U.S. Department of Energy

Livermore Site Office, Livermore, California 94550

Lawrence Livermore National Laboratory

University of California, Livermore, California 94550

UCRL-AR-222569

Final Amendment to the Interim Site-Wide Record of Decision for the Pit 7 Complex at Lawrence Livermore National Laboratory Site 300

January 2007

Environmental Protection Department

Environmental Restoration Division

This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

UCRL-AR-222569

Final Amendment to the Interim Site-Wide Record of Decision for the Pit 7 Complex at Lawrence Livermore National Laboratory Site 300

January 2007

Environmental Protection Department

Environmental Restoration Division

Table of Contents

List of Figures

List of Tables

1. Declaration

1.1. Site Name and Location

This Amendment to the Interim Site-Wide Record of Decision (ROD) is for the Pit 7 Complex, located in Operable Unit (OU) 5 at the Lawrence Livermore National Laboratory (LLNL) Site 300 (U.S. Environmental Protection Agency [EPA] Superfund Site Identification No. 0902742). Site 300 is located approximately 8.5 miles southwest of downtown Tracy, California.

LLNL Site 300 has been divided into eight OUs based on the nature and extent of contamination to effectively manage site cleanup. A Final OU-specific ROD was signed in January 1997 for the General Services Area (OU 1) (DOE, 1997). An Interim Site-Wide ROD for LLNL Site 300 (DOE, 2001) was signed in February 2001 for the following OUs:

- Building 834 (OU 2)
- Pit 6 Landfill (OU 3)
- High Explosives (HE) Process Area (OU 4) including:
  - Building 815
  - HE Lagoons
  - HE Burn Pit
- Building 850/Pits 3&5 (OU 5) including:
  - Building 850 Firing Table area
- Building 854 (OU 6)
- Building 832 Canyon (OU 7) including:
  - Building 830
  - Building 832
- Buildings 801, 833, 845, and 851 and the Pit 2, 8, and 9 Landfills (OU 8)

The Building 850/Pits 3&5 area (OU 5) is divided into two areas: the Building 850 Firing Table and the Pit 7 Complex, that consists of the Pit 3, 4, 5, and 7 Landfills. The Interim Site-Wide ROD addressed the Building 850 Firing Table area of OU 5. The Pit 7 Complex was not included in the 2001 Interim Site-Wide ROD because the U.S. Department of Energy (DOE) and the regulatory agencies agreed that additional characterization of the Pit 7 Complex was needed before a remedy for this area could be selected. The characterization work was completed in 2004. The characterization results and cleanup alternatives were then presented in the Remedial Investigation/Feasibility Study (RI/FS) for the Pit 7 Complex (Taffet et al., 2005). A preferred remedy was presented in a Proposed Plan for Environmental Cleanup of the Pit 7 Complex in 2006 (DOE, 2006). An interim remedy for cleanup of the Pit 7 Complex area is presented in this Amendment to the Interim Site-Wide ROD.

The 2001 Site-Wide ROD was considered interim because: (1) additional testing and evaluation of remediation technologies was taking place, (2) final ground water cleanup standards are being determined, and (3) some areas of Site 300 still needed further investigation. A Final Site-Wide ROD is scheduled for 2008.

1.2. Statement of Basis and Purpose

This decision document presents the selected interim remedy for the Pit 7 Complex portion of OU 5 at LLNL Site 300. This interim remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Contingency Plan (NCP). This decision is based on the Administrative Record for Site 300.

The DOE and the U.S. EPA, Region IX jointly selected the interim remedy, and the State of California Department of Toxic Substances Control (DTSC) and the Central Valley Regional Water Quality Control Board (RWQCB) were involved and concur with the selection of the interim remedy for the Pit 7 Complex.

Unless otherwise specified, use of "remedy" or any derivations thereof implies that such measures are interim.

1.3. Assessment of the Site

The response actions selected in this Amendment to the Interim Site-Wide ROD are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous or radioactive substances into the environment.

1.4. Description of the Selected Remedy

In June 1992, a Federal Facility Agreement (FFA) for cleanup of the LLNL Site 300 Experimental Test Facility was signed by the U.S. EPA, the California DTSC, the RWQCB, and DOE. DOE is the responsible party and lead agency for environmental investigations and cleanup. A number of remedial alternatives were evaluated in the RI/FS for the Pit 7 Complex. DOE's and the regulatory agency's preferred alternative was presented in the Proposed Plan for Environmental Cleanup at the Pit 7 Complex. The selected interim remedy (Alternative 5a) for the Pit 7 Complex and the estimated present-worth costs are shown in Table 1-1.

The major components of DOE's interim remedy for the Pit 7 Complex are:

- Monitoring to determine if the cleanup is adequately protecting human health and the environment and to measure cleanup progress.
- Risk and hazard management, including institutional/land use controls, to control exposure where an unacceptable risk to human health remains.
- Monitored natural attenuation to allow tritium activities in subsurface soil/rock and ground water to decline naturally.
- Installing an engineered drainage diversion system to hydraulically isolate the contaminant sources in the landfills and underlying bedrock from subsurface water, thereby preventing infiltration of rainwater runoff that can result in ground water rising into Pits 3, 4, 5, and 7 and releasing contaminants.

- Extracting and treating ground water to reduce uranium, perchlorate, nitrate, and volatile organic compound (VOC) concentrations in ground water to meet cleanup standards that will be selected in the Final Site-Wide ROD.

The estimated costs shown for Alternative 5a on Table 1-1 are the sum of capital and operation and maintenance (O&M) costs over 30 years, expressed as present-worth values. The present-worth costs are based on conceptual designs and are presented for comparison purposes only. Based on DOE's selected cleanup alternative, the estimated 30-year present-worth cost to clean up the Pit 7 Complex described in this Amendment to the Interim Site-Wide ROD is approximately $10,845,000.

1.5. Statutory Determinations

The selected interim remedy for the Pit 7 Complex protects human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and provides adequate protection. The remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reducing the toxicity, mobility or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment) to the extent practicable. The mobility of all contaminants of concern present in the pit waste and the underlying vadose zone will be reduced through source control measures. The mobility and volume of contaminants (uranium, perchlorate, nitrate, and VOCs) in ground water will be reduced through extraction and treatment. The spent treatment media will also be treated/recycled to reduce the toxicity of perchlorate, nitrate, and VOCs, and further reduce the volume of all contaminants. While there is no effective treatment technology for tritium, natural attenuation will reduce the toxicity, mobility, and volume of tritium in a reasonable timeframe. Because the remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years after initiation of the remedial action to ensure that the remedy is or will be protective of human health and the environment.

1.6. National Environmental Policy Act (NEPA) Integration

Section II.E. of the DOE Secretarial Policy Statement on the National Environmental Policy Act (NEPA) requires that when DOE remedial actions under CERCLA trigger the procedures set forth in NEPA, the procedural and documentation requirements of NEPA and CERCLA are to be integrated. Integration is to be accomplished by conducting the NEPA and CERCLA environmental planning and review procedures concurrently to avoid duplication, conflicting analysis, and delays in implementing remedial action on procedural grounds. The preferred remedial alternative for the Pit 7 Complex was reviewed and evaluated for potential environmental impacts under NEPA. The review was completed on August 21, 2006. Copies of the completed review are available at the City of Tracy Public Library and the Lawrence Livermore National Laboratory Visitor Center.

The NEPA evaluation provides the additional information necessary to evaluate potential environmental impacts of the interim remedy under NEPA in compliance with the requirements of the DOE NEPA Implementing Procedures (10 CFR 1021), Section II.E. of the Secretarial

Policy Statement on NEPA (issued June 1994), and the Council of Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508, July 1986, as amended).

As appropriate, this evaluation includes a discussion of the:

1. Relationship of the remedy to other activities at LLNL.
2. Environmental setting and potentially affected environment including:
   - Land use and socioeconomics.
   - Vegetation, wildlife, and sensitive species.
   - Air quality.
   - Noise and traffic.
   - Aesthetics.
   - Floodplains and wetlands.
   - Cultural resources.
3. Potential environmental impacts of the remedy.
4. Potential accidents.
5. Cumulative impacts to human health, land use, air quality, and surface water.

1.7. ROD Data Certification Checklist

The following information is included in the noted sections of the Decision Summary portion of this Amendment to the Interim Site-Wide ROD:

- Contaminants of concern (COCs) and their respective concentrations (Section 2.7.4).
- Baseline risk represented by the COCs (Section 2.9).
- Key factors that led to selecting the remedy (Section 2.13.1).
- A description of the selected remedy (Section 2.13.2).
- Estimated capital, annual O&M, and total present-worth costs and the number of years over which the remedy cost estimates are projected (Section 2.13.3).
- Cleanup standards established for COCs and the basis for these standards (Section 2.13.4.3).
- Current and reasonably anticipated future land use assumptions and current and potential beneficial uses of ground water (Sections 2.8.1 to 2.8.6).
- Potential land and ground water use that will be available as a result of the selected interim remedy (Sections 2.13.4.1 and 2.13.4.2).
- How source materials constituting principal threat wastes are addressed (Section 2.14).

Additional information can be found in the Administrative Record for this site.

1.8. Authorizing Signatures and Support Agency Acceptance

Each representative of the undersigned party certifies that he or she is fully authorized to enter into the terms and conditions of this agreement and legally bind such party to this agreement.

IT IS SO AGREED:

2/20/07
Date

Kathleen H. Johnson
Chief, Federal Facilities Cleanup Branch
Superfund Division
U.S. Environmental Protection Agency
Region IX

1-31-07
Date

Barbara J. Cook, P.E.
Chief, Northern California Coastal Cleanup Operations Branch
California Department of Toxic Substances Control

Date

Pamela Creedon
Executive Officer
State of California Regional Water Quality Control Board
Central Valley Region

2/12/07
Date

Camille Yuan-Soo Hoo
Manager, Livermore Site Office
National Nuclear Security Administration
U. S. Department of Energy

2. Decision Summary

2.1. Site Name, Location, and Description

LLNL Site 300 is a DOE experimental test facility operated by the University of California. The facility is located in the eastern Altamont Hills about 17 miles east of Livermore and 8.5 miles southwest of downtown Tracy (Figure 2-1). The site covers 11 square miles (mi^2), most of which is in San Joaquin County. The western one-sixth of the site is located in Alameda County.

Site 300 is used to conduct research, development, and testing associated with high explosives (HE) materials. The Pit 7 Complex is located in the East and West Firing Areas in the northwest portion of Site 300 (Figure 2-2). The majority of activities in the East and West Firing Areas involve testing of conventional explosives that can be used to detonate nuclear devices. No actual fissionable material is used in these hydrodynamic tests. The Pit 7 Complex release site area consists of the Pits 3, 4, 5, and 7 landfills (Figure 2-3). Access to Site 300 and the Pit 7 Complex is restricted by fencing and full-time security guards.

DOE began environmental investigation activities at Site 300 in 1981. Prior to August 1990, investigations of potential chemical contamination at Site 300 were conducted under the oversight of the RWQCB. Site 300 was placed on the National Priorities List (NPL) in August 1990. Since then, all investigations have been conducted in accordance with CERCLA under the oversight of the three supervising regulatory agencies: EPA, RWQCB, and DTSC.

DOE is the lead agency for all environmental restoration activities at Site 300 and is the sole source of funding. The EPA Superfund identification number for LLNL Site 300 is 0902742.

2.2. Site History and Enforcement Activities

LLNL currently consists of two non-contiguous sites—Livermore Site and Site 300. Each is designated as a separate and distinct entry on U.S. EPA's NPL. LLNL is operated by the University of California for DOE and began weapons research operations at the Livermore Site in 1952. At that time, LLNL was a part of what was then the University of California Radiation Laboratory (UCRL). UCRL proposed the Site 300 location for an HE test site along Corral Hollow between Livermore and Tracy in July 1953. HE experiments began at Site 300 in 1955. The size of the original site was approximately 3 square miles. In 1957, the site was enlarged to 11 mi^2. The Livermore Site and Site 300 portion of UCRL became LLNL in 1971. Prior to acquisition by UCRL, land use in the Site 300 area was limited to sheep and cattle grazing.

From 1958 until 1988, debris from explosive tests conducted at Site 300 firing tables was disposed in unlined landfill Pits 3, 4, 5, and 7 at the Pit 7 Complex. The waste placed in the pits included wood; plastic; material and debris from tent structures; pea gravel; and exploded test assemblies that frequently contained tritium and depleted uranium. During years of above-normal rainfall (i.e., 1997-1998 El Niño), ground water rose into the bottom of the landfills and the underlying bedrock. This resulted in the release of tritium, uranium, VOCs, perchlorate, and nitrate to ground water in the Pit 7 Complex area.

2.3. Basis for Amendment

The Pit 7 Complex is contained within the Building 850/Pits 3 and 5 OU (5). This OU also includes the Building 850 Firing Table (Figure 2-3). A CERCLA cleanup remedy was selected for the Building 850 Firing Table in the 2001 Interim Site-Wide ROD. A cleanup remedy for the Pit 7 Complex was not included in the Interim Site-Wide ROD because DOE and the regulatory agencies agreed that additional characterization was needed for this area. This additional characterization was completed in 2004. In July 2005, a RI/FS report presented the characterization results, and proposed and evaluated alternatives for cleanup of contamination at the Pit 7 Complex. A preferred remedy was presented in a Proposed Plan for Environmental Cleanup of the Pit 7 Complex in 2006. The preferred remedy was also presented for public comment at a public meeting held on April 5, 2006. The purpose of this ROD Amendment is to document the selection of the remedial alternative for the Pit 7 Complex and incorporate it into the Interim Site-Wide ROD.

2.4. Community Participation

The Pit 7 Complex RI/FS and the Proposed Plan were made available to the public in July 2005 and March 2006, respectively. These documents can be found in the Administrative Record file and the Information Repositories located in the LLNL Visitor's Center in Livermore, California and in the Tracy Public Library in Tracy, California. A public comment period on the Proposed Plan was held from March 21 to May 5, 2006. In addition, a public meeting was held on April 5, 2006 to present the Proposed Plan to the community to increase the number of participants involved in the site's cleanup process. At this meeting, representatives from the DOE, LLNL, U.S. EPA, and the State of California answered questions about environmental contamination at the site and the remedial alternatives. DOE's responses to the comments received during this period and at the community meeting are included in a Responsiveness Summary in Section 3 of this document.

DOE has prepared a Community Relations Plan to meet the following objectives:

- Provide information to interested members of the community.
- Provide for an open dialogue on Site 300 cleanup issues between DOE and the public, and factor community concerns into the ongoing environmental investigation.
- Continue to work closely with the neighbors of Site 300.
- Be responsive to the special information needs of elected officials, agency representatives, and interested members of the public, including environmental citizens groups.
- Seek to increase the level of understanding in the community with regard to Site 300 cleanup plans.
- Respond to changes in community concerns and interest levels.

Reviews of the objectives and the methods described in the Community Relations Plan are conducted regularly to assure the objectives are being met.

The public is invited to attend various CERCLA-required and voluntary public meetings and workshops to learn about and comment on planned environmental restoration activities at Site 300. Tri-Valley Communities Against a Radioactive Environment (CAREs) has held a

Technical Assistance Grant from the U.S. EPA since 1994 and representatives meet quarterly with DOE, regulators, and LLNL staff to discuss on-going and planned project status. The local community will continue to be provided with information via local information repositories, newsletters, and public workshops.

2.5. Scope and Role of the Response Action

This Amendment to the Interim Site-Wide ROD presents the interim remedy selected by DOE and the regulatory agencies to address contamination at the Pit 7 Complex. Although this is an interim remedy, it is anticipated to be consistent with the final remedy and cleanup standards which will be selected in the final ROD.

Investigations at the Pit 7 Complex portion of OU 5 identified COCs that have been released to environmental media, and risk to human or ecological receptors posed by the contamination. COCs at the Pit 7 Complex include tritium and uranium in subsurface soil and rock, and tritium, uranium, nitrate, VOCs (trichloroethylene [TCE] and 1,1-dichloroethylene [DCE]), and perchlorate in ground water. Tritium, uranium, and nitrate have been detected in ground water at concentrations exceeding drinking water standards, and perchlorate is present above the California Public Health Goal. While concentrations of VOCs in ground water are below drinking water standards, they are listed to meet the RWQCB requirement that any constituent present in ground water above background concentrations be listed as a COC.

No COCs were identified in surface soil or surface water. The only unacceptable risk to human health posed by contaminants in the Pit 7 Complex area was inhalation of tritium evaporating from subsurface soil by onsite workers in the vicinity of the Pit 3 Landfill. There was no unacceptable risk for offsite residents or hazard to ecological receptors identified in the risk assessment.

The purpose of the selected remedy for the Pit 7 Complex presented in this Amendment to the Interim Site-Wide ROD is to protect human health and the environment by:

- Monitoring ground water to determine if the cleanup is adequately protecting human health and the environment and to measure the progress of cleanup.
- Preventing exposure to contaminants where an elevated risk to human health exists.
- Controlling the contaminant source to prevent further releases to ground water.
- Reducing contaminant concentrations in ground water to meet cleanup standards that will be selected in the Final Site-Wide ROD.

2.6. CERCLA/RCRA Relationship

As stated in the Site 300 FFA, DOE intends to integrate CERCLA response obligations and Resource Conservation and Recovery Act (RCRA) corrective action obligations that relate to the release(s) of hazardous substances, hazardous wastes, pollutants, or contaminants. Therefore, the FFA signatories intend that activities covered by the Site 300 FFA will achieve compliance with CERCLA, 42 U.S.C. Section 96-1 et seq; satisfy the corrective action requirements of RCRA 3004 (u) & (v), 42 U.S.C. Section 6924 (u) & (v) for a RCRA permit, and RCRA Section 3008 (h), 42 U.S.C. Section 6298 (h) for interim status facilities; and meet or exceed all applicable or relevant and appropriate Federal and State laws and regulations to the extent required by CERCLA Section 121, 42 U.S.C. Section 9621.

DOE also intends that any remedial action selected, implemented, and completed will protect human health and the environment such that remediation of releases covered by this Amendment to the Interim Site-Wide ROD shall obviate the need for further corrective action under RCRA. DOE agrees that with respect to releases of hazardous waste covered by the Interim ROD Amendment, RCRA shall be considered an applicable or relevant and appropriate requirement (ARAR) pursuant to CERCLA Section 121, 42 U.S.C. Section 9621.

In 1992, DOE constructed an engineered cap over Pits 4 and 7 in compliance with RCRA requirements. The cap was designed to prevent leaching of contaminants by precipitation infiltrating through the pit waste. Long-term monitoring of this closure is included in a formal Post-Closure Plan (Rogers/Pacific Corp., 1990).

2.7. Site Characteristics

This section discusses the characteristics of the Pit 7 Complex area including the physical setting (Section 2.7.1), geology (Section 2.7.2), and hydrogeology (Section 2.7.3).

2.7.1. Physical Setting

The Pit 7 Complex is located within the Elk Ravine drainage area in the northwestern part of Site 300 (Figures 2-2 and 2-3). It covers about 2 mi^2 and includes the Pit 7 Complex landfill release site and associated soil and ground water contamination. The Elk Ravine drainage area is characterized by a series of native grass-covered linear, northwest-southeast trending ridges and incised valleys. The ridges and valleys in the vicinity of the Pit 7 Complex are bounded to the north and south by valleys (e.g., Doall Ravine) oriented roughly perpendicular (northeast-southwest) to the northwest-trending ridges and valleys. Doall Ravine connects the valley where the Pit 7 Complex is located with the next valley to the east, Elk Ravine, where the Elk Ravine Fault is located. Figure 2-3 shows topography, monitor wells, springs, various cultural features, and the outline of the landfills in the Pit 7 Complex area.

2.7.2. Geology

The Pit 7 Complex area is underlain by weathered and fractured sedimentary rocks. A veneer of soil and colluvium covers the southwest slope, while the northeast slope is steeper and consists of resistant sandstone outcrops. The valley bottom contains an ephemeral drainage channel and associated Quaternary alluvium and weathered bedrock (Qal/WBR) consisting of fine-grained soil, decomposed bedrock, and colluvium eroded from the hillslopes. The channel extends southeastward to the Building 850 area, where it merges with the northeast-trending drainage channel in Doall Ravine.

The bedrock in the Pit 7 Complex area consists primarily of interbedded siltstone, sandstone, conglomerate, and minor claystone of the lower Neroly Formation ($Tnbs_1$). At the base of the $Tnbs_1$ is a 10-foot thick silty sandstone ($Tnbs_0$). The $Tnbs_0$ is overlain by a several foot thick claystone confining layer and underlain by 50 to 100 feet (ft) of interbedded siltstone, claystone, and minor sandstone ($Tnsc_0$). The $Tnsc_0$ overlies sandstone of the Cierbo Formation (Tmss).

2.7.3. Hydrogeology

This section describes the general framework of the hydrogeology of the Pit 7 Complex area, including the occurrence of surface water and ground water.

2.7.3.1. Surface Water

Due to the semi-arid climate, natural surface water in the Pit 7 Complex area is relatively rare and has been observed as surface runoff only during heavy rainfall events. When surface runoff is generated during heavy El Niño-type events, surface water generally flows southeastward toward Doall Ravine.

The closest surface water body to the Pit 7 Complex in the direction of bedrock ground water flow is Spring 24. This spring is located in the next valley northeast of the Pit 7 Complex, approximately 2,500 ft from the landfills (Figure 2-3). However, surface water at Spring 24 is addressed as part of the remedy for the Building 850 area because Building 850 is the closest upgradient source and likely the predominant source of contamination detected in Spring 24. For this reason, surface water in Spring 24 was not evaluated specifically for the Pit 7 Complex area.

2.7.3.2. Ground Water

In the Pit 7 Complex, a shallow, ephemeral water-bearing zone within Qal/WBR channel fill deposits is in contact with an underlying bedrock water-bearing zone within the $Tnbs_0$ sandstone. The spatial and temporal distribution of ground water in the Pit 7 Complex area is influenced by several factors, including: episodic El Niño-type rainfall events, hill slope steepness and ground cover, geologic structures (including bedding orientation, fractures, and faults), and the inclined axes of alluvial drainage channels. Figure 2-4 shows the conceptual hydrogeologic model for the Pit 7 Complex. The interaction between the highly-transmissive alluvial drainage system and the less transmissive, underlying fractured bedrock is important to ground water flow and contaminant transport in the Pit 7 Complex area. Ground water flow and contaminant transport are accelerated during episodic winter rainfall, especially heavy El Niño-type events. It is during these events that shallow ground water rises, inundates the landfill pits, and comes in contact with the pit contents (Figure 2-5).

Saturated stratigraphic intervals in the Pit 7 Complex area have been grouped into hydrostratigraphic units (HSUs). An HSU is a mappable water-bearing zone that exhibits similar hydraulic and geochemical properties. Three HSUs have been identified in the Pit 7 Complex: the Qal/WBR, $Tnbs_0$, and Tmss HSUs, as described below.

Quaternary alluvium/weathered bedrock (Qal/WBR) HSU

The Qal/WBR HSU is an ephemeral, unconfined, transmissive water-bearing zone. When saturated, ground water in the Qal/WBR HSU flows to the southeast down the inclined valley axis. Ground potentiometric surface contours for the Qal/WBR HSU in 2003 are shown in Figure 2-6. Water level data indicate that during extended periods of drought (e.g., 1989 to 1994), most of the wells completed in the Qal/WBR HSU were either dry or contained very little water. During the dry season in typical rainfall years, any water present in this HSU occurs mostly in the weathered bedrock zone. The saturated thickness of the Qal/WBR HSU ranges from 0 to 45 ft, with the depth to ground water ranging from 5 to 50 ft below ground surface. Recharge of this HSU occurs at the base of the hillsides and within the valley bottom. Hydraulic conductivity, as calculated from hydraulic tests in wells screened in the Qal/WBR HSU in the Pit 7 Complex area, ranges from 10^{-3} to 10^{-4} centimeters per second (cm/sec). Assuming a porosity of 0.3, the average ground water velocity ranges from 60 to 100 ft per year in the Qal/WBR HSU. These ground water velocities are only relevant when there is continuous saturation within the HSU, i.e., during wet seasons. Therefore, over the course of a year or years, cumulative ground water movement is slower than this velocity range would indicate.

Contamination from the Pit 7 Complex is present in the Qal/WBR ground water. However, the geometry of the Qal/WBR HSU and lack of recharge causes large portions of this HSU to become unsaturated, significantly slowing the migration of any contaminant in this HSU.

Lower Neroly Formation ($Tnbs_0$) HSU

Ground water in the $Tnbs_0$ HSU flows to the east-northeast (Figure 2-6). In addition to flow in porous media, there are also preferential flow paths in localized fractures. Ground water in the $Tnbs_0$ HSU is unconfined in the vicinity of the Pit 7 Complex landfills and confined to the east in the vicinity of Elk Ravine. The confining layer is a 2- to 3-foot thick claystone.

The saturated thickness of the $Tnbs_0$ HSU ranges from 5 to 15 ft, with the depth to ground water ranging from 30 to 250 ft below ground surface. Hydraulic conductivity, as calculated from hydraulic tests in wells screened in the $Tnbs_0$ HSU in the Pit 7 Complex area, ranges from 10^{-4} to 10^{-5} cm/sec. Assuming a porosity of 0.3, the average ground water velocity ranges 6 to 12 ft per year in the $Tnbs_0$ HSU. The extent of $Tnbs_0$ strata and the extent of saturation within this HSU do not extend beyond the Site 300 boundary in the direction of ground water flow, and therefore is limited in the northeast direction. Several faults and other geologic structures also impede ground water flow in the northeast direction. The $Tnbs_0$ HSU is the bedrock water-bearing zone that transmits contaminated ground water in the Pit 7 Complex.

Cierbo Formation Aquifer

The Cierbo Formation sandstone (Tmss) HSU underlies the Neroly Formation in the Pit 7 Complex area. The Tmss HSU is unconfined beneath the Pit 7 Complex landfills and is under confined to flowing artesian conditions in the adjacent Building 850 area. The upper part of the Tmss HSU is unsaturated beneath the Pit 7 Complex. The depth to ground water in the Tmss aquifer beneath the Pit 7 Complex is estimated to be about 100 ft. The Tmss aquifer is hydraulically separated from the $Tnbs_0$ HSU by a 30- to 50-foot thick, fine-grained interval ($Tnsc_0$). Contaminants have not been detected in this aquifer. This lack of contamination is likely due to the integrity of the overlying $Tnsc_0$ confining layer and the upward hydraulic gradient that exists between the confined portions of this aquifer and overlying water-bearing zones.

2.7.4. Nature and Extent of Contamination

The nature and extent of contamination at the Pit 7 Complex was evaluated through a detailed characterization process performed in accordance with EPA guidelines. The process included: record searches, interviews with operating personnel and retirees, examination of aerial photographs, site visits, and subsurface investigations. Subsurface investigations included soil vapor surveys, installation of boreholes and ground water monitor wells, and analysis of soil, rock, vapor, ground water and surface water samples. Additional investigations were conducted within the landfills to: (1) characterize the lateral and vertical extent of the pit waste, (2) define the landfill bottoms, (3) identify buried metal objects, and (4) determine the distribution of contaminant concentrations within the waste. These investigative methods included drilling boreholes, geophysical surveys and soil gas surveys. Samples of landfill material from auger and cone penetrometer boreholes were analyzed for tritium in soil moisture and uranium isotopes.

Soil gas from screened drivepoints was collected and analyzed for tritium and helium-3, a tritium daughter product. Soil vapor survey samples were analyzed for VOCs.

DOE and the regulatory agencies agree that the characterization of the Pit 7 Complex is sufficient to select an interim remedy. This section summarizes the nature and extent of contamination in environmental media at the Pit 7 Complex including: (1) identification of COCs (Section 2.7.4.1), (2) sources of contamination (Section 2.7.4.2), (3) nature and extent of contamination in soil and rock (Section 2.7.4.3), and (4) nature and extent of contamination in ground water (Section 2.7.4.4).

Additional information about nature and extent of contamination in the Pit 7 Complex area is available in Chapter 11, Section 11-4 of the Site-Wide Remedial Investigation (SWRI) report (Webster-Scholten, 1994), Chapter 2 of the SWRI Addendum (Taffet et al., 1996), the Ground Water Tritium Plume Characterization Summary report (Ziagos and Reber-Cox, 1998), Chapter 1 of the Site-Wide Feasibility Study (SWFS) (Ferry et al., 1999), and Section 2.3 of the Pit 7 Complex RI/FS.

2.7.4.1. Identification of Contaminants of Concern

As part of the RI/FS for the Pit 7 Complex, a final screening and evaluation process was conducted for the contaminants of potential concern to complement the screening process that was conducted in the SWRI, the SWRI Addendum, and the SWFS. The objective of this evaluation was to determine which contaminants of potential concern were actual COCs based on the:

- Frequency with which each substance has been detected.
- Concentration of the compound relative to background concentrations.
- Risk or hazard presented by the compound.
- Potential for a compound present in soil or rock to affect ground water.

The four criteria used in this evaluation process are discussed below:

1. The frequency with which each substance has been detected. This criterion was used because it reflects the fact that for a substance to have been detected frequently, it is likely to be both persistent in the environment and relatively widespread. The potential for human exposure is directly related to these parameters as well as to the tendency of the contaminant to migrate within and between environmental media. Contaminants in ground water and surface soil detected at less than 2% frequency of detection were not considered to be COCs.
2. Concentration of the constituent relative to background concentrations. If a compound was detected in an environmental media at the Pit 7 Complex but was reported at concentrations within the range of natural background concentrations, it is not considered to be a COC. Background levels for naturally-occurring substances (i.e., metals, ions and radionuclides) are discussed in Appendix A of the SWFS and Appendix D of the RI/FS for the Pit 7 Complex.
3. Risk or hazard presented by the constituent. Constituents in surface and subsurface soil/rock and surface water are not considered COCs if the calculated cancer risk was less than 10^{-6} (one in one million) and the hazard index was less than one.

4. Potential for a constituent in soil or rock to affect ground water. Constituents in surface soil and subsurface soil or rock are not considered COCs if the constituent does not present a threat to ground water. However, if a constituent in soil or rock did not present a threat to ground water but the calculated risk was greater than 10^{-6} or the hazard index was greater than one, it is still considered a COC. The only contaminants of potential concern in soil and rock are tritium and uranium. Since these constituents have already impacted ground water, they were automatically considered to be COCs in soil and rock.

Additional screening criteria were used in the SWFS including the use of established background and/or statistical limits as part of either a Pit/Landfill Post-Closure Plan or Waste Discharge Requirements monitoring program, the length of time since a chemical of potential concern had been detected in ground water, and if the presence of the substance could be attributed to a source other than an operable unit release.

COCs for each environmental medium were selected based on the following:

- Any constituent detected in surface soil at greater than 2% frequency and above background concentrations is considered to be a COC if: (1) a risk above 10^{-6} or hazard quotient above one was calculated for complete exposure pathways for the contaminant and media, and/or (2) the contaminant presents a potential threat to ground water as determined by modeling.
- Any constituent detected in subsurface soil/rock above its background concentration is considered to be a COC if: (1) a risk above 10^{-6} or hazard quotient above one was calculated for complete exposure pathways for the contaminant and media, and/or (2) the contaminant presents a potential threat to ground water.
- Any constituent detected in ground water at greater than 2% frequency and above background concentrations is considered to be a COC.
- Volatile substances detected in surface water (Spring 24) are considered to be COCs if a cancer risk greater than 10^{-6} or hazard quotient greater than one was calculated for an inhalation pathway. Non-VOC constituents detected at greater than 2% frequency and volatile constituents above background but with no associated risk or hazard were compared to COCs in ground water. Spring 24, located southeast of the Pit 7 Complex area (Figure 2-3), is fed by ground water. If a non-VOC constituent (or a VOC constituent above background but with no associated risk or hazard) detected in surface water is present as a COC in ground water, that contaminant will be addressed in ground water remedial alternatives. The contaminant is not considered to be a COC in surface water if either: (1) no complete exposure pathway exists for non-VOC contaminants, or (2) no risk or hazard is associated with the volatile contaminant.

Tables 2-1 and 2-2 list the COCs and the media of concern in the Pit 7 Complex. No COCs were identified in surface soil. Tritium and uranium were identified as COCs in subsurface soil and ground water at the Pit 7 Complex. COCs identified in ground water include perchlorate, VOCs (trichloroethylene [TCE] and 1,1-dichloroethylene [DCE]), and nitrate. Tritium, uranium, nitrate, and perchlorate have been detected in ground water at concentrations exceeding drinking water standards or Public Health Goals when no drinking water standards exist. While TCE and 1,1-DCE concentrations in ground water are below drinking water standards, they are listed in Table 2-2 (COCs in ground water) to meet the RWQCB requirement that any constituent with concentrations exceeding background in ground water be listed as a contaminant of concern.

Concentrations of these VOCs in ground water are currently detected in only four wells, and are continuing to decrease toward background concentrations. There is no surface water present in the Pit 7 Complex area other than occasional short-term rainwater runoff. There were no COCs identified in Spring 24 which is the closest surface water body to the Pit 7 Complex in the direction of bedrock ground water flow.

2.7.4.2. Sources of Contamination

Historical information, analytical data, and other characterization data have been used to identify the nature and extent of anthropogenic contamination in environmental media at the Pit 7 Complex. These data were also used to identify COCs and for contaminant fate and transport modeling and baseline risk assessment.

Characterization data collected to date indicate that the main source of subsurface soil and rock, and ground water contamination in this area was the waste in the landfill pits. Tritium and various metals, including depleted uranium, were used in explosives experiments conducted at Site 300. The bulk of the tritium received at Site 300 was used in experiments conducted between 1962 and 1972, when Pits 3 and 5 were actively receiving waste. Nearly all the tritium and depleted uranium-bearing waste generated at the Building 850 Firing Table, the most active firing table at Site 300, was disposed in Pits 3 and 5. By the time Pit 7 was actively receiving waste between the late 1970s and the late 1980s, tritium use at Site 300 had decreased significantly, although depleted uranium use continued.

Depleted uranium was used in open-air explosives experiments conducted on the Buildings 850 and 851 firing tables at Site 300. Disposal of depleted uranium-bearing gravels from these firing tables in the unlined Pit 7 Complex landfills from 1958 to 1988 created a source of depleted uranium to nearby soil and ground water. Depleted uranium does not exist naturally and is the product of a separation process in which the uranium-235 (^{235}U) isotope is extracted from natural uranium. The remaining material contains less of the ^{235}U isotope and is called depleted uranium (i.e., depleted in ^{235}U).

LLNL B Division, which conducts the explosives experiments at Site 300, confirmed that no natural or enriched uranium was used in these experiments (Krauter, 2004; Wood, 2004). However, higher activities of natural uranium have been detected in ground water samples from wells downgradient of the Pit 7 Complex than in samples from wells upgradient of the pits. Results of geochemical modeling indicate that it is possible that some combination of natural and landfill-induced geochemical effects are causing an increase in natural uranium activities in ground water downgradient of the pits (Figure 2-7).

The tritium and depleted uranium were released from the landfill waste as ground water rose into the landfills during years of abnormally high rainfall (e.g., the 1997-1998 El Niño). As water elevations subsequently declined, contaminants in the receding ground water were conveyed to the underlying rock and ground water. An inventory study of the mass of tritium within the landfills and in adjacent and underlying soil and bedrock was conducted in 2000 (Taffet et al., 2005). This study indicated that 20% of the tritium remained in Pit 3, 4% in Pit 5, and 76% was present in the soil, bedrock and ground water. Thus, the majority of the tritium present in the vadose zone occurs in bedrock beneath the pits.

The occurrence of nitrate in local ground water may be attributable to a combination of natural and anthropogenic sources. Based on the spatial distribution of perchlorate concentrations, it is likely that both Pits 3 and 5 contain low-level perchlorate sources.

Soil vapor surveys indicated a possible minor source of VOCs was present in the Pit 5 Landfill. However, because VOCs were not detected in soil or bedrock, and VOC concentrations in ground water have decreased below drinking watering water standards, also known as Maximum Contaminant Levels (MCLs) and continue to decline toward background levels, VOC concentrations in Pit 5 have diminished and are no longer considered a contaminant source.

2.7.4.3. Nature and Extent of Contamination in Soil and Rock

Surface (0- to 0.5-ft depth) and subsurface (below 0.5-ft depth) soil and bedrock samples were collected in the Pit 7 Complex area and analyzed for a variety of chemicals and radionuclides, including tritium, uranium, metals, and VOCs. Although some of these substances detected in soil and rock are attributed to the Pit 7 Complex landfills, some occur naturally. Background concentrations for naturally occurring substances were established in Section 4.2.2 of the SWRI and Appendix A of the SWFS.

Tritium and uranium are COCs in subsurface soil and bedrock in the Pit 7 Complex. No COCs were identified in surface soil in this area.

Spatial analysis of soil analytic data from within and adjacent to Pits 3 and 5 indicate that a total of 12 curies (Ci) of tritium and 1.5 Ci of depleted uranium still exist in this source area. Of the 12 Ci of tritium, an estimated 2.4 Ci (20%) remain in Pit 3, 0.5 Ci (4%) remain in Pit 5, and 9.1 Ci (76%) are located in the unsaturated bedrock underlying the pits. Of the 1.5 Ci of depleted uranium remaining, an estimated 0.5 Ci (33%) remain in the pits and 1.0 Ci (67%) are located in the underlying bedrock. Uranium and tritium sources appear to be co-located in both pits (e.g., the highest tritium activity was detected where the highest depleted uranium activity was detected). The most significant tritium source appears to be located near the bottom of Pit 3 and in the underlying unsaturated bedrock. Otherwise, the distribution of tritium within the landfills is relatively homogeneous. The magnitude of the residual uranium sources appears to be comparable in both pits, with about 67% of the total uranium in the immediate area of the pits occurring in the underlying bedrock. Based on continued releases of depleted uranium to ground water downgradient of Pit 7, depleted uranium is assumed to be in the buried waste in this landfill.

The presence of significant amounts of contamination in unsaturated bedrock beneath the pits is a significant factor regarding the feasibility of remedial alternatives with source control components that involve waste excavation.

2.7.4.4. Nature and Extent of Contamination in Ground Water

Ground water samples have been collected in the Pit 7 Complex area and analyzed for a broad range of parameters, including radionuclides, metals, perchlorate, nitrate, and VOCs. Figures 2-8 through 2-10 show the distribution of tritium; uranium; and VOCs, perchlorate, and nitrate in ground water in both the Qal/WBR and $Tnbs_0$ HSUs.

Tritium activities in Qal/WBR HSU ground water (Figure 2-8) are dependent on the temporally and spatially varying extent of saturation exhibited by this water-bearing zone.

During drought years, this HSU becomes almost entirely unsaturated as shallow ground water levels drop. However, during heavy rainfall events, the extent of saturation in the Qal/WBR HSU increases laterally and vertically, and it is the first to be impacted by releases from the pits. The distribution of tritium in the $Tnbs_0$ HSU exhibits a pattern that is consistent with two coalescing plumes, one emanating from sources in and beneath Pit 3 and a lower activity plume emanating from sources within and beneath Pit 5 (Figure 2-8). Tritium sources still exist in the pits and unsaturated bedrock. These residual sources release tritium to shallow ground water during heavy, El Niño-type rainfall events. However, their impact is fairly limited in both space and time. The historical maximum tritium activity of 2,660,000 pCi/L was detected in a Qal/WBR HSU ground water sample following the 1998 El Niño event. However, tritium activities decreased significantly following these events.

Since the 1998 El Niño, and specifically for the period between 2000 and 2003, the extent of the tritium plume exceeding the 20,000 pCi/L MCL in both the Qal/WBR and $Tnbs_0$ HSUs has declined. In 2003, tritium above background activities (>100 pCi/L) extended 2,400 and 3,700 ft from the landfills in the Qal/WBR and $Tnbs_0$ HSUs, respectively (Figure 2-8). During 2003, tritium activities exceeding the MCL in the Qal/WBR and $Tnbs_0$ HSUs extended about 1,300 and 1,000 ft, respectively from the landfills. The Pit 7 tritium plumes in the Qal/WBR and $Tnbs_0$ HSUs have commingled with the tritium plume emanating from the Building 850 area (Figure 2-8). However, ground water data collected in the area where these plumes merge, indicate that the tritium plumes from the Pit 7 Complex are not contributing significant mass to the Building 850 tritium plumes.

Modeling of tritium migration along conservative shortest distance paths to the Site 300 boundaries in both HSUs indicates that, even without remediation, tritium activities offsite will never exceed background activities (100 pCi/L). The maximum 2003 tritium activity detected in the Pit 7 Complex was 439,000 pCi/L.

Analytical data from ground water samples collected in the Pit 7 Complex area since the mid-1990s indicate that both depleted and natural uranium are present. The nature and extent of both depleted and natural uranium in ground water in the Pit 7 Complex area were evaluated using uranium-235/uranium-238 ($^{235}U/^{238}U$) atom ratio data. Depleted and natural uranium in ground water are differentiated using mass spectrometry to determine the mass ratio of $^{235}U/^{238}U$ isotopes. A $^{235}U/^{238}U$ atom ratio less than 0.007 indicates the presence of depleted uranium and a $^{235}U/^{238}U$ atom ratio approximately equal to 0.007 indicates natural uranium. Similar to tritium, releases of depleted uranium from the pits and underlying bedrock correlate with abnormally high rainfall and resulting water table rises into the pits. During the following years of normal rainfall and lower water levels, the total uranium activity and depleted uranium percentage generally decrease in ground water. The extent of depleted uranium is defined by the wells with ground water samples with an atom ratio less than 0.007.

The extent of uranium in Qal/WBR and $Tnbs_0$ HSU ground water at the Pit 7 Complex is shown on Figure 2-9. The data for wells that yielded ground water samples containing some depleted uranium are highlighted in orange on Figure 2-9. Wells in which ground water samples contained only natural uranium, as identified by a $^{235}U/^{238}U$ atom ratio (0.007+/-0.0002), are shown in black on this figure. The total uranium activity posted for these wells is due solely to natural uranium. Ground water samples from wells screened in the $Tnbs_0$ HSU have not shown a depleted uranium atom ratio, indicating that depleted uranium has not migrated downward into the $Tnbs_0$ HSU. In 2003, the extent of total uranium in ground water that exceeded the

20 pCi/L MCL was about 700 and 300 ft from the landfills in the Qal/WBR and $Tnbs_0$ HSUs, respectively. The maximum total uranium activity detected in Pit 7 ground water in 2003 was 123 pCi/L. Fate and transport modeling of uranium migration along conservative shortest distance paths to the Site 300 boundaries indicates that, even without remediation, uranium activities will fall below the 20 pCi/L MCL well within the Site 300 boundaries in the Qal/WBR and $Tnbs_0$ HSUs, at distances of 400 ft and 1,000 ft, respectively.

The distribution of perchlorate in Pit 7 Complex ground water is shown on Figure 2-10. Perchlorate monitoring began at the Pit 7 Complex in 1998 as part of a site-wide effort to characterize the presence and distribution of perchlorate in Site 300 ground water. Perchlorate has been detected above the 6 μg/L State Public Health Goal in samples collected from wells completed in the Qal/WBR and $Tnbs_0$ HSUs. The maximum historic perchlorate concentration detected in ground water in the Pit 7 Complex area was 23 μg/L. The maximum perchlorate concentration detected in Pit 7 ground water in 2003 was 21 μg/L. Based on the spatial distribution of the perchlorate in ground water, it is likely that both Pits 3 and 5 contain low-level perchlorate sources.

Although elevated nitrate has been detected in ground water from the Pit 7 Complex area, the spatial distribution of nitrate indicates that the landfill pits are not the only source (Figure 2-10). In fact, some wells located west and upgradient of the landfills contain appreciable concentrations of nitrate (10 to 36 mg/L). Elevated nitrate concentrations in Qal/WBR HSU ground water (Figure 2-10) in the immediate vicinity of the pits indicate that residual nitrate sources may still exist within the pit waste. The nitrate released to ground water from the landfills appears to be restricted to the Qal/WBR HSU. Some nitrate detected in Qal/WBR ground water may also result from dissolution of naturally-occurring nitrate from the alluvium and weathered bedrock derived from the Neroly Formation. Therefore, within the Qal/WBR HSU, concentrations of nitrate in excess of the 45 mg/L MCL may be attributable to a combination of anthropogenic and natural sources. The increasing downgradient trend of nitrate in $Tnbs_0$ HSU ground water (Figure 2-10) can be explained by the interaction of ground water with a nitrate-bearing rock matrix and increasing residence time along the flow path. The maximum nitrate concentration detected in Pit 7 ground water in 2003 was 88 mg/L.

Monitoring for VOCs in ground water began at the Pit 7 Complex in the mid-1980s. The most commonly detected VOC is TCE. Other VOCs include 1,1-DCE, toluene, total xylene isomers, and perchloroethylene (PCE). The maximum historical TCE concentration (15 μg/L) was detected in a ground water sample collected in 1995. As shown on Figure 2-10, TCE is not detected in ground water samples from wells in the Pit 7 Complex area at concentrations above its 5 μg/L MCL. Based on historical data it appears that Pit 5 is the likely source of TCE. However, given the decreasing TCE trend to concentrations below the MCL, and the absence of any significant increase in TCE following the 1998 El Niño, it is likely that any remaining VOC sources, if present, are very minor. In 2003, the only VOCs detected in Pit 7 Complex ground water were TCE and 1,1-DCE at maximum concentrations of 2.8 and 1.0 μg/L, respectively, below their 5 μg/L MCLs. The samples containing these VOCs were collected from a well located 50 ft from Pit 5. These VOCs are currently detected in ground water samples from only four wells, and concentrations are continuing to decrease toward background.

2.7.4.5. Nature and Extent of Contamination in Surface Water

The closest surface water body to the Pit 7 Complex in the direction of bedrock ground water flow is Spring 24. This spring is located in the next valley northeast of the Pit 7 Complex approximately 2,500 ft from the landfills (Figure 2-3). Tritium is the only elevated anthropogenic chemical that has been identified in Spring 24 water. Tritium contamination in surface water at Spring 24 is addressed as part of the remedy for the Building 850 area because Building 850 is the closest upgradient source and likely the predominant source of tritium detected in Spring 24. For this reason, tritium was not identified as a COC in surface water for the Pit 7 Complex area. Surface water in Spring 24 has been monitored since in 1999. The maximum Spring 24 tritium activity, 2,380 pCi/L, was detected in March 2002 and December 2003. The most recent sample, collected in October 2005, contained 2,070 pCi/L. Spring 24 is used to characterize the leading edge of the tritium plume in the $Tnbs_0$ HSU. It is most likely a discharge point for confined ground water from the $Tnbs_0$ HSU along the Elk Ravine Fault.

2.8. Current and Potential Future Site and Resource Uses

2.8.1. Current Onsite Land Uses

Site 300 is primarily an experimental test facility that conducts research, development, and testing associated with HE materials. This work includes explosives processing, preparation of new explosives, and pressing, machining, and assembly of explosives components. Site 300 activities also include hydrodynamic testing for verifying computer simulation results, obtaining equation-of-state data for explosives materials, evaluating material behavior at assembly joints and welds, evaluating the quality and uniformity of implosion, and evaluating the performance of post-nuclear test design modifications. Access to Site 300 is restricted.

The Pit 7 Landfill Complex was used to dispose debris from firing table experiments at Site 300 between 1958 and 1988. In 1988, when waste disposal in the pits ceased, the pits were covered with compacted native soil. In 1992, DOE constructed a engineered cap over the Pit 4 and 7 Landfills in compliance with RCRA. Since 1992, activities at the Pit 7 Complex have been restricted to environmental investigations, and periodic monitoring and maintenance of the landfill caps and monitoring network.

2.8.2. Reasonably Anticipated Future Onsite Land Use

LLNL Site 300 is a federal facility owned by the U.S. DOE and operated by the University of California that is currently used as an experimental test facility to support the Department's mission of research, development, and testing of HE materials. While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to open the land for recreational or residential uses. Provisions in the Site 300 FFA and in law assure that DOE will not transfer lands with unmitigated contamination that could cause potential harm. Because of DOE's current intentions and these assurances, non-DOE land uses for Site 300 have not been considered in any future land use assumptions. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through another means, DOE shall retain ultimate responsibility for remedy integrity.

The Site 300 Federal Facility Agreement provides:

"Per Section 28.1 of the FFA, DOE shall retain liability in accordance with CERCLA, not withstanding any change in ownership or possession of the real property interests comprising the Federal Facility. DOE shall not transfer any real property interests comprising the Federal Facility except in compliance with Section 120(h) of CERCLA, 42 U.S.C. § 9620 (h)."

CERCLA Section 120 (h) provides:

"Section (3) (A) . . . in the case of any real property owned by the United States on which any hazardous substance was stored for one year or more, known to have been released, or disposed of, each deed entered into for transfer of such property by the United States to any other person or entity shall contain –

(ii) a covenant warranting that

(I) all remedial action necessary to protect human health and the environment with respect to any such substance remaining on the property has been taken before the date of such transfer, and

(II) any additional remedial action found necessary after the date of such transfer shall be conducted by the United States.

[or](C)(i)... the Administrator or Governor, as the case may be, determines that the property is suitable for transfer, based on a finding that –

(I) the property is suitable for transfer for the use intended by the transferee, and the intended use is consistent with protection of human health and the environment; …"

In the unlikely event that the property is transferred in the future, DOE will execute a land use covenant at the time of transfer in compliance with Title 22 California Code of Regulations (CCR), Division 4.5, Chapter 39, Section 67391.1. A Memorandum of Understanding between DOE and DTSC will be prepared to document this agreement.

2.8.3. Current Offsite Land Use

Current land use distribution in the vicinity of Site 300 and the Pit 7 Complex is shown in Figure 2-11. Major users of land surround Site 300 include:

- Carnegie State Vehicular Recreation Area, an outdoor recreational facility operated by the California Department of Parks and Recreation for riding and racing private and commercial off-road motorcycles and four-wheel drive vehicles.
- SRI International, a private firm that operates an explosives test site in the hills south of the Carnegie State Vehicular Recreation Area.
- The Gallo and Connolly Ranches that are located south of Site 300 and used primarily for cattle grazing.
- Fireworks America, a private firm that operates a fireworks storage facility adjacent to the eastern border of Site 300.
- California Department of Fish and Game ecological reserve located east of Site 300 that currently allows no public access.

- Range land owned by the Mulqueeney, Yroz, and Vieira families immediately north and northwest of Site 300. This land and smaller parcels to the west are used primarily for cattle grazing and are generally absentee ownership.
- Privately owned land northeast of Site 300 where future residential development is planned (Tracy Hills Development).
- Wind turbine generators located north of Site 300.

Land use at Site 300 is designated as a restricted access, federal government industrial (experimental test) facility. The site boundary located closest to the Pit 7 Complex is approximately 2,500 ft north of the landfills and abuts private ranch land.

2.8.4. Reasonably Anticipated Future Offsite Land Use

Site 300 was originally selected as a DOE experimental test site because of the sparsely populated surrounding area. On the basis of residential population, the average density around the perimeter of Site 300 is less than one person per square mile.

Tracy is the closest city to Site 300, located northeast of Site 300. Tracy's location near three interstate freeways (I-580, I-205, and I-5) and railroad lines make it an important warehousing and distribution center. Tracy's population is growing rapidly. In January 1992, the population was 38,000. Commuters moving from the San Francisco and East Bay metropolitan areas in search of affordable housing have nearly doubled Tracy's population to approximately 74,000 by 2005. Tracy is expected to continue to grow to approximately 80,000 by the year 2010. Increased development throughout the Central Valley has become a major concern to area residents, as prime agricultural land is converted to housing, retail, and industrial space. Developers are now locating housing projects in the hilly regions (such as the area surrounding Site 300), to avoid the agricultural versus housing conflict. The Tracy Hills housing project, with a projected population of 28,000 people, is planned for development. This planned housing project is located on property adjacent to the northeast portion of Site 300.

2.8.5. Current Ground and Surface Water Uses

There are no water-supply wells located in or near the Pit 7 Complex. Onsite, bottled water is the primary source of drinking water, however, ground water from Site 300's water-supply Well 20 is available as necessary. Water from Well 20 is used primarily in program activities, dust and fire suppression, and for restroom facilities. Well 20 is located near the southern site boundary, approximately 2.5 miles southeast of the Pit 7 Complex (Figure 2-12). Well 18, located near Well 20, is used as a backup water-supply well for the site. There is no pathway for contaminated ground water at the Pit 7 Complex to reach Wells 18 or 20.

There are no offsite water-supply wells that pump ground water from aquifers that are hydraulically connected to contaminated water-bearing zones at the Pit 7 Complex. Because the $Tnbs_0$ bedrock HSU that contains contamination from the Pit 7 Complex is eroded away and/or unsaturated at the east-northeastern site boundary, there is no pathway for contaminants to reach offsite water-supply wells.

There are no perennial streams in the Pit 7 Complex area. Due to the semi-arid climate, natural surface water in the Pit 7 Complex area is relatively rare and has been observed as surface runoff only during heavy rainfall events. When surface runoff is generated during heavy El Niño-type events, surface water generally flows southeastward toward Doall Ravine.

The closest surface water body to the Pit 7 Complex in the direction of bedrock ground water flow is Spring 24. This spring is located in the next valley northeast of the Pit 7 Complex approximately 2,500 ft from the landfills (Figure 2-3). Although tritium has been detected in Spring 24, water from this spring is not used by humans at the site and there are no human activities conducted in the vicinity of the spring other than annual sampling of the spring water. The risk assessment indicated that there was no risk to human health posed by the tritium in the spring. While some animals at the site may use the spring for drinking, the ecological risk assessment indicated that there was no threat to animal populations.

2.8.6. Potential Ground and Surface Water Uses

While DOE does not anticipate significant changes in ground water or surface water use at Site 300 in the near future, it has agreements and plans in place to use Hetch-Hetchy water. When this occurs, Well 18 and/or Well 20 will likely be retained as backup water-supply wells for possible use in dust and/or fire suppression. Institutional controls are in place to prevent the drilling of water-supply wells in contaminated areas of Site 300.

There are plans to develop the land parcel to the east of Site 300 for residential housing (Figure 2-11), but DOE has not been informed about the potential water-supply for this development. However, because the $Tnbs_0$ bedrock HSU that contains contamination from the Pit 7 Complex is eroded away and/or unsaturated at the east-northeastern site boundary, there is no pathway for contaminants to reach potential offsite water-supply wells at this proposed development.

2.9. Summary of Pit 7 Complex Risks

This section summarizes the results of the baseline risk assessment conducted to evaluate risks to human and ecological receptors that may be exposed to contaminants from the Pit 7 Complex. Additional details may be found in Chapter 6 of the Site 300 SWRI report, the Building 850 SWRI Addendum, the Site 300 SWFS, and most recently, the Pit 7 Complex RI/FS.

2.9.1. Basis for Action

The response action selected in this Interim ROD Amendment is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances from this site.

The baseline risk assessment evaluated potential present and future public health and ecological risks associated with environmental contamination at the Pit 7 Complex using the assumption that no cleanup or remediation activities would take place at the site. The baseline risk assessment provides the basis for implementing a remedial action and identifies the potential exposure pathways that need to be addressed. Selection of a cleanup action was based in part on the extent to which it can reduce human and ecological risks. Risks due to potential ingestion of contaminated ground water were not evaluated because ground water is not currently used as drinking water and institutional controls will prohibit such use during cleanup. DOE and the regulators have agreed that ground water cleanup will be driven by ARARs.

The COCs identified at the Pit 7 Complex are uranium and tritium in subsurface soil/rock and ground water, and VOCs, nitrate, and perchlorate in ground water. Tables 2-1 and 2-2 list the COCs addressed in this Interim ROD Amendment, along with the historical and most recent maximum concentrations/activities.

2.9.2. Human Health Risks

The human health baseline risk assessment presented in the SWRI report consists of six components:

1. Identification of contaminants of potential concern.
2. Identification of the contaminated environmental media and exposure pathways.
3. Estimation of potential exposure-point concentrations of contaminants.
4. Human exposure and dose assessment.
5. Toxicity assessment.
6. Risk characterization.

Figure 2-13 shows the conceptual human exposure scenarios for the Pit 7 Complex.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where:

risk = a unitless probability (e.g., $2{\times}10^{-5}$) of an individual developing cancer.

CDI = chronic daily intake averaged over assumed exposure period (mg/kg-day).

SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$.

Risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to ultraviolet radiation. U.S. EPA requires that cancer risks above one in one million must be addressed by various risk controls and/or remedial actions.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level to which an individual may be exposed that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium, or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI/RfD}$$

where:

CDI = Chronic daily intake.

RfD = reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Baseline human health risks and hazards for the Pit 7 Complex were estimated using industrial adult onsite exposure and offsite residential exposure scenarios. The adult onsite exposure scenario estimates health risk where an adult is assumed to work in the immediate vicinity of worst-case contamination 8 hours a day, 5 days per week, for 25 years. Potential risks due to ingestion of contaminated ground water were not evaluated because ground water is not currently used as drinking water and institutional controls will prohibit such use during cleanup. DOE and the regulators have agreed that ground water cleanup will be driven by ARARs. Figure 2-13 shows the conceptual exposure scenarios for the Pit 7 Complex.

The results of the risk assessment (Table 2-3) indicate that the only unacceptable risk to human health posed by contaminants in the Pit 7 Complex area was inhalation of tritiated water evaporating from subsurface soil by onsite workers in the vicinity of the Pit 3 Landfill. This risk was estimated to be 4×10^{-6} (four in one million) and was calculated based on the assumption that a worker spends 8 hours a day, 5 days a week for 25 years at the Pit 7 Complex. However, only periodic monitoring activities are conducted at the landfills and no workers actually spend this amount of time in the area. There was no unacceptable risk identified for offsite residents.

A risk for exposure to contaminants in the pit waste could not be calculated due to safety restrictions on penetrating landfill waste. Institutional and use controls discussed in Section 2.13.2.2, based on the potential exposure to contaminants in pit waste, assume that the waste contaminants may pose a risk to human health.

2.9.3. Ecological Hazard Assessment

The ecological assessment included the following components:

- Determination of the presence or potential presence of threatened or endangered species.
- Determination of the significant ecological exposure pathways to the ecological contaminants of potential concern.
- Selection of ecological assessment and measurement endpoints.
- Final estimation of ecological impact and hazard on the selected assessment endpoints.

Assessment endpoints are explicit expressions of the specific environmental values that are to be protected. The assessment endpoints were selected using an exposure pathway/food web analysis; a threatened and endangered species analysis; and an evaluation of contaminants of potential concern. The assessment endpoints selected for the Site 300 baseline ecological assessment that are relevant to the Pit 7 Complex include:

- Changes in species composition in native grassland communities.
- Reduction in the abundance of California ground squirrel populations.
- Reduction in the abundance of black-tailed deer populations.
- Mortality or reduction in reproductive potential of individual San Joaquin kit fox.

Measurement endpoints were selected for each assessment endpoint. Hazard indices were calculated for individual terrestrial animals and plants, species diversity indices were calculated for plant communities, and changes in abundance (both spatially and temporally) were evaluated for the ground squirrel population. An HI or toxicity quotient greater than 1 indicates that an elevated ecological hazard potentially exists to individuals of the selected species, although this may not reflect hazard to the overall population.

The results of the baseline ecological assessment indicate there were no unacceptable hazards identified for plants and animals residing in this area. This determination was based on estimates of hazard from potential exposure to contaminants that were calculated for mammals, amphibians, and birds that could potentially inhabit this area, including threatened and endangered species.

2.10. Remedial Action Objectives

The NCP specifies that Remedial Action Objectives (RAOs) be developed which address: (1) COCs, (2) media of concern, (3) potential exposure pathways, and (4) preliminary remediation levels.

The development of these goals involves consideration of action-specific ARARs and requirements that may become ARARs in the Final ROD, along with the results of the baseline human and ecological risk assessments. The proposed actions are based upon the assumption that cleanup standards for ground water contaminants in the Final ROD will be between MCLs and background. RAOs describe what the remedy for the Pit 7 Complex is expected to accomplish:

For Human Health Protection:

- Prevent people from drinking ground water containing contaminant concentrations above the State and federal drinking water standards and any more stringent water quality objectives.
- Prevent onsite workers from inhaling tritiated water volatilizing from subsurface soil to air that poses an unacceptable risk (greater than one in one million [1×10^{-6}]) or hazard.
- Prevent people from being exposed to any contaminated media (e.g., soil or ground water) that pose an unacceptable additive risk or hazard for all contaminants.

For Environmental Protection:

- Restore water quality, at a minimum, to water quality objectives that protect beneficial uses within a reasonable timeframe and prevent plume migration to the extent technically and economically practicable.
- Maintain existing water quality that complies with water quality objectives.
- Ensure existing contaminant conditions do not change so as to threaten wildlife populations and vegetation communities.

To the degree that these cleanup objectives are achieved by interim measures, the interim measures may be selected as the final cleanup remedies for the site pending review of their effectiveness and any needed contingency plans. Final ground water cleanup standards will be selected in the Final Site-Wide ROD scheduled for 2008.

2.11. Description of Alternatives

This section describes the interim remedial alternatives considered to address COCs in the Pit 7 Complex area. The RI/FS for the Pit 7 Complex presented five remedial action alternatives (1, 2, 3 [a and b], 4 [a and b], and 5 [a and b]). These actions are intended to: (1) mitigate potential exposure to, (2) control the migration of, and/or (3) remediate the COCs in subsurface soil/rock and ground water in the Pit 7 Complex area. These remedial action alternatives are summarized in Table 2-4.

2.11.1. Alternative 1—No Further Action

A no-action alternative is generally required by U.S. EPA guidance to provide a baseline for comparison to other remedial alternatives, and is the postulated basis of the baseline risk assessment. Under a no-action response, all monitoring and maintenance activities at the Pit 7 Complex would cease. There are no costs associated with the no-action alternative.

2.11.2. Alternative 2—Monitoring, Risk and Hazard Management/Exposure Control, Monitored Natural Attenuation of Tritium in Ground Water, and Waste Excavation and Disposal

The primary components of Alternative 2 include:

1. Monitoring ground water for COCs.
2. Risk and hazard management, including institutional/land use controls, to prevent exposure of humans and ecological receptors to COCs.
3. Monitored natural attenuation of tritium in ground water.
4. Excavation and disposal of waste in Pits 3 and 5.

These components are described in Sections 2.11.2.1 through 2.11.2.4.

The present-worth cost of Alternative 2 for the Pit 7 Complex area is $56,635,000 based on 30 years of monitoring, exposure control, and monitored natural attenuation. One-time capital costs for excavation and disposal of the waste in Pits 3 and 5 are also included. Although Alternative 2 was costed for 30 years, modeling indicates that it could require up to 500 years for uranium to attenuate to its MCL. For Alternative 2, the annual present-worth cost to monitor uranium in ground water is $73,000 in year 31. The annual present-worth monitoring cost for year 31 could be used to estimate longer-term cleanup costs associated with Alternative 2, although the reliability of these estimates decreases as the duration of the remedy increases.

The locations of the components of Alternative 2 are shown on Figure 2-14.

2.11.2.1. Monitoring

Sampling and analysis of ground water from monitor wells in the area would continue in order to monitor COCs in the subsurface. Additional monitor wells would be installed, if necessary, to monitor the effectiveness of the remedial action in meeting remedial action objectives and ARARs.

Monitoring would be conducted to:

1. Track changes in concentration and distribution of COCs to ensure there is no impact to downgradient receptors.

2. Evaluate the effectiveness of the overall remedial action.
3. Evaluate the effectiveness of source control measures and the natural attenuation of contaminants in ground water to meet ARARs and cleanup goals.
4. Detect and analyze deviations from expected rates of natural attenuation of contaminants.
5. Verify the attainment of cleanup standards.

Monitoring would focus on COCs in ground water. This monitoring would be conducted to assess potential contaminant migration, changes in COC concentrations, and assess human or ecological impacts while source control measures prevent further releases. Because active remediation of VOCs, uranium, nitrate, and perchlorate in ground water is not proposed in Alternative 2, monitoring would provide an indication of changes in the nature and extent of these contaminants that could impact human or environmental receptors. Source control measures would prevent further releases and natural processes would reduce COC concentrations in ground water.

The ground water data obtained as part of the Alternative 2 monitoring program would be reviewed regularly. If data indicate that contaminant concentrations, ground water flow direction, and/or velocity have changed, the monitoring program would be reevaluated. The Site 300 Contingency Plan would be modified to include actions to be implemented in the event that unanticipated COC migration occurs.

2.11.2.2. Risk and Hazard Management/Exposure Control

As part of Alternative 2, a risk and hazard management program, including institutional/land use controls will be implemented to:

1. Ensure RAOs are achieved.
2. Manage risk and/or hazard by preventing exposure to contaminated media.

These controls provide a degree of protection to human health by restricting access to or activities in areas of contamination, thereby preventing exposure to contaminants.

The risk and hazard management program would include: (1) implementing restrictions for construction in the Pit 7 Complex area, (2) modeling outdoor air annually (or until two successive years indicate no risk) for tritium at Pit 3, (3) reviewing exposure pathway-related conditions, such as facility and land use, (4) refining risk and hazard models using current data, and (5) reporting the results to the stakeholders.

There is no unacceptable risk of exposure to contaminants in any media in the vicinity of the Pit 7 Complex to individual adult or juvenile ground squirrels, deer, or kit fox. While specific exposure control measures for ecological receptors are not needed, the current LLNL program of conducting ecological resource surveys for sensitive species prior to the initiation of any ground-disturbing activities would continue. The need for detailed ecological resource surveys would be evaluated every five years.

The Site 300 Contingency Plan would be modified, as necessary, to include actions to be implemented in the event that exposure control measures do not achieve RAOs or comply with ARARs. For example, the Site 300 Contingency Plan would be amended to also address situations where existing access restrictions are removed or relaxed.

2.11.2.3. Monitored Natural Attenuation of Tritium in Ground Water

Alternative 2 includes monitored natural attenuation to reduce tritium activities in ground water to meet RAOs and ARARs.

U.S. EPA's OSWER Directive 9200.4-17 (1997) states that monitored natural attenuation may be appropriate as a remedial approach where it can be demonstrated to be capable of achieving a site's remedial objectives within a time frame that is reasonable compared to that offered by other methods and given the particular circumstances of the site. According to this directive, the elements that are important to establish a monitored natural attenuation remedy are: (1) the contamination is not currently posing an unacceptable risk, (2) source control measures have been implemented or the data show that the source is no longer releasing contaminants to the environment, and (3) static or reduction in areal extent of plume contours. Natural attenuation may be demonstrated through a variety of lines of evidence, including static or reduced areal extent of plume concentration contours, the presence of contaminant breakdown products, or the formation or depletion of geochemical indicator compounds.

The tritium plume at the Pit 7 Complex meets these criteria because: (1) no unacceptable risk was identified for this plume, and (2) fate and transport modeling indicates that, even without source control measures, tritium in ground water will naturally attenuate to drinking water standards or lower within a reasonable timeframe without migrating offsite above background activities, and (3) the areal extent of the tritium plume with activities above drinking water MCLs is static or retreating, and once source control measures are implemented, natural attenuation will reduce the extent of the tritium plume contours above background activities. In addition, there is no effective technology capable of removing tritium from ground water.

The following activities would be conducted to monitor the effectiveness of monitored natural attenuation and detect any changes in activities or plume size that could result in impacts to human or ecological receptors:

- Measure ground water levels.
- Sample and analyze ground water for tritium.
- Manage, analyze, and present data.
- Perform fate and transport modeling to predict the spatial distribution of tritium and uranium over time and to demonstrate the efficacy of monitored natural attenuation in meeting RAOs and ARARs.
- Assess risk, as necessary, to re-evaluate risk and hazard posed to human and ecological receptors based on newer data and modeling results.
- Install additional monitoring wells, if required.

The Site 300 Contingency Plan would be modified to include actions to be implemented in the event that monitored natural attenuation of tritium in ground water does not achieve remedial action objectives or comply with ARARs. If such a situation arose, the remedy would be changed and documented in the final Site-Wide ROD, an Explanation of Significant Difference, or a ROD amendment.

2.11.2.4. Waste Excavation of Pits 3 and 5 and Disposal

As part of Alternative 2, the waste in the Pit 3 and 5 Landfills would be excavated and disposed offsite. This component of Alternative 2 is designed to eliminate the potential for continued releases of contaminants from the pits and entails removing approximately 26,200 cubic yards (yd^3) volume of waste from Pit 3 and 29,000 yd^3 of waste from Pit 5. Some vadose zone material outside the landfills would also be removed. However, material beneath and some material to the sides of the landfills, some with elevated activities of tritium and depleted uranium, would remain as would all of Pits 4 and 7, which are beneath a RCRA cap. As a result, additional releases of tritium and uranium could occur from bedrock underlying the Pit 7 Complex, even after excavation of the pit contents.

The Pit 7 RCRA cap covers about 30% of Pit 3. However, this portion of the cap does not include the 2-ft thick impermeable clay layer, and therefore excavation of Pit 3 would not breach that layer. A berm of fill gravel and soil comprise the portion of the Pit 7 RCRA cap that overlies Pit 3. This berm would be excavated, segregated prior to excavation of Pit 3, and reconstructed after excavating and filling the pit with clean soil.

2.11.3. Alternative 3—Monitoring, Risk and Hazard Management/Exposure Prevention, Monitored Natural Attenuation of Tritium in Ground Water, Waste Excavation and Disposal, and Treatment of Uranium, Nitrate, and Perchlorate in Ground Water

Alternative 3 includes the following elements of Alternative 2 as described in Sections 2.11.2.1, 2.11.2.2, 2.11.2.3 (for tritium only), and 2.11.2.4:

1. Monitoring of ground water for COCs.
2. Risk and hazard management, including institutional/land use controls, to prevent exposure of COCs to humans and ecological receptors.
3. Monitored natural attenuation of tritium in ground water.
4. Waste excavation and disposal.

Alternative 3 also includes the following component:

5. Controlling migration of uranium, nitrate, and perchlorate in Qal/WBR and $Tnbs_0$ HSU ground water through the use of *ex situ* treatment of ground water (Alternative 3a) or *in situ* treatment of Qal/WBR ground water coupled with extraction and *ex situ* treatment of $Tnbs_0$ ground water (Alternative 3b).

The estimated present-worth cost of Alternative 3a ranges from $63,741,000 to $68,326,000 for 30 years of monitoring, exposure control, monitored natural attenuation, *ex situ* ground water treatment activities, and one-time costs for waste excavation and disposal. The lower cost includes ground water extraction from Qal/WBR and $Tnbs_0$ wells and *ex situ* treatment. The higher cost includes Qal/WBR ground water extraction using a funnel and sump combined with $Tnbs_0$ ground water extraction using wells with *ex situ* treatment.

The estimated present-worth cost of Alternative 3b for the Pit 7 Complex area is $73,979,000 for 30 years of monitoring, exposure control, monitored natural attenuation, *in situ* treatment of Qal/WBR ground water combined with extraction and *ex situ* treatment of $Tnbs_0$ ground water, and one-time capital costs for waste excavation and disposal.

Although Alternatives 3a and 3b were both costed for 30 years, modeling indicates that it could require up to 150 years for uranium activities to be reduced below its MCL under Alternative 3a, and up to 500 years for Alternative 3b. The estimated present-worth costs for Alternative 3a in year 31 ranges from $137,000 (extraction wells) to $301,000 (funnel and sump with $Tnbs_0$ extraction wells). The estimated present-worth cost Alternative 3b in year 31 is $454,000. The annual present-worth costs for year 31 could be used to estimate longer-term cleanup costs associated with Alternative 3a and b, although the reliability of these estimates decreases as the duration of the remedy increases.

The locations of the components of Alternatives 3a and 3b are shown on Figure 2-15. Sections 2.11.3.1 and 2.11.3.2 present the additional components of Alternative 3 (a and b) that were not included or discussed in Alternative 2.

2.11.3.1. Ex situ Treatment of Uranium, Nitrate, and Perchlorate in Ground Water (Alternative 3a)

In Remedial Alternative 3a, uranium, nitrate, and perchlorate in ground water would be extracted using a funnel and sump system and extraction wells or extraction wells immediately downgradient of Pits 3 and 5.

The funnel and sump system would consist of a subsurface trench filled with permeable material constructed across the path of the contaminant plumes in Qal/WBR HSU ground water. The funnel would collect and direct contaminated ground water toward the collection sump. Ground water would be extracted from the sump and treated in an aboveground treatment system. Ground water collection, extraction, and treatment would continue until the contaminants plumes had fully moved through the system. In addition to the funnel and sump system, ground water would be extracted from two $Tnbs_0$ wells that contain perchlorate at concentrations above the Public Health Goal, and/or nitrate above the MCL. Ground water extracted using the funnel and sump system and extraction wells would be treated in an *ex situ* treatment system and an infiltration gallery would be used to return the treated water to the subsurface.

If only extraction wells were used to remove ground water from the subsurface, the wells would be placed within the areas of highest depleted uranium activities in Qal/WBR ground water adjacent to and downgradient of Pits 3 and 5. In addition, natural uranium would be extracted and treated from the three wells from which recent samples contained natural uranium activities in excess of the 20 pCi/L total uranium MCL. These wells also contain elevated concentrations of perchlorate and nitrate. Ground water extracted from the wells would be treated in an *ex situ* treatment system using ion exchange or other similar treatment media. The treated water would then be reinjected into wells located downgradient of the extraction wells.

Because there is currently no viable technology available to treat tritiated ground water, the treated water containing only tritium would be reintroduced to the subsurface through infiltration trenches or reinjection wells.

VOC (TCE and 1,1-DCE) concentrations in ground water are below drinking water standards, are currently detected in only four wells, and are continuing to decrease toward background concentrations. For these reasons, VOCs in ground water are not specifically targeted for extraction. However, because VOCs may be present with other COCs in extracted ground water, additional treatment (i.e., granular activated carbon) may be needed to reduce

VOC concentrations to meet RWQCB effluent discharge requirements prior to reinfiltration or reinjection.

2.11.3.2. In Situ Treatment of Uranium, Nitrate, and Perchlorate in Ground Water (Alternative 3b)

In Remedial Alternative 3b, the migration of uranium, nitrate, and perchlorate in ground water would be controlled by installing an *in situ* permeable reactive barrier downgradient of the Pit 5 Landfill within the Qal/WBR HSU coupled with the extraction of ground water from two wells screened in the $Tnbs_0$ HSU. The permeable reactive barrier would be designed to prevent the migration of uranium downgradient of its source in Pits 3 and 5 and remove uranium from Qal/WBR ground water. Nitrate and perchlorate that exist as co-contaminants within the Qal/WBR HSU could also be treated by adding resins capable of sorbing these constituents to the cow bone char in the barrier. In addition to the permeable reactive barrier, ground water would be extracted from two $Tnbs_0$ wells that contain perchlorate at concentrations above the Public Health Goal, and/or uranium and nitrate above the MCL and treated using an *ex situ* treatment unit. The treated water would then be reinjected into wells located downgradient of the extraction wells.

Because there is currently no viable technology available to treat tritiated ground water, the treated water containing only tritium would be reintroduced to the subsurface through reinjection wells. VOC concentrations in ground water are below MCLs and continuing to decrease toward background, and are limited in extent to the area immediately downgradient of the landfills. Therefore, it is not anticipated that treatment media for VOCs will be needed as part of the *in situ* or *ex situ* treatment.

2.11.4. Alternative 4—Monitoring, Risk and Hazard Management/Exposure Prevention, Monitored Natural Attenuation of Tritium in Ground Water, and Source Control/Isolation

Alternative 4 includes the following elements of Alternative 2 as described in Sections 2.11.2.1, 2.11.2.2, and 2.11.2.3:

1. Monitoring ground water for COCs. The Site 300 Contingency Plan would contain measures to be implemented if the remedy does not proceed as anticipated.
2. Risk and hazard management, including institutional/land use controls, to prevent exposure of humans and ecological receptors to COCs.
3. Monitored natural attenuation of tritium in ground water.
4. Alternative 4 also includes source control by installing hydraulic diversion to prevent water from entering the landfills (Alternative 4a), or source containment by installing hydraulic barriers to prevent water from entering the landfills (Alternative 4b).

Alternative 4 includes two sub-alternatives designed to isolate the landfills from ground water to prevent future release of contaminants from the pits. Alternative 4a includes source control using hydraulic drainage diversion to prevent lateral and upward flow of ground water into the pits. Alternative 4b includes source isolation by installing a hydraulic barrier designed to isolate the pits from ground water contact.

The present-worth cost of Alternative 4a for 30 years of monitoring, exposure control, monitored natural attenuation, and hydraulic diversion is $3,738,000. The present-worth cost of

Alternative 4b for 30 years of monitoring, exposure control, monitored natural attenuation, and hydraulic barrier containment is $4,344,000. Although Alternatives 4a and 4b were both costed for 30 years, modeling indicates that it could require up to 500 years for uranium to attenuate to its MCL. For Alternative 4a and b, the annual present-worth cost to monitor depleted uranium in ground water ranges from $78,000 (Alternative 4a) to $79,000 (Alternative 4b) in year 31. The annual present-worth monitoring cost for year 31 could be used to estimate longer-term cleanup costs associated with Alternatives 4a and b, although the reliability of these estimates decreases as the duration of the remedy increases.

The locations of the components of Alternative 4a and 4b are shown on Figure 2-16. Sections 2.11.4.1 and 2.11.4.2 present the additional components of Alternative 4 (a and b) that were not included or discussed in Alternative 2.

2.11.4.1. Source Control: Hydraulic Diversion (Alternative 4a)

Alternative 4a incorporates a series of engineered water diversion structures to reduce infiltration of recharge, and prevent subsequent inundation of Pits 3, 4, 5, and 7 by ground water. This approach would isolate the contaminant source zones from subsurface water, effectively preventing further releases from the pits and vadose zone.

The hydraulic diversion system proposed in Alternative 4a would be designed to divert surface runoff and shallow ground water from the hill slopes west and east of the pits to minimize rapid water table rises and pit inundation. This would effectively control the sources allowing tritium and uranium to decay in place, while preventing the migration of uranium, nitrate, and perchlorate in ground water.

2.11.4.2. Source Isolation: Barrier (Alternative 4b)

Alternative 4b includes an hydraulic barrier system to prevent water from entering the pits from the sides or below. Under this alternative, a continuous slurry wall would be installed around Pits 3, 4, 5, and 7 by drilling or trenching and high-pressure pumping of a slurry to create a continuous barrier of low permeability material that would enclose the landfills.

2.11.5. Alternative 5—Monitoring, Risk and Hazard Management/Exposure Prevention, Monitored Natural Attenuation of Tritium in Ground Water, Source Control, and Treatment of Uranium, Nitrate, and Perchlorate in Ground Water

Alternative 5 includes the following elements of Alternative 2 as described in Sections 2.11.2.1, 2.11.2.2, and 2.11.2.3 (for tritium only), Alternative 3 as described in Sections 2.11.3.1 and 2.11.3.2, and Alternative 4 as described in Sections 2.11.4.1:

1. Monitoring ground water for COCs.
2. Risk and hazard management, including institutional/land use controls, to prevent exposure of humans and ecological receptors to COCs.
3. Monitored natural attenuation of tritium in ground water.
4. Phased *ex situ* (5a) or *in situ* (5b) treatment of uranium, nitrate, and perchlorate in ground water.
5. Source control through hydraulic diversion.

Ground water treatment would be conducted using a phased approach because design of the systems to treat uranium, nitrate, and perchlorate in ground water could not be finalized until the effects of the hydraulic diversion system on local hydrologic conditions have stabilized. The drainage diversion system used for source control will alter ground water recharge patterns in the Pit 7 Complex area, causing changes to the hydrologic conditions adjacent to and downgradient of the landfills. As a result of recharge diversion, the volume of ground water and extent of saturation may be reduced in the Qal/WBR HSU near the pits and in the areas of highest depleted uranium activities in ground water. These changes in hydrologic conditions will have the greatest impact on the design and placement of the *in situ* treatment system (permeable reactive barrier) (Alternative 5b), less on the funnel and sump with an *ex situ* treatment system, and least on the extraction well, *ex situ* treatment, and reinjection system (Alternative 5a).

The present-worth cost of Alternative 5a (selected remedy) for 30 years of monitoring, exposure control, monitored natural attenuation of tritium, *ex situ* treatment of uranium, nitrate, and perchlorate in ground water, and source control by hydraulic diversion ranges from $10,845,000 to $15,429,000. The lower cost includes ground water extraction from Qal/WBR and $Tnbs_0$ wells and *ex situ* treatment. The higher cost includes Qal/WBR ground water extraction from a funnel and sump combined with $Tnbs_0$ ground water extraction using wells, and *ex situ* treatment. The present-worth cost of Alternative 5b for 30 years of monitoring, exposure control, monitored natural attenuation of tritium, and *in situ* treatment of uranium, nitrate, and perchlorate in Qal/WBR ground water combined with extraction and *ex situ* treatment of $Tnbs_0$ ground water, and source control by hydraulic diversion is $21,082,000. Although Alternatives 5a and 5b were both costed for 30 years, modeling indicates that it could require up to 150 years for uranium activities to be reduced below its MCL under Alternative 5a, and up to 500 years for Alternative 5b. The present-worth costs for Alternative 5a in year 31 range from $142,000 (extraction wells) to $306,000 (funnel and sump with $Tnbs_0$ extraction wells) and are $459,000 for Alternative 5b in year 31. The annual present-worth costs for year 31 could be used to estimate longer-term cleanup costs associated with Alternative 5, although the reliability of these estimates decreases as the duration of the remedy increases.

The locations of the components of Alternatives 5a (selected remedy) and 5b are shown on Figure 2-17.

2.12. Comparative Analysis of Alternatives

The NCP and the U.S. EPA identify nine criteria to be used in the detailed analysis of remedial alternatives, as described in Section 2.12.1. Section 2.12.2 presents the analysis of the Pit 7 Complex alternatives against these criteria.

2.12.1. Evaluation Criteria

The nine criteria identified by the NCP and the U.S. EPA for analysis of remedial alternatives are:

1. Overall protection of human health and the environment.
2. Compliance with ARARs and regulations.
3. Long-term effectiveness and permanence.
4. Reduction of toxicity, mobility, and volume through treatment.

5. Short-term effectiveness.
6. Implementability.
7. Cost.
8. State acceptance.
9. Community acceptance.

The first two criteria, called threshold criteria, are the most important since alternatives that do not meet them are not considered viable. Criteria 3 through 7 are called balancing criteria and are used to evaluate trade-offs among the alternatives. The last two criteria, called modifying criteria, are to be considered in the remedy selection and are evaluated after State of California and community comments are received on the subsequent Proposed Plan for the Pit 7 Complex. Each of these criteria is discussed below.

2.12.1.1. Overall Protection of Human Health and the Environment

This criterion addresses whether the alternative provides adequate protection of human health and the environment and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2.12.1.2. Compliance with ARARs and regulations

Unless a waiver is obtained, the alternative or combination of alternatives that are finally selected must comply with all location-, action-, and applicable chemical-specific ARARs and regulations.

2.12.1.3. Long-Term Effectiveness and Permanence

This criterion is used to evaluate how each alternative maintains reliable protection of human health and the environment over time once cleanup standards have been met.

2.12.1.4. Reduction of Toxicity, Mobility, and Volume through Treatment

This criterion is used to evaluate the anticipated ability of an alternative to reduce the toxicity, mobility, and/or volume through treatment of hazardous components present at the site.

2.12.1.5. Short-Term Effectiveness

This criterion addresses the period of time needed to complete the remedy, and any adverse impact on human health and the environment that may be posed during the construction and implementation period. This includes the safety of workers and the public, disruption of site and surrounding land uses, and time necessary to achieve protective measures.

2.12.1.6. Implementability

This criterion addresses the technical and administrative feasibility of each alternative. Factors considered include:

- Availability of goods and services.
- Flexibility of each alternative to allow additional modified remedial actions.
- Effectiveness of monitoring.

- Generation and disposal of hazardous waste.
- Substantive permitting requirements.

2.12.1.7. Cost

Capital, operation and maintenance, monitoring, and contingency costs are estimated for each alternative and are presented as 2004 present-worth costs using a 5% discount rate. Total costs for all alternatives were estimated within an accuracy of +50% and –30% in accordance with EPA guidance (U.S. EPA, 2000) and are provided for comparison purposes only.

2.12.1.8. State Acceptance

The California DTSC and RWQCB have reviewed and commented on this document. These State agencies have participated in the selection of the remedy described in this Interim ROD Amendment.

2.12.1.9. Community Acceptance

A Public Meeting was held on April 5, 2006 during the 45-day comment period for the Proposed Plan to present and receive public input on the proposed remedial alternatives for the Site 300 OUs. Public comments made during the Public Meeting and 45-day comment period are addressed in the Responsiveness Summary (Section 3) of this document.

2.12.2. Comparative Evaluation of Remedial Alternatives for the Pit 7 Complex

This section and Table 2-4 present a comparative evaluation of the characteristics of each alternative against the other alternatives for the Pit 7 Complex with respect to the nine EPA criteria specified by the NCP.

2.12.2.1. Overall Protection of Human Health and the Environment

Alternative 1 (no action) may not be protective of human health and the environment because without monitoring COCs in ground water, there would be no means of determining changes in plume size and location that could impact downgradient receptors. No water-supply wells are currently contaminated with VOCs, tritium, uranium, nitrate, or perchlorate originating from the Pit 7 Complex, or are located near plumes in this area. Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a [selected remedy] and b) address risk to human health from potential ingestion of contaminated ground water and inhalation of tritium in water vapor evaporating from subsurface soil/rock. These alternatives include the same measures to prevent exposure of human and ecological receptors to contamination while contaminant concentrations/activities are being reduced, such as administrative controls to prevent access to contaminated ground water. Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a and b) include measures to reduce contaminant concentrations and mass in ground water and monitor for changes that could impact human health and the environment. The monitored natural attenuation and monitoring components of Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a and b) include monitoring and modeling of contaminant fate and transport in ground water that would help to determine any changes in contaminant activities or plume size that could impact human health and warrant more active remedial measures. While it may take up to 500 years to reduce uranium activities and mass to meet its MCL under Alternatives 2 and 4 (a and b), human health would be protected because the plume would not significantly migrate once the source is controlled. In addition, the ground water in this area is not suitable for potable uses due to naturally high total dissolved solid concentrations in ground water. Also, there are no complete pathways for this ground water to reach human or ecological receptors. Therefore, DOE believes that Alternatives 2 and 4 (a and b) can protect human health and the environment during the time period necessary to reduce uranium mass to meet its MCL. However, the U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe for achieving the MCL or other RAOs for uranium. Under Alternatives 2 and 4 (a and b), nitrate and perchlorate concentrations in ground water would be reduced to meet regulatory standards by natural processes well in advance of depleted uranium.

The *ex situ* or *in situ* treatment of depleted uranium, nitrate, and perchlorate in Alternatives 3 (a and b) and 5 (a [selected remedy] and b) would reduce activities/concentrations of these contaminants to levels that are protective of human health and the environment.

The excavation component of Alternatives 2 and 3 (a and b) would provide additional long-term protection for human health and the environment by removing the contaminant source in the pit waste, thereby mitigating tritium inhalation risk. Although these alternatives would reduce further releases of contaminants in the pit waste to ground water, contamination that has already migrated to the underlying bedrock would not be controlled. Exposure potential for workers would also increase during excavation and disposal. Offsite disposal could create risks associated with transport of potentially hazardous materials on public roads. The hydraulic diversion component of Alternatives 4a and 5 (a [selected remedy] and b) and the hydraulic barrier component of Alternative 4b would provide long-term protection for human health and the environment by preventing ground water contact with contaminant sources both in the pit waste and underlying bedrock, thereby preventing further releases to ground water.

In summary, all of the remedial alternatives, except for Alternative 1, protect human health and the environment.

2.12.2.2. Compliance with ARARs

Alternative 1 (no action) may not comply with ARARs. Natural attenuation, primarily the radioactive decay of tritium and uranium, would act to reduce contaminant concentrations. However, there are no provisions in this alternative to monitor for the attainment of ARARs and the timeframe to reduce concentrations to MCLs or lower may not be reasonable without source control or source isolation measures to prevent further releases.

Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a [selected remedy] and b) include measures to meet State and Federal ground water chemical-specific ARARs by reducing contaminant concentrations/activities to MCLs, water quality objectives, or below. These alternatives include source control or source isolation measures to prevent further releases of contaminants to the subsurface. Alternatives 2 and 3 (a and b) include waste excavation and Alternatives 4 (a and b) and 5 (a and b) include either hydraulic diversion or barriers to prevent contaminant releases to ground water. Because the waste excavation proposed in Alternatives 2 and 3 (a and b) do not include removal of bedrock containing residual contamination, these alternatives would not be as effective in meeting ARARs as Alternatives 4 (a and b) and 5 (a and b). These alternatives employ hydraulic diversion or barriers to prevent: (1) water contact with both the pit waste and contaminants in the underlying bedrock, and (2) any future degradation of water quality. Because there are no effective treatment technologies for tritium, all alternatives rely on monitored natural attenuation to reduce tritium activities in ground water to meet State and Federal chemical-specific ARARs. Monitoring and modeling data indicate that tritium should meet ARARs in a reasonable timeframe whether or not source control or source isolation measures are implemented.

Alternatives 2 and 4 (a and b) rely on sorption, dispersion, and diffusion to reduce uranium activities, and nitrate and perchlorate concentrations in ground water. While it may take up to 500 years to reduce uranium activities and mass to meet its MCL, human health would be protected because the plume should not significantly migrate once the source is controlled. In addition, ground water in this area is not suitable for potable uses due to naturally high total dissolved solid concentrations in ground water. Also, there are no complete pathways for this ground water to reach human or ecological receptors. Therefore, DOE believes that since human health and the environment will be protected during the time period necessary to reach the uranium MCL, Alternatives 2 and 4 (a and b) are capable of achieving RAOs and ARARs without impacting human health or the environment. This timeframe should also be adequate to reduce perchlorate and nitrate concentrations below water quality objectives. However, the U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe for achieving MCLs or other RAOs for uranium.

Alternatives 3 (a and b) and 5 (a and b) provide measures to actively reduce the activities/concentrations and mass of depleted uranium, nitrate, and perchlorate in ground water to meet ARARs. Modeling results indicate that it may take up to 500 years for the funnel and sump/extraction and treatment system in Alternatives 3a and 5a, and the permeable reactive barrier in Alternatives 3b and 5b to reduce total uranium activities to below its MCL. Modeling results indicate that it may take up to 150 years to reduce total uranium activities to below its MCL using an extraction wellfield and *ex situ* treatment system (Alternatives 3a and 5a [selected remedy]). However, since total uranium activities were used in the model, the time to reduce depleted uranium activities to below the MCL may be less.

In summary, all the alternatives, except for Alternative 1, would mitigate future releases of COCs to ground water and employ monitored natural attenuation to reduce pre-existing ground water tritium contamination to meet ARARs. *In situ* or *ex situ* treatment provided under Alternatives 3 (a and b) and 5 (a and b) can reduce uranium activities in ground water faster to meet ARARs than monitoring (Alternatives 2 and 4a and b) alone.

2.12.2.3. Long-Term Effectiveness and Permanence

Alternative 1 (no action) may provide some long-term effectiveness in meeting ARARs or permanently reducing contaminant concentrations. The radioactive decay of tritium and uranium is irreversible and hence effective in the long term and permanent. However without monitoring, the effectiveness and permanence of the remedy cannot be verified because new releases would not be detected.

Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a [selected remedy] and b) provide long-term effectiveness by controlling or containing the contaminant sources, and the natural attenuation of contaminants in ground water. The excavation component of Alternatives 2 and 3 (a and b) would provide for the most effective and permanent prevention of future contaminant releases from the landfill waste to ground water, but would not prevent future releases of contaminants in the bedrock underlying the landfills. The drainage diversion and barrier components of Alternatives 4 (a and b) and 5 (a [selected remedy] and b) would be more effective because they would prevent future contaminant releases from both the landfill waste and the underlying bedrock. The *ex situ* or *in situ* treatment components of Alternatives 3 (a and b) and 5 (a and b) would permanently remove uranium, nitrate, and perchlorate from the subsurface and control the migration of these contaminants more rapidly than by natural attenuation (Alternatives 2 and 4 a and b) only. Once the landfill sources are isolated, the treatment of uranium, nitrate, and perchlorate would only be required until these anthropogenic contaminants are removed from ground water. Therefore, the ground water treatment technologies proposed would be effective in the long term.

2.12.2.4. Reduction of Toxicity, Mobility, and Volume through Treatment

While Alternative 1 (no action) does not remove COCs from the subsurface, the natural attenuation of contaminants may result in the long-term reduction of the volume of contaminants if further releases do not occur. However, because no source control measures are included in Alternative 1, further contaminant releases could occur, and the toxicity and mobility of contaminants would not be reduced.

Because there are no effective treatment technologies for tritium, Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a [selected remedy] and b) all rely on the monitored natural attenuation to achieve a long-term reduction in toxicity, mobility, and volume of tritium in the subsurface. Alternatives 2 and 4 (a and b) rely on sorption to reduce the mobility of depleted uranium in ground water, however the toxicity and volume would not be reduced.

The excavation component of Alternatives 2 and 3 (a and b) would reduce the mobility of the contaminants in the pit waste by removing any waste that constitutes a significant source, thereby preventing further leaching of contaminants in the pit waste to the subsurface. It would not reduce the toxicity or volume of the contaminants as the waste would be deposited at a new location. Because the waste excavation proposed in Alternatives 2 and 3 (a and b) does not include removal of bedrock underlying the landfills that contains residual contamination, these alternatives would not reduce the toxicity, mobility, or volume of contaminants remaining in the bedrock. The hydraulic barrier and hydraulic drainage diversion components of Alternatives 4 and 5, respectively, would be more effective because they would reduce the mobility of contaminants in both the landfill waste and the underlying bedrock.

The extraction and *ex situ* treatment component of Alternatives 3a and 5a (selected remedy) would reduce the volume and mobility of uranium, nitrate, and perchlorate, and some VOCs in ground water. Although the uranium collected in the treatment media is not destroyed, radioactive decay would reduce the toxicity and volume of the uranium removed from ground water.

Alternatives 3b and 5b employ *in situ* reactive barriers to limit the mobility of uranium, nitrate, and perchlorate by sorption onto reactive materials within the barrier. Removal of the spent barrier materials would reduce the volume of uranium in the subsurface. Although the uranium collected on the ion exchange resins and/or cow bone char is not destroyed, radioactive decay would reduce the toxicity and volume of the uranium removed from ground water.

The source control component of Alternatives 4a and 5 (a and b) and the source isolation component of Alternatives 4b would reduce the mobility of contaminants in the pit waste and shallow vadose zone by preventing further releases of contaminants to the subsurface. These components would not reduce toxicity or volume of the contaminants, as the contaminated waste would remain in place.

The mobility of contaminants would be curtailed by Alternatives 2, 3, and 4, though excavation (Alternatives 2 and 3 [a and b]) would only prevent migration from landfill wastes, as contaminant sources in the underling bedrock would remain. Drainage diversion (Alternatives 4a, 5a [selected remedy], and 5b]) is superior to excavation of the pit waste in that it would prevent further release from both the pit waste and underlying bedrock and reduce local ground water gradients, effectively slowing tritium and uranium plume migration. The barrier containment proposed in Alternative 4b would prevent further releases of contaminants to ground water but may not reduce plume migration as effectively as the drainage diversion alternatives.

The proposed *ex situ* (Alternatives 3a and 5a [selected remedy]) and *in situ* (Alternatives 3b and 5b) treatment technologies would reduce the mobility of uranium, nitrate and perchlorate more than the monitoring proposed under Alternatives 2 and 4 (a and b). *Ex situ* treatment would remove the uranium, nitrate, and perchlorate from the aquifer as the contaminated water is pumped from the subsurface and treated. *In situ* treatment would concentrate contaminants on the treatment media in the ground until it is removed and replaced at approximately ten-year intervals. Both techniques should be equally effective in reducing contaminant mobility, although pumping contaminated water from the funnel and sump system with *ex situ* treatment provides for somewhat more complete capture than passive capture from the reactive borehole array used for *in situ* treatment. Installation of the *in situ* barrier would require careful emplacement and flow modeling to assure adequate residence time and flow into the reactive media.

While there is no effective treatment technology for tritium, radioactive decay would reduce the volume of tritium within a reasonable timeframe in all alternatives. Excavation as proposed under Alternatives 2 and 3 (a and b) would remove contaminants in the landfill waste from the Pit 7 Complex area, but would not reduce the volume or toxicity of the contaminants because the excavated waste will be disposed at a different location.

2.12.2.5. Short-Term Effectiveness

Since there would be no remediation-related construction occurring in Alternative 1, there would be no short-term impact to human or ecological receptors.

Exposure control components of Alternatives 2, 3 (a and b), 3 (a and b), 4 (a and b) and 5 (a [selected remedy] and b) would protect human and ecological receptors from exposure to contamination in the short-term. There would be minimal impact to onsite workers for the monitoring component of these alternatives, as workers would follow Site 300 operational safety procedures to mitigate potential risks that may be posed during monitoring activities.

The monitored natural attenuation of tritium and monitoring of depleted uranium components of Alternatives 2, 3 (a and b), 3 (a and b), 4 (a and b) and 5 (a and b) would also protect human and ecological receptors from exposure to contamination in the short-term. Allowing tritium to naturally attenuate and depleted uranium to disperse, sorb, diffuse, and to a lesser extent, radioactively decay below the ground surface would prevent exposure of onsite workers to these contaminants that would occur by pumping ground water to the surface for *ex situ* treatment.

Alternatives 2 and 3 (a and b) have the potential for short-term exposure for onsite workers during waste excavation and disposal. This is likely to increase the number of exposure pathways, as well as disrupt habitat, increasing the potential for short-term exposure and impacts to the environment. A much higher level of exposure control would be necessary to prevent short-term exposure of onsite workers and ecological receptors during excavation than for the implementation of source control measures in Alternatives 4 (a and b) and 5 (a and b). Offsite disposal would require measures to prevent exposure during the transport of potentially hazardous materials over public roads.

The *ex situ* treatment component of Alternatives 3a and 5a (selected remedy) pose short-term and possibly long-term exposure risk to onsite workers as contaminants, including tritium, depleted uranium, perchlorate, and possibly VOCs, would be brought to the surface. Workers could be exposed during the installation, operation and maintenance of the treatment systems and the handling and storage of uranium-contaminated resin. This is due to the fact that uranium is removed and concentrated in ion exchange resins as part of the treatment process. Exposure control measures would be needed to prevent exposure until the uranium is safely disposed.

Alternatives 3b and 5b slightly increase the short-term exposure risk for workers during the installation of the *in situ* permeable reactive barrier and removing contaminated barrier materials at ten-year intervals. Operational safety procedures would minimize risk to prevent exposure to materials containing uranium until they are safely disposed. Such exposure protection should not be an issue as the uranium is principally an ingestion hazard.

The source control/hydraulic diversion component of Alternatives 4a and 5 (a and b) and the source isolation/hydraulic barrier component of Alternative 4b may slightly increase the short-term exposure risks for workers while installing the diversion or barrier system. However, since the construction of these systems would primarily occur outside the main area of contamination, the need for short-term exposure control measures would likely be limited. If necessary, workers would use appropriate protective procedures, clothing, and equipment to prevent the possibility of exposure during the installation of these systems.

Alternative 1 would be the least effective in terms of the time to cleanup compared to the other alternatives because without source control, contaminant releases would continue. Modeling indicates that it may take up to 500 years to reduce uranium activities below its MCL under Alternatives 2 and 4, and between 150 to 500 years for Alternatives 3 and 5. However, human health would be protected in all alternatives because the plume would not significantly migrate once the source is controlled and the ground water in this area is not suitable for potable uses due to naturally high total dissolved solid concentrations in ground water. Also, there are no complete pathways for this ground water to reach human or ecological receptors. Therefore, DOE believes that because human health and the environment will be protected during the period of time necessary to reach the uranium MCL, all alternatives provide short-term effectiveness without impacting human health or the environment. The active remediation of uranium in ground water in Alternatives 3 and 5 would achieve the MCL more rapidly than Alternatives 2 and 4 that rely on the natural attenuation of uranium in ground water.

In summary, the greatest short-term exposure to workers could occur during excavation and disposal of landfill wastes proposed under Alternatives 2 and 3 (a and b). The *ex situ* and *in situ* treatment of uranium (Alternatives 3 [a and b] and 5 [a and b]) pose lesser potential short-term and long-term exposures as contaminated ground water and spent reactive materials are brought to the surface and disposed. There may be an effective trade-off with the increase in exposure risk posed by extracting and treating uranium-contaminated ground water (Alternatives 3a and 5a), which would also contain tritium, versus removing exhausted *in situ* reactive media (Alternatives 3b and 5b) to the surface, thereby increasing the number of exposure pathways and the need for controls. The reduction of uranium activities in ground water to its MCL would be achieved more rapidly using Alternatives 3 and 5 than using Alternatives 1, 2, and 4.

2.12.2.6. Implementability

No actions would be necessary to implement Alternative 1.

The monitoring components of Alternatives 2, 3 (a and b), 4 (a and b) and 5 (a and b) can be implemented easily. Most of the monitoring network is already in-place, although the installation of additional monitor wells may be necessary.

Many of the exposure control measures in Alternatives 2, 3 (a and b), 4 (a and b), and 5 (a and b) are also already in-place but additional exposure controls would need to be evaluated and implemented, as necessary.

The monitored natural attenuation component of Alternatives 2, 3 (a and b), 4 (a and b) and 5 (a and b) can also be implemented easily.

The excavation of landfill waste under Alternatives 2 and 3 (a and b) is implementable but would require extensive provisions to prevent exposure and protect the safety of onsite workers, transport personnel, and the public during transport of the waste. It would also require locating a facility permitted and willing to accept low-level mixed waste at a reasonable cost.

The *ex situ* ground water treatment portion of Alternatives 3a and 5a (selected remedy) is implementable. The operation of the *ex situ* ground water treatment system would require reinjection of the treated effluent in such a way as to prevent enhanced migration of COCs in ground water or the contamination of pristine ground water.

The *in situ* ground water treatment (reactive barrier) component of Alternatives 3b and 5b is implementable but is limited by issues associated with the removal and replacement of spent materials in the subsurface barriers and permitting requirements for the long-term storage of uranium-contaminated materials. The *in situ* reactive barrier may require RWQCB Waste Discharge Requirements to ensure that residual materials or byproducts do not adversely impact the beneficial uses of ground water.

The source control/hydraulic diversion component of Alternatives 4a and 5 (a [selected remedy] and b) and the source isolation/hydraulic barrier component of Alternative 4b are implementable. The implementability of the hydraulic barrier may be limited by special engineering considerations necessary to prevent ground water mounding under pressure that would compromise the integrity of the slurry wall barrier.

In summary, monitoring, exposure controls, and monitored natural attenuation can all be implemented easily. The other remedial measures are all implementable, but would require special engineered measures or controls to: (1) protect worker safety and dispose of landfill wastes during excavation (Alternatives 2 and 3[a and b]), (2) prevent enhanced migration of contaminants during *ex-situ* uranium treatment in Alternatives 3a and 5a, (3) replace and dispose of reactive materials generated by *in situ* uranium treatment in Alternatives 3b and 5b, and (4) install the hydraulic barrier component of Alternative 4b.

2.12.2.7. Cost

The estimated present worth of the life-cycle costs for the Pit 7 Complex alternatives ranges from no cost for Alternative 1 to $73,979,000 for Alternative 3b (Tables 1-1 and 2-4). Costs are summarized in Table 1-1. Significant differences in the costs of the alternatives are due to the following differences in the alternatives listed below. Compared to the other alternatives:

- Alternative 1 has no cost because no remedial action would occur.
- Alternative 2 has an estimated present-worth cost of $56,635,000 for landfill waste excavation and disposal, 30 years of exposure control, monitored natural attenuation of tritium, and ground water monitoring. Alternative 2 costs are higher than the costs for Alternatives 4 (a and b) and 5 (a [selected remedy] and b) primarily due to high costs for the excavation of the landfill waste. The cost for Alternative 2 is lower than the cost for Alternative 3 (a and b) because it relies on natural attenuation to reduce contaminant concentrations in ground water rather than the active treatment of ground water in Alternative 3 (a and b).
- Alternative 3a has an estimated present worth-cost range of $63,741,000 to $68,326,000 for landfill waste excavation and disposal, and 30 years of exposure control, monitored natural attenuation of tritium, extraction and *ex situ* treatment of uranium, nitrate, and perchlorate, and ground water monitoring. Alternative 3a is more expensive than Alternatives 4 (a and b) and 5 (a [selected remedy] and b) primarily due to the high costs for the excavation of the landfill waste. The Alternative 3a costs are higher than Alternative 2 because it includes the active treatment of ground water, whereas Alternative 2 relies on natural attenuation to reduce contaminant concentrations in ground water. Alternative 3a costs are lower than the cost of Alternative 3b because the *ex situ* ground water treatment component is less expensive than the *in situ* treatment included in Alternative 3b.
- Alternative 3b has an estimated present worth-cost of $73,979,000 for landfill waste excavation and disposal, and 30 years of exposure control, monitored natural attenuation of tritium, *in situ* treatment of uranium, nitrate, and perchlorate, and ground water monitoring. Alternative 3b is more expensive than Alternatives 4 (a and b) and 5 (a [selected remedy] and b) primarily due to the high costs for the excavation of the landfill waste. The Alternative 3b cost is higher than Alternative 2 because it includes the active treatment of ground water, whereas Alternative 2 relies on natural attenuation to reduce contaminant concentrations in ground water. Alternative 3b costs are higher than the cost of Alternative 3a because its *in situ* ground water treatment component is more expensive than the *ex situ* treatment included in Alternative 3a.
- Alternative 4a has an estimated present-worth cost of $3,738,000 for 30 years of monitoring, exposure control, monitored natural attenuation of tritium, and source control by hydraulic diversion. Alternative 4a is less expensive that Alternatives 2 and 3 (a and b) primarily due to the lower cost of its source control measure (hydraulic diversion) compared to the costs for the excavation of the landfill waste in Alternatives 2 and 3 (a and b). The Alternative 4a cost is also lower than the costs for 3 (a and b) and 5 (a [selected remedy] and b) because it relies on natural attenuation to reduce contaminant concentrations in ground water rather than the active treatment of ground water in Alternatives 3 (a and b) and 5 (a and b).

- Alternative 4b has an estimated present-worth cost of $4,344,000 for 30 years of monitoring, exposure control, monitored natural attenuation of tritium, and source control using hydraulic barriers. Alternative 4b is less expensive that Alternatives 2 and 3 (a and b) primarily due to the lower cost of its source control measure (hydraulic barrier) compared to the costs for the excavation of the landfill waste in Alternatives 2 and 3 (a and b). Alternative 4b is more expensive that Alternative 4a because the cost to install and operate the hydraulic barrier component of Alternative 4b is higher than the cost of the hydraulic diversion system in Alternative 4a. The Alternative 4b cost is also lower than the costs for 3 (a and b) and 5 (a [selected remedy] and b) because it relies on natural attenuation to reduce contaminant concentrations in ground water rather than the active treatment of ground water in Alternatives 3 (a and b) and 5 (a and b).
- Alternative 5a (selected remedy) has an estimated present-worth cost range of $10,845,000 to $15,429,000 for 30 years of exposure control, monitored natural attenuation of tritium, hydraulic diversion, extraction and *ex situ* treatment of nitrate, perchlorate, and uranium, and ground water monitoring. Alternative 5a is less expensive that Alternatives 2 and 3 (a and b) primarily due to the lower cost of its source control measure (hydraulic diversion) compared to the costs for the excavation of the landfill waste in Alternatives 2 and 3 (a and b). The Alternative 5a cost is higher than Alternative 2 because it includes the active treatment of ground water, whereas Alternative 2 relies on natural attenuation to reduce contaminant concentrations in ground water. Alternative 5a is less expensive that Alternative 5b because the cost to install and operate the hydraulic diversion system in Alternative 5a is lower than the cost of the hydraulic barrier component of in Alternative 5b.
- Alternative 5b has an estimated present-worth cost of $21,082,000 for 30 years of exposure control, monitored natural attenuation of tritium, hydraulic diversion, extraction and *in situ* treatment of nitrate, perchlorate, and uranium, and ground water monitoring. Alternative 5b is less expensive that Alternatives 2 and 3 (a and b) primarily due to the lower cost of its source control measure (hydraulic barrier) compared to the costs for the excavation of the landfill waste in Alternatives 2 and 3 (a and b). The Alternative 5b cost is higher than Alternative 2 because it includes the active treatment of ground water, whereas Alternative 2 relies on natural attenuation to reduce contaminant concentrations in ground water. Alternative 5b is more expensive that Alternative 5a (selected remedy) because the cost to install and operate the hydraulic barrier component of Alternative 5b is higher than the cost of the hydraulic diversion system in Alternative 5a.

2.12.2.8. State Acceptance

The California DTSC and RWQCB provided ARARs and other requirements that were used as the basis for developing the selected interim remedy. ARARs related to potential ground water cleanup standards are not included in this document, because the selection of the interim remedy for the Pit 7 Complex constitutes an Amendment to the Interim Site-Wide ROD. ARARs related to potential ground water cleanup standards will be evaluated in the Final Site-Wide ROD scheduled for 2008. These State agencies reviewed and evaluated the remedial technologies and alternatives, participated in the selection of the interim remedy, and provided oversight and enforcement of state environmental regulations. In addition, the regulatory agencies have monitored and reviewed public input on the preferred interim remedy for the Pit 7 Complex.

The Department of Toxic Substances Control (DTSC) and the Regional Water Board have stated their preference for Alternative 5a, the selected alternative. They have also expressed support for Alternative 5b which they judge to be equally effective at protecting human health and the environment and complying with ARARs, but would cost more and take longer to achieve the same objectives than Alternative 5a. They have very little support for Alternatives 3a and 3b because these alternatives do not address contamination remaining in the vadose zone below the bottom of the pits and have a significantly higher cost. They do not support Alternatives 1, 2, 4a or 4b because they do not think these alternatives comply with ARARs, a threshold criterion.

2.12.2.9. Community Acceptance

The regulatory agencies have monitored and reviewed public input on the preferred remedy. Public comments concerning each alternative and the selected remedy have been considered and used, as appropriate, in the preparation of this ROD Amendment. All public comments on the preferred remedy presented in the Proposed Plan for Environmental Cleanup of the Pit 7 Complex are addressed in the Responsiveness Summary section of this document (Section 3).

The responding members of the community appear to support the ground water extraction and treatment actions for uranium, VOCs, perchlorate, and nitrate in ground water. They expressed concerns about whether the tritium plume will expand, and impact offsite residential water-supply aquifers and downgradient clean ground water during the time it takes for tritium to naturally attenuate to meet cleanup standards. In particular, there were concerns about possible impacts of site contamination on the proposed Tracy Hills Development, adjacent to Site 300.

Community members also expressed concerns about leaving the landfills onsite and the degree of characterization of the landfill contents needed to assure long-term release prevention. In particular, there were concerns about land use restrictions that would remain as a result of leaving the landfills in place if Site 300 were to close and be proposed for residential development or uses in the future.

There were also concerns regarding impacts to threatened and endangered plants and animals from contaminant exposure and during implementation of the cleanup remedy.

The public concerns are addressed in detail in Section 3 "Public Responsiveness Summary" of this document.

2.13. Selected Interim Remedy

DOE, U.S. EPA, and California DTSC and RWQCB agree that Alternative 5a is the most appropriate remedial alternative considering the CERCLA evaluation criteria.

Alternative 5a includes:

- Monitoring to determine if the cleanup is adequately protecting human health and the environment and to measure the progress of cleanup.
- Risk and hazard management, including institutional/land use controls, to control exposure where an elevated risk to human health remains.

- Monitored natural attenuation under which tritium in subsurface soil/rock and ground water would decline naturally.
- Installing an engineered drainage diversion system to isolate the contaminant sources in the landfills and underlying bedrock from subsurface water, and prevent the infiltration of rainwater runoff that could result in ground water rising into Pits 3, 4, 5, and 7 and releasing contaminants.
- Pumping and treating ground water to reduce contaminant concentrations in ground water to meet cleanup standards that will be selected in the Final Site-Wide ROD.

This section summarizes: (1) the rationale for selection of the remedy (Section 2.13.1), (2) a description of the remedy components (Section 2.13.2), (3) the costs to implement and operate the remedy (Section 2.13.3), and (4) the expected outcome of remedy implementation (Section 2.13.4).

2.13.1. Summary of the Rationale for the Selected Remedy

The selected interim remedy (Alternative 5a) meets the two U.S. EPA threshold criteria of: (1) protecting human health and the environment, and (2) complying with applicable laws and regulations. The preferred interim remedy also provides the best combination of tradeoffs among the alternatives with respect to the balancing criteria. The rationale for selection of Alternative 5a and why DOE and the regulatory agencies believe it best meets the EPA/NCP evaluation criteria are discussed below.

2.13.1.1. Protection of Human Health and the Environment and Compliance with ARARs

Source Control

In Alternative 5a (selected remedy), the contaminant sources in both the pit waste and underlying bedrock would be controlled using a hydraulic drainage diversion system. This component of Alternative 5a would prevent further contaminant releases from both the pit waste and underlying bedrock, and local ground water gradients will be reduced, effectively slowing migration of the pre-existing tritium and uranium ground water plumes. The hydraulic drainage diversion system is more protective of human health and ground water and able to better meet ARARs than excavation of the pit waste in Alternatives 2 and 3 (a and b). Characterization data indicates that the majority of the tritium and uranium has already migrated from the pit waste into the underlying bedrock. Therefore, while excavation would remove the source of contamination in the pits, it would not prevent further releases of contaminants from the underlying bedrock to ground water. In addition, Alternatives 2 and 3 (a and b) have the potential for short-term exposure for onsite workers during waste excavation and disposal. This is likely to increase the number of exposure pathways, as well as disrupt habitat, increasing the potential for short-term exposure and impacts to the environment.

Ground Water Plume Control and Cleanup

The extraction and *ex situ* treatment of uranium, nitrate, and perchlorate in ground water under Alternative 5a (selected remedy) would reduce contaminant concentrations to meet federal and state cleanup standards and provide long-term and effective protection of human health and the environment. Alternative 5a would achieve these goals and control the migration of these contaminants more rapidly than by natural attenuation only (Alternatives 2 and 4) or by treatment of ground water in the subsurface (Alternative 5b). The cleanup of uranium, nitrate, and perchlorate in ground water would be achieved more effectively and faster using Alternative 5a than Alternative 3b or 5b. This is because Alternative 5a uses extraction wells that can be strategically placed to optimize contaminant mass removal and concentrations reduction, resulting in a shorter cleanup time. Alternatives 3b and 5b include *in situ* treatment (a permeable reactive barrier) that relies on ground water flow to bring contaminants to the treatment area, extending the cleanup time.

Because there is no effective treatment technology for tritium, monitored natural attenuation of tritium in ground water is component of all remedial alternatives, including Alternative 5a. Fate and transport modeling of tritium in ground water indicates that, even if all the tritium in the landfills and underlying bedrock was added to the pre-existing ground water plume, tritium activities would decreased to the drinking water standard within 45 years or less without impacting ground water offsite above background. This timeframe is consistent with the rapid decay of tritium that results in a 50% reduction in tritium mass and activities every 12.3 years. This component of Alternative 5a also includes ongoing monitoring of ground water to assess the effectiveness of natural attenuation and detect any changes in activities or plume size that could result in impacts to human or ecological receptors. The process to implement contingent remedial actions if cleanup does not progress as expected (e.g., tritium activities are not reduced as projected to meet ARARs and protect human health and the environment) are specified in the Site 300 Contingency Plan. If such a situation arose, modifications or changes to the remedy would be documented in an Explanation of Significant Differences or a ROD Amendment.

2.13.1.2. Long-Term Effectiveness and Reduction in Toxicity, Mobility, and Volume through Treatment

Alternative 5a (selected remedy) would permanently remove uranium, nitrate, perchlorate, and some VOCs from the subsurface and reduce their mobility and volume in ground water. The irreversible decay of tritium in all environmental media, including ground water, would achieve a long-term and permanent reduction in the toxicity, mobility, and volume of tritium in the subsurface. The source control component of Alternative 5a would permanently reduce the mobility of contaminants in the pit waste and underlying bedrock by preventing further releases of contaminants to the subsurface.

Alternative 5a is more effective than Alternatives 2, 3a, and 3b because the excavation component of these alternatives would not reduce the toxicity, mobility, or volume of contaminants remaining in unsaturated bedrock underlying the landfills, allowing continued releases of contamination to ground water. In addition, the excavation component of Alternatives 2, 3a, and 3b would not reduce the toxicity or volume of the contaminants because the waste would be placed in an offsite landfill. Because there is no effective treatment technology to remove tritium from ground water, Alternatives 2, 3, 4, and 5 all include natural attenuation to reduce the volume of tritium in ground water. Therefore, Alternatives 2, 3 (a and b), 4 (a and b) and 5b would not be more effective in reducing the volume of tritium in ground water than Alternative 5a.

12.13.1.3. Short-Term Effectiveness

Alternative 5a (selected remedy) is effective in the short-term without impacting human health or the environment. Construction of the hydraulic drainage diversion system component of Alternative 5a will primarily occur outside the area of contamination at the Pit 7 Complex, and the system will be handling clean rainwater runoff and shallow ground water during its operation. Therefore, there is minimal short-term exposure risk to workers that can be controlled. The extraction and treatment system component of Alternative 5a can be designed as a closed-loop system to prevent worker exposure during ground water treatment. In addition, ground water contaminant concentrations can be reduced to drinking water standards and water quality objectives more rapidly using Alternative 5a than for other proposed alternative because: (1) contaminant sources in both the landfill waste and underlying bedrock will be controlled, and (2) ground water extraction and treatment that target areas of highest uranium, nitrate, and perchlorate concentrations will reduce existing ground water contamination more rapidly. While VOCs (TCE and 1,1-DCE) in ground water are not specifically targeted for extraction, some VOCs will be extracted where present with other ground water COCs, concentrations are below drinking water standards, and VOCs are limited in extent and are continuing to decrease toward background concentrations. Tritium in ground water will naturally attenuate to drinking water standards or other water quality objectives in a reasonable timeframe.

A much greater potential for short-term exposure for workers and impacts to the environment could occur during the waste excavation and disposal included in Alternatives 2, 3a, and 3b. Buried waste and associated contamination would be excavated, handled, transported and disposed offsite. This would likely increase the number of exposure pathways, as well as disrupt habitat, increasing the potential for short-term exposure and impacts to the environment. In addition, because excavation would not remove contamination in the bedrock underlying the pits, continued releases would increase the time until drinking water standards and water quality objectives would be achieved.

2.13.1.4. Implementability

Alternative 5a (selected remedy) is implementable using existing, proven technologies. The ground water monitoring and exposure control measures are largely in-place and functioning. The excavation of landfill waste under Alternatives 2, 3a, and 3b is implementable but would require extensive provisions to prevent exposure and protect the safety of onsite workers, transport personnel, and the public during excavation and transport of the waste. Also waste excavation proposed in Alternatives 2, 3a, and 3b would not prevent further contaminant releases from sources in the bedrock underlying the landfills.

2.13.1.5. Cost

The estimated cost of the selected remedy, Alternative 5a ($10.9 million), is much lower than Alternatives 2, 3a, and 3b that include $54 million to excavate the pit waste, and Alternative 5a will protect human health and the environment more effectively and achieve cleanup standards more rapidly than these alternatives. Alternative 5a costs $6.6 million to $7.2 million more than Alternatives 4 (a and b), respectively but will achieve cleanup standards in ground water within a timeframe that is acceptable to the regulatory agencies. Alternative 5a costs $10 million less than Alternative 5b to accomplish the same objectives, but in a shorter timeframe.

2.13.2. Description of the Selected Interim Remedy

This section presents a detailed description of the elements of the selected remedy (Alternative 5a) for the Pit 7 Complex that consists of:

- Monitoring (Section 2.13.2.1).
- Risk and hazard management including institutional/land use controls (Section 2.13.2.2).
- Monitored natural attenuation of tritium in ground water (Section 2.13.2.3).
- Source control using hydraulic drainage diversion (Section 2.13.2.4).
- Extraction and treatment of uranium, nitrate, perchlorate, and some VOCs in ground water (Section 2.13.2.5).

Table 2-6 summarizes the elements and scope of the selected remedy.

The description of the remedy below is conceptual and is not intended to provide design information. DOE will present more detailed information to support the implementation of the selected interim remedy in a future Remedial Design for the Pit 7 Complex scheduled for 2007. The Remedial Design report will include details of the remedial design, monitoring programs, and health and safety plans and quality assurance/quality control plans for construction and operation of the selected remedy. The Remedial Design report will also include implementation and maintenance actions for the institutional/land use controls identified in Section 2.13.2.2, including periodic inspections and reporting to the regulatory agencies. The schedule for submittal of the Remedial Design report is contained in the Site 300 Federal Facility Agreement, Attachment A. The current (2006) schedule includes submittal of the Final Remedial Design report in November 2007.

2.13.2.1. Monitoring

Monitoring consists of collecting ground water samples from monitor wells for chemical and radiological analyses and ground water elevation measurements. Monitoring of the selected remedial action at the Pit 7 Complex will be conducted to:

- Track changes in plume concentrations and size to ensure there are no impacts to downgradient receptors.
- Evaluate the effectiveness of the remedial action in controlling the contaminant sources to prevent further releases, and in reducing contaminant concentrations in ground water to meet ARARs and cleanup standards.
- Determine when ground water cleanup standards, to be selected in the Final Site-Wide ROD, are achieved.
- Detect any future releases of contaminants from the landfills.

The monitoring network for the Pit 7 Complex currently consists of 85 ground water monitor wells that are sampled quarterly or semi-annually. Additional monitor wells may be added to the monitoring network as needed. The monitoring network includes:

- Detection monitoring wells located along the perimeter and immediately downgradient of the landfills,

- Plume tracking wells that monitor for changes in contaminant concentrations and distribution in ground water, and
- Guard wells are " clean" wells located downgradient of the distal, leading edge of the contaminant plume used to provide an early indication of plume migration into uncontaminated ground water and/or toward the Site 300 boundary.

A detailed sampling plan for the Pit 7 Complex will be developed in the Remedial Design and incorporated into the Site 300 Site-Wide Compliance Monitoring Program. Monitoring will include collection and analysis of ground water samples for ground water COCs (VOCs, tritium, uranium, nitrate, and perchlorate). The detection monitoring program administered under RCRA to detect any future releases of contaminants from the landfills will continue.

The monitoring program data will be presented in the Semi-Annual Site-Wide Compliance Monitoring Report. In addition, these semi-annual reports will include:

- A remediation progress analysis for the Pit 7 Complex remedy.
- A summary of monitoring data used to determine compliance with regulatory requirements associated with the cleanup remedy.
- An assessment of the performance of the interim remedy.
- An evaluation of current contaminant concentrations and distribution.
- Identification of any performance issues.

Monitoring results will be discussed with the regulatory agencies at monthly Remedial Project Manager's meetings. Any changes in ground water conditions will be evaluated against RAOs to ensure continued protection of human health and the environment. The Site-Wide Contingency Plan contains measures to be implemented if the remedy does not proceed as anticipated.

Consistent with the NCP, the ground water and surface water data obtained as part of the monitoring program will be reviewed at least every five years. If these data indicate that contaminant concentrations, ground water flow direction, and/or velocity have changed and significantly affect the cleanup, the monitoring program and if necessary, the selected remedial action would be re-evaluated.

2.13.2.2. Risk and Hazard Management

The results of the baseline risk assessment for the Pit 7 Complex identified potential exposure pathways and risk that needed to be addressed by the selected interim remedial action. This risk assessment indicated there was an unacceptable risk (4×10^{-6}) to onsite workers from potential inhalation of tritium evaporating from subsurface soil in the vicinity of the Pit 3 Landfill. In addition, there is a potential for onsite workers to be exposed to contamination in the pit waste in the case of unintentional excavation into the pits. There is no risk to humans from exposure to contaminants in ground water because there are no onsite water-supply wells in the Pit 7 Complex area and ground water contaminants will not migrate and impact offsite water-supply wells. However, concentrations of some contaminants in onsite ground water in this area exceed drinking water MCLs. There were no risks identified for offsite residential receptors. A risk and hazard management program will be implemented to prevent exposure of onsite workers to contaminants at the Pit 7 Complex until the risk is mitigated through remediation efforts. The institutional/land use controls that will be used to manage risk and prevent exposure as part of the risk and hazard management program are discussed in this section.

There were no unacceptable hazards to ecological receptors. However, ongoing measures that are taken to protect plant and animals at LLNL Site 300 are also discussed in this section.

Institutional/Land Use Controls – Institutional/land use controls are non-engineered actions or measures used to prevent or limit the potential for human exposure to contamination at Site 300 and to protect the integrity of the remedy. The general types of institutional/land use controls that will be used to prevent human exposure to contamination at the Pit 7 Complex include:

- Access controls – Measures such as fences, signs, and security forces that are used to prevent exposure by controlling and/or restricting access to areas of contamination.
- Administrative controls – Measures such as pre-construction review and controls for limiting or restricting access to contaminated areas.

Table 2-5 presents a description of: (1) the institutional/land use control objective and duration, (2) the risk necessitating land use controls, and (3) the specific institutional/land use controls and implementation mechanisms used to prevent exposure to contamination at the Pit 7 Complex. Figure 2-16 shows the specific areas of the Pit 7 Complex where the institutional/land use controls will be implemented and maintained.

Monitoring and inspection of the Pit 7 Complex will be performed throughout the remediation period to determine whether the institutional/land use controls remain protective and consistent with all remedial action objectives. In addition, DOE will: (1) review facility and land use to evaluate changes in exposure pathway conditions that could affect the risk assessment assumptions and calculations, and (2) re-evaluate the inhalation risk for onsite workers at the Pit 3 Landfill using modeled annual tritium air sample data until no risk is indicated for two successive years. The mechanism, methodology, and frequency of the monitoring, inspections, facility/land use reviews, and risk re-evaluations will be provided in the Remedial Design Report for the Pit 7 Complex.

These institutional/land use controls will be incorporated in the Risk and Hazard Management Program contained in the Site-Wide Compliance Monitoring Plan. Risk and hazard monitoring results conducted during the year will be submitted to the U.S. EPA and State regulatory agencies in the Annual Site 300 Site-Wide Compliance Monitoring Reports. In addition, DOE will work with LLNL Site 300 Management to incorporate these institutional/land use controls into the Site 300 Integrated Strategic Plan or other appropriate institutional planning documents.

The land use controls and requirements described herein are only applicable to the Pit 7 Complex landfills and associated contaminated environmental media that are being addressed through the CERCLA process. DOE will implement, maintain, and enforce these institutional/land use controls at the Pit 7 Complex for as long as necessary to keep the selected remedy for the Pit 7 Complex protective of human health and the environment.

If DOE later transfers these procedural responsibilities to another party by contract, property transfer agreement, or through another means, DOE will retain ultimate responsibility for the integrity of the remedy. In the event that the property is transferred in the future, DOE will execute a land use covenant at the time of transfer in compliance with Title 22 CCR, Division 4.5, Chapter 39, Section 67391.1. If the Site 300 property were to be transferred to an entity outside the U.S. Department of Energy, the necessary institutional/land use controls would be determined prior to the property transfer based on: (1) the intended land use subsequent to the property transfer (e.g., industrial versus residential), and (2) contamination and associated risk, if any, remaining at the Pit 7 Complex.

Ecological Hazard Controls – There was no unacceptable risk of exposure to contaminants in any media identified for ecological receptors in the vicinity of the Pit 7 Complex. In addition, there are currently no threatened, endangered, or species of special concern that may be potentially exposed to unacceptable levels of contaminants at the Pit 7 Complex. As a result, specific exposure control measures for ecological receptors are not needed. However, the current LLNL program of conducting ecological resource surveys prior to the initiation of any ground-disturbing activities, including actions that will occur as a result of the final remedial actions implemented at the Pit 7 Complex, will continue to ensure that sensitive species are not negatively impacted by any planned ground-disturbing activities.

As currently implemented, any area proposed for an activity that may cause significant surface disturbance (e.g., well installation or facility construction) must be surveyed by a wildlife biologist for the presence of sensitive species. If sensitive species are found, then mitigation measures as defined in the Environmental Impact Statement/Environmental Impact Report for continued operation of LLNL (DOE, 2004) would be implemented.

In addition, biologists will continue to monitor Site 300 for the presence of sensitive species not previously identified at Site 300. The life history of these species will be reviewed to determine the potential for unacceptable exposure to contaminants at the site. Should it be determined that these species do have a potential risk of significant exposure, their presence in areas where hazard indices exceed 1 will be determined. Finally, environmental contamination data will continue to be evaluated to ensure that site conditions do not change to such an extent as to threaten any wildlife populations for plant communities.

Although no threatened, endangered, or species of special concern currently reside at the Pit 7 Complex, the area could potentially be used by California Tiger Salamander for upland dispersal and refugia. Because the final remedial design for all features of the selected remedial alternative has not been completed, it is premature for LLNL to conduct a final consultation on habitat protection needs with the U.S. Fish and Wildlife Service. However, it is anticipated that protections will able to assure that there is no significant impact to the upland dispersal and refugia areas used by the California Tiger Salamander. As specified by the Initial Study DTSC has prepared to comply with the California Environmental Quality Act, the remedial design shall include an opinion from the U.S. Fish and Wildlife Service that demonstrates that the project activities will avoid or protect the California Tiger Salamander upland habitat in a manner that will not result in significant impacts.

2.13.2.3. Monitored Natural Attenuation of Tritium in Ground Water

The monitored natural attenuation of tritium in ground water will be instituted in conjunction with a specific monitoring plan for upgradient, near-source/interior plume, and guard wells. The monitoring plan will be specifically designed to:

- Ensure that tritium sources in the landfill waste and underlying bedrock are adequately controlled by the hydraulic drainage diversion system.
- Detect any new release of tritium to ground water.

- Monitor plume migration and the effectiveness of natural attenuation processes (i.e., radioactive decay) in reducing tritium activities and extent in ground water to meet cleanup standards.

The following activities would be conducted to monitor the effectiveness of monitored natural attenuation and detect any changes in activities or plume size that could result in impacts to human or ecological receptors:

- Measure ground water levels.
- Sample and analyze ground water for tritium.
- Manage, analyze, and present monitoring data.
- Perform fate and transport modeling to predict the spatial distribution of tritium over time and to demonstrate the efficacy of monitored natural attenuation in meeting RAOs and ARARs.
- Conduct risk assessments, as necessary, to re-evaluate risk and hazard posed to human and ecological receptors based on newer data and modeling results.
- Install additional monitoring wells, if required.

The Site 300 Contingency Plan would be modified to include actions to be implemented in the event that monitored natural attenuation of tritium in ground water does not achieve RAOs or comply with ARARs. If such a situation arose, the remedy would be changed and documented in the final Site-Wide ROD, an Explanation of Significant Differences, or a ROD amendment.

2.13.2.4. Source Control using Hydraulic Drainage Diversion

The primary mechanism for the release of residual contamination from the Pit 7 Complex is the rise of shallow ground water and inundation of the landfills and underlying vadose zone during abnormally high rainfall seasons (i.e., the 1997-1998 El Niño). The water balance study, conducted as part of the Pit 7 Complex RI/FS, indicated that 10% of average rainfall infiltrates in the Pit 7 Complex area. Under these average annual recharge conditions, the contaminant sources are isolated from shallow ground water and contaminant releases are not likely. Ground water monitoring data show no evidence of significant contaminant releases during periods of average or below average rainfall when shallow ground water remained below the pit bottoms. When the recharge rate increases to 25% of rainfall during years of high rainfall, the pits and underlying bedrock are inundated and residual contamination comes into contact with shallow subsurface water.

An engineered hydraulic drainage diversion system will be installed to divert surface and shallow subsurface water away from the Pit 7 Complex landfills, preventing water from entering the landfills and underlying vadose both laterally and from below as a result of water table rises. The drainage diversion system will be comprised of interceptor trenches including French drains, horizontal wells, and shallow terrace drains constructed on the hill slopes to the west and east of the valley where the Pit 7 Complex is located. To be effective, the system does not need to capture and divert 100% of rainfall recharge during El Niño-type rainfall events. It is estimated that about 20 to 30 acre-feet of water will need to be diverted to prevent inundation of the pits and underlying contaminated bedrock. In addition, the reduction in recharge to the water table underlying the pits will reduce the hydraulic gradient, slowing the migration of existing contaminants in ground water.

The interceptor trenches will divert surface and shallow subsurface water from the hill slopes to the existing concrete-lined drainage ditches that discharge north of the Pit 7 Complex watershed and south of the landfills. Because this water will be diverted prior to entering the pits, it would be devoid of contaminants and therefore would not adversely impact the water quality for downstream users, springs, or wetlands. The diversion system will be designed to minimize the creation of wetlands and will not significantly alter the regional recharge conditions in the Pit 7 Complex or the overall ground water basin.

Hydraulic diversion systems are commonly used by the California Department of Transportation and in many construction sites throughout the state. There are well-established guidance and best management practices for dealing with storm water and non-storm water diversion projects. Many of these projects are operational and have proven effective for long-term applications with minimal maintenance. DOE will follow existing guidance and best management practices to design and implement the hydraulic diversion system at the Pit 7 Complex.

The specific design details of hydraulic diversion structure will be presented in the Remedial Design report for the Pit 7 Complex that is scheduled for 2007. The system will be designed so that its components can be expanded or modified as the system's performance is monitored.

2.13.2.5. Extraction and Treatment of VOCs, Uranium, Nitrate, and Perchlorate in Ground Water

Uranium, VOCs, nitrate, and perchlorate have been identified as COCs in ground water downgradient of Pits 3, 5, and 7. The goal of the ground water extraction and treatment component of Alternative 5a is to reduce uranium activities, and concentrations of anthropogenic nitrate and perchlorate in ground water, to meet RAOs and ARARs. Because VOC concentrations in ground water at the Pit 7 Complex are below MCLs and decreasing, extraction and treatment will not be designed to specifically target VOCs in ground water. However, where VOCs are extracted with other contaminants, VOCs will be treated to meet effluent discharge limits.

The selected remedy will use wells (Alternative 5a, Option 2) to extract ground water for *ex situ* treatment of contaminants. Ground water will be extracted from alluvial and bedrock wells located in areas where uranium and nitrate concentrations exceed their MCLs and perchlorate concentrations exceeding the Public Health Goal. There are two areas of high uranium activities, one located adjacent to and downgradient from Pit 3, and a second area located adjacent to and downgradient from Pit 5. The highest concentrations of nitrate and perchlorate in ground water are generally located in the same areas as the highest uranium activities. A conceptual design for the extraction wellfield for the selected remedy (Alternative 5a) is shown in Figure 2-17 (Option 2).

If safety considerations allow, ground water extraction will be implemented simultaneously with construction of the hydraulic drainage diversion system by converting existing ground water monitor wells to extraction wells. The drainage diversion system used for source control will alter recharge patterns in the Pit 7 Complex area, causing changes to the hydrologic conditions adjacent to and downgradient of the landfills. As a result, the volume of ground water and extent of saturation may be reduced near the pits and in the areas of highest contaminant concentrations in ground water. Therefore, ground water extraction will be implemented using a phased approach until the effects of the hydraulic diversion system on local hydrologic conditions have stabilized. Modifications to the extraction wellfield will be implemented as needed, based on changes to local ground water conditions resulting from the installation of the drainage diversion system. The final extraction well configuration will be determined during the Remedial Design process. Pumping from ground water extraction wells may be adjusted spatially and temporally during long-term operation of the wellfield to optimize contaminant mass removal.

Extracted ground water will be piped to an *ex situ* treatment system designed to remove uranium, nitrate, perchlorate, and if necessary, VOCs. The preliminary design and cost estimate assumes that ion-exchange resins would be used to remove uranium, nitrate, and perchlorate as this is a proven, off-the-shelf technology for these contaminants. Because uranium in local ground water occurs as anionic complexes $[(UO_2)\ (CO_3)_2^{-2}]$ and $[(UO_2)\ (CO_3)_3^{-4}]$, the same ion-exchange resin may also be effective in removing nitrate and perchlorate from extracted ground water. If the same ion-exchange resin is not capable of removing nitrate, perchlorate, and uranium from ground water, several ion-exchange resins would be employed in series. Other media for the treatment of uranium, such as aerogel/granular activated carbon, cow bone char (hydroxyapatite), and electro-coagulation may be implemented if they are demonstrated to be more cost-effective. VOC (TCE and 1,1-DCE) concentrations in ground water are below drinking water standards, are currently detected in only four wells, and are continuing to decrease toward background concentrations. For these reasons, VOCs in ground water are not specifically targeted for extraction. However, because VOCs may be present with other COCs in extracted ground water, additional treatment (i.e., granular activated carbon) may be needed to reduce VOC concentrations to meet RWQCB effluent discharge requirements prior to reinjection. The final treatment media, as well as the rationale for their selection, will be specified in the Remedial Design report for the Pit 7 Complex. Depending on the treatment media selected, regeneration and/or disposal of spent treatment media as radioactive or mixed waste may be required. Spent ion-exchange resin or other treatment media will be sent to a licensed facility for disposal or further treatment.

Because there are no commercially-available, off-the-shelf technologies for the treatment of tritium, ground water would be discharged through a series of reinjection wells or infiltration trenches following treatment for uranium, nitrate, and perchlorate. The wellfield will be designed and located to reinject tritium-bearing treatment facility effluent to a portion of the aquifer that already contains elevated tritium activities so that the reinjected water would not impact clean ground water. The reinjection wellfield would also be designed to maintain a steady-state water balance and prevent changes in hydrological conditions that could result further releases of contaminants or plume migration. A conceptual design for the reinjection wellfield is shown in Figure 2-17 (Alternative 5a-Option 2). This design is based on modeling that indicates that the volume of water to be reinjected would not increase ground water elevations or the hydraulic gradient such that inundation of contaminant sources or enhanced tritium migration would result. Safety precautions would be implemented to prevent exposure to tritium during the extraction and infiltration/reinjection process. The reinjected water will comply with Substantive Requirements developed by the RWQCB. In addition, DOE/LLNL will submit the results of an evaluation that will be conducted to identify any by-products or alterations in chemistry that may be created during ground water *ex situ* treatment.

The performance of the ground water extraction and *ex situ* treatment system in reducing uranium, nitrate, and perchlorate concentrations to satisfy RAOs and ARARs will be measured by: (1) total uranium activities, (2) the percentage of total uranium activities attributable to depleted uranium as determined by the mass ratio, and (3) nitrate and perchlorate concentrations in ground water.

2.13.3. Estimated Costs of the Selected Remedy

To estimate the cost of the selected interim remedy, the work required to implement the remedy was divided into a series of activities and a unit cost was developed for each. The bases of the unit costs are a series of assumptions regarding the resources necessary to complete the activity.

The unit cost of labor resources is based on an average for all staff in a category, such as scientists and engineers. For most other resources, the unit cost is based on a current contract, e.g., the hourly cost for drilling rigs used to install monitoring wells. All LLNL overhead rates and taxes are included in the unit rates. The base year for all cost estimates is fiscal year 2004.

A detailed cost estimate for the selected remedy is provided in Table 2-7. The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This is an order-of-magnitude engineering cost estimate that is expected to be within + 50% to - 30% of the actual project cost.

It is assumed that all costs associated with direct and indirect capital will occur in the first year. The period of performance for all ongoing activities is assumed to be 30 years.

Site-wide regulatory compliance and management activities are not included in the cost estimates. It is assumed that periodic reports to regulatory agencies will be required, but these costs are not included. Similarly, project management and support costs and contingency costs are not included.

All costing was performed following the guidance of the U.S. EPA "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study," Report No. EPA/540-R-00-002.

2.13.4. Expected Outcomes of the Selected Remedy

2.13.4.1. Available Land Uses

DOE has no plans to release any portion of LLNL Site 300 for residential or industrial use. Some areas will require long-term management due to the presence of COCs. This long-term management would primarily affect land use for LLNL programs.

Long-term waste management will be required because landfills will be left in place.

2.13.4.2. Available Ground Water Uses

DOE has agreed to clean up contaminated ground water at Site 300 to meet drinking water MCLs, at a minimum, to the extent that is technically and economically practicable. For this reason, ground water use will be unrestricted upon achievement of cleanup standards. The selected remedy for the Pit 7 Complex was designed assuming that the final cleanup standard for ground water will be to reduce contaminant concentrations to drinking water MCLs or lower in all ground water at Site 300, including at the Pit 7 Complex. In addition, the point-of-compliance is assumed to be the ground water underlying the site, consistent with California regulations. Achievement of this cleanup goal in ground water equates to an acceptable risk associated with onsite ground water under a residential exposure scenario. For this reason, the cleanup objective of reducing contaminant concentrations in both onsite and offsite ground water to drinking water MCLs (or lower) should be sufficiently protective of ground water resources and human health under any current or future land use scenario.

2.13.4.3. Cleanup Standards

Because this is an Amendment to the Interim Site-Wide ROD that was signed in 2001, no ground water cleanup standards are contained in this document. The 2001 Interim Site-Wide ROD was designated as interim for three primary reasons: (1) ground water cleanup standards were not finalized, (2) DOE was continuing to evaluate treatment technologies, and (3) further characterization was occurring in some areas of the site. Ground water cleanup standards will be selected in a Final Site-Wide ROD, scheduled for 2008. This Interim ROD Amendment will allow DOE to begin cleanup at the Pit 7 Complex. DOE does not expect to achieve specific cleanup standards at the Pit 7 Complex before the Final ROD in 2008. Experience indicates that ground water remediation typically requires several decades to reduce contaminants to the low concentrations typically used as cleanup standards. However, DOE's selected interim remedy for ground water remediation at the Pit 7 Complex focuses on achieving source control and reducing contaminant mass and concentrations. The conceptual design of the selected interim remedy is based upon achieving ground water cleanup standards at least as protective as MCLs and are intended to be consistent with remedies and cleanup standards to be selected in the Final ROD.

DOE makes the following specific assurances for the cleanup of ground water:

1. DOE will not discontinue operation of any ground water extraction and treatment system or other component of the selected interim remedy before the Final ROD without the notification and approval of the regulatory agencies.
2. The actions DOE will undertake under this Interim ROD Amendment will be consistent with the RAOs for Site 300, which include remediating ground water to protect human health and the environment and restoring beneficial uses of ground water.
3. In the Remedial Design documents, DOE will provide the details and specifications of the extraction and treatment and hydraulic diversion systems that will be implemented during the interim cleanup period.
4. The cleanup standard for the ambient air exposure pathway is a risk of 1×10^{-6} and a hazard quotient of 1. Modeling will be conducted periodically to re-evaluate changes in inhalation risk and hazard levels resulting from remediation and progress toward meeting the cleanup standards.

2.14. Principal Threat Waste

The NCP establishes an expectation that the lead agency will use treatment to address the principal threats posed by a site wherever practicable. Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threat wastes are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Contaminated ground water is not usually considered a principal threat waste.

The principal threat at the Pit 7 Complex is the landfill waste because contaminants associated with the waste are found at high concentrations, are toxic, and can be mobilized when ground water rises into the pit waste. Contaminants in subsurface soil/rock are considered a low-level threat because of their impacts to underlying ground water. Although contaminants in ground water exceed drinking water standards, the U.S. EPA does not generally classify ground water contamination as a principal threat waste.

The selected remedy will isolate the principal threat waste using engineering and institutional controls. None of the remedial alternatives, including excavation, would treat the principal threat waste.

2.15. Statutory Determinations

Under CERCLA Section 121 and the NCP, DOE must select remedies that protect human health and the environment, comply with ARARs, are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against offsite disposal of untreated wastes. Sections 2.15.1 through 2.15.5 discuss how the selected interim remedy for the Pit 7 Complex meets these statutory requirements.

2.15.1. Protection of Human Health and the Environment and Compliance with ARARs

Alternative 5a will adequately protect human health and the environment by preventing exposure to contaminants while the natural attenuation of tritium and extraction and *ex situ* treatment of depleted uranium, nitrate, and perchlorate reduces activities/concentrations in ground water to health-protective and ARAR-compliant levels. Monitoring will be used to demonstrate the effectiveness of the remedial measures in reducing contaminant levels to meet State and Federal chemical-specific ARARs in a reasonable timeframe. Contact with landfill waste will be prevented by long-term institutional/land use controls.

Table 2-8 summarizes how the ARARs apply to the selected remedy identified for the Pit 7 Complex.

2.15.2. Cost-Effectiveness

The remedy for the Pit 7 Complex selected in this Interim ROD Amendment is cost-effective and represents a reasonable value for the cost. In making this determination, the following definition was used: "A remedy shall be considered cost-effective if its costs are proportional to its overall effectiveness." [NCP 300.450(f)(1)(ii)(D)]. This was accomplished by evaluating the "overall effectiveness" of the alternatives that satisfied the threshold criteria (i.e., protect human health and the environment and comply with ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence, reduction in toxicity, mobility and volume through treatment, and short-term effectiveness). Overall effectiveness was then compared to estimated present-worth costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedial alternative was determined to be proportional to the cost and hence represents a reasonable value.

A comparative evaluation of the Pit 7 Complex alternatives is summarized in Table 2-4. The cost-effectiveness of the selected interim remedy is based on this evaluation and summarized in Table 2-9.

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

DOE and the regulatory agencies have determined that the selected remedy addressed in this Interim ROD Amendment represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Pit 7 Complex. Of those alternatives that protect human health and the environment and comply with ARARs, DOE and the regulatory agencies have determined that the selected interim remedy for the Pit 7 Complex (Alternative 5a) provides the best balance of trade-offs in terms of the U.S. EPA/NCP five balancing criteria and two modifying criteria. The selected interim remedy also considers the statutory preference for treatment as a principal element and a bias against offsite treatment and disposal, and State and community acceptance.

2.15.4. Preference for Treatment as a Principal Element

By using ground water extraction and treatment to treat contaminated ground water using ion exchange resin or similar treatment media, the selected interim remedy for the Pit 7 Complex uses treatment technologies as a principal element. There is no effective treatment technology available for tritium, therefore, the selected interim remedy utilizes natural attenuation to reduce tritium activities in ground water. Because tritium has a short radioactive decay half-life (12.3 years), tritium activities will be reduced to meet drinking water standards within 45 years. Treatment is not a practical option for principal threat waste (i.e., landfill waste) left in place under Alternatives 2, 4, and 5 or for excavation and disposal under Alternative 3.

2.15.5. Five-Year Review Requirements

Because the remedy for the Pit 7 Complex selected in this Interim ROD Amendment will result in hazardous substances remaining onsite above levels allowable for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.16. Documentation of Significant Changes

The Pit 7 Complex Proposed Plan was released for public comment on March 21, 2006. The Proposed Plan identified the Preferred Alternative for the Pit 7 Complex area of OU 5 at Site 300 addressed in this Interim ROD Amendment. DOE and the regulatory agencies reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the interim remedy as originally identified in the Proposed Plan were necessary or appropriate.

3. Responsiveness Summary

This section responds to public comments directed to DOE, U.S. EPA, and the State of California regarding the *Final Proposed Plan for Environmental Cleanup at the Pit 7 Complex Lawrence Livermore National Laboratory Site 300* (DOE, 2006). Responses to community comments and questions are incorporated into this Interim ROD Amendment.

The 45-day public comment period on the Proposed Plan began on March 21 and ended on May 5, 2006. On April 5, 2006, DOE and the regulatory agencies held a public meeting at the Tracy Community Center, Tracy, California to present the proposed remediation plans and receive public questions and comments on the preferred remedial alternative. At the meeting, representatives from DOE summarized information from the Feasibility Study and Proposed Plan. Following the presentations, the public was given the opportunity to present their comments into the formal public record. These comments are presented in Section 3.2. The meeting transcript and a copy of the written comments are available to the public at the LLNL Visitors Center and the Tracy Public Library.

Community acceptance was measured by both the magnitude and substance of comments received. In addition to the formal written comments provided in this Section, numerous verbal discussions have helped DOE interpret the issues of importance to the responding interested parties.

The interested public at Site 300 is made up of residents who live within about a mile of the Site, the nearby community of Tracy (approximately 8 miles from the northeast boundary of the Site) and the local environmental community represented primarily by Tri-Valley CAREs.

Public meetings have typically attracted a few nearby residents, several Tracy residents (5-15) and members of Tri-Valley CAREs and their affiliates. Individuals in these groups have routinely expressed reservations about future land use assumptions, inclusion of community input, assurances that commitments are met, and about continued funding of the cleanup. There have also been general concerns over the application of monitored natural attenuation, risk and hazard management techniques, leaving landfills onsite, treatment options for radionuclides, cleanup standards, and whether site characterization is (and will be) adequate for effective remedial design.

Specific areas of support, reservations, or opposition are listed under the Community Acceptance Section 2.12.2.9.

3.1. Organization of the Responsiveness Summary

Section 3.2 of this Responsiveness Summary responds to the questions and comments received at the April 5, 2006 public meeting and recorded in the transcript of that meeting. Section 3.3 responds to the written comments received by May 5, 2006. Responses to similar questions or comments are cross-referenced.

DOE, EPA, and the State of California have consulted on the following responses and agree on their content.

3.2. Public Meeting (April 5, 2006, at the Tracy Community Center in Tracy, CA)

Verbal comments from the transcript of public comments.

Marylia Kelley— Executive Director of Tri-Valley CAREs, Livermore, California

Ms. Kelley comment #1: *Hi, I am Marylia Kelley. If I speak too loudly or too softly please let me know and I will try to adjust. I am the executive director at Tri-Valley CAREs. Our office is based in Livermore, California near the Lawrence Livermore National Laboratory main site and our members are from Livermore, the Tri Valley area, Tracy and the Central Valley area and some from the greater San Francisco Bay Area. So we represent approximately 4500 members and families. We have been working on the cleanup of Site 300, basically, since our group was formed in 1983 and we have been working on the Superfund cleanup since it was named to the Federal Superfund list of the most contaminated sites in the country in 1990 and just briefly, I don't have a Powerpoint presentation, but I want to point out in terms of the map of contaminants similar to the one that Leslie showed that we are talking about, tonight, this area up here (indicating) and that the Lab's map of the Pit 7 complex plume did not show the plume that comes from the open air firing table (Building 850) directly into the groundwater, which is something to think about when they told you that they were still doing open air tests on these firing tables today, in terms of what's getting to the groundwater tomorrow. So when one puts those two together, that plume is approximately two miles long and still growing and then the Pit 6 unlined dump site that this gentleman was talking about is right down here on Corral Hollow across the street from the Carnegie Recreation Area and then there are some more areas of contamination at other parts of the site. And we do try to work on them all. Our goal is a complete and effective cleanup of soil and groundwater on the site. So we've already submitted comments on the earlier phases of this plan including several iterations of the remedial investigation/feasibility study and the draft proposed plan that preceded the draft final one that you have in your hand here tonight. So I want to start out by talking about some of the successes and areas of agreement that Tri-Valley CAREs has in terms of this draft final plan and then spend most of the time talking about some improvements that we believe still need to be made. But I want to make very clear that there are improvements that have already been made because of public comment and our participation in this process. We proposed early on, and the Lab completely agreed, on an upstream diversion system, the French drains and the ditches. We think it is very, very important to keep groundwater -- I am sorry, to keep rain water from getting into the pits. And we also agree on active remediation of the uranium sub-plume where the uranium is in the groundwater above the safe drinking water limit and they have agreed to act to pull that out as you heard and actually remove the uranium from the groundwater and as you heard, unfortunately, you can't do that with tritium, uranium is a metal, tritium is the radioactive hydrogen of the hydrogen bomb; it is already, it is basically radioactive water. That is our concern, and what I will concentrate on tonight are some additional measures having to do with the tritium that will be left in the groundwater. And there are remaining weaknesses to this plan and there are two critical additional cleanup measures that we believe must be included in the final proposed plan in order to ensure that the cleanup at the end of the day is successful; complete and adequate to protect human health in the environment. So, first, I appreciate that based on prior comments they have clearly included, quote, "preventing plume migration" and this was something that Tri-Valley CAREs spoke on a lot as this process has gone forward and it* *is right in there as part of the remedial action objective. So if you did get your thing, go to Page 5 and if you look at the top. It says, Remedial Action Objectives and on the right-hand side under, For Environmental Protection, the very first bullet ends with -- and prevent plume migration. However, that objective is not specifically carried forward in the summary of cleanup alternatives that are listed on Page 5 underneath the remedial action objectives. That is this summary here. So it is listed as an objective on the top of the page, but it is not carried forward when you look at what they are actually going to do. So to put it plainly, the Department of Energy and the Lab need to add a remedy component that will actually meet the objective. As it presently stands, while the objective of preventing plume migration is listed, there is nothing in the draft final proposed plan to demonstrate how Livermore Lab and the DOE are going to carry that objective out. So this situation is analogous to me saying I have an objective of becoming a professional dancer, but I have no dance lessons in my plan. So to ensure that the objective of preventing plume migration is carried out, we recommend that DOE and the lab add a horizontal line to this table and then summarize the cleanup objectives -- in the clean up alternatives, I am sorry, on Page 5. And so the objective is, if you just read down, you know, left and right here, the objective is retarding plume migration. The remedy component could be enhanced monitoring of the leading edge of the plume accompanied by hydraulic control measures as needed and Peter Strauss who is an environmental scientist and Tri-Valley CARE's technical advisor on the Superfund cleanup, is going to discuss this in more detail; but, there are several more feasible methods to be utilized to prevent plume migration. We agree with the increased diversion upstream; it will probably slow, as Michael Taffet had said, slow the migration of the plume which will make it easier to actually stop it or further retard it and that it isn't necessary to do that recirculation as a sort of all or nothing measure. There are other ways to do it and it can be done without adding more hydraulic head upstream.*

Response: Ms. Kelley is correct that the tritium plume emanating from the Building 850 firing table release site was not shown at the Public Meeting for the Pit 7 Complex as the focus of the meeting was to discuss the proposed remedy for cleanup of the Pit 7 Complex. The Building 850 release site plumes and cleanup remedy have been presented in previous public meetings, workshops, and documents and are discussed in the semi-annual Compliance Monitoring Reports. Although the tritium plume from the Pit 7 Complex commingles or joins with the downgradient Building 850 tritium plume, ground water tritium data show that there is not a significant increase in tritium activities where these plumes meet. This indicates that the Pit 7 Complex tritium plume is not contributing significant contaminant mass to the Building 850 plume. Both plumes are monitored regularly and the data reviewed and evaluated by DOE/LLNL and the regulatory agencies. Maps showing the tritium plumes from both the Pit 7 Complex and Building 850 are presented in the Annual Compliance Monitoring Reports for LLNL Site 300 that are accessible to the public at the LLNL Environmental Community Relations website: www-envirinfo.llnl.gov.

The tritium in ground water with activities that exceed drinking water standards extends approximately 1,300 ft (1/4 mile) from the source areas at the Pit 7 Complex and Building 850, and remains more that 2 miles from the site boundary. The portion of the tritium plumes with activities above drinking water standards are stable or shrinking in both the Building 850 and Pit 7 Complex areas. Ground water modeling results show that the portion of the plume in excess of drinking water standards (20,000 pCi/L) will not migrate during the 45 years necessary for all tritium activities to decline to below this standard. While tritium is present in ground water above background levels at a greater distance from these source areas, the activities of tritium in this portion of the plumes are within levels considered as safe for drinking water supplies by the State of California and the U.S. Environmental Protection Agency.

There are also significant geologic and hydrogeologic constraints to the movement of tritium-contaminated ground water in bedrock in the vicinity of and northeast of the Pit 7 Complex. Ground water in the sandstone bedrock flows to the northeast of the pit area at a low velocity (6 to 12 ft/year). The sandstone is unsaturated (does not contain ground water) to the east and northeast of the Site 300 boundary. This sandstone bedrock is eroded away in northeastern Site 300 and to the east, and therefore there is no continuous saturated pathway between the plume and offsite receptors such as the City of Tracy water-supply wells. In addition, significant water level mounding occurs across the Elk Ravine Fault, located east-northeast of the pits. The decreases in water elevation across the fault indicate that the fault significantly retards the flow of ground water in the east-northeast direction. These geologic and hydrogeologic conditions indicate that there is not a complete pathway to existing water-supply wells east or north of Site 300.

In addition, DOE/LLNL conducted fate and transport modeling of tritium and uranium to the site boundary as part of the human health risk assessment to determine the potential for residential exposure to ground water contaminants from the Pit 7 Complex. The exposure scenario used in the risk assessment assumed that water-supply wells would be drilled at the site boundary and was developed in consideration of the fact that land in the vicinity of Site 300 have been subject to development. The modeling results indicate that tritium and uranium activities would not exceed background levels in hypothetical wells at the site boundaries. Therefore, there is no risk of exposure to these ground water contaminants to existing or potential residential populations.

At the request of the Regional Water Quality Control Board (RWQCB) and Tri-Valley CAREs, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume using recirculation with both partial and complete hydraulic capture as part of the Remedial Investigation/Feasibility Study (RI/FS) for the Pit 7 Complex. A summary of this evaluation was included in the Pit 7 Complex RI/FS (Appendix F, Section F-16).

The objective of hydraulic recirculation would be to prevent the tritium plume from adversely impacting downgradient waters of the State by extracting tritium-bearing ground water within the plume and injecting this ground water at upgradient locations to allow more time for radioactive decay and dispersion to attenuate the plume. Hydraulic recirculation was simulated using both partial and complete plume capture scenarios in the alluvial and bedrock aquifer ground water.

The results of the evaluation indicated that the recirculation of ground water in both the alluvium/weathered bedrock and bedrock aquifers would result in the following adverse impacts:

1. Pit inundation,
2. Additional release of contaminants,
3. Accelerating migration of the high activity plume “hot spots”, and
4. Discharge of contaminated ground water at the surface.

DOE/LLNL recognizes that hydraulic capture and recirculation has been used to prevent tritium plume migration at a DOE site (Brookhaven National Laboratory). As is the case with all remediation technologies, site-specific conditions affect the applicability and success of the technology. The aquifer underlying the Brookhaven site consists of highly permeable, unconsolidated sediment in which large quantities of ground water can be stored and moved in and out of the aquifer. For example, the rate at which ground water moves through the Brookhaven aquifer is approximately one foot per day and numerous wells can produce over 40 gallons of ground water per minute. Because of these characteristics, hydraulic recirculation could be implemented without negative impacts on the tritium plume, such as increasing migration or causing additional releases.

The bedrock aquifer underlying the Pit 7 Complex consists of a much lower permeability, consolidated sandstone in which the rate of ground water movement is 0.01 to 0.03 foot per day and wells typically produce less than 1 gallon per minute. These characteristics limit the amount of water that can be reinjected, stored in, and moved through the aquifer. For this reason, continuous reinjection of ground water into the upgradient portion of the plume near the contaminant source area (the pits), would cause ground water levels to rise into the pits and push contaminants downgradient faster. To achieve even partial hydraulic capture and recirculation of the tritium plume at the Pit 7 Complex would upset the local water balance and exceed the amount of water the aquifer could hold, resulting in significant rises in ground water and possible inundation of the pits. Attempting partial hydraulic capture and recirculation of the tritium plume by reinjecting ground water downgradient of the pits would also have negative impacts; causing the lateral expansion of the plume into uncontaminated ground water. Although the alluvial aquifer consists more permeable material than the bedrock aquifer, tritium plume migration is currently limited due to extended periods of dry conditions at Site 300. The alluvial/weathered bedrock HSU is not saturated for significant periods during the year, therefore, measurable downgradient plume migration does not occur. Hydraulic recirculation would create a continuously saturated pathway year-round in the higher conductivity alluvial/weathered bedrock HSU, resulting in faster migration of the tritium plume. Therefore, both partial and complete hydraulic capture and recirculation of the tritium plume is not a technically feasible technology for controlling tritium plume migration at the Pit 7 Complex.

In addition, the objective of hydraulic recirculation at the Brookhaven site was to prevent the tritium plume with activities exceeding drinking water standards near the site boundary from migrating offsite into residential neighborhoods and water-supply wells. As stated previously, the tritium plume with activities above drinking water standards at the Pit 7 Complex is more than 2 miles from the site boundary, is stable to decreasing in activity, and does not pose a threat to existing or potential offsite receptors. The tritium in ground water will decrease to meet drinking water standards within a reasonable timeframe.

DOE/LLNL and the regulatory agencies believe the monitored natural attenuation of tritium in the preferred remedy (Alternative 5a) for the Pit 7 Complex will be protective of human health and the environment because:

- The portion of the tritium plumes that exceed drinking water standards remain over two miles from the site boundary, and is shrinking through natural attenuation.
- The tritium plume will not migrate offsite at activities above background levels.
- There are no existing or planned water-supply wells in the tritium plume.
- There is no pathway for the tritium-contaminated ground water to reach existing water-supply wells.

The preferred remedy (Alternative 5a) meets the remedial objective of preventing plume migration to the extent possible because: (1) it contains a component to extract and treat uranium, perchlorate, nitrate, and VOCs in ground water, and (2) there are other no technologies, including hydraulic recirculation, that would completely control migration of the tritium plume through active measures without causing additional contaminant releases and enhancing plume migration.

The Site 300 Contingency Plan, the Five-Year Review process, and the semi-annual Compliance Monitoring reports provide multiple mechanisms for the ongoing evaluation of the progress of remediation at the Pit 7 Complex and at Site 300 to ensure continued protection of human health and the environment. DOE regularly reviews and discusses monitoring data and remediation progress with the U.S. EPA and State regulatory agencies. Both the Site 300 Contingency Plan and the Five-Year Review process contain mechanisms for re-evaluating and implementing changes to the remedy if cleanup does not proceed as expected.

Because the proposal for hydraulic recirculation of the tritium plume at the Pit 7 Complex is contained in several subsequent comments, the explanation of the infeasibility of this technology at the site discussed in this comment response is referred to in later responses to those comments.

Ms. Kelley comment #2: *The second additional cleanup measure that must be included in the final plan involves two stages, we believe. Step one is additional, albeit very careful, characterization of the waste remaining in the unlined dump sites and step two, if needed and feasible, excavation of hot spots. Excavation is treated in this draft final plan as an all or nothing. You know, it is either we are going to excavate every single molecule from those pits and have no upstream diversion or we are going to have upstream diversion and not excavate even one molecule from the pits and there are logical middle paths where you would have upstream diversion, you would definitely, definitely keep that, but you might with additional characterization identify some hot spots where you could excavate the pits and if 80 percent of the wastes are sort of in the bottom right below, I would suggest that actually your pit bottom has dropped, as opposed to saying that unequivocally they are out of the pits. And Tri-Valley CAREs has a long involvement with this issue and I really need to, I won't spend too much time, but I need to express some frustration because this is a cautionary tale that I want to offer for the entire clean up. On Page 2 Livermore Lab says it put waste in the unlined pits until 1988. I testified in 1989, me, myself on behalf of Tri-Valley CAREs at that very RCRA hearing that you referred to and at that time I said: Livermore Lab and the Department of Energy should characterize and excavate those pits. On Page 3 of this proposed plan, it says in 1998, like ten years later, during the El Nino year, groundwater rose substantially, and that was that wonderful back and forth graph that Mike Taffet had showed of it rising in and mixing with the waste -- well, if they had excavated it in 1989 when Tri-Valley CAREs first requested this, those wastes wouldn't have been there to get into the groundwater in 1998. So the cautionary tale is this: Anything not cleaned up today will migrate and spread out and be more costly and difficult to clean up tomorrow. So think of this also when we are talking about some additional measures to stop the forward migration of the plume. It is going to be cheaper, better and more effective to do it today than ten years from now go "Oh, my God we should have done some additional measures and to try to institute them then." I also want to point out that in the July 2005 Final Remedial/Investigation Feasibility Study, it appears that monitoring wells for groundwater weren't placed actually in like the middle of Pits 3 and 5, only around the edges, and there were 7 bore holes that were in the Pit 5, I believe, measuring soil moisture concentration and that's* *where they found 6.9 million picocuries per liter, as the concentration, showing there are probably some hot spots that could, perhaps, be effectively excavated and they only did three, I believe, in Pit 5 and those three bore holes were along the edge. So, I definitely want to protect the workers and want to have this done in a very cautious manner but Tri-Valley CAREs is not convinced that the characterization of the pits is sufficiently adequate to rule out any excavation and again that it shouldn't only be listed in the plan as an all or nothing. You are either going to excavate every molecule or none. There is that middle path of potentially excavating hot spots and we do strongly recommend that the characterization step and then potential hot spot removal be put in the plan and that that they not bump out hydraulic diversion upstream, that that is in addition to.*

Response: Characterization of the landfill waste was conducted from 1985 to 2004 and included: (1) a soil tritium moisture survey in Pits 3 and 5, (2) tritium and isotopic uranium analysis of cores from Pits 3 and 5 and underlying bedrock, (3) a helium-3 survey of pit vapor from which tritium activities within the landfills were determined, (4) seismic, induction, and magnetometer surveys that provided data on variations in pit depth and density, and (5) definition of metal objects within the waste. The results of these investigations indicate that the distribution of tritium and uranium within the landfills is fairly homogeneous and did not indicate the presence of localized areas of elevated tritium or uranium activities that could be preferentially excavated from the pits to reduce or prevent potential releases from the pits. Excavation of the pit waste will not fully prevent further releases to ground water because a significant portion of the contaminants are already present in the bedrock underlying the pits and would still remain as a contaminant source after waste excavation. In addition, excavation of the pit waste presents additional short-term exposure risks during excavation, transport, and disposal.

The hydraulic drainage diversion system component of Alternative 5a is designed to prevent ground water from entering the landfills and underlying contaminated bedrock and resulting in further releases of contaminants.

Ms. Kelley comment #3: *I also want to point out that -- and this wasn't talked about in the Lab's presentation and perhaps should have been, that there is a possible closure of Site 300 in 2011 and that's in the Department of Energy's fiscal year 2007 budget request before Congress right now. So, the DOE is looking at whether or not they are going to move toward closeout of present activities by 2011. So our point is: Shouldn't the Department of Energy and the Lab plan to clean the subsurface soil and the groundwater to the more strict residential standards that would support multiple land uses rather than merely the industrial standard? In the presentation you were told that this will remain a classified, controlled area forever, but in fact, it might not, and so if the Department of Energy were to want to sell the site or to do other kinds of uses, perhaps in ten years, they might have to clean it up then to a more strict standard -- and again, in ten years, things will have migrated, it will be more expensive, it will be more difficult. So we are calling on the Lab and the Department of Energy to commit now to doing it to the more strict residential standard so that they could have multiple uses on the site.*

Response: While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to open the land for recreational or residential uses. Section 28 of the Federal Facility Agreement (FFA) states: "The Department of Energy shall retain liability in accordance with CERCLA, not withstanding any change in ownership of the real property interests... shall not transfer any real property interests

... except in compliance with Section 120 (h) of CERCLA..." This provision ensures that DOE will not transfer lands with unmitigated contamination that could cause potential harm. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Additionally, the Five-Year Review Process and the Site-Wide Compliance Monitoring Plan/Contingency Plan specifically evaluate changes that have either occurred or can be foreseen for the future, including potential changes in land use.

It should also be noted that DOE has committed to cleanup ground water at Site 300 to drinking water standards, at a minimum, unless technically impracticable. Drinking water standards do not differentiate between residential and industrial uses, therefore cleanup to meet these standards would be protective of residential populations.

Ms. Kelley comment #4*:* *And in the short run, and I want to close by saying something about the short run between now and 2011. Peter Strauss mentioned the Site-Wide Environmental Impact Statement permits the introduction, again, of tritium, radioactive hydrogen in the open air bomb tests and this is what contaminated, that part of the plume they didn't show you, below the Building 850 firing table. And so we have a concern that there is an escalation in the short run of nuclear weapons work being planned at Livermore Lab Site 300 and that this plan doesn't look at and neither do any of the other plans for the other contaminated areas on site, how expanding weapons work at Site 300 might impact the environment. And one other thing, there was some discussion about the tests and I just want to point out some pictures. These are from Livermore Lab's archives, so these are their pictures, because we are talking about these tests and you were talking about the ground shaking and the shockwave and blowing out your windows and I have a friend that owns some of the wind mills in the Altamont and he also hears the tests. This is in one of the tests and if you come up and look really close, you will see that these little teenie-weenie dots are buildings. These are big tests. This one here is pyrophoric, it is believed that this is a uranium-238 test and these chards of metal spontaneously burst into flame when they come into contact with oxygen and so you can see, hear, the pyrophoric metal just going, basically, all over the hills and so we have a very serious concern about the plans to continue doing these open air tests at Site 300 on the future health of the employees as well as of the community and believe that this needs to be taken into account when you are talking about cleaning up because if you continue to pollute while you are cleaning up, then that becomes a forever job. Thank you.*

Response: Tritium is no longer used in explosives tests at Building 850 and therefore, tritium is not being added to the environment there. The contamination at Site 300 was caused primarily by past waste handling practices. Ongoing activities at all LLNL sites are designed to minimize hazardous releases to the environment. Activities have changed significantly since LLNL began operation 50 years ago, with experiments now designed with a much better understanding of environmental protection and safety. Program activities are planned and monitored for compliance with the Resource Conservation and Recovery Act (RCRA) and other environmental regulations (such as the Clean Air and Clean Water Acts) to ensure that future harmful releases do not occur. LLNL has extensive environmental protection procedures in place that are designed to prevent any additional contamination. Those preventive and mitigating activities and monitoring for any releases are reported in the Site Annual Environmental Report. Current operations at Site 300 are overseen by several environmental regulatory agencies and are conducted in compliance with their regulations to prevent future releases that could be detrimental to human health and the environment. The Site Annual

Environmental Report provides information on releases and background environmental conditions around LLNL's sites. This report can be found at www-envirinfo.llnl.gov/.

Peter Strauss—Technical Advisor to Tri-Valley CAREs, San Francisco, California

Mr. Strauss comment #1: *Hi. My name has been mentioned a lot. So my name is Peter Strauss. I am the technical advisor to Tri-Valley CAREs and I have been working on this site for about, almost fifteen years now. And I want to take this opportunity to thank the environmental staff of Livermore who have worked on Site 300 and I realize it is a difficult process, I mean, it is, and it's been a long, long, long time. I also would like to thank the regulators who have held them to the fire on a lot of things and requiring them to go the extra mile. I mean, it is not too long ago that the remedy was no remedy. The remedy was just leaving it alone and so we have come a long way. I want to point out that EPA did a marvelous job on convincing and persuading the Lab to clean up the uranium. It was a terrific piece of forensic analysis and I really want to compliment them on that. So I hope you are listening, Kathy. It is important to note that in this larger context that the State of California has non-degradation policy for drinking water. So whatever you heard about the plume moving off site or not, it doesn't really matter for the State of California in terms of the drinking water standard. They are not supposed to degrade clean waters that is a potential drinking water source, potential drinking water source and that is what we are talking about here. So every time the plume moves we are degrading that potential drinking water source. And if you just read the paper about drinking water these days, you know that water is going to be an issue in the next century. It has been for California and it is going to be a more important issue. So I want to pickup on the issue that is of most concern to me and to Tri-Valley CAREs and what Marylia has talked about and that is she noted that the remedial action objective of preventing plume migration -- and that was inserted and it was a great, it was a milestone and a success, and, you know, I just hope that these are not merely words to satisfy the community or the regulators and that the Lab is going to do something about that. Now, we have proposed for a long time a series of remedies that could be staged and the diversion -- we talked about hot spot removal; we've talked about downstream extraction of groundwater and bringing it back in a circulation cell, Michael described that. Now, what I fear is that, that in the analysis of rejecting that, they use the all or nothing approach to it. They said: All the water, and they didn't, they didn't take in to consideration some of the really important points. In my opinion, if we had this staged approach, it would provide them with an adaptable and a flexible strategy at a number of points and that might be modified as data comes into being. I think that the DOE response -- this is not new comment -- and DOE, in its response to Tri-Valley CAREs's comments missed the point – an important piece of information is unable to step further in the remedy selection which would truly provide long-term protection for the environment. DOE stated that, "Even partial hydraulic control would require much larger volumes of water to be extracted and reinjected in an upgradient lens underlying the pits." DOE has posited that this would inundate the pits or flow in directions that would contaminate pristine waters. Nobody wants that. Now, that may be true if all the water that was extracted was modeled. First of all, all the water does not have to be extracted and it could be extracted only at the subsurface – there is a subsurface volume to allow that extraction. So you could create a reservoir, I mean, you have a natural reservoir and you have a diversion project that is going to keep some of that water out of that groundwater table. So you have some room there and we are asking that they use that as an option in the remedy selection. In another point, they assume that it would be put into one lens, to use a term, or a hydrostratigraphic unit where the water would -- would be in a very narrow lens, but it* *could be reinjected in very many places. I want to put this into larger context. In environmental cleanup, years of experience have led to the realization that significant uncertainty requires adopting a flexible iterative approach -- uncertainty in health risks, uncertainty in budgets, uncertainty in land use -- all those things come to bear on this situation and, you know, just for an example: Only recently did the staff discover that there was this lens, this hydrostratigraphic unit underlying the pit, there was a new one, they discovered that. So I mean, there is uncertainty about, about many things and I think that a lot of people have expressed that today. So the proposed plan will lead to the record of decision and the record of decision, essentially, is a strategic plan for achieving remedial action objectives, e.g., preventing plume migration. So by its very nature, the ROD should incorporate a decision logic and the basis for future adaptations as part of the overall completion of the strategy and that's really what we are recommending -- that they have a staged remedy that includes not only the hydraulic diversion, but other kinds of activities. Thank you.*

Response: As discussed in the response to Ms. Kelley's comment #1, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume using recirculation as part of the RI/FS for the Pit 7 Complex. The results of the evaluation indicated that the recirculation of ground water in both the alluvium/weathered bedrock and bedrock aquifers would result in the following adverse impacts:

1. Pit inundation,
2. Additional release of contaminants,
3. Accelerating migration of the high activity plume "hot spots", and
4. Discharge of contaminated ground water at the surface.

To achieve even partial hydraulic control of the tritium plume would upset the local water balance and exceed the storage capacity of the aquifer, resulting in significant rises in ground water, possible inundation of the pits, and the lateral migration of tritium into uncontaminated ground water. For these reasons, DOE/LLNL does not consider this a technically feasible technology for controlling tritium plume migration. A summary of this evaluation was included in the Pit 7 Complex RI/FS (Appendix F, Section F-16).

Mr. Strauss suggests that the portion of the aquifer that would be dewatered by the hydraulic drainage diversion component of Alternative 5a could be used to reinject tritium-bearing water extracted from the downgradient portion of the plume. This is not a feasible option because the drainage diversion system is designed to divert clean ground water from the recharge area so that it will not migrate beneath and rise into the landfills. Because the ground water to be reinjected would contain tritium, the RWQCB regulations do not allow reinjection of contaminated water into a clean aquifer "reservoir." DOE/LLNL evaluated using both "lenses" or HSUs (alluvial/weathered bedrock and $Tnbs_0$ bedrock) for extraction and reinjection of tritiated ground water to control plume migration. We were not able to identify any HSUs in the Pit 7 Complex area where reinjection would not cause negative impacts such as pit inundation or accelerated plume migration. The reference to discovery of a new HSU by DOE/LLNL staff refers to refinement of the hydrogeologic framework for the Pit 7 Complex into two HSUs: alluvial/weathered bedrock and bedrock HSUs, and not the discovery of a previously unknown water-bearing unit. This refinement has improved the understanding of the movement of ground water and the long-term fate of contaminants in the landfills and ground water.

Michael Daw, Tri-Valley CAREs, Pleasanton, California

Mr. Daw comment #1: *All right. Is this on? Okay. So I will be brief. I wrote something in advance. I will just try to be as energetic as I possibly can. I am here tonight because I care about a sound cleanup for the Site 300. As I am a member of the public I have been made aware that local groundwater plumes are currently contaminated which affects plant life, humans and a myriad of endangered animals in the area. I believe that the same government agencies responsible for contributing to these environmental hazards should also clean up their mess. And as some might recall the bomb testing which occurred during the 1950's has resulted in the contamination that we have today. Our groundwater is now threatened. During high rain years, the contents of the Pit 7 dump site became saturated and were washed out of the pits and into what had previously been clean groundwater. Though there are many contaminants released during these trials I am particularly concerned about tritium, a substance used to make H bombs or thermo nuclear weapons. I am particularly focused on this contaminant because tritiated water is processed by plants, animals and humans alike and it can be transformed into DNA proteins, directly harming human fetal development. I believe that our public should be protected against pollutants causing birth defects and miscarriages. Right now the drinking water standard for tritium of 20,000 picocuries per liter does not take effects like miscarriages and birth defects into account. It is noteworthy that other states such as Colorado have a more stringent standard than the EPA drinking water standard for California. The acceptable limits themselves are also questionable. The tritium plume between Tracy and Livermore is approximately 100 times above the EPA's maximum contaminant level which is currently at 20,000 picocuries per liter. In sum, Tracy's drinking water could put the public's health at risk as the concentration of tritium in local groundwater far exceeds a safe amount even by relatively loose standards. Moreover, activities at Site 300 severely threaten several species of wild animals protected by the Endangered Species Act. Site 300 is one of the largest native grasslands in California. Specifically, Lab activities endanger the California red legged frog, the California tiger salamander, the Alameda whip snake, the San Joaquin kit fox and 24 species of birds that are federal species of concern. With pollutants like tritium mixing in the local groundwater these animals have a greater chance of dying out in this area. The department of -- sorry about that. The Department of Energy has already made plans to extract uranium-238 from the contaminated water plume, however, it took considerable pressure to get the DOE to agree to clean up the uranium. Based on the information that I can publicly glean, it appears to me, that the Department of Energy should implement both upstream and downstream hydraulic controls ensuring that contaminated tritium plume does not continue to migrate and pollute new and/or pristine water. California's clean water is a scarce resource. This recommendation was not adopted by the DOE when it was drafted, when it drafted a proposed cleanup plan for Pit 7. For this hearing I am speaking in favor of controlling the outer edges of contaminant plumes. Do not let tritium plume -- do not let the tritium plume emanating from Pit 7 expand. Further, Site 300 should be cleaned up to residential standards because the site is likely to close in the near future and we need to protect all future users and occupants. Thank you.*

Response: The maximum tritium activity detected in ground water at the Pit 7 Complex has decreased by over 75% from a historical maximum of over 2,000,000 pCi/L in 1998 to 500,000 pCi/L in 2005 due to natural attenuation processes. These processes will continue to reduce tritium activities to reach drinking water standards within 45 years. There is no hydraulic connection between the ground water plume at the Pit 7 Complex and the aquifer that provides drinking water to the City of Tracy. Therefore, there is no pathway for humans to drink or otherwise be exposed to tritium-bearing water from the landfills.

An ecological risk assessment was conducted to evaluate potential impacts to plants and animals from exposure to contamination at the Pit 7 Complex using EPA risk assessment guidelines. This assessment indicated that there is no threat to animals or plants, including endangered and threatened species, from exposure to contaminants at the Pit 7 Complex. DOE/LLNL has an ongoing program to ensure the continued health and protection of threatened and endangered species and plant and animal communities at the site. This program includes annual surveys of special status species, evaluations of all Site 300 activities for possible impacts to plant and animal communities, and regular consultations with the U.S. Fish and Wildlife Service.

As discussed in the responses to Ms. Kelley's comment #1 and Mr. Strauss' comment #1, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume at the Pit 7 Complex using recirculation. The results of the evaluation indicated that the recirculation of ground water would result in additional releases from the landfills and accelerated plume migration. For these reasons, DOE/LLNL does not consider this a technically feasible technology for controlling tritium plume migration at the Pit 7 Complex. (Please refer to the response to Ms. Kelley's comment #1 for additional details.) The selected remedy component for the tritium plume will be protective of human health and the environment because:

1. The tritium source in the landfills and underlying bedrock will be isolated to prevent further releases.
2. Tritium activities will naturally attenuate (decay) to meet drinking water standards within 45 years.
3. During this timeframe and beyond, tritium will not migrate offsite above background levels or impact water-supply wells or threaten human health or plant and animal communities.

Tara Dorabji—Outreach Director with Tri-Valley CAREs

***Ms. Dorabji comment #1**: Hello, I am Tara Dorabji. I am the outreach director with Tri-Valley CAREs. I wanted to thank you for this opportunity to give public comment. It is important to me, the future of the land and the water in this region and Site 300 is huge. It is 11 square miles and some of the activities out there include fabricating high explosives, detonating full-size mock nuclear bombs with depleted uranium and as we know the most contaminated site is the Pit 7 complex that covers over 3200 acres and specifically what we want to see cleaned up is the radioactive tritium, uranium-238, PCB's furans, dioxins and other high explosive compounds. Within the Pit 7 complex, the maximum concentration of tritium that has been found is measured at two million picocuries per liter. This is more than 100 times greater than the maximum amount permitted in the Safe Drinking Water Act and the U.S. EPA has estimated that if the groundwater at Site 300 is not cleaned up and somebody drinks it, it will pose a cancer risk of 7 cancers per 100 residents. So there is a serious mortality level in that level of contamination. It isn't a question of, oh, it is not likely that someone drinks it, look at all these things, that level of contamination is real, it is unacceptable and it is very dangerous. And it is really important to the community that we have real cleanup and that means cleaning up the site to residential standards. That's the level we are talking about, residential standards* *cleanup. That's what we want. That's what cleanup means to me as a community member. In addition, I think that we talked a lot about the assumptions in the model and an assumption that I would like to see in that model for when we talk about what the clean water is, is the possibility of large residential communities relying on the regional aquifer for drinking water. It is some pristine water in this area. Water is a serious issue for the State of California, not sometime off, but now. And when we are talking about cleanup and looking at the models, that needs to be an assumption in the model, that this water will be used as drinking water. That's the type of cleanup that we want to see. So cleanup needs to be set in the strictest state and federal government levels. That means that federal and state maximum contaminant levels for all groundwater on site and off site should be the bottom line, the base line, below which the cleanup will not fall.*

Response: We assume that Ms Dorabji is referring to several release sites and plumes at Site 300 as because the Pit 7 Complex contamination does not encompass 3,200 acres and PCBs, furans, dioxins, and high-explosive compounds are not contaminants of concern for the Pit 7 Complex. DOE/LLNL are committed to cleanup of environmental contamination at Site 300, and have over 20 treatment facilities operating and other remedial actions underway or completed for site cleanup. Although final ground water cleanup standards have not yet been selected, DOE/LLNL have committed and remedial actions designed and implemented to clean up ground water at Site 300 to drinking water standards, at a minimum unless it is demonstrated and the regulatory agencies concur it is technically impracticable. The clean up of contaminants in subsurface soil and bedrock are also designed to mitigate any risk and prevent impacts to ground water above drinking water standards, at a minimum. Drinking water standards do not differentiate between residential and industrial uses, therefore Maximum Contaminant Levels (i.e., drinking water standards) would be protective of residential populations.

The maximum tritium activity detected in ground water at the Pit 7 Complex has decreased by over 75% from a historical maximum of over 2,000,000 pCi/L in 1998 to 500,000 pCi/L in 2005 due to natural attenuation processes. These processes will continue to reduce tritium activities to reach drinking water standards within 45 years. Active cleanup measures (pump and treat) are part of the selected remedy (Alternative 5a) to remove other contaminants in Pit 7 Complex ground water until drinking water standards are achieved, at a minimum.

A human health risk assessment was conducted to determine the potential for residential exposure to ground water contaminants from the Pit 7 Complex. The exposure scenario used in the risk assessment assumed that water-supply wells would be drilled at the site boundary and was developed in consideration of the fact that land in the vicinity of Site 300 have been subject to development. As part of the assessment, DOE/LLNL conducted fate and transport modeling of tritium and uranium to the site boundary. The modeling results indicated that tritium and uranium activities would not exceed background levels in hypothetical wells at the site boundaries. Therefore, there is no risk of exposure to these ground water contaminants to existing or potential residential populations.

In addition, the Agency for Toxic Substances and Disease Registry conducted an independent health assessment of Site 300 contamination in 2005 which concluded that there are no past or current exposures to contaminants associated with LLNL – Site 300, and the potential for future exposure is unlikely.

***Ms. Dorabji comment #2**: The migration of pollutants into pristine water must be addressed. This needs to be addressed. And it is really important, several folks have all* *mentioned the need that DOE needs to change its cleanup plan to include a downstream hydraulic control that ensures that the contaminated tritium plume does not continue to migrate and pollute presently pristine water as it advances. This needs to be part of the plan. Put that money in now. It is essential. It is key. The technology is there and what we can do here at Livermore Site 300 can be used as a model for other sites across the country, let's invest in it now, let's do it, it needs to happen.*

Response: As discussed in the responses to Ms. Kelley's comment #1 and Mr. Strauss' comment #1, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume at the Pit 7 Complex using recirculation. The results of the evaluation indicated that the recirculation of ground water would result in additional releases from the landfills and accelerated plume migration. For these reasons, DOE/LLNL does not consider this a technically feasible technology for controlling tritium plume migration at the Pit 7 Complex. Additional information regarding the evaluation of hydraulic recirculation to prevent migration of the tritium plume at the Pit 7 Complex is provided in the response to Ms. Kelley's comment #1.

The selected remedy (Alternative 5a) component for the tritium plume will be protective of human health and the environment because:

1. The tritium source in the landfills and underlying bedrock will be isolated to prevent further releases.
2. Tritium activities will naturally attenuate (decay) to meet drinking water standards within 45 years.
3. During this timeframe and beyond, tritium will not migrate offsite above background levels or impact water-supply wells or threaten human health or plant and animal communities.

Ms. Dorabji comment #3*: In addition, the public needs to continue to be involved in the cleanup process. I really appreciate the opportunity today and a lot of people from the community have come out. People care about this issue and we appreciate being involved but we want that to continue on. We want to receive notification and then have opportunity for dialogue to give our input on an ongoing basis. And in addition to that, there is a growing Latino population in Tracy. I would ask that all future materials be translated into Spanish. There should be Spanish translators available at meetings. You don't see a huge representation here because that was not made available. It needs to be, when you have a public meeting, that needs to be put into Spanish, that outreach needs to be done and I would like to see that in the future.*

Response: The restoration of Site 300 is being conducted under CERCLA, which requires public participation in the decisions made to determine cleanup strategies. DOE/LLNL exceed the CERCLA public participation requirements for notifications, public meetings and workshops, as well as for providing public information. This includes conducting voluntary public workshops to present the status of site cleanup and to discuss the contents of draft versions of major documents. All public meetings and workshops are publicly noticed in at least two local newspapers and all major documents are placed on the web at http://www-envirinfo.llnl.gov/ as well as in the Tracy Public Library and the LLNL Visitor's Center. DOE/LLNL complies with all State and Federal requirements for public notifications, conducting Public Meetings, and other community participation and outreach efforts. However, DOE will evaluate the feasibility of issuing the next public fact sheet, the "Proposed Plan for Environmental Cleanup of LLNL Site 300," in both English and Spanish. This document is scheduled to be published in the fall of 2006.

Ms. Dorabji comment #4*: In addition, decisions should not be based solely on computer modeling. Computer modeling is an important tool, but it is not valid unless it is continually updated by field testing.*

Response: Decisions are not based solely on computer modeling. Modeling is only one tool used in the cleanup decision-making process. DOE/LLNL collect and analyze hundreds of ground water samples and collect water elevation measurements from the field each quarter from monitor wells at the Pit 7 Complex to define any changes in local ground water chemistry and flow and to be certain that modeling assumptions and results continue to be valid.

Ms. Dorabji comment #5*: And in addition, I just wanted to make one other comment about the concept of safe and risk and what's really important to me is that there is no safe dose of radiation -- BEIR VII states that. There is no amount of ionizing radiation that does not bear some negative potential biological reaction and recently they have found out that women are over 30 percent more likely to gain cancers from radiation risks than men and so that needs to be incorporated into the assumptions of what is safe. Let's assume that it is a pregnant woman. Let's use that as a baseline instead of using the standard, standard male.*

Response: DOE/LLNL followed the "Risk Assessment Guidance for Superfund (RAGS)" to develop the risk estimates for the Pit 7 Complex. A risk assessment, the framework of the EPA human health evaluation, is a characterization of the probability of adverse effects from human exposures to environmental hazards. Risk assessments are quantitative, chemical-oriented characterizations that use statistical and biological models to calculate numerical estimates of risk to health. Data from human epidemiological investigations are used in the risk assessment, when available, and when human toxicological data are unavailable, the results of animal toxicology studies are used. The standard exposure factors used to calculate intake of a chemical are intended to be used for calculating reasonable maximum exposure levels. The risk estimate is upper bound because it is an estimate based on conservative dose-response modeling and the true risk may in fact be lower and protective of the general population. The exposure factors are not based on a male versus female, but on a body weight of 70 kilograms or 154 pounds. As mentioned above, the ATSDR conducted a health assessment of Site 300 in 2005 and concluded that there are no past or current exposures to contaminants associated with LLNL – Site 300, and the potential for future exposure is unlikely.

Ms. Dorabji comment #6*: And I think another thing that really stood out to me in the discussion of assumptions is one: It assumes no recontamination -- that, you know, the models that we saw all assumed that there wouldn't be additional leakage, additional spills and it also assumes that there is no new contamination and I want to share that vision, believe me. I am only 26 and I am already tired of being here and I see a future of being here again, and again, and again, and again and again, and again and my children coming and their children coming because, you know, we talk about tritium and yeah, that is a short, short radioactive life, 12 years, that is going to be longer than mine. We are not talking about plutonium. We are not talking about uranium that we are talking about hundreds of thousands of years and it is not stopping here. The cleanup buck stops here, right? We are going to have to battle, do we have enough for those downstream hydraulic control? Yet you look, what about the expansion. It is* *an endless expansion. That is the most frustrating part is that we sit here discussing the cleanup and the stream just keeps coming more and more than I can ever imagine and it needs to be addressed. For instance, the record of decision for the Site-Wide Environmental Impact Statement says that the Livermore Lab is able to reinstate the use of tritium and open air bomb tests at Site 300. This would have allowed tritium to be used on an outdoor, uncontained firing table increasing worker and community exposure to radiation. Why isn't that in the model. That is the reality. They have made that legal, they have the mandate, that needs to be part of it.*

Response: Modeling of tritium fate and transport in ground water, as presented in the Pit 7 Complex Remedial Investigation/Feasibility Study, included a very conservative simulation of a worst case release of all tritium still remaining in the landfills and underlying bedrock to ground water, as well as the fate of the current tritium and uranium in ground water. In all modeled cases, tritium and uranium activities were at or below background at the relevant Site 300 boundary in the direction of ground water flow. Tritium is no longer used in tests at the Building 850 firing table. Building 850 is not part of the Pit 7 Complex, therefore this area was not included in ground water fate and transport modeling for the Pit 7 Complex. The contamination in the Building 850 area was evaluated and summarized in the Site-Wide RI/FS, and an interim remedy selected in the Interim Site-Wide ROD. There are no sources of tritium and uranium in the Pit 7 Complex area other than the pits. Therefore, no additional sources could be included in the modeling.

The remedial alternative that is implemented at the Pit 7 Complex would be continuously monitored and the results of the monitoring would be reported to the regulatory agencies and general public semi-annually. Any changes needed to the remedy would be discussed with the regulatory agencies. In addition, upon completion of the remedial design, the Five-Year Review process for the remedy would begin. Any deficiencies in the remedial design would be identified and addressed.

Ms. Dorabji comment #7*: Further, Site 300 is now being considered as a site for the National Zoonotic and Agricultural Research Center. This is a new plan to build a high level bio weapons facility within the confines of a super secret nuclear weapons site, the Site 300. I mean, this is outrageous. It shouldn't happen but it is being proposed, which means suddenly with, now you are talking about potential bio warfare agents which there is no known antidotes escaping in and mixing with the radiation that is already there. It is unacceptable and it is upsetting and yes, I am upset because you see a whole new host of problems being proposed when we can't even address the ones that have already happened. The real solution to clean up is to stop making the waste. And to do that, there is already talk within the budget proposals for 2007 to look at potential close out of Site 300. The current capacities of Site 300 are duplicative and they should be closed out and yes, we should be talking about closing out the site and actually making it clean and up to residential standards.*

Response: While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to open the land for recreational or residential uses. If the land use changes, the clean up remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Please see the response to Ms. Kelley's comment #3 for additional information.

Discussion of ongoing or proposed activities at Site 300 not directly related to cleanup of the Pit 7 Complex, such as the biological research center, is not within the scope of this document.

All proposed and existing cleanup remedies at Site 300 are also designed to cleanup ground water to drinking water standards, at a minimum. Drinking water standards do not differentiate between residential and industrial uses, therefore cleanup to meet these standards would be protective of residential populations.

***Ms. Dorabji comment #8**: I just want to reiterate the request for a two week extension for public comments and I hope that you will be able to give us a decision about that by the end of the evening and thank you very much.*

Response: DOE has extended the public comment period to May 5, 2006.

Loulena Miles—Staff Attorney with Tri-Valley CAREs

***Ms. Miles comment #1**: My name is Loulena Miles. I am the staff attorney at Tri-Valley CAREs. And for the record, our address is 2582 Old First Street, Livermore, California. I just wanted to start out by saying that I think we need to look at both ecological and political concerns when we are conceptualizing the cleanup for Site 300. I will add, I am here to advocate for a clean up that is both responsible and robust. The clean up work at the main site has thus far been respectable and I want to make sure that Site 300 follows suit. I was just in Washington, D.C. last week and I was speaking with a senior government official in the Department of Energy who acknowledged that Site 300 is redundant with other facilities and that due to its proximity in residential areas DOE is going to work toward closing out the site because they don't want to be doing this open air testing, for example, near homes and residences, they are acknowledging there are risks there. And because Site 300 may go off line in the near future I believe we should clean it up to a standard that takes that into consideration. As some of you may know, Rocky Flats was just opened up as a wild life refuge. This is a former Department of Energy site where they created the Pits for nuclear weapons and it was extremely contaminated and there is still a lot of controversy among the watch-dog community or public oversight community around whether it is truly clean, at this point, and it is open as a wild life refuge and I think that we need to envision that kind of future for Site 300 and think about now how do we clean up for that kind future. We should be cleaning it up to protect the children who may one day play there and we should clean it up for the animals that live there now and hopefully will continue to exist. I want to remind you that ecologically, even with the contamination, Site 300 is still a precious resource for the State of California. Not only is it one of the largest native grasslands of its kind in California but it is teaming with animal life and much of that animal life is endangered species and Mike already told you a list of some of the animals like the California red legged frog and the Tiger salamander that is out there, and the Kit fox. I wanted to highlight the California red legged frog tonight because it is a federally listed threatened species that is actually known to breed in ponded areas at Site 300. In fact, 60 percent of the site is listed as critical habitat for the frog and in the July 2005 final remedial investigation feasibility study, the ecology of the Pit 7 area is described and it states that amphibians are known to use one of the springs out there, spring 24, an area within the detectable tritium plume and it doesn't state whether that is a red legged frog but I think it should and I think that this process should take into account more information about the endangered species out there and consider the impacts to them.*

Response: While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to open the land for recreational or residential uses. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Please see the response to Ms. Kelley's comment # 3 for additional information.

An ecological risk assessment was conducted to evaluate potential impacts to plants and animals from exposure to contamination at the Pit 7 Complex using EPA risk assessment guidelines. This assessment indicated that there is no threat to animals or plants, including endangered and threatened species, from exposure to contaminants at Spring 24 or elsewhere in the Pit 7 Complex area. Similar ecological risk assessments were conducted for all areas of contamination at Site 300 and the selected cleanup remedies were designed to address and mitigate any potential impacts to ecological receptors at the site. In addition, DOE/LLNL has an ongoing program to ensure the continued health and protection of threatened and endangered species and plant and animal communities at the site. This program includes annual surveys of special status species, evaluations of all Site 300 activities for possible impacts to plant and animal communities, and regular consultations with the U.S. Fish and Wildlife Service.

The presence of the San Joaquin kit fox has not been confirmed at Site 300, although there have been confirmed sightings on adjacent ranch land. Both California red-legged frog and California tiger salamander occur at Site 300. Although a large portion of Site 300 was initially proposed by the U.S. Fish and Wildlife Service as critical habitat, the recent final critical habitat listing did not include Site 300. Although Site 300 is no longer considered critical habitat, potential impacts to any endangered species are considered as part of ecological risk assessment activities conducted at Site 300. In addition, DOE/LLNL has created protected habitat at the site for several endangered species including the California red-legged frog, California tiger salamander, and the Large-flowered fiddleneck.

***Ms. Miles comment #2**: We must prevent migration of the plume to protect the delicate ecosystem upon which these species rely. Survival of these species is indicative of the general health of the environment and when animal or plant life is threatened, so would human life be threatened. I wasn't clear from the presentation tonight whether animal life would be threatened. I would assume when water could come up again if there was high rain years and again that would be bringing into the environment, into the immediate ecosystem, I know it was stated animals are not affected at this point because it is below ground. I wasn't clear it seemed to me intuitively that they would be, then put at risk during high rain years and incidents where, for whatever reason, contamination came up and definitely during the open air firing tests that are planned for Site 300 are ongoing.*

Response: Ground water containing tritium or other contaminants at the Pit 7 Complex does not rise to surface or threaten animal or plant life, even during years of high rainfall (i.e., the 1997-1998 El Niño). As discussed in the response to Ms. Miles comment #1, the ecological risk assessment indicated that there is no threat to animals or plants, including endangered and threatened species, from exposure to contaminants at Spring 24 or elsewhere in the Pit 7 Complex area. DOE/LLNL has an ongoing program to ensure the continued health and protection of threatened and endangered species and plant and animal communities at the site.

***Ms. Miles comment #3**: So I wanted to just say that both the city of Tracy and growing residential developments are scattered throughout the area and there are high numbers of people of color in Tracy and in the central valley that should be taken into consideration when deciding whether to cleanup the area to a residential standard. I know that people of color, the low income families tend to be most vulnerable to contamination or shoddy cleanup processes and are often not taken into consideration in government decision-making and so I didn't see any* *materials in Spanish here tonight or Spanish speaking outreach and I would really like to see that in the future. I think this should be done in this process and I also want to echo the request for an extension on the public comment period and to put out some translated materials in the interim.*

Response: DOE extended the public comment period for the Proposed Plan for Environmental Cleanup of the Pit 7 Complex by an additional two weeks (until May 5th) as requested at the Public Meeting. DOE/LLNL complies with all State and Federal requirements for public notifications, conducting Public Meetings, and other community participation and outreach efforts. However, DOE will evaluate the feasibility of issuing the next public fact sheet, the "Proposed Plan for Environmental Cleanup of LLNL Site 300," in both English and Spanish. This document is scheduled to be published in the fall of 2006.

***Ms. Miles comment #4**: Finally, I believe that Site 300 should have a robust cleanup so that the government will be able to weigh the full cost of cleanup when it is deciding to undertake future nuclear weapons testing endeavors. I think if we do a shoddy cleanup today then the government will feel that the costs are not very great and why not take new projects for nuclear weapons testing and development and I know that the government is pushing for that right now as a matter of fact with things like the reliable replacement warhead. So with these things in mind I expect my government to stop -- and particularly the regulators here, who I know -- I have heard definitely some sincere concerns coming from the regulators. We need to stop tritium from migrating to new water and we need to cleanup the area to residential standards. Also, I think we need to be more considerate of the threatened endangered or special status species and for that matter all species that are attempting to survive in this area. Finally, we cannot let Site 300 become the next Plum Island advanced bio weapons and research facility. This is an absurd proposal and we must nip it in the bud now before it develops. I know that the Department of Energy the Laboratory, the University of California has really jumped on this opportunity to turn this into the next Plum Island which was an island -- and this is not an island -- and so it is another reason why we shouldn't be doing it out here. This is the San Francisco Bay Area with 7 million people surrounding I know the Livermore Lab, so this is not an appropriate area to be doing this kind of research. Thank you.*

Response: As discussed in the response to Ms. Miles comment #1, the ecological risk assessment indicated that there is no threat to animals or plants, including endangered and threatened species, from exposure to contaminants at Spring 24 or elsewhere in the Pit 7 Complex area.

Clean up activities for the Pit 7 Complex area and other contaminated areas at Site 300 have all been designed to:

- Cleanup ground water contaminants to meet drinking water standards, at a minimum.
- Mitigate risk associated with exposure to contamination to both human and ecological (plant and animal) receptors.
- Control exposure to contamination until exposure risks are mitigated through the cleanup effort.
- Control and prevent contaminant plume migration to the extent technically feasible.

Wherever it is technically feasible, DOE/LLNL has included measures in the cleanup remedies for the Pit 7 Complex and other contaminated areas of the site, to prevent migration of contaminant plumes. Additional information regarding the evaluation of hydraulic recirculation to prevent migration of the tritium plume at the Pit 7 Complex is provided in the response to Ms. Kelley's comment #1.

Discussion of ongoing or proposed activities at Site 300 not directly related to cleanup of the Pit 7 Complex is not within the scope of this document.

Fred Norman — Tri-Valley CAREs, 7986 Driftwood Way, Pleasanton, California.

Mr. Norman comment #1*: Good evening. My name is Fred Norman. I live at 7986 Driftwood Way in Pleasanton, California. I came here tonight to offer support for the Tri-Valley CAREs plan of cleaning up this area. I hope that the DOE EPA people, I am not quite clear in my mind exactly what the proper title is, but the people who explain their plan, I hope they will listen carefully to and read carefully the Tri-Valley CAREs plan because I think it takes your plan a step further -- a step further toward success; however, I am not optimistic that you will do that, nor am I optimistic that your plan will succeed. As I was listening to your presentation, it made me disregard my plan here to express my support for the Tri-Valley CAREs plan because I heard the statement: Contamination was discovered in 1982 and I became very, very angry. Where, here I am tonight, this is 24 years, this has been time for my children to become adults, this has been time for my children to have children. Where has DOE been? Where has the EPA been? Ms. Dorabji mentioned standing here over and over and over again and envisioning her children standing here giving the same talk and her children's children standing here giving the same talk and I wish only to add to that, if they live. Somebody has to be responsible. You people have a job to clean up this area. I believe it can be done. If Pit 7 were in your backyard, I believe you could do something about it. It is in our backyard and I believe something could be done about that. I can only say that if something is not done about that, if that is not cleaned up successfully, if my children are affected, if my grandchildren are affected, if any of the people here end up with the cancers and the other illnesses that this problem creates, I hold you responsible. Thank you.*

Response: The statement that indicated that contamination was discovered in 1982 meant that the first indication that contamination existed at the site occurred in 1982 following collection and analysis of a ground water sample. At that point in time, DOE/LLNL began extensive environmental investigations throughout Site 300 to determine:

- How, where, and what type of contaminants had been released.
- What environmental media (i.e., soil, bedrock, ground water, and surface water) had been affected.
- How far contamination had spread and where it could migrate in the future.
- What were the risks to humans, plants, and animals that could be exposed to the contamination.

Environmental investigation activities included:

- Records searches and interviews.
- Drilling of boreholes to collect soil and bedrock samples.
- Installation of over 650 ground water monitor wells.
- Analysis of tens of thousands of soil, bedrock, ground water and surface water samples.
- Soil vapor and geophysical surveys.

- Hydraulic testing.
- Observing water level responses to rainfall events.
- Geologic mapping.
- Ground water transport modeling.
- Geologic and hydrogeologic characterization.
- Risk assessments.

While these investigations were still underway, DOE/LLNL initiated cleanup activities at Site 300 in the mid-1980s to begin addressing contamination. Cleanup activities to date have included installing 20 ground water and soil vapor treatment systems; removing contaminated soil; capping and closing landfills, rinsewater lagoons and burn pits; removing firing table gravels; and implementing administrative and engineered controls to prevent workers from being exposed to contamination while cleanup proceeds. This included the construction of an engineered cap over Pits 4 and 7 in compliance with Resource Conservation and Recovery Act requirements in 1992, and testing of a permeable reactive barrier to remove uranium from ground water downgradient of the Pit 7 Complex. With the number one priority of protecting human health, the earliest cleanup and removal actions were focused on areas where contamination was located at the site boundary or had already migrated offsite. With that objective achieved, cleanup efforts were then shifted to areas of contamination located in the interior portions of the site where contamination was far from the site boundaries.

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements, a Site-Wide Remedial Investigation report was completed in 1994 that summarized the results of environmental investigations at the site. A Site-Wide Feasibility Study was submitted in 1999, followed by a Proposed Plan in 2000 in which proposed cleanup alternatives for addressing contamination identified at the site. In 2001, cleanup remedies were selected to address contamination at the site. However, the regulatory agencies requested that additional site characterization and evaluation of cleanup options be performed prior to selecting a remedy for the Pit 7 Complex, therefore the Pit 7 Complex was not included in the Interim Record of Decision. The investigations conducted since that time included: (1) installing and sampling of additional ground water monitor wells, (2) performing geophysical and helium-3 soil vapor surveys of the pits, (3) conducting a water budget study to refine the hydrogeological conceptual model, (4) additional ground water modeling to evaluate the movement of contaminants in ground water, (5) updates to the risk assessments, and (6) evaluation and screening of technologies to address contamination at the Pit 7 Complex. The Final Remedial Investigation/Feasibility Study for the Pit 7 Complex was completed in 2005, followed by the Proposed Plan and Public Meeting for Environmental Cleanup of the Pit 7 Complex in 2006. Implementation of a long-term cleanup remedy for the Pit 7 Complex is planned for next year (2007). DOE/LLNL acknowledges that the CERCLA process is long, but much cleanup work has been accomplished since contamination was first discovered at Site 300 in 1982.

The ground water contamination at the Pit 7 does not pose a risk to human health because:

- The portion of the tritium plumes that exceed drinking water standards remain over two miles from the site boundary, are stable, and will shrink through natural attenuation.
- The tritium plume will not migrate offsite at activities above background levels.

- There are no existing or planned water-supply wells within the tritium plume.
- There is no pathway for the tritium-contaminated ground water to reach existing water-supply wells.

However, the cleanup remedy for ground water at the Pit 7 Complex is designed to reduce ground water contamination to drinking water standards, at a minimum. There is no risk to offsite residents from exposure to contamination in other environmental media, such as subsurface soil and rock. Onsite worker exposure to contamination is controlled while cleanup proceeds.

A major component and objective of the cleanup effort is to protect the hundreds of workers at Site 300. In addition, many DOE and LLNL employees and their families, including Environmental Restoration staff, reside in the City of Tracy and nearby communities. The cleanup effort at Site 300 is not a theoretical exercise conducted from afar without true regard and concern for the adequacy of cleanup or the effects on nearby residents. The health and safety of site workers and neighboring residents and communities remains the highest priority for the cleanup effort.

Bob Sarvey — 26139 Corral Hollow Road, Tracy, California

Mr. Sarvey comment #1*: My name's Bob Sarvey. I live at 26139 Corral Hollow Road and I am speaking on behalf of myself, my wife and my three children. First, I'd like to give the comments that my wife wanted to give. Unfortunately, she couldn't stay. She wants to have an earthquake expert to comment in person on your proposal. She wants signs at Tracy Hills and Carnegie property lines before the green belts that state this is a radioactive contaminated area. She also feels why should we allow a level IV bio lab if you can't clean up your contaminated mess effectively. You heard tonight that these folks know what's in those pits. They understand the contamination. They can tell you. I want to read something to you, and this is from John Belluardo, the Public Affairs Director from Lawrence Livermore Lab. When he was asked that: Why aren't you going to spend the money to dig those pits up, this was his response and you can spin this anyway you want but this was his response: We don't feel confident that we have enough data to properly characterize the contamination, there Belluardo said. Adding that the documentation from the '60's and 70's is incomplete. So the Lab does not have a complete picture of what's in those pits. You don't want to excavate those pits at the risk of injuring your employees. And I'd like to enter that into the record, please. So what you've heard from the experts tonight is they know what's in those pits. The Lab public affairs spokesman admits publicly in the newspaper Saturday March 25th, 2006, Tracy Press, they don't have a clue what's in those pits. Much of the things that was buried in those pits was buried by people who are now dead. So they have no clue what's in those pits. That's why the only effective way, the only surefire way to clean this mess up is to dig those pits out and that is one of the alternatives.*

Response: The engineered structures for hydraulic diversion under Alternative 5a that will be built at the Pit 7 Complex to prevent additional releases of contaminants from the pits will be designed to assure that they can remain intact in the event of the maximum credible earthquake that could occur in the area. DOE/LLNL will evaluate the necessity for additional signs at the Site 300 boundary. The cleanup strategy under Alternative 5a will be effective in meeting all remedial action objectives.

Characterization of the landfill waste was conducted from 1985 to 2004 and included: (1) a soil tritium moisture survey in Pits 3 and 5, (2) VOC soil vapor surveys, (3) tritium and isotopic uranium analysis of cores from Pits 3 and 5 and underlying bedrock, (4) a helium-3 survey of pit vapor from which tritium activities within the landfills were determined, and (5) seismic, induction, and magnetometer surveys that provided data on variations in pit depth and density; and definition of metal objects within the waste.

LLNL also conducted extensive interviews of past and current LLNL personnel that worked at the firing tables where the landfill debris was generated, as well as those who participated in the placement of the waste into the landfills. Several historical photos showing the pit contents while the landfills were still in use were obtained and reviewed. These sources verified that the waste placed in the pits primarily consisted of wood, plastic, material and debris from tent structures, pea gravel, and exploded test assemblies from Site 300 firing tables that were contaminated with volatile organic compounds, nitrate, perchlorate, tritium, and depleted uranium.

In addition to investigations conducted within the pits, DOE/LLNL collected and analyzed surface soil samples, soil and bedrock samples from boreholes, and thousands of ground water samples from over 85 monitor wells installed in the vicinity of the landfills to identify contaminants released from the landfills. The regulatory agencies have concurred that the nature and extent of the contamination associated with the Pit 7 landfills has been characterized sufficiently to propose and select a cleanup remedy.

In his statement from the March 25th Tracy Press newspaper, John Belluardo was referring to the fact that DOE/LLNL did not keep detailed records of the disposal of waste within the landfills and the possibility that something could have been put in the landfill that would present a safety issue if the pit waste were to be excavated. He was not commenting on the adequacy of the environmental investigations within the landfills.

Excavation of the pit waste was not included as a component of the preferred remedy because it would not be as effective in preventing further release of contaminants as would the hydraulic diversion system component of Alternative 5a. In addition, excavation presents additional health and safety concerns for workers.

***Mr. Sarvey comment #2**: Now, I appreciate the DOE coming to Tracy to explain their plan for cleaning this mess up. But like most documents, the DOE has produced on Site 300, it assumes that Tracy is 8.5 miles away. Well, the last Site-Wide feasibility study said that Tracy was nine miles away. This is a copy of our current general plan. The City of Tracy has annexed directly to the site boundary. We are right there. Should that plume cross the site boundary, it is in the city of Tracy so I submit this general plan as part of the record. This is our general plan document. This is very serious and to be marginalizing this, you know, we know what's in those pits when we don't, is very, very irresponsible.*

Response: The distance of Site 300 to the city of Tracy being referenced in the Site 300 documents is based on the location of the downtown area of Tracy, and is used to give the reader perspective on the location of Site 300. A human health risk assessment was conducted to determine the potential for residential exposure to ground water contaminants from the Pit 7 Complex. The exposure scenario used in the risk assessment assumed that water-supply wells would be drilled at the site boundary and was developed in consideration of the fact that land in the vicinity of Site 300 have been subject to development. As part of the assessment, DOE/LLNL conducted fate and transport modeling of tritium and uranium to the site boundary. The modeling results indicated that tritium and uranium activities would not exceed background levels in hypothetical wells at the site boundaries. Therefore, there is no risk of exposure to these ground water contaminants to existing or potential residential populations.

In addition, geologic mapping and cross-section that were constructed out to the Tracy water-supply wells show that the geologic unit that contains contaminated ground water from the Pit 7 Complex has been eroded away and/or is unsaturated near the Site 300 boundary. As a result, the ground water containing contaminants is hydraulically isolated from the aquifer below the City of Tracy and any proposed residential development.

Mr. Sarvey comment #3*: Now, I like the people who have been working on this. I have been talking with them for over ten years. Ten years ago they told me we are putting a cap on this pit and it is not gonna to spread any further. That plan failed. Now they are producing yet another plan where they are going to channel water around these pits. Well, in an El Nino year it doesn't matter where you channel the water, it is going to rise, it is going to soak those pits and that tritium, that U-238 is going to spread. There is only one way to keep that from happening, dig out those pits. You don't know what is in those pits. John Belluardo, the Lab public affairs director, has admitted it openly in the Tracy Press. So anything you say here is totally contradicted by this. So we need to dig those pits out. That is the bottom line.*

Response: The Pit 7 cap was not constructed to prevent contaminant releases from ground water rises. It was constructed to satisfy the requirements of the Federal Resource Conservation and Recovery Act, which requires capping upon closure of any landfill that was receiving waste during or after 1980. The cap was completed in 1992. DOE/LLNL had previously determined that an impermeable cap would not stop the contaminant releases. A shallow interceptor ditch was built on the northwest edge of the cap as this could be done without additional expense during cap construction. This ditch conveys a small portion of the rainwater away from the pits, but was not anticipated to stop releases. The hydraulic diversion will include a number of deeper interceptor trenches and other engineered features that will capture rain water percolating into the subsurface and divert it away from the landfills to keep the water table beneath the landfills. As stated previously, excavation of the pit waste will not be as effective in preventing contaminant releases because contaminants would still be released from the underlying bedrock.

As discussed in the response to Mr. Sarvey's comment #1, Mr. Belluardo was referring to the possibility that something could have been put in the landfill that would present a safety issue if the pit waste were to be excavated. He was not commenting on the adequacy of the environmental investigations within the landfills. The regulatory agencies have concurred that the nature and extent of the contamination associated with the Pit 7 landfills has been characterized sufficiently to propose and select a cleanup remedy.

Mr. Sarvey comment #4*: So, as I said, like most documents the DOE produces, they are saying that the City of Tracy is 7, 8, 9 miles away. That totally taints their analysis. They believe that Site 300 is some remote location. It is not. It is next to the Tracy city limits. The present proposal to contain the radioactive plume at Pit 7 suffers from the same shortfall because they are saying the city of Tracy is 8.5 miles away. It is not. It is adjacent to the site. The City of Tracy plans on building 5,500 homes in the Tracy Hills project which will be next to Site 300.*

Response: Please refer to the response to Mr. Sarvey's comment #2.

Mr. Sarvey comment #5*: Now, the groundwater from Elk Ravine, the area where the pits are located, drains into Corral Hollow Creek. There is no dispute about that fact. Today, the front page of the Tracy Press shows Corral Hollow Creek, the normally dry Corral Hollow*

Creek sprang to life Tuesday and sent water spilling across Corral Hollow Road above, that happens to be the road I live on, and through the woods nearby. Weather forecasters predict rain every day next week. So should they be wrong, should that plume spread into Corral Hollow Creek it will be right down Corral Hollow Road. I would like to enter that into the record as well.

Response: Ground water in the bedrock aquifers underlying the Pit 7 Complex do not drain into Corral Hollow Creek. This is substantiated by significant amounts of data and extensive evaluations of the geology and ground water flow at Site 300. The results of fate and transport modeling indicate that this ground water will not migrate offsite above background levels. There is an extensive ground water monitoring network in place at the site that is regularly sampled to evaluate migration of the tritium plume and to validate the assumptions used in the modeling.

While Elk Ravine is part of the surface water drainage basin for Corral Hollow Creek, the Pit 7 Complex is over two miles from the creek along the path of this drainage way. There is no surface soil contamination associated with the Pit 7 Complex that could be dissolved in surface water that flows in the Elk Ravine drainage way and ultimately reach Corral Hollow Creek. Therefore, there is no threat of contamination of Corral Hollow Creek from surface water flow from the Pit 7 Complex, even during heavy rainfall events.

***Mr. Sarvey comment #6**: The preferred plan we should be adopting tonight is not plan 5. It should be alternative 3b, alternative 3b includes excavation of the pits and above ground remediation of the groundwater. The plan removes any potential danger of groundwater migrating off site into the City of Tracy since the source will be removed. We don't know what is in that pit, once again. I am going to say it over and over. You do not know what's in that pit. You have got some samples from some wells you have got around, you don't know what's in that pit. None of you guys. You won't even dig into it. You won't even go spend a little bit of time over it because you are afraid the tritium plumes are going to get you. So you don't know what is in that pit. Alternative 3b is the plan that should be adopted. Site 300 is not a remote location. Please stop playing that game, stop playing with the health of my family and the rest of the citizens of Tracy. As I have for many years, I am advocating again removal of the contaminated debris and remediation of all the soil and groundwater to residential standards. Ten years ago I asked that pit be exhumed. Now they are saying that the majority of the pollution in the pit has gone out of the pit. They don't know what's in that pit. They are speculating. Alternative 3b is the only alternative that eliminates the threat of contamination moving over the site boundary and entering the city of Tracy. This alternative is feasible. How do I know it is feasible? It is listed in the summary of cleanup alternatives. Under NEPA and CEQA, this is a feasible alternative. Now, under NEPA and CEQA, it also has to be cost effective. It also has to be within the monetary means of the agency. Well, it happens that 77 million dollars that the Lab doesn't want to spend to properly clean this mess up is less than 5 percent of their annual budget. They can spend 95 percent of their budget and still make a mess and all they got to do is spend 5 percent of their budget one year to clean this up. 77 million dollars is not too much to ask. The City of Tracy, the residents of Tracy need to insist this stuff be dug up, hauled off and taken somewhere where it is not going to affect people's lives. We can no longer wait for the DOE to fully characterize the contamination in those pits. Once again, I am going to refer to this article, I know I am being repetitive, but they do not know what's in these pits. We want the material removed and we want the groundwater and soil remediated to residential standards.*

Response: As discussed in the response to Mr. Sarvey's comment #1, many years and millions of dollars have been spent characterizing the contamination in the Pit 7 Complex. The U.S. EPA and the State regulatory agencies (DTSC and RWQCB) have concurred that the nature and extent of the contamination associated with the Pit 7 landfills has been characterized sufficiently to propose and select a cleanup remedy. The ground water containing contaminants is hydraulically isolated from the aquifer below the City of Tracy and any existing or proposed residential development. Modeling indicates that contamination will not migrate offsite at concentrations above background levels. An extensive monitoring network is in place and ground water will be monitored under the selected remedy to ensure the cleanup progresses as the modeling predicts. The Contingency Plan and Five-Year Review provide a process to evaluate the remedy, and to modify the remedy if cleanup does not progress as expected.

All the cleanup alternatives were evaluated by DOE/LLNL, the U.S. EPA, and the State regulatory agencies against the EPA evaluation criteria for cleanup. The most important (threshold) criteria that a cleanup alternative must meet to even be considered is the protection of human health and the environment. EPA's balancing criteria to evaluate remedial alternatives include long-term effectiveness, reduction in toxicity, mobility, and volume, short-term effectiveness, and cost. The objective of evaluation against these criteria is to identify the alternative that provides the best balance of these criteria.

In Alternative 5a, the contaminant sources in both the pit waste and underlying bedrock would be controlled using a hydraulic drainage diversion system. The source control measure component of Alternative 5a would prevent further contaminant release from both the pit was and underlying bedrock, and local ground water gradients will be reduced, effectively slowing migration of the pre-existing tritium and uranium ground water plumes. The hydraulic drainage diversion system is considered to be more protective of human health and ground water and able to better meet federal and state laws and regulations than excavation of the pit waste in Alternatives 3b. Characterization data indicates that the majority of the tritium and uranium has already migrated from the pit waste into the underlying bedrock. Therefore, while excavation would remove the source of contamination in the pits, it would not prevent further releases of contaminants present in the underlying bedrock to ground water. In addition, Alternative 3b has the potential for short-term exposure for onsite workers during waste excavation and disposal. This is likely to increase the number of exposure pathways, as well as disrupt habitat, increasing the potential for short-term exposure and impacts to the environment. The estimated cost of Alternative 5a is lower than Alternatives 3b that includes excavation of the pit waste, but will protect human health and the environment more effectively and achieve cleanup standards more rapidly. In addition, the cleanup of uranium, perchlorate, nitrate, and volatile organic compounds can be achieved more effectively and faster using Alternative 5a than Alternatives 3b. Alternative 5a removes these contaminants by pumping ground water from wells in areas with the highest concentrations, maximizing contaminant removal. Alternative 3b includes the use of a below-ground treatment barrier, which removes contaminants as ground water moves through it. Because this technology relies on ground water flow to bring contaminants to the treatment barrier, ground water cleanup would take considerably longer.

***Mr. Sarvey comment #7**: Now, I want to make one more comment on this plan. You propose to divert all water that is going into this valley, the Elk Ravine Valley, here. That happens to be the home of endangered species and endangered plants. You plan to make a desert out of Elk Ravine. What is the consequences to the endangered species and the* *endangered plants that are in that ravine. So I would like to see that addressed and I thank you very much for the opportunity to comment. Thank you.*

Response: Implementation of the hydraulic diversion system at the Pit 7 Complex will not create a "desert" in Elk Ravine. The water balance study, conducted as part of the Pit 7 Complex RI/FS, indicated that 10% of average rainfall infiltrates in the Pit 7 Complex area. Under these average annual recharge conditions, the contaminant sources are isolated from shallow ground water and contaminant releases are not likely. Ground water monitoring data show no evidence of significant contaminant releases during periods of average or below average rainfall when shallow ground water remained below the pit bottoms. When the recharge rate increases to 25% of rainfall during years of high rainfall (i.e., the 1997-1998 El Niño), the pits and underlying bedrock are inundated and residual contamination comes into contact with shallow subsurface water. Therefore, to be effective, the hydraulic diversion system does not need to capture and divert 100% of rainfall recharge to prevent ground water rises into the pits that result in contaminant releases. Only a small percentage of the water that falls on the Pit 7 Complex valley will be diverted by the hydraulic diversion component of Alternative 5a.

Due to the semi-arid climate, natural surface water in the Pit 7 Complex area is relatively rare and has been observed as surface runoff during heavy rainfall events. Elk Ravine is a dry drainage channel during most of the year and there is no continuous flow of surface water from the Pit 7 Complex valley to Elk Ravine except possibly during extreme rainfall events. Surface water in Elk Ravine arises from rainfall on Elk Ravine. For these reasons, the hydraulic drainage diversion systems will not affect surface water or impact plants and animals in Elk Ravine, including special status species such as the California red-legged frog, California tiger salamander, and Elderberry plants that provide habitat to the Valley Elderberry longhorn beetle. The Big tarplant, a species considered by the California Native Plant Society to meet the definition of threatened or endangered, utilizes water infiltrating from rain into the upper soil column. Therefore, populations of this species occurring in Elk Ravine will not be impacted by the hydraulic diversion at Pit 7.

Terry Donaldson — 6020 Lindemann Road, Byron, California

Ms. Donaldson comment #1*: Thank you. I am Terry Donaldson. I live out in Alameda County with a Byron address of 6020 Lindemann Road. I live on the Delta and I am very close to the new community of Mountain House and I have seen what has happened to that community and what is happening with the water and the water table. And I just found out about this today when I ran into Susan Sarvey and I am absolutely appalled with what is going on. I don't know your name, Mary was it? When you talked about 1989, you warned everything that was happening and they didn't do anything for ten years? And Bob talked to them ten years ago and they are still sitting on it, nothing is happening. This is like a horror story. And it is frightening. And I am hearing the government agency disagreeing with this government agency and this one, and it like after hearing what is going on in Washington, DC and how they are selling out the political situation. It is like it is scary. And I am sad that so few people attended this meeting and I do hope that you will have another public forum, extend this two weeks so we can have another one where we can mobilize and get more people to wake up to what is going on. Thank you.*

Response: DOE/LLNL understands the public concerns regarding the presence of contamination at Site 300. To that end, DOE has formulated and funded a restoration project for Site 300 intended to characterize and clean up contamination resulting from past operations to protect human health and the environment and restore beneficial uses of natural resources in a cost-effective, efficient, and compliant manner. Please refer to the response to Mr. Norman's comment #1 for a full description of characterization and cleanup activities conducted by DOE/LLNL at the Pit 7 Complex and at Site 300 to date. DOE/LLNL-sponsored public workshops, which DOE offers, even though they are voluntary and not required by CERCLA, are an attempt to share information and hear the concerns and priorities of the community. This open dialogue between DOE/LLNL, government regulatory agencies, the public, and local government is considered in the technical work scope for ongoing and planned Site 300 restoration activities. DOE extended the public comment period for the Proposed Plan for Environmental Cleanup at the Pit 7 Complex by two weeks, as requested at the Public Meeting.

3.3. Written Comments, Received by May 5, 2006

Ernest Goitein — 167 Almendral, Atherton, California

a) There is obviously great concern that the radioactive isotopes at Site 300 and particularly those at the Pit 7 Complex could (already have) contaminate groundwater and surface soil. The surface soil contamination resulting from overflow will make the site unsuitable for an ecological preserve or a mixed residential site or other beneficial uses rather than the current use. Site 300 is being evaluated for FY 2011 close out. It is not too soon to act to prevent further contamination. The groundwater is already contaminated. Unless steps are taken to reduce the hydraulic gradient the contaminated groundwater will threaten off-site users of groundwater. Once aquifers, now pristine, are contaminated there is no easy way of ever making them suitable from human consumption. I think you will agree that Site 300 has destroyed a beautiful part of land – 3,200 acres.

Response: There is no surface soil contamination at the Pit 7 Complex and no mechanism for future releases of contaminants to surface soil. The hydraulic drainage diversion system to be implemented as part of the selected remedy (Alternative 5a) will not cause contaminated ground water to rise to the surface but rather will lower ground water levels in the vicinity of the Pit 7 Complex. This system will prevent further releases to ground water while tritium decays in place. Hydraulic diversion will have an added benefit of reducing the hydraulic gradient, slowing contaminant migration in ground water due to dewatering of the water-bearing zones. As part of the selected cleanup remedy, other contaminants present in ground water will be extracted and treated to remove contaminant mass from the subsurface until drinking water standards are achieved. DOE/LLNL have committed and remedial actions designed and implemented to clean up ground water at Site 300 to drinking water standards, at a minimum unless it is demonstrated and the regulatory agencies concur it is technically impracticable.

As discussed in the responses to Ms. Kelley's comment #1 and Mr. Strauss' comment #1, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume at the Pit 7 Complex using recirculation. The results of the evaluation indicated that the recirculation of ground water would result in additional releases from the landfills and accelerated plume migration. For these reasons, DOE/LLNL does not consider this a technically feasible technology for controlling tritium plume migration at the Pit 7 Complex. Additional information regarding the evaluation of hydraulic recirculation to prevent migration of the tritium plume at the Pit 7 Complex is provided in the response to Ms. Kelley's comment #1.

As part of the risk assessment conducted for the Pit 7 Complex, DOE/LLNL conducted fate and transport modeling of tritium and uranium to the site boundary. The modeling results indicated that tritium and uranium activitieswould not exceed background levels in hypothetical wells at the site boundaries. Therefore, there is no risk of exposure to these ground water contaminants to existing or potential residential populations.

Site 300's thirteen different ecological habitats have been protected due to the restricted nature of activities conducted there. The site is primarily undeveloped, and has not impacted by cattle grazing for 50 years or recreational vehicle traffic. It is home to over 150 vertebrate and 300 plant species, as well as numerous species of insects. Several of these species are federal- and state-protected species. The regular controlled burns at Site 300 have resulted in some of the best remaining native grasslands in California, and are an important factor in the persistence of several rare or endangered plant species. The flora and fauna at Site 300 are monitored by LLNL wildlife biologists who work very closely with the U.S. Fish and Wildlife Service.

The question now is what can be done prevent the damage from creeping off-site and what can be done to limit further contamination. Please address the following:

b) What are DOE's plans to prevent overflow at Pit 7 Complex?

Response: Please see response to previous comment.

c) How will DOE prevent the contaminated groundwater plume from spreading?

Response: The selected remedy for the Pit 7 Complex includes measures to: (1) isolate the contaminant sources in the landfill and underlying bedrock to prevent further releases, (2) extract and treat uranium, perchlorate, and nitrate in ground water, and (3) monitor the natural attenuation of tritium in ground water. Tritium activities will naturally attenuate (decay) to meet drinking water standards within 45 years. During this timeframe and beyond, tritium and other contaminants will not migrate offsite above background levels or impact water-supply wells or threaten human health or plant and animal communities.

d) What steps are being considered in anticipation of closing Site 300 for bomb-making purposes and return the land to useful uses?

Response: While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to release the land for recreational or residential uses. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Please see the response to Ms. Kelley's comment #3 for additional information.

e) How much, if any, additional radioactive and/or toxic wastes are expected to be generated at Site 300 before releasing the land to productive use?

Response: Please refer to the 2004 Site-Wide Environmental Impact Statement available at http://www-envirinfo.llnl.gov/ and in local public libraries.

f) What steps are being contemplated to protect adjacent land-owners and municipalities?

Response: Even without remedial action, adjacent landowners and municipalities are not threatened by the landfills or the ground water from the Pit 7 Landfill area. The selected remedy (Alternative 5a) component for the tritium plume will be protective of human health and the environment because:

1. The contaminant sources (including the tritium source) in the landfills and underlying bedrock will be isolated to prevent further releases.
2. Tritium activities will naturally attenuate (decay) to meet drinking water standards within 45 years.
3. During this timeframe and beyond, tritium and other contaminants will not migrate offsite or impact water-supply wells or threaten human health or plant and animal communities.
4. Ground water extraction and treatment will remove uranium, perchlorate, nitrate, and VOCs contaminants in ground water to meet drinking water standards at a minimum.
5. Exposure control measures will prevent exposure of onsite workers during cleanup. There are no exposure risks to the public.

Ground water monitoring is included as part of the selected remedy to track changes in contaminant concentrations and distribution to ensure there are no impacts to downgradient receptors, and to evaluate the effectiveness of the cleanup. There are processes in place to review the progress of cleanup with the regulatory agencies, as well as to consider remedy modifications, if the selected remedy does not progress as expected.

g) What steps are being proposed to remove the uranium from the contaminated groundwater?

Response: The selected remedy, Alternative 5a, includes pumping and treating of ground water at the Pit 7 Complex to remove uranium, as well as perchlorate, nitrate, and VOCs to meet drinking water standards, at a minimum.

h) Since every radioactive waste facility in unlined trenches has leaked, why has the DOE not learned the lesson? Will DOE prepare a lined pit with a leachate collection system for future waste?

Response: The contamination at the Pit 7 Complex is from legacy activities that were conducted from the 1958 until 1988 when debris from explosive tests was disposed in the unlined landfill pits. Firing table experiment waste is no longer disposed of in this manner, but is disposed offsite in lined landfills. Current waste disposal activities comply with applicable environmental regulations.

Ralph Hoffman and Eric Hoffmann, 1011 Hartz Way, Suite 203, Danville, California

Both my son and I have worked in industry our entire careers since receiving our final degrees. We are in total agreement with Tri-Valley CAREs that the clean-up of Pit 300, a huge Superfund site, so close to the Metropolitan San Francisco Bay Area should be given highest priority.

Response: The cleanup of contamination at Site 300, including the Pit 7 Complex, is a priority for DOE. However, it is important to note that there are no unacceptable health risks to the general public from Site 300’s ground water or soil.

Ray and Cori Cornwell, Mulqueeney Ranch Properties (MRP)

We represent Mulqueeney Ranch Properties (MRP), a 4700 acre ranch immediately north of the Pit 7 complex and we share two miles of common border. Cattle graze and cowboys are present immediately next to these common borders. Tule Springs, one of the springs where we *draw water, is about one half mile from the Pit 7 Complex and in fact extends slightly into the Site 300 area. We have been aware of the cleanup plans for a long time and have never been concerned with any migration of the contaminants moving on to MRP. The area bordering Site 300 is regularly monitored by ourselves and LLNL safety experts and no problems have ever been found. We keep in touch with LLNL personnel at very frequent intervals, and thoroughly study the periodic reports as they are issued. If we have a question we consult with the appropriate LLNL personnel as well as our own independent experts. The spread of the plumes of contaminants are generally to the northeast of Pit 7 and it does not appear to us to that will ever get close to MRP property. The spread of tritium appears to be of most concern to other groups but not to MRP. Considering the 12 yr half life of tritium and slow movement of the plume we see absolutely no possibility of any concern. Since we are by far the closest property to the contaminant area we should have the most concern and we don't. We have great confidence in the ability of LLNL to monitor the problem and keep interest parties informed. The cleanup process seems to be well planned and is being properly executed.*

Response: Thank you for your comment. Those individuals who work on the Site 300 Environmental Restoration Project care about the environment and many live in the local communities including Tracy. We strive to provide open and honest communication and the best technical methods for cleanup at the site. The preferred alternative was selected because it was not only the most cost-effective use of tax-payer dollars but it is protective of human health and the environment and will clean up the site to safe levels.

San Francisco Bay Area Physicians for Social Responsibility, 2288 Fulton St., Suite 307, Berkeley, California

a) SFPSR recommends that DOE should strengthen its plans to hydraulically control the spread of the tritium plume by including additional control measures downstream of the plume. We understand that the DOE proposes to keep water from further saturating the unlined pits by installing a series of surface water diversions upstream of the pits to reduce the rate of groundwater movement and allow more time for tritium to decay. We understand that Tri-Valley CARES has consistently advocated that the DOE should, in addition to these upstream control measures, also implement control measures downstream of the plume. Downstream measures are needed to ensure that the contaminated tritium does not continue to migrate and pollute presently uncontaminated water. We are concerned that controlling the outer edges of the contaminant plume is not currently part of the DOE's plans for Site 300, and want to support Tri-Valley CARES in their consistent advocacy for such measures.

Response: As discussed in the responses to Ms. Kelley's comment #1 and Mr. Strauss' comment #1, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume at the Pit 7 Complex using recirculation. The results of the evaluation indicated that the recirculation of ground water would result in additional releases from the landfills and accelerated plume migration. For these reasons, DOE/LLNL does not consider this a technically feasible technology for controlling tritium plume migration at the Pit 7 Complex. Additional information regarding the evaluation of hydraulic recirculation to prevent migration of the tritium plume at the Pit 7 Complex is provided in the response to Ms. Kelley's comment #1.

Tritium activities will naturally attenuate (decay) to meet drinking water standards within 45 years. During this timeframe and beyond, tritium and other contaminants will not migrate offsite or impact water-supply wells or threaten human health or plant and animal communities.

Ground water monitoring is included as part of the selected remedy to track changes in contaminant concentrations and distribution to ensure there are no impacts to downgradient receptors and to evaluate the effectiveness of the cleanup. There are processes in place to review the progress of cleanup with the regulatory agencies, as well as to consider remedy modifications if the selected remedy does not progress as expected.

b) SFPSR recommends that DOE's environmental remediation plan for Site 300 take into account the public health impacts of current and future planned operations at the facility.

Response: The contamination at the Pit 7 Complex is from legacy activities that were conducted from the 1958 until 1988 when debris from explosive tests was disposed in the unlined landfill pits. Firing table experiment waste is no longer disposed of onsite landfill, but is disposed offsite in lined landfills. Current waste disposal activities at Site 300 comply with applicable environmental regulations.

The contamination at Site 300 was caused primarily by past waste handling practices. Ongoing activities are designed to minimize hazardous releases to the environment. Activities have changed significantly since LLNL began operation 50 years ago, with experiments now designed with a much better understanding of environmental protection and safety. Program activities are planned and monitored for compliance with the Resource Conservation and Recovery Act (RCRA) and other environmental regulations (such as the Clean Air and Clean Water Acts) to ensure that future harmful releases do not occur. LLNL has extensive environmental protection procedures in place that are designed to prevent any additional contamination. Those preventive and mitigating activities and monitoring for any releases are reported in the Site Annual Environmental Report. Current operations at Site 300 are overseen by several environmental regulatory agencies and are conducted in compliance with their regulations to prevent future releases that could be detrimental to human health and the environment. The Site Annual Environmental Report provides information on releases and background environmental conditions around LLNL's sites; it can be found at www-envirinfo.llnl.gov/.

c) The current self-described main mission of Livermore Lab including Site 300 is to oversee the U.S. nuclear arsenal. The U.S. nuclear arsenal is maintained in support of our nation's current nuclear policy, recently characterized by former U.S. Secretary of Defense Robert McNamara as "immoral, illegal, militarily unnecessary, and dreadfully dangerous." Former President Carter said last week, "A global [nuclear weapons related] holocaust is just as possible now, through mistakes or misjudgments, as it was during the depths of the Cold War." That the pursuit of nuclear weapons has also led to global environmental degradation is a well-established fact. For example, the National Academy of Sciences has stated that at many DOE nuclear weapons sites, ... "radiological and non- radiological hazardous wastes will remain, posing risks to humans and the environment for tens or even hundreds of thousands of years. Complete elimination of unacceptable risks to humans and the environment will not be achieved, now or in the foreseeable future." It is in this context that Livermore Lab plans as escalation of nuclear weapons work. In the immediate future, Site 300 will be used for bomb testing, including the proposed use of tritium in open-air bomb tests. The bomb-testing proposal specifically allows radioactive tritium to be used on an outdoor, uncontained firing table. We are also gravely concerned that other contemplated activities at Site 300 include bio-weapons research. Historically, DOE assurances regarding risks to public health related to nuclear weapons activities have often been found to have nothing in common with the facts that emerge *over time. As one of the more blatant illustrations of DOE's practice, it said for decades that no toxic waste from the leaking tanks at its nuclear weapons facility in Hanford, Washington would reach the groundwater for at least 10,000 years --- but it is already there, 10,000 years ahead of DOE's schedule.*

Response: This comment is not relevant to the selection of a cleanup remedy for the Pit 7 Complex and is outside the scope of this document.

d) A Livermore Lab spokesperson recently assured the community that "The Lab has a long history of handling nuclear material safely and soundly" while the same spokesperson admitted that the Livermore Lab does not "… feel confident that we have enough data to properly characterize the contamination there [at Site 300's Pit 7 Complex]" adding that documentation from the 1960s and '70s is incomplete, so the lab doesn't have a complete picture of what's in the pits.

Response: As discussed in the response to Mr. Sarvey's comment #1, many years and millions of dollars have been spent characterizing the contamination in the Pit 7 Complex. The DOE spokesman, Mr. Belluardo, was referring to the possibility that something could have been put in the landfill that would present a safety issue if the pit waste were to be excavated. He was not commenting on the adequacy of the environmental investigations within the landfills. The U.S. EPA and the State regulatory agencies (DTSC and RWQCB) have concurred that the nature and extent of the contamination associated with the Pit 7 landfills has been characterized sufficiently to propose and select a cleanup remedy.

e) The fact that Livermore Lab's main site and Site 300 are both listed on the National Priorities list of the most contaminated sites in the nation also does not appear to support Livermore Lab's claim of a "long history' as environmental stewards.

Response: The contamination at Site 300 was caused primarily by past waste handling practices that were legal at the time. Current waste handling practices comply with all applicable environmental regulations. Much of the Lawrence Livermore National Laboratory main site contamination occurred when the site was a Naval air station.

f) SFPSR recommends that the DOE's plans ensure transparent, timely, and sufficient precautions to protect the public health from current and future weapons activities at Site 300. The local population directly in the path of the toxic and radioactive substances that are being generated by Site 300's nuclear weapons activities continues to grow. The population of Tracy has more than doubled since the 1990s, from about 35,000 residents to a 2004 population estimated at 76,900. DOE's plan needs to address the public health impacts of its practices to the growing local population and for all the planet's inhabitants.

Response: There are no current or planned weapons or waste disposal activities within the Pit 7 Complex area. The proposed plan only addresses contamination within the Pit 7 Complex. This contamination is confined to the Pit 7 Complex and contaminated ground water will not migrate offsite. A comprehensive risk assessment indicated no unacceptable risk to public health from this contamination. The Agency for Toxic Substances and Disease Registry performed an independent health assessment of contamination at Site 300 in 2005. The results of this assessment concluded that there are no past or current exposures to contaminants associated with LLNL – Site 300, and the potential for future exposure is unlikely.

g) DOE should provide a full and detailed accounting of how expanding weapons work at Site 300 will impact the public and environmental health in its broadest dimensions, including, *but not limited to: worker health and safety; radioactive and toxic emissions to the local ground water, air, and soil; the volume of toxic and radioactive waste that will be generated; and, plans for addressing waste generation and disposal.*

Response: The information requested is provided in the 2004 Site Wide Environmental Impact Statement available at http://www-envirinfo.llnl.gov/ and in local public libraries.

Comments summarized from a form letter submitted to the Department of Energy by:

Stephanie Santy, 459 Hemlock Ave., South San Francisco

Kathleen Lyons, 2197 Rock St., Mountain View

Maureen Wesolowski, 1176 Shattuck Ave., Berkeley

Daisey Chand, 104 Windflower Ln., Union City

Scott Yundt, 1664 Miami Ct., Oakland

Jonathan Oldfather, 158 Pine St., San Anselmo

Cheryl Brown, 5000 Reid Court, Richmond

Tara Dorabji, 749 Hazel St., Livermore

Virginia Shaskey, 157B N. Star Dr., Santa Rosa

Edwin Ehmke and Mary Jane Parvial, 8 Bolton Pl., Menlo Park

Glenda Pawsey, 1127 Fresno Ave., Berkeley

Lorin Peters, 467 Lewis Ave., San Leandro

Teresa Acuna, 828 Leith Ave., Santa Clara

LeRoy Cisneros, 8400 Enterprise Way, Oakland

Paul & Georgia Worley, 311 Acacia St., Tracy

Sarah Jones, 2986 Barrett St., Oakland

Thad Binkley, 4132 Cristobal Way, Pleasanton

Juan and Christa Smart, 1702 Biarritz Ct., Tracy

Phyllis Jardine, 4132 Cristobal Way, Pleasanton

Nathan Taylor, Del Valle Pkwy.

Diana Milligan, 3431 Castle Ct., Tracy

Mary Pesner, 3717 Carrigan Commons, Livermore

J. Hooper, 241 West Highland Ave., Tracy

Jonathon Chapman, 364 Linden Way, Pleasanton

Emma Sarvey, 30,000-94 Kasson Road, Tracy

Beverly King, 645 N. #8 Livermore Ave., Livermore

Carl Hassell, 427 Yosemite Drive, Tracy

Patricia A. Moore, 23 Diamond Drive, Livermore

Loulena Miles, 2582 Old First St., Livermore

Ann Seitz, 22103 Main St., Hayward

Martha Priebav, 3375 Norton Way, Pleasanton

Janis Turner, 749 Hazel St., Livermore

1. Sets cleanup to residential standards. The assumptions of the cleanup plan should include the possibility of large residential communities relying on the regional aquifer for drinking water.

Response: All proposed and existing cleanup remedies at Site 300, including the selected remedy for the Pit 7 Complex, are designed to cleanup ground water to drinking water standards, at a minimum, to the extent that it is technically possible. Drinking water standards do not differentiate between residential and industrial uses, therefore cleanup to meet these standards would be protective of residential populations.

During the timeframe necessary to achieve this cleanup standard (45 years), contaminants in the Pit 7 Complex ground water will not migrate offsite above background levels, impact water-supply wells, or threaten human health or plant and animal communities.

2. Sets cleanup to the strictest state and federal government levels. Federal and state maximum contaminant levels for all groundwater (onsite and off site) should be the bottom line, below which the cleanup will not fall. The migration of pollutants into pristine water must be addressed in the cleanup plan.

Response: As stated in the response to the comment above, DOE/LLNL has committed to cleanup ground water to meet Federal and State drinking water standards, at a minimum.

3. Includes a downstream hydraulic control that ensures that the contaminated radioactive tritium plume does not continue to migrate and pollute presently pristine waste as it advances.

Response: The selected remedy for the Pit 7 Complex prevents migration of contaminants to the extent that is technically possible without creating additional releases and accelerating plume migration. Please refer to the response to Ms. Kelley's comment #1 for additional information regarding plume migration control.

4. Determine what the contaminants are that were dumped in these unlined pits. A plan for excavation of portions of the pits should be developed following full characterization.

Response: As discussed in the response to Mr. Sarvey's comment #1, many years and millions of dollars have been spent characterizing the contamination in the Pit 7 Complex. The U.S. EPA and the State regulatory agencies have concurred that the nature and extent of the contamination associated with the Pit 7 landfills has been characterized sufficiently to propose and select a cleanup remedy.

Excavation of the pit waste was not included as a component of the preferred remedy because it would not be as effective in preventing further release of contaminants as would the hydraulic diversion system component of preferred remedy, Alternative 5a. In addition, excavation presents additional health and safety concerns for workers. Please see the response to Mr. Sarvey's comment #1 for additional details regarding characterization of the Pit 7 Complex and the evaluation of pit waste excavation.

5. Commits to keeping the public informed and receiving comments on an ongoing basis. In addition, materials should be produced in Spanish as well as English. Future public meetings *and hearings should be held in Spanish and English.*

Response: The restoration of Site 300 is being conducted under CERCLA, which requires public participation in the decisions made to determine cleanup strategies. DOE/LLNL exceed the CERCLA public participation requirements for notifications, public meetings and workshops, as well as for providing public information. This includes conducting regular public workshops to present the status of site cleanup and to discuss the contents of draft versions of major documents. All public meetings and workshops are publicly noticed in at least two local newspapers as large display notices and all major documents are placed on the web at http://www-envirinfo.llnl.gov/ as well as in the Tracy Public Library and the LLNL Visitor's Center. DOE/LLNL complies with all State and Federal requirements for public notifications, conducting Public Meetings, and other community participation and outreach efforts. However, DOE will evaluate the feasibility of issuing the next public fact sheet, the "Proposed Plan for Environmental Cleanup of LLNL Site 300," in both English and Spanish. This document is scheduled to be published in the fall of 2006.

6. The Record of Decision for the Site Wide Environmental Impact Statement at Livermore Lab reinstates the use of tritium in open-air bomb tests at Site 300. This would allow tritium to be used on an outdoor uncontained firing table, increasing worker and community exposure to radiation. This plan should be halted immediately.

Response: This comment is not relevant to the selection of a cleanup remedy for the Pit 7 Complex and is outside the scope of this document.

7. Site 300 is being considered as a site for the "National Zoonotic and Agricultural Research Center," a BSL-4 (Bio-safety level 4) facility, which would work with the most deadly biowarfare agents known to humans, such as Ebola Virus. This work would be done within the confines of a super secret nuclear weapons laboratory. This plan is dangerous and should be cancelled. Further, the DOE plan to place a BSL-3 at the Livermore Lab main site is in litigation.

Response: This comment is not relevant to the selection of a cleanup remedy for the Pit 7 Complex and is outside the scope of this document.

8. The DOE is evaluating its programmatic requirements for test capabilities at Site 300 at Livermore Lab in order to evaluate the closure of the site within the next 6 years. The Site 300 testing facility is duplicative of both the DARHT facility at Los Alamos and facilities at the Nevada Test Site. Site 300 should be cleaned up to residential standards and closed.

Response: Please refer to response to Ms. Kelley's comment #3.

Additional comments from Paul & Georgia Worley, 311 Acacia St., Tracy, California

Millions of people reside within 100 miles of Livermore, California. No nuclear waste should ever be deposited, placed, stored or released in an area where this many humans reside, work, or stay. This project should be closed and the activities performed there, moved to an unpopulated area.

Response: This comment is not relevant to the selection of a cleanup remedy for the Pit 7 Complex and is outside the scope of this document.

Additional comments from Thad Binkley, 4132 Cristobal Way, Pleasanton

Now is not a time to start another nuclear arms race. The future of the human race is at stake. We need to show our leadership in reducing nuclear stockpiles to the world.

Response: This comment is not relevant to the selection of a cleanup remedy for the Pit 7 Complex and is outside the scope of this document.

Additional comments from Phyllis Jardine, 4132 Cristobal Way, Pleasanton

I strongly oppose any proliferation of nuclear weapons; we have enough to clean up now. We should destroy some rather then create more. I also strongly oppose the test said to be conducted in Nevada on June allegedly not nuclear, for the purpose of estimating needs for nuclear weapons. It is unthinkably dangerous to plan to wage war on Iran, especially with nuclear weapons.

Response: This comment is not relevant to the selection of a cleanup remedy for the Pit 7 Complex and is outside the scope of this document.

Additional comments from Diana Milligan, 3431 Castle Ct., Tracy

Please do not contaminate our ground water.

Response: The selected remedy for the Pit 7 Complex includes measures to: (1) isolate the contaminant sources in the landfill and underlying bedrock to prevent further releases, (2) extract and treat uranium, perchlorate, and nitrate in ground water, and (3) monitor the natural attenuation of tritium in ground water. Tritium activities will naturally attenuate (decay) to meet drinking water standards within 45 years. During this timeframe and beyond, tritium and other contaminants will not migrate offsite above background levels, impact water-supply wells or threaten human health or plant and animal communities.

Additional comments from Carl Hassell, 427 Yosemite Drive, Tracy

Snap out of it. Stop this insanity.

Response: DOE/LLNL understands the public concerns regarding the presence of contamination at Site 300. To that end, DOE has formulated and funded a restoration project for Site 300 intended to characterize clean up contamination resulting from past operations to protect human health and the environment and restore beneficial uses of natural resources in a cost-effective, efficient, and responsible manner.

Additional comments from Beverly King

1. The complexity of cleaning up Site 300 boggles my mind, but the major concern does not. Site 300 is loaded with radioactive materials of various kinds and dangers which can destroy the environment, specifically water, and reach human beings causing all the horrors of radioactive exposures. In the intricacies of cleaning up this site, people and the environment must be kept as top priority always. The most effective means must be used. This must be the DOE's top priority. To do less is criminal, unthinkable. Yet the technical details bog down the issues. For sixteen years controversy has ruled over what and how to clean up the site. Next are just two brief examples. Large amounts of tritium in a plume are in Pit 7 Complex. Because of the complications and controversy the tritium plume was excluded from the Interim Remedial Action Plan which is hardly a thorough cleansing. Suggestions for hydrolic control have not been accepted for many years. The plume still flows and glows.

Response: As discussed in the responses to Ms. Kelley's comment #1 and Mr. Strauss' comment #1, DOE/LLNL conducted an evaluation of the feasibility of hydraulically controlling the tritium plume at the Pit 7 Complex using recirculation. The results of the evaluation indicated that the recirculation of ground water would result in additional releases from the landfills and accelerated plume migration. For these reasons, DOE/LLNL does not consider this a technically feasible technology for controlling tritium plume migration at the Pit 7 Complex. Additional information regarding the evaluation of hydraulic recirculation to prevent migration of the tritium plume at the Pit 7 Complex is provided in the response to Ms. Kelley's comment #1. The selected remedy for the Pit 7 Complex prevents migration of contaminants to the extent that is technically possible without creating additional releases and accelerating plume migration.

2. TriValley CAREs has pressed for residential clean up standards rather than industrial ones. In view of Tracy's growth in the site's direction this is imperative. Residential growth is in concurrence with the California Regional water Quality Control Board's non-gradation policy for groundwater, not industrial potential. The DOE prefers to clean up the boundries, not the source. This would leave Tracy's drinking and irrigation water at risk, hardly in the best public interest.

Response: In the Interim Site-Wide Record of Decision document in 2001, DOE committed to cleanup all contaminated ground water to meet drinking water standards, at a minimum. All proposed and existing cleanup remedies at Site 300 are also designed to cleanup ground water to drinking water standards. The cleanup of contaminants in soil and bedrock are also designed to mitigate any risk to human health, plants, and animals that could be exposed to the contamination, and to prevent impacts to ground water above drinking water standards, at a minimum. Drinking water standards are established by the Federal and State governments, and do not differentiate between residential and industrial use. Therefore, cleanup to meet these standards is protective of residential populations.

3. The details of the controversy are very difficult for the public to understand. The DOE and related agencies are very adept at circumventing, contradicting, excuding and confusing every detail. In the end the contamination remains. The controversy over how to accomplish the clean up goes back to 1955, when the Site was first used for processing and testing nuclear weapons. By 1990 the site was so contaminated it was placed on the Superfund List. Since that time investigations and recommendations, cloaked in an alphabet soup of names and technical details have been proposed. Each one has been flawed. In the meantime the tritium flows in the underground water system and depleted uranium along with other deadly substances remain on the Site, many of these radioactive for 1,000's of years. The people of Tracy and their children are the inheritors of the poisons their own government procrastinates in correcting.

Response: We appreciate your concern and would like to assure you that DOE/LLNL are committed to the characterization and cleanup of environmental contamination at Site 300. Cleanup activities were initiated at Site 300 in the mid-1980s and significant progress has already been made in site cleanup. This has included installing 20 ground water and soil vapor treatment systems, removing contaminated soil, capping and closing landfills, rinsewater lagoons and burn pits, removing firing table gravels, constructing an engineered cap over Pits 4 and 7 in compliance with Resource Conservation and Recovery Act requirements in 1992, and testing a permeable reactive barrier to remove uranium from ground water downgradient of the Pit 7 Complex.

These remedial actions were designed and implemented to clean up ground water at Site 300 to drinking water standards, at a minimum, unless the regulatory agencies concur it is technically impracticable. The cleanup of contaminants in subsurface soil and bedrock are also designed to mitigate any risk and prevent impacts to ground water above drinking water standards, at a minimum. Drinking water standards are protective of residential populations.

4. In 1955, Site 300 was an isolated area whose deadly purpose could be easily concealed. Today Tracy has grown to nearly meet its borders. No one, but watchdogs on the Site, has *informed the new residents of the dangers in its vicinity. Understanding the complexity is beyond most citizens' comprehension. I certainly do not and I try to understand. It is up to the DOE in the name of humanity to do the most comprehensive planning to clean up this site in the most efficient way for the preservation of life today and in the future*.

Response: DOE/LLNL has conducted many public outreach efforts over the years to inform the public and site neighbors about the contamination and cleanup efforts at the site and to provide a forum for public input into the cleanup process. These have included:

- Conducting Public workshops and meetings in the City of Tracy since 1994. Notifications of these events are posted in the Tracy newspapers and letters to site neighbors. Public Meetings were held to discuss contamination and cleanup of Site 300 on April 5th and May 15th.
- Holding quarterly Technical Assistance Grant meetings.
- Posting site cleanup information on the LLNL Environmental Restoration Community Relations website including major documents containing the results of contaminant investigations and cleanup efforts and progress.
- Placing all major documents related to site investigations and cleanup in information repositories located at Tracy Public Library and LLNL Visitor's Center.
- Preparing Site-Wide Annual Environmental Reports that contain information about environmental monitoring and cleanup.
- Holding meetings with City of Tracy officials and other neighbors to discuss contamination and cleanup efforts.

DOE/LLNL are committed to the characterization and cleanup of environmental contamination at Site 300. The health and safety of site workers and neighboring residents and communities remains the highest priority for the cleanup effort.

City Manager's Office, 325 East Tenth St., Tracy

On April 18, 2006, the Tracy City Council voted to submit a letter of support for Cleanup Alternative 3b as the City of Tracy's preferred alternative for cleanup of the Pit 7 Complex Area of Site 300.

Response: DOE/LLNL appreciates the Tracy City Council's interest in and comments on the selection of a cleanup remedy for contamination at the Pit 7 Complex. We have worked with the U.S. Environmental Protection Agency and the State environmental regulatory agencies to develop and evaluate remedial alternatives to address contamination in this area. As part of this evaluation, DOE/LLNL and these agencies rigorously evaluated these alternatives to identify the best, most effective cleanup remedy. Alternative 5a was identified as the preferred remedy for contaminant cleanup at the Pit 7 Complex because:

1. **Alternative 5a is more effective than Alternative 3b in controlling the source of contamination and preventing further contaminant releases.**

   Characterization data indicates that the majority of the tritium and uranium has already migrated from the pit waste into the underlying bedrock. The source control measure component of Alternative 5a (hydraulic drainage diversion) would prevent further contaminant releases from both the pit waste and underlying bedrock, by preventing ground water rises that inundate that pits and bedrock during years of heavy rainfall such as the 1997-1998 El Niño. It would also reduce the rate of local ground water flow, effectively slowing migration of the pre-existing tritium and uranium ground water plumes. While the waste excavation component of Alternative 3b would remove the source of contamination in the pits, it would not prevent further releases of contaminants present in the underlying bedrock to ground water.

2. **Alternative 3b has a greater potential than Alternative 5a to expose workers to contamination during waste excavation and disposal and impact plants and animals by disrupting their habitat.**

3. **Cleanup of existing ground water contamination can be achieved more effectively and faster using Alternative 5a than Alternative 3b.**

   Alternative 5a removes existing uranium, perchlorate, nitrate, and volatile organic compounds from the subsurface by pumping contaminated ground water from wells for treatment in an aboveground treatment system. Wells are placed in areas of highest contamination to maximize contaminant removal. Alternative 3b includes the treatment of existing uranium, perchlorate, nitrate, and volatile organic compounds in ground water by a combination of pumping and aboveground treatment, and treatment in place (below ground). In place treatment consists of constructing a subsurface trench filled with reactive material that removes the contaminants as ground water flows through it. Because this technology relies on ground water flow to bring contaminants to the treatment trench, ground water cleanup would take considerably longer under Alternative 3b.

4. **The estimated cost of Alternative 5a ($10.9 million [M]) is much lower than Alternative 3b that includes $54M to excavate the pit waste, and will protect human health and the environment more effectively and achieve cleanup standards more rapidly than Alternative 3b.**

   While cost is one of several criteria used to evaluate cleanup alternatives, the protection of human health and the environment and compliance with environmental laws and regulations are the primary consideration when selecting a remedy. The amount of money spent does not necessarily equate to the best solution or the highest level of protection. In addition, because cleanup funds come from taxpayer's dollars, the selection of a cleanup remedy that is both protective and cost-effective is not only a reasonable choice but our obligation to the public.

For these reasons, DOE/LLNL and the regulatory agencies believe that Alternative 5a is more protective of human health and ground water, better able to meet applicable Federal and State environmental laws and regulations, and provides for faster, more cost-effective cleanup than Alternative 3b. The highest priority of the cleanup effort is to protect workers at Site 300, site neighbors, and the residents of Tracy and nearby communities, which includes many DOE and LLNL employees and their families.

DOE/LLNL conducted a risk assessment to determine the potential for residential exposure to ground water contaminants from the Pit 7 Complex. The exposure scenario used in the risk assessment assumed that water-supply wells would be drilled at the site boundary and was developed in consideration of the fact that land in the vicinity of Site 300 have been subject to development. As part of the assessment, DOE/LLNL conducted fate and transport modeling of tritium and uranium in ground water to the site boundary. The modeling results indicated that tritium and uranium activities would not exceed background levels in hypothetical wells at the site boundaries. Therefore, there is no current or future risk of exposure to these ground water contaminants to existing or potential residential populations (i.e., the Tracy Hills development). We have an extensive monitoring program at the site that is designed to evaluate any changes in ground water conditions or contaminant plume concentrations and distribution that could affect the assumptions used in the risk assessment and/or result in potential impacts to human health or the environment. There are several processes in place, such as the Five-Year Review process and the Site 300 Contingency Plan, to allow for re-evaluation of and modifications to the cleanup remedies if cleanup does not progress as expected.

Although final ground water cleanup standards have not yet been selected, DOE/LLNL have committed and remedial actions designed and implemented to clean up ground water at Site 300 to drinking water standards, at a minimum. Because drinking water standards do not differentiate between residential and industrial uses, cleanup to these standards would be protective of residential populations.

Contamination in other environmental media at Site 300 (such as soil and bedrock) is confined to Site 300 property. Access to these areas by members of the general public is prohibited and prevented by fences and security guards. There is no contamination that a trespasser could encounter at the Pit 7 Complex, because there is no surface soil contamination and ground water is inaccessible. While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to release the land for recreational or residential uses or development. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws.

A more detailed description of the rationale for selection of Alternative 5a as the preferred remedy for cleanup of contamination at the Pit 7 Complex over Alternative 3b and other alternatives evaluated is provided in Section 2.13.1 of this document. In addition, DOE/LLNL would be happy to provide any additional information on the Site 300 cleanup project.

Susan Sarvey, — 26139 Corral Hollow Road, Tracy, California

Written comment #1:

I am writing to support cleanup alternative 3b. This alternative presents the best opportunity to clean up the site and restore it to background levels for soil and groundwater standards. We were promised many years ago that the landfill caps would prevent ground water contamination from spreading and now your experts are admitting their plan was a failure.

Response: DOE/LLNL and the regulatory agencies believe that Alternative 5a is more protective of human health and ground water, better able to meet applicable Federal and State environmental laws and regulations, and provides for faster, more cost-effective cleanup than Alternative 3b for the following reasons:

1. Alternative 5a is more effective than Alternative 3b in controlling the source of contamination and preventing further contaminant releases.
2. Alternative 3b has a greater potential than Alternative 5a to expose workers to contamination during waste excavation and disposal and impact plants and animals by disrupting their habitat.

3. Cleanup of existing ground water contamination can be achieved more effectively and faster using Alternative 5a than Alternative 3b.
4. The estimated cost of Alternative 5a ($10.9 million [M]) is much lower than Alternative 3b that includes $54M to excavate the pit waste, and will protect human health and the environment more effectively and achieve cleanup standards more rapidly than Alternative 3b.

Please refer to the response to the Tracy City Council comment and/or Section 2.13.1 of this document for more detailed description of the rationale for selection of Alternative 5a as the preferred remedy for cleanup of contamination at the Pit 7 Complex over Alternative 3b and other alternatives evaluated.

The Pit 7 landfill cap was designed to prevent rainwater from infiltrating. It was not designed to prevent water table rises into the bottom of the landfill material. The landfill caps are performing as planned.

Susan Sarvey written comment #2

We don't need another interim remedy that may or may not clean the contamination out of the groundwater. That is why I am supporting the removal of contaminated soil from this site. I have heard your excuses why you can't remove the contaminated soil but your experts have told us that thus material can be safely removed and the only way to be contaminated is to eat the soil or drink the contaminated water. Tracy is a growing community and it needs the site to be cleaned to the highest standards to protect our groundwater.

Response: Please refer to the responses to your comment #1 above and to the Tracy City Council comment and/or Section 2.13.1 of this document for more detailed description of the rationale for selection of Alternative 5a as the preferred remedy over Alternative 3b, which includes excavation of the pit waste.

All proposed and existing cleanup remedies at Site 300 are designed to clean up ground water to drinking water standards, at a minimum. Drinking water standards do not differentiate between residential and industrial uses, therefore cleanup to meet these standards would be protective of residential populations. There is no current or future risk of exposure to these ground water contaminants from the Pit 7 Landfill to existing or potential residential populations.

Susan Sarvey written comment #3

There is a proposed development, Tracy Hills that is touting a buffer zone between your site and their development as an open space recreation area. It would be inappropriate to allow this area to be used by young children and unknowing members of the public who may wonder onto Site 300. I am requesting that the DOE place signs on the border of the buffer zone and around Site 300 warning children and others to stay out of the buffer zone around the site. The buffer zone should be off limits to all but Site 300 personnel to prevent unauthorized access to the Site. In addition the buffer zone is the home of many endangered species and is protected by the USFWS. There is also the possibility of uncharacterized contamination in the buffer zone so access should not be permitted.

Response: The Tracy Hills buffer zone is not owned by DOE, therefore the use of this area is not in DOE's control. Site 300 is protected by fencing and signage that indicate it is a high-explosive test site and trespassing is prohibited. Ground water contamination from the Pit 7 Complex does not extend offsite to the proposed buffer zone for the Tracy Hills Development. Contamination in other environmental media at Site 300 (such as soil and bedrock) is confined to

Site 300 property. Access to these areas by members of the general public is prohibited and prevented by fences and security guards.

Bob Sarvey — 26139 Corral Hollow Road, Tracy, California

Written comment #1:

1. Thank you for the opportunity to comment on the proposed cleanup plan for the Pit 7 complex at Site 300. As a citizen of Tracy I have attended all meetings related to clean up at Site 300 over the last ten years. Your current preferred plan for cleanup at the pit 7 complex is inadequate. Your proposed hydraulic diversion plan isolates U-238 in the unlined pits and does not deal with the long term clean up issues at the complex. Unless the U-238 is removed from the pits the soil and ground water cannot be restored to residential standards because the U-238 which will now be isolated in the pits has a half life of several billion years.

Response: Please refer to the response to Mr. Sarvey's verbal comment #6.

2. It is very important to the City of Tracy that you do the most comprehensive cleanup possible since our city has now annexed to the site boundary. It is reasonably foreseeable that the City of Tracy may someday have Site 300 within the City limits. Currently we have annexed to your site boundary and a local developer has plans to use the area near your boundary as open space to the public. Until you have fully characterized all contamination to residential standards this should not be allowed.

Response: Please refer to the response to Susan Sarvey's written comment #3.

3. Further I am requesting that you post signs near that open space boundary forbidding entry and warning citizens of the radioactive contamination at the Site. We do not want unattended children or uninformed residents trespassing on or near Site 300 property.

Response: Site 300 is protected by fencing and signage that indicate it is a high-explosive test site and trespassing is prohibited. DOE will consider the installation of additional signs at the site boundary.

4. I support cleanup alternative 3b. Clean up alternative 3b is the most comprehensive cleanup presented in your plan although I believe that the DOE's obligation should not stop there. Cleanup alternative 3b is feasible with adequate protective equipment for workers who will perform the removal action. Cleanup alternative 3 is also cost effective as it is less than one percent of the labs annual budget over 30 years. The plan will also restore valuable land for beneficial uses when the lab has completed its mission at Site 300. Procrastination on the removal of this radioactive contamination will only lead to higher costs as the DOE will be required to completely remediate this site by state and federal regulations. NEPA and CEQA require that you adopt cleanup alternative 3b as it is both feasible and cost effective and limits impacts to the environment to the greatest extent possible under the alternatives that you have identified.

Response: Please refer to the responses to Mr. Sarvey's verbal comment #6 and the Tracy City Council comment, and/or Section 2.13.1 of this document for more detailed description of the rationale for selection of Alternative 5a as the preferred remedy for cleanup of contamination at the Pit 7 Complex over Alternative 3b and other alternatives evaluated.

5. The entire site must be remediated to residential soil and ground water standards as quickly as possible. Recent documents published by the DOE suggest that the DOE may conclude activities at Site 300 by 2015. Hydraulic diversion merely relies on the natural *attenuation of the tritium contamination at the Pit 7 complex but does not address the U-238 contamination that remains in the unlined pits that will be isolated by the hydraulic diversion. Additionally further characterization is necessary to understand exactly what is contained in those pits as well as other areas of Site 300. You are aware that practically every year the citizens of Tracy must pressure the DOE to keep current funding levels in place for the cleanup at Site 300. This must stop immediately and the DOE must guarantee full funding for this cleanup so that we are not forced to lobby our elected representatives every year to force you to do what you are legally required to do in you clean up plans.*

Response: DOE has committed and remedial actions are designed and implemented to clean up ground water at Site 300 to drinking water standards at a minimum, unless the regulatory agencies concur that it is technically impracticable.

While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to release the land for recreational or residential uses. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Please see the response to Ms. Kelley's comment #3 for additional information.

Please see the response to Mr. Sarvey's verbal comment #1 and #6 regarding the effectiveness of the selected remedy (Alternative 5a) and characterization of the Pit 7 Complex, respectively.

DOE submits annual funding requests to Congress for the cleanup of the LLNL Livermore Site and Site 300. The cleanup funding requests are submitted to Congress as specific line-items for the CERCLA cleanup effort, and are separate from funding requests made for other activities conducted at LLNL. The funding requests are based on cleanup commitments and regulatory deliverables agreed upon with the regulatory agencies and contained in the Federal Facility Agreement, the Records of Decision, and other CERCLA cleanup documents. Actual funding levels received for DOE site cleanup, which do not always match the funding requests, are based on decisions made and allocated at the Congressional level based on national priorities, not at the local DOE office level. Therefore, petitioning of elected officials (Congress) is an appropriate mechanism to ensure that actual cleanup funding requests are met.

Paul Sundberg written comment #1

1. The DOE must require the most stringent cleanup possible for the Pit 7 complex at Site 300. Alternative 3b, although not complete, is the best alternative for the Citizens of Tracy because it has the best chance of restoring groundwater and soil to residential standards. The city is growing and has plans to put executive homes at Site 300 boundary and a youth's sport park in the near proximity. I recognize the important roll the lab plays in national security and our local economy but the lab must be responsible for its impacts on the environment. Especially the radioactive contamination at Site 300 since at some point in time the lab will most undoubtedly abandon that site.

Response: DOE has committed and remedial actions are designed and implemented to clean up ground water at Site 300 to drinking water standards at a minimum, unless the regulatory agencies concur that it is technically impracticable.

DOE/LLNL and the regulatory agencies believe that Alternative 5a is more protective of human health and ground water, better able to meet applicable Federal and State environmental laws and regulations, and provides for faster, more cost-effective cleanup than Alternative 3b for the following reasons:

1. Alternative 5a is more effective than Alternative 3b in controlling the source of contamination and preventing further contaminant releases.
2. Alternative 3b has a greater potential than Alternative 5a to expose workers to contamination during waste excavation and disposal and impact plants and animals by disrupting their habitat.
3. Cleanup of existing ground water contamination can be achieved more effectively and faster using Alternative 5a than Alternative 3b.
4. The estimated cost of Alternative 5a ($10.9 million [M]) is much lower than Alternative 3b that includes $54M to excavate the pit waste, but will protect human health and the environment more effectively and achieve cleanup standards more rapidly than Alternative 3b.

Please refer to the response to the Tracy City Council comment and/or Section 2.13.1 of this document for more detailed description of the rationale for selection of Alternative 5a as the preferred remedy for cleanup of contamination at the Pit 7 Complex over Alternative 3b and other alternatives evaluated.

While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to release the land for recreational or residential uses. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Please see the response to Ms. Kelley's comment #3 for additional information.

2. I would hope that the lab post signs around Site 300 at the proposed buffer zone specifying that there is radioactive contamination in the soil and groundwater. And under no circumstances should that open space be utilized for recreational purposes as the area is preserved for wildlife and restrictions on its use will prevent children from the soon to develop Tracy Hill Development from encroaching on the boundaries of Site 300. I would not want to be the recipient of a class action law suit of children dying when there were preventable steps that should have been done.

Response: The Tracy Hills buffer zone is not owned by DOE, therefore the use of this area is not in DOE's control. Site 300 is protected by fencing and signage that indicate it is a high-explosive test site and trespassing is prohibited. DOE will consider the posting of additional signs at the site boundaries.

Ground water contamination from the Pit 7 Complex does not extend offsite to the proposed buffer zone for the Tracy Hills Development. Contamination in other environmental media at Site 300 (such as soil and bedrock) is confined to Site 300 property. Access to these areas by members of the general public is prohibited and prevented by fences and security guards. There is no contamination that a trespasser could encounter at the Pit 7 Complex, because there is no surface soil contamination and ground water is inaccessible.

TRAQC, Tracy Region Alliance for a Quality Community, written comment #1.

TRAQC appreciates the opportunity to comment on the proposed plan for cleanup of the Pit 7 complex at Site 300. TRAQC believes that alternate 3b in your proposed plan offers the best opportunity to restore soil and groundwater at Site 300 to residential standards. In the

March 25, 2006 edition of the Tracy press enclosed as attachment 1, your public affairs director John Bellardo made several statements in the press that indicate that the Lab is uncertain of the contents of the unlined pits in the Pit 7 complex. Specifically he stated, "We don't feel confident that we have enough data to properly characterize the contamination there." We believe because there is uncertainty as to what is contained in those pits the best course of action is to remove the radioactive waste from all the unlined pits to eliminate the uncertainty and completely halt plume migration." The DOE has had over 10 years to adequately sample and characterize these pits and we are disappointed that DOE has failed to devote the proper resources to accomplish this task. That being said our confidence in your commitment to clean up the radioactive contamination at the Pit 7 complex and the rest of the site is low.

We realize that alternative 3b has a higher price tag than the other alternatives but judging by your failure to even adequately investigate the contamination in the pits we must insist that you now remove the radioactive debris to a safer location. The 7 million dollar cost is a fraction of your annual operating budget at the lab. Your inclusion of the alternative in your analysis demonstrates that the alternative is technologically feasible. As the alternative is both technologically feasible and cost effective we believe your obligation under NEPA and CEQA require you to remove the radioactive waste from the Site. The City of Tracy has approved an ill advised residential development called Tracy Hills which will soon be encroaching on your operations at the Site. We believe that it is inappropriate to locate large residential developments near a toxic superfund site where high explosives tests utilizing Tritium and U-238 are occurring. Besides the obvious conflicts with noise and vaporization of radioactive elements near large residential developments we are concerned that children or unaware adults may trespass onto Site 300 property and be exposed to contamination. Mr. Bellardo in the aforementioned Tracy Press article stated "that several years ago a lab worker got sick after being exposed to the debris in those pits." We are not only concerned about the Pit 7 complex we are concerned that you have devoted so little resources to characterizing contamination in and around the Site. We are therefore recommending that you properly post signage around Site 300 warning residents of the radioactive contamination at Site 300. We also think that it would be prudent to prevent anyone from obtaining access to the proposed buffer zone that Tracy Hills is required to offer for open space. We recommend the area be closed to the public and signage be installed at the perimeter of the buffer zone to warn children and residents of the presence of radioactive waste near the buffer zone.

Response:

Alternative 3b: DOE/LLNL and the regulatory agencies believe that Alternative 5a is more protective of human health and ground water, better able to meet applicable Federal and State environmental laws and regulations, and provides for faster, more cost-effective cleanup than Alternative 3b for the following reasons:

1. Alternative 5a is more effective than Alternative 3b in controlling the source of contamination and preventing further contaminant releases.
2. Alternative 3b has a greater potential than Alternative 5a to expose workers to contamination during waste excavation and disposal and impact plants and animals by disrupting their habitat.
3. Cleanup of existing ground water contamination can be achieved more effectively and faster using Alternative 5a than Alternative 3b.

4. The estimated cost of Alternative 5a ($10.9 million [M]) is much lower than Alternative 3b that includes $54M to excavate the pit waste, but will protect human health and the environment more effectively and achieve cleanup standards more rapidly than Alternative 3b.

Please refer to the response to the Tracy City Council comment and/or Section 2.13.1 of this document for more detailed description of the rationale for selection of Alternative 5a as the preferred remedy for cleanup of contamination at the Pit 7 Complex over Alternative 3b and other alternatives evaluated.

Characterization of the Pit 7 Complex: As discussed in the response to Mr. Sarvey's comment #1, many years and millions of dollars have been spent characterizing the contamination in the Pit 7 Complex. In his statement from the March 25th Tracy Press newspaper, John Belluardo was referring to the fact that DOE/LLNL did not keep detailed records of the disposal of waste within the landfills and the possibility that something could have been put in the landfill that would present a safety issue if the pit waste were to be excavated. He was not commenting on the adequacy of the environmental investigations within the landfills. Please refer to the response to Mr. Sarvey's comment 1 for more details on the characterization that was conducted at the Pit 7 Complex. The U.S. EPA and the State regulatory agencies (DTSC and RWQCB) have concurred that the nature and extent of the contamination associated with the Pit 7 landfills has been characterized sufficiently to propose and select a cleanup remedy.

The ground water containing contaminants is hydraulically isolated from the aquifer below the City of Tracy and any existing or proposed residential development. Modeling indicates that contamination will not migrate offsite at concentrations above background levels. An extensive monitoring network is in place and ground water will be monitored under the selected remedy to ensure the cleanup progresses as the modeling predicts. The Contingency Plan and Five-Year Review provide a process to evaluate the remedy, and to modify the remedy if cleanup does not progress as expected.

Use of Tracy Hills buffer zone: The Tracy Hills buffer zone is not owned by DOE, therefore the use of this area is not in DOE's control. DOE also does not have control over the development of property surrounding the site. Site 300 is protected by fencing and signage that indicate it is a high explosive test site and trespassing is prohibited. DOE will consider the posting of additional signs at the site boundaries.

Ground water contamination from the Pit 7 Complex does not extend offsite to the proposed buffer zone for the Tracy Hills Development. Contamination in other environmental media at Site 300 (such as soil and bedrock) is confined to Site 300 property. Access to these areas by members of the general public is prohibited and prevented by fences and security guards. There is no contamination that a trespasser could encounter at the Pit 7 Complex, because there is no surface soil contamination and ground water is inaccessible.

Irene Sundberg written comment #1

The DOE must require the most stringent cleanup possible for the Pit 7 complex and Site 300. As a member of the City Council I have endorsed cleanup alternative 3b. This alternative although not complete is the best alternative for the Citizens of Tracy because it has the best chance of restoring groundwater and soil to residential standards. The Tracy City Council represents 80,000 citizens and has endorsed cleanup alternative 3b because our City *has now annexed to your site boundary. We recognize the important mission the lab plays in national security and our local economy but we feel that the lab must now clean up the radioactive contamination at Site 300 since at some point in the near future the lab will abandon that site. We have plans for residential development in close proximity to Site 300 and it is essential that residents who move there are aware of the contamination and are properly notified to stay out of Site 300. I recommend that the lab post signs around Site 300 and at the boundary of the proposed buffer zone for the Tracy Hills project which is being proposed as open space. The signs should specify that radioactive contamination exists in the soil and groundwater. Under no circumstances should that open space be utilized for recreation as the area is preserved for wildlife and restrictions on its use will prevent children from the Tracy Hills Development from encroaching on the boundary of Site 300.*

Response:

***Alternative 3b*:** DOE/LLNL and the regulatory agencies believe that Alternative 5a is more protective of human health and ground water, better able to meet applicable Federal and State environmental laws and regulations, and provides for faster, more cost-effective cleanup than Alternative 3b for the following reasons:

5. Alternative 5a is more effective than Alternative 3b in controlling the source of contamination and preventing further contaminant releases.
6. Alternative 3b has a greater potential than Alternative 5a to expose workers to contamination during waste excavation and disposal and impact plants and animals by disrupting their habitat.
7. Cleanup of existing ground water contamination can be achieved more effectively and faster using Alternative 5a than Alternative 3b.
8. The estimated cost of Alternative 5a ($10.9 million [M]) is much lower than Alternative 3b that includes $54M to excavate the pit waste, and will protect human health and the environment more effectively and achieve cleanup standards more rapidly than Alternative 3b.

Please refer to the response to the Tracy City Council comment and/or Section 2.13.1 of this document for more detailed description of the rationale for selection of Alternative 5a as the preferred remedy for cleanup of contamination at the Pit 7 Complex over Alternative 3b and other alternatives evaluated.

Use of Tracy Hills buffer zone: The Tracy Hills buffer zone is not owned by DOE, therefore the use of this area is not in DOE's control. Site 300 is protected by fencing and signage that indicate it is a high explosive test site and trespassing is prohibited. DOE will consider the posting of additional signs at the site boundaries.

Ground water contamination from the Pit 7 Complex does not extend offsite to the proposed buffer zone for the Tracy Hills Development. Contamination in other environmental media at Site 300 (such as soil and bedrock) is confined to Site 300 property. Access to these areas by members of the general public is prohibited and prevented by fences and security guards. There is no contamination that a trespasser could encounter at the Pit 7 Complex, as there is no surface soil contamination and ground water is inaccessible.

DOE Use of Site 300: While DOE is evaluating the consolidation of activities throughout the DOE complex that could result in changes to activities conducted at Site 300, DOE control of the site is expected to continue for the foreseeable future. There are no plans to release the land for recreational or residential uses. If the land use changes, the cleanup remedies and standards would be reviewed to ensure they are consistent with its intended use in accordance with Federal and State laws. Please see the response to Ms. Kelley's comment #3 for additional information.

Pamela Sihvola, Committee to Minimize Toxic Waste, P.O. Box 9646, Berkeley

1. The above referenced 12 page cursory cleanup plan should have included a more detailed topographical site map showing all the water courses at the site, including a discussion on the direction of ground water movement.

Response: Maps showing the distribution of ground water and contaminants were presented and discussed at the Public Meeting for the Proposed Plan for the Pit 7 Complex in Tracy on April 5th. More detailed maps of the Pit 7 Complex area including the ground water and plume maps are contained in the Remedial Investigation/Feasibility Study for the Pit 7 Complex that is available to the public in the Tracy City Library and at the LLNL Visitor's Center. Information related to contamination and cleanup efforts for other parts of Site 300 has been provided to the public at previous public meetings and workshops.

2. It is critical that the cleanup plan include comprehensive sampling of groundwater at the leading edges of the various contamination plumes, which include radioactive tritium, uranium-238, PCBs, Furans, Dioxins, and high explosive compounds.

Response: The cleanup plan for the Pit 7 Complex does include a comprehensive monitoring plan for contaminants in the area including tritium, uranium, perchlorate, volatile organic compounds, and nitrate. While PCBs, dioxins, furans, and high explosive compounds have been identified in environmental media at other parts of the site, these are not contaminants at the Pit 7 Complex. Because the focus of the Proposed Plan and Public Meeting was the Pit 7 Complex, the cleanup plans for these contaminants were not discussed. These other areas have been the focus of other Public Workshops and Meetings, and documents, and comprehensive monitoring networks are in place to monitor these contaminants.

3. The document was also deficient in providing a clear description of the site geology (surface and subsurface), how and where earthquake faults act as conduits for contaminated ground waters, where springs and seeps occur and how and where ground water contamination becomes surface water/creek runoff during high rain years, when the water tables rise. It is crucial that the cleanup plan include a comprehensive ground water, surface water (creeks, stormwater), and sediment monitoring/sampling and management program, preferably with independent and/or citizen oversight.

Response: The Proposed Plan document is a fact sheet that was intended to provide a summary of the characterization of contamination at the Pit 7 Complex, the alternatives that were evaluated for contaminant cleanup, and the preferred remedy identified by DOE/LLNL, the U.S. EPA, and State regulatory agencies. Detailed information about the geology including faults identified in the Pit 7 Complex area and their affect on ground water movement, the hydrogeology (ground water and surface water), the nature and extent of contamination, exposure risks associated with the contamination, and the proposed cleanup alternatives including the monitoring program are presented in detail in the Remedial Investigation/Feasibility Study for the Pit 7 Complex. This document is available to public in the Tracy Public Library and the LLNL Visitor's Center.

4. Of special concern is TRITIUM, and its proposed new use at Site 300 should absolutely be prohibited, especially in view of the already existing legacy tritium contamination in the *groundwater and the ever expanding population growth in the Livermore-Tracy area, dependent on clean ground water. A recent report (June 2005) by the National Academy of Sciences panel, formally known as the Committee on Biological Effects of Ionizing Radiation (BEIR VII) concluded that "…even very low doses of radiation pose a risk of cancer or other health problems and there is no threshold below which exposure can be viewed as harmless." (See attachment 1.) Tritium has a hazardous life of about 12.5 years. Those most vulnerable are pregnant women and children. "Tritium acts like a bullet inside the body's cells breaking the DNA strands, leaving damaged cells that can develop into cancers", says physicist Arjun Makhijani of the Institute for Energy and Environmental Research (IEER), when interviewed by the PBS program News Hour with Jim Lehrer (April 17, 2006) after a huge tritium leak occurred at the EXELON nuclear power plant in Illinois. The entire news segment, titled "Radioactive Leaks, American Nuclear Story," is included on video tape, as part of my comments and I would like the transcript be made part of the administrative record for this process. (See attachment 2.). It illustrates clearly the continuous agony and frustration residents must endure living close to nuclear power plants and Department of Energy facilities such as the Lawrence Livermore and Berkeley National Laboratories. The following summarization by Will County State's Attorney James Glasgow, regarding Exelon, applies to DOE operations as well: Absolute disregard for the health, safety and welfare of local people, They don't tell until they are caught, Then they make promises that they don't fulfill. Again Arjun Makhijani re: Exelon leak: "Because there is a drinking water limit of 20,000 pCi/L (for tritium), does not mean that 5000 or 1000 pCi/L won't harm you. They do pose a risk, proportenately a lower risk, but it is not a zero risk. So Exelon should just cool it and stop telling people that there is no harm from low levels of tritium, because it is contrary to established science and the official scientific guidance." – "Tritium has higher risks for children, because they are growing faster and their cells are multiplying faster. So when you have that kind of situation, radioactivity generally will have a greater impact- and tritium especially – because it crosses the placenta." Therefore DOE/LLNL must report the community's requests and clean up Site 300 to the most protective, residential standards, clean up ground water contamination to pristine condition and finally start seriously protecting the beneficial uses of ground water for the future generations of residents in the Livermore-Tracy area.*

Response: The parallels referred to between the Exelon power plant and the LLNL Site 300 cleanup project are not clear other than the presence of tritium. DOE/LLNL has made significant efforts to identify and implement cleanup of contamination at Site 300.

When contamination was first discovered in wells at Site 300, it was reported to the regulatory agencies. At that time, DOE/LLNL began extensive environmental investigation activities that included: (1) records searches and interviews, (2) drilling of boreholes to collect soil and bedrock samples and the installation of over 650 ground water monitor wells, (3) analysis of tens of thousands of soil, bedrock, ground water and surface water samples, (4) soil vapor and geophysical surveys, (5) hydraulic testing; evaluating observed water level responses to rainfall events; geologic mapping, (6) ground water transport modeling, (7) geologic and hydrogeologic characterization, and (8) risk assessments.

While these investigations were still underway, DOE/LLNL initiated cleanup activities at Site 300 in the mid-1980s to begin addressing contamination. Cleanup activities to date have included installing 20 ground water and soil vapor treatment systems, removing contaminated soil, capping and closing landfills, rinsewater lagoons and burn pits, removing firing table gravels, and implementing administrative and engineered controls to prevent workers from being exposed to contamination while cleanup proceeds.

DOE/LLNL has been sponsoring public workshops and meetings since 1994 to present to the public the status of site cleanup, proposed cleanup plans, and to discuss the contents of draft versions of major documents. Final documents have been made available to the public at the Tracy Public Library and the LLNL Visitor's Center and have been posted on the Community Relations website.

DOE/LLNL has honored the cleanup commitments made in Records of Decision and other decision documents for Site 300. The highest priority of the cleanup effort is to protect workers at Site 300, site neighbors, and the residents of Tracy and nearby communities, which includes many DOE and LLNL employees and their families.

Tritium contamination in ground water from the Pit 7 Complex does not extend outside the Site 300 boundary. DOE/LLNL conducted a risk assessment to determine the potential for offsite residential exposure to ground water contaminants, including tritium, from the Pit 7 Complex. The exposure scenario used in the risk assessment assumed that water-supply wells would be drilled at the site boundary and was developed in consideration of the fact that land in the vicinity of Site 300 have been subject to development. As part of the assessment, DOE/LLNL conducted fate and transport modeling of tritium and uranium in ground water to the site boundary. The modeling results indicated that tritium activities would not exceed background levels of 100 pCi/L in hypothetical wells at the site boundaries and that total uranium in ground water would not exceed the 20 pCi/L MCL in ground water at a maximum distance from the Pit 7 Complex of 400 ft in bedrock and 1,000 ft in alluvium. . Therefore, there is no current or future risk of exposure to these ground water contaminants to existing or potential residential populations. We have an extensive monitoring program at the site that is designed to evaluate any changes in ground water conditions or contaminant plume concentrations and distribution that could affect the assumptions used in the risk assessment and/or result in potential impacts to human health or the environment. There are several processes, such as the Five-Year Reviews and the Site 300 Contingency Plan, in place to allow for re-evaluation of and modifications to the cleanup remedies if cleanup does not progress as expected.

K. Leo (Kleo) Pullin written comment #1, 515 Peerless Way #6, Tracy

I attended the Public Meeting on LLNL Site 300 Pit 7 Complex Cleanup in Tracy, California on April 5, 2006. I was left confused by certain issues. The background presentation was poorly done. The Site 300 geology and hydrogeology were not accurately characterized. Sometimes diagrams, answers and past documentation were in conflict, in particular the exact relationship among the contaminant plumes of concern, the groundwater in the northern portion of Site 300, the groundwater in the northern portion of Site 300, the groundwater supplies of Tracy, particularly in the western portion, the groundwater aquifers of Carnegie Vehicular Recreation Area, and the geologic formations and faulting in these areas, and how much knowledge project workers have of the geologic setting of the site. This failure to accurately characterize the bedrock geology, the faulting, and the hydrogeology, in addition to the differences between what the DOE and what the Lab was saying led to confusion. For example, in figure 1-5 of LLNL Environmental Report for 1995, Site Overview of "Approximate ground water elevations" indicates that groundwater in the northern portion of the site where the Pit 7 Complex is located is moving in a east by northeastern direction. If this is the case why was this not pointed out when questions were asked about Carnegie's groundwater supplies to the south of Site 300? If *the plume starts away from Carnegie and continues moving away from Carnegie, then it should be readily seen from the slides during the presentation that CVRA will not be impacted by these COC plumes, and this can be emphasized in response to the question. The LLNL geologist told the audience that he did not know the faulting history of the area. How is this possible? If the Site 300 aquifers are separated from Tracy drinking water aquifers by Coast Range thrust faulting that allows for no geologic connection between the two, this may significantly lower concerns about contamination of Tracy's groundwater aquifers. There are plenty of faults on and near Site 300. Why are they shown in a slide, then the geologist cannot answer questions about faulting that might impact movement of the contaminant plumes? At another point the DOE representative mentioned that shearing along fault zones immobilizes the forward migration of plumes across fault boundaries. If this is the case, why didn't she take the questions audience members had about the fault history of the area, instead of leaving the LLNL geologist to give us an "I don't know?" Then a slide in the presentation (p. 20) title "Contaminated ground water in bedrock does not flow offsite" shows groundwater moving in two directions on different sides of the Elk Ravine Fault. Again, a simpler side might have demonstrated the abstract answer given us by the DOE representative? Is the plume mounding up at the ELK Ravine Fault? But there's groundwater on both sides of the fault, presumably the same aquifer, so ….. Other Site 300 documents characterize the bedrock as highly fractured, yet neither the DOE representative nor the LLNL geologist mentioned this in relation to faulting and groundwater permeability. I realize that there is another stage in this process that will deal with groundwater issues in the cleanup of Site 300, however, if any decision is made to adopt a less permanent (non-excavation non-sealing) alternative to reducing the risk of contaminants of concern from unlined pits in the Pit 7 Complex at Site 300, citizens of Tracy should be fully informed of the risk to their drinking water aquifers. If the LLNL geologist does not know the faulting of the area, how does he know the locations of the formations and the relationships between them, how did he map the smaller faults on the site without knowledge of their place in the San Andreas fault zone and the Coast Range thrust faults? How can LLNL or DOE predict the movement of the contaminant plume in order to measure the feasibility of various alternatives without understanding the bedrock geology and the hydrogeology, part of which is understood from the relationship between formations at fault boundaries? The drains and sumps alternative that is preferred at this time does not address the SOURCE of groundwater contamination and the plume leachate created when groundwater rises into the contaminated materials in the pit. Grouting between the Pit Complex and the bedrock, sealing the pit materials in any way or excavating the pit does address the source of contamination. No matter how much more expensive these alternatives are, they are the only ones that do anything to permanently reduce the future threat of groundwater contamination. Mention was made at the Public Meeting of the change of gradient due to withdrawing water downstream and injecting it upstream, the front of the plume, and, again, the impact of shear zones along faults, but none of this can be accurately characterized without an accurate characterization of the geology and faulting. Are all groundwater resources in Site 300 in the lower Neroly Formation? What about Tracy groundwater, where is it, only in the Quaternary alluvium? And what is the connection between these aquifers, if any? The slides at the Public Meeting were busy, but missing necessary details. The public documents are not well organized and are difficult to find information in. There is mention of 8 endangered plants on Site 300, but I could only find 3 mentioned by name (Amsinckia grandiflora, Eschscholzia rhombipetala, and Blephanzonia plumosa). What is being done about these plants? Are any in the footprint the drains and sumps* *would use? What are the other 5 plants? What is the naturally occurring background radiation in this part of the Diablo Ranges? Apparently LLNL and the DOE disagree about this. Again, if the geology was fully characterized maybe there would be an agreement. The audience was told at the Public Meeting that TriValley CARES was allowed to exceed the "5 Minute Public Comment" period in part because the Lab and TriValley CAREs have a "special relationship," Bert Heffner, April 5, 2006, Tracy. LLNL should not be giving any citizen group extra time at a Public Meeting when there is an opportunity to make comments for the record. Instead, LLNL should monitor the time to allow as many people as possible to get their comments on the record, particularly if instead of allowing folks who've signed up to speak, LLNL has chosen to honor a "special relationship" with a group from outside of Tracy so speak on behalf of Tracy citizens. I have not granted Tri-Valley CAREs any right to speak on my behalf. I can speak for myself, unless I'm excluded for lack of a "special relationship" with LLNL. I have never been to a public meeting with comments for the record where speaker after speaker from outside the area was allowed to speak for well over the allotted time. While groundwater issues in California should be of concern to everyone, Public Meetings in Tracy should not be conducted in such a sloppy manner just to give a political soapbox to one "special" group in preference over others. In the future, if you intend to give some people more time speak than others, give everyone their five minutes first, then those who want more time can speak after everyone else has had their first five minutes. The slides were too busy, the fonts too small to read, the diagrams poorly labeled. Ground water plumes are 3-dimensional, yet the depth to the plume, to the groundwater, the extent of the vadose zone were not mentioned. Some slides that showed the plumes had multiple plume locations (page 7 in the Presentation), not just the Pit 7 Complex, in an array of colors, too small to distinguish the individual colors, too many to even follow what was going on. How about showing one slide with a limited amount of text that shows the location of various plumes, just the location, all in one color, all over Site 300, then showing the Pit 7 Complex plumes, maybe distinguishing the COC plumes from the others? This isn't just an opportunity to editorialize, the slides were extraordinarily difficult to get the piece of information offered from them, because it was often obscured with extraneous information. The half lives of the radioactive materials were not prominently mentioned in the slide presentation or in most documents. Please display this information prominently when first introducing radioactive contamination. I would like the geology to be characterized in a straight-forward single resource, the slides to conform with this presentation, be clear and show only one or two things, not 7 different kinds of contaminants in multiple locations on one map. I would like the connections between the two aquifers and everything preventing the connectivity of the two aquifers (the aquifer containing the tritium plume at Site 300, Pit Complex and Tracy's drinking water aquifers) to be clearly described. It is difficult to appreciate any value to Preferred Alternative 5a without fully understanding what the potential consequences to Tracy's future drinking water resources are. The developers in the area aren't paying attention to it. Tri-Valley CAREs has their own agenda and their own "special relationship" with LLNL that I don't have. Money spent simply to divert rainwater around a hazard left in place to prevent infiltration seems to be a waste of money, no matter how much is saved from excavating the waste or sealing the waste from the surrounding ecosystem. I want a solution to the unlined pits, not a diversion around them.*

Response: The geology and hydrogeology of Site 300 have been characterized in great detail. This knowledge has been gained by evaluating and integrating many types of data including the mapping of surficial geologic features, rock core descriptions and geophysical logs from over 650 wells and boreholes drilled throughout the site, ground water elevation and chemical measurements, fault-trenching, and from other techniques that were used to develop a comprehensive, three-dimensional geologic and hydrogeologic model of the subsurface at Site 300.

Because many of the people attending our Public Meetings and Workshops may not have a technical background in the areas of geology, hydrogeology, or environmental contamination, we attempt to simplify some of the more complicated technical information and concepts to reach all members of the audience. More detailed information on the geology (including faults) and hydrogeology at the Pit 7 Complex can be found in the Remedial Investigation/Feasibililty Study for the Pit 7 Complex that is available at the Tracy Public Library, LLNL Visitor's Center, or the LLNL Environmental Community Relations website (www-envirinfo.llnl.gov/). Also, although we try to anticipate the types of questions or areas of concern people may have when we develop presentations, it is often difficult to determine all concerns in advance so that they are adequately addressed or shown in the presentations (i.e., faulting). We appreciate your suggestions for improvements to our public presentations and the Proposed Plan document, and will consider them for future meetings, workshops, and Proposed Plan documents.

As mentioned at the Public Meeting, contamination from the Pit 7 Complex is contained in ground water in the lowermost Neroly Formation sandstone bedrock unit ($Tnbs_0$) and alluvial sand and gravel deposits present in the valley bottom where the Pit 7 Complex is located. In the northwest part of Site 300 adjacent to the Pit 7 Complex, ground water in the Neroly bedrock flows east-northeast. Approximately 1,800 ft northeast of the Pit 7 Complex, the Elk Ravine Fault represents a partial barrier to ground water. In the vicinity of this fault, ground water flow from the Pit 7 Complex is generally deflected by this barrier, and moves toward the southeast. In addition, further to the northeast of the Pit 7 Complex near the Site 300 boundary, the Neroly Formation has been eroded away and therefore does not present a continuous pathway for ground water flow in this bedrock unit offsite toward Tracy and will not reach its water-supply wells. The Tulare Formation aquifer is the source of Tracy's water-supply. Ground water in the alluvial deposits, when present, flows general toward the southeast from the Pit 7 Complex. However, due to the semi-arid nature of Site 300 climate, ground water is present only periodically, primarily in the rainy season. For this reason, contaminant migration in alluvial deposits is limited and will not migrate offsite.

The Carnegie State Vehicular Recreation Area (SVRA) is located approximately 9,000 feet (1.7 miles) south and cross-gradient of ground water contamination at the Pit 7 Complex. Therefore, ground water contamination at the Pit 7 Complex will not affect the Carnegie SVRA.

DOE/LLNL conducted fate and transport modeling of tritium and uranium in ground water in both the Neroly bedrock and alluvial deposits to the Site 300 boundaries. The modeling results indicated that tritium activities would not exceed background levels of 100 pCi/L in hypothetical wells at the site boundaries and that total uranium in ground water would not exceed the 20 pCi/L MCL in ground water at a maximum distance from the Pit 7 Complex of 400 ft in bedrock and 1,000 ft in alluvium. . Therefore, there is no current or future risk of exposure to these ground water contaminants to existing or potential residential populations in Tracy or in the proposed Tracy Hills Development. We have an extensive monitoring program at the site that is designed to evaluate any changes in ground water conditions or contaminant plume concentrations and distribution that could affect the assumptions used in the modeling and/or result in potential impacts to human health or the environment.

Most ground water contamination at other parts of Site 300 is present in different water-bearing units within the Neroly Formation, but the direction of ground water flow within these rocks varies due to geologic structural features such as folds and the bedrock dip direction. For example, ground water in the Neroly Formation bedrock generally flows toward the south-southeast in the southern part of Site 300. However, other faults at Site 300 can also influence ground water flow direction locally.

We apologize for the confusion that was generated in responding to Ms. Sarvey's question at the Public Meeting regarding potential impacts of a severe earthquake on the tritium plumes and the Tracy water-supply. It was not meant to imply a lack of understanding of the fault systems or their history at Site 300. The Elk Ravine fault has been evaluated extensively and is classified as a non-active fault. This indicates that there are no indications of movement on this fault within the last 10,000 years. At the Public Meeting, the LLNL geologist conservatively avoided speculating as to all possible impacts of earthquakes in the Bay area in the future. However, it is not a credible scenario that an earthquake would cause continuous open fractures several miles long that would create a pathway for contamination in the Neroly Formation sandstone at the Pit 7 Complex to rapidly migrate to the Tracy water-supply aquifer in the Tulare Formation. An earthquake of the magnitude that could create this type of scenario has not been observed during historic time.

Characterization data for the Pit 7 Complex indicate that the majority of the tritium and uranium has already migrated from the pit waste into the underlying bedrock. The hydraulic drainage diversion component of Alternative 5a, termed the "drains and sumps alternative" in the comment, would prevent further contaminant releases from both the pit waste and underlying bedrock, by preventing ground water rises that inundate that pits and bedrock during years of heavy rainfall such as the 1997-1998 El Niño. It would also reduce the rate of local ground water flow, effectively slowing migration of the pre-existing tritium and uranium ground water plumes. While the waste excavation component of Alternative 3b would remove the source of contamination in the pits, it would not prevent further releases of contaminants present in the underlying bedrock to ground water. The hydraulic barrier (grouting) method for source control proposed in Alternative 4b also has limitations in that it would be difficult to assure that the grout has fully filled the pores within the sandstone bedrock, providing a positive seal to prevent ground water from entering the pits and underlying bedrock. A more detailed description of the remedial technology options evaluated and their limitations, including waste excavation and hydraulic barriers, are presented in Appendix G of the Pit 7 Complex Remedial Investigation/Feasibility Study document, which is available online at http://www-erd.llnl.gov/library/AR-202492.pdf.

The only federal- (U.S. Fish and Wildlife Service) or state-listed endangered plant identified at Site 300 is the Large-flowered fiddleneck (*Amsinckia grandiflora)*. This plant is not present at or near the Pit 7 Complex. DOE designated a preserve at Site 300, south of the Building 854 Operable Unit, to protect this endangered plant. There are seven species considered to be rare by the California Native Plant Society (CNPS) present at Site 300 as follows:

- The Big tarplant (*Blepharizonia plumose*) - CNPS List 1B (plants that are rare, threatened or endangered). This plant is not found at the Pit 7 Complex, but has been found in the vicinity of Building 850.

- Diamond petaled poppy (*Eschscholzia rhombipetala*) - CNPS List 1B. This plant is not found at the Pit 7 Complex, but has been found in the southwestern portion of the Site 300, west of the Building 854 OU.
- California macrophylla (formerly known as *Erodium macrophylla*, round-leaved erodium) - CNPS List 2 (species that are rare, threatened or endangered in California, but more common elsewhere). This plant is not found at the Pit 7 Complex, but has been found in six locations in the northern part of the site, primarily associated with fire trails (i.e., near Building 851, and the firetrails in the far northwestern part of the site).
- California rock jasmine (*Androsace elongata* subsp. acuta) – CNPS List 4 (species of limited distribution but not considered rare from a statewide perspective, but are uncommon enough to be monitored regularly). This plant is not found at the Pit 7 Complex, but has been found in rocky outcrops along Doall Ravine and the very northern part of the site.
- Stinkbells (*Fritillaria agrestis*) - CNPS List 4. This plant is not found at the Pit 7 Complex, but has been found the far northwest portion of the site.
- Hogwallow starfish (*Hesperevax caulescens*) - CNPS List 4. This plant is not found at the Pit 7 Complex, but has been found southwest of Building 851.

More details on these plants can be found in the "Rare Plant Restoration and Monitoring Program at LLNL Site 300 - Project Progress Reports" in the ERD library webpage (http://www-erd.llnl.gov/library/AR-202492.pdf). The most relevant would be the October 2001-September 2002 and October 2002-October 2004 reports.

An ecological risk assessment was conducted to evaluate potential impacts to plants and animals from exposure to contamination at the Pit 7 Complex using EPA risk assessment guidelines. This assessment indicated that there is no threat to animals or plants, including endangered and threatened species, from exposure to contaminants in the Pit 7 Complex area. DOE/LLNL works with the U.S. Fish and Wildlife Service during the detailed design and construction of cleanup actions to mitigate any potential impacts to endangered and threatened species. In addition, DOE/LLNL has an ongoing program to ensure the continued health and protection of threatened and endangered species and plant and animal communities at the site. This program includes annual surveys of special status species, evaluations of all Site 300 activities for possible impacts to plant and animal communities, and regular consultations with the U.S. Fish and Wildlife Service.

Background activities of tritium in Site 300 ground water are currently between 100 and 300 pCi/L. Uranium background activities in ground water at Site 300 are variable due to the presence of natural uranium in the Neroly bedrock that can be released to ground water. Further information on background activities of radionuclides at Site 300 and the Pit 7 Complex in particular can be found in Appendix D of the Pit 7 Remedial Investigation/Feasibility Study document, which is available online at http://www-erd.llnl.gov/library/AR-202492.pdf.

The speaking order during the public comment period portion of the Public Meeting was determined by the order in which people signed up on the speaker's sheet. We attempted to follow the format of most community meetings in establishing a general time limit, but also tried to allow for additional time requested if possible. It was not meant to imply that the comments of some speakers were more important than others. We consider the comments of each speaker individually and do not assume they represent the site neighbors or Tracy community as a whole.

The comment period was not closed until there were no individuals left who had expressed a desire to speak on the record. However, we appreciate your comments and will consider them for future Public Meetings.

Marylia Kelley— Executive Director of Tri-Valley CAREs, Livermore, California & Peter Strauss—Technical Advisor to Tri-Valley CAREs, San Francisco, California

1. We want to take this opportunity to thank the environmental management staff who have worked on Site 300/Pit 7. We realize that it has been a difficult process, and it has taken some time to get to this point in the process. We have been working for more than 15 years on this cleanup, and this specific site is of major concern to us.

Response: Thank you for the comment.

*2. The Final Feasibility Study (FS) and the Proposed Plan both reflect the addition of language that the remedy **should prevent plume migration**. We hope that these are not merely words added to satisfy regulators and the community, but a real commitment on the part of DOE to attempt to actually prevent the tritium plume from migrating. First, we appreciate that based on prior comments from TVC, the DOE/LLNL has clearly included "preventing plume migration" as part of the Remedial Action Objectives, or RAO (page 5). However, that objective is not specifically carried forward in the Summary of Cleanup Alternatives that are listed on page 5 underneath the Remedial Action Objectives.*

*We recommend that DOE/LLNL need to add a "remedy component" that will actually meet the objective. As it presently stands, while the objective of preventing plume migration is listed at the top of the page, there is nothing in the draft final proposed plan to demonstrate **how** LLNL/DOE will carry it out. To ensure that the objective of preventing plume migration is carried out, we recommend that DOE/LLNL add a horizontal line to the table that summarizes cleanup alternatives on page 5. The objective is "retarding plume migration," the remedy component could be listed as "enhanced monitoring of the leading edges of the plume accompanied by hydraulic control measures as needed." Tri-Valley CAREs strongly recommends that this additional horizontal line to the table be added – specifying the method that will be used to carry out the RAO.*

Response: Wherever it is technically feasible, DOE/LLNL has included measures in the cleanup remedy for the Pit 7 Complex and other contaminated areas of the site, to prevent migration of contaminant plumes. This includes both source control measures to prevent further contaminant releases, and extraction and removal of uranium, perchlorate, nitrate, and volatile organic compounds from ground water. As discussed in the response to Ms. Kelley's verbal comment #1, it is not technically feasible to implement hydraulic control measures for the tritium plume without causing additional contaminant releases and accelerating migration of the tritium plume. Natural attenuation processes will reduce tritium activities to meet drinking water standards without the plume migrating offsite above background levels or impacting human health.

3. Tri-Valley CAREs remains convinced that active hydraulic control of the distal end of the tritium plume should be part of the remedy, at least as an option, if the other parts of the remedy do not sufficiently "prevent migration". TVC believes that the remedy is not adequate unless the tritium plume is <u>contained</u>. We use this word with care, as opposed to "captured", because we believe that there should be flexibility in meeting the goal of preventing plume migration. It does *not have to be complete capture: but it should slow the migration of the tritium plume to the maximum extent practicable, which would allow more time for the tritium to decay. In other words, it does not have to be all or nothing. The all or nothing approach is what, we fear, has been DOE's approach to the problem.*

TVC has suggested in previous comments that the extraction/injection well gallery be expanded with a few additional extraction wells that would serve the purpose of slowing down the tritium plume. In or opinion, this would provide LLNL with an adaptable strategy that could be optimized at any of a number of points, as the remedy is staged and data indicates. ***Optimization could take place in the upstream hydraulic diversion, extraction of source material, ex-situ treatment and re-injection, and partial hydraulic control.***

These are not new comments, and we think that DOE in its response (dated February 15, 2006) has missed the point, an important piece of information, and is unable to go a step further in your remedy selection, which would truly provide long-term protection for the environment. DOE stated that achieving "even partial hydraulic control" would require much larger volumes of water to be extracted and re-injected into an upgradient lens underlying the pits. DOE has posited that this would inundate the pits or flow in directions that would contaminate pristine waters. This may be true if all of the water was extracted and re-injected in that lens, but that is not the only option. First of all, all the water does not have to be extracted. Second, it could be re-injected into the alluvial aquifer, or another hydrostratigraphic unit. Third, we expect that with the upstream hydraulic diversion, there would be some drying out of the aquifers, allowing more space for re-injected water. So, again, it is our strong recommendation that DOE keep this option open, and make it part of the Proposed Plan.

Response: Please refer to the responses to Ms. Kelley's verbal comment #1 and Mr. Strauss' verbal comment #1.

4. Additionally, we have reviewed all the information presented in the Remedial Investigation and the Feasibility Study. Based on our analysis, the waste sites were not fully characterized so that hot spots could be identified and excavated if appropriate. It appears from the final RI that monitoring wells (for groundwater) were not placed in Pit 3 or 5, only around them. Several boreholes measuring soil moisture concentrations were made into Pit 3, but only three in Pit 5, and along the edge of the pit. (Figure 2-15 in the July 2005 Final RI/FS). It is based on maximum tritium samples measured in 1999, at various depths.

The seven Boreholes in Pit 3 ranged from 1.6 million to 6.9 million pCi/L of tritium. We believe that these values are significant and the higher locations should be considered for excavation. Three boreholes in Pit 5 had the following results: 76 thousand pCi/L - 595 pCi/L. Because these were taken along the edges of the pit, they most likely are not representative of activities in the middle of the pit.

The text of the Proposed Plan (p. 18) estimates that 11.7 Ci of tritium remain in Pit 3, with 80% residing in the vadose zone below the pit, and only 2.4 Ci in the pit. It states that the presence of significant amounts of contamination in the vadose zone beneath the pits has bearing on the "feasibility of remedial alternatives with source control components that involve waste excavation". We believe that it is a significant weakness of the proposed plan that excavation is taken as an all or nothing proposition. There is potentially, a "middle path" -- one that utilizes hydraulic diversion and that adds "hot spot" removal/excavation in the pits. We strongly recommend that the preferred alternative preserve the future option of excavation or "hot spot" *removal by including as part of the "remedy component" further characterization and possible partial removal of toxic and radioactive waste from one or more of the unlined pits.*

Response: Please refer to the response to Ms. Kelley's verbal comment #2.

5. To provide a larger context, in environmental cleanup, years of experience has led to the realization that the significant uncertainty requires adopting a flexible, iterative approach. Frequently missed target dates and failure to meet remedial action objectives (RAOs) have forced the development of mechanisms that allow for the continuous improvement and optimization of remediation technologies and techniques, known as Remedial Process Optimization (RPO). The Proposed Plan will lead to the Record of Decision. The ROD is essentially the strategic plan for achieving the Remedial Action Objectives (RAOs) (e.g., preventing plume migration). By its very nature, the ROD should incorporate a decision logic and the basis for future adaptations as part of the overall completion strategy for the site. Whatever is agreed upon here becomes the overriding legal requirement for cleanup of the site. We note that the Interstate Technology Regulatory Council (ITRC) of which the state of California is a founding member and is funded by EPA and DOE has prepared some guidance on RPO. It notes that ***"Optimization should be an inherent element of the remedy evaluation, selection, and design process".*** *(ITRC – Remediation Process Optimization: Identifying Opportunities September 2004 for Enhanced and More Efficient Site Remediation). What we are proposing is that DOE adopt a strategy for cleaning up Pit 7 that is flexible and iterative.*

Response: Optimization of the cleanup process is a key component of the DOE/LLNL strategy for remediation of contamination at Site 300. The remedial actions are continuously evaluated to optimize contaminant mass removal and to ensure continued effective progress toward meeting remedial action objectives. The results of these ongoing remediation optimization evaluations are reported in the semi-annual Compliance Monitoring Reports for Site 300 that are available on the LLNL Environmental Community Relations website (www-envirinfo.llnl.gov/).

6. TVC reiterates from previous comments that if Monitored Natural Attenuation is selected, most of the contaminant mass must be reduced through degradation. We propose that an objective for any remedy that uses MNA have at least 75 percent of the reduction take place through biological, chemical or radiological degradation. The assumed future use of the land will dictate the clean-up levels, and thereby restrict the allowable uses of the land. This is a conundrum (i.e., current cleanup levels dictating future land use) that we would not like to see.

Response: Because tritium has a relatively short half-life of 12.3 years, most of the reduction of the tritium mass will occur through natural radioactive decay processes. It is estimated that the tritium in ground water will decay to meet drinking water standards within 45 years. For example, the maximum tritium activity in ground water at the Pit 7 Complex was 469,000 pCi/L in 2003. The tritium activities in ground water would decrease to a maximum activity of 234,500 pCi/L by 2015, 117,250 pCi/L by 2027, 58,625 pCi/L by 2039, and 29,312 pCi/L by 2051 solely through the decay process. Therefore, in the estimate of time to reach the drinking water standard of 20,000 pCi/L, radioactive decay would be the primary mechanism for reducing tritium activities in ground water.

7. Tri-Valley CAREs' disagrees that industrial standards should be used for Site 300. As we have stated in our Community Acceptance Criteria for Site 300, the strictest clean-up standards should be applied to the site. We recognize that residential standards may not be feasible in a *few small places, but on the whole, residential standards should be used. In the future, this would allow DOE to more easily dispose of the property and limit its liability. Also, because the Bay Area is growing so rapidly, and residential growth is beginning to occur in Tracy and near Site 300, it would be unfortunate if the cleanup performed in 2006 dictate how this 11 square mile site will be used in the future. In addition there have been high level talks within the current administration of stopping Site 300 related test activities. The DOE fiscal year 2007 budget request specifies that close out is being considered for Site 300.*

Response: Please refer the response to Ms. Kelley's verbal comment #3.

8. TVC strongly reiterates that State Water Resource Control Board Resolution (SWRCB) 68-16 (i.e., the non-degradation policy) applies to groundwater at this site, not merely to discharges of treated water. This resolution applies to discharges: either underground or above ground discharges as is commonly understood by the general term discharge. While EPA notes that Resolution 92-49, paragraph III.G may be the more stringent of ARARs for setting in-situ cleanup standards, other Sections of 92-49 are also relevant, including paragraph III. F. Specifically, this paragraph cites that cleanup and abatement activities (emphasis added) shall conform to the provisions of Resolution 68-16.

Response: DOE/LLNL acknowledges that SWRCB Resolution 68-16, 92-49, and the RWQCB Water Quality Goals will be potential applicable or relevant and appropriate requirements (ARARs) to be considered during the selection of final ground water cleanup standards in the Final Site-Wide ROD in 2008.

9. Given that there are ecological receptors of special status and several rare and endangered species at Site 300 that may be affected by remedial action, we find it improper to proceed with a decision before the effects are fully known. Of particular concern are the red-legged frog and the tiger salamander. We recommend that both the United States Fish and Wildlife Service and the California Department of Fish and Game it be provided the opportunity to comment on this document before a decision is final. Note that Figure 2-18 of the same document charts 2nd quarter 2003 tritium plume. The extent of the 1,000 pCi/L goes beyond Spring 24, which was 2290 pCi/L. Also, page 13-14 describes the ecology of the Pit 7 area. It notes that "amphibians are known to use Spring 24".

Response: DOE/LLNL is committed to protecting all special status and endangered species and their habitats. Mandatory 60-day advance notification of all ground-breaking activities will initiate an ecological survey by an LLNL biologist to identify the presence of sensitive species and to mitigate any adverse impacts of the project. The LLNL biologist is aware of potential habitat for the California red-legged frog and California tiger salamander at Site 300 and works in concert with the United States Fish and Wildlife Service and the California Department of Fish and Game when necessary to ensure compliance with these agency regulations.

10. An ecological risk assessment was conducted to evaluate potential impacts to plants and animals from exposure to contamination at the Pit 7 Complex using EPA risk assessment guidelines. This assessment indicated that there is no threat to animals or plants, including endangered and threatened species, from exposure to contaminants at Spring 24 or elsewhere in the Pit 7 Complex area. Given the extensive community of Spanish-speaking residents in Tracy, we recommend that the Proposed Plan (and/or a fact sheet of its key points) be offered in Spanish and English.

Response: DOE/LLNL complies with all State and Federal requirements for public notifications, conducting Public Meetings, and other community participation and outreach efforts. However, DOE will evaluate the feasibility of issuing the next public fact sheet, the "Proposed Plan for Environmental Cleanup of LLNL Site 300," in both English and Spanish. This document is scheduled to be published in the fall of 2006.

11. Again, thank you for this opportunity to comment on the Proposed Plan for the Pit 7 Complex. We continue to appreciate the commitment to effective remediation that staff at DOE and LLNL have shown over the years. And, we further commend your commitment to community involvement – even as we reiterate our request for key materials to be offered in Spanish and English and that additional outreach be undertaken to involve the Latino community in the Tracy area.

We offer these recommendations in the spirit of ensuring a comprehensive and effective cleanup of Site 300 not only in the present but also into the future (until completion). We have noted above the relationship of the Proposed Plan to the ROD. In sum, we believe that the Proposed Plan for this area is one of the critical decision points for achieving the goal of effective cleanup of Site 300.

Response: Thank you for the comment.

4. References

Ferry, L., R. Ferry, W. Isherwood, R. Woodward, T. Carlsen, Z. Demir, R. Qadir, and M. Dresen (1999), *Final Site-Wide Feasibility Study for Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-132609).

Ferry, R., L. Ferry, M. Dresen, and T. Carlsen (2002), *Compliance Monitoring Plan/Contingency Plan for Interim Remedies at Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-147570).

Krauter, G. (2004), Lawrence Livermore National Laboratory, B Division, Livermore, Calif., memorandum to Michael Taffet, LLNL, Environmental Restoration Division, Livermore, Calif., June 21, 2004, "Use of Natural Uranium in Explosives Experiments at Site 300 Firing Bunkers."

Rogers/Pacific Corporation (1990), *Closure and Post-Closure Plans Volume II, Landfill Pits 1 and 7*, prepared for Lawrence Livermore National Laboratory, Livermore, Calif. (EPA ID No. 2890090002).

Taffet, M.J., L.K. Green-Horner, L.C. Hall, T.M. Carlsen, and J.A. Oberdorfer (1996), *Addendum to the Site-Wide Remedial Investigation Report*, *Lawrence Livermore National Laboratory Site 300*, *Building 850/Pit 7 Complex Operable Unit*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR108131 Add. 1).

Taffet, M.J., L., Ferry, V. Madrid, T. Carlsen, Z. Demir, J. Valett, M. Dresen, W. Daily, S. Coleman, and V. Dibley (2005), *Final Remedial Investigation/Feasibility Study for the Pit 7 Complex at Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-202492).

U.S. DOE (1997), *Final Record of Decision for the General Services Area Operable Unit Lawrence Livermore National Laboratory Site 300,* Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-124061).

U.S. DOE (2001), *Interim Site-Wide Record of Decision for Lawrence Livermore National Laboratory Site 300,* Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-138470).

U.S. DOE (2004), *Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories*, *Livermore, California*, U.S. Department of Energy, Washington, D.C.

U.S. DOE (2006), *Proposed Plan for Environmental Cleanup at the Pit 7 Complex Lawrence Livermore National Laboratory Site 300,* Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-215719).

U.S. EPA (2000), *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, Office of Emergency and Remedial Response, Washington, D.C. (EPA 540-R-00-002) OSWER 9355.0-75.

Webster-Scholten, C.P., Ed. (1994), *Final Site-Wide Remedial Investigation Report*, *Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-108131).

Wood, C. (2004), Lawrence Livermore National Laboratory, B Division, Livermore, Calif., memorandum to Michael Taffet, LLNL, Environmental Restoration, Livermore, Calif., June 15, 2004, "Site 300 Depleted Uranium."

Ziagos, J., and E. Reber-Cox (1998), *Ground Water Tritium Plume Characterization Summary Report for the Building 850/Pits 3&5 Operable Unit*, *Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif.

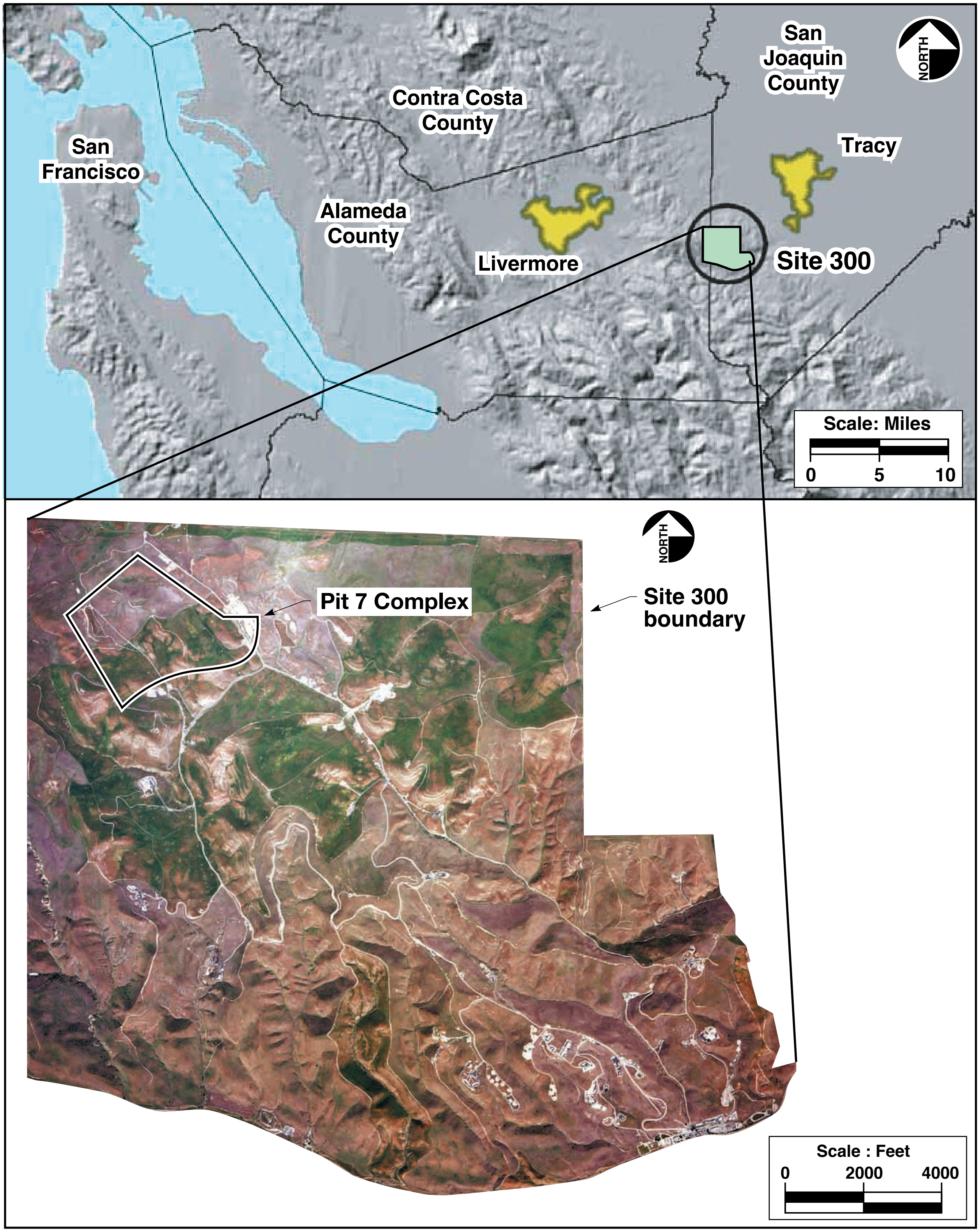
5. Acronyms and Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below ground surface
CAREs	Communities Against a Radioactive Environment
CCR	California Code of Regulations
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Ci	Curies
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cm/sec	Centimeters per second
COCs	Contaminants of Concern
CO_3	Carbonate
DCE	Dichloroethylene
DOE	Department of Energy
DTSC	(California) Department of Toxic Substances Control

EPA	Environmental Protection Agency
FFA	Federal Facility Agreement
ft	Feet
gpd	Gallons per day
HE	High Explosives
HI	Hazard Index
HQ	Hazard quotient
HSU	Hydrostratigraphic unit
I	Interstate
LLNL	Lawrence Livermore National Laboratory
MCL	Maximum Contaminant Level
mi^2	Square mile
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
O&M	Operation & Maintenance
OU	Operable Unit
PCE	Perchloroethylene, also known as tetrachloroethylene
pCi/L	PicoCuries per liter
ppm	Part per million
Qal/WBR	Quaternary alluvium and weathered bedrock
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RfD	Reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RWQCB	(California) Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SF	Slope factor
SVRA	Carnegie State Vehicle Recreation Area
SWFS	Site-Wide Feasibility Study
SWRCB	(California) State Water Resources Control Board
SWRI	Site-Wide Remedial Investigation
TCE	Trichloroethylene
Tmss	Tertiary Cierbo Formation
$Tnbs_0$	Tertiary Neroly basal sandstone
$Tnbs_1$	Tertiary Neroly lower blue sandstone

$Tnsc_0$	Tertiary Neroly basal siltstone/claystone
U	Uranium
UCRL	University of California Radiation Laboratory
UO_2	Uranium dioxide
VOCs	Volatile organic compounds
WBR	Weathered bedrock
WQOs	Water quality objectives
μg/L	Micrograms per liter
yd^3	Cubic yards

Figures



ERD-S3R-06-0028

Figure 2-1. Location of LLNL Site 300.

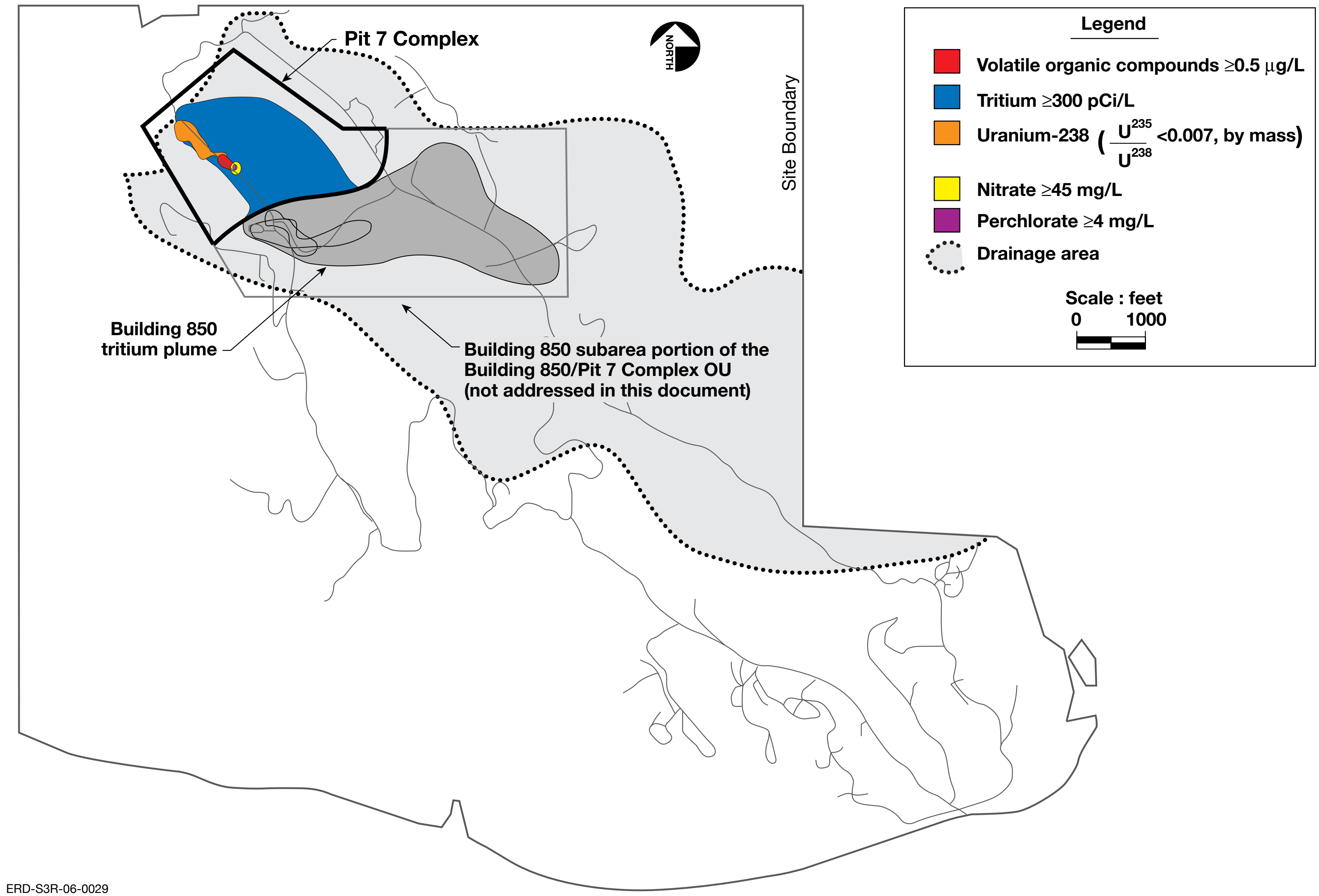
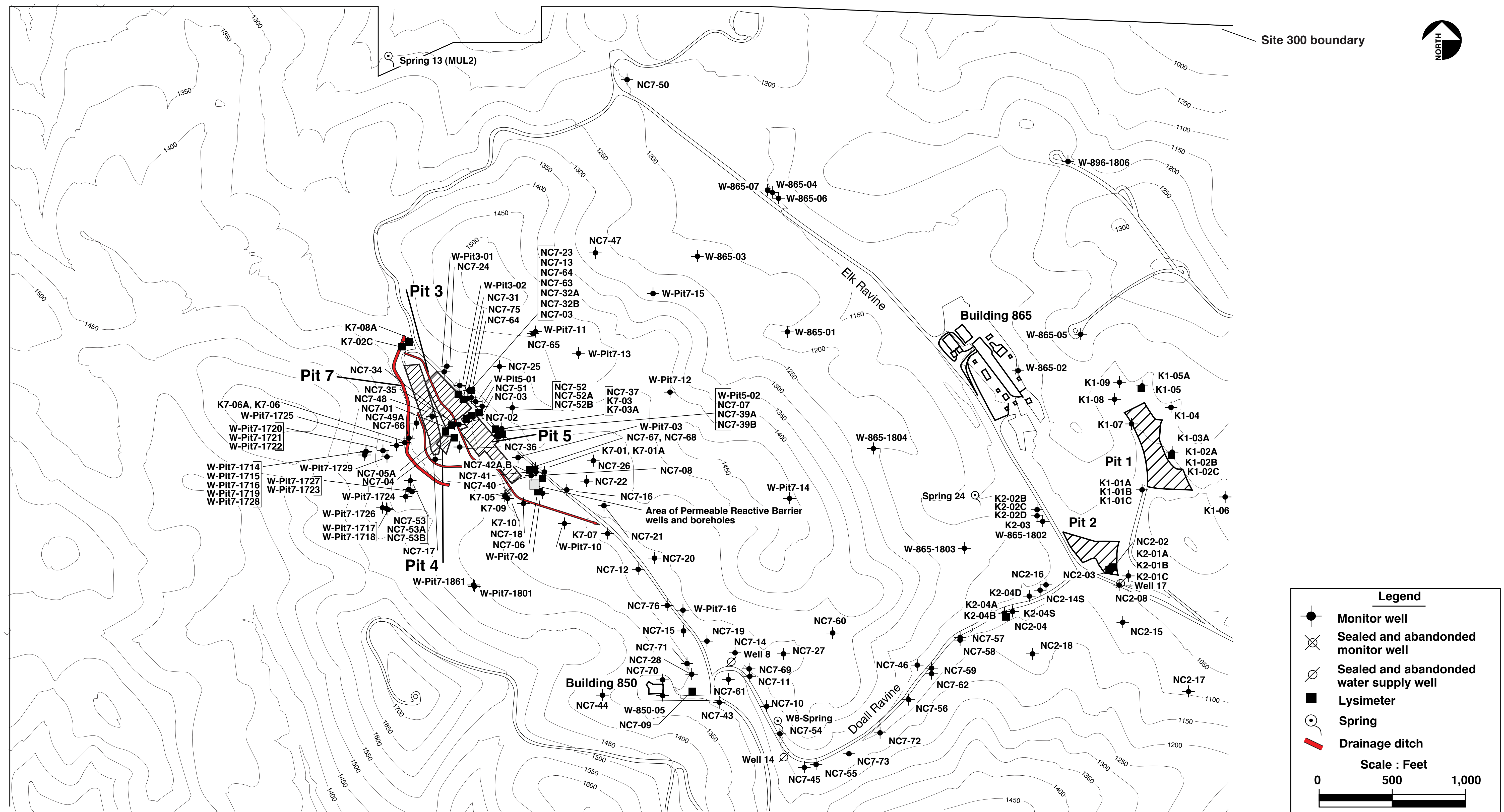
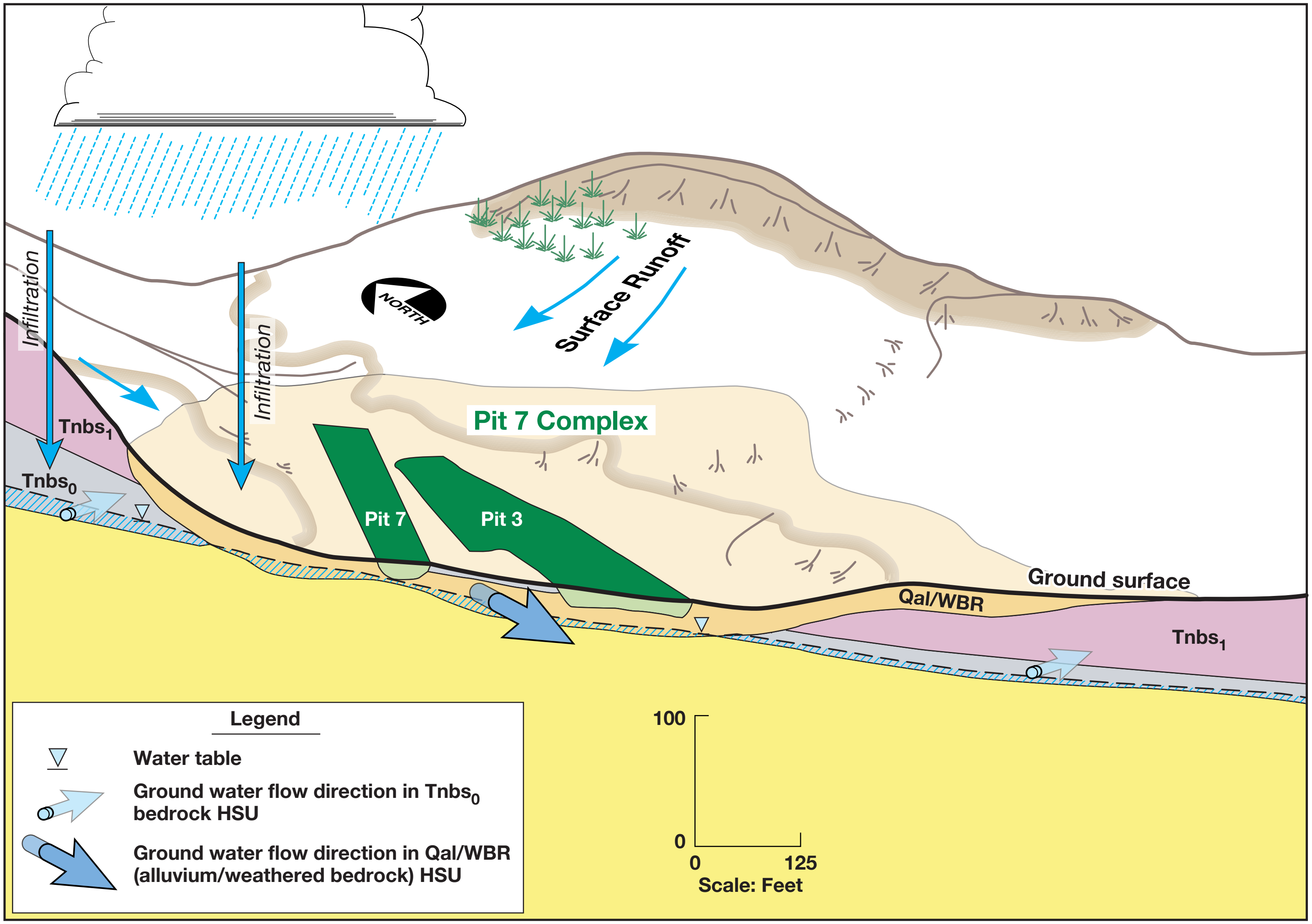


Figure 2-2. Location of the Pit 7 Complex and contaminant plumes.



ERD-S3R-06-0030

Figure 2-3. Pit 7 Complex Area map showing topography, roads, buildings, wells, lysimeters, springs, pits, and drainage ditches.



ERD-S3R-06-0054

Figure 2-4. Conceptual hydrogeological model for the Pit 7 Complex (view is to the northeast).

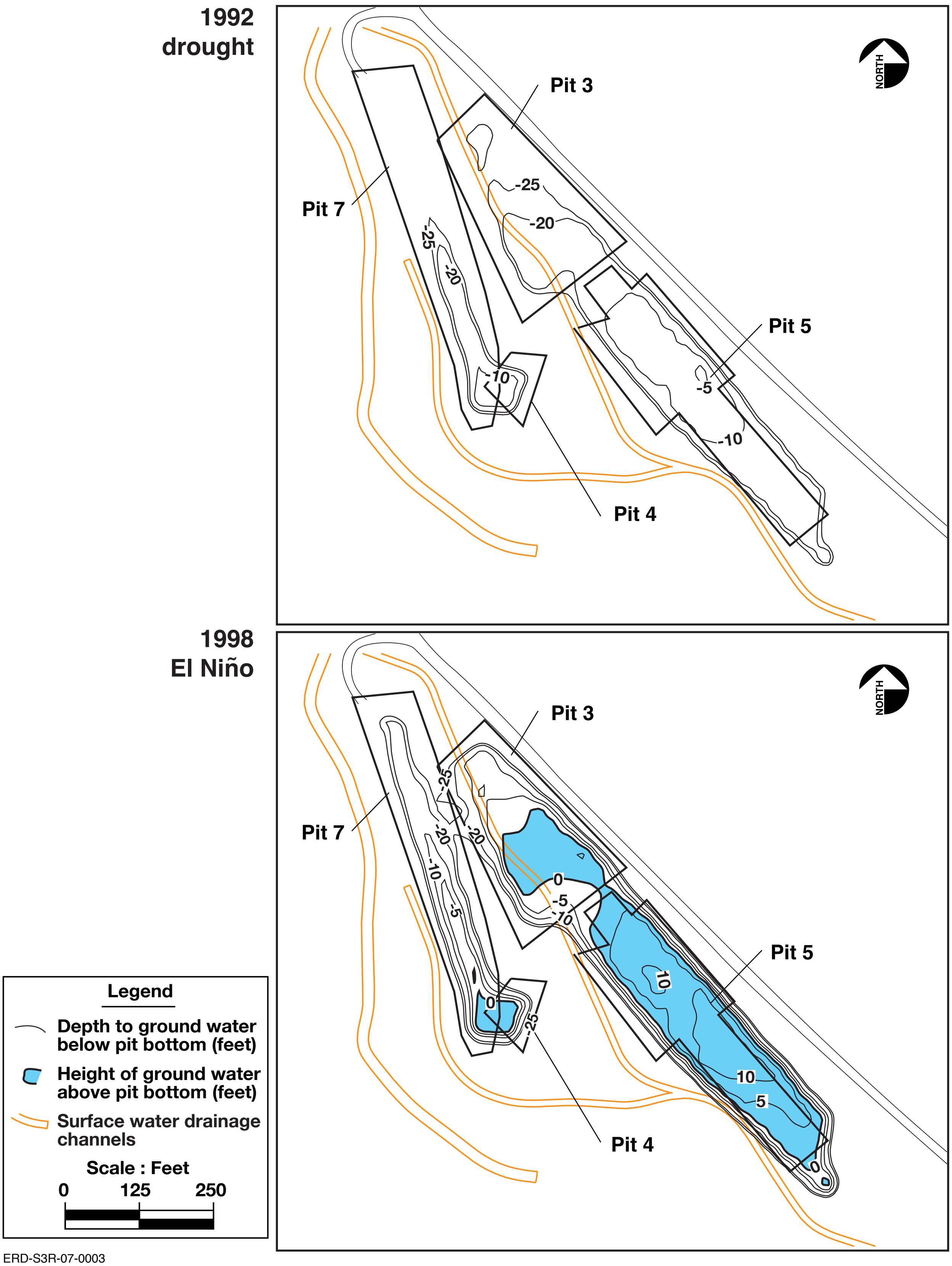
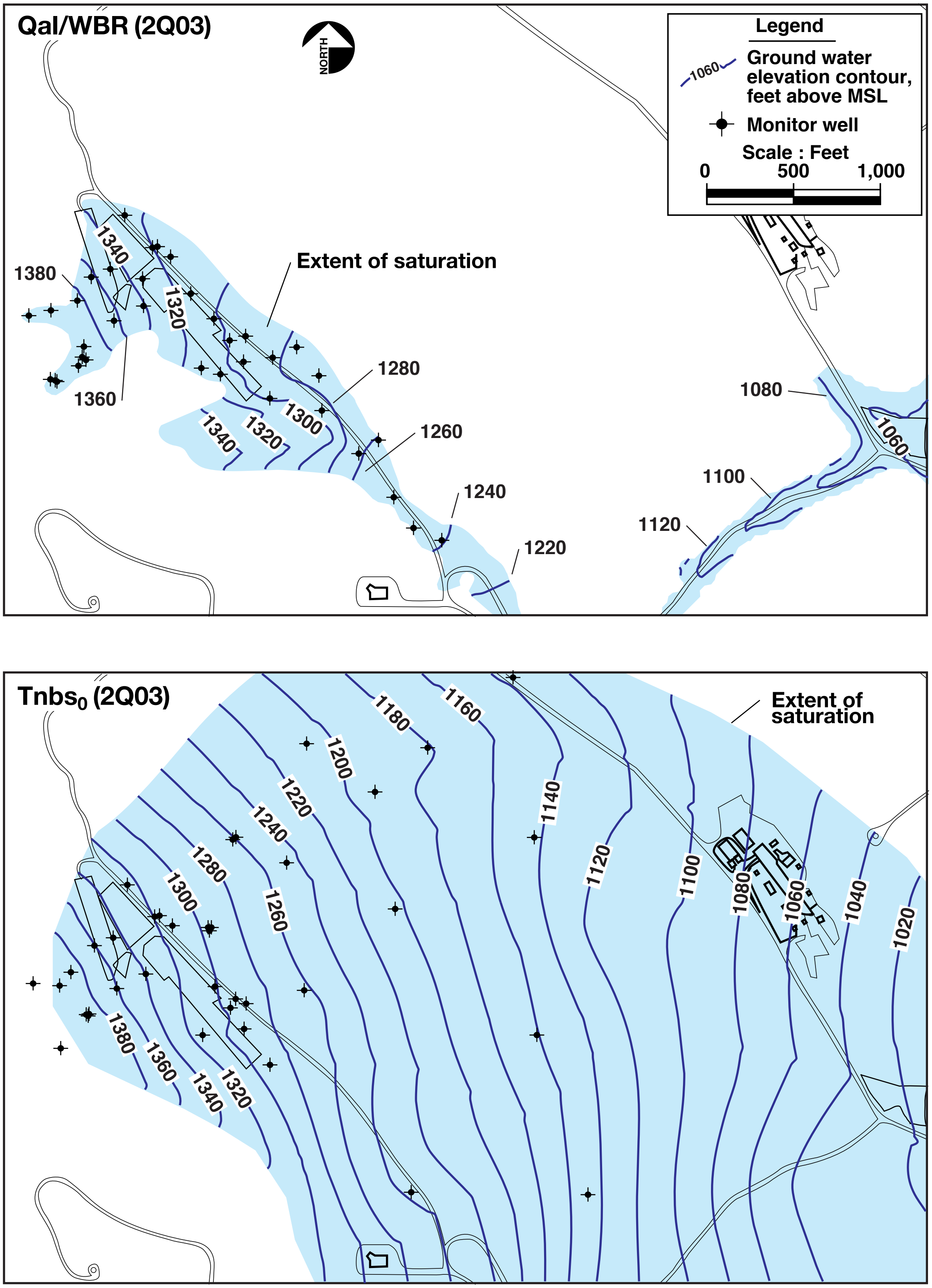


Figure 2-5. Ground water depth in relation to pit bottom at the Pit 7 Complex in 1992 (drought) and 1998 (El Niño).



ERD-S3R-06-0125

Figure 2-6. Second quarter 2003 ground water elevation contour maps for the Qal/WBR and $Tnbs_0$ HSUs.

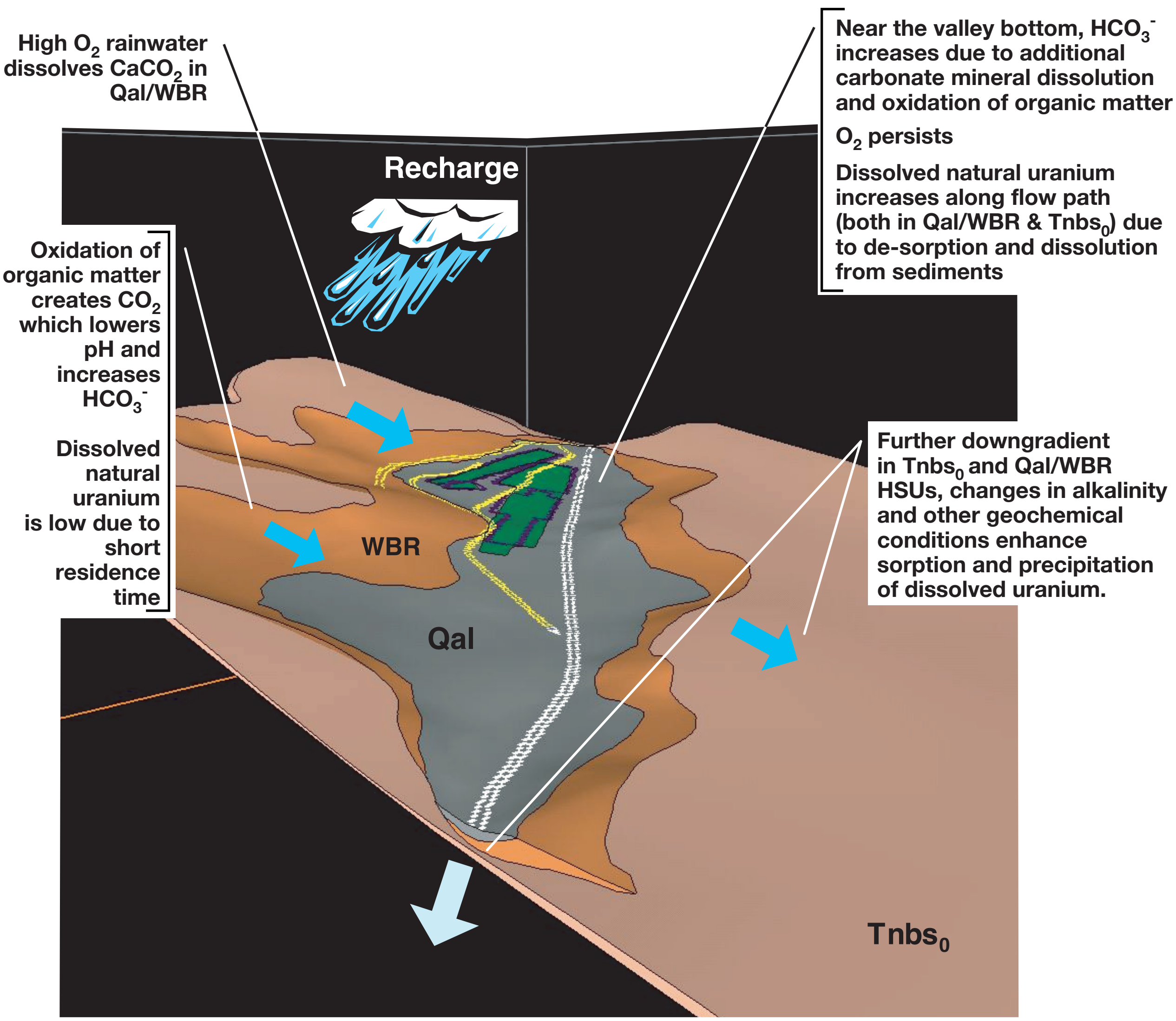
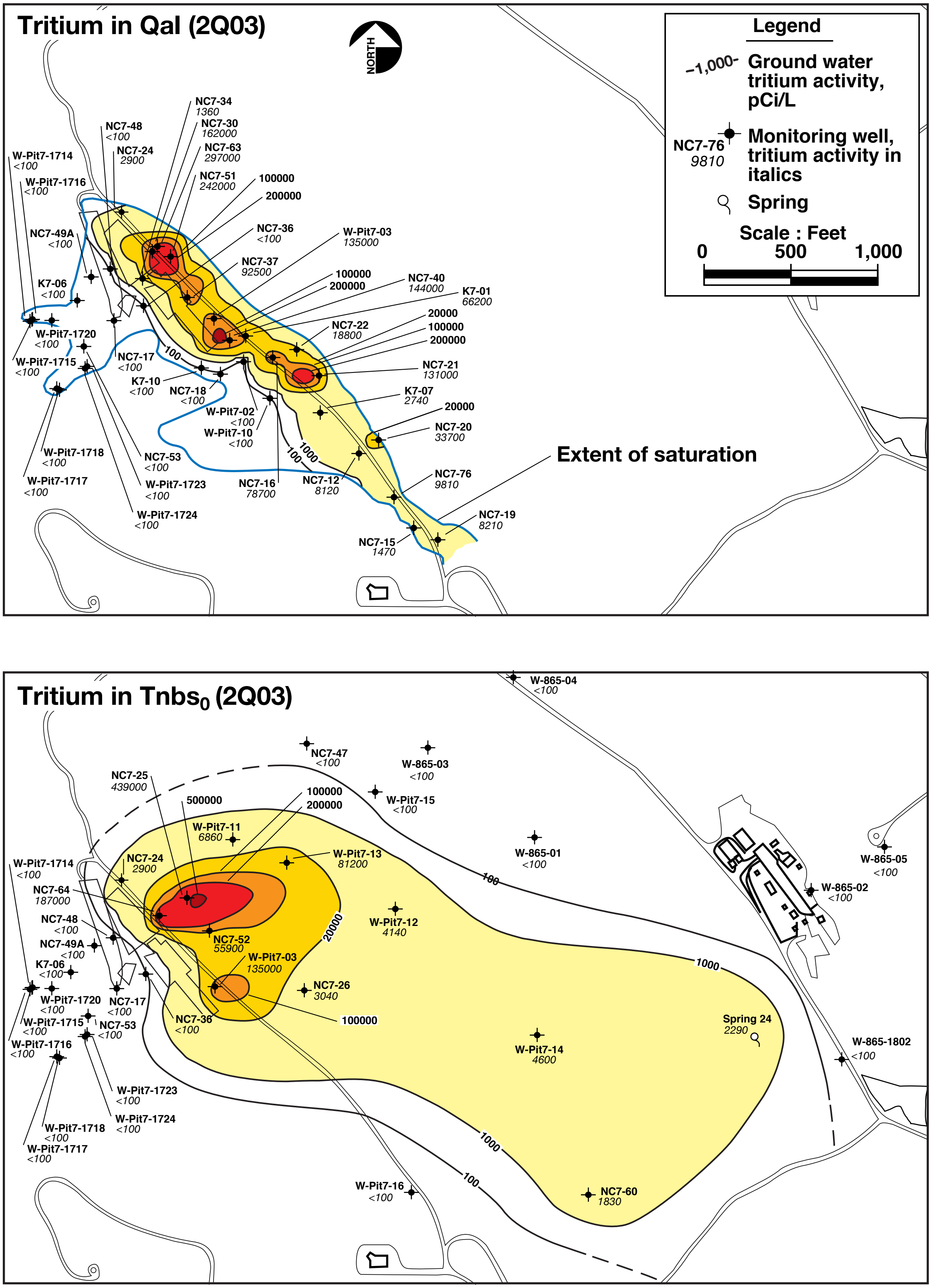
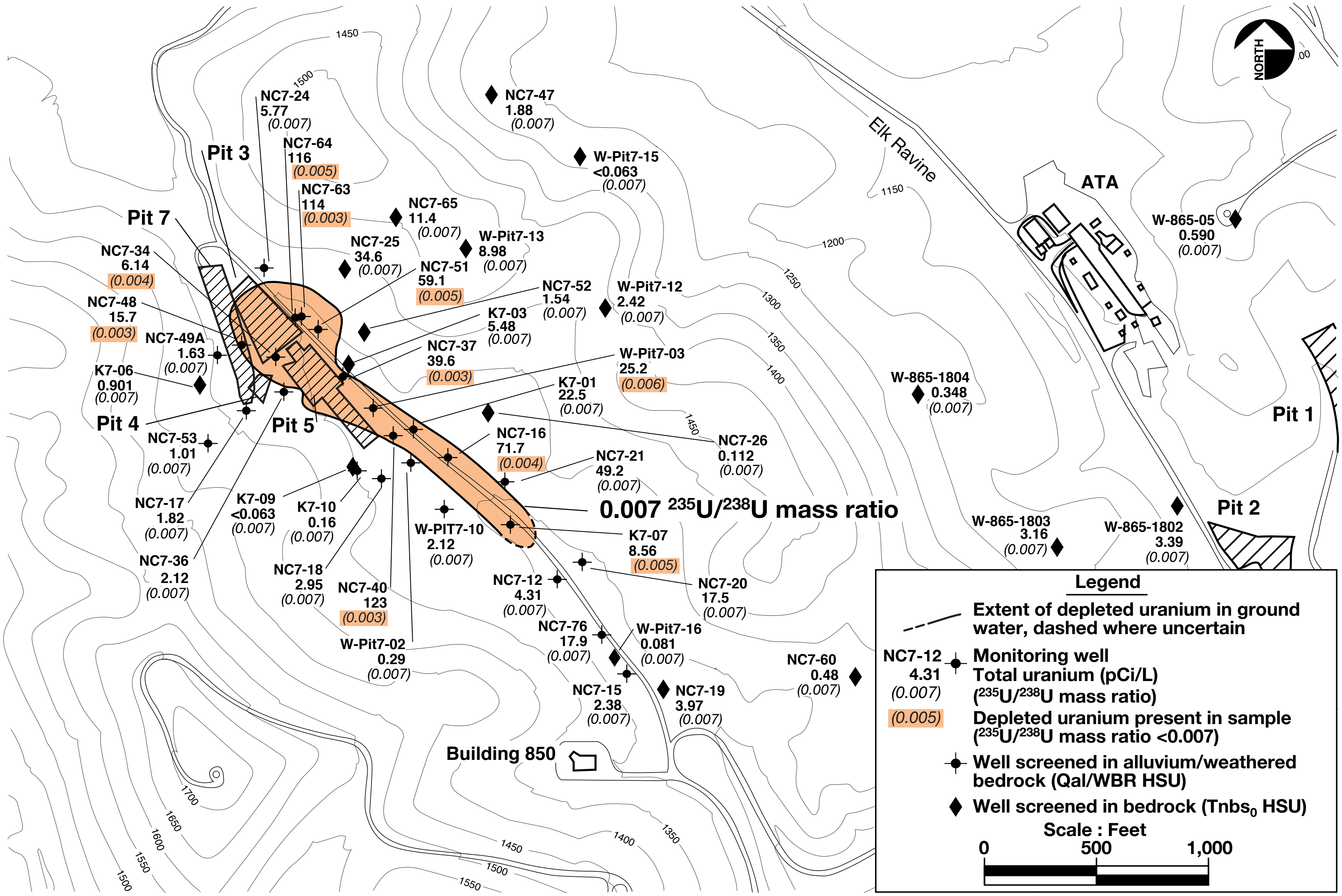


Figure 2-7. Conceptual model of ground water chemical evolution relevant to uranium mobilization at the Pit 7 Complex.



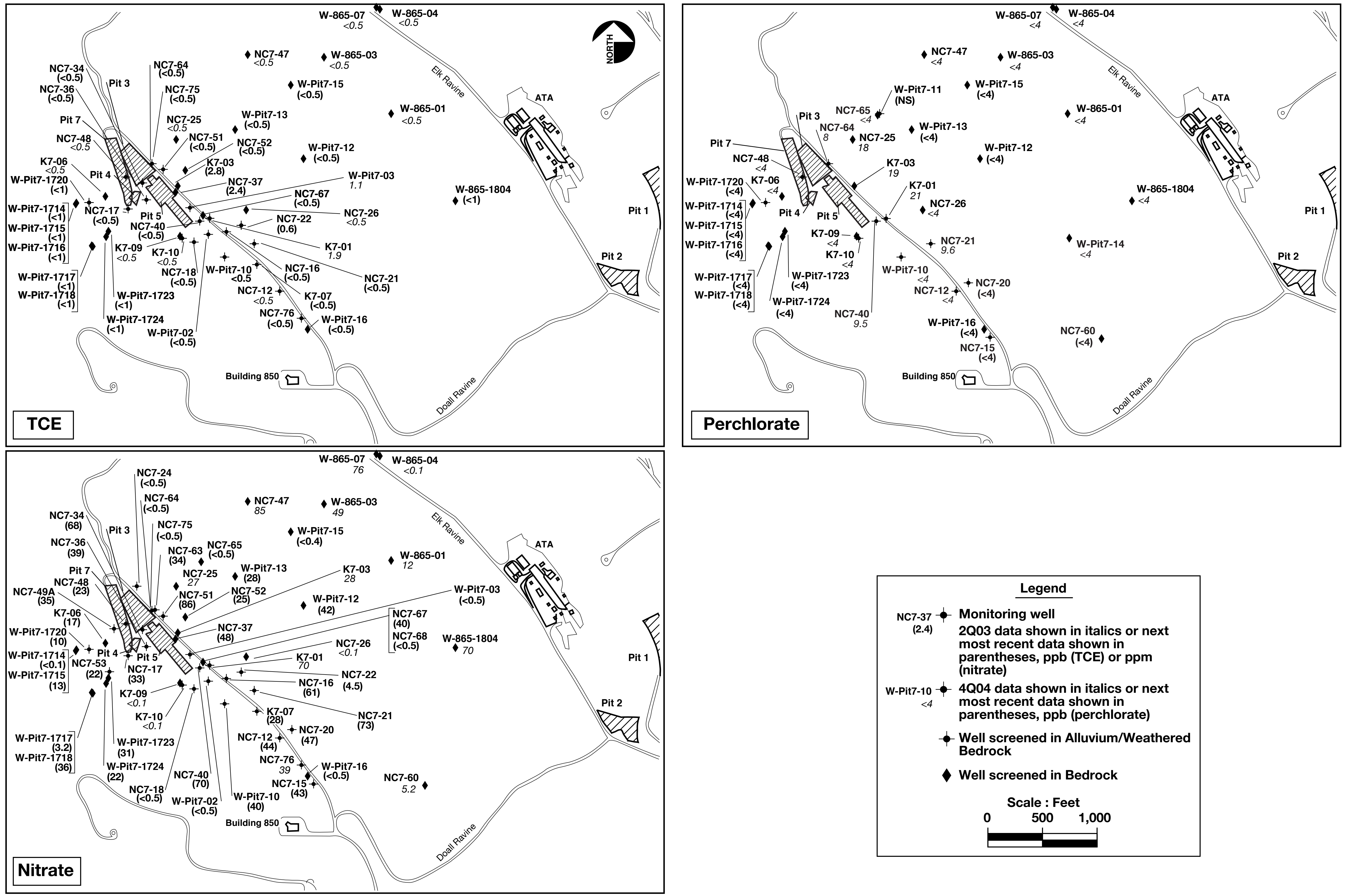
ERD-S3R-06-0122

Figure 2-8. Second quarter 2003 tritium plumes in the Qal/WBR and Tnbs$_0$ HSUs.



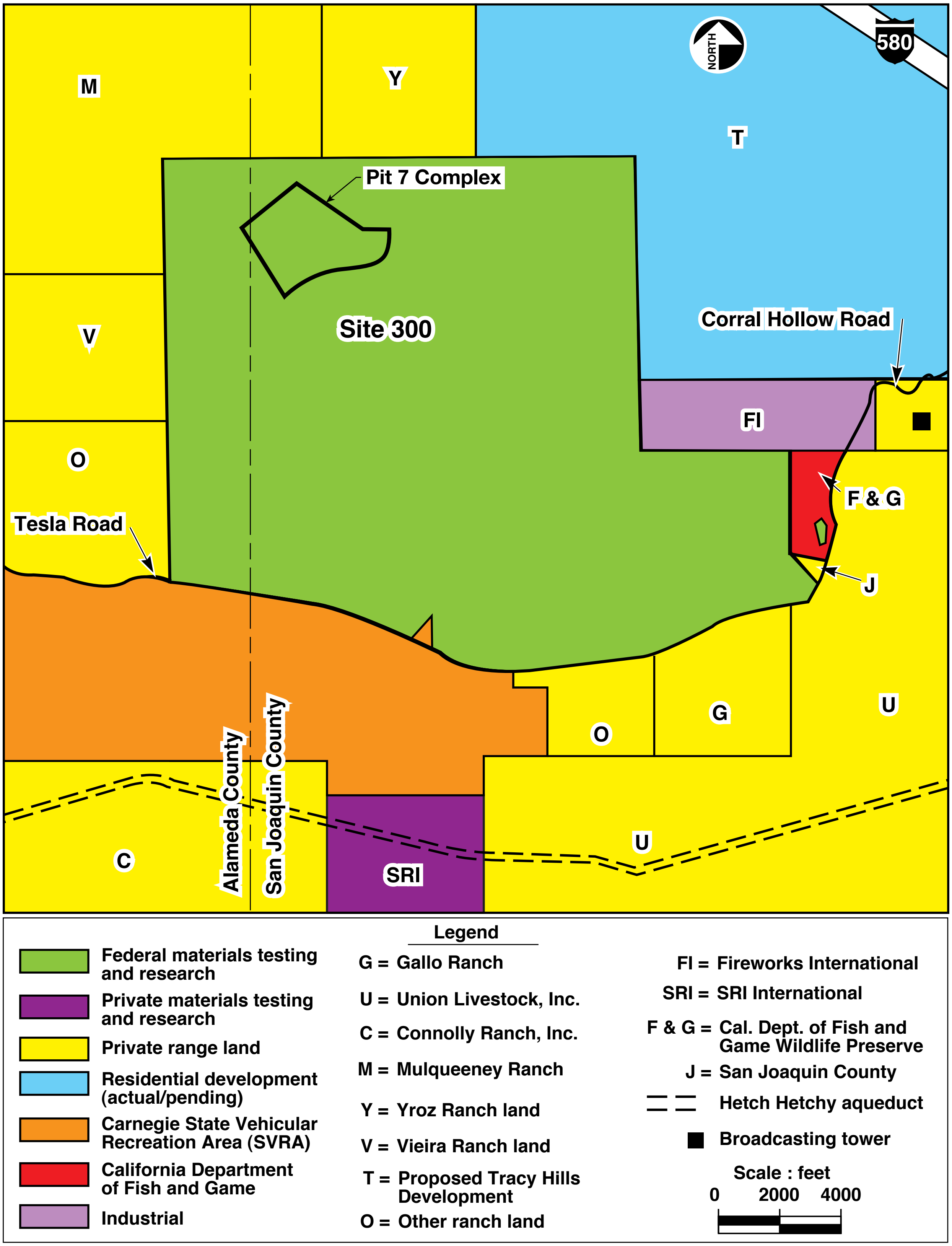
ERD-S3R-06-0123

Figure 2-9. Extent of depleted uranium mass ratio in ground water.



ERD-S3R-06-0124

Figure 2-10. TCE, perchlorate, and nitrate concentrations in ground water.



ERD-S3R-06-0036

Figure 2-11. Land use in the vicinity of Site 300.

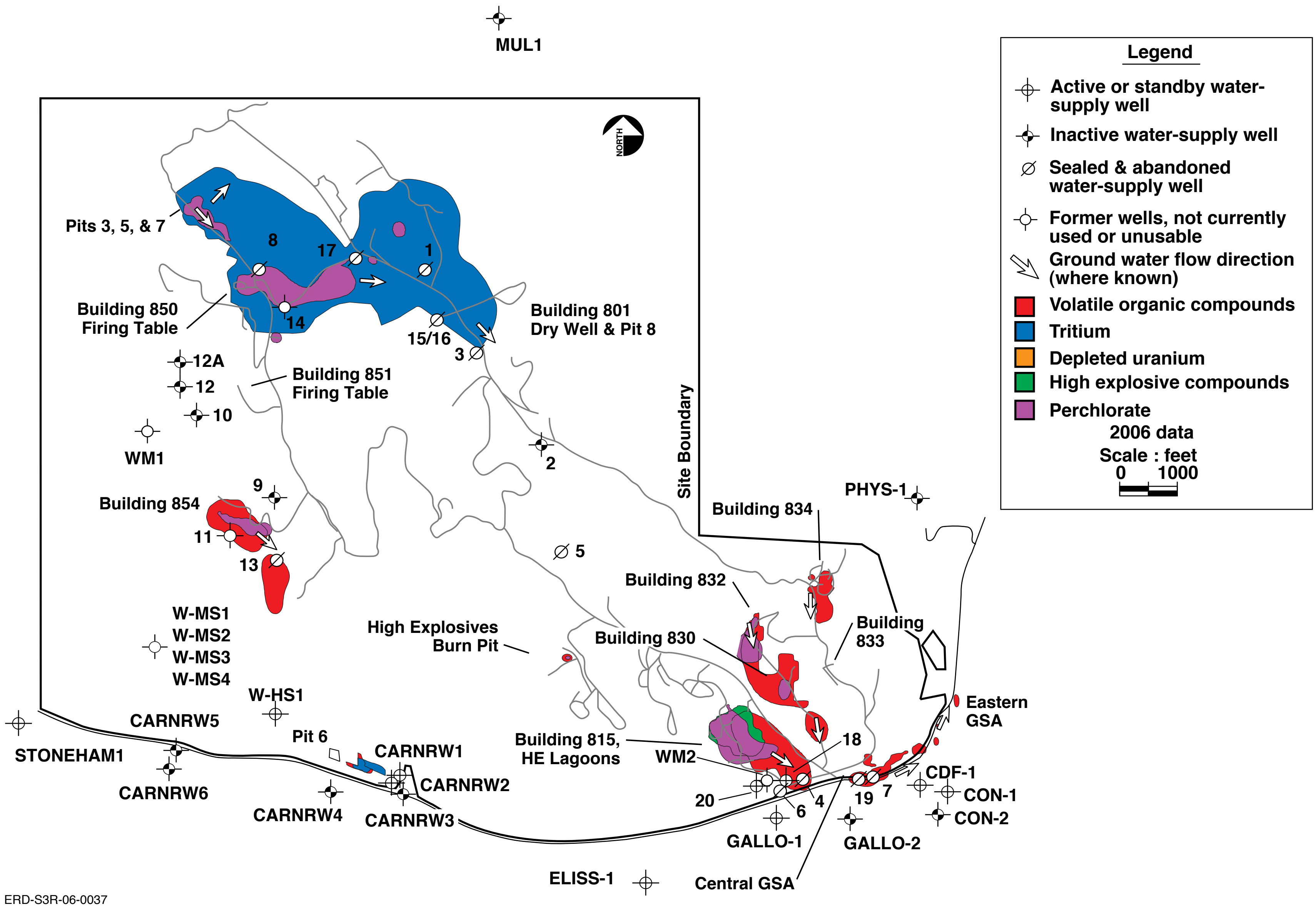
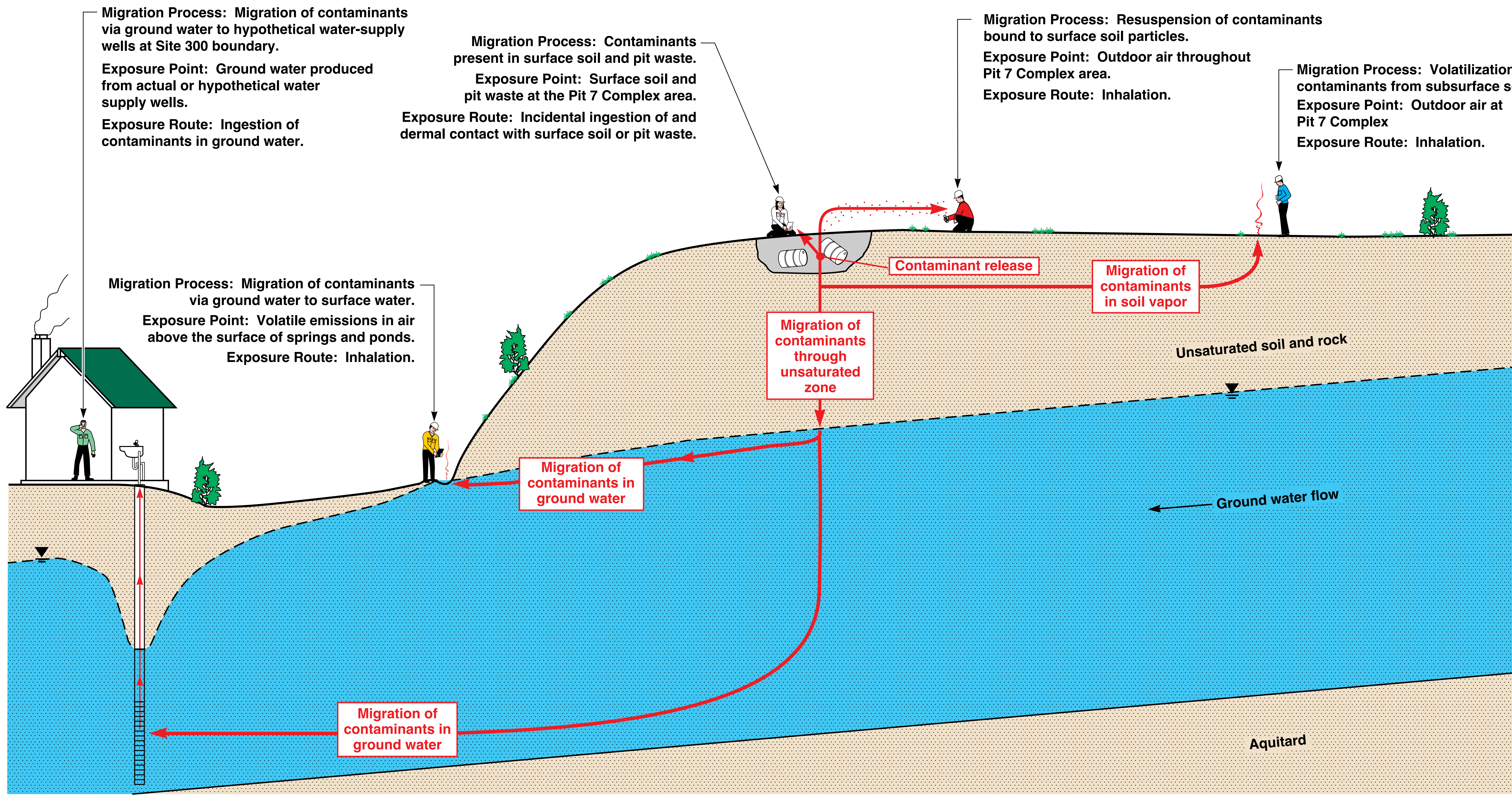
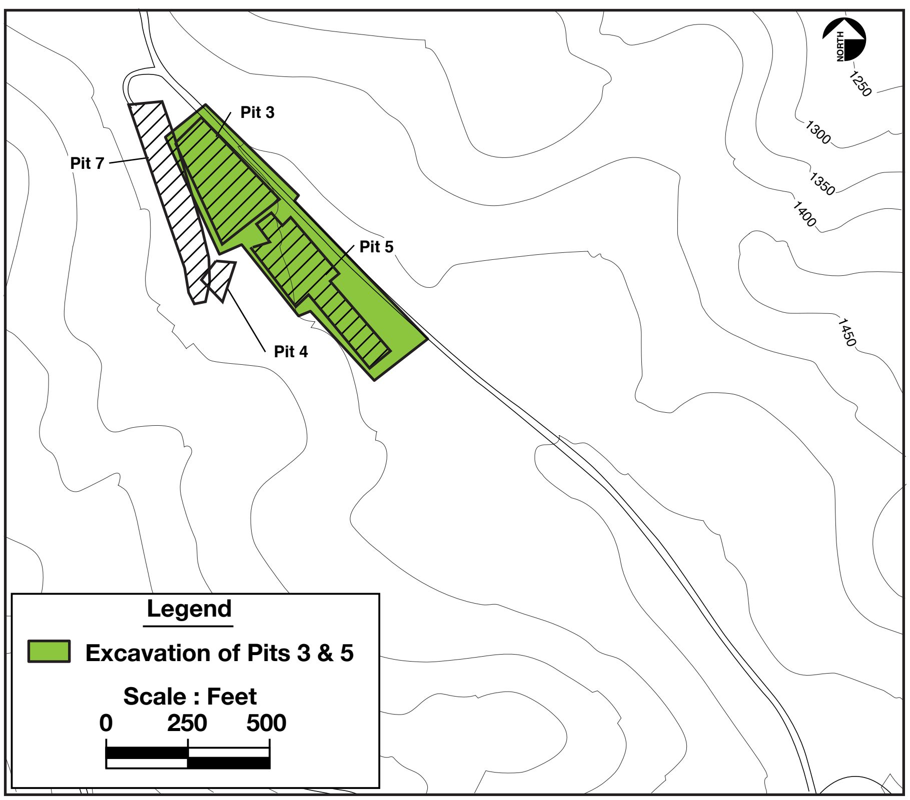


Figure 2-12. Locations of water-supply wells in relation to Site 300 ground water contaminant plumes.



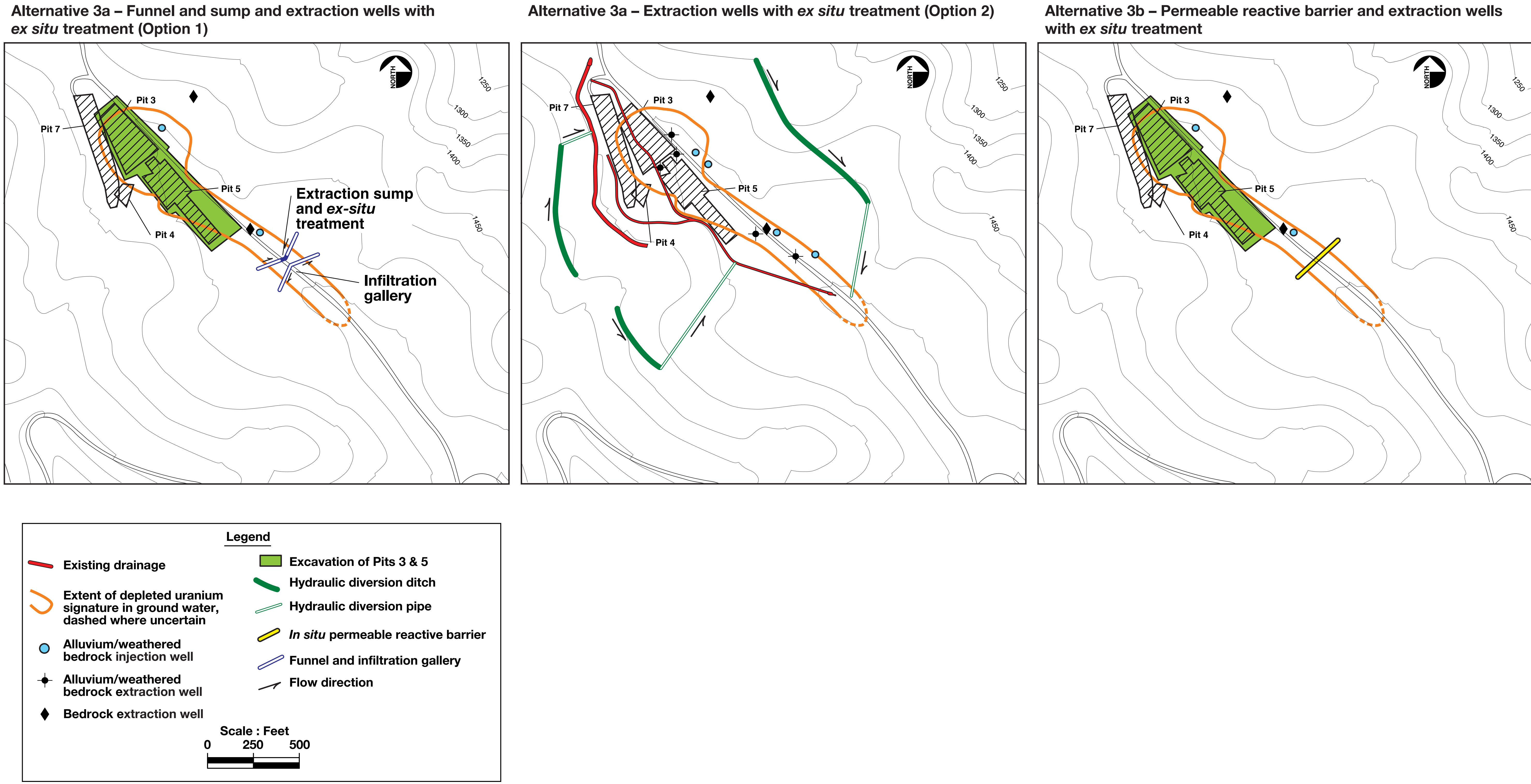
ERD-S3R-06-0033

Figure 2-13. Conceptual human exposure scenarios for the Pit 7 Complex.



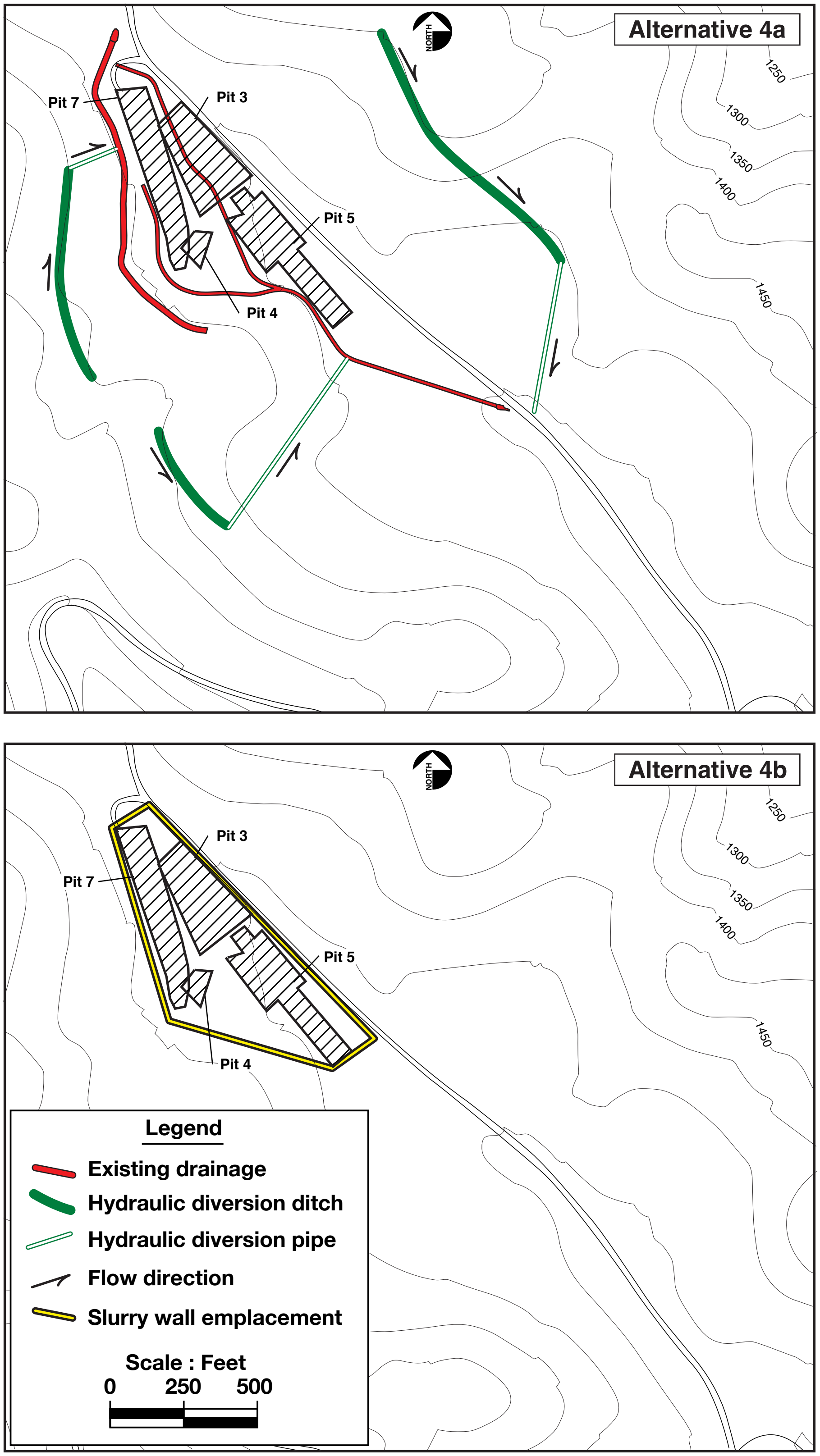
ERD-S3R-06-0038

Figure 2-14. Locations of the components of Remedial Alternative 2 at the Pit 7 Complex.



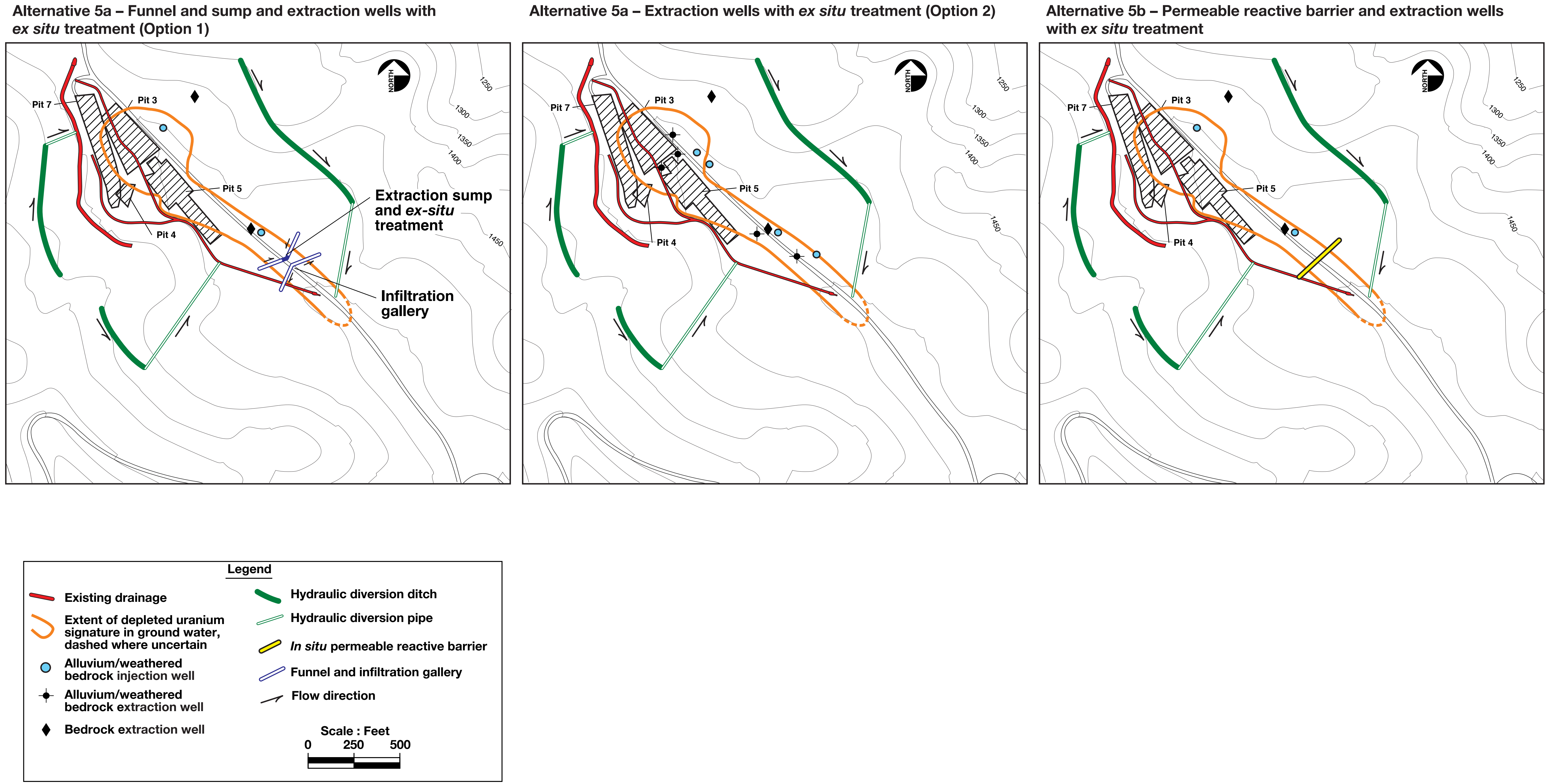
ERD-S3R-06-0039

Figure 2-15. Locations of the components of Remedial Alternatives 3a and 3b at the Pit 7 Complex.



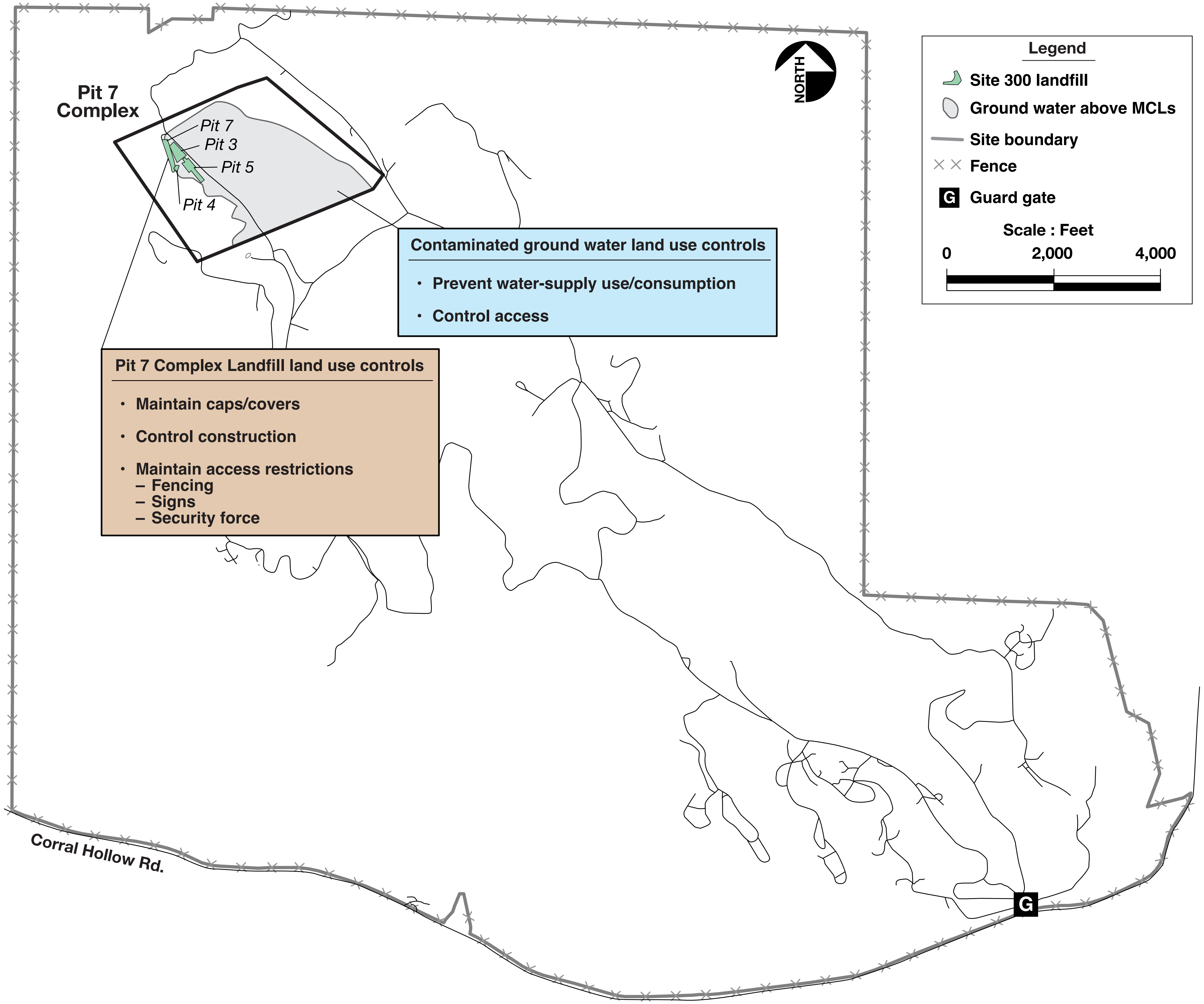
ERD-S3R-06-0040

Figure 2-16. Locations of the components of Remedial Alternatives 4a and 4b at the Pit 7 Complex.



ERD-S3R-06-0041

Figure 2-17. Locations of the components of Remedial Alternatives 5a and 5b at the Pit 7 Complex.



ERD-S3R-06-0104

Figure 2-18. Pit 7 Complex land use controls.

Tables

Table 1-1. Remedial alternatives for the Pit 7 Complex.

Alternative 1	Alternative 2	Alternative 3a	Alternative 3b
No further action for all contaminants and media of concern.	**Component A: Ground water monitoring.**	**Component A: Ground water monitoring.**	**Component A: Ground water monitoring.**
	Component B: Exposure control through risk and hazard management.	**Component B: Exposure control through risk and hazard management.**	**Component B: Exposure control through risk and hazard management.**
	Component C: Monitored natural attenuation of tritium in ground water.	**Component C: Monitored natural attenuation of tritium in ground water.**	**Component C: Monitored natural attenuation of tritium in ground water.**
	Component D: Excavation and disposal of Pit 3 and 5 waste.	**Component D: Control migration of uranium, nitrate, and perchlorate in ground water using *ex situ* ground water extraction and treatment.**	**Component D: Control migration of uranium, nitrate, and perchlorate in Qal/WBR ground water using *in situ* reactive permeable barrier and extraction and *ex situ* treatment of $Tnbs_0$ ground water.**
		Component E: Excavation and disposal of Pit 3 and 5 waste.	**Component E: Excavation and disposal of Pit 3 and 5 waste.**
Previous interim actions: Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).	**Previous interim actions: Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**	**Previous interim actions: Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**	**Previous interim actions: Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**
Total Estimated Cost: $0	**Total Estimated Cost: $56,635,000**	**Total Estimated Cost: $63,741,000 (extraction wells) to $68,326,000 (funnel and sump with extraction and *ex situ* treatment)**	**Total Estimated Cost: $73,979,000**

Table 1-1 (Cont.). Remedial alternatives for the Pit 7 Complex.

Alternative 4a	Alternative 4b	Alternative 5a	Alternative 5b
Component A: **Ground water monitoring.**	**Component A:** **Ground water monitoring.**	**Component A:** **Ground water monitoring.**	**Component A:** **Ground water monitoring.**
Component B: **Exposure control through risk and hazard management.**	**Component B:** **Exposure control through risk and hazard management.**	**Component B:** **Exposure control through risk and hazard management.**	**Component B:** **Exposure control through risk and hazard management.**
Component C: **Monitored natural attenuation of tritium in ground water.**	**Component C:** **Monitored natural attenuation of tritium in ground water**	**Component C:** **Monitored natural attenuation of tritium in ground water.**	**Component C:** **Monitored natural attenuation of tritium in ground water.**
Component D: **Source control by installing hydraulic diversion to prevent water from entering landfills.**	**Component D:** **Source containment by installing hydraulic barriers (slurry walls) to prevent water from entering landfills.**	**Component D:** **Source control by installing hydraulic diversion to prevent water from entering landfills.**	**Component D:** **Source control by installing hydraulic diversion to prevent water from entering landfills.**
		Component E: **Phased migration control of uranium, nitrate, and perchlorate in ground water using *ex situ* ground water extraction and treatment.**	**Component E:** **Phased migration control of uranium, nitrate, and perchlorate in Qal/WBR ground water using *in situ* reactive permeable barrier and extraction and *ex situ* treatment of $Tnbs_0$ ground water.**
Previous interim actions: **Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**	**Previous interim actions:** **Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**	**Previous interim actions:** **Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**	**Previous interim actions:** **Capped Pits 4 and 7 (and 30% of Pit 3) under RCRA (1992).**
Total Estimated Cost: **$3,738,000**	**Total Estimated Cost:** **$4,344,000**	**Total Estimated Cost:** **$10,845,000 (extraction wells) to $15,429,000 (funnel and sump with extraction and *ex situ* treatment).**	**Total Estimated Cost:** **$21,082,000**

Table 2-1. Contaminants of concern in surface soil and subsurface soil and rock for the Pit 7 Complex.

Media	Contaminant of Concern	Historical Maximum Concentration	Most Recent Maximum
Surface soil	**No surface soil contaminants of concern.**	**NA**	**NA**
Subsurface soil and rock (all sampled depths)	**Tritium**	**1,180 pCi/g (1984)** **(8,089,000 pCi/L in soil moisture)**	**947 pCi/g (1999)** **(6,210,000 pCi/L in soil moisture)**
	Uranium	**210 pCi/g (1999)** **(652.2 mg/kg)**	**210 pCi/g (1999)** **(652.2 mg/kg)**

Notes:

mg/kg = **Milligrams per kilogram.**

NA = **Not applicable.**

pCi/g = **Picocuries per gram.**

pCi/L = **Picocuries per liter.**

Table 2-2. Contaminants of concern in surface and ground water for the Pit 7 Complex.

Media	Contaminant of Concern	Historical Maximum Concentration	Maximum Concentration in 2005
Surface Water			
Spring 24	**No surface water COCs. No inhalation risk or hazard associated with volatile contaminants (tritium). All contaminants with activities greater than background are addressed in ground water.**	**NA**	**NA**
Ground Water	**VOCs[a, b]**		
	1,1-DCE	**6.2 μg/L (1985)**	**0.86 μg/L**
	TCE	**15 μg/L (1995)**	**2.6 μg/L**
	Radionuclides		
	Tritium	**2,660,000 pCi/L (1998)**	**398,000 pCi/L**
	Uranium	**781 pCi/L (1998)**	**170 pCi/L**
	Other		
	Nitrate (as NO_3)	**195 mg/L (1993)**	**150 mg/L**
	Perchlorate	**19 μg/L (2003)**	**29 μg/L**

Notes:

COC = Contaminant of concern.
DCE = Dichloroethylene.
mg/L = Milligrams per liter.
NA = Not applicable.
pCi/L = Picocuries per liter.
TCE = Trichloroethylene.
VOCs = Volatile organic compounds.
μg/L = Micrograms per liter.

[a] **Toluene and total xylenes were included as COCs in ground water in the Pit 7 RI/FS due to a limited sampling history. Additional sampling has been conducted after the Pit 7 RI/FS data cutoff date. These compounds have not been detected at a frequency to warrant being a COC. Therefore DOE has removed toluene and xylene from the list of ground water COCs.**

[b] **While concentrations of VOCs in ground water are below drinking water standards, they are listed in this table to meet the RWQCB requirement that any constituent with concentrations exceeding background in ground water be listed as a contaminant of concern. VOCs in ground water are detected in only four wells, and are continuing to decrease toward background concentrations.**

Table 2-3. Summary of re-evaluation of baseline human health effects for the Pit 7 Complex.

Media (Exposure Pathways)	Contaminant of Potential Concern	Baseline Risk
Surface soil (outdoor adult onsite exposure from inhalation of resuspended particulates, dermal absorption, and incidental ingestion)	Tritium	1×10^{-7}[a]
	Uranium-235	3×10^{-7}[a]
	Uranium-238	2×10^{-7}[a]
	Total Risk (surface soil)	6×10^{-7}
Subsurface soil (outdoor adult onsite exposure from inhalation of tritium volatilized from subsurface soil to air)	Tritium	4×10^{-6}[b]
Surface water (outdoor adult onsite exposure from inhalation of tritium volatilized from Spring 24 to air)	Tritium	1×10^{-9}[c]

Notes:

PRG = U.S. EPA Preliminary remediation goal.

[a] **Risk value was derived from comparison to the appropriate cancer PRG. The 95% upper confidence limit of each contaminant was divided by the contaminant-specific PRG and multiplied times 10^{-6} to calculate the risk value.**

[b] **Risk value from the SWRI report.**

[c] **Risk value from the Pit 7 Complex RI/FS.**

Table 2-4. Comparative evaluation of remedial alternatives for the Pit 7 Complex.

Alternative Number	Alternative Components	Overall Protection of Human Health and the Environment	Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Long-term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume (TMV)	Short-term Effectiveness	Implementability	Net Present Worth Cost
1.	No Further Action	○	○	○	○	◒	●	$0
		Least protective of human health or the environment compared to the other alternatives. Changes to plume size and location that could impact downgradient receptors cannot be determined without monitoring contaminants of concern (COCs).	Least compliant with remedial action objectives (RAOs) compared to the other alternatives. Potential inhalation of tritium vapors by onsite workers cannot be prevented without exposure control measures.	Least effective for the long-term without source control due to continued release of contaminants compared to the other alternatives.	Least effective for TMV compared to the other alternatives. Without source control and relying solely on natural attenuation, TMV may not be reduced in a reasonable timeframe due to continued release of contaminants.	The most effective alternative for the short-term protection of onsite workers since there would be no remediation-related construction occurring. There would be no short-term impact to human or ecological receptors. Least effective in terms of time to cleanup compared to the other alternatives as without source control, contaminant releases would continue.	This alternative is the easiest to implement.	This alternative has no implementation cost.
2.	Monitoring, exposure control, Monitored Natural Attenuation (MNA) for tritium source control through waste excavation	●	◍*	◔	◔	◔	◔	$56,635,000
		Addresses risk to human health (ground water ingestion and inhalation of tritium), controls source, and utilizes MNA to reduce tritium and other processes to reduce uranium activities in ground water.	Includes measures to meet State and Federal ARARs in ground water. Monitoring of the effects of dispersion, sorption, diffusion, and to a lesser extent, radioactive decay of uranium, will take longer than more active remedies in Alternatives 3a, 3b, 5a, and 5b*. Because human health and the environment will be protected during the time period necessary to reach the MCL for uranium, Alternative 2 is capable of achieving RAOs and ARARs without impacting human health or the environment. However, U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe for achieving the MCL or other RAOs for uranium. Alternative 2 may not be as effective in meeting ARARs as Alternatives 4 (a and b) and 5 (a and b) because contamination remains in the vadose zone that could degrade water quality. Alternative 2 does not comply with ARARs for perchlorate and nitrate, and there is no basis for an ARAR waiver.	Provides a more effective long-term, permanent solution for contaminant source in the pit waste through excavation, compared to Alternatives 4a, 4b, 5a, and 5b. However, the contaminant source in the vadose zone is not addressed.	Effectively and permanently reduces the mobility of the contaminants by removing the pit waste source. It would not reduce the toxicity or volume of the contaminants as the waste would be redeposited at a different location. The TMV of contaminants in the vadose zone bedrock would not be reduced. The mobility of uranium in ground water would be reduced through sorption to aquifer rocks, but its toxicity and volume would not be reduced. The TMV of VOCs, nitrate, and perchlorate in ground water would not be reduced.	Not as effective as 1, 4a, 4b, 5a, and 5b for short term onsite worker protection. A high level of exposure control would be necessary to prevent short-term exposure of onsite workers and ecological receptors during excavation. Compares equally to Alternatives 3a and 3b. Because human health would be protected during time period (up to 500 years) to reach the MCL for uranium, Alternative 2 provides short-term effectiveness without impacting human health or the environment. However, U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe to achieve the MCL or other RAOs for uranium.	This alternative is not as implementable as Alternatives 1, 4a, 4b, 5a, and 5b. Implementability is contingent on locating a facility permitted and willing to accept low-level mixed waste at a reasonable cost. Compares equally to Alternatives 3a and 3b.	Cost of this alternative is very high compared to Alternatives 4a, 4b, 5a, and 5b.

Table 2-4 (Cont.). Comparative evaluation of remedial alternatives for the Pit 7 Complex.

Alternative Number	Alternative Components	Overall Protection of Human Health and the Environment	Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Long-term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume (TMV)	Short-term Effectiveness	Implementability	Net Present Worth Cost
3a.	Monitoring, exposure control, MNA for tritium, source control through waste excavation, uranium, nitrate, and perchlorate plume migration control by *ex situ* treatment	●	◕	◕	◒	◔	◔	$63,741,000 (extraction wells) to $68,326,000 (funnel and sump with extraction and *ex situ* treatment
		Addresses risk to human health (ground water ingestion and inhalation of tritium), controls source, and utilizes MNA to reduce tritium and *ex situ* treatment to reduce uranium, nitrate, and perchlorate in ground water.	Includes measures to meet State and Federal ARARs in ground water. Uranium, nitrate, and perchlorate will be treated using *ex situ* treatment to meet ground water cleanup standards to be agreed upon in the final Site-Wide ROD. Alternative 3a may not be as effective in meeting ARARs as Alternatives 4 (a and b) and 5 (a and b) because contamination remains in the vadose zone that could degrade water quality.	Provides a more effective long-term, permanent solution for contaminant source in the pit waste through excavation, compared to Alternatives 1, 2, 4a, 4b, 5a, and 5b. However the contaminant source in the vadose zone is not addressed.	Effectively and permanently reduces the mobility of the contaminants by removing the pit waste source. Alternative 3a would not reduce the toxicity or volume of the contaminants as the waste would be redeposited at a different location. The TMV of contaminants in the bedrock may not be reduced. The ground water contaminants' TMV would be reduced using active uranium remediation, therefore this alternative would more rapidly reduce TMV than Alternatives 1, 2, 4a, and 4b that use MNA.	Not as effective as 1, 4a, 4b, 5a, and 5b for short-term onsite worker protection. A high level of exposure control would be necessary to prevent short-term exposure of onsite workers and ecological receptors during excavation. Compares equally to Alternatives 2 and 3b. Because human health would be protected during time period (150 to 500 years) to reach the MCL for uranium, Alternative 3a provides short-term effectiveness without impacting human health or the environment.	This alternative is not as implementable as Alternatives 1, 4a, 4b, 5a, and 5b. Implementability is contingent on locating a facility permitted and willing to accept low-level mixed waste at a reasonable cost. Compares equally to Alternatives 2 and 3b.	Cost of this alternative is very high compared to Alternatives 4a, 4b, 5a, and 5b.
3b.	Monitoring, exposure control, MNA for tritium, source control through waste excavation, uranium, nitrate, and perchlorate plume migration control by *in situ* treatment of Qal/WBR ground water and extraction and *ex situ* treatment of $Tnbs_0$ ground water	●	◕	◕	◒	◔	◔	$73,979,000
		Addresses risk to human health (ground water ingestion and inhalation of tritium), controls source, and utilizes MNA to reduce tritium and *in situ* treatment to reduce uranium, nitrate, and perchlorate in ground water.	Includes measures to meet State and Federal ARARs in ground water. Uranium, nitrate, and perchlorate will be treated using a combination of *in situ* and *ex situ* treatment to meet ground water cleanup standards to be agreed upon in the final Site-Wide ROD. Alternative 3b may not be as effective in meeting ARARs as Alternatives 4 (a and b) and 5 (a and b) because contamination remains in the vadose zone that could degrade water quality.	Provides a more effective long-term, permanent solution for contaminant source in the pit waste through excavation, compared to Alternatives 1, 2, 4a, 4b, 5a, and 5b. However the contaminant source in the vadose zone is not addressed.	Effectively and permanently reduces the mobility of the contaminants by removing the pit waste source. It would not reduce the toxicity or volume of the contaminants as the waste would be redeposited at a different location. The TMV of contaminants in the bedrock may not be reduced. The TMV of uranium, nitrate, and perchlorate in ground water would be reduced using active remediation, therefore this alternative would more rapidly reduce TMV than Alternatives 1, 2, 4a, and 4b that use MNA.	Not as effective as 1, 4a, 4b, 5a, and 5b for short-term worker protection. A high level of exposure control would be necessary to prevent short-term exposure of onsite workers and ecological receptors during excavation. Compares equally to Alternatives 2 and 3a. Because human health would be protected during time period (up to 500 years) to reach the MCL for uranium, Alternative 3b provides short-term effectiveness without impacting human health or the environment.	This alternative is not as implementable as Alternatives 1, 4a, 4b, 5a, and 5b. Implementability is contingent on locating a facility permitted and willing to accept low-level mixed waste at a reasonable cost. Compares equally to Alternatives 2 and 3a.	Cost of this alternative is the highest of all alternatives.

Table 2-4 (Cont.). Comparative evaluation of remedial alternatives for the Pit 7 Complex.

Alternative Number	Alternative Components	Overall Protection of Human Health and the Environment	Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Long-term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume (TMV)	Short-term Effectiveness	Implementability	Net Present Worth Cost
4a.	Monitoring, exposure control, MNA for tritium and source control through hydraulic diversion	●	◍*	◒	◔	◒	◕	$3,738,000
		Addresses risk to human health (ground water ingestion and inhalation of tritium), controls source, and utilizes MNA to reduce tritium and other processes to reduce uranium activities in ground water.	Includes measures to meet State and Federal ARARs in ground water. Monitoring the effects of dispersion, sorption, diffusion, and to a lesser extent, radioactive decay of uranium will take longer than more active remedies in Alternatives 3a, 3b, 5a, and 5b*. Because human health and the environment will be protected during the time period necessary to reach the MCL for uranium, Alternative 4a is capable of achieving RAOs and ARARs without impacting human health or the environment. However, U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe for achieving the MCL or other RAOs for uranium.	Effectively and permanently controls releases from the contaminant source in the pit waste and vadose zone by hydraulic diversion. Because the waste remains in place, it is not as effective as removing the source (Alternative 2, 3a, 3b). However, it is more effective in addressing the vadose zone contamination. Would require long-term maintenance of the hydraulic diversion.	Effectively and permanently reduces the mobility of contaminants in the pit waste and shallow vadose zone by preventing further releases. Would not reduce the toxicity or volume of the contaminants, as the contaminated waste would remain in place. The mobility of uranium in ground water would be reduced through sorption to aquifer rocks, but its toxicity and volume would not be reduced. The TMV of VOCs, nitrate, and perchlorate in ground water would not be reduced.	More effective than Alternatives 2, 3a, 3b, 5a, and 5b for short-term onsite worker protection. Minimal impact to onsite workers during monitoring and hydraulic diversion construction activities. Compares equally to Alternative 4b. Because human health would be protected during time period (up to 500 years) to reach the MCL for uranium, Alternative 4a provides short-term effectiveness without impacting human health or the environment. However, U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe to achieve the MCL or other RAOs for uranium.	This alternative is more implementable than Alternatives 2, 3a, 3b, 4b, 5a, and 5b. Monitoring and MNA can be implemented easily. The hydraulic diversion implementation requires special design considerations.	Alternative cost is implementable.
4b.	Monitoring, exposure control, MNA for tritium and source control through hydraulic barrier	●	◍*	◒	◔	◒	◕	$4,344,000
		Addresses risk to human health (ground water ingestion and inhalation of tritium) controls source, and utilizes MNA to reduce tritium in ground water.	Includes measures to meet State and Federal ARARs in ground water. Monitoring the effects of dispersion, sorption, diffusion, and to a lesser extent, radioactive decay of uranium will take longer than more active remedies in Alternatives 3a, 3b, 5a, and 5b*. Because human health and the environment will be protected during the time period necessary to reach the MCL for uranium, Alternative 4b is capable of achieving RAOs and ARARs without impacting human health or the environment. However, U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe for achieving the MCL or other RAOs for uranium.	Effectively and permanently controls releases from the contaminant source in the pit waste and vadose zone by hydraulic barrier. Because the waste remains in place, it is not as effective as removing the source (Alternative 2, 3a, 3b). However, it is more effective in addressing the vadose zone contamination. Would require long-term maintenance of the hydraulic barrier.	Effectively and permanently reduces the mobility of contaminants in the pit waste and shallow vadose zone by preventing further releases. Would not reduce the toxicity or volume of the contaminants, as the contaminated waste would remain in place. The mobility of uranium in ground water would be reduced through sorption to aquifer rocks, but its toxicity and volume would not be reduced. The TMV of VOCs, nitrate, and perchlorate in ground water would not be reduced.	More effective than Alternatives 2, 3a, 3b for short-term onsite worker protection. Minimal impact to onsite workers during monitoring and hydraulic barrier construction activities. Compares equally to Alternative 4a. Because human health would be protected during time period (up to 500 years) to reach the MCL for uranium, Alternative 4b provides short-term effectiveness without impacting human health or the environment. However, U.S. EPA and the State regulatory agencies do not agree that 500 years is an acceptable timeframe to achieve the MCL or other RAOs for uranium.	This alternative is more implementable than Alternatives 2, 3a, and 3b. Monitoring and MNA can be implemented easily. The hydraulic barrier implementation requires special design considerations.	Alternative cost is implementable.

Table 2-4 (Cont.). Comparative evaluation of remedial alternatives for the Pit 7 Complex.

Alternative Number	Alternative Components	Overall Protection of Human Health and the Environment	Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Long-term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume (TMV)	Short-term Effectiveness	Implementability	Net Present Worth Cost
5a.	Monitoring, exposure control, MNA for tritium, source control through hydraulic diversion, and phased uranium, nitrate, and perchlorate plume migration control by *ex situ* treatment	●	●	◒	◒	●	◕	$10,845,000 (extraction wells) to $15,429,000 (funnel and sump with extraction and *ex situ* treatment.
		Addresses risk to human health (ground water ingestion and inhalation of tritium), controls source, and utilizes MNA to reduce tritium and *ex situ* treatment to reduce uranium, nitrate, and perchlorate in ground water.	Includes measures to meet State and Federal ARARs in ground water. Uranium, nitrate, and perchlorate will be treated using *ex situ* treatment to meet ground water cleanup standards to be agreed upon in the final Site-Wide ROD.	Effectively and permanently controls releases from the contaminant source in the pit waste and vadose zone by hydraulic diversion. Because the waste remains in place, it is not as effective as removing the source (Alternatives 3a and 3b). However, it is more effective in addressing the vadose zone contamination. Would require long-term maintenance of the hydraulic diversion.	Effectively and permanently reduces the mobility of contaminants in the pit waste and shallow vadose zone by preventing further releases. Would not reduce the toxicity or volume of the contaminants, as the contaminated waste would remain in place. The ground water contaminants' TMV would be reduced using active uranium remediation, therefore this alternative would more rapidly reduce TMV than Alternatives 1, 2, 4a, and 4b that use MNA.	More effective than Alternatives 1, 2, 3a, 3b, 4a, and 4b. Minimal impact to onsite workers during monitoring, uranium treatment and hydraulic diversion construction activities. Additional exposure controls may be necessary due to the re-injection of tritiated water from *ex situ* uranium treatment. Because human health would be protected during time period (150 to 500 years) to reach the MCL for uranium, Alternative 5a provides short-term effectiveness without impacting human health or the environment.	This alternative is more implementable than Alternatives 2, 3a, and 3b. Monitoring and MNA can be implemented easily. The implementation of the hydraulic diversion and re-injection of tritiated water from *ex situ* uranium treatment requires special design considerations.	Costs are higher compared to Alternatives 4a and 4b. A faster timeframe for uranium remediation is achieved for the additional costs.
5b.	Monitoring, exposure control, MNA for tritium, source control through hydraulic diversion, and phased uranium, nitrate, and perchlorate plume migration control by *in situ* treatment of Qal/WBR ground water and extraction and *ex situ* treatment of $Tnbs_0$ ground water	●	●	◒	◒	◕	◕	$21,082,000
		Addresses risk to human health (ground water ingestion and inhalation of tritium), controls source, and utilizes MNA to reduce tritium and *in situ* treatment to reduce uranium, nitrate, and perchlorate in ground water.	Includes measures to meet State and Federal ARARs in ground water. Uranium, nitrate, and perchlorate will be treated using a combination of *in situ* and *ex situ* treatment to meet ground water cleanup standards to be agreed upon in the final Site-Wide ROD.	Effectively and permanently controls releases from the contaminant source in the pit waste and vadose zone by hydraulic diversion. Because the waste remains in place, it is not as effective as removing the source (Alternatives 3a and 3b). However, it is more effective in addressing the vadose zone contamination. Would require long-term maintenance of the hydraulic diversion.	Effectively and permanently reduces the mobility of contaminants in the pit waste and shallow vadose zone by preventing further releases. Would not reduce the toxicity or volume of the contaminants, as the contaminated waste would remain in place. The ground water contaminants' TMV would be reduced using active uranium remediation, therefore this alternative would more rapidly reduce TMV than Alternatives 1, 2, 4a, and 4b that use MNA.	More effective than Alternatives 1, 2, 3a, 3b, 4a, and 4b. Minimal impact to onsite workers during monitoring and hydraulic diversion construction activities. Because human health would be protected during time period (up to 500 years) to reach the MCL for uranium, Alternative 5b provides short-term effectiveness without impacting human health or the environment.	This alternative is more implementable than Alternatives 2, 3a, and 3b. Monitoring and MNA can be implemented easily. The hydraulic diversion implementation requires special design consideration.	Costs are higher compared to Alternatives 4a and 4b. A faster timeframe for uranium remediation is achieved for the additional costs.

Table 2-4 (Cont.). Comparative evaluation of remedial alternatives for the Pit 7 Complex.

Key:

○ **= Alternative fails to satisfy criterion.**

● **= Alternative fully satisfies criterion.**

◍ *** = DOE and the regulatory agencies do not agree on the degree to which the alternative satisfies criterion.**

Notes:

ARARs = Applicable or relevant and appropriate requirements.
COCs = Contaminants of concern.
MCLs = Maximum Contaminant Levels.
MNA = Monitored Natural Attenuation.
Qal/WBR = Quaternary alluvium/Weathered bedrock.
RAOs = Remedial action objectives.
TMV = Volatile organic compounds.

Table 2-5. Description of institutional/land use controls for the Pit 7 Complex (Alternative 5a).

Institutional/land use control performance objective and duration	Risk necessitating institutional/land use control	Institutional/land use controls and implementation mechanism
Ground Water:		
Prevent water-supply use/consumption of contaminated ground water until ground water cleanup levels are met.	**Uranium, tritium, nitrate, and perchlorate concentrations in ground water exceeding drinking water standards or California Public Health Goal.**	**There are no existing or planned water-supply wells in the Pit 7 Complex area. Any proposed onsite well drilling activities will be submitted to LLNL Work Induction Board, and reviewed by LLNL Environmental Restoration Division to ensure that new water-supply wells are not located in areas of ground water contamination. Prohibitions on drilling water-supply wells in areas of ground water contamination will be incorporated into the LLNL Site 300 Integrated Strategic Plan or other appropriate institutional planning documents.** **Contamination is limited to onsite ground water and modeling indicates the plumes will not migrate offsite. Therefore, land use controls are not needed to prevent offsite water-supply use/consumption of contaminated ground water.**
Pit 3, 4, 5, and 7 Landfills:		
Maintain the integrity of landfill covers and the drainage diversion system as long as the pit waste remains in place.	**Potential exposure to contaminants in pit waste[a].**	**DOE will inspect and maintain the landfill covers and the drainage diversion system, and ground water monitoring systems. Landfill cap maintenance and inspection requirements are specified in post-closure plans for the landfills and will be included in the revision to the Site-Wide Compliance Monitoring Plan/Contingency Plan for LLNL Site 300.**
Control construction and other ground-breaking activities on the Pit 7 Complex Landfills to prevent cap/cover damage and/or inadvertent exposure to pit waste as long as the pit waste remains in place.	**Potential exposure to contaminants in pit waste[a].**	**All proposed ground-breaking construction activities must be cleared through LLNL Work Induction Board and require an excavation permit. The Work Induction Board coordinates with the LLNL Environmental Restoration Division to identify if there is a potential for exposure to contaminants in the proposed construction areas. If a potential for contaminant exposure is identified, the LLNL Site 300 Hazards Control Department ensures that hazards**

Table 2-5 (Cont.). Description of institutional/land use controls for the Pit 7 Complex (Alternative 5a).

Institutional/land use control performance objective and duration	Risk necessitating institutional/land use control	Institutional/land use controls and implementation mechanism
Pit 3, 4, 5, and 7 Landfills continued		
Control of construction and other ground-breaking activities continued.		are adequately evaluated and necessary controls identified and implemented prior to the start of work. The Work Induction Board including the LLNL Environmental Analyst will also work with the Program proposing the construction project to determine if the work plans can be modified to move construction activities outside of areas of contamination. Controls for construction and other ground-breaking activities will be incorporated into the LLNL Site 300 Integrated Strategic Plan or other appropriate institutional planning documents. In addition, health and safety procedures will be developed as part of the Remedial Design Report for the Pit 7 Complex for both construction and long-term maintenance of the remedial action to ensure worker safety and the proper handling of all hazardous materials.
Maintain access restrictions to prevent inadvertent exposure of onsite workers to the pit waste as long as the waste in the Pit 7 Complex Landfills remain in place.	Potential exposure to contaminants in pit waste[a].	There are currently no active facilities located in the vicinity of the Pit 7 Complex. Signage is in place and will be maintained at the Pit 7 Landfill Complex access points prohibiting unauthorized access and requiring notification and authorization by LLNL Site 300 Management to enter, dig, excavate, or otherwise disturb soil or vegetation in this area (see administrative controls for ground-breaking construction activities above). These access restrictions will be incorporated into the LLNL Site 300 Integrated Strategic Plan or other appropriate institutional planning documents.
Maintain access restrictions to prevent inadvertent exposure of unauthorized trespassers to the pit waste as long as the waste in the Pit 7 Complex Landfills remain in place.	Potential exposure to contaminants in pit waste[a].	Site access by unauthorized trespassers is prevented by fences and warning signs at the site boundary and control entry systems at Site 300. These measures are maintained by the LLNL Security Department. There is no offsite contamination associated with the Pit 7 Complex to which the public could be exposed.

Table 2-5 (Cont.). Description of institutional/land use controls for the Pit 7 Complex (Alternative 5a).

Institutional/land use control performance objective and duration	Risk necessitating institutional/land use control	Institutional/land use controls and implementation mechanism
Pit 3, 4, 5, and 7 Landfills continued		
Maintain access restrictions to prevent inadvertent exposure continued.		**These access restrictions will be incorporated into the LLNL Site 300 Integrated Strategic Plan or other appropriate institutional planning documents.**
Maintain access restrictions and activities at the Pit 3 Landfill to prevent onsite site worker inhalation exposure to tritium until annual risk re-evaluation indicates that the risk is less than 10^{-6}.	**4 x 10^{-6} risk to onsite workers from potential inhalation of tritium from subsurface soil in the vicinity of the Pit 3 Landfill.**	**There are currently no active facilities located in the vicinity of the Pit 7 Complex, and the Pit 3 Landfill was closed and covered with native soil fill in 1967. Current activities in the vicinity of the Pit 3 Landfill are restricted to quarterly sampling of monitor wells. The time spent sampling is well below the exposure scenario for which the unacceptable exposure risk was calculated, which assumed a worker would spend 8 hours a day, five days a week for 25 years working at the Pit 3 Landfill.** **Any significant changes in activities conducted in the vicinity of the Pit 3 Landfill must be cleared through LLNL Work Induction Board. The Work Induction Board coordinates with the LLNL Environmental Restoration Division to identify if there is a potential for exposure to contaminants as a result of the proposed area usage. If a potential for contaminant exposure is identified as a result of these changes in activities or area use, the LLNL Site 300 Hazards Control Department is notified and determines any necessary personal protective equipment or engineered control requirements to prevent exposure.** **Signage is in place and will be maintained at the Pit 7 Landfill Complex access points prohibiting unauthorized access and requiring notification and authorization by LLNL Site 300 Management to enter, dig, excavate, or otherwise disturb soil or vegetation in this area. All ground-breaking construction activities must be cleared through LLNL Work Induction Board and require an excavation permit. The Work Induction Board coordinates with the LLNL Environmental Restoration Division to identify if there is a potential for exposure to**

Table 2-5 (Cont.). Description of institutional/land use controls for the Pit 7 Complex (Alternative 5a).

Institutional/land use control performance objective and duration	Risk necessitating institutional/land use control	Institutional/land use controls and implementation mechanism
Pit 3, 4, 5, and 7 Landfills continued		
Maintain access restrictions and activities at the Pit 3 Landfill to prevent onsite site worker inhalation exposure continued.	**See Page 3.**	**contaminants in the proposed construction areas. If a potential for contaminant exposure is identified, the LLNL Site 300 Hazards Control Department is notified and provides project hazard control requirements to prevent exposure during construction. These access restrictions will be incorporated into the LLNL Site 300 Integrated Strategic Plan or other appropriate institutional planning documents.** **DOE will conduct annual risk re-evaluations to determine when the tritium inhalation risk at the Pit 3 Landfill has been mitigated. The risk re-evaluations mechanism, methodology, and frequency will be documented in the Remedial Design Report for the Pit 7 Complex.**
Prohibit transfer of lands at Site 300 with unmitigated contamination that could cause potential harm under residential or unrestricted land use.	**Potential exposure to contaminated waste and/or environmental media.**	**The Site 300 Federal Facility Agreement contains provisions that assure that DOE will not transfer lands with unmitigated contamination that could cause potential harm (as described in Section 2.8.2). In the event that the Site 300 property is transferred in the future, DOE will execute a land use covenant at the time of transfer in compliance with Title 22 California Code of Regulations (CCR), Division 4.5, Chapter 39, Section 67391.1.** **Development will be restricted to industrial land usage. These restrictions will remain in place until and unless a risk assessment is performed in accordance with then current U.S. EPA risk assessment guidance and is agreed by the DOE, the U.S. EPA, DTSC, and the RWQCB as adequately showing no unacceptable risk for residential or unrestricted land use. These restrictions will be incorporated into the LLNL Site 300 Integrated Strategic Plan or other appropriate institutional planning document.**

Notes appear on following page.

Table 2-5 (Cont.). Description of institutional/land use controls for the Pit 7 Complex (Alternative 5a).

Notes:

CCR = **California Code of Regulations.**

DOE = **U.S. Department of Energy.**

DTSC = **California Department of Toxic Substances Control.**

EPA = **U.S. Environmental Protection Agency.**

LLNL = **Lawrence Livermore National Laboratory.**

RWQCB = **California Regional Water Quality Control Board.**

[a] **A risk for exposure to contaminants in the pit waste could not be calculated due to safety restrictions on penetrating landfill waste. Land use controls based on the potential exposure to contaminants in pit waste conservatively assume that the waste contaminants may pose a risk to human health.**

Table 2-6. Description of the selected remedy for the Pit 7 Complex (Alternative 5a).

Element	Scope
Monitoring	• **Sample and analyze ground water and measure water levels at approximately 65 wells.** • **Sample and analyze surface water from Spring 24.** • **Report results in the semiannual Compliance Monitoring Reports.**
Risk and hazard management	• **Maintain institutional/land use controls specified in Table 2-5 for the Pit 7 Complex.** • **Review facility and land use to evaluate changes in exposure pathway conditions that could affect the risk assessment assumptions and calculations.** • **Develop and implement a risk and hazard monitoring and assessment program:** 1. **Estimate risk for outdoor ambient air annually for tritium at the Pit 3 Landfill until risk $<10^{-6}$ for at least two years;** 2. **Perform ecological surveys and data review once every five years:** 3. **Integrate these data into risk assessment calculations to determine any changes in risks and hazards; and** 4. **Review these data to evaluate compliance with RAOs.**
Monitored natural attenuation of tritium in ground water	• **Perform fate and transport modeling to predict the spatial distribution of tritium over time and demonstrate the efficacy of monitored natural attenuation in meeting RAOs and ARARs.** • **Develop contingency criteria for determining whether a more active remediation is necessary to address tritium.**
Source control by installing hydraulic diversion to prevent water from entering landfills	• **Install two interceptor trenches with sub-components comprised of French drains, horizontal wells, and shallow terrace drains on the western slope of the valley.**
Ground water extraction and treatment of uranium, nitrate, and perchlorate	• **Extract ground water from approximately five existing Qal/WBR monitor wells.** • **Extract ground water from approximately one existing WBR and $Tnbs_0$ bedrock monitor well.** • **Extract ground water from approximately one existing $Tnbs_0$ bedrock monitor well.** • **Install new extraction wells as necessary.** • **Perform hydraulic tests as necessary.** • **Treat all extracted ground water by a treatment unit using ion-exchange.**

Notes:

Remediation-specific details, such as the number and location of extraction wells used for pump-and-treat are approximations based on best professional judgement and are presented in this Interim ROD Amendment for purposes of costing and strategy preparation only. The actual site- and technology-specific details will be based on additional data and design criteria presented in Remedial Design document.

Table 2-7. Cost summary for the selected remedy (Alternative 5a) for the Pit 7 Complex.

Activity	Parameter	Quantity	Unit	Direct Capital ($)	Indirect Capital ($)	Annual O&M ($)
Component A. Ground Water Monitoring						
Monitoring						
Water levels (65 wells)	Quarterly measurements	65	Each			$1,796
Water quality sampling/analysis (65 wells)	Quarterly sampling	65	Each			$80,687
Data analysis & representation	Labor	192	Hour			$17,723
Pump maintenance or replacement (7 wells)	Wells	7	Each			$3,353
Total for Component A				$0	$0	$103,559
Component B. Exposure Control Through Risk and Hazard Management						
Institutional Controls						
Exposure assessment	Report	1	Each		$18,998	
Install warning signs	Labor & materials	Once	Lot		$602	
Sub total				$0	$19,600	$0
Risk and Hazard Monitoring						
Prepare Risk and Hazard Monitoring Plan	Plan	1	Each		$12,369	
Re-evaluate tritium inhalation risk	Report	1	Each			$17,404
Ambient outdoor air sampling for tritium	Location	1	Each			$3,129
Conduct wildlife survey	Survey	1	Each			$4,185
Prepare Risk and Hazard Management Summary for Annual Compliance Monitoring Report	Report	1	Each			$7,833
Sub total				$0	$12,369	$32,551
Total for Component B				$0	$31,969	$32,551
Component C. Monitored Natural Attenuation (MNA) of Tritium in Ground Water						
MNA Evaluation						
Exposure assessment	Labor	172	Hour			$19,456
Modeling	Labor	160	Hour			$17,823
Total for Component C:				$0	$0	$37,279

Table 2-7 (Cont.). Cost summary for the selected remedy (Alternative 5a) for the Pit 7 Complex.

Activity	Parameter	Quantity	Unit	Direct Capital ($)	Indirect Capital ($)	Annual O&M ($)
Component D. Source Control by Installing Hydraulic Diversion to Prevent Water from Entering Landfills						
System Design and Construction						
Design labor	Labor	448	Hour		$52,873	
Construction oversight and labor	Labor	820	Hour		$79,327	
Materials and contract	3500' trench, 2000' pipe	1	Each	$261,667		
Sub Totals:				$261,667	$132,200	$0
Operations and Maintenance (O&M)						
O&M labor	Labor	56	Hour			$4,772
Total for Component D:				$261,667	$132,200	$4,772
Component E. Control Migration of Uranium, Nitrate, and Perchlorate in Ground Water Using *ex situ* Ground Water Extraction and Treatment						
Extraction/Injection Wellfield System Design and Construction						
Design labor	Labor	600	Hour		$71,429	
Construction oversight	Labor	656	Hour		$67,144	
Materials and contracts	Wells, pumps, piping	1	Each	$864,440		
Sub Totals:				$864,440	$138,573	$0
Extraction/Injection Wellfield Operations and Maintenance						
Materials and equipment	Equipment replacement, utilities	1	Cubic yards			$2,886
O&M labor	Sampling and Reporting	168	Hour			$20,902
Sub Totals:				$0	$0	$23,788
Ion Exchange Resin Treatment for Extraction Wellfield System Design and Construction						
Materials & contracts	System, 9 columns, resin	1	Each	$152,000		
Construction / oversight	Labor	440	Hour		$38,809	
Design labor	Labor	300	Hour		$33,227	
Sub Totals:				$152,000	$72,036	$0
Ion Exchange Resin Treatment for Extraction Wellfield Operations and Maintenance						
Materials & contracts	Filters, resin, disposal, analytical	1	Cubic yards			$354,000
O&M labor	Maintenance, labor, sampling	568	Hour			$42,000
Sub Totals:				$0	$0	$396,000
Total for Component E:				$1,016,440	$210,609	$419,788
Cost Summary for Alternative 5a:				$1,278,107	$374,779	$597,950
Assumed interest rate= 5% (30 year design life)						
Total Costs (net present value):				$10,845,000		

Table 2-8. ARARs for the Pit 7 Complex.

Action(s)	Source	Description	Application
Ground water: monitored natural attenuation, ground water extraction, *in situ* treatment, containment, and hydraulic control	***State:*** **State Water Resources Control Board (SWRCB) Resolution 92-49, Paragraph IIIG[a]** **(Relevant and appropriate[b], chemical-specific)**	**Establishes requirements for investigation and cleanup and abatement of discharges.**	**All cleanup activities associated with the implementation of remedial actions will be conducted under the supervision of the Central Valley Regional Water Quality Control Board (RWQCB).**
	Chapter 15, California Code of Regulations (CCR), Title 23, Sections 2550.7, 2550.10 **(Relevant and appropriate, action-specific)**	**Requires monitoring of the effectiveness of the remedial actions.**	**Contaminant concentrations in *in situ* ground water will be measured.**
	CCR, Title 27, Section 20410 **CCR, Title 23, Section 2550.6** **(Relevant and appropriate, chemical-specific)**	**Requires monitoring for compliance with remedial action objectives for three years from the date of achieving cleanup standards.**	**Applies to ground water and soil remedial actions.**
	CCR, Title 27, Section 20080 (d) **CCR, Title 23, Section 2510 (d)** **(Applicable, action-specific)**	**Requires monitoring programs for existing units (landfills). Existing units are those operating which were operating prior to November 27, 1984.**	**Existing landfills.**
	CCR, Title 27, Section 20090 (d) **CCR, Title 23, Section 2511 (d)** **(Applicable, action-specific)**	**Requires that remedial actions intended to contain wastes at the place of release shall implement applicable provisions of Title 27 Division 2 [Title 23 Chapter 15] to the extent feasible.**	**Applies to the remediation and monitoring of sites.**
	CCR, Title 27, Section 20385 (c) **(Applicable, action-specific)**	**Requires a detection monitoring program concurrent with corrective action to monitor for any additional releases from the landfills.**	**Applies to monitoring of existing landfills.**

Table 2-8 (Cont.). ARARs for the Pit 7 Complex.

Action(s)	Source	Description	Application
Ground water: monitored natural attenuation, ground water extraction, *in situ* treatment, containment, and hydraulic control (cont.)	**CCR, Title 27, Section 20400** **CCR, Title 23, Section 2550.4** **(Applicable, action-specific)**	**Requires the discharger to propose either background or an alternative to background as the concentration limit. In the Interim ROD, the concentration limit is used for determining the analytical detection limits and the adequacy of the monitoring network to evaluate the extent of polluted ground water above background.**	**Applies to detection limits and to determine the extent of the ground water plume above background concentrations.**
	CCR, Title 27, Section 20415 (b)(1)(A) **CCR, Title 23, Section 2550.7** **(Applicable, action-specific)**	**Requires a sufficient number of background monitoring points to yield ground water samples representative of ground water that has not been affected by releases from the landfills.**	**Applies to background monitoring for polluted ground water.**
	CCR, Title 27, Section 20415 (b)(1)(D) **CCR, Title 23, Section 2550.7** **(Applicable, action-specific)**	**Lists the requirements for the number, location and depths of monitoring points for a corrective action monitoring program.**	**Applies to plume monitoring.**
	CCR, Title 27, Section 20415 (b)(2) **CCR, Title 23, Section 2550.7** **(Applicable, action-specific)**	**Allows background locations not hydraulically upgradient of the landfill if they are representative of the background quality of ground water.**	**Applies to background monitoring for polluted ground water.**
	CCR, Title 27, Section 20415 (b)(3) **CCR, Title 23, Section 2550.7** **(Applicable, action-specific)**	**Requires copies of driller's logs be available to the Regional Water Board.**	**Applies to drilling monitor wells as part of the remedial action.**
	CCR, Title 27, Section 20415 (b)(4) **CCR, Title 23, Section 2550.7** **(Applicable, action-specific)**	**Describes the monitoring well performance standards.**	**Applies to drilling monitor wells as part of the remedial action.**

Table 2-8 (Cont.). ARARs for the Pit 7 Complex.

Action(s)	Source	Description	Application
Ground water: monitored natural attenuation, ground water extraction, *in situ* treatment, containment, and hydraulic control (cont.)	**CCR, Title 27, Section 20415 (c)(2)(D) CCR, Title 23, Section 2550.7 (Applicable, action-specific)**	**Requires adequate surface water monitoring to assess corrective action.**	**Applies to surface water monitoring.**
	CCR, Title 27, Section 20415 (e)(1-9) CCR, Title 23, Section 2550.7 (Applicable, action-specific)	**Describe general monitoring requirements.**	**Applies to all ground water monitoring.**
	CCR, Title 27, Section 20420 CCR, Title 23, Section 2550.8 (Applicable, action-specific)	**Describes detection monitoring requirements.**	**Applies to all detection ground water monitoring.**
	CCR, Title 27, Section 20430 (d) CCR, Title 23, Section 2550.10 (Applicable, action-specific)	**Describes the requirements for establishing a corrective action program.**	**Applies to all corrective action ground water monitoring.**
Surface discharge of treated ground water	***State:*** **SWRCB Resolution 68-16 (anti-degradation policy) (Applicable, chemical-specific)**	**Requires that high quality surface and ground water be maintained to the maximum extent possible.**	**Ground water treatment system effluent will be monitored to ensure that surface and ground water quality will be maintained to the maximum extent possible.**
Treated ground water reinjection	***Federal:*** **Safe Drinking Water Act Underground Injection Control Program (40 CFR 144.26-144.27) (Applicable, action-specific)**	**Requires monitoring for reinjection of treated water.**	**Treated ground water will be analyzed to verify complete removal of contaminants to regulatory treatment standards, prior to reinjection.**

Table 2-8 (Cont.). ARARs for the Pit 7 Complex.

Action(s)	Source	Description	Application
Treated ground water reinjection (cont.)	***State:*** **SWRCB Resolution 68-16 (anti-degradation policy)** **(Applicable, chemical-specific)**	**Requires that high quality ground water be maintained to the maximum extent possible.**	**Treated ground water will be analyzed to verify complete removal of contaminants to regulatory treatment standards, prior to reinjection.**
	Water Quality Control Plan (Basin Plan) for RWQCB **(Applicable, chemical-specific)**	**Establishes beneficial uses and water quality objectives for ground water and surface waters in the Central Valley Region as well as implementation plans to meet water quality objectives and protect beneficial uses.**	**Monitoring will be conducted to preclude any activity, including, but not limited to, the discharge of contaminated waters that result in actual water quality exceeding water quality objectives.**
Monitoring and maintenance of landfills	***State:*** **CCR, Title 27, Sections 20950, 22207 (a), 22212 (a), and 22222** **CCR, Title 23, Sections 2550.0 (b), 2580, 2580 (f)** **(Applicable, action-specific)**	**General closure requirements, including continued maintenance of waste containment, drainage controls, and ground water monitoring throughout the closure and post-closure maintenance periods.**	**Applies to the landfill pits.**
Disposition of waste	***State:*** **California Health and Safety Code, Division 20, Chapter 6.5, CCR, Title 22, Division 4.5, Chapters 11 and 12: Minimum Standards for Management of Hazardous and Extremely Hazardous Wastes** **(Applicable, action-specific)**	**Controls hazardous wastes from point of generation through accumulation, transportation, treatment, storage, and ultimate disposal.**	**Applies to the spent resin and to excavated contaminated soil or waste.**
	State: **CCR, Title 23, Division 3, Chapter 15** **(Applicable, action-specific)**	**Establishes waste and siting classification systems and minimum waste management standards for discharges of waste to land for treatment, storage, and disposal. Engineered alternatives that are consistent with Title 23 performance goals may be considered. Also establishes corrective action requirements for responding to leaks and other unauthorized discharges.**	**Applies to *ex situ* treatment, storage, and disposal of any remediation-derived hazardous solid wastes.**

Table 2-8 (Cont.). ARARs for the Pit 7 Complex.

Action(s)	Source	Description	Application
Disposition of waste (cont.)	***State:*** **CCR, Title 27, Division 2, Subdivision 1** **(Applicable, action-specific)**	**Regulates hazardous wastes that are discharged to land.**	**Waste and site classifications and waste management requirements will be applied for solid waste storage or disposal on land.**
	State: **Title 22, CCR, Section 66260.1** **(Applicable, action-specific)**	**Established criteria for determining waste classification for the purposes of transportation and disposal of wastes.**	**Applies to spent resin and to excavated contaminated soil or waste.**
	Title 22, CCR, Section 66262.1 **(Applicable-action specific)**	**Establishes standards applicable to generators of hazardous waste**	
	Title 22, CCR, Chapter 18 **(Applicable, action-specific)**	**Identifies hazardous waste restricted from land disposal unless specific treatment standards are met**	
	Title 22, CCR, Chapter 13 **(Applicable, action-specific)**	**Governs transportation of hazardous materials.**	
	Health and Safety Code, Chapter 6.5, Section 253000-25395.15	**Establishes hazardous waste control measures**	
Storm water controls	***Federal:*** **40 CFR Parts 122, 123, 124, National Pollution Discharge Elimination System, implemented by State Water Resources Control Board Order No. 92-08 Division of Water Quality** **(Applicable, action-specific)**	**Regulates pollutants in discharges of storm water associated with construction activity (clearing, grading, or excavation) involving the disturbance of 5 acres or more. Includes requirements to ensure storm water discharges do not contribute to a violation of surface water quality standards.**	**Applies to construction areas over 5 acres in size. Includes measures to minimize and/or eliminate pollutants in storm water discharges and monitoring to demonstrate compliance.**

Table 2-8 (Cont.). ARARs for the Pit 7 Complex.

Action(s)	Source	Description	Application
Protection of endangered species	*Federal:* Endangered Species Act of 1973, 16 USC Section 1531 et seq. 50 CFR Part 200, 50 CFR Part 402 [40 CFR 257.3-2] (Applicable, action-specific) *State:* California Endangered Species Act, California Department of Fish and Game Sections 2050-2068 (Applicable, location-specific)	Requires that facilities or practices not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife. National Environmental Policy Act implementation requirements may apply.	Prior to any well installation, facility construction, or similar potentially disruptive activities, wildlife surveys will be conducted and mitigation measures implemented if required.
Land use control	*State:* Hazardous Waste Property (22 CCR 67391.1 (e) (Relevant and appropriate, action-specific)	Prohibits the federal government from transferring land where hazardous substances remain at levels that do not allow unrestricted use of the land, unless a land use covenant or other institutional control is used to ensure that future land use will be compatible with the levels of remaining hazardous materials.	Would apply in the event that DOE transfers property at Site 300 to another owner.

Notes:

[a] ARARs pertaining to clean-up standards will be selected at the time of the Final ROD.

[b] The RWQCB considers 92-49 applicable to the remediation of the Pit 7 Complex, but agrees to disagree with EPA for inclusion of 92-49 as relevant and appropriate in the Interim ROD Amendment for the Pit 7 Complex.

Table 2-9. Cost and effectiveness summary for the Pit 7 Complex remedial alternatives.

Alternative	Cost effectiveness
1. No action.	**Alternative 1 is not considered cost-effective.**
2. Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, and excavation and disposal of Pit 3 and 5 waste.	**Alternative 2 is not considered cost effective because it is the least effective in the long-term of the alternatives, not as effective in the short term as Alternatives 4a, 4b, 5a, and 5b, and does not reduce toxicity, mobility, and volume (TMV) as effectively as 3a, 3b, 5a, and 5b. Alternative 2 is also more costly than Alternatives 4a, 4b, 5a, and 5b.**
3a. Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, control migration of uranium, nitrate, and perchlorate in ground water using *ex situ* ground water extraction and treatment, and excavation and disposal of Pit 3 and 5 waste.	**While Alternative 3a is more effective in the long term then Alternatives 2, 4a, 4b, 5a, and 5b, It is not as effective in the short-term or as implementable as Alternatives 4a, 4b, 5a, and 5b. In addition, only Alternative 3b is more expensive.**
3b. Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, control migration of uranium, nitrate, and perchlorate in Qal/WBR ground water using *in situ* reactive permeable barrier and extraction and *ex situ* treatment of $Tnbs_0$ ground water, and excavation and disposal of Pit 3 and 5 waste.	**While Alternative 3b is more effective in the long term then Alternatives 2, 4a, 4b, 5a, and 5b, It is not as effective in the short-term or as implementable as Alternatives 4a, 4b, 5a, and 5b. In addition, it is the most expensive of the alternatives.**
4a. Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, and source control by installing hydraulic diversion to prevent water from entering landfills.	**Although the least expensive alternative, it does not reduce the TMV of contaminants as well as Alternatives 3a, 3b, 5a, and 5b and it is not as effective in the short-term as Alternatives 5a and 5b.**
4b. Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, and source containment by installing hydraulic barriers (slurry walls) to prevent water from entering landfills.	**Does not reduce the TMV of contaminants as well as Alternatives 3a, 3b, 5a, and 5b. Alternative 4b is not as effective in the short-term as Alternatives 5a and 5b. The only alternative that is less expensive than Alternative 4b is Alternative 4a.**
5a. (The selected interim remedy). Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, source control by installing hydraulic diversion to prevent water from entering landfills, and phased migration control of uranium, nitrate, and perchlorate in ground water using *ex situ* ground water extraction and treatment.	**Alternative 5a is the most cost-effective alternative. It is more effective in the short term than the other alternatives and while the costs are higher compared to Alternatives 4a and 4b, a faster timeframe for uranium remediation is achieved for the additional cost.**

Table 2-9 (Cont.). Cost and effectiveness summary for the Pit 7 Complex remedial alternatives.

Alternative	Cost effectiveness
5b. Monitoring of ground water, exposure control through risk and hazard management, monitored natural attenuation of tritium in ground water, source control by installing hydraulic diversion to prevent water from entering landfills, and phased migration control of uranium, nitrate, and perchlorate in Qal/WBR ground water using *in situ* reactive permeable barrier and extraction and *ex situ* treatment of $Tnbs_0$ ground water.	**Costs are higher than Alternative 5a while not being as effective in the short term.**

LAWRENCE LIVERMORE
NATIONAL LABORATORY
University of California • Livermore, California • 94550