

**SITE ASSESSMENT FOR CALIFORNIA RED-LEGGED FROG  
(*RANA AURORA DRAYTONII*) HABITAT  
IN THE KILARC-COW PROJECT AREA**

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# **SITE ASSESSMENT FOR CALIFORNIA RED-LEGGED FROG (*RANA AURORA DRAYTONII*) HABITAT IN THE KILARC-COW PROJECT AREA**

## **1.0 INTRODUCTION**

Pacific Gas and Electric Company (Licensee) owns and operates the Federally licensed Kilarc-Cow Creek Project (Project) facilities located in southeastern Shasta County, California. The Licensee intends to file an Application for New License for the Kilarc-Cow Creek Project (FERC No. 606) by March 2005, two years before the current license expires. Diversion canals from Old Cow Creek and South Cow Creek are the principal water sources for Kilarc Powerhouse and Cow Creek Powerhouse, respectively. These creek basins are believed to lie within the distribution of the California red-legged frog (*Rana aurora draytonii*), which is included in the U.S. Fish and Wildlife Service (USFWS) list of threatened species under the Endangered Species Act (USFWS 2000, 2002). Under current USFWS guidelines, any project within the distribution of this species must include site assessments for potential California red-legged frog (CRLF) habitat within one mile of the edge of the Project area. Assessment procedures are provided in the USFWS (1997) CRLF site assessment protocol. This report presents the results of a CRLF habitat site assessment of the South Cow and Old Cow Creek basins within one mile of the Project area (defined below), conducted during June and September 2003 by ENTRIX, Inc. biologists.

## **1.1 DEFINITIONS**

**“Project”** The Project encompasses the entire Pacific Gas and Electric (PG&E) Kilarc-Cow Creek Project in the Old Cow Creek and South Cow Creek drainages and tributaries, including structures, maintenance, and management.

**“Project Area”** as referenced in this report, is the area within the Federal Energy Regulatory Commission (FERC) Project Boundary which includes the territory from wetted edge of each creek or bypass reach to one quarter of a mile outward from the waterways or Project features (Figure 1).

**“Site Assessment”** A Site Assessment is a field survey of aquatic or riparian habitat to determine its potential suitability for some life history stage of the California red-legged frog. This report documents the collective results of numerous Site Assessments within the Site Assessment Area (defined below).

**“Site Assessment Area”** The Site Assessment Area as discussed in this report includes the Project Area defined above, and the territory from the wetted edge of each creek or bypass to one linear mile outward (as defined by USFWS [1997]). It includes numerous Site Assessments (Figures 1 through 3).

## **1.2 SCOPE OF WORK**

On June 24, 2002 the Licensee issued a First Stage Consultation Document (FSCD) for the Project. The FSCD described the Project and known resources and proposed studies to gather additional information required for the Application for New License. Study Plan 18, *California*

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**Figure 1. California Red-Legged Frog Site Assessment Area, Kilarc-Cow Creek Project.**

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**Figure 2. Potential Habitat Sites for California Red-Legged Frog Identified in the Old Cow Creek Study Area.**

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**Figure 3. Potential Habitat Sites for California Red-Legged Frog Identified in the South Cow Creek Study Area.**

*Red-Legged Frog Surveys* (Appendix A) addressed how information CRLF would be obtained. The scope of the study plan included a site assessment and focused surveys for CRLF in accordance with the USFWS approved protocol/guidelines. Under the current guidelines (i.e., *USFWS Guidance on Site Assessment and Field Surveys for California Red-legged Frogs, February 1997*), this included: (1) determining the location of CRLF within five miles of the Project area, (2) describing habitats in and within one mile of the Project area, (3) preparing a site assessment report, and (4) completing focused surveys if determined necessary by the USFWS. During CRLF field surveys, all special-status amphibians and reptiles observed (including foothill yellow-legged frog and northwestern pond turtle) were identified and mapped.

The locations of CRLF within the Project area and within eight km (five miles) of Project boundaries were determined through consulting the California Natural Diversity Database, museum records, biological consultants, local residents, species experts, herpetologists, resource managers, and agency biologists. In addition, all habitats present within one mile of the project site were identified. This included review of recent aerial photographs and of National Wetlands Inventory (NWI) maps, followed by ground-truthing.

This report was prepared in accordance with the USFWS Guidelines that include the following: photographs of the Project area, survey dates and times, names of surveyors, a description of methods, a map of the Project area and vicinity indicating habitats present (e.g., aquatic and upland habitat). The USFWS will determine, following receipt of this report, if focused protocol-level CRLF surveys would be necessary. If it is determined that focused surveys are



required, the Licensee will complete these surveys in accordance with the USFWS protocol/guidelines.

### **1.3 PROJECT DESCRIPTION**

The Project is located about 30 miles east of the City of Redding, near the rural community of Whitmore. The Project Area totals 187.13 acres, of which PG&E own 117 acres, 50.9 acres are private owned, and 19 acres are patented.

The Project Area is located within the USFWS CRLF Recovery Unit 1, Sierra Nevada Foothills and Central Valley (Figure 1). It is not in a Core area or priority watershed for focused recovery efforts because there are few historical or current records for this species in the northern and central part of Recovery Unit 1 (north of the Feather River watershed - USFWS 2002).

#### ***1.3.1 Kilarc Powerhouse Facilities***

Kilarc Powerhouse is supplied with water from the Old Cow Creek Watershed, and with water diverted from North and South Canyon Creeks (tributaries to Old Cow Creek). The Old Cow Creek Watershed is about 80 square miles (sq. mi.) in area, with 25-sq. mi. located above the Kilarc (main canal) Diversion Dam. The average yearly runoff at the dam is 48,900 acre-feet (af). About 55 percent (27,000 af) is diverted to the Kilarc Powerhouse via a bypass and siphon system that includes Kilarc Main Canal Diversion Dam and Main Canal, Kilarc Forebay Dam, Penstock, and Powerhouse, supplemented by diversions from the Canyon Creek Watershed via North and South Canyon Creeks Diversion Dams and Canals, and Canyon Creek Siphon

Water from Old Cow Creek is diverted at the Kilarc Diversion Dam into the Kilarc Main Canal, which then flows into the Kilarc Forebay. The North Canyon Creek Canal diverts water from North Canyon Creek into South Canyon Creek. The water from South Canyon Creek is diverted into South Canyon Creek Canal, which then enters Canyon Creek Siphon and then into the Kilarc Main Canal. From the Kilarc Forebay, water flows through the penstock to the Kilarc Powerhouse and then back to Old Cow Creek (Figures 2 and 3).

### ***1.3.2 Cow Creek Powerhouse Facilities***

The Cow Creek Powerhouse is supplied with water from the South Cow Creek Watershed including Mill Creek (tributary to South Cow Creek). The South Cow Creek Watershed is about 78-sq. mi. in area, with 53-sq. mi. above the South Cow Creek Diversion Dam. The average yearly runoff at the dam is 79,500 af. About 37 percent (29,000 af) is diverted to the Cow Creek Powerhouse via South Cow Creek Diversion Dam and Main Canal, Cow Creek Forebay Dam and Cow Creek Forebay, Penstock and Powerhouse, and diversions from Mill Creek Diversion Dam to Mill Creek-South Cow Creek Canal (Figures 2 and 3).

The Mill Creek-South Cow Creek Canal diverts water from Mill Creek into South Cow Creek. Water is diverted from South Cow Creek into the South Cow Creek Main Canal and into the Cow Creek Forebay. From Cow Creek Forebay, water flows through the penstock to Cow Creek Powerhouse, into Hooten Gulch, and back into South Cow Creek.

### ***1.3.3 Routine Maintenance Activities***

Routine maintenance at the Kilarc, South Canyon Creek, North Canyon Creek, Mill Creek, and South Cow Creek diversion structures includes visual inspection of the equipment, daily to

weekly manual clearing of the intake trash racks, and monthly inspection and lubrication of the slide and radial gates. The Project is shut down annually for three to five days during low flow periods (October through December) to inspect, maintain, and repair the generators, turbines, circuit breakers, transformer banks, penstock, canals and South Cow Creek Main Canal tunnel. The canals are drained, inspected, and if necessary repaired annually. The tunnel is drained, inspected, and if necessary repaired biannually.

Bed and suspended sediment load that is transported by Old Cow Creek and South Cow Creek typically enters the canals only during infrequent high flow events. These canals can transport relatively little sediment because their gradients are too low (~1/4 inch/linear foot). Sediment typically deposits within the first few hundred yards of the head-gates at the canal entrances. Most sediment on South Cow Main Canal is caught at the spillway sand-trap, which returns excess canal flow to South Cow Creek just downstream from the head-gate. The sand-trap drain-gate is opened during the winter when South Cow Creek flows are relatively high and turbid.

Since little sediment accumulates in the canals, it is usually removed manually with shovels, but small-track Bobcats may be used to remove boulders. ENTRIX inspections of the canals revealed no evidence of spoils storage from sediment maintenance activities along either canal. There were also no sediment deposits within the canals.

The Licensee will continue to operate the Project as it has in the past, with modifications occurring when it is necessary to do maintenance on the Project or in the interest of public safety.

#### 1.4 ENVIRONMENTAL SETTING

The Project is located in the northern portion of the Sacramento River drainage. The elevation within the Project area ranges from about 820 ft above mean sea level (MSL) at the Cow Creek Powerhouse to 3,940 ft above MSL at the North Canyon Diversion. The topography varies from gently rolling low hills near the Cow Creek Powerhouse to steep, narrow canyons in the upper Old Cow and Canyon Creek watersheds. The Kilarc Powerhouse and Forebay are sited in the Sierra Nevada/Cascade lower montane forest of California (Rundel et al., 1977). A mixed coniferous forest comprised of ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), incense cedar (*Calocedrus decurrens*), and California black oak (*Quercus kelloggii*) typical of this association predominates at Kilarc Forebay. Cow Creek Powerhouse and Forebay are located in the valley oak savannah of the foothills (Griffin, 1977), which abut California's Great Valley. The oak-gray pine (*Pinus sabiniana*) association at Cow Creek Forebay has a sparse and scattered overstory. Land within the Site Assessment Area is used for grazing, rural residences, and limited forestry/timber harvest.

South Cow Creek is an incised, low- to moderate-gradient channel. The terrain surrounding South Cow Creek consists of broad plateaus and rolling hills. The Cow Creek Forebay is sited on the flat crest of a southwest-trending ridge capped with volcanic rocks. The Cow Creek Powerhouse, located on Hooten Gulch, is sited on level ground in a gently dissected alluvial valley at the junction of several small tributaries.

Old Cow Creek is a narrow, steep-gradient channel with a steep-walled canyon. The Kilarc Forebay is situated on a flat plateau at the west end of a spur from Miller Mountain. The Kilarc Powerhouse is situated on a terrace above the streambed of Old Cow Creek.

## **1.5 CALIFORNIA RED-LEGGED FROG BIOLOGY AND NATURAL HISTORY**

The CRLF (*Rana aurora draytonii*) is the largest native frog (to about 140mm SUL (snout-urostyle length)) of the western United States. Of frog species that currently occur in the western US, only the exotic bullfrog (*Rana catesbeiana*) grows larger (to almost 200mm SUL). Distinctive CRLF identification characters include dorsolateral folds, a dark eye “mask,” whitish throat, brown to gray face, light-centered black dorsal spots, mottled dark groin patches, and red pigment on the feet, sometimes extending onto the legs and body. Bullfrogs lack all of those characters and usually have green faces and yellow throats. Foothill yellow-legged frogs (*Rana boylei*) have much rougher skin than red-legged frogs and lack distinct dorsal markings or an eye mask. Pacific tree frogs (*Hyla regilla*) lack dorsolateral folds and rarely grow larger than about 30mm SUL. Accurate identification is important because all three species may be found during CRLF surveys.

CRLF populations have been found from coastal Sonoma County and western Glenn County south along the coast to Baja California Norte, and from near Redding (Shasta County) south along the Sierra Nevada foothills to Fresno County (Storer, 1925; Jennings and Hayes, 1994). CRLF populations apparently never occurred in the Central Valley north of the Kern River basin, but they were widespread in southern California until the 1970’s (Jennings and Hayes, 1994; Stebbins 2003). Just 22 CRLF populations have been documented credibly (with collected

specimens or identifiable photographs) from the Sierra Nevada, of which seven are known to survive and most of the remainder are of unknown status. The known surviving Sierra Nevada populations occur from central Butte County south to western Calaveras County at or below 3500 feet elevation, primarily on private land (Barry and Fellers, in prep).

CRLF's favor fully sunlit ponds and slow sections of sunlit streams as spawning habitat.

Indicators of suitable CRLF spawning habitat include:

1. Still or very slow water with at least 0.7m in depth but no more than 1-1.25m in depth at its deepest point. Water of that depth range should extend at least two meters outward from the wetted edge. The water may be seasonal or permanent, but seasonal water must last into August.
2. Mud or silt substratum. Waterways with continuous aggregate or rocky substrata (sand, gravel, pebbles, cobble, boulders, and bedrock) are not known to provide CRLF spawning habitat, probably because aggregate substrata rarely support sufficient submersed, emergent, and floating vegetation for egg mass attachment (see 3, below).
3. Dense, continuous bordering, overhanging, and emergent vegetative cover usually comprised of tules (*Scirpus*), cattails (*Typha*), sedges (*Juncus*) and willows (*Salix*) in pure stands or in combination.
4. Available direct sunlight for most of the day. The site cannot be completely shaded, again probably because shaded waterways rarely support extensive vegetation.

5. Scarcity or absence of exotic centrarchids (“warm water game fish”) such as bass (*Micropterus*) or green sunfish (*Lepomis cyanellus*); absence of large populations of bullfrogs.
6. A forage base that includes a complex invertebrate macrofauna with small rodent (micromammal) populations (an important component of the adult forage base), and extensive algae and herbaceous submersed plant material for tadpole forage.

Additionally, CRLFs favor aquatic spawning pool habitat dominated by masses of rooted floating vegetation (e.g., *Ludwigia*, *Potamogeton*); such vegetation occurs at all currently documented Sierra Nevada reproductive population habitats (Barry and Fellers, in prep). If incident sunlight is adequate in intensity and daily duration, the predominant surrounding vegetation community seems not to be a direct factor in CRLF habitat selection. Extant Sierra Nevada CRLF populations are known from bottomland hardwood/yellow pine forest, meadows, coniferous forest, and valley oak woodland (Barry and Fellers, in prep).

The typical water temperature of CRLF Sierra Nevada spawning pools during the late spring and summer ranges from 18 to about 22°C, far warmer than normally favored by salmonid fish (Baltz et al., 1987; Barry and Fellers, in prep.). All life history stages of CRLFs may inhabit spawning pools and their margins, but during the summer adult CRLFs may move to forested sections of slow streams with undercut banks and exposed root masses. Such “summer habitat” seems not to be an absolute population survival requirement because radio-tracking data from coastal populations show that many adult frogs inhabit the margins of spawning pools throughout the year except during hibernation (G. Fellers, unpubl. data). CRLFs may also aestivate during the

warmest summer period, but this behavior is also inconsistent within populations; many large adult frogs may be found close to spawning pools in July and August in the Sierra Nevada (Barry, unpubl. data; Barry and Fellers, in prep.).

In coastal California, red-legged frogs hibernate briefly from early November through late December or early January, and commence spawning-related activity by mid-January. Hibernaculum (and aestivation) habitat preferences are undocumented, but are believed to include rodent burrows in upland meadow and forest areas near spawning pools and probably also vegetation mats along the edges of these pools (Jennings and Hayes, 1994; Barry and Fellers, in prep.). The spawning period in Sierra Nevada populations is unknown but is believed to begin in March or April (Barry and Fellers, in prep.). Frogs congregate along the edges of spawning pools as described above and females attach baseball-sized masses of 500-2000 eggs (up to 6000 have been reported) to emergent or floating vegetation (Storer, 1925; Stebbins, 2003). The eggs hatch in seven to 14 days and the larvae usually metamorphose by late August (Storer, 1925; Barry, unpubl.).

## **1.6 POTENTIAL IMPACTS ON CALIFORNIA RED-LEGGED FROGS**

Significant changes in current Project operations could affect CRLF populations. Further, any streambed alteration, dredging, pond/stream drainage during seasons when water levels do not normally recede rapidly, exotic predator introduction, or ecological change that might benefit exotic predators could also affect CRLF populations. The impacts to CRLF populations are unpredictable but likely to be proportionate to the extent and duration of the activities. The first



step in identifying these impacts is to assess whether CRLF populations are likely to occur within or near the Project Area.

## **2.0 METHODS**

### **2.1 HISTORICAL RECORDS**

Historical CRLF records from all of Shasta and Tehama counties (an approximately 60-mile radius around the Project Area) were obtained from the California Natural Diversity Data Base (CNDDDB) (CDFG, 2002), and from a search of the catalogues of the Museum of Vertebrate Zoology, UC Berkeley (UC Berkeley, 2003), and California Academy of Sciences, San Francisco (CAS, 2003). Search terms for the CNDDDB were element=rana aurora and county=shasta, tehama (two runs). Search terms for the museum collections were species=rana aurora (MVZ) or genus=rana species=aurora (CAS) and county=shasta or tehama (two runs at each database). Tehama County was included in the query because the Shasta-Tehama county line is within a few miles of the southern part of the Site Assessment Area. ENTRIX biologist Sean Barry also queried his dataset from several natural history museums nationwide for further Shasta and Tehama County CRLF records. Disclaimer: Unless otherwise noted, neither the CNDDDB nor the museum database records are verified independently and they therefore carry some degree of uncertainty. Experts usually identify museum specimens during accession, but taxonomic changes and misidentifications are always possible. Further, the absence of CNDDDB or museum species records from any site does not indicate that the species is absent from that site.

Natural history and habitat information on CRLFs was obtained from Storer (1925), Stebbins (1951), Hayes and Jennings (1988), Jennings and Hayes (1994), Barry (1999, 2000), and USFWS (2002). ENTRIX biologist Sean Barry, who helped conduct some of the site evaluations, is also an expert on Sierra Nevada populations of the CRLF (Barry, 1999, 2000; Barry and Fellers, in prep) and is cited as such in the CRLF recovery plan (USFWS 2002).

## **2.2 SITE ASSESSMENTS**

The CRLF Site Assessments were based primarily on protocols recommended by USFWS (1997) and by Fellers and Freel (1995). According to all authorities the ecologically central component of CRLF habitat is the spawning pool, so all Site Assessments were based on the presence within the Site Assessment Area of such habitat. The absence of potential spawning pool habitat within one mile of any geographic point suggests strongly that CRLF populations are also absent (USFWS, 2002). Potential CRLF spawning habitat within the Site Assessment Area was identified from a preliminary helicopter survey (detailed below), and from topographic maps, aerial photographs, and preliminary information obtained during aquatic habitat mapping surveys and vegetation surveys conducted as part of other Project relicensing studies.

Project Area or Project-affected reaches (bypass reaches) in Old Cow Creek, South Cow Creek, diverted tributaries, Hooten Gulch, and diversion canals were divided into half-mile reaches on a topographic map and each half-mile reach was numbered. Half-mile reaches were used because they were short enough to document photographically yet long enough to intercept habitat changes that might occur along the streams. Springs and ponds within the Site Assessment Area

not affected by the Project that could potentially support CRLFs were also identified on topographic maps and numbered.

ENTRIX, Inc. biologists Ruth Sundermeyer and Sarah Yarnell, and Licensee biologist Alicia Pool conducted a helicopter reconnaissance survey on July 8, 2003 to document potential habitat within the Site Assessment Area during early summer when seasonal waterways capable of functioning as CRLF spawning habitat still contain sufficient water (Barry, unpubl.). Photographs of potential habitat were taken (Appendix B) and waypoints (Figure 2 and 3) of these sites were recorded during the flight. Time and accessibility constraints made complete ground Site Assessments of the entire Site Assessment Area or the Project Area impossible, so three representative reaches of Old Cow Creek and two reaches of South Cow Creek were selected for ground Site Assessments based on their seeming similarity to the remaining portions of the creeks from the helicopter surveys (Tables 1 and 2 follow Section 5.0). Ground Site Assessments for potential CRLF spawning or summer habitat were conducted concurrently with daytime ground surveys for foothill yellow-legged frogs (*Rana boylei*) at 11 locations (Table 1).

Ground site assessments for CRLF were conducted in representative Project Area reaches by Ruth Sundermeyer (all surveys), Sarah Yarnell (July 7 and 8), Alicia Pool (July 7 and 8), and ENTRIX, Inc. biologists Rick Kuyper (July 9 to 12) and Sean Barry (September 5 to 6). Ground site assessments were conducted in the downstream and upstream portions of South Cow and Old Cow creek bypass reaches to include a range of elevations. About 130 meters of Hooten Gulch upstream of the Wild Oak Powerhouse (private hydroelectric facility) and 0.25 mile of Hooten Gulch upstream of the Cow Creek Powerhouse were examined during the CRLF Site

Assessment. The Cow Creek Forebay was assessed for CRLF habitat during other relicensing-related studies.

During ground site assessments, factors that may affect the suitability of habitat for CRLFs were recorded in field notebooks. Relevant data included habitat description, water temperature, the presence of pools and backwater areas, vegetation, cover, the presence of other aquatic species such as fish, aquatic garter snakes and bullfrogs, and the availability of insects that may provide forage for frogs or algae that may contribute to primary productivity and provide food for tadpoles.

Potential spawning (aquatic) habitat was categorized as having high, moderate, low or no value for spawning, or as dispersal habitat only. High value habitat is seasonal or permanent deep pools (0.7 to 1.25 meters) with mud or silt substrata, 18-22°C water continuously during the summer, abundant bordering and floating vegetation, a very substantial and diverse invertebrate and micromammal forage base, and no exotic warmwater predatory fish (bass and green sunfish). Moderate value habitat is physically similar but lacks a substantial forage base and may also support limited warmwater fish populations. Bordering cover at low value habitat is usually very limited and the habitat may support large warmwater predatory fish populations; substrata may be aggregate, bedrock, or manmade (such as concrete). Habitat probably lacks value for spawning if cover is absent, it is permanently shaded, summer water temperatures average lower than 18°C, or exotic warmwater predatory fish are abundant. High quality seasonal red-legged frog habitat usually does not support exotic bullfrogs, but these large frogs may coexist with red-legged frogs at permanent pools (Barry and Fellers, in prep.). CRLFs are

also usually absent from habitat that supports large bullfrog populations, probably because such habitat is better suited to bullfrogs than to CRLFs (Barry and Fellers, in prep.). Waterways without suitable breeding habitat may have value as dispersal habitat, particularly if it is physically close to breeding habitat. However, preliminary radio-tracking data obtained by Gary Fellers (USGS, pers. comm.) indicate that CRLFs in coastal areas may disperse across any terrestrial or aquatic habitat that does not harm them (such as salt water), and that few structures or habitats represent true dispersal barriers.

The start and end points of the creek and canal reach ground site assessments were documented with photographs and GPS coordinates (where signal strength was sufficient). Additional photographs were taken of representative habitats at selected points along the reaches, to indicate the predominant type of habitat available along each assessed reach. Photographs were also taken of sites that contained habitat characteristics favorable for CRLFs along the reaches (Appendix B).

### **3.0 RESULTS**

#### **3.1 HISTORICAL RECORDS**

Verifiable historical records from Shasta and Tehama Counties include a specimen in the UC Berkeley Museum of Vertebrate Zoology (catalogue #9981) from Elliott's, five miles west of Paynes Creek Post Office, Tehama County, (about 20 miles southeast of the Project Area) collected June 5, 1925 (UC Berkeley, 2003), and a specimen in the California Academy of Sciences collection (catalogue #30662) from "Redding," Shasta County (about 18 miles west of the Project Area), collected October 4, 1911 (CAS, 2003). Habitat and precise siting information

is not available for either record. Additionally, the University of Michigan Museum of Zoology has a specimen from a few miles south of Redding along Clear Creek, Shasta County, collected in 1926 (catalogue #71495), also about 18 miles from the Project Area. These well-validated records place the Project Area at the extreme northeastern edge of the distribution of the CRLF. The nearest CNDDDB record (CDFG 2002) is an unverified 1986 sighting from the Cottonwood Creek drainage 24 miles west of Red Bluff, Tehama County, in the coastal mountains about 50 miles southwest of the Project Area. The CNDDDB search yielded no records of CRLFs in Shasta County and no other records for Tehama County. The Licensee has no records of CRLF surveys conducted within their Project boundaries. ENTRIX biologist Sean Barry's extensive review of Sierra Nevada CRLF occurrences has also failed to locate any otherwise undocumented verifiable or anecdotal Tehama or Shasta County records (Barry and Fellers, in prep.).

### **3.2 SITE ASSESSMENT**

Topographic maps indicate that numerous ponds and springs exist within the Site Assessment Area, in addition to the Project creek stream reaches, canals, diversions, and forebays (Figures 2 and 3). Photographs taken during the helicopter survey (Appendix B) document these ponds as well as green areas that suggest the presence of springs. GPS locations associated with helicopter photographs and ground Site Assessments are presented in Figures 2 and 3.

The helicopter survey identified 55 sites with seemingly adequate water and sunlight to support CRLF populations within the Site Assessment Area (Table 1, Figures 2 and 3; Appendix B). Eleven sites were selected for ground Site Assessment either because they appeared to be representative samples of their reaches or because they appeared to offer elements of CRLF

habitat besides water and sunlight (Table 2). The springs and ponds mentioned above appeared to be within private land boundaries and so these were not assessed further. Locations, habitat type, dates assessed, and “habitat value” for the sites assessed for this report are summarized in Table 1, and aerial and ground habitat photographs are included in Appendix B. Table 2 summarizes the dates and locations of the ground Site Assessments

### **3.2.1 Potential Spawning Habitat**

#### **Old Cow and South Cow Creeks Bypass Reaches, tributaries, and canals (Project Area, excluding forebays): Sites 1-25, 28 (Old Cow), 50-68, 73-74 (South Cow including Hooten Gulch)**

The predominant aquatic habitat type along South Cow and Old Cow bypass reaches is typical medium gradient Sierra Nevada rocky stream with aggregate (sand, gravel, pebble, cobble, or bedrock) substrata, fast to very fast cold (<18°C) water, limited or absent bordering vegetation, moderately dense to completely obstructive canopy, and very limited invertebrate fauna (Storer and Usinger, 1963) (Table 1). Centrarchid fishes are absent, as are large bullfrog populations (although bullfrogs occur sporadically in seemingly small numbers along both bypass reaches). Such medium to high gradient cold and fast water habitat has never been known to offer spawning sites for CRLFs anywhere in California, and CRLFs have never been reported individually from any such Sierra Nevada aquatic habitat (Mark Jennings, pers. comm.; Barry and Fellers, in prep.). Nowhere along South Cow and Old Cow bypass reaches and their associated tributaries and canals did the Site Assessments reveal anything but some combination of the above characters and the consequent apparent absence of suitable CRLF spawning habitat as defined by USFWS (1997, 2002). Pools and backwaters along the bypass reaches tended to be unvegetated (or to have only bordering vegetation with no submersed or emergent growth)

and to have aggregate substrata, without undercut banks and with few other suitable daytime retreats for CRLFs. Canal banks were generally unvegetated and the water velocity was clearly far too great for CRLF spawning habitat. Thus, the Project Area bypass reaches of South Cow and Old Cow Creeks and their associated tributaries and canals are believed to have no value as CRLF spawning habitat. It is unlikely that the fast water habitat in the Site Assessment Area or elsewhere in the Sierra Nevada has ever figured in Sierra Nevada CRLF natural history except perhaps as dispersal corridors (Mark Jennings, pers. comm.; Barry and Fellers, in prep.). Any of the waterways discussed in this section could represent CRLF dispersal habitat, but as noted earlier these frogs may utilize a wide variety of habitats for that purpose.

#### **Project Area Diversions and Forebays: Sites 12B, 61A, 75, 76**

Emergent and submersed vegetation characteristic of CRLF spawning habitat is absent from the diversions at the upper ends of Old Cow and South Cow bypass reaches. Emergent vegetation exists along the southeastern part of Kilarc Forebay (Old Cow Creek basin) and along part of Cow Creek forebay (South Cow Creek basin) but the water depth drops off rapidly around the banks of both reservoirs. The presence of large trout in Kilarc Forebay indicates also that the water is too cold for CRLF spawning habitat. Additionally, bullfrogs and green sunfish (potential predators of CRLF) are present in the Cow Creek Forebay. The diversions and forebays collectively offer no CRLF spawning habitat.

#### **Non-Project Area Aquatic Habitat: Sites 26, 26a, 27, 70-72**

Several ponds on private land within the Site Assessment Area photographed during the helicopter survey and seen from access roads during the ground Site Assessments appear to



include elements of CRLF habitat discussed earlier. The borrow pits and stock ponds at the east end of the Old Cow Creek basin Site Assessment Area seemingly offer the best potential spawning habitat. However, the absence of floating vegetation from all of the sites photographed for the Site Assessment indicates that none of these sites resembles currently documented Sierra Nevada CRLF spawning habitat (Barry and Fellers, in prep.). These ponds seem to offer CRLF spawning habitat that ranges from no value to moderate value. Closer inspection may reveal that some of these sites offer moderate to high value spawning habitat.

### **3.2.2      *Potential Summer Habitat***

#### **Hooten Gulch: Site 64**

Hooten Gulch within 100 meters of its junction with South Cow Creek offers potential summer habitat for adult CRLFs. Though Hooten Gulch within this bracket has an aggregate substratum there are also muddy substrata, very slow warm water, and moderately undercut banks. The forest canopy was estimated to be about 70-75%. The site assessment crew observed a large western pond turtle (*Clemmys marmorata*) at Hooten Gulch on September 5, 2003. These turtles frequently occur in CRLF habitat, though their presence does not necessarily indicate the presence of CRLFs. Several foothill yellow-legged frogs were observed within 100 meters of the confluence with South Cow Creek, and the stream channel was the only site found within the Site Assessment Area that CRLFs might use as summer habitat. However, as stated previously, “potential summer habitat” may become “actual summer habitat” only if occupied spawning habitat exists within one mile.

## **4.0 CONCLUSIONS**

### **4.1 CALIFORNIA RED-LEGGED FROG HABITAT**

No habitat deemed likely to support CRLF spawning activity was found within the Project Area, but several ponds on private land within the Site Assessment Area may be suitable. Potential “summer habitat” exists along Hooten Gulch within 100 meters of its confluence with South Cow Creek, but only if confirmed spawning habitat exists within one mile of Hooten Gulch. Any future protocol surveys for CRLFs should be concentrated in these areas.

### **4.2 POTENTIAL PROJECT-RELATED EFFECTS**

Potential Project-related impacts to individual CRLFs include changes in flow regimes in “summer” or dispersal habitat. The diversion canals, bypass reaches, and forebays do not contain suitable spawning habitat and thus maintenance activities as they currently exist would not affect CRLF populations.

The best potential summer habitat for CRLFs in Project-affected reaches is in Hooten Gulch. The Cow Creek tailrace augments summer flow into Hooten Gulch, which probably sustains pool habitat that would otherwise be more shallow or dry. Thus, Project operations as they currently exist may have increased the potential summer habitat for CRLFs in Hooten Gulch.

## **5.0 REFERENCES**

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## **TABLES**

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup>.**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
<b>Sites 1-8=1/2 mile reaches of Old Cow Creek, sequentially from downstream to upstream limits of Project Area (Bypass Reach)</b>									
1	OC	Downstream 1/3 of Old Cow Creek bypass reach	Y	Perennial fast rocky stream	Low to moderate gradient cold (12-17° C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	Bullfrogs, trout	in limestone substrate only, ~1% of reach	N/N/D
2	OC	Downstream 1/3 of Old Cow Creek bypass reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	N/A	scarce/none	N/N/D
3	OC	Downstream of Old Cow and Canyon Creek confluence	Y	Perennial fast rocky stream	Low to moderate gradient cold (12-17° C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	Trout, sculpin, aquatic garter snake, rough-skinned newt	scarce/none	N/N/D
4	OC	Upstream of Old Cow and Canyon Creek confluence	Y	Perennial fast rocky stream	Low to moderate gradient cold (12-17° C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	Trout, sculpin, aquatic garter snake, rough-skinned newt	scarce/none	N/N/D
5	OC	Middle 1/3 of Old Cow Creek bypass reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	N/A	scarce/none	N/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
6	OC	Middle 1/3 of Old Cow Creek bypass reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	N/A	scarce/none	N/N/D
7	OC	Upstream 1/3 of Old Cow Creek bypass reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Coniferous forest	N/A	scarce/none	N/N/D
8	OC	Upstream 1/3 of Old Cow Creek bypass reach	Y	Perennial fast rocky stream	Low to moderate gradient cold (8.5-13°C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Coniferous forest	Aquatic garter snakes	scarce/none	N/N/D
9	OC	Downstream 1/3 of North Canyon Creek, tributary to Old Cow Creek Bypass reach	N	Perennial or seasonal fast rocky stream	Low to moderate gradient stream, 100% forest canopy	Coniferous forest	N/A	N/A	N/N/D
10	OC	Middle 1/3 of North Canyon Creek, tributary to Old Cow Creek Bypass reach	N	Seasonal fast rocky stream	Low to moderate gradient stream, 100% forest canopy	Coniferous forest	N/A	N/A	N/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
12	OC	Downstream end of Kilarc Main Canal (near Forebay trashrack)	Y	Manmade canal	Low gradient cold water (8-12 <sup>o</sup> C) canal, no vegetation	Open coniferous forest	Trout, aquatic garter snakes	scarce/none	N/N/N
12B	OC	Kilarc Forebay	Y	Manmade lake	Coldwater forebay upstream of Kilarc Powerhouse, little bordering or emergent vegetation, nearly vertical banks	Open coniferous forest	Trout	scarce/none	N/N/N
<b>Sites 13-18=1/2 mile reaches of Kilarc Main Canal, sequentially from downstream to upstream limits of Project Area</b>									
13	OC	Kilarc Main Canal, downstream 1/3	N	Manmade canal	Low gradient cold water (8-12 <sup>o</sup> C, based on downstream temperatures) canal, scattered brush along banks	Open coniferous forest	N/A	N/A	N/N/N
14	OC	Kilarc Main Canal, middle 1/3	N	Manmade canal	Low gradient cold water (8-12 <sup>o</sup> C, based on downstream temperatures) canal, partially in concrete channel, scattered brush along banks	Open coniferous forest	N/A	N/A	N/N/N
15	OC	Kilarc Main Canal, middle 1/3	N	Manmade canal	Low gradient cold water (8-12 <sup>o</sup> C, based on downstream temperatures) canal, partially in concrete channel, partially completed enclosed and elevated, scattered brush along banks	Open coniferous forest	N/A	N/A	N/N/N
16	OC	Kilarc Main Canal, middle 1/3	N	Manmade canal	Low gradient cold water (8-12 <sup>o</sup> C, based on downstream temperatures) canal, partially in concrete channel, partially completed enclosed and elevated, scattered brush along banks	Open coniferous forest	N/A	N/A	N/N/N



**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
17	OC	Kilarc Main Canal, upstream 1/3	N	Manmade canal	Canal, partially in concrete channel, partially to completely enclosed and elevated, scattered brush along banks where not enclosed	Open coniferous forest	N/A	N/A	N/N/N
18	OC	Kilarc Main Canal, upstream 1/3	N	Manmade canal	Low gradient cold water (8-12° C, based on downstream temperatures) canal, scattered brush along banks	Open coniferous forest	N/A	N/A	N/N/N
19	OC	Kilarc Main Canal	N	Manmade canal	Canal, enclosed and elevated	Open coniferous forest	N/A	N/A	N/N/N
20	OC	Old Cow Creek downstream of Kilarc Powerhouse, not in Project Area	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	N/A	N/A	N/N/D
21	OC	Old Cow Creek downstream of Kilarc Powerhouse, not in Project Area	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	N/A	N/A	N/N/D
22	OC	North Canyon Creek, upstream of diversion	N	Perennial or seasonal rocky stream	High gradient stream, ~95% forest canopy	Coniferous forest	N/A	N/A	N/N/D
23	OC	North Canyon Creek, upstream of diversion	N	Perennial or seasonal rocky stream	High gradient stream, ~95% forest canopy	Coniferous forest	N/A	N/A	N/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N/?)	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
24	OC	Old Cow Creek, within 100m of Kilarc Main Canal diversion, downstream	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Coniferous forest	None	none	N/N/D
25	OC	Old Cow Creek, upstream of Kilarc Main Canal diversion	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Coniferous forest	N/A	N/A	N/N/D
26	OC	Borrow pit ponds 0.6 mi north of Kilarc Powerhouse, not in Project Area	N	Agriculture, stock, or recreation ponds	Probable warmwater ponds with limited bordering and emergent vegetation, no floating vegetation, mud or silt substrata	Modified meadow, very open coniferous forest; private rangeland/rural residence	N/A	N/A	L-N/N/D
26a	OC	Borrow pit pond 0.3 mi northeast of Kilarc Powerhouse, not in Project Area	N	Agriculture, stock, or recreation ponds	Probable warmwater ponds with limited bordering and emergent vegetation, no floating vegetation, mud or silt substrata	Modified meadow, very open coniferous forest, mixed hardwoods and brushland; private rangeland/rural residence	N/A	N/A	M-L/N/D
27	OC	Private ponds ~0.66 mi southeast of Kilarc Powerhouse, not in Project Area	N	Agriculture, stock, or recreation ponds	Probable warmwater ponds with extensive bordering and emergent vegetation, no floating vegetation, mud or silt substrata, unknown but probably substantial water depth	Modified meadow, very open coniferous forest, mixed hardwoods and brushland; private rangeland/agriculture/rural residence	N/A	N/A	M/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
28	OC	Unnamed tributary ~0.1 mi upstream of Kilarc Powerhouse, not in Project Area	N	Perennial or seasonal rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and coniferous forest, scattered brush and meadows	N/A	N/A	N/N/D
<b>Sites 50-57=1/2 mile reaches of South Cow Creek, sequentially from downstream to upstream limits of Project Area (Bypass Reach)</b>									
50	SC	Downstream 1/3 of South Cow Creek, Bypass Reach	Y	Perennial fast rocky stream	Low to moderate gradient cold (12-17° C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	Foothill yellow-legged frog, bullfrog, trout	scarce/none	L-N/N/D
51	SC	Downstream 1/3 of South Cow Creek, Bypass Reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	N/A	N/A	N/N/D
52	SC	Upper Downstream and Lower Middle 1/3 of South Cow Creek, Bypass Reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	N/A	N/A	N/N/D
53	SC	Middle 1/3 of South Cow Creek, Bypass Reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	N/A	N/A	N/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
54	SC	Middle 1/3 of South Cow Creek, Bypass Reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	N/A	N/A	N/N/D
55	SC	Upstream 1/3 of South Cow Creek, Bypass Reach	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	N/A	N/A	N/N/D
56	SC	Upstream 1/3 of South Cow Creek, Bypass Reach	Y	Perennial fast rocky stream	Low to moderate gradient cold (12-17° C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	Aquatic garter snake, trout	None	N/N/D
57	SC	Upstream 1/3 of South Cow Creek, Bypass Reach	Y	Perennial fast rocky stream	Low to moderate gradient cold (12-17° C) stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush and meadows	Foothill yellow-legged frog, trout	None	N/N/D
<b>Sites 58-61=1/2 mile reaches of South Cow Main Canal, sequentially from Cow Creek Forebay upstream to South Cow Creek Diversion</b>									
58	SC	Downstream 1/2 of South Cow Creek Main Canal	N	Manmade canal	Excavated U-shaped cold, fast water canal, unvegetated banks, aggregate substrate, 80-100% forest canopy	Mixed hardwood and riparian forest, scattered brush	N/A	N/A	N/N/N

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
59	SC	Downstream 1/2 of South Cow Creek Main Canal	N	Manmade canal	Excavated U-shaped cold, fast water canal, unvegetated banks, aggregate substrate, 80-100% forest canopy	Mixed hardwood and riparian forest, scattered brush	N/A	N/A	N/N/N
60	SC	Upstream 1/2 of South Cow Creek Main Canal	N	Manmade canal	Excavated U-shaped cold, fast water canal, unvegetated banks, aggregate substrate, 80-100% forest canopy	Mixed hardwood and riparian forest, scattered brush	N/A	N/A	N/N/N
61	SC	Upstream 1/2 of South Cow Creek Main Canal	N	Manmade canal	Excavated U-shaped cold, fast water canal, unvegetated banks, aggregate substrate, 80-100% forest canopy	Mixed hardwood and riparian forest, scattered brush	None	None	N/N/N
61a	SC	Cow Creek Forebay, at downstream end of South Cow Creek Main Canal	N	Manmade lake	Earthen impoundment with steep unvegetated banks and a narrow band of bordering vegetation	Grassland, scattered to dense brush	Bullfrogs and green sunfish found during fisheries surveys	N/A	L-N/N/D
62	SC	South Cow Creek at downstream limit of Site Assessment Area, not in Project Area	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush	N/A	N/A	N/N/D
63	SC	South Cow Creek at downstream limit of Site Assessment Area, not in Project Area	N	Perennial fast rocky stream	Low to moderate gradient stream with riffles interspersed with shallow pools, no emergent vegetation, no overhanging cover, no undercut banks, aggregate substrate	Mixed hardwood and riparian forest, scattered brush	N/A	N/A	N/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
<b>Sites 64-66=1/2 mile reaches of Hooten Gulch, tributary to South Cow Creek, sequentially from confluence upstream, in Site Assessment Area but not in Project Area</b>									
64	SC	Downstream 1/3 of Hooten Gulch	Y	Perennial slow stream	Low to level gradient stream with silt and aggregate bottom, light to moderately dense canopy, patchy bordering and emergent vegetation	Hardwood and riparian forest	Foothill yellow-legged frog, western pond turtle	Abundant	L-N/M/D
65	SC	Middle 1/3 of Hooten Gulch (Private)	N	Perennial slow stream	Low to level gradient stream with silt and aggregate bottom, light to moderately dense canopy, patchy bordering and emergent vegetation	Hardwood and riparian forest	N/A	N/A	unk
66	SC	Upstream 1/3 of Hooten Gulch (Private)	N	Perennial slow stream	Low to level gradient stream with silt and aggregate bottom, light to moderately dense canopy, patchy bordering and emergent vegetation	Hardwood and riparian forest	N/A	N/A	unk
67	SC	South Cow Creek first 1/2 mile upstream of Diversion, not in Project Area	N	Perennial fast rocky stream	Low to level gradient stream with silt and aggregate bottom, light to moderately dense canopy, patchy bordering and emergent vegetation	Riparian forest and meadow/rangeland	N/A	N/A	unk
68	SC	South Cow Creek ranch 0-1/2 mile upstream of Diversion, not in Project Area	N	Perennial fast rocky stream, ag pond	Low to level gradient stream with silt and aggregate bottom, light to moderately dense canopy, patchy bordering and emergent vegetation, pond with dense bordering vegetation, unknown depth and substratum	Riparian forest and meadow/rangeland	N/A	N/A	unk

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
69	SC	Mill Creek near Project impoundment, ~0.2 mi upstream of South Cow Creek confluence	Y	pool with concrete impoundment	Small pool with overhanging vegetation, unknown depth and substratum	Riparian forest	None	None	L-N/L-N/D
70	SC	Pond in Mill Creek	N	Ag/live-stock pond with earthen dam	Small pond with scant bordering or emergent vegetation, no floating vegetation, earthen banks	Meadow, sparse coniferous forest; private rangeland/rural residence	N/A	N/A	L-N/L-N/D
71	SC	Pond ~1.2 mi north of Cow Creek Powerhouse, not in Project Area	N	Ag/live-stock pond with earthen dam	Small pond with scant bordering or emergent vegetation, no floating vegetation, earthen banks	Meadow, scattered brush; private rangeland/rural residence	N/A	N/A	M-L/N/D
72	SC	Pond ~1.5 mi northeast of Cow Creek Powerhouse, not in Project Area	N	Ag/live-stock pond with earthen dam	Small pond with scant bordering or emergent vegetation, no floating vegetation, earthen banks	Meadow, scattered brush; private rangeland/rural residence	N/A	N/A	M-L/N/D
73	SC	Unnamed tributary to Hooten Gulch, south of Hooten Gulch channel	N	Seasonal rocky stream	Narrow stream channel with isolated pools, nearly dry by July 8, 2003	Rangeland, oak woodland	N/A	N/A	N/N/D

**Table 1. Site Assessments for California Red-legged Frogs in the Kilarc-Cow Creek Project Area<sup>1</sup> (Continued).**

Site	Watershed <sup>2</sup>	Identification	Ground Site Assessment (Y/N)?	Habitat Type	General Description and Key Habitat Features	Surrounding Plant Community. Land Use for Project unless Stated Otherwise	Aquatic Vertebrates Observed	Aquatic Invertebrates Observed?	Potential Habitat Value: Sp/Su/D <sup>3</sup>
74	SC	Unnamed tributary to Hooten Gulch, north of Hooten Gulch channel	N	Spring	Spring and associated shallow pools, nearly dry by July 8, 2003	Rangeland, mixed coniferous and deciduous forest	N/A	N/A	M-L/N/D
<b>Sites 75-76: Project Diversions</b>									
75	OC	Kilarc Diversion	N	Diversion	Concrete diversion dam with small associated pool, unvegetated banks, rocky substrata	Grassland, scattered scrub, hardwood forest	N/A	N/A	N/N/N
76	SC	South Cow Creek Diversion	N	Diversion	Concrete diversion dam with associated pools, wooded and brushy banks, rocky substrata	Grassland, scattered to dense scrub	N/A	N/A	N/N/D

<sup>1</sup> All sites are within the Site Assessment Area, and they are also within the Project Area unless otherwise noted. See Figures 2 and 3 for site locations and Table 2 for ground survey dates.

<sup>2</sup> OC: Old Cow Creek Watershed; SC: South Cow Creek Watershed.

<sup>3</sup> Sp/Su/D: Spawning/Summer/Dispersal habitat: N: No value; L: Low value; M: Moderate value; H: High value; D: Presumed dispersal value.



**Table 2. Ground Surveys Conducted in Project-Affected Reaches.**

<b>Date</b>	<b>Stream</b>	<b>Location</b>	<b>Site Number</b>	<b>Maximum Length<sup>1</sup> (m)</b>
7/8, 7/12, 9/3	South Cow	Downstream end of bypass	50	526.4
7/9, 9/2	South Cow	Downstream of diversion	56, 57	1,455.0
9/5	Hooten Gulch	Upstream of Wild Oak PH	64	130.0
7/9	Mill Creek	Downstream of diversion	69	112.0
7/7, 9/6	Old Cow	Upstream of Kilarc PH	1	1,066.3
7/10, 9/5	Old Cow	Lower middle reach	3,4	1,218.0
7/11, 9/4	Old Cow	Downstream of diversion	8	1,130.7
7/11, 9/4	Kilarc Forebay	Perimeter of forebay and up canal to road and trashrack	12,12B	

<sup>1</sup>The maximum length surveyed in one day.

**APPENDIX A**

**STUDY PLAN 18 – CALIFORNIA RED-LEGGED FROG SURVEYS**

**Study 18**  
**California Red-Legged Frog Surveys**  
**Kilarc-Cow Creek Project**

**FERC 606**

**Study Plan Title:** California Red-legged Frog Surveys

**Objective of Study:** To determine the location of habitat and the presence or absence of California red-legged frog and develop mitigation, as necessary.

**Study Methods:** A site assessment and focused surveys for California red-legged frog (CRLF) will be conducted in accordance with USFWS approved protocol/guidelines. Under the current guidelines (i.e., USFWS Guidance on Site Assessment and Field Surveys for California Red-legged Frogs, February 1997), this would include the following: (1) determine the location of CRLF within 5 miles of the project site, (2) describe habitats on the project site and within 1 mile of the site, (3) prepare a site assessment report, and (4) complete focused surveys if determined necessary by USFWS. Each of these components is described below. During CRLF field surveys, all special-status amphibians and reptiles observed (including foothill yellow-legged frog and northwestern pond turtle) will be identified and mapped.

The locations of CRLF within the Project Area and within 8 km (5 miles) of the Project Area would be determined through consulting the California Natural Diversity Database, biological consultants, local residents, species experts, herpetologists, resource managers, and agency biologists. In addition, all habitats present within 1 mile of the Project Area would be identified. This would include review of recent aerial photographs and of National Wetlands Inventory (NWI) maps, followed by ground-truthing. In addition, PG&E will provide a helicopter for one

aerial overflight of the Project Area to assess potential CRLF habitat. Photographs of potential breeding habitat and reconnaissance habitat data sheets will be completed. Upon completion of an appropriate literature review, aerial photograph review, and helicopter overflight of the Project Area, site assessment findings will be summarized and discussed with PG&E biologists to develop a strategy for selecting survey sites if necessary.

Following completion of the above tasks, a preliminary report would be prepared in accordance with the USFWS Guidelines that include the following: photographs of the Project Area, survey dates and times, names of surveyors, a description of methods, a map of the project site and vicinity indicating habitats present (e.g., aquatic and upland habitat). Following transmittal of this report to the USFWS, ENTRIX and PG&E will meet with the USFWS to discuss the need for additional surveys. If it is determined that focussed surveys are required, ENTRIX will complete these surveys in accordance with the USFWS protocol/guidelines.

**Products of Study:** A site assessment report and a report discussing the results of protocol visual encounter surveys (if required) will be prepared and provided in the Exhibit E of the FERC license application.

**Study Schedule:** Surveys will be conducted in June and August of 2003.

**APPENDIX B**

**SITE PHOTOGRAPHS**