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APPENDIX F: FLOODPLAIN AND WETLANDS ASSESSMENT

F.1 INTRODUCTION

This appendix is prepared to provide an analysis of the potential impacts on floodplains and wetlands from the No Action Alternative, Proposed Action, and Reduced Operation Alternative. See Chapter 3 of the *Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (LLNL SW/SPEIS). It is also prepared to demonstrate U.S. Department of Energy (DOE) efforts to avoid, as much as possible, adverse impacts to floodplains and wetlands located at its facilities as directed by Executive Order (EO) 11988, Floodplain Management, and EO 11990, Protection of Wetlands, respectively. Figure F.1–1 illustrates the relationship of Appendix F to other LLNL appendices and sections of the text in this LLNL SW/SPEIS, and DOE requirements.

F.2 FLOODPLAIN EFFECTS

F.2.1 Methods

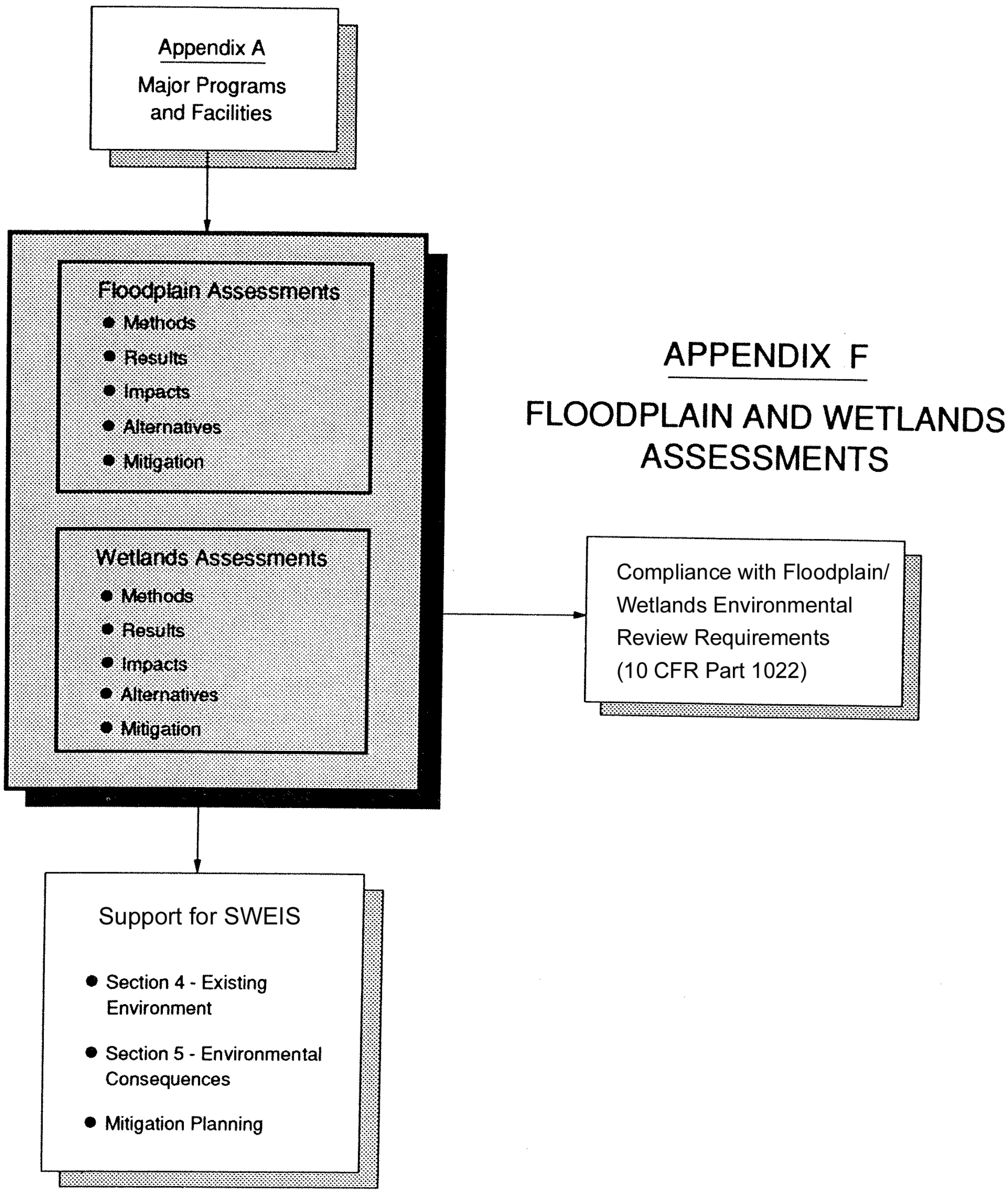
Livermore Site

The 100-year floodplain at the Livermore Site was identified from studies performed in 1981 and 1997 by the Federal Emergency Management Agency (FEMA) to determine flood hazards in the Alameda County area. These floodplains were incorporated into the Flood Insurance Rate Maps (FEMA 1997a, FEMA 1997b, FEMA 1981) and are shown in Figure F.2.1–1.

Since completion of the FEMA studies, DOE has modified the banks and channel of the Arroyo Las Positas. Specifically, a berm was constructed along the southern bank of the arroyo to ensure that the 100-year flood event would not inundate the Livermore Site.

Site 300

Site 300 includes several large canyons that drain into Corral Hollow Creek. The Flood Insurance Rate Map for Corral Hollow Creek was used to characterize the 100-year floodplain in the area adjacent to the Site 300 (Figure F.2.1–2). Because FEMA did not map other areas within the Site 300 boundaries in their studies, DOE conducted modeling for the 1992 Lawrence Livermore National Laboratory (EIS/EIR) to characterize the 100-year floodplain for the canyons at Site 300. Three drainages (Oasis/Draney Canyon, Elk Ravine, and Middle Canyon) were used as representative drainages for the analysis. Peak runoff was computed using the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center Flood Hydrograph Package (USACE 1981). Model parameters, which represented average conditions within the drainage basins, included drainage area, rainfall, precipitation loss factor, and unit hydrograph and flood routing parameters. The computed hydrographs at the outlet of each basin provide the peak flows for the 100-year flood event. The 500-year event was not examined because there is no 500-year floodplain in the Corral Hollow Creek area at Site 300.



Source: Original.

FIGURE F.1–1.—*Appendix F Interface with Site-wide Environmental Impact Statement Sections, Appendix A, and Regulatory Reviews*

As part of this LLNL SW/SPEIS, site-specific rainfall data from 1996 through 2002 were examined and compared to data used for the 1992 modeling effort. Rainfall intensities and amounts during this period were generally comparable to data used for the 1992 modeling effort; i.e., an average of about 10 inches per year, with most precipitation occurring in the winter months, with the exception of 1998 when almost 19 inches of precipitation were recorded at Site 300.

F.2.2 Results

Livermore Site

At the time of the FEMA mapping effort, the 100-year floodplain of the Arroyo Las Positas primarily extended north of the channel, but did extend south of the banks of the Arroyo Las Positas for a short distance. However, as previously discussed, the berm constructed for the Arroyo Las Positas Maintenance Project has effectively confined the 100-year floodplain to the buffer zone north of the Livermore Site. Thus, the southerly extent of the 100-year floodplain is no longer as depicted on Figure F.2.1–1.

As shown on Figure F.2.1–1, the 100-year and 500-year floodplains do encroach on the far eastern boundary of the Livermore Site. No structures are located within either the 100-year or 500-year floodplains in this area.

The Arroyo Seco crosses the Livermore Site at the far southwestern corner for a distance of about 1,800 feet. As shown on Figure F.2.1–1, the 100-year and 500-year floods are contained within the channel; therefore, Arroyo Seco poses no threat of flooding to the Livermore Site.

Site 300

As shown on Figure F.2.1–2, the 100-year floodplain of Corral Hollow Creek, as mapped by FEMA, is located adjacent to the General Services Area (GSA) area along Corral Hollow Road. Parts of Corral Hollow Road in this area are within the 100-year floodplain and would, therefore, be inundated during a 100-year event.

The results of DOE's modeling indicated peak flows of 91 cubic feet per second for Middle Canyon (13.9 feet wide), 368 cubic feet per second for Elk Ravine (19.5 feet wide), and 355 cubic feet per second for Oasis/Draney Canyon (19.6 feet wide). Depth of flow ranged from 1 to 2.4 feet. These results indicate that the 100-year flood elevation is contained within the channels; therefore, no 100-year floodplains exist at Site 300 (LLNL 1992a).

F.2.3 Impacts of the Proposed Action

Livermore Site

Because no structures are proposed to be located within the 100-year or 500-year floodplain at the Livermore Site under the Proposed Action, there would be no impact to the 100-year or 500-year floodplain from implementing the Proposed Action. Maintenance activities within the channel of the Arroyo Las Positas would continue. The impacts from these activities are discussed in the project-specific environmental assessment prepared for that maintenance project (DOE 1998b).

The 1992 LLNL EIS/EIR assessed flooding of Livermore Valley by a postulated seismic failure of Del Valle Dam. It was concluded that under such a scenario, the Livermore Site would not be flooded. Similarly, a postulated seismic failure of the Patterson Reservoir or the nearby South Bay Aqueduct would not flood the Livermore Site because the floodwaters would flow into and be contained within Arroyo Las Positas and Arroyo Seco (LLNL 2001ay).

Site 300

Because there are no 100-year floodplains at Site 300, the Proposed Action would not affect 100-year floodplains. Furthermore, because the 100-year storm event is contained within the channels of the canyons and ravines at Site 300, activities at Site 300 would not be affected by the 100-year storm event.

F.3 WETLAND EFFECTS

Wetland delineations for 3 small wetland areas along Arroyo Las Positas at the Livermore Site and 16 wetlands at Site 300 were included in the 1992 LLNL EIS/EIR (LLNL 1992a). Subsequently, additional wetland delineations have been performed at the Livermore Site in 1997 and at Site 300 in August 2001 and July 2002 (Jones and Stokes 1997, 2002c). Text from the wetland delineation reports prepared in 1997 for Arroyo Las Positas and in 2002 for Site 300 have been incorporated into this appendix with little change to retain the nature of agreements between LLNL, DOE, and USACE regarding jurisdictional wetlands subject to Section 404 of the *Clean Water Act* (Jones and Stokes 1997, 2002c).

In January 2003, USACE and the U.S. Environmental Protection Agency (EPA) jointly released a request for agency and public comment on the definition of "waters of the U.S.," particularly the definition for isolated wetlands that are both intrastate and non-navigable (68 FR 1991). Depending on the terminology adopted for the revised definition of "waters of the U.S.," some of the wetlands currently anticipated to qualify as jurisdictional wetlands, listed in Table F.3.2.2–1, may become exempt from jurisdictional wetland regulation under Section 404 of the *Clean Water Act*. However, those wetlands may still qualify for protection under California law.

F.3.1 Livermore Site

F.3.1.1 *Methods*

Jurisdictional wetlands and other waters of the U.S. were delineated using the routine onsite determination procedure from the USACE wetland delineation manual (USACE 1987). The manual provides technical guidelines and methods for determining the boundaries of jurisdictional wetlands, based on three parameters:

- Hydrophytic vegetation
- Hydric soils

- Wetland hydrology

A wetland delineation was performed of Arroyo Las Positas on August 5, 1997. Sample plots were established in representative locations in each plant community present: six in wetland plant communities and one in the upland plant community. At each sample point, the dominant plant species were recorded (Jones and Stokes 1997).

Because flowing water was present in the Arroyo Las Positas channel, wetland hydrology was determined to be present by direct observation of inundation or saturation. Wetland hydrology is defined by the USACE to occur when an "area is inundated either permanently or periodically at mean water depths less than or equal to 6.6 feet, or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation" (USACE 1987). Under the USACE classification of wetland hydrologic regimes, wetlands typically are inundated or saturated for more than 12.5 percent of the growing season, although areas inundated or saturated between 5 percent and 12.5 percent of the time may also qualify as wetlands (Jones and Stokes 1997).

The growing season in Livermore is between 250 and 255 days (Welch et al. 1966); therefore, inundation or saturation for 31 days or more is characteristic of wetlands in the Livermore area, although areas inundated or saturated for more than 12.5 days may also qualify as wetlands.

Hydric soils were assumed to be present from an aquic moisture regime. An aquic moisture regime is one of the primary indicators of hydric soils (USACE 1987). This situation occurs when the soil is saturated by groundwater or water of the capillary fringe and respiration by microorganisms, roots, and soil fauna removes oxygen from the soil, creating reducing conditions. A peraquic moisture regime occurs when soils are permanently saturated. Areas potentially qualifying as wetlands or other waters of the U.S. which are subject to USACE jurisdiction, were mapped (Figures F.3.1.1–1, F.3.1.1–2, and F.3.1.1–3). Routine wetland determination forms were completed during the field delineation (Jones and Stokes 1997).

Approximately 900 feet of Arroyo Seco is on LLNL property. In July 2001, a wetland delineation survey was performed. Potential wetland areas are shown in Figure F.3.1.1–4 (LLNL 2001ap).

F.3.1.2 *Results and Discussion*

Arroyo Las Positas on the Livermore Site is an approximately trapezoidal channel. The channel is concrete-lined and riprapped at two locations where the channel makes 90-degree bends. Several other small concrete spillways occur in the channel and along the southern bank, where drainage outfalls occur. Most of the channel is vegetated, although several small areas of open, standing water are present. A total of 0.171 acre of open water habitat is present in the channel. A description of the plant communities present and an assessment of the hydrology and soils are presented below (Jones and Stokes 1997).

Vegetation

A total of 1.963 acres of wetland habitat is present in the Arroyo Las Positas channel. Three wetland plant communities were identified: ruderal wetland, freshwater marsh, and riparian scrub. The locations of the wetland plant communities are displayed in Figures F.3.1.1–1, F.3.1.1–2, and F.3.1.1–3. An upland plant community of annual grassland was present on the upper channel banks and in the fields north of the channel (Jones and Stokes 1997).

The scientific names and wetland indicator status of plant species mentioned in the text are provided in Table F.3.1.2–1. The wetland indicator status of plants has been determined under the following scheme: species that occur in wetlands 99 percent of the time are called obligate species; those that occur in wetlands 67 to 99 percent of the time are facultative-wet species; those equally likely to occur in wetlands or nonwetlands are facultative plant species; and those that occur 67 to 99 percent of the time in nonwetlands are facultative-upland species. Hydrophytic vegetation is defined as "macrophytic plant life growing in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content." An area has hydrophytic vegetation when, under normal circumstances, more than 50 percent of the vegetation is obligate, facultative-wet, or facultative species (Jones and Stokes 1997).

Ruderal Wetland

Ruderal plant species are adapted to colonizing recently disturbed soils. Ruderal wetland species colonize disturbed soils in areas with wetland hydrology, such as along streams, irrigation canals, and drainage ditches, and in pastures and irrigated cropland. The dominant species in the ruderal plant community along Arroyo Las Positas are tall flatsedge (*Cyperus eragrostis*), bristly ox-tongue (*Picris echioides*), bearded sprangletop (*Leptochloa fasciculata*), Bermuda grass (*Cynodon dactylon*), and barnyard grass (*Echinochloa crus-gallii*). Nearly half (45.9 percent) of the 37 species observed in the Arroyo Las Positas channel were nonnative ruderal species (Jones and Stokes 1997).

Freshwater Marsh

Freshwater marsh is a wetland plant community dominated by perennial, emergent monocots, typically cattails (*Typha*) or bulrushes (*Scirpus*). A freshwater marsh along Arroyo Las Positas is dominated by narrow-leaved cattail (*T. angustifolia*), broad-leaved cattail (*T. latifolia*), and alkali bulrush (*Scirpus robustus*). Many of the ruderal wetland species occurring in the channel are also associated with the freshwater marsh plant community (Jones and Stokes 1997).

Riparian Scrub

Riparian scrub is a streamside wetland plant community dominated by woody shrubs, typically willows (*Salix*). Most of the riparian scrub along Arroyo Las Positas is dominated by narrow-leaved willow (*S. exigua*). Goodding's willow (*S. gooddingii*), arroyo willow (*S. lasiolepis*), and red willow (*S. laevigata*) also occur along the channel. A small stand of cottonwoods (*Populus*), progeny of trees planted along the north side of the channel, is also becoming established in the channel (Jones and Stokes 1997).

TABLE F.3.1.2–1.—*Plant Species Observed in Arroyo Las Positas, Lawrence Livermore National Laboratory*

Scientific Name	Common Name	Channel Position		Wetland Indicator Status
		Upper Bank	Lower Bank and Channel Bottom	
Atriplex semibaccata	Australian saltbush	X		FAC
Atriplex triangularis	Halberd-leaved saltbush		X	FACW
Avena fatua	Wild oats	X		- -
Azolla filiculoides	Mosquito fem		X	OBL
Bromus diandrus	Ripgut brome	X		- -
Baccharis salicifolius	Mule fat		X	FACW
Bromus hordeaceus	Soft chess	X		FACU
Casuarina sp.	Beefwood		X	- -
Centaurea solstitialis	Yellow star-thistle	X		- -
Cirsium vulgare	Bull thistle		X	FACU
Convolvulus arvensis	Field bindweed	X		- -
Conyza bonariensis	South American horseweed	X		- -
Conyza canadensis	Canada horseweed	X	X	FAC
Crypsis schoenoides	Swamp timothy		X	OBL
Cynodon dactylon	Bermuda grass	X	X	FAC
Cyperus eragrostis	Tall flatsedge		X	FACW
Distichlis spicata	Saltgrass	X	X	FACW
Echinochloa crus-gallii	Barnyard grass		X	FACW
Epilobium brachycarpum	Panicled willow-herb	X	X	- -
Epilobium ciliatum	Hairy willow-herb		X	FACW
Eremocarpus setigerus	Turkey mullein	X		- -
Eschscholzia californica	California poppy	X		- -
Gnaphalium luteo-album	Weedy cudweed		X	FACW
Hemizonia fitchii	Fitch's spikeweed	X		- -
Hirschfeldia incana	Mediterranean mustard	X		- -
Leptochloafasciculata	Bearded sprangletop		X	OBL
Lolium multiflorum	Italian ryegrass	X	X	FAC
Lotus corniculatus	Bird's-foot trefoil		X	FAC
Lythrum hyssopifolium	Hyssop loosestrife		X	FACW
Malvella leprosa	Alkali mallow	X	X	FAC
Medicago polymorpha	California bur-clover	X		- -
Melilotus indica	Indian sweetclover	X		FAC
Oenothera biennis	Common evening-primrose		X	- -
Phalaris aquatica	Harding grass	X		FAC
Picris echioides	Bristly ox-tongue	X	X	FAC
Plantago lanceolata	English plantain	X		FAC
Polygonum persicaria	Lady's thumb		X	FACW
Polypogon monspeliensis	Annual rabbit's-foot grass		X	FACW
Populus fremontii	Fremont cottonwood		X	FACW

TABLE F.3.1.2–1.—*Plant Species Observed in Arroyo Las Positas, Lawrence Livermore National Laboratory (continued)*

Scientific Name	Common Name	Channel Position: Upper Bank	Channel Position: Lower Bank and Channel Bottom	Wetland Indicator Status
Ranunculus sceleratus	Celery-leaved buttercup		X	OBL
Rorippa nasturtium-aquaticum	Watercress		X	OBL
Rumex conglomeratus	Clustered dock		X	FACW
Rumex crispus	Curly dock	X	X	FACW
Salix exigua	Narrow-leaved willow		X	OBL
Salix gooddingiana	Black willow		X	OBL
Salix laevigata	Red willow		X	- -
Salix lasiolepis	Arroyo willow		X	FACW
Scirpus robustus	Alkali bulrush		X	OBL
Tragopogon porrifolius	Salsify	X		- -
Typha angustifolia	Narrow-leaved cattail		X	OBL
Typha latifolia	Broad-leaved cattail		X	OBL
Veronica anagallis-aquatica	Water speedwell		X	OBL
Vicia villosa	Winter vetch	X		- -
Xanthium strumarium	Common cocklebur		X	FAC

Source: Jones and Stokes 1997.
Wetland indicator status (USFWS 1988).
OBL = obligate, 99% occurrence in wetlands; FACW = Faculative Wetland, 66-99% occurrence in wetlands; FAC = Faculative, 33-66% occurrence in wetlands; FACU = Faculative upland, 1-33% occurrence in wetlands; -- = no indicator status, assumed to be upland species.

Annual Grassland

Annual grassland on the upper Arroyo Las Positas channel bank and outside of the channel is an upland plant community dominated by annual grasses and forbs. The dominant species on the site are wild oats (*Avena barbata*) and brome grasses (*Bromus*). Associated species include alkali mallow (*Malvella leprosa*) and yellow star-thistle (*Centaurea soltitialis*) (Jones and Stokes 1997).

Hydrology

An ordinary high watermark was not readily apparent in the Arroyo Las Positas channel. Evidence such as scour, watermarks, or sediment and debris deposits, was lacking. A small flow of water was observed in the channel where it enters the Livermore Site at its eastern boundary. This offsite source of water was not investigated. The flow of water was not continuous in the channel, and some sections of the channel were not inundated. Most of the water observed in the channel appeared to be treated groundwater that Livermore releases regularly into the channel. Because seasonal streams in California are dry during the summer months and because of the presence of perennial wetland vegetation in the stream channel, water is assumed to be present in the channel on a permanent or semipermanent basis. Because no ordinary high watermark was evident, the extent of saturated soil was used to distinguish the limit of wetland hydrology (Jones and Stokes 1997).

Soils

The present channel of Arroyo Las Positas on the Livermore Site was excavated in areas mapped as Rincon loam (zero- to 3-percent slopes), San Ysidro loam, and Rincon clay loam (3- to 7-percent slopes) (Welch et al. 1966). None of these soils are listed as hydric. Soils in the channel bottom and lower portion of the bank were assessed as hydric, based on the presence of a peraquic moisture regime. Soil characteristics in the channel were not examined, but hydric soil characteristics may have formed following redirection of the stream flow (Jones and Stokes 1997).

Jurisdictional Assessment

Approximately 2.13 acres are likely to be waters of the U.S., subject to USACE jurisdiction. Table F.3.1.2–2 shows wetlands and other waters by type and acreage (Jones and Stokes 1997). These delineations are preliminary and subject to verification by the USACE.

TABLE F.3.1.2–2.—*Wetland Acres, by Type and Size*

Habitat Type	Size (acres)
Open water	0.171
Ruderal wetland	1.224
Freshwater marsh	0.649
Riparian scrub	0.090
Total	**2.134**

Source: Jones and Stokes 1997.

In July 2001, a wetland delineation survey was performed along approximately 1,800 feet of Arroyo Seco on LLNL property. Within the arroyo, six vegetated areas were determined to be potential jurisdictional wetlands with a total area of 0.04 acre. These occur on the channel bottom with three of the areas associated with storm drain outfalls (LLNL 2001ap).

F.3.2 Site 300

F.3.2.1 *Methodology*

Wetlands were delineated using the routine onsite determination procedure described in the USACE Wetlands Delineation Manual (USACE 1987). Although the study site is larger than 5 acres, the routine determination procedure was used, rather than the comprehensive determination procedure, because the areas of potential wetlands were small and widely scattered across the site. Sampling along regular transects would not have been an effective or efficient means for determining wetland boundaries (Jones and Stokes 2002c).

During the vegetation mapping study conducted by Jones and Stokes in August 2001, field surveys were done to characterize the vegetation types and verify the map unit boundaries. The wetlands identified during the previous 1991 study were visited to verify their presence and to re-map their boundaries. Additional wetlands were identified by consulting with LLNL wildlife biologists familiar with Site 300 and by walking transects along the canyons. To delineate the wetlands more accurately, global positioning system (GPS) data recorders were used to collect point locations and to record linear features and map unit polygons. Wetland boundaries were identified in the field on the basis of the plant community present. Areas of hydrophytic vegetation, composed of green, growing perennials, were readily differentiated from the adjacent upland vegetation composed of brown, dried annual grasses.

Additional information on wetland soils was collected on July 3, 2002. Because of the overall similarity of wetlands at Site 300, only a limited number of representative sample points were examined. At each data point, paired soil pits were excavated: one on the wetland side of the wetland boundary and the other on the upland side of the boundary. Each shallow soil pit was excavated by hand to compare soil characteristics with the mapped units and to determine whether soils exhibited redoximorphic features. Data from each sample point were recorded on standard data forms. Geographic information system (GIS) files were created from field-delineated maps, and the GPS data were differentially corrected and the topology was cleaned for positional errors (Jones and Stokes 2002c).

F.3.2.2 *Results And Discussion*

Forty-six wetlands were identified during this study, with a total area of 8.605 acres. Wetlands appearing to meet the USACE criteria for jurisdictional wetlands total 4.388 acres. The delineation is shown in Figures F.3.2.2–1 through F.3.2.2–31 at the end of this appendix. The wetlands include vernal pools, freshwater seeps, and seasonal ponds. Table F.3.2.2–1 provides information on the type, size, and characteristic plant species of each wetland and a preliminary jurisdictional assessment (Jones and Stokes 2002c).

The previous delineation (LLNL 1992a) identified 6.76 acres of wetlands at Site 300, including 5.80 acres of herbaceous wetlands, 0.64 acre of woody riparian wetland, and 0.32 acre of vernal pool wetland. Of these wetlands, 1.88 acres were characterized as artificial. Most of these wetlands are still present and were delineated in 2001 (Jones and Stokes 2002c).

An artificial wetland that was mapped near Building 827 and that was supported by cooling tower water, is no longer present. Some of the areas mapped as creeping ryegrass-dominated wetlands, such as one near the pistol range, no longer exhibit wetland characteristics. Many wetlands were mapped in 2001 that were not mapped in the previous delineation, including the larger vernal pool (Wetland 1) and many small wetlands supported by seeps. The greater number of wetlands delineated in the 2001 study probably reflects a greater familiarity with Site 300 developed by LLNL wildlife biologists since the previous delineation (Jones and Stokes 2002c).

A description of the wetland types at Site 300 is presented below. The scientific names and wetland indicator status of plant species mentioned in the text are provided in Table F.3.2.2–2.

Vernal Pools

Vegetation

Vernal pools provide habitat for numerous endemic plant species and are known for their colorful spring floral displays. Vernal pools at Site 300 are not typical and do not fit any of the current vernal pool classifications. Unlike typical vernal pools, in which many of the species are endemic to vernal pool habitats, the three vernal pools at Site 300 (Wetlands 1 through 3) have vegetation composed mostly of wetland generalists that are often found in, but not restricted to, vernal pools, including stipitate-popcorn flower (*Plagiobothrys stipitatus*), annual hairgrass (*Deschampsia danthonioides*), cleistogamous spike-primrose (*Epilobium cleistogamum*), and creeping spikerush (*Eleocharis macrostachya*). The dominant plants in the vernal pools are usually or almost always found in wetlands. The smaller pool appears to have a much shorter period of inundation, as Mediterranean barley (*Hordeum marinum*) is the dominant species. Therefore, vernal pools meet the hydrophytic vegetation criterion (Jones and Stokes 2002c).

Soils

The vernal pools at Site 300 are located in small basins where the soils are mapped as Diablo clay, 30- to 45-percent slopes. The texture, structure, and low chroma matrix of the soil at data point 2A are characteristics of the Diablo clay soil, which is a well-drained, nonhydric Vertisol. However, when considered in conjunction with the topography and landscape position of the vernal pool features, the low matrix chroma was considered sufficient to qualify the soil at data point 2A as hydric. The soil matrix at data point 2B also has a low chroma, but was determined to be hydric based primarily on the presence of redoximorphic iron-oxide concentrations; i.e., mottles, in the surface horizon (Jones and Stokes 2002c).

Hydrology

Wetland hydrology in vernal pools is dependent on rainfall. Vernal pools typically are inundated for 4 to 12 weeks. However, berms have been constructed at the outlet end of each vernal pool at Site 300, an action that has resulted in deeper water and a longer period of inundation. The two larger pools (Wetlands 1 and 2) are inundated for a period sufficient for the breeding of the California tiger salamander; the larger pool remains inundated long enough to provide breeding habitat for the California red-legged frog (Jones and Stokes 2001). The longer inundation regime is likely responsible for the prevalence of wetland generalist plants, rather than vernal pool endemics. The smaller pool (Wetland 3), which occurs where a swale was bermed by a fire trail, appears to have a shorter period of inundation because the vegetation is less hydrophytic (Jones and Stokes 2002c).

Seasonal Ponds

Seasonal ponds at Site 300 have seasonal wetland hydrology, similar to vernal pools, but vernal pool endemics and wetland generalist species characteristic of vernal pools are absent. These seasonal pools are Wetlands 16, 26, 40, 41, and 46. Vegetation in the seasonal ponds is absent to sparse and is composed of ruderal hydrophytic species, including annual rabbit's foot grass (*Polypogon monspeliensis*), horseweed (*Conyza Canadensis*), perennial peppercress (*Lepidium latifolium*), and salt heliotrope (*Heliotropium curassavicum*). Wetland hydrology in the seasonal ponds is dependent on rainfall. Two of the seasonal ponds (Wetlands 16 and 26) were formed where fire trails bermed swales. Wetland 46 was originally constructed as an overflow pond for the sewage treatment facility, but now ponds independently. Wetlands 40 and 46 are inundated for a period sufficient for the breeding of the California red-legged frog (Jones and Stokes 2001). Soils in these wetlands were not investigated but were presumed to be hydric on the basis of an aquic moisture regime present during the rainy season (Jones and Stokes 2002c).

Freshwater Seeps and Springs

Vegetation

Vegetation in the freshwater seeps is generally dominated by herbaceous perennial hydrophytes, although riparian scrub is also associated with seeps at several locations. Where perennial soil moisture is present, the dominant species is usually narrow-leaved cattail (*Typha angustifolia*), although broad-leaved cattail (*Typha lalifolia*) is also present. Other common species in the seeps include creeping wild rye (*Leymus triticoides*), hoary nettle (*Urtica dioica*), saltgrass (*Distichlis spicata*), Baltic rush (*Juncus balticus*), white hedgenettle (*Stachys albens*), and annual rabbit's-foot grass. Woody vegetation is associated with freshwater seeps in some areas. Red willows (*Salix laevigata*) are present along Wetland 31, in Elk Ravine. Scattered Fremont cottonwood *(Populus fremontii)* and willows are present along the downstream portion of Wetland 20, and valley oak (*Quercus lobata*) and Fremont cottonwood are present adjacent to the upstream end of Wetland 12. Mulefat (*Baccharis salicifolius*) is present at scattered locations in seeps that occur along the bottoms of drainages (Jones and Stokes 2002c).

Soils

Information on soils in seeps was collected at four sites (Data Points 1A, 1C, 3A, 4A, 4C, and 5B) (Jones and Stokes 2002c). Soils in seeps at Site 300 consist of sandy loams, silt loams, clay loams, silty clay loams, and clays that frequently contain accumulations of carbonate salts below the surface soil horizon. Soils in seep wetlands were determined to be hydric, based on the presence of gleyed or low chroma matrix colors and the presence of redoximorphic iron-oxide concentrations; i.e., mottles.

Soils at Data Points 4A and 4C were problematic. Although soils at these points exhibited no hydric soil indicators, the points were placed where the vegetation was clearly hydrophytic and either in a stream channel (4A) or in a hillside swale (4C). A possible explanation for the absence of redoximorphic features may be that water flows primarily aboveground at these locations and remains relatively well oxygenated.

Hydrology

Wetland hydrology in many of the wetlands at Site 300 is provided by natural seeps and springs that occur where water-bearing sandstone crops out in the canyon bottoms. Other seeps are associated with superficial slope failures or "slumps" induced, in part, by excess moisture where the water-bearing bedrock is near the surface. Most of these wetlands are confined to small areas immediately adjacent to the seeps. Flows at the seeps appear to vary throughout the year; some seeps were dry during surveys, and others exhibited saturated soils in only part of the seep (Jones and Stokes 2002c).

In contrast, more extensive wetlands are present where perennial springs provide water for wetlands that extend for a considerable distance downstream from the spring source. Perennial springs are present in portions of Wetlands 4, 7, 12, 28, and 31. Wetland 12 is supported by a spring that flows from an abandoned mine shaft. The spring at Wetland 28 was exposed during excavation of sediments and bedrock during construction of a facility in a small canyon at that location. The spring at Wetland 31 in Elk Ravine is a natural groundwater spring that occurs where the bed of the stream channel intercepts a groundwater aquifer (Jones and Stokes 2002c).

Uplands

Vegetation

Uplands adjacent to the wetlands consist of annual grassland dominated by wild oats (*Avena fatus*) and brome grasses (Jones and Stokes 2002c).

Soils

Information on soils in uplands adjacent to wetlands was collected at Data Points 1B, 3B, 4B, and 5A (Jones and Stokes 2002c). Upland soils located adjacent to vernal pools and seep wetlands at Site 300 consisted of silt loams, sandy loams, and clays that were found to be nonhydric based on topography, landscape position, and the absence of hydric soil indicators.

Hydrology

No evidence of wetland hydrology was found outside of the vernal pools and seeps. Annual grasslands are usually not inundated and have saturated soils only for short periods during or immediately following rainfall. This period of saturation is not sufficiently long to inhibit the growth of upland species or to promote the growth of plants adapted to grow under saturated soil conditions (Jones and Stokes 2002c).

Jurisdictional Assessment

This section provides an assessment of the aquatic habitats that may be subject to regulation by USACE. USACE regulates many wetlands, streams, and water bodies. It generally regulates wetlands that cross state boundaries and have an interstate or foreign commerce connection, that are adjacent to regulated waters, or that are habitat for endangered species. It may make a nonjurisdictional determination for wetlands that are isolated, that lack an interstate or foreign commerce connection, or that are artificial. Such artificial features include nontidal drainage and irrigation ditches excavated on dry land or artificial lakes created by excavating and/or diking dry land to collect water used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing (Jones and Stokes 2002c).

Almost all of the wetlands on Site 300 appear to be isolated (Jones and Stokes 2002c). The streams at Site 300 are ephemeral, and most lack an ordinary high watermark. Only Corral Hollow Creek, an intermittent stream that crosses the southeastern edge of Site 300 in the Ecological Reserve, possesses an ordinary high watermark. Water typically is present in the channels only after storms or where seeps and springs are present. Most of the streams lack a channel confluent with Corral Hollow Creek; stream flows drain into the soil before reaching the end of the channels. Only Elk Ravine and the unnamed stream in the western portion of the site have channels confluent with Corral Hollow Creek. Wetlands in Elk Ravine (Wetland 31) are supported by a perennial spring, but stream flows sufficient to reach Corral Hollow Creek do not ordinarily occur. The unnamed stream on the west side of Site 300 has a well-defined bed and banks, but stream flow primarily occurs in Wetland 12, which is supported by a perennial spring. Therefore, only Wetlands 4, 5, 7, and 12 appear to be associated with a stream tributary to regulated water.

Wetlands 1, 40, and 46 and portions of Wetlands 7, 12, and 27 are known breeding sites for the California red-legged frog, which is listed under the Federal *Endangered Species Act* as threatened (Jones and Stokes 2001). Wetlands 2, 4, 20, and 26 and portions of Wetlands 12,17, and 31 are known nonbreeding sites for the California red-legged frog (Jones and Stokes 2001, 2002c).

Several wetlands at Site 300 are artificial. Wetland 27 was originally created by releases of cooling tower water at Building 865 and is currently maintained with potable water. Wetlands 14 and 15 appear to be maintained by runoff from Building 825, and Wetlands 29 and 30 appear to be maintained by runoff from Building 801. These wetlands would likely not persist if their artificial water source was discontinued. Wetlands 3, 16, and 26 were formed by impoundment of water in swales behind berms created by fire trails. These wetlands would likely persist as long as the berms remain intact. Wetland 46 was excavated on dry land to retain wastewater overflow. This pond persists as a seasonal pond, although it is no longer used for wastewater retention (Jones and Stokes 2002c).

Table F.3.2.2–1 indicates which wetlands may be subject to USACE regulation. This assessment is preliminary and subject to verification by USACE, which may make jurisdictional determinations on a case-by-case basis (Jones and Stokes 2002c).

In January 2003, USACE and EPA jointly released a request for agency and public comment on the definition of "waters of the U.S.," particularly the definition for isolated wetlands that are both intrastate and nonnavigable (68 FR 1991). Depending on the terminology adopted for the revised definition of "waters of the U.S.," some of the wetlands currently anticipated to qualify as jurisdictional wetlands in Table F.3.2.2–1 may become exempt from jurisdictional wetland regulation under Section 404 of the *Clean Water Act*. However, those wetlands may still qualify for protection under California law.

F.4 REFERENCES

68 FR 1991	United States Department of the Army, Corps of Engineers (USACE), "Advanced Notice of Proposed Rulemaking on the Clean Water Act, Regulatory Definition of Waters of the United States," *Federal Register*, Vol. 68 Pgs.1991-1998, Office of the Federal Register National Archives and Records Administration, United States Government Printing Office, Washington, DC, January 15, 2003.
EO 11988	Executive Order 11988, "Floodplain Management," Issued on May 24, 1977 by President Jimmy Carter.
EO 11990	Executive Order 11990, "Protection of Wetlands," Issued on May 24, 1977 by President Jimmy Carter.
DOE 1998b	DOE, *Draft Environmental Assessment Arroyo Las Positas Maintenance Project at Lawrence Livermore National Laboratory's Livermore Site*, DOE/EA-1272, United States Department of Energy, Oakland Operations Office, Oakland, CA, September 30, 1998.
FEMA 1981	Federal Emergency Management Agency (FEMA), *National Flood Insurance Program, Flood Insurance Rate Map, Alameda County, California, Panel 230*, Federal Emergency Management Agency, Washington, DC, 1981.
FEMA 1997a	FEMA, *National Flood Insurance Program, Flood Insurance Rate Map, Alameda County, California, Panel 210*, Federal Emergency Management Agency, Washington, DC, 1997.
FEMA 1997b	FEMA, *National Flood Insurance Program, Flood Insurance Rate Map, City of Livermore, California, Panel 10*, Federal Emergency Management Agency, Washington, DC, 1997.
Jones and Stokes 1997	Jones and Stokes Associates, Inc., *Delineation of Waters of the United States for Arroyo Las Positas, prepared for Lawrence Livermore National Laboratory, Alameda County, California,* JSA 97-107, Lawrence Livermore National Laboratory, Livermore, CA, November 7, 1997.
Jones and Stokes 2001	Jones and Stokes Associates, Inc., *Biological Assessment for the United States Department of Energy's Lawrence Livermore National Laboratory, (Site 300)*, prepared for Lawrence Livermore National Laboratory, Livermore, CA, November 2001.

Jones and Stokes 2002c — Jones and Stokes Associates, Inc., *Delineation of Waters of the United States, for Arroyo Las Positas, for Lawrence Livermore National Laboratory*, prepared for Lawrence Livermore National Laboratory, Livermore, CA, September 2002.

LLNL 1992a — Lawrence Livermore National Laboratory (LLNL), *Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence National Laboratory and Sandia National Laboratories,* Vols. 1-5, DOE/EIS-0157, Lawrence Livermore National Laboratory, Livermore, CA, August 1992.

LLNL 2001ap — LLNL, *Arroyo Seco Draft Wetland Delineation Report*, prepared by Questa Engineering Corporation for Lawrence Livermore National Laboratory, Livermore, CA, July 30, 2001.

LLNL 2001ay — LLNL, *Building 231 Vault Flood Hazard Analysis 2001* (UCNI), UCRL-ID-146099, Lawrence Livermore National Laboratory, Livermore, CA, 2001.

USACE 1981 — USACE, *HEC-1 Flood Hydrograph Package User's Manual*, United States Army Corps of Engineers, 1981.

USACE 1987 — USACE, *United States Army Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-87-1, United States Army Corps of Engineers, Environmental Laboratory, Vicksburg, MS, 1987.

USFWS 1988 — United States Fish and Wildlife Service (USFWS), *Amendment to the United States Fish and Wildlife Service Biological Opinion (1-1-97-F-173) on the Arroyo Maintenance Project on Arroyo Las Positas at LLNL, Alameda County, CA*, United States Fish and Wildlife Service, 1998.

Welch et al. 1966 — Welch, L. E., R. C. Huff, R. A. Dierking, T. D. Cook, L. A. Bates, and W. F. Andrews, *Soil survey of the Alameda Area, California*, United States *Department of Agriculture, Soil Conservation Service,* March 1966.