

**Site Assessment for California Red-  
Legged Frog for the Battle Creek Salmon  
and Steelhead Restoration Project—  
Jeffcoat East and West, Willow Springs,  
and Asbury Project Sites**

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# Acronyms and Abbreviations

|                         |   |
|-------------------------|---|
| CEQA                    | California Environmental Quality Act  |
| cfs                     | cubic feet per second   |
| CMP                     | corrugated metal pipe   |
| CNDDB                   | California Natural Diversity Database   |
| DFG                     | California Department of Fish and Game  |
| EIS/EIR                 | Environmental Impact Statement/Environmental Impact Report  |
| FERC                    | Federal Energy Regulatory Commission  |
| Hydroelectric Project   | Battle Creek Hydroelectric Project  |
| IHN                     | infectious hematopoietic necrosis virus   |
| MLTF                    | Mount Lassen Trout Farm   |
| NEPA                    | National Environmental Policy Act   |
| PG&E                    | Pacific Gas and Electric Company  |
| projects sites          | Jeffcoat East and West Mitigation Site, Willow Springs Mitigation Site, and Asbury Diversion Dam Site |
| Reclamation             | U.S. Department of the Interior, Bureau of Reclamation  |
| red-legged frog         | California red-legged frog  |
| Restoration Project     | Battle Creek Salmon and Steelhead Restoration Project   |
| SWRCB                   | California State Water Resources Control Board  |
| Willow Springs facility | Willow Springs Aquaculture Facility   |

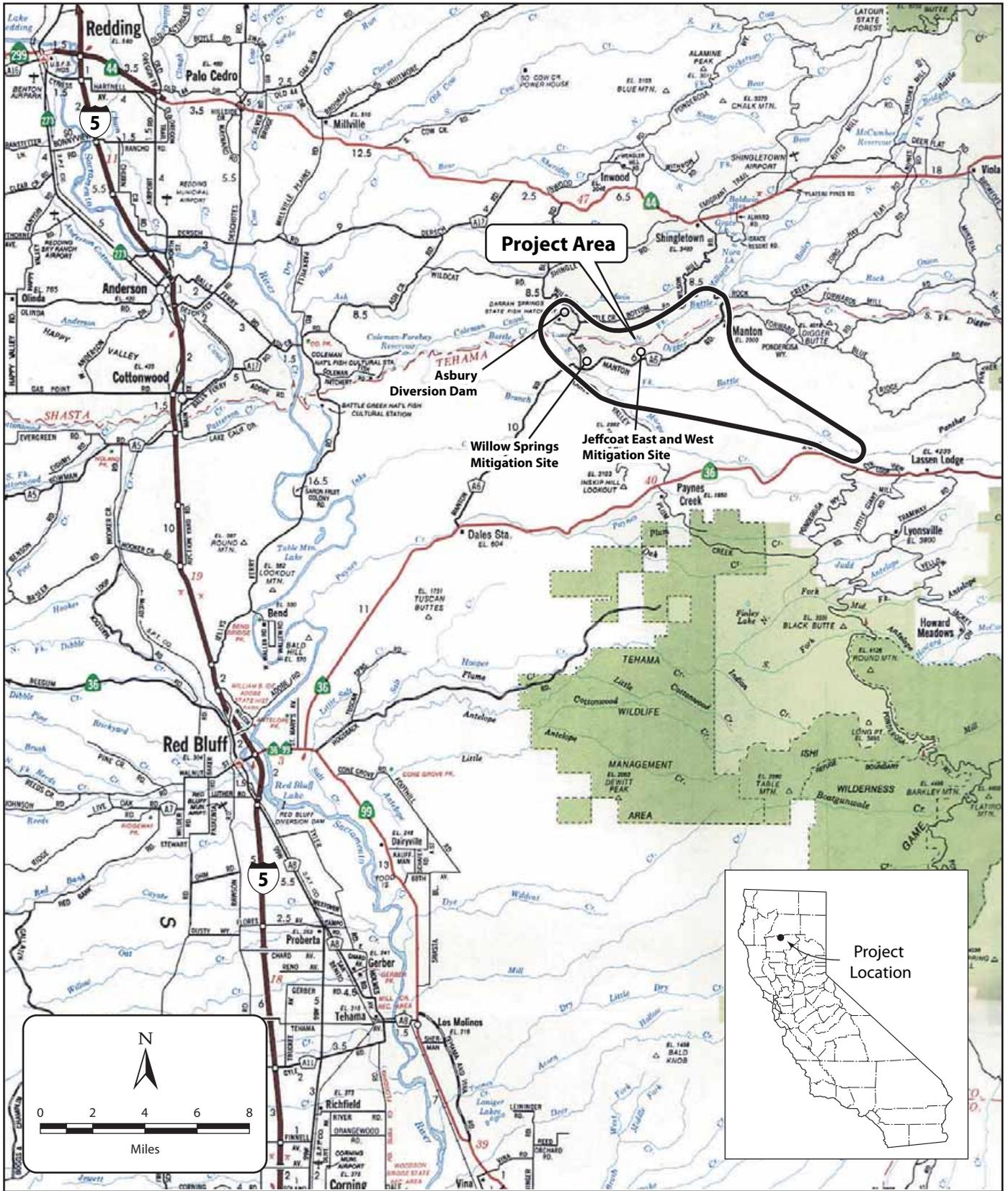
# Site Assessment for California Red-Legged Frog for the Battle Creek Salmon and Steelhead Restoration Project—Jeffcoat East and West, Willow Springs, and Asbury Project Sites

This report presents the methods and results of a site assessment that was conducted for California red-legged frog (*Rana aurora draytonii*) on behalf of the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) for the Battle Creek Salmon and Steelhead Restoration Project (Restoration Project). Previously, Jones & Stokes conducted a site assessment for California red-legged frog at 11 proposed restoration sites within the Restoration Project area in June 2000 (Jones & Stokes 2001). The site assessment discussed in this report was conducted at two sites (Jeffcoat East and West Mitigation Site and Willow Springs Mitigation Site) where mitigation for impacts from the Restoration Project will be implemented. A site assessment was also conducted at a proposed restoration site (Asbury Diversion Dam Site) that was not surveyed during the 2000 site assessment. (For readability, the Jeffcoat East and West Mitigation Site, Willow Springs Mitigation Site, and Asbury Diversion Dam Site are referred to in this report as projects sites.) Background information on the overall project and a description of the proposed activities at these sites are included below.

## Project Background

Reclamation and the California State Water Resources Control Board (SWRCB) are proposing the Restoration Project. The Restoration Project lies within the Battle Creek watershed, which is situated on the volcanic slopes of Mt. Lassen in southeastern Shasta and northeastern Tehama counties (Figure 1). Battle Creek is a high-gradient, headwater stream with an elevation change in excess of 5,000 feet over 50 miles (1,524 m over 80 km). The creek flows through remote, deep-shaded canyons and riparian corridors with little development near its banks. Battle Creek flow consists of rainfall and snowmelt from the western slope of the Cascade Range, complemented by the year-round flow of natural springs.

The proposed Restoration Project presents an opportunity to reestablish approximately 42 miles (68 km) of prime salmon and steelhead habitat on Battle Creek, plus an additional 6 miles (10 km) of habitat on its tributaries. Restoration would be accomplished primarily through modification of the Battle



03035.03.02R (01/05)

**Figure 1**  
**Location of the Jeffcoat East and West Mitigation Site,**  
**Willow Springs Mitigation Site, and Asbury Diversion Dam**  
**within the Battle Creek Restoration Project Boundary**

Creek Hydroelectric Project (Federal Energy Regulatory Commission [FERC] Project No. 1121) (Hydroelectric Project) facilities and operations, including instream flow releases. Any proposed changes to the Hydroelectric Project trigger the need for Pacific Gas and Electric Company (PG&E) to seek a license amendment from FERC. Habitat restoration would enable safe passage for naturally produced salmonids and would facilitate their growth and recovery in the Sacramento River and its tributaries. These salmonids include Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), state- and federally listed as threatened; Sacramento River winter-run Chinook salmon, state- and federally listed as endangered; and Central Valley steelhead (*Oncorhynchus mykiss*), federally listed as threatened.

Because of the federal and state actions associated with the Restoration Project, compliance with both the National Environmental Policy Act (NEPA) (42 U.S. Code [USC] 4321–4347) and the California Environmental Quality Act (CEQA) (Public Resources Code 21000 et seq.) is required. A joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) was prepared to fulfill the requirements of both NEPA and CEQA. The Draft EIS/EIR was circulated for public comment from July 18 to October 16, 2003.

## Project Description

Mount Lassen Trout Farm (MLTF) is an aquaculture operation consisting of 12 small facilities in the Battle Creek watershed that raise rainbow trout for sale as stock for lakes and ponds. Three of these facilities—Jeffcoat East, Jeffcoat West, and Willow Springs—use spring water in their trout ponds that comes in part from seepage from two PG&E canals that carry Battle Creek water: the Eagle Canyon Canal and the Inskip Canal.

The trout farm has to adhere to certain restrictions regarding its ability to sell “disease-free” fish, although there is currently some risk of disease in the Battle Creek system. The goal of the Restoration Project is to restore populations of anadromous fish to Battle Creek, which increases the potential to carry the infectious hematopoietic necrosis (IHN) virus into the upper reaches of Battle Creek. Because of the extremely porous volcanic soils in the Battle Creek watershed, increasing the numbers of anadromous fish in Battle Creek could potentially increase the risk of the IHN virus seeping from PG&E’s canals into the groundwater and resurfacing at the MLTF source springs. If fish raised at MLTF facilities become exposed to the IHN virus, MLTF would experience economic losses as a result of fish mortality and regulations against selling diseased stock.

Some public comment letters received on the 2003 Draft EIS/EIR raised a concern that the potential effects of the Restoration Project on MLTF operations were not adequately analyzed or addressed in the Draft EIS/EIR. Concurrently, the California Department of Fish and Game (DFG) expressed concern about the spread of the IHN virus from MLTF facilities (through stocking of these fish) to

fish that reside in other waters of California where such diseases do not occur and that, as a result, do not have as much immunity from the diseases. Although the State of California (state) has several regulatory planning processes intended to protect fish communities from the spread of diseases categorized as serious or catastrophic, DFG may not be able to implement these measures because of limited testing and enforcement capability (Rectenwald pers. comm.).

Thus, Reclamation and the SWRCB proposed mitigation measures to ensure that MLTF fish will not be exposed to the IHN virus, thereby avoiding any socioeconomic impacts on MLTF as well as avoiding the risk of spreading the disease to other uninfected waters of California. A description of the mitigation measures to be implemented at the Jeffcoat East and West facilities and the Willow Springs aquaculture facility (Willow Springs facility) are described below.

## Jeffcoat East and West Mitigation Site

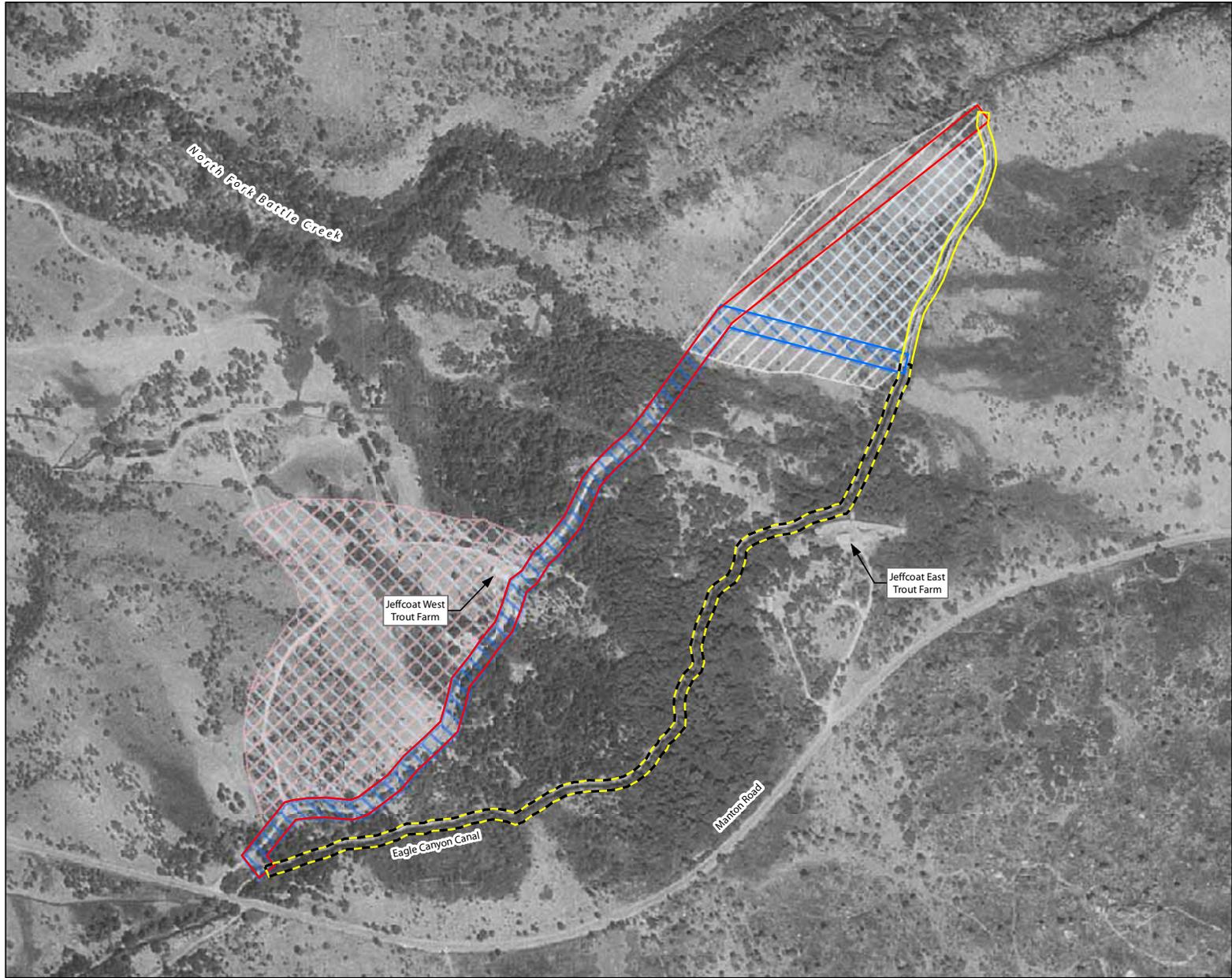
The Jeffcoat East and West Mitigation Site is located between Manton Road and North Fork Battle Creek (Figure 1). Canal water from Eagle Canyon Canal will be diverted into a new watertight pipeline (e.g., high-density polyethylene with heat-welded joints) at a point along the canal that is far enough upstream of the spring area to prevent canal water from mixing with the spring water. The long-term risk of waterborne pathogen contamination of MLTF aquaculture facilities is minimal because the pipe will be sealed and buried. The new pipeline will be constructed and operational before proposed fish passage facilities at Eagle Canyon Diversion Dam become operational.

Four different pipeline alignments are proposed at the Jeffcoat East and Jeffcoat West facilities (Figure 2). The four different alignments include:

- Alternative A—cross-country alignment,
- Alternative B—modified cross-country alignment,
- Alternative C—Eagle Canyon Canal alignment, and
- Alternative D—modified Eagle Canyon Canal alignment.

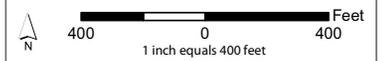
Each alignment is described below.

**Alternative A, Cross-Country Alignment**—The Alternative A pipeline alignment will follow a new “cross-country” alignment downslope of the present canal (Figure 2). This alignment is approximately 4,500 feet (1,372 m) long, and the construction corridor will be approximately 80 feet (24 m) wide along the length of this alignment. The first leg of the pipeline alignment extends from the Eagle Canyon Canal flume across open rangeland that crosses an existing drainage. As the route continues southwest, it parallels an existing access road through the Jeffcoat West facility. This route would avoid all spring sources associated with the Jeffcoat East facility (located east and uphill of Eagle Canyon



**FIGURE 2**  
 PROPOSED CONSTRUCTION AREAS AT THE  
 JEFFCOAT EAST AND WEST MITIGATION SITE

-  PROPOSED ALTERNATIVE A
-  POTENTIAL AREA AFFECTED BY ALTERNATIVE A
-  PROPOSED ALTERNATIVE B
-  POTENTIAL AREA AFFECTED BY ALTERNATIVE B
-  PROPOSED ALTERNATIVE C
-  PROPOSED ALTERNATIVE D
-  STAGING AREA



NOTES: 1 AERIAL PHOTO SOURCE: USGS DOQQ 1998

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Canal) and most of the spring sources for the Jeffcoat West facility (located west and downhill of Eagle Canyon Canal). The pipe continues on a route close to the access road through the Jeffcoat West facility and discharges back into Eagle Canyon Canal at a point downstream of the spring area. This final segment of the pipeline from the Jeffcoat West facility to its terminus approximately 150 feet (46 m) upstream of Manton Road is anticipated to follow the proposed alignment. However, it is possible that the pipeline could follow any alignment within the greater area shown in Figure 2.

Under the Alternative A alignment, Eagle Canyon Canal will remain open along the portion of the canal that will be replaced by the new pipeline (approximately 4,900 feet (1,494 m) between the new pipeline's point of diversion and discharge back into the canal). This will allow spring flows and overland runoff from rain and snowmelt to continue to be captured and conveyed to the Hydroelectric Project facilities, in accordance with PG&E's water rights

**Alternative B, Modified Cross-Country Alignment**—The Alternative B pipeline alignment is similar to the Alternative A alignment; however, Alternative B could vary between the starting point of Alignment A and a point 1,100 feet (335 m) downstream of the end of the flume (Figure 2). From its beginning, the pipeline travels due west until it meets the cross-country alignment described above for Alternative A. Similar to the Alternative A alignment, the Alternative B route travels southwest; parallels an existing access road through the Jeffcoat West facility; and discharges back into Eagle Canyon Canal at a point downstream of the spring area, approximately 150 feet (46 m) upstream of Manton Road. The full length of the Alternative B alignment as shown in Figure 2 is approximately 3,900 feet (1,189 m). However, the exact length of the pipeline could vary depending on which alignment is chosen within the areas described above. The construction corridor will be approximately 80 feet (24 m) wide along the length of this alignment.

As under the Alternative A alignment, Eagle Canyon Canal will remain open along the portion of the canal that will be replaced by the new pipeline (approximately 3,800 feet (1,158 m) between the new pipeline's point of diversion and discharge back into the canal). This will allow spring flows and overland runoff from rain and snowmelt to continue to be captured and conveyed to the Hydroelectric Project facilities, in accordance with PG&E's water rights.

**Alternative C, Eagle Canyon Canal Alignment**—The Alternative C pipeline alignment follows Eagle Canyon Canal from the end of the flume downstream to a terminus approximately 150 feet (46 m) upstream of Manton Road (Figure 2). This alignment is approximately 4,900 feet long (1,494 m). The construction corridor will be approximately 45 feet (14 m) wide along the length of this alignment.

**Alternative D, Modified Eagle Canyon Canal Alignment**—The Alternative D pipeline alignment follows Eagle Canyon Canal beginning at a point approximately 1,100 feet (335 m) downstream from the end of the flume (Figure 2). This is the same point where the Alternative B alignment begins, as described

above. The alignment follows Eagle Canyon Canal downstream to a terminus approximately 150 feet (46 m) upstream of Manton Road. This alignment is approximately 3,800 feet long (1,158 m). The construction corridor will be approximately 45 feet (14 m) wide along the length of this alignment.

## Willow Springs Mitigation Site

The Willow Springs Mitigation Site is located near the intersection of Manton Road and Wildcat Road (Figure 1). Diverting water from Inskip Canal into a watertight pipeline, similar to the mitigation proposed for the Eagle Canyon Canal, is not a feasible mitigation measure for the Willow Springs facility. A substantial amount of the spring water used by MLTF to operate its Willow Springs facility is received by water leaking from Inskip Canal into the groundwater. Obstructing this leakage would reduce MLTF spring water to a degree that would interfere with the trout-farming operation. Because a structural solution is not possible to eliminate the hydraulic connection between Inskip Canal and the MLTF Willow Springs facility, Reclamation is currently investigating the feasibility of three mitigation options. These options include:

- Option A—installing a disinfection facility,
- Option B—raising catfish instead of trout, and
- Option C—“buying out” MLTF’s Willow Springs facility.

Each mitigation option is described below.

**Option A, Installing a Disinfection Facility**—The Willow Springs facility receives its water from Willow Springs, a natural spring source approximately 3,000 feet (914 m) southeast of the Willow Springs facility. Water from the spring source is conveyed to the Willow Springs facility through an existing 24-inch-diameter (61-cm) metal pipeline approximately 4,000 feet (1,219 m) long. As the pipeline approaches the trout farm, it travels under Manton Road and resurfaces on the west side of the road, then travels another 700 feet (213 m) to the rearing ponds. The pipe terminates at a 4-foot-high (1.2-m) concrete catch basin, where sands are allowed to settle out of the water. A pipe attached to the upper part of the catch basin sends water about 50 feet (15 m) to furnish water to the rearing ponds.

The new disinfection facility will be located east (upstream) of the catch basin. A new pipeline will divert water from the existing Willow Springs pipeline to a new settling basin. From this basin the water will be piped to the disinfection facility. The disinfection equipment will be housed in new buildings (up to six buildings approximately 30 feet by 60 feet [9 m by 18 m] in size). These buildings will be located immediately east (upstream) of the existing catch basin and trout rearing ponds in the northern section of the Willow Springs property. Water from the new pipeline will enter the disinfection buildings, where the water will then pass through pressurized sand beds to filter and clean the water before passing through an ultraviolet disinfection process using ultraviolet bulbs.

The water must be 99% clear or sediment-free before passing through the ultraviolet light; otherwise the disinfection process does not work properly. Once the disinfection process is complete, the water is piped to the trout-rearing ponds. After passing through the ponds, the water is discharged through an existing point of discharge into a nearby canal. Wastewater from the sand beds will be conveyed to the west end of the trout rearing ponds through a new pipeline where it will be combined with the water discharged from the ponds into the nearby canal. The disinfection process requires a significant amount of power. As a result, new power lines may need to be installed to power the facility. Site grading will be required to allow construction of the concrete slab foundation pads for the new equipment buildings, and trenches will be excavated for installing the new buried pipelines.

**Option B, Raising Catfish instead of Trout**—*A description of this mitigation option will be available at a later date.*

**Option C, “Buying out” MLTF’s Willow Springs Facility**—*A description of this mitigation option will be available at a later date.*

## Asbury Diversion Dam Site

The Asbury Diversion Dam site is located within Baldwin Creek at the Darrah Springs State Fish Hatchery (Figure 1). Asbury Pump Station and Diversion Dam are located on Baldwin Creek, approximately 0.7 mile (1.1 km) above its confluence with Battle Creek. Proposed restoration actions in Baldwin Creek include an instream flow release of up to 5 cubic feet per second (cfs) from Asbury Diversion Dam. Cold spring water entering Baldwin Creek from Darrah Springs above the dam would be allowed to continue downstream of the dam site. PG&E would be required to operate a remote-sensing device to continuously measure and record total flow and stage fluctuations at the diversion dam during all operations to verify compliance with applicable provisions under the FERC license.

The instream releases would be accomplished by fitting three or four existing bays with flow measurement weirs, which would replace the existing flashboard weirs mounted on the crest of the dam. The use of multiple weirs would disperse the flow over a wide area, which is expected to reduce the potential for attraction to areas of higher passage potential. To ensure that the minimum flow of 5 cfs is released over the flashboards, PG&E’s Asbury Pump Station would continuously monitor the reservoir water level behind the dam. The pump station has an electronic controller that receives input from water level sensors that transmit the water surface elevation of Asbury Pond behind Asbury Diversion Dam. The pump station then maintains the pond water surface elevation by discharging the correct amount of water. This ensures a constant release rate over the flashboards. Under flood conditions, the extra water that cannot be pumped simply spills over the flashboards and results in an increased release over the required 5 cfs.

A weatherproof, secure enclosure, such as a locked, vertical-oriented, 4-foot-diameter (1.2-m) corrugated metal pipe (CMP), would be located above the creek. All necessary electronic and telemetry equipment would be housed inside the existing Asbury Pump Station.

Once the flow measurement weirs have been installed and are operational, PG&E would visit the site regularly to maintain the weir structures, which would include the removal of any debris that may be blocking the weir, and to ensure that flows required under the FERC license amendment are maintained. The elevation of the pond impounded behind Asbury Diversion Dam should not fall below a level that would ensure a minimum flow of 5 cfs is released to Baldwin Creek. The elevation of the pond behind Asbury Diversion Dam would be continuously monitored and telemetered using the Pit 3 Switching Center, which is staffed 24 hours per day.

Asbury Diversion Dam impounds water to an approximate average depth of 3 feet (0.9 m) near the dam. Under current operating conditions, a 10-foot-wide (3-m) flashboard spill gate is periodically opened completely to allow sediments that accumulate behind the dam to pass through. Under future conditions, the sediment pass-through operations may continue.

In addition to implementing the structural changes described above to maintain a minimum flow release of 5 cfs, construction of a fish barrier downstream of the dam may be necessary. The most cost-effective and reliable disease prevention remedy will be used to prevent the spread of virulent fish diseases above Asbury Diversion Dam and to protect Darrah Springs State Fish Hatchery and fish communities in the waters of the state where hatchery fish may be stocked.

## Background

The proposed projects are within the current and historical range of the California red-legged frog (Jennings and Hayes 1994; U.S. Fish and Wildlife Service 2002). Critical habitat for the California red-legged frog was designated on March 13, 2001 (66 Federal Register [FR] 14626), but a November 2002 court decision overturned the majority of the critical habitat designation. Critical habitat was repropoed on April 13, 2004 (69 FR 19620). The project site is not located within currently proposed critical habitat.

Information regarding potential habitat at the project site, as well as California red-legged frog locality information, is important in determining the likelihood that the taxon will occur at the site. Conducting a site assessment is the first step in reaching such a determination, according to the U.S. Fish and Wildlife Service's (USFWS's) *Guidelines on Site Assessment and Field Surveys for California Red-legged Frogs* (U.S. Fish and Wildlife Service 1997). A Jones & Stokes wildlife biologist conducted a site assessment to determine if the site contains suitable habitat for California red-legged frog. This report documents the results of the site assessment. USFWS will use the results of this site

assessment to determine the need to conduct additional surveys to determine the presence or absence of the species.

## Species Description

### Legal Status

California red-legged frog is one of two subspecies of red-legged frog (*Rana aurora*) found on the Pacific coast. USFWS designated California red-legged frog as a threatened subspecies on June 24, 1996 (61 FR 25813). As described above, critical habitat was proposed by USFWS on April 13, 2004 (69 FR 19620).

### Distribution

The historical range of the California red-legged frog (red-legged frog) extended coastally from the vicinity of Point Reyes National Seashore, Marin County, California, and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Storer 1925, Jennings and Hayes 1985, Hayes and Krempels 1986). Its current range consists of isolated locations in the Sierra Nevada and North Coast and northern Transverse Ranges. It is relatively common in the San Francisco Bay area and along the central coast and is still present in Baja California, Mexico (U.S. Fish and Wildlife Service 2002). Red-legged frogs have been found at elevations that range from sea level to about 5,000 feet (1,524 m). They use a variety of habitat types, which include various aquatic, riparian, and upland habitats (U.S. Fish and Wildlife Service 2002). However, they may complete their entire life cycle in a pond or other aquatic site that is suitable for all life stages (66 FR 14626).

### Reasons for Decline

The decline of red-legged frog is attributable to a variety of factors. Large-scale commercial harvesting of red-legged frogs led to severe depletions of populations at the turn of the century (Jennings and Hayes 1985). Subsequently, exotic aquatic predators such as bullfrogs (*Rana catesbeiana*), crayfish (*Procambarus clarki*), and various species of fish became established and contributed to the continued decline of the species (Hayes and Jennings 1986). Habitat alterations such as conversion of land to agricultural and commercial uses, reservoir construction, off-highway vehicle use, and certain land-use practices (i.e., livestock grazing) threaten the remaining populations (Kauffman et al. 1983; Kauffman and Krueger 1984; Bohn and Buckhouse 1986; Jennings and Hayes 1994).

## Habitat Requirements

Red-legged frogs require cool water habitats, including pools, streams, and ponds, with emergent and submergent vegetation (Storer 1925; Stebbins 1972). Red-legged frogs are found in habitats with deep (at least 2.3 feet deep [0.7 m]), still or slow moving water and vegetation consisting of willows (*Salix* sp.), tules (*Scirpus* sp.), or cattails (*Typha* sp.). Juvenile frogs seem to favor open, shallow aquatic habitats with dense submergent vegetation. Although red-legged frogs can inhabit either ephemeral or permanent streams or ponds, populations probably cannot be maintained in ephemeral streams in which all surface water disappears (Jennings and Hayes 1994.)

As adults, red-legged frogs are highly aquatic when active but depend less on permanent water bodies than do other frog species (Brode and Bury 1984). Adults may take refuge during dry periods in rodent holes or leaf litter in riparian habitats. Although red-legged frogs typically remain near streams or ponds, marked and radio-tagged frogs have been observed to move more than 2 miles (3.2 km) through upland habitat. These movements are typically made during wet weather and at night (U.S. Fish and Wildlife Service 2002).

Red-legged frogs typically lay their eggs in clusters around aquatic vegetation from December to early April. Eggs hatch in 6–14 days (Jennings 1988). Increased siltation of water bodies, which may occur during the breeding season, can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3.5–7 months after hatching (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1990). Recent information, however, indicates that larvae can take more than a year to complete metamorphosis (Fellers et al. 2001). Of the various life stages, larvae probably have the highest mortality rates; less than 1% of the eggs laid reach metamorphosis (Jennings et al. 1992). Sexual maturity is normally reached at 3–4 years (Storer 1925; Jennings and Hayes 1985), and life expectancy is 8–10 years (Jennings et al. 1992).

The diet of red-legged frogs is highly variable. Larval red-legged frogs probably eat algae (Jennings et al. 1992). Hayes and Tennant (1985) found invertebrates to be the most common food item for juveniles and adults. Vertebrates such as Pacific treefrogs (*Hyla regilla*) and California deer mice (*Peromyscus californicus*) represented more than half of the food source for the larger frogs. Juvenile frogs are active diurnally and nocturnally, whereas adult frogs are largely nocturnal. Feeding activity most commonly occurs along the shoreline and on the surface of the water (Hayes and Tennant 1985).

## Assessment Methods

Jones & Stokes wildlife biologist Jennifer Alvarez examined a topographic-based map of the Jeffcoat East and West project site, aerial photographs of all project sites, and the Shingletown and Tuscan Buttes NE 7.5-minute U.S. Geological Survey topographic quadrangles and identified potential habitat (i.e., streams,

springs, and ponds) for red-legged frogs within 1 mile (1.6 km) of the project sites. A records search of the California Natural Diversity Database (CNDDDB) (2004) was conducted for areas within a 5-mile (8 km) radius of the project sites. In addition, the *Recovery Plan for the California Red-Legged Frog* (U.S. Fish and Wildlife Service 2002) was reviewed for known locations of red-legged frogs in the project vicinity.

Ms. Alvarez conducted a site visit to the Jeffcoat East and West Mitigation Site on August 31, 2004, to assess the suitability of habitat to support breeding, provide refuge, and supply dispersal corridors for red-legged frogs. Site assessments were conducted at the Willow Springs Mitigation Site and Asbury Diversion Dam Site on November 3, 2004, and areas within 1-mile of these sites were assessed on November 15, 2004.

All of the site assessments were based on habitat requirements described in USFWS's 1997 *Guidance on Site Assessment and Field Surveys for California Red-Legged Frogs*. At each site, potential habitat was assessed within a designated study area; the boundaries of the study areas are shown on several figures in this report. Potential habitat within Jeffcoat East and West project site consists of a ponded area within an unnamed canal, Pond A, Pond B, two forebays, Juniper Gulch, Eagle Canyon Canal, and unnamed creek #1 (Table 1). The ponded area within the unnamed canal was not accessible because of impenetrable vegetation. Juniper Gulch and unnamed creek #1 were viewed from an adjacent dirt road. A 300-foot (91-m) portion of Eagle Canyon Canal was surveyed. Potential habitat within the Willow Springs project site consists of Pond C, unnamed creek #2, Pond D, unnamed creek #3, Pond E, unnamed ditch, and Wildcat Canal (Table 1). Potential habitat at the Asbury project site consists of Baldwin Creek. Ponds were viewed from one or more points. The perimeters of most of the ponds were not walked because of dense vegetation and uncertain footing. Ms. Alvarez took notes on the characteristics of the aquatic habitat, topography of the areas, and vegetation present, which is summarized in the results section of this report. Representative photographs were taken of the potential habitat that was assessed.

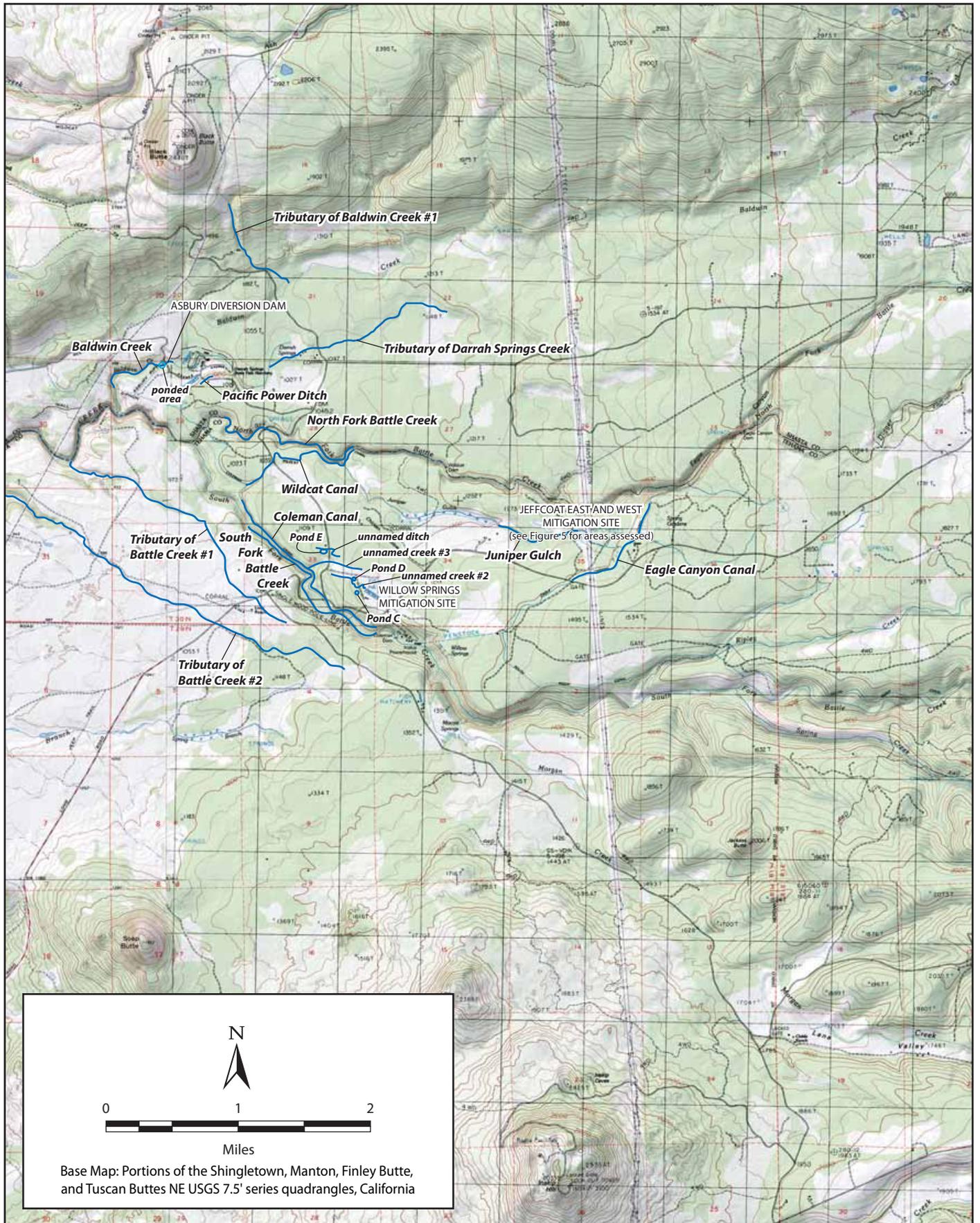
Seventeen areas of potential habitat were identified within 1 mile of the three project sites (Table 2). Seven of the potential habitat areas were not accessible and therefore were not assessed (Table 2, Figure 3). An assessment was made of the overall habitat at each area based on observations at selected points; photographs were taken at the majority of sites. Figure 4 shows the locations of areas that were assessed within the project sites and within 1-mile of the project sites.

**Table 1.** Potential Habitat for California Red-Legged Frog at the Jeffcoat East and West, Willow Springs, and Asbury Diversion Dam Project Sites

| Potential Habitat Name              | Assessed? | Comments  |
|-------------------------------------|-----------|---|
| <b>Jeffcoat East and West</b>       |           |   |
| Ponded area within an unnamed canal | No        | Not accessible because of impenetrable vegetation                     |
| Pond A                              | Yes       |   |
| Pond B                              | Yes       |   |
| Forebays #1 and #2                  | Yes       | Forebay #2 was not accessible but assumed to be similar to Forebay #1 |
| Juniper Gulch                       | Yes       |   |
| Eagle Canyon Canal                  | Yes       |   |
| Unnamed creek #1                    | Yes       | Only viewed from the car because of the presence of an aggressive dog |
| <b>Willow Springs</b>               |           |   |
| Pond C                              | Yes       |   |
| Unnamed creek #2                    | Yes       |   |
| Pond D                              | Yes       |   |
| Unnamed creek #3                    | Yes       |   |
| Pond E                              | Yes       |   |
| Unnamed ditch                       | Yes       |   |
| Wildcat Canal                       | Yes       |   |
| <b>Asbury Diversion Dam</b>         |           |   |
| Baldwin Creek                       | Yes       |   |

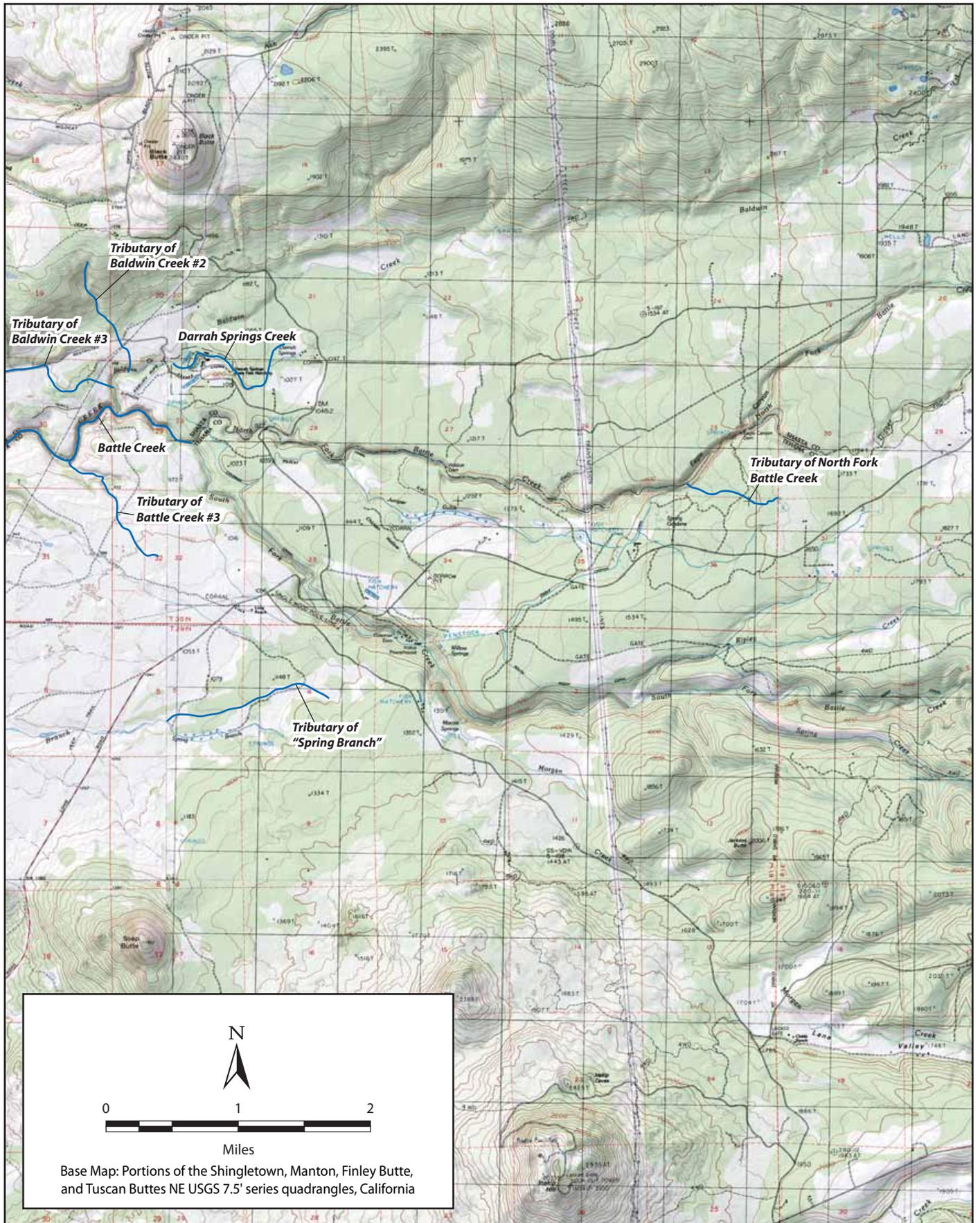
**Table 2.** Potential Habitat for California Red-Legged Frog within 1 Mile of the Jeffcoat East and West, Willow Springs, and Asbury Diversion Dam Project Sites

| Potential Habitat Name               | Assessed? | Comments   |
|--------------------------------------|-----------|--|
| North Fork Battle Creek              | Yes       |  |
| Tributary of North Fork Battle Creek | No        | No access because of locked gate   |
| South Fork Battle Creek              | Yes       |  |
| Coleman Canal                        | Yes       |  |
| Tributary of Battle Creek #1         | Yes       |  |
| Tributary of Battle Creek #2         | Yes       |  |
| Tributary of Battle Creek #3         | No        | No access because of locked gate   |
| Tributary of "Spring Branch"         | No        | No access because of locked gate   |
| Eagle Canyon Canal                   | Yes       |  |
| Juniper Gulch                        | Yes       |  |
| Pacific Power Ditch                  | Yes       |  |
| Darrah Springs Creek                 | No        | Access denied by DFG hatchery manager  |
| Tributary of Darrah Springs Creek    | Yes       |  |
| Tributary of Baldwin Creek #1        | Yes       |  |
| Tributary of Baldwin Creek #2        | No        | No access because of locked gate   |
| Tributary of Baldwin Creek #3        | No        | No access because of locked gate   |
| Battle Creek                         | No        | No access within a mile of project sites; assumed to be unsuitable because of creek size |



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**Figure 3**  
**Areas Assessed for Suitability**  
**for California Red-Legged Frog**



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**Figure 4**  
**Potential Habitat Areas for California Red-Legged Frog That Were Not Accessible and Not Assessed**

## Results

### Occurrence at the Project Site or in Vicinity

The CNDDDB (2004) report from the search of the 7.5-minute U.S. Geological Survey topographic quadrangles for Shingletown, Tuscan Buttes NE, Manton, Dales, Inskip Hill, and Finley Butte contained no records of red-legged frog sightings within a 5-mile (8 km) radius of the project sites. The closest record for a red-legged frog is approximately 48 miles (77 km) southwest of the site at Sunflower Gulch in Tehama County (CNDDDB 2004). One adult red-legged frog was observed at this location in 1986. The closest population of red-legged frogs is more than 50 miles (32 km) southeast of the project site in a pond at the headwaters of Jack Creek (CNDDDB 2004, Barry 1999, U.S. Fish and Wildlife Service 2002). This population, known as the French Creek population, was discovered in 1997 and revisited several times between 1997 and 1999. Reproduction at the site appears successful (U.S. Fish and Wildlife Service 2002). A red-legged frog larva was collected from an adjacent pond in 1998 (CNDDDB 2004).

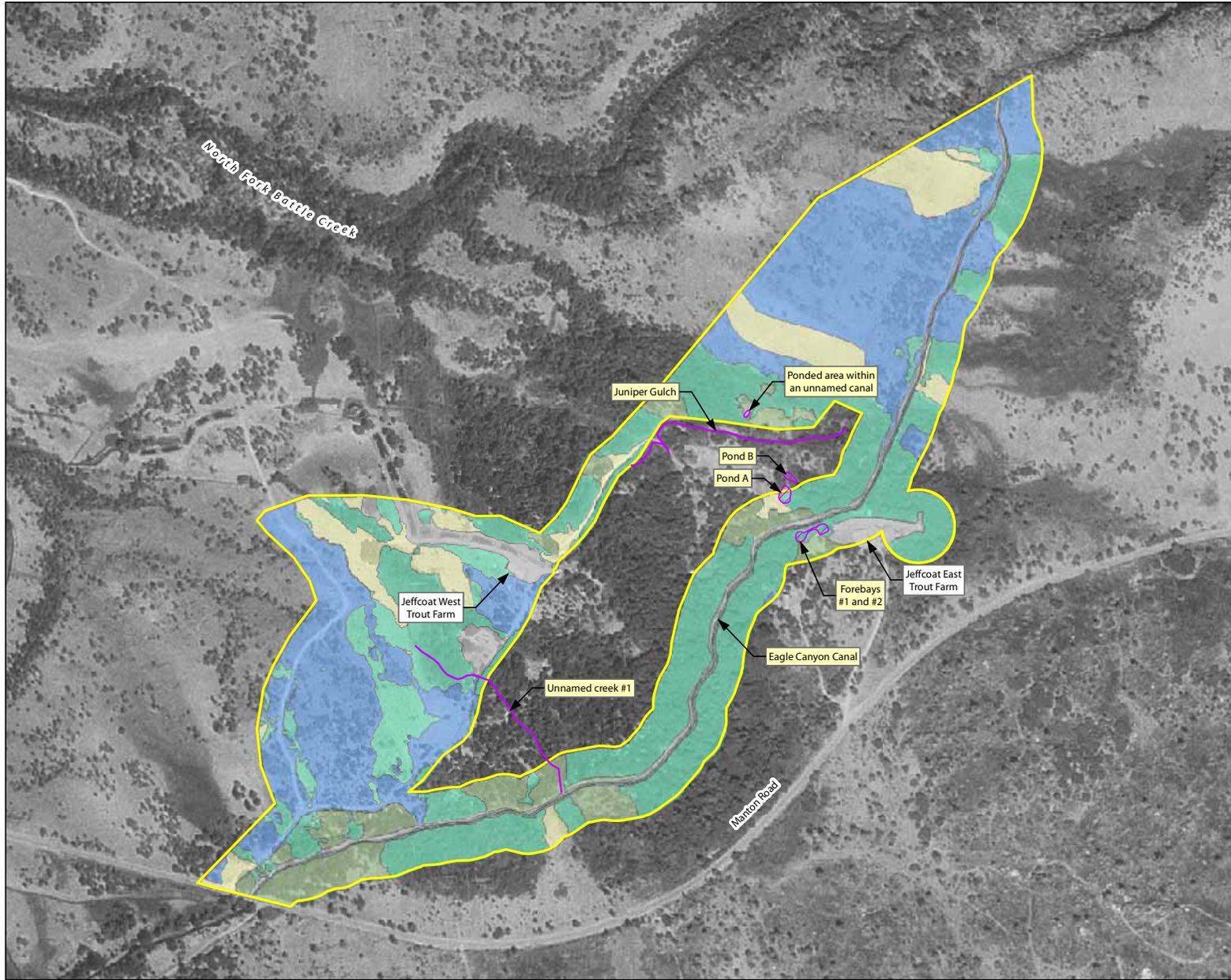
### Potential Habitat at the Project Sites

#### Jeffcoat East and West Mitigation Site

Potential habitat within the Jeffcoat East and West Mitigation Site consists of a ponded area within an unnamed canal, Pond A, Pond B, two forebays (#1 and #2), Juniper Gulch, Eagle Canyon Canal, and unnamed creek #1 (Figure 5). As mentioned previously, the ponded area within the unnamed canal was not accessible because of impenetrable vegetation. Two other unnamed creeks shown on the topographic map of the project site could not be located. These creeks either do not exist or are very small and are masked by dense vegetation. Potential habitat at the project site was surveyed between 11:00 am and 6:00 pm on August 31, 2004. The weather was clear, sunny, and hot (90–100°F [32–38°C]). The elevation at this site is approximately 1,360 feet (415 m).

#### Pond A

Pond A is located north of Eagle Canyon Canal, on the eastern side of the study area (Figure 5). The pond is approximately 80 feet (24 m) long by 60 feet (18 m) wide (Figure 6). Depth of the pond could not be determined because of a layer of algae and sludge on the surface of the pond. The pond is completely surrounded by vegetation such as willows, cattails, sedges, and various grasses. The surrounding upland consists of oak woodland, disturbed grassland, and patches of dense wetland vegetation. Upland vegetation included curly dock (*Rumex crispus*), willows (*Salix* sp.), white alder (*Alnus rhombifolia*), valley oak (*Quercus lobata*), yellow star-thistle (*Centaurea solstitialis*), and various grasses.



**FIGURE 5**  
 AREAS ASSESSED FOR SUITABILITY FOR CALIFORNIA RED-LEGGED FROG AT THE JEFFCOAT EAST AND WEST MITIGATION SITE



NOTES: 1 AERIAL PHOTO SOURCE: USGS DOQQ 1998

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Pond A.



Pond B.

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The upland vegetation was very dense and tall. Pond A is used to grow bloodworms to use as fish food for the MLTF. Fish wastes are placed in the pond to create conditions that are suitable to grow bloodworms. The condition of Pond A was very poor at the time of the site assessment. The pond emitted a strong putrid smell and appeared severely polluted. No red-legged frogs, other amphibians, or fish were observed in the pond. Pond A appears to provide appropriate breeding and refuge habitat for red-legged frogs; however, its use as a bloodworm breeding area may decrease the quality of the habitat.

## Pond B

Pond B is located north of Pond A, just outside the study area (Figure 5). This pond is approximately 60 feet (18 m) long by 25 feet (8 m) wide with a depth of 1–2 feet (0.3–0.6 m) (Figure 6). Pond B was viewed from its northwest side. The entire pond is surrounded by vegetation consisting mainly of watercress (*Rorippa nasturtium-aquaticum*) and Himalayan blackberry (*Rubus discolor*). A fair amount of algae and floating vegetation were present in the pond. A large number of cattails (*Typha* sp.) to the north of the pond indicate that there is flow from the pond northward. This area was damp but did not appear to pond. Pond B shares upland with Pond A. This pond is also used to grow bloodworms for the MLTF. Although the condition of pond B was fair during the site visit, this pond could become foul during other times of the year, as indicated by Pond A. No red-legged frogs, other amphibians, or fish were observed in the pond. Pond B appears to provide appropriate breeding and refuge habitat for red-legged frogs; however, its use as a bloodworm breeding area may decrease the quality of the habitat.

## Forebays #1 and #2

Forebays #1 and #2 are located south of Eagle Canyon Canal on the eastern side of the study area (Figure 5). It appears that water is diverted from the Eagle Canyon Canal to flow through fish rearing facilities and then is returned to the canal. Before returning to the canal, the water pools within two forebays just west of the fish rearing facility. Forebay #1 could be viewed from the fish rearing facility; however, forebay #2 was not visible from this point and could not be accessed from other points because of the presence of the canal. Forebay #1 is connected to forebay #2 through a short channel. Forebay #1 is approximately 50 feet (15 m) long by 50 feet (15 m) wide with a depth of 1–2 feet (0.3–0.6 m) (Figure 7). The substrate is silt and cobble. There was a fair amount of emergent and floating vegetation along the edges of the forebay. Vegetation surrounding the pond included watercress, willows, and Himalayan blackberry. No red-legged frogs, other amphibians, or fish were observed in the forebay. Forebay #1 appears to provide suitable breeding and refuge habitat for red-legged frogs. It is likely that forebay #2 is similar to forebay #1 because of their close proximity, and it is assumed that this area also provides suitable habitat for red-legged frogs.



Forebay #1.



Juniper Gulch.

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## Juniper Gulch

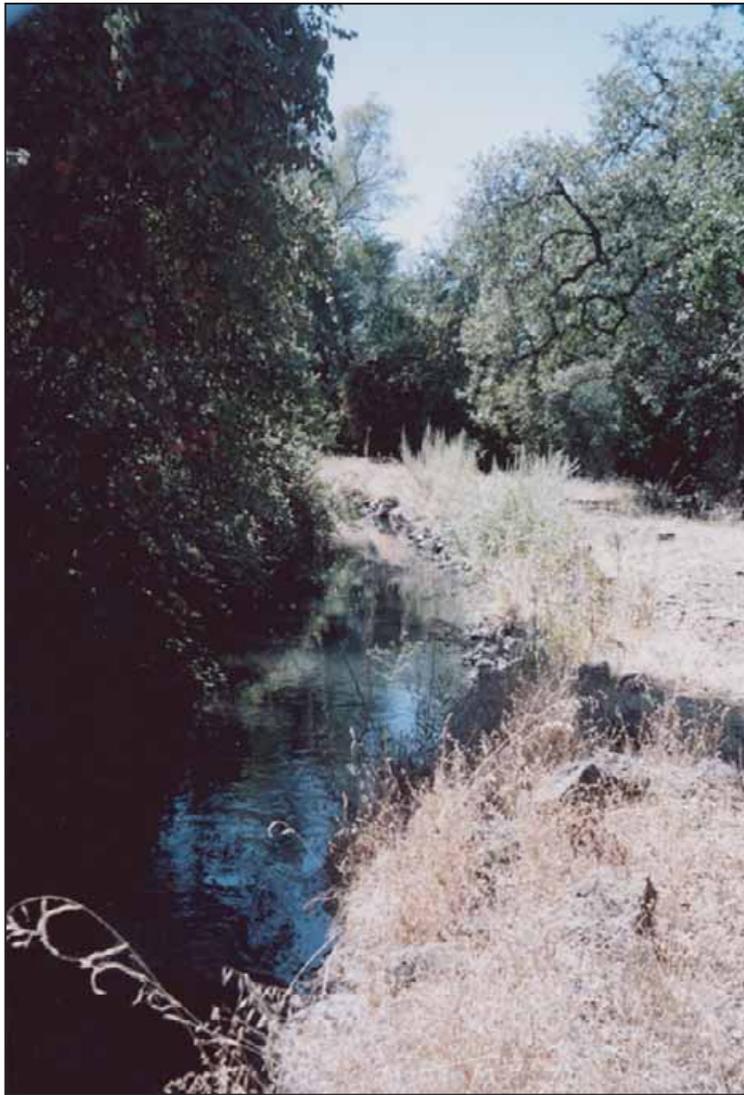
Juniper Gulch crosses the access road through the study area at two locations and parallels a portion of the study area (Figure 5). This creek is obscured from sight along a substantial portion of its length because of dense vegetation. The portion of the creek that was most visible and accessible occurs near the point where the road heading northeast curves to the east. Evaluation of this creek was made from this location. Juniper Gulch is a small stream ranging from 1 to 4 feet (0.3 to 1.2 m) wide with an average depth of 12 inches (30 cm) (Figure 7). The channel width may actually be larger, but its edges are obscured by dense vegetation. The substrate consists of silt and cobble. On the south side of the road, there is a small run near the culvert, which becomes a slow-flowing pooled area (Figure 7). On the north side of the road, the creek is almost completely covered by low growing wetland vegetation. Streamside vegetation consists of Himalayan blackberry, white alder, willows, and ferns. The surrounding upland consists of oak woodland and patches of dense wetland vegetation. No red-legged frogs, other amphibians, or fish were observed in the creek. Juniper Gulch appears to provide suitable breeding, refuge, and dispersal habitat for red-legged frogs.

## Eagle Canyon Canal

Eagle Canyon Canal flows along the eastern edge of study area (Figure 5). The canal has steeply cut banks that are concrete lined (Figure 8). The upper edges are covered with cobble and grassy vegetation. Silt and cobble cover the canal bottom. Water flow in the canal was moderately swift, and water depth was approximately 1 foot (0.3 m). Surrounding vegetation consists of valley oak, live oak (*Q. wislizenii*), and white alder. No red-legged frogs, other amphibians, or fish were observed in the canal. Because of the steep banks and moderately swift flowing water, Eagle Canyon Canal does not appear to provide suitable breeding, refuge, or dispersal habitat for red-legged frogs.

## Unnamed Creek #1

Unnamed creek #1 is located in the southern portion of the study area (Figure 5). Traveling southwest to northeast, this unnamed creek is the first visible creek that is crossed by the access road through the study area. The creek was dry except for a small puddle near the culvert (Figure 9). The creek channel was approximately 4 feet (1.2 m) wide and has low-sloped banks. Depth of the creek is probably ranges from a few inches to a foot deep when flowing. The substrate consists of silt and cobble. Vegetation along the creek consists of grasses, Himalayan blackberry, white alder, and valley oak. No red-legged frogs or other amphibian species were observed in the creek; however, the creek was not walked because of the presence of an aggressive dog. It appears that the creek would provide appropriate refuge and dispersal habitat for red-legged frogs, but based on the vegetation present in the creek, it is unlikely to hold water long enough to support breeding.



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## Willow Springs Mitigation Site

Potential habitat within the Willow Springs Mitigation Site consists of Pond C, unnamed creek #2, unnamed creek #3, Pond D, Pond E, an unnamed ditch, and Wildcat canal (Figures 10a and 10b). Potential habitat in the study area was surveyed between 11:00 am and 5:00 pm on November 3 and 15, 2004. The weather was partly cloudy, windy, and cold (50–60°F [10–15.6°C]) on November 3, and clear and cold (50–60°F [10–15.6°C]) on November 15. The elevation at this site is approximately 1,160 feet (354 m).

### Pond C

Pond C is located in the southeast portion of the study area (Figure 10a). This pond is approximately 100 feet (30.5 m) long by 80 feet wide (24.4 m) (Figure 11). The pond appeared to be rather shallow (6 inches to 2 feet deep [15.2 cm–0.6 m]) but the maximum depth was difficult to determine. A fair amount of emergent vegetation consisting of cattails and grasses was present in Pond C. Vegetation along the pond's perimeter included grasses, rush (*Juncus* sp.), and Himalayan blackberry. Two drains were evident at the pond, and it appears that the pond is filled by overflow from the fish rearing facility via a culvert. No red-legged frogs, other amphibians, or fish were observed in the pond. The pond appears to provide suitable breeding and refuge habitat for red-legged frogs.

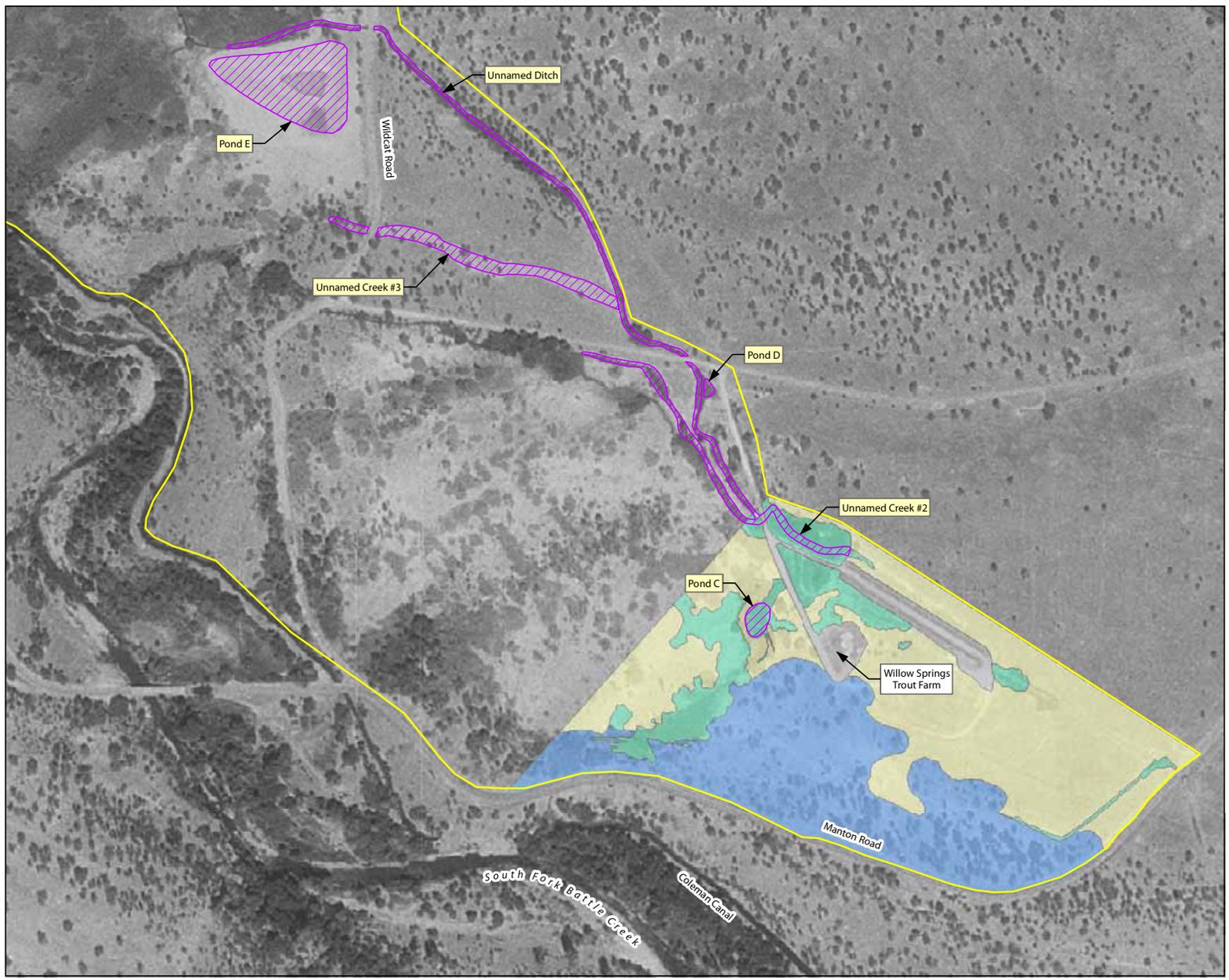
### Unnamed Creek #2

Unnamed creek #2 is located along the northern edge of the study area. This creek flows from a fish rearing facility and then along a dirt road that runs through the hatchery property (Figure 10a). The creek crosses under the road and splits into two channelized drainages. One of these channelized drainages becomes an unnamed ditch that crosses Wildcat Road and is described below. Unnamed creek #2 is a slow-flowing, shallow (less than 1 foot [0.3 m] deep) creek (Figure 11). The creek has pools between areas of riffle or run. Watercress covers the outer portions of the creek. The banks of the creek are entirely covered with Himalayan blackberry and cattails. Willows are also present along the creek channel. No red-legged frogs, other amphibians, or fish were observed in the creek. The upland consists of oak woodland. Although the creek provides suitable dispersal and refuge habitat for red-legged frogs, the lack of deeper pooled areas probably preclude its use as breeding habitat.

### Pond D

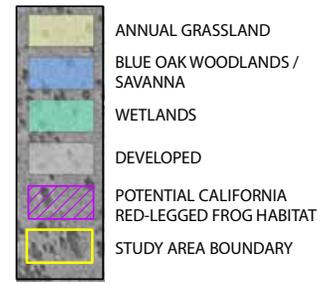
Pond D is located near the hatchery entrance in the northeastern portion of the study area (Figure 10a). The maximum size of the pond is approximately 50 feet (15.2 m) by 25 feet (7.6 m), but the area that was ponded during the survey was about 35 feet (10.7 m) by 15 feet (4.6 m) (Figure 12). The depth of the pond was

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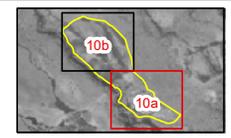


**FIGURE 10a**

AREAS ASSESSED FOR SUITABILITY FOR CALIFORNIA RED-LEGGED FROG AT THE WILLOW SPRINGS MITIGATION SITE

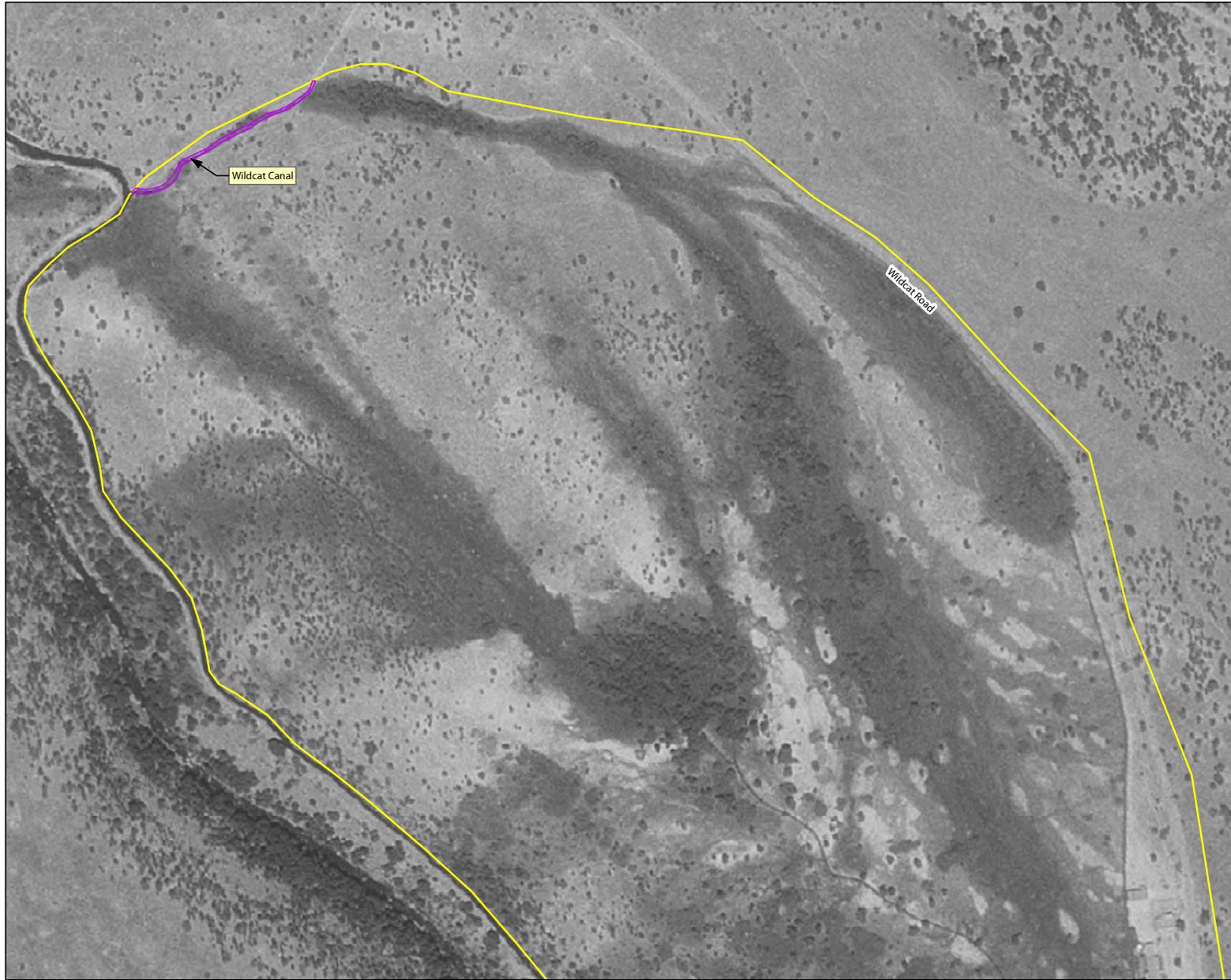


NOTES: 1 AERIAL PHOTO SOURCE: USGS DOQQ 1998



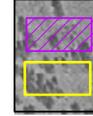
INDEX TO MAP SHEETS

|   |   |
|---|---|
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|---|---|



**FIGURE 10b**

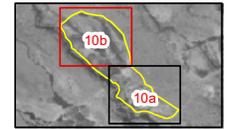
AREAS ASSESSED FOR SUITABILITY FOR CALIFORNIA RED-LEGGED FROG AT THE WILLOW SPRINGS MITIGATION SITE



POTENTIAL CALIFORNIA RED-LEGGED FROG HABITAT  
STUDY AREA BOUNDARY



NOTES: 1 AERIAL PHOTO SOURCE: USGS DOQQ 1998



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Pond C.



Unnamed Creek #2.

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Pond D.



Unnamed Creek #3.

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about 1 foot (0.3 m) at the time of the survey but could reach a maximum depth of approximately 2 feet (0.6 m). The pond appears to be filled by an irrigation pipe and from spillover from the creek when the water level gets high. There was no emergent vegetation within Pond D. The perimeter of the pond was covered with grassy vegetation. No red-legged frogs, other amphibians, or fish were observed in the pond. The upland consists of oak woodland. Because of the shallow depth and lack of emergent vegetation, this pond does not appear to stay inundated long enough to provide appropriate breeding or refuge habitat for red-legged frogs.

### **Unnamed Creek #3**

Unnamed creek #3 is located north of the road leading to the Willow Springs fish hatchery (Figure 10a). Upstream of Wildcat Road, the creek is 10–20 feet (3.0–6.1 m) wide and has a moderately fast flow (Figure 12). The banks are gently sloped and covered with grassy vegetation. Downstream of Wildcat Road, the creek is 3–5 feet (0.9–1.5 m) wide and fast flowing. The creek banks are more steeply sloped with grassy and shrubby vegetation. Depth of the creek is 6 inches (15.2 cm) to 1 foot (0.3 m), and it has a silt, gravel, and cobble substrate. The creek has riffle and run, but no pooled areas were observed. No red-legged frogs, other amphibians, or fish were observed in the creek. Because of the fast flow, lack of pools, and lack of emergent vegetation, unnamed creek #3 is not suitable for red-legged frogs.

### **Pond E**

Pond E is located near the center of the study area (Figure 10a) and is approximately 260 feet (79.2 m) long by 130 feet (39.6 m) wide (Figure 13). Pond depth ranged from a foot to several feet deep. The pond was created by a large borrow pit. The southern corner of the pond has emergent vegetation consisting of cattails; the remainder of the pond does not have emergent vegetation. The pond perimeter is moderately sloped and covered with cobble and grasses. No red-legged frogs, other amphibians, or fish were observed in the pond. The upland consists of oak woodland. Pond E provides suitable breeding and refuge habitat for red-legged frog.

### **Unnamed Ditch**

An unnamed ditch crosses Wildcat Road, just northeast of Pond E (Figure 10a). Water in this ditch comes from unnamed creek #3. The ditch is 3 feet (0.9 m) wide and has a silt, gravel, and cobble substrate (Figure 13). Depth of water was approximately 6 inches (15.2 cm). Water in the creek was fairly slow flowing with a few riffles. The slopes of the ditch are low to moderately sloped and covered with cobble, boulders, grasses, and Himalayan blackberry. Low-growing emergent or floating vegetation was present along the edges of the ditch. No red-legged frogs, other amphibians, or fish were observed in the ditch. The



Pond E.



Unnamed Ditch.

03035.03 02R (01/05)

upland consists of oak woodland. This ditch provides dispersal and areas of refuge habitat for red-legged frog but no breeding habitat.

## **Wildcat Canal**

Wildcat Canal is located at the northwest end of the project site (Figure 10b). The canal was viewed from the point where Wildcat Road crosses it (Figure 4). The north (upstream) side of the canal was dry; the south (downstream) side had shallow standing water (less than 6 inches [15.2 cm]) (Figure 14). The canal is 2–3 feet (0.6–0.9 m) wide with a silt bottom with some cobble and woody debris. The banks of the canal are moderately sloped and are covered with grassy vegetation. The upland consists of oak woodland. The canal may provide dispersal habitat for red-legged frog but does not appear to provide appropriate breeding or refuge habitat.

## **Asbury Diversion Dam**

Potential habitat at the Asbury Diversion Dam site consists of Baldwin Creek. Potential habitat at the Asbury project site was surveyed between 12:30 pm and 1:30 pm on November 3 2004. The weather was partly cloudy, windy, and cold (50–60°F [10–15.6°C]). The elevation at this site is approximately 900 feet (274 m).

## **Baldwin Creek**

Baldwin Creek passes through the middle of the Asbury Diversion Dam study area (Figure 15). The Asbury Dam has created a large ponded area within the creek (Figure 16). This ponded area is approximately 100 feet (30.5 m) long by 100 feet (30.5 m) wide. An island within the ponded area is covered with Himalayan blackberry, small alders, and cattails. The ponded area is 1–4 feet (0.3–1.2 m) deep and has a silt and cobble bottom. Approximately half of the perimeter of the ponded area is concrete lined. Another quarter of the perimeter of the pond is steeply sloped and covered with Himalayan blackberry. The remainder of the pond perimeter is gently sloped and covered with low-growing vegetation and a small valley oak. Fish were observed in the ponded area but no red-legged frogs or other amphibians were observed. This ponded area appears to provide suitable breeding habitat for red-legged frog, however the steep edges on the majority of the pond and the presence of fish decrease the suitability.

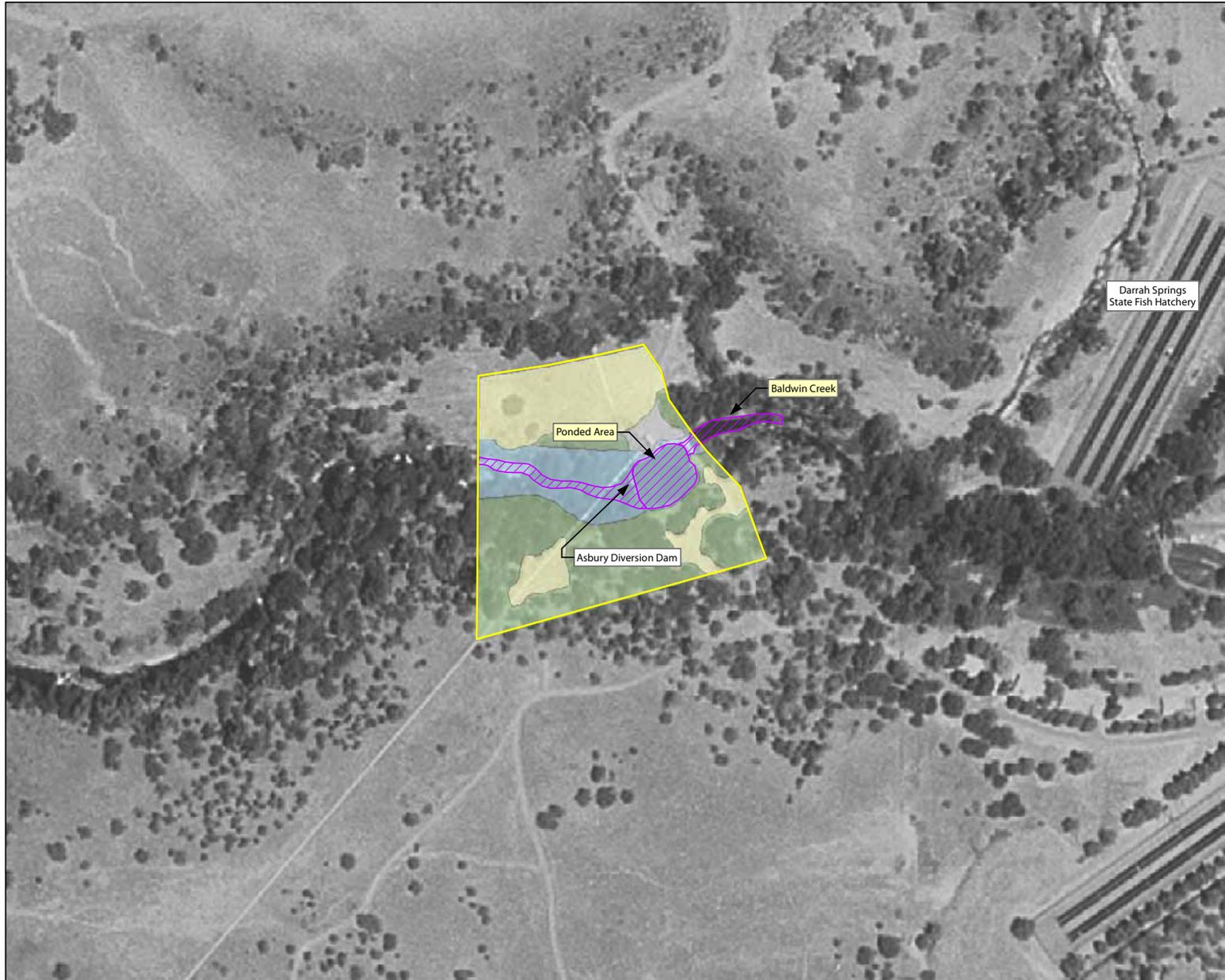
Baldwin Creek downstream of the ponded area is approximately 30 feet (9.1 m) wide. It is 1–3 feet (0.3–0.9 m) deep with a bedrock and cobble substrate. The banks are gently to moderately sloped and are covered with rush, Himalayan blackberry, alders, willows, and grasses. Because this area is wide near the weir, the flow is relatively slow but increases further downstream. A side channel is also present; it is shallow (3–6 inches [7.6–15.2 cm]) with grasses and rushes



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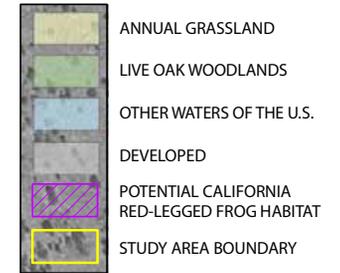
**Figure 14**  
**Wildcat Canal at Wildcat Road near the**  
**Willow Springs Mitigation Site**

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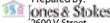


**FIGURE 15**

AREAS ASSESSED FOR SUITABILITY FOR CALIFORNIA RED-LEGGED FROG AT THE ASBURY DIVERSION DAM SITE



NOTES: 1 AERIAL PHOTO SOURCE: USGS DOQQ 1998

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Ponded area within Baldwin Creek.



Baldwin Creek - upstream of ponded area.

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within and along the edges of the channel. Backwater areas and slower portions of Baldwin Creek downstream of the ponded area provide suitable breeding habitat for red-legged frog. In addition, the side channel provides suitable refuge and dispersal habitat for red-legged frogs.

Baldwin Creek upstream of the ponded area is approximately 20 feet (6.1 m) wide with a bedrock and boulder substrate (Figure 16). The flow is moderate with riffle and run. No pooled areas were observed from the road overcrossing. The banks of the creek are gently sloped and covered with grassy vegetation. Vegetation alongside the creek includes alders, willows, Himalayan blackberry, and valley oak. Baldwin Creek upstream of the ponded area does not provide suitable habitat for red-legged frogs because of the unsuitable substrate and lack of pooled areas and emergent vegetation.

## Other Potential Habitat in the Project Vicinity

The Shingletown and Tuscan Buttes quadrangles were examined to identify potential red-legged frog habitat within 1 mile (1.6 km) of the three project sites. As described above, 17 creeks, tributaries, and canals were identified on maps and in the field as potential habitat (Figures 3 and 4). Seven creeks and tributaries were not assessed because they could not be accessed. These areas of potential habitat were evaluated on August 31, 2004, between 11:00 am and 6:00 pm, and between 11:00 am and 5:00 pm on November 3 and 15, 2004. The 11 sites within a mile of the project sites are described below.

### North Fork Battle Creek

North Fork Battle Creek is within 1 mile (1.6 km) of the Jeffcoat East and West and Willow Springs mitigation sites. North Fork Battle Creek was evaluated from the Wildcat Road overcrossing (Figure 4). North Fork Battle Creek is a fast-flowing stream with a boulder, cobble, and gravel substrate (Figure 17). The creek is dominated by riffle and run, and no pooled areas were visible from Wildcat Road. However, a few slower backwater areas are present. Vegetation adjacent to the creek consists of willows, oaks, and grasses. The canopy over the creek is fairly open. Although a few backwater areas may provide suitable areas for red-legged frogs, the majority of the creek did not appear to provide suitable breeding, dispersal, or refuge habitat because of the high flow-rate, rocky substrate, and lack of pool habitat.

### South Fork Battle Creek

South Fork Battle Creek is within 1 mile (1.6 km) of the Willow Springs and Asbury sites. South Fork Battle Creek was evaluated from the Manton Road overcrossing (Figure 4). The creek is approximately 40 feet (12.2 m) wide and 1-foot (0.3 m) to several feet deep. Upstream of Manton Road the creek is



North Fork Battle Creek.



South Fork Battle Creek.

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composed of riffle and run; downstream of Manton Road the creek consists of a large slow run (Figure 17). The creek has a silt, cobble, and boulder substrate. A small amount of grassy emergent vegetation is present in the downstream portion of the creek. The banks of the creek are gently sloped and streamside vegetation consists of willows, cottonwoods, and grasses. A Pacific treefrog (*Hyla regilla*) was heard at the creek. Portions of South Fork Battle Creek (pooled areas and backwater areas) provide suitable breeding habitat for red-legged frogs. The creek may also provide refuge and dispersal habitat during times of the year when flows have subsided.

## Coleman Canal

Coleman Canal is within 1 mile (1.6 km) of the Willow Springs and Asbury sites. Coleman Canal was evaluated from the Manton Road overcrossing (Figure 15). Near the Manton Road crossing, the canal is concrete lined, but the banks are dirt farther from the road. The canal sides are steeply sloped with some cobble and grassy vegetation along them (Figure 18). Water flow in the canal was moderately swift. Coleman Canal does not provide suitable habitat for red-legged frog because of the steep banks and swift water flow.

## Tributary of Battle Creek #1

Tributary of Battle Creek #1 is within 1 mile (1.6 km) of the Willow Springs and Asbury sites. This tributary was evaluated from the Manton Road overcrossing (Figure 15). Tributary of Battle Creek #1 consists of a small (1–3 feet [0.3–0.9 m] wide) meandering stream through a pasture (Figure 18). The stream is shallow (approximately 6 inches) and has a silt substrate. The upstream portion of the stream has cattails and rushes within and adjacent to the stream. Himalayan blackberry and grassy vegetation are also present adjacent to the stream. The downstream portion of the stream has only grassy vegetation along its edges. The stream consists of runs; no pools were visible from the roadway. The upland consists of grassland and oak woodland. Tributary of Battle Creek #1 provides suitable refuge and dispersal habitat for red-legged frog. It is unlikely to provide suitable breeding habitat because of the lack of deeper pooled areas.

## Tributary of Battle Creek #2

Tributary of Battle Creek #2 is within 1 mile (1.6 km) of the Willow Springs Mitigation Site. This tributary was evaluated from the Manton Road overcrossing (Figure 15). Tributary of Battle Creek #2 consists of a small (1–2 feet [0.3–0.6 m] wide) stream through a ranchette (Figure 19). The stream is very shallow (3–6 inches [7.6–15.2 cm]) and has a silt substrate. Both the upstream portion and downstream portion of the stream have a pooled area adjacent to the roadway. Cattails are present in and adjacent to the stream. Other



Coleman Canal.



Tributary of Battle Creek #1.

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Tributary of Battle Creek #2.



Tributary of Darrah Springs Creek.

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streamside vegetation includes Himalayan blackberry and grasses. The upland consists of pasture and oak woodland. Fish were observed in the stream. Tributary of Battle Creek #2 provides suitable refuge and dispersal habitat for red-legged frog. It is unlikely to provide suitable breeding habitat because of the lack of deeper pooled areas.

## Eagle Canyon Canal

Eagle Canyon Canal is within 1 mile (1.6 km) of the Willow Springs Mitigation Site. However, a portion of this canal is located within the Jeffcoat East and West project site (Figure 5). A description of Eagle Canyon Canal was included above under Jeffcoat East and West Mitigation Site.

## Juniper Gulch

Juniper Gulch is within 1 mile (1.6 km) of the Willow Springs Mitigation Site. However, a portion of this creek is located within the Jeffcoat East and West project site (Figure 5). A description of Juniper Gulch was included above under Jeffcoat East and West Mitigation Site.

## Pacific Power Ditch

The Pacific Power Ditch is located within 1 mile (1.6 km) of the Asbury Diversion Dam Site. This ditch was viewed from the road leading to the Darrah Springs Fish Hatchery (Figure 4). Depth of water in the ditch was less than a foot deep at the time of the survey. The banks of the ditch are steep and are covered with grassy vegetation. Other vegetation along and within the ditch included bulrush (*Scirpus* sp.) and willows. The substrate within the ditch consisted of silt and cobble. Pacific Power Ditch receives overflow water from the Darrah Springs Creek. Pacific Power Ditch provides suitable refuge and dispersal habitat for red-legged frogs but is unlikely to support breeding because the duration of inundation may not be long enough to allow for larval development.

## Tributary of Darrah Springs Creek

The tributary of Darrah Springs Creek is located within 1 mile (1.6 km) of the Willow Springs and Asbury sites. The tributary was viewed from the Wildcat Road overcrossing (Figure 4). This tributary was dry at the time of the site assessment. The creek channel is 10–20 feet (3.0–6.1 m) wide with a boulder substrate (Figure 19). The banks of the creek are gently sloped and covered with grassy vegetation. It appears that majority of the creek would be riffle and run, but one small pooled area may occur near the road. Vegetation adjacent to the creek includes valley oaks and gray pine (*Pinus sabiniana*). The upland consists

of oak woodland. The tributary of Darrah Springs Creek did not appear to be suitable for red-legged frog because of the unsuitable substrate, lack of emergent vegetation, and lack of areas that are likely to pool.

## Tributary of Baldwin Creek #1

The tributary of Baldwin Creek #1 is located within 1 mile (1.6 km) of the Asbury Diversion Dam Site. The tributary was viewed from the shoulder of Wildcat Road (Figure 4). This tributary was mostly dry at the time of the site assessment. The creek channel appeared to be 3–4 feet (0.9–1.2 m) wide with a silt, cobble, and gravel substrate. Only one small pool was visible from the roadway and the depth of the pool could not be determined. The creek has moderately steep to very steep banks. Vegetation along the creek consists of willows, oaks, Fremont cottonwood (*Populus fremontii*), and grasses. The upland is oak woodland, including a steep hillside to the north. A picture was not taken of this site because vegetation obstructed the majority of the view of the creek. The tributary of Baldwin Creek did not appear to be suitable for red-legged frog because of the unsuitable substrate, lack of emergent vegetation, and the low likelihood that the creek would have deep pools for breeding.

## Conclusion

Fourteen areas of potential habitat within the Jeffcoat East and West, Willow Springs, and Asbury Diversion Dam project sites were examined for their suitability to provide breeding, refuge, or dispersal habitat for red-legged frogs. Table 3 provides a summary of habitat suitability at each of these areas. Four areas (Pond A, Pond B, forebays #1 and #2, and Juniper Gulch) in the Jeffcoat East and West project site provide both breeding and refuge habitat for red-legged frogs. However, the use of Pond A and Pond B as bloodworm breeding areas may reduce the quality of the breeding habitat. Juniper Gulch also provides suitable dispersal habitat. Unnamed creek #1 provides suitable refuge and dispersal habitat, but it is unlikely to hold water long enough to support breeding. Within the Willow Springs project site, Pond C and Pond E provide suitable breeding and refuge habitat for red-legged frogs. Pond D appeared too shallow to provide suitable breeding habitat. Unnamed creek #2 and the unnamed ditch provide suitable refuge and dispersal habitat while Wildcat Canal only provides suitable dispersal habitat. Within the Asbury Diversion Dam project site, Baldwin Creek provides suitable breeding, refuge, and dispersal habitat; however the presence of fish and the steeply sloped edge of the majority of the ponded area decreases the suitability as breeding habitat.

Ten areas within 1 mile (1.6 km) of the project boundaries were assessed for their habitat suitability. Table 4 provides a summary of habitat suitability at each of these areas. Five creeks and canals were determined to be unsuitable breeding, refuge, or dispersal habitat for red-legged frogs because of their high flow-rates, unsuitable substrate, and lack of deeper pooled areas and emergent vegetation.

**Table 3.** Summary of Habitat Suitability for California Red-Legged Frog at Sites Assessed in the Jeffcoat East and West, Willow Springs, and Asbury Diversion Dam Project Sites

| Site Assessed                 | Habitat Suitability |        |           | Comments   |
|-------------------------------|---------------------|--------|-----------|--|
|                               | Breeding            | Refuge | Dispersal |  |
| <b>Jeffcoat East and West</b> |                     |        |           |  |
| Pond A                        | Yes                 | Yes    | N/A       | Reduced quality because of use as a bloodworm breeding area  |
| Pond B                        | Yes                 | Yes    | N/A       | Reduced quality because of use as a bloodworm breeding area  |
| Forebays #1 and #2            | Yes                 | Yes    | N/A       |  |
| Juniper Gulch                 | Yes                 | Yes    | Yes       |  |
| Eagle Canyon Canal            | No                  | No     | No        | Steep banks and moderately swift water flow  |
| Unnamed creek #1              | No                  | Yes    | Yes       |  |
| <b>Willow Springs</b>         |                     |        |           |  |
| Pond C                        | Yes                 | Yes    | N/A       |  |
| Unnamed creek #2              | No                  | Yes    | Yes       | Lack of deep pools probably precludes breeding   |
| Pond D                        | No                  | No     | N/A       | Shallow depth and lack of emergent vegetation probably preclude breeding                                     |
| Unnamed creek #3              | No                  | No     | No        |  |
| Pond E                        | Yes                 | Yes    | N/A       |  |
| Unnamed ditch                 | No                  | Yes    | Yes       |  |
| Wildcat Canal                 | No                  | No     | Yes       |  |
| <b>Asbury Diversion Dam</b>   |                     |        |           |  |
| Baldwin Creek                 | Yes                 | Yes    | Yes       | Presence of fish and steeply sloped edge of majority of ponded area decrease suitability as breeding habitat |

**Table 4.** Summary of Habitat Suitability for California Red-Legged Frog at Sites Assessed within 1 Mile (1.6 km) of the Jeffcoat East and West, Willow Springs, and Asbury Diversion Dam Project Sites

| Site Assessed                     | Habitat Suitability |        |           | Comments   |
|-----------------------------------|---------------------|--------|-----------|--|
|                                   | Breeding            | Refuge | Dispersal |  |
| North Fork Battle Creek           | No                  | No     | No        | High flow-rate, rocky substrate, and lack of pool habitat  |
| South Fork Battle Creek           | Yes                 | Yes    | Yes       | Portions of the creek may provide suitable breeding habitat; creek may provide refuge and dispersal habitat during the time of the year when the flow subsides |
| Coleman Canal                     | No                  | No     | No        | Steep banks and swift water flow   |
| Tributary of Battle Creek #1      | No                  | Yes    | Yes       | Lack of deeper pooled areas  |
| Tributary of Battle Creek #2      | No                  | Yes    | Yes       | Lack of deeper pooled areas  |
| Eagle Canyon Canal                | No                  | No     | No        | Steep banks and moderately swift water flow  |
| Juniper Gulch                     | Yes                 | Yes    | Yes       |  |
| Pacific Power ditch               | No                  | Yes    | Yes       | Duration of inundation may not be long enough to allow larval development  |
| Tributary of Darrah Springs Creek | No                  | No     | No        | Unsuitable substrate, lack of emergent vegetation, and lack of areas that are likely to pool   |
| Tributary of Baldwin Creek #1     | No                  | No     | No        | Unsuitable substrate, lack of emergent vegetation, and low likelihood of deep pools  |

Two creeks and one ditch provide suitable refuge and dispersal habitat but lack deeper pooled areas or a sufficient period of inundation for breeding. Two creeks appeared to provide appropriate breeding, refuge, and dispersal habitat for red-legged frogs.

No California red-legged frogs or other amphibians were observed during the site assessments, although a Pacific treefrog was heard calling at one of the sites. As described above, several areas at the project sites and within a mile of the sites provide suitable habitat for California red-legged frog. However, the closest recorded sighting of a California red-legged frog is approximately 48 miles (77 km) southwest of the site in Tehama County (CNDDDB 2004).

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