CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION
MEETING OF MAY 12 and 13, 2010
HESPERIA, CALIFORNIA

ITEM: **6**

SUBJECT: **RESOLUTION AUTHORIZING THE EXECUTIVE OFFICER TO SIGN THE RECORD OF DECISION FOR THE BUILDING 210 AREA, SIERRA ARMY DEPOT, HERLONG, LASSEN COUNTY**

CHRONOLOGY: This is a new item before the Board

ISSUE: The board will be asked to evaluate whether the Army's proposed remedy for the Building 210 Area complies with State requirements based on information presented with this item.

DISCUSSION: The Building 210 Area (B210A) is in the southern portion of Sierra Army Depot. The groundwater contains dissolved chlorinated solvents from past disposal and maintenance practices at the B210A. Activities conducted at the B210A included vehicle maintenance and degreasing tank engines with solvents.

A portion of the groundwater plume has migrated off-depot and onto the Doyle Wildlife Area, a designated mule deer wintering area. Approximately 30 acres of the 180 acre-sized plume is beneath the Doyle Wildlife Area. The California Department of Fish and Game, California Department of Toxic Substances and the Army signed a Memorandum of Understanding that allows installation of a treatment system to remediate groundwater contamination beneath the Doyle Wildlife Area.

The Army is proposing to actively remediate chlorinated solvents in groundwater using enhanced reductive dechlorination (ERD). ERD is created in the subsurface by injecting a dilute food-grade molasses solution that enhances native microbial growth. In the presence of excess organic carbon and a strongly reducing environment, the microbes will destroy the chlorinated solvents dissolved in groundwater. Active treatment will occur over a period of twenty years. Long term monitoring will be maintained for a

period of 30 years. The Army modeled the existing groundwater plume and estimated the plume will be remediated to achieve drinking water standards (maximum contaminant levels) within 30 years with the proposed remedy.

The Record of Decision (ROD) presents the Army's proposed remedial action to protect the environment and restore groundwater quality. Prior to selecting the proposed remedy, the Army determined the horizontal and vertical extent of contaminants in soil and groundwater. The highest contaminant concentration of trichloroethene is 2,100 micrograms per liter, 420 times the maximum contaminant level for drinking water. The Army will maintain land use controls until the constituents of concern in groundwater have been reduced to levels that allow for unrestricted use.

The Army does not accept that California State requirements such as the Basin Plan, State Water Board Resolutions No. 68-16 and No. 92-49 are requirements for this remedial action from a legal perspective. However, the Army has agreed to substantively comply with these requirements from a technical perspective in the proposed action. The ROD includes "agree-to-disagree" language that preserves each party's legal rights.

Water Board staff has reviewed the proposed remedial action. As described in the enclosed staff report, the proposed remedy meets state requirements and is a feasible, cost effective method to restore groundwater quality at the site.

The Department of Toxic Substances Control (the lead agency) provided a 30 day public comment period for the Proposed Plan. The public comment period ended February 3, 2010. No public comments were received.

RECOMMENDATION: Adoption of the Resolution as proposed.

Enclosures:
1. Proposed Resolution
2. Staff Report

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

RESOLUTION NO. R6T-2010-PROPOSED

AUTHORIZING THE EXECUTIVE OFFICER TO SIGN
THE RECORD OF DECISION
FOR BUILDING 210 AREA,
SIERRA ARMY DEPOT

_____Lassen County_____

WHEREAS, the California Regional Water Quality Control Board, Lahontan Region, (Water Board) finds:

1. In January 2010, the United States Army submitted a Draft Record of Decision (ROD) for the Building 210 Area (B210A) for Sierra Army Depot. The Army will remediate chlorinated solvents in groundwater, primarily trichloroethene, using enhanced reductive dechlorination (ERD) and soil vapor extraction (SVE). Major components of the selected remedy are: ERD and SVE treatment, monitored natural attenuation, and land use controls.

2. The proposed remedial activities in the January 2010 Draft ROD will comply with all applicable or relevant and appropriate requirements of the Water Board and are protective of water quality.

3. The California Department of Toxic Substances Control is lead agency for remedial activities at Sierra Army Depot and has completed the Mitigated Negative Declaration for this project in accordance with the California Environmental Quality Act (Public Resource Section 21000 *et seq.*). Water Board staff concur with the lead agency's determination that the proposed project could not have a significant effect on the environment.

THEREFORE BE IT RESOLVED:

That the Lahontan Water Board authorizes the Executive Officer to:

1. Approve the remedial actions as documented in the January 2010 Draft Final Record of Decision; and

2. Sign the final version of the Record of Decision provided that there are no significant changes between the Draft and the Final Record of Decision.

I, Harold J. Singer, Executive Officer, do herby certify that the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Control Board, Lahontan Region, on May 12 and 13, 2010.

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HAROLD J. SINGER
EXECUTIVE OFFICER

STAFF REPORT

RECORD OF DECISION

For

BUILDING 210 AREA

SIERRA ARMY DEPOT

April 2010

California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

Prepared by: James Brathovde, Engineering Geologist

1. Introduction

This item provides information for the Regional Water Quality Control Board (Water Board) when considering whether it concurs with a Record of Decision (ROD) for remedial actions at the Building 210 Area (B210A) at the Sierra Army Depot (SIAD). The Army is proposing to actively remediate chlorinated solvents in groundwater using enhanced reductive dechlorination and soil vapor extraction. Background water quality should be achieved within 30 to 50 years, a reasonable period of time given the current and expected land use.

The B210A and other areas at SIAD are being investigated under the Army's Installation Restoration Program (IRP). The purpose of the IRP at SIAD is to protect human health and the environment by identifying and cleaning up environmental contamination resulting from past disposal practices. The cleanup at SIAD is being conducted under the requirements of the California Water Code, California Health and Safety Code, and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). SIAD is not listed on the National Priorities List (NPL). This B210A ROD was prepared pursuant to the requirements set forth in the *Sierra Army Depot Federal Facilities Site Remediation Agreement* between the State of California and the Army, dated May 30, 1991.

The selected remedy for the B210A consists of the following components:

- In-situ groundwater remediation using a dilute food-grade molasses solution to enhance microbial destruction of dissolved solvents,
- Targeted soil vapor extraction and treatment,
- Monitored natural attenuation of constituents in groundwater,
- Five-Year reviews to evaluate the effectiveness of the remediation, and
- Land use controls to prevent exposure to contaminants.

The primary constituent of concern in groundwater is the chlorinated solvent trichloroethene (TCE). The Army is proposing to actively remediate groundwater for twenty years and the proposed cleanup action is expected to reduce TCE and its degradation products to achieve drinking water standards (maximum contaminant levels) in a reasonable period of time (30 years). Remedial actions proposed for the B210A meet state requirements and are feasible and cost effective methods to restore groundwater quality. As discussed further in this staff report, Water Board staff has reviewed the proposed remedy and it is: 1) consistent with maximum benefit to the people of the State, 2) does not unreasonably affect present and anticipated beneficial uses, and 3) complies with plans and policies of the State.

The highest concentration of TCE in groundwater has moved approximately 1,200 feet from the source areas, and a portion of the groundwater plume has migrated off-depot and onto the State of California Doyle Wildlife Area, a designated mule deer wintering area. Approximately 30 acres of the 180 acre-sized plume is beneath the Doyle Wildlife Area. The California Department of Fish and Game, California Department of Toxic Substances Control and the Army signed a Memorandum of Understanding that allows installation and operation of a treatment system to remediate groundwater contamination beneath the Doyle Wildlife Area.

2. Site Information

SIAD is in the Honey Lake Valley of Lassen County, approximately 40 miles southeast of Susanville. SIAD occupies approximately 38,000 acres. The surrounding land use is mostly open space/grazing areas. The B210A site is located on the southeast corner of the Depot (Figure 1) and includes the area surrounding the maintenance shops and industrial Buildings 201, 202, 206, 207, 208, 209, 210, 211, and 227 (Figure 2). The site is bounded on the north by supply and storage buildings and on the south by railroad tracks and the Depot boundary fence. The State of California's Doyle Wildlife Area is adjacent to the southern boundary of the Depot.

The vehicle maintenance shops operated at the site from 1942 to 1979. Activity at SIAD has fluctuated depending on the United States' involvement in active military conflicts. During the Korean Conflict and the Vietnam War, the work force increased as demand for storage depot for supplies and vehicle maintenance increased. Chlorinated solvents were used in vehicle maintenance operations.

3. Site Hydrogeology and Groundwater Contamination

Annual precipitation in the SIAD area varies from as much as 20 inches in the surrounding mountains to less than 5 inches on the Honey Lake Valley floor, with approximately half of this occurring as snow during the winter. Honey Lake dries up during drought years. Recharge to the groundwater near Honey Lake is from subsurface flow from the surrounding mountains and upland areas. Regional groundwater flow is toward the center of Honey Lake. However, at B210A, localized sources of groundwater recharge, includes seepage of landscape irrigation and possible exfiltration from sewer and water lines on the Depot, alter the direction of groundwater to the southeast. The southeast direction of groundwater has been constant since groundwater gauging and monitoring

started in the 1990s. Background water quality at the B210A averages close to 1,200 milligrams per liter (mg/L) total dissolved solids.

Groundwater is encountered at approximately 95 feet below ground surface (bgs). The saturated lithology from approximately 95 feet bgs to the underlying confining silt layer at approximately 120 to 155 feet bgs consists of interbedded fine to medium sand and gravelly sands with little to no fines. Lower permeability silts were encountered from approximately 120 to 155 feet bgs. Wells are screened over approximately 10- to 20-foot intervals at depths ranging from 83.5 to 125.5 feet bgs.

Since 1993, 80 monitoring wells have been installed to determine the lateral and vertical extent of the groundwater plume. The B210A groundwater plume is unique in that TCE is present only in the upper-most 10 to 20 feet of the aquifer. Modeling shows that groundwater is not recharged vertically from rainfall, but recharged almost exclusively from lateral sources - hence the shallow contaminated thickness of the approximately 4,000 foot long plume. The TCE detected in groundwater is mainly from the Korean Conflict and Vietnam War periods.

The highest concentration of TCE detected recently in groundwater is 2,100 micrograms per liter (µg/L). The maximum contaminant level (MCL) in drinking water for TCE is 5 µg/L. The groundwater plume at the B210A encompasses an area of approximately 180 acres at or above the 5 µg/L concentration. A TCE isoconcentration map is shown on Figures 2 and 3.

The Lahontan Region's Water Quality Control Plan (Basin Plan) established beneficial uses and water quality objectives (WQOs) for surface and groundwaters in the Lahontan region. The Basin Plan considers the WQOs as a cleanup standard for contaminated water that is, or may be, used for drinking water. The WQO for TCE is the MCL, 5 µg/L. The beneficial uses of the groundwater beneath the B210A and the Doyle Wildlife Area include municipal and domestic supply, agricultural supply, industrial service supply and freshwater replenishment.

4. Site Investigations and Remedial Pilot Studies

Previous investigations at the B210A consisted of seven subsurface investigations conducted between 1983 and 2002. These investigations determined the horizontal and vertical extent of the constituents of concern (COCs) in soil and groundwater, evaluated the potential for COCs detected in soil to impact groundwater, and characterized the geology and hydrogeology of

the B210A for modeling purposes. A detailed summary of these investigations was provided in the Draft Final Feasibility Study for B210A.

The following six remedial pilot studies have been completed or are currently underway to determine a feasible and cost efficient method to treat impacted groundwater:

1) Pump and Treat Interim Remedial Activity - From July 2000 through May 2006, a groundwater pump and treatment system was operated. The system treated 1.28 trillion gallons of groundwater and removed approximately 1,050 pounds of TCE. Results from groundwater monitoring in the extraction wells and in monitoring wells near extraction wells showed an overall decrease in TCE concentration. The system was not able to reduce TCE concentrations in the extraction wells or monitoring wells to the 5 µg/L MCL for TCE.

2) Hydrogen Release Compound® Pilot Tests – In October 2000, an enhanced biodegradation pilot test study was completed using Hydrogen Release Compound® (HRC®). The pilot tested included injecting 3,600 pounds of HRC® upgradient of an extraction well. The pilot test injection was within the estimated radius of hydraulic influence. HRC® was injected slowly to release hydrogen into the subsurface which, under anaerobic conditions, is used for the reductive dechlorination of TCE. In 2002, a follow-up HRC® injection was completed. In both pilot tests, an insufficient mass of HRC® was delivered to the aquifer due to the high viscosity of the HRC® slurry. It was concluded that the hydrogen release rate of HRC® was not sufficient to support ongoing reductive dechlorination of TCE in the groundwater.

3) Zero Valent Iron Pilot Tests - In October 2001 and May and June 2003, zero valent iron (ZVI) pilot tests were conducted at the site to evaluate the effectiveness of the ZVI technology to create a treatment zone to intercept and treat TCE impacted groundwater. Injection of micro-scale ZVI particles and placement of a permeable reactive barrier (PRB) were both tested at the site after laboratory bench scale testing confirmed that ZVI could reduce TCE concentrations to below 5 µg/L within 24 days. In October 2001, micro-scale ZVI particles were injected under pressure into nine injection points reducing TCE concentrations temporarily. In May and June 2003, a ZVI PRB was constructed across the water table using patented technology. Again, monitoring showed a temporary decrease in TCE concentrations, but TCE concentrations have rebounded. The ZVI technologies were not effective because of 1) the apparently highly oxygenated environments of the groundwater, and 2) the difficulty in achieving sufficient iron concentration and exposure duration along the contaminant flow path.

4) Hydrogen/Nutrient Pilot Test – In September 2002, a hydrogen/nutrient (propane) pilot test was completed to determine if the gas injection technology would be successful in enhancing the biodegradation process of TCE in groundwater. No decrease in TCE concentrations in groundwater were detected during or after the injection of propane into the groundwater.

5) Soil Vapor Extraction Pilot Test - From August 2006 to present, a soil vapor extraction (SVE) pilot is being conducted. The SVE pilot test system has been removing TCE at a rate varying from 2 to 9 pounds per month. The majority of the mass removed has been from the vadose zone just above the water table. Reductions in groundwater TCE concentrations were seen only at shallow depths (two to three feet below the water table). Removal of TCE from the groundwater by SVE is diffusion-limited. For TCE below depths eight to ten feet below the water table, it would take greater than 50 years for the TCE to off-gas out of groundwater and into the vadose zone.

6) Enhanced Reductive Dechlorination (ERD) Pilot Test - From July 2004 to present, an ERD pilot test is being conducted at the site that consists of four injection wells and two observation wells, carbon substrate mixing and injections, and performance monitoring. Overall decreasing TCE concentration trends were recorded in performance monitoring wells in the ERD pilot test area when compared to the baseline sampling results. During the first 300 to 400 days, the decreases in TCE concentrations can be attributed to dilution rather than to the reductive dechlorination process, as indicated by the absence of corresponding amounts of TCE degradation products (cis-1,2 dichloroethene [cis-1,2 DCE], vinyl chloride, and ethene). Since then, the pilot test showed increases in cis-1,2-DCE concentrations in the four monitoring points, indicating reductive dechlorination. Both concentrations of TCE and cis-1,2-DCE are being reduced to towards their respective MCLs.

   There was successful delivery of the carbon substrate to the monitoring well network as shown by the total organic carbon (TOC) response in the monitoring wells. The introduction of TOC reduced the ambient aerobic conditions (*i.e.,* enhanced reductive environment) in the groundwater, as shown by the onset of methanogenesis (production of methane) during the second half of the pilot test.

5. Enhanced Reductive Dechlorination

ERD is an engineered biological remedial approach using native microbes that occur in the soil. A dilute solution of molasses (the carbon substrate) is injected into the groundwater contaminated with chlorinated solvents through injection wells to create an in-situ reductive zone. The molasses acts as food for the microbes and the microbes consume both the molasses and the chlorinated solvents in groundwater. By maintaining excess organic carbon in the groundwater, through periodic injection of a dilute molasses solution via injection wells, the enhanced reductive dechlorination technology stimulates microbial activity, driving the groundwater environment within the reactive zone to anaerobic and strongly reducing conditions. This subsurface reducing environment facilitates rapid rates of degradation of chlorinated solvents to progressively less chlorinated intermediates and finally to chlorine salts, carbon dioxide and water. If the highest concentration of TCE detected in the plume (2.1 mg/L) was totally degraded to chlorine salts, carbon dioxide and water, then the total dissolved solids in groundwater would increase 2.1 mg/L (or 2.1 parts per million) as a result of the proposed corrective action.

Groundwater modeling of the contaminant plume was conducted comparing migration of the TCE plume with and without ERD treatment, assuming a 30-year period of groundwater movement. Without treatment and considering only natural attenuation, the degradation rates for TCE was very low and TCE in groundwater would still exceed WQOs. The B210A ERD Pilot Test documented increased degradation rates for TCE and its degradation products. The proposed remedy was modeled assuming a treatment period of twenty years to simulate the conditions of ERD treatment and natural attenuation. The modeling results indicate that the concentration TCE and its degradation products will be reduced to WQOs within 30 years and reach background within 50 years.

6. Proposed Corrective Actions

The Army developed remedial action objectives for the B210A based on likely future land use, which is consistent with the (1) current use as an operating Army facility and (2) current and future use for the Doyle Wildlife Area as a wintering ground for mule deer. The remedial action objectives for the B210A are (1) remediate and monitor groundwater until groundwater has obtained background water quality objectives, (2) protect human health by preventing exposure to groundwater that has contaminant concentrations above state and federal drinking water requirements, and (3) limit the potential for exposure to residual hazardous substances above unrestricted use cleanup levels.

The Army's Feasibility Study evaluated the following remedial alternatives:

Alternative 1 – *No Action*.

Alternative 2 – *Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs)*.

Long-term groundwater monitoring would be conducted for a period of 30 years to determine natural attenuation of the groundwater plume due to dispersion, dilution and degradation. LUCs, such as a prohibition of drilling groundwater supply wells, will be implemented to protect against potential exposure to groundwater. Estimated present worth cost - $1.5 million.

Alternatives 3a through 3c - *Targeted In-situ Treatment using Enhanced Reductive Dechlorination with MNA and LUCs.*

Based on the results of the pilot test, ERD is a viable technology for reducing TCE concentrations in the groundwater as shown by the reduction of TCE and cis-1,2-DCE concentrations towards their respective MCLs.

Alternative 3a consists of approximately 50 ERD injection wells on-site with an active remediation period of approximately 15 years. Estimated present worth cost- $4.5 million.

Alternative 3b consists of approximately 70 ERD injection wells on-site as well as some off-site in the Doyle Wildlife Area with an active remediation period of approximately 20 years. Estimated present worth cost - $6.3 million.

Alternative 3c consists of approximately 125 ERD injection wells, on-site and off-site, with an active remediation period of approximately 20 years. Estimated present worth cost - $9.8 million.

The ERD injection well transects would be installed across the area of the plume with the highest TCE concentration greater than (500 µg/L). Transects would be spaced throughout the plume at approximately 900 feet apart, equivalent to five years of transport time. The spacing between the wells within each transects would be 50 feet. The first five-year review would evaluate the effectiveness of the remedy.

Alternative 4 – *Targeted Treatment with SVE with MNA and LUCs*.

This alternative includes active remediation using the SVE process. The proposed system would target areas with the highest TCE concentrations within the site (TCE greater than 500 µg/L) and is estimated to be operated for approximately 20 years to remove a majority of the COCs from groundwater. Based on the pneumatic conductivity and TCE reduction achieved in the B210A Pilot Test, approximately 70 extraction wells at 80-foot spacing (50-foot radius of influence with 20 percent overlap) would be required to cover this area. The system would be operated such that half of the wells (35) would be operated as extraction wells, while the other half would be operated as passive vent wells. The operation of passive vent wells would enhance TCE removal from the groundwater by drawing fresh air across the water table. The wells would be rotated from extraction to passive vents as the TCE concentrations change over time. Estimated present worth costs – $11.8 million.

Alternatives 5a through 5c – *Targeted In-situ Treatment via ERD with SVE Enhancement, MNA and LUCs.*

Alternative 5a consists of approximately 50 ERD injection wells on-site with an active remediation period of approximately 15 years in conjunction with SVE treatment using portable units over 2 years. Estimated present worth cost- $5.6 million.

Alternative 5b (Figure 3) consists of approximately 70 ERD injection wells on-site as well as some off-site in the Doyle Wildlife Area with an active remediation period of approximately 20 years in conjunction with SVE treatment using four portable units over three years. Estimated present worth cost - $7.6 million.

Alternative 5c consists of approximately 125 ERD injection wells, on-site and off-site, with an active remediation period of approximately 20 years in conjunction with SVE treatment using eight portable units over four years. Estimated present worth cost - $13.4 million.

The transects for alternatives 5a, 5b, and 5c would be spaced at a distance of 900 feet, equal to five years of transport time. Wells would be spaced 50 feet apart within these transects. The wells would be constructed so they can be used as ERD injection wells, SVE extraction wells, or passive vent wells. Therefore, during times when the wells are

not being used for carbon substrate injection, they could be used for SVE operations.

Periodic molasses injections would be completed in the injection wells at each transect. Initial injection frequency, concentrations, and volumes would be similar to those during the later phase of the ERD pilot test, characteristically at low molasses concentration and high volume. Carbon substrate injections would be completed at half of the injection wells each quarter, resulting in semiannual injections at each well. Frequency of the injections, molasses concentration, and injection volume would be adjusted throughout the process based on monitoring observations to optimize the subsurface conditions that promote ERD.

SVE would be implemented at every other well within the transects, using the wells in between the extraction wells as passive vent wells. Existing monitoring wells located between the transects with appropriate screen intervals (i.e., those screened across the water table with a minimum of 3 feet of screen above the water table) would also be opened to the atmosphere to promote air movement between transects. The SVE operations would be accomplished with mobile, trailer-mounted units containing a 15-horsepower regenerative blower, knock-out drum, granular activated carbon (GAC), and associated controls. Each well would be individually piped to an extraction manifold and metered to provide adequate control of the extraction flow rates from each well. All extraction piping would be run above grade to provide flexibility in the operation of the SVE system.

After the completion of ERD and SVE at the site, MNA would be implemented to remediate the remaining low levels of COCs. In addition, the Army would implement and manage LUCs at the site until COC concentrations in groundwater have been reduced to levels that allow for unrestricted use and exposure.

The above alternatives were compared against the nine CERCLA required criteria shown below to evaluate remedial alternatives. These criteria are:

1. Overall protectiveness;
2. Compliance with state and federal requirements;
3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, or volume;
5. Short-term effectiveness;
6. Implementability;
7. Cost;
8. Regulatory agency acceptance; and
9. Community acceptance.

7. Selected Remedy- Alternative-5b

Based on the detailed evaluation of the potential remedial alternatives for the B210A groundwater, the Army recommends Alternative 5b (70 ERD wells and 20 years of active remediation in conjunction with SVE treatment over three years) be implemented as the remedial action. Groundwater modeling shows that this remedy will achieve MCL levels within 30 years and approach background levels within 50 years through naturally occurring physical (e.g., dilution, dispersion, volatilization), chemical (e.g., hydrolysis, iron reduction), and biological degradation processes. Long-term groundwater monitoring will be conducted for a period of 30 years, in order to confirm that concentrations of COCs in groundwater are decreasing and approaching background levels.

Five-year reviews of the selected remedy will be performed by the State of California (Department of Toxic Substances Control and Lahontan Water Board staff) since the selected remedy will require an extended time frame to meet cleanup goals and contaminants will remain in soil and groundwater at concentrations that do not allow for unlimited use and exposure. These reviews will be conducted every five years after the ROD is signed, until concentrations of contaminants are reduced to levels that allow for unlimited use and unrestricted exposure, to ensure that the remedy continues to provide adequate protection of human health and the environment. Alternative 5b is protective of public heath and the environment, and any residual contamination does not pose an unacceptable risk. Estimated present worth cost using a discount rate of 4 percent for a 30-year time period for this alternative is $7.6 million (see Table 1).

The selected remedy provides the best ratio of overall effectiveness relative to cost in comparison to the other alternatives considered for the site. The remedy

provides superior short-term effectiveness, long-term effectiveness and permanence, and reduction of toxicity, mobility and volume through treatment.

8. Volume and Fate of Molasses

The molasses solution is 1% based on volume. Assuming an effective porosity of 15%, the total solution that is needed for each injection well (to reach a radius of influence of 25 feet) is approximately 44,000 gallons, which indicates a pure molasses volume of 440 gallons. The total pure molasses for the proposed 70 wells is 30,800 gallons for one injection event. Based on the above calculation, the total pure molasses volume for the porosity of 15% is about 1,850,000 gallons, assuming quarterly injections in the first 10 years and semiannual injections in the second 10 years.

The injection of large volume of molasses solution should not cause significant increase in the total dissolved solids (TDS) concentrations in groundwater. The rationale is as follows:

TDS is a measure of the combined content of all inorganic and organic substances, which are present in a groundwater sample in two forms: ionized and molecular. The ionized species can be approximately estimated by the magnitude of the conductivity value, because the conductivity of the water sample is due to the presence of dissolved ionic species. The molecular hydrocarbons can be estimated by the total organic carbon (TOC) in a groundwater sample.

The Army's consultant, ARCADIS, has measured the specific conductance of molasses solutions ranging from 0.5 to 1%, by volume, with specific conductance values ranging from 1,000 to 3,000 microsiemens per centimeter (µS/cm). The site background specific conductivity values are in the range of 2,500 µS/cm, showing similar electrical conductivity as the 1% concentration. This indicates that the dissolved ionic species concentrations in the 1% molasses solution are close to those in the site background concentrations. Therefore, injection of 1% molasses solution will not change the dissolved ionic species concentrations in groundwater significantly.

The target TOC concentration in the groundwater within the radius of influence of an injection well is 3,000 milligrams per liter (mg/L). ARCADIS estimates the half life of molasses is about 20 days. A half life of 20 days suggests that TOC concentration will be below 100 mg/L after 3 months. Therefore, there will not be any significant increase in the TDS concentration because of the molecular organic carbon contribution in the TDS measurement in the long term.

9. Compliance with State Requirements

Water Board staff's evaluation of the proposed remediation for the B210A has determined that the proposed remedy meets requirements of the Basin Plan, State laws, policies and regulations, as summarized below:

A. Section 13304 of the California Water Code requires dischargers that have polluted groundwater to clean it up. Water Board staff agree that the Army's proposed remedy to clean up the groundwater at the B210A satisfies Section 13304.

B. State Water Resources Control Board (State Board) adopted Resolution No. 92-49, the *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*. This Policy sets forth the policies and procedures to be used during an investigation or cleanup of waste and requires that cleanup standards be consistent with State Board Resolution 68-16 (the nondegradation policy). State Board Resolution 92-49 and the Basin Plan for the Lahontan Region establish the cleanup levels to be achieved. Section III.G of Resolution 92-49 states in part that dischargers are required to cleanup and abate the effects of discharges in a manner that promotes attainment of background water quality, or the best water quality which is reasonable if background levels cannot be restored, or if that is not reasonable, to an alternative level that is the most stringent level that is economically and technologically feasible in accordance with California Code of Regulations (CCR), title 23, section 2550.4.

   The Army's proposed cleanup action is expected to reduce TCE and its degradation products to below the MCL in a reasonable period of time (30 years) and approach background groundwater quality within 50 years. This approach complies with the substantive requirements of Resolution No. 92-49, III.G and CCR, title 23, section 2550.4. Water Board staff agree that the Army's proposed remedy complies with State Board Resolution. No. 92-49.

C. In accordance with State Board Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Waters in California*) and the Water Quality Control Plan for the Lahontan Region (Basin Plan), water degradation may be allowed if the following conditions are met: 1) any change in water quality must be consistent with maximum benefit to the people of the State; 2) will not unreasonably affect present and anticipated beneficial uses; and 3) will not result in water quality less than that prescribed in the Basin Plan; and 4) discharges must use the best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with maximum benefit to the people of the State.

The Enhanced Reductive Dechlorination process is designed to be the equivalent of the Best Practicable Technology, as required by State Board Resolution No. 68-16. In addition, molasses injection has been calculated to be the lowest dosage possible for creating anaerobic reducing conditions and should not unreasonably affect present and anticipated beneficial uses in treated groundwater. Degradation to water quality by the revised project will be confined to a limited area within the project boundaries and will occur for only a limited time. The long-term benefit of the project will result in removal of TCE and its degradation products from groundwater and restore groundwater quality to background levels. Therefore, the resulting water quality from this project will be consistent with State Board Resolution No. 68-16. Water Board staff agree that the Army's proposed remedy complies with State Board Resolution No. 68-16.

D. The Basin Plan designates groundwater beneficial uses and establishes water quality objectives to protect those uses. The Basin Plan, Chapter III, Water Quality Objectives, states, in part, the following: "Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses." "Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels specified in title 22, CCR." The Basin Plan requires the polluted groundwater be restored in compliance with State Board Resolution No. 92-49. Water Board staff agree that the Army's proposed remedy complies with the Basin Plan.

E. The Department of Toxic Substances Control (DTSC) noticed the Proposed Plan for a 30-day public comment period ending February 3, 2010. No comments were received. DTSC prepared and signed a mitigated negative declaration for the B210A ROD, per the California Environmental Quality Act. The mitigation measures include land use controls, such as prohibiting installation of water supply wells, until groundwater is cleaned enough for unrestricted use.

10. Agree-to-Disagree Position Regarding State Requirements

Water Board staff assert that 42 United States Code section 9620(a)(4) (CERCLA section 120(a)(4)) is fully applicable because the ROD is for a non-NPL site. CERCLA section 120(a)(4) provides that state laws concerning removal and remedial actions apply to cleanups of facilities owned or operated by the United States, if such facilities are not included on the NPL. Because the ROD pertains to a non-NPL site, the State reserves the right to invoke CERCLA

section 120(a)(4) if needed and does not agree to waive this provision in any manner.

The Army disagrees about whether the following are Applicable or Relevant and Appropriate Requirements under CERCLA for the B210A ROD:

(1) California Water Code, section 13304,
(2) State Board Resolution No. 92-49,
(3) State Board Resolution No. 68-16,
(4) California Code of Regulations (CCR), title 23, Chapter 15, section 2550.4,
(5) Chapter 2, *Beneficial Uses*, Chapter 3, *Water Quality Objectives*, and the Sections "Regionwide Prohibitions" numbers 1 through 4, "Requirements for Site Investigation and Remediation" and "Cleanup Levels" from Chapter 4, *Implementation,* of the Lahontan Basin Plan, and,
(6) Secondary MCLs.

Water Board staff do not agree with the Army's conclusion that State Board Resolution No. 92-49 and CCR, title 23, Chapter 15, section 2550.4 are not applicable requirements for this cleanup. However, staff agrees that, in this case, the proposed actions would comply with State Board Resolution 92-49 and Resolution 68-16, CCR, title 23, section 2550.4 and the Lahontan Basin Plan.

In short, Water Board staff asserts that (1) California Water Code section 13304, (2) State Board Resolution No. 92-49, (3) State Board Resolution No. 68-16, (4) CCR, title 23, Chapter 15, section 2550.4, (5) Chapter 2, *Beneficial Uses*, Chapter 3, *Water Quality Objectives*, and the Sections "Regionwide Prohibitions" numbers 1 through 4, "Requirements for Site Investigation and Remediation" and "Cleanup Levels" from Chapter 4, *Implementation,* of the Lahontan Basin Plan, and, (6) Secondary MCLs, are applicable requirements because they specifically address remedial actions to be taken in order to protect the quality of the waters of the State. Water Board staff asserts they are substantive requirements that are legally enforceable, of general applicability, and more stringent than federal requirements.

11. Conclusions

In January 2010, the United States Army submitted a Draft ROD for the B210A for SIAD to DTSC and the Lahontan Water Board. Water Board staff has reviewed the ROD and other available data and information. Based on our review, the technical remedies proposed for the soil and groundwater meet requirements of the Basin Plan, State laws and regulations and State Board

policies. The Army and the Water Board staff "agree to disagree" over the applicability of the above mentioned state requirements.

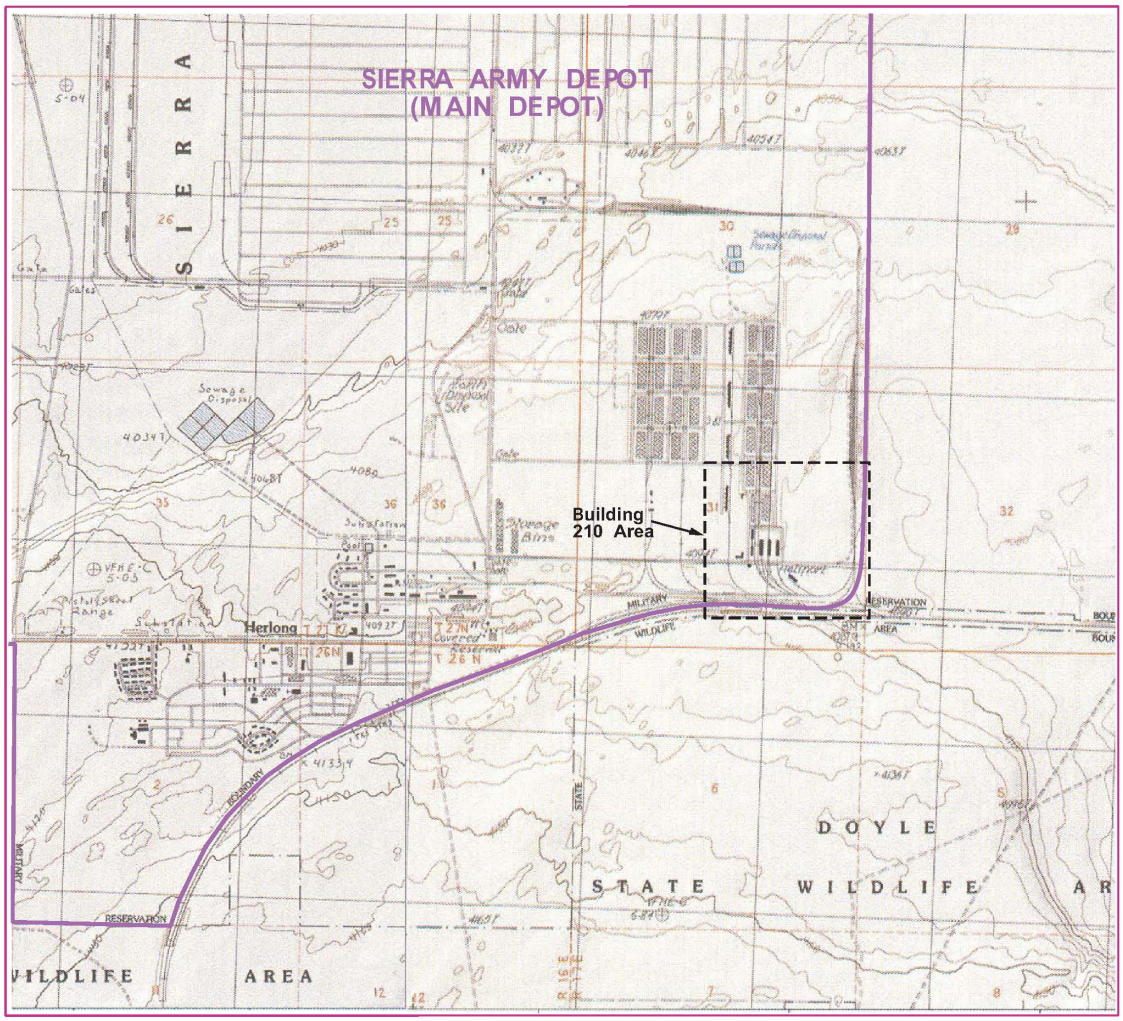
12. Recommendation

The Army has prepared the Draft ROD with a remedy that satisfies state requirements. The Water Board is party to the Federal Facilities Site Remediation Agreement for the SIAD and is now asked to sign the B210A ROD indicating it concurs with the actions proposed in the ROD. Staff recommends that the Board adopt a resolution authorizing the Executive Officer to sign the B210A ROD.

Enclosures:

Figure 1 - Site Location Map
Figure 2 - Possible Historic Sources, Building 210 Area
Figure 3 - Recommended Alternative 5b, Building 210 Area
Table 1 - Estimated Costs for Alternative 5b

JEB/SIADstaffReport.B210A.May2010.doc



CONTOUR INTERVAL 10 FEET

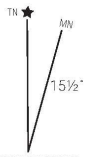
SCALE 1:37,598

0 .5 1 MILE

1000 0 1000 2000 3000 4000 5000 FEET

1 .5 0 1 KILOMETER

QUADRANGLE LOCATION



MAGNETIC DECLINATION
ON 12/10/03

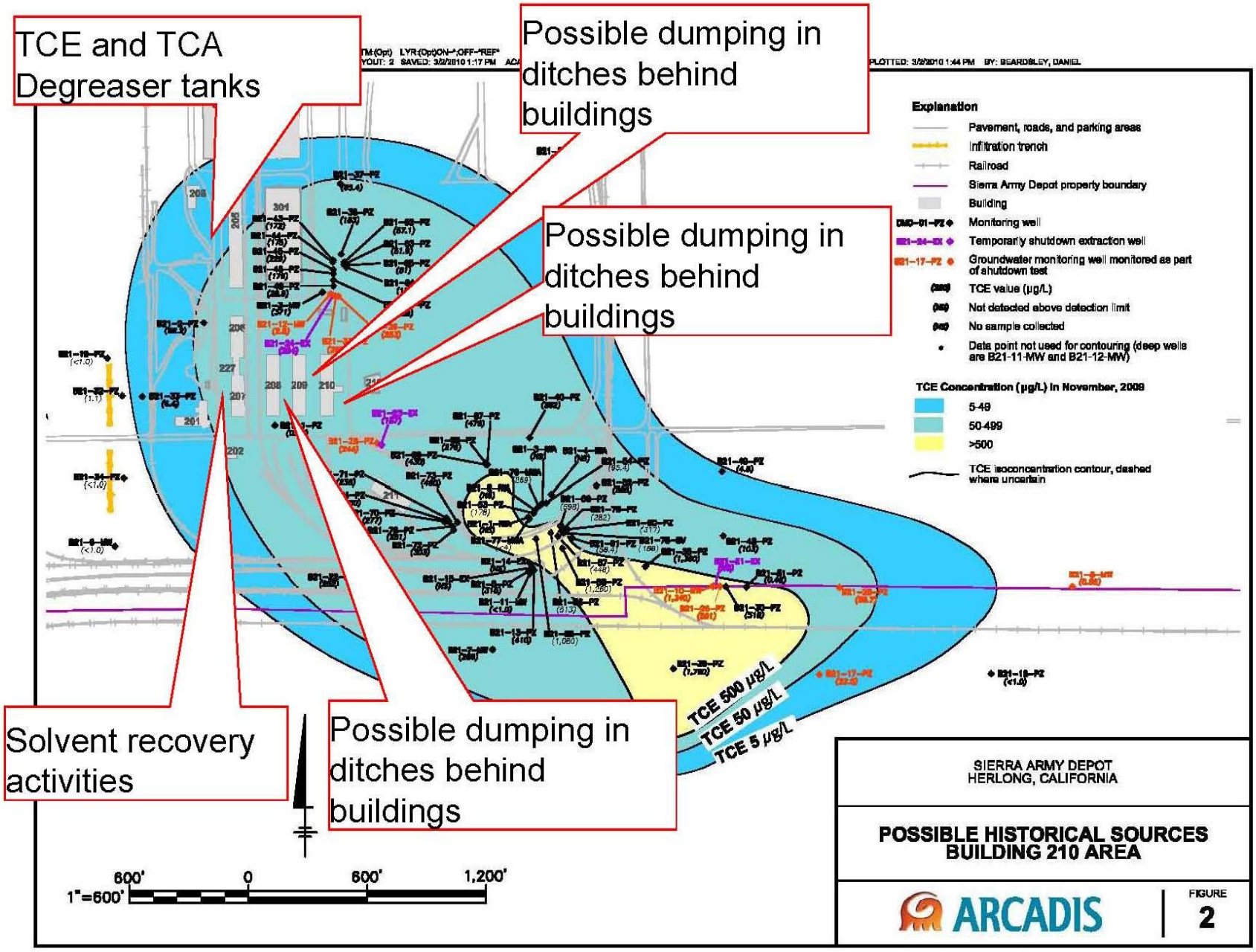
Reference: USGS Herlong, CA and Calneva Lake, CA Quadrangles; 7.5-minute Series, 1986.

SIERRA ARMY DEPOT
HERLONG, CALIFORNIA
BUILDING 210 AREA

SITE LOCATION MAP

ARCADIS

FIGURE
1


TCE and TCA Degreaser tanks
Possible dumping in ditches behind buildings
Possible dumping in ditches behind buildings
Solvent recovery activities
Possible dumping in ditches behind buildings
Explanation
Pavement, roads, and parking areas
Infiltration trench
Railroad
Sierra Army Depot property boundary
Building
Monitoring well
Temporarily shutdown extraction well
Groundwater monitoring well monitored as part of shutdown test
TCE value (µg/L)
Not detected above detection limit
No sample collected
Data point not used for contouring (deep wells are B21-11-MW and B21-12-MW)
TCE Concentration (µg/L) in November, 2009
5-49
50-499
>500
TCE isoconcentration contour, dashed where uncertain
TCE 500 µg/L
TCE 50 µg/L
TCE 5 µg/L
600' 0 600' 1,200'
1"=600'
SIERRA ARMY DEPOT
HERLONG, CALIFORNIA
POSSIBLE HISTORICAL SOURCES
BUILDING 210 AREA
ARCADIS
FIGURE
2

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Emeryville\ACT\RC000654\0022\NA0025\Figure 7_4oxC009 TCE.dwg LAYOUT: 3 SAVED: 3/2/2010 1:17 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: — PLOTSTYLETABLE: LFR STANDARD.CTB PLOTTED: 3/2/2010 2:20 PM BY: BEARDSLEY, DANIEL
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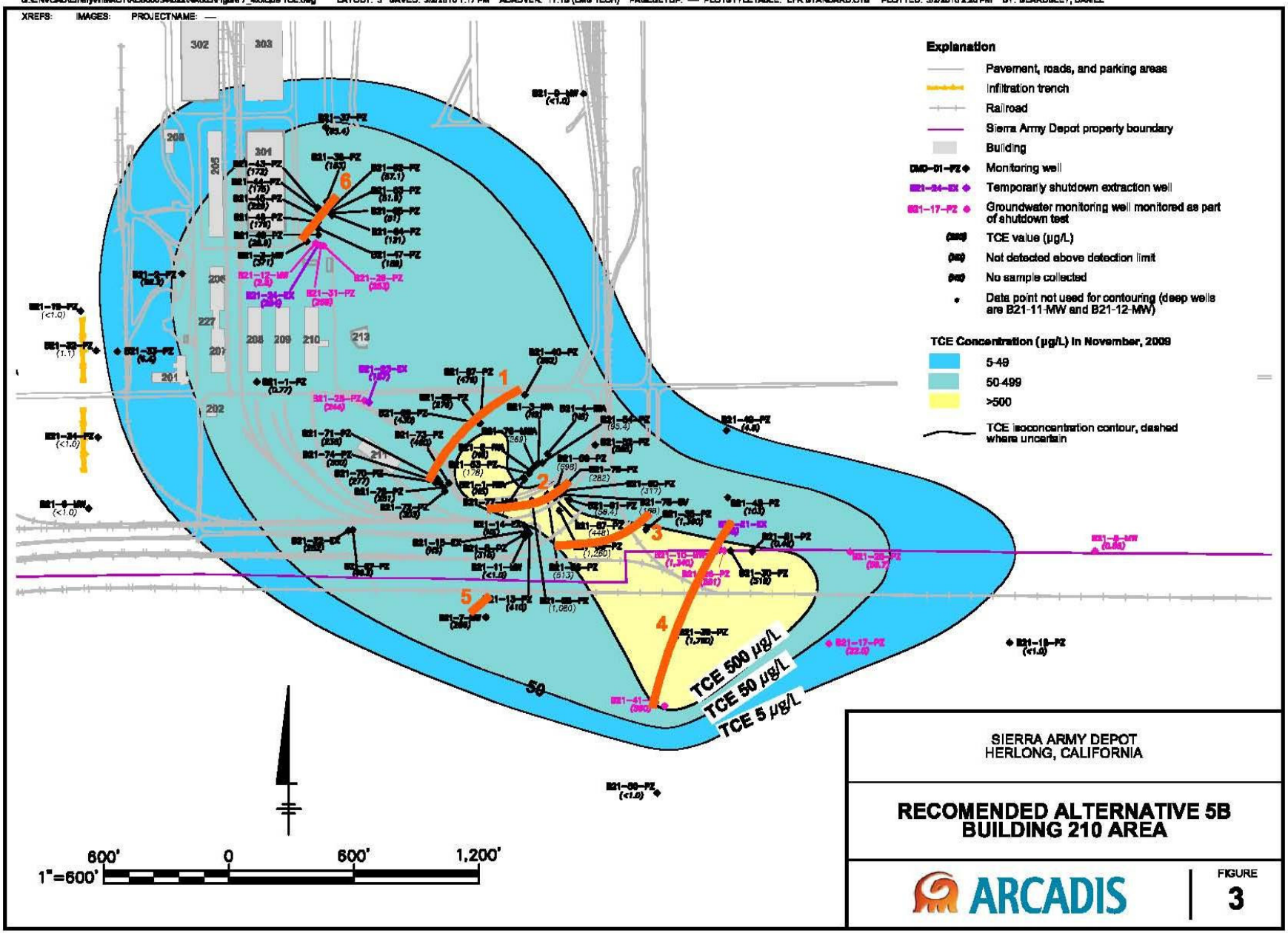

SIERRA ARMY DEPOT
HERLONG, CALIFORNIA

RECOMENDED ALTERNATIVE 5B
BUILDING 210 AREA

ARCADIS

FIGURE
3

Table 1
Estimated Costs for Alternative 5b
Building 210 Area
Sierra Army Depot
Herlong, California

Item	Description	Units	Unit of Measure	Unit Cost	Total
	Capital Costs				
1	Monitoring Well Installation 8 Additional Monitoring Wells (between transects)	8	Well	$ 15,000	$ 120,000
2	Injection Well Installation (70 Injection Wells)	70	Well	$ 15,000	$ 1,050,000
3	SVE and ERD System Installation (4 portable SVE units)	1	LS	$ 301,795	$ 301,795
4	Land Use Controls- Changes to SIAD Master Plan	1	LS	$ 10,000	$ 10,000
5	**TOTAL CAPITAL COST FOR ALTERNATIVE 5b**				**$ 1,481,795**
	Long Term Operations and Maintenance				
6	Quarterly ERD Injections and Monitoring (Years 1-20)	20	Annual	$ 109,423	$ 2,188,456
7	SVE O&M (Years 1-3 - operation of 4 blowers)	3	Annual	$ 221,906	$ 665,718
8	Quarterly Groundwater Monitoring and Reporting (Year 1)	4	Quarters	$ 31,603	$ 126,413
9	Annual Groundwater Monitoring and Reporting (Years 2-30)	29	Annual	$ 31,603	$ 683,400
10	5-Year Reviews (Years 5, 10, 15, 20, 25, 30)	6	Annual	$ 74,896	$ 449,376
11	Total Long Term Costs (without 4% during 30 years)				$ 4,113,364
12	**TOTAL LONG TERM COSTS (Present Value based on 30 years at 4%)**				**$ 3,098,845**
13	SUBTOTAL COST FOR ALTERNATIVE 5b (Add Items 5 and 12)				$ 4,580,639
14	**Mobilization and Demobilization (6% of Cost)**				**$ 274,838**
15	**Engineering (15% of Cost)**				**$ 687,096**
16	**Construction Management (20% of Cost)**				**$ 916,128**
17	**Contingency (25% of Cost)**				**$ 1,145,160**
18	**TOTAL COST FOR ALTERNATIVE 5b**				**$ 7,603,862**