7.0 CONCLUSIONS

7.1 Comparison of Proposed Action and Alternatives

The Proposed Action meets the requirements of Section 10(a) of the Federal Power Act, which directs FERC to license projects that are best adapted to a comprehensive plan for improving or developing a waterway. When compared to the No Action and UARP-only alternatives, the Proposed Action is clearly better adapted to the resource. Not only does it incorporate the beneficial and protective environmental measures of the UARP-only alternative, the Proposed Action augments the UARP capacity by 400 MW with little potential to affect environmental resources. This conclusion is based on a balancing of developmental and non-developmental issues, giving equal consideration to power generation/capacity and environmental resources such as water quality, fish and wildlife, recreation, and socioeconomics.

Demonstration of the substantial benefits of the Proposed Action is facilitated by review of the three alternatives:

- No Action Alternative: Under this alternative, the UARP, as currently configured with no additional developments, will continue to operate under the terms and conditions of the existing license. Continued operation of the UARP in this manner will not alter project economics or affect environmental resources with respect to their current conditions. In this sense, the No Action Alternative represents baseline.

- UARP-only Alternative: Under this alternative, the UARP, as currently configured with no additional developments, will operate under a new set of license terms and conditions including a set of environmental measures designed to enhance and protect existing environmental resources. Some of the new terms and conditions will alter operation of the project, while others won't alter operation of the project but will have an economic effect on the project.

- Proposed Action: Under this preferred alternative, the current UARP configuration will be augmented with the addition of the Iowa Hill Development. The Proposed Action will include the environmental measures contained in the UARP-only Alternative and additional environmental measures to ensure project expansion does not impose new significant long-term environmental impacts.

The Proposed Action is the alternative best-adapted to the comprehensive use of waters within the upper American River basin because the addition of the Iowa Hill Development to the UARP greatly expands project capabilities without a significant effect on the environment.

7.1.1 Power Generation Considerations

From a power generation value perspective, the No Action and UARP-only alternatives provide continued and essential power-related benefits to SMUD, but neither addresses many of the upcoming energy challenges SMUD and the Northern California region will face throughout the 50-year period of the next license term. In contrast, the Proposed Action expands power generation for the UARP, which will play a pivotal role in meeting system reliability needs throughout the new license term for the Sacramento Valley regional electric market. The Proposed Action will not only provide SMUD with 400 MW of additional local peaking capacity, which represents about six to seven years of SMUD's anticipated load growth, but it will also play an important role in assisting SMUD to achieve its overall long-term strategic and portfolio planning objectives by:

(a) Meeting State public policy objectives and energy challenges in the Northern California region;
(b) More comprehensively developing the waterway by expanding project capabilities without a significant impact on the environment;
(c) Producing significant local generation in the Sacramento region to maintain system reliability as well as alleviate anticipated voltage and transmission constraints during peak-demand periods;
(d) Aiding management of greatly increased minute-by-minute load balancing and control area challenges presented by wind and other non-dispatchable generation technologies that are needed to meet SMUD's renewable portfolio standards;
(e) Shifting energy from low-demand to significantly more valuable peak-demand periods when appropriate;
(f) Reducing emission burdens by displacing the need for additional thermal peaking power plants in the Sacramento region, which is a non-attainment area; and
(g) Providing generation diversity within SMUD's resource portfolio.

Because the Sacramento Metropolitan Air Quality Management District is a non-attainment area for ozone and PM_{10}, the development of thermal power facilities is severely restricted. SMUD cannot easily construct new thermal peaking plants due to limited availability of emission offsets. Thus, SMUD is dependent to some degree on transmission imports to meet the increasing summer peak load requirements. However, importing more power to meet expanding peak load is constrained in two important ways. First, an increasing reliance on transmission imports reduces voltage control in the local area. Second, constructing new transmission lines to bring in more power is beset with a series of siting and environmental constraints. The Iowa Hill Development will provide local generation for peak demand, thereby reducing reliance on imported energy into the service area and providing voltage support to the local transmission system.

In addition, the Proposed Action will dovetail with many of California's mandated long-term energy policy objectives. For example, several state entities, including the California Energy Commission, the California Public Utilities Commission, and the California Independent System Operator have determined that additional generating capacity is needed to meet California's growing summer peak energy demand. Moreover, these same entities and the California Legislature have declared it is in the public interest to ensure that to the maximum extent possible, additional generating capacity incorporates renewable, non-fossil fuel-based projects. The problem with certain renewable resource technologies (such as wind) is that they are not dispatchable; wind energy is generated only when the wind blows, which creates system-planning dilemmas related to managing this uncontrollable and intermittent resource. The Iowa Hill Development, with its ability to convert intermittent wind energy into future hydroelectric energy, alleviates this operational challenge, and supports both of these publicly adopted objectives.

The Proposed Action, with the inclusion of the Iowa Hill Development, is far superior than both the UARP-only or No Action alternatives from a power generation perspective, as it provides renewable, local peaking power generation capacity and will help SMUD meet projected demand throughout the term of the license.

7.1.2 Environmental Considerations

As compared to the No Action Alternative, the Proposed Action and the UARP-only Alternative will enhance water quality, fish and wildlife habitat, and recreation while resulting in few if any adverse environmental effects. Implementation of SMUD's minimum release schedule and adaptive plan for addressing warm water conditions in Ice House Dam Reach will enhance cold freshwater fish habitat throughout much of the project. SMUD's proposal to further investigate, in consultation with the ENF, SWRCB, and CDFG, the need for pulse flows in Loon Lake Dam Reach provides an opportunity to enhance aquatic habitat conditions in the reach if needed. The Proposed Action and the UARP-only Alternative will assure the outstanding recreational benefits currently enjoyed by the public in the Crystal Basin. The Recreation Plan is adaptive in nature and will ensure maintenance and augmentation of the substantial recreation facilities presently associated with the UARP. Whitewater recreation opportunities in the SFAR drainage will be supplemented by new opportunities in the SFSC downstream of Ice House Dam, while the coordination of operations between PG&E and SMUD will enhance whitewater recreation in the Reach Downstream of Chili Bar. Implementation of SMUD's proposed HPMP will assure that sensitive cultural sites are protected.

The Proposed Action will provide all the environmental benefits and protective measures of the UARP-only Alternative plus providing the substantial energy benefits with very little additional environmental costs. The light environmental imprint of the Iowa Hill Development stems largely from its design and location, factors which simultaneously benefit construction costs and environmental effects. For example, a primary design and location objective was to lower construction costs by using existing facilities to the maximum extent possible. In using the existing Slab Creek Reservoir as the lower reservoir, only one new reservoir needs to be constructed, thereby limiting environmental effects. Placing the upper reservoir as high above Slab Creek Reservoir as possible, on top of Iowa Hill, eliminates the need to build a dam on an existing stream or river. Furthermore, by implementing the cost-saving measure of using the tunnel excavation material to build the upper reservoir berm, SMUD will alleviate the need for borrow sites and spoil piles, which is environmentally beneficial. SMUD also located the Iowa Hill Development close to the existing UARP transmission line, a cost-saving measure that required a short, approximately 2.0-mile-long, tie-in transmission line.

The most significant aspect of the Iowa Hill Development design that minimizes potential environmental effects is the fact that most of the project facilities will lie underground or underwater. The Iowa Hill Powerhouse, water conveyance system, and intake/outlet facilities will not be visible, thereby minimizing the effects of the development on visual resources. The intake/outlet structure will lie approximately 80 feet below the surface of Slab Creek Reservoir, which, when combined with SMUD's proposal to build protective measures, will minimize entrainment potential of fish residing in the reservoir. SMUD has also incorporated input from relicensing participants and the public into design features of the development. For example, material excavated from the tunnels and powerhouse cavern will be transported to the upper reservoir site for berm construction using a vertical lift system rather than employing trucks to haul the material. The upper reservoir berm will also be vegetated and screened with trees to the maximum extent possible to reduce the visual effects of the upper reservoir.

The Proposed Action's Iowa Hill Development will have environmental effects when compared to the No Action or UARP-only alternatives. However, most of these impacts (noise and traffic) are localized and will not extend past the five-year construction period. Visual impacts are also considered less-than-significant and short-term as most of the power generation equipment is located underground and the berm will be vegetated to reduce long-term aesthetic impacts. The permanent loss of habitat due to the construction of the Iowa Hill Development is considered an unavoidable effect on wildlife and botanical resources; however, these effects are expected to be less-than-significant, given that these habitats are well represented in the regional landscape and do not provide any unique life requisites. In addition, SMUD will implement a Wildlife Protection Plan during construction to alleviate any potential short-term effects to wildlife and botanical species. However, without the 400 MW of capacity from the Iowa Hill Development, SMUD will have to meet future generation needs with power purchased from the energy market, which would likely be produced by less environmentally friendly fossil fuel generation sources.

7.1.3 Economic Considerations

As described in Section 6.0 (Developmental Analysis), the environmental measures of the UARP-only Alternative will result in a $3 million loss in annual net benefit for the UARP compared to baseline, or approximately 3.5 percent loss in value. This includes project value losses associated with reduced energy output from flow-related environmental measures as well as the cost of implementing non-flow-related environmental measures. These losses are reasonable given the balance of environmental needs and power generation. As described in Section 5 (Environmental Consequences), the existing environmental resources throughout much of the project area are in good condition, thus limiting opportunities for enhancement.

With the addition of the Iowa Hill Development under the Proposed Action, the net annual benefit of the UARP will increase by $11.2 million above the UARP-only Alternative. This increase is due to a variety of power generation and economic factors. Because the Proposed Action includes the same environmental measures as the UARP-only Alternative, generation at the existing UARP facilities will still be reduced from baseline. The Iowa Hill Development will not increase overall power generation at the UARP because it will use more power pumping water than it generates. Thus, the net amount of power produced at the UARP under the

Proposed Action will decrease compared to baseline. However, the economic value of the Iowa Hill Development lies not in the change in net power output, but rather, in the timing of the power generation and in the economic value of other services it provides, specifically capacity-based benefits. Most of the energy produced by the Iowa Hill Development will be super-peak power, which has a much higher value than off-peak power. Also, the economic benefit of the 400 MW increase in unloaded capacity due to the development is estimated at $30 million. These increases in the value of the Iowa Hill component of the Proposed Action factor into the net annual benefit of $94.4 million. This benefit represents an incremental increase of $8.2 million over baseline. Moreover, the Iowa Hill Development will provide other benefits that are less easily converted into estimates of project net value, such as those described earlier in this section (e.g., management of non-dispatchable resources).

7.1.4 Summary

On balance, the Proposed Action is the alternative best adapted to the comprehensive use of waters within the upper American River when considering power generation, environmental, and economic factors. The Iowa Hill Development greatly expands power generation capabilities without a significant effect on the environment and reduces the need for importing power purchased from the energy market, which would likely be produced by less environmentally-friendly fossil fuel generation sources.

7.2 Comprehensive Development

Section 4(e) and 10(a) of the FPA require FERC to give equal consideration to all uses of the waterway on which a project is located. When FERC reviews a hydropower project, FERC considers water quality, fish and wildlife, recreational, and other non-developmental values of the involved waterway equally with its electric energy and other developmental values. In determining whether, and under what conditions, to license a project, FERC must weigh the various economic and environmental tradeoffs involved in the decision.

SMUD believes that issuance of a new 50-year license for the Proposed Action is consistent with the comprehensive development of the Rubicon River, Silver Creek and SFAR because: 1) issuance of a new license will allow SMUD to continue to operate the UARP as a dependable source of electric energy for its customer-owners; 2) the addition of the Iowa Hill Development to the UARP will enhance SMUD's ability to assure reliable power to its customer-owners and support reliability in California without a significant effect on the environment; 3) the electricity generated by the Proposed Action (total installed capacity of 1,088 MW) will avoid the need for an equivalent amount of fossil fuel-fired electric generation and capacity, continuing to help conserve these nonrenewable energy resources while reducing atmospheric pollution; and 4) the proposed environmental measures will enhance fish and terrestrial resources, improve public use of recreational facilities and resources, and maintain and protect historic and archaeological resources within the area affected by project operations.

7.3 Cumulative Effects

The Proposed Action will not result in any significant cumulative effects. The Council on Environmental Quality (CEQ) regulations define cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR § 1508.7). Past actions include not only the UARP and other hydroelectric projects, but also farming and development within the area. Together these actions have changed the environment, affecting flows, fisheries, and other wildlife and aquatic resources. The Proposed Action includes a number of measures intended to ameliorate some of these past effects. Therefore, the cumulative effect of the Proposed Action, taken together with other past actions, is not significant, but rather will result in positive changes to the environment.

Present and future actions that could potentially add to the cumulative effects of the Proposed Action include the Bureau of Land Management's (USBLM) management of its lands along the river for recreation, continued residential development, and other hydroelectric relicensing projects. Other hydroelectric relicensing projects include PG&E's Chili Bar Project, which lies downstream of the UARP on the SFAR, EID's El Dorado Project (FERC Project No. 184), which lies upstream of the Camino Powerhouse on the SFAR, and Placer County Water Agency's (PCWA) Middle Fork Project (FERC Project No. 2079), which lies on the Middle Fork of the American River (MFAR) and Rubicon River.

During the scoping process, stakeholders identified the area of primary interest for the cumulative effects analysis as the 19.1-mile stretch below PG&E's Chili Bar Reservoir to USBR's Folsom Reservoir (Reach Downstream of Chili Bar). The geographic scope of this cumulative analysis, therefore, focuses on the effects of PG&E's Chili Bar Project and SMUD's UARP on the Reach Downstream of Chili Bar and on the effects of the continued operation of these projects on this 19.1-mile stretch of the SFAR. In Scoping Document 2 (SD2), the stakeholders identified the following resources as having the potential to be cumulatively effected by the Proposed Action in combination with the Chili Bar Project: 1) water quality; 2) water temperature; 3) fisheries populations; 4) benthic macroinvertebrates; 5) amphibian populations; and 6) recreation. Subsequent to issuance of SD2, SMUD added stream morphology to the list of resources that could be potentially affected by the Proposed Action. Jointly, SMUD and PG&E conducted a number of studies to assess the potential cumulative effects of their joint projects. The temporal scope of this analysis is the next 30 to 50 years.

This section first describes the current state of Chili Bar Reservoir and the Reach Downstream of Chili Bar, focusing on the resource areas identified in SD2. Next, this section analyzes the cumulative effects of the PG&E's Chili Bar Project and the UARP on those resources and concludes that given the UARP and Chili Bar Project Operations Coordination Plan that is included as part of the Proposed Action, there will be no cumulative effects on the SFAR in the Reach Downstream of Chili Bar. Finally, this section considers the cumulative effects of the UARP, in conjunction with: 1) the El Dorado Project on a small segment of the SFAR between the confluence with Silver Creek and Slab Creek Reservoir; and 2) PCWA's operation of Hell

Hole Reservoir on the stretch of the Rubicon River downstream of Hell Hole Reservoir, and finds there will be no cumulative effects from the continued operation of the projects.

7.3.1 Affected Environment

PG&E's Chili Bar Reservoir is the regulating afterbay for the UARP's White Rock Powerhouse. Under regulated conditions, Chili Bar Powerhouse typically begins to ramp up as water is released from SMUD's White Rock Powerhouse into Chili Bar Reservoir, and ramps down when inflows from White Rock Powerhouse decrease and Chili Bar Reservoir water level begins to decrease. The reservoir surface typically fluctuates daily by about seven feet, usually between elevation 990 feet and 997 feet. Water is released downstream from Chili Bar Dam through a 14-foot-diameter intake to the tunnel that supplies water to the Chili Bar Powerhouse located at the downstream base of the dam. Water may also be released from the dam through a 10-foot diameter tunnel equipped with a synchronous bypass valve, or it may spill over the 170-foot-wide spillway. PG&E typically does not draw Chili Bar Reservoir down below an elevation of 984 feet. The tunnel/powerhouse has a maximum capacity of 1,979 cfs when Chili Bar Reservoir is at full pool.

According to the FERC original license for the Chili Bar Project, the minimum flow requirement is 100 cfs. However, PG&E typically passes a minimum flow of about 200 cfs through Chili Bar Powerhouse, which represents the low end of the powerhouse operating range.

The 19.1-mile-long Reach Downstream of Chili Bar extends from the base of Chili Bar Dam (elevation 964 feet) to the normal high water line of Folsom Reservoir (elevation 466 feet), and has a mean channel gradient of approximately 0.005 (0.5%). Major tributaries include Dutch Creek, Granite Creek, Jacobs Creek, Greenwood Creek, Hastings Creek, Norton Ravine, and Weber Creek. The reach includes three distinct subreaches: Upper Subreach (Upper Canyon), Middle Subreach (Coloma), and Lower Subreach (Gorge). The Upper Canyon Subreach is characterized by higher channel gradient, long rapids, steep canyon walls, and few noteworthy alluvial deposits. The Coloma Subreach lies in a broad, gently sloping valley and the channel is comparatively wider, more sinuous, and has more developed floodplains. Sections of this subreach have been mined for gold using suction dredges, which removed the original channel bottom and deposited dredge tailings in piles on the banks of the river. Suction dredging altered the channel morphology by removing coarse sediment and leaving behind large boulders, resulting in an artificially deepened channel. In the Gorge Subreach, the regional slope increases again and the river enters a confining canyon. Here, the majority of the channel is formed in bedrock or boulders and depositional zones are typically found in areas where the canyon bottom widens.

Accretion within this reach has a high level of seasonal variability, peaking around February and receding during late summer and early fall. The median monthly accretion flows in Above Normal water years range from 1,098 during the peak month of February to a low of 46 cfs in September. In a Below Normal water year, median accretion flows range from 708 and 24 cfs for February and September, respectively.

SMUD, in coordination with PG&E, conducted studies in Chili Bar Reservoir and the Reach Downstream of Chili Bar, as described in the various resource areas in Section 5.3. Provided below is a brief description of the current conditions for the following resources identified in SD2: 1) water quality; 2) water temperature; 3) fish populations; 4) benthic macroinvertebrates; 5) amphibian populations; and 6) recreation. SMUD has added geomorphology to this list.

7.3.1.1 Water Quality

Chili Bar Reservoir is a coldwater reservoir with surface water temperatures of less than 20ºC in summer and bottom temperatures as cold as 6ºC to 7ºC. Chili Bar Reservoir is polymictic, meaning that is does not ice over, does not stratify, and mixes freely. Chili Bar Reservoir is well oxygenated with dissolved oxygen (DO) concentrations ranging from 95.2 to 121.3 percent saturation (10.0 to 14.3 mg/l) of oxygen. The water is clear with Secchi depth values ranging from 4.9 to 21.3 feet. Values for pH range from 6.7 to 7.8 (DTA 2005d).

The Reach Downstream of Chili Bar is well oxygenated with DO concentrations ranging from 74 to 110 percent saturation (7.4 to 13 mg/l) of oxygen. Alkalinity in the reach is low, with most readings less than 20 mg/l. The highest reading (114 mg/l) was recorded at a site downstream from the Salmon Falls/Highway 49 Bridge. Excluding this one reading, the alkalinity readings in this reach never exceeded 30 mg/l, ranging from 9.6 to 28 mg/l (DTA 2005d). Turbidity and total suspended solids are also low, with mean values of less than 1 nephelometric turbidity unit (NTU) and 1 mg/l, respectively (DTA 2005d). Total dissolved solids (TDS) were determined, as well as individual levels of calcium, magnesium, potassium, sodium, chloride, and sulfate, which are also low. Values are generally below reporting limits, with minimal site or seasonal differences. All organic compounds (oil and grease, MTBE, TPH, and gasoline range organics) are below detection limits (DTA 2005d). The water is soft with hardness readings less than 27 mg/l. Nutrients are also low. Total phosphorus and ortho-phosphorus each ranged from a low of less than 0.01 mg/l to a high of 0.22 mg/l for total phosphorus and 0.03 mg/l for ortho-phosphorus (DTA 2005d). Total Kjeldahl nitrogen ranged from less than 0.023 mg/l to 0.55 mg/l. Nitrate-nitrite ranged from less than 0.023mg/l to 0.29 mg/l (DTA 2005d). The maximum nitrate concentration in the reach is well below the 1.0-mg/l nitrate standard used to characterize source waters that can stimulate algae growth. Normally, pH ranges from about 6.5 to 8.0 (DTA 2005d) and mineral levels are low.

Fecal coliform concentrations were higher than Basin Plan numerical limits in the Reach Downstream of Chili Bar, but not in Chili Bar Reservoir. The fecal coliform concentration in the reach was higher than the Basin Plan geometric mean numerical limit at two sites: upstream of Hastings Creek (322 organisms/100 ml) and downstream of Weber Creek (327 organisms/100 ml) (DTA 2005d). The fecal coliform concentration was higher than the Basin Plan fecal coliform single sample numerical limit on a number of occasions, but did not follow an upstream to downstream pattern.

With the exceptions of cyanide and selenium, metals are found in reportable quantities in the Reach Downstream of Chili Bar. Table 7.3.1-1 summarizes the range of total recoverable metal concentrations in Chili Bar Reservoir and the reach.

Table 7.3.1-1. Reportable quantities of metals in the Reach Downstream of Chili Bar (*Water Quality Technical Report*, DTA 2005d).	
Metal	**(Total mg/l)**
Aluminum	<50 – 290
Arsenic	<1.0 – 1.3
Barium	<20 – 27
Cadmium	<0.05 - <0.2
Copper	0.26 – 3.4
Cyanide	<50 – 189
Iron	<5
Lead	<0.05 – 1.4
Manganese	<10 - <50
Mercury	<0.005 – 0.01
Nickel	<2 – 2.5
Selenium	<2
Silver	<0.04 – 0.12
Zinc	<5

None of these readings is greater than the DHS' Primary MCLs numerical limits, but one does exceed DHS' Secondary MCLs numerical limits, which do not have specific human health considerations but are related to taste and odor. Aluminum concentration on November 12, 2002 (first-major-rain sampling event) downstream from Chili Bar Dam was 290 µg/l. The Secondary MCL for aluminum is 200 µg/l.

7.3.1.2 Water Temperature

Thermal profiles of Chili Bar Reservoir show an unstratified reservoir during the Fall Turnover, First Major Rain, and Spring Runoff sampling periods. While the water temperature in the reservoir varies between these periods, the profiles indicated isothermal conditions (i.e., essentially the same temperature throughout the water column) in each of these sampling periods. During the Summer Low Flow sampling period, the thermal profile showed slight surface warming. Surface temperatures on September 15 were approximately 17°C, while bottom temperatures were approximately 13.5°C (Table 7.3.1-2).

Table 7.3.1-2. Chili Bar Reservoir water quality profiles over four sampling periods.

Depth (m)	Temperature (°C)	pH	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat)	Specific Conductance (µS/cm)
Fall Turnover Sampling Period October 9, 2002					
0.5	11.5	6.8	10.6	99.3	20.2
2	11.3	6.7	10.6	99.2	20.1
6	11.2	6.7	10.6	99.3	20.1
8	11.0	6.7	10.6	99.7	19.8

Table 7.3.1-2. Chili Bar Reservoir water quality profiles over four sampling periods.

Depth (m)	Temperature (ºC)	pH	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat)	Specific Conductance (µS/cm)
10	11.0	6.7	10.7	100.1	19.7
14	11.0	6.7	10.7	99.1	19.7
First Major Rain Sampling Period November 13, 2002					
0.5	10.2	7.1	10.7	N/A	26.0
2	9.8	7.1	10.8	98.2	26.0
6	9.8	7.0	10.8	98.1	26.1
10	9.8	7.0	11.0	99.5	26.2
14	9.7	7.0	10.8	97.8	25.0
16	9.7	7.0	10.6	95.8	25.0
Spring Runoff Sampling Period May 5, 2003					
0.5	8.3	7.8	N/A[1]	N/A	37.0
2	8.2	7.7	N/A	N/A	37.0
4	8.2	7.6	N/A	N/A	37.0
6	8.2	7.6	N/A	N/A	37.0
8	8.2	7.5	N/A	N/A	37.0
Summer Low Flow Sampling Period September 15, 2003					
0.5	17.6	10.0	7.4	102.6	24.0
2	15.8	10.2	7.3	100.4	24.0
4	14.5	10.6	7.3	100.9	24.0
6	14.4	10.6	7.3	100.4	24.0
8	13.9	10.6	7.2	99.4	23.0

[1] Oxygen levels were not within range. Possible calibration error.

SMUD and PG&E monitored water temperature at four sites within the Reach Downstream of Chili Bar: 1) SFAR immediately downstream of Chili Bar Dam; 2) SFAR directly upstream of Dutch Creek; 3) SFAR directly downstream of Greenwood Creek; and 4) SFAR directly upstream of Weber Creek. The period of monitoring at these four sites was from July 2002 through September 30, 2004.

The results of the monitoring study show that water temperatures from Chili Bar Dam range between 6º and 10°C during the winter and between 14º and 17°C during summer. A gradual warming trend was observed over the course of the 19.1 miles of river between Chili Bar Dam and Folsom Lake (Figure 7.3.1-1). At the lowermost monitoring site, below Weber Creek, mean daily winter temperatures range between 6º and 10°C, representing limited wintertime warming throughout the reach. Summer mean daily water temperatures reach values of between 16 and 20°C, which represented limited warming throughout the reach.

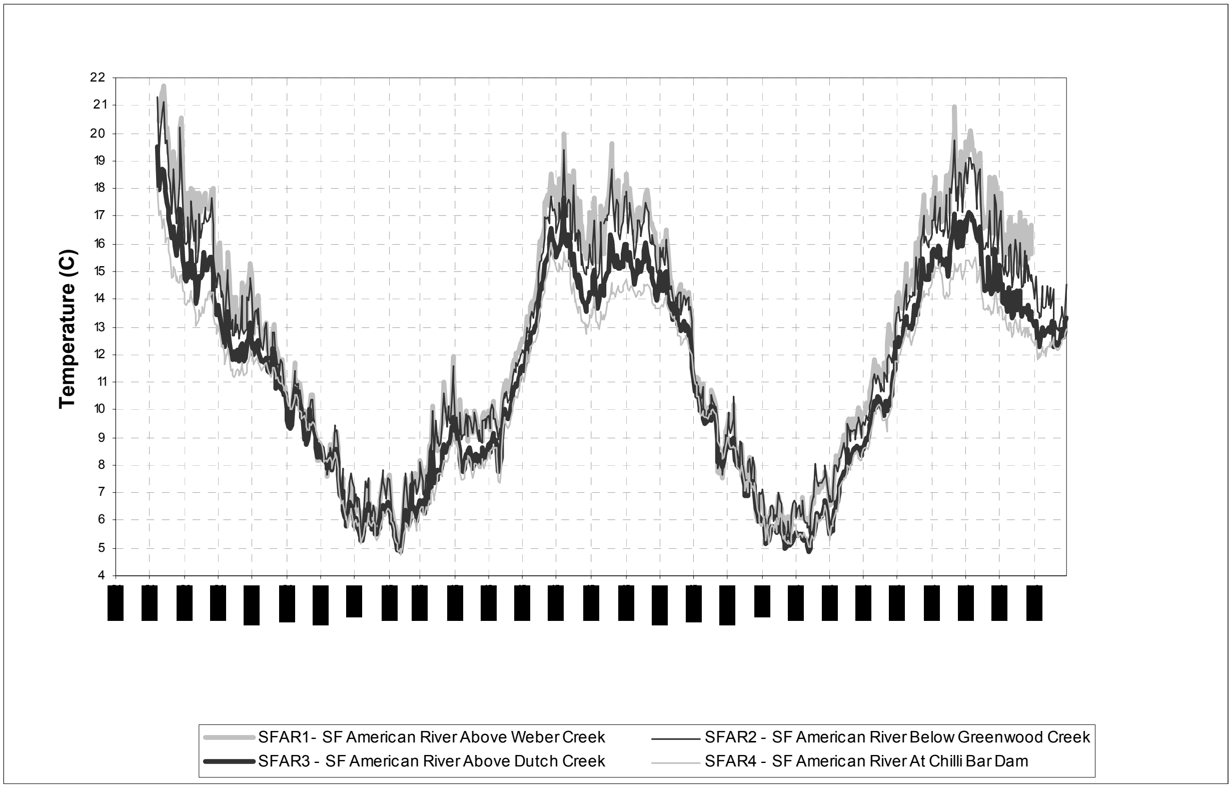


Figure 7.3.1-1. Mean daily water temperatures at four locations in Reach Downstream of Chili Bar, July 2002 – September 2004.

7.3.1.3 Stream Morphology

Chili Bar Reservoir and the Reach Downstream of Chili Bar are chiefly underlain by Paleozoic siliclastic sedimentary rocks that were deposited 350 to 400 million years ago in a continental margin setting and later recrystallized (metamorphosed) by prolonged heating during the emplacement of the Sierra Nevada batholith. The dominant rocks in this category are quartzite, pelitic schist, crystalline limestone and dolomite. These rocks are capped by Miocene-Pliocene volcanic rocks of the Mehrten Formation. Below Chili Bar, the SFAR cuts a gorge across both the granitic and metasedimentary rock formations. Chili Bar Reservoir is a re-regulating reservoir, receiving water from White Rock Powerhouse and releasing it into the SFAR. The slopes around the reservoir are steep, ranging from 30-45 percent to near vertical (> 45%). Localized slumping and bank erosion were evident in areas of shoreline characterized by bedrock and/or a coarse substrate with steep slopes (30-45%), thin soil development, and sparse shrub cover. Overall, the shoreline of Chili Bar Reservoir is considered stable, composed of bedrock and sand substrates with vegetation (p. 16, DTA and Stillwater 2004k).

In general, the channel beds within the Reach Downstream of Chili Bar are comprised of cobble, with numerous boulders, and small amounts of gravel and sand. The channels are typically narrow, and located within bedrock-controlled canyons of moderate to steep slopes. 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. Table 7.3.1-3 provides general geomorphic information at various sections in the Reach Downstream of Chili Bar.

The Reach Downstream of Chili Bar is mostly composed of transport sections of river: stream channels that are generally resilient and insensitive to changes in flow and/or sediment supply (pgs. 18-19, DTA and Stillwater 2004d). Channel character in these transport sections is primarily controlled by bedrock geology and dominant, coarse boulder substrate. In these channels, the available transport capacity is greater than the local sediment supply, and fine sediment is transported downstream while coarser material (e.g., cobble and boulder) remains. Any net loss in coarse sediment supply due to Chili Bar Reservoir is likely replaced by downstream tributary and hillslope sediment sources. Thus, there is very little fine sediment stored at the transport sections of the Reach Downstream of Chili Bar, although deposits do temporarily form in pockets behind large flow obstructions and along the channel margins on the receding limb of storm or runoff hydrographs. These deposits are usually re-mobilized during subsequent high flow events.

In contrast to transport sections of streams, response sections are stream channels that are most likely to show effects from alterations to hydrology or sediment supply, and are generally defined as having channels with: 1) low slope (< 4 percent); 2) predominantly alluvial bed and banks (cobble-gravel facies or finer); and 3) plane bed or pool-riffle morphology.

On-the-ground stream habitat mapping was not conducted for the Reach Downstream of Chili Bar (pg. 14, DTA and Stillwater 2004l), but Level I Rosgen geomorphic characterization (Rosgen 1996) of the reach shows that the entire reach length is composed of Rosgen channel types C and/or F. Although C channels are typically characterized as response channels, F channel types may either be transport or response dominated. In this reach, the SFAR is deeply incised within the low-lying, rolling landscape of the Sierra foothills. The river flows through a steep-walled bedrock gorge in the upper and lower sections of the reach, while meandering through a broad, gently sloping valley in the middle section. Detailed geomorphological investigations were conducted along four sections of the Reach Downstream of Chili Bar: Upper Canyon; Upper Coloma; Lower Coloma; and Gorge.

Results from on-the-ground Rosgen Level II and Level III surveys indicate that the channel is transport dominated in three of the four sections. The Upper Canyon, Lower Coloma, and Gorge sections are all transport sections because channel processes along these sections are primarily bedrock controlled. Although more alluvial deposition was observed at each of the three transport sections than at any of the upstream UARP transport reaches, field observations show that numerous boulders and bedrock outcrops occur along the banks and in the channel at each of these sections. These observations suggest that bed and bar deposits of particles cobble sized and finer represent a relatively thin cover over bedrock in most of the Reach Downstream of Chili Bar.

Table 7.3.1-3. Geomorphic data summary table for the Reach Downstream of Chili Bar.

			Channel Geometry									Particle Size Distribution (mm)							Channel Type			Incipient Motion (cfs)
Site	Sub-reach	XS	Mean Local Slope	S	Wbf (ft)	Wfp (ft)	Dbf max (ft)	Dbf mean (ft)	Dfp (ft)	Wbf / Dbf	E	D_{90}	D_{84}	D_{65}	D_{50}	D_{35}	D_{16}	D_{10}	Level II	Morph-ology	Type	
Upper Canyon (CB-G1)	Upper	Upper	0.01	1.00	268	340	9.2	5.3	19	51	1.3	300	230	134	89	60	34	25	F3	Bedrock/ Plane-bed	Transport	NA
		Middle			194	337	10	6.2	21	31	1.7	284	220	149	92	65	35	23				
		Lower			238	345*	12	8.0	23	30	1.4*	384	290	139	90	70	40	32				
Upper Coloma (CB-G2)	Middle	Upper	0.007	1.20	265	377*	7.8	4.8	16	55	1.4*	290	243	135	104	79	51	42	C3	Pool-riffle	Response	4,317
		Middle			205	415*	9.5	3.6	19	57	2*	295	246	158	122	103	71	62				1,703
		Lower			143	420	9.4	4.1	19	35	2.9	384	284	200	158	128	89	71				2,061
Lower Coloma (CB-G3)		Upper	0.009	1.20	217	378	5.9	4.4	12	49	1.7	192	169	113	84	56	7	1	C3	Pool-riffle	Transport	NA
		Middle			178	363	8.2	4.7	17	38	2.0	240	211	146	108	81	45	25				
		Lower			185	370*	9.7	5.2	19	36	2*	251	211	154	125	102	52	45				
Gorge (CB-G4)	Lower	Upper	0.006	1.00	300	457*	9.8	3.7	20	81	1.5*	155	132	94	66	52	33	23	F3	Pool-riffle	Transport	NA
		Middle			309	396	6.6	5.5	13	56	1.3	168	150	110	90	67	52	42				
		Lower			245	356	8.8	4.8	18	51	1.5	259	175	119	88	74	56	50				

XS = Cross-section W/D = width/depth ratio fp = refers to floodprone width and/or depth D_{90} = bed particle size where 90 percent is finer *Values based on estimated elevations (see text)

S = Sinuosity E = entrenchment ratio bf = refers to bankfull width and/or depth NA = Not Applicable (see text) *Counts with <100 particles, or no counts performed* (see text)

Survey results show that the one remaining section, Upper Coloma, is the only response section in the Reach Downstream of Chili Bar. This section is located 5.1 miles downstream of Chili Bar Dam near Coloma just below the steep-walled bedrock gorge section of the upper part of the reach. In general, the channel bed, bars, and banks in this section are stable, with no signs of rapid degradation or aggradation. Bedrock outcrops occur within the section, which is indicative of the stabilizing influence of the underlying structural control. The section is characterized by cobble and small boulder alluvial fill with no notable signs of erosion or deposition in the channel or along the banks (pg. 50, DTA and Stillwater 2004d). A few sand and silt deposits occur in the low-velocity zones at the tail end of pools and along the high-flow margins of the channel. The cobble channel is slightly embedded and surfaces are mostly dull. Cross-section plots indicate, however, that occasional high flow events may cause incision into the cobble fill (pg. 50, DTA and Stillwater 2004d). Fine sediment (sand and finer) was not observed filling pools (if they existed) or in excess quantities in bar deposits, indicating that most fine material is transported downstream by the current flow regime. Gravel in the channel bed at the Upper Coloma Site is cemented in a matrix of cobble, and may only be released by flows that mobilize the larger material. Patchy gravel deposits occur in low-velocity zones and behind flow obstructions, but may be remobilized by regular flow events.

Incipient motion and bankfull discharge analyses suggest that the bed material is mobilized regularly under the current flow regime and that the floodplain remains well connected with the active channel. In this section, the bed is expected to mobilize (i.e., reach incipient motion threshold) at flows between 1,703 cfs and 4,317 cfs. Incipient motion analyses indicate that the thresholds of bed mobility are much lower than regulated and pre-regulation bankfull flows ($Q_{1.5}$), 5,667 and 5,813 cfs, respectively, suggesting that bed mobility occurs frequently. Section photographs show that the banks at the section are sparsely vegetated with primarily young woody species on cobble bars. Some older growth was observed set back from the primary channel. A couple of bedrock outcrops were observed in the channel bed and along the banks at this site, evidence of the pervasive influence of the underlying bedrock that appears regularly throughout this reach.

Large Woody Debris (LWD)

As described above, most of the Reach Downstream of Chili Bar is a transport reach. Transport dominated rivers are predominantly higher gradient, bedrock and boulder controlled channels with limited sediment storage. Typically, bedrock and coarse boulder substrates do not allow LWD anchoring. Furthermore, the Reach Downstream of Chili Bar lies in the lower portion of the SFAR watershed, and as such has a very large upstream contributing drainage area (598 to 860 square miles) and wide channel (193-285 feet). Channels of this type typically do not retain LWD within their bankfull width because of larger flows, lower channel roughness, and higher transport capacities. In addition, these characteristics lead to the rapid disintegration of LWD within these reach types. Consequently, LWD has very little effect on channel morphology in this setting.

LWD physical characteristics (e.g., frequency and size) were analyzed at the lower Coloma geomorphology sites in the Reach Downstream of Chili Bar and compared to results of a similar survey done of streams within the Stanislaus National Forest. LWD piece frequency in Lower Coloma response section of the Reach Downstream of Chili Bar was 1.4 pieces/100m, which is less than the mean value of 15 pieces/100m but within the range of values reported by Ruediger and Ward (1996). LWD piece volume in the reach was 0.2 m^3/ha, which is less than the mean of 132 m^3/ha but within the range of values reported by Ruediger and Ward (1996). Because of the general features described above for this reach (large drainage area and wide channel), many of the channel processes along at this response section are driven by the same controls as the transport sections (i.e., bedrock control, high transport capacity, few alluvial deposits). Although more deposition was observed at the Upper Coloma Site in the Reach Downstream of Chili Bar, the channel is very wide here, with few roughness elements present in the bankfull channel. Bankfull flows are easily capable of transporting or disintegrating very large pieces of LWD along this section. Therefore, LWD has very little effect on channel morphology in or along response sections of the Reach Downstream of Chili Bar.

7.3.1.4 Fish Populations

In general, fish populations currently exhibit low abundance in the Reach Downstream of Chili Bar (pg. 56, DTA and Stillwater 2005e) possibly due to reduced reproductive success (e.g. spawning), increased juvenile mortality (e.g. stranding or displacement), higher bioenergetic costs, and reduced habitat availability associated with the fluctuation in flow during the summer boating season. A summary of fish population condition in the reach is provided below.

In November 2002, SMUD and PG&E sampled fish in Chili Bar Reservoir by beach seine at two sites and by gill net at six sites. Fish were captured at all six gill net sites. Sacramento sucker represented 70 percent of the catch followed by hardhead (23%) and brown trout (7%). Most of the brown trout and hardhead were captured in the middle portion of the reservoir. Sacramento sucker captures were concentrated in the eastern (upstream) portion of the reservoir. No fish were captured at the two beach seining sites in Chili Bar Reservoir. The length-frequency distribution, as well as field observations, indicates the presence of sexually mature adult brown trout as well as adult hardhead and Sacramento sucker.

A total of 12 fish species were observed during the 2003-2004 stream fish surveys at four locations in the Reach Downstream of Chili Bar: rainbow trout, sculpin spp. (combined riffle and prickly), Sacramento sucker, Sacramento pikeminnow, hardhead, brown trout, Chinook salmon (hatchery origin), speckled dace, smallmouth bass, green sunfish, and bluegill. Rainbow trout was the most abundant species (n = 122), followed by Sacramento sucker (n = 99), Sacramento pikeminnow (n = 52), and brown trout (n = 10). Sculpin species are likely the most abundant species numerically in the reach, but are not discussed here because reliable abundance estimates could not be made. Other species were present in low numbers ($n \leq 10$), including one hardhead.

The mean linear density of catchable trout (> 150 mm TL) was 68 trout/mile. Mean densities of all trout were 88 trout/mile and 8 trout/acre.

A summary of fish populations by sampling site is provided below.

Old Flume Site

The most upstream site sampled was at the "Old Flume" memorial, off Highway 49, approximately 1.7 miles downstream of Chili Bar Dam. Five habitat units (two riffles, two runs, and one pool) were snorkeled in 2003 and four in 2004 (one riffle, two runs, and one pool). Discharge from the dam at the time of sampling both years was approximately 200 cfs. Physical habitat conditions are presented in Appendix B of the *Stream Fisheries Technical Report* (DTA and Stillwater 2005j). A total area of 181,018 square-feet (4.2 acres) and a total length of 2,176 feet (0.41 mi) were snorkeled at this site on October 7, 2003. In 2004, a total area of 155,401 square-feet (3.6 acres) and a total length of 1,705 feet (0.32 mi) were snorkeled. In addition, in both 2003 and 2004, stream margins at this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey.

Riffle and prickly sculpin (n = 17 for combined species and years) were captured by electrofishing the stream margins at this site. Sculpin were identified to species until the presence of both riffle and prickly sculpin was confirmed at each site. After the presence of both species was confirmed, sculpin were identified only to family.

During snorkel surveys, rainbow trout, brown trout were observed in both years, while Sacramento pikeminnow and sculpin species were only observed in 2003. Rainbow trout was the numerically dominant species both years. Rainbow trout ranged in length from 75 mm to 375 mm. Rainbow trout length-frequency distributions were relatively evenly distributed from 125 mm to 250 mm with a low percentage of young-of-year (YOY) fish, which seems to suggest a low recruitment in this area (Figure 4.15-9 and 4.15-10, DTA and Stillwater 2005j). However, in a large river system such as the SFAR, it is often difficult to observe YOY fish.

Based on direct observation, the minimum density of trout species at this site was 109 trout/mile in 2003, while in 2004, minimum density of trout species was notably lower at 56 trout/mile. Minimum numbers of catchable trout (> 150 mm TL) were 78 trout/mile in 2003 and 50 trout/mile in 2004.

Coloma Site

The second fish-sampling site was located near the town of Coloma located approximately 6.2 miles below Chili Bar Dam. Five habitat units were snorkeled in 2003 and four in 2004 in the vicinity of the state park at Coloma. The lowermost habitat unit, a long run, was located just below the Old Coloma Bridge. Sampling proceeded continuously upstream from this unit (with the exception of some high gradient areas). The uppermost unit sampled at Coloma was a pool just downstream of a large rapid. A total area of 291,389 square-feet (6.7 acres) and total length of 2,479 feet (0.47 mi) were snorkeled at this site on October 6, 2003; 298,159 square-feet (6.8 acres) and 2,592 feet (0.49 mi) were snorkeled at this site in 2004. Discharge from the dam at the time of sampling was approximately 200 cfs. Physical habitat conditions are presented in Appendix B of the *Stream Fisheries Technical Report* (DTA and Stillwater, 2005j). In addition, the stream margins of this site were electrofished both years to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey.

Rainbow trout, brown trout, Sacramento pikeminnow, Sacramento sucker, riffle and prickly sculpin were captured by electrofishing in the stream margins at this site. In 2004, Sacramento sucker, Sacramento pikeminnow, hardhead, bluegill, and riffle and prickly sculpin were captured.

During snorkel surveys, rainbow trout, brown trout, Sacramento sucker, and sculpin species were observed. Sacramento pikeminnow and Chinook salmon were observed in 2004 only. Sacramento sucker was the numerically dominant species in both years (Figure 4.15-3, DTA and Stillwater 2005j).

Rainbow trout ranged in length from 100 mm to 275 mm. Rainbow trout length-frequency distributions peaked at 125 mm in 2003 and at 275 mm in 2004, without discernable modes at other size classes (see Figure 4.15-11 and 4.15-12, DTA and Stillwater 2005j).

Based on direct observation, minimum densities of trout species at this site were 45 trout/mile in 2003 and 56 trout/mile in 2004. Minimum densities of catchable trout (> 150 mm TL) were 21 trout/mile in 2003 and 14 trout/mile in 2004.

Camp Lotus Site

In both 2003 and 2004, six habitat units were snorkeled near Camp Lotus, approximately 9.2 miles below Chili Bar Dam. The lowermost unit sampled was a long run located immediately above a large pool at the campground. The remaining habitat snorkeled was contiguous above this unit with the exception of one short, shallow riffle. A total area of 326,874 square-feet (7.5 acres) and total length of 3,168 feet (0.60 mi) were snorkeled at this site on September 30, 2003; in 2004, a total area of 318,173 square-feet (7.3 acres) and total length of 2,214 feet (0.42 mi) were snorkeled at this site. In addition, in both 2003 and 2004, stream margins at this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey. Discharge at the time of sampling was approximately 200 cfs for both years. Physical habitat conditions are presented in Appendix B (DTA and Stillwater 2005j).

During electrofishing, Sacramento pikeminnow, Sacramento sucker, green sunfish, and riffle and prickly sculpin were captured in both years. Rainbow trout, brown trout, and one juvenile hardhead (fork length = 102 mm) were also captured in 2003. Sculpin was the most abundant species captured in 2003, whereas, in 2004, Sacramento sucker was the most dominant.

During snorkel surveys, rainbow trout, brown trout, and Sacramento sucker were observed during both years. In 2003, speckled dace and Sacramento pikeminnow were also observed; Chinook salmon were observed during 2004 surveys only. Sacramento pikeminnow was the dominant species in 2003, whereas rainbow trout was the most abundant in 2004.

Rainbow trout ranged in length from 75 mm to 425 mm with length-frequency distributions peaking at 200 and 275 mm for 2003 and 2004 respectively, without discernable modes at other size classes for either year (see Figure 4.15-13 and 4.15-14, DTA and Stillwater 2005j).

Based on direct observation, minimum densities of trout species at this site were 45 trout/mile in 2003 and 40 trout/mile in 2004. Minimum densities of catchable trout (> 150 mm TL) were 38 trout/mile in 2003 and 33 trout/mile in 2004.

Weber Creek Site

Four habitat units were snorkeled in the vicinity of the Weber Creek confluence with the SFAR, approximately 18.7 miles below Chili Bar Dam and 0.4 miles above the high water line of Folsom Reservoir. Weber Creek enters the SFAR on river left, from a high gradient riffle. Immediately below this riffle is a large pool, which marks the lowermost habitat unit sampled at this site. The survey continued to the high gradient riffle immediately above this pool, but portions of this riffle were too fast to snorkel efficiently or safely. Moreover, due to turbid and polluted discharge from Weber Creek, these two habitat units, which were surveyed in 2003, could not be surveyed in 2004. Immediately above the outlet of Weber Creek is a large pool, which was snorkeled in its entirety both in 2003 and 2004. Additional habitat units were snorkeled upstream of the extent that was surveyed in 2003 to compensate for the habitat units not snorkeled below the Weber Creek confluence. The additional habitat units resulted with slightly more total area and stream length snorkeled in 2004 (total area of 94,679 square-feet [2.2 acres] and total length of 1,591 feet [0.30 mi]) than in 2003 (total area of 89,315 square-feet [2.1 acres] and a total length of 1,140 feet [0.22 mi]). In addition, the stream margins of this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey. Physical habitat conditions at the time of the surveys are presented in Appendix B (DTA and Stillwater 2005j). Discharge from the dam at the time of sampling was approximately 200 cfs.

During electrofishing, bluegill, and riffle and prickly sculpin (for combined sculpin species) were captured in both years. Brown trout was also captured in 2003. Sculpin was the most abundant species captured during both years.

During snorkel surveys, rainbow trout and Sacramento sucker were observed in both years. In addition, smallmouth bass, sculpin species, and Sacramento pikeminnow were observed in 2003. In 2004, brown trout, green sunfish, and Chinook salmon were also observed. Rainbow trout was the numerically dominant species in both years.

Rainbow trout ranged in length from 125 mm to 400 mm. Rainbow trout length-frequency distributions peaked near 175 mm, with less distinct modes at larger size classes in both 2003 and 2004 (see Figure 4.15-15 and 4.15-16, DTA and Stillwater 2005j).

Based on direct observation, minimum densities of trout species at this site were 53 trout/mile in 2003 and 43 trout/mile in 2004. Minimum densities of catchable trout (> 150 mm TL) were 134 trout/mile in 2003 and 22 trout/mile in 2004.

7.3.1.5 Benthic Macroinvertebrates

SMUD and PG&E sampled six sites in the Reach Downstream of Chili Bar in the fall of 2003 and 2004. Two reference sites were sampled in 2004: one on the North Fork American River at Ponderosa Way and one on the Cosumnes River within the elevation range of the Reach Downstream of Chili Bar. For additional reference, 1995 Cosumnes River data (CDFG, unpublished data) from site COS-2 were included in the composite metric score analysis.

From the 45 samples collected within the Reach Downstream of Chili Bar and reference site samples, 12,600 benthic macroinvertebrates (BMI) were processed comprising 96 distinct taxa, which included 39 Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa, 13 mayfly taxa, 12 stonefly taxa and 14 caddisfly taxa (Appendix D, DTA and Stillwater 2005b). The mean tolerance value was 5.4, and overall Shannon Diversity was 3.0. Site median and range values (Table 7.3.1-4) indicate a wide range of variation.

Table 7.3.1-4. Metric summaries for benthic macroinvertebrate assemblages from the Reach Downstream of Chili Bar (years 2003 and 2004) and reference sites (year 2004).

Metric	Cumulative Project Totals (Years 2003/2004)	Year 2003		Year 2004[1]	
		Total	Site Median (range)	Total	Site Median (range)
Taxa Richness	96	61	35 (19 - 41)	93	38 (23 – 57)
EPT Taxa	39	23	13 (8 – 16)	38	16 (6 – 24)
Ephemeroptera	13	7	5 (4 – 7)	13	5 (3 – 9)
Plecoptera	12	10	4 (2 – 5)	10	5 (2 – 7)
Trichoptera	14	6	4 (2 – 5)	15	5 (1 – 11)
Tolerance Value	5.4	5.7	5.7 (4.4 – 7.0)	5.2	4.9 (3.3 – 6.7)
Shannon Diversity	3.0	2.6	2.4 (1.5 – 2.6)	3.1	2.6 (1.7 – 3.1)

[1] Includes reference site data from year 2004.

Table 7.3.1-5. Mean values by site for samples collected in 2003 and 2004 for the Reach Downstream of Chili Bar[1].

Metric	CB-I1		CB-I2		CBI-I3		CB-I4		CB-I5		CB-I7	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Taxonomic Richness	17 (1.5)	15 (2.0)	23 (2.1)	23 (2.0)	25 (2.3)	27 (0.6)	25 (2.4)	26 (1.5)	23 (1.9)	22 (2.8)	25 (1.8)	26 (1.0)
EPT Taxa	5.7 (1.5)	4 (0.3)	8.7 (2.2)	8 (0.6)	9.3 (1.1)	11.7 (1.3)	9.3 (2.2)	11 (1.5)	11 (1.1)	10 (0.6)	9 (1.4)	12.3 (0.3)
Shannon Diversity	1.4 (0.3)	1.6 (0.2)	2.2 (0.2)	2.2 (0.1)	2.3 (0.2)	2.5 (0.0)	2.4 (0.1)	2.1 (0.2)	2.4 (0.1)	2.3 (0.2)	2.2 (0.1)	2.4 (0.0)
Tolerance Value	7 (0.1)	6.7 (0.2)	5.8 (0.3)	6.3 (0.1)	5.6 (0.2)	5.3 (0.2)	5.4 (0.8)	6.4 (0.3)	4.3 (0.1)	4.5 (0.4)	5.7 (0.4)	4.6 (0.3)
Sample Abundance (x1000)	1.1 (0.2)	4.5 (1.1)	1.6 (1.0)	1.0 (0.3)	0.59 (0.1)	1.0 (0.1)	0.67 (0.1)	0.7 (0.2)	1.2 (0.2)	1.9 (0.2)	0.9 (.4)	1.9 (0.2)

[1] Standard error shown in parentheses.

Taxa richness increased from upstream to downstream, and ranged from 17 (2003) and 15 (2004) at Site CB-I1 to 25 (2003) and 26 (2004) at Site CB-I7 (Table 7.3.1-5). Number of EPT taxa and Shannon Diversity indices both were lower at Site CB-I1 than at the other sites for both years. Tolerance was greatest at the most upstream site and was similar at the five downstream sites, although somewhat higher values were observed at sites CB-I2 and CB-I4 in 2004. Abundance estimates varied; the highest abundance was observed at Site CB-I2 in 2003, approximately two miles downstream of Chili Bar Dam and at CB-I1 in 2004. Standard error was high at both sites. Patchily distributed organisms, such as black flies and isopods contribute to this high abundance value and error at this site. Low abundance values were observed at sites CB-I3 (SFAR at Mt. Murphy Road Bridge, Coloma) in 2003 and CB-I4 (SFAR at Camp Lotus) in both 2003 and 2004.

BMI composite metric scores are shown in Figure 7.3.1-2 for sites within the Reach Downstream of Chili Bar and the reference sites. The site immediately downstream of Chili Bar Dam (site CB-I1) scored consistently below average, while the reference sites and sites CB-I5 (year 2003) and CB-I7 (year 2004) scored consistently above average. Five of the six samples from site CB-I2 scored below average. The other sites within the Reach Downstream of Chili Bar ranked within an intermediate range with respect to the other sites. Oligochaetes, primarily within the families Naididae and Enchytraeidae, were numerically dominant at site CB-I1 (Appendix D, DTA and Stillwater 2004b), which contributed to the site's low score for both years. A relatively high percentage of oligochaetes (Figure 7.3.1-3) was observed at all of the sites in the Reach Downstream of Chili Bar for both 2003 and 2004 (site mean: 35%; range: 14% to 70%) and 2004 (site mean: 31%; range: 8% to 52%). In comparison, the mean percentage of oligochaetes sampled from the reference sites was seven percent (range: 3% to 13%).

EPT and Coleoptera richness were consistently lower in the Reach Downstream of Chili Bar, but stonefly richness was similar when compared to the reference sites. Although natural history information is incomplete for many BMI taxa, especially oligochaetes, the generally longer and more complex life cycles of EPT and Coleoptera taxa may have contributed to their more limited occurrence in the Reach Downstream of Chili Bar when compared to the reference sites. The burrowing behavior of oligochaetes may be favored in habitats with frequent fluctuating flow conditions and altered temperature regimes, the latter of which is known to limit BMI taxa that require temperature cues and thermal accumulation to complete their life cycles.

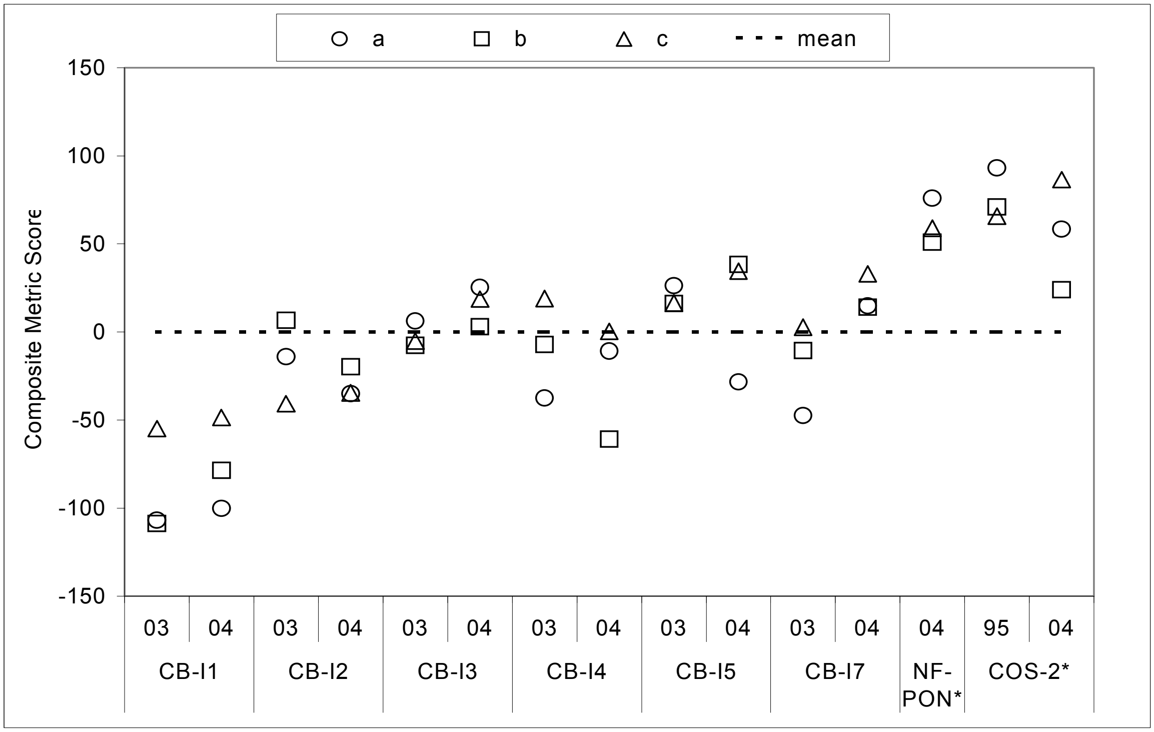


Figure 7.3.1-2. Composite metric scores for benthic macroinvertebrate samples (a, b, and c) collected from sites in the Reach Downstream of Chili Bar and reference sites (identified with asterisks), Fall 2003 and 2004. Year 1995 COS-2 data were obtained from CDFG.

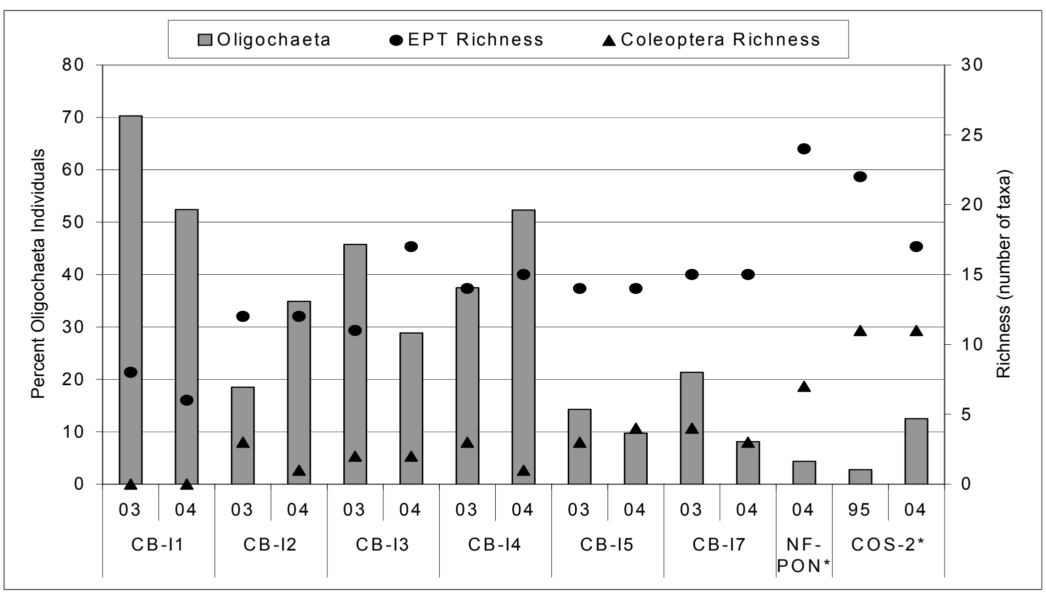


Figure 7.3.1-3. Plot of cumulative site total oligochaete individuals and EPT/Coleoptera Richness for the Reach Downstream of Chili Bar and reference sites (identified with asterisks). Year 1995 COS-2 data were obtained from CDFG.

A cluster dendrogram showing relative similarity of BMI composition of samples and sites within the Reach Downstream of Chili Bar is shown in Figure 7.3.1-4. At the highest level of grouping (level 1), BMI composition separated all sites within the Reach Downstream of Chili Bar from the reference sites. At the second highest level of grouping (level 2), BMI composition separated the two reference sites. There did not appear to be a meaningful grouping of sites by year of sampling, suggesting low annual variation in BMI composition. The distribution of oligochaete individuals and Coleoptera taxa were major factors contributing to the partitioning of sites shown in the cluster dendrogram.

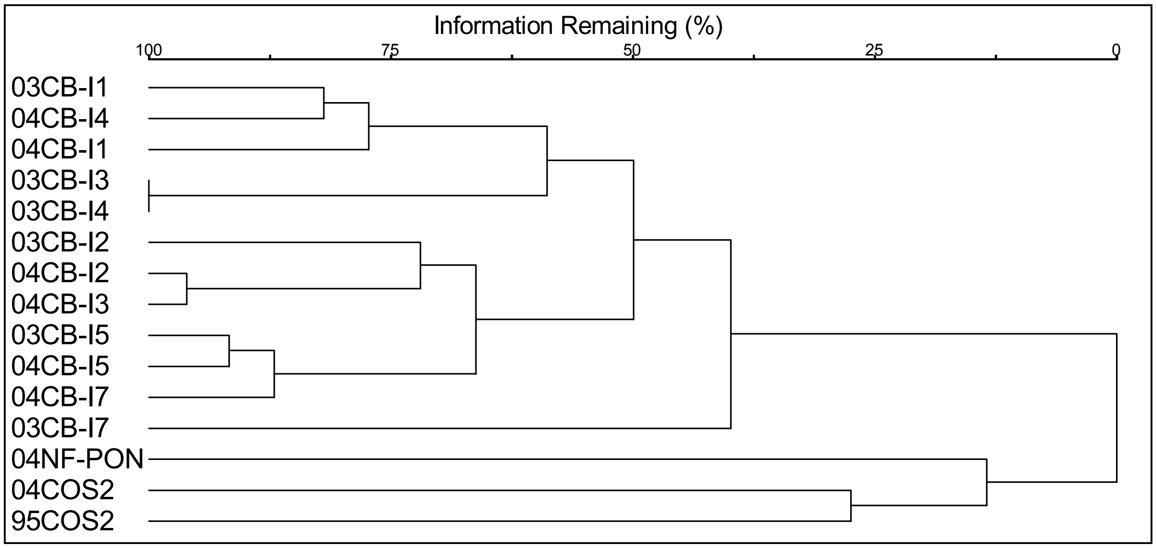
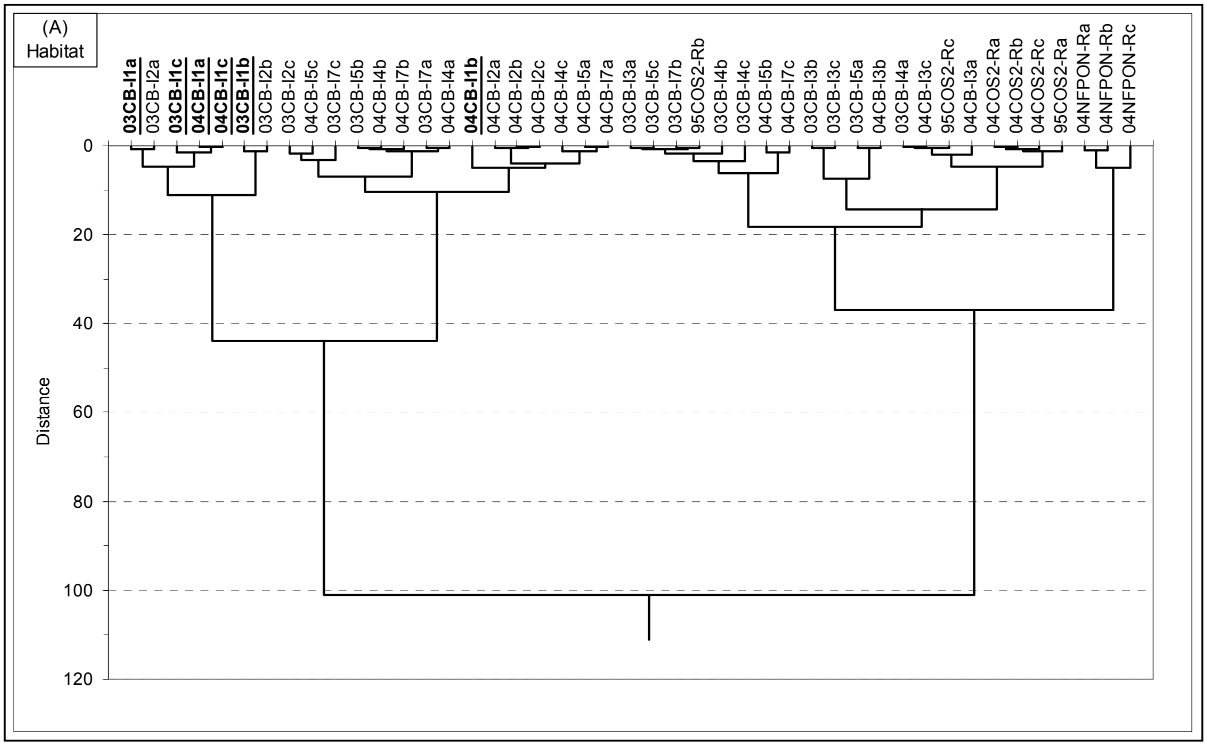


Figure 7.3.1-4. Dendrogram showing relative site similarity based on the composition of benthic macroinvertebrates sampled from the Reach Downstream of Chili Bar (CB) for years 2003 and 2004 and reference sites (NF-PON and COS2) for 2004. Year 1995 (95) COS-2 data were obtained from CDFG.

To evaluate factors contributing to the increasing composite metrics scores with distance downstream of Chili Bar Dam, supplemental cluster dendrograms were prepared depicting relative site/transect similarity as a function of habitat variables (substrate, gradient, and canopy) and biological metrics (Figure 7.3.1-5 A and B). The reference sites for years 1995 and 2004 were included in the analysis for comparison.



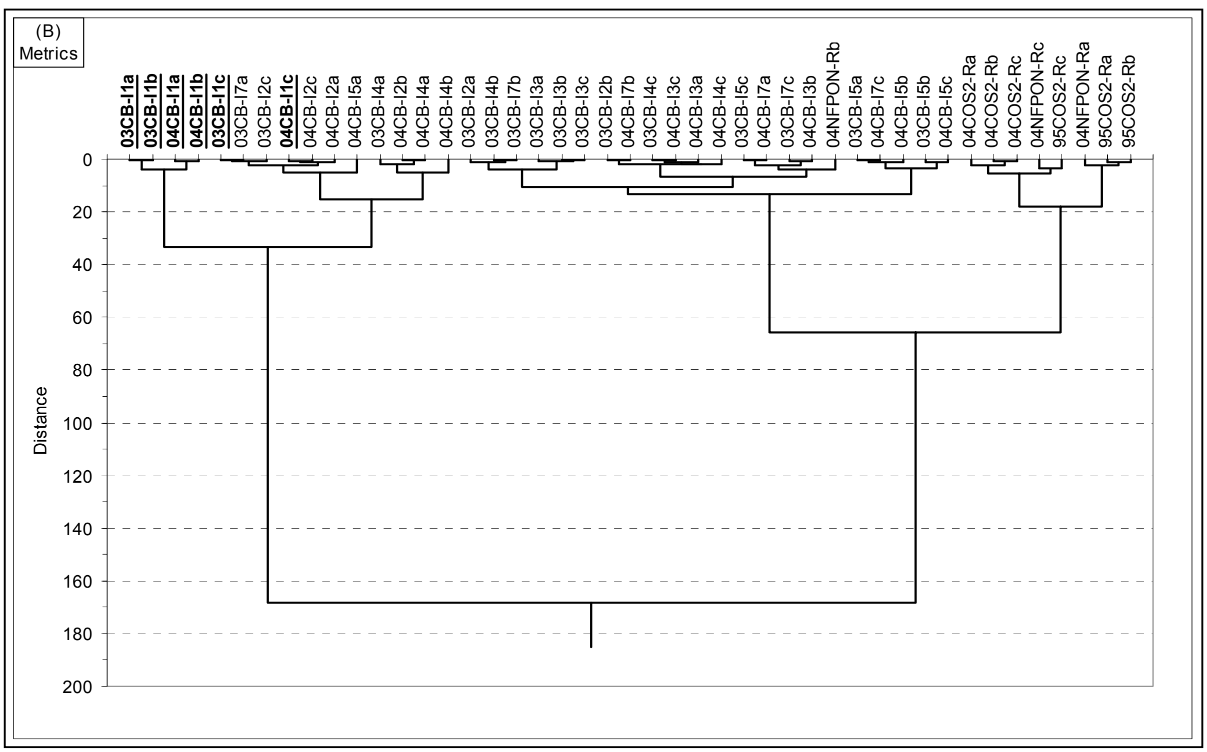


Figure 7.3.1-5 A and B. Dendrograms showing relative site and transect (denoted as a, b and c) similarity based on habitat (Dendrogram A) and metrics (Dendrogram B) for the Reach Downstream of Chili Bar (CB) for years 2003 and 2004 and reference sites (R) for year 2004. Site CB-I1 transects are identified in bold and underlined for reference.

There was a similar grouping of sites and transects for both habitat and biological metrics, which suggests that habitat contributed to the grouping of sites as a function of BMI assemblage quality. Transects comprising site CB-I1 grouped similarly with respect to both habitat and metrics. Bedrock was a dominant substrate class at site CB-I1 and two of the CB-I2 transects, and is likely to contribute to the low composite metric scores for site CB-I1.

Nevertheless, these reduced metric values of BMI populations in the Reach Downstream of Chili Bar are likely the result of a variety of factors, including the summer flow fluctuations. The repetition of these flows may flush organic matter and small woody debris from the stream, and shift habitat suitability. This may reduce food availability and habitat complexity, both of which can lead to reductions in BMI populations. Another factor that might be a cause of lower BMI metrics is the relatively constant cool water release from Chili Bar Dam. However, this effect if it occurs, is localized, as the CSBP metrics recover downstream.

7.3.1.6 Amphibians and Aquatic Reptiles

SMUD and PG&E identified three special-status amphibian species and one aquatic reptile that potentially could be cumulatively affected: foothill yellow-legged frog (FYLF), the California red-legged frog (CRLF), and western pond turtle. Surveys performed by SMUD and PG&E did not find these species in Chili Bar Reservoir or the Reach Downstream of Chili Bar. Each of the species and habitat for them in the Reach Downstream of Chili Bar is discussed below.

Foothill Yellow-Legged Frog (FYLF)

FYLF breeding is typically associated with cobble and gravel bars with suitable near-shore low-velocity habitats for egg laying and tadpole rearing. Although this type of habitat is present under base flow conditions in the Reach Downstream of Chili Bar, daily flow fluctuations preclude suitability of this habitat for FYLF. Many sites identified under low flow conditions as being moderately suitable were deemed low quality when re-visited during high flow conditions. Suitable habitat was present at low and high flows, but fluctuations in the flow reduced habitat stability and constancy necessary for egg and tadpole development. Suitable egg-laying and tadpole rearing habitats became increasingly inundated at higher discharges and rendered the habitat unsuitable (i.e., water was too deep and/or too fast). Large cobble bars along mid-channel islands, split channels, and protected side-channels were identified at low flows (200–500 cfs), but were often completely inundated and inaccessible less than 24 hours later (e.g., Site CB-5). As discharge increased, suitable edgewater habitats became deep (greater than 50 cm) and velocities increased to unsuitable levels. Conversely, in many cases, suitable habitat at high flows (1,500 cfs) located in side channels and protected backwater areas was dewatered when discharge decreased.

The presence of introduced fishes (such as brown trout, smallmouth bass, green sunfish, and bluegill), bullfrogs, and crayfish may further limit the viability of the mainstem as breeding habitat for FYLF. Although egg-laying and tadpole rearing may be precluded from mainstem habitats in the Reach Downstream of Chili Bar, use of the mainstem SFAR by FYLF as a dispersal corridor is possible. The Visual Encounter Survey (VES) methods do not provide information on the degree to which the mainstem SFAR may be used as a dispersal corridor.

FYLF have been observed in Indian Creek, a tributary to the SFAR in Coloma. Adults and tadpoles were observed approximately 0.5 miles upstream of its confluence with the SFAR, and for approximately one mile upstream from there. The lower 0.25 mile of the tributary becomes dry by mid-summer. FYLF has also been observed in several reaches of the SFAR and its tributaries upstream of Chili Bar Reservoir (e.g., Silver Creek downstream of Camino Dam, and SFAR immediately upstream and downstream of the Silver Creek confluence).

California Red-Legged Frog (CRLF)

CRLF occur in Spivey Pond, a within-channel pond in Weber Creek, approximately ten river miles upstream of the confluence of Weber Creek and the SFAR. A breeding population has been documented there for the last several years (USFS, unpublished data). Surveys conducted on Weber Creek in 2003, just upstream of its confluence with the SFAR, documented over 50 bullfrog tadpoles in one small backwater pool. Although CRLF and bullfrogs can co-exist, bullfrogs are known to prey on CRLF (Hayes and Jennings 1986) and could preclude high CRLF densities. Bullfrogs have been documented in Spivey Pond, however, co-existing with CRLF.

Although suitable habitat within Weber Creek and several other tributaries in the vicinity (e.g., Greenwood, Hastings, and Dutch creeks) provide potentially suitable habitat for CRLF, surveys in 2003 of the lower 0.5 to one mile of these tributaries (upstream of their confluences with the SFAR) yielded no sightings.

CRLF typically breed in low velocity, deep pool habitats, with emergent vegetation. These types of habitats are less common along the mainstem SFAR except under higher discharges, and even then, are patchy in distribution. Furthermore, the side channels and backwater areas that become inundated at these higher discharges are generally of low quality and lack the habitat complexity that would create still-water pools with appropriate riparian vegetation for cover (i.e., increasing discharge would not necessarily increase the potential for CRLF on the SFAR in the Reach Downstream of Chili Bar).

Off-channel water bodies (e.g., stock ponds) are not impacted by flow fluctuations in the main channel, and thus provide more stable habitat. Thus, potentially suitable habitat for CRLF is less likely to be impacted by flow fluctuations than habitat for FYLF in this reach. Both stock ponds surveyed near this reach contained suitable shallow water fringe habitats, with appropriate vegetation, and deeper areas within the center of the pond. Bullfrogs and tree frogs were abundant at both ponds, but no CRLF were observed.

Western Pond Turtle

Western pond turtles were found at two sites within this reach: one on the mainstem SFAR near Coloma, and one in Greenwood Creek. The turtle found on the SFAR was in a protected side channel, and was found close to shore amidst emergent vegetation. An adult was found at the confluence of Greenwood Creek and the SFAR, basking on large woody debris. Both sites also had bullfrogs. Western pond turtles were also documented at two locations along the margin of Chili Bar Reservoir (ECORP, Inc., pers. comm., 2004).

The daily fluctuations in the mainstem SFAR likely preclude the establishment of western pond turtles within most of the reach. Although suitable habitat occurs at low flow conditions, high flows inundate suitable habitats typically associated with adult western pond turtles, including stillwater or slow-flowing pools with large woody debris basking sites and aquatic vegetation. The SFAR location where the adult was observed (Site CB-15) is one of the few protected side channels within the reach that is not as affected by daily flow fluctuations. That site also has abundant cover on a mid-channel island that does not become completely inundated at higher discharges.

Successful breeding populations are rarely associated with large reservoirs (Holland 1991), although three adult western pond turtles were observed in Chili Bar Reservoir. In most cases, large fish predators may prey on hatchlings and young, and may compete with adult turtles for the available prey. While adult turtles can be habitat generalists, young turtles have very specific habitat requirements, including dense vegetation cover for foraging and resting, in shallow water (Holland 1991). These types of microhabitats are difficult to find in large reservoirs, such as Chili Bar Reservoir, as well as in reaches with fluctuating flows, such as the Reach Downstream of Chili Bar.

Based on the general lack of habitat suitable for western pond turtle within the SFAR, as well as the daily flow fluctuations, a self-sustaining population of western pond turtles would not be likely in the Reach Downstream of Chili Bar. Evidence of use of the tributaries and the reservoir itself, however, indicates incidental use of the SFAR corridor is occurring.

7.3.1.7 Recreation

The combined operations of the UARP and Chili Bar Project have, in part, helped create a thriving whitewater boating industry, which complements local tourism and recreation-related activities in the Reach Downstream of Chili Bar. The present value of the whitewater boating industry in El Dorado County is estimated to be about $33 million annually (pg. 23, DTA 2004u). The total number of boaters (commercial and non-commercial) was reported to peak in 1995 at 147,500 then steadily drop in recent years to 89,850 in 2003 (Table 4.3.1-1, DTA 2004u). This industry supports commercial businesses as well as county and state parks, primarily in the Lotus-Coloma communities, which provide seasonal and full time employment opportunities. The County, USBLM, and California Department of Parks and Recreation all collect fees from the commercial boaters. In addition, many of the businesses interviewed by SMUD and PG&E indicated that they are dependent on the flows in the SFAR and that the relationship between the dependability and predictability of the flows in the SFAR is important to the economic health of the region.

The 19.1-mile Reach Downstream of Chili Bar also provides opportunities for other recreational activities. The town of Coloma is located at the approximate midpoint of the reach. Here, there are access roads and gentle slopes adjacent to the river that allows easy access for users. This town has historic significance because it is the site where gold was first discovered in California in 1848. The State of California developed the Marshall Gold Discovery State Historic Park (State Park) to preserve the physical features associated with this historical event and to provide interpretive opportunities for visitors. This State Park includes a museum/visitor center, park, trail and interpretive programs which many people visit year-round.

The SFAR has many other locations that are attractive for flow dependent recreation activities including fishing, swimming, gold panning and gold dredging. Most of the areas suitable for these activities are also located in the Coloma area where the public has the most access to the river. Trout fishing is a popular activity throughout streams and rivers in the central Sierra Nevada. Other non-sport species present in the reach, such as the Sacramento pikeminnow and Sacramento sucker, also affect the quality of fishing. In general, the Reach Downstream of Chili Bar is not known for providing an outstanding angling experience when compared to other streams and rivers in the central Sierra Nevada.

Swimming is a common activity in the Reach Downstream of Chili Bar. It provides an opportunity for visitors to cool off, particularly in the hot summer temperatures. Because water temperatures are usually below 70°F most swimmers do not stay in the water for extended periods of time. Most swimmers are whitewater boaters, day users or campers in one of the many campgrounds along the SFAR. In general, the Reach Downstream of Chili Bar appears to provide swimming opportunities for visitors to take advantage of while they are participating in other activities. However, for a visitor that seeks a location primarily suited for swimming, there are nearby areas, such as Folsom Lake, that have warmer and calmer water that is more suitable for swimming than the Reach Downstream of Chili Bar.

Gold panning and dredging activities occur throughout the Sierra Nevada; however, the regional importance of the SFAR downstream of Chili Bar for these activities is significant because of the historic events that occurred at and near Coloma. Visitors associate gold with this particular area even though gold was discovered in many other locations of the Sierra Nevada. The presence of mining claims along the Reach Downstream of Chili Bar and State Park in Coloma as well as the institution of a permit system for recreational gold dredging by the BLM in 2004 underscore the significance of these activities in the region both now and into the future.

7.3.2 Environmental Effects

To determine the cumulative environmental effects of the Proposed Action, SMUD considered the Proposed Actions in combination with the effects of past, present, and future actions. As identified by the stakeholder groups in SD2, the focus of this analysis was on the cumulative effects of the UARP and PG&E's Chili Bar Project on resources in the Reach Downstream of Chili Bar. In addition, SMUD also analyzed the cumulative effect of the UARP in conjunction with EID’s El Dorado Project on a segment of the SFAR between the confluence with Silver Creek and Slab Creek Reservoir and PCWA's Middle Fork Project on resources in the Rubicon River downstream of Hell Hole Reservoir. The seven resource areas identified by SMUD and the SD2 are: 1) water quality; 2) water temperature; 3) stream geomorphology; 4) fish populations; 5) benthic macroinvertebrates; 6) amphibian populations; and 7) recreation. The temporal scope of the analysis is the next 30-50 years. The Proposed Action would be considered to have a significant cumulative effect if any of the resources were expected to exceed threshold limits, which were identified in the appropriate areas of this document. Here, however, no cumulative effects were found to be significant. In fact, the UARP and Chili Bar Project Coordinated Operations Plan will have a beneficial effect on the Reach Downstream of Chili Bar by providing improved water management at Chili Bar Reservoir.

The cumulative effects analysis in the SFAR focuses on SMUD's Proposed Action in combination with pertinent operational measures proposed by PG&E in their License Application for the Chili Bar Project, as identified in SD2. Key features of the Proposed Action and operational measures proposed by PG&E are described below.

Coordinated Operations Plan

The Proposed Action includes a Coordinated Operations Plan, which is described in Appendix H. This plan has two major components. First, the plan provides that SMUD will assure the quantity of water needed by PG&E to meet its license-required flow releases (including minimum flows, ramping rates, and recreational flows) are delivered to the Chili Bar Reservoir in a timely fashion for PG&E to meet its requirements. Second, the plan provides for enhanced efficiency and operational coordination between the UARP and PG&E, which is expected to provide the best comprehensive use of the resource, and in particular, reduce the frequency of spills over Chili Bar Dam. This is described in detail in the following sections.

Operations Based on Five Water Year Types

Also, as described in the Proposed Action, SMUD and PG&E will jointly operate the UARP and Chili Bar Project on the basis of five different water year types. Each year, in each of the months of February, March, April, May, and October, SMUD and PG&E will determine the water year type based on the California Department of Water Resource's (DWR) forecast for annual unimpaired inflow into Folsom Reservoir as set forth in DWR's Bulletin 120 entitled *Water Conditions in California*. In each of February, March, and April, the water year type shall be based on DWR's forecast for the month and shall apply from the tenth day of the month through the ninth day of the next month. In May, the water year type shall be based on DWR's forecast for May 1 and shall apply from May 10 through October 9. From October 10 through February 9 of the following calendar year, the water-year type shall be based on DWR's October 1 confirmation of prior water year type. PG&E will use this method of water year type definition to implement a minimum flow releases schedule (Table 7.3.2-1) and a recreation flow release schedule (see Table 7.4.3-2).

Table 7.3.2-1. Monthly minimum release schedule (cfs) from Chili Bar Dam, proposed in the License Application for the Chili Bar Project, by water year type.**

	Water Year Type				
Month	**Critical Dry**	**Dry**	**Below Normal**	**Above Normal**	**Wet**
October*	100	100	200	200	200
November	100	100	200	200	200
December	100	100	200	200	200

Table 7.3.2-1. Monthly minimum release schedule (cfs) from Chili Bar Dam, proposed in the License Application for the Chili Bar Project, by water year type.**

	Water Year Type				
Month	**Critical Dry**	**Dry**	**Below Normal**	**Above Normal**	**Wet**
January	100	100	200	200	200
February*	100	100	200	200	200
March*	100	200	200	250	250
April*	150	225	250	300	350
May*	150	225	250	300	350
June	100	200	250	300	350
July	100	200	200	250	300
August	100	200	200	250	300
September	100	200	200	250	300

* Based on DWR forecast, prelim./final WY will be classified , flow changes by 10th.
** Or inflow, whichever is less, once available water in Chili Bar Reservoir has been depleted to minimum operating level.

Table 7.3.2-2. Daily recreation release schedule (cfs) from Chili Bar Dam, proposed in the License Application for the Chili Bar Project, by water year type (start time, am - flow, cfs - duration, hrs).**

	Water Year Type				
Day of Week	**Critical Dry**	**Dry**	**Below Normal**	**Above Normal**	**Wet**
Monday*	0	0	0	0	0
Tuesday	0	0	9-1200-3	9-1500-3	9-1500-5
Wednesday	0	0	9-1200-3	9-1500-3	9-1500-5
Thursday	0	0	9-1200-3	9-1500-3	9-1500-5
Friday	9-1200-3	9-1200-3	9-1200-3	9-1500-3	9-1500-5
Saturday	8-1200-3	8-1500-3	8-1500-5	8-1500-6	8-1750-6
Sunday	8-1200-3	8-1500-3	8-1500-5	8-1500-6	8-1750-6
Time Period	Memorial Day to Labor Day	Memorial Day to Labor Day	Memorial Day to Labor Day	Memorial Day to September 15	Memorial Day to September 15

* Exceptions: Memorial Day and Labor Day, when the Saturday schedule will apply.
** Or inflow, whichever is less, once available water in Chili Bar Reservoir has been depleted to minimum operating level.

Ramping Rates at Chili Bar Dam

Another pertinent element of PG&E's License Application proposal is the implementation of controllable discharge, or ramping rates, at Chili Bar Dam. Ramping rates will apply to situations when PG&E increases or decreases release from the dam as they transition between the minimum and recreational release schedules. Under the proposal, PG&E will maintain a ramping rate of 550 cfs/hr for up- and down-ramping at all times.

Balancing Flow Requirements of Aquatic Resources and Recreation

In jointly developing the Proposed Action and pertinent proposals for the Chili Bar Project License Application, SMUD and PG&E considered various means of balancing the many valuable, and sometimes competing, resources in the Reach Downstream of Chili Bar. As discussed in Section 7.3.1 (Affected Environment), the existing conditions of certain aquatic resources in the reach are low in abundance. This includes fish and macroinvertebrate populations. Foothill yellow-legged frog is not present in the reach, but inhabit a tributary to the reach. While a variety of variables likely contribute to the existing aquatic resource conditions, summer fluctuating flows is one of the contributing factors.

In developing the combination of minimum and recreation releases of Tables 7.3.2-1 and 7.3.2-2, consideration was given to modifying the fluctuating flows to lessen the flow-fluctuation-related effects on aquatic resources. Consideration was given to converting the flow regime in the reach to a more moderate level of fluctuation. This can be accomplished by either decreasing peak flows or increasing base flows. The Chili Bar Project could be operated in such a way to greatly moderate the summer flow fluctuations by simultaneously decreasing peak flows and increasing base flows, thereby create a flow regime that fluctuates by only a few hundred cfs throughout the day. This option, while beneficial to aquatic resources, would significantly reduce opportunities for whitewater rafting and kayaking. Commercial whitewater boating would be severely reduced under this option, limited to off-season months. Another option would be to maintain peak recreational flows, while substantially increasing baseflows. This option, however, would require large increases in water passing through the UARP system during summer months. This would severely disrupt water management in the UARP storage reservoirs, impacting a variety of project values including capacity value load following capabilities throughout the summer, flatwater boating, and fall carryover storage.

Many of the stakeholders in the UARP ALP have described the importance of whitewater boating in the Reach Downstream of Chili Bar, in particular the commercial rafting industry. Thus, the minimum and recreation flow schedules proposed in PG&E's License Application preserves the public benefit derived from whitewater boating, while simultaneously enhancing aquatic resources to the extent possible in the reach given the primary purpose of the project. Aquatic resource enhancement will be achieved by reducing the incidence and magnitude of summer spill events at Chili Bar Dam and providing more fish habitat complexity than current conditions. The proposed release schedule will not eliminate all the effects of fluctuating flows on aquatic resources, but represents a reasonable balance of all beneficial uses for this very important reach.

7.3.2.1 Water Quality

The Proposed Action will have no incremental adverse effect on water quality in Chili Bar Reservoir. SMUD and PG&E's water quality studies indicate that water in Chili Bar Reservoir meets all Basin Plan Water Quality objectives. With the implementation of the various environmental measures to avoid impacts during construction of the Iowa Hill Development, the Proposed Action will have no incremental adverse affect on water quality in Chili Bar Reservoir.

As described in Section 7.3.1.1 (Affected Environment – Water Quality), water quality in the Reach Downstream of Chili Bar is generally good and meets all Basin Plan water quality objectives with the exception of Bacteria and Chemical Constituents. Fecal coliform concentrations were greater than Basin Plan numerical limits on occasion. However, there is no apparent direct nexus to operation of the UARP or Chili Bar Project since the exceedances appeared to be relatively random in the reach (e.g., no spatial trend from the Chili Bar Dam downstream), and the higher concentrations were found at the downstream end of the reach – 19 miles below Chili Bar Dam and 25 river miles downstream of White Rock Powerhouse. The causes of these fecal coliform bacteria concentrations may be recreationists along the 19.1-mile-long reach, residences, or inflows from tributaries, including Weber Creek, which receives effluent discharge from a wastewater treatment plant.

Additionally, SMUD and PG&E's water quality studies indicate that aluminum concentrations in the Reach Downstream of Chili Bar are sometimes greater than Secondary MCL levels. SMUD and PG&E are unaware of any UARP activity that could result in an increase in aluminum concentration downstream of Chili Bar Dam.

Under the Proposed Action, SMUD will implement a Erosion and Sedimentation Control Plan and a Storm Water Pollution Prevention Plan during the construction phase of the Iowa Hill Development. With these plans in place, there will be no effect on water quality in the Reach Downstream of Chili Bar during Iowa Hill Development construction activities. The operation of the Iowa Hill Development will also not affect water quality in the Reach downstream of Chili Bar.

7.3.2.2 Water Temperature

The Proposed Action will have no incremental adverse affect on water temperature in the Reach Downstream of Chili Bar. Under the Proposed Action, SMUD will continue to provide cool water to Chili Bar Reservoir from the White Rock Powerhouse. Summer water temperature in Chili Bar Reservoir will continue to range between 14°C and 18°C. In the Reach Downstream of Chili Bar, mean daily water temperature will continue to be less than 20°C throughout the reach, which will support the existing coldwater fish populations such as trout.

Under the Proposed Action, operation of the Iowa Hill Development will have a very minor effect on the temperature of water released from Slab Creek Reservoir. The operation of the Iowa Hill Development will decrease water temperatures emanating from Slab Creek Reservoir by less than 0.5°C. This change will have no affect on water temperatures in Chili Bar Reservoir or the Reach Downstream of Chili Bar. Thus, water temperature in Chili Bar Reservoir and the Reach Downstream of Chili Bar will continue to support the Basin Plan Cold Freshwater Habitat designated Beneficial Use.

7.3.2.3 Channel Morphology

The Proposed Action will have no cumulative effect on channel morphology in the Reach Downstream of Chili Bar. Most of the stream is a transport section, so any decrease in sediment supply due to capture in upstream reservoirs will have little effect on channel morphology. Springtime flows will continue to be high and will mobilize streambed material. With implementation of the Coordinated Operations Plan, the resulting decrease in summertime and fall spills at Chili Bar Dam will not affect channel morphology since these flows are well below springtime high flows that mobilize bed material. LWD has very little effect on channel morphology in the Reach Downstream of Chili Bar, so the loss of wood captured in upstream reservoirs does not significantly affect channel morphology. However, SMUD proposes to transport woody debris around Slab Creek Reservoir as part of the Proposed Action.

As described in the Section 7.3.1.3 (Affected Environment – Channel Morphology), most of the Reach Downstream of Chili Bar is composed of transport sections of river: that is, the channels are resilient and insensitive to changes in flow and/or sediment supply. In these channels, the available transport capacity is greater than the local sediment supply, and fine sediment is transported downstream while coarser material (e.g., cobble and boulder) remains. Thus, there is very little fine sediment stored in these transport sections, although deposits do temporarily form in pockets behind large flow obstructions and along the channel margins on the receding limb of storm or runoff hydrographs. These deposits are remobilized during the next high flow event.

The only significantly contiguous response section of river occurs in the middle of the Reach Downstream of Chili Bar near Coloma. This section of the reach is characterized by cobble and small boulders, with few pockets of sediment. SMUD and PG&E's incipient motion and bankfull discharge analyses show this bed material is mobilized regularly under the current flow regime and that the floodplain remains well connected with the active channel. These processes will continue under the Proposed Action.

7.3.2.4 Fish Populations

Under the Proposed Action, the implementation of the Coordinated Operations Plan will enhance fish populations by reducing the frequency and magnitude of summer/fall spill events. Water balance model simulations predict that coordinated operations will reduce the number of spill events over the 26-year simulation period from 423 days, predicted to occur without coordination, to 234 days, or roughly from 16 to 9 days per year (Table 4.2-2, DTA 2005b). Reduced spill events will be beneficial to fish populations since a reduced incidence of spill events, during which streamflows are substantially higher than the typical recreation flows of 1,200 to 1,500 cfs, will decrease the average magnitude of flow fluctuation. Also, as mentioned above, the Proposed Action will assure a continued supply of cold water to the reach, which will benefit cold freshwater habitat.

The minimum flow schedule described in Table 7.3.2-1 will provide an incremental improvement in fish population habitat in the Reach Downstream of Chili Bar. The summer minimum releases will range from 100 to 300 cfs. Unimpaired hydrology data show that median flows in August through October range from 193 to 212 cfs; consequently, the proposed minimum releases represent higher base flows than the unimpaired hydrograph during this period. This range of flows compares favorably with the results of the fish habitat studies performed in the reach, which indicated that the most diverse habitat occurred at the lowest flow study (186 cfs) and as flows increase habitat becomes more homogeneous as deeper and faster water dominate. The most significant loss of habitat diversity occurs as flows increased above 500 cfs (pg. 74, DTA and Stillwater 2005e). Thus, the proposed range of base flows will provide an incremental enhancement of fish habitat.

Despite the enhancements associated with the Proposed Action and the minimum release in PG&E's License Application, fish populations in the Reach Downstream of Chili Bar will likely continue to exhibit low abundance, as described in Section 7.3.1.4 (Affected Environment – Fish Populations)

7.3.2.5 Benthic Macroinvertebrates

The Proposed Action, in combination with the releases schedules proposed in the PG&E License Application, will have no incremental adverse effects on, and will likely benefit to a degree, BMI in the Reach Downstream of Chili Bar. The reduction in spill events that will result from implementation of the Proposed Action (see discussion in Section 7.3.2.4) will likely enhance BMI populations. The proposed minimum release schedule will result in an increase in base wetted width, which will provide more habitat area for BMI colonization.

Despite the enhancements associated with the Proposed Action, the benthic macroinvertebrate community in the Reach Downstream of Chili Bar will likely continue to exhibit reduced composite metric scores, as described in Section 7.3.1.5 (Affected Environment – Benthic Macroinvertebrates).

7.3.2.6 Amphibians and Aquatic Reptiles

The Proposed Action will have no incremental adverse effects on habitat for FYLF or CRLF. As described above, the lack of suitable frog habitat in the Downstream Reach of Chili Bar is likely due primarily to fluctuating flows during the summer for whitewater boating purposes and during the spring when the frogs are breeding. The Proposed Action will reduce spill events at Chili Bar Dam, which may be beneficial to frogs.

7.3.2.7 Recreational Resources

SMUD's Proposed Action, in combination with the recreation release schedule proposed in PG&E's Chili Bar Project License Application, will enhance whitewater boating in the Reach Downstream of Chili Bar. The schedule includes the quantity and timing of the desired flows that would be released between Memorial Day and Labor Day based on the day of the week and water year type. The range of minimum recreational streamflows included in PG&E's License Application conforms to a range of suitable values described by representatives of the commercial boating community. Releases of 1,000 to 1,200 cfs were identified as values below which a substantial change in retail business would result. A release of 1,500 cfs was described as a value that the boating community "really needs flows to be at" (Table 4.3.3-2, DTA 2004u). SMUD will use its best efforts to deliver water to Chili Bar Reservoir in sufficient volume and at appropriate times of the day to support the level of whitewater boating identified in Table 7.3.2-2, consistent with the power generation objectives of the UARP.

The most beneficial effect of the Proposed Action on recreation is associated with the coordinated operation that would result in SMUD being the *de facto* operator of the Chili Bar Project. This will result in improved water management, with a concomitant reduction in recreation-season spill events. Water balance model simulations predict that coordinated operations will reduce the recreation-season spill days over the 26-year simulation period from 423 days, predicted to occur without coordination, to 234 days, or roughly from 16 to 9 days per year (Table 4.2-2, DTA 2005b). By minimizing spill events, more water will remain available for release for whitewater boating (e.g. during the day rather than evening). A higher degree of certainty that there will be sufficient water to meet minimum recreation releases and knowing when water from the UARP will be delivered to Chili Bar Reservoir will increase the likelihood that flows would be provided in the Reach Downstream of Chili Bar consistent with the recreation release schedule provided in Table 7.3.2-2. This expected outcome was demonstrated in the water balance model simulation results, which showed that imposing coordinated operations increased the percent of boating days achieved from 76 to 100 percent (Table 4.2-2, DTA 2005b). This will be a beneficial effect since there would simply be more days when suitable flows would be provided. A second beneficial effect would be that commercial and private boaters have higher levels of certainty of knowing when suitable flows would be provided. The greater certainty would allow commercial boating outfitters to better plan their operations (e.g., hiring staff and scheduling trips) and, in turn, make their operations more profitable (pg. 19, DTA 2004u).

SMUD's Proposed Action, in combination with PG&E's recreation releases proposed in PG&E's Chili Bar Project License Application, will not negatively affect the other forms of recreation that occur in the Reach Downstream of Chili Bar. The overlapping relicensing studies indicate the river flow scenario that supports whitewater boating does not significantly affect other forms of recreational activities, such as swimming, gold panning, gold dredging and angling. In the case of swimming, there are sufficient alternative sites with favorable conditions that are created as flows are increased for whitewater boating. Angling typically coincides with fish feeding behavior, which is generally during the morning hours. Under PG&E's proposal, recreation releases will commence either at 8:00 AM (weekends) or 9:00 AM (weekdays). Given that most angling occurs in the Coloma area, or midway through the 19.1-mile reach, high flows released at these hours would not reach the Coloma area until approximately midday (pg., 30, DTA and Stillwater 2005e), which would not affect morning angling. Because gold dredging is dependent on periodic high flow events, it is not affected by daily flow fluctuations. The most important area for gold panning is at the Marshall Gold Discovery State Historic Park, and park staff report that the wide channel and low gradient allow gold panning to take place irrespective of flow fluctuations. This is largely due to the fact that gold panning does not require extensive water contact (pg. 25, DTA and LBG 2005e).

Unlike the four recreation activities discussed above, whitewater boating is heavily dependent on flows in the Reach Downstream of Chili Bar. Analysis of hydrology information indicates that operation of the UARP and Chili Bar Project create whitewater boating opportunities in the reach through the summer and fall seasons when typically there would be no boatable days during this time if the two projects did not exist.

7.3.3 Cumulative Effects on the SFAR reach between its confluence with Silver Creek and Slab Creek Reservoir

The operation of the UARP and the El Dorado Project (FERC Project No. 184) jointly affect stream flows in a 2.8-mile segment of the SFAR reach between its confluence with Silver Creek and Slab Creek Reservoir. The FERC recently issued a final EIS for the relicensing of the El Dorado Project. Because the FERC EIS did not find significant adverse environmental effects in this segment of the SFAR resulting from the El Dorado Project proposed action, SMUD concludes that the SMUD Proposed Action will not contribute to a significant cumulative effect.

7.3.4 Cumulative Effects in the Rubicon River

The operation of the UARP affects the amount of water that flows down the Rubicon River and into PCWA's Hell Hole Reservoir, which lies over 11 miles downstream from the UARP's Rubicon Reservoir. This 208,000 ac-ft reservoir also receives water diverted from French Meadows Reservoir. Given its size and distance from UARP facilities, water management in Hell Hole Reservoir is dictated entirely by PCWA; therefore, the effects of reservoir releases and spill events at the reservoir are not affected by the operation of the UARP. SMUD and PCWA do not coordinate operations between the two projects that would affect the water management at Hell Hole Reservoir since the PCWA project is primarily located on the MFAR. Accordingly, there are no cumulative effects associated with the combined operations of the two projects that would occur in the stretch of the Rubicon River downstream of Hell Hole Reservoir.

7.4 Consistency with Comprehensive and Other Resource Plans

Section 10(a)(2) of the FPA requires FERC to consider the extent to which a project is consistent with federal and state comprehensive plans filed with FERC for improving, developing and conserving waterways affected by the project. A review of FERC's *Revised List of Comprehensive Plans* dated June 2004, which can be found at FERC's eLibrary (http://www.ferc.gov/industries/hydropower/gen-info/complan.pdf), shows that federal and California agencies have filed 53 comprehensive plans specifically for California and 27 plans for the United States in general. Fifteen of these plans address resources relevant to the Rubicon River, Silver Creek, and SFAR waterways. These plans are:

1. California Department of Fish and Game. 1979. Rubicon River wild trout management plan. Sacramento, California. July 1979. 46 pp.

2. California Department of Parks and Recreation. 1998. Public opinions and attitudes on outdoor recreation in California. Sacramento, California. March 1998.

3. California Department of Parks and Recreation. 1980. Recreation outlook in Planning District 2. Sacramento, California. April 1980. 88 pp.

4. California Department of Parks and Recreation. 1994. California outdoor recreation plan-1993. Sacramento, California. April 1994. 154 pp. and appendices.

5. California Department of Water Resources. 1983. The California water plan: projected use and available water supplies to 2010. Bulletin 160-83. Sacramento, California. December 1983. 268 pp. and attachments.

6. California Department of Water Resources. 1994. California water plan update. Bulletin 160-93. Sacramento, California. October 1994. Two volumes and executive summary.

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8. California State Water Resources Control Board. 1975. Water quality control plan report. Sacramento, California. Nine volumes.

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11. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior, Portland, Oregon. May 1986. 19 pp.

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13. National Parks Service. 1982. The nationwide rivers inventory. Department of Interior, Washington, DC. 432 pp.

14. Forest Service. 1988. ENF land and resource management plan. Department of Agriculture, Placerville, California. December 1988. 752 pp.

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The following 18 additional plans were identified by stakeholders as possibly being relevant to the UARP or the proposed Iowa Hill Development, as documented in the *UARP Land Use Technical Report* (pgs. 21-44, DTA and Goodavish 2005c) and the *Iowa Hill Development Land Use Technical Report* (pgs. 12-30, DTA and Goodavish 2005a):

1. USDA. 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement and Record of Decision. Pacific Southwest Region. January 2001.
2. USDA. 1998. Desolation Wilderness Management Guidelines, Land Management Plan Amendment. Pacific Southwest Region, Eldorado National Forest and Lake Tahoe Basin Management Unit. November 1998.
3. El Dorado County. 2004. El Dorado County General Plan. Adopted on July 19, 2004.
4. El Dorado County. 2001. River Management Plan. November 2001.
5. El Dorado County. 1997. El Dorado County Trails Master Plan. May 1997.
6. El Dorado County Water Agency. 2003. Water Resource Development and Management Plan. June 2003.
7. Bureau of Land Management. 2004. The South Fork American River – A Management Plan and Record of Decision. BLM Folsom Field Office. July 2004.

8. Bureau of Land Management. 1988. Sierra Planning Area Management Framework Plan, as amended. 1988.
9. El Dorado County Water Agency. 2003. Resource Conservation District Watershed Plan – a component of the Water Resource Development and Management Plan. June 2003.
10. Sacramento County. 1993. Sacramento County General Plan. December 1993.
11. California Office of Historic Preservation. 2001. Comprehensive Statewide Historic Preservation Plan for California 2000 – 2005. May 2001.
12. California State Parks. 2002. California Outdoor Recreation Plan. 2002.
13. Water Forum. 2000. Water Forum Agreement. January 2000.
14. Sacramento Area Council of Governments. 2002. Regional Transportation Plan for 2025. July 2002.
15. California Department of Transportation. 2003. Draft California Transportation Plan 2025. 2003.
16. Task Force (Lower American River Task Force). 2003. Annual Report – Implementation of the Lower American River Corridor Management Plan for the period January 2002 – December 2002. June 2003.
17. City of Folsom. 1993. City of Folsom General Plan. January 1993.
18. USDA. 2003. South Fork American River – Chili Bar Watershed Lower Middle Fork American River Watershed Landscape and Roads Analysis. Eldorado National Forest. September 2003.

No inconsistencies were found between the plans listed above and the Proposed Action.