estimated in indoor air."

The DTSC guidance further describes the usage or the J/E model as follows, "The J/E model is a simple, deterministic model, having single-point inputs and outputs. The J/E model is based on the basic principles of contaminant fate and transport, contaminant partitioning between media, and the physical and chemical properties of the contaminants themselves. The model incorporates both diffusion and advection as mechanisms of transport of subsurface vapor into the indoor air environment."

The Army utilized the automated EXCEL™ spreadsheet model to screen for vapor intrusion risk related to buildings on the Fed EX property directly above the current groundwater plume. Using site specific inputs, "the J/E model can allow users to quickly screen sites for vapor intrusion risk. The output of the J/E model is the dimensionless attenuation factor "alpha" *State of California DTSC / Cal – EPA Vapor Intrusion Guidance Document – Final Interim December 15, 2004* D – 2 (α) that represents the ratio of the indoor air concentration to the vapor concentration at a subsurface source. Using the attenuation factor and the appropriate target indoor air concentrations, contaminant concentrations in soil gas and groundwater that are protective of human health can be calculated, and these calculated values can be used as site cleanup goals." Finally, the guidance notes the following when screening for VI risk:

> ***Evaluation of Vapor Intrusion Risk***
> *DTSC recommends the use of a two-phased approach in evaluating the vapor intrusion at a facility. A phased approach ensures that simple cases can be evaluated relatively quickly with minimal resources. The first phase of the evaluation utilizes default attenuation factors to quickly quantify the risk for vapor intrusion (Step 5)….. If the preliminary screening demonstrates that the risk associated with vapor intrusion is acceptable, no further evaluation for the exposure pathway is warranted.*

Using the DTSC EXCEL™ spreadsheet, the decision tree in Figure 3, and site specific data, the Army concluded the following:

Step 1 – Identify the spill(s) or release(s): The releases are well documented and covered in the five year review. TCE contamination in the groundwater is the main contaminate of concern (COC) at SAAD.

Step 2 – Characterize the site: The site is fully characterized with 5 COCs present at SAAD including: Trichloroethylene, Tetrachloroethylene, Carbon Tetrachloride, cis-1,2-Dichloroethylene, trans-1,2-Dichloroethylene, and 1,2-dicholorethane.

Step 3 – Identify the site as one where vapor intrusion into indoor air may represent a complete exposure pathway (VOCs are detected in the subsurface): The site may represent a complete exposure pathway.

Step 4 – For an existing building, identify whether an imminent hazard exists from vapors migrating into indoor air. If none exists,: No imminent hazard exists at this site.

Step 5 – Perform a screening evaluation using the provided default vapor attenuation factors. If a potential risk exists: Potential risk may exist and the Amy utilized the J&E model to evaluate risk. The Army also used the following site specific input parameters to increase the accuracy of the model:

1. Concentrations and depth to groundwater levels used in the model are from the Fall 2007 GW sampling activities at MW1028. This is the A-Zone well closest to buildings on the FedEx property.
2. Silt is the predominate soil strata in the vadose zone above the A aquifer and it was used as the input in the model.

The following table represents the modeling output using the inputs provided in Step 5.

COC	Concentration* (µg/L)	Water Level* (cm)	GW Concentration** (µg/L)	Cancer Risk***	Hazard Quotient****
Trichloroethylene	**12**	1929	**172**	**$7x10^{-8}$**	**$1.4x10^{-4}$**
Tetrachloroethylene	ND	1929	37	NA	NA
Carbon Tetrachloride	ND	1929	2.77	NA	NA
cis-1,2-Dichloroethylene	**1.5**	1929	**131**	**NA**	**$1.1x10^{-4}$**
trans-1,2-Dichloroethylene	ND	1929	1,190	NA	NA
1,2-dicholorethane	ND	1929	121	NA	NA

* Concentrations and depth to groundwater provided from the Fall 2007 GW sampling activities at MW1028. This is the A-Zone well closest to buildings on the FedEx property.

** Concentration derived from the J&E model that would be needed in groundwater to cause an indoor air exposure given depth to contaminate and soil characteristics (Silt is the predominate soil strata above the aquifer in this area)

*** Cancer Risk values derived from the J&E model are all below $1x10^{-6}$ and are not considered a cancer hazard.

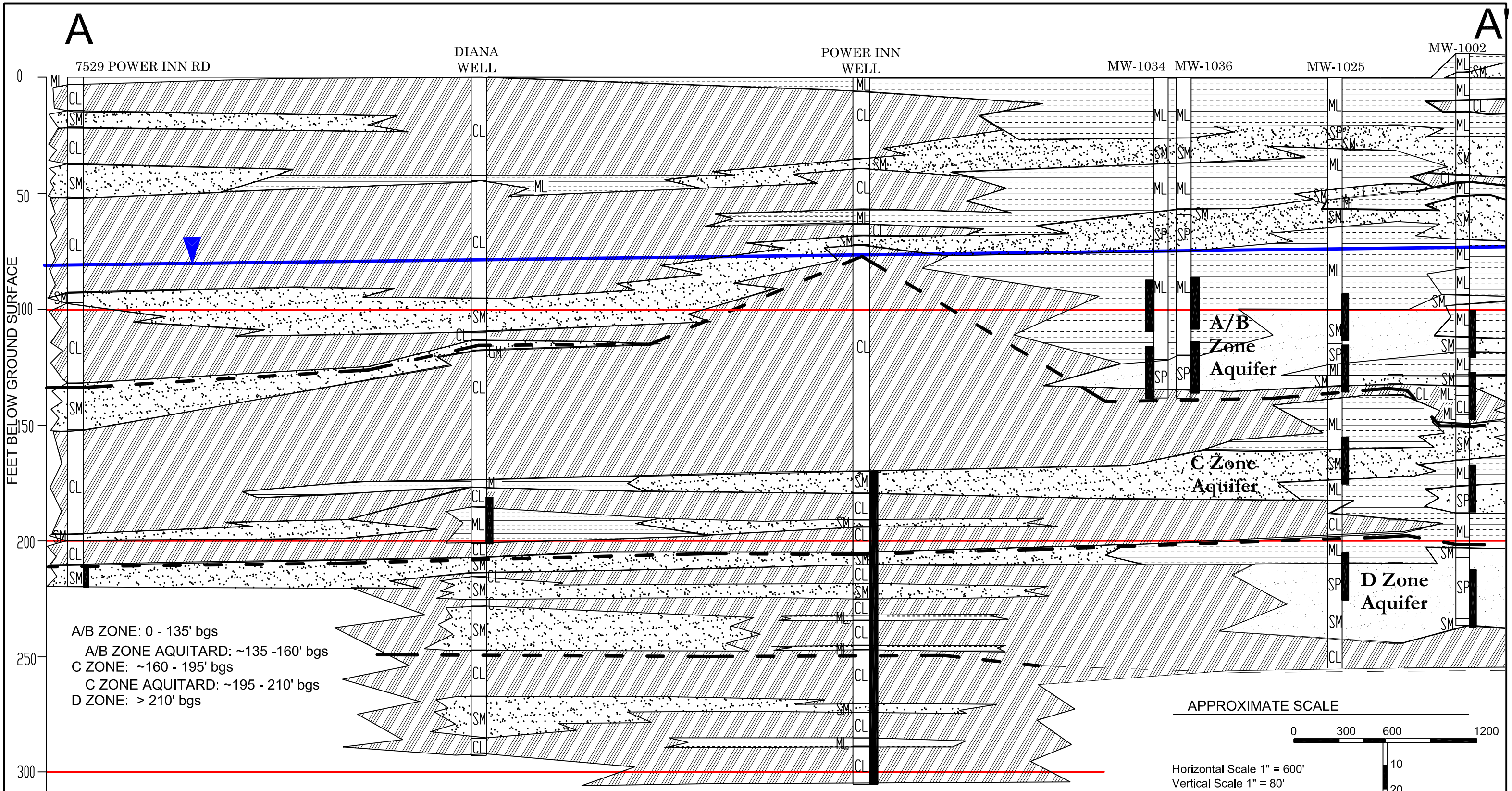
**** Hazard Quotient values derived from the J&E model are all below 1.

ND - Not detected *NA* - not applicable

Conclusions

As requested by the Environmental Protection Agency, Region 9, during the process of this 5-Year Review, the Army evaluated vapor intrusion risk possibly associated with groundwater contamination located off site of the previous Sacramento Army Depot and presently in the vicinity of buildings located on the Fed Ex property on Berry Avenue (south post plume). To accomplish this, the Army used site specific data collected in the Fall 2007 Groundwater Sampling round and input the data into the DTSC J&E model for screening of vapor intrusion risks associated with SAAD groundwater contamination. After careful review of modeling

results, given the depth to contaminates, concentration, and geology, the Army does not believe that there are any vapor intrusion concerns associated with groundwater contamination at SAAD. Furthermore, if the model is run on the most restrictive screening level with sand as the predominate strata in the vadose zone, the values remain below those needed to indicate a risk associated with the groundwater in this area.



LEGEND

CL - Clay, Silty Clay
ML - Sandy Silt
SM - Silty Sand
SP - Sand
GM - Sandy Gravel

Approximate Depth to Groundwater
Approximate Boundry of Aquifer Zone
Approximate Screen Interval

Clay, Silty Clay
Sands
Silts

Note: The Power Inn, Diana and 7529 Power Inn Rd. (Private) wells were logged in by the driller and may not have involved professional geologists in the logging process.

SCA ENVIRONMENTAL, INC.

Drawn By: C. Sununu
Project No.: F-5437
Date: 12-10-02
Filename: Fig 4.dwg

FENCE DIAGRAM
SOUTH OF SACRAMENTO ARMY DEPOT

SACRAMENTO ARMY DEPOT
SACRAMENTO, CALIFORNIA

FIGURE
1

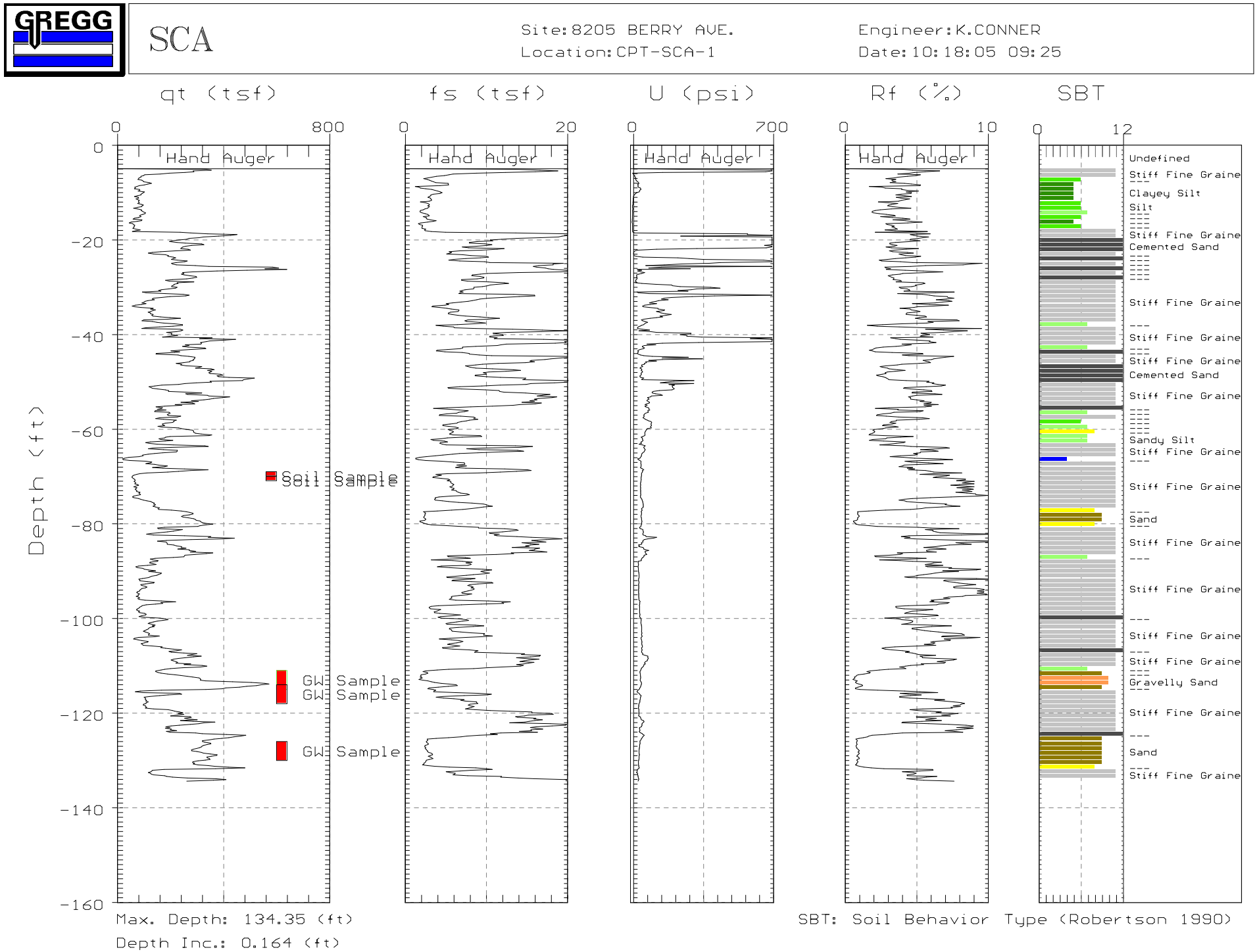
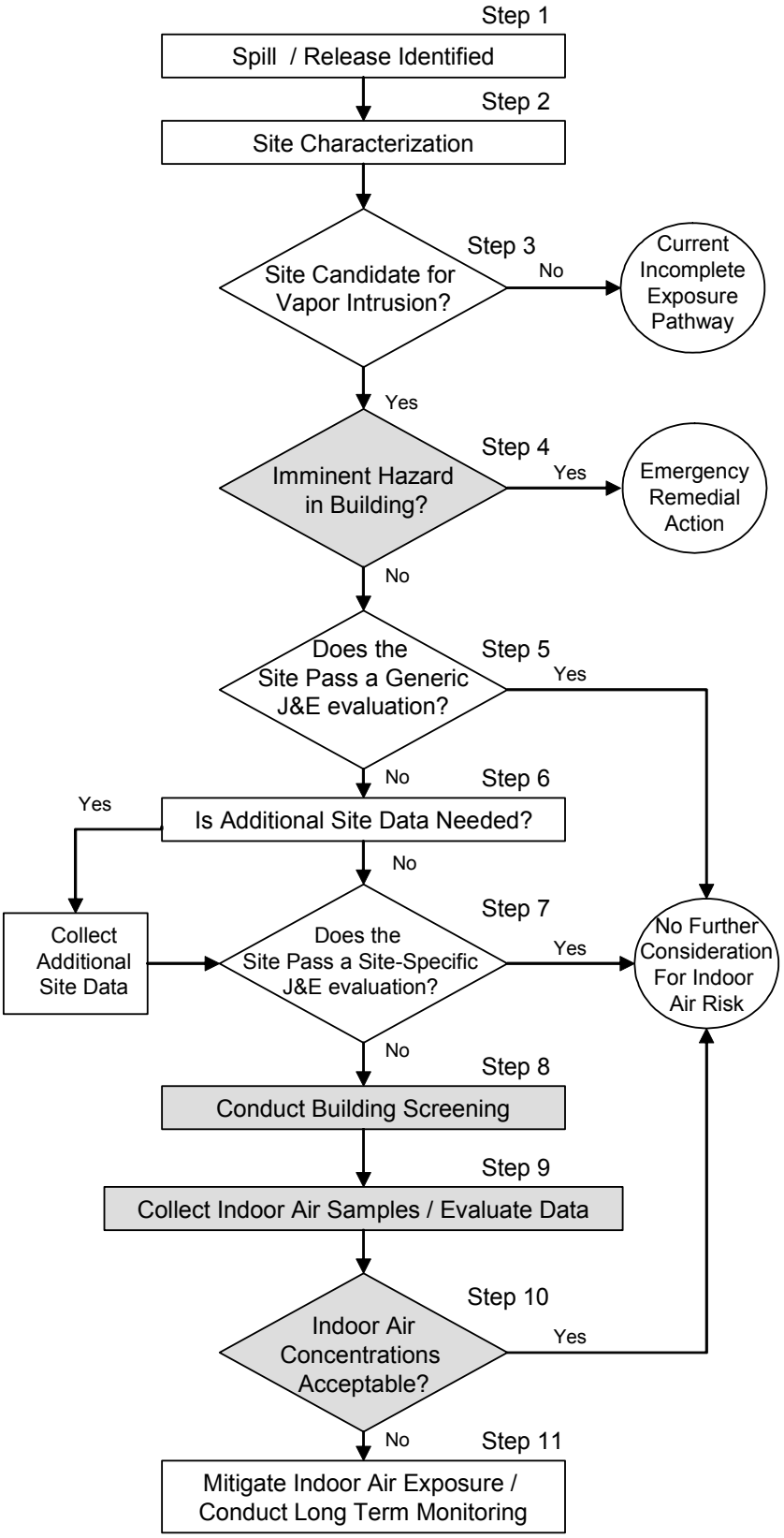

GREGG
SCA
Site: 8205 BERRY AVE.
Location: CPT-SCA-1
Engineer: K.CONNER
Date: 10:18:05 09:25
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
Hand Auger
Soil Sample
GW Sample
Depth (ft)
Undefined
Stiff Fine Graine
Clayey Silt
Silt
Cemented Sand
Sandy Silt
Sand
Gravelly Sand
Max. Depth: 134.35 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

Figure 2

FIGURE 3 – VAPOR INTRUSION TO INDOOR AIR ASSESSMENT



Note: Shaded steps do not apply to future building scenarios

APPENDIX

Army Response to EPA Comments on the Draft Third Five-Year Review Report for Sacramento Army Depot, Sacramento California, June 2007

From: Work.Michael@epamail.epa.gov
Sent: Monday, November 26, 2007 10:52 AM
To: Armstrong, Scott; Carolyn Tatoian-Cain; Marcus Pierce
Cc: Ball.Harold@epa.gov; Stralka.Daniel@epamail.epa.gov
Subject: SAAD Five-Year Review

Follow Up Flag: Follow up
Due By: Thursday, November 29, 2007 12:00 AM
Flag Status: Red

Hi Scott et al,

we are almost there! One final comment re VI.

EPA Technical Support has reviewed the model parameters for VI submitted by the Army. The Army is using the same version as DTSC so that is consistent and using the California tox value for TCE which is good.
They use the same max TCE concentration but different depths to gw, DTSC 64' and Army 71'. Both use default soil physical properties but DTSC uses sand and the Army uses sandy clay.

Comment: The text edits, as written in the latest submittal, do not present a sufficient logic train to support the conclusion. Overall, the concentrations are not particularly high enough to cause a vapor intrusion concern but what EPA would like is an appendix/attachment/ memo that:

- presents the model used,
- provides the justification for the soil physical properties,
- runs the model for the risk from each of the COCs (TCE, PCE, CCL4, cis/trans 1,2-DCE, and 1,2-DCA)
- shows a table of the max concentration currently, the risk and hazard quotient associated with each and then
- presents the conclusion.

Please include some discussion of the boring log reviews for the appropriateness of the soil type chosen and the number of borings reviewed to support that decision.

EPA does not believe this to be onerous and it would answer the question re vapor intrusion concern. Also, this request appears to be in line with what we requested in our conference call on October 23, namely an appendix/attachment/memo that documents the analysis

Thanks.

p.s. I have suggested to counsel that citing the documents which contain the deed and related deed information ought to be enough to satisfy the documentation of ICs and land use restrictions.

mw

Michael Work
US EPA, Region 9 (SFD-8)
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San Francisco, CA 94105

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email: work.michael@epa.gov

DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600

REPLY TO

November 3, 2007

Army Base Realignment and Closure Division

MEMORANDUM FOR:

Mr. Michael Work, Region IX U.S. Environmental Protection Agency, 75 Hawthorne St., San Francisco, CA 94105

SUBJECT: Response to Comments on the Draft Final Third Five-Year Review Report for the Former Sacramento Army Depot (SAAD)

Dear Mr. Work:

The Department of the Army received the EPA comments on the *Draft Final Third Five-Year Review Report for the Former Sacramento Army Depot (SAAD)* on October 4, 2007 and has completed its corresponding review. Note that these comments were subsequently discussed in greater detail during a conference call on Oct. 23, 2007 in an effort to reconcile areas of disagreement. The enclosed response to comments incorporates the conclusions resulting from that conference call and outlines the final responses and amendments to the report. The Army will include all of the comments/responses as an enclosure to the *Final Third Five-Year Review Report for the Former Sacramento Army Depot (SAAD)*. With the final resolution of EPA's comments now completed, the Army will now work toward obtaining signature approval for this report from all members of the BRAC Cleanup Team. If you have any questions concerning this report, please contact Scott Armstrong at (916) 961-6504.

Sincerely,

for Jeffery Willis
Chief, Operational Army and Medical Branch

Enclosures

Copies Furnished:

Carolyn Tatoian-Cain, DTSC PM
Marcus Pierce, CVRWQCB PM
Guy Romine, AEC RM
Scott Armstrong, BEC
William Brawner, BRAC PM

Draft Army Response to EPA Comments on the Draft Final Third Five-Year Review Report for Sacramento Army Depot, Sacramento California, June 2007

1.

Response to General Comment 2: The response indicates that the requested information was provided in Section 4.6.1; however there is no such section in the draft final document provided. If this information was provided please indicate where it can be found in the text. If this information was omitted, please provide it in the final version of the Third Five-Year Review Report for Sacramento Army Depot (the Five-Year Review Report).

Army Response: *This was a typographical error and the text should have stated 4.3.1.*

2.

Response to General Comment 3: The response did not adequately address the vapor intrusion issue. The potential that vapor intrusion is an issue is dismissed in the document for several reasons including comparison to San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) screening levels and review of Johnson and Ettinger modeling. The SFBRWQCB screening levels are not applicable since they assume Bay Mud as the dominant soil horizon. The Five-Year Review Report is deficient in providing adequate information about the Johnson and Ettinger review completed by the Army. In particular, there is no information on site specific assumptions and screening levels utilized. Appropriate screening approaches are outlined in the EPA "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," dated November 29, 2002. (http://www.epa.gov/epaoswer/hazwaste/ca/eis/vapor.htm). Review of this guidance suggests that vapor intrusion could be an issue at Sacramento Army Depot. The draft Five Year Review does not indicate that the vapor intrusion screening completed by the Army is consistent with EPA guidance. Please use screening assessments as provided in the above mentioned guidance and provide site specific assumptions and screening levels utilized in the vapor intrusion modeling efforts.

Army Response: *As discussed in our team conference call on Oct. 23, 2007, the Army amended the report to include specific details on the model used to evaluated VI issues at SAAD and the inputs for the model. The Army also forwarded the spreadsheets detailing the screening model to the EPA on October 24, 2007. The Army has thoroughly reviewed the EPA Guidance, DTSC Guidance, Army Guidance, and J&E model with respect to this issue. The depth to contaminates, concentration, geology, and reality of the situation at the FedEx property, including the fact that it is not zoned for residential use, sufficiently rule this site out as a concern for vapor intrusion. For screening purposes the following conservative parameters were used to run the DTSC model: depth to groundwater is approximately 70 feet, the groundwater temperature is an average of 19 degrees Celsius, strata was set to sandy-clay, vadose zone soil total porosity is 0.41, and the vadose zone soil/water-filled porosity 0.167* cm^3/cm^3*. Given these parameters based off of field data, conservative screening levels would need to be above 459 ppb for TCE before groundwater concentrations would be a concern from a vapor intrusion standpoint. Utilizing these parameters but focusing on the incremental risk of vapor intrusion from a lifetime cancer hazard risk, the levels are well below the* $1x10^{-6}$ *standard at* $5.9x10^{-8}$*.*

Draft Army Response to EPA Comments on the Draft Final Third Five-Year Review Report for Sacramento Army Depot, Sacramento California, June 2007

3.

Response to General Comment 4: The Oxidation Lagoons Operable Unit, Battery Disposal Well (Investigation-Derived Waste), and Building 300 Burn Pits all have institutional controls (ICs) as part of the selected remedy; therefore a discussion of these ICs must be included in the Five-Year Review Report. Please discuss the Oxidation Lagoons Operable Unit, Battery Disposal Well, and Building 300 Burn Pits. This discussion should include the protectiveness statements that were removed from the Draft Final. Also, please include an assessment of the adequacy of the ICs at these three sites.

Further, each Five-Year Review should confirm that any and all ICs required as part of a remedy are in place and legally enforceable. Please provide confirmation of the establishment and enforceability of all land use restrictions and ICs. Toward this end, please provide copies of the LUCs, with the recorder's date-stamp and a title search to confirm that they have been recorded and remain in place.

Additionally, since the last five-year review, the State of California has promulgated a new regulation pertaining to land use covenants. 22 CCR 67391.1 requires that, at the conclusion of a response action, if hazardous wastes, materials, constituents or substances remain at the property at levels which are not suitable for unrestricted use of the land, limitations on land use shall be incorporated into a State Land Use covenant. This State Land Use Covenant shall be executed by the Department of Toxic Substances and Control and the landowner and shall be recorded in the County where the property is located. EPA considers this new State requirement an ARAR that goes to the protectiveness of the remedial action. Therefore, for parcels at Sacramento Army Depot that may be transferred to a nonfederal entity, this requirement in 22 CCR 67391.1 should be identified as an ARAR that must be complied with.

Army Response: *There are no land use restrictions on the soils in the areas noted above. This information was provided in the last five year review with all parties agreeing that there are no more restriction associated with the soil in these areas and that they no longer needed to be addressed in future reports. The only area with soil restriction at SAAD is the South Post Burn Pits/CAMU and this is adequately addressed in the report. In addition, all the land transfer data, including FOSTs, LUCs, and Deeds requested by the EPA were previously provided to the EPA Project Manager, Xuan-Mai Tran. All of these issues were outlined and addressed in the Remedial Design Addendum, 2004, concurred with by the EPA, DTSC, and RWQCB and referenced in this report along with the appropriate deeds. All land use controls are fully described in this 5-yr Review report, are currently in place, and enforced. To further clarify this point, and at the request of the EPA, references to the FOSTs associated with the transfers at SAAD were added to several sections of the report and included under the references in attachment 2.*

A ROD Ammendment/Modification would be necessary to add an ARAR promulgated after the institution of the ROD. The five-year review is not the appropriate vehicle for adding ARARs to the ROD. However, the Army has completed FOSTs and deeds covering the regulation noted above and agreed to previously by all parties. The Army and City of Sacramento are in full compliance with the LUCs established for the former installation.

Draft Army Response to EPA Comments on the Draft Final Third Five-Year Review Report for Sacramento Army Depot, Sacramento California, June 2007

4.

Response to Specific Comment 1: This first portion of the comment was addressed, but the second portion of the comment was not appropriately addressed, perhaps because of a misunderstanding of the intent of the original comment. It appears that this Five-Year Review was issued a year late based on the site chronology as presented in Table 1. Please add a discussion of the timing of the third Five-Year Review in the context of the two preceding Five-Year Reviews.

Army Response: *This report has been delayed and the paper trail, including comments/response-to-comments and contracting issues has been documented and outlined in the development of this final report.*

5.

Response to Specific Comment 8: Community Notification through the Restoration Advisory Board does not appear inclusive enough to allow adequate time for public input. Please reconsider the extent to which the Community Notification requirement is being followed.

Army Response: EPA guidance as outlined in Comprehensive Five-Year Review Guidance, EPA 540-R-01-007, OSWER No. 9355.7-03B-P, June 2001, *Appendix A notes the following:*

> "The Community Involvement Coordinator (CIC) serves as a public participation and communications advisor. It is his/her job to ensure effective communications with the community."……
>
> "You should begin working with the site's Regional CIC during the initial planning stages of the five-year review to determine the appropriate level of community involvement for the five-year review."……
>
> "The site team should determine the best means for notifying the community that the five-year review process is underway. In some communities, holding an open house or public meeting where community members may stop by and ask questions or pick up fact sheets, brochures, etc., may work effectively."……..

The RAB committee chair is the designated CIC and in the past we have never received any comment or concern from the public beyond the RAB committee. The RAB committee and chair have been involved since the beginning, and like the last five-year review, they agreed that notification through the RAB board was adequate. Upon completion of the five-year review, the Army will provide a general notification in the newspaper, notify the RAB, and provide copies of the report if they are requested. Public comment as indicated in the guidance is optional and the Army is confident that the RAB is the best indication of the publics will in regard to this process:

> *"…Depending on the nature of the site and the interest in the community, another **option** for involving the public is to provide a public comment period on the findings of the five-year review."*

In addition, given the lengthy review and production time of this document, the Army is confident that any public concerns/comments would have already been aired if there were any at this time. Given the regulatory concern during this review, the Army will provide a notification via the newspaper and the RAB board during the next 5-Year review.

6.

Response to Specific Comment 9: This response states that "EPA's assertion that MW-50 has increasing concentrations is incorrect;" however it should be noted that the inset graph for MW-50 on Plate B-1 provided in this Five-Year Review Report states that trichloroethene (TCE) for Well MW-50 has an "Increasing Trend." Please resolve this discrepancy.

Army Response: *There is no discrepancy. This is the same data that is provided every quarter in the Groundwater Monitoring Report and outlines the TCE trend for the life of the specific monitoring well. The Mann-Kendall Results cover the lifetime of sampling which statistically show an increasing trend due to the constraints of the analysis. However, in the last several years the trend has been decreasing. To alleviate any further misunderstandings, the text at the bottom of the graphs has been removed.*

7.

Response to Minor Comment 2: There are two number fours in the "Recommendations and Follow-up Actions" section of the Summary Form on page xii. Please resolve this discrepancy.

Army Response: *Corrected.*

Army Response to EPA Comments on the Draft Third Five-Year Review Report for Sacramento Army Depot, Sacramento California, June 2007

GENERAL COMMENTS

1. The Third Five-Year Review Report for the Sacramento Army Depot, Sacramento, California, dated June 2007 (the Five-Year Review) generally follows the recommended format provided in the related guidance titled *Comprehensive Five-Year Review Guidance, EPA 540-R-01-007*. The level of detail provided is generally adequate to clearly define the current and historical activities that occurred on site, and/or those planned for the future. However, in some instances, the interrelationship between information provided in the varied sections is not clearly noted or referenced. For example, the Executive Summary and Section 6.3 simply states that Institutional Controls (ICs) are in place and appear to be operating correctly, while later sections actually identify some or all of the ICs that may apply to certain areas/units at the site. In the instance noted above, the Five-Year Review could better tie the information together by either expanding the discussion on the applicable ICs in the Executive Summary and Section 6.3 or by providing reference to subsequent sections where further details are provided. Please provide a table in which all the applicable ICs are identified and described.

Army Response: *General ICs were described and a table with the ICs was added to Section 3.2.*

2. The reasons that final remediation goals (RGs) for groundwater in the South Post area were not achieved in nine years (i.e., by 2004) are not discussed in the Five-Year Review. Since the Basewide Record of Decision (ROD) indicated that RGs should have been achieved in the period covered by the Third Five-Year Review, reasons this was not accomplished should be discussed in the Five-Year Review. The pumping rate was initially too low to capture the volatile organic compounds (VOC) plume and was increased in 1999; this would extend the timeframe for cleanup and should be specifically discussed. In addition, it is unclear if the mass of VOCs in the subsurface was underestimated when the ROD was issued; this should also be discussed. Further, the 1.5 to 3.0 foot increase in the potentiometric surface elevation may have resulted in increased concentrations of VOCs in groundwater. Please revise the Five-Year Review to discuss the reasons that the Remedial Action Objective (RAO) of reaching the RGs for groundwater by 2004 was not achieved, including a discussion of the failure to fully capture the contaminant plumes prior to 1999, the possibility that the mass of VOCs in the subsurface was underestimated, the potential impact of the increase in the potentiometric surface elevation on VOC concentrations, and other relevant factors.

Army Response: *A discussion as to why the RGs might not have been reached by 2004 was added to Section 4.6.1.*

3. It appears that the protectiveness evaluation did not include air intrusion issues. For example, as written, it is unclear if the remedy for South Post Groundwater Operable Unit (OU) can be regarded as protective because the potential for and risk associated with vapor intrusion into the Fed Ex facility has not been evaluated. We understand from discussions at our meeting of May 22, 2007, SAAD representatives have already screened out this pathway. Please provide the backup information in this document.

Army Response: *The Army has compared the current contamination levels to the San Francisco Bay Regional Water Quality Control Board "Table E-1a. Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns". For the most conservative scenario, the concentration of TCE in the groundwater would need to be 530 µg/L at 3 meters in depth for high permeability soil before vapor intrusion would be considered a concern. The current highest concentration of TCE is 27 µg/L. This is almost twenty times lower and at a depth of five times deeper than or the screening level. For the more realistic Commercial/Industrial screening level of 1800 µg/L, the current level is almost sixty-seven times lower. In addition, the risk assessment completed during finalization of the ROD found no inhalation risk associated with the air, even focused on the area near the burn pits with the highest groundwater/soil contaminant levels at the time. Finally, the Army has reviewed the Johnson and Ettinger model in relation to the screening levels and current concentrations and finds no risk in regard to potential vapor intrusion. Therefore, the Army does not believe that there are any vapor intrusion concerns associated with the present groundwater contamination. This discussion was added to Section 6.2.3.*

4. The Protectiveness Statement may require modification to address the potential need for institutional controls for the Soil Remedies (see comment on Section 7.1.1.3).

Army Response: *The need for institutional controls was evaluated and agreed to by all parties associated with SAAD, including the EPA, prior to transferring the property and during finalization of the Basewide ROD. The Army stands by the past agreements in regard to cleanup status and believes the soil remedies are appropriate. In fact, as noted in the last 5-year review these sites were released for unrestricted use and their inclusion in this report was for informational purposes only and not necessarily required.. The Quitclaim Deed for Parcel 2A, No. DACA05-9-99-569, states;*

> *"The soil beneath the Property has been contaminated with hazardous or petroleum substances and heavy metals. The top ten (10) feet of soil are free of contamination or have been remediated to residential standards such that further remediation is not required to ensure there is no adverse effect to human health or the environment. Soils below the top ten (10) feet have been remediated to levels necessary to protect human health and the environment with respect to any hazardous or petroleum substance remaining on the Property. The Basewide Record of Decision has determined that no further action is required with regard to soils and that there is no further threat to groundwater from contaminated soils. Therefore, the reuse of the Property is unrestricted as far as soil is concerned."*

5. Section 4. Land use controls (LUC) are discussed in various places in a generic manner and the document suggests that they are sound. However, additional documentation should be presented that these LUC are actually in place.

Army Response: A table was added to Section 3.2 that lists all the land use controls and restrictions.

SPECIFIC COMMENTS

1. **Executive Summary, Pages iv and v:** While it is understood that this is a summary, it would be helpful to provide additional detail because some details do not appear until later in the document. For example, the text on page v states that Institutional Controls (ICs) are in place and currently enforced or maintained, however no information was provided to even briefly identify the ICs in use. In addition, the same portion of the document and the associated Five-Year Review Summary Form which follows the Executive Summary states that the five-year review site inspection took place on July 11, 2006 which is less "recent" than typically desired (i.e., *Comprehensive Five-Year Review Guidance, EPA 540-R-01-007, Section 3.5.3: How should I conduct site inspections,* generally considers "recent" as meaning the site inspection occurred within nine months of the signature date of the Five-Year Review). In addition, since the Five-Year Review was submitted in June 2007, the "4/30/07" date provided as the end of the Review Period on the Five-Year Review Summary Form has been exceeded. Please revise the Five-Year Review to include the requested additional details in the Executive Summary. In addition, please explain why the overall timing and period for completion of the Five-Year Review will go over the specified timeframe (i.e., 7/1/2006 to 4/30/2007) since it appears that the total time to produce and finalize this document will exceed one year and it will not be finalized until September or October 2007 at the earliest.

Army Response: *The ICs in place have been identified in the table in Section 3.2. The specified timeframe, 7/1/2006 to 4/30/2007 is the time over which the fieldwork and research was done and the report was drafted. The Army doesn't believe a discussion of internal contracting issues and the associated timeframes are appropriate for inclusion in this document.*

2. **Five-Year Review Summary Form, Page vii; and Section 4.6.1, Remedy Selection, Page 14; and Table 4, Recommendations and Follow-up Actions, Page 32:** The first recommendation and follow-up action on the summary form and in Table 4 indicates that "final soil cleanup levels and the basis for their selection [will be included] in the next update to the Basewide ROD," but a ROD is not updated; normally a ROD is either amended or an Explanation of Significant Differences (ESD) is produced. In addition, a specific milestone date needs to be provided. Since item 2 on the form and table includes an "update" of the Basewide ROD with a fiscal year (FY) 2007 milestone date, it is unclear why the milestone for item 1 was "coordinate with other issues." Similarly, text on page 14 refers to "the update to the decision document." Please delete the term "update" and revise the text and Table 4 to state whether an amended ROD or an ESD is

planned. In addition, please resolve the discrepancy between the milestone dates in recommendation items 1 and 2 of Table 4 and provide a realistic completion date.

Army Response: *References to updating the ROD have been changed to reflect that the ROD will either be amended or an ESD will be developed as appropriate. The Army has not determined which path is appropriate at this time. The milestone dates have been changed.*

3. Section 3.1, Physical Characteristics, Page 4 and Table 1, Chronology of Site Events: The text in the first paragraph indicates that closure of the Sacramento Army Depot (SAAD) occurred in 1995, but Table 1 indicates that SAAD was closed in September 1994. Please resolve this discrepancy.

In addition, the last sentence of the first paragraph of this section states that the property has been transferred for a combination of commercial, state and federal related reuses, but this did not occur as a single transfer. It would be more accurate to indicate that certain portions (i.e., Parcels) of the property were transferred at different times after the closure of SAAD to a combination of commercial, state and federal entities for related reuses, and where appropriate, to reference Plate 2. Please make this clarification in the text. Please consider providing a table which identifies and states time of transfer for each parcel.

Army Response: *Table 1 was changed to 1995, which is the correct date. Table 1 identifies and states the time of transfer for each parcel. The wording on the transfer has been changed as requested.*

4. Section 4.5.3, Parking Lot 3 Groundwater. The report indicates that remedial goals have not been achieved, that the Army does not think resuming groundwater extraction is an effective way to treat the remaining contamination, and that a Groundwater Cleanup Optimization Report is under review. Since LUC are in place and there is no exposure, there does not appear to be a protectiveness issue at present. However, the document needs to be clear that if the existing pump and treat remedy cannot meet remedial action objectives, then the ROD will need to be amended at some point in the future. Evaluation of the effectiveness of other remedial approaches (e.g. thermal or in situ chemical oxidation) to achieve remedial objectives should be undertaken if not considered already.

Army Response: *Text has been added to reflect that the ROD will either be amended or an ESD will be developed as appropriate. The Army has not determined which path is appropriate at this time. The Army notes EPA's concerns with the Parking Lot 3 groundwater remedy.*

5. Section 4.6.3, System Operations/Operation and Maintenance, Page 15: The reason the total extraction rate was increased to 440 gallons per minute (gpm) was not discussed in the text. Since this extraction rate was increased to address off-site contamination that was continuing to migrate downgradient, the reason for the increase should be discussed in the text. Please revise the text to explain why the extraction rate was increased.

Army Response: Text has been added to explain why the extraction rate was increased.

6. **Section 4.6.3, System Operations/Operation and Maintenance, Page 16:** Since biological growth may be responsible for halving the extraction rate in EW-10 and this well appears to be critical for capturing the off-site portion of the trichloroethylene (TCE) plume, this well should be rehabilitated. Please discuss whether rehabilitation of EW-10 is planned and if not, explain why.

Army Response: *Text has been added that the Army is planning on rehabilitating EW-10 if pump and treatment is continued.*

7. **Section 5.0, Progress Since the Last Review, Page 18 and Section 7.2.1.2, Opportunities for Optimization, Page 27:** Although the discussion of the partial implementation of groundwater recommendations indicates that the Groundwater Cleanup Optimization Report (the GCOR) reviewed further action in the areas of Parking Lot 3 (PL3) and the South Post Groundwater Operable Unit (OU), the GCOR only evaluated monitored natural attenuation and various changes to the extraction well system and pumping rates. It did not consider other options like enhanced in-situ bioremediation, injection of zero valent iron (ZVI) or a modified Fenton's reagent to treat contamination in-situ. These technologies may be effective for addressing the PL3 groundwater contamination since the plume is no longer in the vicinity of the extraction wells. If a ROD amendment is being considered, changes to the remedy like those mentioned above should be considered. Please revise the text to discuss whether changes to the remedy that would treat the PL3 and South Post plumes in-situ are being considered.

Army Response: *Noted. If the ROD is amended, in-situ treatment will be discussed.*

8. **Section 6.1, Community Notification.** Public notice of both the initiation and completion of the 5YR is called for by the guidance and confirmed by EPA in response to a recent audit by the IG. While the document suggests that the completion of the report will be noticed in the newspaper, a notice of the ongoing effort should be published as soon as possible in order to ensure an opportunity to receive public input before the effort is complete.

Army Response: *The public was notified of the Five-Year Review through the Restoration Advisory Board.*

9. **Section 6.2.2, Parking Lot 3 Groundwater, Page 18:** The text does not discuss whether the PL3 plume is migrating downgradient since the extraction wells were shut down. TCE concentrations in the source have decreased, but concentrations in MW-50, which is downgradient, have increased. It appears that the PL3 plume may be migrating downgradient. Please discuss this issue and its effect on overall remedy protectiveness.

Army Response: *Text was added to address the situation at PL3. However, it should be noted that the EPA's assertion that MW-50 has increasing concentrations is incorrect. Please review the quarterly groundwater data for SAAD. Concentrations have been decreasing since 2005*

10. **Section 6.2.4, Recommended Changes to Monitoring Program, Page 22:** The text within this section discusses and recommends changes to the current and future monitoring programs. While the recent and historical data appear to provide justification for some or all of the actions proposed, the Five-Year Review is not the most appropriate forum for presenting or justifying "recommended" changes. Please revise the Five-Year Review and state in the text how the facility plans to present and discuss potential enhancements and modifications to the system.

Army Response: *Text has been added as requested.*

11. **Section 6.3, Site Inspection, Page 23:** The text on the top of page 24 states that the ICs appear to be enforced, based on visual observations made during the site inspection, however it is not apparent what ICs were in place and which could be observed or evaluated. Please revise the Five-Year Review to further identify (or reference from another section) the ICs in place and those observed/evaluated during the site inspection. (see also General Comment 1.)

Army Response: *Text has been added as requested.*

12. **Section 7.1.1.3, Soil Remedy ICs, Page 25:** The document indicates that "There are no soil related institutional controls for the Oxidation Lagoons OU, Battery Disposal Well (Investigation-Derived Waste), and Building 300 Burn Pits because the remaining contaminant concentrations are consistent with industrial reuse." Unless these areas meet the definition of "unlimited use and unrestricted exposure" then an institutional control is required to restrict future use to industrial scenarios.

Army Response: *The text was corrected.*

13. **Section 7.1.2.1, Changes in Standards, Newly Promulgated Standards and TBCs, Page 26:** The text within the second paragraph states that toxicity values for some of the metals have changed to reflect somewhat greater risks and hazard and that the concentrations remaining after excavations are low and it is expected that the remaining risk will fall within the EPA risk range for the individual sites. While it is not expected to be an ongoing concern, this statement needs further explanation within the context of the Five-Year Review. As it stands, the ambiguity presented in these statements brings to light concern over the risks associated with metals at portions of the site even though the follow on paragraphs (in Section 7.1.2.1) appear to further explain the rationale for requiring no further action or concern. Please revise the Five-Year Review to further substantiate the statement that these risks fall within the risk range.

Army Response: *Please see Attachment 7, RISK ASSESSMENT AND TOXICOLOGY EVALUATION for further information on the analysis and changes.*

14. **Table 3, Issues and Table 4, Recommendations and Follow-up Actions:** It is unclear why issue 4 in Table 3 states, "The South Post Groundwater remedy will likely not achieve RAOs within predicted timeframes," when the predicted timeframe in the ROD for achieving cleanup was 2004, which is already past. Similarly, the recommendation in Table 4 is to evaluate whether the South Post Groundwater remedy will meet RAOs. Please revise issue in Table 3 to state that cleanup has not been achieved within the predicted timeframe or, alternatively, revise the text in earlier sections to discuss changes to the predicted timeframe and RAO.

Army Response: *Table 3 has been revised to state that RAOs have not been met.*

15. **Section 9.0, Recommendations and Follow-up Actions, Table 4:** Table 4, the Form, should be revised to reflect the data in EPA's National Database (CERCLIS) which indicates that the trigger date for the draft review document was 2/6/2002 and the due date was 2/6/2007.

Army Response: *The Army does not understand this comment in regard to Table 4. The Five-Year Review Form has been changed to reflect the dates noted. However, this does not appear to be applicable to Table 4.*

16. **Section 9.0, Summary Form:** For ease of future tracking EPA recommends recasting the issues and follow up actions to focus on the three main issues identified: groundwater optimization, the need for a ROD amendment, and ICs. For example:

> Follow up 1: Complete ongoing remedial system evaluation. Implement optimization recommendations.
>
> Follow up 2: Update site decision documents with a Rod Amendment to address: 1) final soil cleanup levels, 2) clarify cis-DCE ARAR discussion, and 3) if necessary, incorporate potential changes to groundwater remedy resulting from the remedial system evaluation.
>
> Follow up 3: Implement Soil Remedy institutional control for Oxidation Lagoons OU, Battery Disposal Well (Investigation-Derived Waste), and Building 300 Burn Pits.

Army Response: *Although this might make tracking actions easier, Table 4 was not changed as the actions are tied to the issues in Table 3 and line up one-for-one to make sure each issue is addressed.*

17. **Table 4, Recommendations and Follow-up Actions:** A recommendation and follow-up action has not been presented for Issue 7 in Table 3. Since a vapor intrusion pathway evaluation has not been provided in this document (see General Comment 3) and contaminant concentrations beneath the Fed Ex facility have been increasing, the risk from the vapor intrusion pathway should be calculated. Please revise Table 4 to provide a recommendation/follow-up action for Issue 7 (Table 3).

In addition, Table 4 should include an assessment about whether the issues affect current and future protectiveness. Please revise Table 4 to include an assessment of current and future protectiveness for each issue.

Army Response: *Please see the response to General Comment #3. Since this document now addresses the vapor intrusion issue, Issue #7 has been removed. Table 4 already identifies whether or not issues affect current and future protectiveness.*

18. **Section 10.5, Parking Lot 3 Groundwater, and Section 10.6, Operable Unit – South Post Groundwater, Page 33:** The protectiveness statements provided for these units appears generic and does not take into account the ongoing and/or future remedial actions pertaining to groundwater that relates to these sites, more specifically with regard to the groundwater remedial actions for the South Post Groundwater. The statements should also indicate that ongoing and future groundwater extraction and treatment will help to ensure that the remedy is protective. Please revise the protectiveness statements in these sections to more accurately reflect the ongoing and future groundwater-related activities that are designed to ensure or enhance protectiveness.

In addition, the protectiveness statement for South Post Groundwater should be revised to include vapor intrusion, since concentrations in groundwater have increased beneath the off-site Fed Ex facility. Please make this change.

Army Response: *These sections were not changed. They state that the "remedy …. protects human health and the environment." Part of the remedy is the extraction and treatment of the groundwater, so making the recommended changes would be redundant. Also, please see the response to General Comment #3 for the vapor intrusion issue.*

MINOR COMMENTS

1. The signature page of the Five-Year Review is incomplete as it does not provide the specific names, positions or offices for the U.S. EPA and Department of Toxic Substances Control (DTSC) personnel. Please revise the Five-Year Review accordingly to provide this information.

Army Response: *Waiting for regulators to indicate who will have signatory authority for the report.*

2. During review of this document, some grammatical/spelling or other issues were noted. These issues should be corrected where possible in the final version of the Five-Year Review. A few examples, but not a complete list, of these issues include:

- Page 20, third paragraph, second sentence states ….the average at MW-50, 450 down gradient of MW-73….” It appears that the term “feet” may be missing after “450.” (as confirmed in the text at the bottom of page 19)
- Page 22, second to the last paragraph, last sentence and Page 30, Section 7.3.2.2, In the last sentence it appears that the term “contaminate(s)” should be “contaminant(s).”

Please review the text for grammatical and typographical errors and correct them in the next version of the Five-Year Review.

Army Response: *An editorial check has been performed.*

3. **Plate 2, Current Facility Map, Sacramento Army Depot:** It is not clear if Plate 2 has been updated since the drawing date is listed as “09-12-05;” if correct, this date indicates that the pate may not include more current information such as the transfer of Parcel 2B to the City of Sacramento, which (per Table 1) occurred in April 2006, after the date of the drawing. Please review Plate 2 and where appropriate revise the dates and/or information to reflect the current (i.e., late 2006 or early 2007) status of the information, as well as the noted drawing date.

Army Response*: The Plate has been corrected.*