

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION**

**RESOLUTION R6T-2008-(PROPOSED)**

**AUTHORIZING THE EXECUTIVE OFFICER TO SIGN  
THE RECORD OF DECISION  
FOR ABANDONED LANDFILL/ SOUTHERN SITES AREA,  
SIERRA ARMY DEPOT**

Lassen County

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

1. In June 2008, the United States Army submitted a Draft Final Record of Decision (ROD) for the Abandoned Landfill/Southern Sites Area (ALF/SSA) for Sierra Army Depot. The Army will remediate chlorinated solvents in groundwater, primarily trichloroethene, using in-situ reactive zone (IRZ) dechlorination. Major components of the selected remedy are: IRZ treatment, monitored natural attenuation, and land use controls.
2. The proposed remedial activities in the June 2008 Draft Final 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 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 June 2008 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 Final and the Final Record of Decision.

I, Harold J. Singer, Executive Officer, do hereby 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 July 23 and 24, 2008.

**HAROLD J. SINGER  
EXECUTIVE OFFICER**

**STAFF REPORT**

**RECORD OF DECISION**

**ABANDONED LANDFILL / SOUTHERN SITES AREA**

**SIERRA ARMY DEPOT**

**July 2008**

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

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**Reviewed by: Richard Booth, Senior Engineering Geologist**

## 1. Introduction

This item provides information for the Lahontan Regional Water Quality Control Board (Water Board) when considering whether it concurs with a Record of Decision (ROD) for remedial actions at the Abandoned Landfill and Southern Sites Area (ALF/SSA) at the Sierra Army Depot (SIAD). The Army is proposing to actively remediate chlorinated solvents in groundwater using in-situ reactive zone dechlorination. Background water quality will be achieved within a reasonable period of time (30 to 50 years or less).

ALF/SSA 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. This ALF/SSA 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 ALF/SSA consists of the following components:

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

The primary constituent of concern in groundwater is trichloroethene (TCE). The Army's proposed cleanup action is expected to reduce TCE and its degradation products to below drinking water standards (maximum contaminant levels) in a reasonably short period of time (2 to 10 years) and can be reasonably expected to reduce contaminant concentrations to background levels in thirty years and certainly within fifty years. Remedial actions proposed for the ALF/SSA meet state requirements and are feasible, cost effective methods to restore groundwater. 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.

## 2. ALF/SSA Site Information

SIAD is in the Honey Lake Valley of Lassen County, approximately 40 miles southeast of Susanville (Figure 1). SIAD occupies approximately 38,000 acres. The surrounding land use is mostly open space/grazing areas. The ALF/SSA is located in the southern portion of the SIAD (Figure 2). The neighboring community of Herlong is next to the southern entrance to SIAD's Main Depot.

The Abandoned Landfill (ALF) (Figure 3) was used as the main disposal area for domestic wastes at SIAD from the early 1940s to 1965. The primary method of disposal was waste burning followed by spreading and burning of resulting residue. The dimensions of the ALF are approximately 1,800 by 2,500 feet (approximately 103 acres). The ALF is a trench type landfill. The landfill is not an engineered landfill, and therefore does not have a liner or leachate collection system. Geophysical and soil gas surveys conducted at the ALF identified two burial trenches in the western portion of the landfill and scattered areas of shallow debris; however, disposal areas within the landfill were not well documented. The ground surface in this area is not covered with asphalt, pavement, or any other impermeable surface.

The Southern Sites Area (SSA) (Figure 3) is located immediately south of the ALF. The SSA was used for chemical storage, fuel storage and dispensing, and vehicle maintenance and cleaning. Many of these locations formerly contained underground storage tanks (USTs) that stored solvents, motor fuels, or waste oil. The dimensions of the site are approximately 1,200 by 2,100 feet (approximately 58 acres). Approximately 80 percent of the SSA ground surface is covered with asphalt or pavement.

## 3. ALF/SSA 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. Recharge to the groundwater near Honey Lake is predominantly from subsurface flow from the surrounding mountains and upland areas. Other sources of recharge at SIAD are seepage of landscape irrigation and possible exfiltration from sewer lines.

In general, the strata at ALF/SSA consist of sands with interbedded silt/clay sequences in three interconnected hydrostratigraphic zones: 1) Perched Zones, 2) Upper Aquifer Zones ("A" [83 to 124 feet below ground surface (bgs)], "B" [125 to 162 feet bgs], and "C" [174 to 205 feet bgs]), and 3) Deep Zones. The majority of the regional water supply is drawn from the deep zones, which extend below the "C"-zone (from approximately 205 feet bgs).

Two potable supply wells were installed on the southern side of the SSA between 1953 and 1968, and supplied water to the SSA that contained naturally occurring total dissolved solids (TDS) that averaged 1,075 milligrams per liter (mg/L), and ranged from 455 to 4,340 mg/L. One supply well (PSW-08) is currently operated for approximately two weeks per year during the summer in periods of high demand, the other (PSW-02) is no longer in operation because of nitrate concentrations exceeding the maximum contaminant level (MCL). PSW-02 is screened at multiple depths between 167 and 655 bgs, and PSW-08 is screened at multiple depths between 165 and 690 feet bgs. PSW-08 is the well closest to the ALF/SSA plume. Protecting this well from potential contaminant impacts is the primary concern for limiting contaminant migration from the shallow "A"-zone.

TCE is the primary constituent of concern (COC) in groundwater beneath ALF/SSA, with associated chlorinated volatile organic compounds (VOCs) and their breakdown products also detected. TCE is primarily present in the "A"-zone, where the maximum concentration of TCE is approximately 150 micrograms per liter ( $\mu\text{g/L}$ ). The concentration of TCE in the "B"- and "C"-zones ranges from non-detect (at a reporting limit of 0.5  $\mu\text{g/L}$ ) to approximately 5  $\mu\text{g/L}$ . The MCL for TCE in tap water is 5  $\mu\text{g/L}$ .

Water Quality Control Plan for the Lahontan Region (Basin Plan) identified present and potential beneficial water uses. Beneficial uses of the groundwater beneath the ALF/SSA include municipal and domestic supply, agricultural supply, industrial service supply and freshwater replenishment.

#### **4. ALF/SSA Site Investigations and IRZ Pilot Study**

Previous investigations at the ALF/SSA consisted of nine site investigations conducted between 1990 and 2002. These investigations determined the disposal site boundaries at the ALF, defined the horizontal and vertical extent of elevated concentrations of COCs in soil and groundwater, evaluated the potential for COCs detected in soil to impact groundwater, evaluated the potential for vertical migration of contaminants into the deeper aquifer zones, and characterized the geology and hydrogeology of the ALF/SSA for modeling purposes. A detailed summary of these investigations was provided in the Draft Final Feasibility Study for ALF/SSA (ARCADIS, 2007).

The area of SSA groundwater contamination that exceeds the MCL for TCE is approximately 30 acres. The SSA plume extends across most of the SSA in the east-west direction and then into the ALF. The ALF plume is also approximately 30 acres but has a lower TCE concentration. Both plumes are present in the shallow "A-zone" groundwater (Figure 4).

An in-situ reactive zone (IRZ) Pilot Study began in July 2004 to evaluate the effectiveness of the enhanced reductive dechlorination to treat TCE, the primary COC in groundwater. Local concentrations of TCE were reduced to levels below

the MCL as a result of the Pilot Study. A line of proposed injection wells will be installed perpendicular to the direction of groundwater flow, with individual injection wells spaced 40 feet apart to optimize the enhanced reductive dechlorination of the COCs.

Enhanced reductive dechlorination is an engineered biological remedial approach using native microbes that occur in the soil. A dilute solution of molasses is injected into the groundwater contaminated with solvents through injection wells/points to create an IRZ. 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.

Groundwater modeling of the contaminant plume was conducted assuming a 30-year period of transport of TCE. Increased degradation rates, which were based on the degradation rates observed during the ALF/SSA IRZ Pilot Test, were applied over a period of 3 years to simulate the conditions of treatment. Modeling was conducted assuming different pumping rates from the active public supply well PSW-08. The modeling results indicate that as a result of enhanced reductive dechlorination and natural attenuation, the proposed remedy can be reasonably expected to reduce contaminant concentrations to background levels in thirty years. Because of the essentially asymptotic (very slowly changing with time) behavior of concentration levels as very low values are reached, and also because of the inherent difficulty in precisely predicting groundwater flow and transport processes in general, it is impossible to be certain background levels will be attained within thirty years.

## **5. Proposed Corrective Actions**

The Army developed remedial action objectives for ALF/SSA based on its most likely future land use, which is consistent with its current use as an operating Army facility. There are two cleanup action objectives for the ALF/SSA: 1) until groundwater has obtained background water quality objectives, protect human health by preventing exposure to groundwater that has contaminant concentrations above state and federal drinking water requirements and 2) limit the potential for exposure to residual hazardous substances in soils above unrestricted use cleanup levels.

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

Alternative 1 – No Action.

Alternative 2 – Monitored Natural Attenuation and Land Use Controls. Long-term groundwater monitoring will be conducted for a period of 30 years.

Alternative 3a – Targeted In-situ Treatment via Enhanced Reductive Dechlorination with Monitored Natural Attenuation and Land Use Controls. Nine injection wells (three transects with three wells each) in the SSA in the vicinity with highest TCE concentrations. Six additional wells will be installed in pairs, upgradient of select ALF monitoring wells. The treatment period would be 3 years. The proposed treatment action is expected to reduce TCE and its degradation products to below the MCL in a reasonable period of time (2 to 10 years) and can be reasonably expected to reduce contaminant concentrations to background levels in thirty years and certainly within fifty years. Estimated present-worth cost for this alternative is \$2.5 million.

Alternative 3b – Extensive In-situ Treatment via enhanced Reductive Dechlorination with Monitored Natural Attenuation and Land Use Controls. In order to reduce contaminant concentrations to below MCLs across the ALF/SSA within 2 to 3 years, an additional 410 injection wells would be required using enhanced reductive dechlorination. The treatment period would be 10 years and background water quality should be achieved within thirty years. Estimated present-worth cost for this alternative is \$26 million, compared to \$2.5 million for Alternative 3a.

These alternatives were compared against the nine criteria shown below used by the Army 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.

## 6. Selected Remedy- Alternative 3a

Based on the detailed evaluation of the potential remedial alternatives for ALF/SSA groundwater, the Army recommends Alternative 3a be implemented as the remedial action. This alternative will provide permanent long-term effectiveness and is protective of beneficial uses by ensuring that environmental and health concerns due to COCs in groundwater beneath ALF/SSA are minimized. This will be accomplished by installing nine injection wells in the SSA, to reduce concentrations in the plume hotspot, and six injection wells in pairs up-gradient of two hot spots in the ALF. Natural attenuation processes will also reduce the volume and toxicity of contaminated groundwater at the ALF/SSA 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 thirty years, in order to confirm that concentrations of TCE in groundwater are decreasing and approaching background levels. The continued attenuation of the contaminant plume will be confirmed by monitoring down-gradient wells, and the potential for vertical migration of TCE will be monitored by sampling wells in the deeper "B"- and "C"-zones and the Deep Zones.

Five-year reviews of the selected remedy will be performed 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 no less often than every five years after commencement of the remedial action, 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 3a is protective of public health and the environment, and residual contamination does not pose unacceptable risk. Estimated present-worth cost for this alternative is \$2.5 million.

## 7. Compliance with State Requirements

Water Board staff's evaluation of the proposed remediation for the ALF/SSA has determined that the proposed remedy meets requirements of the Water Quality Control Plan for the Lahontan Region (Basin Plan), State laws, policies and regulations. See summary 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 ALF/SSA 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 reasonably short period of time and can be reasonably expected to reduce contaminant concentrations to background levels in thirty 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. State Board Resolution No. 68-16 provides that no degradation occur unless certain conditions are determined by the Water Board to be met. Where polluted groundwater migrates to areas of high quality groundwater, the Water Board has determined the migration of polluted groundwater to be the same as a discharge of waste. The policy requires that waste discharged to existing high quality waters are required to meet best practical treatment of control. In order to comply with this resolution, a mechanism needs to be in-place to reduce the size of the plume and, in addition, the Army must show that there will be no continuing in-situ migration of waste as a result of the cleanup because the plume will become stable. Water Board staff agree that the Army's proposed remedy complies with 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 because the groundwater will not contain concentrations of chemical constituents in excess of the maximum contaminant levels and the polluted groundwater will be restored to background,

E. Section 20950, title 27, CCR provides general standards for closure and post-closure maintenance applicable to waste management units for solid waste. Section (a)(2)(A) describes the closure and post-closure performance standards for landfill units that are not clean-closed. The goal of closure is to minimize the production of leachate and gas, typically accomplished by providing a final cover. Soil gas testing at the ALF documents that gas generation/migration is not occurring. The groundwater monitoring shows that contaminants such as metals, pesticides, VOCs and semi-VOCs present in ALF soil are not a current source of volatile organic compounds to ALF/SSA groundwater. The well-established vegetated soil cover over the ALF serves to limit precipitation infiltration into the waste due to evapotranspiration. Groundwater performance monitoring, land use controls restricting exposure pathways, and maintenance of the cover over the duration of thirty years, satisfy the goal of post-closure maintenance.

### **8. 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 and State agree-to-disagree about whether the following state requirements are Applicable or Relevant and Appropriate Requirements under CERCLA for the ALF/SSA ROD:

- (1) Water Code, section 13304;
- (2) State Board Resolution No. 92-49;
- (3) State Board Resolution No. 68-16;
- (4) CCR, title 23, Chapter 15; and
- (5) CCR, title 27, section 20950
- (6) 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.

Water Board staff do not agree with the Army's conclusion that State Board Resolution No. 92-49 and provisions of California Code of Regulations, title 23, Chapter 15, are not applicable requirements for this cleanup. However, staff agree that, in this case, the proposed actions will comply with State Board Resolution No. 92-49 and that compliance with the provisions of California Code

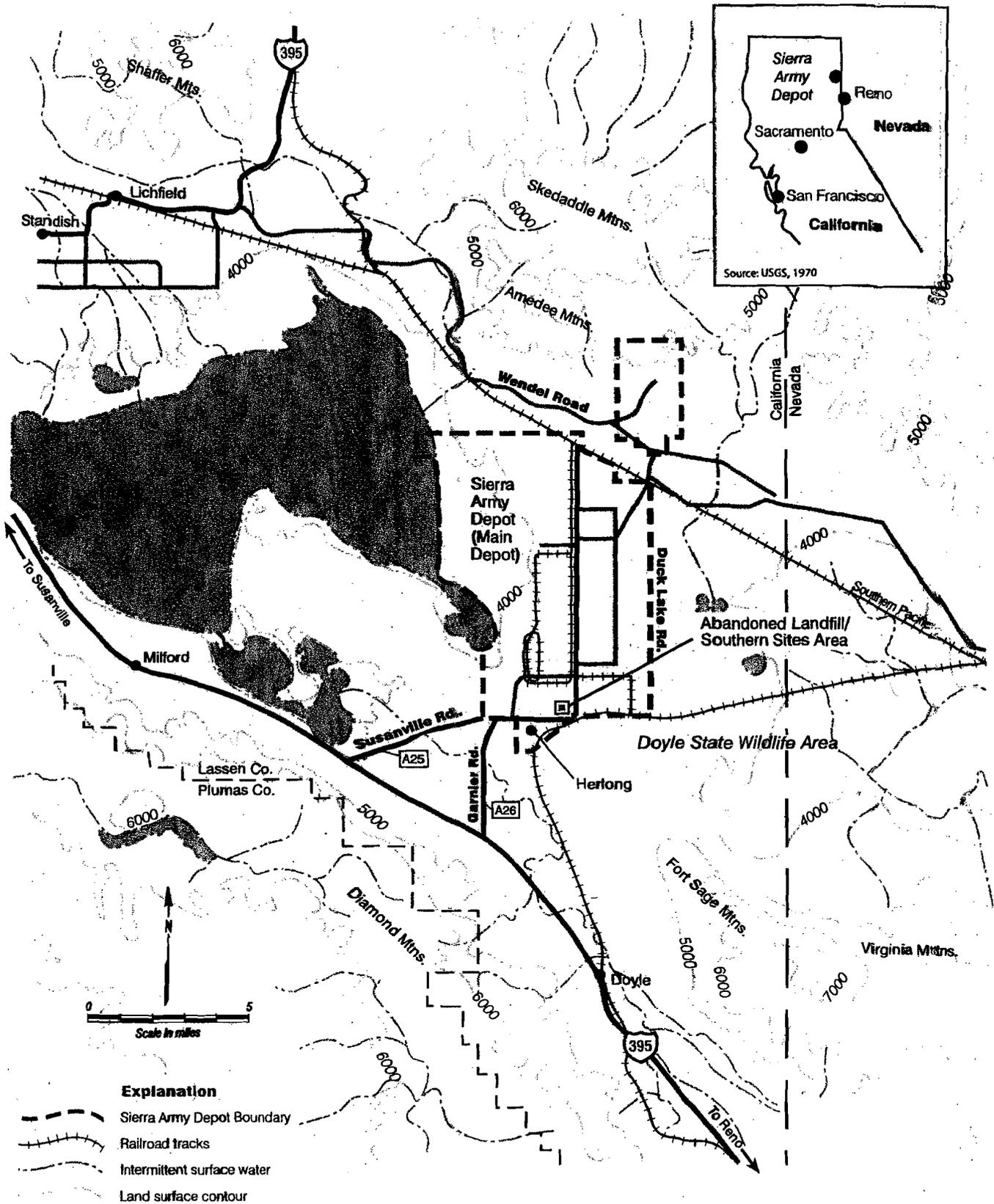
of Regulations, title 22 will result in compliance with the applicable provisions of California Code of Regulations, title 23 and title 27.

### **9. Conclusions**

In June 2008, the United States Army submitted a Draft Final ROD for the ALF/SSA for SIAD. 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 Regional Board "agree to disagree" over the applicability of the above mentioned state requirements.

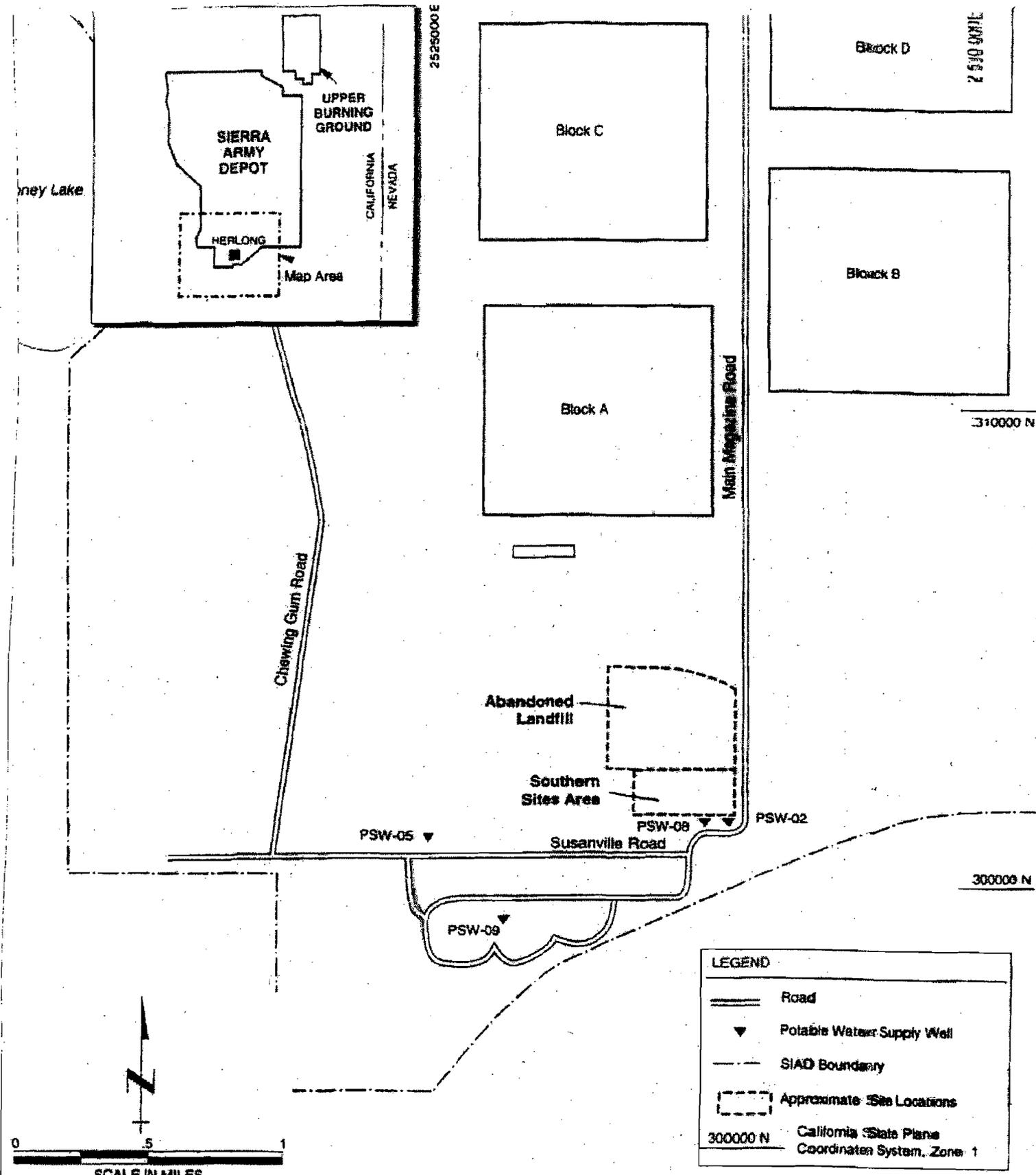
### **10. Recommendation**

The Army has prepared the Draft Final 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 ALF/SSA 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 ALF/SSA ROD.



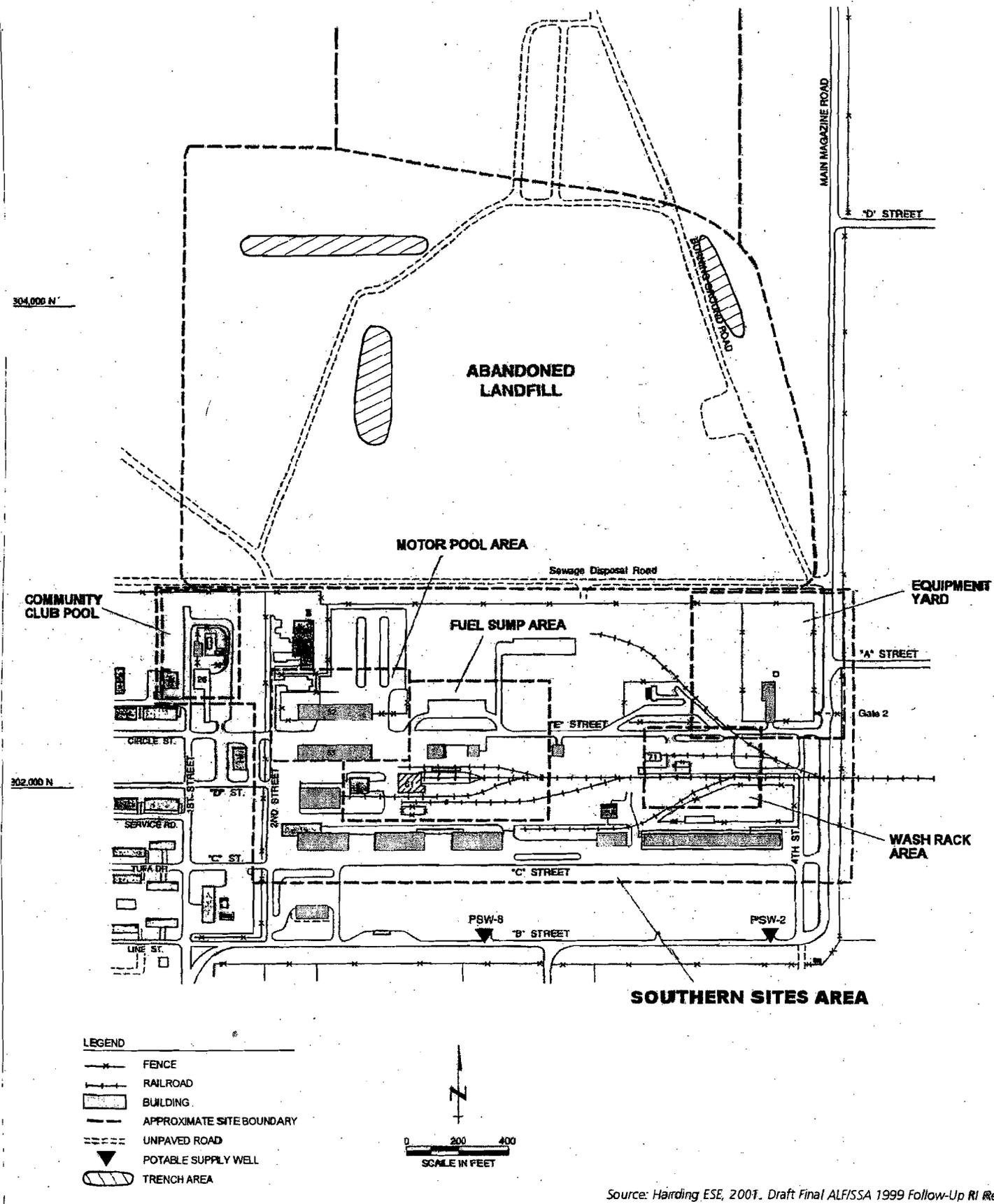
Source: Harding ESE, 2001. Draft Final ALFSSA 1999 Follow-up Report.

Figure 1. – Sierra Army Depot Facility Location Map



Source: Harding ESE, 2001. Draft Final ALF/SSWA 1999 Follow-Up RI Report.

Figure 2. – Abandoned Landfill and Southern Sites Areas



**Figure 3. – Abandoned Landfill and Southern Sites Areas Site Features**

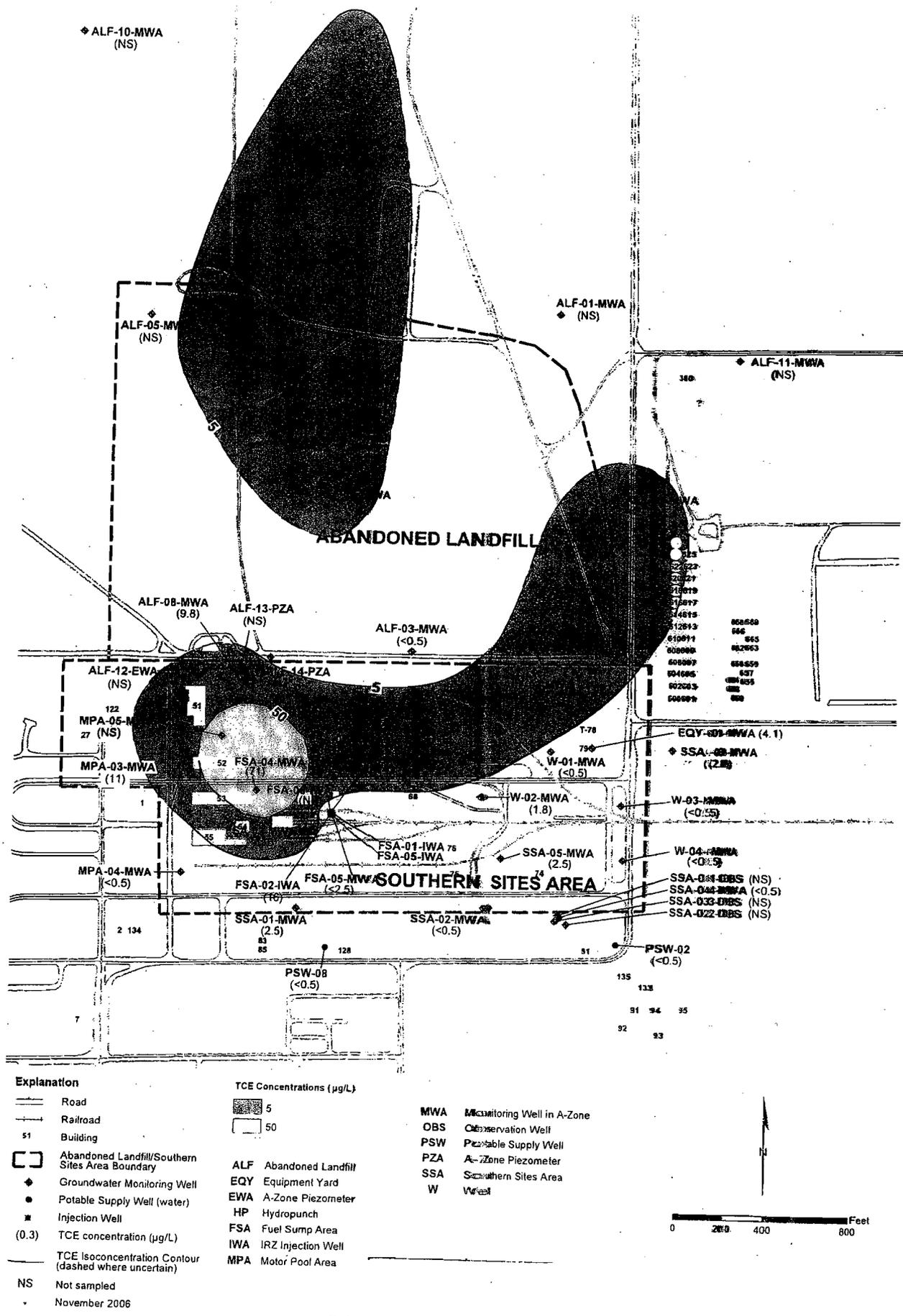


Figure 4. – “A” Zone TCE Isoconcentration Map