COVER SHEET

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE UPPER AMERICAN RIVER AND CHILI BAR
HYDROELECTRIC PROJECTS
Docket Nos. P-2101-084 and P-2155-024

Section 3
Environmental Effects
Pages 3-1 through 3-350

DEIS

3.0 ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting in the project vicinity and any environmental resources that could be cumulatively affected by relicensing the UARP and Chili Bar Project. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions—and then the environmental effects of the proposed project, including proposed articles included in appendix A of the Settlement Agreement. Unless otherwise stated, the source of our information is the license applications for the Projects (SMUD, 2005; PG&E, 2005).

3.1 GENERAL DESCRIPTION OF THE RIVER BASINS

3.1.1 Rubicon River

The Rubicon River originates near Clyde Lake in the Desolation Wilderness. Upstream of UARP's Rubicon reservoir, the major tributary on the Rubicon River is Phipps Creek. From its headwaters, the Rubicon River flows generally north to Rubicon reservoir, then northwest to the mouth of the Little Rubicon River, and to Placer County Water Agency's 209,000 acre-foot Hell Hole reservoir. The Rubicon River flows westerly from the Hell Hole reservoir until it joins the Middle Fork American River, then to the North Fork American River near Auburn, California. This confluence forms the main stem of the American River. Besides the main stem of Rubicon River on which Rubicon dam is located, UARP facilities are located on three tributaries to the Rubicon River: Little Rubicon River (Buck Island dam), Gerle Creek (Loon Lake and Gerle Creek dams), and the SFRR (Robbs Peak dam).

The Little Rubicon River headwaters originate near Highland Lake in the Desolation Wilderness. Highland Creek is the major tributary to the Little Rubicon and generally flows north to Rockbound Lake and then to Buck Island reservoir. Upstream of Buck Island reservoir lay the natural Rockbound and Highland lakes. From Buck Island reservoir, the Little Rubicon flows generally northwesterly to its mouth at the Rubicon River.

3.1.2 Silver Creek

The Silver Creek headwaters originate in the Desolation Wilderness at the confluence of Tells, Big Silver, and Jones Fork Silver creeks at Union Valley reservoir. From the reservoir, Silver Creek flows generally southwesterly to its terminus at the SFAR. Major tributaries of the Silver Creek downstream of Union Valley reservoir include SFSC, Little Silver, Onion, Jaybird Canyon, and Round Tent Canyon creeks. Three UARP facilities occur along the main stem of Silver Creek: Union Valley, Junction, and Camino dams. One UARP facility, Ice House dam, is located on the SFSC, a tributary to Silver Creek. The SFSC headwaters also originate in the Desolation

Wilderness and flow generally westerly and northerly to Silver Creek Junction reservoir. Major tributaries of the SFSC include Lyons and Peavine creeks and Big Hill Canyon. No reservoirs occur on the SFSC upstream of Ice House dam.

3.1.3 South Fork of the American River

SFAR headwaters originate in the Crystal Range and flow generally westerly to its terminus at the American River at Folsom Lake. Major tributaries of the SFAR above Slab Creek dam include Pyramid, Strawberry, Alder, Silver, Brush, and Slab creeks and the Silver Fork American River. Downstream of Slab Creek dam, Rock and Iowa Canyon creeks are the primary tributaries. UARP facilities are located on the Brush Creek and in the Silver Creek watershed. The headwaters of Brush Creek originate near Little Sugar Pine Mountain and then flow generally southwesterly to the SFAR at Slab Creek reservoir. No reservoirs occur on Brush Creek upstream of Brush Creek reservoir.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environment Quality's regulations for implementing NEPA (§1508.7) a cumulative effect is the effect on the environment that results from the incremental effect of the actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time to include hydropower and other land and water development activities. Resources that could be affected cumulatively by the continued operation of the UARP and Chili Bar Project, and the construction of the Iowa Hill development, in combination with other activities in the SFAR Basin include sediment supply; water quality; water temperature; aquatic resources including fisheries, benthic macroinvertebrates, and amphibian populations; botanical resources; and recreation.

3.2.1 Geographic Scope

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the projects action’s effect on resources. The geographic scope is defined by the physical limits or boundaries of (1) the UARP's and Chili Bar Project's effects on the resources, and (2) the contributing effect from other hydropower and non-hydropower activities. In this case, the overall scope of analysis for the potentially cumulatively affected resources encompasses the SFRR from the upstream influence of the Rubicon reservoir downstream to the confluence with the SFAR and then downstream to Folsom Lake. Additionally, the geographic scope of the recreation analysis for the UARP also encompasses the Eldorado National Forest.

UARP operations, in conjunction with Chili Bar Project operations, interact in a cumulative sense. The operation of the UARP 7.5 miles upstream controls the waters that flow into the Chili Bar Project. Therefore, the waters in the 19.1 mile reach downstream of the Chili Bar dam are controlled mainly by the UARP but also by the Chili Bar Project operations

3.2.2 Temporal Scope

The temporal scope of the cumulative effects analysis in the EIS includes past, present, and future actions and their possible cumulative effects on each resource. Based on the license term, the temporal scope looks 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion is, by necessity, limited to available information for each resource.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

Geological resources in the vicinity of the Projects that could be affected by Proposed Actions include the reservoir shorelines, channel attributes of the 12 reaches of river (totaling 81 river miles, excluding reservoirs), the extent and quality of large woody debris within those channels, and selected upland watershed areas, mostly related to recreation and roads.

Geology

The rocks of the UARP area are part of the Sierra Nevada metamorphic belt, a 200-mile-long, northwest-trending belt that makes up the western foothills of the Sierra Nevada Mountains. The geology within and surrounding the UARP can be divided into two general categories in relation to the location of Union Valley reservoir, which is about mid-elevation within the project area. Reservoirs upstream of Union Valley reservoir are underlain primarily by the Sierra Nevada batholith,[25] which is of Mesozoic age – about 80 to 130 million years old. Downstream of Union Valley reservoir, reservoirs are chiefly underlain by older sedimentary rocks deposited 350 to 400 million years ago. The dominant rocks in this category are quartzite, schists, crystalline limestone, and dolomite. These rocks underlie most of the lower watershed area and are capped by volcanic rocks formed about 2 to 24 million years ago. Except for the main stem SFAR, which cuts a gorge across the rock formations, all high-order streams in the project area have developed deep canyons only in the sedimentary rock reaches.

The geology in the area of the proposed Iowa Hill development includes the northwest flank of Iowa Hill (situated above the east shore of Slab Creek reservoir) and

[25] A batholith is an exposed area of mostly continuous plutonic (granite) rock that covers an area larger than 100 square kilometers. The Sierra Nevada batholith is a continuous granitic formation that forms much of the Sierra Nevada in California.

the surrounding area. The Iowa Hill area is underlain by bedrock shown on state geologic maps as consisting of undifferentiated Paleozoic rocks. More specifically, the proposed site of the Iowa Hill development is located within the eastern metamorphic terrane of the Sierra Nevada Mountains. This terrane, known as the Shoo Fly Complex, is bound on the east by rock of the Sierra Nevada batholith, and on the west by the Melones fault (northern branch) and the Calaveras-Shoo Fly thrust fault. Rocks in this terrane originally consisted of sand and clay probably deposited on the slopes of the continental margin during early Paleozoic time.

Regional Faulting and Seismicity

The proposed Iowa Hill development lies in central California, an area that has historically experienced relatively low seismic activity. Most seismic activity in the region is concentrated in the region from the northwest to the east and southeast of Lake Tahoe, as well as the area immediately south of Lake Oroville. According to the California Geological Survey, no active or potentially active faults pass through or near the site of the proposed Iowa Hill development.

Five faults or fault systems within a 62-mile radius of the proposed Iowa Hill site are active. The North Tahoe fault and the Genoa fault are located 38 miles northeast and 47 miles east of the proposed site, respectively. Neither of these has produced an earthquake of magnitude 5.0 or greater in known history, but the Genoa fault is believed to be capable of producing an earthquake with a moment magnitude[26] of 6.9. The remaining three faults or fault systems are described in the following section.

The Truckee fault is about 10 miles long and is located about 50 miles northeast of the Iowa Hill site. A recent earthquake was associated with the fault, in 1966, which registered a magnitude of 6.0. Most of the Foothills fault system, approximately 7 miles southwest of the Iowa Hill site, is inactive; however, there are potentially active portions of this fault system across the Bear Mountain and Melones fault segments that are capable of producing an earthquake with a maximum moment magnitude of 6.5. The Cleveland Hill fault segment, a portion of the Foothills fault system (located about 60 miles northwest of the proposed site), ruptured in 1975, triggering the Oroville earthquake that registered 5.7 on the Richter scale.

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[26]The moment magnitude scale is a successor to the Richter scale and is used by seismologists to compare the energy released by earthquakes. The constants used in the equation to determine moment magnitude are chosen so that estimates of moment magnitude roughly agree with estimates using other scales such as the Richter magnitude scale. One advantage of the moment magnitude scale is that, unlike other magnitude scales, it does not saturate at the upper end—e.g., there is no particular value beyond which all large earthquakes have about the same magnitude. For this reason, moment magnitude is now frequently used to estimate large earthquake magnitudes.

The Dunnigan Hills fault is located about 62 miles west of the proposed site, and is about 12 miles long. Historically, no earthquakes of magnitude 5.0 or greater have occurred on the Dunnigan Hills fault; however, it is believed that this fault is capable of generating a maximum credible earthquake with a moment magnitude of 6.5.

Other faults and fault systems within a 62-mile radius of the proposed site are considered to be potentially active. The Maidu fault and an unnamed east-dipping fault that is located near the community of Rescue are both about 14 miles west of the proposed site. They both show evidence of prehistoric displacements, though not historic displacements. As described above, they are both part of the Bear Mountains Fault Zone within the Foothills fault system. SMUD reported that "an assumed maximum credible earthquake of 6.5 magnitude occurring on the most easterly, possibly active strand of the Bear Mountains fault zone (also referred to as the Rescue fault)…represents the potential earthquake that would give rise to the most severe ground motion at…Slab Creek Dam." According to SMUD, the maximum peak ground acceleration expected at Slab Creek dam resulting from the maximum credible earthquake on this fault is 0.30 g (horizontal ground acceleration).

Unnamed faults near the community of Volcanoville and Jenkinson Lake also show evidence of prehistoric displacements, though not historic displacements. The unnamed normal fault near Volcanoville is located about 12 miles north-northwest of the proposed Iowa Hill development. Two additional unnamed faults, one on the east side and one on the west side of Jenkinson Lake, are located about 7 miles east-southeast of proposed site.

The geology within and downstream of the Chili Bar Project area is similar to that described above for the areas downstream of Union Valley reservoir. The geology of the SFAR from the confluence with Rock Creek (just upstream of Chili Bar reservoir) to Folsom Lake includes granite rocks and sedimentary rocks that have recrystallized over time. As the SFAR flows through the town of Coloma, it also passes through a granite inclusion from the Sierra Nevada batholith before changing back to the Calaveras Complex geology. Serpentine rock masses also occur where the SFAR enters into Folsom Lake.

Reservoir Shorelines

The shorelines of the UARP reservoirs exhibit a wide range of characteristics, owing in part to their differing elevations, geologic settings, and reservoir water elevation changes (annually and daily). Studies examining reservoir shorelines focused on warmwater or reservoir-spawning fish species. Buck Island, Rubicon, and Brush Creek reservoirs are generally composed of erosion-resistant rock and do not support warmwater fish species. Camino reservoir, a reregulating reservoir with daily water level fluctuations of up to 15 feet, was also removed from the study because of safety and access constraints and no shoreline erosion data are available.

Gerle Creek and Robbs Peak reservoirs are smaller reservoirs that are largely ringed by either stable vegetation or bedrock/boulders. Gerle Creek reservoir impounds only 1,260 acre-feet and has an average annual water level fluctuation of 9 feet, with an average daily water level fluctuation of 1.5 feet. Robbs Peak reservoir is much smaller, impounding only 30 acre-feet in an on-channel reservoir with bedrock and boulder banks. The average annual water level fluctuation is 5 feet, while the average daily fluctuation is less than 0.5 foot. Shoreline erosion on these two reservoirs is minimal.

Table 3-1 shows information on the shorelines of the remaining five reservoirs in the UARP. Changes in operations are not proposed or recommended that would affect average water surface level fluctuations and reservoir shoreline erosion, except for development of Iowa Hill which would affect the frequency of water level fluctuations in Slab Creek reservoir but not the weekly range of fluctuations.

Table 3-1. Reservoir shoreline data within the UARP. (Source: SMUD, 2005)

Reservoir	Shoreline Slopes (%)	Shoreline Substrate (%)	Emergent Vegetation (% of shoreline)	Shoreline Erosion (%)	Average Annual Water Level Fluctuation		Notes
					Annual	Daily	
Loon Lake	Flat to moderate (0–5 to 10–30)	Bedrock and boulder (approx. 70)	(65) covered	Mild erosion (2)	43.6 feet	NA	Loon Lake is part of a storage reservoir that experiences gradual changes in water surface elevation
Union Valley	Gradual to steep (5–10 to 30–44)	Sand and silt dominant; some boulder and bedrock	NA	Mild erosion (80); significant erosion (> 14)	60 feet	< 0.5 foot	Mild erosion is largely a slow, progressive shoreline retreat. Slumping also occurs along a peninsula.
Ice House	Moderate to steep (10–29 to 30–44)	Sand and silt dominant; some cobble and boulders	(5) covered	Mild erosion (74); remainder stable	37 feet	NA	NA

Reservoir	Shoreline Slopes (%)	Shoreline Substrate (%)	Emergent Vegetation (% of shoreline)	Shoreline Erosion (%)	Average Annual Water Level Fluctuation		Notes
					Annual	Daily	
Junction Reservoir	Steep (30–45) to over 45	Bedrock and cobble (85)	(6) covered	Mild erosion (1)	NA	20 feet	Junction reservoir is a re-regulating reservoir with frequent daily water level elevation changes.
Slab Creek	Steep (30–45) to over 45	Bedrock (> 70)	(> 50) covered	Mild erosion (18); significant erosion (< 1); remainder stable	30 feet	6 feet	Slab Creek reservoir is in a steep canyon, contributing to its frequent water surface elevation changes

Chili Bar reservoir shoreline has very little erosion. Emergent vegetation is present on 94 percent of the shoreline although more than 80 percent of the shoreline is steeply (30 to 45 percent) sloped. The shoreline is mostly composed of sand-silt substrate. Data on daily fluctuations (based on 2002 hourly data) shows an average of 4.2 feet of fluctuation, and a maximum of 7 feet.

Reservoir Sedimentation

No issues regarding reservoir sedimentation were identified during scoping, so no studies were conducted during relicensing to consider loss of reservoir storage or other sedimentation effects on UARP operations. However, sources of sediment and potential future erosion were identified.

Upland Erosion and Sediment Sources

SMUD investigated erosion caused by the use of the approximately 104 project roads (see section 3.3.7, *Land Use*) including: (1) main access roads that are paved and have structured drainage systems, (2) transmission line maintenance roads, and (3) unpaved surface roads that are near water bodies. The study concluded that main roads, which are paved, and transmission line maintenance roads, which are rarely used and tend to be located farther away from shorelines, contribute insignificant amounts of sediment supply or erosion to the project waters. Unpaved roads contribute some sediment, but the amount is insignificant relative to the capacity of the project water bodies, and these roads have both higher usage and maintenance. Project owners and local agencies maintain the roads and drainage features to prevent sediment runoff from entering streams and reservoirs.

Spoil Piles

SMUD investigated the stability of the three piles in the project that could erode and add sedimentation in the channels and reservoirs: the Jaybird Tunnel Adit spoil pile, the Camino Tunnel Adit spoil pile, and the White Rock Tunnel Adit No. 2 spoil pile. They are upslope of the waterways within the Junction dam reach, the Camino dam reach, and the Slab Creek dam reach, respectively. The material has historically been used for roadway maintenance.

All three piles show no signs of erosion and exist in stable angles of repose. The first two piles are mostly covered with rock and therefore are not susceptible to erosion from normal rainfall. They are also surrounded with diversion ditches to prevent runoff from causing erosion by mobilizing the piled material. Also, the UARP relicensing water quality study (see section 3.3.2, *Water Resources*) did not detect any elevated levels of chemical or foreign substances that might have leached from the piles.

Bathymetry studies indicate that total storage in Chili Bar reservoir has been reduced by 1,011 acre feet, and useable storage (storage between the spillway crest and the preferred operating minimum) has been reduced by 252 acre feet. About 13 percent of the annual or long-term incoming sediment load is trapped in the Chili Bar reservoir, and the remaining 87 percent is passed downstream. Based on observations made at the upstream end of the reservoir and the upstream face of the dam during valve maintenance activities, it appears that the most particles greater than 2 millimeters (mm) settle out, while particles being transported downstream are virtually all fine material (less than 2 mm).

Stream Channel Morphology

In general, the channel beds within the reaches comprise a veneer of cobble, with numerous boulders, and small amounts of gravel and sand overlying bedrock. The channels are typically narrow and located within bedrock-controlled canyons of moderate to steep slopes. Sections of channel with changing silt and sand deposits are the exception and occur in isolated reaches defined by topography.

Generally, very little fine sediment occurs in the stream channel or in the pools, although small pockets of fine sediment are deposited behind large flow obstructions and in low-velocity zones along the channel margins. Sections of stream channels that are relatively resilient and insensitive to changes in flow and/or sediment supply are termed “transport reaches” or “transport segments.” Channel character in these transport sections is primarily controlled by bedrock geology and coarse boulder substrate emplaced largely by processes such as glaciers. In these channels, the available capacity of the stream to transport sediment is greater than the local sediment supply, and most sediment supplied to the channel is transported downstream while coarser material (e.g., cobbles and boulders) remains either as a result of size (boulders) or local hydraulic conditions (gravels upstream of local in-channel or channel margin obstructions). Because the channel morphology is essentially unrelated to the supply of sediment, any net loss in sediment supply from project operations is less likely to have any morphologic significance.

Transport channel types dominate much of the project stream reaches. Eight of the 11 UARP project reaches (Rockbound dam, Buck Island dam, Gerle Creek dam, Junction dam, Camino dam, SFAR dam, Slab Creek dam, and Brush Creek dam) are considered transport sections of stream throughout the entire length of each reach.

Response sections of streams, in contrast to transport sections, contain stream channels that are likely to be affected by changes in hydrology or sediment supply. Response sections of stream are generally defined as having channels with low slope (<4 percent); mostly silt, sand, or clay bed and banks (cobble-gravel or finer); and plane bed or pool-riffle characteristics. Within the UARP, there are seven sections of channel with response characteristics. These seven sections occur in four of the project reaches: three in the Loon Lake dam reach; two in the Ice House dam reach; and one section each in the Rubicon dam reach and Robbs Peak dam reach. These response sections are generally short, between 400 and 1,300 feet long.

Because these seven response sections may be responsive to changes in hydrology and sediment supply, survey sites were established at each section during the relicensing studies to investigate their geomorphic condition. Two response sections exhibited very little effect from the existing hydrology: the Middle Loon Lake dam reach section and the Upper Ice House dam reach section. In these sections, the channel bed, bars, and banks are generally stable; vegetation on the banks is well-established; and fine sediment was not being deposited in areas of slower flow. The other five sections in the Rubicon, Loon Lake, and Ice House dam reaches showed that changes in hydrology could affect the characteristics of their geomorphology.

Rubicon Dam Reach

The 4.2-mile-long Rubicon dam reach on Rubicon River extends from the base of Rubicon dam downstream to the confluence with Miller Creek, and has a low mean gradient. The entire reach is over 6,000 feet in elevation and drains a glaciated watershed, much of which is designated as federal wilderness, and flows through many sections of exposed granite and steep, confined bedrock chutes. No major tributaries enter this reach. On-the-ground stream mapping shows that bedrock and boulder comprise up to 70 percent of the dominant substrate over the length of the project reach, indicating that a majority of the stream channel within the reach is transport dominated. The response channel portions of the reach are mostly in a low gradient, 1.9-mile-long segment near Rubicon Springs, a private land parcel owned by parties involved in off-highway vehicle recreation. This section is in a mature conifer forest and contains deposits of gravel, sand, and silt with a number of beaver dams present. Studies show movement of the substrate depending on the level of flow, but the section is mostly stable bed, bars, and vegetated banks, and the sediment supply is virtually balanced with the flows.

Loon Lake Dam Reach

The 8.5-mile Loon Lake dam reach on Gerle Creek extends downstream from the base of Loon Lake dam to the normal high water line of Gerle reservoir, and has a mean gradient of about 2.3 percent. Tributaries in this reach include Jerrett, Barts, Dellar, and Rocky Basin creeks. From the Loon Lake reservoir outlet, Gerle Creek flows initially to the west through a wide and swampy valley that is surrounded by moderately sloping and glaciated hillsides. This upstream portion meanders for about 5 miles across the alluvial valley before the bedrock slopes constrict the channel near Wentworth Springs. Below the bedrock constriction, the valley widens and the stream channel is free to meander again through the middle portion of the reach (Neck and Gerle meadows). Before reaching Gerle reservoir, the creek flows through a steeper, lower portion (about 3 miles long) along a contact between granitic rocks and glacial till deposits.

Broad-scale geomorphic characterization (Rosgen Level I [Rosgen, 1996]) suggests 20 percent of the Loon Lake dam reach on Gerle Creek is composed of transport-dominated channel types; the other 80 percent is characterized by response channels. Results from field surveys corroborate this, indicating that sediment, cobble, and fine particles represent more than 50 percent of the substrate of the channel throughout the length of the reach.

The upper response section of Gerle Creek is located 0.5 mile downstream of Loon Lake dam, and it meanders through most of all project response sections because it lies in a large, unconfined valley with relatively flat topography. It then travels into a constriction at the lower end of this section, where steep bedrock walls confine the channel near Wentworth Springs. Historically, the meadow was probably formed by sediment deposition as a result of the bedrock constriction, causing water storage upstream. This area is still wet during some seasons, but it is likely that the water table is not as high as it was in the past.

The middle response section of Gerle Creek is 2.7 miles downstream of Loon Lake dam, immediately downstream of the confluence with Jerrett Creek, at the head of densely vegetated Gerle Meadow. This section is steeper than the upper response section, median grain sizes are much higher, and number of bends is significantly lower. Many lateral bars that have bright sediment grains indicate that sediment mobilization likely occurs regularly at moderate flows. Debris jams that were encountered and numerous pieces of large woody debris create areas of scour and deposition in the channel. In this section, analysis indicates that the sediment would likely mobilize at flows between 149 and 326 cfs. These flows correspond to the 1.5- to 4-year recurrence floods under the existing flow regime, which suggests that sediment and bed transport probably occurs with this frequency. Young vegetation on some of the bars and banks provides evidence of this.

The lower response section of Gerle Creek is 7.5 miles downstream of Loon Lake dam and has discrete pool-riffle sequences. Approximately 30 to 50 percent of the channel area has erosion and deposition at obstructions, bends, and constrictions. Many high-flow side channels and woody debris jams are present well above the streamflow surface elevation along the right bank. Sand deposits are present in low velocity zones behind larger obstructions and along the channel banks. Based on analysis, sediment would likely mobilize in this section at flows between 940 and 1,241 cfs. These flows reflect floods with 4- to 5-year recurrence intervals under the existing flow regime, so bed mobilization would not occur as often as in the middle section. This section is a multi-channel reach so the recurrence intervals for bed mobilization in the main channel would be less frequent because flows are distributed among various channels. The main channel bed is likely to have become more armored than the side channels by the higher flows it carries

Robbs Peak Dam Reach

The 5.9-mile-long Robbs Peak dam reach on the SFRR extends from the base of the Robbs Peak forebay downstream to the confluence with the Rubicon River. It has a mean gradient of about 5.5 percent, although some segments of this reach exceed 8 percent slope. Major tributaries to this reach include Gerle and South creeks. Upstream of the Gerle Creek confluence, the river flows through a glaciated, low-relief landscape, and this area contains the main response segment investigated in this reach. Downstream of the Gerle Creek confluence, the river becomes progressively more entrenched within the surrounding canyon. For the first 2 miles, the river is confined by moderate canyon slopes; then a contact between granitic and more erodable rocks marks a transition from the moderate canyon to a deeper gorge with 1,500-foot walls.

Broad-scale reach characterization of the reach shows that about 85 percent of the length of the reach is composed of transport-dominated channel types, while the other 15 percent is response-type channels. The response section investigated during relicensing is about 0.5 mile downstream of Robbs Peak forebay, within private property just upstream of the confluence of the SFRR and Gerle Creek. Here, the stream enters a broader, low-gradient segment of the reach where willows grow on many bars within the channel area and small conifers grow on recently scoured surfaces and other channel bars. Field observations and pebble counts reflect that finer sediments in the channel are likely stored in this section because of a constriction downstream. Valley topography creates a backwater effect during periods of high flow, which likely causes sediment to be deposited within the section. Local timber harvesting also likely adds to the sediment supply.

Ice House Dam Reach

The 11.5-mile-long Ice House dam reach on SFSC extends from the base of Ice House dam to the normal high water line of Junction reservoir and has a mean gradient of about 1.4 percent. The 1992 forest fire known as the Cleveland Fire created a fire-burned area that covers about two-thirds of the total reach length. The reach is characterized by moderate valley walls that confine the channel to a narrow floodplain. Peavine Creek, Winmiller ravine, and Big Hill canyon are the three major tributaries in this reach. In the first 2 miles below Ice House dam, the creek transitions from a steep canyon into a deeper gorge (near the Silver Creek campground) as the geology changes from granite terrain to deposited finer sediments. For the remainder of its 9.5 miles, the reach is confined to a bedrock valley and maintains an average gradient of 2 percent.

Despite the fact that on-the-ground stream mapping indicates that bedrock and boulder make up over 60 percent of the substrate of this reach, there are also substantial portions of the reach that are response-channel types. In the upper response section that was studied, located 1.5 miles downstream of Ice House dam, the channel is generally plane-bed morphology with some bends and bar formation. Mobilization of the sediment occurs at flows ranging from 185 to 393 cfs, which corresponds to floods with 1.5- to 3-year recurrence intervals under the current regulated flow regime. This indicates that bed material is regularly mobilized, and fresh, newly scoured surfaces are visible along the stream banks. Moderately high levels of sand and fine gravel observed in the section suggest that sediment supply from bank runoff and upstream sources may be greater than transport capacity.

The lower response section studied is located 8.6 miles downstream of Ice House dam in an area that was burned during the Cleveland Fire. A narrow band of riparian vegetation has recovered along the banks. Sediment mobilization in this section occurs at flows ranging from 497 to 775 cfs, which corresponds to floods with 1.5- to 2-year recurrence intervals under the existing flow regime. Bed mobilization therefore occurs frequently; however, because of the fire, fine sediment deposits are visible throughout and channel sediments are highly embedded, with many dull surfaces in the section. Sand covers the channel bed with larger deposits in lower flow areas, behind obstructions, and on the floodplain. Higher depositions of fine sediment and woody debris exist in the channel section, as compared to other project reaches.

Camino Dam Reach to the South Fork of the American River Reach

Like the Camino dam and Junction dam reaches, the SFAR reach is characterized by steep valley bedrock walls in a highly confined gorge. The reach is 2.8 miles long and travels from the confluence with Silver Creek to the Camino and El Dorado powerhouses. Relatively little vegetation is present along the channel slopes.

Broad-scale geomorphic characterization of the reach concludes that about 10 percent of the reach is made up of channels with transport-dominated characteristics, while the other 90 percent of the reach is characterized as response channel. However, on-the-ground surveys along a 520-foot segment show that the channel is actually a transport-dominated channel. Like the Camino dam and Junction dam reaches, many boulders and bedrock outcroppings are present that do not mobilize even during high-flow events. Cobble substrate does exist as a veneer, but finer sediments are only deposited in low-flow areas near obstructions and along channel margins. Sediment supply is not greater than transport capacity, so the sediments that do exist do not affect channel morphology. The 1992 Cleveland Fire also affected this area of the watershed, so fine sediments probably increased in supply because of increased erosion in the contributing drainage area. However, no evidence of increased sediment was seen in the channel during on-the-ground surveys of the segment.

Slab Creek Dam Reach

The Slab Creek dam reach is an 8-mile reach extending from the base of the Slab Creek dam and powerhouse to the high-water level of Chili Bar reservoir. In this reach, the SFAR again flows through an area dominated by high-gradient channel segments, bedrock and boulder outcroppings, and steep valley slopes in a highly confined gorge. The valley slopes are also sparsely vegetated.

Broad-scale geomorphic characterization of the reach indicated that 40 percent of the reach is made up of transport-dominated channel segments, while the other 60 percent of the reach is characterized as response segments. An on-the-ground survey investigated a 650 foot portion of the project reach above the Rock Creek confluence, about 4.6 miles below Slab Creek dam. This portion was originally characterized as a response channel, but the survey indicates that the channel is actually a transport-dominated channel. Like other reaches in the UARP watershed, many boulders and bedrock outcroppings are present that do not mobilize even during high-flow events. Cobble substrate does exist as a veneer, but finer sediments are only deposited in low-flow areas near obstructions and along channel margins. Sediment supply is not greater than transport capacity, so the sediments that do exist do not affect channel morphology. There is no evidence of lateral bar movement.

Chili Bar Dam Reach

The SFAR downstream of Chili Bar dam extends to the normal high water line of Folsom reservoir, falling about 500 feet over 19.1 miles with an average gradient of about 0.5 percent. From upstream to downstream, tributaries to the SFAR include Dutch Creek, Granite Creek, Jacobs Creek, Greenwood Creek, Hastings Creek, Norton Ravine, and Weber Creek. The reach is differentiated into three subreaches of different character, the upper subreach (Upper Canyon site), the middle subreach (Upper and Lower Coloma sites), and the lower subreach (Gorge site). The upper and lower subreaches are characterized by higher channel gradients that create flowing rapids, steeper canyon walls, and fewer deposits of finer material. They are generally bounded by bedrock and boulders, with alluvial deposits only in areas of lower flow. In contrast, the middle subreach channel is wider, more sinuous, and more gently sloping floodplains and channel gradients. Some areas of it were not studied because dredging, associated with gold mining activities, has artificially deepened the channel and substrate characteristics.

Broad-scale geomorphic characterization indicates that the reach is dominated by transport sections, where sediment transport capacity does not exceed fine sediment supply. On-the-ground survey confirms this, as fine sediment deposits are not visible in main channel flow areas; only cobble substrate exists that is covering bedrock. The channel slopes are very steep, have little vegetation other than a thin forest, and there is little evidence of bank erosion. The reach also has an average slope of about 1.0 percent, creating higher velocity areas and rapids.

Broad-scale characterization indicates that the Upper subreach is dominated by response sections. The Upper Canyon site is a transitional area exiting the upper subreach, and is characterized by moderately steep slopes with varying levels of vegetation. South-facing slopes that receive more sunlight are generally too dry to support a wide variety of plant life, while north-facing slopes are more densely vegetated. South-facing slopes could contribute to sediment supply, and the gradient at this site is lower than the other sites studied in the reach. The analysis indicates that this subreach is probably a response channel, since a mid-channel bar is present and fines were observed within the coarse substrate. Calculations show that the flow threshold of incipient motion at one cross-section is as low as 1,703 cfs. It is therefore possible that the morphology of the site changes even during flood events that are well below the 1.5 year regulated flood of 5,667 cfs, since Chili Bar reservoir has limited storage.

In contrast, the section at the Lower Coloma site was surveyed to determine if it is characterized as a response section, and it is likely not. Gold mining sites that may have mobilized fines are located between this location and the Upper Canyon, but this subreach has a steeper gradient, and no fines were observed in the main channel areas. Also, much of the channel and banks are stabilized by bedrock outcroppings. Any depositions that exist appear to only occur in low-flow areas behind these types of obstructions. The valley slopes are not as steep and do not appear to be contributing sediment supply, and residential development along the channel banks helps to retain sediment runoff. Based on the analysis of this section, transport capacity exceeds sediment supply.

Like upstream areas of the reach, the slopes are more sparsely vegetated, which appears to contribute to sediment supply. However, the local gradient is steeper, bars that do exist are dominated by cobble, and the lack of algal growth and fines in the main channel areas suggest higher transport capacity. Although this section of the canyon is an alluvial section with some sandy beaches, most of the lower subreach at the Gorge Site is characterized by rapids and bedrock/boulder outcroppings in the channels. All evidence suggests that it is a transport-dominated channel, where sediment transport capacity exceeds supply.

3.3.1.2 Environmental Effects

Upland Erosion and Sediment Sources

Changes in the operation of the UARP could contribute to sediment supply and degradation of water quality.

No changes in project operations are proposed that would affect upland sediment supply, but SMUD proposes to address the erosion that does occur in existing conditions. Under Proposed Article 1-30, *Transportation System Management*, SMUD would develop a transportation system management plan for roads on or affecting National Forest System lands. As part of this plan, SMUD would address measures to control project-related erosion including dust and soil movement induced by project roads and maintenance activities. This proposed plan would address the sediment that currently runs off the unpaved roads near project shorelines. Although SMUD and other agencies maintain these roads periodically, long-term sediment erosion could affect channel morphology or reservoir storage, and in turn affect biological resources or project operations.

Our Analysis

Development of a transportation system management plan would allow SMUD to coordinate road maintenance and use of project roads with the other land-managing agencies to ensure that protocols for erosion control are followed that would minimize sediment disturbance and transport into streams and reservoirs.

Pulse Flows

SMUD's studies showed that sediment deposition occurs in the Rubicon, Robbs Peak, Loon Lake, Ice House, and Slab Creek reaches. Under Proposed Article 1-2, *Pulse Flows*, SMUD would provide pulse flows in three of these reaches: in the Rubicon River below Rubicon dam, in the Gerle Creek below Loon Lake dam, and in the SFSC below Ice House dam.

Under Proposed Articles 1-5, *Monitoring Program*, and 2-6, *Sediment Management Plan*, SMUD would monitor reaches with significant response channel segments for changes in geomorphology during the license term: the reaches below Rubicon dam, Loon Lake dam, and Ice House dam, Silver Creek below Camino dam, and Slab Creek below Slab Creek dam. PG&E would monitor the reach below the Chili Bar Project. In addition, SMUD would monitor three of the above-listed reaches that are mostly transport channels for changes in characterization: the reaches below Robbs Peak dam, Camino dam, and Slab Creek dam.

Under Proposed Articles 1-5, *Monitoring Program*, and 2-6, *Sediment Management Plan*, SMUD and PG&E would use this geomorphology monitoring to determine if sediment should be placed in area(s) of the UARP reaches or if reservoirs should be dredged. If dredging of reservoirs is necessary, SMUD and PG&E would place the dredged sediment at locations determined in consultation with the Agencies and BLM.

Rubicon Dam Reach

Proposed Article 1-2, *Pulse Flows*, provides for pulse flows to coincide with high winter flows or spring snowmelt runoff. The goal of Article 1-2 for the Rubicon dam reach is to provide pulse flows of at least 600 cfs for 3 days or a total of 3,600 acre-feet of spill within those 3 consecutive days during BN, AN, and Wet water years. The pulse flows would be delivered to the Rubicon dam reach by inducing spill over Rubicon dam through operation of the flashboard gates at the Rubicon tunnel headworks. The purpose is to provide flows that would imitate natural flushing flow conditions during this time of year, to ensure that the morphology of the reach does not adversely affect biological resources. Proposed Article 1-5, *Monitoring Program*, provides for geomorphological evaluation to monitor changes in channel conditions and the effects from project operations.

Loon Lake Dam Reach

The upper section's floodplain—a relatively flat meadow—is characterized as somewhat swampy and has unstable banks and fine sediment deposits, which could affect biological or recreational resources if the conditions continue to degrade. Under Proposed Article 1-7, *Gerle Creek Channel Stabilization*, SMUD would develop and implement a plan to stabilize Gerle Creek channel. The plan would require Forest Service approval and involvement in its implementation, and would address the areas of erosion, instability, and sediment deposits to prevent future degradation of the channel conditions and any affected resources.

The proposed pulse flows would provide for ongoing channel flushing, timed to coincide with spring snowmelt runoff. Included would be test pulse releases of up to 740 cfs or the maximum capacity of the outlet works, whichever is less. These test flows would be evaluated based on their impact on channel conditions, bridges, and recreational sites, and then the Forest Service might reduce (but may not increase) the prescribed flows. Currently, flows in wet years are prescribed over a 5-day period: 600 cfs on days 1, 2, 4, and 5 and up to 740 cfs on day 3. Ongoing monitoring of the channel morphology would ensure that channel conditions do not adversely impact area resources in the future. Monitoring would identify how these changes in operations affect the geomorphology of the reach, particularly in the upper response section. Currently, the single point outlet below the Loon Lake dam carves a distinct channel through the meadow. In part, the monitoring would determine if this channel and floodplain would be unchanged regardless of operations—possibly because of the bedrock constriction downstream of the meadow.

Ice House Dam Reach

The 11.5-mile-long Ice House dam reach on SFSC has been significantly affected by project operations. As compared to the unregulated flow regime, reduced peak flows have allowed fine sediment to build up, especially since the 1992 Cleveland Fire. The reach and surrounding area are still clearly showing the effects of that event. The channel itself is primarily affected by the sediment deposition from that event, and that accumulation may be affecting biological resources in the reach.

Because of these effects, Proposed Article 1-2, *Pulse Flows*, provides for flushing flows timed to coincide with winter storm events and spring snowmelt runoff. These flows would serve as peak flows for channel flushing to imitate the unregulated condition. During wet years for example, releases of 600 cfs would be provided for 5 days, with 780 cfs—or the maximum capacity of the outlet works—being released on the third day. The flushing flows would influence the geomorphology of the channel sections, to scour the finer sediments in areas where sediment supply has exceeded transport capacity, which in turn would restore the channel condition that existed before the fines from the Cleveland Fire affected the biological resources. The bed of the channel would also continue to be mobilized more frequently, so that future events that affect the channel substrate could be flushed in a more natural period of time and the aquatic resources of the reach could be restored. Proposed Article 1-5, *Monitoring Program*, provides for geomorphology monitoring to develop benchmarks and comparatively study the future effects of these flushing flows.

Chili Bar Dam Reach

Three subreaches were studied in the Chili Bar dam reach on the SFAR. Only one section was found to currently be characterized as a response section, but fines are being transported into the reservoir and downstream of the dam, and they could affect channel conditions throughout the reach. Under Proposed Article 2-6, *Sediment Management Plan*, PG&E would plan and implement a geomorphology monitoring program to evaluate long-term changes in cross-section, longitudinal profile, bed substrate, and channel and bank stability in the sections studied. The purpose would be to verify that project operations would not be adversely affecting the resources of the reach.

Under Proposed Article 2-6, *Sediment Management Plan*, PG&E could elect to dredge the reservoir to increase reservoir storage, since the waterbody has captured a significant amount of sediment that has been transported from upland sources over the life of the dam. Prior to any dredging activity, PG&E would consult with the Agencies and BLM to develop a sediment management plan to protect the project resources. The sediment management plan would not only address the potential adverse effects of dredging on the reservoir and related mitigating measures, but it also may include a provision to deposit the dredged material in the downstream reach.

Our Analysis

Under natural conditions, periodic high flows would move sediments through the river system. Based on geomorphology studies, SMUD and the Agencies have identified reaches that would benefit from periodic pulse flows to move flush sediments downstream. Coordinating the provision of pulse floods with natural high flow events is reasonable.

Monitoring changes in sediment deposition in the reaches prone to sediment deposition would allow SMUD and PG&E, in consultation with the Agencies and BLM, to determine if and when to dredge the reservoirs and where to deposit the dredged materials. Based on our review of the studies, we would conclude that pulse flows in the reaches where sediments are trapped or deposited would help to transport these sediments downstream. The downstream reaches are where sediments most likely would have traveled if the impoundment did not exist; however because any added material could threaten the resources of the reach, the development of a sediment management plan would minimize these potential effects.

Iowa Hill Development

Reservoir Sedimentation

Construction of the proposed Iowa Hill development could affect soil erosion and water turbidity in stream effluent from the development, as well as in Slab Creek reservoir. The construction of the development would include clearing and grading, cutting, and filling to create the upper reservoir, installation of an underground tunnel/penstock, construction of a multiport (octagonal) intake in Slab Creek reservoir, and construction of about 2 miles of transmission line. During construction, SMUD would prevent water pollution and erosion by implementing management practices described in the storm water pollution prevention plan proposed under Article 1-42, *Water Quality and Water Pollution*, including keeping all equipment staging for the construction of the tunnel at least 100 feet from the SFAR and removing all material that is used within the riverbed, including siltation fabric, after the completion of construction. In addition, SMUD would implement best management practices to stabilize soil and retain sediment during construction as described in the erosion and sedimentation control plan included in appendix A of the license application. Under Proposed Article 1-47, *Spoils Disposal*, Forest Service approval would be required prior to discharging any spoils on National Forest System lands.

Our Analysis

Effects of Iowa Hill Construction

Erodable soil is present that could be disturbed by construction activities. Construction of the proposed Iowa Hill development could potentially result in substantial soil effects. An octagonal intake would eliminate the need to alter the mountain slope (both under water and above the shoreline) during construction. The natural slope has existed under water for more than 30 years and has existed in-the-dry for thousands of years. Like the slopes in other UARP reservoirs, it is not anticipated that stability enhancements would be needed. Because of the octagonal configuration, the horizontal net velocity component on the reservoir would be minimal, greatly reducing any concern about stirring up sediment.

The risk of water quality disturbance and soil erosion could be minimized by implementing a storm water pollution preventive plan identifying the best management practices for erosion and sediment control, including the stabilization of spoil piles. This plan would also include the method of installation and removal of a temporary coffer dam in Slab Creek reservoir to prevent any construction disturbance to the water quality in the reservoir. SMUD indicates that the construction of the Iowa Hill development would achieve a balance between excavated materials and fill such that there would be no permanent spoils discharge. We anticipate that the proposed storm water pollution prevention plan and use of best management practices would provide reasonable assurance that SMUD's construction activities would not directly or indirectly adversely affect water quality and aquatic habitat.

Effects of Iowa Hill Operation

While the UARP predominantly has bedrock, boulder, and cobble substrate in its waterways, geological investigations concluded that material in the area of the proposed Iowa Hill development is not watertight enough to prevent seepage from the proposed upper reservoir. Residual soil and fractured deposits could result in storage losses during operation

Seismicity and Groundwater Effects

If active or potentially active faults were passing through or near the site of the Iowa Hill development, seismic activity could potentially cause failure of the structures associated with the development. However, no faults or fault systems are considered active or near enough to create any greater risk than that associated with the structures that already impound project waters. In fact, the construction of a reservoir with earthen berms and an impermeable layer is likely to withstand an earthquake better than the closest dam—on Slab Creek reservoir, the lower reservoir in the pumped storage development—since there would be no possibility of the earthen berms overturning. However, the underground penstock/tunnel would be susceptible to seismic activity, so best management practices should account for this in design and construction.

The proposed operation of the Iowa Hill development could increase turbidity and erosion within Slab Creek reservoir because of increased reservoir surface fluctuation and turbulence from the proposed intake/outlet. SMUD investigated whether the proposed development would cause these effects, and concludes that the turbidity and shoreline erosion would not increase significantly because (1) the proposed upper reservoir would be lined with a clay/bentonite or synthetic impermeable layer to prevent seepage, which would also preclude sediment mobilization in that reservoir and its' transport to Slab Creek reservoir, (2) the proposed intake/outlet structure would be located 90 feet above the channel bed in Slab Creek reservoir, so it would be very unlikely to mobilize sediment on the reservoir's bottom, and (3) the more frequent reservoir surface fluctuation would not affect shoreline erosion, since the shoreline is mostly cobble, boulder, and bedrock.

The proposed development could also impact groundwater by creating seepage paths along the proposed tunnel that lead to instability, or adversely affecting natural resources by altering or polluting the water table and surrounding soil. Under Proposed Article 1-43, *Groundwater*, SMUD would develop and implement a plan for managing the flow of groundwater during construction and for post-construction monitoring of groundwater to evaluate project impacts on groundwater. The proposed plan would establish baseline measurements of the project area and affected groundwater levels. During construction, SMUD would document all groundwater encountered and propose corrective measures if the levels encountered are different than what were expected. Ongoing monitoring and reporting would last for 5 years, and it would evaluate springs and creeks that could be affected by project seepage or piping. An approved plan would also include mitigating measures in the case of any adverse effects, which would ensure that the proposed development would not create any significant impact.

Our Analysis

Effects of Project Construction

We have reviewed the report and the physical conditions of the shoreline and conclude that the shoreline attributes and location of the intake combined with the use of an impermeable liner in the upper reservoir would minimize sediment mobilization and shoreline erosion in the Slab Creek reservoir.

Effects of Project Operation

Implementation of a plan for monitoring groundwater during and after construction of the Iowa Hill development would provide information on the effects of the development on groundwater and allow SMUD and the Agencies to recommend mitigation to remedy identified effects on groundwater.

UARP-only Alternative

The Iowa Hill development would not be constructed or operated under the UARP-only Alternative. All other proposed environmental measures would be implemented. Operations would otherwise be similar to those in the Proposed Action, without the effects of the Iowa Hill development.

The effects of the Iowa Hill development that would not occur under this alternative include changes in water-level fluctuations in Slab Creek reservoir, effects on turbidity within the reservoir, and clearing, cutting and filling, and soil erosion as a result of the construction of the development. Impacts on geology in that area would not occur at Iowa Hill.

3.3.1.3 Unavoidable Adverse Effects

None.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Quantity

The UARP and the Chili Bar Project use water of the SFAR and Rubicon River watersheds to generate electricity (figure 3-1). The river basins drain a portion of the western slope of the Sierra Nevada Mountains between Placerville and the Sierra crest, which reach over 9,000 feet, just west of Lake Tahoe. The total drainage area for the SFAR is 598 square miles as measured near Placerville (USGS gage no. 11444500) (figure 3-2) about 700 feet downstream of Chili Bar dam. The total drainage of the reservoirs within the Rubicon River (a major tributary to the Middle Fork of the American River) watershed used for diverting some of inflow to the reservoirs to the SFAR watershed is about 76 square miles.

The American River Basin has warm dry summers and cool and wet winters. Temperatures and precipitation vary considerably depending on elevation. Summer high temperatures are normally above 90 degrees in the lower elevations and low temperatures are normally substantially below freezing during the winter in the higher elevations. Average precipitation ranges from 40 to 70 inches with more than 90 percent of the precipitation occurring from October through April, mainly in the form of snow in the higher elevations. A snowpack of 5 to 10 feet is common in the higher elevations, with little or no snow in the lower elevations, below 2,000 feet. Much of the snowpack below 5,000 feet melts by the end of April, but snowmelt from higher elevations continues into at least June in most years. Streamflow normally peaks during the late spring and/or early summer from snowmelt runoff. Low flows within this watershed typically occur during the late summer or early fall, after the snowmelt and before the runoff from the fall storms moving in from the Pacific Ocean. In the higher elevations above 6,000 feet, most precipitation during fall, winter, and spring falls as snow which results in low flows other than from occasional rain-on-snow events, until snowmelt begins, normally in April.

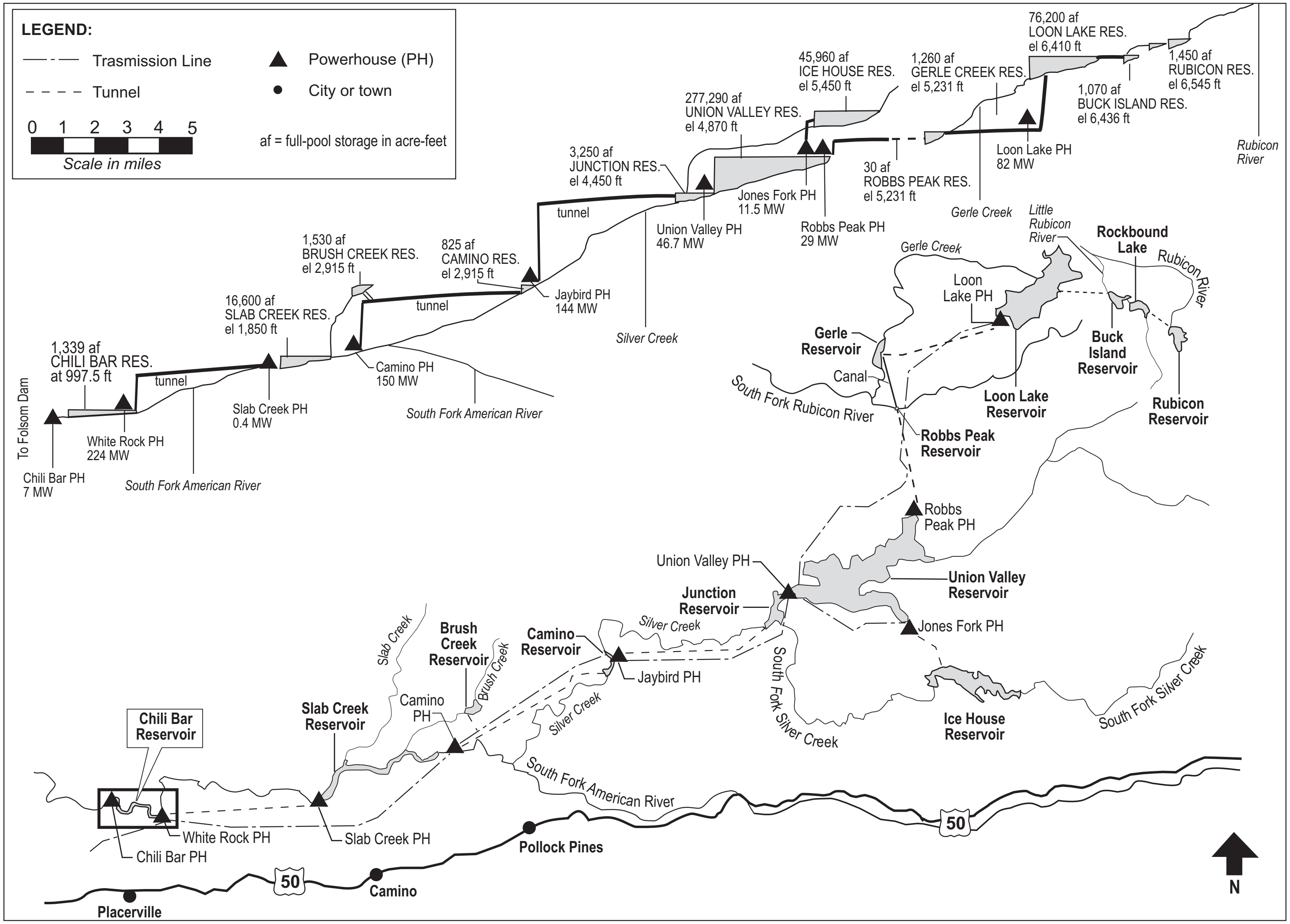

Figure 3-1. Profile of the Upper American River system, Rubicon Lake to the Chili Bar Project. (Source: SMUD, 2005; PG&E, 2005, as modified by staff)

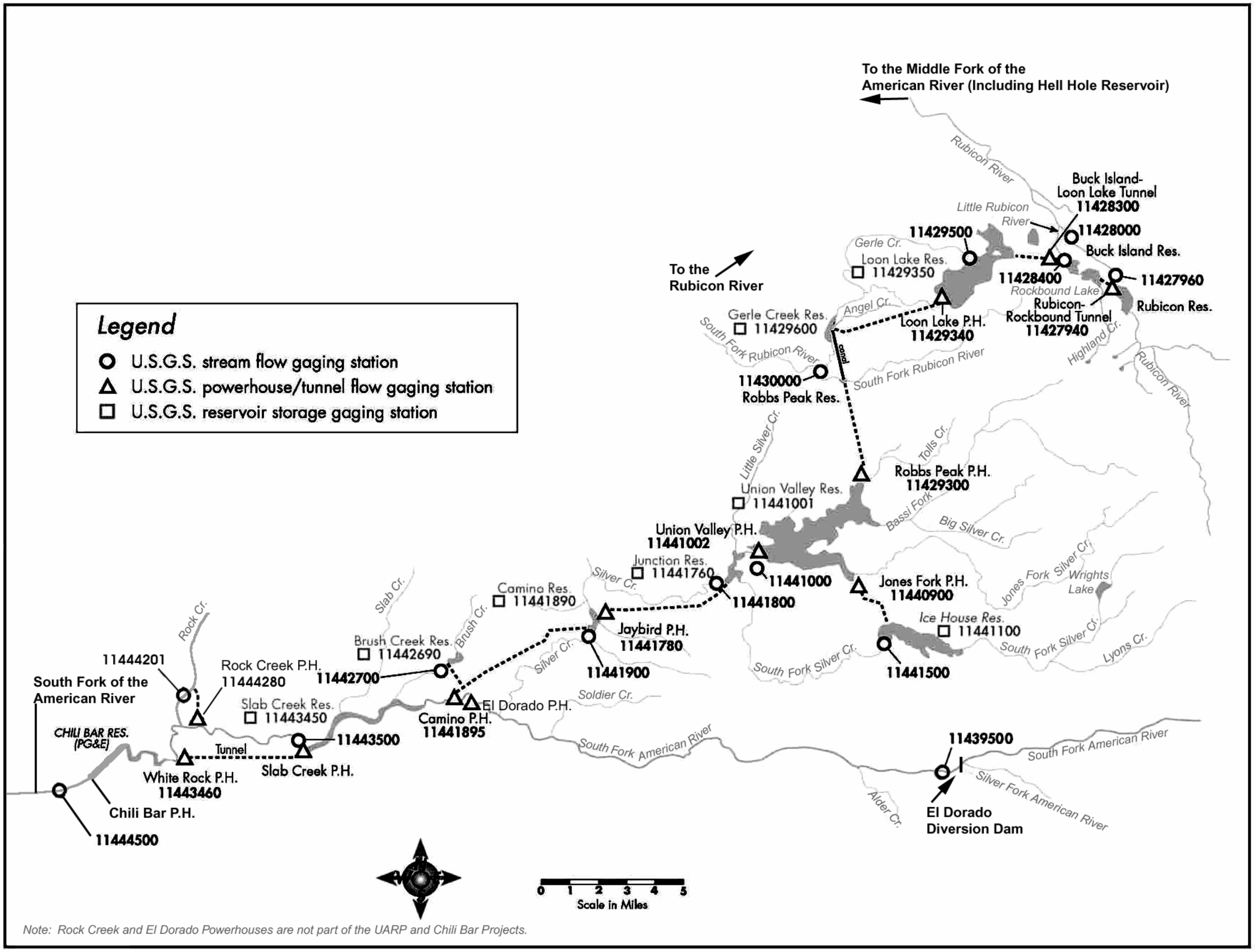

Figure 3-2. Existing USGS gages within the Upper American River system. (Source: SMUD, 2005; PG&E, 2005, as modified by staff)

Rubicon Reservoir

The primary purpose of the Rubicon reservoir is diversion of high spring-time flow from the main stem of the Rubicon River to Buck Island reservoir via the Rubicon - Rockbound tunnel, which diverts into Rockbound Lake. Rubicon reservoir is not used for long-term storage; however, SMUD has water rights for storage of up to 450 acre-feet in the reservoir, out of a total useable storage capacity of 1,010 acre-feet (table 3-2). Water is released downstream from Rubicon dam by either passing over the spillway or through one or both 10-inch-diameter globe valve controlled low-level outlets, which have a combined capacity of about 18 cfs at full reservoir pool.

Table 3-2. Reservoir summary for the Projects. (Source: SMUD, 2005; PG&E, 2005)

Reservoir	**Drainage Area (square miles)**	**Normal Maximum Water Surface Elevation (feet msl)**	**Useable Storage (acre-feet)**	**Typical Daily Elevation Changes/Typical Annual Elevation Changes (feet)**	**Diversion Tunnel or Powerhouse**
Rubicon	26.5	6,545	1,010	<0.5/11.8	Rubicon-Rockbound tunnel
Buck Island	6.0	6,436	648[a]	<0.5/11.5	Buck-Loon tunnel
Loon Lake	8.0	6,410	68,988	<0.5/36	Loon Lake powerhouse
Gerle Creek	28.7	5,231	483	1.5/9	Gerle Creek canal
Robbs Peak	15.2	5,231	30	<0.5/5	Robbs Peak powerhouse
Ice House	27.2	5,450	35,065[a]	<0.5/42	Jones Fork powerhouse
Union Valley	83.7	4,870	266,303[a]	<0.5/60	Union Valley powerhouse
Junction	147.0	4,450	2,140	20/32	Jaybird powerhouse
Camino	160.0	2,915	489	20/30	Camino powerhouse
Brush Creek	8.0	2,915	374	20[b]/<1	Camino powerhouse
Slab Creek	493	1,850	5,580	6/30	White Rock powerhouse
Chili Bar	598	997.5	1,088	4.2/14.5	Chili Bar powerhouse

[a] Top of spillway or bulkhead gates, or stop logs in place.

[b] Brush Creek is rarely used in super peaking mode, but when it is, the typical daily change in elevation is about 20 feet.

Because Rubicon reservoir is operated primarily as a diversion facility, the water level in the reservoir fluctuates with changing volumes of inflow, ranging between the minimum operating level of 6,533.2 feet and the maximum normal operating level of 6,545.0 feet. Water levels are also determined by the manual installation of gates which normally occurs in July and are removed in October. During the summer recreational season of May 1 through September 10, the minimum operating pool level is increased by 6.0 feet to an elevation of 6,539.2 (figure 3-3). Although the daily water surface elevations are highly variable, the monthly median minimum water surface elevation is higher during the recreational season.

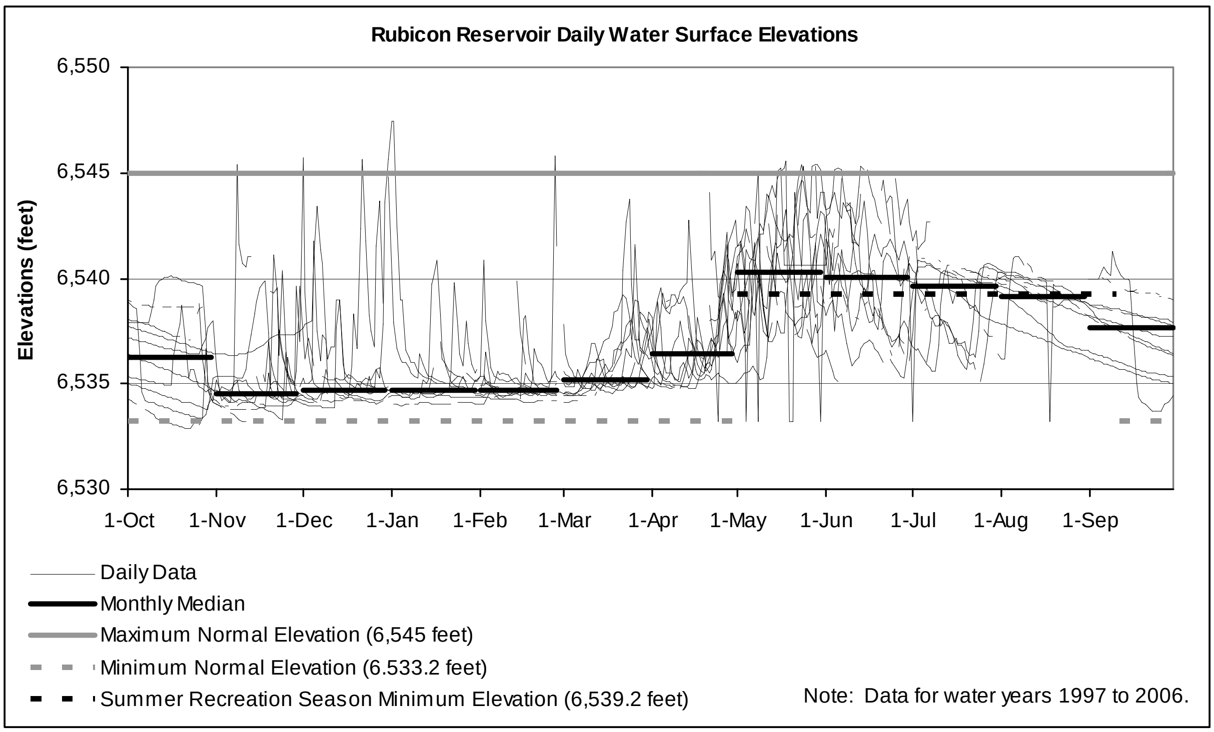

Figure 3-3. Rubicon reservoir daily water surface elevations. (Source: CDEC, 2007)

Buck Island Reservoir

The primary purpose of the Buck Island reservoir, like Rubicon reservoir, is diversion of high spring-time flow from the Rubicon River via the Buck-Loon tunnel to Loon Lake reservoir. Buck Island reservoir is not used for long-term storage; however, SMUD has water rights for storage up to 440 acre-feet in this reservoir, out of a total useable storage volume of 648 acre-feet. Water is released downstream from Buck Island dam by either passing over the spillway or through one 12-inch diameter, globe valve, low-level outlet, which has a capacity of about 11 cfs at full reservoir pool. The water level in Buck Island reservoir fluctuates between the minimum operating pool level of 6,424.5 feet and the maximum normal elevation of 6,436.0 feet. During the summer recreational season of May 1 through September 10, SMUD increases the minimum operating level by 6.5 feet to 6,431.0 feet, effectively narrowing the median range of maximum water elevation fluctuation from 11.5 to normally 5.0 feet (figure 3-4). As with Rubicon reservoir, the daily elevation changes are highly variable. As shown in figure 4-6, the monthly median water is higher during the recreational season.

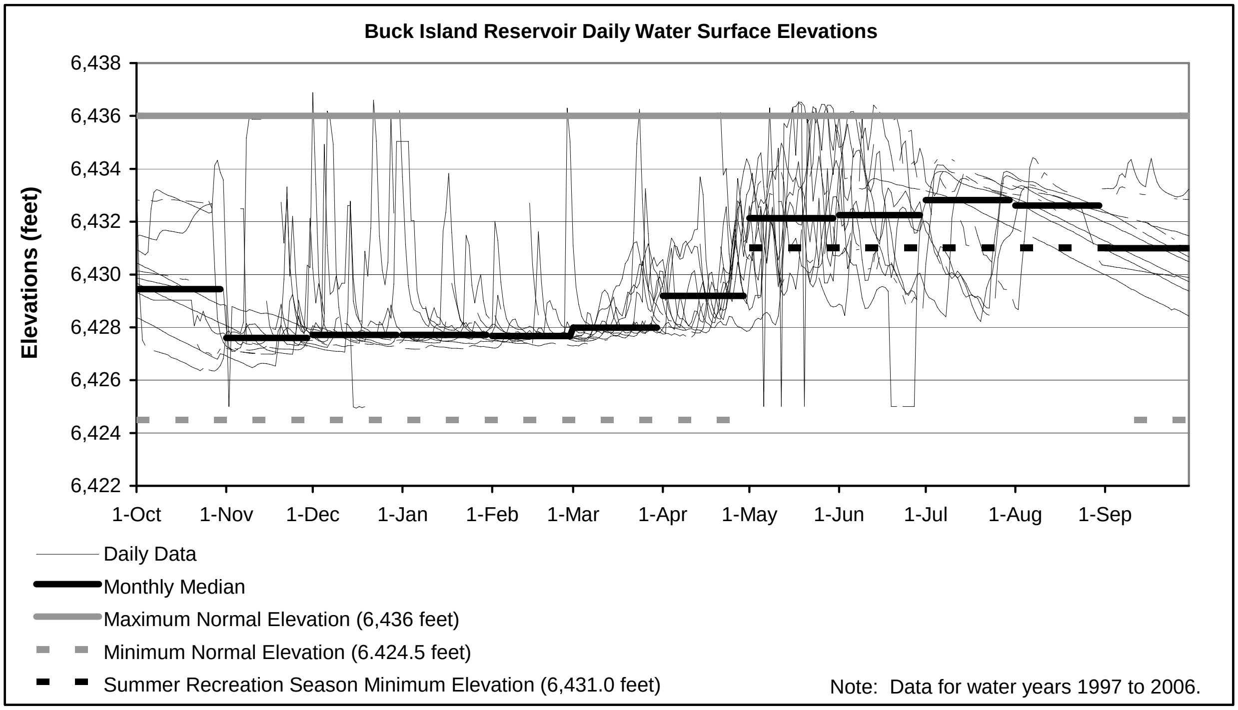

Figure 3-4. Buck Island reservoir daily water surface elevations. (Source: CDEC, 2007)

Loon Lake Reservoir

Loon Lake reservoir is the highest elevation storage reservoir in the UARP with a total useable storage volume of about 69,000 acre-feet. Water is released from the reservoir though the Loon Lake penstock to the Loon Lake powerhouse and then into Gerle Creek reservoir. Water is also released downstream from Loon Lake dam by either passing over the spillway or through one or more of two 10-inch-diameter, globe valves (maximum capacity of 41 cfs) or one 42-inch-diameter, Howell-Bunger valve (maximum capacity of 600 cfs). Variation in Loon Lake reservoir levels typically follows an annual cycle, with reservoir elevations reaching their highest levels during early summer months. The reservoir levels gradually lower throughout the summer months continuing into the fall and winter months. The water elevation slowly rises during the spring and early summer as the rain and snowmelt runoff refill the reservoir (figure 3-5).

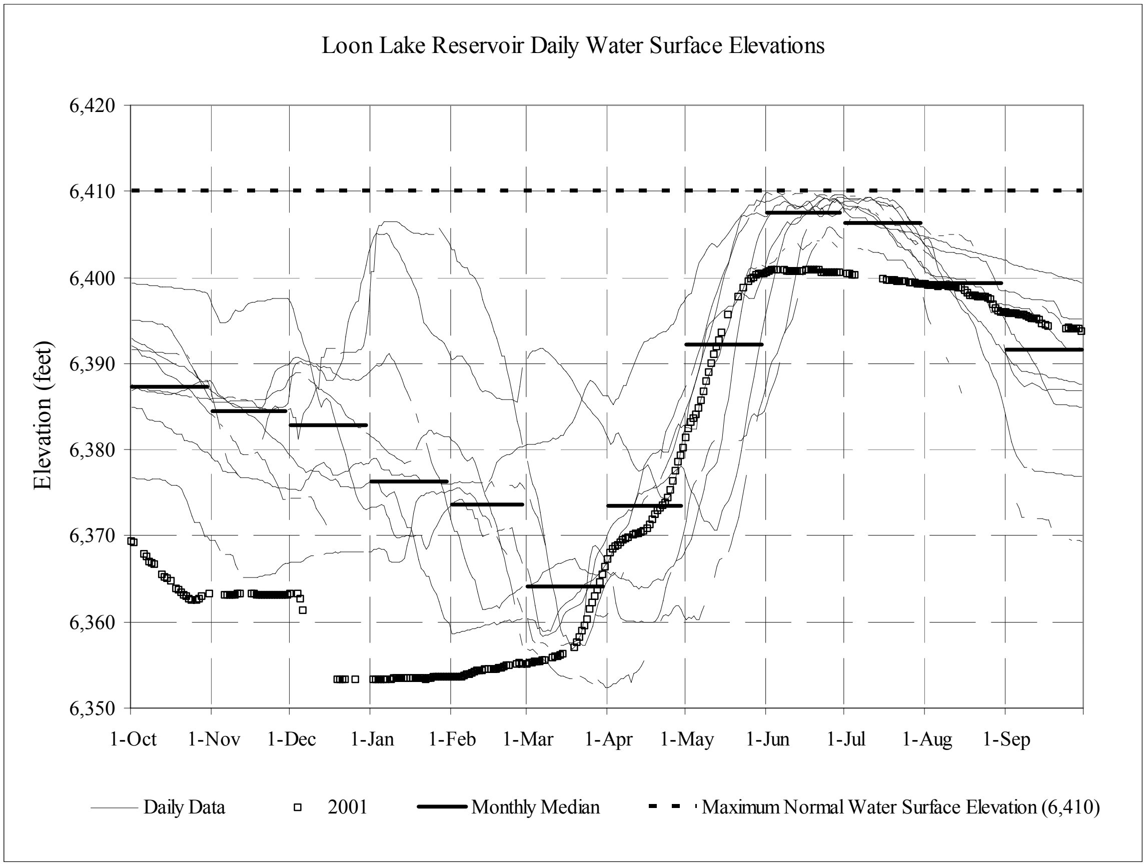

Figure 3-5. Loon Lake reservoir daily water surface elevations. (Source: CDEC, 2007)

Gerle Creek Reservoir

As with Rubicon and Buck Island, the primary purpose of the Gerle Creek reservoir is diversion of high spring-time flow and water re-diverted from upstream UARP facilities via the Gerle canal to Robbs Peak reservoir and then to Robbs Peak powerhouse on Union Valley reservoir. There are no storage rights at Gerle Creek reservoir, and the reservoir has a useable storage volume of 483 acre-feet. According to SMUD, daily average variation is about 1.5 feet and 9 feet annually (see table 3-2). Water is also released downstream from Gerle Creek dam by either passing over the spillway or through one 10-inch-diameter, globe valve, low-level outlet, which has a capacity of about 13 cfs at full pool.

Robbs Peak Reservoir

Robbs Peak reservoir, which has a useable storage volume of 30 acre-feet, primarily diverts water from the SFRR and the Gerle canal into the Robbs Peak tunnel and regulates inflow to the Robbs Peak powerhouse located on the northeast shore of Union Valley reservoir. Water is also released downstream from Robbs Peak dam by either passing over the spillway or through one 6-inch-diameter, diaphragm valve, low level outlet, which has a capacity of about 4 cfs at full pool. DWR requires that the Robbs Peak dam bulkhead gates be held in a full open position from October 1 through May 31, except that gate 2 may be closed for the full year. SMUD states that Robbs Peak reservoir has an average daily fluctuation of less than 0.5 foot and an annual fluctuation of about 5 feet (see table 3-2).

Ice House Reservoir

The primary purpose of Ice House reservoir is storage, and it has a useable storage volume of about 35,000 acre-feet. Water is released from the reservoir though the Jones Fork tunnel to the Jones Fork powerhouse located on the shoreline of the Union Valley reservoir. In addition, water can be released downstream from Ice House dam by either passing over the spillway or through one or both of two 10-inch-diameter globe valve low-level outlets and one 42-inch diameter Howell-Bunger valve low-level outlet, which have a combined capacity of about 740 cfs at reservoir full pool. DWR requires that the spillway gates be held in the full open position from November 1 through April 1. Between April 1 and April 15, water may be impounded to the top of the spillway gates (elevation 5,445.0 feet). After April 15, water level may be increased to elevation 5,447.0 feet (figure 3-6). During October, the water level must be lowered gradually to elevation 5,436.5 feet, the spillway crest.

Union Valley Reservoir

The primary purpose of Union Valley reservoir is storage, and it is the largest reservoir in the UARP and Chili Bar Project area, with a useable storage volume of about 266,000 acre-feet. Water is released from the reservoir though the Union Valley tunnel to the Union Valley powerhouse located on Junction reservoir, which serves as an afterbay for Union Valley powerhouse. Union Valley dam does not have a low level outlet. DWR requires that the spillway gates be held in the full open position from November 1 through April 1. Between April 1 and April 15, water may be impounded to elevation 4,865 feet. After April 15, water level may be increased to elevation 4,867.0 feet, near the maximum normal elevation of 4,870 feet (figure 3-7). During October, water level must be lowered gradually to elevation 4,855.0 feet, the spillway crest.

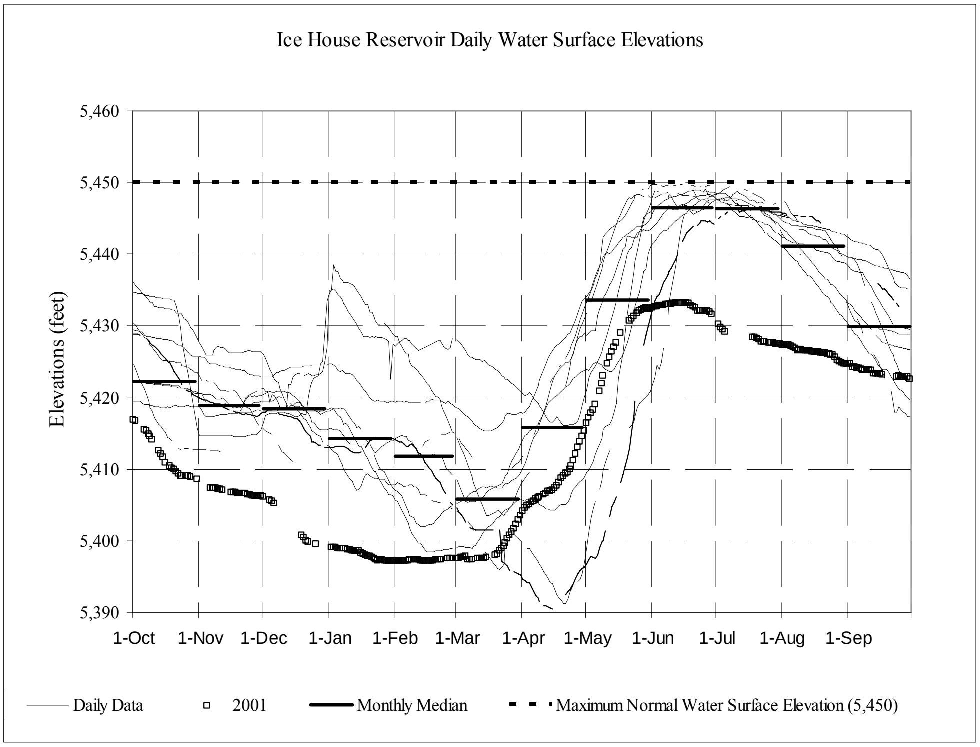

Figure 3-6. Ice House reservoir daily water surface elevations. (Source: CDEC, 2007)

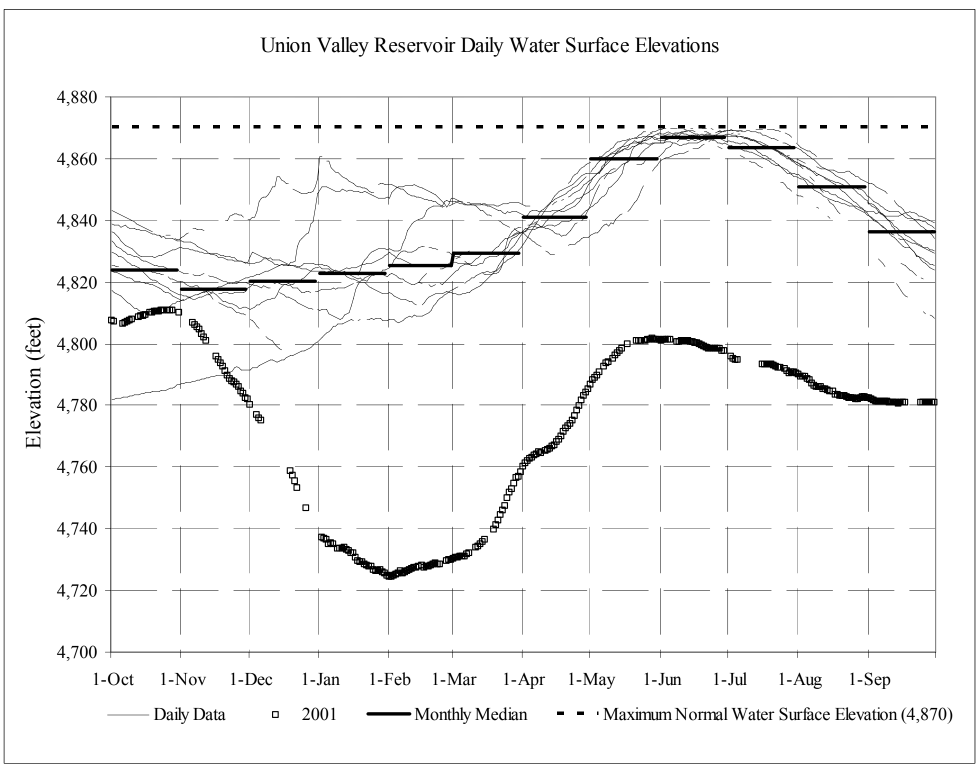

Figure 3-7. Union Valley reservoir daily water surface elevations. (Source: CDEC, 2007)

Junction Reservoir

The primary purpose of Junction reservoir is to act as a regulating afterbay for Union Valley powerhouse and a regulating forebay for the Jaybird tunnel, which leads to the Jaybird powerhouse. Water released from the Jaybird powerhouse flows directly into Camino reservoir. In addition, water is also released downstream from Junction dam by either passing over the spillway or through one 18-inch-diameter hollow cone valve low-level outlet, which has a maximum capacity of about 138 cfs at reservoir full pool (elevation 4,450 feet). Junction reservoir has a useable storage volume of 2,140 acre-feet, an average daily fluctuation of about 20 feet, and an annual fluctuation of about 32 feet (see table 3-2).

Camino Reservoir

Camino reservoir is a regulating afterbay for the Jaybird powerhouse and one of two regulating forebays for the Camino powerhouse. Brush Creek dam forms the other regulating forebay for the Camino powerhouse. Water is directed from Camino reservoir into the Camino tunnel, which joins the Brush Creek tunnel. Water is also released downstream from Camino dam by either passing over the spillway or through one 18-inch-diameter hollow cone valve low-level outlets, which has a capacity of about 112 cfs at full pool. Camino reservoir has a useable storage volume of 489 acre-feet, an average daily fluctuation of about 20 feet, and an annual fluctuation of about 30 feet (see table 3-2).

Brush Creek Reservoir

Unlike the Camino reservoir and other reservoirs within the UARP, Brush Creek reservoir is often operated to provide spinning reserves for reliability purposes. It is also used to generate maximum peak power during emergency and other short-term situations, such as when all available generating units are expected to operate at full load for short periods of time. Under this super-peaking operating mode, the daily water level may fluctuate up to 20 feet, ranging between the operating pool levels of 2,895.0 and 2,915.0 feet. Over the appropriate nighttime periods of the next 2 to 3 days following this operating mode, SMUD typically shuts down the operation of the Camino powerhouse while operating the Jaybird powerhouse. Concurrently, the water exiting the Jaybird powerhouse is transported via the Camino and Brush Creek tunnels to refill Brush Creek reservoir. Water is released downstream from Brush Creek dam by either passing over the spillway or through a low-level outlet, which has a capacity of about 145 cfs at full pool. Brush Creek reservoir has a useable storage volume of 374 acre-feet and an average annual fluctuation of less than 1 foot (see table 3-2).

Slab Creek Reservoir

Slab Creek reservoir is a regulating afterbay for the Camino powerhouse and a regulating forebay for the White Rock powerhouse, which releases into PG&E's Chili Bar reservoir. Under the Proposed Action, Slab Creek reservoir also would function as the lower reservoir for the Iowa Hill development. Water is released from the reservoir through the White Rock tunnel. Water is also released downstream from Slab Creek dam by either passing over the spillway or through one 24-inch-diameter Howell-Bunger valve low-level outlet, which leads either to the Slab Creek powerhouse or a bypass facility if the powerhouse is not operating. The low-level outlet valve has a capacity of about 270 cfs at full pool. Slab Creek reservoir has a useable storage volume of 5,580 acre-feet, an average daily fluctuation of about 6 feet, and an annual fluctuation of about 30 feet (see table 3-2 and figure 3-8).

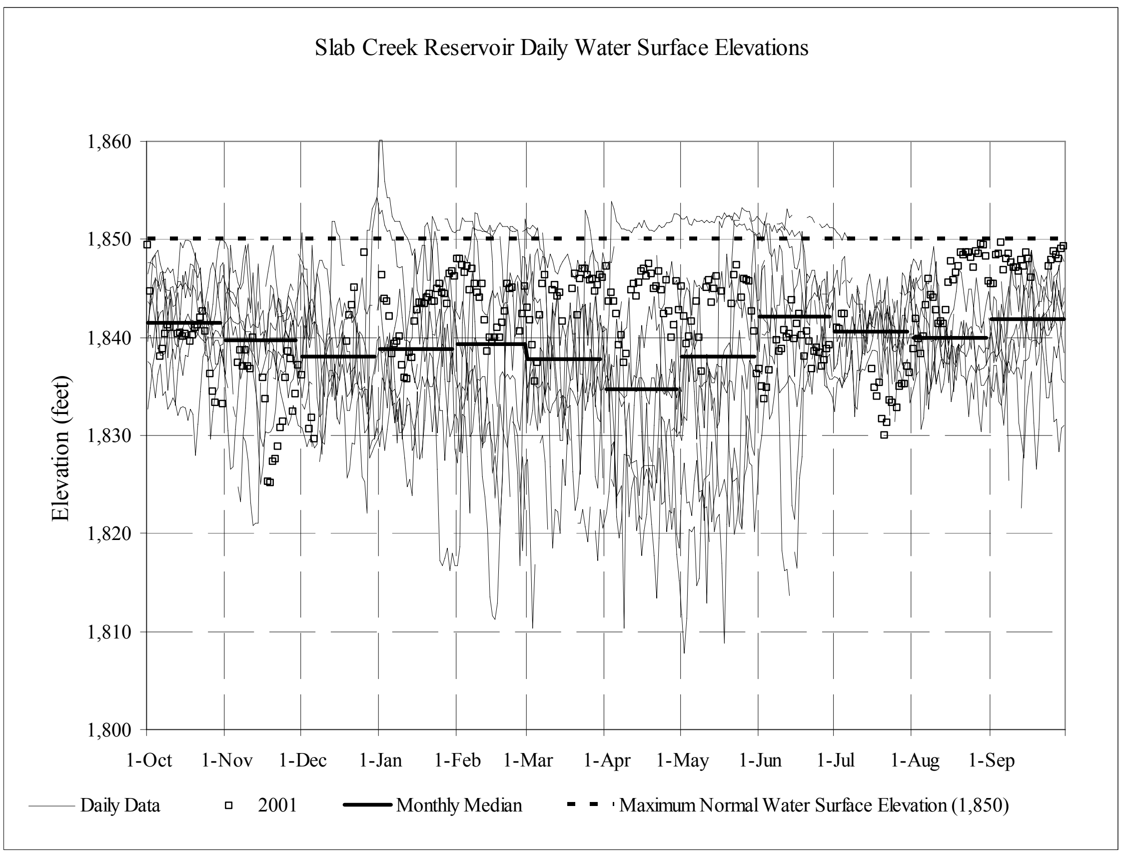

Figure 3-8. Slab Creek reservoir daily water surface elevations. (Source: CDEC, 2007)

Chili Bar Reservoir

PG&E's Chili Bar reservoir is a regulating afterbay for SMUD's White Rock powerhouse and a regulating forebay for PG&E's Chili Bar powerhouse. Water is released from the reservoir through the penstock leading to the powerhouse located near the base of the dam or though the spillway. PG&E describes the operation of Chili Bar as a reregulation facility from the upstream SMUD system to maintain the desired flow regime in the SFAR during peaking operations at White Rock powerhouse while providing minimum and recreational flow releases to downstream reaches. Chili Bar reservoir has a useable storage volume of 1,088 acre-feet, an average daily fluctuation of 4.2 feet and normally not exceeding 7 feet per day, and an annual variation of about 14.5 feet (see table 3-2).

Flow in Project Reaches

Twelve sections of river (about 81 river miles, excluding reservoirs) are affected by the UARP through either a bypass of water around the section of river via a project tunnel or canal, or storage at and release of water from a UARP dam directly into the reach (see figure 3-1). These sections of river are called project reaches, and are mostly named after the UARP facility from which the water is diverted or stored. The downstream end of each project reach is established by a UARP facility (typically the normal high water line of the next downstream reservoir), a non-UARP reservoir, or the confluence with a major tributary.

The volume of water flowing in the different project reaches is a function of three factors: (1) minimum releases at project reservoirs; (2) accretion provided by various tributaries within the reaches; (3) and spill from the reservoirs. SMUD is currently required to release minimum water quantities for the protection of aquatic resources in downstream reaches. The minimum releases required by the current license generally vary by month and water year type. Four water year types are specified in the current license, with each defined by the total annual volume of water inflow to Folsom Lake, which is located downstream of the UARP on the main stem of the American River:

- Type 1—Inflow less than 1.0 million acre-feet
- Type 2—Inflow between 1.0 to 1.499 million acre-feet
- Type 3—Inflow between 1.5 to 1.999 million acre-feet
- Type 4—Inflow greater and equal to 2.0 million acre-feet.

Accretion is an important factor in determining flows in the project reaches. A characteristic feature of the UARP area is the high level of seasonal variability in runoff which dictates the distribution and volume of accretion that flows into the UARP reaches. The majority of the runoff in the different watersheds occurs during the snowmelt period, roughly between April and June, when melting snow runs off the dominant metamorphic and granitic rock surfaces. Little water is retained in the watersheds beyond the runoff period due to the shallow soil deposits overlaying the rock surfaces. Thus, the difference in volume of water flowing in project reaches between spring and summer is substantial, ranging from many hundreds of cfs to less than 1 cfs, or in some cases no flow. The typical spring snowmelt runoff pattern of the upper reaches is replaced in the lower reaches by a winter runoff pattern. In the Junction, Camino, and Slab Creek reaches, for example, the accretion attains its highest point in February and March.

Spill from UARP reservoirs into the project reaches occurs with varying levels of frequency and magnitude. In general, spills are less frequent at the three large storage reservoirs, Loon Lake, Union Valley, and Ice House. These reservoirs often have sufficient storage capacity to capture the snowmelt flows without spilling, except in wetter water years. The afterbay/forebay reservoirs (such as Junction, Camino, Gerle Creek, and Robbs Peak) spill more frequently due to their limited size compared to the volume of accretion flows that originate within their watersheds.

The existing flow regime in each project reach is discussed below. Tables 3-3, 3-4 through 3-10, and 3-11 (at the end of this discussion) summarize the reach data and terminology, current required minimum streamflows and streamflow data for the reaches with seasonally adjusted minimum streamflow requirements and USGS gages in the project reaches.

Rubicon Dam Reach

The existing flow regime in the Rubicon dam reach is highly variable, due primarily to accretion flows associated with snowmelt runoff. The existing release schedule for Rubicon dam requires a year-round minimum release of 6 cfs as measured at USGS gage no. 11427960 (Rubicon River below Rubicon Lake) or natural inflow from the Rubicon River. During the late summer/early fall period, when inflow falls below 1 cfs or to zero SMUD usually releases 1 cfs from the dam. Generally, accretion in the project reach is also zero during this low-flow period, which results in the 1 cfs release extending throughout the entire reach, even past Miller Creek, which typically dries up in summer. The sole augmentation of flow in this reach during this period occurs at the confluence with the Little Rubicon River, where the 1 cfs released by SMUD from Buck Island reservoir enters the Rubicon River.

During the snowmelt runoff, flows in the reach are substantially higher than the minimum release value of 6 cfs because of the substantial accretion runoff. Monthly median values for accretion throughout the reach during the snowmelt period climb to values of approximately 200 to 250 cfs. Winter base flows are generally low, however, due to the fact that much of the precipitation that falls on the project reach watershed is in the form of snow that remains frozen during winter. Spill at Rubicon reservoir occurs during the spring snowmelt period, generally in wetter water years. Flow is diverted at Rubicon Lake by the Rubicon –Rockbound tunnel to Rockbound reservoir. Flow in the diversion tunnel typically peaks in May with a monthly mean and median of 300 cfs, and reaches its minimum in September with a monthly mean and median less than 15 cfs.

Rockbound Dam Reach

The Rockbound dam reach is a 0.3-mile ungaged segment of stream that lies between Rockbound Lake, a non-UARP facility, and Buck Island reservoir. Rockbound Lake is a natural lake with a small non-UARP masonry dam at its outlet. At Rockbound Lake, dam maintenance and operation are CDFG's responsibility. Because the dam outlet facilities are currently inoperable, flows out of Rockbound Lake are the result of water passing over the dam into the stream reach. The existing flow regime in the stream reach is a combination of water diverted from the Rubicon River at Rubicon reservoir (and passed through the Rubicon - Rockbound tunnel into Rockbound Lake) and natural flows in Highland Creek, which also enter Rockbound Lake. SMUD estimates that Highland Creek (the main natural tributary to Rockbound Lake) has peak flows of about 100 cfs during high snowmelt periods. During low-flow periods (such as during the summer and early fall), inflow to the lake from all sources often ceases. During these times, flows out of Rockbound Lake into the reach are at constant levels of less than 1 cfs from leakage at the outlet facilities of the masonry dam.

Buck Island Dam Reach

The existing flow regime in the Buck Island dam reach is very similar to that of the Rubicon dam reach. Once the snowmelt runoff has ceased, generally by July, flows in the entire watershed quickly fall to zero. This is true of Highland Creek, the feeder stream that provides the majority of natural inflow to Buck Island reservoir, and of the watershed downstream of the reservoir. There are no tributaries of significance along the 2.5-mile reach of the Little Rubicon River before its confluence with the Rubicon River, resulting in very minor accretion values during the dry months. The year-round minimum release schedule for Buck Island reservoir is 1 cfs, measured at USGS gage no. 11428400 (Little Rubicon River below Buck Island dam) for all months and water year types. This reservoir release is augmented by snowmelt accretion in April and May, although it is of a reduced volume compared to the Rubicon River. Spill at Buck Island dam, which is not presently measured by the downstream USGS gage, into the reach generally coincides with the spill events at Rubicon reservoir and occurs primarily in wet water years. Flow is diverted at Buck Island reservoir by the Buck Island–Loon Lake to Loon Lake reservoir. Flow in the diversion tunnel typically peaks in May and June with a monthly mean and median near 300 cfs, and reaches its minimum in August and September with a monthly mean and median less than 20 cfs.

Loon Lake Dam Reach

The existing flow regime in the Loon Lake dam reach is similar in nature to that of the other high elevation project reaches. The existing license requires a year-round minimum release of 8 cfs from Loon Lake into Gerle Creek during all months and all water year types as measured at USGS gage no. 11429500 (Gerle Creek below Loon Lake). Unlike Rubicon and Buck Island reservoirs, which have limited storage capacity, releases at Loon Lake during the summer/fall period are not contingent upon the natural inflow from Ellis Creek, which typically dries up during summer. Instead, because there is greater storage capacity, releases from Loon Lake reservoir remain fixed at 8 cfs all summer and fall. Generally, during this low-flow period, accretion is insignificant, which results in about 8 cfs, throughout the course of the 8.5-mile-long reach to Greek Creek reservoir.

During the snowmelt runoff, flows in the reach are substantially higher than the minimum release value of 8 cfs. SMUD estimates the total-reach accretion amounts during the snowmelt period reach as about 100 to 150 cfs in AN and BN water years. The substantial storage capacity of Loon Lake reservoir and its location at the uppermost end of the watershed result in very infrequent spill, which is presently measured at the USGS gage below the dam. SMUD states that daily flows from reservoir releases and accretion through the reach during the winter and spring are quite variable, with short duration peaks in winter reaching highs near 1,000 cfs in some years. Flow is diverted at Loon Lake reservoir to the Loon Lake powerhouse (measured by USGS gage no. 11429340). SMUD states the Loon Lake powerhouse is typically operated as a daily peaking unit with high load settings and is turned off during non peaking periods. The average daily flow at the Loon Lake powerhouse peaks in June, with a mean and maximum in excess of 200 cfs. The powerhouse is not operated many days during many months other than during the spring. Water is discharged from the Loon Lake powerhouse to Gerle Creek reservoir via 3.8 mile tunnel.

Robbs Peak Dam Reach

The existing flow regime in the Robbs Peak dam reach is a function of releases from Robbs Peak and Gerle Creek dams, spill events at both dams, and accretion along the 5.9-mile-long reach of the SFRR down to its confluence with the main stem Rubicon River. Major inflow sources to Gerle Creek dam include the discharge from the Loon Lake powerhouse and Gerle Creek. At the small Gerle Creek reservoir, water is diverted to Robbs Peak reservoir via a 1.9-mile-long canal (see figures 3-1 and 3-2). The release from Gerle Creek dam enters the Robbs Peak dam reach 1.1 miles downstream of Robbs Peak dam. The current license requires a combined release from the two dams ranging from 5 to 11 cfs measured at USGS gage no. 11430000 (SFRR below Gerle Creek) depending on month and water year type. These releases constitute the primary sources of flow at the confluence of the SFRR and Gerle Creek, as each segment of the reach extends about 1 mile, with little contribution from accretion. Downstream of the confluence of SFRR and Gerle Creek, the reach drops precipitously through a deeply incised canyon with no major tributaries. Accretion within the reach is low given the lack of tributaries. During the spring runoff period, the median monthly accretion throughout the reach is between 40 and 100 cfs in BN and AN water years. Similarly, accretion in summer/fall is about 5 to 10 cfs.

Flow from Robbs Peak reservoir is diverted by a 3.6 mile tunnel and penstock to the Robbs Peak powerhouse along the shoreline of Union Valley reservoir, within the Silver Creek portion of the SFAR watershed. Because Robbs Peak powerhouse relies largely on water from Loon Lake and lesser amounts from Gerle Creek and Robbs Peak reservoirs, Robbs Peak powerhouse operates similarly to Loon Lake powerhouse as a daily peaking unit with high load settings and is turned off during non peaking periods.

Ice House Dam Reach

The existing flow regime in the Ice House dam reach is similar to that of the other high elevation project reaches although the elevation of the reach is about 1,000 feet lower than the others. The existing release schedule at Ice House dam (as measured at USGS gage no. 11441500, SFSC below Ice House dam), ranges from winter lows of 3 cfs to summer highs of 15 cfs in wet years, but is less variable in other water year types. Despite the fact that inflow to Ice House reservoir from the SFSC typically falls to very low values in late summer and early fall, releases from Ice House dam during this low-flow period are between 5 and 15 cfs because of the reservoir's storage capacity. Generally, during this low-flow period, accretion in the reach below the dam is low with normal rates less than 10 cfs, which results in the 5 to 15 cfs releases accounting for a substantial amount of the stream flow throughout the course of the 11.5-mile-long reach.

During the snowmelt runoff, flows in the Ice House reach are substantially higher than the minimum release values because of the substantial accretion runoff from tributaries. Daily flows in the reach during winter and spring are quite variable, with short duration peaks in winter reaching highs of over 1,000 cfs. Like the other high elevation reaches, winter base flows are generally low because precipitation that falls on the watershed in the form of snow remains frozen during winter. Ice House reservoir does not spill regularly. Flow is diverted at Ice House reservoir to the Jones Fork powerhouse (measured by gage no. 11440900) on the shoreline of Union Valley reservoir. The Jones Fork powerhouse is typically operated as a daily peaking unit with high load settings and is turned off during non peaking periods. The amount of flow diverted to Jones Fork powerhouse typically peaks in June, with median monthly flows slightly above 70 cfs, and decreases to flows less than 10 cfs in October and November.

Junction Dam Reach

In contrast to the upstream project reaches, the flow regime in the Junction dam reach is influenced by different timing of minimum releases, accretion, and spill events. The minimum release schedule from Junction dam ranges from a low of 5 cfs to a high of 20 cfs depending upon month and water year type. Flows up to 40 cfs are measured by USGS gage no. 11441800 (Silver Creek below Junction dam). Flows in the reach are augmented by accretion from small tributaries that enter Silver Creek over the 8.3-mile reach. However, because of the lower elevation of the project reach watershed, the timing of accretion flow is shifted with respect to that of the higher elevation project reaches. Most of the precipitation that falls into the reach watershed does so as rain during winter storms. Therefore the pattern of accretion runoff peaks in February and March, with median monthly flows of between 100 and 150 cfs in BN and AN water years. Another feature of the accretion pattern evident in the Junction dam reach is the higher volume of inflow entering Silver Creek in the summer/fall. In contrast to the upper reaches of the UARP, the watersheds in the lower reaches have deeper soil layers overlaying the bedrock, resulting in more moisture retention into the summer/fall, and thus, more accretion during the low-flow period. The resulting daily flows in Silver Creek downstream of Junction dam range from summer/fall lows of 20 to 40 cfs to winter highs of 100 to 200 cfs. The pattern of flow in the reach is more variable because the high flow events are dominated by winter rain events rather than by a sustained snowmelt.

Spill events occur in AN and Wet water years, typically during winter storms, due in part to the inflow from SFSC and Little Silver Creek, a direct tributary to Junction reservoir. February and March spill rates during normal and wet years range from about 500 to 2,000 cfs. Flow is diverted at Junction reservoir to the Jaybird powerhouse (measured by gage no. 11441780) located at Camino reservoir. SMUD states that the normal operation of Jaybird powerhouse is continuous baseload due to discharge problems with two generators, but preferred operation is full load daily peaking. The amount of flow diverted to Jaybird powerhouse typically peaks in May with median monthly flows near 900 cfs and decreases to median flows near 350 cfs in October and November.

Camino Dam Reach

The existing flow regime in the Camino dam reach is very similar to that of the Junction dam reach, and the timing of flows in the reach is driven by the similar influences. The minimum release schedule of Camino dam is the same as Junction dam, ranging from 5 to 20 cfs, depending upon month and water year type. Flow is measured at USGS gage no. 11441900 (Silver Creek below Camino dam), which also measures spillage from the dam. The volume and timing of accretion entering the Camino dam reach differs from the Junction dam reach due to its lower elevation and lack of substantial tributaries in its 6.2 mile distance.

Due to the lower elevation of the reach, most of the winter precipitation falls as rain, resulting in highest flows occurring in the winter. The accretion pattern in summer and fall in the Camino dam reach is similar to that described in the Junction dam reach, but the volume is lower. The median monthly accretion levels in the Camino dam reach are generally less than 10 cfs, and the resulting daily flows in the Camino dam reach range from summer lows of approximately 10 to 20 cfs to winter highs of between 50 and 100 cfs.

SMUD states that spills into the Camino dam reach occur in Wet and AN years, mostly in the winter months of February and March, and normal spill rates are about 500 to 2,000 cfs. Flow is diverted at Camino reservoir to the Camino powerhouse (measured by gage no. 11441895), located upstream of Slab Creek reservoir. According to SMUD, normal unit operation is near full load during peak periods of the day, when water is available. The amount of flow diverted to Camino powerhouse typically peaks in July through September with median monthly flows over 700 cfs and decreases to median flows near 350 cfs in October and November.

The confluence of Silver Creek with the SFAR occurs about 2.8 miles upstream of the Camino powerhouse. The El Dorado Project (FERC Project No. 184) is located on the SFAR and consists of four lakes in the upper portion of the watershed and operated by the El Dorado Irrigation District (EID) to supplement flows in the SFAR. EID operates these lakes to retain spring and early summer snowmelt for releases later in the year. This allows EID to meet the consumptive needs of its downstream water users during the drier July through the early winter period. EID diverts water from the SFAR at a diversion dam about 22 river miles upstream of the Camino powerhouse as well as from small tributaries along the south side of the SFAR above the confluence with Silver Creek. EID withdraws a total of 15,080 acre-feet per year at rates up to 40 cfs in April through October and 10 to 20 cfs the reminder of the year (FERC, 2003). The water diverted into the canal, which has an annual mean flow of 100 cfs (FERC, 2003), in excess of that needed for downstream consumptive users is directed to the El Dorado powerhouse located along the SFAR just upstream of the Camino powerhouse. According to the USGS (USGS, 2007), flows in the SFAR downstream of the El Dorado diversion dam, as measured at USGS gage 11439500 (SFAR near Kyburz), peak in May with a monthly median flow near 1,000 cfs and quickly decrease to monthly median flows near 50 cfs during the July through November.

Brush Creek Dam Reach

The existing flow regime at Brush Creek dam is primarily the result of releases from Brush Creek dam and accretion over the 2.2-mile project reach. Minimum releases from the dam range between 2 and 6 cfs, depending on month and water year type, as shown in table 3-9. These flows are measured at USGS gage no. 11442700 (Brush Creek below Brush Creek reservoir). No major tributaries enter Brush Creek along its short and steep descent to Slab Creek reservoir, therefore the only flow augmentations to the dam releases are the accretion flows that accumulate within the immediate watershed of the stream segment. SMUD states that the median monthly accretion during the winter runoff period range between 10-20 cfs and drops to 1-2 cfs in summer and fall.

Slab Creek Dam Reach

The existing minimum release schedule at Slab Creek dam ranges from 10 to 36 cfs, depending on month and water year type, and flows are measured at USGS gage no. 11443450 (SFAR near Camino), which also measures spillage from Slab Creek dam. Reach flows are augmented by several tributaries that flow into the SFAR along the 8.0-mile reach, including Iowa Canyon, Mosquito, and Rock Creek. Rock Creek, which is located about five miles downstream of Slab Creek dam, is the largest of the tributaries, draining a watershed of 74.5 square miles. On Rock Creek, there are diversion weirs that divert water to the Rock Creek powerhouse (FERC Project P-3189 operated by Enel North America Inc.), which is operated in a run-of river-mode and only when inflow is greater than the minimum flow requirements (FERC, 2003). Combined inflow to the SFAR from the powerhouse and bypassed reach[27] of Rock Creek peak in March and April, with flows near 50 cfs, and low flows occur in August through October, with flows slightly under 10 cfs. SMUD estimates that during February and March, these tributaries contribute median monthly accretion of about 200 to 300 cfs in BN and AN water years and 15 to 30 cfs during the summer/fall low flow period.

Spill at Slab Creek dam occurs primarily during winter and spring. Winter storms, such as rain-on-snow events in the upper SFAR Basin, can result in large, short-duration flows entering Slab Creek reservoir and spill events at the dam. Also, in Wet and AN water years, the SFAR spring snowmelt often leads to flows that exceed the capacity of Slab Creek reservoir and the White Rock tunnel, resulting in spillage at the dam. The AN and Wet year spring spill events are generally longer in duration (lasting for weeks and months) and lower in magnitude, generally augmenting flow in the reach by less than 10,000 cfs.

Flow is diverted by a 4.9 mile tunnel from Slab Creek reservoir to the White Rock powerhouse (measured by gage no. 11443460) on Chili Bar reservoir. Normal unit operation is near full load during peak periods of the day, when water is available, and the powerhouse is commonly shutdown during off peak periods. The amount of flow diverted to White Rock powerhouse typically peaks in May, with median monthly flows near 2,100 cfs, and decreases to median flows near 450 cfs in October and November. The Slab Creek powerhouse is located at the

[27]Median flows for USGS gage no. 11444280, Rock Creek powerhouse near Placerville, and USGS gage no. 11444201, Rock Creek near Placerville.

base of Slab Creek dam and has a maximum hydraulic capacity of 36 cfs. The powerhouse uses the minimum flow releases for power generation.

Chili Bar Dam Reach

The existing minimum release at Chili Bar dam is 100 cfs, but according to PG&E, due to project operations, the minimum flow released is typically 200 cfs. This flow is measured at USGS gage no. 11444500 (SFAR near Placerville) and also measures powerhouse flow and dam spillage. Flows in the reach are augmented by several tributaries such as Greenwood and Weber creeks in the 19.1 mile segment downstream of Chili Bar dam before the tailwater associated with the large Folsom reservoir. As is the case with the Slab Creek dam reach, accretion from these low elevation tributaries can be substantial during runoff from winter rain events, but accretion is low during the June through October period.

PG&E operates the Chili Bar powerhouse near the base of the dam as a daily peaking plant during the mid June through October period or when water is not available to operate the plant at full capacity. This operation normally results in the flow changing from about 200 to about 2,000 cfs during most days, but in drier years the flows typically peak between 1,100 and 1,500 cfs. On other days or periods when more flow is available, outflow from White Rock powerhouse and spillage over Chili Bar dam can cause daily flows to reach over 3,600 cfs. Median daily flows as measured at USGS gage no. 11444500, peak at 2,300 cfs in May and are below 600 cfs in October and November. Short-duration spillage at Chili Bar dam occurs on a relatively regular basis, similar to Slab Creek dam, from winter storm events. Longer duration spillage flows are common during normal and wet years during peak snowmelt periods from the upper watershed.

Tables 3-4 through 3-10 summarize the current minimum streamflow requirements for the stream reaches which vary by water year type and or month. The current minimum streamflow requirement for the SFAR below Chili Bar dam is 100 cfs regardless of the water year type.

Table 3-3. Data for project reaches. (Source: SMUD, 2005; PG&E, 2005, as modified by staff)

Section	Reach Name	Upstream and Downstream Termini	Length (miles)	Elevation Range (feet, from base of dam)	Average Gradient (percent)
Main Stem	Rubicon dam	Rubicon dam–Miller Creek	4.2	6,509–6,046	1.9
Little Rubicon	Rockbound dam	Rockbound dam–Buck Island reservoir	0.3	6,529–6,436	7.2
	Buck Island dam	Buck Island dam–Rubicon River	2.5	6,413–5,945	2.9
Gerle Creek	Loon Lake dam	Loon Lake dam–Gerle reservoir	8.5	6,320–5,231	2.3
Gerle Creek (cont.)	Gerle Creek dam	Gerle Creek dam–SFRR	1.2	5,170–4,980	3.5
SFRR	Robbs Peak dam	Robbs Peak dam–Rubicon River	5.9	5,817–3,540	5.5
Silver Creek	SFSC	Ice House dam–Junction reservoir	11.5	5,300–4,450	1.4
	Main Stem	Junction dam–Camino reservoir	8.3	4,290–2,915	3.2
		Camino dam–SFAR	6.2	2,810–2,055	2.3
SFAR	Brush Creek	Brush Creek dam–Slab Creek reservoir	2.2	2,710–1,850	9
	Main Stem	Silver Creek–Slab Creek reservoir	2.8	2,055–1,850	1.2
	Main Stem	Slab Creek dam–Chili Bar reservoir	8	1,650–995	1.5
	Main Stem	Chili Bar dam–Folsom reservoir	19.1	930–430	0.5

Table 3-4. Current minimum streamflow requirements (cfs) for SFRR below Robbs Peak dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	1	1	3	3
November	1	1	1	1
December	1	1	1	1
January	1	1	1	1
February	1	1	1	1
March	1	1	1	1
April	1	1	1	1
May	1	1	3	3
June	1	1	3	3
July	1	1	3	3
August	1	1	3	3
September	1	1	3	3

Table 3-5. Current minimum streamflow requirements (cfs) for Gerle Creek below Gerle Creek dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	4	4	7	7
November	4	4	4	4
December	4	4	4	4
January	4	4	4	4
February	4	4	4	4
March	4	4	4	4
April	4	4	4	4
May	4	4	7	7
June	4	4	7	7
July	4	4	7	7
August	4	4	7	7
September	4	4	7	7

Table 3-6. Current minimum streamflow requirements (cfs) for SFSC below Ice House dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	5 or NF	5 or NF	12 or NF	12 or NF
November	5 or NF	5 or NF	10/4 or NF	10/4 or NF
December	5 or NF	5 or NF	4 or NF	4 or NF
January	5 or NF	5 or NF	3 or NF	3 or NF
February	5 or NF	5 or NF	3 or NF	3 or NF
March	5 or NF	5 or NF	3 or NF	3 or NF
April	5 or NF	5 or NF	3 or NF	3 or NF
May	5 or NF	5 or NF	8 or NF	8 or NF
June	5 or NF	5 or NF	8 or NF	8 or NF
July	5 or NF	5 or NF	15 or NF	15 or NF
August	5 or NF	5 or NF	15 or NF	15 or NF
September	5 or NF	5 or NF	15 or NF	15 or NF

Table 3-7. Current minimum streamflow requirements (cfs) for Silver Creek below Junction dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	5	10	15	20
November	5	6	8	10
December	5	6	8	10
January	5	6	8	10
February	5	6	8	10
March	5	6	8	10
April	5	6	8	10
May	5	10	15	20
June	5	10	15	20
July	5	10	15	20
August	5	10	15	20
September	5	10	15	20

Table 3-8. Current minimum streamflow requirements (cfs) for Silver Creek below Camino dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	5	10	15	20
November	5	6	8	10
December	5	6	8	10
January	5	6	8	10
February	5	6	8	10
March	5	6	8	10
April	5	6	8	10
May	5	10	15	20
June	5	10	15	20
July	5	10	15	20
August	5	10	15	20
September	5	10	15	20

Table 3-9. Current minimum streamflow requirements (cfs) for Brush Creek below Brush Creek dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	2	2	3	3
November	4	4	6	6
December	4	4	6	6
January	4	4	6	6
February	4	4	6	6
March	4	4	6	6
April	4	4	6	6
May	4	4	6	6
June	2	2	3	3
July	2	2	3	3
August	2	2	3	3
September	2	2	3	3

Table 3-10. Current minimum streamflow requirements (cfs) for SFAR below Slab Creek dam. (Source: SMUD, 2005, as modified by staff)

Month	Type 1	Type 2	Type 3	Type 4
October	36	36	36	36
November	36/10	36/10	36	36
December	10	10	36	36
January	10	10	36	36
February	10	10	36	36
March	10	10	36	36
April	10	10	36	36
May	10	10	36	36
June	36	36	36	36
July	36	36	36	36
August	36	36	36	36
September	36	36	36	36

Table 3-11. Monthly discharge (cfs) statistics for gages in the project area. (Source: USGS, 2007)

	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly
Rubicon Development	**USGS Gage No. 11427940 Rubicon-Rockbound Tunnel (water years 1992–2005)**							**USGS Gage No. 11427960 Rubicon River below Rubicon Lake (water years 1992–2005)**						
Mean	58.0	365.4	313.5	115.9	16.1	2.8	101.8	5.9	7.5	7.2	6.6	4.9	3.0	5.9
Median	35.4	331.5	266.5	37.0	0.1	0.0	25.0	5.8	7.4	7.1	6.6	6.2	1.6	6.6
Max.	875	973	896	858	248	105	1,180	8.8	9.3	9.2	8.6	8.0	7.9	9.4
Min.	4.2	0.0	0.0	0.0	0.0	0.0	0.0	3.7	6.0	5.7	0.8	0.3	0.1	0.1
10% Exceed.	113.7	705.1	671.1	344.5	52.7	7.5	329.0	7.2	8.6	8.2	7.8	7.6	7.0	7.7
90% Exceed.	10.8	118.6	16.0	0.0	0.0	0.0	0.0	4.8	6.6	6.3	5.9	1.1	0.8	1.3
Buck Island Development	**USGS Gage No. 11428300 Buck-Loon Tunnel (water years 1992–2005)**							**USGS Gage No. 11428400 Little Rubicon River below Buck Island Dam (water years 1992–2005)**						
Mean	76.4	462.8	392.6	138.1	18.4	2.5	129.3	1.3	1.4	1.4	1.3	1.2	1.2	1.3
Median	48.0	429.5	335.5	35.0	0.6	0.1	31.0	1.2	1.3	1.3	1.2	1.2	1.2	1.3
Max.	940	1,160	1,070	1,040	313	80	1,160	1.8	2.0	1.8	1.6	1.7	1.5	2.0
Min.	5.7	16.0	0.5	0.0	0.0	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	0.0
10% Exceed.	157.8	899.0	854.2	441.5	54.4	1.3	427.0	1.4	1.6	1.6	1.4	1.4	1.4	1.5
90% Exceed.	14.4	152.2	19.9	0.2	0.0	0.0	0.0	1.1	1.2	1.2	1.1	1.1	1.1	1.1

	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly
Loon Lake Development	**USGS Gage No. 11429340 Loon Lake Powerhouse (water years 1992–2005)**							**USGS Gage No. 11429500 Gerle Creek below Loon Lake (water years 1992–2005)**						
Mean	117.4	188.1	273.4	233.3	185.4	101.0	150.1	10.4	13.7	10.3	10.6	9.7	9.8	10.6
Median	40.5	143.5	222.0	199.5	152.5	12.0	52.0	10.1	10.0	9.9	9.5	9.5	9.5	9.9
Max.	796	1,030	990	935	869	773	1,030	27.0	403	16	50	13	13	403
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	8.2	8.0	8.9	8.3	8.3	8.0
10% Exceed.	352.7	436.1	664.7	507.0	461.7	368.5	434.0	12.0	14.0	12.0	12.0	12.0	12.0	12.0
90% Exceed.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	9.1	8.9	9.2	8.9	8.7	8.9
Robbs Peak Development	**USGS Gage No. 11429300 Robbs Peak Powerhouse (water years 1992–2005)**							**USGS Gage No. 11430000 SF Rubicon River below Gerle Creek (water years 1992–2005)**						
Mean	252.4	500.6	404.8	252.0	184.4	101.7	267.6	20.5	40.3	14.1	10.5	10.5	10.7	19.2
Median	197.6	494.5	312.5	216.5	152.5	3.0	184.0	8.8	11.0	11.0	11.0	11.0	11.0	11.0
Max.	1,042	1,190	1,180	1,150	874	758	1,220	2,018	3,200	203	20	14	26	8,050
Min.	6.6	0.5	0.0	0.0	0.0	0.0	0.0	5.2	5.3	5.1	5.2	5.1	5.1	5.1
10% Exceed.	533.7	932.4	943.1	529.3	469.7	378.2	681.1	13.0	15.0	13.0	12.0	13.0	13.0	13.0
90% Exceed.	45.2	73.0	1.0	0.5	0.5	0.0	0.5	6.1	6.1	6.6	6.6	6.0	6.1	6.0
Ice House Development	**USGS Gage No. 11440900 Jones Fork Powerhouse (water years 1988–2005)**							**USGS Gage No. 11441500 South Fork of Silver Creek (water years 1988–2005)**						
Mean	56.8	77.7	93.4	61.4	62.0	67.9	63.3	8.0	13.4	26.5	16.5	13.4	13.5	11.6
Median	27.4	31.5	65.5	31.5	43.0	26.5	34.0	6.7	9.7	9.4	16.0	16.0	16.0	6.2

	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly
Max.	270	287	285	285	254	264	287	418	1,250	457	250	20	25	2,840
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	5.1	5.1	5.2	5.1	5.1	3.0
10% Exceed.	158.3	256.3	262.0	172.5	162.2	194.2	180.0	8.7	11.0	13.0	19.0	19.0	20.0	17.0
90% Exceed.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	5.8	5.6	5.7	5.6	5.5	4.8
Junction Development	**USGS Gage No. 11441780 Jaybird Powerhouse (water years 1992–2005)**							**USGS Gage No. 11441800 Silver Creek below Junction Dam (water years 1992–2005)**						
Mean	512.6	735.3	737.0	678.0	757.1	688.4	598.7	11.2	18.2	17.9	18.3	18.5	18.5	14.2
Median	440.6	777.0	654.0	647.5	758.0	723.5	492.0	12.4	21.0	21.0	21.0	21.0	21.0	11.0
Max.	1,331	1,400	1,400	1,490	1,390	1,370	1,490	26.9	30.0	23.0	27.0	30.0	28.0	37.0
Min.	0.0	0.0	0.0	0.0	0.5	0.0	0.0	5.7	5.6	5.6	5.7	5.7	5.6	5.4
10% Exceed.	1,032.5	1,390	1,390	1,237	1,280	1,200	1,287	13.9	22.0	22.0	22.0	23.0	22.0	22.0
90% Exceed.	74.7	74.7	181.8	280.3	337.8	194.7	106.0	6.8	11.0	11.0	11.0	11.0	11.0	6.9
Camino Development	**USGS Gage No. 11441895 Camino Powerhouse (water years 1988–2005)**							**USGS Gage No. 11441900 Silver Creek below Camino Dam (water years 1988-2005)**						
Mean	514.4	661.2	667.9	673.1	749.5	680.1	585.8	73.7	95.3	117.8	120.5	86.6	78.5	80.7
Median	402.9	378.0	520.5	636.5	761.0	705.0	453.0	15.1	15.3	16.9	18.4	19.6	20.5	20.1
Max.	1,407	1,560	1,510	1,530	1,440	1,470	1,560	5,904	6,868	7,177	6,941	2,247	2,017	6,504
Min.	1.2	0.0	0.0	0.0	4.0	0.0	0.0	5.7	5.6	5.6	5.6	5.6	5.5	5.3
10% Exceed.	1,057.7	1,440	1,450	1,160	1,260	1,162	1,310	62.5	101.0	214.5	215.5	210.4	195.3	184.7

	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly	Avg. (Oct–Apr)	May	Jun	Jul	Aug	Sept	Yearly
90% Exceed.	107.1	85.0	131.3	279.4	338.0	245.9	116.0	7.5	7.3	7.2	7.0	7.0	6.9	6.5
Slab Creek Development	**USGS Gage No. 11443460 Whiterock Powerhouse (water years 1988–2005)**							**USGS Gage No. 11443500 SFAR near Camino, CA (water years 1988–2005)**						
Mean	974.4	1,884.3	1,482.6	971.8	841.9	759.1	1,062.7	130.5	282.5	287.4	93.1	36.9	37.3	122.0
Median	810.2	1,680	1,055	795.5	768.0	723.0	755.0	36.4	37.0	38.0	37.0	37.0	37.0	37.0
Max.	3,304	3,940	3,910	3,860	2,710	2,740	3,950	10,249	12,400	4,260	2,800	43	42	48,900
Min.	0.0	226.0	1.0	0.0	0.0	0.0	0.0	13.3	10.0	28.0	36.0	29.0	29.0	10.0
10% Exceed.	1,903	3,530	3,271	1,876	1,520	1,360	2,600	68.2	248.6	905.1	40.0	40.0	40.0	40.0
90% Exceed.	272.2	541.6	324.9	314.4	308.7	233.9	229.0	13.7	10.0	36.0	36.0	36.0	36.0	10.0
Brush Creek Development	**USGS Gage No. 11442700 Brush Creek below Brush Creek Dam (water years 1988–2005)**							**USGS Gage No. 11444500 SFAR near Placerville (water years 1988–2005)**						
Mean	6.1	6.1	3.5	3.2	3.2	3.2	5.1	1,238.1	2,377.6	1,883.1	1,114.8	925.6	838.3	1,316.1
Median	6.3	6.6	3.4	3.4	3.4	3.4	4.4	960.9	1,835	1,195	903.0	836.5	766.5	854.0
Max.	97.6	9.3	8.8	6.9	4.1	7.6	620	15,064	16,900	7,000	5,770	2,760	2,890	57,100
Min.	3.8	4.2	2.2	2.1	2.1	2.1	2.1	142.0	210.0	125.0	114.0	130.0	113.0	98.0
10% Exceed.	6.7	7.1	4.4	4.0	3.8	3.9	7.0	2,335.8	4,360	4,789	2,016	1,600	1,480	3,020
90% Exceed.	4.1	4.4	2.4	2.4	2.3	2.4	2.6	337.0	583.4	400.8	388.0	390.4	342.0	313.4

Note: All data for 1988 to 2005 water years.

Water Use

As table 3-12 shows, SMUD currently holds five licenses and one permit issued by the Water Board for water rights related to the UARP. These water rights authorize SMUD to directly divert and store water to generate hydroelectric power, provide recreation, and protect wildlife at its UARP facilities. PG&E is also listed as a water user for hydroelectric power use at its Chili Bar Project facilities. The current water rights licenses and permits incorporate the minimum instream flow releases mandated in the current Commission license. To improve water quality and benefit aquatic resources, the Proposed Action would increase the instream flow releases mandated in the FERC license.

Table 3-12. Summary of water rights in the UARP and Chili Bar Projects. (Source: Water Board, 2005)

License/ Permit/ Priority (date)	Source(s)	Quantity: Direct Diversion	Quantity: Storage	Quantity Cap	Diversion Season	Beneficial Use
License 11073 Application 12323 2/13/1948	SFSC Silver Creek	400 cfs at Ice House, Union Valley, Junction, and Camino dams	49,700 acre-feet annually in Ice House reservoir 195,000 acre-feet annually in Union Valley reservoir	459,300[a] acre-feet annually (max. total storage 238,900 acre-feet annually)	Direct diversion: 1/1–12/31 Storage: 10/1–7/31	Recreation, Power at Jones Fork, Union Valley, Jaybird, Camino, White Rock, Slab Creek, and Chili Bar powerhouses
License 11074 Application 12624 7/29/1948	Rubicon River Little Rubicon River (aka Rockbound Creek) Gerle Creek SFRR	500 cfs at Rubicon dam 200 cfs at Buck Island dam 325 cfs at Loon Lake and Gerle dam 175 cfs at Robbs Peak dam	450 acre-feet annually in Rubicon reservoir, 440 acre-feet annually in Buck Island reservoir, 92,000 acre-feet annually in Loon Lake reservoir, 141,500 acre-feet annually in Union Valley reservoir	281,100[b] acre-feet annually (max. total storage 226,900 acre-feet annually)	Direct diversion: 1/1–12/31 Storage: 10/1–7/31	Recreation, Wildlife Protection and Enhancement, Power at Loon Lake, Robbs Peak, Union Valley, Jaybird, Camino, White Rock, Slab Creek, and Chili Bar powerhouses

License/ Permit/ Priority (date)	Source(s)	Quantity		Quantity Cap	Diversion Season	Beneficial Use
		Direct Diversion	Storage			
License 10495 Application 14963 8/12/1952	Silver Creek	400 cfs at Union Valley, Junction, and Camino dams	NA	NA	Direct diversion: 1/1–12/31	Power at Union Valley, Jaybird, Camino, White Rock, Slab Creek, and Chili Bar powerhouses
	SFAR	800 cfs at Slab Creek and Chili Bar dams	NA	NA		
License 10496 Application 20522 12/12/62	SFAR Brush Creek	1,900 cfs at Brush Creek, Slab Creek and Chili Bar dams	NA	NA	Direct diversion: 1/1–12/31	Power at White Rock, Camino, Slab Creek and Chili Bar powerhouses
License 10513 Application 22110 4/23/1965	SFAR	800 cfs[c] at Slab Creek and Chili Bar dams	NA	NA	Direct diversion: 1/1–12/31	Power at White Rock, Chili Bar and Slab Creek powerhouses
Permit 19025 Application 26768 3/30/81	SFSC	270 cfs at Ice House dam	60,000 acre-feet annually in Ice House and Union Valley reservoirs	NA	Direct diversion: 1/1–12/31 Storage: 10/1–7/31	Power at Union Valley and Jones Fork powerhouses

[a] The total amount of water to be taken from the sources (direct diversion plus collection to storage) shall not exceed 459,300 acre-feet annually. The total amount of water to be placed to beneficial use (flow through Jaybird powerhouse) under license 11073 and license 10495 shall not exceed 528,400 acre-feet annually.

[b] The quantity of water to be put to beneficial use at Robbs Peak powerhouse shall not exceed 250,000 acre-feet annually.

[c] The maximum average amount diverted in any 30-day period through the White Rock powerhouse from Slab Creek dam under Licenses 10513, 10495, and 10496 shall not exceed 3,500 cfs.

On May 24, 2005, SMUD filed two water rights applications to the Water Board: (1) application no. 31595 for sources from the Rubicon River and (2) application no. 31596 for diversions from Silver Creek and SFAR sources. The applications involve the use of SMUD's existing facilities, including increases in individual storage rights in reservoirs above the volumes authorized by SMUD's existing water right licenses and permit. Water proposed to be stored under these applications would not exceed the total quantity that SMUD is currently licensed to store under licenses 11073 and 11074. In its water rights application, SMUD states that this application does not propose a change to the historical operations of the UARP.

Application 31595 requests a permit to directly divert water from Rubicon River sources to maximize use of its existing conveyance and power generation facilities. Because the water would be moved from the Middle Fork American River watershed to the SFAR watershed, it would flow into Folsom Lake by an alternate channel system. SMUD seeks to store the water in Rubicon, Buck Island, Gerle Creek, and Robbs Peak reservoirs for later release to provide for downstream recreational uses, releases for fish enhancement, and enhanced power generation.

Application 31596 requests a permit to divert water to storage from the Rubicon River, Silver Creek, and SFAR systems into the Camino Junction, Brush Creek, and Slab Creek reservoirs. SMUD seeks the additional storage to maintain consistent reservoir levels to maximize efficiency of power generation and to provide higher lake levels for recreation. The stored water would consist of a mix of new diversions and of re-diversions of water discharged from existing UARP facilities upstream.

According to the Water Board, Silver Creek, the American River, and their tributaries are listed as fully appropriated under Water Right Order 98-08, the Declaration of Fully Appropriated Stream Systems. Water right applications for diversions from stream systems that have fully appropriated status under Water Right Order 98-08 are subject to special conditions for acceptance, including limitations on seasons of diversion. However, the Water Board allows acceptance of water right applications that propose non-consumptive use of water, including hydropower generation, from fully appropriated sources. Water directly diverted under these applications would flow to Folsom Lake via the SFAR instead of the Middle Fork of the American River. SMUD made a case to the Water Board for its applications to fall within the definition of non-consumptive use. However, according to the Water Board, the notice of acceptance of these applications does not constitute a definitive finding by the Water Board that (1) the proposed use does not substantially diminish the quantity or quality of water in the source; or (2) the proposed use does not regulate the flow in the source in such a manner as to impair any other existing reasonable and beneficial use, including instream use.

Placer County Water Agency uses water of the Middle Fork of the American River for its Middle Fork American River Project (FERC No. 2079), which lies downstream of SMUD's UARP facilities in the Rubicon River watershed. Placer County Water Agency filed a protest letter (letter from F.E. Francis and W.S. Huang, Attorneys for Placer County Water Agency, Auburn, CA, dated January 23, 2007) with the Water Board against SMUD's 2005 application for new water rights licenses. The protest is based on its analysis that shows that SMUD has diverted water in excess of amounts permitted by the current licenses which has resulted in a reduction of energy production.

The Water Board will make a final determination regarding the water rights application following its normal procedures which might include a hearing, if necessary. Within the UARP or Chili Bar Project areas, there are no consumptive diversions such as those on the SFAR upstream of the confluence with Silver Creek at the El Dorado Project.

Water Quality

The existing and potential beneficial uses of waterbodies in the study area for the UARP and the Chili Bar Project, as determined by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) Basin Plan, 4th Edition (Central Valley Water Board, 2004) are presented in table 3-13. Although SMUD provided information on the beneficial uses for Desolation Valley Lakes, the Water Board considers these lakes to only be the lakes within Desolation Valley and therefore not applicable to waters affected by either of the Projects being evaluated in this EIS. Table 3-14 presents state standards and objectives for temperature, DO, pH, coliform bacteria, selected metals, and other physical parameters. The values presented include criteria set in the Basin Plan, drinking water standards, and California Toxics Rule. The highest level of a contaminant that is allowed in drinking water, maximum contaminant level (MCL), is included for several parameters. Primary MCLs are set to protect human health; whereas, secondary MCLs are set to protect the odor, taste, and appearance of drinking water. There are no numerical or narrative criteria for nutrients.

Table 3-13. Designated beneficial uses of surface waters in the study area. (Source: Central Valley Water Board, 2004)

Beneficial Use	Middle Fork[a]	SFAR, Upstream of Placerville[b]	SFAR, Placerville to Folsom Lake[c]
MUN: Municipal and domestic supply	Existing	Existing	Existing
AGR: Agriculture (irrigation and/or stock watering)	Existing	--	Existing
POW: Hydropower	Existing	Existing	Existing
REC-1: Water contact recreation	Existing	Existing	Existing
REC-2: Non-contact water recreation	Existing	Existing	Existing
WARM: Warm freshwater habitat	Potential	Potential	Existing
COLD: Cold freshwater habitat	Existing	Existing	Existing
SPWN: Cold freshwater habitat spawning	Existing	Existing	--
WILD: Wildlife habitat	Existing	Existing	Existing

Note: -- – not designated

[a] Applicable to surface waters of the Rubicon River and its tributaries including the Rubicon, Buck Island, Loon Lake, Gerle Creek, and Robbs Peak reaches.

[b] Applicable to surface waters associated with the Ice House, Union Valley, Junction, Camino, Brush Creek, and Slab Creek reaches.

[c] Applicable to surface waters associated with the Chili Bar Project.

Table 3-14. Water quality objectives to support designated beneficial uses in the study area. (Sources: Central Valley Water Board, 2004; CDHS, 2002; 40 CFR § 131.8)

Parameter	**Objective/Standard**
Temperature	Natural water temperatures of basin waters shall not be altered unless it can be demonstrated to the satisfaction of the Central Valley Water Board that such alteration does not affect beneficial uses. At no time or place, should water temperature be increased by more than 5°F (2.8°C) above natural receiving water temperature.
Dissolved oxygen	Monthly median of the mean daily DO concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percent concentration shall not fall below 75 percent of saturation. DO concentrations shall not be reduced below 7.0 mg/L.
pH	From 6.5 to 8.5 units, and changes of no more than 0.5 unit.
Fecal coliform bacteria	Based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200 MPN per 100 mL, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400 MPN/100 mL.
Settleable solids	Shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.
Turbidity	Shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: 1 NTU for natural turbidity of 0 to 5 NTU, 20 percent for 5 to 50 NTU, 10 NTU for 50 to 100 NTU, and 10 percent for natural turbidity greater than 100 NTU.
Chemical constituents	Water designated for use as domestic or MUN shall not contain concentrations of chemical constituents in excess of the MCLs specified in the various provisions of Title 22 of the California Code of Regulations.
Aluminum	Primary MCL 1,000 μg/L, Secondary MCL 200 μg/L
Iron (California Toxics Rule)	Secondary MCL 300 μg/L

Parameter	Objective/Standard
Lead[a]	Primary MCL: At a minimum, water designated for use as domestic or MUN shall not contain lead in excess of 15 μg/L. CCC of 0.13 μg/L, CMC of 3.44 μg/L
Mercury (California Toxics Rule)	Primary MCL 2.0 μg/L
Cadmium[a]	Primary MCL of 5 μg/L, CCC of 0.37 μg/L, CMC of 0.32 μg/L
Copper[a]	Secondary MCL 1,000 μg/L, CCC of 1.25 μg/L, CMC of 1.54 μg/L
Nickel[a]	Primary MCL of 100 μg/L, CCC of 7.41 μg/L, CMC of 66.75 μg/L
Silver[a]	Secondary MCL 100 μg/L, instantaneous maximum of 0.07 μg/L
Zinc[a]	Secondary MCL 5,000 μg/L, CCC of 16.79 μg/L, CMC of 16.66 μg/L

Note: mg/L – milligrams per liter

μg/L – micrograms per liter

CCC – criterion continuous concentrations

CMC – criterion maximum concentrations

MCL – maximum contaminant level

mL – milliliter

MPN – most probable number

MUN – municipal supply

NTU – nephelometric turbidity units

[a] The Basin Plan's toxicity water quality objective is to maintain waters free of toxic substance concentrations that produce detrimental physiological responses in human, plant, animal, and aquatic life. Therefore, we use criteria set in the California Toxics Rule (40 CFR § 131.8) to assess the support of these beneficial uses. These criteria are for dissolved metals, rather than total metals, are dependent on hardness, and include levels of CCC and CMC. Listed criteria were calculated based on a typical hardness of 10 mg/L as $CaCO_3$.

General Water Quality

General water quality is largely dependent on the geologic and hydrologic characteristics of a basin. Project area waters are soft, with hardness ranging from less than 1 to about 20 mg $CaCO_3$/L, and most total alkalinity measurements are below 10 mg $CaCO_3$/L, indicating a low capacity to buffer changes in pH. Concentrations of total suspended and dissolved solids are low, with values generally less than 10 mg/L. Water in the reservoirs is relatively clear, with Secchi depths ranging from about 10 to 30 feet. The trophic status of the reservoirs range from mesotrophic to oligotrophic, based on Secchi depth and total nitrogen and phosphorus concentrations. The maximum nitrate concentration in each reservoir and stream reach is generally well below the concentration of 1.0 mg/L, which SMUD used to characterize source waters that can stimulate growth of algae. However, large algal mats have been observed in the lower portion of the Junction dam reach, and excessive algal growth has been reported to occur in the Chili Bar dam reach (DTA and Stillwater Sciences, 2005a,b). Large amounts of algae also have been reported to occur in portions of the Ice House, Loon Lake, and Slab Creek dam reaches (DTA and Stillwater Sciences, 2005b). Organic compounds (including oil and grease, methyl-t-butyl ether, and total petroleum hydrocarbons) are below detection limits.

None of the project reservoirs or stream reaches was included on the 2002 section 303(d) list of water quality limited waterbodies for any water quality parameters (Central Valley Water Board, 2003).

Temperature—Table 3-15 presents a summary of thermal characteristics of each of the reservoirs along with other factors that have the potential to affect water temperature within and/or downstream of the reservoir. Five of the reservoirs (i.e., Rubicon, Buck Island, Gerle Creek, Robbs Peak, and Camino) do not typically thermally stratify. Each of these reservoirs has relatively small storage capacity and an average retention time of less than 5 days. Rockbound and Loon Lake, which are located at upper elevations, are dimictic[28] with turnover occurring prior to icing over and again in the spring after the ice cover melts. In contrast, several of the lower elevation reservoirs (i.e., Ice House, Union Valley, Junction, Brush Creek, and Slab Creek) are monomictic with turnover occurring once in the late fall and remaining well mixed until spring. These reservoirs do not ice over.

Table 3-16 summarizes the hourly water temperature data recorded with thermographs in the stream reaches during the relicensing studies conducted in 2000 through 2004. Hourly temperature data were collected during different periods at the sites. The table summarizes the hourly measurements by providing the absolute range of temperatures recorded, the maximum of the mean daily temperatures for each day (maximum mean temperature), and the months that had at least one day with a mean daily temperature that exceeded 20.0°C[29] for each of the monitoring sites. The summary indicates that temperatures remain relatively cool:

- throughout Loon Lake reach (8.5 miles);

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[28]Lakes and reservoirs that freeze over and normally go through two stratifications and two mixing cycles a year.

[29]We used daily average temperatures of greater than 20.0°C as an indicator of thermal conditions that may limit cold freshwater habitat. This is consistent with the Water Control Board’s approach for several other locations in the Sacramento River Basin.

Table 3-15. Summary of selected reservoir characteristics that affect water temperatures along with vertical profiles of water temperature collected by applicants, 2000 to 2004. (Source: DTA, 2005a, as modified by staff)

Reservoir	Normal Maximum Storage Capacity and Water Surface Elevation	Max. Depth (feet)	Average Retention Time (days)	Low-Level Outlet	Water Temperature (°C)[a]	Thermal Stratification Characteristics
Rubicon	1,450 acre-feet at 6,545 feet	9[b]	4.6	Centerline 6,523 feet, capacity 18 cfs	6.1 to 15.7 (1.2 on May 12, 2004)	Does not thermally stratify
Rockbound	1,010 acre-feet at 6,529 feet	82[b]	--	None	5.1 to 16.9 (9.1 on September 17, 2003)	Dimictic, develops strong thermal stratification with a 40-foot-deep epilimnion
Buck Island	1,070 acre-feet at 6,436 feet	33[b]	2.5	Centerline 6,420 feet, capacity 11.6 cfs	5.8 to 16.8 (2.2 on June 26, 2003)	Does not thermally stratify
Loon Lake	76,200 acre-feet at 6,410 feet	165	142.5	Centerline 6,327 feet, capacity 640 cfs	4.9 to 17.0 (7.7 on September 16, 2003)	Dimictic, weak thermal stratification
Gerle Creek	1,260 acre-feet at 5,231 feet	51	--	Centerline 5,186 feet, capacity 13.6 cfs	5.2 to 17.2 (2.3 on May 6, 2004)	Does not thermally stratify
Robbs Peak	30 acre-feet at 5,231 feet	--	--	Centerline 5,196 feet, capacity 4.3 cfs	No profile data	Does not thermally stratify
Ice House	45,960 acre-feet at 5,450 feet	138	162.3	Centerline 5327.5 feet, capacity 46.8 cfs	5.1 to 19.0 (12.9 on June 12, 2003)	Monomictic, develops strong thermal stratification with a 40-foot-deep epilimnion
Union Valley	277,290 acre-feet at 4,870 feet	360	261.6	None	5.1 to 20.3 (12.2 on October 1, 2002)	Monomictic, develops strong thermal stratification with a 60-foot-deep epilimnion

Reservoir	Normal Maximum Storage Capacity and Water Surface Elevation	Max. Depth (feet)	Average Retention Time (days)	Low-Level Outlet	Water Temperature (°C)[a]	Thermal Stratification Characteristics
Junction	3,250 acre-feet at 4,450 feet	141	1.5	Centerline 4,335 feet, capacity 138 cfs	5.7 to 14.3 (7.9 on May 5, 2004)	Monomictic, develops a thin (<10-foot-deep) epilimnion
Camino	825 acre-feet at 2,915 feet	76	0.3	Centerline 2,840 feet, capacity 112 cfs	9.4 to 10.1 0.0	Does not thermally stratify
Brush Creek	1,530 acre-feet at 2,915 feet	140	--	Centerline 2,775 feet, capacity 145 cfs	5.7 to 20.1 (11.2 on September 16, 2003)	Monomictic, develops strong thermal stratification with a 50-foot deep epilimnion
Slab Creek	16,600 acre-feet at 1,850 feet	186	2.2	Centerline 1,680 feet, capacity 263 cfs	5.7 to 19.1 (10.1 on May 4, 2004)	Monomictic, develops a thin (<10-foot-deep) epilimnion
Chili Bar	3,139 acre-feet at 997.5 feet	61[b]	1.3	Centerline 924 feet, capacity 1,100 cfs	8.2 to 17.5 (4.1 on September 15, 2003)	Little thermal stratification

Note: -- – not available

[a] Overall range of water temperatures measured in reservoir along with the maximum difference in water temperatures in any profiles and the corresponding date.

[b] Based on vertical profiles of water quality.

Table 3-16. Summary of hourly water temperature (°C) data collected by applicants for selected sites, 2000 to 2004.[a] (Source: DTA, 2005a, as modified by staff)

Reach	Site	Absolute Min.	Absolute Max.	Max. Mean[b]	Months with Mean >20.0°C[c]
Rubicon Reservoir Tributary[d]					
	Rubicon River upstream of Rubicon reservoir (RR4)[d]	–1.9	26.8	21.3	July to August
Rubicon Dam Reach (4.2 miles)					
	Rubicon River at Rubicon dam (RR3)	–0.2	22.7	22.2	July to August
	Rubicon River upstream of Rubicon Springs (RR2)	0.0	24.1	21.9	July to August
	Rubicon River downstream of Little Rubicon River (RR1)	–0.1	23.7	22.9	June to August
Buck Island Dam Reach (2.5 miles)					
	Little Rubicon at Buck Island dam (LRR2)	–0.4	23.6	22.9	June to September
	Little Rubicon River upstream of Rubicon River (LRR1)	0.0	26.4	23.7	July to August
Loon Lake Dam Reach (8.5 miles)					
	Gerle Creek at Loon Lake dam (GC6)	0.7	17.1	16.9	None
	Gerle Creek upstream of Jerrett Creek (GC5)	–0.2	19.1	15.8	None
	Gerle Creek downstream of Barts Creek (GC4)	0.0	20.1	18.2	None
	Gerle Creek upstream of Gerle Creek reservoir (GC3)	–0.3	24.3	19.8	None
Gerle Creek Dam Reach (1.2 miles)					
	Gerle Creek at Gerle Creek dam (GC2)	–0.2	18.6	18.4	None
	Gerle Creek upstream of S.F. Rubicon River (GC1)	0.0	19.3	17.0	None
Robbs Peak Dam Reach (5.9 miles)					
	S.F. Rubicon River upstream of Robbs Peak forebay (SFRR4)[d]	–0.6	24.5	21.3	July
	S.F. Rubicon River at Robbs Peak forebay dam (SFRR3)	–0.3	23.1	22.5	July to August

Reach	Site	Absolute Min.	Absolute Max.	Max. Mean [b]	Months with Mean >20.0°C[c]
	SF Rubicon River upstream of Gerle Creek (SFRR2)	0.0	20.2	18.4	None
	S.F. Rubicon River downstream of Gerle Creek (SFRR1)	–0.2	20.4	18.8	None
	S.F. Rubicon River 2 miles downstream of Gerle Creek (SFRR.5) [e]	3.0	19.7	18.1	None
Ice House Reservoir Tributary					
	S.F. Silver Creek upstream of Ice House reservoir (SFSC6)[d]	0.0	21.7	19.7	None
Ice House Dam Reach (11.5 miles)					
	S.F. Silver Creek at Ice House dam (SFSC5)	2.8	8.6	8.0	None
	S.F. Silver Creek upstream of Ice House dam road (SFSC4)	–0.2	13.9	8.6	None
	S.F. Silver Creek downstream of Ice House dam road (SFSC3)	0.1	15.9	10.8	None
	S.F. Silver Creek midway between burn area (SFSC2)	–0.1	26.0	20.7	July to August
	S.F. Silver Creek upstream of Junction reservoir (SFSC1)	–0.2	26.0	21.3	July to August
Junction Dam Reach (8.3 miles)					
	Silver Creek at Junction dam (SC4)	–0.2	13.4	11.2	None
	Silver Creek upstream of Jaybird powerhouse (SC3)	–0.1	22.0	20.2	July
Camino Dam Reach (6.2 miles)					
	Silver Creek at Camino dam (SC2)	0.0	15.3	12.7	None
	Silver Creek upstream of SFAR (SC1)	0.5	25.5	23.2	May to August
SFAR Reach (2.8 miles)					
	SFAR upstream of Silver Creek (SFAR12) [d]	–0.1	26.7	24.3	June to September
	SFAR downstream of Silver Creek (SFAR11)	0.0	25.9	23.7	June to September

Reach	Site	Absolute Min.	Absolute Max.	Max. Mean [b]	Months with Mean >20.0°C[c]
	SFAR downstream of Camino powerhouse (SFAR10)	0.4	24.7	21.9	July to August
Brush Creek Dam Reach (2.2 miles)					
	Brush Creek upstream of Brush Creek dam (BC3) [d]	5.8	18.6	16.9	None
	Brush Creek at Brush Creek dam (BC2)	1.9	19.0	18.7	None
	Brush Creek upstream of Slab Creek reservoir (BC1)	3.7	20.5	19.9	None
Slab Creek Dam Reach (8.0 mile)					
	SFAR at Slab Creek dam (SFAR9)	2.7	16.7	16.3	None
	SFAR downstream of walking bridge (SFAR8)	2.1	19.0	16.8	None
	SFAR at Mosquito Bridge (SFAR7)	1.2	24.0	21.6	May to July
	Rock Creek upstream of SFAR (RC1) [d]	2.6	24.4	23.2	July to September
	SFAR upstream of White Rock powerhouse (SFAR6)	2.8	26.7	24.4	June to September
	SFAR downstream of White Rock powerhouse (SFAR5)	1.8	30.4	19.4	None
Reach Downstream of Chili Bar (19.1 miles)					
	SFAR at Chili Bar dam (SFAR4)	4.5	17.9	17.2	None
	SFAR upstream of Dutch Creek (SFAR3)	3.6	21.3	18.7	None
	SFAR downstream of Greenwood Creek (SFAR2)	4.2	22.6	21.3	July
	SFAR upstream of Weber Creek (SFAR1)	4.2	23.6	21.7	June to July

[a] Not all sites were monitored in all years.

[b] Max. Mean indicates the maximum of all of the average temperatures for each of the days monitored.

[c] Months with Mean >20.0°C indicates the month(s) with at least one day having a mean temperature of greater than 20.0°C.

[d] Not affected by the Projects.

[e] Less than two full seasons of data collected.

- throughout Gerle Creek reach (1.2 miles);
- in the lower portion of the Robbs Peak reach (about 4 miles);
- in the upper portion of Ice House reach (about 7 miles);
- throughout Junction reach (8.3 miles);
- in the upper end of Camino reach (about 3 miles)
- throughout Brush Creek reach (2.2 miles);
- in the Upper portion of Slab Creek reach (about 4 miles) and
- in the upper portion of Chili Bar dam reach (about 7 miles).

Seasonally warm temperatures occur:

- throughout Rubicon reach (4.2 miles);
- throughout Buck Island reach (2.5 miles);
- in the upper end of Robbs Peak reach (about 2 miles);
- in the lower end of Ice House reach (about 4 miles);
- throughout SFAR reach (2.8 miles);
- in the lower portion of Slab Creek reach (about 4 miles); and
- in the lower portion of Chili Bar dam reach (about 12 miles).

In addition, the summary provides information on several stream reaches that are not affected by the Projects. Relatively cool streams include the SFSC inflow to Ice House reservoir and Tells Creek inflow to Union Valley reservoir. Seasonally warm temperatures occur in the Rubicon River inflow to Rubicon reservoir, Big Silver Creek and Jones Fork Silver Creek inflow to Union Valley reservoir, SFAR upstream of the Silver Creek confluence, and Rock Creek inflow to SFAR.

Dissolved Oxygen and pH—DO concentrations usually remain above the 7.0-mg/L criterion in the upper portions of the reservoirs. However, DO concentrations of less than 7.0 mg/L were measured in nine of the twelve reservoirs during late summer and early fall (table 3-17). Based on average DO concentrations for 0.5-meter increments, the majority of these low DO concentrations ranged from 5.0 to 6.9 mg/L, although average DO concentrations of less than 5.0 mg/L occurred:

- Near the middle of Rockbound Lake in the bottom 10 feet during early October 2002.
- In deep water at various locations in the Union Valley reservoir during fall and in the Jones Fork arm of the reservoir in the late summer. Hypoxic (DO <2.0 mg/L) conditions were measured in the bottom 6.5 to 26 feet of the reservoir during mid-October to early November of 2002.

- Ice House reservoir in the bottom 13 to 41 feet during late September to mid-November.
- Throughout the entire water column of Junction reservoir in mid-September 2004.
- Near the middle of Brush Creek reservoir in the bottom 6.5 to 36 feet during mid-September to early November. Hypoxic conditions in bottom 8.5 feet in mid-September 2003.

Results of the seasonal pH monitoring of vertical profiles in the reservoirs ranged from 5.8 to 8.5 standard units. Generally, pH levels decreased with depth in the reservoirs and were lowest near the bottom of the reservoirs. Seven of the 12 reservoirs had pH values of less than the lower allowable limit of 6.5 units, but none of them exceeded the upper limit of 8.5 units (table 3-17).

Table 3-17. Summary of the range of water quality data in reservoirs for all vertical profiles and the maximum fluctuation within any of the profiles, 2002 through 2004. (Source: DTA, 2005a, as modified by staff)

Location	Number of Vertical Profiles	Range of DO Concentrations (mg/L)	Range of DO Percent of Saturation	Range of pH
Rubicon reservoir	4	8.3 to 12.0 (0.4 on 10/7/02)	77 to 102 (4 on 10/7/02)	6.7 to 7.8 (0.5 on 10/7/02)
Rockbound lake	5	4.1 to 12.9 (5.0 on 10/7/02)	42 to 110 (62 on 10/7/02)	6.1 to 7.7 (0.9 on 10/7/02)
Buck Island reservoir	6	5.4 to 11.8 (1.9 on 9/21/04)	53 to 99 (18 on 9/21/04)	6.5 to 7.9 (0.5 on 9/21/04)
Loon Lake reservoir	21	5.6 to 12.7 (5.2 on 9/16/03)	57 to 104 (41 on 9/16/03)	5.8 to 7.7 (0.9 on 9/16/03)
Gerle Creek reservoir	7	7.6 to 12.1 (1.5 on 9/15/04)	72 to 125 (19 on 9/15/04)	6.1 to 7.4 (1.0 on 9/15/04)
Union Valley reservoir	32	0.8 to 11.8 (7.9 on 11/06/02)	6 to 116 (90 on 11/06/02)	5.8 to 7.9 (1.1 on 10/16/02, 10/31/02, and 9/14/04)
Ice House reservoir	28	2.3 to 13.2 (6.8 on 11/14/02)	20 to 117 (79 on 10/24/02)	6.0 to 8.5 (1.4 on 11/06/02)
Junction reservoir	5	3.4 to 12.6 (2.3 on 9/16/03)	29 to 110 (23 on 9/16/03))	6.2 to 7.8 (0.7 on 5/13/03)

Location	Number of Vertical Profiles	Range of DO Concentrations (mg/L)	Range of DO Percent of Saturation	Range of pH
Camino reservoir [a]	2	9.4 to 9.5 (0.1 on 11/13/02)	82 to 102 (2 on 11/13/02)	6.8 to 7.3 (0.1 on 11/13/02 and 9/12/04)
Brush Creek reservoir	6	1.6 to 10.4 (7.7 on 9/16/03)	14 to 103 (89 on 9/16/03)	6.1 to 7.7 (0.9 on 9/16/03)
Slab Creek reservoir	17	4.8 to 14.0 (2.4 on 9/15/03)	46 to 116 (17 on 9/13/04)	6.5 to 7.8 (0.5 on 6/25/03)
Chili Bar reservoir	13	4.9 to 14.3 (3.4 on 9/13/04)	51 to 123 (36 on 9/13/04)	6.7 to 7.8 (0.7 on 11/13/02)

Note: The values within the "()"s are the maximum fluctuations within vertical profile and the date(s) that this was measured.

Results of the 2002 to 2004 periodic monitoring program of stream reaches indicate that DO levels generally satisfy the applicable water quality criteria, although low DO concentrations were measured at a few stream sites during the late summer and early fall. These included DO concentrations of less than 7.0 mg/L at two UARP affected stream sites (5.5 mg/L in the outflow from Loon Lake on October 8, 2002, and 4.7 mg/L in the SFAR outflow from Slab Creek reservoir on September 13, 2004), one Chili Bar Project affected stream site (6.1 mg/L in the SFAR downstream of Greenwood Creek on September 13, 2004), and one stream site not affected by either project (3.7 mg/L in Rocky Basin Creek on September 17, 2003).

Monitoring results for pH in the stream reaches ranged from 4.9 to 8.7 indicating that pH is occasionally outside the allowable range of 6.5 to 8.5. Of the 221 riverine pH measurements, 24 (11 percent) were below 6.5 and 1 (<1 percent) was greater than 8.5. Most of the sites monitored in the headwaters of the Rubicon River had at least one low pH value; whereas only four of the SFAR Basin sites had low pH values. Two of these four sites are upstream of the Projects' effects. The other two sites are a short distance downstream of Ice House and Camino reservoirs. The only pH value above 8.5 was measured in the SFAR at the most downstream site monitored, just upstream of the Weber Creek confluence.

Metals and Polychlorinated Biphenyls—The applicants sampled reservoir and stream reaches for metals, total hardness and total cyanide during seven sampling events in 2002 to 2004 to monitor conditions during fall turnover, the first major rain, spring runoff, and summer low flow. Hardness in the UARP and Chili Bar Project reservoirs ranged from 1 to 9 mg/L as $CaCO_3$. Hardness in UARP-affected reaches and non-project reaches ranged from approximately 1 to 20 mg/L, while hardness in the reach downstream of Chili Bar dam ranged from about 7 to 12 mg/L. All of these results show that surface waters in the area are soft.

Analyses for metals consisted of total metals in 2002 and 2003 and were expanded to also include the dissolved fraction of metals in 2004. Comparison of the results of this sampling effort to the Primary and Secondary MCLs indicates that the concentrations of metals generally satisfy the Primary and Secondary MCLs in reservoirs and stream reaches of the Projects. Although 10.8 percent of the 406 total lead samples and 3.7 percent of the 215 total mercury samples exceeded the corresponding Primary MCLs, QA/QC test results indicate that these high concentrations were likely a result of contamination from sampling devices used in 2003 and 2004. Sample results for total iron and total aluminum exceeded the corresponding secondary MCL in 4.2 and 0.7 percent of the samples, respectively.

Table 3-18 displays the percent of the dissolved fraction samples for cadmium, copper, lead, nickel, silver, and zinc that exceed the corresponding criterion continuous concentrations (CCC) and criterion maximum concentrations (CMC). This analysis indicates that most samples had concentrations that were below the CCC and CMC for most of these metals. In streams, more than 10 percent of the samples exceeded the CCC and/or the CMC for copper and lead. Both the UARP and Chili Bar Project-affected stream reaches tended to exceed the CCC and CMC for copper more than the reaches not affected by the Projects. Due to contamination of the samples collected in 2004 from the sampling device, it is not possible to determine how frequently the lead CCC or CMC was exceeded in the reservoirs. However, it appears that the frequency of exceedance of the CCC and CMC in the project reservoirs is about the same as in project-affected stream reaches, based on comparison of the total recoverable lead levels for both stream and reservoir sites in samples collected in 2002 and 2003. Dissolved copper concentrations exceeded the CCC and CMC in half of the samples from Chili Bar reservoir and 21.7 percent of the samples from the UARP reservoirs. More than 10 percent of the samples from Chili Bar reservoir exceeded the CCC and CMC for cadmium and zinc.

Table 3-18. Frequency of dissolved cadmium, copper, lead, nickel, silver, and zinc water samples that exceed the corresponding CCC and CMC criteria, 2004. (Source: DTA, 2005b)

	CCC/CMC Criteria Exceedance[a]				
Metal	**Non-Project Affected Reaches**	**UARP Affected Reaches**	**Chili Bar Project Affected Reaches**	**UARP Reservoirs**	**Chili Bar Reservoir**
Cadmium	0/0	1.5/4.5	0/0	2.9/2.9	12.5/12.5
Copper	3.3/3.3	16.6/16.6	33.3/33.3	21.7/21.7	50/50
Lead	33.3/0	33.3/0	11.1/0	[b]	[b]

Metal	CCC/CMC Criteria Exceedance[a] Non-Project Affected Reaches	UARP Affected Reaches	Chili Bar Project Affected Reaches	UARP Reservoirs	Chili Bar Reservoir
Nickel	0/0	0/0	0/0	0/0	0/0
Silver	NA/6.6	NA/1.5	NA/0	NA/2.9	NA/0
Zinc	0/0	4.5/4.5	0/0	0/0	16.2/16.2

Note: NA – indicates not applicable.

[a] Values are reported as the percent of samples that exceed the CCC followed by "/" and the percent of samples that exceed the CMC.

[b] Reservoir samples were contaminated with lead from the Kemmerer sampler and thus lead results are not valid.

The applicants analyzed bioaccumulation of trace metals using samples of four piscivorous fish species collected from five UARP reservoirs and Chili Bar reservoir. Sampling these piscivorous fish is expected to document near maximum effects of biomagnifications on body burdens. The applicants analyzed one composite fish fillet sample and one composite fish liver sample collected from each reservoir. Table 3-19 provides descriptions of the composite fish tissue samples and the concentration of trace metals in them, along with screening values intended to protect humans from consumption of contaminated fish. As expected, the fish liver samples generally had higher concentrations of all of the metals analyzed.

Arsenic concentrations in some fish fillets exceeded the screening values set to protect recreational and subsistence anglers. The recreational screening value of 0.026 milligram per kilogram (mg/kg) was exceeded in samples from three of the reservoirs (Ice House, Union Valley, and Gerle Creek). Since the detection level for arsenic was higher than the screening value for subsistence anglers, it is not possible to determine whether fish from the other three reservoirs sampled also exceed the subsistence screening value. The applicants analyzed the fish samples for total mercury, not methylmercury. However, EPA (2000) recommends the use of total mercury as a conservative surrogate for methylmercury in fish tissue since most of the mercury accumulated in fish is generally in the form of methylmercury and methylmercury analysis is relatively expensive. Comparison of the total mercury concentrations to the concentrations of screening values set for methylmercury suggests that contamination of piscivorous fish in Slab Creek and Union Valley reservoirs may be at harmful levels for recreational anglers. This conservative approach also suggests that mercury contamination of piscivorous fish in three of the other reservoirs (Gerle Creek, Loon Lake, and Chili Bar) may be harmful to subsistence anglers. All of the cadmium and

Table 3-19. Trace metal concentrations (mg/kg) in composite fish fillet and fish liver samples (shown in parentheses) from selected UARP and Chili Bar project reservoirs, samples collected on December 16, 2003.[a] (Source: DTA, 2005b; EPA, 2000)

Metal	Screening Values[a]	Loon Lake	Gerle Creek	Union Valley	Ice House	Slab Creek	Chili Bar
Composite sample description		6 brown trout with fork lengths of 13.5 to 14.8 inches	1 brown trout with fork length of 20.1 inches	4 smallmouth bass with fork lengths of 11.8 to 15.7 inches	7 rainbow trout with fork lengths of 8.4 to 13.4 inches	1 brown trout with fork length of 19.1 inches	8 Sacramento pikeminnow with fork lengths of 9.4 to 12.8 inches
Silver	--	<0.002 (1.74)	<0.002 (1.86)	<0.002 (0.013)	<0.002 (0.22)	<0.002 (0.17)	<0.002 (<0.002)
Aluminum	--	0.37 (<0.02)	<0.02 (6.55)	<0.02 (21.2)	<0.02 (<0.02)	<0.02 (<0.02)	<0.02 (<0.02)
Arsenic	Rec 0.026, Subs 0.00327	<0.02 (0.38)	0.028[b] (1.19)	0.06 (0.12)	0.16 (0.099)	<0.02 (0.038)	<0.02 (0.051)
Cadmium	Rec 4.0, Subs 0.491	0.0080 (0.62)	0.0008[b] (0.83)	<0.0004 (0.64)	<0.0004 (0.025)	<0.0004 (0.029)	0.0013 (0.019)
Chromium	--	0.094 (0.139)	0.093 (0.121)	0.086 (0.161)	0.080 (0.156)	0.089 (0.09)	0.066 (0.118)
Copper	--	0.48 (87.8)	0.52 (126)	0.47 (4.11)	0.46 (35.3)	0.44 (9.74)	0.39 (2.12)
Manganese	--	0.037 (1.11)	0.0009[b] (0.43)	0.13 (0.97)	0.12 (1.47)	0.012 (1.17)	<0.0006 (0.41)
Nickel	--	<0.001 (0.015)	<0.001 (0.034)	0.009 (<0.001)	<0.001 (<0.001)	<0.001 (0.007)	<0.001 (0.006)
Lead	--	<0.0004 (<0.0024)	<0.0004 (0.012)	<0.0004 (0.015)	<0.0004 (0.0018)	<0.0004 (<0.0004)	0.0043 (<0.0004)
Selenium	Rec 20, Subs 2.457	0.32 (9.14)	0.39 (30.6)	0.21 (0.99)	0.19 (0.91)	0.086 (1.31)	0.14 (0.72)
Zinc	--	4.92 (25.0)	3.53 (52.6)	4.19 (17.8)	4.32 (22.9)	3.60 (27.8)	8.05 (12.0)

Metal	Screening Values[a]	Loon Lake	Gerle Creek	Union Valley	Ice House	Slab Creek	Chili Bar
Mercury	Rec 0.4, Subs 0.049[c]	0.137 (--)	0.321 (--)	0.419 (--)	0.036 (--)	0.595 (--)	0.075 (--)

Note: -- – indicates no guideline criteria from selected literature sources or data available, as appropriate.

[a] Screening values are directly comparable to concentrations in fish tissues typically eaten by humans (i.e., fillets), but not liver samples. "Rec" screening values set to protect recreational anglers, based on fish consumption rate of 17.5 grams (g)/day, 70 kg body weight and, for carcinogens, 10^{-5} risk level and 70-year lifetime. "Subs" screening values set to protect subsistence anglers, based on fish consumption rate of 142.4 g/day, 70 kg body weight and, for carcinogens, 10^{-5} risk level and 70-year lifetime.

[b] Value is below reporting limit, but above the method detection limit.

[c] As methylmercury, although it is recommended that total mercury be analyzed and the conservative assumption be made that all mercury is present as methylmercury since most mercury in fish and shellfish tissue is present primarily as methylmercury (NAS, 1991, as cited by EPA, 2000; Tollefson, 1989, as cited by EPA, 2000; Tollefson, 1989) and because of the relatively high cost of analyzing for methylmercury. This approach is deemed to be most protective of human health and most cost-effective (EPA, 2000).

selenium concentrations measured in fish fillets were less than the corresponding screening values set for recreational and subsistence anglers.

Coliform Bacteria—During the summer of 2003, SMUD and PG&E sampled 21 different locations for fecal coliform in a manner consistent with the applicable water quality standard (i.e., 5 samples in a 30-day period). All of these 30-day periods include the holiday weekend of either Independence Day or Labor Day, and are therefore representative of the high recreational season. Table 3-20 summarizes the results of this sampling effort.

Table 3-20. Summary of fecal coliform sampling results for UARP reservoirs and reaches and the reach downstream of Chili Bar, based on 5 samples collected during a 30-day period in summer 2003 [a] showing location with exceedances of criteria. (Source: DTA, 2005b)

Site	**Range (MPN/100 mL)**	**Geometric Mean (MPN/100 mL)**	**Samples in Excess of 400/100 mL criterion (MPN/100 mL on date)**
Union Valley reservoir at Camino Cove	<1–3,180	38	**3,180** on 6/23 **1,200** on 7/01
Union Valley reservoir at Fashoda Beach	<1–600	10	**600** on 6/23
Union Valley reservoir at Jones Fork Campground	<1–2,900	17	**550** on 6/23 **2,900** on 7/01
Jones Fork Silver Creek at Ice House Road	165–1,500	**468**	**730** on 6/23 **1,500** on 7/22
Big Silver Creek at bike bridge	37–1,160	133	**1,160** on 7/22
SFAR downstream of Miner's Cabin	<1–6,100	159	**6,100** on 7/01 **438** on 7/08
SFAR downstream of Greenwood Creek	<1–728	31	**578** on 7/01 **728** on 7/08
SFAR upstream of Hastings Creek	28–3,900	**322**	**3,900** on 7/01 **462** on 7/08
SFAR downstream of Weber Creek	<1–9,300	**327**	**660** on 6/25 **9,300** on 7/01 **1,350** on 7/08

Notes: MPN/100 mL is Most Probable Number/100 milliliter.

Bold values exceed applicable criterion.

[a] Each sampling period included either Independence Day or Labor Day weekend.

Fecal coliform concentrations generally satisfied the applicable criteria in the sampled reservoirs. However, the 400 most probably number (MPN)/100 mL criterion that is not to be exceeded in more than 10 percent of the samples was exceeded in 20 to 40 percent of the samples from all three of the Union Valley reservoir sample sites. The 400 MPN/100 mL criterion also was exceeded at two sites in tributaries to Union Valley reservoir that are not affected by the Projects, and four sites in the Chili Bar bypassed reach. Although the highest values and most frequent exceedances occurred at the most downstream site, which is located downstream of Weber Creek and about 1 mile upstream of Folsom Lake, SMUD reported that fecal coliform concentrations did not increase in an upstream to downstream direction on each day sampled. The geometric mean remained below the 200 MPN/100 mL criterion for 18 of the 21 sample sites. This criterion was exceeded at the two most downstream sites in the Chili Bar bypassed reach and at a site in Jones Fork Silver Creek that is upstream of the project's influence.

3.3.2.2 Environmental Effects

Water Quantity

The Settlement Agreement's proposed minimum streamflow schedules and water level regimes for project-influenced reaches and reservoirs include a variety of alternative measures for each project development. Because measures related to streamflow primarily pertain to protecting and enhancing aquatic and riparian habitat and recreational opportunities, we discuss the specific aspects of these measures in sections 3.3.2.2, *Water Quality;* 3.3.3.2, *Aquatic Resources*; 3.3.4.2, *Terrestrial Resources*; and 3.3.6.2, *Recreational Resources*. In this section we discuss the effects of the proposed water level regimes on reservoirs affected by the UARP and Chili Bar Project operations as well as the means to ensure compliance with the proposed minimum streamflow schedules and water levels.

Reservoir Levels

Under Proposed Article 1-23, *Reservoir Levels*, SMUD would within 6 months of license issuance meet or exceed the end-of-the month reservoir elevations for Loon Lake, Union Valley, and Ice House reservoirs (table 3-21) and would manage reservoir levels at Rubicon, Buck Island, Gerle, Junction, Brush, and Slab Creek to meet seasonal targets as described below. This measure and other reservoir level related measures also pertain to protecting and enhancing aquatic and riparian habitat, recreational opportunities, and aesthetics, therefore, we also discuss additional aspects of these measures in sections 3.3.3.2, *Aquatic Resources*; 3.3.4.2, *Terrestrial Resources*; 3.3.6.2, *Recreational Resources; and 3.3.8.2, Aesthetic Resources.*

Table 3-21. Loon Lake, Union Valley, and Ice House reservoirs levels by water year. (Source: SMUD and PG&E, 2007)

	End-of-Month Reservoir Elevation				
Reservoir/Month	**CD**	**Dry**	**BN**	**AN**	**Wet**
Loon Lake					
July	6,388	6,395	6,399	6,400	6,400
August	6,382	6,389	6,394	6,393	6,393
September	6,379	6,385	6,390	6,390	6,390
Union Valley					
July	4,816	4,836	4,856	4,856	4,856
August	4,803	4,827	4,835	4,841	4,842
September	4,796	4,818	4,830	4,830	4,830
Ice House					
July	5,435	5,437	5,440	5,441	5,441
August	5,430	5,433	5,434	5,435	5,434
September	5,420	5,429	5,430	5,431	5,430

Rubicon and Buck Island Reservoirs—SMUD would attempt to maintain the water surface in Rubicon and Buck Island reservoirs at as high an elevation as practicable, and with a minimum of fluctuation, from May 1 to September 10 of each year in order to secure the maximum recreational benefits. Both of these high elevation reservoirs are remote and due to access issues, the gates are manually installed in June or July and are removed in mid- to late September or October. As described in Proposed Article 1-1, *Minimum Streamflows*, SMUD would maintain an overwintering minimum pool of 6,527 feet in elevation in Rubicon reservoir for the protection of aquatic species.

Gerle Reservoir—SMUD would attempt to maintain the water surface in Gerle reservoir at as high an elevation as practicable, and with a minimum of fluctuation, from May 1 to September 10 of each year. If SMUD anticipates the reservoir will be drawn down below 5,225 feet during this time period, SMUD would consult with the Forest Service, Water Board, FWS, and CDFG.

Junction and Brush Creek Reservoirs—SMUD would maintain the seasonal reservoir levels at Junction and Brush Creek reservoirs within the range of levels measured between 1975 through 2000 based on the databases maintained by CDWR and SMUD.

Slab Creek Reservoir—SMUD would attempt to maintain the reservoir level above 1,830 feet in elevation during daylight hours between 10:00 a.m. and

8:00 p.m. during the period from July 1 through September 30. SMUD would also attempt to limit daily fluctuations to less than 7 feet per day during daylight hours between 10:00 a.m. and 8:00 p.m. from July 1 through September 30. The minimum reservoir elevation and maximum daily fluctuation would be reassessed and modified if necessary to accommodate (1) the operation of the proposed Iowa Hill development, should it be constructed, (2) the recreational use at Slab Creek reservoir, and (3) other applicable factors.

Water Levels during a Super Dry Water Year—A Super Dry (SD) is defined as any Critically Dry (CD) year that is immediately preceded by a Dry or CD year or any Dry year that is immediately preceded by any combination of two Dry or CD years. In the event of a SD year, SMUD would, by March 10, notify the Forest Service, CDFG, and the Water Board about their concerns related to reservoir levels. By June 1 of a SD year, SMUD would confer with the Forest Service, CDFG, Water Board, and the Consultation Group to discuss reservoir operations plans and reservoir levels during the SD water year. The licensee would implement the revised operations while balancing as discussed in the Settlement Agreement a wide range of aquatic, recreation, water supply and power generation issues for a SD year upon approval by the Forest Service, the Commission, Water Board, and CDFG.

Our Analysis

End of Month Water Levels

The proposed end of the month water levels at Loon Lake, Ice House, and Union Valley are somewhat similar to historical operation of all three reservoirs. However, the Settlement Agreement includes a wide range of proposed measures including increased minimum flows, pulse flows, ramping rates, recreational releases and others which would affect reservoir water levels while providing enhancement to water quality, aquatic, terrestrial, recreational and other resources.

As part of the Settlement process, CDFG modeled the operations of the UARP and Chili Bar Project using the HEC-ResSim[30] model to help evaluate the effects of various streamflow and reservoir elevation targets. In addition to reservoir and streamflow requirements, the model also included energy generation based on the Settlement Agreement and several other factors. The model included simulation of project operations under current measures and operation practices, designated as the "Base." Simulation of the Proposed Action including the proposed minimum flows, pulse flows, reservoir elevation, maintenance, and other

[30]HEC-ResSim is a computer reservoir system simulation program developed by the U.S. Army Corps of Engineers for performing reservoir operation modeling under a variety of operational goals and constraints.

measures using the historical inflow data, designated in the following figures as the “Settlement Agreement.” Output from the model included streamflow data, power generation, reservoir elevation data, and other information at both 30-minute and 1-day intervals for the 1975 to 2000 water years.

Table 3-22 shows the water year types for water years 1992 through 1999. Figures 3-9 through 3-11 are representative of the reservoir levels in Loon Lake, Ice House, and Union Valley reservoir for water years 1992 through 1999 (a grouping of years that include a reasonable representation of water year types) from the output of the HEC-ResSim model under the Proposed Action. These figures show that in almost all cases, SMUD could achieve the end of month target elevations while meeting the proposed minimum streamflow schedules included in the Settlement Agreement. However, as shown in the figures, the end of month water levels would not have been met at the reservoirs in 1992, which under the Settlement Agreement would have been classified as an SD year as discussed later in this section.

Table 3-22. Water year types for 1992–1999. (Source: SMUD, 2005)

Year	**Water Year Type**
1992	Dry
1993	Above Normal
1994	Critically Dry
1995	Wet
1996	Above Normal
1997	Wet
1998	Wet
1998	Above Normal

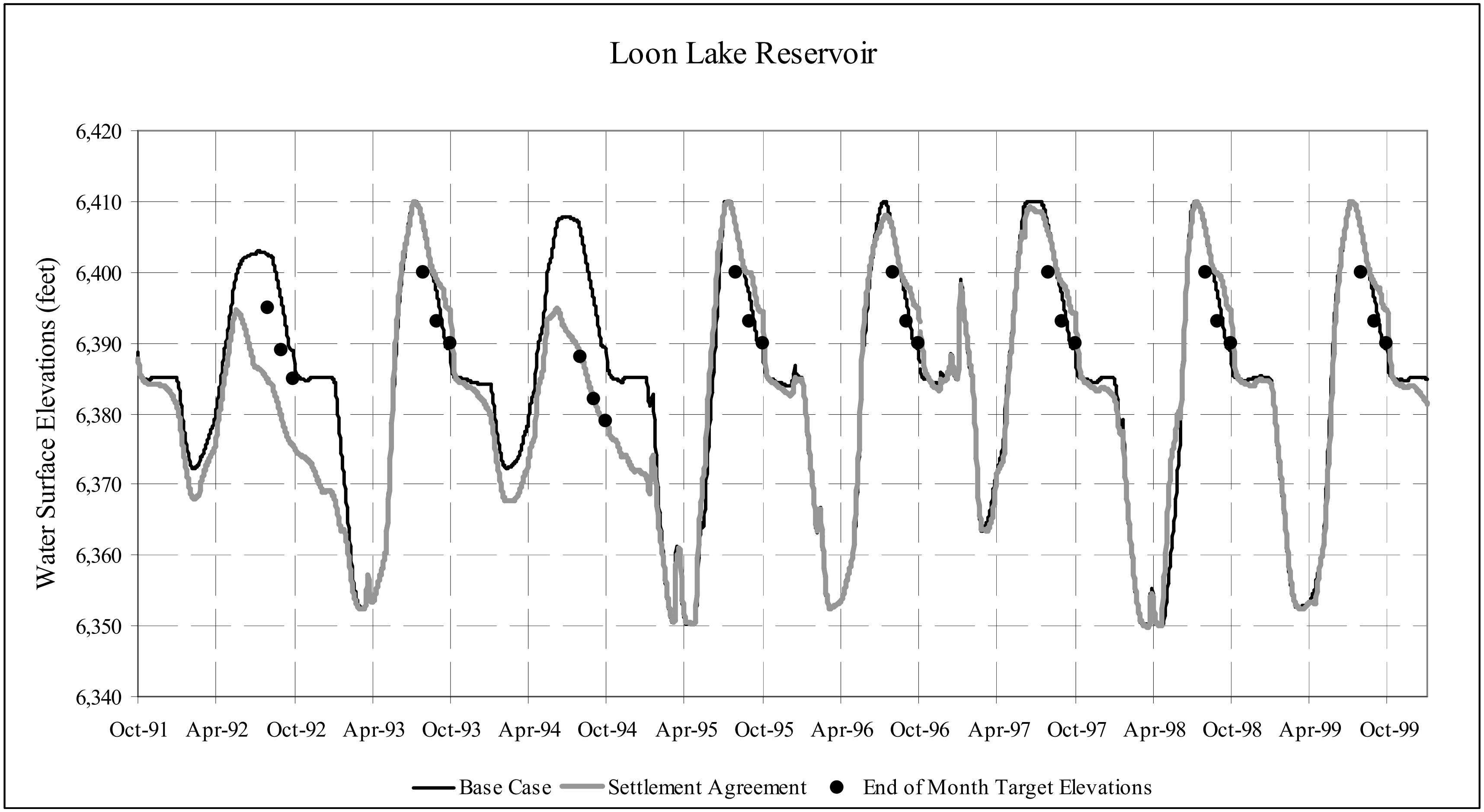

Figure 3-9. Loon Lake reservoir modeled elevations for 1992 to 1999 water years. (Source: CDFG, 2007, as modified by staff).

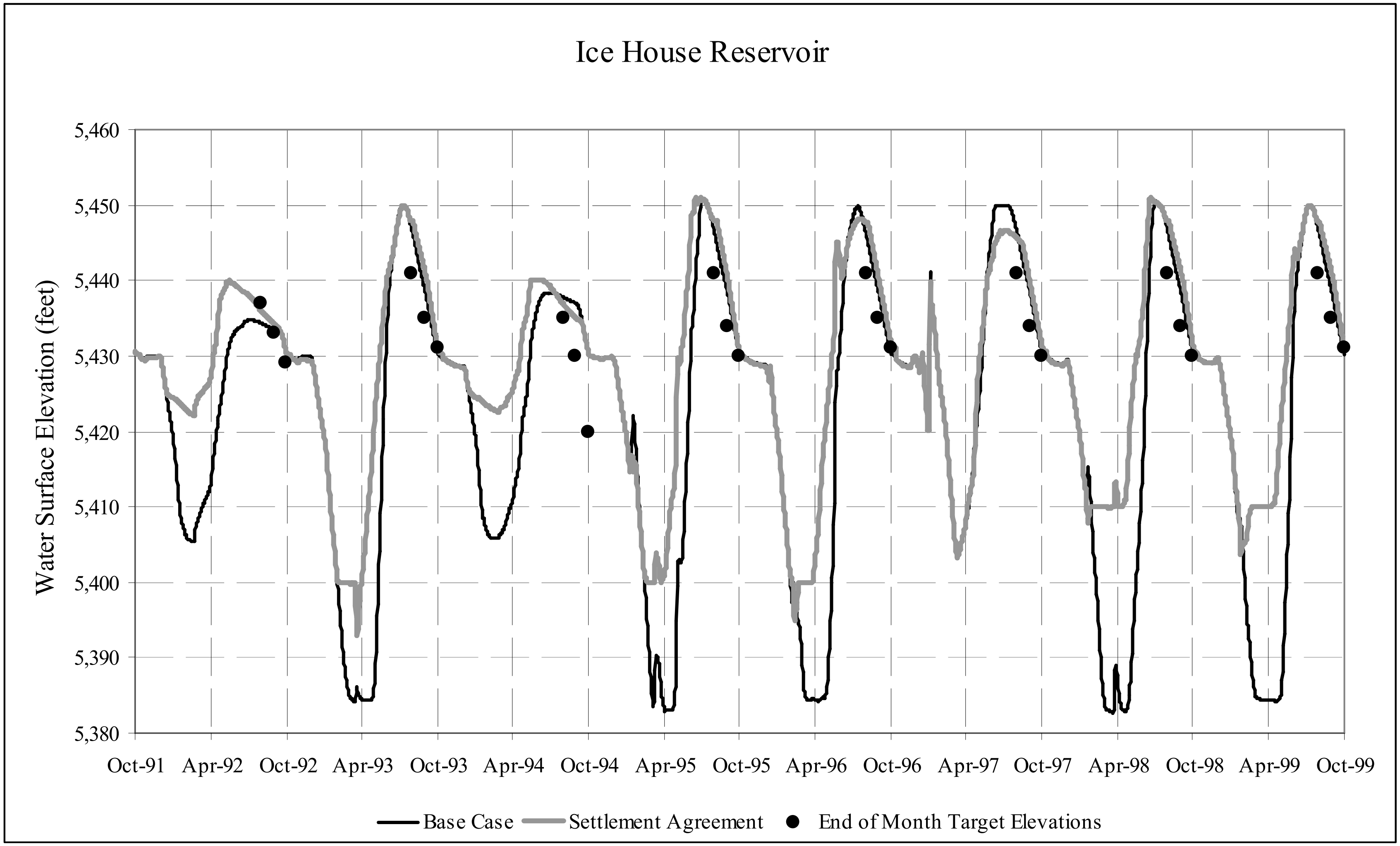

Figure 3-10. Ice House reservoir modeled elevations for 1992 to 1999 water years. (Source: CDFG, 2007, as modified by staff).

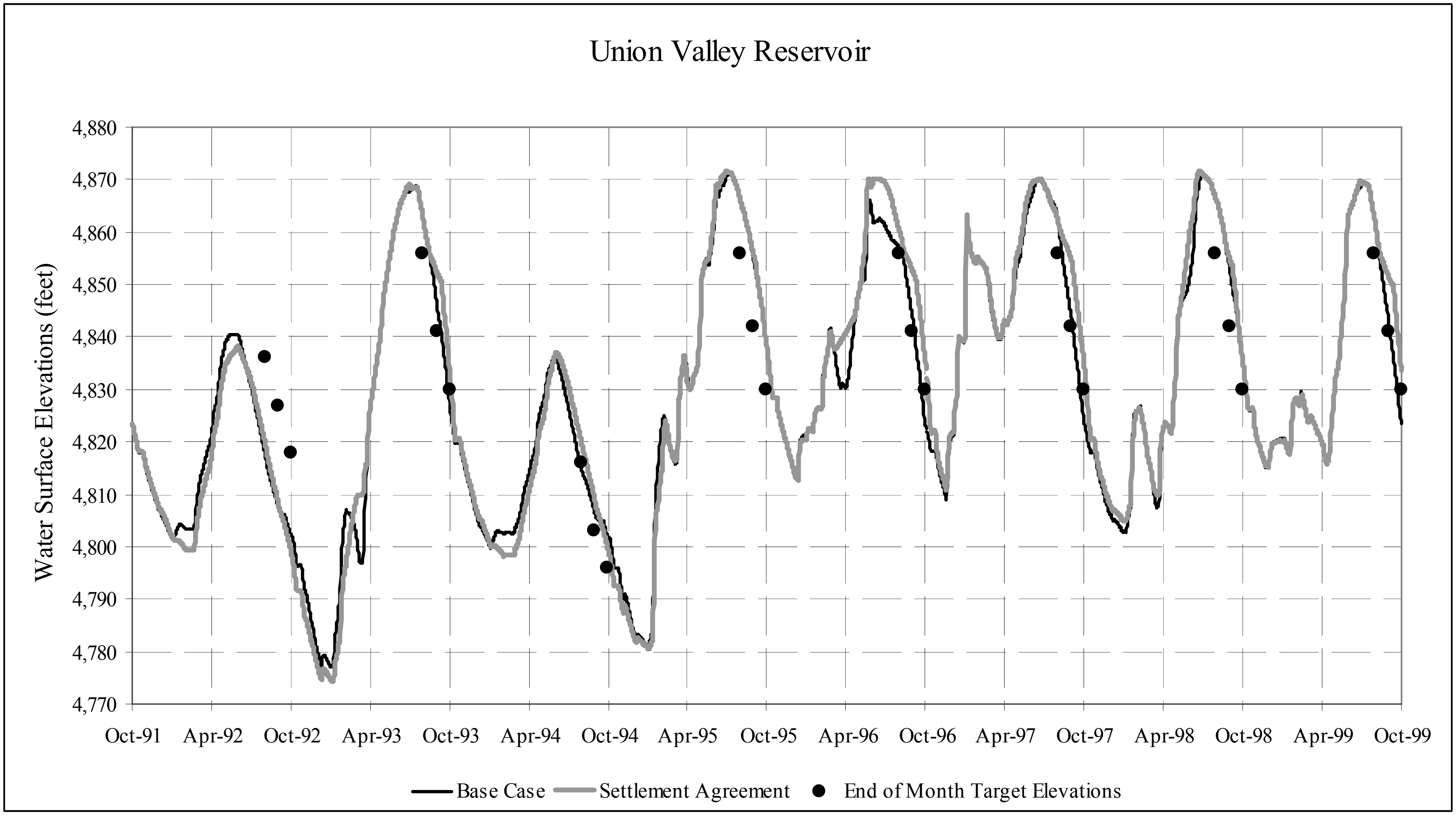

Figure 3-11. Union Valley reservoir modeled elevations for 1992 to 1999 water years. (Source: CDFG, 2007, as modified by staff).

Water Levels during a Super Dry Water Year

Review of the water year type records indicate the SD water year types have occurred three times between 1975 and 2005 (1977, 1988, and 1992). HEC-ResSim modeling indicated that water levels in the three main storage reservoirs could fail to meet the CD end of month targets during these years. Figure 3-12, which shows the Base and the Proposed Action water levels during these SD years at Union Valley reservoir, the largest storage reservoir. This figure is representative of several important aspects including the variation in severity of SD years. Another key feature of this figure is the additional drawdown that would have occurred in 1977, when measures included in the Settlement Agreement would have resulted in additional drawdown during the summer.

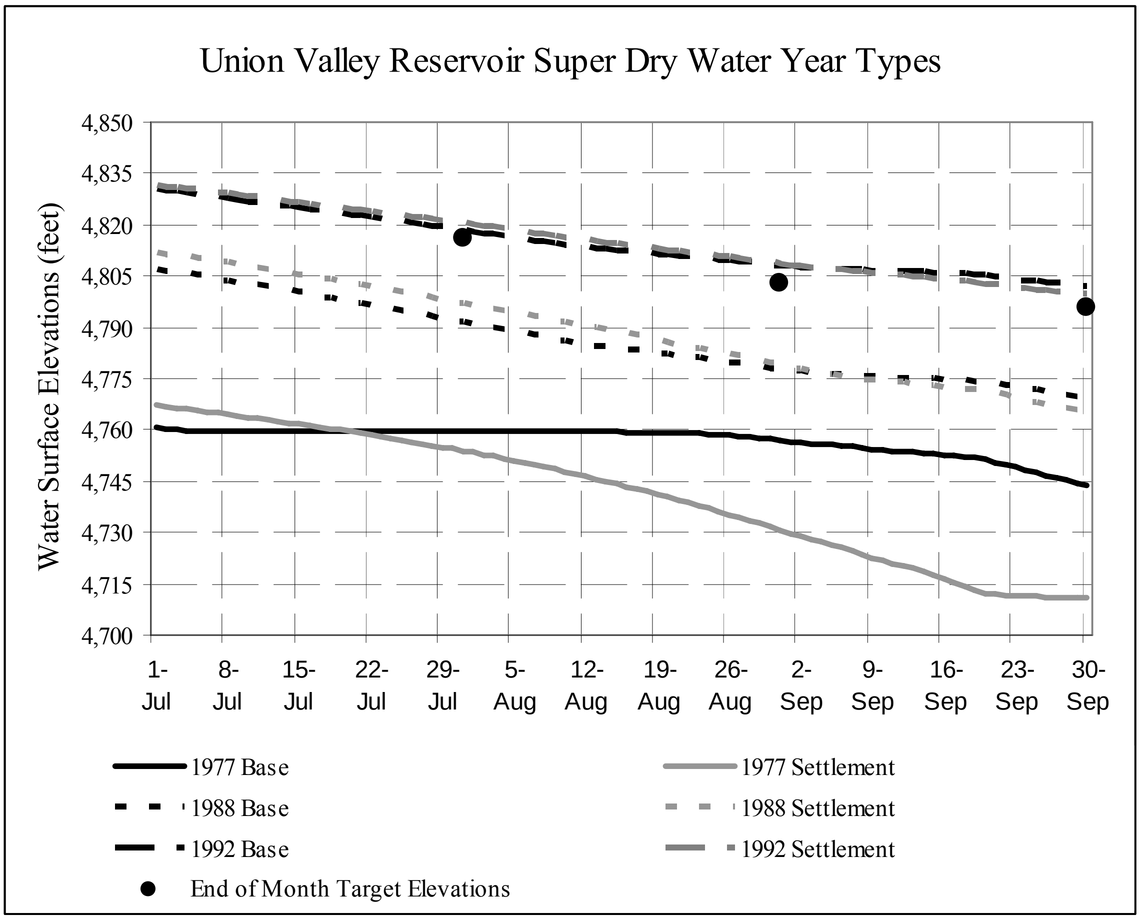

Figure 3-12. Union Valley reservoir modeled base and Proposed Action water surface elevations from July to September 30 for 1977, 1988, and 1992. (Source: CDFG, 2007, as modified by staff)

Rubicon and Buck Island Reservoirs

HEC-ResSim modeling of the effects of the Proposed Action on the reservoir levels at Rubicon and Buck Island reservoirs showed that fluctuations of the water levels of these two reservoirs would still occur and be somewhat similar to existing conditions. Existing conditions for the past 8 years at these reservoirs are shown in figures 3-13 and 3-14. Many of these fluctuations, especially early in the May through September 10 period as shown in figures 3-13 and 3-14, are due to rapidly varying inflow to the reservoirs. These high elevation reservoirs have limited storage capacity and are affected by changes in the inflow to the reservoirs, normally driven by snowmelt. However, these graphs do show a relatively stable water surface elevation during low inflow conditions which normally start during July and extending through the recreational season. In addition, the manual installations of the gates at these reservoirs normally occur in early June or July and are removed in mid- to late September or October. Not provided in the graphs are overwintering reservoir elevations at Rubicon reservoir. Modeled elevations during the winter period are similar to existing operations and did not fall below elevation 6,532 feet, 5 feet above the proposed minimum pool elevation.

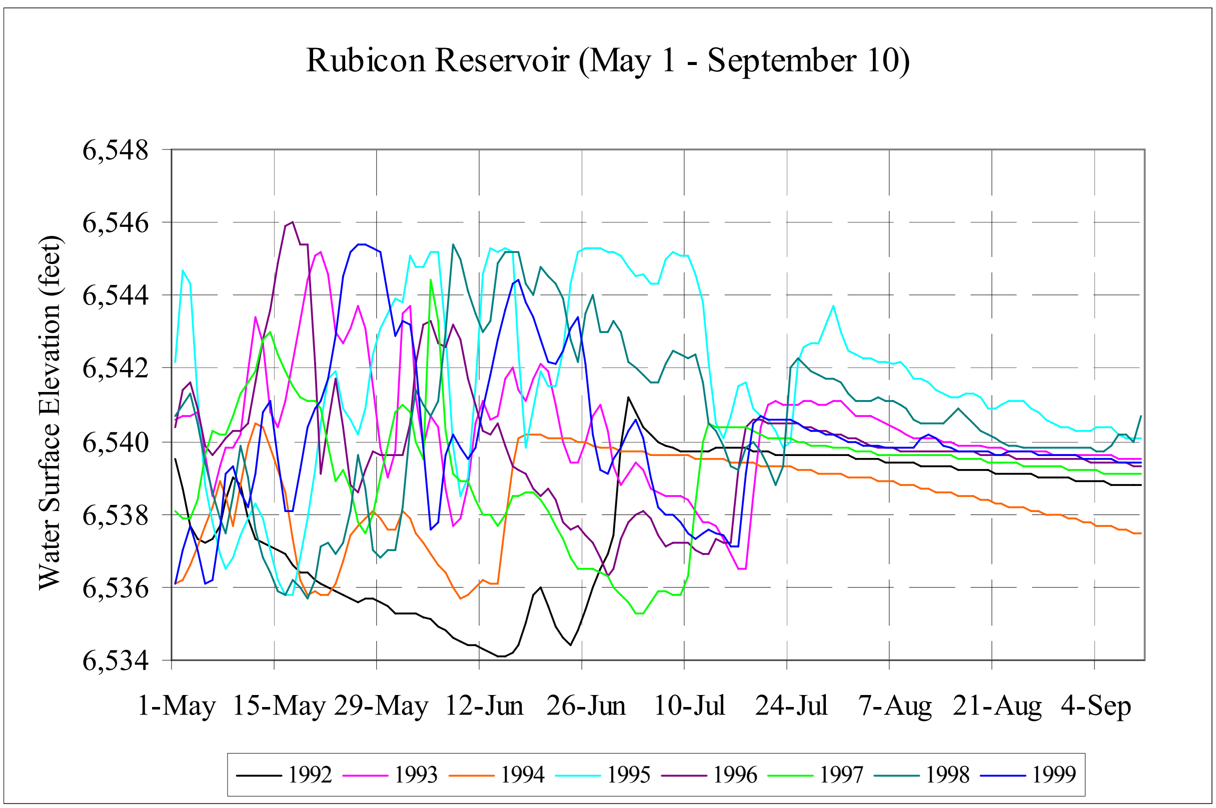

Figure 3-13. Rubicon reservoir modeled elevations between May 1 and September 10 for 1992 to 1999. (Source: CDFG, 2007, as modified by staff)

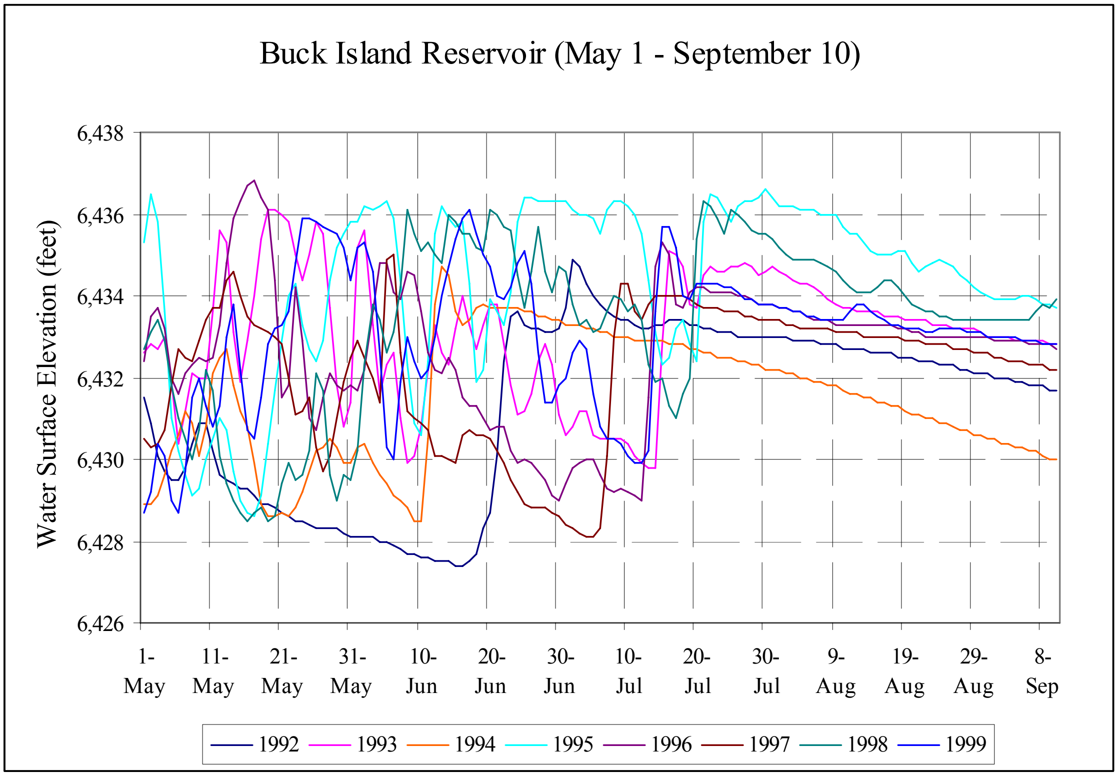

Figure 3-14. Buck Island reservoir modeled elevations between May 1 and September 10 for 1992 to 1999. (Source: CDFG, 2007, as modified by staff)

Gerle Reservoir

HEC-ResSim modeling of the measures in the Proposed Action analyzed its effects on the reservoir levels at Gerle reservoir and showed that fluctuations of the water levels of this reservoir would still occur. This is partly because Gerle reservoir operates as an afterbay for Loon Lake Powerhouse and as a forebay for the canal leading to Robbs Peak reservoir and powerhouse. Many of the variations in the early part of the May 1 to September 10 period (see figure 3-15) are the result of limited storage capacity and rapid variations in inflow similar to the Rubicon and Buck Island reservoirs. These graphs also show that the licensee would not be able to maintain the reservoir at elevation of 5,225 feet, the trigger elevation for consulting with the Agencies.[31]

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[31]For model simplicity purposes, the transition between Gerle Creek reservoir and the Gerle Creek canal was modeled as an uncontrolled outlet. However, in actuality, there are gates at the headworks to the Gerle Creek canal, and it is expected that SMUD would use these gates to help regulated the elevation of Gerle Creek reservoir at or above 5,225 feet during the summer recreation season, and at or above 5,228 feet during the August through October period so that brown trout can access spawning areas in Gerle Creek.

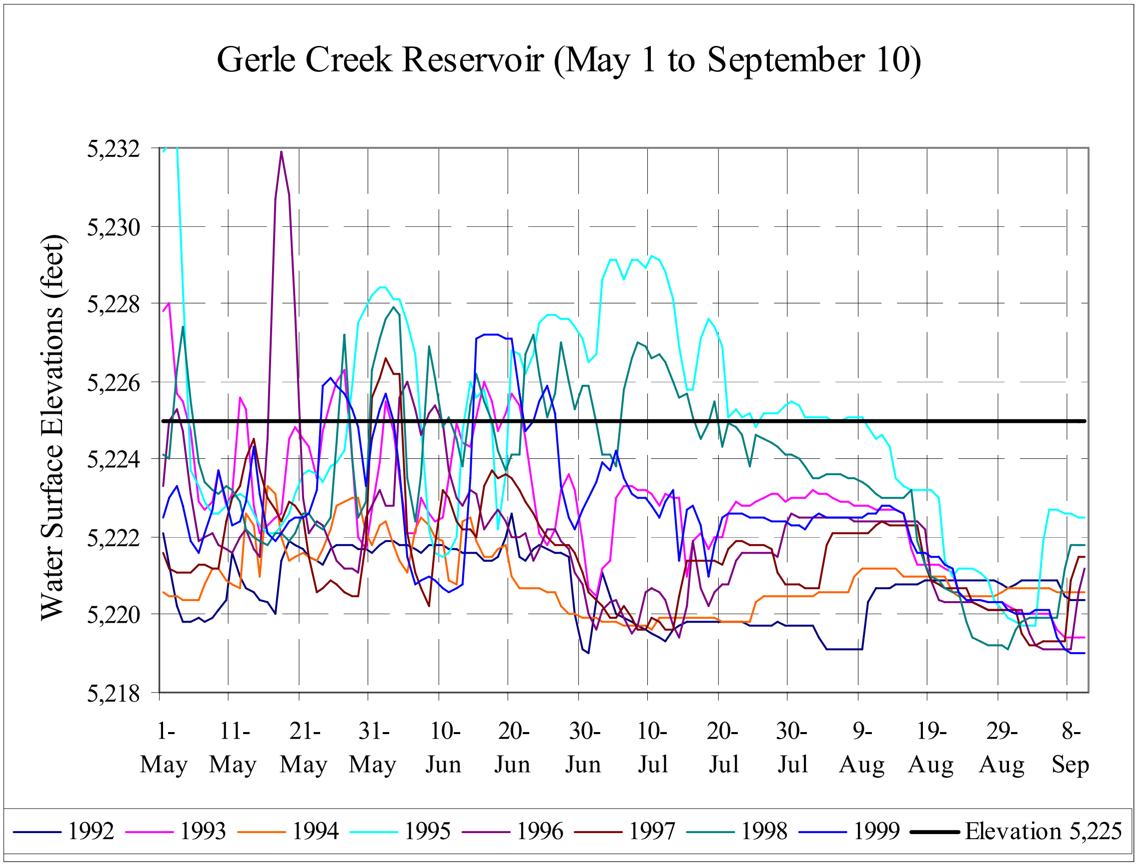

Figure 3-15. Gerle Creek reservoir modeled elevations between May 1 and September 10 for 1992 to 1999. (Source: CDFG, 2007 as modified by staff)

Junction and Brush Creek Reservoirs

Both of these reservoirs serve as afterbays and forebays for downstream and upstream powerhouses. In the past, SMUD has operated them with water variations of approximately 20 feet per day during peaking operations. HEC-ResSim modeling of the Proposed Action indicates that this type of variation would continue to occur, largely the result of continued daily peaking operations and the limited storage capacity of the reservoirs.

Slab Creek Reservoir

HEC-ResSim modeling of the effects of the Proposed Action's measures on reservoir levels at Slab Creek reservoir shows that daily fluctuation at this reservoir would occur, but would be likely to be less than existing conditions. Existing daily fluctuations at this reservoir are normally about 6 feet, with only a few days per year over 7 feet. Figure 3-16 provides representative short interval data of historical and modeled water surfaces in Slab Creek reservoir for July 1 through September 30, 1999.

This figure shows a substantial decrease in the daily fluctuation of Slab Creek reservoir and that water levels remain above elevation 1,830.[32]

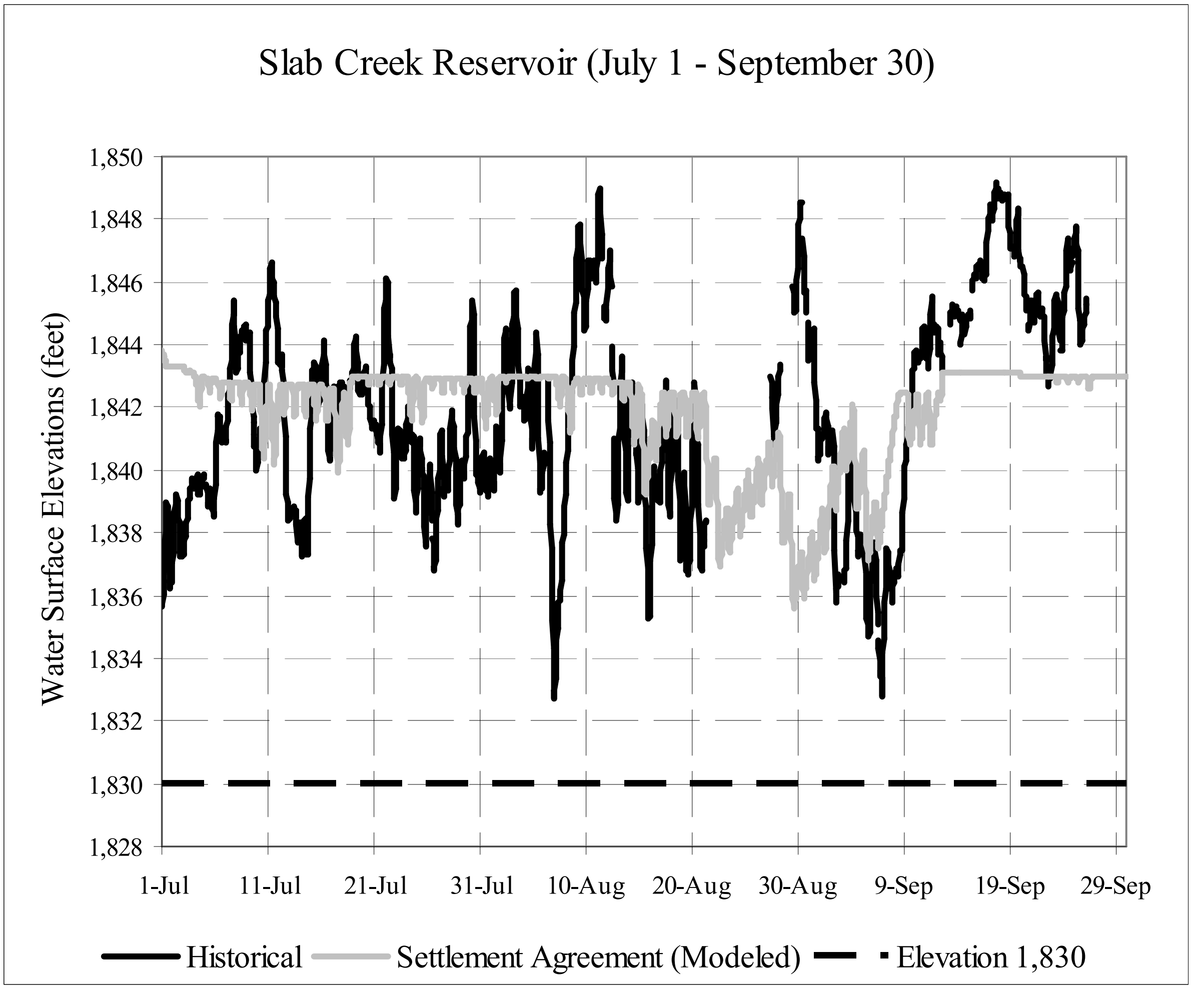

Figure 3-16. Slab Creek reservoir historical one hour and modeled half hour elevations between May 1 and September 10 1999. (Source: CDFG, 2007; CDEC, 2007, as modified by staff)

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[32]For model simplicity purposes, coordinated operations between Slab Creek reservoir and Chili Bar reservoir was simulated using the implicit storage balance option within HEC-ResSim. In addition, the target elevation for Slab Creek reservoir was set at a constant elevation of 1,843 feet. The reservoir fluctuation depicted in the model output is primarily a result of these modeling simplifications. It is expected that the daily fluctuation in Slab Creek reservoir water surface elevations (absent affects from the Iowa Hill development) will be similar to historical operations.

Flow and Water Level Monitoring—Flow and water level gages are in place on many project-affected reaches and reservoirs (tables 3-23 and 3-24).

Table 3-23. Existing streamflow gages in the UARP area. (Source: SMUD, 2005, USGS, 2007)

Existing USGS Gage No.	Gage name
11427960	Rubicon River below Rubicon dam, near Meeks Bay[a]
11428400	Little Rubicon River below Buck Island dam[b]
11429500	Gerle Creek below Loon Lake dam
11430000	SFRR below Gerle Creek
11441500	SFSC near Ice House
11441800	Silver Creek below Junction dam near Pollock Pines[c]
11441900	Silver Creek below Camino dam
11442700	Brush Creek below Brush Creek dam near Pollock Pines
11443500	South Fork of the American River near Camino

[a] measures flows below 10 cfs, does not measure dam spillage.
[b] measures flows below 2 cfs, does not measure dam spillage.
[c] measures flows up to 40 cfs, does not measure dam spillage.

Table 3-24. Existing reservoir gages in UARP area. (Source: SMUD, 2005, CDEC, 2007)

Existing USGS No.	Existing DWR Abbreviation	Reservoir Name
NA	RBL	Rubicon
11429350	LON	Loon Lake
11429600	GLL	Gerle Creek
11441100	ICH	Ice House
11441001	UNV	Union Valley
11441760	JNC	Junction
11441890	CMI	Camino
11442690	BHC	Brush Creek
11443450	SLB	Slab Creek

Currently, SMUD maintains these gages and conducts monitoring and other procedures under the supervision of, and in conjunction with USGS. Under Proposed Article 1-10, *Streamflow and Reservoir Elevation Gaging*, SMUD would maintain gages at almost all the current locations to monitor stream flows and reservoir levels as well as conduct gage installation, rating, and measurements.

PG&E's existing and proposed compliance point for flows released from Chili Bar is the existing USGS gage no. 11444500 (SFAR near Placerville). Under Proposed Article 2-8, *Streamflow and Reservoir Elevation Gaging*, PG&E also proposes to monitor the water level of Chili Bar reservoir to insure compliance.

Our Analysis

We have reviewed the existing gaging and determined that SMUD would need to modify the current gaging in order to demonstrate compliance with the proposed minimum streamflow schedules in several of the downstream reaches.

<u>Measuring flows below Rubicon dam</u>. USGS gage no. 11427960 (Rubicon River below Rubicon dam) is a measuring device located in the outlet pipes of Rubicon dam and computes flow up to 10 cfs and does not measure flow from the spillway. An auxiliary, but non-recording gage is located about 1,300 feet downstream from the dam at a point where flow from spillway has rejoined the channel. Currently, the recording gage is suitable for measurement of the 6 cfs or natural flow minimum flow existing requirement. However, the proposed minimum flows are above 10 cfs during the March through June period of most water year types, as shown in table 3-36. To demonstrate compliance with the proposed minimum streamflow schedule, SMUD would need to establish a means to measure outflow in excess of 10 cfs and this might be possible by converting the existing downstream non recording gage to a fully operational and recording gage station. In addition, according to SMUD, the current maximum low level outlet capacity is 18 cfs, so SMUD would need to modify the outlet pipe and or structure to allow compliance with streamflows of 20 cfs (April) or 35 cfs (May) during below normal (BN), above normal (AN), or Wet water years. However, SMUD would need to install a gage downstream of the confluence of the channel from spillways on the main and auxiliary dams and the low level outlet to monitor the recommended pulse flow event of at least 600 cfs for 3 consecutive days. Because the Rubicon dam and reservoir are in the Desolation Wilderness Area, SMUD would need Forest Service approval of any construction of a gage or modifications to the dam, gage, or other likely changes

<u>Measuring flows below Buck Island dam</u>. USGS gage no. 11428400 (Little Rubicon River below Buck Island dam, near Meeks Bay) is a water stage recording V-notch sharp-crested weir near the low level outlet of the dam. This gage currently measures up to 2 cfs and does not measure flow from the spillway and is suitable for measuring the present minimum flow requirement of 1 cfs. Because the proposed minimum flows are above 2 cfs during the March through June period of most water year types, as shown in table 3-37, SMUD would need to establish a means to measure outflow in excess of 2 cfs and up to 8 cfs such as modifying the existing weir measurement structure.

Measuring flows below Gerle Creek and Robbs Peak dams. USGS gage no. 11430000 (SFRR below Gerle Creek, near Georgetown) is a water stage recorder located about 600 feet downstream of the confluence with Gerle Creek and about 1.2 miles downstream from Gerle Creek dam. Currently this gage measures both minimum flows and spillage over the dam. This gage is also used to also measure minimum flows from Robbs Peak dam which is located about 1.1 miles upstream on the SFRR. SMUD states that manual staff gaging downstream of each dam is currently used in conjunction with the SFRR gage data. A rectangular weir staff gage is located at the base of Robbs Peak dam that provides gage data to correctly adjust releases from both Robbs Peak and Gerle Creek reservoirs. The gaging data is currently used to measures flows released from each dam during low flow period. Accretions in the reaches below these two dams during the summer months are not substantial between the dams and the existing gage. It would be difficult to install new flow gaging stations in the area below these two dams because of the general stairstep boulder/bedrock nature of the stream channels. Installation of gages at this location would have both short-term and long-term environmental consequences (e.g., potential erosion and sedimentation, destabilization of existing slopes, disturbance of aquatic and riparian habitat, potential degradation of the local visual quality, and potential disturbance of cultural sites). Plans for the gaging stations could provide site-specific details regarding how these effects would be addressed. Consultation with USGS for the development of these gage sites, if part of a new license, would help ensure future compliance with USGS standards for flow measurement.

Measuring flows below Junction dam. USGS gage no. 11441800 (SFSC below Junction dam, near Pollock Pines) is located in the outlet pipe from Junction dam. Currently this gage does not measure flow above 40 cfs and does not have the ability to measure flow over the spillway. SMUD states that the low level outlet pipe from Junction dam has a maximum capacity of 138 cfs. Minimum flows in excess of 40 cfs, as shown in table 3-44, are proposed for the months of April, May, and June in some water years. In order to demonstrate compliance with the proposed minimum streamflow schedule, , SMUD would need to establish a means to measure flow in excess of the current 40 cfs, such as modifying the existing measurement structure.

Measuring flows below Loon Lake dam, Ice House dam, Camino dam, Brush Creek dam, and Slab Creek dam. USGS gage no. 11429500 (Gerle Creek below Loon Lake dam, near Meeks Bay) is a water-stage recorder and V-notch sharp-crested weir about 0.3 miles below the dam. USGS gage no. 11441500 (SFSC near Ice House) is a water stage recorder with concrete control, located about 0.4 mile downstream from the dam. USGS gage no. 11441900 (Silver Creek below Camino dam) is a water stage recorder located about 0.4 miles downstream from the dam and measures low flow and dam spillage. USGS gage no. 11442700 (Brush Creek below Brush Creek dam, near Pollock Pines) measures flow in the outlet pipe from Brush Creek dam. According to SMUD, the low level outlet pipe from Brush Creek dam has a maximum capacity of 145 cfs. USGS gage no. 11443500 (SFAR near Camino) measures flow with an acoustic velocity meter approximately 1000 feet below the dam. Currently these gages measure both minimum flows and spillage over the dams and would be sufficient to measure the proposed minimum streamflow schedules, including the proposed pulse flows and/or recreational streamflows.

Operation of reservoir water level elevation gages. Currently, SMUD operates and maintains all of the water level gages listed in table 3-24, and SMUD reports the water levels on an hourly basis to the DWR.[33]. This type of monitoring is needed as part of project operations, to coordinate multiple reservoirs, powerhouses, tunnels and other structures within the project area and would be expected to be continued. The effects of the Iowa Hill development would include changes in the water-level fluctuations in Slab Creek reservoir, with a general withdraw of water during the night and increased inflow during the day during generation.

Measuring flows below Chili Bar dam. USGS gage no. 11444500 (SFAR near Placerville) measures flow with a water-stage recorder approximately 700 feet downstream of the dam. Currently this gage measures both minimum flows and spillage over the dam and would be sufficient to measure any reasonable flow regime, including possible recreational streamflows.

Streamflow and Reservoir Elevation Gaging Plan

Under Proposed Article 1-10, *Streamflow and Reservoir Elevation Gaging*, SMUD would, within 1 year after license issuance, develop and submit to the Commission for approval a streamflow and reservoir elevation gaging plan that meets the USGS standards and includes include a minimum of 10 streamflow gage locations (see table 3-23) and nine reservoir elevation compliance gaging locations (see table 3-24). This plan would be approved by the Water Board prior to filing with the Commission. SMUD would detail in the plan the maintenance and operation of all of the above mentioned streamflow and reservoir elevation gages, with the exception of USGS gage no. 11430000 (SFRR below Gerle Creek). This gage would be replaced by new gages, one below Gerle Creek reservoir and one below Robbs Peak reservoir.

As part of the Settlement Agreement, SMUD also proposes to: (1) install and maintain simple staff gages at the put-ins for the Slab Creek and Ice House recreational boating runs and perform an investigation to determine whether telemetry equipment can be installed at Rubicon River below Rubicon dam and Little Rubicon River below Buck Island dam to monitor conditions and/or control operations both within 2 years of licensing; and (2) provide real time information at 15 minute intervals for all streamflow and reservoir elevation gages.

Under Proposed Article 2-8, *Streamflow and Reservoir Elevation Gaging*, PG&E would, within one year after license issuance, develop and file for approval from the

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[33]The data are available online at http://cdec.water.ca.gov/reservoir.html.

Commission a stream flow and reservoir elevation gaging plan, which would meet USGS standards. This plan, which would be approved by the Water Board prior to filing with the Commission, would address compliance streamflow gaging below Chili Bar dam at the existing USGS gage no. 11444500 (SFAR near Placerville) and in water level compliance at Chili Bar reservoir.

The Placer County Water Agency recommends that SMUD implement a gaging system of SMUD's facilities that would verifiably and effectively monitor, report, and limit the rate of water diversion at SMUD's diversions facilities in the Rubicon River watershed. To effectively perform these functions, gaging would be required at the diversion gage locations shown in table 3-25 and real time telemetry reporting capability installed, maintained, and made available to PCWA and other resource agencies.

Table 3-25. Existing diversion structure gages in Rubicon River watershed area of the UARP. (Source: SMUD, 2005)

Existing USGS Gage Number	Gage Name
11427940	Rubicon–Rockbound tunnel
11428300	Buck Island–Loon tunnel
11429340	Loon Lake powerhouse
11429300	Robbs Peak powerhouse

Our Analysis

SMUD and PG&E already monitor, or in some cases provide assistance to the USGS for monitoring and recording, many hydrological indicators, such as reservoir water level and stream gaging sites in the project area. Daily and, in many cases, hourly or shorter interval data recording allows SMUD and PG&E to manage its facilities for hydroelectric generation and document environmental compliance within the terms of its existing license. The configuration of future flow and water level monitoring gages would depend on the operating conditions that may be specified in new licenses. Developing a coordinated gage installation plan, in consultation with resource and land management agencies, as well as USGS, would ensure that any new gages necessary to measure the flows and water levels that may be specified in a new license would provide accurate data consistent with applicable USGS standards. It also would provide the justification for the type of new gage (i.e., a gage with real-time, telemetry capabilities, or a gage without such capabilities) that is installed at each site to be documented, and any needed modifications to existing streamflow or reservoir elevation gages. Other specific details of the streamflow gaging and reservoir elevation plans are discussed below.

Currently, real time reporting is not available on any diversion structures located within the Rubicon River watershed area of the UARP area. Proposed Article 1-10, *Streamflow and Reservoir Elevation Gaging*, does not include gaging at the diversion structures listed in table 3-25. Although the installation of real-time telemetry and other equipment to monitor, report, and limit the diversion flow at these structures, as suggested by Placer County, would provide information on quantity of water diverted from these structures, we see no nexus between the requested gaging and this relicensing proceeding. In fact, this would seem to be a matter that would fall under the jurisdiction of the Water Board.

Public Information Services

Under Proposed Articles 1-25 and 2-14, *Public Information Services*, SMUD and PG&E would provide real-time streamflow and reservoir level information to the public via staff gages in the reservoirs, websites and toll free telephone numbers.

Our Analysis

<u>Staff gages for recreational boating at the put-ins for Slab Creek and Ice House boating runs.</u> Staff gages at these sites would allow boaters to observe the actual water level before launching on these whitewater runs. These gages would be roughly calibrated to flow levels that are too low, too high, or suitable for recreational boating activities. This measure is discussed in more detail in section 3.3.6.2, *Recreational Resources*.

<u>Telemetry equipment on gages on the Rubicon River below Rubicon dam and on the Little Rubicon River below Buck Island dam.</u> As is the case with possible modification to the existing gage, or replacement of the gage below Rubicon dam, SMUD and the Forest Service would need to concur that telemetry equipment is economically and technologically feasible, and whether it could be installed consistent with law, regulations, and policies applicable to Desolation Wilderness Area.

<u>Provide real-time information at 15 minute intervals for all stream flow and reservoir elevation gages within the UARP area.</u> Currently, real-time reporting is not available to the public on any streamflow gaging sites within the UARP area. Hourly real-time reservoir levels are available on the CDEC website. Real-time information for all streamflow and reservoir elevation locations can normally be easily and inexpensively collected in either 1-hour or 15-minute intervals and made available to the public and would allow the public, operators of downstream projects, such as Chili Bar Project and the Middle Fork American River Project, and others to coordinate their activities and operations based on this information.

<u>Chili Bar streamflow and reservoir gaging plan</u>. Flow compliance monitoring for releases from Chili Bar reservoir would necessitate the continuing operation of gage no. 11444500 located below Chili Bar dam. Currently this is not a real-time USGS gage, but flows and gage heights at one hour intervals are presently available on the CDEC website for this streamflow gage. Reservoir level compliance would entail likely upgrade of the current system that PG&E uses to monitor the water level within Chili Bar reservoir.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed. Minimum flows, pulse flows, ramping rates, streamflow and reservoir elevation gaging, and public information services would be as described in the Proposed Action. As a result, the effects of the UARP-only Alternative would be the same as discussed under the Proposed Action with the exception that Slab Creek reservoir would not experience the daily and weekly fluctuations from the operation of the pumped storage project.

Effects of Project Operations on Water Quality

Operation of the Projects has the potential to affect water temperatures, water quality, and algae. The available information that serves as the basis for our analysis regarding the effects of project operations on water temperatures is not consistent between reaches. SMUD used water temperature observations and the SNTEMP model (Theurer et al., 1984) to simulate the effects of altered flow regimes on water temperatures in the Ice House, Camino, and Slab Creek dam reaches; and it used CE-QUAL-W2 (Wells, 2000) to simulate the effects of the proposed Iowa Hill development on water temperatures within Slab Creek reservoir. Water temperature was not modeled for the other UARP or Chili Bar Project-affected reaches and our analysis is by necessity based on observed temperatures.

The results of hourly temperature measurements made during 2000 to 2004 are used to represent existing conditions for all reaches. We compare the mean temperature for each day (i.e., 24-hour period), which we refer to below as "mean temperature", to 20.0°C as an indicator of whether thermal conditions fully support cold water fishes. The lack of directly comparable information as discussed above, resulted in our using two approaches to evaluate the effects of flows on water temperatures, depending on whether or not modeling had been done. For the reaches that were modeled, our analysis focuses on the applicants' water temperature simulations for 2002, a BN water year. To determine the potential effects of proposed operations on water temperature in project reaches that were not modeled, we consider the changes in the proportion of total flow for BN years that would be supplied by the corresponding dam release (as opposed to the percentage provided by natural accretion). The existing minimum streamflow schedules referred to in our analysis are shown in tables 3-4 through 3-10 in section 3.3.2.2, *Water Quantity*. A summary of the temperatures in 2000–2004 referred to in our analysis are shown in table 3-16, and the elevations of the low water intakes and outlets are shown in table 3-15 in section 3.3.2.1, *Water Quality.* In addition, we evaluate the effects of proposed minimum flows and operation of the proposed Iowa Hill development below using the results of SMUD's CE-QUAL-W2 simulations. The results of our analyses of these issues are summarized in table 3-26, and discussed below.

Table 3-26. Summary of general water temperature characteristics for the UARP and Chili Bar Project affected reaches under existing and proposed minimum instream flows and proposed Iowa Hill operations.[a] (Source: Staff)

Reach	Existing Operations[b]	Proposed Operations[c]
Rubicon	Warm late spring to summer releases. In comparison to dam release temperatures, major warming in May and June transitioning to minor to moderate cooling in July, which continues through September. Frequently >20°C in portions of the reach in July and August.	Temperatures slightly reduced compared to existing conditions in May and June, but negligible change in July–September.
Buck Island	Warm late spring to summer releases. Moderate to major warming within the reach during May–June, transitioning to minor cooling in July, which continues through September. Frequently >20°C throughout the reach in July and August.	Temperatures slightly reduced in May and June, but negligible effects in July–September.
Loon Lake	Cool releases through mid-September. Moderate warming in May, major warming in June–August, and minor cooling in late September. Remain <20°C throughout the bypassed reach.	Temperatures moderately reduced in June and July, and slightly reduced in May and August.
Gerle Creek	Moderate warming in May–July followed by minor warming in August and minor cooling in September. Remain <20°C throughout the bypassed reach.	Temperatures somewhat reduced during May through mid-August, and slightly increased in September.
Robbs Peak	Moderate warming in May–July, minor cooling in August, and moderate cooling in September. Remains <20°C in most years, but frequently >20°C in Dry years.	Temperatures somewhat reduced during May through mid-August, and slightly increased in September.
Ice House	Cold May–September releases. Major warming May–September. Infrequently >20°C in July and August in the lower half of the reach.	Based on temperature simulations for a BN year, temperatures would be reduced 3 to 4°C in June and reduced about 2°C in July. The cooling effect would be smaller at both the upper and lower ends of the reach, although temperatures would likely remain <20°C throughout the entire reach.
Junction	Cool May–September releases. Major warming May–September. Rarely >20°C at lower end of reach in July.	Temperatures substantially reduced in May–July, maintaining <20°C. Temperatures slightly increased in August and September of AN and Wet water years due to lower minimum flow releases.

Reach	Existing Operations [b]	Proposed Operations [c]
Camino	Moderate release temperatures. Major warming in May–September. At the lower end of the reach, >20°C frequently in July, occasionally in June and August, and rarely in May.	Based on temperature simulations for a BN year, temperatures at the lower end of the reach would be reduced substantially in May–July, and remain virtually the same in August and September. Temperatures would be >20°C less often than under the existing conditions.
SFAR	At the upper end of the reach warm inflows from both the SFAR and Camino dam reach resulting in >20°C frequently in July and August, occasionally in June, and rarely in September.	Minimal to no measurable effects on temperatures.
Brush Creek	Major warming in May–July and moderate warming in August–September. Remains <20°C throughout the bypassed reach.	Temperatures somewhat reduced throughout the reach.
Slab Creek	Moderate release temperatures. In the reach upstream of White Rock powerhouse, major warming in May–September. In the lower portion of this section, frequently >20°C in June–August.	Based on temperature simulations for a BN year, temperatures substantially reduced at the lower end of the reach, although temperatures of >20°C could continue to occur in June–August. Pumping/generation cycling of the proposed Iowa Hill development would result in slightly cooler conditions (<1 °C) within Slab Creek reservoir and the streamflow releases from Slab Creek dam.
Chili Bar	Major warming in June–September and moderate warming in May. The lower end of the reach is rarely >20°C.	Temperatures slightly reduced May–September, likely to levels that remain <20°C.

[a] General trends based on mean temperatures.

[b] For Existing Operations, effects are presented as a comparison to release temperatures from the respective dam.

[c] For Proposed Operations, effects are presented as a comparison to existing conditions.

Our Analysis

Rubicon Dam and Buck Island Dam Reaches

The thermal regime of releases from both Rubicon and Buck Island reservoirs, which do not thermally stratify, have the same general seasonal pattern as in the Rubicon River inflow to Rubicon reservoir. The mean daily temperatures at the upstream end of the Rubicon dam reach are about 3 to 6°C in early May, increase to about 12°C in mid- to late June, rapidly increase to over 20°C in mid-July, then gradually cool after mid-August. Warmer temperatures occur earlier in the season during Dry water years. The temperature of releases from Buck Island dam into the

Little Rubicon River follow the same general pattern as the Rubicon dam releases, but they are about 1.5 to 3°C warmer in late spring to early summer, and slightly (<1°C) warmer in late summer.

The Rubicon dam and Buck Island dam reaches experience similar changes in water temperature. Based on mean daily temperatures, both reaches experience substantial warming (increases of about 1.5 to 3.5°C) in May and June, a transition from warming to cooling in July, and cooling in August and September. These characteristics are closely linked to the relationship between accretion and release flows. Typically, accretion flows account for more than 90 percent of the total flow during May and June, but less than 15 percent of the total flow in August and September. Downstream of the confluence of the two rivers, water temperatures tend to closely follow those of the Little Rubicon River.

Under the Settlement Agreement, the primary objectives for the Rubicon River downstream of Rubicon dam and Buck Island dam reach are to provide cold freshwater habitat for healthy trout and mountain yellow-legged frog populations, and less conducive conditions for California roach, speckled dace, and golden shiners. The Settlement Agreement also attempts to reduce elevated aluminum concentrations that may adversely affect aquatic organisms.

Proposed Article 1-1, *Minimum Streamflows*, would increase minimum streamflow releases from both dams during May and June, but would not change releases during July through September, with the exception of releasing 1 cfs when natural flows are less than 1 cfs (tables 3-36 and 3-37, see section 3.3.3, *Aquatic Resources*, below). Based on our analysis, we conclude that the proposed minimum streamflow releases would slightly lower May and June water temperatures in both bypassed reaches, but not change water temperatures during July through September. Although the settlement parties indicated that the proposed flow regime is intended to address the elevated aluminum concentrations in Rubicon reservoir, there is no evidence that they would substantially reduce aluminum concentrations nor is there any evidence that the aluminum concentrations are project related. In order to conclusively determine whether aluminum concentrations are reduced in the reservoir, aluminum concentrations would need to be monitored after the new flow regime is implemented.

Loon Lake Dam Reach

Mean daily temperatures typically remain below 20°C in the bypassed reach between Loon Lake dam and Gerle Creek reservoir. Loon Lake dam releases are made from the low-level outlet, which is at a depth of 83 feet below the reservoir's normal maximum level, resulting in mean daily release temperatures of about 4 to 6°C in early May, slowly and steadily increasing to about 12°C by late August to mid-September. During drawdown of Loon Lake in the late summer of some years, mean daily temperatures of reservoir releases increase to 15 to 17°C at a faster rate. Within this bypassed reach, mean daily temperatures increase about 1.5°C in May, about 5°C in

June and August, about 7°C in July, and decrease in late September. Much of this warming of the cool deepwater releases from Loon Lake appears to result from ambient air temperatures and solar insolation within 2 miles of the dam. Thermal characteristics of the Loon Lake dam reach appear be highly influenced by the cool late spring and summer releases from the dam and accretion from tributaries and other sources. Typically, releases account for less than 10 percent of the total flow during May, about 30 percent of the total flow in June, about 70 percent of the total flow in July, and 90 percent of the flow in August and September.

Under the Settlement Agreement, the primary objectives for the Loon Lake dam reach are to provide cold freshwater habitat for healthy rainbow trout, brown trout, and mountain yellow-legged frog populations. Proposed Article 1-1, *Minimum Streamflows*, would increase minimum streamflow releases during May through September of most years, with the largest increases occurring in May and June (table 3-38, see section 3.3.3, *Aquatic Resources*, below). Based on our analysis, we conclude that the proposed minimum streamflow releases would slightly lower May and August water temperatures, and moderately lower water temperatures during June and July.

Gerle Creek Dam and Robbs Peak Dam Reaches

Streamflow releases from both Gerle Creek reservoir and Robbs Peak reservoir, which do not thermally stratify, have mean daily temperatures that do not exceed 20°C in most years, although releases from Robbs Peak dam frequently exceed 20°C in July and August of Dry water years. Mean daily temperatures of releases from Gerle Creek dam are about 5 to 7°C in early May, increase to about 12°C in mid- to late June, and increase to their peak of about 15 to 18°C in late August or early September. Warmer temperatures occur earlier in the season during Dry water years, resulting in 12°C as early as late May. The temperature of releases from Robbs Peak dam into the SFRR were warmer and much more variable than Gerle Creek dam releases, which are highly influenced by deep-water releases from Loon Lake, reaching their peak mean daily temperatures of 18 to 22°C in late July to August. In 2001, a Dry water year, mean daily temperatures of Robbs Peak dam releases exceeded 20°C continuously from July 14 through August 16, indicating that coldwater fishes are not fully supported.

Based on differences in mean daily temperatures within the Gerle Creek and Robb Creek releases, the temperatures of streamflow releases from Gerle Creek dam and Robbs Peak dam increase about 1.5 to 2°C during May through July before reaching the Gerle Creek/SFRR confluence. In August, these reaches tend to transition from increasing to reducing temperatures as a result of ambient air temperatures becoming cooler. The cooler ambient air temperatures lower mean daily temperatures about 0.5 to 1.5°C in September. Inflow from the Gerle Creek dam reach had little effect on temperatures with the largest effects being an increase of about 0.5°C in September. These thermal characteristics are closely linked to release temperatures from Gerle Creek dam, which are sometimes affected by drawdowns of Loon Lake and Robbs Peak dam.

Under the Settlement Agreement, the objectives include providing cold freshwater habitat for healthy mountain yellow-legged frog populations in the Gerle Creek dam reach, and providing cold freshwater habitat for healthy mountain yellow-legged frog and foothill yellow-legged frog populations in the SFFR downstream of Robbs Peak dam. Proposed Article 1-1, *Minimum Streamflows*, would increase minimum streamflow releases from both Gerle Creek dam and Robbs Peak dam during May through September, with the largest increases occurring in May and June (tables 3-39 and 3-40, see section 3.3.3, *Aquatic Resources*, below). Based on our analysis, we conclude that the proposed minimum streamflow releases would somewhat lower water temperatures during May through mid-August, and slightly increase water temperatures in September. We anticipate that the largest reduction in temperatures would occur in the SFRR because the proposed minimum streamflow releases are more than four times the current requirements in May and June.

Ice House Dam Reach

Mean daily temperatures generally remain below 20°C in most of the SFSC bypassed reach between Ice House dam and Gerle Creek reservoir. Releases from the Ice House dam low-level outlet, which is at a depth of approximately 122 feet below the reservoir's normal maximum level, are drafted from the hypolimnion of Ice House reservoir, resulting in mean daily release temperatures of about 5 to 7°C from May through September. About two thirds of this reach flows through a large area that was burned by the Cleveland Fire in 1992 and that is not fully revegetated. Water temperature increases are moderate upstream of the area that was burned, but they are substantial within the burned area. Between the dam and about 0.5 mile upstream of the burn, mean daily temperatures increased about 2 to 3.5°C in May through August and about 1°C in September, although temperatures remain below 12°C.

Between the dam and the lower end of the reach, mean daily temperatures increase about 11 to 12°C in June through August, and about 7°C in May and September. The monitoring results indicate that mean daily temperatures occasionally exceed 20°C in the area affected by the burn in July and August, and that they nearly reach 20°C in June of some years. Thermal characteristics in the Ice House dam reach are highly influenced by the cool spring through summer releases from the hypolimnion of Ice House reservoir, the open unshaded burn area, and accretion from tributaries and other sources. Based on required minimum flows for BN water years, dam releases account for about 15 to 20 percent of the total flow in May and June and about 50 percent of the total flow in July through September.

Under the Settlement Agreement, one of the primary objectives for the Ice House dam reach is to provide temperatures that allow for management of native coldwater fish species and improve habitat conditions for foothill yellow-legged frog populations. Proposed Article 1-1, *Minimum Streamflows*, would substantially increase minimum streamflow releases during May through July of all years, and August and September of CD and Dry water years (table 3-42, see section 3.3.3, *Aquatic Resources*, below).

These higher minimum streamflow releases would reduce water temperatures throughout much of the bypassed reach.

Comparison of simulated daily mean and daily maximum temperatures indicates that the existing hypolimnetic releases result in cooler than existing conditions throughout much of the reach. Simulated temperatures for existing conditions were as much as 15°C cooler (7°C for existing versus 22°C for natural) just downstream of the dam, about 3 to 4°C cooler than existing temperatures near the middle of the reach, and virtually the same at the lower end of the reach. Comparison of simulated temperatures for the existing and proposed operations suggests that proposed operations would result in mean temperatures in June that about 3 to 4°C lower than under existing operations and about 2°C lower in July. This cooling effect would be smaller at both the upper and lower ends of the reach. However, it appears that mean daily temperatures of 20°C or less would be maintained throughout the entire reach. Recovery of vegetation in the burn area is expected to slowly increase shading of this reach and thereby reduce input of solar energy and somewhat lower temperatures in the lower half of the reach through any new license term.

Junction Dam Reach

Mean daily temperatures rarely exceed 20°C in Silver Creek between Junction dam and Camino reservoir, the Junction dam reach. At Junction dam, releases to the bypassed reach are typically provided through the low-level outlet, which is at a depth of 115 feet below Junction reservoir's normal maximum level. Mean daily release temperatures are about 4 to 7°C in early May, increase to about 7 to 11°C by early June, and remain in that temperature range through September. Considerable warming occurs in the reach, as is evidenced by mean daily temperatures just upstream of Camino reservoir averaging about 5°C higher than at the release in May and September, and 7 to 8.5°C higher in June through August. Limited monitoring conducted during July through September of 2004 indicates that release temperatures increase by about 1°C within 0.5 miles of the dam.

It appears that the water temperature in this reach is primarily controlled by the quantity and temperature of releases from Junction dam, and accretion from tributaries and other sources in the reach. Based on accretion and required minimum streamflow releases for BN water years, releases account for about 25 to 30 percent of the total flow during May and June and about 55 to 60 percent of the total flow in July through September.

Under the Settlement Agreement, an objective for the Junction dam reach is to provide temperatures that allow for management of native coldwater fish species and improve habitat conditions for foothill yellow-legged frog breeding. Another objective is to reduce the presence of an unidentified algae species that has proliferated throughout the reach. Proposed Article 1-1, *Minimum Streamflows*, would increase minimum streamflow releases from Junction dam during May through July of all water year types, in August of Dry and CD water years, and September of CD water years (table 3-44, see section 3.3.3, *Aquatic Resources*, below).

In addition, this proposed article would somewhat reduce minimum streamflow releases from Junction dam in August and September of AN and Wet water years. We anticipate that the large increases in May through July minimum streamflow releases would substantially reduce temperatures in the reach. We anticipate that the proposed reduction of minimum streamflow releases for August and September of AN and Wet water years would increase temperatures in the reach, although this warming effect is expected to be minimal since the proposed reductions in streamflow are small. Mean daily temperatures under the proposed minimum streamflow releases are expected to remain below 20°C, although water temperatures have not been monitored recently during AN or Wet water years so there is a possibility that mean daily temperatures could exceed 20°C. We anticipate that warmer water temperatures would occur in edgewater habitat that has slower velocities and is not thoroughly mixed with the main flow of the river.

In order to maintain mean daily temperatures of no more than 20°C in the Junction dam reach, Proposed Article 1-1, *Minimum Streamflows*, also includes a clause that would require SMUD to release a block of water for temperature control in Wet water years. If water temperature measured in Silver Creek immediately upstream of Camino reservoir exceeds a mean daily temperature of 20ºC in July, August, or September of a Wet water year, SMUD would be required to release additional water into Silver Creek below Junction dam as directed by the Agencies. A block of water shall not exceed 1,044 acre-feet for July, 491 acre-feet for August, or 475 acre-feet for September. Within 1 year of license issuance, SMUD would, in consultation with the Agencies, develop a plan for the block of water that addresses, at a minimum: notification protocols for temperature exceedances, emergency temperature operation contingencies, and ecological monitoring needs associated with use of the block of water. Reserving the block of water, monitoring water temperatures at the lower end of the Junction dam reach, and developing a plan for notification protocols and ecological monitoring needs associated with the block of water would facilitate making informed decisions of how best to manage the block of water to provide the most cost-effective improvement of ecological resources, if necessary.

During the settlement process, pulse flows were strongly considered for this reach to address the stagnant conditions that contribute to excessive algae growth and limit movement of spawning gravels. However, to conserve water for hydroelectric generation and recreational interests, minimum streamflows that follow the shape of the unimpaired hydrograph and are higher than the current minimum streamflows were included in the settlement instead, in hopes that they will address these undesirable ecological conditions. In their rationale for the Settlement Agreement, both the Forest Service and CDFG indicate that they expect the higher minimum streamflows to suppress unknown algae species in the reach. The Settlement Agreement includes an adaptive management approach to address this issue, which we discuss in section 3.3.2.2, *Algae Monitoring and Adaptive Management*.

Camino Dam and SFAR Reaches

Streamflow releases from Camino dam have the potential to affect water temperatures in Silver Creek from Camino dam to the SFAR confluence (Camino dam reach) and in the SFAR from this confluence to Slab Creek reservoir (SFAR reach). Monitoring results indicate that mean daily temperatures exceed 20°C in the lower end of the Camino dam reach and in the SFAR reach (see table 3-16). Mean daily temperatures of streamflow releases from Camino reservoir, which does not thermally stratify, are about 7-10°C in early May, increase to about 8 to 11°C throughout most of June through September, but generally remain below 12°C. Between Camino dam and the SFAR confluence, mean daily temperatures increase about 6°C in May and September and about 8.5 to 10°C in June through August. Evaluation of mean daily temperatures for the 2000 through 2004 monitoring period show that exceedances of 20°C occurred at the lower end of the Camino dam reach on nearly 70 percent of the days in July, about 20 percent of the days in June and August, and occasionally (<5 percent of the days) in May.

At the confluence of the lower end of the Camino dam reach and the SFAR, the SFAR contributes very warm water, as documented by mean daily temperatures exceeding 20°C on nearly 90 percent of days in July and 60 percent of days in August. The SFAR temperatures are increased by higher temperature inflow from the Camino dam reach in May and June, and slightly reduced by cooler conditions in the Camino dam reach in July and August. In September, Camino dam temperatures have negligible effects on SFAR temperatures. Overall, this results in mean daily temperatures immediately downstream of the confluence of Silver Creek with the SFAR that exceed 20°C frequently in July and August, occasionally in June, and rarely in September. A short distance upstream of Slab Creek reservoir, Camino powerhouse discharges much cooler water into the SFAR, resulting in mean daily temperatures that are generally 10 to 15°C during late spring through early fall, with rare exceedances of 20°C in July and August.

Under the Settlement Agreement, the objectives for the Camino dam reach include providing temperatures that allow for management of native fish and improve conditions for foothill yellow-legged frog breeding, and providing good water quality to improve bioassessment composite metric scores, particularly in the lower portion of the reach. SMUD and the parties involved in the settlement do not provide their objectives for the SFAR reach, which also is affected by Camino dam releases.

Proposed Article 1-1, *Minimum Streamflows*, would substantially increase minimum streamflow releases from Camino dam during May through July of all water year types, in August of Dry and CD water years, and September of CD water years (table 3-46, see section 3.3.3, *Aquatic Resources*, below). In addition, this proposed article would somewhat reduce minimum streamflow releases from Camino dam in August and September of AN and Wet water years.

Simulated temperatures for the BN year of 2002 suggest that the proposed minimum flows would reduce mean daily temperatures in Silver Creek upstream of the confluence with the SFAR about 5°C in May and June, and about 3°C in July, but still remain above 12°C from mid-May through September. It appears that mean daily temperatures at the lower end of the Camino dam reach would seldom exceed 20°C in May though July of BN water years. Proposed operations would remain virtually the same for August and September of BN water years, and thus the thermal regime would remain the same. Mean daily temperatures would occasionally exceed 20°C in August. In 2001, a Dry water year, mean daily temperatures for the lower end of the Camino dam reach exceeded 22°C in June, July, and August. The proposed increased minimum streamflow releases would reduce these temperatures, although it is not evident whether these reductions would lower temperatures to less than 20°C, since water temperatures were not simulated for a Dry year. Temperature monitoring would need to be conducted at this site to determine if the new flow regime reduced mean daily temperatures to less than 20°C. If mean daily temperatures continue to exceed 20°C, the licensee could determine whether further increasing minimum flows could reduce temperatures to acceptable conditions. We discuss the effects of warmer termperatures on life stages of trout in section 3.3.3.2, *Environmental Effects*, in Aquatic Resources.

SMUD addressed the possibility that the proposed minimum flows would not reduce mean daily temperatures to acceptable levels by including a provision to use a block of water to further reduce Camino dam reach temperatures in Wet years. Proposed Article 1-1, *Minimum Streamflows*, includes a provision to adaptively use up to 1,044 acre-feet for July; 491 acre-feet for August; or 475 acre-feet for September. If water temperature measured in Silver Creek immediately upstream of the SFAR confluence (USGS gage no. 11442000, SMUD station SC-1) exceeds a mean daily temperature of 20ºC in July, August, or September of a Wet water year, SMUD would be required to release additional water into Silver Creek below Camino dam as directed by the Agencies. Within 1 year of license issuance, SMUD would, in consultation with the Agencies, develop a plan for the block of water that addresses, at a minimum: notification protocols for temperature exceedances, emergency temperature operation contingencies, and ecological monitoring needs associated with use of the block of water.

Reserving the block of water, monitoring water temperatures at the lower end of the Camino dam reach, and developing a plan as to notification protocols and ecological monitoring needs associated with the block of water would facilitate making informed decisions of how best to manage the block of water to provide the most cost-effective improvement of ecological resources, if necessary. However, we note that our analysis indicates that mean daily temperatures could potentially exceed 20°C at the lower end of the Camino dam reach under the proposed minimum streamflow release schedule in water year types other than just Wet water years, for which this adaptive process is reserved.

Although the proposed minimum streamflow releases would increase the quantity of water contributed by the Camino dam reach and reduce the temperature of those contributions, their effect on water temperatures in the SFAR reach would likely be negligible due to the much greater contributions of flow from the SFAR.

Brush Creek Dam Reach

Mean daily temperatures typically remain below 20°C in Brush Creek between the diversion dam and Slab Creek reservoir, the Brush Creek dam reach. Dam releases from the low-level outlet, which is at a depth of 140 feet below the reservoir's normal maximum level, result in mean daily release temperatures of about 7-10°C in early May, increasing to about 12-14°C by mid-June, and reaching their peak of about 13-15°C in August. Mean daily temperatures for the lower end of the bypassed reach were very similar to those measured in the creek just upstream of Brush Creek reservoir, suggesting that they were near their equilibrium with ambient conditions. This is likely due to the reach's steep gradient with frequent small waterfalls, along with minimal accretion during the summer. Annual maximums of mean daily temperatures for the lower end of the reach ranged from about 16-20°C.

The existing license requires June through September minimum streamflow releases from Brush Creek dam ranging from 2 to 3 cfs or the natural flow, whichever is less. Under Proposed Article 1-1, *Minimum Streamflows*, corresponding minimum streamflow releases would be increased to a range of 3 to 9 cfs or natural flow, or 1 cfs if natural inflow is less than 1 cfs (table 3-47, see section 3.3.3, *Aquatic Resources*, below). This flow regime was developed with an emphasis on managing for native aquatic species. The mean trout biomass present in Brush Creek is well below the recommended objective, so the objective of minimum streamflows is to increase biomass by increasing the available stream habitat via streamflow regime manipulation. Increasing the summer minimum streamflow releases would provide more cool water at the upper end of the bypassed reach, and is therefore expected to result in somewhat cooler temperatures throughout the reach. Providing minimum streamflow releases of 1 cfs when the natural flow is less than 1 cfs is expected to somewhat reduce temperatures, at least in the upper end of the bypassed reach.

Slab Creek Dam Reach

Mean daily temperatures frequently exceed 20°C in the lower portion of the SFAR between Slab Creek dam and Chili Bar reservoir (the Slab Creek dam reach). Slab Creek dam releases are made from the low-level outlet, which is at a depth of 170 feet below Slab Creek reservoir's normal maximum level. This results in mean daily release temperatures of about 7 to 11°C in early May, increasing to about 12°C by late May to early June. Temperatures reach their peak of 14 to 16°C in June, and generally remain at 10 to 15°C through September. Mean daily temperatures at

Mosquito Bridge, located near the middle of the reach length, average about 3.5 to 4.5°C higher than at the release point in May through August and are about 2°C higher in September. In the lower end of the reach, Rock Creek contributes its flow, which is typically warmer than Mosquito Bridge site flows. Just upstream of the White Rock powerhouse (located at the lower end of the Slab Creek dam reach) mean daily temperatures are generally 18 to 24°C in June through August. Mean daily temperatures exceeding 20°C are common at this site in June, July, and August.

Under the Settlement Agreement, the objectives for the Slab Creek dam reach include providing temperatures that allow for management of native fish and improve habitat conditions for foothill yellow-legged frogs and hardhead, and providing good water quality to improve bioassessment composite metric scores, particularly in the lower portion of the reach. Proposed Article 1-1, *Minimum Streamflows*, would substantially increase minimum streamflow releases from Slab Creek dam during May through September of all water year types (tables 3-48 and 3-49, see section 3.3.3, *Aquatic Resources*, below).

Simulated mean daily temperatures suggest that the proposed minimum streamflows would substantially reduce temperatures at the lower end of the Slab Creek dam reach. SMUD also provided longitudinal plots of the range of mean daily temperatures simulated for flow releases of 30 to 270 cfs. These plots suggest that mean daily temperatures at the lower end of the reach would generally be about 10 to 15°C in May, 14 to 21°C in June, 19 to 22°C in July, 17 to 21°C in August, and 13 to 19°C in September. These simulations suggest that mean daily temperatures could exceed 20°C, which we use as an indicator of providing the designated coldwater habitat, in the lowermost one-third of the reach in June and July and the lowermost mile in August. Because water temperature modeling was only done for a BN water year type, it is not possible to use model simulations to assess conditions for other water year types. However, the proposed minimum streamflow releases are substantially higher than the existing required minimum flow releases, so we anticipate that a substantial reduction in warming would also occur in other water year types.

Construction and Operation of Iowa Hill Development

SMUD's Proposed Action includes construction and operation of the Iowa Hill development, which would use the existing Slab Creek reservoir as a lower reservoir and a new 6,400 acre-foot upper reservoir on top of Iowa Hill (section 2.4.1, *Proposed Project Facilities*). Operation of the proposed Iowa Hill development has the potential to affect the thermal regime of Slab Creek reservoir and the SFAR directly downstream of the Slab Creek dam. In order to evaluate this potential effect, SMUD used version 3.2 of CE-QUAL-W2, a 2-dimensional (vertical and longitudinal) hydrodynamic water quality model developed by the U.S. Army Corps of Engineers, Waterway Experiment Station and Scott Wells (Cole and Buchak, 1995; Wells, 2000), to simulate water temperatures for the period of April 1 through October 1 of 2003, a BN water year.

A pumping/generation cycle was developed for a heavy use scenario using output from the CHEOPS UARP operations model. Under this scenario, the general pattern of operation is to pump water up to Iowa Hill reservoir at night (approximately midnight to 5 am), and release generation flows from Iowa Hill reservoir during the daytime (approximately 7 am to 8 pm). The temperature analysis repeated this daily pattern of pumping and generation from April 2 through September 29. Simulated mean water column temperatures for Slab Creek reservoir near the dam were a little cooler (as much as 0.87°C cooler and averaged 0.39°C cooler) for the heavy use scenario than the without Iowa Hill development scenario. The range of these differences was very close to the absolute mean errors computed for the calibrated vertical profiles from the nearest site to the Slab Creek dam (0.28 to 0.55°C). The combination of these factors suggests that pumping/generation cycling of the proposed Iowa Hill development would result in cooler water being discharged from the proposed Iowa Hill reservoir during the daytime that would cause minimal cooling within Slab Creek reservoir and the streamflow releases from Slab Creek dam.

Chili Bar Dam Reach

Mean daily temperatures occasionally exceed 20°C in the lower portion of the SFAR reach between Chili Bar dam and Folsom Lake, the Chili Bar dam reach. Chili Bar dam water is released from the low-level outlet, which is at a depth of about 73 feet below Chili Bar reservoir's normal maximum level. This results in mean daily release temperatures of about 8 to 12°C in early May, increasing to their peak of about 16 to 17°C in late June to early July, and generally remaining above 12°C through September. Water temperatures increase at a similar rate throughout the reach's length. Between the Chili Bar dam and the lower end of the reach mean daily temperatures increase about 2 to 2.5°C in May, June, and September and about 3 to 3.5°C in July and August. It appears that the thermal characteristics in this reach are primarily controlled by the quantity and temperature of releases from Chili Bar dam and ambient conditions.

Under the Settlement Agreement, the primary objectives for the Chili Bar dam reach include providing habitat for healthy foothill yellow-legged frog populations, and reducing or eliminating water quality conditions that encourage algae growth in the Chili Bar dam reach. Proposed Article 2-1, *Minimum Streamflows,* would substantially increase the current minimum streamflow releases of 100 cfs from Chili Bar dam during May through September of all water year types (table 3-51, see section 3.3.3, *Aquatic Resources*, below). We base our analysis of the effects of the proposed minimum streamflow schedule on the assumption that the heat load downstream of the dam would remain virtually the same as it is under existing conditions. This leads us to conclude that the proposed minimum streamflow releases would slightly lower May through September water temperatures, probably to mean temperatures of less than 20°C.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Project operations at all reaches and reservoirs, with the exception of Slab Creek reservoir would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on water temperature and algae would be the same as those described under the Proposed Action, without the effects discussed for the Iowa Hill development.

Effects of Project Construction and Maintenance on Water Quality

Construction of project facilities and maintenance of existing facilities have the potential to adversely affect water quality.

Under Proposed Article 1-11, *Canal and Penstock Emergency and Maintenance Release Points*, SMUD would, within 1 year after license issuance, file with the Commission a plan approved by the Forest Service and the Water Board, to evaluate canal and penstock emergency and maintenance release points to determine if improvements can be made to minimize potential adverse water quality effects when the release points are used. SMUD also would consult with CDFG and FWS in the development of the plan. Upon Commission-approval of the plan, SMUD would implement the recommendations contained in it.

Iowa Hill Development

Under Proposed Article 1-42, *Water Quality and Water Pollution*, SMUD would consult with the Agencies, Central Valley Water Board, U.S. Army Corps of Engineers, and other resource agencies with authority over public trust resources within the area of potential effects (APE) from construction and operation of the proposed Iowa Hill development. Prior to initiating any construction activities, SMUD would provide detailed design plans and a proposed timeline for construction to appropriate state and federal regulatory agencies, and obtain all necessary permits. These permits would include but not be limited to National Pollutant Discharge Elimination System Permit, Waste Discharge Requirements, section 404 Permit, section 401 Certification, Streambed Alteration Permit and/or other authorizations or certifications as determined necessary under state or federal law.

Prior to undertaking activities on National Forest System lands, SMUD would file with the Commission a storm water pollution prevention plan that is approved by the Forest Service, the Water Board, and CDFG. During construction, operation and maintenance of the project, SMUD would prevent water pollution by implementing management practices identified in the Storm Water Pollution Prevention Plan and other requirements identified by the Forest Service, the Water Board, and Central California Water Board. All equipment for construction of the tunnel would be staged at least 100 feet from the SFAR. After construction activities are completed, all material used within the river bed would be removed, including siltation fabric.

Our Analysis

In order to conduct some necessary project maintenance activities, SMUD needs to drain the associated project canals/penstocks. Some of the agencies including the Forest Service and CDFG expressed concern as to potential adverse water quality effects that could result from using some release points to drain Gerle canal and the project's penstocks. SMUD would evaluate ways to minimize the potential for adverse water quality effects to result from emergency and/or planned use of the release points along Gerle canal and project penstocks. We anticipate that this evaluation would focus on the potential for erosion and sideslope failure, which could result in substantial increases in turbidity and degradation of stream habitat in the vicinity of the release points. We conclude that developing a plan that designates preferred canal/penstock drainage structures and release points to be used for draining project canals/spillways during maintenance would minimize adverse effects to water quality, particularly turbidity, and aquatic biota.

Construction of the proposed Iowa Hill development could potentially result in substantial adverse effects on water quality and related resources. Pathways by which this could occur include, but are not limited to, increasing erosion along and into surface waters, suspending sediments during construction of the new intake in Slab Creek reservoir, and introducing substances used during construction such as fuel, oil, and concrete. The risk of these events could be limited through implementation of best management practices including scheduling, minimizing in-water work, erosion control practices, managing stormwater runoff, and restricting areas that equipment is allowed and where it is maintained. SMUD would develop detailed plans and a proposed schedule for its construction of the proposed Iowa Hill facilities before initiating construction activities. It would develop the plan in consultation with the appropriate federal and state agencies, and obtain all necessary permits and authorizations. We anticipate that conditions in these permits and authorizations along with the proposed storm water pollution prevention plan would provide reasonable assurance that water quality and aquatic habitat are not directly or indirectly adversely affected by SMUD's construction activities. We conclude that implementing Proposed Article 1-42, *Water Quality and Water Pollution*, would provide reasonable assurance that water quality and aquatic resources would not be adversely affected by construction of the proposed Iowa Hill facilities.

Effects of Recreational Activities on Water Quality

Recreational use concentrated around UARP and Chili Bar Project reservoirs and stream reaches has the potential to act as a source of human pathogens to surface waters in the area, which could lead to increased risk of adversely affecting human health. As recreational use of the area increases and additional recreational facilities are developed and used there could be increased contamination of surface waters.

Our Analysis

A recent study of fecal coliform bacteria concentrations in six UARP reservoirs indicates that fecal coliform concentrations have recently exceeded the upper allowable limit at three sites in Union Valley reservoir (see table 3-20). SMUD states that the most plausible source of this contamination is recreation at the Forest Service's Camino Cove, Fashoda Beach, and Jones Fork campgrounds, which are near the sampling locations.

Under the Proposed Action, SMUD would increase the potential for recreational access throughout the UARP area, particularly near the reservoirs and Slab Creek dam reach. Increased recreational use would add to the potential for contamination from human waste in these areas. SMUD proposes to address sanitation along with other recreation-related issues by annually paying the Forest Service to provide operation, maintenance, and administration of developed recreational sites, facilities, or uses that are adjacent to or in the vicinity of UARP reservoirs and facilities (see section 3.3.6.2, *Specific Recreation Site Improvements*). SMUD also would prepare a recreation management plan that addresses whitewater recreational needs, including sanitation, in the Slab Creek dam reach, as discussed in section 3.3.6.2, *Recreation Streamflows*. Providing an appropriate level of operation and maintenance for recreational facilities, as proposed, would limit the potential for contamination from human waste, although there still would be a risk of creating conditions that could be hazardous to human health. We discuss the need to monitor this risk in section 3.3.2.2, *Water Quality Monitoring*.

A recent study indicates that fecal coliform bacteria concentrations have substantially exceeded their upper allowable limits at four sites in the Chili Bar dam reach (see table 3-20). Under the Proposed Action, PG&E would not add substantial new boating opportunities to the reach downstream of Chili Bar dam. Therefore, we expect negligible changes in coliform concentrations to result from implementation of the proposal. We discuss the need to monitor bacteria as an indicator of this risk in section 3.3.2.2, *Water Quality Monitoring*.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Development and maintenance of recreational facilities in the UARP vicinity would be virtually the same as those described in the Proposed Action. As a result, effects of the UARP-only Alternative on human pathogens would be the same as those described under the Proposed Action.

Water Temperature Monitoring

To document the effects of altered project operations on water temperatures in the UARP and Chili Bar reaches, SMUD and PG&E would need to monitor water temperatures at numerous locations.

Primary Stream Flow and Reservoirs

Under Proposed Articles 1-5(9) and 2-4(5), *Monitoring Program*, both SMUD and PG&E would develop a water temperature monitoring plan. The applicants would: (1) consult with the agencies and BLM on development of the plan within 3 months of license issuance; (2) provide a draft plan to these agencies for a minimum 90-day review period; and (3) file a Water Board-approved plan with the Commission within 1 year of license issuance. For the UARP, the plan would include using continuous recording devices to monitor water temperatures at a minimum of 17 stream stations associated with the project (table 3-27) from March 15 through September 30 in each year of the new license. Based on review of the annual data and consultation with the Agencies, monitoring could be required at up to five additional water temperature monitoring stations. If SMUD demonstrates that the resulting thermal regime(s) reasonably protect the designated cold freshwater beneficial use, they may be able to cease temperature monitoring at some stations. Proposed Article 1-5(9) would also reserve the potential to recommend monitoring of water temperature profiles in reservoirs if the Agencies determine that reservoir temperatures are a controllable factor that may resolve stream temperature issues. If this should occur, vertical profiles would be monitored seasonally in the applicable reservoir(s) during multiple water year types to provide data necessary for decision making. Water temperature data would be used to determine the need for adaptively managing project operations as described in section 3.3.2.2, *Effects of Project Operations on Water Quality*.

Table 3-27. Recommended continuous stream temperature monitoring stations under the Settlement Agreement.[a] (Source: SMUD and PG&E, 2007)

Reach	Recommended Monitoring Stations
Rubicon dam	Immediately downstream of Rubicon dam,
	Downstream of Little Rubicon River confluence (at the project boundary)
Buck Island dam	Immediately downstream of Buck Island dam
Loon Lake dam	Immediately downstream of Loon Lake dam
Gerle Creek dam	Immediately downstream of Gerle Creek dam
Robbs Peak dam	Immediately downstream of Robbs Peak dam,
	Downstream of confluence with Gerle Creek (at Project boundary)
Ice House dam	Immediately downstream of Ice House dam,
	Immediately upstream of Junction reservoir

Reach	Recommended Monitoring Stations
Junction dam	Immediately downstream of Junction dam, Immediately upstream of Camino reservoir dam
Camino dam	Immediately downstream of Camino dam, Immediately upstream of confluence with SFAR
SFAR	None
Brush Creek dam	Immediately downstream of Brush Creek dam
Slab Creek dam	Immediately downstream of Slab Creek dam, Approximately ½ mile upstream of White Rock powerhouse, Downstream of White Rock powerhouse to measure powerhouse outflow temperatures
Chili Bar dam	Immediately downstream of Chili Bar dam, Upstream of the confluence with Dutch Creek, Immediately upstream of Camp Lotus, Immediately upstream of the confluence with Greenwood Creek

[a] All of the monitoring stations associated with the Chili Bar dam reach are included in Proposed Article 2-4(5), *Monitoring Program*; whereas, all of the other designated monitoring stations are recommended for the UARP under Proposed Article 1-5(9), *Monitoring Program*.

For the Chili Bar Project, the plan would include using continuous recording devices to monitor water temperatures at a minimum of four stream stations associated with the project from March 15 through October 15 in each year of the new license. Up to two additional stream temperature monitoring stations may be added based on need determined through review of the annual data and consultation with the Water Board, CDFG, FWS, and BLM. Requirements for monitoring temperature could be altered based on demonstration of the need for additional monitoring. Under Proposed Article 2-4(5), *Monitoring Program*, PG&E would seasonally monitor vertical temperature profiles in Chili Bar reservoir during multiple water year types if the Water Board, CDFG, FWS, and BLM determine that reservoir temperatures are a controllable factor that may resolve temperature issues in the reach downstream of Chili Bar dam or if impoundment chemistry dictates a need for additional temperature considerations. We conclude that if PG&E demonstrates that the thermal regime under the new license reasonably protects the cold freshwater beneficial uses there would be little value in continuing to monitor temperature at these stations.

Edgewater of Streams and Reservoirs

As a component of the evaluation of habitat for amphibians and aquatic reptiles, Proposed Article 1-5(3), *Monitoring Program*, SMUD would use a minimum of six micro-thermographs to monitor water temperatures in stream margin habitats associated with known or suitable foothill yellow-legged frog breeding sites in the reaches downstream of the Camino and Slab Creek dams. Under Proposed Article 1-6(9), *Adaptive Management Program*, the Agencies would have the opportunity to use the results of this temperature monitoring effort along with the results of the associated monitoring of the foothill yellow-legged frog to determine whether the water temperature used is an indicator of breeding initiation, which is currently set at 12°C as a 7-day running average of mean daily temperatures in the proposed license article, should be increased or decreased. Proposed Articles 1-6(1) and 1-6(2) would use the selected temperature indicator of breeding initiation, results of monitoring water temperatures in the SFSC immediately upstream of Junction reservoir and the SFAR immediately downstream of Slab Creek dam, and documentation of the foothill yellow-legged frog to adaptively manage scheduled high flow releases to the Ice House dam reach and Slab Creek dam reach.

As a component of Proposed Article 1-40, *Aquatic Resources,* for the proposed Iowa Hill development, SMUD would monitor temperatures between May and September in edgewater of Slab Creek reservoir at locations approved by the Forest Service, CDFG, and the Water Board. These data in combination with monitored locations of hardhead would be used to confirm that the effects of proposed Iowa Hill development pump-discharge operations on the distribution of hardhead.

Our Analysis

SMUD and PG&E conducted substantial monitoring and modeling of water temperature for relicensing of the Projects. This information provides the basis for our evaluation, in which we conclude that the proposed operations would generally reduce spring through summer stream temperatures in most of the reaches affected by the UARP and Chili Bar Project. These effects on temperatures would enhance the quality of habitat for desired aquatic-dependent communities.

Monitoring water temperature immediately downstream of the UARP dams, as proposed, would document thermal conditions at the upper end of the UARP bypassed reaches under any new project operations. Monitoring at the other sites listed in table 3-27 along with up to five additional sites would document thermal conditions downstream of confluences, and in critical locations within the Ice House dam, Camino dam, and Slab Creek dam reaches. We see little value in using a thermograph to monitor water temperature immediately upstream of the Camino reservoir dam, since temperatures also would be monitored immediately downstream of the dam. Instead, we assume that SMUD intended that water temperature be monitored immediately upstream of Camino reservoir, which would provide data to evaluate the extent of water temperature changes in the Junction dam reach. Monitoring temperature in the Ice House dam reach just upstream of Junction reservoir and in the SFAR immediately downstream of Slab Creek dam would provide the temperature data necessary to determine whether scheduled geomorphic pulse flow or recreational flow releases to these reaches may need to be adaptively managed to protect foothill yellow-legged frogs and other biological resources. See section 3.3.4.2, *Environmental Effects, Special Status Amphibians and Reptiles*, for our evaluation of these proposed measures.

Including the option to monitor temperature profiles in UARP reservoirs is expected to provide limited benefit in terms of the ability to use any cold water available in the reservoirs to further improve thermal conditions in UARP stream reaches. The results of SMUD's 2002 to 2004 monitoring of reservoir temperatures provides evidence that there is virtually no cold water available in the Rubicon, Buck Island, Gerle Creek, Robbs Peak, and Camino reservoirs (table 3-15). Because substantial temperature data were collected within the past 10 years (DTA, 2005a), sufficient data likely already exist to answer most questions about coldwater availability in the other UARP reservoirs. Therefore, the existing temperature data could be used, as appropriate, to evaluate coldwater availability prior to collecting any additional reservoir temperature data. We conclude that development and implementation of the water temperature monitoring plan referred to in Proposed Article 1-5(9), *Monitoring Program*, would document spring through summer water temperatures in UARP bypassed reaches under any new project operations, and help confirm that desired fish and amphibian communities are supported, although there would be little benefit in monitoring temperatures in UARP reservoirs.

Monitoring the timing of amphibian breeding and larval periods along with water temperature in areas used by foothill yellow-legged frogs for breeding could provide data that would lead to a better indicator of the onset of foothill yellow-legged frog breeding. We discuss this further in section 3.3.4.2, *Environmental Effects, Special Status Amphibians and Reptiles*.

Monitoring water temperature immediately downstream of the Chili Bar dam, as proposed in Proposed Article 2-4(5), *Monitoring Program*, would document thermal conditions at the upper end of the Chili Bar reach under any new project operations. Monitoring at the other three designated sites downstream of the Chili Bar dam with up to two additional sites would document thermal conditions in critical locations within the Chili Bar dam reach. Because this reach is not managed for coldwater fishes and results of PG&E's 2002 to 2004 temperature monitoring study show that little cold water is available in Chili Bar reservoir (table 3-15), we conclude that requiring PG&E to conduct additional monitoring of Chili Bar temperatures would not be warranted. We conclude that development and implementation of the water temperature monitoring plan referred to in Proposed Article 2-4(5), *Monitoring Program*, would confirm that the temperature range would be suitable for the desired fish communities and amphibians under any new project operations.

Iowa Hill Development

Simulations of the operation of the proposed Iowa Hill development suggest that operation of the development could lead to water temperatures in Slab Creek reservoir that are generally slightly cooler than occur currently. Because the model simulates conditions for a complete cross-sectional area of the reservoir, it is possible that water temperatures could be influenced even more along the edge of the reservoir. Monitoring water temperatures along the edge of the Slab Creek reservoir, per Proposed Article 1-40(2), *Aquatic Resources*, would provide data that could be used along with information about the distribution of hardhead to confirm that Iowa Hill development operations do not adversely affect hardhead by causing them to relocate to less desirable areas in the reservoir, including in front of the new intake structure for the Iowa Hill development where they could become entrained.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Therefore there would not be a need for monitoring water temperature in edgewater of Slab Creek reservoir.

Water Quality Monitoring

Water quality data indicate occasional seasonal exceedances of several water quality criteria. In addition, arsenic and mercury concentrations in fish exceed screening values set to protect anglers. Changing project operations has the potential to alter water quality conditions. Increasing the carrying capacity for recreational access could potentially elevate fecal coliform concentrations. In order to document that water quality standards are met under any new license, and concentrations of metals are at safe levels for humans who consume fish from the project area, it would be necessary to monitor water quality and body burdens of metals in fish.

Under Proposed Articles 1-5(10) and 2-4(6), *Monitoring Program,* both SMUD and PG&E would develop a draft water quality monitoring program plan. Within 3 months of license issuance, the applicants would consult on the development of the plan with the Agencies, Central Valley Water Board, and BLM for the UARP. This plan would address monitoring water chemistry, physical properties, and bacteria. The plan would provide detail on field sampling (locations, sampling frequency, handling methods, and QA/QC); and define the laboratory analyses and associated method detection limits for all constituents and parameters to be monitored. Following consultation, and within 6 months of license issuance, the applicants would submit the draft plan for review and approval by the Chief, Division of Water Rights, Water Board and then file the final plan with the Commission. The plan(s) could be modified pursuant to adaptive management program needs as recommended by Central Valley Water Board, CDFG, FWS, BLM, (and the Forest Service for the UARP plan), and approved by the Water Board and the Commission.

SMUD and PG&E would sample water chemistry to demonstrate seasonal conditions at all reservoir and stream locations described in the January 8, 2003 version of the Water Quality Study Plan that was approved by the plenary group for UARP and Chili Bar Project relicensing efforts. Laboratory analyses would use methods approved by EPA that are adequately sensitive to detect constituent levels for determination of compliance with recognized state and federal criteria. Table 3-28 describes the strategy and schedule for various water chemistry and physical properties of this recommended seasonal plan. Conditions at representative locations would be monitored by making *in situ* measurements of water temperature, DO, pH, specific conductance, and turbidity; collecting and analyzing water samples for minerals, nutrients, metals, hardness, and petroleum products; and measuring Secchi depths (reservoirs only).

Table 3-28. Recommended strategy for monitoring water chemistry and physical properties under the Settlement Agreement.[a] (Source: Settlement)

Monitoring Type	**Parameters**	**Monitoring Sites**	**Frequency/Duration**
In situ at representative locations	Water temperature, DO, pH, specific conductance, and turbidity	UARP bypassed reaches and the SFAR downstream of Chili Bar dam	Seasonally in spring (April–May), summer (August), fall (November), and winter (January–February, as accessible) each year after license issuance
In situ at 1-meter intervals vertically	Water temperature, DO, pH, specific conductance, and turbidity	Loon Lake, Gerle Creek reservoir, Ice House reservoir, Union Valley reservoir, Junction reservoir, Camino reservoir, Slab Creek reservoir, and Chili Bar reservoir	Seasonally in spring (April–May) and fall (October–November) each year after license issuance
General chemistry at representative locations[b]	Minerals, nutrients, metals (total and dissolved fractions), hardness, and petroleum products	UARP dam release points from reservoirs, representative sites along all UARP bypassed reaches greater than 1 mile long, and at least three representative sites along the SFAR between Chili Bar dam and the confluence with Greenwood Creek.	Seasonally in spring, summer, fall, and immediately following the second or third measurable rain event of the fall–winter period, once every 5 years beginning in year 3 after license issuance

Monitoring Type	Parameters	Monitoring Sites	Frequency/Duration
General chemistry at the surface and near bottom at multiple representative locations[b]	Nutrients, minerals, hardness, metals (total and dissolved fractions), and petroleum products	At the surface and near the bottom at multiple representative locations in each UARP impoundment and Chili Bar reservoir	Seasonally in spring, summer, fall, and immediately following the second or third measurable rain event of the fall–winter period, once every 5 years beginning in year 3 after license issuance
Water clarity [b]	Secchi depth	Loon Lake, Ice House reservoir, Union Valley reservoir, and Slab Creek reservoir	Seasonally in summer and fall once every 5 years after license issuance

[a] All of the monitoring sites associated with the Chili Bar dam reach are recommended for the Chili Bar Project; whereas, all of the other designated monitoring sites are recommended for the UARP.

[b] After a minimum of three data sets have been collected, if the data demonstrate that exceedances are not occurring at specific locations, the frequency may be reviewed to determine if it can be modified.

SMUD and PG&E would also seasonally monitor bacteria in a manner consistent with the Basin Plan objectives for protection of the REC-1 (water contact recreation) beneficial uses at a minimum of 15 shoreline recreational locations within the UARP boundary and 8 shoreline recreational locations in the Chili Bar Project-affected reach. By May 31 of each designated sampling year, the licensees would select sampling locations for the upcoming season based on criteria that include known swimming and other water contact recreational areas, and potential sources of pathogen introduction to the water column in the immediate vicinity. Sampling would be conducted at each of the selected sites by collecting five near-shore samples during a 30-day period that spans either the Independence Day Holiday or the Labor Day Holiday, using the five samples in 30-day methodology or other protocol as amended in the Basin Plan. Bacterial monitoring would be conducted annually for the first 5 years after license issuance. Then, monitoring could be decreased in frequency to every other year at UARP reservoirs and Chili Bar Project sites where no exceedances of Basin Plan objectives for protection of REC-1 designated waters are identified during years 1-5, but would continue annually through the life of the license at reservoirs where data demonstrate bacterial concentrations that present risks to human health.

SMUD proposes to consult with the Central Valley Water Board, and the Agencies for selection of UARP sampling locations. Candidate monitoring sites would include developed recreational sites and frequently used dispersed sites at reservoir and riverine locations. The UARP bacterial monitoring sites would include a minimum of four annually rotating stations at Union Valley reservoir swim areas; and a minimum of two beach locations each at Buck Island reservoir, Loon Lake, Ice House reservoir, and Gerle Creek reservoir, along with three other selected stations.

For the Chili Bar Project, PG&E would consult with the Water Board, the Central Valley Water Board, CDFG, FWS, and BLM for selection of sampling locations. Candidate monitoring sites would include developed recreational sites and frequently used whitewater boating take-out sites along the Chili Bar dam reach. Chili Bar bacterial monitoring sites would include a minimum of four swim beach sites including the Coloma and Camp Lotus areas, along with four other selected sites.

Under Proposed Articles 1-5(10) and 2-4(6), *Monitoring Program*, SMUD and PG&E also propose to monitor potential uptake of mercury, copper, lead, and silver through the aquatic food chain resident in impoundments affected by the UARP and Chili Bar Project. They would determine the target species and number of individuals, sampling strategy, and analytical methods through consultation so that they are consistent with the Water Board's Surface Water Ambient Monitoring Program needs. They would collect and analyze fish tissue samples for bioaccumulation once every five years. Collection of these samples would begin in the second year after license issuance and continue through the term of any new license.

For the UARP, SMUD would consult with the Agencies, the Central Valley Water Board, and the state Office of Environmental Health Hazard Assessment. Resident fish species would be collected from Loon Lake, Gerle Creek reservoir, Ice House reservoir, Union Valley reservoir, Camino reservoir, and Slab Creek reservoir and samples would be prepared and analyzed for concentrations of mercury, copper, lead, and silver. Under Proposed Article 1-6(8), *Adaptive Management Program*, the Agencies may request that SMUD conduct additional studies of metals bioaccumulation if comparing the results of metal testing to published scientific information leads to suspicion that the health of aquatic species are adversely affected.

For the Chili Bar Project, PG&E would consult with the BLM, FWS, CDFG, the Water Board and the Central Valley Water Board, and the state Office of Environmental Health Hazard Assessment. Resident fish species from Chili Bar reservoir would be collected and samples would be prepared and analyzed for concentrations of mercury, copper, lead, and silver. Proposed Article 2-4(6), *Monitoring Program*, also includes monitoring of an invasive algae species in the Chili Bar dam reach. We discuss the algae component of this proposed article along with proposed monitoring of algae at UARP sites in section 3.3.2.2, *Algae Monitoring and Adaptive Management*.

Our Analysis

Our review of available water quality information (section 3.3.2.1, *Water Quality*) indicates that UARP- and Chili Bar-affected waters typically comply with the applicable federal and state standards for most water quality parameters. However, available information indicates that waters affected by the Projects sometimes do not satisfy the applicable criteria for DO, pH, fecal coliform bacteria, and several metals.

Sampling results from a study of bioaccumulation of several metals in fish residing in project reservoirs indicate that arsenic and mercury exceed screening values set to protect anglers who consume their catch. One of the objectives used while developing proposed operations and environmental measures was to maintain water quality adequate to protect beneficial uses and meet state water quality standards. Monitoring water quality and body burdens of metals in resident fish under any new project operations could confirm that the aforementioned objectives are met.

SMUD and PG&E's proposed approach for monitoring water chemistry and physical properties would document compliance with water quality standards, including support for the targeted aquatic ecosystem. Proposed Articles 1-5(10) and 2-4(6), *Monitoring Program*, designate the general parameters that would be sampled and provides the schedule and general locations for each sampling effort. Specific parameters and locations of sampling would be presented in the proposed monitoring plan, which would be developed in consultation with appropriate agencies.

Implementation of this plan would provide data to annually document seasonal variation in DO concentrations, pH, specific conductance, and turbidity in UARP-affected stream reaches and impoundments. SMUD and PG&E's proposal also would document concentrations of nutrients, minerals, hardness, metals, and petroleum products at 5-year intervals, which could be used to evaluate long-term trends. We note that concentrations of minerals are primarily controlled by geologic and hydrologic characteristics and many of the waters affected by the UARP and Chili Bar Project have little potential for contamination from petroleum products. Therefore, monitoring of each of these parameters at each monitoring location would likely provide little incremental benefit.

SMUD and PG&E's proposed approach to select specific metals and monitor bioaccumulation of the specified metals in aquatic organisms at 5-year intervals would ensure that results of this sampling effort are consistent with the Water Board's approach and would facilitate evaluation of changes in fish body burdens of these metals. However, we note that biomagnification of silver is unlikely (Howe and Dobson, 2002).

SMUD and PG&E's proposed approach to select and monitor 15 shoreline recreational locations within the Project boundary would document near worst-case bacteria concentrations at locations of greatest concern.

We conclude that Proposed Articles 1-5(10) and 2-4(6) would provide water quality regulators with sufficient data to document compliance with water quality standards under any new project operations and identify any trends in risks to the health of humans and wildlife.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. As a result, the need for monitoring water quality and bioaccumulation of metals for the UARP-only Alternative would be the same as those described under the Proposed Action.

Algae Monitoring and Adaptive Management

Relicensing studies indicate that under existing conditions algae are abundant in some reaches of the Projects, particularly in the lower end of the Junction dam reach and the Chili Bar dam reach. In addition, there are anecdotal accounts of an exotic invasive species of diatom, *Didymosphenia geminata*, in the Chili Bar dam reach. Specific objectives of the Settlement Agreement include reducing or eliminating conditions that encourage algae growth in the Junction and Chili Bar dam reaches. We evaluate the effects of project operations on algae and water quality above in section 3.3.2.2, *Effects of Project Operations on Water Quality*. In this section, we discuss monitoring algae and adaptive management associated with algae.

Under the Settlement Agreement, SMUD and PG&E would monitor algae. For the UARP (Proposed Article 1-5(6), *Monitoring Program*), SMUD would develop an algae species identification and monitoring plan in consultation with the Agencies. SMUD would provide a draft plan to these agencies for a minimum 90-day review and approval period, and implement the plan upon its approval. Under the plan, SMUD would collect, identify, and archive samples of the species of algae inhabiting the stream channel of the Junction dam reach using a lab selected in consultation with the Agencies. SMUD would collect additional baseline samples from the SFRR downstream of Robbs Peak dam, Camino dam reach, and Slab Creek dam reach. Additional sites or reaches may be added should algal species be deemed to have negative effects upon the aquatic ecosystem. The Settlement Agreement does not specify the proposed monitoring period for the UARP. However, because SMUD did not provide costs for this measure we assume that SMUD only plans to monitor algae under Proposed Article 1-5(6), *Monitoring Program*, in 1 or 2 years within license issuance.

Under Proposed Article 1-6(7), *Adaptive Management Program*, SMUD would adaptively manage algae based on results of monitoring algae in the Junction dam reach, SFRR downstream of Robbs Peak dam. If the new streamflow regime does not reduce algae growth in the Junction dam reach or SFRR downstream of Robbs Peak dam within 2 years of license issuance, SMUD would reduce or eliminate the excessive algae growth using a method approved by the Agencies. If any future pervasive algal growths are identified in any UARP-affected stream reaches, and the Agencies determine the algae needs to be reduced or eliminated, SMUD should reduce or eliminate the algae growth using a method approved by these agencies.

As a component of Proposed Article 2-4(6), *Monitoring Program*, PG&E would annually monitor for the presence/absence of the diatom *Didymosphenia geminata*, an invasive algae in the Chili Bar dam reach. This monitoring would be done in conjunction with the other water quality monitoring.

Our Analysis

SMUD has documented dense growth of green-colored algae in the Junction dam reach of Silver Creek that is abnormal. Excessive algae growth can substantially alter hydraulics and sediment transport and thereby adversely affect other aquatic plants, macroinvertebrate, and amphibian communities. In addition to these issues, CDFG indicates that it has observed *Didymosphenia geminata* nearby in the Middle Fork American River. In the past two decades, *D. geminata* has substantially expanded its geographical range in the United States and across much of the world, and has increasingly been found to form excessive growths in streams (EPA, 2006; IUCN, 2007; Kilroy, 2004). In some streams, *D. geminata* covers more than 90 percent of available substrates, and the dense mats can cover miles of stream length. These dense mats trap sediments and may suppress the native algae and invertebrate communities. In Rapid Creek, located in the Black Hills of South Dakota, brown trout populations have experienced severe declines that have been correlated to dense growths of *D. geminata* (SDGFP, 2006).

Given the extent of algae growth in the Junction dam reach and the potential for *D. geminata* to adversely affect the aquatic ecosystem, we conclude that it is important to determine the algae species present and their general level of abundance in this reach under the new flow regime. This information could be used to determine whether the new streamflow releases effectively reduce the extent of algae in the Junction dam reach. We conclude that the combination of Proposed Articles 1-5(6), *Monitoring Program*, and 1-6(7), *Adaptive Management Program*, would provide information to determine whether any new flow regime substantially reduces algae growth in the Junction dam reach and determine if *D. geminata* is present in the reach. Although algae does not appear to be a problem in the other UARP-affected stream reaches, Proposed Articles 1-5(6), *Monitoring Program*, and 1-6(7), *Adaptive Management Program*, would provide information to confirm that there are no algae-related problems in selected UARP-affected stream reaches. SMUD’s proposal to monitor algae could also determine whether *D. geminata* is present in the other monitored UARP-affected stream reaches.

Given the extent of algae growth in the Chili Bar dam reach, and the potential for *D. geminata* to adversely affect water quality and the aquatic community, we conclude that it is important to periodically evaluate whether *D. geminata* has become established in this reach. We conclude that this could be accomplished by developing and implementing the plan in Proposed Article 2-4(6), *Monitoring Program*.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Monitoring and adaptive management requirements for algae would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on algae would be the same as those described under the Proposed Action.

3.3.2.3 Cumulative Effects

Water temperatures have been affected by natural events, and water and land management practices in the Rubicon River Basin to the SFAR Basin. Impoundment of water by the project dams generally results in higher spring through fall temperatures near the surface of the reservoirs than would occur in the same reach if the stream was still free-flowing. Using low-level outlets for streamflow releases has substantially reduced water temperatures immediately downstream of some dams (e.g., Ice House and Loon Lake developments). However, diverting water around stream reaches tends to increase spring through summer temperatures in the bypassed reaches. Similarly, UARP's diversion of water from the Rubicon River Basin to the SFAR Basin has reduced flows in the Rubicon River Basin and thereby increased the potential for streamflow warming in the basin.

Fires have cleared much of the upland and riparian vegetation in portions of the UARP area, resulting in reduced shading of the streams and reservoirs. In the lower portion of the Ice House dam reach, the 1992 Cleveland Fire substantially reduced stream shading and thereby substantially increased stream temperatures. Riparian vegetation has recovered well along the stream banks, which has somewhat increased shading and reduced stream temperatures. Recovery of upland vegetation is expected to occur through any new license term and thereby increase stream shading and further reduce stream temperatures.

EID operates the El Dorado Project, which diverts up to about 165 cfs of water around a 22-mile-long section of the SFAR to its domestic water supply system and the El Dorado powerhouse, located a short distance further downstream than the river's confluence with Silver Creek. This has resulted in an incremental increase in spring through summer temperatures in the river between the confluence and the El Dorado powerhouse. Under a new FERC license issued for the El Dorado Project in 2006 (FERC, 2006), minimum flow releases from EID's dam to the SFAR were substantially increased resulting in a reduction in the aforementioned incremental increase in spring through summer temperatures. The UARP and Chili Bar Project proposed increased minimum streamflows would tend to reduce spring through summer temperatures in most of the UARP- and Chili Bar Project-affected stream reaches. The operation of the proposed Iowa Hill development would reduce water temperatures emanating from Slab Creek reservoir by less than 0.5°C. This change would have no observable effect on water temperatures in Chili Bar reservoir or the Chili Bar dam reach. Under the Proposed Action, these cumulative effects are expected to provide a thermal regime that would support the designated beneficial uses including a coldwater habitat for resident fish and amphibians.

Water quality in the UARP and Chili Bar Project-affected reaches is generally good, although it currently does not always satisfy the Basin Plan water quality objectives for bacteria and some chemical parameters. Numerous factors, including mining, land management, water-resource projects, development, and water-oriented recreation, have all incrementally adversely affected water quality, particularly fecal coliform concentrations in heavily-used areas of reservoirs and in the Chili Bar dam reach and metals in several of the UARP and Chili Bar Project reservoirs. Additional increases in development and recreation are expected to further increase the potential for water quality degradation. In contrast, expansion of the Hangtown Creek Wastewater Treatment Plant in Placerville is expected to somewhat reduce bacteria and nutrient loadings from Weber Creek to the SFAR. EID's recent replacement of a damaged and unstable section of the El Dorado Project's canal with a 2-mile-long bypass tunnel is expected to reduce canal failures and resulting erosion and sedimentation that have occurred historically. Under the Proposed Action, SMUD would implement an erosion and sedimentation control plan and a storm water pollution prevention plan during the construction phase of the Iowa Hill development. Implementation of these plans is expected to minimize adverse effects on water quality during construction. The cumulative effects of these actions would be an overall improvement in water quality.

3.3.2.4 Unavoidable Adverse Effects

None.

3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

Fisheries Resources

Table 3-29 lists fishes known to occur in the Sacramento-San Joaquin drainage basin in the vicinity of the UARP and/or Chili Bar Project.

Table 3-29. Fishes in the UARP and Chili Bar Project study area. (Sources: DTA and Stillwater Sciences, 2005c,d,e)

Common Name	Scientific Name	Status[a]	Sacramento-San Joaquin Drainage[b]
Fall-run Chinook salmon[c]	*Oncorhynchus tshawytscha*	--	Native
Rainbow trout	*Oncorhynchus mykiss*	MIS	Native
Kokanee salmon	*Oncorhynchus nerka*	--	Introduced
Brown trout	*Salmo trutta*	MIS	Introduced
Brook trout	*Salvelinus fontinalis*	MIS	Introduced

Common Name	Scientific Name	Status[a]	Sacramento-San Joaquin Drainage[b]
Lake trout (mackinaw)	*Salvelinus namaycush*	--	Introduced
Lahontan cutthroat trout[d]	*Oncorhynchus clarki henshawi*	FT	Introduced
Pacific lamprey[e]	*Lampetra tridentata*	--	Native
Sacramento hitch	*Lavinia exilicauda exilicauda*	--	Native
California. roach[f]	*Lavinia symmetricus symmetricus*	CSC	Native
Hardhead	*Mylopharodon conocephalus*	CSC	Native
Sacramento pikeminnow	*Ptychocheilus grandis*	--	Native
Sacramento speckled dace	*Rhinichthys osculus ssp.*	--	Native
Carp	*Cyprinus carpio*	--	Introduced
Golden shiner	*Notemigonus crysoleucas*	--	Introduced
Sacramento sucker	*Catostomus occidentalis*	--	Native
Sacramento tule perch	*Hysterocarpus traski traski*	--	Native
Prickly sculpin	*Cottus asper*	--	Native
Riffle sculpin	*Cottus gulosus*	--	Native
Mosquitofish	*Gambusia affinis*	--	Introduced
Green sunfish	*Lepomis cyanellus*	--	Introduced
Bluegill	*Lepomis macrochirus*	--	Introduced
Smallmouth bass	*Micropterus dolomieui*	--	Introduced

[a] Status: FT – Federally Threatened; CSC - CDFG species of concern; MIS - listed by the Eldorado National Forest as a management indicator species.

[b] Native or introduced into the Sacramento-San Joaquin Drainage Basin. Prior to the California Gold Rush in 1848, all of the steams and natural lakes in the UARP area were fishless, with the exception of the lower 0.83 mile of Brush Creek, the lower 3.30 miles of Silver Creek, and the SFAR. Therefore, while considered native to the Drainage, any fish currently present in these formerly fishless areas should be considered 'introduced' in these areas.

[c] Excess hatchery stock planted in Folsom may migrate into reach downstream of Chili Bar dam.

[d] Stocked upstream of the Project area.

[e] Pacific lamprey no longer occur upstream of Nimbus dam, which is below Folsom dam.

[f] Some reports prepared by the licensees refer to the Sacramento roach, which is a subspecies of California roach. To minimize confusion, we will refer to Sacramento roach as California roach throughout this document.

Reservoirs

To determine fish species composition in the project reservoirs, sampling was conducted at multiple sites in five project reservoirs (Loon Lake, Ice House, Union Valley, Junction, and Slab Creek). Camino reservoir was not sampled due to safety and access constraints. Gerle Creek reservoir was surveyed to provide the Forest Service with information for trout management, and Chili Bar reservoir was surveyed since there was no historical fish survey information available. Rubicon, Buck Island, Robbs Peak and Brush Creek reservoirs and Rockbound Lake were not surveyed because there was no historical data, or there was no indication these areas supported fish that could be significantly affected by reservoir operations. Table 3-30 presents results from historical reports and reservoir surveys in 2002/2003.

Table 3-30. Fish species present in UARP and Chili Bar Project reservoirs reported during historical and relicensing studies. (Sources: DTA and Stillwater, 2005c,e)

Common Name	**Rubicon**	**Buck Island**	**Loon Lake**	**Gerle Creek**	**Robbs Peak**	**Union Valley**	**Ice House**	**Junction**	**Camino**	**Brush Creek**	**Slab Creek**	**Chili Bar[a]**
Rainbow trout	•	•	⦿	•	•	⦿	⦿	•	•	•	⦿	
Brown trout	•	•	⦿	⦿	•	•	⦿	⦿	•	•	⦿	○
Brook trout	•	•	•	•			•	•	•		•	
California golden trout	•											
Kokanee salmon						⦿	•	•			•	
Lake trout (mackinaw)						⦿						
Lahontan cutthroat trout						•						
Hardhead											⦿	○
California roach			⦿	○			○		•		•	
Sacramento pikeminnow											○	○
Sacramento speckled dace											•	
Golden shiner						•						

Common Name	Rubicon	Buck Island	Loon Lake	Gerle Creek	Robbs Peak	Union Valley	Ice House	Junction	Camino	Brush Creek	Slab Creek	Chili Bar[a]
Sacramento sucker			⦿			⦿		⦿	●		⦿	○
Sacramento tule perch			●									
Riffle sculpin									●			
Mosquitofish						●						
Green sunfish			●			●	●					
Smallmouth bass						⦿					●	○

Note: ● indicates historical, ○ indicates relicensing studies, and ⦿ indicates historical and relicensing studies.

[a] In 2003, CDFG collected several Sacramento pikeminnow and a smallmouth bass from Chili Bar reservoir. However, PG&E did not collect either of these fish from Chili Bar reservoir during their sampling in 2002/2003.

Trout (brown and rainbow) dominated the fish collected from Gerle Creek, Ice House, and Loon Lake reservoirs (table 3-31). Trout were less dominant in lower elevation reservoirs, although kokanee salmon comprised 20 percent of the fish collected from Union Valley reservoir. Trout only accounted for 18 percent of the fish collected from Junction reservoir and less than 10 percent of the fish collected from Union Valley, Slab Creek, and Chili Bar reservoirs. The fish community was most diverse in Union Valley reservoir, which was dominated by smallmouth bass. Sacramento sucker were dominant in the Junction, Slab Creek, and Chili Bar reservoirs.

Table 3-31. Number and composition of fish captured in reservoirs of the Projects using gill netting and beach seining, October to November 2002 and October 2003. (Source: DTA and Stillwater, 2005c)

Species	Loon Lake	Ice House	Gerle Creek	Union Valley	Junction	Slab Creek	Chili Bar
Total (number captured)	85	55	64	110	57	74	44
Rainbow trout (%)	8	20	0	6	0	0	0
Brown trout (%)	46	69	92	0	18	7	7
Lake trout (%)	0	0	0	1	0	0	0
Kokanee salmon (%)	0	0	0	20	0	0	0
Hardhead (%)	0	0	0	0	0	39	23
Sacramento pikeminnow (%)	0	0		0	0	1	0

Species	Loon Lake	Ice House	Gerle Creek	Union Valley	Junction	Slab Creek	Chili Bar
Sacramento sucker (%)	2	0	0	15	82	53	70
Smallmouth bass (%)		0	0	58	0	0	0
California roach (%)	44	11	8	0	0	0	0

SMUD conducted intensive gill net, snorkel, and trawl surveys of Slab Creek reservoir to characterize the locations of greatest fish abundance in late fall (November 2003), spring (May 2004), and summer (July and August 2004). Results of this study indicate that hardhead, Sacramento sucker, and Sacramento pikeminnow use both the upper and lower reaches of the reservoir. Brown trout and rainbow trout also use the upper reservoir, but were not observed in the lower reservoir. The fish captured in the lower reservoir consisted primarily of Sacramento suckers and hardhead with a single Sacramento pikeminnow. More fish were captured at the 10- to 25-foot and 50-foot depths than at 100-foot sampling depths, although all three species were captured at each of the three sampling depths. Most of the juvenile fish captured in September 2004 were captured in the lower reservoir near the location of proposed Iowa Hill intake, and consisted of 79 percent hardhead and 21 percent Sacramento pikeminnow.

CDFG stocks fish into several of the UARP reservoirs, and in Wrights Lake located on SFSC upstream of Ice House reservoir. Between 1995 and 2004, CDFG stocked nearly 1.5 million fish, about 0.5 million of which were catchable size. The species and size of fish stocked into each of the reservoirs varies depending on management goals for the reservoir and availability of fish. CDFG typically stocks rainbow trout in Rubicon reservoir, Rockbound Lake, Loon Lake, Union Valley and Ice House reservoirs. Brown trout are stocked in Ice House reservoir and Wrights Lake, and kokanee salmon in Union Valley reservoir.

Streams

SMUD and PG&E used a variety of historical information to determine which fish species were known to exist in the stream reaches in the project area (table 3-32). These data show that rainbow, brown, and brook trout have historically (post-Gold Rush) been present in most of the stream reaches evaluated, and Sacramento sucker and riffle sculpin have occurred in several of the lower elevation reaches. SMUD and PG&E conducted fish population surveys in October of 2002, 2003, and 2004 using electrofishing or snorkel surveys in reaches that depth or flow made electroshocking impractical. Figures 3-17 through 3-20 display the location of each of the stream segments where these fish population surveys were conducted, and table 3-33 displays results of these surveys. Sacramento suckers were observed in six of the 13 reaches surveyed, all six were lower elevation reaches. These results indicate that the reach downstream of Chili Bar dam has the most diverse fish community, followed closely by the Slab Creek reach and then the SFAR reach.

Table 3-32. Fish presence in project stream reaches[a] observed during historical and relicensing studies. (Source: DTA and Stillwater Sciences, 2005d)

Common Name	Rubicon dam reach	Buck Island dam reach	Loon Lake dam reach	Gerle Creek dam reach	SFRR upstream of Robbs Peak	Robbs Peak dam reach	Ice House dam reach	Junction dam reach	Camino dam reach	SFAR reach	Brush Creek dam reach	Slab Creek dam reach	Downstream of Chili Bar dam reach
Chinook salmon[b]													○
Rainbow trout	◉	○	◉	◉	◉	○	◉	◉	◉	◉	◉	◉	○
Brown trout	○		◉	◉		○	◉	◉	◉		◉	◉	○
Brook trout	●		●	●									
California roach	○	○	●	●						◉		○	
Hardhead										◉		◉	○
Sacramento pikeminnow										◉		◉	○
Sacramento speckled dace	○									◉		◉	○
Golden shiner		○											
Sacramento sucker							◉	◉	◉	◉		◉	○
Prickly sculpin												○	○
Riffle sculpin								●	●	●		◉	○
Green sunfish												●	○
Bluegill													○
Smallmouth bass												◉	○

Note: ● indicates historical, ○ indicates relicensing studies, and ◉ indicates historical and relicensing studies.

[a] No fish population information (either historical or 2002-2004) is known to exist for Rubicon tunnel outlet reach or Rockbound dam reach.

[b] Likely fall-run Chinook stocked into Folsom Reservoir.

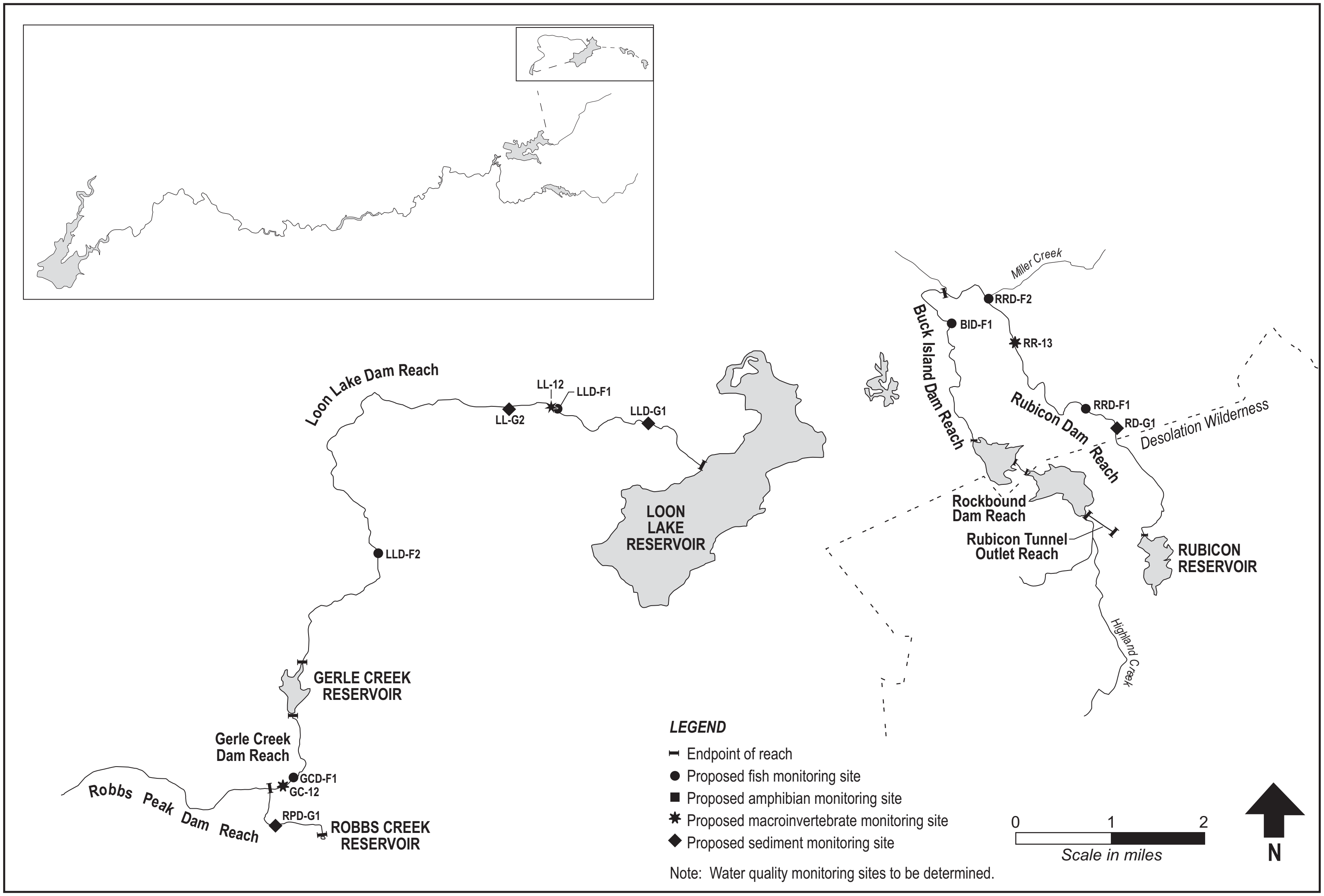

Figure 3-17. Stream segment sampling reaches—UARP northeast area. (Source: SMUD, 2005, as modified by the staff)

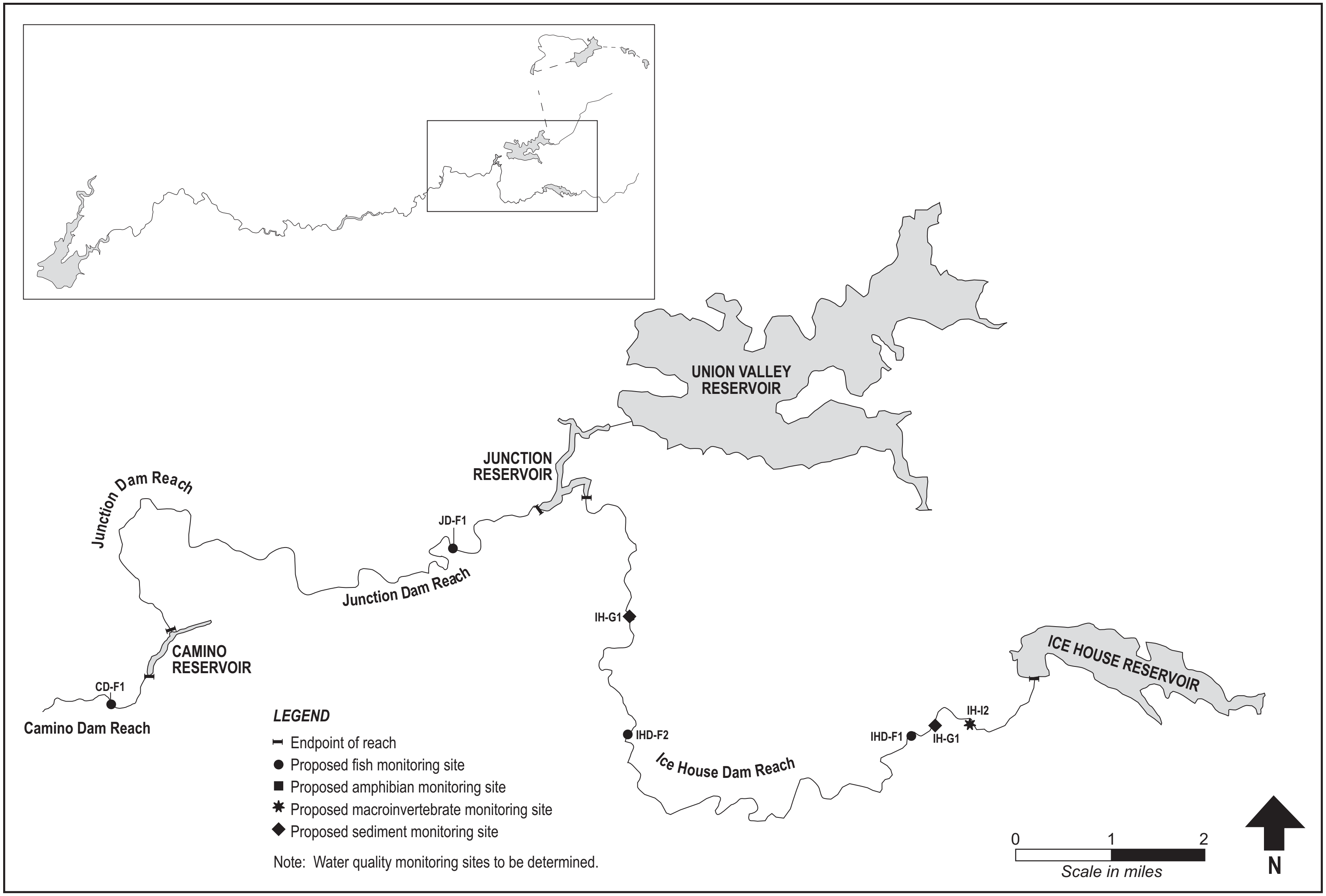

Figure 3-18. Stream segment sampling reaches—UARP southeast area. (Source: SMUD, 2005, as modified by the staff)

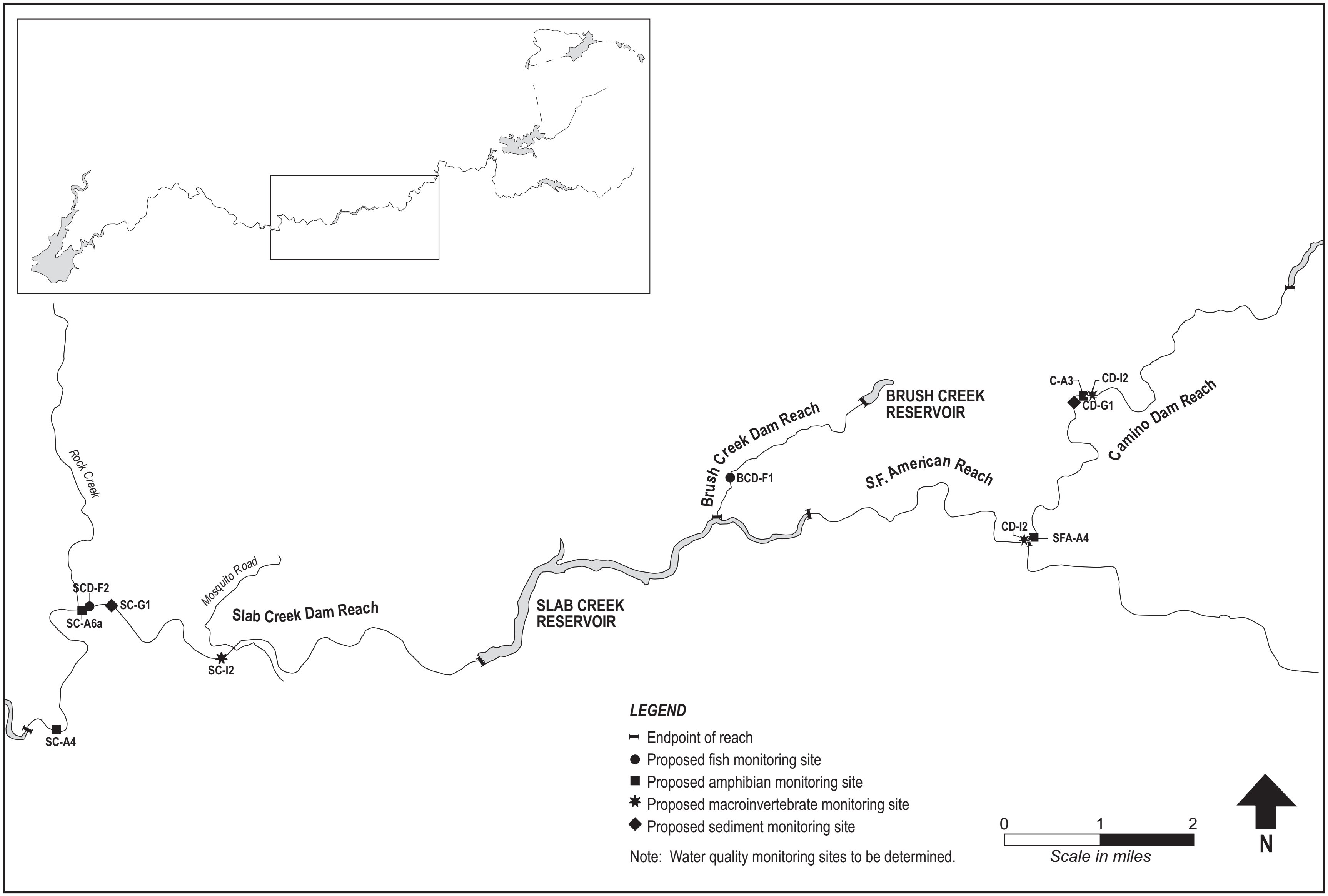

Figure 3-19. Stream segment sampling reaches—UARP southwest area. (Source: SMUD, 2005, as modified by staff)

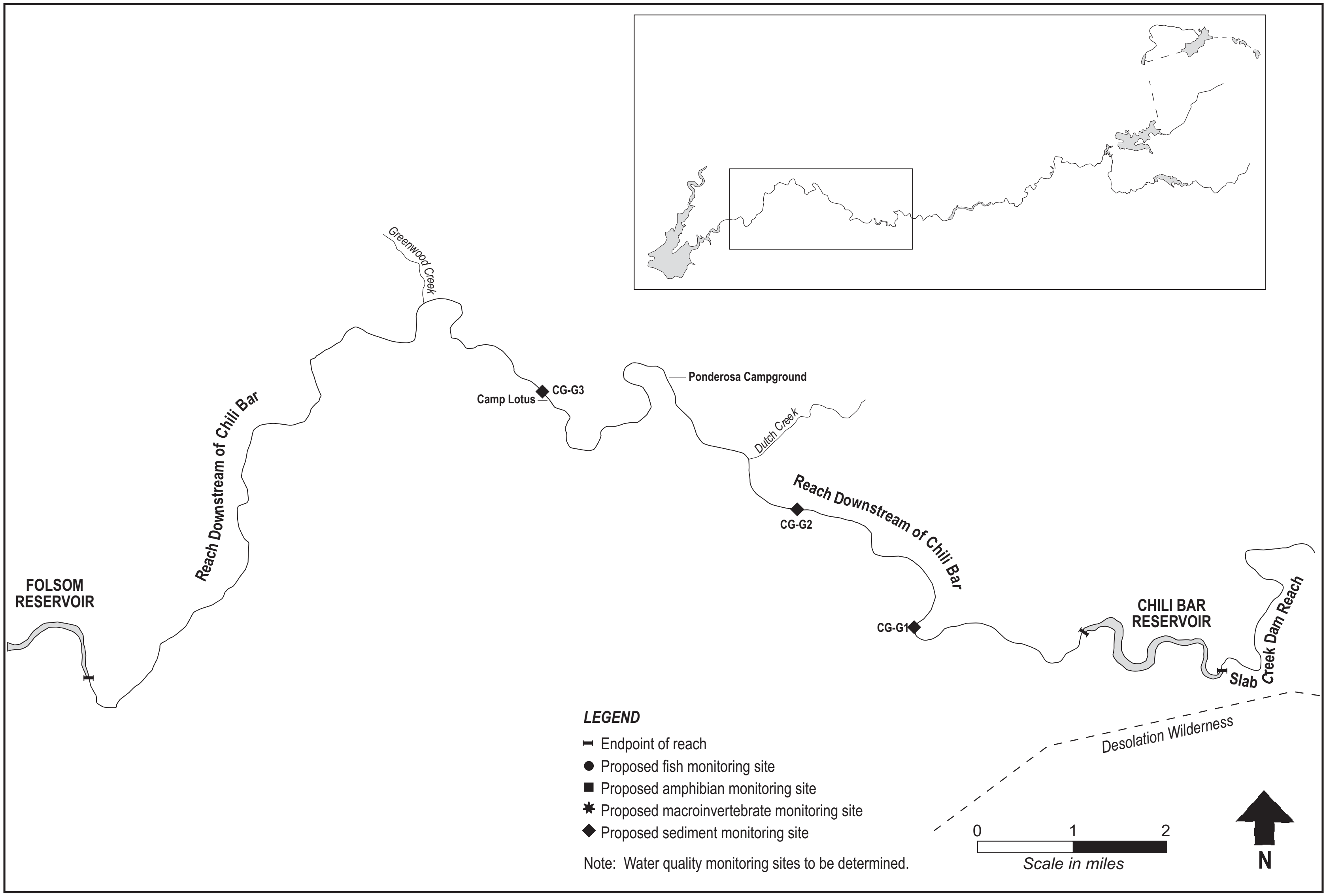

Figure 3-20. Stream segment sampling reaches—UARP western area. (Source: SMUD, 2005, as modified by the staff)

Table 3-33 summarizes the results of the applicant's 2002 through 2004 fish population studies and estimates of trout density and biomass in project streams. All study segments contained rainbow trout and most contained brown trout; these were the dominant species in most of the stream segments sampled. Stream segments where trout were not dominant include sites in the lower Rubicon dam reach (RRD-F2), Buck Island dam reach (BID-F1), lower Ice House dam reach (IHD-F2), SFAR reach (SFAR-F1), lower Slab Creek dam reach (SCD-F2), and at a study site in the reach downstream of Chili Bar dam (CB-F2). SMUD's studies reported that average condition factors[34] for both rainbow and brown trout were close to 1.0 for all 3 years (i.e., 2002-2004), indicating that trout are generally in good condition in the reaches sampled.

SMUD evaluated the longitudinal distribution of fish in the Slab Creek dam reach by snorkeling 14 sites located between 3.65 and 7.64 miles downstream of Slab Creek dam (i.e., between 0.21 and 4.2 miles upstream of Chili Bar reservoir) in October 2004. SMUD did not evaluate the fish community within the first 2.5 miles downstream of the dam due to accessibility and safety concerns. Figure 3-21 displays the location where each fish species was observed. In total, nine species were observed in the reach, seven of which were observed during the 2004 longitudinal study. The distribution of fish species was consistent with longitudinal trends expected with increasing temperature downstream of Slab Creek dam. At the uppermost sample site, rainbow trout were dominant, and subdominant species included brown trout, Sacramento sucker and sculpin. Diversity of fish species was higher at downstream sample sites with the addition of transition zone species including hardhead, Sacramento pikeminnow, and California roach. The most abundant species was California roach followed by hardhead. Only one smallmouth bass (250 to 275 mm) was observed in the reach. SMUD reported that the cryptic marking and benthic nature of sculpins may have caused them to be under represented due to the difficulty in observing them while snorkeling.

Aquatic Habitat

Reservoirs

SMUD and PG&E conducted a study to evaluate reservoir habitat that could affect warmwater or reservoir spawning fishes in project reservoirs. Based on the historical or suspected fish species present, Loon Lake, Ice House, Union Valley, Junction, Slab Creek, and Chili Bar were studied. Camino was excluded due to access and safety

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[34]Condition factor, or K, is a calculation used as an indicator of overall health of a fish, where $K = 10^5 \text{weight}/\text{length}^3$.

Table 3-33. Summary information from 2002 to 2004 stream fisheries studies. (Source: DTA and Stillwater Sciences, 2005d, CDFG, 2007)

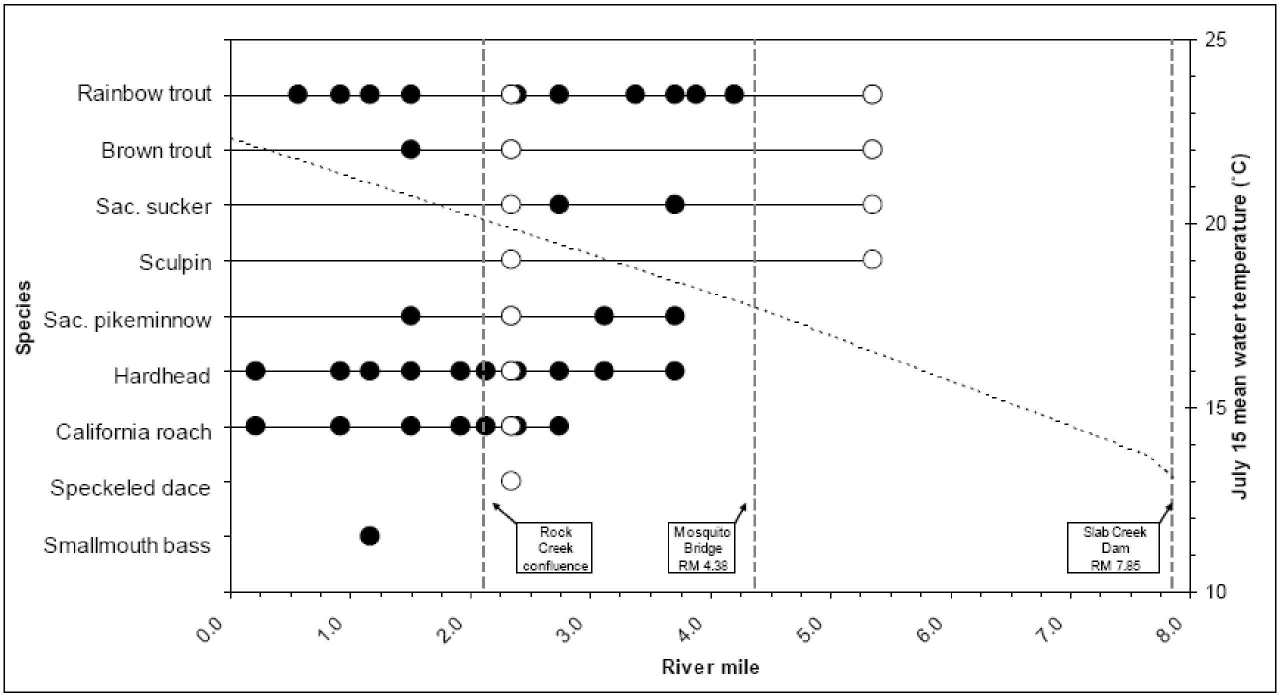
Stream Reach And Segment (Site ID)	Dominant Species	Dominant Trout	Mean Rainbow Trout Biomass (lbs/acre)	Rainbow Trout Age Classes	Brown Trout Age Classes
Rubicon dam reach upstream of Rubicon Springs (RRD-F1)	Rainbow trout	Rainbow	11.3	YOY to 2+	YOY to 3+, but low recruitment of YOY in 2002 and 2003
Rubicon dam reach at Miller Cr. Confluence (RRD-F2)	Speckled dace and California roach	Brown	0.9	YOY to 1+	YOY to 3+ in 2002, up to 1+ in 2003
Little Rubicon River Buck Island dam reach (BID-F1)	Golden shiner	Rainbow	0	YOY to 2+	NA
Gerle Creek Loon Lake dam reach at Wentworth Springs (LLD-F1)	Brown trout	Brown	19.5	YOY to 2+	YOY to 3+
Gerle Creek Loon Lake dam reach at Rocky Basin Cr. Confluence (LLD-F2)	Brown trout	Brown	40	No YOY or 2+ in 2002 and 2003, only 2 YOY in 2004	YOY to 3+
Gerle Creek below Gerle dam reach (GCD-F1)	Rainbow trout	Rainbow	11.5	YOY to 2+ (most YOY)	Up to 3+
SFRR upstream of Robbs Peak reservoir (--)	Rainbow trout	Rainbow	7	YOY to 1+ (most 1+)	NA
SFRR Robbs Peak dam reach (RPD-F1)	Rainbow trout	Rainbow	23	YOY to at least 2+	YOY to 2+ with good distribution of older age classes

Stream Reach And Segment (Site ID)	Dominant Species	Dominant Trout	Mean Rainbow Trout Biomass (lbs/acre)	Rainbow Trout Age Classes	Brown Trout Age Classes
SFSC Ice House dam reach downstream of Silver Cr. Campground (IHD-F1)	Rainbow trout	Rainbow	10.6	Good distribution of YOY and 1+	YOY to 4+ (most 1+)
SFSC Ice House dam reach at Bryant Springs (IHD-F2)	Sacramento sucker	Rainbow /Brown	3	YOY to 2+	YOY to 3+
Silver Cr. Junction dam reach, 2 miles downstream of dam (JD-F1)	Rainbow trout	Rainbow	7.5	Most YOY	Older age classes evenly distributed
Junction dam reach upstream of Sugar Pine Cr. (JD-F2)	Rainbow trout	Rainbow	NC	YOY to 3+ (moderate recruitment of YOY and good distribution1+ to 3+)	NA
Silver Cr, Camino dam reach downstream of Tent Canyon (CD-F1)	Rainbow trout	Rainbow	NC	YOY to 3+	One 100 mm and one 150 mm
Silver Cr. Camino dam reach at Camino tunnel adit access (CD-F2)	Rainbow trout	Rainbow	NC	YOY to 4+ with peak in 2+	NA
Brush Creek dam reach (BCD-F1)	Rainbow trout	Rainbow	14.7	YOY to 3+ with strong recruitment of YOY	YOY to 3+ with strong recruitment of YOY

Stream Reach And Segment (Site ID)	Dominant Species	Dominant Trout	Mean Rainbow Trout Biomass (lbs/acre)	Rainbow Trout Age Classes	Brown Trout Age Classes
Slab Creek dam reach upstream of Rock Cr. powerhouse (SCD-F2)	Speckled dace/hardhead in 2002; riffle sculpin in 2003	Rainbow	4.65	Peak at YOY	Three fish older than YOY
Downstream of Chili Bar reach at Old Flume Memorial (CB-F1)	Rainbow trout, sculpin along margins	Rainbow	NC-	Low percentage of YOY	Only 5 fish [a]
Downstream of Chili Bar reach at Coloma State Park (CB-F2)	Sacramento sucker, sculpin along margins	Rainbow	NC	Peak at 125 mm (ages not discussed)	Only 4 fish [a]
Downstream of Chili Bar reach downstream of Camp Lotus (CB-F3)	Rainbow trout, sculpin along the margins	Rainbow	NC	Peak at 200 mm (ages not discussed)	Only 6 fish [a]
Downstream of Chili Bar reach at Weber Cr. Confluence (CB-F4)	Rainbow trout, sculpin along margins	Rainbow	NC	Peak at 175 mm (ages not discussed)	Only 1 fish [a]

Notes: -- – no data
mm – millimeter
NA – not applicable
NC – not calculated
YOY – young-of-the-year

[a] Size not given.



Note: Solid black circles indicate species observed in 2004, and open circles indicate species observed in 2002 and 2003 surveys. Dashed line is the water temperature relationship.

Figure 3-21. Species presence by river mile in Slab Creek dam reach. (Source: DTA and Stillwater Sciences, 2005d, figure 4.14-6)

constraints. Primary characteristics, including water-level fluctuations, physical shoreline habitat, number of tributaries and potential barriers to upstream fish migration, and shoreline fish spawning habitat were evaluated for each of these reservoirs. Note that we describe existing water level fluctuations in greater detail in section 3.3.2.1, *Water Quantity* (and erosion discussed in section 3.3.3.1, *Geology and Soils*).

Most of the shoreline of Junction, Slab Creek, and Chili Bar reservoirs is steep, but little erosion occurs along these shorelines due to bedrock and large-sized substrate along with dense vegetation along Chili Bar reservoir. Most of Loon Lake's shoreline, which is predominantly flat to moderately sloped, is also stable. In contrast, Ice House and Union Valley reservoirs have substantial mild erosion along their shorelines. Emergent vegetation is sparse along the shoreline of Ice House, Junction, and Union Valley reservoirs. Considerable emergent vegetation occurs in Chili Bar reservoir, and moderate levels of emergent vegetation occur in Loon Lake and Slab Creek reservoir.

No potential upstream fish migration barriers were identified for Loon Lake, Ice House, or Junction reservoirs. Potential barriers were identified for the other three reservoirs, although most of these barriers are not expected to preclude all fish species from entering the tributaries.

Streams

SMUD and PG&E evaluated stream habitat in numerous reaches affected by the Projects by conducting on-the-ground and aerial surveys during 2002 and 2003. This included on-the-ground mapping of seven reaches and aerial mapping of six reaches that were not safely accessible by foot or where ground surveys were not feasible. For both on-the-ground and aerial surveys, habitat units were delineated and categorized by habitat type, and then the percent of each habitat type was determined. The ground surveys recorded the type of substrate and cover, quantity of trout spawning gravel, large woody debris, potential upstream migration barriers for trout, and tributaries. The potential migration barriers were further evaluated to determine if they are absolute barriers to upstream trout migration or likely passable at anticipated high flows during spring runoff and/or winter storms. The results of these stream mapping and barrier evaluations are summarized in table 3-34.

Table 3-34. Summary characteristics for UARP and Chili Bar Project stream reaches. (Sources: DTA and Stillwater Sciences, 2005f, 2004a)

Reach (miles)	Cascade/High Gradient Riffle[a]/Low Gradient Riffle[a]/ Run/ Pool/ Pocket water %	Spawning Gravel (sq ft/ mile)	Large Woody Debris[b] (#/ mile)	# Trout Migration Barriers[c]	# of Tribu-taries
Rubicon River Rubicon dam[d] (5.8)	9.1/1.3/6.6/39.2/41.6/0.8	1,908	136	9/6	9
Rockbound dam (0.3)	13.5/11.7/28.9/8.8/37.2/0.0	0	329	4/2	0
Little RR Buck Island dam (2.5)	9.3/2.0/12.9/14.8/61.0/0.0	2	96	5/3	5
Gerle Cr Loon Lake dam (9.3)	10.4/7.8/18.9/25.9/35.9/1.1	3,932	194	7/3	2
Gerle Creek Gerle Creek dam (1.2)	18.1/0.0/4.6/1.1/36.7/39.4	1,606	7	0/0	4
SF Rubicon Robbs Peak dam (5.6)	25.2/11.5/18./15.8/25.2/3.4	--	--	2/1	--
Silver Cr. Ice House dam (12.3)	1.4/3.3/43.6/42.2/9.5/0.0	407	66	0/4	25
Silver Cr. Junction dam (8.3)	23.9/4.0/17.4/27.5/23.9/3.3	--	--	3/1	--
Silver Cr Camino dam (6.0)	16.3/2.8/2.6/14.0/59.0/5.6	--	--	1/0	--
Brush Creek dam (2.3)	17.0/10.6/21.9/19.2/31.3/0.0	134	42	19/8	0
SFAR Slab Creek dam (8.0)	4.9/13.3/18.9/28.8/26.1/8.0	--	--	0/0	--
SFAR Downstream of Chili Bar dam (20.0)	8.1/15.7/21.8/37.0/16.3/1.2	--	--	0/0	--

Note: -- indicates not reported.

[a] High gradient riffle has slope of greater than 4 percent. Low gradient riffle has slope of 4 percent or less.

[b] The minimum requirements used to define large woody debris were 6 inches in diameter and 3 feet in length where the total length was greater than or equal to one-half the channel width.

[c] Number before "/" is the number of migration barriers (other than the dam) to trout throughout the year. Number after "/" is the number of additional seasonal barriers that appear to be passable by trout at typical high flows during spring runoff and/or winter storms. Estimates for reaches where aerial mapping was done were made using aerial videography.

[d] Values for this reach include the Rubicon River from the base of Rubicon dam to the confluence with Miller Creek.

The estimated quantity of trout-spawning gravel for the seven ground-surveyed reaches ranges from zero to 3,932 square feet per mile. SMUD reports that virtually no spawning gravel occurs in the Rockbound dam and Buck Island dam reaches, but this is likely due primarily to geological features at these locations such as the predominance of relatively unweathered exposed bedrock. In contrast, more than 1,500 square feet of spawning gravel per mile occurs in the Loon Lake dam, Rubicon dam, and Gerle Creek dam reaches. Moderate volumes of spawning gravel exist in the Ice House dam and Brush Creek dam reaches.

The density of large woody debris ranged from 7 to 329 pieces per mile (table 3-34). The Gerle Creek dam reach had much less large woody debris than the other six reaches evaluated.

The applicants' trout barrier analysis revealed few year-round and seasonal barriers to upstream trout migration in the lower elevation reaches. The largest number of barriers to upstream passage was reported for the Brush Creek dam reach. Hardhead have relatively poor swimming abilities in cool water in comparison to trout, thus hardhead may have additional velocity barriers that permit the passage of salmonids (Moyle, 2002).

SMUD and PG&E sampled macroinvertebrate communities and assessed water quality by using measures of stream benthic macroinvertebrate community and physical/habitat characteristics to evaluate the biological integrity of stream ecosystems consistent with the California Stream Bioassessment Procedure (CDFG, 2003). They collected data at 30 sites in 13 reaches of the UARP during fall of 2002 and 2003, and at 6 sites in the reach downstream of Chili Bar dam in 2003 and 2004

About half of the distinct taxa identified at most UARP study sites were Ephemeroptera (mayfly), Plecoptera (stonefly), or Trichoptera (caddisfly). The overall number of mayflies, stoneflies, and caddisflies made up more than 40 percent of the organisms for the majority of the UARP study sites. However, mayflies, stoneflies, and caddisflies made up a much smaller percentage of the organisms at most of the sites downstream of the Chili Bar dam. The lowest percentage of organisms that were mayflies, stoneflies, and caddisflies occurred a short distance downstream of the Chili Bar and Junction dams, where they comprised about 6 and 14 percent of the total organisms, respectively.

Composite metric scores, which are indicators of biological integrity, were below average immediately downstream of the three largest UARP storage dams (Loon Lake, Ice House, and Junction) and generally increased with distance downstream of the reservoirs. Similarly, elmid beetles (riffle beetles of the family Elmidae) and perlid stoneflies (*Calineuria californica*), most of which are relatively long-lived taxa that require a full annual cycle or more for their development, are absent just below these reservoirs with increasing numbers further downstream. These factors suggest potential impairment immediately downstream of the Loon Lake, Ice House, and Junction dams, but recovery further down the corresponding reaches. Conversely, benthic macroinvertebrate composite metric scores decrease with distance downstream in the Camino and Slab Creek reaches, suggesting a decline in water quality at the lower ends of these reaches. Composite metric scores for the reach downstream of Chili Bar dam are consistently lower than at reference sites in the North Fork American and Cosumnes rivers, although this is partially due to the larger substrate in the upper end of the reach. Oligochaetes are dominant and taxonomic richness and diversity are generally low in this reach, particularly at the upper end.

3.3.3.2 Environmental Effects

This section evaluates the environmental effects of the Proposed Actions on the aquatic resources of the Projects. Environmental measures are considered to have a significant effect if they interfere with reproduction, recruitment, or survival of fish to the degree that they adversely affect the species at the population level; cause water quality characteristics to become suboptimal for fish compared to reference conditions; or result in decreases in benthic macroinvertebrate diversity in project reaches.

While historically the upper reaches of the UARP area were fishless, under the terms of the Settlement Agreement, the resource agencies chose trout (rainbow or brown trout) and hardhead biomass amounts as indicators of favorable ecological conditions in the project areas. Specific indicators used include components articulated in the “Fish Community Assessment Metrics” (SMUD, 2004a), or biomass numbers. If the Fish Community Assessment Metrics, or existing biomass numbers are less than expected for Northern Sierra trout biomass numbers (according to Gerstung, 1973), the goal for the reach is to improve biomass to meet those numbers.

Table 3-35 compares existing rainbow trout biomass (and brown trout on some reaches) by reach, survey reach number, and measured stream width from 2002–2004 SMUD surveys with the trout biomass goals taken from Gerstung (1973) (CDFG, 2007). Agency objectives for each reach are also included in the table.

Table 3-35. Rainbow trout and brown trout biomass by reach from 2002–2004 SMUD Surveys, with agency objectives for trout biomass in each reach.

Reach Name (site #)	Objective	Existing Mean Biomass for Rainbow Trout (lbs/surface acre)	Rainbow Trout Biomass Goal[a] (lbs/surface acre)
Rubicon River below Rubicon dam (RRD-F1)	Increase RT	11.3	24
Rubicon River below Rubicon dam (RRD-F2)	Increase RT	0.9	33
Little Rubicon River below Buck Island dam (BID-F1 (upper)	Reduce or eliminate golden shiners and increase RT	0	Reduce or eliminate golden shiners and move toward 33 RT
Gerle Creek below Loon Lake dam (LLD-F1)	Increase RT and maintain BN	19.5	Combined biomass of RT and BN–24
Gerle Creek below Loon Lake dam (LLD-F2)	Increase RT and maintain BN	40	Combined biomass of RT and BN–24
Gerle Creek below Gerle dam (GCD-F1)	Increase RT and maintain BN	11.5	Combined biomass of RT and BN–24
SF Rubicon upstream of Robbs Peak dam	Increase RT	7	33
SF Rubicon below Robbs Reak dam (RPD-F1)	Increase RT and maintain BN	23	Combined biomass of RT and BN–24
SF Silver below Ice House dam (IHD-F1)	Increase RT	10.6	RT-24
SF Silver below Ice House dam (IHD-F2)	Increase RT	3	24
Silver Creek below Junction Dam (JD-F1)	Increase RT	7.5	24
Silver Creek below Junction dam (JD-F2)	Increase RT	Use Fish Community Assessment Metrics[b]	
Silver Creek below Camino dam (CD-F1)	Increase RT	Use Fish Community Assessment Metrics[b]	278 catchable trout per mile[a]
Brush Creek (BCD-F1)	Increase RT	14.7	35

Reach Name (site #)	Objective	Existing Mean Biomass for Rainbow Trout (lbs/surface acre)	Rainbow Trout Biomass Goal[a] (lbs/surface acre)
SFAR Below Slab Creek dam (SCD-F2)	Provide healthy age class distribution of transitional fishery (coldwater to warmwater)	4.65 RT; Age class distribution that represents healthy population of hardhead. Use Fish Community Assessment Metrics[b]	13 rainbow trout; use electrofishing and snorkeling for hardhead
SFAR Below Chili Bar dam (CB-1 and F4)	Provide healthy age class distribution of transitional fishery (coldwater to warmwater)	Use Fish Community Assessment Metrics[b] rainbow trout and hardhead	

Note: RT = rainbow trout, BN = brown trout.

[a] Gerstung (1973)

[b] SMUD (2004a)

Minimum Streamflows

The proposed minimum streamflow schedule would apply to the Rubicon River below Rubicon dam, Little Rubicon River below Buck Island dam, Gerle Creek below Loon Lake dam, Gerle Creek below Gerle Creek dam, SFRR below Robbs Peak dam, SFSC below Ice House dam, Silver Creek below Junction dam, Silver Creek below Camino dam, Brush Creek below Brush Creek dam, and the SFAR below Slab Creek dam.

The proposed schedules specify minimum streamflows by month and water year type for each of the specified stream reaches, and allow the licensees a 3-year period after the license is issued or 3 years after completion of necessary facility modifications, whichever is later, to adjust operations to meet the required minimum streamflows. During this time period, daily mean streamflows may vary up to 10 percent below the amounts specified in the minimum streamflow schedules, provided that the average monthly streamflow in any given month equals or exceeds the required minimum amount for the month. After the applicable period, the licensees would meet the minimum streamflow requirements specified in the minimum streamflow schedules.

The minimum streamflow schedules are separated into five water year types: Wet, AN, BN, Dry, and CD. For the Proposed Action, SMUD would determine water year type based on the predicted unimpaired inflow to Folsom reservoir and spring forecasting information provided by DWR Bulletin 120 report of water conditions in California each month from February through May. The water year types are defined as follows:

- Wet = greater than or equal to 3.5 MAF
- AN = greater than or equal to 2.6 MAF but less than 3.5 MAF
- BN = greater than 1.7 MAF or equal to but less than 2.6 MAF
- Dry = greater than 0.9 MAF or equal to but less than 1.7 MAF
- CD = less than 0.9 MAF
- SD = any year that is immediately preceded by a Dry or CD year or any Dry year that is immediately preceded by any combination of two Dry or CD years. Applies to flows below Chili Bar dam only.

In our analysis of the potential effects of the proposed minimum streamflow schedules on aquatic resources, we refer to the results of water temperature monitoring shown in table 3-16, in section 3.3.2.1, *Water Quality*, and the summary characteristics of the stream reaches presented in table 3-34 and Agency objectives for aquatic resources shown in table 3-35.

Rubicon River below Rubicon Dam

Historically, the high-elevation Rubicon River was fishless. Rainbow trout, brown trout, California roach and speckled dace now inhabit the reach. Rainbow trout biomass observed at sample sites in this reach were low, with 11.3 pounds per surface acre in the upper sample site (RRD-F1), and 0.9 pounds per surface acre in the lower site (RRD-F2) (see table 3-33), below the management goal of 24, and 33 pounds per surface acre, respectively. Spawning gravels in the reach are comparatively high, with 1,908 square feet per mile.

Resource agency objectives for this reach are to increase rainbow trout habitat, and "de-emphasize" California roach and speckled dace populations. Settlement Agreement Proposed Article 1-1, Minimum Streamflows, calls for a minimum streamflow schedule that varies by water year and month, in an attempt to more closely mimic a natural hydrograph (table 3-36).

Our Analysis

The presence of warm, slow moving water likely accounts for the fact that California roach and speckled dace are dominant over trout in this reach. Both rainbow and brown trout both appear to be reproducing here, with age classes of rainbow trout up to 2+, and brown trout up to 3+ (see table 3-33). According to PHABSIM analysis conducted by CDFG (CDFG, 2006a), approximately 100 percent of rainbow trout available Weighted Usable Area[35] (WUA) for spawning in this reach of the Rubicon River occurs at 60 cfs (figure 3-22). In the Settlement Agreement, the May flow in a BN water year (beginning of rainbow trout spawning) was set at 35 cfs, which provides 84 percent of available WUA for rainbow trout, and provides 40 to 55 feet of wetted perimeter. After the May minimum streamflow was established, the unimpaired hydrograph was used to shape the streamflow regime for the remainder of the BN water year. For CD water years the minimum May streamflow was set at 48 percent WUA, since during natural conditions, fish would have had less habitat available during these dry years.

Table 3-36. Proposed minimum streamflow schedule (cfs) for the Rubicon River below Rubicon dam. (Source: SMUD and PG&E, 2007)

Month	**CD**	**Dry**	**BN**	**AN**	**Wet**
July–February	6 or NF	6 or NF	6 or NF	6 or NF	6 or NF
March	6 or NF	8	15	15	15
April	8	12	20	20	20
May	10	15	35	35	35
June	6 or NF	8	15	15	15

Note: If Natural Flow (NF) measured in the Rubicon River above Rubicon reservoir is below 1 cfs, the minimum streamflow would be 1 cfs. In CD water year types, if the useable storage in Rubicon reservoir is less than 60 acre-feet and the licensee cannot maintain 1 cfs due to lack of NF into and storage in Rubicon reservoir, SMUD would notify the Agencies at least 30 days prior to not meeting the streamflow. After notification of the Agencies, SMUD may reduce minimum flows below 1 cfs, but at no time would the minimum streamflow be less than the NF into Rubicon reservoir, until sufficient water is available to resume prescribed minimum streamflow releases.

SMUD would maintain an over-wintering minimum pool of 6,527 feet in elevation in Rubicon reservoir once the reservoir begins to freeze for the protection of aquatic species. Below an elevation of 6,527 feet, streamflow releases from Rubicon reservoir would equal the lesser of the applicable flow listed in the table or the NF into Rubicon reservoir.

Proposed increases in minimum stream flows are expected to benefit the rainbow trout population by creating more available spawning habitat during April, May, and June in all water year types. Increasing flows during these months would slightly lower water temperatures in the stream during May and June resulting in temperatures that would benefit the preferred trout species, but that are less favorable for California roach and speckled dace.

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[35] Weighted Usable Area is the amount of usable habitat available for a given fish species.

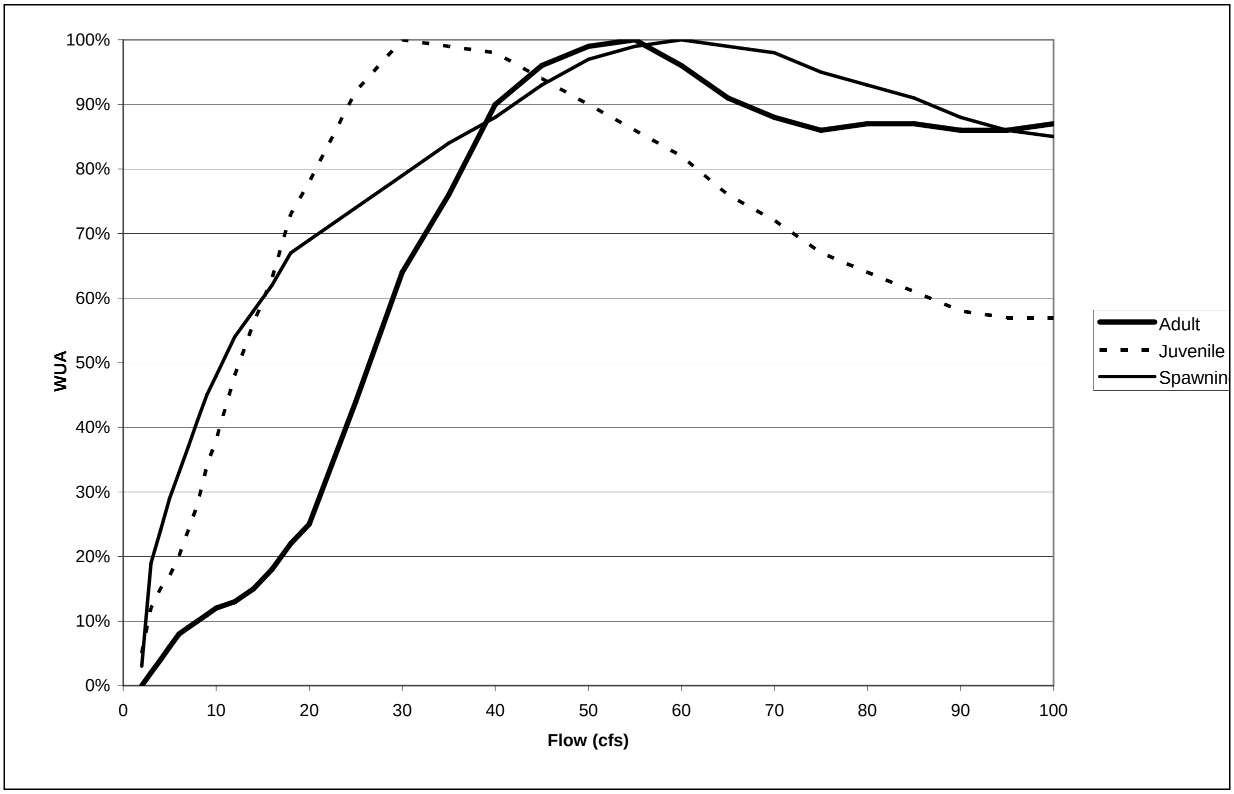

Figure 3-22. Weighted usable area for rainbow trout in the Rubicon River downstream of Rubicon dam. (Source: CDFG, 2006b)

Little Rubicon River below Buck Island Dam

Historically, the Little Rubicon River reach was fishless, and currently rainbow trout and golden shiners are found in the reach. There is a lack of spawning habitat for trout (less than 5 square feet in the entire reach), and there are 9 potential fish migration barriers. Without the current constant 1 cfs flow release, the high-elevation river would likely freeze in the winter, with limited habitat available only in deeper pools, and the river would be intermittently dry in the summer months. Water temperatures during March to April are near 0ºC, and during the summer the lower portions of the reach can reach 26ºC, near lethal temperatures for rainbow trout. These conditions result in low flow, warm water conditions during the summer that are more favorable for golden shiners, an exotic species that were likely introduced into the reach as baitfish.

Agency objectives for fish in this reach are to reduce or eliminate golden shiners, and increase existing populations of rainbow trout. The minimum streamflow schedule was developed by taking the Rubicon River minimum streamflows, and adjusting them by watershed area. There are approximately 26.5 square miles in the Rubicon River watershed, and approximately 6 square miles in the Little Rubicon River watershed, therefore the minimum flow regime was determined by dividing the Rubicon River minimum flows by 4.4. The proposed minimum flows are presented in table 3-37.

Table 3-37. Proposed minimum streamflow schedule (cfs) for the Rubicon River below Buck Island dam. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
July to February	1	1	1	1	1
March	1	2	3	3	3
April	2	3	5	5	5
May	2	3	8	8	8
June	1	2	3	3	3

Notes: Compliance point, USGS gage 11428400, located at the outlet structure on Buck Island dam. If Natural Flow (NF) measured in Highland/Rockbound Creek above Buck Island reservoir is below 1 cfs, the minimum flow would be 1 cfs. In CD water year types, if the useable storage in Buck Island reservoir is less than 60 acre-feet and the licensee cannot maintain 1 cfs due to lack of NF into and storage in Buck Island reservoir, SMUD would notify the Agencies at least 30 days prior to not meeting the streamflow. After notification of the Agencies, the licensee may reduce minimum flows below 1 cfs, but at no time would the minimum streamflow be less than the NF into the Buck Island reservoir, until sufficient water is available to resume prescribed minimum streamflow releases.

Our Analysis

Few fish inhabit this reach of the Little Rubicon River. Sampling at two sites in 2002 and 2003 yielded only 5 rainbow trout in total. In 2002, 12 golden shiners were captured, and in 2003 over 200 young-of-the-year golden shiner were captured. These young fish may have originated in the Buck Island reservoir. The small amount (less than 5 square feet) of spawning gravels present for trout along with the 9 passage barriers render this reach unproductive for trout at almost any flow. The proposed minimum streamflow schedule provides for increased flows from March through June in all but CD years. In CD years flows would be increased during April and May. The volume of watershed runoff that enters the reach as accretion during these months is significantly greater than the proposed increase in minimum flows, which would likely mask any potential benefit of the increased releases. Increases in minimum flow, particularly during May and June may benefit trout by lowering streamflow temperatures in the reach slightly; however, given the lack of available spawning gravels, this benefit may be limited to preventing pools in the stream from drying and providing rearing habitat.

Gerle Creek below Loon Lake Dam

Brown trout, a non-native but desirable fish species, and rainbow trout are relatively abundant in this reach (see table 3-31) and support an important recreational fishery. Agency objectives for Gerle Creek flows below Loon Lake dam are to emphasize rainbow trout and brown trout fisheries, reintroduce some similarity to the natural hydrograph to restore ecosystem processes that have been altered by project operations, and to inundate banks to a greater degree than present to move fines and to improve riparian condition.

The Settlement Agreement proposed minimum streamflow schedule is shown in table 3-38. To facilitate fish passage to Gerle Creek below the reservoir, the Settlement Agreement also contains a provision (Proposed Article 1-8, *Fish Passage at Gerle Creek*) that specifies that the reservoir level at Gerle Creek reservoir be maintained at an elevation that provides fish passage into Gerle Creek from August through October.

Table 3-38. Proposed minimum streamflow (cfs) schedule for Gerle Creek below Loon Lake dam. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October–November	7	11	16	20	23
December	8	13	18	22	26
January	12	15	19	23	28
February	14	18	22	27	32
March	19	24	30	37	44
April	23	32	40	49	58
May	25	32	40	49	58
June	10	16	22	27	32
July	5	14	22	27	32
August–September	5	10	14	17	20

Note: Compliance point, USGS gage 11429500, located on Gerle Creek approximately 0.3 mile downstream from Loon Lake dam.

Our Analysis

The proposed minimum streamflow schedule was developed to accomplish several objectives. These include increasing available habitat for brown trout and rainbow trout, particularly during their respective spawning seasons; providing cold freshwater instream habitat; ensuring low terraces and flood-prone areas are inundated during the growing season; and providing flows that will reduce encroachment of riparian vegetation in the channel. Allowing flows to vary among seasons and more closely follow flow patterns of an unimpaired flow regime would help to accomplish these objectives.

Brown trout typically spawn during a natural low-flow period of the year in October and November, and rainbow trout spawn during April through June. Results of CDFG's WUA analysis (CDFG, 2006b) for rainbow trout and brown trout are presented in figures 3-23 and 3-24. The current 8 cfs minimum flow provides 85 percent, 98 percent and 77 percent WUA for rainbow trout adult, juvenile, and spawning, respectively, and 92 percent, and 100 percent, and 77 percent WUA for brown trout adult, juvenile, and spawning, respectively. The Proposed Action would increase flows and available WUA for all life stages of rainbow trout and brown trout spawning in all water years, with the exception of brown trout spawning in CD years, where WUA would decrease slightly in October and November.

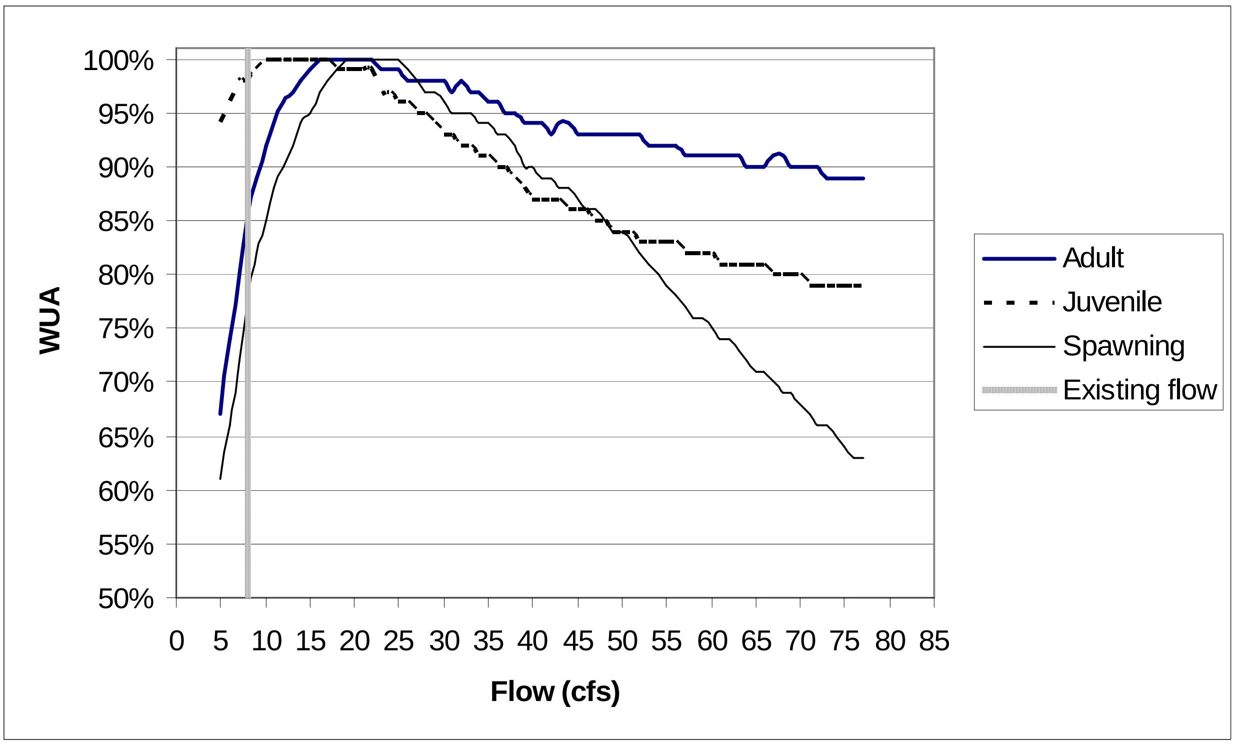

Figure 3-23. Rainbow trout composite WUA for Gerle Creek below Loon Lake dam. (Source: CDFG, 2006b; memorandum from R.W. Hughes, P.E., Associate Hydraulic Engineer, Fisheries Engineering Team, CDFG, to S. Lehr, Associate Fishery Biologist, Sacramento Valley Central Sierra Region CDFG, dated October 9, 2006)

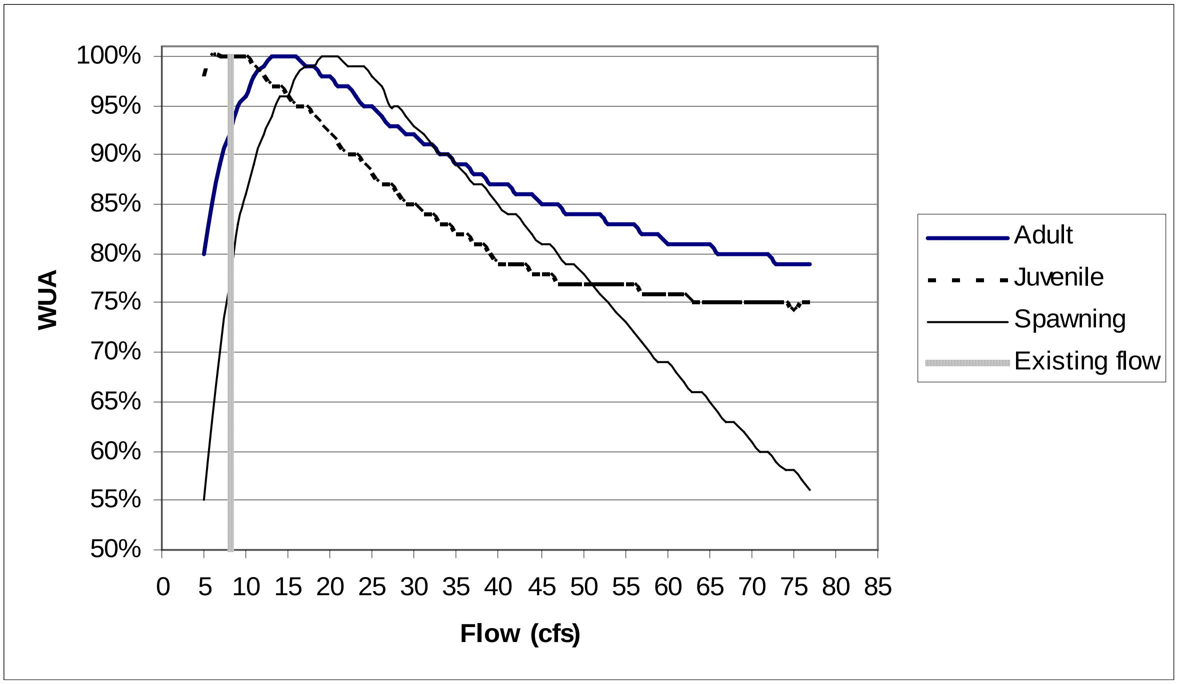

Figure 3-24. Brown trout composite WUA for Gerle Creek below Loon Lake dam. (Source: CDFG, 2006b; memorandum from R.W. Hughes, P.E., Associate Hydraulic Engineer, Fisheries Engineering Team, CDFG, to S. Lehr, Associate Fishery Biologist, Sacramento Valley Central Sierra Region CDFG, dated October 9, 2006)

The proposed increases in minimum streamflows would result in increased channel size and wetted perimeter downstream of the meadow section of Loon Lake reach of Gerle Creek, where channel mapping showed that increased flow would add habitat along the sides of the stream that may serve as a nursery for juvenile trout.

Increased flows during the spring months would result in inundation of stream margin habitats and primary flood terraces that would occur under an unimpaired flow regime. Such variations in streamflows and inundation are anticipated to increase the health of riparian vegetation and increase functioning of the riparian ecosystem by promoting stream bank stability and water quality, reducing the potential for erosion, increasing storage of nutrients and water, and providing forage and habitat for wildlife.

Currently, Gerle reservoir levels below 5,228 feet have been found to block passage of brown trout upstream to spawning grounds in Gerle Creek. Gerle Creek has been identified as an important and unique brown trout fishery by sports anglers that recreate in the Crystal Basin. By ensuring that fall reservoir elevation levels stay above 5,228 feet between August and October, the brown trout using the reservoir would be able to access Gerle Creek for their spawning run.

Robbs Peak Dam Reach and Gerle Creek below Gerle Dam

Rainbow trout and non-native brown trout populations inhabit the Gerle Creek dam reach. Agency goals for fish are to increase biomass of rainbow trout and maintain that of brown trout in Gerle Creek, and improve cold freshwater habitat.

The proposed minimum flows are presented below in table 3-39. Minimum streamflows for this reach are currently measured as combined flows below the confluence of Gerle Creek and SFRR.

Table 3-39. Proposed minimum streamflow (cfs) schedule for Gerle Creek below Gerle dam. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October	5	9	10	10	10
November	4	4	6	6	6
December	4	5	6	6	6
January to February	5	6	6	6	6
March	7	10	12	9	9
April	9	12	15	9	9
May to June	9	12	15	15	15
July	7	10	13	15	15
August	5	9	12	12	12
September	5	9	10	10	10

Our Analysis

Currently brown trout and rainbow trout are present in this short reach, providing valued opportunities for anglers. The existing minimum flows in this reach range between 4 cfs (CD, Dry, and BN years) and 7 cfs (during May through Oct of AN and Wet years). The current 4 cfs flows provide only 59 and 76 percent of WUA for brown trout and rainbow trout, respectively (figures 3-25 and 3-26). The proposed minimum flows would provide higher streamflows during the spring, which would increase the WUA available for rainbow trout spawning and adults, which may lead to increased production in the reach. The proposed minimum flows provide for increased flows during the fall brown trout spawning season as well, which could benefit production in the reach. The proposed flow releases more closely resemble an unimpaired hydrograph, which would likely benefit the production of healthy riparian vegetation and improve channel morphology.

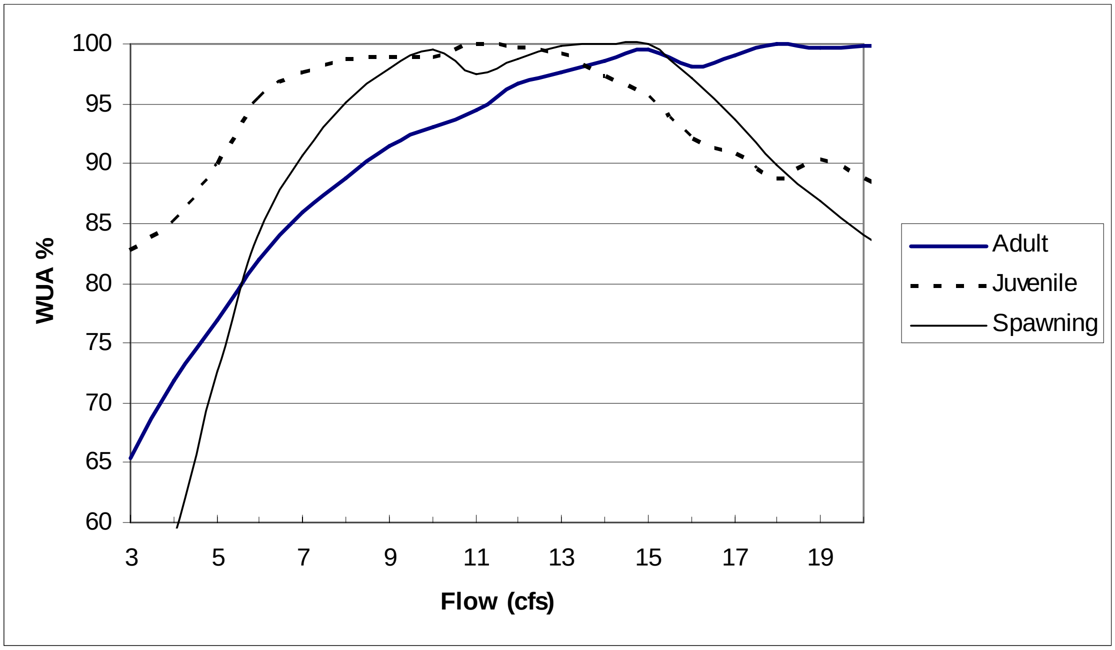

Figure 3-25. Brown trout composite WUA for Gerle Creek below Gerle dam. (Source: CDFG, 2006b; memorandum from R.W. Hughes, P.E., Hydraulic Engineer, Fisheries Engineering Team, CDFG, to S. Lehr, Associate Fishery Biologist, CDFG, dated October 9, 2006)

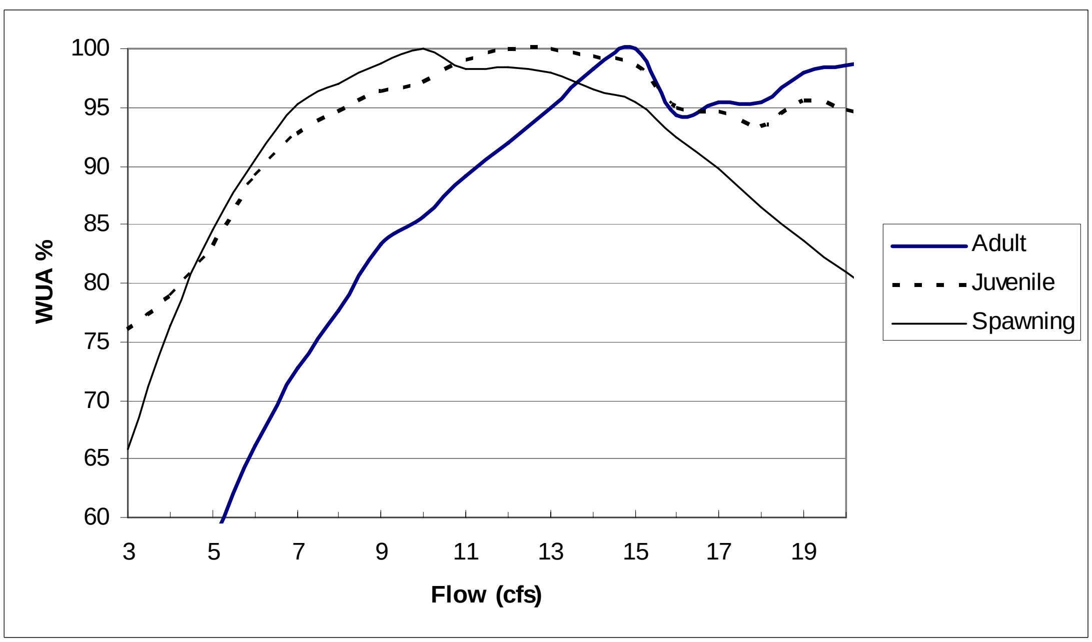

Figure 3-26. Rainbow trout composite WUA for Gerle Creek below Gerle dam. (Source: CDFG, 2006b; memorandum from R.W. Hughes, P.E., Hydraulic Engineer, Fisheries Engineering Team, CDFG, to S. Lehr, Associate Fishery Biologist, CDFG, dated October 9, 2006)

South Fork of the Rubicon River below Robbs Peak Dam

Agency objective for the fisheries resources in this reach are to increase rainbow trout production and maintain production of brown trout. Current minimum flow releases for this reach are 1 cfs for all months and water years, except that in AN and Wet years 3 cfs are released from May through October. The proposed minimum streamflow schedule is presented below in table 3-40.

Table 3-40. Proposed minimum streamflow (cfs) schedule for the SFRR below Robbs Peak dam. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October	3	3	3	3	3
November	1	2	3	3	3
December	1	3	4	4	4
January	2	5	7	7	7
February	2	5	8	8	8
March	3	7	11	9	9
April	4	9	13	10	10
May to June	4	9	13	13	13
July	3	5	6	13	13
August	3	5	6	11	11
September	3	5	6	6	6

Our Analysis

The proposed minimum streamflow schedule would establish a more natural hydrograph compared with the existing 1 or 3 cfs releases. The Agency goal for fisheries in this reach is to increase rainbow trout and maintain brown trout biomass.

Table 3-41 shows the percent WUA for all water types for rainbow trout for the proposed minimum flows. For all water year types there will be more juvenile and adult trout habitat available under the proposed flow regime than there would be under the unimpaired hydrograph or under the existing flow regime. The increased flows are also anticipated to decrease the potential for entrainment at the entrance to the Robbs Peak powerhouse tunnel. If this is found not to be successful based on monitoring results, the adaptive management program described in Proposed Article 1-6, *Adaptive Management Program* of the Settlement Agreement includes, but is not limited to, mitigation for the entrainment by installing a partial-flow fish screen in the SFRR upstream of Ice House Road, or other appropriate mitigation measures that are approved by the Forest Service, CDFG, and the Water Board.

Table 3-41. Percent WUA for all water year types for rainbow trout for SFRR below Robbs Peak dam. (Source: CDFG, 2007)

Month	Water Year Type	Flow Range	Percent WUA	Benefiting Life Stage
October to December	CD	1–3	53–86 (no PHABSIM for 1 cfs)	Adult
	Dry	2–3	53–86	Adult
	BN, AN, Wet	3–4	86–93	Adult
January to March	CD	2-3	53–86	Adult
	Dry	5-7	98	Adult
	BN	7-11	90-98	Adult
	AN, Wet	7-9	90-98	Adult
April	CD	4	93/85	Adult/spawning
	Dry	9	90/98	Adult/spawning
	BN	13	69/100	Adult/spawning
	AN, Wet	10	85/99	Adult/spawning
May to June	CD	4	93/81/100	Adult/spawning/juvenile
	Dry	9	90/98/90	Adult/spawning/juvenile
	BN, AN, Wet	13	69/100/82	Adult/spawning/juvenile
July	CD	3	86/72/99	Adult/spawning/juvenile
	Dry	5	98/85/99	Adult/spawning/juvenile
	BN	6	100/90/97	Adult/spawning/juvenile
	AN, Wet	13	69/100/82	Adult/spawning/juvenile
August	CD	3	86/99	Adults/juveniles
	Dry	5	98/99	Adults/juveniles
	BN	6	100/97	Adults/juveniles
	AN, Wet	11	80/85	Adults/juveniles
September	CD	3	86/99	Adults/juveniles
	Dry	5	98/99	Adults/juveniles
	BN, AN, Wet	6	100/97	Adults/juveniles

The PHABSIM modeling showed the May minimum streamflow of 13 cfs would inundate some areas of the primary flood terrace in the reach, which is anticipated to benefit riparian vegetation during the growing season, thus improving riparian cover in the reach.

The proposed increase in winter flow releases from Robbs Peak reservoir would help maintain the wetted width of the channel, which would help to minimize freezing and the chance of significant ice formation, and increase available overwintering habitat for adult and juvenile trout.

Minimum streamflows for this reach and Gerle Creek below Gerle dam are currently combined and measured below the confluence of Gerle Creek and SFRR. Therefore current the streamflow gaging in this reach is inadequate to determine actual flows. Installation of a stream gage as proposed in Proposed Article 1-10, *Streamflow and Reservoir Elevation Gaging*, would ensure minimum streamflows are being released.

South Fork of Silver Creek below Ice House Dam

The Ice House dam reach of SFSC was historically fishless; however, it now contains naturalized populations of rainbow trout, brown trout and, in the lower reaches, Sacramento sucker. Currently the watershed in the lower portion of the reach is not forested because of a wildfire that swept through the area in 1992. The trout biomass is well above average in the upper portion of Ice House dam reach, while the lower portion of the reach exhibits below average trout biomass, which may be related, in part, to a combination of habitat features and high mean daily temperatures during summer months in SFSC. Water released from Ice House dam originates in the hypolimnion of Ice House reservoir and remains cold throughout the year, with summertime temperatures of about 7ºC. In the summer, temperatures in the lower portions of this reach are often 20º to 21ºC, outside the optimal range for rainbow trout. While stream flow strongly influences stream temperature in the reach, high summer temperatures in the lower segment of the Ice House dam reach are also likely due to the loss of vegetation shading throughout most of the reach as a result of the 1992 wildfire.

Agency objectives for minimum flow releases to SFSC below Ice House dam for fisheries include providing peak flows to ensure bedload is moved through this reach; providing out-of-bank flows to inundate the lower terrace and floodplain to maintain the riparian ecosystem and keep the banks stabilized; providing temperatures that allow for management of native coldwater fish species. The goals for improving rainbow trout biomass at study sites in the reach are listed in table 3-35. Currently, rainbow trout biomass in the SFSC below Ice House dam is below agency objectives for the reach. The proposed minimum streamflow schedule is presented in table 3-42.

Table 3-42. Proposed minimum streamflow (cfs) schedule for SFSC below Ice House dam. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October	5	10	15	15	15
November	5	7	8	8	8
December	5	8	11	11	11
January to February	6	12	18	18	18
March	8	16	24	24	24
April	15	28	41	41	41
May	30	46	68	68	68
June	25	31	46	46	46
July	21	21	30	30	30
August	14	14	15	15	15
September	10	10	15	15	15

Note: Compliance point, USGS gage 11441500, located on SFSC approximately 0.4 mile downstream from Ice House dam.

Our Analysis

The proposed minimum flow regime would more closely simulate the snowmelt period in the spring and provide quality habitat coinciding with the life history of native fish and amphibians. Figure 3-27 and table 3-43 show the percent WUA that would be available under the proposed flow regime. The minimum streamflow schedule was developed with the goal of maximizing both rainbow trout adult habitat and spawning habitat, particularly in May.

The Agencies state the recommended minimum streamflows were referenced against the PHABSIM transects to ensure that inundation of the primary flood terraces and bank margins would occur. This would benefit riparian vegetation during the spring by promoting initial scouring, sediment and nutrient deposition, and seed dispersal (CDFG, 2007).

As stated in section 3.3.3.2., water temperature modeling shows the proposed minimum flows would result in cooler June and July conditions than existing minimum flows, and mean daily temperatures of 20°C or less would be maintained throughout the entire reach. Simulated temperatures were as much as 15°C cooler (7°C versus 22°C existing) just downstream of the dam, about 3 to 4°C cooler near the middle of the reach, and virtually the same at the lower end of the reach. Bell (1991) reports an optimal range for rainbow trout of 12 to 19°C, while Moyle (2002) reports an optimal growth range of 15 to 18°C, therefore cooler temperatures would benefit rainbow trout populations in the reach.

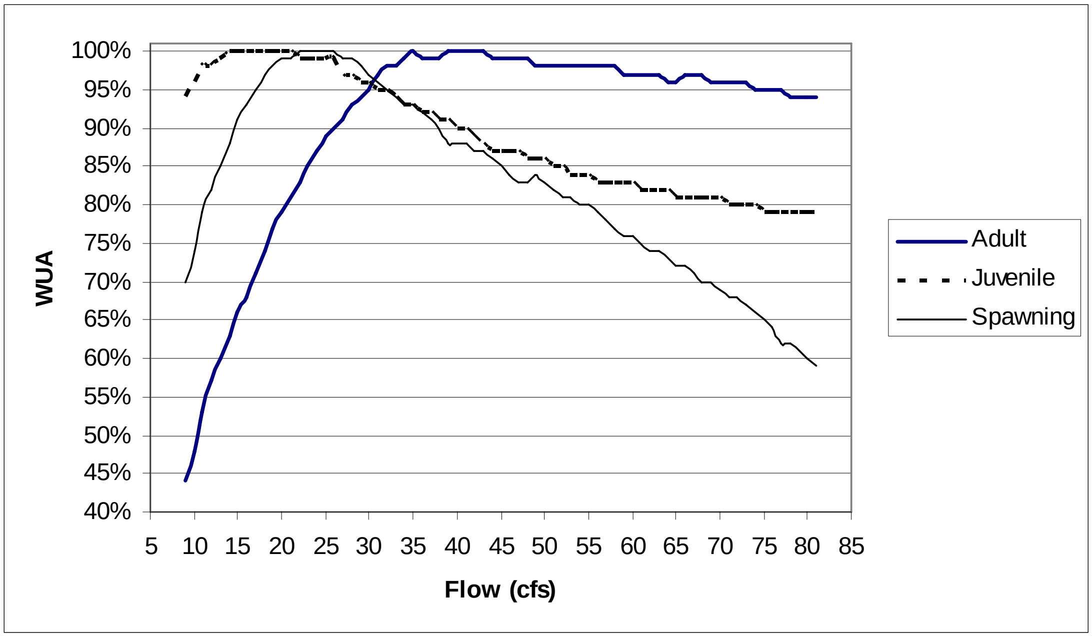

Figure 3-27. Rainbow trout composite WUA for the SFSC below Ice House dam. (Source: CDFG, 2006b; memorandum from R.W. Hughes, P.E., Hydraulic Engineer, Fisheries Engineering Team, CDFG, to S. Lehr, Fishery Biologist, CDFG, dated October 9, 2006)

Table 3-43. Percent WUA for all water year types for rainbow trout for SFSC below Ice House dam. (Source: CDFG, 2007)

Month	**Water Year Type**	**Flow Range (cfs)**	**Percent WUA**	**Benefiting Life Stage**
October	CD	5	44/73	Adults/juveniles
	Dry	10	48/76	Adults/juveniles
	BN, AN, Wet	15	65/88	Adults/juveniles
November to December	CD	5	Below 44	Adults
	Dry	7 to 8	Below 44	Adults
	BN, AN, Wet	8 to 11	Below 44 to 53	Adults
January to February	CD	6	Below 44 to 53	Adults
	Dry	12	57	Adults
	BN, AN, Wet	18	74	Adults
March	CD	8	Below 44	Adults
	Dry	16	68	Adults

Month	Water Year Type	Flow Range (cfs)	Percent WUA	Benefiting Life Stage
	BN, AN, Wet	24	87	Adults
April	CD	15	65	Adults
	Dry	28	93	Adults
	BN, AN, Wet	41	100	Adults
May	CD	30	95/97	Adult/spawning/juvenile
	Dry	46	99/84	Adult/spawning
	BN, AN, Wet	68	96/71	Adult/spawning
June	CD	25	89/100/99	Adult/spawning
	Dry	31	97/96/100	Adult/spawning
	BN, AN, Wet	46	99/84/97	Adult/spawning
July	CD	21	81/99/96	Adult/spawning
	Dry	21	81/99/96	Adult/spawning
	BN, AN, Wet	30	95/97/100	Adult/spawning
August to September	CD, Dry	10 to 14	48/76 to 63/86	Adult/juvenile
	BN, AN, Wet	15	65	Adult/juvenile

Silver Creek below Junction Dam

The Junction dam reach was historically fishless, but now supports reproducing populations of rainbow trout and brown trout. Agency objectives for establishing minimum flows in Silver Creek below Junction dam include providing temperatures that allow for management of native fish and address foothill yellow-legged frog breeding, to establish some similarity to the natural hydrograph, and to provide connectivity of flows from the SFSC below Ice House dam through Silver Creek below Junction dam. The existing biomass for rainbow trout for this reach is 7.5 pounds per surface acre, below the resource agency biomass objective of 24 pounds per surface acre. The proposed minimum streamflow regime (table 3-44) was designed to increase instream habitat to improve the rainbow trout biomass and move it closer to the objective. Currently, SMUD releases between 5 and 20 cfs during various flow years.

Table 3-44. Proposed minimum streamflow (cfs) schedule for Silver Creek below Junction dam. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October	5	10	15	15	15
November	5	7	20	20	20
December	5	8	20	20	20
January to February	6	12	20	20	20
March	8	16	25	25	25
April	15	28	42	42	42
May	30	46	68	68	68
June	25	31	50	59	59
July	21	21	30	35	35[a]
August	14	14	15	18	18[a]
September	10	10	15	18	18[a]

[a] SMUD would be required to release additional water into Silver Creek below Junction dam annually in July, August and/or September in Wet water year types for temperature control upon approval of the Agencies. A block of water would not exceed the acre-feet of water as follows: July, 1,044 acre-feet; August, 491 acre-feet; September, 475 acre-feet. Details of the block of water release flows are described in Proposed Article 1-1, *Minimum Streamflows*.

Our Analysis

The proposed minimum streamflows provide for increased flows through the reach for most all months and water year types. The minimum streamflow regime maximizes WUA for adult rainbow trout during most water years, although it decreases WUA available for rainbow trout spawning WUA when compared to existing conditions (figure 3-28). Table 3-45 displays the percent WUA for all water year types for rainbow trout for Silver Creek below Junction dam for the proposed minimum flow releases. The increase in streamflows during May through July would likely substantially reduce stream temperatures in the reach, which could benefit trout spawning, however the decrease in flows during August and September of AN and Wet years may slightly increase temperatures. However these warmer temperatures would most likely occur in edgewater habitat in lower portions of the reach (see discussion in section 3.3.2.2, *Water Temperature*) and would not likely have an impact on adult fish.

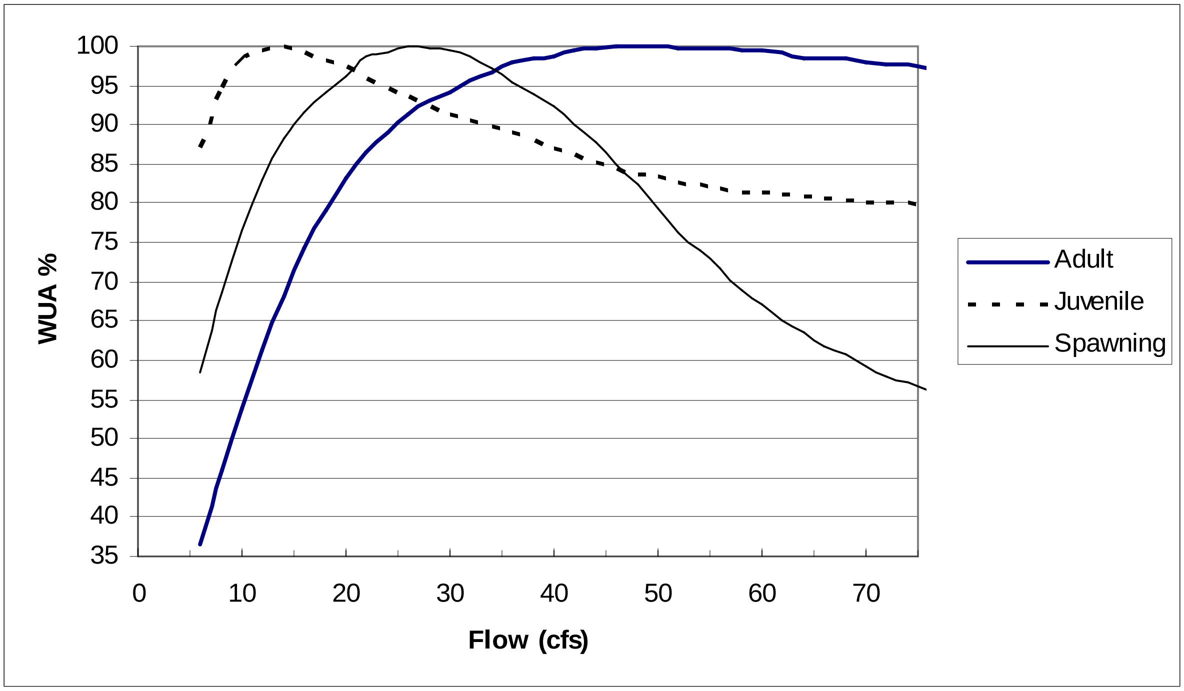

Figure 3-28. Rainbow trout WUA for Silver Creek below Junction dam. (Source: DTA and Stillwater Sciences 2004b)

Table 3-45. Percent WUA for all water year types for rainbow trout for SFSC below Junction dam. (Source: DTA and Stillwater Sciences, 2004b)

Month	**Water Year Type**	**Flow (cfs)**	**Percent WUA**	**Benefiting Life Stage**
October	CD	5	<36/<86	Adult/juvenile
	Dry	10	54/98	Adult/juvenile
	BN	15	71/99	Adult/juvenile
	AN	15	71/99	Adult/juvenile
	Wet	15	71/99	Adult/juvenile
November to February	Dry	7	41	Adult
	BN	20	83	Adult
	AN	20	83	Adult
	Wet	20	83	Adult
	CD	8	46	Adult

Month	Water Year Type	Flow (cfs)	Percent WUA	Benefiting Life Stage
March	CD	8	46	Adult
	Dry	16	74	Adult
	BN	25	90	Adult
	AN	25	90	Adult
	Wet	25	90	Adult
April	CD	15	71/90	Adult/spawning
	Dry	28	93/100	Adult/spawning
	BN	42	100/90	Adult/spawning
	AN	42	100/90	Adult/spawning
	Wet	42	100/90	Adult/spawning
May	CD	30	95/100	Adult/spawning
	Dry	46	100/85	Adult/spawning
	BN	68	98/61	Adult/spawning
	AN	68	98/61	Adult/spawning
	Wet	68	98/61	Adult/spawning
June	CD	25	90/99/94	Adult/spawning/juvenile
	Dry	31	95/99/91	Adult/spawning/juvenile
	BN	50	100/79/84	Adult/spawning/juvenile
	AN	59	100/68/81	Adult/spawning/juvenile
	Wet	59	100/68/81	Adult/spawning/juvenile
July	CD	21	85/97/96	Adult/spawning/juvenile
	Dry	21	85/97/96	Adult/spawning/juvenile
	BN	30	94/100/91	Adult/spawning/juvenile
	AN	35	97/96/89	Adult/spawning/juvenile

Month	Water Year Type	Flow (cfs)	Percent WUA	Benefiting Life Stage
	Wet	35	97/96/89	Adult/spawning/juvenile
Aug-Sept	CD	14	68/98-100	Adult/juvenile
	Dry	14	68/98-100	Adult/juvenile
	BN	15	71/99	Adult/juvenile
	AN	18	79/98	Adult/juvenile
	Wet	18	79/98	Adult/juvenile

Currently, the coldwater releases from Junction dam in summer months create a mean daily temperature range between approximately 8°C at the dam and 20°C at the bottom of the reach. Bell (1991) reports an optimal range for rainbow trout of 12 to 19°C, while Moyle (2002) reports an optimal growth range of 15 to 18°C. As stated in section 3.3.3.2, the large increases flow in May through July would substantially reduce temperatures in the reach, which may benefit trout in the reach. Reducing flows during August and September of Wet and AN years would likely only slightly increase temperatures.

Monitoring water temperatures and releasing blocks of water as described in Proposed Article 1-1, *Minimum Streamflows*, would provide a larger influx of cooler water, helping to maintain instream temperatures below 20°C and protecting trout in the stream.

Silver Creek below Camino Dam

Agency objectives for minimum flows in this reach are to provide habitat for healthy macroinvertebrate populations and foothill yellow-legged frogs in the entire reach, provide connectivity of flows from SFSC below Ice House dam through Silver Creek below Junction and Camino dams, provide temperatures that allow for management of native fish, and provide good water/habitat quality, resulting in improved bioassessment composite metric scores for rainbow trout, particularly in the lower reach. The proposed minimum streamflow schedule is presented in table 3-46.

Our Analysis

Flows in this reach were shaped to mimic the natural hydrograph, with decline of discharges during the summer that result in decreasing water depths and warmer water temperatures in order to facilitate reproduction of the foothill yellow-legged frog in the reach (CDFG, 2007). The flow regime was also developed to provide continuous streamflows from Silver Creek below Junction dam to improve habitat for rainbow trout in the reach.

Table 3-46. Proposed minimum streamflow (cfs) schedule for Silver Creek below Camino dam. (Source: SMUD and PG&E, 2007)

Month	**CD**	**Dry**	**BN**	**AN**	**Wet**
October	5	10	15	15	15
November	5	7	20	20	20
December	5	8	20	20	20
January–February	6	12	20	20	20
March	8	16	25	25	25
April	15	28	42	42	42
May	30	46	68	68	68
June	25	31	50	59	59
July	21	21	30	35	35[a]
August	14	14	15	18	18[a]
September	10	10	15	18	18[a]

[a] SMUD would be required to release additional water into Silver Creek below Camino dam annually in the months of July, August, and/or September in Wet water year types for temperature control upon approval of the Agencies. A block of water would not exceed these amounts: July, 1,044 acre-feet; August, 491 acre-feet; and September, 475 acre-feet. Details of the block of water release flows are described in proposed Article 1-1, *Minimum Streamflows*.

Based on snorkel surveys, there are an estimated 137 rainbow trout per mile in this reach (CDFG, 2007), and the stated goal for this reach is 278 adult fish per mile. The proposed minimum streamflows regime in this reach would result in an increase in available WUA for rainbow trout adults and spawning habitat during most months in all water years, although habitat for rainbow trout juveniles will decrease somewhat due to the higher flow regime (figure 3-29). The increase in habitat for adult and spawning rainbow trout is greater than the loss of juvenile habitat, thus the net result is anticipated to be that production of trout in the reach would likely increase.

As discussed in section 3.3.3.2, instream temperatures exceeded 20ºC in the lower end of the reach nearly 70 percent of the time in July, 20 percent of the time in June and August, and occasionally in May. The proposed streamflow release schedule would reduce mean daily temperatures approximately 5ºC in May and June, about 3ºC in July. It would likely keep stream temperatures below 20ºC from May through July in BN years, which would benefit rainbow trout in the reach during those months. However it is not clear if the increased streamflows in other years would lower temperatures below 20ºC, particularly in July and August. Monitoring water temperatures and releasing blocks of water as described in Proposed Article 1-1, *Minimum Streamflows*, would provide a larger influx of cooler water, helping to maintain instream temperatures below 20°C, thereby keeping temperatures closer to the preferred levels for trout in the stream.

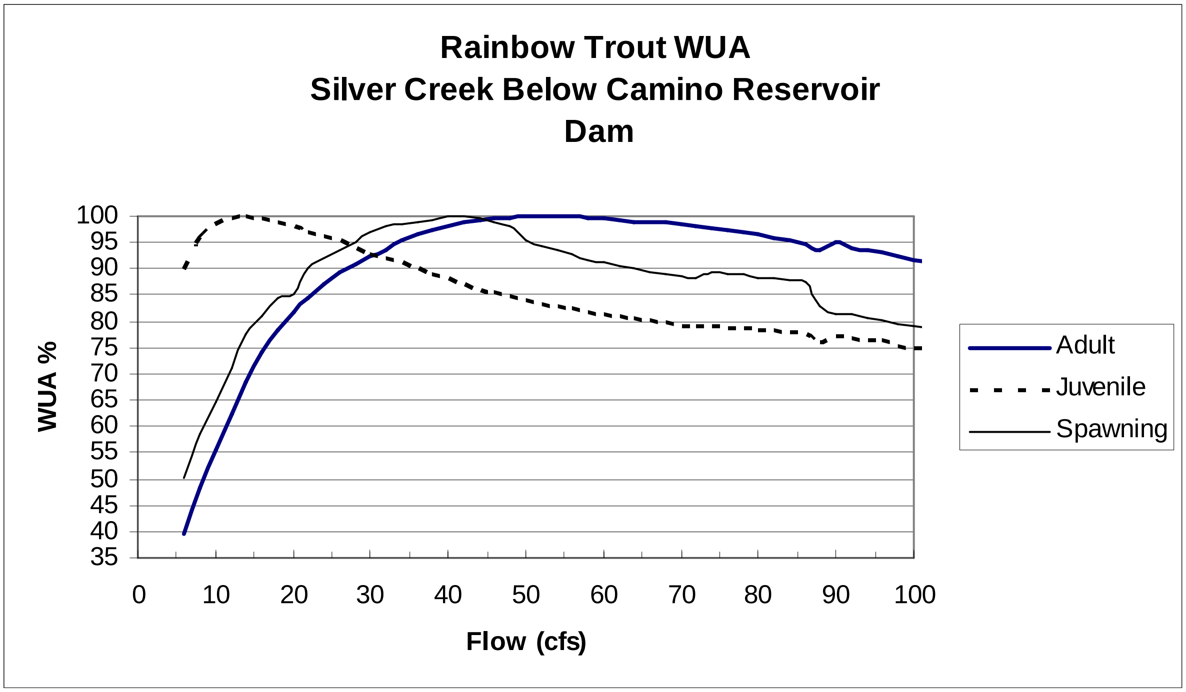

Figure 3-29. Rainbow trout WUA for Silver Creek below Camino dam. (Source: DTA and Stillwater Sciences 2004b)

Brush Creek below Brush Creek Dam

Historically, Brush Creek was fishless except at its confluence with the SFAR. Naturalized populations of rainbow and brown trout now occupy the stream. This reach has the highest productivity, in terms of fish per mile, of any of the other streams surveyed in 2003, and it appears there is strong recruitment of YOY fish for both trout species, with a distribution of older age classes up to the 3+ age group. The presence of multiple age classes indicates the rainbow and brown trout populations in the reach are reproducing in the reach.

Agency objectives for this reach are to manage flows to benefit native aquatic species. The Agencies recommended a mean rainbow trout biomass objective of 35 pounds per surface acre. The current mean biomass present in Brush Creek is 14.7 pounds per surface acre, so the recommended minimum streamflows were developed to increase biomass by increasing the available stream habitat. The proposed minimum streamflow schedule is presented in table 3-47.

Table 3-47. Proposed minimum streamflow (cfs) schedule for Brush Creek below Brush Creek dam. (Source: SMUD and PG&E, 2007)

Month	**CD**	**Dry**	**BN**	**AN**	**Wet**
October	4 or NF	4 or NF	4 or NF	4 or NF	4 or NF
November	6 or NF	7 or NF	8 or NF	9 or NF	9or NF
December–May	6 or NF	7 or NF	8 or NF	9 or NF	10or NF
June	6 or NF	7 or NF	8 or NF	9 or NF	9 or NF
July	5 or NF	5 or NF	5 or NF	5 or NF	5 or NF
August	4 or NF	4 or NF	4 or NF	4 or NF	4 or NF
September	3 or NF	3 or NF	3 or NF	3 or NF	3 or NF

Notes: NF=natural inflow. In all months and all water year types, if natural inflow is below 1 cfs, the minimum flow would be 1 cfs. Compliance point, USGS gage 11442700, located on the Brush Creek dam outlet structure.

Our Analysis

Current minimum streamflow releases from Brush Creek dam range from 2 to 3 cfs from June through October, and 4 to 6 cfs from November through May. The proposed minimum flow regime varies from 3 to 12 cfs from June through October, and 6 through 10 cfs from November through May (or natural inflow, or 1 cfs if natural inflow is less than 1 cfs).

The proposed minimum flows are increased over existing releases in all water years and months, except for the month of September in wetter years, where is it unchanged. Based on analysis of rainbow trout WUA, these proposed flows will increase available habitat for adult, juvenile, and spawning rainbow trout in Brush Creek compared to the existing conditions (figure 3-30). An increase in available habitat is anticipated to increase production of trout to meet agency biomass objective for this reach.

South Fork of the American River below Slab Creek Dam

The existing flow regime in the Slab Creek dam reach supports a wide variety of fish species. The reach is located within a transitional zone where the stream fish community comprises both coldwater and coolwater species. Trout are dominant in the upper portion of the reach, while hardhead, a special status species, are found as part of a native transition zone fish community (sucker-pikeminnow-hardhead) in the lower portion of the reach. The primary cause of this is rising water temperatures from upstream to downstream.

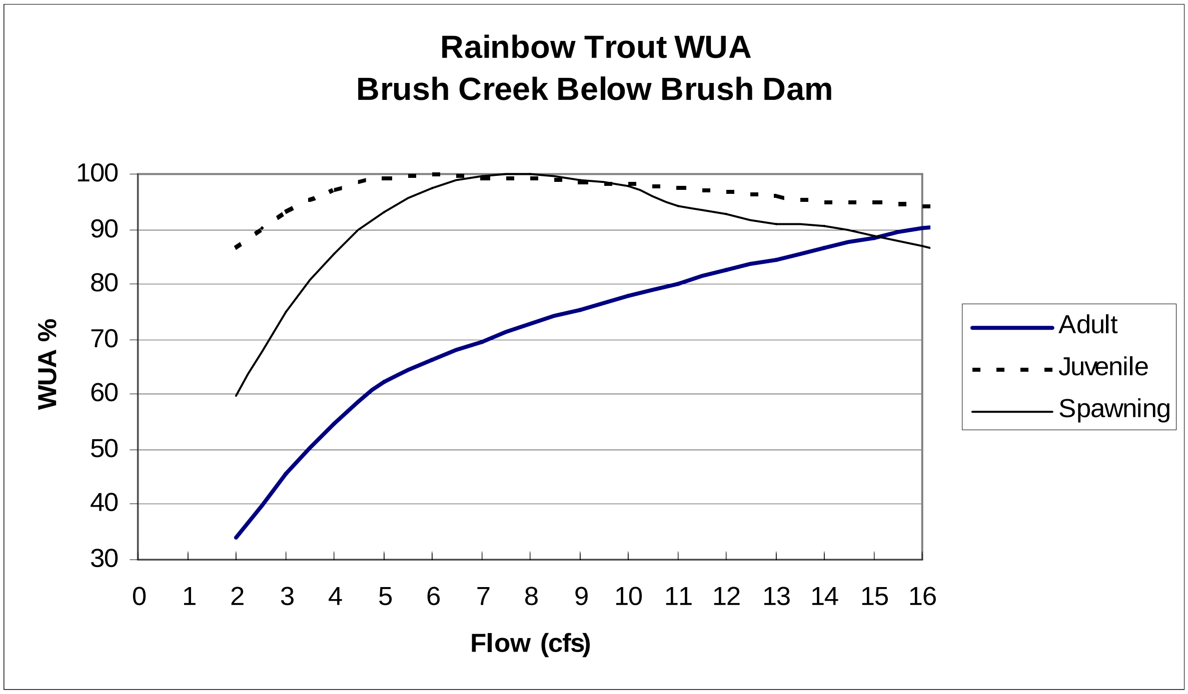

Figure 3-30. Rainbow trout WUA for Brush Creek below Brush Creek dam. (Source: DTA and Stillwater Sciences 2004b)

The Agencies' objectives for fisheries resources in the SFAR below Slab Creek dam are to provide habitat for hardhead, and to provide temperatures that allow for management of native fish (hardhead and rainbow trout); to reduce non-native species, such as bullfrogs and bass; to reestablish some similarity to a natural hydrograph; and to maintain streamflows in the SFAR above Slab Creek reservoir below Slab Creek dam.

The proposed minimum flow releases schedule is presented in tables 3-48 and 3-49. Because the higher spring flows would require SMUD to modify facilities, there is a minimum streamflow regime for years 1 to 3 of the new license that is within the capability of the existing facility, and then the minimum streamflows increase once appropriate facility modifications are made to accommodate the flows.

Our Analysis

The coldwater releases from Slab Creek reservoir facilitate a coldwater trout fishery in the upper portion of the reach, although there is a warmer water "transition zone" fishery above Slab Creek reservoir. The summer flow regime creates warmer water conditions in the lower portion of the reach that do not sustain a significant trout population. The existing biomass for rainbow trout in this reach is 4.6 pounds per surface acre, below the agency biomass objective of 13 pounds per surface acre. The proposed flow regime is designed to improve instream habitat to increase the trout biomass and move it closer to the desired objective.

Table 3-48. Proposed minimum streamflow (cfs) schedule for SFAR below Slab Creek dam, years 1–3. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October–February	63	63	70	80	90
March	63	101	110-130-150-180	110-130-150-180	110-130-150-180
April	100	101-132-156-183	188-197-213-222	188-197-213-222	188-197-213-222
May	109	164-145-126-107	229-236-247-263 [a]	229-236-247-263[a]	229-236-247-263 [a]
June	90	90	228-193-158-123	228-193-158-123	228-193-158-123
July	77	90	90	90	90
August	63	70	70	70	70
September	63	63	70	70	70

a Or maximum capacity of the valve, whichever is less.

Note: In months with more than one minimum streamflow, SMUD would maintain each minimum streamflow listed for 1 week prior to reducing to the next minimum streamflow for the month. Minimum streamflow would be measured at USGS gage 11443500, located approximately 500 feet upstream from Iowa Canyon Creek.

Table 3-49. Proposed minimum streamflow (cfs) schedule for SFAR below Slab Creek dam, years 4 through term of license. (Source: SMUD and PG&E, 2007)

Month	CD	Dry	BN	AN	Wet
October–February	63	63	70	80	90
March	63	101	110-130-150-180	110-130-150-180	110-130-150-180
April	100	110-130-150-183	222-236-247-263	222-236-247-263	222-236-247-263
May	109	164-145-126-107	272-286-297-303	272-316-367-395[a]	272-337-387-415[a]
June	90	90	255-210-165-120	324-256-188-120	352-274-197-120
July	77	90	90	90	90
August	63	70	70	70	70
September	63	63	70	70	70

[a] Or maximum capacity of the valve, whichever is less.

Note: In months with more than one minimum streamflow, SMUD would maintain each minimum streamflow listed for 1 week prior to reducing to the next minimum streamflow for the month. Minimum streamflow would be measured at USGS gage 11443500, located approximately 500 feet upstream from Iowa Canyon Creek.

Rainbow trout spawning in the reach occurs in pocket gravels, pool-tail crests and small lateral bar areas that increase in availability and area with higher flows. Results of licensee's WUA analysis of flows in this reach are presented in table 3-50 and figure 3-31. The proposed release schedule would increase releases from the dam during the all months. Increasing minimum streamflows would provide increase available rainbow trout WUA compared to the existing flow regime (figure 3-31). The WUA analysis predicted rainbow trout spawning habitat would increase as flow increases to a point where the flow inundates the entire channel and additional spawning habitat is not available

Table 3-50. Percent WUA for all water year types for rainbow trout for SFAR below Slab Creek dam. (CDFG, 2007)

Month	Water Year Type	Flow Range	Percent WUA	Benefiting Life Stage
October thru February	CD	63	80	Adult rainbow trout
	Dry	63	80	Adult rainbow trout
	BN	70	83	Adult rainbow trout
	AN	80	89	Adult rainbow trout
	Wet	90	92	Adult rainbow trout
March	CD	63	80	Adult rainbow trout
	Dry	101	95	Adult rainbow trout
	BN	180	100	Adult rainbow trout
	AN	180	100	Adult rainbow trout
	Wet	180	100	Adult rainbow trout
April/May	CD	100–109	81–82	Rainbow trout spawning
(years 1–3)	Dry	107–183	81–82	Rainbow trout spawning
	BN	222–263	93–95	Rainbow trout spawning
	AN	222–263	93–95	Rainbow trout spawning
	Wet	222–263	93–95	Rainbow trout spawning
April/May	CD	100–109	81–82	Rainbow trout spawning
(years 3 thru license term)	Dry	107–183	81–82	Rainbow trout spawning
	BN	263–303	95–96	Rainbow trout spawning
	AN	263–395	95	Rainbow trout spawning
	Wet	263–415	95	Rainbow trout spawning

Month	Water Year Type	Flow Range	Percent WUA	Benefiting Life Stage
June	CD	90	75	Rainbow trout spawning
(years 1–3)	Dry	90	75	Rainbow trout spawning
	BN	123–228	84–94	Rainbow trout spawning
	AN	123–228	84–94	Rainbow trout spawning
	Wet	123–228	84–94	Rainbow trout spawning
June	CD	90	75	Rainbow trout spawning
(years 3 thru license term)	Dry	90	75	Rainbow trout spawning
	BN	120–255	84–92	Rainbow trout spawning
	AN	120–324	84–97	Rainbow trout spawning
	Wet	120–352	84–97	Rainbow trout spawning
July	CD	77	85/87	Rainbow trout juveniles / adults
	Dry	90	80/92	Rainbow trout juveniles / adults
	BN	90	80/92	Rainbow trout juveniles / adults
	AN	90	80/92	Rainbow trout juveniles / adults
	Wet	90	80/92	Rainbow trout juveniles / adults
August/September	CD	63	90/80	Rainbow trout juveniles / adults
	Dry	70	88/83	Rainbow trout juveniles / adults
	BN	70	88/83	Rainbow trout juveniles / adults
	AN	70	88/83	Rainbow trout juveniles / adults
	Wet	70	88/83	Rainbow trout juveniles / adults

The proposed flow schedule would also restore to the reach a flow regime that more closely resemble a natural hydrograph, with increase in flows during the spring (March through June), and decreasing flows later in the year. This decline in the hydrograph during June is anticipated to serve as an important cue for hardhead spawning. Details on hardhead spawning are not yet fully understood, however they mainly spawn in spring, when the hydrograph is declining (Moyle, 2002) therefore the proposed flow regime may facilitate hardhead spawning in the reach.

Higher spring flows in BN, AN, and Wet years would redistribute spawning gravels to maintain trout habitat and transport some large woody debris downstream. Because approximately 75 percent of this reach is low gradient, large woody debris and spawning gravels should frequently settle into niche areas.

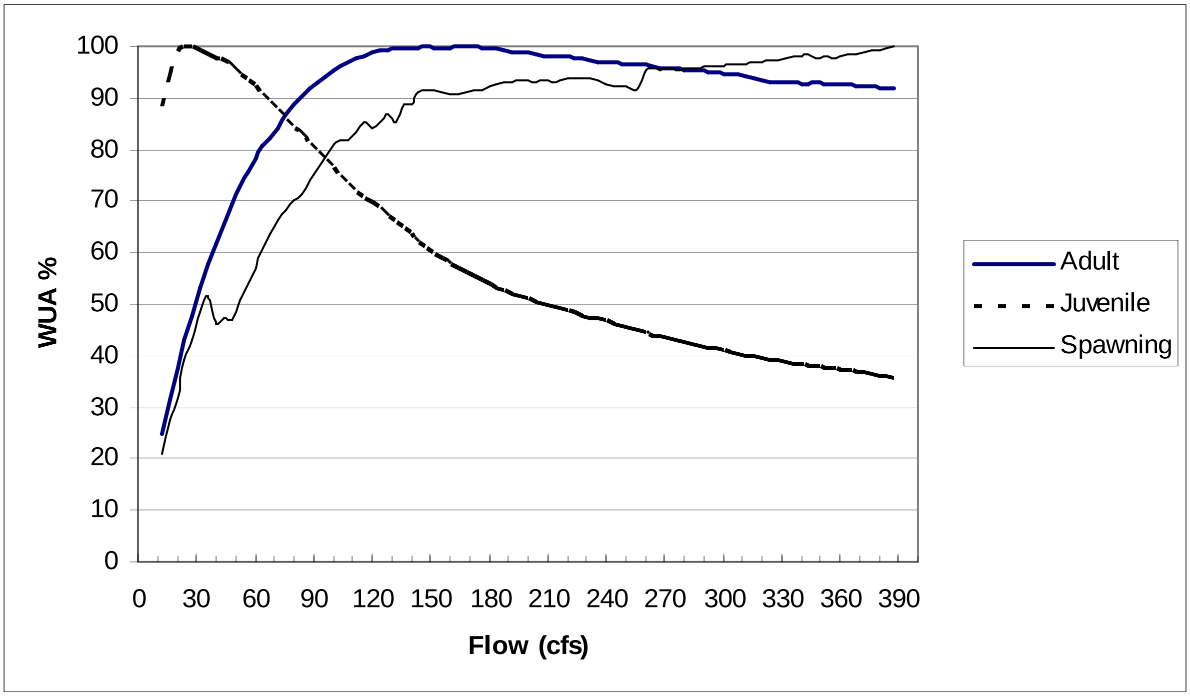

Figure 3-31. Rainbow trout WUA in the SFAR below Slab Creek dam. (Source: DTA and Stillwater Sciences, 2004b)

Modeling the proposed release flows indicates that mean daily temperatures are the lower end of the reach would be substantially reduced compared to existing conditions (section 3.3.2.1, *Water Resources*, *Water Quality*), extending downstream the range of temperatures preferred by rainbow trout. Mean daily temperatures would generally be 10 to 15ºC in May, 14 to 21ºC in June, 19 to 22 ºC in July, 17 to 21 ºC in August, and 13 to 19 ºC in September. While in years when temperatures above 20 ºC would be less optimal for rainbow trout, they would still support hardhead (optimal temperatures for hardhead appear to be 24 to 28ºC (Moyle, 2002).

South Fork of the American River below Chili Bar Dam

Flow fluctuations can affect aquatic resources in this reach by influencing the potential for fish stranding, causing changes to fish habitat, benthic macroinvertebrate populations, changing stream flow time-of-travel, and affecting fish access to and use of tributaries of the SFAR. This reach showed a low overall abundance of fish; however, low number of juvenile fish observed may not necessarily indicate spawning limitations in this reach. The sampling methods used (snorkeling) were appropriate to document the abundance of adult fish, but the snorkeling surveys may likely have underestimated the true abundance of juvenile fish present as juvenile fish are difficult to observe. The proposed minimum streamflow schedule is presented in table 3-51.

Table 3-51. Proposed minimum streamflow (cfs) schedule for SFAR below Chili Bar dam. (Source: SMUD and PG&E, 2007)

Month	SD	CD	Dry	BN	AN	Wet
September–October	150	185	200	250	250	250
November–March	150	185	200	200	200	250
April	150	200	250	250	300	350
May	150	200	250	250	350	500
June	200	200	250	250	350	500
July	150	185	200	250	300	350
August	150	185	200	250	300	300

Our Analysis

Fish abundance is low in this reach. The specific mechanisms causing low fish abundance are unclear but flow fluctuations above the typical base flow reduce the quantity of suitable habitat for all species and life stages studied. The flow fluctuations cause disturbance and subject fish to stresses that may limit feeding behavior, making it more difficult to forage for food during these daily high velocity events and increasing risks of stranding during rapid dewatering as flows decrease.

The current flow fluctuation regime in this reach does not appear to have significant effects on most metrics of the benthic macroinvertebrate community in the base flow channel, although overall benthic macroinvertebrate abundance appears to be low and benthic macroinvertebrates decrease in numbers in the flow fluctuation zone. In areas of the stream channel with periodic exposure to air due to flow fluctuations, total taxa richness, total insect taxa, total Ephemeroptera (mayfly), Plecoptera (stonefly), or Trichoptera (caddisfly) taxa, and individuals per square foot of benthic macroinvertebrates decrease as the period of time the substrate is exposed increases.

The Settlement Parties report the minimum streamflow regime would reduce the difference between daily high and low flows, and increase wetted perimeter. This would provide more stable and suitable habitat for benthic macroinvertebrate colonization and for fish, which will likely result in greater productivity in the reach. If the standing crop of benthic macroinvertebrate were increased, it would likely lead to a reduction in the energetic demands on foraging fish, and thereby support fish growth in the reach.

Ramping Rates

Significant rapid flow reductions in a stream channel have the potential to strand fish in areas of the channel that are relatively low-gradient, or where pockets or side channels exist in the river channel. Smaller juvenile fish (less than about 2 inches long) are most vulnerable to potential stranding due to weak swimming ability and preference for shallower, near-shore areas with slower velocities in a stream channel. Up-ramping flows generally do not affect fish stranding; however, the magnitude of flow change both upward and downward can affect fish behavior and habitat use, as well as affect production of benthic macroinvertebrates, which are an important source of food for most riverine fish species. Rapid changes in flow also can affect benthic macroinvertebrates, which become vulnerable to stranding and drift (leaving the substrate and floating downstream).

Proposed Article 1-3, *Ramping Rates*, specifies 1 foot per hour ramping rates for the following project-controlled releases:

1. Pulse flows in Gerle Creek below Loon Lake dam and SFSC below Ice House dam.
2. Minimum streamflow releases in Silver Creek below Junction dam, Camino dam and the SFAR below Slab Creek dam.
3. Recreational streamflow releases in SFSC below Ice House dam, and the SFAR below Slab Creek dam.

For the SFAR below Chili Bar dam, the proposed ramping rates are shown in table 3-52.

Table 3-52. Proposed ramping rates for the SFAR below Chili Bar dam. (Source: SMUD and PG&E, 2007)

Ramp Up	Ramp Down
500 cfs per hour for flows between 150 and 1,000 cfs	1 foot per hour for flows between 1,000 and 1,950 cfs
1 foot per hour for flows between 1,000 and 1,950 cfs	500 cfs per hour for flows between 1,000 and 600 cfs
	250 cfs per hour for flows between 600 cfs and 150 cfs

Our Analysis

Implementation of controlled fluctuations in flows may result in dramatic changes over a short term to the wetted perimeter of stream channels. The magnitude and temporal progression of the change is a function of the stream channel morphology, and extent of flow fluctuation in the reach. Impacts associated with ramping are variable, depending on species, life-stage, and in some case, time of day of the ramping event. Limiting ramping rates would decrease the potential for such stranding to occur. The proposed 1 foot ramping rate is typical for other hydropower projects in the Sierras, and has a history of success (CDFG, 2007).

Studies conducted by SMUD and PG&E in the reach below Chili Bar dam indicated that fish stranding potential at most study sites peaked when flows decrease in the 400- to 200-cfs and 600- to 400-cfs ranges, with smaller peaks occurring in the

1,400- to 1,200-cfs and 800- to 600-cfs ranges. The Gorilla Rock study site was the primary site for stranding impacts at these lower flow ranges and the Camp Lotus site was affected largely by the flow fluctuations from 2,400 to 2,000 cfs and 400 to 200 cfs. The study concluded that base flows established at or above 600 cfs would minimize the impacts of stranding throughout the reach, and minimum flows of 400 cfs could significantly reduce losses.

Proposed minimum flows for most months of the Wet and AN water year types are high enough to moderate rates of stranding, and monthly base flows for all other water year types should provide an improvement over the existing rate of stranding (CDFG, 2007). Adherence to the proposed ramping rates will reduce the effects of flow fluctuations on sensitive aquatic species that are vulnerable to sudden changes in flow.

Pulse Flows

In an unregulated system, periodic peak flows serve to improve channel conditions by shaping and maintaining depositional features, transporting sediments, and moving large woody debris, all important elements in maintaining well-functioning habitat for aquatic resources. Under natural conditions, periodic high flows would move sediments through the river system. Based on geomorphology studies, SMUD and the Agencies identified three reaches that would benefit from periodic pulse flows: Rubicon River below Rubicon dam, Gerle Creek below Loon Lake dam, and SFSC below Ice House dam (see section 3.3.1.2, *Geology and Soils*, for a description of pulse flows under Proposed Article 1-2, *Pulse Flows*).

Our Analysis

The addition of pulse flows in these three reaches would simulate peak flows that would occur naturally. Such flows help reduce riparian vegetation that is encroaching in the channels, which would benefit fish and other aquatic species. Pulse flows also serve to sort and clean spawning gravel, increase depth of pools by scour, and form exposed bar features, which are important components of healthy aquatic ecosystems.

In the SFSC below Ice House dam reach, the flushing flows would scour the finer sediments in areas where sediment supply has exceeded transport capacity, which in turn would restore the channel condition that existed before the deposition of fines from the Cleveland Fire. In all reaches where pulse flows are proposed, the channel bed would continue to be mobilized more frequently, so that future events that affect the channel substrate could be flushed in a more natural period of time. This would help improve instream habitat for fish and facilitate increased production towards the desired biomass goals.

Monitoring and Adaptive Management Program

In order to assess the effects of ongoing project operations under the terms of the new license, SMUD and PG&E would develop and implement monitoring plans in consultation with the Agencies. Results of the monitoring would be used to determine the need for measures described in Proposed Articles 1-6 and 2-5, *Adaptive Management Program*.

Fish monitoring methods include repeating electrofishing and/or snorkeling surveys (as conducted in 2002–2003 by the licensee) during late summer/fall for brown trout in the Gerle Creek below Loon Lake dam reach only, and hardhead sampling in SFAR below Slab Creek dam reach only.

Rainbow trout would be monitored in the Rubicon River below Rubicon dam, Little Rubicon River below Buck Island dam, Gerle Creek below Loon Lake dam, Gerle Creek below Gerle Creek dam, SFRR below Robbs Peak dam, SFSC below Ice House dam, Silver Creek below Junction dam, Silver Creek below Camino dam. Brush Creek below Brush Creek dam would be surveyed once every 10 years after license issuance. Hardhead snorkeling would be conducted in the SFAR below Slab Creek dam from immediately downstream of Mosquito Road Bridge to and including site SCD-F2.

Electrofishing and/or snorkeling for rainbow and brown trout would be conducted in the SFAR at two stations. Hardhead detected would be noted.

The frequency of fish monitoring actions would be as follows:

- Rainbow trout and brown trout: Years 5, 6, 10, 11, 15, 16, and thereafter for 2 consecutive years during every 10 years for the term of the license.
- Hardhead: Years 2, 3, 5, 6, 10, 11, 15, 16 and thereafter for 2 consecutive years during every 10 years for the term of the license.

The proposed adaptive management monitoring program calls for an examination of whether fish are being entrained in the Robbs Peak powerhouse during downstream migration. If so, the measure calls for the licensee to implement appropriate adaptive management measures as approved by the agencies.

SMUD and PG&E would develop and implement an aquatic macroinvertebrate monitoring plan in consultation with the Agencies. Monitoring would include sites in the Rubicon River below Rubicon dam, Gerle Creek below Loon Lake dam, Gerle Creek below Gerle dam (impaired reach), SFRR below Robbs Peak dam, SFSC below Ice House dam (impaired reach), Silver Creek below Junction dam, Silver Creek below Camino dam, the SFAR below Slab Creek dam, and the SFAR below Chili Bar dam (see figures 3-17 through 3-20). Reference streams that were sampled as part of the macroinvertebrate monitoring program during the relicensing would be incorporated into the monitoring program if the Agencies determine they are necessary.

Our Analysis

SMUD and PG&E have conducted extensive sampling of aquatic resources in the project area, and the resources agencies have developed objectives and goals for instream resources for each reach affected by project operations (see table 3-35). The Proposed Action includes measures intended to improve habitat conditions and increase biomass of desired populations of fish, amphibians, and invertebrate populations in the project area. In the case of minimum flow releases, for example, the post-license hydrograph in many reaches will change. Monitoring the response of instream resources to the new measures over the term of the license would provide information that can be used to inform resource managers whether or not the stated goals are being met.

Analysis of monitoring results would allow for the determination of the need to modify proposed measures. Decisions based on monitoring results, new scientific information or new technologies would aid in the achievement, or modification where appropriate, of goals and objectives established during the Settlement Agreement process.

Currently there is little evidence that fish are being entrained at the Robbs Peak powerhouse. Studies performed by the licensee showed that the population of rainbow trout in the SFFR upstream of the powerhouse is naturally limited by intermittent summer flow, sub-optimal water temperatures, and unfavorable winter conditions (DTA and Stillwater Sciences, 2005g). Fish that transit the Gerle Canal from Gerle Reservoir may also become entrained in the powerhouse. However the canal provides very little suitable habitat for trout and during a canal maintenance drawdown conducted in October of 2004 only 97 California roach, 41 brown trout, and 3 rainbow trout were captured in the 1.9-mile-long canal (DTA and Stillwater Sciences, 2005g). While studies performed during relicensing showed the potential for fish to become entrained at Robbs Peak powerhouse is extremely low, the adaptive management program nevertheless calls for development of mitigation measures should monitoring indicate fish are being entrained there. The development of mitigation to minimize any entrainment at Robbs Peak afterbay through the adaptive management program would likely protect the few native trout currently in the SFRR, where populations appear to be declining.

Large Woody Debris

Large woody debris is an important component of a healthy stream ecosystem. Large trees and snags that fall into streams play an important role in forming pools, metering sediment, trapping spawning gravels, and creating a more complex stream environment. Heavier pieces require higher flows for mobilization, and longer pieces are more likely to be caught by the stream bank and its vegetation. The presence of dams can interfere with downstream movement of large woody debris.

Under Proposed Articles 1-9 and 2-7, *Large Woody Debris*, SMUD and PG&E would ensure that, provided conditions permit safe and reasonable access and working conditions, mobile instream large woody debris continues downstream beyond Robbs dam, Junction dam, Camino dam, Slab Creek dam, and Chili Bar dam. At a minimum, all sizes greater than both 20 centimeters wide and 12 meters long would be allowed to continue downstream beyond dams. Smaller sizes would be allowed but would not be required to be moved beyond these dams.

Our Analysis

Currently SMUD removes woody debris at each of the project reservoirs prior to July 15 of each year. SMUD reports this is a necessary procedure due to concerns over boating safety and the eventual sinking of the material and resultant clogging of intake structures or low-level outlets. The removed woody debris is stockpiled in various locations within the project boundary and eventually burned.

Transporting woody debris that collects in the UARP and Chili Bar project reservoirs to the natural stream downriver will result in an enhancement in aquatic resource habitat and populations in each of the project reaches included in the plan.

Iowa Hill Development

The proposed Iowa Hill development may affect aquatic resources in Slab Creek reservoir if operation or construction alters fish habitat by affecting water quality (turbidity or temperature), or physically changes shoreline habitat used for rearing or spawning through water level fluctuations, or if fish become entrained in the intakes.

Slab Creek reservoir historically supported three species of fish that potentially spawn in reservoirs: kokanee salmon, speckled dace, and smallmouth bass. Kokanee salmon and smallmouth bass would have been introduced and recent surveys have not documented their persistence in the reservoir. Kokanee salmon and speckled dace typically spawn in tributary streams and would not be affected by fluctuation in reservoir levels associated with the Proposed Action. The reservoir contains a very small amount of spawning habitat for these species.

Five fish species historically documented in Slab Creek reservoir could potentially rear in the reservoir: Sacramento sucker, smallmouth bass, hardhead, Sacramento pikeminnow and kokanee salmon. Juvenile pikeminnow, hardhead, and suckers are known to rear in the SFAR upstream of Slab Creek reservoir. Juvenile suckers would find little rearing habitat within the reservoir due to the lack of emergent vegetation. Smallmouth bass may find some habitat in Slab Creek reservoir for rearing, since the upper sections of the reservoir contain moderately shallow edges along with some woody debris, although the species is not currently documented there. Habitat for smallmouth bass may be restricted due to cool water temperatures and the high velocity of the water flowing through this section that makes the habitat unsuitable. Kokanee salmon would be expected to find rearing habitat in Slab Creek reservoir, although the species is not currently documented there. Hardhead are known to inhabit Slab Creek reservoir.

Studies conducted to document fish abundance and distribution in the reservoir showed hardhead and Sacramento sucker were the most common, and were observed throughout the reservoir. The highest frequency of occurrence for hardhead was along the shorelines. In spring months, the concentration of hardhead appears to be much higher in the upstream segments of the reservoir. In summer, hardhead shift in distribution to the lower end of the reservoir, with the highest concentrations occurring along the shoreline. In the pelagic (open water) zone, hardhead numbers decrease with depth, with the lowest hardhead numbers occurring at the 100 foot depth. Surveys were not conducted in water deeper than 100 feet.

Spawning and rearing habitat for hardhead occurs primarily in streams (Moyle, 2002). While juvenile hardhead are known to rear upstream of Slab Creek reservoir in the SFAR, they also rear in the reservoir since they can utilize woody debris or other larger cover objects that occur in the reservoir in place of vegetation. This was confirmed by the capture of juvenile hardhead along the margins of Slab Creek reservoir. However, even though the reservoir contains their preferred warm-water environment (primarily downstream from the inlet of the SFAR) with large cobble and boulder substrate, it is missing the preferred habitat characteristics of shallow water and densely vegetated shorelines (Moyle, 2002), thus rearing habitat is limited.

Under Proposed Article 1-40, *Aquatic Resources*, SMUD would:

1. For 2 years prior to and 2 years after the Iowa Hill development begins to operate, monitor hardhead during all four seasons of the year to establish the locations of all life stages in Slab Creek reservoir (including edgewater locations) and in the water fluctuation zone upstream on SFAR above and below the Iowa Hill development.
2. Monitor edgewater temperatures of Slab Creek reservoir between May and September in locations approved by the agencies to demonstrate that pump discharge is not affecting hardhead distribution by reducing temperatures in shallow water areas of the Slab Creek reservoir.
3. Ensure the operation of Iowa Hill would not further reduce water temperature below 12°C during the months of June (after the descending limb of the hydrograph), July, and August in the Slab Creek dam reach below Mosquito Bridge.
4. Ensure that flow fluctuations in the SFAR below Slab Creek dam do not occur as a result of the Iowa Hill development, with the exception of flow fluctuations that occur as a result of specific requirements of the license (recreational streamflows).
5. Monitor hardhead using a method approved by the Agencies to determine whether entrainment is occurring as a result of the Iowa Hill development. If entrainment is occurring, the Agencies reserve the right to establish appropriate mitigation measures.

Our Analysis

Historically, the Slab Creek reservoir elevation levels remained fairly constant with a minimal average daily fluctuation of 3.3 feet (DTA and Stillwater Sciences, 2005b). Under the proposed Iowa Hill development project operations, water elevations in the reservoir would increase then decrease 9-15 feet (maximum of 30 feet) on a daily basis (DTA and Stillwater Sciences, 2005b). This change in water levels at the upstream end of the reservoir could affect fish passage at Brush Creek and Slab Creek by limiting connectivity to those coldwater streams when temperatures in the reservoir are not optimal for trout, or by making habitat unsuitable that was previously used for trout spawning. Although the operation of the Iowa Hill development would increase the daily range of fluctuation and the rate of drawdown, it would not change the current weekly range of water surface fluctuation in Slab Creek reservoir (i.e., between 1,810 and 1,850 feet).

As discussed in section 3.3.1.2, *Geology and Soils*, the daily drawdown of the reservoir would mobilize a small amount of sediment in the upstream portion of Slab Creek reservoir, but neither high turbidity nor chronic erosion of sediments in the vicinity of the intake/outlet structure would occur in Slab Creek reservoir. The minor increase in turbidity that would occur at the beginning of operations would not like affect any fish in the vicinity of the intakes. Shoreline in the reservoir is predominately steep bedrock, boulder and cobble, and not likely to experience significant erosion associated with the increased frequency of reservoir fluctuations. Because the operation of the Iowa Hill development would have a less-than-significant effect on turbidity and sedimentation in Slab Creek reservoir, and no effect on shoreline erosion, its operation would not affect the abundance and composition of near-shore habitat for fishes in the reservoir.

Water temperature modeling results show operation of the Iowa Hill development would not significantly alter the thermal regime of Slab Creek reservoir or the SFAR (section 3.3.3.2, *Water Quality*); therefore, there would likely be no effects on fishery resources and hardhead due to changes in reservoir water temperatures or for about 4.3 miles of the downstream reach

Trout is a management indicator species (MIS) for the Eldorado National Forest. A management indicator species analysis was completed for the Iowa Hill Pumped Storage Project (Williams, 2007a). Trout adults and juvenile life stages could be affected by the Iowa Hill development as a result of the daily pumping of stored water. The proposed Iowa Hill development would have the potential to entrain trout and other fish that may be in the vicinity of the intakes. The base of the multi-port intake/outlet facility in the reservoir would be located at an elevation of approximately 1,770 feet. Although not specifically described, it appears that the top of the intake structure would be at approximately 1,785 feet. SMUD states that the typical weekly fluctuation of Slab Creek reservoir would be between 1,820 feet and 1,850 feet. Historical records show that the reservoir elevation has dropped down to 1,820 feet and even down to 1,810 feet during 1998 and 1999, and 1,807 feet in 2005. Therefore, the depth of water above the Iowa Hill intake structure would normally fluctuate between 50 and 80 feet, although during low flow years, it could be 35 feet or less. Trout were only found at the 10- to 25-foot depths, and hardhead were primarily found at depths of 50 feet or less (DTA and Stillwater Sciences, 2005b). This suggests that entrainment of trout into the intake would be minimal, since most of the fish are at shallower depths and/or near the reservoir margins.

The highest frequency of occurrence of hardhead was along the shoreline, and juvenile hardhead are not expected to occur at the depth of the intake. Because hardhead exist at depths of 35 feet, the depth at which the intake structure could be located during the pumping phase, there is the potential that hardhead may be entrained during the pumping phase. Also, because hardhead can exist even below 35 feet, though in reduced numbers, there is the potential that hardhead may be entrained when the water depth above the intake structure is deeper than 35 feet. Depending on the operations, the potential for entrainment could have substantial effects on the hardhead population within Slab Creek reservoir.

It is unknown whether hardhead upstream from the reservoir would move into the reservoir and be entrained. Monitoring using fish tagging may be able to determine this. SMUD's proposal to monitor hardhead distribution, and whether entrainment of these fish (or others) occurs as a result of the Iowa Hill development would document whether this expectation is borne out. If entrainment is found to occur, the reservation of the right of the Agencies to establish appropriate mitigation measures would be expected to address entrainment mortality.

Based on the above information, we find that project-level habitat effects would likely contribute to a stable forest-wide habitat trend for trout (Williams, 2007a).

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed. Minimum flows, pulse flows, ramping rates, monitoring and adaptive management programs, and large wood debris management would remain the same as described under the SMUD's Proposal. As a result, the effects of the UARP-only Alternative on fish populations and macroinvertebrates would be the same as those described under the Proposed Action.

3.3.3.3 Unavoidable Adverse Effects

None.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

Vegetation

The UARP area encompasses a mosaic of forests, shrublands, grasslands, wetlands, agriculture, and other vegetation cover types within parts of the Central Valley, Sierra Nevada Foothills, and Sierra Nevada Highlands floristic regions. Undeveloped lands support vegetation typical of these regions: coniferous forests in the Sierra Nevada Highlands and upper Sierra Nevada Foothills floristic regions, and grasslands and oak woodlands in the Central Valley and lower Sierra Nevada Foothills regions.

Upland Vegetation

Twenty-nine vegetation alliances are found in the project area, including 16 forested and nine shrubland alliances. Upland vegetation generally reflects the topographic and precipitation patterns of the area. Uplands surrounding Rubicon and Loon Lake reservoirs are dominated by broad expanses of high-elevation evergreen shrubs such as huckleberry oak interspersed with granitic outcrops devoid of vegetation and sparse tree cover. Coniferous forests are the dominant upland vegetation type beginning just below Loon Lake reservoir and continuing west past the Slab Creek reservoir area, including the lands surrounding Gerle Creek, Union Valley, Ice House, Junction, Camino, and Brush Creek reservoirs and their associated reaches. White fir, red fir, and Jeffrey pine are common dominants near Ice House and Gerle Creek reservoirs, giving way to Douglas-fir, ponderosa pine, and California black oak at lower elevations.

UARP transmission line corridors that traverse coniferous forests are subject to large tree removal, which results in a mixed chaparral habitat in such corridors that are dominated by shrubs such as mountain whitethorn, wedgeleaf ceanothus, bitter cherry, and greenleaf manzanita. At the lower elevations west of White Rock powerhouse, however, chaparral becomes a common habitat across the landscape. Typical species in chaparral habitats of the project vicinity include whiteleaf manzanita, hoary coffeeberry, deerbrush, and western poison oak.

Upland vegetation at the Iowa Hill development was identified and mapped by SMUD in 2003 as part of a focused relicensing study. Mapped sites included proposed locations of the upper reservoir and berm, intake structure, transportation and construction access routes, temporary spoils sites, laydown areas, and a preliminary transmission line route (the precise alignment of the transmission line had not yet been established by engineering field surveys). Nearly 520 acres were mapped into five different types using the California Wildlife Habitat Relationships classification system. The following vegetation types were identified: Sierran Mixed Conifer (397.2 acres), Ponderosa Pine (93.2 acres), Mixed Chaparral (15.2 acres), Montane Hardwood

(12.1 acres), and Barren (0.9 acre). Habitat types were further subdivided based on size class and canopy coverage. Most of the study area was mature mixed-conifer with dense (>60 percent) canopy closure (390.8 acres, 75.4 percent). These stands were dominated by Douglas-fir, with black oak subdominant, and ponderosa pine, sugar pine, canyon live oak, and incense cedar as common associates. Stands that had been selectively logged were predominantly comprised of ponderosa pine, with fewer Douglas-fir; these stands were classified as Ponderosa Pine habitat type. Montane Hardwood dominated by canyon live oak occurs on the steep, west-facing slope above Slab Creek reservoir, and patches of Mixed Chaparral dominated by whiteleaf manzanita also occur. A small, partially eroded area near the edge of Slab Creek reservoir was characterized as Barren.

The Chili Bar project area is located on the steep slopes along the SFAR. Overall, much of the Chili Bar project area of composed of cismontane woodlands and lower montane coniferous forests. Dominant canopy species along south-facing slopes include interior live oak, black oak, California buckeye, ponderosa pine, and gray pine. Douglas fir and white fir dominate many of the north-facing slopes. Much of the understory is dominated by poison oak, scotch broom, California wild grape, and Himalayan blackberry.

Special-Status Plants

Fifteen special-status plants are found in the project area (table 3-53). Special-status plants are not uniformly distributed: a few key habitats support most occurrences. Chief among these is the gabbro chaparral near Pine Hill, in the westernmost section of the project area. Three federally-listed species, Pine Hill ceanothus (*Ceanothus roderickii*), Pine Hill flannelbush (*Fremontodendron decumbens)*, and Layne's ragwort (*Senecio layneae*) occur within the Pine Hill area and discussed in section 3.3.5, *Threatened and Endangered Species*.

A serpentine-soil outcrop in the western half of the UARP supports the only known occurrence of Jepson's onion (*Allium jepsonii*) in El Dorado County. Key habitats elsewhere in the project area include rock outcrops, roadcuts, and chaparral near UARP reservoirs and facilities, which support occurrences of Stebbins' phacelia (*Phacelia stebbinsii*), mariposa phacelia (*Phacelia vallicola*), Sierra bolandra (*Bolandra californica*), and Pleasant Valley mariposa lily *(Calochortus clavatus* var. *avius*). Round-leaved sundew (*Drosera rotundifolia*) occurs in small wetlands immediately below Ice House dam and nearby Silver Creek, and in a meadow adjacent to Union Valley reservoir. Only Pacific yew (*Taxus brevifolia*) and woolly violet (*Viola tomentosa*) are found in the forested habitats most common in the UARP area, and these occur in riparian zones and granitic gravel and duff, respectively.

Table 3-53. Summary of special-status plant occurrences documented in the UARP area in 2000 and 2003. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

Scientific Name/Common Name	Status[a]	Number and General Location of Occurrences
Allium jepsonii Jepson's onion	Fed: none CA: none CNPS: 1B ENF: none	1 occurrence. Serpentine outcrop in Greenstone Country subdivision
Bolandra californica Sierra bolandra	Fed: none CA: none CNPS: 4 ENF: W	1 occurrence. Forest near Camino reservoir
Calochortus clavatus var. *Avius* Pleasant Valley mariposa lily	Fed: SC CA: none CNPS: 1B ENF: S	3 occurrences. Chaparral and *Quercus chrysolepis* forest near Junction and Camino reservoirs
Ceanothus roderickii Pine Hill ceanothus	Fed: E CA: R CNPS: 1B ENF: none	1 occurrence. Transmission line corridor near Pine Hill
Chlorogalum grandiflorum Red Hills soaproot	Fed: SC CA: none CNPS: 1B ENF: W	3 occurrences. Transmission line corridor near Pine Hill and Independence Point
Clarkia biloba ssp. *Brandegeeae* Brandegee's clarkia	Fed: SC CA: none CNPS: 1B ENF: none	1 occurrence. Roadcut along Slab Creek reservoir access road
Drosera rotundifolia Round-leaved sundew	Fed: none CA: none CNPS: none ENF: W	3 occurrences. Seepage area south of Ice House Dam, Silver Creek, and a wetland at Union Valley reservoir

Scientific Name/Common Name	Status[a]	Number and General Location of Occurrences
Fremontodendron decumbens Pine Hill flannelbush	Fed: E CA: R CNPS: 1B ENF: none	4 occurrences. Transmission line corridor near Pine Hill
Navarretia prolifera ssp. *Lutea* Yellow bur navarettia	Fed: SC CA: none CNPS: 4 ENF: S	4 occurrences. Transmission line corridor between Iowa Hill and Badger Hill
Phacelia stebbinsii Stebbins' phacelia	Fed: SC CA: none CNPS: 1B ENF: S	Numerous occurrences. Three general localities in chaparral and rock outcrops near Camino and Junction reservoirs
Phacelia vallicola Mariposa phacelia	Fed: none CA: none CNPS: none ENF: W	1 occurrence. Rock outcrops near Camino reservoir
Senecio layneae Layne's ragwort	Fed: T CA: R CNPS: 1B ENF: S	2 occurrences. Transmission line corridor near Pine Hill
Taxus brevifolia Pacific yew	Fed: none CA: none CNPS: none ENF: W	4 occurrences. Transmission line corridor southeast of Slab Creek reservoir; mouth of Brush Creek at Brush Creek reservoir
Viola tomentosa wooly violet	Fed: none CA: none CNPS: 1B ENF: W	10 occurrences. Campgrounds at Union Valley and Gerle Creek reservoirs, transmission line corridor west and southwest of Loon Lake reservoir
*Wyethia reticulata*El Dorado County mule ears	Fed: SC CA: none CNPS: 1B ENF: none	2 occurrences. Transmission line corridor near Pine Hill

[a] Status listings definitions are as follows:

Federal:

E = listed as endangered under the Endangered Species Act (ESA).

T = listed as threatened under ESA.

SC = species of concern.

California (CA):

R = state listed rare plant.

California Native Plant Society (CNPS):

1B = plants considered to be rare, threatened, or endangered in California and elsewhere.

2 = plants considered to be rare, threatened or endangered in California, but more common elsewhere.

3 = plants about which more information is needed – a review list.

4 = plants of limited distribution – a watch list.

Eldorado National Forest (ENF):

S = sensitive plants. Plants known to, or have potential to occur on the Forest Service lands that are considered valid candidates for federal threatened or endangered classification under the ESA.

W = a watch list of plants that do not meet all the criteria to be included on the Regional Forester's Sensitive List, but are of sufficient concern that they need to be considered in the planning process.

No sensitive plant species are known or expected to occur within the Iowa Hill Development area. No special-status plant species were observed within the Chili Bar project boundary during 2004 special-status plant surveys. Potentially suitable habitat was found for five special-status species: Big-scale balsamroot (*Balsamorhiza macrolepis* var. macrolepis), Brandegee's clarkia (*Clarkia bibloa* ssp. *brandegeeae*), Butte County fritillary (*Fritillaria eastwoodiae*), Stebbin's phacelia (*Phacelia stebbinsii*), and oval-leaved viburnum (*Viburnum ellipitcum*).

Noxious and Invasive Weeds

The Noxious and Invasive Weeds Study conducted by UARP in 2000, 2003, and 2004 identified ten species within the UARP area (table 3-54). Noxious and invasive weeds are concentrated in the western part of the project area (primarily in the lower transmission line corridor west of White Rock powerhouse), and are especially prevalent near development, along roadsides, in agricultural fields, and in annual grassland and oak woodland habitats. In this western area, dominance by yellow starthistle or medusahead is uniformly associated with disturbed habitats, and roadsides are commonly infested with rush skeleton weed. Few weeds occur in the forested habitats found in the eastern parts of the project area, even where transmission line clearing has resulted in bare soil and sparsely vegetated areas. Burned lands areas along the Jones Fork-Union Valley transmission line are a notable exception, supporting strong infestations of cheatgrass and ripgut grass.

Table 3-54. Noxious weeds located during 2000, 2003 and 2004 survey efforts. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

Scientific Name Common Name	Distribution in Study Area
Aegilops triuncialis Goatgrass	Uncommon to occasional in annual grasslands and along roadsides. Western and southwestern sections of the study area
Carduus pycnocephalus Italian thistle	Uncommon to occasional in annual grasslands. Western section of the study area
Centaurea solstitialis Yellow starthistle	Common to dominant in physically disturbed areas, especially roadsides and developed areas. Western and southwestern sections of the study area.
Chondrilla juncea Rush skeleton weed	Occasional along roadsides or in developed areas. Western and southwestern sections of the study area
Cytisus scoparius Scotch broom	Occasional along roadsides and in transmission line corridor. Southwestern and upper western sections of the study area
Genista monspessulana French broom	Occasional along roadsides and in transmission line corridor. Southwestern and upper western sections of the study area
Lythrum salicaria Purple loosestrife	One occurrence in wetland/creek. Far western section of the study area
Bromus tectorum cheatgrass	Occasional in annual grasslands and along roadsides; common in burned areas under transmission line. All sections of the study area
Bromus diandrus Ripgut grass	Occasional to dominant in annual grasslands, less often on roadsides; common in burned areas under transmission line. West, southwest, southeast sections of the study area
Taeniatherum caput-medusae Medusahead	Occasional to common in annual grasslands; dominant where physically disturbed. Western section of the study area

Five weeds are found in close association to UARP facilities. Yellow starthistle occurs near White Rock access roads and powerhouse, Slab Creek access roads and dam areas, Camino reservoir access road and Jaybird powerhouse, and Union Valley campgrounds. Scotch broom occurs near White Rock powerhouse access roads, adit, and penstock. Goatgrass is found near Slab Creek reservoir access roads, and Camino reservoir access road. Italian thistle occurs near White Rock powerhouse and access roads, Slab Creek access roads and reservoir, Brush Creek reservoir access road, and Camino reservoir access road. Rush skeleton weed is found near Camino reservoir access road.

Four noxious weed species were documented on the site of the proposed Iowa Hill development: ripgut grass, cheatgrass, Italian thistle, and rush skeleton weed. These weeds are uncommon and concentrated in areas of disturbance such as along roads and in clear-cuts.

PG&E identified eight species of noxious weeds within the Chili Bar Project area: barbed goatgrass, Italian thistle, yellow starthistle, rush skeletonweed, Scotch broom, klamathweed, Himalayan blackberry, and medusahead. Scotch broom dominated significant portions within the project area including the reservoir shorelines and roadsides. Smaller populations of other noxious weeds, including barbed goatgrass, italian thistle, yellow starthisle, rush skeletonweed, klamathweed, and medusahead were observed and mapped throughout the project area. In addition, Himalayan blackberry, a non-target, invasive weed, was observed throughout the project area, dominating portions of the riparian understory and other adjacent areas.

Riparian Vegetation

The applicants conducted an overlapping study for both Projects to identify riparian vegetation within both project boundaries. About 360 acres of riparian vegetation are found in the UARP boundary, mostly in the form of a narrow fringe on the edge of the stream channel. Riparian vegetation is sparse or absent in sub-reaches characterized by bedrock or boulder banks, but generally occurs elsewhere, wherever there are suitable substrates. Nine riparian vegetation alliances are found; however, three are predominant: Mountain Alder, White Alder, and Mixed Riparian Hardwoods. Riparian vegetation alliances follow predictable patterns based on elevation (table 3-55), with composition similar to that reported elsewhere for North and Central Sierra Nevada riparian systems.

At most sites where riparian vegetation is found, there is evidence of periodic regeneration of woody vegetation, based on moderate to high numbers of seedlings and saplings, and the presence of relatively young mature shrubs. However, more stable conditions and only infrequent replacement may occur at the Robbs Peak dam reach site (less than 0.5 mile downstream of dam) and the uppermost Ice House dam reach site (about 1.5 miles downstream of the dam), where there are dense, mature shrubs, and few seedlings or saplings.

Channel encroachment by woody species is generally not evident. However, at the Robbs Peak dam reach site, dense woody vegetation has colonized alluvial bars on both sides of the stream, suggesting an absence of recent high flows capable of scouring vegetation. In the Loon Lake dam reach just below the dam, there is also limited encroachment by small mountain alder and lodgepole pine. The number of herbaceous species is highest in the upper reaches where the dominant species are strongly indicative of moist soil conditions.

The dominant vegetation alliances around Chili Bar reservoir are upland forests supporting ponderosa pine, Douglas fir, and canyon live oak. In general the occurrence of riparian vegetation along the reservoir is constrained by steep slopes and well-drained substrates. Some small areas of riparian-influenced (but often upland) vegetation do occur, most often as patches or thin bands of relatively modest gradient. The riparian habitats are dominated by tree and shrub-sized shining willow, California sycamore, Freemont cottonwood, and white alder, with lesser coverage of black walnut, tree-of-heaven, and occasional upland species such as black oak.

Table 3-55. The extent, type, and limitations of riparian vegetation along UARP reaches. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

Project Reach	Length of Reach	Percent of Reach with Riparian Vegetation	Width of Riparian Vegetation Zone	Dominant Riparian Vegetation Alliance	Limiting Factors
Rubicon Dam	4.2	15.4	5–50 feet	Mountain alder	Bedrock and boulder banks extensive; some steep sections
Rockbound Dam	0.3	None detectable	Not applicable	Not applicable	Entirely bedrock banks and steep
Buck Island Dam	2.5	1.5	5–20 feet	Mountain alder	Bedrock banks extensive, mostly steep
Loon Lake Dam	8.5	94.7	5–200 feet	Mountain alder	About a third of reach is steep with bedrock, but much is lower gradient with alluvium or glacial till
Gerle Creek Dam	1.2	97.0	5–30 feet	Mountain alder	Small areas of bedrock and boulder banks
Robbs Peak Dam	5.9	43.2	5–65 feet	Mountain alder	Extensive areas of bedrock
Ice House Dam	11.5	81.5	5–80 feet	Mountain alder	Width of riparian zone limited by valley form
Junction Dam Reach	8.3	29.7	5–35 feet	White alder	Extensive areas of bedrock
SFAR	2.8	27.3	5–70 feet	White alder	Extensive bedrock confinement
Camino Dam	6.2	42.1	10–85 feet	White alder	Extensive bedrock banks and steep slopes
Brush Creek Dam	2.2	Not discernible	Unknown	Unknown	Very steep
Slab Creek Dam	8.0	83.2	10–85 feet	White alder	Relatively steep canyon limits width; areas of bedrock and boulder banks have scant vegetation

The reach of SFAR below Chili Bar dam extends 19.1 miles from the base of Chili Bar dam to the normal high water line of Folsom Lake, ranging in elevation from 960 feet to approximately 470 feet. The reach downstream of Chili Bar contains three geomorphic sub-reaches: the Georgia Sub-reach, the Coloma Sub-reach, and the Canyon Sub-reach. Of these only the Coloma Sub-reach is confined and line with poorly vegetated boulder/cobble complexes, areas that are geomorphically unable to sustain well-developed stands of riparian vegetation.

The near-channel species composition of areas that are vegetated is similar in each sub-reach. Overstory dominants are typically white alder, arroyo willow, or shining willow, most often 10 to 20 feet in height and fewer than 20 years old, based on increment bores. In the Coloma Sub-reach, but rarely elsewhere, Freemont cottonwood is well represented, either as large trees on high banks, or as occasional young saplings (few cottonwood of intermediate size occur anywhere on the reach downstream of Chili Bar). Overall, 62 percent of the shoreline of the reach downstream of Chili Bar supports riparian vegetation. A total of about 192 acres of riparian vegetation were mapped, 167.4 acres (87.3 percent of the total) of which were Mixed Riparian Hardwood. Other vegetation alliances mapped were Willow (11.7 acres), Fremont Cottonwood (6.5 acres), White Adler (5.8 acres), and Wet Meadow (0.4 acre).

Wetlands

The applicants conducted an overlapping study for both Projects to identify wetlands within both project boundaries. Wetlands can be found near the three UARP storage reservoirs (Union Valley, Ice House, and Loon Lake), and at Gerle Creek, Buck Island, and Rubicon reservoirs (table 3-56). Most reservoir-associated wetlands are in good condition, dominated by native plant species with few or no weeds. Wetlands are located on shorelines and small lakeshore-basin meadows with only slight topographic relief at Rubicon, Buck Island, and Gerle Creek reservoirs. Vegetation comprises inflated sedge and a few other species.

Table 3-56. The extent, type, and limitations of wetlands associated with UARP. (SMUD, 2005, PG&E, 2005, as modified by staff)

Reservoir	Area (acres)	Types	Limiting Factors
Rubicon	15.0	Lakeshore meadows	Wetlands mostly restricted to a few shallow coves and gradually sloping shorelines.
Buck Island	8.2	Lakeshore meadows	Wetlands mostly restricted to small areas of gradually sloping shorelines. Through most of the growing season water level varies by no more than 6 feet.
Loon Lake	37.9	Lakeshore meadows, and depressions within swales	Wetlands occur in shallow bays and associated with swales, but are absent in areas of bedrock and areas submerged for

Reservoir	Area (acres)	Types	Limiting Factors
			prolonged periods by deep water.
Gerle Creek	0.9	Lakeshore meadows	Wetlands occur in the relatively narrow fluctuation zone on a few gradually sloping shorelines.
Ice House	4.9	Lakeshore meadows	Wetlands scarce because of steep slopes and extensive areas of bedrock. Little or no supplemental hydrology.
Union Valley	140.0	Lakeshore meadows, and sloping meadows	Wetlands absent on steep slopes without supplemental hydrology (drainages) and in areas submerged for prolonged periods by deep water. Sloping wetlands all begin well above reservoir high water.

Other wetlands within or adjacent to the project areas are located along the UARP transmission lines, near the Gerle Canal, and adjacent to the Robbs Peak penstock. These include a very large (more than 10 acres) wetland complex at Robbs Valley, behind a commercial campground, which includes emergent, shrubs, and forested components. The remaining wetlands are less than 025 acre in size. Some of these wetlands are proximate to, or intersected by, project service access roads, and two appear to be created and maintained by impedance of drainage by these roads.

No palustrine wetlands were found within the area of the proposed Iowa Hill development. Small intermittent drainages on the site are generally intermittently flooded and do not fall within the definition of riverine wetlands. At least one small drainage located along the proposed transmission line route is a seasonally flooded riverine wetland.

Although NWI wetland maps do not indicate any wetlands along the steep-sided Chili Bar reservoir, field investigations conducted in 2004 by PG&E documented occasional small herbaceous wetlands within the water fluctuation zone of Chili Bar reservoir. In general they are too small to map and exist as thin (less than 7 feet wide), steep fringe of hydrophytes that is frequently submerged. According to NWI maps, a series of palustrine scrub-shrub and palustrine forested wetlands occur along that reach downstream of Chili Bar, mostly within the Coloma Sub-reach. No palustrine emergent wetlands occur.

Wildlife

The UARP area is comprised of a mosaic of forests, shrublands, grasslands, wetlands, agriculture, and other vegetation cover types ranging in elevation from roughly 6,500 feet at Rubicon reservoir to less than 450 feet above sea level at Folsom Junction, the terminus of the UARP transmission line. These lands support a diverse terrestrial fauna with an estimated 337 terrestrial wildlife species known or believed to occur in the vicinity of the project.

The proposed Iowa Hill development is located on the southeast slope of the Slab Creek reservoir, north of Iowa canyon. In 2003, SMUD conducted a focused study to map vegetation and characterize wildlife habitat at the site. SMUD identified and mapped nearly 520 acres of existing vegetation with Sierran Mixed Conifer being predominant with smaller amounts of Ponderosa Pine, Mixed Chaparral, and Montane Hardwood. Based on the type, size, and age-class of existing vegetation, SMUD used California Wildlife Habitat Relationship database software to predict the potential occurrence of 256 species of terrestrial vertebrates within or adjacent to the study area based on a low threshold of habitat suitability. Of the total, 209 species were primarily associated with Sierran Mixed Conifer or Ponderosa Pine forest, 26 were associated only with Mixed Chaparral, and 46 were associated with adjacent aquatic habitat found on Slab Creek reservoir, but not terrestrial habitats.

Reptiles and Amphibians

Twenty-three species of reptiles are known or believed to occur in the UARP area and 11 species were observed by biologists conducting relicensing studies during 2002-2005 including: western fence lizard, northern alligator lizard, gopher snake, western aquatic garter snake, and western rattlesnake. Eighteen amphibians and aquatic reptiles have the potential to occur in the vicinity of the UARP. Of these, four species—foothill yellow-legged frog, mountain yellow-legged frog, California red-legged frog, and western pond turtle—are special-status species.

Birds

An estimated 230 species of birds are known or believed to occur in the vicinity of the UARP. Biologists engaged in relicensing studies during 2002-2005 observed 150 of these species. Project reservoirs, streams, and shorelines provide potential foraging, resting, and breeding habitat for at least 50 species of waterbirds (i.e., loons, grebes, pelicans, cormorants, egrets, herons, geese, ducks, swans, rails, coots, shorebirds, and gulls). Of these, 36 species were observed during relicensing studies including: common loon, pied-billed grebe, eared grebe, American white pelican, great blue heron, Canada goose, wood duck, mallard, blue-winged teal, bufflehead, common merganser, ruddy duck, common moorhen, American coot, spotted sandpiper, and ring-billed gull.

The diverse vegetation types within the UARP area provide habitat for at least 29 species of raptors (i.e., vultures, hawks, eagles, falcons, owls). Of these, 18 species were observed in the project area during 2002-2005 relicensing studies including: turkey vulture, osprey, white-tailed kite, bald eagle, northern goshawk, red-tailed hawk, American kestrel, barn owl, flammulated owl, great horned owl, and California spotted owl. In addition to waterbirds and raptors, the UARP area provides habitat for a diversity of upland game birds, pigeons and doves, swifts and hummingbirds, woodpeckers, passerines, and other avifauna.

The Chili Bar reservoir is in a steep canyon with no emergent wetland, herbaceous vegetation, or low shrub-land along the shoreline to serve as nesting habitat for waterfowl. There is no shallow-water wetland or upland grazing that would provide suitable foraging. A total of 5 species was observed during the boat surveys that were part of the bald eagle study: Canada goose, mallard, American wigeon, wood duck, and common merganser. None of these species were observed in large numbers.

Cavity Nesting Birds

Population status and trend were monitored by the breeding bird survey (BBS)[36] from 1966–2004 within the Sierra Nevada bioregion for four cavity nesting bird species: pileated woodpecker, red-breasted sapsucker, Williamson's sapsucker, and hairy woodpecker.

Pileated Woodpecker—The Sierra Nevada-wide BBS data classify pileated woodpecker as "possibly decreasing" (Siegel and DeSante, 1999), with a decrease of –1.8 percent (range –4.6 to 1 percent) per year in 21 routes. The Regional Credibility ranking is "Yellow," i.e., data with small sample size, low precision, due to low abundance on routes.

Red-breasted Sapsucker—The Sierra Nevada-wide BBS data classify red-breasted sapsucker as "possibly decreasing" (Siegel and DeSante 1999), with a decrease of –3.18 percent (range –7.8 to 1.6 percent) per year in 24 routes. The Regional Credibility ranking is "Blue," i.e., data with larger sample size, and at least moderate precision and moderate abundance on routes).

Williamson's Sapsucker—The Sierra Nevada-wide BBS data indicate an increase of 1.6 percent (range –12.8 to 15.9 percent) per year in 6 routes for Williamson's sapsucker. The Regional Credibility ranking is "Red," i.e., poor, due to small sample size. However, this trend is consistent with trends observed at the state and survey-wide scales.

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[36]The Breeding Bird Survey (BBS) is an annual, volunteer-based point count survey coordinated by the Biological Resources Division of the USGS and the Canadian Wildlife Service. The survey consists of a continent-wide array of roadside point count transects, or routes. Each route is 24.5 miles long, and comprises 50 point counts at 0.5-mile intervals. Expert volunteer observers conduct point counts once each year during the peak of the breeding season, recording numbers of every species detected within a quarter mile radius. BBS data provide the most extensive, long-term data set available on landbird population trends and are therefore tremendously valuable for conservation planning (Institute for Bird Populations, 2007).

Hairy Woodpecker—Sierra Nevada-wide BBS data classify hairy woodpecker as "definitely stable" (Siegel and DeSante, 1999), with a slight decrease of -0.1 percent (range –2.5 to 2.3 percent) per year in 624 routes. The Regional Credibility ranking is "Blue.

Mammals

An estimated 83 species of native and introduced terrestrial mammals are known or believed to occur in the UARP vicinity. Biologists engaged in relicensing studies during 2002-2005 observed 32 species. American marten, black bear, mountain lion, and mule deer all occur within the project area. In addition to bats, mesocarnivores, and large mammals, the UARP area provides habitat for a diversity of insectivores, rabbits and hares, chipmunks, tree squirrels, gophers, mice, weasels, skunks, and other mammalian species.

The Sierra Nevada provides roosting and foraging habitat for an estimated 17 species of bats. Bats can be found in all vegetation types and elevation zones present in the project area, foraging extensively on insects taken in flight over aquatic and upland locations or gleaned from foliage. Suitable roosts vary by species and include a variety of natural (e.g., caves, trees, cliffs) and man-made (e.g., buildings, bridges, powerhouses, mines) structures. Five species of bats were captured around existing project features: fringed myotis, Yuma myotis, California myotis, big brown bat, and Brazilian free-tailed bat.

Bat trapping and acoustic sampling was performed at the proposed Iowa Hill development in 2004. This effort resulted in the capture of two bat species, California myotis and big brown bat, and the acoustic detection of bats belonging to the 40 kHz Myotis group, which includes: long-legged myotis, little brown bat, and small-footed myotis. Of these, only the long-legged myotis is a special-status species. Recorded sonograms also suggest the presence of either silver-haired bat or big brown bat, whose echolocation characteristics overlap making exact species determination difficult.

During June and July of 2004, PG&E conducted bat surveys throughout the Chili Bar project area. These surveys confirmed the presence of four bat species, Yuma myotis, big brown bat, silver-haired bat, and western pipestrelle and indicated the likely presence of two additional species, Mexican free-tailed bat and pallid bat within the project area (see table 3-56). Of these, the Yuma myotis (*Myotis yumanensis*) is a special status bat species (a federal species of concern and a BLM sensitive species).

Special Status Wildlife

Ninety of the wildlife species that may occur in the UARP and Chili Bar Project areas are special-status species (table 3-57). Two of these species, valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) and California red-legged frog (*Rana aurora draytonii*), are federally listed species and are therefore discussed in section 3.3.5, *Threatened and Endangered Species*. The western pond turtle (*Clemmys* *marmorata)* and Yuma myotis (*Myotis yumaensis)* are the only special status species located during relicensing studies conducted by PG&E within the Chili Bar project boundary.

Table 3-57. Special-status wildlife species known or with the potential to occur within the UARP and Chili Bar Project areas. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

Common Name (*Scientific Name*)	**Status Designations**[a]
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	FT
California horned lizard (*Phrynosoma coronatum frontale*)	FSC, CSC, CP
Sage brush lizard (*Sceloperus graciolus)*	BLMS
Mountain yellow-legged frog (*Rana muscosa*)	FC, CSC, CP, FSS
California red-legged frog (*Rana aurora draytonii*)	FT, CSC, CP
Foothill yellow-legged frog (*Rana boylii*)[b]	FSC, CSC, CP, FSS
Western pond turtle (*Clemmys marmorata)*[b]	FSC, FSS, CSC, CP
Common loon (*Gavia immer*)[b]	FSC, CSC, MNBMC
American white pelican (*Pelecanus erythrorhynchos*)[b]	CSC
Double-crested cormorant (*Plalacrocorax auritus*) [b]	CSC
Great egret (*Ardea alba*)[b]	CDFS
Snowy egret (*Egretta thula*)	FSC, USBC
Great blue heron (*Ardea herodias*)[b]	CDFS
Black-crowned night heron (*Nyctiorax nycticorax)*	BLMS
Harlequin duck (*Histrionicus histrionicus*)	FSC, CSC, BLMS
Barrow's goldeneye (*Bucephala islandica*)	CSC
Osprey (*Pandion haliaetus*)[b]	CSC, CDFS
White-tailed kite (*Elanus leucurus*)[b]	FSC, FP, MNBMC
Bald eagle (*Haliaeetus leucocephalus*)[b]	CE, MIS, FP, CDFS
Northern harrier (*Circus cyaneus*[b]	CSC
Sharp-shinned hawk (*Accipiter striatus*)[b]	CSC

Common Name (*Scientific Name*)	Status Designations[a]
Cooper's hawk (*Accipiter cooperi*)[b]	CSC
Northern goshawk (*Accipiter gentilis*)[b]	FSC, CSC, FSS, MIS, CDFS, MNBMC
Swainson's hawk (*Buteo swainsoni*)	FSC, CT, FSS, USBC, Audubon-Y
Ferruginous hawk (*Buteo regalis*)	FSC, CSC, MNBMC, BLMS, Audubon-Y
Golden eagle (*Aquila chrysaetos*)[b]	CSC, FP, BLMS, CDFS
Merlin (*Falco columbarius*)	CSC
American peregrine falcon (*Falco peregrinus anatum*)	FSC, CE, FP, MNBMC, MIS, FSS, CDFS
Prairie falcon (*Falco mexicanus*)[b]	CSC
Mountain quail (*Oreortyx pictus*)[b]	MIS, Audubon-Y
Blue grouse (*Dendragapus obscurus*)[b]	Audubon-Y
Greater sandhill crane (*Grus canadensis tabida*)[b]	CT, FP, FSS
Mountain plover (*Charadrius montanus*)	FSC, CSC, MNBMC, USBC, Audubon-R
Long-billed curlew (*Numenius americanus*)	FSC, CSC, MNBMC, USBC, Audubon-R
California gull (*Larus californicus*)[b]	CSC
Black tern (*Chlidonias niger*)	FSC, CSC, MNBMC
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	FC, CE, FSS, MNBMC
Band-tailed pigeon (*Columba fasciata*)[b]	Audubon-Y
Burrowing owl (*Athene cunicularia*)	FSC, CSC, BLMS, MNBMC
California spotted owl (*Strix occidentalis occidentalis*) [b]	FSC, CSC, FSS, MIS, MNBMC, BLMS, USBC, Audubon-R
Great gray owl (*Strix nebulosa*)	CE, FSS, CDFS
Flammulated owl (*Otus flammeolus*)[b]	FSC, Audubon-Y
Long-eared owl (*Asio otus*)	CSC
Short-eared owl (*Asio flammeus*)	CSC, MNBMC, USBC, Audubon-Y
Black swift (*Cypseloides niger*)	FSC, CSC, MNBMC, USBC, Audubon-Y
Vaux's swift (*Chaetura vauxi*)	FSC, CSC, MNBMC
White-throated swift (*Aeronautes saxatalis*)[b]	Audubon-Y
Rufous hummingbird (*Selasphorus rufus*)	FSC, MNBMC, Audubon-Y

Common Name (*Scientific Name*)	Status Designations[a]
Allen's hummingbird (*Selasphorus sasin*)	FSC, MNBMC, USBC, Audubon-Y
Calliope hummingbird (*Stellula calliope*)[b]	Audubon-Y
Lewis' woodpecker (*Melanerpes lewis*)[b]	FSC, USBC, MNBMC, Audubon-Y
Nuttal's woodpecker (*Picoides nuttallii*)[b]	FSLC, Audubon-R
White-headed woodpecker (*Picoides alborlarvatus*)[b]	FSC, Audubon-Y
Red-breasted sapsucker (*Sphyrapicus rubber*)[b]	FSC, MNBMC
Williamson's sapsucker (*Sphyrapicus thyroides)*	BCC
Pileated woodpecker (*Dryocopus pileatus* [b]	MIS
Olive-sided flycatcher (*Contopus cooperi*)[b]	FSC, MNBMC, USBC, Audubon-Y
Little willow flycatcher (*Empidonax traillii brewsteri*)	FSC, CE, FSS, MIS, USBC, Audubon-Y
Pacific-slope flycatcher (*Empidonax difficilis*)[b]	FSC, MNBMC
Yellow-billed magpie (*Pica nuttalli*)[b]	Audubon-Y
American dipper (*Cinclus mexicanus*)[b]	FSLC
Loggerhead shrike (*Lanius ludovicianus*)	FSC, CSC, MNBMC
Oak titmouse (*Baeolophus inornatus*)[b]	FSC, Audubon-Y
Wrentit (*Chamaea fasciata*)	Audubon-Y
California thrasher (*Toxostoma redivivum*)	FSC, Audubon-Y
California horned lark (*Eremophila alpestris actia*)[b]	CSC
Common yellowthroat (*Geothlypis trichas*)	CSC
Spotted towhee (*Pipilio maculates*)	CSC
Purple martin (*Progne subis*)	CSC
Bank swallow (*Riparia riparia*)	FSC, CT
Yellow warbler (*Dendroica petechia brewsteri*)	CSC
Hermit warbler (*Dendroica occidentalis*)[b]	FSC, Audubon-Y
Yellow-breasted chat (*Icteria virens*)	CSC, MNBMC
Tricolored blackbird (*Agelaius tricolor*)	FSC, CSC, MNBMC, USBC, BLMS, Audubon-Y
Lawrence's goldfinch (*Carduelis lawrencei*)	FSC, USBC, MNBMC, Audubon-R

Common Name (*Scientific Name*)	Status Designations[a]
Fringed Myotis (*Myotis thysanodes*)[b]	FSC, BLMS, WBWG
Yuma myotis (*Myotis yumaensis*)[b]	FSC, BLMS
Long-eared myotis (*Myotis evotis*)	FSC, BLMS
Long-legged myotis (*Myotis volans*)	FSC, BLMS, WBWG
Western small-footed myotis (*Myotis ciliolabrum*)	FSC, BLMS
Western red bat (*Lasiurus blossevillii*)	FSS, WBWG
Spotted bat (*Euderma maculatum*)	FSC, CSC, BLMS, WBWG,
Townsend's big-eared bat (*Corynorhinus townsendii*)	FSC, CSC, FSS, BLMS, WBWG
Pallid bat (*Antrozous pallidus*)	CSC, FSS, BLMS, WBWG
Western mastiff bat (*Eumops perotis*)	FSC, CSC, BLMS, WBWG
Sierra Nevada snowshoe hare (*Lepus americanus tahoensis*)[b]	FSC, CSC
Sierra Nevada mountain beaver (*Aplodontia rufa californica*)	FSC, CSC
Sierra Nevada red fox (*Vulpes vulpes necator*)	CT, FSC, FSS
Ringtail (*Bassariscus astutus*)	FP
Black bear (*Ursus americanus*)[b]	MIS
California wolverine (*Gulo gulo luteus*)	CT, FSC, FSS, FP
American marten (*Martes americana*)[b]	FSC, FSS
Fisher (*Martes pennanti*)	FSC, CSC, FSS, BLMS
Mountain lion (*Felis concolor*)[b]	CSPM
Mule deer (*Odocoileus hemionus*)[b]	MIS
Northern river otter (*Picoides nuttali*)	FSC, FSLC
Northern flying squirrel (*Glaucomys sabrinus*)	CSC

[a] Status: Audubon = Audubon Watch List species (R = Red List: Declining rapidly, have very small populations and face major conservation threats; Y = Yellow List: Declining but a slower rate than Red List species)

BLMS = Bureau of Land Management Sensitive Species

CDFS = California Division of Forestry Sensitive Species

CE = Listed as Endangered under the California Endangered Species Act

CP = Protected under CDFG sport fishing regulations

CSC = California Department of Fish and Game Species of Concern

CSPM = Specially protected mammal under the California Fish and Game Code

CT = Listed as Threatened under the California Endangered Species Act

FC = Federal Candidate Species

FE = Listed as Endangered under the Federal ESA

FP = Fully protected species under the California Fish and Game Code

FSC = Federal Species of Concern

FSLC = Federal Species of Local Concern

FSS = United States Forest Service Sensitive Species

FT = Listed as Threatened under Federal ESA

MIS = U.S. Forest Service Management Indicator Species

MNBMC = FWS designated migratory nongame bird of management concern

USBC = United States Bird Conservation Watch List

WBWG = Western Bat Working Group designation for high priority bat species

[b] Species was observed during relicensing studies.

Bald Eagle—Bald eagles require habitat near large lakes, reservoirs, major rivers, or coastal areas that have adequate food, perching sites and nesting or wintering habitat. Resident populations of suitably sized fish (>200 mm total length) are often required. In California, nest-sites are typically at or near the tops of ponderosa pines or sugar pines within 1 mile of key foraging habitat. Bald eagles tend to prefer secluded habitat away from human activities. During winter, relatively protected stands near diurnal activity areas are important communal roosting habitat. Within the project areas, bald eagle nesting has been observed at two reservoirs, Loon Lake and Union Valley. Wintering bald eagles could sporadically be found at any of the Projects' reservoirs or reaches; however, no winter roost concentration areas have been identified. PG&E conducted bald eagle wintering and nesting surveys in 2003 and 2004, respectively; however, no wintering or breeding bald eagles were observed during surveys in the Chili Bar Project area.

Loon Lake Reservoir

During 2003–2004 surveys conducted by SMUD, adult, sub-adult, and juvenile bald eagles were seen frequently during both boat and ground-based surveys at Loon Lake reservoir. Eagles were sighted during seven of eight survey days in 2003 and during 20 of 23 survey days in 2004. Adults were the most commonly observed age class of bald eagles observed at Loon Lake reservoir (71.4 percent of all age classes), although no more than two adults were observed on the reservoir during a single survey. Sub-adults comprised a large segment of the population (25 percent), relative to the number of subadults observed at Union Valley reservoir (8.5 percent). Favored perches at Loon Lake reservoir ranged from dominant trees and snags to saplings and shoreline boulders. Bald eagle nesting had not been observed at Loon Lake reservoir prior to relicensing surveys. In 2004, two eaglets hatched from this nest; however, they both later died. Nesting was not observed in 2005.

Union Valley Reservoir

From November 2002 through July 2005, up to four bald eagles were observed at Union Valley reservoir at one time; on most visits, the territorial pair were the only eagles observed. All age classes of eagles were observed at Union Valley reservoir with an age distribution of 83 percent adults, 8.5 percent sub-adults, and 8.5 percent juveniles. Numbers of sub-adult and juvenile eagles were highest in winter and fall months, corresponding with the expected seasonal influx of wintering bald eagles into the Crystal Basin. Table 3-58 shows the breeding productivity of bald eagles at Union Valley reservoir.

Perch structures commonly used at Union Valley reservoir included dominant and sub-dominant sugar pines, lodgepole pines, incense cedar, white fir, Jeffrey pine, ponderosa pine and various snags that border the reservoir, and occasionally in saplings and shoreline boulders. Most perch sites were on the south and east perimeter of the reservoir with only two observations of perched birds occurring on the north side of the reservoir between Yellowjacket and Wolf Creek campgrounds. Most habitually used foraging perches were located less than 20 meters from the shoreline along the west and south shores of the reservoir, in the forest stands adjacent to Union Valley dam, and in the stands on the Sunset/Fashoda Peninsula and Granlees Point. Night roosts of the territorial pair were primarily located on or near Granlees Point and occasionally on the Sunset/Fashoda Peninsula.

Table 3-58. Productivity summary for bald eagles nesting at Union Valley reservoir, 1986–2005. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

Year	Status	Young Fledged	Location
1986	Successful	1	Wench Creek
1987	Successful	1	Wench Creek
1988	Occupied/Success Unknown	Unknown	Wench Creek
1989	Occupied/Unsuccessful	0	West Point
1990	Occupied/Unsuccessful	0	Wench Creek
1991	Occupied/Unsuccessful	0	Wench Creek
1992	Successful	2	Granlees Point nest #1
1993	Successful	2	Granlees Point nest #1
1994	Successful	2	Granlees Point nest #1
1995	Occupied/Unsuccessful	0	Granlees Point nest #1

Year	Status	Young Fledged	Location
1996	Occupied Unsuccessful	0	Granlees Point nest #1
1997	Successful	2	Granlees Point nest #1
1998	Occupied/Unsuccessful	0	Granlees Point nest #1
1999	Occupied/Unsuccessful	0	Granlees Point nest #1
2000	Successful	Unknown	Granlees Point nest #1
2001	Occupied/Unsuccessful	0	Granlees Point nest #1
2002	Occupied/Unsuccessful	0	Granlees Point nest #1
2003	Occupied/Unsuccessful	0	Granlees Point nest #2
2004	Successful	1	Granlees Point nest #1
Summary	Nesting attempts of known outcome (young fledged) at Union Valley reservoir = 18		
	Known young produced at Union Valley reservoir = 11		
	Young/known outcome at Union Valley reservoir = 0.61		

Osprey—SMUD determined during relicensing studies that ospreys are common in suitable habitat throughout the UARP area from early spring through late summer. The earliest calendar-year observation of an osprey during relicensing studies was a single bird flying over Big Hill on March 26, 2003. Seven active osprey nests with undetermined outcome were recorded in the study area in 2002 and four active nests were recorded in 2003. At Union Valley reservoir, these nests were located at the top of dominant snags, primarily along the south shore within the area burned by the Cleveland Fire in 1992, and in the SFSC arm of Junction reservoir. Several of these snags fell during the winter of 2002-2003, likely because of rotting combined with high winds and snow loading. Nesting was also confirmed at Ice House reservoir and suspected but not confirmed at Loon Lake reservoir.

Northern Goshawk—On the west slope of the Sierra Nevada, the northern goshawk breeds from about 2,500 feet in elevation in the ponderosa pine/mixed-conifer vegetation types up to approximately 10,000 feet in the red fir and lodgepole pine types. They are generally year-round residents in suitable habitat but some limited seasonal altitudinal movements may occur. Relicensing studies conducted by SMUD and monitoring conducted by the Eldorado National Forest indicate that northern goshawks nest in the vicinity of the project and spatial analysis determined that three Protected Activity Centers (PACs) (G11_04; G11_06; and G22_12) are within 0.25-mile of existing project facilities. PACs were assumed to be occupied and were excluded from the area surveyed during protocol surveys of the UARP. Broadcast calling surveys at 83 call points near existing project facilities failed to elicit a response from any goshawks. However, goshawks were observed incidentally at two locations near Jaybird Springs Road and these birds may have been associated with PAC G22_09. In 2004-–2005, broadcast calling surveys at 78 call points associated with the Iowa Hill development failed to elicit any responses from goshawks. The nearest designated PAC to the development is G23_03, located approximately 0.93-mile southeast of the eastern end of the proposed transmission line that will service the development.

California Spotted Owl—The California spotted owl ranges from south of the Pit River in Shasta County, throughout the entire Sierra Nevada, and the south and central Coast Range as far north as Monterey. Relicensing studies conducted by SMUD and monitoring conducted by the Eldorado National Forest indicate that California spotted owl nests in the vicinity of the UARP and spatial analysis determined that 14 PACs have been designated within 0.25-mile of existing UARP facilities. PACs were assumed to be occupied and were excluded from the area surveyed during protocol surveys of the UARP. Broadcast calling surveys in 2002 yielded responses from two adults and one juvenile in the vicinity of Long Canyon, southeast of Slab Creek reservoir. In 2003, responses were obtained from two adults and two juveniles near Union Valley dam. Also in 2003, four responses were obtained from adult owls presumed to be the pair recorded in 2002 in Long Canyon. All responding birds appear to be associated with known PACs. In 2004-2005, broadcast calling surveys at 27 call points within 1.5 miles of the Iowa Hill development elicited responses from two adults and one juvenile in the vicinity of Long Canyon near the eastern end of the proposed transmission line for the Iowa Hill development. This pair is presumed to be associated with PAC ED_034. Additional responses were obtained from adult owls (breeding status undetermined). One PAC is located within 0.25-mile of the Iowa Hill development footprint but no PACs have been designated within 0.25-mile of the proposed transmission line.

Bats—Yuma myotis were captured at the most locations and in the greatest number. A large night roost, used primarily by Brazilian free-tailed bats, was discovered at White Rock powerhouse. Smaller roosts were found under non-project bridges along Ice House Road at the crossings of Tells Creek, Big Silver Creek, and Jones Fork Silver Creek, which are located 0.26 to 0.48 mile upstream of the maximum surface elevation (high water line) of Union Valley reservoir. A fourth roost was found under the Ice House Road Bridge crossing of SFSC, approximately 0.82 mile downstream from Ice House reservoir.

Bat trapping and acoustic sampling was performed at the proposed Iowa Hill development in 2004. Acoustic detection identified bats belonging to the 40 kHz myotis group, which includes the long-legged myotis, as well as several other bat species without special status.

Black Bear—The black bear is widespread and relatively common throughout the Sierra Nevada, from foothill habitats to alpine zones. They generally occur in fairly dense, mature stands of many forest habitats, valley foothill riparian habitat, and wet meadow. The black bear is a legally hunted species in California with an estimated more than 2,200 animals taken in 1999. Suitable habitat for this species is distributed throughout most of the project area and bears are known to be common and increasing in number in the region.

Mule Deer—Mule deer in the vicinity of the project are considered to be part of the Pacific Deer Herd, with the exception of those deer in the westernmost portion of the project area. The herd occupies approximately 353 square miles of public and private lands within El Dorado County and that portion of Placer County south of the Rubicon River. The Pacific Deer Herd has four significant habitat designations: critical summer range, fawning habitat, holding areas, and winter range. Based on the existing information provided by CDFG and the Eldorado National Forest, the critical summer ranges, fawning habitat, and holding areas of the herd occur from the mid to upper elevations of the Crystal Basin within the Eldorado National Forest, usually above 4,000 feet in elevation. These critical areas are found east of Ice House reservoir, north and east of Union Valley reservoir and north of Loon Lake reservoir. The known winter range of the herd lies mainly on south-facing slopes between 2,000 and 4,500 feet elevation and between the SFAR and Peavine Ridge Road from the town of Kyburz and westward to Highway 49. The Pacific Deer Herd uses the major east-west trending ridges (Poho, Telephone, and Peavine) of the Eldorado National Forest as primary migration corridors between high- and low-elevation habitats. The winter range lies mainly on south-facing slopes between 2,000 and 4,500 feet elevation. Intermediate range generally extends from 4,000 to about 6,000 feet elevation, and is used primarily during spring and fall migration. Most of this intermediate range consists of east-west parallel ridges used as migration routes, especially Peavine, Poho, and Telephone ridges. The summer range lies mainly above 5,000 feet.

Mountain Yellow-legged Frog—Mountain yellow-legged frogs are generally found from elevations of 4,500 feet to over 12,000 feet. In the Sierra Nevada, mountain yellow-legged frogs have been documented to occur in ponds, lakes, and small streams. Reproduction begins soon after water bodies are free of ice. Breeding and oviposition generally occurs in ponds or lakes from April through July, depending upon the elevation. Streams may be important to mountain yellow-legged frogs as dispersal corridors. Mountain yellow-legged frog tadpoles are likely to be present from June through September and adults can be found from June through October. Since water temperatures at higher elevations in the Sierra Nevada remain relatively cold throughout the year, mountain yellow-legged frog tadpoles overwinter 2 to 3 times before metamorphosing. The tadpoles spend the winter beneath the ice and do not metamorphose until their third or fourth year.

The nearest known populations of mountain yellow-legged frogs are in the headwaters of Highland Creek, at Highland Lake (Highland Creek flows into Rockbound Lake), and in Lake Zitella (on a tributary to the Rubicon River), which are about 2 miles from the UARP upper elevation reaches. In addition, large populations of mountain yellow-legged frogs are found in many of the smaller lakes and ponds in Desolation Wilderness, as well as in Lake Aloha (which is located in the higher elevation of the Desolation Wilderness northeast of the UARP).

SMUD and PG&E conducted an overlapping amphibian study within the proposed project areas. The elevation of the Chili Bar project is too low to support mountain yellow-legged frogs; therefore, it was not surveyed. SMUD identified 14 stream and 17 pond or reservoir margin sites on the UARP sites as potential mountain yellow-legged frog habitat, which were subsequently surveyed in 2003. No mountain yellow-legged frogs were found. The highest project reservoir (Rubicon reservoir) is located at approximately 6,500-foot elevation, which is at the lower end of the mountain yellow-legged frog range, and may explain why no mountain yellow-legged frogs are found within project reaches and reservoirs. The nearest known populations of mountain yellow-legged frogs are at elevations greater than 7,500 feet. Project reaches and reservoirs do support some habitat suitable for the mountain yellow-legged frog. However, most of the UARP reservoirs are too large, with much of the nearshore habitat comprised of bedrock. Because of this, suitable habitat is patchy in distribution. Mountain yellow-legged frog populations are typically found in water bodies (lakes or streams) that provide deep pools for overwintering, preferably without tadpole predators, such as trout. Although all of the reservoirs in the study area have deep pools, trout are present in all three of the upper elevation reservoirs (Rubicon, Rockbound, and Buck Island). Project stream reaches with high quality habitat occur within this elevation range, for example, in the upper reaches of Gerle Creek downstream of Loon Lake dam. This particular reach does not currently support mountain yellow-legged frog populations, which may be due, in part, to the presence of predatory brown trout in Gerle Creek.

Foothill Yellow-legged Frog—Foothill yellow-legged frogs occur in the Coast Ranges from the Oregon border south to the Transverse Mountains in Los Angeles County and in most of central and northern California along the west slopes of the Sierra Cascade crest. The elevation range of the foothill yellow-legged frog extends from sea level to 5,000 ft (1,525 m) in the Sierra Nevada Mountains. Egg deposition is generally initiated on the descending limb of the spring hydrograph when temperatures reach 12-15°C. Metamorphosis generally occurs within 3 to 4 months. Once breeding has occurred, adults and juveniles move upstream into nearby tributaries or to cooler microhabitats.

Foothill yellow-legged frogs have been found along the Upper American River, both on the SFAR and Silver Creek. Sightings along the mainstem SFAR extend as far upstream as Riverton, and downstream below Slab Creek reservoir.

SMUD and PG&E conducted an overlapping study within the proposed project areas. Studies identified a total of 22 stream sites within the UARP boundary with potentially suitable habitat for foothill yellow-legged frogs. SMUD conducted surveys at these sites in 2003 and 2004. Foothill yellow-legged frogs were documented at 4 sites in 2 reaches of the UARP: in the Camino dam reach, approximately 2 miles downstream of Camino dam and at the confluence of Silver Creek with SFAR; and in the SFAR reach, near Akin powerhouse (part of the El Dorado Project) and near Camino powerhouse. Foothill yellow-legged frogs were not found in three reaches (Ice House, Junction, and Slab Creek dam reaches) despite the availability of potentially suitable habitat, although there was a single foothill yellow-legged frog sighting in the

Slab Creek dam reach by the Forest Service. Ice House dam reach is at the upper elevation limit of the foothill yellow-legged frog.

SMUD and PG&E surveyed the upper 2 miles and the lower 1 mile of Junction dam reach in mid-summer 2004. Water temperatures in the upper reaches were too cold (~8°C) for breeding. Although temperatures in the lower portion of Junction dam reach were suitable for breeding, large algal mats covering suitable egg attachment substrates may have prevented successful breeding. No adult frogs were observed in this reach. The Slab Creek dam reach is within the elevation range of the species, and water temperatures are suitable throughout the reach. Although the Forest Service has observed a single foothill yellow-legged frog in this reach, the presence of potential competitors and predators (e.g., bullfrogs, crayfish, bass) in this reach may limit foothill yellow-legged frog establishment.

Habitat associations of the foothill yellow-legged frog were similar at the four locations where foothill yellow-legged frogs were found. Based on site observations, bedrock seeps likely provide important refugia for adults, juveniles, and subadults. Evidence of foothill yellow-legged frog breeding was documented at all four sites. Successful breeding and subsequent life history stages were documented in Camino dam reach and the SFAR reach of UARP, which suggests habitat conditions currently exist in these reaches to support eggs, tadpoles, and adults of this species. An analysis of suitable habitat for egg deposition and tadpole rearing conducted by the applicants confirmed that suitable habitat for egg deposition and tadpole rearing occurs at both sites. The study found that egg deposition and tadpole rearing habitat were of moderate to high quality at flows of 20 and 50 cfs, but at 100 cfs the habitat had decreased to low quality habitat. Under current UARP operation, mean daily flows fall within typical reach values of approximately 40 cfs during breeding and rearing periods of May–July.

Eighteen sites were surveyed for the foothill yellow-legged frog within the Chili Bar project area, 15 of which were on a tributary of the SFAR or on the SFAR near a tributary. No foothill yellow-legged frogs were observed. Subsequent surveys conducted by PG&E in 2004 documented approximately 14 foothill yellow-legged frog tadpoles and one adult on Indian Creek, a tributary to SFAR near the town of Coloma, approximately 0.5 miles upstream from its confluence with SFAR.

Western Pond Turtle—Historically, the western pond turtle had a relatively continuous distribution throughout California. It is currently found throughout much of its historical range, principally west of the Sierra-Cascade crest, from western Washington south to northwest Baja California, though in population numbers that are a fraction of historical levels.

The western pond turtle inhabits a wide range of fresh or brackish water habitats including ponds, lakes, backwater and low flow regions of streams and rivers, ditches, pools remaining in intermittent streams. Sites for basking are an important element. Basking substrate includes rocks, logs, banks, emergent vegetation, root masses, and tree limbs. Although primarily an aquatic reptile, western pond turtles often spend time on land. Terrestrial activities include basking, overwintering, nesting, and moving between ephemeral sources of water.

Breeding activity peaks from June to July, but may occur year-round, when females begin to search for suitable nesting sites upslope from water. Egg-laying sites vary from sandy shoreline to forest soil types. Females excavate a nesting site at least four inches (10 cm) deep, and lay from three to eleven eggs. Incubation takes 73 to 80 days. Along major rivers western pond turtles are often concentrated in areas of optimal habitat, often in side channel and backwater areas. Turtles may move to off-channel habitats, such as oxbows, during periods of high flows.

Many of the stream sites surveyed by the applicants in the UARP for the California red-legged frog and the foothill yellow-legged frog contained suitable habitat for western pond turtle, including undercut banks, emergent vegetation, and basking sites, as well as suitable adjacent upslope areas for breeding. Western pond turtles were documented in the Slab Creek dam reach, approximately 0.5 miles upstream of White Rock powerhouse.

Within the Chili Bar Project area, western pond turtles were observed in 2003 along the west bank of Greenwood Creek, near the confluence with SFAR and in emergent vegetation in the side channel adjacent to a mid-channel island on the SFAR. Additionally, the western pond turtle was observed at two sties along the eastern edge of the Chili Bar reservoir in 2004.

3.3.4.2 Environmental Effects

Riparian Vegetation and Wetlands

Riparian vegetation and wetlands are subject to flow alterations and large water level fluctuations as a result of the proposed Projects' operations. Diverting flow and reducing the intensity of peak flows in project reaches could potentially alter riparian vegetation composition, cause encroachment, or cause a decrease in riparian cover. Reservoir water fluctuations could potentially reduce wetland abundance and species diversity.

Under the Proposed Articles 1-1 and 2-1, *Minimum Streamflows*, SMUD and PG&E would provide minimum streamflows to project reaches. Additionally, under Proposed Article 1-2, *Pulse Flows*, SMUD would provide pulse flows in three river reaches. In order to maximize recreational resources, SMUD would operate the project to maintain the reservoir levels as described in Proposed Article 1-23, *Reservoir Levels*. These flows and reservoir levels are described in sections 3.3.2, *Water Resources*, and 3.3.3, *Aquatic Resources*. Under the Proposed Action, minimum flows would be released partly to provide benefits to riparian vegetation during spring flows. SMUD would release pulse flows in the Rubicon River below Rubicon dam, Gerle Creek below Loon Lake dam, and in SFSC below Ice House dam partly to maintain a properly functioning riparian community.

Under Proposed Articles 1-5 and 2-4, *Monitoring Program,* SMUD and PG&E would conduct a riparian vegetation monitoring program. They would develop and implement a riparian vegetation monitoring plan in consultation with the Agencies with monitoring beginning 5 years after license issuance and continuing in years 10, 15, and every 10 years thereafter for the length of the licenses. This monitoring program is intended to provide an index of changes in riparian conditions over that period of modified streamflow, to determine if riparian conditions are in proper functioning condition, and to determine if riparian areas are being maintained or are in need of restoration.

Our Analysis

Maintaining the health of riparian vegetation is important for a number of reasons, including promoting streambank stability, reducing erosion, preventing the establishment and spread of noxious weeds, improving water quality, and providing foraging, hiding, nesting, and denning habitat for a number of wildlife species. Wetlands, which are often concurrent with riparian vegetation, especially within project reaches, provide many of the same functions. Under natural hydrologic conditions, high spring flows seasonally inundate stream margin habitats and floodplains. Additionally, peak storm flows would naturally occur at a frequency great enough to scour floodplain soils and redeposit sediment, which is needed to rejuvenate habitat for many riparian species. The proposed Projects alter the natural hydrograph by diverting flows, reducing the frequency and magnitude of naturally occurring pulse flow events, and causing large fluctuations in reservoir water levels. Additionally, the locations and species diversity of reservoir wetlands are partially determined by reservoir fluctuations.

The overlapping applicants' study, *Riparian Vegetation and Wetlands Technical Report* (DTA, 2004a) found that riparian vegetation in the project reaches meets the characteristics of "proper functioning condition". This is defined as having: a diverse age structure of vegetation; diverse composition of vegetation; species composition indicating maintenance of riparian soil moisture characteristics; streambank vegetation comprised of plants or plant communities that have root masses capable of withstanding high stream flow events; riparian plants with high vigor; adequate vegetative cover to protect banks and dissipate energy during high flows; and, plant communities in the riparian area providing an adequate source of coarse and/or large woody debris. Although the riparian vegetation in project reaches meets the requirements to be characterized as being in proper functioning condition, there is evidence that project operations have reduced the quality. Several project reaches show signs of encroachment and reduced bank stability, including Gerle Creek below Loon Lake dam, SFRR below Robbs Peak dam, SFSC below Ice House dam, SFAR below Slab Creek dam, and, within the Chili Bar Project, SFAR below Chili Bar dam (CDFG, 2007).

Within the Gerle Creek reach below Loon Lake dam, the upland species lodgepole pine has increased over historic conditions. Additionally, the banks through much of the reach are exposed and undercut and there is a high level of fine sediment bedload. Within Gerle Creek below Gerle dam, riparian vegetation on the upper banks is narrow and dependent upon seasonal seepage. Within the SFRR below Robbs Peak dam, during the riparian vegetation study, dense woody vegetation colonizing alluvial bars occurred on both sides of the stream and herbaceous vegetation was rooted underwater, suggesting an absence of recent high scouring flows. In SFSC below Ice House dam, signs of bank erosion were observed. In Silver Creek below both Junction and Camino dams and in Brush Creek below Brush Creek dam, riparian vegetation is limited by natural geology and topography. In SFAR below Slab Creek dam, riparian vegetation is narrow in the upper portion of the reach, even in areas of low-gradient banks.

Although spring flows are not being managed purely for the benefit of riparian vegetation in all reaches, the proposed minimum flows and pulse flows would be beneficial to the health of the riparian vegetation in all reaches by returning to a more natural hydrograph. The minimum flows would inundate the stream margins and upper streambanks, providing longer duration saturation than existing conditions. Species that favor upland conditions, such as the lodgepole pine, would likely die off in favor of hydrophytic species that are specially adapted to emerge with high spring flows. Additionally, in many cases, low banks would overflow, saturating floodplains and expanding the riparian species into a wider channel. In the reaches where SMUD proposes pulse flows (the Rubicon River below Rubicon dam, Gerle Creek below Loon Lake dam, and SFSC below Ice House dam) naturally occurring spring storm events would be mimicked, scouring floodplain soils, redistributing sediment, and reducing encroachment.

Because the effects of the proposed minimum flows and pulse flows on riparian vegetation are not definitively known, the proposed riparian monitoring program would monitor the changes in riparian condition, including species composition, percent cover, and length and width of riparian communities, to compare changes with the baseline established in the riparian vegetation study. Monitoring every 5 years for the first 15 years of a new license, followed by subsequent monitoring every 10 years, would allow enough time for riparian vegetation to respond to the proposed flow regimes without being confused by short-term changes based on one-time events. If the results of this monitoring identify on-going or new adverse effects on riparian functions, this information would be used in the proposed *Adaptive Management Program* (Proposed Article 1-6) to provide needed changes or restoration.

The largest areas of wetlands with the UARP boundary are located at Union Valley and Loon Lake reservoirs with smaller areas of wetland located Ice House, Gerle Creek, Rockbound, and Rubicon reservoirs. Wetlands at all project reservoirs are influenced by project operations; however, reservoir fluctuations are greatest at Loon Lake, Union Valley, and Ice House reservoirs. Wetlands at Loon Lake reservoir are located in and around shallow bays that are influenced by reservoir fluctuations. At Union Valley reservoir, wetland hydrology is influenced by reservoir water level from the point of annual high water to the point of annual low water. In 2003, the water level declined almost 34 feet during the growing season (DTA, 2004a). As reservoir elevations decline, wetland areas are exposed and become vegetated except at areas exposed during maximum drawdown, which tend to remain unvegetated. According to the overlapping applicants' riparian vegetation and wetland study (DTA, 2004a), species richness of wetlands seasonally inundated by the reservoirs was much lower than in wetlands that are never inundated.

Under Proposed Article 1-23, *Reservoir Levels*, SMUD would maintain reservoir levels during the summer months to maximize recreational use. Although reservoir fluctuations would continue under the Proposed Action, they would be reduced during portions of the growing season in Rubicon, Buck, Loon, Gerle Creek, Ice House, and Union reservoirs. It is expected that the increased time of inundation in these locations could result in increased species diversity in the wetlands within this zone. It is expected that daily reservoir fluctuations at the Slab Creek reservoir would increase due to operation of the proposed Iowa Hill development but would be within the current weekly range of fluctuation (see section 3.5.3, *Water Resources*). Slab Creek reservoir has steep slopes that greatly limit wetland and riparian vegetation from developing. As a result, it is expected that increased reservoir fluctuations would have minimal effect on wetlands.

Like the UARP reaches, the conditions of the reach below Chili Bar dam meet the criteria for proper functioning condition (DTA, 2004a). The Freemont cottonwood population in the Coloma sub-reach, however, contains large older trees only on high banks 8 to 10 feet above the river with infrequent saplings and seedlings. This is indicates germination or recruitment is impaired by flow fluctuations because seedlings are cued to germinate too high on the banks when flows are high and then face moisture stress (and mortality) when flows recede (DTA, 2004a). Under existing conditions, flows within the Chili Bar reach fluctuate daily by up to 1000 cfs, as flows at the Chili Bar project are dependant upon the upstream operation of SMUD's Slab Creek reservoir and White Rock powerhouse. PG&E proposes to increase the minimum streamflow, which would reduce daily fluctuations. Because large fluctuations would continue under the Proposed Action, the proposed riparian monitoring program would monitor any changes in riparian health and identify on-going or new adverse effects on riparian functions. This information would be used in the proposed adaptive management program (Proposed Article 1-6, *Adaptive Management Program*) to provide needed changes or restoration.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Project operations at all reaches and reservoirs, with the exception of Slab Creek reservoir would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on riparian vegetation and wetlands would be the same as those described under the Proposed Action.

Wildlife and Plant Protection Measures

Several special status plant and wildlife species occur within the UARP boundary, including several special status plants, northern goshawk, osprey, California spotted owl, special status bats, black bear, mountain quail, cavity nesting birds, and mule deer. Yuma myotis is also known to occur near the Chili Bar Project boundary. Project operations and maintenance could potentially affect these species, and other special status species that may be listed during the term of the license. SMUD and PG&E propose a number of measures designed to protect wildlife and plants in the project areas.

The applicants propose to provide wildlife and sensitive plant protection measures in Proposed Articles 1-12 and 2-9, *Wildlife and Plant Protection Measures*. Under Proposed Article 1-12, SMUD would:

1. maintain and operate in working condition all devices and measures for wildlife along project canals deemed necessary by the Forest Service, FWS, and CDFG. SMUD would provide the Agencies annual reports describing the date, location, and species found in project canals. If annual wildlife mortality during any 3-year period exceeds three individuals, SMUD would develop and implement a Wildlife Exclusion Plan that is approved by the Forest Service, FWS, and CDFG;
2. complete a biological evaluation before commencing any new construction or maintenance (including new recreational developments) authorized by any new license on Forest Service lands if it may affect a Forest Service, FWS, or CDFG sensitive plant or wildlife species or its habitat. The biological evaluation would be approved by the Forest Service and mitigation measures developed in consultation with the Commission, the Forest Service, FWS, and CDFG may be required for the protection of the species ;
3. immediately notify the Forest Service, FWS, and CDFG if any Forest Service, FWS, or CDFG sensitive plant or wildlife species is detected prior to or during ongoing project construction, operation, or maintenance. If the agencies determine that the project activities are adversely affecting the sensitive species, SMUD would develop and implement appropriate protection measures in consultation with the agencies;
4. review the current list of special status plant and wildlife species annually, in consultation with the Forest Service, FWS, and CDFG, that may occur on Forest Service lands in the project area directly affected by project operations. For each new species added to the list, SMUD would determine, in consultation with the agencies, if the species or its habitat is likely to occur on Forest Service lands in the project area, and if so, develop and implement a study plan in consultation with the same agencies to assess

the effects of the project on the species. SMUD would then prepare and file a report on the study including recommended resource measures and an implementation schedule. The report would be reviewed and approved by the Forest Service, FWS, and CDFG and then filed with the Commission;

5. not undertake maintenance under transmission lines within the Pine Hill Rare Plant Preserve until consultation with BLM, FWS, and CDFG has been completed;

6. develop an Avian Protection Plan within 1 year of license issuance, approved by FWS, that addresses retrofitting the problem project transmission lines, to meet the design and siting standards established by Avian Power Line Interaction Committee (APLIC) standards for avoidance or minimization of bird electrocutions and collisions (APLIC, 1996, 1994).

In addition, SMUD proposes, as part of Proposed Article 1-5, *Monitoring Program*, to develop and implement a bear management monitoring plan in consultation with the Agencies to monitoring the effectiveness of measures relating to managing bear populations to keep them away from recreational sites, as described in section 3.3.6, *Recreational Resources*.

PG&E proposes, in Proposed Article 2-9, *Wildlife and Plant Protection Measures*, measures similar to items 2, 3, or 4 above, except the BLM would be a consulting and approving agency for BLM lands instead of the Forest Service on Forest Service lands.

Our Analysis

Project canals and penstocks could potentially affect wildlife migration and cause drowning, particularly for mule deer. No deer mortalities have ever been recorded within the Gerle canal, however. The canal walls are gradually sloped with gunnite or natural rock walls with several shallow areas that can act as escape ramps. The vast majority of the project penstocks are greater than 24 inches above ground, which is the height identified in the *Mule Deer Technical Report* (DTA, 2004b) as adequate for mule deer passage. Although it appears that project facilities are not causing deer mortality or migration impediment, the proposed measure would monitor wildlife mortality and ensure that any fencing or crossing structures required by the Forest Service, FWS, or CDFG meet design requirements and are functional.

Proposed and future maintenance activities have the potential to adversely affect special-status plant species, particularly within the Pine Hill Preserve. The Pine Hill Preserve contains a high concentration of rare plant species because of the serpentine and/or gabbro soil formations. Three of these species, Pine Hill ceanothus, Pine Hill flannelbush, and Layne's ragwort are federally listed species that are discussed in section 3.3.5, *Threatened and Endangered Species*. Project transmission lines, which require occasional maintenance clearing, cross through sections of the Pine Hill Preserve. Because transmission line right-of-way maintenance includes occasional disturbance to vegetation and soils, the proposed measure to consult with the BLM, FWS, and CDFG prior to conducting maintenance activities within the Pine Hill Preserve would ensure that the locations and methods of maintenance are designed to minimize effects to rare plant species.

Additionally, the proposed measures to consult with the Forest Service, FWS, and CDFG prior to any new construction or maintenance, notify the agencies if any sensitive plant species are identified, and to review the current list of sensitive species annually, while subsequently assessing the potential for project effects on the species, would protect any special status species that occur either within the Pine Hill Preserve or elsewhere within the project boundary. Special status wildlife species, such as special status bats, California spotted owls, and northern goshawk, which could be affected by project maintenance activities on powerhouses, road maintenance, or vegetation management would also be protected by these proposed measures.

The Bird-Powerline Associations Technical Report (DTA, 2004c) identified several transmission lines that do not meet the design and siting standards for avoidance or minimization of bird electrocutions and collisions (APLIC, 1996, 1994): (1) the Jones Fork-Union Valley 69 kV line with several structures having less than 36 inches of clearance between energized jumper wires and grounded cross-arms; (2) the Brush Creek 12-kV tap line has inadequate phase-to-phase and phase-to-ground spacing; and, (3) high elevation segments of the transmission line from Loon Lake powerhouse to just west of Camino powerhouse, including the Jones Fork-Union Valley transmission line segment, and an isolated segment near White Rock powerhouse have overhead groundwires. The risk of bird electrocution increases when transmission lines do not have adequate spacing between conductors or between the lines and the ground,. This is especially true for highly susceptible raptors such as special status osprey, northern goshawk, and the federally listed bald eagle (discussed in section 3.3.5, *Threatened and Endangered Species*). Additionally, these species are at risk for collision with transmission lines with overhead groundwires because their small diameter makes them less visible to birds. The proposed measure to prepare an avian protection plan would address retrofitting transmission lines to have them meet the APLIC standards. Once all transmission lines meet these standards, the potential for avian electrocution or collision would be minimized.

Although the Black Bear Technical Report (DTA, 2004d) determined that the project is not affecting black bear denning or harvest, it did identify a concern relating to human-bear interactions at recreational sites. As a result, SMUD proposes, in Proposed Article 1-19, *Specific Recreation Measures,* improvements at several recreational areas to provide bear proof food lockers and bear proof trash bins (see section 3.3.6, *Recreation Resources* for further discussion). In Proposed Article 1-5, *Monitoring Program*, SMUD proposes a bear management monitoring plan. This plan would determine if the proposed human-bear interaction measures are successfully keeping bears away from campgrounds or if additional measures would be needed.

Iowa Hill Development

A biological evaluation has been completed to assess effects of the proposed Iowa Hill development on Forest Service sensitive terrestrial species (Lipton, 2007a).

Although no rare plants are known to exist in the Iowa Hill development area, due to the anticipated length of the delay between the rare plant surveys and the actual undertaking of construction on the Iowa Hill development, it is possible rare plants could become established in the construction areas. Additionally, Forest Service survey guidelines require project areas to be resurveyed after a 5-year period. If new surveys for sensitive plants are completed prior to the beginning of construction, the surveys would locate any new populations of rare plants or any new rare plants species that may be added to the current rare plant lists by the time construction begins. If any new rare plant locations or habitat information changes as a result of these surveys, the Forest Service's biological evaluation may be amended prior to the beginning of construction (Taylor, 2007).

The proposed Iowa Hill development could directly affect California spotted owls through removal of habitat. The project would eliminate up to 141 acres of suitable habitat, a portion of which occurs on National Forest System lands. The habitat that would be removed is approximately a mile from the nearest known spotted owl activity center; however, the incomplete survey visits conducted in 2004 indicated that an additional spotted owl nest or roost site may occur in closer to the project, since an individual spotted owl was detected within 0.25 mile of the project boundary.

If spotted owl nesting is occurring in proximity to the project (within 0.25 mile), noise associated with construction activities could cause abandonment of a spotted owl nest site or could impact nesting success. Removal of vegetation could eliminate occupied or potential nesting habitat and would reduce foraging habitat for two spotted owl sites (PACs ED 123 and ED034) with activity centers about 1.5 miles of the project area.

At present, the spotted owl population on the Eldorado National Forest is estimated to be stationary (FWS, 2006). Given this fact and the findings of the FWS on the magnitude of threats to the species (FWS, 2006), the biological evaluation contains a determination that the direct and cumulative effects of the project may affect spotted owl individuals but are not expected to result in a loss of viability or lead to a trend toward federal listing for the California spotted owl (Lipton, 2007a).

The proposed Iowa Hill development could directly affect northern goshawks through removal of habitat. The project would eliminate up to 141 acres of suitable habitat, about half of which occurs on National Forest System lands. The habitat that would be removed is not known to be used for nesting but protocol-level surveys have not been completed. If goshawks are nesting in proximity to the project (within 0.25 mile), noise associated with construction activities could cause abandonment of a nest site or impact nesting success. Loss of habitat could also eliminate use of the area by a goshawk pair.

In a status review conducted in 1998, FWS concluded that goshawks remain widely distributed throughout their historic range in the western United States and found no evidence that goshawk habitat is limiting the population, or that a significant curtailment of the species' habitat is occurring. For this reason, the biological evaluation contains a determination that the magnitude of effects associated with the Iowa Hill development may affect goshawk individuals but is not likely to result in a trend toward federal listing or loss of viability for the northern goshawk (Lipton, 2007a).

The proposed Iowa Hill development would directly affect sensitive bat species through removal of potential roosts on 141 acres of land proposed to be cleared for project developments. Project construction noise would be likely to impact roosting bats over a larger area. Open water created by the upper reservoir could improve foraging opportunities for bats along the forested edge of this habitat. Based on the information above, the biological evaluation contains a determination that the Iowa Hill development may affect individual pallid bats, Western red bats, and/or Townsend's big-eared bats, but is not likely to result in a trend toward federal listing or loss of viability for these species (Lipton, 2007a).

The proposed Iowa Hill development would directly affect unoccupied but potentially suitable Pacific fisher habitat through removal of 141 acres of land proposed to be cleared for project developments. This would have no direct or indirect effects upon the species unless it was to recolonize habitat on the Eldorado National Forest. Based on this information, the biological evaluation contains a determination that the Iowa Hill development project would have no effect upon the Pacific fisher, though updating the biological evaluation is recommended prior to construction to ensure this determination is still valid (Lipton, 2007a).

Proposed Article 1-12 would require SMUD to complete a biological evaluation before commencing any new construction or maintenance authorized by a new license. This requirement is necessary for evaluating the effects of the Iowa Hill development on California spotted owls, northern goshawks, sensitive bats, and Pacific fisher. Because the existing spotted owl and northern goshawk surveys do not meet survey protocols and because these surveys would also be out of date by the time construction of the Iowa Hill project begins, additional spotted owl and goshawk surveys would be necessary prior to project construction in order to fully evaluate project effects. If new spotted owl nest or daytime roost locations or new goshawk nest locations are identified within 0.25 mile of project activities prior to the beginning of construction, SMUD would develop appropriate mitigation measures under the proposed measure.

Proposed Article 1-41 requires that prior to initiating construction of Iowa Hill, SMUD would purchase an equivalent acreage of land (or a conservation easement for an equivalent acreage of land) to be managed as wildlife habitat over the term of the license to mitigate the loss of wildlife habitat associated with the Iowa Hill development. The Forest Service and CDFG would determine the in-kind value of lands proposed for this purpose. The purchase of an equivalent acreage of land may help to offset effects on California spotted owl, northern goshawk, sensitive bat, and Pacific fisher habitat if the acquired lands provide similar habitat and/or are occupied by these species. This cannot be analyzed, however, without knowing what land would be purchased, what habitat types it contains, or which wildlife management goals would be applied to the property.

A management indicator species analysis has been completed to assess the effects of the Iowa Hill development on Eldorado National Forest MIS (Lipton, 2007b).

Mule Deer—The management indicator species analysis contains the following conclusions: Deer foraging habitat on the Eldorado National Forest is estimated to have increased between 1991 and 1997. Project-level effects would contribute to a decline in the amount of deer habitat unless habitat acquired by SMUD as mitigation replaces habitat lost through project effects. Project-level effects are not expected to alter deer population trends because the project area is not identified as important winter or summer range for migratory deer and the area represents a very small portion of available deer habitat (Lipton, 2007b).

Black Bear—The amount of black bear denning/cover habitat on the Eldorado National Forest declined between 1991 and 1997. Project-level effects would contribute to the declining habitat trend on the Forest. The black bear data infer an increasing trend for black bear on the Eldorado National Forest, based on CDFG population estimates (CDFG, 2004). Project-level effects are unlikely to influence the black bear population trend (Lipton, 2007b).

Mountain Quail—The amount of mountain quail habitat on the Eldorado National Forest increased between 1991 and 1997. Project-level effects would not contribute to the increasing habitat trend on the Eldorado National Forest. From mountain quail survey data, a stable population trend has been estimated for the Sierra Nevada bioregion (Forest Service, 2007). Project-level effects are unlikely to affect mountain quail population trends (Lipton, 2007b).

California Spotted Owl—As discussed above, the amount of spotted owl habitat on the Eldorado National Forest declined between 1991 and 1997. Project-level effects would contribute to declining habitat trends on the Eldorado National Forest. The spotted owl population trend on the Eldorado National Forest is estimated to be stable. Project-level effects would reduce nesting and foraging habitat that may contribute habitat for one or two spotted owl sites (Lipton, 2007b).

Northern Goshawk—As discussed above, the amount of northern goshawk habitat on the Eldorado National Forest declined between 1991 and 1997. Project-level effects would contribute to declining habitat trends on the Eldorado National Forest. Goshawk population trends on the Eldorado National Forest remain unknown (Lipton, 2007b).

Cavity Nesting Birds—Population status and trend is monitored within the Sierra Nevada Bioregion for the following four cavity nesting bird species: Pileated woodpecker, red-breasted sapsucker, Williamson's sapsucker, and hairy woodpecker. Project-level effects would contribute to decreasing snag habitat trends on the Eldorado National Forest (Lipton, 2007b).

The only special status plant or wildlife species that is known to occur near the Chili Bar project boundary is the Yuma myotis. The Yuma myotis has a night roost within the UARP White Rock powerhouse, but is expected to occur within the Chili Bar project boundary. Although no special status plant or wildlife would be affected by the proposed project, the measures proposed by PG&E would protect any special status plant or wildlife species that either currently occur or could occur in the future within the project boundary from project maintenance activities on powerhouses, road maintenance, vegetation management, or any new ground-breaking activities.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. The effects of the proposed project without the Iowa Hill development would be the same as with the Iowa Hill development because no special-status plant species are known to occur within the Iowa Hill development, no project canals or penstocks that would adversely affect wildlife are proposed for the Iowa Hill development, and the proposed Iowa Hill transmission line would not be built to meet APLIC standards.

Vegetation and Noxious Weed Management

Noxious weeds occur throughout the project boundaries. Project operations and maintenance activities create dispersal pathways and conditions that are favorable to the spread of noxious weeds. Vegetation management and noxious weed control methods could control existing populations and prevent new populations from forming.

SMUD proposes, as specified in Proposed Article 1-13, *Vegetation and Invasive Weed Management Plan*, to file with the Commission, within 2 years of license issuance, an Invasive Weed Management Plan developed in consultation with the Forest Service, FWS, the appropriate County Agricultural Commissioner, and the California Department of Food and Agriculture. Invasive weeds would be those weeds defined in the California Food and Agriculture code, and other species identified by the Forest Service. The plan would address both aquatic and terrestrial weeds and vegetation within the UARP boundary and adjacent to UARP features directly affecting National Forest System lands including roads and distribution and transmission lines. Monitoring as part of the plan will be done in conjunction with other UARP maintenance and resource surveys, so as not to require separate travel and personnel. Monitoring information would be provided to the Forest Service as part of the annual consultation on affected Forest Service resources described in Proposed Article 1-14, *Annual Review of Ecological Conditions*. To assist with this monitoring requirement, training in invasive plant identification would be provided to UARP employees and contractors by the Forest Service. SMUD also proposes, as specified in the same article to file with the Commission and thereafter implement a Vegetation Management Plan. The plan would include, among other elements, hazard tree removal and trimming, revegetation of disturbed sites, and soil protection and erosion control.

PG&E proposes similar invasive weed and vegetation management plans, as specified in Proposed Article 2-10, *Invasive Weed and Vegetation Management Plans*. The difference in the PG&E proposed plan is that it is intended for BLM lands, with consultation with the BLM, instead of Forest Service lands and consultation with the Forest Service, as proposed by SMUD.

Our Analysis

Ten species of noxious weeds occur within the project boundary, five of which are in close proximity to UARP facilities. Noxious weeds have the potential to out-compete special status plant species, if they move into special status plant habitat. Project maintenance and operations can aid the proliferation of noxious weeds. Project roads can act as a method of seed dispersal into areas previously not infested and vegetation management within transmission lines can cause disturbance which allows noxious weeds to move in. The construction of the Iowa Hill development would also act as new disturbance that would create conditions favorable to the establishment of noxious weeds if appropriate control measures are not implemented. Finally, project-related recreation acts both as a means of dispersal from one project area to another and as a source of disturbance, which creates conditions favorable to noxious weed establishment.

Implementing the proposed invasive weed and vegetation management plans would control current populations and future infestations of noxious weeds within the project boundary on Forest Service lands. We interpret the proposed Invasive Weed Management Plan to be intended for lands within the project boundary that are adjacent to project features directly affecting National Forest System lands. Because not all project-related noxious weed infestations occur on project lands that affect National Forest System lands, expanding the invasive weed and vegetation management plan to all lands within the project boundary that are affected by project operations or maintenance would result in more complete control of noxious weeds that are affected by the proposed project. Currently, there are only small areas of noxious weeds located on the proposed Iowa Hill development site, concentrated on currently disturbed areas. Construction of the proposed upper reservoir and transmission line would create disturbance that would create conditions favorable to the establishment of noxious weeds. The proposed vegetation management plan would ensure the areas of disturbance that are not permanently lost to project facilities would be revegetated with native species and noxious weeds would be controlled.

Significant populations of the noxious weeds Scotch broom and Himalayan blackberry occur on the Chili Bar reservoir shoreline and along roadsides. Project operations and maintenance activities create conditions that are favorable to the existence of noxious weeds. Implementing the proposed invasive weed and vegetation management plans would control current populations and future infestations of noxious weeds within the project boundary on BLM lands. Because not all project-related noxious weed infestations occur on BLM lands, expanding the invasive weed and vegetation management plan to all lands within the project boundary would result in more complete control of noxious weeds that are affected by project operations and maintenance. The proposed vegetation management plan would establish practices that would minimize conditions favorable to the establishment of noxious weeds.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed. The project effects on noxious weed proliferation would remain the same as for the Proposed Action, except the Iowa Hill development sites would remain undisturbed and conditions favorable for noxious weed establishment would not occur.

Special Status Amphibians and Reptiles

Minimum Flows

Foothill yellow-legged frog habitat is found in several project reaches. The mountain yellow-legged frog has not been found in project-affected reaches or reservoirs during recent surveys, although suitable habitat may be available in higher elevations. Western pond turtle occur in the Slab Creek and Chili Bar dam reaches. Minimum flows have the potential to affect foothill yellow-legged frog, MLYF, and western pond turtle habitat. There is a tradeoff between the potential benefits of higher minimum flows creating more foothill yellow-legged frog habitat and the negative effects of cooler water during May through September delaying breeding, egg development, and tadpole metamorphosis (Kupferberg, 2006). Maintaining the water temperatures below 20°C during the summer months (to benefit coldwater fisheries) could potentially slow down foothill yellow-legged frog egg and tadpole development because it is outside the range of natural conditions for the foothill yellow-legged frog. Mountain yellow-legged frogs require stable, coldwater habitats as tadpoles develop over a period of 2 to 3years. Additionally, project operations potentially create warm edgewater conditions favorable to bullfrogs, a predator of foothill yellow-legged frogs and young western pond turtles.

The applicants propose to provide minimum streamflows to project reaches as specified in Proposed Articles 1-1 and 2-1, *Minimum Streamflows*.

Our Analysis

Foothill yellow-legged frogs evolved with wet winters and dry summers, and their life cycle is adapted to these predictable, seasonal cycles of peak flow and base flow (Mount et al., 2006). Studies from other Sierran rivers have demonstrated that foothill yellow-legged frog egg masses may be negatively affected by flow fluctuations associated with spills, channel maintenance pulse flows, ramping rates, whitewater recreational flows, and other operations. Flow fluctuations during the foothill yellow-legged frog breeding season can desiccate egg masses if they are laid during prolonged spills and then water levels drop quickly prior to hatching (Mount et al., 2006; Kupferberg, 2006). Additionally, egg masses can be scoured by high flows. Tadpole stranding, particularly during the late summer-early fall, is also a concern related to flow fluctuations. Stable, increased minimum flows may benefit tadpoles during the low-flow summer months by providing additional habitat.

Continuity and connectivity of foothill yellow-legged frog habitat is critical to long-term survival of frog populations. Foothill yellow-legged frogs could be adversely affected by thermal conditions that create barriers to migration and result in small, isolated breeding populations with low resiliency to perturbations. Project-affected reaches that are too cold or too warm and project reservoirs may represent dispersal barriers and create reproductive isolation. Minimum flows in project reaches affect instream temperatures. SMUD proposes minimum flows in the Camino dam reach, SFAR reach, Ice House reach, Junction dam reach, and Slab Creek dam reach that could decrease instream temperatures, affecting foothill yellow-legged frog populations. Additionally, altered flow regimes may also create aquatic habitat conditions that favor introduced coldwater species such as brown trout or warmwater species such as smallmouth bass and bullfrog that prey on foothill yellow-legged frogs, western pond turtles, and/or mountain yellow-legged frogs.

Although there are no known populations of mountain yellow-legged frogs within the project reaches, suitable habitat may be available in higher elevations (e.g., upper reaches of Gerle Creek below Loon Lake dam). Mountain yellow-legged frogs occur mostly within ponds or lakes, but could potentially breed and disperse in coldwater project reaches. Trout prey on mountain yellow-legged frog tadpoles, therefore managing high-elevation reaches with potential mountain yellow-legged frog habitat (Rubicon dam reach, Buck Island dam reach, Loon Lake dam reach, Gerle Creek dam reach, and Robbs Peak dam reach) for trout population growth would reduce the likelihood of successful mountain yellow-legged frog breeding. Higher minimum flows in these reaches, however, are expected to maintain coldwater conditions, which is favorable to mountain yellow-legged frog habitat.

Rubicon and Buck Island Dam Reaches—The mountain yellow-legged frog has not been found in these reaches, although Rubicon reservoir is within the range of the mountain yellow-legged frog (6,500-foot elevation), and there is potential habitat. The nearest known populations of mountain yellow-legged frogs are at elevations greater than 7,500 feet, in Highland Creek that flows into Rockbound Lake.

Under the Settlement Agreement, the primary objectives for the Rubicon dam reach and the Buck Island dam reach are to provide cold freshwater habitat for healthy rainbow trout and mountain yellow-legged frog populations, and less conducive conditions for California roach, speckled dace, and golden shiners. Increased minimum streamflow releases in both reaches would slightly lower May and June water temperatures in both reaches providing cooler and more stable conditions and increasing potential habitat for mountain yellow-legged frogs.

Loon Lake Dam Reach—All of Loon Lake dam reach (8.5 miles) is currently considered coldwater habitat. The mountain yellow-legged frog has not been found in the Loon Lake dam reach, although the upper end of the reach is within the elevational range and there is potential habitat. The absence of mountain yellow-legged frogs may be due, in part, to the predatory brown trout population.

Under the Settlement Agreement, the primary objectives for the Loon Lake dam reach are to provide cold freshwater habitat for healthy rainbow trout, non-native brown trout, and mountain yellow-legged frog populations, and make the flows more closely resemble the natural hydrograph. Increased minimum streamflows during May through September, with the largest increases occurring in May and June, would slightly lower May and August water temperatures, and moderately lower water temperatures during June and July (see section 3.3.2.2, *Water Resources*), providing cooler and more stable conditions and increasing potential habitat for mountain yellow-legged frogs, but also for predatory trout.

Gerle Creek Dam and Robbs Peak Dam Reaches—Mountain yellow-legged frogs and foothill yellow-legged frogs have not been found in these reaches, although there is potential habitat (CDFG, 2007). Predatory brown trout occur in Gerle Creek dam and Robbs Peak dam reaches because the upstream Loon Lake dam reach is managed for this non-native sportfish.

Under the Settlement Agreement, the objectives include providing cold freshwater habitat for healthy mountain yellow-legged frog populations in the Gerle Creek dam reach, and providing cold freshwater habitat for healthy mountain yellow-legged frog and foothill yellow-legged frog populations in the Robbs Peak dam reach. Increased minimum streamflow releases from both Gerle Creek dam and Robbs Peak dam during May through September, with the largest increases occurring in May and June, would somewhat lower May through mid-August water temperatures, and slightly increase September water temperatures. We anticipate that the largest reduction in temperatures would occur in the Robbs Peak dam reach due to the proposed minimum streamflow releases that are more than four times the current requirements in May and June. Therefore, the proposed minimum flows may provide potential habitat for the mountain yellow-legged frog that is cooler and more stable than current conditions, particularly in upper Robbs Creek dam reach, where optimal temperatures for the mountain yellow-legged frog are currently exceeded in the summer months. The proposed minimum flows may also provide potential habitat for the foothill yellow-legged frog in the lower end of the reaches. However, these reaches are not within the optimal elevation ranges for these species (too low for the mountain yellow-legged frog, too high for the foothill yellow-legged frog), and the proposed minimum flows would also provide more habitat for predatory trout.

Ice House Dam Reach—Ice House dam reach is at the upper elevation range for the foothill yellow-legged frog, and the upper 7 miles of the 11.5-mile long reach is considered coldwater habitat. Extant foothill yellow-legged frog populations were not found in this reach during relicensing surveys. There are no temperature objectives for Ice House dam reach, although under the Settlement Agreement, primary objectives for this reach are to provide temperatures that allow for management of native coldwater fishes and to not preclude foothill yellow-legged frog breeding if they recolonize the reach.

Increased minimum streamflow releases during May through July of all years, and August and September of CD and Dry years (see section 3.3.2.2, *Water Resources*) would further reduce water temperatures and maintain temperatures less than 20°C throughout the reach in BN water years. The proposed minimum flows may create water temperatures that are too cool to provide potential foothill yellow-legged frog breeding and rearing habitat throughout most of the reach. SMUD would conduct monitoring, as discussed below under *Monitoring and Adaptive Management Programs*, to determine optimal temperature requirements for the foothill yellow-legged frog.

Junction Dam Reach—The entire 8.3-mile-long Junction dam reach is considered coldwater habitat. Extant populations of the foothill yellow-legged frog were not found in this reach during relicensing surveys. Primary objectives of the Settlement Agreement are to provide temperatures that allow for management of native fishes, provide habitat for healthy foothill yellow-legged frog populations, and provide habitat for healthy macroinvertebrate populations in the entire reach. Water temperatures in upper 2 miles were too cold to support foothill yellow-legged frog reproduction (~8°C) during 2004 amphibian surveys.

Increased minimum streamflows during May through July of all water year types, in August of Dry and CD years, and September of CD years would substantially reduce temperatures in the reach, and the proposed reduction of minimum streamflow releases for August and September of AN and Wet years would increase temperatures in the reach slightly. Mean daily temperatures under the proposed minimum streamflow releases are expected to remain below 20°C and may further decrease the amount of potential foothill yellow-legged frog habitat. Warmer temperatures are expected in low velocity, edgewater habitat that may be used by the foothill yellow-legged frog.

There are no specified temperature objectives for Junction Creek dam reach except during Wet water years, when SMUD would release water blocks to maintain mean daily temperatures of less than or equal to 20°C, as measured at the lower end of the reach, just upstream from Camino reservoir. In Wet water years, the temperature in the lower end of the reach could also be less than optimal for foothill yellow-legged frogs because of the water block release could further decrease the amount of potential foothill yellow-legged frog habitat. If the water temperature in the Junction dam reach is exceeded prior to release of the Wet year water block, SMUD would monitor for the presence of foothill yellow-legged frogs prior to and after the release of a block of water. The monitoring would allow SMUD and the Agencies to implement adaptive management measures, discussed below, as needed, to protect foothill yellow-legged frogs during water block releases.

Although surveyors found temperatures suitable for foothill yellow-legged frog breeding in lower Junction dam reach in 2004, large algal mats cover the substrate and probably prevent successful reproduction. The algal mats are indicative of elevated water temperature, nitrate, or other water quality issues and their decomposition reduces DO in the water column. The proposed minimum flows may improve water quality in the lower end of the reach, and SMUD would develop an algal species identification and monitoring plan for the Junction dam, Camino dam, Ice House dam, and Slab Creek dam reaches to assess the distribution and possible adverse affects of alga(e) in the project-affected reaches. Identification of the alga(e) and changing project operations, as needed, to improved water quality could create potential foothill yellow-legged frog habitat in lower Junction dam reach if water temperatures are suitable (see section 3.3.2.2, *Water Resources*).

It is also important to consider continuity and connectivity of appropriate thermal habitat to potential breeding populations of frogs. An objective of the Settlement Agreement is to provide connectivity of flows in the SFSC below Ice House reservoir dam through Silver Creek below Junction and Camino dams. If the upper reaches are too cold, this may increase the migratory barrier between the two reaches. The reservoirs may also be a migratory barrier to foothill yellow-legged frog dispersal. SMUD would conduct monitoring, as discussed below under *Monitoring and Adaptive Management Programs*, to determine optimal temperature requirements for the foothill yellow-legged frog.

Camino Dam and SFAR Reaches—The 6.2-mile-long Camino dam reach and the 2.6-mile-long SFAR reach down to Camino powerhouse would be potentially affected by the increased flows. The upper 3 miles of the Camino dam reach is currently coldwater habitat; all of the SFAR reach is currently warmwater habitat. SMUD surveys in 2003 and 2004 documented breeding populations of foothill yellow-legged frog in the Camino dam reach and the SFAR reach.

Primary objectives of Proposed Article 1-1, *Minimum Streamflows*, are to increase minimum flows in the Camino dam reach to benefit native fishes, improve habitat conditions for healthy foothill yellow-legged frog populations, and provide habitat for healthy macroinvertebrate populations in the entire reach. There are no specified water temperature objectives for the SFAR reach except during Wet water years. Within 2 years of license issuance, a telemetry system would be installed to provide hourly temperature monitoring data (see section 3.3.2.2, *Water Resources*). Micro-thermographs would be used to monitor the stream margin, edgewater habitats that are known or suitable foothill yellow-legged frog breeding sites.

Increased minimum streamflows during May through July of all water year types, in August of Dry and CD years, and September of CD years would reduce mean daily temperatures in Silver Creek upstream of the confluence with the SFAR May through July, but still remain above 12°C from mid-May through September. It appears that mean daily temperatures at the lower end of the Camino dam reach would seldom exceed 20°C in May though July of BN years, and would occasionally exceed 20°C in August. In Dry years, the increased minimum streamflow releases would reduce temperatures in lower Camino dam reach although it is not evident whether these reductions would lower temperatures to less than 20°C, particularly in July and August (see section 3.3.2.2, *Water Resources*). Therefore, it appears there may be less warmwater habitat for foothill yellow-legged frogs in lower Camino dam reach during some water years (e.g., BN) after implementation of the new minimum flow, than under the current conditions. The SFAR reach would continue to provide warmwater habitat for the foothill yellow-legged frog during all water year types because implementation of the Camino dam reach minimum flows would have little influence on water temperature in this reach due to the relatively large contributions of inflow from the SFAR (see section 3.3.2.2, *Water Resources).*

The proposed minimum flows in the Camino dam reach during the foothill yellow-legged frog reproductive season (May through September) would generally be less than 50 cfs, except in May of BN, AN, and Wet years (68 cfs) and June of AN and Wet years (59 cfs). DTA and Stillwater (2004c) concluded that flows of 20 to 50 cfs provided moderate to high quality habitat for foothill yellow-legged frog egg deposition and tadpole rearing in the Camino dam and SFAR reaches. They also concluded foothill yellow-legged frog breeding and rearing habitat in these reaches decreased to low quality at 100 cfs; however, further monitoring may be needed to definitively reach this conclusion. For example, in the North Fork Feather River, initial studies (2003-2004) lead to conclusions that optimal foothill yellow-legged frog breeding and tadpole rearing habitat would decrease as instream flows increased above 150 cfs, and that 150 cfs provided the greatest amount of suitable habitat (GANDA, 2004). Later monitoring results (2005-2006) indicated that initial conclusions regarding the relationship of foothill yellow-legged frog habitat and flow were not correct, and that at current (depressed) population levels habitat did not appear to be a limiting factor at higher flows. Foothill yellow-legged frog populations are also depressed in the Camino dam reach, and the proposed minimum flows would be expected to provide more foothill yellow-legged frog breeding and rearing habitat during all water year types than current conditions as long as water temperatures are suitable.

Low flows have the potential to be over-topped by spill events, turbine trips, or fluctuations caused by upstream projects. Higher minimum flows would reduce the difference between operational flow fluctuations and normal operating conditions and reduce the risk of egg mass desiccation and tadpole stranding from any flow perturbations. The proposed minimum flows would also provide a more natural hydrograph to initiate timely foothill yellow-legged frog breeding triggers.

During Wet water years, SMUD would also be required to release blocks of water into Camino dam reach during July, August, and/or September to maintain temperatures less than or equal to 20°C below Camino dam. The water block releases may create unseasonal temperature and flow fluctuations that could adversely affect developing tadpoles and metamorphs (tadpoles becoming frogs) in both reaches during Wet water year types. If the water temperature in the Camino dam reach is exceeded prior to release of the Wet year water block, SMUD may be required to monitor for the presence of foothill yellow-legged frogs prior to and after the release of a block of water. The monitoring would allow SMUD and the agencies to implement adaptive management measures, discussed below, as needed, to protect foothill yellow-legged frogs during water block releases.

Brush Creek Dam Reach—All of the Brush Creek dam reach (2.2 miles) is considered coldwater habitat. There is potential foothill yellow-legged frog habitat in the reach. The primary Settlement objectives for the reach include providing habitat for healthy foothill yellow-legged frogs and macroinvertebrates. Under Proposed Article 1-1, *Minimum Streamflows*, minimum streamflow releases would be increased to a range of 3 to 9 cfs or natural flow, or 1 cfs if natural inflow is less than 1 cfs. The proposed minimum streamflows would provide more cool water at the upper end of the bypassed reach, and is expected to result in somewhat cooler temperatures throughout the reach. Providing minimum streamflow releases of 1 cfs when the natural flow is less than 1 cfs is expected to somewhat reduce temperatures, at least in the uppermost part of the upper bypassed reach (see section 3.3.2.2, *Water Resources*). The proposed minimum flows would provide more stable flows for foothill yellow-legged frogs during the reproductive season, if water temperatures are suitable. SMUD would conduct monitoring, as discussed below under *Monitoring and Adaptive Management Programs*, to determine optimal temperature requirements for foothill yellow-legged frogs.

Slab Creek Dam Reach—Currently, the upper 4 miles of the 8-mile-long Slab Creek dam reach are considered coldwater habitat. This reach has the most extreme temperature fluctuations of all the reaches in the project, and does not provide appropriate magnitude or timing of flows to trigger foothill yellow-legged frog breeding (CDFG, 2007). Slab Creek dam reach is designated both cold and warm freshwater beneficial uses and should support a transitional community between cold and warm water species. Regarding western pond turtle sightings, two young western pond turtles were seen in 2003 by Forest Service surveyors downstream from Slab Creek reservoir in the SFAR between Rock Creek and Chili Bar reservoir. There is also an unconfirmed report of a single foothill yellow-legged frog in Slab Creek dam reach. Additionally, the Forest Service observed western pond turtle approximately 0.5 mile upstream of the White Rock powerhouse.

There are no specified temperature objectives for Slab Creek dam reach; however, primary objectives for the reach include providing temperatures that improve habitat conditions for healthy populations of foothill yellow-legged frogs and hardhead; allow management of native fish; and reduce non-native species such as bullfrogs and bass. Micro-thermographs would be used to monitor the stream margin, edgewater habitats that are known or suitable foothill yellow-legged frog breeding sites. As discussed below under *Monitoring and Adaptive Management Programs*, under Proposed Article 1-6(9), *Adaptive Management Program*, the Agencies would have the opportunity to use the temperature monitoring results to determine whether the water temperature that is currently used is an indicator of breeding initiation (12°C mean daily temperature for a 7-day running average), should be increased or decreased.

Proposed Article 1-1, *Minimum Streamflows*, would substantially increase minimum streamflow releases from Slab Creek dam during May through September of all water year types. Modeling indicates that the proposed minimum flows would substantially reduce mean daily temperatures at the lower end of the Slab Creek dam reach in BN water years to approximately 10-15°C in May, 14-21°C in June, 19-22°C in July, 17-21°C in August, and 13-19°C in September. These simulations suggest that mean daily temperatures could exceed 20°C in the lower one-third of the reach in June and July, and the lowest mile in August during BN water years. The proposed minimum streamflow releases would probably reduce warming in other water year types although there is insufficient information to quantify these reductions or determine the areas where mean daily temperatures would still exceed 20°C (see section 3.3.2.2, *Water Resources*).

The proposed minimum flows would provide a more natural hydrograph and would reduce the difference between operational flow fluctuations and normal operating conditions. Therefore, the proposed minimum flows during the foothill yellow-legged frog reproductive season would reduce the risk of egg mass desiccation and tadpole stranding from any flow perturbations and maintain suitable temperatures in the lower reach to provide potential foothill yellow-legged frog habitat.

Current conditions in lower Slab Creek dam reach, including warmwater and perennial flow during the summer and early fall favor potential competitors and predators such as bullfrogs, crayfish, and bass that prey on foothill yellow-legged frog and western pond turtle hatchlings. Increased minimum streamflows in the spring could benefit foothill yellow-legged frogs and western pond turtles by dislodging second year bullfrog tadpoles from pools. If higher spring flows reduce the survival of over-wintering bullfrog tadpoles, foothill yellow-legged frog and western pond turtle habitat conditions would improve.

It is also important to consider continuity and connectivity of appropriate thermal habitat to potential breeding populations of frogs. An objective of the Settlement Agreement is to provide connectivity of flows in the SFAR above Slab Creek reservoir and below the Slab Creek dam. It currently appears that the foothill yellow-legged frog population is more robust upstream in the Camino dam reach where July maximum water temperatures were approximately 24ºC in 2001, 22ºC in 2002, and 21ºC in 2003. If the upper portion of the Slab Creek dam reach is too cold after implementation of the proposed minimum flows, this would increase the migratory barrier between the two reaches (Kupferberg, 2006). Slab Creek reservoir may also be a migratory barrier to foothill yellow-legged frog dispersal. SMUD would conduct monitoring, as discussed below under *Monitoring and Adaptive Management Programs*, to determine optimal temperature requirements for the foothill yellow-legged frog.

Operation of the proposed Iowa Hill development has the potential to affect the water temperature of Slab Creek reservoir and the SFAR directly downstream of the Slab Creek dam. Simulated mean water column temperatures for Slab Creek reservoir near the dam were as much as 0.87°C cooler and averaged 0.39°C cooler, and streamflow releases from Slab Creek dam also were slightly cooler for the heavy use scenario than the without Iowa Hill development scenario (see section 3.3.2.2, *Water Resources*). It is unlikely that these small changes would affect the quality of potential foothill yellow-legged frog habitat.

Iowa Hill Pumped Storage Project—Downstream of Slab Creek Reservoir only one foothill yellow-legged frog has been observed in the SFAR in 2004, a distance of 6 miles downstream of Slab Creek dam. Effects on foothill yellow-legged frogs would occur primarily in their habitat downstream, as the reservoir itself is not habitat for foothill yellow-legged frogs, but acts as a barrier to habitat connectivity. Operation of the proposed Iowa Hill development has the potential to affect the water temperature of Slab Creek reservoir and the SFAR directly downstream of the Slab Creek dam, although simulated flows from modeling show these water temperature changes are minor. Article 140 proposes protective measures that ensure fluctuating flows would not dislodge egg masses or tadpoles of any reproductive foothill yellow-legged frogs occurring below Mosquito Bridge, and water temperatures would not affect foothill yellow-legged frogs by being too cool for their normal development. Implementation of best management practices, obtaining all necessary permits and authorizations, and a storm water pollution prevention plan would provide reasonable assurances that SMUD would protect water quality for foothill yellow-legged frogs. Assuming all of these measures are implemented, there should not be adverse effects to any possible foothill yellow-legged frog populations downstream, although it is unknown whether these measures are effective since the Iowa Hill development has not been implemented. Based on this information, the biological evaluation prepared by the Forest Service contains a determination that the Iowa Hill development may affect individual foothill yellow-legged frogs but is not likely to result in a trend toward federal listing or a loss of viability for the foothill yellow-legged frog (Williams, 2007b).

Due to the anticipated length of the delay between the existing foothill yellow-legged frog surveys and the actual undertaking of construction on the Iowa Hill development, conducting new surveys for foothill yellow-legged frogs prior to beginning of construction would provide up-to-date foothill yellow-legged frog location information. If information analyzed in the biological evaluation changes as a result of these surveys, the Forest Service may amend the biological evaluation prior to the beginning of construction (Williams, 2007b).

Chili Bar Dam Reach—PG&E surveys in 2004 documented tadpoles and an adult frog on Indian Creek, a tributary to SFAR downstream of Chili Bar dam. Western pond turtle were found on the mainstem SFAR near Coloma and in Greenwood Creek, a tributary. There are no specific water temperature objectives set for the Chili Bar reach; however, the primary objectives in the Settlement Agreement include providing habitat for healthy foothill yellow-legged frog, western pond turtle, hardhead populations; increasing wetted perimeter, and providing more suitable habitat for benthic invertebrates; and reducing or eliminating water quality conditions that encourage algae growth.

Proposed Article 2-1, *Minimum Streamflows*, would substantially increase minimum streamflow releases from Chili Bar dam during May through September of all water year types. The proposed minimum streamflows would slightly lower water temperatures in the Chili Bar dam reach in May through September. We anticipate that this would reduce mean daily temperatures so that they no longer exceed 20°C and may decrease the amount of potential foothill yellow-legged frog habitat (see section 3.3.2.2, *Water Resources*).

Currently, flow fluctuations in the Chili Bar dam reach reduce habitat stability and consistency, which is necessary for foothill yellow-legged frog egg and tadpole development. In the span of 24-hours, flow fluctuations can inundate habitat creating depths and flows that are too deep and fast for foothill yellow-legged frogs or suitable habitat that is present at high flows becomes dewatered as flows recede. Although flow fluctuations under the proposed minimum flows would continue, providing higher minimum flows would reduce the difference between daily base and peak flows, which would result in more stable foothill yellow-legged frog habitat conditions and a lower probability that egg mass desiccation or tadpole stranding would occur.

During amphibian and reptile surveys, bullfrogs were observed at 7 of the 21 sites surveyed, including the Chili Bar dam reach near Scott Road. Current conditions in the reach, including warmwater and perennial flow during the summer and early fall favors potential competitors and predators such as bullfrogs, crayfish, and bass that may prevent the successful establishment of the foothill yellow-legged frog and western pond turtle. Increased minimum streamflows in the spring could benefit the foothill yellow-legged frog and western pond turtle by dislodging second year bullfrog tadpoles from pools. If higher spring flows reduce the survival of over-wintering bullfrog tadpoles, foothill yellow-legged frog and western pond turtle habitat conditions would improve.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Project operations at all reaches and reservoirs, with the exception of Slab Creek reservoir would remain unchanged from those described in the Proposed Action, and no special status amphibians or reptiles occur within the Iowa Hill site. As a result, effects of the UARP-only Alternative on the foothill yellow-legged frog and mountain yellow-legged frog would be the same as those described under the Proposed Action.

Pulse Flows

Immobile foothill yellow-legged frog egg masses and developing tadpoles and metamorphs with limited mobility are particularly vulnerable to changes in flow. Proposed Article 1-2, *Pulse Flows*, would require SMUD to provide annual channel maintenance pulse flows in the Rubicon dam, Loon Lake dam, and Ice House dam reaches within three months after license issuance but not prior to implementation of the new minimum flows. Pulse flows would not be implemented in water years when natural spills provide flows of equivalent magnitude and duration during spring snowmelt runoff or a natural storm that occurs in the months of January through May in the specified watershed (for more specific information see sections 3.3.2, *Water Resources*, and 3.3.3, *Aquatic Resources*.

Our Analysis

The Ice House dam reach is the only reach with potential foothill yellow-legged frog habitat that may be affected by the proposed channel maintenance pulse flows. Studies in other California rivers have found that foothill yellow-legged frogs spend the winter months on smaller tributary streams, and migrate to large rivers during the spring-fall reproductive season. If in fact, foothill yellow-legged frogs occupy this section of SFSC, we assume they would not be in the river when the pulse flows are scheduled to coincide with winter storms (December 15 to April 10) because foothill yellow-legged frogs occupy tributary stream habitat during the winter months.

Pulse flows that are scheduled to coincide with spring snowmelt runoff after April 10 could occur during the foothill yellow-legged frog reproductive migration, breeding, and egg laying periods. However, the proposed pulse flows are within the range of natural conditions (450 to 780 cfs; duration 5 days), and to date, the foothill yellow-legged frog has not been found in the Ice House dam reach. Foothill yellow-legged frog monitoring would be implemented, and if foothill yellow-legged frogs are found in the reach, adaptive management measures would be implemented in consultation with the agencies.

The mountain yellow-legged frog is not known to occur in Rubicon dam, Loon Lake dam, and Ice House dam reaches. Therefore, the proposed pulse flows would have no effect on the mountain yellow-legged frog.

There are no pulse flows proposed in the Chili Bar dam reach.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Pulse flows at all reaches would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on the foothill yellow-legged frog and mountain yellow-legged frog would be the same as those described under the Proposed Action.

Ramping Rates

Immobile foothill yellow-legged frog egg masses and developing tadpoles and metamorphs with limited mobility are particularly vulnerable to changes in flow. Under Proposed Articles 1-3 and 2-2, *Ramping Rates*, SMUD and PG&E would implement the ramping rates described in section 3.3.3.2, *Aquatic Resources, Ramping Rates*.

Our Analysis

The proposed ramping rates for pulse flows, minimum instream flow releases, and/or whitewater recreational releases have the potential to affect foothill yellow-legged frogs or their potential habitat in Ice House dam, Junction dam, Camino dam, and Slab Creek dam reaches. The proposed minimum flows in conjunction with the controlled up- and down-ramping rates, would attempt to provide stable flow regimes in these reaches to protect foothill yellow-legged frogs during the reproductive season. Stable flows during the breeding season are optimal, to avoid egg mass desiccation from decreasing flows, egg mass scouring from increasing flows, and tadpole stranding from flows receding and draining from isolated pools. Successful implementation of the ramping rates would minimize the potential for foothill yellow-legged frog egg mass scouring and tadpole and juvenile stranding and displacement.

The mountain yellow-legged frog is not known to occur within the project-affected reaches. Therefore, the proposed ramping rates would have no effect on mountain yellow-legged frogs.

The proposed minimum flows in conjunction with the controlled up- and down-ramping rates, would attempt to provide stable flow regimes in the Chili Bar dam reach to protect foothill yellow-legged frogs during the reproductive season. Stable flows during the breeding season are optimal, to avoid egg mass desiccation from decreasing flows, egg mass scouring from increasing flows, and tadpole stranding from flows receding and draining from isolated pools. When the controlled ramping rates are successfully implemented, they would minimize the potential for foothill yellow-legged frog egg mass scouring and tadpole and juvenile stranding and displacement.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Ramping rates at all reaches would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on the foothill yellow-legged frog and mountain yellow-legged frog would be the same as those described under the Proposed Action.

Recreational Streamflows

The whitewater recreation streamflow releases proposed in Slab Creek dam reach and Ice House dam reach (Proposed Article 1-24, *Recreation Streamflows*) and Chili Bar dam reach (Proposed Article 2-15, *Recreational Streamflows*) may affect foothill yellow-legged frogs or their potential habitat. The mountain yellow-legged frog is not known to occur in the project reaches. Therefore, the proposed recreational streamflows would have no effect on mountain yellow-legged frogs. The proposed recreational streamflows below Slab Creek dam and Ice House dam are described in section 3.3.6.2, *Recreational Resources.*

Our Analysis

Other studies in northern California rivers have found foothill yellow-legged frog egg masses are deposited on the declining limb of the hydrograph (GANDA, 2006). This is a natural adaptation to California river systems that experienced predictable cycles of high spring run-off followed by low summer base flows prior to hydropower developments (Mount et al., 2006). Therefore, uncontrollable and/or untimely whitewater recreation streamflows may initiate foothill yellow-legged frog egg deposition or site selection that may result in desiccation when the flows recede, or detachment of existing egg masses. Developing tadpoles and metamorphs with limited mobility are also vulnerable to changes in flow.

Preliminary research in experimental conditions indicates that the critical velocity that tadpoles are flushed out of the substrate is probably between 20 to 40 centimeters/second (Mount et al., 2006). During the experiments, less than 50 percent of the tadpoles that were flushed into higher velocity habitat (10 to 15 centimeters/second) were able to find low-flow refugia in the substrate or swim cross-current to lower velocity areas. Tadpoles that have been flushed out of the substrate or stranded in isolated pools are at higher risk of predation from aquatic and terrestrial predators, as well as desiccation as isolated pools recede.

The magnitude of the recreational flow releases proposed for mid-March through May 31 are within the range of natural conditions; however, the short-durations of these flows are outside the range of natural conditions and may adversely affect foothill yellow-legged frog egg masses. Effective implementation of the proposed ramping rates when the recreational flow releases occur would be essential to the protection of egg masses. If foothill yellow-legged frogs are found in the SFSC and water temperatures at SFSC 1 rise above 12°C mean daily temperature for a 7-day running average at USGS gage 11441500 (the temperature assumed to initiate foothill yellow-legged frog breeding), or if water temperatures in the Slab Creek dam reach rise above 12°C mean daily temperature for a 7-day running average at SFAR 6, SMUD would cancel the recreational flows unless the Agencies determine that such events are compatible with protection of foothill yellow-legged frogs and other biological resources. SMUD would provide notice to the Commission, the Forest Service, the

Water Board, and CDFG within 10 days of determining that the above temperature trigger has been met in either of these scenarios, causing cancellation of the recreational streamflows in either of these reaches. SMUD would provide notice to the Commission if the Forest Service, the Water Board, and CDFG approve a modification to the water temperature trigger.

SMUD would attempt to avoid spilling at Slab Creek dam and Camino dam once foothill yellow-legged frog breeding has been initiated. If a spill does occur, the licensee would make a good faith effort to manage the spill to minimize flow fluctuations in the SFAR. If the Agencies determine that spills below Slab Creek dam and/or Camino dam are resulting in unacceptable environmental impacts based on aquatic species and temperature monitoring, appropriate mitigation measures would be developed and implemented upon approval of the Agencies.

Larger/later developmental stage tadpoles appear less able to withstand increasing water velocities than mid-developmental stage tadpoles, and late summer pulse flows may have greater negative effects than previously expected (Mount et. al, 2006). No recreational flow releases are proposed from June 1 through September 30 to protect foothill yellow-legged frog tadpoles and metamorphs.

Studies also indicate that fall recreational flow releases may cause large numbers of benthic macroinvertebrates to enter the drift and be exported downstream (Kupferberg, 2006). As a result, less insect food may be available for foothill yellow-legged frog metamorphs in the fall, prior to the on-set of winter. If the Agencies determine that unacceptable environmental impacts are occurring in the Slab Creek dam reach due to October recreational streamflows based on amphibian monitoring, adaptive management measures may include but are not limited to cancellation of the October recreational streamflows.

Therefore, implementation of the proposed timelines, ramping rates, monitoring, and adaptive management measures would be important to determine if any adverse impacts on foothill yellow-legged frogs are occurring as a result of recreational flow releases.

Recreational streamflows have the potential to affect foothill yellow-legged frog egg masses, tadpoles, and metamorphs, as described above. No foothill yellow-legged frogs were located during relicensing surveys on the mainstem SFAR within this reach and habitat was classified as low to moderate. If foothill yellow-legged frogs inhabit this reach in the future, amphibian monitoring discussed below would identify any adverse effects occurring as the result of streamflow modifications. Subsequently, the adaptive management program proposed in Proposed Article 2-5, *Adaptive Management Program*, would provide a mechanism to alter recreational flows in the future if it's determined to be necessary.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Therefore, recreational streamflows would not increase after year 15, and the potential recreational streamflow effects of the UARP-only Alternative on the foothill yellow-legged frog and mountain yellow-legged frog would be the same as those described under the Proposed Action up until year 15.

Monitoring and Adaptive Management Programs

The effects of the proposed minimum flows, decreased water temperature, pulse flows, ramping rates, and recreational streamflows on all life history stages of the foothill yellow-legged frog, mountain yellow-legged frog, and western pond turtle are unknown. Therefore, monitoring the response of all life stages of foothill yellow-legged frogs, mountain yellow-legged frogs, and western pond turtles over time would be necessary to evaluate potential effects of the proposed flow changes, along with effective adaptive management changes, as needed.

Within 1 year of license issuance SMUD proposes to develop an amphibian and reptile habitat evaluation and species presence monitoring plan in consultation with the Agencies and would implement it following review and approval. SMUD would conduct protocol-level surveys for the foothill yellow-legged frog in a sub-sample of appropriate habitat types to document species presence and distribution and identify amphibian breeding and larval periods in project-affected reaches. The first year of the surveys would determine the timing and success of egg laying, tadpole rearing, metamorphosis, and size/condition of metamorphs. SMUD would also place micro-hydrothermographs for future monitoring within the stream margins in the Camino and Slab Creek dam reaches. Monitoring sites would include: (1) Junction dam reach; (2) Camino dam reach; (3) Slab Creek dam reach; and, (4) Rock Creek, a SFAR tributary located upstream of the White Rock powerhouse, from the confluence with SFAR to a point 1 mile upstream. Monitoring would occur in the Rock Creek and Camino dam reach during spill flows that happen after water temperatures rise above 12°C mean daily temperature for a 7-day running average in the SFAR. This monitoring would determine effects on amphibians, fish, and aquatic reptiles as soon as possible after the decline of the spill.

SMUD proposes monitoring frequency as follows: (1) years 2, 3, 5, 10, 15 and thereafter for every 5 years for the term of the license in Junction dam reach; (2) as soon as possible after the decline of spill flows in Slab Creek and Camino dam reaches; (3) years 1, 2, 3, 5, 6, 10, 11, 15, 16 and thereafter for 2 consecutive years during every 5 years for the term of the license in the Camino dam reach; (4) years 1, 2, 3, 4, 5, 6, 10, 11, 15, 16 and thereafter for 2 consecutive years during every 5 years for the term of the new license in Slab Creek dam reach; and, (5) years 1, 2, 3 in Rock Creek.

SMUD also proposes to develop, within 1 year of license issuance, an amphibian flow fluctuation monitoring plan in consultation with the Agencies and implement it upon approval in order to determine if flow fluctuations are displacing egg masses or tadpoles. SMUD would conduct visual surveys for the foothill yellow-legged frog in the Camino dam reach at any time between June and September when streamflows are 100 cfs or less and the flows fluctuate more than 40 cfs or more over 1 week's time. SMUD would record water velocities and discharge. If possible, SMUD would provide advance notice to the Agencies if such fluctuations are going to occur and conduct visual surveys before and after the fluctuations. These surveys could be discontinued if the Agencies determine that the flow fluctuations could occur without egg mass or tadpole displacement.

Proposed Article 1-5, *Monitoring Program*, would also require SMUD to develop a mountain yellow-legged frog monitoring plan in consultation with the Agencies within 2 years of license issuance. Protocol surveys for sensitive species, using the procedures of CDFG (2001), would be conducted in a subsample of appropriate habitat types to document the presence/absence and distribution of mountain yellow-legged frogs. Surveys would focus on the presence/absence of larval stages by periodically surveying reaches with known populations during the spring/summer. Rubicon reservoir, Rockbound Lake, and Buck Island reservoir would be monitored for the mountain yellow-legged frog during years 5, 10, 15, and every 10 years thereafter for the term of the license.

SMUD would also implement an *Adaptive Management Program* (Proposed Article 1-6) within 3 months of license issuance. The program would generally consists of: (a) implementation of a monitoring program; and (b) specific adaptive management measures that would be implemented if the Monitoring Program and other information indicate that the applicable resource objectives identified in the Rationale Report (CDFG, 2007) would likely not be met without adjustment of the initial conditions. For purposes of the Adaptive Management and Monitoring Programs, each year is a calendar year, January through December. Year 1 is the first year that all initial streamflows required by the license are implemented by May 1. Specific components of the Adaptive Management Program which are associated with special status amphibians and reptiles include: (1) cancellation of pulse and recreational streamflows in SFSC due to water temperature; (2) cancellation of recreational streamflows in SFAR due to water temperatures; (3) avoiding untimely spill events in the Slab Creek and Camino dam reaches; (4) cancellation of October recreational streamflows in the Slab Creek dam reach if monitoring determines there are unacceptable environmental effects; and (5) alteration of the water temperature used as the trigger for foothill yellow-legged frog breeding.

The Chili Bar Monitoring Program (Proposed Article 2-4, *Monitoring Program*) would require PG&E to consult and coordinate with SMUD and the Agencies to implement a monitoring program through the term of the new license. Within 1 year of license issuance, PG&E proposes to conduct protocol surveys for special status, sensitive (foothill yellow-legged frog and western pond turtle), and listed amphibians (California red-legged frog), to determine the presence and distribution of special status amphibians and reptiles and to evaluate the potential effects resulting from streamflow modifications. The other Chili Bar survey parameters would be the same as the protocol surveys described for the foothill yellow-legged frog, above. The survey area would be both banks of the entire reach downstream of Chili Bar dam (from CB-A15 to Ponderosa Campground). Monitoring would be conducted in years 2, 3, 5, 6, 10, 11, 15, 16, and 2 consecutive years during every five years for the term of the license. PG&E also proposes to implement an *Adaptive Management Program* (Proposed Article 2-5) which would implement the monitoring program and specific adaptive management measures if the monitoring program and other information indicate that resource objectives identified in the Rationale Report are not being met.

Our Analysis

Mountain yellow-legged frogs have not been found in the project-affected reaches or reservoirs despite suitable habitat, perhaps due to populations of predatory fishes and bullfrogs. However, mountain yellow-legged frogs may use project-affected reaches as migratory corridors. Monitoring would determine the presence/absence and distribution of foothill yellow-legged frogs, mountain yellow-legged frogs, and western pond turtles in project-affected reaches, and help identify potential migration/dispersal barriers. The proposed monitoring would also identify the potential effects of the proposed changes in minimum flows, operational spills, channel maintenance pulse flows, ramping rates, and the recreational streamflow releases on all foothill yellow-legged frog life stages.

Studies on the North Fork Feather River in northern California (GANDA, 2006) concluded that the river water temperatures must meet a strict temperature threshold before foothill yellow-legged frogs initiate breeding, and that the absolute flow level was not as important to the initiation of egg deposition as the location of the flow on the declining hydrograph. Researchers suspect that suitable water temperatures to initiate foothill yellow-legged frog breeding may be site-specific, and water temperatures that initiate breeding on one river cannot be extrapolated to another (Kupferberg, 2006). Monitoring in the stream margin habitats associated with known or suitable breeding sites in the Camino dam reach and the Slab Creek dam reach in years 1 to 5 would establish the mean water temperature trigger for foothill yellow-legged frog breeding in these reaches.

It is difficult to predict how higher minimum flows and lower water temperatures would influence the rate of tadpole development (Kupferberg, 2006). Although cool temperatures are required for foothill yellow-legged frog breeding, foothill yellow-legged frogs evolved in relatively low elevation systems with warm summer temperatures that facilitate the rapid maturation of young of the year. Cooler temperatures during the foothill yellow-legged frog rearing period may slow development of foothill yellow-legged frog eggs, tadpoles, and metamorphs to some unknown degree. Possible effects include increased risk of predation or displacement due to longer periods of immobility or low mobility. The water temperature monitoring data and the visual survey data would be used to determine how the proposed minimum flows would affect other foothill yellow-legged frog life stages.

If the foothill yellow-legged frog or mountain yellow-legged frog populations are negatively affected by changes in flows and ramping rates specified in a new license and subsequent water temperature changes, then monitoring could identify these factors and could provide a timely adaptive management mechanism(s). The adaptive management measures would be implemented as needed, based on monitoring and streamflow gaging results, to protect foothill yellow-legged frogs, mountain yellow-legged frogs, and other amphibians and reptiles from detrimental flow releases in the project-affected reaches.

To detect the effects of new license conditions on amphibian populations, lag times need to be incorporated into the design and interpretation of monitoring because the response of breeding populations may not be detected for years after the new discharge regimes have changed conditions for spawning and tadpole rearing (Kupferberg, 2006). This is a common problem because many amphibian species have greater than 2 years until sexual maturity. The proposed monitoring would provide an index of long-term changes in amphibian populations, following sufficient response time to streamflow modifications and other potential impacts.

As discussed previously, PG&E proposes changes in project operations, such as minimum flows and recreational flows which could affect special status reptiles and amphibians in the Chili Bar reach. Monitoring would determine the presence and distribution of these special status species throughout the term of the license. As a result, monitoring would identify the effects of changes in streamflow on various life stages of special status reptile or amphibian and allow changes to take place through the Adaptive Management Program. Because monitoring would occur for 2 years every 5 years, it would provide index of long-term changes in amphibian populations, following sufficient response time to streamflow modifications.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Monitoring and adaptive management requirements would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on foothill yellow-legged frogs, western pond turtles, and mountain yellow-legged frogs would be the same as those described under the Proposed Action.

Large Woody Debris

Large woody debris is a critical component of functional and productive aquatic ecosystems and creates habitat for amphibians and macroinvertebrates. The project reservoirs trap large woody debris and prevent downstream transport. Currently the large woody debris that accumulates in project reservoirs is stockpiled and burned.

In Proposed Articles 1-9 and 2-7, *Large Woody Debris*, SMUD and PG&E, respectively, propose to allow mobile instream large woody debris equal to or greater than both 20-centimeters wide by 12-meters long (~8 inches by 39.5 feet) to continue downstream of the dams, provided conditions are safe and there is reasonable access and working conditions to do so. Smaller sizes may also be moved but SMUD would not be required to do so.

In Proposed Article 1-24, *Recreation Streamflows*, SMUD proposes, in cooperation with the Forest Service, CDFG, and the Consultation Group, to identify all the large woody debris that is considered hazardous to boaters. The large woody debris would be relocated within the channel, with the Forest Service approval.

Our Analysis

The measures to pass large woody debris downstream of the dams would benefit foothill yellow-legged frogs and other amphibians and reptiles by providing substrate for macroinvertebrates, trapping organic material and sediment, creating pools, and slowing water velocity during peakflows.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. Large woody debris management would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on foothill yellow-legged frogs and other amphibians would be the same as those described under the Proposed Action.

Secondary Effects of Wildlife and Plant Protection Measures

Project-related construction, operations, and maintenance activities that occur in riparian and aquatic habitats or migratory corridors may directly or indirectly affect foothill yellow-legged frogs and mountain yellow-legged frogs. The following measures to protect wildlife in Proposed Article 1-12, *Wildlife and Plant Protection Measures*, are applicable to foothill yellow-legged frogs and other Forest Service Region 5 sensitive amphibians in project-affected areas.

SMUD would complete a biological evaluation, including any necessary surveys, prior to new construction or maintenance authorized by the license on National Forest System lands that may affect a Forest Service sensitive plant or wildlife species or its habitat. SMUD would include the Forest Service recommendations and any mitigation measures for the protection of sensitive species and/or their habitats in the biological evaluation.

If occurrences of Forest Service sensitive plant or wildlife species are detected prior to or during on-going construction, operation, or maintenance of the project or during project operations, the licensee(s) would immediately notify the Forest Service and FWS. If the Forest Service determines that the project-related activities are adversely affecting the sensitive species, SMUD would, in consultation with the Forest Service and FWS, develop and implement appropriate protection measures.

Our Analysis

The wildlife protective measures in Proposed Article 1-12 and 2-9, *Wildlife and Plant Protection Measures*, would protect foothill yellow-legged frogs and other Forest Service sensitive amphibians from project construction, operation, and maintenance activities that occur on National Forest System lands and have the potential to affect individuals, populations, and/or their habitats. Biological evaluations, surveys, and mitigations to protect these species would be developed in consultation with the FWS.

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. The wildlife protection measures would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on foothill yellow-legged frogs and other amphibians would be the same as those described under the Proposed Action.

Secondary Effects of Recreational Measures

Project facilities and modifications proposed for recreational resources have the potential to affect terrestrial resources. Construction, expansion, and improvement of recreational facilities could result in the disturbance and loss of vegetation. Recreational fish stocking may increase the abundance and distribution of foothill yellow-legged frog and mountain yellow-legged frog predators.

The applicants both propose recreational enhancements, as specified in Proposed Articles 1-19, *Specific Recreation Measures* and 2-13, *BLM Recreation Improvements*. The specific recreational measures are described in greater detail in section 3.3.6, *Recreation Resources*. Specific measures proposed by SMUD that would result in vegetation disturbance include: (1) improvement or relocation of an existing trail on the west shoreline of Buck Island reservoir; (2) reconstruction or relocation of two trails in the high country near Rubicon development; (3) expansion of the Northshore Recreational Vehicle campground in the Loon Lake development; (4) construction of a new campground on the south shore of Loon Lake; (5) hardening an additional area of the Airport Flat campground within the Gerle Creek reservoir area; (6) extension of the Angel Creek trail within the Gerle Creek reservoir area; (7) additional parking area near the Azalea Cove campground within the Union Valley reservoir area; (8) expansion the West Point campground within the Union Valley reservoir area; (9) completion the Union Valley bike trail; (10) construction of access trails from North Union Valley Road; (11) construction of access trails from Icehouse Reservoir Lakeshore Road; (12) construction and development of the Highland Point day use area within the Ice House reservoir area; (13) construction and development of the Upper Silver Creek Ice House day use area; (14) extension of the Ice House Mountain bike trail; (15) construction of boat launch sites at Slab Creek reservoir at Forebay Road; and, (16) construction of boat launch sites near the Slab Creek dam.

Under Proposed Article 1-26, *Fish Stocking*, SMUD would match the amount of fish stocked by CDFG, up to a total of 50,000 pounds for either CDFG or SMUD, of fish per year. SMUD would provide a minimum of 25,000 pounds of fish per year. The stocked fish would be distributed in Loon Lake, Union Valley, and Ice House reservoirs, as directed by CDFG.

Specific measures proposed by PG&E which would result in vegetation disturbance includes a gravel parking area off of Rock Creek Road and a new trail from the parking area to Chili Bar reservoir.

Our Analysis

Construction and improvements on new and existing recreational areas would cause the loss of some vegetation and wildlife habitat and create conditions favorable for the spread of noxious weeds. The special status plant, wooly violet occurs in numerous places around Union Valley reservoir, including near campgrounds. Additionally, increased recreational use could potentially increase human disturbance to wildlife. One of the goals of the proposed recreational improvements, however, would be to minimized dispersed recreation, which can affect vegetation and wildlife susceptible to human disturbance such as California spotted owl and nesting waterfowl. The loss of large areas of vegetation would likely have minor effects on wildlife from loss of habitat and displacement. The vegetation lost at the remaining areas is minimal and would be unlikely to affect wildlife. The proposed wildlife and plant protection measures and the noxious weed and vegetation management plans, discussed above, would limit potential effects of recreational improvements on special status species and the spread of noxious weeds. Recreational fish stocking may adversely affect mountain yellow-legged frogs in Loon Lake (elevation 6,410 feet). Union Valley and Ice House reservoirs are probably too low in the watershed for fish stocking to affect mountain yellow-legged frogs (5,450-foot and 4,870-foot elevation, respectively). Fish stocking may also adversely affect foothill yellow-legged frogs in the reaches downstream of these reservoirs, particularly Ice House dam reach, due to escapement.

The expansion of recreational facilities at the Chili Bar project would result in the loss of some vegetation and wildlife habitat and create conditions favorable for the spread of noxious weeds. The vegetation lost would be minimal and would be unlikely to affect wildlife. The proposed wildlife and plant protection measures and the noxious weed and vegetation management plans, discussed above, would limit potential effects of recreational improvements on special status species and the spread of noxious weeds. Fish stocking is not proposed for the Chili Bar dam reach.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be built. Because no recreational developments are planned for Iowa Hill, the effects would be the same as for the Proposed Action.

Bald Eagle

The state endangered bald eagle currently nests at Loon Lake and Union Valley reservoirs. In addition to nesting bald eagles at Union Valley and Loon Lake reservoirs, wintering bald eagles can be found throughout the UARP area. No nesting or wintering bald eagles were observed during relicensing surveys within the Chili Bar Project boundary or the Iowa Hill development. Project operations, maintenance, and recreation all have the potential to disturb nesting bald eagles, decreasing their productivity. Additionally, electrocution or collisions with project transmission lines could injure or kill bald eagles.

SMUD proposes, as specified in Proposed Article 1-5, *Monitoring Program*, to develop and implement a bald eagle monitoring plan within 6 months of license issuance in consultation with the Agencies. The plan would require SMUD to continue to monitor bald eagle nest sites in coordination with the Forest Service and FWS to ensure that bald eagle nesting is not being affected by project-related activities. Additionally, SMUD proposes, as specified in 1-12, *Wildlife and Plant Protection Measures,* to develop an Avian Protection Plan within 1 year of license issuance, approved by FWS, that addresses retrofitting the problem project transmission lines, to meet the design and siting standards established by APLIC standards for avoidance or minimization of bird electrocutions and collisions (APLIC, 1996, 1994).

Our Analysis

Bald eagles are sensitive to a variety of human activities, especially during the nesting season. If bald eagles are disturbed during nesting or foraging, they have to expend additional energy and time being flushed from their nest or locating a different foraging area. If the disturbance is great enough, bald eagles may abandon their nests, reducing the productivity of that nest territory. Project activities that could disturb bald eagles include helicopter flights for inspection and maintenance and project recreation, such as boating, fishing, hiking, camping, etc. Each individual nesting bald eagle pair has a different sensitivity to disturbance, based on such factors as acclimation and nest tree screening.

SMUD uses helicopters to access remote locations, primarily at the Loon Lake, Rubicon, and Buck Island reservoirs, although SMUD may occasionally fly over the Union Valley reservoir. The Loon Lake bald eagle nest was first observed in 2003. Prior to confirmation of bald eagle nesting, helicopter flights often flew near this location; however, since then SMUD observes a 0.5-mile buffer around the nest site. As long as 0.5-mile helicopter flight buffers are maintained around all nest sites, it is unlikely helicopter flights would adversely affect the bald eagle.

Extensive recreational facilities are located on Union Valley reservoir, including 11 campgrounds, three public boat launching ramps, and a paved bike/pedestrian path along the east side of the reservoir that passes directly through the nest area at Granlees Point. The Forest Service also manages a number of recreational facilities at Loon Lake reservoir, including developed and undeveloped campgrounds, boat launches, day use facilities, OHV areas, and numerous hiking trails including the Rubicon hiking trail that passes within 100 meters of the nest tree used in 2004. Several reconstructed, expanded, or new recreational facilities are proposed for both Union Valley and Loon Lake reservoirs (see section 3.3.6, *Recreation Resources*), including: (1) expansion of the Northshore Recreational Vehicle campground in the Loon Lake development; (2) construction of a new campground on the south shore of Loon Lake; (3) additional parking area near the Azalea Cove campground within the Union Valley reservoir area; (4) expansion the West Point campground within the Union Valley reservoir area; (5) completion the Union Valley bike trail; and (6) construction of access trails from North Union Valley Road.

Between 1986 and 2005, the Union Valley bald eagle nest territory produced 0.61 young/active breeding pair, which is below the Pacific Bald Eagle Recovery Plan (FWS, 1986) goal of 1 young/active breeding pair. Successful hatching was only observed in 2004 at the Loon Lake nesting territory; however, both bald eagle hatchlings died when they fell from the nest. The Bald Eagle and Osprey Technical Report (DTA, 2004f) suggests that late spring storms with unseasonable freezing temperatures and precipitation alternating between rain and snow during nesting season is the cause of the low productivity. Although it is likely the nesting bald eagles are accustomed to the current level of recreation at Union Valley and Loon Lake reservoirs, the Proposed Action would increase recreational facilities and therefore use. Although most project recreation occurs during summer months, winter recreation also occurs with camping, cross-country skiing, snowshoeing, and snowmobiling.

Electrocution and/or collision with project transmission lines also can adversely affect bald eagles. As discussed in section 3.3.4.2, *Terrestrial Resources*, the Bird-Powerline Associations Technical Report (DTA, 2004c) identified three transmission lines that do not met the design and siting standards for avoidance or minimization of bird electrocutions and collisions (APLIC, 1996, 1994): (1) the Jones Fork-Union Valley 69-kV line; (2) the Brush Creek 12-kV tap line; and (3) high-elevation segments of the transmission line from Loon Lake powerhouse to just west of Camino powerhouse, including the Jones Fork-Union Valley transmission line segment, and an isolated segment near White Rock powerhouse that have overhead groundwires. The risk of bird electrocution increases when transmission lines do not have adequate spacing between conductors or the lines and the ground. This is especially true for highly susceptible raptors with large wing spans, like the bald eagle. Additionally, bald eagles are at risk for collision with transmission lines with overhead groundwires because their small size makes them less visible to birds. The proposed measure to prepare an avian protection plan would address retrofitting transmission lines to have them meet the APLIC standards. Once all transmission lines meet these standards, the potential for avian electrocution or collision would be minimized.

SMUD's proposal to continue to monitor bald eagle nest sites in coordination with the Forest Service and FWS would allow nest productivity numbers to be assessed to determine if project recreation is adversely affecting bald eagle fledging success. If monitoring shows project activities are adversely affecting bald eagles, the adaptive management program proposed in Proposed Article 1-6, *Adaptive Management Program*, would allow project activities to be changed. The monitoring, combined with making the 0.5-mile helicopter nest buffer official, would minimize adverse effects on bald eagles; however, in all, the UARP would be likely to adversely affect bald eagles.

Bald eagles are not known to occur in the vicinity of the Chili Bar Project. Therefore, the Chili Bar Project would not affect bald eagles.

Habitat Loss and Temporary Disturbance

The habitat within and adjacent to the proposed Iowa Hill development contains habitat for a number of plant and wildlife species, including species such as mule deer, California spotted owls, and myotis bats. Construction of the proposed development would clear approximately 141.5 acres of land. The loss of this habitat, as well as temporary disturbance during construction, could affect wildlife.

SMUD proposes to mitigate for the loss of wildlife habitat, as specified in Proposed Article 1-41, *Terrestrial Resources*, by purchasing lands prior to construction with an equivalent habitat value (or a conservation easement for an equivalent habitat value) to be managed as wildlife habitat over the term of the license. The Forest Service, FWS, and CDFG would determine the in-kind value of lands proposed to be purchased or obtained.

Our Analysis

Iowa Hill Development

Construction of the Iowa Hill development would require the clearing of approximately 141.5 acres of land, including approximately 95.4 acres for the upper reservoir, berm, and switchyard, 22.3 acres for the transmission line, 3.4 acres for the new road, and 20.4 acres of temporary use areas. The upper reservoir, berm, and switchyard would result in the loss of upland mixed-conifer forest and the transmission line would result in the conversion of mixed conifer forest to non-forested montane shrubland habitat. The temporary construction area would be revegetated. No riparian vegetation or wetlands would be affected by construction of the proposed development.

Special status species that would lose habitat as the result of Iowa Hill construction include the mule deer and California spotted owl. Construction of the Iowa Hill development would generally result in the loss of mule deer thermal cover, generally fair hiding cover, and localized areas of good quality forage habitat. However, construction of the proposed transmission line would eventually provide valuable foraging habitat and hiding cover for mule deer. The upper reservoir would cause some habitat fragmentation and hindrance to migrating mule deer. Additionally, during construction, noise and activity associated with site construction would temporarily cause mule deer to avoid the area surrounding construction. Suitable

California spotted owl habitat exists within the Iowa Hill development habitat; however, there are no known nests within the development boundary. Construction of the Iowa Hill development would result in the loss of potential foraging and nesting habitat and temporary avoidance of the area during construction due to noise and activity.

Additional species that would lose habitat include the northern goshawk and various bat species. No northern goshawks were located within the project during relicensing surveys and the closest Protected Activity Center is almost 1 mile away. The site does contain potential nesting and foraging habitat; however, which would be lost as a result of project construction. Although no special status bats were located during relicensing surveys, habitat is suitable for bats utilizing snags, tree bark and man-made structures as roosts. Tree-roosting bat species would lose foraging habitat, whereas open water foraging species may benefit from the creation of new habitat.

SMUD proposes to mitigate for the loss in habitat by purchasing or acquiring a conservation easement of equivalent habitat value and managing it as wildlife habitat. Although we concur with the proposed measure, we are unable to analyze whether or not the proposed measure would adequately mitigate for the lost habitat without knowing what land would be purchased, what habitat types it contains, or which wildlife management goals would be applied to the property. Once the property is purchased or obtained, we could assess its value at that time and ensure that appropriate wildlife management goals are met to mitigate for the loss of upland mixed-coniferous forest.

In addition to the proposed land purchase, SMUD proposes several other measures that would protect terrestrial resources during Iowa Hill construction. A measure contained within Proposed Article 1-12, *Wildlife and Plant Protection Measures*, discussed above, would require SMUD to conduct a biological evaluation, including necessary surveys prior to any new construction or maintenance on National Forest System lands. Conducting a biological evaluation and nest surveys prior to the proposed construction for rare species such as the California spotted owl and northern goshawk would ensure that breeding spotted owls or goshawks have not begun nesting in close proximity to the project. The standard Forest Service 4(e) condition no. 3-24 prescribes SMUD to prepare and implement an erosion control plan which includes a requirement to revegetate disturbed areas with native plants. Additionally, SMUD proposes an invasive weed and vegetation management plan which also would implement sediment and erosion control and revegetation efforts, all of which would minimize the effects of Iowa Hill construction on wildlife habitat.

3.3.4.3 Cumulative Effects

Private land development, public land use, and hydropower development have cumulatively affected foothill yellow-legged frogs and mountain yellow-legged frogs in the American River Basin due to construction of roads, multiple land use practices, facilities and operations, and other development that fragment breeding populations.

Flow releases to benefit coldwater fisheries during the summer and early fall, and project reservoirs may isolate foothill yellow-legged frog breeding populations. For example, it is likely that foothill yellow-legged frogs located in lower Slab Creek dam reach and lower Camino dam reach are reproductively isolated by coldwater water releases in upper Slab Creek dam reach and the Slab Creek reservoir (Kupferberg, 2006). The proposed minimum flow releases would not increase or decrease the current population fragmentation.

Previous management activities on National Forest System lands have reduced the amount and suitability of California spotted owl, northern goshawk, sensitive bat tree roosting, and Pacific fisher habitat in the Iowa Hill area. These include the Independence Cable Timber Sale, vegetation removal for the PG&E transmission line, and the Slab Creek Insect Salvage Sale. These Projects have reduced interior forest habitat and increased fragmentation of existing spotted owl, goshawk, and fisher habitat. These Projects have not substantially altered habitat availability for sensitive bat species, however, and, by increasing edge habitats may have improved foraging opportunities in some areas. Based on the Eldorado National Forest Schedule of Proposed Actions, there are no additional habitat altering activities currently being planned within or adjacent to the analysis area. Timber harvest on intermixed private timber lands within the area have contributed to a reduction of habitat. These effects, combined with the direct and indirect effects of the Iowa Hill development on up to 141 acres of habitat, would cumulatively reduce the ability of the area to support spotted owls, goshawks, and fisher, and would cumulatively affect the amount of foraging habitat available for owl site ED123. These effects also would cumulatively reduce the amount of bat roosting habitat available; however, as previously described, the presence of additional habitat edge and open water could improve foraging conditions for bats. Assuming that the project is unlikely to affect maternal roost sites for pallid bats or Townsend's big-eared bats, the project is unlikely to result in substantial cumulative effects on sensitive bat species.

3.3.4.4 Unavoidable Adverse Effects

The construction of the Iowa Hill development would result in the permanent alteration of 121.5 acres of wildlife habitat, of which 94.5 acres would be permanently lost to project facilities.

3.3.5 Threatened and Endangered Species

3.3.5.1 Affected Environment

Five plant and animal species federally listed as threatened or endangered could be affected by the proposed Projects. These include the endangered Pine Hill ceanothus (*Ceanothus roderickii*) and Pine Hill flannelbush (*Fremontodendron decumbens*) and the threatened Layne's butterweed (*Seneco layneae*), valley elderberry longhorn beetle

(*Desmocerus californicus dimorphus*), and California red-legged frog (*Rana aurora draytonii*).

Pine Hill Endemic Plants

The Pine Hill formation, located in the western-most part of the UARP area, occurs on a formation of gabbro soils which support a number of rare plants, including three federally listed plants: Pine Hill ceanothus, Pine Hill flannelbush, and Layne's butterweed. Two additional species, the endangered El Dorado bedstraw (*Galium californicum*) and Stebbin's morning glory (*Calystegia stebbinsii*) have the potential to occur within the Pine Hill formation; however, they were not located during special-status plant surveys conducted by SMUD, and therefore are assumed to not occur within the project boundary. A UARP transmission line crosses the Pine Hill Preserve, which comprises the Pine Hill and Penny Lane preserve units identified in the 2002 FWS recovery plan for gabbro soil endemics in the Central Sierra Nevada foothills.

Pine Hill ceanothus is a low-statured shrub that flowers during May–June. It is restricted to chaparral in open rocky areas on gabbroic soils of the Pine Hill formation. Potential habitat in the UARP area totals approximately 247.5 acres. It occurs primarily as a low shrub layer underneath taller native chaparral vegetation, but dense, tall stands of older chaparral appear to be less suitable for the species. Pine Hill ceanothus also occurs at the edges of road corridors and other periodically disturbed areas, including the middle of infrequently used transmission line access roads, and under transmission towers. However, it does not appear to tolerate frequently recurring or severe disturbance (e.g., OHV use or development). All known occurrences are within the bounds of the Pine Hill formation of El Dorado County; they are distributed among the northern, central, and southern parts of the formation.

SMUD conducted a detailed study of special-status plants within the project boundary, including comprehensive field surveys during 2003 along the UARP transmission line near the Pine Hill Preserve. Survey methods followed California Native Plant Society guidelines for rare plant surveys. The UARP transmission line corridor runs approximately northeast-southwest, traversing private lands proposed for inclusion in the Pine Hill and Penny Lane units of the Pine Hill Preserve, but not currently protected. One large occurrence of Pine Hill ceanothus, consisting of thousands of stems, was located in the transmission line corridor within and near the proposed Pine Hill Unit. The plants form a vigorous understory in sparse to dense chaparral within the transmission line corridor, and also occur near roads and in clearings, including those created for transmission towers and associated vehicular access. Because Pine Hill ceanothus is a multi-stemmed plant and roots at the nodes (a form of asexual reproduction), it is unclear how many individual plants are present in this occurrence.

Pine Hill flannelbush is a perennial shrub that flowers from late April to early July. It is restricted to gabbroic soils of the Pine Hill formation in El Dorado County, California. It occurs in chaparral and cismontane woodland communities at elevations ranging from approximately 1,400 to 2,500 feet. Potential habitat identified in the UARP area totals approximately 247.5 acres. Of these, less than 1 acre is currently occupied by Pine Hill flannelbush. It most often occurs at the edges of road corridors or other periodically disturbed areas.

The special-status plant surveys located four populations of Pine Hill flannelbush within the Pine Hill Unit; these populations appear to be comprised of fewer than 15 plants, although the number of genetically distinct plants was unclear because the species often reproduces asexually. The plants were clustered near roads or in clearings, including clearings created for transmission line towers and access roads, and the occurrences had not been previously reported in the California Natural Diversity DataBase.

Layne's butterweed is a perennial herb that flowers from April to July. It occurs in chaparral in open rocky areas on gabbroic soils, including disturbed areas, or less frequently on serpentine. Potential habitat identified in the UARP area totals approximately 247.5 acres. The species most often occurs at the edges of road corridors or other periodically disturbed areas, although it does not tolerate frequently recurring or severe disturbance (e.g., OHV use or development). Most known occurrences occur within and adjacent to the Pine Hill formation of El Dorado County; there are occurrences in the northern, central, and southern parts of the formation. There are also a small number of records from elsewhere in El Dorado County, Tuolumne County, and Yuba County. Known occurrences range in elevation from approximately 650 to 3,300 feet and primarily occur on privately owned lands.

The special-status plant surveys located two large, diffuse occurrences of Layne's butterweed within the transmission line corridor, estimated to support several hundred to several thousand plants. The plants were clustered near roads and clearings, including those created for transmission towers and associated access roads.

Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle habitat consists of elderberry thickets located in riparian woodlands, oak woodlands, or grasslands within the Central Valley watershed below 3,000 feet elevation. Adult valley elderberry longhorn beetles deposit their eggs in the bark of living elderberry plants and larvae bore into the pith of stems. The beetles' use of elderberries is not readily apparent; often the only exterior evidence is an exit-hole created by the larva just prior to pupation. A variety of branch sizes are used for larval development and pupation; although, stems 2-4 inches in diameter at the exit hole have been reported to be used most often. Infrequently, exit holes have been found in smaller branches less than 1.5 inches in diameter, but generally not in branches less than 1.0 inch in diameter. Thus, larvae appear to be distributed primarily in large, mature plants with stems greater than 1.0 inch in diameter near ground level.

SMUD conducted searches for elderberry plants (not valley elderberry longhorn beetle presence or exit holes) in the project area via helicopter, automobiles, and on foot and included all areas where SMUD had legal access (e.g., ownership/easement rights, public lands) within 100 feet (as per FWS protocols for buffer zones) of project features below 3,000 feet elevation where valley elderberry longhorn beetles could be directly or indirectly affected by project construction (e.g., facility development or expansion, road construction), operation (e.g., recreational developments), and maintenance (e.g., vegetation clearing). The search area along the transmission line corridor included the area within approximately 200 feet of the transmission line centerline (i.e., 400-foot total width; this includes the 200-foot defined right-of-way plus the 100-foot-wide buffer on each side of the right-of-way). Elderberry shrubs or clumps were located at eight sites within the 400-foot-wide search area along the project transmission line corridor during 2002 and 2003 surveys. Plants found at these locations were located directly beneath the transmission line or immediately adjacent to the line, and in one location a large plant was growing entirely within the steel lattice cage of the support tower.

With the exception of the plants found along the UARP transmission line corridor, no elderberry plants were found adjacent to existing project facilities (i.e., dams, powerhouses, switchyards, appurtenant facilities) below 3,000 feet. Similarly, no elderberry plants were found at the site of the proposed Iowa Hill development or within the Chili Bar project boundary. Stream reaches below UARP facilities were not included in the study area because elderberry plants growing along foothill streams generally occur above the high water mark unlike willow and cottonwood. As a result, elderberry plants that support the valley elderberry longhorn beetle are not likely to occur in stream fluctuation zones.

California Red-legged Frog

The historical range of the California red-legged frog extended through Pacific slope drainages from at least as far north as Sonoma County, California along the coast (possibly as far north as Mendocino County, if analyses by Shaffer et al. 2004 are valid) and inland from the vicinity of Redding, Shasta County south to Baja California, Mexico, including the Coast Range, Transverse Ranges, Central Valley, and west slope of the Sierra Nevada Range. Nearly all occurrences were at elevations below 3,500 feet. Biologists estimate that the California red-legged frog has been extirpated from at least 70 percent of its historical range, including an estimated 99 percent of known occurrences in the western foothills of the Sierra Nevada. Most of the known remaining populations are located in coastal counties from Ventura County north. In the Sierra Nevada foothills, very few populations are known to be extant, but there are recent records from each of the following counties: El Dorado, Placer, Nevada, Yuba, and Butte.

The California red-legged frog lays eggs from late November to late April in quiet water of stream pools, backwaters, ponds, and marshes. Emergent vegetation (often cattails or bulrushes) serves as attachment sites or braces for the egg masses. Larvae remain in these aquatic habitats until metamorphosis, which typically occurs between July and September, although over-wintering larvae have been found at some sites. The California red-legged frog requires still or slow-moving water for breeding and tends to remain in proximity (within 200 feet) of aquatic habitats except when dispersing. Occupied sites typically have dense riparian or shoreline vegetation, presumably because these are good foraging habitats and afford hiding cover from predators. The types of vegetation that seem to provide the most suitable structure are willows, cattails, and bulrushes. Hiding cover may also be afforded by partially submerged woody debris and undercut banks. Occupied sites also usually include areas of deep water (greater than 2.3 feet) and generally do not support populations of introduced fishes (such as sunfish, bass, or trout) or bullfrogs.

Seasonal dispersal of the California red-legged frog may occur upstream, downstream, or upslope of breeding habitats. Seasonal movements as far as 1 mile between aquatic habitats have been documented, and California red-legged frogs have been found in streams more than 2 miles from any possible breeding site. At various times, including during summer drought, frogs may use perennial seeps, springs, or deep pools in intermittent streams when other aquatic habitat are dry, or may seek shelter in existing burrows or the cracks at the bottoms of dry pools.

SMUD, in collaboration with PG&E, conducted a detailed study identifying potential California red-legged frog habitat within 1 mile of the proposed Projects' reservoirs and reaches, up to 5,000 feet in elevation. Potential habitat was initially identified at 12 sites (see table 3-59); however, field examinations further refined the areas of potential habitat. Following the potential habitat identification, Stillwater Sciences conducted protocol-level visual encounter surveys in areas identified as high or moderate habitat quality. No California red-legged frogs were located during these surveys within either the UARP or Chili Bar Project area; however, two areas of potential habitat were not surveyed due to lack of access.

Table 3-59. Description of sites and survey results at sites with potential habitat for California red-legged frog.

Site Location	Elevation (ft)	Number of VES Site Visits[a]	Original Suitability Rating[b]	Site Characteristics	Conclusions
UARP					
GC-8: SF Rubicon River	4,987	5 (3 day, 2 night)	High	Mainly pool with some low-gradient riffle and a minimal amount of run/glide. Boulder substrate with some silt, cobble, sand, gravel and bedrock. Ample margin vegetation and a large amount of aquatic and terrestrial cover.	No frogs of any species were found.
UV-1: Jones Fork Silver Creek	4,902	5 (3 day, 2 night)	High	Mainly run/glide with some pool. Sand substrate with small amounts of gravel. Several side/split channels, multiple lateral/point sand bars, and a small tributary that entered on the left bank near the top of the site. Margin vegetation (mostly grasses) in a majority of the reach	No frogs of any species were found.
UV-2: Big Silver Creek at Ice House Road	4,919	None	Moderate	Some side channel pool habitat. Large boulders in channel. Water velocity high near margins of channel	Site exhibited less habitat complexity than UV-1, and water velocity was unfavorably high.
UV-3: Tells Creek downstream of Ice House Road	5,065	None	High	Step-pool, moderate to high gradient morphology. Large boulders, some backwater pools. Downed wood	Lower suitability then UV-1
SC-3: SFAR at Mosquito Road Bridge	1,352	None	Moderate	Large substrates, shallow pools. High Gradient. Little vegetation along margin of channel	Site exhibits lower suitability than expected because of high stream gradient and limited vegetation cover.

Site Location	Elevation (ft)	Number of VES Site Visits[a]	Original Suitability Rating[b]	Site Characteristics	Conclusions
Chili Bar					
CB-2: Weber Creek	522	4 (2 day, 2 night)	Moderate	Perennial creek. Primarily pool and low-gradient riffle. The substrate was mainly bedrock, boulder and cobble. Abundant margin vegetation, grasses and overhanging vegetation. Aquatic vegetation (especially algae) was very thick in some parts.	California red-legged frogs not found. Bullfrogs abundant.
CB-4.1: Stock Ponds (A)	900	4 (2 day, 2 night)	Moderate	The larger of the two ponds, substrate is primarily silt with some sand. Some margin vegetation and grasses, some overhanging vegetation. Maximum water depth is 15 feet; water is very turbid and discolored.	California red-legged frogs not found. Bullfrogs present.
CB-4.2: Stock Ponds (B)	900	4(2 day, 2 night)	Moderate	The smaller of the two ponds. Substrate is predominantly silt with some sand. Abundant margin vegetation, mostly forbs, some emergent and submerged vegetation, ample aquatic vegetation and large woody debris. Shallower than Pond A.	California red-legged frogs not found. Bullfrogs present.
CB-7B: Hastings Creek	650	5 (3 day, 2 night)	Moderate	Small, perennial creek with split channels. Primarily run/glide with some low gradient riffle and pool. Substrates are mainly cobble and gravel. Margin grasses and forbs present in all of reach, ample willow and alder canopying stream.	California red-legged frogs not found. Bullfrogs present.

Site Location	Elevation (ft)	Number of VES Site Visits[a]	Original Suitability Rating[b]	Site Characteristics	Conclusions
CB-8B Greenwood Creek	672	5 (3 day, 2 night)	Low	Small, perennial creek with split channels. Mainly pool, run/glide and low-gradient riffle. Substrates are mainly cobble, gravel, and boulder. Margin vegetation, terrestrial cover, and overhanging vegetation are prominent. Willow and grasses appear dominant.	California red-legged frogs not found. Bullfrogs present.
CB11: Stock Ponds	824	None	Moderate	Stock ponds with emergent vegetation around the edges.	VES were planned but access was not granted.
CB13: Five Stock Ponds	832	None	Moderate	Stock ponds with emergent vegetation (cattails) around the edges.	The site is on private property and was not accessible.

[a] Visual encounter survey.

[b] Original habitat suitability rating of stream sites also reflected suitability for other target species: the foothill yellow-legged frog and/or mountain yellow-legged frog.

3.3.5.2 Environmental Effects

Pine Hill Endemic Plants

SMUD proposes, as specified in Proposed Article 1-12, *Wildlife and Plant Protection Measures*, to not undertake maintenance under transmission lines within the Pine Hill Rare Plant Preserve until consultation with the BLM, FWS, and CDFG has been completed. Additionally, they propose to ensure a biological assessment is prepared prior to beginning any activities to construct, operate, or maintain, the UARP that may affect a species proposed for listing or listed under the federal ESA or its critical habitat to evaluate potential effects of the action on the species or its habitat, in consultation with the appropriate federal agency.

Our Analysis

The Pine Hill Preserve contains a high concentration of rare plant species because of the serpentine and/or gabbro soil formations. Three of these species, Pine Hill ceanothus, Pine Hill flannelbush, and Layne’s ragwort are federally listed species. Project transmission lines cross through sections of the Pine Hill Preserve. SMUD maintenance on project transmission line right-of-ways includes vehicle use to access towers on existing roads, mechanical removal of trees, and other vegetation clearing for fire control and to facilitate access. Vegetation clearing could result in the direct loss of the listed plants. Additionally, transmission line right-of-way maintenance that facilitates access to the right-of-way could increase noxious weed dispersal within the rare plant habitat by providing a vector. Noxious weeds could outcompete the rare plants, decreasing their available habitat. All three of the federally listed species located within the Pine Hill Preserve, however, are currently found in open habitats such as transmission lines and road clearings within the UARP area. Transmission line right-of-way maintenance maintains this habitat, which could be beneficial to the three plant species.

Because transmission line right-of-way maintenance includes occasional disturbance to vegetation and soils, the proposed measure to consult with the BLM, FWS, and CDFG prior to conducting maintenance activities within the Pine Hill Preserve would ensure that the locations and methods of maintenance are designed to minimize effects to rare plant species. Additionally, SMUD proposes vegetation and invasive weed management plans, in Proposed Article 1-13, *Vegetation and Invasive Weed Management* Plan, which are described in detail in section 3.3.4.2, *Vegetation and Invasive Weed Management*. The invasive weed management plan would attempt to control current populations of noxious weeds and prevent future populations from being established. The vegetation management plan would address transmission line right-of-way-clearing. Although SMUD's proposal only includes Forest Service land influenced by project activities, as discussed in section 3.3.4, *Terrestrial Resources*, expanding this plan to cover all land within the project boundary affected by project activities would be appropriate. As a result, this plan would protect the Pine Hill endemic plants from noxious weed infestation. The consultation proposed in Proposed Article 1-12, *Wildlife and Plant Protection Measures*, would establish agency-approved maintenance activities to maintain the preferred habitat minimizing effects on the federally listed plants. Although the Proposed Action would minimize possible effects on these species, maintenance activities could still result in the occasional loss of individual plants. As such, the UARP is likely to adversely affect the Pine Hill ceanothus, Pine Hill flannelbush, and Layne's ragwort.

The Chili Bar Project would have no effect on the Pine Hill endemic plants because they do not occur within the project boundary.

UARP-Only Alternative

Because these species are endemic to the Pine Hill Preserve area which, is outside the Iowa Hill development area, relicensing the project without the Iowa Hill development would have the same effect on Pine Hill endemic plants as discussed for the Proposed Action.

Valley Elderberry Longhorn Beetle

The federally threatened valley elderberry longhorn beetle's host plant, elderberry, is found within the UARP transmission line. If the valley elderberry longhorn beetle occurs within these shrubs, it could be affected by right-of-way maintenance. SMUD does not proposed any measures specifically designed for the valley elderberry longhorn beetle; however, it does propose, as specified in Proposed Article 1-12, *Wildlife and Plant Protection Measures,* to ensure a biological assessment is prepared prior to beginning any activities to construct, operate, or maintain, the UARP that may affect a species proposed for listing or listed under the federal ESA or its critical habitat to evaluate potential effects of the action on the species or its habitat, in consultation with the appropriate federal agency.

Our Analysis

SMUD observed elderberry, the host species for the valley elderberry longhorn beetle, at 8 locations during 2002-2003 surveys within the UARP area (DTA, 2004e), all either directly underneath or immediately adjacent to the UARP transmission line. Although full protocol valley elderberry longhorn beetle surveys were not conducted, UARP assumed that the elderberry shrubs found within the project boundary are occupied by valley elderberry longhorn beetles. Maintenance activities on the UARP transmission line and its right-of-way include tree and vegetation clearing, facility inspections, facility replacement, and access road maintenance. All of these activities could potentially result in disturbance to elderberry bushes within the right-of-way, and, therefore, the valley elderberry longhorn beetle. Vegetation management typically does not need to clear low-growing trees or shrubs if they are not a safety hazard to the line.

As part of their draft biological assessment, SMUD proposed to comply with FWS's Valley Elderberry Longhorn Beetle Conservation Guidelines (FWS, 1999), prior to conducting any ground or vegetation disturbing activities within the proposed project boundary. These guidelines call for protocol level surveys of the area to be disturbed for the presence of the valley elderberry longhorn beetle and its elderberry host plant, protection measures such as fencing and otherwise identifying elderberry plants, and compensation requirements for elderberry plants with one or more stems measuring 1.0 inch or greater in diameter at ground level that may be directly or indirectly affected. Additionally they proposed to provide annual employee environmental awareness program workshops to educate employees and key personnel about the known locations of special status species and habitats. Although these measures were not included in the Proposed Action, implementing them as part of the vegetation management plan proposed in Proposed Article 1-13, *Vegetation and Invasive Weed Management Plan*, would effectively protect elderberry shrubs and any valley elderberry longhorn beetles located within them within the project boundary from any transmission line maintenance activities by clearly delineating them as areas to be excluded from maintenance. Additionally, valley elderberry longhorn beetle surveys prior to vegetation disturbing activities that comply with the conservation guidelines would further protect the valley elderberry longhorn beetle. Even with implementation of the compliance with conservation guidelines and employee training, adverse effects could still occur. Therefore, the UARP would be likely to adversely affect the valley elderberry longhorn beetle.

The Chili Bar Project would have no effect on the valley elderberry longhorn beetle because elderberry shrubs do not occur within the project boundary.

UARP-Only Alternative

Because no elderberry plants are found in the Iowa Hill development area, relicensing the project without the Iowa Hill development would have the same effect on valley elderberry longhorn beetles as discussed for the Proposed Action.

California Red-legged Frog

The Proposed Actions that would affect the foothill yellow-legged frog and the mountain yellow-legged frog described in section 3.3.4.2, *Terrestrial Resources,* also have the potential to affect the California red-legged frog.

Our Analysis

A recovery plan for the California red-legged frog was issued by FWS in 2002. Eight recovery units and core areas in the recovery units were identified for focused recovery actions. The Action Area is within the largest recovery unit, the Sierra Nevada Foothills and Central Valley Recovery Unit, and is between two core areas: Cosumnes River to the south, and Traverse Creek/Middle Fork American River/Rubicon River to the north. FWS designated critical habitat on April 13, 2006. The nearest designated critical habitat is located at Spivey Pond, south of Highway 50, in El Dorado County approximately 3.5 miles from the nearest project facility.

Much of the project area is located at elevations above that which is typical for the California red-legged frog and probably not within the historical range of the species. At lower elevations suitable habitat exists, but is limited in extent and is almost entirely associated with tributaries of project-affected stream reaches, not mainstem reaches, and stock ponds outside of the project boundary. None of the UARP reservoirs contain suitable habitat for the California red-legged frog.

The closest known extant occurrence is at Spivey Pond, southwest of the town of Pollock Pines, which is approximately 3.5 miles from the nearest project facility or affected stream reach, none of which contain suitable habitat for the California red-legged frog. Spivey Pond and other historical occurrences in the Weber Creek drainage are also separated from these project facilities and reaches by a highway (U.S. 50) and by urban and agricultural areas that may constitute barriers to California red-legged frog dispersal. South-north dispersal may also be unlikely because the SFAR lies within a relatively deep, steep-sided valley. The mainstem SFAR reach does not constitute suitable habitat for the California red-legged frog, although three tributaries of the reach might be suitable if bullfrogs were not present. Bullfrogs are also well established in stock ponds that were surveyed within the evaluation area.

The UARP transmission lines span Weber Creek more than 14 miles downstream of Spivey Pond. The towers for the lines are located high on the steep valley slopes on either side of the creek (more than 200 vertical feet above the creek). Therefore, the transmission line has no foreseeable effect on aquatic or riparian habitats along Weber Creek. Areas with extant, documented California red-legged frog occurrences north of the project on Skunk Canyon Creek, and Brushy Canyon Creek are located more than 25 miles from the action area where project operations have no effect on hydrology or habitats.

As previously discussed in section 3.3.4.2, predators such as bullfrogs have the potential to keep the California red-legged frog from becoming established. Flow regulation may benefit introduced predatory fishes and bullfrogs, by maintaining flow in areas that would otherwise dry up seasonally. The California red-legged frog is known to persist in areas where ponds or streams dry up seasonally by dispersing to springs or other sources of water, or by aestivating in burrows or in cracks at the bottom of dried pools. Minimum streamflows would ensure that naturally intermittent or ephemeral streams do not dry in summer and could thus benefit predatory species that are unable to survive dry periods (fish and bullfrogs). Predatory bass, crayfish, and bullfrogs were found in lower Slab Creek dam reach and are well established in off-channel stock ponds and tributaries in the Chili Bar Project area, downstream of UARP. The Slab Creek reach is unlikely to dry up even without regulated minimum flows and higher proposed minimum flows in the spring could potentially reduce bullfrog populations by washing the tadpoles downstream.

Although California red-legged frogs are not currently known to occur within the UARP boundary, if they do become established the proposed amphibian monitoring and adaptive management plans (see section 3.3.4.2) would minimize any potential adverse effects on California red-legged frogs, and a biological assessment would be required prior to any ground-disturbing activities that would potentially affect California red-legged frogs. Therefore, because the California red-legged frog is not known to occur within the project boundary, suitable habitat is limited, and monitoring and adaptive management would minimize any potential effects should it become established, we conclude that the UARP is not likely to adversely affect California red-legged frogs.

No California red-legged frogs were found within the Chili Bar Project area, including tributaries and side stock ponds, during relicensing surveys. The Chili Bar dam reach does not contain suitable for California red-legged frog breeding habitat. Bullfrogs, a California red-legged frog predator, were found to be abundant in potential California red-legged frog habitat (tributaries and stock ponds) during surveys. Flow regulation may benefit introduced predatory fishes and bullfrogs, by maintaining flow in areas that would otherwise dry up seasonally. The Chili Bar reach, however, is a relatively large reach that is unlikely to dry up even without regulated minimum flows and tributaries and stock ponds are not subject to project-regulated flows. Additionally bullfrogs are well established in off-channel stock ponds and in tributaries. Higher proposed minimum flows in the spring could potentially reduce bullfrog populations by washing the tadpoles downstream. Therefore, it is unlikely the proposed project would contribute to the proliferation of California red-legged frog predators.

Although California red-legged frogs are not currently known to occur within the Chili Bar Project boundary, if they do become established the proposed amphibian monitoring and adaptive management plans (see section 3.3.4.2) would minimize any potential adverse effects on California red-legged frogs and a biological assessment would be required prior to any ground disturbing activities that would potentially affect California red-legged frogs. Therefore, because the California red-legged frog is not known to occur within the project boundary, suitable habitat is limited, and monitoring and adaptive management would minimize any potential effects should it become established, the Proposed Action is not likely to adversely affect the California red-legged frog.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed or operated. The Settlement Agreement Articles and other measures that would potentially affect California red-legged frogs would remain unchanged from those described in the Proposed Action. As a result, effects of the UARP-only Alternative on the California red-legged frog would be the same as those described under the Proposed Action.

3.3.5.3 Cumulative Effects

Private land development, public land use, and hydropower development have cumulatively affected the California red-legged frog in the American River Basin due to roading, multiple land use practices, facilities and operations, and other development that fragment breeding populations.

Flow releases to benefit coldwater fisheries during the summer and early fall, and project reservoirs may isolate California red-legged frog breeding populations. The proposed minimum flow releases would not increase or decrease the current population fragmentation.

3.3.5.4 Unavoidable Adverse Effects

None.

3.3.6 Recreational Resources

3.3.6.1 Affected Environment

Regional Setting

Recreational resources in the region provide for a full range of activities, from tourist-based recreation associated with the historical mining towns in the region, to rural and wilderness activities, such as hiking, fishing and boating. The primary recreational sites in the American River drainage include the Forest Service lands, the towns of Coloma and Placerville, and Folsom Lake.

The numerous lakes and reservoirs in the eastern part of the region, which includes the project reservoirs, provide a variety of recreational opportunities and varying levels of developed facilities for camping and day-use activities. Paved roads and boat launches at the larger water bodies in the area provide opportunities for motorized boating use. Off-highway vehicle (OHV) use is also popular in the region. There are 12 designated routes or areas for OHV use in the region, most of which are on National Forest System lands or state lands.

Whitewater recreation is another popular recreational activity in the region. Within the American and Rubicon river drainages alone, there are at least 20 whitewater boating runs, most of which are rated class IV and V and provide high quality whitewater recreational opportunities in the spring. The most important whitewater recreation resource in the region occurs on the 19.1-mile reach of the SFAR downstream of the Chili Bar dam. This section of river is the most popular whitewater recreational run in California, with approximately 3,000 to 4,000 visitors per day on summer weekends.

Recreational Resources within the Projects' Boundaries

Recreation at the Projects can be separated into three geographic areas: High Country, Crystal Basin, and Canyonlands. The High Country consists of the area north and east of Loon Lake reservoir. The Crystal Basin includes the area bounded by Loon Lake reservoir on the north to Highway 50 on the south, and Union Valley dam to the west and Wrights Lake on the east. The Canyonlands geographical area extends along the Silver Creek and SFAR drainages from Union Valley dam on the east to Chili Bar Project boundary on the west.

Nearly all shoreline lands surrounding the project reservoirs within the project boundary are federal lands managed by the Forest Service and are available for public use. Figures 3-32 to 3-35 show the locations of these facilities.

High Country

The High Country geographical area (elevation 6,400 feet and above) includes Buck Island and Rubicon reservoirs. There are no developed recreational facilities at either reservoir because these are remote, hike-in reservoirs. Depending on the timing of snowfall and snowmelt, this area is usually accessible to hiking between Memorial Day and November 1.

At Rubicon reservoir, which is located within the Desolation Wilderness boundary, motorized public access and campfires are not allowed. The main route of access is by way of the Rubicon Hiking Trail from the Loon Lake. Overnight use requires a wilderness permit and there are quotas on the number of permits issued. At least nine dispersed campsites are present at Rubicon reservoir.

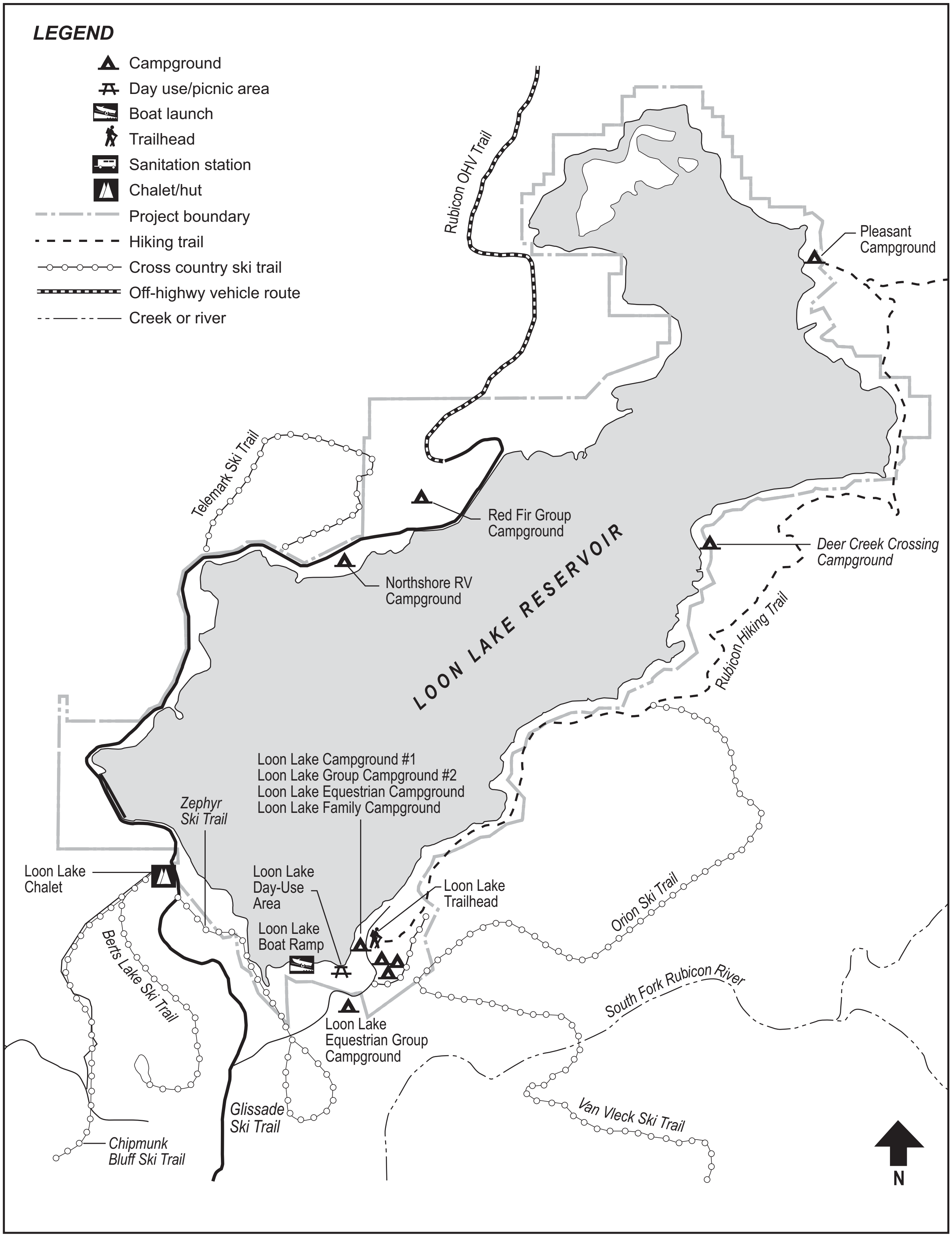

Figure 3-32. Recreational facilities at Loon Lake reservoir. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

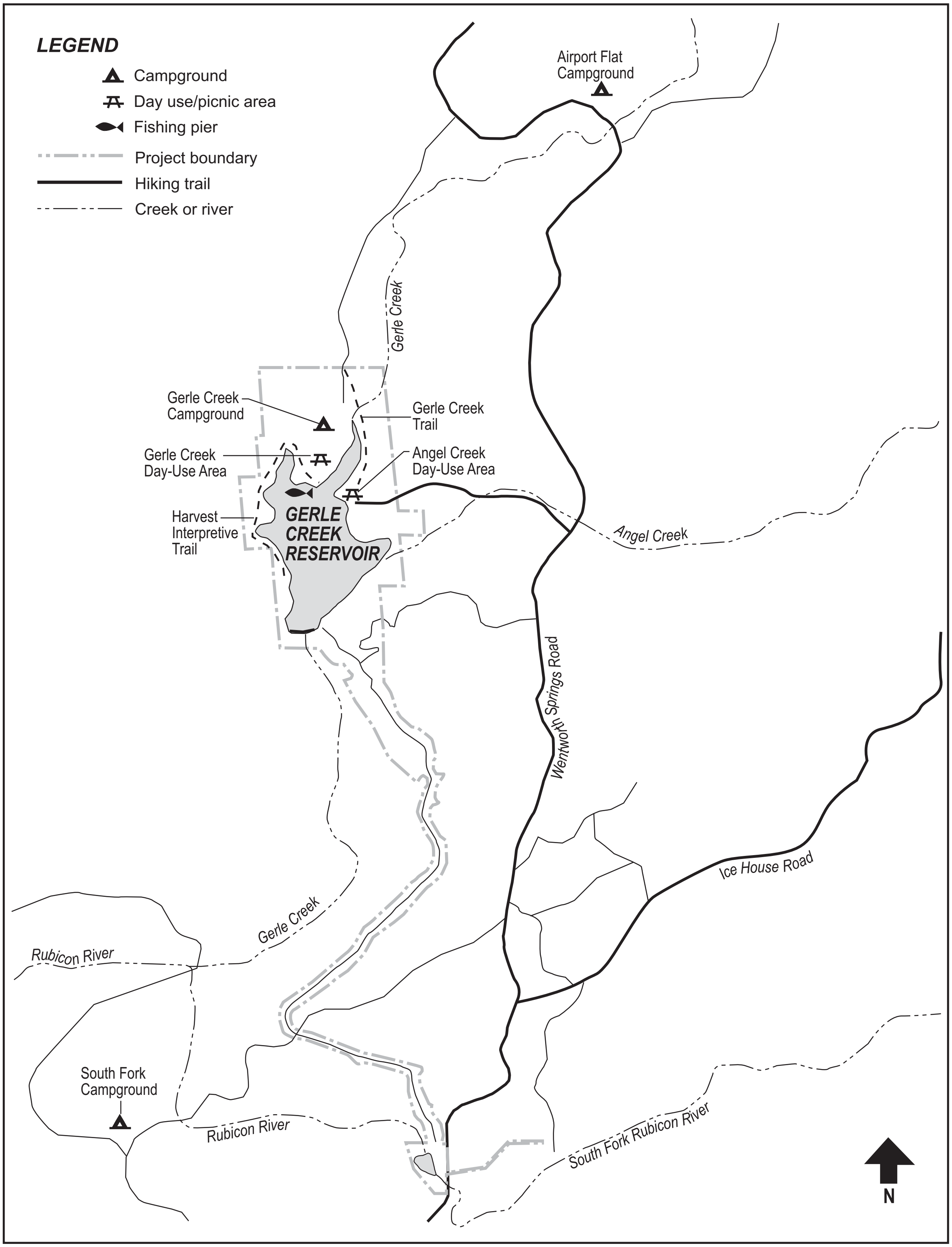

Figure 3-33. Recreational facilities at Gerle Creek reservoir. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

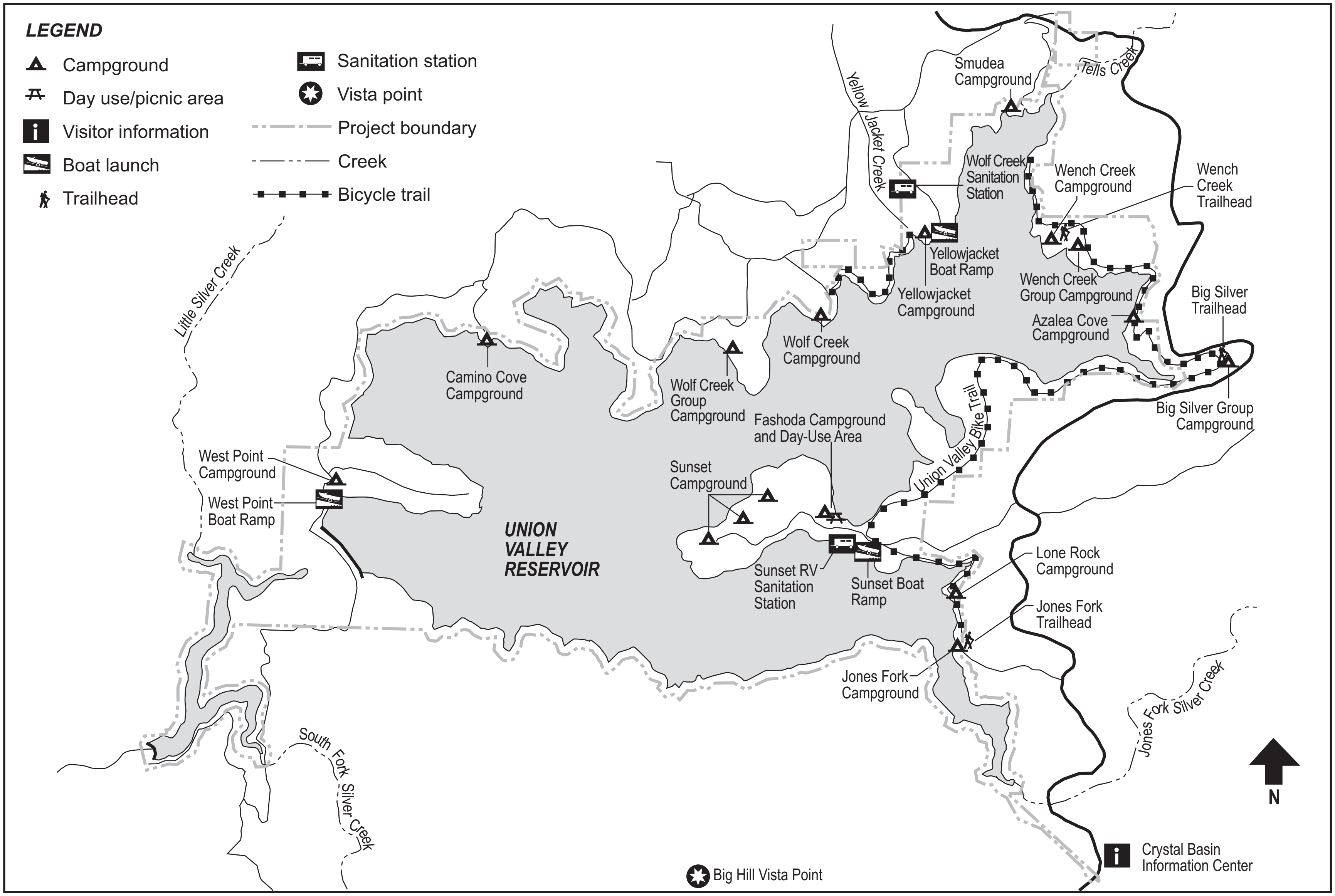

Figure 3-34. Recreational facilities at Union Valley reservoir. (Source: SMUD, 2005; PG&E, 2005, as modified by staff)

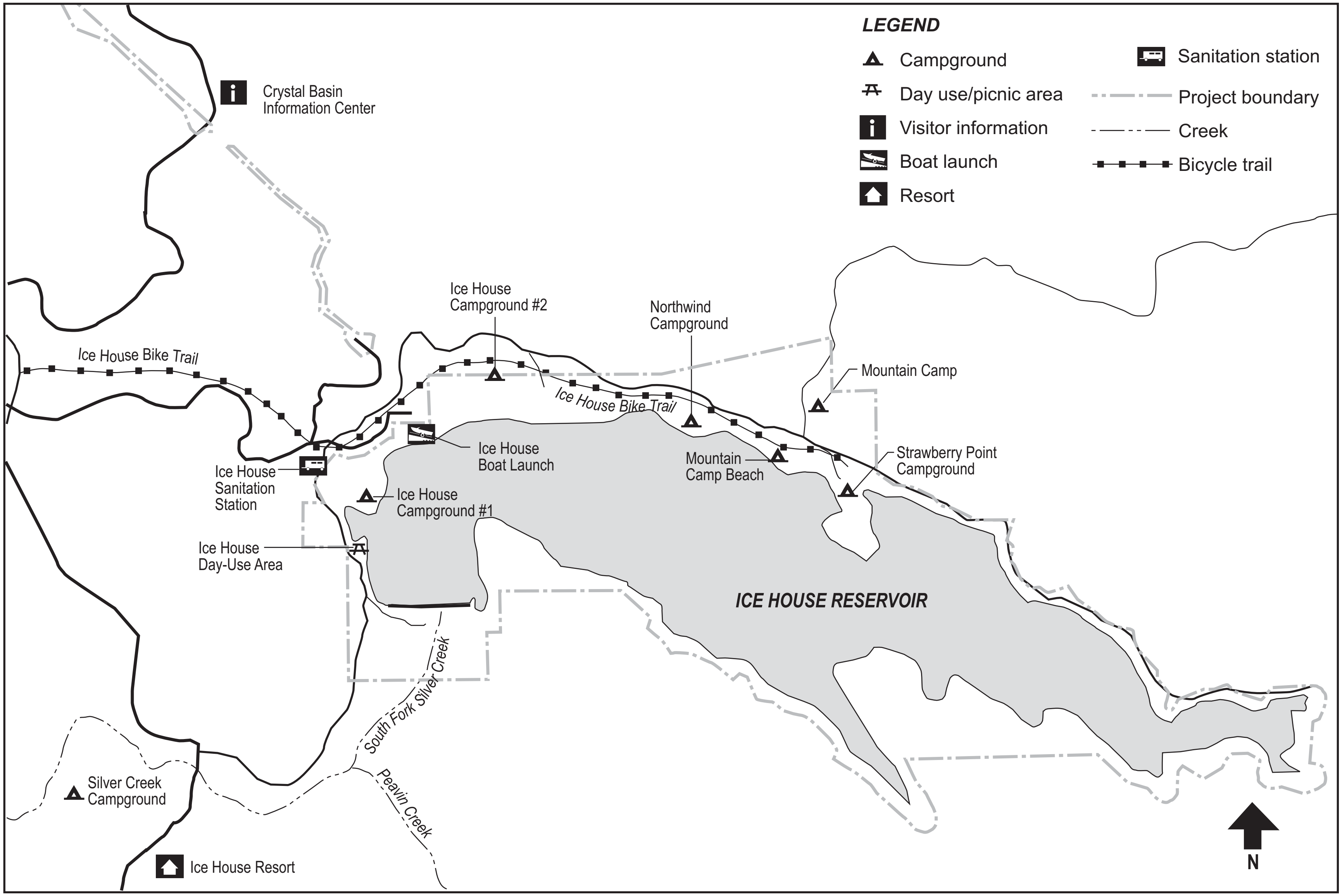

Figure 3-35. Recreational facilities at Ice House reservoir. (Source: SMUD, 2005, PG&E, 2005, as modified by staff)

Buck Island reservoir is located adjacent to and outside of the Desolation Wilderness. The Rubicon OHV Route passes through the project boundary. Many OHV visitors camp overnight along the Buck Island reservoir shoreline; there are as many as 17 user developed campsites, most of which are close to the water's edge or riparian areas.

Crystal Basin

The Crystal Basin area is in the mid-elevation range of the project at approximately 4,800 to 6,400 feet. Routes of access to the Crystal Basin include Ice House Road from Highway 50 and Wentworth Springs Road from Georgetown, both county roads. Crystal Basin includes four project reservoirs, which collectively provide most of the reservoir-based recreational use and opportunities at the Projects. Three of these four are the primary storage reservoirs of the UARP, including Loon Lake, Union Valley and Ice House; the fourth is Gerle Creek reservoir.

There are 47 project recreational facilities in Crystal Basin, including campgrounds, day use areas, boat launches, trails (biking, hiking, and interpretive), a scenic overlook, and a chalet. These facilities provide a full spectrum of recreational opportunities for overnight and day use activities. All of these facilities are on Forest Service-managed lands adjacent to the project. The total developed overnight capacity in the Crystal Basin is 5,325 people-at-one-time (PAOT).

The Loon Lake Chalet is the only project recreational facility available for rental year round. The chalet is heavily used, to near-capacity, in winter by visitors who hunt, ski, camp and hike in Crystal Basin during the winter.

Dispersed recreation occurs throughout Crystal Basin. Dispersed day use activities typically include hiking swimming, fishing, and some whitewater boating, all of which are allowed by Forest Service. Dispersed overnight camping outside of designated areas is generally prohibited immediately along the project reservoirs, but occurs throughout the Crystal Basin. The Forest Service has closed some unauthorized roads in the area in an attempt to discourage prohibited use where it is causing resource damage. Visitors continue to access the shoreline areas, such as at the southern shoreline of Ice House Reservoir, through locked gates, to gain access and camp along the shoreline.

Canyonlands

The Canyonlands area includes five reservoirs: Junction, Camino, Brush Creek, and Slab Creek and Chili Bar. The Canyonlands area is in the lowest elevation range of the project at approximately 1,800 to 4,400 feet. The terrain in this geographical area above PG&E's Chili Bar reservoir is typically steep which makes access difficult and there are few roads. The shorelines of the project reservoirs are also typically steep and not well suited for recreational use; however, the reservoirs provide angling and some boating opportunities. The Canyonlands reservoirs are generally accessible year round.

There are no developed recreational facilities at the Canyonlands reservoirs. However, small, informal boat launch sites exist at all but Camino reservoir. These sites consist of single-lane paved and unpaved routes leading to the reservoir.

Recreational Use within the Project Boundary

SMUD estimates that summer use at the project recreational facilities in the Crystal Basin is between 206,500 and 235,000 recreation-days (table 3-60). There are approximately 24,000 recreation-days at the project recreational facilities during the shoulder season.

Table 3-60. Estimated recreation days at dispersed recreational sites, 2002–2003. (Source: DTA and Louis Berger, 2004a)

	Summer			Winter		
Location	**Day Use**	**Overnight Use**	**Total**	**Day Use**	**Overnight Use**	**Total**
Ice House	2,329	0	2,329			
Union Valley	2,760	2,226	4,986			
Gerle Creek	377	2,416	2,793			
Loon Lake	1,648	15,217	16,865			
Crystal Basin				11,403	2,908	14,311
SMUD Canyonlands reservoir	4,785	938	5,723	1,911	7,29	2,640
Chili Bar reservoir	1,313		1,313			

SMUD estimates the annual dispersed use that occured generally within 0.25 mile of project reservoirs between April 1, 2002, and March 31, 2003, in the Crystal Basin was 43,406 recreation-days. Approximately one-third of this dispersed use occurred at Loon Lake reservoir during the summer months, and about one-third of the total use in the Crystal Basin occurred during the winter season.

Campgrounds, day-use areas, boat launches, and trailhead parking areas are usually filled to capacity during peak times on holidays and some weekends during the summer; during the weekdays, occupancy at the recreational facilities is low.

The reservoirs in the Canyonlands and the High Country are either small in size or difficult to access. The visitation to several of the Canyonlands and High Country reservoirs is substantial, though less than the reservoirs in the Crystal Basin.

At project recreational facilities, between 49 and 61 percent of the visitors surveyed in 2002–2003 identified changes or improvements they would like to see at the facility where they were interviewed. The most common suggestion by far was related to restrooms or the need for showers (47 percent). There were also several comments from visitors regarding bears raiding campsites and damaging vehicles.

Recreational Facilities Management

SMUD operates the project to maintain water surfaces in project reservoirs at as high an elevation as practicable and with a minimum of fluctuation, from May 1 to September 10 of each year, as is consistent with power generation needs. Priority is given to water retention in Rubicon and Buck Island reservoirs. In addition, SMUD removes and disposes of floating debris in the project reservoirs prior to July 15 of each year and removes any trees that may die along the shorelines of the reservoirs.

UARP boat ramps are available for use at each of the three storage reservoirs between Memorial Day and Labor Day under most water year types. During low water years or extraordinary circumstances, the storage reservoir levels may render some of the boat launches unusable at certain times.

The Forest Service operates and maintains some of the UARP-related recreational facilities through a Special Use Permit issued to a third party (concessionaire). Under the terms of the permit, the concessionaire agrees to collect fees for operating and maintaining government-owned facilities and returns a portion of the gross receipts to the federal government. The concessionaire is responsible for all tenant types of maintenance, such as broken infrastructure, utilities, grounds maintenance, and enforcing campground/facility rules. In effect, the cost of daily operation and maintenance of the facilities is an operating expense borne by the concessionaire. The concessionaire can either pay the fees due to the federal government under the permit or the concessionaire can provide work-in-lieu of fees. Under the latter, the Forest Service coordinates with the concessionaire to accomplish facility replacement or improvements at facilities operated under the permit, e.g., modifications necessary to comply with the ADA. This allows a portion of the fees collected at the site to be used for replacement of and improvements to the facilities, though these fees cover only a portion of the costs for replacement and improvements needed to the facilities.

The Forest Service operates the remaining recreational facilities under the Fee Demonstration Project. Under this program, the Forest Service collects the fees at the facilities, performs operation and maintenance, and uses the fees to offset its costs for operation, maintenance and replacement of the facilities.

PG&E owns most of the land around Chili Bar reservoir, with the exception of a few small private parcels and a large tract of BLM-managed by lands. PG&E manages the informal public boat ramp at the Chili Bar dam, which is the only site on the reservoir that is easily accessible. BLM allows public use of its lands and visitors access the reservoir along two steep trails from the north.

Angling

All project reservoirs are available to the public for angling. The CDFG carries out a stocking program at the UARP storage reservoirs, including Loon Lake, Ice House, and Union Valley. The survey data collected by SMUD indicates a high level of participation in reservoir angling. The boat launches provide access for boating so anglers have access to the reservoir surfaces as well as the shorelines. Winter access provided by SMUD's snow removal allows access to boat launches at Ice House and Union Valley reservoirs.

The reaches below project dams do not receive much angling use, due to the steep and rugged terrain, which limits access. The river sections downstream of the Canyonlands reservoirs, with the exception of Chili Bar reservoir, lie in deep canyons. Access to the river in the canyons is limited to roads leading to project facilities (e.g., Jaybird powerhouse) or to a few hiking trails. Access is also restricted along the river by the presence of large boulders, steep bedrock banks, or cliffs. Access to the upper project reach streams is also limited due to the lack of roads, although a popular OHV road (the Rubicon Trail) and a system of trails leading into the Desolation Wilderness area provide a greater degree of access than the Canyonland project reaches.

In general, stream angling in the Sierra Nevada is constrained on unregulated reaches by flows that are too high for angling during snowmelt runoff and too low (or even dry streambeds) during the late summer. This general condition exists in the project area streams where many of the background stream segments upstream of project reaches experience very low flows (less than 1 cfs) or dry up during late summer/early fall.

Whitewater Boating

There are considerable opportunities for class III-V whitewater boating[37] in the region, as shown in table 3-61, including the SFAR, one of the most popular whitewater runs in the state.

SMUD found that whitewater boating is feasible on the Slab Creek, Camino, and Ice House dam reaches. The other project reaches have low whitewater recreation potential due to various attributes such as remoteness, physical barriers or excessive or insufficient gradient. During periods when there is sufficient flow resulting from spill events, there are days when flows in the boatable range exist on the Slab Creek and Camino dam reaches, but this rarely occurs on the Ice House Reach. Boating has been documented on the Slab Creek dam reach during past spill events and this dam is known to spill in AN and Wet water year types.

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[37]The American Whitewater Scale of River Difficulty: Class I, Easy: Fast moving water with riffles and small waves; Class II, Novice: Straightforward rapids with wide, clear channels which are evident without scouting; Class III, Intermediate: Rapids with moderate, irregular waves which may be difficult to avoid and which can swamp an open canoe; Class IV, Advanced: Intense, powerful but predictable rapids requiring precise boat handling in turbulent water; Class V, Expert: Extremely long, obstructed or very violent rapids which expose a boater to added risk; Class VI, Extreme and Exploratory: These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability, and danger.

Table 3-61. Regional whitewater recreational opportunities. (Source: DTA and Louis Berger, 2004b)

Name of Run	Put-In & Take Out	Length (miles)	Gradient (feet per mile)	Class	Boating Range and (Optimum Flow)	Boating Season
North Fork American River						
Generation Gap	Tadpole Creek to Colfax-Foresthill Rd.	12.3	75	IV to V 0 portages	600–2,000 (1,200)	Spring
Giant Gap	Euchre Bar to Colfax-Iowa Hill Rd.	14.5	54	IV to V 0 portages	600–2,500 (1,000)	Winter, spring
Chamberlain Falls	Colfax-Iowa Hill Rd. to Colfax-Foresthill Rd.	4.8	44	III to IV+ 0 portages	800–2,500 (1,500)	Winter, spring
Ponderosa Way	Colfax-Foresthill Bridge to Ponderosa Way Bridge	5	21	II+ to III 0 portages	500–1,500 > 1,500 (1,200)	Spring
Middle Fork American River						
No. Middle Fk. American River	Last Chance Bridge to Middle Fk. American	12.9	129	V 7 portages	600–800 (600)	Winter, spring
Tunnel Run	Ralston Afterbay to Spring Garden Rd.	17	23	IV 1 portage	800–1,500 (1,200)	Spring, summer
Rubicon River						
Lower Run	Ellicott Bridge to Ralston Afterbay	20.3	108	V- to V 2 portages	500–1,000 1,000–2,000 (1,200)	Spring
SFAR						
Lovers Leap	Strawberry to Kyburz	9.6	171	V 3 portages	500–1,200 (1,000)	Spring
Dugald Bremner	Upper Bridge to Girard Cr.	3.5	191	V 1 portage	30–800 (500)	Winter, spring
Lower Run	China Flat to So. Fk. American	3.3	236	V+ 2 portages	350–550 (400)	Spring, summer
Kyburz to Riverton	Kyburz to Route 50 Bridge	9.6	90	III to IV+ IV to V 2 portages	700–1,200 1,200–1,300 (1,200)	Spring

Name of Run	Put-In & Take Out	Length (miles)	Gradient (feet per mile)	Class	Boating Range and (Optimum Flow)	Boating Season
Riverton to Peavine	Route 50 Bridge to Peavine Ridge Rd.	3.5	69	III to IV 0 portages	700–4,000 (1,500)	Spring
Golden Gate	Peavine Ridge Rd. to Forebay Rd.	9.4	117	V+ 5 portages	700–1,500 (1,000)	Spring
Silver Creek	Near Road 12N25 to Ice House reservoir	1.75	481	V	50–3002 (150-200)	Spring
Silver Creek	Camino reservoir to SFAR	9.2	119	V 8 portages	600–800 (600)	Spring
Slab Creek	Slab Cr. dam to White Rock powerhouse	7	89	V 1 portage	500–2,000 (1,500)	Spring
Rock Creek	Near Dutch Cyn to Rock Cr. Rd.	6.3	110	IV+ 2 portages	300–800 (600)	Winter, spring
Chili Bar	Route 193 to Coloma	5.8	31	III+ III to IV 0 portages	700–1,500 1,500–10,000 (2,000)	Year-round

The 19.1-mile reach downstream of the project is the most popular whitewater boating run in California, with use levels of approximately 3,000 to 4,000 users per day on summer weekends. The reach provides a unique whitewater opportunity because of relatively predictable year-round boatable flows and its close proximity to major population centers, including Sacramento and the San Francisco Bay Area. The reach also provides opportunities for other recreational activities, including fishing, swimming, and gold panning and dredging.

Inflow to Chili Bar Project during regulated flow periods is controlled predominantly by the UARP's upstream storage and water use. UARP controls the major storage and water use in the river system upstream of Chili Bar Project, with a storage capacity of more than 425,000 acre-feet. Chili Bar Project encompasses approximately three river-miles of the SFAR and operates on a water-available, peaking basis. Therefore, flows in the reach downstream of Chili Bar typically fluctuate on a daily basis.

3.3.6.2 Environmental Effects

Recreation Implementation Plan

The Projects include some of the most important recreational resources in the region, and they act as a gateway to Forest Service managed lands, including designated wilderness. As part of the relicensing process, SMUD and PG&E found that, in general, the quality of existing recreational facilities associated with the project is good, with some sites showing deterioration as a result of insufficient capital investment, increased use, and deferred maintenance.

As part of the Settlement (Proposed Article 1-15, *Recreation Implementation Plan)*, SMUD would develop and execute a recreation implementation plan for the project in coordination with the Forest Service within 6 months of license issuance. The implementation plan would include a construction schedule for recreational facilities as defined in Proposed Article 1-19, *Specific Recreation Measures*, as well as other details including, but not limited to, signage and sign placement, public information dissemination and a schedule for design of facilities to be reconstructed.

The implementation plan would be maintained and updated in conjunction with the review of recreational developments as described in Proposed Article 1-18, *Review of Recreation Developments*. SMUD proposes to meet with the Forest Service at least every 6 years to consider the condition and needs of all project recreational facilities on Forest Service lands, and to agree upon necessary maintenance, rehabilitation, construction, and reconstruction work needed. The criteria for project selection would depend on the amount and type of use, current recreational facility policy, the condition of facilities, effects on surrounding areas. Following the review, the licensee would develop a 6-year schedule for maintenance, rehabilitation, and reconstruction, in consultation with the Forest Service prior to being filed with the Commission.

Our Analysis

The proposed recreation implementation plan would increase and formalize SMUD's responsibilities to provide and update recreational resources throughout the project area, including those formal and dispersed recreational sites that provide public access to the project. The plan would provide a framework for the licensees to implement the recreational site improvements and coordinate management of recreational resources with the land managers that have jurisdiction over project lands, as well as monitor recreational use and needs over the term of any new license. These measures would provide improvements to the management and delivery of recreational resources and would expand recreational opportunities within the project.

The proposed plan reflects the unique character and management responsibilities of public recreational sites around the Projects. The plan would recognize that, while SMUD has no legal authority to redevelop public access sites owned or managed by others, they do have some responsibility to ensure reasonable public access to project lands and waters for those portions of the recreational sites currently within the project boundary or proposed to be within the project boundary. The assistance and funding included in the plan would improve delivery of recreational services by streamlining implementation of the improvement measures, while simultaneously minimizing jurisdictional conflicts between the Commission and the various land management agencies, and providing a mechanism for earmarking licensees' funds to specific project-related improvements.

PG&E does not propose to develop a recreation plan. PG&E proposes a few specific recreational measures (discussed below) to improve recreational access to the project. In its license application, PG&E contends that recreational use is low, safe public access is best achieved at the upstream end of the reservoir, and project operations limit recreational opportunities near Chili Bar dam. In subsequent sections, we generally agree with this assessment. However, we expect that recreational use and needs would change over the term of any new license issued for the Chili Bar Project. Development of a recreation plan for the project, based on periodic monitoring, would help the licensee manage these changes in recreational demand and provide a structure to evaluate the adequacy of project recreational facilities to meet future recreational demand. Such a plan would be designed to achieve the following objectives: (1) promote public safety and increase public awareness of recreational opportunities at the Chili Bar Project; (2) maintain reasonable health and safety standards through a litter and sanitation management; (3) provide safe and reasonable access to the project reservoir; (4) address congestion and conflicts among visitors and resources related to recreational activities, if any; (5) provide reasonable recreational facilities for a range of recreational opportunities; (6) reduce recreational effects on cultural, terrestrial, and aquatic resources; and (7) provide a forum for public and agency input into recreational facility needs at the project.

Specific Recreational Site Improvements

Developed and informal recreational sites provide primary public access to the UARP and Chili Bar Project. Many of the facilities were constructed as part of the current license in the 1960s to meet visitor demand. Much of the infrastructure at these recreational sites is old, some of which is in disrepair from deferred maintenance and some of which has reached its useful life. As visitor demographics and use patterns change over the term of any new license, recreational amenities at these sites may no longer serve the type of recreational uses that visitors expect.

Under Proposed Article 1-19, *Specific Recreation Measures,* SMUD would implement numerous and substantial improvements to many recreational sites, as well as upgrade and expansion of some informal recreational facilities to provide an improved level of service. These proposed measures, summarized in table 3-62, would be developed within or immediately adjacent to the project boundary on Forest Service lands and all improvements would become Forest Service property upon completion and acceptance by Forest Service. Proposed Article 1-19 calls for the SMUD to improve recreational sites within the project boundary including, survey; design; contract preparation and administration; environmental analysis and documentation necessary for construction of proposed facilities, including any permits; and preparation of "as-built" drawings for those facilities on federal lands. SMUD would be responsible for funding the actual capital costs of the improvements, but all capital investment would become the property of the Forest Service when they are completed.

SMUD would also develop a plan to install bear-proof food storage lockers and bear-proof trash receptacles at all recreational facilities due to the lack of such equipment as identified in the recreational use surveys within 2 years of new license issuance. The plan would include a schedule for installing the bear-proof equipment within five years of plan approval by the Forest Service and CDFG.

Proposed Article 1-18, *Review of Recreation Developments*, also calls for SMUD to include the specific recreational facilities listed in Proposed Article 1-19, *Specific Recreation Measures*, within the project boundary. If these facilities are not currently within the license boundary, the boundary would be adjusted to include them as detail in the Forest Service Preliminary Terms and Conditions, Attachment 1, filed January, 29, 2007.

PG&E proposes facility enhancements that would be downstream and outside of the project boundary. Specifically, under Proposed Article 2-13, *BLM Recreation Improvements*, PG&E would construct (1) a gravel parking area for three to four vehicles off Rock Creek Road; (2) a 36-inch-wide trail that meets a grade of 5 percent or less from the parking area to Chili Bar reservoir; (3) a kiosk sign along the trail near the beginning of the trailing, explaining the rules of the area; and (4) one picnic table of coated wire mesh material in a leveled out area that is outside of the Chili Bar reservoir floodplain.

Our Analysis

Existing recreational facilities within the project include numerous formal or semi-formal public-access sites that have some level of recreational infrastructure ranging from minor to substantial, including camping areas and boat launches, trails, beaches and many undeveloped, dispersed, or informal sites (see figures 3-33 to 3-36). These facilities provide the primary public access to Projects' land and waters. The current conditions of the project recreational facilities range from poor to excellent. Examples of poor facility conditions include cracked pavement and broken traffic control barriers, short campsite parking spurs, and worn and dated campsite components and restrooms. Most of the developed facilities are below ADA accessibility standards; however, the more recently constructed facilities have been designed to comply with ADA accessibility guidelines. Although most recreational visitors interviewed expressed general satisfaction with the condition of the sites, they also noted their desire for improvements, such as improved public access when the reservoirs are low, additional facilities along the reservoirs, and site improvements throughout the Projects.

SMUD's proposal to enhance, expand and formalize the sites listed in table 3-62 would substantially improve public access in the project area. The proposed improvements to recreational facilities within the project boundary would be site-specific, derived from a recreational needs assessment, prepared in consultation with the Forest Service and stakeholders, and targeted at either improvements to existing facilities or development of informal facilities. In addition, the proposal considers recreational needs from a geographical perspective and recommends site improvement measures based on the overall need in the project area. This approach would help to ensure that certain areas of the project or certain facilities are not over-capitalized and that other areas receive appropriate improvements to meet existing and projected needs.

Table 3-62. SMUD's proposed recreational site improvements. (Source: SMUD and PG&E, 2007, Proposed Article 1-19, *Specific Recreation Measures*)

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
High Country			
Buck Island Reservoir Area: North Shoreline	Inventory areas affected by dispersed recreation to the northwest and northeast of the dam, and develop a dispersed motorized camping area (Development Level 2) in these areas. Also construct new vault toilet, to be maintained by helicopter; identify and mark designated campsites; restrict vehicle access to motorized trail and designated camping areas only through the use of barrier rocks and other natural materials, and restore impacted areas; and reroute a portion of the Rubicon OHV route away from sensitive areas and rehabilitate existing route.		2 years
Rubicon OHV Trail System–Ellis Creek Tie to Rubicon Trail	Provide improvements at the Ellis Creek staging area: trailhead parking, sanitation, and improved information (Loon Lake spillway) where uncontrolled parking currently occurs; implement measures to confine OHVs to this designated route using barrier rocks and other natural materials; and close and restore user-created routes adjacent to Loon Lake shoreline.		2 years

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
Crystal Basin			
Loon Lake Area	Prepare a Loon Lake Recreation Plan to be approved by the Forest Service that addresses impacts on the lakeshore zone and islands from unmanaged recreation, and the need for additional day-use opportunities. Develop sites and/or implement measures identified in the plan within 5 years of license issuance. Detailed elements required, as well as additional specific areas to be evaluated, are included in Proposed Article 1-19.		2 years
Loon Lake: Pleasant Campground	Redesign and reconstruct the 10-unit boat-in campground, retaining existing capacity on existing footprint.	●	10 years
Loon Lake: Northshore Recreational Vehicle Campground	Upgrade the existing 15-unit campground and expand to the east and west to take in areas heavily affected by dispersed camping. Target capacity will be 35 units.	●	5 years
Loon Lake Campground (including Equestrian Loop)	Redesign and reconstruct the 62-unit campground, retaining existing capacity on existing footprint.	●	8 years
Loon Lake (Group) Campgrounds	Upgrade Loon Lake Group Site 1 (30 PAOT) and 2 (50 PAOT). See Proposed Article 1-19 for detailed elements.	●	8 years
Loon Lake Group Equestrian Campground	Redesign and reconstruct 5-unit (30 PAOT) group campground; retain existing capacity on existing footprint.	●	8 years
Loon Lake Boat Launch (and Day Use Area)		●	8 years
Loon Lake: Red Fir Group Campground		●	20 years
Loon Lake Chalet		●	8 years
Loon Lake (Schlein) Sanitation Station	Remove part of the concrete island in front of the water tower to reach the control valve from the turn out. Lower the control valve, and replace it with a lever type control.	●	20 years

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
Loon Lake Trailhead	Opened in 1992, facility components are in good condition and not in immediate need of replacement.	●	8 years
Loon Lake: South Shore	Develop a new campground (500 PAOT) on the South Shore of Loon Lake between the LL Hiking Trail Facility and Deer Camp. Construct new paved two-lane access road from the existing Loon Lake campground to new campground site, including new trailhead parking for the Loon Lake and Desolation area. This site was previously identified as proposed Red Fir campground in the "Recreation Plan for Crystal Basin, Project 2101, November 1973."		20 years
Gerle Creek Reservoir Area	Prepare development plan, to be approved by the Forest Service, that addresses impacts on the Gerle Creek and Airport Flat areas from unmanaged recreation, and the need for additional day-use opportunities. Develop sites and/or implement measures identified in this plan within 15 years of license issuance. Address sanitation, user conflicts, carrying capacity, day-use versus overnight camping, vehicle control, boating access, and emergency resource protection measures.		2 years
Gerle Creek Campground	Redesign and reconstruct the 50-unit campground, retaining existing capacity on existing footprint.	●	5 years
Gerle Creek Day Use Area	Site has an accessible fishing pier. See Proposed Article 1-19 for specific elements.	●	5 years
Angel Creek Day Use Area	See Proposed Article 1-19 for specific elements.	●	5 years
Airport Flat Campground	Harden adjacent dispersed area on the south side of Gerle Creek.	●	10 years
Union Valley Reservoir Area	Prepare development plan, to be approved by the Forest Service, that addresses impacts on the Union Valley area from unmanaged recreation, and the need for additional day-use opportunities. Develop sites and/or implement measures identified in this plan within 10 years of license issuance.		2 years
Union Valley Reservoir	Develop and implement a plan approved by Forest Service and CDFG that addresses reservoir surface use and hazards.		2 years

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
Azalea Cove Campground	Provide paved off-site parking area for 10 vehicles at the intersection of the existing service road and the bike trail; develop a potable water source and distribution system; improve shoreline adjacent to facility to enhance boating access; and provide vegetative screening, and use natural materials to restrict indiscriminate pedestrian and bicycle traffic within and between campsites and use areas.		5 years
Big Silver Group Campground	Upgrade existing facilities offered at this 50 PAOT group campground.		20 years
Camino Cove Campground		●	15 years
Fashoda Campground and Day Use Area, Jones Fork and Lone Rock Campgrounds		●	5, 5, 20, and 20 years
Sunset Campground	Redesign and reconstruct the 131-unit campground, retaining existing family unit capacity on existing footprint, and add a group site.	●	5 years
Sunset Boat Launch		●	5 years
Wench Creek Campground and Group Campground	Redesign and reconstruct the 100-unit campground and the two, 50 PAOT group sites, retaining existing capacity on existing footprint.	●	15 years
West Point Campground	Design and construct expansion of the existing family campground by 25 units, and add a group campground (30 PAOT) adjacent to the facility, across the road to meet current Forest Service standards.	●	8 years
West Point Boat Launch and Wolf Creek Campground/ Group Campground		●	5 and 15 years

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
Yellowjacket Campground	Redesign and reconstruct the 40-unit campground, retaining existing capacity on existing footprint.	●	8 years
Yellowjacket Boat Launch		●	5 years
Ice House Reservoir Area	Prepare development plan, to be approved by the Forest Service that addresses impacts on the Ice House area from unmanaged recreation, and the need for additional day-use opportunities. Plan also would address the whitewater recreational opportunities in SFSC, above and below Ice House reservoir. Develop sites and/or implement measures identified in this plan within 8 years of license issuance.		2 years
Ice House Campground and Day Use Area	Redesign and reconstruct the 83-unit campground and existing 10-unit day-use area, retaining existing capacity on existing footprint.	●	5 years
Northwind Campground	Upgrade facilities at this existing 9-unit campground, provide potable water, and address needs for lakeshore access.	●	15 years
Strawberry Point Campground	Upgrade facilities at this existing 10-unit campground, provide potable water, and address needs for lakeshore access.	●	15 years
Ice House Boat Launch	Upgrade facilities and repair damage to boat launch parking lot upgrade and pavement.	●	5 years
Ice House Sanitation Station	Redesign and reconstruct the facility, on existing footprint.	●	5 years
Highland Point Day Use Area	Develop Highland Point for fishing access and day use. Land acquisition may be required. Construct new 10-unit picnic area to include detailed elements included in Proposed Article 1-19.		5 years
Upper Silver Creek Ice House Day Use	Develop parking and day-use facilities to accommodate existing unmanaged dispersed day use associated with Ice House reservoir and Silver Creek. Land acquisition and/or easements may be necessary.		5 years
Crystal Basin Work Center and Information Station	Upgrade existing facilities, including existing water storage facilities, and construct EPA approved fueling station.		15 years

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
Big Hill Vista	Provide visitor amenities including installation of two accessible tables and picnic pads, and purchase or retrofit refuse containers for accessibility and bear resistance.	•	15 years
Cleveland Corral Information Station	Provide visitor amenities.	•	15 years
Silver Creek Campground	When whitewater flows are provided by SMUD, redesign and reconstruct the 12-unit Silver Creek campground, and provide access on adjacent land for whitewater access parking and staging.		
Canyonlands			
Junction Reservoir Boat Launch	Improve boat launch (for day use only).		10 years
Dispersed Area - Bryant Springs Road and SFSC Bridge	Improve access trail (construction road) between Bryant Springs Road and stream. Provide turnouts for parking at take-out site for whitewater boating on SFSC.		10 years
Brush Creek Reservoir Boat Launch	Prepare development plan, approved by the Forest Service, that addresses reservoir access, day use opportunities, and facility needs or improvements. Develop sites and/or implement measures identified in this plan within 8 years of license issuance.		5 years
Boat Launch at Slab Creek Reservoir at Forebay Road	Prepare development plan, approved by the Forest Service, that addresses safe and reasonable boating access, impacts from unmanaged recreation, and the need for additional day-use and overnight facilities. Develop sites and/or implement measures identified in this plan within 5 years of license issuance.		2 years
Boat launch at Slab Creek Reservoir near dam	Prepare development plan, approved by the Forest Service, that addresses safe and reasonable boating access, impacts from unmanaged recreation, and the need for additional day-use facilities. Develop sites and/or implement measures identified in this plan within 5 years of license issuance.		2 years

Geographic Area/ Recreational site	Proposed Plan, Upgrade, or Measure	Upgrade to Forest Service/ ADA?[a]	Within How Many Years of License Issuance?
SFAR to Slab Creek dam to Chili Bar Reservoir Reach Put-In	Prepare recreation management plan, approved by the Forest Service and BLM, to address whitewater recreation needs in the Slab Creek dam to Chili Bar reservoir reach. Develop sites and/or implement measures identified in this plan within 8 years of license issuance.		5 years

[a] Site will be redesigned or upgraded to meet current Forest Service design standards and requirements of the ADA.

PG&E's proposal to provide a parking area off Rock Creek Road, a trail that leads from the Rock Creek Road to Chili Bar reservoir, an informational kiosk along the trail, and a picnic table at the reservoir would address the demand for day use recreational opportunities identified in the recreation needs study.

The FPA requires the project licensee to provide safe public access to project lands and waters and include those lands necessary for project operations in the project boundary. In accordance with this law, the Commission requires that the project boundary contain the primary recreational facilities used to access project waters, as well as the lands necessary to ensure access for the term of the license, and the lands necessary to ensure an appropriate buffer between the project and neighboring lands. As part of any new license, SMUD and PG&E would provide revised exhibit G (project boundary map) for the Projects that would include a detailed description and maps of the project boundary.

Most of the recreational facilities proposed to be included in the project boundary are immediately adjacent to the existing project boundary and directly associated with recreational sites that provide access to the lands and waters used for hydroelectric operations. There is a clear physical nexus between the project and these sites, many of which have been developed by SMUD to provide access to reservoir shorelines, boat launches, campgrounds or shoreline trails.

However, a few of the proposed recreational site enhancements listed in table 3-62 are well outside the current boundary and we note that the Commission does not have the authority to require site modification beyond the project boundary. These sites include the Airport Campground, Big Hill Communication Site, and Cleveland Coral. We discuss each of these sites below and their nexus to the project.

SMUD built Airport Flat Campground in 1996 as part of the exhibit R amendment to the License. It is one of the few licensee-developed facilities away from a main reservoir. This site was developed in lieu of expanding Gerle Creek Campground as a result of concerns that an expanded Gerle Creek Campground would lead to crowding conditions and degradation of the recreational experience. As such, the Airport Flat Campground was developed to handle recreational demand associated with the project. This relationship appears to establish a nexus between the site and project operations.

Big Hill Communication Site is primarily used as a communication, fire observation and fire staging area for the Forest Service. The site also includes the Big Hill Vista, which SMUD built under the current license. Recreational visitors to the area often drive to the top of Big Hill to overlook Crystal Basin and the high Sierra Mountains to the east. Although the principal purpose of the site is for Forest Service operations, including those recreational specific facilities within the project boundary on top of Big Hill would ensure that the site is maintained for public use for the term of any new license issued.

Cleveland Coral Information Center serves as the first public contact facility for visitors to the Crystal Basin, providing public information services to nearly 70,000 visitors annually. The site provides visitors with the best opportunity to find appropriate campgrounds and plan the details of their trip to the basin. Therefore, recreational use of the site appears to be project related.

Recreational Access Plan for Slab Creek Reservoir

Slab Creek reservoir is located deep in the SFAR canyon. The site is difficult to access and the parking and staging area at the end of the project road is steep, narrow and in disrepair. Nonetheless, SMUD's whitewater boating study determined that the reach is Class IV-V and would be boatable by advanced and expert boaters if sufficient flows were available. Under Proposed Article 1-24, *Recreation Streamflows*, SMUD proposes to provide recreational releases below Slab Creek dam, which would attract more recreational use to confined staging area.

Under Proposed Article 1-19, *Specific Recreation Measures,* SMUD proposes to develop a recreation access plan that addresses recreational access to the reservoir. This plan would address recreational access during the time of construction of Iowa Hill reservoir and the tunnel connecting to Slab Creek reservoir, and when Iowa Hill reservoir and associated powerhouse are operational.

Our Analysis

SMUD found public access difficulties associated with the Slab Creek run, including the lack of suitable sites to develop sufficient parking at the put-in and potential take-out locations due to steep terrain, the lack of existing legal public access to potential take-out locations, and limited possibility to achieve public access to potential take-out locations by securing easements from private landowners. Developing an access plan to help provide a reasonable level of public access to these facilities would help ensure that boaters could use recreational releases.

Monitoring and Adaptive Management

Project licenses typically extend from 30 to 50 years. Over such long timeframes, recreational use patterns would likely change, potentially causing impacts to important environmental resources or reducing the adequacy of existing recreational facilities to meet visitors' needs. In addition, many of the environmental measures proposed by the licensee and recommended by the Agencies could alter recreational use patterns or have direct adverse affects on habitats that have been established under existing conditions. For example, the proposed recreational flow releases could directly affect aquatic and terrestrial habitats or could attract an unanticipated number of boaters that have not historically visited these areas.

As part of the Settlement, SMUD proposes a monitoring program (Proposed Article 1-5 *Monitoring Program*) to track changes in important habitats and indicators species associated with recreational use, pulse flows and recreational flows. SMUD also proposes to enter an adaptive management process to change project operations in response to adverse effects on environmental resources observed through the monitoring program.

The Proposed Action calls for SMUD to implement a monitoring program after license issuance and through the term of the new license and any annual licenses, in coordination with the Agencies. The recreational monitoring component is further defined in Proposed Article 1-16, *Recreation Survey*, under which SMUD would conduct a Recreational Survey and prepare a report on recreational resources every 6 years of the new license. The survey would include, but not be limited to, changes in kinds of use and use patterns, levels of use, user preferences in recreational activities, kinds and sizes of recreational vehicles, preference for day use versus overnight use, carrying capacity information sufficient to indicate changes in capacity, and recreation user trends within the project area.

In addition, Proposed Article 1-25, *Public Information Services*, calls for SMUD to provide data to support the determination of carrying capacity on lands affected by the project, including, but not limited to: visitor perceptions of crowding, user perceptions of "desired conditions," user preferences for amenities, capacity conditions at developed facilities within or affected by the project, and resource impacts and social experience. It appears that this information would be collected as part of the surveys discussed above.

SMUD's proposed adaptive management measures (Proposed Article 1-6, *Adaptive Management Program*), which are closely tied to the environmental monitoring and recreational use survey findings, would include changes to project operations if the monitoring program and other scientific information indicates that the ecological resource objectives would not likely be met without adjustment. SMUD and the consulting agencies would analyze monitoring results and other scientific information to determine the effects on applicable ecological resource objectives identified in the Settlement Rationale Report. Specific recreation-related adaptive management measures that SMUD and the agencies would consider include: cancellation of pulse and recreational releases in SFSC if foothill yellow-legged frogs are found on the creek and water temperatures in the creek become unsustainable for the frogs; cancellation of recreational flows in SFAR below Slab Creek dam if water temperatures below the dam rise above 12°C mean daily temperature for a 7-day running or if October releases adversely affect foothill yellow-legged frogs; implement good-faith effort to avoid untimely spill events below Slab Creek and Camino dams once foothill yellow-legged frog breeding has been Initiated.

Our Analysis

Monitoring recreational use over time would provide environmental and recreational use baseline data from which to change project operations to protect sensitive environmental resources. As proposed, the recreational measures would provide substantial benefits to recreational visitors and the proposed recreational releases are generally planned to mimic natural conditions and enhance terrestrial and aquatic resources within and downstream of the project developments. Based on what is known about the Projects, the proposal appears to simultaneously protect and enhance environmental resources while continuing to provide and enhance recreational opportunities.

However, as with any complex system, changes in recreational use patterns or project operations could have unanticipated adverse effects on aquatic or terrestrial resources. The proposed adaptive management measures would provide a means to address these effects over the term of any new license issued. As proposed, SMUD would file reports with the Commission summarizing monitoring results. If any recreation-related adaptive measures are required during the term of any new license, SMUD would file an amendment to the proposed recreation implementation plan with the Commission for approval.

Recreational Site Operation and Maintenance

Long-term O&M of project recreational facilities helps ensure that the quality of the recreational sites is maintained for the term of any new license. Under the current license, SMUD has contributed O&M funds annually to the Forest Service and has assisted the Forest Service with new capital improvements at its recreational sites. Overall, the recreational facilities at the project are generally in fair to good operating condition. However, some formal sites and many of the informal sites have deferred maintenance needs or receive minimal ongoing services.

As part Proposed Article 1-21, *Recreation Operation, Maintenance, and Administration*, SMUD proposes to contribute annually to the Forest Service up to a maximum of, $1,000,000 (year 2005 cost basis). As part of the Settlement, the Forest Service would use the funds to provide for operation, maintenance, and administration of those developed recreational sites, facilities, or uses that are adjacent to or in the vicinity of project reservoirs and facilities listed in Proposed Articles 1-18, *Review of*

Recreation Developments, and 1-19, *Specific Recreation Measures* (either developed as part of the original/amended license or affected by operations). The proposal would include, but not be limited to, managing use within and immediately adjacent to the project boundary, and performing both regular and annual maintenance. In addition, the Forest Service would use the funds for the special use permit administration required for facilities developed as part of the original/amended license and operated by a concessionaire. Work to be completed within these areas would consist of conducting patrols, picking up litter, providing public information, enforcing rules and regulations, rehabilitating impacted areas, addressing sanitation, maintaining day use sites (such as concentrated use areas), maintaining trails, information signs, and regulatory signs, responding to fires and other emergencies, assisting in search and rescue, addressing resource impacts, and area condition monitoring.

Our Analysis

Operation and maintenance measures are essential components of any recreational measure to ensure that the facilities are maintained at a level that provides reasonable public access for the term of any new license issued. Operations of project recreational facilities would include management-type measures to keep the facilities clean and safe, such as cleaning restrooms, picking up litter and removing trash. Maintenance typically includes keeping recreational facilities in a clean, safe and functional order. Such measure may include replacing worn equipment or painting buildings, or maintaining lawns and paths.

As part of its ongoing licensee responsibilities, SMUD may contract with the Forest Service to operate and maintain project recreational facilities; however, SMUD is ultimately responsible for maintaining project recreational facilities in good and safe condition.

Fish Stocking

One of the primary recreational activities associated with the project includes angling in the large storage reservoirs. CDFG currently stocks these reservoirs to improve the recreational fishery, but does not guarantee that stocking would continue through the term of any new license.

Under Proposed Article 1-26, *Fish Stocking*, SMUD proposes to match the amount of fish stocked by CDFG, per direction from CDFG, and distribute the fish among Loon Lake, Union Valley, and Ice House reservoirs. SMUD would provide between 25,000 and 50,000 pounds per year.

Our Analysis

Because reservoir-related angling is one of the most important recreational activities associated with the project, particularly in the large storage reservoirs, including Loon Lake, Union Valley, and Ice House reservoirs, assisting CDFG in stocking would help ensure that the recreational fishery is maintained for the term of any license issued.

Trails System Management

Hiking and camping along the Forest Service-managed trail systems is an important recreational use, particularly in Crystal Basin and the high-elevation areas. In some cases, the highest reservoirs are in or near wilderness areas with no road access, requiring SMUD to carry in project-related equipment.

As part of Proposed Article 1-19, *Specific Recreation Measures*, SMUD proposes specific trail enhancements including new trails, trail closings, and rehabilitation of existing trails, as summarized in table 3-63.

Table 3-63. SMUD's proposed trail enhancements. (Source: SMUD and PG&E, 2007, Proposed Article 1-19)

Location	Proposed Trail Enhancements	Within How Many Years of License Issuance?
Buck Island reservoir Area: West Shoreline	Improve or relocate existing non-motorized trails connecting to the Rubicon Hiking Trail.	2 years
High Country Area Trails	Improve selected connecting trails off Rubicon hiking trail that access Spider Lake.	2 years
Rubicon Hiking Trail	Reconstruct or relocate portions of the trail to meet Forest Service standards and facilitate proper drainage, including improvement of tread on the portion of the trail using the old construction road. Trail width would accommodate quads for SMUD's administrative use only up to the wilderness boundary.	2 years
Trail Connecting Pleasant Boat-In Campground to Rubicon Hiking Trail	Reconstruct trail to standard, including tread, vegetation clearing, drainage, and signage.	2 years
Angel Creek Trail	Extend the trail to tie to the Summer Harvest Trail (making a loop trail around the reservoir).	5 years
Summer Harvest Trail	Upgrade trail surface to a similar standard (aggregate base) as the new trail at Angel Creek Day Use Area. Replace missing or damaged interpretive signs as needed.	5 years
Union Valley Bike Trail	Complete the bicycle trail system around Union Valley reservoir.	
Ice House Reservoir Lakeshore Road	Provide access trails from paved turnouts and/or parking pockets along the road to the shore. Restore damaged sites between road and shoreline.	5 years

Location	Proposed Trail Enhancements	Within How Many Years of License Issuance?
Ice House Mountain Bike Trail	Extend the Ice House Mountain Bike Trail (native surface) completely around Ice House reservoir, including stream and spillway crossings. Construct an interconnecting trail between the Ice House mountain bike trail and the Union Valley mountain bike trail.	10 years

As part of Proposed Article 1-31, *Trails System Management*, SMUD proposes to file with the Commission a trails system management plan for the trails that are needed for project operations and are located on or affect National Forest System lands. The licensee would implement the plan upon approval. At a minimum, the plan would: (1) include a map showing the location of all trails, both the Forest Service system (classified) trails and Forest Service non-system (unclassified) trails associated with the project; (2) map trail locations using a global positioning system (GPS), software, pre and post-processing standards, collection standards and data dictionary approved by Forest Service, to ensure that data collected meet national standards; (3) identify the season(s) of use and the amount of use by the licensee for each trail annually; and (4) identify the condition of the trails described above, including any construction or maintenance needs. SMUD would update the plan every 5 years identifying maintenance and reconstruction needs for trails. The licensee would file the plan with the Commission after approval by Forest Service.

For the Chili Bar Project, as part of Proposed Article 2-13, *BLM Recreation Improvements*, PG&E proposes to plan, design, and construct a new hiking trail between Rock Creek Road and the Chili Bar reservoir to provide public access and formal, safe travel to the reservoir shoreline as previously described under *Specific Site Improvements*.

Our Analysis

Trails provide important recreational and hunting access to the federal lands adjacent to the project, as well as access to the project from surrounding roads, and, in cases, access for SMUD to project developments in the remote high-county areas. Although many other types of recreational uses are declining on a national level, demand for trail-related activities, such as walking, hiking, and biking appear to be increasing.

Of the numerous recreational and hiking trails that provide access to public lands managed by federal agencies near the Projects, many begin along roads or recreational sites related to the project. Some of these trails are informal and formed by user groups, including the trail on BLM lands from Rock Creek Road to Chili Bar reservoir, and many of the short spur trails that access SMUD's reservoirs from Forest Service roads in the Crystal Basin.

As proposed by SMUD and PG&E, the trail-specific measures would provide substantial benefits to recreational visitors by extending and formalizing trail access to project facilities. The trails would continue to provide a variety of recreational opportunities, including walking, hiking, angling, sightseeing and biking access.

SMUD's proposed trail plan would help to ensure that the condition of the trail system is maintained at an adequate level over time. In addition, the plan would help ensure that trail users are educated about permissible and prohibited activities in order to avoid adverse effects on aquatic and terrestrial resources in the area.

PG&E's proposal to develop a trail on BLM lands to access the Chili Bar reservoir would formalize recreational use that already occurs in this area. Currently, anglers, picnickers, and other visitors follow an old logging road part way into the canyon and follow a user-made trail to the water's edge. Formalizing this trail would help ensure that it is designed to follow natural contours and reduces erosion and other impacts that can be associated with informal trials. Based on existing use of the informal trial, PG&E's proposal would also address a clear recreational demand for improve trails to the reservoir. Developing the trail and associated facilities in the context of a recreational plan for the project, updated periodically with the filing of FERC Form 80, would help ensure that the licensee responds to changing recreational demand and needs over the term of any license issued.

Reservoir Levels

Project operations include substantial drawdown of lake elevations, although most of this drawdown does not occur during the primary recreational season. Such drawdown can interfere with boat access to the reservoirs and reduce the quality of the boating experience.

Proposed Article 1-23, *Reservoir Levels*, calls for SMUD to meet or exceed the end-of-month reservoir elevation targets for Loon Lake, Union Valley, and Ice House reservoirs and attempt to maintain higher levels and reduce daily fluctuations during the primary recreational season. These measures are fully defined and considered from an operational perspective in section 3.3.2 *Water Resources*.

Our Analysis

Recreational use within the Projects is primarily associated with the project reservoirs. Typically, SMUD operates Loon Lake, Union Valley, and Ice House reservoirs (the large storage reservoirs in the project) at full pool by mid-June, drops the reservoirs consistently through the summer and reaches full drawdown in October. During this period, and in most years, most of the public boat ramps are accessible.

As proposed, SMUD would ensure that the reservoirs would be maintained at a higher level than those allowed under current conditions during the primary recreational season. This would improve the quality of recreational experience by covering much of the lake bottom when most of the visitors are at the project and establishing minimum standards for lake levels associated with different water years.

The operation of a pumped-storage project could create hazardous hydraulic conditions at the intake/outlet structure in Slab Creek reservoir during operations in both the turbining and pumping mode. The minimum operating elevation is 1,800 feet, and the intake is located 80 feet below elevation 1,850 feet or elevation 1,770 feet. The lowest recorded elevation during the period of record we reviewed was 1,807.8 feet in 2005. Using that value as the minimum operating elevation and assuming the intake structure is 15 feet high, the water depth above the intake during pumping operations could be as little as 22 feet. Under the proposed operations, SMUD would release up to 5,200 cfs when the water surface elevation is at the lowest point of the operating range and this release would cause water surface disturbances. The design of the intake for the lower reservoir would need to provide for adequate safety features, including boat restraining barriers, warning signs, and other guidance to the general public. Such designs should use the Commission *Guidelines for Public Safety at Hydropower Projects* to develop adequate protection for the public. The design of such barriers should use either physical modeling or computation fluid dynamics modeling to assess the zone of potential influence and design preventative measures accordingly. Typically, such details[38] are developed during the final design stage and are subject to review by an external engineering board of review and by the Commission.

Coordinated Operations

Currently, boatable flows downstream of the Chili Bar development are primarily controlled by operations of the UARP. The lack of coordination leads to substantial variability in flows and loss of generation capacity when inflow to Chili Bar exceeds the hydraulic capacity of the powerhouse and the project spills.

Proposed Article 1-4, *Coordination with Chili Bar Licensee*, calls for SMUD to coordinate operations with the licensee of the Chili Bar Hydroelectric Project, in order to comply with the minimum stream flows, pulse flows, ramping rates, and recreational stream flows for both Projects. Proposed Article 2-3 calls for PG&E to coordinate operations with SMUD.

Our Analysis

The whitewater runs between Chili Bar dam and Folsom reservoir are of regional, if not national importance. Theses river sections are the most heavily boated in California, in part because the flows are relatively dependable and extend well into

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[38]Although the location of the intake/outlet structure was provided in exhibit F-160 and shown to be near the east shore of Slab Creek reservoir, we did not find a detailed drawing showing the structure or any boat restraining barriers.

the summer and falls months and in part because of their close proximity to large population centers. Historically, SMUD and PG&E have had limited coordination, where PG&E calls SMUD plant operators shortly before upstream releases in order for PG&E to decide how low to draw down Chili Bar reservoir. Often, this coordination does not work well, causing Chili Bar to spill and providing unpredictable flows in the whitewater runs below the Chili Bar dam. As proposed, coordination would provide substantial improvements to recreational resources by allowing boaters and other recreational users to more closely predict the timing and magnitude of flows and helping PG&E avoid lost generation opportunities.

Recreational Streamflows

SMUD determined that project operations limit whitewater boating opportunities between Slab Creek dam and Chili Bar reservoir, as well as the SFSC downstream of Ice House reservoir. In some years, these developments spill intermittently and unpredictably, or do not spill at all.

As part of Proposed Article 1-24, *Recreation Streamflows*, SMUD proposes to provide recreational streamflows in the SFSC downstream of Ice House reservoir (tables 3-64 and 3-65). The releases would include a range of flows and durations during spring months associated with the water year. The duration and magnitude of the proposed flows would be based on the water year, with shorter flow events at lower magnitudes occurring during dryer years.

SMUD proposes to spill water from the Slab Creek dam to provide recreational streamflows between 850 cfs and 1,500 cfs in BN, AN, and wet water years within 3 months of license issuance. These flows would be provided between the hours of 10:00 a.m. and 4:00 p.m. in no fewer than three flow events.

Table 3-64. Proposed recreational streamflows in the Ice House dam reach the first 5 years. (Source: SMUD and PG&E, 2007)

Water Year Type	May	June
CD	300 cfs for 1 weekend day	
Dry	300 cfs for 1 weekend days	
BN	400 cfs for 2 weekend days/holidays plus 500 cfs for 2 weekend days/holidays	
AN	400 cfs for 2 weekend days/holidays plus 500 cfs for 4 weekend days/holidays	
Wet	400 cfs for 4 weekend days/holidays plus 500 cfs for 5 weekend days/holidays	

Table 3-65. Maximum possible recreational streamflows in the Ice House dam reach after year 5. (Source: SMUD and PG&E, 2007)

Water Year Type	May	June
CD	300 cfs for 2 weekend days	
Dry	300 cfs for 6 weekend days	
BN	400 cfs for 5 weekend days/holidays plus 500 cfs for 2 weekend days/holidays	
AN	400 cfs for 5 weekend days/holidays plus 500 cfs for 5 weekend days/holidays	
Wet	400 cfs for 7 weekend days/holidays or Fridays plus 500 cfs for 9 weekend days/holidays or Fridays	

SMUD would monitor the amount and type of boating use for both runs for 5 years. For the Slab Creek run, SMUD would prepare a whitewater boating recreation plan at the end of 5 years, in consultation with the Forest Service, the Water Board, BLM, and other interested parties, describing whitewater recreational use and impacts on aquatic species and establishing triggers that would determine if SMUD enhances recreational streamflows after the construction of the Iowa Hill development. SMUD would continue to provide spring releases as shown in table 66 through year 10 at which time SMUD would determine if physical modifications would need to be made to the White Rock tunnel adit to continue to provide the proposed October recreational flow releases. After 15 years SMUD would provide the recreational streamflow releases shown in table 3-66 whether or not the Iowa Hill development is built or the recreational use triggers have been meet.

Within 2 years of new license issuance, SMUD would also prepare a plan to provide easement for access and parking in the immediate vicinity of White Rock powerhouse for recreational flow events, as well a management plan to address the whitewater recreation needs in the Slab Creek dam to White Rock powerhouse. SMUD would develop and implement measures identified in this plan. The management plan would address the following elements: use levels and projected future use levels; carrying capacity; sanitation and garbage; user conflicts; resource effects along the river and including effects to private land; necessary put-ins, take-outs and parking for whitewater activities; emergency resource protection measures; public safety, search and rescue needs and other emergency response needs; information and educational signing needs; demand for commercial services or outfitting, including shuttle services and guiding; on-river boat patrol.

For the SFSC run, SMUD would annually, in cooperation with the Forest Service, CDFG, and other interested parties, identify large woody debris that is hazardous to recreation streamflow users. SMUD would relocate the large woody debris within the channel, with approval by the Forest Service.

Table 3-66. Proposed recreational streamflows in the Slab Creek dam reach after Iowa Hill development is constructed, or year 15 if criteria are met. (Source: SMUD and PG&E, 2007)

<table>
<tr><th>Water Year Type</th><th>March</th><th>April</th><th>May</th><th>October</th></tr>
<tr><td>CD</td><td></td><td>850–950 cfs from 10:00 a.m. to 1:00 p.m. for 4 weekend days and
1,400–1,500 cfs from 10:00 a.m. to 1:00 p.m. and 850–950 cfs from 1:30 to 4:00 p.m. for 2 weekend days</td><td></td><td></td></tr>
<tr><td>Dry</td><td colspan="2">850–950 cfs from 10:00 a.m. to 1:00 p.m. for 4 weekend days and 1,400–1,500 cfs from 10:00 a.m. to 1:00 p.m. and 850–950 cfs from 1:30 to 4:00 p.m. for 6 weekend days</td><td></td><td>850–950 cfs from 10:00 a.m. to 1:00 p.m. for 2 weekend days</td></tr>
<tr><td>BN</td><td></td><td colspan="2">850–950 cfs from 10:00 a.m. to 1:00 p.m. for 3 weekend days/holidays[a] and 1,400–1,500 cfs from 10:00 a.m. to 1:00 p.m. and 850–950 cfs from 1:30 to 4:00 p.m. for 9 weekend days/holidays[a]</td><td>850–950 cfs from 10:00 a.m. to 1:00 p.m. for 6 weekend days</td></tr>
<tr><td>AN</td><td></td><td colspan="2">1,400–1,500 cfs from 10:00 a.m. to 1:00 p.m. and 850–950 cfs from 1:30 to 4:00 p.m. for 12 weekend days/holidays[a]</td><td>850–950 cfs from 10:00 a.m. to 1:00 p.m. for 6 weekend days</td></tr>
<tr><td>Wet</td><td colspan="3">1,400–1,500 cfs from 10:00 a.m. to 1:00 p.m. and 850–950 cfs from 1:30 to 4:00 p.m. for 12 days, weekend days/holidays[a]</td><td>850–950 cfs from 10:00 a.m. to 1:00 p.m. for 6 weekend days</td></tr>
</table>

[a] Priority given to Memorial Day weekend

Under Proposed Article 2-15, PG&E would maintain minimum recreational streamflows below in the SFAR downstream of the Chili Bar dam as shown in table 3-67. If the Water Board, California Department of Parks and Recreation, and BLM determine there should be changes to the times shown in table 3-67, PG&E would adjust the minimum recreational streamflows accordingly provided that inflows to the Chili Bar reservoir and Chili Bar reservoir elevations are sufficient to maintain these flows.

Our Analysis

SMUD's investigation of all of the reaches below project dams determined that whitewater recreation is feasible on the Slab Creek, Camino, and Ice House dam reaches. The other project reaches have low whitewater recreation potential due to various attributes such as remoteness, physical barriers or excessive or insufficient gradient. During periods when there is sufficient flow resulting from spill events, there are days when flows in the boatable range exist on the Slab Creek and Camino dam reaches, but this rarely occurs on the Ice House reach. The Slab Creek dam reach has received boating use during past spill events and this dam is known to spill in AN and Wet water year types.

SMUD's proposed spring recreational streamflows releases during years 1 through 15 would provide reliable boating flows of high difficulty that would enhance whitewater boating opportunities at the UARP. SMUD's monitoring for effect of these flows on aquatic species and to determine use would provide SMUD and the Agencies with the information necessary to adjust flows in response to environmental effects and user demand. After 15 years, however, both the spring and fall flows would be provided regardless of the effects on aquatic species or the amount of demand. A review of the environmental and use triggers as part of the 10 year monitoring report would be important for assessing whether the spring and fall recreational streamflow releases should continue after the construction of the Iowa Hill development, or after 15 years if the Iowa Hill development is not constructed.

As proposed, SMUD's and PG&E's recreational releases would provide substantial recreational benefits for whitewater boaters, especially during dry years when these dams would not typically spill. The proposed flows would occur at a magnitude that would provide high-quality boating opportunities for a variety of skill levels and for a variety of boats and that would be consistent with the results of the recreational use and boating studies.

Streamflow and Reservoir Elevation Gaging

Accurate and timely stream flow and reservoir levels provide important information for recreational visitors planning water-related visits to the project. Currently, flow information is provided by SMUD on a public Internet site for a number of project related waterways. However, the public information is incomplete and does not include flows on many of the project's creeks and streams.

As part of Proposed Articled 1-10 and 2-8, *Streamflow and Reservoir Elevation Gaging*, SMUD and PG&E propose to develop and file with the Commission for approval a streamflow and reservoir elevation gaging plan within 1 year of license issuance that meets USGS standards. SMUD and PG&E would provide copies of their respective plans and USGS review results to the Forest Service, the Water Board, CDFG, and the Commission. The Chief of the Division of Water Rights would approve the plans prior to filing with the Commission. See section 3.3.2.2, *Water Resources, Water Quantity*, for details of the streamflow and reservoir gaging locations.

Table 3-67. South Fork of the American River downstream of Chili bar reservoir dam minimum recreational flow by water year (cfs). (Source: DTA and Louis Berger, 2004c)

Water Year Type	**Period**	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Super Dry	April–Memorial Day	3 hrs at 1:00 p.m.					3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
	Memorial Day–Labor Day	3 hrs at 1:00 p.m.			3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	5 hrs at 1:00 p.m.	5 hrs at 1:00 p.m.
	Labor Day–September						3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
	October–March						3 hrs at 1:00 p.m.	
Critically Dry	March–Memorial Day	3 hrs at 1:00 p.m.					3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
	Memorial Day–Labor Day	3 hrs at 1:00 p.m.			3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	5 hrs at 3:00 p.m.	5 hrs at 3:00 p.m.
	Labor Day–September					3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
	October–February						3 hrs at 1:00 p.m.	
Dry	March–Memorial Day	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.			3 hrs at 1:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	Memorial Day–Labor Day	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.		3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	5 hrs at 3:00 p.m.	5 hrs at 3:00 p.m.
	Labor Day–September					3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
	October–February						3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
Below Normal	March–Memorial Day	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.		3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	Memorial Day–Labor Day	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.		3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	6 hrs at 3:00 p.m.	6 hrs at 3:00 p.m.
	Labor Day–September				3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	October	3 hrs at 1:00 p.m.				3 hrs at 1:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	November–February						3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.
Above Normal	March–Memorial Day	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	3 hrs at 1:00 p.m.	4 hrs at 5:50 p.m.	4 hrs at 5:50 p.m.
	Memorial Day–Labor Day	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	6 hrs at 5:50 p.m.	6 hrs at 5:50 p.m.
	Labor Day–September				3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	October	3 hrs at 1:00 p.m.				3 hrs at 1:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	November–February						3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
Wet	March–Memorial Day	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	6 hrs at 5:50 p.m.	6 hrs at 5:50 p.m.
	Memorial Day–Labor Day	4 hrs at 3:00 p.m.	4 hrs at 3:00 p.m.	4 hrs at 3:00 p.m.	4 hrs at 3:00 p.m.	4 hrs at 3:00 p.m.	6 hrs at 5:50 p.m.	6 hrs at 5:50 p.m.
	Labor Day–September				3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	October	3 hrs at 1:00 p.m.				3 hrs at 1:00 p.m.	3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.
	November–February						3 hrs at 3:00 p.m.	3 hrs at 3:00 p.m.

The measure also calls for SMUD to install and maintain simple staff gages at the put-ins for the Slab Creek and Ice House recreational boating runs within two years of new license issuance. SMUD would perform an investigation to determine whether telemetry equipment can be installed at Rubicon River below Rubicon dam and Little Rubicon River below Buck Island dam to monitor conditions and/or control operations. If SMUD and the Forest Service concur that such equipment is economically and technologically feasible and can be installed consistent with law, regulations, and policies applicable to Desolation Wilderness, SMUD would seek necessary approvals for such installation and would install this equipment if the necessary approvals are received.

SMUD and PG&E also propose to develop public information services (Proposed Articles 1-25 and 2-15, *Public Information Services*) to provide stream flow and reservoir level information on the Internet.

Elements of SMUD's stream flow and reservoir level measure would include:

1. Publication of flow and reservoir level on the Internet.
2. Notification of recreational streamflow releases at least 7 days in advance of the actual releases.
3. A plan that addresses, at a minimum, information on daily average reservoir stage height for the following reservoirs: Rubicon, Loon Lake Ice House, Union Valley, Gerle Creek, Brush Creek, and Junction. The plan would also address, at a minimum, information on hourly average reservoir stage height and storage for Slab Creek reservoir.
4. A plan that addresses real-time streamflows for the following Project-related stream reaches: Rubicon River below Rubicon dam; Little Rubicon River below Buck Island dam; Gerle Creek below Loon Lake dam; Gerle Creek below Gerle Creek dam; SFRR below Robbs Peak dam; SFSC below Ice House dam; Silver Creek below Junction dam; Silver Creek below Camino dam; Brush Creek below Brush Creek dam; SFAR below Slab Creek dam.
5. The plan would be approved by the Forest Service and the Water Board prior to filing with the Commission. Following approval, the minimum streamflow schedules from appendix a, section 1, and current water year type information would be published on the licensee's website. Within 6 months of completion of the information plan described above, the licensee would implement the elements described in the information plan. The streamflow and reservoir level information plan may be modified upon mutual agreement of the licensee, Forest Service, CDFG, and the Water Board.

PG&E's plan would include: (1) real-time lake stage height and storage information for Chili Bar reservoir; (2) installation of up to two simple staff gages for use by the public; (3) real-time streamflow and reservoir level information that is available to the public year-round via toll-free telephone number or other appropriate technology approved by BLM; and (4) streamflow information collected consistent with the standard USGS gage facilities downstream of the Chili Bar reservoir dam (using USGS gage 11444500) on a website that includes 15-minute increments and streamflow releases from the past 7 days.

Our Analysis

SMUD's and PG&E's proposals, including gaging and publication of flow information, would provide substantial amounts of new flow and lake level data for recreational visitors. This information would be useful in planning and staging water-related trips to the project, such as flat water and whitewater boating trips and fishing trips.

Public Information Services

Public information at the primary recreational sites helps visitors understand acceptable and prohibited activities, as well as provide information about important cultural and environmental resources in the area.

As part of Proposed Article 1-25, *Public Information Services*, SMUD proposes to develop public information services that would require SMUD to develop brochures and maps, and develop an interpretation and education plan for the project. Specifically, SMUD proposes develop and print one or more brochures and maps that describe the recreational opportunities, recreational facilities, rules, and responsibilities within the area of the project, including the Canyonlands, high country lakes, and streams. The brochure would be provided to the Forest Service for review and approval prior to completion. The licensee would make the brochure/map available to the public free of charge. The brochure/map would be made available continuously and would be updated as conditions change.

SMUD also proposes to develop an interpretive, educational, and public information plan within 2 years of license issuance, in consultation with the Forest Service and other appropriate agencies and interested parties. At a minimum, the plan would include themes, design, audience, delivery methods, and schedule for implementation for providing up-to-date information such as: sightseeing, hiking, observing wildlife, and utilizing facilities such as boat ramps, campgrounds, and beaches. SMUD proposes to coordinate development of this plan with PG&E.

As part of Proposed Article 2-14, *Public Information Services* PG&E would annually pay $15,000 (escalated by GDP-IDP) to BLM to provide project recreation brochures and maps and an interpretive, education, and public information plan.

Our Analysis

The proposed brochures and map and the interpretive, education, and public information plan would improve upon existing public education and interpretation information with updated materials that compliment the Forest Service and BLM publications. The proposal would help expand recreational opportunities by providing visitors with easily accessible information about project resources.

UARP-Only Alternative

The effects of project operations on existing and proposed recreational facilities would be the same as under the Proposed Action, except that if recreational use triggers are met, the provision of enhanced recreational boating flows would require physical modifications to the White Rock tunnel in year 15.

3.3.6.3 Cumulative Effects

The recreational measures proposed by SMUD and PG&E would improve recreational opportunities throughout much of the SFAR Basin. Each proposed measure is incrementally small. However, together, the recreational measures would improve opportunities in the region, allowing the Projects to adapt to change recreational use over time, better using existing recreational resources, and developing new resources that address current and foreseeable recreational activities, such as hiking and biking.

3.3.6.4 Unavoidable Adverse Effects

None.

3.3.7 Land Use

3.3.7.1 Affected Environment

Land Ownership

The UARP is located in El Dorado County and the northeastern part of Sacramento County, California, within the SFRR, SFSC, and SFAR drainages. The project boundary encompasses about 9,432 acres, which includes the seven developments as well as the proposed Iowa Hill development (including transmission tie-in and access roads) (table 3-68). The Forest Service administers about 64 percent (6,048 acres) and BLM administers less than 1 percent (42 acres) of the federal lands within the UARP boundary, none of which are in the proposed Iowa Hill development. SMUD owns about 34 percent (3,193 acres) of the land. The private owners (Sierra Pacific Industries) hold about 2 percent (150 acres) of the land within the project boundary.

Table 3-68. Land ownership (acres) within the FERC project boundaries, by development.[a] (Source: DTA and Goodavish, 2005)

Development	SMUD	Forest Service	BLM	Private	Totals
Loon Lake	253.1	2,041		11.3	2,305.4
Robbs Peak	28.2	188.8		33.5	250.5
Jones Fork	666.6	518.8			1,185.4
Union Valley	2,018.1	2,257.5		6.8	4,282.4
Jaybird	52	336		7.9	395.9
Camino		227.1		0.2	227.3
White Rock	96.6	293.4	42.3	70.3	502.6
Iowa Hill	77.9	185		20	282.9
Total	**3,192.5**	**6,047.6**	**42.3**	**150**	**9,432.4**

[a] The Commission charges SMUD annually for the use of federal lands under section 10(e) of the FPA for 4,553.41 non-transmission line acres and 359.79 transmission line acres, which is less than the total federally owned acres in this table because acreage transferred to the Forest Service in the 1960s for which SMUD retains occupancy rights is not included in the total.

The proposed Iowa Hill development boundary including the transmission line tie-in would include 282.9 acres of land. The Forest Service administers 185 of these acres, and the remaining acres are owned and managed primarily by SMUD (77.9 acres) and Sierra Pacific Industries (20 acres).

BLM owns about 227 acres of undeveloped land in the vicinity of the Chili Bar Project. About 48 of those acres are located inside the Chili Bar Project boundary.

Land Uses

Industrial Uses

Industrial uses with the project areas are predominantly related to SMUD and PG&E's hydropower operations. These facilities (described in sections 2.1.1 and 2.2.1, *Project Description)* include 12 reservoirs, 12 transmission lines, tunnels, and support facilities.

Recreational Uses

Rubicon reservoir in the Loon Lake development is surrounded by the Desolation Wilderness Area within the Eldorado National Forest, and the Forest Service manages the land around the reservoir consistent with wilderness goals and objectives. The land within and immediately surrounding Buck Island and Loon Lake reservoirs is public land managed primarily for recreational activities, including boating, fishing, hiking, horseback riding, camping, and wilderness appreciation. The Rubicon OHV

Trail passes along the north side of Loon Lake and Buck Island reservoir, and users camp at informal dispersed campsites near the route.

SMUD provides formal public recreational facilities and shoreline access primarily at four of the reservoirs in Crystal Basin (described in section 3.3.6.1, *Recreational Resources*). Facilities include four campgrounds, a boat launch, a wilderness trailhead, and a chalet at the Loon Lake development; two campgrounds, two day-use areas, an interpretive trail, and a fishing pier at the Robbs Peak development (Gerle reservoir); three campgrounds, a day-use area, a boat-launch, a trail, an information station, and a sanitation station at the Jones development (Ice House reservoir); and 12 campgrounds, a day-use area, three boat launches, and two sanitation stations at the Union Valley development. There are two private resorts, Robbs Valley Resort which intrudes on the project boundary at the Robbs Peak development, and Ice House Resort in the vicinity of the Jones Fork development. A commercial whitewater put-in, a public whitewater put-in, and the Nugget Campground are located along the SFAR downstream of Chili Bar dam.

Recreational use in the Canyonlands at the Jaybird, Camino, and Slab Creek/White Rock developments is informal and minimal and generally limited to fishing and dispersed camping on Eldorado National Forest lands; boating on Junction, Brush Creek, Slab Creek, and Chili Bar reservoirs via informal boat launches (boats are not permitted on the Camino reservoir); and OHV use. There are no developed recreational facilities at the reservoirs associated with the three developments. The downstream reach of the Chili Bar Project is a popular whitewater recreation run.

The proposed Iowa Hill development would be located within the Eldorado National Forest, near Slab Creek reservoir and the communities of Camino and Swansboro/Mosquito. No formal recreational facilities are proposed at this development.

Timber Harvesting

There are an estimated 428,844 acres of land managed for commercial timber production on the Eldorado National Forest. Timber-producing land is classified into five major forest types: mixed conifer, red fir, ponderosa pine, sub-alpine, and hardwoods. Timber harvesting emphasizes regeneration of poorly stocked stands. Timber harvesting occurs near each development at Robbs Peak, Jones Fork, Union Valley, Jaybird, and the proposed Iowa Hill development, as well as on privately owned lands owned by Sierra Pacific Industries adjacent to the project boundary.

Residential Uses

Private residential development in the project area is sparse with several privately owned parcels abutting the project boundary along the north end of Loon Lake reservoir, several parcels in vicinity of Gerle reservoir, two parcels in the vicinity of Jones Fork development, several parcels abutting the Union Valley development, one parcel near the access road to the south of Camino developments, and several parcels in the vicinity of the Slab Creek/White Rock development. All of these private-residential parcels are zoned as Natural Resource Areas by El Dorado County and may be used for rangeland, wildlife management, forestry, water resource development, and or residential use supporting one dwelling per 40 to 160 acres. There is also sparse residential development to the north and south of the Iowa Hill site, which would be constructed on SMUD-owned land currently designated as rural residential with a platted lands overlay, on Eldorado National Forest lands, and on Sierra Pacific Industries lands designated as Natural Resource. The lands in the Chili Bar Project area include rural residential parcels, and several residences are located within 0.75 mile downstream of Chili Bar dam.

Access Roads

The SMUD operations and maintenance staff use a variety of federal, state, county, and private highways/roads to access project facilities. SMUD's use of these roads consists of light and heavy vehicles at varying levels of frequency. All roads (about 104) within the UARP were surveyed and identified for existing or potential sources of erosion or sediment that may reach a watercourse. SMUD, Sierra Pacific Industries, the Forest Service, El Dorado County, or a combination of two or more of these jurisdictions maintains these roads. Main access roads to project features and project campgrounds that were paved generally had formal drainage systems, implemented erosion control measures, and little or no observed erosion and sediment transport. Access roads to transmission line towers generally followed the natural grade and used water bars for drainage. Ruts were observed on several of these roads, but sediment usually did not leave the roadway. In the worst cases, sediment traveled 15 to 20 feet from the road. Because these roads are typically on the tops of ridges and far from streams or rivers, there is little opportunity for sediment reaching watercourses.

Unpaved roads and trails (surfaced with gravel or native materials) that provide access to project features typically have drainage features, including side ditches, water bars, and cross culverts. Some of these roads are near watercourses and have the potential to transport sediment to the water; however, most of these roads have higher usage and appear to be maintained. Very few problem areas were identified. During the winter, SMUD plows Ice House Road and several other roads needed to operate and maintain the UARP facilities. SMUD also voluntarily plows selected parking areas for recreationists in accordance with the Eldorado National Forest's annual snow removal plan, and during spring opening of campgrounds. SMUD removes the snow from Ice House Road consistent with a use permit issued by El Dorado County.

The roads that would serve the Iowa Hill development are U.S. Highway 50 (U.S. 50), Carson Road, Larsen Drive, North Canyon Road, Slab Creek dam access road, Slab Creek reservoir access road, Cable Road, and Iowa Hill Road. U.S. Highway 50 is the primary east-west transportation corridor through the county that serves all of the county's major population centers. Carson Road is a two-lane, east-west roadway extending from Camino to Placerville. Cable Road is a two-lane road paved up to the Sierra Express Drive intersection that runs generally north-south (with many curves). The remaining road segment to Iowa Hill Road is loose gravel or dirt. Cable Road would serve as the primary access route for the upper reservoir site, and it would be graveled from Sierra Express Drive to the Iowa Hill development as part of the project improvements. Iowa Hill Road, off of Cable Road, is the access road to the upper reservoir site. Iowa Hill Road is a dirt road with no shoulder, and it would be graveled as part of the project improvements. Larsen Drive is a two-lane, rural local collector that runs generally north-south between North Canyon Road and Carson Road. It also connects North Canyon Road to Cable Road. North Canyon Road is a two-lane north-south local road between Placerville and Camino. Slab Creek dam access road, off of North Canyon Road, provides access to the lower reservoir site, and it has a varying roadway width and no shoulder. It connects to Slab Creek reservoir access road at Slab Creek reservoir. Both Slab Creek dam access road and Slab Creek reservoir access road would be upgraded as part of the Proposed Action.

The Chili Bar Project access road extends to the project facilities east from Highway 93. Three privately developed roads lead to shoreline areas that are located on project lands including two roads off of Rock Creek Road along the northern shore of the Chili Bar reservoir and one road off of Bear Rock Road on the southern side of the Chili Bar reservoir.

Vegetation Management below Transmission Lines

SMUD currently implements a vegetation management program to maintain the vegetation in the transmission line right-of-way. SMUD voluntarily complies with California Public Utility Commission rules and regulations regarding power line clearances (General Order 95). The purpose of the plan is to sustain an adequate distance between overhead transmission lines and vegetation within the right-of-way. SMUD mainly uses mechanical methods, such as hand cutting and bulldozing, to clear the right-of-way outside the Eldorado National Forest. Recently, the Forest Service authorized SMUD to use herbicides in addition to mechanical treatment within the right-of-way on National Forest System lands. Herbicides allow for selective treatment of vegetation where undesirable plant species, such as noxious weeds, are selectively treated, and desirable species, such as low-growing trees and shrubs that provide wildlife habitat or food for foraging, are preserved. The reduction of fuels within the right-of-way has an added benefit as it creates a fuel break that will contribute to the control or containment of a wildfire.

Fire Risk and Protection

SMUD conducted a fire risk and protection study that concluded that that fire risk is highest in lands within the immediate vicinity of the UARP reservoirs and where recreation occurs. Fire risk progressively decreases moving further away from the reservoirs. Within the Pacific Ranger District, there are about 28,200 acres in need of fuels reduction treatment. Projected fuel treatments to reduce fire hazard to acceptable levels includes treating areas with a combination of thinning and slashing in the first decade, followed by periodic underburning to maintain desired conditions over the next five decades. SMUD's study found a positive correlation between human-caused fires and proximity to dispersed recreation located on Eldorado National Forest-managed lands sites; historically, fires are clustered along roads and surrounding recreational areas such as Union Valley, Loon Lake, and Ice House reservoirs. However, available data do not allow distinction between the types of human-caused fires. While transmission line sag is a fire risk, measures are in place to evaluate and remove hazard trees under and adjacent to transmission lines. Removal of these trees on a periodic basis minimizes the risk of fire start from the transmission lines.

While some wildfires in the UARP area have occurred historically, the Eldorado National Forest has an active fuels management program in place to minimize fire risk. Fires at UARP-related recreational areas are relatively rare, and when they occur they are usually small and quickly suppressed.

Land Management

Federal

As noted above, federal lands managed by two federal agencies (Forest Service and BLM) account for about two-thirds (6,090 acres) of the acreage within the project boundary.

Forest Service—In 2001 and 2004, the Eldorado National Forest Land Resources and Management Plan was amended by the Sierra Nevada Forest Plan Amendment. This was a planning effort to respond to the study of the Sierra Nevada Mountain bioregion. The Sierra Nevada Plan addressed the following five management problems: (1) old forest ecosystems and associated species, (2) aquatic, riparian, and meadow ecosystems and associated species, (3) fire and fuels management, (4) noxious weeds, and (5) lower Westside hardwood forest ecosystems. The 2004 amendment established management direction and goals; land allocations; desired future conditions; standards and guidelines for future management actions; and strategies for inventory, monitoring, and research to support adaptive management.

The goals of the old forest and associated species strategy are to (1) protect, increase, and enable desired conditions of old forest ecosystems and conserve species associated with these ecosystems while meeting people's needs; (2) increase the frequency of large trees, increase structural diversity of vegetation, and improve stability and distribution of old forests across the landscape; and (3) restore forest species composition and structure following large-scale, stand-replacing disturbance.

The aquatic management strategy goals are to maintain and restore (1) water quality, (2) species viability, (3) plant and animal diversity, (4) special habitats,

(5) watershed connectivity, (6) floodplains and water tables, (7) watershed condition, (8) streamflow patterns and sediment regimes, and (9) stream banks and shorelines.

The goals for fire and fuels management include reducing threats to communities and wildlife habitat from large, severe wildfires and re-introducing fire into fire-adapted ecosystems. The long term goals are (1) treating fuels in a way that reduces intensity and spread, therefore making fire suppression more effective; (2) treating hazardous fuels in a cost-efficient manner to maximize program effectiveness; and (3) actively restoring fire-adapted ecosystems. The management of hazardous fuels in and around communities combined with strategic placement of treatment across broad landscapes can modify wildland fire behavior.

The Eldorado National Forest Land and Resource Management Plan was also amended in 1998 to include the Desolation Wilderness Management Guidelines. These guidelines were developed because of the following issues: (1) increased day use in the wilderness due to increasing population in urban areas and improved access at wilderness trailheads, (2) the development of more refined methods of managing wilderness use, and (3) the national direction for the Forest Service to use land resource management plans to create standards and guidelines for consistent wilderness management.

Bureau of Land Management—The BLM's management plan for the SFAR pertains to the management of public lands. This management plan contains a set of assumptions that apply to the UARP and the Chili Bar Project. Planning Assumption #10 states, "It's anticipated that there will be no significant changes in water flow in the SFAR in the foreseeable future" (BLM, 2004, not seen, as cited in DTA and Goodavish, 2005).

The Federal Land Policy and Land Management Act is the organic act of the BLM. The act establishes the agency's multiple-use mandate to serve present and future generations. The act requires periodic and systematic inventorying of publics and land use planning to project present and future land uses.

El Dorado County—All lands in the study area owned by El Dorado County are located outside the project boundary. Lands in El Dorado County are subject to the policies detailed in the El Dorado County General Plan, River Management Plan, Trails Master Plan, and Water Agency Water Resource Development and Management Plan.

In El Dorado County, designations include Rural Residential, Low, Medium and High Density Residential, Natural Resource Areas, and Open Space. Rural Residential is defined as areas for residential and agricultural development where there is one dwelling unit per 10 to 160 acres. Low Density Residential establishes areas for single-family residential development in a rural setting with a maximum of one dwelling unit per 5 acres. Medium Density Residential is for detached single-family residences with larger lot sizes that enable limited agricultural land management activities. There is a maximum of one dwelling unit per 1 acre. High Density Residential areas are suitable for intensive single-family residential development (condominiums, townhouses, detached dwellings, and manufactured homes) at densities from one to five dwelling units to 1 acre. In the vicinity of UARP, within the Eldorado National Forest boundary, both governmental and non-governmental lands are designated as Natural Resources Area, which means these areas contain economically viable natural resources and protect the economic viability of those resources and those engaged in harvesting/processing of those resources, including water resources development. Compatible uses may include agriculture, rangeland, forestry, wildlife management, recreation, water resources development, and single-family dwellings necessary to support compatible uses. The Open Space land use designation includes public lands under governmental title (other than those designated as Natural Resources) where no development other than that specifically needed for governmental-related open space uses is desired.

3.3.7.2 Environmental Effects

Land Ownership, Management, and Use

The proposed management plans and associated land management strategies and implementation measures could affect land use and land management within the UARP area over the term of a new license. There are no measures in PG&E's Proposed Action that would affect land use at the Chili Bar Project.

Transportation System Management Plan

Under Proposed Article 1-30, *Transportation System Management,* SMUD would (1) develop and implement a transportation system management plan, approved by the Forest Service, for roads on or affecting National Forest System lands, (2) undertake specific road improvements, and (3) provide to the Forest Service an annual snow plowing plan to address public safety and access.

The proposed transportation system management plan would (1) establish SMUD's level of responsibility for project roads with SMUD having primary responsibility for non-system roads and for maintenance level 1 and 2 roads and sharing levels of responsibility for maintenance level 3, 4, and 5 roads with the Forest Service; (2) include maps showing all roads, a traffic safety and signage plan, drainage crossings, easements or right-of-way agreements identifying those roads for which an easements or right-of-way agreements are needed; road use by season, conditions of the roads, a signage plan, measures to control erosion at the UARP facilities; and identification of access points at the UARP; and (3) provision for 5-year plan updated every 5 years to identify the maintenance and reconstruction needs for project roads.

SMUD would also address specific road projects, including (1) improvements to North Union Valley Road; Wrights Lake Tie Road to improve the intersection with Ice House campground entrance road, and Lakeshore Road within 5 years of license issuance and close the road to Junction dam to public access and construct a turnaround/parking area within 10 years of license issuance.

Our Analysis

Some of the Forest Service and other public roads the licensee uses to access project facilities for operation and maintenance purposes are also used by the Forest Service for administrative and land management purposes, and the public for recreational activities. The development of a transportation management plan, in consultation with the Forest Service, would enable ongoing maintenance and associated planning responsibilities to be clearly defined. Such clarification of maintenance responsibilities and implementation of erosion control measures during maintenance activities would minimize the potential for road erosion and damage caused by snow removal or other factors and other resource damage caused from precipitation and increased traffic. We note that any project access road requiring routine maintenance would need to be included in the project boundary. Implementation of the specific road improvements to those roads constructed by SMUD and used solely for project purposes would enhance public safety and access at several highly used recreational facilities.

Iowa Hill Development

The construction process of Iowa Hill would begin with updating existing access roads to accommodate construction vehicles. Roads that would be updated are Cable Road, Slab Creek dam access road, and Slab Creek reservoir access road. The updated roads would serve as the main avenues for accessing the upper and lower construction areas for the estimated 235 temporary construction workers. The project construction would improve the roads that service the project area. Also the project construction may enhance the potential for development because of access road improvements and regular road maintenance.

Once operating, we could not expect the two employees and periodic trips by supply and maintenance vehicles to generate much project-related traffic at Iowa Hill.

Trails System Management Plan

Under Proposed Article 1-31, *Trails System Management*, SMUD would develop a trails system management plan, approved by the Forest Service, for the trails that are needed for Project operations and are located on or affect National Forest System lands. SMUD would also address specific trails management projects, as described in Proposed Article 1-19, *Specific Recreation Measures*. Section 3.3.6, *Recreational Resources*, contains information on specific elements of the plan and trails projects.

Our Analysis

The trail system management plan would identify measures to ensure that safety, maintenance, and rehabilitation measures associated with the trails are addressed in a consistent manner and so as not to adversely affect environmental resources. Some of the Forest Service trails the licensee uses to access project facilities for operation and maintenance purposes are also be used by the Forest Service for administrative and land management purposes, and the public for recreational activities. The trails system management plan would provide for ongoing maintenance and improvement of the trail system for UARP, Forest Service, and people using the recreational facilities at the reservoir. Trails requiring routine maintenance would need to be included within the project boundary.

Iowa Hill Development

The construction schedule at Iowa Hill does not include initial upgrades of trails as the trails are not main avenues for accessing the construction areas at Iowa Hill or Slab Creek. The trail usage generated from construction activity would be minimal.

Trail usage created during operation of the proposed hydropower project would be minor.

Facility Management

Under Proposed Article 1-32, *Facility Management*, SMUD would develop and implement a facility management plan, approved by the Forest Service. The proposed plan would include a map showing all UARP facilities, including structures on or affecting National Forest System or BLM lands and above-or below-ground storage tanks; a description of the type and season of use of each structure; and a description of the condition of each structure, and planned maintenance or removal. In addition, every five years SMUD would prepare a plan identifying maintenance, reconstruction, and removal needs for UARP facilities, including transmission lines.

Our Analysis

Development and implementation of the proposed facility management plan would provide Forest Service or BLM with information on planned maintenance activities that might affect federal lands.

Proposed Project Boundary

Project boundaries of the UARP and Chili Bar Project would be changed under the proposed actions. SMUD proposes to revise the UARP Project boundary to encompass the new Iowa Hill development south of Slab Creek reservoir, which covers about 283 acres and includes a berm, tunnel, powerhouse, and transmission line. Steep terrain limits land use in the area. Currently, lands are used minimally for timber production by Sierra Pacific Industries and Eldorado National Forest with limited dispersed recreation. SMUD would also include the project recreational facilities.

PG&E proposes to revise the Chili Bar Project boundary. The existing Chili Bar Project boundary includes about 255 acres of PG&E-owned lands from approximately 50 to 250 feet from either side of the river and extending from 3.2 miles upstream of the

Chili Bar dam to 320 feet downstream of the dam. The PG&E proposed boundary would be about 103 acres within the normal maximum water surface elevation at 997.5 feet mean sea level and would enclose all project works, as well as a 12-foot wide corridor for a new proposed hiking trail (the Sand Bar Trail) to provide public access to the reservoir shoreline.

Our Analysis

The UARP proposed boundary change would not affect land ownership, but would change land use in vicinity of the project south of Slab Creek reservoir. Under the Proposed Action, existing timber production and recreational use would be converted to industrial use. However, because existing land use is limited to timber production and dispersed recreation, the environmental effects of the proposed boundary change would be minor. Inclusion of the project recreational facilities would ensure the ability of the Commission to enforce compliance with the proposed measures for recreation facility, road, and trail improvements and maintenance over the term of any license issued for the project.

The proposed Chili Bar Project boundary excludes approximately 152 acres of BLM, PG&E, and private lands included in the existing boundary. PG&E does not provide any specific information about why the lands are no longer needed for project purposes. However, land use and ownership would not be changed, and recreational access to the reservoir would be provided through development of the Sand Bar Trail. Environmental effects of the proposed boundary on land use and management would be negligible.

Effects of Proposed Iowa Hill Development (Overall)

The proposed Iowa Hill development would be located south of Slab Creek reservoir. The current land uses, including recreation, are minimal due to the steep terrain. The SMUD-owned lands have no existing use while the Sierra Pacific Industries and Eldorado National Forest lands are management mainly for timber production. The construction of the proposed Iowa Hill development would have minimal effects on land use and management at UARP. The development of the project would not prevent future development of residences on the private parcels around the project, but would adversely affect residential parcels, ranging from short-term construction-related disturbances to the long-term obstruction of views. However, the project may enhance the potential for development because of access road improvements and regular road maintenance.

Vegetative Management Plan

The proposed vegetation management plan primarily affects terrestrial resources and is discussed in section 3.3.4.2, *Terrestrial Resources, Vegetative and Noxious Weed Management* and would address vegetative management under project transmission lines.

Fire Management and Response Plan

Under Proposed Article 1-34, *Fire Management and Response Plan*, SMUD would develop and implement a plan for the prevention, cost sharing, coordination, reporting, control, and extinguishing of fires in the vicinity of the Project resulting from project operations. The proposed plan would include (1) the identification of fire hazard reduction measures to prevent the escape of project-induced fires, (2) the locations of exit routes and determination of fire suppression strategies, as well as address fire danger and public safety associated with project-induced recreation, (3) analysis of emergency response and fire prevention needs including equipment and personnel, (4) reporting, (5) lists of the location and availability of fire suppression equipment and personnel, and assurances that prevention measures meet water quality protection practices, and (6) investigation of project-related fires.

Our Analysis

The UARP continues to create a wildfire threat. Recreation at the reservoirs and stream reaches, including project facilities and user-created dispersed sites, pose a substantial fire risk and that risk will increase as recreational use increases in the future. Given the known high incidence of fire starts and previously treated and untreated fuels in the area, SMUD should take reasonable preventative and pre-suppression actions at its project facilities to help prevent wildfires and create safer conditions for the visitors brought to the Crystal Basin by the Project facilities and reservoirs. Implementation of the proposed fire management and response plan would improve planning, management, and coordination for wildfire protection and prevention measures, as well as lead to a reduction in the occurrence and suppression of wildfires that might be project-induced.

3.3.7.3 Unavoidable Adverse Effects

None.

3.3.8 Aesthetic Resources

3.3.8.1 Affected Environment

The UARP is located in El Dorado County and the northeastern part of Sacramento County, California. UARP lies on the western slope of the Sierra Nevada mountain range. This part of the county is largely undeveloped and retains much of its natural character, with scattered rural residences and small communities located along major corridors throughout the western slope. Nearly all of the UARP facilities, except for the White Rock powerhouse and the section of the UARP transmission line that leads from the powerhouse to Folsom Junction, are located on lands within the Eldorado National Forest.

The UARP existing facilities and proposed Iowa Hill development can be placed into three aesthetically distinct geographic areas: Desolation Wilderness, Crystal Basin, and Canyonlands. SMUD identified key view points (table 3-69) associated with Eldorado National Forest viewsheds within and near the project boundary to assess the existing visual condition of UARP facilities and operations within the surrounding forest landscape.

Table 3-69. Aesthetics resources at UARP, key viewpoints. (Source: DTA and Goodavish, 2005)

Rubicon Trail	Sunset / Fashoda Road
Loon Lake reservoir	Union Valley reservoir
North Loon Lake Road	Union Valley Bike Path
Red Fir Access Road	Big Hill Lookout Road
McKinney Creek Road	Ice House-Wrights Road
Wentworth Springs Road	Ice House Reservoir Road
Gerle Creek Access Road	Ice House reservoir
Gerle Creek reservoir	Bryant Springs Road
Ice House Road	Forebay Road
Wolf Creek Road	Highway 193
Yellow Jacket Road	State Scenic Highway 50
Deer Knob Peavine Road	

Desolation Wilderness

The Desolation Wilderness lies within the crest zone of the Eldorado National Forest. The Eldorado National Forest is managed in terms of visual quality objectives (VQO), which are reflected in the 1988 Land and Resource Management Plan (Forest Service, 1988, not seen as cited in DTA and Goodavish, 2004). The VOQs represent a combined rating of the scenic integrity or visual variety of the landscape with a sensitivity rating that reflects the number and relative concern of viewers for the scenic quality of the landscape. The Desolation Wilderness is characterized by a strongly glaciated landscape with peaks that tower above glaciated rocky basins. The UARP boundary is excluded from wilderness designations but is required to be managed in a manner that is consistent with the adjacent wilderness. Desolation Wilderness is managed for a VQO of Preservation that allows only ecological changes to be made, where management activities (except for low visual impact recreational facilities) are prohibited. Because the facilities at UARP are man-made, the project will never meet the wilderness Preservation VQO. The Forest Service goal is to move as close to a Preservation VQO as is reasonable.

The UARP facilities within the wilderness are associated with Rubicon reservoir and affect views from the Rubicon Trail. As viewed from the trail, the scale and color of the main dam blend in fairly well with the surroundings. The auxiliary dam has an angular form that contrasts with but does not dominate the characteristic landscape. Due to the proximity of the trail to the intake structure, boom, and gaging structure, the built facilities are major visible features that contrast with the natural appearing wilderness area and dominate views from the trail. Traveling north from the reservoir, Rubicon trail splits. Along the northwest trail, the outlet structure, gauging station, and cable crossing over the channel dominate the view. The tunnel outlet is gated by a chain link fence that detracts from the natural setting. The concrete color and texture of the tunnel matches that of the surrounding rocks although the smooth texture and geometric form appear unnatural. The light color of the gaging station, contrasts with the characteristic landscape.

Crystal Basin Landscape

The Crystal Basin lies within the mixed conifer-red fir zone of the Eldorado National Forest. Within the Crystal Basin are 5 areas of power generating developments: Loon Lake, Robbs Peak, Union Valley, Jones Fork, and Jaybird. Views from trails, roads, and reservoirs are affected by the UARP facilities.

At the Loon Lake development, the main and auxiliary dams at Buck Island reservoir have a horizontal form and smooth texture that contrasts with the natural setting, whereas the scale and color of the dams reasonably blend well. The Buck Island dam, intake, transmission lines, and powerhouse are not obvious to those utilizing the Rubicon Trail or the Buck Island reservoir. At Loon Lake reservoir, the scale and horizontal line of the main and auxiliary dam contrasts with the natural settings surrounding the dam, although the colors blend in well. Looking at these features from the reservoir and Red Fir Access Road they are unnatural appearing and dominate the view. The main and auxiliary dams at Loon Lake are intermittently visible from Rubicon Trail but are obscured by the landforms and vegetation. The Loon Lake dike and powerhouse are off the reservoir shoreline and are not visually evident from the reservoir, although the angular shape of the powerhouse contrasts the surrounding landscape. The powerhouse is visually evident from North Loon Lake Road. The intake at Loon Lake is near the shoreline, light in color, and angular in shape making it subordinate to the surrounding landscape. The Loon Lake intake can be seen easily from the Rubicon Trail and other points on the reservoir. The transmission line and substation at this development are hard to see from the reservoir but are noticeable from North Loon Lake Road and McKinney Road. One tower is visible from Rubicon Trail.

Within the Robbs Peak development, users at Gerle Creek reservoir, the trail to Angel Peak, and the Summer Harvest Trail can see the UARP dam and intake. The dam and intake area introduce an angular shape and smooth texture into the landscape. The color is similar to the granite rock but contrasts with the forested background.

At the Union Valley development UARP facilities such as the Gerle Creek canal, Robbs Peak dam area, and the Robbs Peak penstock can be seen from Ice House Road near the Robbs Peak forebay. The Gerle Creek canal and the Robbs Peak dam area do not dominate the view but both have contributed to the developed nature of the forebay site. Development at the dam area at Robbs Peak includes dam gates, an intake structure, fences and gates, cleared areas, and a small building. The dam area also consists of angular shapes and light colors which contrast with the surrounding scenery. The Robbs Peak penstock forms a dominate line that can be seen briefly from Ice House Road. The penstock is also evident from Big Hill Lookout Road, Big Hill Vista, Union Valley reservoir, and portions of the Union Valley bike path.

The Jones Fork penstock, near the Jones Fork powerhouse, is also visible from Ice House Road. The penstock is well screened to the east but is visible to the west of Ice House Road because of clearing from the road. The penstock is visible where there are forest openings at other locations, such as from Big Hill Lookout Road. It is also visible in the middle-ground viewed from Big Hill Vista. The penstock is light in color and contrasts the soil and dark green surrounding vegetation.

Along Deer Knob Peavine Road, the Union Valley dam, powerhouse, switchyard, and intake can be seen. The dam dominates the view. The powerhouse is angular and the color contrasts with the surrounding environment. The switchyard and substation are in close proximity to the powerhouse which together dominates the view of a confined canyon setting. Two towers of the Union Valley transmission line can also be seen from Wolf Creek Road near Deer Knob Peavine Road.

The Union Valley dam and transmission lines, and the Robbs Peak penstock, transmission lines, and powerhouse, can be seen from the Union Valley reservoir. The horizontal form of the Union Valley dam is apparent and contrasts with the surrounding landscape. The Robbs Peak penstock color blends well with surrounding soil but in combination with other surrounding features, such as the powerhouse, it dominates the view. The powerhouse is dark in color and contrasts with the light soil surrounding it in the foreground view from the reservoir but blends in with the surrounding vegetation when viewed in the middleground. Most of the Union Valley transmission lines are shielded from view by the forest, although visibility is temporarily increased due to the Cleveland Fire, which occurred in 1997.

From different view points on Ice House reservoir, there are views of the main dam, intake, and dikes. The main dam is angular and contrasts with the surrounding landscape. When the water level is high, the scale of the dam is relatively small when compared to the size of the reservoir; it is noticeable but does not dominate the view from any location. The intake is only visible to viewers directly in front of it. The dikes at Icehouse reservoir are low and similar in color to the surrounding shoreline.

At the Jaybird development from Bryant Springs Road, the Union Valley dam and substation, as well as Union Valley-Jaybird transmission line are visible. From the road, the Union Valley dam is large in scale and takes up the view. The substation is seen in front of the dam contributing to the dominating view. The Union Valley-Jaybird transmission towers are screened by forest vegetation and only visible intermittently whereas the transmission lines govern the view around Junction reservoir.

Canyonlands Landscape

The Canyonlands lie within the front country zone of the Eldorado National Forest. The front country terrain is characterized by rolling uplands and steep rugged river canyons. The canyon lands contain the Camino development and the Slab Creek reservoir / White Rock development. At the Camino development there are no Eldorado National Forest managed viewsheds in the area. Relatively few people view the UARP facilities in this area.

UARP facilities, such as the Camino penstock and powerhouse, and the Camino-White Rock transmission lines affect views from Forebay Road (El Dorado County Road). The penstock contrasts with the natural setting because it is linear in form and does not blend well with the dark green forested hillside. Where the penstock is visible from Forebay Road, it dominates the upstream view. From Forebay Road bridge, the powerhouse and substation are not easily noticeable. The transmission line corridor dominates the view from locations along Forebay Road and where they cross over the canyon from the powerhouse to a knoll above the river.

Within the Slab Creek/White Rock development, the White Rock Spoil pile can be seen from State Highway 193. The spoil pile stands out and dominates the view because of its geometric shape, color, and size, in comparison to the surrounding forest land.

Reservoir Levels

SMUD conducted a survey to evaluate visitors' aesthetic expectations for, and satisfaction with, water surface elevations at the Loon Lake, Union Valley, and Ice House storage reservoirs. Visitors were asked about their historical and current use and satisfaction with reservoir levels. They were shown three pictures of different reservoir elevations, and asked what their level of satisfaction would be if the reservoir looked like the picture during their visits.

Of those interviewed who had visited Loon Lake reservoir before, only 15 percent said they had been dissatisfied with water levels in the past. Most respondents (92 percent) at Loon Lake reservoir were neutral, satisfied, or very satisfied with reservoir elevations at or above 6,399 feet (11 feet below full-pool). About half of the respondents were dissatisfied or very dissatisfied at an elevation of 6,390 feet

(20 feet below full-pool), but only a quarter of respondents would find the 6,390-foot elevation to have a negative effect on their experiences.

Of those interviewed who had visited Union Valley reservoir before, 38 percent said they have been dissatisfied with water levels in the past. Over three-fourths of the respondents (78 percent) at Union Valley reservoir were neutral, satisfied or very satisfied with the 4,852-foot reservoir elevation (17 feet below full-pool). At elevation 4,816 feet (54 feet below full pool), 70 percent of the respondents were dissatisfied or very dissatisfied with the appearance of the reservoir and 72 percent said their experience would be negatively affected.

Of the respondents who have visited Ice House reservoir before, 34 percent said they have been dissatisfied with water levels in the past. Most respondents (88 percent) at Ice House reservoir were satisfied with reservoir elevations at and above 5,438 feet (12 feet below full-pool). At elevation 5,425 feet (25 feet below full-pool), 55 percent of the respondents were dissatisfied or very dissatisfied with the appearance of the reservoir. Similarly, 47 percent of respondents said their experience would be negatively affected at the 5,425-foot level.

Proposed Iowa Hill Development

SMUD identified key observation points (figure 3-36) within and near the proposed Iowa Hill development boundary to represent views of the aesthetic environment of the UARP facilities and operations as well as assess the aesthetic resources of the project. The analysis includes the effects on visual resources due to the existence of existing and proposed facilities, their operations, and their noise. Field results indicated that views of proposed Iowa Hill development are confined to lots located on the canyon side of roads and courts that border the outer edge of the subdivision above the SFAR: Deer Canyon Court, Cableview Court, Log Cabin Lane, Slab Creek Court, and White Oak Drive. There appear to be no views of proposed Iowa Hill reservoir from the "interior" roads of the development.

Along Deer Canyon Court, the proposed Iowa Hill development would not be seen from the road although the road ends in a cul-de-sac where three lots may have views of the proposed development. On Cableview Court (no. 1 on figure 3-36), there would not be views of Iowa Hill because the area is heavily forested. A view of Iowa Hill to the south would be possible from an unmarked road off the side of Cableview Court, although vegetation would partly screen the view. Views from Log Cabin Lane (no. 2 on figure 3-36) were obscured by forested areas. About 10 lots on the east side of the road between Cableview and Slab Creek Courts (no. 4 on figure 3-36), would be affected by the proposed Iowa Hill development. Iowa Hill would be visible from the backyard of a lot at the north end of Slab Creek Court.

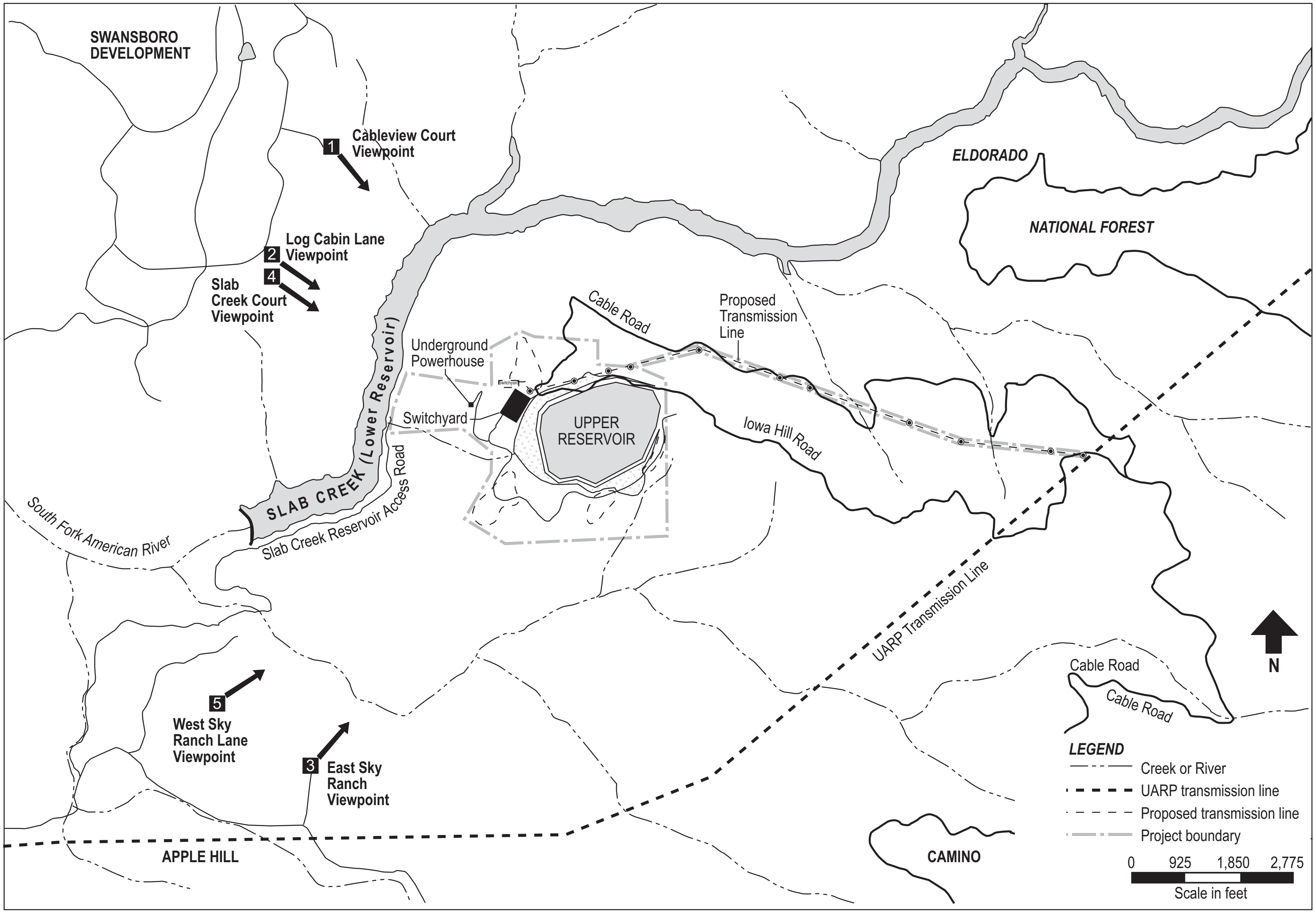

Figure 3-36. Key observation points in project area. (Source: SMUD, 2005; PG&E, 2005, as modified by staff)

A key observation point is located on White Oak Drive (no. 4 on figure 3-36), which terminates at an entrance gate to a large lot from which Iowa Hill can be seen to the west. The proposed Iowa Hill development can be seen from the gate on Chute Camp Road (no. 5 on figure 3-36). Sky Ranch Lane (east and west) heads north and veers west, where the proposed Iowa Hill development can be seen (no. 3 on figure 3-36). It then turns into a private drive where the posted signs ask people to turn around. Along Winding Lane, the area is heavily wooded and there is no access to the lot at the end of the road. The lot, however, appeared to have a direct view to the north of the proposed Iowa Hill development based on the parcel map information. Skyview Drive passes under the existing UARP (Loon-White Rock) transmission line, where Iowa Hill could be seen from near the transmission line tower along the road. No apparent views of the proposed facility were evident from Mace Drive. Forebay Road provides access to the east end of Slab Creek reservoir and the Camino powerhouse. From this observation point, a view of Iowa Hill and the slope the transmission line was found at the last switchback in Forebay Road before descending into the SFAR canyon.

Project Area Management

Forest Service

Management of all National Forest System lands within the project boundary is guided by several documents including the Eldorado National Forest Land and Resource Management Plan. All of the project lands and lands influenced by project operations that are managed under the Eldorado National Forest Land and Resource Management Plan fall within the Desolation Wilderness, Crystal Basin, or the Canyonlands areas.

The Eldorado National Forest Land and Resource Management Plan provides standards and guidelines for the VQO specified for each management area. VQOs are a measure of the degree of acceptable alteration permitted within the natural characteristic landscapes and are applied to all project proposals and activities on National Forest System lands. The VQOs prescribed by the Eldorado National Forest Land and Resource Management Plan for the National Forest System lands within the UARP facilities boundary are as follows.

Preservation—The Preservation VQO allows for ecological change only. Except for very low visual-impact recreational facilities (such as hiking trails), management activities are prohibited. This objective applies to wilderness areas, primitive areas, other specially classified areas, areas awaiting classification and some unique management units that do not justify special classification. Project facilities that fall under the Preservation VQO include Rubicon reservoir and its diversion and tunnel. Although the Rubicon reservoir area sits inside the Desolation Wilderness boundary, the reservoir itself is not within the wilderness due to congressional exclusion, however, the act calls for the excluded lands "…. to be managed in a manner that is consistent with the adjacent wilderness."

Retention—The Retention VQO provides for management activities that are not visually evident. Under Retention, activities may only repeat the form, line, color and texture frequently found in the characteristic landscape, but changes in their qualities of size, amount, intensity, direction and pattern should not be evident. Most of the reservoirs and surrounding shorelines associated with the UARP have a Retention VQO, including Buck Island, Loon Lake, Gerle Creek, Union Valley, Ice House, Robbs Forebay, and Slab Creek reservoirs.

Partial Retention—The Partial Retention VQO allows for management activities that remain visually subordinate to the characteristic landscape. Activities may repeat the form, line, color, or texture common to the characteristic landscape, but they should remain subordinate to the visual strength of the characteristic landscape. The area surrounding Junction reservoir has a Partial Retention VQO. Portions of Union Valley and Ice House reservoirs (and the surrounding area), and the upper development area for the Iowa Hill development have a Partial Retention VQO.

Modification—Under a Modification VQO, management activities may visually dominate the characteristic landscape. However, activities of vegetative and land-form alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area character-type. None of the UARP reservoir areas are in a Modification VQO.

Bureau of Land Management

The BLM-managed land in the UARP boundary is about a 40-acre parcel, located at White Rock. Visual Resource Management by BLM is based on the agency's Visual Resource Management system, which involves inventorying scenic values and establishing management objectives for those values through the resource management planning process. The BLM VQOs are defined by the Eldorado National Forest Land and Resource Management Plan. The standard intended to decrease conflicts with visual management objectives of the National Forests and BLM, yet allow continued project operation. The BLM visual management objectives also apply to the 48 acres of BLM-managed lands within the Chili Bar Project boundary.

El Dorado and Sacramento County General Plans

The general plans for El Dorado and Sacramento counties include goals and objectives associated with the protection of visual resources, however there are no inventory and assessment systems similar to those of the federal agencies for managing visual resources. Therefore, the aesthetic assessment of Project facilities on lands outside the Eldorado National Forest (except for BLM lands where the VRM system applies) will use the environmental checklist questions from the CEQA Guidelines for evaluating any on-going visual or auditory effects of the Project within El Dorado and Sacramento counties.

3.3.8.2 Environmental Effects

Visual Resource Protection Plan

Under Proposed Articles 1-27 and 2-16, *Visual Resource Protection*, SMUD and PG&E would develop and implement, in coordination with the Forest Service and BLM, respectively, visual resource protection plans. The proposed visual resource protection plan was designed to improve how well project facilities blend in with the surrounding landscape. SMUD and PG&E would file plans with the Commission with the Forest Service (for UARP) and BLM approval (for Chili Bar) including proposed mitigation and implementation schedules to bring the Projects' facilities affecting visual resources into compliance with visual resource standards and guidelines. Enhancement measures would include (1) surface treatments with natural appearing materials that will be in harmony with the surrounding landscape, (2) use of non-specular conductors for the transmission lines, (3) use of native plant species to screen facilities from view, (4) reshaping and revegetating disturbed areas to blend well with surrounding visual characteristics, and (5) locating transmission facilities to minimize visual impacts.

Under the plan, SMUD would implement the following specific visual enhancement measures: (1) at Rubicon reservoir, paint the metal components of the gaging station, intake booms, telemetry facilities, cable crossing and bucket a non-reflective black color and replace the chain link fence with black fencing within 2 years of license issuance; (2) at Robbs Peak forebay, paint the railings black, replace the chain link fences with vinyl black fences, paint the roof a dark gray color; (3) at Robbs Creek, paint the powerhouse facilities the same color as the penstock within 8 years of license issuance; (4) at Union Valley dam and substation, sandblast the guardrail to remove white paint then repaint with black paint or replace with core-ten guardrail, within 13 years of issuance; and replace the chain link fences with vinyl black fence with black posts, where powder coated posts are preferred over painted metal; (5) at Loon Lake, paint the doors on the substation a dark gray within the first two years, and remove the Loon Lake passive reflector (Wentworth Peak) from the skyline to a location with a backdrop and camouflage it to blend into the surroundings within 2 years of license issuance, and paint the roof of the gate shaft with approved colors within 2 years of issuance; (6) paint the handrails and guardrails at Gerle reservoir non-reflective black and paint the licensee-owned weather stations with non-reflective black paint within 4 years; and (7) at the Jones Fork, paint the penstock to match the color of the Robbs Peak penstock with in the first 3 years the license is issued.

Under Proposed Article 1-44, *Compliance with Visual Quality Standards*, SMUD would develop a design for the Iowa Hill development that meets the visual quality standards of the Eldorado National Forest Land and Resource Management Plan and would provide the Eldorado National Forest with plan specifications and simulated views of the design to assist in determining whether the design meets the visual quality standards.

Our Analysis

Some project facilities and operations are visible on the landscape and contrast with the surrounding forested setting. Implementation of visual resources plans including the proposed measures would help to ensure that project facilities blend with the surrounding landscape, yet allow the operation of UARP and Chili Bar Project facilities. Painting facilities black will make them less visible from a distance considering the facilities are surrounded by dark forested landscapes. Painting the facilities or taking action to blend them in with surroundings would enhance aesthetics at the project by minimizing the view of project facilities.

Reviewing any new construction with BLM, prior to any ground-disturbing activities would ensure that any new construction at the Chili Bar Project would blend with the surrounding landscape.

Iowa Hill Development

Under the proposed construction sequence, SMUD would begin construction by first improving the existing access roads and clearing approximately 150 acres of land. SMUD would then drill and blast to excavate the reservoir and tunnel leading to Iowa Hill. After the reservoir and tunnel are complete, SMUD would construct the powerhouse and other facilities underground. Construction activity would entail using vehicles, trailers, equipment, materials, laborers, earthen debris, and fencing. The area would be de-vegetated, re-graded, leveled, barricaded, lined, and filled. Effects from construction on the visual resources would last for up to 5 years. The contractor would be responsible for implementing dust control measures within the project limits and approaches to the construction area. During construction traffic would increase on the local roads. Dust and dirt in the area would increase from all the construction vehicles as well as the excavation and construction process. The negative impacts would affect boaters, anglers, trail users, road users, residents, and any others near the construction of Iowa Hill. The level of use in the project area is relatively low and the effects associated with dust, dirt, and traffic would be limited to the 4 year construction period. The project as proposed does not currently meet Eldorado National Forest VQOs. Provision of plan specifications and simulated views of the proposed facilities would help to ensure that project facilities meet the VQOs of the Eldorado National Forest.

The operation of Iowa Hill would vary from day to day. Some days the development will not be used at all and other days it may be used heavily. On heavy use days, the water level fluctuation would increase then decrease about 9 to 15 feet, whereas weekly fluctuation would be approximately 30 feet; however the maximum fluctuation in Slab Creek reservoir would not be altered by Iowa Hill. Generally, the Iowa Hill reservoir would rise during the day, in response to generation, and fall during the night, in response to pumping. The operation of Iowa Hill reservoir would have minimal effects on the aesthetic environment.

Reservoir Levels

Also, under Proposed Article 1-23, *Reservoir Levels*, SMUD would, within 6 months of licensing issuance, meet or exceed the end-of-the month reservoir elevations for Loon Lake, Union Valley, and Ice House reservoirs as shown in table 3-21 in section 3.3.2.2, *Water Resources*.

Our Analysis

Based on the user preference surveys, reservoir levels in BN, AN, and Wet water years would satisfy the majority of users of the Loon Lake, Union Valley and Ice House reservoirs. At Loon Lake, about 50 percent of the users would be satisfied with end of month water surface levels except for all month in CD water years and September in Dry water years. At Union Valley and Ice House reservoirs, at lease 75 percent of users would be satisfied with end of month water surface levels in July of BN water years and in AN and Wet water years. Users would generally not be satisfied with surface water levels in CD and Dry water years; however these reservoir levels would be similar to the current operations and would not have any additional effect on water surface levels.

UARP-Only Alternative

Under the UARP-only Alternative, the Iowa Hill development would not be constructed and the visual impacts on Iowa Hill and the surrounding canyon terraces would not occur. The remaining aesthetic enhancements proposed by SMUD would be as described under SMUD's Proposal.

3.3.8.3 Unavoidable Adverse Effects

There would be short-term negative effects from construction activity on boaters, anglers, trail users and residents in the vicinity of the proposed Iowa Hill development.

3.3.9 Cultural Resources

3.3.9.1 Affected Environment

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (section 106), requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register of Historic Places (National Register) prior to an undertaking. An undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. In this case, the undertaking is the proposed issuance of new licenses for the Projects. Potential effects that may be associated with this undertaking include any project-related effects associated with the day-to-day operation and maintenance of the Projects after issuance of a new license.

Historic properties are cultural resources listed or eligible for listing in the National Register. Historic properties represent things, structures, places, or archeological sites that can be either Native American or European-American in origin. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register. Cultural resources also have to have enough internal contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archeological sites may not have enough contextual integrity to be considered eligible.

Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Officer (SHPO) on any finding involving effects or no effects on historic properties, and allow the Advisory Council on Historic Preservation an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by a proposed new license within a project's APE. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties and/or traditional cultural properties (TCPs), if any such properties exist. In this case, the APE for the UARP encompasses all lands and waters within that project's boundaries plus the location of the proposed Iowa Hill development. The APE for the Chili Bar Project encompasses all lands and waters within the existing licensed project boundary, including the access road from Highway 193, the powerhouse and dam, and upstream to a point upriver of the UARP White Rock development. It also includes the route of PG&E's proposed Sand Bar hiking trail, which PG&E proposes to bring within its proposed license boundary. The SHPO concurred with these respective APEs by letters dated April 22, 2003 and November 24, 2004.

Cultural History Overview

Over the years, archaeologists have proposed a number of archaeological chronologies for the North-Central Sierra Nevada and for the Sacramento Valley/foothills regions in which the American River drainage lies. Collectively, they can be loosely organized into five general periods characterized by artifacts and other remnants of human settlement.

To date, archaeologists have found no conclusive evidence that humans occupied the American River drainage during the Late Pleistocene period, prior to 10,000 BP. This appears to have begun to change toward the end of the Early Holocene period (10,000 BP-7000BP) in areas to the east of the Sierra crest, as indicated by the presence of stemmed projectile points and stone tools.

Archaeologists have found more evidence of human occupations for the Archaic period (7000 BP to 3200 BP) to suggest that indigenous peoples were beginning to incorporate seeds and other vegetable matter into a diet heretofore based largely on meat (and in the foothills area, fish as well). There is also evidence of trade among groups in the form of shell ornaments and other "exotic" materials that suggest interaction between groups in the Central Valley and groups normally occupying areas east of the Sierras.

During the Early-Middle Sierran period (3200 BP to 600 BP), archaeologists believe there was increasing regionalization of Native land use and also regular use of certain locales. Although no evidence of permanent habitation above 3,500 feet has been found in the American River watershed, scholars generally believe that indigenous peoples timed forays above that elevation to take advantage of local resources. Big game and acorns appear to have been the staple components of Native diet during this period. Toward the end of this period archaeologists have discerned the introduction of the bow and arrow—an important technological development for both subsistence and warfare. Also during this time, relatively large, dense and increasingly sedentary populations began to concentrate in the foothill regions.

By the Late Sierran period (600 BP to 150 BP; also known as the Late Emergent period), there was year-round native occupation in the American River area; there is archaeological evidence of village sites in foothill areas, and increasing populations would have increased competition for resources.

Although contact with Europeans began with mid-16th century coastal explorations by Spaniards, the effect of European presence did not become evident until arrival of Spanish missionaries in 1769. That year initiated a period—extending into the early 19th century—during which missionaries implemented a process to aggregate and colonize the Native inhabitants through the institutions of missions, presidios and pueblos, greatly affecting the demography, social life and culture of the area's indigenous peoples.

With Mexico's independence from Spain in 1821, the missions were gradually secularized as "ranchos" dependent on Native inhabitants for labor required for farming and ranching. The United States' war with Mexico in the middle 1840s resulted in the cession of California in 1848. That same year, discovery of gold initiated Euro-American migration into the region on an enormous scale. There soon emerged a need for food, shelter and the infrastructure that accompanies thousands of people in a developing area. Immigrants from Europe, Asia and elsewhere followed the miners to the gold fields to grow crops, raise cattle, harvest timber, and build towns. Roads were built over the Sierra Nevada, often following trails utilized by Native populations for millennia.

By 1850, El Dorado County had one of the largest populations in the state. Miners, agriculturalists, loggers and merchants all settled in the area. The UARP and Chili Bar Project area intersects a number of historic period mining districts, in which an elaborate network of ditches and flumes were built, beginning in the mid-19th century, to provide power for miners. As the call for hydraulic power increased, so did the size of the ditches, at first providing water for placer mining and later to the expanding agriculture of the region. Grazing emerged as one of the biggest industries in the county and surrounding area, even as the gold rush began to decline. The many unsettled areas of the Sierra Nevada and foothills drew cattlemen, soon followed by sheepherders, including a significant number of Basques. In the 1890s logging, which had begun in the area in the mid-19th century, became a major extractive activity in the county under the American River Land and Lumber Company and under successor companies until the Great Depression.

Of the many cultural groupings occupying various ecological niches in the Sierra Nevada and foothills, those most usually associated with the UARP and Chili Bar Project area are the Miwok, Nisenan (Southern Maidu) and Washoe. Travelers and explorers in the early 19th century would have encountered these people living within their traditional territories. The Coast Miwok and Plains Miwok had for many years been affected by missionization and the Mexican ranchos, the Sierra Miwok less so. The Nisenan occupied the Sierra foothills below about 3000 feet in the vicinity of the American, Bear, Cosumnes and Feather River. The Washoe lived in the vicinity of Lake Tahoe, east of the Sierra crest, but traveled extensively to the west. However, traditional ways of life were deeply disrupted by the disease, wars with military expeditions, enslavement and relocation that attended Euro-American occupation of the region in the 19th century and precipitated significant disruption of traditional ways of life. Nisenan, Miwok and Washoe communities were displaced from their lands by miners, ranchers and others seeking to extract resources from the region.

By the late 19th century the "Rancheria" emerged as a Euro-American solution to problems of displaced Native peoples in California. The rancherias were lands purchased by Congressional authorization for displaced and homeless Native Americans of various tribal groups. Although the US government terminated 30 rancherias under the California Rancheria Act of 1958, court decisions forced the government to recognize the "tribes, bands, communities and groups" of 17 rancherias and restore those Rancherias to their previous status. Among these were the Shingle Springs and Auburn Rancherias, whose residents include Nisenan and Miwok families; and the Jackson Rancheria, home to a population of primarily Sierra Miwok. Some Nisenan and Miwok are affiliated with other Rancherias, such as Sheep Ranch, Tuolumne, Chicken Ranch, and Buena Vista.

The El Dorado Indian Council is among groups without federal recognition that represent descendants of the historical tribes affected by displacement and Federal Indian policy. The Washoe, after many attempts to regain their lands and establish a reservation, were provided with 156 acres of land near Carson City for the Carson Indian Colony in 1917; an additional 40 acres were allocated for the Washoe at Dresslerville, and the Reno Sparks Indian Colony was allocated for both Washoe and Northern Paiute communities. In 1970, in a settlement of a claim against the government, the Washoe gained another 40 acres near Woodfords in Alpine County, California.

Prehistoric and Historic Archaeological Resources

Archaeological surveys in and around the UARP began in the 1940s, with increasing frequency after passage of the NHPA in the mid-1960s. Many of the surveys have been conducted by the Forest Service or its consultants in association with various logging and other projects, particularly during the period from the 1970s to 1990s. Archaeological surveys conducted between 1999 and 2004 in association with SMUD's relicensing effort combined verification of data from the earlier surveys and systematic field investigations of locations not previously surveyed in the APE. These surveys did not include the land above the project's tunnels because there are no project operations on the surface at these locations. The archaeological resources inventory report prepared for SMUD documented 87 sites in the APE. Forty-seven of the sites consisted of prehistoric components (with three of these also having some historic period artifacts), while 40 sites dated to the historic period. The prehistoric sites generally consist of bedrock mortars and lithic scatters, a few possibly associated with camps or other Native American use of the area. The historic-period sites include old roadbeds, remnant ditches and dams associated with irrigation, mining remains, and home sites. The Forest Service had previously determined five of the prehistoric sites and two of the historic sites were ineligible for the National Register. The eligibility of the remaining 80 sites has not been formally determined; these "unevaluated" sites are considered by the archaeologists, SHPO and SMUD as "potentially eligible" until such time as more intensive archaeological investigations may be undertaken.

Location surveys conducted for SMUD and PG&E in 2004 and 2005 in the Chili Bar project APE were accomplished chiefly by boat, due to the steep slopes of the river canyon and heavy vegetation. These surveys identified four historic-period archaeological sites. PG&E ultimately determined, in consultation with the SHPO, that two of these (a mine adit and a hydraulic mining cut with associated equipment pad, were ineligible for the National Register. PG&E did not evaluate the third site, known as the Chili Bar Toll House Cemetery, because it lies on BLM land outside its proposed project boundary. This cemetery consists of a headstone marker and possible cemetery pad; information in PG&E's application associates the grave with Ella Coolidge (who died April 24, 1862), daughter of a toll house keeper whose wife was a Native American. The fourth recorded resource is an old road alignment from Rock Creek Road to Chili Bar reservoir, which features a section of fieldstone wall. PG&E has asked the SHPO to concur in its opinion that the road alignment is not eligible for the National Register. By letter dated August 9, 2005, the SHPO concurred with PG&E's determination that the road alignment is not eligible.

Traditional Cultural Properties

The previously-mentioned Chili Bar Toll House Cemetery is the only publicly-known TCP to have been formally recorded to date in either the UARP or Chili Bar Project APE.

SMUD contacted the Native American Heritage Council in association with its relicensing effort. By letter of March 16, 2004, they informed SMUD that a sacred site was located in the project, and suggested contact with the El Dorado Miwok Tribe for further information. SMUD also commissioned an ethnographic report in its effort to identify TCPs in the UARP. The study included a review of existing literature coupled with interviews with Tribal elders and others knowledgeable of traditional Sierra Miwok, Nisenan and Washoe lifeways in the area of the project. Interviews with descendants of 19th and early 20th century Euro-American settlers were also included in the study to provide a fuller picture of land use and occupation of the UARP area over time. The ethnographic study did not result in identification of specific TCPs (beyond the recorded prehistoric sites, which may be considered potential TCPs by virtue of their association with area Native American groups). The failure to record specific TCPs may be attributable to Native American concerns about potential plundering of cultural sites should they be identified. The study did, however, document the tribes' strong sense of association with the area and the continued importance to them of gathering plants for instrumental, medicinal, ceremonial and food uses.

PG&E also contacted tribes, identified by California's Native American Heritage Council as potentially interested in the project, to elicit information or concerns those tribes might have regarding TCPs in the Chili Bar Project. Although none of the contacted tribes and groups (El Dorado Miwok Tribe; Ione Band of Miwok Indians, Shingle Springs Band of Miwok Indians, Sierra Native American Council, United Auburn Indian Community, and Wilton Rancheria) offered comment, the El Dorado Miwok Tribe requested a map of the area depicting the project.

Historic Buildings and Structures

Neither project APE contains buildings or structures more than 50 years old and both hydroelectric Projects (including project facilities) date to the late twentieth century.

3.3.9.2 Environmental Effects

Continued project operation and enhancements and new construction could affect cultural resources listed in or eligible for inclusion in the National Register.

Under Proposed Articles 1-28 and 2-17, *Heritage Resources*, SMUD and PG&E would complete, within 6 months after license issuance, HPMP for the Forest Service (for UARP) and BLM (for Chili Bar) approval. Each HPMP would take into account Project effects on prehistoric and historic resources, Native American traditional cultural values, direct and indirect effects to heritage resources within the APE, ethnographic studies, historic archaeological studies, and Project recreational impacts to archaeological properties affecting National Forest System or BLM lands, as applicable. Each HPMP would also provide measures to mitigate the identified impacts, a monitoring program, and management protocols for the ongoing protection of archaeological properties. The plans would be filed with the Commission, and SMUD and PG&E would implement the plans upon approval.

Under Proposed Articles 1-29 and 2-18, *Heritage Resource Discovery*, if prior to or during ground disturbance or as a result of Project operations, items of potential cultural, historical, archeological, or paleontological value are reported or discovered, or a known deposit of such items is disturbed on National Forest System or BLM lands and licensee adjoining property, a licensee would immediately cease work in the area so affected. SMUD or PG&E would notify the Forest Service or BLM, as applicable, and would not resume work on ground disturbing activities until it received written approval from the land-owning agency. If it deems it necessary, the Forest Service or BLM could require SMUD or PG&E to perform recovery, excavation, and preservation of the site and its artifacts at the licensee's expense through provisions of an Archaeological Resources Protection Act permit issued by the Forest Service or BLM.

Iowa Hill Development

The Settlement Agreement also contains a separate provision (Proposed Article 1-45, *Heritage Resources Protection*) regarding cultural resources protection for the construction and operation of the event that the Iowa Hill development. Under this provision if prior to or during ground disturbance or as a result of project operations, items of potential cultural, historical, archeological, or paleontological value were reported or discovered, or a known deposit of such items was disturbed, SMUD would immediately cease work in the area so affected. SMUD would then notify the Forest Service and would not resume work on ground-disturbing activities until it received written approval from the Forest Service.

Our Analysis

SMUD drafted an HPMP that is currently under review in second draft form by the Forest Service. Finalization and implementation of SMUD's HPMP in consultation with the SHPO, Tribes, the Forest Service and the Commission would ensure that adverse effects on historic properties arising from UARP operations or project-related activities over the term of the license would be avoided or satisfactorily resolved. Similarly, an HPMP for the Chili Bar Project, prepared and implemented by PG&E in consultation with the SHPO, Tribes, BLM and the Commission would ensure that adverse effects on historic properties arising from project operations or project-related activities over the term of the license would be avoided or satisfactorily resolved.

UARP-Only Alternative

Under the UARP-only Alternative, the proposed Iowa Hill development would not be constructed and measures to protect historic properties at Iowa Hill would not be necessary; however, SMUD and PG&E would still develop and implement the proposed HPMPs to address the potential effects of issuing new licenses for the continued operation of the UARP and Chili Bar Project on historic properties.

3.3.9.3 Cumulative Effects

The UARP and Chili Bar Project are among a large number of hydroelectric projects in central California that affect prehistoric and historic archaeological resources located along the American River and its tributaries. These Projects attract recreational use around the reservoirs. The increased recreational use resulting from the availability of the reservoirs has contributed to both inadvertent and intentional destruction of prehistoric and historic archaeological resources and of TCPs. While continued erosion and recreational use of the American River area would be expected to continue to affect archaeological resources and TCPs, the measures included in HPMPs for the UARP and Chili Bar Project, as well as measures being or already developed and implemented at other hydroelectric projects in the area, would cumulatively reduce the rate of destruction of these cultural resources.

3.3.9.4 Unavoidable Adverse Effects

In the event of relicensing and pursuant to the NHPA, the Commission would execute PAs with the SHPO and the Advisory Council on Historic Preservation (should they chose to participate) to implement final HPMPs within one year of license issuance as a condition of any license for the UARP or Chili Bar Project. Each licensee, the Tribes, the Forest Service and BLM would be invited to participate in the respective PA as consulting parties.

Execution of the PAs and implementation of the final HPMPs would ensure proper protection and management of significant cultural resources within the Projects' APEs and would also provide satisfactory resolution of any project-related adverse effects.

3.3.10 Socioeconomic Resources

3.3.10.1 Affected Environment

The region of influence includes the local area, or El Dorado County as a whole and communities in proximity to the UARP, Chili Bar Project, and Iowa Hill development, and the regional area, or the Sacramento Primary Metropolitan Statistical Area (PMSA), which comprises the economically linked counties of Sacramento, Placer, and El Dorado.

El Dorado County

El Dorado County occupies 1,711 square miles of land and is located on the western slope of the Sierra Nevada between the Central Valley of California and the state of Nevada. It contains the Eldorado National Forest, which is considered one of California's most prized recreational areas. The northern boundary of the county is primarily defined by the Middle Fork American River and the southernmost border is shared with Amador County. U.S. Highway 50 runs east/west through El Dorado County, while state highways 49 and 89 run north/south through the western and eastern portions of the county, respectively.

Population

El Dorado County has an estimated population of 176,841 (103.4 persons per square mile), an increase of 40.3 percent from the 1990 census, approximately double the growth of the entire United States (20.4 percent) and 1.7 times the comparable growth for the state of California (U.S. Census, 2005). The population of El Dorado County is projected to reach 241,263 individuals by 2025. New home permits, which grew by nearly threefold during 1995-2004, will decelerate gradually from a peak of 2,123 in 2005 to 1,743 in 2025 as constraints on developable land begin to bind (California Department of Finance, 2004).

Employment

There were an estimated 87,689 full-time and part-time jobs in El Dorado County during 2004, a 68 percent gain over the 1990 count. Of the 2004 total, just over 54,000 jobs were classified as wage and salary as opposed to proprietor's employment (BEA, 2007).

In contrast to much of the United States, El Dorado County added a significant number of manufacturing jobs during the 1990s, but the California Department of Finance is projecting a sharp slowdown in that growth going forward. The western slope of the county is "emerging as an information technology center" recently attracting such businesses as software engineering and research and development. This shift is reflected in recent historical growth patterns and in the current population projections (California Department of Finance, 2004).

Much of the job growth is in white collar occupations. Growth in information technology jobs, which was virtually flat from 1995-2004 (530 jobs to 540 jobs), is expected to accelerate to 710 jobs in 2025. Professional services jobs increased from 2,000 in 1995 to 5,840 in 2004 and are projected to climb to nearly 12,000 in 2025 (California Department of Finance, 2004). In 2005 38.9 percent of the work force was engaged in management and professional service jobs (U.S. Census, 2005). Jobs in health and education and in leisure services will experience similar expansions, but farming and construction jobs (300 and 4,960 jobs, respectively) will be relatively unchanged from the 2004 count, the latter owing to an anticipated slowdown in the home construction industry.

Income and Demographics

Median household nominal income in El Dorado County was $63,147 in 2005, and per capita nominal income is estimated to be $38,652 (U.S. Census, 2005). Household income for the county amounted to $6.6 billion in 2004 (U.S. Bureau of Economic Analysis, Regional Economic Accounts).

El Dorado County's racial and ethnic composition is less diverse than much of California. Most of the residents (89.2 percent) were White, 3.7 percent Asian, 1.2 percent Native American or Alaska Native, 0.8 percent African American, 0.03 percent Native Hawaiian and other Pacific Islander, 2.8 percent some other race, and 2.2 percent two or more races.

The median age is 39.3 years, and 66.1 percent of the population was between 18 and 64 years of age. The poverty rate was 7.7 percent compared to 13.2 percent for the state as a whole. The housing stock for El Dorado County stood at 77,181 units as of January 1, 2004. Single-family homes accounted for 64,227 units, multiple-family dwellings accounted for 8,580 units, and mobile homes accounted for 4,374 units. In December 2001, the median home price in the county was $215,000 but in 2005 it was $542,000 (U.S. Census, 2005).

Placerville is the county seat of El Dorado County and is located at an elevation of 1,866 feet. Incorporated in 1853, Placerville had a population of about 9,900 individuals as of 2001. Besides Placerville, communities with populations of 1,000 or more in the county include South Lake Tahoe, El Dorado Hills, Shingle Springs, Pollock Pines Cameron Park, and Diamond Springs. The closest major population center outside the county is the city of Sacramento, located about 44 miles to the west.

Sacramento County

Employment

There were 779,572 full and part-time jobs in the county in 2004 with 642,586 classified as wage and salary. Government jobs (181,118 workers) form the bulk of Sacramento County's employment. Other service jobs, such as retail (83,596 jobs), healthcare and social assistance (67,099 jobs), and professional and technical services (50,947 jobs), dominate the economy. Construction jobs (55,892 workers) are the majority of non-service occupations. During 2001–2004, job growth was a modest 4.3 percent but this was more than twice the growth for the state of California. During the same interval, jobs in educational services, construction, utilities and real estate underwent the fastest rate of growth while management of companies and enterprise, forestry, fishing and related activities, mining, and manufacturing have each declined.

Income and Demographics

The inflation-adjusted household income in 2005 in Sacramento was $51,793 and inflation adjusted per capita income was $24,616. The total household income for the county amounted to $43.2 billion in 2004, or 3.4 percent of the total state of California personal income.

Sacramento's racial and ethnic composition is similar to the state of California. Approximately 60.2 percent are White, 13.8 percent Asian, 1.2 percent Native American or Alaskan Native, 10.1 percent African American, 0.7 percent Native Hawaiian and other Pacific Islander, 9.9 percent some other race, and 4.2 percent two or more races.

Sacramento County's population has a median age of 33.7, and individuals 18 to 64 years of age accounted for 61.7 percent of Sacramento County's total population in 2005. The poverty rate in Sacramento County rose from 11.1 percent in 2003 to 13.6 percent in 2005. In 2005, the median home value of occupied units was $365,500.

Placer County

Employment

The Projects are expected to affect only small parts of Placer County. Placer County's population has a slightly lower median age than that of El Dorado's population; 38.4 compared to 39.9, but it is still considerably higher than the median age of the state of California (34.4). Individuals aged 18 to 64 make up 63.1 percent of the total population. Placer County's poverty rate during 2005 was just 5.5 percent, less than half the poverty rate of California and Sacramento County.

The racial composition of Placer County is comparable to El Dorado County's, with 84.9 percent White, 5.2 percent Asian, 0.9 percent Native American or Alaskan Native, 1.1 percent African American, 0.1 percent Native Hawaiian and other Pacific Islander, 5.0 percent some other race, and 2.7 percent two or more races.

The median value for homes in Placer County in 2005 was $492,000, and housing in Placer County is 78 percent single-unit.

Income and Demographics

Placer County has a higher inflation adjusted median household income than the state of California, $62,080 and $53,629, respectively, and the 2005 inflation-adjusted per capita income is also higher at $31,853.

The most common occupations in Placer County in 2004 were in retail trade, which employs more than 25,000 workers or 15.6 percent of private sector wage and salary employment. Retail trade is followed closely by construction, employing almost 14 percent of private sector workers. From 2001-2004, there have been no apparent significant shifts in employment among industry employment shares.

3.3.10.2 Environmental Effects

The Impact Analysis for Planning (IMPLAN) model was used to derive estimates of the socioeconomic costs and benefits of the UARP and the Iowa Hill development. The IMPLAN model is an input-output model developed in 1979 by the Forest Service and is one of the most widely used input-output models to evaluate the impact of changes in policy on regional socioeconomics and to produce socioeconomic forecasts. Its primary attribute is that it captures multiplier effects as changes in policy create ripples throughout the economy. The effects of policy can be classified as direct, referring to changes in production associated with a change in demand; indirect, referring to a secondary impact caused by the changing input requirements of producers; and induced, referring to changes in household spending as a function of the additional employment generated by the direct and indirect effects. IMPLAN's assumptions are limiting in that they restrict production functions to be homogenous across all firms within an industry, and linear with constant returns to scale. Output is also assumed to be homogenous or undifferentiated by quality, branding, etc. The IMPLAN model places no constraints on supply, and it assumes that in- and out-migration maintains the region under study at full employment at all times. While these assumptions are not entirely realistic, the model does serve as a sound approximation of real world effects of policy changes on the local and regional economies.

UARP

IMPLAN model results indicate that UARP-related operation and maintenance expenditures directly benefit the local and regional economies. At the local level, UARP generates 131 jobs in El Dorado County and additional personal income totaling $9.7 million. Total operation and maintenance expenditures within the county produce $26.2 million in additional outputs. At the regional level, 186 jobs are associated with the UARP adding $13.9 million in personal income. Additional regional output amounts to $37.0 million. Non-resident recreational activities in the Crystal Basin generate 166 direct jobs and 63 secondary or induced jobs at the local and regional levels. These jobs raise personal income by $3.6 million at the local level and $1.7 million at the regional level. Whitewater recreation downstream on the SFAR downstream of Chili Bar dam generates $33.0 million in revenues and taxes annually to El Dorado County.

Further benefits accrue to Eldorado National Forest and El Dorado County in the form of fees and taxes. SMUD subsidizes Eldorado National Forest in the maintenance of recreational facilities located at the UARP. These payments amounted to approximately $335,000 in 2004. SMUD also contributes to the local infrastructure including maintenance of roads, fire fighting, and telephone lines. SMUD has also contributed to producing recreation brochures for Crystal Basin and is a contributor to one-time projects such as helipad lighting, restoration of the Crystal Basin Information Station, lighting design for Loon lake Chalet and reconstruction of the Eldorado National Forest lookout at Big Hill. Although SMUD lands are tax-exempt under

California law, SMUD paid $184,000 in property taxes to El Dorado County in 2003 and has paid approximately $3.0 million through the middle of 2005.

SMUD lists six specific socioeconomic elements where the baseline operation of UARP provides benefits at the local level.

- **Air Quality Benefits—**By generating significant amounts of electricity without producing any undesirable air emission as a byproduct, the UARP has a positive effect on air quality.
- **Summer Recreational Opportunities—**The general operational regime of storing some of the spring runoff and releasing it in the summer and early fall contributes to the whitewater recreation industry on the SFAR. And in years with sufficient precipitation, near full reservoirs during the spring and summer provide an abundance of flat-water recreation opportunities in the Crystal Basin.
- **Access for Winter Recreation—**SMUD plows snow during the winter from Highway 50 to the Loon Lake Chalet area and creates parking areas along the route for winter recreationists.
- **Economic Effects—**expenditures by SMUD's local project operations (Fresh Pond) and non-resident visitors to the Crystal Basin area create local jobs, direct income, and secondary income.
- **Road Maintenance—**SMUD helps maintain the roads it uses to access project features, performing paving, repairing road segments, installing guardrails, and cleaning out culverts.
- **Grid Stability—**the UARP is used to help ensure reliability of the electric transmission system within SMUD's service area and Northern California.

SMUD indicates that the Proposed Action does not cause any change from baseline conditions and therefore would not interfere with the provision of the above benefits to the local community.

Our Analysis

SMUD's conclusions regarding employment and income at the local and regional levels are drawn from the application of the IMPLAN model to the operation of the proposed facility under the Proposed Action. As such, we consider the results to be sound. Regarding the six specific socioeconomic elements, the Proposed Action would not change baseline conditions, and, therefore, the flow of the above benefits to the local area would continue unimpeded.

Iowa Hill Development

The Iowa Hill development would have short-term effects during its construction and long-term, operational effects.

SMUD identifies and summarizes the local short-term socioeconomic benefits of the Iowa Hill development as derived primarily from the creation of short-term construction jobs and long-term operations jobs. Secondarily, SMUD indicates that the upper reservoir would facilitate access to water for the purposes of fighting forest fires by airdrop. Access to the upper reservoir would provide a safer source of water for aircraft, which currently must fly through narrow canyons. At the regional level, SMUD asserts that benefits would accrue in the form of increased operational flexibility, efficiency and reliability; [power] transmission system benefits; and environmental benefits.

Effects of Construction of Iowa Hill

Input-output analysis was used to evaluate the contribution of the Iowa Hill development construction to the El Dorado County economy. The inputs to the model were construction cost estimates on capital, materials and supplies, and labor. The output of the model is employment and income. The following 10 assumptions served as a backdrop to the model:

1. The region of influence for the construction economic impact analysis is El Dorado County.
2. Construction is anticipated to start July 2009 with operation expected to commence in 2014.
3. Impacts are evaluated for a 5-year construction period.
4. Total construction expenditures on materials and supplies are estimated to be $235 million in 2004 dollars. Of these expenditures, $75 million would be spent within El Dorado County.
5. Average local (within El Dorado County) construction expenditures on materials and supplies for a 5-year construction period are $15 million.
6. SMUD is expected to hire a total of 830 construction personnel over the course of the 5-year construction period, for an average of 166 personnel working on the project each of the 5 years.
7. Total construction payroll was estimated at $115 million in 2004 dollars.
8. About 25 percent of the construction workforce is assumed to be local (from El Dorado County). Thus, the average local construction payroll over the 5-year construction period is estimated at $5.75 million in 2004 dollars.
9. Disposable labor income is 70 percent of total labor income. This means that 30 percent of gross income is used for taxes and savings.
10. The base year of analysis is 2001 but the impacts were adjusted to reflect year 2004 price levels.

Each assumption is based on distributions of average expenditures developed for the project by Montgomery Watson-Harza. Assumptions 1 through 3 frame the geographic market and the length of the construction period. Assumptions 4 through 8 outline project costs, labor requirements, and source. Table 3-70 partially reproduces the cost estimates for materials, supplies, and labor.

Table 3-70. Iowa Hill development construction cost estimates, 2004.

	Total Cost	**Average Annual Cost**
Expenditures on materials and supplies	$235,000,000	$47,000,000
Local expenditures on materials & supplies	$75,000,000	$15,000,000
Construction payroll	$115,000,000	$23,000,000
Local construction payroll	$28,750,000	$5,750,000

A more detailed cost estimate is provided in CH2MHill and DTA (2005, appendix D) and reproduced below in table 3-71. Total construction costs are projected to be $445,130 million 2002$.

Table 3-71. Iowa Hill development construction cost estimates (millions of 2002$). (Source: CH2MHill-DTA, 2005, appendix D)

Element	**Cost (millions of 2002$)**
1. Mobilization and Water Handling	$2,000
2. Permanent Access Roads	$1,650
3. Upper Reservoir	$68,000
4. Waterways and Intakes	$57,000
5. Powerhouse and Access Tunnels	$65,500
6. Equipment (Installed)	$121,300
7. Transmission Lines and Reconductoring	$11,000
Subtotal	$326,450
Civil Contingency (25% lines 1-5, 7)	$51,300
Equipment Contingency (10% line 6)	$12,130
Licensing, SMUD Project Management and Geotechnical Exploration	$55,250
Total Construction Cost With Contingencies	$445,130

Our Analysis

SMUD provides average project construction expenditures but not statistical distributions of estimated costs that would permit the derivation of a range of possible employment and income outcomes. The project is relatively small scale such that even large deviations from average expenditure estimates would not yield employment and income effects that would have a substantial impact on local and regional economies.

Regarding assumption 8, SMUD estimates that 25 percent of the construction labor force would be sourced locally. Given that approximately 10.1 percent of the El Dorado county workforce is engaged in wage and salary construction jobs (California Department of Finance, 2004), this is a reasonable assumption.

The construction expenditures, including the payroll for the 166 direct jobs, are projected to generate a further 370 indirect and induced jobs, primarily in the service sector (i.e., grocery stores, restaurants, gas stations). This projection is derived using the IMPLAN model. The projected 370 secondary jobs rests on the assumption that about 32 percent of the total expenditures ($75 million out of $235) million would go to local suppliers. SMUD does not indicate how it arrived at a figure of 32 percent local sourcing.

Monetizing the local short-term benefits, the IMPLAN model indicates that construction of the Iowa Hill development would generate local income on the order of $18.9 million per year over the 5-year construction period. There would be $4 million in direct income (payments to local suppliers of labor and materials) and $14.9 million in secondary income (worker and supplier expenditures on goods and services). SMUD asserts that $18.9 million annual additional income represents just 0.3 percent of the total 2004 El Dorado County annual personal income of $6.31 billion.

Effects of Operations of Iowa Hill

The IMPLAN model was also used to evaluate the long-term employment and income benefits for the operational phase of the Iowa Hill development. The Covered Employment and Wages data published by the U.S. Bureau of Labor Statistics proved inadequate for use as inputs to the model, so SMUD substituted an input data set composed of actual operations and maintenance average expenditure distributions for the SMUD Fresh Pond hydroelectric facility (a similar facility to the proposed Iowa Hill development) and SMUD personnel expertise. Expenditures are those devoted to labor, materials, and supplies required to operate the project. The total cost in 2004 is just slightly more than $3.5 million. Table 3-72 shows Iowa Hill development operations expenditure data.

Table 3-72. Iowa Hill operational payroll and operation and maintenance expenditures, 2004. (Source: CH2M Hill and DTA, 2005)

	Total Cost	Cost Spent Within El Dorado County	Cost Spent Within Sacramento County
Payroll[a]	$262,480[b]	$262,480[b]	$262,480[b]
Other O&M Expenditures	$3,306,000	$1,653,000	$1,983,600
Total[c]	$3,568,480	$1,915,480	$2,246,080

[a] Includes benefits. Payroll shown for El Dorado County is for the two Iowa Hill employees who are assumed to be El Dorado County residents while that shown for the Sacramento region is for the same two Iowa Hill employees who are also residents of the Sacramento region (El Dorado, Placer, and Sacramento counties).

[b] Total annual O&M labor cost at Fresh Pond was estimated at $10,637,230. Because 2 percent of these costs are spent on headquarters staff, only 98 percent is actually associated with Fresh Pond. Assuming 81 full-time employees at Fresh Pond, the average labor cost (salary plus benefits) per employee is $128,722. Since Iowa Hill operation would have two O&M employees, the labor cost for these two additional O&M employees is estimated at $257,400 (or 2 times $128,722).

[c] 50 percent of the other O&M expenditures are spent within El Dorado County. Thus, of the total $3,306,000 in other O&M expenditures, $1,653,000 (or 50 percent), is spent within El Dorado County. For the Sacramento region, the amount of other O&M expenditures spent within the region is $1,9843,600 or 60 percent of the total other O&M expenditures for Iowa Hill in 2004.

The payroll component accounts for just a small fraction (7.3 percent) of total expenditures and would support just two full-time employees sourced from within the Sacramento Region (including El Dorado County). The remaining expenditures on materials and supplies are assumed to be split 50-50 between El Dorado County and other areas and 60-40 between the Sacramento region (including El Dorado County) and areas outside. Such a split reflects the same local/regional distribution as do operational expenditures at the SMUD Fresh Pond site.

Using this expenditure data and its geographic distribution as inputs to the IMPLAN model generates 12 indirect and induced jobs in addition to the two jobs directly generated at the project. These 14 jobs are just a tiny fraction (0.03 percent) of the overall employment for El Dorado County, and the annual income generated from them ($698,300 direct, indirect, and included) is an even smaller fraction (0.01 percent) of the county total personal income.

The project operation is expected to add $3.5 million in direct output, $670,129 in indirect output, and $303,162 in induced output for a total of $4.5 million.

The IMPLAN model is also run for the Sacramento region, inclusive of El Dorado County. In this case, the direct jobs generated by the operation of the project remain at two but there are 18 indirect and induced jobs created as well. These lead to

$262,500 in direct income and $812,300 in indirect and induced income. These outcomes represent insignificant fractions of the total income for the Sacramento region.

In terms of output in the Sacramento Region, the IMPLAN model predicts $6.1 million or just 0.01 percent of the total regional output.

Our Analysis

As for estimating the effects of construction, use of the IMPLAN model is a sound approach to evaluating the effect on labor and income from proposed operations. Although the use of expenditure data from the Fresh Pond facility is not ideal, in light of the lack of published government data, it is acceptable. The numbers of jobs and their associated income and output are extremely small relative to the economies of El Dorado County and the Sacramento region as a whole, and the operational phase of the proposed project would not carry with it substantial economic benefits.

Regional and Environmental Benefits

SMUD lists the benefits of the project to the region and to itself as the provision of operational flexibility, efficiency, and reliability; transmission system benefits; and environmental benefits.

Operational flexibility, efficiency, and reliability imply that the project would strengthen SMUD's ability to cover periods of peak power demand without the need for additional power generation facilities. SMUD's UARP provides about 20 percent of the power needs to about 180,000 homes in its service area during a normal water year. The Proposed Action would support this operation by improving the facility's ability to smooth the delivery of power between peak and off-peak periods. Transmission system benefits refer to the reliability and stability of the system in delivering power to customers without constructing new transmission lines. Environmental benefits refer primarily to improved air quality in the Sacramento Valley that would ensue during project operations, and secondarily, SMUD indicates that the Iowa Hill development would create a safer source of water for aircraft engaged in fighting forest fires in the vicinity to refill their water buckets. Currently, aircraft must fly through narrow canyons to refill their buckets

Our Analysis

SMUD does not explicitly project that the Iowa Hill development would result in lower energy prices to consumers, nor does it relate the smoothing of power delivery to socioeconomic benefits such as the potential for increased disposable income, positive employment effects, and economic development of the region. Improved regional air quality is mentioned as a key socioeconomic benefit of the existing project, but it is not quantified in monetary terms. The benefit of facilitated access to water for fire-fighting aircraft also is not quantified in monetary terms. Likely, the lack of supporting empirical data and analysis is a function of the relatively small size of the project. While socioeconomic benefits would certainly accrue to the region, the extent of these benefits would be negligible from a social accounting perspective.

Property Values

The number of jobs created by the project would be small. Because at least 25 percent of those jobs would be sourced from the local labor market, the Iowa Hill development likely would have zero or negligible effects on the overall demand for local housing. However, the Iowa Hill development may affect housing amenities in the area, particularly scenic views. This section describes the nature of the change in scenic views and the potential monetary impact on area housing values.

SMUD evaluated short- and long-term effects of the Iowa Hill development on residential property values from the effects of (1) views of the upper reservoir, switchyard, and transmission tie-in; (2) the proximity of the proposed transmission lines to nearby properties; and (3) the improved accessibility brought about by the upgrading of Cable Road and Iowa Hill Road on the properties to which access is provided. Particular attention is paid to the Apple Hill and Swansboro areas (see figure 3-36). In both areas property values are rising significantly. It is possible that, owing to negative alteration of scenic views and construction of transmission lines, the Iowa Hill development could adversely affect or even reverse this trend. In total, there are 70 properties from which scenic views may be affected by the Iowa Hill development, all of which are located within a 3-mile radius of the proposed site (this geographic definition is based on standards developed by the Forest Service).

SMUD concludes that property values in the area would suffer a short-term reduction as scenic views are adversely affected by the construction itself. Secondarily, high noise levels and reduced air quality during the construction period would also reduce housing values. In the long-term, however, SMUD concludes that housing values would be unaffected and further, that in the case of 28 properties directly adjacent to the Iowa Hill site, improved access through project road improvements would support a small increase in property values.

SMUD's analysis is qualitative and based on a review of applied academic and practical literature on the effects of scenic views and transmission lines on property values. Assessment of the Iowa Hill development's impact on scenic views from surrounding properties is derived from a review of the literature on the impact of scenic views on property values. The conclusions are supported by the presentation of a series of photographs that show the actual pre-construction view and a simulated, post-construction view.

In addition, SMUD referenced recent sales data, and conducted interviews with local real estate professionals. SMUD identified the changes to the visual environment seen from residences in the project area. These study results are supplemented by existing academic and applied research on property values, presumably because of a lack of existing data on property sales in the vicinity of the site and because the project represents a new development from which historical comparisons are not available.

The literature on the impact of scenic views on property values is nearly unanimous. Several academic studies reveal that scenic views have an unequivocally positive impact on sales price ranging from 1.4 to 16.6 percent. Some studies reviewed are clearly not relevant to the project, however, such as the case where ocean views offer the highest premium on property values.

Our Analysis

Rather than undertake original research, SMUD submitted results based on an extensive review of already existing academic and applied property value research. Much of this research is based on the use of statistical models that isolate and quantify the effect of various attributes on the value of a particular good. When applied in the study of property/housing values, these models frequently incorporate attributes such as the square footage of the property, its number of bathrooms, lot size, distance from major transportation facilities, age, and any other feature(s) that could create variation in property values, including environmental attributes such as whether the property offers a scenic view and its proximity to infrastructure. This approach is a generally accepted methodology and has been featured prominently in the academic literature. SMUD reviewed articles taken from both the peer-reviewed academic journals (*Land Economics, Journal of Real Estate Literature, Journal of Real Estate Research*) and from private consulting firms and government agencies.

The property value research described above was supplemented by an analysis of project views based on comparisons of actual and simulated photographs for five viewpoints located within Forest Service guidelines of 3 miles from the proposed site. The actual photographs show the viewpoints as they currently exist and the simulated photos show the viewpoints' likely appearance one year after construction and 10 years after construction. Of particular concern are the views of the canyons that surround Iowa Hill. According to the photos, the project does not obscure the views of the canyons; however, the project includes construction of a berm that is visible from all five viewpoints. Also a portion of the proposed switchyard and a portion of the proposed transmission lines are visible. The changes in view moderate over time as the berm is covered with more mature vegetation and thicker forest cover screens views of the switchyard and transmission lines. While the analysis of the photo simulations can be considered subjective, the method is a reasonable approach to the analysis.

Proximity to Transmission Lines

In addition to the construction of the upper reservoir itself, a 3-acre switchyard would be located adjacent to the reservoir, and a new, 2-mile long 230-kV transmission line would connect the switchyard to the existing Loon-White Rock transmission line. SMUD states that the switchyard would not be visible and would therefore have no effect on property values in the area, although it does not support this position with any data.

SMUD concedes that the placement of transmission lines would have aesthetic effects and possibly health, safety, and noise effects as well. To estimate the monetary impact of transmission lines on property values, SMUD relied extensively on research conducted by Hamilton and Schwann who examined the impact of transmission lines on Canadian properties. The authors found that transmission lines have no statistically significant impact on property value past a distance of 656 feet, and SMUD applies this result to Iowa Hill. Only 6 properties would lie within 656 feet of the proposed transmission lines, and SMUD concedes that they would experience some negative impact. But in general, SMUD indicates that any negative impacts on property values would be mitigated because the views of the proposed transmission lines would be partially obscured by thick tree cover. However, there are two very small (2.5-acre) undeveloped parcels that lie partially within the transmission line's zone of potential influence, whose values could be decreased by as much as 33 percent ($1,650).

In addition to the Canadian study, SMUD refers to several other studies in the Montana and in Australia that show distance thresholds to be in the range of 0.31 mile to 1.24 miles before negative perceptions of health, safety, and aesthetics begin to erode property values. In general, transmission lines were found to have only small impacts on property values (on the order of 2 to10 percent for single family homes). Some findings suggest that there is no impact on property values and in other cases, transmission lines were found to raise property values because they offer owners the use of right-of-way for recreational purposes.

The number, quality and geographic dispersion of the studies reviewed by SMUD appear to include adequate representations of the impact of transmission lines on property values in the markets studied and are reasonably applied to El Dorado County, California.

Of the 70 properties under study, SMUD concludes that housing values would decrease up to 33 percent for two undeveloped properties adjacent and 15 percent for two properties just east of the Iowa Hill site. In the Apple Hill area, 16 properties would decline by 3 percent in value and in Swansboro, 22 properties would undergo a 5 to 10 percent decrease. SMUD concludes that the 28 properties adjacent to Iowa Hill Road would rise in value by 5 percent because of the slated improvements to the road.

SMUD believes that the long-term effects of the Iowa Hill development on property values would be zero at worst and modestly improved at best as mitigation efforts such as re-vegetation of the site help to adjust perceptions over time. SMUD is already committed to mitigate the impact on scenic views and under the Settlement Agreement would develop a design for the Iowa Hill development that meets the visual quality standards of the Eldorado National Forest Land and Resource Management Plan to ensure adequate protection during utilization of the Forest. Modest (assumed 5 percent) improvement in property values would result from upgrading Cable Road/Iowa Hill Road. There are 28 properties affected by this action.

In sum, SMUD's conclusions regarding the impact of the Iowa Hill development on area property values are reasonable. Because the Project is not expected to affect property values by generating increased demand for housing, the conclusions rest primarily on the effect of the Iowa Hill development on aesthetics and secondarily on the improved access with the upgrading of Cable Road/Iowa Hill Road. SMUD is committed to achieving Forest Service standards of visual quality according to the Settlement Agreement.

Effects on Fiscal Conditions and Services

In this section we address the impact of the project on local government fiscal resources in El Dorado County. According to SMUD, El Dorado County's revenues and expenditures increased from approximately $100 million in fiscal year (FY) 1998–1999 to about $160 million in FY 2002–2003. Major sources of El Dorado County revenue are intergovernmental transfers from the federal and state governments, and taxes and assessments. Intergovernmental transfers account for approximately half of all revenue sources while taxes and assessments account for about a third. Over the past 5 years, the proportion of county revenues from taxes and assessments has declined from about 32 percent in FY 1998–1999 to 29 percent in FY 2002–2003. On the other hand, the proportion of the county's revenues from intergovernmental transfers has increased from about 45 percent in FY 1998–1999 to 51 percent in FY 2002–2003. In each FY from FY 1998–1999 to FY 2002-2003, El Dorado County government appears to have generated a surplus of revenues over expenditures.

In the area of the proposed Iowa Hill development, five elements of government services were studied, including schools, fire protection, law enforcement, emergency response services and hospital use, and available hospital resources.

Schools—SMUD asserts that, after conversations with local school officials, overall enrollment in El Dorado elementary public schools is undergoing a decline and that this trend is expected to continue. High school enrollment, on the other hand, has been experiencing a slight increase. Further, since the Iowa Hill development is not expected to generate any meaningful level of population increase, the capacity of the local school system should remain adequate.

Fire Protection—The majority of the physical space of the Iowa Hill development would be located on private SMUD-owned property with some additional encroachment on federal lands (Eldorado National Forest). However, the California Department of Forestry and Fire Protection is agreed to provide assistance to the El Dorado County Fire Department in the event of a major fire. SMUD disagrees that Iowa Hill development would raise the probability of a fire and thus does not attempt to quantify its impact on the local budget. However, under Proposed Article 1-34, *Fire*

Management and Response Plan, SMUD would develop in consultation with state and locate fire agencies and implement a fire prevention and response plan.

Law Enforcement—SMUD claims that, in spite of an anticipated increase in theft and vandalism at the site, plus an increase in emergency medical situations, there would be no impact on local law enforcement. SMUD plans to deploy its own private security personnel at the site during construction.

Emergency Response—SMUD does not anticipate any significant impacts on the county's emergency response system because it plans to implement construction safety plans, particularly with respect to blasting.

Search and Rescue—The workers at the site would not engage in activities that would raise the possibility of the need for additional search and rescue operations.

Hospital—Because it is a relatively small undertaking, the Iowa Hill development would not have any material impact on hospital care in El Dorado County. SMUD does not address the potential costs associated with providing hospital services for construction workers who may be injured on the job, except to state that in the event of such an occurrence, patients would receive treatment in trauma centers located outside of El Dorado County. As such, the fiscal impact of the project on El Dorado hospitals would be at or near zero.

Our Analysis

We have reviewed the information provided on the potential impact to schools in El Dorado County and conclude that construction of the project would not result in school population growth over the normal growth. Again, the relatively small size of the project is consistent with SMUD's conclusions.

The fact that there will be human activity involving heavy equipment and machinery in the area where there was none before would probably increase the risk of fire but given that the state of California has agreed to assist the county in the event of such an occurrence, the impact on El Dorado's fiscal budget would be zero. Therefore, SMUD's neglect of this fiscal impact element is entirely reasonable.

Since local law enforcement would be assisted by private security, we would not expect cost impacts on local law enforcement services.

There is no reason to doubt that SMUD's construction safety plan would preclude an increase in the county's emergency response activity or in search and rescue hospital services.

Economic Value of Harvestable Timber

The Iowa Hill development would permanently eliminate 128 acres of timberland and temporarily affect 25 acres during construction. SMUD used prevailing market prices for species known to be common to the Eldorado National Forest, and applied growth estimates provided by the Forest Service. Assuming all timber is composed of the most valuable species (Ponderosa Pine), the financial loss associated with its removal would amount to $699 per year and a net present value of $11,500 (using a 6 percent discount rate).

Our Analysis

There was no formal timber inventory or "cruise" of the area. However, it is understood that the estimates of the financial losses provided by SMUD are conservative, in that they account for the worst possible case. Given that the acreage is relatively small and that a full forest inventory of the area is not available, SMUD's approach is sound and its findings reasonable. Construction of the Iowa Hill development would have a minor effect on timber harvesting.

Construction Traffic Impact and Impact on Tourism at Apple Hill

SMUD provides a worst case scenario for the impact of construction-related traffic and then measure these findings against California Environmental Quality Act guidelines. The guidelines state that the impact of the Iowa Hill development would be significant if it would:

1. Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to ratio on roads, or congestion at intersections);
2. Exceed, either individually or cumulatively, a level of service standard established by El Dorado County for designated intersections;
3. Result in a change in traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks;
4. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses;
5. Result in inadequate emergency access;
6. Result in inadequate parking capacity; or
7. Conflict with adopted policies, plans, or programs supporting alternative transportation.

Because the area does not have public transportation facilities and is generally not suitable for walking or bicycling, SMUD focused on automobile and truck traffic likely to be generated by the project. Of most concern is the impact of traffic on tourism at Apple Hill.

Traffic would be generated by construction workers driving to the site and by trucks delivering construction materials and supplies to the site. SMUD assumes the worst case scenario, where all construction workers travel to the site from the greater

Sacramento area. They assume 360 daily trips will be generated under the assumptions that average vehicle occupancy is 1.3 persons and the peak-level workforce is 235. SMUD does not make clear why it chose 1.3 as the average vehicle occupancy but it may be assumed that it derives from previous research on journey-to-work habits for construction workers in the area. Most if not all of the worker trips generated by the construction would occur in off-peak hours assumed to be 5:30 a.m to 6:30 a.m. and 3:30 p.m. to 4:30 p.m. Normal highway peak traffic commute hours are 7:00 a.m. to 8:00 a.m., and 5:00 p.m. to 6:00 p.m. Project-related trips overlap with the afternoon school bus hour of 3:00 p.m. to 4:00 p.m.

According to the January 2005 "Iowa Hill Pumped Storage Development Socioeconomic Assessment of Construction and Operations Technical Report" (page 57) the Iowa Hill construction would further generate 25 delivery truck trips per day traveling over the same routes used by construction workers during non-commute hours. The specific materials and equipment expected to be delivered to the project site was not given. SMUD concludes that while there will be additional traffic generated by the Project, most of it will occur in off-peak hours and further, since it will occur in off-peak directions (west-east during mornings and east- west during evenings) its impact will be minimal. SMUD's studies show that the construction activity would not affect the level of service at key intersections except at the Carson Road Eastbound ramp during the A.M. period. Assuming that 10 percent of the construction-generated traffic uses this intersection to access the site, SMUD concludes that there would be a minimum of queuing delays. Queuing problems are not expected to emerge until more than 20 percent of construction traffic uses this intersection. In this case, congestion could occur on U.S. Route 50, which is the area's major highway. These findings are based on levels of service outlined in the *2000 Highway Capacity Manual.* It is not clear why SMUD chooses to assume a 10 percent split between the use of the Carson Road interchange and The Old Highway interchange. SMUD further asserts that there is sufficient capacity to accommodate the construction traffic in the peak years of construction and consequently it will have minimal impact on traffic conditions during the off-peak years of construction.

In spite of the fact that most of the traffic will occur on week days, SMUD indicates that construction activities could exacerbate the traffic congestion that currently occurs during the annual Apple Hill recreational season. This is because while most of the estimated 500,000 visitors to the area during the season come on weekends, there is substantial traffic generated on weekdays as well. SMUD does not quantify the impact of construction traffic on Apple Hill tourism but given the modest level of additional traffic it would be reasonable to assume that Apple Hill tourism will not be significantly affected. The report addresses air traffic, emergency access and parking and finds no reason to believe that Project-generated traffic would have any impact on any of them. Finally, post-construction traffic impacts would be extremely minimal because the number of workers during this phase is negligible.

Our Analysis

SMUD does not appear to have undertaken a rigorous and quantitative study of traffic patterns in the Iowa Hill area; however, except for the lack of clarity on the reasons for the spit between interchanges, we find the results reasonable. SMUD provides a worst-case scenario where it is assumed that all workers and deliveries are sourced from the greater Sacramento area and the analysis is conducted during what are scheduled to be the peak construction years. Further, SMUD does not support its contention that the peak travel hours in the area are different from the peak travel hours for construction workers, except to say that the non-construction hours are "normal."

Finally, SMUD does not consider the potential adverse effects on the condition of the area roads that could result from increased truck traffic, likely because there are no weight restrictions on the roads that are most likely apt to serve the trucking needs of the project.

A review of the information provided on traffic supports SMUD's conclusions. We find that because the project would generate only a small number of additional vehicle traffic, its impact on total traffic would be minimal. As discussed in section 3.3.7.2 SMUD would develop and implement a transportation system management plan to address traffic safety and road improvements.

Recreational Impacts

SMUD indicates that there is little if any recreational activity in the Iowa Hill area owing primarily to (1) the lack of water-related recreational opportunities; (2) the lack of recreational facilities (campgrounds, trails, etc.); and (3) the unimproved, 4-mile-long segment of Iowa Hill Road/Cable Road leading to the site from Camino which consists of loose gravel/dirt.

There are, on the other hand, limited recreational activities downstream of the Iowa Hill site at Slab Creek reservoir and other places further downstream from Slab Creek and Chili Bar. SMUD studies show that recreational use of Slab Creek reservoir is low compared to other UARP sites, primarily because at an elevation of 1,850 feet with steep topography, access is limited. The area is used primarily by local residents who are limited to just two points of access. Construction traffic could impact recreation at Slab Creek reservoir by periodically limiting access to the area but the SMUD does not foresee any drastic change in the availability of the recreational activities at this site during the construction phase of the Project.

Construction techniques planned for the Project would not affect water levels in areas downstream of Slab Creek reservoir, including White Rock powerhouse, the SFAR downstream of Slab Creek dam, Chili Bar reservoir, and the reach downstream of Chili Bar reservoir. Therefore, recreational activities in these areas such as flat water boating will not be affected by the Project and therefore will not have any socioeconomic effects.

SMUD reports that the *operation* of the project could impact recreational use at various downstream locations. In particular, 1) the 8-mile reach of the SFAR between the Slab Creek dam and PG&E's Chili Bar reservoir; 2) at Chili Bar reservoir; and 3) in the 19.1-mile reach of SFAR between Chili Bar dam and Folsom lake. Since flat water boating and swimming at Chili Bar reservoir are currently prohibited, there is no reason to consider the socioeconomic impact of the project on them. Recreational activities around Chili Bar reservoir such as picnicking, off-highway vehicle use, hiking and fishing are not anticipated to be adversely affected by Project operations.

To simulate the impact on recreational use of downstream facilities, SMUD relies upon the CHEOPS model. This is a model of water balance required to meet particular monthly and daily power generation schedules. The recreational effects of the Project stem primarily from the level of fluctuation in water levels at the reservoir. The model predicts that operation of the project will cause water levels the Slab Creek reservoir to fluctuate by 6 feet or more approximately 95 percent of the time, more than 18 feet approximately 5 percent of the time, up to a maximum of 30 feet. In relative terms, current water level fluctuations at the Slab Creek reservoir are typically between 2 and 5.1 feet but on a weekly basis may fluctuate by up to 30 feet.

Our Analysis

SMUD concludes that construction techniques employed during the construction would preclude any adverse impact on recreation during the construction of the Project. There is no basis for argument on a socioeconomic basis and therefore this statement is considered valid.

The recreational impact of the project-operation phase is concentrated in the Slab Creek reservoir. According to a visitor survey and use count conducted in summer of 2002, annual use of the Slab Creek reservoir is 5,100 visitor days per year and that 78 percent of the users reside locally in El Dorado County. Swimming is the most popular activity among visitors while 36 percent reported fishing along streams and rivers in the area, and 33 percent fishing directly at the reservoir. Twenty-eight percent reported canoeing or kayaking. Other activities were non-water based such as hiking/walking (44 percent), wildlife viewing (42 percent) picnicking (31 percent) and photography (25 percent). Slab Creek reservoir has limited access at this time, no signing or other information to direct the public to the access points, and a lack of facilities and security. As these items are provided, recreational use is expected to increase considerably. The Slab Creek reservoir access plan and recreation plan would address these needs, consistent with Iowa Hill operations needs. The current low use should not be assumed into the future.

SMUD reports that the change in daily water level fluctuations at the Slab Creek reservoir during the operation of the project would be 6 feet or more 95 percent of the time compared to current fluctuations of between 2 and just over 5 feet for the same proportion of the day. SMUD states that the reservoir levels will change more rapidly than what recreational visitors are used to and goes on to say that without properly informing visitors of this development, these fluctuations could pose a safety issue. The difference in overall levels, however, is not stark and in isolation will not impact swimming or other water-related activities at the site. Nor will they impact non-water-related activities at the site. SMUD does not provide empirical support on which to base this conclusion either through original research or published literature. And because SMUD does not believe recreation at Slab Creek reservoir would be affected, there is no accompanying socioeconomic impact statement.

Implicit in SMUD's conclusion is that the predicted fluctuations in water levels during operations are not materially different from current water level fluctuations at the site and further, that recreational activity at Slab Creek reservoir is relatively light and owing to Department of Homeland Security concerns, will likely be restricted going forward. Given the small amount of recreational activity at Slab Creek, SMUD's conclusion is reasonable. One could argue that even if there were to be a decline in recreational use at Slab Creek reservoir, the socioeconomic impact in monetary terms would be negligible because 78 percent of visits were from the local area and therefore do not contribute to El Dorado County's tourism services economy to any significant degree.

Impact on Camino Community Lifestyle

SMUD reaches the conclusion that because the population of the County and in particular, the city of Camino will be unaffected by the number of jobs created, there would be negligible impacts on public services and lifestyles in the community. This section describes the SMUD analyses and conclusions in more detail.

SMUD is concerned with the impact of the Iowa Hill development on the lifestyle of the Camino Community. The effects of the Iowa Hill development are measured against elements of the Camino Community Action Plan (CCAP) "that are relevant to the construction and operation of the [Project]." These include,

- Enhance the sense of community, maintain Camino's natural environmental qualities, and small town atmosphere.
- Minimize traffic hazards/impacts on local roads and on U.S. 50.
- Improve access to recreational services.
- Growth should be slow and controlled.

SMUD reports that the Iowa Hill development is consistent with the relevant goals outlined in the CCAP. The Iowa Hill development will not draw increased population to the area nor will it cause current residents to leave the area. This conclusion is based on the relatively few numbers of workers required for construction and operation of the project and further, that the construction and operation of the Iowa Hill development is not expected to induce commercial, industrial or residential development in the area. It follows that the Iowa Hill development would not alter Camino's population growth or composition, nor will it change Camino's rural, small town character.

SMUD also states that the Iowa Hill development would not significantly alter the topography, geology or vegetation of the area, except where the proposed upper reservoir and associated facilities and the proposed transmission line would be sited. This would preserve the Camino Community's natural environmental qualities.

Operation of the Iowa Hill development would not result in air emissions but during construction, expectations are that there will be air emissions in the form of dust particulates and hydrocarbons. However, the report states that emissions will be localized in the vicinity of the upper reservoir and along the dirt road portions of the access roads until such time as they are upgraded with gravelling. With respect to noise, as discussed in section 3.3.10.2, *Air and Noise* Quality, construction and operation of the project would raise ambient noise levels but as in the case of air quality, it will be limited to the immediate vicinity of the site and would not impact the Camino community.

SMUD states that casual visitors to Camino or Apple Hill or motorists on U.S. 50 would not notice the changes in topography, geology or vegetation caused by the Iowa Hill development because intervening topography and vegetation will obscure many of the views. SMUD also states that although recreationists at Slab Creek reservoir would notice the facilities, these facilities would not stand in stark contrast to already existing man-made features of the area and thus would not have a drastic impact on the recreational experience.

Access to recreational services, in particular, those at Slab Creek reservoir could be impeded by traffic congestion during the construction phase, but in the operations phase, upgrades to the road made during construction will improve access. Therefore, while it may be concluded that the Iowa Hill development is inconsistent with CCAP objectives regarding recreational facilities in the short-term, it would be consistent with these objectives over the long-term.

SMUD believes that, traffic hazards would develop during the peak construction period (months 30-36), and that these hazards could adversely effect the quality of life in Camino. Specifically, SMUD concedes that construction traffic could have an impact on (1) children walking in the morning to their bus stops on roads that comprise the project access routes (if they are walking at or before 6:30 a.m.); (2) vehicles on the roads that comprise the project access routes between approximately 5:30 a.m. to 6:30 a.m., including those attempting ingress or egress to/from residences, those transporting children to the bus stops in the morning, and other vehicles on the road; (3) the local p.m. school bus trips (3:00 p.m. to 4:00 p.m.); (4) children walking home from their bus stops in the afternoon, if walking on roads that comprise the project access routes; (5) vehicles on the roads that comprise the project access routes between approximately 3:30 p.m. to 4:30 p.m., including those attempting ingress or egress to/from residences, those transporting children to their homes from the bus stops in the afternoon, and other vehicles on the road; and (6) the traffic congestion that occurs during the Apple Hill season.

Our Analysis

Assuming that the results of the IMPLAN model are correct, it is reasonable to state that given the small number and temporary nature of the construction workforce to be employed during construction of the Iowa Hill development and the even smaller workforce required for its operation, the conclusions drawn by SMUD regarding the impact on Camino's population are reasonable. Even the indirect and induced jobs generated by the construction will not be sufficient to alter the population of Camino because similar to the directly induced construction jobs, many indirect or secondary jobs will be filled by workers commuting from the Sacramento region while others will be sourced from other areas of El Dorado and perhaps even Placer Counties. Finally, traffic hazards created by the project are clearly inconsistent with the objectives of the CCAP; however, SMUD is committed to minimize the impact in its Transportation Management Plan, which is to be submitted prior to the initiation of the construction phase.

3.3.10.3 Unavoidable Adverse Effects

The Iowa Hill development will have unavoidable adverse effects on property values adjacent to the site both during the construction and operational phase of the project. Traffic congestion will have an unavoidable adverse effect during the construction phase of the project, particularly in the peak months (30–36).

Property values in the area immediately adjacent to the site may decline in value by as much as 33 percent, and 15 percent for two properties just east of the Iowa Hill site. In the Apple Hill area, 16 properties would decline by 3 percent in value and in Swansboro, 22 properties would undergo a 5 to 10 percent decrease.

Traffic congestion on roads leading to the site is likely to worsen during the construction phase and in addition, would create hazards for residents of Camino during this period. Traffic congestion during the construction phase could also adversely impact tourism in the area.

3.3.11 Air Resources

3.3.11.1 Affected Environment

The California Air Resources Board (CARB), as part of the California Department of Environmental Protection, is responsible for protecting public health and the environment from the harmful effects of air pollution. Pollutants associated with air emissions, such as ozone, particulate matter, and nitrogen dioxide, are associated with respiratory illness. Carbon monoxide, another air pollutant, can be absorbed through the lungs into the bloodstream and reduce the ability of blood to carry oxygen. Sources of air emissions include commercial facility operations, fugitive dust, on-road vehicles and trucks, aircraft, boats, trains, and natural sources such as biogenic and geogenic hydrocarbons and wildfires.

The topography and meteorology of the western slope of the Sierras are the important factors in the environmental effects of air quality emissions. Dispersion of high pollutant concentrations in downwind areas is hindered by the mountainous topography. Frequent inversions, in which warm air overlays cool air, trap pollutants close to the ground. In summer, long days, stagnant air, and high temperatures facilitate photochemical production of ozone (O_3) from precursor air pollutants such as volatile organic compounds (VOC) and oxides of nitrogen (NOx). Regional transport of these precursors from the Sacramento Valley and the San Francisco Bay area result in high ozone concentrations. CARB has officially designated the western portion of El Dorado County as “ozone impacted” from transport from those areas.

To reduce harmful exposure to air pollutants, the federal Clean Air Act requires the EPA to set outdoor air quality standards for the nation with the option for states to adopt additional or more protective standards if needed. CARB has adopted ambient (outdoor) air quality standards (AAQS) that are more protective than federal standards and has implemented standards for some pollutants not addressed by federal standards. An AAQS establishes the concentration above which the pollutant is known to cause adverse health effects to sensitive groups within the population such as children and the elderly. The goal is for a localized project effects not to cause or contribute to an exceedance of the standards. Criteria pollutants for which AAQS have been established are ozone, carbon monoxide, lead, nitrogen dioxide, particulate matter, and sulfur dioxide. California and federal AAQS for criteria pollutants are presented in table 3-73.

Table 3-73. California and federal ambient air quality standards. (Source: CARB, 2006).

Pollutant	Averaging Time	California Standards	Federal Standards Primary	Federal Standards Secondary
Ozone (O_3)	1 hour	0.09 ppm (180 μg/m^3)	-	Same as primary standard
	8 hour	0.07 ppm (137 μg/m^3)	0.08 ppm (157μg/m^3)	
Respirable Particulates (PM_{10})	24 hour	50 μg/m^3	150μg/m^3	Same as primary standard
	Annual mean	20 μg/m^3	--	
Fine Particulates ($PM_{2.5}$)	24 hour	No standard	35 μg/m^3	Same as primary standard
	Annual mean	12 μg/m^3	15 μg/m^3	
Carbon Monoxide (CO)	1 hour	20 ppm (23 μg/m^3)	35 ppm (40 μg/m^3)	None
	8 hour	9.0 ppm	9 ppm	

Pollutant	Averaging Time	California Standards	Federal Standards Primary	Federal Standards Secondary
		(10 μg/m^3)	(10 μg/m^3)	
Nitrogen Dioxide (NO_2)	1 hour	--	--	Same as primary standard
	Annual mean	0.25 ppm (470 μg/m^3)	0.053 ppm (100 μg/m^3)	
Sulfer Dioxide (SO_2)	1 hour	0.25 ppm (655 μg/m^3)	--	--
	3 hour	--	--	0.5 ppm (1300 μg/m^3)
	24 hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	_
	Annual mean	--	0.03 ppm (80 μg/m^3)	--

Existing Air Quality

To manage air quality problems, California is divided into 15 air basins, each of which is associated with an Air Quality Management District. The UARP study area is located across Sacramento and El Dorado counties, which are respectively within the Sacramento Valley Air Basin and Mountain Counties Air Basin. El Dorado has its own AQMD and Sacramento falls within the Sacramento Metropolitan AQMD. The proposed Iowa Hill development would lie in western El Dorado County. Chili Bar Project facilities are also located in El Dorado County, downstream of the UARP.

State and National Area Designations

Both the California and federal governments use ambient air monitoring data to classify areas according to their attainment status with respect to criteria pollutants. These designations are used to identify areas with air quality problems and help determine wheter project emissions would be considered significant under the NEPA and California Environmental Quality Act assessments. The three basic designation categories are:

- Attainment—indicates that ambient air quality is not in violation of the established standard for the specific criteria pollutant.
- Non-attainment—indicates that the ambient air quality violates the established standard for the specific criteria pollutant.
- Unclassified—indicates that there is currently insufficient data for determining attainment or non-attainment.

In addition to the above designations, the California includes a subcategory of the non-attainment designation:

- Non-attainment-transitional—given to non-attainment areas that are making progress and nearing attainment.

Sacramento and El Dorado counties are currently in attainment for nitrogen dioxide, sulfur dioxide, and lead, non-attainment for ozone (O_3) and particulate matters (PM), and in maintenance (previously non-attainment) for carbon monoxide (CO). Specifically, both the Sacramento Valley Air Basin exceed the national and state AAQS for ozone and the state AAQS for PM10, the Sacramento Valley and PM10. Table 3-74 presents the study areas' existing state air quality designations for criteria pollutants. State standards are presented as they are more protective than federal standards.

Table 3-74. California State area designations for criteria air pollutants.

Air Basin	O_3	PM_{10}	$PM_{2.5}$	CO	NO_2	SO_2	VRP
Sacramento Metropolitan Air Basin (Sacramento County)	N	N	N	A	A	A	U
Mountain Counties Air Basin (Eldorado County)	N	N	U	U	A	A	U

Note: A – attainment
N – non-attainment
U – unclassifed
O3 – ozone
PM10 – respirable particulate matter
PM2.5 – fine particulate matter
CO – carbon monoxide
NO2 – nitrogen dioxide
SO2 – sulfur dioxide
VRP – visibility reducing particulates

The 1990 amendments to the Clean Air Act require federal agencies to conform to applicable State Implementation Plans (SIP) for non-attainment areas. SIPs are state air quality regulations that provide for the implementation, maintenance, and enforcement of the National AAQS and include emissions limitations and control measures to attain and maintain the standards. The Sacramento Metropolitan Air Basin and the El Dorado Air Basin adopted the 1994 Sacramento Area Ozone Regional Clean Air Plan submitted as a SIP for ozone non-attainment. As of 2002, the Sacramento area has exceeded its goals for reduction of VOC and met its goal for reduction of NOx (SMAQD, 2003).

EPA has developed two conformity regulations for transportation and non-transportation projects. Transportation projects are governed by the "transportation conformity" regulations (40 CFR Parts 51 and 93). Non-transportation projects are governed by the "general conformity" regulations (40 CFR Parts 6, 51, and 93) described in the final rule for Determining Conformity of General Federal Actions to

State or Federal Implementation plans. Since the proposed project is a non-transportation project, only the general conformity rule applies.

The general conformity rule applies to federal actions occurring in air quality regions designated as being in non-attainment for the National AAQS or attainment areas subject to maintenance plans (maintenance areas). Federal actions occurring in attainment areas are not subject to the conformity rules. The proposed Projects are currently designated as serious non-attainment for 8-hour ozone, and as CO maintenance (previously nonattainment) areas. Sacramento County is also designated as moderate nonattainment for PM_{10}. An air conformity analysis was prepared as a supplement to this EIS and is included in appendix A of this document.

3.3.11.2 Environmental Effects

Construction of the Iowa Hill development under the UARP would create additional air emissions. Operations of the UARP under the No-action, UARP-only, and Iowa Hill alternatives would also increase air emissions. The environmental effects of air emissions related to the implementation of UARP alternatives are presented in this section. A General Conformity Analysis includes all operational and construction emissions from each alternative is included Attachment Air-2.

The potential environmental effects of the Chili Bar Project were evaluated and examined for air emissions. The Chili Bar Project has limited reservoir and storage, and operation by PG&E is to manage flow releases from upstream of SMUD's White Rock powerhouse. PG&E proposes only minor modifications as needed to implement resource management measures, and does not propose changing existing Chili Bar operations, thus air emissions resulting from Chili Bar operation would continue to be negligible.

Effects of Construction

The No-action Alternative and the UARP-only Alternative do not involve construction of any kind and thus would not have air emissions effects related to construction activities. Only construction activities during development of Iowa Hill have potential environmental effects on ambient air quality.

Construction of the Iowa Hill development under SMUD's Proposed Action would potentially result in effects on air emissions. Short-term air quality may be affected by emissions of exhaust pollutants from construction equipment and dust from earthmoving activities. Both potential effects would be temporary (limited to the construction period) and local (only occurring in the immediate vicinity of the construction activity).

To assess potential short-term effects of construction emissions on ambient air quality, SMUD conducted a worst-case screening using an air quality dispersion modeling analysis.

The predicted worst-case construction impacts and ambient air quality concentrations are shown in table 3-75.

Table 3-75. Predicted total ambient concentrations during construction period.

Pollutant	Averaging Time	Maximum Construction Impacts ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Ambient Concentration ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
NO_2	1 hour	241	198	439	470	--
	Annual	16.9	16.9	33.8	--	100
SO_2	1 hour	2.7	83.6	86.3	650	--
	24 hour	0.3	45.9	46.2	109	365
	Annual	0.0	6.5	6.5	--	80
CO	1 hour	503	2,240	2,743	23,000	40,000
	8 hour	114	992	1,106	10,000	10,000
PM_{10}	24 hour	29.5	52	81.5	50	150
	Annual	6.6	16.8	23.4	30	50
$PM_{2.5}$	24 hour	9.0	40	49.0	--	65
	Annual	2.0	9.9	11.9	12	15

The air conformity analysis estimated construction-related emissions with the EPA NONROAD model. The usage of equipment, likely duration of each activity, and manpower estimates for each activity for the construction were determined by the Engineer. Results of this analysis are presented in table 3-76.

Table 3-76. Estimated air emissions from construction activities.

	Peak-Year Emissions (tons/year)					
Activity	**NO_X**	**CO**	**VOC**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
On-Site Heavy Equipment and Trucks	44.3	18.3	4.0	0.1	3.4	3.2
Fugitive Dust	NA	NA	NA	NA	31.0	6.1
Vehicles for Deliveries (on-road)	0.2	0.6	0.3	0.02	0.06	0.05
Worker Travel Vehicles (on-road)	0.1	9.8	1.1	0.01	0.07	0.05
Total Construction Emissions	44.6	28.7	5.4	0.13	34.5	9.4
De Minimus Emission Levels Significance	50	100	50	--	100	100

Our Analysis

Development of Iowa Hill would result in air emissions from construction equipment, earth moving activities, construction worker's commutes, material deliveries, and earth hauling. Fugitive dust during construction, particularly during excavation of the site, would contribute substantially to particulate matter emissions.

Table 3-75 indicates that maximum construction effects during the worst-case scenario would still be within the most stringent state standards, despite elevated short-term emissions at the site. Because PM10 emissions are predominantly caused by fugitive dust (table 3-76), staff recommends application of water or chemical dust suppressant on unpaved surfaces, combined with vacuum sweeping and water flushing of paved surfaces to minimize fugitive dust emissions during construction. Additionally, re-planting vegetation in disturbed areas as quickly as possible would further reduce fugitive dust emissions.

Non-road equipment would be required to follow the updated emission standards established by EPA's Clean Air Nonroad Diesel Engine Standard (May 2004) to reduce exhaust emissions from construction engines. Staff also recommends limiting diesel engine idling, shutting off engines when not in use, and using preventative maintenance to keep engines running optimally to further minimize NO_x emissions.

Implementation of these measures would reduce the short-term air emissions effects from construction activities.

Effects of Operations

The existing UARP produces 1,835,000 MWh of renewable energy by utilizing the water cycle. Conventional hydroelectric generation is a reliable, efficient, economical, and less polluting source of energy resulting in zero air emissions. However, future demand calculations estimate a need for 2,696,000 MWh of energy, which would require simple cycle turbine, gas-fired generation to supply 861,000 MWh of on-peak generation. Annual emissions for a No-action Alternative have been estimated assuming gas-fired generation using a simple cycle turbine.

The required energy generation and overall emissions from the operation of the Proposed Action and UARP-only Alternative have been evaluated based upon best- and worse-case emission scenarios with the best-case being all electric generation supplied by gas-fired combined cycle turbines and the worst-case scenario being coal fired generation. Energy requirements and generation sources for all scenarios are summarized in table 3-77.

Table 3-77. Energy generation and requirements for all project alternatives.

	Energy Generation (MWh)			
Scenario	**Hydroelectric**	**Simple Combustion Turbine**	**Combine Cycle Turbine or Coal**	**Total**
No-Action	1,835,000	861,000	--	2,696,000
UARP-Only	1,699,000	931,000	66,000	2,696,000
Iowa Hill	1,443,000	--	1,253,000	2,696,000

No-Action Alternative

Under the No-action Alternative (Baseline Condition), the continued operation of existing UARP facilities will not result in any atmospheric emission of criteria pollutants or other hazardous material that can affect air quality. The continued operation of the existing facilities under the No-action Alternative will, on average, result in the annual generation of 1,835,000 MWh of clean energy.

Future demand need is estimated to be 2,696,000 MWh, which represents an increase of 861,000 MWh. This increased demand beyond the generation capacity of the hydroelectric project would have to be generated by an additional energy supply. In the case of no action, this supply would most likely be a simple combustion turbine, which is considered "state of the art" and is most easily permittable. Air emissions resulting from simple combustion turbine generation are presented in table 3-78.

UARP-Only Alternative

The UARP-only Alternative is identical to the Proposed Action with the exception of the Iowa Hill development. The UARP-only Alternative would reduce flows available for energy generation, resulting in the annual generation of 1,699,000 MWh of hydroelectric energy and a deficit of 136,000 MWh from the No-action Alternative. Because the Iowa Hill development would not be constructed under this alternative, the energy deficit from the new flow regime as well as future energy needs would be met by other energy sources, such as power purchase from the energy market, a mix of fuel generation sources, gas turbines, etc. These additional sources would create emissions that may result in environmental effects. The analysis presented here assumes that additional energy requirements would be met through a combination of simple combustion turbine and combined cycle turbine (best-case) or coal-fired (worst-case) generation. Air emissions resulting from the UARP-only Alternative are presented in table 3-78.

Proposed Action-Iowa Hill Development

The Proposed Action would increase flows to project-related streams during the spring, thereby decreasing the volume available to generate electricity at UARP facilities. SMUD proposed a pumped-storage facility to compensate for this reduction in energy generation. The reduction in energy from loss of flow combined with the increased energy demand to run the pump-storage results in a loss of 392,000 MWh compared to the No-action Alternative. In this case, 931,000 MWh of on-demand energy provided by the Iowa Hill development would help meet future energy needs when coupled with 1,253,000 MWh from combined cycle turbine or coal-fired energy sources. The pumped storage facility would not contribute air emissions because reversible turbines would use electricity from a transmission line tied in to the existing Camino-White Rock line to pump water into the upper reservoir. Additional air emissions would be added only through combine cycle turbine or coal-fired generation sources. Air emissions resulting from the Proposed Action are presented in table 3-78.

Table 3-78. Estimated air emissions from operational activities.

Scenario	Energy Source		Peak-Year Annual Emissions (tons/year) NO_X	CO	VOC	PM_{10}	SO_2
No-Action	Hydroelectric + On-Peak simple combustion turbine	--	71.9	35.3	20.7	8.6	10.3
UARP-only	Hydroelectric + On-Peak simple combustion turbine	Combined cycle turbine	81.0	39.5	23.6	10.0	12.0
		Coal	81.4	41.8	23.0	10.6	14.5
Iowa Hill	Hydroelectric Pump-Storage	Combined cycle turbine	62.7	25.7	23.8	12.5	15.0
		Coal	69.5	68.3	12.5	24.4	63.9

Our Analysis

Operation of the existing UARP with conventional hydroelectric generation would not contribute air emissions. Environmental effects of air emissions would result only from energy generation by additional sources such as simple combustion turbine, combined cycle turbine, and coal-fired generation, which are needed to meet estimated future demands. Table 3-79 presents net operational air emissions between No-action and the UARP-only alternatives and Proposed Action after the implementation of the Iowa Hill development in 2014 and compares the net increase or decrease in emissions to thresholds levels established in 40 CFR 93.153.

Table 3-79. Net peak-year emissions due to the UARP-only Alternative and Proposed Action following operation of Iowa Hill Development (post 2014).

Scenario	Additional Source	Net Annual Emissions (tons/year) NO_X	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$
UARP-only	Combined Cycle Turbine	9.1	4.2	2.9	1.6	1.4	1.3
	Coal	9.5	6.5	2.3	4.2	2.0	1.8
Iowa Hill	Combined Cycle Turbine	–9.2	–9.6	3.1	4.7	3.9	3.5
	Coal	–2.4	33.0	-8.1	53.6	15.8	14.2
De Minimis		*50*	*100*	*50*	*100*[a]	*100*	*100*

[a] SO_2 *de minimus* level does not apply to the Projects, as located in attainment area.

Table 3-79 indicates that net emissions of all criteria pollutants would not exceed de minimis threshold levels compared to the No-action Alternative. Net increases of air emissions between the No-action Alternative and UARP-Only Alternative would be substantially lower than threshold levels. In some cases, net emissions from the Proposed Action are lower than no action emissions. For instance, use of combined cycle turbine in the place of simple combustion turbine generation under the Proposed Action would reduce emissions of NOx and CO. Coal-fired generation in the Proposed Action would increase emissions of CO, SO2, and PM but would decrease emissions of ozone precursors NOx and VOC compared to the No-action Alternative. In general, air emissions from additional energy generation would increase compared to zero emission conventional hydroelectric generation, net increases under proposed alternatives would not exceed thresholds and in some cases the Proposed Action would decrease emissions compared to no action.

3.3.11.3 Cumulative Effects

The cumulative effects on air quality for various Project Alternatives to include emissions and air quality effects resulting from all operational and construction activities of UARP and Chili Bar Project are evaluated, either quantitatively or qualitatively. The cumulative effects are mainly resulting from the UARP, while the Chili Bar project has negligible effect on air resources.

3.3.11.4 Unavoidable Adverse Effects

Air quality analysis indicates construction of the Iowa Hill development would contribute to air pollutants levels of NO_x, CO, and PM_{10}. These effects would be limited to worst-case conditions during a short-term construction period. With a mitigated construction schedules and on-site control measures, the air emissions would not exceed the *de minimus* levels.

Among the viable substitute resources to cover the energy supply shortage resulting from the project alternatives, the gas turbine plants are likely to be used to supply peak energy because they can be started rapidly during periods of high demand. Air emissions resulting from these substitute plants can be controlled to meet the regulations and conformity requirements.

3.3.12 Noise Resources

3.3.12.1 Affected Environment

Noise is defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, power generation plants, and highway vehicles. The magnitude of noise is described by its sound pressure. Because the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, the decibel. Sound pressures described in decibels are called sound pressure levels.

Sound levels measured using an A-weighted decibel scale are expressed as dBA. Throughout this analysis, all noise levels are expressed in dBA. Several examples of noise pressure levels in dBA are listed in table 3-80.

Table 3-80. A-weighted (dBA) sound levels of typical noise environments. (Source: FICON, 1992, as modified by staff)

A-Weighted	Overall Level	Noise Environment
120	Uncomfortably Loud (32 times as loud as 70 dBA)	Military jet takeoff at 50 feet
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1,000 feet
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1,000 feet; diesel truck 40 mph at 50 feet
70	Moderately loud	Freeway at 50 feet from pavement edge; vacuum cleaner (indoor)
60	Relatively quiet (1/2 as loud as 70 dBA)	Air condition unit at 10 feet; dishwasher at 10 feet (indoor)
50	Quiet (1/4 as loud as 70 dBA)	Large transformers; small private office (indoor)
40	Very quiet (1/8 as loud as 70 dBA)	Bird calls; lowest limit of urban ambient sound
10	Extremely quiet (1/64 as loud as 70 dBA)	Just audible
0	Threshold of hearing	

Note: dBA – A-weighted decibel scale

The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

- the amount and nature of the intruding noise;
- the relationship between the background noise and the intruding noise; and
- the type of activity occurring where the noise is heard.

In considering the first of these factors, it is important to note that individuals have different sensitivity to noise. Loud noises bother some people more than others, and some patterns of noise also enter into people's judgment of whether or not a noise is offensive.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). The blowing of a car horn at night when background noise levels are approximately 45 dBA generally would be more objectionable than the blowing of a car horn in the afternoon when background noises might be 55 dBA.

The third factor is related to the interference of noise with activities of individuals. In a 60-dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Time-averaged descriptors are utilized to provide a better assessment of time-varying sound levels. The three most common noise descriptors used in community noise surveys are the equivalent sound level (L_{eq}), percentile distributions of sound levels ($L_{\%}$), and the day-night average sound level (L_{dn}).

The L_{eq} is an energy-averaged sound level that includes both steady background sounds and transient short-term sounds. The L_{eq} is equivalent in energy to the fluctuating sound level over the measurement period. The L_{eq} is commonly used to describe traffic noise levels, which tend to be characterized by fluctuating sound levels.

The $L_{\%}$ indicate the sound level exceeded for a percentage of the measurement period. For example, the L_{90} is the sound level exceeded for 90 percent of the measurement period and is commonly used to represent background sound levels. The L_{10} is the sound level exceeded for 10 percent of the measurement period and represents the peak sound levels present in the environment.

The L_{dn} is another descriptor used to evaluate community noise levels. The L_{dn} is a 24-hour average sound level, which includes a 10 dBA penalty added to nighttime sound levels (10:00 p.m. to 7:00 a.m.) because people tend to be more sensitive to noise during the nighttime. The day-night average sound level is commonly used to describe aircraft and train noise levels.

For the state of California, noise intensity is also discussed in terms of Community Noise Equivalent Level, which presents a weighted average noise level that increases the relative significance of evening and nighttime noise. The Community Noise Equivalent Level descriptor is used to evaluate community noise levels, which includes a 5 and 10 dBA penalty added to evening (7:00 p.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) sound levels, respectively, in consideration of people’s increased sensitivity to noise during the evening and nighttime periods.

Existing Noise Environment

The proposed Iowa Hill development is located in a remote and forested area near the communities of Mosquito/Swansboro and Camino, placing it in a rural area where a small number of privately-owned residential properties may be affected by a change in noise levels. Most of the nearby residences with potential to be affected by construction noise are located in Swansboro, approximately one mile northwest of the proposed upper reservoir, along the north canyon rim of the SFAR. There are also a few homes south of the upper reservoir site (along or near Copperton Road) within one mile of the upper reservoir, and several more homes are located approximately one mile southwest of the upper reservoir site. Residences closest to the upper reservoir site include a group of 28 privately-owned parcels along Iowa Hill Road. Some of these parcels abut the proposed project boundary for the Iowa Hill development. There are no utility services (e.g., electricity, water) in the vicinity of Iowa Hill, therefore current and future development is limited.

Noise Standards

The El Dorado County General Plan has the following specific policy for construction noise:

- **Policy 6.5.1.11**—The standards outlined in table 3-81 shall apply to those activities associated with actual construction of a project as long as such construction occurs between the hours of 7 a.m. and 7 p.m., Monday through Friday, and 8 a.m. and 5 p.m. on weekends, and on federally recognized holidays. Exceptions are allowed if it can be shown that construction beyond these times is necessary to alleviate traffic congestion and safety hazards.

Table 3-81. Maximum allowable noise exposure for nontransportation noise sources in rural regions—construction noise.

Land Use Designation	Time Period	Noise Level L_{eq}	Noise Level L_{max}
All Residential (LDR)	7 a.m.–7 p.m.	50	60
	7 p.m.–10 p.m.	45	55
	10 p.m.–7 a.m.	40	50
Commercial, Recreation, and Public Facilities	7 a.m.–7 p.m.	65	75
(C, TR, PF)	7 p.m.–7 a.m.	60	70
Rural Land, Natural Resources, Open Space, and Agricultural Lands (RR, NR, OS, AL)	7 a.m.–7 p.m.	65	75
	7 p.m.–7 a.m.	60	70

3.3.12.2 Environmental Effects

Iowa Hill Development

Effects of Construction

The construction of the Iowa Hill development has the potential to generate noise levels that could be disturbing to residents living in the surrounding area and to recreational visitors at the informal boat launch site at the Slab Creek reservoir.

Under Proposed Article 1-48, *Construction Noise*, SMUD would provide a noise mitigation plan to minimize noise emissions from the construction site. The plan would address vehicle idling, and include provisions to provide advance notice of any materials transport and construction activities within 0.5 mile of the tract where construction is occurring; notices to residents indicating the nature, timing, and duration of all materials transport and construction activities occurring within 0.5 mile of their residences; a noise hot line telephone system for reporting construction noise disturbances; monitoring to address compliance with the above measures; and it would specify actions to mitigate violation of the above measures. SMUD would provide monthly monitoring reports to the Forest Service that includes lists of any complaints of noise disturbances.

Our Analysis

Noise at the construction sites would be intermittent and the intensity would vary. The degree of construction noise may vary depending on the construction phase and activities.

While a large portion of the construction activities for the water conduits and the powerhouse cavern would take place underground, construction of the upper reservoir atop Iowa Hill would generate noise as earth-moving equipment clear the site and build the reservoir berm. SMUD states that most construction work at the Iowa Hill development will begin at 6:30 a.m. in order to avoid traffic congestion. Starting construction work at this time would reduce local construction-related traffic congestion and safety hazards and is allowed under El Dorado County General Plan.

Blasting for the construction of the Iowa Hill development would exceed the El Dorado County General Plan maximum allowable noise limit (60 dB) at several noise sensitive sites; however, the blasting would meet federal and industry standards and be less disruptive over time as activities progress underground. Traffic due to the construction of the Iowa Hill development would not exceed General Plan traffic noise limits.

During the construction period, some of the sensitive sites that are close to the project may be exposed to high noise levels. Effective noise control during the construction of a project means minimizing noise disturbances to the surrounding community. We would expect SMUD to use a combination of mitigation techniques including equipment noise controls and administrative measures to provide the most effective means to minimize effects of the construction activity noise on people living nearby or visiting the Iowa Hill area.

SMUD would use standard noise mitigation measures to comply with the El Dorado County General Plan noise limits. These measures would likely include ensuring that all equipment items have the manufacturers' recommended noise abatement measures, such as mufflers, engine enclosures, and engine vibration isolators, intact and operational and that all construction equipment is inspected at periodic intervals to ensure proper maintenance and presence of noise control devices (e.g., mufflers and shrouding). Other typical measures would include limitations on the duration of certain construction/demolition activities, building temporary noise barriers, and planning truck routes to minimize backup alarms and keep trucks away from residences.

Development and implementation of a plan to control construction noise would minimize but not eliminate the potential effects of noise during construction. Neighboring residents and visitors to the Iowa Hill area would hear the construction activities during the daytime but to a lesser extent than would occur without implementation of noise abatement techniques.

Effects of Operations

Operation of the Iowa Hill development has the potential to increase ambient noise levels in the Iowa Hill area. Operational noise associated with the Iowa Hill development is unlikely to be an issue, however, because noise generating facilities (the powerhouse and intake structure) would be located underground.

Our Analysis

The stationary noise source (the turbine/generating units) at the proposed Iowa Hills development would be placed in an underground powerhouse and would not affect noise levels on the surface. Therefore, noise effects associated with operation of the proposed project would not be significant.

Traffic noise would be limited two employees and periodic deliveries and maintenance activities and would be minor. Not many sensitive land uses would be in the proximity of the proposed Iowa Hills development and the proposed transmission alignment. As noted above, most of these areas are mountainous and desolate, except for a few small housing developments and ranch homes that are at least 1,000 feet away.

The higher voltages at which modern transmission lines operate have increased noise problems. Consequently, these lines are now designed, constructed, and maintained so that during dry conditions they would operate below the corona-inception voltage, meaning that the line would generate a minimum of corona-related noise. Under wet weather conditions, high-tension transmission lines may generate audible noises. The audible noise emitted from high-voltage lines is caused by the discharge of energy that occurs when the electrical field strength on the conductor surface is greater than the "breakdown strength" (the field intensity necessary to start a flow of electric current) of the air surrounding the conductor. This discharge is also responsible for radio noise, a visible glow of light near the conductor, an energy loss known as corona loss, and other phenomena associated with high-voltage lines. The degree or intensity of the corona discharge and the resulting audible noise are affected by the condition of the air—that is, by humidity, air density, wind, and water in the form of rain, drizzle, and fog. Water increases the conductivity of the air and in turn increases the intensity of the discharge. Also, irregularities on the conductor surface such as nicks or sharp points and airborne contaminants can increase the corona activity. Aging or weathering of the conductor surface generally reduces the significance of these factors.

For AC lines and voltages above 400-kV, noise levels of 60 dBA or less at the edge of right-of-way can be annoying to the receptors nearby. However, the short section of 230-kV line associated with the Iowa Hill development would be designed to ensure that corona noise does not exceed 50 dBA at the right-of-way.

3.3.12.3 Unavoidable Adverse Effects

During some phases of construction operations, exceedances to El Dorado County General Plan Noise Criteria are likely to occur. SMUD is committed to employing a combination of mitigation techniques including equipment noise controls and administrative measures to provide the most effective means to minimize effects of the construction activity noise on people living nearby or visiting the Iowa Hill area. However, with a large complex project, the information available during the preliminary engineering phase may not allow final decisions to be made on all specific mitigation measures, and the extent of these exceedances to noise criteria cannot be determined. But they will be temporary and less intrusive because of SMUD's mitigation plan.

3.4 NO-ACTION ALTERNATIVE

Under the No-action Alternative (Baseline Condition), the continued operation of existing UARP facilities will be of significant importance to air quality in the Sacramento region and foothill communities in Placer and El Dorado counties over the term of the new license. Operation of the existing UARP facilities does not result in any atmospheric emission of criteria pollutants or other hazardous material that can affect air quality. The continued operation of the existing facilities under the No-action Alternative will, on average, result in the annual generation of 1,835,000 MWh of clean energy.

3.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Continued operation of the existing Projects would continue to commit lands and waters previously developed for energy production. Construction of the proposed Iowa Hill development would convert about 185 acres of existing forest land to energy production use. This commitment would not necessarily be irreversible or irretrievable because removal of the project dams and restoration of disturbed areas could return the Projects' areas to near pre-project conditions. However, given the substantial costs and loss of energy, recreational, and socioeconomic benefits, removal of the dams is unlikely in the foreseeable future.

3.6 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM USES

Under all alternatives considered, the Projects would continue to generate power for customers of SMUD and PG&E and provide recreation and socioeconomic benefits for the duration of any new licenses. The Proposed Actions with staff-recommended modifications would provide significant long-term protection and enhancement of biological, cultural, and recreational resources in the Upper American River Basin, although energy generation at the existing Projects would be somewhat reduced. Construction of the proposed Iowa Hill development would provide a new source of off-peak energy for use during high peak periods and improved the reliability of energy from SMUD.

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