Supplement Analysis
for
The Proposed Cleanup of Contaminated Soil at the Building 850 Firing Table, Site 300 Lawrence Livermore National Laboratory

(Department of Energy/Environmental Impact Statement 0348–SA–02)

April 2009

Department of Energy/Environmental Impact Statement 0348-SA-02

Department of Energy
National Nuclear Security Administration
Livermore Site Office
7000 East Avenue, L-293
Livermore, CA 94551-0808

Supplement Analysis for the Proposed Cleanup of Contaminated Soil at the Building 850 Firing Table, Lawrence Livermore National Laboratory Site 300

1.0 Introduction

In the 2005 *Record of Decision for the Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SW/SPEIS) U. S. Department of Energy/Environmental Impact Statement (DOE/EIS) 0348, (DOE/EIS-0236-S3) (DOE 2005), DOE decided to implement the proposed action alternative as defined in the final March 2005 Lawrence Livermore National Laboratory (LLNL) SW/SPEIS. The proposed action, identified as the preferred alternative in the Record of Decision (ROD), was to continue operations of LLNL including the remediation of contaminated soil and groundwater at Site 300.

In 2000, an Environmental Assessment/Finding of No Significant Impact (EA/FONSI) (DOE/EA-1348) was prepared to evaluate the remediation of environmental contamination at 11 contaminated areas at Site 300, including the Building (B) 850 Firing Table. In the *Finding of No Significant Impact for the Remediation of Environmental Contaminants at Lawrence Livermore National Laboratory Experimental Test Facility Site 300, California* (DOE/EA-1348) (DOE 2000), DOE determined that the proposed project did not constitute a major Federal action significantly affecting the quality of human health or the environment, and that no significant cumulative impacts or environmental justice concerns were expected.

The B850 Firing Table was constructed in 1960 and was used to conduct explosives experiments until January 2008. Prior to polychlorinated biphenyls (PCB) becoming regulated substances, an estimated 1,000 capacitors were destroyed on the B850 Firing Table, resulting in PCB, dioxin, and furan contamination of the surrounding soil.

DOE conducted investigations to determine the extent of contamination, and a risk assessment to evaluate potential adverse human health effects and impacts to plants and animals that could result from exposure to these soil contaminants. The baseline risk assessment identified a risk to onsite workers; who could inhale, ingest, or contact PCBs, dioxins, or furans in surface soil in the vicinity of the firing table. It also identified a hazard to animals that could be exposed to this soil contamination.

In 2001, an interim remedy was selected in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) *Interim Site-Wide Record of Decision Livermore National Laboratory Site 300* (Interim Site-Wide ROD) (DOE 2001a) to mitigate the risk to workers associated with the PCBs, dioxins, and furans in the soil, and the threat to ground water presented by a tritium-contaminated sand pile at the B850 Firing Table. The interim remedy consisted of the excavation and offsite disposal of the contaminated soil and sand pile. The SW/SPEIS included a discussion in Section 4.17.2., Description of Existing Environment: Site Contamination and Remediation, of the proposed activities identified in the Interim Site-Wide

ROD. Impacts were analyzed in Section 5.2.15 for the No Action Alternative and Section 5.3.15 for the Proposed Project Alternative. DOE scheduled the activity to be completed in Fiscal Year (FY) 2006.

In 2006, additional sampling and analysis of the sand pile adjacent to the B850 Firing Table showed that the current maximum tritium activities were not a threat to ground water. However, PCBs were detected in the sand pile at concentrations of up to 50.4 milligrams per kilogram (mg/kg) exceeding the U.S. Environmental Protection Agency (EPA) Region 9 industrial soil Preliminary Remediation Goal (PRG) of 0.74 mg/kg. Thus, the sand pile requires remediation due to PCBs, not due to tritium. As the planning for the FY2006 activity proceeded, the cost estimates for the excavation, shipment, and disposal of contaminated soil increased to over $8 million. Additional characterization and a decrease in the PRG for PCBs resulted in a larger volume of soil that needed remediation. As a result, the interim remedy selected for cleanup of the contaminated soil at the B850 Firing Table in 2001 was no longer considered economically practicable.

DOE requested that other more cost-effective technologies be identified that were capable of addressing the PCBs, dioxins, and furans in a manner that was equally protective as the remedy identified in the Interim ROD resulting in this proposed project. An Engineering Evaluation/Cost Analysis (EE/CA) (LLNL 2008a) for cleanup of the PCB, dioxin, and furan contaminated soil at the B850 Firing Table has been prepared that presents three soil remediation method alternatives. The selection of the approved alternative by the EPA, California Department of Toxic Substances Control (DTSC), the California Regional Water Quality Control Board (RWQCB) and DOE was documented in the Action Memorandum for the Removal Action at the B850 Firing Table (LLNL 2008b).

Because the area and volume of soil and sand pile material to be excavated would be larger, an alteration to electrical utilities would occur, and an alternate remediation technology is being proposed that was not evaluated in the 2005 SW/SPEIS, 2000 EA, or 2001 Interim Site-Wide ROD, this supplement analysis evaluates the potential environmental impacts of these changes.

2.0 Background

B850 is located in the northwest part of Site 300. The facility was constructed in 1960 and the firing table has since been used to conduct hydrodynamic experiments. The B850 bunker is located directly adjacent to the firing table and the rear of the building is below the elevated firing table. The front of B850 is at ground surface elevation.

B850 and the adjacent firing table are located in a topographic "bowl" with elevations ranging from about 1,310 feet above Mean Sea Level (MSL) at the firing table to over 1,500 feet above MSL on the surrounding hillside. The firing table is covered with up to 5 feet of pea gravel used to absorb shot blasts and minimize impact to bunker occupants. Much of the surrounding hillside is covered with a 0 to 5 foot thickness of soil, and native perennial and introduced annual grasses and associated herbaceous plants. However, in places there are steep rock outcrops that are generally devoid of both soil and vegetation. The climate is semi-arid and windy with an average annual rainfall of 10.2 inches.

Characterization activities at B850 commenced in the mid-1980s under the oversight of the RWQCB. Site 300 was placed on the National Priorities List in August 1990 and all subsequent investigations have been conducted in accordance with CERCLA under the oversight of three supervising regulatory agencies: the EPA, the RWQCB, and the DTSC.

Prior to PCBs becoming regulated substances, an estimated 1,000 capacitors were destroyed on the B850 Firing Table. As a result of the dispersal of contaminated shrapnel during explosives testing, surface soil (defined as the upper 6 inches of soil), and shallow subsurface soil (defined as soil greater than 6 inches below ground surface at the B850 Firing Table area and sand pile were contaminated with PCBs, dioxin and furan compounds.

In the 2000 EA/FONSI and 2001 Interim Site-Wide ROD, several methods of remediation at B850 were specified for the various contaminants and environmental media including ground water monitoring, risk and hazard management, monitored natural attenuation of tritium in ground water, and PCB, dioxin, and furan bearing soil removal with transport to a licensed off-site treatment, storage and disposal facility. At the time, the soil contamination was estimated to encompass an area of approximately 40,000 square feet (ft^2) adjacent to the B850 Firing Table. It was proposed that the soil be removed to a depth sufficient to reach clean soil (as defined by cleanup standards). The total estimated volume of soil to be removed was approximately 800 cubic yards (yd^3). In addition, the contaminated sand pile was to also be removed. The sand pile covers an area of approximately 1,250 ft^2 and is 7-10 feet high. The estimated volume of sand to be removed was 460 yd^3. The combined estimated total area of shallow soil and sand pile material to be removed as evaluated in the 2000 EA/FONSI was approximately 41,250 ft^2 with a combined estimated volume of approximately 1,260 yd^3.

Subsequent to the 2000 EA, a soil cleanup standard of 0.74 mg/kg total PCB concentration was established in the Site-Wide Interim ROD. This cleanup standard is the U.S. EPA PRG for the protection of outdoor workers from PCBs in surface soil at industrial sites. Additional soil samples were collected and analyzed in 2003 to better define the lateral and vertical extent of PCB contamination exceeding the soil cleanup standard to be excavated in support of the remedial design (LLNL 2004). Based upon this additional soil sampling and analysis, and the establishment of the 0.74 mg/kg total PCB concentration as the cleanup standard, the total area of excavation was revised to encompass an area of 318,000 ft^2 and the volume of soil and sand pile material to be excavated was revised to about 16,000 yd^3 as described below.

In 2008, an EE/CA was prepared that proposed a more cost-effective removal action alternative that could be implemented to address contaminated soil at B850. Following regulatory and stakeholder review, a removal action alternative was documented in an action memorandum.

3.0 Proposed Action

The proposed action consists of 1) terminating utility services and rerouting of electrical services including installation of up to 10 [12-kilovolt (kV)] new power poles, 2) excavating PCB, dioxin, and furan contaminated soil and sand, 3) solidifying the contaminated soil and sand, and 4) consolidating and placing a cover over the solidified, consolidated soils and sand to prevent direct contact, ingestion, and inhalation of re-suspended particulates. The most likely site for

placement of the solidified soil would be the upper corporation yard adjacent to B850. This treatment option would prevent exposure of human and ecological receptors to the PCBs, dioxins, and furans by excavating, solidifying, and consolidating the contaminated surface soil and sand pile material.

3.1 Terminating Utility Services and Rerouting of Electrical Services

An existing underground septic system would be cut and capped in place following regulatory procedures, and the phone utility would be disconnected in place. Water service would be continued during project activities, but cut and capped in place at completion of the project. Existing underground electrical power would be terminated at the B850 and rerouted above ground to continue to provide 12-kV electrical services to the existing power grid. Seven to ten new power poles and approximately 2000 feet of new 12-kV distribution line would be installed above ground and connected into the existing 12-kV line. Pole installation areas would be accessed from a paved road, and mechanical equipment would be used to clear vegetation from an area having a maximum radius of 20 feet around each pole resulting in a ground disturbance of 0.3 acres. Vegetation–free areas around the poles would be maintained annually by spraying of herbicides to limit fire damage associate with annual prescribed burns. If the removed power poles are contaminated with creosote or other hazardous materials, they would be disposed of as hazardous waste or handled under DTSC alternate management standards for treated wood waste.

3.2 Excavation of Contaminated Soil and Sand Pile

Impacted soils and the sand pile containing PCBs at concentrations above the 0.74 mg/kg industrial soil PRG would be excavated from areas around B850 to depths up to 3 feet. The extent of contamination is now estimated to be approximately 318,000 ft^2 and the estimated volume of soil and sand pile material is about 16,000 yd^3 (**Figure 1**). Soil removal would occur over an approximately 7.3-acre area of previously-disturbed land on and surrounding the B850 Firing Table with up to 18.2 acres disturbed for access by heavy equipment. A maximum thickness of 3 feet of soil and 8 feet of sand pile material would be removed from the flat area adjacent to the firing table. A minimum thickness from where rock is exposed to 2 feet would be removed from the slopes above the firing table. Front loaders and backhoes would be used to excavate the soil/sand. The excavated soil/sand would be covered and protected from wind and water while awaiting solidification. Excavation and staging of the soil/sand would be conducted under best management practices including sediment control and erosion-prevention practices such as employing fabric filter fences around the perimeter of storm drains, and stabilizing the construction entrance and exit. Once excavation is completed, verification sampling and analysis of exposed soil for PCBs, dioxins, and furans would be performed. If analytical results indicate that PCBs, dioxins, or furans occur in the soil at concentrations in excess of cleanup standards, additional soil would be excavated until these standards are met or exposed rock is encountered.

Immediately following completion of the soil excavation and verification sampling, site restoration and slope stabilization would be conducted. This would include temporary

and long-term erosion control measures such as terracing, use of fiber rolls, placement of erosion-control fabric, and hydro seeding until the vegetative cover would be sufficiently established to control erosion. A surface drainage network would also be established to help control erosion. The hill slopes and flat area adjacent to B850 would be returned to a grade that is similar to current conditions and would maintain the bowl-shape of the hillside. No imported soil from offsite locations would be used as "fill" material. At completion of the excavation and removal of soil, permanent erosion control practices would be applied to all remaining disturbed soil areas.

The excavation work would be conducted in accordance with substantive provisions of the National Pollutant Discharge Elimination System (NPDES) requirements for storm water discharges from construction activities to minimize erosion and to prevent enhanced sediment load from entering ephemeral stream drainages. A Storm Water Pollution Prevention Plan (SWPPP) that stipulates erosion prevention, slope stabilization, and drainage collection measures would be developed and implemented.

3.3 **Solidification of Contaminated Soil and Sand Pile**

The excavated soil and sand pile material would be solidified on-site using a rotary mixer or similar system. The solidification technology would encapsulate the PCB, dioxin, and furan contaminated particles in a concrete-like matrix that would render them unavailable for on-site worker and ecological receptor exposure through the dermal contact, ingestion, or inhalation of re-suspended particulate pathways, and ecological receptor exposure through inhalation or ingestion pathways. Decontamination of equipment would occur onsite in the upper corporation yard and all wastewater would be contained for appropriate disposal or until chemical characterization and regulatory approval allows local infiltration of the wastewater.

3.4 **Consolidation of Solidified Contaminated Soil and Sand Pile**

The primary proposed on-site consolidation area under consideration for placement of the solidified soil and sand pile material is the B850 upper corporation yard, within the area of PCB contamination. In this location, the soil would be solidified and consolidated such that the most highly contaminated soils would be solidified and consolidated first to minimize the ecological risk of exposure. The area of the consolidated soil would cover an area of 59,800 ft^2, approximately 1 acre, and at its highest point, would be a few feet in thickness to a maximum of 20 ft above the current grade. The consolidated soil unit would be placed directly adjacent to the hillside to maintain the bowl-shape hillside. If additional soil, in excess of 16,000 yd^3, requires excavation and solidification due to verification sample results exceeding the PCB PRG, some consolidation may be conducted at the lower corporation yard. Prior to placement, a pre-project engineering study would be completed which includes verification of soil stability by excavating an 80' long x 15' deep trench to confirm the depth of placement for the Consolidated Soil Unit (CSU).

The material covering the top and sides of the consolidated soil unit would include a combination of concrete, cobbles, or other materials. The cover would protect and

maintain the long-term stability of the consolidated material and prevent direct contact with rainfall runoff, prevent animals from digging into the consolidated material, would not support ecological habitat, and would not allow weathering or erosion of the consolidated materials.

The cover would be designed such that all storm water would run off the consolidated soil unit rather than infiltrate. The tops and sides of the consolidated soil unit would be sloped to convey runoff water into a surface drainage network that would convey the runoff water into a sedimentation basin that would dissipate the energy of the water, allowing sediment to settle out, prior to the water entering the surface water channel.

Regular inspections of the consolidation area would be made to assess the integrity of the solidification treatment and maintenance/repairs would be conducted as necessary.

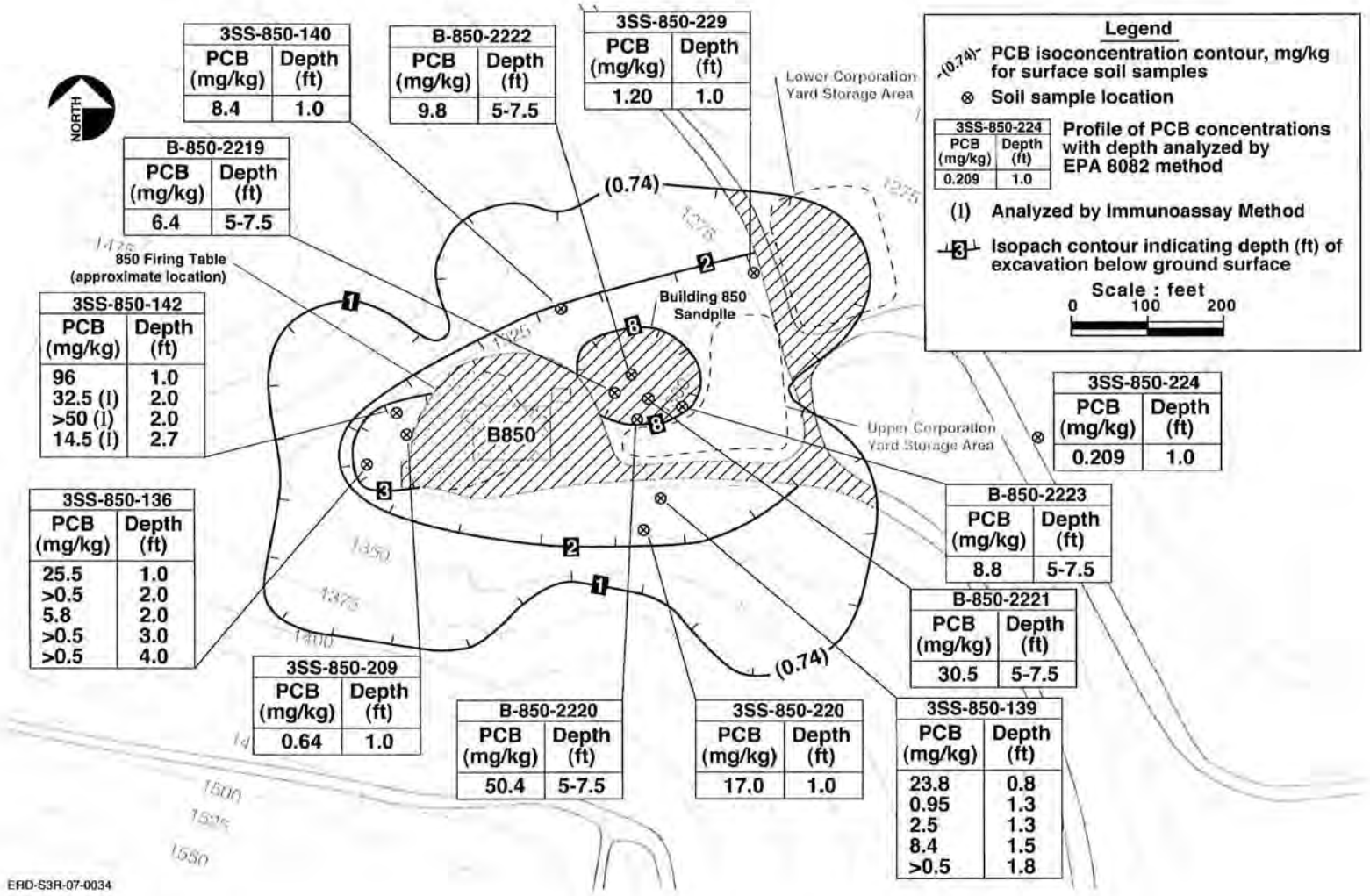

FIGURE 1: B850 Firing Table soil remediation area of excavation showing depths of excavation and representative soil PCB concentrations with depth.

CQ:kr
EE08-003

4.0 Potential Environmental Impacts

This discussion compares the relevant activities and impacts of the proposed action with those analyzed in the 2005 SW/SPEIS. Project specific information presented in the 2000 EA/FONSI is also discussed.

4.1 Geology and Soils/Site Contamination

The 2000 EA/FONSI analyzed the removal of approximately 1 acre of contaminated surface soil (to a uniform depth of approximately 6 inches) from the B850 Firing Table on previously disturbed soil. The 2000 EA/FONSI concluded that the soil disturbance would not cause unstable earth conditions or create erosion because it would be limited in depth and extent, and would be dispersed throughout the project area. Thus, there would be no significant impacts to earth resources.

Under the proposed project, soil removal would occur over an approximately 7.3 acre area of previously-disturbed land on and surrounding the B850 Firing Table, to varying depths from 1-3 feet (8 feet at the sand pile) with up to 18.2 acres disturbed for access by heavy equipment, and an additional 0.3 acres for rerouting of electrical services. The design of the proposed project incorporates measures to ensure stability of the soil and to prevent erosion. Pre-project earth disturbance would include excavation of an 80' long x 15' deep trench to verify soil stability in the upper corp yard and confirm the depth of the placement of the CSU. These measures, identified above in the project description section of this report, include the following:

- The excavation work would be conducted in accordance with NPDES requirements to minimize erosion;
- A SWPPP that stipulates erosion prevention and slope stabilization would be developed and implemented; and
- After soil excavation is completed, the hill slopes would be returned to a grade that is similar to current conditions, stabilized, and reseeded with native grasses.

With the incorporation of these measures in the work plan for the remediation of soil at the B850 Firing Table, there would be no additional impacts to the soil from those analyzed in Sections 5.3.6 and 5.3.15 of the 2005 SW/SPEIS or Section 4 of the 2000 EA/FONSI.

4.2 Air Quality

Potential impacts to air quality from the proposed project would include air emissions from fugitive dust associated with construction activities. Fugitive dust would be minimized by dust prevention and suppression measures, when necessary, according to Air District Rules and internal LLNL policies.

Impacts to air quality under the proposed project are unchanged from those analyzed in Section 5.3.8 of the 2005 SW/SPEIS and Section 4 of the 2000 EA/FONSI. Therefore,

there would be no additional impacts to air quality by the proposed soil remediation and onsite consolidation at the B850 Firing Table.

4.3 **Water**

All water quality issues associated with the proposed project are overseen by the RWQCB. The RWQCB reviewed and commented on the Site-Wide Feasibility Study (LLNL 1999), a document that evaluated different cleanup technologies for Site 300, and participated in the selection of the cleanup technologies that are presented as part of the proposed action alternative in the 2000 EA.

The 2000 EA/FONSI concluded that any soil-disturbing activities or discharge of treated water to the surface would comply with the RWQCB substantive requirements and the requirements of the *Storm Water Pollution Prevention Plan, Site 300, Lawrence Livermore National Laboratory, Livermore, California*, May 1994, or subsequent revisions. Therefore, there would be no significant impacts to water quality or water resources.

The B850 Firing Table soil remediation project would be required to comply with the substantive requirements of the RWQCB and implementation of an approved SWPPP, regardless of the increased size of the proposed project. Therefore, the proposed soil remediation and onsite consolidation at the B850 Firing Table would not create a greater impact to water resources from that analyzed in Section 5.3.9 of the 2005 SW/SPEIS and Section 4 of the 2000 EA/FONSI.

4.4 **Biological Resources**

The B850 Firing Table contaminated area occurs in an upland setting dominated by grassland. The following non-federal special-status and rare species and habitats are listed in the 2000 EA/FONSI as having been observed, or were potentially occurring, in the vicinity of the B850 Firing Table: 1) American badger, 2) Western burrowing owl, 3) Big tarplant, and 4) wetlands. Habitat "marginally suitable" for the San Joaquin kit fox was also noted in the 2000 EA/FONSI, but no federally listed species were identified in the vicinity of B850.

The 2000 EA stated prior to any ground-disturbing operations a pre-activity survey would be performed to determine if special-status species or habitats are present. It also stated that "if a resource were found that could not be avoided, supplemental analysis would be required and mitigation might be required." The 2000 EA/FONSI, supported by the 1992 EIS/Environmental Impact Report (EIR) (DOE 1992) and the most recent plant findings outlined in a 1997 site-wide update report (Jones and Stokes 1997), concluded that there would be no significant impact to special-status or rare species and habitats as a result of the proposed project.

In 2001, a Biological Assessment (BA) for *Routine Maintenance and Operations Projects at the Lawrence Livermore National Laboratory Site 300 Experimental Test Site* (LLNL 2001) was submitted to the US Fish and Wildlife Service (USFWS). In 2002, the

USFWS issued a Biological Opinion (BO) (USFWS 2002). The LLNL wildlife protection program is referenced as mitigation that would protect special-status species and habitats in accordance with federal and state regulations. The proposed soil remediation project at B850 was not included as part of the proposed action in this BA.

In 2004, formal consultation was requested by the DOE/National Nuclear Security Administration (NNSA), Livermore Site Office (LSO) with submission of a BA, Appendix E.2, in the *Draft Site-Wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (DOE 2004), to the USFWS. The USFWS did not issue a BO.

In 2007, formal consultation was requested again by LSO with submission of a BA, *Formal Consultation on the Continued Operation of Lawrence Livermore National Laboratory's Livermore Site and Site 300* (LLNL 2007), to the USFWS, updating the 2004 BA and analyzing a larger area (approximately 16,000 ft^2) for soil remediation projects than was considered in the 2000 EA/FONSI. The 2007 BA notes that the California Tiger Salamander is now listed as federally threatened with breeding habitat within the vicinity of B850 (approximately 1 kilometer away). The 2007 BA provides that "salamander densities are likely to be low because of the overall distance of the project sites from breeding locations, and because of the substantial topography that exists between the project area and the breeding pool." The proposed project description in the BA also anticipated ecological restoration of a majority of the area affected by the soil remediation project to pre-project conditions. The 2007 BA concluded that "no breeding habitat will be affected, nor will the project affect movement or dispersal of California Tiger Salamanders. No other federally threatened or endangered species are known to, or likely to, inhabit" the project area.

On July 12, 2007, LLNL received a BO from the USFWS (USFWS 2007) indicating that they concurred with most of the findings of the 2007 BA. However, USFWS also responded that insufficient information was received to proceed in evaluating impacts of the proposed B850 Firing Table soil remediation.

An amendment (LLNL 2008c) to the 2007 BA has been drafted and submitted by LSO to USFWS providing the project specific activities and an assessment of impacts to plants and animal life of the proposed B850 Firing Table soil remediation. The 2008 Amendment to the BA states that "no breeding habitat will be affected," but that following excavation, the excavated area would likely be "no longer suitable upland habitat for California Tiger Salamanders." The amendment also states that "take of California Tiger Salamanders inhabiting California Ground Squirrel burrows may occur in the project area" and that "based on the distance and topography between the project area and known breeding locations, salamander densities within the project area are expected to be low." To reduce and offset impacts and potential adverse effects to the California Tiger Salamanders from the loss of upland habitat, LLNL would implement avoidance and minimization measures during construction and implement a mitigation

plan developed during NNSA/LSO Endangered Species Act consultation with USFWS. A draft of the mitigation plan is included as attachment 1 to this supplement analysis. In summary, the plan proposes to enhance and protect one of two breeding locations onsite (including upland habitat) that are known to be population sinks.

The 2008 Amendment to the 2007 BA also provided an assessment of impacts from the project specific activities on the California Red-Legged Frog (CRLF). The document concluded that the project may affect but would not adversely affect the CRLF "based on the implementation of avoidance and minimization measures and that the occurrence of the California Red-Legged Frogs is unlikely in the project area. No other federally listed species are expected to be affected by this project."

Additionally, the mitigation measures identified in the 1992 EIS/EIR for the Western Burrowing Owl and American Badger would be implemented including pre-activity surveys, exclusion zones, and consultation with the California Department of Fish and Game if active dens would be unavoidably impacted. The proposed project would also provide protection for Burrowing Owls and the American Badger as the contaminated soil and sand would be excavated and solidified to prevent exposure of ecological receptors. The cover system employed would provide protection to prevent animals from burrowing into the solidified soil.

The increased size of the B850 soil remediation project area over that analyzed in the 2000 EA/FONSI and 2005 SW/SPEIS does not have a significant effect on the findings due to the avoidance and minimization measures and mitigation plan that would be implemented during the project activities. No additional impacts to plant and animal life are anticipated by the soil remediation and onsite consolidation at the B850 Firing Table.

4.5 **Land Uses and Applicable Plans**

Under the proposed project, soil remediation activities at the B850 Firing Table would occur within an approximately 7.3-acre area of previously disturbed land adjacent to the existing facility with up to 18.2 acres disturbed for access by heavy equipment, and an additional 0.3 acres for rerouting of electrical services. No new land area would be added to Site 300, however, the siting of the consolidated soil unit would place constraints on how DOE would use the approximately one acre location in the future. The proposed project would not violate any zoning, plans, or other land use controls.

The proposed action would not add any new personnel and would not result in any disproportionately high and/or adverse impacts to minority or low-income populations. The proposed project would not affect population, housing, or recreation.

Because the soil contamination at B850 is wholly contained onsite, site access is restricted, and there are no offsite exposure pathways, the proposed project would protect the health of site neighbors and residents in nearby communities. While restricted access to Site 300 plays a major role in protecting public health and safety, soil remediation provides additional protection by reducing the potential for human exposure to

contaminants. A goal of the cleanup effort is to isolate human and ecological receptors from contaminant concentrations in soil to protect human and ecological health.

Impacts to land use and socioeconomics under the proposed project are unchanged from those analyzed in the impact analyses in Section 5.3.1 in the 2005 SW/SPEIS and Section 4 of the 2000 EA/FONSI which stated "the range of uses at Site 300 could also be affected by soil contamination." Therefore, no additional impacts to land use and socioeconomics are anticipated by the proposed soil remediation and onsite consolidation at the B850 Firing Table.

4.6 **Traffic and Transportation/Utilities and Energy**

Under the proposed project, there would be no impact to utility services or capacity because the electrical services would be rerouted to existing distribution lines, the existing underground septic system would no longer be used and would be cut and capped in place following regulatory procedures, and the phone utility would be disconnected in place. Water service would be continued during project activities, but cut and capped in place at completion of the project. There would be no impact to public services because LLNL does not foresee hiring additional personnel to perform the proposed remediation work.

As opposed to that analyzed in the 2000 EA/FONSI, under the proposed project contaminated soil would not be removed from Site 300. Traffic at Site 300 would be minimally increased by construction activities, however traffic to and from the site on public roadways would not be affected.

Impacts to infrastructure under the proposed project are less than those analyzed in Sections 5.3.11 and 5.3.12 of the 2005 SW/SPEIS and Section 4 of the 2000 EA/FONSI. Therefore, no additional impacts to infrastructure are anticipated by the proposed soil remediation and onsite consolidation at the B850 Firing Table.

4.7 **Noise**

A short-term increase in noise level associated with routine construction activities would be expected to occur. However, because the majority of the surrounding land outside of Site 300 consists of rangeland, open space, and a State vehicular recreation area, noise increases from construction activities associated with the proposed project would not be noticeable offsite. There would be no long-term increase in noise level once the soil remediation project is completed.

Impacts from noise under the proposed project are unchanged from those analyzed in Section 5.3.10 of the SW/SPEIS and Section 4 of the 2000 EA/FONSI. Therefore, no additional impacts from noise are anticipated by soil remediation and onsite consolidation at the B850 Firing Table.

4.8 **Aesthetics and Scenic Resources**

Under the proposed project, soil removal would occur over a larger area than analyzed in the 2000 EA/FONSI. Grading of the surrounding hillside and the placement of the

consolidated soil unit could create an impact to aesthetics if it were of sufficient magnitude to remove or level the hillside that provides visual, auditory, and safety protection to the north, west, and south sides of the building and firing table. However, only the lower areas of the previously disturbed hillside would be graded to a depth of 1-3 feet and the consolidated soil unit would be directly adjacent to the hillside thereby maintaining the bowl-shape of the hillside. Following removal of all contaminated soil, the graded areas would be restored and reseeded with native grasses. Therefore, the aesthetics provided by the presence of the hillsides surrounding B850 and the firing table would not be significantly altered from the current profile. The covering of the consolidated soil unit would be visibly distinct from the hillside, but because the facility is not visible from public roadways, the impact is anticipated to be insignificant.

Impacts to aesthetics under the proposed project, including the cover on the consolidated soil unit which has been determined to have an insignificant impact, are unchanged from those analyzed in Section 5.3.5 of the SW/SPEIS and Section 4 of the 2000 EA/FONSI. Therefore, no additional impacts to aesthetics are anticipated by the soil remediation and onsite consolidation at the B850 Firing Table.

4.9 **Prehistoric and Historic Cultural Resources**

The proposed action would take place within a National Register of Historic Places (NRHP)-eligible historic district. This district was identified, evaluated, and designated as such after the 2000 EA/FONSI and 2005 SW/SPEIS were completed. The non-contiguous historic district consists of Buildings 850 and 851A, the test pads above them, and the land within a 10-foot radius around each of them.

The 2000 EA/FONSI indicates that if it is determined that a project activity would have the potential to impact an historic property, the location of the activity would be moved so that there would be no impact. The EA further states that "the project locations have sufficient flexibility that they can be relocated to areas where they would not impact cultural resources." This statement is in error in respect to the B850 soil remediation project as excavation of contaminated soil must occur where the contamination is, regardless of the proximity of cultural resources.

As noted in Section 4.8 *Aesthetics and Scenic Resources* (above), grading of the surrounding hillside and the consolidated soil unit could create an impact to aesthetics (and thereby the setting of the historic district) if it were of sufficient magnitude to remove or level the hillside that functions as visual, auditory, and safety protection to the building and firing table. However, only the lower areas of the previously-disturbed hillside would be graded to a depth of 1-3 feet and the consolidated soil unit would be directly adjacent to the hillside thereby maintaining the bowl-shape of the hillside. Following removal of all contaminated soil, the graded areas would be restored and reseeded with native grasses. Therefore, the aesthetics provided by the presence of the hillsides surrounding B850 and the firing table would not be significantly altered from its current profile, but the covering of the consolidated soil unit would be visibly distinct from the hillside.

According to 36 Code of Federal Regulation (CFR) 800.5 *Assessment of Adverse Effects*, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the national register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. While the surrounding hillside was not identified as a qualifying characteristic of the historic district, it provides a unique function for B850 by providing a level of protection and security to the activities conducted at the building and firing table. Significant grading or reshaping of the hillside to the extent that the amphitheater setting of the building is lost could diminish the impact of this function. This would be an adverse effect to a contributing element (B850) to the historic district. However, mitigation in the form of a Historic American Building Survey/Historic American Engineering Record (HABS/HAER) report and photo documentation are being prepared for B850 pursuant to guidance provided in Sections 106 and 110 of the NRHP, and in accordance with a draft Programmatic Agreement currently being reviewed by the State Historic Preservation Officer. As such, integration of the following stipulation in the work plan for the remediation of soil at B850 would allow for a finding of no adverse effects to a historic property.

- Exterior photo documentation consistent with guidance provided by the HABS/HAER program would be completed before any equipment, architectural features, or above ground utilities are removed, and before the start of any ground-disturbing work.

The B850 Firing Table is located in an area of Site 300 that has been determined to have low potential for archaeological and paleontological resources. LLNL guidance is to have an archaeological monitor on site for excavations below 1 foot in areas of undisturbed soil. For the proposed project, the areas of excavation with depths of 2-3 feet would be on steep hill slopes and/or areas previously disturbed by construction and operation of the facility. Therefore, archaeological monitoring would not be necessary during any of the proposed project activities. Additionally, mitigation in the 2000 EA/FONSI and 2005 SW/SPEIS related to unanticipated discoveries would still apply and not be affected by the increased size of the project area.

With integration of the above mitigation in the work plan, no additional impacts to cultural resources are anticipated by the soil remediation and onsite consolidation at the B850 Firing Table from those analyzed in Section 5.3.4 of the 2005 SW/SPEIS and Section 4 of the 2000 EA/FONSI.

5.0 Cumulative Impacts

The 2000 EA/FONSI and the 2005 SW/SPEIS concluded that there would be no cumulative impacts to the resource areas analyzed, but also acknowledged that the range of uses of Site 300 could be affected by soil contamination. All impacts identified in this supplement analysis related to termination of utility services and rerouting of electrical services, the increase in project area to be remediated, and onsite consolidation at the B850 Firing Table would be

mitigated by the incorporation of avoidance and minimization measures and implementation of mitigation plans. Therefore, no additional significant impacts and no significant cumulative impacts would result beyond those described in the 2000 EA/FONSI and the SW/SPEIS.

6.0 Summary Conclusion and Determination

The proposed action: utility termination and rerouting of electrical services, removal, solidification, and consolidation of contaminated soil at the B850 Firing Table was reviewed to assess if: 1) the activities would make substantial changes in the proposed actions for the SW/SPEIS preferred alternative that are relevant to environmental concerns; or 2) there are significant new circumstances or information relevant to environmental concerns bearing on the proposed action or its impacts. The potential impacts for the proposed action would be very small in comparison to and are bounded by the SW/SPEIS preferred alternative selected in the ROD.

Potential impacts were discussed in Section 4 of this supplement analysis. Areas of potential environmental concerns include geology and soils/site contamination, air quality, water, biological resources, land uses and applicable plans, traffic and transportation/utilities and energy, noise, aesthetics and scenic resources, prehistoric and historic cultural resources and cumulative impacts. In each case, the comparison of the impacts associated with the proposed project and the SW/SPEIS demonstrated that the impacts of the proposed project were not substantially changed from the impacts analyzed in the SW/SPEIS. There are no new circumstances or significant new information relevant to environmental concerns associated with the proposed project. DOE concludes that the proposed action is not a substantial change to the SW/SPEIS preferred alternative selected in the ROD. Further, there are no significant new circumstances or information relevant to environmental concerns bearing on the proposed action or its impacts. Therefore, a supplement to the SW/SPEIS is not needed under 40 CFR Part 1502.9.

April 16, 2009
Date

Alice C. Williams
Manager, Livermore Site Office
DOE/NNSA

7.0 References

Jones and Stokes, 1997. Jones and Stokes Associates, Inc. *Special-Status Plant Species Survey, Lawrence Livermore National Laboratory, Site 300.* Lawrence Livermore National Laboratory, Livermore, CA. 1997.

LLNL 1999, *Final Site-Wide Feasibility Study for Lawrence Livermore National Laboratory Site 300.* Lawrence Livermore National Laboratory, Livermore CA. (UCRL-AR-132609), dated November 1999.

LLNL 2001, "*Routine Maintenance and Operations Projects at the Lawrence Livermore National Laboratory's Livermore, Site 300 Experimental Test Site.*" Lawrence Livermore National Laboratory, Livermore, CA. February 2007.

LLNL 2004, *Interim Remedial Design for the B850 Operable Unit at Lawrence Livermore National Laboratory Site 300.* Lawrence Livermore National Laboratory, Livermore, CA. (UCRL-AR-201835), dated August 2004.

LLNL 2007, *Formal Consultation on the Continued Operation of Lawrence Livermore National Laboratory's Livermore Site and Site 300.* Lawrence Livermore National Laboratory, Livermore, CA. February 2007.

LLNL 2008a, *Final Engineering Evaluation/Cost Analysis for PCB-, Dioxin-, and Furan-contaminated Soil at the B850 Firing Table, Lawrence Livermore National Laboratory Site 300.* Lawrence Livermore National Laboratory, Livermore CA. (UCRL-AR-233862), dated February 2008.

LLNL 2008b, *Action Memorandum for the Removal Action at the B850 Firing Table, Lawrence Livermore National Laboratory Site 300.* Lawrence Livermore National Laboratory, Livermore CA. (LLNL-AR-403206), September, 2008.

LLNL 2008c, *Amendment to the Biological Assessment Titled "Formal Consultation on the Continued Operation of Lawrence Livermore National Laboratory Site and Site 300 for the B850 PCB-Bearing Soil Removal Project."* Lawrence Livermore National Laboratory, Livermore, CA. August *2008.*

DOE 2000, *Environmental Assessment of the Remediation of Environmental Contaminants at Lawrence Livermore National Laboratory Experimental Test Facility Site 300, California* and

Finding of No Significant Impact. U.S. DOE, Oakland Operations Office, Oakland, CA. (DOE/EA-1348).

DOE 2001, *Interim Site-Wide Record of Decision for Lawrence Livermore National Laboratory, Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, CA. (UCRL-AR-138470), dated February 2001.

DOE 2004, *Draft Site-Wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement*, US DOE, Livermore Site Office, Livermore, CA. (DOE/EIS-0348, DOE/EIS-0236-S3).

DOE 2005, *Record of Decision of the Final Site-Wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement*, DOE, Livermore Site Office, Livermore, CA. (DOE/EIS-0348, DOE/EIS-0236-S3).

USFWS 2002, *Formal Consultation on the Routine Maintenance and Operations Projects at the Lawrence Livermore National Laboratory's Livermore, Site 300 Experimental Test Site, Alameda and San Joaquin Counties (1-1-02-F-0062)*. U.S. Fish and Wildlife Service, dated May 2002.

USFWS 2007, *Amendment to the Routine Maintenance and Operations Projects at the Lawrence Livermore National Laboratory, Site 300 Experimental Test Site Biological Opinion (Service File Number 1-1-02-F-0062), Alameda and San Joaquin Counties, California*. Letter to Mr. Robert Kong, Acting Assistant Manager, US DOE, Livermore Site Office (1-1-07-F-0224). U.S. Fish and Wildlife Service, dated July 2007.

Attachment 1

Proposed Compensation and Mitigation Plan

COMPENSATION AND MITIGATION PLAN

The proposed B850 soil clean-up project would potentially result in a maximum and long-term loss of up to 17.8 acres of upland habitat for the California Tiger Salamander. This acreage value is based on the soil cleanup removal action approved by the CERCLA regulatory agencies and the current design (roughly 35% design level). There is a strong likelihood that permanent upland habitat loss for the California Tiger Salamander will be sized smaller than the 17.8 acres identified; if significantly different, DOE/NNSA may wish to discuss a mitigation plan that has been down-sized from the scope of those presented herein after soil cleanup has been completed and actual habitat impacts have been assessed (Fall 2009).

Based on current design, and to compensate for potential adverse effects to the species and potential incidental take during soil excavation activities, DOE/NNSA will implement one of the following two habitat enhancement options to benefit the federally-threatened Tiger Salamander onsite.

This mitigation plan is designed to improve poorly performing breeding pools (population sinks) at Site 300 and permanently protect a minimum area of 48.5 acres (based on a radius of 250-meters) of upland habitat surrounding the pool [based on Trenham (2001)]. See figure 9 for detailed locations of the two identified sites.

Breeding Pool Enhancement and Protection options are:

1) Southwest Corner Pool (Pool BC); and

2) Northwest Pool Overflow (Pool OA).

DOE/NNSA proposes to enhance one of the two mitigation options approximately 18 months after receipt of a BO (e.g., end of summer 2010) for the B850 soil clean-up project and protect a minimum area of 48.5 acres of upland habitat surrounding the enhanced pool. The enhancement pools are ranked based on salamander ecology; historic significance; watershed size and hydro period length; and engineering and construction suitability.

Mitigation Proposal: Breeding Pool Enhancement and Protection

The mitigation proposal would enhance a current California Tiger Salamander breeding (sink) pool at Site 300 and permanently protect a minimum area of 48.5 acres (based on a 250-meter radius) surrounding the pool to contain approximately 95% of the adult salamanders (Trenham 2001). The area of upland habitat proposed for protection around the pool would be identified by modifying a 250-meter radius circle around the pool to include approximately the same area (48.5 acres) comprising upland grassland habitat with Ground Squirrel burrows, excluding developed facility areas.

The mitigation goal for the B850 Project would be to increase California Tiger Salamander recruitment at Site 300 by increasing the length and depth of a breeding pool known to be a population sink. This action would result in a longer pool hydro period (sustainability) during average rain years and allow for increased metamorphosis of salamander larvae to the terrestrial phase. Increasing salamander recruitment at Site 300 would increase population size and contribute to the overall viability of the meta population of this threatened species. Protecting upland habitat surrounding the pool would provide long-term conservation of the population.

Previous Habitat Enhancement Sites: DOE/NNSA has previously enhanced ephemeral aquatic habitat for the California Tiger Salamander at two locations in the northwest corner of Site 300 (Figure 7). The population center (source) for both of these sites is pool A (Figures 7 and 8).

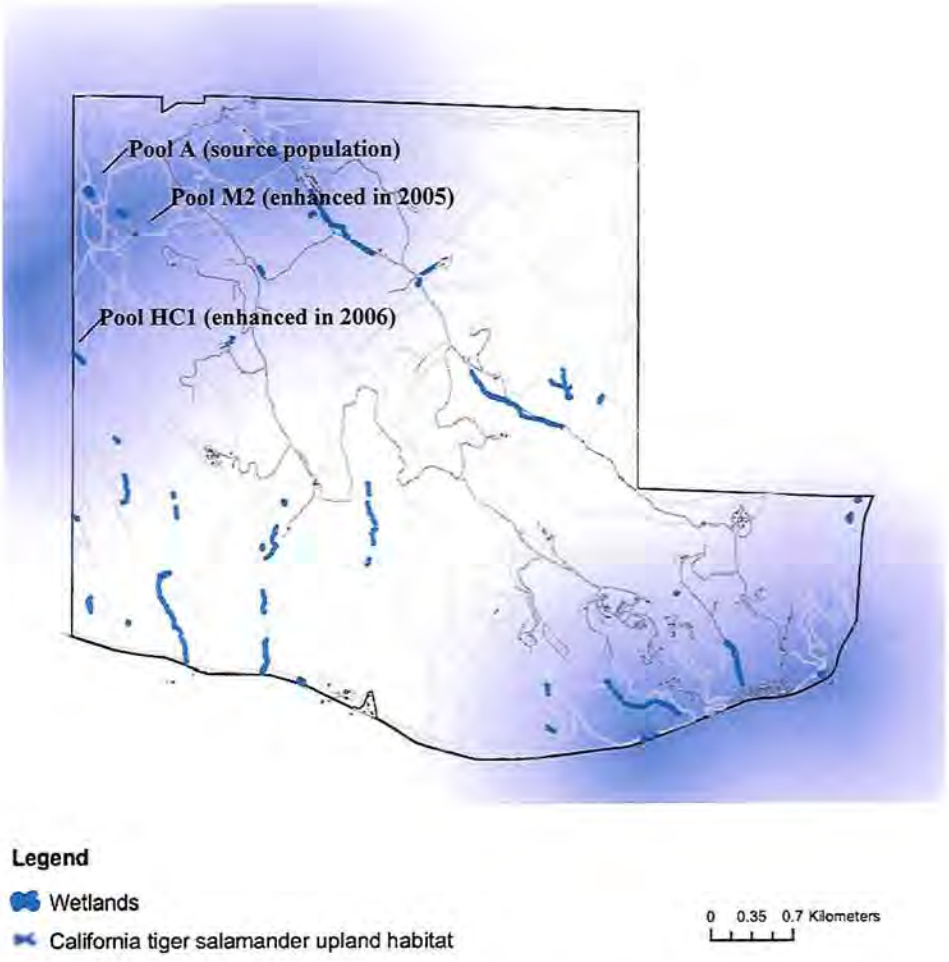

Figure 7. Locations of the California Tiger Salamander Mitigation Pool and Habitat Conservation Pool in relation to Pool A, the population source in the northwestern portion of Site 300.

Figure 8. Pool A is a large, deep (> 2 m at the western edge), usually ephemeral pool that is the source population for California Tiger Salamanders in the northwest portion of Site 300. This pool was bermed by LLNL personnel in the early 1980's to increase its size and depth. The pool fills in December-February and dries in August-September during average rain years. The pool also supports a small population of California Red-Legged Frogs.

Potential Breeding Pool Mitigation Sites

Although recently completed in fall of 2005, the California Tiger Salamander pool M2 produced metamorphosis (juvenile salamanders) in 2006, considered an average rain year. Subsequent years have yielded below average rainfall for this site and metamorphosis/recruitment has not occurred. Nonetheless, the pool M2 will likely strengthen the meta population structure of the 3 pools in the northwestern pool complex and potentially provide an additional source pool. Further enhancements could focus on sink pools that are located in other portions of the site in order to increase overall salamander recruitment and meta population strength at Site 300.

LLNL biologists have determined, based on salamander presence, ecology, meta population structure, locations of previous salamander breeding habitat improvements at Site 300, and availability of potential California Tiger Salamander breeding enhancement sites, that the best strategy for further protection of California Tiger Salamander breeding habitat at Site 300 is to enhance breeding locations onsite that are known to be population sinks.

This section describes two potential California Tiger Salamander mitigation pool sites at Site 300 that currently serve largely as population sinks for salamanders: 1) pool BC (in the southeast corner of the site), an 2) pool OA (overflow to the Pool A, the source pond in this area Figure 9). The uplands surrounding these pools consist of grassland with abundant California Ground Squirrel burrows and are in close proximity to areas that are included in the annual prescribed burn at Site 300.

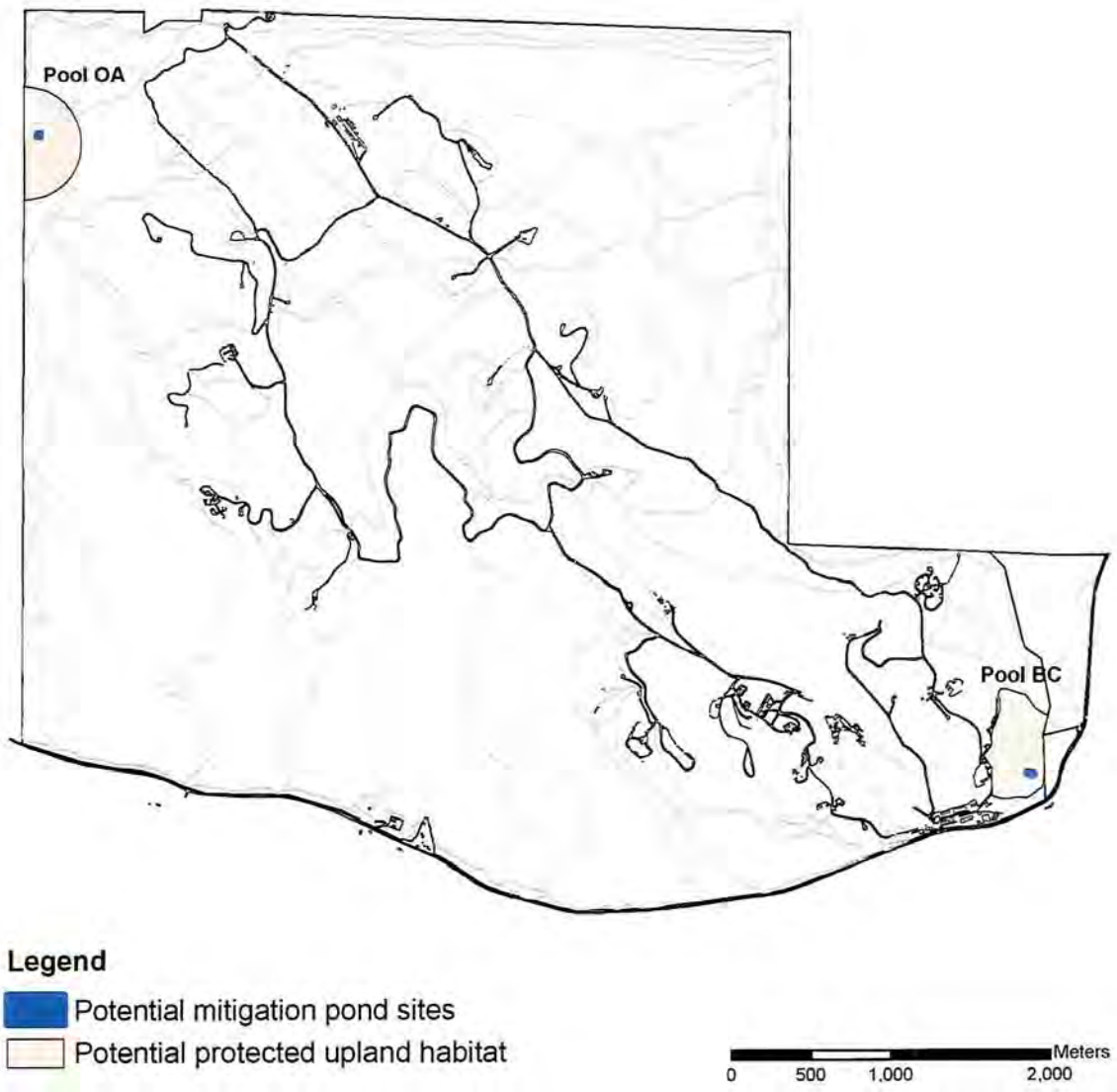

Figure 9. Protected upland habitat for each proposed pool. Pink shading consists of 48.5 acres of upland habitat (based on a radius of 250-meters that avoids developed areas) and depicts the upland dispersal habitat for the California Tiger Salamander around breeding pools. Pools OA and BC contain breeding salamanders but do not produce metamorphosis because of a limited hydro period. These pools could benefit from design and earthwork enhancements.

Site 1: Pool BC

Figure 10: Pool from its southern vantage looking northward and up-gradient.

Pool BC is located in the southeast portion of the site, approximately 900-feet (274 meters) northeast of the general services area facilities at Site 300 and is used for breeding by California Tiger Salamander on average rain years. Amphibian surveys conducted by LLNL biologists since the 1990's have documented breeding in this location by California Tiger Salamanders, California Red-Legged Frogs, and Western Spadefoot Toads, a California species of special concern. This pool has been heavily impacted by sediment deposition, has a shortened hydro period, and dries before metamorphosis of amphibian larvae can occur.

Enhancement of the pool would consist of deepening the pool area, providing an in-stream sediment collection feature above the pool, and installing an overflow culvert with an energy dissipater device at the tail-end of the pool where a dirt road crosses the ravine. Maintenance actions could be required periodically to remove sediment transported from upstream. Preliminary design should focus on evaluating the site for hydrologic adequacy: potential water retention until the August-September timeframe given seasonal evaporation and watershed rainfall input. Upland habitat consists of grassland with abundant Ground Squirrel burrows.

Site 2: Pool OA

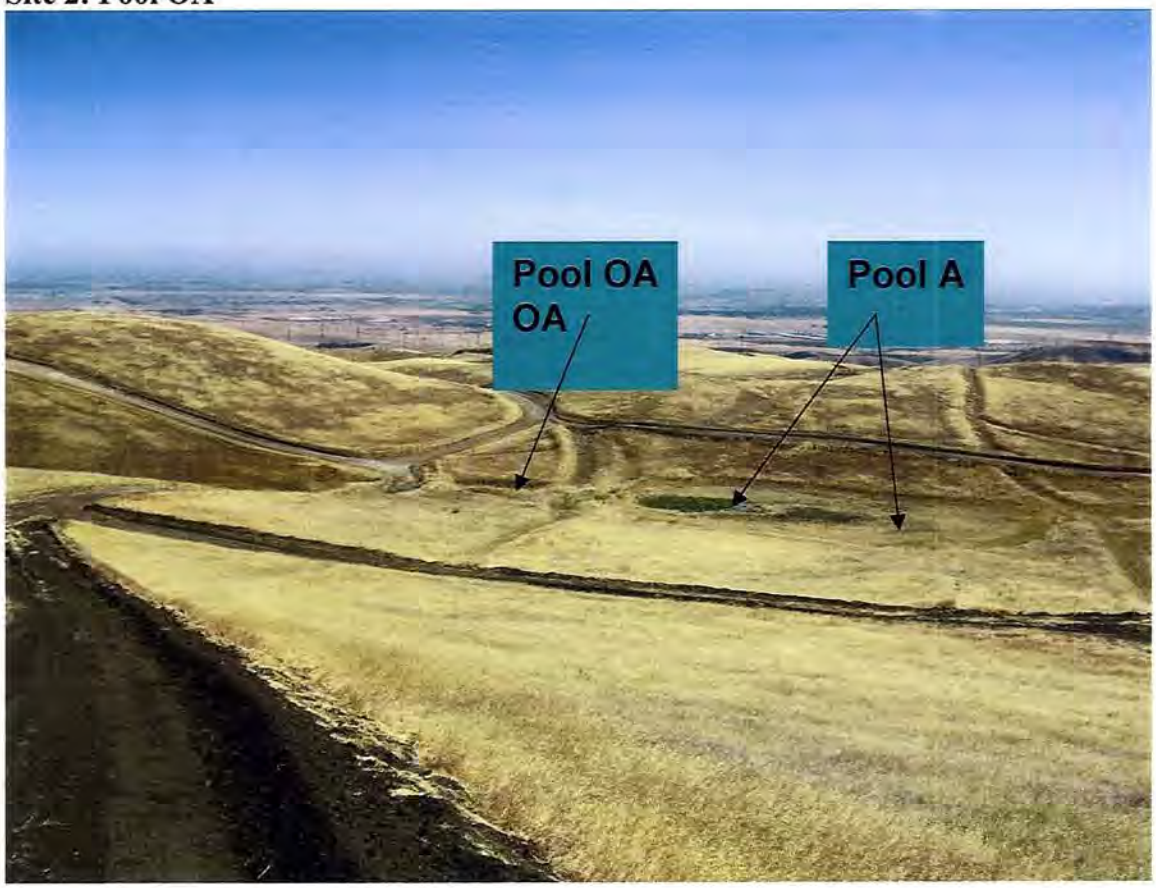

Figure 11: Looking northward from the ridge south of the pool complex. A fire trail crosses below Pool OA on the far left of photo.

Pool OA is located in the remote northwest portion of the site, immediately below pool A, and is a small pond used for breeding by California Tiger Salamander on average rain years. Amphibian surveys conducted by LLNL biologists since the 1990's have documented breeding by California Tiger Salamanders and Western Toads at this location. California Red-Legged Frogs, Clam Shrimp, and *Linderiella* Fairy Shrimp also occur in pool A. This pool has been impacted by sediment deposition from pool A (when water overflows the current berm feature), has a shortened hydro period, and dries before metamorphosis of amphibian larvae can occur.

Enhancement of this small pool would consist of increasing depth, shoring-up the berm of pool A with rock (or other material) to strengthen the structure from overflow erosion, and installing two overflow culverts (one from pool A and one at the tail end of pool OA where a fire trail occurs). Annual or periodic maintenance actions of pool OA will not be required because of the self-scoring aspect of the pool A culvert. Upland habitat consists of grassland with abundant Ground Squirrel and Gopher Burrows.

General Methods for Enhancement of Breeding Sites

As stated above, DOE/NNSA would enhance one of two potential breeding pools at Site 300 that are currently population sinks for the California Tiger Salamander. In addition, a maximum of 48.5 acres of upland habitat surrounding the pool would be permanently protected. The methods and monitoring strategy developed for the pool enhancement would be similar to those followed for enhancing ponds elsewhere at Site 300. A general description follows, however methods used will depend on pending engineering analyses. A more detailed design (Wetland Enhancement and Monitoring Plan) would be provided to the service prior to implementation of the enhancement action.

Methods: The natural shape, configuration and slope of the pool would be incorporated into the new pool design, which would essentially be a slimmer and deeper version of the existing pool. The pool would be situated where the natural contour of the land is conducive for excavation to cover equal or less than the current pool surface area and double the current pool depth (Table 1). Because salamander larvae require significantly more time to transform into juvenile adults than other amphibians, pool sustainability into the summer months is vital. The enhanced pool would vary by site but conceptually would be approximately 12ft (4 meters) deep, and have a 1:1 to 2:1 slope (depending on soil dynamics). Up to approximately 1,000-pounds of Bentonite clay (Benseal™) would be added to the already clayey soil to further reduce percolation. Excess soil would be built up to form the berm. A culvert with a T-fitting energy dissipater may be installed in the berms of the enhanced pools to convey high flows through the pool; rock may be placed in the channel section below the culvert. The excavated berm and pool would be compacted to the greatest extent possible to minimize percolation through the berm.

Table 1. Estimated dimensions for each potential site.

Potential Mitigation Pool	Approximate Length (feet)	Approximate Width (feet)	Approximate Depth (feet)
Pool BC	70	15-18	10 to 12
Pool OA	50	15-18	10 to 12

Excavation would be conducted in summer of 2010, although work would not begin until the pool area had dried and was dry enough to allow for optimal excavation and compaction (approximately July/August-October 15).

While excavation would be performed when the pool is dry, there is the potential for a minimal amount of take of California Tiger Salamanders and, to a lesser degree, California Red-Legged Frogs. California Tiger Salamanders are known to occur in all three potential enhancement pools and California Red-Legged Frogs have been documented at all three infrequently. There is the potential for both these species to occur in burrows within the area that would be excavated. However, their occurrence in the excavation area during construction would likely be at very low densities.

Pre-activity surveys conducted by LLNL wildlife biologists prior to excavation would minimize adverse impacts to sensitive species due to project activities. The top 6-inches of soil on the pool bottom would be collected and staged at the project site and replaced once the new pool is created to conserve branchiopod populations. Any California Tiger

Salamanders or California Red-Legged Frogs encountered would be collected and placed within the next closest burrow outside of the project area.

All work would be performed in accordance with Federal and State regulations and all required permits would be obtained prior to the start of work. Best Management Practices would be used as appropriate at the pool site including placing filter fabric, hydro-seeding the disturbed areas where necessary with a native seed mix, storing the equipment on the fire trail graded area to prevent inadvertent leaks into the habitat area, and having a spill kit available on the project site to clean-up leaks and drips. The LLNL labor shop or a qualified contractor would perform excavation, fill, and culvert installation activities. A LLNL wildlife biologist or a qualified contractor would provide the design. All work would be monitored and directed by an LLNL wildlife biologist.

Monitoring: Currently the potential mitigation pools do not fill every year, but fill on average rain years (based on yearly observations since 1994). It is expected that average rain years would fill the enhanced pool. The following data would be collected each year for the enhanced pool and reported to the service at the end of five years:

1) Approximate date of initial inundation;
2) Approximate date of complete hydration and inundation;
3) Date of first eggs encountered (natural substrate or egg grid);
4) Dip netting to determine relative abundance using a scheme consistent from year to year (federal 10(A)(1)(a) permit being amended for this);
5) Visual encounter surveys would be conducted during the final days of inundation to determine desiccation mortality; and
6) Status report due to the service after 5 years or as required.

Performance Criteria: The potential mitigation pools are ephemeral; therefore inundation would be based on precipitation totals for each year. It is expected that during average to above average rain years that the enhanced pool would fill. In years when the pool fills, it is predicted that California Tiger Salamander larvae would metamorphose and disperse from the pool. On average to above average rain years (11-inches total precipitation or more per year), monitoring strategies would verify whether the enhanced pool is functioning as predicted and producing metamorphic California Tiger Salamanders.

Contingency Plan: If this mitigation project is unsuccessful (i.e., failure of the pool to produce metamorphic larvae on average to above average rain years) and doesn't enhance breeding population numbers, DOE/NNSA will consult with the service.

Possible additional pool modifications (activities would be performed during the summer when the pool is dry) include:

1) Compaction of the pool;
2) Addition of Bentonite clay;
3) Shore up the berm; and

4) Excavate the pool: re-contour the pool and dredge the pool if needed.

The mitigation plan, as proposed, would generate useful data that can be reviewed, published, and used to develop a contingency plan or alternative approach to the original compensation package.

References

Cook, D.G., P.C. Trenham, and D. Stokes. 2005. *Sonoma County California Tiger Salamander meta population, preserve requirements, and exotic predator study. Report to U.S. Fish and Wildlife Service*, dated December, 2005.

Trenham, P.C. 2001. *Terrestrial habitat use by adult California Tiger Salamanders*, Journal of Herpetology 35:343-346.